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PROCEEDINGS OF THE ROCHESTER ACADEMY OF SCIENCE

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10. The Vascular Plants and Ecological Factors Along a Transect in Bergen-Byron Swamp.[1, 2]

RONALD S. WALKER

INTRODUCTION

Bergen-Byron Swamp* is located about twenty-four miles west of Rochester, New York, and three miles west of the village of Bergen. The swamp is actually about six miles long and a mile and a half wide at its greatest north-south extent. It is bisected by the West Sweden Road which runs north and south. The western part is known as the Bergen-Byron Swamp and it is the site of this work. This area is oval-shaped, three miles long and a mile and a half wide. It is fed by springs on the south side and local surface run-off. Black Creek, which bounds the swamp on the north and west sides, drains it to the east and ultimately joins the Genesee River. The swamp is pierced by Torpy Hill, a northeast-southwest drumlin. (Figure 1)

The geology of the area has played an extremely important part in producing and maintaining Bergen-Byron Swamp. The bedrock is Camillus shale which is bordered on the north by the Lockport dolomite and on the south by the Onondaga limestone, both of which form extensive escarpments in western New York. The strike of these limestones is east-west and consequently their outcroppings run in a generally east-west direction. (Figure 2)

It is thought that as the glaciers passed over a large region of western New York they gouged out more of the less resistant Camillus shale than they did of the tougher dolomite and limestone. This produced an east-west running trough between the two limestone outcrops. Meltwater from the last retreating glacier filled the trough and the surrounding area, producing an ancient lake, the more western portion of which is known as Lake Tonawanda. In time the ice dams to the north, in the St. Lawrence River Valley, which blocked the drainage of Lake Tonawanda, melted and the lake disappeared. Then only small ponds dammed by local glacial deposits remained in the bottom of the trough. They exist today as a

1. Based on work done under Independent Study at State University College, Brockport, and in partial fulfillment of requirements for the M.S. degree at Cornell University. Copies of the thesis are available in the Libraries of State University College at Brockport and in Cornell University.

2. The author is greatly appreciative of a publication grant provided by the Bergen Swamp Preservation Society, Inc.

* Editor's Note: This area was previously called Bergen Swamp but has been renamed because part of it is in the town of Byron.

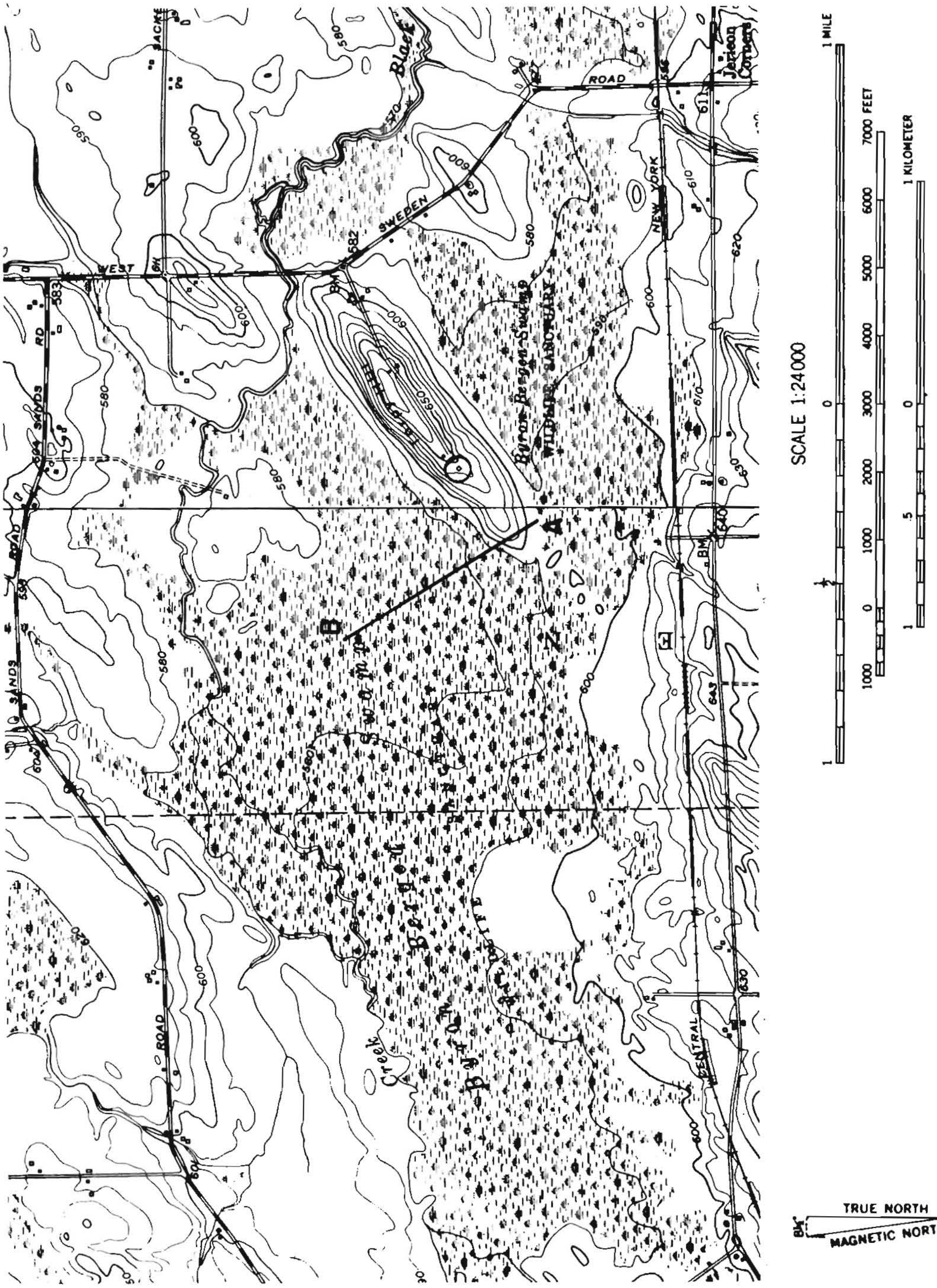

FIGURE 1. A–B locates the transect.

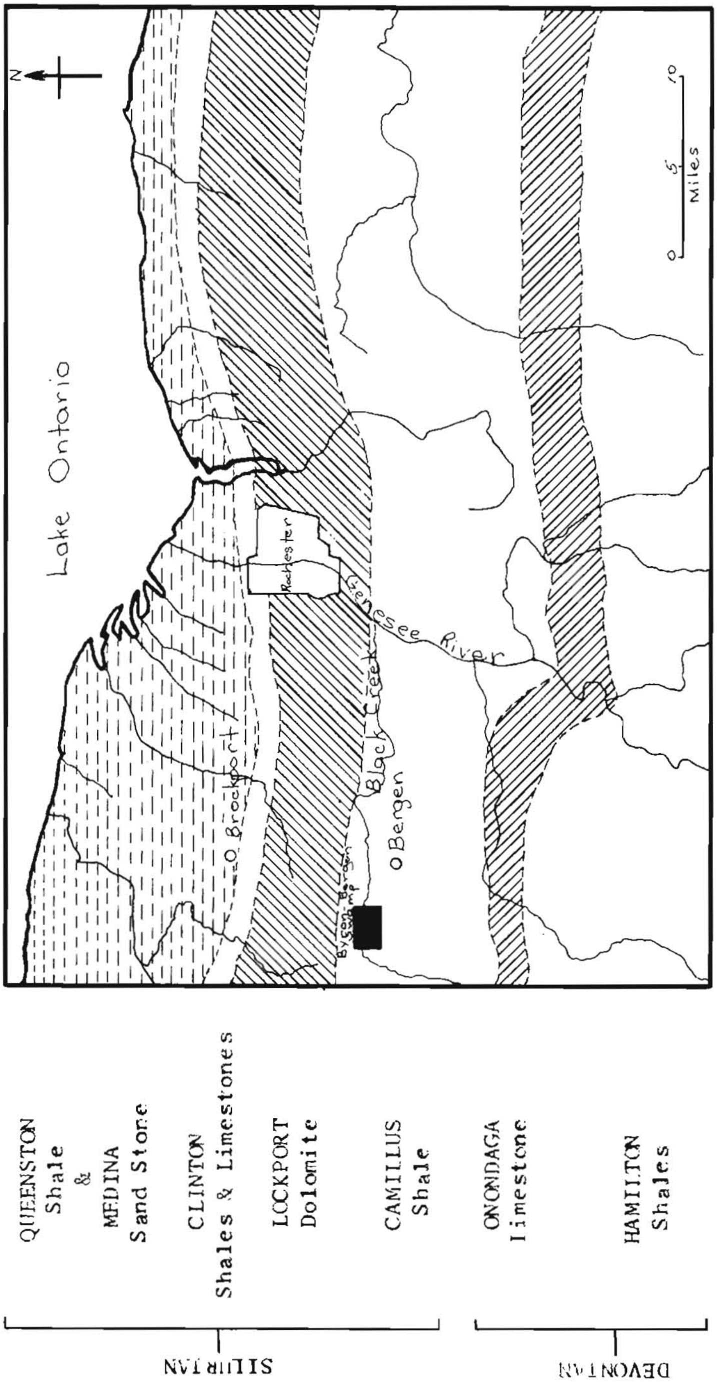

FIGURE 2. Bergen-Byron Swamp. Location, associated strata and drainage. (Redrawn after Stewart, 1937)

series of swamps and bogs that run from Lake Erie to Syracuse. The Bergen-Byron swamp is one of these.

HISTORY OF VEGETATIONAL STUDIES

There have been several published studies that include the flora of Bergen Swamp, plus many small contributions by interested amateurs. Day (1882) recorded plants from Bergen Swamp in "The Plants of Buffalo and Its Vicinity." Florence Beckwith and Mary E. Macauley (1896) selected eight areas in Monroe County and listed the flora of these sites; Bergen Swamp was one of the sites used in their study.

Baxter and House (1925) published a report in a state bulletin entitled "Rare Plants of Bergen Swamp." Taylor, in 1928, also listed the plants of Bergen Swamp in his "The Vegetation of New York State."

The first detailed study of Bergen Swamp was carried out by Paul A. Stewart and William D. Merrell (1937). Their study included the general flora, geology of the region, past history and ecology of the swamp. They used weather conditions recorded at Rochester as the environmental conditions in the swamp. The soil pH was the only environmental factor measured in the swamp. Stewart and Merrell listed their plants by zones.

In 1946, and subsequently, Walter C. Muenscher and a group of his graduate students published a series of papers on the flora of Bergen Swamp. Each student worked with a group of plants which was his specialty and compiled a list of the representatives of that group found in Bergen Swamp. Muenscher's major contribution was "The Vegetation of Bergen Swamp, I: The Vascular Plants." He listed some 860 vascular plants in Bergen Swamp.

METHODS AND MATERIALS

The objectives of this present study were: the establishment of a permanent study area, the systematic collection of data, the provision of a more accurate record of plant associations, the measurement and evaluation of environmental factors, and an evaluation of field techniques and equipment.

The earlier floristic studies of Bergen Swamp were general and pioneering in nature. A further step would be to establish a series of quadrats for the study of plant associations within defined limits. This appeared necessary because a "typical" stand of the swamp does not exist. The ecological processes, the interactions between organisms, between environmental factors, and between organisms and environmental factors, are so dynamic in a place such as the swamp, that a few meters change in location may mean an entirely new plant association.

The problem of changing plant communities is easily solved by the transect method of study. A transect is essentially an elongated quadrat. The collection of data throughout the transect was not feasible; thus only sections of the transect were studied. The resulting pattern was a series of quadrats along a transect. Such a combination of quadrats and transects was proposed by Clements in 1928.

In order for any real comparisons to be made or conclusions to be developed by future workers, it should be possible to duplicate or evaluate the methods used in this study. This is the second purpose of the study: to collect data in systematic fashion and to describe these methods for future reference. In this way the study will not be of current value only, but may have meaning in the future.

The provision of a more accurate record of the plant associations is dependent on the first two objectives of the study. If the first two objectives are accomplished the third will naturally follow.

Because of the lack of commercially prepared and specifically designed equipment, both equipment and techniques were improvised in some areas. Also, the techniques used came from a variety of sources; some are widely accepted; others are still in the developmental stages.

A. *Establishing a Transect*

Easy, rapid accessibility and a variety of plant associations were the first criteria in looking for a possible site for the transect. A place that had not been altered from its natural state or that would not be molested during the study was also desired.

Preliminary reconnaissance during December 1965, showed the area northwest of Torpy Hill to fulfill best the above requirements. At the western tip of Torpy Hill there is an intersection of a climax forest on two sides and a fallow field on the third side. This is point A on Figure 1. From this point a line approximately twenty degrees west of north was laid out. This line, the transect, was continued for 700 meters into the eye of the swamp (point B).

B. *Quadrats Along the Transect*

In January 1966, eight quadrats were established along the transect, each in the center of a then visibly different vegetational community. By establishing the quadrats in January the presence or absence of dominant woody plants identified the different plant communities. The quadrats were two by five meters in size and were outlined with stakes and twine. Each quadrat along the transect was given a number starting at point A and will be referred to as quadrat #1 through #8. Quadrats #1, #2, #3, #4, #5, #6, and #8 were approximately evenly spaced along the transect. Quadrat #7 was placed close to #6 and in the same community for comparison with #6.

Quadrat #1

These quadrats can serve as a permanent reference. The first is located 135 meters from point A on the tip of Torpy Hill. This quadrat is about 610 feet above sea level, the highest point on the transect. The soil in this woodland community is Ontario Loam (U. S. Dept. of Agriculture, 1927). Figure 3 includes two photographs of this quadrat taken three months apart, one before and one after spring growth.

Quadrat #2

Quadrat #2 is located 211 meters from point A on the transect. It is in the edge of the swamp proper, with an elevation of about 580 feet above sea level. The community here is a marginal fen, which will be explained in the discussion. The substratum is marl, overlaid with a thin sheet and a few hummocks of humus. Young woody plants, *Thuja,* and *Sphagnum* are abundant. Slow, wide, shallow streams flow on each side. *Equisetum* blankets the ground in summer.

Quadrat #3

Here the elevation over that of Quadrat #2 is increased by the accumulation of about 25 centimeters of humus over the marl bed. Before man lumbered off this area, the climax forest had at one time pushed out over the swamp. Numerous stumps remain as evidence of the past plant community and of the lumbering activities. This quadrat is in an area of secondary succession 302 meters from point A. *Tsuga canadensis* and *Fagus grandifolia* are common representatives of climax forest here. *Equisetum* is plentiful.

Quadrat #4

Quadrat #4 is in the middle of the bog forest which rings the swamp. This area is dominated by an extremely dense growth of *Thuja occidentalis.* The *Thuja* range from 1 to 60 centimeters in diameter and are growing at all angles. The humus thins out here and is mostly associated with hummocks produced around the roots of the *Thuja.* The quadrat is 391 meters from point A and is often flooded after rains with up to 30 centimeters of water. See Figure 4 for photographs of this quadrat.

Quadrat #5

In the middle of the moss-heath association, this quadrat is the site of very dense growth. This quadrat is 466 meters from point A and from here on along the transect, the humus is present only in small hummocks. The substratum is mainly composed of marl. This quadrat and the remaining three quadrats are subjected to flooding in the spring and after each major rainfall. *Thuja occidentalis* and *Larix laricina* are the dom-

FIGURE 3a. 4/16/66 Quadrat #1. This quadrat is located on the western tip of Torpy Hill.

FIGURE 3b. 7/17/66 Quadrat #1. The large tree in the center of the quadrat is *Tsuga canadensis*.

FIGURE 4a. 4/16/66 Quadrat #4. This area is well dissected by a network of cold streams. Very old *Thuja* trees are present here.

FIGURE 4b. 7/17/66 Quadrat #4. This is a very drab area during the winter months, but it bursts forth with a lush growth of ferns, orchids and other woodland plants in the summer months.

FIGURE 5a. 4/16/66 Quadrat #6. Water stands on the marl surface about half of the year. Notice the "dwarf" *Larix laricina* in the middle of the quadrat.

FIGURE 5b. 7/17/66 Quadrat #6. Where the *Phragmites communis* was obvious in the earlier photograph, the *Typha* is obvious now.

inant woody plants; *Sphagnum sp.* makes up the moss complement of this sere. Members of the heath family are present.

Quadrat #6

The last three quadrats are located in what Stewart (1937) called the secondary marl. The dominant plants in this community are sedges and grasses. Thus in this study this community will be referred to as the sedge-meadow. Quadrat #6 is 570 meters from point A and seasonal photographs may be seen in Figure 5.

Quadrat #7

It is very much like Quadrat #6 and is 618 meters from point A. There is a slight hummock of moss-heath sere on one end of the quadrat. Sedges and grasses hide water standing on the marl. This quadrat is the site of the meteorology instrument shelter. See Figure 6.

Quadrat #8

This is the last quadrat on the transect and is 686 meters from point A. This quadrat is point B on the transect in Figure 1. Quadrat #8

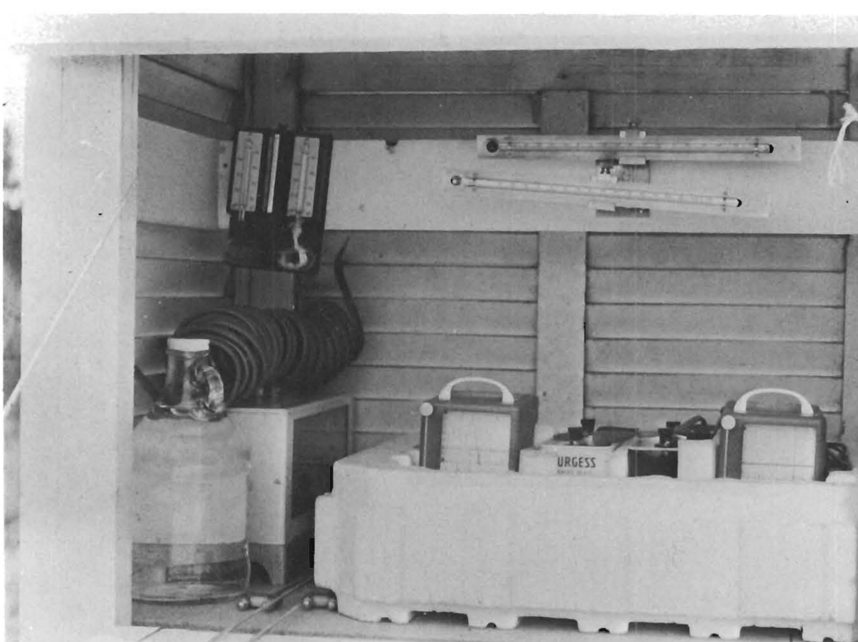

FIGURE 6. The thermograph and cover to the styrofoam box have been removed to show the Ruskrak recorders.

lacks any hummocks and is covered with water much of the year (Figure 7). Dwarf arborvitae, larch, and pine characterize the area.

FIGURE 7. 4/16/66 Quadrat #8. Standing at point B on the transect and facing south, looking back down the transect. The white box in the upper center is the instrument shelter at quadrat #7.

C. *Environmental Measurements*

Physical environmental factors related to community distribution are: available water, soil type, soil nutrients, acidity, temperature and light. The physical environmental measurements recorded can be considered in two groups: those that were continuously recorded at Quadrat #7 and those single measurements which were recorded every two weeks. The continuously recorded factors were air temperature, soil temperature at depths of 10 and 50 centimeters, and relative humidity. The environmental readings taken at all quadrats included available light; available water in the surface litter, at 10 and 50 centimeters deep; pH at same depths; soil temperature at 15, 30, 45, and 90 centimeters deep; and bottom profile.

DISCUSSION

Bergen-Byron Swamp is an excellent example of the product of the interaction between the physical environment and living organisms. The course of development is not precisely known, but it can be inferred from a study of the present vegetation, the materials upon which the vegetation rests, and the underlying strata.

In the introduction, the history of Bergen-Byron Swamp was proposed up to the point in which a series of small ponds existed in the Camillus Trench. The ponds that were once the bottom of Lake Tonawanda have a bottom layer of blue clay. Probably this blue clay is outwash material from the retreating glacier, ground to extreme fineness by the movement of the ice. As Lake Tonawanda drained away, the exposed blue clay was eroded away leaving a layer only in the protected bottom of the locally dammed ponds. This clay is relatively impermeable to water and prevents seepage from the ponds into the glacial till, thus insuring permanency for the ponds.

The filled-in lakes and ponds of western New York are of two distinct types: bogs and marl ponds (Rowlee, 1918). The difference is determined by the pH of the water which they contain. Bergen-Byron Swamp is paralleled by Lockport dolomite on the north and Onondaga limestone on the south (Figure 2). Also, the Ontario loam which surrounds the swamp has developed from calcareous glacial till (U. S. Dept. of Agriculture, 1927). Thus the water originally supplied to Bergen-Byron Pond by Black Creek, springs and local run-off was highly calcareous. The calcareous nature of the pond water determined the future evolution of the pond.

Chara, a green alga, thrives in hard water and it converts free lime into calcium carbonates, which it deposits in its cell walls. Several studies have shown that as the *Chara* dies and decomposes it forms marl (Hinman, 1928; Rigg, 1940; Lindeman, 1941; Curtis, 1959). It does not seem possible that *Chara* could deposit marl to any great extent, but *Chara* has been found in beds up to 5.5 meters deep and given sufficient time it could deposit the three meter marl bed in Bergen-Byron Swamp. Although *Chara* is a major depositor of marl, studies have shown that marl, calcium carbonate, is also deposited by chemical precipitation and mechanical sedimentation (Thiel, 1930; Davis, 1900; Bray, 1930).

Calcium carbonate is being deposited at a very slow rate in Bergen-Byron Swamp presently and in time should almost cease to be deposited at all. *Chara* is an inhabitant of open water; today these areas are all but completely filled with deposited marl. Thus the amount of *Chara* and its deposition of calcium carbonate appears almost negligible today. Also the amount of lime in the incoming water has been decreasing as the local soil is leached of its lime, and in time only Black Creek will furnish hard water to the swamp from the limestone and dolomite formations. Black Creek contributes to the water supply of the swamp only during flood times. Normally the creek merely drains the swamp.

The next question about Bergen-Byron's development is why is the substratum mainly marl? Why did bog-like conditions not develop in

Bergen-Byron Swamp as they developed in the numerous bogs with marl bottoms? The production of peat is a main feature of bogs. *Sphagnum,* the major component of peat, can not tolerate alkaline water. The constant renewal of alkaline water by the network of streams and springs probably prevented any extensive growth of *Sphagnum* during the early development of the swamp. Stewart and Merrell stated that the *Sphagnum* growth was very limited as late as 1937. Today the *Sphagnum* growth is extensive and occurs in areas where it was not found earlier. The reason for this may be the decrease of lime in the inflowing waters, which is probably associated with a general shift in swamp soil pH from alkaline to neutral and in some places to slightly acidic.

The fact that peat may not be present today by no means indicates that it never was. Conditions similar to those today may very well have existed in the past and since then the deposited peat has been destroyed. Dansereau and Segadas-Vianna (1952) state that consolidated peat, when infiltrated by alkaline water, will ferment and disintegrate. Fire would be another way in which the peat could have been destroyed. The drying out of the swamp, which would induce peat production, would also make it highly susceptible to fire. The fire would destroy the organic matter leaving only marl as evidence of past history. Later on in the weather cycle the swamp would once again be flooded, making it possible again to add to the marl deposit. Repeated weather cycles with fires during the dry period would build up the marl deposit and prevent the deposition of any extensive peat layer.

During dry cycles lacking a fire, a layer of peat would be deposited which would be covered the following wet cycle by marl. Such a layer of peat was reported by Stewart (1937). Stewart's peat layer is three to eight inches thick and twenty to twenty-five inches below the surface. Stewart's peat layer was not observed in this study. The auger used to collect the soil samples would have penetrated any peat layer at a depth of twenty to twenty-five inches. The rod used to profile the bottom of the swamp did not show any evidence of deeper peat layers. The peat layer would have had to have been rather extensive, or the profile rod would have passed it unnoticed.

When the bottom of Bergen-Byron Swamp was profiled, the number of logs and stumps encountered by the probe was startling. The presence of this buried material at different levels supports the theory of several fire and water disclimaxes. In order for an extensive plant growth, such as woody plants, organic soil is required. Thus organic layers were present at one time. They may have all been destroyed. Also there is charcoal on the large *Thuja* of the present bog forest as evidence of past fires. See Figure 8 for a cross-sectional view of the transect in Bergen-Byron Swamp.

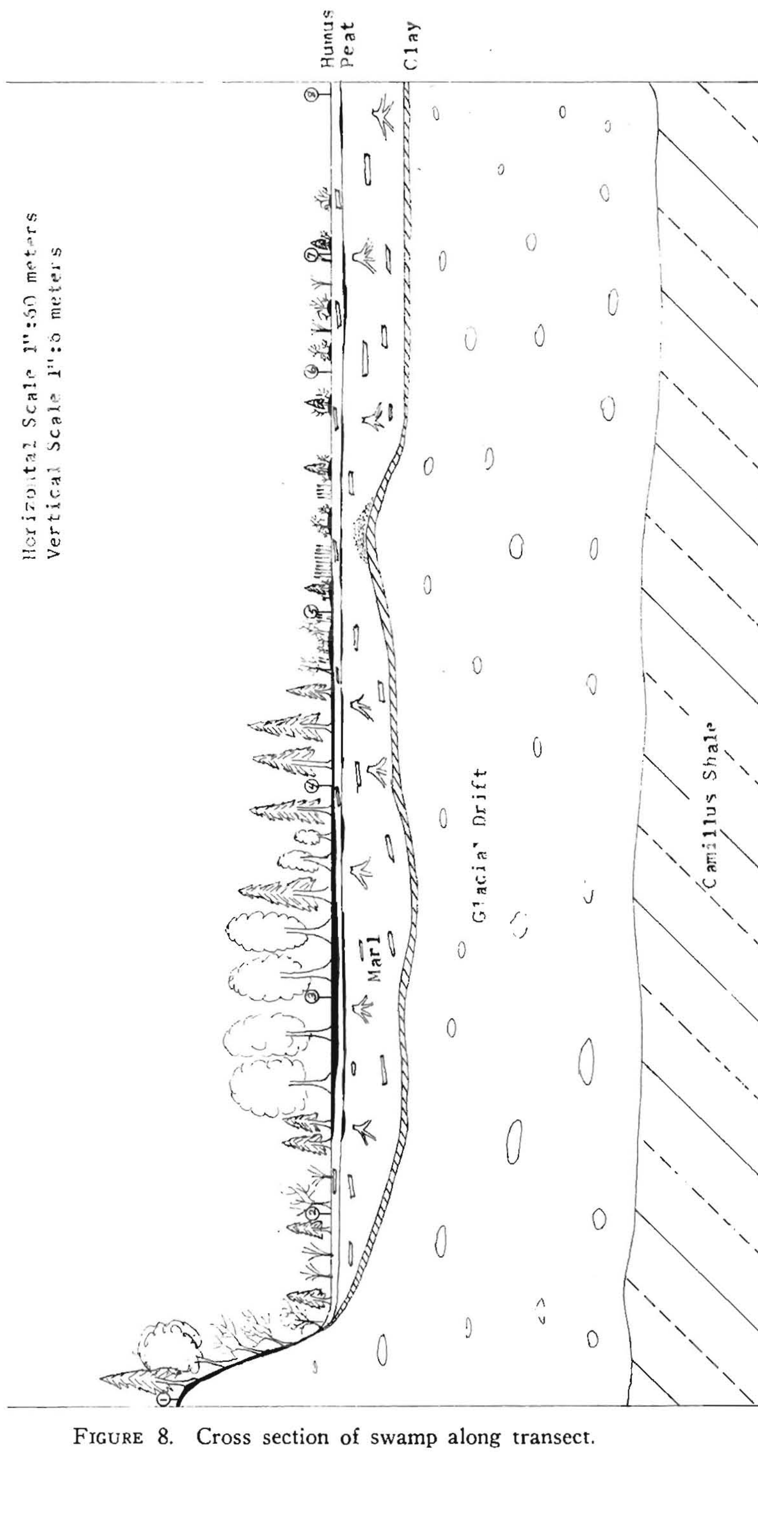

FIGURE 8. Cross section of swamp along transect.

The major successional stages existing along the transect are sedge-meadow, moss-heath, bog forest and climax forest. The sedge-meadow is the oldest of the stages and presently occupies the eye of the swamp. Grasses and sedges are the dominant plants in the sedge-meadow sere. They are tolerant and hardy plants. The substratum is perpetually saturated with water. This retards the diffusion of oxygen into the soil and restricts the availability of mineral plant foods. Because of the low oxygen content in the water, nutrients are "locked up" in undecayed plant tissues. The main contribution of the sedge-meadow community to succession is the thin sheet of humus it starts to develop on top of the marl.

Because of the repeated disclimaxes, the sedge-meadow sere in Bergen-Byron Swamp is a hybrid community. Throughout the sedge-meadow sere exist small hummocks consisting of moss-heath and bog forest successional stages. The bog forest representatives on these hummocks seem to be dwarfed. A study of the ages of *Thuja occidentalis* shows the "dwarfed" trees to be the same age as plants of equal diameter and height in the climax forest and up to fourteen years younger than plants in the moss-heath and bog forest sere. Intraspecific competition seems to be the major growth limiting factor in the case of the *Thuja.*

The transition from the sedge-meadow sere to the moss-heath sere is abrupt. This abruptness is common between the older seral stages. This is not necessarily due to environmental changes, but to the difference in the life forms of the vegetation. Due to the presence of *Sphagnum,* this sere, moss-heath, is the greatest contributor of organic material to the substratum. Competition is intense in the moss-heath and bog forest.

Larix is an indicator of the early stages of the bog forest sere. *Larix* seedlings are tolerant of submergence but can not stand shade. *Thuja* and *Pinus strobus* are typical of the mature bog forest. The seedlings of these plants are sensitive to high light intensities. Root growth is extensive in this sere for two reasons: lack of light energy and high water table. Because of lack of light, vegetative growth, which requires little energy, rather than reproductive growth, is extensive (Salisbury, 1942). There is a fusion of roots when two roots cross, and the formation of adventitious roots whenever a branch comes in contact with the ground for a long period of time. The resulting interweaving of the roots does decrease the chances of the trees being uprooted by wind. This interweaving compensates for the lack of a solid substratum in which to anchor. The second reason for the seemingly extensive root system is that the downward penetration of the roots is limited by the water table. The limited amount of free oxygen in water prevents roots lacking special adaptations from carrying on respiration below the water table. Because of this the root system extends laterally and this increases the chances of natural graft. This all tends to form a highly competitive dense growth.

Between the communities of the swamp surface (quadrats #3 through #8) and the community of the mineral soil (quadrat #1) is a narrow zone known as the marginal fen (quadrat #2). This part of the swamp is under the influence of alkaline spring waters. The marginal fen that the transect crosses is fed by two streams which originate as springs on the south side of the swamp. In Bergen-Byron Swamp, although the climax forest has skipped over this community and advanced toward the center of the swamp, plants common to the moss-heath and bog forest sere are present in the marginal fen. (See Table VI p. 266).

The climax forest in Bergen-Byron Swamp is beech (*Fagus*), birch (*Betula*), maple (*Acer*), and hemlock (*Tsuga*). This community requires humus before it is able to advance out on the swamp proper. This is a uniform and stable community.

Aerial photographs show an extensive increase in the bog forest sere and climax forest over a twenty-five year period. The sedge-meadow sere has not only decreased in diameter, but the hummock successions have spread out and claimed large islands in the sedge-meadow sere. Black Creek has shifted toward the center of the swamp from its earlier position on the extreme north side. The present position of the stream probably allows for better drainage of the swamp. There has also been a decrease in the cultivation of the land immediately adjacent to the swamp.

