Seasonal dynamics of plankton productivity in Anarkali Lake, a wetland of Bahraich, U.P.

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Abstract- ***Planktons occupy a central position in the food web of aquatic ecosystem. They being integral part, contribute significantly the biological productivity of the fresh water ecosystem. The present investigation was undertaken to study the monthlies changes in the density and diversity of plankton in Anarkali Lake, a wetland of Bahraich district of Uttar Pradesh, India. The work was carried out for a period of one year from July 2019 to June, 2020. Total 23 species of phytoplankton and 20 species of zooplankton were recorded. Bimodal pattern of seasonal variation of plankton was found, with a primary peak in the month of July and secondary peak in January.***

Indexed Terms- ***Planktons, Anarkali Lake***

I. INTRODUCTION

Freshwater ecosystems are among the most essential natural resources for sustaining life on Earth. These ecosystems include rivers, ponds, lakes, and wetlands. Wetlands, in particular, are recognized as some of the most productive and valuable ecosystems, supporting a wide range of biodiversity (Verma and Prakash, 2020). However, with the rapid increase in human population, the generation of waste has become a serious environmental issue. Improper disposal of this waste has led to significant water pollution, resulting in the eutrophication of many natural lakes, taals, and wetlands (Prakash, 2020). The growth and development of plankton within these ecosystems are influenced by various biotic and abiotic factors, including light availability, temperature, nutrient concentration, dissolved oxygen levels, and pH (Prakash and Ansari, 2000). Phytoplankton, which form the base of the aquatic food web, are followed by zooplankton at the next trophic level. The abundance and diversity of zooplankton are directly affected by the physicochemical properties of the water, and their populations fluctuate with seasonal variations (Prakash et al., 2002).

The population density and diversity of plankton in aquatic ecosystems play a crucial role in formulating sustainable management strategies, as they often vary between different locations and even among aquatic systems within the same region. A lack of adequate knowledge regarding plankton communities and their dynamics poses a significant challenge to fully understanding the ecological processes of freshwater bodies. Therefore, hydrobiological studies are essential for assessing the aquatic biota, including plankton populations (Prakash et al., 2015a; Verma and Prakash, 2020). Although several studies on zooplankton diversity have been conducted across various parts of India, there remains a noticeable gap in research concerning the freshwater bodies of eastern Uttar Pradesh. Notable exceptions include the works of Prakash and Ansari (2000), Prakash (2001), Prakash et al. (2002, 2015b, 2015c), Verma et al. (2016a, 2016b), and Sugumaran et al. (2020). In this context, the present study aims to report on the diversity and density of plankton in Anarkali Lake, located in Bahraich district of eastern Uttar Pradesh, India.

II. MATERIAL AND METHODS

Anarkali Lake is a large shallow perennial lentic waterbody with irregular margin and dense growth of macrophytes. It is situated in Ratanpur Tepraha of district Bahraich at a distance of about 5.0 km away from Bahraich district. It is situated between the latitude $27^{O}60.785^{/}$N latitude and $81^{o}60528^{/}$ E longitude (Fig. 1; Plate1).

Fig1. Satellite map of Anarkali Lake of Bahraich district of U.P.

Plate 1. Photograph of Anarkali Lake of Bahraich district of U.P.

Plankton samples from three sites (located in three different locations) 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. Approx. 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 in 4% formalin. Zooplankton productivity was measured by using Sedge Wick Rafter Plankton counting cell and quantities are expressed as unit per liter of the taal water. The diversity of plankton was studied under light microscope with magnification 10X initially and followed by 40X. The specimen were identified following standard literature of Needham and Needham (1962) and other standard literature.

