TROPHIC STATUS OF SELECTED NORTHERN NEW MEXICO LAKES

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Introduction

A characterization of the algae, the bacteria, and the chemical and limnological conditions in Fenton Lake, Hopewell Lake, Lagunitas Lakes, and Eagle Nest Lake were conducted to determine the trophic status of these northern New Mexico lakes. This investigation was initiated because algal blooms have been reported to occur regularly during the summer months on these lakes and these lakes represented different physical and biological environments. While the blooms on these lakes have not been regarded as serious problems, it was deemed important to obtain data on the present trophic status of these lakes so that the impact of increased human activity may be evaluated in the future.

In this study, special attention was given to conditions preceeding the algal blooms and to the biological and chemical characteristics of the bloom. The algal studies included primary productivity measurements, species identification, and species enumeration. An examination of the dissolved and suspended nutrients was employed to determine the contribution of nitrogen and phosphorus to production of blooms in each lake. A comparison of the abundance of microorganisms and physiological type of planktonic bacteria to algal populations was determined to evaluate the contribution of microorganisms, especially bacteria, to algal blooms. Assessment of trophic status is based on primary productivity, nutrient levels, and the predominant phytoplankton genera.

Research Procedures

1. Algal Identification

Phytoplankton samples were collected throughout the year of investigation. The phytoplankton samples were preserved in the field with iodine and returned to the laboratory where they were concentrated by the settling method. The phytoplankton were enumerated and identified by genus and/or by species (Jackson and Williams) and the species diversity was computed using the Shannon-Wiener function (Krebs).

2. Primary Productivity Measurements

Primary productivity was determined using the ^{14}C method originally developed by Steemann Nielsen (Nelson) and modified by Kidd and Johnson. Water samples were collected with a plastic Kemmerer water sampler and aliquots added to transparent bottles (light bottles) and an opaque bottle (dark bottle), each of which contained radioactive carbon as $NaH^{14}CO_3$. The dark bottle provided a correction factor for non-photosynthetic $^{14}CO_2$ fixation and exchange of ^{14}C which would not indicate primary productivity. These bottles were incubated *in situ* at the depth of collection; thus primary productivity was measured under the conditions of temperature and light intensity prevailing in the environment of sample collection.

After four to six hours of incubation, bottles were removed from the lake and placed in a dark chamber until algae were collected on a membrane filter with 0.45 micron pore size. The membrane filter retained both the phytoplankton and consumer organisms in the water sample. After drying, the ^{14}C retained on the filter was measured using a liquid scintillation counter. From the data for ^{14}C assimilation in the dark and light bottles and the bicarbonate content of the sample, primary production was calculated in units of milligrams of carbon fixed per hour on a volume or surface area basis.

3. Water Chemistry and Limnological Conditions

Water chemistry and selected limnological measurements were made throughout the year. Alkalinity and pH measurements were made using a glass electrode pH meter and titration with dilute H_2SO_4 (Golterman). Transparency was determined using a Secchi disk. The depth of 1% incident light penetration was determined using a Beckman Enviroeye (Beckman Instrument, Inc., Cedar Grove, New Jersey).

The following nitrogen and phosphorus measurements were made on three replicate water samples. Total nitrogen content of unfiltered water samples was determined after Kjeldahl digestion. The nitrogen was distilled into Nessler's reagent and measured spectrophotometrically (APHA). Nitrate nitrogen, orthophosphate, and total phosphorus were determined on samples filtered through 0.45μ membrane filters shortly after collection. After filtration, samples were stored on ice until analysis, usually 24 to 48 hours after sample collection. Nitrate nitrogen was determined spectrophotometrically by an ultraviolet absorption procedure (APHA, 1971). Phosphorus determinations were by the ascorbic acid reduction method and the molybdenum blue color was measured spectrophotometrically (EPA, 1974). In addition to phosphate determinations on filtered water samples, from March through October, 1975, unfiltered water samples were preserved by acidification with H_2SO_4 in the field and analyzed for total phosphate as currently recommended by the EPA (1974).

In July, 1975, samples collected and filtered through a 0.45μ membrane filter were combined for each sample station and depth. These samples were preserved by addition of hydrochloric acid (64 drops/liter) and refrigeration. These samples were analyzed for sodium, potassium, calcium and magnesium by atomic absorption spectrophotometry.

During and following algal blooms in the summer of 1975 chlorophyll and pheophytin were determined as described by Golterman. Duplicate 100 ml water samples were filtered through glass fiber filters (Whatman GF/C). The filter was homogenized in 90% acetone and absorption of non-acidified and acidified extracts was measured at 663 and 750 nm with a 10 cm light path.

Dissolved oxygen was determined in the field with an oxygen electrode or in the laboratory by the Winkler method (Golterman).

4. Microbiological Studies

The Millipore membrane filter technique was used to determine the number of aerobic and anaerobic planktonic bacteria, fecal coliform and fecal streptococci using M-RGE broth, M-Coliform broth, and M-Enterococcus agar, respectively. Several times throughout the year, the number of bacteria in each of the following physiological groups was determined employing procedures in the Manual of Microbial Methods: Starch hydrolysis, protein hydrolysis, H_2S production, nitrification, and de-nitrification. Molds were enumerated by cultivation on Rose Bengal Agar Medium (Difco) and actinomycetes by growth on Actinomycete Isolation Medium (Difco). The relative abundance of the microorganisms and the physiological types of bacteria were compared to the diversity of algal species and number of algae present. Unless the number of microorganisms exceeded 300/100 ml, 100 ml was passed through the millipore filter and the filter was placed on the appropriate medium. Total aerobic and anaerobic bacteria were enumerated in 10 ml volumes of lake water. Invertebrates were counted in 200 ml volumes of water.

5. Diversity Indices

The Shannon-Wiener Index (H) was used to express the diversity of phytoplankton taxa in water samples according to the formula given by Krebs:

$$H' = -\sum_{i=1}^{S}(p_i)(\log_e p_i)$$

H' = information content of sample(bits/individual).

S = number of species in sample.

p_i = proportion of total sample belonging to i^{th} species.

thus $p_i = n_i/N$ n_i = number of individuals in species i.

N = total number of individuals in sample.

H', or information content, is a measure of uncertainty in predicting the species of the next individual collected. If all individuals are of the same species, there is no uncertainty and H' = 0. The value of H' increases as the number of species increases, and also increases with a more even distribution of individuals among the species present. H'_{max} is the species diversity under conditions of maximal equitability, i.e., equal numbers of individuals of each species. The ratio of H' (observed species diversity) to H'_{max} (maximum species diversity) indicates the equitability (E) of the distribution of individuals among the species in the community. Equitability ranges from E=0 when all individuals are of the same species to E=1 when there are equal numbers of individuals of each species.

$$H'_{max} = \log_e$$

$$E = H'/H'_{max}$$

Eagle Nest Lake

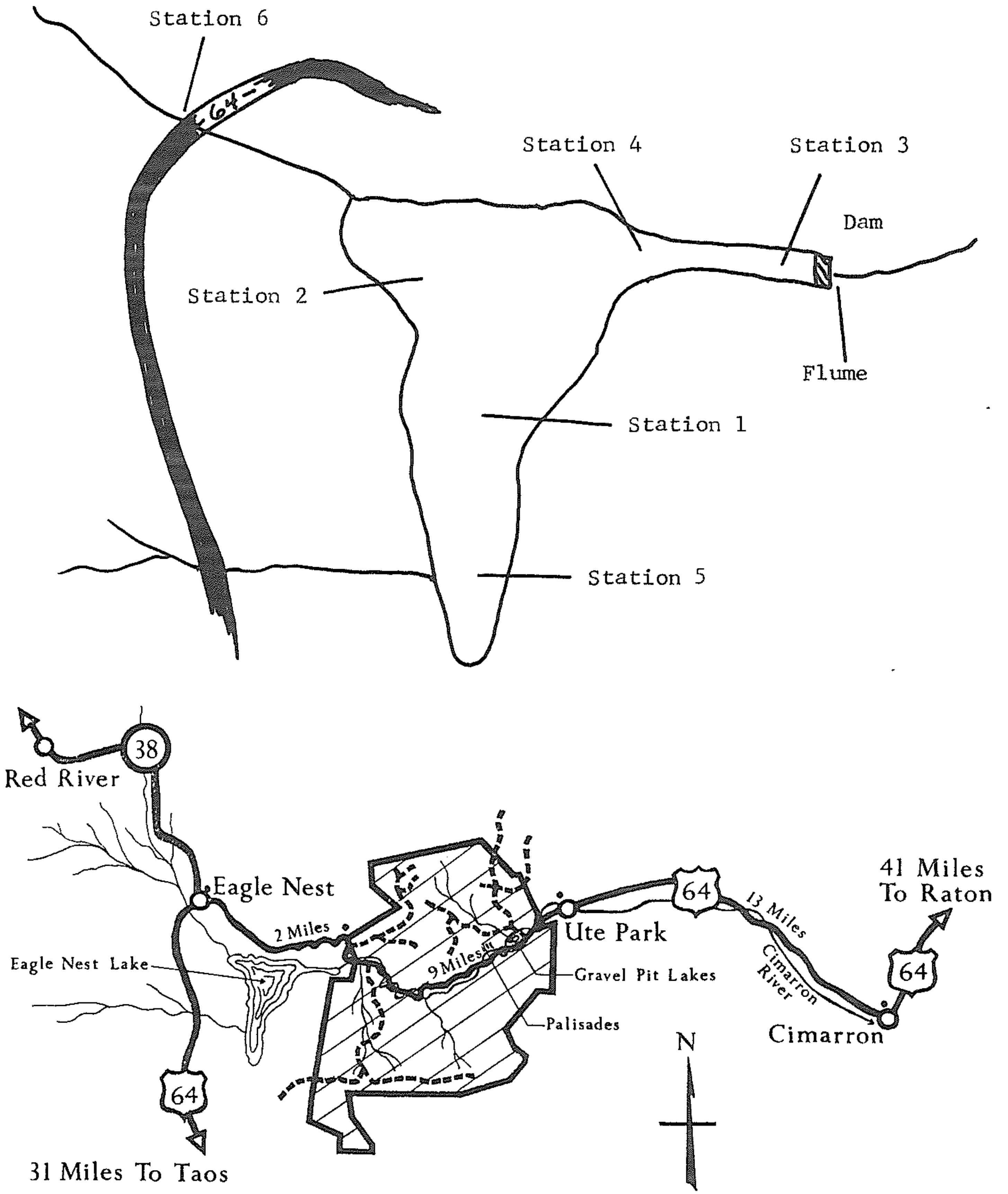
1. Location

Eagle Nest Lake is privately owned and is the largest lake in the study in that it contains about 25,000 acre-feet of water. It has an elevation of about 8,500 feet above sea level and is located near the small town of Eagle Nest in a grassy, tree-less valley. At the east end of the lake, the water flows out of the lake through a canyon and it was in this canyon that a concrete dam was placed over 50 years ago. The location and sampling stations are presented on the maps in Fig. 1.

2. Sampling Stations

Station 1 was deep, open water with considerable mixing due to wind action. Station 2 was generally not subject to as much wave action as Station 1 and the depth at Station 2 was about three meters. Station 3 was near the dam, protected from winds by the canyon walls, and was a region where algae collected. Station 4 was at the mouth of the canyon and Station 5 was at the south end of the lake, where the depth was about 1 meter. Samples were not routinely collected from Stations 4 and 5 but these stations were

Figure 1. Eagle Nest Lake Showing Location and Sampling Stations



added to get a more complete analysis on this lake. Station 6, one of the inlets leading into Eagle Nest Lake, was selected for routine examination because it was near the small sewage treatment plant for the town of Eagle Nest and would indicate the contribution of the town to the lake.

An ice cover was on the lake from late November to mid-April and the maximum thickness of the ice was 2 to 2.5 feet, which was observed at Stations 1, 2, and 3. Samples were collected in the winter with the aid of an ice auger but measurements of water transparency and primary productivity were not made when the lake was frozen over.

Samples were collected at the surface of all stations as well as at 1.5 meters at Station 1. At Station 3, samples were also obtained at 1.5 meters and at 6 meters.

3. Water Temperature and Transparency

Temperature fluctuations occurred with the seasons at all four lakes and only at Eagle Nest Lake did it appear that stratification occurred (Table 1). The coolest lake in the summer was Hopewell. Secchi disc transparencies were in agreement with the penetration of incident light (Tables 2, 3). Although the lakes often contained some suspended dirt, there appeared to be a good correlation with algal abundance. The depth of 1% light penetration decreased from 4-5 meters in the early summer to 2-3 meters with the occurrence of the algal bloom.

4. Biological Measurements

Considerable variation of biological activity was observed at the various stations and depths at Eagle Nest Lake (Fig. 5, 7-10, Table 52, Appendix). The number of algae per unit volume was greatest at the surface and, as expected, decreased with depth. When the number of algae at the surface of the lake is examined, considerable algal abundance occurs at two different times. In March a peak of algal numbers is reached at Station 2 and although six species of algae were present, the most abundant organism was *Chlamydomonas*. *Chlamydomonas* may have been growing autotrophically because the ice was very clear; however, heterotrophic growth must also be considered since it is difficult to envision that sufficient light would penetrate the 18-24 inches of ice cover to support photosynthetic activity of this magnitude. Another obvious proliferation of algae was noticeable at all three stations between August and October, 1975. This algal bloom was attributed to *Aphanizomenon*. It should be kept in mind that the number of algal cells per unit volume of lake water may be much greater than shown here since enumeration of *Aphanizomenon* was based on the number of heterocysts and not on the number of cells. The occurrence of the *Chlamydomonas* and *Aphanizomenon* blooms correspond to very low equitability (E) values (Table 19).

The distribution of planktonic bacteria in Eagle Nest Lake was examined and the following generalizations can be made.

Total aerobic bacterial numbers are most abundant on 2-20-75 and 7-23-75 or 8-6-75, while anaerobic bacteria vary considerably from more than 10:1 to 1:7 (Tables 12, 13). It takes 12 to 15 days for surface bacteria at Station 3 to drop to the 6-meter level and about 18 days for the bacteria to be discharged from the lake through the flume. If one compares the physiological types of bacteria to the algal production, there are no obvious correlations that can be made. No one physiological type coincides, precedes, or follows the algal bloom nor do the ratios of N_2-producing:NH_3-liberating; starch hydrolyzing: protein hydrolyzing; or number of a specific colony, color or morphology (Fig. 6, Table 56-58, Appendix).

The abundance of actinomycetes on the surface of the lake is reasonable since spores of actinomycetes are not wettable and probably come from the soil as a result of run-off (Table 14). Molds may also be attributed to run-off but the abundance in January, under the ice, must reflect lake activity (Table 15).

Evaluations of fecal pollution reveal that considerable fecal input occurs at Station 6 (Table 16, 17). These organisms flow into Eagle Nest Lake near the surface and gradually drop as the water is moved toward the dam and ultimately fecal bacteria are found in the flume. Although the fecal organisms are diluted sufficiently in the lake to have little effect on the lake at this time, certainly there is a concern for the future if this pollution problem is not rectified.

A rather interesting succession of populations is demonstrated at Stations 1 and 3 (Fig. 7-10). One may expect the number of molds, invertebrates, bacteria and algae to fluctuate with time, as was observed, but the effect of the various organisms with respect to algal blooms cannot be predicted by molds, bacteria or invertebrate population density.

The typical change in populations is observed in this lake (Fig. 7-10). The sequence of populations is: algae; invertebrates and molds, either alone or together; and bacteria, with the exception that intense algal growth in the fall coincides with greatest bacterial numbers. Whether the occurrence of high numbers of bacteria and algae during the fall indicates one organism is supporting the other, or reflects changes in the lake, such as fall turnover, which results in two independent, simultaneous growth responses, is unclear at this time.

Primary productivity as mg carbon/m^3/hr increased to high levels in late July and August corresponding to the appearance of the Aphanizomenon bloom (Table 10, Figs. 4, 5). The floating algae was carried by the winds and current to Station 3 (near dam) and an extremely high productivity was measured at this site in early August. Later in the summer much of the algae accumulating at the surface at Station 3 was moribund and primary productivity was below that of Station 2. In mid-October primary productivity decreased and this corresponded to a very large decrease in the population of Aphanizomenon.

The descrepancies between time of maximal CO_2 fixation and occurrence of greatest numbers of algae at Station 1 in August is understandable since the number of algal heterocysts were counted and not the actual number of algal cells in the trichome (Fig. 11).

5. Chemical Measurements

The pH of Eagle Nest Lake water samples ranged from 6.5 in the winter to 9.0 during the summer months (Table 9). Abundant inorganic carbon was available for photosynthesis even during blooms. Based on the calcium concentration, this lake would be classed as a hard water lake (Table 11). The concentration of sodium (11.7 mg/liter) exceeded that of potassium by five-fold. The high pH and abundance of sodium would favor the growth of blue-green algae (Wetzel).

In filtered water samples the concentration of total phosphorus only slightly exceeded the orthophosphate (Tables 4, 5, Fig. 2). The filterable phosphorus was about 0.05 mg/liter until mid-August when it rapidly increased. The total phosphorus in unfiltered water began to increase in early August and thereafter considerably exceeded the phosphorus in the filtered water samples (Table 6, Fig. 2). Nitrate nitrogen remained rather constant at about 0.2 mg/liter, while the total nitrogen concentration decreased to a minimum in late May and then gradually increased to its highest level in August (Tables 7, 8, Fig. 3). The marked increases in total nitrogen and total phosphorus in unfiltered water samples in the late summer correspond to the *Aphanizomenon* bloom and its subsequent decomposition (Fig. 12). It is of particular interest that the increase in total nitrogen begins in early June, perhaps as a result of nitrogen fixation by *Aphanizomenon*, while a large increase in total phosphorus was not observed until early August.

Some depletion of oxygen is apparent in samples collected in August and September (Table 11a). The reduction in oxygen concentrations was most evident near the dam (Station 3) where large masses of decomposing algae accumulated. Oxygen concentrations at greater depths near the dam would probably have been very low in the late summer and fall.

TABLE 1

Water temperatures in degrees Centigrade

Eagle Nest Lake

	Station 1		Station 2		Station 3		Flume
Date	Surf	1.5 m	Surf	Surf	1.5 m	6.0 m	
10/19/74	14	14	11	13			10.5
11/29/74	3		5	2			
2/20/75	3	2	1.5	3		5.0	6.0
3/25/75	1	3	1	1	3.5	4.0	4.5
4/29/75			5.5	5.0	5.0		5.0
5/27/75	13	12.5	12.5	13	13	12.5	
6/11/75	14	14	14	14	15	14	13.5
6/25/75	16	16	16	16	16	16	
7/9/75	20	20	20	20.5	20	19.5	
7/23/75				21	21		16
8/6/75	19.5	19	20	21.5	21		
8/19/75	19	19	19.5	19	19	19	
9/16/75	18	19	18	19	18	17	
10/18/75	10	10	10	11	11	11	

Fenton Lake

	Station 1		Station 2		Station 3		Inlet
Date	Surf	1.5 m	Surf	1.5 m	Surf	1.0 m	
10/26/74	8		8		8		
12/7/74	3		4		3		
1/26/75	2		2		2		4
3/1/75	2		2	2	2		
4/8/75	1	2	0	2		.5	
5/20/75	12	12	12	12	12	13	14
6/3/75	16	16	16	16	17		
6/17/75	17	16	17	16	16	17	
7/1/75	20	19.5	20	19	21	21	
7/15/75	18.5	18.5	19	18.5	20	19	
7/29/75	18	17.5	18	17.5	17	17	
8/12/75	21	20	20.5	20	21	20.5	
9/9/75	17	16	16	15.5	15.5	15.5	
10/7/75	11.5	11	12	11.5	11	8.5	

Hopewell

	Station 1		Station 2	
Date	Surf	1.5 m	Surf	1.5 m
5/28/75	7	6	8	7.5
6/10/75	11	10	10	10
6/24/75	15.5	15.5	17	16
7/8/75	19.5	19	18.5	18.5
7/22/75	19	19	19	19
8/5/75	18	17	18	18
9/2/75	17	-	18	-
9/30/75	11	11	-	-

Lagunitas Lake One and Two

	Lake One	Lake Two	
		Sta 1	Sta 2
Date	Surf	Surf	Surf
6/10/75	11	11	13
6/24/75	16	16	16
7/8/75	19	21	20
8/5/75	-	18	-
9/30/75	11.5	12	10.5

TABLE 2

Secchi disc transparency in centimeters

Eagle Nest Lake

Date	Station 1	Station 2	Station 3
10/19/74	152	46	122
11/29/74	140	124	
4/29/75		74	97
5/27/75	100	100	81
6/11/75	116	119	136
6/25/75	150	162	
7/9/75	216	175	277
8/6/75	127	90	113
8/19/75	224	114	97
9/16/75	132	107	58
10/18/75	-	61	41

Fenton lake

Date	Station 1	Station 2	Station 3
10/26/74	419	B[1]	213
5/20/75	51	48	61
6/17/75	124	124	122
7/1/75	208	192	155
7/15/75	125	114	92
7/29/75	114	137	114
8/12/75	427	358	B
9/9/75	310	304	244
10/7/75	322	256	152

Hopewell Lake

Date	Station 1	Station 2
6/10/75	122	B
6/24/75	160	138
7/8/75	135	148
7/22/75	57	124
8/5/75	137	117
9/2/75	63	-
9/30/75	226	224

Lagunitas Lake Two

Date	Station 1
6/24/75	185
7/8/75	142
8/5/75	200
9/30/75	224

[1]Visible on bottom of lake.

Table 3

Irradiance loss coefficient (k) and depth of 1% incident light penetration (z) in meters as measured by a relative irradiance meter (Beckman Enviroeye, EV3)

Eagle Nest Lake

	Station 1		Station 2		Station 3	
Date	k	z	k	z	k	z
6/11/75	.94	4.88	1.02	4.53	.87	5.29
7/9/75	.39	11.87	1.02	5.80	.73	6.30
8/6/75	1.10	4.17	1.16	3.96	1.22	3.77
8/19/75	.64	7.22	1.40	3.29	1.49	3.09
9/16/75	---	---	1.20	3.84	---	---
10/18/75	---	---	1.88	2.45	---	---

Fenton Lake

	Station 1		Station 2		Station 3	
Date	k	z	k	z	k	z
6/17/75	.79	5.80	.99	4.65	1.45	3.17
7/1/75	.50	9.20	.79	5.80	1.31	3.51
7/15/75	1.02	4.50	.90	5.11	3.05	1.54
7/29/75	.87	5.29	1.08	4.27	2.53	1.82
8/12/75	---	---	.28	16.38	---	---
9/9/75	.38	12.14	.43	10.81	2.19	2.10

Hopewell Lake

	Station 1		Station 2	
Date	k	z	k	z
6/10/75	1.87	2.46 (overcast)	1.69	2.72
6/10/75	.85	3.90 (clear)	---	---
6/24/75	1.13	4.06	1.04	4.42
7/8/75	1.11	4.14	1.23	3.74
7/22/75	3.36	1.37	1.33	3.46
9/1/75	.96	4.78	---	---
9/30/75	.64	7.22	---	---

Lagunitas Lake

	Lake one		Lake two			
			Station 1		Station 2	
Date	k	z	k	z	k	z
8/5/75	.96	4.78	.45	10.30	.86	5.38

TABLE 4

Ortho phosphate concentrations in Eagle Nest Lake as mg phosphorus/liter. Water samples were filtered using a 0.45 μ membrane filter.

	Station 1		Station 2		Station 3		Flume	Inlet
Date	Surface	0.5 m	Surface	Surface	1.5 m	6.0 m		
10-19-74	.036±.000*	.030±.001 b**	.029±.004 b	.036±.003 b			.047±.004 a	
11-29-74	.053±.003 bc	.051±.001 bc	.048±.002 b	.058±.003 c			.077±.002 a	.009±.000 –
1-7-75	.030±.001	.037±.006 b	.032±.001 b	.049±.004 c	.054±.000 c	.050±.005 c	.067±.001 a	
2-20-75	.030±.002 b	.034±.003 b	.013±.002 c	.032±.003 b	.048±.004 d	.07±.002 c	.218±.004 a	
3-25-75	.021±.000	.025±.000	.012±.000	.068±.001 a	.077±.006 a	.106±.012 –	.119±.006 –	
4-29-75			.033±.004 a	.029±.004 a	.030±.005 a		.026±.001 a	
5-27-75	.054±.007 a	.048±.002 ac	.048±.004 ac	.048±.003 ac	.043±.006 ac	.037±.004 bc	.053±.004 a	.036±.000 –
6-11-75	.042±.002 ac	.037±.006 c	.042±.002 ac	.034±.001 c	.044±.006 ac	.042±.001 ac	.050±.004 a	.018±.003 b
6-25-75	.042±.001 ca	.041±.001 ad	.037±.002 cd	.036±.002 d	.036±.001 d		.046±.002 a	.022±.002 b
7-9-75	.029±.001 d	.024±.001 c	.030±.002 bd	.021±.001 c	.022±.001 c	.02±.001 bd	.112±.000 a	.033±.002 b
7-23-75				.028±.001 b	.030±.000 b	.117±.023 a	.141±.001 a	.048±.002 –
8-6-75	.049±.005 a	.035±.001 ab	.043±.002 ac	.038±.004 ac	.025±.004 cb	.045±.013 ac	.214±.007 –	.019±.001 b
8-19-75	.118±.001 be	.120±.000 be	.120±.002 be	.102±.004 be	.099±.000 e	.155±.001 c	.257±.007 a	.049±.022 b
9-16-75	.123±.003 dc	.131±.002 ac	.115±.013 d	.144±.001 a	.140±.000 a	.142±.001 a	.137±.001 ac	.028±.002 b
10-18-75	.114±.001 ac	.116±.000 ac	.116±.002 ac	.113±.000 c	.113±.000 c	.118±.003 a		.013±.001 b

*Standard error
**Significant differences were determined by Duncan's new multiple range test. On each date values with differing letters are significantly different (P=0.05).

TABLE 5

Total phosphorus concentrations in Eagle Nest Lake as mg phosphorus/liter. Water samples were filtered using a 0.45 μ membrane filter.

	Station 1		Station 2	Station 3			Flume	Inlet
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		
10-19-74	.079±.007	.071±.008 a	.062±.003 a	.129±.051 a			.044±.004 a	
11-29-74	.051±.000 cb	.045±.006	.043±.004 b	.058±.002 c			.072±.003 a	
1-7-75	.052±.000 –	.047±.007 b	.056±.004 bc	.059±.001 cb	.065±.001 ac	.061±.005 c	.074±.002 a	
2-20-75	.050±.000 d	.048±.004 d	.004±.001 d	.052±.002 d	.074±.006 c	.087±.003 b	.230±.004 a	
3-25-75	.017±.002 c	.023±.006 c	.029±.008 c	.069±.003 b	.074±.004 b	.088±.006 b	.126±.013 a	
4-29-75			.051±.000 a	.040±.002 a	.051±.006 a		.041±.002 a	
5-27-75	.068±.004 a	.036±.005 b	.030±.003 b	.029±.002 b	.030±.007 b	.033±.008 b	.032±.001 b	.004±.000 –
6-11-75	.045±.002 ad	.032±.005 c	.036±.002 cd	.036±.003 cd	.040±.006 cd	.042±.003 cd	.054±.004 a	.018±.002 b
6-25-75	.041±.004 b	.048±.003 b	.045±.001 b	.044±.001 b	.043±.000 b		.056±.002 a	.024±.002 c
7-9-75	.040±.002 bd	.036±.003 cde	.039±.002 be	.032±.001 c	.034±.000 ce	.036±.003 dce	.117±.000 a	.043±.003 b
7-23-75				.037±.002 b	.038±.003 b	.091±.028 c	.154±.004 a	.058±.002 bc
8-6-75	.063±.005 b	.046±.002 –	.052±.002 b	.084±.014 b	.050±.012 b	.065±.017 b	.222±.004 a	.028±.000 –
8-19-75	.129±.000 b	.129±.001 b	.131±.001 b	.116±.002 c	.109±.005 c	.152±.003 a		.020±.001 –
9-16-75	.141±.005 a	.151±.003 a	.093±.033 c	.163±.003 a	.168±.000 a	.168±.001 a	.159±.001 a	.043±.001 b
10-18-75	.124±.002 b	.124±.003 b	.123±.001 b	.123±.002 b	.126±.001 b	.133±.002 a		.020±.001 c

TABLE 6

Total phosphorus concentrations in unfiltered Eagle Nest Lake water samples as mg phosphorus/liter.

	Station 1		Station 2	Station 3			Flume	Inlet
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		
3-25-75	.038±.001 b	.042±.001 b	.110±.017 c	.112±.009 c	.118±.003 c	.122±.005 c	.157±.003 a	
4-29-75			.098±.007 a	.084±.004 a	.091±.003 a		.094±.004 a	
5-27-75	.061±.001 a	.069±.004 a	.039±.004 b	.068±.007 a	.072±.001 a	.064±.009 a	.060±.001 a	.070±.063 -
6-11-75	0.56±.003 d	.073±.001 ac	.005±.004 d	.074±.009 ab	.070±.001 acd	.078±.002 a	.079±.003 a	.085±.009 a
6-25-75	.068±.002 cd	.078±.004 c	.063±.002 d	.069±.001 cd	.074±.003 cd		.088±.001 a	.043±.006 b
7-9-75	.049±.003 bd	.107±.008 c	.048±.003 bd	.054±.005 b	.058±.002 b	.056±.003 b	.143±.001 a	.156±.071 -
7-23-75				.061±.001 b	.061±.000 b	.113±.037 -	.176±.004 a	.073±.013 b
8-6-75	.111±.001 h	.124±.004 ef	.117±.004 fh	.148±.006 d	.133±.003 e	.080±.004 b	.244±.002 a	.032±.000 g
8-19-75	.159±.002 d	.152±.003 d	.190±.211 c	.229±.002 a	.204±.005 c	.222±.009 a		.029±.003 b
9-16-75	.246±.025 a	.192±.003 c	.254±.014 -	.229±.010 ac	.201±.001 c	.193±.008 c	.237±.004 a	.049±.006 b
10-18-75	.162±.002 d	.161±.003 d	.177±.004 cd	.222±.011 a	.180±.004 c	.166±.003 cd		.020±.002 b

TABLE 7

Nitrate nitrogen concentrations in Eagle Nest Lake as mg nitrogen/liter. Water samples were filtered through a 0.45 μ membrane filter.

	Station 1		Station 2	Station 3			Flume	Inlet
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		
10-19-74	.296±.000 –	.121±.025 bc	.233± ac	.317±.035 a			.176±.046 ac	
1-29-74	.268±.010 b	.245±.009 b	.243±.010 b	.254±.002 b			.370±.065 a	
1-7-75	.234±.018 –	.239±.003 b	.261±.008 bc	.294±.009 c	.299±.018 c	.323±.005 c	.383±.002 a	
2-20-75	.272±.009 b	.260±.009 b	.263±.004 b	.414±.009 c	.443±.020 c	.483±.008 a	.366±.006 d	
3-25-75	.249±.013 b	.267±.008 b	.196±.007 d	.335±.011 c	.357±.012 ac	.391±.032 a	.372±.017 ac	
4-29-75			.186±.009 a	.184±.002 a	.182±.005 a		.182±.006 a	
5-27-75	.233±.008 a	.231±.006 a	.242±.008 a	.258±.027 a	.239±.004 a	.247±.006 a	.244±.010 a	.452±.218 –
6-11-75	.213±.020 a	.227±.022 a	.213±.003 a	.207±.003 a	.213±.009 a	121±.000 a	.21±.000 a	.200±.04 a
6-25-75	.207±.002 ac	.191±.011 ac	.194±.003 ac	.191±.003 ac	.199±.008 ac		.244±.090 a	.098±.004 bc
7-9-75	.168±.018 bc	.219±.015 –	.175±.011 bc	.221±.015 a	.210±.002 ac	.209±.020 ac	.177±.001 –	.092±.004 –
7-23-75				.306±.000 –	.971±.092 a	.286±.080 –	.245±.015 b	.266±.057 b
8-6-75	.211±.006 a	.232±.067 a	.213±.033 a	.227±.038 a	.187±.019 a	.153±.003 ac	.176±.005 a	.069±.010 bc
8-19-75	.047±.021 b	.072±.018 bd	.142±.002 ac	.119±.011 cd	.086±.029 cb	.181±.014 a	.169±.010 –	.172±.024 –
9-16-75	.216±.004 de	.224±.000 de	.205±.013 e	.215±.003 de	.205±.005 b	.220±.003 de	.243±.007 a	.145±.003 b
10-18-75	.168±.013 c	.190±.005 ac	.187±.008 ac	.201±.016 ac	.217±.004 a	.201±.007 a		.002±.010 b

TABLE 8

Total nitrogen concentration in unfiltered Eagle Nest Lake water samples as mg nitrogen/liter.

	Station 1		Station 2	Station 3			Flume	Inlet
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		
10-19-74	.610±.038 c	1.04±.101 a	.914±.041 ab	.917±.041 ab	.905±.115 ab		.712±.052 bc	
11-29-74	.518±.021 a	.542±.003 a	.640±.098 a	1.36±.132 b			1.22±.050 b	
1-7-75	.711±.023 cb	.731±.032 cb	.662±.024 b	.858±.026 a	.773±.016 ac	.796±.059 ca	.799±.023 –	
2-20-75	.785±.041 a	.732±.041 b	1.29±.130 –	1.17±.010 –	.898±.024 c	1.00±.137 –	1.2±.027 b	
3-25-75	.585±.004 a	.613±.020 a	.997±.019 b	.839±.013 c	.843±.017 c	.754±.014 d	.894±.004 –	
4-29-75			.755±.028 a	.727±.040 a	.724±.017 a		.664±.000 –	
5-27-75	.296±.029 b	.327±.086 b	.234±.043 b		.616±.026 a	.619±.025 a	.596±.061 a	.518±.013
6-11-75	.559±.017 cb	.636±.062 –	.485±.052 –	.575±.030 cb	.610±.014 ac	.641±.030 a	.535±.018 bd	.567±.001 bc
6-25-75	.529±.014 b	.538±.009 b	.537±.018 b	.580±.013 b	.605±.036 b		.786±.001 b	.316±.056 a
7-9-75	.486±.021 b	.753±.063 c	.518±.039 –	.578±.025 cb	.66±.032 ec	.621±.027 de	.564±.007 eb	.997±.018 a
7-23-75				.737±.038 a	.582±.012 b	.536±.028 b	.566±.018 b	1.16±.015 –
8-6-75	1.03±.023 ac	.940±.004 ac	.910±.062 ac	1.37±.013 a	1.42±.045 a	1.22±.501 ac	.56±.111 bc	.791±.284 ac
8-19-75	.249±.010 eb	.466±.128 bd	1.42±.020 a	1.04±.133 c	1.44±.292 a	.726±.027 cd	.630±.041 d	.170±.048 b
9-16-75	1.06±.493 a	.777±.162 a	.860±.081 a	.689±.031 a	.521±.044 a	.545±.014 a	.438±.077 a	
10-18-75	.667±.089 ca	.478±.014 b	.567±.072 c	.785±.022 a	.757±.076 a	.459±.017 bc		.092±.016 b

Table 9

pH of Eagle Nest Lake Water Samples

	Station 1				Station 2			Station 3					Flume
Date	Surface	1 m	2 m	3 m	Surface	1 m	2 m	Surface	1 m	2 m	3 m	6 m	
01/07/75	7.7				8.4			7.5				7.7	
02/20/75	6.5	6.4			8.5			6.7	6.4			6.8	7.5
03/25/75		8.4											7.4
05/27/75	7.4	7.3	7.4		8.2	8.2	8.2	8.2	8.3	7.9	8.4	8.3	
06/12/75	7.6	7.6	8.1		8.3	7.8	8.1	8.3	8.2	8.1	7.8		7.9
06/25/75	7.6	8.2	7.6		8.1	7.8	8.2	8.3	8.3	8.3	7.9		8.0
07/08/75	8.8	8.9	8.8		8.5	8.8	8.8	8.9	8.9	9.0	9.0		
07/21/75								8.9	8.9	9.0	8.8		
08/04/75	8.9	8.7	8.8	8.9	8.9	8.8	8.8	8.9	9.0	9.0	9.0		
08/20/75	8.7	8.6	8.6	8.6	8.6	8.7	8.7	8.5	8.4	8.6	8.6		

TABLE 10

Primary productivity of Eagle Nest Lake in mg carbon/m^3/hr.

