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"A Study On Seasonal Variation And Species Composition Of Phytoplankton In Bansagar Dam"

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Article History:

ABSTRACT:

Hydrological changes and riverine fauna serve as key indicators of river health. In India, the natural flow of rivers has been heavily modified by dams and water diversions to meet agricultural and power demands, often neglecting the fisheries sector. These alterations have degraded aquatic ecosystems, disrupted breeding cycles of important species especially large carps and severely affected the livelihoods of river-dependent communities.

The present study was carried out in the Bansagar Dam, Shahdol district, Madhya Pradesh, India for Seasonal Variation and Species Composition of Phytoplankton, in which it can be concluded that The phytoplankton community of Bansagar Dam comprised four major groups Chlorophyceae, Bacillariophyceae, Cyanophyceae, and Euglenophyceae with over 25 recorded species. Chlorophyceae was the most dominant and species-rich group, peaking in summer (542 org/l) due to favorable temperature and light conditions. Bacillariophyceae showed moderate abundance, indicating good water quality, while Cyanophyceae increased in nutrient-rich summer conditions, suggesting eutrophication trends. Euglenophyceae were least abundant, occurring mainly in slightly polluted waters. Overall, phytoplankton diversity and abundance were highest in summer and lowest in winter, indicating a mesotrophic to slightly eutrophic nature of the Bansagar Dam ecosystem.

Keywords: Water diversion, disrupted breeding cycle, abundance, eutrophication etc.

INTRODUCTION:

Hydrological changes and Riverine fauna are the indicator of Riverine health. In India, natural flow of all major rivers have been regulated for fulfilling water demand of agriculture and power sector without giving any attention to fisheries sector. As a result, rivers have lost their character and fisheries have local fished huge losses. Severe and drastic changes in the entire hydrological cycle of the river by dams and water abstractions has affected recruitment of most species, especially large carps. Larger dams are major cause of degradation of aquatic environment also the livelihood of communities along the river depend upon the fishery along the rivers. Therefore, ichthyofaunal documentation is essential to analyze status of fish species as it helps in the quality and quantity of fish fauna planning to improve and conserve the biodiversity.

Now, Hydrobiological analysis become important to provide proper and complete spectrum of the water resources, which can play an important role in the growth of the economy of any country. Instead of large river system and other lotic inland resources the stagnant water in the form of ponds, reservoirs, lakes, water tanks are also considered as valuable sources for the development of capture and culture fisheries. India has over 800 big reservoirs and dams and thousands of small tanks and ponds and other water bodies, but unfortunately most of them are being highly vegetated due to excessive eutrophication. The inland water resources have become the main focus of the study in present century and limnology is drawing special attention of scientists for the development of science of ecology. According Schwoerbel (1968) the science of limnology deals specially

with the section of inland water and life in habiting in it.

MATERIALS AND METHODS:

Quantitative analysis of phytoplankton:

Phytoplankton were collected by filtering of 500 ml of water sample from each station in narrow mouth polythene bags and preserved in 4% formalin.
Phytoplankton and Zooplanktons were counted with the help of Sedgwick-Rafter counting cell and drop count method under the microscope. Counts were made in triplicate and results were represented in organisms per liter.

OBSERVATION AND RESULT:

Mean values of monthly distribution of Phytoplankton species wise (org/l) in Bansagar Dam from November 2014 to October 2015 gives a clear picture of the seasonal and monthly fluctuations of various groups of phytoplankton. The record indicates that the phytoplankton community was predominantly comprised of four broad groups Chlorophyceae (green algae), Bacillariophyceae (diatoms), Cyanophyceae (blue-green algae), and Euglenophyceae (euglenoids). Of these, Chlorophyceae was the most prevalent group during the study duration, with the greatest abundance from the summer months (March–May) at a peak of 542 organisms per liter. This indicates that green algae prefer warm temperatures and intense light, where the photosynthetic process is favored. Pediastrum, Chlorella, and Protococcus were the dominant contributors in this group.
Bacillariophyceae (diatoms) presented moderate abundance, peaking in summer (274 org/l) and lowest in winter. The group characteristically likes cold and well oxygenated water and the finding indicates good water quality and proper nutrient balance. The group Cyanophyceae (blue green algae) also had a distinct seasonal trend, rising substantially in summer (415 org/l) when water temperature and nutrient levels were high. The predominance of Microcystis and Coelosphaerium during the period indicates a trend towards eutrophic since these species tend to grow in well nourished and stagnant waters.
The Euglenophyceae division, dominated by Euglena and Phacus, was the scarcest. Its density was low all year round with somewhat greater numbers during summer, reflecting conditions with nutrients or slightly polluted waters. In general, the entire phytoplankton population showed strong seasonal variation, with a maximum in summer and minimum during winter. The trend is indicative of the environmental influence of temperature, light, and nutrient level on the productivity of phytoplankton. The predominance of Chlorophyceae and Cyanophyceae during warm months indicates that the Bansagar Dam reservoir water body favors greater biological productivity, especially under desirable summer conditions.
The investigation of mean monthly distribution of phytoplankton species in Bansagar Dam (November 2014–October 2015) indicates strong variation in both species richness and species abundance among seasons. Phytoplankton abundance is the total count of individuals (individuals per liter), whereas richness is the number of unique species present in the community.
During the study duration, the phytoplankton population consisted of four predominant algal groups Chlorophyceae, Bacillariophyceae, Cyanophyceae, and Euglenophyceae, consisting of more than 25 individual species. Chlorophyceae was the richest in species with eight species such as Pediastrum, Scenedesmus, Chlorella, Cladophora, Mougeotia, Rhizoclonium, Protococcus, and Tetraedron. This group also prevails in abundance, with the highest contribution to overall phytoplankton density, particularly in the summer season, when the number was as high as 542 org/l. The prevalence of green algae reflects auspicious light, temperature, and nutrient level conditions conducive to active growth and photosynthesis.
Bacillariophyceae or diatoms constituted the second most diverse group, including ten species like Asterionella, Fragilaria, Melosira, Synedra, Navicula, Frustulia, Gomphonema, Cymbella, Nitzschia, and Pinnularia. While their relative abundance was relatively lower than green algae, they had a moderate species richness and were more uniformly distributed throughout the year. The diatom population was highest during summer (274 org/l) and lowest during winter, reflecting their tolerance of fluctuating environmental conditions and their use as indicators of good water quality.
Cyanophyceae (blue-green algae) had slightly lower species richness (seven species) but relatively high abundance, especially in the summer months (415 org/l). Microcystis, Coelosphaerium, Anabaena, and Oscillatoria were the most dominant species. Their increased counts in warmer months imply nutrient enrichment and decreased water movement, conditions that are conducive to cyanobacterial blooms. The occurrence of these species, particularly Microcystis and Anabaena, may signal the onset of eutrophication or organic pollution.
Euglenophyceae, with just two species (Euglena and Phacus), exhibited least species richness and abundance

(21 org/l during summer). Their presence in lower numbers but distinct peaks during warmer months indicates weakly enriched or stagnant conditions in the dam water.
In general, based on this study, species richness was maximum in Chlorophyceae and Bacillariophyceae and maximum species abundance in Chlorophyceae, followed by Cyanophyceae. Seasonal variation had a strong impact on both abundance and diversity, the richest and most abundant phytoplankton in summer and the poorest in winter. These results indicate that the ecosystem of Bansagar Dam has a productive and diverse phytoplankton community with green algae being the dominant group in terms of both number and diversity, indicating the water body to be mesotrophic to slightly eutrophic in nature.

DISCUSSION:

According to Brunberg and Blomqvist (2000) Microcystis is a widely distributed organisms which dominate the phytoplankton community in nutrient rich lakes. Microcystis aeruginosa is one of the main pollution producers of lake (Lindholm et al., 2003). Further, other two pollution indicator genera, Anabaena and Oscillatoria that produces neurotoxins were also recorded in Bansagar Dam but in low density. The presence of Anabaena and Oscillatoria indicates beginning of biological pollution, Mischke and Nixdorf (2003). Agale and Patel (2013) reported the maximum density of blue green algae in winter, minimum during monsoon and the moderate during summer season. Abdar (2013) reported the maximum phytoplankton density in summer and minimum in winter in Morna lake of Shirala (M.S.). Laskar and Gupta (2009) reported minimum density of phytoplankton during monsoon and maximum during summer in Chatla lake, Assam.
High density of phytoplankton in summer was also observed by Nandan and Aher (2005) and Chellappa et al. (2008). Baba and Pandit (2014) reported that phytoplankton population show two peaks, one in summer and other in autumn, with Bacillariophyceae dominating in autumn and winter, Chlorophyceae dominating in spring and both Cyanophyceae and Euglenophyceae dominating in summer. Singh (2015) reported the 5 groups of phytoplankton namely Cyanophyceae, Bacillariophyceae, Chlorophyceae, Dinophyceae and Euglenophyceae in open pond of Town Deeg (Bharatpur) Rajasthan. He reported the most important phytoplankton was blue green algae, Microcystis with a relative abundance of 47% and the least was the dinoflagellate, Peridium with a relative abundance of 1.17%. The occurrence of Microcystis, Anabaena and Aphanocapsa is a clear indication of pollution. In present study, the dominant group was Chlorophyceae, though in Cyanophyceae (blue green algae), Microcystis and Anabaena was also present. Singh (2015) reported the maximum density of phytoplankton during summer season and minimum during monsoon season supports our observation. The bright sunlight, isothermal water column, reasonable catchment area with rich nutrients helps developing the phytoplankton communities. They also reported that turbidity is a controlling factor or even a crucial one on the growth of phytoplankton.