Although it was not possible to establish several meteorological stations with which to compare recorded data, the collected data do allow a general description of part of the physical environment in Bergen-Byron Swamp. The weekly maximum and minimum air temperatures are compared with those recorded at Stafford, New York by the U. S. Weather Bureau. Stafford is six miles due south of Bergen-Byron Swamp and is the closest recording station. Table I shows Bergen-Byron Swamp to have a lower minimum temperature throughout the recording period than Stafford. This is a common feature of wetlands and because of this they are much more susceptible to summer frosts than adjacent areas. Curtis (1959) states that differentials of 10°C to 18°C between the temperature on the wetland surface and on the near uplands are common. The lack of air circulation is probably responsible for the high maximum temperature in early spring, and accounts for the low minimum temperatures throughout the year.

Extremely high humidity readings were recorded throughout each week. Whenever the air temperature remained above freezing the probability of a morning dew was extremely high. Temperature exerts a more severe limiting effect on plants when moisture conditions are extreme. In the case of Bergen-Byron Swamp the presence of moisture intensifies the effects of temperature. This is due to the latent heat of evaporation and melting.

The soil temperatures were lower than the air temperatures throughout the recording period (Table II). This is due to the loss of energy through the evaporation of the water in the soil. The winter recordings showed an increase in temperature with an increase in depth. Summer readings showed just the reverse. These readings are also verified by the continuously recorded soil temperatures at quadrat #7 which have not been included in Table II. These temperature readings are due to the heat-holding capacity of water and the lack of circulation of the water in the soil.

The difference in soil and air temperatures causes a differential between the transpiring surfaces of plants and the absorbing surfaces of the roots. In early spring the greatest differential exists and plants rooted in saturated soil (Table III) are actually growing in xeric conditions. The plants of the moss-heath show many adaptations that appear to keep the moisture deficiency to a minimum.

Table III, Available Water, needs some explanation. The extremely high surface readings were caused by standing water on the surface of the ground. After a rainfall, most of the lower quadrats were underwater. All readings over one hundred percent should be considered as saturated. A direct relationship between the degree of saturation on the soil and its organic content was noticed when collecting the soil samples. The soils of quadrats #5 through #8 contained chunks of organic material even at the depth of 50 centimeters. A large number of buried logs exists throughout this area. The amount of water in the soil in this area did not consistently change with depth. The soils of quadrats #2 through #4 were organic at the surface, but almost pure marl at the 50 centimeter depth. The water holding capacity of the more organic soils seems to be at least twice that of the marl. A similar comparison can be made at quadrat #1. Here the surface soils are highly organic, but the subsoil (50 centimeters) is sandy. The difference in water holding capacity is even greater here.

The chart showing the pH of the soil simply shows the pH tolerance of the plants growing in this particular spot.

The horizontal means on the chart were not calculated because the pH may vary for a given area throughout the year. Buried logs in the marl tested about neutral. This may be due to the fact that their decomposition has been almost stopped. The neutral readings are probably due to the formation of carbonates ($-CO_3$) and bicarbonates ($-HCO_3$) when carbonic acid (H_2CO_3) reacts with limestone. These compounds act as natural buffers and keep hydrogen ion concentration near the neutral point.

Nine species of plants previously common to Monroe County, but not noted before in Bergen-Byron Swamp were recorded in this study. Five species of plants not previously noted in Monroe County nor Bergen-Byron Swamp were included in the transect. Of this list, only *Ribes odoratum* stands out as an unlikely member of the swamp flora. It is probably an escaped plant from some cultivated hedge. The complete list of vascular plants identified along the transect may be seen in Table V. The plants are arranged according to the "Checklist of the Vascular Plants of the Cayuga Quadrangle." Names and terminology were checked with "Gray's Manual of Botany 8th Edition."

The vascular plants identified are listed in Table VI showing their distribution along the transect. Some species tend to exhibit growth in zones while others blend into several seres. The zonation effect is to be

Table I AIR TEMPERATURE (°C)

Week of	Bergen-Byron Swamp		Stafford, N.Y.	
	Maximum Reading	Minimum Reading	Maximum Reading	Minimum Reading
4/17/66 to 4/23/66	25.60	-5.56	22.30	-1.11
4/23/66 to 4/30/66	20.00	-5.00	14.00	0.0
4/30/66 to 5/7/66	26.10	-3.34	23.95	-2.15
5/7/66 to 5/14/66	21.70	-7.23	17.20	-2.80
5/14/66 to 5/21/66	26.70	-3.34	20.60	4.50
5/21/66 to 5/28/66	21.70	0.0	28.30	5.00
5/28/66 to 6/4/66	22.30	-1.11	27.25	1.60
6/4/66 to 6/11/66	27.25	-1.11	29.60	4.00
6/11/66 to 6/18/66	26.70	0.0	28.90	7.30
6/18/66 to 6/25/66	32.80	3.89	32.80	8.30
6/25/66 to 7/2/66	35.00	6.68	35.00	11.70
7/2/66 to 7/9/66	35.00	3.89	34.50	12.20
7/9/66 to 7/16/66	31.70	1.67	30.60	7.80
7/16/66 to 7/23/66	31.70	1.67	30.60	10.00
7/23/66 to 7/30/66	31.70	3.34	31.60	10.60
7/30/66 to 8/6/66	30.60	3.89	28.90	7.30

Bergen-Byron air temperature readings were recorded at quadrat #7 by a Ruskrak recorder and by maximum-minimum thermometers. Stafford air temperature readings were recorded by the U.S. Weather Bureau station at Stafford, New York.

expected as dominant species are the criteria used to identify the various communities.

There exists a unique blending of boreal and temperate plants in Bergen-Byron Swamp. Boreal plants, such as *Ledum groenlandicum* and the other members of the heath family have temperate orchids and insectivorous plants growing at their bases. Heath plants, with their xeric

Table II SOIL TEMPERATURES (°C)

Location	Depth	April 17	July 10	July 23	August 7
Quadrat #1	15 cm.		16.1	16.3	16.8
	30 cm.		14.7	15.1	15.3
	45 cm.		13.0	14.9	14.4
	90 cm.		10.9	11.9	12.9
Quadrat #2	15 cm.		16.8	18.8	16.7
	30 cm.		15.1	16.6	15.1
	45 cm.		14.9	15.7	14.7
	90 cm.		12.3	13.9	13.9
Quadrat #3	15 cm.		16.1	18.0	16.6
	30 cm.		14.8	15.2	15.5
	45 cm.		14.0	16.1	15.0
	90 cm.		11.4	17.2	13.8
Quadrat #4	15 cm.		16.7	16.9	17.2
	30 cm.		14.9	15.3	16.0
	45 cm.		13.9	14.8	14.7
	90 cm.		10.1	11.8	11.9
Quadrat #5	15 cm.		14.5	15.0	14.4
	30 cm.		13.0	14.0	14.0
	45 cm.		11.2	13.0	13.9
	90 cm.		8.5	9.8	10.3
Quadrat #6	15 cm.		20.0	19.9	18.8
	30 cm.		17.9	18.0	17.1
	45 cm.		15.7	17.0	15.9
	90 cm.		11.2	13.4	13.2
Quadrat #7	15 cm.	2.9	20.5	21.9	21.2
	30 cm.	3.7	19.0	19.2	19.6
	45 cm.	4.2	16.9	18.0	18.3
	90 cm.	4.35	12.1	14.0	14.9
Quadrat #8	15 cm.		19.8	20.0	19.5
	30 cm.		18.2	18.2	17.6
	45 cm.		16.6	17.8	16.9
	90 cm.		12.2	8.5	13.2
Air Temperature		15.0	25.0	29.0	29.0

The above temperatures were measured by a Leeds and Northrup portable temperature potentiometer.

adaptations, and insectivorous plants, with their nitrogen acquiring adaptations, appear to have selective advantages in the competition for space in the exacting environment of Bergen-Byron Swamp.

Table III AVAILABLE WATER (In % of Total Volume)

Location	Depth	April 23	June 12	June 25	July 10	July 23	August 7
Quadrat #1	Litter	252	95	112	22	101	62
	10 cm.	35	18	21	29	19	15
	50 cm.	12	15	15	9	12	14
Quadrat #2	Litter	695	580	400	396	375	395
	10 cm.	532	528	453	417	426	455
	50 cm.	106	128	224	149	157	159
Quadrat #3	Litter	562	490	440	343	220	300
	10 cm.	610	510	470	428	220	361
	50 cm.	72	88	83	94	70	878
Quadrat #4	Litter	1120	500	433	407	428	427
	10 cm.	482	643	535	535	418	518
	50 cm.	258	212	269	185	212	200
Quadrat #5	Litter	1313	875	360	346	317	357
	10 cm.	341	398	414	382	315	346
	50 cm.	747	626	747	524	530	564
Quadrat #6	Litter	1490	3035	1120	746	642	436
	10 cm.	635	550	630	657	563	511
	50 cm.	1040	834	723	850	719	679
Quadrat #7	Litter	855	639	955	560	600	1020
	10 cm.	826	126	360	624	316	386
	50 cm.	970	1030	600	1040	453	790
Quadrat #8	Litter	505	670	305	169	185	154
	10 cm.	420	280	343	356	495	307
	50 cm.	349	610	571	645	540	564

Readings in excess of 100% represent samples collected below water table. Surface litter was subject to high recordings due to the standing water which contaminated the sample.

Table IV SOIL pH

Location	Depth	April 23	June 12	June 25	July 10	July 23	August 7	Ave.	Stewart 1937
Quadrat #1									
	Litter	5.58	5.78	6.75	7.60	5.90	6.40	6.34	6.45
	10 cm.	4.50	5.00	5.95	6.25	5.80	5.95	5.58	
	50 cm.	5.88	6.60	6.85	6.30	5.70	5.90	6.21	
Quadrat #2									
	Litter	6.60	6.35	6.45	6.40	6.50	5.70	6.34	
	10 cm.	6.80	6.35	7.65	7.05	7.05	6.90	6.97	
	50 cm.	7.83	8.20	7.70	7.80	7.70	7.10	7.71	
Quadrat #3									
	Litter	5.42	6.60	6.20	6.40	5.50	5.65	6.96	
	10 cm.		7.36	7.25	6.80	7.20	7.05	7.15	
	50 cm.	8.06	8.20	7.45	7.80	7.65	7.80	7.81	
Quadrat #4									
	Litter		7.82	7.80	7.75	7.05	7.55	7.60	6.12
	10 cm.		7.40	7.00	7.40	7.25	7.35	7.28	
	50 cm.	6.91	7.60	7.05	7.80	7.50	7.40	7.38	
Quadrat #5									
	Litter	7.30	7.25	7.40	7.20	7.60	7.55	7.40	7.05
	10 cm.		7.80	7.20	7.80	8.45	6.95	7.64	
	50 cm.	6.62	7.20	7.40	7.60	7.05	7.00	7.14	
Quadrat #6									
	Litter	6.90	7.27	7.50	6.60	6.80	6.95	7.00	7.32
	10 cm.		7.20	7.10	7.40	6.65	6.85	7.04	
	50 cm.		7.20	7.00	7.00	6.85	7.00	7.01	
Quadrat #7									
	Litter	6.23	7.10	6.75	6.70	6.80	6.75	6.72	7.32
	10 cm.		7.10	6.95	7.65	7.40	7.40	7.30	
	50 cm.		6.80	6.85	7.35	7.10	7.30	7.08	
Quadrat #8									
	Litter	6.00	6.90	7.00	7.75	7.55	7.60	7.13	7.32
	10 cm.		7.60	7.80	7.80	7.15	7.50	7.57	
	50 cm.		7.25	7.40	7.40	7.00	7.00	7.21	

The above pH readings were obtained from the soil samples collected beside the "sample stake" of each quadrat. A Beckman (model 76) pH meter was used to measure these samples.

Table V VASCULAR PLANTS FOUND IN QUADRATS ALONG TRANSECT

Family Equisetaceae

Equisetum palustre L.—Marsh Horsetail[1, 2, 3]

Family Selaginellaceae

Selaginella apoda (L.) Fernald—Creeping Spike-moss[2, 3]

Family Ophioglossaceae

Botrychium virginianum (L.) Swartz—Rattlesnake Fern

Family Osmundaceae

Osmunda cinnamomea L.—Cinnamon-fern

Family Polypodiaceae

Woodwardia virginica (L.) Sm.—Virginia Chain Fern
Cystopteris bulbifera (L.) Bernh.—Bulb Fern
Polystichum acrostichoides (Michx.) Schott—Christmas Fern
Dryopteris disjuncta (Ledeb.) C. V. Mort—Oak-fern

Family Pinaceae

Tsuga canadensis (L.) Carr.—Hemlock
Larix laricina (DuRoi) Koch—Tamarack

Family Cupressaceae

Juniperus horizontalis L.—Creeping Juniper
Thuja occidentalis L.—Arbor Vitae

Family Taxaceae

Taxus canadensis (Marshall) Pilger—American Yew

Family Ranunculaceae

Actaea rubra (Ait.) Willd.—Red Baneberry[2]
Coptis trifolia (L.) Salisb.—Goldthread

Family Salicaceae

Populus deltoides Marsh.—Cottonwood
Populus tremuloides Michx.—Trembling Aspen
Salix serissima (Bailey) Fernald—Autumn Willow[2]
Salix pedicellaris Pursh.[2]

Family Moraceae

Morus alba L.—White Mulberry

Family Sarraceniaceae

Sarracenia purpurea L.—Pitcher Plant

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[1] Recorded by Beckwith and Macauley (1896)
[2] Not recorded by Stewart (1937)
[3] Not recorded by Muenscher (1946)

Family Polygalaceae

Polygala paucifolia Willd.—Fringed Polygala

Family Anacardiaceae

Rhus typhina L.—Staghorn Sumach

Family Aquifoliaceae

Nemopanthus mucronata (L.) Trel.—Mountain Holly[2]

Family Aceraceae

Acer nigrum Michx. f.—Black Maple
Acer rubrum L.—Red Maple
Acer negundo L.—Ash-leaved Maple[1, 2, 3]

Family Vitaceae

Parthenocissus quinquefolia (L.) Planch.—Virginia Creeper
Vitis palmata Vahl—Red Grape[1, 2, 3]

Family Corylaceae

Betula lutea Michx. f.—Yellow Birch

Family Fagaceae

Fagus grandifolia Ehrh.—American Beech

Family Myricaceae

Myrica cerifera (L.)—Wax-myrtle[1, 2, 3]
Myrica pensylvanica Lois.—Bayberry

Family Violaceae

Viola cucullata Ait.—Marsh Blue Violet[2]
Viola renifolia Gray—White Violet
Viola lanceolata L.—Lance-leaved Violet[2, 3]

Family Droseraceae

Drosera rotundifolia L.—Round-leaved Sundew

Family Primulaceae

Trientalis borealis Raf.—Starflower

Family Ericaceae

Ledum groenlandicum Oeder—Labrador Tea
Gaultheria procumbens L.—Aromatic Wintergreen
Vaccinium oxycoccus L.—Small Cranberry
Vaccinium macrocarpon Ait.—Large Cranberry
Vaccinium myrtilloides Michx.—Velvetleaf Blueberry[2]
Vaccinium corymbosum L.—High-bush Blueberry
Gaylussacia dumosa (Andr.) T. & G.—Dwarf Huckleberry[2, 3]

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[1] Recorded by Beckwith and Macauley (1896)
[2] Not recorded by Stewart (1937)
[3] Not recorded by Muenscher (1946)

Family Oleaceae

Fraxinus americana L.—White Ash

Family Solanaceae

Solanum dulcamara L.—European Bittersweet

Family Lentibulariaceae

Utricularia intermedia Hayne—Flat-leaved Bladderwort[2]

Family Labiatae

Lycopus rubellus Moench.[2, 3]

Family Lobeliaceae

Lobelia siphilitica L.—Great Lobelia
Lobelia kalmii L.—Kalm's Lobelia

Family Saxifragaceae

Tiarella cordifolia L.—False Miterwort
Parnassia glauca Raf.—Grass of Parnassus
Ribes odoratum Wend.—Golden Currant[2, 3]

Family Rosaceae

Spiraea tomentosa L.—Steeple Bush[1, 2, 3]
Potentilla fruticosa L.—Shrubby Cinquefoil
Rubus idaeus L.—Red Raspberry[2]
Pyrus arbutifolia (L.) Ell.—Red Chokeberry
Pyrus aucuparia (L.) Ehrh.—European Mountain Ash[2]

Family Cornaceae

Cornus stolonifera (Michx.)—Red Osier Dogwood
Cornus canadensis L.—Dwarf Cornel

Family Rubiaceae

Galium triflorum Michx.—Sweet-scented Bedstraw

Family Caprifoliaceae

Viburnum acerifolium L.—Mapleleaf Viburnum
Lonicera oblongifolia (Goldie) Hook.—Swamp Fly Honeysuckle
Linnaea borealis L.—Twinflower

Family Compositae

Eupatorium urticaefolium Houtt.—White Snakeroot
Solidago ulmifolia Muhl.
Solidago ohioensis Riddell
Solidago uliginosa Nutt.[1, 2, 3]
Aster divaricatus L.—White Wood Aster[2]

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[1] Recorded by Beckwith and Macauley (1896)
[2] Not recorded by Stewart (1937)
[3] Not recorded by Muenscher (1946)

Aster junciformis Rydb.[1,2,3]
Aster lateriflorus (L.) Britt.[2]
Aster simplex Willd.—White Field Aster
Erigeron annuus (L.) Pers.—Daisy Fleabane[2]
Senecio pauperculus Michx.
Prenanthes alba L.—Rattlesnake-root
Sonchus oleraceus L.—Common Sow Thistle[2]

Family Juncaginaceae

Triglochin maritima L.—Arrow-grass

Family Typhaceae

Typha latifolia L.—Broad-leaved Cat-tail
Typha angustifolia L.—Narrow-leaved Cat-tail[2]

Family Liliaceae

Smilacina racemosa (L.) Desf.—False Solomon's Seal
Polygonatum biflorum (Walt.) Ell.—Great Solomon's Seal[1,2,3]
Maianthemum canadense Desf.—Canada Mayflower
Tofieldia glutinosa (Michx.) Pers.
Zigadenus glaucus Nutt.—White Camass[1,2,3]

Family Cyperaceae

Eleocharis rostellata Torr.
Carex howei Mackenzie
Carex hystricina Muhl.
Carex gynocrates Wormsk.

Family Gramineae

Glyceria striata (Lam.) Hitch.[2]
Phragmites communis Trin.—Reed Grass
Agropyron repens (L.) Beauv.—Quack Grass[2]
Elymus virginicus L.—Wild Rye[2]
Muhlenbergia racemosa (Michx.) BSP.[2]

Family Orchidaceae

Calopogon pulchellus (Sw.) R. Br.—Grass-pink Orchid
Epipactis latifolia (L.) All.[2]

[1] Recorded by Beckwith and Macauley (1896)
[2] Not recorded by Stewart (1937)
[3] Not recorded by Muenscher (1946)

Table VI HORIZONTAL DISTRIBUTION OF VASCULAR PLANTS ALONG TRANSECT

Vegetation Type	Climax Forest	Margin Fen	Climax Forest	Bog Forest	Moss-Heath	Hybrid Sedge-Meadow		Sedge-Meadow
Quadrat	1	2	3	4	5	6	7	8
Equisetum palustre	.	X	X	.	.	.	.	.
Selaginella apoda	.	.	.	.	.	X	X	X
Botrychium virginianum	.	X	.	.	.	.	.	.
Osmunda cinnamomea	.	X	.	.	.	.	.	.
Woodwardia virginica	.	X	.	.	.	.	.	.
Cystopteris bulbifera	.	.	.	X	.	.	.	.
Polystichum acrostichoides	.	X	.	.	.	.	.	.
Dryopteris disjuncta	.	.	X	.	.	.	.	.
Tsuga canadensis	X	X	X	X	.	.	.	.
Larix laricina	.	.	.	.	X	X	X	.
Juniperus horizontalis	.	.	.	.	X	X	X	.
Thuja occidentalis	.	X	.	X	X	X	X	X
Taxus canadensis	X	X	X	.	.	.	.	.
Actaea rubra	.	X	.	.	.	.	.	.
Coptis trifolia	.	X	X	X	X	.	.	.
Populus deltoides	X	.	.	.	.	.	.	.
P. tremuloides	.	X	.	.	.	.	.	.
Salix serissima	.	.	.	.	X	.	.	.
S. pedicellaris	.	X	.	.	X	.	.	.
Morus alba	.	.	X	.	.	.	.	.
Sarracenia purpurea	.	.	.	.	.	.	X	.
Polygala paucifolia	.	.	.	.	X	.	.	.
Rhus typhina	.	X	.	X	.	.	.	.
Nemopanthus mucronata	.	.	.	X	.	.	.	.
Acer nigrum	X	X	.	.	.	.	.	.
A. rubrum	.	.	X	X	X	.	.	.
A. negundo	X	.	.	.	.	.	.	.
Parthenocissus quinquefolia	.	.	.	X	.	.	.	.
Vitis palmata	.	X	.	.	.	.	.	.
Betula lutea	.	.	.	X	.	.	.	.
Fagus grandifolia	X	.	X	.	.	.	.	.
Myrica cerifera	.	.	.	.	.	.	.	X
M. pennsylvanica	.	.	.	.	X	.	.	.
Viola cucullata	.	.	X	.	.	X	.	.
V. renifolia	.	.	.	.	.	.	X	X
V. lanceolata	.	.	.	.	.	X	X	X
Drosera rotundifolia	.	X	.	.	.	X	X	.
Trientalis borealis	.	.	.	X	X	.	X	.

Vegetation Type	Climax Forest	Margin Fen	Climax Forest	Bog Forest	Moss-Heath	Hybrid Sedge-Meadow		Sedge-Meadow
Quadrat	1	2	3	4	5	6	7	8
Ledum groenlandicum	.	.	.	X	X	X	X	X
Gaultheria procumbens	.	.	.	.	X	.	.	.
Vaccinium oxycoccus	.	.	.	.	.	.	X	.
V. macrocarpon	.	.	.	X	X	X	X	X
V. myrtilloides	.	X	.	.	.	.	.	.
V. corymbosum	.	.	.	.	X	.	.	.
Gaylussacia dumosa	.	.	.	.	.	.	.	X
Fraxinus americana	X	.	.	.	.	.	.	.
Solanum dulcamara	.	X	.	X	.	.	.	.
Utricularia intermedia	.	.	.	.	.	X	X	.
Lycopus rubellus	.	.	.	X	.	.	.	.
Lobelia siphilitica	.	.	.	X	.	.	.	.
L. kalmii	.	.	.	.	.	X	X	.
Tiarella cordifolia	.	.	.	X	.	.	.	.
Parnassia glauca	.	.	.	X	.	X	X	X
Ribes odoratum	.	X	.	.	.	.	.	.
Spiraea tomentosa	.	.	.	X	.	.	.	.
Potentilla fruticosa	.	.	.	.	X	X	.	X
Rubus idaeus	.	X	.	.	.	.	.	.
Pyrus arbutifolia	.	.	.	.	X	X	X	X
P. aucuparia	.	.	.	X	.	.	.	.
Cornus stolonifera	.	X	.	X	.	.	.	.
C. canadensis	.	.	.	X	.	.	.	.
Galium triflorum	.	.	.	.	X	.	X	.
Viburnum acerifolium	X	X	.	.	.	.	.	.
Lonicera oblongifolia	.	.	.	.	X	X	.	.
Linnaea borealis	.	.	.	.	X	.	.	.
Eupatorium urticaefolium	.	X	.	X	.	.	.	.
Solidago ulmifolia	.	X	X	X	.	.	.	.
S. ohioensis	.	.	.	.	.	.	.	X
S. uliginosa	.	.	.	.	.	X	X	X
Aster divaricatus	.	.	.	X	.	.	.	.
A. junciformis	.	X	.	X	.	.	.	.
A. lateriflorus	.	.	.	X	X	.	.	.
A. simplex	.	.	.	.	.	.	.	X
Erigeron annuus	.	.	.	X	.	.	.	.
Senecio pauperculus	.	.	.	.	.	X	X	X
Prenanthes alba	.	.	.	X	.	.	.	.

Vegetation Type	Climax Forest	Margin Fen	Climax Forest	Bog Forest	Moss-Heath	Hybrid Sedge-Meadow		Sedge-Meadow
Quadrat	1	2	3	4	5	6	7	8
Sonchus oleraceus	.	X	.	.	.	.	.	.
Triglochin maritima	.	.	.	.	.	X	X	X
Typha latifolia	.	X	.	.	X	X	X	.
T. angustifolia	.	.	.	.	X	X	X	.
Smilacina racemosa	X	.	.	.	.	.	.	.
Polygonatum biflorum	X	.	.	.	.	.	.	.
Maianthemum canadense	X	X	.	X	.	.	.	.
Tofieldia glutinosa	.	.	.	.	.	.	X	.
Zigadenus glaucus	.	.	.	.	.	.	.	X
Eleocharis rostellata	.	.	.	.	.	X	X	X
Carex howei	.	.	.	.	X	.	.	.
C. hystricina	.	.	.	.	.	X	.	.
C. gynocrates	.	.	.	.	.	.	X	.
Glyceria striata	.	.	.	.	.	X	X	.
Phragmites communis	.	.	.	.	X	X	X	.
Agropyron repens	.	.	.	.	X	X	X	X
Elymus virginicus	.	.	.	.	.	.	.	X
Muhlenbergia racemosa	.	.	.	.	.	X	X	X
Calopogon pulchellus	.	.	.	.	.	.	X	.
Epipactis latifolia	.	X	.	.	.	.	.	.

"X" indicates the presence of this species in the quadrat.

SUMMARY

An extensive supply of lime and several disclimaxes have kept peat deposition to a minimum in Bergen-Byron Swamp. The swamp is probably best described as a marl pond.

The several disclimaxes have also led to a blending of the different vegetational seres. This is especially evident in the eye of the swamp. The general associations present in the swamp today are: water-*Chara,* sedge-meadow, moss-heath, bog forest, and climax forest.

Selaginella apoda, Viola lanceolata, Gaylussacia dumosa, Lycopus rubellus, and *Ribes odoratum* are additions to the previous flora of Monroe County and Bergen-Byron Swamp. *Equisetum palustre, Acer negundo, Vitis palmata, Myrica cerifera, Spiraea tomentosa, Solidago uliginosa, Aster junciformis, Polygonatum biflorum,* and *Zigadenus glaucus* were previously noted in Monroe County but not in Bergen-Byron Swamp. This is an addition of fourteen vascular plants to Dr. Muenscher's work in Bergen-Byron Swamp.

The importance of maintaining areas such as Bergen-Byron Swamp in their "natural" state are manyfold. They are needed as study areas,

plant and animal preserves, water storage areas, and, if for no other reason, for their aesthetic value. This was a very enjoyable study that led to many pleasant moments. There were sad parts however. They were man's destruction of the study sites, the riddling of the meteorology shelter with gunfire and finally the burning of the shelter without regard to the signs requesting that it not be disturbed.

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THE EFFECTS OF ROTENONE ON CERTAIN FISH FOOD CRUSTACEANS

FRANCIS J. CLAFFEY[1, 2] and ROBERT R. COSTA[1, 3]

ABSTRACT. Four test organisms: the crayfish *Cambarus bartoni,* the amphipod *Gammarus fasciatus,* the daphnid *Daphnia pulex,* and the cyclopoid *Cyclops vernalis* were subjected to various rotenone concentrations ranging from 0.009–3.3 ppm. *Cambarus* had the greatest resistance and *Daphnia* the least. No change in structure or deterioration of organs in *D. pulex* and *C. vernalis* and gills in *C. bartoni* and *G. fasciatus* before and after rotenoning could be observed by microscopic examination. Based upon rotenone concentrations currently used today in fish eradication, crayfish and amphipod populations probably would be little affected. However, a drastic reduction in the daphnid and cyclopoid populations might result from the higher concentrations that are sometimes used.

INTRODUCTION

Rotenone is extensively used by virtually every state conservation department in both powdered and emulsifiable forms to obtain fish for population and aging studies, as well as to eradicate undesirable fish species. This study was conducted to learn what effect currently-used concentrations of rotenone had on four crustaceans which are important fish food organisms.

Rotenone has many advantages as a fish toxicant. It has low mammalian toxicity and rapid detoxification in comparison to chlorinated hydrocarbon and organic phosphorus insecticides. The latter kill fish in high dilutions, but have a high mammalian toxicity and a long residual action (Leonard, 1939; Smith, 1939; Greenback, 1940; Ball, 1945; Krumholz, 1948; Henderson *et al.,* 1959).

Factors that influence the concentration of rotenone necessary to bring about a fish kill include size and species of fish, temperature, pH, turbidity of the water and the occurrence of weed beds (Reynolds and Barry, 1951; Burdick *et al.,* 1955; Leonard, 1939; Zillox and Pfeiffer, 1956; Jenkins, 1956).

Clemens and Martin (1953) recommended 1–2 ppm as a minimum con-

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centration for 5% emulsifiable rotenone (0.05–0.1 ppm pure rotenone) and slightly higher for the powdered form. Bennett (1962) found that it was risky to depend upon a 5% rotenone formulation of less than 1 ppm (0.05 ppm pure rotenone) to give a complete kill of fish. Leonard (1939) reported that a 0.5 ppm concentration of 5% derris root (0.025 ppm pure rotenone) was adequate to kill many common species of small fish. Krumholz (1948) used rotenone concentrations of 1.0–1.5 ppm (0.05–0.075 ppm pure rotenone) and failed to produce a complete kill of bullheads. Burdick *et al.* (1955) indicated that 0.5 ppm of a 5% rotenone emulsion (0.025 ppm pure rotenone) was not adequate if a complete kill was required. Zillox and Pfeiffer (1956) found that Noxfish at a concentration of 0.5 ppm (0.025 ppm pure rotenone) was capable of killing all species of fish. Burdick *et al.* (1956) showed that yellow perch could be killed by concentrations of a 5% rotenone emulsion as low as 0.05 ppm (0.0025 ppm pure rotenone).

In this paper rotenone concentrations shown in parentheses are the equivalents of commercial preparations and refer to 5% pure rotenone. A 95% solution of 5% pure rotenone was used in all tests conducted in this investigation.

MATERIALS AND METHODS

The crayfish *Cambarus bartoni*, the amphipod *Gammarus fasciatus*, the daphnid *Daphnia pulex*, and the cyclopoid *Cyclops vernalis* were used as test organisms. They were selected on the basis of their importance in the diet of fish, their ability to survive under laboratory conditions, and their availability in large numbers.

The organisms and water used in the tests were obtained from the Barge Canal at Brockport, New York. They were collected and transported a short distance to an air conditioned animal suite at the State University College at Brockport. The water and organisms were acclimated in this controlled environment prior to each test. Animals of each species used in the tests were nearly uniform in size.

The purest form of rotenone possible according to the Pesticide Reference Standards of the Entomological Society of America and supplied by the City Chemical Corporation was used. It consisted of a minimum of 95.0% rotenone and a maximum of 5.0% related and inert compounds. This was used because the concern was with the effect of rotenone and not the additives.

A 5% rotenone stock solution was obtained by adding 5 g. of 95% rotenone to 95 g. of distilled water. A new stock solution was made for each test. By serial dilution a measured quantity was placed in glass battery jars each containing 2 liters of water to give the desired rotenone concentration.

For each test organism, duplicate concentrations required to bring about mortalities ranging from 100%–0% were used in approximately 10% intervals. Ten organisms were placed in each concentration and 100 in a battery jar containing just water from the natural habitat. As organisms died they were removed from the battery jars. At the end of 48 hours the percentage of mortality was determined for each test organism at each concentration used. Four tests were run for each test organism. These were averaged to give the percentage of mortality for each concentration used (Figure 1).

Preliminary tests were made on each test organism prior to full scale testing to learn the minimum concentration required to bring about 100% mortality and the maximum concentration at which 0% mortality occurred.

The test organisms were classed as killed by the toxicant if they appeared near death and displayed only periodic twitching movements of legs and gills (*C. bartoni* and *G. fasciatus*) or legs (*D. pulex* and *C. vernalis*). Those which maintained coordinated movements at the time of observation were considered living.

