

DIURNAL VARIATIONS OF PHYTOPLANKTON IN LAKHOTIA LAKE OF PALI

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INTRODUCTION

The present knowledge of diurnal studies comes through a number of workers who explored various freshwater habitats not only in south-north part of India but also in the east-west regions of the country. Most of the research work focussed either on physical, physico-chemical and biological parameters in one season. The details of diurnal studies on phytoplankton are wanting particularly in Rajasthan which is the second largest state in area in the country yet information available in the field of present study is relatively less. Hence, an attempt was made to know the diurnal rhythms of phytoplankton in different seasons in tropical lake of Western Rajasthan.

STUDY AREA

Lakhotia lake is located in the heart of Pali city, which comes in the western part of Rajasthan and passes through three seasons namely summer (March-June), Monsoon (July-October) and winter (November-February). Lakhotia is a manmade, rain-fed, perennial lake roughly triangular in shape having a maximum length of 1825 m on the east-west direction and a breadth of 950 m on the north-south direction with a maximum depth of 4.5 m during the study period. The lake receives water through a channel coming from an adjacent temporary impoundment 'Lhoria', situated on its eastern side. The loss of water is due to evaporation and seepage. The vegetation around the vicinity of the lake is mainly confined to the southern side consisting of xerophytic shrubs and trees. In the littoral zone an aquatic grass *Scirpus tuberosus* grows only on the eastern bank. The colour of the water was generally yellowish green due to muddy nature of the bed. For details of study area see Khatri (1983).

METHODS

In order to know the seasonal and vertical movements of phytoplankton in Lakhotia lake, three diurnal studies—one each in summer, monsoon and winter were conducted. The samples were collected from surface, 1m and the bottom at three hourly intervals,

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over a period of 27 hours from a place located almost in the centre of the lake. The time and dates of three diurnal studies are given in Table—1. Water samples for the collection of phytoplankton were taken in 500 ml wide mouth, screw—capped polythene bottles. The phytoplanktons were fixed in the bottles by adding Lugol's iodine solution and preserved in 3% formalin. The phytoplankton cells were counted by sedimentation method using Sedgwick rafter slide under a binocular compound microscope. Identification was done only up to generic level after Edmondson (1965) and Chapman and Chapman (1975). Results were expressed in units / l.

Table—1

The dates and time of the three diurnal studies conducted in Lakhotia lake of Pali.

S. No.	Season	Date	Hours
1.	Summer	23 & 24 May, 1977	1200 hrs (1st day) to 1200 hrs (2nd day)
2.	Monsoon	27 & 28 Sept., 1977	—do—
3.	Winter	25 & 26 Jan., 1978	—do—

RESULTS

Total phytoplankton exhibited a definite diurnal trend of increase in day time and decrease in night hours at the surface in summer while in monsoon and winter seasons no such trends were observed. In summer population of total phytoplankton attained its peak position at 1500 hrs. A gradual decrease in density was observed from 1800 hrs onwards, minimizing it at the surface at 2400 hrs and 1m and bottom at 0300 hrs (Plate—1, Fig. 1). In monsoon total phytoplankton showed marked fluctuations in population. The maximum population was 220×10^8 units / lit. recorded at the surface at 1800 hrs and minimum was 106×10^3 units/lit. at the bottom at 0900 hrs (Plate—II, Fig—1). In winter total phytoplankton showed two maxima, the first at 2100 hrs and the second at 0900 hrs both at the surface and 1m. At the bottom only one peak (at 2100 hrs) was observed. The minimum number of phytoplankton was recorded at 0300 hrs at the surface and 1 m and at 0900 hrs at the bottom (Plate—III, Fig. 1).

The phytoplankton population composed of members of Chlorophyceae, Cyanophyceae and Bacillariophyceae. The various genera in each family identified during three seasons are given in Table—2. The dominant genera in summer, monsoon and winter in each family are described as under.

