Quest Journals
Journal of Research in Environmental and Earth Sciences
Volume 8 ~ Issue 2 (2022) pp: 35-42
ISSN(Online) :2348-2532
www.questjournals.org

Research Paper

List of Phytoplankton in Haflong Lake, Karbi Anglong, Assam, India

[1]RAKHAL ROY CHOUDHURY and [2]Dr. UTPAL PHUKAN
[1]*Faculty, Botany Department*
[2] *Assistant Professor, Botany Department*
Rabindranath Tagore University
Hojai, Assam, India

***ABSTRACT*:** *The role of freshwater phytoplankton in the biogeochemical cycle is immense and it holds a diverse area in taxonomy. Phytoplankton is a major source of producer for all other aquatic consumers. Phytoplankton are key component in the trophic level of aquatic ecosystem as they play vital role in nutrient uptake, food chain to balance the ecosystem. This study is based on the examination of species diversity of freshwater phytoplankton samples from the Lake of Haflong of District Karbi Anglong of State Assam. We examined and documented 27 phytoplankton species, which includes 13 Bacillariophyceae species, 08 Chlorophyceae species, 04 Cyanophyceae species and 01Euglenophyceae species. Thus, the present study disclosed the intense dominance of Bacillariophyceae followed by Chlorophyceae, CyanophyceaeandEuglenophyceae.*

***KEYWORDS*:** *Phytoplankton, Study Area, Aquatic Ecology, Phycology and Microbiology, Haflong Lake.*

***R**eceived 05 Feb, 2022; **R**evised 15 Feb, 2022; **A**ccepted 18 Feb, 2022 © The author(s) 2022.*
P**ublished with open access at **www.questjournals.org

I. INTRODUCTION

Phytoplankton aremicroscopic, unicellular photosynthetic organisms that live freely in water. Like land plants, they make carbohydrates using light energy, carbon dioxideand release oxygen. They are what is known as primary producers of the aquatic ecosystem—the organisms that form the base of the aquatic food chain.Phytoplankton is a polyphyletic groupwith extreme variation in shape, size, colour, type of metabolism, and life-history traits [1]. The unicellular microscopic Phytoplankton differs in size from <1 µm to 500 µm [2]. Phytoplankton is mainly classified into four classes namely *Bacillariophyceae, Chlorophyceae, Cyanophyceae* and *Euglenophyceae* [3].

Because they need light, phytoplankton live near the water surface, where enough sunlight can penetrate to power photosynthesis. Phytoplankton are some of the Earth's most critical organisms and so it is vital study and understand them. They generate about half the atmosphere's oxygen, as much per year as all land plants.Through photosynthesis Phytoplankton transform inorganic carbon in the atmosphere and in water into organic compounds, making them an essential part of Earth's carbon cycle as they sink and carry this organic carbon to the bed of aquatic system after their death. Thus, phytoplankton act as an important factor in the climate system. Phytoplankton also form the base of virtually every aquatic food web. In short, they make most other aquatic life possible. Phytoplankton are good biological indicator in a fluid environment. Due to their short life span, phytoplankton show quick response against environmental changes. However, dense blooms of some Phytoplankton can deplete dissolved oxygen content, causing fish and shellfish to suffocate. The main objective of this study is to document the Phytoplankton species in Haflong Lake, Haflong district, Assam, India.

II. MATERIALS AND METHODS

Study Area: The Haflong Lake is a natural freshwater ecosystem of Haflong district and well maintained by the Municipal corporation of Haflong town of State Assam. The Lake is situated in the middle of the town and surrounded by beautiful hills. Haflong is the only hill station of Assam and is also famous as Switzerland of the East[27].

The Lake is important as it has vegetation consists of Cycas sp., Tree fern, many of the flowering plants and medicinal plants[28]. The Lake and its rich biodiversity attract thousands of birds every year. Water samples were taken from Haflong Lake (Latitude 25.169°N, Longitude 93.016°E) in the month of March 2021. Figure 1 illustrates the Lake view and sampling sites of Haflong Lake.

