

**STATISTICAL MODELING OF INTER-RELATIONSHIPS BETWEEN
LIMNOLOGICAL PARAMETERS IN URBAN POND ECOSYSTEMS OF BHAGALPUR,
INDIA*****Dr. Priyama Kumari**

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ABSTRACT

This study investigates the complex inter-relationships between 18 physicochemical parameters in two urban ponds, Sahjangi and Bhairwa, in Bhagalpur, Bihar. Utilizing Pearson correlation coefficients, the research identifies critical drivers of aquatic health. Key findings include a strong negative correlation between water temperature and dissolved oxygen (-0.738) and significant relationships between nutrient levels and primary productivity. These findings provide a statistical basis for managing urban aquaculture systems under varying seasonal stresses.

KEYWORDS: Limnology, Statistical Modelling, Pond, Ecosystem.**1. INTRODUCTION**

Urban ponds are dynamic ecosystems that serve as vital "refuges" for aquatic biodiversity in heavily modified landscapes. In India, these water bodies are traditional sources for domestic use and aquaculture. However, rapid urbanization and sewage discharge increasingly threaten their ecological balance. Understanding the chemical equilibrium through statistical modeling is essential for effective conservation.

- Sampling: Monthly sampling was conducted from January 2021 to December 2022.
- Parameters: Eighteen parameters were assessed, including Water Temperature, pH, DO, BOD, COD, TDS, and nutrient concentrations (Nitrate and Phosphate).
- Statistical Analysis: Pearson correlation coefficients (r) were computed to evaluate the strength and direction of relationships between variables.

2. MATERIALS AND METHODS

- Study Area: Data was collected from Sahjangi and Bhairwa ponds in Bhagalpur. Bhairwa pond (25°14'47"N, 86°57'13"E) is a domestic pond used for cattle and fisheries.

3. RESULTS AND DISCUSSION**3.1 Monthly Limnological Variations**

The following data represents the monthly variation in Bhairwa Pond, showcasing the seasonal fluctuations of key parameters.

Parameters	Jan	Mar	Jun	Sep	Dec	Average
Water Temp (°C)	18.0	222.3	33.8	27.5	19.6	25.44
pH	7.49	7.34	7.19	7.24	7.36	7.29
TDS (mg/l)	76	81	92	87	75	84.33
DO (ppm)	6.31	6.30	5.89	5.97	6.24	6.09
BOD (mg/l)	3.64	3.91	5.06	4.91	4.03	4.42
Nitrate (ppm)	2.41	2.73	2.93	2.73	2.52	2.71

Statistical Correlation Analysis

- Temperature Drivers: Water temperature showed strong positive correlations with pH, CO₂, TDS, BOD, and COD. However, it exhibited a strong negative correlation with Dissolved Oxygen (-0.738), confirming that warmer water holds less oxygen.
- Oxygen Dynamics: Dissolved Oxygen (DO) was strongly negatively correlated with Total Suspended Solids (TSS) and Total Alkalinity. As TSS increases, DO levels tend to decrease, indicating the impact of organic load on oxygen availability.
- pH and Nutrients: pH showed significant negative correlations with Total Acidity (-0.903) and Nitrates (-0.837) in Shahjangi pond. This suggests that as pH decreases, the levels of nitrates and acidity increase.
- Total Dissolved Solids (TDS): TDS showed a strong negative correlation with alkalinity, implying that the composition of dissolved substances significantly dictates the buffering capacity of the water.

4. CONCLUSION

The statistical analysis reveals that while the ponds are currently fit for aquaculture (BOD < 4-10 mg/L), they are in a state of delicate chemical equilibrium. The strong correlations between temperature, oxygen, and nutrient levels highlight the vulnerability of these urban ecosystems to seasonal fluctuations and pollution. Implementing scientific pond management is necessary to maintain these productivity levels.

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