

Studies on Physico-Chemical Parameters of Fish Inhabiting Four Water Bodies in the Vicinity of Kokrajhar, Btad, Assam

**Sharmistha Chakraborty,^{1,2*} Mehdi Al Kausor,² Arvind Kumar Goyal,¹
Amit Kumar Basumatary,¹ and Birendra Kumar Brahma¹**

¹*Bamboo Technology, Department of Biotechnology, Bodoland University,
Kokrajhar, BTAD, Assam, India*

²*Department of Chemistry, Science College, Kokrajhar- 783370, BTAD, Assam, India*

**Corresponding author*

Abstract

Kokrajhar district of Assam is bestowed with unique wetland eco-systems which serve as an important catchment for the ground water resources. The Diplai beel, Haloidol beel, Gour beel and Gaurang river wetlands are nourished by the perennial streams that originate from the hill tracts in and around the district. At the same time they are recharged by the flood waters of river Brahmaputra. These water bodies serve as important breeding ground and nurseries for numerous fish population. The study was carried out to evaluate the physico-chemical parameters of study of these wetlands viz- Diplai beel, Haloidol beel, Gour beel and Gaurang river. In this paper we discuss temperature, pH, Total Dissolved Solids (TDS), total alkalinity, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), turbidity and salinity. Degradation in the wetland ecosystem can change water bird species composition, particularly breeding fauna, by influencing habitat use for nesting and breeding activities. The results of the study inferred that proper emphasis must be taken to improve the quality of water to ensure the healthy environment enriched with water bodies with high nutritional demand.

Keywords: Diplai beel; Gaurang River; Assam; Kokrajhar; Physico-chemical parameters; TDS; Alkalinity; BOD; COD; DO; Turbidity; Salinity

INTRODUCTION

Wetlands are one of the most important natural resources because of the many environmental and economic benefits that they provide us. It is due of these properties they are often referred to as biological supermarkets [1]. Cowardin *et al* [2] defined wetlands as “lands transitional between terrestrial and aquatic ecosystems where the water table is usually at or near the surface or the land is covered by shallow water”. Wetland plays a vital role since they are highly productive and possesses genetically diversified ecosystems. In addition to these they are also associated with stabilization of the climate. Despite the invaluable benefits the wetlands provide, they are enlisted in the most threatened habitats globally [3].

The beautiful Diplai Beel flank the world's only Golden Langur Sanctuary *viz.* Chakrashila Wildlife Sanctuary. It is a large water body which is not only a storehouse of valuable flora and fauna specially fishes but also the prime wintering habitat for a large number of migratory birds [4]. The Haloidol beel, about 3-4 km from Kokrajhar town is maintained by the Department of fisheries, Government of Assam for pisciculture. The Gour beel is a natural water body about 2 km from Kokrajhar town. This beel is rich in variety of small food fishes. The Gaurang River originating from Bhutan traverses in Kokrajhar District of BTAD, Assam. The Gaurang river houses diverse fish species consumed by the local tribes of the region.

Review of literature revealed that though these water bodies have great biological and environmental importance but till date no studies have been conducted to access the water quality. Thus keeping this in mind the present study was taken to study the physico-chemical properties of the water of these water bodies. This study will help us to understand the status of water quality and also provide ample ideas to undertake subsequent management measurements.

MATERIALS AND METHODS

Study area

The investigation was undertaken to evaluate the quantitative report of the status of the surface water of major fish inhabiting water bodies around Kokrajhar, BTAD, Assam.

Collection, pre-treatment and preservation of samples

Water samples were collected randomly from three beels and one river surrounding the Kokrajhar town during January-March of 2016. They were stored in pre-cleaned 250 ml polyethylene bottles and BOD bottles in triplicates and brought to laboratory for further analysis. The samples were collected from 12-15 cm beneath the water surface. All the precautionary measures were adopted during sampling.

Physico-chemical analysis

The collected samples were experimented to analyse different physico-chemical parameters such as pH, temperature, TDS, alkalinity, BOD, COD, DO, turbidity and salinity by following the standard protocols as per APHA 22nd Edition [5]. Samples were analyzed immediately for parameters like temperature, which need to be determined instantly.

