International Journal of Ecology and Environmental Sciences 49: 589-594, 2023
ISSN: 2320-5199 (Online); https://doi.org/10.55863/ijees.2023.3082

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An Investigation on Certain Water Quality Parameters of Borsola Beel (Wetland) from Upper Assam

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ABSTRACT
Borsola beel is one of the largest floodplain wetland located in Jorhat district in Upper Assam with an area of 83.42 ha. About 9 limnological parameters of the beel were recorded from 2017 to 2018. The beel is well connected with the Brahmaputra only during the monsoon season. The water quality of the beel showed that the highest atmospheric temperature (29±1.24^{0}C) was recorded in August and its lowest (18±1.02^{0}C) in January while the highest water temperature (25±1.24^{0}C) was recorded in August and its lowest (20±0.8^{0}C) in January. pH was ranged from 7.0±0.14 (August) to 7.9±0.24 (January); transparency values ranged from 35±4.22 to 210±9.34 cm during August and February; DO was found between 5.24±0.94 and 9.46±0.38 mg/l during June and January. Free carbon dioxide ranged from 2.86±0.14 to 8.14±0.28 mg/l. during January and June. Total alkalinity ranged from 71±6.22 to 160±16.62 mg/l. during July and January. Total suspended solids value ranged from 98±8.20 to 390±24.24 mg/l during January and August. Total dissolved solids ranged from 118±9.58 and 430±26.42 mg/l during January and August. The results reveal that a slight seasonal variation occurs in certain physicochemical parameters due to surface run-off and other excessive human activities. However, these values of water quality are within permissible limits (BIS).

Key words: Limnological parameters, Borsola beel, Jorhat

INTRODUCTION

The *beels* (wetlands) constitute a major inland fisheries resource and providing livelihood support to thousands of riparian poor fisher folks for centuries. Wetlands are the transitional or 'ecotonal' zones between terrestrial and aquatic ecosystems (Mitch and Gosselink, 1986) and where the water body is usually at or near the surface or the land is covered by shallow water. The North-East Region (NER) of India is blessed with a large number of water bodies and floodplain wetlands as low lying areas bordering larger rivers, which are inundated by floodwaters from the main river during the rainy season, these water bodies are commonly known as *beel* (Jhingran and Pathak 1987), that are the only source of fish and other edible macrophytes for the poor people in the surrounding villages. As per Barbier (1989) beels (wetlands) are freshwater wetlands and no satisfactory general definition of wetland exists.

The state of Assam comprises a total area of 1,01,232 ha. and 3,151 number of wetlands in Assam. Lake, ox-bow lake, waterlogged areas Swamp/marsh are natural and reservoir and pond are man made wetlands. All natural wetlands are called '*beels*' in Assam and '*pat*' in Manipur. Deepor beel is the lone Ramsar site in Assam and the second of its kind in Northeast India, after Loktak Lake in Manipur (Bera et al. 2008). The Loktak Lake of Manipur, a Ramsar site (recently added to the Montreux record) is the largest natural freshwater lake in eastern India (Sanjit et al. 2005). There are also a good number of reports available on the hydrobiology of floodplain wetlands (beels) of North-east India.The most significant contributions on beel ecology are those of Biswas and Boruah (2000) in lentic and lotic water bodies of upper Brahmaputra basin; Dutta (2002) in "closed" and "open" beels in upper Assam; Sanjit et al. (2005) in Loktak lake; Bera et al. (2008) in Deepor beel; Singh et al. (2009); Dakua et al. (2009); Abujam et al. (2011) in Maijan beel.

The studied water body is completely confined and there is well connected with the Brahmaputra River during monsoon seasons only over the years the water quality of the wetland has been changed due to influx of the untreated waste water from the overflowing water of the Brahmaputra River, and

other excessive human activities. Considering the importance and current scenario, the present study has taken up to measure the seasonal variation of the water quality from the Borsola beel of upper Assam.

MATERIALS AND METHODS

Borsola beel (N 26°50'22.3" and E 94°13'12") is also one of the largest floodplain wetland in the Upper Assam with an area of 83.42 ha and it is about 9 km from Jorhat town (Fig. 1). The present investigation was carried out during 2016-2018 and period was divided into four seasons: viz., winter season (December-February), pre-monsoon (March-May), monsoon (June-August) and post monsoon (September-November). The water sampling was done from two different sites of Borsola wetland, collected monthly from the near banks between 6:30 to 9:00 am and analyzed certain physico-chemical parameters as per standard procedure of Trivedy et al. (1986) and APHA (1998).

