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Assessing the Water Quality of Hatirjheel Lake of Dhaka City, Bangladesh

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Abstract: Excessive and unplanned growth of urbanization caused severe environmental degradation. Lakes are important ecosystems because of the variety of uses for their water, including industrial, recreational, agricultural, and water retention. Hatirjheel Lake became one of the famous recreational destinations in Dhaka, Bangladesh and due to this reason, the water quality has deteriorated; therefore, it is necessary to monitor the water quality regularly. This paper aims to assess the water quality of Hatirjheel Lake to find out its present state. Water samples were collected from five different sampling points based on sources of pollution by the purposive sampling method. The water sample has been analyzed for various physiochemical parameters, including Color, Odor, Temperature, pH, Dissolved Oxygen (DO), Electrical Conductivity (EC), Total Dissolved Solid (TDS), and Total Suspended Solid (TSS) and also calculated the correlation between parameters. From the overall analysis, it is evident that six types of color and strong odor were found, and water temperature varied from 30°C to 31°C, pH varied from 6.35 to 7.16, DO varied from 2.80 to 4.42 mg/L, EC from 0.6 to 0.7 dS/m, TDS varied from 577 to 680 mg/L, and TSS varied from 2.41 to 5.61 mg/L. Moreover, interpreting the findings in the context of comparison with previous studies, the results collectively suggest a decline in water quality, highlighting the need for immediate attention and intervention. Therefore, inclusive public consciousness, and government monitoring must be adopted to save the quality of water in Hatirjheel Lake.

1. Introduction

Water is fundamental for human health, food security, and economic development (Nahar, 2000). However, Water availability and quality have become a significant worldwide concern while water availability and quality are under increasing pressure due to population growth, urbanization, industrialization, climate change, and pollution (APHA, 1995; Shamsad and Islam, 2005; UNEP, 2018). Critically, water pollution is a major environmental challenge affecting millions worldwide, causing waterborne diseases, ecosystem degradation, and economic losses (WHO, 2019). The world has different types of natural and artificial water bodies, such as oceans, lakes, and rivers. Lakes serve numerous purposes and play an important role among natural water bodies. They maintain ecological balance and greatly impact people's lives in terms of water quality and quantity (Razo et al., 2004).

Water bodies, such as oceans, lakes, and rivers, have a remarkable ability to absorb and store heat from the sun due to their higher specific heat capacity compared to other materials on land. As a result, during the daytime, water bodies tend to warm up at a slower rate than the surrounding areas. This creates a cooling effect, making water

bodies similar to "cool islands" amidst the heat. This phenomenon is particularly noticeable on hot summer days when the land surface is scorching, but the water remains refreshingly cool. The slower warming-up rate of water bodies can also significantly impact the climate, influencing weather patterns and even ecosystem dynamics (Hatje, 1998; Farnham et al., 2015). Moreover, water bodies mitigate overheating in buildings by acting as cool sinks, maintaining lower surface temperatures, increasing humidity through evaporation for improved thermal comfort, and influencing local wind patterns (Ruefenacht and Acero, 2017).

Globally, in many urban cities, such as Dhaka, Bangladesh, rapid urbanization and industrialization harm the utilization and quality of water badly (Chowdhury and Chowdhury, 2018). In Dhaka, water sources are subjected to a substantial influx of organic and inorganic contaminants due to human activities, leading to ongoing pollution. The presence of a high concentration of fecal coliforms in lake water implies severe microbial pollution, which signifies extremely low water quality (Uddin et al., 2023). Hatirjheel Lake is one of the large water bodies of the capital of Bangladesh, which is Bangladesh's capital, located in the center of Dhaka city (Alam, 2014). According to historical records, the lake in question was once part of a larger network of water bodies in the Dhaka region. It was connected to several other lakes, including Banani, Dhanmondi, Gulshan, and the Begun Bari Khal at the Rampura Bridge (Islam, 2015). This network of lakes and canals played an important role in the transportation and irrigation systems of the city and was also an important source of fish for local communities (Khan, 2014). However, due to rapid urbanization and encroachment, most of these water bodies have either disappeared or become severely polluted (Islam, 2015). The environmental conditions of these lakes have a significant impact on the city and its inhabitants, according to Razzak et al. (2012). Tourists are satisfied with the lake area's capacity, air quality, noise pollution levels, and sanitation conditions, as per Hossain et al. (2017). However, Hatirjheel Lake has been experiencing a decline in water quality due to the high population density, lack of awareness, and ineffective enforcement of legal regulations, as stated by Tariquzzaman et al. (2016) and Chowdhury and Chowdhury (2018).

It is crucial to evaluate whether the water quality of Hatirjheel Lake is within the standard level or not. By conducting extensive research, raising public awareness, involving the government, and implementing regulations, the water of Hatirjheel Lake and Dhaka metropolitan city can be preserved, thus ensuring a safe and healthy water environment for future generations. The primary goal of this research is to evaluate the water quality of Hatirjheel Lake, with the following specific objectives:

a) to evaluate the current water quality of Hatirjheel Lake in Dhaka City, and

b) to compare the water quality of Hatirjheel Lake with that of other lakes in Dhaka City.

2. Materials and Methods

2.1. Study Area

Hatirjheel Lake has been selected as the study area for this water quality study. It is situated at the core of the capital city, Dhaka. With geographical coordinates of 3°44′N to 23°48′ N and 90°23′E to 90°26′E (Figure 1), the lake is adjacent to residential areas such as Gulshan, Tejgaon, Badda, Banasree, Niketon, and Moghbazar making transportation of people living in this neighbourhood much easier. Hatirjheel Lake is the largest body of water in the capital city. The average depth of this lake is 2.6 m (Tariquzzaman et al., 2016). During the dry season, it can hold approximately 3.06 billion liters of water and about 4.81 billion liters of water during the wet season. Moreover, this lake has been an important component of Dhaka city’s drainage system as it has been used to link the Banani Lake, Gulshan Lake, Dhanmondi Lake, and Begun Bari Khal (Tariquzzaman et al., 2016).

