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Seasonal Diversity of Phytoplankton in Relation to Seasonal Changes in physicochemical Parameters of Khedi Kalan Station of Dholawad Dam of Ratlam District M. P.

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ABSTRACT

In the present study an attempt has been made to assess the Phytoplankton species diversity in reference to physicochemical parameters of fresh water Khedi Kalan station of Dholawad Dam (Saroj sarovar Dam) of Ratlam District (M. P.). Present paper is based on evaluation of Phytoplankton Diversity of fresh water perennial Dholawad Dam of rural area of Ratlam. The present work is useful to explore Phytoplankton species, their composition along with relation with physicochemical parameters of Dholawad Dam. Phytoplankton could be used as the indicator of physicochemical status of any water body Mittal and Sengar[11]. Physicochemical parameters play significant role for algal growth. A total of five groups Chlorophyceae, Bascillariophyceae, Cynophyceae, Dinophyceae and Euglenophyceae of phytoplankton were identified during the study period.

Key words: *Phytoplankton, Diversity, Physicochemical parameter, Water.*

INTRODUCTION

Phytoplankton represents the microscopic algal communities of water bodies and the creator of aquatic food chain. The productivity of an ecosystem is directly related to diversity of phytoplankton Ansari *et al*[3]. Phytoplankton is the primary producer of the aquatic environment which fixes solar energy by process of Photosynthesis assimilating carbon dioxide and water to produce carbohydrate. Phytoplankton is the good indicator of trophic status of aquatic ecosystem Whitton[25]. The seasonal fluctuation of physicochemical parameters determines the diversity of phytoplankton. Phytoplankton is a key component of the dam biota in General because it forms the base of the pyramid of productivity. Phytoplankton species have different physiological requirements and thus show diverse responses to physico-chemical parameters like light, temperature, pH etc. Therefore phytoplankton composed of the first ring of food chain should be examined taxonomically and ecologically Ganaia and Parveen[5].

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The present study attempted to analyze the phytoplankton diversity with relation to physicochemical parameters of Dholawad Dam of rural area of Ratlam. Based on this data an attempt has been made to access the water quality and to evaluation the trophic status of the dam.

MATERIAL METHOD

Study area

This dam is situated in a rural area of Ratlam district and used for drinking water supply, fisheries, irrigation, Cattle bathing. This is a medium irrigation dam. It is located in 23^0 16' N latitude and $74^0$54' E longitude. The Dam constructed at river Jaman a tributary of Mahi River near village Vasindra of Ratlam district. The present study is first hydro biological work ever under taken in this reservoir.

Collection of sample

To study the physicochemical changes and profit structure of Dholawad dam seasonal observations taken for one year (Summer, Rainy and winter) from March 2014 to February 2015. The different physicochemical parameters such as water temperature, pH, transparency, TDS, dissolved oxygen, total alkalinity, total hardness, Chloride and biological oxygen demand were analyzed by Standard methods APHA[2], Trivedi and Goel[24].

Biological analysis

Samples for plankton analysis were collected once in a month for a period of one year from March 2014 to February 2015. Plankton was collected along with water samples. For qualitative studies plankton sample were collected by standard plankton net made of bolting silk number 14 (120µ) and 25 (64µ). The samples were preserved in Lugol's Iodine solution.

Identification of phytoplankton was done with the help of keys given by Edmondson W. T.[4], Prescott[14] and APHA[2].

RESULT AND DISSCUSION

Physico-chemical parameters

The physico-chemical parameters of Khedi kalan station of Dholawad dam have been given in **Table 1.**

In present investigation, the water temperature ranged from 31.3°c to 20°c. Water temperature is of enormous importance as it regulates various abiotic characteristics and biotic activities of an aquatic ecosystem[9]. The lowest water temperature was recorded in the month of December (20°C) and highest in March (31.3°C). The observed variation in water temperature might be related to the weather conditions. pH marked a fluctuation from 7.1 in July to 8.3 in March. Similar result observed by Garg *et al.*[4] their study on Water quality and conservation management of Ramsagar reservoir, Datia, Madhya Pradesh. In the present study maximum 102.32cm in December during winter seasons and minimum 29.19cm in August during the rainy season. Similar result observed by Patil[12], she noticed the lowest transparency during summer and highest values were recorded during rainy season, during first year and highest values during winter in the next year of study period in Birnal Water Body of Sangli, Maharashtra.

