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Impact of City Sewage on Selected Water Parameters of the Sacred Basistha River along Guwahati City and Deepor Beel, a Ramsar Wetland

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Abstract

City sewage from Guwahati is mainly carried by sacres Basistha river especially during monsoon season to utimately discharge it to Deepor beel, a Ramsar wetland. A rapid survey conducted during monsoon revealed that the water quality of the hilly river Basistha was strongly influenced by city sewage loading both from point and non-point sources. Total of nine water quality parameters viz. water temperature, water pH, specific conductivity, total alkalinity, total hardness, chloride and plant nutrients like available nitrate, phosphate and silicate were monitored. Most of the water parameters changed sharply along the river course. Water quality of the wetland had a similarity with the lower stretch of the river revealing the influence of the city sewage to this wetland.

Key words : Water quality, Basistha river, Deepor beel, City sewage, Water quality.

Guwahati, the capital city of the state of Assam is considered as the gateway of northeast India due to its unique location and well-developed connectivity with other parts of the country. The 264 sq km of Guwahati metropolitan area is densely populated with total population of 890,773 (based on 2001 census) with a population density of 3741. Drainage system of the city is mainly dependent on two small hilly streams viz. river Bharalu (the upstream part called Bahini) and river Basistha (Fig.1). Both of them originated from the hills of Meghalaya and pass through Guwahati city to provide natural drainage channels in the city area. River Basistha pass through southern part of the city and carries waste water to discharge into Deepor beel, a Ramsar wetland. During most of the period of the year, a significant portion of wastewater of Guwahati city is drained by Bharalu river to discharge directly to Brahmaputra river. However, increased water level in Brahmaputra during monsoon created back pressure to carry whole waste water of Guwahati city to Basistha river from Bharalu river through a link channel between two rivers called Marabharalu [locally called Kolanadi means black (water) river]. This link channel starts at Fatasil Bazar from Bharalu river joins with Basistha river at Kotahbari beside ISBT. This raw sewage discharge by Basistha river to Deepor beel during monsoon season makes the aquatic environment hazardous for native flora and fauna (1). Pollution of Bharalu river attracted some attention of researchers (2), but study on Basistha river is scanty except some trace metal study by Kakati and Bhattacharjya (3). Considering immense biological importance of Deepor beel which receives the major city waste water during monsoon through river Basistha, a rapid survey was conducted during monsoon to measure the changes of selected water parameters of the river as it passed through the city along with the water parameters of Deepor beel.

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Methods

Subsurface water of the Basistha river was collected for analysis of different water parameters. Water was collected from upper hilly station (RB_1), middle stretch (RB_2) where river just entered the city and lower stretch (RB_3) after receiving whole city waste and also from Deepor beel. Parameters like water temperature and pH were measured in the field while other parameters were analyzed after carrying to laboratory in the same day following standard methods (4).

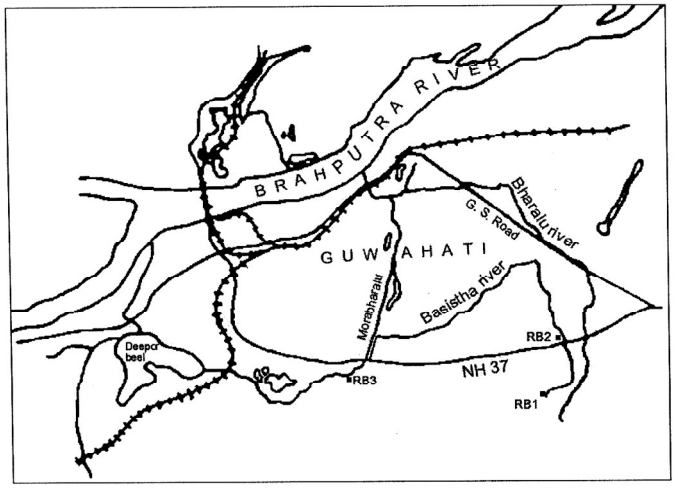


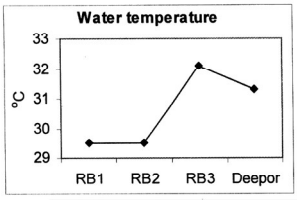
Figure 1. Sampling sites in river Basistha.