RESULTS AND DISCUSSION

Altogether 9 abiotic parameters viz. water & air temperature, pH, transparency, DO, free carbon dioxide, alkalinity, total dissolved and suspended solid were recorded from the beel water on a monthly basis from October' 2016 to September' 2018 (Table 1).

Temperature

The highest value (29±1.24°C) of atmospheric temperature and its lowest (18±1.02°C) was recorded in August and January. Highest water temperature (25±1.24°C) was recorded in August and that of lowest (20±0.8°C) was recorded in January. The atmospheric and water temperature was found to be higher in monsoon months (being peak in August) while, the lowest in winter (Fig. 2). Temperature of water is basically important because it effects bio-chemical reactions in aquatic organisms.

pH

The highest (7.9±0.24) value of pH was observed during January and its lowest (7.0±0.14) during August. The highest pH value was recorded in winter and declining trend in monsoon months (Fig. 2). It shows slightly alkaline features and the pH was found within the permissible limit of 6.5 to 8.5 (BIS 1982, WHO 1993).

Transparency

Figure 1. A view of Borsola beel

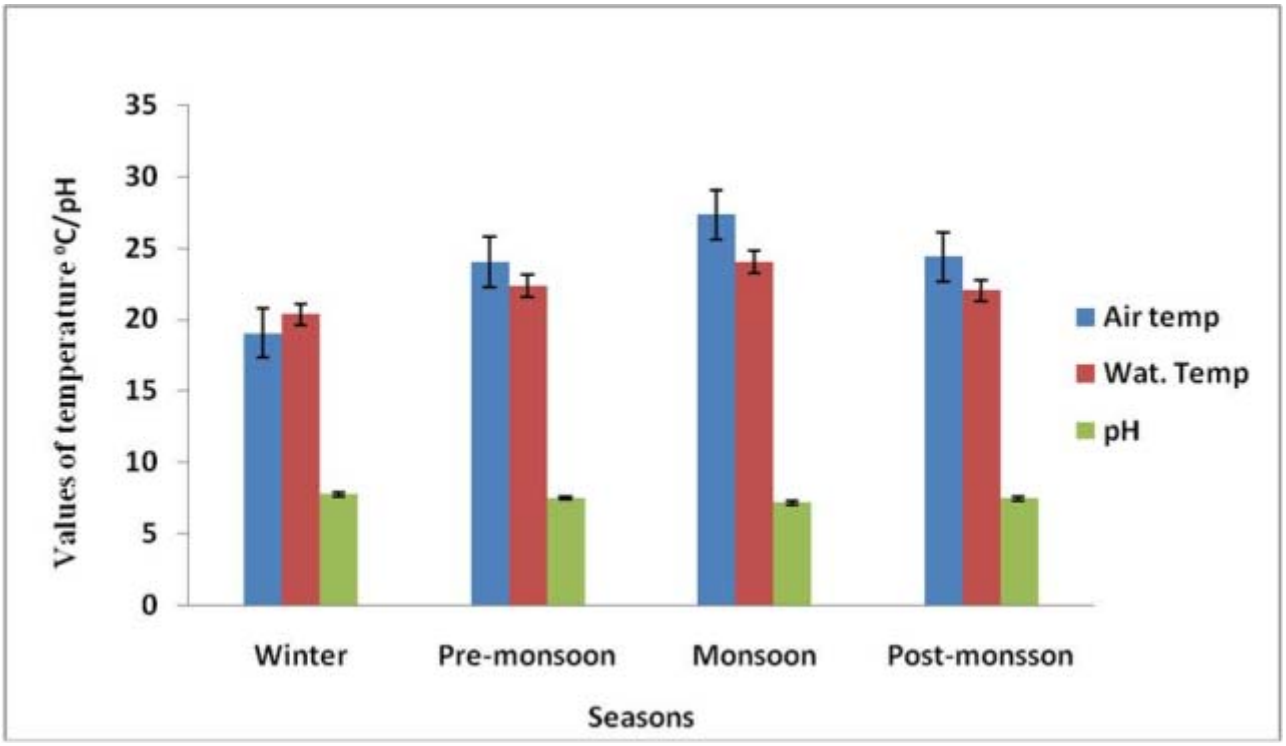

Figure 2. Seasonal trends of air and water temperature and pH

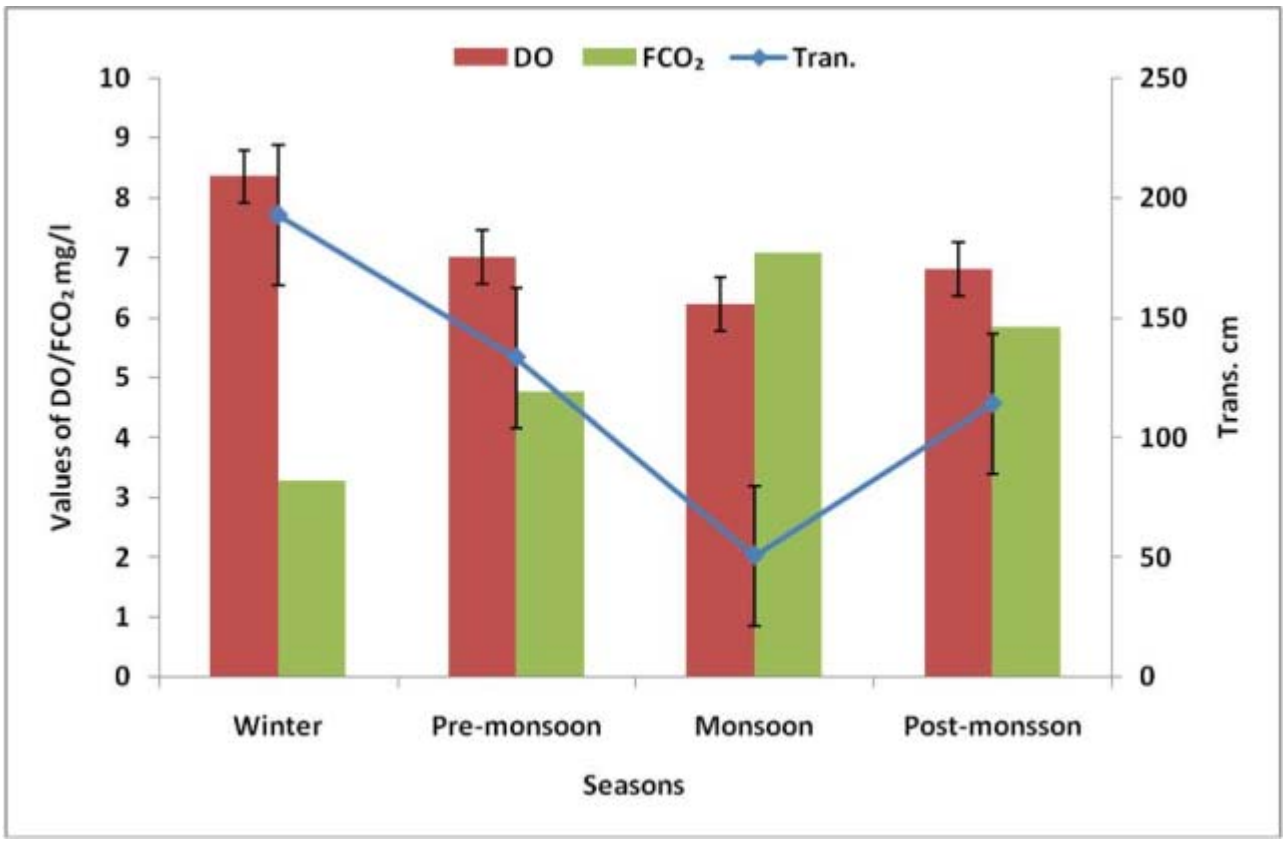

Figure 3. Seasonal trends of DO, FCO_2 and transmission

Table 1. Average variations physico-chemical parameters of Borsola beel during October 2016 - September 2018