Date	Station 1				Station 2			Station 3			
	Surface	1.0 m	2.0 m	3.0 m	Surface	1.0 m	2.0 m	Surface	1.0 m	2.0 m	3.0 m
5-27-75	22.66±2.36	26.76±1.39	14.30±0.76	-	11.20±3.83	15.72±1.78	6.38±0.23	57.82±30.23	39.77±14.55	7.78±0.22	4.17±0.56
6-11-75	17.70±16.69	63.00±0.20	35.46±2.10	-	24.46±0.80	31.08±0.06	20.28±0.00	25.01±24.86	49.12±1.62	39.75±2.11	11.70±2.15
6-25-75	7.68±0.00	36.79±0.00	27.54±10.28	-	16.54±8.49	22.91±1.52	17.64±0.00	-	18.87±.18	13.35±1.34	12.43±0.00
7-9-75	6.6±1.1	10.3±.91	16.0±0.0	-	22.1±7.4	18.4±.80	9.22±1.8	9.84±.36	10.0±1.2	39.8±5.2	12.9±3.0
7-23-75	-	-	-	-	-	-	-	40.90±.00	22.98±3.28	22.94±2.68	11.21±1.93
8-6-75	64.3±.05	134.52±1.06	27.8±2.2	10.9±.12	65.5±1.2	38.5±1.4	7.7±.43	276.18±14.7	87.0±7.2	16.0±3.5	13.1±8.2
8-19-75	67.5±.00	6.59±.71	3.22±.40	1.6±.46	9.58±2.53	18.56±2.29	2.96±.16	42.00±28.18	49.00±10.55	14.02±.25	31.09±9.65
9-16-75	66.98±4.35	51.23±3.17	28.36±4.76	12.46±2.62	92.34±3.97	39.46±14.60	9.40±5.31	33.08±6.78	16.58±9.82	2.18±0.95	.122±0.02
10-18-75	32.04±3.93	13.24±3.54	.948±.281	1.24±.140	10.82±2.04	8.60±.465	3.22±1.66	40.51±2.84	7.47±.35	4.57±3.82	1.10±.99

TABLE 11. Calcium, magnesium, potassium and sodium concentration in mg/liter in water samples[1]

Location	Date	Ca	Mg	K	Na
Fenton Lake	7/15/75	11.12±0.92[2]	1.72±0.05	2.02±0.01	7.48±0.08
Fenton Lake inlet	7/15/75	20.70	3.45	2.31	7.75
Lagunitas Lake One	7/8/75	50.60	7.13	0.64	2.30
Lagunitas Lake Two	7/8/75	15.33±0.77	2.99±0.00	0.57±0.00	1.97±0.07
Hopewell Lake	7/8/75	4.60±0.00	1.15±0.00	1.08±0.01	1.91±0.04
Eagle Nest Lake	7/9/75	41.86±1.13	8.92±0.11	2.21±0.01	11.68±0.06
Eagle Nest Lake inlet	7/9/75	41.40	9.43	2.19	11.70
Eagle Nest Lake flume	7/9/75	41.40	9.43	2.24	11.75

[1]All samples were filtered through 0.45 μ membrane filters. Fenton Lake, Lagùnitas Lake Two, Hopewell Lake and Eagle Nest Lake values are means for surface and 1 or 1.5 meter depths at the regular sample sites.

[2]Standard error

TABLE 11 a

Oxygen concentration in water samples as mg O_2 per liter.
Oxygen measurements were by the Winkler method unless otherwise noted.

EAGLE NEST LAKE

	Station 1		Station 2	Station 3			Flume	Station 6
Date	Surface	1.5 M	Surface	Surface	1.5 M	6.0 M		(Inlet)
6/24/75	8.3	7.5	9.0	9.0	9.0	-	7.8	7.4
7/9/75	10.0	10.2	8.8	10.7	12.3	10.1	10.8	-
7/23/75	-	-	-	10.1	10.1	8.4	7.6	8.4
8/6/75	10.3	11.1	9.3	12.5	12.3	9.7	7.7	9.5
8/19/75	6.8	6.0	7.2	7.3	6.9	8.4	6.7	-
9/16/75	-	-	-	4.6	1.4	-	-	-
10/18/75	-	8.2	7.4*(1M)	8.5	8.9	7.8	-	9.4

FENTON LAKE

	Station 1			Station 2		Station 3		Inlet
Date	Surface	1.5 M	6.0 M	Surface	1.5 M	Surface	1.0 M	
7/1/75	9.2	9.7	-	9.2	9.9	9.3	9.6	7.6
7/15/75	12.2	12.7	1.0(5M)	12.7	11.8	11.9	12.2	8.1
7/29/75	8.2	5.9	-	-	9.2	9.2	8.3	8.0
8/12/75	9.0	8.0	7.4	9.0	9.2	11.1	10.6	-
9/9/75	-	5.7	4.0	7.5	8.7	-	-	-
10/7/75	10.2*	10.2*	9.8*	10.0*	8.2*	10.3*	8.2*	-

HOPEWELL LAKE

	Station 1			Station 2	
Date	Surface	1.5 M	3.0 M	Surface	1.0 M
6/24/75	8.3	7.6	-	7.8	7.5
7/8/75	9.8	10.0	-	10.1	9.3
7/22/75	11.3	12.6	-	10.8	9.1
8/15/75	8.0	8.1	2.6(5M)	8.7	10.2
9/1/75	8.4	-	2.5	-	9.0
9/30/75	8.6(9.4*)	9.0(4.2*)	1.6*	10.2	9.6

LAGUNITAS LAKES

	Lake One	Lake Two			
		Station 1		Station 2	
Date		Surface	1.0 M	Surface	0.5 M
6/24/75	13.5	10.7	-	10.8	-
7/8/75	12.0	12.8	14.8	14.8	14.6
7/22/75	15.1	10.8	11.7	10.5	11.8
8/5/75	14.1	9.3	9.9	10.1	9.9
9/30/75	15.4	10.7	10.2	10.5	-

* Measured in the field with an oxygen electrode.

TABLE 11 b

Chlorophyll a concentration in water samples in mg/m^3

EAGLE NEST LAKE

	Station 1		Station 2	Station 3			Station 4
Date	Surface	1.5 M	Surface	Surface	1.5 M	6.0 M	Surface
7/23/75	-	-	-	38	52	-	-
8/6/75	34	10	44	76	100	34	78
8/19/75	39	20	47	35	47	24	0
9/16/75	71	10	28	19	5	-	34
10/18/75	14	10	34	43	-	-	-

FENTON LAKE

	Station 1		Station 2		Station 3	
Date	Surface	1.5 M	Surface	1.5 M	Surface	1.0 M
7/15/75	98	66	38	65	65	49
7/29/75	42	21	0	24	20	45
8/12/75	-	-	-	-	15	0

HOPEWELL LAKE

	Station 1		Station 2	
Date	Surface	1.5 M	Surface	1.0 M
7/22/75	110	186	43	48
8/5/75	20	20	22	37
9/1/75	64	10	139	102
9/30/75	66	0	72	-

LAGUNITAS LAKES

	Lake One	Lake Two			
		Station 1		Station 2	
Date	Surface	Surface	1.0 M	Surface	0.5 M
7/22/75	24	43	38	19	66
8/5/75	6	20	8	10	6
9/30/75	-	0	-	-	-

TABLE 11c

Total carbon dioxide as mg CO_2/liter

Eagle Nest Lake

	Station 1				Station 2			Station 3					Flume
Date	Surf	1 M	2 M	3 M	Surf	1 M	2 M	Surf	1 M	2 M	3 M	6 M	
01/07/75	157	-	-	-	155	-	-	149	-	-	-	150	-
02/20/75	99	100	-	-	99	-	-	117	104	-	-	105	102
03/25/75	-	58	-	-	-	-	-	-	-	-	-	-	87
05/27/75	138	128	123	-	130	130	142	128	136	123	113	129	-
06/11/75	123	125	130	-	132	127	130	132	127	128	124	-	128
06/25/75	129	133	128	-	131	127	130	126	129	127	130	-	129
07/09/75	94	84	95	-	105	103	93	88	91	84	82	-	-
07/23/75	-	-	-	-	-	-	-	82	82	85	96	-	-
08/06/75	96	93	77	92	80	90	90	83	66	69	79	-	-
08/19/75	97	90	93	99	99	103	97	110	110	96	128	-	-
09/16/75	117	117	120	117	114	118	108	122	115	112	113	-	-
10/18/75	115	131	122	-	-	-	130	-	123	124	-	-	-

Fenton Lake

	Station 1			Station 2			Station 3		Inlet
Date	Surf	1 M	2 M	Surf	1 M	2 M	Surf	1 M	
10/26/74	-	-	-	49	-	-	52	-	-
12/07/74	45	46	-	47	53	-	51	48	46
01/26/75	48	59	-	52	51	-	48	-	-
03/01/75	37	43	-	35	42	-	35	35	27
05/20/75	33	35	-	33	31	-	33	30	33
06/03/75	33	31	37	33	39	39	37	37	-
06/17/75	45	41	41	44	42	41	41	43	41
07/01/75	23	24	25	18	19	14	14	9.7	-
07/15/75	7.9	4.4	7.9	7.0	15.8	25	28	7.9	-
07/29/75	25	24	23	27	30	27	25	26	-
08/12/75	18	26	33	22	21	32	18	20	-
09/09/75	35	19	19	30	14	28	26	23	-
10/07/75	41	45	40	42	-	42	42	45	40

Hopewell Lake

	Station 1			Station 2	
Date	Surf	1 M	2 M	Surf	1 M
06/10/75	15	8.8	11	26	14
06/24/75	21	22	22	-	-
07/08/75	34	48	-	23	17
07/22/75	6.2	2.6	7.0	10.6	15
08/05/75	29	18	18	13	13
09/01/75	36	30	-	-	33
09/30/75	-	28	-	32	-

Lagunitas Lakes

	Lake One	Lake Two			
		Station 1		Station 2	
Date	Surf	Surf	1 M	Surf	1 M
06/10/75	41	16	-	47	-
06/24/75	56	35	57	28	14
07/08/75	38	11	16	11	-
07/22/75	26	27	28	18	15
08/05/75	11	45	34	46	41

TABLE 12

Aerobic Bacteria/100 ml in Eagle Nest Lake

	Station 1		Station 2	Station 3			flume	Station 4	Station 5	Station 6
Date	Surface	1.5 m	Surface	Surface	1.5 m	6 m		Surface	Surface	
10-19-74	470	650	1,320	830	---	---	1,260	---	---	---
11-30-74	960	1,360	1,410	2,120	---	---	4,700	---	---	---
1-7-75	10,180	5,210	410	2,235	5,180	5,180	2,815	---	---	---
2-20-75	20,010	10,020	20,240	20,010	20,020	2,020	2,030	---	---	---
3-25-75	5,130	2,120	50,030	35,110	12,360	21,130	2,680	---	---	---
4-29-75	---	---	2,680	1,520	3,600	---	3,648	---	---	---
5-27-75	7,240	4,720	7,900	4,900	5,400	4,400	6,540	6,200	9,440	20,420
6-11-75	9,680	9,700	8,080	6,680	4,540	5,240	2,480	1,740	4,700	17,480
6-25-75	5,080	4,580	14,760	7,580	6,580	---	2,840	---	---	7,400
7-9-75	860	600	2,320	860	2,780	2,300	2,760	1,280	---	43,000
7-23-75	---	---	---	137,960	10,500	---	3,380	---	---	162,000
8-6-75	30,060	31,400	28,040	59,880	31,760	36,420	3,680	---	---	114,000
9-20-75	8,601	10,360	12,460	17,660	19,160	25,380	13,520	---	---	11,640
9-16-75	4,020	3,080	8,550	4,330	4,650	9,200	6,570	10,400	---	26,400
10-18-75	293	92	447	541	636	698	---	---	---	656

Table 13

Anaerobic Bacteria/100 ml in Eagle Nest Lake

	Station 1		Station 2	Station 3			flume	Station 4	Station 5	Station 6
Date	Surface	1.5 -	Surface	Surface	1.5 m	6.0 m		Surface	Surface	
10-19-74	1,050	910	1,040	580	---	---	175	---	---	---
11-30-74	3,330	7,370	3,080	---	---	---	---	---	---	---
1-7-75	450	140	440	3,505	1,940	2,220	3,855	---	---	---
2-20-75	30	20	320	1,050	640	0	1,350	---	---	---
3-25-75	130	0	50,370	10,030	4,140	3,150	1,220	---	---	---
4-29-75	---	---	1,560	1,460	1,460	---	1,100	---	---	---
5-27-75	2,480	1,720	2,180	1,320	1,520	2,280	3,020	1,720	3,880	8,580
6-11-75	960	1,020	460	760	560	440	480	200	2,460	11,400
6-25-75	1,360	3,800	1,160	1,800	720	---	680	---	---	6,660
7-9-75	120	240	520	380	100	1,160	1,180	100	---	44,200
7-23-75	---	---	---	3,220	1,520	---	1,920	---	---	60,000
8-6-75	---	12,320	19,380	10,560	---	1,720	1,260	---	---	3,600
8-20-75	750	1,780	6,480	1,240	13,000	29,100	8,500	---	---	5,540
9-16-75	2,400	1,230	10,940	3,730	9,940	5,840	29,850	31,350	---	54,500
10-18-75	37	12	97	505	1,100	725	---	---	---	740

Table 14

Actinomycetes/100 ml in Eagle Nest Lake

	Station 1		Station 2	Station 3			flume	Station 4	Station 5	Station 6
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		Surface	Surface	
10-19-74	-	-	-	-	-	-	-	-	-	-
10-30-74	-	-	-	-	-	-	-	-	-	-
1-7-75	-	-	-	-	-	-	-	-	-	-
2-20-75	0	0	0	0	0	0	0	-	-	-
3-25-75	0	0	0	0	0	0	0	-	-	-
4-29-75	-	-	0	10	35	-	10	-	-	-
5-27-75	5	0	30	0	20	0	40	15	0	0
6-11-75	20	15	0	0	5	0	0	0	0	0
6-25-75	0	0	0	0	0	-	0	-	-	0
7-9-75	5	5	0	0	0	0	20	0	-	120
7-23-75	-	-	-	40	30	-	80	-	-	1,200
8-6-75	25	15	5	10	25	10	45	-	-	30
8-20-75	55	15	20	0	50	0	35	-	-	95
9-16-75	25	35	20	155	100	110	330	80	-	25
10-18-75	30	20	45	85	30	60	-	-	-	0

TABLE 15

Molds/100 ml in Eagle Nest Lake

	Station 1		Station 2	Station 3			flume	Station 4	Station 5	Station 6
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		Surface	Surface	
10-19-74	4	4	0	0	-	-	0	-	-	-
11-30-74	20	0	20	130	-	-	0	-	-	-
1-7-75	105	15	10	215	10	35	5	-	-	-
2-20-75	30	10	35	25	0	0	0	-	-	-
3-25-75	75	5	130	10	0	0	0	-	-	-
4-29-75	-	-	15	10	5	-	5	-	-	-
5-27-75	10	5	70	0	0	5	0	15	0	0
6-11-75	10	20	20	50	10	15	5	35	25	10
6-25-75	5	0	5	0	25	-	0	-	-	10
7-9-75	0	0	0	0	9	0	20	6	-	120
7-25-75	-	-	-	100	20	-	5	-	-	85
8-6-75	125	0	0	0	0		5	-	-	0
8-20-75	-	-	-	-	-	-	-	-	-	-
9-16-75	45	10	95	1,150	120	1,125	1,750	85	-	0
10-18-75	10	15	70	0	15	15		-	-	0

TABLE 16

Fecal Coliform/100 ml at Eagle Nest Lake

	Station 1		Station 2	Station 3			flume	Station 4	Station 5	Station 6
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		Surface	Surface	
10-19-74	0	0	1	0	-	-	0	-	-	-
11-30-74	0	0	0	0	-	-	0	-	-	-
1-7-75	4	0	0	2	0	2	4	-	-	-
2-20-75	3	0	0	2	0	5	1	-	-	-
3-25-75	0	0	39	0	0	0	2	-	-	-
4-29-75	-	-	6	0	0	-	0	-	-	-
5-27-75	0	0	1	0	0	0	0	0	1	3
6-11-75	5	0	1	2	1	0	9	0	2	48
6-25-75	3	2	0	8	3	-	6	-	-	44
7-9-75	2	4	2	0	0	0	8	1	-	300
7-23-75	-	-	-	1	0	-	9	-	-	50
8-6-75	0	0	0	41	0		63	-	-	58
8-20-75	0	0	0	1	24	5	0	-	-	5
9-16-75	0	0	0	0	0	0	0	2	-	93
10-18-75	1	2	0	0	0	0	-	-	-	15

Table 17

Fecal Streptococci/100 ml at Eagle Nest Lake

	Station 1		Station 2	Station 3			flume	Station 4	Station 5	Station 6
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		Surface	Surface	
10-17-74	10	1	0	1	-	-	1	-	-	-
11-30-74	0	2	9	0	-	-	102	-	-	-
1-7-75	0	2	0	0	0	0	0	-	-	-
2-20-75	0	0	0	0	0	0	0	-	-	-
3-25-75	0	0	64	2	1	0	0	-	-	-
4-29-75	-	-	3	2	0	-	1	-	-	-
5-27-75	0	0	6	0	0	2	1	0	4	31
6-11-75	0	1	0	0	1	1	1	1	1	194
6-25-75	7	1	0	3	7	-	2	-	-	152
7-9-75	7	2	2	1	3	1	83	0	-	500
7-23-75	-	-	-	96	3	-	1	-	-	1,000
8-6-75	3	0	0	0	0	10	2	-	-	74
8-20-75	0	0	0	12	4	67	0	-	-	18
9-16-75	0	0	0	1	0	0	0	1	0	54
10-18-75	0	0	25	36	31	1	-	-	-	77

TABLE 18

Invertebrates/100 ml at Eagle Nest Lake

	Station 1		Station 2	Station 3			flume	Station 4	Station 5	Station 6
Date	Surface	1.5 m	Surface	Surface	1.5 m	6.0 m		Surface	Surface	
10-19-74	-	-	-	-	-	-	-	-	-	-
11-30-74	.25	2	5.75	0.5	-	-	0.25	-	-	-
1-7-75	.5	.5	2	0	0	.5	2	-	-	-
2-20-75	12	15	3	20	20	10	3	-	-	-
3-25-75	0	0	0	0	0	3	4	-	-	-
4-29-75	-	-	10	6	4	-	2	-	-	-
5-27-75	5	20	1	5	40	6	8	4	30	0
6-11-75	0	0	0	0	0	0	0	0	0	0
6-25-75	0	0	0	0	0	0	0	0	0	0
7-9-75	0	0	0	0	0	0	0	0	0	0
7-23-75	0	0	0	0	0	0	0	0	0	0
8-6-75	0	0	0	0	0	0	0	0	0	0
8-20-75	2	12	0	28	23	22	0	-	-	0
9-16-75	1	6	2	0	2	0	3	2	-	0
10-18-75	3	0	3	1	7	7	-	-	-	0

TABLE 19

SHANNON-WIENER INDICES FOR EAGLE NEST LAKE

Date	Station	H'max	H'	E
10-19-74	1-S	0	0	0
	1-1.5	0	0	0
	2-S	1.099	.271	.233
11-30-74	1-S	0	0	0
	1-1.5	.693	.032	.046
	2-S	0	0	0
	3-S	.693	.441	.636
	Flume	.693	.681	.993
01-07-75	1-S	.693	.602	.869
	1-1.5	0	0	0
	2-S	.693	.676	.975
	2-1.5	.693	.288	.416
	3-S	1.099	.776	.706
	3-1.5	.693	.311	.449
	Flume	.693	.681	.993
02-23-75	1-S	1.61	.540	.335
	1-1.5	1.38	.622	.451
	2-S	1.79	.739	.412
	3-S	1.61	1.041	.647
	3-1.5	1.386	.840	.606
	3-6	1.099	.896	.888
	Flume	.693	.232	.335
03-25-75	1-S	1.609	.143	.089
	1-1.5	1.099	.097	.088
	2-1.5	1.386	.393	.284
	3-S	1.099	.142	.129
	3-1.5	1.099	.705	.641
	Flume	1.609	1.226	.762
04-29-75	2-S	1.609	.480	.298
	3-S	1.792	.569	.318
	3-1.5	1.609	.725	.451
	Flume	1.386	.590	.426
	1-S	1.792	.635	.354
	1-1.5	1.792	1.286	.718
	2-S	1.609	1.025	.637
	2-1	1.386	.704	.508
	3-S	1.386	.932	.672
	3-1.5	1.386	1.196	.863
	Flume	0	0	0

Date	Station	H'max	H'	E
06-10-75	1-S	1.792	.931	.520
	1-1.5	1.386	.550	.397
	2-S	1.306	1.295	.934
	3-S	1.609	.702	.436
	3-1.5	1.792	1.416	.790
	3-6	1.386	.894	.645
	Flume	1.386	1.370	.988
	4-S	1.609	1.484	.922
	5-S	1.602	1.270	.789
06-24-75	1-S	1.609	1.474	.916
	2-S	1.386	1.256	.906
	3-S	1.609	1.593	.990
	3-1.5	.693	.981	.680
	Flume	1.099	.904	.823
07-09-75	1-S	1.386	.324	.234
	1-1.5	1.099	.888	.808
	2-S	1.386	.629	.454
	3-S	1.386	.430	.310
	3-1.5	1.099	.709	.645
	Flume	1.099	.834	.759
	4-S	1.099	.511	.465
07-23-75	3-S	1.386	.464	.339
	3-1.5	1.386	.464	.339
	Flume	.693	.599	.807
	1-S	1.386	.416	.300
	1-1.5	1.386	.581	.419
	2-S	1.792	.864	.482
	3-S	1.609	.370	.230
	3-1.5	1.609	.542	.337
	3-6	1.609	.495	.308
	Flume	.693	.636	.918
08-20-75	1-S	.693	.015	.022
	1-1.5	.693	.146	.211
	2-S	0	0	0
	2-1.5	1.099	.203	.185
	3-S	1.099	.133	.121
	3-1.5	.693	.124	.179
	Flume	0	0	0
	Inlet	0	0	0
09-16-75	1-S	1.099	.063	.057
	1-1.5	1.099	.144	.131
	2-S	1.099	.028	.025
	3-S	1.386	.179	.129
	3-1.5	1.099	.249	.227
	3-6	1.099	.181	.105
	Flume	.693	.605	.873

Date	Station	H'max	H'	E
10-18-75	1-1.5	1.099	.230	.209
	2-S	1.099	.383	.348
	3-S	1.099	.193	.176
	3-1.5	0	0	0
	3-6	1.099	.557	.507
	Inlet	1.099	.905	.823

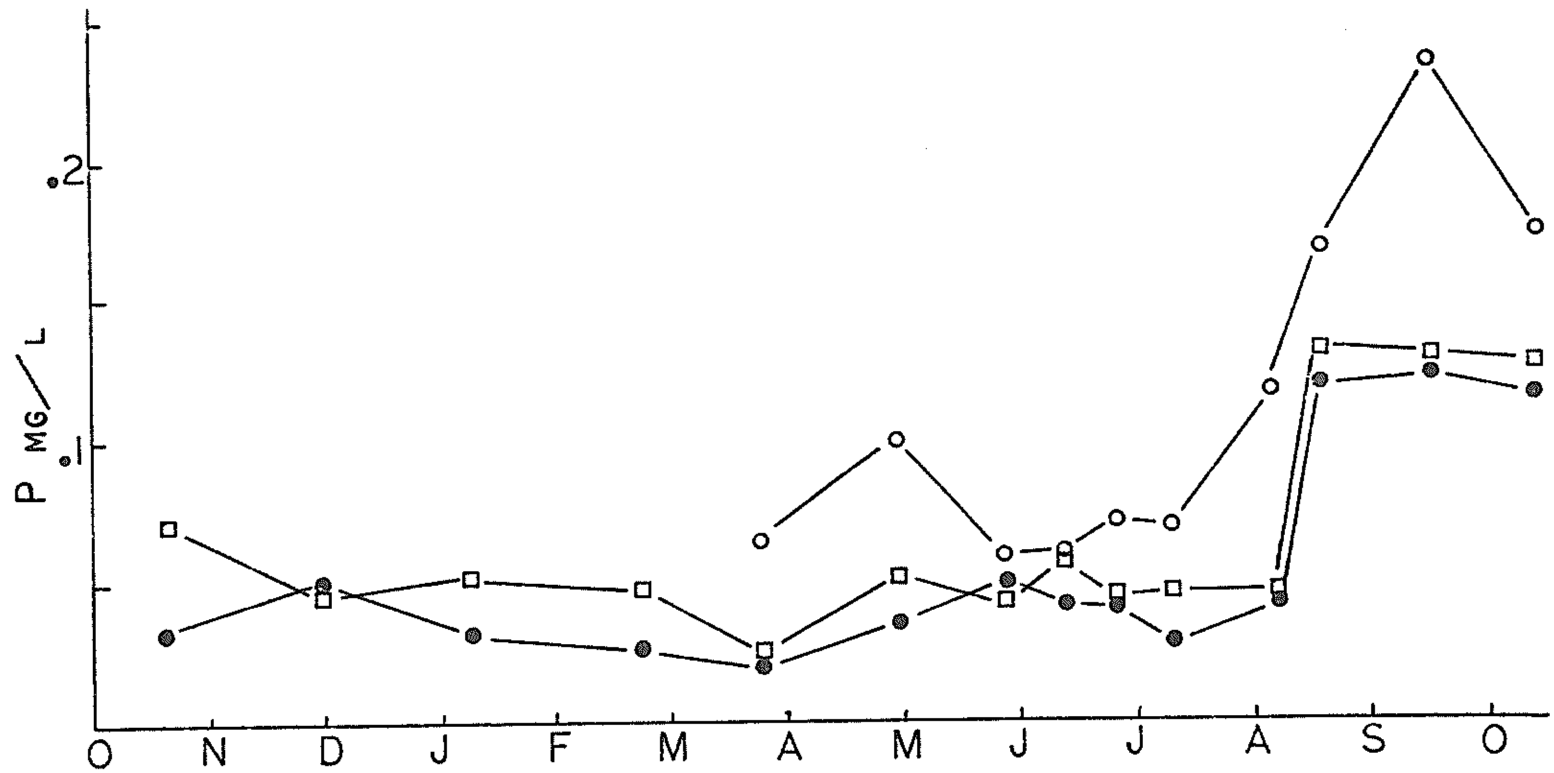


Figure 2. Phosphorus Analysis of Water from Eagle Nest Lake. Samples were filtered through 0.45 μ membrane filters and analyzed for orthophosphate (● - ●) and total filtered phosphorus (□ - □). Total phosphorus (○ - ○) was determined using unfiltered samples. Values are means for surface and 1.5 meter depths at sample stations 1 and 2.

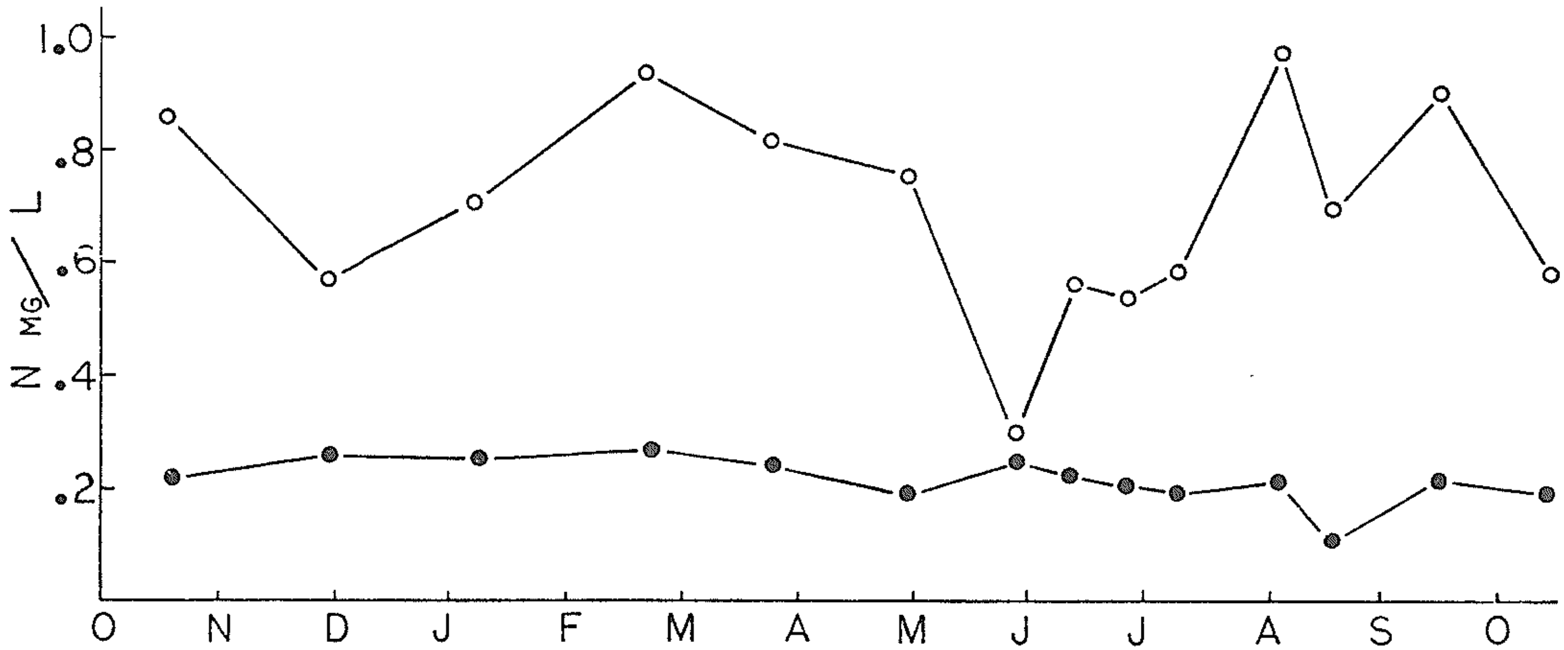


Figure 3. Nitrogen Analysis of Water from Eagle Nest Lake. Nitrate (● - ●) measurements were made on water filtered through 0.45 μ membrane filters. Total nitrogen (○ - ○) was determined using unfiltered samples. Values are means for surface and 1.5 meter depths at sample station 1 and 2.

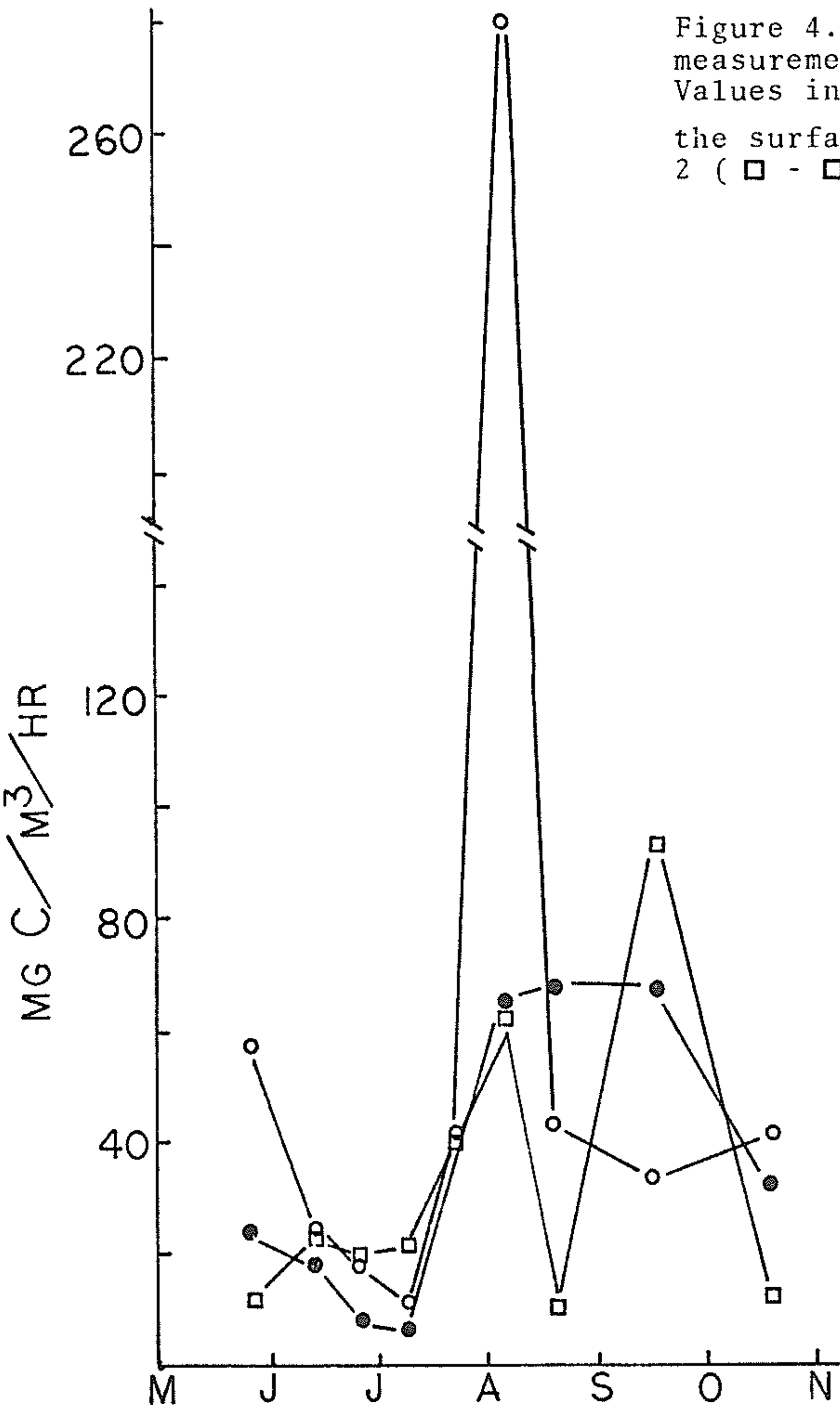
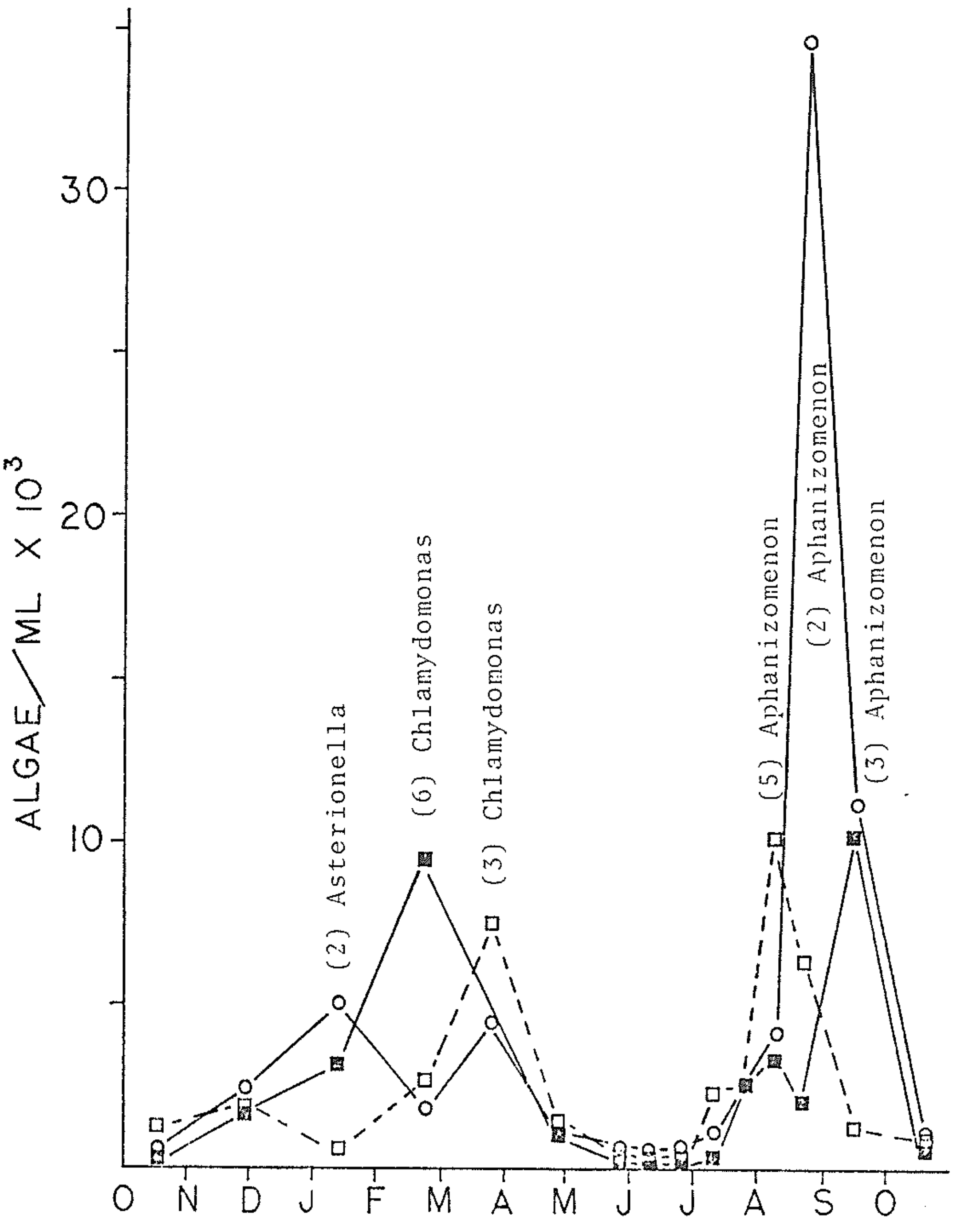


Figure 4. Primary Productivity measurements at Eagle Nest Lake. Values indicate CO_2 fixation at the surface at stations 1 (● - ●), 2 (□ - □) and 3 (○ - ○).

Figure 5. Abundance of Algae at Eagle Nest Lake. The number of algae are indicated at the surfaces of stations 1 (O - O), 2 (■ - ■), and 3 (□ - □). The number in parentheses indicates the number of algal species at that time and the predominant algae is listed.