Total dissolved solids of the Dam were 280.22 mg/l in rainy, which is the highest value and the lowest values 220.46 mg/l was noticed in summer. Similar result obtained by Rana[17]. Hydrobiological studies on freshwater reservoir of Malhaniya dam, Pendra Road Bilaspur.

DO and BOD are important parameters which increase the favorable condition of algal growth during the study period. Do is important parameter of biological life in the water. Throughout the investigation period, high dissolved oxygen contents were noticed during winter season 9.9 mg/l and low during summer 6.2 mg/l. similar observation found by Abir[1] his studies on Seasonal Variations in Physico-Chemical Characteristics of Rudrasagar Wetland - A Ramsar Site, Tripura, North East, India. BOD is found to be more sensitive test for organic pollution. BOD value of dam water ranged between 0.7-1.9 mg/ l. Highest BOD value was observed in winter season. Increased temperature and sedimentation load reduce BOD Pyatkin and Krivoshein[13]. Chloride

values were found ranging between 16.22 to 26.25 mg/l of which maximum value was noticed in summer and the lowest value in winter may be due to dilution effect in post monsoon period. Singh and Pandey[21] also found similar behavior of chlorides in their studies on Gangapur tank. Alkalinity ranged between 112.42–130.31 mg/l with maximum value in summer and minimum in winter. Silambarasan *et al*[20] also reported similar results that it was maximum in summer and minimum in winter their Studies on Ichthyofaunal Biodiversity in Relation with Physicochemical Variables of Kolavoi Lake, Chengalpet, Tamil nadu. Total hardness varied from 120.29 – 143.38 mg/l highest peak being observed in the month of May (143.38) mg/l and lowest in January (120.29 mg/l). Total hardness was highest during summer months and lower in winter that can be attributed to higher temperature level which includes concentration of salts by excessive evaporation. Hujare[8] reported total hardness was high during summer than rainy season and winter season. During this study period physicochemical parameters of Dam water such as water temperature, pH, transparency, TDS, dissolved oxygen, total alkalinity, total hardness, Chloride and biological oxygen demand measured and found within the suitable range for phytoplankton production.

Phytoplankton

Plankton population largely depends on the physico-chemical characteristic of a water body. Phytoplankton showed variations in their abundance during different months of the year. The phytoplankton communities of Phytoplankton given in **Table 2** and the total phytoplankton diversity during different seasons in the year 2014-1015 has been given in **Graph 1**.

The present research study shows that the phytoplankton diversity of the Dholawad dam was low during monsoon and high diversity during summer and winter season. Chaturvedi *et al*, reported that the summer is the most suitable season for the growth of phytoplankton in freshwater lakes because of long duration of sunshine period, increased salinity, pH and trophotropic activities The highest diversity were observed during summer, Winter and lowest in monsoon period Sharma *et al.*[19], also noticed that phytoplankton grow and multiply best during summer months when the temperature is high and having longer photoperiod. Similar findings were also reported by Shrinivasan *et al*[23]. The phytoplankton fluctuates monthly and its productivity high during summer and low in monsoon the basic process of phytoplankton production was dependent upon temperature, turbidity and nutrients the abundance of phytoplankton was lowest during monsoon season, when the water column was remarkably stratified to a large extent because of heavy rainfall and decreased temperature cool conditions.

In the present investigation, 5 group of algae *viz.* Chlorophyceae, Cyanophyceae, Bacillariophyceae, Dinophyceae and Euglenophyceae were identified. Similar observation were recorded by Rao and choubey[16]; Rajagopal *et al.*[15], Percentage wise contribution of phytoplankton groups are shown in **Table 3**. Chlorophyceae group presented maximum (37%) while minimum (3%) Euglenophycae and Dinophyceae.

