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RESEARCH ARTICLE

Comparative Phytoplankton studies of two reservoirs Punasa and Omkareshwar of Narmada River, MP, India.

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Abstract

The River Narmada along with its tributaries is considered the lifeline of the State of Madhya Pradesh India. In the recent times the ecology of River Narmada is seriously affected by the domestic sewage discharge, effluents from different industries located near the banks and by dam formation. Phytoplankton is a fundamental component of aquatic ecosystem as they are major source of biologically important and labile organic carbon, located at the base of the food chain. The density and productivity of the phytoplankton are greatly influence by different physico-chemical characteristics of water. The present study was carried out for a period of one year from September 2011 to August 2012 to enumerate the various Physico-chemical parameters of Narmada River near Dams. Water samples were taken from sampling stations every month and were analyzed as per standard methods. In the present work in river Narmada forty-five genera of phytoplankton were recorded which comprised , twenty one genera belonged to Chlorophyceae, fourteen to Bacillariophyceae and ten to Cyanophyceae. The highest phytoplankton density (1700 units/lit) in the river Narmada, during present work, was found near Omkareshwar dam (station II) in April and lowest (293 units/lit) near Punasa Dam (station I) in August. The phytoplankton population showed two peak in summer and winter.

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INTRODUCTION

Planktons are minute organisms and are essential links in food chain in aquatic system. The Narmada River is one among the important rivers in India with varied rich biodiversity (Sharma *et al.,* 2013). Plankton are organisms of relatively small size mostly microscopic, which have either relatively small powers of locomotion or else none at all and which drift in the water subject to the action of waves, currents and other forms of water motion and is essential links in food chain in aquatic system .Plankton is of utmost importance in the freshwater ecosystem as these are the main source of energy and having a very high nutritive value (Mishra and Joshi 2003). Phytoplankton's and zooplankton's are the major group of plankton. Phytoplankton's play a phenomenal role in the biosynthesis of organic material while zooplankton forms important components of secondary production. Plankton population and their distribution are greatly affected by physical and chemical properties of water (Sharma and Diwan, 1997). The magnitude and dynamics of phytoplankton population has become an essential tool to assess the general health of an aquatic ecosystem. Some of algal genera increase in polluted waters and Palmer (1969) listed them as pollution tolerant forms. According to Arora (1961) certain zooplankton, like rotifers occur only in polluted waters. The occurrence of Rotarians is sufficient enough as evidence of deterioration of water quality (Hynes, 1960).

Dams, built to change natural flow regimes, are one of the most significant human interventions in the hydrological cycle. The construction of dam's results in physical, chemical and biological changes to natural ecosystems. The construction of a series of dams in Narmada basin is continuously bringing about changes in microclimate of the region. A free flowing river, when arrested behind dams, is subjected to different ecological dynamics and bio-geo chemical cycles. The reservoirs created behind the dams are different aquatic ecosystems compared to a free flowing river. Reduction of flood peaks reduces the frequency, extent and duration of floodplain inundation. Truncated sediment transport results in complex changes in degradation and aggregation below the dam. Reservoirs act as thermal regulators so that seasonal and short-term fluctuations in temperature, that are characteristic of many natural rivers, are regulated. The chemical composition of water released from reservoirs can be significantly different to that of inflows. Changes occur in pH and salinity as well as in the concentration of nutrients (e.g. phosphorous), carbon-dioxide, oxygen, hydrogen sulphide, iron, manganese and even heavy metals (e.g. mercury).The changes caused by dams directly and indirectly influence a myriad of dynamic factors that affect habitat heterogeneity and successional trajectories and ultimately the ecological integrity of river ecosystems (Ward and Stanford, 1995).

Study Area:

The points of study at the river where water samples were collected are referred as stations. The hydro biological study of the river Narmada at the stretch selected has been done for round the year, by taking the samples monthly with a view to assess the nature and degree of pollution. The sampling was done usually in morning hours between 8 a.m. to 11 a.m. and samples were collected from just below the water surface. At each of the station, three types of water samples-first from 200 m upstream, second from the confluence and third from 200 m downstream-were collected, for all biological analysis.