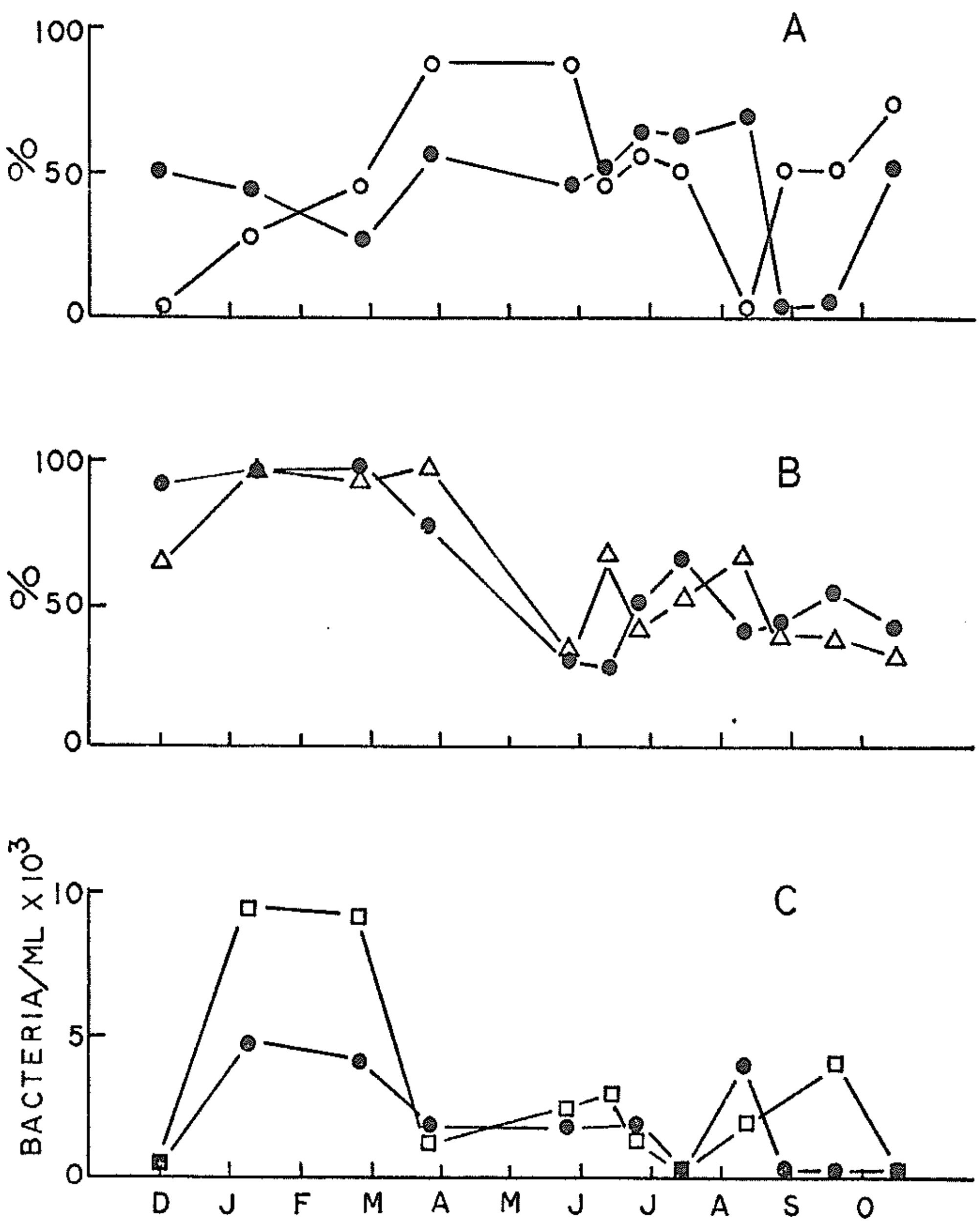


Figure 6. Evaluation of Bacteria in Eagle Nest Lake. A indicates the number of N_2 liberating bacteria divided in the number of N_2 liberating bacteria plus the number of bacteria producing NH_3 X 100 (○ - ○) and the number of starch hydrolyzing bacteria divided by the number of potein hydrolyzing bacteria plus the number of starch hydrolyzing bacteria X 100 (● - ●). B indicates the percentage of aerobic bacteria that had cream-colored colonies (● - ●) and pinpoint colonies (▲ - ▲). C indicates the number of starch hydrolyzing bacteria (● - ●) and protein hydrolyzing bacteria (□ - □).

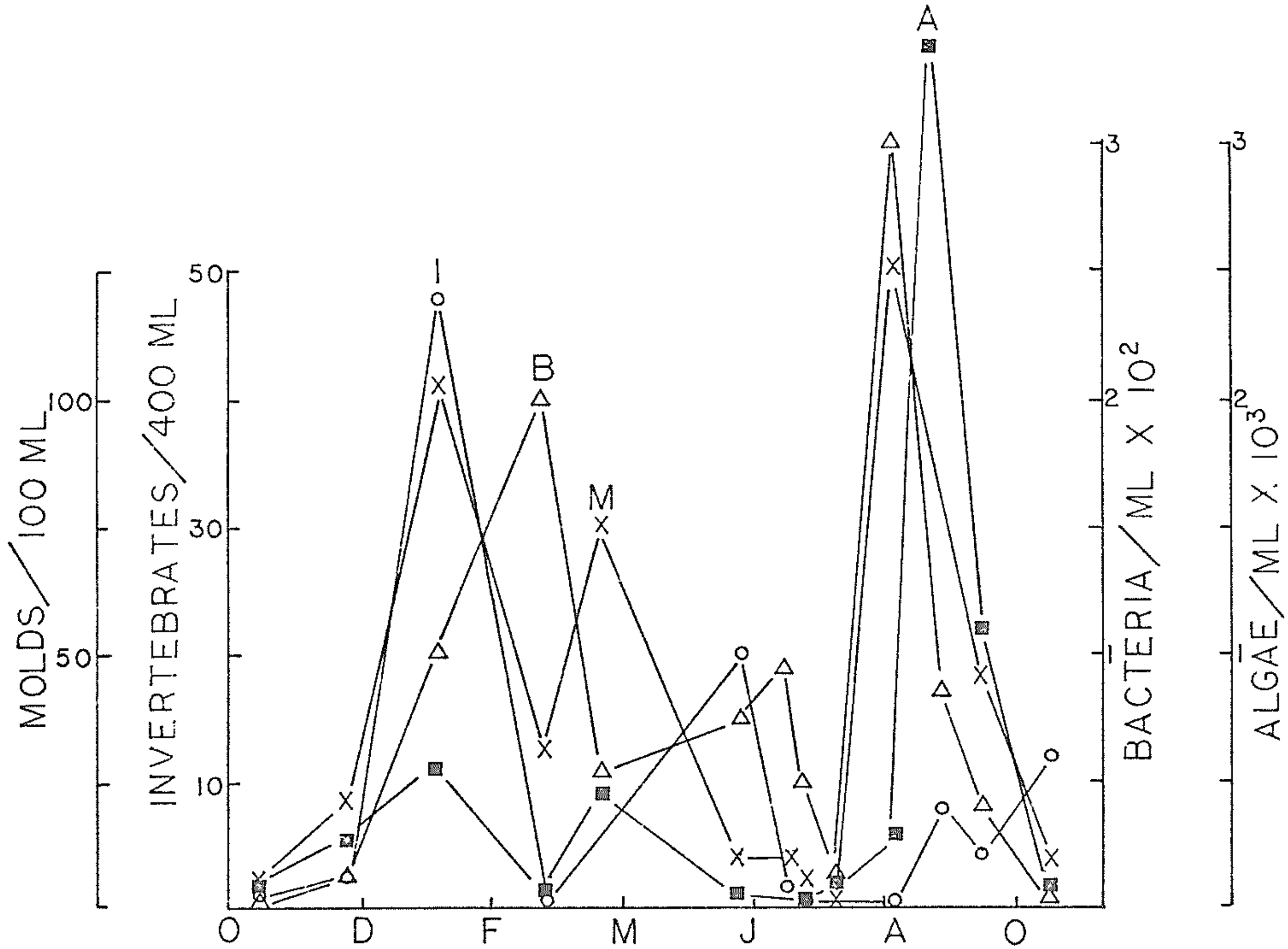


Figure 7. The abundance of organisms on Eagle Nest Lake at the surface of station 1. Invertebrates (o - o), bacteria (Δ - Δ), molds (X - X), and algae (■ - ■).

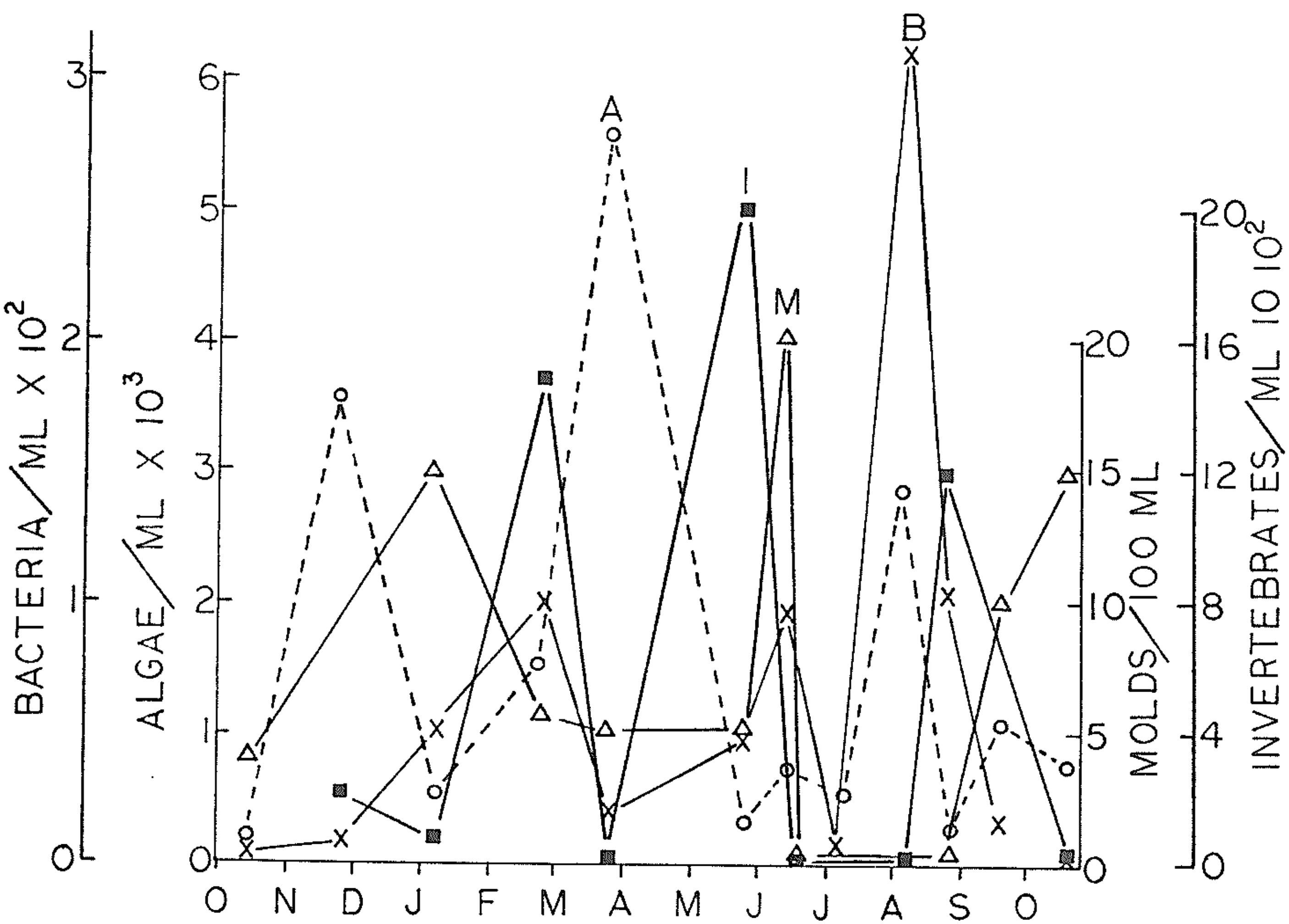


Figure 8. Abundance of organisms at the 1.5 meter depth of station 1 at Eagle Nest Lake. Invertebrates (■ - ■), bacteria (X - X), molds (△ - △), and algae (o - o).

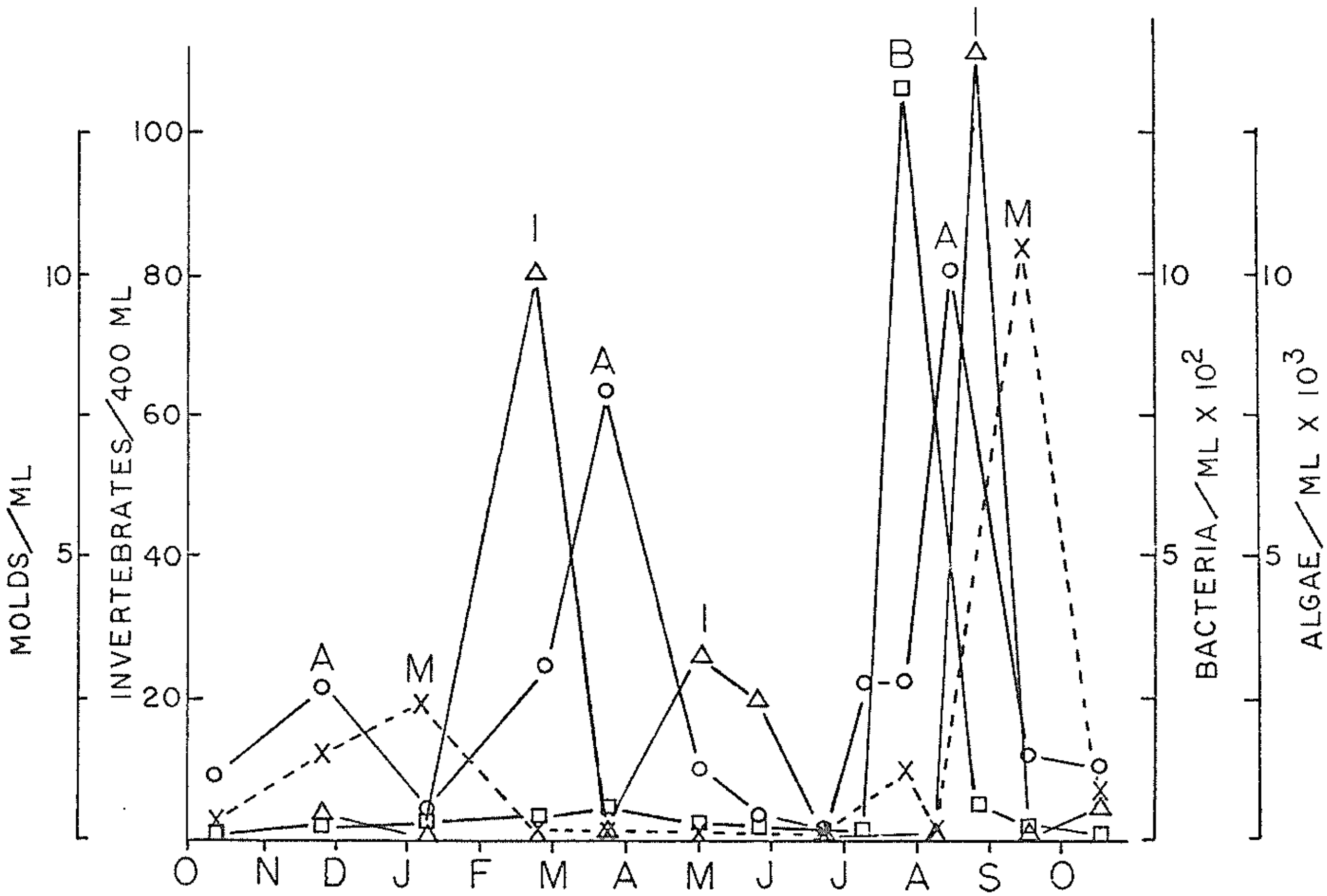


Figure 9. Abundance of organisms at the surface of station 3 at Eagle Nest Lake. Invertebrates (△ - △), algae (o - o), bacteria (□ - □), and molds (X - X).

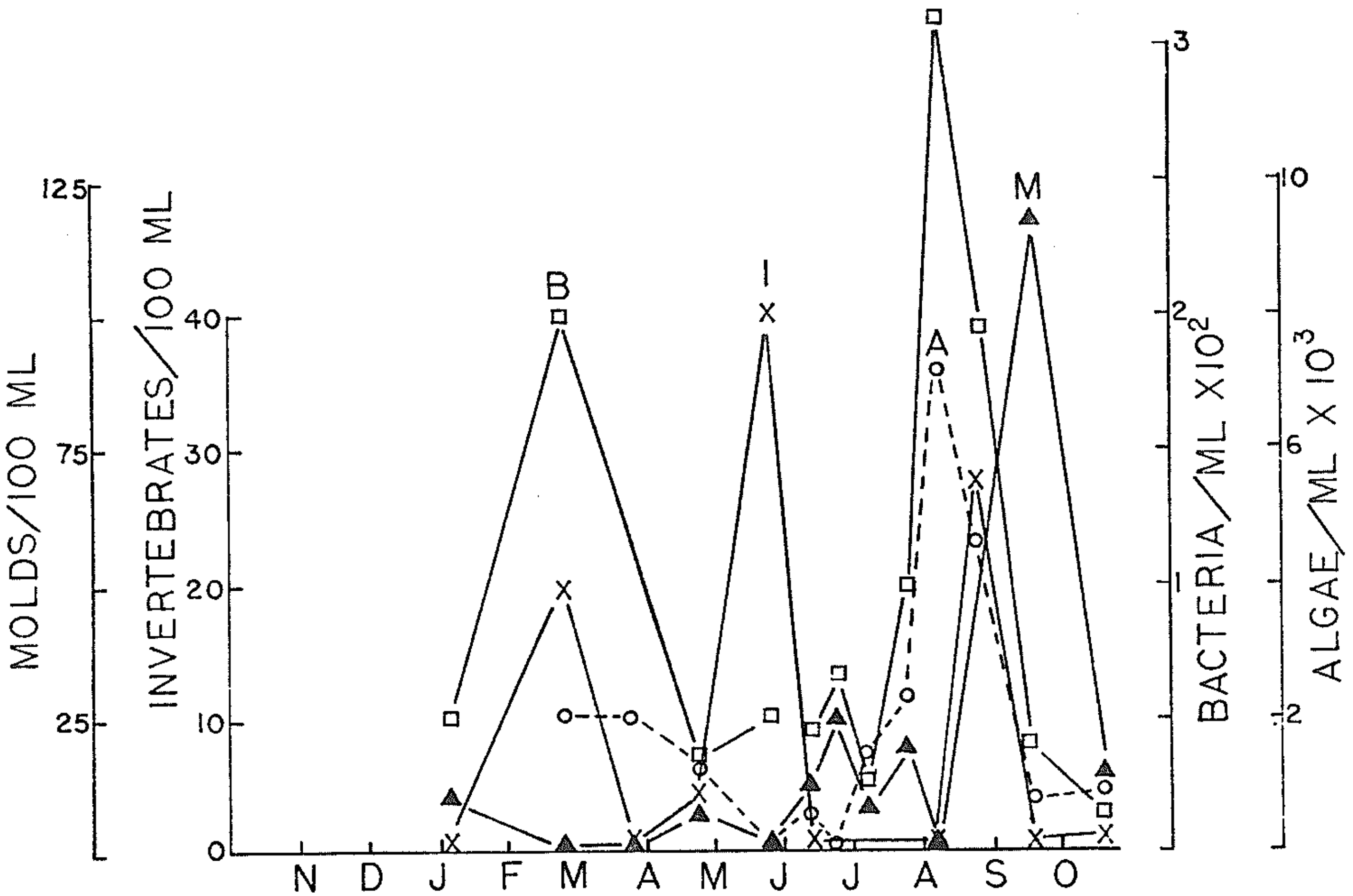


Figure 10. Abundance of organisms at the 1.5 meter depth at station 3 at Eagle Nest Lake. Bacteria (□ - □), invertebrates (X - X), algae (o - o), and molds (▲ - ▲).

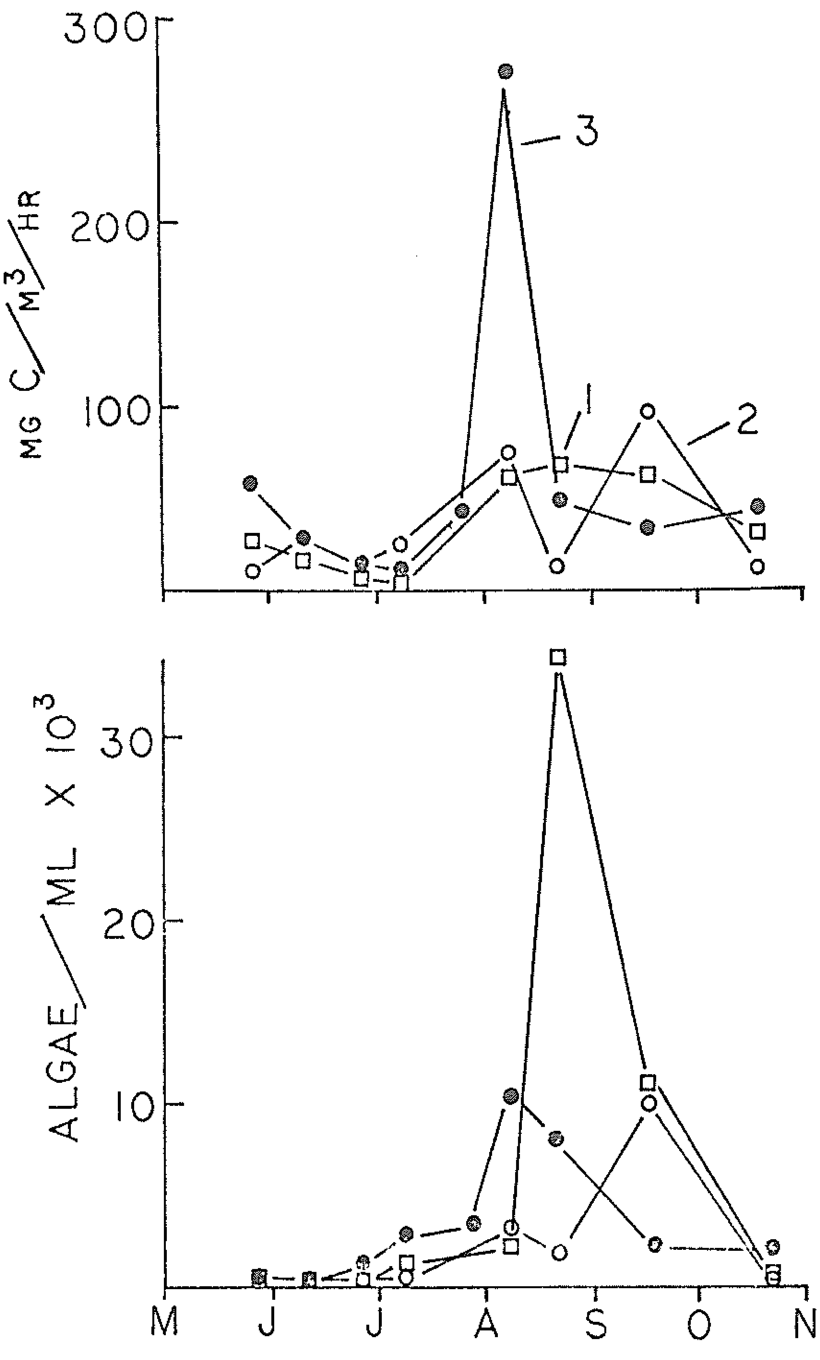


Figure 11. Comparison of primary productivity and algal numbers at Eagle Nest Lake. Values to surface levels at stations 1 (□ - □), 2 (○ - ○), and 3 (● - ●) are presented.

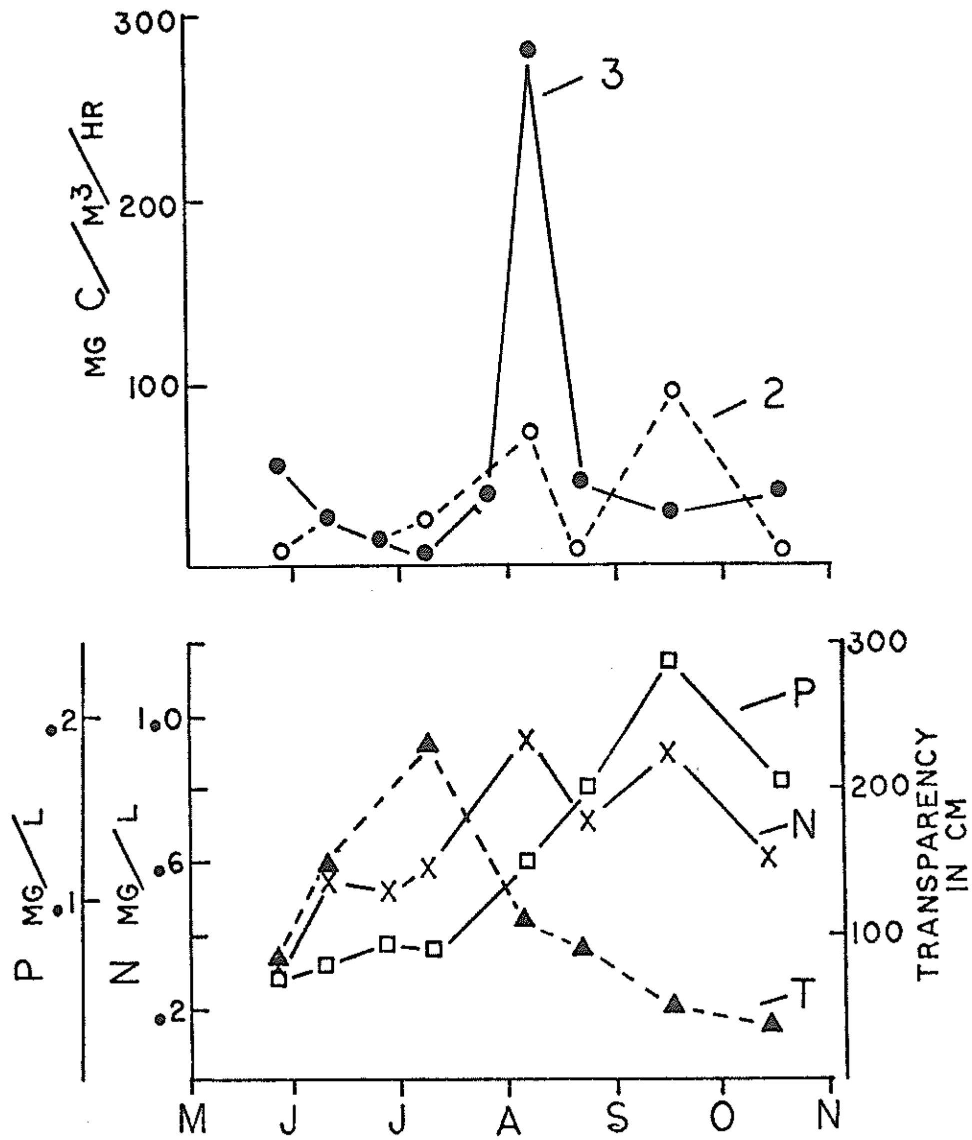


Figure 12. Comparison of primary productivity to transparency and nitrogen and phosphorus levels in Eagle Nest Lake. Values are indicated for surface levels of station 2 (O - O) and 3 (● - ●). Total nitrogen (X - X) and total phosphorus (□ - □) values are from unfiltered samples. Transparency (▲ - ▲) was measured with a Seechi disc.

Fenton Lake

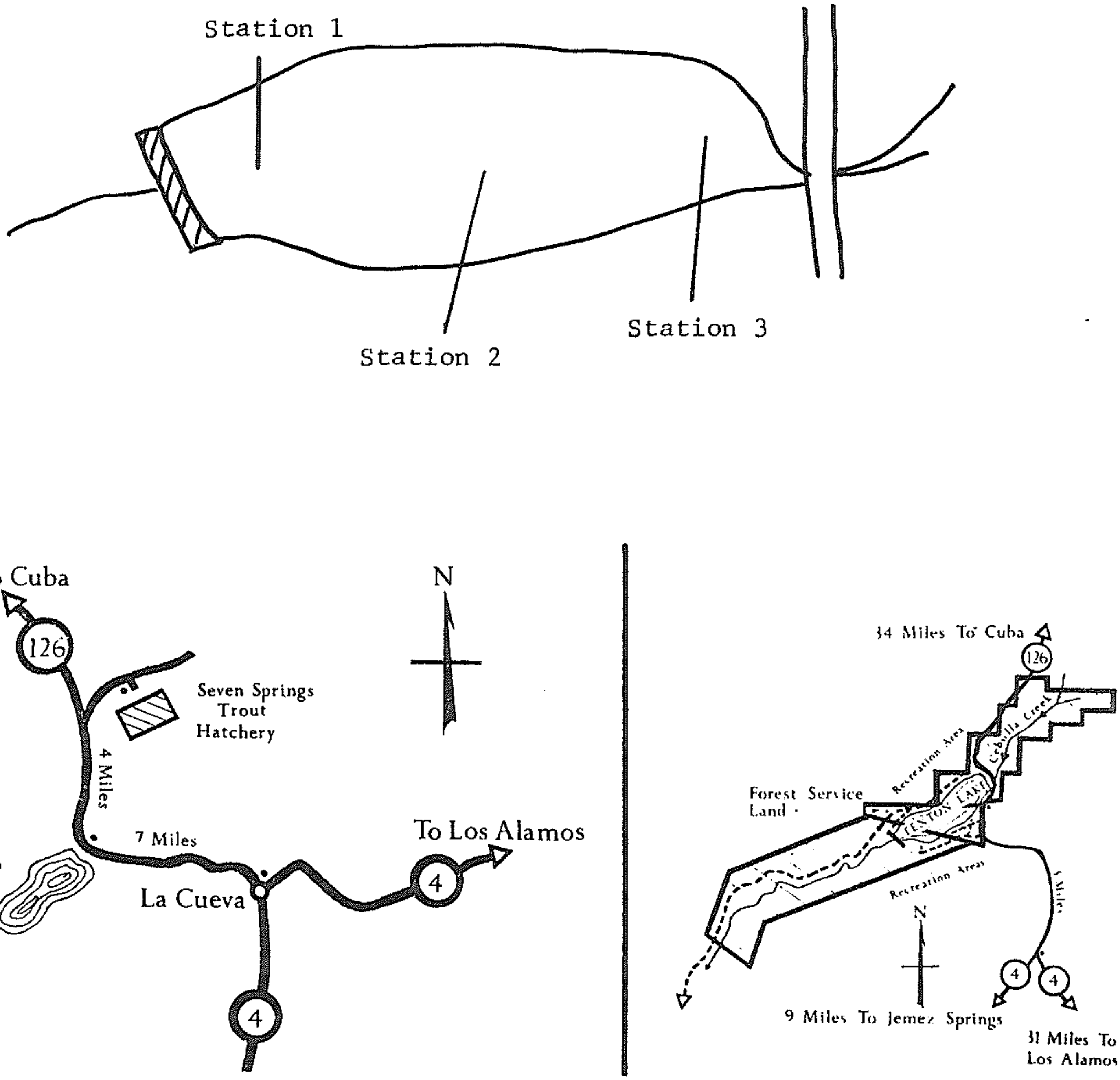
1. <u>Location</u>

Fenton Lake, at an elevation of about 7,500 feet, was established by an earthen dam in 1942 and covers 25 surface acres. It is located in Jemez Mountains and is probably one of the most heavily fished spots in New Mexico. Conifers surround the lake and the camping and picnicking sites around the lake are heavily used. The location and sampling stations are indicated on the maps on the following page(Fig. 14).

2. <u>Sampling Stations</u>.

Three stations on the lake were examined and when the inlet was not frozen, it too was monitored. Station 1 is near the dam and was the deepest, 5 to 6 meters, while Stations 2 and 3 were about 3 and 1.5 meters deep, respectively. A considerable amount of the higher plant, <u>Elodea canadensis</u>, was present throughout the lake. Although the <u>Elodea</u> proliferation was not quantified, it was observed to nearly disappear during the winter, but by the summer covered virtually the entire bottom of the lake. Sampling depths were all at the surface and 1.5 meters. The ice cover on the lake extended from early December through April with a maximum depth of about 2 feet at all three stations.

Figure 14 Fenton Lake Showing Location and Sampling Stations



3. Water Temperature and Transparency

As shown in Table 1, Fenton Lake is about 20 C for July and part of August. The snow melt was later in 1975 than other years and this slow warming of the lake retarded the growth of the aquatic plants and the total "crop" of *Elodea* was less than observed other years. The turbidity observed in May was considered to be due to suspended solids as a result of run-off as well as to an algal bloom (Table 2, 3). A good correlation of data from Secchi disc transparency and measurements of incident light occurred.

4. Biological Measurements

Algal activity was considerable at four different periods throughout the investigation: December, 1974; March, May, and July, 1975 (Fig. 20, Table 53, Appendix). Appreciable primary productivity occurred between May and August and may have been appreciable under the ice (Table 23, Fig. 18, 19). Bacterial activities, on the other hand, were appreciable only in August, with slight increases in bacterial numbers observed in May (Table 25, Fig. 21). There appeared to be good correlations of bacteria (both anaerobic and aerobic) to algae at Station 1 at the surface and depth of 1.5 meters (Fig. 23).

The large number of algal types is reflected in the large Shannon-Wiener Indices and only in a few cases was the E-value less than 0.1 indicating predominance of one species (Table 29, Table 53, Appendix). Only on 15 July, 1975 did a blue-green alga (*Anabaena*) predominate.

Primary productivity of Fenton Lake was quite high from late May until the beginning of July when it dropped greatly (Table 23, Fig. 18). This was followed by a rather large increase in mid-July; however, subsequent measurements into October were all quite low. A very noticeable increase in transparency of the water occurred when productivity decreased abruptly, and this is apparent in measurements with the Secchi disc and of the depth of light penetration (Table 2, 3).

The *Elodea* in the lake, in addition to being a nuisance for fishermen, appeared to play a major role in the ecology of the lake. The aquatic plant would trap available nutrients as they came into the lake and the *Elodea* severely limited algal growth by mid-summer. *Elodea* must be a major portion of the primary productivity of the lake. The growth of *Chlamydomonas* early in the year and under the ice could be accomplished by bacteria and molds decomposing the higher plants.

Analysis of samples of *Elodea canadensis* collected in several areas in the lake indicated that the tissue contents of nitrogen tended to decrease gradually from June through October, while the phosphorus content decreased from June until mid-July (Table 24, Fig. 17). Gerloff has determined critical nutrient concentrations for several species of higher aquatic plants and proposes that limiting nutrients in an aquatic system may be determined by an analysis of an appropriate higher plant species. He established 1.60% and 0.14% as the critical tissue concentrations for nitrogen and phosphorus respectively in *E. occidentalis*.

Tissue concentrations below these critical values would indicate that the nutrient is limiting for growth of this rooted aquatic macrophyte, and possibly phytoplankton as well. While Gerloff cautions that critical concentrations may vary between species, the analyses of samples from Fenton Lake suggest that neither nitrogen nor phosphorus were limiting for Elodea in Fenton Lake. Elodea absorbs nutrients both from the mud via roots, and the water, and hence utilizes nutrients not available to the phytoplankton.

5. Chemical Measurements

The pH of Fenton Lake water ranged from 6 in the winter to 9.5 during mid-summer (Table 22). The lake would be classified as a soft water lake based on a calcium concentration of 11 mg/liter (Table 11).

Total and orthophosphate in membrane-filtered water gradually increased from low levels from October until March, suggesting the release of this element as the Elodea decomposed (Table 20, 21, 21a, Fig. 15). A decline in phosphorus concentrations then occurred to low levels in May, June, and July, with a minimum in mid-July. The nitrate concentration in filtered water increased and decreased parallel to the phosphorus concentrations (Table 21b, Fig. 16). Nitrate was virtually absent from the water in mid-June and then increased to a low level. The low levels of phosphorus and nitrate in filtered water coincide closely with low primary productivity and phytoplankton numbers on 1 July and

and 29 July. Productivity was quite high on 15 July, and this corresponds with the only predominance of the nitrogen-fixing blue-green alga, *Anabaena*, at Fenton Lake. On this date there was also a marked rise in the total nitrogen content of water samples (Table 21c, Fig. 16). Phytoplankton productivity and numbers remained low in subsequent samples. It appears that as a result of severe competition for nutrients between phytoplankton and *Elodea*, the phytoplankton are relegated to a minor role in this lake by mid-summer.

TABLE 20

Orthophosphate concentrations in Fenton Lake as mg phosphorus/liter. Water samples were filtered using a 0.45u membrane filter.

