Seasonal Dynamics of Chlorophyceae Phytoplankton in the Nandigama Minor Project: A Three-Year Study

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Abstract- **This study investigates the seasonal variations in Chlorophyceae phytoplankton populations in the Nandigama Minor Project, a freshwater ecosystem, over a two-year period. Chlorophyceae, as primary producers, play a crucial role in energy transformation through photosynthesis. The research focuses on understanding the influence of physicochemical factors on the distribution and abundance of Chlorophyceae phytoplankton. Sampling and analysis techniques were employed to quantify and identify Chlorophyceae phytoplankton species. Statistical analyses revealed significant seasonal variations in plankton density. The findings shed light on the ecological dynamics of Chlorophyceae phytoplankton communities, providing valuable insights for ecosystem management and conservation.**

Keywords: **Chlorophyceae, Phytoplankton, Nandigama Minor Project, Seasonal Variation, Photosynthesis, Primary Production, Physicochemical Factors, Population Dynamics, Ecosystem Management.**

INTRODUCTION:

The study explores the seasonal dynamics of Chlorophyceae phytoplankton populations in the Nandigama Minor Project, a freshwater ecosystem. Chlorophyceae, comprising various taxa such as [add relevant taxa], serve as primary producers by converting solar radiation into biological energy through photosynthesis. These microscopic organisms play a vital role in regulating oxygen and carbon dioxide levels in the water, thus influencing the micro-climate. Additionally, Chlorophyceae serve as a fundamental food source for herbivorous animals and contribute to the ecosystem's primary production. Physicochemical characteristics of water, such as temperature, dissolved oxygen, nutrients, and pH, influence the distribution and abundance of Chlorophyceae phytoplankton in freshwater ecosystems. Understanding the seasonal fluctuations in Chlorophyceae phytoplankton populations is essential for assessing ecosystem health and identifying potential impacts of environmental changes.

LITERATURE REVIEW:

Previous studies have highlighted the significance of Chlorophyceae phytoplankton in freshwater ecosystems. Meshram and Dhande (2000) emphasized the role of Chlorophyceae in energy conversion through photosynthesis and its contribution to ecosystem productivity. Negi and Rawat (2011) documented seasonal variations in Chlorophyceae populations, indicating the importance of understanding temporal dynamics in phytoplankton communities. Furthermore, Pawar and Parulekar (2011) reported diverse Chlorophyceae species in different aquatic habitats, highlighting the ecological significance of these organisms.

MATERIAL AND METHODS :

Phytoplankton samples were taken monthly from the three sites between April 2017 and March 2019. Filtering 40 lit of water through a 400 BSS sieve is used for sampling (pore size 0.038 mm). The phytoplanktons were immediately preserved in 1 percent Lugol's iodine after collecting. With the use of standard keys Palmer, (1669) and Prescott, (1969), plankton identification was done up to the genus level; APHA (1991). Lackey's Drop method was used to count the birds, as described in APHA (1998), Trivedy and Goel (1887), Ayoade et al., (2009), and Sudarshan et al., (2010). (2013). The following is the formula for calculating phytoplankton (units/l):

Plankton (unit/I) = N1×V1/V2×N2

Where

N1= Number of organisms per drop.
V1=Volume of concentrated sample in ml.
V2= Volume of original sample in liters.
N2=Volume of one drop (ml).

During research periods, zooplankton studies were conducted to investigate seasonal fluctuations in zooplankton diversity. There were both qualitative and quantitative investigations conducted. Once a month, between the hours of

9.00 a.m. and 11.00 a.m., samples were taken. Filtering 50 liters of surface water was used to gather samples through a plankton net fashioned from no. 20 bolting silk cloth at the time of sampling, great care was taken to ensure that the water remained undisturbed.

The samples were stored in a 4 percent formalin solution. The samples were transported to a facility for qualitative and quantitative examination. Battish (1992) and Dhanapati (1993) techniques were used to identify zooplankton (2000). The Sedgwick rafter cell was used to do quantitative research. The sample was properly stirred in order to evenly disseminate the microbes. A pipette was used to transfer one ml of sample onto the cell. The cover slip was perfectly positioned, with no air bubbles. After allowing the planktons to settle for a while, they were counted under a microscope. By moving the cell vertically and horizontally and covering the entire region, all of the planktons present in the cell were counted.