A quality controlled procedure was steadily maintained throughout. The instruments were recalibrated. All chemicals and reagents used were of analytical grade. For all solutions distilled water was used. The standard solutions were made by diluting the stock solution.

Table: 1 Physicochemical parameters of the water samples

Sl No	Test Parameters	Gaurang River	Gour Beel	Diplai Beel	Haloidal Beel
1	pH value	7.1	6.8	7.0	7.3
2	Temperature (°C)	24	23	24	23
3	Total Dissolved Solid (TDS) (mg/L)	48	346	16.0	50.0
4	Dissolve Oxygen (DO) (mg/L)	7.65	6.21	7.46	7.65
5	Biochemical Oxygen Demand (BOD) (mg/L)	1.6	2.4	1.2	1.5
6	Chemical Oxygen Demand (COD) (mg/L)	5.76	9.60	4.80	5.76
7	Alkalinity (mg/L)	12	14.0	4.0	6.0
8	Turbidity (Nephelometric Turbiditu Unit, NTU)	7.7	130.0	5.0	24.0
9	Salinity (Practical Salinity Unit, PSU)	0.05	0.32	0.02	0.05
10	Viscosity (mm ² /S)	0.9118	0.9359	0.9125	0.9328

(1NTU= 1/3 mg/L & 1 PSU= 1g/Kg)

RESULTS AND DISCUSSION

Determination of pH

In the above experiment, it was evident that the pH ranged from 6.8 to 7.3 (Fig.1). Maximum pH was recorded in Haloidal beel where as the minimum was found in Gour Beel. Choudhury *et al* [6] reported a range of pH in between 7.0 to 8.3. Shrivastava *et al.* [7] documented the range of the same in between 6.93 to 7.55 when studied the physico-chemical status of different surface waters of pond water of Surguja District Chattisgarh, India. Sharma *et al* [8] stated that in India, many small confined water pockets are particularly alkaline in nature. This was justified in our present study. The pH values of all the water samples showed alkaline trend. Islam *et al.*[9] reported that this pH has been noted to be productive and thus suitable for pisciculture.

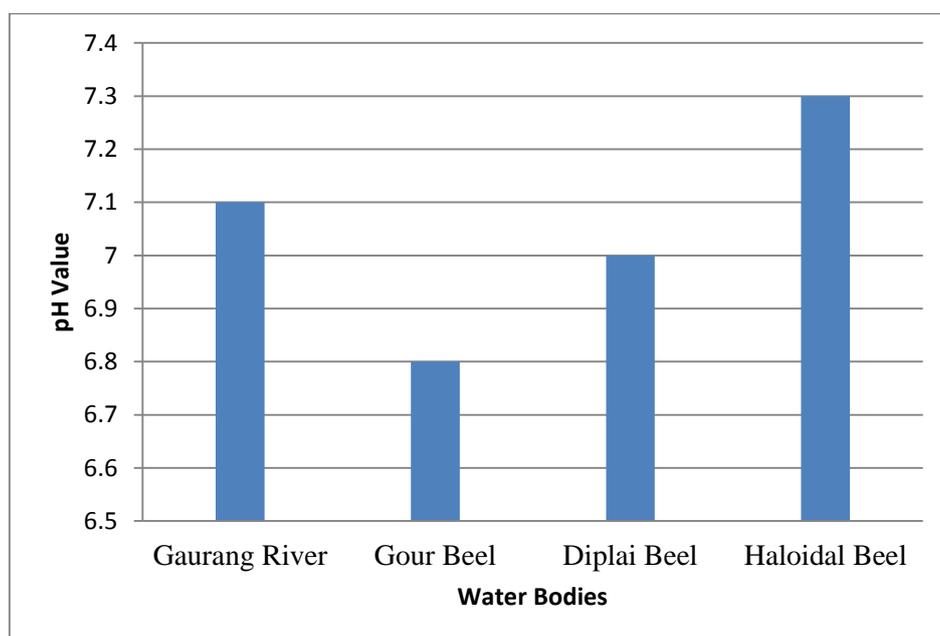


Fig.1 Variations of pH in different water bodies

Measurement of temperature

Temperature determines the extent of hotness of any material. It influences the physical and chemical characteristics of water and also affects the aquatic lives in it. A prior knowledge of temperature of the water body is essential for fish culture. According to Hemlata *et al.*[10] the Guidelines for water Quality Management for fish culture in Tripura the optimum temperature is 24°C - 30°C. So far the current work is concerned the least variation of temperature from 23°C-24°C was recorded which is well within the guidelines limit (Fig. 2). Maximum temperature was recorded in Gaurang river and Diplai beel.

