How to Cite:
Das, J., & Das, M. (2022). Comparative analysis of bloom phytoplankton community composition and environmental factors in selected lentic ecosystems of Assam, India. *International Journal of Health Sciences*, *6*(S4), 5298–5314.
https://doi.org/10.53730/ijhs.v6nS4.10079

Comparative analysis of bloom phytoplankton community composition and environmental factors in selected lentic ecosystems of Assam, India

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***Abstract*---**Limnology is the study of the aquatic system. The current research focuses on the physical, chemical, and biological properties of Bomani *beel* and Garjan *beel* in the Kampur district. The study looked into the existence of phytoplankton and compared it to two different *beels*. The community of plankton changes the water quality based on the parameters. The study looked at 12 water quality characteristics, as well as algae weight analysis and statistical analysis. There are no significant differences in temperature, pH, alkalinity, hardness, turbidity, or other chemical properties. The chlorophyll-a varies significantly; for example, in the winter, the Bomani *beel* has 10.232 and the Garjan *beel* has 7.312. Both *beels* have a Mesotrophic trophic state index. As a result, it is critical to raise public awareness and develop policy strategies for the conservation of these natural resources.

***Keywords*---**beel, algae, phytoplankton, water quality, ecosystem.

Introduction

Wetlands are areas of shallow water on the earth's surface. Assam's Digaru and Kalong river basins contain these natural water bodies known as *beels*. *Beels* play an important role in preserving environmental quality (Kim et al., 2020). Wetlands include swamps, lagoons, and other bodies of water. Wetlands have played an important role in the evolution of landscapes throughout history (Kumar et al.,

Manuscript submitted: 27 March 2022, Manuscript revised: 18 May 2022, Accepted for publication: 9 June 2022

2020). Beels are formed as a result of river action. During the monsoon season, entire areas of wetlands flood. These *beels* live in a variety of flora and fauna habitats. Wetlands are connected by river channels and occur as a result of flooding (Kumar et al., 2018). Seasonal or perennial *beels* can be found. The depth and size of *beels* are used to classify them. The maximum depth is 10 meters, and the total area is more than 500 hectares. The interaction of physical, chemical, and biological processes complicates the ecosystem in water bodies. Assam is endowed with a variety of wetlands that provide people with opportunities for fishing, agriculture, and irrigation. Unfortunately, as the population grows, so does the dumping of solid and liquid waste, poaching, and the exploration of resources through engineering structures. These wetlands contribute to improved water quality, flood control, increased groundwater levels, and other benefits. River regulation in India has undergone significant changes as a result of seasonal changes in flooding patterns. These, in turn, have an impact on the floodplain and its plant community. The changes in the faunal community are caused by changes in the quality of water in the floodplain. Fish and primary production suffers from a lack of nutrition (Ziauddin, 2021). Wetlands near rivers, for example, control phytoplankton productivity, which is the foundation of the trophic chain and indicates water quality. These are typically influenced by nitrogen and phosphorus concentrations (Narchonai et al., 2019). Water quality monitoring is carried out by several environmental institutes (Adloff et al., 2018). Water is essential for life's sustenance. Water is essential to life. Water bodies are divided into two types: lentic-standing water and lotic-running water. The soil in wetlands remains saturated. It contains a significant amount of substance among the standing water. Wetlands cover approximately 6% of the earth's surface. Many wetlands in Assam are unregistered and are managed by both private and public bodies (Kar, 2019). An increase in anthropogenic loads creates an unfavorable situation that destroys the natural cycle. Water quality variables include pH, oxygen, temperature, and so on (Zhang et al., 2019). Many scientists have looked into the physio-chemical parameters. However, investigating specific *beel* for seasonal changes remains challenging (Bera, 2021). Cyanobacteria are the first organisms to produce oxygen. *Microcystis*, for example, regulates density by accumulating carbohydrates (Christensen et al., 2019). This enables us to comprehend the formation of blooms at the water's surface. Human and agricultural activities reduce bloom formation in bodies of water, increasing toxic products (Kashyap, 2019). The current study focuses on Bomani and Garjan *beel*, which are located in the Kamrup district and cover an area of 22.75 hectares. Bomani is a large natural water body that is deteriorating day by day as a result of human activity. The purpose of this study is to determine the Bomani and Garjan *beel* trophic state index, category, and algae assemblages. The study examines the 12 water quality characteristics of two important *beels* in Assam State. The research aids in understanding the current state of water quality and identifying the algae weight, performing statistical analysis. The samples data were analyzed for chlorophyll-a, chlorophyll-b, total phosphorus, total nitrate, Temperature (0C), pH, Alkalinity (mg/L), Hardness (mg/L), Turbidity (NTU), Nitrate [NO3—N] (mg/L), Iron (mg/L), Zinc (mg/L), Manganese (mg/L), and Copper (mg/L). As a result, policymakers will be able to design a strategy for the effective management of these wetlands.

Materials and Methods

Study area

Wetlands in Assam's Kamrup district include Bomani *beel* and Garjan *beel*. It is primarily used for community fishing. Hundreds of cheers on Uruka bring the wetlands' banks to alive. Culture and development activities are required to ensure the preservation of the wetlands (Yang et al., 2020). The study area is 323.18 square kilometers and is located between 26°N and 26°11' N, 91°45'E latitude, and 92°E longitude (Deka, 2015 & Deka, 2020). The wetlands can be found in the flood plains of Kalong and Digaru. The Bomain and Garjan, which are bordered by villages such as Bejini, Chamata, Sakuripara, Teteliguri, and Kapalkata, are two of the most important *beels* in these plains. Figure 1 shows a map of the area of study.