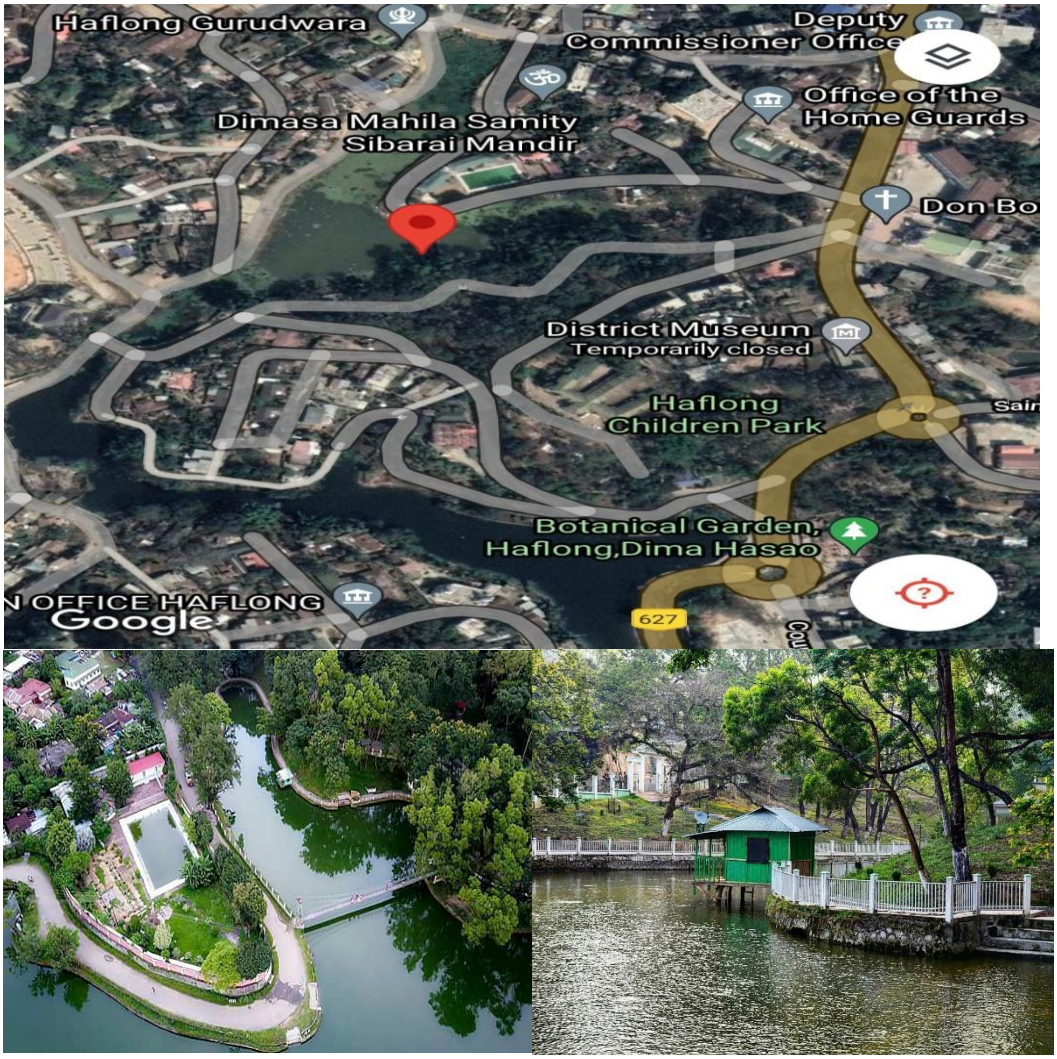


Figure 1: Map and images of study area and sampling site in Haflong Lake, Karbi Anglong District, Assam, India.

Methods of sample collection:

The phytoplankton samples were collected with 250 ml water bottles from the water surface and filtered immediately with plankton net which is made up of nylon bolting cloth with a mesh size of 50 µm to avoid contamination (Figure. 2). The collected specimens of phytoplankton were persevered in bottles containing 4% of neutralized formalin and examine species identification using monographs, standard manuals and text books [11-21].

All the collected samples were centrifuged using 10 to 30ml graduated centrifuge tubes. The samples were then allowed to settle down by incubating for 24 hours in formalin. The supernatant was discarded and collected pellet was subjected to microscopic analysis for species identification. With the help of a light microscope and inoculation needle the species of phytoplankton were separated and isolated. Eachphytoplankton species was mounted on glass slides on a drop of 20% Glycerine for further analysis followed by Manickam *et.al.* 2020 [2]. (Fig. 3-5)