Ankistrodesmus showed its presence throughout the summer diurnal cycle. The maximum number was recorded during day time and minimum during night hours. The

population was found to be richer at 1m depth than at the surface and bottom (Plate—I, Fig. 2). In monsoon its population was maximum at 1500 hrs at the surface and 1800 hrs at 1 m and bottom. Minimum number was present at 2100 hrs at the surface and 1 m and at 2400 hrs at the bottom (Plate—II, Fig. 2) During winter it showed no marked fluctuations in the population. The population was at its peak at 1500 hrs and was minimum at 0600 hrs (Plate—III, Fig. 2)

Table—2

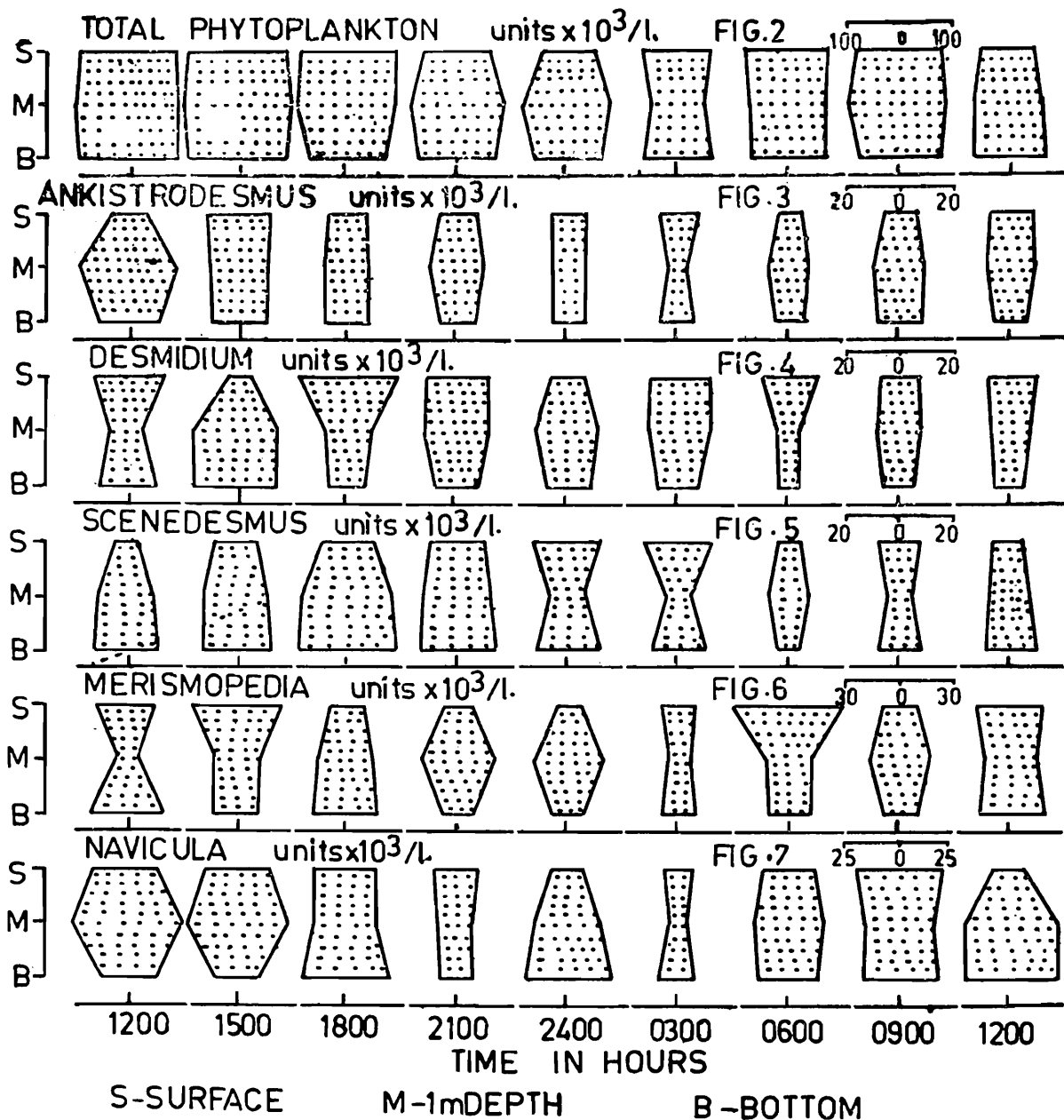
Occurrence of various genera of phytoplankton during three diurnal studies in Lakhotia lake of Pali.