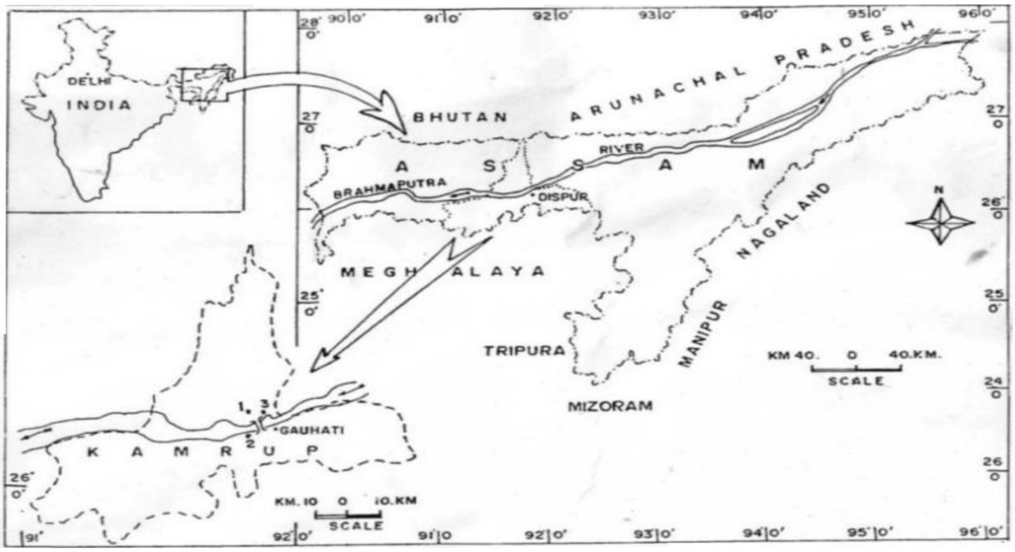

Figure 1 Map of the Study Area

Data Collection and analysis

The data was collected from the study region and tracked for four seasons in 2020. The analysis used chlorophyll-a, chlorophyll-b, and carotenoids concentrations (mg/L) as well as statistical measurements. Equation (1) was used to calculate the mean for each variable.

$$Mean\ m = \sqrt[n]{y1y2y3 \dots yn} \qquad (1)$$

The chlorophyll-a values were analyzed to understand the category from ultraoligotrophic, oligotrophic, mesotrophic, eutrophic, supereutrophic, and hypereutrophic classifications (Chandran et al., 2021). Equations (2), were used to calculate the Trophic Status of tropical and subtropical regions.

$$TSI(Chla)_{tsr} = 10\left[6 - \left(\frac{-0.2512\ In\ Chla + 0.842257}{In\ 2}\right)\right] \qquad (2)$$

Results and Discussion

Physicochemical Parameters

The physical and chemical characteristics of water provide important information on the water quality of the Bomani and Garjan *beel*. Tables 1 and 2 give descriptive information about the physicochemical parameters, such as mean and standard deviation.

Table 1 Descriptive statistics of the water quality parameters- Bomani *beel*

Water Parameters	Winter, 2020		Pre-Monsoon, 2020		Monsoon, 2020		Post-Monsoon, 2020	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Temperature ^0C	20.14	0.3225	26.38	0.1575	29.71	0.303	27.49	0.28
pH	7.48	0.1	7.25	0.132	7.11	0.167	7.4	0.1535
Alkalinity (mg/L)	127.63	2.2875	123.27	1.88	121.2	0.6005	124.485	1.661
Hardness (mg/L)	133.46	0.8955	123.46	0.8955	110.71	0.56	123.458	1.371
Turbidity (NTU)	4.17	0.33	4.42	0.361	5.51	0.279	4.88	0.1735
Nitrate [NO_3-N] (mg/L)	0.894	0.082	0.725	0.131	0.6005	0.055	0.7065	0.0085
Iron (mg/L)	0.0505	0.003	0.036	0.0095	0.0015	0.0005	0.0025	0.001
Zinc (mg/L)	0.0485	0.0025	0.034	0.008	0.0245	0.0035	0.022	0.006
Manganese (mg/L)	0.045	0.0045	0.034	0.006	0.023	0.0075	0.022	0.0085
Copper (mg/L)	0.0205	0.003	0.024	0.005	0.014	0.0045	0.023	0.007
Total Nitrogen (mg/L)	0.925	0.065	0.603	0.1815	0.628	0.053	0.747	0.0145
Total Phosphorus (mg/L)	0.091	0.022	0.065	0.011	0.045	0.02	0.07	0.036

Table 2 Descriptive statistics of the water quality parameters- Garjan *beel*

Water Parameters	Winter, 2020		Pre-Monsoon, 2020		Monsoon, 2020		Post-Monsoon, 2020	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Temperature	20.45	0.141	26.23	0.114	29.87	0.233	27.48	0.205

^{0}C								
pH	7.47	0.1385	7.32	0.132	7.075	0.167	7.404	0.1595
Alkalinity (mg/L)	127.23	2.6445	124.31	2.327	120.29	1.001	125.59	1.826
Hardness (mg/L)	124.42	1.4695	124.02	0.906	115.974	1.615	122.18	1.3065
Turbidity (NTU)	4.06	0.4325	4.48	0.3765	5.934	0.2685	4.99	0.1845
Nitrate [NO_3-N] (mg/L)	0.832	0.069	0.703	0.066	0.5699	0.0535	0.771	0.0305
Iron (mg/L)	0.034	0.002	0.03	0.0085	0.0023	0.001	0.003	0.001
Zinc (mg/L)	0.0345	0.0025	0.04	0.007	0.0248	0.004	0.023	0.007
Manganese (mg/L)	0.032	0.0015	0.031	0.006	0.0271	0.0055	0.032	0.011
Copper (mg/L)	0.005	0.0015	0.0025	0.0025	0.0168	0.0215	0.0145	0.0095
Total Nitrogen (mg/L)	0.888	0.031	0.735	0.0585	0.584	0.0615	0.7915	0.0485
Total Phosphorus (mg/L)	0.073	0.013	0.03	0.005	0.048	0.071	0.071	0.0235

Tables 1 and 2 show the descriptive statistics of four seasons for the various water quality parameters. Winter, Pre-Monsoon, Monsoon, and Post-Monsoon are the four seasons examined. The 12 water quality parameters such as Temperature ^{0}C, pH, Alkalinity (mg/L), Hardness (mg/L), Turbidity (NTU), Nitrate [NO_3-N] (mg/L), Iron (mg/L), Zinc (mg/L), Manganese (mg/L), Copper (mg/L), Total Nitrogen (mg/L), Total Phosphorus (mg/L) are considered for the study.