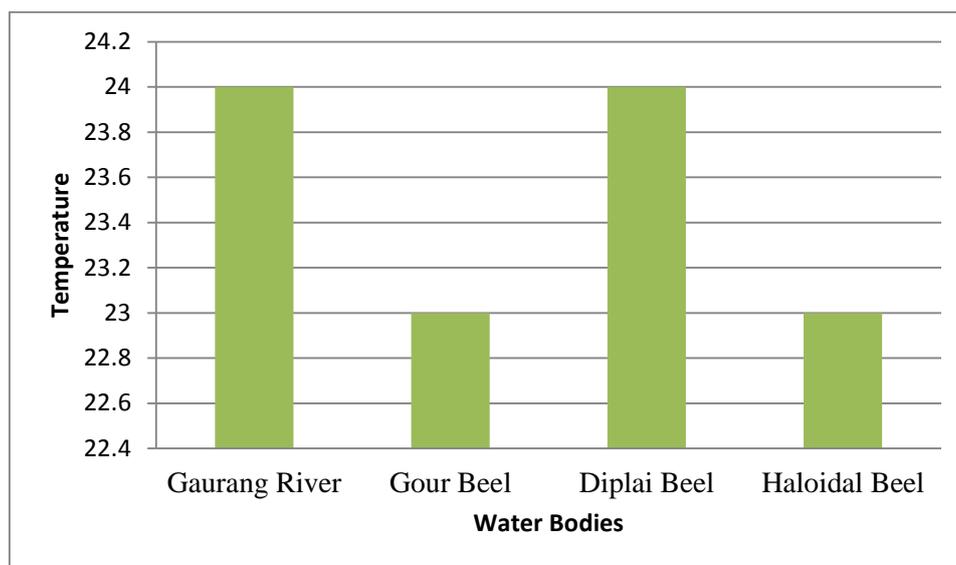


Fig.2 Variations of Temperature in different water bodies

Measurement of total dissolved solid (TDS)

In the current study the TDS values ranged from 16 mg/L to 346 mg/L (Fig. 3). Maximum TDS value was found in Gour beel and the minimum was in Diplai beel. High TDS values imply the increased nutrient status of water body which leads to eutrophication of aquatic bodies as reported by Swarnalatha *et al.* [11] & Singh *et al.* [12]. Yadav *et al.* [13] reported that the water having more than 500mg/L of TDS values are not recommended for drinking purpose. The current work revealed that the selected water samples may be used for drinking by the local communities.

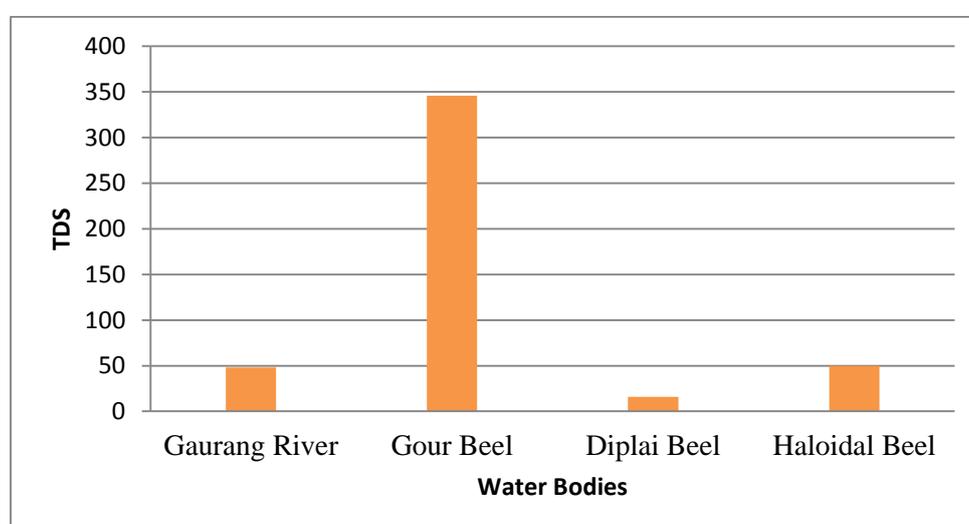


Fig.3 Variations of TDS in different water bodies

Determination of Dissolved Oxygen (DO)

