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B Keshavulu
Research Scholar, Department of Botany, University College of Science, Osmania University, Hyderabad, Telangana, India

K Shailaja
Professor, Department of Botany, University College of Science, Osmania University, Hyderabad, Telangana, India

Corresponding Author:
B Keshavulu
Research Scholar, Department of Botany, University College of Science, Osmania University, Hyderabad, Telangana, India

A study on fresh water phytoplankton diversity in gopaldinne reservoir, wanaparthy, Telangana

B Keshavulu and K Shailaja

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Abstract
Fresh water Algae are diversified photosynthetic organisms. Hydrological cycles regulate freshwater ecosystems, evaporation by solar radiation drives the planet Earth, recycling of nutrients. Freshwater ecosystems are the home for a wide variety of biodiversity. Algae are involved in recycling of nutrients. Urbanization and other undue pressure by anthropogenic activities and ultimately water become unfit for drinking and even for irrigation. The study was carried out during the period, 2022 to 2024. The present study documents the richness of algae in Wanaparthy district of Telangana State, India. The study revealed that total 85 species, with 35 belonging to the Chlorophyceae, 25 belonging to the Bacillariophyceae, 22 belonging to the Cyanophyceae and 6 belonging to the Euglenophyceae. In terms of average incidence across the sample period, Chlorophyceae were the most prevalent, followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae. The species diversity pattern was more or less uniform throughout the study period in lake, indicating the oligotrophic nature and it is useful for human consumption.

Keywords: Chlorophyceae, bacillariophyceae, cyanophyceae, euglenophyceae, freshwater ecosystem

Introduction
Freshwater ecosystems are one of the vital components of ecosystems and they are part of inland waters. Lakes, ponds, rivers, streams, spring, and wetlands, are broadly classified into lentic and lotic systems, i.e., still and flowing waters, respectively. Hydrological cycles regulate freshwater ecosystems, evaporation by solar radiation drives the planet Earth, recycling of nutrients. Freshwater ecosystems are the home for a wide variety of biodiversity. Freshwater ecosystems are repertoire of resources for the living organisms such as drinking water, flood control, climate regulation, food production etc. Aquatic ecosystems offer eco-tourism and recreation.

Nearly 3% of water on the planet is considered “fresh water” (i.e., salinity < 0.5 parts per thousand). Of the 3% of global water, that is fresh water, only an extremely small proportion is available as habitats for living organisms on the surface of the Earth. The aquatic freshwater habitats are both flowing (lotic) and static (lentic). The freshwater habitats may also contain some of the most endangered species in the biosphere.

Living organisms are made of cells and every cell is composed of on average 60% of water, and it is the universal solvent and necessary for the metabolic activities in cells. Human population is exploding astronomically and to meet the demands of food grains, usage of pesticides and fertilizers became inevitable. These residues ultimately cause biomagnification and urbanization increased the pressure on water bodies. There is a need to protect them from pollution to continue the life on earth. Environmental conditions such as salinity, oxygen, temperature, P^H and nutrients influence the composition distribution and growth of its biota [1].

Phytoplanktons are the producers in aquatic ecosystem and from these energy is transferred to higher organisms through food chain [2] [3]. Phytoplanktons are the pioneers of aquatic pond chain. The productivity of an aquatic system is directly related to diversity of phytoplankton. They are source of food for zooplankton, fishes and other aquatic organisms.

Maintenance of a healthy aquatic ecosystem depends on the physico-chemical and the biological diversity of ecosystem.

Physico-chemical parameters effect plankton distribution, occurrence and species diversity [4]. Diversity of phytoplankton is influenced by aquatic environment particularly silica and other nutrients [5]. In India, diversity of phytoplankton in different freshwater bodies along with their physic-chemical characteristics were studied by earlier workers [6, 7, 8, 9, 10]

Materials and Methods

Study Area: Gopaldinne reservoir is located in between 16. °7'51"N 78. °6'6"E Wanaparthy of Telangana. The Present study aims to study the diversity of phytoplanktons so as to assess the water quality of the lake. The purpose of the present study is to determine the distribution and density of phytoplankton population in the lake.

Water samples were collected from the lake in clean 2L plastic bottles at monthly intervals for two years from June 2022 to May 2024. Two sampling sites were identified in the lake. The sampling sites are; Site-S1- is the location of the lake receives water from Jurala project (Indhira Priyadarshini), Sampling Site-S2- is the location of the lake that opens into irrigation canal that supplies water to its catchment area.

Phytoplankton sampling and analysis

Water samples for phytoplankton quantification were collected from two different study sites of Gopaldinne Reservoir, Wanaparthy. After being treated with 15 mL of 4 percent formaldehyde and 10 mL of Lugol's iodine, a 1000 mL composite sample was exposed to sedimentation. The sediment was then concentrated to a volume of 20 mL and deposited in a vial to be used later on in the process. Carefully the drops were placed on a slide and then covered with a cover slip, with one drop placed in each vial.

Results and Discussion

Four algal types were discovered in the lake during phytoplankton sampling (2022-2024): the Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyceae. In terms of average incidence across the sample period, Chlorophyceae were the most prevalent, followed by Bacillariophyceae, Cyanophyceae and Euglenophyceae.

Chlorophyceae include species *Pandorina morum*, *Pediastrum duplex, Pediastrum boryanum, Scenedesmus quadricaudus, S. acuminatus, Closterium actum, Cosmarium geminatum, Staurastrum manfeldtii, Pediastrum simplex, Pediastrum tetras, var. tetrahedron, Selenastrum gracile, Scenedesmus armatus, Closterium tumidilum, Cosmarium submidin* and *Staurastrum javanicum*. *Pandorina morum* and *Pediastrum simplex* are the dominating species.

