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Freshwater phytoplankton communities in varaha reservoir, Kalyanapulova, Visakhapatnam

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Abstract

Aquatic organisms, especially plankton form the most sensitive component of the ecosystem and signal environment disturbances. Apart from primary production, phytoplankton play an important role in the energy transfer. This paper deals with the analysis of plankton composition for two years of Varaha reservoir in Kalyanapulova. Sampling data was obtained from February to November 2010 - 2012. Phytoplankton was represented with 3 groups which Chlorophyceae was dominant with 10 species followed by Bacillariophyceae (2), Cyanophyceae (3) a total of 15 species of phytoplankton were recorded with similar distribution. The study helps in better understanding for the management of the Varaha reservoir for intensive fish culture.

Keywords: Varaha reservoir, phytoplankton, chlorophyceae

1. Introduction

Seasonal variations of phytoplankton composition have long fascinated aquatic ecologists. Their regularity from year to year prompts some to speak of 'periodicity' (West and Fritsch, 1927) [19], others to speak of 'succession' analogous to that observed in terrestrial plants (Hutchinson, 1967) and others to liken changes in phytoplankton composition to 'gradual climate change', noting the very short generation times of phytoplankton relative to rates of seasonal change (Wilson, 1994). Concepts of periodicity, succession and response to environmental change attract the interest of many ecologists to phytoplankton.

Phytoplankton is the pioneer of an aquatic food chain. The productivity of an aquatic environment is directly correlated, with the density of phytoplankton. The physico-chemical factors are directly related with their productions. The phytoplankton is the base of most of the lake food webs and fish production is linked to phytoplankton (Ryder, 1974) [16]. Moreover, number and species of phytoplankton serves to determine the quality of water body. It was then the subsequent works were aimed at finding out the causative factors responsible for the growth and sustenance of groups of phytoplankton or zooplankton (Edmondson, 1946; Nygaard, 1949 and 1955; Gossler, 1950; smith, 1950 and Gerloff *et al.*, 1952) [49, 17, 5]

A rich and productive phytoplanktonic community is significant of Varaha reservoir, the quantity and quality of phytoplankton is studies for 2 consecutive years. The dominant phytoplanktonic organisms were categorized mainly into Chlorophyceae, Cyanophyceae and Bacillariophyceae. The Chlorophyceae dominate the total population and constitute 67% of the total estimate followed by Cyanophyceae consisting 20%, and Bacillariophyceae 13%. A total number of species were recorded and the quantitative compositions of all the 15 species are shown in table 1, 2, 3.

2. Materials and Methods

The present study was conducted for a period of 2 years, 2010 - 2012. A mechanized fiber boat was used for travelling in the reservoir and for collection of various samples for chemical analysis of water and qualitative and quantitative analysis of plankton. The total number of plankton organisms was estimated in 1 ml of the sediment sample and calculated for 1 liter. A compound microscope and binocular microscope were used for identification of various phytoplankton and zooplankton communities (Lackey, 1938; Vollenweider, 1971; Ratna rao 1984) [8, 18, 13]. Samples were collected between 8 and 10 AM from the reservoir. For the collection of phytoplankton collections were made employing a modified Heron Tranter net with square metallic frame of 0.625m area. The inside of the net was thoroughly washed with water to obtain any adhering organisms. Then the plankton concentrate was transferred to a polythene tube and preserved in 5% formaldehyde solution analysis of plankton was carried in the laboratory. Collected samples were transferred to labeled vial bottles containing 5% formalin.

Quantitative analysis and identification was done on a Sedgwick rafter counter cell by taking 1ml sample. Detailed taxonomic identification was earned out with Tonapi (1980), Needham and Needham (1962) [9], APHA (1985) [1], Kodarkar (1992) [7] and Hosmani (2008) [6]. For counting of plankton, a sub-sample of one ml was quickly drawn with a wide mouthed pipette resembling that of a 'sample pipette' and poured into a counting cell, similar to that of Sedgwick rafter cell of one ml of capacity. All the organisms of the aliquot were completely counted. However, when there were blooms (especially in case of rotifers) and copepods only random squares were counted from which total numbers per 50 liters of water were collected.