Statistical Analysis :

With the help of Sukhame (1985), Kothari, and other standard literature, ANOVA and correlation coefficient were utilized to calculate plankton density .(2010)

RESULTS AND DISCUSSIONS :

Under the microscope, the recorded algal or phytoplankton species from the families Chlorophyceae, Bacillairophyceae, Cyanophyceae, and Euglenophyceae were observed and identified by six species in both Chlorophyceae and Bacillairophyceae, four species in Cyanophyceae, and one species in Euglenophyceae.

FAMILY – CHLOROPHYCEAE :

In the years 2020to 2021, the average Chlorophyceae population density ranged from 41 to 79 org/ml at station A, 41 to 77 org/ml at station B, and 39 to 91 org/ml at station C. While the average Chlorophyceae population density ranges from 46 to 100 org/ml at station A, 42 to 103 org/ml at station B, and 43 to 99 org/ml at station C in 2021-2022, the average Chlorophyceae population density ranges from 50 to 96 org/ml at station A, 49 to 103 org/ml at station B, and 41 to 99 org/ml at station C in 2022-2023. Table 40 lists the Chlorophyceae density values, which are depicted in figures 31, 32, and 33. According to Jayabhaye (2010), the Chlorophyceae produce greenish scum on the surface of quiet stagnant water or grow firmly adhered to rocks, pieces of wood, and other things in water. Pawar et al. (2011) investigated phytoplankton diversity and discovered 19 Chlorophyceae species. Negi et al. (2011) investigated phytoplankton diversity and found that the Chlorophyceae had 50 percent more species diversity than the other pecies at site I. Shinde et al. found that Chlorophyceae seasonal changes were highest during the summer season and lowest during the monsoon season (2012). Chlorophyceae was the most abundant and progressive family across all months, according to George et al., and it was also the most dominant family (2012). Sharma et al. found a positive and substantial association between DO, Ca, Mg, CO3, and water temperature and chloride in Chlorophyceae (2013). Chlorophyceae have the ability to absorb nutrients, particularly phosphorus and nitrogen. Baba et al., (2014) investigated the phytoplankton community and discovered that Cyanophyceae population density was lowest in June and highest in May.

TABLE: 1 – MONTHLY VARIAION OF Chlorophyceae in 2020-221

Source	DF	Sum of Square	Mean Sum of Square	F-Calculate
Sample	3.5	392.680	195.25	12.766**
Months	**12**	6722.026	625.191	41.583**
Error	**23**	346.004	16.273	
Total	**38.5**	7650.683	216.645	

Significant at 5 % level, ** Significant at 1%level, NS Non Significant.

TABLE:2 – MONTHLY VARIAION OF Chlorophyceae in 2021-22

Source	DF	Sum of Square	Mean Sum of Square	F-Calculate
Sample	3.5	27.402	14.252	3.426*
Months	12	11024.085	1053.099	241.003**
Error	23	97.163	4.465	
Total	38.5	12148.7125	334.596	

Significant at 5 % level, ** Significant at 1%level, NS Non Significant

TABLE:3– MONTHLY VARIAION OF Chlorophyceae in 2022-2023

Source	DF	Sum of Square	Mean Sum of Square	F-Calculate
Sample	3.5	76.144	37.084	2.436*
Months	12	8964.750	815.516	51.427**
Error	23	350.843	14.989	
Total	38.5	9488.653	269.255	

Significant at 5 % level, ** Significant at 1%level, NS NonSignificant.

Table:4. Monthly Variation of Chlorophyseae [org/ml]

MONTHS	**Year 2020-2021**			**Year 2021-2022**			**Year 2022-2023**		
	Sampling Stations			Sampling Stations			Sampling Stations		
	A	B	C	A	B	C	A	B	C
June	43	44	45	48	46	45	53	52	44
Justly	63	64	66	53	52	53	56	57	52
August	45	43	46	55	57	59	62	64	63
September	45	49	52	63	64	63	64	68	66
October	52	53	54	65	66	65	69	72	74
November	58	62	70	69	72	73	74	76	82
December	65	67	76	75	81	83	83	81	84
January	72	69	80	83	82	84	84	85	94
February	75	77	82	88	87	89	89	94	79
March	83	87	92	102	101	103	101	106	102
April	77	76	87	100	97	101	94	102	96
May	78	75	83	91	93	95	84	94	84
Mean	63.8	62.9	69.7	75.4	76.7	78.5	73.8	77.4	74.8

