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PHYSICO-CHEMICAL PARAMETERS AND DISTRIBUTION OF PHYTOPLANKTON IN GUNDLA CHERUVU IN ARMOOR VILLAGE, ARMOOR MANDAL, NIZAMABAD DISTRICT, TELANGANA STATE.

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ABSTRACT
From November 2014 to October 2015, a study was conducted on Gundla cheruvu in Armoor village, Armoor mandal, Nizamabad District, Telangana state. Samples were collected in the morning each month to analyze their physical, chemical, and biological characteristics. The examined physico-chemical parameters included Water Temperature, Turbidity, pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and nutrients such as Chloride, Nitrate, Phosphate, Sulphates, and Silicates. Results indicated that the concentration of physico-chemical parameters was higher in the summer than in other seasons. The primary producer community, known as phytoplankton diversity, consisted of various algae forms, which serve as significant biological indicators of water quality. The study suggested that Gundla cheruvu was at risk of eutrophication, emphasizing a potential combination of water quality indices and pollution contamination.

Keywords
Physico-chemical analysis, Phytoplankton diversity, Gundla cheruvu.

INTRODUCTION
Water is an essential component of all living organisms and plays a crucial role in the biosphere, biogeochemical cycles, and Earth's ecosystem. Freshwater resources are increasingly scarce, and the rapid decline in water quality has become a national concern, Abdar (2013). Threats to global freshwater biodiversity can be categorized into five interacting groups: overexploitation, water pollution, and habitat degradation, Agarwal (1999), Abd-Ellatif et al., (2016). To prevent the use of contaminated water for human consumption, it is crucial to thoroughly understand the ecosystems of this lake. Local populations use lake water for various purposes, including bathing, laundry, and washing kitchenware. Additionally, inlets discharging water into lakes often carry chemical pesticides and fertilizers, further contaminating the water. Considering the environmental impact of water chemistry, biological assessment is a valuable alternative for evaluating the ecological quality of aquatic ecosystems, Amin Hossaini Motlagh, Navatha and Manikya Reddy (2013).

Eutrophication is a phenomenon linked to the nutrient enrichment of aquatic ecosystems, resulting from the gradual aging process of lakes. This process, known as succession, is exacerbated by the inability of lakes to purify themselves, making them prone to accumulating pollutants and becoming more intricate and delicate. The decline in water quality and the shrinkage of water bodies, driven by increasing anthropogenic influence in the catchment area, have accelerated eutrophication. Understanding the distribution of plankton and the stratification of lakes requires consideration of physical characteristics such as temperature, light penetration, and water movement. These factors collectively determine the lake biological community and consequently, the quality of the water. Both human activities and natural dynamics can significantly alter a lake physico-chemical characteristics, impacting the quantity and quality of the water, the distribution and diversity of species, the lake productive capacity, and the balance of the surrounding ecological system.

Phytoplankton form the foundation of nutritional cycles in aquatic ecosystems. Their composition is influenced by numerous factors that change with ecological shifts. The structure of the ecosystem relies heavily on phytoplankton and the composition of their communities, Abd-Ellatif et al., (2016). As primary producers, phytoplankton are a vital energy source and the building blocks for all life in aquatic environments. Photosynthetic primary production ultimately drives productivity at higher trophic levels. Eutrophication has already pushed some lakes to the brink of disappearance. Therefore, to prevent further degradation, these lakes need focused attention and a thorough understanding of their ecosystems. Water Quality Indices vary, while pollution indices calculations indicate that these lakes are contaminated and at risk of eutrophication.

MATERIALS AND METHODS

The majority of the analysis, including measurements of Water Temperature, Turbidity, pH, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Dissolved Oxygen (DO), Total Dissolved Solids (TDS), Total Suspended Solids (TSS), and concentrations of Chloride, Nitrate, Phosphate, Sulphates, and Silicates is conducted through laboratory tests as outlined by Altaf Ganai and Saltanat Parveen (2014).

Planktonic algal species were sampled monthly from Gundla cheruvu between November 2014 to October 2015. Terrestrial algae were collected early in the morning using a knife, while benthic algae were retrieved with forceps. Samples were preserved in a 4% formaldehyde aqueous solution in the lab for research purposes. Morphological examinations of the fresh material were conducted using a light microscope. The identification of taxa was based on the methodologies of Airill, Querijero and Ching (2016), Arumugam, Sivakami and Premkishore (2015), Tiwari, Rana, and Chauhan (2006), Bowling (2009) and Boyd et al. (2013).