Table 1. Sampling location of Hatirjheel Lake

Loc. site	Sample name			GPS Coordinates		Collection Date	Outside Temp. °C
	Surface water	3 Feet depth	6 Feet depth	Latitude	Longitude		
1	A1	A2	A3	23°45′33.96″N	90°24′20.77″E	5 April 2022	33
2	B1	B2	B3	23°46′5.00″N	90°24′32.29″E		
3	C1	C2	C3	23°46′14.34″N	90°25′15.19″E		
4	D1	D2	D3	23°45′9.84″N	90°24′9.23″E		
5	E1	E2	E3	23°44′55.99″N	90°23′46.02″E		

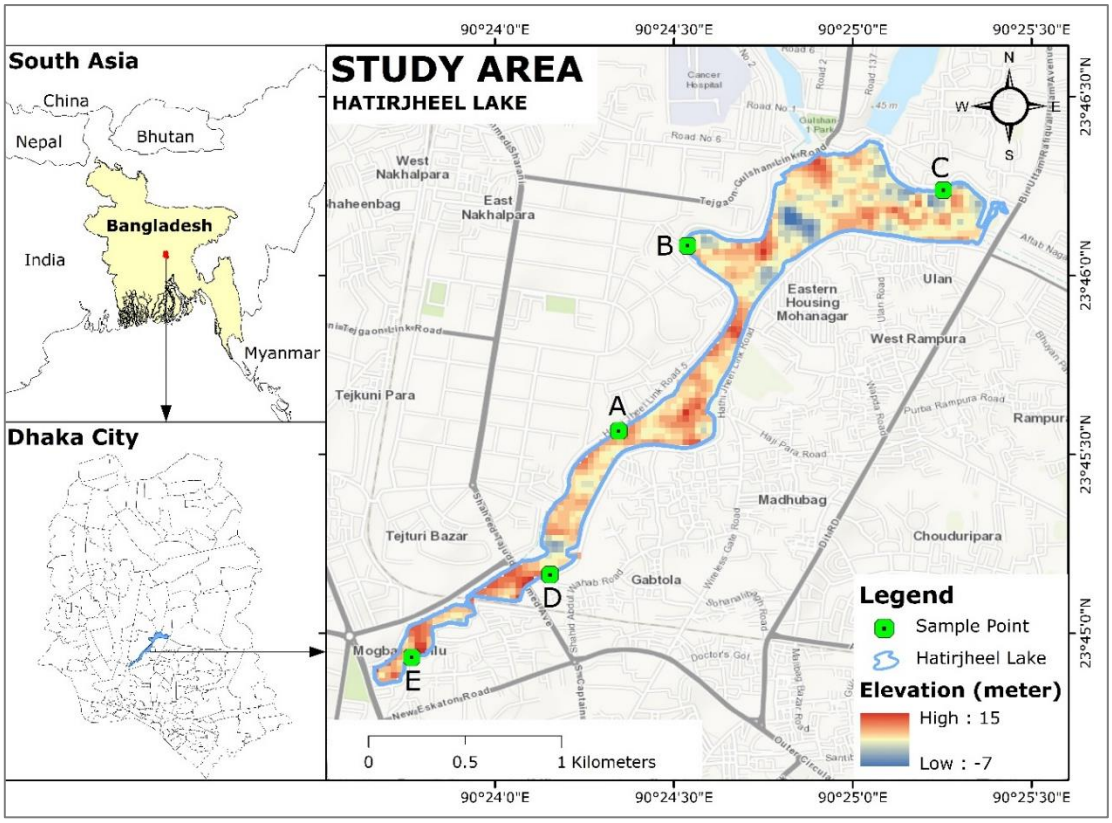


Figure 1: Sampling locations of the study area Hatirjheel Lake.

2.2. Sampling Procedure

The vital water quality parameters are color, odor, temperature, pH, Total Suspended Solid (TSS), TDS, TS, BOD, COD, DO, turbidity, EC, and salinity (WHO, 1984). However, color, odor, temperature, pH, TSS, DO, EC, and TDS parameters were taken in this study. Samples have been taken by the Purposive Sampling Method, targeting certain points from Hatirjheel Lake with characteristics of interest in the study (Table 1). The 250 ml plastic bottles with a narrow-mouthed neutral plastic stopper were used to collect water samples. The bottles were washed with detergent and air-dried. The sampling bottles were only opened during sample collection and laboratory tests. Water samples collected from Hatirjheel Lake were securely sealed, labeled, and transported to the laboratory for physical and chemical analysis. Aeration during collection was avoided to ensure accurate results (Uddin et al., 2014). The indigenous method was adopted to collect samples. Three bamboo sticks, each 8 feet height were taken and the bottle was tied at the end of the stick. The stopper of the bottle was attached to another stick. One bottle was dipped in the surface water and the other two bottles were dipped about 3 feet and 6 feet deep; the stopper was pulled out, and when the bottle was filled with water, then the stopper was sealed again.

2.3. Laboratory Test Procedure

2.3.1. Water Temperature

The temperature of the water was measured using a mercury thermometer that had markings from 0° C to 100° C. To ensure accuracy, a clean beaker was used to hold the water sample, and the thermometer's bulb was submerged in the water for one minute. The mercury in the bulb gradually rose through the narrow tube of the thermometer and stopped at a certain point. A mark was placed on the thermometer stem at the point where the top of the mercury stopped. This process was repeated three times, and the mean value was recorded as the water temperature.

2.3.2. pH

Initially, the pH meter was standardized using distilled water and buffer solution. To measure pH, a 50 ml sample was taken in a clean 100 ml plastic beaker, and the pH meter electrode was immersed in it. The electrode was left in the sample for at least five minutes, after which the pH reading was noted down in a notebook. Before measuring the pH of each new sample, the pH meter electrode was rinsed in distilled water or buffer solution. The same process was repeated for all other samples.

