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STUDY OF PHYSICO-CHEMICAL PARAMETERS AND DISTRIBUTION OF PHYTOPLANKTON IN ALISAGAR LAKE AT THANAKALAM VILLAGE, EDAPALLI MANDAL, NIZAMABAD DISTRICT, TELANGANA STATE.

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ABSTRACT

From March 2019 to February 2020, the Alisagar lake at Thanakalam village, Edapalli mandal, Nizamabad District, Telangana state was the site of the current study. The samples were taken in the morning, and every month, their physical, chemical, and biological characteristics were examined. Water temperature, Turbidity, pH, Biological Oxygen Demand, Chemical Oxygen Demand, Dissolved Oxygen, Total Dissolved Solids, Total Suspended Solids, Nutrients Like Chloride, Nitrate, Phosphate, Sulphates and Silicates were among the many physico-chemical parameters that were examined. According to the results, summertime has a higher concentration of physico-chemical parameters than other seasons. The principle producer community, known as phytoplankton flocculation, is made up of algae, including a variety of forms. One of the most significant biological indicators of the water quality is the phytoplankton. This study suggested a possible combination of water quality indices and pollution contamination of Alisagar lake which was at risk of eutrophication.

Keywords: Nutrients, Biological indicators, Phytoplankton flocculation.

INTRODUCTION

A vital component of all living things is water. Additionally, it carries out special functions in the biosphere, biogeochemical cycles, and earth's ecosystem. Freshwater resources are becoming more and more scarce, and the faster rate at which the quality of the water is declining is becoming an national issue, Abdar. M.R 2013. Five interacting categories can be used to group threats to global freshwater biodiversity: overexploitation, water pollution, and habitat degradation, Adesalu, T. A., & Nwankwo, D. I. (2008); Agarwal A.K and Rajwar, G.S. 2010. In order to ensure that the contaminated water is not used for human consumption, these lakes require thorough understanding of their ecosystem. The people living around use water for a variety of things, such as cleaning kitchenware, laundry, and bathing. Chemical pesticides and fertilizers are also carried

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by inlets that discharge water into lakes, further contaminating the water. Biological communities incorporating the environmental effect of water chemistry, biological assessment is a valuable alternative for evaluating the ecological quality of aquatic ecosystems, Dorgham, 1997.

A phenomenon linked to the nutrient enrichment of aquatic ecosystems is eutrophication. In order, succession is eventually brought about by the gradual ageing process of lake. Because lakes are unable to purify themselves and thus easily gather pollutants and is more intricate and delicate. The decline in water quality and shrinkage of water bodies, has accelerated eutrophication by causing the growing anthropogenic influence in catchment area. Physical characteristics like temperature, light penetration, and water movement are crucial for understanding the distribution of plankton and the stratification of lakes. These elements work together to determine the lake's community and, in turn, the quality of the water. Human activities and natural dynamics, can significantly alter a lake's physico-chemical characteristics. These changes can then have an impact on the quantity and quality of the lake, the distribution and diversity of its species shows capacity for production, and even the balance of the ecological system in which they live.

An aquatic ecosystem's nutritional cycles are based entirely on phytoplankton. Numerous factors have an impact on phytoplankton composition, and these factors vary with ecological shifts. The ecosystem structure depends on phytoplankton and the makeup of its communities, El-sherif Z. and Mikhail S.K 2003. The primary producers, phytoplankton is a vital source of energy and the building block of all life in aquatic environments. As a result, photosynthetic primary production

is ultimately what drives production at the higher tropical levels. Eutrophication has already brought some of these lakes dangerously close to disappearing. Therefore, in order to prevent further degradation, these lakes require focused attention towards a thorough understanding of their ecosystem. The Water Quality Indices varies whereas pollution indices calculation indicates lakes are contaminated by pollution which is at risk of eutrophication

MATERIALS AND METHODS

PHYSICO-CHEMICAL PARAMETERS ANALYSIS

The majority of the analysis Water temperature, Turbidity, pH, biological oxygen demand, chemical oxygen demand, dissolved oxygen, total dissolved solids, total suspended solids, chloride, nitrate, phosphate, sulphates and silicates, Trivedy and Goel,1984 and APHA. 1995, the laboratory tests are performed.