Chlorophyceae group was the most significant and dominant group of phytoplankton contributing 37% of total phytoplankton recorded. The group was mostly represented by Chlorella sp., Pediastrum simplex, Scenedesmus sp., Volvox sp., Eudorina sp., Zygenema sp., Spirogyra sp., Straurastrum sp., Ulothrix sp., Hydrodictchyon sp. And Closterium sp. etc. Hegde and Bharati[7], pointed that alkaline pH is one of the important factor that regulate the presence of chlorophyceae in aquatic medium. In the present study alkaline pH were recorded at Khedi kalan of Dholawad Dam. Singh[22] summarized that temperature affect the growth of algae, as low temperature favored the growth of Euglenophyceae and high temperature that of Chlorophyceae. In the present investigation, the diversity of Chlorophyceae in Dam water was found to be maximum during summer. Rajgopal *et al.*[15]

noticed that Dissolve oxygen, pH, alkalinity play a significant role in distribution of Chlorophycean members in fresh water zones there study on two perennial ponds in sattur area, Tamilnadu.

Bacillariophyceae group contributed 33% from the total phytoplankton population. The group was mostly represented by Cymbella sp., Navicula microspora, Amphora sp., Nitzschia sp., Synendra sp., Pinnularia sp., Gyrosigma sp. Cocconies sp., Melosira sp. and Tabellaria sp. Harikrishnan *et al.*[6], stated that alkaline pH favors the abundance of diatomic population. In the present studies alkaline pH were recorded at Khedi kalan station of Dholawad Dam Ravishankar *et al.* studied the Bacillariophyceae is the dominating group with 31.12% in two Lakes of Tumkur, Karnataka State, India.

Cyanophyceae group contributed 24% from the total phytoplankton population. The group was mostly represented by Microcystis aruginosa, Anabaena sp., Chrococcus sp., Nostoc sp., Oscillatoria sp. Phormidium sp. and Spirulina sp. In the present investigation, the diversity of cyanophyceace in Dam water was found to be maximum during summer seasons. It may be due to higher water temperature. Zafar[26]; Hedge and Bharati[7], were of the opinion that high temperature favors the luxuriant growth of blue-green algae. Only one species of Dinonophyceae viz., Ceratium hirudinella were identified from the Dholawad Dam. In the present investigation Dinophyceae was recorded in summer season while absent in the rainy season.

Only one species of Euglenophyceae viz., Euglena sp. were identified from the Dholawad Dam. The high temperature, chloride, TDS, and BOD might have played an important role in growth and development of Euglenophyceae. Seeneyya[18] reported that temperature above 25°C was good for the growth of Euglenophyceae. Euglenophyceae was reported maximum during the summer months were temperature values were noted higher. Previous studies on freshwater environment showed that higher temperature favors the growth of euglenoids. The high temperature, chloride, TDS, and BOD might have played an important role in growth and development of Euglenophyceae[3].

Table 1: seasonal variation in physicochemical conditions of the Dholawad Dam water

season	Month	Water Temp °c	TDS Mg/l	Transparency Cm	pH	Total alkalinity Mg/l	Total hardness Mg/l	DO Mg/l	Chloride Mg/l	BOD Mg/l
Summer	**Mar 14**	**31.3**	225.16	76.00	**8.3**	120.43	128.27	**6.2**	25.00	1.1
	Apr	31.0	223.30	72.81	8.2	122.17	135.00	6.3	**26.25**	0.8
	May	29.3	**220.46**	69.61	8.0	**130.31**	**143.38**	6.3	25.37	**0.7**
	Jun	26.2	240.14	63.00	7.8	125.29	138.52	6.4	25.16	0.9
Monsoon	**July**	24.0	273.46	31.44	**7.1**	128.52	134.27	6.5	24.74	1.3
	Aug	24.0	**280.22**	**29.19**	7.2	129.20	134.44	7.0	23.91	1.2
	Sep	21.2	276.30	38.43	7.2	117.00	135.50	6.9	23.18	1.4
	Oct	21.6	264.36	58.31	7.3	117.34	125.25	7.1	19.00	1.7
Winter	**Nov**	20.9	258.21	84.24	7.5	119.68	133.23	8.8	18.14	1.8
	Dec	**20.0**	240.42	**102.32**	7.5	116.00	126.11	**9.9**	**16.22**	**1.9**
	Jan 15	21.4	238.36	99.22	7.7	**112.42**	**120.29**	9.2	18.39	1.8
	Feb	26.6	227.20	98.16	7.9	116.25	123.18	7.1	20.27	1.6

