

# A Twice Taken Qualitative and Quantitative Sampling of Phytoplankton in Four Areas of Dewart Lake, Indiana

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## Introduction

In any limnetic investigation dealing with primary productivity, it is essential to make qualitative and quantitative evaluation of the primary producers, i.e., the phytoplankton. As one part of an overall investigation being carried out at the David Worth Dennis Biological Station on Dewart Lake, located in Kosciusko County in northern Indiana, it is the purpose of this paper to present the results of some preliminary studies of the phytoplankton of this lake.

On July 15 and 23, 1964 phytoplankton samplings were taken in four locations in the limnetic zone of Dewart Lake within one meter of the surface. Qualitative and quantitative analyses were determined for each sample with comparison made between areas.

## Methods

Samples of phytoplankton were taken with the Clarke-Bumpus qualitative plankton sampler using a No. 20 net at a depth of  $\frac{3}{4}$  meter. Samples were taken in the early afternoon and on both sampling dates the weather was clear with a recorded temperature between 85-90°F. The alga collected were identified by using keys of Prescott (1951) and Smith (1950). Also, Mr. William A. Daily from Lilly Research Laboratories and Mr. John Winters, the stream biologist of the Indiana State Board of Health, helped with the identification work.

The samples were taken to the laboratory in oxygen bottles where 10 ml. of 3% formalin was added to each bottle. The volume of each sample was measured and the bottles were then placed in the refrigerator until counts were made. Five counts were made from each bottle. Each count was composed of 10 random drops. Counting was done on glass slides with a Unitron mechanical-stage microscope at a magnification of 150 times. Quantitative calculations were made by taking the average of the 5 counts and fitting this average into the following formulas.

$$\frac{\text{vol. of sample}}{.576 \text{ ml}} \times N = T$$
$$\frac{T}{1} = \text{organisms per liter}$$

576 = average measured volume of 10 drops from the eyedropper

N = average number of the individuals of a species in one 10 drop sample

T = total number of individuals in the sample bottle

1 = number of liters of lake water filtered

## Results

The species as listed in Table 1, represented 99% of the phytoplankton types observed. Because of their greater abundance these were the only 12 species considered in the quantitative study. The

other 1% not considered was composed of such genera as *Mougeotia*, *Schroederia*, *Urococcus*, *Asterionella*, *Navicula*, *Aphanizomenon*, *Oscillatoria*, and *Agmenellum*. These occurred in such low frequency, throughout the quantitative analysis, that we consider them insignificant.

TABLE 1

Chlorophyta	<i>Pediastrum Boryanum</i> (Turp.) Menegh. <i>Microspora stagnorum</i> (Kuetzing) <i>Staurastrum</i> sp.
Chrysophyta	<i>Melosira granulata</i> (Ehrenb.) Ralfs. <i>Cyclotella Meneghiniana</i> Kutz. <i>Fragilaria crotonensis</i> Kitton
Pyrrhophyta	<i>Ceratium hirundinella</i> (O.F.M.) Schrank.
Cyanophyta	<i>Anacystis cyanea</i> (Kuta) Drouet and Daily <i>Gomphospaeria Wichurae</i> (Hilse) Drouet and Daily <i>Anabaena circinalis</i> (Kutz.) Rabenh. <i>Lyngbya Birgei</i> G. M. Smith.

The rotifer, *Keratella*, was also included in the counts because of its quantity at  $\frac{3}{4}$  of a meter.

As shown in Fig. 1, the four species *Lyngbya*, *Anabaena*, *Anacystis* and *Melosira* occur in the greatest quantities and this could be considered the most significant in this study.

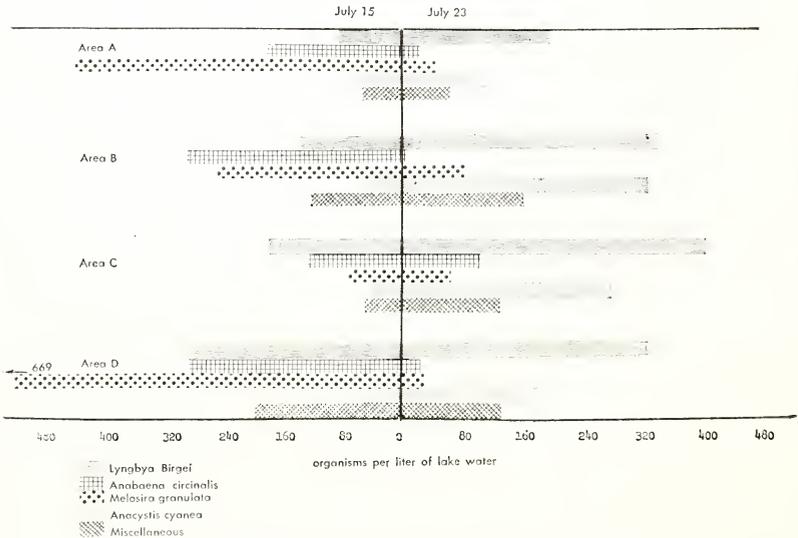


Figure 1. Quantities of the 4 major phytoplankton in Dewart Lake.

