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Daniel J. Faber, Ed.

A HIGH SCHOOL FIELD AND LABORATORY STUDY OF LAC LAPÊCHE IN GATINEAU PARK, QUÉBEC, DURING MARCH, 1972

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A HIGH SCHOOL FIELD AND LABORATORY STUDY OF LAC LAPÊCHE IN GATINEAU PARK, QUEBEC, DURING MARCH, 1972

Edited by
Daniel J. Faber
Canadian Oceanographic Identification Centre

Syllogeus No. 4

National Museum of Natural Sciences
National Museums of Canada

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Ottawa, December, 1973

Resume

Eleven high school students participated in a special Ottawa and Carleton Board of Education work-experience programme in association with the National Museum of Natural Sciences during the week of 20-24 March, 1972. This programme was developed in order to give the students a better idea of what an aquatic or pollution biologist actually does in performing his or her job. The students spent their first two days at the Museum working together and learning how to use field limnological equipment for gathering samples from a lake, the next two days and one night were spent at the Haven Field School in Gatineau Park, Quebec, where they used the equipment to sample the plant and animal life and chemical characteristics of Lac LaPêche, and the last day of the week was spent back at the Museum analyzing the samples and completing their report. The Haven Field School is owned by the National Capital Commission of the Federal Government but is presently being loaned to the Ottawa Board of Education for outdoor education purposes.

The students were divided into four teams for the work, 1. Bottom Fauna, 2. Environment, 3. Microbiology and 4. Zooplankton. The Bottom Fauna team used an Ekman dredge to collect bottom samples and identified five different kinds of animals in the bottom mud of Lac LaPêche. Each mud sample showed a different composition and different numbers of animals. The Environment team determined a vertical profile of the water of Lac LaPêche for temperature, oxygen content, dissolved solids (or conductivity) and pH. In addition the bottom mud was analyzed for nitrogen, potassium, phosphorus, calcium and humus content. The Microbiology team determined the composition and abundance of phytoplankton and the bacillus *Escherichia coli*. They determined that the lake contained large numbers of algal cells from the surface to the bottom but only small numbers of the bacillus *E. coli* directly under the ice. The Zooplankton team used a plankton net to collect the microscopic animals in the lake water. They determined that five kinds of microscopic animals were extremely abundant in the lake despite the fact that the lake was frozen over.

Résumé

Entre le 20 et le 24 mars 1972, 11 étudiants du cours secondaire ont participé à une expérience de travail inédite, mise à l'essai par le Conseil scolaire d'Ottawa-Carleton et le Musée national des Sciences naturelles. Le programme visait à instruire les participants de la tâche du biologiste oeuvrant dans le domaine du milieu aquatique et de la pollution. Les étudiants ont d'abord passé deux jours au Musée, apprenant à se servir des instruments de recherche limnologique. Ils passèrent ensuite deux jours et une nuit à l'école de plein air Haven dans le parc de la Gatineau, où ils prélevèrent des échantillons de la faune et de la flore aquatiques, ainsi que de l'eau du lac LaPêche. La dernière journée de la semaine, ils étaient de retour au Musée, pour analyser les échantillons et rédiger leur compte rendu. L'école de plein air Haven appartient à la Commission de la Capitale nationale du gouvernement fédéral, mais celle-ci la prête actuellement au Conseil scolaire d'Ottawa-Carleton pour y faire des expériences d'enseignement dans la nature.

Quatre équipes se partagèrent le travail. La première s'occupait de la faune du fond, la deuxième de l'environnement, la troisième de la microbiologie et la quatrième du zooplancton. L'équipe du fond, utilisant un filet de drague Ekman, échantillonna les vases et y identifia cinq sortes d'animaux qu'on trouve au fond du lac. La nature de chaque échantillon était différente et le nombre des organismes présents variait. L'équipe de l'environnement établit un profil vertical des eaux du lac LaPêche afin de déterminer la température, le taux d'oxygène, celui des solides en solution (ou de conductivité), ainsi que le pH. En outre, on analysa la vase du fond pour en connaître la teneur en azote, en potassium, en phosphore, en calcium et en humus. L'équipe de microbiologie détermina la nature et la densité du phytoplancton et celle du bacille *Escherichia coli*. Elle s'est rendu compte de la présence d'un grand nombre d'algues microscopiques, de la surface jusqu'au fond, mais d'un très petit nombre de bacilles *E. coli* immédiatement sous la glace. L'équipe du zooplancton utilisant un filet très fin, récolta une faune microscopique, où cinq catégories d'animaux étaient extrêmement abondants en dépit de la glace qui recouvrait le lac.