Season	Chlorophyceae	Cyanophyceae	Bacillariophyceae
Summer	<i>Actinastrum</i>	<i>Lyngbya</i>	<i>Anomoeneis</i>
	<i>Ankistrodesmus</i>	<i>Merismopedia</i>	<i>Diatomus</i>
	<i>Cosmarium</i>	<i>Spirulina</i>	<i>Navicula</i>
	<i>Desmidium</i>		<i>Pleurosigma</i>
	<i>Kirchneriella</i>		
	<i>Pediastrum</i>		
Monsoon	<i>Scenedesmus</i>		
	<i>Actinastrum</i>	<i>Anabaena</i>	<i>Navicula</i>
	<i>Ankistrodesmus</i>	<i>Lyngbya</i>	
	<i>Botryococcus</i>	<i>Merismopedia</i>	
	<i>Pediastrum</i>		
	<i>Cosmarium</i>		
Winter	<i>Scenedesmus</i>		
	<i>Actinastrum</i>	<i>Anabaena</i>	<i>Navicula</i>
	<i>Ankistrodesmus</i>	<i>Lyngbya</i>	<i>Diatoma</i>
	<i>Botryococcus</i>	<i>Merismopedia</i>	
	<i>Chlorococcus</i>	<i>Spirulina</i>	
	<i>Cosmarium</i>		
	<i>Pediastrum</i>		
	<i>Mougeotia</i>		
<i>Scenedesmus</i>			

Desmidium showed considerable variation in number along the vertical profile of the lake during summer and monsoon. The population was maximum at 1800 hrs at the surface. It decreased during night hours at the surface and increased at 1 m depth (Plate—I, Fig. 2). In monsoon its population ranged from nil to 22×10^3 units/lit. at the surface, 8 to 20×10^3 units/lit. at 1 m depth and 2 to 18×10^3 units/lit. at the bottom (Plate—II, Fig. 3).

Scenedesmus exhibited an increasing trend in population from 1500 to 0300 hrs at the surface and 1200 to 1800 hrs at 1 m and bottom during summer (Plate—I, Fig. 4). In monsoon a decreasing trend in number was observed at the surface from 2400 to 0900 hrs but at 1 m and bottom a reverse trend was noticed during the same period (Plate—II, Fig. 4). In winter the maximum population was recorded at 2100 hrs at all depths while minimum density was at 1200 hrs at the surface, 1500 hrs at the bottom and 0600 hrs at 1 m (Plate—III, Fig. 5).