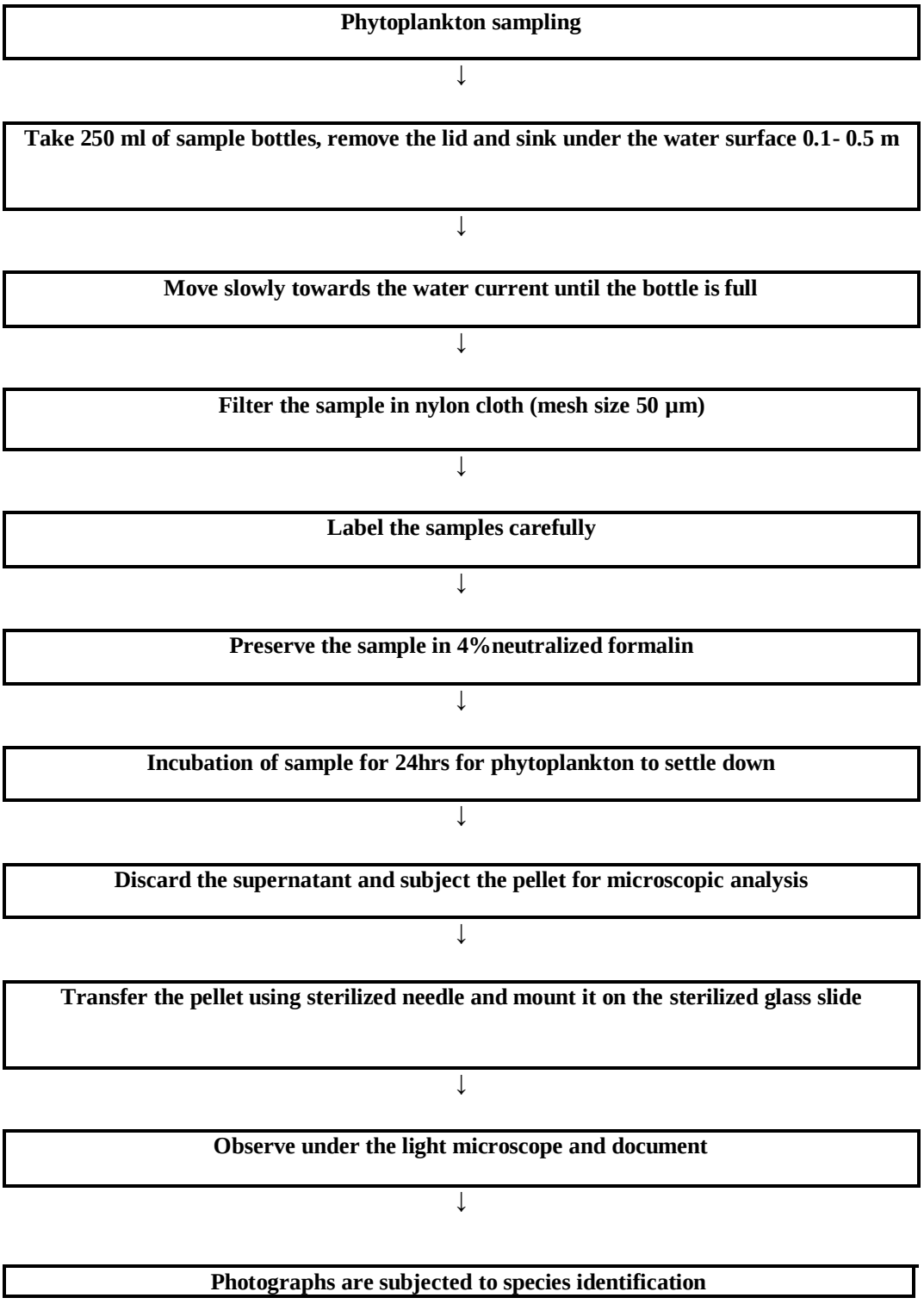


Figure 2: The flowchart showing method of sample collection and analysis

Phytoplankton Identification

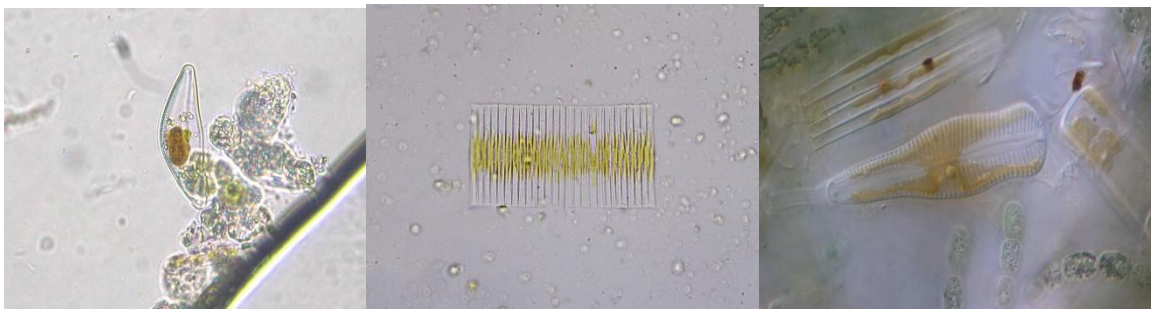
By usinga light microscope with a magnification of 40X and 100X the taxonomical identification of collected samples of Phytoplankton were identified and were photographed manually with the help of a smart phone [2]. The various tools used here were Monographs, Standard Manuals, and Text Books [11-21].

III. RESULTS AND DISCUSSION

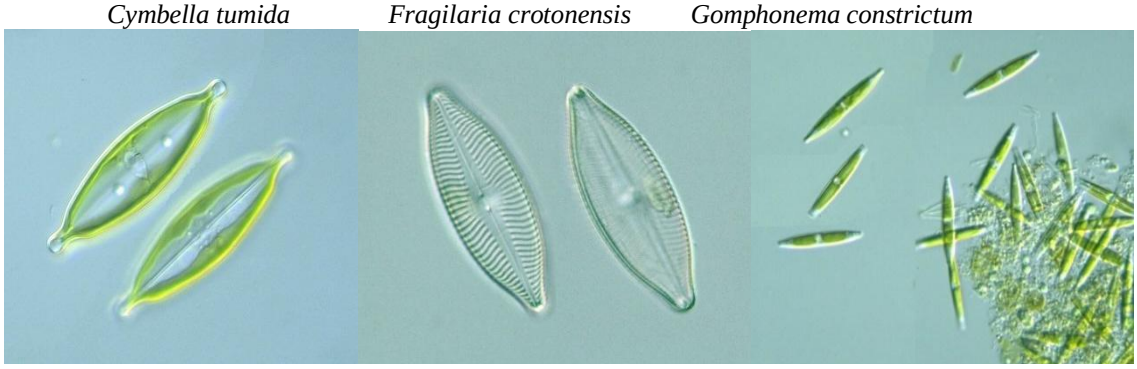
A total of **27**Phytoplankton species were recorded from the Haflong Lake, during this survey on the month of march 2021 (Table 1) (Figure 3-5). Among the species recorded,**13** species were identified to the class of ***Bacillariophyceae*** which belong to 8 families and 8 genera; **8** species of class ***Chlorophyceae***which belong to 7 families and 7 genera; **5** species of class ***Cyanophyceae***which belong to 5 families and 5 genera and **1** species of class ***Euglenophyceae***. (Figure: 6)

Table 1: List of Phytoplankton sp. recorded from Haflong Lake.

Class	Genus	Family	Species
Bacillariophyceae (Haeckel, 1878)	*Fragilaria* (Lyngbye, 1819)	*Fragilariaceae* (Grev, 1833)	*Fragilaria crotonensisFragilaria capunia* (Desm, 1830)
	Synedra (Ehrenberg, 1830)	*Fragilariaceae* (Grev, 1833)	*Synedra acus* (Kutzing, 1844) *Synedra vaucheriae* (Kutzing, 1844) *Syndera ulna* (Ehrenberg, 1832)
	Cymbella (C.Agardh, 1830)	Cymbellaceae	*Cymbella aequalis* (W.Smith, 1855)