SE±			9.51			5.71			9.72
CD at 0.05%			6.64			3.56			6.96

Table 1.Sampling Stations **Year 2020-2021**

MONTHS	**Year 2020-2021**		
	Sampling Stations		
	A	B	C
June	43	44	45
Justly	63	64	66
August	45	43	46
September	45	49	52
October	52	53	54
November	58	62	70
December	65	67	76
January	72	69	80
February	75	77	82
March	83	87	92
April	77	76	87
May	78	75	83
Mean	63.8	62.9	69.7
SE±			9.51
CD at 0.05%			6.64

Fig. 1 : Months of 2020-2021

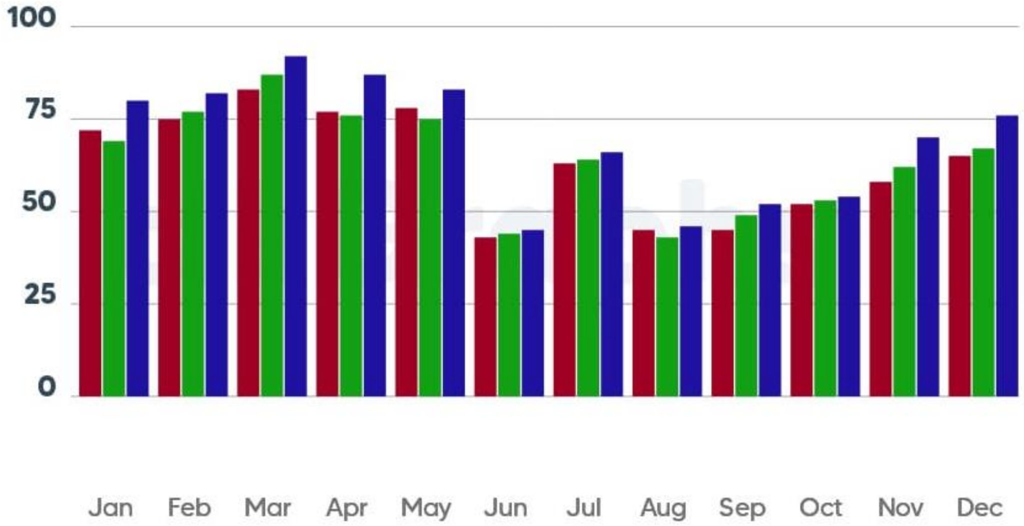


Table 2.Sampling Stations Year 2021-2022

MONTHS	**Year 2021-2022**
	Sampling Stations

	A	B	C
June	48	46	45
Justly	53	52	53
August	55	57	59
September	63	64	63
October	65	66	65
November	69	72	73
December	75	81	83
January	83	82	84
February	88	87	89
March	102	101	103
April	100	97	101
May	91	93	95
Mean	75.4	76.7	78.5
SE±			5.71
CD at 0.05%			3.56