From Fig. 1, two qualitative aspects can be considered, 1, variation in number of the same species in the four different areas and 2, variations in numbers of the same species within one of the areas during the 8 day interval. In dealing with both aspects, it was clearly evident

that no type of consistency exists. *Melosira* sp. occur in quantities of 440/liter and 699/liter in areas A and D respectively while occurring in areas B and C in considerably lower frequency.

Variations within the individual species during the 8 day interval were even more extreme with both increases and decreases evident. Again as best exemplified in *Melosira*, 10 fold changes or greater occurred within areas A and D. In all species considerable change was noted. Other species including *Ceratium hirundinella*, *Dinobryon sociale*, *Gomphosphaeria Wichurae*, *Fragilaria crotonensis*, *Pediastrum Boryanum*, *Cyclotella Meneghiniana*, *Keratella*, and *Staurastrum* were plotted together under miscellaneous. Here again the pattern of variations was clear.

In Table 2, a comparison of total phytoplankton for the same area is shown for the beginning and end of an 8 day period.

TABLE 2

	Total Phytoplankton Per Liter of Lake Water	
	July 15	July 23
Area A	822.32	453.96
B	842.91	925.92
C	475.14	992.37
D	1,520.91	805.14

In both areas A and D there is a 50% reduction in the total phytoplankton after eight days while in area C there is a 100% increase and in area B there is relatively little change. No explanation for this change is possible at this time.

#### Discussion

It would seem that in dealing with the limnetic zone of any large body of water, the various ecological factors controlling the growth of population would be relatively constant. However, there is a continual fluctuation in certain major species of phytoplanktons in this lake. In all four areas *Lyngbya Birgei*, *Anacystis cyanea*, *Keratella*, and *Gomphosphaeria Wichurae* increased in total abundance after the eight days, while *Anabaena circinalis* and *Melosira granulata* decreased. *Dinobryon sociale*, *Ceratium hirundinella*, *Fragilaria crotonensis*, *Pediastrum Boryanum*, *Cyclotella Meneghiniana*, and *Staurastrum* showed little or no fluctuations.

These great variations in the numbers of phytoplanktons observed in the short interval must be attributed to the complex interaction of several factors. The qualitative penetration of light in water is one important factor. The depth to which rays are able to penetrate the water is dependent upon the amount of dissolved salt, the turbidity, and the color of the water. Light intensity at 1 meter in Dewart Lake was determined to be approximately  $\frac{1}{2}$  that of the surface. Because of the shallow depth and the lack of clouds, the light factor was relatively constant on both days of samplings and during the eight day period. Temperature is another factor that plays a role in the accelera-

tion or retardation of algae growth. Here again there was little or no difference in the temperature over the eight days, and certainly no differential in the four areas. The inorganic compounds of magnesium and calcium can also be considered important in influencing the total number of alga present at any given time. These two elements are important because their bicarbonates furnish a supplemental supply of carbon dioxide for photosyntheses. However, because of relative hardness of this lake, both elements are in abundance. Smith (1950) indicates that the organic compounds dissolved in water also greatly affect the algae flora, although he adds that the relationship is so complex that it is impossible to determine. One factor to which little significance has been attributed is the mixing or disturbance of surface water by high speed outboard motors. Though no direct cause can be determined for the observed fluctuations, continual agitation, the addition of small amounts of oil and gas, may affect these surface plankton to considerable extent. It has also been observed that certain areas of the lake receive far more motor abuse than others.

#### Summary

Phytoplankton samplings taken with the Clark-Bumpus quantitative plankton sampler on July 15, and July 23, 1964 showed that all species observed were found in all four areas of the lake studied. The second sampling taken after eight days showed considerable fluctuations in the relative total abundance of the species within each area. *Lyngbya Birgei*, *Anacystis cyanea*, and *Gomphospaeria Wichurae* increased in abundance in all four areas. *Anabaena circinalis* and *Melosira granulata* decreased in abundance in the four areas. In comparing each area with itself after the period of eight days as well as comparing each area with other three areas, there was considerable variation in the total number of phytoplankton observed.

#### Literature Cited

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