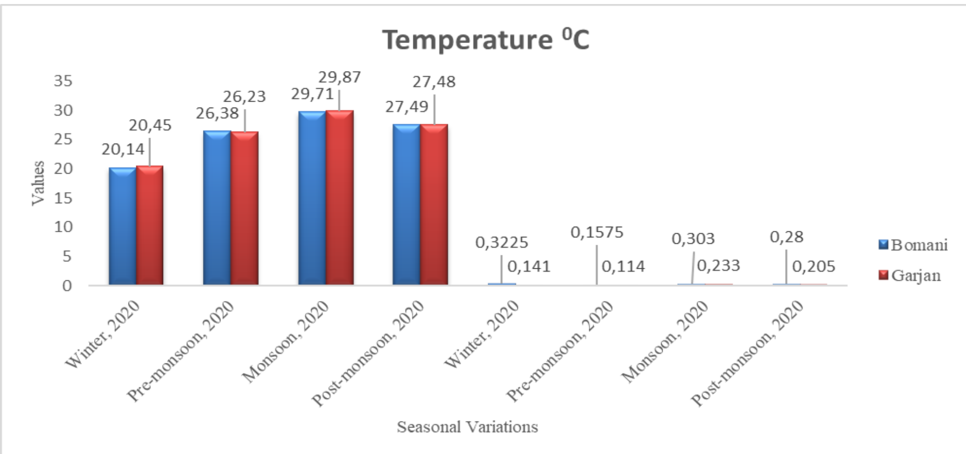

Figure 2 Temperature Variation

Figure 2 depicts a temperature variation graph. During the winter season, the mean score of the bomani *beel* is 20.14, which is similar to the mean score of the Garjan *beel* 20.45. Similarly, the pre-monsoon, monsoon, and post-monsoon mean scores of bomani are 26.38, 29.71, and 27.49, respectively. Garjan's pre-monsoon, monsoon, and post-monsoon mean scores are 26.23, 29.87, and 27.48, respectively. The mean scores of bomani and Garjan *beel* do not differ significantly. There is insufficient oxygen for the survival of aquatic life during warm conditions. The amount of dissolved oxygen in a pond is determined by its temperature. The temperature is higher during the monsoon season than during the winter season.

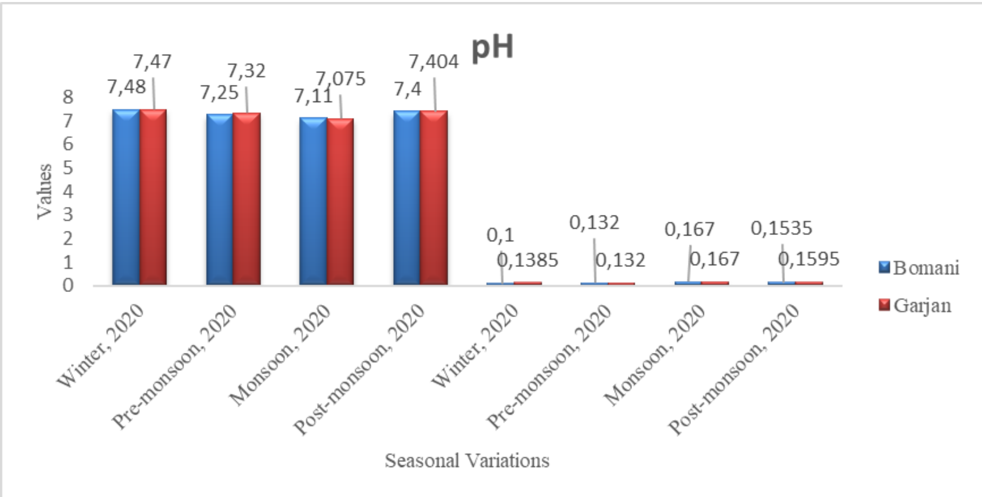

Figure 3 pH Variation

Figure 3 depicts the pH variations. Winter, Pre-Monsoon, Monsoon, and Post-Monsoon variations of Bomani *beel* are 7.48, 7.25, 7.11, and 7.4 respectively. Similarly, the pH variations in Garjan *beel* during the winter, pre-monsoon, monsoon, and post-monsoon seasons are 7.47, 7.32, 7.07, and 7.404, respectively. The pH variations of bomani and Garjan *beel* are not substantially different. The presence of dissolved gases such as carbon dioxide, hydrogen sulphide, and ammonia, among others, could describe the pH variation. A pH range of 6.0 to 8.5 indicates that the water body is productive (Chirico et al., 2020), which is consistent with our findings, as all of the wetlands contain aquatic life.

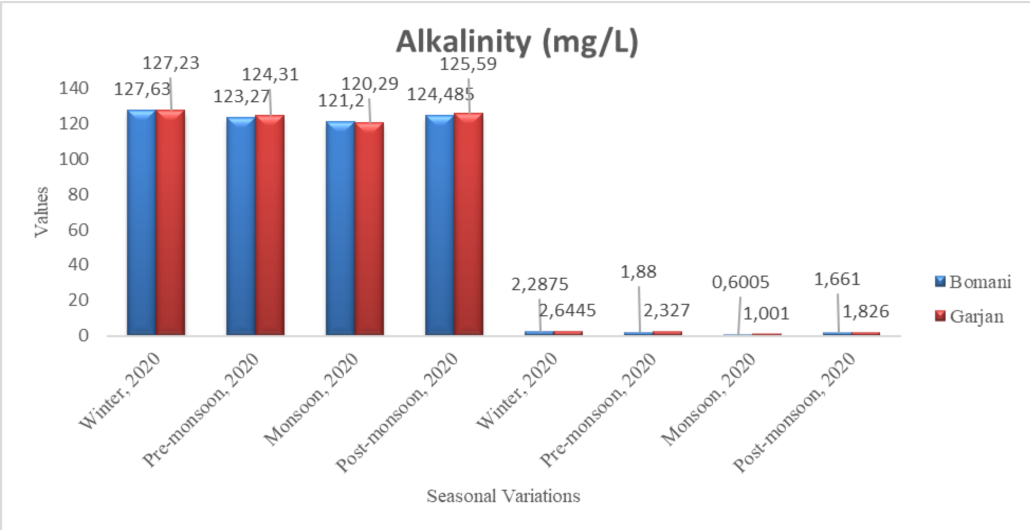

Figure 4 Alkalinity Variations

Alkalinity is a chemical measure of water's capability to neutralize acids. Figure 4 depicts the alkalinity variation. Winter, Pre-Monsoon, Monsoon, and Post-Monsoon variations in bomani *beel* are 127.63, 123.27, 121.2, and 124.485, respectively. Similarly, for Winter, Pre-Monsoon, Monsoon, and Post-Monsoon, the Garjan *beel* variations are 127.23, 124.31, 120.29, and 125.59, respectively. The alkalinity variations in Bomani and Garjan *beel* are not significantly different. When acids or bases are added, the capacity to endure pH changes. The amount of alkalinity in normal drinking water should be between 20 and 200 mg/L. The presence of high alkalinity in our drinking water is good since it makes the water safe to drink. This proves that the water is unsafe to consume.