3. Results

Although phytoplankton species composition and diversity changes with environmental conditions such as nutrient levels, temperature, light, predator pressure etc., the relative importance of these factors varies considerably among different taxa. Under conditions of nutrient enrichment or eutrophication, the blue-greens algae are known to proliferate and form noxious blooms in freshwater environments. The annual growth cycle of the species is closely connected to thermal stratification in the mere. The main growth phase is the planktonic form which is photo autotrophic while the benthic form is photo heterotrophic and serves as the for the plankton. The development of phytoplankton blooms in the reservoir is attributed to their ability to accommodate reduced nitrogen to phosphorus ratios, low edibility due to their large colony sizes coupled with large herbivore regulation of other taxa. The species recorded in Varaha reservoir as that causing water bloom Microcystis aeruginosa is a gas-vacuolate, non-nitrogen-fixing cyanophyte. It can assimilate ammonia and this affords it a competitive advantage over other species under conditions of nitrogen limitation. Cyanophytes also exploit nutrients at the bottom of the euphotic zone by buoyancy regulation of its gas vacuoles. The combination of these unique physiological attributes under environmentally- a favorable condition is responsible for the proliferation and bloom of the species. The formation of blooms also depends on retention time, type and age of water body as well as calm weather conditions with low turbulence of water.

The blue green algae present in very large numbers during the period August to October forming more than 80% of the total phytoplankton Spirogyra sp. And Volvox sp. Were quite common. Spirogyra sp. was absent during the month of January to April.

A rich and productive phytoplanktonic community is significant of Varaha reservoir, the quantity and quality of phytoplankton is studies for 2 consecutive years. The dominant phytoplanktonic organisms were categorized mainly into Chlorophyceae, Cyanophyceae and Bacillariophyceae. The Chlorophyceae dominate the total population and constitute 67% of the total estimate followed by Cyanophyceae consisting 20%, and Bacillariophyceae 13%. A total number of 15 species were recorded and the quantitative compositions of all the species are shown in table 1, 2, 3.

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Table 1: Species-Wise Counting of Chlorophyceae

S. No	Name of the Species	Summer	Rainy	Winter	Total (%)
1.	*Cosmarium*	2	2	1	5
2.	*Chara*	3	1	1	5
3.	*Cladaphora*	2	0	1	3
4.	*Chlorilla*	1	1	1	3
5.	*Chlamydomonas*	1	2	1	4
6.	*Volvox*	2	2	1	5
7.	*Hydrodicto*	0	0	1	1
8.	*Spirodictiona*	3	2	0	5
9.	*Spirozyra*	3	2	3	8
10.	*Zygenema*	1	0	1	2

Table 2: Species-Wise Counting of Cyanophyceae

S. No	Name of the Species	Summer	Rainy	Winter	Total (%)
1.	*Spirulina*	3	1	1	5
2.	*Anabaena*	2	2	2	6
3.	*Nostoc*	2	0	1	3

Table 3: Species-Wise Counting of Bacillariophyceae

S. No	Name of the Species	Summer	Rainy	Winter	Total (%)
1	*Pinnularia*	2	2	1	5
2	*Navicula*	1	1	1	3

4. Discussion

The topography and the surrounding environmental conditions favor primary production of Varaha reservoir. The phytoplankton dependent zooplankton communities are also abundant in the reservoir. The blue green alga forms the main stage of plankton community. The bright sunlight, isothermal water column, reasonable catchment area with rich nutrients helps developing the phytoplankton communities. Usually, turbidity is a controlling factor or even a crucial one on the growth of phytoplankton. A depletion of plankton population was earlier reported due to the "blanketing effect" of suspended particles interfering with the photosynthetic activity of phytoplankton (welch 1952, Roy 1955 Chtakrabarty *et al*, 1959) [20, 15]. But Varaha reservoir waters always appear green even during rainy season. The occasional and rare influence of turbidity of reservoir waters towards the peripheral shallow regions by the reservoir do not really influence the plankton growth, the turbidity appearance is only of short duration after a heavy rain.