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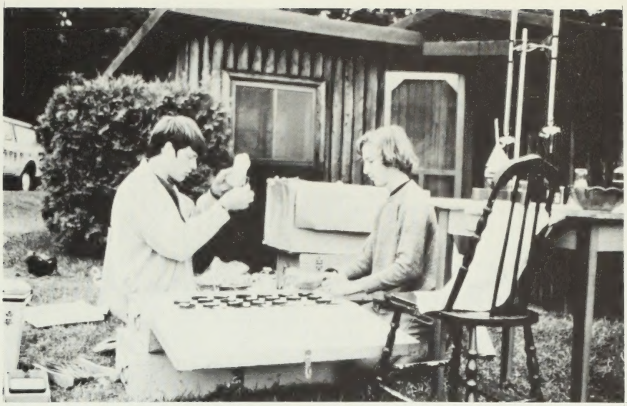

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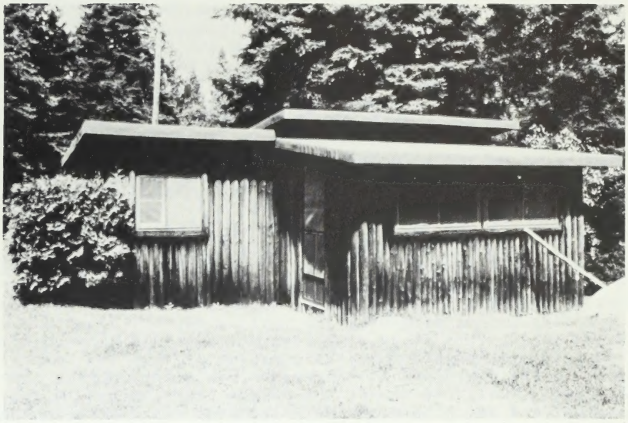

Fig. 4 Typical sleeping cabin available to students at the Haven Field School. (Neg. No. 73-14242)

PREFACE

Eleven high school students participated in a special Board of Education work-experience programme in association with the National Museum of Natural Sciences during the week of 20-24 March, 1972. The arrangements for this unique programme were jointly arranged between members of the National Museum of Natural Sciences (Dr. Faber from Zoology Division, Mr. Fournier from Information and Education Division) and the Ottawa Board of Education (Mr. Booth from Placement Services and Mr. Whiting from the Outdoor Education office). Previous work-experience weeks held at the Canadian Oceanographic Identification Centre, National Museum of Natural Sciences, involved only laboratory work, and in particular included a cursory examination of invertebrate and vertebrate animals from Canadian lakes, rivers and oceans. It was decided during this work-experience week in March to provide a combined field and laboratory programme in order to give the students a better idea of what an aquatic or pollution biologist actually does in performing his or her job. The sudents who participated in this programme had indicated an interest to work during their week off from school in such areas as pollution, marine biology, oceanography and microbiology.

After a preliminary meeting to introduce the planned activities, the interested students were divided into four teams for the week's work (bottom fauna, environment, microbiology and zooplankton). They spent their first two days of the work-experience week at the Museum working together and learning how to use field limnological equipment for gathering samples from a lake. The next two days and one night were spent at the Haven Field School in Gatineau Park where the students used the equipment to sample the plant and animal life and chemical characteristics of Lac LaPêche. On Friday and Monday they returned to the Museum where they analyzed the samples they had taken and completed their reports on their findings. This report is an edited version of their activities and scientific results.

The Haven Field School is located on Lac LaPêche in the northern part of Gatineau Park. It is owned by the National Capital Commission of the Federal Government but is presently being loaned to the Ottawa Board of Education for outdoor education purposes. The field school is composed of 12 log cabins and a main lodge, which contains a meeting hall, dining room and kitchen. The smaller cabins, which are suitable for overnight accommodations, are equipped with beds, mattresses, study tables and wash basins. Figures 1, 2, 3 and 4 show outside views of the main lodge and several log cabins. Although our group did not have the opportunity to use them, there are several nearby nature trails leading to numerous biological, geological, geographical, artistic and scenic areas.

