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Seasonal variation of phytoplankton in Nandeshwer dam, Udaipur, Rajasthan India

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Abstract
Nandeshwer Dam is situated at the Arawali ranges of Udaipur, Rajasthan. It provide bulk of water to meet demands of the city. The present study deals with planktonic diversity of Nandeshwer dam. A total of 35 species of phytoplankton were noticed. Out of 35 species of phytoplankton Chlorophyceae (20 genera), Myxophyceae (6 genera), Dinophnyceae (2 genera), Bacillariophyceae (4 genera) and Xanthophyceae (3 genera) from this dam.

Keywords: Phytoplankton, biodiversity, Nandeshwer dam, Udaipur lake

Introduction
Phytoplankton are the autotrophic microorganism containing chlorophyll in their cells that trap the solar energy from the sunlight. Phytoplankton produce energy throughout the process of photosynthesis and these are live in the euphotic zone of water body. The phytoplankton are the main primary producers in surface waters, so they grossly influence structure and density of consumers and also the physico-chemical characteristics of water. Moreover, phytoplanktonic organisms are sensitive indicators, of water quality as phytoplankton structure and metabolism changes quickly in response to environmental changes. Growth rate and variability of phytoplankton are subject to cyclic changes, fluctuation and succession. Phytoplankton constitute a major part of aquatic vegetation, they being primary producers which support the growth of aquatic fauna, produce oxygen by photosynthetic process. Some of these may cause pollution by changing the quality of water in which they grow. Phytoplankton constitutes the basis of nutrient cycle of an ecosystem hence play an important role in maintaining equilibrium between living organisms and abiotic factors [14].
At the base of aquatic ecosystem phytoplankton are the producers, hence, they are looked for as a major component of any freshwater system. They play a key role in solving several environmental problems, understanding aquatic ecosystem and also the production of useful substances [7]. Since phytoplankton are the primary producers forming the first trophic level of food chain in aquatic system, investigations of the phytoplankton community are of great importance for monitoring them.

Materials and Methods
The present study was carried out in the period July, 2015 to July, 2016 with a view to investigate the phytoplankton of Nandeshwer dam for assessing aquacultural possibilities with reference to prevailing limnological conditions. In the present investigation, three sampling stations were selected in the dam. Sampling stations namely A, B and C were selected. All these sampling stations were selected on the basis of dam topography. Station A was located just near the dam. Station B was located at the North-western shore of Nandeshwar dam. Sampling station C, selected, was fixed at the western shore of the dam. The phytoplankton samples were collected along with the sampling of water. For the sample collection, an appropriate quantity of water sample (*i.e.* 50 litres from surface) was filtered through bolting silk No.16 and preserved in 4% neutralized formaline. For quantitative analysis of plankton, one ml subsample was taken in Sedgwick Rafter plankton counting cell with the help of plankton pipette and counted under C.Z. inverted microscope. The total number of phytoplankton counted in each sample were multiplied with dilution factor and results were expressed as No.l^{-1} and Cell ml^{-1}, phytoplankton [1].

Results and Discussion

In this study 5 main groups of phytoplankton recorded were: Chlorophyceae (20 genera), Myxophyceae (6 genera), Dinophnyceae (2 genera), Bacillariophyceae (4 genera) and Xanthophyceae (3 genera). Fortnightly recorded variation of phytoplankton population is shown in (table 1 to 3). Total 35 phytoplankton genus were recorded out of them Chlorophyceae 151.48 (67%), 170 (68%), 171.48 (71%) Myxophyceae 31.60 (14%), 36.6 (15%), 30.52 (13%) Denophyceae 4.4 (2%), 5.4 (2%), 4.72 (2%) Bacillariophyceae 32.8 (15%), 33.8 (13%), 29.08 (12%) and Xanthophyceae 4.4 (2%), 5.8 (2%) and 5.6 (2%) in stations A, B and C respectively shown in figure 1. Season wise dominant phytoplankton are recorded in table 1 to 3.

Summer: Chlorophyceae> Myxophyceae > Bacillariophyceae > Dinophnyceae > Xanthophyceae

Monsoon: Chlorophyceae> Bacillariophyceae >Xanthophyceae > Myxophyceae > Dinophnyceae

Winter: Chlorophyceae> Myxophyceae > Bacillariophyceae > Xanthophyceae > Dinophnyceae The density of phytoplankton in the surface water of the Nandeshwer dam fluctuated between 51.00 to 486.67 Cell ml^{-1} during the study period. At the three sampling stations of surface water, however, phytoplankton ranged from 33.00 to 475.00, 70.00 to 490.00 and 50.00 to 505.00 Cell ml^{-1} at stations A, B and C respectively. Corresponding annual average phytoplankton values were 224.20, 251.60 and 241.40 Cell ml^{-1} at different stations of surface water.

