

Diurnal Variation in Some Aspects of Limnology of Gopalpura Tank of District Guna (Madhya Pradesh, India)

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Abstract

Gopalpura tank is one of the artificial water bodies of Guna (M. P.). It is used mainly for irrigation and pisciculture by the nearby villagers. Diurnal variations in physico-chemical factors such as water temperature, pH, dissolved oxygen, free CO₂, alkalinity and plankton (phytoplankton as well as Zooplankton) of the tank were studied. Fluctuations were found in water temperature, pH, dissolved oxygen, free CO₂ and alkalinity. Free CO₂ and alkalinity exhibited a negative relationship with the temperature. Abundance of plankton also showed a distinct diurnal variation.

Key Words: *Gopalpura tank, diurnal variation, limnology, plankton*

Introduction

Gopalpura tank is one of the artificial water bodies of Guna, situated at a distance of just 2 km from Guna town. The work on the tank was started in December 1971 and completed in March 1977. Surrounded by village from all the sides, the reservoir has a catchment area of approximately 6 sq. ft. Though, the tank is not very large but it serves as a source of irrigation for the villagers. The water is also utilized for pisciculture by the fishermen and local villagers.

Diurnal variation study of the fresh water bodies of India has been made by few workers. A few to mention are Ganapati, 1955 George 1961, Michael 1966, Verma 1967, Sumitra 1971, Mishra *et al.* 1975 and 1976 Bohra *et al.* 1979, Sharma and Gupta 1981 and Dobriyal and Singh 1981. Since no such study was carried out so far on Gopalpura tank, it was considered desirable to study the diurnal variation in physico-chemical factors as well plankton of the tank.

Material and Methods

Investigation on the diurnal variations of Gopalpura tank was made on Feb. 10 and 11 2001. Samples were collected from different sites-Station A, Gopalpura village side and station B, Cantt side, at an interval of 3 hours, starting at 9 AM on Feb. 10, 2001. Standard methods by APHA, 1985 and Trivedi and Goel 1986 were followed for the analysis of physico-chemical factors and Plankton studies. The water for hydrobiological analysis was collected from the shore and little below the surface. The water was filtered and preserved in 4% formaline. The qualitative and quantitative analysis of plankton was made in Sedgwick Rafter Counting chamber.

Results and Discussion

The results are shown in Figure 1 and 2 and Table 1 and 2. The details are given in forgoing paragraphs.

Physico-chemical Factors

Water Temperature

The water temperature varies from 12.5°C (at station 'A') to 20.5°C (at both stations) being maximum at 15.00 hours on Feb. 10, 2001 and minimum at 03.00 hours on Feb. 11, 2001. The maximum temperature obtained during noon corresponds to the atmospheric temperature, which was also highest during day hours and falls during night. Similar results were obtained by Sumitra 1971, Bohra *et al.* 1979 and Sharma and Gupta 1981 and Dobriyal and Singh 1981. The maximum temperature observed during noon can be explained by the fact that the rate of cooling and heating of water temperature depends on atmospheric temperature.

pH

In case of pH, we obtained a slight increase (0.2) in pH during day hours at both the stations. The difference between pH values of day and night hours may be due to photosynthetic activity (Consumption of CO_2), whereas during night it was slightly less due to respiratory activity. George 1961 observed similar diurnal variation in pH in his study on Delhi pond. Verma 1967 also reported similar observations.

Dissolved Oxygen

Dissolved oxygen varied from 8.5 mg/L to 13.5 mg/L (station A) and 9.00 mg/L to 13.5 mg/L (station B). The minimum values were obtained at 9.00 hours while maximum values were obtained at 15.00 hours on 10.2.2001. The dissolved oxygen was found to be high during day hours. There are two main sources of dissolved oxygen in water- i. Diffusion from air and ii. Photosynthetic activity within water.

Since photosynthetic activity of Phytoplanktons is highest during day (noon) hours, peak values of dissolved oxygen were obtained during that time (15.00 hours. To 18.00 hours). During night hours the photosynthetic activity stops, it results in the consumption of accumulated oxygen and liberation of CO_2 . The dissolved oxygen shows positive relationship with temperature. Though, Misra *et al* 1976 and Dobriyal and Singh 1981 reported negative relationship of dissolved oxygen with temperature. Positive relationship was found by Itzava 1957 and Sharma and Gupta 1981.

Free CO_2

Free CO_2 varied from 7.00 mg to 16.00 mg/L. The minimum value was obtained at 15.00 hours, while maximum value was obtained at 3.00 hours at both stations. Free CO_2 increases during night and during day it decreases. The high values during night may be due to respiration. As the photosynthetic activity stops, the CO_2 increases during night. Thus we found an inverse relationship between free CO_2 and dissolved oxygen.

Alkalinity

The alkalinity attributed was mainly due to bicarbonates. The alkalinity was found to be maximum during early morning hours and then decreasing during noon and then again increasing, with a decrease in the temperature, during night and thus it showed negative relationship with temperature. High values of alkalinity represent nutrient rich quality of the tank.

