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SEASOINAL VARIATION OF PHYTOPLANKTON DIVERSITY IN HARDIHA POND HANUMANA, REWA (M.P.)

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ABSTRACT:- Plankton play a significant role in the food chain and the cycling of organic materials in the aquatic ecosystem, therefore their significance is well understood. A significant barrier to a better understanding of the dynamics of plankton in freshwater bodies is our lack of knowledge of these organisms. Phytoplankton succession in pond depends on the availability of nutrients, temperature, light intensity and transparency. Phytoplankton communities usually undergo a fairly predictable annual cycle, but some species may grow exponentially forming the blooms. Accordingly, the seasonal diversity and dynamics of phytoplankton and their correlation with environmental factors were investigated in Hadiha pond, from June, 2023 to May, 2024. Samples were taken from four different sites of the pond; each of these sampling sites had their own unique characteristics. Seasonal plankton samples were collected using nylobolt plankton net (No. 25). Cyanophyta, Chlorophyta and Bacillariophyta accounted 96% of the total phytoplankton abundance during the study period. Pediastrum, Scendesmus and Closterium species were the predominant Chlorophyta, during the rainy seasons. The average Cyanophyta count was positively and non-significantly correlated with water temperature and turbidity of the pond. Overall, the four seasons exhibit different phytoplankton species composition across different sites. The diversity was high during winter season in all sampling sites. In the present investigation, total 29 species of phytoplankton were also recorded. Bimodal pattern of seasonal variation of plankton was observed with a primary peak in the month of June and secondary peak in December. It was determined that the physical, chemical, and biological parameters were favorable for agricultural and fish culture.

KEYWORDS: Phytoplankton, diversity, seasonal density, Hadiha pond.

INTRODUCTION :-

Plankton is small, mostly microscopic and extremely diverse form of organisms that play a crucial role in aquatic ecosystems. They occur in all natural lotic and lentic water bodies as well as in artificial impoundments like ponds, tanks, reservoirs, irrigation canals etc. Welch divided the plankton into two major groups, namely phytoplankton and zooplankton. The biological productivity of any aquatic water body is generally determined by the quantitative and qualitative estimation of plankton, which forms the natural food of aquatic animals including fishes.

Phytoplanktons are microscopic free floating animals which play a vital role in aquatic ecosystem. Phytoplanktons are highly sensitive to environmental variation, as a result change in abundance, species diversity or community composition can provide important indication of environmental health. Phytoplankton diversity is controlled by seasonal variation.

The primary contributor to the generation of organic matter in aquatic ecosystems, plankton is typically found at the base of the aquatic food chain. Most frequently, the interaction of water's physical, chemical, and biological qualities results in the creation of phytoplankton, and these properties also shape their assemblage (composition, distribution, variety, and abundance).

In order to implement sustainable management practices, it is crucial to consider the population density and diversity of plankton in a water body, as these factors differ between aquatic systems and locations. A significant barrier to a better understanding of the dynamics of plankton in freshwater bodies is our lack of knowledge of these organisms. For the implementation of environmental impact assessment (EPA)-style

sustainable environmental management practices, the density and diversity of plankton in a water body are of utmost importance. Almost all fish depend on them as their primary source of nutrition while they are still in the larval stage.

Some plankton species provide accurate data on the level of water pollution. These are hence referred to as good water quality indicators. Controlling the physico-chemical and biological conditions of the water can be accomplished with the help of these investigations and monitoring. Plankton plays a crucial role in tropical reservoir ecosystems because it helps scientists predict the yield of future fish. Wetlands are significantly impacted by the scope of socioeconomic activities, urbanization, industrialization, and hydropower production. These operations have an impact on aquatic biodiversity and water quality.

Numerous works on plankton diversity and limnological studies have already been reported from different parts of India including Ansari and Prakash (2000); Prakash *et al*. (2002, 2015a, 2015b and 2015c); Ranjan and Prakash (2020); Verma *et al*. (2016a, 2016b), Verma (2019) and Sugumaran *et al*. (2020) but a quality research is still awaited from the study area.