RESULTS AND DISCUSSION

Physico-chemical parameters

The temperature range at Gundla cheruvu varied from 21.30 to 32.50°C shown in Table-1 and Figure-1, Similar reports on temperature of aquatic ecosystems were produced by Ross (1969),

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Thomas (1973), Swarnalatha and Narasingrao (1998), Bhalla et al., (2006) and Chinnaiah et al., (2011). Turbidity values ranged from 19.4 to 29.5 at Gundla cheruvu, Table-1 and Figure-1, Comparable observations have been made by Krishnamoorthi et al., (2011), Young et al., (1985), Garg et al., (2006), and Solanki et al., (2015).

A pH meter scale measures the concentration of hydrogen ions in a solution, indicating its acidity or alkalinity. pH fluctuations in water can affect various physicochemical properties. The pH values ranged over a year at Gundla cheruvu from 6.9 to 8.9, With alkaline conditions promoting the growth of primary producers, consistent with findings reported by Ishaq & Khan (2013), Kumar and Prabhahar (2012). The estimated BOD content as shown in Table-1 and Figure-1. In November 2014 to October 2015, The BOD range at Gundla cheruvu 8.2 to 17.2. In findings, Mittal and Senegar (1989) and Warwick and Wolverton et al., (1983) noted reduced BOD readings throughout the winter and attributed this to phyto populations as the main cause. Blue greens were observed by Panday and Tripati (1984) to be both qualitatively frequent and directly connected to changes in BOD, Table-1 and Figure-2.

The range in COD values are shown in Table-1 and Figure-2. The COD values range for a year at Gundla cheruvu 83 to 161. In their studies on the ecology of water bodies, Trivedy et al., (1990). increased the use of BOD and COD to assess the standards of water quality. Monthly COD was high in the summer, which was consistent with Chatterjee (1992) observations. Sinha and Biswas (2016) and Rajashekar et al., (2010), recently completed comparable work in the field of water bodies. The DO range for a year at Gundla cheruvu 5.8 to 10.6 shown in Table-1 and Figure-2. A higher DO value in an aquatic environment indicates more photosynthetic activity and less organic matter that will be destroyed by biological processes. These findings concurred with those of Kannel et al., (2007), Rai (1978), Shashikant and Raina (1990), Rajakumar and Ramanibai (1994).

The TDS range for a year at Gundla cheruvu 122 to 240 shown in Table-2 and Figure-3, Hascoet et al., (1986), Subba Rao (1981), are a few notable reports that are comparable to the current study. The total dissolved solids are unevenly distributed throughout the many water bodies in India, Chinnaiah et al., (2011), Sharma et al., (2010), Kumbhar et al., (2009). The TSS values range for a year at Gundla cheruvu 85 to 506 shown in Table-2 and Figure-3. TSS is a benchmark that protects the supporting food web of lakes, Berry et al., (2003), Chapman et al., (2017), Lloyd (1985), Arruda et al., (1983), Caux et al., (1997).

The Chloride content range for a year at Gundla cheruvu 77 to 97.7 shown in Table-2 and Figure-3. Munawar 1970, a high chloride content suggests an increased level of organic contamination. The findings of the content of chlorides has a correlation with the purity or impurity of water. The nitrates ranged from 0.42 to 0.92 shown in Table-2 and Figure-4. According to Jones et al., (1993), nitrate in surface water is a significant element in determining the quality of the water, with waste discharges and synthetic nitrogenous fertilizers being the

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main contributors. However, bacterial oxidation and plant nitrogen fixation also make a small but significant contribution, EPA (2001). According to Mithani et al., (2012), the increased levels of nitrate during the monsoon season were mostly caused by the nitrate to rich runoff from agricultural areas and a significant amount of sewage that was tainted. Khound et al., (2012), Lalparmawii (2007), Singh, M.R. and Gupta, A. (2010) all observed similar findings.

