A Review On Phytoplankton Diversity In Freshwater Lakes Of India

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Abstract

A supply of water is necessary for human survival. Access to clean drinking water is essential for a person's healthy development. This is a thorough analysis of the phytoplankton ecology found in India's freshwater lakes. To gain a deeper comprehension of the dispersion of phytoplankton, review research was conducted. The relationship between phytoplankton and several parameters in Indian lakes, including temperature, wind, transparency, sunlight penetration, pH, and seasonal fluctuations, was covered by the authors. Additionally, the relationship between phytoplankton and nutrient enrichment and prey-predator dynamics was examined. The findings showed the authors that every lake environment is unique from the others. The authors came to the final conclusion that phytoplankton ecology serves as an indicator for assessing the effects of influencing factors. These elements offer a good lake management strategy. The ecology of phytoplankton offers a platform for tracking and evaluating freshwater lake management tactics.

Keywords: Phytoplankton, Lake, Seasonal fluctuation, ecology, pH

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I. INTRODUCTION

Life began in an aquatic environment approximately 4,000 million years ago. Nowadays, the majority of taxonomic phyla live in aquatic habitats. Phytoplankton is the most common microscopic, unicellular organism in an aquatic environment. Approximately half of the earth's primary producers were phytoplankton. Giripunje, Manisha D. 2013. The word "plankton" comes from the Greek word "Wandering." Victor Hensen (1887) coined the term "plankton" to describe the aquatic populations of drifting and floating animals that are predominantly propelled by water currents rather than by their own swimming prowess. While this is true, it's important to keep in mind that many plankton creatures can swim quite well and cover rather large distances over time, especially when traveling vertically, despite their small size. Animal and plant-based creatures are included in the category of plankton. Phytoplankton refers to the plant portion of plankton, while zooplankton refers to the animal portion. A third class of organisms known as saproplankton is capable of absorbing dissolved organic materials. The families Chlorophyceae, Cyanophyceae, and Bacillariophyceae comprise the bulk of phytoplankton. They play a crucial role in the food chain due to their special capacity to fix inorganic carbon and increase organic matter through primary production.

Researchers have been involved in the study of India's freshwater lakes' phytoplankton ecology in recent years. But in the early years, a number of studies were published on the distribution and density of phytoplankton in freshwater lakes throughout India (Ganapati, 1940; Mohan, 1987; Chaudhary & Pillai 2009; Singh & Balasingh 2011; Dakshini & Gupta 1979; Sarwar, 1996, Tiwari & Chauhan 2006, Mukherjee et al., 2010; Jain et al., 1999; Chattopadhyay & Banerjee 2007; Ghosh et al., 2012; Jhingran, 1989; Somani et al., 2007; Maske et al., 2010). We provided a thorough literature synthesis on the interactions between several factors and phytoplankton ecology in freshwater lakes located in the north, south, east, and west of India in this review. An enhanced comprehension of phytoplankton ecology in the context of freshwater lakes in India could be obtained from this review. It ought to evaluate qualitatively any anthropogenic modifications that led to nutrient enrichment. Future research on the management of freshwater lakes with phytoplankton distribution can build on this foundation.

II. PHYTOPLANKTON ECOLOGY

Numerous studies on the dispersion of phytoplankton in freshwater lakes with respect to light availability (Singh & Sharma, 2012) and physical, chemical, and biological properties (Zafar, 1967; Munawar, 1974) have been reported by Indian researchers. Freshwater lakes in India are currently under extreme ecological stress as a result of growing pollution brought on by fast industrialization. Nonetheless, seasonal variations mostly controlled the growth pattern of phytoplankton. According to studies, the summer is the best season for phytoplankton growth in freshwater lakes due to the long daylight hours, higher salinity, pH, and trophotropic activity (Chaturvedi et al., 1999).

On the other hand, due to factors like high turbidity, decreased salinity, temperature, pH, overcast skies, low nutrient concentration, and phytoplankton consumption by fish and zooplankton, phytoplankton production decreased in the late summer and monsoon season (Saravanakumar et al., 2008). According to Chaudhary & Pillai (2009) and Sugunan (2000), the phytoplankton community advances in serial successions that end in peak sequences with low turbidity and low wind velocity in the lakes. Anand (2000) elucidated the limnological importance of a Diatom species' ecology in connection to variations in water quality metrics at various sections of a Jammu stream. According to Coesel (2001), desmids are extremely sensitive microorganisms from an ecological standpoint. They are a valuable tool for managing aquatic conservation, particularly when macro organisms are unable to succeed.

In two lakes in Mysore, India, Mahadev and Hosmani (2002) examined the relationship between phytoplankton and the Langliers index. According to their findings, the presence of significant pollution in water is indicated by the absence of Desmids. When Steinhart et al. (2002) investigated phytoplankton in southern Chilean lakes as a sign of nutrient deficit, they discovered that phosphorus is still a limiting component in aquatic systems. Desmids were shown to be markers of high water quality. Microcystis is a widely dispersed organism that predominates in the phytoplankton community in nutrient-rich lakes, according to Brunberg and Blomqvist (2002).Lange and Tiffany (2002) observed that diatoms, which are typically associated with benthic and epiphytic habitats, get mixed into plankton in such systems when turbulence is significant in a lake, as during severe winds.

