(RESEARCH ARTICLE)

Comparative analysis of water quality in two Wetlands of Berhampore, Murshidabad, West Bengal

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Abstract

This study provides a comparative analysis of the water quality in two wetlands, Chaltia Beel and Bishnupur Beel, located in Berhampore, Murshidabad, West Bengal. Water samples were analyzed for microbiological and chemical parameters, including Total Coliform, pH, Temperature, Total Dissolved Solids (TDS), Turbidity, Dissolved Oxygen (DO), Nitrate, Phosphate, Ammoniacal Nitrogen, and Total Alkalinity. The results indicated significant differences between the two wetlands. Chaltia Beel exhibited higher levels of microbial contamination and phosphate, while Bishnupur Beel had better dissolved oxygen levels and lower total coliform counts. These findings highlight the varying impacts of anthropogenic activities on the water quality of the two wetlands. Continuous monitoring and management efforts are essential to preserve their ecological health.

1. Introduction

Wetlands are crucial ecosystems that provide numerous environmental benefits, including water purification, flood control, and habitat for diverse flora and fauna (Mitsch & Gosselink, 2007). This study focuses on the comparative analysis of water quality in two wetlands located in Berhampore, Murshidabad, West Bengal: Chaltia Beel and Bishnupur Beel. Understanding the water quality of these wetlands is vital for conservation efforts and for maintaining the ecological balance in the region (Gopal, 2013).

2. Material and methods

2.1. Study Area

Chaltia Beel and Bishnupur Beel are two significant wetlands in the Berhampore area. Both serve as important ecological zones and are influenced by various anthropogenic activities (Bassi et al., 2014). Chaltia Beel is located at latitude 24.0863° N and longitude 88.2670° E, while Bishnupur Beel is situated at latitude 24.0675° N and longitude 88.2444° E.

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| Figure 1 Photograph of ChaltiaBeel | Figure 2 Photograph of Bishnupur Beel |

2.2. Sample Collection

Water samples were collected from Chaltia Beel and Bishnupur Beel on November 6, 2023. The samples were analyzed from November 7 to November 11, 2023. Standard procedures were followed for the collection, preservation, and analysis of water samples (APHA, 2023).

2.3. Analytical Methods

The water samples were analyzed for various parameters using standard methods as outlined in the APHA 24th Edition (2023) and IS 3025 (BIS, 1986). The parameters included Total Coliform, pH, Temperature, Total Dissolved Solids (TDS), Turbidity, Dissolved Oxygen (DO), Nitrate, Phosphate, Ammoniacal Nitrogen, and Total Alkalinity.

3. Results and Discussion

3.1. Microbiological Analysis

Table 1 Microbiological Parameter

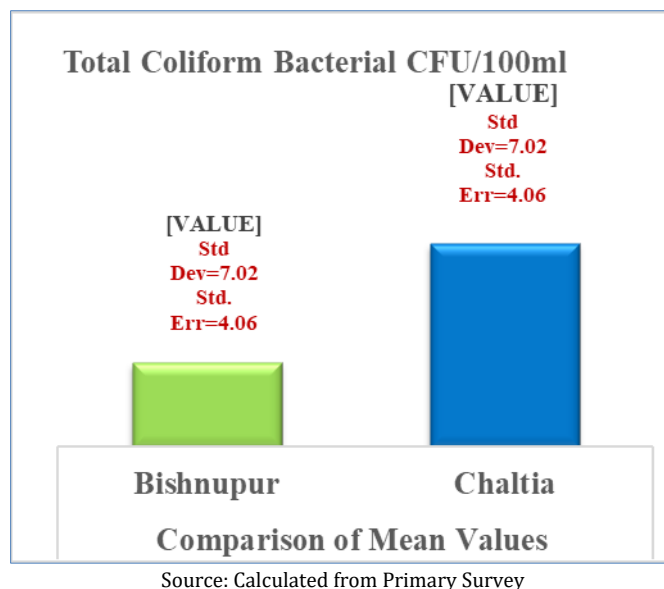| Total Coliform Bacteria CFU/100ml	Name of Beel	
	Bishnupur	Chaltia
Mean	81.3	197.3
Standard Deviation	7.02	4.06
Standard Error	7.02	4.06

Source: Calculated from Primary Survey

Figure 1 Graphical Representation of Microbiological Parameter of Water

- Chaltia Beel: Mean = 197.3, SD = 7.02
- Bishnupur Beel: Mean = 81.3, SD = 7.02

The total coliform levels in Chaltia Beel were significantly higher than in Bishnupur Beel, indicating a higher level of microbial contamination in Chaltia Beel. High coliform counts are often associated with fecal contamination and can pose health risks (WHO, 2006).