2.3.3. Water Odor

Water odors were observed by the nose. A bad odor from the water signifies pollution. Therefore, a 75 ml sample was taken in a 100 ml beaker to observe and record odour.

2.3.4. Water Color

Water color was observed through the naked eye. We found pure water as a crystal clear color. When this water becomes polluted, its color turns dark. Two test tubes were fitted: one test tube with the sample and the other with clean distilled water and then with the white sheet in the background.

2.3.5. Total Suspended Solids (TSS)

TSS is an essential factor for drinking water as well as fish culture. It can be defined as the portion of the total solids retained on a filter paper with a specific pore size of 0.05 µm, measured after being dried at a specified temperature (105 ^{0}C). TSS expressed in mg/L.

2.3.6. Dissolved Oxygen (DO)

To measure dissolved oxygen (DO) in water samples, the DO meter is first standardized using distilled water and buffer solution. Then, 50 ml of the sample is placed in a clean plastic beaker and the DO meter electrode is immersed, waiting for at least five minutes. The DO reading is recorded in a notebook. Before each subsequent measurement, the DO meter is submerged in distilled water or buffer solution. This process is repeated for all water samples (Uddin et al., 2014).

2.3.7. Electrical Conductivity (EC) and Total Dissolved Solid (TDS)

In this step, the conductivity TDS meter electrode was cleaned with distilled water. The cell constant was then verified. A 20 ml sample was taken, and the electrode was immersed for ten seconds. The EC and TDS readings were then taken and recorded in the notebook (Uddin et al., 2014).

2.4. Data Processing, Analysis, and Mapping Technique

The relevant data were processed and analyzed manually and using Microsoft Excel as well as various types of maps were produced by ArcGIS (10.3) to show the water quality of the Hatirjheel Lake (Figure 2). Geo-statistical interpolation, often known as kriging, is a more advanced type of interpolation. It utilizes statistical analysis to

ascertain the geographical correlations among data points. It performs in probabilistic methods. From the ArcMap 10.3 software, we defined deterministic or probabilistic methods for spatial interpolations from spatial autocorrelation reports. According to the spatial autocorrelation report, Kriging method has used for TSS, and Odor mapping; and IDW used for Color, Temperature, and pH mapping. Before color and odor mapping, colors and odors frequencies from the collected sample points were converted into number and use in color and odor mapping.

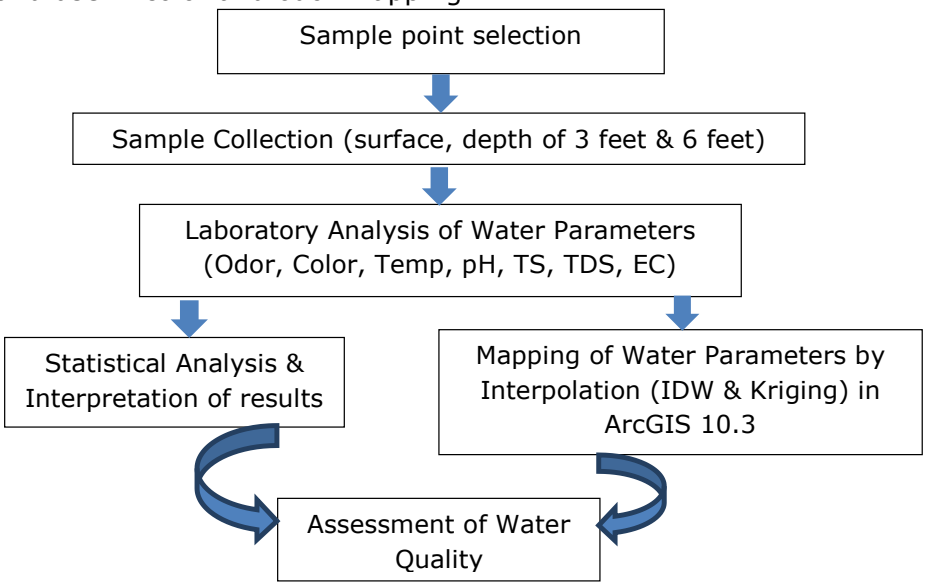


Figure 2. Methodological steps for the water quality assessment in Hatirjheel Lake.

3. Results

3.1. Temperature and pH

The temperature of water plays a significant role in various aspects of water quality. These include the presence of odors, chemical reactions, solubility, taste, and viscosity. The Temperature of Hatirjheel Lake water samples varies from 30°C to 31°C at the field and the average temperature is 30°C, where room temperature varies from 21.6°C to 26.9°C and the average temperature at room is 25°C (Table 2). Research conducted by Islam et al., 2015 showed that the maximum temperature was found in the month of April and the minimum temperature was found in February, which was similar to the findings of the present investigation. The temperature of the lake's water for A, B, and E was 31°C, which was just above 30°C and exceeded the standard limit (Figure 3a and Figure 4a).