COLLECTION, PRESERVATION AND IDENTIFICATION

The planktonic algal species were sampled from the Alisagar lake every month. The terrestrial members were collected with a knife early in the morning, whereas benthic algae were retrieved with forceps. For collection, between March 2019 to February 2020. Samples are stored in a 4% formaldehyde aqueous solution in the lab for research. The morphological examinations were carried out on fresh material using a light microscope, Fritsch (1907); Prescott (1938); Philipose (1960); Tiwari A, Rana A, and Chauhan S V S (2006) and Misra, T. N et al., (2005), were used to identify the taxa.

RESULTS AND DISCUSSION

The physico-chemical characteristics of Alisagar Lake. The Alisagar lake from March 2019 to February 2020 showing Maximum and Minimum values of temperature 31.5 ^{0}C and 21.5 ^{0}C, shown in Table-1 and Figure-1. Water temperature has a significant impact on every metabolic and physiological process as well as life processes including feeding, reproduction, movement, and dispersal of aquatic organisms. The temperature of the surface is highly reflective of the surrounding air. This is especially true for ponds and lakes like the ones in the current study, Moss, B. (1996). The current investigation's fluctuating water temperature could be caused by various sampling intervals, seasonal variations, and the presence of more home sewage, Jayaraman P. R.,

et al., (2003); Tiwari S., et al., (2004). Turbidity is the suspension of particles in water that obstructs light flow. The range of turbidity Maximum and Minimum values is NTU 11.4 to 9.2 NTU. Summer time records showed a high value, and monsoon records showed a low value. The results align with the research conducted by Verma et al., 2011 and Jain ,2008. Summer time turbidity levels may be at their highest because of rain and precipitation, shown in Table-1 and Figure-1.

The recorded pH Maximum and Minimum values 9.7 and 6.5. The monsoon's low value could be the result of rainwater dilution. Elevated pH levels encourage the growth of algae and cause a significant phytoplankton bloom, Nandan and Patel, 1992. Natural water has a pH of less than 8, which is caused by photosynthetic rates that requires CO2 that provide respiration and decomposition, shown in Table-1 and Figure-1. The amount of oxygen used by microorganisms during the aerobic oxidation of organic matter is referred to as the BOD. The lake's BOD readings Maximum and Minimum values 16.3 mg/L to 3.7 mg/L. BOD is the dissolved oxygen that microorganisms need in order to break down organic matter in water aerobically. BOD is regarded as a crucial metric in aquatic ecosystems for determining the level of pollution. The source of sulphur to natural water are rocks, fertilizers, dry deposition from the combustion products of industry, sewage are transported in precipitation whose requirement are for protein synthesis. The sulphates value recorded in mg/L having Maximum and Minimum values 38 mg/L to 22 mg/L respectively. Sulphate deficiency can inhibit algal population indirectly by hindering chlorophyll synthesis (Cole, J. J., & Likens, G. E. (1979).

Table-1: Physico-chemical parameters of Alisagar lake showing Minimum(Min) and Maximum(Max) values expressed in (mg/L), except Temperature(^{0}C), Turbidity (NTU) and pH for the year 2019-2020

	Temperature (^{0}C)	Turbidity (NTU)	pH	Biological Oxygen Demand (mg/L)	Sulphates (mg/L)
Max	31.5	11.4	9.7	16.3	38.0
Min	21.5	9.2	6.5	3.7	22.0