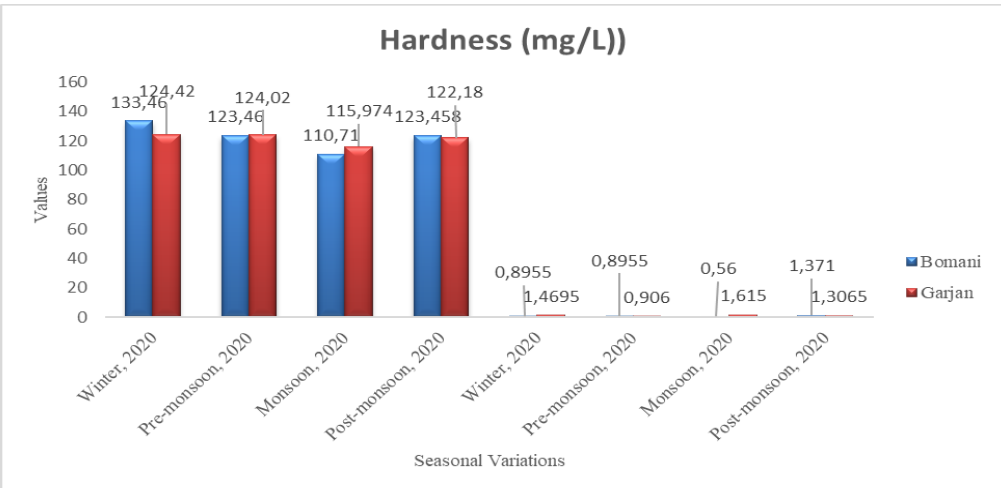

Figure 5 Hardness Variations

Figure 5 displays the hardness variation in the same way. For Winter, Pre-Monsoon, Monsoon, and Post-Monsoon, the variations in bomani *beel* are 133.46, 123.46, 110.71, and 123.458 respectively. Similarly, the mean score of Garjan *beel* is 124.42, 124.02, 115.974, and 122.18 for Winter, Pre-Monsoon, Monsoon, and Post-Monsoon respectively. There is no significant difference in the mean scores of bomani and Garjan *beel*. The presence of alkaline earth metals is responsible for the total hardness of the water. It is a characteristic of water that inhibits the creation of lather with soap and raises the boiling point of water. Based on hardness, water can be classed as mild (75 mg/L), moderately hard (75-150 mg/L), hard (150-300 mg/L), or very hard (300 mg/L) (Russell et al., 2006). The total hardness of the water was found to be in the range of 110 mg/L to 133 mg/L, indicating that it is moderately hard.

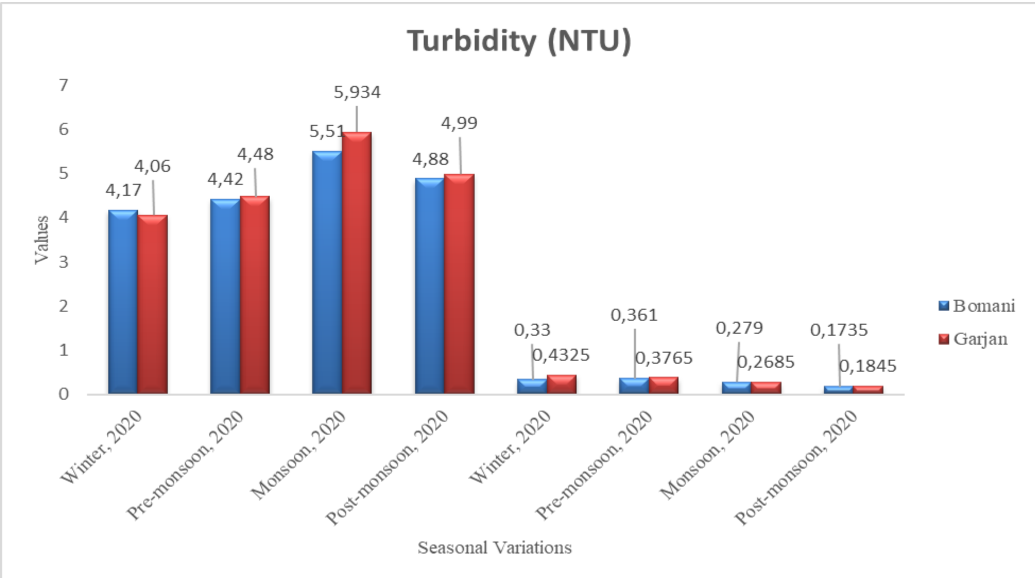

Figure 6 Turbidity Variations

Turbidity is the cloudiness in water that prevents us from seeing through it, ranging from excessive turbidity to spring water that appears to be entirely clear (low turbidity). The turbidity fluctuation is depicted in Figure 6. Winter, Pre-Monsoon, Monsoon, and Post-Monsoon turbidity variations in bomani *beel* are 4.17, 442, 5.51, and 4.88 respectively. Similarly, the variations in Garjan *beel* are 4.06, 4.48, 5.934, and 4.99 respectively. There is no significant difference in the turbidity variations of the Bomani and Garjan *beel*. The amount of suspended sediment in the water can harm aquatic life in a variety of ways. Depending on the season, high turbidity might have detrimental consequences for the water.

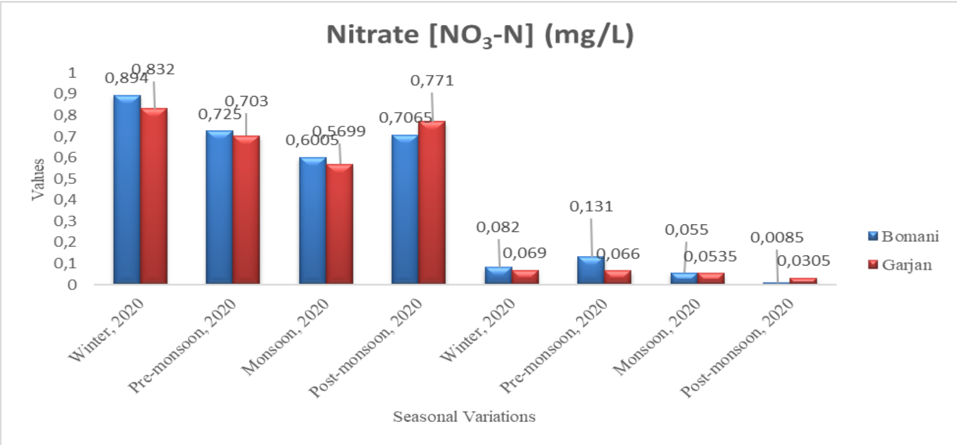

Figure 7 nitrate variations

Nitrates in water can have serious consequences. During seasons of high phytoplankton growth, phosphorus and nitrates are heavily absorbed in the upper portion of water. The nitrate variation is depicted in Figure 7. Excess nitrates, when combined with phosphorus, can hasten eutrophication, resulting in substantial increases in aquatic plant growth and changes in the types of plants and animals that dwell in streams. The nitrate changes in the winter, pre-monsoon, monsoon, and post-monsoon seasons of Bomani *beel* are 0.894, 0.725, 0.6005, and 0.7065 respectively. Similarly, for Garjan *beel* the variations are 0.832, 0.703, 0.5699, and 0.771. there is no significant difference in the nitrate variation of Bomani and Garjan *beel*. As a result, the water is unfit for human consumption.