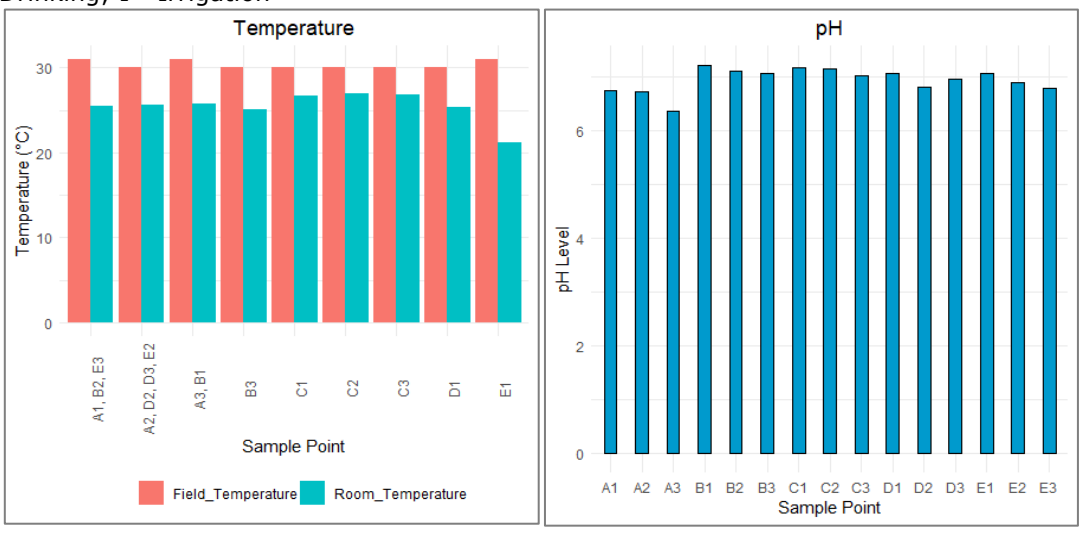
Water quality assessment parameters are crucial for evaluating the state of aquatic environments. Among these parameters, pH is a key indicator of water quality (Hasan et al., 2009). We found that pH values ranged from 6.35 to 7.2 in water samples (Figure 3b). The highest pH value was recorded at sampling point B1 (7.2), while the lowest was at A3 (6.35), which indicates acidic water quality. Similar findings have been reported in other studies, which found mean pH values of 7.18 (Islam et al., 2015) and 6.80 (Pasha et al., 2023) in Hatirjheel Lake. The pH level of water affects its properties, including the potential toxicity of substances present in the aquatic environment and the viability of aquatic organisms. High pH levels indicate alkaline water with high chloride, bicarbonate, and carbonate levels. Extremely high or low pH levels can cause irreversible damage to aquatic life (Hasan et al., 2009). The maximum pH value of Hatirjheel Lake is 7.2, and the minimum is 6.35, while the standard value is 7 ((Figure 4b)). The permissible limit of pH for drinking water is 6.5-7.5 (GOB, 1997). Overall, the study found that the maximum pH value at Hatirjheel Lake falls within the standard value, which indicates

normal pH level in the lake water. However, some pH levels in the lake water are lower than the standard value and require further attention to ensure the safety of aquatic life and human health.

Table 2. Water Parameters of Hatirjheel Lake.

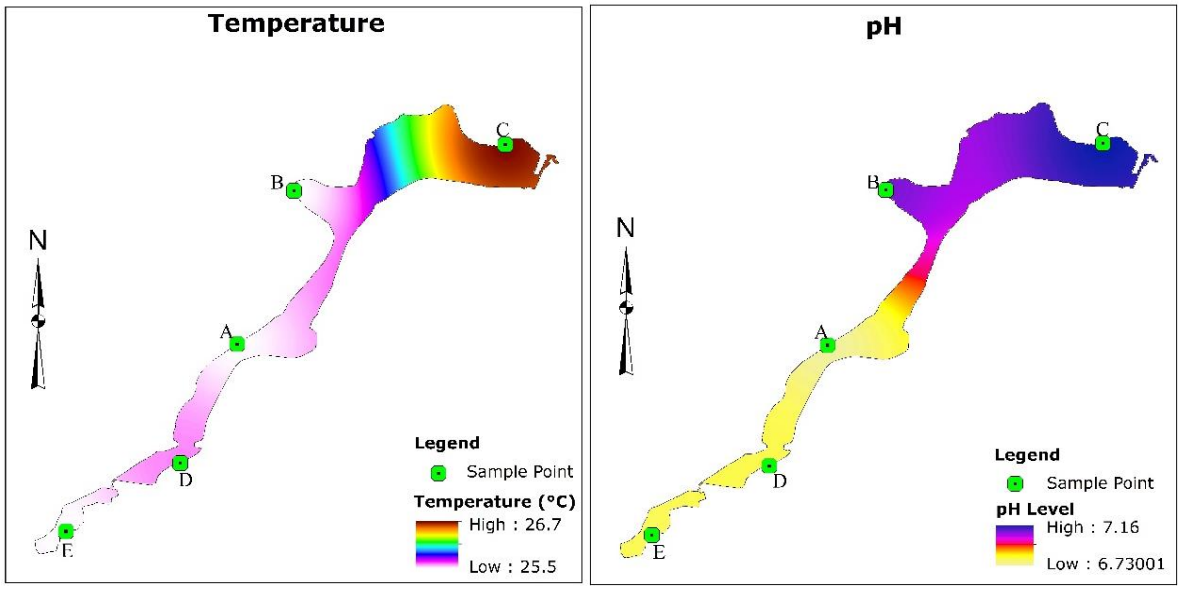
	Parameters								
	Odor	Color	Temp (°C)		pH	DO (mg/L)	TDS (mg/L)	TSS (mg/L)	EC (dS/m)
			Field	Room					
A1	Very strongly bad smell	Deep green	31	25.5	6.73	4.11	599	5.08	0.6
A2	Very strongly bad smell	Green	30	25.6	6.72	4.11	599	2.41	0.6
A3	Strongly bad smell	Light green	31	25.7	6.35	4.11	599	5.15	0.6
B1	Slightly smell	Light green	31	25.7	7.2	4.42	596	5.30	0.7
B2	Strongly bad smell	Light green	31	25.5	7.09	4.42	596	4.89	0.7
B3	Very strongly bad smell	Light green	30	25.1	7.06	4.42	596	5.61	0.7
C1	Very slight	Very light green	30	26.7	7.16	4.36	680	4.57	0.6
C2	Slightly smell	Light green	30	26.9	7.14	4.36	680	5.14	0.6
C3	Slightly smell	Light green	30	26.8	7.02	4.36	680	5.15	0.6
D1	Very strongly bad smell	Green	30	25.3	7.05	2.80	588	4.67	0.6
D2	Slightly smell	Grey	30	25.6	6.8	2.80	588	4.75	0.6
D3	Slightly smell	Grey	30	25.6	6.95	2.80	588	4.91	0.6
E1	Medium smell	Very light green	31	21.2	7.06	2.86	577	5.53	0.6
E2	Slightly smell	Grey	30	25.6	6.88	2.86	577	4.89	0.6
E3	No smell	Very light green	31	25.5	6.79	2.86	577	5.09	0.6
WQ Standard (DoE) D*	Odorless	Colorless	20-30		6.5-8.5	4-8	1000	10	0.5
I*					6.5-8.5		2000		