Lac LaPêche which was used as the study lake because of its convenient location to the Haven Field School is the largest lake in Gatineau Park covering about 1680 acres. Figure 5 is an outline of the lake and shows the positions of the sampling stations and the location of the Haven Field School. Lac LaPêche is a complex lake with an irregular shoreline, extensive shallow regions, and deep basins attaining 100 feet in depth.[1] The lake was frozen over in March during this study with several inches of snow covering the ice.

In retrospect, it appears that the division of time that was allowed between work in the field and at the Museum was approximately correct for a week's programme, i.e., one day at the Museum learning how to operate the field equipment and being briefed (with lectures and discussion) on the next day's activities; two days at the lake taking the necessary samples and performing as many analyses of the collections as time permits; and two days back at the Museum completing the analyses and writing up the results.

1. Cuerrier, J.P. and M. Dadswell 1969. Limnology and experimental fishery management studies in Gatineau Park during 1968. Manuscript Report, Limnology Section, Canadian Wildlife Service, Ottawa.

We took two extra days to finish the reports owing to unexpected delays caused by inoperative equipment and inclement weather. I would recommend that supervisory staff carefully plan the programme in advance and introduce all the field procedures during the first day. Our programme was carried out with two part-time and one full-time staff members, two in the field phase (one trained in biology and one in education) and two in the Museum phase (both trained in biology).

Although the equipment that was used for this programme did not always function properly, it was entirely adequate. Since we did not have a budget to purchase equipment, we borrowed those items which were necessary from several agencies in the Ottawa region.

One of the major problems facing our technological and urban civilization is devising meaningful techniques of having the individual adopt a philosophy of conservation rather than exploitation and it is the responsibility of all educational institutions to assist in pursuit of this ideal. It is apparent that an important aspect of environmetal awareness is an appreciation of the actual environment and aquatic studies, as one of several possibilities, hold a particular fascination for many people. In addition this programme served to bridge the gap between formal education and research with high school students and scientists working side by side. It is recommended that Museums, as well as other educational institutions, use this programme as a model to instill in students an increased awareness in the fauna and flora of Canada. Staff of the National Museum of Natural Sciences will be happy to answer questions about this Lac LaPêche programme and to assist other institutions in developing similar ones.

Acknowledgements: I would like to acknowledge the support of the Ottawa Board of Education, the National Museum of Natural Sciences, the National Capital Commission, and the Canadian Wildlife Service. I would particularly like to thank the eleven high school students whose names appear in this report for without their undying interest and enthusiasm this project could never have been completed. Len Marhue, N.M.N.S., supervised students in the field at Lac LaPêche and in the lab at the Museum as well as helping with miscellaneous administrative duties. Alex Fournier, N.M.N.S., supervised students in the field as well as helping with miscellaneous administrative duties. Frank Booth, O.B.E., organized the work-experience week and coordinated it with the Museum. John Whiting, O.B.E., helped with coordination of the programme and with miscellaneous administrative duties. Jack Harrison, N.C.C., helped move equipment and personnel into the Haven Field School from the parking area. Dale Tozer, N.M.N.S., photographed the students' activities and J.P. Cuerrier, C.W.S., provided us with some limnological equipment. Despite the inclement weather during the field phase, all personnel accomplished their tasks in a more than satisfactory manner.