Date	Station 1 Surface	Station 1 1.5m	Station 2 Surface	Station 2 1.5m
10-26-74	.014±.000	.017±.001 a	.013±.002 a	.013±.001 a
12-7-74	.015±.006 b	.032±.006	.020±.004 b	.017±.004 b
1-26-75	.062±.000 cd	.036±.000 e	.067±.002 c	.051±.001 b
3-1-75	.076±.004 b	.042±.003 c	.070±.005 b	.068±.001 b
4-8-75	.030±.004 b	.048±.002 a	.039±.001 c	.043±.003 ac
5-20-75	.016±.003	.020±.006	.012±.000 a	.012±.000 a
6-3-75	.016±.006 a	.023±.004 a	.025±.003 a	.027±.001 a
6-17-75	.020±.001 bc	.025±.002 c	.021±.002 bc	.025±.003 c
7-1-75	.020±.001 cd	.017±.002 bd	.017±.001 bd	.023±.002 c
7-15-75	.004±.000 b	.004±.000 b	.005±.001 b	.004±.000 b
7-29-75	.016±.002 b	.015±.002 b	.016±.001 b	.016±.001 b
8-12-75	.035±.002 b	.040±.004 b	.032±.001 b	.033±.006 b
9-9-75	.030±.001 b	.029±.001 b	.029±.000 b	.031±.001 b
10-7-75	.018-.001 a	.021±.001 a	.019±.000 a	.021±.001 a

Date	Station 3 Surface	Station 3 1m	Station 3 Inlet
10-26-74	.010±.004 a	.015±.000 a	---
12-7-74	.037±.005 c	.027±.001 bc	.060±.002 a
1-26-75	.069±.002 c	.055±.006 bd	.082±.003 a
3-1-75	.084±.001	.078±.002 b	.096±.004 a
4-8-75	.038±.003 c	.040±.000 c	.068±.000
5-20-75	.012±.001	.012±.000 a	.038±.001
6-3-75	.018±.002 a	.024±.002 a	.052±.004
6-17-75	.020±.002 bc	.019±.002 b	.058±.002 a
7-1-75	.022±.001 c	.022±.002 c	.076±.001 a
7-15-75	.004±.000 b	.004±.000 b	.016±.001 a
7-29-75	.019±.002 b	.018±.000 b	.081±.003 a
8-12-75	.035±.004 b	.035±.004 b	.083±.002 a
9-9-75	.029±.001 b	.030±.001 b	.065±.001 a
10-7-75	.020±.002 a	.020±.001 a	.052±.000

TABLE 21

Total phosphorus concentrations in Fenton Lake as mg phosphorus/liter. Water samples were filtered using a 0.45μ membrane filter.

	Station 1		Station 2	
Date	Surface	1.5m	Surface	1.5m
10-26-74	.050±.007	.034±.006 ca	.023±.004 bc	.042±.008 a
12-7-74	.050±.004 d	.033±.004	.059±.004 c	.034±.001 b
1-26-75	.077±.003 b	.046±.002 c	.076±.002 b	.065±.006 b
3-1-75	.091±.004 c	.066±.003 b	.081±.001 bc	.065±.003 b
4-8-75	.048±.005 a	.056±.007	.056±.003 a	.059±.004 a
5-20-75	.036±.009	.024±.003	.040±.001 a	.034±.004 a
6-3-75	.034±.003 ac	.034±.002 ac	.033±.001	.038±.004 ac
6-17-75	.037±.002 bc	.037±.004 bc	.037±.001 bc	.039±.002 b
7-1-75	.033±.003 bc	.028±.001 b	.028±.000	.032±.002 bc
7-15-75	.032±.003 bc	.028±.008	.027±.004 b	.015±.002 c
7-29-75	.032±.008 b	.033±.001 b	.032±.001 b	.041±.012
8-12-75	.041±.002 a	.059±.007 a	.041±.004 a	.045±.008 a
9-9-75	.051±.004 b	.046±.003 b	.049±.005 b	.058±.003 bc
10-7-75	.032±.001 a	.032±.000 a	.033±.002 a	.034±.003 a

	Station 3		
Date	Surface	1m	Inlet
10-26-74	.017±.001 c	.023±.004 bc	---
12-7-74	.048±.003 d	.030±.002 b	.074±.001 a
1-26-75	.078±.001 b	.072±.009 b	.095±.004 a
3-1-75	.092±.003	.084±.005 c	.123±.010 a
4-8-75	.053±.002 a	.056±.003 a	.078±.002
5-20-75	.032±.012	.031±.003 a	.046±.006
6-3-75	.031±.001 bc	.041±.002 a	.056±.004
6-17-75	.034±.002 bc	.031±.002 c	.068±.002 a
7-1-75	.041±.001 c	.039±.000	.094±.005 a
7-15-75	.018±.001 bc	.020±.003 bc	.082±.004 a
7-29-75	.033±.005 b	.029±.002 b	.105±.003 a
8-12-75	.047±.006 a	.054±.009 a	.103±.003
9-9-75	.044±.004 b	.069±.003 c	.085±.006 a
10-7-75	.032±.002 a	.036±.004 a	.104±.000

TABLE 21 a

Total phosphorus concentrations in unfiltered Fenton Lake water as mg phosphorus per liter

	Station 1		Station 2		Station 3		Inlet
	Surface	1.5 M	Surface	1.5 M	Surface	1.0 M	
3-1-75	.102±.003 ac	.067±.003 b	.093±.005 c	.073±.005 b	.105±.004 ac	.104±.004 ac	.115±.004 a
4-8-75	.077±.006 c	.092±.004 ab	.082±.003 ac	.093±.002 a	.089±.006 ac	.077±.005 bc	.095±.004 a
5-20-75	.096±.002 -	.079±.006 a	.099±.011 a	.093±.005 a	.092±.006 a	.097±.004 a	.101±.010 a
6-3-75	.062±.009 a	.077±.007 a	.065±.009 a	.063±.011 a	.077±.002 a	.078±.006 a	.091±.013 a
6-17-75	.085±.001 c	.074±.001 b	.074±.003 b	.076±.002 b	.073±.002 b	.079±.003 -	.114±.001 a
7-1-75	.068±.003 b	.066±.015 b	.058±.000 -	.063±.002 b	.063±.001 -	.108±.022 a	.137±.003 a
7-15-75	.074±.002 b	.080±.004 b	.083±.003 b	.084±.001 b	.077±.006 -	.084±.003 b	.133±.013 a
7-29-75	.080±.006 -	.078±.002 ac	.094±.012 ac	.099±.003 a	.076±.002 bc	.089±.000 -	
8-12-75	.066±.003 b	.062±.000 -	.082±.014 cb	.080±.010 cb	.071±.009 -	.066±.010 b	.147±.005 a
9-9-75	.069±.004 b	.084±.004 c	.069±.004 b	.071±.001 cb	.078±.004 bc	.079±.004 bc	.121±.007 a
10-7-75	.048±.012 b	.042±.003 b	.039±.000 b	.044±.001 b	.053±.004 b	.053±.007 b	.089±.000 a

TABLE 21 b

Nitrate nitrogen concentrations in membrane filtered Fenton Lake samples as mg nitrogen per liter

	Station 1		Station 2		Station 3		Inlet
Date	Surface	1.5 M	Surface	1.5 M	Surface	1.0 M	
10-26-74	.114±.004 -	.114±.001 a	.126±.017 a	.134±.002 a	.135±.007 a	.103±.013 a	
12-7-74	.255±.015 b	.142±.001 -	.241±.016 b	.128±.005 c	.23 ±.016 b	.122±.001 -	.331±.003 a
1-26-75	.495±.008 bc	.228±.005 e	.533±.007 a	.371±.005 f	.525±.007 ac	.458±.023 d	.521±.013 ac
3-1-75	.52 ±.007 a	.247±.017 b	.519±.005 a	.377±.022 c	.538±.006 -	.523±.005 a	.524±.006 a
4-8-75	.239±.010 c	.327±.009 b	.324±.007 b	.397±.024 a	.320±.008 b	.357±.007 b	.439±.005 -
5-20-75	.122±.023 a	.101±.036 -	.112±.004 a	.081±.017 a	.144±.035 a	.117±.007 a	
6-3-75	.095±.013 ac	.100±.006 ac	.101±.006 ac	.118±.006 a	.076±.008 bc	.095±.014 ac	.151±.000 -
6-17-75	.000 a	.000 a	.000 a	.000 a	.000 a	.000 a	.036±.002 b
7-1-75	.075±.013 -	.060±.022 -	.062±.006 a	.060±.004 a	.062±.000 -	.045±.010 a	.202±.011 b
7-15-75	.127±.009 c	.109±.001 bc	.097±.003 b	.11 ±.006 bc	.099±.016 b	.092±.007 b	.321±.005 a
7-29-75	.121±.012 a	.084±.03 a	.131±.035 a	.147±.028 a	.16 ±.011 a	.118±.025 a	.359±.003 -
8-12-75	.136±.013 cd	.166±.019 c	.123±.014 ed	.113±.007 bd	.085±.009 eb	.078±.010 b	.227±.012 a
9-9-75	.119±.004 c	.107±.006 cb	.091±.002 b	.097±.003 b	.097±.006 b	.088±.003 b	.227±.003 a
10-7-75	.115±.003 a	.090±.013 b	.071±.007 b	.057±.007 bc	.113±.004 a	.119±.003 a	.238±.000 -

TABLE 21 c

Total nitrogen concentrations in unfiltered FentonLake water as mg nitrogen per liter

	Station 1		Station 2		Station 3		Inlet
	Surface	1.5 M	Surface	1.5 M	Surface	1.0 M	
10-26-74	.432±.044 a	.470±.072 a	.362±.005 a	.352±.051 a	.374±.037 a	.378±.019 a	
12-7-74	.346±.022 ac	.312±.010 ac	.365±.059 ac	.277±.009 bc	.292±.030 bc	.409±.040 a	.264±.009 c
1-26-75	.473±.016 ad	.531±.050 a	.427±.025 cd	.454±.017 ad	.302±.011 b	.394±.011 d	.50 ±.042 ac
3-1-75	.324±.008 bc	.425±.022 a	.38 ±.017 ac	.393±.020 ac	.350±.008 ac	.411±.054 ac	
4-8-75	.351±.040 bc	.293±.021 bc	.389±.019 ac	.462±.035 a	.461±.017 a	.361±.053 ac	.428±.014 -
5-20-75	.685±.047 ac	.555±.075 bc	.777±.062 a	.697±.036 ac	.768±.012 a	.653±.032 ac	.403±.021 d
6-3-75	.483±.041 bc	.552±.007 c	.455±.009 b	.464±.031 b	.666±.030 a	.638±.027 a	.514±.010 bc
6-17-75	.518±.013 a	.448±.008 bc	.496±.013 ac	.449±.003 bc	.489±.012 ac	.411±.039 b	.34 ±.032 d
7-1-75	.347±.011 bc	.298±.020 bc	.319±.015 bc	.422±.038 ac	.423±.091 ac	.512±.039 a	.415±.045 ac
7-15-75	1.03 ±.047 a	1.05 ±.010 a	.817±.089 ac	.764±.084 ac	.639±.177 bc	.914±.053 ac	.200±.027 d
7-29-75	.725±.033 ac	.551±.125 c	.706±.064 ac	.891±.025 a	.782±.015 a	.853±.102 a	.269±.024 b
8-12-75	.466±.028 a	.531±.074 a	.379±.044 a	.478±.022 a	.474±.014 a	.499±.038 a	.227±.062 b
9-9-75	.313±.034 ac	.298±.002 ac	.327±.018 ac	.403±.041 a	.346±.047 ac	.283±.027 bc	.286±.011 -
10-7-75	.261±.032 bc	.328±.040 ac	.451±.092 a	.254±.024 bc	.16 ±.014 b	.138±.013 b	.193±.023 bc

TABLE 22

pH of Fenton Lake Water Samples

	Station 1			Station 2			Station 3		Inlet
Date	Surface	1-1.5 m	2 m	Surface	1-1.5 m	2 m	Surface	1-1.5 m	
10/26/74				8.4			8.4		
12/07/74	7.4	6.7		6.8	7.7		7.4	6.7	7.2
01/26/75	6.2	6.1		6.2	6.0		6.1		
03/01/75	6.6	6.8		6.7	6.7		6.7	6.6	6.5
05/21/75	7.3	6.8		7.6	7.1		7.2	6.6	7.0
06/03/75	8.5	6.9	7.0	8.5	8.0	7.8	8.3	8.3	
06/17/75	8.1	7.9	8.1	7.8	7.8	7.7	8.3	8.0	7.9
06/30/75	8.9	8.8	8.9	9.0	9.0	9.0	9.0	8.9	
07/15/75	9.4	9.4	8.6	9.5	9.4	9.3	9.5	9.3	
07/29/75	9.2	9.1	9.1	8.5	8.9	8.8	9.2	8.9	
08/12/75	8.9	9.0	8.5	8.9	9.0	8.7	9.0	9.2	

TABLE 23

Primary productivity of Fenton Lake in mg carbon/m^3/hr.

	Station 1			Station 2			Station 3	
Date	Surface	1.0 m	2.0 m	Surface	1.0 m	2.0 m	Surface	1.0 m
5-20-75	58.23±8.86	12.34±0.48	-	91.83±3.24	2.30±0.16	-	93.30±5.77	17.72±4.01
6-3-75	56.26±0.33	40.20±0.28	15.60±2.52	71.65±2.70	44.36±0.76	17.54±3.35	61.10±3.33	33.00±1.37
6-17-75	64.22±2.70	52.78±0.38	23.54±0.78	76.52±1.22	62.85±1.30	35.04±0.83	64.30±1.46	49.93±0.10
7-1-75	19.94±0.58	20.82±0.70	10.63±0.48	22.79±1.83	15.91±0.64	5.12±0.64	14.50±2.74	5.34±0.27
7-15-75	78.07±3.30	36.28±0.54	6.40±1.11	47.50±10.32	54.77±6.97	17.58±1.49	34.69±0.50	11.12±0.39
7-29-75	8.82±3.11	8.42±2.88	4.34±0.66	9.00±4.18	20.50±0.00	7.09±1.93	8.76±0.28	4.64±0.00
8-12-75	2.3±.09	2.26±.30	2.59±.79	3.76±.57	1.02±.15	.98±.07	4.57±.03	1.56±.14
9-9-75	8.00±4.71	5.42±.05	4.0±.55	7.28±.26	3.74±.82	12.8±3.0	5.70±.19	6.04±.42
10-7-75	.790±.45	1.01±0.0	3.34±.91	2.60±.225	8.14±1.86	3.32±.24	7.44±1.05	61.1±2.42

[1] This sample was collected and incubated at 1.5 m.

TABLE 24

Nitrogen and phosphorus content of *Elodea* samples collected from Fenton and Hopewell Lakes

Fenton Lake[1]

Date	Nitrogen %	Phosphorus %
6/17/75	3.54±0.32[2]	1.09±0.05
7/1/75	3.47±0.18	0.90±0.10
7/15/75	2.74±0.12	0.61±0.02
7/29/75	3.15±0.41	0.78±0.11
8/12/75	2.78±0.13	0.58±0.05
9/9/75	2.68±0.27	0.60±0.09
10/7/75	2.30±0.10	0.65±0.08

Hopewell Lake[3]

Date	Nitrogen %	Phosphorus %
8/5/75	2.28	0.61
9/30/75	3.27±0.39	0.66±0.08

[1]Samples were identified as *Elodea canadensis*

[2]Standard error

[3]Samples were identified as *Elodea densa*

TABLE 25

Aerobic Bacteria/100 ml in Fenton Lake

Date	Station 1 Surface	Station 1 1.5 m	Station 2 Surface	Station 2 1.5 m	Station 3 Surface	Station 3 1.0 m	Inlet
10-26-74	1,385	1,830	2,635	2,335	1,550	1,630	-
12-7-74	4,600	7,890	3,210	2,250	4,860	2,640	2,170
2-5-74	5,160	5,410	10,595	5,450	10,585	5,350	11,570
3-1-74	30,020	5,020	20,020	5,010	10,010	10,000	5,070
4-8-75	6,080	8,040	8,080	4,540	12,160	10,160	-
5-20-75	8,660	9,640	10,060	11,740	6,500	9,540	32,040
6-3-75	14,440	17,720	19,920	13,480	15,820	10,740	12,600
6-17-75	22,340	20,720	11,120	19,780	18,320	17,000	76,260
7-1-75	11,480	5,380	21,740	7,900	19,400	9,780	186,500
7-15-75	60,680	16,560	17,780	14,780	8,600	15,640	18,580
7-29-75	101,800	44,420	78,200	47,420	28,160	29,580	19,180
8-12-75	19,940	29,600	18,300	24,080	16,960	14,700	40,440
9-9-75	2,680	2,860	11,080	3,590	4,010	2,510	16,410
10-6-75	5,770	10,200	5,260	5,580	15,100	12,500	10,690

Anaerobic Bacteria/100 ml in Fenton Lake

Date	Station 1 Surface	Station 1 1.5 m	Station 2 Surface	Station 2 1.5 m	Station 3 Surface	Station 3 1.0 m	Inlet
10-26-74	230	655	160	515	90	560	-
12-7-74	1,410	990	2,700	1,270	940	2,550	2,130
2-5-75	5,115	5,080	5,160	5,000	5,630	5,035	5,000
3-1-75	30,000	5,050	10,020	5,010	10,000	10,010	5,050
4-8-75	6,000	2,880	3,620	3,700	3,760	3,940	-
5-20-75	6,280	4,220	9,640	19,280	9,400	7,900	8,400
6-3-75	4,820	14,400	17,680	10,720	11,360	12,880	840
6-17-75	7,280	6,180	7,660	4,460	5,080	6,980	5,540
7-1-75	2,340	1,500	2,120	2,560	1,420	1,580	16,320
7-15-75	10,120	1,800	1,300	1,000	1,340	1,160	8,880
7-29-75	4,800	26,020	7,340	3,520	5,580	37,260	12,880
8-12-75	100	2,560	1,340	620	9,400	580	-
9-9-75	320	460	990	8,900	8,700	1,110	6,400
10-6-75	340	160	300	480	2,150	9,600	3,100

TABLE 26

Fecal Coliforms/100 ml in Fenton Lake

	Station 1		Station 2		Station 3		Inlet
Date	Surface	1.5 m	Surface	1.5 m	Surface	1.0 m	
10-26-74	1	0	1	1	3	1	-
12-7-74	0	0	0	0	0	1	0
2-5-75	0	1	2	0	0	4	0
3-1-75	0	0	2	0	0	2	0
4-8-75	1	4	1	0	0	3	-
5-20-75	0	0	0	0	4	3	1
6-3-75	1	1	0	0	1	1	18
6-17-75	3	5	1	0	9	3	0
7-1-75	4	7	11	5	12	4	0
7-15-75	19	1	0	1	0	1	36
7-29-75	0	3	0	8	7	0	31
8-12-75	5	1	20	0	0	0	82
9-9-75	0	0	0	0	0	0	0
10-6-75	0	0	0	0	0	0	0

Fecal Streptococci/100 ml in Fenton Lake

	Station 1		Station 2		Station 3		Inlet
Date	Surface	1.5 m	Surface	1.5 m	Surface	1.0 m	
10-26-74	0	0	0	0	9	0	-
12-7-74	18	1	11	2	4	5	2
2-5-75	2	0	2	2	5	6	3
3-1-75	1	0	0	0	0	0	0
4-8-75	5	5	8	6	4	11	-
5-20-75	7	3	2	8	1	2	3
6-3-75	2	3	3	1	0	0	18
6-17-75	6	4	1	1	3	3	44
7-1-75	14	2	18	5	22	11	200
7-15-75	62	13	2	3	0	2	33
7-29-75	9	9	31	93	141	1	71
8-12-75	5	1	1	2	0	1	31
9-9-75	0	2	3	2	1	1	71
10-6-75	0	0	2	0	1	2	37

TABLE 27

Actinomycetes/100 ml in Fenton Lake

Date	Station 1 Surface	Station 1 1.5 m	Station 2 Surface	Station 2 1.5 m	Station 3 Surface	Station 3 1.0 m	Inlet
10-26-74	-	-	-	-	-	-	-
12-7-74	-	-	-	-	-	-	-
2-5-75	0	0	0	0	0	0	0
3-1-75	20	10	15	15	15	20	195
4-8-75	25	20	20	1500	385	290	-
5-20-75	-	-	-	-	-	-	-
6-3-75	-	-	-	-	-	-	-
6-17-75	15	5	0	0	0	0	0
7-1-75	25	35	45	35	55	20	140
7-15-75	70	35	40	15	30	40	320
7-29-75	25	45	25	10	5	75	165
8-12-75	0	0	6	5	10	150	250
9-9-75	10	25	0	75	10	10	70
10-6-75	5	0	15	20	10	20	50

Molds/100 ml in Fenton Lake

Date	Station 1 Surface	Station 1 1.5 m	Station 2 Surface	Station 2 1.5 m	Station 3 Surface	Station 3 1.0 m	Inlet
10-26-74	-	-	-	-	-	-	-
12-7-74	6	2	5	2	9	1	4
2-5-75	90	15	10	15	75	45	5
3-1-75	30	25	50	10	60	15	20
4-8-75	10	25	20	30	50	555	-
5-20-75	10	10	20	20	10	15	30
6-3-75	165	230	0	30	5	10	15
6-17-75	120	20	35	15	30	60	45
7-1-75	95	235	165	95	145	85	175
7-15-75	20	0	0	0	5	0	30
7-29-75	35	60	15	0	0	15	5
8-12-75	150	330	350	250	50	250	100
9-9-75	220	265	170	0	255	20	0
10-6-75	5	0	15	20	10	20	50

TABLE 28

Invertebrates/100 ml in Fenton Lake

Date	Station 1 Surface	Station 1 1.5 m	Station 2 Surface	Station 2 1.5 m	Station 3 Surface	Station 3 1.0 m	Inlet
10-26-74	-	-	-	-	-	-	-
12-7-74	0	0	0	.25	0	1.75	0
2-5-75	-	-	-	-	-	-	-
3-1-75	0	20	0	10	0	0	0
4-8-75	0	0	0	0	0	0	-
5-20-75	0	0	0	0	0	0	0
6-3-75	0	0	0	0	0	0	0
6-17-75	0	0	0	0	0	0	0
7-1-75	0	0	0	0	0	0	0
7-15-75	0	0	0	0	0	0	0
7-29-75	0	0	0	0	0	0	0
8-12-75	0	80	160	180	0	0	0
9-9-75	27	30	14	17	5	10	0
10-6-75	7	5	4	10	0	0	0

TABLE 29

SHANNON-WIENER INDICIES
FOR FENTON LAKE

Date	Sample	H'max	H'	E
10-26-74	1-S	0	0	0
	1-1.5	0	0	0
	2-S	1.386	1.070	.722
	3-S	1.609	.611	.380
	3-1.5	1.609	1.049	.622
12-07-74	1-S	.693	.113	.163
	1-1.5	0	0	0
	2-S	1.946	.924	.475
	2-1.5	1.946	.772	.397
01-26-74	1-S	0	0	0
	2-S	X	X	X
	2-1.5	1.099	1.047	.953
	3-S	1.792	1.226	.684
	3-1	1.946	1.719	.883
03-01-75	1-S	1.386	.724	.522
	1-1.5	1.792	.867	.484
	2-S	1.792	.863	.482
	2-1.5	1.609	.476	.296
	3-S	1.792	1.297	.724
	3-1	2.079	1.413	.680
04-08-75	1-S	1.386	1.224	.883
	1-1.5	1.386	1.114	.804
	2-S	1.099	.942	.857
	2-1.5	1.609	1.336	.830
	3-S	1.099	.855	.778
	3-1	.693	.550	.794
05-20-75	1-S	2.197	1.575	.717
	1-1.5	2.303	1.784	.775
	2-S	1.792	1.156	.645
	2-1.5	2.079	1.439	.692
	3-S	2.079	1.054	.507
	3-1	1.792	.880	.491

Date	Sample	H'max	H'	E
06-03-75	1-S	1.609	.835	.519
	1-1.5	1.792	1.122	.626
	2-S	2.565	1.832	.714
	2-1.5	2.079	1.128	.543
	3-S	1.792	1.334	.744
	3-1	1.946	.810	.171
06-17-75	1-S	1.946	1.587	.816
	1-1.5	1.386	1.029	.724
	2-S	2.079	1.374	.661
	2-1.5	1.946	1.521	.782
	3-S	1.609	1.387	.862
	3-1.5	1.609	1.416	.880
07-01-75	1-S	2.079	1.662	.799
	1-1.5	1.946	1.589	.817
	2-S	1.609	1.158	.720
	2-1.5	1.609	1.121	.697
	3-S	1.792	1.372	.766
	3-1	1.609	1.143	.710
	inlet	1.609	1.463	.909
07-15-75	1-S	.693	.082	.118
	1-1.5	1.386	.148	.107
	2-S	0	0	0
	2-1.5	1.609	.691	.429
	3-S	1.386	.103	.074
	3-1.5	.693	.086	.124
07-29-75	1-S	.693	.383	.553
	1-1.5	1.386	.630	.456
	2-S	1.099	.785	.714
	2-1.5	1.099	.579	.527
	3-S	1.792	1.433	.800
	3-1.5	1.946	1.526	.784
	inlet	.693	.350	.505
08-12-75	1-S	1.609	1.307	.812
	1-1.5	D	D	D
	2-S	1.099	.953	.867
	2-1.5	.693	.566	.817
	3-S	1.946	1.767	.908
	3-1	1.946	1.363	.700
	inlet	1.386	.474	.342

Date	Sample	H'max	H'	E
09-09-75	1-S	.693	.493	.711
	1-1.5	1.609	1.474	.916
	2-S	1.386	1.151	.830
	2-1.5	1.386	1,222	.882
	3-S	1.386	.824	.595
	3-1	1.609	1.214	.755
	inlet	1.099	1.060	.965
10-07-75	1-S	.693	.646	.932
	1-1.5	X	X	X
	2-S	0	0	0
	2-1.5	.693	.683	.986
	3-S	1.946	1.538	.790
	3-1	1.386	.647	.467

Note: X refers to no algae present
D refers to heavy debris obscuring algae

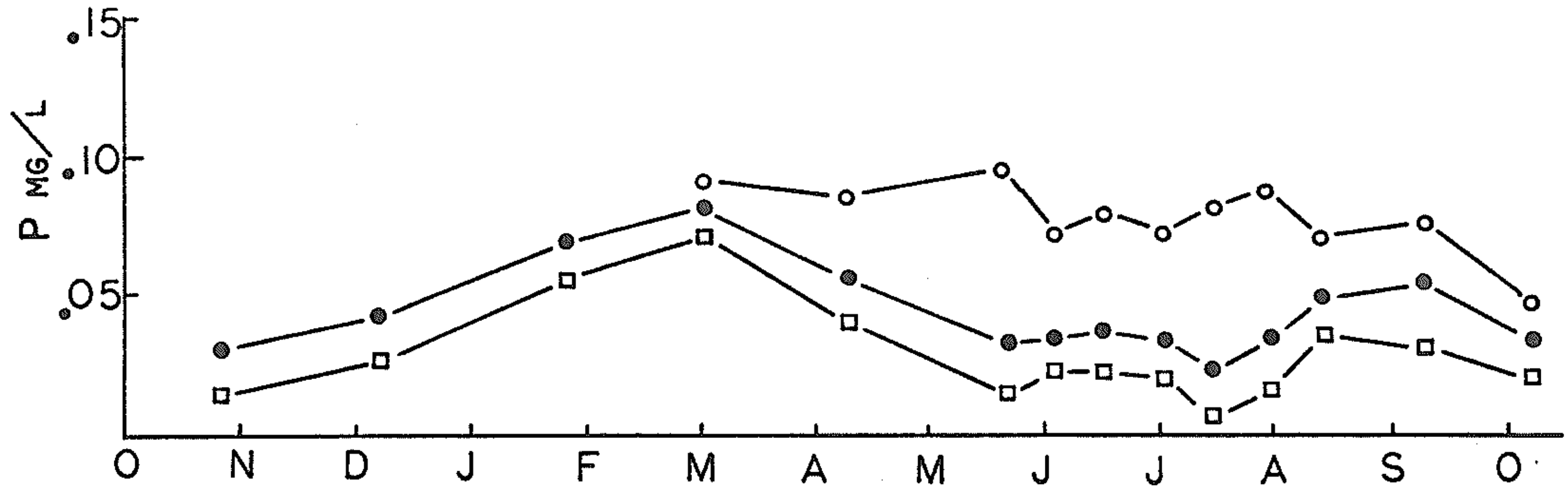


Figure 15. Phosphorous determinations of water from Fenton Lake. Samples were filtered through 0.45 μ membrane filters and analyzed for orthophosphate (○ - ○) and total filtered phosphorus (● - ●). Total phosphorous (□ - □) was determined using unfiltered samples. Values are means for surface and 1.5 meter depths at sample stations 1 and 2.

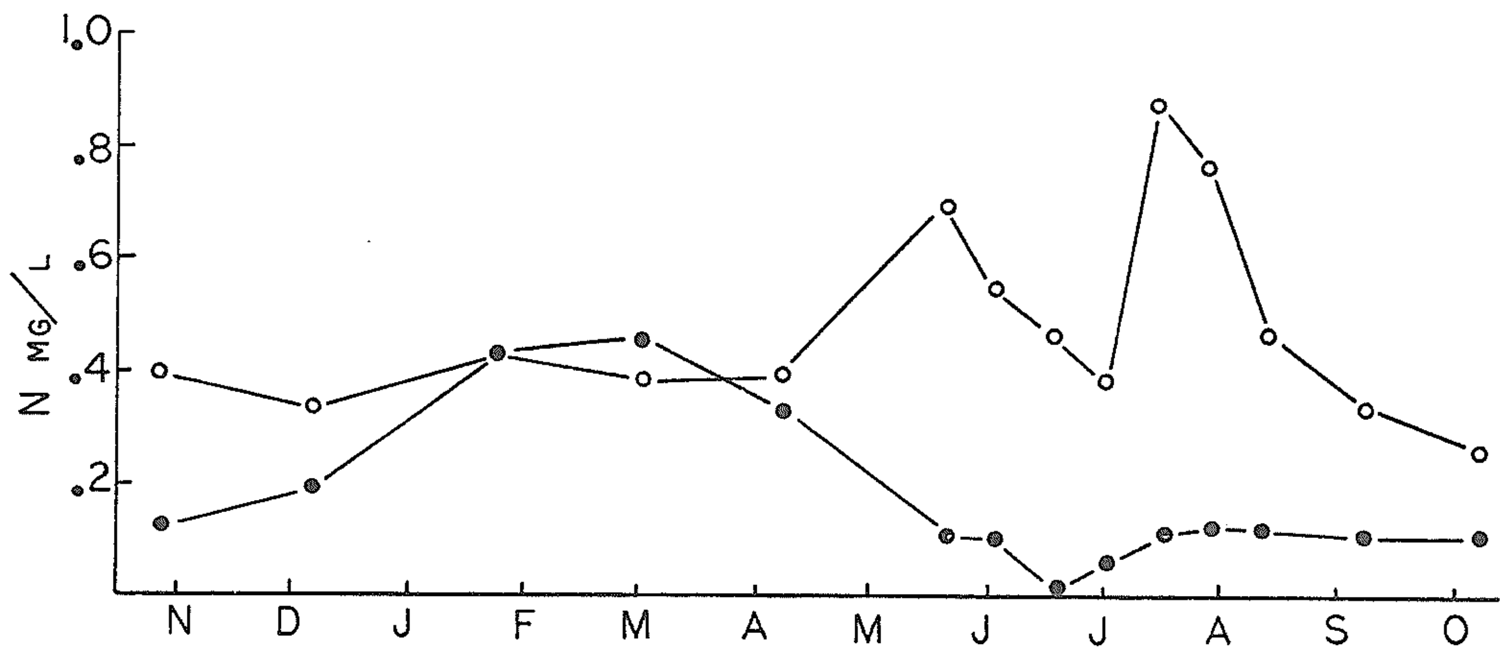


Figure 16. Nitrogen determinations of water from Fenton lake. Samples were filtered through 0.45 μ membrane filters and analyzed for nitrate (● - ●) and total nitrogen (○ - ○) was determined using unfiltered samples. Values are means for surface and 1.5 meter depths at sample stations 1 and 2.

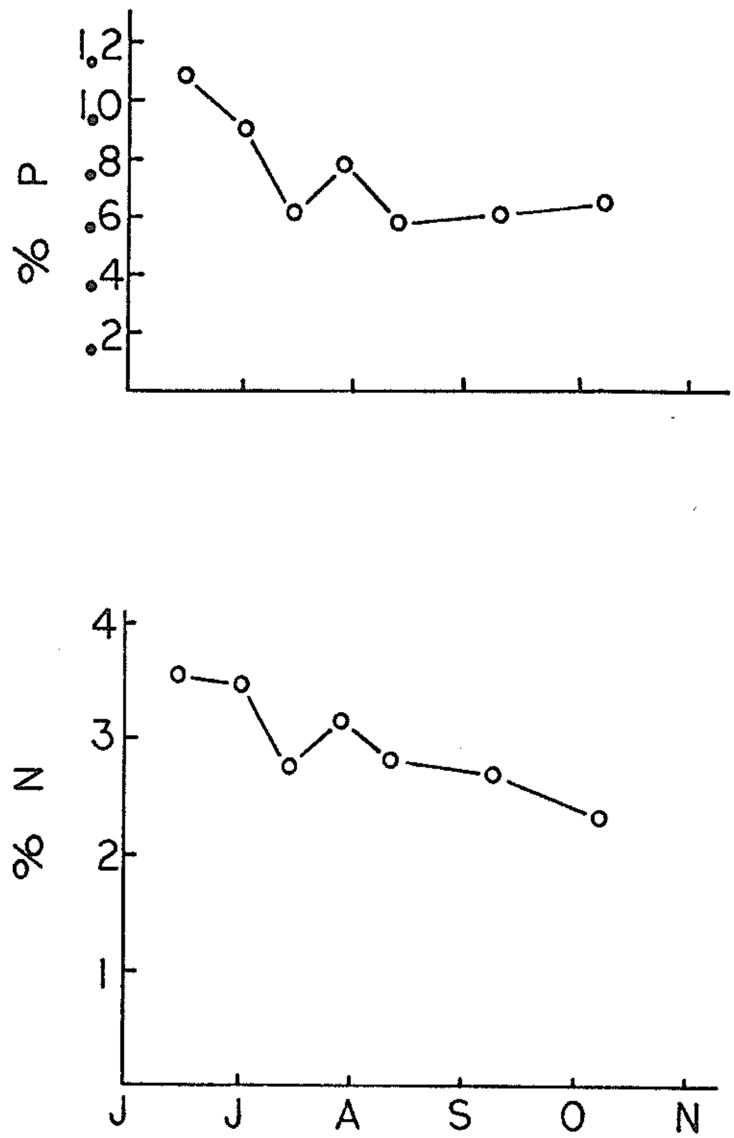


Figure 17. Total phosphorus and total nitrogen determinations of Elodea from Fenton Lake. Expressed as % of dry weight.

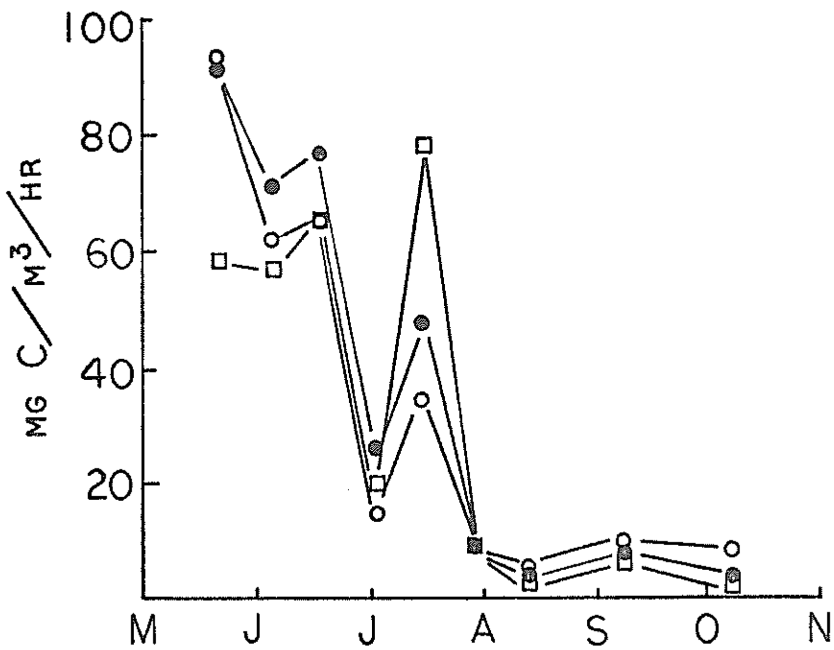


Figure 18. Primary productivity measurements at surface levels on Fenton Lake. Values were determined at station 1 (□-□), 2 (●-●), and 3 (○-○).