D= Drinking; I= Irrigation



(a) **(b)**

Figure 3. Temperature (a) and pH (b) of Hatirjheel Lake water



(a) **(b)**

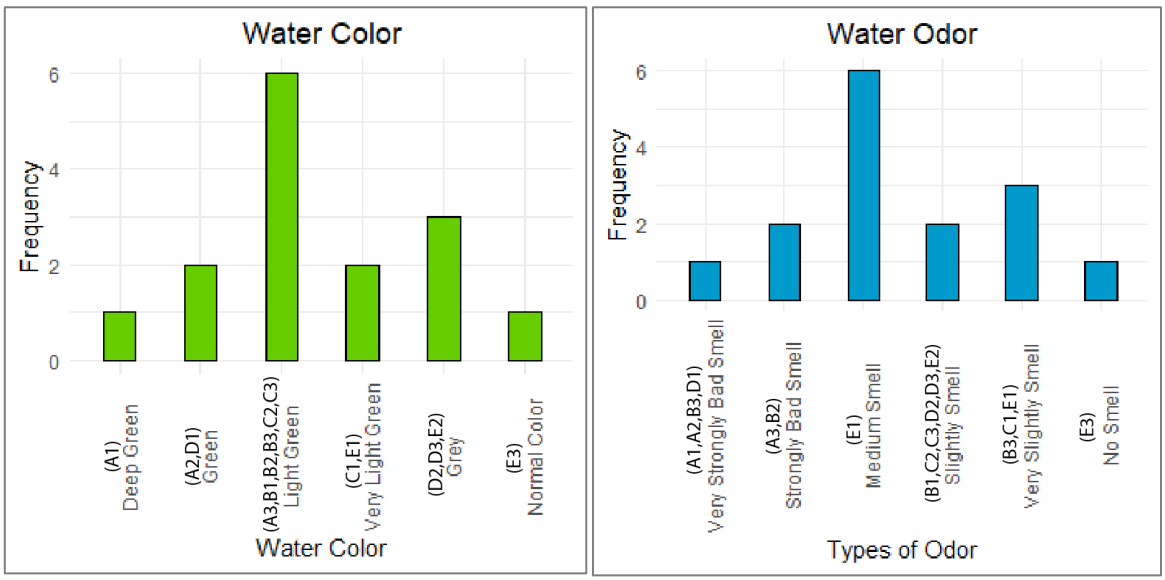
Figure 4. Temperature (a) and pH (b) of Hatirjheel Lake water

3.2. Color and Odor

Color and Odor are important physical parameters of water for determining the quality of water. Various types of pollutants discharged into the water create obnoxious color and odor, and harm fishes and other aquatic organisms by deteriorating the water quality of aquatic habitats. In different sample points of the Lake water, we found a fishy odor. There were six types of color found in Hatirjheel Lake – deep green, green, light green, very light green, grey, and on the other hand normal color (Figure 5a). The deep green color was found in sample A1 while very light green color and green color were found in samples C1, E1, E3, and A2, D1, respectively. Also, grey color is found in D2, D3, and E2 whereas light green color was found in A3, B1, B2, B3, C1, and C3. The maximum colors found in the sample water are light green. According to DOE, 2001, the Standard color for the lake water is normal, and in Bangladesh, the standard color for fisheries (EQS, 1997) is very light green while domestic standards (De, 2005) of color is very light green and drinking standards (ADB, 1994) is normal color. Overall, the sample of Hatijheel Lake water's result analysis reveals that green and deep green color are also found along with other colors. Deep green color is harmful which can affect the aquatic ecosystem (Figure 6a).

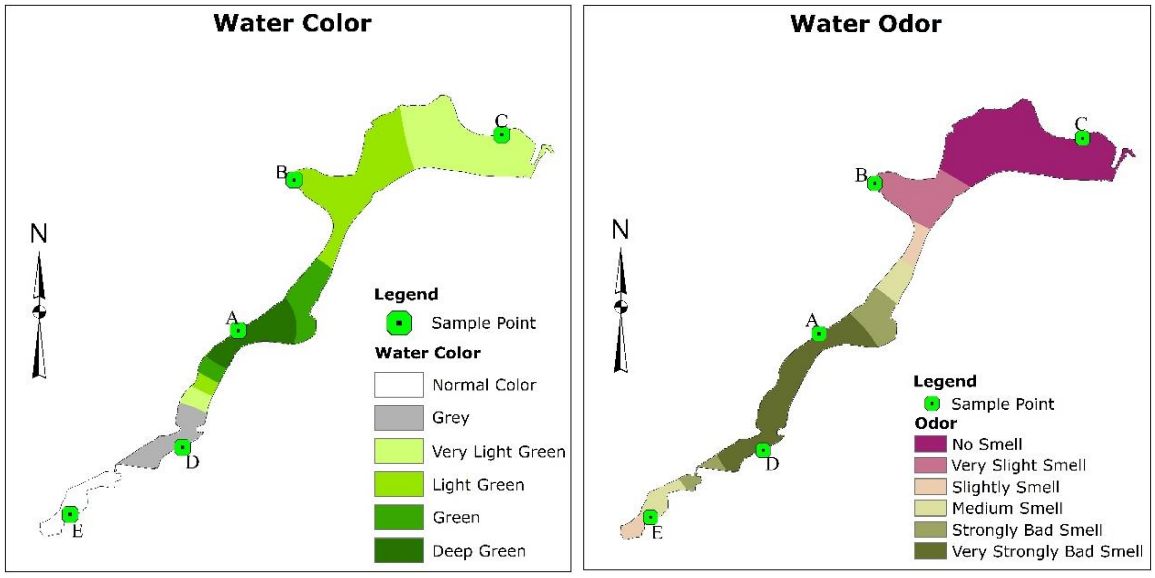
Five types of odor were found in Hatirjheel Lake. Odor for most of the water samples has a slight smell, and the very few water samples have no smell (Figure 5b). Sample A3 and B2, C3 contains a strong bad smell while A1, A2, B3, and D2 contain a very strong bad smell. On the other hand, samples B1, C2, C3, D2, and D3 contain a slight smell, and B3, C1, and E1 contain a very slight smell. Also, E3 has no smell.