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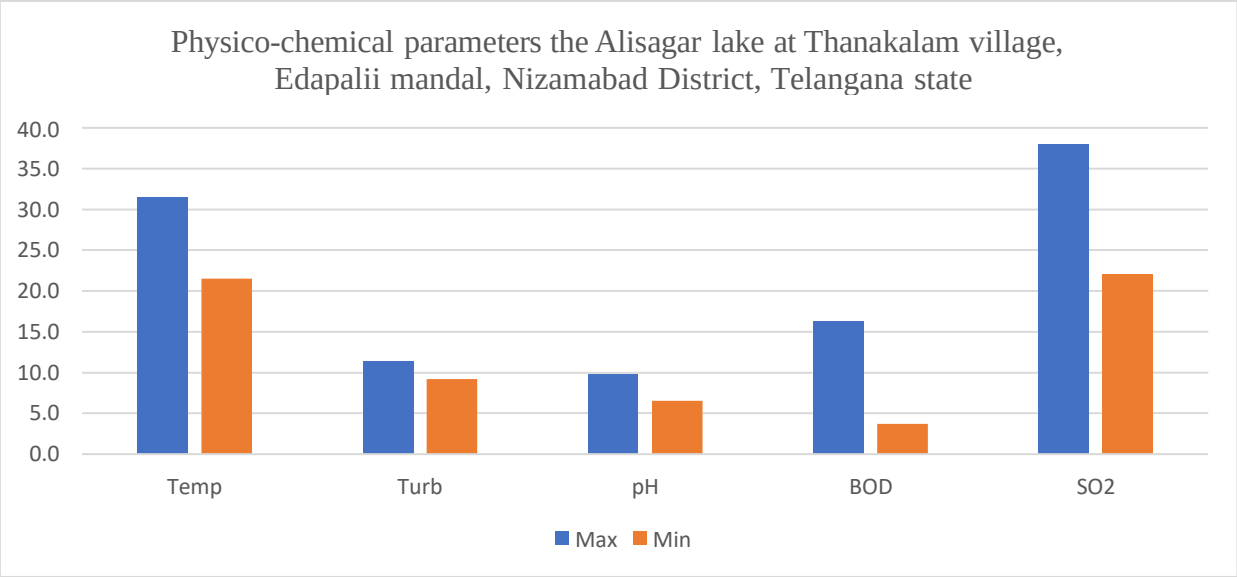

Figure-1: Physico-chemical parameters of Alisagar lake showing Minimum(Min) and Maximum(Max) values expressed in (mg/L), except Temperature(^{0}C), Turbidity (NTU) and pH for the year 2019-2020

The nitrate content varies Maximum and Minimum values 0.9 and 0.5 mg/L. Runoff from agricultural fields, industrial wastes, and sewage discharge add nitrates to fresh water. Increased concentration could result from the inflow of floodwater that is rich in nitrogen and contains a lot of sewage. The highest concentration of nitrate-nitrogen, which is known to facilitate the development of algal blooms, was observed, Anderson D. M. et al., (1998). shown in Table-2 and Figure-2. The primary nutrient that also causes eutrophication, which promotes widespread algal growth, is phosphate. A lake's phosphate content may result from the release of phosphate from the organic load in the water and bottom sediment. This promotes the growth of weeds and phytoplankton in the lake. Phosphate levels in the lake Maximum and Minimum values 1.0 mg/L to 0.1 mg/L, Hulyal S. B. and Kaliwal B. B. (2011); Verma P. U., Purohit A. R. and Patel N. J. (2012).

Silicate is a second most abundant element in the lithosphere. Its main sources weathering of feldspar rocks. Availability of silica can have strong influence on the overall pattern of algal succession and productivity in freshwater (Wetzel, R.G. 2001). Maximum and Minimum values 7.3 and 2.3 mg/L as shown in Table-2 and Figure-2. Where there is a healthy aquatic life, there is

more DO present. DO Maximum and Minimum values 10.9 and 7.9 mg/L. Water contains oxygen that is created by photosynthetic organisms like algae and aquatic plants or that is dissolved from the air. Since oxygen is a gas that dissolves poorly in water and is dependent on both temperature and partial pressure, there is a direct correlation between DO and photosynthesis. The aeration rate and photosynthetic activity both influence DO, Hulyal S. B. and Kaliwal B. B. (2011); Ramulu N. K and Benarjee G. (2013).