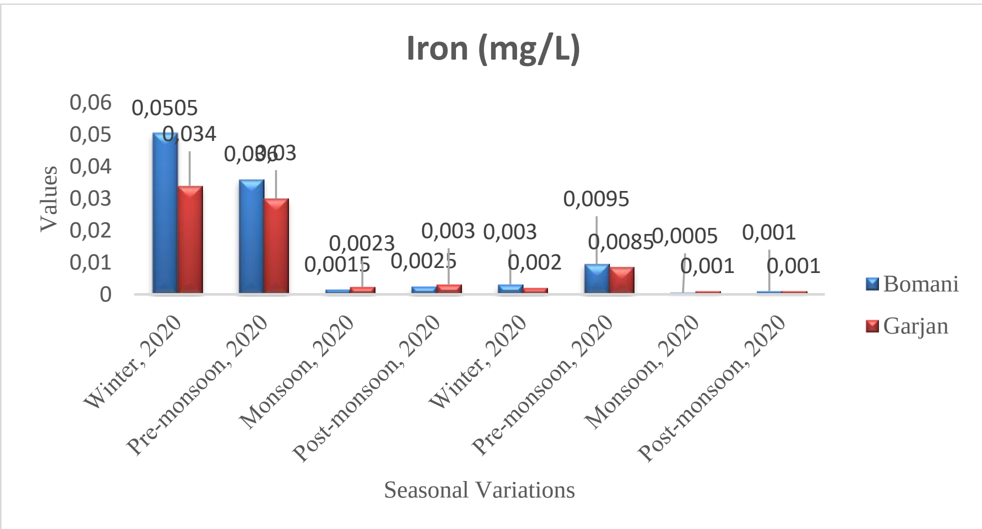

Figure 8 Iron Variations

Figure 8 illustrates the iron variations. The iron variations in Bomani *beel* over the winter, pre-monsoon, monsoon, and post-monsoon seasons are 0.0505, 0.036, 0.0015, and 0.0025, respectively. Similarly, the variations for Garjan *beel* are 0.034, 0.03, 0.0023, 0.003. There is no significant difference in the iron variations between the Bomani and Garjan *beel*. In its natural state, iron can be found in rivers, lakes, and underground water. Human health may benefit from drinking iron-fortified water. Excess iron has negative consequences.