III. RESULTS AND DISCUSSION

In the present study, a total of 23 species of phytoplankton were recorded. These included 8 species of Chlorophyceae (*Pediastrum, Coelastrum, Scenedesmus, Botryococcus, Colosterium, Crucigenia, Ulothrix,* and *Chlorella*), 7 species of Bacillariophyceae (*Synedra, Navicula, Cymbella, Melosira, Cyclotella, Pinnularia,* and *Asterionella*), 6 species of Cyanophyceae (*Anabaena, Spirulina, Raphidiopsis, Merismopedia, Cloeocapsa,* and *Oscillatoria*), and 2 species of Euglenophyceae (*Euglena* and *Phacus*). Additionally, 20 species of zooplankton were identified. These comprised 7 species of Rotifers (*Asplanchna, Brachionus, Keratella, Notomata, Notholca, Polyarthra,* and *Lecane*), 8 species of Cladocerans (*Diaphanosoma, Daphnia, Simocephalus, Chydorus, Bosmina, Bosminopsis, Sida,* and *Macrothrix*), 3 species of Copepods (*Cyclops, Diaptomus,* and *Nauplius larva*), and 2 species of Ciliates (*Paramecium* and *Vorticella*). Most of these species have also been reported from other freshwater bodies of eastern Uttar Pradesh (Prakash, 2001a; Prakash et al., 2002; Sinha et al., 2002). The presence of 23 species of phytoplankton and 20 species of zooplankton indicates that the taal supports a rich and diverse planktonic community.

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Table1. Monthly fluctuations in Plankton Population in Anarkali Lake (July, 2019 to June, 2020)

Months	Phytoplankton Group density (Units / Litre)					Zooplankton Group density (Units / Litre)				
	Chloro-phyceae	Cyaono-phyceae	Bacillariophyceae	Euglenophyceae	Total	Rotifera	Cladocera	Copepods	Ciliates	Total
Jul.	374	442	366	44	1226	524	379	154	124	1181
Aug.	388	513	388	50	1339	607	307	204	97	1215
Sep.	364	472	411	73	1320	539	433	201	95	1268
Oct.	411	446	533	60	1450	419	277	303	157	1156
Nov.	413	433	504	51	1401	379	441	356	133	1309

Dec.	577	562	533	53	1725	848	633	644	285	2410
Jan.	340	359	244	34	977	271	436	455	174	1336
Feb.	286	379	232	24	921	302	435	206	165	1108
Mar.	312	524	235	32	1103	412	382	293	176	1263
Apr.	266	633	265	67	1231	514	424	355	194	1487
May.	287	644	253	76	1260	544	477	393	235	1649
Jun.	1047	1502	977	1627	5153	1656	1459	1328	946	5389
Total	5065	6909	4941	2191	19106	7015	6083	4892	2781	20771
%age	26.50	36.16	25.86	11.47		33.77	29.28	23.55	13.39	-

The annual periodicity of phytoplankton shows that Cyanophyceae dominated and constituted 36.16% of the total phytoplankton followed by Chlorophyceae (26.50%), Bacillariophyceae (25.86%) and Euglenophyceae (11.47%). In the present study the maximum density of phytoplankton was recorded in June and minimum in the month of February. The annual productivity of zooplankton shows that Rotifers dominated and constituted 33.77% of the total zooplankton followed by Cladocerans (29.28%), Copepods (23.55%) and Ciliates (13.39%). In the present study the maximum density of zooplankton was recorded in June and minimum in February. Similar observation were made by Ansari and Prakash (2000), Prakash (2001a) and Sinha *et al* (2002). The plankton density in the Baghel taal shows is highly productive. In the present study bimodal pattern of seasonal variation of plankton was found, with a primary peak in the month of June and secondary peak in December. Similar pattern of plankton distribution were reported in the fresh waterbodies of U.P. by Khan and Siddiqui (1974), Ansari and Prakash (2000) and Prakash (2001a).

The annual analysis of phytoplankton periodicity revealed that Cyanophyceae dominated the community, accounting for 36.16% of the total phytoplankton population. This was followed by Chlorophyceae (26.50%), Bacillariophyceae (25.86%), and Euglenophyceae (11.47%). The highest density of phytoplankton was recorded in June, while the lowest was observed in February. Similarly, the annual productivity of zooplankton showed that Rotifers were the dominant group, comprising 33.77% of the total zooplankton population. They were followed by Cladocerans (29.28%), Copepods (23.55%), and Ciliates (13.39%). The density of zooplankton was also highest in June and lowest in February. These findings are consistent with earlier observations reported by Ansari and Prakash (2000), Prakash (2001a), and Sinha et al. (2002).The plankton density observed in Anarkali lake indicates that it is a highly productive freshwater body. A bimodal pattern of seasonal variation in plankton density was recorded during the study, with a primary peak in June and a secondary peak in December. Similar patterns of plankton distribution have been reported from other freshwater bodies of Uttar Pradesh by Khan and Siddiqui (1974), Ansari and Prakash (2000), and Prakash (2001a).