3.2. Chemical Analysis

Table 2 Water Quality Parameters of Bishnupur &Chaltia Beel

Sl.No.	Parameter	Mean		Std. Dev		Std. Error	
		Bishnupur	Chaltia	Bishnupur	Chaltia	Bishnupur	Chaltia
1	pH at 250 C	8.04	7.75	0.02	0.01	0.02	0.01
2	Temperature in 0 C	28.20	28.17	0.10	0.06	0.06	0.03
3	Total Dissolved Solid in mg/l	427.33	402.00	3.06	1.76	4.00	2.31
4	Turbidity in NTU	1.70	1.23	0.10	0.06	0.15	0.09
5	Dissolved Oxygen (DO) in mg/l	8.23	6.43	0.15	0.09	0.15	0.09
6	Nitrate(asNO3) in mg/l	<0.5	<0.5	0.00	0.00	0.00	0.00
7	Phosphate (PO4)in mg/l	0.51	1.40	0.03	0.02	0.02	0.01
8	Ammoniacal Nitrogen asin mg/l	0.52	0.58	0.01	0.01	0.03	0.01
9	Total Alkalinity (as CaCO3)in mg/l	243.20	281.20	3.80	2.19	3.80	2.19

Source: Calculated from Primary Survey

pH at 25°C

- Chaltia Beel: Mean = 7.75, SD = 0.015
- Bishnupur Beel: Mean = 8.04, SD = 0.021

The pH levels in both wetlands were within the acceptable range for surface water, although Bishnupur Beel exhibited slightly more alkaline conditions (Kumar & Chopra, 2012).

Temperature (°C)

- Chaltia Beel: Mean = 28.17, SD = 0.058
- Bishnupur Beel: Mean = 28.2, SD = 0.1

The temperature readings for both wetlands were similar, indicating comparable thermal conditions, which are crucial for the metabolic activities of aquatic organisms (Boyd, 1990).

Total Dissolved Solids (mg/l)

- Chaltia Beel: Mean = 402, SD = 5.033
- Bishnupur Beel: Mean = 427.3, SD = 3.06

TDS levels were higher in Bishnupur Beel, suggesting a greater concentration of dissolved minerals and salts. High TDS can affect the taste and health of aquatic organisms (Hem, 1985).

Turbidity (NTU)

- Chaltia Beel: Mean = 1.85, SD = 0.152
- Bishnupur Beel: Mean = 1.7, SD = 0.1

Both wetlands exhibited low turbidity, indicating clear water, with Chaltia Beel having slightly higher turbidity. Turbidity can affect light penetration and photosynthesis in aquatic ecosystems (Davies-Colley & Smith, 2001).

Dissolved Oxygen (mg/l)

- Chaltia Beel: Mean = 6.43, SD = 0.152
- Bishnupur Beel: Mean = 8.23, SD = 0.153

Bishnupur Beel had higher DO levels, which is beneficial for aquatic life. DO is a critical parameter for the survival of fish and other aquatic organisms (Wetzel, 2001).

Nitrate (mg/l)

- Chaltia Beel:<0.5
- Bishnupur Beel:<0.5

Nitrate levels were below the detection limit in both wetlands. Low nitrate levels indicate minimal agricultural runoff and wastewater discharge (Camargo & Alonso, 2006).

Phosphate (mg/l)

- Chaltia Beel: Mean = 1.4, SD = 0.015
- Bishnupur Beel: Mean = 0.51, SD = 0.026

Phosphate levels were higher in Chaltia Beel, which could be indicative of nutrient pollution. High phosphate levels can lead to eutrophication, causing algal blooms and oxygen depletion (Smith, 2003).

