Journal of Bioresources 14 (2): 26-31, October – December 2025

JOURNAL OF BIORESOURCES

journal webpage: https://jbr.rgu.ac.in

ISSN: 2394-4315 (Print)
ISSN: 2582-2276 (Online)

RESEARCH ARTICLE

Water quality assessment of Baria, Finguaparua and Bahua-tabha Beels using the Water Quality Index (WQI): insights from freshwater wetlands in the agricultural landscape of Barpeta district, Assam, India

Sadananda Nath[1*] and Rodali Talukdar[2]

[1]Department of Zoology, B.H. College, Howly -781316, Barpeta, Assam, India
[2]Department of Chemistry, B.H. College, Howly - Howly-781316, Barpeta, Assam, India

Corresponding author email: nathsada@gmail.com
Article No.: SNJBR189; Received: 02.09.2025; Peer-reviewed: 16.11.2025; Accepted: 20.11.2025; Published: 31.12.2025
DOI: https://doi.org/10.5281/zenodo.18671609

Abstract

Freshwater wetlands, commonly called Beels in Assam, are the most degraded ecosystem. Various anthropogenic activities, along with different factors of climate change, have seriously affected the health of these freshwater ecosystems. Additionally, the wetlands are used by the public to meet their societal and economic needs. Most of the wetlands of Barpeta district of Assam are in an agricultural landscape, hence agricultural runoff as the nonpoint source of pollution has the potential to cause a serious impact on water quality and aquatic biodiversity. Frequent monitoring of water quality helps in understanding the role of different agents causing negative effects on these water bodies. Based on such analysis proper management plan can be initiated to make these ecosystems sustainable. The present study assessed some common water quality parameters such as Water Temperature (WT), pH, Electrical Conductivity (EC), Total Suspended Solids (TSS), Total Hardness (TH), Total Alkalinity (TA), Chloride, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Sulphate ion, Phosphate ion and Nitrate ion during the dry and wet seasons in three major wetlands of Barpeta district of Assam. The study also carried out a calculation of the water quality index (WQI) to ascertain the water quality status of these wetlands. The study discussed the parameters in relation to water quality standards. The study identified the dry season as one of the factors of low water quality, unsuitable for the use of water for different purposes.

Keywords: Water Quality Parameters; Water Quality Index; Freshwater Wetland; Agricultural Landscape; Dry and Wet seasons; Aquatic Ecosystem.

1. Introduction

Water quality is one of the prime factors determining the status of human health. It also influences the environment, soil and crop production (Kirda, 1997). The majority of pollutants influencing the water quality of rural areas are made up of more complex organic compounds or particles and simple inorganic ions. Various sources, including soils and decaying vegetation, as well as animal dung, can provide these materials (Goss et al., 2000). One of the nonpoint sources of pollution that has an impact on water quality is agricultural runoff. Inadequate animal husbandry techniques, overgrazed grasslands, and excessive use of fertilisers, pesticides, and ploughing over irrigated fields are examples of agricultural practices that can lead to pollution (Khatri and Tyagi, 2015). Since lakes, rivers, streams, and groundwater are the only common natural water sources that support life, they must have high-quality water. Due to the growing human population and the need for clean water for household and commercial uses, water is becoming more and scarcer. Climate change has also made precipitation unpredictable (Giorgi et al., 2004). Wetlands in India are at risk (Singh et al., 2020). To improve the conditions of these freshwater ecosystems, monitoring of water quality is essential (Dinka et al., 2015). Water quality is evaluated by comparing its physicochemical and biological characteristics to a set of criteria. This allows one to ascertain if the water is safe for the environment or fit for human consumption. In India, use of Water Quality Index (WQI) for determining water quality has been used by many workers (Bora and Goswami, 2017; Murali et al., 2020). The Paddy and Jute cultivation, along with the production of different types of vegetables, made the district of Barpeta one of the leading districts in Assam in terms of agricultural produce. Additionally, the district has great potential in the pond fishery sector. The district has 59038 hectares under wetland area, and there are 37 wetlands commonly called Beels covering an area of 2644 hectares, out of which 235 hectares are under ox-bow lakes (Space Applications Centre, ISRO, 2010). Most of the wetlands of Barpeta district of Assam are situated in the agricultural landscape and adjacent to human settlements, leading to the use of these natural water bodies for different purposes. Under this background, the present study has attempted to determine the status of water quality of three major freshwater wetlands of the Barpeta district using WQI.