Moreover, the water sample with a strong bad smell is mostly green color. According to DOE, 2001 Standard, Bangladesh Standard for Fisheries, Domestic Standards (De, 2005), and Drinking Standards, Lake water should have no smell. However, the water found in Hatirjheel Lake contains a strong bad smell (Figure 6b). People, pedestrians, and visitors are visiting the place regularly and unconsciously polluting the water of this lake. However, it is found the normal color and no bad smell in sample E3. This sample point is situated far from the public and high land than other surrounding points which is why this area is out of reach and pollution is also low considering other sampling points.



(a) **(b)**

Figure 5. Water color (a) and water odor (b) of Hatirjheel Lake water

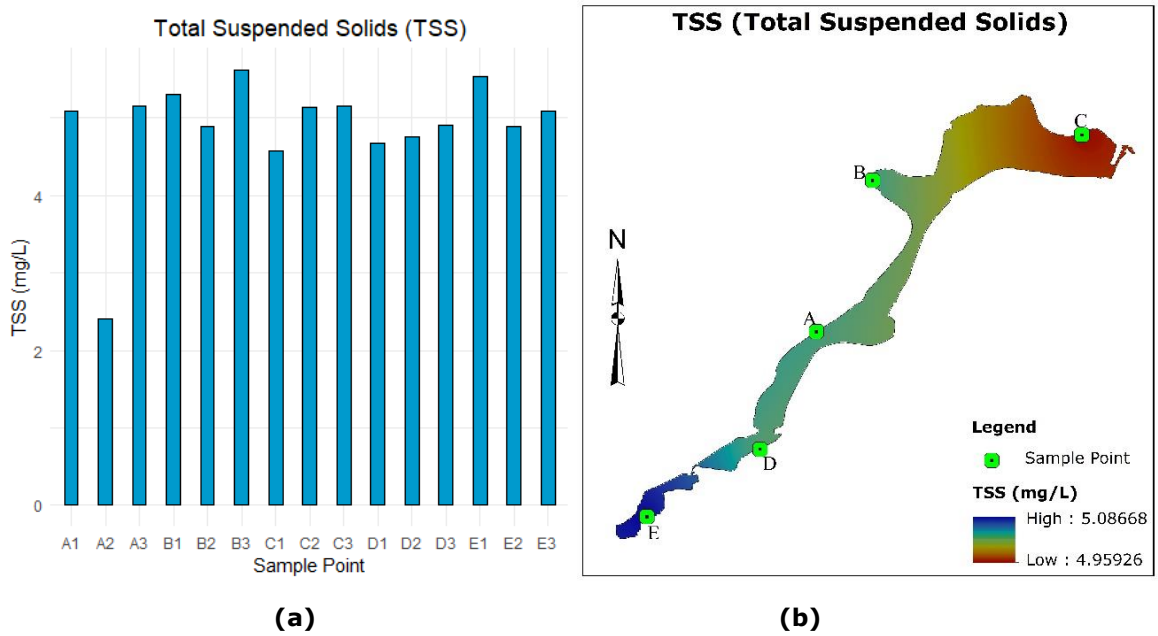


(a) **(b)**

Figure 6. Water color (a) and water odor (b) of Hatirjheel Lake water

3.3. Total Suspended Solids (TSS)

Total suspended solids (TSS) refers to microscopic solid or liquid particles that are present in water. These particles are a mixture of organic and inorganic matter, and can vary in size, composition, and origin. It is important to note that the smaller the particles, the more hazardous they can be to breathe, as they can penetrate deeper into the respiratory system. TSS is different for each sample water of Hatirjheel Lake. The maximum TSS value of Hatirjheel Lake water is 5.61 mg/L and the minimum is 2.41 mg/L (Figure 7). Other water sample carries medium TSS. Also, A2 has 2.41 mg/L which is less than other water samples. Water sample from the sampling point E1 has TSS value 5.61 mg/L, and A3, and C1 have 5.15 and 4.57 mg/L TSS, respectively. The standard value of TSS is 10 mg/L (ECR 1997). However, the water of Harirjheel Lake contains about 5.61 mg/L TSS, which is below the standard.