Dissolved oxygen is very important component to break down man-made pollutants. According to Dixit *et al.* [14] the presence of DO is vitally essential to maintain the higher forms of lives balancing different pollutions which make the aquatic bodies healthy. Quantification of DO values stands for the key test of water pollution. In the present study dissolved oxygen ranged from 6.21 to 7.65mg/L (Fig. 4). Maximum DO was recorded in Gaurang river and Haloidal beel i.e. 7.65 mg/L. Similar observations were also made by Bhavimani and Puttaiah 2014. According to Adakole [15] the concentration of DO not less than 5.0 mg/L is suitable for aquatic lives. Thus all the sites are good for aquatic life in general and fishes in particular.

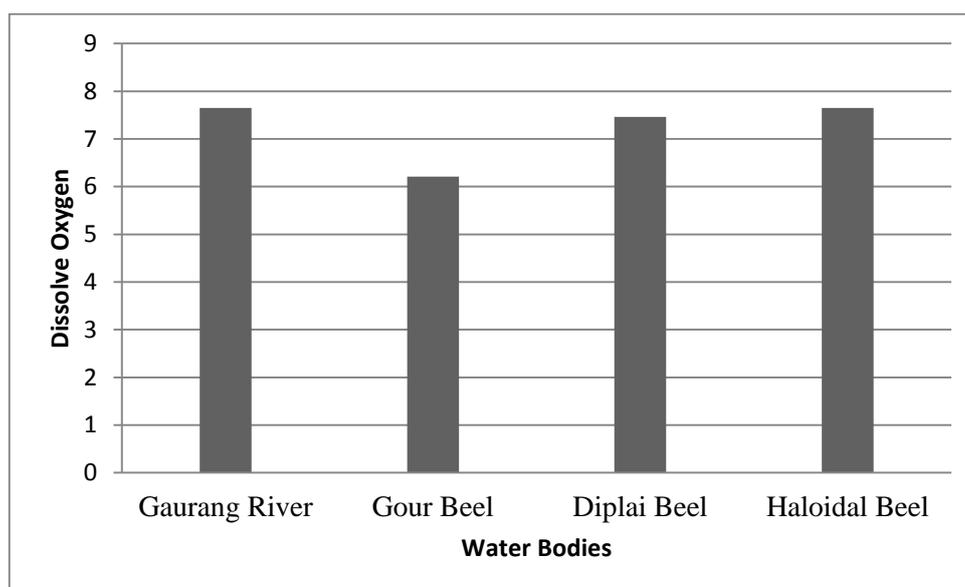


Fig.4 Variations of Dissolve Oxygen in different water bodies

Determination of Biological Oxygen Demand (BOD)

BOD is dissolved oxygen required by micro organism for aerobic decomposition of organic matter present in water. Jain *et al.* [16] have considered BOD as an important parameter in aquatic ecosystem to establish the status of pollution. In the present study BOD values ranged from 1.2 to 2.4 mg/L (Fig. 5). Maximum BOD was found in Gour Beel. The least value was recorded in Diplai beel. The BOD of unpolluted water is less than 1.00 mg/L ,moderately polluted water 2-9 mg/L while heavily polluted water have BOD values more than 10 mg/L (Adakole, 2000). The present study revealed the water samples being moderately polluted.