Chlorophyceae

In the surface water 20 forms of chlorophyceae were observed and these, phytoplankton ranged from 25.00 to 380.00, 40.00 to 398.00 and 35.00 to 405.00 Cell ml^{-1} in stations A, B and C respectively. Corresponding the annual average community respiration values were .151.48, 170.00 and 171.48 Cell ml^{-1}. The most dominant species were recorded at station C, followed by B and A. These dominant forms were *Asterococcus sp., Chlamydomonas sp., Chlorella sp. Cosmarium sp., Desmarium sp. Eudorina sp., Hydrodictyon sp.,Microspora sp., Mougeotia sp. Oedogonium sp.. Oocystis sp., Pandorina sp., Scenedesmus sp., Schizomeris sp., Spaerocystis sp. Spirogyra sp., Volvox, Ulothrix sp.* and *Zygnema sp.*

Myxophyceae

In surface water 6 forms of myxophyceae were observed and these, phytoplankton ranged from 5.00 to 85.00, 5.00 to 90.00 and 0.00 to 95.00 Cell ml^{-1} at station A, B and C, respectively. Corresponding annual average values were 31.60, 36.60 and 30.52 Cell ml^{-1}. The most dominant species were recorded at station B, followed by A and C. The dominant forms were *Anabena spp., Lyngbya spp., Nostoc spp., Oscillatoria spp., Phormidium spp. and Spirulina spp.*

Dinophyceae

In surface water 2 forms of dinophyceae were observed These, phytoplankton ranged from 0.00 to 15.00, 0.00 to 15.00 and 0.00 to 15.00 Cell ml^{-1} at stations A, B and C, respectively. Corresponding annual average values were 4.40, 5.40 and 4.70 Cell ml^{-1}. The most dominant species were recorded at station B followed by C and A. The dominant forms were *Peridinium sp. and Sphaerozosma sp*.

Bacillariophyceae

In surface water 4 forms of bacillariophyceae were observed. Here these, phytoplankton ranged from 5.00 to 75.00, 5.00 to 75.00 and 5.00 to 70.00 Cell ml^{-1} at station A, B and C, respectively. Corresponding annual average values were 32.80, 33.80 and 29.08 Cell ml^{-1}. The most dominant species were recorded at station B, followed by A and C. The dominant forms of these plankton included *Amphora sp., Cymbella spp., Melosira spp., Tabellaria spp.*

Xanthophyceae

In surface water 3 forms of xanthophyceae were observed. These, phytoplankton ranged from 0.00 to 15.00, 0.00 to 15.00 and 0.00 to 25.00 Cell ml^{-1} at stations A, B and C, respectively. Corresponding the annual average values were 4.40, 5.80 and 5.60 Cell ml^{-1}. The most dominant species were recorded at station B, followed by C and A. The dominant forms were *Botrydiopsis sp., Chlorobotrys sp.* and *Trobonema sp.*

Plankton communities in the surface water of tropical lakes are playing an important role in maintaining the ecology and water quality of freshwater ecosystems [8, 13]. Kadra reservoir in karnataca which algae belong to chlorophyceae, Euglenophyceae and Bacillariophyceae are water pollution indicator [15]. The phytoplankton production in relation to physical chemical conditions in lake Kondakarla, where they found bloom of cyanophyceae in the lake considered it an obvious sign of cultural eutophication which is basically caused by addition of sewage effluents [4]. In many temperate lakes the maxima of phytoplankton abundance and bloom were detected in summer [9] or in spring and summer [12]. Nutrient limitation is also an important factor for phytoplankton abundance in shallow freshwater lakes [10, 5, 3]. Phytoplankton abundance was limited by the concentration of nitrogen rather than by the concentration of phosphorus [11].