The change in structure or deterioration of organs in *D. pulex* and *C. vernalis* and the gills on *C. bartoni* and *G. fasciatus* were studied by microscopic examination using 10 test organisms of each species that had not been exposed to rotenone and 10 of each species that had succumbed at the end of 48 hours to a rotenone concentration that produced approximately a 50% mortality.

RESULTS AND DISCUSSION

The average percentage of mortality produced by various concentrations of pure rotenone for each test organism over a period of 48 hours is shown in Figure 1. The survival of all four organisms was excellent under laboratory conditions. It was found that each of the four crustaceans had a different range of rotenone concentration in which mortalities from 100%–0% occurred. *C. bartoni* had the greatest resistance to rotenone and *D. pulex* the least.

A concentration of 0.9 ppm pure rotenone produced a 10.25% crayfish mortality and a concentration of 0.4 ppm pure rotenone caused a 11.25% amphipod mortality. It appears that crayfish and amphipod populations would be little affected by rotenone concentrations generally used in fisheries work today. This would be true especially in weed beds where higher concentrations are generally employed.

A concentration of 0.1 ppm of pure rotenone produced a 70.0% daphnid

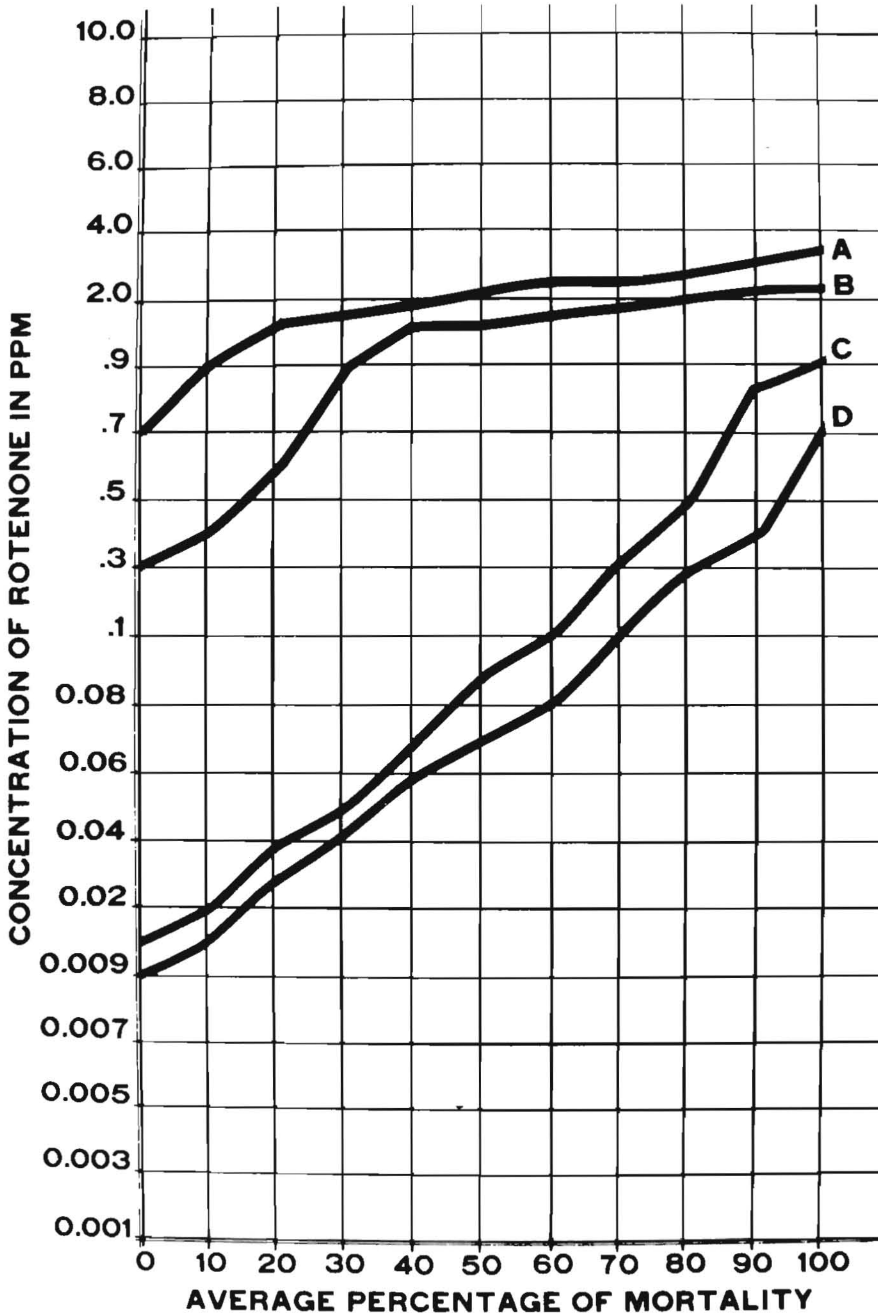

FIGURE 1.—The concentration of rotenone (ppm) and the average percentage ot mortality over a 48 hour period for the four test organisms: A – *C. bartoni*, B – *G. fasciatus*, C – *C. vernalis*, D – *D. pulex*.

mortality and a 60.75% cyclopoid mortality. Daphnid and cyclopoid populations could be drastically reduced, especially by higher concentrations that are sometimes used in fisheries work. Since *D. pulex* and *C. vernalis* are two zooplankters of importance in the staple diet of young fishes, their depletion would be of significance because plankton are basic to the productivity of any body of water.

Almquist (1959) working on fish food organisms in three lakes in Sweden found that most of the zooplankton, much of the aufwuchs community and bottom animals along with some of the phytoplankters were killed by 0.5–0.6 ppm of 5% rotenone (0.025–0.03 ppm pure rotenone). These concentrations generally are used in fish eradication. Kiser *et al.* (1962) also showed that concentrations of 0.5–1.0 ppm of 5% rotenone (0.025–0.05 ppm pure rotenone) seriously affected zooplankton populations but did not permanently eliminate them.

Microscopic examination of the test organisms that had succumbed to rotenone showed no structural differences or deterioration of gills. The mechanism by which fish and aquatic arthropods are killed by rotenone has not been established. Hamilton (1941) concluded that rotenone killed fish by causing the constriction of gill capillaries preventing the passage of blood through the gills. Daneel (1933) reported that rotenone actually destroyed the gill tissues of fish. Burdick *et al.* (1955) were unable to find any apparent mechanical injury or loss of gill filaments in fish that had been subjected to various rotenone concentrations.

Fukami (1962), working with the American cockroach, demonstrated that rotenone affected the nervous system and respiration by primarily causing a disruption in the citric acid cycle. It is highly possible that this may be the mechanism by which both fish and aquatic arthropods are also affected by rotenone.

This investigation shows the need for additional studies relating to the effects of rotenone upon aquatic invertebrates. The effect of rotenone upon other food organisms of importance to the diet of fish should be assessed.

Preliminary work on the effects of rotenone on four important fish food insects has been done by Claffey and Ruck (1967). The nymphs of the dragonfly (*Anax*), the damselfly (*Agrion*), the mayfly (*Siphlonurus*) and the caddisfly larvae (*Phryganea*) were all subjected to rotenone concentrations in the ranges shown in Figure 1. It was found that dragonfly nymphs had the greatest resistance and caddisfly larvae the least.

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A BIOLOGICAL SURVEY OF THE UPPER TONAWANDA CREEK RELATIVE TO A PROPOSAL OF IMPOUNDMENT

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ABSTRACT. A proposal by the Erie-Niagara Basin Regional Water Resources Planning Board to impound the Upper Tonawanda Creek suggests that the creek is suitable for such a plan in spite of a relative absence of published data on the creek. A survey of the macroinvertebrate diversity, conducted during July and August of 1971, yielded the result that the biological quality of the creek is questionable.

INTRODUCTION

It has been generally acknowledged that the demand for fresh water is going to increase for the next several years. In 1969, the Erie-Niagara Basin Regional Water Resources Planning Board (E.N.B.R.W.R.P.B.) reported that by the year 2020, the Erie-Niagara Basin municipal and industrial water demands are projected to be in the area of 469 million gallons per day (mgd). The projected volume of waste water at that time is 410 mgd while the 47 sewage treatment plants in existence cannot adequately handle the present estimated 270 mgd. Furthermore, a growing population and expanding agriculture are expected to make demands on water for recreational and irrigational purposes respectively. E.N.B.R. W.R.P.B. states that the water resources of the region are sufficient to supply all foreseeable demands if the inland ground and surface water resources tributary to Lake Erie and the Niagara River are properly developed and utilized. To this end, E.N.B.R.W.R.P.B. has proposed that this development can be partly accomplished with the construction of five multi-purpose dams at upstream sites on major tributary streams. The resulting reservoirs will provide for storage of the volumes of water needed, offer areas for water-oriented recreation and wildlife conservation, provide adequate supplies of water for stream flow augmentation, and effect flood control. One such dam is to impound the Tonawanda Creek at a point roughly three miles south of the village of Attica, New York.

The Tonawanda Creek is a perennial stream (Morisawa, 1968) originating in the low hills of Wyoming County and flowing north toward

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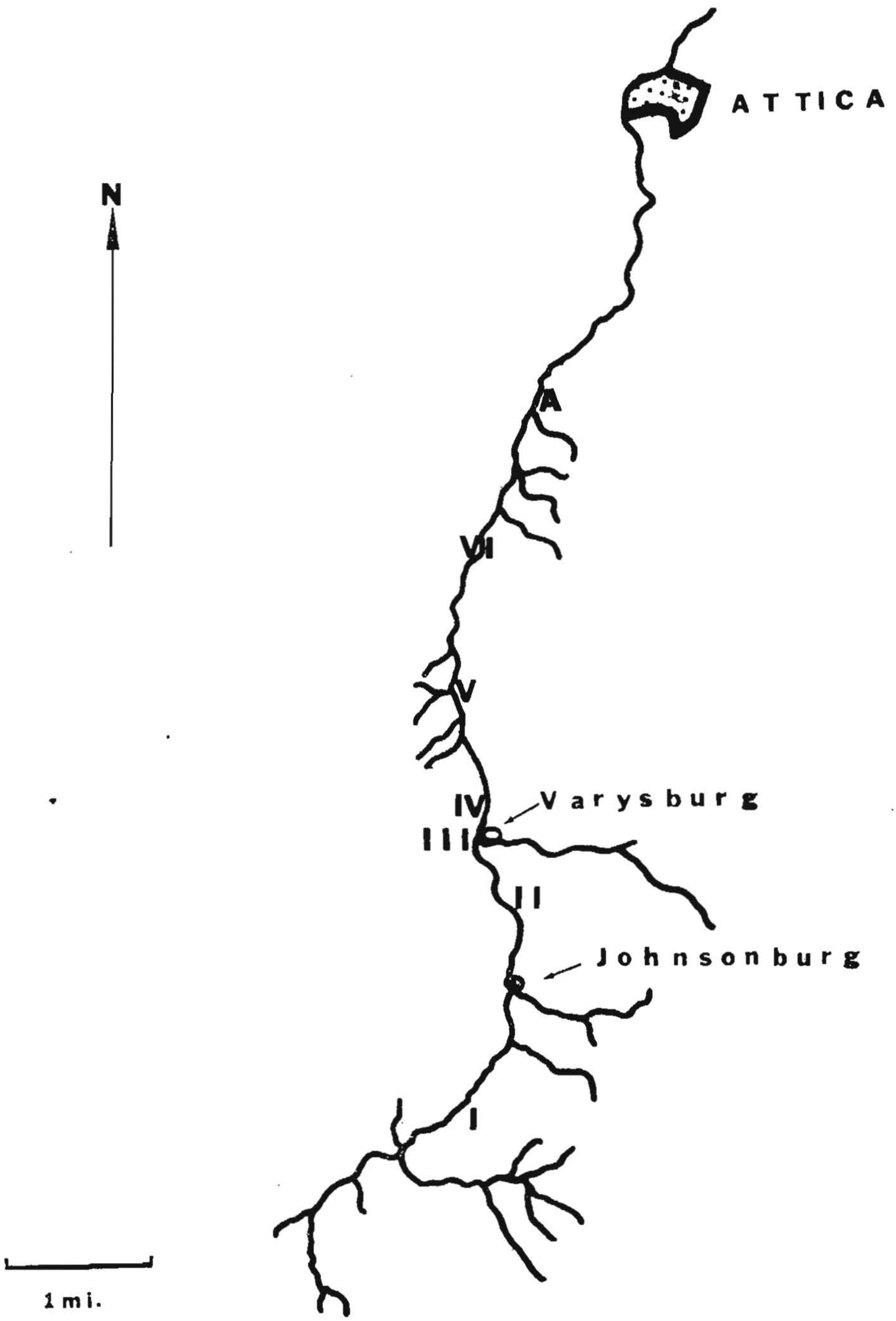

FIGURE 1. Map of upper Tonawanda Creek showing collection stations (I–VI) and site of proposed dam (A).

Batavia, New York, where it then heads west, joining with the Barge Canal at Pendleton, New York and finally emptying into the Niagara River at Tonawanda, New York. The upper section (Figure 1) of the creek basin, near the source, is generally forested, and some logging goes on. The remainder of the creek upstream from the proposed dam site drains rolling farmland. The stream probably receives some domestic sewage from streamside residences and two small settlements plus barnyard seepage. Marcus (1973) reported on finding coliform bacteria levels from February 2, 1971 to May 5, 1971 ranging from 2,200 to in excess of 16,090 (MPN). Archer, La Sala, and Kammerer (1968) reported nitrate concentrations near Johnsonburg, New York of 1.5 ppm on May 8, 1963 and 0.6 ppm on July 2, 1963. Archer and La Sala (1968) found suspended sediment concentrations ranging between 94 ppm and 1,640 ppm on five occasions from March 26, 1963 through March 26, 1964. The authors, after an intensive search, were unable to find any additional published data relevant to the region of the Tonawanda Creek upstream from the proposed dam site.

Among the uses envisioned by E.N.B.R.W.R.P.B. for the reservoir to be created by damming the creek are fishery and wildlife management and water-oriented recreation. It is difficult to see precisely how these projected uses were arrived at, considering the relative absence of data on the quality of the stream. It was thought, therefore, that further data are needed before a meaningful conclusion can be reached regarding the wisdom of proceeding with construction of the dam. To this end, an investigation was conducted during July and August of 1971 to gain additional information on the quality of the stream.

PROCEDURES

Biological quality of the stream was determined by macroinvertebrate species diversity (Gaufin and Tarzwell, 1952). Specimens were collected by placing multiple-plate samplers (Hester and Dendy, 1962) in riffles (Odum, 1971) and allowing them to stand for six weeks. At the end of that period, the samplers were returned to the laboratory where specimens were removed, identified, and counted.

Diurnal changes in dissolved oxygen concentrations were determined according to Standard Methods . . . (1965). The remaining data were obtained with the Model DR–EL Hach Portable Engineer's Laboratory, checked and calibrated vs. Standard Methods.

All field work was carried on at seven stations, described in Table I, located on a stretch of the creek from a point roughly five miles south of Attica, New York to the point where the stream first crosses Rte. 98 just south of Johnsonburg, New York. Field work was conducted during July and August of 1971.

Table I - Location of Sampling Stations

Site	North	West	Description
I	42^{o} 43' 14.4"	78^{o} 19' 10.8"	Rte. 98 - South of Johnsonburg.
II	42^{o} 44' 42.9"	78^{o} 18' 19.2"	Rte. 98 - South of Varysburg.
IIIa	42^{o} 45' 32.2"	78^{o} 18' 49.2"	Upstream of Stony Brook Creek.
IIIb	42^{o} 45' 32.2"	78^{o} 18' 49.2"	Downstream of Stony Brook Creek
IV	42^{o} 45' 45"	78^{o} 19' 02.4"	Bridge @ Rte. 20A, Varysburg
V	42^{o} 47' 34.6"	78^{o} 19' 10.8"	Merle Farm, Rte. 98.
VI	42^{o} 48' 38.5"	78^{o} 18' 53.4"	Halfway Farm, Rte. 98.

RESULTS AND DISCUSSION

According to Odum (1971), animals inhabiting the riffles are the characteristic stream fauna. Hynes (1966) described a variety of such organisms and pointed out that different types of pollution tend to vary the stream ecosystem such that certain forms are selectively eliminated as pollution increases. Gaufin and Tarzwell (1952) have shown that certain organisms can be used to classify "clean water" while others are more pollution tolerant. The multiple-plate sampler (Hester and Dendy, 1962) provides an artificial substrate of known area to which aquatic organisms can adhere. Furthermore, it allows for a more complete sampling than does the Surber-type sampler. (K. K. Sheaffer, personal communication). The use of artificial substrates is described by Mason *et al.* (1970).

All data are summarized on Figure 2 and Tables II–IV. Chemically, the stream does not appear to be in bad shape. Dissolved oxygen does not exceed saturation at any time, but neither does it fall below the lower limit established for streams by New York State (Classifications and Standards . . . , 1967). More significantly, it does not approach zero as is the case of strongly polluted streams (Odum, 1956). Specific nutrients, in this case nitrates and phosphates, tend to fluctuate seasonally (Reid, 1961) and although the stream was found to sometimes exceed the 1.0 ppm nitrate concentration of unpolluted streams (Reid, *ibid.*), the values determined are not considered severely limiting. Similarly, carbon dioxide is not present in sufficient quantities to indicate recent pollution (Needham, 1969).

Biological data, however, present an altogether different story. First,

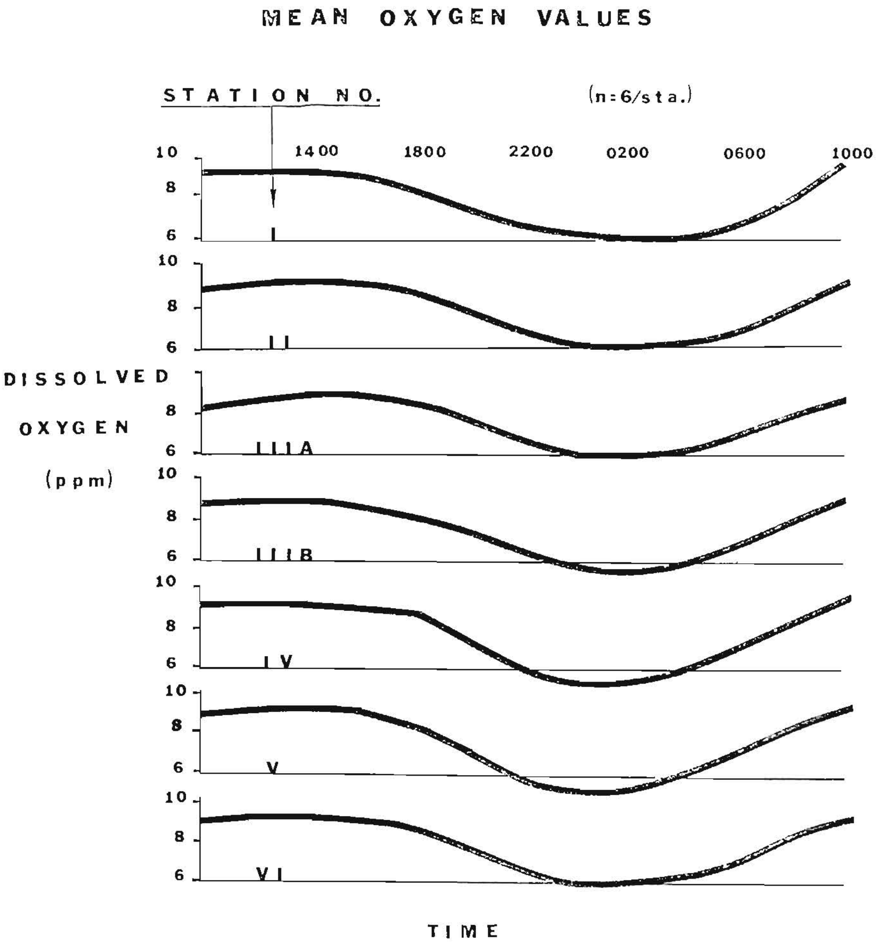

FIGURE 2.

with the exception of crayfish captured at Station I, no aquatic invertebrates outside of the class Insecta were found. Normal riffle inhabitants include various flatworms, Annelids, Mollusks, and other forms of Arthropods as well (Hynes, 1966). Secondly, of those insects captured, only one species of each of two genera were taken in significant numbers. One of these, *Cheumatopsyche* sp. has been reported from clean water (Gaufin and Tarzwell, 1952), while the other, *Chironomous* sp., is often described as pollution tolerant (Paine and Gaufin, 1956; Pennak, 1953). A significant fraction of the Chironomids taken at all stations showed the presence of hemoglobin, a characteristic that permits survival under conditions

Table II

Diversity and Densities (Organisms/m^2) of Organisms at Each Station

Stations

	I	II	IIIA	IIIB	IV	V	VI
Decapoda							
Cambarus bartoni	65	-	-	-	-	-	-
Coleoptera							
Psephenus herricki	22	22	-	-	-	-	-
Megaloptera							
Corydalus cornutes	22	-	-	-	-	-	-
Trichoptera							
Cheumatopsyche sp.	1,018	2,465	950	344	192	237	1,500
Diptera							
Chironomus sp.	57,720	38,860	36,900	19,350	43,000	37,200	24,600
Hexatoma sp.	22	-	-	-	-	-	-
Tabanus sp.	22	-	-	-	-	-	-
Plecoptera							
Neoperla sp.	86	-	-	-	-	-	-
Paragnatina sp.	129	22	-	-	-	43	-
Acroneuria ruralis	65	43	22	-	-	22	43
Neophosgenophora sp.	-	-	22	22	-	-	-
Ephemeroptera							
Isonychia sp.	-	43	43	-	-	80	474
Stenonema sp.	-	-	-	-	-	-	22
Tricorythodes sp.	-	-	-	-	-	-	22

Table III

Mean Diurnal Temperature (°C) Values (N=6)

Stations

Time	I	II	IIIA	IIIB	IV	V	VI
10:00	17.9	18.8	18.2	18.2	18.2	19.3	19.5
14:00	22.1	21.4	23.0	21.3	23.2	22.0	22.5
18:00	20.6	22.1	22.0	22.5	22.2	22.6	22.6
22:00	19.2	20.8	18.8	20.3	20.7	21.1	20.3
02:00	17.0	17.3	17.2	17.3	17.5	18.2	18.2
06:00	15.5	15.8	16.3	16.2	16.2	17.5	17.5

Table IV

Concentrations of Specific Abiotic Parameter, Mean Values ($\bar{y}$) and Range (r) (N = 5)

Parameter		Station I	II	IIIA	IIIB	IV	V	VI
Alkalinity (Total)	$\bar{y}$	168	176	158	162	164	165	166
(ppm)	r	150-180	150-190	140-190	150-175	140-190	150-170	145-195
CO_2	$\bar{y}$	3.0	1.75	2.45	2.0	1.7	3.0	3.0
(ppm)	r	Trace-4	1.0-2.0	0.25-4		0.8-2	2.0-4.0	2.0-4.0
Hardness (Total)	$\bar{y}$	205	185	223	185	190	153	188
(ppm)	r	180-230	175-200	190-260	170-200	170-210	150-160	180-200
NO_3	$\bar{y}$	1.36	1.18	0.87	1.02	1.17	1.16	0.86
(ppm)	r	0.88-1.64	0.75-1.94	0.70-1.10	0.70-1.10	0.44-2.20		0.26-1.41
pH	$\bar{y}$	8.70	8.67	8.76	8.75	8.83	8.76	8.61
	r	8.50-8.80	8.48-8.75	8.20-9.10	8.55-8.90	8.60-9.30	8.60-8.96	8.45-8.70
PO_4 (Total)	$\bar{y}$	0.17	0.17	0.26	0.16	0.11	0.15	0.17
(ppm)	r	0.10-0.25	0.10-0.30	0.10-0.45	0.08-0.18	0.01-0.15	0.10-0.25	0.10-0.30
Turbidity	$\bar{y}$	13.7	29.3	12.0	22.0	19.0	25.0	50.0
(ppm)	r	2-18	15-50	10-16	7-55	8-55	13-70	22-70

of low oxygen (Walshe, 1950) as sometimes occurs in strongly polluted water (Odum, 1956).

The question that immediately arises then, is, how does one account for the low macroinvertebrate diversity under the reasonably favorable abiotic conditions of the creek? Perhaps a clue can be taken from the work of Sheaffer and Little (1969) on Shamokin Creek. Here, back pollution from Shamokin Creek was found to have limiting effects on macroinvertebrates in tributary streams. During periods of low water the mouths of the tributaries were free from pollution, yet clean water organisms were relatively absent. This reflects the statement by Keup, Ingram, and Mackenthum (1966) that it is extremes in conditions, not averages, which have the greatest effects on biological communities. As the investigation under consideration was conducted during July and August, the possibility exists that during other times of the year conditions may occur which have limiting effects on the stream fauna. One such condition, since much of the upper Tonawanda Creek, and all of the section under investigation, lies in farmland, is the possible leaching or runoff of fertilizer from cultivated fields. Pursuing this, a questionnaire was circulated among farmers in the area asking about their use of fertilizers. Of those responding, all stated that synthetic fertilizers are used during May at corn planting. The authors hypothesize, then, that at this time fertilizers lost from the fields into the creek upset the stream community. As these materials are washed downstream favorable conditions return to the creek. By August, however, the faunal community has not recovered.

SUMMARY

The results of this study indicate that the quality of the Tonawanda Creek, based on macroinvertebrate diversity, is, during at least part of the year, questionable. Since a number of phenomena tend to limit the life of an artificial reservoir (Neel, 1966), and since there is evidence that the conditions of the Tonawanda Creek are not ideal, it is clear that the proposal for impounding the creek should be reconsidered, at least until more complete data are available.

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LEROY LAGUNE

A LIMNOLOGICAL STUDY OF A LAKE ON THE CAMPUS OF MONROE COMMUNITY COLLEGE

1969–1970

GRACE L. MURRAY[1]

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1. Professor of Biological Sciences, Monroe Community College, Rochester, New York.

HISTORICAL SKETCH[1]

LeRoy Lagune, a gem on the Monroe Community College Campus, has, in spite of its newness, become a favorite relaxing place for man and a natural area for wild mammals and birds. Deer and fox leave their tracks in the snow near its northern edge, muskrats make their watery homes on its island, coots and mallards play on its waters, hawks and kingfishers watch for frogs and fish from branches of dead trees on its borders, killdeers and mourning doves drink at its inlets, barn swallows criss-cross over its surface and golden-winged dragonflies and fairy-like damselflies skim along its margins. All attest to the fact that the lagune is a welcome addition to the campus.

Eons ago the glaciers took a hand in compounding the soil of the area, leaving behind as they retreated a very compressed, compact mixture of gravel, sand, silt, and clay such as is found in many lake bottoms. Beneath this mixture, glacial till extends downward more than fifty feet.[2, 3] The very fine-grained soil drains poorly when wet; when dry, it is practically impervious.

Before it was to be a college campus, the land was part of the Monroe County Penitentiary Farm. Meadow flowers and grasses grew on its drier areas; sedges, cattails and other water-loving plants grew in its marshes. The uninhabited area with its woods, streams and high grasses had been a favorite hunting ground. Although Brighton has now restricted that sport within its boundaries, after a winter's snow, tracks of man and dogs around the lake and the bordering woodlot indicate that some devotees still visit their former haunts.

The lake concept, originally designed for campus beautification, developed also as a utilitarian project. As early as 1962, Dr. LeRoy V. Good conceived the idea of having a lake as a spot of beauty on the campus. Because of the swampy condition of part of the eastern and northern sections of the site, and the need for a catch basin for water from higher ground, the lake became a necessity. Before 1962 had ended, Caudill, Rowlett, and Scott, Architects, sketched a graceful, somewhat kite-shaped lagune in their conceptual drawings of what the campus was to become.[4] It was to be a poet's spot, a place for calm contemplation and study where man and meadows, birds and clouds are one. In planning its drainage function,

1. Editor's note: This paper is published as a courtesy to the author and as a service to the students and faculty of Monroe Community College, in the hope that the information contained herein might be of value to future studies.
2. Hough, B. K., *Report on Reconnaissance and Preliminary Evaluation of the Site for the Monroe Community College,* Town of Brighton, Rochester, New York, 1964.
3. Hough, B. K., *Final Report on Investigation and Analysis of Subsurface Conditions at Site of Monroe Community College,* Rochester, New York, 1965.
4. Caudill, Rowlett, Scott, Campus Development Plan, Monroe Community College, Lozier Engineers, Inc., Rochester, New York, p. 70.

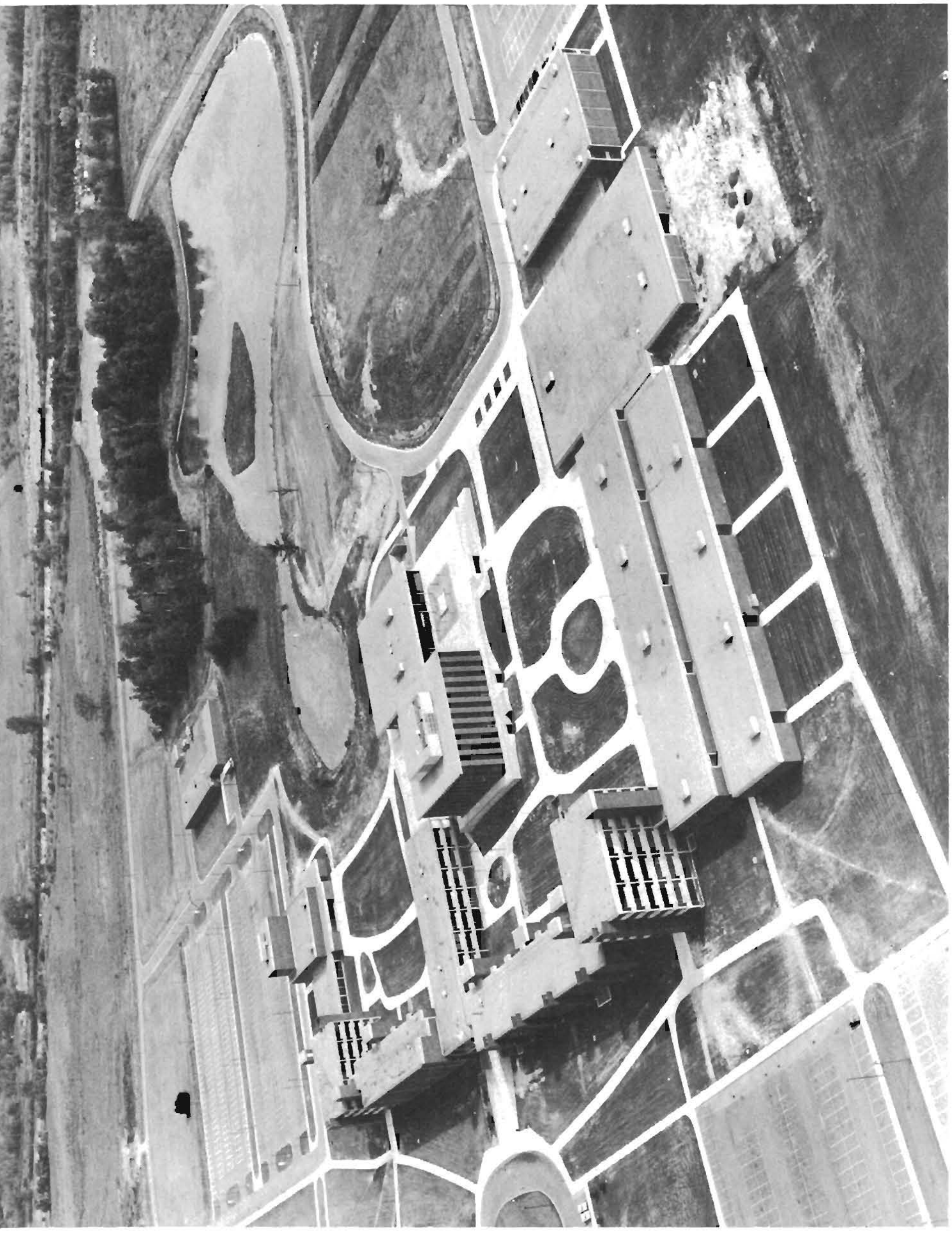

FIGURE 1—Aerial view showing Monroe Community College, 1967, and LeRoy Lagune. (Photo by Martin R. Wahl, Pittsford, N. Y.)

this vision was never lost. Like the wall of windowless buildings bordering East Henrietta Road, it was an integral part of the concept of looking inward. The completed lake is shown in Figure 1.