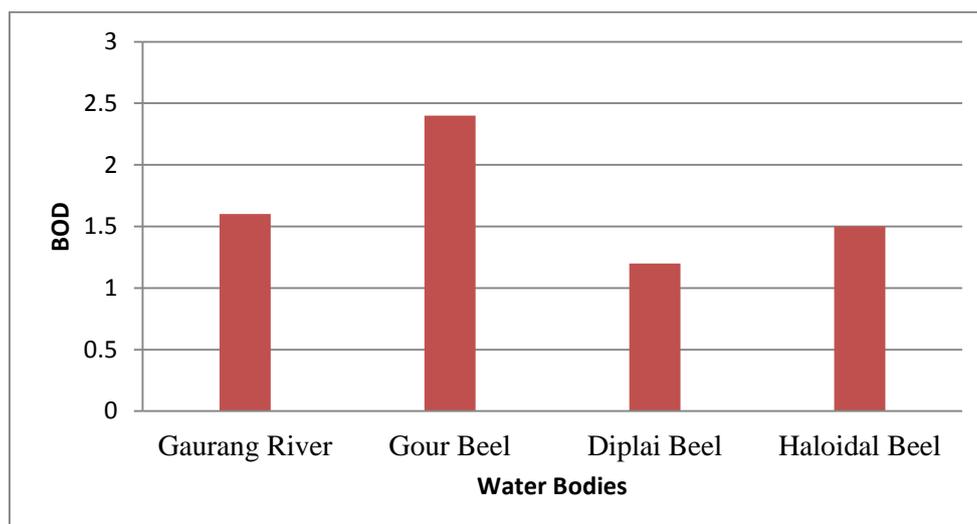


Fig.5 Variations of BOD in different water bodies

Determination of Chemical Oxygen Demand (COD)

The value of COD ranged from 4.8 mg/L to 9.60 mg/L (Fig. 6). COD determines the oxygen required for chemical oxidation of all organic matter, biodegradable and non-biodegradable by a strong chemical oxidant as reported by Mahananda *et al.*[17]. The optimal COD value for fish culture is fixed below 50 mg/L as per the Guidelines for water Quality Management for fish culture in Tripura (Hemlata *et al.*, 2014). In the present study the COD value of all the three aquatic system were well within the limit and was found to be suitable for pisciculture.

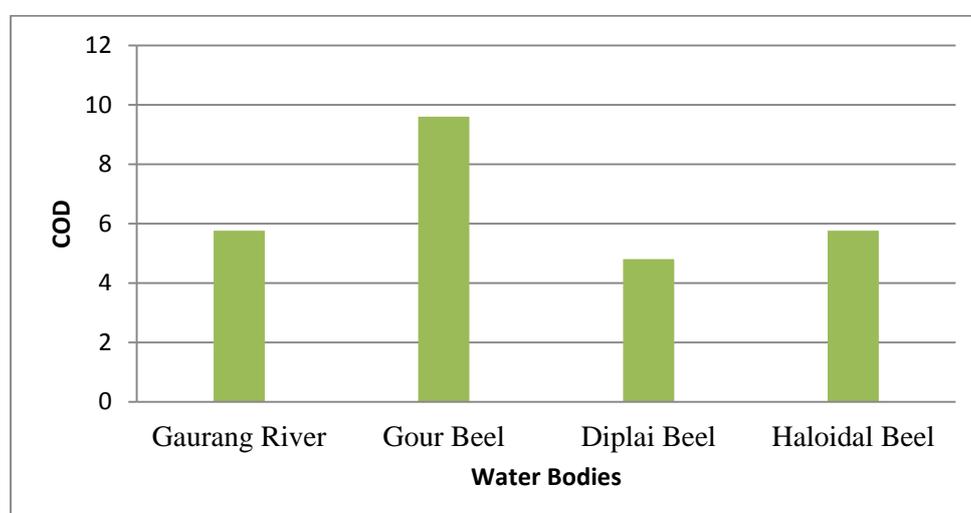


Fig.6 Variations of COD in different water bodies

Determination of total alkalinity

Total alkalinity of the water samples ranged from 4-14 mg/L (Fig. 7). Highest alkalinity was recorded in Gour Beel and the lowest in Diplai beel. According to Yadav *et al.*[18], alkalinity in most natural water estimates the amount of carbonates and bicarbonates whose salts get hydrolysed in solution and produced hydroxyl ions. It is used as a measure of productivity [19].