Biodiversity is the 'foundation of human life' on earth because each organism plays an important role and helps in producing more productive and stable ecosystem which has the ability to survive in stress conditions (Prakash, 2019, 2021). Environmental conditions play a key role in defining the function and distribution of organisms, in combination with other factors. Environmental changes have had enormous impacts on biodiversity patterns in the past and will remain one of the major drivers of biodiversity patterns in the future (Prakash and Verma, 2019 & 2022). The biodiversity helps to maintain the ecological balance; however, climate or environmental change adversely affect the biological diversity (Ashok, 2017 & 2018; Verma, 2021).

Phytoplanktons are the basic component of aquatic ecosystems and hence change in phytoplankton population has a direct link with the changes of water quality of any water body (Ranjan and Prakash, 2020; Bhagde et al., 2020). Phytoplankton serves as a food for development and growth of zooplankton. Some of phytoplankton species gives a reliable information about pollution status of aquatic bodies. So, these are called good indicator of water quality because they are strongly affected by environmental conditions and respond quickly. It is more or less related with limnological studies (Verma, 2019; Prakash and Verma, 2020).

Though numerous works on phytoplankton diversity are being reported from different parts of India but there is scarcity of report from freshwater lentic water body of eastern Uttar Pradesh except some work (Prakash et al. 2015; Prakash, 2001; Sinha et al., 2002; Sugumaran et al., 2020). However, Singh and Kushwaha (2022) studied the water quality of this river.

So, the present study was an attempt for reporting plankton diversity and density Hardiha Pond of Hanumana Tehsil of district Rewa (M.P.).

MATERIAL AND METHODS:-

Plankton samples from Hardiha Pond were collected fortnightly with plankton net of bolting no. 25 with a mesh size 25µ attached with a collection tube at the base of net throughout the year, between 9.00 and 10.00 am. The 50 liter of surface water was sieved through the plankton net and sample was collected inside the collection tube. The sample was transferred to plastic bottle and preserved. Plankton productivity was measured by using Sedge Wick Rafter plankton counting cell and quantities are expressed here as units per liter of the Taal water. The diversity of plankton was studied under light microscope with magnification 10X initially and followed by 40X. Plankton were identified with the help of a book entitled "A guide to the study of fresh water biology" written by Needham and Needham (1962), Sharma and Sharma (2008) and other standard literature.

RESULTS AND DISCUSSION:-

In the present study, 29 species of phytoplankton belonging to four class, Chlorophyceae, Cyanophyceae, Bacillariophyceae and Euglenophyceae. Out of 29 species, 11 species, *Ankistrodesmus* sp., *Chlamydomonas* sp., *Crucigenia* sp., *Cosmarium* sp.,