2. Methodology

2.1. Study area

The map of the Barpeta district of Assam with major wetlands is shown in Figure 1, and the geographical coordinates of the wetlands of the present study are shown in Table 1, which depicts the study area. The Baria Beel is located in the Sundardia, Kaiakuchi and Bamuna area of the Barpeta district. It has an approximate area of 56 hectares. The water spread area reduces drastically in the dry season. The wetland is in the vicinity of the agricultural fields. The Finguaparua Beel, with a total area of 64 hectares, is located in the Patbaushi village near the “Satra” of Srimanta Sankardeva, the great Assamese Vaishnava saint. The adjacent areas are basically used for agriculture and fish farming. The Bahua-tabha Beel is located in the Sarukhetri revenue Circle of

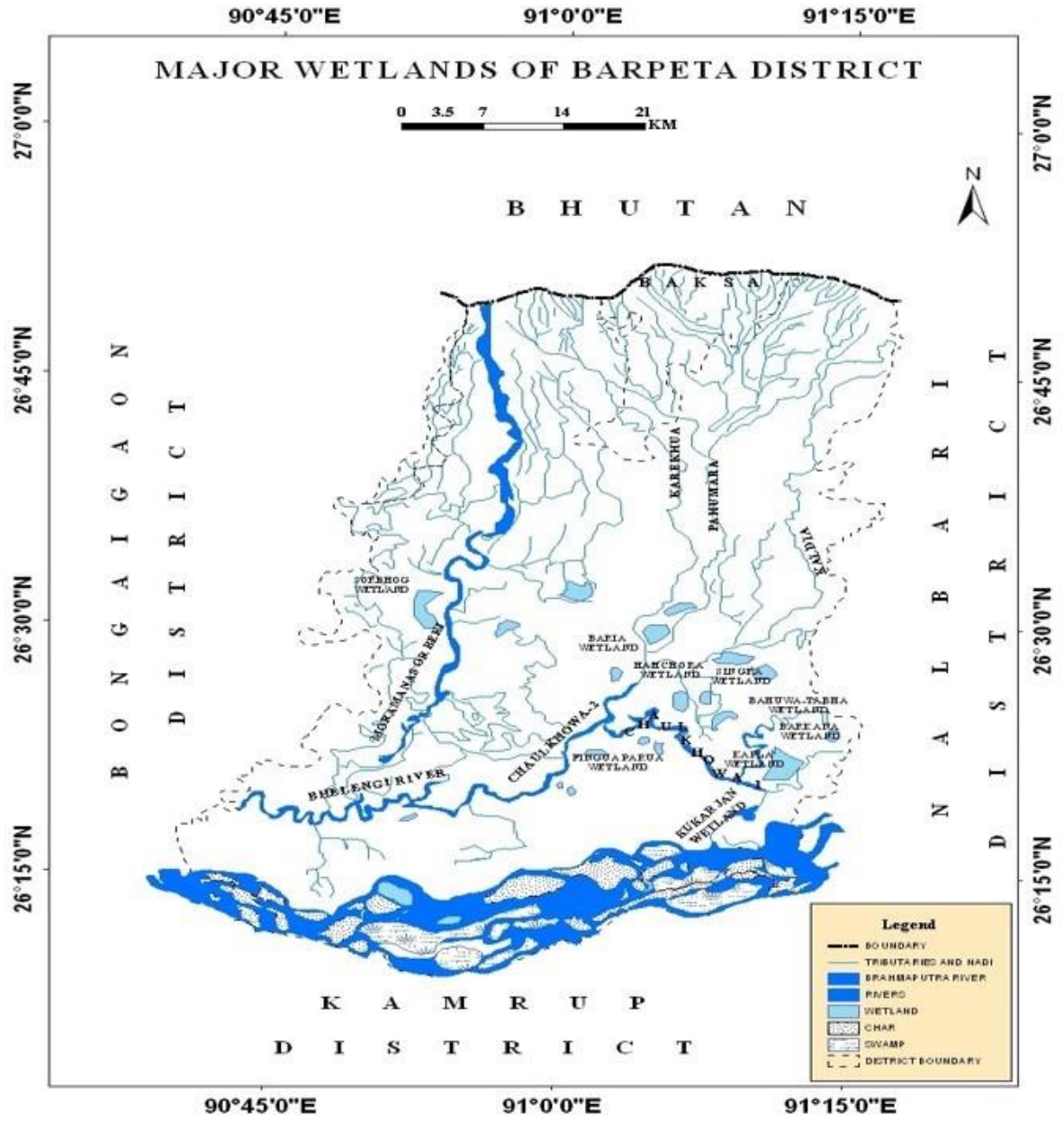

Figure 1. Map showing the study area: Baria Wetland, Finguaparua Wetland and Bahua-tabha Wetland in the Barpeta District of Assam, India.

Barpeta District. The land area is approximately 62 hectares. The villages in the area are Bamundi, Ara and Baksara gaon. The "Nasatra Krishnaguru ashram", a religious place, is very close to this wetland. Apart from agricultural fields, the residential housing of the villagers is in proximity to the wetland. The Assam Fisheries Development Corporation (AFDC) is the government agency under which all three wetlands are registered.