Ammoniacal Nitrogen (mg/l)

- Chaltia Beel: Mean = 0.58, SD = 0.025
- Bishnupur Beel: Mean = 0.52, SD = 0.1

Ammoniacal nitrogen levels were similar in both wetlands, with Chaltia Beel having a slightly higher concentration. Ammoniacal nitrogen is a product of organic matter decomposition and can be toxic to fish at high concentrations (Randall & Tsui, 2002).

Total Alkalinity (mg/l)

- Chaltia Beel: Mean = 281.2, SD = 3.8
- Bishnupur Beel: Mean = 243.2, SD = 3.8

Total alkalinity was higher in Chaltia Beel, indicating a greater capacity to neutralize acidic pollution. Alkalinity is essential for buffering pH changes in aquatic environments (Wetzel, 2001).
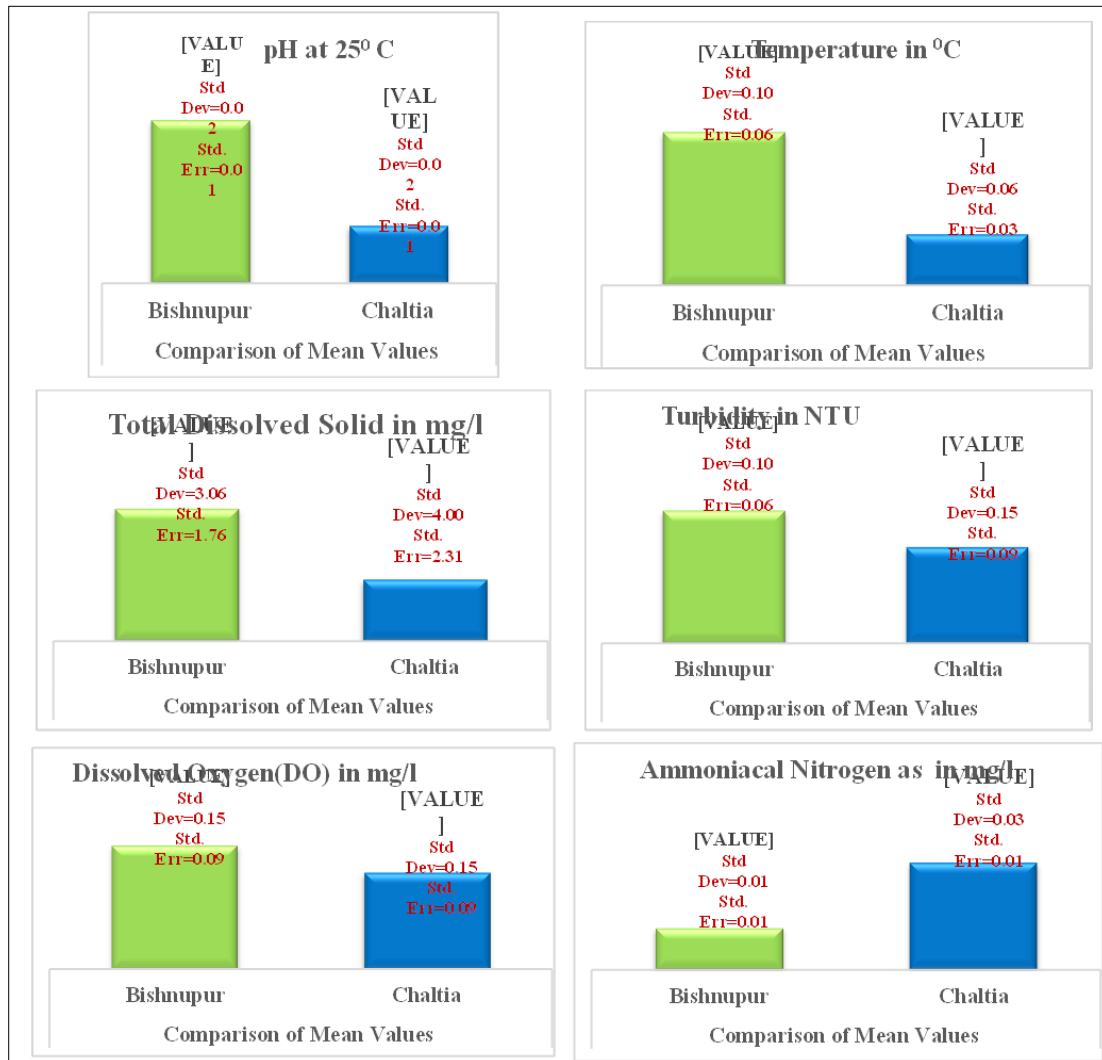