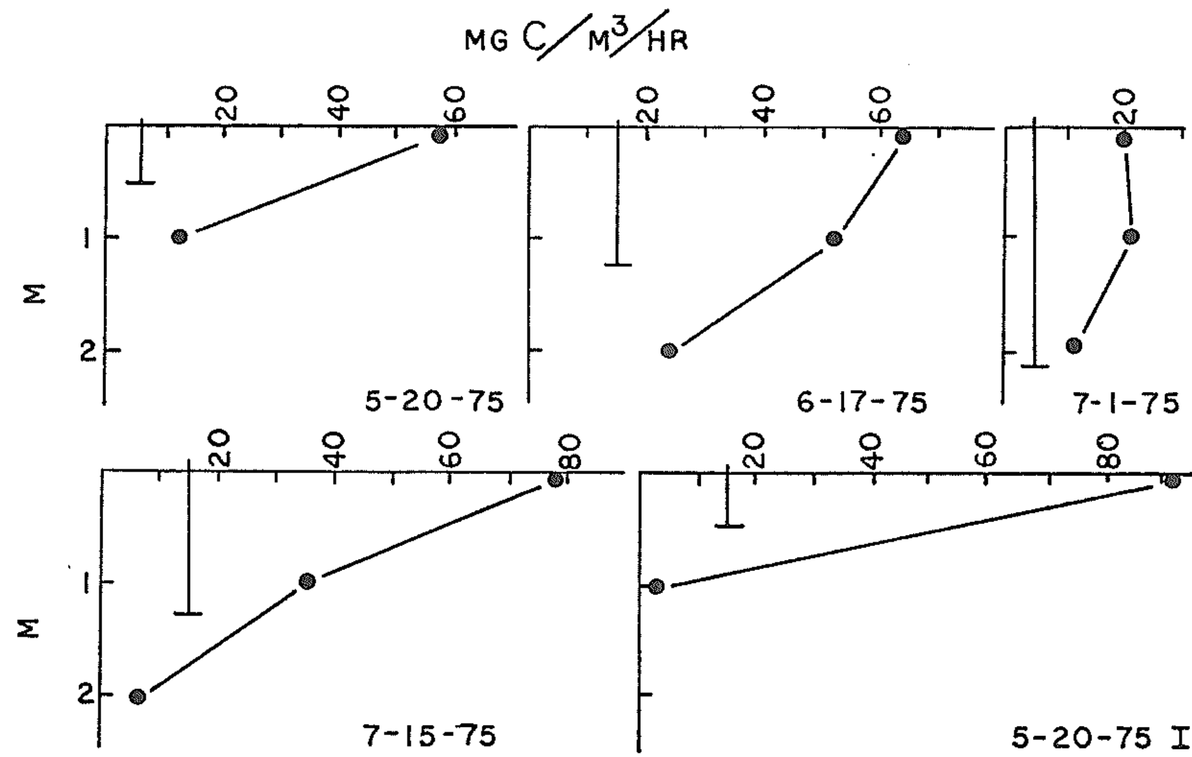


Figure 19. Primary productivity distribution in Fenton Lake at Station 1 with respect to depth. The inserted symbol (⊥) reflects seechi readings and the figure of 5-20-75 II reflects primary productivity at station 2 on date specified.

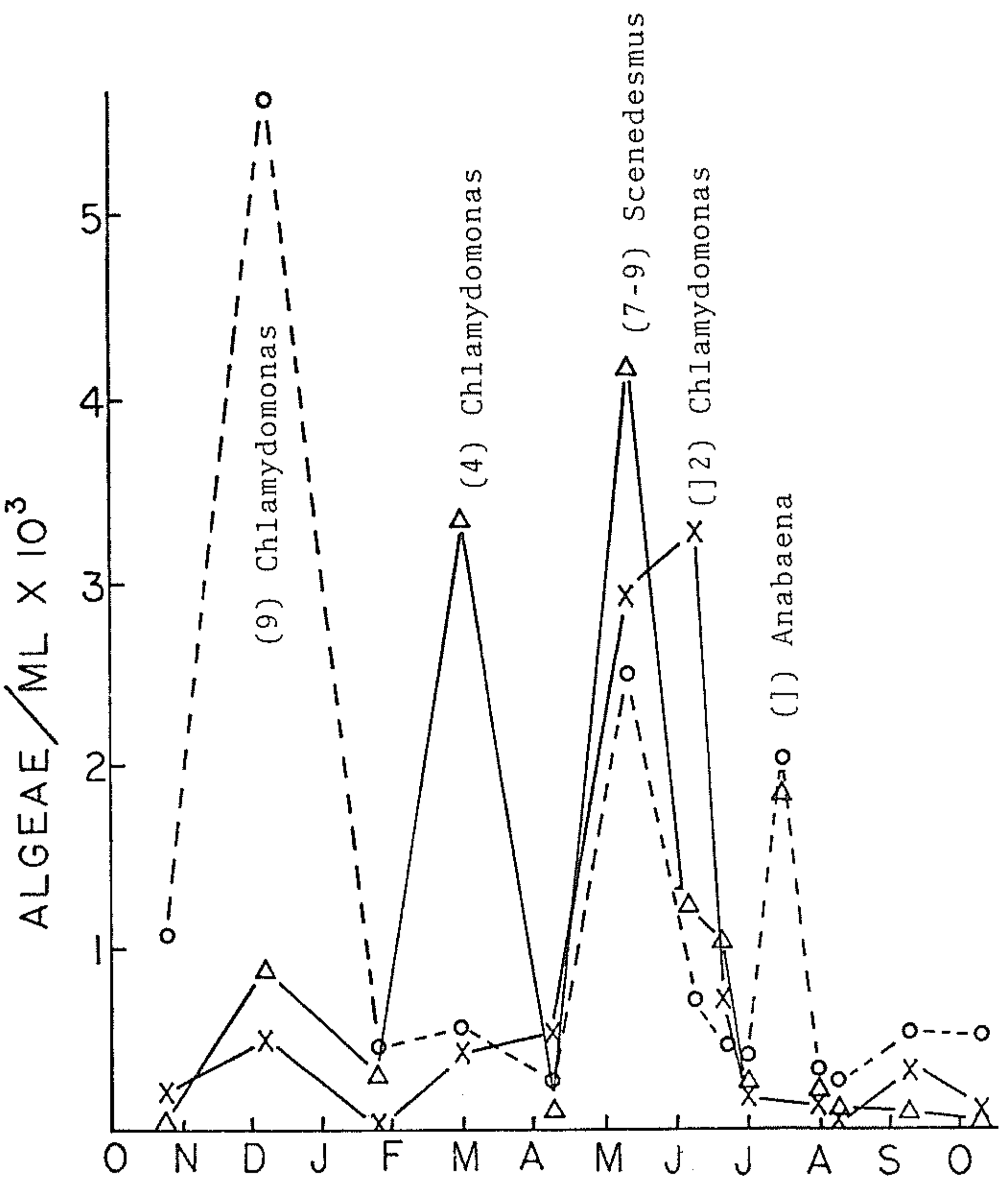


Figure 20. Yearly distribution of algae on the surface at Fenton Lake. Algal densities are noted at station 1 (Δ-Δ), 2 (X-X), and 3 (O-O). At times of algal blooms, the major algal species is indicated and the number in parentheses is the number of different algal species.

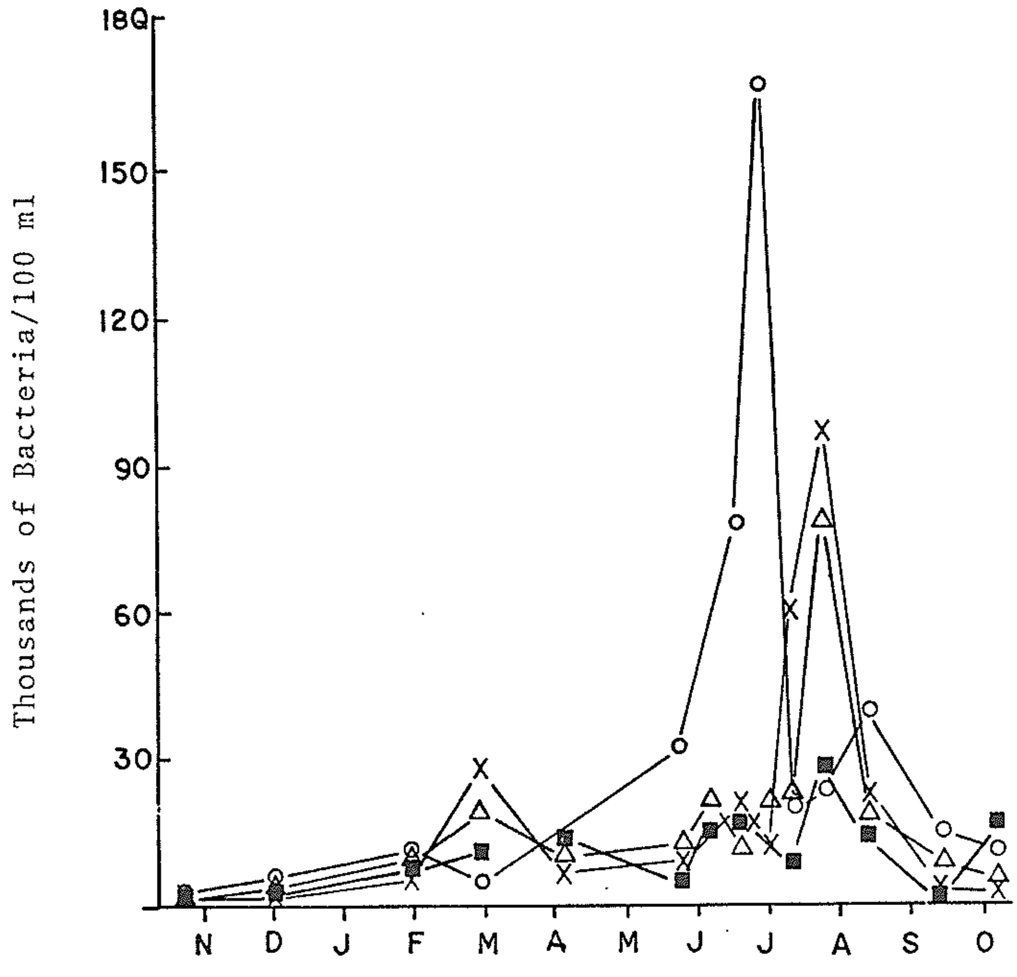


Figure 21. Distribution of aerobic bacteria on the surface of Fenton Lake. Values were determined at station 1 (X-X), 2 (△-△), 3 (■-■), and the inlet (O-O).

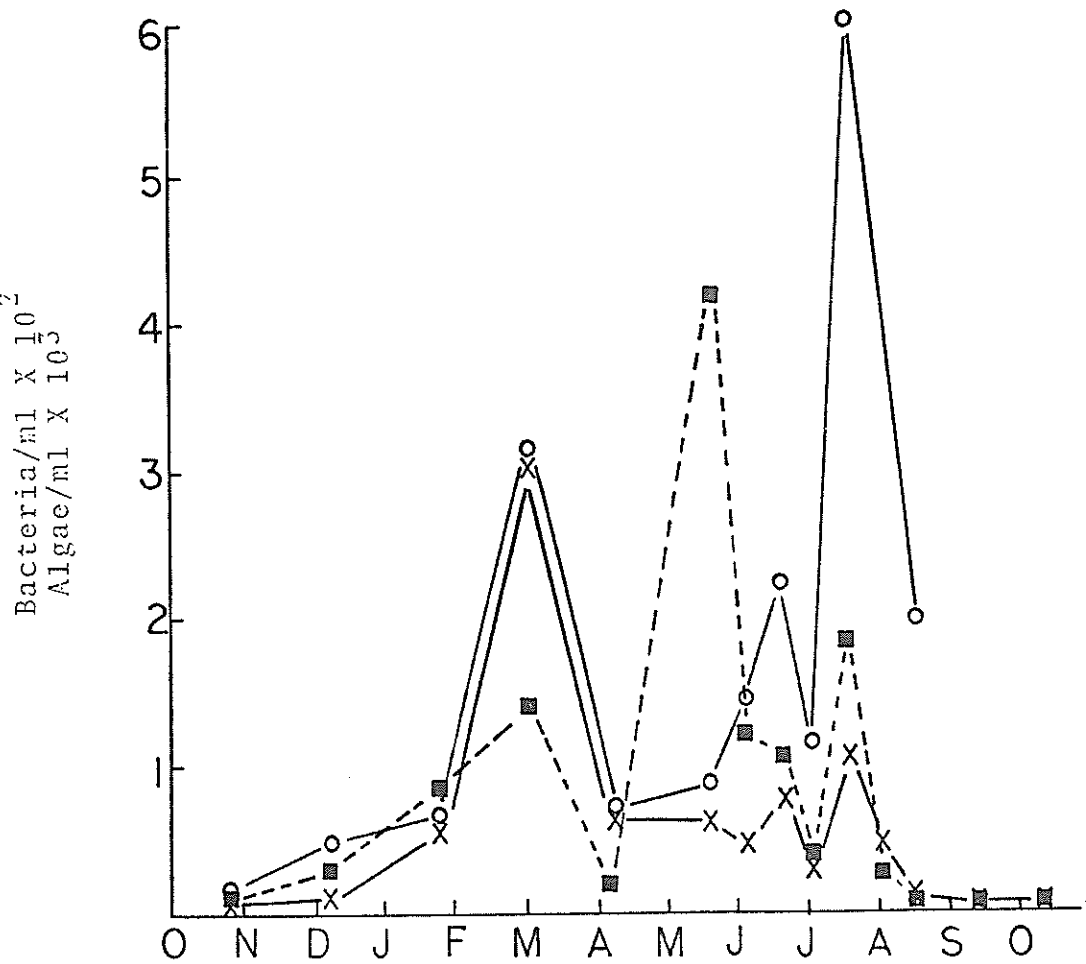


Figure 22. Relationship of algae to bacterial at the surface on station 1 at Fenton Lake. Algae (■ - ■), anaerobic bacteria (X - X), and aerobic bacteria (o - o).

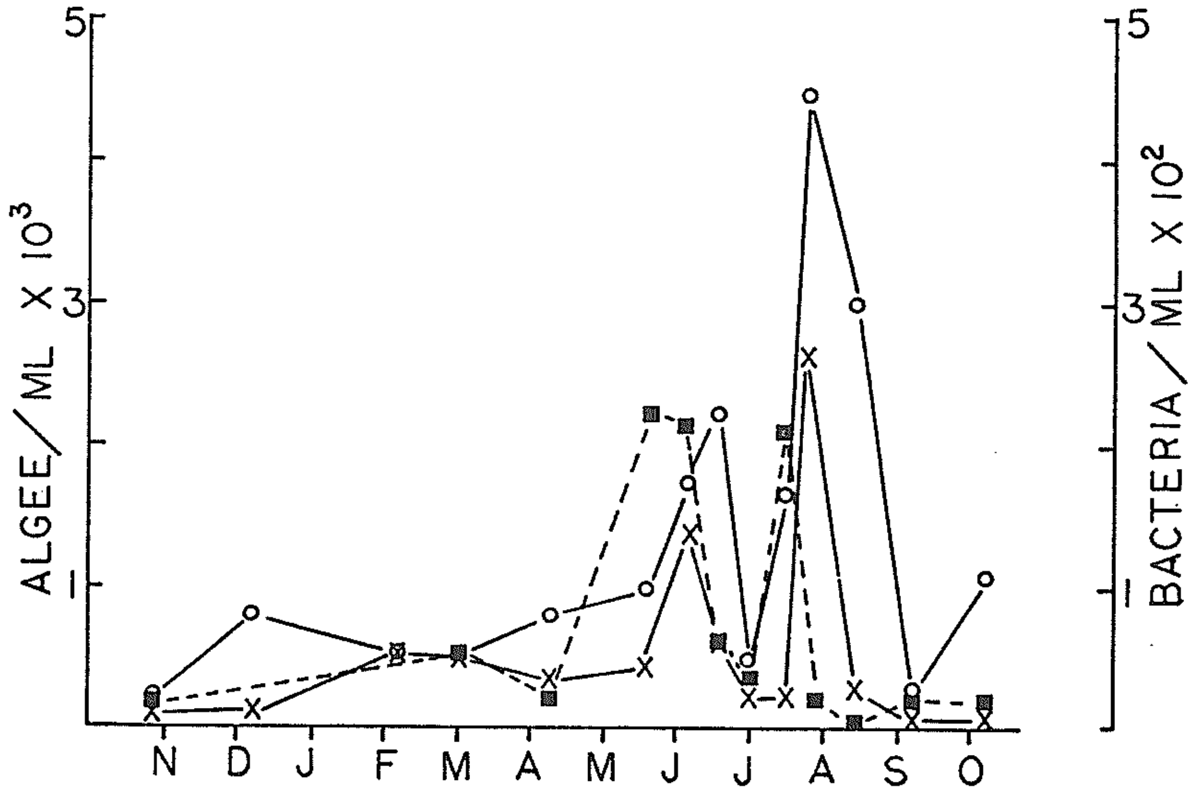


Figure 23. Relationship of algae and bacteria at 1.5 meter depth at station 1 on Fenton Lake. Algae (■-■), anaerobic bacteria (X-X), and aerobic bacteria (O-O).

Hopewell Lake

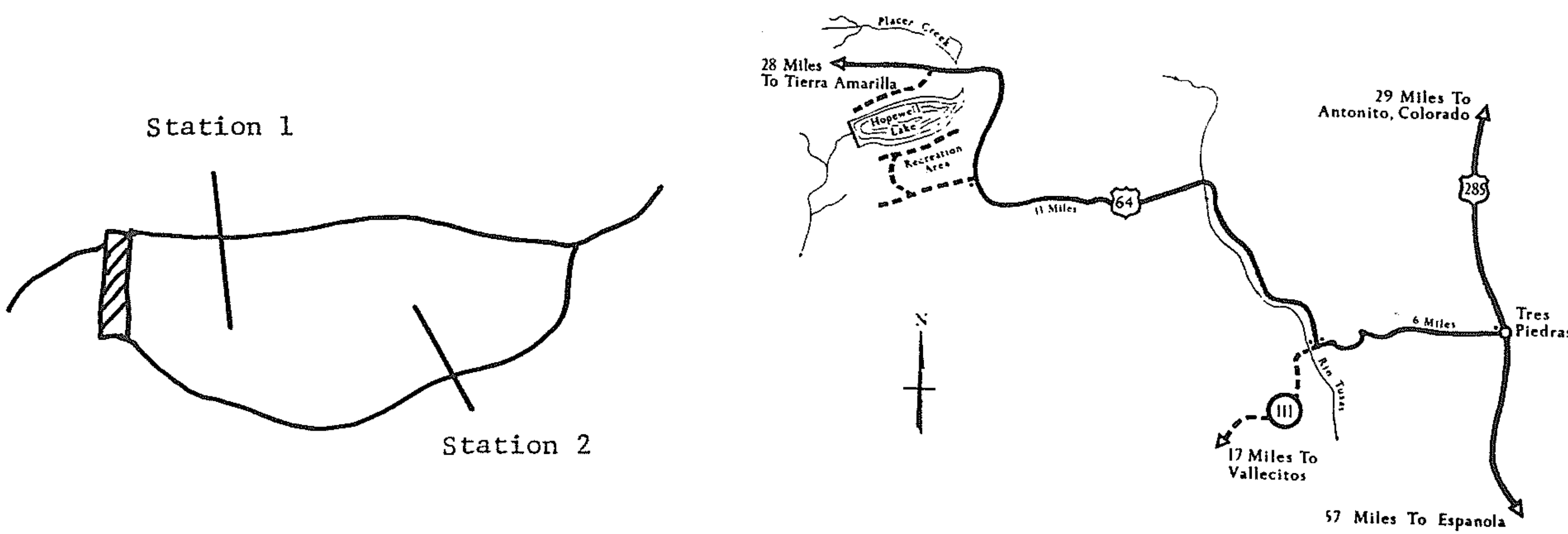
1. Location

Hopewell is a small lake of 19 surface acres which is located in a mixed forest containing conifers and aspen and has an elevation of 9765 feet above sea level. The development of Hopewell Lake was started in 1951 and today serves as a public recreational area for campers and fishermen, as well as furnishing water for cattle. Because it is almost impossible to get to Hopewell Lake in the winter, collections were made only when the roads were open. The location and sampling stations are presented in the maps on the following page (Fig. 24).

2. Sampling Stations

Station 1 is in the deepest region of the lake about 25 to 30 meters from the dam and of equal distance to each shore. Station 2 was at the shallow end of the lake where the depths varied from 1 to 2 meters. Higher plants (*Elodea densa* and *Potamogeton pectenatus*) were abundant in the shallow portion of the lake in late summer, i.e. around Station 2. These aquatic plants were very heavily covered with unidentified small larvae. Hopewell was covered by ice from mid-November until about 20 May.

Figure 24. Hopewell Lake Showing Location and Sampling Stations



3. Water Temperature and Transparency

The data for temperature and turbidity are presented in Tables 1, 2 and 3.

4. Biological Measurements

Phytoplankton productivity was very low in late May and increased only slowly in June(Table 36, Fig. 27). An *Anabaena* bloom occurred in early July, and this was associated with a very great increase in productivity (Fig 28, 29, 30). It was at the height of this bloom that numerous fish were found dead along the shore, and this may be a cause for alarm in the future. Productivity remained high into early August; however, by early September productivity greatly declined and *Anabaena* was virtually absent. Productivity was very low in October. Bacterial numbers do not increase appreciably until August, which would suggest that bacteria do not contribute to the algal blooms on Hopewell Lake (Table 38, 39). The *Anabaena* bloom occured at the expense of other algae and resulted in the low Shannon-Wiener Indices (Table 41). *Anabaena* was the only phytoplankton taxa in several samples in July and August(Table 54, Appendix).

The termination of the *Anabaena* bloom and sharp decline in productivity occurred while there were increasing concentrations of phosphorus in the water and abundant total nitrogen. This suggests that the *Anabaena* bloom was limited by other nutrients or natural control mechanisms. Blue-green algae have been reported to produce toxins which limit the growth of other algae and this may have been responsible for the relatively low numbers of phytoplankton observed in September(Fogg et al.)

The similarities in Hopewell and Fenton Lakes would suggest that establishment of a fenced drainage into Hopewell, which would reduce nutrient input from livestock, could result in reduced *Anabaena* populations. It is possible also that in a few years, the higher aquatic plants in Hopewell may become more abundant and these could absorb nutrients entering Hopewell Lake and thus restrict phytoplankton blooms.

Samples of *Elodea densa* were analyzed for nitrogen and phosphorus in early August and at the end of September(Table 24). The nitrogen and phosphorus contents were well above the critical tissue concentrations established by Gerloff for *E. occidentalis*, suggesting that neither nutrient was limiting for the growth of *Elodea* in Hopewell Lake. The phosphorus concentration was similar in *E. densa* from Hopewell Lake to that found in *E. canadensis* by early fall. The higher nitrogen content of the Hopewell Lake *Elodea* is very likely related to the higher total nitrogen concentration in Hopewell Lake water during July and August when a bloom of the nitrogen fixing blue-green alga, *Anabaena* occurred.

5. *Chemical Measurements*

The pH of Hopewell Lake varied from about 6 in late May to 9 in July and early August(Table 35). Hopewell Lake is a soft water lake with a calcium concentration of 4.6 mg/liter (Table 11).

The total phosphorus content of unfiltered water samples increased rapidly in July to a maximum in August and early September and then declined by early October (Table 34, Fig. 25). The total phosphorus and orthophosphate content of membrane filtered water increased more gradually to maximum values in early September and then decreased by early October(Table 32, 33, Fig. 25). The total nitrogen content increased very rapidly in July to a peak in early August and then decreased sharply in early September and October(Table 31, Fig. 26). The nitrate nitrogen concentration in membrane filtered water increased very slowly during the rapid rise and subsequent decline in the total nitrogen(Table 30, Fig. 26).

The rapid rise in the total nitrogen content of the water samples in July and early August corresponds to the occurrence of a bloom of the nitrogen fixing blue-green alga, Anabaena. The increase in total phosphorus content in unfiltered water samples during the same period of time is possibly due to the development of the bloom in deeper water and its subsequent movement to the surface. The more gradual increase in dissolved phosphorus(i.e. in filtered water) is probably a result of decomposition of cells from the algal bloom.

Oxygen measurements (Table 11a) at Hopewell Lake indicated that the oxygen concentration at the 3-5 meter depth was considerably reduced in August and September following the bloom. Oxygen concentrations were not depressed at the surface or 1-1.5 meter depths.

TABLE 30

Nitrate Nitrogen Concentrations in Hopewell Lake Water as mg Nitrogen per Liter. Water samples were filtered through a 0.45 μ membrane filter.

Date	Station 1 Surface	Station 1 1.5 m	Station 1 6 m	Station 2 Surface	Station 2 1 m
11/18/74	.175 ± .009 a	.183 ± .006 a		.143 ± .014 b	
05/28/75	.106 ± .003 a	.126 ± .029 -		.116 ± .032 a	.126 ± .012 a
06/10/75	.106 ± .005 a	.093 ± .012 a		.099 ± .010 a	.106 ± .002 a
06/24/75	.079 ± .005 a	.101 ± .005 a		.097 ± .048 a	.028 ± .022 a
07/08/75	.138 ± .031 a	.114 ± .006 a		.101 ± .005 a	.115 ± .008 a
07/22/75	.141 ± .017 b	.252 ± .019 a		.142 ± .015 b	.141 ± .013 b
08/05/75	.100 ± .012 bc	.129 ± .003 ac	.129 ± .014	.155 ± .006 a	.125 ± .004 ac
09/02/75	.106 ± .004 a	.146 ± .020 a		.196 ± .006 b	.23 ± .019 b
09/30/75	.176 ± .019 a	.225 ± .019 a		.249 ± .025 a	.211 ± .023 a

TABLE 31

Total Nitrogen Concentrations in Unfiltered Hopewell Lake Water as mg Nitrogen per Liter

Date	Station 1 Surface	Station 1 1.5	Station 1 6 m	Station 2 Surface	Station 2 1 m
11/18/74	.811 ± .014 c	.914 ± .056 a		.600 ± .019 b	
05/28/75	.345 ± .949 a	.353 ± .028 a		.404 ± .041 a	.353 ± .010 a
06/10/75	.407 ± .008 a	.351 ± .005 b		.388 ± .009 b	.397 ± .015 b
06/24/75	.431 ± .008 ac	.473 ± .028 a		.425 ± .027 ac	.391 ± .014 bc
07/08/75	.961 ± .140 ac	1.06 ± .039 a		.867 ± .041 ac	.781 ± .031 bc
07/22/75	1.38 ± .022 c	1.99 ± .122 a		.859 ± .070 b	.689 ± .046 b
08/05/75	2.63 ± .148 a	1.71 ± .112 c	.802 ± .112 b	.940 ± .137 b	1.22 ± .269 bc
09/02/75	.629 ± .251 a	.385 ± .038 a		.538 ± .062 a	.562 ± .049 a
09/30/75	.104 ± .017 b	.238 ± .026 a		.070 ± .016 b	.104 ± .039 b

TABLE 32

Orthophosphate Concentrations in Hopewell Lake as mg Phosphorus per Liter. Water samples were filtered using a 0.45 μ membrane filter.

	Station 1			Station 2	
Date	Surface	1.5 m	6 m	Surface	1 m
11/18/74	.028 ± .000 ac	.029 ± .001 ac		.028 ± .001 ac	
05/28/75	.020 ± .003 a	.029 ± .004 a		.022 ± .006 a	.016 ± .004 a
06/10/75	.013 ± .002 a	.011 ± .002 a		.008 ± .001 a	.014 ± .001 a
06/24/75	.014 ± .001 a	.016 ± .001 a		.017 ± .001 a	.018 ± .003 a
07/08/75	.018 ± .001 a	.018 ± .002 a		.016 ± .001 a	.017 ± .002 a
07/22/75	.019 ± .001 ac	.017 ± .003 bc		.014 ± .001 bc	.025 ± .003 a
08/05/75	.042 ± .000 c	.036 ± .003 bc	.103 ± .004 a	.032 ± .002 b	.032 ± .001 b
09/02/75	.045 ± .000 a	.047 ± .001 a		.031 ± .013 a	.048 ± .001 a
09/30/75	.027 ± .000 a	.030 ± .000 a		.026 ± .002 a	.028 ± .001 a

TABLE 33

Total Phosphorus Concentrations in Hopewell Lake as mg Phosphorus per Liter. Water samples were filtered using a 0.45 μ membrane filter.

	Station 1			Station 2	
Date	Surface	1.5 m	6 m	Surface	1 m
11/18/74	.051 ± .005 a	.054 ± .010		.068 ± .021 a	
05/28/75	.012 ± .002 a	.027 ± .002 -		.009 ± .004 a	.006 ± .001 a
06/10/75	.017 ± .001 a	.022 ± .004 a		.02 ± .002 a	.017 ± .001 a
6/24/75	.024 ± .002 a	.023 ± .000 a		.024 ± .001 a	.025 ± .004 a
07/08/75	.031 ± .002 a	.028 ± .003 a		.031 ± .004 a	.031 ± .002 a
07/22/75	.048 ± .006 a	.066 ± .008 -		.027 ± .001 a	.034 ± .001 a
08/05/75	.059 ± .001 -	.055 ± .004 b	.113 ± .001 a	.054 ± .004 b	.049 ± .003 b
09/02/75	.078 ± .004 a	.081 ± .006 a		.077 ± .005 a	.072 ± .001 a
09/30/75	.044 ± .001 a	.041 ± .001 ac		.037 ± .004 bc	.044 ± .001 a

TABLE 34

Total Phosphorus Concentrations in Unfiltered Hopewell Lake Water as mg Phosphorus per Liter

	Station 1			Station 2	
Date	Surface	1.5 m	6 m	Surface	1 m
05/28/75	.072 ± .005 a	.036 ± .010 -		.060 ± .000 a	.006 ± .009 a
06/10/75	.055 ± a	.042 ± .003 ab		.042 ± .005 ab	.037 ± .003 b
06/24/75	.046 ± .001 a	.047 ± .003 a		.047 ± .001 a	.045 ± .001 a
07/08/75	.043 ± .009 b	.082 ± .009 a		.048 ± .001 b	.050 ± .004 b
07/22/75	.075 ± .001 bc	.126 ± .005 a		.064 ± .003 c	.077 ± .004 b
08/05/75	.082 ± .004 b	.106 ± .003 ab	.154 ± .003 a	.103 ± .007 ab	.134 ± .038 ab
09/02/75	.099 ± .001 a	.107 ± .003 a		.101 ± .001 a	.108 ± .005 a
09/30/75	.059 ± .002 b	.061 ± .002 b		.060 ± .001 b	.070 ± .003 a

TABLE 35

pH of Hopewell Lake Water Samples

	Station 1			Station 2	
Date	Surface	1-1.5 m	2 m	Surface	1-1.5 m
05/28/75	6.0	5.8		6.4	6.0
06/12/75	6.9	6.3	6.0	6.5	6.8
06/24/75	6.9	6.6	6.7		
07/08/75	8.4	8.0	8.2	8.3	8.6
07/22/75	9.1	9.1	9.1	9.1	9.1
08/04/75	8.5	8.7	8.7	9.0	8.8

TABLE 36

Primary productivity of Hopewell Lake in mg carbon/m^3/hr

	Station 1			Station 2	
Date	Surface	1.0 m	2.0 m	Surface	1.0 m
5/28/75	0.69±0.53	3.23±3.12	-	1.22±0.01	0.17±0.05
6/10/75	3.70±0.38	2.34±0.10	-	2.64±0.08	2.71±0.83
6/24/75	8.96±0.16	7.34±0.62	3.34±1.76	6.64±0.90	6.83±1.50
7/8/75	98.6±10.8	110.2±1.55	36.8±.25	88.0±.65	32.7±1.6
7/22/75	58.1±.60	2.18±.15	1.19±.17	30.0±.05	21.0±.05
8/5/75	24.32±3.52	30.83±2.78	6.23±.53	74.96±5.29	26.94±2.33
9/2/75	20.60±5.04	16.60±3.59	3.70±1.66	16.46±6.06	0.71±0.19
9/30/75	1.80±.52	1.86±.59	2.14±.32	4.68±.90	3.32±.56

TABLE 37

Actinomycetes/100 ml in Hopewell Lake

	Station 1		Station 2	
Date	Surface	1.5 m	Surface	1.0 m
11-16-74	—	—	—	—
5-28-75	35	0	90	60
6-10-75	55	20	20	0
6-24-75	0	0	0	0
7-8-75	—	10	15	25
7-22-75	70	25	60	10
8-5-75	10	5	15	20
9-1-75	0	0	5	0
10-1-75	0	0	10	0

Invertebrates/100 ml in Hopewell Lake

	Station 1		Station 2	
Date	Surface	1.5 m	Surface	1.0 m
11-16-74	—	—	—	—
5-28-75	0	0	0	0
6-10-75	0	0	0	0
6-24-75	0	0	0	0
7-8-75	7	9	27	17
7-22-75	9	6	15	20
8-5-75	10	27	19	12
9-1-75	14	21	12	10
10-1-75	0	3	0	5

TABLE 38

Fecal Coliform/100 ml in Hopewell Lake

	Station 1		Station 2	
Date	Surface	1.5 m	Surface	1.0 m
11-16-74	3	—	0	—
5-28-75	1	1	0	0
6-10-75	6	11	7	5
6-24-75	5	3	4	5
7-8-75	0	3	2	2
7-22-75	3	0	3	23
8-5-75	6	5	1	48
9-1-75	0	0	0	0
10-1-75	0	0	0	0

Fecal Streptococci/100 ml in Hopewell Lake

	Station 1		Station 2	
Date	Surface	1.5 m	Surface	1.0 m
11-16-74	1	—	0	—
5-28-75	3	10	2	1
6-10-75	8	82	15	20
6-24-75	0	0	4	2
7-8-75	8	7	5	1
7-22-75	13	6	22	12
8-5-75	1	1	6	16
9-1-75	0	0	0	0
10-1-75	0	0	0	0

TABLE 39

Aerobic Bacteria/100 ml in Hopewell Lake

Date	Station 1 Surface	Station 1 1.5 m	Station 2 Surface	Station 2 1.0 m
11-16-74	—	—	—	—
5-28-75	12,120	11,400	10,940	10,900
6-10-75	48,100	10,480	11,860	6,200
6-24-75	29,720	20,920	8,840	10,120
7-8-75	—	2,240	1,900	13,040
7-22-75	70,800	98,360	180,940	12,780
8-5-75	23,900	9,240	5,300	6,580
9-1-75	6,200	2,480	2,770	2,520
10-1-75	729	415	356	290

Anaerobic Bacteria/100 ml in Hopewell Lake

Date	Station 1 Surface	Station 1 1.5 m	Station 2 Surface	Station 2 1.0 m
11-16-74	—	—	—	—
5-28-75	3,580	3,360	2,500	4,660
6-10-75	3,120	2,980	2,860	3,060
6-24-75	4,420	17,000	1,720	1,240
7-8-75	—	580	5,400	11,560
7-22-75	20,440	21,860	80,940	1,580
8-5-75	940	1,840	480	1,860
9-1-75	390	350	680	440
10-1-75	65	83	60	98

TABLE 40

Molds/100 ml in Hopewell Lake

	Station 1		Station 2	
Date	Surface	1.5 m	Surface	1.0 m
11-16-74	—	—	—	—
5-28-75	75	75	45	40
6-10-75	40	40	25	15
6-24-75	40	5	5	40
7-8-75	—	20	10	15
7-22-75	175	30	35	30
8-5-75	0	0	0	5
9-1-75	0	0	0	0
10-1-75	0	0	0	0

TABLE 41

SHANNON-WIENER INDICIES
FOR HOPEWELL LAKE

Date	Sample	H'max	H'	E
05-28-75	1-S	1.099	.734	.668
	1-1.5	1.099	.875	.796
	2-S	1.386	1.178	.850
	2-1	1.386	1.165	.841
	flume	1.609	1.314	.817
06-11-75	1-S	1.946	1.686	.866
	1-1.5	1.946	1.714	.881
	2-S	2.197	1.759	.801
	2-1	2.197	.819	.819
06-25-75	1-S	1.609	1.997	.961
	1-1.5	2.197	1.801	.820
	2-S	1.609	1.106	.687
	2-1	1.792	1.585	.884
07-08-75	1-S	1.609	.268	.167
	1-1.5	1.099	.236	.215
	2-S	.693	.249	.359
07-22-75	1-S	.693	.020	.029
	1-1.5	0	0	0
	2-S	0	0	0
	2-1.5	0	0	0
08-05-75	1-S	1.099	.720	.655
	1-1.5	0	0	0
	2-S	0	0	0
	2-1.5	0	0	0
09-01-75	1-S	0	0	0
	1-1.5	.693	.693	.100
	2-S	.693	.653	.942
	2-1	1.386	1.388	.100
09-30-75	1-S	0	0	0
	1-1.5	0	0	0
	2-S	1.386	.966	.697
	2-1	0	0	0

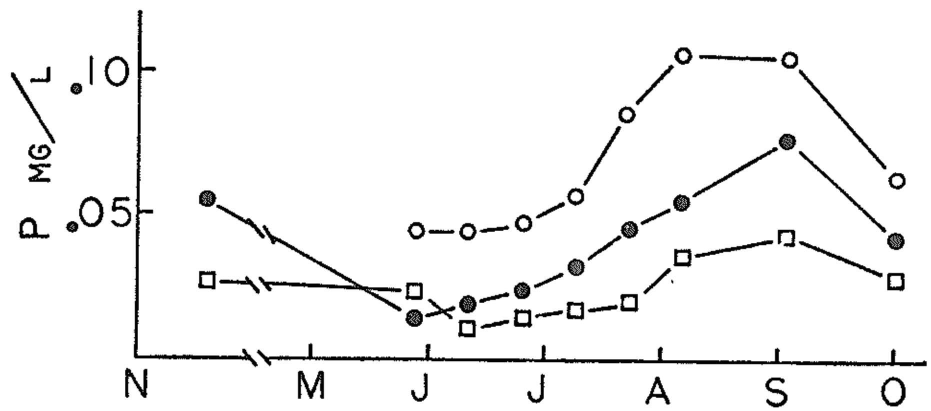


Figure 25. Phosphorus determinations of water from Hopewell Lake. Samples were filtered through 0.45 μ membrane filters and analyzed for orthophosphate (□-□) and total filtered phosphorus (●-●). Total phosphorus (○-○) was determined using unfiltered samples. Values are means for surface and 1.5 meter depths at sample stations 1 and 2.