Results and Discussion

The water parameters which were monitored to understand the impact of city sewage on river Basistha and ultimately to Deepor beel, the Ramsar wetland were water temperature, water pH, specific conductivity, total alkalinity, total hardness, chloride and plant nutrients like available nitrate, phosphate and silicate. Most of the water parameters changed rapidly as the river passed through the city due to city sewage discharge both from point and non-point sources. Parameter wise discussion is given below.

Water Temperature

Water temperature is one of the key parameters governing metabolic activity of aquatic organism. Though solar radiation is the main controlling factor for water temperature, turbidity by plankton and silt particle, dissolved and suspended particulate organic carbon can also moderate water temperature. During this study it was observed that water temperatures of upper (RB_1) and middle stretch (RB_2) of the hilly river were much lower than that of the lower stretch (RB_3) of the river (Fig. 2). Absorption of solar radia-



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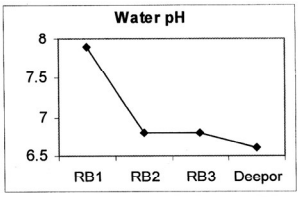

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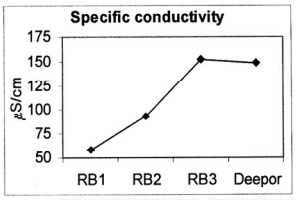

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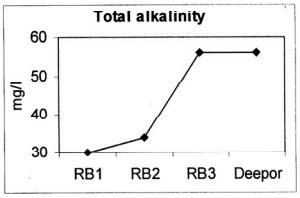
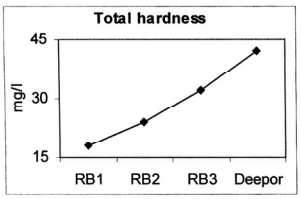


Fig. 5.

Figure 2. Variation in water temperature. **Figure. 3.** Variation in water pH. **Figure 4.** Variation in sp. conductivity. **Figure 5.** Variation in total alkalinity.



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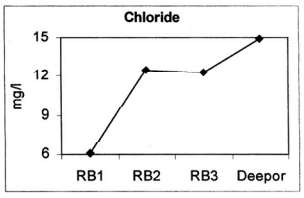

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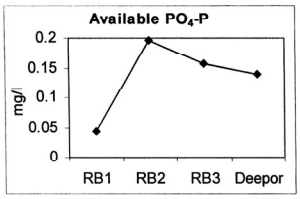

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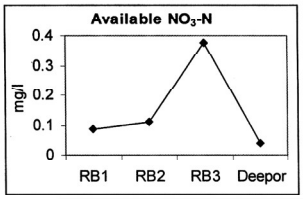

Fig. 9.

Figure 6. Variation in total hardness. **Figure 7.** Variation in chloride. **Figure 8.** Variation in available PO_4-P. **Figure 9.** Variation in available NO_3-N.

tion by higher amount of organic load in water at RB_3 and Deepor beel might have a role in higher water temperature at those two sites. A difference of 2.6 C was noted between RB_2 and RB_3 during the study.

Water pH

Water pH was reported as one of the key factors to control survival and growth of aquatic organism. The water of upper stretch (RB_1) of the Basistha river was alkaline (pH 7.9) as observed in water of river Brahmaputra (pH 7.4) during the same period (Fig. 3). However, organic load by city waste discharge in middle and lower stretch of the river generated lot of free CO_2 and organic acids from microbial respiration to turn water into acidic (pH 6.8) at those stretches of the river. Water of Deepor beel was also quite acidic with a pH of 6.6 during the study.

Specific Conductivity

Specific conductivity of water indicates amount of dissolved ions in it. It also reflects mineralization rate of suspended and deposited organic matter. City sewage discharge brought lot of ions to increase specific conductivity sharply from upper stretch (RB_1, 59 μ S/cm) to lower stretch (152 μS/cm) (Fig. 4). However, specific conductivity of water of Deepor beel was slightly less (149 μS/cm) probably due to utilization of ions by aquatic vegetation present in the beel.

Total Alkalinity

Water with total alkalinity of 0-50 mg/liter is usually less productive as compared to water with total alkalinity of 50-200 mg/liter as carbon availability for photosynthesis of aquatic plant communities depends upon total alkalinity of water especially in absence of free CO_2. Total alkalinity increased from 30 mg/liter in upper in stretch to 56 mg/liter in lower stretch of the river and the water of the Deepor beel observed same total alkalinity value of the lower stretch revealing the impact of the river on the wetland (Fig. 5).