Table-2: Physico-chemical parameters of Alisagar lake showing Minimum(Min) and Maximum(Max) values expressed in (mg/L) for the year 2019-2020

	Nitrates(mg/L)	Phosphates(mg/L)	Silicates(mg/L)	Dissolved Oxygen(mg/L)
Max	0.9	1.0	7.3	10.9
Min	0.5	0.1	2.3	7.9

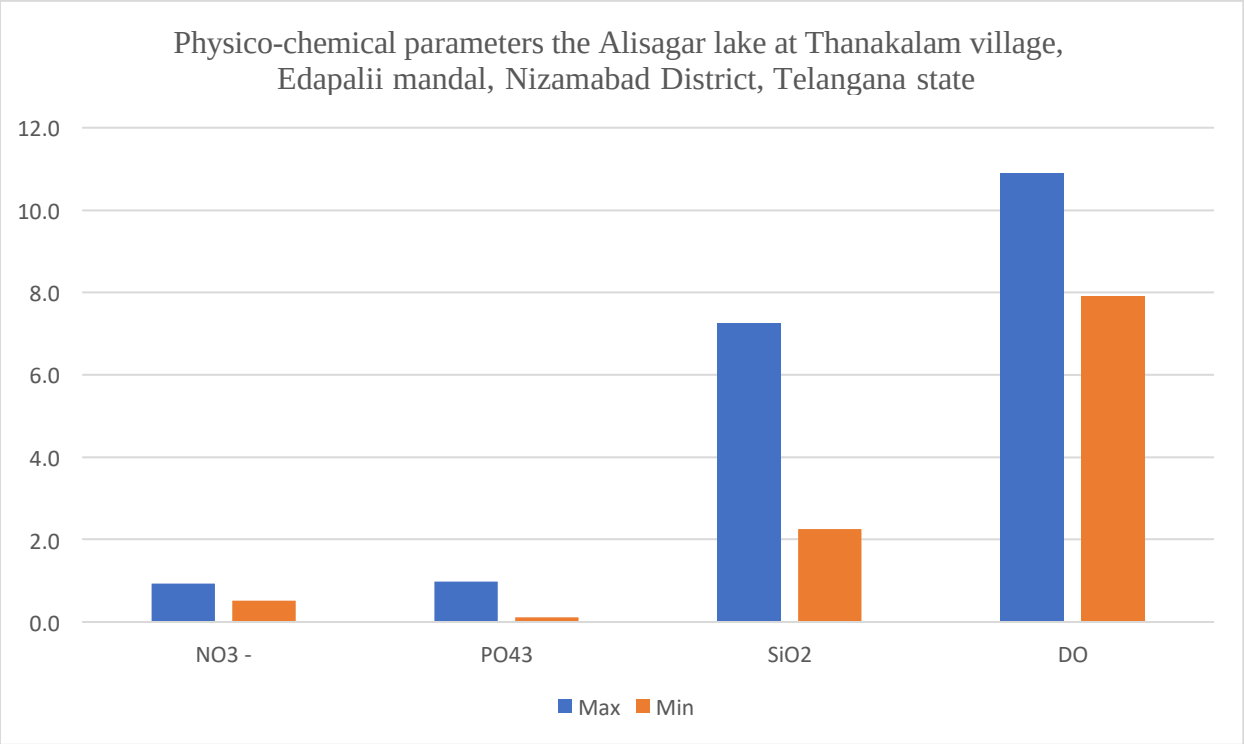

Figure-2: Physico-chemical parameters of Alisagar lake showing Minimum(Min) and Maximum(Max) values expressed in (mg/L) for the year 2019-2020

The lake's COD readings Maximum and Minimum values 163 mg/L to 53 mg/L. The elevated COD levels suggest the presence of non-biodegradable oxygen-demanding contaminants in the water to some extent, Elayaraj B. and Selvaraju M (2014). TDS refers to the dissolved solids that are found in water. TDS concentrations Maximum and Minimum values 246 mg/L to 113 mg/L as shown in Table-3 and Figure-3. TDS primarily indicates the different types of minerals that are found in the water. The summer time high TDS value could be caused by sewage, trash, and other household wastes being added to the natural surface water body ,Verma P. U., Purohit A. R. and Patel N. J. (2012). Aquatic bodies become eutrophic due to elevated high TDS concentrations, which also raise the nutrient status of the water body ,Singh R. P. and Mathur P. (2005).