Sampling stations:

(A) Indra Sagar Dam (S1)

Indra Sagar Dam is 10 km away from Punasa village in Khandwa district of western Madhya Pradesh. It is 653 m long concrete gravity dam with a slightly curved alignment. It is about 92 m high from the deepest foundation level. Its catchment area is 61542 sq. kms. Its longitude is 76 º 28'00'' and latitude 22 º 17'00''.

(B) Omkareshwar (S2)

Omkareshwar is a famous place of pilgrimage situated 77 km from Indore in Khandwa District, Madhya Pradesh. This station has a religious importance and is visited by pilgrims from all over the country to seek blessing at the temple of Shri Omkar Mandhata. It's latitude 22º15, 1"N and Longitude 76º8',48"E.

Biological analysis

The samples for the quantitative analysis of plankton were collected by filtering 40 liters of water through a plankton net, made up of bloting silk no. 25 (75 Mesh size). The samples were preserved in Lugol's solution. Counting and density computation of plankton was done by Leaky's micro transect method. The identification of phytoplankton species was done with the help of literature of Fritsch (1959), Desikachary (1959) and APHA (1998).

Results and discussion

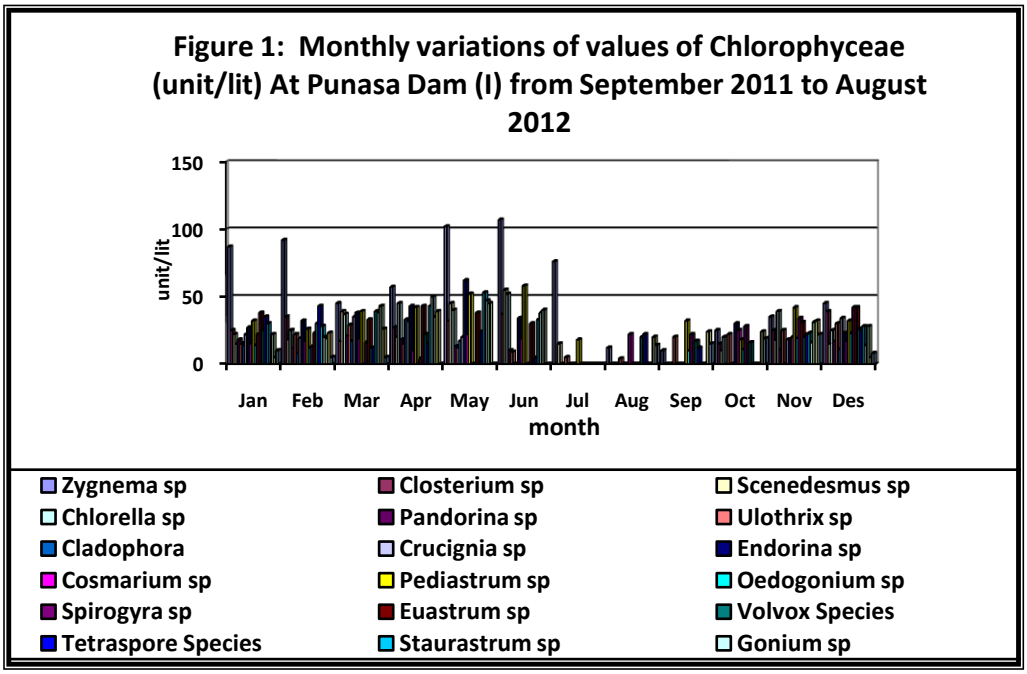
Phytoplankton community:

In the present work in river Narmada forty-five genera of phytoplankton were recorded which comprised , twenty one genera belonged to Chlorophyceae, fourteen to Bacillariophyceae and ten to Cyanophyceae. Similar groups of phytoplankton in river Narmada also reported by Palharya and Malviya (1988), Shrivastava (1999),Verma (2006) and Sharma *et al.* (2011).