Total Hardness

Total hardness (TH) of water refers to the concentration of divalent metal ions in it, expressed as mg/liter of equivalent $CaCO_3$, which is usually related to total alkalinity as the anions of alkalinity and the cations of hardness are normally derived from the solution of carbonate minerals (Fig. 6.) During the study period, water of all the sampling stations was soft and varied between 18 to 42 mg/liter. However, hardness of water increased from upper stretch (18 mg/liter) to lower stretch (32 mg/liter) of the river. Hardness of water of Deepor beel (42 mg/liter) was even higher than that of the river water.

Chloride

Chloride content of water is not only an index of eutrophication but also of pollution caused by cattle, sewage and other wastes especially where no possibility of salt water intrusion takes place. It was said that even a moderate level of chloride indicats sufficient water pollution. Chloride content of middle (12.51 mg/liter) and lower stretch (12.26 mg/liter) of the river were double than that of upper stretch (6.13 mg/liter) indicating the impact of city sewage on the river (Fig. 7) Water of Deepor beel contained more chloride (14.88 mg/liter) than that in river water.

Available PO_4-P

Available phosphorus content in water is often considered to be the most critical single element in the maintenance of aquatic productivity. At upper stretch of river Basistha, available phosphate content was low (0.044 mg/liter) (Fig. 8). However, this increased sharply in middle stretch of the river with a value of 0.196 mg/liter. Slightly lower available phosphorus in lower stretch of the river as well as in Deepor beel might be due to its assimilation by higher density of micro-organisms as well as aquatic vegetation in beel.

Available NO_3-N

Nitrogen being a major constituent of protein occupies a predominant place in productivity of aquatic ecosystem. A significantly high value of nitrate (0.38 mg/liter) was recorded in lower stretch of river Basistha as compared to upper stretch (0.09 mg/liter) and middle stretch (0.11mg/liter) of the river revealing the impact of Marabharalu channel carrying city waste to Basistha river (Fig 9). Interesting available nitrate content in Deepor beel was quite low (0.08 mg/liter) which might be due to higher assimilation by aquatic hydrophytes.

Available SiO_3-Si

Silicon, structural constituent of diatoms, remains as silicate form in natural waters. Available silicate-Si remained quite high during the entire stretch of the river and varied between 10.19 to 10.63 mg/liter (Fig. 10). The high value of silicate-Si may be attributed to flowing condition of the river water caused by washing from catchment areas. However, in Deepor beel it reduced drastically with a value of 7.24 mg/liter. This may be due to partial lentic nature of the beel water and utilization by high density of periphytic diatom associated with submerged hydrophytes.

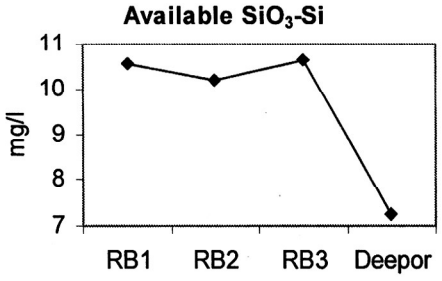

Figure 10. Variation in available SiO_3-Si.

Conclusion

From this rapid survey it was quite evident that city sewage can change total character of a river water to influence its aquatic flora and fauna. Deepor beel, the famous Ramsar wetland was also influenced by it as the river ultimately discharges in the wetland. The study has its importance as Deepor beel is a biological hotspot harboring a wide variety of hydrophytes, birds, mammals, fish, reptiles and amphibian species (5).

References

1. Deka S. K. and D. C. Goswami. 1992. Hydrology, sediment characteristics and depositional environment of wetlands : a case study of Deepor beel, Assam. *J. Assam Sci. Soc.* 34 : 62—84.
2. Sarma D., G. Chetri, J. Kalita and A. Dutta. 1994. Pollution status of the Bharalu river with special reference to physico-chemical parameters. *J. Fresh. Biol.* 6 : 209—213.
3 Kakati G. N. and K. G. Bhattacharjya. 1990. Trace metals in surface water of greater Guwahati. *Indian J. Environ. Helth* 32 : 276—279.
4. APHA, AWWA and WEF. 1998. *Standard methods for the examination of water and wastewater.* 20th edition. Am. Pub. Helth. Assoc., Am. Water Works Assoc. and Water Environ. Fed., NY, USA.
5. Gogoi R. 2007. Conserving deepar beel Ramsar site, Assam. *Curr. Sci.* 93 : 445—446.