Since the campus site is about forty feet higher in the western part than in the moist northeastern section, the lake was to store excess storm runoff from roughly the northern half of the campus courtyard, part of the athletic fields, and some lands west of East Henrietta Road, and to modify the flow toward the Clinton Avenue residential area. Lest the lake would become too shallow during periods of extended drought, water would need to be introduced from time to time. To achieve this a water-controlling connection was planned to the Barge Canal.

At the Site Reconnaissance held in January 1964, B. K. Hough was selected to investigate the site. Three soil borings were made by Fact Technical Services, Inc. in September of 1964 in the location selected for the lagune. (See Hough references 2 and 3 on page 290).

The soil research having been completed, during the last week of October of 1965 and during two weeks in the middle of November, a caterpillar scraper and a D8 bulldozer were moved into the area under the direction of H. J. Kearse, Inc. A lake was being born, but not without pains. It was a race with time and the elements. Scarcely had topsoil been carted to cover the island, than a severe rain storm broke, leaving an impassable hole of heavy, compact, sticky earth. Even with the aid of pumps, the fall rains made the spot too wet for earth moving equipment, and excavation had to be interrupted until the spring of 1966. Eventually drain tiles were laid, storm water sewers and manholes built, the lake augmentation pipe line connected to lagune and canal, ripraps and culverts constructed, and water directed to fill the lagune.[5]

Soon nature adopted this infant lake. Field grasses and meadow flowers including the hardy and belligerent common thistle (*Cirsium lanceolatum*) bordered its shores and decorated its island. In June of 1967, LeRoy Lagune was stocked with smallmouth bass (*Micropterus dolomieui*), large-mouth bass (*M. salmoides*), some sixteen inches in length, and with bluegill sunfish (*Lepomis macrochirus*) which would furnish food for the bass. The fish were transported in buckets from the ponds of Durand Eastman Park by Conservation Department personnel.[6]

An aerial survey which included LeRoy Lagune was made by Monroe County in 1967.

At the suggestion of Drs. LeRoy V. Good, James P. Walsh, and John C. Scholes, with Dr. Frank G. Milligan as coordinator, a limnological study

5. Lozier Engineers, Inc., Proposal, Contract, and Specifications for Underground Utilities (Contract B), June, 1965.
6. De Roos, Anthony, private communication.

was made by the author to investigate depth changes in the lagune, and to determine whether there was sufficient life in the lagune for it to be valuable for research and field trips by biology and ecology students.

The study was begun in June of 1969. A fiberglass flat-bottomed boat was purchased, christened "The Lillian Good" and put into research service September 24. Studies of ecological conditions and the aquatic life were investigated from June 1969 through 1970.

Life originated in water. In the microcosm which is LeRoy Lagune, the lower forms of life attest to the unity and simplicity of early organisms. As a young, shallow lake, it already has a great variety of animals and plants uniquely different and superbly beautiful. The lake will be a most useful and enjoyable laboratory for Monroe Community College students and a place to attract not only the "sojourners in Nature," or the reflective philosopher, but also will be a haven for nature's wild creatures.

Changing its moods and dress countless times through every season, receiving the silvery drops of summer's rain or the silent crystals of winter's snows, it is a place where man can "glance occasionally at the stars or think for a moment about eternity." LeRoy Lagune adds a dimension of grandeur to the campus of Monroe Community College.

LOCATION AND PHYSICAL CHARACTERISTICS OF THE LAKE

LeRoy Lagune, which is located south of Rochester, New York, in Brighton Township, on the Monroe Community College Campus, latitude 43°07′ N. and longitude 77°37′ W. is an artificial lake with free-flowing lines. It is 1,148 feet or about one-fifth of a mile in length, 750 feet straight across at its widest part and 812 feet along the longest possible diagonal crossing the lake, and has a circumference of 3,363 feet or roughly six-tenths of a mile. Inlets into it, carrying runoff from the north half of the campus, from the grounds of the College Complex, a group of apartments opposite the college buildings facing East Henrietta Road, and from a number of farms west of the road, enter the lake toward its west end. Water can be admitted from the Barge Canal through a pipe at the northeast end if it becomes too shallow, and it can overflow at the east weir into a channel which eventually drains into the Canal again east of the inlet pipe. Its average depth is 3.2 feet. Since the banks slope for some twenty feet, if the readings along the slope are neglected, a more meaningful average depth of 4.0 feet results. Near the center of the larger body there is a dip to 5.5 feet.

When completely filled with water, the lake surface had an elevation of

499.97 feet above sea level varying 0.32 feet during the stadium surveys in 1969 and 1970. When filled to maximum depth, the lake had an area of 400,524 square feet, or approximately 9.2 acres, and its volume was 1,277,671 cubic feet or 47,321 cubic yards. The lake includes an island of 27,500 square feet or 0.63 of an acre (Figure 2).

FIGURE 2—The finished lake, 1969.

On the 21st of August, 1969, temperatures taken every fifty feet along the shallow shores about one foot from the bank, ranged from 25°C. to 32°C. (77°F. to 90°F.), averaging 31°C. The water was warmest in the shallower places and coolest where the Canal water leaked into the lagune. This leakage helps slightly to modify the water temperature during very hot weather.

At the principal testing stations of the lake bottom, temperatures ranged from 10°C. (50°F.) in October, to 4°C. (39°F.), through December, 1969, January, February, and most of March, 1970, during which months ice covered the lake, to 24°C. (75°F.) in August. (Figure 3)

The surface water temperature varied very slightly from those at the lake floor, never showing a difference greater than 4°C. and generally not greater than 2.5°C. The variation on any one day from one collecting site to another was never more than 2°C. Being a shallow lake, there was little evidence of temperature layering or stratification and no noticeable spring or autumn turnover. The lake's uniformity in this respect, was not surprising as strong winds generally lashed its surface and churned the water.

A stand of maples, oaks, and other trees bordered the lake on the north

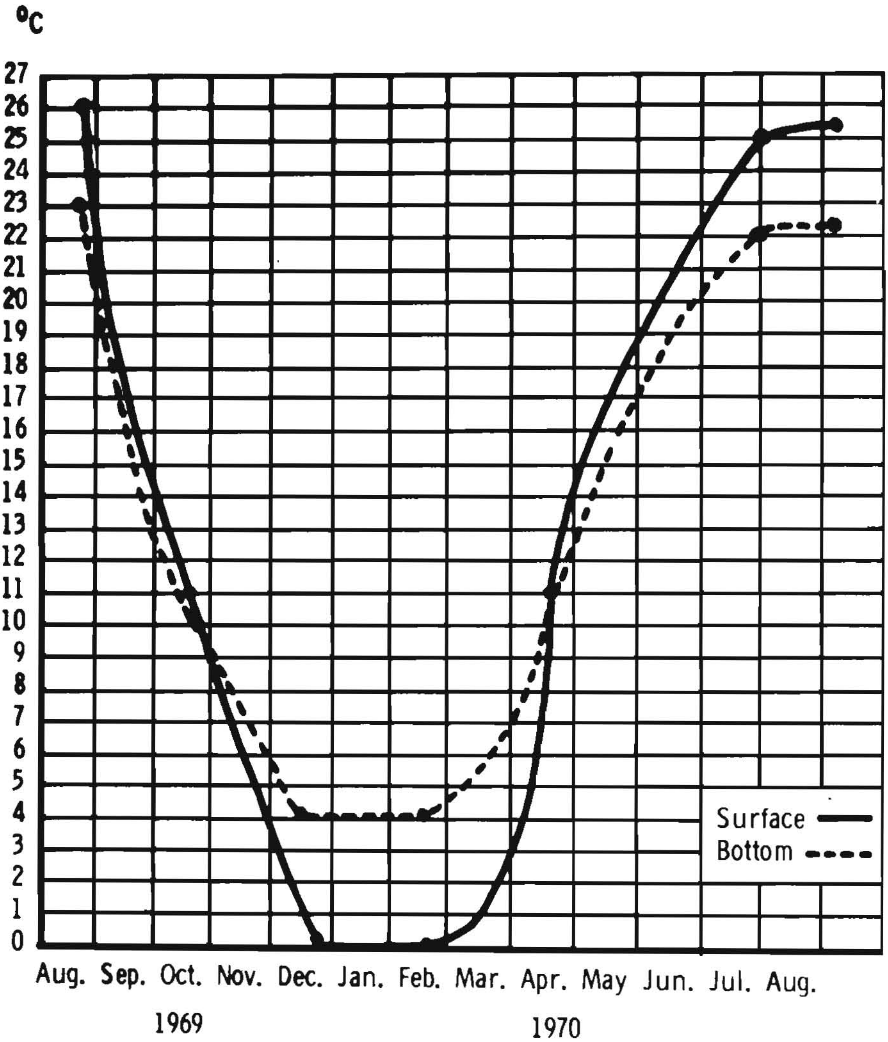

FIGURE 3—Seasonal changes in temperature.

side, and a single tree, beside which was one of the few large boulders to be found on campus, was on the south bank. The rock resembled others in Rochester that have been carried down from the Hudson Bay region by a glacier.

The graceful lines of the lake, its constantly moving waters, and its location, extending from the college buildings to the wilder uncultivated reaches of campus, gave it an aesthetic quality. However, the sloping shores, shallow depth, warmth and relative clearness made it so productive in autumn that some of its beauty was lost.

THE SOIL OF THE BANKS AND BED OF LEROY LAGUNE

As very complete studies were made of the soil before the buildings were erected on Monroe Community College Campus, and as no geological study was done in 1969 or 1970, the results of these reports and the experiences of the two years of this study will be combined to describe the conditions of the soil in and around the lake.

Three borings twenty feet in depth were made by Fact Technical Services, Inc. at the sites of the drainage basin; one at the location of what is now the small section, and the others in the areas that have become the north and south shores of the large section of the lake. The results of the studies were reported by B. K. Hough, Consulting Engineer.[2, 3] At all three pits, the soil was found to be of lacustrine origin. Bedrock was not reached at any of these borings, nor at any other on campus although some of the latter extended downward forty or fifty feet. The top two feet of all borings were of impervious, lacustrine silty clay, rich in organic matter. This is the soil of the banks of the lagune. At 494.4 feet elevation, which was the level of the original floor of the basin, the soil was compact brown or gray silt or sandy silt with some clay and a trace of gravel. Beneath this was stiff, silty clay at the test pit at the small section of the lake, and compact gray or brown till, and sandy silt with a trace of clay and gravel at the large section. The soil particle sizes of the silt varied from 0.05 to 0.005 mm and the clay from 0.005 to 0.001 mm. The very fine compressed soil, increasing in density with depth, prevents the downward movement of water almost entirely. Since this part of the campus site is low and flat, the soil tends to hold the water immobile. The report referred to this condition as a "perched water table."

To a large extent the marshy condition was corrected by creating the drainage basin, but the shore, particularly around the banks of the small area, remained soft and wet when the snow melted and after heavy rains, and the lake floor was soft in most places, resulting in the sinking of the sounding rod a few inches in the adhesive clay when measurements of depth were being made. When measuring distances across the lake with rod and transit, on October 17, 1969, the bank had been freshly plowed and was wet. Walking along the edge of the north bank, one sank into the mud, and when trying to take the next step, not only rubbers, but shoes also, were pulled off. Because of this sticky condition of the soil on bank and bed, and the tangled growth of water milfoil on its floor, even though the lake is shallow, falling into it from a boat or through the ice might be hazardous.

A dearth of large stones was evident in bottom samples collected with an Ekman dredge. When sieved, very few pebbles three millimeters in diameter remained in a #10 sieve (ten openings to the inch) after washing the contents, and, except where samples were taken on the lake side of the east weir, where solids were dropped as the wall slowed the flow of water, very few small pebbles remained after washing in the #40 sieve. The #100 sieve held fine, gray clay, which, though appearing very smooth and creamy when wet, was an excellent abrasive.

It was amazing to find that as close as the particles were in this finest mud, rotifers, worms and protozoa moved around the wet soil readily. Leaving a petri dish full of this smooth moist material, and returning on the following day, one was likely to find a group of little chimneys standing upright from the surface, the work of busy worms.

In short, the soil of the lake bottom, as well as that of the banks, is fairly uniform, adhesive, and fine-particled. It is of lacustrine origin, impervious to downward percolation of water and rich in living and non-living organic matter.

DEPTH STUDIES OF LEROY LAGUNE

One of the purposes of this study was to determine the elevation of the lake bottom and to ascertain how much shallower it had become since the survey was made by Lozier Engineers, Inc. in June of 1965. As one studies the lake, certain changes come to mind for its preservation.

The elevation of the lake bottom in that survey was 494.4 feet above sea level. When the lake was full and overflowing over the entire wall between the lake and the weir, the elevation of the surface of the water was 499.97 feet.

Over one hundred and sixty soundings were taken in 1969 and over one hundred and twenty-five in 1970, the latter to determine how much change had occurred within a year. The average depth from readings taken in 1969 was 3.19 feet. As this included the shore soundings, where originally for fifteen feet of the bank there was a pitch of three feet, readings twenty or more feet from shore form a basis for a better estimate. One hundred such readings gave a depth of 4.0 feet and an elevation of the floor of 495.97 feet above sea level. The elevation of the surface of the water varied during the summer and fall of 1969 from 499.97 to 499.65 feet, and averaged 499.77 feet.

Unlike the condition at the time of the 1965 survey, the elevation of the bottom of the lake varied considerably in 1970. The deepest part near the middle of the large section had become 1.2 inches shallower in the five years since the survey. No significant change in the bottom elevation was evident there between 1969 and 1970. Much of the lake floor of the rest of this section as well as the south channel had become seven inches higher in the five years from 1965 to 1970, a change of more than an inch a year. At the western extremity of the lake (see Figure 4), due to the erosion of the banks, about two inches of soil were being added to the floor. Cattails extended their growth much farther into the water there.

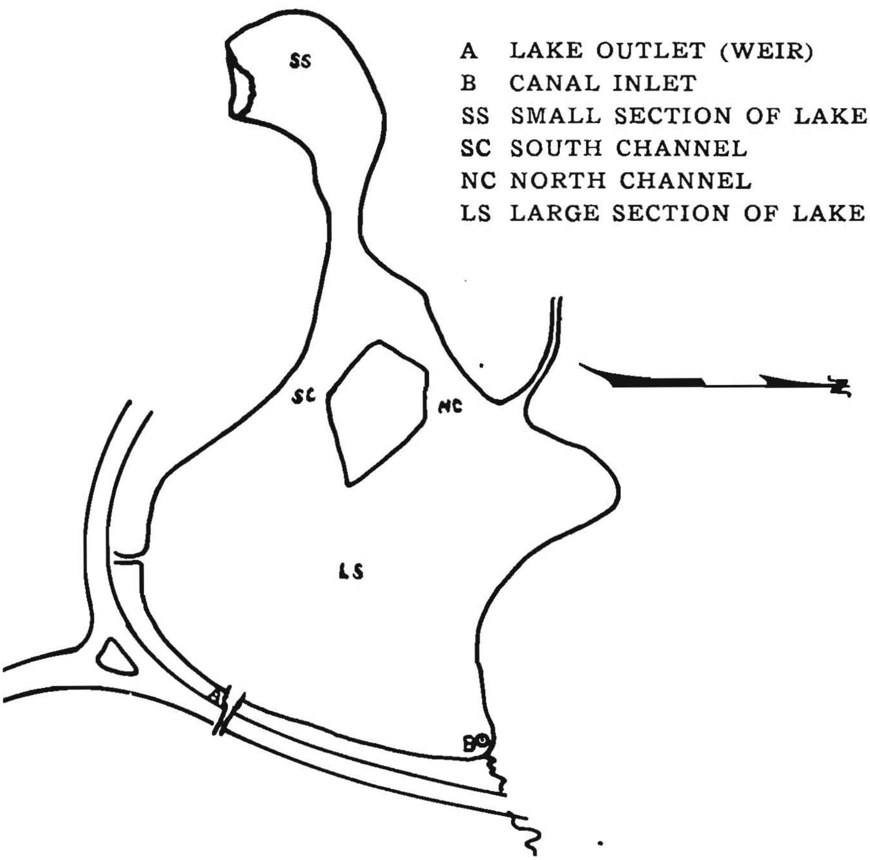

FIGURE 4—Outline of the lake shore.

An irregular area of roughly one hundred square feet on the lake bottom in the center of the small section also had an elevation of 495 feet above sea level. It had filled in at a rate of slightly more than one inch a year. However, along the west and north shores, the rate was from six to ten inches a year. This was the result of water carrying silt into the three drainage inlets after storms and during the spring thaws, and also from the washing of soil into the lake from the banks. An island was forming east of the west inlet. Cattails, sedges, rushes, grasses, and other water and land plants were rapidly claiming this area.

The most striking change in depth, however, occurred where silt was carried into the lake from farms west of East Henrietta Road. Part of the section southeast of the north inlet became about five and a quarter feet shallower than at the time of the first survey and filled in at approximately a foot a year. In 1969 an island was forming about 25 feet from the inlet, the top of which in some places was just three inches from the water surface. Since then more soil was deposited between the mouth of the inlet and this island, forming a peninsula, nearly level with the shore and extending a third of the way toward the island. Cattails grew abundantly, and in 1970, mallards and grebes glided in and out among their sheltering stems. The banks of the island were washing down into the lake also, changing their slope opposite this inlet. Thirty feet northeast of the island the depth was in some places only one and a quarter foot. These factors tended to close the eastern opening to the north channel, which was deep only at its very center.

The west channel or the neck of the lake had a depth of four feet and was wide enough for a row boat to pass through easily. It was being filled in about an inch a year at the center and about two inches a year at its north and south sides.

As a result of the erosion of the island's banks and the steeper shores at the northwestern part of the lake referred to previously, muskrats were relocating their homes from the island to the north banks, and to a lesser extent, to the south banks.

The large section of the lake is much more accessible than the small section for collecting samples and for field trips as it is near the roads which are kept free of snow during the winter. At all seasons, when water is flowing over the east weir, water samples can be taken with comparative ease. Because of the concrete wall, chemical tests can be performed on the spot. On the other hand, the small section of the lake is far from walks and roads. A three and a half foot bank near the southwest riprap and an eight foot bank west of the lake make carrying equipment and samples difficult. Most of the shore around this section is marshy and overrun with cattails, and the clay soil is wet and clings to shoes. Collecting in the small section of the lake is most easily done by means of a boat.

The lake is a scenic addition to the campus. It appears, however, that to keep it both beautiful and useful for boating, parts of it will need to be dredged every five or six years. (See Figure 5.) This would disturb the life that had established itself in this habitat and would make the lake

FIGURE 5—The lake provides recreation as well as study.

less useful for students of biology and other sciences. Thought might be given to certain changes.[1] If the opening from the Barge Canal were entirely closed, the water quality would be preserved. Although the Canal is lowered in the late fall, it is not completely emptied. When water is introduced into the Canal in spring, mud and sediment churn through the water. This muddy water was introduced into LeRoy Lagune in the spring of 1970. On the other hand, leakage from the Canal tends to keep the water of the lake somewhat cooler in summer. A sewer built to divert the runoff from west of East Henrietta Road and from the Campus Complex would reduce the silt which would otherwise be carried into the lake. If this sewer would also carry the salt water resulting from the salting of the parking lots during winter, the great increase in salt in the lake during the spring thaws would be eliminated. In time, if not checked, this salt could destroy the life in the fresh water lake.

Winds are strong in this area much of the time. With this in mind, the banks were given considerable slope. The sloping shores, however, encourage the encroachment of land plants, causing the lake to shrink in size and eventually become swamp land. Steeper shores would reduce this danger. In the original plans for the drainage basin, the elevation suggested for the lake floor was 490–495 feet. When excavated, the bottom was 494.4 feet. If the 490 foot elevation had been maintained, less light would have reached the bottom and plants would not have grown so profusely.

1. In the time since this study, extensive changes have been made which reduced the introduction of silt and the excessive growth of algae.

As parts of the lake are being filled in with silt which will have to be removed from time to time and, as the shallowness of the lake causes too abundant growth of water plants, consideration might be given to the long range plans for the preservation of LeRoy Lagune by closing off the inlet from the Barge Canal, having a fountain in the lake, deepening the lake, and having sewers carry off the slit and salty water from the drainage area.

THE CHEMICAL NATURE OF THE WATER

The physical and aesthetic lives of people are closely bound to water. The nearly one and one half million acres of lakes in New York State have modulated the temperature, made the State verdant, and stimulated the study of their waters and the organisms living in them as evidenced by numerous monographs. The Finger Lakes, particularly Cayuga, have been studied extensively. Berg (1963) has written an excellent summary of the limnological studies of the state covering the years from 1926 to 1963. A chemical study of LeRoy Lagune was made in 1969 and 1970. Water was collected at several sites indicated on the map (Figure 6) and tested for hydroxide, carbonate, bicarbonate, and total alkalinity; for dissolved oxygen and free carbon dioxide; for calcium, magnesium, and total hardness and for salinity and chlorinity. The pH was measured and the temperature recorded. The tests were made by the author using LaMotte Chemical Units. Dissolved oxygen and free carbon dioxide were tested in the field and the other tests were made directly on returning to the laboratory close to the lake. The significance of these tests is discussed below. During the fall semester a chemistry class at Monroe Community College Evening School taught by Professor Walter Scheible performed laboratory exercises using the lake water, collected at the east weir and the southwest riprap. The results are included with Professor Scheible's permission in Table 1 "Chemical Analysis."

Although the lake is used for drainage and boating only, the following chemical standards for drinking water quality issued by the U.S. Department of Public Health are given for purposes of comparison:

Calcium	200 ppm
Chloride	250 ppm
Magnesium	150 ppm
pH	7–9

Water is a versatile solvent. Its solvent power begins before it reaches the earth, dissolving gases as it falls as rain. Among these is carbon dioxide

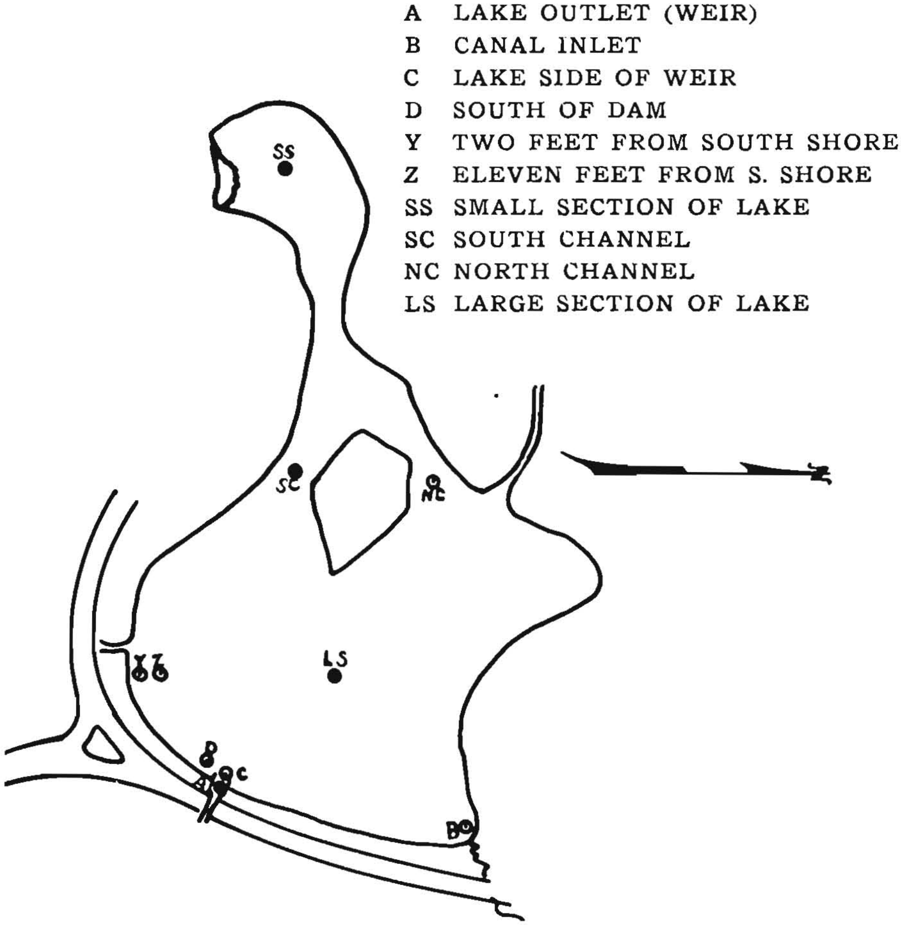

FIGURE 6—Collecting stations.

which changes naturally distilled, neutral water to a weak acid that dissolves minerals from the soil through and over which it flows, thus making them available for use by plants. Among the common solutes are carbonates and bicarbonates. Most natural waters are alkaline and rich in bicarbonates. Carbon dioxide is a waste product of respiration and decay, and, with the aid of the sun's energy, is used by green plants in food-making, during which process oxygen is released. The oxygen-carbon dioxide cycle is related to the kinds and amount of carbonates. Water rich in calcium carbonate dissolves carbon dioxide from the air, which reacts to form bicarbonates. These, if free oxygen is in short supply, are used by plants in photosynthesis. Since decaying organic matter uses oxygen and releases carbon dioxide, the amount of these gases is an indication of water purity. The more the depletion of oxygen, the greater the death and decomposition of organisms and the further reduction of the gas, resulting in an increase in anaerobic bacteria, in carbon dioxide, in acidity and in the release of minerals.

Hardness as well as alkalinity are effects of this solvent power. In spring, calcium and magnesium salts are leached from the soil with the melting of snow and are carried into the water increasing its hardness. This condition, however, is temporary as plants take up the minerals for food-making and growth.

The activity of the hydrogen ions, the amount of weak organic and inorganic acids, the corrosiveness or noncorrosiveness of a liquid are indicated by measurement of the pH. When it is high, in general, more calcium carbonate will be deposited as scale; when low, more minerals will be dissolved. Any factor which increases carbon dioxide, increases the bicarbonates, and lowers the pH; while photosynthesis, by reducing the amount of carbon dioxide, produces the opposite effects. Most natural waters range from pH 5 to pH 8.5, and fish take in oxygen and give off carbon dioxide more readily in waters near the upper range.

Since sodium chloride passes unchanged through the animal body, chlorinity as a function of salinity may result from human wastes, or, if rain or melting snow and ice drain into the lake, chlorinity may result from de-icing parking lots, roads, and sidewalks.

Some of the chemical characteristics of LeRoy Lagune are shown in Tables 1–8. The water is alkaline. Alkalinity due to hydroxide (phenolphthalein alkalinity) was found in tests in December, 1969. That due to carbonates as calcium carbonate was greatest near shore in February under three inches of ice, and in July of 1970, in the large section of the lake. A small amount was indicated in the body of the lake in April, also, but not in August. Alkalinity was mostly due to bicarbonates which were in highest concentration in April and lowest in July.

The amounts of calcium and magnesium salts were low from December, 1969 through February, 1970. Their concentration increased as a result of the melting snow leaching the soil, and decreased markedly in July, remaining at a low level through August as plants incorporated the minerals into their cells or rains diluted them. Magnesium increased more than calcium and, although both were high for natural waters in the Ontario-Oneida-Champlain Lake Plain region which includes Monroe Community College Campus (Berg, 1963), magnesium was considerably higher.

The abundant plant growth continually oxygenated the water and removed carbon dioxide from it, as some of the plants remained green under ice even through the severe winter. The percentage of saturation of oxygen

CHEMICAL ANALYSIS

DATE	ANALYSIS	VALUE
4/7/70	Total Phosphate	1.0 ppm as PO4
	Orthophosphate	0.6 ppm as PO4
3/24/70	Ammonia Nitrogen	0.5 ppm N
3/10/70	Total Iron	0.2 ppm
October 1969	BOD 5-day	2.0 ppm
"	COD - Dichromate	7.1 ppm
"	pH	7.6
November 1969	Total Solids	300 ppm
"	Suspended Solids	31 ppm
"	Turbidity	less than -25 units
December 1969	Hardness	267 ppm as $CaCO_3$
October 1969	Chlorides	110 ppm
February 1970	Chlorides	* 645 ppm
10/21/69	DO (over dam near school)	6.0 ppm
February 1970	Alkalinity (total)	56 ppm as $CaCO_3$

* Possibly street salting runoff

TABLE 1

CHEMISTRY OF LEROY LAGUNE

December 9, 1969

	Over Dam A	Canal Entrance B No water entering
Alkalinity ppm		
Hydroxide	0	0
Carbonate as $CaCO_3$	10	0
Bicarbonate as $CaCO_3$	74.5	76.5
Total	84.5	76.5
Hardness ppm		
Calcium	81	113
Magnesium	53	56
Total ppm	134	169
pH	8.0	7.65

TABLE 2

CHEMISTRY OF LEROY LAGUNE

December 10, 1969
Ice Cover on Lake

	A Water Over Dam Temp 8°C	B Canal Inlet No Water Entering Temp 7°C	Y Under Ice * Two feet from Shore Depth 6 in. Temp 4°C	Z Under Ice Eleven ft. From Shore Depth 18 in. Temp 4°C
Alkalinity ppm				
Phenolphthalein	5	0	0	0
Hydroxide	0	0	0	0
Carbonate as $CaCO_3$	10	0	15	0
Bicarbonate as $CaCO_3$	74.5	76	85	89.5
Total $CaCO_3$	84.5	76	100	89.5
Oxygen ppm	11.4*	8.9	8	10
Carbon Dioxide	4.5*	0	4.5	0
Hardness ppm				
Calcium	81	113	115	74
Magnesium	53	56	46	48
Total	134	169	161	122
Salinity ppt	.8	.6	.8	.8
Chlorinity ppt	.4	.3	.4	.4
pH	8	7.5	7.6	8.5

* Water flowing over the dam dissolved oxygen and carbon dioxide from the atmosphere.

TABLE 3

CHEMISTRY OF LEROY LAGUNE

February 24, 1970
Ice Cover on Lake

	A Over Dam Water Temp. 7°C	Y Under Ice 2 Ft. From S. Shore Depth 6 in. * Temp. 4°C	Z Under Ice 11 Ft. From S. Shore Depth 18 in. Temp. 4°C
Alkalinity ppm			
Hydroxide as $CaCO_3$	0	0	0
Carbonate as $CaCO_3$	24	25	15
Bicarbonate as $CaCO_3$	45	45	56.5
Total	69	70	71.5
Oxygen ppm	8.9*	4.5	10.24
Carbon Dioxide ppm	5.0*	0	0
Hardness ppm			
Calcium	115	123	130
Magnesium	62.5	57	47
Total	177.5	180	177
Salinity ppt	1.2	0.8	0.8
Chlorinity	0.63	0.4	0.4
pH	7.6	7.9	7.9

* Water flowing over dam dissolved oxygen and carbon dioxide from the atmosphere.

TABLE 4

CHEMISTRY OF LEROY LAGUNE

Wind - 56 miles per hour

Temperatures - Surface 6° C. Thru Dam 2° C.