2.2. Study design

To ascertain the water quality of these wetlands, common parameters such as Water Temperature (WT), pH, Electrical Conductivity (EC), Total Suspended solids (TSS), Total Hardness (TH), Total Alkalinity (TA), Chloride, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Sulphate ion, Phosphate ion and Nitrate ion were studied in the year 2023 during the Dry (January–March) and Wet (June-September) Seasons. Nine replicate water samples were collected and analysed in each season from each wetland by following the standard methods of APHA (2005). The water temperature was recorded in the field by the use of a mercury in-glass thermometer graduated 0^{o} to 100 ^{o}C and pH with an electronic portable pH meter (Hanna Instruments, India) after calibrating it with phosphate buffer of known pH value. All the other parameters were analysed in the laboratory of the department of chemistry, B.H. College, Howly, Barpeta, Assam.

2.3. Water Quality Index (WQI)

The method used is the "weighted arithmetic index method" (Brown et al., 1970). The parameters included in its calculation are pH, Electrical Conductivity (EC), Total Suspended solids (TSS), Total Hardness (TH), Total Alkalinity (TA), Chloride, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Sulphate ion, Phosphate ion and Nitrate ion. The equation given below shows the steps for the calculation of WQI.

$WQI = \sum Qn\ Wn / \sum Wn$

Where,

Qn denotes the quality rating of the *n*th water quality parameter, and Wn denotes the unit weight of the *n*th water quality parameter (Bora and Goswami, 2017).

Table 2. WQI range, status and possible usage of the water sample (Brown et al., 1972).

WQI	Water Quality Status (WQS)	Possible usage
0-25	Excellent	Drinking, irrigation and industrial
26-50	Good	Drinking, irrigation and industrial
51-75	Poor	Irrigation and industrial
76-100	Very Poor	Irrigation
Above 100	Unsuitable for drinking and fish culture	Proper treatment is required before use

Table 3. Descriptive statistics for the water quality parameters of the Baria Beel (Wetland).

Parameter	Dry Season	Wet Season
Water Temperature (WT) in oC	22.14 ± 1.93 (20.6-24.8)	29.91 ± 1.29(28.2-31.6)
pH	7.14 ± 0.19 (6.8-7.4)	7.07 ± 0.22(6.7-7.41)
Electrical Conductivity (EC) in µS/cm	70.11 ± 21.55 (46-105)	95.78 ± 43.02(31-146)
Total Suspended Solids (TSS) in mg/l	10.81 ± 4.11 (6.1-16.2)	48.17 ± 23.17(19.6-78.2)
Total Hardness (TH) in mg/l	82.23 ± 8.93 (68.9-95.1)	57.87 ± 10.27(44.01-70.12)
Total Alkalinity(TA) in mg/l	74.82 ± 10.12 (59.4-89.2)	18.56 ± 4.68(12.2-23.02)
Chloride(Cl) in mg/l	12.52 ± 2.25 (9.1-15.8)	12.45 ± 2.32(8.02-15.2)
Dissolved Oxygen (DO) in mg/l	6.99 ± 0.31 (6.6-7.5)	5.4 ± 0.19(5.12-5.71)
Biological Oxygen Demand (BOD) in mg/l	3.71 ± 0.38 (3.1-4.3)	2.98 ± 0.38(2.5-3.65)
Sulphate ion in mg/l	10.5 ± 2.56 (8.2-16.2)	6.4 ± 0.53(5.19-7.05)
Phosphate ion in mg/l	0.35 ± 0.07 (0.288-0.446)	0.17 ± 0.03(0.119-0.196)
Nitrate ion in mg/l	0.84 ± 0.09 (0.71-0.98)	0.38 ± 0.08(0.281-0.504)

Values are: Mean ± SD ; Range of values within the parentheses

Table 4. Descriptive statistics for the water quality parameters of the Finguaparua Beel (Wetland).

Parameter	Dry Season	Wet Season
Water Temperature (WT) in oC	22.41±1.93(20.7- 25.1)	30.16 ± 1.14(28.6 - 31.6)
pH	7.19±0.19(6.9- 7.6)	6.48 ± 0.25(6.2 - 6.9)
Electrical Conductivity (EC) in µS/cm	77.33±17.79(51- 106)	193.22 ± 130.33(71 - 387)
Total Suspended Solids (TSS) in mg/l	9.66±3.79(6.2- 16.5)	31.52 ± 7.25(20.16 - 40.06)
Total Hardness (TH) in mg/l	79.64±5.92(70.5- 88)	59.46 ± 8.73(50.12 - 74.02)
Total Alkalinity(TA) in mg/l	76.34±10.36(60.2- 90.5)	15.98 ± 3.13(11.21 - 20.1)
Chloride(Cl) in mg/l	9.36±1.82(6.5- 12)	10.29 ± 1.87(8.01 - 12.9)
Dissolved Oxygen (DO) in mg/l	7.07±0.26(6.7- 7.5)	6.8 ± 0.25(6.41 - 7.11)
Biological Oxygen Demand (BOD) in mg/l	3.46±0.71(2.6- 4.4)	3.77 ± 0.15(3.51 - 3.99)
Sulphate ion in mg/l	11.14±2.25(9.1- 14.6)	4.51 ± 0.63(3.96 - 5.51)
Phosphate ion in mg/l	0.31±0.095(0.195-0.432)	0.13 ± 0.05(0.061 - 0.192)
Nitrate ion in mg/l	0.88±0.043(0.81- 0.94)	0.41 ± 0.17(0.191 - 0.673)