	Nitzchia (Hassal, 1845)	Bacillariaceae	*Nitzchia dissipata* (Rabenhorst, 1860) *Nitzchia palea* (W.Smith, 1856)
	Navicula (Bory de SaintVincent, 1822)	Naviculaceae (Kutz, 1844)	*Navicula gastrum* (Kutzing, 1844) *Navicula cuspidate* (Kutzing, 1844)
	Gomphonema (Ehrenberg, 1832)	Gomphonemataceae (Kutz. 1844)	*Gomphonema consrictum* (Ehrenberg, 1844) *Cymbella tumida* (Van Heurck, 1880)
	Cymbella (C.Agardh, 1830)	Cymbellaceae (Grev. 1833)	
	Pinnularia (Ehrenberg, 1843)	Pinnulariaceae (Ehrenberg, 1843)	*Pinnularia undulata* (W.Gregory, 1854)
Chlorophyceae (Willein Warming, 1884) (green algae)	*Pediastrum* (Meyen, 1829)	Hydrodictyaceae (Dumortier, 1829)	*Pediastrum boryanum* (Meneghini, 1840) *Pediastrum duplex* (Meyen, 1829)
	Spirogyra (Link, 1820)	Zygnemataceae (Kutzing, 1843)	*Spirogyra sp.*
	Pleurosigma (W.Smith, 1852)	Bacillariineae	*Pleurosigma sp.*
	Desmidium (C. Agardh ex Ralfs, 1848)	Desmideaceae	*Desmidium sp.*
	Volvox (Linnaeus, 1758) *Pandorina* (Bory, 1826) *Chlamydomonas* (C.G. Ehrenberg, 1786)	Volvocaceae Volvocaceae Chlamydomonodaceae	*Volvox sp.* *Pandorina sp.* *Chlamydomonas sp.*
Euglenophyceae (Schoen, 1925)	*Euglena* (Ehrenberg, 1830)	Euglenaceae (Carter, 1859)	*Euglena sp.*
Cyanophyceae(Sachs, 1874) (blue green algae)	*Anabaena*	Nostocaceae	*Anabaena sp.*
	Oscillatoria (Vauc. ex Gomont, 1892)	Osillatoriaceae (Engler, 1898)	*Oscillatoria sp.*
	Merismopedia (Meyen, 1839)	Merismopediaceae	*Merismopedia sp.*
	Spirulina (Gomont, 1892) *Nostoc* (Vaucher & Flahault, 1886)	Spirulinaceae (Gomont, 1892) Nostocaceae	*Spirulina sp.* *Nostoc sp.*