Daniel J. Faber
October, 1973

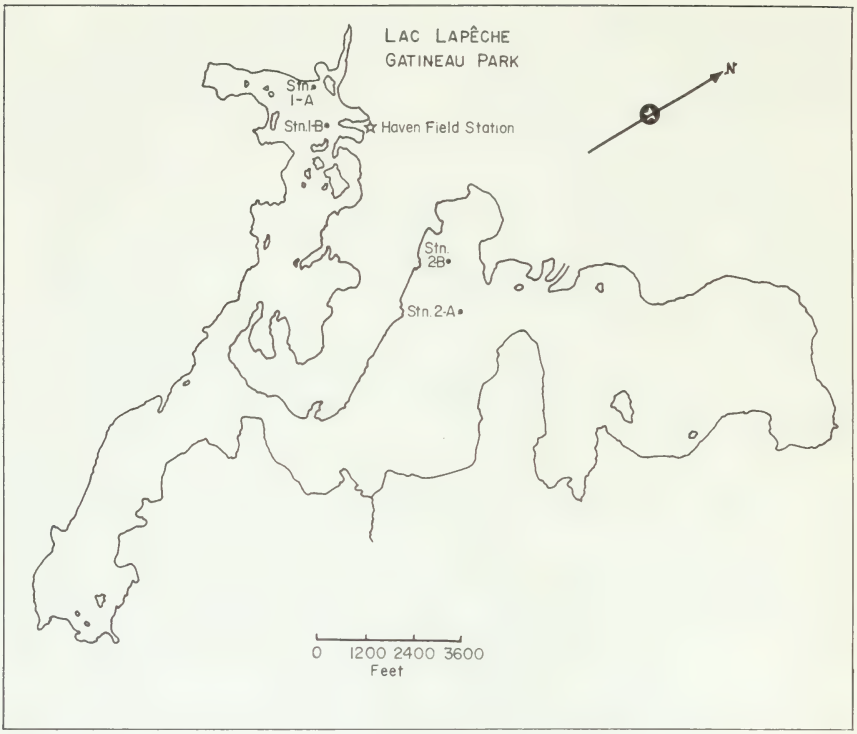

Fig. 5 Outline map of Lac LaPêche, Gatineau Park, Quebec, [illegible] sampled in March, 1972. (Neg. No. 73-17526)

I. BOTTOM FAUNA

Robert Hartnett, Gary Milne and Jane Sutherland

Introduction

The Bottom Fauna Group was assigned to collect mud samples from the bottom of Lac LaPêche and identify the small animals that were found in the samples. These animals were to be preserved, classified and put into labelled bottles. The abundance of bottom fauna in different parts of lakes can identify areas of high productivity as well as areas of pollution. In addition many fish feed exclusively on bottom invertebrate animals.

Methods and Materials

First of all we had to chop a hole through the ice with an ice auger. The most important piece of equipment was the Ekman dredge, which was tied with 33 metres of rope and lowered through the hole in the ice into the lake. Once the dredge reached the bottom, a steel messenger was sent down on the rope to close the jaws of the dredge. When they closed, it was brought to the surface and the collected mud was put into 24-oz. jars with water and enough formalin to make a 5% solution. A short gillnet was set along the bottom for several hours.

When we returned to the Haven Field Station, the mud was filtered through four metal sieves with mesh openings of 6.35 mm, 4.46 mm, 0.21 mm and 0.05 mm. The filtrate was brought back to the Museum lab in Ottawa where the animals were separated from the remaining mud by scanning small amounts of the sample under the microscope and picking each animal out individually. These animals were then classified and put into separate vials, adding the time, date, and station where they were found. Approximately 2½ hours were spent straining each 24-oz. mud sample. Sample *I* was taken at 1805 hours, sample *II* at 1813 hours, sample *III* at 1830 hours, sample *IV* at 1835 hours and sample *V* at 1845 hours on 22 March, 1972.

The equipment used is as follows:

Ice auger	24-oz. jars
Ekman Dredge (6" x 6")	Formalin (100%)
Nylon line	Nikon dissecting microscope
Messengers	Vials
Sieve bucket	Slides and cover slips
Gillnet (3/4 inch mesh)	Alcohol
Trays	Wild compound microscope
Forceps	4 metal sieves

The book used to identify the animals was *Guide to the Study of Freshwater Biology*.

Results

The mud samples were very black and contained many weeds. After filtering, the weeds were carefully picked out. Table *I*-1 shows the numbers of bottom animals collected in the Ekman grabs from Station 2B (see Fig. 5). Five groups of animals were found in the dredge samples. Diptera were overwhelmingly more abundant than any of the others. It is significant to note that almost five times as many animals were caught in sample *II* as in sample *IV*.

Diptera were quite variable among the samples ranging from 5 in sample *IV* to 39 in sample *II*. These Diptera are the larval stages of gnats or midges that will hatch in spring or summer.

Bottom fauna might also include the fish of the lake and one small yellow perch which measured 14 centimetres was caught at a depth of 6 metres in a gillnet set. The fish was dissected and found to contain mud in its stomach and broken diatoms in its intestine. These results suggest that the fish was feeding on the bottom.

Fig. 6. Setting a gillnet for the Bottom Fauna Group during the field programme at Lac LaPêche March, 1972, (left, R. Hartnett, right, G. Milne). (Neg. No. 72-1945)

TABLE *I*-1. An analysis of the numbers of bottom fauna collected in five samples with an Ekman dredge at Station 2B (depth 1.5 metres) in Lac LaPêche, Gatineau Park on March 22, 1972.