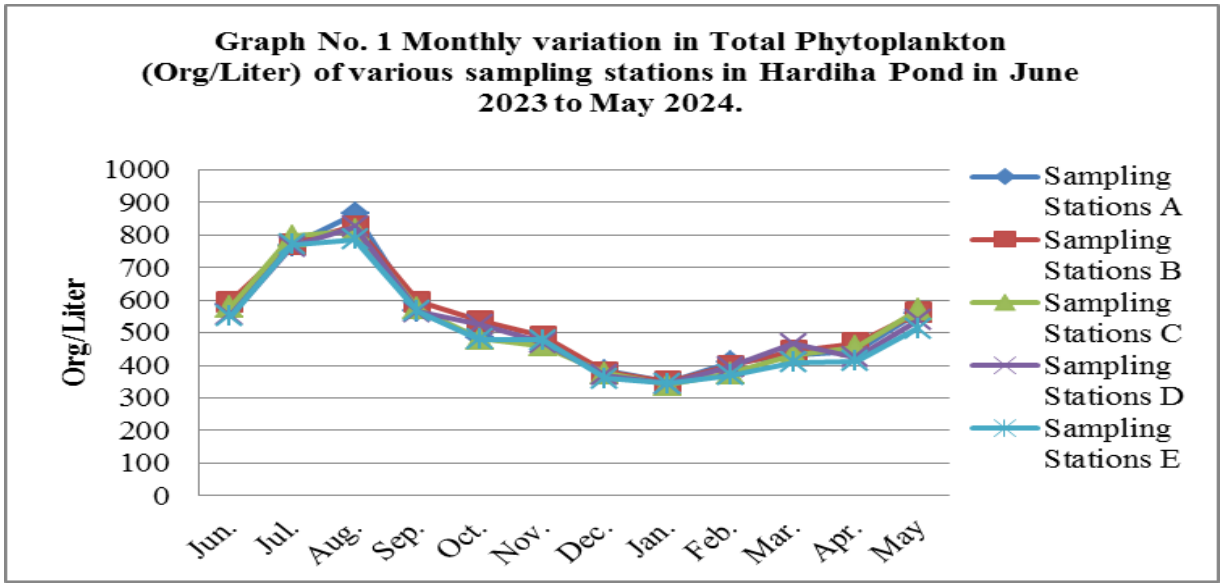
Chlorella sp., *Oedogonium* sp., *Pediastrum* sp., *Spirogyra* sp., *Scenedesmus* sp., *Ulothrix* sp. and *Volvox* sp. Belonged to Chlorophyceae; 09 species, *Aphanothecac* sp., *Arthrospira* sp., *Anabaena* sp., *Gloeocapsa* sp., *Lyngbya* sp., *Microcystis* sp., *Nostoc* sp., *Oscillatoria* sp. and *Spirulina* sp. to Cyanophyceae; 07 species, *Cymbella* sp., *Cyolotella* sp., *Eragillaria* sp., *Melosira* sp., *Navicula* sp., *Nitzschia* sp. and *Synedra* sp. to Bacillariophyceae and 02 species, *Euglena* sp. & *Phacus* sp. to Euglenophyceae. Presence of these species was also reported in fresh water bodies (Prakash, 2001a, Prakash *et al*., 2002 and Sinha *et al*., 2002). Presence of 29 species of phytoplankton shows that the pond is rich in planktonic diversity. Similar observation was made by Ansari and Prakash (2000), Prakash (2001b) and Sinha *et al* (2002). The plankton density in the pond shows is highly productive. Increase in plankton density is a good sign for healthy aquatic ecosystem required for the maintenance of biodiversity (Ashok, 2017a and 2017b), however, excessive anthropogenic activities, electronic wastes and microplastics in general influence aquatic life (Verma and Prakash, 2020; Prakash and Verma, 2022; Verma and Prakash, 2022).

The Monthly variation in Total Phytoplankton (Org/Liter) during the period from June 2023 to May 2024 is illustrated in table no.1 The highest value of total phytoplankton in Hardiha pond was recorded 865 org/l in the month of August 2023 at the sampling station A, while the lowest value of total phytoplankton was recorded 335 org/l in the month of January 2024 at the sampling station B.

In the present study bimodal pattern of seasonal variation of plankton was observed, with a primary peak in the month of June and secondary peak in December. The maximum average plankton density was found in summer season, moderate in winter season and minimum in monsoon season. It was observed that maximum plankton production occurred during the summer months due to optimum ecological conditions. Similar pattern of plankton distribution were also reported in the fresh water bodies (Khan and Siddiqui, 1974).

Table No. 1- Monthly variation in Total Phytoplankton (Org/Liter) of various sampling stations in Hardiha Pond in June 2023 to May 2024.

S.N.	Months 2023-24	Sampling Stations					Mean±SD
		A	B	C	D	E	
1.	Jun.	585	595	578	555	551	572.80±19.11
2.	Jul.	768	771	795	765	770	773.80±12.07
3.	Aug.	865	827	813	824	785	822.80±28.83
4.	Sep.	565	596	574	563	566	572.80±13.63
5.	Oct.	484	536	482	525	480	501.40±26.88
6.	Nov.	468	490	460	470	478	473.20±11.37
7.	Dec.	383	379	375	369	360	373.20±09.01
8.	Jan.	348	35	340	344	345	342.40±5.03
9.	Feb.	408	400	375	395	369	389.40±16.68
10.	Mar.	430	444	432	466	408	436.00±21.21
11.	Apr.	442	468	456	425	413	440.80±22.33
12.	May	559	562	569	539	513	548.40±22.71
Range	**Min**	**348**	**335**	**340**	**344**	**345**	
	Max	**865**	**827**	**813**	**824**	**785**	
ANOVA one way test for Phytoplankton there is a not significant difference between sampling sites (p=0.9413)							