Values are: Mean ± SD; Range of values within the parentheses

For the calculation of Qn, the following equation is used:

$$Qn = 100 [(Vn-Vi)/(Vs-Vi)]$$

Where,
Vn represents the actual estimated amount of the *n*th parameter, Vi represents the ideal value of the parameter [Vi = 0, except for DO (Vi = 14.6 mg/l) and pH (Vi = 7)], and Vs represents the accepted standard permissible limit for the *n*th water quality parameter.

Unit weight (Wn) is calculated using the formula:

$$Wn= k/Vs$$

Here,
k represents the constant of proportionality. The value of k is calculated with the following equation:

$$k = [1/\sum 1/Vs=1,2, ...n]$$

The calculated value of WQI of each wetland is used to identify the status of water quality by matching with the standard values of WQI classification given by Brown et al (1972) shown in Table 2.

3. Result and discussion

Water temperature was recorded as higher in the wet seasons in all three wetlands, with a maximum value of 30.16 °C in the Finguaparua Beel and a minimum value of 22.14 °C in the Baria Beel. Value of dissolved oxygen decreases, solubility of gases reduces, and the fastest chemical reaction occurs at high water temperature (Bhateria and Jain, 2016; Bhat and Pandit, 2014). The atmospheric temperature has brought these differences between the dry and wet seasons. The lowest value of pH (6.48) was during the wet season in Finguaparua Beel, and the highest value was 7.39 in the Bahua-tabha Beel during the dry season. The pH range of 6.5-9.0 is desirable for the production of diverse species of fish (Boyd and Tucker, 1998). The values of pH are favourable in the wetlands from the fish culture point of view. Dissolved ions have a direct relation with Electrical Conductivity. The highest value of EC (207.67 µS/cm) was during the wet season in the Bahua-tabha Beel, and the lowest value (70.11 µS/cm) was during the dry season in the Baria Beel. In all the wetlands, the EC values were higher during the wet seasons. High runoff caused during the wet season may be one of the causative factors for such an EC value. The concentration of ions varied widely in all three wetlands. The TSS values ranged between 9.66 mg/l (Finguaparua Beel, dry season) and 48.17mg/l (Baria Beel, wet season). The values are found to be higher in the wet seasons in the wetlands under study. The values are within the BIS permissible limit of 500 mg/l. The presence of Ca^{2+} and Mg^{2+} ions in the water indicates hardness (Barua et al., 1993). Hardness was lower in the wet seasons than in the dry seasons in the wetlands. The highest value was (82.23 mg/l) during the dry season, and the lowest (57.87 mg/l) was during the wet season in the Baria Beel. Leaching of salts from the adjoining areas during the dry season may have contributed to the higher values of hardness during dry seasons, and dilution of water has caused such low values during the wet season. The alkalinity of water is the ability to neutralise acid. It indicates the buffering capacity of water. The highest value (81.09 mg/l) was during the dry season,

Table 1. Geographical coordinates of the Wetlands under the present study

Sl. Nos.	Names of Wetlands	Geographical Locations					
		Latitude (North)			Longitude (East)		
		Degree	Min	Sec	Degree	Min	Sec
1	Baria Beel (Wetland)	26	27	6.4	91	2	47.54
2	Finguaparua Beel (Wetland)	26	22	27.6	91	2	5.91
3	Bahua-tabha Beel (Wetland)	26	23	55.9	91	8	3.56

Table 5. Descriptive statistics for the water quality parameters of the Bahua-tabha Beel (Wetland).

Parameter	Dry Season	Wet Season
Water Temperature (WT) in oC	22.48 ± 1.71(20.8-24.9)	30.07 ± 1.26(28.4-31.8)
pH	7.39 ± 0.22(7.1-7.8)	6.94 ± 0.24(6.6-7.3)
Electrical Conductivity (EC) in µS/cm	73.44 ± 22.18(50-109)	207.67 ± 136.51(72-412)
Total Suspended Solids (TSS) in mg/l	10.19 ± 3.5(6.4-15.62)	28.74 ± 7.73(20.2-40.5)
Total Hardness (TH) in mg/l	67.59 ± 4.3(60.5-72.6)	66.42 ± 10.87(50.12-78.2)
Total Alkalinity(TA) in mg/l	81.09 ± 15.57(60.6-99.2)	13.73 ± 2.06(10.4-15.9)
Chloride(Cl) in mg/l	12.4 ± 2.02(9.2-15.2)	11.5 ± 2.36(8.01-14.9)
Dissolved Oxygen (DO) in mg/l	6.62 ± 0.48(6.1-7.4)	6.86 ± 0.51(6.12-7.5)
Biological Oxygen Demand (BOD) in mg/l	3.52 ± 0.33(3-3.9)	3.17 ± 0.08(3.06-3.29)
Sulphate ion in mg/l	7.67 ± 0.4(7.1-8.2)	4.78 ± 0.55(4.02-5.41)
Phosphate ion in mg/l	0.21 ± 0.08(0.121-0.311)	0.15 ± 0.07(0.042-0.209)
Nitrate ion in mg/l	0.68 ± 0.11(0.52-0.79)	0.5 ± 0.18(0.216-0.692)