(a) **(b)**

Figure 7. Total suspended solids of Hatirjheel Lake water (a) and spatial distribution (b)

3.4. Dissolved Oxygen (DO)

Oxygen, also known as DO, is required for respiration. Sufficient DO levels are essential for maintaining good water quality, supporting the survival of aquatic organisms, and enabling the decomposition of waste by microorganisms (Islam et al., 2015). Fish require DO levels of at least 5-6 mg/L to survive, whereas levels below 1 mg/L are unsuitable for them. An average DO level of 6.5 mg/L is considered to be of good quality for river water (APHA, 2005). The study found that the concentrations of dissolved oxygen (DO) in Hatirjheel lake were between 2.80 to 4.42 mg/L, with an average of 3.71 mg/L. These values are below the standard value of 6.5 mg/L, indicating poor water quality in the lake. The low DO concentration in the water is not sufficient for fish and other aquatic life to survive. This points out the urgent need for improving the water quality of the lake to maintain the ecological balance and to ensure the survival of aquatic life (Figure 8a)

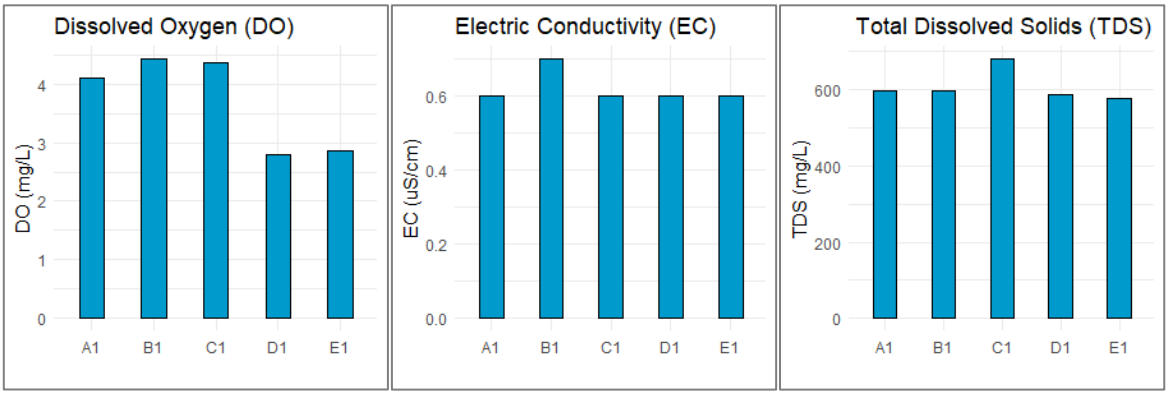
3.5. Electric Conductivity (EC)

The electrical conductivity (EC) of water is a measure of the concentration of ions present in it. The concentration of ions in water depends on various factors such as the environment, movement, and sources of water. EC is an important parameter for measuring water quality because it helps in detecting contamination levels. High EC values indicate the presence of a large number of contaminants in water. In a recent study, the EC values of water samples ranged from 0.6 to 0.7 dS/m, which is higher than the drinking water standard of 0.5 dS/m. However, the EC values of lake water were found to be within the standard limit for natural waters (Figure 8b). The recommended threshold EC values for water quality vary across different organizations. FAO (1992) recommends a threshold value of 0.70 dS/m, while ADB (1994) recommends 0.75 dS/m. GOB7 (1997) recommends a higher threshold of 1.2 dS/m. Therefore, it is crucial to maintain EC values within the recommended thresholds to ensure safe water.

3.6. Total Dissolved Solid (TDS)

It has been determined that the substance in question is not suitable for standard uses. The study revealed that the Total Dissolved Solids (TDS) in the area being examined ranged from 577 to 680 mg/L (Table 2). The highest TDS value was found in

sampling point C, while the lowest was found in sampling point E (Figure 8c). When comparing the average value to the standard value, there is only a slight variation, and furthermore, the field value is lower than the standard value (which is set at 1000 mg/L).



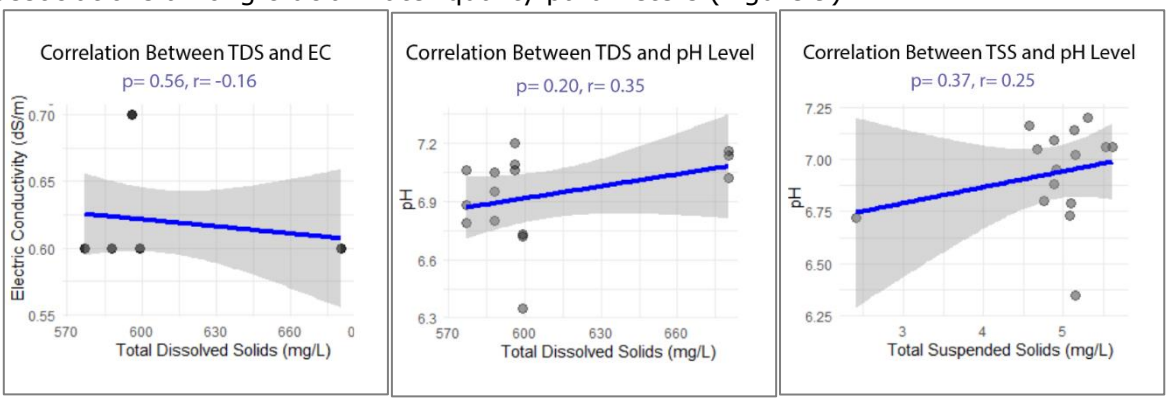
(a) **(b)** **(c)**

Figure 8. Dissolved Oxygen (a), Electric Conductivity (b) and Total Dissolved Solids (c) of Hatirjheel Lake water

4. Discussion

4.1 Correlation between the Water Quality Parameters

The interplay between different water quality parameters forms a complex web of relationships, influencing the overall state of a water body. The correlations were carried out among the key water quality parameters to find the comprehensive state of the water quality, namely pH (Hydrogen Ion Concentration), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Dissolved Oxygen (DO), and Electrical Conductivity (EC). The relationships between these parameters demonstrated valuable perspectives on the intricate balance and potential stressors shaping the quality of water in diverse environments. This study uses Pearson's correlation method to investigate the associations among crucial water quality parameters (Figure 9).