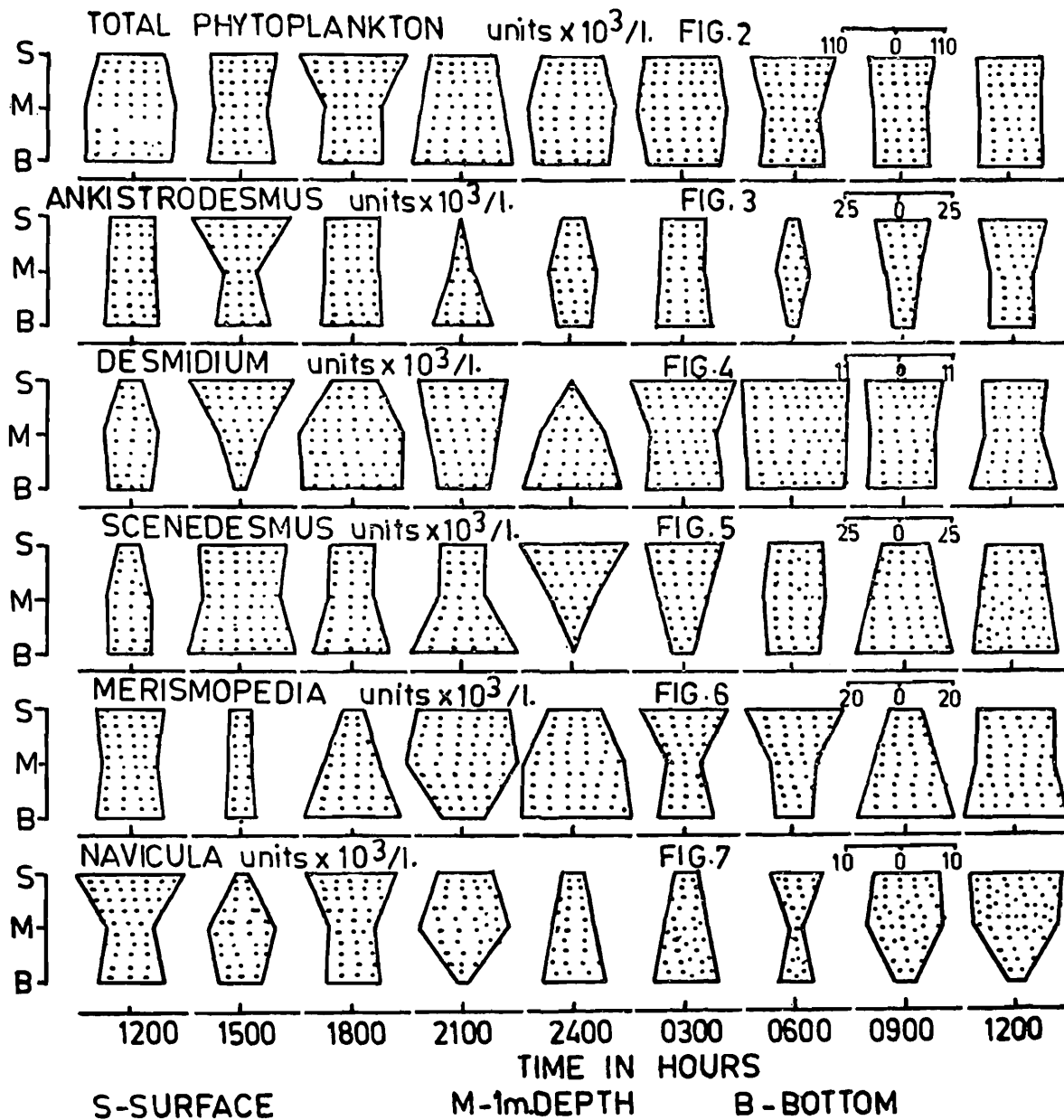
PLATE-I



Chlorococcus was observed only during winter and showed movements along the vertical profile of the lake. The population moved upwards from bottom to the surface during day time, while at night hours it again moved to the bottom. The population ranged from 2 to 28×10^3 units/lit. at the surface, 6 to 32×10^3 units/lit. at 1 m and 4 to 24×10^3 units/lit. at the bottom (Plate—III, Fig. 4).

The maximum population of *Merismopedia* was observed during day hours at the surface (1500 hrs) and bottom (1200 hrs) and at night hours at 1 m (2100 hrs) during summer. The minimum number at surface and bottom was during night hours while