Values are: Mean ± SD ; Range of values within the parentheses

Table 6. Recommended Standard values (BIS, 2012; Bora and Goswami, 2017) and Relative weights (Wn) of the parameters used for WQI determination.

Parameter	ICMR/BIS standard (Vs)	Unit weight (Wn)
pH	6.5-8.5	0.030185
Electrical Conductivity (EC) in µS/cm	300	0.000855
Total Suspended Solids (TSS) in mg/l	500	0.000513
Total Hardness (TH) in mg/l	200	0.001283
Total Alkalinity(TA) in mg/l	200	0.001283
Chloride(Cl) in mg/l	250	0.001026
Dissolved Oxygen (DO) in mg/l	5	0.051314
Biological Oxygen Demand (BOD) in mg/l	5	0.051314
Sulphate ion(SO_4) in mg/l	200	0.001283
Phosphate ion (PO_4) in mg/l	0.3	0.855241
Nitrate ion (NO_3) in mg/l	45	0.005702
	∑Wn =1.00	

All the parameters are in milligrams per litre except pH and EC.

and the lowest (13.73 mg/l) value was during the wet season in the Bahua-tabha wetland. The Fish production is low within the range of 0.0-0.2 mg/litre, and within 20-40 mg/litre the fish production is medium, and the fish production is high between 40-90 mg/litre (Boyd and Tucker, 1998). The estimated values of alkalinity of water indicate the presence of a favourable environment for medium to high production of fish in these wetlands. Pollution from animal origin results in higher concentrations of chloride in water (Munawar, 1970). Sewage pollution also indicates high chloride concentration (Wetzel, 1966). The highest value of chloride (12.52 mg/l) was during the dry season in the Baria Beel, and the lowest value (9.36 mg/l) was also in the dry season in the Finguaparua Beel. The maximum acceptable limit in drinking water is 5 mg/l (WHO, 2008) and 250 mg/l (BIS, 2012). The highest (7.07 mg/l) value of dissolved oxygen was during the dry season in the Finguaparua wetland, and the lowest value (5.4 mg/l) was during the wet season in the Baria wetland. Dissolved oxygen level in water is an important parameter, and for the reproduction of fish minimum acceptable level is 5.0 mg/l (Boyd and Tucker, 1998). Biological oxygen demand measures the dissolved oxygen required for breaking down organic materials in a given sample of water by aerobic organisms over a specific time period at a certain temperature. The range of BOD was between 2.98 mg/l (during the wet season in the Baria Beel) and 3.77 mg/l (during the wet season in Finguaparua Beel), and its value is less than 1.00 mg/l in unpolluted water (Adakola, 2000). High pollution in water leads to more oxygen consumption and results in high BOD levels (Sharma and Capoor, 2010). The highest value (11.14 mg/l) of sulphate was during the dry season, and the lowest value (4.51 mg/l) was in the wet season in the Finguaparua Beel. Agricultural sources may lead to a higher concentration of sulphate in the water body (Geurts et al., 2009). The highest level of phosphate was 0.35 mg/l during the dry season in the Baria Beel, and the lowest value was 0.13 mg/l during the wet season in the Finguaparua Beel. Similarly, the highest level of nitrate was 0.88 mg/l during the dry season in the Finguaparua Beel, and the lowest value was 0.38 mg/l during the wet season in the Baria Beel. Organic pollution level is indicated by the higher concentration of nitrate and phosphate. Eutrophication in the water body is the result of high concentrations of phosphate and nitrate. Very low levels of pollution are generally shown by the wetlands of flood plains (Gogoi et al., 2015). The descriptive statistics for the water quality parameters in all three wetlands are shown in Tables 3, 4 and 5.