Fig. 2 : Months of 2021-2022

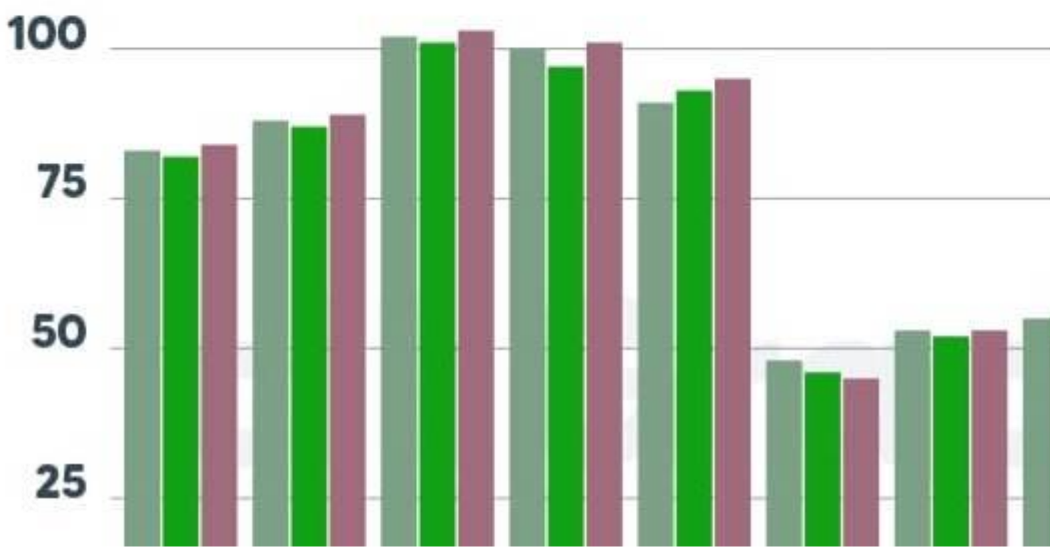
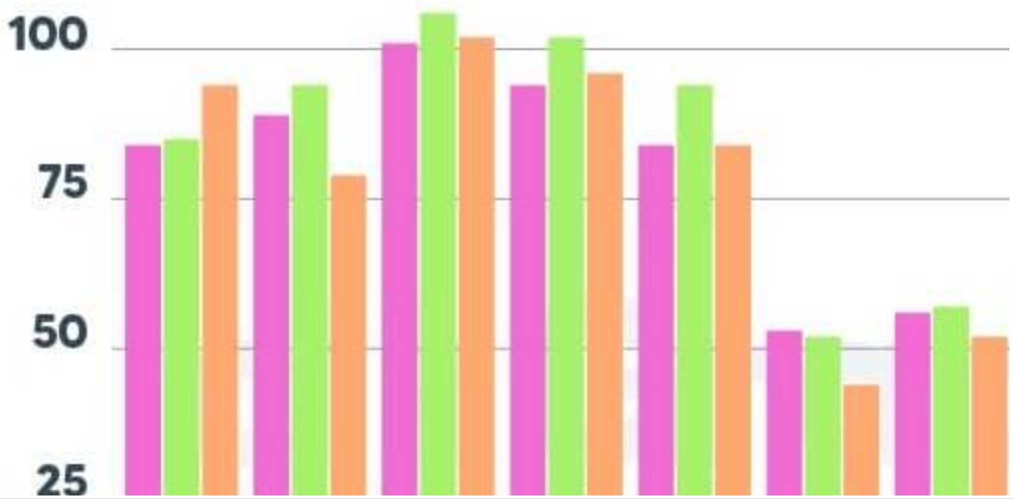


Table 3.Sampling Stations Year 2022-2023

MONTHS	Year 2022-2023		
	Sampling Stations		
	A	B	C
June	53	52	44
Justly	56	57	52
August	62	64	63
September	64	68	66
October	69	72	74
November	74	76	82

December	83	81	84
January	84	85	94
February	89	94	79
March	101	106	102
April	94	102	96
May	84	94	84
Mean	73.8	77.4	74.8
SE±			9.72
CD at 0.05%			6.96

Fig. 3 : Months of 2022-2023



Usefulness to Society:
This research provides valuable insights into the seasonal dynamics of Chlorophyceae phytoplankton populations in the Nandigama Minor Project, a freshwater ecosystem. Understanding the factors influencing Chlorophyceae phytoplankton populations is crucial for ecosystem management and conservation. By monitoring Chlorophyceae phytoplankton populations, scientists and policymakers can assess ecosystem health, detect environmental changes, and implement effective management strategies to preserve freshwater habitats. Furthermore, the findings of this study contribute to the broader scientific understanding of aquatic ecosystems and their responses to environmental stressors, thereby facilitating informed decision-making for sustainable resource management.

Conclusion:
The study highlights significant seasonal variations in Chlorophyceae phytoplankton populations in the Nandigama Minor Project over a two-year period. Chlorophyceae serve as primary producers, contributing to energy transformation and ecosystem productivity. The findings underscore the importance of monitoring Chlorophyceae phytoplankton communities to assess ecosystem health and detect environmental changes. By understanding the factors influencing Chlorophyceae phytoplankton populations, stakeholders can implement effective management strategies to conserve freshwater ecosystems and ensure their sustainability.

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