Cyanobacterial toxins are contained within the living cells and are not released into surrounding water until senescence or death of the cells. Pre chlorination during water treatment or the application of copper Sulphate in controlling blooms (used in some European countries) results in cell death and release of toxins into water (Paerl 1988b, Carmichael and Falconer 1993). In 1988 within 2-3 weeks of copper treatment of the Goczalkowice reservoir, south Poland, the District Medical Officers recorded a rise in the number of cases of spastic bronchitis especially in children in this locality (Bucka and Zurek 1992) In view of the use of the reservoir for water supply, control measures aimed at preventing bloom formation such as reduction of nutrient load into the reservoir, artificial mixing of the water and bio manipulation of food-web components should be implemented.

5. References

1. American Public Health (APHA) American Water Works Association (AWWA) and Water Pollution Control Federation (WPCF) Standard Methods for the Examination of Water and Waste Waters 16th edition, American Public Health Association Inc. New York, 1985, 4.
2. BUCK H, ZUREK R. Trophic relations between phyto- and zooplankton in a field experiment in the aspect of the formation and decline of water blooms. Acta Hydrobiol. 1994; 34:139-155.
3. Edmondson, factors in the dynamics of rotifer populations, ecol. Monogr. 16:357-372.
4. BERÓN L. Features of the limnological behavior of Salto Grande's reservoir (Argentina-Uruguay). Ecol. Model., 1990; 52:87-102.
5. Gerloff GC, Fitzgerald GP, skoog F. The mineral nutrition of Microcystis aeruginosa, American journal of botany. 1952; 39:26-32.
6. Hosmani P. Ecology of Euglenaceae from Dharwad, Karnataka, Indian Hydrobiology. 2008; 11(2):303-312.
7. Kodarkar MS. Methodology for Water Analysis, Physico-chemical, Biological and Micro-biological, Indian Association of Aquatic Biologists (IAAB), Hyderabad publ. 1992, 2-50.
8. Laekey JB. The manipulation and counting of river plankton and changes in some organisms due to formalin preservation. US. Public Health Rep., 1938; 53:2080-2093.
9. Nidham JG, Nidham PR. A guide to the study of Fresh water biology, 1962.
10. Nygaard G. Studies of some ponds and lakes. II. The quotient hypothesis and some new or little known phytoplankton organism. Danska Vidersk Selsk, 1949; 7:1-293.
11. Pearl H. Nuisance phytoplankton blooms in coastal, esturine and inland waters. Limnol. Oceanogr, 1988; 33:823-847.
12. Tonapi GT. Fresh water animals of India: An ecological approach, oxfordand IBH Publishing co, New Delhi, India, 1980.
13. RATNA Rao. Studies on Limnological aspects of Lake Kondakarla (Visakhapatnam) with special reference to Plankton and Perphyton. Ph.D.Thesis Andhra University. Visakhapatnam, 1984.
14. Reynolds CS. *The ecology of freshwater phytoplankton.* Cambridge University Press, Cambridge. 1984, 384.
15. ROY HR. Plankton ecology of river Hooghley at Patla, West Bengal. *Ecology*, 1955; 36(2):169-175.
16. Ryder RA, Kerr SR, Loftus KM, Regier HA. The morphoedaphic index. A fish yield estimator- review and evaluation. Journal of the fisheries. 1974.
17. Smith GM. The Fresh water algae of the United States. McGraw–Hill Book Company, Inc., New York, 1950.
18. Vollenweider RA. Scientific Fundamentals of the Eutrophication of lakes and Following Waters. OECD. Paris, 1971.
19. West GS, Fritsch FE. Treatise on the British Freshwater Algae, 2nd edn. Cambridge University Press, Cambridge, 1927.
20. Welch PS. Limnology, 2nd ed. Mc Grow-Hill book co, New York, 1952, 538.
21. Wilson J. The intermediate disturbance hypothesis of species coexistence is based on path dynamics. N. Z. J. Ecol., 1984; 18:176-181.