CONCLUSION:-

Concluding the above account we can state that Phytoplanktons are popular organisms found in fresh water resources. They are important part of aquatic food chain and food webs and proves to be very good indicators about the water quality. In the above account it has been observed that studies were reported regarding their diversity and seasonal variation. Thus seasonal variation of phytoplanktons study is a very important tool in limnology. The current study shows that Hardiha Pond is rich in density and diversity of phytoplankton, indicating that this pond is suited for aquaculture. So, it is necessary to control human activity in watershed areas in order to reduce water contamination. In light of the significance of the study, actions should be taken to ensure its conservation and upkeep. Therefore, measures must be taken to minimize the water pollution by regulating human activities in watershed areas.

REFERENCES:-

1. Alfred, J.R.B., Bricice, S., Issac, M.L. (1973). A guide to the study of freshwater organisms. Journal Madras Universal Supply. 1:103-151.
2. Ansari KK, Prakash S. Limnological studies on Tulsidas Tal of tarai region of Balrampur in relation to fisheries. Poll. Res. 2000;19(4):651-655.
3. Ansari, K.K. and Prakash, S. (2000). Limnological studies on Tulsidas Tal of tarai region of Balrampur in relation to fisheries. Poll. Res.19(4): 651-655.
4. Ashok K.V. (2017). Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology. 4(2): 158-160.
5. Ashok K.V. (2018). Ecological Balance: An Indispensable Need for Human Survival. Journal of Experimental Zoology, India. 21 (1): 407-409.
6. Ashok KV.(2017a) Environmental Ethics: Need to Rethink. International Journal on Environmental Sciences.;8(1):7-9.
7. Ashok KV. .(2017a) Necessity of Ecological Balance for Widespread Biodiversity. Indian Journal of Biology.;4(2):158-160.
8. Bhagde R.V., Pingle S.A., Bhoye M.R. Pansambal S.S. and Deshmukh D.R. (2020). A Comparative Study of Physico-Chemical Parameters of the Freshwater Ponds from Sangamner Taluka of Ahmednagar, Maharashtra, India. International Journal of Biological Innovations. 2(2): 137-142. https://doi.org/10.46505/IJBI.2020.2209
9. Khan MA, Siddiqui AQ (1974). Seasonal changes in the limnology of a perennial fish pond at Aligarh. Indian J Fish.; 21(2):463-478.
10. Needham JJ, Needham PR.(1962)- A Guide to the study of freshwater Biology, Charles Cthomas Publisher, USA; c1962.
11. Needham, J.J and Needham, P.R. (1962). A Guide to the study of freshwater Biology, Charles CthomasPublisher,U.S.

12. Prakash S, Ansari KK, Sinha M.(2002) Seasonal dynamics of zooplankton in a fresh water pond developed from the wasteland of brick-kiln. Poll. Res.;21(1):81-83.

13. Prakash S, Verma AK, Kumar S, Mishra BK.(2015b) Monthlies variations in phytoplankton density in Alwaralake of District- Kaushambi (U.P.). Global Journal for Research Analysis.;4(12):62.

14. Prakash S, Verma AK, Sadguru P.(2015a) Limnological Studies of Alwara Lake of Kaushambi (Uttar Pradesh). International Journal on Biological Sciences.;6(2):141-144.

15. Prakash S, Verma AK, Sadguru P. (2015c)Seasonal variation of Zooplankton and Zoobenthos Population in Alwaralake of District Kaushambi (UP) India. Journal of Zoology Studies.;2(5):13-16. 21.

16. Prakash S, Verma AK.(2022)- Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations.;4(1):94-103.

17. Prakash S. (2021). Impact of Climate change on Aquatic Ecosystem and its Biodiversity: An overview. International Journal of Biological Innovations. 3(2):312-317. https://doi.org/10.46505/IJBI.2021.3210

18. Prakash S. and Verma A.K. (2019). Biodiversity Assessment of Khanwari Pond of District Kaushambi (U.P.). International Journal on Environmental Sciences. 10 (1): 24-28.