The highest phytoplankton density (1700 units/lit) in the river Narmada, during present work, was occurred at Omkareshwar dam (station II) in April and lowest (293 units/lit) at Punasa Dam (station I) in August (Figure - 1 to 6). The phytoplankton population showed two peak in summer and winter. This was in agreement with Pahwa and Mehrotra (1966) in river Ganga; Dad (1981) in river Chambal and Palharya and Malviya (1988) and Sharma *et al.* (2011) in river Narmada.

The present observations showed that different groups of phytoplankton populations were fluctuated at different sampling stations. Diatoms were dominant at all stations (40.3 to 40.5%) and found throughout the study period. Populations of green algae (38.50 to 38.72%) were second in dominance and decreased a bit at all stations in summer months. Decamps *et al.* (1984) observed that a lot rivers of Europe over 90% of the plankton consists of

diatoms and greens. The blue greens were the third dominant group of phytoplankton (20.68% to 21.11%). At polluted stations the greens were replaced by blue greens enormously.



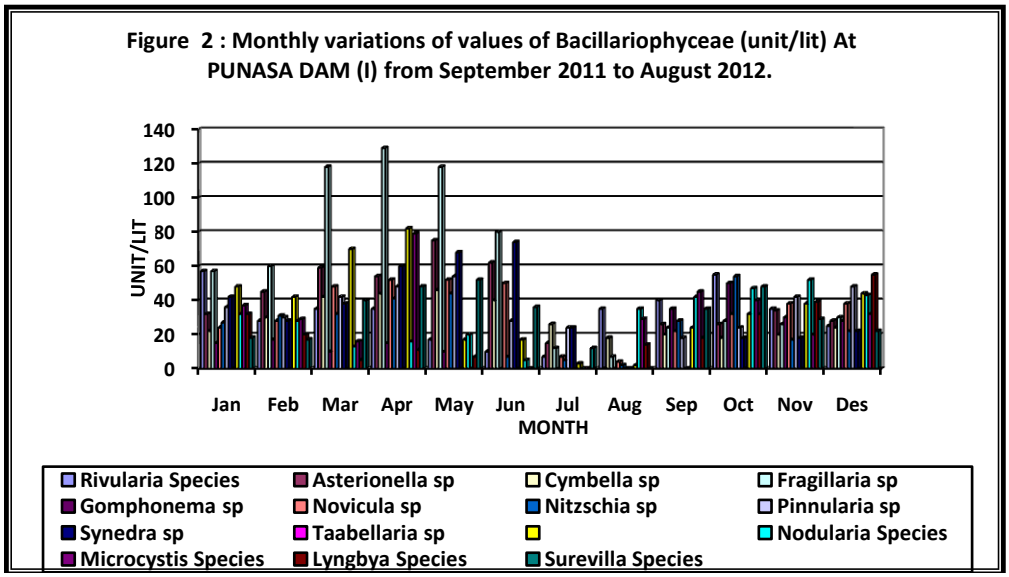


Figure 3 : Monthly variations of values of Cyanophyceae (unit/lit) At Punasa Dam (II) from September 2011 to August 2012.