The Total Suspended Solids are crucial phenomenon in lakes as the Maximum and Minimum values 563 mg/L to 116 mg/L of Alisagar lake is shown in Table-3 and Figure-3. One crucial metric for identifying sewage contamination was the concentration of chloride. Chloride levels Maximum and Minimum values 95.6 mg/L to 74.3 mg/L. One of the main inorganic anions in water is the concentration of chloride in the form of chloride ions, Chaurasia M. and Pandey G. (2007). It usually happens when sewage, irrigation waste, and other industrial effluent discharges are made Manivasakam N. (2003). There was a noticeable seasonal variation in the chloride content, with a maximum during the summer and a minimum during the monsoon season, Hulyal S. B. and Kaliwal B. B.(2011); Ramulu N. K. and Benarjee G. (2013).

Table-3: Physico-chemical parameters of Alisagar lake showing Minimum(Min) and Maximum(Max) values expressed in (mg/L) for the year 2019-2020

	Chemical Oxygen Demand (mg/L)	Total Dissolved Solids (mg/L)	Total Suspended Solids (mg/L)	Chlorides (mg/L)
Max	163.0	246.0	563.0	95.6
Min	53.0	113.0	116.0	74.3

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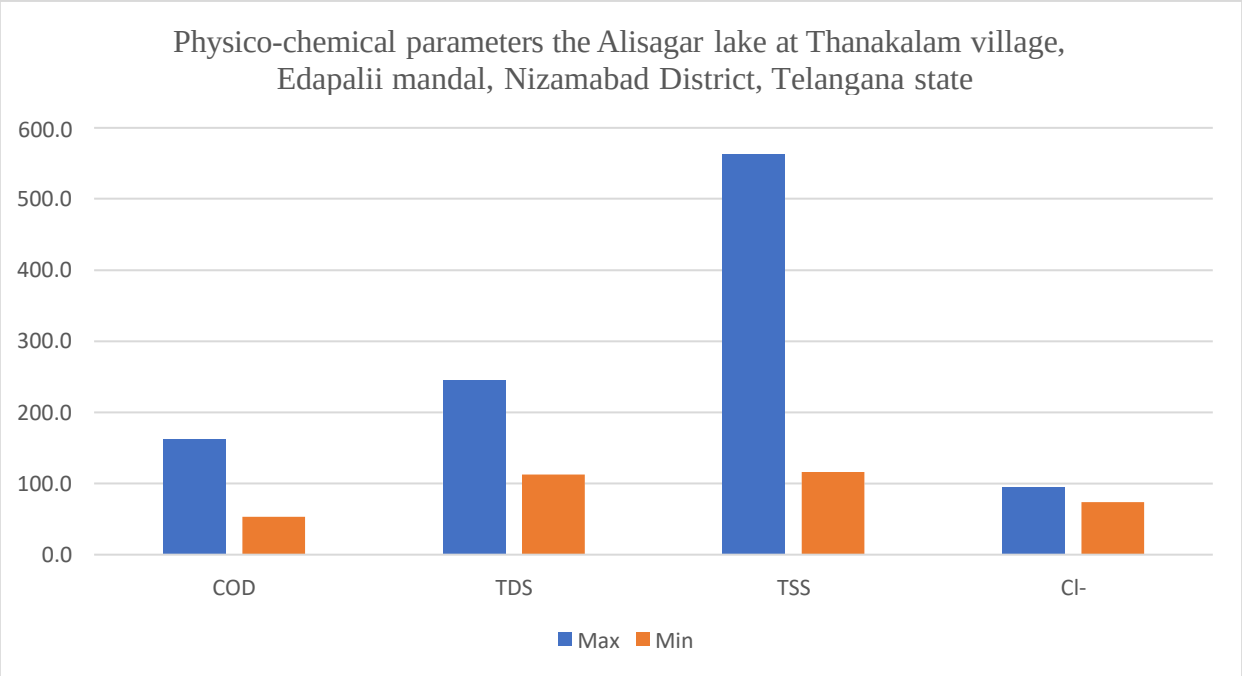