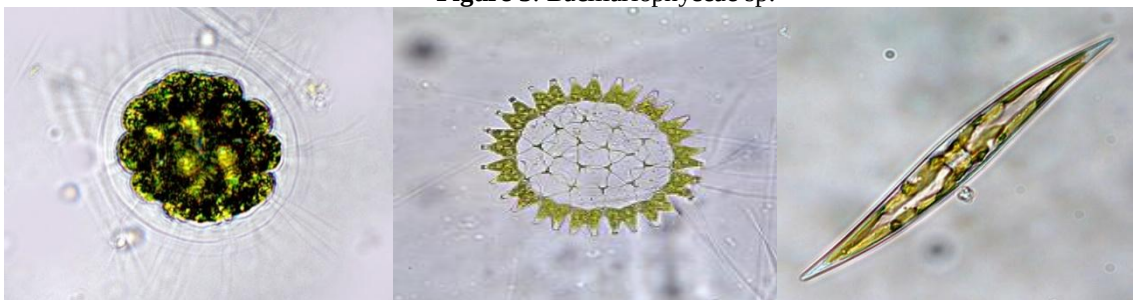
Cymbella tumida *Fragilaria crotonensis* *Gomphonema constrictum*



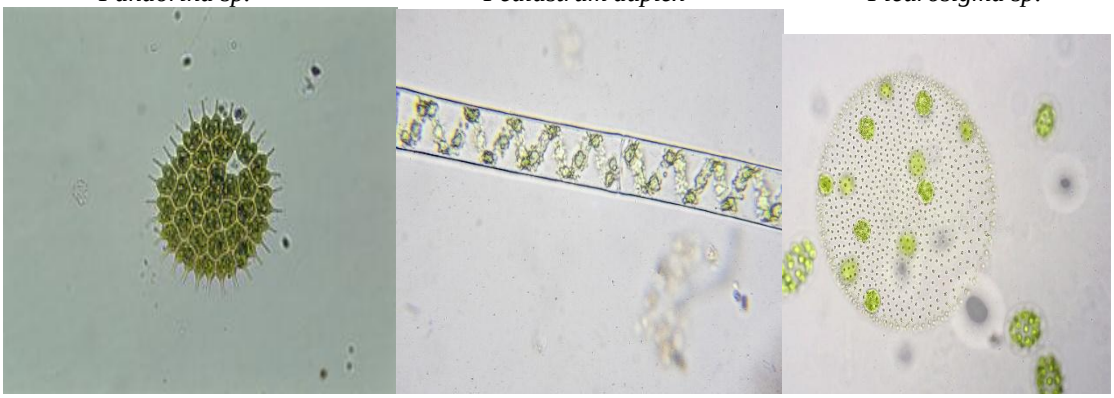
Navicula cuspidate *Navicula gastrum* *Nitzschia palea*

Synedra ulna

Figure 3: Bacillariophyceae sp.