Table-2 and Figure-4, illustrate the range of phosphate concentrations found in the sampling site. For a year at Gundla cheruvu 0.13 to 0.90. The research cites previous studies by Mithani et al., (2012), Dwivedi and Pandey (2002), Jones et al., (1993), Lalparmawii (2007), Singh and Gupta (2010), and Khound et al., (2012) to support the significance of nitrate levels in surface water quality assessment. The results of sulfate ranged for a year at Gundla cheruvu 19.5 to 40.1 shown in Table-2 and Figure-5. Sulfate plays a crucial role in the aquatic environment due to its various effects. It can act as a lethal agent against slugs and snails and help regulate algae populations. Moreover, sulfate is essential for the aquatic environment, as it aids in the treatment of bacterial and ectoparasitic disorders. Shuhaimi et al., (2010), Saifullah et al., (2014), and Wani et al., (2013) have all contributed to understanding the significance of sulfate in aquatic ecosystems through their research. The silicate content in the water samples collected from Gundla cheruvu displayed a distinct trend in the range in silicate content, which is a common component of the water found in any body of water. During the year of November 2014 to October 2015, at Gundla cheruvu 2.1 to 5.2 shown in Table-2 and Figure-5, Das and Pandey(1978), Garg et al., (2006 and 2009) presented reports indicating the impact of silicates in relation to pollution of water body.

Table-1: Physico-chemical parameters of Gundla cheruvu showing ranges expressed in (mg/L), except Temperature(°C), Turbidity (NTU) and pH for the year 2014-2015

Range	Temperature	Turbidity	pH	Biological Oxygen Demand	Chemical Oxygen Demand	Dissolved Oxygen
Min	21.3	19.4	6.9	8.2	83	5.8
Max	32.5	29.5	8.9	17.2	161	10.6

Note: Max=Maximum, Min=Minimum

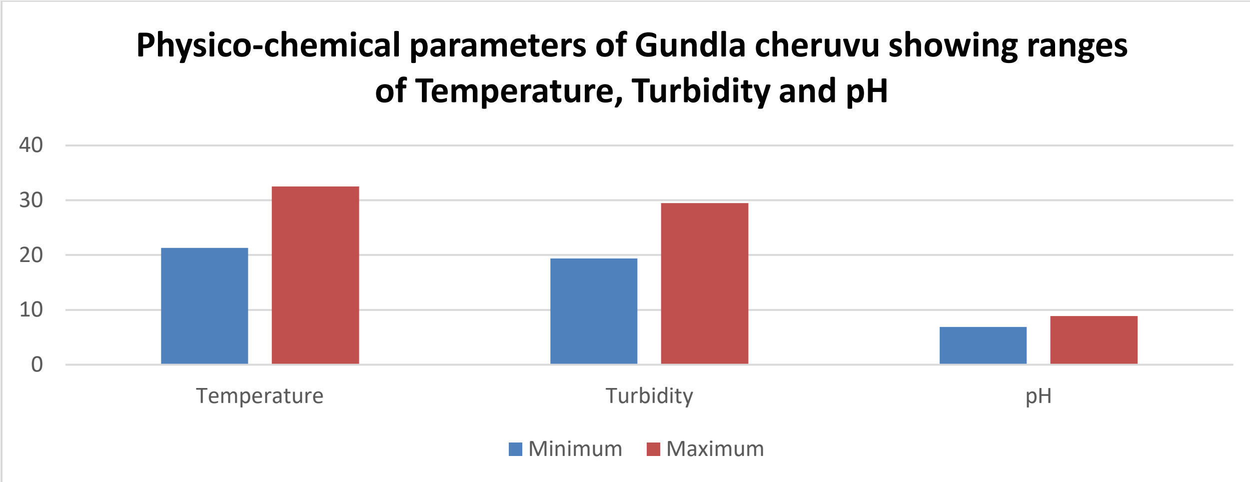

Figure-1: Temperature(°C), Turbidity(NTU) and pH of Gundla cheruvu showing Ranges in for the year 2014-2015