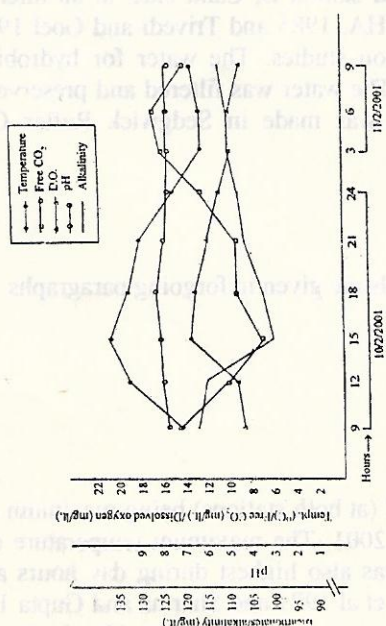


Fig. 1. Diurnal variation in physico-chemical factors of Gopalpur tank - Spot A

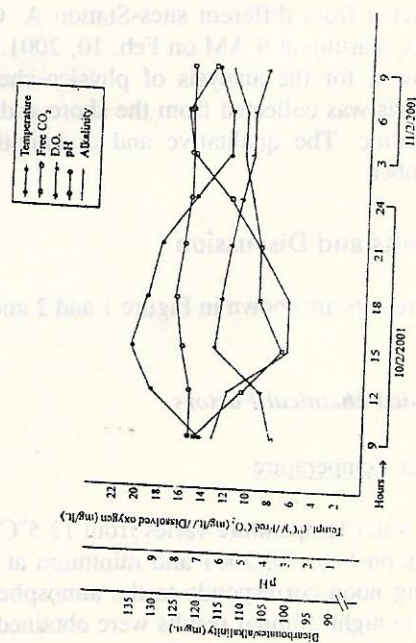


Fig. 2. Diurnal variation in physico-chemical factors of Gopalpur tank - Spot B

Plankton

The plankton manifest a remarkable vertical movement. The phytoplankton included *Euglena*, *Oxyuris*, *Oscillatoria* sp., *Closterium* sp., *Anabaena* sp. *Syndra* sp. and *Navicula* sp. The Zooplanktons were represented by rotifers, Cladoceran and copepods. Rotifer, cladoceran and copepod fauna of Indian fresh water have been studied by a number of workers, however, the studies on diurnal variations are scanty. Jolly 1952, George 1961, Michael 1966 Sharma and Gupta 1981 have done work on this aspect.

The phytoplanktons showed high number during early morning hours and increasing during the day and reaching maximum during noon. They then migrated downwards. Similar findings were obtained by Khare *et al.* 1970 while working on fish pond in Shahjehanpur (U. P.). Thus, it appears that their diurnal movement is affected by phototropism. Though it cannot be said that this is the single factor affecting their movement but Light, temperature, food, gravity may also be the probable cause for distribution of planktons as indicated by Pennak 1944 and Jolly 1952. The zooplanktons represent the clearest variation. The maximum numbers were observed during night (21 hours to 24 hours). The minimum number in most of the zooplanktons (as indicated in the tables- 1 and 2) were found during day time. Similar results were obtained by Michael 1966. It appears that they avoid high temperature and bright light during day time. Vaas and Sachlan 1953 and George 1961 also observed maximum rotifer population at night.

Table 1. Diurnal variation in Plankton of Gopalpura tank of Guna District (M.P.) – Spot - A

Sl. No	Parameters	Time in Hours							
		10.02.2001				11.02.2001			
		0900	1200	1500	1800	2100	2400	0300	0600
A	Phytoplankton								
1.	<i>Euglena oxyuris</i>	30	40	42	25	10	4	10	10
2.	<i>Oscillatoria</i> sp.	15	14	14	10	10	4	5	6
3.	<i>Closterium</i> sp.	6	16	20	14	4	4	5	7
4.	<i>Anabaena</i> sp.	4	4	10	6	1	2	3	2
5.	<i>Syndra</i> sp.	15	17	20	14	9	4	4	3
6.	<i>Navicula</i> sp.	45	15	20	20	10	5	5	10
B	Zooplankton								
1.	Daphnia	200	20	20	90	120	300	210	180
2.	Cyclops	30	9	17	10	28	20	35	39
3.	Brachinus	5	7	6	10	15	35	10	10
4.	Nauplius larvae	10	4	2	16	20	30	32	2
5.	Eggs	90	15	15	80	155	240	175	115

All the values are Number/ L

Table 2. Diurnal variation in Plankton of Gopalpura tank of Guna District (M.P.)- Spot - B

Sl. No	Parameters	Time in Hours							
		10.02.2001				11.02.2001			
		0900	1200	1500	1800	2100	2400	0300	0600
A	Phytoplankton								
1.	<i>Euglena oxyuris</i>	32	45	47	22	12	4	10	10
2.	<i>Oscillatoria</i> sp.	17	15	14	10	10	5	5	6
3.	<i>Closterium</i> sp.	6	15	20	15	4	5	5	7
4.	<i>Anabaena</i> sp.	4	4	12	7	2	2	4	2
5.	<i>Syndra</i> sp.	16	17	22	14	9	4	4	4
6.	<i>Navicula</i> sp.	47	15	22	22	10	6	6	10
B	Zooplankton								
1.	Daphnia	210	25	25	90	120	280	210	175
2.	Cyclops	35	10	177	10	30	20	40	42
3.	Brachinus	5	7	7	10	18	35	10	10
4.	Nauplius larvae	10	5	6	16	25	30	32	12
5.	Eggs	95	20	20	80	150	220	175	125

All the values are Number/ L

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