April 7, 1970

	Lake Side* of Dam 12" Deep	Thru Dam	From Plank South Bank 8" Deep
Alkalinity ppm			
Hydroxide	0	0	0
Carbonate as Ca CO_3	15	15	16
Bicarbonate as Ca CO_3	100	100	99
Total	115	115	115
Oxygen ppm	10.4	—	10.4
Carbon Dioxide ppm	0	—	0
Hardness ppm			
Calcium	120	120	125
Magnesium	107	107	101
Total	227	227	226
Salinity ppt	1.8+	1.8 ppt	1.8 ppt
Chlorinity	.96	.96	.96
pH	8.1	8.0	8.1

TABLE 5

CHEMISTRY OF LEROY LAGUNE

April 15, 1970

	Middle of Large Area	Middle of Small Area	Between Island & N. Shore	Between Island & S. Shore
Alkalinity ppm				
Hydroxide	0	0	0	3.0
Carbonate as Ca CO_3	12.0	12.0	11.0	6.0
Bicarbonate as Ca CO_3	100.5	100.5	103.5	102.0
Total	112.5	112.5	114.5	108.0
Oxygen ppm	8.4	5.6	10.8	5.28
Carbon Dioxide ppm	0	0	0	0
Hardness ppm				
Calcium	142.5	130	137.5	130.0
Magnesium	120.0	115	102.5	111.0
Total	262.5	245	240.0	241.0
Salinity ppt	2.0 ppt	1.8 ppt	1.7 ppt	1.6 ppt
Chlorinity	1.1	.96	.90	.85
pH	8.4	8.4	8.4	8.4

TABLE 6

CHEMISTRY OF LEROY LAGUNE

July 21, 1970

	Lake Side of Dam Depth 12 In. Temp. 19°C	Near South Bank Depth 6 In. Temp. 20°C
lkalinity ppm		
Hydroxide	15	10
Carbonate as $CaCO_3$	30	20
Bicarbonate as $CaCO_3$	22	40
tal as $CaCO_3$	52	60
xygen ppm	9.6	11.4
arbon Dioxide ppm	0.0	0.0
ardness ppm		
Calcium	60	45.5
Magnesium	45	64.5
otal	105	110.0
alinity ppt	0.5	0.5
Chlorinity	0.24	0.24
H	9	9

TABLE 7

CHEMISTRY OF LEROY LAGUNE

August 4, 1970

	Middle of Large Area Temperatures Surface " 26°C Bottom " 22°C	Middle of Small Area Temperatures Surface " 25°C Bottom " 23°C	Between Island and N. Shore Temperatures Surface " 25°C Bottom " 22°C	Between Island and S. Shore Temperatures Surface " 25°C Bottom " 22°C	Canal Inlet B Temp. 25°C
Alkalinity ppm					
Hydroxide	0	0	0	0	0
Carbonate as $CaCO_3$	0	0	0	0	0
Bicarbonate as $CaCO_3$	84	79	81	86	126
Total	84	79	81	86	126
Oxygen ppm	6.2	6.0	5.4	6.2	6.6
Carbon Dioxide ppm	0.0	0.0	2.0	0.0	3.25
Hardness ppm					
Calcium	60	58.75	43.75	55	125
Magnesium	65	47.50	67.25	60	40
Total	125	106.25	111.00	115	165
Salinity ppt	0.266	0.23	0.34	0.266	0.266
Chlorinity	0.12	0.10	0.15	0.12	0.12
pH	7.8	8.5	7.5	8.5	7.3

TABLE 8

in the October samples averaged 85% ; those of December, 70% in water eighteen inches deep under three inches of ice, and 35% near shore under ice in water six inches deep in which plants were decaying; in February, under ice, 70% ; in April, 85% ; and in August, 70%. The water was found to be supersaturated in the July tests, as oxygen was being released by plants faster than it could escape from the water and because the water, as its temperature rose, held less of it in solution. Tests showed very little carbon dioxide to be present. It was found in December near shore six inches deep under ice and in August near the Canal inlet, where a small amount of water was continually entering, and at the beginning of the north channel. All other tests showed free carbon dioxide to be lacking in the lake. That the quality of the water was good is indicated by the high concentration of oxygen, by the nearly complete absence of free carbon dioxide, and by the abundance and variety of life which is thriving in this habitat.

Salinity and chlorinity increased at an alarming rate. In October, 1969, chlorinity was found to be 110 ppm; in February, 1970, over 600 ppm; on April 7, 960 ppm; on April 15, between 860 and 1100 ppm. This is four and four-tenths times the maximum considered acceptable by the U.S. Public Health standards for drinking water. As the lake is a catch basin for drainage from the parking lots and roads, receiving runoff and no sewage, this is a result of salting of parking lots and roads. Although many organisms can tolerate small increases in sodium chloride when added to the environment gradually, large increases, followed by a rapid rise in temperature must be highly detrimental especially to the young organisms.

The pH measurements were always above 7. They were lowest in December, 1969 and in February, 1970, averaging 7.8. They continued to rise through April (8.1 and 8.4), becoming highest in July (over 9), then lowering again to around 7.9 in August.

The water of LeRoy Lagune is alkaline due largely to calcium bicarbonate; is of relatively high pH; is nearly saturated with dissolved oxygen, especially during summer; is low in free carbon dioxide; and is rich in calcium and magnesium compounds. The amount of salt entering the lake as a result of street and parking lot salting is excessive and will limit the development of a number of species. The chemical nature of the lake, especially its alkalinity and abundance of minerals, contribute to its productivity.

FLORA AND FAUNA

A distinctively picturesque feature of the Monroe Community College Campus is LeRoy Lagune. Its mystery, beauty and accessibility attract with magnetic propensity. It was not surprising that in this academic environment, the nature of the life in its waters provoked curiosity. The biologists especially became interested in whether this four year old lake had become sufficiently populated by plants and animals to make it of value for field trips. To research this and other changes in the lake, this study was initiated in June, 1969 and continued to the fall of 1970.

During June, July, August and September of 1969, before a boat was purchased, collecting of organisms was done along the lake borders and the edges of its outlet. Giant water beetles, *Benacus griseus,* and snails, *Lymnaea palustris,* rested on the algae, water boatmen swam, *Culex* mosquito larvae wiggled up to the water's surface and dragonfly nymphs crawled along the bottom mud. Giant hydra attached themselves to the cattail stems, extending their tentacles to capture the worms, water fleas, midges, and protozoa that happened to venture too close. Filamentous algae and diatoms provided food and oxygen for the myriads of animal forms which were associated with them in this water world.

The lake had been dredged out of the center of a low, marshy field, and meadow flowers, high grasses, and weeds grew in profusion along its borders. The giant purple blossoms of the common thistle, *Cirsium lanceolatum,* the towering plumes of the goldenrod, *Solidago canadensis,* the modest daisy fleabane, *Erigeron ramosus,* and the red clover, *Trifolium praetense,* bowed to their reflections in its waters and served as momentary stopping places for the busy *Libellula* dragonflies that coursed in gay profusion back and forth along their chosen domain.

On the north side close to the lake, a stand of maples and oaks, some leafless and hollow, furnished lookout stations for the hawks and kingfishers that from time to time swooped down upon a frog, or speared a bass or sunfish, venturing too close to the surface. Near the shore, with their feet in the water, were a few stands of cattails, bur reeds, and sedges. Contrasting with them in delicacy, were the four-leafed clover plant or water shamrock, *Marsilia quadrifolia,* frogbit, or *Elodea,* and the yellow violet, *Viola pubescens var. scabriuscula.*

The October 21 collections revealed a surprising variety of organisms. Water milfoil, *Myriophyllum exalbescens,* and a filamentous alga, *Mougeotia,* were the most prevalent at all stations. So abundant was the water milfoil that it was hard to find a spot in the lake where it was not thriving, its blossoms and seeds pointing like so many little spears above the water. So strongly anchored were its roots, so thick its growth in some places that it made rowing difficult and threatened to reduce the lake to a bog. Other than these two plants, species were more varied than numerous. Lightness of color and texture of the silky *Spirogyra* made its green patches stand out from the darker *Mougeotia.* Other algae, such as *Oedogonium, Oscillatoria, Cosmarium* and diatoms were frequently encountered. Protozoa, nematodes, water earthworms, water fleas, and seed shrimp were generally distributed. Rotifers were numerous in the finest mud. In the October samples, the soil from the station in the center of the large area of the lake and the one near the Canal inlet were richest in numbers and varieties of organisms. At all the collecting areas, abundance of forms was greater in the water than in the soil.

Severe cold weather with snow came early, and by December 9, 1969 three inches of ice covered the lake. Unlike the conditions in autumn, when the water forms appeared to outnumber those in the mud, life in the water was now less abundant than in the soil. Water milfoil and some of the algae, although beginning to lose their chlorophyll, were still oxygenating the water, so that only at station Y was there any noticeable free carbon dioxide. The diatom genera *Gyrosigma* and *Navicula* were withstanding the cold. In 100 ml. of moist mud, 385 protozoa, nine segmented worms, and five wireworms were counted. Water earthworms hidden in *Physa* shells were dining on the remains of the snails. One cubic centimeter of this soil in the #40 sieve diluted and examined in small samples under low power, resulted in a count of nine bristle worms, three seed shrimp shells, three colonies of protozoa, thirteen *Paramecium,* twenty-five *Amoeba radiosa,* one large *Euglena,* one *Peridinium,* one dinoflagellate, parts of water milfoil, strands of *Spirogyra,* and *Vaucheria, Protococcus,* an occasional diatom, and many bacteria. Although the Monroe County water system was plagued with diatoms clogging the filters, only an occasional one was free in these water samples, but 135 *Cocconeis* cells were clinging to a filament of alga pulled up in the mud.

Ice covered the lake in February. A one liter sample of water taken through the weir, filtered through a hard filter, reduced to one milliliter and examined under low power yielded besides bacteria, only three diatoms, one *Euglena,* one other protozoan, and a colony of *Eudorina.* Other samples yielded a few more organisms. Certainly winter was taking its toll.

Water taken on the lake side of the weir on the seventh of April, 1970, when surface water was 6°C., still contained few living forms. One pair of conjugating protozoa, *Tachysoma parvistyla,* one *Holophyra* protozoan, *Euglena* and the algae, *Chlorella, Tetracyclus,* and *Docidium baculum* were in the samples. Now long ribbons of *Fragilaria,* which could very easily clog water filters, were beginning to appear. Great masses of winter-killed water milfoil were washed up along the shores. Winter, however, had lost its grip on the lake.

The renewal of life was heralded by a full chorus of peepers in the surrounding swamps. Spring was evident in the April 15 samples. Eggs of various kinds were abundant. From some of these nematodes were emerging. *Cyclops* were laden with their sacks. Shells of seed shrimp were caught in the gelatinized masses of eggs, and some were abandoning their shells. Young copepods were scurrying around. The soil sample from the middle of the large section of the lake station which had been emptied into a glass jar and refrigerated overnight was topped with a green layer a quarter of an inch deep. This proved to be a layer of *Euglena.* One would expect a pure culture, but instead there were many species varying in size, shape, length of flagella, and types and numbers of chromatophores, but all wearing a ruby set in emerald, their spring attire. The more unusual algae of LeRoy Lagune, *Meringosphaera spinosa* and *Arthrospira* were joining the cosmopolitan *Gyrosigma* and *Cocconeis.* Although more and more salt water was draining into the basin as a result of salting the parking lots during the winter, it did not prevent the rebirth of the lake.

On June 13 the author investigated the surface growth on the water at two indentations in the lake's border near the canal inlet, one dull green and the other bright red. As no collecting bottles were available, a sample of some red water was scooped up on a piece of insulating material that had been thrown into the lake. Microscopic examination revealed numerous *Euglena* in cysts. While being watched several stretched out slowly to display their single flagellum and red eyespot. They were *Euglena rubra.* Contrasting with their leisurely movements were the hurrying, scurrying copepod, *Diaptomus,* red also, due to stored oil drops in its body. Another trip was made to the red and green areas that day, now equipped with collecting materials. The green and red coloring resulted from the same organism. Johnson (1939) says this difference in coloration is due to differences in temperature, the euglenid being red where the water is warm, green where it is cool. Both areas were near one another, the green one, however, was somewhat shaded.

This surface water was teeming with life. A liter sample was filtered to concentrate the solids into twenty milliliters of water. One milliliter of this in a Sedgwick-Rafter counting cell gave besides *Euglena,* thirty-six conjugating molds, forty strands of filamentous algae, five *Eremosphaera viridis,* two *Cosmaria,* thirty-two *Navicula,* sixteen *Scenedesmi,* 132 *Chroococci minuti,* six colonial protozoa, 184 rotifers, eight *Cyclops* and numerous water mites, *Hydracarina.* As one would expect, the abundance of life in June contrasted sharply with the paucity of organisms in February.

Mud was collected with an Ekman dredge on July 22, 1970 in the area just over the weir on the lake side. It contained detritus carried by the currents and deposited as the velocity of the water was decreased by the wall of the weir. In the coarsest sieve (#10) from 500 cc. of soil, half of which was brown plant material, with the water milfoil sending out occasional green shoots, were seventy-six empty snail shells, three of them of *Lemnaea palustris* and seventy-two of *Physa gyrina*. The rotifer, *Scapholeberis aurita,* said to be uncommon by Pennak (1953), nematodes, two water fleas, worms, two *Tendipes* (*Chironomus*) midges, one *Chaoborus* midge, a midge egg (from which emerged in the laboratory a green larva), and ctenoid fish scales were among the debris. The worms and midges were busily reducing the detritus to valuable plant food.

The second sieve (#40), from the soil above, contained numerous little pebbles but just as numerous, small *Physa* shells. Seventy-three nematodes and many rotifers, including *Scapholeberis aurita* were in the mud in the #200 screen, the rotifers again being the most numerous of the fauna in the finest soil. It was interesting to find in the same sample, *Chaoborus,* the phantom midge, an organism indicating good water quality, and *Tendipes* (*Chironomus*), the red blood worm, an insect indicating poor water quality, though one of each was hardly an indication of anything. *Chaoborus* was found just at the interface between soil and water. The water tested at this station at the time the sample was collected was high in dissolved oxygen and lacking in dissolved carbon dioxide, so *Chaoborus* could very well live with its gaseous needs fulfilled. Whereas in the mud, so rich in decaying organisms, bacteria would be using up the oxygen, leaving the correct environment for *Tendipes*. *Tendipes* is green when the oxygen is high in its environment and bright red when it is low. This sample from the lake's own dumping or disposal area was the only one in which the midge larva was bright red indicating that throughout the lake during all the seasons, and even under an ice cover, the water quality was high.

Early one spring morning, a cloud of midges were ascending and descending in the air between the lake and the nearby stand of trees. It was not surprising then that when the samples of August 4 and 27, 1970 were examined, there were few midge larvae large enough to be retained in the coarsest sieve. Their empty cases, however, were plentiful. The soil still contained a few of their kind, as well as nematodes, *Cyclops* and their eggs, midges and other insect larvae. Again in the finest soil, rotifers were numerous and varied. Too small to be seen under the binocular microscope, they indicated their presence by a rapid vibration of the mud particles.

In August of 1970, the water samples seemed to catch the lake dwellers between seasons. There were filaments of *Oedogonium* with their zygospores, and fertilized eggs of water fleas at the same time that water fleas were emerging from their eggs and the nauplii were scurrying about busily among their slower moving neighbors. The warmer water, averaging now 25°C., resulted in a marked increase in the biomass. The species were more numerous than in the earlier samples and many of the ones previously collected were appearing again.

It was a pleasant break in the study, when looking through the binocular microscope, to come suddenly upon a blue and silver spider, *Neumania*. In the south channel station where life was not abundant but often unusual, *Diatoma* was prevalent; accompanied by a few cells of the alga *Pseudotetradon neglectum,* said by Prescott (1964) to be "reported but rarely from the United States." Many of the higher protozoa were collected. *Euglena,* still in the samples, had decreased in numbers.

Ubiquitous as change is, it is nevertheless mysterious. Even in the short span of time during which this study was made, changes were taking place. The most striking was the encroachment of the shore plants farther and farther into the lake. The depth was less in 1970 than in 1969. Soil, washed down from the drainage inlet from west of East Henrietta Road, was filling the channel between the north bank and the island. The shores of the island were eroding, and the muskrats that formerly built their homes there were now excavating the banks of the lake proper. In the summer of 1969, when one walked along the edges, innumerable little frogs ascribed semicircles into the water. Though from their sounds there must have been hundreds around the swamps, they were not often seen around the lake in 1970, but a few large frogs could always be startled during the warmer months sunning themselves along the banks. Dragonflies were fewer in number and variety. More water birds, including the great blue heron, visited the lagune, coming earlier in the spring and staying for longer periods in the fall in 1970. However, the gulls that occasionally flew over the lake and settled on its surface in 1969 went elsewhere on campus the second autumn, feeding on delicacies found among the wet grasses, perhaps because human activity on and around the lake had increased.

The microcosm that is LeRoy Lagune does not reveal all its secrets in a fourteen month study. Many questions remain unanswered; many species are still unidentified. However, the abundance of life in its soil and water has been established. Water milfoil, *Myriophyllum exalbescens,* was its most prevalent flowering plant. Nearly covering the lake's floor, it was a nuisance on the one hand and a treasure on the other, keeping the water well oxygenated and attracting the waterfowl that delighted in its seeds. *Mougeotia* was its most common filamentous alga, but *Oedogonium, Oscillatoria, Spirogyra,* and *Rhizoclonium* were also abundant. A variable array of one-celled algae, especially diatoms, were to be found. *Cosmarium's* many species jewel the waters.

Although muskrats lived in the banks of the island and the lake proper, and deer and various water birds visited the lagune, most of the fauna occupied the lower rungs of the evolutionary ladder. Protozoa of the higher genera were found throughout the year, while *Euglena* seemed to have taken over the entire lake especially in the warm days of summer and fall. *Hydra* could be found on the *Typha* stems in the outlet. The fascinating and often grotesque rotifers with their moving eyes were exceedingly numerous and varied. Flatworms, wireworms, nematodes, and water earthworms were actively decomposing detritus as well as furnishing food for hungry fish. Midge larvae were in the bottom soil throughout the year, while dragonfly and damselfly nymphs were found less frequently. The snails were *Lymnaea palustris* and *Physa gyrina;* the frogs were leopard frogs; the fish which had been introduced were largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*) ; and sunfish, *Lepomis macrochirus,* while minnows wandered in from places unknown. The fish continued to thrive in spite of an unusually severe winter and high salt content of the water. The great variety of species indicates that in spite of the over-abundance of water milfoil and the shallowness of its depths, the lake was still a young body of water.

FLORA AND FAUNA COLLECTED ALONG THE CANAL OUTLET AND LAKE MARGINS[1]

SUMMER 1969

WATER

PLANTS

Algae
- *Rhizoclonium*
- *Hydrodictyon*
- *Ankistrodesmus*
- *Scenedesmus*
- *Mougeotia*
- *Closterium*
- *Fragilaria*
- *Navicula*

HIGHER PLANTS

- Duckweed—*Lemna*
- Cattails—*Typha*
- Meadow plants

ANIMALS

Protozoa
- *Mallomonas*
- *Volvox*
- *Euglypha ciliata*
- *Euchlanis*
- *Coleps hirtus*
- *Stentor*
- *Vorticella*

HIGHER FORMS

- Rotifers
  - *Branchionus*
- Nematodes
- Segmented worms
- Water fleas
  - *Daphnia*
- Copepods
  - *Cyclops*
- Snails
  - *Lymaea palustris*
- Giant water beetles
  - *Benacus*
- Water boatmen (Family Corixidae)
- Mosquitoes
  - *Culex*
- Dragonflies, larvae and adults
- Mayflies, larvae

1. See Editor's note on p. 333 concerning the author's choice of classification of motile green algae as protozoa.

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES
OCTOBER 21, 1969
LARGE AREA OF LAKE STATION

Water temperatures
Surface 11° C
Bottom 11° C

Water depth 5.25 feet
Weight of solids/1000 ml.-0.075g

WATER

PLANTS	*ANIMALS*
Algae	Protozoa
Troschiscia vestitus	Colonial protozoa
Cosmarium botrytis	*Euglena*
Stauroneis anceps	*Amoeba guttula*
Fragilaria	*Paramecium*
Higher Plants	
Water milfoil	
Myriophyllum exalbescens	

BOTTOM DWELLERS

PLANTS	*ANIMALS*
Algae	Protozoa
Rhizoclonium hieroglyphicum	*Volvox*
Closterium	Other colonial forms
Desmidium	*Amoeba verrucosa*
Gyrosigma	*Stentor*
Navicula rhynchocephala	Higher Forms
Stauroneis anceps	Nematodes
Amphora ovalis	Bristleworms
	Snails
	Physa gyrina
	Damselfly nymphs
	Mayfly nymphs

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

OCTOBER 21, 1969

NORTH CHANNEL STATION

Water temperatures
Surface 11° C
Bottom 10.7° C

Water depth 4.7 feet
Weight of solids/1000 ml.-0.05g

WATER

PLANTS

Algae
- *Myrmecia aquatica*
- *Actidesmium hookeri*
- *Pediastrum*
- *Chlorella*
- *Mougeotia*
- *Cosmarium*
- *Decidium*
- *Desmidium*
- *Penium closteroides*
- *Staurastrum crenulatum*
- *Fragilaria*
- *Gyrosigma*
- *Oscillatoria*

Higher Plants
- *Myriophyllum exalbescens*

ANIMALS

Protozoa
- Colonial protozoa
- *Euglena*
- *Heteronema acus*
- *Coleps hirtus*
- *Paramecium*
- *Pleuromonas jaculans*

Higher Forms
- Flatworms
  - *Microstomum lineare*
- Water fleas
- Copepods
  - *Cyclops*
- Water mites

BOTTOM DWELLERS

PLANTS

Algae
- *Oedogonium*
- *Penium*

ANIMALS

Protozoa

Higher Forms
- Nematodes
  - *Rhabdolaimus minor*
- Copepods
  - *Cyclops*

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

OCTOBER 21, 1969

SMALL AREA OF LAKE STATION

Water temperatures
  Surface 11° C
  Bottom 11° C

Water depth 4.7 feet
Weight of solids/1000 ml.-0.05g

WATER

PLANTS

Algae
- *Oedogonium*
- *Lagerheimia*
- *Mougeotia*
- *Spirogyra*
- *Cosmarium margaritatum*
- *Cosmarium botrytis*
- *Desmidium*
- *Straurastrum*
- *Vaucheria repens*
- *Fragilaria*
- *Gyrosigma*
- *Navicula*

ANIMALS

Protozoa
- *Gonium sociale*
- *Euglena* (numerous)
- *Cryptoglena*
- *Nuclearia simplex*
- *Amoeba*
- *Euglypha compressa*
- *Paramecium*
- *Oxytricha*
- *Vorticella*

Higher Forms
- *Cladocera*
- Seed shrimp, *Cypris*
- Water mites

BOTTOM DWELLERS

PLANTS

Algae
- *Rhizoclonium*
- *Micrasterias*
- *Cyclotella*
- *Attheya*
- *Cymbella*

Higher Plants
- *Myriophyllum exalbescens*

Near the Shore
- Water shamrock
- Bur reed, *Sparganium*
- Cattails, *Typha*

ANIMALS

Protozoa
- *Phacotus lenticularis*
- Colonial forms
- *Volvox*
- *Euglena*
- *Cryptoglena*
- *Amoeba verrucosa*
- *Vorticella*

Higher Forms
- Rotifers
  - *Philodina*
  - *Asplanchna*
  - *Branchionus*
- Nematodes
  - *Prismatolaimus*
- Water fleas
  - *Holopedium gibberum*
- Copepods
  - *Cyclops*
- Seed shrimp, *Cypris*

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

OCTOBER 21, 1969

SOUTH CHANNEL STATION

Water temperatures
- Surface 11° C
- Bottom 11° C

Water depth 3.7 feet
Weight of solids/1000 ml.-0.059g

WATER

PLANTS

Algae
- *Mougeotia*
- *Spirogyra*
- *Vaucheria repens*
- *Gyrosigma*
- *Navicula*
- *Nostoc commune*
- *Cosmarium botrytis*
- *Oedogonium*

ANIMALS

Protozoa
- *Nuclearia simplex*
- *Euglena*
- *Trachelomas verrucosa*
- *Amoeba*
- *Euglypha compressa*
- *Coleps hirtus*
- *Vorticella*

Higher Forms
- Fresh water sponges
- Rotifers
  - *Cochlearet urbo* Gosse (male)
- Nematodes
- Seed shrimp and their nauplii larvae
- Water flea nauplii

BOTTOM DWELLERS

PLANTS

Algae
- *Sorastrum*
- *Spirogyra*
- *Gyrosigma*

ANIMALS

Protozoa
- *Euglena*
- *Vorticella*

Higher Forms
- Sponges
- Rotifers (numerous)
- Water earthworms
- Seed shrimp (*Cladocera*)
- Water fleas
- Copepods
  - *Cyclops*
- Water mites

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

OCTOBER 21, 1969

STATION NEAR CANAL INLET

Water temperatures
- Surface 11° C
- Bottom 11° C

Water depth 4.7 feet
Weight of solids/1000 ml.-0.015g

WATER

PLANTS

Algae
- (Much filamentous algae)
- *Aphanochaete*
- *Echinosphaerella*
- *Scenedesmus*
- *Zygnemopsis* (conjugating)
- *Closterium*
- *Cosmarium botrytis*
- *Cosmarium margaritatum*
- *Eurastrum pinnatum*
- *Staurastrum gracile*
- *Navicula*
- *Strauroneis anceps*
- *Anabaena*

ANIMALS

Protozoa
- *Cryptoglena*
- *Scytomonas*
- *Arcella*
- *Euglypha compressa*
- *Paramecium*
- *Stentor*

Higher Forms
- Proboscis worms
  - *Prostoma rubrum*
- Rotifers
  - *Brachionus*
  - *Pleosoma*
- Nematodes
  - *Rhabdolaimus minor*
- Water mites

BOTTOM DWELLERS

PLANTS

Algae
- (Filamentous algae)
- *Rhizoclonium*
- *Pediastrum*
- *Mougeotia*
- *Spirogyra*
- *Vaucheria*
- *Stephanodiscus*

Higher Plants
- *Myriophyllum exalbescens*

ANIMALS

Protozoa
- *Cryptoglena*
- *Scytomonas*
- *Euglypha*
- *Stentor*
- *Paramecium*

Higher Forms
- Proboscis worms
- Rotifers
  - *Pleosoma truncata*
  - *Brachionus*
  - *Colurella*
- Nematodes
- Worms (115 counted in 250cc of soil)
  - Horsehair worms
  - Water earthworms
    - *Aeolosoma*
    - *Tubifex tubifex*
- Snails
- Insects
  - Mayfly nymphs
  - Dragonfly nymphs
  - Diptera larvae
- Fish scales (ctenoid)

ORGANISMS UNDER ICE AND IN SNOW

DECEMBER 9, 1969

STATION Z

Water Temperature under ice 4° C
Thickness of ice 3 inches

Distance from south bank 11 feet
Depth of water 18 inches

WATER

PLANTS

Algae
- (One-celled algae)
- *Draparnaldia*
- *Bulbochaete*
- *Spirogyra*
- *Zygnema*
- *Closterium*
- *Gyrosigma*
- *Navicula*
- *Tolypothrix*

Higher Plants
- *Myriophyllum exalbescens*

ANIMALS

Protosoa
- *Volvox edridinium*

Higher Forms
- Rotifera
- Insects
  - Chrysalis
  - Mayfly egg (hatched in laboratory)

BOTTOM DWELLERS

PLANTS

Algae
- *Protococcus*
- *Pediastrum*
- *Spirogyra*
- *Penium*
- *Vaucheria*
- *Diatomella*
- *Synedra*
- *Cocconeis*
- *Gyrosigma*
- *Naviculum*
- *Stauroneis*
- *Amphora*
- *Chroococcus*

Higher Plants
- *Myriophyllum exalbescens*

ANIMALS

Protozoa
- *Euglena*
- *Peridinium tabulatum*
- *Volvox*
- *Heteromita ovata*
- *Phyllomitus amylophagus*
- *Amoeba radiosa*
- *Amoeba verrucosa*
- *Paramecium*
- *Leucophrys patula*
- *Pleurotriche*
- *Vorticella*

Higher Forms
- Rotifers
  - *Diplois daviesiae* (male)
- Proboscis worms
- Nematodes
  - *Tylenchus*
  - *Aphelenchus*
  - *Rhabdolaimus minor*
- Wire worms
- Water earthworms
  - *Aerosoma*
- Bristleworms
- Seed shrimp (Ostracoda)
  - *Cypris bicuspidatus*
  - *Cypris dentata*
  - *Cypris viridis*
- Snails
  - *Physa gyrina*

FLORA AND FAUNA COLLECTED FROM WATER FLOWING UNDER ICE THROUGH WEIR WALL AND NEAR WEIR

FEBRUARY 2, 1970

NEAR WEIR

Wind 56 miles per hour	Water depth near weir 12 inches
Water temperature through weir 4° C	Weight of solids/1000 ml. water near weir-0.25g

WATER

PLANTS	*ANIMALS*
Bacteria	Protozoa
Algae	*Eudorina*
Diatoms	*Euglena*
Netrium digitus	Leech cocoon
Higher Plants	
Myriophyllum cxalbescens	

SNOW FROM SOUTH BANK

MARCH 26, 1970

Springtail (*Collembola*)
Archorutes nivicolus

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

APRIL 7, 1970

LAKE SIDE OF WEIR AND THROUGH WEIR

Temperature of water Flowing through weir 4° C		Depth of Water 8 inches Lake side of weir	
WATER		*BOTTOM DWELLERS*	
PLANTS	*ANIMALS*	*PLANTS*	*ANIMALS*
Algae	Protozoa	Algae	Protozoa
Enteromorpha intestinalis	*Chlamydomonas*	*Nephrocytium agardhianum*	*Euglena*
Chlorella	*Euglena*	*Fragilaria*	*Spathidium spatula*
Nephrocytium agarthianum	*Holophyra*	*Synedra*	*Tachysoma parvistyla*
Cosmarium	*Procodon*	*Navicula*	
Docidium baculum	(conjugating)	*Amphora*	
Fragilaria	*Tachysoma parvistyla*	*Oscillatoria*	
Tetracyclus			
Synedra	Higher Forms		
Cocconeis	Sponges		
Amphora	Nematodes		
Chroococcus mastogloia			
Oscillatoria			

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

APRIL 15, 1970

LARGE SECTION OF LAKE STATION

Temperature of Water
Surface 11° C
Bottom 11° C

Depth of Water 5.00 feet

WATER		*BOTTOM DWELLERS*	
PLANTS	*ANIMALS*	*PLANTS*	*ANIMALS*
Algae	Protozoa	Algae	Protozoa
Echinosphaerella	*Chlamydomonas*	*Eudorina*	*Euglena* (very numerous in green layer on soil)
Meringosphaera spinosa	*Euglena*	*Scenedesmus*	
Cocconeis	*Paramecium*	*Spirogyra*	Higher Forms
Gyrosigma		*Cosmarium*	Flatworms
Arthrospira jenneri	Higher Forms	*Meringosphaera spinosa*	Rotifers
Oscillatoria	Nematodes	*Fragilaria*	*Asplanchna*
	Copepods, *Cyclops*	*Cocconeis*	Nematode & eggs
	Seed shrimp & eggs	*Gyrosigma*	*Dorylaimus*
	Fish scales	*Navicula*	Copepods
		Arthrospira jenneri	*Cyclops* & eggs
		Oscillatoria	Seed shrimp
			Snails
			Physa gyrina
			Midges
			Chironomus
			Fish scales

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

APRIL 15, 1970

NORTH CHANNEL STATION

Water temperatures
Surface 11° C
Bottom 10° C

Depth of Water 4.0 feet

WATER

PLANTS

Algae
- *Sphaeroplea*
- *Enteromorpha intestinalis*
- *Ankistrodesmus*
- *Diatomella*
- *Tetracyclus lacustris*
- *Diatoma*
- *Synedra*
- *Cylindrotheca*
- *Gyrosigma*
- *Mastogloia*
- *Navicula*
- *Stauroneis anceps*
- *Surirella ovalis*
- *Coelosphaerium kützingianum*

Higher Forms
- *Myriophyllum exalbescens*

ANIMALS

Protozoa
- *Chlamydomonas*
- *Haematococcus* (Sphaerella)

Higher Forms
- Flatworms

BOTTOM DWELLERS

PLANTS

Bacteria

Algae
- *Enteromorpha intestinalis*
- *Akistrodesmus*
- *Diatomella*
- *Tetracyclus lacustris*
- *Meridion circulare*
- *Synedra*
- *Cocconeis*
- *Amphipleura pellucida*
- *Cylindrotheca*
- *Gryosigma*
- *Mastogloia*
- *Navicula*
- *Stauroneis anceps*
- *Gomphoneis herculeana*
- *Surirella ovalis*