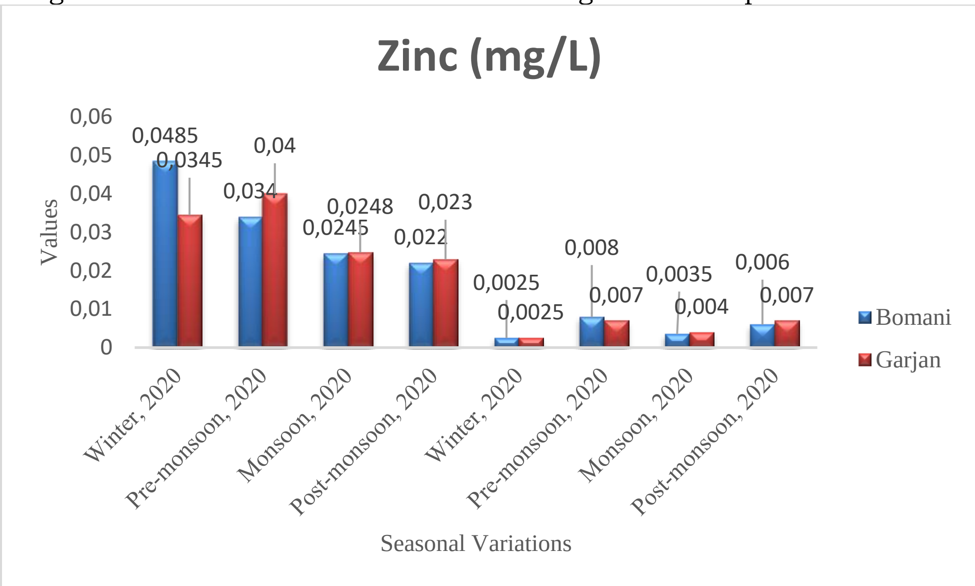

Figure 9 Zinc Variations

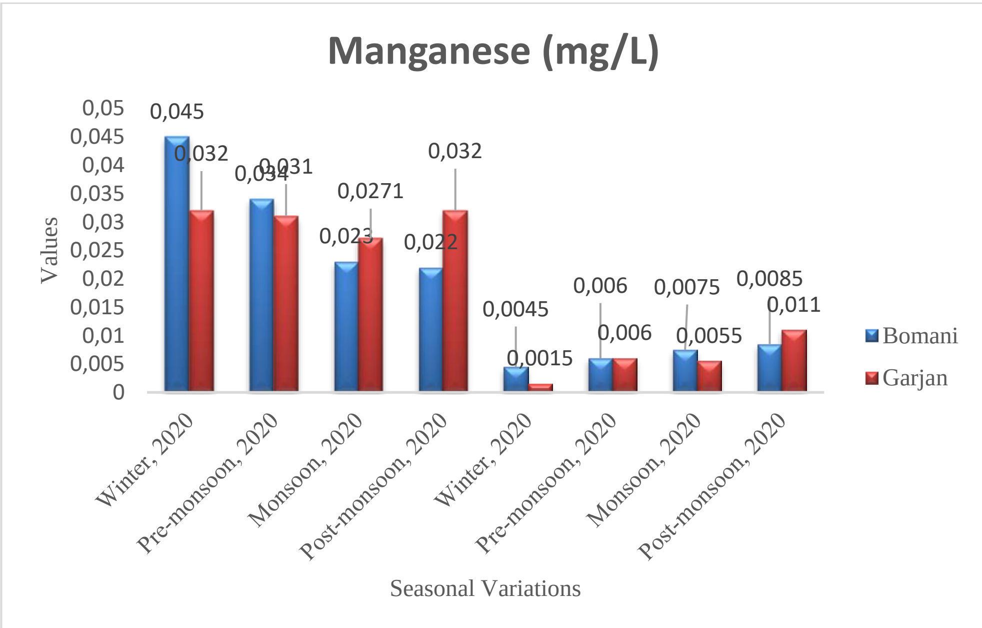

Figure 10 Manganese Variations

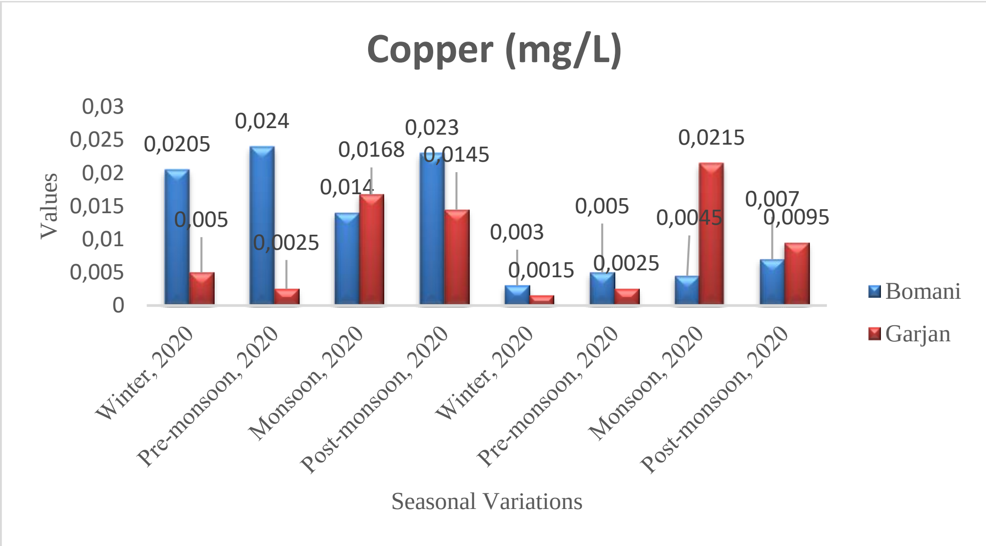

Figure 11 Copper Variation

Zinc, manganese, and copper variations of Bomani and Garjan *beel* are depicted in Figures 9, 10, and 11.

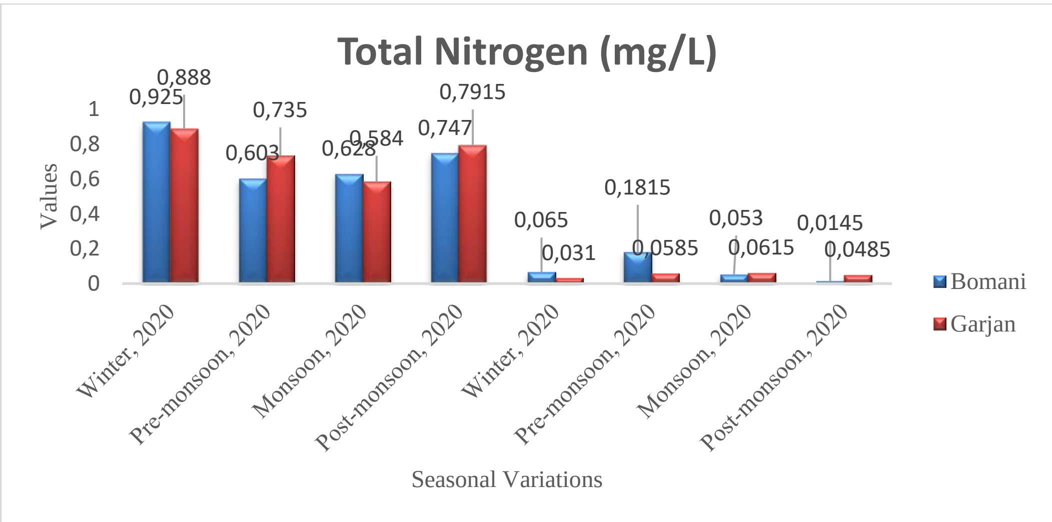

Figure 12 Total Nitrogen

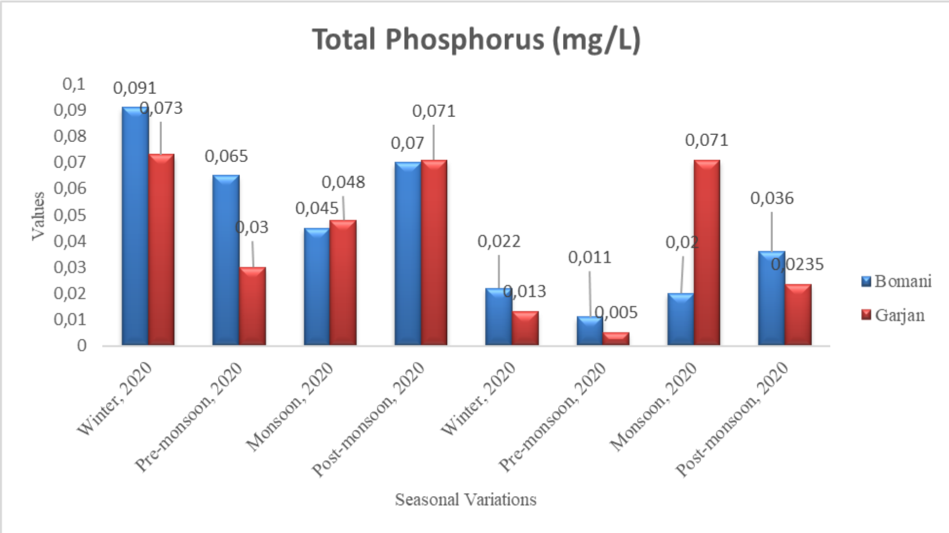

Figure 13 Total Phosphorus

Total nitrogen and total phosphorus are depicted in Figures 12 and 13, respectively. Bomani *beel* total nitrogen variations are 0.925, 0.603, 0.628, and 0.747 for the winter, pre-monsoon, monsoon, and post-monsoon seasons, respectively. In the same way, the variations in Garjan *beel* are 0.888, 0.735, 0.584, and 0.7915. The nitrogen variations in Bomani and Garjan *beel* are not significantly different. Total Phosphorus variations in Bomani *beel* are 0.091, 0.065, 0.045, and 0.07. It's 0.073, 0.03, 0.048, and 0.071 for Garjan beel. The Bomani and Garjan *beel* have no noteworthy distinctions. The presence of organic and inorganic pollutants indicates contamination from anthropogenic sources such as household wastewater, untreated municipal sewage discharge, release from industrial effluents, and water treatment plants.