Table 2: List of Identified Plankton from Dholawad Dam

Phytoplankton	
Cynophyceae	
1	Anabena sp.
2	Chroococcus sp.
3	Oscillatoria sp.
4	Nostoc sp.
5	Spirulina sp.
6	Microcystis aruginosa
7	Phormidium sp.
Chlorophyceae	
1	Chlorella sp.
2	Pediastrum simplex
3	Scenedesmus sp.
4	Volvox sp.
5	Eudorina sp.
6	Zygenema sp.
7	Spirogyra sp.
8	Straurastrum sp.
9	Ulothrix sp.
10	Hydrodictchyon sp
11	Closterium sp.
Bacillariophyceae	
1	Cymbella sp.
2	Navicula microspora
3	Amphora sp.
4	Nitzschia sp.
5	Synendra sp.
6	Pinnularia sp.
7	Gyrosigma sp.
8	Cocconies sp.
9	Melosira sp.
10	Tabellaria sp.
Dinophyceae	
1	Ceratium hirudinella
Euglenophyceae	
1	Euglena sp.

Table 3: Percentage of group of phytoplankton of Khedi kalan station of Dholawad dam

S. No.	Group	No. of species	%
1	Chlorophyceae	11	37%
2	Bacillariophyceae	10	33%
3	Cynophyceae	7	24%
4	Dinophyceae	1	3%
5	Euglenophyceae	1	3%
	Total	30	100%

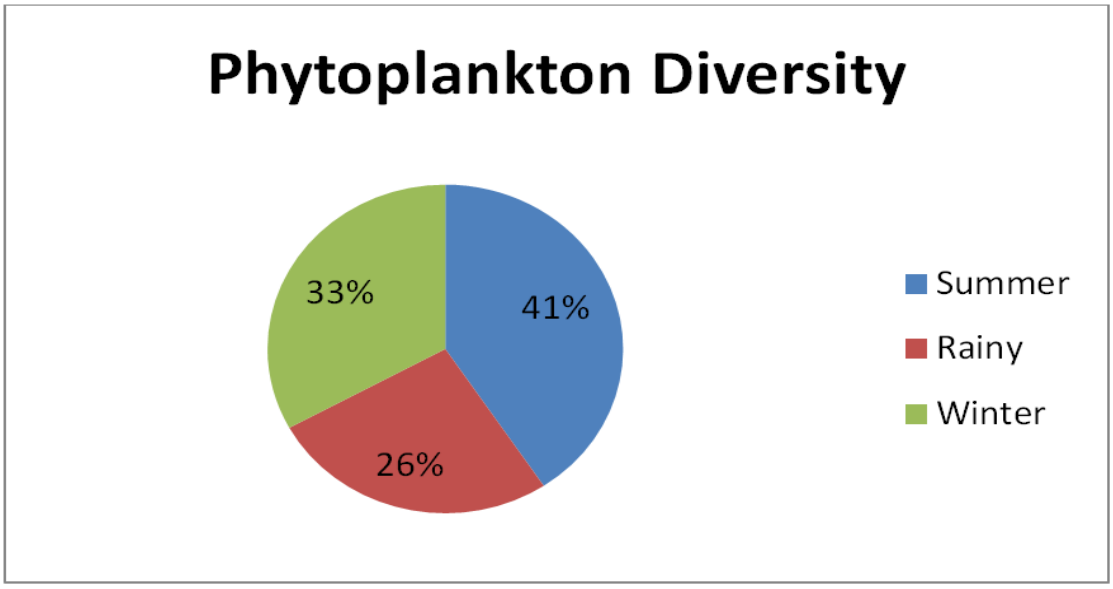

Fig. 1: Seasonal Diversity of Phytoplankton Khedi Kalan station of Dholawad Dam

CONCLUSION

In the present study phytoplankton diversity is highly oscillate in the Rainy, winter and summer season throughout the study period. The growth of phytoplankton showing less in rainy season in comparison to winter and summer. During study period Dam shows maximum algal growth in summer and winter. Physicochemical parameters as the pH, Transparency, light are show statically

correlated with algal growth. The obtained results show that phytoplankton species diversity is variable in freshwater Dholawad Dam. No single factor is responsible for this variability. However, temperature, sunlight exposure period, sunlight penetration, water pH, wind, transparency, may be related to variable changes in the phytoplankton distribution and their diversity in the Dam.

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