Table 1: Seasonal distribution of phytoplankton (Cell ml^{-1}) groups in Nandeshwer dam of surface water Station A

Groups	Winter	Summer	Monsoon
1.Chlorophyceae	2387.00	955.00	445
2. Myxophyceae	390.00	360.00	40.00
3. Dinophyceae	30.00	80.00	0.00
4. Bacillariophyceae	365.00	340.00	115.00
5. Xanthophyceae	60.00	0.00	50.00

Table 2: Seasonal distribution of phytoplankton (Cell ml^{-1}) groups in Nandeshwer dam of surface water Station B

Groups	Winter	Summer	Monsoon
1.Chlorophyceae	2650.00	1070.00	530.00
2. Myxophyceae	445.00	415.00	55.00
3. Dinophyceae	40.00	95.00	0.00
4. Bacillariophyceae	395.00	300.00	150.00
5. Xanthophyceae	75.00	0.00	70.00

Table 3: Seasonal distribution of phytoplankton (Cell ml^{-1}) groups in Nandeshwer dam of surface water Station C

Groups	Winter	Summer	Monsoon
1.Chlorophyceae	2830.00	932.00	525.00
2. Myxophyceae	384.00	344.00	35.00
3. Dinophyceae	35.00	83.00	0.00
4. Bacillariophyceae	342.00	259.00	135.00
5. Xanthophyceae	70.00	0.00	70.00

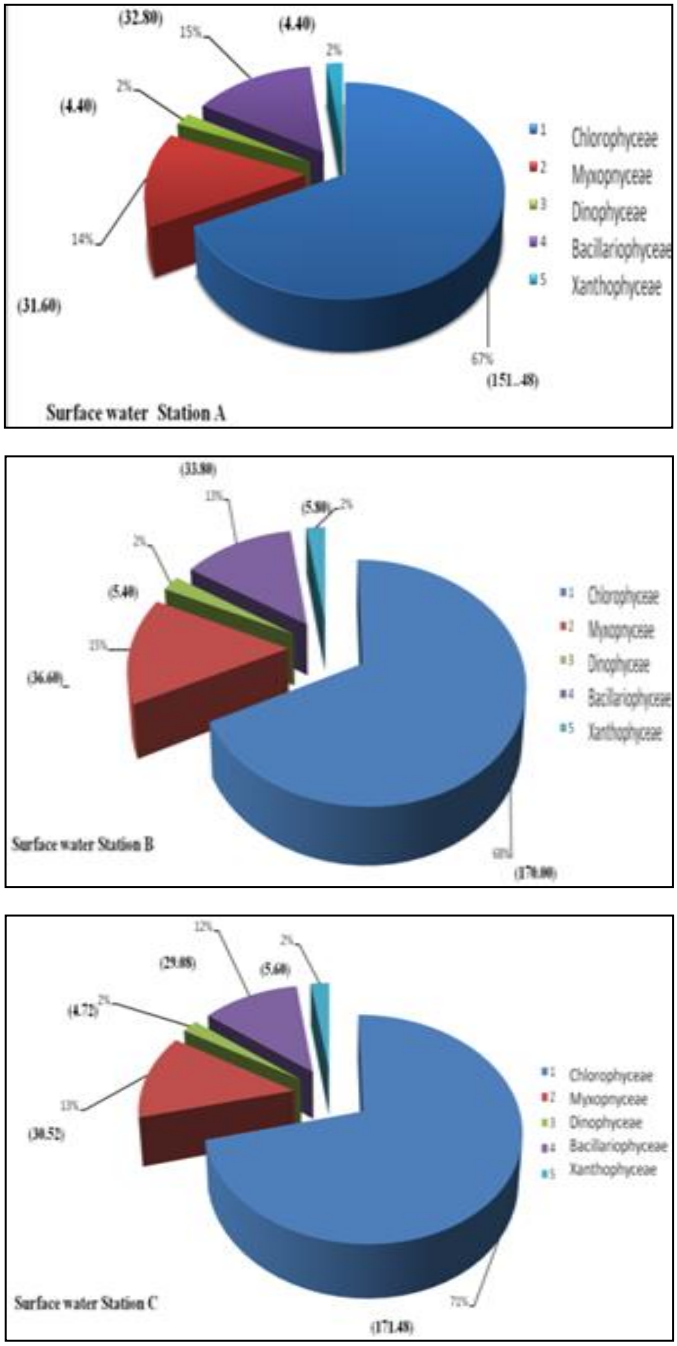

Fig 1: Group wise variations in phytoplankton population in different surface stations of Nandeshwer dam.

Conclusion

In any aquatic ecosystem limnological characteristic can affect both fauna and flora. On the basis of the physico chemical parameters of lake and diversity of fish species and plankton Nandeshwar, Dam is eutrophic and the status becoming more and more eutrophic day by day and need to be conserved in the future.

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