Figure-3: Physico-chemical parameters of Alisagar lake showing Minimum(Min) and Maximum(Max) values expressed in (mg/L) for the year 2019-2020

PHYTOPLANKTON DIVERSITY

The primary producer of all aquatic ecosystems, phytoplankton, exhibits a remarkable diversity. The primary benefit of biological methods lies in their ability to measure pollution effects directly. According to plankton In our present investigation plankton species where 48 overall, divided into 19 families and 4 classes (Table-4). Of these, the most numerous were Chlorophyceae, which included 18 species, Bacillariophyceae, 15 species, Cyanophyceae 12 species and euglenophyceae 3 species. Summer time saw the highest phytoplankton density, while the monsoon season saw the lowest. Similarly, Laskar H. S. and Gupta S. (2009). reported that the phytoplankton density was highest in the summer and lowest during the monsoon. Summertime phytoplankton concentrations were found to be high, Wojciechowska W, Pasztaleniec. A and Solis .M (2007); Chellappa N. T, Borba J. M and Rao. O (2008).

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CHLOROPHYCEAE

Scenedesmaceae family includes 3 species which are *Scenedesmus quadricauda, Scenedesmus acuminatus, Scenedesmus armatus,* Hydrodictyaceae family includes 5 species *Pediastrum duplex, Pediastrum simplex, Pediastrum boryanum, Pediastrum angulosum, Pediastrum tetras,* Desmidaceae family 8 species are *Closterium acutum, Closterium moniliferum, Closterium tumidum, Cosmarium botrytis, Cosmarium geminatum, Cosmarium subtumidum, Staurastrum manfeldtii, Staurastrum javanicum,* Selenastraceae family includes 1 species *Selenastrum gracile,* Family Oocystisteaceae includes species *Oocystis gigas,* as shown in Table-4, Rajgopal et al., 2010.

BACILLARIOPHYCEAE

Naviculaceae family with 3 species are *Navicula cuspidata, Navicula cryptocephala, Navicula cincta,* Bacillariaceae family including 1 species *Nitzschia denticula,* Cymbellaceae family with 2 species *Cymbella aspera, Cymbella tumida,* Family Achnanthaceae includes 2 species *Achnanthes microcephala, Achnanthes minutissima,* Pinnulariaceae family having 2 species *Pinnularia borealis, Pinnularia viridis,* Fragilariaceae family with 4 species *Synedra tabulata, Synedra ulna, Gomphonema acuminatum, Gomphonema intricatum,* Family Melosiraceae 1 speceis including *Melosira granulata,* Elayaraj, B., & Selvaraju, M. (2014).

CYANOPHYCEAE

Family Nostocaceae with 1 speceis *Nostoc commune,* Chroococaceae family with 1 species *Chroococcus minutus,* Oscillatoriaceae family including 7 species namely *Oscillatoria formosa, Oscillatoria limosa, Oscillatoria curviceps, Oscillatoria amoena, Oscillatoria tenuis, Anabaena orientalis, Anabaena flos-aquae,* Family Microcystaceae includes 1 species *Merismopedia glauca,* Merismopediaceae family includes 1 species *Aphanocapsa Nägeli,* Gloeotrichiaceae family with 1 species *Gloeotrichia raciborskii,* Unni, 1984.

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EUGLENOPHYCEAE

Family Euglenaceae with 3 species *Phacus curvicauda, Phacus longicauda, Trachelomonas hispida,* Kumar, J. N., & Oommen, C. (2011).

