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Phytoplankton Fluctuatuations under the Stress of Abiotic Factors at Kohargaddi Dam, Balrampur

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ABSTRACT: In this investigation, water samples were collected in different seasons such as rainy, winter and summer from Kohargaddi dam. Then phytoplankton diversity was studied in relation to same physico-chemical parameters. Total 18 species of phytoplankton were identified belonging Cyanophyceae, Chlorophyceae, Bacillariophyceae and Euglenophyceae. Cyanophyceae includes *Nostoc sp.*, *Oscillatoria sp.*, *Anabaena sp.*, *Microcystic sp., Gleocapsa sp.*, *Spirulina sp.*, while Chlorophyceae includes *Ulothrix sp.*, *Chlorella sp.*, *Spirogyra sp.*, *Hydrodictyon sp.*, *Pediastrum sp.,* Besides these, Bacillariophyceae includes *Cyclotella sp.*, *Navicula sp.*, *Diatom sp.*, *Synedra ulna* and Euglenophyceae includes *Euglena sp.*, *Trachelomonas sp.*, *Volvocinia sp.* During phytoplankton analysis, Chlorophyceae group contributed maximum phytoplankton density followed by Cyanophyceae, Bacillariophyceae, Euglenophyceae respectively. The study reveals that plankton population is dependent upon quality of water and climatic factors.

Key words: Physico-chemical parameters, Water quality, Phytoplanktons, Kohargaddi dam

Introduction

Kohargaddi dam is one of the important dams of district-Balrampur. It is situated at Indo-Nepal Border at Pachperwa town. It is approx 53 km away from district head quarter.
This dam is situated at longitude 82°-36´ east and latitude 27-36 north. Usually this dam is utilized to irrigate 50,342 acres unirrigated land of district-Balrampur. This dam is a about 8 km. is length having 120 meter water level. The height of dam is 36 meter, which will discharge about 24,000 cumex minimum water every year.
It covers about 126 km. catchments area. The objective of present study was to assess the effect of various physico-chemical parameters on phytoplanktons.

Materials and Methods

The samples were collected in polythene bottle cleaned by nitric acid and distilled water. The samples were collected every month at early in the morning (8.00am) from July 2006 to June 2007. pH value and temperature were recorded on the spot in the field. The further physico-chemical analysis of water as well as phytoplankton diversity were carried out by standard method (APHA. 1998).

Result and Discussion

Temperature

The temperature of water (Table A) was found to be in the range between 22.3 to 30.5°C. The temperature of water was maximum (30.5°C) is the summer and minimum (22.3°C) in winter. Normally diurnal fluctuation occurs in temperature.

pH value

During the study pH value ranged from 7.2 to 8.1. It was maximum (8.1) in the summers and minimum 7.2 in the rainy. Factors like temperature influences in pH. Singai (1986) has reported a direct relationship between water temperature and pH. The lower value of pH during rainy season is due to dilution of alkaline substances or atmospheric CO_2.

DO

The dissolved oxygen (DO) was varied from 4.3 to 7.2 mg/L during the study. The DO found to be maximum (7.2 mg/L) in the winter and minimum (4.3 mg/L) in the summer.

Hardness

The hardness raged from 32.0mg/L to 52.1 mg/L during the study. The hardness was found to be maximum (52.1mg/L) in summer and minimum (32.0 mg/L) in the rainy season.
Hiware and Jadhav (2001) observed that the high value of hardness was 48.7 mg/L during summer and 34.5 mg/L during rainy season.

Table 1: Physico-chemical properties of Kohargaddi Dam-Balrampur

Properties	Rainy season	Winter season	Summer season
Water temp.(°C)	25.2	22.3	30.5
pH	7.3	7.9	8.1
Dissolved oxygen(DO)	6.3	7.2	4.3
Hardness	40.2	32.0	52.1
Calcium	17.5	21.3	29.2
Magnesium	14.1	10.9	21.3
Chloride	15.3	16.8	21.4
Sulphate	11.3	18.0	13.9
Phosphate	0.9	0.6	1.3
Nitrate	10.0	8.0	15.0
Total solid	61.2	50.7	30.2

Calcium

The calcium is an important element influencing flora of ecosystem which plays an important role in metabolism and growth. The average of it varied from 17.5 to 29.2 mg/L. The maximum concentration of 29.2 was noticed in summer, while minimum concentration is 17.5 in the rainy season. Normally these ions are not problematic but at higher concentration, increases total hardness of water. (Ravi Kumar *et. al.* 2005).

Magnesium

Magnesium level varied from 10.9 to 21.3 mg/L. The minimum value (10.9 mg/L), was during winter while maximum value (21.3 mg/L) in summer season. Mohanta and Patra(2000), observed the values of magnesium maximum during summer while minimum during winter. Similar results are observed in present study.

Chloride

Chloride content varied from 9.2 -21.4 mg/L indication non pollution status of the water body. The maximum value was recorded in summer season while minimum value was recorded in rainy season. Swarnalatha and Rao (1998) also reported that fresh water contains 8.3mg/L chloride in generally.

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Sulphate

The sulphate value showed marked seasonal fluctuation. During this study, sulphate ranged from 11.3 to 18.0 mg/L. It was maximum (18.0mg/L) during rainy.

