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Seasonal Variation in Plankton Diversity and Water Quality Parameters in Freshwater Tanks of Chintamani, Karnataka

Author: Dr. Muniraju

Assistant Professor, Department of Zoology, Government first Grade College for Women, Chintamani, Karnataka, India

1. Abstract

Plankton communities serve as key bioindicators for freshwater health. This study assesses the seasonal variation in plankton diversity and water quality in three major freshwater tanks of Chintamani Taluk, Karnataka, across pre-monsoon, monsoon, and post-monsoon periods during 2015. Quantitative and qualitative analyses of phytoplankton and zooplankton populations were conducted using standard limnological techniques. Concurrent water parameter assessments (temperature, pH, DO, BOD, nitrate, phosphate) revealed strong correlations with plankton abundance. Chlorophyceae dominated phytoplankton in pre-monsoon, while rotifers led the zooplankton communities post-monsoon. Findings highlight anthropogenic stress during summer and suggest conservation strategies for planktonic productivity management.

2. Keywords

Plankton diversity, limnology, freshwater ecology, water quality, Chintamani, phytoplankton, zooplankton, seasonal variation

3. Introduction

Freshwater ecosystems, particularly small tanks and ponds, are critical to biodiversity, water conservation, and rural livelihoods in semi-arid zones like Chintamani. Plankton, the primary producers and grazers, form the base of aquatic food chains and reflect ecosystem productivity.

Environmental variables such as temperature, nutrient load, and dissolved oxygen drive **seasonal fluctuations** in plankton populations. However, few studies from Karnataka have documented this interaction in the context of **rural freshwater tanks** influenced by agriculture and seasonal rainfall.

This study seeks to fill this gap by:

- Cataloging seasonal changes in **plankton diversity**
- Analyzing physicochemical parameters of tank water across seasons
- Correlating water quality with plankton abundance and composition

4. Materials and Methods

4.1 Study Sites

Three tanks were selected for their accessibility and local usage:

1. **Kerehalli Tank**
2. **Ramagondanahalli Tank**
3. **Thippenahalli Tank**

Each tank serves agricultural, domestic, and limited aquaculture purposes.

4.2 Sampling Period

Sampling was conducted **monthly from January to December 2015**, covering three main seasons:

- Pre-monsoon (Feb–May)
- Monsoon (June–Sept)
- Post-monsoon (Oct–Dec)

4.3 Plankton Collection and Identification

- **Plankton net mesh size**: 20 µm
- **Volume filtered**: 50 liters/site
- **Fixation**: 4% formalin
- **Analysis**: Sedgewick-Rafter counting chamber under 40x magnification
- **Identification**: Edmondson (1959) and APHA standards

4.4 Water Quality Assessment

Standard protocols followed (APHA, 2012):

- pH, Temperature, Dissolved Oxygen (DO), BOD
- Nitrate and Phosphate content using spectrophotometry

4.5 Data Analysis

- Diversity Indices: **Shannon-Weiner (H'), Simpson's Index**
- Pearson correlation: Plankton abundance vs. water quality parameters

5. Results and Discussion

5.1 Seasonal Plankton Variation

- **Phytoplankton**: 42 species across Chlorophyceae (dominant), Cyanophyceae, Bacillariophyceae
- **Zooplankton**: 27 species, dominated by Rotifera, Cladocera, and Copepoda
- Pre-monsoon: High density of *Scenedesmus* and *Nostoc*
- Monsoon: Reduced diversity due to dilution, but increased nutrient loads
- Post-monsoon: Bloom of *Brachionus* and *Moina* spp.

5.2 Water Quality Correlations

- Nitrate and phosphate peaked post-harvest months (May and November)
- **Positive correlation** between DO and phytoplankton diversity (r = 0.71)
- **Inverse correlation** between BOD and zooplankton abundance (r = -0.63)
- Sites near agriculture runoff had higher nutrient loads, promoting algal blooms

5.3 Interpretation

- Summer (pre-monsoon) stress due to evaporation and anthropogenic withdrawal
- Monsoon rejuvenates diversity but also introduces sediment runoff
- Post-monsoon stability fosters species succession

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6. Conclusion

The study underscores the **sensitivity of plankton communities to seasonal and anthropogenic changes**. Conservation of water bodies in Chintamani must consider plankton dynamics as part of tank management strategies.

Recommendations:

- Reduce fertilizer runoff using vegetative buffer strips
- Encourage community-based water quality monitoring
- Integrate limnological data in tank restoration planning

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7. Endnotes

1. Plankton diversity peaks during stable oxygen conditions.
2. Rotifers act as sensitive indicators of organic pollution.
3. Tanks serve as microcosms of ecological succession.
4. Cyanophyceae blooms may indicate eutrophication risk.
5. Water withdrawal during pre-monsoon can lead to hypoxia.
6. Cladocerans dominate under low turbidity.
7. Seasonal rainfall dilutes but also transports nutrients.
8. Phosphorus is often the limiting nutrient for algal growth.
9. DO saturation is highest near aquatic vegetation.
10. Farmer practices around tanks influence trophic dynamics.

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