Table-4: Distribution of phytoplankton species with respect to class and family in Alisagar lake for the year 2019-2020

Alisagar lake	**2019-2020**		
S.No	**Class**	**Family**	**Name of Algal forms**
Chlorophyceae			
1		Scenedesmaceae	*Scenedesmus quadricauda* (Turpin) Brebisson
2			*Scenedesmus acuminatus* (Lagerheim) Chodat
3			*Scenedesmus armatus* (Chod) G.M.Smith
4		Hydrodictyaceae	*Pediastrum duplex* Meyen
5			*Pediastrum simplex* Meyen
6			*Pediastrum boryanum* (Turpin) Meneighini
7			*Pediastrum angulosum* (Ehr) Menegh
8			*Pediastrum tetras, var. tetrahedron*
9		Desmidaceae	*Closterium acutum* Brébisson
10			*Closterium moniliferum* (Bory) Ehrenb. ex Ralfs
11			*Closterium tumidum* var. *striatum* Bourrelly
12			*Cosmarium botrytis* Meneghini ex Ralfs
13			*Cosmarium geminatum* P.Lundell

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14			*Cosmarium subtumidum* Nordstedt
15			*Staurastrum manfeldtii* Delponte
16			*Staurastrum javanicum* W.B.Turner, nom. inval.
17		Selenastraceae	*Selenastrum gracile* Reinsch
18		Oocystisteaceae	*Oocystis gigas* W.Archer
Bacillariophyceae			
1		Naviculaceae	*Navicula cuspidata* (Kutzing) Kutzing
2			*Navicula cryptocephala* Kuetz
3			*Navicula cincta* (Ehr) Kutz
4		Bacillariaceae	*Nitzschia denticula* Grunow
5		Cymbellaceae	*Cymbella aspera* (Ehrenberg) Cleve
6			*Cymbella tumida* (Brébisson) van Heurck
7		Achnanthaceae	*Achnanthes microcephala f. scotica* J.R.Carter
8			*Achnanthes minutissima* Kütz
9		Pinnulariaceae	*Pinnularia borealis* Ehrenberg
10			*Pinnularia viridis* (Nitzsch) Ehrenberg
11		Fragilariaceae	*Synedra tabulata* (C.Agardh) Kützing

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12			*Synedra ulna* (Nitzsch) Ehrenberg
13			*Gomphonema acuminatum* Ehrenberg
14			*Gomphonema intricatum* var. *vibrio* (Ehrenberg) Cleve
15		Melosiraceae	*Melosira granulata* f. *sparsipunctata* Manguin
Cyanophyceae			
1		Nostocaceae	*Nostoc commune* Vaucher ex Bornet & Flahault
2		Chroococaceae	*Chroococcus minutus* var. minimus Keissler
3		Oscillatoriaceae	*Oscillatoria formosa* Bory ex Gomont
4			*Oscillatoria limosa* C.Agardh ex Gomont
5			*Oscillatoria curviceps* var. *angusta* Ghose
6			*Oscillatoria amoena* var. *lacustris* Margalef
7			*Oscillatoria tenuis* C.Agardh ex Gomont
8			*Anabaena orientalis* f. *major* Laloraya & Mitra
9			*Anabaena flos-aquae* Brébisson ex Bornet & Flauhault
10		Microcystaceae	*Merismopedia glauca* (Ehrenberg) Kützing

11		Merismopediaceae	*Aphanocapsa* Nägeli
12		Gloeotrichiaceae	*Gloeotrichia raciborskii* f. *lillienfeldiana* (Woloszynska) Geitler
Euglenophyceae			
1		Euglenaceae	*Phacus curvicauda* Svirenko
2			*Phacus longicauda* (Ehrenberg) Dujardin
3			*Trachelomonas hispida* (Perty) F.Stein

Table-5: Total values and Percentage(%) of phytoplanton in Alisagar lake for 2019-2020

Alisagar lake	**2019-2020**	**Percentage%**
Chlorophyceae	3983	37
Bacillariophyceae	3461	32
Cyanophyceae	2788	25
Euglenophyceae	674	6