The South American wetland's algal assemblages were examined by Izaguirre et al. (2004). According to the study, the phytoplankton in the lake was primarily made up of microscopic autotrophic green algae and a large number of flagellates belonging to the groups Euglenophyceae, Dinophyceae, and Cryptophyceae. The findings suggested that the macrophytes cover was most likely the driving force behind the algae species' selection in the transitional zone that makes up a shallow lake on a floodplain. Following a thorough study of Kenya's wetlands, Owen et al. (2004) noted that the Diatom flora exhibits distinct variations between different types of wetlands.

Tewari and Srivastava (2004) looked into the pattern of algal flora distribution in a body of water impacted by the adjacent Indian rubber factory's effluents. They claim that because algae have a great range of tolerance against the contaminated water released from rubber factories, they serve highly significant roles as pollution indicators. The study conducted by G.M.N. Rao and colleagues (2010) examined the seasonal variations in phytoplankton composition in the Pandi Backwaters of the Godavari Estuary, Andhra Pradesh, and the abundance of micro algae therein.

According to the current study, the Chlorophyceae and other groups are the leading group, followed by diatoms. An urban freshwater river's algae was studied hydrobiologically by Jafari, N.G. and Gunale, V. R. (2006). Blue-green algae and diatoms such as Oscillatoria, Lyngbya, Anabena, Microcystis, Navicula, Nitzschia, Synedra, and Gomphonema predominate in the algal flora of contaminated water bodies. Several green algae, including Chlamydomonas, Scenedesmus, Ankistrodesmus, and Pandorina, were also widely and often found throughout the examination. The study conducted by Kolhapur, Patil Shilpa G. et al. (2012) examined the effects of the physico-chemical characteristics of lakes on phytoplankton communities. Nine species belonging to the Chlorophyceae class, four species from the Cyanophyceae class, three from the Bacillariophyceae class, and three from the Euglenophyceae class were observed.

III. DISCUSSION

At the base of the food chain, phytoplankton is a large source of physiologically significant and labile organic carbon, making it an essential part of aquatic ecosystems. Several physico-chemical properties of water have a significant impact on the density and productivity of phytoplankton. When estimating eutrophication, algae are

a great resource. Algal indices of pollution have been developed by thorough studies of the distribution and quality of the algal flora in rivers.
Temperature and light have an impact on the number and quality of phytoplankton. The current observation revealed a peak time between April and June when taking plankton as a whole. It's likely that the water's steady temperature rise encouraged the ideal conditions for the algae population's development and reproduction.
According to Prescott (1984), the ideal temperature range for fresh water is 20–25 0C. Depending on the species, a rise in temperature can have either a favorable or negative impact on phytoplankton's net growth.
In the results portion of this review study, the ecology of phytoplankton was covered. The regulation of phytoplankton in freshwater lakes and rivers in India was largely dependent on variables. The groups of phytoplankton, which include green and blue-green algae, differed according to the freshwater's nutrient availability. Due to several circumstances, phytoplankton in lakes across India underwent diversification. Early winter phytoplankton composition was influenced by diatoms such as Navicula sp., Nitzschia sp., Synedra sp., and Melosera sp. across the country. Diatoms, which are excellent markers of pollution, were found in the uncontaminated areas of the waters. Green and blue green algae were used by the phytoplankton group to replace the diatom flora, causing more pollution in waterways. The presence of phytoplankton in freshwater is ultimately determined by variables like seasonality, daylight duration, wind patterns, lake depth, temperature, pH, turbidity, dissolved oxygen, and nutrient enrichment such as phosphate, organic carbon, and dissolved chloride. We also paid attention to how biotic variables affected the population of phytoplankton. That could have an impact on phytoplankton's dispersal pattern. The writers of this review talked about how many factors affected the phytoplankton in India's freshwater. Every ecosystem for a resource is unique. In order to prevent algal blooms caused by the variables mentioned above, rivers and lakes needed appropriate management measures. Diffuse nitrogen sources from changing land cover were seen in some freshwater investigations. These studies are probably manageable, but recovery takes many years.

IV. CONCLUSION

The review makes it abundantly evident that a variety of factors significantly impact phytoplankton ecology in India's freshwaters. According to a review study, climate conditions are a major factor in the majority of Indian studies on phytoplankton ecology. However, phytoplankton assemblages are not the only things impacted by climate conditions. Phytoplankton ecology was also influenced by soil or sediment, geochemical properties, land use, and watershed characteristics. Studies of Indian freshwater does not properly report research on these or other unknown aspects. To explain the relationship between phytoplankton populations and freshwater chemistry as well as other aspects in the Indian context, more research was needed. Nonetheless, the majority of the case studies that are covered are fundamental and offer the data required to create management and protection strategies.

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