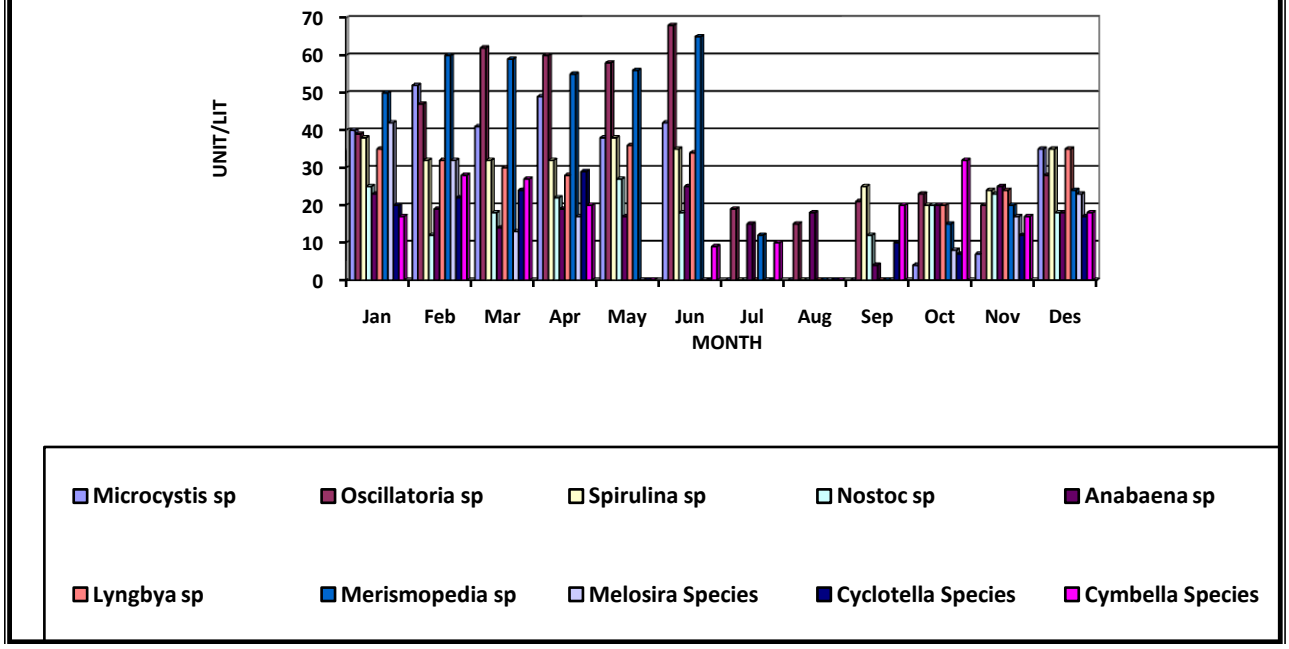


Figure 4: Monthly variations of values of Chlorophyceae (unit/lit) At Omkareshwar Dam (II) from September 2011 to August 2012.