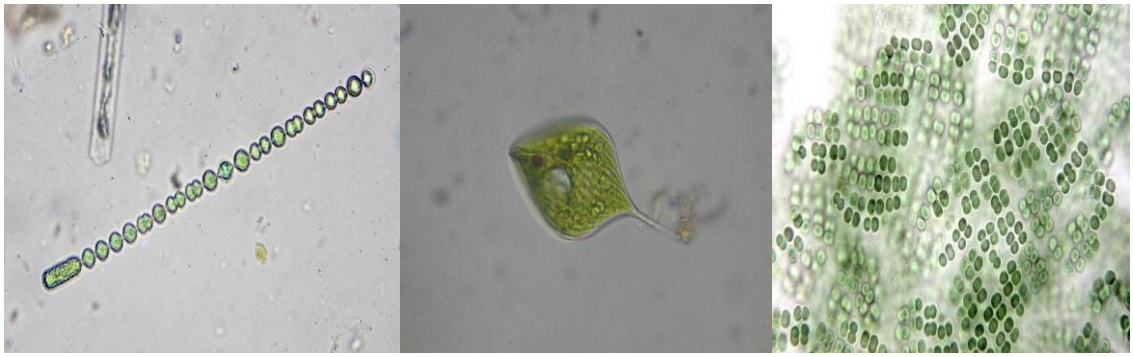


Pandorina sp. *Pediastrum duplex* *Pleurosigma sp.*



Pediastrum boryanum *Spirogyra sp.* *Volvox sp.*

Figure 4: Chlorophyceae sp.



Anabaena sp. *Euglena sp.* *Merismopedia sp.*

Spirulina sp.

Figure 5: Euglenophyceae sp. and Cyanophyceae sp.

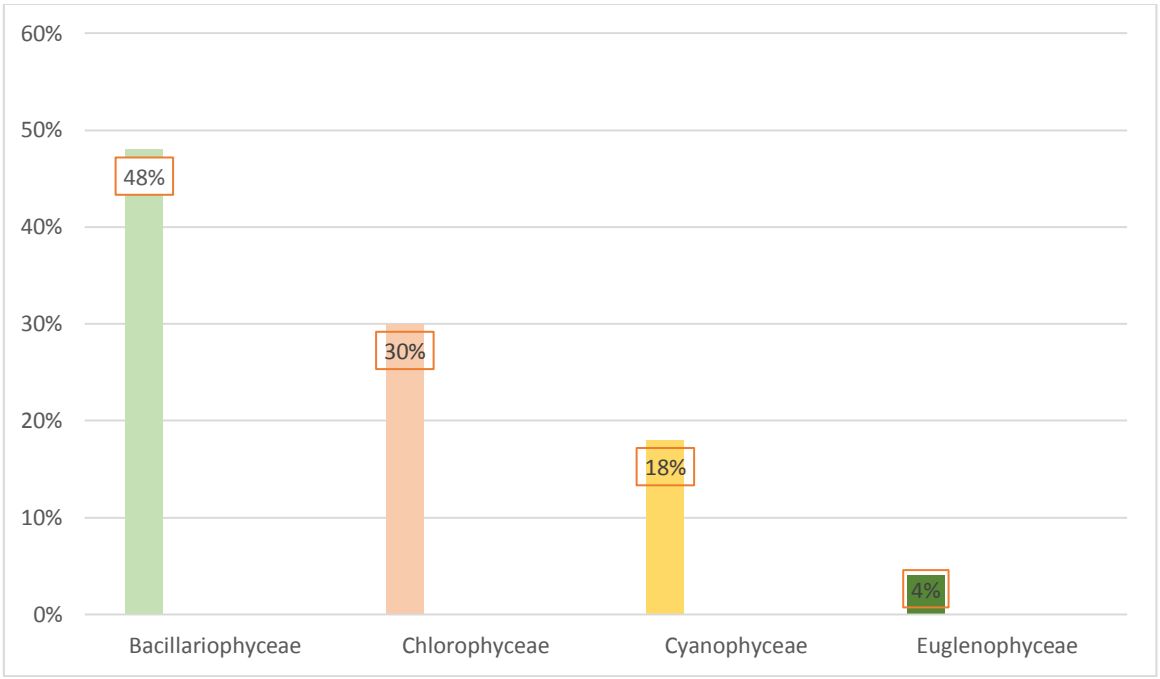


Figure 6: Percentage composition chart of Phytoplankton species recorded from Haflong Lake.