Table: Mean values of monthly distribution of Phytoplankton species wise (org/l) in Station A of Bansagar Dam from November 2014 to October 2015.

Group's Species Name	Nov. 2014	Dec.	Jan-15	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct-15	Min.	Max.	Winter	Summer	Rainy
Pediastrum	15	12	3	17	37	25	17	11	10	3	19	27	3	37	47	90	59
Scendesmus	3	0	8	0	14	27	7	0	0	5	16	14	0	27	11	48	35
Chlorella	21	10	12	32	23	36	8	0	30	7	11	0	0	36	75	67	48
Chladophora	7	30	6	3	20	38	3	15	16	10	5	12	3	38	46	76	43
Mougeotia	0	7	3	0	36	10	0	18	7	5	2	0	0	36	10	64	14
Rhizoclonium	3	0	2	0	24	0	18	4	3	5	7	10	0	24	5	46	25
Protococcus	4	0	10	38	7	50	36	0	10	3	0	27	0	50	52	93	40
Teraedron	7	12	0	10	36	10	0	12	11	0	8	23	0	36	29	58	42
Chlorophyceae	**60**	**71**	**44**	**100**	**197**	**196**	**89**	**60**	**87**	**38**	**68**	**113**	**6**	**284**	**275**	**542**	**306**
Asterionella	3	0	0	0	5	0	0	0	0	2	0	5	0	5	3	5	7
Fragilaria	0	7	3	10	15	1	2	0	0	3	0	7	0	15	20	18	10
Melosira	0	0	3	0	0	10	0	3	0	0	5	12	0	12	3	13	17
Synedra	6	0	5	0	12	30	0	3	0	7	0	10	0	30	11	45	17
Navicula	0	5	0	7	0	14	10	5	0	0	0	18	0	18	12	29	18
Frustulia	6	5	4	0	18	26	3	0	0	10	0	20	0	26	15	47	30
Gomphonema	0	0	5	3	11	5	7	0	3	0	2	7	0	11	8	23	12
Cymbella	5	8	2	10	22	8	3	0	7	0	5	11	0	22	25	33	23
Nistzchia	0	0	3	2	7	5	10	0	3	0	8	10	0	10	5	22	21
Pinnularia	5	7	0	15	10	11	0	18	5	7	0	14	0	18	27	39	26
Bacillariophyceae	**25**	**32**	**25**	**47**	**100**	**110**	**35**	**29**	**18**	**29**	**20**	**114**	**0**	**167**	**129**	**274**	**181**
Microcystis	26	5	15	20	21	36	55	40	18	25	12	45	5	55	66	152	100
Merismopedia	0	12	6	0	20	10	8	9	14	0	14	18	0	20	18	47	46
Phormidium	3	0	0	10	0	6	7	0	5	0	5	0	0	10	13	13	10
Gomphospaeria	0	0	5	12	32	19	14	0	6	8	0	6	0	32	17	65	20
Anabaena	3	6	4	0	6	26	0	8	10	0	10	8	0	26	13	40	28
Coelosphaerium	0	5	8	10	28	32	0	10	6	4	4	0	0	32	23	70	14
Oscillatoria	6	0	0	12	14	0	6	8	3	5	10	8	0	14	18	28	26
Cyanophyceae	**38**	**28**	**38**	**64**	**121**	**129**	**90**	**75**	**62**	**42**	**55**	**85**	**5**	**189**	**168**	**415**	**244**
Euglena	0	0	0	0	6	4	0	8	0	0	2	0	0	8	0	18	2
Phacus	4	0	0	6	0	3	0	0	0	2	0	4	0	6	10	3	6
Euglenophyceae	**4**	**0**	**0**	**6**	**6**	**7**	**0**	**8**	**0**	**2**	**2**	**4**	**0**	**14**	**10**	**21**	**8**

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