Figure 2 Water Quality Parameters of Bishnupur & Chaltia Beel: Graphical Representation

Recommendations

Based on the comparative analysis of water quality in Chaltia Beel and Bishnupur Beel, the following recommendations are proposed to improve and maintain the ecological health of these wetlands:

- Implement Regular Monitoring Programs
  - Establish routine monitoring of key water quality parameters such as Total Coliform, Dissolved Oxygen, pH, Temperature, TDS, Turbidity, Nitrate, Phosphate, Ammoniacal Nitrogen, and Total Alkalinity. This will help in tracking changes over time and identifying emerging issues promptly.
- Reduce Pollution Sources
  - Identify and control pollution sources contributing to high levels of microbial contamination and chemical pollutants in Chaltia Beel. This may include regulating agricultural runoff, wastewater discharge, and other anthropogenic activities impacting the wetland.
  - Encourage the adoption of best management practices (BMPs) in surrounding agricultural areas to minimize nutrient runoff, particularly nitrogen and phosphorus, which contribute to eutrophication.
- Enhance Public Awareness and Engagement
  - Conduct awareness programs for local communities, stakeholders, and policymakers about the importance of wetland conservation and sustainable practices. Engaging the community can lead to more effective pollution control and conservation efforts.

- Promote community participation in monitoring and conservation activities, fostering a sense of stewardship and responsibility towards the wetlands.
- Implement Restoration Projects
  - Undertake habitat restoration projects to improve water quality and biodiversity in both wetlands. This can include the reestablishment of native vegetation, creation of buffer zones, and restoration of natural hydrological regimes.
  - Consider introducing constructed wetlands or artificial aeration systems in Chaltia Beel to enhance the natural purification processes and improve dissolved oxygen levels.
- Strengthen Policy and Enforcement
  - Develop and enforce stringent regulations to control industrial discharges, sewage effluents, and agricultural runoff into the wetlands. Ensuring compliance with environmental standards is crucial for maintaining water quality.
  - Collaborate with local government agencies, environmental organizations, and research institutions to formulate and implement effective wetland management policies.
- Promote Sustainable Practices
  - Encourage sustainable agricultural practices that minimize chemical fertilizer and pesticide use, such as organic farming and integrated pest management (IPM). These practices can reduce the influx of harmful chemicals into the wetlands.
  - Support sustainable fishery practices to prevent overfishing and maintain the ecological balance within the wetlands.
- Conduct Further Research
  - Encourage interdisciplinary research to understand the complex interactions between various factors affecting wetland water quality. This can provide valuable insights for designing more effective management strategies.
  - Explore the potential impacts of climate change on wetland ecosystems and develop adaptive management plans to mitigate adverse effects.
  - By implementing these recommendations, it is possible to mitigate the adverse impacts of pollution, enhance the ecological health of Chaltia Beel and Bishnupur Beel, and ensure the long-term sustainability of these vital wetland ecosystems. Continuous efforts and collaboration among various stakeholders are essential to achieve these goals.

4. Conclusion

The comparative analysis of Chaltia Beel and Bishnupur Beel reveals significant differences in water quality parameters. Chaltia Beel exhibits higher levels of microbial contamination, phosphate, and total alkalinity; whereas Bishnupur Beel shows better dissolved oxygen levels and lower total coliform counts. These differences highlight the varying impacts of anthropogenic activities and natural conditions on the two wetlands. Continuous monitoring and management efforts are essential to preserve the ecological health of these vital water bodies (Gopal, 2013; Mitsch & Gosselink, 2007).

Compliance with ethical standards

Disclosure of conflict of interest

The author declares that there is no conflict of interest.

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