Animal Group	Samples *I*	*II*	*III*	*IV*	*V*	No. of Animals	Ave. No. Animals	Range	Standard Deviation
Diptera	12	39	15	5	8	76	15.8	5-39	13.43
Odonata	3	5	0	0	2	10	2.0	0-5	2.10
Amphipoda	3	1	2	2	1	9	1.8	1-3	0.09
Gastropoda	0	0	3	3	0	6	1.2	0-3	1.64
Trichoptera	0	1	3	0	2	6	1.2	0-3	1.34
Total No. of animals in sample	18	46	23	10*	13	110	22.0	10-46	14.3

*In addition 1 Acari was collected.

Suggested Readings For Bottom Fauna

Allen, R.T. 1970 The Great Lakes. Natural Science of Canada Ltd. Toronto 160 pp.

Carpenter, K.E. 1928 Life in inland waters, N.Y., N.Y. 267 pp.

Chu, H.F. 1949 How to know the immature insects. Wm. C. Brown Co., Dubuque, Iowa 234 pp.

Eddy, 1969 How to know the freshwater fishes, Brown Co., Dubuque, Iowa.

Macan, T.T. and E.B. Worthington 1951 Life in lakes and rivers, London, England 272 pp.

Morgan, A.H. 1930 Field book of ponds and streams N.Y., N.Y. 448 pp.

Needham, James and Paul Needham 1927 Guide to the study of Fresh-water biology. American Viewpoint Society N.Y., N.Y. 88 pp.

Pennak, R.W. 1953 Fresh-water invertebrates of the United States, The Ronald Press Co., N.Y. 769 pp.

Peres, J.M. date unknown La vie dans les eaux douces, "Que sais-je?" No. 233 Presses Universitaires de France, 108, Boulevard Saint-Germain, Paris.

Pratt, H.S. 1935 Manual of the common invertebrate animals, Revised edition Philadelphia, Penn. 854 pp.

Prescott, 1969 How to know the aquatic plants. Brown Co., Dubuque, Iowa.

II. ENVIRONMENT

Barbara Culham, Pierre Fournier, David Plewes and Dave Romanowicz

Introduction

The Environment Group was charged with the task of determining some of the physical and chemical parameters of the water of Lac LaPêche in the area of the Haven Field School.

Lac LaPêche is ringed by rather steep hills covered by mixed deciduous and coniferous forest. It tends to be shallow except for one basin that attains about 100 feet, and is divided roughly into four large basins. Much of the shoreline is rocky and steep but there are numerous rather shallow bays.

Methods and Materials

Stations 1A and 1B are situated in a basin of the lake that faces the Haven Field School (see Fig. 5). This basin which is at the foot of a large, steep, tree-covered hill tends to be shallow and marshy throughout. Stations 2A and 2B are situated in another large shallow basin.

WATER ANALYSES

The parameters measured were: depth, temperature, dissolved oxygen, dissolved solids, and acidity. The equipment used is as follows:

a. Depth - Rope marked every metre.
b. Temperature - Instrument probe was lowered at ½ metre intervals (Y.S.*I.* temperature gauge model 42SE and Mark *II* Martek Model A Water Quality Monitoring System).
c. Dissolved oxygen - Water samples from different depths were tested. (Hach testing kit, model OX-10 and Mark *II* Martek Water Quality Monitoring System).
d. Dissolved solids - Samples from different depths were tested. (Myron D.S. meter, model SI2T5).
e. Acidity - Water samples were obtained from different depths in a Kemmerer sampling bottle, then tested with a probe (Analytical pH meter, model 107 and Mark *II* Martek Water Quality Monitoring System, Model A).

The results of these analyses are listed in Tables *II*-1, *II*-2, and *II*-3.

BOTTOM MUD ANALYSIS

The parameters measured were acidity, nitrogen content, potassium content, phosporus content, calcium content and humus content. The Lamotte Soil Testing Kit, model STH-6, was used to perform all the analyses on the lake bottom mud. The results are listed in Table *II*-4.

Results

Table *II*-1 lists the characteristics of the vertical column of water under the ice at Station 1A (see Fig. 5). The results obtained on 22 March were determined with one piece of equipment (Hach Kit) while the 30 March results

were determined with another piece of equipment (Martek System). Table *II*-2 lists the characteristics of the vertical column of water at Station 1B and Table *II*-3 lists the characteristics of the vertical column of water at Station 2A. The methods used to determine the results in Table *II*-3 are the same as for Table *II*-1. Table *II*-4 lists the analyses of mud samples taken from the bottom at Stations 2A and 2B.