Freshwater Phytoplankton is among the most widespread organisms on the planet. Like all other organisms, Phytoplankton also play a significant role in the cyclic transformation of nutrients. Phytoplankton holds the first trophic level as being the producers in the food chain of an aquatic ecosystem [1,22]. Again, some Phytoplankton species are toxic to the water bodies and results in the water becoming unsuitable for human consumption. The indian freshwater ecosystem is currently under constant stress of pollution due to growing industrialization and urbanization [9]. The increasing population and deforestation may lead to climate change and may eventually alter the Taxonomical composition, structure and seasonal dynamics in Phytoplankton [9]. Though Haflong Lake is highly potential for aquatic organisms and various migratory birds, the affect of climate chamge on the Lake and its ecosystem needs an intense examination.the Lake has diverse healthy aquatic life

such as fishes, turtles, reptiles; many migratory birds such as Tiger bittern, Black bittern, Little egret, Pond heron, Indian pitta, Kingfishers, Bar headed goose, Green pigeon, Black drongo, Hill partridge etc., because of the rich food source and healthy primary producers. By attracting thousands of land and water birds, aquatic lives, Plankton diversity and benefiting to agriculture and humans may be considered Haflong Lake as a best model of aquatic ecosystem. Therefore, Phytoplankton which forms one of the common primary producers of the aquatic ecosystem, demandsan intense insights to their diversity, conservation and production.

IV. CONCLUSION

The relationship between biodiversity and ecosystem is complex as the structure of ecosystem is linked to species diversity and distribution. Hence, any change in the structure of an ecosystem may change the ability of a species to carry out its function and provide services to the ecosystem and eventually to the disruption of the ecological balance. With the increase in Global Warming and rapid environmental changes, Phytoplankton being the significant base primary producers is susceptible to lose of their diversity and accordingly variations in taxonomical composition and seasonal interactions. A long-term study on diversity of freshwater Phytoplankton will help to understand the quality and health of the particular aquatic ecosystem.

This study is based on the information of Phytoplankton diversity in Haflong Lake, which needs to be explored comprehensively to determine the relationship between ecological structure and diversity of the producers. This study revealed that *Bacillariophyceae* being the dominant class among all Phytoplankton,followed by *Chlorophyceae*, *Cyanophyceae* and *Euglenophyceae*. This study also alarms the continuous supervision of Phytoplankton diversity and potent hydrolytical factor, with a goal towards sustainable management of the water and its related ecosystem of the Lake.

ACKNOWLEDGEMENT

We offer our heartfelt thanksto Haflong Municipal Corporation for providing permission and facilities to our project.

This particular study on the *"**List of Phytoplankton in Haflong Lake, Karbi Anglong, Assam, India**"*has no connectionto human and animal use. The collection of samples were made manually. There is no external source of funding provided to this study. The whole concept of this study was designed by the author and in consultation with the co-author. The drafting of the whole article is all the credit to author. We also offer our heartfelt thanks to the University authority for allowing us and providing the Laboratory for use. We have no conflicts of interest to disclose the article.