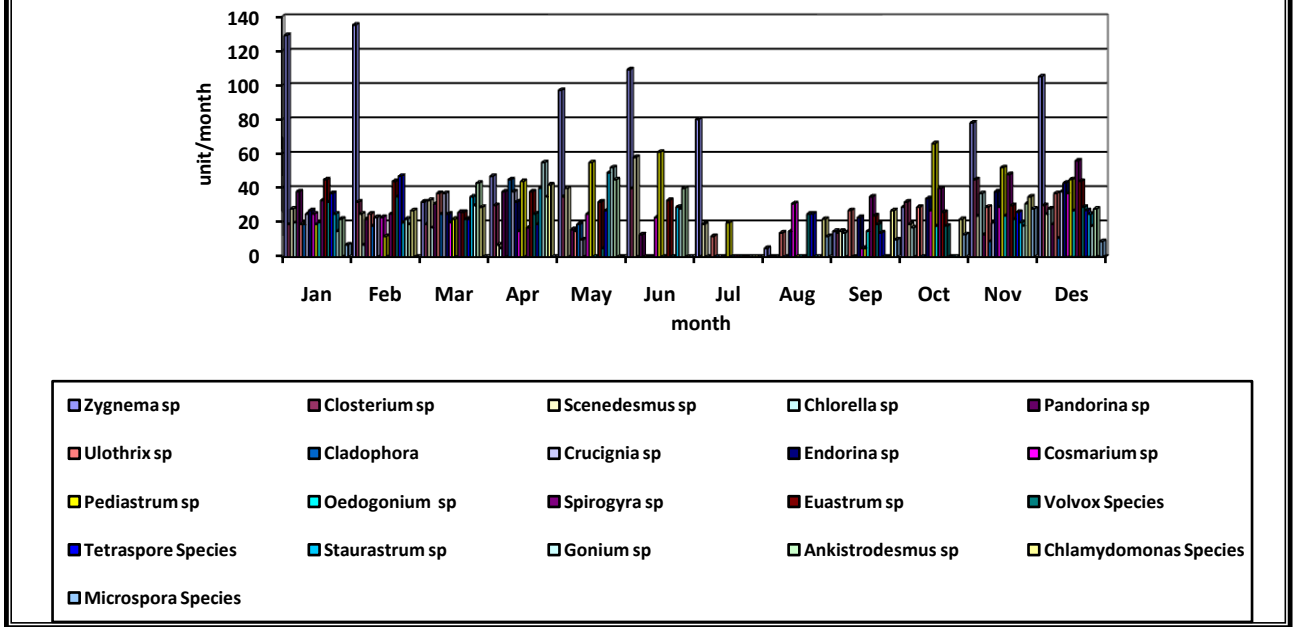


Figure 5: Monthly variations of values of Bacillariophyceae (unit/lit) At Omkareshwar Dam (II) from September 2011 to August 2012.

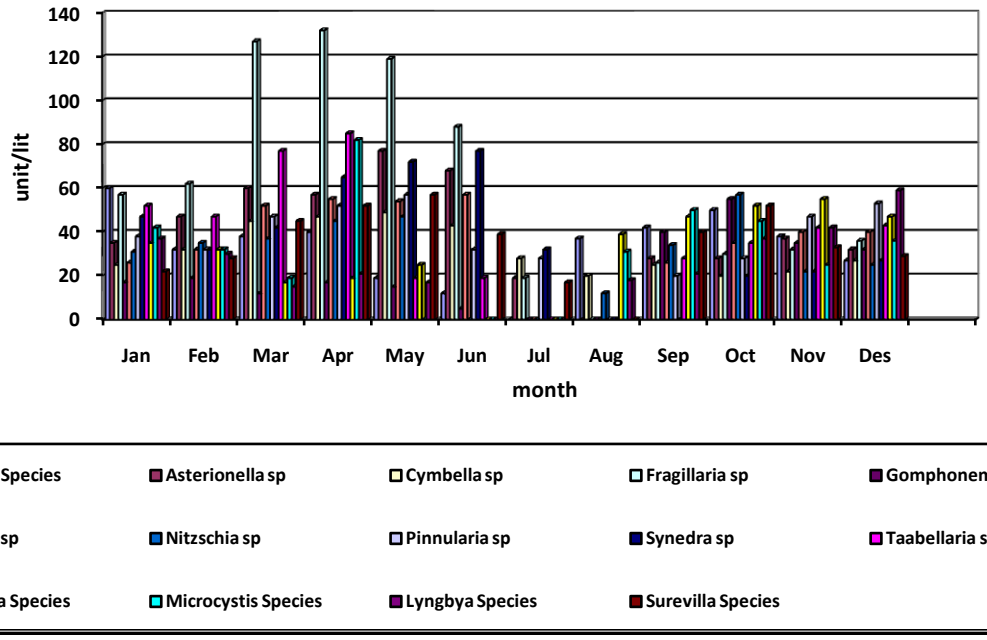
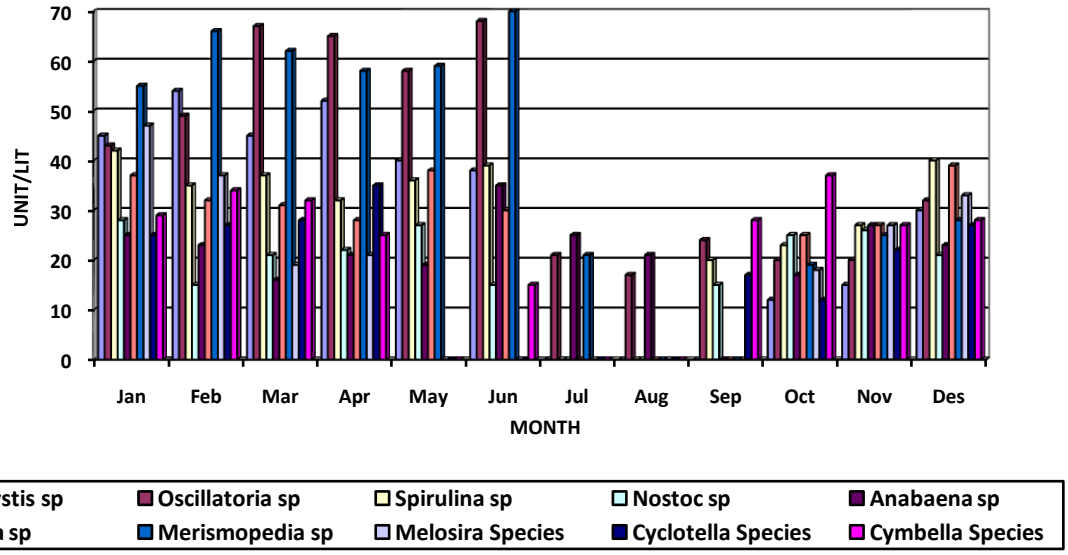