PLATE-II

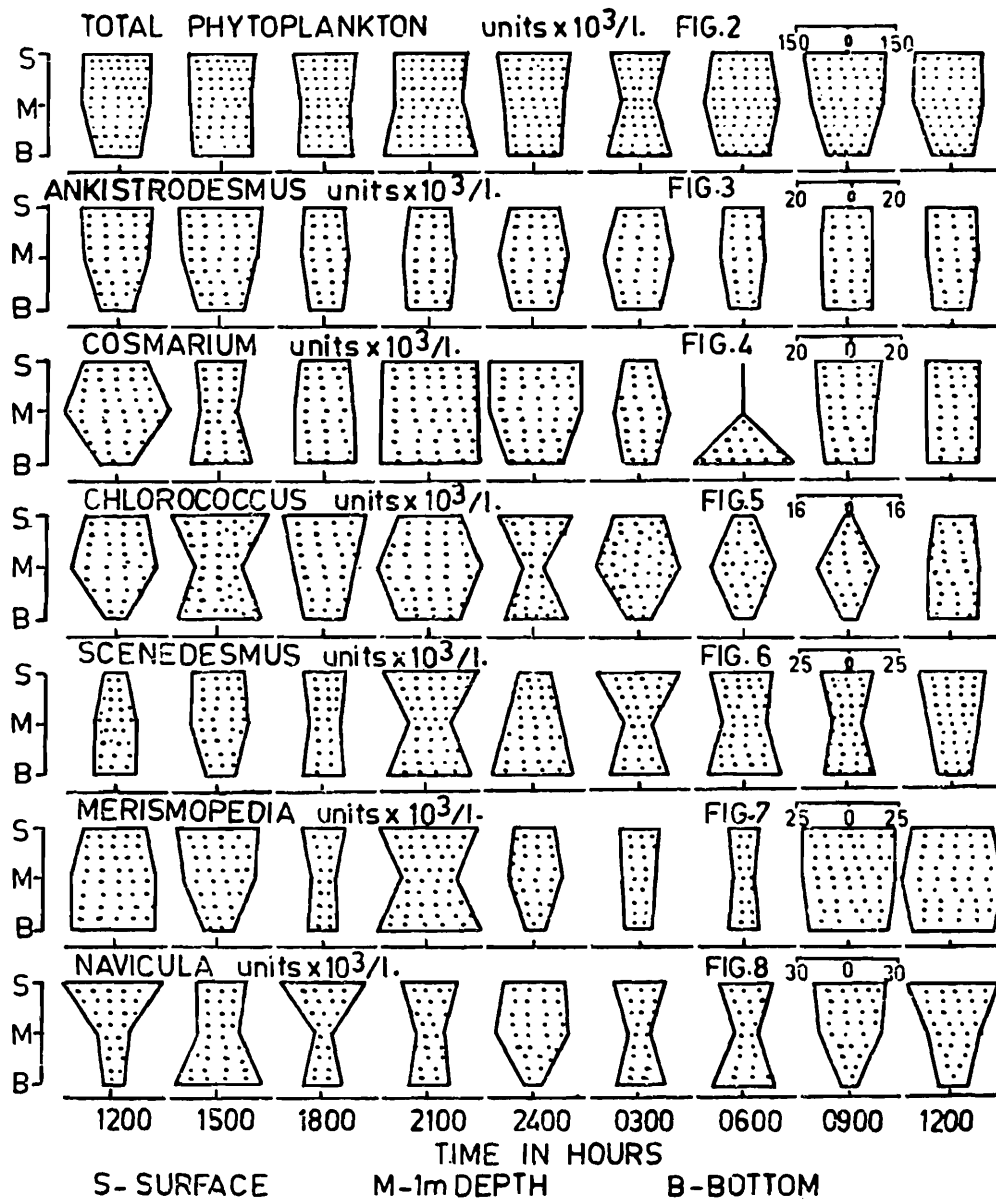


at 1 m during day time (Plate—I, Fig. 5). In monsoon vertical movement was shown by *Merismopedia*. The population was maximum at 1500 hrs at all depths while maximum was recorded at 2100 hrs at the surface and 1 m and 2400 hrs at bottom (Plate—II, Fig. 5). Unlike in the diurnal studies of summer and monsoon season, it showed vertical movements during winter studies as was evident by increase in population at the surface during day time and at the bottom at night hours. The population fluctuated from 16 to 48 × 10³ units/lit. at the surface, 4 to 50 × 10³ units/lit. at 1 m and 8 to 50 × 10³ units/lit. at the bottom (Plate—III, Fig. 6).

In summer the population of *Navicula* was maximum at 1200 hrs at the surface

and 1 m. Then from 1500 hrs onwards the number decreased, reaching its maximum at 0300 hrs on the following day. At the bottom the population was minimum at 1500 hrs and maximum at 2100 hrs of the same day (Plate—I, Fig. 6). Its population was poor in monsoon in comparison to that of the summer and showed vertical

PLATE - III



movements. The population moved from bottom to 1 m and then at the surface from 1200 to 1800 hrs and thereafter showed downward movements (Plate—II, Fig. 6). In winter the population of *Navicula* was higher at the surface in comparison to 1 m and bottom, during day hours. But during night hours, due to downward movement the population increased at the lower layers (Plate—III, Fig. 7). Vertical distribution of *Chlorococcus* during winter is shown in Plate—III. Fig. 4.

DISCUSSION

The phytoplankton flora was rich qualitatively as well as quantitatively in winter studies. In summer Chlorophyceae and Bacillariophyceae, in monsoon Cyanophyceae and Bacillariophyceae and in winter Chlorophyceae and Cyanophyceae were found dominant. The results showed that *Ankistrodesmus*, *Scenedesmus*, *Merismopedia* and *Navicula* were the permanent members in all the three seasons. *Desmidium* occurred in summer and monsoon seasons, whereas *Chlorococcus* appeared during the winter only. All these genera, with the exception of *Desmidium*, exhibited vertical movements.

Ankistrodesmus was observed to be maximum at the surface during the summer and the winter during day hours and minimum at the night time. *Navicula* also showed a similar trend during the summer and the monsoon seasons. But surprisingly, *Scenedesmus* and to some extent *Merismopedia* showed reverse trends i.e., the maximum concentration at the surface during night time and minimum in day hours. It is difficult to explain this unusual reversal of the trend which has been reported for the first time.

SUMMARY

Diurnal variations of phytoplankton in summer, monsoon and winter seasons have been discussed in a tropical lake of western Rajasthan. Phytoplankton showed a definite vertical movement in summer. *Ankistrodesmus*, *Scenedesmus*, *Merismopedia* and *Navicula* were present in all seasons. *Desmidium* occurred in summer and monsoon and *Chlorococcus* appeared in winter. All genera except *Desmidium* exhibited vertical movements.

ACKNOWLEDGEMENTS

I wish to express my sincere gratitude to Dr. S. C. Bhargava, Reader, University of Jodhpur, Jodhpur for his guidance and encouragement.

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