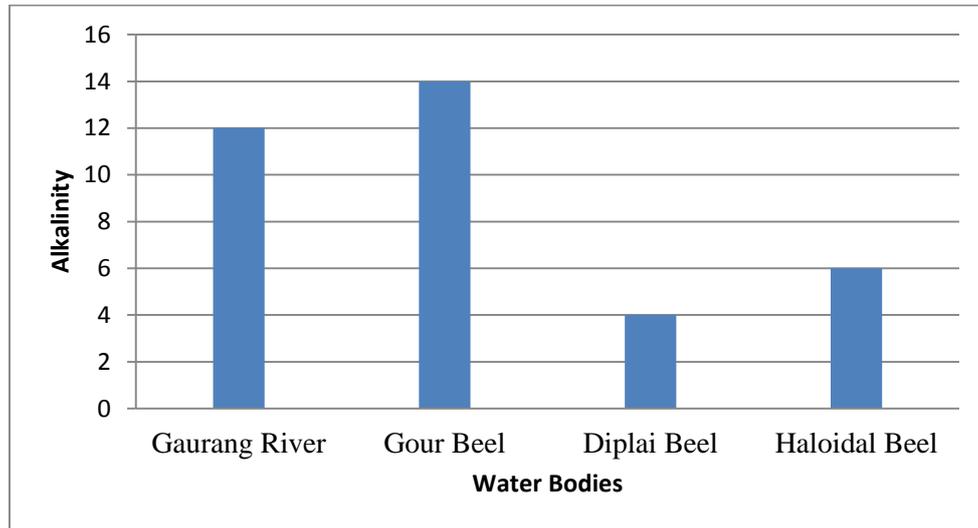


Fig.7 Variations of Alkalinity in different water bodies

Determination of turbidity

Turbidity values of the water samples in the present study ranged from 5 NTU -130 NTU (Fig. 8). Turbid water is generally originated from aesthetic problem. It is generated by overflow from disturbed areas neighbouring the pond or bottom dwelling fish and muskrats. Muddy water usually disappears with the growth of vegetation around the pond. In the current study all water samples have the turbidity level within the permissible range of World Health Organization. As per Zweigh [20] turbidity of 20-30 is apt for pisciculture. Thus the turbidity of Halwadol beel (24 NTU) was more suitable for fish culture compared to the other three.

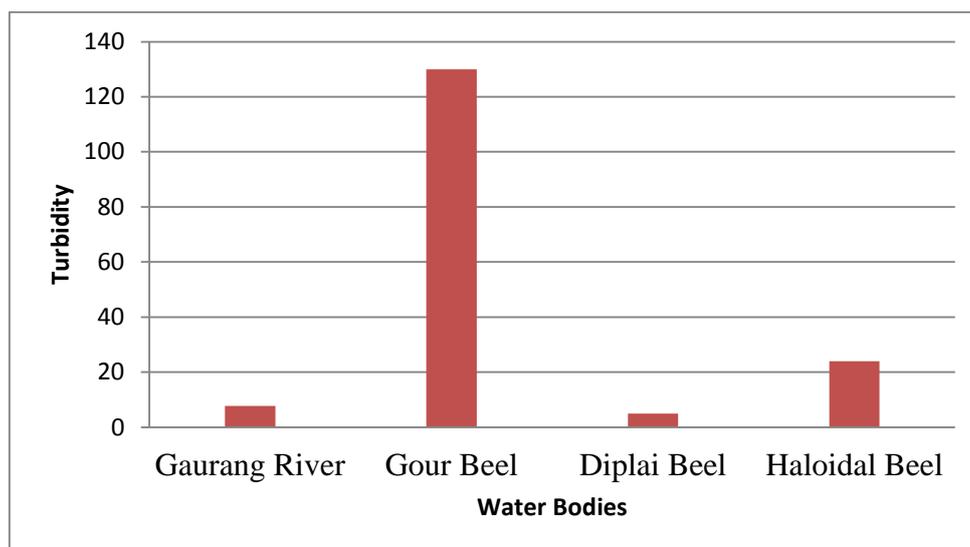


Fig.8 Variations of Turbidity in different water bodies

Determination of salinity

Salinity of the studied water samples ranged from 0.02-0.32 PSU (Fig. 9). Salinity implies the measure of saltiness of a water body. Low salinity implies the sites have more dissolved oxygen which is required for the aquatic life.