(a) **(b)** **(c)**

Figure 9. Examining the correlation between (a) Total Dissolved Solids (TDS) and Electrical Conductivity(EC), (b) Total Dissolved Solids (TDS) and pH levels, (c) Total Suspended Solids (TSS) and pH levels.

The correlation between Total Dissolved Solids (TDS) and pH levels in water samples reveals a positive correlation ($p = 0.20$, $r = 0.35$), though its strength is characterized as weak. As TDS concentrations elevate, there is a tendency for pH levels also increase, yet the correlation is not robust. The correlation coefficient (r) of 0.35 signifies a weak to moderate positive association, emphasizing the nuanced and moderate nature of the relationship between TDS and pH in the examined water samples. On the other hand,

the correlation between Total Suspended Solids (TSS) and pH levels examined ($p = 0.37$, $r = 0.25$) is a weak positive correlation. With increasing TSS levels, there is a modest rise in pH ($r = 0.25$). The scatter plot illustrates dispersed data points, indicating variability in this relationship.

The correlation between Total Dissolved Solids (TDS) and Electrical Conductivity (EC) was found to be weakly negative with a correlation coefficient of -0.16 and a p-value of 0.56. This indicates that there is a low association between TDS and EC, suggesting that changes in one parameter may not necessarily affect the other. As TDS concentration increases, there is a subtle decrease in EC values. This correlation's minimal strength suggests other factors' influence on water conductivity. For instance, the presence of different ions may impact conductivity. This emphasizes the multifaceted nature of water quality dynamics, highlighting the need for further investigation into factors contributing to the observed patterns in electrical conductivity.

4.2 Comparison between Hatirjheel and Others Lake's water quality of Dhaka City

The assessment of Hatirjheel Lake's water quality unveiled critical insights into various physiochemical parameters compared to the other inland water quality of Dhaka City (Table 3). The temperature of the lake water exceeds room temperature averages and deviates from the standard limits. Unexpectedly high temperatures in A, B, and E sampling points, surpassing the standard limit, raise concerns about potential pollutants. All listed lakes experience temperatures slightly above room temperature (24-26°C), which, while not directly harmful, can contribute to oxygen depletion and accelerate pollutant breakdown. Unexpected higher temperatures in specific Hatirjheel sampling points warrant further investigation as potential hotspots of pollution.

Though mostly within the standard range, pH values show some acidic instances. This aligns with previous studies indicating pH fluctuations. The acidic nature of A3's water is unexpected and suggests localized contamination. Hatirjheel Lake's pH falls within the acceptable range of 6.5-8.5, which is close to the neutral level. This similarity is observed in other lakes, including Dhanmondi, Banani, and Gulshan Lakes. Uttara and Ramna Lake's pHs are on the verge of deviating from the acceptable range, potentially indicating different pollution sources or environmental factors.

Table 3. Comparing Parameters of Hatirjheel lake with other lakes of Dhaka City.

Parameters (Water)	***Uttara Lake**	***Dhanmondi Lake**	***Banani Lake**	***Gulshan Lake**	***Ramna Lake**	****Hatirjheel Lake**
Temperature (◦C)	24	24	25	25	26	26
pH	8.33	7.63	7.4	7.76	6.63	7.44
DO (mg/L)	5.41	5.55	3.56	3.45	4.35	3.51

Source: *Alom & Alom, 2019 & **Author, 2022.

Hatirjheel Lake's DO levels (2.80-4.42 mg/L) are concerning, falling below the minimum recommended level of 4 mg/L at several points. Uttara and Dhanmondi Lakes boast the highest DO levels, suggesting healthier aquatic life conditions. Banani and Gulshan Lakes also struggle with low DO levels, similar to Hatirjheel, highlighting wider water quality issues across Dhaka and raise significant concerns about the health of its aquatic ecosystem. The water quality of Hatirjheel Lake, while not the worst compared to some other Dhaka lakes, still requires urgent attention.

The presence of various colors and odors further supports the notion of pollution, echoing concerns raised in comparable research. The coexistence of strong odors and green colors emphasizes potential anthropogenic contributions to the lake's degradation. Interpreting these findings in the context of existing literature, the results collectively suggest a decline in water quality, highlighting the need for immediate attention and intervention.

Overall, this study primarily focused on physiochemical parameters; however, a more comprehensive analysis involving microbiological aspects could provide a more holistic understanding. Additionally, the study did not assess the specific sources of pollution, limiting targeted intervention strategies. Moreover, future research should delve into the microbial aspects of water quality, identifying specific pollutants and their sources. A detailed analysis of the anthropogenic activities impacting water quality could guide regulatory measures. Moreover, exploring the seasonal variations in water quality can provide insights into dynamic environmental factors.

5. Conclusions

Hatirjheel Lake is an important part of the environment in Dhaka, Bangladesh. It contributes to biodiversity enhancement and ecosystem conservation, while also serving as a popular recreational spot for locals. The laboratory results of the physicochemical parameters in the present study indicate that the water temperature ranged from 30°C to 31°C. The pH values varied from 6.35 to 7.16, dissolved oxygen (DO) varied from 2.80 to 4.42 mg/L, electrical conductivity (EC) ranged from 0.6 to 0.7 dS/m, total dissolved solids (TDS) ranged from 577 to 680 mg/L, and total suspended solids (TSS) varied from 2.41 to 5.61 mg/L. Moreover, six types of color and strong odor were found in the Lake water. Thus, considering all of the analysis, the water quality of Hatirjheel Lake, while not the worst compared to some other Dhaka lakes, still requires urgent attention and wide public awareness, government participation, and government regulations must be adopted to save the standard quality of water in Hatirjheel Lake. Implementation of the proper solid and other waste disposal sites should be made to avoid pollution and degradation of the aquatic environment of the lake. Therefore, it is very urgent to develop people awareness and proper co-ordination among government, water resource experts, city-planners, environmentalists, engineers, architects, socio-economists and stakeholder to keep save the water of Hatirjheel Lake.

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