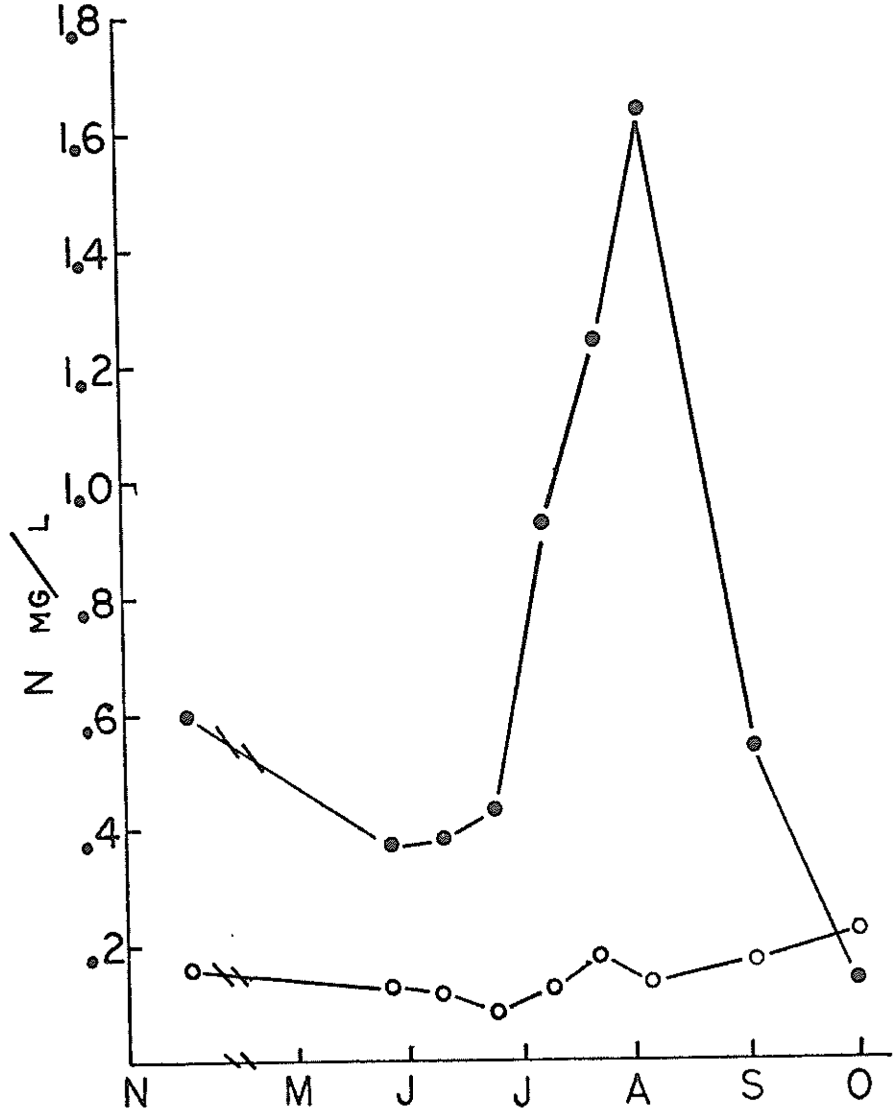


Figure 26. Nitrogen determinations of water from Hopewell Lake. Samples were filtered through 0.45 μ membrane filters and analyzed for nitrate (O - O) and total nitrogen (●-●) was determined using unfiltered samples. Values are means for surface and 1.5 meter depths at sample stations 1 and 2.

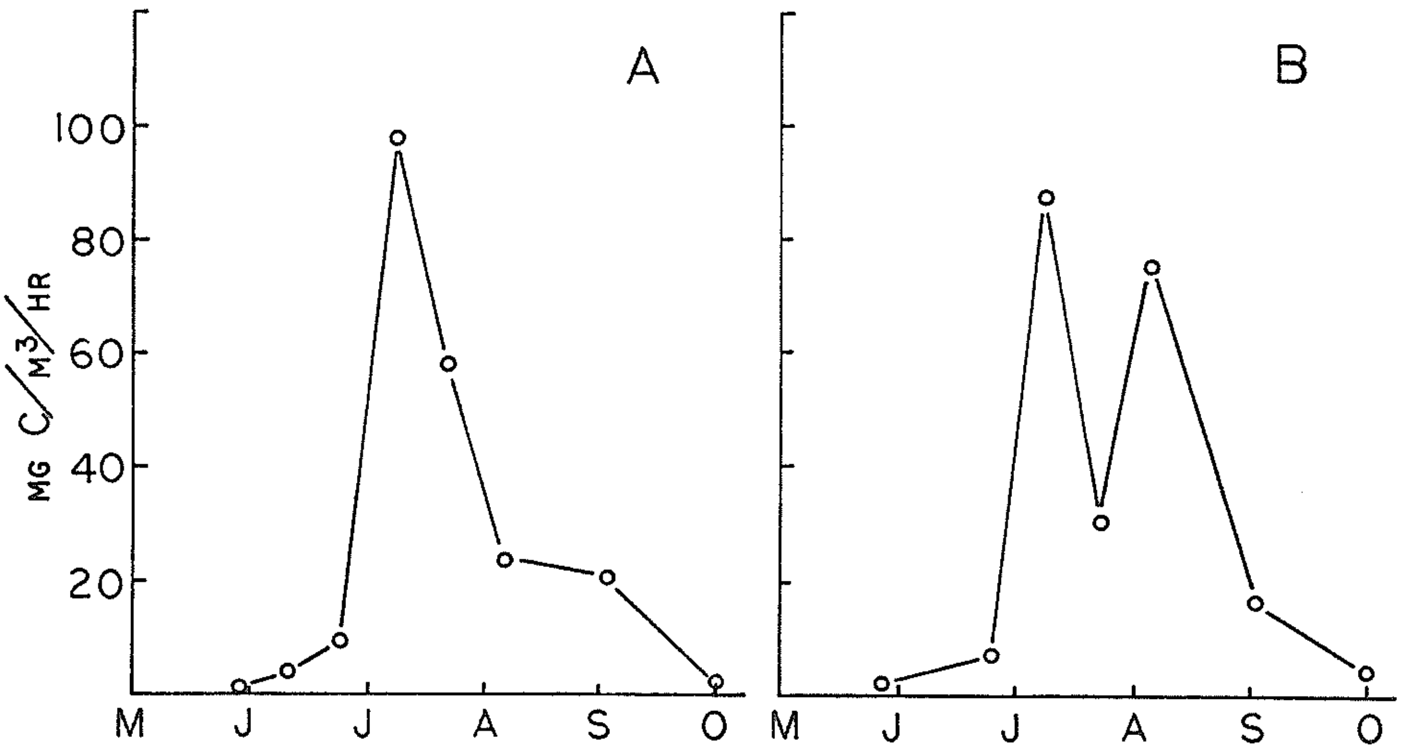


Figure 27. Primary productivity measurements at Hopewell Lake. A is at station 1 and B is station 2, both are surface values.

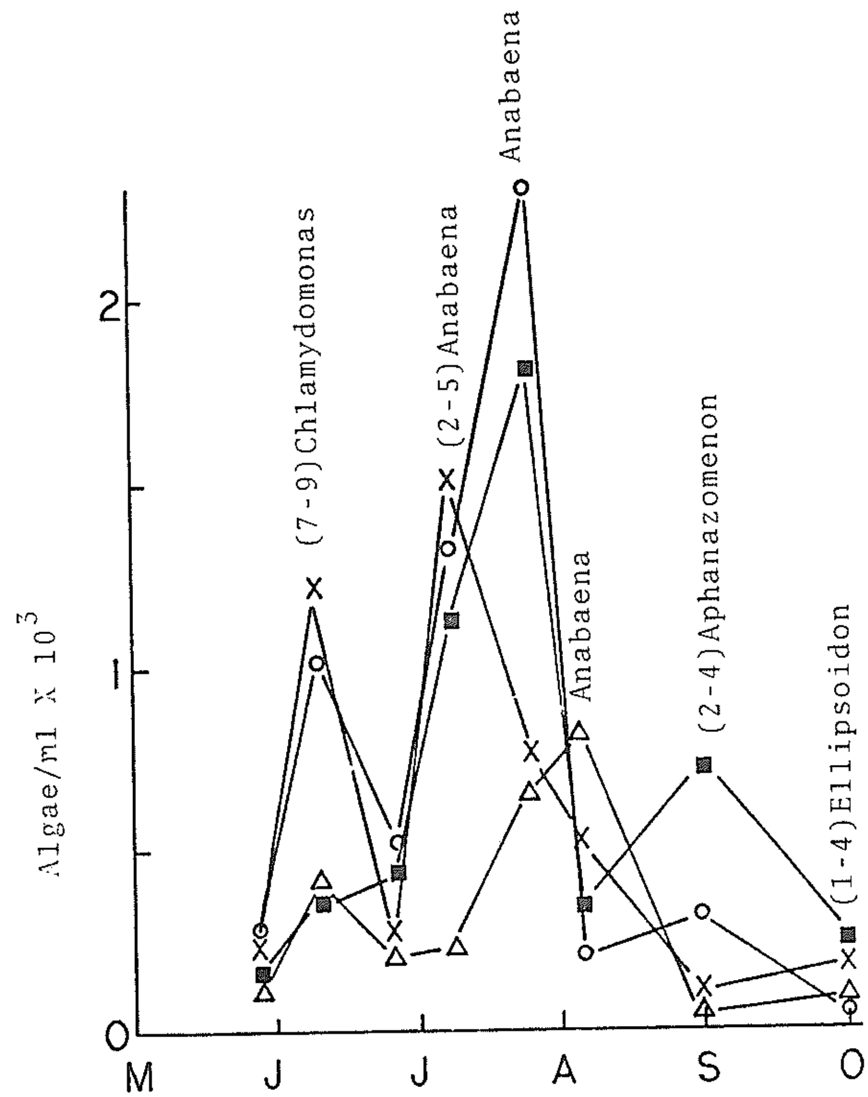


Figure 28. Yearly distribution of algae on the surface of Hopewell Lake. The major species is indicated and the number of algal species is noted for each bloom at station 1 (O - O) and 2 (X - X) at the surface and at station 1 (□ - □) and 2 (△ - △) at the 1.5 meter depth.

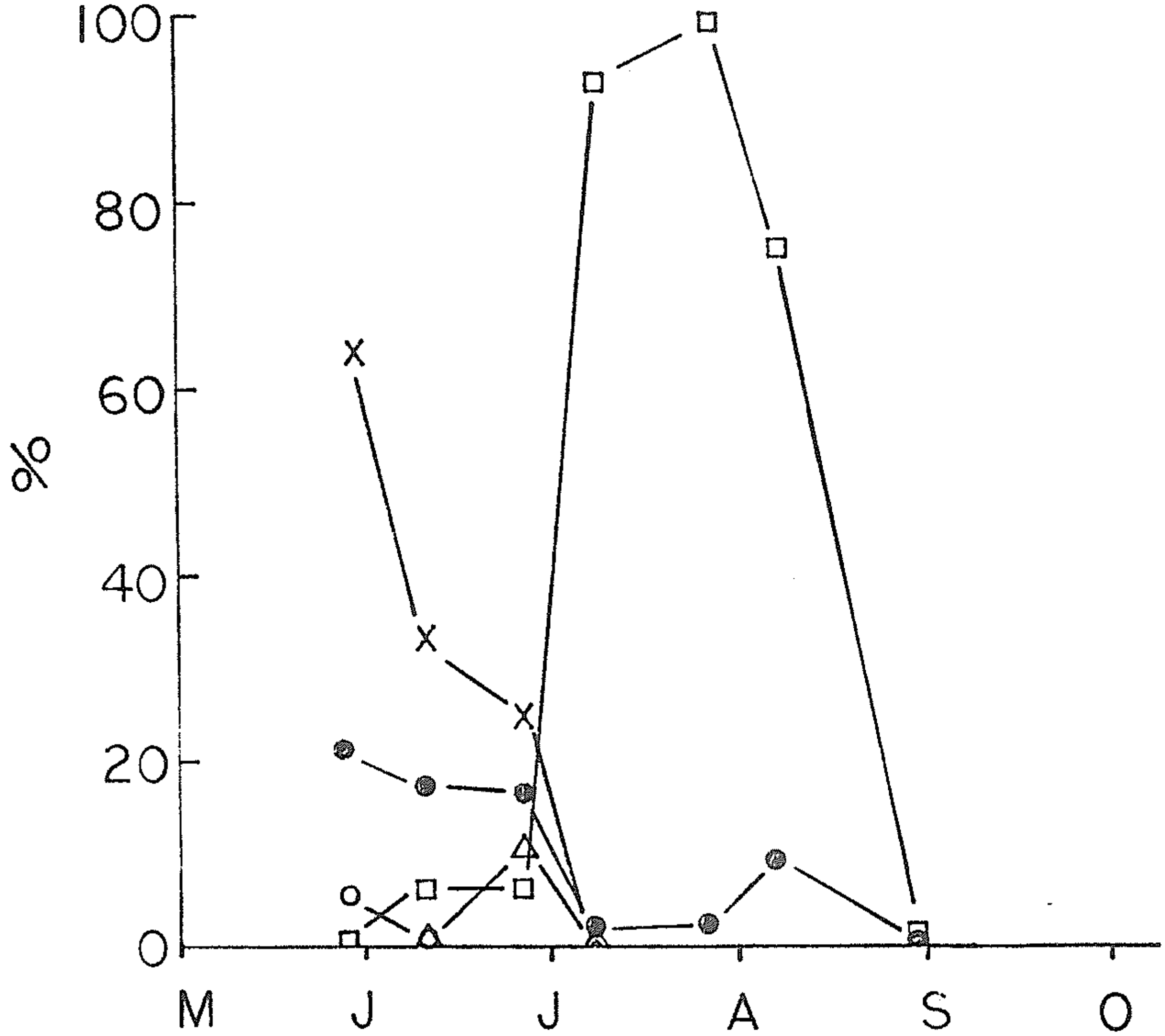


Figure 29. Abundance of algal species at Hopewell Lake at the surface of station 1. Navicula (●), Chlamydomonas (X), Aphanazomenon (O), Ellipsoidan (△), and Anabaena (□) are expressed as % of total algae present.

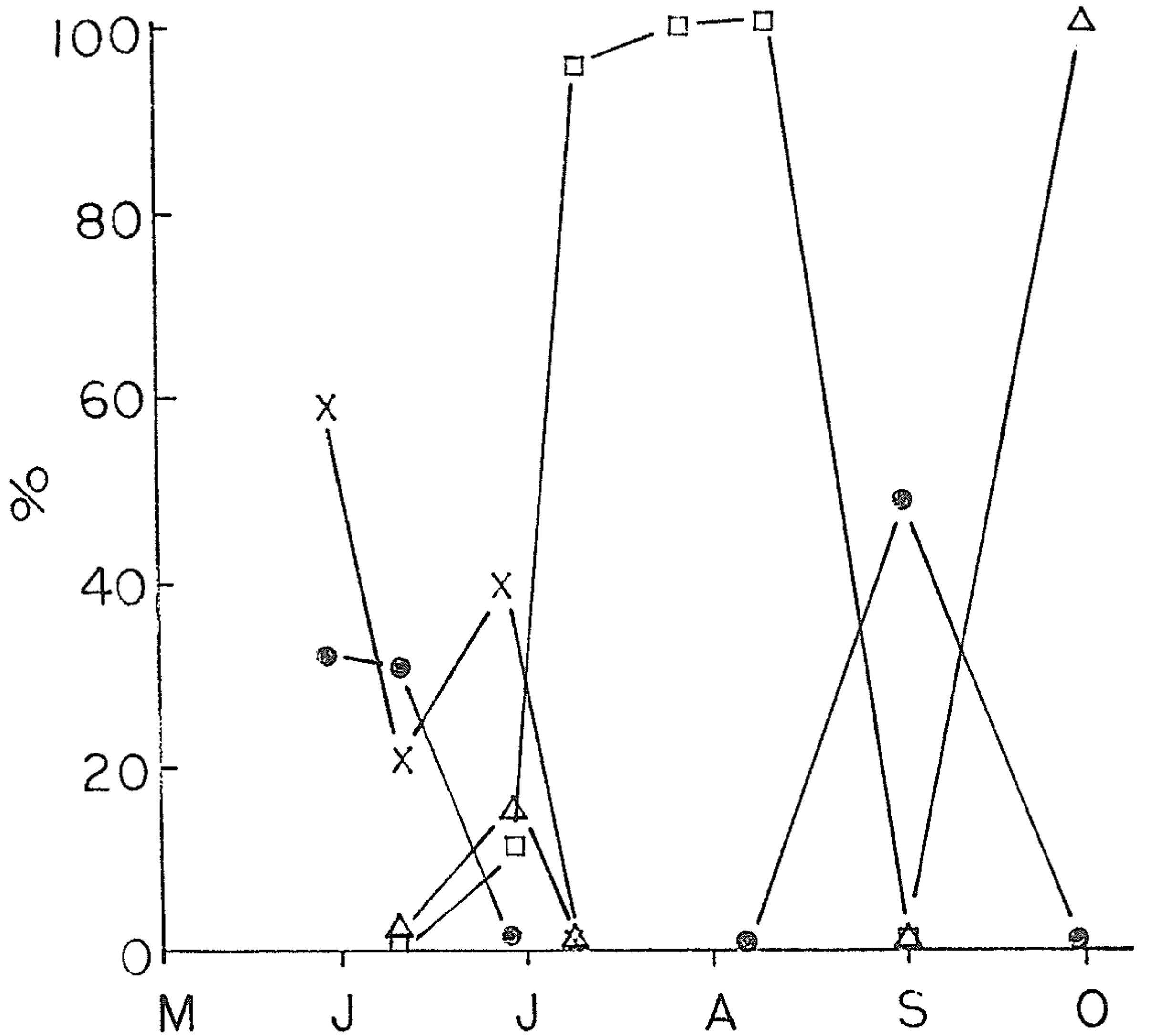


Figure 30. Abundance of algal species at Hopewell Lake at the 1.5 meter depth at station 1. Navicula (●), Chlamydomonas (X), Aphanazomenon (o), Ellipsoidon (△), and Anabaena (□) are expressed as % of total algae present.

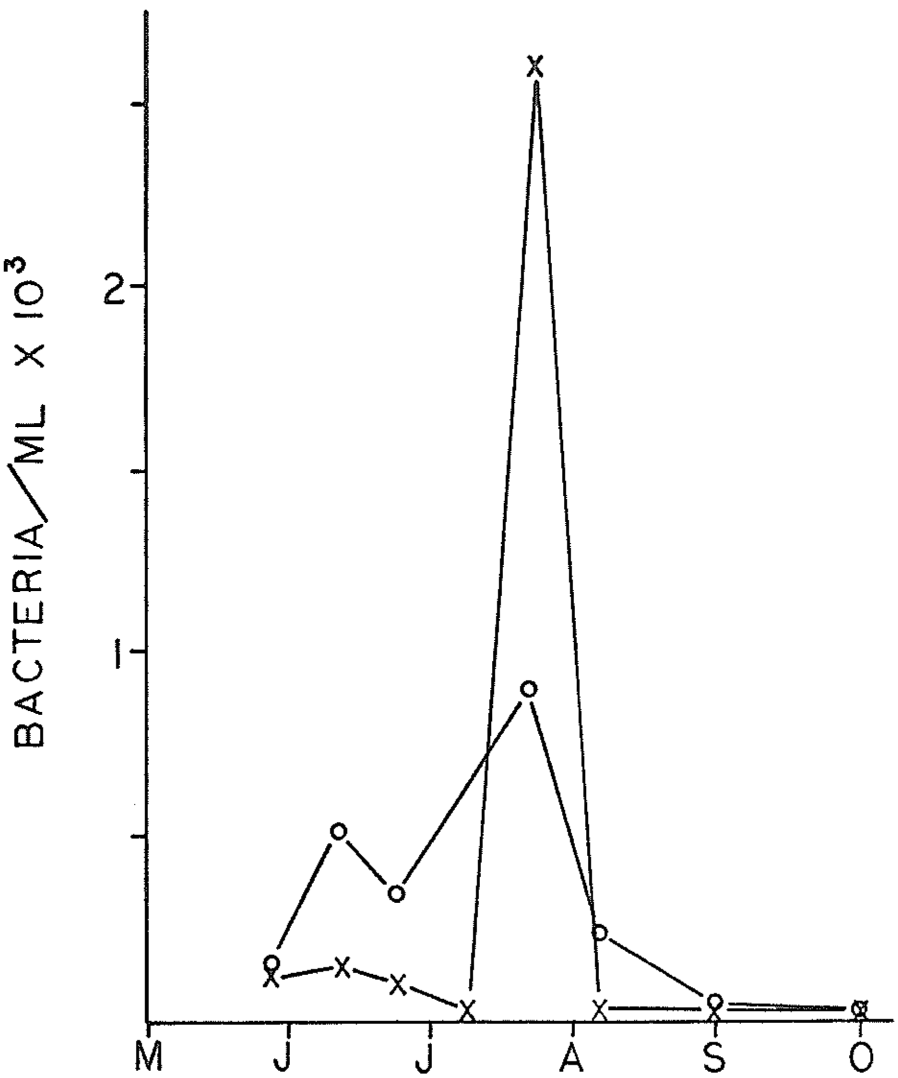


Figure 31. Abundance of bacteria in Hopewell Lake. Aerobic plus anaerobic bacterial seems are given for surfaces of station 1 (o) and station 2 (X).

Lagunitas Lakes

1. Location and Sampling Stations

The Lagunitas Lakes are a chain of small lakes established primarily by a series of beaver dams. The altitude is about 9500 feet above sea level. The two uppermost lakes in the series were included in this study with Lake 1, about 2 acres of water surface, being the upper lake, which was separated from Lake 2, about 5 acres of surface water, by a natural earthen foundation. Lake 2 was restrained by a relatively long beaver dam. Since these lakes were almost 30 miles off of the main road and the access was by primitive jeep trails, water samples could be collected only from June through October when snow did not block the route. Lake 1 did not appear to be more than 1-2 meters deep while Lake 2, which was about 15 feet lower than Lake 1, appeared to be about at most 3-5 meters deep. At both Station 1 and 2 on Lake 2, the water depth was 1-2 meters. The location and sampling stations of the Lagunitas Lakes are shown in Fig. 32.

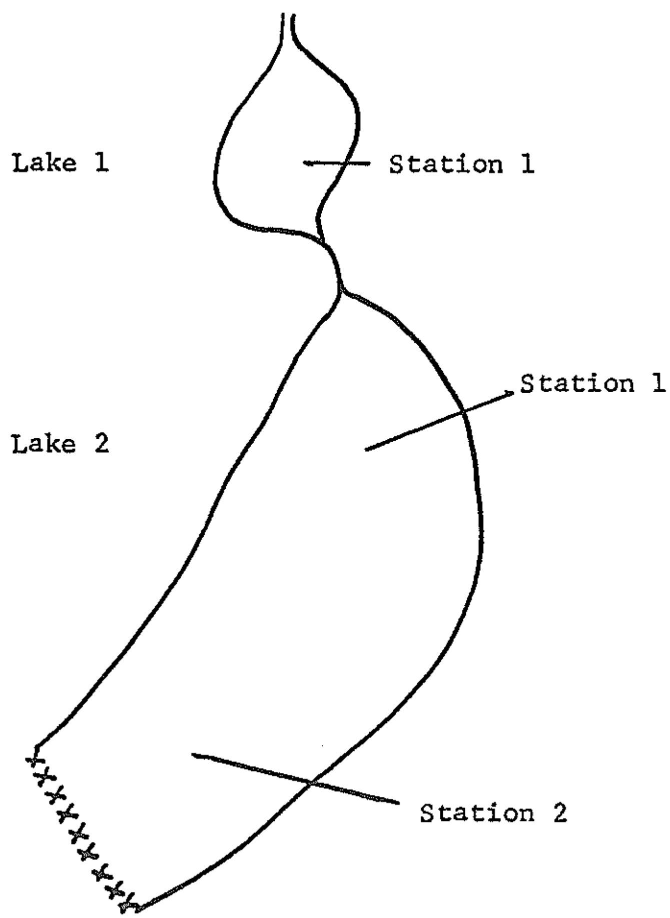
2. Water Temperature and Transparency

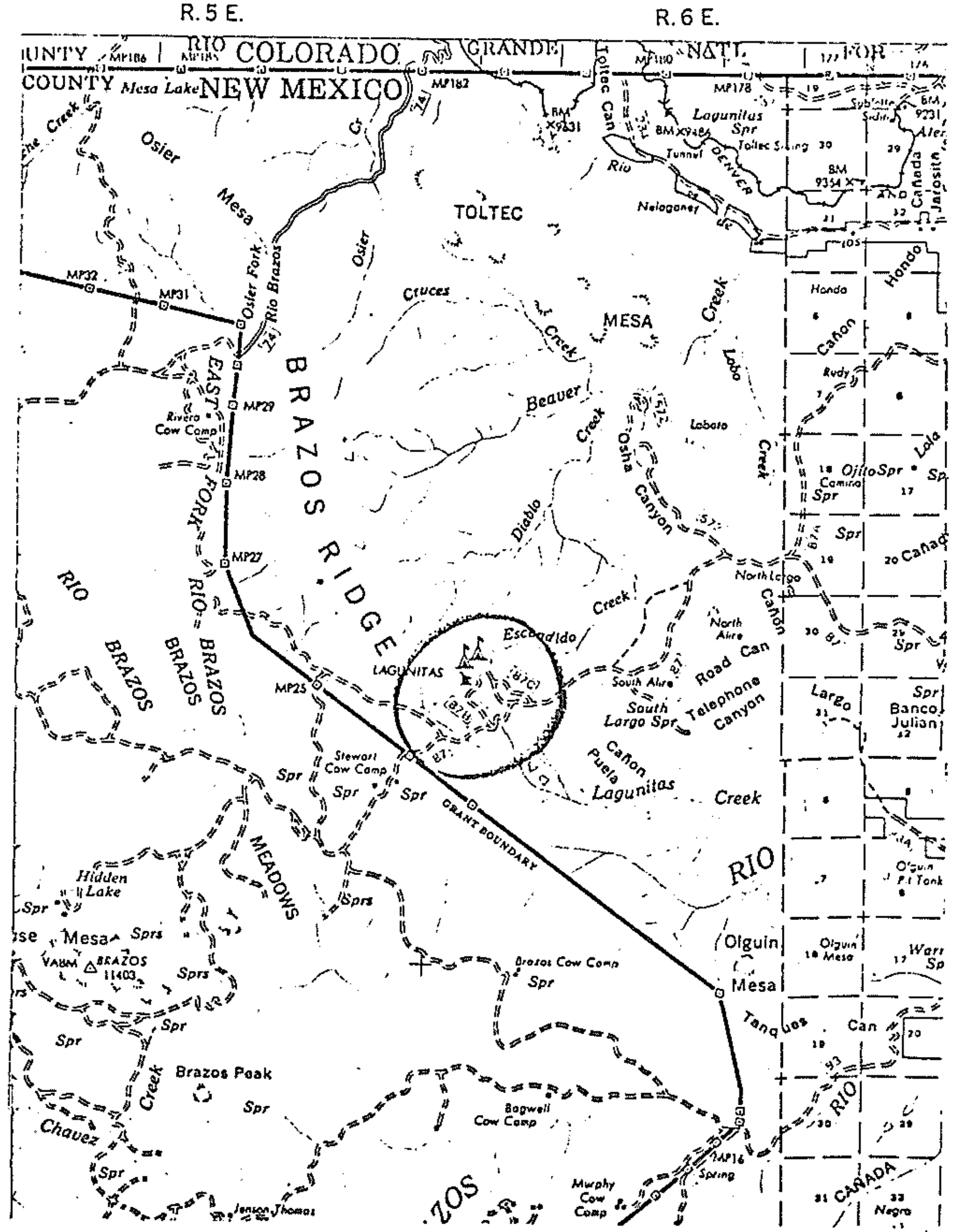
Measurements of temperature and water transparency are presented in an earlier series of tables (Table 1-3).

3. Biological Measurements

Floating masses of algae, often as large as 3 cm in diameter, accumulate along the banks of Lake 1 and Lake 2. The collected algal masses are several feet across in Lake 1

Figure 32 Lagunitas Lakes Showing Location and Sampling Stations





around the narrow passage where it drains into Lake 2. These same masses are found in Lake 2 but never accumlate to the extent that they do in Lake 1 because the waves wash the algae over the beaver dam. The algae were examined and found to contain 10-25 different algal types and numerous types of bacteria. These floating masses of algae do not indicate eutrophic conditions in the Lagunitas Lakes. On the contrary phytoplankton productivity in Lake 1 was usually very low.

Of greater concern than the algal masses is the algal bloom due to *Anabaena* in the larger lake. In Lake 2 at both Stations 1 and 2, *Anabaena* is in competition with *Fragilaria*. This competition may be important to keep *Anabaena* under control. Only in the 22 July samples from Lake 2 was *Anabaena* the dominant phytoplankton genus and even then several other genera were represented. The diversity of the phytoplankton population is indicated by Shannon-Weiener indicies (Table 50) which exceeded values of 0.2 in all but three of the 25 samples analyzed. Bacterial populations (Table 49) increase in Lake 2 along with algal numbers, suggesting that bacteria are contributing to algal growth.

For small lakes, the absence of aquatic macrophytes seemed unusual. However, the metal analysis, Table 11, suggests that the low potassium might limit growth of higher aquatic plants.

Phytoplankton productivity (Table 48, Fig. 35) of Lake 1 was quite low (<6 mg carbon/m^3/hr) in all samples except the one collected on 22 July 1975. The large standard error of the latter measurement suggests that this sample may not have been representative. Because Lake 1 is both very clear (Table 3) and shallow the apparently abundant attached algae on the bottom of the lake probably exceed the primary productivity of the phytoplankton; however, periphyton productivity was not measured in this investigation. Phytoplankton productivity, except for the 22 July sample, was 5-10 times greater in surface water samples from Lagunitas Lake 2 than Lake 1. The bottom of Lake 2 was visible only near the shoreline and the periphyton appeared to be of limited importance compared to the shallower Lake 1. At the times of maximum phytoplankton productivity, production was lower for Lagunitas Lake 2 than for Eagle Nest, Fenton, or Hopewell Lakes. Lagunitas Lake 2 did not show the striking drop in productivity following the summer bloom, as occurred in Fenton and Hopewell Lakes.

4. Chemical Measurements

The pH of Lake 1 was 8.5 on the first sampling date (12 June) and increased to 9-9.5 in samples obtained through August (Table 47). The pH of Lake 2 was found to be above 9.0 in most samples with a maximum pH of 9.8 occurring in early July. Metal analysis (Table 11) indicates that the water is hard in Lake 1 (50.6 mg/liter Ca) while relatively soft in Lake 2 (15.3 mg/liter) while the potassium concentration is similarly low in both lakes at 0.6 mg/liter. Because of the high pH in both lakes and hardness of Lake 1 it is predicted that iron and perhaps other micronutrient cations would be limiting for growth of both higher plants and phytoplankton.

The total phosphorus concentration in unfiltered water samples from Lagunitas Lakes 1 and 2 were similar (Table 46, Fig. 33); however, the ortho and total phosphorus in membrane filtered water was usually lower in Lake 2 than Lake 1 (Table 45, 46, Fig. 33). This probably reflects the greater phytoplankton activity and nutrient demand in Lake 2 than Lake 1. The phosphorus concentrations in Lagunitas Lake 2, tended to be lower than phosphorus concentrations in other lakes included in this investigation.

The total nitrogen content of Lake 2 was always somewhat higher than for Lake 1 while nitrate concentrations were similar for both Laganitas Lakes sampled (Tables 42, 43, Fig. 34). In June the total nitrogen content of the Lagunitas Lakes was similar to that of the other lakes sampled. As in the other lakes there was an increase in the total nitrogen content of water samples in mid-summer. This increase in total nitrogen corresponds to the one sampling date on which Anabaena was the predominant phytoplankton genus present in both Lake 1 and Lake 2(Fig. 36, 37).

Oxygen concentrations (Table 11a) measured at the Lagunitas Lakes were always very high. The measurements made by the Winkler method exceeded the solubility of oxygen at the existing temperature and altitude and the oxygen electrode did not give valid readings in Lagunitas lake water. Possibly the high pH or other chemical characteristics of these lakes interferred with the oxygen determinations.

TABLE 42

Nitrate Nitrogen Concentrations in Lagunitas Lakes Water as mg Nitrogen per Liter. Water samples were filtered through a 0.45 μ membrane filter.

	Lake One	Lake Two			
		Station 1		Station 2	
Date	Surface	Surface	1 m	Surface	1 m
06-10-75	.111 ± .005 a	.139 ± .017 a	.105 ± .009 a		
06-24-75	.102 ± .010 a		.088 ± .004 a	.064 ± .014 -	
07-08-75	.056 ± .016 -	.079 ± .004 a	.084 ± .004 a		.080 ± .002 a
07-22-75	.086 ± .012 a	.065 ± .016 a	.103 ± .014 a	.094 ± .001 -	.068 ± .009 a
08-05-75	.062 ± .005 -	.098 ± .012 a	.091 ± .003 a	.054 ± .003 b	.085 ± .007 a
09-30-75	.135 ± .008 a	.153 ± .010 a	.178 ± .026 -		

TABLE 43

Total Nitrogen Concentrations in Unfiltered Lagunitas Lakes Water as mg Nitrogen per Liter

Date	Lake One	Lake Two			
		Station 1		Station 2	
	Surface	Surface	1 m	Surface	1 m
06-10-75	.330 ± .022 a	.467 ± .020 b		.538 ± .019 -	
06-24-75	.248 ± .007 a	.447 ± .043 -		.439 ± .004 b	
07-08-75	.349 ± .011 b	.485 ± .014 c	.525 ± .021 ca	.543 ± .011 a	
07-22-75	.646 ± .111 a	.611 ± .049 a	.973 ± .210 a	.611 ± .021 a	.865 ± .024 a
08-05-75	.456 ± .909 a	.584 ± .112 a	.681 ± .065 a	.691 ± .046 a	.514 ± .029 a
09-30-75	.306 ± .134 a	.540 ± .014 a	.501 ± .044 a	.561 ± .040 a	

TABLE 44

Orthophosphate Concentrations in Lagunitas Lakes as mg Phosphorus per Liter. Water samples were filtered using a 0-45 μ membrane filter.

	Lake One	Lake Two			
		Station 1		Station 2	
Date	Surface	Surface	1 m	Surface	1 m
06-10-75	.024 ± .022 a	.005 ± .001 b		.004 ± .000 b	
06-24-75	.033 ± .001 a			.008 ± .001 b	.009 ± .001 b
07-08-75	.030 ± .000 a	.008 ± .000 b	.009 ± .001 b	.010 ± .001 b	
07-22-75	.022 ± .004 a	.011 ± .002 b	.011 ± .002 b	.010 ± .002 b	.012 ± .002 -
08-05-75	.018 ± .002 ac	.017 ± .002 ac	.021 ± .001 a	.016 ± .001 ac	.013 ± .002 bc
09-30-75	.006 ± .001 a	.007 ± .002 a		.008 ± .000 -	

TABLE 45

Total Phosphorus Concentrations in Lagunitas Lakes as mg Phosphorus per Liter. Water samples were filtered using a 0.45 μ membrane filter.