Fig. 7. Students collecting water samples for chemical analyses by the Environment Group during the field programme at Lac LaPêche, March, 1972 (left to right, J. Marois, P. Fournier, P. Bernath and G. Milne). (Neg. No. 72-1943)

Temperature: Two stations (1A and 1B) showed results that seemed reasonable, but station 2A gave results that appeared extraordinary. There appeared to be a thermocline (a rapid change in temperature) at a depth between one and two metres, and a bottom temperature of over 9°C. If this were an exact situation, then it was a transitory situation because the following week a check on the same site with the Martek Water Quality Monitoring System showed a different but more probable temperature profile. We had difficulty with the Hach Kit, but it was re-standardized at each hole by checking against melting snow. Our group suspects that the temperature profile obtained with the Hach Kit is erroneous but we cannot account for the error.

Dissolved Oxygen: Our readings for this component were erratic and consistently high (Tables *II*-1, *II*-2 and *II*-3) and we cannot account for the obviously erroneous readings. The probability of finding super-oxygenated water at the end of a long winter seems remote. Fortunately, we were able to check stations 1A and 2A (Tables *II*-1 and *II*-3) a week later with the Martek Portable Water Quality System and the results this time were more reasonable and probably reflect more accurately the conditions of the oxygen profile.

Dissolved Solids: Results of these readings also seem somewhat erratic. Dissolved solids values for similar lakes in Ontario range from 10 to 90[1] with most lakes in the 30 to 60 range. Assuming an error of ± 10 ppm for each reading, the curves could be smoothed out and a fairly consistent reading for this parameter would result for the three stations. Conductivity readings made on Stations 1A and 2A the following week would seem to support this idea. Again, the group is unable to give an explanation for what it considers to be anomalous readings for this parameter.

Although some of the results are suspect, the group feels that valuable experience was derived. The Environment Group suugests that the project should be repeated by succeeding groups so that an accurate picture of the yearround water conditions of Lac LaPêche can be obtained. These environmental data should be correlated with the biological conditions of the lake to obtain an assessment of yearly cycles in the lake.

Suggested Readings For Environment

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Dussart, 1966 Limnologie: l'étude des eaux continentales. Paris, Gauthier-Villars.

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Welch, P.S. 1948 Limnological methods, Philadelphia, Penn. 381 pp.

Welch P.S. 1952 Limnology (Revised edition) N.Y. N.Y. 538 pp.

1. Patalas, K. 1971 Crustacean plankton communities in forty-five lakes in the experimental lakes area, northwestern Ontario. *Journal of the Fisheries Research Board of Canada*. Volume 26, pages 2135-2164.

Table *II*-1 Characteristics of the water at Station 1A in Lac LaPêche, Gatineau Park 1972. Data on 22 March was obtained with Hach testing kit and data on 30 March was obtained with Martek water quality System.

Depth (metres)	Temp. (°C.)	Dissolved Oxygen (p.p.m.)	Dissolved Solids (p.p.m.)	PH
22 March, 1458 hours, snow depth 33 cm, ice depth 53 cm.				
0	0.28	31.0	80	6.7
0.5	0.28	22.0	100	6.7
1.0	0.39	30.0	80	6.9
1.5	0.90	28.0	80	7.
2.0	0.94	30.0	80	6.9
2.5	1.80	24.0	80	7.1
3.0	1.94	32.0	80	6.9
7.0	2.20	22.0	100	6.8
7.5	2.40	-	-	-
8.0	2.80	-	-	-
8.5	2.83	29.0	80	6.7
8.9	3.05	-	-	-

Depth (metres)	Temp. (°C.)	Dissolved Oxygen (p.p.m.)	Conductivity (millimhos)	PH
30 March, 1330 hours, snow depth 30 cm, ice depth 50 cm.				
0	0.5	11.0	5.2	6.99
0.5*	0.5	11.0	5.2	6.99
1.0*	0.5	11.5	5.2	7.18
1.5*	1.5	8.5	5.2	7.28
2.0*	2.5	8.6	5.4	7.33
2.5*	3.0	8.5	5.5	7.37
5.0*	3.0	8.0	5.6	7.44
8.7*	3.5	6.0	5.8	7.38

*Depth was estimated.