CONCLUSIONS

The ecological importance of plankton is well recognized, as they form a vital component of the aquatic food chain and play a crucial role in the cycling of organic matter within aquatic ecosystems. The findings of the present study on Anarkali Lake indicate a rich density and diversity of plankton, particularly rotifers, suggesting that this wetland holds significant potential for aquaculture. Rotifers, being an excellent natural food source for fish larvae, enhance the suitability of this habitat for fish production. The dominance of rotifers also serves as an indicator of eutrophic conditions in the lake. Therefore, effective management strategies are essential to control pollution levels, primarily by regulating anthropogenic activities within the surrounding watershed areas to maintain ecological balance and support sustainable aquaculture.

REFERENCES

[1] Prakash, S. (2001). Seasonal dynamics of Plankton in a fresh water body at Balrampur. GEOBIOS. 28(1):29-32.

[2] Prakash, S. (2020). Conservation status of fishes reported from Semara Taal of District Siddharthnagar (U.P.). India. Interntional Journal of Fauna and Biological Studies. 7(3): 21-24

[3] Prakash, S. and Ansari, K.K. (2000). Characteristics of zooplankton community in the Bhagwanpur Dam of Tarai Region, Tulsipur, distt. Balrampur, U.P. UGC sponsored first national conference on recent trends in life management, organized by Bipin Bihari College, Jhansi.54-56.

[4] Prakash, S. and Srivastava, S. (2019). Impact of Climate change on Biodiversity: An Overview. International Journal of Biological Innovations. 1(2):60-65. DOI: https://doi.org/10.46505/IJBI.2019.1205.

[5] Prakash, S. and Verma, A.K. (2019). Comparative Analysis of Sarus Crane Population from 2012-2019 in and around Alwara Lake of District Kaushambi (U.P.), India. International Journal of Biological Innovations. 1 (2): 36-39. DOI: https://doi.org/10.46505/IJBI.2019.1201

[6] Prakash, S., Ansari, K.K. and Sinha, M. (2002). Seasonal dynamics of Zooplankton in a fresh water pond developed from the wasteland of Brick-kiln. Poll. Res. 21(1): 82-83.

[7] Prakash S., Verma A.K., and Prakash S. (2015a). Limnological Studies of Alwara Lake of Kaushambi (U.P.). International Journal on Biological Sciences. 6 (2): 141-144.

[8] Prakash S., Verma A.K., Prakash S. (2015b). Seasonal variation of Zooplankton and Zoobenthos Population in Alwaralake of District Kaushambi (UP) India. Journal of Zoology Studies. 2(5): 13-16.

[9] Prakash, S., Verma, A.K., Kumar, S. and Mishra, B.K. (2015c). Monthlies variations in phytoplankton density in Alwara lake of District-Kaushambi (U.P.). Global Journal for Research Analysis. 4(12). DOI: 10.15373/22778160/December2015/62.

[10] Prakash, S., Kumar, A., Prakash, S. and Mishra B.K. (2020).A Survey of Fish Fauna of Rapti River, Balrampur (U.P.), India. International Journal of Biological Innovations. 2(1): 76-81. DOI: https://doi.org/10.46505/IJBI.2020.2110

[11] Verma, A.K., Prakash, S. and Mishra, B.K. (2016a). Phytoplankton diversity in Alwara lake of district Kaushambi (U.P.). Journal of Entomology and Zoology Studies, 4(1): 170-172.

[12] Verma, A.K., Kumar, S. and Prakash, S. (2016b). 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.

[13] Verma, A.K. and Prakash, S. (2018). Qualitative and quantitative analysis of macrozoobenthos of Baghel Taal, a wetland of U.P. Indian Journal of Biology. 5 (2): 127-130.

[14] Verma, A. K. and Prakash, S. (2020). Limnological Studies on Semara Taal, A wetland of District Siddharthnagar, Uttar Pradesh,India. Journal of Fisheries and Life sciences. 5(1): 15-19.