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PHYTOPLANKTON DIVERSITY IN KIRHAI DAM OF AMARPATAN, SATNA (M.P.)

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ABSTRACT: - Phytoplankton's are chlorophyll bearing suspended microscopic organisms consisting of algae with representative from all major taxonomic groups; the majority of members belong to Chlorophyceae, Cyanophyceae and Bacillariophyceae. Their unique ability to fix inorganic carbon to build up organic matter through primary production makes their study a subject of prime importance. The quality and quantity of phytoplankton and their seasonal successional patterns have been successfully utilized to assess the quality of water and its capacity to sustain heterotrophic communities. In the present study, four major group of phytoplankton have been identified, Bacillariophyceae, Chlorophyceae, Cyanophyceae and Euglenophyceae and only the "net plankton" community have been analysed qualitatively and quantitatively; their seasonal variations have also been studied and the data obtained have been analysed statistically to estimate the significance of the impact of physico-chemical parameters on the phytoplankton community. Effort has also been made to evaluate the correlation between physico-chemical parameters and the "net phytoplankton" community. Monthly samplings of phytoplankton were documented at 4 stations of Kirhai dam, Amarpatan Satna (M.P.) for January 2012 to December 2013. Phytoplankton diversity was represented by Chlorophyceae, Cyanophyceae, Bacillariophyace and Euglenophyace. Among four groups of phytoplankton 17 species belong to Chlorophyace, 14 species belong to Cyanophyceae, 13 species to Bacillariophyceae and two species to Euglenophyceae.

KEYWORDS: Kirhai dam, phytoplankton, Eutrophic status**.**

INTRODUCTION

Biological parameters are perhaps of greatest importance from productivity point of view. All natural waters contain a variety of organisms, both plants and animals as the natural flora and fauna. Biological condition of an aquatic environment indicates the quantity and quality of nutritive organisms present in medium. The nutritive organisms are aquatic plants and animals which are required by the fish as food. As a result of the two natural processes (interaction between living and non-living factors) going on since olden days a variety of organic substances are produced and added up in the ecosystems. These substances are sources of energy and result in biological production. The production by plants is primary production and by animals secondary one. Uncontrolled use of water to dispose of waste material emanating from various sources, have deteriorated the water resources. These water pollutants may alter natural conditions by reducing dissolved oxygen contents, pH and temperature or by direct toxic action that can be lethal or can affect reproduction and physiology of the organisms. There may be sudden disappearance of certain species and consequently some other forms may appear. Likewise one kind of organism becomes extremely abundant because of the disappearance of one or more species but in a balanced ecosystem, large populations of a single species rarely maintain themselves over a long period of time, because predators quickly reduce their numbers. Therefore, biological monitoring is essential in determining the synergistic or antagonistic interactions of components of waste discharges and the resulting effects on living organisms.

Biological monitoring provides enough information for supplementing the physico-chemical observations and also the state and extent of pollution of a water body. The biological examination of water serves as a useful tool for the control of water quality and treatment. Welch (1952) designated the plankton as the heterogenous assemblage of suspended microscopic materials, minute organisms and detritus in water which wander at the mercy of winds, currents and tides. They are divided into two major groups, namely, phytoplankton and zooplankton. The distribution and composition of planktonic communities appear to vary considerably from one water body to another.

The phytoplankton forms a very important component of aquatic vegetation, occurring in all kinds of water bodies and consequently enjoying a worldwide distribution. All types of growth forms emergent, submerged, free-floating and floating leaved aquatic environment indicates the quantity and quality of nutritive organisms present in the organism present in the medium. These nutritive organisms are aquatic plant and animals as food. These nutritive organisms are produced by mineral nutrients in solution in the water by means of the sun, heat and light. The green vegetation is able to transform the inorganic matter and carbonic acid in solution in the water into organic matter which forms vegetable tissue.

Phytoplanktons are chlorophyll bearing suspended microscopic organisms consisting of algae with representative from all major taxonomic groups; the majority of members belong to Chlorophyceae, Cyanophyceae and Bacillariophyceae. Their unique ability to fix inorganic carbon to build up organic matter through primary production makes their study a subject of prime importance. The quality and quantity of phytoplankton and their seasonal successional patterns have been successfully utilized to assess the quality of water and its capacity to sustain heterotrophic communities.
The present investigation has been undertaken to assess the monthly variations in the occurrence of phytoplankton were documented at 4 stations of Kirhai dam, Amarpatan Satna (M.P.) for January 2012 to December 2013.