Table *II*-2 Characteristics of the water at Station 1B in Lac LaPêche Gatineau Park, on 22 March, 1972. At this station the ice depth was 50 cm and the snow depth was 16 cm. Measurements were taken at 1730 hours with Hach testing kit.

Depth (metres)	Temp. (°C.)	Dissolved Oxygen (p.p.m.)	Dissolved Solids (p.p.m.)	PH
0	0	12.	70	6.2
0.5	0	24.	60	6.0
1.0	1.0	25.	80	6.8
1.5	1.5	26.	90	6.7
2.0	2.0	25.	80	6.5
2.5	2.2	27.	90	6.6
3.0	3.0	26.	80	6.7
3.5	4.0	24.	90	6.9
4.0	4.5	-	-	-

Table *II*-3 Characteristics of the water at Station 2A in Lac LaPêche Gatineau Park, 1972. Data on 23 March was obtained with Hach testing kit and data on 30 March was obtained with Martek water quality system.

Depth (metres)	Temp. (°C.)	Dissolved Oxygen (p.p.m.)	Dissolved Solids (p.p.m.)	PH
23 March, 1100 hours, ice depth 50 cm.				
0	1.5	24.	90	6.9
0.5	1.0	27.	80	7.1
1.0	1.7	22.	100	7.1
1.5	6.0	21.	90	7.1
2.0	7.5	24.	100	7.2
2.5	8.5	-	-	-
3.0	8.5	-	-	-
3.5	8.5	-	-	-
4.0	8.5	29.	90	7.0
4.5	9.25	25.	90	6.9
5.0	8.0	20.	89	6.9
5.5	8.0	-	-	-

Depth (metres)	Temp. (°C.)	Dissolved Oxygen (p.p.m.)	Conductivity (millimhos)	PH
30 March, 1530 hours, ice depth 50 cm.				
0	0.5	12.4	3.1	7.08
0.5*	1.0	11.5	3.7	7.44
1.0*	1.4	9.4	4.0	7.45
2.0*	1.8	8.5	4.0	7.4
2.5*	2.2	8.2	3.5	7.38
3.0*	2.6	8.3	4.1	7.4
4.0*	3.0	8.1	4.4	7.4
5.5*	3.0	2.2	3.7	7.11

*Depth was estimated.

Table *II*-4 Characteristics of the bottom muds of Stations 2A and 2B in Lac LaPêche, Gatineau Park, on March 22, 1972. Data was obtained with Lamotte Soil Testing Kit.

Station 2A	
PH	5.4
Nitrogen content	10-20 lbs/acre
Potassium content	barely detectable
Phosphorous content	75-100 lbs/acre
Calcium content	undetected
Humus content	not detectable

Station 2B	
PH	5.1
Nitrogen content	10-20 lbs/acre
Potassium content	barely detectable
Phosphorous	100-150 lbs/acre
Calcium content	undetected
Humus content	not detectable

III. MICROBIOLOGY

Peter Bernath and Joanne Marois

Introduction

The Microbiology Group was assigned the job of determining the composition and abundance of phytoplankton and the bacillus *Escherichia coli* in Lac LaPêche. Since *E. coli* lives in human intestinal tracts, its abundance serves as an indicator of contamination of human waste. The composition and abundance of phytoplankton in the lake shows where plant life is found in winter within a frozen lake.

Materials and Methods

The samples of water were collected with a Kemmerer sampler (1200cc. model) which was not entirely satisfactory since the tape markers along the rope did not permit free movement of the steel messenger. Even after the tape depth markers were removed, and replaced by Magic Ink markers, thereby increasing the uncertainty of depth measurements, the sampler refused to operate properly. Eventually we discovered that two messengers would operate the sampler. The precise depth of the samples was made even more uncertain by the 40-cm long sampling tube. In short, the samples are unfit for accurate quantitative analyses, but qualitative or general trends can be determined concerning the relative abundance of *Escherichia coli* and phytoplankton at the surface, mid-depth, and bottom of Lac LaPêche.

ESCHERICHIA COLI

The materials and techniques utilized for the analysis of *E. coli* are provided in kit form by the Millipore Filter Company. The procedures require that a quantity of water -enough to produce 20-80 colonies- be passed through a 0.45 micron filter. Proper care was taken to avoid contamination with the forceps and to distribute the bacteria evenly over the filter surface by dilution and careful rinsing with distilled water. The filter was then transferred onto an absorbent pad set in a Petri dish and soaked with MF Endo Broth. The Petri dish was then inverted and incubated for 48 or more hours at room temperature. The *E. coli* showed a distinctive greenish lustre because of the fuchsine dye and sodium sulphite present in the medium. The number of colonies counted in a 100 ml sample was recorded in the table.