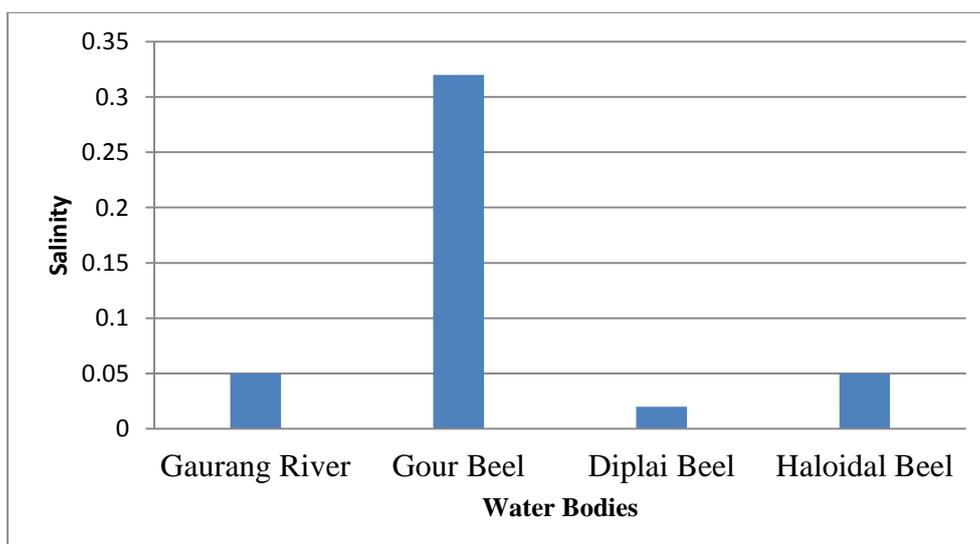


Fig.9 Variations of Salinity in different water bodies

Determination of viscosity

Viscosity of the studied water bodies ranged from 0.9118-0.9359 mm²/S (Fig. 10). The highest value was recorded in Gour Beel and the lowest in Gaurang river.

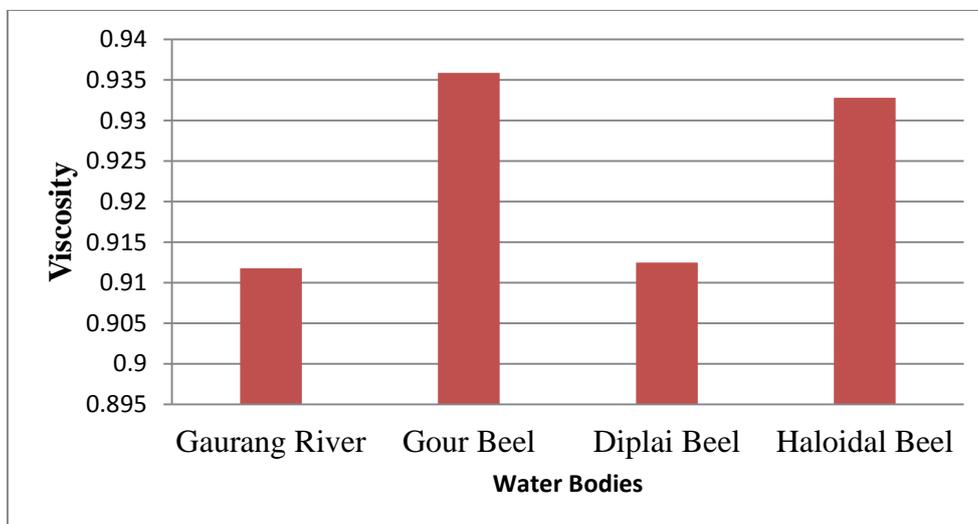


Fig.10 Variations of Viscosity in different water bodies

CONCLUSION

From the above experimentation it was revealed that all the water samples from different habitat were safe for drinking, bathing as well as other domestic uses. These water bodies can be treated as secured place for several aquatic organisms including fishes. However, proper care should be taken for the maintenance of the water quality of the studied aquatic bodies.