Phosphate

The average value of phosphate ranged from 0.6 to 1.3 mg/L. The maximum phosphate was recorded as 1.3 mg/L and minimum as 0.6 mg/L during summer and winter respectively. Through the phosphate are nutrients their concentration above normal range is found to be cause eutrophification (Koshy and Nayar, 1999).

Nitrate

The average value of nitrate ranged from 8-15 mg/L. The maximum value of nitrate was recorded during summer season 15mg/L. winter season (8mg/L).

Total solid

The total solid value ranged from 30.2 to 61.2 mg/L. The total solid value was high (61.2 mg/L) in summer season.

The high values of suspended solid during monsoon are due to an increased surface run off. This was also reflect on the turbidity level.

The physico-chemical parameters of Kohargeddidam have been given described above.

The phytoplankton communities of the present water body were represented mainly by 4 classes of algae viz.

(a). Chlorophyceae (b). Cyanophyceae
(b). Bacillariophyceae (c). Euglenophyceae

Table2: Diversity of phytoplankton at Kohargaddi dam, Balrampur

Cyanophyceae	Chlorophyceae	Bacillariophyceae	Euglenophyceae
Nostoc sp.	*Ulothrix sp.*	*Cyclotella sp.*	*Euglena sp.*
Oscillatoria sp.	*Chlorella sp.*	*Navicula sp.*	*Trachelomonas sp.*
Anabaena sp.	*Spirogyra sp.*	*Diatoma sp.*	*Volvocinia sp.*
Microcystis sp.	*Hydrodictyon sp.*	*Synedra ulna*	
Gloeocapsa sp.	*Pediastrum sp.*		
Spirunlna sp.			

Table 3: Seasonal observation of Phytoplankton

Phytoplankton	Rainy	Winter	Summer
Cyanophyceae			
Nostoc sp.	+	+	-
Oscillatoria sp.	+	-	-
Anabaena sp.	+	+	+
Microcystis sp.	+	+	-
Gloeocapsa sp.	-	-	+
Spirulina sp.	+	+	+
Chlorophyceae			
Ulothrix sp.	+	-	+
Chlorella sp.	+	+	-
Spirogyra sp.	+	+	+
Hadrodictyon sp.	+	+	-
Pediastrum sp.	+	+	+
Bacillariophyceae			
Cyclotella sp.	+	+	+
Navicula sp.	+	+	-
Diatoma sp.	+	+	+
Synedra ulna	-	+	+
Euglenophyceae			
Euglena sp.	+	+	+
Trachelomonas sp.	+	-	+
Volvocinia sp.	-	-	+

Table 4: Density of phytoplankton of different classes during different season (Organism/Liter)

Family	Rainy	Winter	Summer
Cyanophyceae	33000	72030	30060
Chlorophyceae	67993	44203	56363
Bacillariophyceae	34308	35697	42502
Euglenophyceae	29715	28357	32106

Cyanophyceae

It was the most significant group having a contribution of 26.68% to the total phytoplankton population. It exhibited higher density during winter (72050) and minimum density during summer (30060). The class include *Nostoc sp., Oscillatoria sp., Anabaena sp., Microcystis sp. Gloeocapsa sp., Spirulina sp*.

Chlorophyceae

It was concluded as the most significant group of phytoplankton with a contribution of 33.29%. It is maximum in rainy season and minimum in summer season. e.g. *Ulothrix sp., Chlorella sp., Spirogyra sp., Hydrodictyon sp., Pediastrum sp.*

Bacillariophyceae

It accounted for a contribution of 22.22% of the total phytoplankton population. It has maximum periodicity during summer season (42502) and minimum during rainy season (34308).
e.g. *Cyclotella sp., Navicula sp., Diatoma sp., Synedra ulna.*

Euglenophyceae

Total contribution of this family was 17.81%. It is maximum during summer season (32106) and minimum during winter season. This class includes *Euglena sp.*, *Trachelomonas sp., Volocenia sp.*

Diversity of plankton population is fairly dependent on quality of water and climatic factors.
Various physico-chemical and biological characteristics must be simultaneously taken in to consideration for understanding the fluctuation of plankton population. (Davis, 1955).
Water temperature was considered to be an important physical factor which influenced the phytoplanktonic periodicity.
In this study, we concluded that Cyanophyceae was abundant during low temperature period while Chlorophyceae, Bacillariophyceae and Euglenophyces were more at high temperature.
Temperature, pH, alkalinity and phosphate have been emphasized to be significant factor for Cyanophycean algae (Singh, 1965).
The density of Bacillariophyceaen population was found to be closely associated with pH. Alkaline water (Having pH above 8.0) supports their density.
Tripathi and Pandey (1990) and Hegde and Sujatha (1997) reported that high water temperature, phosphate, nitrate, low DO and CO_2 supported the growth of Euglenophyceae.
The phytoplankton community, on which whole aquatic population depends, is largely influenced by interaction of a number of physio-chemical factors. From the present observation it is difficult to point out any single factor which is responsible for the fluctuation in phytoplankton diversity.

Conclusion

The present study, ensures that variations in the phytoplankton density can be best explained, when environmental factors jointly influence. Thus, it may be concluded that the density of phytoplankton is dependent on different abiotic factors either directly or indirectly.

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