3.1. Water Quality Index (WQI) analysis

The parameters included in the WQI calculation are assigned a "unit weight". It is estimated by following the method of "weighted arithmetic index". A common scale is prepared by transforming the parameters included under WQI, although they have different units and dimensions. Table 6 shows the recommended standard values (BIS, 2012; Bora and Goswami, 2017) and relative weights (Wn) of the parameters used for WQI determination. Calculated WQI with the observed values of the parameters of Baria Beel, Finguaparua Beel and Bahua-tabha Beel in the dry and wet seasons are given in Tables 7, 8 and 9. The summary of Water Quality Index (WQI) and Water Quality Status (WQS) of the Baria Beel, Finguaparua Beel and Bahua-tabha Beel are given in Table 10, and the Figure 2 displays the WQI rating of the wetlands in the dry and wet seasons. The summary of WQI rating demonstrates that in the dry season, the water quality status of Baria Beel is unsuitable for drinking and fish culture; Finguaparua Beel is very poor, and Bahua-tabha Beel is poor. On the contrary, in the wet season, the status of water quality of the wetlands is quite different, showing some improvement with Baria Beel reflecting poor water quality status and Finguaparua Beel and Bahua-tabha Beel showing good water quality status. The study identified the dry season as one of the factors of low water quality, unsuitable for the use of water for different purposes. The shift in the water quality during the wet season, showing some improvement, may be due to an increase in the water volume. The life and habitat of aquatic animals are regulated by the quantity of water. A rise in the water quantity leads to an increase interaction of the aquatic life with the terrestrial environment. It also improves nutrients to the aquatic ecosystem and thereby has a positive impact on food accessibility to the aquatic animals (Poff and Ward, 1989; Poff et al., 1997). The calculated WQI of the present study revealed comparatively higher status of water quality in Bahua-tabha Beel, followed by Finguaparua Beel and Baria Beel.

4. Conclusion

The study using the Water Quality Index (WQI) determined the overall quality of water of the three wetlands situated in the significant locations within the agricultural landscape of Barpeta district of Assam. In order to maintain a sustainable aquatic environment of the wetlands, monitoring of the water quality by the use of WQI can be regarded as a best practice. This type of study has the strength to create public awareness, as it uses numerical values to display the quality of water. Water quality of the wetlands during the dry seasons can be improved by the arrangement of water flow structures into these water bodies from some other sources of water to increase the volume of water during the dry seasons. Additionally, improvement of the wetland beds through increasing the depth of the wetlands, preventing growth of unwanted plants during the dry season in the wetland proper and creation of public awareness for the water quality management can work together to improve the WQI of these wetlands during the dry seasons.

Table 7. Calculation of WQI at Baria Beel.

Parameter	Dry Season			Wet Season		
	Vn	Qn	QnWn	Vn	Qn	QnWn
pH	7.14	9.333333	0.281727	7.07	4.666667	0.140863
Electrical Conductivity (EC) in µS/cm	70.11	23.37	0.019987	95.78	31.92667	0.027305
Total Suspended Solids (TSS) in mg/l	10.81	2.162	0.001109	48.17	9.634	0.004944
Total Hardness (TH) in mg/l	82.23	41.115	0.052745	57.87	28.935	0.03712
Total Alkalinity(TA) in mg/l	74.82	37.41	0.047992	18.56	9.28	0.011905
Chloride(Cl) in mg/l	12.52	5.008	0.00514	12.45	4.98	0.005111
Dissolved Oxygen (DO) in mg/l	6.99	79.27083	4.067741	5.4	95.83333	4.917637
Biological Oxygen Demand (BOD) in mg/l	3.71	74.2	3.807534	2.98	59.6	3.058343
Sulphate ion in mg/l	10.5	5.25	0.006735	6.4	3.2	0.004105
Phosphate ion in mg/l	0.35	116.6667	99.77814	0.17	56.66667	48.46367
Nitrate ion in mg/l	0.84	1.866667	0.010643	0.38	0.844444	0.004815
		∑QnWn=	108.0795		∑QnWn=	56.67581
		WQI=∑QnWn/∑Wn=	108.08		WQI=∑QnWn/∑Wn=	56.68

Table 8. Calculation of WQI at Finguaparua Beel.

Parameter	Dry Season			Wet season		
	Vn	Qn	QnWn	Vn	Qn	QnWn
pH	7.19	12.66667	0.382343	6.48	-34.6667	-1.04641
Electrical Conductivity (EC) in µS/cm	77.33	25.77667	0.022045	193.22	64.40667	0.055083
Total Suspended Solids (TSS) in mg/l	9.66	1.932	0.000991	31.52	6.304	0.003235
Total Hardness (TH) in mg/l	79.64	39.82	0.051084	59.46	29.73	0.038139
Total Alkalinity(TA) in mg/l	76.34	38.17	0.048967	15.98	7.99	0.01025
Chloride(Cl) in mg/l	9.36	3.744	0.003842	10.29	4.116	0.004224
Dissolved Oxygen (DO) in mg/l	7.07	78.4375	4.024979	6.8	81.25	4.169301
Biological Oxygen Demand (BOD) in mg/l	3.46	69.2	3.550961	3.77	75.4	3.869111
Sulphate ion in mg/l	11.14	5.57	0.007146	4.51	2.255	0.002893
Phosphate ion in mg/l	0.31	103.3333	88.37492	0.13	43.33333	37.06045
Nitrate ion in mg/l	0.88	1.955556	0.01115	0.41	0.911111	0.005195
		∑QnWn=	96.47843		∑QnWn=	44.17147
		WQI=∑QnWn/∑Wn=	96.48		WQI=∑QnWn/∑Wn=	44.17

Table 9. Calculation of WQI at Bahua-tabha Beel.