19. Prakash S. and Verma A.K. (2022). Anthropogenic activities and Biodiversity threats. International Journal of Biological Innovations. 4(1): 94-103. https://doi.org/10.46505/IJBI.2022.4110

20. Prakash S.(2001a) Seasonal dynamic of plankton in a fresh waterbody at Balrampur. GEOBIOS.;28(1):29-32.

21. Prakash S. (2001b) Utilization of Brick- Kiln land in aquaculture. GEOBIOS.;28(4):193-196.

22. Prakash S., Verma A.K., Kumar S. and Mishra B.K. (2015). Monthlies variations in phytoplankton density in Alwara lake of DistrictKaushambi (U.P.). Global Journal for Research Analysis. 4 (12): https://www.doi.org.10.36106/gjra

23. Prakash, S. (2001). Seasonal dynamics of Plankton in a fresh waterbody at Balrampur. GEOBIOS. 28(1):29-32.

24. Ranjan R, Prakash S.(2020) Seasonal variation in Population dynamics of phytoplankton in Guthia Taal, Wetland of Bahraich (U. P.). Flora and fauna.;26(2):266-270.

25. Ranjan, R. and Praksh, S. (2020). Seasonal variation in phytoplankton diversity in Guthia Taal, Wetland of Bahraich (U. P.). Flora and Fauna. 26(2):26(2):266-270.

26. Sharma BK, Sharma S.(2008)- Zoolplankton diversity in floodplain lakes of Assam. Records of Zoological Survey of India. Occasional paper no.;290:1-307.

27. Singh R. and Kushwaha A. (2022). Water quality of Sai River at Unnao district of U.P. International Journal on Biological Sciences. 13 (1): 97-102.

28. Sinha M, Prakash S, Ansari KK.(2002) Seasonal dynamics of phytoplankton population in relation to abiotic factors of a fresh water pond developed from wasteland of brick-kiln. Asian Jr. of Microbiol. Biotech. Env. Sc. 2002;4(1):43-45.

29. Sinha, M., Prakash, S. and Ansari, K.K. (2002). Seasonal Dynamics of Phytoplankton population in Relation to abiotic factors of a fresh water pond developed from wasteland of Brick-kiln. Asian Jr. of Microbiol. Biotech. Env.Sc. 4(1):43- 45.

30. Sugumaran E, Shabeen B, Radhakrishnan MV.(2020)- Zooplankton Diversity in Sathanur Reservoir of Thiruvannamalai (Tamil Nadu), India. International Journal of Biological Innovations. 2020;2(2):95-101.

31. Sugumaran E., Shabeen B. and Radhakrishnan M. V. (2020). Zooplankton Diversity in Sathanur Reservoir of Thiruvannamalai (Tamilnadu), India. International Journal of Biological Innovations. 2 (2): 95-101. https://doi.org/10.46505/IJBI.2020.2203.

32. Verma A.K. (2019). Studies of Hydrobiological Properties of Balapur Pond of Prayagraj (U.P.). Hort Flora Research Spectrum. 8(1): 09-11.

33. Verma AK, Kumar S, Prakash S.(2016a) Seasonal Correlation between physico-chemical factors and phytoplankton density in Alwara Taal of Kaushambi, U. P., India. International Research Journal of Biological Sciences.;5(3):40-45.

34. Verma AK, Prakash S, Mishra BK. (2016b) Phytoplankton diversity in Alwara Lake of district

Kaushambi (U.P.). Journal of Entomology and Zoology Studies. ;4(1):170-172.

35. Verma AK, Prakash S.(2020)- E-wastes and their impact on environment and public health. International Journal of Applied Research.;6(9):164-168.

36. Verma AK, Prakash S.(2022) Microplastics as an emerging threat to the fresh water fishes: A review. International Journal of Biological Innovations.;4(2):368-374.

37. Verma AK.(2019)- Studies of Hydrobiological Properties of Balapur Pond of Prayagraj (U.P.). Hort Flora Research Spectrum.;8(1):09-11.