ANIMALS

Protozoa
- *Chlamydomonas*
- *Euglena*
- *Stichotricha secunda*

Higher Forms
- Sponges
- Nematodes
- Flatworms

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

APRIL 15, 1970

SMALL SECTION OF LAKE STATION

Water temperatures
Surface 11° C
Bottom 11° C

Depth of Water 3.8 feet

WATER		*BOTTOM DWELLERS*	
PLANTS	*ANIMALS*	*PLANTS*	*ANIMALS*
Algae	Protozoa	Algae	Protozoa
Colonial algae	*Euglena*	One-celled algae	Colonial protozoa
Fragilaria	*Pleuromonas jaculans*	*Ulothrix*	*Euglena*
Cocconeis	*Amoeba*	*Sphaeroplea*	*Pleuromonas jaculans*
Gyrosigma	*Tachysoma parvistyla*	*Tabellaria*	*Amoeba*
Navicula	*Stichotricha secunda*	*Astrionella*	*Stichotricha secunda*
		Fragilaria	
Higher Forms	Higher Forms	*Eunotia pectinalis*	Higher Forms
Broken stems of water milfoil	*Cyclops*	*Gyrosigma*	Flatworms
	Midge larvae	*Navicula*	Rotifers
		Oscillatoria	*Asplanchna*
			Diplois diviesiae
		Higher Forms	Nematodes
		Water milfoil	*Dorylaimus*
		Various seeds	Water earthworms
			Lumbriculus variegatis
			Copepods
			Cyclops
			Snails
			Physa grina
			Midge larvae

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

APRIL 15, 1970

SOUTH CHANNEL STATION

Water temperatures
Surface 11° C
Bottom 11° C

Depth of Water 3.6 feet

WATER

PLANTS

Algae
- *Tabellaria*
- *Cocconeis*
- *Oscillatoria*

ANIMALS

Protozoa
- Colonial protozoa
  - *Chlamydomonas*
- *Pleuromonas jaculans*
- *Amoeba*
- *Tachysoma parvistyla*

Higher Forms
- *Cyclops*
- Midge larvae

BOTTOM DWELLERS

PLANTS

Algae
- *Oedogonium*
- *Ankistrodesmus*
- *Excentrosphaera viridis*
- *Synedra*
- *Cocconeis*
- *Gyrosigma*
- *Surirella*

Higher Plants
- Water milfoil

ANIMALS

Protozoa

Higher Forms
- Nematodes
- Segmented worms
- Seed shrimps
- Midges
  - *Tendipes (Chironomus)*
  - *Chaoborus*
- Cast skin of spider
- Fish scales

STATION NEAR CANAL INLET

Water temperatures
Surface 11° C
Bottom 11° C

Depth of Water 4.8 feet

PLANTS

Algae
- *Spirogyra*
- *Staurastrum*
- *Navicula*
- *Oscillatoria*

ANIMALS

Protozoa
- *Euglena*

Nematodes
Seed shrimp

FLORA AND FAUNA OF THE SURFACE WATER
NEAR THE CANAL INLET STATION
JUNE 13, 1970
WATER ONLY

PLANTS

Algae
- *Ankistrodesmus*
- *Eremosphaera viridis*
- *Actinastrum*
- *Scenedesmus*
- *Mougeotia*
- *Cosmarium crenatum*
- *Navicula*
- *Chroococcus minutus*
- *Synechococcus aeruginosa*

ANIMALS

Protozoa
- *Volvox*
- *Euglena rubra*
- *Mastigamoeba longifilum*

Higher Forms
- Rotifera
  - *Asplanchna*
  - *Anuraeopsis*
  - *Keratella cochlearis*
  - *Keratella quadrata*
  - *Monostyla lunaris*
- Cladocera
  - *Scapholeberis aurita*
- Copepods
  - *Cyclops*
- Nauplii of seed shrimp
- Water spider, *Hydrocarina*

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES AT THE CANAL OUTLET—OVER WEIR AND NEAR WEIR

JULY 22, 1970

Temperature of Water over Weir 19° C
South corner of Weir 22.5° C

Depth of Water near Weir 8 inches

WATER		*BOTTOM DWELLERS*	
PLANTS	*ANIMALS*	*PLANTS*	*ANIMALS*
Algae	Protozoa	Algae	Protozoa
Enteromorpha intestinalis	*Chrysococcus*	*Closteriopsis*	Higher Forms
Mougeotia	*Euglena*	*Spirogyra*	Nematodes and eggs
Cosmarium	*Placus*	*Diatomella*	Cladocera
Docidium baculum	*Trachelomas hispida*	*Fragilaria*	*Scapholeberis aurita* (with moving green eyes)
Fragilaria	*Amoeba*	*Synedra*	Worms
	Coleps hirtus	*Gyrosigma*	Wireworms
Higher Forms	*Oxytricha*	*Navicula*	Snails
Water milfoil		*Oscillatoria*	*Lymnaea palustris* (3 in coarsest sieve)
	Higher Forms		*Physa gyrina* (76 in coarsest sieve)
	Water fleas	Higher Forms	Copepods
		Water milfoil	*Cyclops*
			Water fleas
			Insects
			Chaoborus
			Tendipes (Chironomus) larvae and pupae
			Green midge emerging from egg

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

AUGUST 4, 1970

LARGE SECTION OF LAKE STATION

Temperature of Water
Surface 26° C
Bottom 22° C

Depth of Water 4.85 feet

WATER

PLANTS

- Algae
  - Zygospores of filamentous algae
  - *Oedogonium*
  - *Pediastrum*
  - *Scenedesmus*
  - *Spirogyra*
  - *Cosmarium*
  - *Euastrum*
  - *Staurastrum*
  - *Navicula*
  - *Oscillatoria*

ANIMALS

- Protozoa
  - *Euglena*
  - *Phacus*
- Higher Forms
  - Flatworms
  - Rotifera
    - *Mniobia*
    - *Lecane*
    - *Bdelloidea*
  - Worms
    - Aquatic roundworm
  - Copepods
    - *Cyclops*
    - Immature copepods
  - Seed shrimp (Ostracoda)
    - *Cypris*
    - *Candona*
  - Insects
    - Spider, *Neumania*
    - Fly larvae
      - *Pentaneura monilis*

BOTTOM DWELLERS

PLANTS

- Algae
  - Filamentous algae conjugating
  - *Cosmarium meneghinii*
  - *Cocconeis*
  - *Mastigloia smithii*
  - *Gyrosigma*
  - *Navicula*
- Higher Forms
  - Water milfoil
  - Seeds

ANIMALS

- Protozoa
  - *Euplotes patella*
- Higher Forms
  - Rotifers (very numerous, some w/eggs)
  - Copepods
    - *Cyclops*
  - Snail shells (empty)
  - Midge larvae
  - Fish scales

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

AUGUST 4, 1970

NORTH CHANNEL STATION

Temperature of Water
Surface 25° C
Bottom 22° C

Depth of Water 3.95 feet

WATER

PLANTS

Algae
- *Chlorella*
- *Scenedesmus*
- *Spirogyra*
- *Cosmarium*
- *Staurastrum*
- *Fragilaria*
- *Navicula*
- *Stauroneis*
- *Gomphoneis*
- *Oscillatoria*

ANIMALS

Protozoa
- *Euglena*
- *Tachelomonas hispida*
- *Stentor*
- *Oxytricha setigera*
- *Difflugia corona*

Higher Forms
- Rotifera, Monostyla
- Flatworms
- Leech
- Nematodes (numerous)
- Water fleas, Cladocera
  - *Scapholeberis aurita*
- Copepods
  - *Cyclops*
- Water mites

BOTTOM DWELLERS

PLANTS

Algae
- Very little other than broken stems of water milfoil seen under binoculars

ANIMALS

Protozoa
- Flatworms
  - *Stenostomum*
  - *Dugesia tigrina*
- Nematodes & eggs
- Leech
- Copepods
  - *Cyclops*
- Midge larvae
- Insect larvae
- Fish scales

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

AUGUST 4, 1970

SMALL SECTION OF LAKE STATION

Temperature of Water
Surface 25° C
Bottom 23° C

Depth of Water 3.7 feet

WATER		*BOTTOM DWELLERS*	
PLANTS	*ANIMALS*	*PLANTS*	*ANIMALS*
Algae	Protozoa	Algae	Protozoa
Spirogyra	*Tachelomas hispida*	This soil was almost entirely fine mud (no significant algae).	*Oxytricha*
Cosmarium	*Euglena*		Worms
Penium	*Oxytricha*		Rotifers
Staurastrum	*Coleps hirtus*		
Fragilaria			
Navicula	Higher Forms		
Oscillatoria	Cladocera		
	Copepods		
Higher Forms	*Cyclops*		
Water milfoil			

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

AUGUST 4, 1970

SOUTH CHANNEL STATION

Temperature of Water
Surface 25° C
Bottom 22° C

Depth of Water 3.55 feet

WATER		*BOTTOM DWELLERS*	
PLANTS	*ANIMALS*	*PLANTS*	*ANIMALS*
Algae	Protozoa	Algae	Protozoa
Spirogyra	*Difflugia corona*	*Closterium*	*Euglypha ciliata*
Closterium	*Euglypha ciliata*	*Scenedesmus*	*Volvox*
Cosmarium reniforma		*Cosmarium*	
Cosmarium subtumidum	Higher Forms	*Staurastrum*	Higher Forms
Staurastrum	Water fleas with eggs—	*Diatoma*	Nematodes
Pseudotetraedron neglectum	Some emerging		Copepods (*Cyclops*)
Tabellaria	*Daphnia*	Higher Forms	Water fleas (*Daphnia*)
Diatoma elongata	Copepods	Water milfoil	Fertilized egg of *Ostracoda*
Navicula	*Cyclops*		Seed shrimp
Oscillatoria			Insect larvae
			Fish scales (ctenoid)

FLORA AND FAUNA IN THE WATER AND SOIL SAMPLES

AUGUST 4, 1970

STATION NEAR CANAL INLET

Temperature of Water
Surface 25° C
Bottom 24° C

Depth of Water 4.75 feet

WATER		*BOTTOM DWELLERS*	
PLANTS	*ANIMALS*	*PLANTS*	*ANIMALS*
Algae	Protozoa	Algae	Protozoa
Chlorococcum	*Cryptomonas ovata*	*Oscillatoria*	*Crytomonas ovata*
Selenastrum gracile	*Volvox*	*Navicula*	*Volvox*
Spirogyra	*Euglena*	*Spirogyra*	*Euglena*
Cosmarium	*Difflugia corona*	*Cosmarium*	*Difflugia corona*
Staurastrum		*Chlorococcum*	*Centropyxis*
Fragilaria	Higher Forms	*Staurastrum*	*Coleps hirtus*
Navicula	Flatworms	*Scenedesmus*	
Oscillatoria	Nematodes	*Fragilaria*	Higher Forms
Anabaena	Rotifers		Flatworms
	Monostyla	Higher Forms	Rotifers
	Seed shrimp	Water milfoil	*Monostyla*
	Water fleas		Nematodes
			Water fleas
			Midge larvae

ALGAE

Because the lake was rich in nutrients, shallow, and warm, algae grew much too abundantly. December samples collected under ice contained *Draparnaldia, Protococcus, Bulbochaete, Closteriopsis, Eremosphaera, Scenedesmus, Cocconeis, Zygnema, Penium,* and *Staurastrum.* In February, *Netrium digitus* was collected. Among the first filamentous algae to populate the water in spring, were small, fine, but active strands of *Oscillatoria,* moving back and forth, from side to side, and hooking their ends in a wormlike fashion. In late April, along with *Oscillatoria,* the samples contained *Oedogonium, Enteromorpha, Ankistrodesmus, Excentrosphaera,* and many beautiful species of *Cosmarium,* which jewelled the lake through the spring and summer months. Large masses of *Spirogyra* stood out from the other darker *Mougeotia* and *Rhizoclonium.* Very long ribbons of *Fragilaria* cells and numerous *Diatoma* cells were in the summer samples.

The abundance of algae and other water plants kept the water rich in oxygen as well as furnishing food for the worms, insect larvae, fish, and water birds.

ALGAE[1, 2]

	SAMPLE	*SAMPLE SITE*	*DATE*
I. Division Chlorophyta			
A Sub-division Chlorophyceae			
Order 1 Volvocales (See Protozoa)			
Order 3 Ulotrichales			
Family Chaetophoraceae			
Draparnaldia	Water	Large section of lake	10-21-69
	Water	Lake side of weir	12-9-69
Family Protococcaceae			
Protococcus	Mud	Station Z under ice	12-9-69
Order 4 Cladophorales			
Family Cladophoraceae			
Rhizoclonium	Mud	Large section of lake	10-21-69
Order 5 Sphaeropleales			
Family Sphaeropleaceae			
Sphaeroplea	Mud	North channel	4-7-70
Order 6 Oedogoniales			
Family Oedogoniaceae			
Bulbochaete	Water	Large section of lake	10-21-69
	Water	Station Z	12-9-69

1. Listing follows classification of Prescott, G. W. *How to Know the Fresh-water Algae,* Wm. C. Brown Company, 1964, except that motile cells with flagella are listed with protozoa.

2. Editor's note: This choice of classification is that of the author. Most biologists choose to follow Prescott's classification in its entirety and include organisms identified here in families Chlamydomonadidae, Volvocidae and others in the appropriate green algal families.

	SAMPLE	SAMPLE SITE	DATE
Oedogonium	Water	North channel	10-21-69
(some with zygospores)	Water	South channel	10-21-69
	Mud	Large section of lake	10-21-69
	Mud	South channel	4-15-70
	Water	Large section of lake	8-4-70
Order 7 Ulvales			
Family Ulvaceae			
Enteromorpha			
E. intestinalis	Water	Lake side of weir	4-7-70
Order 9 Chlorococcales			
Family Chlorococcaceae			
Chlorococcum	Water	Near Canal inlet	8-4-70
Myrmecia			
M. aquatica	Water	North channel	10-21-69
Family Characiaceae			
Actidesmium	Surface water	Near Canal inlet	6-13-70
Family Hydrodictyaceae			
Hydrodictyon	Water	Near Canal outlet	9-15-69
Pediastrum	Mud	Near Canal inlet	10-21-69
	Water	Large section of lake	8-4-70
	Mud	Near Canal inlet	8-4-70
Sorastrum			
S. spinulosum	Mud	South channel	10-21-69
Family Oocystaceae			
Ankistrodesmus	Water	North channel	4-15-70
	Mud	South channel	4-15-70
	Surface water	Near Canal inlet	6-13-70
Chlorella	Water	North channel	10-21-69
	Water	North channel	8-4-70
Closteriopsis	Water	Lake outlet	7-12-69
	Mud	Large section of lake	10-21-69
	Water	Canal inlet	10-21-69
	Water	Lake side of weir	12-9-69
Echinosphaerella	Mud	Lake side of weir	7-22-70
	Water	Near Canal inlet	10-21-69
Eremosphaera	Mud	Large section of lake	10-21-69
	Mud	Station Y	12-9-69
Excentrosphaera			
E. veridis	Mud	South channel	4-15-70
Nephrocytium			
N. agardhianum	Water	Lake side of weir	4-7-70

	SAMPLE	SAMPLE SITE	DATE
Trochiscia	Water	Large section of lake	10-21-69
Family Scenedesmaceae			
Actinastrum	Water	Near Canal inlet	6-13-70
Scenedesmus	Water	Near Canal inlet	10-21-69
	Surface water	Near Canal inlet	10-21-69
	Water	Large section of lake	8-4-70
	Water	South channel	8-4-70
S. caudatus	Water	Station Z	12-9-69
	Mud	Station Z	12-9-69
Order 11 Zygnematales (Conjugales)			
Family Zygnemataceae			
Mougeotia	Common filamentous algae of LeRoy Lagune. Found in some state at all stations throughout the year.		
Spirogyra	Water	South channel	10-21-69
	Mud	North channel	10-21-69
	Water	Large section of lake	8-4-70
S. communis	Mud	Lake side of weir	7-22-70
	Water	North channel	8-4-70
Zygnema	Water	Large section of lake	10-21-69
	Water	Station Z under ice	12-9-69
Zygnemopsis	Water	Canal inlet	10-21-69
Family Mesotaeniaceae			
Netrium			
N. digitus	Water	Lake side of weir	2-24-70
Family Desmidiaceae			
Closterium	Water	Lake outlet	7-4-69
	Water	Large section of lake	10-21-69
	Water	Canal inlet	10-21-69
	Mud	Large section of lake	10-21-69
	Water	Station Y	12-21-69
Cosmarium	Water	Large section of lake	10-21-69
	Water	North channel	10-21-69
	Water	South channel	10-21-69
	Water	Small section of lake (numerous species)	10-21-69
	Water	Lake side of weir	4-7-70
	Mud	Large section of lake	4-15-70
	Surface water	Near Canal inlet	6-13-70
	Water	Near Canal inlet	8-4-70

	SAMPLE	*SAMPLE SITE*	*DATE*
	Water	Large section of lake	8-4-70
	Water	South channel	8-4-70
	Water	North channel	8-4-70
	Water	Small section of lake	8-4-70
C. botrytis	Water	Large section of lake	10-21-69
	Water	Near Canal inlet	10-21-69
	Water	South channel	10-21-69
	Mud	Large section of lake	10-21-69
C. elegans	Mud	Large section of lake	10-21-69
Desmidium	Mud	Large section of lake	10-21-69
Docidium			
D. baculum	Water	Near Canal inlet	10-21-69
Euastrum			
E. pinnatum	Water	Near Canal inlet	10-21-69
Penium			
P. closteroides	Mud	Station Z under ice	12-9-69
	Water	Small section of lake	8-4-70
	Water	North channel	10-21-69
Staurastrum	Water	Large section of lake	10-21-69
	Water	Near Canal inlet	8-4-70
	Water	Small section of lake	8-4-70
	Water	South channel	8-4-70
	Water	Large section of lake	8-4-70
S. crenulatum	Water	Station Z under ice	12-9-69
II. Division Euglenophyta (see Protozoa)			
III. Division Pyrrhophyta			
A Sub-division Desmokontae			
Family Peridiniaceae			
Peridinium	Water	Large section of lake	10-21-69
VI. Division Chrysophyta			
A Sub-division Xanthophyceae (Heterokontae)			
Order 2 Heterococcales			
Family Centritractaceae			
Pseudotetraedron			
P. neglectum	Mud	Near Canal inlet	4-15-70
	Mud	South channel	8-4-70
	Water	South channel	8-4-70

	SAMPLE	*SAMPLE SITE*	*DATE*
Family Meringosphaeraceae			
Meringosphaera			
M. spinosa	Water	Large section of lake	4-15-70
Order 7 Heterosiphonales			
Family Vaucheriaceae			
Vaucheria	Water	Station Z under ice (several)	12-9-69
C Sub-division Bacillariophyceae			
Order 2 Pennales			
Family Tabellariaceae			
Diatomella	Mud	Lake side of weir	7-22-70
Tabellaria	Water	Generally distributed	10-21-69
Family Diatomaceae			
Diatoma	Water	South channel (numerous)	8-4-70
Family Fragilariaceae			
Asterionella	Mud	Small section of lake	4-15-70
Fragilaria	Water	Small section of lake	10-21-69
	Mud	Lake side of weir	4-7-70
	Water	Lake side of weir	4-7-70
	Mud	Lake side of weir	7-22-70
	Water	North channel	8-4-70
	Water	Near Canal inlet	8-4-70
	Water	Small section of lake (very long ribbons)	8-4-70
Synedra	Mud	Lake side of weir	4-15-70
Family Eunotiaceae			
Eunotia			
E. pectinalis	Mud	Small section of lake	4-15-70
Family Achnanthaceae			
Cocconeis	Water	Often crowded on a filament of alga (over 40 on one filament)	
	Water	Large section	10-21-69
	Water	Large section of lake	4-15-70
	Water	South channel	4-15-70
	Mud	Attached to algae	4-15-70

	SAMPLE	*SAMPLE SITE*	*DATE*
Family Naviculaceae			
Gyrosigma	Water	Small section of lake	10-21-69
	Water	Large section of lake	10-21-69
	Mud	South channel	4-15-70
	Mud	Small section of lake	4-15-70
	Mud	Lake side of weir	7-21-70
G. attenuatum	Mud	Large section of lake	10-21-69
	Mud	Small section of lake	10-21-69
	Water	Large section of lake	4-15-70
	Water	Small section of lake	4-15-70
Navicula	Water	Large section of lake	10-21-69
	Water	Station Z under ice	12-9-69
	Mud	Large section of lake	4-15-70
	Water	North channel	4-15-70
	Surface water	Near Canal inlet	6-13-70
	Water	Near Canal inlet	8-4-70
	Water	Small section of lake	8-4-70
	Water	Large section of lake	8-4-70
N. rynchocephala	Mud	Large section of lake	10-21-69
Stauroneis			
S. anceps	Water	Lake outlet	7-12-69
	Water	Large section of lake	10-21-69
	Mud	Large section of lake	10-21-69
	Water	North channel	8-4-70
Family Gomphonemataceae			
Gomphoneis	Water	North channel	8-4-70
Family Cymbellaceae			
Amphora	Mud	Station Z	12-9-69
	Water	Large section of lake	8-4-70
	Mud	Near Canal inlet	8-4-70
A. ovalis	Water	Canal outlet	7-21-69
	Mud	Large section of lake	10-21-69
	Mud	Lake side of weir	4-7-70

	SAMPLE	*SAMPLE SITE*	*DATE*
Cymbella			
C. cuspidata	Mud	Station Z	12-9-69
Family Surirellaceae			
Surirella	Mud	South channel	4-15-70
VII. Division Cyanophyta			
A Sub-division Myxophyceae			
Order 1 Chroococcales			
Family Chroococcaceae			
Chroococcus			
C. minutus	Surface water	Near Canal inlet	6-13-70
	Water	Near Canal inlet	8-15-70
Coelosphaerium	Water	North channel	4-15-70
Gleocapsa	Water	Large section of lake	10-21-69
Synechococcus			
S. aeruginosus	Surface water	Near Canal inlet	6-13-70
Order 3 Hormogonales			
Family Oscillatoriaceae			
Arthrospira			
A. jenneri	Water	Large section of lake	4-15-70
Family Oscillatoriaceae			
Oscillatoria	Water	Generally distributed.	
	Water	Lake side of weir	4-7-70
	Water	Large section of lake	4-15-70
	Water	Small section of lake	4-15-70
	Mud	Lake side of weir	7-22-70
	Water	Small section of lake	8-4-70
	Water	Large section of lake	8-4-70
	Water	North channel	8-4-70
	Water	South channel (very few)	8-4-70
Family Nostocaceae			
Anabaena	Mud	Small section of lake	10-21-69
	Water	Near Canal inlet	10-21-69
	Mud	Station Z	12-9-69
	Mud	Near Canal inlet	8-4-70
	Water	North channel	8-4-70
Nostoc			
N. commune	Water	Small section of lake (rich in algae)	10-21-69
Family Scytonemataceae			
Tolypothrix	Water	Lake side of weir	12-9-69

TRACHEOPHYTA

As the lake had once been meadow, the rich soil was highly productive of field plants. Daisies, dandelions, clover, goldenrod, milkweed, Queen Anne's lace, and chickory gave their distinctive color to the banks. Near the water's edge, rushes, sedges, and cattails predominated, while occasionally, yellow violets found a footing. In the water, *Elodea* and *Marsilea* grew in selected areas, while water milfoil spread through the lake.

In the swamps nearby, purple loosestrife raised its spikes above the grass, and clumps of golden bird's-foot trefoil edged the road.

TRACHEOPHYTA OF THE LITTORAL REGION AND BANKS OF LEROY LAGUNE[1]

PLANT	*LOCATION*	*DATE*
Subdivision D Pteropsida		
Class 1 Filicinae, Ferns		
Order 1 Filicales, Ferns		
Family Marsileaceae, Water Shamrock Family	Littoral	8-24-69
Marsilea		
***M. quadrifolia*, Linnaeus, Four-leafed Clover Plant**	Littoral near southwest inlet	8-24-69
Class 3 Angiosperms		
Subclass A Dicotyledoneae, Dicotyledons		
Group 1 Thalamiflorae, Receptacle Flowers		
Order 1 Ranales		
Family Ranunculaceae Buttercup Family		
Ranunculus		
***R. acris*, Buttercup**	Bank	Summer 1969
R. laxicaulia, Water Plantain	Littoral south bank	Summer 1969

1. Classification follows Benson, L., Plant Classification. D. C. Heath, Boston, 1957, and Fassett, N. C., A Manual of Aquatic Plants, University of Wisconsin Press, Madison, 1960.

PLANT	*LOCATION*	*DATE*
Order 4 Violales		
Family Violaceae, Violet Family		
Viola		
V. pubescens var. *scabriuscula* Downy Yellow Violet	Littoral north bank	7-13-69
Order 13 Sapindales		
Family Aceraceae, Maple Family		
Acer, Maple	Woodland north of lake	
Order 18 Urticales		
Family Ulmaceae, Elm Family		
Ulmus, Elm	Woodland north of lake	
Order 20 Caryophyllales		
Family Polygonaceae, Buckwheat Family		
Polygonum, Smartweed		
P. lapthifolium	Bank	9-14-69
Group 2 Corolliflorae, Corolla Flowers		
Order 26 Apocynales		
Family Asclepiadaceae, Milkweed Family		
Asclepias, Milkweed	Meadow	Fall, 1969
Order 28 Lamiales		
Family Labiatae, Mint Family		
Mentha		
M. arvenis var. *canadensis*, Mint	Swampy bank	8-22-69
Order 29 Scrophulariales		
Family Scrophulariaceae, Figwort Family		
Verbascum		
V. blattaria, Moth Mullein	Meadow	Fall, 1969
Linaria		
L. vulgaris, Butter-and-eggs	South bank	Fall, 1969
Minulus		
M. ringens, Monkey Flower	Swampy bank	8-24-69

PLANT	*LOCATION*	*DATE*
Group 3 Calyciflorae, Cup Flowers		
Order 31 Rosales		
Family Leguminosae, Pulse Family		
Trifolium		
T. pratense, Red Clover	Bank	Summer 1969
Melilatus		
M. alba, White Melilot	Meadow	Summer 1969
M. officinalis, Yellow Melilot	Bank	8-4-69
Lotus		
L. corniculatus, Bird's-foot Trefoil, Crowtoes	Meadow edge	8-4-69
Order 36 Myrtales		
Family Lythraceae, Loosestrife Family		
Decodon		
D. verticillatus, Swamp Loosestrife, Water Willow	Swamp east of lake	Summer 1969
Lythrum		
L. salicaria, Spiked or Purple Loosestrife	Swamp east of lake	9-30-69
Family Haloragaceae, Water Milfoil Family		
Myriophyllum, Mermaid-weed		
M. exalbescens, Northern Milfoil	Most prevalent water plant in lake	Always present
Order 38 Umbellales		
Family Umbelliferae, Parsley Family		
Daucus		
D. carota, Queen Anne's Lace	Meadow	Fall, 1969
Hydrocotyle		
H. americana, Water Pennywort	Littoral	July, 1969
Group 4 Ovariflorae, Ovary Flowers		
Order 44 Rubiales		
Family Dipsacaceae, Teasel Family		
Dipsacus		
D. sylvestris, Common Teasel	Bank	Summer & Fall, 1969
Order 46 Asterales		
Family Compositae, Composite Family		
Eupatorium		
E. perfoliatum, Linnaeus Forma *truncatum*, Boneset	Bank	1969
Bidens		
B. frondosa, Beggar-ticks	North bank	Summer & Fall, 1969

PLANT	*LOCATION*	*DATE*
Solidago		
S. neglecta, Swamp Goldenrod	South bank	Summer & Fall, 1969
S. canadensis, Tall Goldenrod	South bank	Summer & Fall, 1969
Erigeron		
E. ramosus, Daisy Fleabane	South bank	Fall, 1969
Rudbeckia		
R. hirta, Black-eyed Susan	Meadow	Fall, 1969
Arctium		
A. lappa, Burdock	Bank	Fall, 1969
Cirsium		
C. lanceolatum, Common Thistle	Bank	Fall, 1969
C. arvense, Canada Thistle	Bank	Fall, 1969
Hieracium		
H. canadense, Canadian Hawkweed	Bank	Summer, 1969
Leontodon		
L. autumnalis, Fall Dandelion	Bank	Summer, 1969
Taraxacum		
T. officinale, Common Dandelion	Bank	Summer, 1969
Cichorium		
C. intybus, Chicory	South bank	Summer, 1969
Class 3 Angiosperms		
Subclass B Monocotyledoneae, Monocots		
Order 1 Alismales		
Family Alismaceae, Water Plantain Family		
Alisma		
A. triviale, Water Plantain	South edge of small section of lake	9-13-69
Order 2 *Liliales*		
Family Juncaceae		
Juncus		
J. effusus, Soft Rush	Edge of small section of lake	Summer, 1969
Family Butomaceae, Flowering Rush Family		
Butomus		
Order 3 *Arales*		
Family Lemnaceae, Duckweed Family		
Lemna, Duckweed	Near Canal inlet	Summer, 1969

PLANT	*LOCATION*	*DATE*
Order 5 Graminales, Grasses		
Family Cyperaceae, Sedge Family		
Cyperus		
C. erythrorhizos	Marsh opposite the lagune and small section of lake	9-4-69
Eleocharis		
E. obtusa, Spike Rush	Northwest border of lake	9-13-69
Rynchospora, Beak Rush	Northwest border of lake	9-13-69
Family Gramineae, Grass Family		
Phragmites		
P. maxima var. *Berlandieri*, Reed Grass	Marsh opposite lagune	9-4-69
Order 9 Hydrocharitales, Frogbits		
Family Hydrocharitaceae, (*Elodeaceae*), Elodea Family		
Elodea, Waterweed	South inlet	Summer, 1969 (Missing in 1970)
Order 11 Najadales, Pondweeds		
Family Najadaceae		
Potamogeton, Pondweed	Throughout lake	Summers, 1969-1970
Order 13 Panadanales		
Family Sparganiaceae, Bur Reed Family		
Sparganium, Bur Reed	Bur Reed	Fall, Winter, 1969
Family Typhaceae, Cattail Family		
Typha		
T. angustifolia, Narrow-leafed Cattail	Swamp on south side of lake	Late Summer, 1969-1970
T. latifolia, Common Cattail	Edges of lake	Late Summer, 1969-1970

PROTOZOA OF THE WATER AND BOTTOM SOIL

Of the protozoa, *Euglena* was the genus that was most abundant in the lake. Many more species were there than were identified. In April, a one-fourth inch layer of green formed on the soil sample collected from the large area of the lake and left over night in the refrigerator. It contained several species of the organism. In June at the Canal inlet, the surface water had red and green areas where *Euglena rubra* was the prevalent form. As mentioned before, this difference in coloration is said to be due to temperature differences in the water. The organism increased in abundance in July and August of both years but especially in 1970, coloring large sections of the lake red.

In April, *Pleuromonas jaculans,* which develops frequently in water left in the laboratory, was numerous in two samples fresh from the lake's edge.

Stentor and *Euglypha ciliata* were collected in summer. *Amoeba radiosa* and *A. verrucosa* along with *Paramecium, Vorticella,* and *Euglena* were in the mud samples taken under ice in December. The complex protozoa of the family *Oxytrichidae* were found throughout all the seasons. A very large *Stichotricha* was the only animal form alive in water that had been left all winter in the refrigerator.

Protozoa withstand wide ranges of temperature. Those of LeRoy Lagune were fewer but larger when water was cold. Although they were in all samples during all seasons, they were most abundant in autumn.