Parameter	Dry Season			Wet season		
	Vn	Qn	QnWn	Vn	Qn	QnWn
pH	7.39	26	0.78481	6.94	-4	-0.12074
Electrical Conductivity (EC) in µS/cm	73.44	24.48	0.020936	207.67	69.22333	0.059203
Total Suspended Solids (TSS) in mg/l	10.19	2.038	0.001046	28.74	5.748	0.00295
Total Hardness (TH) in mg/l	67.59	33.795	0.043354	66.42	33.21	0.042604
Total Alkalinity(TA) in mg/l	81.09	40.545	0.052014	13.73	6.865	0.008807
Chloride(Cl) in mg/l	12.4	4.96	0.00509	11.5	4.6	0.004721
Dissolved Oxygen (DO) in mg/l	6.62	83.125	4.265516	6.86	80.625	4.137229
Biological Oxygen Demand (BOD) in mg/l	3.52	70.4	3.612539	3.17	63.4	3.253338
Sulphate ion in mg/l	7.67	3.835	0.00492	4.78	2.39	0.003066
Phosphate ion in mg/l	0.21	70	59.86688	0.15	50	42.76206
Nitrate ion in mg/l	0.68	1.511111	0.008616	0.5	1.111111	0.006335
		∑QnWn=	68.66572		∑QnWn=	50.15957
		WQI=∑QnWn/∑Wn=	68.67		WQI=∑QnWn/∑Wn=	50.16

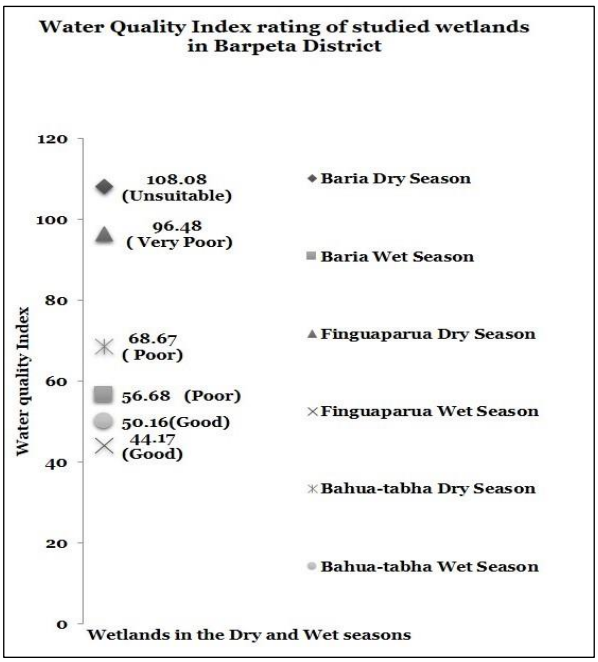

Figure 2 (left). WQI rating of Baria Beel, Finguaparua Beel and Bahua-tabha Beel in the Dry and Wet seasons in Barpeta District, Assam.

Table 10. Summary of Water Quality Index (WQI) and Water Quality Status (WQS) of the Baria Beel, Finguaparua Beel and Bahua-tabha Beel.

Name of Beel	Dry season		Wet Season	
	WQI	WQS	WQI	WQS
Baria Beel	108.08	Unsuitable	56.68	Poor
Finguaparua Beel	96.48	Very Poor	44.17	Good
Bahua-tabha Beel	68.67	Poor	50.16	Good

Acknowledgement

The authors' thanks are due to Principal B.H.College, Howly, for providing the necessary permission to conduct water quality analysis in the laboratory of the Department of Chemistry.

Declaration of conflict of interest

The authors declare that they have no conflict of interest.

Author's contribution

SN- Statistical analysis, Writing- original draft, review & editing. RT- Methodology, Mathematical analysis and Laboratory analysis.

References

Adakole JA. 2000. *The effects of domestic, agricultural and industrial effluents on the water quality and biota of Bindare stream, Zaria – Nigeria*. Phd Thesis, Department Of Biological Sciences, Ahmadu Bello University, Zaria, Nigeria, 256.

APHA (American Public Health Association) .2005. *Standard Methods for the Examination of Water and Wastewater* (21st edn.). American Public Health Association, Washington, DC.