Month	Temperature (°C)		pH	Transmission	DO	FCO_2	Alkalinity	TSS
TDS	Air	Water		(cm)	(mg/l)	(mg/l)	(mg/l)	(mg/l)
January	18±1.02	20±0.8	7.9±0.24	196± 10.24	9.46±0.38	2.86±0.14	160 ±16.62	98±8.20	118±9.58
February	20 ±0.35	21±0.82	7.7±0.26	210 ±9.34	8.24±0.45	3.08±0.46	145 ±17.26	108±12.52	155±15.12
March	23±0.32	21±0.82	7.6±0.18	162± 7.12	7.42 ±0.98	4.04 ±0.18	96±10.34	124±11.24	218±21.26
April	24±0.66	23±0.84	7.5±0.12	148± 7.18	7.62 ±0.84	3.26± 0.24	82± 9.08	155±12.72	272±22.12
May	25 ±1.02	23±1.42	7.4±0.18	90 ±5.42	6.02±0.58	6.96± 0.28	78 ±9.04	290±18.28	324±14.22
June	26 ±1.02	23±1.46	7.3±0.16	76 ±4.42	5.24±0.94	8.14±0.28	72± 7.92	340±22.12	325±16.26
July	27±1.67	24±1.32	7.1± ±0.1	41± 4.32	6.15±0.16	6.25±0.34	71 ± 6.22	380±29.25	380±22.20
August	29 ±1.24	25±1.24	7.0±0.14	35±4.22	7.29±0.45	6.82± 0.19	82 ±8.16	390±24.24	430±26.42
September	27 ±1.37	23±1.78	7.3 ±0.11	72 ±4.23	6.53±0.33	6.55± 0.14	100±11.43	270±15.04	310±17.83
October	25 ±1.8	22±0.42	7.5±0.22	126± 4.81	6.82±0.12	6.72 ±0.16	102 ±11.04	230±18.22	316±12.13
November	21 ±1.0	21±0.82	7.5±0.12	144± 5.24	7.08±0.22	4.24 ±0.38	128 ±12.20	126±18.42	268±11.12
December	19 ±0.26	20±0.92	7.6 ±0.14	172 ±6.33	7.35 ±0.42	3.92±0.15	156±14.46	120±12.08	126±12.22

The transparency values found to be in the range between 35±4.22 and 210±9.34 cm during August and February. The highest transparency was found in winter and that of lowest in monsoon months (Fig. 3). Lower transparency reduced light penetration in the water body that affected photosynthesis process of phytoplankton as well as reduced productivity of the beels.

Dissolved oxygen (DO)

Dissolved oxygen showed a distinct pattern of fluctuations round the year and it ranged between 5.24±0.94 and 9.46±0.38 mg/l. The highest value of DO recorded in January and its minimum in June. The minimum dissolved oxygen was recorded in monsoon and that of maximum in winter months (Fig. 3). The variations of DO depend on the primary production and mainly respiration of aquatic organisms present.

Free carbon dioxide (FCO_2)

The values of free carbon dioxide varied from 2.86±0.14 to 8.14±0.28 mg/l. The minimum value observed in January and that of maximum in June. The minimum value of FCO_2 was observed in winter and that of maximum in monsoon (Fig 3). The variation of FCO_2 was due to the absorption by plants for photosynthesis and due to the activity of other living organisms. Similar observations were also reported by several authors (Jhingran and Pathak 1987, Lahon 1983, Kar 2000, Dutta 2002). Further, Singh et al. (2009) recorded the FCO_2 between 2.4 and 12 mg/l from Maijan beel in Dibrugarh, Assam.

Total Alkalinity (TA)

Total Alkalinity ranged from 71±6.22 to 160±16.62 mg/l. The highest value of total alkalinity recorded in January and lowest value recorded during July. The highest value of TA was recorded in winter season and its lowest in monsoon season (Fig. 4). Alkalinity of water is its capacity to neutralize a strong acid and is normally due to the presence of bicarbonate, carbonate and hydroxide compound of calcium, sodium and potassium.

Total suspended solids (TSS)

Total suspended solids value ranged from 98±8.20 to 390±24.24 mg/l and being maximum during August and minimum during January. The higher