REFERENCES

- [1] W.J. Mitsch, J.G. Gosselink, *Wetlands*. 2nd edition. Van Nostrand-Reinhold, New York, 1993.
- [2] L. M., Cowardin, V. Carter, F.C. Golet, E.T. La Roe, *Classification of Wetlands and Deep water Habitats of the United States*, U.S. Fish and Wildlife Services, Washington, DC.US, 1979, 103p.
- [3] A. Sarkar, B. Upadhyay, *Assessment of the Variations in Physico-Chemical Characteristics of Water Quality of the Wetlands in District Mainpuri (UP) India*, *International Journal of Geology, Earth and Environmental Sciences*, 3,1, 2013, pp. 95-103.
- [4] P. Brahma, *Baukhungri: telling tales*, The Bodoland Guardian. Bhakti Publication, BTAD, Assam, India, 2013, 2 p.

- [5] APHA-AWWA-WPCF. *Standard methods for the examination of water and wastewater*. American Public Health Association (APHA), 22nd edition. Washington. DC. 2012. 201-204p.
- [6] P. Choudhury, N.K. Dhakad, R. Jain R, *Studies on Physico-chemical Parameters of Bilawali Tank, Indore (M.P)India*, IOSR Journal Of Environmental Science, Toxicology and Food Technology, 8,1, 2014, pp. 37-40.
- [7] S. Shrivastava, V.K. Kanungo, *Physico-chemical Analysis of pond water of Surguja District Chattisgarh,India*, International Journal Of Herbal Medicine,1,4, 2013, pp. 35-43.
- [8] M.S. Sharma, L.L. Sharma, V.S. Durve, *Eutrophication of the lake Pichhola in Udaipur, Rajasthan*. Poll Research, 1984, pp. 39-44.
- [9] M. Islam, A.M. Ahmed, B. Barman. *Studies on physio-chemical properties of water in some selected sites of Deepor Beel (Ramsar site), Assam, India*. The Clarion, 3, 2, 2014, pp. 25-32.
- [10] B. Hemalatha, E.T. Puttaiah, *Fish Culture and Physico-chemical Characteristics of Madikoppa Pond, Dharwad Tq/Dist, Karnatak*, Hydrology Current Research, 5,1, 2014, pp. 162.
- [11] N. Swaranlatha, A.N. Rao, *Ecological studies of Banjara lake with reference to water pollution*. Journal of Environmental Biology, 19, 2, 1998, pp.179-186.
- [12] R.P. Singh, P. Mathur, *Investigation of variations in physico-chemical characteristics of a fresh water reservoir of Ajmer city, Rajasthan*. Indian Journal of Environmental Sciences, 9, 1, 2005, pp.57-61.
- [13] K.K. Yadav, N. Gupta, V. Kumar, S. Arya, D. Singh, *Physico-chemical analysis of selected ground water samples of Agra city, India*, Recent Research in Science and Technology, 4, 11. 2012, pp. 51-54.
- [14] A.K. Dixit, *Study of physico-chemical parameters of different pond water of Bilaspur District, Chhattishgarh, India*, Environmental Skeptics and Critics, 4, 3, 2015, pp.89.
- [15] J.A. Adakole, *The effects of domestic, agriculture 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, 2000, 256p.
- [16] Y. Jain, S.K. Dhamija, *Studies on a polluted lentic water body of Jabalpur with special reference to its physico chemical and biological parameters*, Journal of Environment and Pollution, 7, 2, 2000, pp. 83-87.
- [17] M.R. Mahananda, B.P. Mohanty, N.R. Behera, *Physico-chemical analysis of surface and ground water of Bargarh District, Orissa, India*, International

Journal of Research and Reviews in Applied Sciences, 2, 3, 2010, pp. 284-295.

- [18] P. Yadav, V.K.Yadav, A.K. Yadav, P.K. Khare, *Physico-chemical characteristics of a fresh water pond of Orai, U.P., Central India*, Octa Journal of Biosciences, 1, 2, 2013, pp. 177-184.
- [19] S.B. Hulyal, B.B. Kaliwal, *Seasonal variations in physico-chemical characteristics of Almatti reservoir of Bijapur district, Karnataka State*, International Journal of Environmental Protection, 1, 1, 2011, pp. 58-67.
- [20] R.D. Zweigh, *Evolving water quality in a common carp and blue tilapia high production pond*, Hydrobiologia, 171, 1989, pp. 11-21.