

Freshwater Phytoplankton Diversity in an Indian Dam: A Study from Doswada, Tapi District, Gujarat

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Abstract:

The phytoplankton diversity of Doswada Dam was studied to assess ecological health and eutrophication status. Eleven taxa were found, among which four of the dominating phyla consisted of Ochrophyta (2 taxa), Chlorophyta (4 taxa), Cyanobacteria (3 taxa), and Euglenophyta (2 taxa). Predominance of Chlorophyta and presence of bloom-forming cyanobacteria such as *Microcystis aeruginosa*, *Oscillatoria sp.*, and *Spirulina sp.* indicated a nutrient-rich (eutrophic) habitat. Altogether, the community structure of the phytoplankton indicated a moderately diverse and productive aquatic habitat with an initial indication of nutrient loading. These results emphasised the necessity of biological monitoring for maintaining water quality in the reservoir.

Keywords —Phytoplankton, Freshwater Ecosystem, Diversity, Doswada Dam, Gujarat, Nutrient Enrichment

I. INTRODUCTION

Phytoplankton are microscopic photoautotrophic organisms forming the base trophic level in aquatic food webs. They are important not only for carbon fixation and oxygen production but also to keep zooplankton and fish at upper trophic levels [1], [2]. Change in composition and abundance mirrors change in environmental conditions. Therefore, they are good indicators of water quality and health of the ecosystem [3].

In the last decades, anthropogenic processes like agricultural runoff, sewerage outfalls, and industrial effluents have modified the nutrient regimes of Indian freshwater ecosystems. Therefore, it is important to monitor diversity of phytoplankton as an indicator of ecological balance and as an index of the degree of pollution. In Gujarat, plankton diversity in reservoirs and riverine systems like Sabarmati and Tapi Rivers were investigated by various authors [4],[5]. These identified the dominant phyla to be Chlorophyta and Bacillariophyta, which are both sensitive to nutrient enrichment as well as intensity of light.

Though much has been documented about large rivers, less-influential water bodies such as the Doswada Dam have not been explored to that extent.

The present study fills the research gap by reporting information on phytoplankton diversity and its ecological significance.

II. MATERIALS AND METHODS

A. Study Area

Doswada Dam is located at 21.25°N and 73.00°E in Tapi District, Gujarat. The dam is primarily used for irrigation and domestic water supply. It is surrounded by agricultural lands, exposing it to nutrient-rich runoff during monsoon periods.



Fig.1 Doswada Dam, sampling site

Table 1. Characteristic of Doswada Dam

Parameter	Details
State	Gujarat
District	Tapi
River	Mindhola River
Mean Annual Rainfall	1788 mm – 2032 mm
Catchment Area	61 km ²
Area (at FRL)	1.33 km ²
Maximum Depth	30 ft
Length at Top of the Dam	777 m
Maximum Height	10.05 m
Gross Storage Capacity	4.95 million m ³ (mm ³)
Effective Storage Capacity	4.746 million m ³ (mm ³)
Year of Construction	1912

B. Sampling and Identification

Phytoplankton samples were collected in March 2022 using a plankton net (20 µm mesh size). Samples were preserved in 4% formalin and Lugol’s iodine. Identification was conducted using compound microscopy and standard taxonomic keys [7],[8].

III. RESULTS

A total of 11 phytoplankton species were identified, classified into four major phyla:

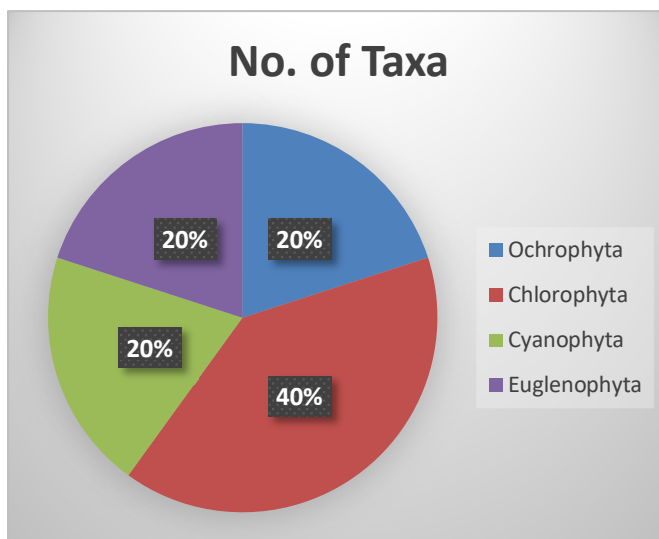


Fig. 1 Taxa classification of phytoplankton

Ochrophyta: *Synedra ulna*, *Nitzschia* sp.

Chlorophyta: *Pediastrum simplex*, *Pediastrum simplex* var. *echinulatum*, *Mougeotia* sp., *Ulothrix* sp.

Cyanophyta: *Microcystis aeruginosa*, *Oscillatoria* sp., *Spirulina* sp.

Euglenophyta: *Euglena viridis*, *Phacus longicauda*

Synedra ulna and *Nitzschia* sp. are representative benthic diatoms and are typically indicators of well-oxygenation with moderate levels of nutrients. Their occurrence indicates stable environmental conditions with probable availability of silicate

Green algae dominance, such as *Pediastrum*, *Ulothrix*, and *Mougeotia*, indicate eutrophic to mesotrophic conditions.

Green algae are normally opted for in scenarios of abundant light and nutrients, indicating productive surface waters.

IV. DISCUSSION

The community structure of phytoplankton in Doswada Dam is characteristic of a moderately eutrophic ecosystem. The occurrence of *Microcystis aeruginosa* and *Oscillatoria* sp. is a sign of anthropogenic nutrient loading, which probably comes from the surrounding agricultural farms. These cyanobacteria are infamous bloom-causing and could be the cause of low oxygen levels [9].

In comparison with studies in Sabarmati River [4], Doswada Dam has shown the same pattern of dominance but with increased Euglenophyta occurrence. This may be due to stagnation conditions along with increased organic content. Contrary to this, Ganga River studies [10] have shown increased diatom occurrence during pre-monsoonal periods, reflecting increased oxygenation.

Rastogi and co-researchers [11] provided a comprehensive review of the factors influencing cyanobacterial blooms, the nature and effects of cyanotoxins, and strategies for mitigating their impact on environmental and public health.

V CONCLUSION

This study introduces the first data on phytoplankton diversity at Doswada Dam. Dominance by Cyanophyta, Chlorophyta, and Bacillariophyta indicates mesotrophic to weakly eutrophic conditions. The results are a baseline for comparative works to follow and underscore the need for continuous monitoring of water quality in

small reservoirs. The presence of cyanobacteria, green algae, and diatoms indicates an ephemeral nutrient regime, potentially mesotrophic to eutrophic

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