Figure 6 : Monthly variations of values of Cyanophyceae (unit/lit) At Omkareshwar Dam (II) from September 2011 to August 2012.



Group Wise –

Chlorophyceae:

The green algae were represented by highest number of genera (twenty one) in the present work. These constituted 38.50 to 38.72% of the total population. The maximum density of chlorophyceae. 681 units/lit was observed in December near Omkareshwar Dam (station II). Chlorophyceae illustrated peak in summer months and maximum growth of this group during summer was similar to earlier report of Bhowmick and Singh (1985) in river Ganga; Raina *et al.* (1982) in river Jhelum, Verma (2006) in river narmada.

Chlorella sp, Ulothrix sp, Zygnema sp, Pediastrum sp, Spirogyra sp, and Cosmarium sp were the most dominant amongst Chlorophyceae. Among these the most dominant species is Zygnema species And Pediastrum simplex stands as second in order of dominance. Zygnema Species showed its maximum density at the station II. This species is recorded in the maximum density during the months of winter and it loses its growth at the onset of the summer.

Bacillariophyceae:

The group Bacillariophyceae constitutes the diatoms and it characteristics of lentic water bodies specially the river.Diatoms were represented by fourteen genera and dominated the phytoplankton population throughout the study in river Narmada. These constituted 40.3 to 40.5% of the total population. In present investigation the maximum density of diatoms. 769 units/lit was recorded in April at Omkareshwar Dam (station II). Bacillariophyceae showed single peak in monthly distribution in the month of April. This is also reported by Verma (2006) and Sharma *et al.* (2011).

This results of Bacillariophyceae indicated that they were more in numbers in summer seasons and low in numbers during rainy seasons.It has been suggested that calcium favors the growth of diatoms (Pearsall, 1923; Patrick, 1948) and water of river Narmada is rich in calcium contents, the dominance of diatoms is obvious. Minimum densities of diatoms were recorded in monsoon months probably due to high velocity of the river.

Rivularia sp, Cymbella sp, Surevilla sp, Navicula sp, Nitzschia sp, Pinnularia sp, Fragillaria sp and Taaballaria sp included in Bacillariphyceae . During the present study Rivularia species is most dominant species among the Bacillariophyceae group. The highest density of this species is recorded at station II. The second dominant species is the Cymbella species.

Cyanophyceae:

Cyanophycean algae possess ability to grow in polluted waters. In present study blue green algae contributed 20.68% to 21.11% of the total phytoplankton and come third in order of dominance. Blue greens were represented by ten genera and Nostoc sp, Oscillatoria sp, Anabaena sp, Merismopedia sp and Microcystis sp in Cyanophyceae were the most dominant.

The maximum density of blue greens, 376 units/lit was recorded in January at Omkareshwar Dam (station II). These groups were more common during summer seasons and minimum in rainy season. Similar observations have been made by Nandan and Jain (2002), Verma (2006) and Sharma *et al.* (2011).

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