PROTOZOA[1] *OF THE WATER AND BOTTOM SOIL*

PROTOZOA	*SAMPLES*	*SAMPLE SITE*	*DATE*
Phylum Protozoa Goldfuss			
Subphylum 1 Plasmodroma Doflein			
Class 1 Mastigophora Diesing			
Subclass Phytomastigina Doflein			
Order 1 Chrysomonadina Stein			
Suborder 1 Euchrysomonadina Pascher			
Family 1 Chromulinidae			
Chrysococcus Klebs			
C. ornatus Pascher	Surface water	Near Canal inlet	7-15-70
	Mud	Large section of lake	7-15-70
Order 2 Cryptomonadina Stein			
Suborder 1 Eucryptomonadina Pascher			
Family 1 Cryptomonadidae Stein			
Cryptomonas Ehrenberg			
C. ovata	Water	Canal inlet	8-4-70
Chilomonas Ehrenberg			
C. paramecium Bütschli	Water	Surface Canal inlet	6-13-70
Order 3 Phytomonadina Blochmann			
Family 1 Chlamydomonadidae Bütschli			
Chlamydomonas Ehrenberg	Water	North channel	4-15-70
Haematococcus Agardh (Sphaerella)	Water	North channel	4-15-70
Family 6 Phacotidae Poche			
Phacotus Perty			
P. curvicauda	Mud	South channel	10-21-69
P. lenticularis	Mud	South channel	10-21-69

1. The enumeration of the Protozoa collected from LeRoy Lagune follows the classification in *Protozoology* by Richard R. Kudo, D. Sc. Ed. 4, Second Printing, 1960, Charles C. Thomas, Publisher. (See Editor's note on p. 333 concerning algae and protozoa.)

PROTOZOA	*SAMPLES*	*SAMPLE SITE*	*DATE*
Family 7 Volvocidae[2] Ehrenberg			
Volvox Linnaeus	Water	Large section of lake	8-4-70
Eudorina Ehrenberg	Mud	Lake side of weir	12-9-69
	Mud	Large section of lake	4-15-70
Order 4 Euglenoidina Blochmann			
Family 1 Euglenidae Stein			
Euglena Ehrenberg	Water	Generally distributed	Throughout Spring, Summer, Fall
	Water	North channel	10-21-69
	Water	Small area of lake	10-21-69
	Water	South channel	10-21-69
	Water	Lake side of weir	4-7-70
	Water	Large section of lake	4-15-70
	Water	Small section of lake	4-15-70
	Water	South channel	4-15-70
	Water	North channel	4-15-70
	Mud[3]	Large section of lake	4-15-70
	Mud[4]	Small section of lake	4-15-70
	Water	North channel	4-15-70
E. convoluta	Water	North channel	4-15-70
	Water	South channel	4-15-70
E. rubra	Surface water	Canal inlet	6-13-70
Phacus Dujardin	Water	Large section of lake	8-4-70
P. longicauda	Water	Near Canal inlet	7-15-70
Lepocinclis Perty	Surface water	Near Canal inlet	6-13-70
Tachelomonas Ehrenberg			
T. hispida	Water	Near Canal inlet	7-15-70
Cryptoglena Ehrenberg			
C. pigra	Mud	South channel	10-21-69

2. Besides those mentioned below, colonial protozoa were found in the water over the weir, March 24, 1970, and on the lake side of the weir April 15, in the middle of the large section of the lake and in the South Channel August 4.
3. Formed a green layer on soil.
4. 138 in counting cell; several species.

PROTOZOA	*SAMPLES*	*SAMPLE SITE*	*DATE*
Family 2 Astasiidae Bütschli			
Astasia Dujardin			
A. Klebsi Lemmermann	Mud	Lake side of weir under ice	12-9-69
Petalomonas Stein			
P. mediocanellata	Water	South channel	10-21-69
	Mud	Station Z (under ice)	2-24-70
	Surface water	Near Canal inlet	6-13-70
Family 3 Anisonemidae Schewiakoff			
Heteronema Dujardin			
H. acus Ehrenberg	Water	North channel	10-21-69
H. ovata	Mud	Lake side of weir	12-9-69
	Mud	Station Z (under ice)	2-24-69
Order 6 Dinoflagellata, Bütschli			
Suborder 2 Peridiniinea Poche			
Family 1 Peridiniidae Kent			
Peridinium Ehrenberg	Water	Station Z (under ice)	2-24-70
Ceratium Schrank			
C. hirundinella Müller	Mud	Large section of lake	10-21-69
Gonyaulax Diesing			
G. polyedra Stein	Mud	Near Canal inlet	4-7-70
Subclass 2 Zoomastigina Doflein			
Order 1 Rhizomastigina Bütschli			
Family 2 Mastigamoebidae			
Mastigamoeba Schultze			
M. longifilium Stokes	Mud	Large section of lake	4-15-70
	Mud	Near Canal inlet	8-4-70
Order 2 Protomonadina Blochmann			
Family 9 Bodonidae Bütschli			
Pleuromonas Perty			
P. jaculans P.	Water	North channel	10-21-69
	Mud	Small section of lake	4-15-70
Phyllomitus Stein			
P. amylophagus Klebs	Mud	Lake side of weir	12-9-69

PROTOZOA	*SAMPLES*	*SAMPLE SITE*	*DATE*
Class 2 Sarcodina Herwig and Lesser			
Subclass 1 Rhizopoda Siebold			
Order 1 Proteomyxa Lankester			
Family 3 Vampyrellidae Doflein			
Nuclearia Cienkowski			
N. simplex C.	Water	South channel	10-21-69
Order 3 Amoebinae Ehrenberg			
Family 2 Amoebidae Bronn			
Amoeba Ehrenberg	Water	Small section of lake[5]	10-21-69
	Water	South channel	6-13-70
	Water	Small section of lake	4-15-70
	Mud	Small section of lake	4-15-70
	Water	Near Canal inlet	6-13-70
A. proteus Pallas	Water	Small section of lake	4-7-70
A. verrucosa Ehrenberg	Mud	Large section of lake	10-21-69
	Mud	Lake side of weir	12-9-69
A. guttula Dujardin	Water	Large section of lake	10-21-69
A. radiosa	Mud	Lake side of weir under ice	12-9-69
Order 4 Testacea Schultze			
Family 2 Arcellidae Schultze			
Arcella Ehrenberg	Water	Near Canal inlet	10-21-69
Family 3 Difflugiidae			
Difflugia Leclerc			
D. corona Wallich	Water	South channel	8-4-70
	Water	Near Canal inlet	8-4-70
Centropyxis Stein	Water	Large section of lake	8-4-70
Family 4 Euglpyhidae Wallich			
Euglypha Dujardin			
E. acanthophora Ehrenberg	Water	Lake side of weir	9-15-70
E. ciliata	Water	Lake outlet	6-13-70
	Water	Lake outlet	9-15-69
E. compressa	Water	Near Canal inlet	10-21-69

5. Inside colony of protozoa.

PROTOZOA	*SAMPLES*	*SAMPLE SITE*	*DATE*
Subclass 2 Actinopoda Calkins			
Order 1 Heliozoa Haeckel			
Family 2 Actinophryidae Claus			
Actinophrys Ehrenberg			
A. sol E.	Water	Near Canal inlet	10-21-69
Subphylum 2 Ciliophora Doflein			
Class 1 Ciliata Perty			
Subclass 2 Euciliata Metcalf			
Order 1 Holotricha Stein			
Suborder 2 Gymnostomata Bütschli			
Tribe 1 Prostomata Schewiakoff			
Family 1 Spathidiidae Kahl			
Spathidium Dujardin			
S. spathula Müller	Mud	Lake side of weir	4-7-70
Family 4 Colepidae Chaparede & Lachmann			
Coleps Nitzsch			
C. hirtus Müller	Water	Lake outlet	9-15-69
	Water	South channel	10-21-69
	Water	Near Canal inlet	8-4-70
	Water	Small section of lake	8-4-70
C. octospinus Noland	Water	North channel	8-4-70
Suborder 3 Trichostomata Bütschli			
Family 8 Parameciidae Grobben			
Paramecium[6] Hill	Water	South channel	10-21-69
	Mud	Station Z (under ice)	2-24-70
	Water	Lake side of weir	4-7-70
	Water	Near Canal inlet	8-4-70
Order 2 Spirotricha Bütschli			
Suborder 1 Heterotricha Stein			
Family 5 Stentoridae Carus			
Stentor Oken			
S. polymorphus Müller	Water	Canal outlet	9-15-69
	Water	Small section of lake	8-4-70

6. Several species; some conjugating.

PROTOZOA	*SAMPLES*	*SAMPLE SITE*	*DATE*
Suborder 4 Hypotricha Stein			
Family 1 Oxytrichidae Kent			
Oxytricha Ehrenberg			
O. setigera Stokes	Water	Small section of lake	4-15-70
Tachysoma Stokes			
T. parvistyla S.	Water	Lake side of weir	4-7-70
Stichotricha Perty			
S. secunda	Water	Small section of lake	4-15-70
	Mud	Small section of lake	4-15-70
Stylonychia Ehrenberg			
S. mytilus[7] Müller	Mud	Canal inlet	8-4-70
Order 4 Peritricha Stein			
Suborder 1 Sessilia Kahl			
Tribe 1 Aloricata Kahl			
Family 5 Vorticellidae Fromental			
Vorticella Linnaeus	Water	Lake outlet	9-15-69
	Mud	Canal inlet	10-21-69
	Water	Small section of lake	10-21-69
V. campanula	Mud	Station Z (under ice)	2-24-70

7. Cysts and excystation.

SPONGES, HYDRA, WORMS, AND ROTIFERS

Very simple fresh water sponges were in the mud samples. They were not further identified. Some very large *Hydra* were attached to cattail stems under the water surface in the drainage ditch just east of the lake outlet in the summer of 1969.

Worms and worm-like organisms were numerous at all collecting stations but were especially so at the lake side of the outlet weir. *Gordius*, the horsehair worm, was seen from time to time. *Turbellaria*, flatworms, were rarely taken, perhaps because of their habit of feeding at night. One was observed issuing from an egg in April, the same month *Dugesia* was found. *Microstomum lineare* was in the October samples.

Rotifers, the smallest known metazoans, were common and varied in the finest soil. Their many unusual shapes and methods of locomotion made them particularly interesting. Mud samples taken throughout the study, even those from beneath the ice in December and February, contained them. The surface water near the Canal inlet in June had organisms belonging to many genera, among which were *Asplanchna, Anureopsis*, and two species of *Keratella, coclearis* and *quadrata*. One male of *Cochlearet urbe* Gosse was the only one of that sex recognized. It was taken from the large section of the lake in October.

Since they withstood all the temperatures of water and soil of the lake, nematodes were continually working over the soil. As they thrashed about, they could be detected in the movement of the soil being examined under the binocular microscope. They were especially numerous in the mud on the lake side of the weir where organisms were decaying. Seventy-three were counted in one-fourth of a pint of this mud. Some were exceedingly small. The Canal inlet in August was also very rich in these organisms. *Dorylaimus, Tylenchus*, and *Aphelenchus* were identified.

Segmented worms were very abundant. Among them were *Aeolosoma, Lymbricus*, and *Tubifex*.

The worms were valuable as they furnished food for insect larvae and small fish and degraded the debris on the lake floor.

	SAMPLE	*SAMPLE SITE*	*DATE*
Phylum Porifera (Sponges and related forms)	Mud	Generally distributed	7-20-69
Phylum Coelenterata			
Class Hydrozoa (Hydra and related forms)			
Hydra	On *Typha* stem	Lake outlet	7-20-69
Phylum Platyhelminthes			
Class Turbellaria (Flat worms)	Water	Lake outlet	9-20-69
	Water	Lake side of weir	10-21-69
	Mud	North channel	4-15-70

	SAMPLE	*SAMPLE SITE*	*DATE*
	Mud	South channel (one coming out of cyst)	4-15-70
	Mud	Small section of lake	4-15-70
	Mud	Lake side of weir	7-22-70
Dugesia			
D. tigrina	Mud	North channel	4-15-70
Stenostomum	Water	Near Canal	10-21-69
Microstomum			
M. lineare	Water	North channel	10-21-69
Phylum Nemertea (Proboscis worms)			
Prostoma			
P. rubrum	Water	Near Canal inlet	10-21-69
Phylum Rotatoria (Rotifers)	Water	Large section of lake	10-21-69
	Water	Small section of lake	10-21-69
	Water	Station Y	12-9-69
	Mud	Large section of lake (one male)	4-15-70
	Surface water	Near Canal inlet	6-13-70
	Water	Near Canal inlet	8-4-70
	Water	North channel	8-4-70
	Mud	Large section of lake (numerous in the finest soil)	8-4-70
Class Digononta			
Mnionia	Water	Large section of lake	8-4-70
Philodina	Mud	South channel	10-21-69
Class Monogononta			
Pleurotricha	Mud	Station Z	12-9-69
Proales			
P. werneckii	Mud	Station Z	12-9-69
Asplanchna	Mud	Small section of lake	4-15-70
	Mud	Large section of lake	4-15-70
	Mud	South channel	4-15-70
	Surface water	Near Canal inlet (attached to a small solid object)	6-13-70
Brachionus			
B. caudatus	Water	(Generally distributed)	
B. entzii	Mud	South channel	10-21-69
Euchlanis	Water	Lake outlet	9-7-69
Keratella	Surface water	Near Canal inlet	6-13-70
Colurella	Mud	Small section of lake	10-21-69
Lecane	Mud	Station Z	12-9-69
	Mud	Small section of lake	4-15-70
	Water	Large section of lake	8-4-70
Monostyla	Surface water	Near Canal inlet	6-13-70
	Water	Near Canal inlet	8-4-70

	SAMPLE	*SAMPLE SITE*	*DATE*
Phylum Nematoda (Roundworms)	Mud	Near Canal inlet (121 worms in 500cc of soil)	10-21-69
	Mud	South channel	10-21-69
	Mud	Station Z (Inside snail shell)	12-9-69
	Mud	Near Canal inlet	4-7-70
	Water	Through weir	4-7-70
	Water	Lake side of weir	4-7-70
	Mud	Large section of lake	4-15-70
	Water	Large section of lake (many egg masses)	4-15-70
	Water	North channel	4-15-70
	Mud	South channel (few)	4-15-70
	Mud	Small section of lake	4-15-70
	Surface water	Near Canal inlet	6-13-70
	Mud	Lake side of weir (345 nematodes in 500cc of soil)	7-22-70
	Water	Near Canal inlet	8-4-70
Class Phasmidia			
Rhabditis	Mud	Large section of lake	10-21-69
Aphelenchus	Mud	Station Z	12-9-69
Tylenchus	Mud	North channel	10-21-69
	Mud	Station Z	12-9-69
Class Aphasmidia			
Rhabdolaimus	Mud	North channel	10-21-69
	Mud	Station Z	12-9-69
R. minor	Mud	North channel	10-21-69
	Mud	South channel	10-21-69
	Mud	Station Z	12-9-69
Dorylaimus	Mud	Large section of lake	4-15-70
Prismatolaimus	Mud	South channel	10-21-69
Phylum Nematomorpha (Horsehair worms)			
Gordius			
G. aquaticus	Mud	Large section of lake	10-21-69
	Water	Near Canal inlet	10-21-69
Phylum Annelida (Aquatic earthworms)	Mud	Large section of lake	10-21-69
	Water	Near Canal inlet	8-4-70
	Mud	Station Z (Feeding on snail)	12-9-69
	Water	Large section of lake	10-21-69
Class Oligochaeta (Bristle worms)			
Aeolosoma			
A. aquatica	Mud	Near Canal inlet	10-21-69
	Mud	Station Z	12-9-69
	Mud	Near Canal inlet	8-4-70
Tubifex			
T. tubifex	Mud	Large section of lake	10-21-69
	Mud	Station Z	12-9-69

MOLLUSCA

During the summer of 1969, *Lymnaea stagnalis* and *Lymnaea palustris* glided over the floating algae near the shore. Three were collected in July among many empty shells on the lake side of the weir. *Physa gyrina* far outnumbered *Lymnaea*. Conditions were especially good for *Physac* as there was a high concentration of calcium and an abundance of algae. They were able to tolerate the salt that was introduced in spring. Winter, however, killed them and when they died, the bristle worm *Aeolosoma* found food and protection in their shells.

MOLLUSCA

	SAMPLE	*SAMPLE SITE*	*DATE*
Class Gastropoda (Snails and related forms)	Mud	Lake outlet	7-7-69
	Water	Station Y (Alive on floating algae)	9-13-69
	Mud	South channel (empty shells)	4-15-70
	Mud	Large section of lake (shells)	4-15-70
	Mud	Lake side of weir (some living; many empty shells)	7-22-70
Family Lymnaceae			
Lymnaea			
L. palustris	Surface water	Near Canal inlet	6-16-70
L. stagnalis	Surface water	Station Y	9-13-69
	Water	Large section of lake	4-15-70
	Mud	Lake side of weir (three living)	7-22-70
Family Physidae			
Physa			
P. gyrina	Water	Station Y (On floating algae)	8-7-69
	Mud	Small section of lake	10-21-69
	Mud	Station Z	12-9-69
	Mud	Small section of lake (empty shells)	4-15-70
	Mud	Lake side of weir (155 snails in 500cc of soil)	7-22-70

WATER FLEAS, COPEPODS, SEED SHRIMP, MITES, AND SPIDERS

Water fleas, or Cladocera, were in the samples throughout the summer and fall. *Daphnia,* was the most common. *Holopedium gibberum* and *Scapholeberis aurita* were identified.

Copepods were collected in water samples throughout the year. They were especially numerous in June at the Canal inlet apparently feeding on *Euglena rubra.* Samples in late summer and fall contained eggs as well as mature and immature organisms. Thirty-four of the nauplii were in one milliliter of water in August of 1970. In December *Cyclops viridis* and *C. bicuspidatus* were taken when the lake was covered with ice.

Seed shrimp, Ostracoda, and their bivalve shells were found in most samples of bottom earth, especially in the south channel. Their nauplii were on the surface of the water near the Canal inlet in June. *Cypris dentata* and a species of *Cypridopsis* were identified.

Tiny red mites (*Atax alticola*), though present throughout the year, were numerous in October in several areas.

One very beautiful blue and white spider of the genus *Neumania* was on algae in the water.

This group of busy little organisms were actively helping to keep the balance of nature in the lake, destroying bacteria and decomposing organic debris.

WATER FLEAS, COPEPODS, SEED SHRIMP, MITES, AND SPIDERS

	SAMPLE	*SAMPLE SITE*	*DATE*
Phylum Arthropoda			
Class Crustacea			
Subclass Brachiopoda			
Order Cladocera (Water fleas)	Water	Small section of lake (eggs)	8-4-70
	Water	South channel (with ephippia and young)	8-4-70
	Water	North channel (Protozoan on its carapace)	8-4-70
Daphnia (with eggs)	Water	Lake outlet	9-17-69
	Water	South channel	8-4-70
Holopedium			
H. gibberum	Mud	South channel	10-21-69
	Mud	Near Canal inlet	10-21-69
Scapholeberis			
S. aurita (Said to be rare —does not seem to be, in LeRoy Lagune)	Mud	Lake side of weir	7-22-70
	Water	North channel	8-4-70

	SAMPLE	SAMPLE SITE	DATE
Subclass Copepoda	Surface water	Near Canal inlet	6-13-70
	Water	Small section of lake (also eggs & nauplii)	8-4-70
	Water	Large section of lake (34 in counting cell)	8-4-70
Order Eucopepoda			
Cyclops	Water	Lake outlet (some with eggs)	9-17-69
	Water	North channel	10-21-69
	Mud	Large section of lake (with eggs)	4-15-70
	Water	South channel	4-15-70
	Water	Small section of lake	4-15-70
	Surface water	Near Canal inlet (eating *Euglena rubrum*)	6-16-70
	Water	North channel	8-4-70
	Water	Small section of lake (also nauplii)	8-4-70
C. viridis	Mud	Station Z	12-9-69
C. bicuspidatus	Mud	North channel	10-21-69
	Mud	Station Z	12-9-69
Subclass Ostracoda (Seed shrimp)	Water	Near Canal inlet	10-21-69
	Water	Small section of lake	10-21-69
	Water	South channel	10-21-69
	Mud	Station Z (137 on one filament of algae)	12-9-69
	Water	Large section of lake (also eggs)	4-15-70
	Water	South channel	8-4-70
	Water	Near Canal inlet	8-4-70
Order Podocopa			
Cypris	Mud	South channel	10-21-69
	Water	Large section of lake	8-4-70
C. dentata	Mud	South channel	10-21-69
	Mud	Near Canal inlet	10-21-69
	Mud	Station Z	12-9-69
Cypridopsis	Water	Station Z	12-9-69
Phylum Arthropoda			
Class Arachnoidea			
Order Hydracarina (Water mites)			
Atax			
A. alticola	Water	Lake outlet	9-17-69
	Water	Large section of lake	8-4-70
Neumania (Various shades of blue)	Water	Large section of lake	8-4-70

ODONATA AND OTHER INSECTS

The Odonata of the lake were for the most part well-distributed, common species found around small lakes and ponds. Of the two families of Anisoptera, the dragonflies, *Anax junius,* the large, blue and green darner and superb flier, was the sole representative of the Aeschnidae. All the others belonged to the Libellulidae. Closely related were *Celithemis, Leucorrhinia,* and *Sympetrum. Pantala flavescens* which shone like flying gold as it coursed a drainage ditch leading into the lake and deftly avoided the net, is quite distinct from the others in the family. Only three, a pair and another male were seen on campus in 1969 and none in 1970. Garman (1927) says it is a southern species that has strayed north.

Of the Sympetrini group, *Celithemis elisa,* a delicately pretty reddish-brown species with spotted wings rested on weeds of similar color along the water's edge. *C. eponina* is larger and has yellow wings more heavily spotted with brown. *Leucorrhinia intacta* was the most prevalent dragonfly on the lake in June of 1970. It was exceedingly difficult to catch, staying low on the weeds and being unusually alert. When attempting to catch a female, which escaped, a love-blind male flying toward her, was caught in the net. *Mesothemis simplicicollis,* Green Jacket, whose thorax is green when it is young and blue plumose, when older, was at first *Leucorrhinia's* only companion. It was frequently seen squatting on stones and litter along the lake edges. *Sympetrum ribicundulum,* the black and red dragonfly, which frequented the swampy areas along the lake, was joined by a smaller, yellow-legged relative, *S. vicinum,* which was the last to leave in fall.

Libellula and *Plathemis,* of the Libellulini group, joined each other in summer. *Libellula pulchella,* each wing of which is decorated with five spots, adopted the lake in fairly large numbers in 1969 but were much less in evidence in 1970, while the reverse was true of *L. luctuosa,* the black and white winged widow. Perhaps the nymphs of the latter can withstand a larger percentage of salt in the water. The female of *Plathemis lydia* has one more spot in each wing than the male.

Lestes was the only Coenagrionidae to be seen around the lake. It frequented the marshy area on the west end and the swamps nearby. Its fluttering flight and its habit of resting with its wings half closed distinguish *Lestes* from the other damselflies. Many pairs of *Lestes unguiculatus* were copulating along one cattail leaf in the swamp north of the lake in August.

Ischnura verticalis, one of the Fork-tails, has females of two different colors. Although it is said to be the first to arrive in spring, our specimens were collected in September of 1969.

Enallagma, the Bluets, the blue and black damselflies which frequent small lakes, floated above the algae at the water's edge, where they were preyed upon by frogs hunting along the shores, or moved effortlessly through the grasses, themselves preying on small insects.

The Odonata, while clearing the area of midges and mosquitoes or chasing each other over the waters, populated the lake and, in so doing, added to it a singular beauty of light and motion.

Other than Odonata, no intensive effort was made to collect all the aquatic insects. As a result, those listed are the common forms found in fresh water such as the giant water beetles and water bugs, water striders, and the larvae of mosquitoes, mayflies, and midges. Diptera pupa were in samples in July and September. In the latter month, a *Culex* mosquito larva, parasitized by round worms, was collected in the outlet ditch. When water which was sampled under ice in December became warm in the laboratory, a mayfly hatched from an egg. Springtails, Collembola, jumped in the snow in March. From time to time, midges issued from the pupa cases.

Midge larvae, very useful organisms of the ooze, were numerous. *Chaoborus,* the Phantom midge, which looked like an object artistically formed of blown glass and which is present when water quality is good, was in the lake. *Tendipes, (Chironomus)* is red when oxygen is low. Although many were collected, only one bright red one was found and that in the poorest area of the lake where the moving water was slowed by the wall of the weir.

It was not surprising that fish flourished in the lake as the larvae of the Odonata and Diptera are a good and abundant source of food.

ODONATA AND OTHER INSECTS

	SAMPLE	*SAMPLE SITE*	*DATE*
Phylum Arthropoda			
Class Insecta (Insects)			
Order Collembola (Springtails)			
Archorutes			
A. nivicolus	Snow	Over Station Y	3-26-70
Order Ephemeroptera (Mayflies) (Nymphs)	Water	Lake outlet	9-17-69
	Water	Large section of lake	10-21-69
	Water	Station Y	12-9-69
	Mud	Station Z	12-9-69
Order Odonata (Damselflies, dragonflies)[1] Nymphs	Water	Lake outlet	9-15-69
	Water	Large section of lake	10-21-69
	Mud	Near Canal inlet	10-21-69

1. Dates are those when specimens were collected. Adults were taken along shores of the lake and its inlets.

	SAMPLE	*SAMPLE SITE*	*DATE*
Suborder Zygoptera			
(Damselflies)			
Lestes			
L. unguiculatus			
(Male and Female)			7-1-70
Enallagma			
E. civile			
(Male and Female)			6-12-70
E. durum			
(Male and Female)			7-14-70
Ischnura			
I. verticalis			
(Male and Female)			9-4-69
Suborder Anisoptera			
(Dragonflies)			
Anax			
A. junius (Female)			7-28-69
Libellula			
L. luctuosa (All males)			7-8-69
			7-10-69
			6-24-70
L. pulchella (Male)			7-17-69
(Male)			8-8-69
(Female)			6-12-70
Plathemis			
P. lydia (Female)			7-1-69
(Male)			8-1-69
Mesothemis			
M. simplicicollis			8-11-69
(Male and Female)			
Sympetrum			
S. rubicundulum (Female)			7-7-69
(Female)			7-11-69
(Male)			7-19-69
(Male)			7-28-69
(Male)			8-22-69
S. vicinum			
(Male and Female)			8-22-69
Leucorrhinia			7-12-69
L. intacta (Male)			
Celithemis			
C. elisa (Male)			7-11-69
(Male)			7-17-69
(Female)			6-12-70
C. eponina (Male)			7-11-69
(Male)			8-19-69
(Female)			8-22-69
Pantala			
P. flavescens (Male)			8-15-69
Order Hemiptera			
Family Gerridae			
(Water striders)	Water	Lake outlet	8-7-69
Family Notonectidae			
(Backswimmers)	Water	Lake outlet	8-7-69

	SAMPLE	*SAMPLE SITE*	*DATE*
Family Belostomatidae (Giant water beetles)			
Lethocerus	Surface water	Station Y (on algae)	9-13-69
Benacus			
B. griseus	Surface water	Station Y	9-13-69
Family Corixidae (Water boatman)	Water	Lake outlet	9-13-69
Order Trichoptera (Caddis flies) (Cases only)	Mud	Generally distributed	
Order Coleoptera (Beetles)			
Hydrophilus (Water scavenger beetles)			
H. triangularis	Surface water	Station Y (On floating algae)	8-7-69
Order Diptera (Flies, mosquitoes, and related forms) General	Water	Large section of lake	10-21-69
	Mud	Large section of lake	8-4-70
Family Culicidae (Mosquitoes, phantom midges)			
Culex (Mosquitoes)	Water	Lake outlet	9-13-69
Chaoborus (Phantom midge)	Water	Large section of lake	4-15-70
	Surface water	Near Canal inlet	6-13-70
Family Tendipedidae (Chironomidae) General	Water	Large section of lake	10-21-69
	Mud	South channel	4-15-70
	Mud	Large section of lake	4-15-70
	Mud	South channel	8-4-70
	Mud	Large section of lake	8-4-70
	Mud	Small section of lake	8-4-70
Tendipes (Chironomus)	Mud	Lake side of weir	7-21-70

VERTEBRATES

Fish, Frogs, and Turtles

Largemouth and smallmouth bass, and bluegill sunfish were introduced into the lake in June of 1967. Because there was an abundance of worms, eggs and larvae of insects, because plants kept the water well aerated while furnishing protected areas for eggs and young, and because fishing was discouraged, conditions were nearly perfect for propagation. The bass, some already sizable when put into the lagune, became very large, and the young, numerous and healthy.

Bluegill sunfish continued to thrive by forming nests in the shallows around the shore, away from their predators, the bass, that preferred the deeper area.

Two other kinds of fish found their way into the lake. Shiners travelled together in schools back and forth near the inlets; and bullheads, the eggs of which were probably carried on the feet and feathers of water fowl, became plentiful later on.

The frogs were mostly leopard frogs. The dominant sound on campus in the spring of 1969 was that of the peepers. Little boys found enough pollywogs around the outlet weir to keep them returning. Little frogs splashed into the water throughout the summer, and large frogs were often seen snapping up a damselfly, or having satisfied their hunger, resting on the sunlit shore. Turtles, though rarely seen, left large shallow depressions in the soft mud just barely covered with water.

Because of the abundance of fish and frogs in the lake; kingfishers, hawks and mammals visited it day and night through the seasons.

VERTEBRATES[1]*—FISH AND FROGS*

Class Teleostomi (Osteichthyes) Bony Fishes
Subclass Actinopterygii

Order Cypriniformes
Suborder Cyprinoides
Family Cyprinidae
Notropis, Shiners

Order Perciformes
Suborder Percoidei
Family Centrarchidae, Bass Family
Micropterus
M. dolomieui Lecépède, Smallmouth Bass
M. salmoides Lecépède, Largemouth Bass

Lepomis
L. macrochirus Ratinesgue, Bluegill Sunfish

Class Amphibia, Amphibians
Subclass Apsidospondyli
Superorder Salientia
Order Anura
Suborder Diplasiocoela
Family Ranidae
Rana Linnaeus
R. pipiens Schreiber, Leopard Frog

Sharing the Campus with the Birds, 1969

Monroe Community College Campus is a haven for wildlife, a peaceful oasis surrounded by population centers. A lagune encircling a small island inhabited by muskrats, mirrors the ever changing heavens. Sunlight dances

1. Classification based on W. F. Blair, A. P. Blair, P. Brodkorb, F. R. Cagle, and G. A. Moore, *Vertebrates of the United States,* Ed. 2 McGraw-Hill Book Co., New York, 1968.

upon its surface, while above it barn swallows cross and recross in effortless flight.

Although as early as March 18, great V's of geese moving noisily above the campus heralded the spring, the wild beauty of the area was at its height during the summer of 1969. Three stands of trees, mostly maples, ash, spruce, and oaks, furnished shelter, nesting sites, and concert hall for a variety of colorful songsters. From the stark branch of an elm bordering the lagune a kingfisher established a look-out from which it kept a wary eye on the waters below, plunging and returning to its watchtower with some ill-fated frog or fish. To the north of this woodland, stretched a grassy area through which a shallow stony stream flowed into the lagune and still further north a swamp extended, where among the cattails in early July, redwinged blackbirds showed off their "deep scarlet epaulets" as they settled on weeds seemingly too frail to give them support. Since no day classes were being held during the summer of 1969, and as construction continued in the wall of buildings, the campus was left to the birds, the deer, and the little furry creatures that scurried among the elbow-high thistles, daisies, chicory, and meadow grasses that bowed in rhythmic waves in the breeze. Never again will the campus be so exquisitely natural.

Bird life abounded on campus. Killdeers soared gracefully high above, announcing their name, hurried jerkily along the bare spots in the meadows, raised their families, cooled themselves in the shallow stony stream, their favorite retreat in the oppressively hot days of summer, or drank in company with a pair of mourning doves at the edge of the lake. The killdeers were the most evident birds throughout the spring and summer, competing in numbers with the barn swallows. More than any other birds, they seemed to enjoy their summer on campus. Startled pheasants flew from the high grasses sometimes five at a time, or led their little ones across a road into the shelter of a grassy swamp. In early morning or late afternoon, a chorus of songs and calls of warblers, robins, catbirds, woodpeckers, wood pewees, mourning doves, mixed occasionally with the raucous calls of grackles, and the caws of crows issued from the woodlot. From time to time, a pair of goldfinches or a cardinal flashed colorfully by as they forsook the woodland for the privacy of a solitary bush.