Limnological Variations

Table 3 Limnological Variations

Season	Bomani *Beel*			Garjan *Beel*		
	Chl a	Chl b	Carotenoids	Chl a	Chl b	Carotenoids
Winter, 2020	10.232	0.498	7.886	7.312	0.518	2.078
Pre-Monsoon, 2020	6.654	0.688	6.188	7.346	0.34	1.48
Monsoon, 2020	4.4	0.43	4.1	2.1	0.34	0.85
Post-Monsoon, 2020	7.6	0.68	8.4	4.2	0.48	1.34

The limnological variations of the Bomani and Garjan *beel* are shown in Table 3. Chlorophyll-a turns algae and plants green, allowing them to photosynthesize. As a by-product of photosynthesis, it also supplies oxygen to the water. In the winter, the Chlorophyll-a value in Bomani *beel* is 10.232, while in Garjan *beel* it is 7.312. There are many significant variations in Pre-monsoon, Monsoon, and Monsoon. Figure 14 depicts the category for different types of variations that occur with each season. Similarly, the Chlorophyll-b values aid in the absorption of light energy for photosynthesis. Other pigments found in chloroplasts, such as carotenoids, act as accessory pigments, capturing solar energy and passing it on to chlorophyll. Table 3 shows the presence of Chlorophyll-b and carotenoids. Further, the comparison of the Weight of Algae is presented in Table 4.

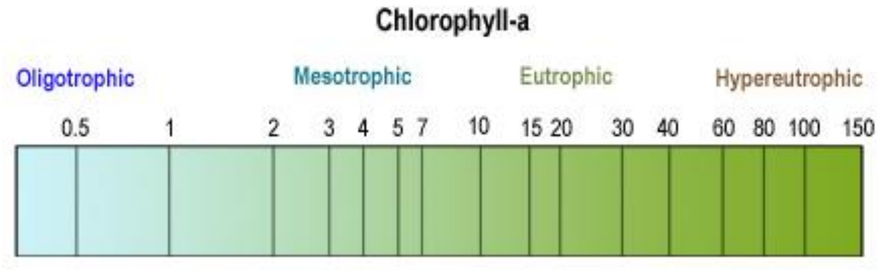

Figure 14 Chlorophyll-a Category

Table 4 Comparison of the Weight of Algae

Season	Fresh Weight of Algae (gm/L)		Dry Weight of Algae (gm/L)	
	Bomani *Beel*	Garjan *Beel*	Bomani *Beel*	Garjan *Beel*
Winter, 2020	1.86	1.7	0.748	0.628
Pre-Monsoon, 2020	1.74	1.6	0.696	0.552
Monsoon, 2020	1.5	1.5	0.31	0.26
Post-Monsoon, 2020	1.7	1.6	0.38	0.48

Algae community

The identified algae community of Bomani *beel* and Garjan *beel* is presented in Tables 5(a), 5(b), 5(c), and 5(d).

Table 5(a) Identified Algae community for Bomani *beel* during Winter and Pre-Monsoon

Bomani *beel*					
Winter, 2020			**Pre Monsoon, 2020**		
Total algal cell density (Cells/ml)	**Algal cell density of individual species (Cells/ml)**	**Algal cell density according to genus (Cells/ml) and % in the Total Count**	**Total algal cell density (cells/ml)**	**The algal cell density of individual species (Cells/ml)**	**Algal cell density according to genus (Cells/ml) and % in the Total Count**
1.52x10^4 cells/ml	*Euglena polymorpha:* 1.216x10^4 cells/ml (**80%**)	*Euglena polymorpha*: 1.216x10^4 cells/ml (**80%**)	1.27x10^4 cells/ml	*Euglena viridis:* 0.9398x10^4 cells/ml (**74%**)	*Euglena* sp: 0.9398x10^4 cells/ml (**74%**)
	i. *Anabaena spiroides:* 0.0304x10^4 cells/ml **(2%)**	*Anabaena sp.:* 0.0608x10^4 cells/ml **(4%)**		i. *Anabaena spiroides:* 0.0889x10^4 cells/ml **(7%)**	*Anabaena* sp: 0.1524x10^4 cells/ml **(12%)**
	ii. *Anabaena majuscula:* 0.0304x10^4 cells/ml **(2%)**			ii. *Anabaena majuscula:* 0.0635x10^4 cells/ml **(5%)**	
	i. *Microcystis aeruginosa:* 0.1064x10^4 cells/ml **(7%)**	*Microcystis sp:* 0.1824x10^4 cells/ml **(12%)**		i. *Microcystis aeruginosa:* 0.0889x10^4 cells/ml **(7%)**	*Microcystis* sp: 0.127x10^4 cells/ml **(10%)**
	ii. *Microcystis pseudofilamentosa:* 0.076x10^4 cells/ml **(5%)**			ii. *Microcystis pseudofilamentosa:* 0.0381x10^4 cells/ml **(3%)**	
	Mougeotia scalaris: 0.0608x10^4 cells/ml **(4%)**	*Mougeotia sp:* 0.0608x10^4 cells/ml **(4%)**		*Phacus elegans:* 0.0508x10^4 cells/ml **(4%)**	*Phacus* sp: 0.0508x10^4 cells/ml **(4%)**

Table 5(b) Identified Algae community for Bomani *beel* during Monsoon and Post-Monsoon

Bomani *beel*					
Monsoon, 2020			**Post Monsoon, 2020**		
Total algal cell density (cells/ml)	**The algal cell density of individual species (Cells/ml)**	**Algal cell density according to genus (Cells/ml) and % in the Total Count**	**Total algal cell density (cells/ml)**	**The algal cell density of individual species (Cells/ml)**	**Algal cell density according to genus (Cells/ml) and % in the Total Count**
1.29x10^4 cells/ml	*Euglena viridis:* 0.774x10^4 cells/ml (60%)	*Euglena sp:* 0.9675x10^4 cells/ml **(75%)**	1.31x10^4 cells/ml	*Euglena viridis:* 0.786x10^4 cells/ml (60%)	*Euglena sp:* 1.0218x10^4cells/ml **(78%)**
	Euglena polymorpha: 0.129x10^4 cells/ml (10%)			*Euglena gracilis:* 0.1572x10^4 cells/ml (12%)	
	Euglena convoluta.: 0.0645x10^4 cells/ml (5%)			*Euglena acus:* 0.0786x10^4 cells/ml (6%)	
	i. *Anabaena spiroides*: 0.1032x10^4 cells/ml **(8%)**	*Anabaena sp:* 0.1806x10^4 cells/ml **(14%)**		i. *Anabaena circinalis:* 0.0393x10^4 cells/ml **(3%)**	*Anabaena sp.:* 0.0655x10^4 cells/ml **(5%)**
	ii. *Anabaena laxa:* 0.0774x10^4 cells/ml **(6%)**			ii. *Anabaena majuscula:* 0.0262x10^4 cells/ml **(2%)**	
	i. *Microcystis flos-aquae:* 0.0903x10^4 cells/ml **(7%)**	*Microcystis sp:* 0.1419x10^4 cells/ml **(11%)**		i. *Microcystis aeruginosa:* 0.1048x10^4 cells/ml **(8%)**	*Microcystis sp:* 0.1703x10^4 cells/ml **(13%)**
	ii. *Microcystis ramose:* 0.0516x10^4 cells/ml **(4%)**			ii. *Microcystis smithii:* 0.0655x10^4 cells/ml **(5%)**	
				Mougeotia scalaris: 0.0524x10^4 cells/ml **(4%)**	*Mougeotia sp:* 0.0524x10^4 cells/ml **(4%)**