Bacillariophyceae include species *Pinnularia borealis, Melosira granulate, Synedra ula, Navicula cuspidate, Cymbella aspera, Synedra tabulate, Achnanthes microcephaly, Achnanthes minutissima, Gomphonema acceptatum, Nitzschia denticule* and *Coelastrum cambricum*

Cyanophyceae species are *Chroococcus minutus, Merismopedia glauca, Oscillatoria formosa, O.curviceps, Anabaena orientalis, Aphanocapsa, Oscillatory amoena* and *O. tenuis. Chroococcus minutus* is the dominating species among the other cyanophyceae members. Euglenophyceae include species *Phacus curvicauda* and *Trachelomonas hispida*.

Table 1: Relative distribution of Phytoplanktons in Gopaldinne reservoir (year 2022-2024)

Chlorophyceae	**193.58**
Bacillariophyceae	139.45
Cyanophyceae	99.85
Euglenophyceae	1.43

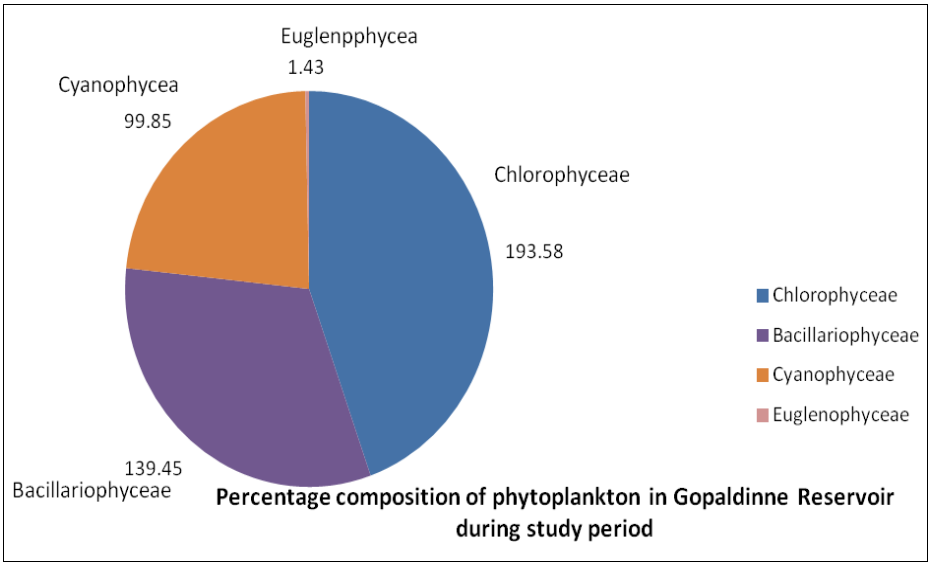

Fig 1: Relative distribution of Phytoplanktons in Gopaldinne reservoir (year 2022-2024)

Diatoms are among the most abundant and diversified algae species that is nearly one fourth of all algae species. These alkaline locations were a huge success with the general population (pH nearly 8). The majority of diatoms were discovered throughout the study.

In winter seasons, the number of Chlorophyceae decreased. It has been discovered that green algae (Chlorophyceae) can thrive in freshwater habitats with high concentrations of nitrate and phosphate. Higher temperatures and longer photoperiods may be responsible for the increased Chlorophycean diversity. In accordance with the findings of this study, other researchers have proposed that the organisms

of this species achieve high or low diversity depending on their tolerance to environmental conditions related to long-term organic contamination [11]. Which is consistent with the findings of this study.

Bacillariophyceae (Diatoms) are vital in pollution research as they are more selective than other algae species in terms of growth. They are single-celled algae with a cell wall composed primarily of silica.

The wall is made up of two flat-surfaced valves that are linked together by a band or girdle to form a solid structure. They can be found in various habitats, including freshwater and saltwater, as well as on moist soil surfaces. It has been shown that the distribution of diatoms is related to lake water, pH and other properties indicating that diatoms are good indicators of water quality. In the aquatic ecosystem, diatoms can be used as markers of past and present environmental conditions by analysing their growth patterns. This is because many diatom species have distinct and often narrow preferences for specific habitats and water quality conditions.

Cyanophyceae were found in all two locations to have a distinct pattern of periodicity in their growth. It was discovered that they were present at two places throughout the investigation period, with a peak in the summer. Even though the meteorological conditions were the same in both locations, it was discovered that the flora composition and population density were significantly different. This is because the chemical composition of the locations differs in terms of average sulphate, chloride, nitrate and phosphate concentrations.

The Cyanophyceae are frequently an essential phytoplankton group in eutrophic tropical lakes because they produce large amount of oxygen [12].. In addition to impacting the phytoplankton community composition, they are known to form dense colonies on occasion. euglenophyceans are expected to thrive in oceans with a high concentration of organic residues. A similar pattern of observations were observed when working on south Indian lakes [13]. Before the onset of the rainy season, the overall amount of phytoplankton was higher [14]. The coexistence of algae species in a phytoplankton community is a fantastic component of the varied patterns discovered by earlier scientists depending on the physicochemical characteristics of the water column and the atmosphere [15].

Species diversity is an excellent indicator of an ecosystem's health and pollution stress. Model studies show a positive relationship between nutrient levels, such as phosphorus, pollution levels and phytoplankton carbon uptake in freshwater and brackish environments. Reduced phytoplankton diversity due to pollution may directly negatively impact aquatic primary production [16].

The total biomass of phytoplankton and the diversity of phytoplankton species are employed as indicators of water quality in lakes and reservoirs because phytoplankton populations are particularly sensitive to changes in their environment [17].

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