II. STUDY AREA

The present study has been carried out on Kirhai dam, Amarpatan Satna in Madhya Pradesh. Kirhai dam is situated in village, Kirhai, tehsil Amarpatan, district Satna (M.P.). Amarpatan is located at 24°32'N latitude and 80°98' E longitude. It lies on National Highway No. 7 and connects Rewa to Maihar. Amarpatan is 36 km from district headquarters, nearest Railway station, is Maihar which is 24 km. It has an average elevation of 358 meters (117.4 feet).
Kirhai dam is made on Kirhai Nalla in 1970. It is situated between 24°15'25" N latitude and 81°10' E longitude. It is located on Amarpatan-Ramnagar road, 9 km from N.H.-7 Aamarpatan Bus stand. The catchment area of the dam was 0.715 sq. mile (1.852 sq. km).

METHODOLOGY

Samples were collected monthly from five different sampling stations namely A, B, C, D, and E for one year (January 2012 to December 2013). The samples were collected at 11 am -1pm during second week of each month. Under qualitative analysis of planktonic communities the identification was done; as for as possible to species level. Sample was collected for planktonic population net in each month. Microphotography, camera Lucida diagrams etc. were the main tools for this taxonomy study of the planktonic species. For the quantitative studies of plankton twenty liter water was filtered through a piece of silk bolting cloth from each station and the collection samples were preserved in 4% formalin. Plankton counting was done with the help of Sedgwick Rafter cell. The average number of planktonic forms per liter was calculated by the following formula:

$$Organism/liter = \frac{C \times 1000m3m3}{L \times D \times W \times S}$$

Where, C = Number of planktonic organisms counted in all strips
L= Length of strip
D= Depth of a strip
W= Width of a strip
S= Numbers of strips counted

RESULT & DISCUSSION:

Monthly sampling of phytoplankton and zooplankton were documented at 4 stations of Kirhai dam, Amarpatan Satna (M.P.) for January 2012 to December 2013. Phytoplankton diversity was represented by Chlorophyceae, Cyanophyceae, Bacillariophyace and Euglenophyace. Among four groups of phytoplankton 17 species belong to Chlorophyace, 14 species belong to Cyanophyceae, 13 species to Bacillariophyceae and two species to Euglenophyceae as given below:

Group 1-Chlorophyceae:
Botryococcus sp., Chlamydomonas sp., Chlorella sp., Chara sp., Coelastrum microporum, Cosmarium sp., Crucigenia sp., Eudorina elagans, Genicularia sp., Mougeotia sp., Netrium sp., Oedogonium sp., Pediastrum simplex, Scenedesmus armatus, Spirogyra sp., Staurastrum sp., Volvox sp.

Group2 –Cyanophyceae:
Anabaena spiroides, Anacystis sp., Aplanocapsa sp., Coelospharenum sp., Gleocapsa sp., Merismopedia sp., Microcystis sp., Nostoc sp., Oscillatoria sp., Phormidium sp., Rivularia sp., Raphidiopsis sp., Spirulina sp., Scytonema sp.

Group3 –Bacillariophyceae:
Amphora sp., Cyclotella sp., Cymbella affinis, Diatoma elongatum, Fragillaria sp., Gomphonema sp., Gyrosigma sp., Melosira sp., Navicula indica, Navicula pulpa, Nitzschia sp., Surirella sp., Synedra capitata.
Group4 –Euglenophyceae: *Euglena sp., Phacus sp.*
The number of species and their percentage composition are given below:

S.No.	Groups	Number of Species	Percentage
1	Chlorophyceae	17	36.96
2	Cyanophyceae	14	30.43
3	Bacillariophyceae	13	28.26
4	Euglenophyceae	2	4.35
	Total	**46**	**100.00**

Chlorophyceae forms the main bulk of phytoplankton gaining 36.96% followed by Cyanophyceae (30.43%), Bacillariophycae (28.26%) and Eugelnophyceae (4.35%) during study period.

The seasonal density of phytoplankton and their mean annual density with percentage composition, recorded during January 2012 to December 2013 are given in Table Below:

Table -1. Total seasonal density (org/l) of phytoplankton during January 2012 to December 2013

Years	Seasons	Stations				Average
		Station A	Station B	Station C	Station D	
July 2010 to June 2011	Winter	1027.1	1075.35	1042	1083.4	**1056.96**
	Summer	959.5	975.6	962	963.8	**965.225**
	Rainy	753.6	801	786.7	740.4	**770.425**
July 2011 to June 2012	Winter	1078.2	1125.7	1093.5	1138.9	**1109.08**
	Summer	1027	1044.6	1031	1032.8	**1033.85**
	Rainy	807.6	856.2	841.9	795.6	**825.325**

Table -2. Mean annual density (org/l) of different groups of phytoplankton of Kirhai Dam, Amarpatan, Satna (M.P.) and their percentage composition during January 2012 to December 2013.