	Lake One	Lake Two			
		Station 1		Station 2	
Date	Surface	Surface	1 m	Surface	1 m
06-10-75	.032 ± .005 a	.010 ± .002 b		.017 ± .002 b	
06-24-75	.038 ± .001 a			.013 ± .002 b	.014 ± .000 b
07-08-75	.035 ± .001 a	.018 ± .001 b	.019 ± .002 b	.020 ± .002 b	
07-22-75	.030 ± .004 a	.023 ± .003 ac	.020 ± .003 bc	.017 ± .007 bc	.015 ± .000 -
08-05-75	.028 ± .005 a	.030 ± .001 a	.033 ± .000 a	.030 ± .002 a	.028 ± .00 a
09-30-75	.015 ± .002 a	.005 ± .001 b		.004 ± .000 -	

TABLE 46

Total Phosphorus Concentrations in Unfiltered Lagunitas Lakes Water as mg Phosphorus per Liter

	Lake One	Lake Two			
		Station 1		Station 2	
Date	Surface	Surface	1 m	Surface	1 m
06-10-75	.061 ± .007 a	.037 ± .016 a		.045 ± .001 a	
06-24-75	.042 ± .001 a			.037 ± .002 ab	.035 ± .001 b
07-08-75	.037 ± .004 a	.040 ± .004 a	.034 ± .001 a	.039 ± .002 a	
07-22-75	.050 ± .007 a	.046 ± .007 a	.057 ± .003 a	.045 ± .006 a	.051 ± .004 a
08-05-75	.033 ± .002 b	.054 ± .010 a	.04 ± .008 ab	.046 ± .001 ab	.045 ± .004 ab
09-30-75	.031 ± .001 a	.026 ± .001 b	.027 ± .001 ab	.024 ± .002 b	

TABLE 47

pH of Lagunitas Lakes Water Samples

	Lake One		Lake Two			
			Station 1		Station 2	
Date	Surface	0.5 m	Surface	1 m	Surface	1 m
06/12/75	8.5		6.5		9.3	
06/24/75	9.0	8.9	8.8	8.2	9.2	9.2
07/08/75	9.3	9.3	9.8	9.4	9.7	9.8
07/22/75	9.0		9.4	9.0	9.4	9.4
08/04/75	9.5		8.7	8.9	8.9	9.0

TABLE 48

Primary productivity of Lagunitas Lakes in mg carbon/m^3/hr

	Lake One		Lake Two			
			Station 1		Station 2	
Date	Surface	0.5 m	Surface	1.0 m	Surface	1.0 m
6/24/75	2.74±0.20	3.96±0.12	17.70±4.17	19.28±11.44	21.46±0.42	5.50±1.56
7/8/75	1.43±.44	1.66±.34	15.0±.15	16.8±.70	11.3±.00	7.2±.50
7/22/75	53.6±32.1	-	34.8±4.3	40.1±9.4	19.8±.85	9.88±2.2
8/5/75	5.52±2.55	-	28.6±7.83	19.76±1.98	45.6±4.22	34.86±2.14

TABLE 49

Aerobic Bacteria/100 ml in Lagunitas Lakes

	LAKE 1		LAKE 2			
	Station 1		Station 1		Station 2	
Date	Surface	1.0 m	Surface	1.0 m	Surface	1.0 m
6-10-75	8,190	---	6,100	---	6,150	---
6-24-75	70	---	610	---	100	---
7-8-75	880	620	900	1,580	520	1,060
7-22-75	6,600	---	2,720	6,720	3,920	4,120
8-5-75	3,860	---	5,400	4,740	5,340	7,180
10-1-75	2,070	2,420	2,520	2,220	2,340	---

Anaerobic Bacteria/100 ml in Lagunitas Lakes

	LAKE 1		LAKE 2			
	Station 1		Station 1		Station 2	
Date	Surface	1.0 m	Surface	1.0 m	Surface	1.0 m
6-10-75	200	---	940	---	840	---
6-24-75	0	---	130	---	100	---
7-8-75	580	460	520	700	200	720
7-22-75	13,440	---	1,520	8,040	960	2,800
8-5-75	240	---	1,500	1,660	1,420	1,120
10-1-75	500	650	600	610	380	---

TABLE 50

Fecal Coliforms/100 ml in Lagunitas Lakes

	LAKE 1		LAKE 2			
	Station 1		Station 1		Station 2	
Date	Surface	1.0 m	Surface	1.0 m	Surface	1.0 m
9-10-75	0	---	0	---	0	---
6-24-75	0	---	0	---	0	---
7-8-75	0	0	0	0	0	0
7-22-75	0	0	0	0	0	0
8-5-75	1	---	0	2	9	1
10-1-75	0	0	0	0	0	0

Fecal Streptococci/100 ml in Lagunitas Lakes

	LAKE 1		LAKE 2			
	Station 1		Station 1		Station 2	
Date	Surface	1.0 m	Surface	1.0 m	Surface	1.0 m
6-10-75	0	---	4	---	2	---
6-24-75	0	---	0	---	0	---
7-8-75	4	2	3	10	11	3
7-22-75	22	---	1	7	0	2
8-5-75	6	---	2	0	2	4
10-1-75	0	10	0	15	0	---

TABLE 51

SHANNON-WIENER INDICES FOR LAGUNITAS LAKES

Date	Station	Lake Number	H'max	H'	E
6-11-75	1-S	1	1.009	.851	.774
	1-S	2	1.386	.449	.324
	2-S	2	1.609	.518	.322
6-25-75	1-S	1	1.099	1.018	.926
	1-S	2	1.609	.769	.478
	2-S	2	1.609	.376	.234
7-08-75	1-S	1	1.386	.579	.360
	1-0.5	1	.693	.636	.918
	1-S	2	1.792	1.531	.854
	1-1.0	2	1.946	1.618	.831
	2-S	2	2.197	1.613	.742
7-22-75	1-S	1	2.079	.513	.247
	1-S	2	1.609	.289	.180
	1-1.0	2	2.079	.846	.407
	2-S	2	2.079	1.296	.610
	2-1.0	2	1.946	.551	.283
8-05-75	1-S	1	.693	.675	.974
	1-S	2	1.792	1.378	.769
	1-1.5	2	1.609	.807	.502
	2-S	2	1.946	1.187	.610
	2-1.0	2	1.609	1.219	.758
9-30-75	1-S	1	.693	.318	.459
	1-S	2	1.099	.680	.619
	1-1.0	2	1.609	.187	.116
	2-S	2	1.386	.134	.186

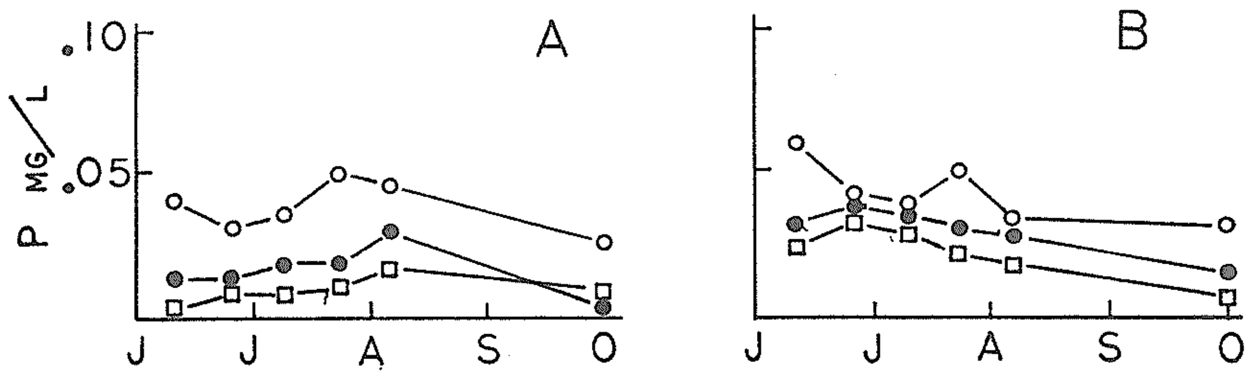


Figure 33. Phosphorus determinations of water from Lagunitas Lakes. Figure A represents Lake 2 and Figure B, Lake 1. Samples were filtered through 0.45 μ membrane filters and analyzed for orthophosphate (□ - □) and total phosphorus (● - ●) was determined using unfiltered samples. Values are means for surface and 1.5 meter depths at sample station 1 and 2. Unfiltered samples were also tested for total phosphorus (○ - ○).

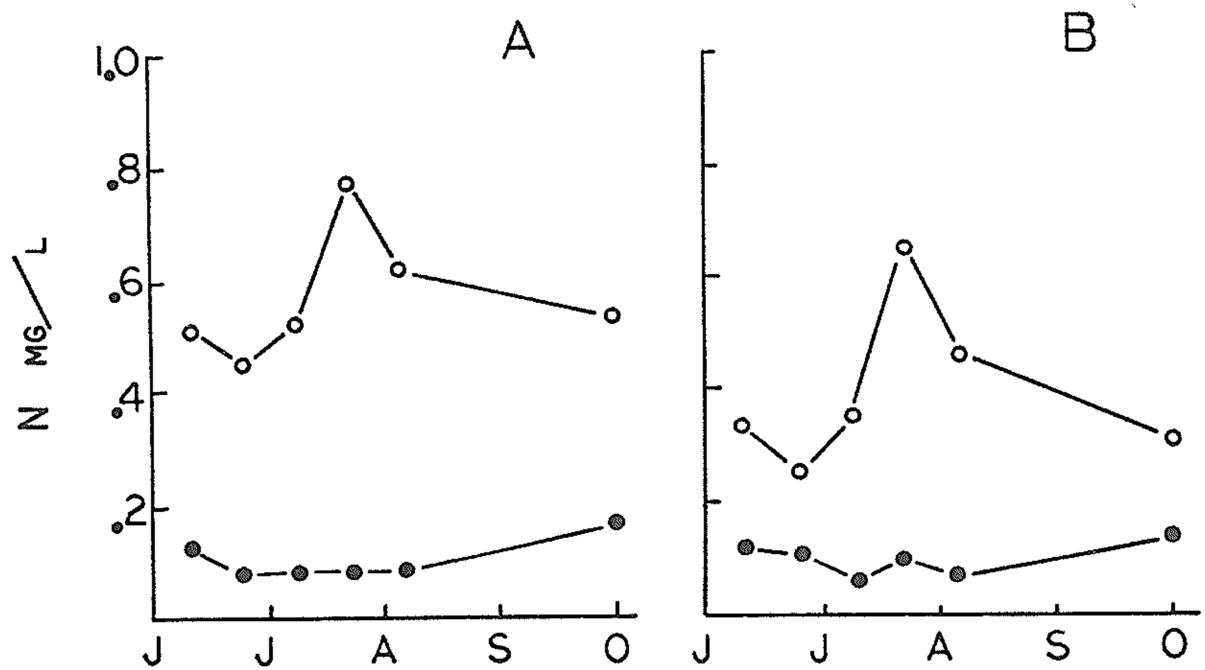


Figure 34. Nitrogen determinations of water from Lagunitas Lakes. Figure A represents Lake 2 and Figure B, Lake 1. Samples were filtered through 0.45 μ membrane filters and analyzed for nitrate (● - ●) and total nitrogen (O - O) was determined using unfiltered samples. Values are means for surface and 1.5 meter depths at sample stations 1 and 2 for Lake 2 (Figure A).

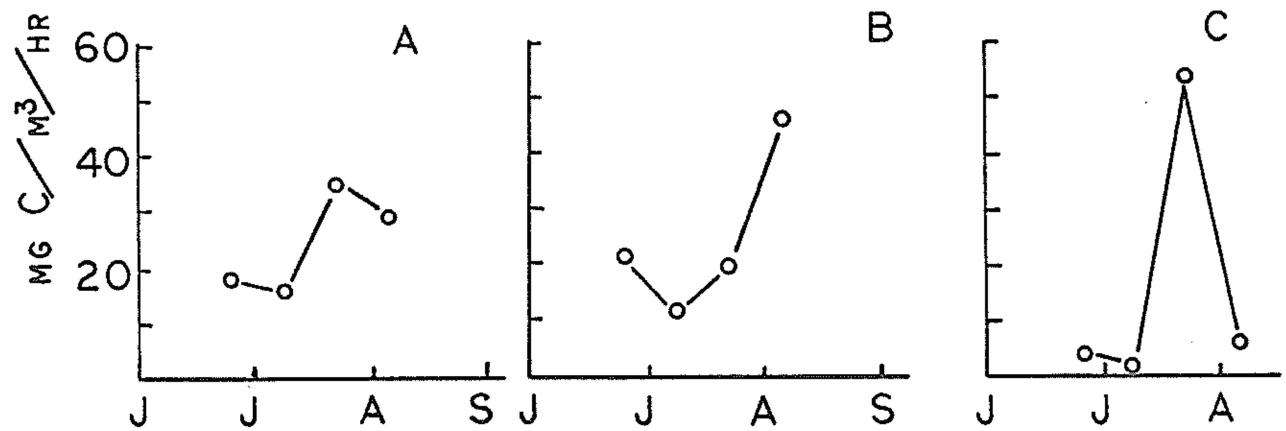


Figure 35. Primary productivity measurements at the surface of Lagunitas Lakes. A refers to lake 2 station 1, B refers to lake 2 station 2, and C refers to lake 1.

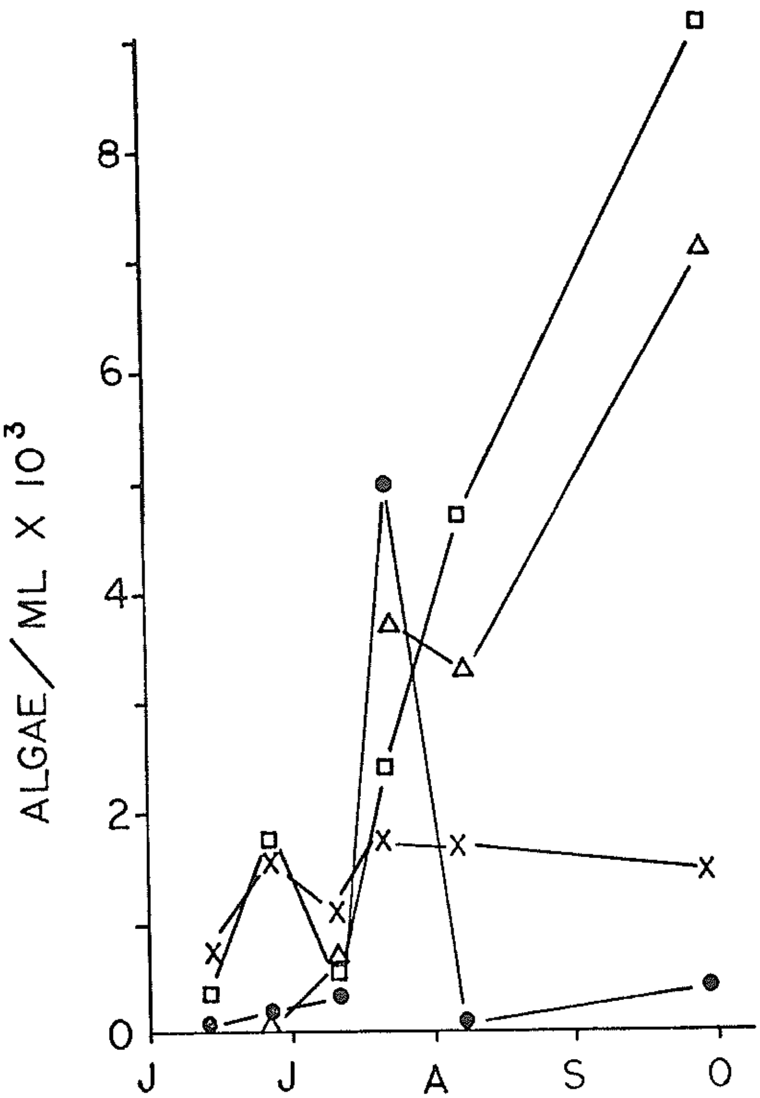


Figure 36. Abundance of algal species in Lagunitas Lakes. Measurements were at the surface of lake 1 (●), lake 2 station 1 (X) and 2 (□) and at 1.5 meter depth of station 2 on lake 2 (△).

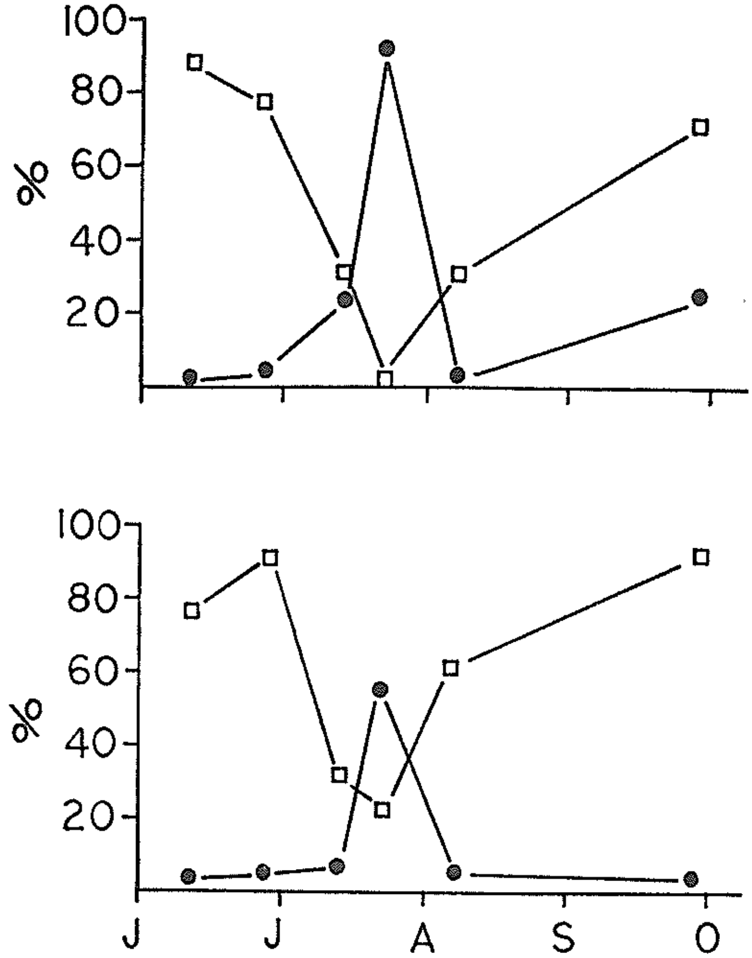


Figure 37. Abundance of major algal species in Lagunitas Lake number 2. The upper figure is station 1 while the lower is station 2. Anabaena (●) and Fragilaria (□) abundance is expressed as % of total algae present.

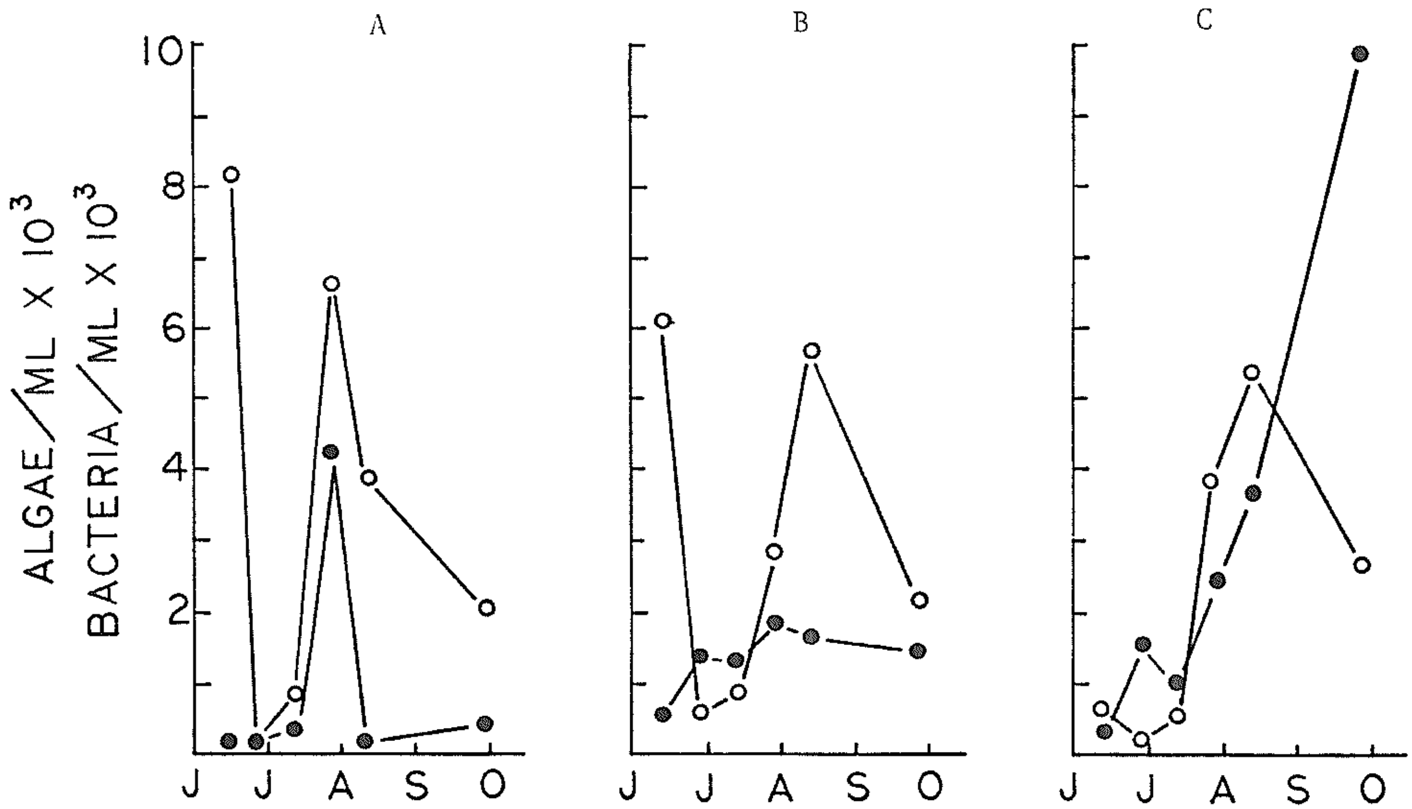


Figure 38. Relationship of algae and bacterial at the surface in the Lagunitas Lakes. A is Lake 1, B is Lake 2 station 1, and C is Lake 2 station 2. The solid circles represent the algae.

Summary

Trophic levels in lakes are generally determined by studying several parameters. Algae have been used as indicators of oligotrophic and eutrophic lakes with the classification as follows (Rawson):

Parameter	Oligotrophic	Eutrophic
Quantity	Poor	Rich
Variety	Many species	Few species
Distribution	To great depths	Trophogenic layer
Diurnal Migration	Extensive	Limited
Water-bloom	Very rare	Frequent
Characteristic algal groups	Chlorophyceae (green algae) Desmids *Staurastrum* Diatomaceae (diatoms) *Tabellaria* *Cyclotella* *Chrysophyceae* *Dinobryon*	Cyanophyceae (blue-green algae) *Anabaena* *Aphanizomenon* *Microcystis* Diatomaceae (diatoms) *Melosira* *Fragilaria* *Stephanodiscus* *Asterionella*

If one uses these qualitative indicators to determine trophic status, the results would be summarized in the following manner:

Parameters of Algal Activity	Eagle Nest	Fenton	Hopewell	Lagunitas
Quantity	E*	E	E	E
Variety	E	O	E	O-E
Distribution	O-E	-	-	-
Water-bloom	E	E	E	O
Algal Groups	E	O-E	E	E

*E = eutrophic state and O = oligotrophic state

The use of microorganisms, other than algae to determine trophic level, is not altogether clear at this time. Certainly the relationship of these microorganisms to algae must be considered because this would reflect the competitive interaction between the aquatic biota.

Wetzel has recently summarized general ranges of primary productivity and nutrient concentrations characteristic of lakes of differing trophic status. The following values can be compared to measurements made in this investigation:

Trophic Type	Mean Primary Productivity (mg C/m^2/day)	Chlorophyll a (mg/m^3)	Total Phosphorus (mg/liter)	Total Nitrogen (mg/liter)	Dominant Phytoplankton
Ultra-oligotrophic	<50	0.01-0.5	<.001-.005	<.001-.250	
Oligotrophic	50-300	0.3-3			Chrysophyceae, Cryptophyceae
Oligo-mesotrophic			<.005-.010	<.250-.600	Dinophyceae, Bacillariophyceae
Mesotrophic	250-1000	2-15			
Meso-eutrophic			.010-.030	.500-1.100	
Eutrophic	>1000	10-500			Bacillariophyceae Cyanophyceae
Hypereutrophic			.030->5.0	.500->15.0	Chlorophyceae Euglenophyceae

Primary productivity of Eagle Nest, Fenton and Hopewell Lakes is expressed on an area basis (mg carbon fixed/m^2/hr) in Table 51 for stations at which several depths were sampled. Daily production can be estimated by multiplying these hourly rates at mid-day by a factor of about 10 to obtain values comparable to those given by Wetzel. On this basis about one-third of the measurements made at Eagle Nest Lake are in the eutrophic range while two-thirds are in the mesotrophic range. At Fenton Lake most (6) of the early summer measurements are in the mesotrophic range with one in the eutrophic range, while all measurements made after 15 July are in the oligotrophic range. At Hopewell Lake the measurement made in early July is in the eutrophic range while subsequent measurements through early September are in the mesotrophic range.

Since the ranges presented by Wetzel are average daily values, clearly none of these lakes would be considered eutrophic based on average phytoplankton productivity through the entire productive season (when lake was not covered by ice). The higher values in Table 51 are similar to maximum primary productivities cited for several meso-eutrophic lakes and below the maximum productivities for eutrophic lakes described by Wetzel.

Since the Lagunitas Lakes are very shallow, productivity was measured only at the surface and 0.5 or 1.0 M depths and

TABLE 51a

Primary productivity expressed on an area basis (mg carbon/m^2/hr)

EAGLE NEST LAKE

Date	Station 1	Station 3
5/27/75	46.0	78.6
6/11/75	91.0	109.5
6/25/75	56.4	-
7/9/75	22.1	61.7
7/23/75	-	73.4
8/6/75	200.8	124.6
8/19/75	44.8	101.4
9/16/75	125.7	34.3
10/18/75	31.0	33.3

FENTON LAKE

Date	Station 1	Station 2
6/3/75	76.3	89.3
6/17/75	99.4	120.2
7/1/75	37.7	14.3
7/15/75	76.0	88.2
7/29/75	14.6	25.5
8/12/75	4.9	3.41
9/9/75	11.4	12.5
10/7/75	3.25	11.0

HOPEWELL LAKE

Date	Station 1
6/24/75	14.0
7/8/75	179.8
7/22/75	34.0
8/5/75	47.9
9/1/75	29.4
9/30/75	4.06

productivity was not computed on an area basis. Most measurements of phytoplankton productivity at Lake 1 would fall into the oligotrophic range, while Lake 2 would be considered mesotrophic.

Chlorophyll a concentrations are related to primary productivity and phytoplankton abundance. Measurements of chlorophyll a (Table 11b) during the summer suggest that Eagle Nest, Fenton and Hopewell Lakes are slightly eutrophic. Measurements from the Lagunitas Lakes were about equally divided between mesotrophic and eutrophic ranges.

Measurements of total phosphorus concentration in the late spring (prior to the occurrence of blooms) indicate that phosphorus concentrations are above the range given for meso-eutrophic lakes in Eagle Nest, Fenton, and Hopewell Lakes. The Lagunitas Lakes had the lowest concentrations of total phosphorus of the lakes studied; however, these values also were slightly above the meso-eutrophic range.

In the late spring the total nitrogen concentration in Fenton, Hopewell and Lagunitas Lakes averaged 0.4 to 0.5 mg/liter. Nitrogen concentrations were just slightly higher in Eagle Nest Lake, the only lake in which a prolonged blue-green algal bloom occurred. While lake trophic types are not clearly separated based on total nitrogen concentrations, these values fall into the upper range for oligo-mesotrophic lakes and the lower range for meso-eutrophic lakes (which has a similar lower range as listed for hypereutrophic lakes). Thus, it appears that nitrogen may be in less abundant supply than is phosphorus in these lakes.

While Eagle Nest and Hopewell Lakes would not be classed as eutrophic lakes based on primary productivity measurements, the blooms of blue-green algae are characteristic of eutrophic conditions. An extensive and prolonged bloom of *Aphanizomenon* occurred at Eagle Nest Lake. A large amount of dead algal material collected near the dam and resulted in depletion of oxygen in water samples in the late summer. The bloom of *Anabaena* at Hopewell Lake was of shorter duration but also resulted in reduced oxygen concentrations. Both *Aphanizomenon* and *Anabaena* have been found to produce toxins which can be lethal to vertebrates (Fogg, et al.). The *Aphanizomenon* toxin has been found to be toxic to fish and crustaceans. It has been suggested that substances produced by blooms of blue-green algae are toxic to other algae and that this is the basis for the frequent predominance of the blooming species and the virtual absence of other more desirable species. Whitton discusses evidence for the production of such an algal toxin by *Aphanizomenon gracile*.

It is apparent that continued surveilance of the extent of the blue-green blooms at Eagle Nest and Hopewell Lakes is needed. While the specific factors controlling blue-green algal blooms are uncertain, increases in nutrient concentrations usually increase the abundance of blue-green species. Future recreational, agricultural, or homesite development in these drainage areas should be planned to minimize the addition of nutrients to these two lakes.

The large growth of an aquatic macrophyte at Fenton Lake probably is a result of a relative abundance of nutrients due to heavy recreational use of the area and perhaps also cattle grazing. While the extensive growth of the macrophyte is a problem, competition for nutrients between Elodea and phytoplankton is probably effective in preventing troublesome algal blooms at Fenton Lake.

Of the lakes studied the Lagunitas Lakes contained the lowest nutrient levels and were least productive. The upper Lagunitas Lake supports floating algal masses which consist of a variety of predominantly green and diatom species. These floating masses, however, do not indicate eutrophic conditions and probably do not have adverse effects on this rather low productivity lake.

LITERATURE CITED

APHA. 1971. Standard methods for the examination of water and wastewater. American Public Health Association, Inc. New York. 874 p.

EPA. 1974. Methods for chemical analysis of water and wastes. U.S. Environmental Protection Agency (EPA-625/74-003). Washington, D.C.

Fogg, G. E., W. D. P. Stewart, P. Fay, and A. E. Walsby. 1973. The blue-green algae. Academic Press. New York. 459 p.

Gerloff, G. C. 1975. Nutritional ecology of nuisance aquatic plants. U.S. Environmental Protection Agency (EPA-660/3-75-027). Corvallis, Oregon. 78 p.

Golterman, H. L. 1969. Methods for chemical analysis of fresh water. IBP Handbook No. 8. Blackwell Scientific Publications. Oxford. 172 p.

Jackson, H. W. and L. Williams. 1962. Calibration and use of certain plankton-counting equipment. Trans. Amer. Mic. Soc. 81:96-103.

Kidd, D. E. and G. V. Johnson. 1969. An investigation of primary productivity using the carbon-14 method and analysis of nutrients in Elephant Butte Reservoir. Completion Report on Project A-021-NMEX-3109-32, New Mexico Water Resources Research Institute. University of New Mexico. Albuquerque. Memeographed. 106 p.

Krebs, C. J. 1972. Ecology: The experimental analysis of distribution and abundance. Harper and Row. New York. 694 p.

Manual of microbiological methods. 1957. Soc. Amer. Bacteriologists. McGraw-Hill.

Rawson, D. S. 1956. Algal indicators of trophic lake types. Limnol. and Oceanog. 1:18.

Wetzel, R. G. 1975. Limnology. W.B. Saunders. Philadelphia. 743 p.

Whitton, B. A. 1973. Interactions with other organisms, p. 415-433. In N. G. Carr and B. A. Whitton, The biology of blue-green algae. University of California Press. Los Angeles.

APPENDIX

TABLE 52

IDENTIFICATION AND ENUMERATION
OF ALGAE AT EAGLE NEST LAKE

Date	Station	Genus	Algae/ml
10-19-74	1-S	Aphanizomenon	407
	1-1.5	Aphanizomenon	177
	2-S	Aphanizomenon	381
		Navicula	17
		Stephanodiscus	8
	3-S	Aphanizomenon	1005
		Stephanodiscus	24
11-30-74	1-S	Asterionella	2554
	1-1.5	Asterionella	3480
		Stephanodiscus	16
	2-S	Asterionella	2022
	3-S	Asterionella	2053
		Aphanizomenon	394
	Flume	Stephanodiscus	163
		Amphipleura	133
01-07-75	1-S	Asterionella	3691
		Chlamydomonas	1502
	1-1.5	Asterionella	755
	2-S	Asterionella	1970
		Chlamydomonas	1366
	3-S	Asterionella	211
		Chlamydomonas	211
		Cyclotella	8
	3-1.5	Asterionella	1396
		Chlamydomonas	145
	Flume	Asterionella	70
		Navicula	35
02-23-75	1-S	Chlamydomonas	1435
		Asterionella	285
		Amphora	23
		Navicula	8
		Pinnularia	8
	1-1.5	Chlamydomonas	1236
		Asterionella	326
		Navicula	27
		Amphora	9

Date	Station	Genus	Algae/ml
	2-5	Chlamydomonas	6162
		Ellipsoidon	3305
		Fragilaria	96
		Astrionella	32
		Volvox	40
		Navicula	8
	3-S	Chlamydomonas	1648
		Asterionella	603
		Ellipsoidon	549
		Fragilaria	31
		Navicula	15
	3-1.5	Chlamydomonas	1374
		Astrionella	656
		Ellipsoidon	114
		Fragilaria	15
	3-6	Chlamydomonas	221
		Astrionella	162
		Aphanizomenon	31
	Flume	Chlamydomonas	947
		Astrionella	63
03-25-75	1-S	Chlamydomonas	4548
		Ellipsoidon	92
		Volvox	8
		Astrionella	8
		Opephora	8
	1-1.5	Chlamydomonas	5455
		Astrionella	91
		Opephora	9
	2-1.5	Chlamydomonas	5073
		Gymnodinium	300
		Ellipsoidon	146
		Astrionella	66
	3-S	Chlamydomonas	7723
		Astrionella	198
		Gymnodinium	31
	3-1.5	Chlamydomonas	1586
		Astrionella	344
		Ellipsoidon	161
	3-6	Astrionella	373
		Chlamydomonas	234
		Gymnodinium	80
		Stenopherobia	7
		Cymbella	7
	Flume	Chlamydomonas	154
		Astrionella	117
		Gymnodinium	51
		Eudorina	22

Date	Station	Genus	Algae/ml
04-29-75	2-S	Chlamydomonas	1272
		Astrionella	66
		Ellipsoidon	66
		Volvox	7
	3-S	Chlamydomonas	892
		Ellipsoidon	44
		Astrionella	44
		Eudorina	22
		Navicula	15
		Stephanodiscus	7
	3-1.5	Chlamydomonas	1184
		Ellipsoidon	154
		Astrionella	95
		Navicula	44
		Cymbella	7
	Flume	Chlamydomonas	614
		Astrionella	88
		Stephanodiscus	22
		Navicula	15
05-27-75	1-S	Chlamydomonas	471
		Scenedesmus	62
		Schroederia	8
		Navicula	8
		Stephanodiscus	8
		Eudorina	8
	1-1.5	Chlamydomonas	182
		Navicula	39
		Aphanizomenon	24
		Stephanodiscus	24
		Schroederia	16
		Ceratium	16
	2-S	Chlamydomonas	255
		Scenedesmus	62
		Aphanizomenon	31
		Navicula	15
		Stephanodiscus	15
	2-1.0	Chlamydomonas	163
		Navicula	16
		Aphanizomenon	16
		Ceratium	8
	3-S	Chlamydomonas	193
		Stephanodiscus	39
		Scenedesmus	31
		Ceratium	15
	3-1.5	Chlamydomonas	76
		Scenedesmus	31
		Stephanodiscus	23
		Ceratium	15
	Flume	Chlamydomonas	67

Date	Station	Genus	Algae/ml
06-10-75	1-S	Ceratium	435
		Navicula	46
		Chlamydomonas	61
		Actinocyclus	31
		Cymbella	8
		Ceratium	8
	1-1.5	Ceratium	649
		Stephanodiscus	53
		Amphora	30
		Ceratium	23
	2-S	Chlamydomonas	60
		Ceratium	37
		Aphanizomenon	22
		Stephanodiscus	22
	3-S	Ceratium	537
		Stephanodiscus	45
		Aphanizomenon	22
		Chlamydomonas	22
	3-1.5	Chlamydomonas	236
		Ceratium	111
		Anabaena	97
		Aphanizomenon	21
		Stephanodiscus	21
	3-6	Ceratium	513
		Chlamydomonas	136
		Stephanodiscus	68
	Flume	Ceratium	118
		Chlamydomonas	87
		Stephanodiscus	47
		Cerasterias	16
	4-S	Chlamydomonas	105
		Ceratium	26
		Anabaena	39
		Stephanodiscus	39
		Scenedesmus	52
	5-S	Chlamydomonas	131
		Aphanizomenon	92
		Stephanodiscus	39
		Cerasterias	13
		Ceratium	13
06-24-75	1-S	Scenedesmus	60
		Ceratium	30
		Cerasterias	37
		Stephanodiscus	15
		Navicula	15
	2-S	Aphanizomenon	77
		Chlamydomonas	54
		Ceratium	39

Date	Station	Genus	Algae/ml
	3-S	Amphora	76
		Ceratium	61
		Aphanizomenon	53
		Chlamydomonas	46
	3-1.5	Ceratium	53
		Chlamydomonas	38
	Flume	Anabaena	64
		Ceratium	18
		Cerasterias	18
07-09-75	1-S	Aphanizomenon	1026
		Anabaena	32
		Ceratium	39
		Cymbella	8
	1-1.5	Ceratium	329
		Aphanizomenon	105
		Actinocyclus	75
	2-S	Ceratium	308
		Aphanizomenon	32
		Actinocyclus	24
		Fragilaria	8
	3-S	Aphanizomenon	2114
		Anabaena	159
		Actinocyclus	68
		Ceratium	23
	3-1.5	Aphanizomenon	830
		Anabaena	144
		Ceratium	112
	Flume	Ceratium	125
		Aphanizomenon	28
		Navicula	28
	4-S	Aphanizomenon	857
		Anabaena	81
		Ceratium	63
07-23-75	3-S	Aphanizomenon	2315
		Anabaena	241
		Ceratium	68
		Navicula	19
	3-1.5	Aphanizomenon	1946
		Anabaena	206
		Ceratium	38
		Navicula	31
	Flume	Aphanizomenon	19
		Ceratium	58
08-06-75	1-S	Aphanizomenon	2778
		Ceratium	324
		Treubaria	39
		Anabaena	8