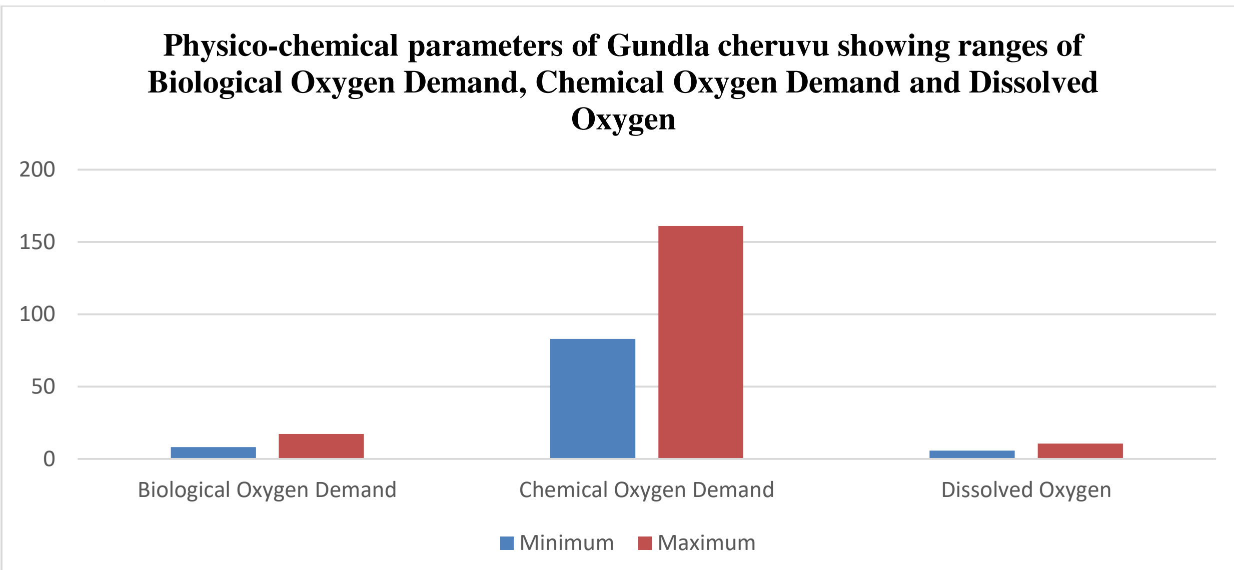

Figure-2: Biological Oxygen Demand, Chemical Oxygen Demand and Dissolved Oxygen of Gundla cheruvu showing Ranges expressed in (mg/L) for the year 2014-2015

Table-2: Physico-chemical parameters of Gundla cheruvu showing ranges expressed in (mg/L) for the year 2014-2015

Range	TDS	TSS	Chlorides	Nitrates	Phosphates	Sulfates	Silicates
Min	122	85.0	77.0	0.42	0.13	19.5	2.1
Max	240	506.0	97.7	0.92	0.90	40.1	5.2

Note: Max=Maximum, Min=Minimum

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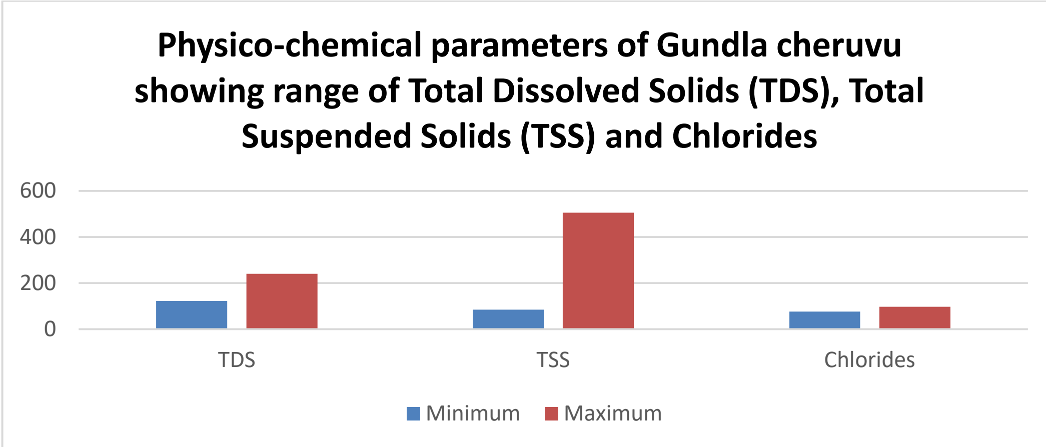

Figure-3: Total Dissolved Solids, Total Suspended Solids and Chlorides of Gundla cheruvu showing Ranges expressed in (mg/L) for the year 2014-2015