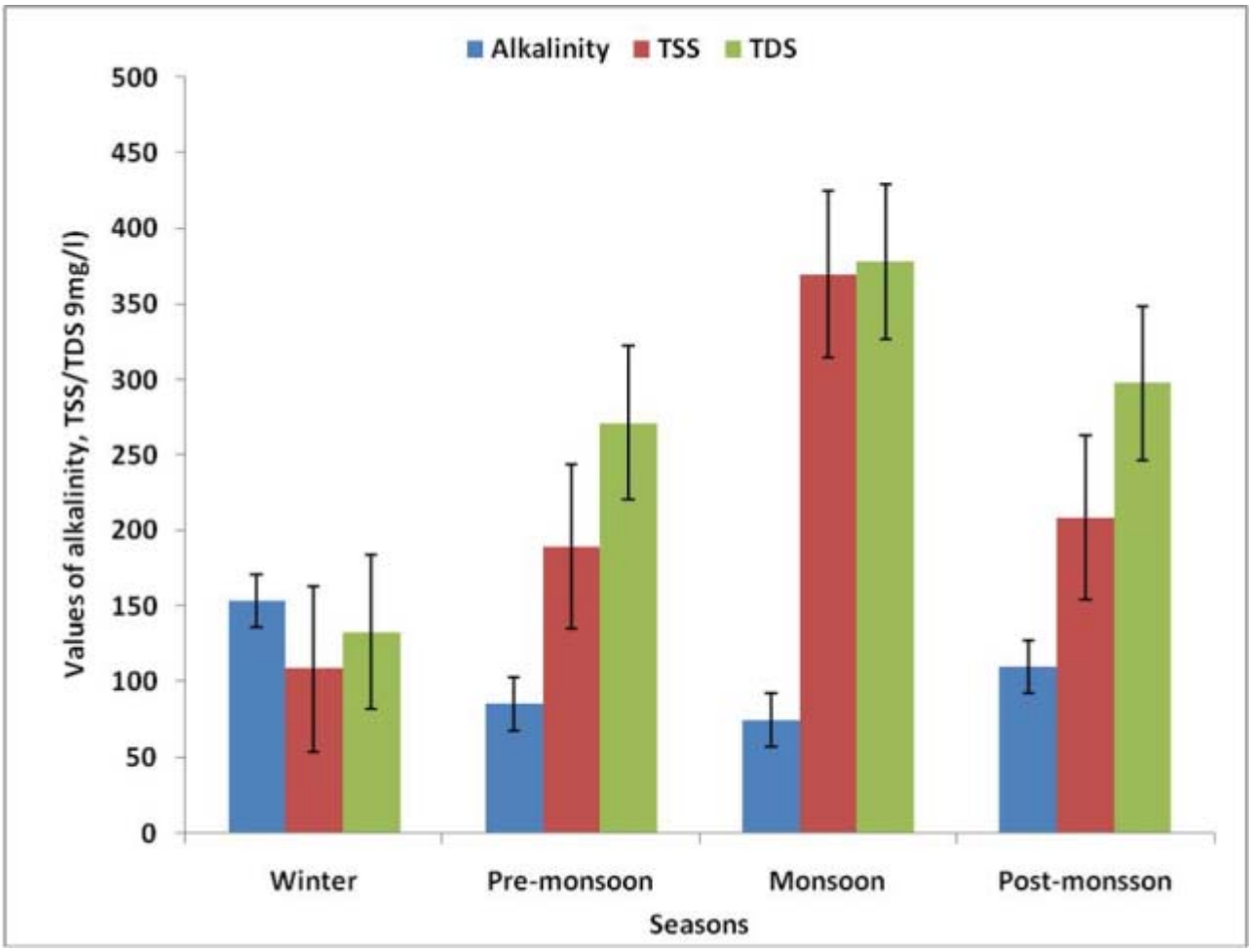

Figure 4. Seasonal variation in alkalinity, TSS and TDS

values were recorded in monsoon and that of lower in winter season, as being minimum in February and maximum in August (Fig. 4). The higher values were observed during monsoon might be due to surface run-off from the Brahmaputra River while lower during winter season due to the stagnant water. Total suspended solids are the materials in water that affect the transparency or light scattering of the water.

Total dissolved solids (TDS)

Total dissolved solids value was found to be between 118±9.58 and 430±26.42 mg/l. The lowest was recorded during January and that of its highest during August. The highest value was observed in monsoon and that of lowest in winter season (Fig. 4). Appreciable TDS values were observed in the sampling sites indicating low pollutants and other anthropogenic activities in and around the beels. Jena et al. (2013) pointed that TSS as well as TDS can be influenced by changes in pH.

From the above, it is clear that a slight seasonal variation in certain physico-chemical parameters of the beel water. Further, it reveal that no significant seasonal variations in physico-chemical parameters occur in beel and all the parameters are within approximate range (BIS 1982) and within the same range as reported earlier for other Indian lakes (Rasool et al. 2003, Kudari et al. 2004, Singh et al. 2009, Dakua et al. 2009). However, there is further investigation on the fish diversity and other water quality of this wetland as regular dilution of the beel water with the overflowing water from Brahmaputra River during monsoon months and vastly thick growth of water hyacinth present.

Authors' contributions: Saikia designed and collected the data and analyzed the data and prepared the manuscript. Biswas revised the manuscript.

Conflict of interest: The author(s) declare no competing interests.

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Received:17th June 2023
Accepted: 6th August 2023