Baruah AK, Sharma RN and Borah GC. 1993. Impact of sugar mill and distillery effluents on water quality of River Gelabil, Assam.Indian Journal of Environmental Health 35(4): 288–293. http://pascal-francis.inist.fr/vibad/index.php?action=getRecordDetail&idt=4211450

Bhat SA, Pandit AK. 2014. Surface water quality assessment of Wular Lake, a Ramsar site in Kashmir Himalaya, using discriminant analysis and WQI. J Ecosyst: 1–18

Bhateria R and Jain D. 2016. Water quality assessment of lake water: a review. Sustainable water resources management 2(2): 161-173.

BIS .2012. Indian standard drinking water- specification, second revision for drinking water. IS 10500: 2012 Bureau of Indian Standards: Manak Bhawan, New Delhi.

Bora M and Goswami DC. 2017. Water quality assessment in terms of water quality index (WQI): case study of the Kolong River, Assam, India. Applied Water Science 7(6): 3125-3135.

Boyd CE and Tucker CS. 1998. *Pond aquaculture and water quality management*. London: Kluwer Academic Pub, pp 44–48.

Brown RM, McClelland NI, Deininger RA, and Tozer RG. 1970. Water quality index-do we dare? Water Sewage Works 117: 339–343.

Brown RM, McClelland NI, Deininger RA and O'Connor MF. 1972. A water quality index—crashing the psychological barrier. In Indicators of Environmental Quality: Proceedings of a symposium held during the AAAS meeting in Philadelphia, Pennsylvania, December 26–31, 1971, pp 173-182. Boston, MA: Springer US.

Dinka MO, Loiskandl W, Ndambuki JM. 2015. Hydrochemical characterisation of various surface water and groundwater resources available in Matahara areas, Fantalle Woreda of Oromiya region. Journal of Hydrology: Regional Studies 3: 444–456.

Geurts J, Sarneel J, Willers B, Roelofs J, Verhoeven J, Lamers L. 2009. Interacting effects of sulfate pollution, sulphide toxicity and eutrophication on vegetation development in fens: a mesocosm experiment. Environ Pollut 157:2072–2081.

Giorgi F, Bi X and Pal J. 2004. Mean, interannual variability and trends in a regional climate change experiment over Europe. II: climate change scenarios (2071–2100). Climate dynamics 23(7): 839-858.

Gogoi B, Kachari A and Das DN. 2015. Assessment of water quality in relation to Fishery perspective in flood plain wetlands of Subansiri river basin, Assam, India. Journal of Fisheries and Aquatic Science 10(3): 171.

Goss MJ, Unc A and Chen S. 2000. Transport of Nitrogen, Phosphorus and Microorganisms from Manure into Surface- and Groundwater. In: Balázs, E., et al (Eds): *Biological Resource Management Connecting Science and Policy*. Springer, Berlin, Heidelberg, pp 31-55.

Khatri N and Tyagi S. 2015. Influences of natural and anthropogenic factors on surface and groundwater quality in rural and urban areas. Frontiers in Life Science 8(1): 23-39.

Kirda C. 1997. Assessment of irrigation water quality. In: Dupuy B. (ed.): *Aspects économiques de la gestion de l'eau dans le bassin méditerranéen* . Bari: CIHEAM, pp 367-377.

Munawar M. 1970. Limnological studies on freshwater ponds of hyderabad-India: II. The biocenose distribution of unicellular and colonial phytoplankton in polluted and unpolluted environments. Hydrobiologia 36(1): 105-128.

Murali K, Meenakshi M and RN Uma. 2020. IOP Conference Series: Materials Science and Engineering, Vol. 932, 012049. 1st International Conference on Science, Engineering and Technology (ICSET) 2020 27 February 2020, Penang, Malaysia.

Poff NL, Ward JV. 1989. Implications of streamflow variability and predictability for lotic community structure: a regional analysis of streamflow patterns. Canadian journal of fisheries and aquatic sciences 46(10): 1805-1818.

Poff NL, Allan JD, Bain MB, Karr JR, Prestegaard KL, Richter BD and Stromberg JC. 1997. The natural flow regime. BioScience 47(11): 769-784.

Sharma R and Capoor A. 2010. Seasonal variations in physical, chemical and biological parameters of lake water of Patna Bird Sanctuary in relation to fish productivity. World Applied Sciences Journal 8(1): 129-132.

Singh D, Kumar K, Singh C, Ahmad T. 2020. Assessment of water quality of Holy Kali Bein rivulet (Punjab), India, using multivariate statistical analysis. Int J Environ Anal Chem: 1–17.

Space Applications Centre, Indian Space Research Organisation. 2010. National Wetland Atlas: Assam, SAC/RESA/AFEG/NWIA/ATLAS/18/2010. Ahmedabad: Space Applications Centre, Indian Space Research Organisation.

Wetzel RG. 1966. Variations in productivity of Goose and hypereutrophic Sylvan Lakes, Indiana. Invest, Indiana Lakes and Streams, VII, 147-184

WHO. 2008. *Guidelines for drinking water quality incorporating the 1st and 2nd addenda*. Vol. I recommendations (3rd edn.), Geneva.