REFERENCES

[1]. Boris, G. Ebonyi, A. Samosa, N. Potocnik, ARE., Freshwater Phytoplankton Diversity: models, drivers and implications for ecosystem properties, Hydrobiologia- 848 (2021) 53-75.
[2]. Manickam, N. et al. Phytoplankton Biodiversity in the Two Perennial Lakes of Coimbatore, Tamil Nadu, India, Acta Ecologica Sinica 40 (2020) 81-89.
[3]. Manthri Kumar Rajesh, A. Selvin Samuel, A. Martin, S. Niveta, A Comparative Study on Phytoplankton Diversity in River Tamiraparani and a Man-Made Fresh Water Body, IJRS, 1(2) (2014) 80–82.
[4]. D.L. Findlay, H.J. Kling, Protocols for Measuring Biodiversity: Phytoplankton in Freshwater, Department of Fisheries and Oceans, Freshwater Institute, University Crescent, Winnipeg, Manitoba, 2001 (19).
[5]. C.S. Reynolds,"Ecology of Phytoplankton", First Edition, Cambridge University Press, Cambridge, 2006.
[6]. E.E. Levi, Impacts of eutrophication and water level change in Turkish shallow lakes: a palaeolimnological approach utilizing plant remains and marker pigments, Doctoral dissertation, Middle East Technical University, Ankara, Turkey, 2016.
[7]. Dilip, M., Swati, B., Lalita, S., Ghosh, T.K. and Pawan, L., Assessment of physicochemical water quality and phytoplankton diversity in Narikulam reservoir in Kanniyakumari district, Tamilnadu, India, Sustainable Water Resources Management, 4 (2017) 735-743.
[8]. Md Ayenuddin, H. et al., Phytoplankton Community Structure and Environmental Variables as Indicators of Organic Pollution in Padma River, Bangladesh, International Journal of Ecology and Environmental Sciences, 45(1) (2017) 19-29.
[9]. Sabita kumara. P. Gayathiri, S. Ramachandra Mohan M. Phytoplankton Diversity in Bangalore Lakes, Importance of Climate Change and Nature's Benefits to people, Journal of Ecology and Natural Resources (2018).
[10]. C. Rahbek, The elevational gradient of species richness: a uniform pattern, Ecography (1995). [11] G. Venkataraman, A systematic account of some south Indian Diatoms, Proceedings Indian Academy Sciences, (1939).
[11]. M.O.P. Iyengar, G. Venkataraman, The ecology and seasonal succession of the algal flora of the River Cooum at Madras with special reference to Diatomaceous, J. Madras University, (1951).
[12]. T.V. Desikachary, Cyanophyta, Indian Council of Agricultural Research, New Delhi, (1959).
[13]. G.W. Prescott, Algae of the Western Great Lakes Area, Wm. C Brown CO, Dubuque Iowa, (1962).
[14]. M.T. Philipose, Chlorococcales, Indian Council of Agricultural Research, New Delhi, (1967).
[15]. A. Adoni, D.G. Joshi, K. Gosh, S.K. Chourasia, A.K. Vaishya, M.M. Yadav, H.G. Verma, Work Book on Limnology, Pratibha Publisher Sagar, (1985).
[16]. M.S. Agarker, H.K. Goswami, S. Kaushik, S.M. Mishra, A.K. Bajpai, U.S. Sharma, Biology, conservation and management of Bhoj wetland, Upper lake ecosystem in Bhopal, Bio. Nat, (1994).
[17]. J.E. Cox, Identification of Freshwater of Diatom Live Material, Chapman & Hall, London, (1996).
[18]. N. Anand, Handbook of Blue-Green Algae, Bishen Singh Mahendra Pal Singh, Publishers, Dehra Dun, India, (1989).
[19]. N. And, Indian Freshwater Microalgae, Bishen Singh Mahendra Pal Singh, Publishers, Dehra Dun, India, (1998).

[20]. V.T. Sreedharan, Phytoplankton and algae studies techniques of plankton methodology, in: V. Sridharan (Ed.), Integrated Environment Programme of Research on the River Kaveri a Training Workshop on Freshwater Phytoplankton, National College, Tiruchirappalli, Tamil Nadu, India, (1989).
[21]. Madhumathi. Vijayakumar, S. Survey of Cyanobacterial flora from Samuthiram Lake of Thanjavur, Tamil Nadu, India, Journal of Algal Biomass utilization. 4(1), (2013) 70-79.
[22]. N. Manickam, P.S. Bhavan, P. Vijayan, G. Sumathi, Phytoplankton species diversity in the Parambikulam-Aliyar irrigational canals (Tamil Nadu, India), IJPMBS. 3(3), (2012).
[23]. N. Manickam, P.S. Bhavan, P. Santhanam, R. Bhuvaneswari, P. Chitrarasu, Physicochemical characteristics and phytoplankton biodiversity in Sulur lake of Coimbatore, South India, Research Journal of Biotechnology 12(11) (2017).
[24]. K.K. Singh., B.M. Sharma, Ecological productivity studies of the macrophytes in Charangpat Lake, Manipur northeast, India, IMAGES, (2012).
[25]. A. M. Tharik, V. S. Saraswathi, T. Brinda, S. Ramasubraniyam, A. Kumaraguru, Checklist of Phytoplankton in Vaduvoor Birds Sanctuary, Tamil Nadu, India, Quest Journals, Journal of Research in Environmental and Earth Sciences, Volume 7, Issue 8(2021) pp: 55-62.
[26]. Haflong - Assam Hill Station Archived 26 August 2014 at the Wayback Machine, India-north-east.com.
[27]. Chaudhuri SK. From Ethnobotany. In: Mitra D, Guha J, editor. Studies in Botany. 7. Volume. 2. Choudhury SK, Kolkata: Manasi Press; 2000. pp. 855–867.