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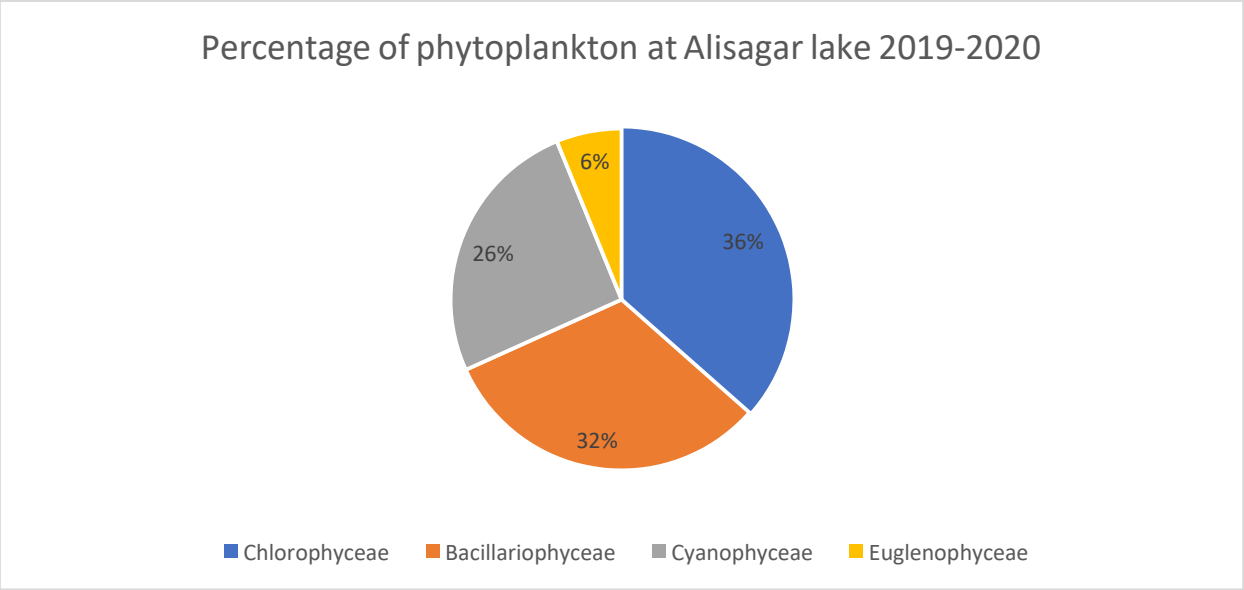

Figure-4: Percentage(%) of phytoplanton in Alisagar lake for 2019-2020

The members of Chlorophyceae class occupied first position in order of dominance in Alisagar lake for 2019 to 2020 with 3983. The percentage recorded as 37%. Bacillariophyceae recorded 3461 with the percentage of 32% followed by Cyanophyceae 2788 with 25% and the least Euglenophyceae 674 with 6%, as shown in Table-5 and Figure-4, similar to Biswas, A. K. (1981).

CONCLUSION

The results indicated a trend towards increasing eutrophication and suggest that Alisagar Lake is moderately polluted. The growth of phytoplanktons was aided by the abundance of phosphates and nitrogen. The distribution of phytoplankton with the Chlorophyceae dominating in the summer and premonsoon, the Bacillariophyceae second dominance species in the premonsoon, the Cyanophyceae in the summer, and the Euglenophyceae in the postmonsoon. The eutrophic condition of Alisagar Lake was indicated by physico-chemical parameters such as Water temperature, Turbidity, pH, biological oxygen demand, chemical oxygen demand, dissolved oxygen, total dissolved solids, total suspended solids, chloride, nitrate, phosphate, sulphates and silicates showed the overall condition of the Alisagar lake. It is advised that the water bodies should receive appropriate maintenance. To maintain these water bodies safe and clean, environmental education and appropriate sanitation practises are crucial. A few simple actions, such as redirecting

sewage and presenting the leaching of nutrients from the catchment area through plantations, would undoubtedly result in a clean, sustainable environment.

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