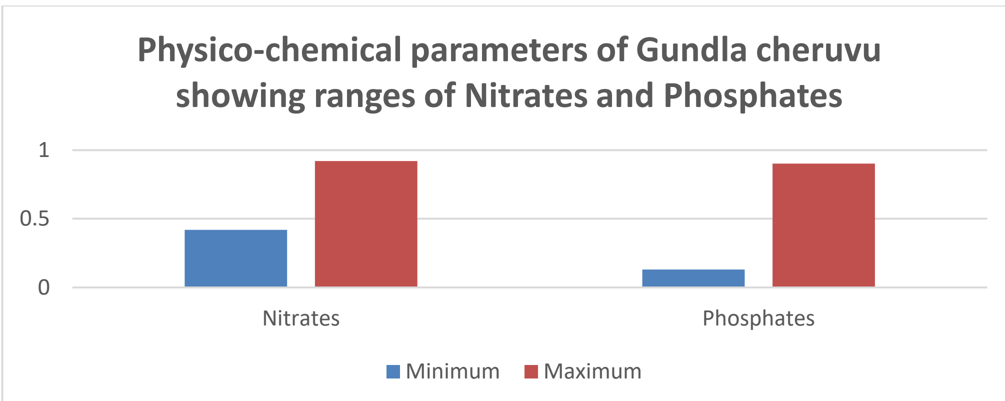

Figure-4: Nitrates and Phosphates of Gundla cheruvu showing Ranges expressed in (mg/L) for the year 2014-2015

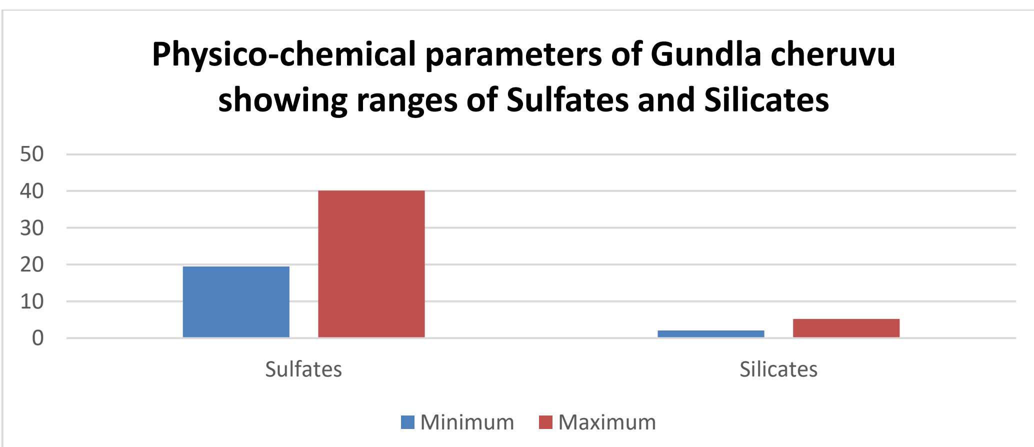

Figure-5: Sulfates and Silicates of Gundla cheruvu showing Ranges expressed in (mg/L) for the year 2014-2015

PHYTOPLANKTON DIVERSITY

Table-3: Distribution of phytoplankton species with respect to class and family in Gundla cheruvu for the year 2014-2015

Gundla Cheruvu (2014-2015)			
S.No	**Class**	**Family**	**Name of algal forms**
1	**Chlorophyceae**	**Volvocaceae**	Pandorina morum (O.F.Müller) Bory
2		**Scenedesmaceae**	Scenedesmus quadricauda (Turpin) Brebisson
3			Scenedesmus acuminatus (Lagerheim) Chodat
4			Scenedesmus armatus (Chod) G.M.Smith
5			Scenedesmus bijugatus (Turpin)
6		**Hydrodictyaceae**	Pediastrum duplex Meyen
7			Pediastrum boryanum (Turpin) Meneighini
8			Pediastrum simplex Meyen
9			Pediastrum Tetraodon (Corda) A.Braun, nom. illeg.
10			Pediastrum tetras (Ehrenberg) Ralfs
11		**Desmidaceae**	Cosmarium geminatumf. ornatum Behre
12			Cosmarium subtumidum Nordstedt
13			Closterium acutum Brébisson
14			Closterium tumidum f. minus Strøm
15			Staurastrum javanicumvar. Maximum C. Bernard
16			Staurastrum manfeldtii Delponte
17		**Selenastraceae**	Selenastrum gracile Reinsch
1	**Bacillariophyceae**	**Naviculaceae**	Navicula cuspidata Kutzing
2			Navicula cincta (Ehr) Kutz
3		**Bacillariaceae**	Nitzschia denticula Grunow
4		**Cymbellaceae**	Cymbella aspera (Ehrenberg) Cleve