Date	Station	Genus	Algae/ml
	1-1.5	Aphanizomenon	2188
		Ceratium	657
		Treubaria	15
		Stephanodiscus	7
	2-S	Aphanizomenon	2208
		Ceratium	958
		Anabaena	104
		Treubaria	35
		Cerasterias	35
	3-S	Aphanizomenon	8847
		Ceratium	460
		Anabaena	162
		Stephanodiscus	36
		Cerasterias	27
	3-1.5	Aphanizomenon	6150
		Ceratium	893
		Anabaena	117
		Stephanodiscus	81
		Treubaria	36
	3-6	Aphanizomenon	2769
		Ceratium	219
		Anabaena	101
		Treubaria	55
		Stephanodiscus	9
	Flume	Aphanizomenon	16
		Ceratium	8
08-20-75	1-S	Aphanizomenon	34,632
		Anabaena	63
	1-1.5	Aphanizomenon	263
		Navicula	9
	2-S	Aphanizomenon	1978
	2-1.5	Aphanizomenon	694
		Stephanodiscus	15
		Navicula	15
	3-S	Aphanizomenon	6283
		Anabaena	134
		Stephanodiscus	33
	3-1.5	Aphanizomenon	5342
		Anabaena	151
	Flume	Aphanizomenon	27
	Inlet	Aphanizomenon	18
09-16-75	1-S	Aphanizomenon	11,158
		Anabaena	78
		Cyclotella	31
	1-1.5	Aphanizomenon	1053
		Cyclotella	23
		Ceratium	8

Date	Station	Genus	Algae/ml
	2-S	Aphanizomenon	10,150
		Anabaena	31
		Cyclotella	15
	3-S	Aphanizomenon	1374
		Cyclotella	31
		Pleodorina	8
		Navicula	8
	3-1.5	Aphanizomenon	656
		Cyclotella	31
		Anabaena	8
	3-6	Aphanizomenon	609
		Cyclotella	16
		Anabaena	8
	Flume	Aphanizomenon	157
		Cyclotella	65
10-18-75	1-1.5	Aphanizomenon	686
		Stephanodiscus	28
		Pandorina	9
	2-S	Aphanizomenon	616
		Stephanodiscus	52
		Anabaena	17
	3-S	Aphanizomenon	1273
		Stephanodiscus	36
		Anabaena	18
	3-1.5	Aphanizomenon	1069
	3-6	Aphanizomenon	274
		Stephanodiscus	37
		Pandorina	18
	6-S	Navicula	48
		Scenedesmus	19
		Cymbella	10

TABLE 53

IDENTIFICATION AND ENUMERATION
OF ALGAE AT FENTON LAKE

Date	Station-Depth	Genus	Algae/ml
10-26-74	1-S	unknown	8
	1-1.5	unknown	3
	2-S	Chlamydomonas	114
		Navicula	28
		Mougeotia	113
		unknown	22
	3-S	Chlamydomonas	840
		Navicula	188
		Amphora	9
		Amphipleura	9
	3-1.5	Chlamydomonas	304
		Navicula	94
		unknown	55
		Synedra	8
		Cymbella	8
		Amphipleura	8
12-07-74	1-S	Chlamydomonas	284
		Amphipleura	8
	2-S	Chlamydomonas	403
		Navicula	52
		Schroederia	22
		Fragilaria	15
		Gomphonema	15
		Amphipleura	15
	2-1.5	Chlamydomonas	500
		Fragilaria	67
		Cymbella	22
		Navicula	15
		Amphipleura	7
		Amphora	7
		Schroederia	7
	3-S	Chlamydomonas	5488
		Fragilaria	231
		Navicula	29
		Spirogyra	30
		Amphipleura	22
		Schroederia	67
		Opephora	7
		Cymbella	7
		Stenopterobia	7

Date	Station-Depth	Genus	Algae/ml
	3-1.5	Fragilaria	2295
		Amphipleura	408
		Chlamydomonas	1434
		Opephora	234
		unknown	158
		Navicula	250
		Cymbella	362
		Gomphonema	31
		Schroederia	15
01-26-75	1-S	Chlamydomonas	870
	2-1.5	Cymbella	14
		Navicula	15
		Synedra	7
	3-S	Fragilaria	263
		Cymbella	66
		Synedra	51
		Navicula	29
		Amphipleura	22
		Mougeotia	5mm
	3-1	Cymbella	58
		Navicula	44
		Fragilaria	102
		Schroederia	29
		Synedra	51
		Opephora	14
		Amphipleura	7
03-01-75	1-S	Chlamydomonas	1059
		Ellipsoidon	197
		Asterionella	80
		Schroederia	30
	1-1.5	Chlamydomonas	380
		Scenedesmus	54
		Navicula	36
		Cymbella	15
		Amphora	17
	2-S	Chlamydomonas	263
		Fragilaria	29
		Ellipsoidon	22
		Navicula	22
		Amphora	15
		Schroederia	7
	2-1.5	Chlamydomonas	197
		Amphora	43
	3-S	Chlamydomonas	292
		Ellipsoidon	89
		Amphora	58
		Navicula	36
		Scenedesmus	30
		Fragilaria	7

Date	Station-Depth	Genus	Algae/ml
	3-1	Chlamydomonas	665
		Asterionella	366
		Fragilaria	132
		Navicula	73
		Cymbella	73
		Amphora	29
		Opephora	22
		Gomphonema	7
04-08-75	1-S	Chlamydomonas	78
		Schroederia	30
		Navicula	30
		Stephanodiscus	15
	1-1.5	Chlamydomonas	109
		Navicula	58
		Schroederia	36
		Stephanodiscus	7
	2-S	Chlamydomonas	263
		Navicula	138
		Schroederia	58
	2-1.5	Navicula	80
		Chlamydomonas	66
		Amphora	15
		Stephanodiscus	15
		Schroederia	15
	3-S	Navicula	154
		Asterionella	37
		Schroederia	37
	3-1	Navicula	137
		Chlamydomonas	43
05-20-75	1-S	Scenedesmus	1879
		Cyclotella	870
		Navicula	599
		Stephanodiscus	365
		Fragilaria	197
		Ellipsoidon	131
		Treubaria	88
		Cymbella	29
		Microcystis	22
	1-1.5	Cyclotella	723
		Scenedesmus	687
		Navicula	219
		Stephanodiscus	132
		Ellipsoidon	132
		Treubaria	87
		Fragilaria	73
		Microcystis	44
		Cymbella	22
		Opephora	7

Date	Station-Depth	Genus	Algae/ml
	2-S	Scenedesmus	1630
		Cyclotella	818
		Navicula	212
		Ellipsoidon	117
		Fragilaria	102
		Microcystis	22
	2-1.5	Scenedesmus	676
		Cyclotella	818
		Ellipsoidon	270
		Navicula	132
		Microcystis	37
		Schroederia	22
		Cerasterias	7
	3-S	Scenedesmus	1623
		Cyclotella	526
		Navicula	132
		Ellipsoidon	80
		Fragilaria	80
		Treubaria	29
		Cymbella	7
		Microcystis	22
	3-1	Scenedesmus	1652
		Cyclotella	534
		Navicula	88
		Fragilaria	44
		Amphipleura	29
		Microcystis	22
06-03-75	1-S	Chlamydomonas	921
		Navicula	120
		Scenedesmus	80
		Amphipleura	53
		Schroederia	27
	1-1.5	Scenedesmus	1273
		Chlamydomonas	532
		Navicula	185
		Pandorina	116
		Fragilaria	35
		Treubaria	12
	2-S	Chlamydomonas	1643
		Scenedesmus	370
		Fragilaria	254
		Aphanizomenon	254
		Pandorina	185
		Navicula	104
		Schroederia	93
		Dicellula	81
		Anabaena	81
		Ellipsoidon	92
		Actinastrum	92
		Pleodorina	81

Date	Station-Depth	Genus	Algae/ml
	2-1.5	Chlamydomonas	705
		Scenedesmus	112
		Pandorina	100
		Schroederia	36
		Aphanizomenon	11
		Dicellula	11
		Opephora	11
	3-S	Scenedesmus	390
		Chlamydomonas	195
		Pandorina	54
		Navicula	54
		Aphanizomenon	43
		Pleodorina	22
	3-1	Chlamydomonas	1702
		Pandorina	246
		Navicula	112
		Schroederia	45
		Eudorina	22
		Treubaria	22
		Fragilaria	22
06-17-75	1-S	Chlamydomonas	385
		Ellipsoidon	293
		Amphipleura	146
		Navicula	131
		Microcystis	54
		Pandorina	38
		Dicellula	15
	1-1.5	Ellipsoidon	316
		Navicula	208
		Amphipleura	46
		Pandorina	23
	2-S	Ellipsoidon	400
		Cyclotella	173
		Navicula	45
		Anabaena	45
		Amphipleura	75
		Microcystis	7
		Opephora	7
		Treubaria	7
	2-1.5	Ellipsoidon	285
		Navicula	138
		Amphipleura	131
		Cyclotella	108
		Scenedesmus	31
		Treubaria	7
		Gomphonema	7
	3-S	Ellipsoidon	190
		Cyclotella	92
		Amphipleura	69
		Navicula	69
		Fragilaria	15

Date	Station-Depth	Genus	Algae/ml
	3-1.5	Ellipsoidon	366
		Cyclotella	241
		Amphipleura	132
		Navicula	132
		Fragilaria	39
07-01-75	1-S	Anabaena	137
		Scenedesmus	61
		Cyclotella	30
		Navicula	23
		Mougeotia	17
		Fragilaria	15
		Amphipleura	15
		Pandorina	8
	1-2	Anabaena	123
		Cyclotella	85
		Amphipleura	31
		Strephonome	23
		Navicula	15
		Mougeotia	15
	2-S	Anabaena	149
		Ellipsoidon	59
		Amphipleura	37
		Mougeotia	10
		Navicula	7
	2-2	Anabaena	84
		Amphipleura	61
		Ellipsoidon	84
		Navicula	31
		Mougeotia	19
	3-S	Anabaena	231
		Ellipsoidon	62
		Navicula	46
		Amphipleura	46
		Pandorina	23
		Mougeotia	15
	3-1	Anabaena	261
		Ellipsoidon	104
		Navicula	37
		Amphipleura	37
		Mougeotia	9
	Inlet	Navicula	686
		Fragilaria	541
		Amphipleura	457
		Cyclotella	282
		Scenedesmus	91

Date	Station-Depth	Genus	Algae/ml
07-15-75	1-S	Anabaena	1809
		Cymbella	29
	1-1.5	Anabaena	1971
		Fragilaria	45
		Eudorina	7
		Opephora	7
	2-S	Anabaena	1710
	2-1.5	Anabaena	1276
		Amphipleura	60
		Fragilaria	186
		Opephora	45
		Gomphonema	15
	3-S	Anabaena	1994
		Ellipsoidon	15
		Cymbella	15
		Eudorina	7
	3-1.5	Anabaena	1008
		Ellipsoidon	22
07-29-75	1-S	Anabaena	204
		Ellipsoidon	30
	1-1.5	Anabaena	152
		Ellipsoidon	15
		Eudorina	7
		Amphipleura	7
	2-S	Anabaena	113
		Ellipsoidon	52
		Eudorina	7
	2-1.5	Fragilaria	384
		Anabaena	98
		Volvox	8
	3-S	Anabaena	142
		Fragilaria	75
		Amphipleura	30
		Scenedesmus	30
		Schroederia	22
		Opephora	7
	3-1.5	Fragilaria	975
		Gomphonema	177
		Scenedesmus	177
		Opephora	184
		Navicula	177
		Amphipleura	118
		Anabaena	66
	Inlet	Scenedesmus	342
		Navicula	43

Date	Station-Depth	Genus	Algae/ml
08-12-75	1-S	Ellipsoidon	54
		Pleodorina	15
		Aphanizomenon	15
		Chlamydomonas	8
		Anabaena	8
	1-1.5	None identifiable - debris	
	2-S	Scenedesmus	37
		Aphanizomenon	19
		Volvox	9
	2-1.5	Chlamydomonas	56
		Anabaena	19
	3-S	Scenedesmus	71
		Anabaena	80
		Microcystis	35
		Ellipsoidon	35
		Fragilaria	35
		Volvox	18
		Spinoclosterium	9
	3-1	Fragilaria	162
		Scenedesmus	72
		Ellipsoidon	27
		Chlamydomonas	18
		Ceratium	9
		Schroederia	9
		Volvox	9
	Inlet	Scenedesmus	1198
		Navicula	142
		Fragilaria	28
		Anabaena	9
09-09-75	1-S	Pseudotetraspora	62
		Pleodorina	15
	1-1.5	Pleodorina	95
		Anabaena	55
		Ellipsoidon	32
		Scenedesmus	32
		Pandorina	23
	2-S	Scenedesmus	187
		Gymnodinium	85
		Aphanizomenon	55
		Anabaena	23
	2-1.5	Ellipsoidon	32
		Pleodorina	19
		Ceratium	8
		Gomphonema	8
	3-S	Scenedesmus	316
		Gymnodinium	149
		Aphanizomenon	16
		Pandorina	8

Date	Station-Depth	Genus	Algae/ml
	3-1	Scenedesmus	114
		Gymnodinium	49
		Fragilaria	33
		Pandorina	8
		Pleodorina	8
	Inlet	Scenedesmus	490
		Navicula	347
		Fragilaria	245
10-07-75	1-S	Navicula	16
		Anabaena	7
	1-1.5	None present	
	2-S	Anabaena	15
	2-1.5	Scenedesmus	28
		Sphaerocystis	21
	3-S	Scenedesmus	200
		Navicula	154
		Fragilaria	108
		Cymbella	31
		Sphaerocystis	23
		Amphora	23
	3-1	Fragilaria	605
		Navicula	141
		Cymbella	22
		Gomphonema	7

TABLE 54

IDENTIFICATION AND ENUMERATION OF ALGAE COLLECTED FROM HOPEWELL LAKE

Date	Station-Depth	Genus	Algae/ml
11-16-74	1-S	no discernible organisms	
	1-1.5	no discernible organisms	
	2-S	no discernible organisms	
05-28-75	1-S	Chlamydomonas	187
		Navicula	55
		Aphanizomenon	16
	1-1.5	Chlamydomonas	104
		Navicula	56
		Scenedesmus	14
	2-S	Navicula	100
		Chlamydomonas	77
		Fragilaria	54
		Aphanizomenon	8
	2-1.0	Navicula	82
		Aphanizomenon	29
		Opephora	22
		Chlamydomonas	15
	Outlet	Chlamydomonas	166
		Ellipsoidon	69
		Navicula	56
		Fragilaria	28
		Schroederia	14
06-11-75	1-S	Chlamydomonas	369
		Navicula	202
		Fragilaria	189
		Pinnularia	167
		Schroederia	62
		Opephora	18
	1-1.5	Navicula	249
		Fragilaria	178
		Chlamydomonas	160
		Pinnularia	115
		Opephora	27
		Schroederia	71
		Ellipsoidon	18

Date	Station-Depth	Genus	Algae/ml
	2-S	Chlamydomonas	476
		Navicula	247
		Pinnularia	199
		Fragilaria	133
		Schroedaria	104
		Anabaena	38
		Ellipsoidon	38
		Opephora	28
		Gyrosigma	10
	2-1.0	Chlamydomonas	178
		Fragilaria	222
		Pinnularia	169
		Navicula	151
		Schroederia	80
		Opephora	18
		Gomphonema	9
		Eunotia	9
06-25-75	1-S	Chlamydomonas	132
		Navicula	79
		Fragilaria	78
		Pinnularia	62
		Gomphonema	54
		Ellipsoidon	54
		Amphipleura	39
		Anabaena	39
	1-1.5	Chlamydomonas	179
		Ellipsoidon	72
		Fragilaria	63
		Anabaena	53
		Gomphonema	18
		Schroederia	9
		Navicula	9
	2-S	Chlamydomonas	168
		Fragilaria	51
		Aphanizomenon	29
		Pinnularia	15
		Opephora	7
	2-1.0	Pinnularia	63
		Anabaena	72
		Chlamydomonas	27
		Aphanizomenon	27
		Navicula	18
		Fragilaria	9

Date	Station-Depth	Genus	Algae/ml
07-08-75	1-S	Anabaena	1280
		Navicula	23
		Aphanocapsa	30
		Nitzchia	8
		Amphipleura	8
	1-1.5	Anabaena	1049
		Cymbella	23
		Aphanocapsa	31
	2-S	Anabaena	1423
		Aphanocapsa	104
07-22-75	1-S	Anabaena	2312
		Navicula	7
	1-1.5	Anabaena	1809
	2-S	Anabaena	769
	2-1.5	Anabaena	636
08-05-75	1-S	Anabaena	156
		Scenedesmus	34
		Navicula	17
	1-1.5	Anabaena	328
	2-S	Anabaena	546
	2-1.5	Anabaena	888
09-01-75	1-S	Pyrobotrys	373
	1-1.5	Pyrobotrys	373
		Aphanizomenon	351
	2-S	Aphanizomenon	68
		Keriochlamys	37
	2-1.0	Anabaena	7
		Navicula	7
		Cymbella	7
		Aphanizomenon	7
09-30-75	1-S	Keriochlamys	16
	1-1.5	Ellipsoidon	201
	2-S	Ellipsoidon	102
		Chlamydomonas	71
		Keriochlamys	8
		Schroederia	8
	2-1.0	Ellipsoidon	84

TABLE 55

IDENTIFICATION AND ENUMERATION
OF ALGAE AT LAGUNITAS LAKES

Date	Station	Lake Number	Genus	Algae/ml
6-11-75	1-S	1	Navicula	46
			Microcystis	15
			Amphora	8
	1-S	2	Fragilaria	563
			Navicula	44
			Anabaena	18
			Opephora	9
	2-S	2	Fragilaria	432
			Anabaena	39
			Opephora	8
			Gomphonema	8
			Microcystis	8
6-25-75	1-S	1	Navicula	26
			Fragilaria	18
			Ellipsoidon	9
	1-S	2	Fragilaria	1134
			Anabaena	114
			Gloeocapsa	114
			Navicula	26
	2-S	2	Fragilaria	1450
			Chroococcus	79
			Anabaena	26
			Ceratium	18
			Cerasterias	9
7-08-75	1-S	1	Tetraedron	227
			Anabaena	13
			Spirogyra	13mm
			Cymbella	13
	1- .5	1	Navicula	20
			Ellipsoidon	10
	1-S	2	Fragilaria	375
			Anabaena	274
			Asterionella	228
			Chroococcus	155
			Tetraedron	110
			Spirogyra	3mm
	1-1.0	2	Fragilaria	244
			Anabaena	171
			Gloeocapsa	110
			Asterionella	73
			Scenedesmus	37
			Microcystis	37

Date	Station	Lake Number	Genus	Algae/ml
	2-S	2	Fragilaria	361
			Tetraedron	333
			Chroococcus	102
			Asterionella	74
			Anabaena	65
			Cerasterias	46
			Navicula	19
			Cymbella	9
7-22-75	1-S	1	Fragilaria	3763
			Navicula	210
			Scenedesmus	116
			Zygnema	87
			Cymbella	58
			Opephora	7
			Spirogyra	1mm
			Oscillatoria	1mm
	large clumps contained: Zygnema, Spirogyra, Scenedesmus, Cymbella, Navicula, Oscillatoria, Mougeotia, Amphipleura			
	1-S	2	Anabaena	1674
			Amphipleura	45
			Fragilaria	45
			Treubaria	37
			Cerasterias	9
	1-1.0	2	Anabaena	2270
			Fragilaria	214
			Amphipleura	98
			Treubaria	80
			Scenedesmus	71
			Ellipsoidon	71
			Cerasterias	27
			Ceratium	18
	2-S	2	Anabaena	1404
			Fragilaria	584
			Scenedesmus	118
			Amphipleura	98
			Treubaria	89
			Schroederia	74
			Cerasterias	44
			Gomphonema	15
	2-1.0	2	Anabaena	1849
			Amphipleura	113
			Treubaria	75
			Cerasterias	30
			Ellipsoidon	30
			Dicellula	15
			Oscillatoria	2mm

Date	Station	Number	Genus	Algae/ml
8-05-75	1-S	1	Anabaena	22
			Navicula	15
	1-S	2	Cerasterias	599
			Fragilaria	527
			Pandorina	239
			Closteridium	216
			Anabaena	16
			Ceratium	16
	1-1.5	2	Fragilaria	2470
			Cerasterias	363
			Pandorina	221
			Closteridium	158
			Anabaena	16
	2-S	2	Fragilaria	2261
			Cerasterias	516
			Closteridium	427
			Pandorina	312
			Ceratium	45
			Anabaena	45
	2-1.0	2	Fragilaria	1544
			Cerasterias	605
			Closteridium	376
			Pandorina	359
			Ceratium	16
9-30-75	1-S	1	Chlamydomonas	363
			Pleodorina	39
	1-S	2	Fragilaria	1113
			Anabaena	401
			Ellipsoidon	39
	1-1.0	2	Fragilaria	7615
			Anabaena	182
			Ellipsoidon	39
			Navicula	32
			Pleodorina	24
	2-S	2	Fragilaria	9560
			Anabaena	316
			Ellipsoidon	36
			Pleodorina	27

Table 56

Characteristics of bacteria isolated from Eagle Nest Station 1-1.5 and expressed as percent of total aerobic bacteria.

Biochemical tests

Date	Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10-19-74	---	0	0	0	---	---
11-30-74	60.3	---	---	---	13.4	73.7
1-7-75	100.0	.4	20.0	0	40.0	93.0
2-20-75	13.3	.2	.7	0	26.6	0
3-25-75	20.0	2.0	1.1	0	6.6	6.6
5-27-75	35.7	.7	1.2	0	0	38.5
6-11-75	40.0	1.2	.5	0	0	40.0
6-25-75	20.0	.2	.2	0	13.3	33.3
7-9-75	26.6	3.9	2.7	0	20.0	0
8-6-75	33.3	---	---	0	13.3	20.0
8-20-75	20.0	.2	.1	6.6	0	20.0
9-16-75	66.6	.5	.5	0	0	53.3
10-18-75	33.3	29.8	29.8	0	0	13.3

Colony characteristics

Yellow	White	Cream	Dark	Transparent
7.7	76.9	0	1.5	3.0
0	9.6	86.8	1.5	2.2
0	0.29	99.6	0	0.1
0	0	99.8	0.1	0.1
0	84.0	16.0	0	0
0	14.4	56.8	0	28.8
1.0	3.3	30.1	.4	44.5
0	8.7	50.7	0	40.6
0	3.3	86.7	0	10.0
1.5	24.2	19.1	0.4	59.9
0	8.9	66.2	0	24.9
.7	3.6	37.3	0	26.0
2.2	8.7	65.2	0	23.9

Table 57

Characteristics of bacteria isolated from Eagle Nest Station 1-S and expressed as percent of total aerobic bacteria.

Date	Biochemical tests Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10-19-75	---	0	10.0	0	---	---
11-30-75	53.6	---	---	---	13.4	53.6
1-7-75	47.0	0.7	2.0	0	60.0	93.0
2-20-75	20.0	0.1	0.2	0	20.0	46.6
3-25-75	33.3	1.6	0.4	0	0	26.7
5-27-75	26.7	2.3	0.5	0	0	30.7
6-11-75	26.6	0.4	0.6	0	20.0	26.6
6-25-75	33.3	0.5	0.4	0	6.6	20.0
7-9-75	20.0	2.3	2.3	0	6.6	13.3
8-6-75	13.3	---	---	0	20.0	6.6
8-20-75	0	0.2	0.2	0	0	40.0
9-19-75	0	0.3	0.3	0	13.3	100.0
10-18-75	6.6	17.6	7.0	0	0	6.6

Colony characteristics

Yellow	White	Cream	Dark	Transparent
8.5	70.0	0	2.1	4.3
0	9.3	90.6	0	0
0	1.8	98.2	0	0
0	0	99.9	0.05	0
0	23.4	76.6	0	0
0	7.5	32.0	0	22.0
1.4	7.0	27.3	0	64.3
0	8.3	50.8	0.4	40.6
0	4.7	65.1	0	30.2
0.4	14.6	39.9	5.1	39.9
0	22.0	41.4	0	37.5
0.5	1.5	52.2	0	32.3
1.0	23.9	41.0	0	34.1

Table 58

Characteristics of bacteria isolated from Eagle Nest Lake Station 3-S and expressed as percent of total aerobic bacteria.

Biochemical tests

Date	Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10-19-74	---	0	0	10.0	---	---
11-30-74	60.3	---	---	---	0	67.0
1-7-75	100.0	1.1	2.3	0	27.0	80.0
2-20-75	40.0	0.1	0.3	0	20.0	26.6
3-25-75	60.0	4.5	0.5	13.3	6.7	33.3
4-29-75	66.7	2.3	0.7	6.7	0	46.7
5-27-75	40.0	1.3	1.1	6.7	0	30.8
6-11-75	26.7	0.7	0.6	0	33.3	26.7
6-25-75	40.0	0.5	0.3	0	6.7	26.7
7-9-75	53.3	4.0	1.9	6.7	6.7	40.0
7-23-75	20.0	0.1	0.02	0	0	46.7
8-6-75	20.0	---	---	0	26.7	6.7
8-20-75	100.0	0.1	0.1	0	0	20.0
9-16-75	53.3	0.3	0.3	0	0	93.3
10-18-75	53.3	8.0	3.2	0	0	26.7

Colony characteristics

Yellow	White	Cream	Dark	Transparent
33.7	59.0	0	0.6	3.5
7.0	7.0	72.2	0.9	12.7
2.7	2.0	95.3	0	0
0	0	99.0	1.0	0
18.3	71.6	9.0	1.1	0
0	10.5	88.2	0	1.3
.02	21.6	46.5	0	31.4
0.6	4.2	30.9	0	64.4
2.1	9.7	39.5	0	48.6
2.3	14.0	67.4	0	16.3
1.4	14.5	69.6	0	14.5
.8	13.3	18.4	.7	83.5
4.6	16.9	62.4	3.2	7.4
0	13.9	69.3	0.7	16.2
1.1	13.9	31.4	0	54.0

Table 59

Characteristics of bacteria isolated from Fenton Lake at Station 1-S and expressed as percent of total aerobic bacteria.

<u>Biochemical tests</u>

Date	Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10-26-74	---	33.4	5.8	20.0	---	---
12-7-74	54.0	2.9	0.5	7.0	13.0	100.0
2-5-75	66.6	0.1	0.3	6.6	26.6	93.3
3-1-75	33.3	0.05	0.04	6.6	0	93.3
4-8-75	33.3	0.2	0.2	13.3	0	13.3
5-20-75	30.8	0.3	0.5	13.3	7.1	50.0
6-3-75	64.4	0.1	0.1	0	0	23.0
6-17-75	60.0	5.4	1.2	0	6.7	66.7
7-1-75	53.3	0.5	0.2	0	0	46.7
7-15-75	46.7	0.6	0.3	0	13.3	80.0
7-29-75	26.7	0.02	0.05	0	0	80.0
8-12-75	13.3	0.8	0.1	23.0	0	20.0
9-9-75	20.0	2.8	1.1	6.7	0	40.0
10-6-75	26.7	0.5	0.5	0	6.7	46.7

Colony characteristics

Yellow	White	Cream	Dark	Transparent
---	---	---	---	---
1.7	0.4	97.8	0	0
0	0.5	99.4	0	0
0	0	99.9	0	0.07
1.0	0	98.7	0.3	0
1.6	31.6	51.5	0	15.2
1.4	2.4	53.7	0	42.5
1.1	7.3	39.4	0	52.2
2.8	6.1	58.2	0	32.9
12.9	6.6	67.2	0.1	26.4
1.7	19.6	39.3	0.1	39.3
0.7	8.0	62.2	0	29.1
0.7	25.0	30.2	0.7	43.3
0.7	27.7	41.6	0.5	29.5

Table 60

Characteristics of bacteria isolated from Fenton Lake at Station 1-1.5 and expressed as percent of total aerobic bacteria.

Biochemical tests

Date	Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10-26-74	---	0.5	0.4	0	---	---
12-7-74	40.0	10.0	1.0	20.0	47.0	100.0
2-5-75	66.6	0.2	0.6	6.6	26.6	93.3
3-1-75	26.7	0.7	0.3	0	0	80.0
4-8-75	40.0	0.2	0.2	0	0	20.0
5-20-75	35.7	0.3	0.2	6.7	7.1	42.9
6-3-75	60.0	0.2	0.07	6.7	14.4	21.4
6-17-75	66.7	3.4	0.09	0	6.7	46.7
7-1-75	53.3	0.9	0.6	6.7	0	86.7
7-15-75	33.3	0.9	0.5	0	20.0	53.3
7-29-75	26.7	0.05	0.05	13.3	0	33.3
8-12-75	0	0.1	0.07	23.0	0	0
9-9-75	0	2.53	0.9	0	6.7	46.7
10-6-75	40.0	0.4	0.3	0	6.7	26.7

Colony characteristics

Yellow	White	Cream	Dark	Transparent
---	---	---	---	---
4.4	0.5	95.0	0	0
0	0.5	99.4	0.1	0
0	0	99.6	0	0.4
0.25	0	99.5	0	0.2
1.0	45.0	41.0	0	12.0
0.1	6.8	65.6	0	21.5
0.8	7.5	47.9	0.2	43.8
1.5	13.4	62.8	0.4	21.9
36.8	16.7	36.7	0	9.8
0.7	18.1	45.0	0.1	36.0
0	68.9	8.1	0	19.6
0.3	24.5	33.2	0.3	41.6
0	8.8	30.4	0	60.8

Table 61

Characteristics of bacteria isolated from Fenton Lake Station 2-S and expressed as percent of total aerobic bacteria.

Date	Biochemical tests Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10-26-74	---	12.5	32.9	0	---	---
12-7-74	34.0	27.0	2.0	20.0	20.0	54.0
2-5-75	40.0	0.5	0.7	13.3	6.6	53.3
3-1-75	46.7	0.11	0.1	7.6	0	93.3
4-8-75	26.7	0.2	0.2	0	0	26.7
5-20-75	42.9	0.1	0.2	0	14.3	21.4
6-3-75	73.3	0.3	0.08	0	0	45.5
6-17-75	80.0	0.5	0.3	0	6.7	53.3
7-1-75	40.0	3.8	0.1	0	0	53.3
7-15-75	40.0	0.1	0.2	0	13.3	60.0
7-29-75	20.0	0.08	0.04	0	0	6.7
8-12-75	6.7	0.3	0.1	6.7	0	13.3
9-9-75	6.7	0.6	0.1	6.7	0	40.0
10-6-75	33.3	1.0	0.7	0	0	40.0

Colony characteristics

Yellow	White	Cream	Dark	Transparent
---	---	---	--	---
8.4	1.2	90.0	0.6	0
0	1.0	99.0	0.05	0
0	0.1	99.9	0	0
1.0	0	99.0	0	0
1.6	41.7	41.6	0	15.1
0.4	7.5	72.2	0	19.9
2.5	8.5	43.9	0.5	44.6
4.2	4.5	55.0	0.5	35.7
2.9	19.5	62.0	0	16.0
0.2	23.0	25.6	0.03	51.2
1.1	12.0	85.2	0.2	6.6
1.9	31.6	39.7	0	26.8
0.4	20.9	4.9	0.8	28.5

Table 62

Characteristics of bacteria isolated from Fenton Lake Station 2-1.5 and expressed as percent of total aerobic bacteria.

Biochemical tests

Date	Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10-26-74	---	12.3	0	0	---	---
12-7-74	34.0	1.2	2.4	7.0	34.0	80.0
2-5-75	---	0.2	0.9	0	0	0
3-1-75	86.7	0.3	0.7	6.7	0	100.0
4-8-75	46.7	0.4	0.2	0	0	60.0
5-20-75	66.7	1.2	0.4	0	20.0	86.7
6-3-75	100.0	0.1	0.1	6.7	0	16.7
6-17-75	93.3	0.3	0.3	0	13.3	40.0
7-1-75	20.0	0.4	0.4	0	0	66.7
7-15-75	26.7	0.2	0.2	0	0	40.0
7-29-75	46.7	0.05	0.01	6.7	0	26.7
8-12-75	20.0	0.2	0.09	23.0	6.7	6.7
9-9-75	20.0	0.6	0.1	13.3	0	13.3
10-16-75	46.7	1.1	0.5	0	0	33.3

Colony characteristics

Yellow	White	Cream	Dark	Transparent
---	---	---	---	---
0.7	0.3	93.0	0	5.7
0	0.73	98.4	0.2	0.5
0	0	99.8	0	0.2
0	0	99.1	0.4	0.4
1.2	8.9	89.6	0	0.3
1.3	1.5	82.4	0	19.2
1.1	6.6	61.7	0.1	30.5
1.0	8.9	54.9	0	37.7
3.5	12.6	58.6	0	25.3
0.04	30.4	34.8	0	34.8
0.3	45.7	28.2	0	25.7
2.2	18.1	57.4	0	22.3
6.8	19.7	46.6	0	26.9

Table 63

Characteristics of bacteria isolated from Fenton Lake Station 3-S and expressed as percent of total aerobic bacteria.

Biochemical tests

Date	Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10-26-74	---	0.1	0.3	10.0	---	---
12-7-74	22.0	1.2	2.9	11.0	11.0	100.0
2-5-75	20.0	0.4	0.5	20.0	6.6	66.6
3-1-75	86.7	0.3	0.1	6.7	0	93.3
4-8-75	46.7	0.1	0.1	0	0	66.7
5-20-75	53.3	1.1	0.2	0	0	14.3
6-3-75	66.7	0.08	0.08	6.7	0	33.3
6-17-75	100.0	0.1	0.1	0	20.0	53.3
7-1-75	46.7	4.4	0.1	6.7	6.7	53.3
7-15-75	20.0	1.3	0.9	0	6.7	33.3
7-29-75	20.0	0.1	0.1	0	13.3	33.3
8-12-75	26.7	0.3	0.09	23.0	6.7	13.3
9-9-75	0	0.6	0.1	0	6.7	66.7
10-6-75	20.0	0.1	0.1	0	0	26.7

<u>Colony characteristics</u>

Yellow	White	Cream	Dark	Transparent
---	---	---	---	---
4.0	0	92.0	0	3.3
0	0.5	99.4	0	0
0	0	99.9	0.1	0
0.8	0	98.7	0.1	0.3
0.3	15.0	68.0	0	16.0
0.8	3.5	82.6	0.3	12.9
1.5	8.5	51.5	0	38.4
14.	6.0	44.1	0.2	48.2
6.5	16.3	46.7	0.9	29.5
1.8	14.6	45.2	0.1	38.3
2.4	7.1	50.0	0.5	40.1
0	17.8	60.4	0	33.4
0.3	19.2	34.4	0	39.4

Table 64

Characterics of bacteria isolated from Fenton Lake Station 3-1.5* and expressed as percent of total aerobic bacteria.

Biochemical tests

Date	Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
10- 6-74	---	0.6	0	10.0	---	---
12-7-74	60.0	1.5	2.1	0	7.0	93.0
(*1.0m)2-5-75	20.0	1.2	1.7	0	0	66.6
(*1.0m)3-1-75	60.0	0.1	0.1	13.3	6.6	73.3
(*1.0m)4-8-75	33.3	0.2	0.1	0	0	66.7
5-20-75	60.0	0.7	0.1	0	6.6	20.0
6-3-75	66.7	0.08	0.08	6.7	0	33.3
6-17-75	100.0	0.1	0.1	0	20.0	53.3
7-1-75	66.7	3.1	0.2	0	0	66.7
7-15-75	26.7	0.1	0.2	0	66.7	26.7
7-29-75	86.7	0.3	0.05	0	0	20.0
8-12-75	20.0	0.3	0.1	6.7	6.7	13.3
9-9-75	6.7	4.7	0.6	20.0	0	60.0
10-6-75	53.3	0.1	0.1	0	0	40.0

Colony characteristics

Yellow	White	Cream	Dark	Transparent
---	---	---	---	--
0.3	2.2	94.0	0.3	3.0
0	0	99.6	0	0.3
0	0	100.0	0	0
1.4	0	98.4	0.2	0
1.5	32.0	49.0	0	17.0
0.8	3.5	82.6	0.3	12.9
1.5	8.5	51.5	0	38.4
0.2	4.7	56.6	0	38.4
7.9	15.0	65.3	0	11.8
3.5	13.6	46.5	0.1	36.3
0.5	9.5	53.1	0	36.7
0	35.8	18.3	0	45.9
0.8	13.6	26.4	0	59.2

Table 65

Characteristics of bacteria isolated from Fenton Lake Inlet and expressed as percent of total aerobic bacteria.

Biochemical tests

Date	Starch Hydrolysis	N_2 Producing	NH_3 Producing	H_2S Producing	Catalase Negative	Protein Hydrolysis
12-7-74	67.0	2.1	1.6	20.0	40.0	60.0
2-5-75	80.0	1.4	0.2	13.3	13.3	53.3
3-1-75	73.3	0.4	0.2	6.7	13.3	60.0
5-20-75	33.3	1.1	0.1	6.7	0	26.7
6-3-75	80.0	0.07	0.07	0	0	26.7
6-17-75	86.7	0.2	0.03	6.7	40.0	13.3
7-1-75	60.0	0.1	0.01	0	0	46.7
7-15-75	93.3	3.3	0.1	13.3	0	46.7
7-29-75	73.3	5.0	0.1	6.7	0	26.7
8-12-75	53.3	39.6	0.06	23.0	0	40.0
9-9-75	0	1.8	0.1	13.3	0	53.3
10-6-75	73.3	0.1	0.1	0	6.7	66.7

Colony characteristics

Yellow	White	Cream	Dark	Transparent
1.4	0	91.0	0	7.4
0.6	0	99.4	0	0
0	0.3	98.6	0.9	0
4.7	10.0	84.3	0	5.2
0.4	6.2	62.4	0	31.2
0.3	13.1	34.1	0	52.5
0.7	0.6	48.3	0.01	50.4
4.3	12.6	39.8	0	43.2
3.0	10.7	36.7	0	47.5
1.1	0.5	42.5	0.05	46.5
1.9	27.4	23.2	0	47.5
1.3	17.1	36.5	0.2	0.5