Water birds enjoyed briefer stays on campus. One day during the summer, when parts of the campus were being plowed, herring gulls settled down in such abundance that the area was white with them. Were they feeding on the larva of the coral-winged locust, adults of which were plentiful in the meadows? Whatever they were eating, they remained throughout the day, following the workmen. In late afternoon the gulls left and although the plowing continued for several days, they did not return that summer. In the middle of October, however, they reappeared for a short time in the morning for their twice yearly diet. From then on gulls occasionally soared above the meadows, but not until November 17 did they rest on the lake. One after another flew in until thirty-seven settled almost motionless on the cold waters. After a half hour of rocking on its waves all flew off and did not return.

Occasionally, a mallard chose LeRoy Lagune for a short swim. Once a group of seven circled the lake several times and then settled in the fields nearby. Grebes made their home on the lake for several weeks in fall during which time, when an appreciative audience gathered, they put on their diving show with great expertise.

Fall migrations reduced the number of species. A couple of mourning doves lived on campus most of the summer. In late August, they were joined by countless others that fed for a few days on the grassy lawn, and then departed for the south. By that time, most of the songbirds and the kingfishers had left, the barn swallows no longer soared across the lagune, and a group of juncos gathered near the woods as if to prepare for the winter. An occasional killdeer hurried across the sky as if fearful that its relatives were leaving it behind. The grebes had gone as mysteriously as they had come, but a robin sang joyfully from the woodland as if glad that, with the other noisemakers gone, its voice could be heard even if singing a farewell to summer.

In early December, a thin coating of ice blanketed the lagune and much too early winter set in on the campus. The birds that remained took winter on its own terms. Early every morning, crows in numbers crossed East Henrietta Road from their rookery to spend the day around the campus, and in the evening reversed their flight. Starlings and sparrows settled for a diet of weed seeds on stems above the snow. Later when LeRoy Lagune was covered with three inches of ice, a sparrow hawk sat alert on a post, its sharp eyes on the now white meadow, searching for an unsuspecting field mouse or sparrow. In February, sometimes a sharp-shinned hawk and sometimes a red-tailed hawk stationed itself on a dead limb overlooking the lake, and an occasional pheasant brightened the campus with its plumage.

Soon the wild geese would again be proclaiming the renewal of life around LeRoy Lagune. Again a succession of bird calls and bird colors would enliven the campus. The redwinged blackbirds would seek out their swamp, now somewhat reduced in size; the warblers would populate the woodlots, the swallows would renew their flights back and forth over the lake; the kingfishers would take up their observation posts and hopefully the happy sandpipers would choose again, Monroe Community College Campus.

One can but hope, as the college population grows and buildings spring up, in and around campus, that the swamps, woodlots, and lake will still furnish a welcome refuge to birds and mammals, and that large sections of campus will be forever wild.

VERTEBRATES[1]*—BIRDS*

Class Aves, Birds
  Subclass Neornithes, True Birds
    Superorder Neognathae, Typical Birds
      Order Gaviiformes
        Family Gaviidae, Loons
          Gavia
            G. immer (Brünnich), Common Loon

      Order Podicipediformes
        Family Podicipedidae, Grebes
          Podiceps
            P. auritus (Linnaeus), Horned Grebe

      Order Ciconiiformes
        Family Ardeidae, Herons and Bitterns
          Ardea
            A. herodias Linnaeus, Great Blue Heron

      Order Anseriformes
        Suborder Anseres
          Family Anatidae, Swans, Geese and Ducks
            Branta
              B. canadensis (Linnaeus), Canada Goose
            Anas
              A. platyrhynchos Linnaeus, Mallard
              A. rubripes Brewster, Black Duck
            Aythya
              A. collaris (Donovan), Ring-necked Duck

      Order Falconiformes
        Suborder Falcones
          Superfamily Falconoidea
            Family Accipitridae
              Subfamily Accipitrinae, Bird Hawks
                Accipiter
                  A. striatus Vieillot, Sharp-shinned Hawk
              Subfamily Buteoninae, Hawks and Eagles
                Buteo
                  B. jamaicensis (Gmelin), Red-tailed Hawk
                  B. lineatus (Gmelin), Red-shouldered Hawk
              Subfamily Circinae, Harriers
                Circus
                  C. cyaneus (Linnaeus), Marsh Hawk
            Family Falconidae, Caracaras and Falcons
              Subfamily Falconinae
                Falco
                  F. sparverius Linnaeus, American Kestrel (Sparrow Hawk)

      Order Galliformes
        Suborder Galli
          Family Phasianidae, Quails, Pheasants, and Peacocks
            Phasianus
              P. colchicus Linnaeus, Ring-necked Pheasant

1. Classification of birds based largely on the *Check-List of North American Birds,* American Ornithologists Union, Ed. 5, 1957 (second printing with minor corrections 1961); The Lord Baltimore Press, Baltimore, Md. and Thirty-second Supplement, *The Auk,* April 1973, pp. 411–419; and also on Wetmore, A.; *A Classification for the Birds of the World.* Smithsonian Miscellaneous Collections. Vol. 139. Number 11. pp. 1–37, 1960. [Note added by Editor]

Order Gruiformes
  Suborder Grues
    Superfamily Ralloidea
      Family Rallidae, Rails, Gallinules, and Coots
        Fulica
          F. americana Gmelin, American Coot

Order Charadriiformes
  Suborder Charadrii
    Superfamily Charadrioidea
      Family Charadriidae, Plovers, Turnstones, and Surfbirds
        Charadrius
          C. vociferus Linnaeus, Killdeer

  Suborder Lari
      Family Laridae, Gulls and Terns
        Larus
          L. argentatus Pontoppidan, Herring Gull

Order Columbiformes
      Family Columbidae, Pigeons and Doves
        Zenaida
          Z. macroura (Linnaeus), Mourning Dove

Order Coraciiformes
  Suborder Alcedines
    Superfamily Alcedinoidea
      Family Alcedinidae, Kingfishers
        Megaceryle
          M. alcyon (Linnaeus), Belted Kingfisher

Order Piciformes
  Suborder Pici
      Family Picidae, Woodpeckers
        Colaptes
          C. auratus (Linnaeus), Common Flicker
        Melanerpes
          M. erythrocephalus (Linnaeus), Red-headed Woodpecker

Order Passeriformes
  Suborder Tyranni
    Superfamily Tyrannoidea
      Family Tyrannidae, Tyrant Flycatchers
        Contopus
          C. virens (Linnaeus), Eastern Wood Pewee

  Suborder Passeres
      Family Alaudidae, Larks
        Eremophila
          E. alpestris (Linnaeus), Horned Lark

      Family Hirundinidae, Swallows
        Hirundo
          H. rustica Linnaeus, Barn Swallow

      Family Corvidae, Jays, Magpies, and Crows
        Cyanocitta
          C. cristata (Linnaeus), Blue Jay
        Corvus
          C. brachyrhynchos Brehm, Common Crow

      Family Turdidae, Thrushes, Solitaires, and Bluebirds
        Turdus
          T. migratorius Linnaeus, American Robin

      Family Sturnidae, Starlings
        Sturnus
          S. vulgaris Linnaeus, Starling

      Family Ploceidae, Weaver Finches
        Passer
          P. domesticus (Linnaeus), House Sparrow

Family Icteridae, Meadowlarks, Blackbirds, and Orioles
Agelaius
A. phoeniceus (Linnaeus), Redwinged Blackbird
Euphagus
E. carolinus (Müller), Rusty Blackbird
Quiscalus
Q. quiscula (Linnaeus), Common Grackle

Family Thraupidae, Tanagers
Piranga
P. olivacea (Gmelin), Scarlet Tanager

Family Fringillidae, Grosbeaks, Finches, Sparrows, and Buntings
Richmondena
R. cardinalis (Linnaeus), Cardinal
Spinus
S. tristis (Linnaeus), American Goldfinch
Junco
J. hyemalis (Linnaeus), Dark-eyed Junco

Mammals

The woodlots and the unplowed meadows of the early days on campus were hospitable to the furry animals and the addition of the lake made foraging more successful. Looking down from the college windows, a group of deer could occasionally be seen. Their tracks could be followed after a fresh snowfall. Fox tracks, also, led to the banks near the north inlet and fox hairs were sometimes left behind as the animals rolled in the snow. At night, raccoons ventured into the surrounding roads. Early in the morning, woodchucks, more approachable than most of the mammals, foraged in the campus meadows, peered over the high grasses, or sat outside their holes people-watching.

Muskrats swam across the lake to the banks of the island, or, during the spring thaws, sat on the ice ledges, ready to capture a fish from the cold waters. They built homes of cattails in the nearby swamp.

Deer mice found their way into the college classrooms or left traces in the snow which told of their wanderings and their tragedies.

VERTEBRATES—MAMMALS

Class Mammalia
Subclass Theria
Intraclass Eutheria
Cohort Glires
Order Rodentia
Suborder Sciuromorpha
Family Sciuridae
Subfamily Sciurunae
Marmota
M. monax (Linnaeus), Woodchuck

Suborder Myomorpha
Superfamily Muroidea
Family Cricetidae, New World Rats and Mice
Subfamily Cricetinae
Peromyscus, Deer Mouse
Ondatra
O. zibethicus (Linnaeus), Muskrat

Cohort Ferungulata
  Order Carnivora
    Suborder Fissipeda
      Family Canidae
        Vulpes, Fox
      Family Procyonidae
        Procyon
          P. lotor (Linnaeus), Raccoon

  Order Artiodactyla, Even-toed ungulate
    Suborder Ruminantia, Ruminant
      Family Cervidae
        Odocoileus, American Deer

THE WEB OF LIFE IN LEROY LAGUNE

The common need for oxygen and food join the lake dwellers in an intricately interwoven dependence which tends to keep the organisms in a delicate balance and to maintain the quality of their watery habitat. Every lake is unique as each biotic community differs in its food producers, consumers, and decomposers.

The lake floor furnishes minerals for the food producers, anchorage for plant roots, and surface for deposition of detritus. Calcium, potassium, and magnesium ions adhere to the fine clay particles, preventing their loss through leaching, while the nitrogen and phosphorus compounds and carbon dioxide are released from the humus by the basic decomposers. The breakdown of organic matter is aided by the protozoa, worms, crustaceans, and midges. As a result, the lake contains the raw materials required by plants.

The aquatic flora, particularly the numerous algae, produce food for the fauna. The fruits of *Marsilea* and *Myriophyllum* are eaten by the visiting ducks while the roots and stalks of cattails are devoured by the muskrats. The energy of the sun which approaches four million horsepower on LeRoy Lagune's surface, captured by the complex molecules of chlorophyll, flows in a continuous but ever decreasing stream from the protozoans and the smallest of the metazoans, the rotifers, through the worms, the crustaceans, the snails and the insect larvae, to the largest of the lake's carnivores, the bass, as each consumer feasts on the organisms smaller than itself, and is in turn preyed upon by the larger animals. Protozoa are eaten by hydra, rotifers, flatworms, and crustaceans. Water fleas and cyclops furnish food for young midges, water beetles, damselflies, and dragonflies. These in turn are hunted by fish, tadpoles, and waterfowl. The splash of the kingfisher, diving from its branch, or the swan-dive of a grebe, may signify the death of a fish or a tadpole, while the tracks of a fox on the snowy bank may suggest the fate of smaller mammals. This passing of energy stored in food nutrients from plants through a series of consumers constitutes an intricate food chain, the links of which are fragile.

At no time is one aware that life within the microcosm is fraught with danger. Instinctive caution, agility, color, or other special adaptations of each species keep the lake dwellers thriving, in spite of their ever present enemies. The struggle prevents one species from predominating as long as there is no radical change in the external environment. While the number of different kinds of organisms in LeRoy Lagune is indicative of its youth and the quality of its water, the over-growth of the water milfoil and the filamentous algae show a lack of perfect balance. Every year, however, more and more waterfowl, which feed on these materials, visit the lake and remain for a greater length of time, helping at least slightly, to mitigate this over-production.

It is not surprising that the web of life in a lake with its intricate cross connections enmeshes the interest of the student of nature as completely as the delicate web of the spider catches the fly. The beauty and variety of creatures, their activities, their competition, their fitness for the lives they lead, their effects on their environment and the ways they are altered by it, are enticing mysteries only a few of which have been unfathomed. The many aspects of a lake and the activities of the life within it make it a source of inexhaustible interest.

METHODS USED IN THE STUDY

Shore-line Survey, Length, Width, Depth, Area, and Volume of the Lake

The magnetic bearing of the lake was determined by means of a transit operated by Gerard Kerwin, a student in the Civil Engineering course at Monroe Community College in the summer of 1969. A base line was established from a point on the shore near the southwest corner of the lake. A transit placed at this point was used to site the north edge of a light pole near the southeast corner of the lake in a triangular plot of grass which divides the road. Along this line, stakes hammered into the ground at intervals of fifty feet were numbered from 0+00, the initial transit station, to 11+50, a point in the road east of the lake.

From these numbered stations, or from a point on the bank perpendicular to the base line at these stations, using transit and stadium rod, distance readings were taken to the near and more remote shores, to the extremities of the lake, and to the east and west limits of the island, and readings of depth and elevations of the floor were taken across the lake. Readings were taken in 1970 to determine how fast the elevation of the lake floor was changing. All data were recorded on a sketch of the lake and in the notebook of the transit operator. Since depths were shallow, the stadium pole rested on the lake bottom for all soundings. For determination of circumference, for some of the island measurements, and for some shoreline configurations, a 100-foot steel tape was employed. An enlarged tracing of an aerial survey map constructed in 1967 by the Department of Public Works of Monroe County, and the Finish Grading Plans #4, 5, and 6 of Monroe Community College Campus prepared by Lozier Engineers, Inc. (Caudill, Rowlett and Scott, New York, New York Co-ordinating Architects) were referred to in comparing the shape of the lake with our measurements. An outline map was drawn on graph paper to the scale of one inch for every fifty feet. The area of the lake was determined by counting the number of squares enclosed by the outline. The elevation readings were transferred to the map and contour lines drawn. Copies were made of this map for use by those studying the lake. The maximum depth of the lake was read when the water just overflowed the wall of the east weir. Since the shore sloped from some twenty to thirty feet from the bank, the readings beyond twenty feet from the shores were used in determining average depth. The area when the lake was at maximum elevation was multiplied by the average depth to determine the volume.

Temperature Readings

For surface temperature readings, a thermometer graduated to 0.2° C. and checked for accuracy, was hand held. Readings were taken every 25 feet along the shore, and at the various collecting areas throughout the study. For bottom readings, the thermometer was fastened to a liter sampling bottle, which was secured in a heavily weighted plastic pail. The thermometer was read at the collecting site while in the sample water.

Bottom Materials

Bottom samples were taken at the stations and on the dates indicated in the tables, using a 15 centimeter square Ekman bottom dredge which closed by means of a messenger. The dredge was emptied into plastic bags, which were tied and labelled with date, depth, temperature and location. A pint of the material, which had been well mixed, was sieved in the laboratory by means of a stream of tap water through graded sieves #10, #40, and #100 mesh. The material in each of the #10 and #40 sieves were washed into large white porcelain pans and examined under a Bausch and Lomb binocular microscope with a 10X ocular and under a Bausch and Lomb medical microscope equipped with a 10X ocular and 10X, 40X, and 100X objectives, a built-in transformer-powered illuminator, a calibrated ocular micrometer, and a mechanical stage. The larger species were transferred to shallow dishes, counted, identified, and preserved in 95% alcohol. Smaller specimens were identified under the medical microscope using the tables and descriptions in books listed in the bibliography. Several measured portions of the material from sieve

#100 were examined under the compound microscope. An unsieved pint of each sample of earth was preserved in formalin until the study was completed.

Chemical Methods

LaMotte Chemical Test Kit, Model AM-11 and additional LaMotte chemicals were used and the enclosed directions followed. A modification of the Winkler method for dissolved oxygen was employed. The water for the dissolved oxygen and the free carbon dioxide tests was collected in the small plastic bottles provided in the kit, which were weighted to bring them quickly to the bottom. They were stoppered under water, care being taken to eliminate all air bubbles. Where depth permitted, bottles were hand held and opened and closed by hand. Tests for free carbon dioxide were made in the field and the tests for dissolved oxygen were completed in the boat or in the shore until sulfuric acid was added. The oxygen tests and the other chemical tests were completed on reaching the laboratory near the lake. Color comparators, furnished by LaMotte were used for pH determinations. Tests were made on the dates indicated in the tables for alkalinity, dissolved oxygen, free carbon dioxide, magnesium and calcium hardness, chlorinity and salinity and hydrogen ion concentration.

Plankton Methods

All samples were taken during the day on the floor of the lake unless otherwise stated. Wide-mouthed, liter bottles with glass stoppers which could be removed mechanically were fastened into weighted plastic pails which permitted them to be lowered rapidly and to fall on their sides. They were brought up rapidly and the first two inches of water removed. After thoroughly mixing each sample, measured amounts of the October 21, 1969 water from each station was centrifuged in a Junior electric centrifuge operated at the speed of 10,000 rpm. The volume of the solid material and its weight per liter were determined. The later samples were measured, and filtered through No. 50 Whatman filter paper without suction. The material was washed from the filter paper into small white porcelain dishes using measured amounts of distilled water. Other portions of the water samples were allowed to settle and some of the bottom material pipetted into the porcelain dishes and onto microscopic slides. The binocular and medical microscopes were used to identify the organisms, sometimes to genus; sometimes to species and variety. No study was made of the bacteria. Organisms were sketched on 5 x 7 cards and some photomicrographs were taken. A Sedgwick-Rafter counting cell, Wildco 1801 with coverglass 1802, was employed for counts and a calibrated ocular micrometer, for measurements.

Odonata

The principal study of the dragonflies and damselflies was carried on during the summer and fall of 1969 with additional observations and some collecting in 1970. As far as could be ascertained, specimens of all species of the Odonata which visited the lake were collected, identified, and mounted. The mounted dragonflies were photographed by Mr. Ray Treat, the chief photographer at Monroe Community College.

Higher Plants

Plants were collected from the lake, its banks, and the campus meadows and woodlots near the lagune. Some of these were pressed for an herbarium collection and some were photographed.

Fish, Amphibians, Birds, and Mammals

The fish and the amphibians mentioned in this study were those living in or near the lake. Some of these were collected, identified and preserved. The birds were those observed in or near the lake and the mammals were those which lived around the lake or visited it in search for food.

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CITATIONS IN THE ROCHESTER ACADEMY OF SCIENCE

1970

(In Volume 12, No. 2, the citations listed for 1970 inadvertently were those read in 1971.)

Wayne M. Harris
Honorary Member

Our Academy is dedicated to the advancement of balanced scientific progress, technological and environmental. A golden mean must be found because Man flourishes on the sap of Nature and would perish if rooted in machine oil. Many of us who despair over our seeming impotence against certain aberrant forces of civilization should take heart in the tremendous accomplishments of one man.

With his background as a lawyer and a member of a Rochester law firm, he has been able to alert, badger, and cajole our busy legislators into action. He has been advisor to the New York State Assembly Committee on Conservation, Natural Resources, and Beautification for several years. The trend toward the destruction of our natural assets has been reversed in numerous encouraging incidences. Many areas—fouled or in danger of becoming so—are being saved for recreation. Regional waters, like Irondequoit Bay, Genesee River, Ontario Beaches, Canandaigua Lake, the Canal, and Honeoye Creek, have benefited from his energy. He is also involved in wider programs dealing with clean air and water, such as those concerned with the Great Lakes. Years of future diligence are needed. This is ensured by the support he has attracted from many effective civic groups. They have recognized his effort with their highest awards.

The Academy wholeheartedly wishes to join in recognizing, and sustaining with our Honorary Membership, his invaluable endeavors.

John Tuzo Wilson
Honorary Member

The hour-hand slow drift of the world's continents has only recently been proved. The scientific insight that first advanced this reality has been dubbed "geopoetry." And, as it is with all recorded poetry, repeated reading has revealed the truths in the apposition of tremendous forces and the lapse of immense periods, with the tick of human affairs. For it is vastness that describes the fantastic geological mechanisms now being discovered, and which are separating pieces of an original land mass. They can no longer be ascribed to flights of fancy.

Our Candidate is one of the leaders in exploring the theories and in gathering and assembling the pieces of data that reconstruct the fact. As a geologist, surveyor, and professor of geophysics in the University of Toronto, he personally knows his subject from Pole to Pole. He has visited 100 of the divisions called nations that Man has made on the Earth. His unconcern for such artificial partition is probably expressed by his finding no incongruity in sailing the Great Lakes in a Hong Kong junk.

He has written three books and over 100 scientific papers. As member, fellow, vice-president, president, and trustee of ten professional and erudite organizations, he actively engages in furthering the collection and the interpretation of information about our environment, the Earth.

For fitting together the pieces of data that solve the greater jig-saw of the continental picture, we are proud to confer Honorary Membership upon him.

Henry E. Byers
Fellow

Our Academy is made up of interested Members and dedicated Officers. This Candidate partakes of the enjoyment of the first and does the hard work of the second. He began his career as a physicist with the Eastman Kodak Company, and it is understandable that he should become interested in our Mineral Section. Following a period of naval duty, he obtained degrees in law and in economics. He is now senior patent attorney for the Company. With such a background, he has been able to help the Academy in affairs dealing with its constitution and incorporation.

He has served as Vice-chairman and Chairman of the Mineral Section, as well as enjoyed field trips, collecting, and other activities. As Chairman, he devoted countless hours to the detailed preparation required for hosting the 19th Annual Convention and Show of the Eastern Federation of Mineralogical and Lapidary Societies, 1969. The Academy's participation in this extensive affair will be remembered as a highly successful venture.

For service that has contributed to the effectiveness and prestige of our Academy, we gratefully extend our honor of the Fellowship.

Ian McLennan
Fellow

The purview of our Academy is mainly the natural sciences of Rochester and its environs. This puts the stars somewhat beyond our territorial limits—unless they are brought to Rochester. And this is what our Candidate has done. He planned the Strasenburgh Planetarium for the Rochester Museum and Science Center and now directs its operation.

He is well qualified as designer because he has inspected planetariums all over the world and studied styles of public presentation in numerous museums, world fairs, and trade shows. The unit here and its programming constitute a leading event in planetarium technology.

His flair for presenting information about the Universe stems from a background in news photography and reporting, and in producing radio and television programs, in his native Canada. Essential knowledge of astronomy was gained from studies and the teaching of astronomy at the University of Alberta.

As the new Executive Director of the Museum, he plans to coordinate all facilities and to develop sections on environmental science and on discovery for children.

For enabling us to reach for the stars without losing the comforting feel of Earth, we proudly welcome him as a Fellow.

Laura Wyand Moon
Fellow

The Academy is very firmly joined with those who are concerned about the decline of our natural environment. Our Candidate focuses attention on what our loss might be by practicing the enjoyment of Nature she evokes in others. As editor of *The Goshawk* for the Genesee Ornithological Society for many years, as a vigorous advocate for the El Dorado Shore Nature Sanctuary and the Bergen Swamp Preservation Society, as an instructor in ornithology for the Rochester Museum and Science Center, as public relations officer for the Rochester Academy of Science and the Burroughs Audubon Nature Club, as a leader at the Allegany Nature Pilgrimage, and in many other ways, she has instilled the love of Nature in countless people.

Her interest is not confined to birds alone. She is one of the relatively few who has climbed all of the 111 mountains of 4,000 feet and over in Maine, New Hampshire, New York, and Vermont, and who has climbed the near 15,000-foot altitude of Mount Whitney. She is a member of more than a dozen groups with interests in botany, gardening, conservation, art, and music, as well as mountaineering and ornithology.

She often retreats to the sanctuary of Nature yet has not forgotten the sustenance provided by civilization and society. She has been a nurses' aide for the Red Cross and has performed many tasks for the League of Women Voters.

For helping us to realize the spiritual need for living with Nature instead of merely living off it, we are happy to make her a Fellow.

1972

Cornelius S. Hurlbut
Honorary Member

When the rocks in the obliterating fires of the Earth cooled, many elements reclaimed part or all of their identity and left us a treasure chest of resources and beauty. It is easily understandable that the study of minerals attracts us. Our candidate has spent his professional life advancing knowledge about the location, structure, and composition of minerals.

After an undergraduate degree from Antioch College in 1929, he completed his doctorate in 1933 at Harvard University, where he has been teaching ever since. He is now Professor of Mineralogy and past Chairman of the Department. He is well known for his contributions to one of the most valued textbooks in the field—Dana's Manual of Mineralogy. He has authored numerous scientific papers and books and described several new minerals. Gracing these accomplishments is his ability as a teacher. In 1966 he received the Neil Miner Award of the National Association of Geology Teachers. He holds memberships and honors in the world's leading geology and mineral societies, as well as a 1955 Guggenheim Fellowship.

That he is still as enthusiastic as ever is evidenced by a 1971 journey with his wife going from Hawaii westward to New Zealand, Australia, across Asia, and on to Africa. Trips and brief stops were made in these countries for the purpose of visiting mineral localities, observing geological features, and photographing both. It is easy to realize why his teaching is so personal and effective.

For reading and translating the books written in the rocks, we are happy to welcome him as an Honorary Member of the Rochester Academy of Science.

Clarence W. Gehris
Fellow

All of our resources are not mineral, for on the rocks flourish the plants and animals. Here are our bonanzas of food and pure air. In mining and working the minerals we must learn not to destroy the plants. Our candidate's interest in the environment began when he was a boy roaming the forests and streams not far from the Hawk Mountain in Pennsylvania. Today that interest dominates his professional and private life. Not only does he teach the importance of biological study but also advises the Monroe County Environmental Management Council as volunteer Chairman. The slowness in many circles of realizing the need for ecological improvement makes both phases of his activity vital.

He earned an undergraduate degree at Temple University and his doctorate at Pennsylvania State University. Some years were spent teaching biology and chemistry. He is now Professor in the Department of Biological Sciences at New York State University College in Brockport. He has been long active in our Academy, a contributor to the Proceedings, and President.

His special interest is studying the development of plant communities since the recession of the glacial ice. Ancient pollen in the boggy archives of the Bergen-Byron Swamp reveals that the post-glacial period in western New York is about 1,000 years longer than previously thought.

He has brought to light pollen that has lain fossilized and unfulfilled for millenia, yet which is capable of fertilizing the imagination of present-day scholars. We are pleased to greet him as a Fellow.

Richard G. Hoppe
Fellow

Children have an unspoiled interest in their environment. And wise is the parent who encourages it. When his children became involved in Scouting, and particularly in mineralogy, our candidate joined the rock generation. The natural focus for their interest was the Mineral Section of our Academy. Here, lectures, fellowships, and field trips provided informative and pleasant activity. Our colleague has contributed much to the accomplishments of the Section and is the current chairman. With photographs taken on trips to gem and mineral locations, thinly disguised as vacations, he has provided scientific programs for his associates.

Indirectly he is an educator, for the aims of our Academy are largely educational. One of the efforts of the Mineral Section is to help in the hosting of ventures like the Annual Convention and Show of the Eastern

Federation of Mineralogical and Lapidary Societies, Incorporated. He was the Treasurer and Executive Chairman of the 1969 event in the Rochester War Memorial. Again, probably without realizing it, he contributes to the effectiveness of educational visual aids, because he is a quality-control engineer in color photography for the Eastman Kodak Company.

For recognizing that it is the education which begins at home that blossoms most fruitfully in the schools and universities, we are proud to make him a Fellow.

Mary Ann Sunderlin
Fellow

Of vital ecological importance are the birds. Each year several hundred million of them migrate across America. Their foraging constitutes the biggest single factor in insect and rodent control. The efforts of amateur ornithologists like our candidate are indispensable in publicizing the worth of such flocks and in drawing attention to the man-made perils that threaten them, and us. Her affinity for conserving our natural heritage is her family heritage. As a girl she grew up in woodland, which she still preserves. She was taken to conservation meetings—such as those organized by the Adirondack Mountain Club in the thirties—that, long before there was a general public and political awareness, drew attention to what we are in danger of losing.

Her family was active in the first local Christmas bird count. She too has given up the comforts of the Yule log for the satisfying excitement of the brisk December woods. She worked hard to obtain donations for the Nature Conservancy Project at El Dorado Shore on the eastern shores of Lake Ontario.

She is past President of the Genesee Ornithological Society, co-editor of *The Goshawk,* and Vice-president of the Federation of New York State Bird Clubs.

Her formal education was obtained at the University of Rochester and at Brockport. She is fourth grade teacher in the Durand Eastman School. Needless to say, her pupils get liberal sprinklings of conservation on their three R's. They enter into nature study and projects with happy enthusiasm. She gives them more than facts. To hold a fact without an appreciation of its meaning is to be a bird without wings.

For all these accomplishments and for motivating a son who is planning to enter a university course in the new field of environmental engineering, we warmly receive her into our circle of Fellows.

1973

Allen E. Kemnitzer
Fellow

The activities of our Academy demonstrate that scientific practice is not confined to laboratories with wall-to-wall panels of searching dials and electronic octaves of responsive buttons. Every layman who observes nature around us is a scientist—from a baby fascinated by an ant crawling up its leg, to an adult unconcerned with the cold of a Christmas bird count. Nor is scientific writing confined to professional reporting. Witness the amount of print that indicates the basic lay desire for environmental awareness.

Our candidate, who retired from Jefferson High School in 1971, with degrees from State Teachers' College in his home town of Buffalo and from the University of Rochester, has been a teacher for over 40 years, formally—and informally during the same period of time. He wrote the weekly bird report in the Democrat and Chronicle for several years. He has contributed numerous features, articles, and reports to the Kingbird for the Federation of New York State Bird Clubs, and to *The Goshawk* for the Genesee Ornithological Society. For the F.N.Y.S.B.C. he has been Auditor; and for the G.O.S., Treasurer and President. He is a member of 8 national and regional ornithological societies and has been on the statistics committee of the Genesee Ornithological Society for 18 years.

His personal qualifications are impressive. He lists 545 species of birds observed. A great ornithological thrill came on a May morning in Webster Park after 3 years of questing. He sighted 120 American Whimbrels on their way to the Arctic. Not only has he observed birds, but also photographed them and studied their song.

Anyone with an eye keen enough to distinguish whimbrels from immature long-billed curlews, with an ear sharp enough to distinguish a black-and-white from a Cape May warbler, with a mind clear enough to realize the need for keeping tuned to nature, and spirit enough to influence his fellows along these lines, merits full citation. Our degree of Fellow does this in part.

Frank A. Myers
Fellow

Museums, zoos, civic groups, teachers and parents get children involved in nature study. Sometimes children get parents involved. Such was the case with our next candidate. When his Girl Scout daughter was earning her bird badge, he caught her communicable enthusiasm. Keeping one page ahead of her in the ornithology books he succumbed to bird fever—and still enjoys it. Then when rocks and minerals intrigued her, it was natural that they join our Academy and its Mineral Section and the Genesee Ornithological Society. His involvement continued when his son became interested in ornithology and malacology. Now a notable collection of sea shells vie with rocks for shelf space at home.

He and his wife are co-leaders of Senior Girl Scout Troop 123 and have introduced them to climbing mountains, including Marcy and Washington, and to rambling the Finger Lakes Trail. He is instructor and consultant for the Ranger Aide Program for the Girl Scouts of Genesee Valley, past Chairman of the Allegany Nature Pilgrimage; this year he has enlisted 40 leaders for 800 people. He is the retiring President of our Academy. His family's activities in the Burroughs Audubon Nature Club prompted his service as Treasurer for seven years and President for five years. He and his family have camped in 48 states and as far north as James Bay.

A graduate of the University of Rochester, he is a patent search specialist for Eastman Kodak Company. His backyard, in the heart of Rochester, is a boon to the birds for he has built a rocky waterfall. He and his son study the numerous visitors and his wife naturalizes wild flowers there.

For effectively demonstrating that there need be no generation gap, we are proud to honor his fine leadership with our degree of Fellow.

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