5		**Achnanthaceae**	Achnanthes microcephala(Kützing) Grunow
6			Achnanthes minutissima Kützing
7		**Pinnulariaceae**	Pinnularia borealis Ehrenberg
8		**Fragilariaceae**	Gomphonema acceptatum Levkov, Mitic-Kopanja & E. Reichardt
9			Synedra ulna (Nitzsch) Ehrenberg
10			Synedra tabulata (C.Agardh) Kützing
11		**Melosiraceae**	Melosira granulate (Ehrenberg) Ralfs (Ehrenberg) Ralfs
1	**Cyanophyceae**	**Chroococaceae**	Chroococcus minutus var. minimus Keissler
2		**Oscillatoriaceae**	Oscillatoria formosa var. australica Playfair
3			Oscillatoria curviceps C.Agardh ex Gomont
4			Oscillatoria obtusa gardener
5			Oscillatoria hamelii fremy
6			Anabaena orientalis f. major Laloraya & Mitra
7			Anabaena sphaerica Born et Flax
8		**Microcystaceae**	Merismopedia glauca (Ehrenberg) Kützing
9		**Merismopediaceae**	Aphanocapsa annulate G.B.Mc Gregor
1	**Euglenophyceae**	**Euglenaceae**	Phacus curvicauda Svirenko
2			Phacus plueronectes (Muell) Dujardin
3			Trachelomonas hispida (Perty) F.Stein

Chlorophyceae

The Chlorophyceae members are categorized as the first high class among phytoplankton group in our present investigation. The results of phytoplankton for Gundla cheruvu, class Chlorophyceae comprises of 5 families, Volvocaceae 1 species Pandorina morum, Scenedesmaceae 4 species Scenedesmus quadricauda, Scenedesmus acuminatus, Scenedesmus armatus, Scenedesmus bijugatus, Hydrodictyaceae 5 species Pediastrum duplex, Pediastrum simplex, Pediastrum boryanum, Pediastrum tetras, Pediastrum tetraodon, Desmidaceae 6 species Closterium acutum, Closterium tumidum, Cosmarium geminatum, Cosmarium subtumidum, Staurastrum manfeldtii, Staurastrum javanicum and Selenastraceae 1 species Selenastrum gracile.

Bacillariophyceae

The results of phytoplankton for Gundla cheruvu, class Bacillariophyceae comprises of 7 families, Naviculaceae 2 species Navicula cuspidate, Navicula cincta, Bacillariaceae 1 species Nitzschia denticule, Cymbellaceae 1 species Cymbella aspera, Achnanthaceae 2 species Achnanthes microcephala, Achnanthes minutissima, Pinnulariaceae 1 species Pinnularia borealis, Fragilariaceae 3 species Synedra tabulate, Synedra ulna, Gomphonema acceptatum and Melosiraceae 1 species Melosira granulate.

Cyanophyceae

The results of phytoplankton for Gundla cheruvu, class Cyanophyceae comprises of 4 families, Chroococaceae 1 species Chroococcus minutus, Oscillatoriaceae 6 species Oscillatoria formosa, Oscillatoria curviceps, Oscillatoria obtusa, Oscillatoria hamelii, Anabaena orientalis, Anabaena sphaerica,, Microcystaceae 1 species Merismopedia glauca and Merismopediaceae 1 species Aphanocapsa annulate.

Euglenophyceae

The results of phytoplankton for Gundla cheruvu, class Euglenophyceae comprises of 1 family, Phacus curvicauda, Phacus plueronectes and Trachelomonas hispida.