Table 5(c) Identified Algae community for Garjan *beel* during Winter and Pre-Monsoon

Garjan beel					
Winter, 2020			**Pre Monsoon, 2020**		
Total algal cell density (cells/ml)	**The algal cell density of individual species (Cells/ml)**	**Algal cell density according to genus (Cells/ml) and % in the Total Count**	**Total algal cell density (cells/ml)**	**The algal cell density of individual species (Cells/ml)**	**Algal cell density according to genus (Cells/ml) and % in the Total Count**
1.26x10^{4} cells/ml	i. *Microcystis aeruginosa:* 0.9072x10^{4} cells/ml **(72%)**	*Microcystis* sp: 1.008x10^{4} cells/ml **(80%)**	1.08x10^{4} cells/ml	i. *Microcystis aeruginosa:* 0.648x10^{4} cells/ml **(60%)**	*Microcystis* sp: 0.7884x10^{4} cells/ml **(73%)**
	ii. *Microcystis flos-aquae:* 0.1008x10^{4} cells/ml **(8%)**			ii. *Microcystis viridis:* 0.1404x10^{4} cells/ml **(13%)**	
	Zygnema spontaneum: 0.0756x10^{4} cells/ml **(6%)**	*Zygnema* sp: 0.0756x10^{4} cells/ml **(6%)**		*Euglena oxyuris* 0.1404x10^{4} cells/ml **(13%)**	*Euglena oxyuris* 0.1404x10^{4} cells/ml **(13%)**
	Mougeotia indica: 0.0252x10^{4} cells/ml **(2%)**	*Mougeotia* sp: 0.0252x10^{4} cells/ml **(2%)**		*Mougeotia oblongata:* 0.0648x10^{4} cells/ml **(6%)**	*Mougeotia:* 0.0648x10^{4} cells/ml **(6%)**
	Cosmarium bioculatum: 0.0378x10^{4} cells/ml **(3%)**	*Cosmarium* sp: 0.0378x10^{4} cells/ml **(3%)**		*Cladophora glomerata:* 0.054x10^{4} cells/ml **(5%)**	*Cladophora glomerata:* 0.054x10^{4} cells/ml **(5%)**
	Cryptomonas lenticularis : 0.1134x10^{4} cells/ml **(9%)**	*Cryptomonas* sp: 0.1134x10^{4} cells/ml **(9%)**		*Cryptomonas lenticularis :* 0.0324x10^{4} cells/ml **(3%)**	*Cryptomonas* sp: 0.0324x10^{4} cells/ml **(3%)**

Table 5(d) Identified Algae community for Garjan *beel* during Monsoon and Post-Monsoon

Garjan beel					
Monsoon, 2020			**Post Monsoon, 2020**		
Total algal cell density (cells/ml)	**The algal cell density of individual species (Cells/ml)**	**Algal cell density according to genus (Cells/ml) and % in the Total Count**	**Total algal cell density (cells/ml)**	**The algal cell density of individual species (Cells/ml)**	**Algal cell density according to genus (Cells/ml) and % in the Total Count**
1.10x10^{4} cells/ml	i. *Microcystis aeruginosa:* 0.385x10^{4} cells/ml **(35%)**	*Microcystis* sp: 0.671x10^{4} cells/ml **(61%)**	1.29x10^{4} cells/ml	i. *Microcystis aeruginosa:* 0.490x10^{4} cells/ml **(38%)**	*Microcystis* sp: 0.877x10^{4} cells/ml **(68%)**
	ii. *Microcystis viridis:* 0.286x10^{4} cells/ml **(26%)**			ii. *Microcystis flos-aquae:* 0.387x10^{4} cells/ml **(30%)**	
	Eudorina indica: 0.22x10^{4} cells/ml **(20%)**	*Eudorina* sp: 0..22x10^{4} cells/ml **(20%)**		*Zygnema subcylindricum:* 0.116x10^{4} cells/ml **(9%)**	*Zygnema* sp: 0.1165x10^{4} cells/ml **(9%)**
	Lyngbya gracilis: 0.11x10^{4} cells/ml **(10%)**	*Lyngbya* sp: 0.11x10^{4} cells/ml **(10%)**		*Mougeotia adnata:* 0.0516x10^{4} cells/ml **(4%)**	*Mougeotia* sp: 0.0516x10^{4} cells/ml **(4%)**
	Cladophora glomerata: 0.099x10^{4} cells/ml **(9%)**	*Cladophora* sp: 0.099x10^{4} cells/ml **(9%)**		*Phormidium tenue* 0.0903x10^{4} cells/ml **(7%)**	*Phormidium* sp: 0.0903x10^{4} cells/ml **(7%)**
				Lyngbya confervoides: 0.1548x10^{4} cells/ml **(12%)**	*Lyngbya* sp: 0.1548x10^{4} cells/ml **(12%)**

As a result of the investigation, it was discovered that Bomani *beel* has a Chlorophyll-a of 10.232 during winter, 6.654 during Pre-monsoon, 4.4 during monsoon, and 7.6 during Post-monsoon, indicating that it is Mesotrophic. The

Garjan *beel* has a Chlorophyll-a of 7.312 during winter, 7.346 during Pre-monsoon, 2.1 during Monsoon, and 4.2 during Post-monsoon, indicating that it is Mesotrophic. Elevated chlorophyll-a concentrations, on the other hand, aren't always a bad thing. Natural and anthropogenic forces are causing environmental degradation in these wetlands. Given the wetland's ecological importance, it necessitates the implementation of appropriate conservation practices as well as improved management. Few measures, such as preventing boundary encroachment, unscientific fishing, and dumping pollution-producing by industries near the *beel*, and raising public awareness of the significance of wetlands will aid in the conservation of these natural resources.

Conclusion

The occurrence of 80% algal blooms of *Euglena polymorpha* 1.216x104 cells/ml is seen in Bomani *beel*. Similarly, the occurrence of 80% *Microcystis sp:* 1.008x104 cells/ml is seen in Garjan *beel*. According to the study, these species are dominant and have higher occupancy. The study area's TSI indicates *Mesotrophic*. Thus, the study identifies the problems of Assam's important wetlands and the need to improve the environmental quality of the region's wetlands.

Conflict of Interest

The authors declare no conflict of interest

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