S.No.	Taxonomic group	First year (January 2012 to December 2012)				
		Winter Season	Summer Season	Rainy Season	Mean annual density (org/l)	%
1	Chlorophyceae	389.5	430.28	251.43	357.07	**38.36**
2	Cyanophyceae	314.93	284.15	251.63	283.57	**30.46**
3	Bacillariophyceae	310.55	215.43	244.65	256.88	**27.59**
4	Euglenophyceae	42.22	35.38	22.73	33.44	**3.59**
	Total	**1057.20**	**965.24**	**770.44**	**930.96**	**100**
S.No.	**Taxonomic group**	**Second year (January 2013 to December 2013)**				
		Winter Season	**Summer Season**	**Rainy Season**	**Mean annual density (org/l)**	**%**
1	Chlorophyceae	409.6	455.4	271.3	378.77	**39.76**
2	Cyanophyceae	314.93	284.15	251.63	283.57	**29.77**
3	Bacillariophyceae	310.55	215.43	244.65	256.88	**26.96**
4	Euglenophyceae	42.22	35.38	22.73	33.44	**3.51**
	Total	**1077.30**	**990.36**	**790.31**	**952.66**	**100.0**

During present study the phytoplankton density was recorded slightly higher during second year (952.66 org/l) in comparison to first year (930.96 org/l) of study period. The maximum density of phytoplankton was recorded in winter season (1056.96 org/l and 1109.08 org/l) followed by summer season (965.25 org/l and

1033.85 org/l) and rainy season (770.425 org/l and 825.325 org/l) during first and second years of study period respectively. Among the different groups of phytoplankton, Chlorophyceae showed its dominance followed by Cyanophyceae, Bacillariophycae and Euglenophyceae during both study years.

The dominant species of phytoplankton were recorded as *Cosmarium sp., Chlorella sp., Botryococcus sp.* and *Chara sp.* among *Chlorophyceae, Coelospharenum sp., Microcystis sp., Anacystis sp.* and *Rivularia sp.* among Cyanophyceae, *Navicula indica, N. pulpa, Gyrosigma sp*. and *Cyclotella sp.* among Bcillariophyceae and *Euglena sp*. among Eugleophyceae during study period. Hastler (1947) observed that the constant addition of even low levels of nitrogen and phosphorus to an aquatic environment could greatly stimulate algal growth and high level of total nitrogen was followed with the growth of Chlorophycean, Eugleninean and Cyanophycean forms. Prescott, (1948) discussed the importance of temperature in the growth and periodicity of blue green algae. Zafar (1964) reported that phosphates were observed in traces during winter season, and Cyanophyceae were in peak when the phosphate content is very low or even undetectable. Nazneen (1974) found that maximum bloom of phytoplankton occurred during summer due to high growth of Myxophyceae, while in Bacillariophyceae growth was greater than Chlorophyceae. A decrease in the abundance of total phytoplankton observed in May and in November was attributed to the disappearance of Microcystis aeruginosa.

During present study, 46 species of phytoplankton were recorded, out of which 17 species belonging to Chlorophyceae, 14 species to Cyanophyceae, 13 species to Bacillariophyceae and 2 species to Euglenophyceae. Maximum density of phytoplankton was recorded in winter season followed summer season and rainy season. Laskar and Gupta (2009) reported minimum density of phytoplankton during monsoon season and maximum during summer season in Chatla lake, Assam. The seasonal changes in the species composition, distribution and density are due to the changing environmental conditions. Baba and Pandit (2014) reported that phytoplankton depicted bimodal growth curve with peaks in spring and autumn which may be as a result of regeneration and availability of minerals as a result of decomposition of organic matter in sediments. The seasonality of phytoplankton is also attributed to the moderate water temperature conditions besides the release and availability of plant nutrients during these periods.

CONCLUSION

Plankton communities exhibit a major biotic component of an aquatic ecosystem an emphasis has been given to identify various plankton species as indicators of particular type of water pollution. Prasad and Singh (1958) emphasized the importance of biological survey in monitoring water quality which is dependent on qualitative and quantitative composition of aquatic population. The most important effect of organic pollution in a water body is due to enrichment of nutrients and total number of algal species. There is a clear correlation between organic pollution and blue green algae and also with certain diatoms like melosira sp. (Palmer 1969). Therefore it can be concluded through this study that there are several reasons for the deterioration of the Kirhai Dam. These findings will help in the future studies for biomonitoring of these areas.

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