Table-4: Total values and Percentage(%) of phytoplanton in Gundla cheruvu from 2014-2015

Phytoplanton	2014-2015	Percentage%
Chlorophyceae	3029	47
Bacillariophyceae	1697	26
Cyanophyceae	1327	21
Euglenophyceae	374	6

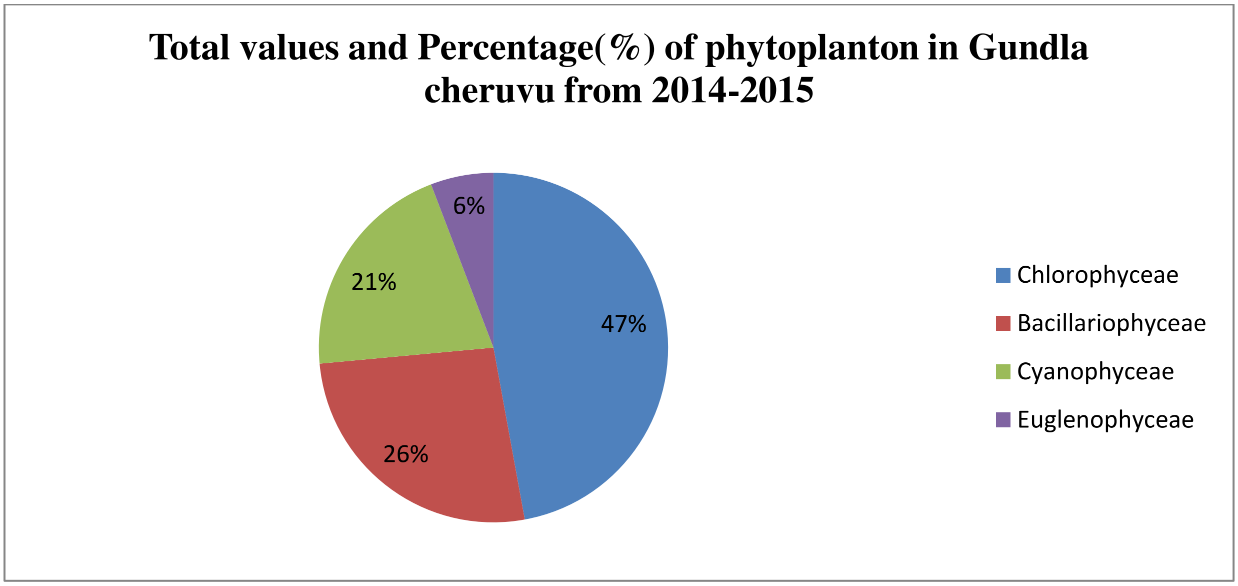

Figure:6 Total values and Percentage (%) of phytoplanton in Gundla cheruvu from 2014-2015

The members of Chlorophyceae class occupied first position in order of dominance in Gundla cheruvu for November 2014 to October 2015 with 3029. The percentage recorded as 47%. Bacillariophyceae recorded 1697 with the percentage of 26% followed by Cyanophyceae 1327 with 21% and the least Euglenophyceae 374 with 6%, as shown in Table-5 and Figure-4, similar to Nygaard (1949), Abdar (2013), Round (1957), Ghosh et al., (2012), Tiwari & Chauhan (2006), Ali, Abd el-Salam (1999) and Lurling et al., (2013).

CONCLUSION

The results indicated a trend towards increasing eutrophication, suggesting that Gundla cheruvu is moderately polluted. The growth of phytoplankton was facilitated by the abundance of phosphates and nitrogen. The distribution of phytoplankton varied with seasons: Chlorophyceae dominated during the summer and pre-monsoon, Bacillariophyceae were the second most dominant species in the pre-monsoon, Cyanophyceae were prevalent in the summer, and Euglenophyceae dominated in the post-monsoon. The eutrophic condition of Gundla cheruvu was reflected in various physico-chemical parameters, including water temperature, turbidity, pH, biological oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), total dissolved solids (TDS), total suspended solids (TSS), and concentrations of chloride, nitrate, phosphate, sulphates, and silicates. To maintain the health of these water bodies, appropriate maintenance is essential. Environmental education and proper sanitation practices are crucial to keeping these waters safe and clean. Simple measures, such as redirecting sewage and preventing nutrient leaching from the catchment area through planting vegetation, can significantly contribute to a clean and sustainable environment.

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