For station 1A (see Fig. 5) 10-ml subsamples (measured by pipette) and for station 2A 50-ml subsamples (measured by a syringelike pump provided in the kit) were passed through the vacuum filter apparatus. Three subsamples were analysed from each station: surface, mid-depth, and bottom. Counting was accomplished with a dissecting microscope. Not enough water -only 10 ml- was used for subsamples from station 1A and thus data for station 2A appears better since 50 ml subsamples were employed.

PHYTOPLANKTON

The Millipore Filter Company also provides a kit for the analysis of phytoplankton. 100 ml or 50 ml of water from various depths was passed through a 0.45 micron filter. The filter was placed on a glass slide and several drops of immersion oil added. The slides were left without cover slips for about 24 hours to allow the membrane filter to become translucent. Counting was aided by calculating the area on the filter where phytoplankton were deposited. By assuming a random distribution, the areas of smaller fields, which were viewed on the filter, were calculated with calibrations on the microscope stage. Most scanning of phytoplankton cells was at 630X power

Fig. 8 Students filtering water samples for the Microbiology Group during the field programme at Lac LaPêche, March 1972 (R. Bernath, left, J. Marcis, right). (Neg. No. 72-1969)

with a width of field of about 0.25 mm. Long (4 mm - 16 mm) horizontal stripes were examined for counts of the larger phytoplankton and microflagellates. The numbers of cells recorded in the stripes were mathematically converted to numbers theoretically estimated to be found on the whole filter and then reconverted to numbers of cells per litre collected in the lake.

Any rectangular or circular object with a distinct pattern was considered to be a diatom and any golden object with a characteristic ovoid shape was considered to be an euglenoid. If there was any doubt, it was counted and hopefully, the generosity was consistent. While actual counts are not very reliable, relative numbers should show significant differences. In addition, the scarcity or conversely high abundance of particular categories such as single diatoms should show up in the counts.

Results

Table *III*-1 shows the results of *E. coli* counts in Lac LaPêche in March, 1972, and Table *III*-2 shows the results of counts of phytoplankton in Lac LaPêche during the same time.

One conclusion that can be drawn from Table *III*-1 is that Lac LaPêche is relatively unpolluted with respect to *E. coli*, since the counts never rose above 36, which is only 3% of the Ontario allowable maximum for drinking water. Since these bacteria originate only in the intestinal tracts of warm-blooded animals, they serve as an indicator of contamination by sewage. Strangely enough we found the highest concentration of bacteria in the well at the Haven Field School (6 per 100 ml) and it is recommended that the water be boiled

while further tests are carried out. Comparison of the data from the two stations suggests that station 1A was not too much different than station 2A even though only 10 ml samples were used. These data show that the bacteria live at or near the surface.

Certain conclusions are suggested by Table *III*-2. Diatoms, in contrast to bacteria, are found in large numbers close to the bottom of the lake and their numbers are significantly smaller at the surface. The data suggest that there is a minimum of diatoms near the middle and a slight increase as one approaches the surface but data from Station 2A does not corroborate this.

The microflagellates are the dominant form of phytoplankton from top to bottom, rivalled only by diatoms at the bottom of the lake. The numbers of microflagellates do not vary significantly but the data suggest that there is a minimum near the middle with a maximum near the lake bottom.

The miscellaneous filaments which represent green algae (i.e. Chlorophyta) appeared dead and decomposed with their cells brown and shapeless. Possibly they are still from summer months. They are at their maximum near the surface and taper off to a minimum at the bottom of the lake, which is exactly opposite to the vertical distribution pattern of the diatoms. Little sense can be made of the euglenoid data that is worthwhile except that possibly there is a minimum at the middle and a small increase at the bottom but the data from each station are not consistent.

Suggested Readings For Microbiology

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Prescott, 1969 How to know the aquatic plants. Wm. C. Brown Co., Dubuque, Iowa.

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TABLE *III*-1 Counts of *E. coli* taken from water samples from Lac LaPêche, Gatineau Park, on March 22, 1972. Numbers represent counts per 100 ml of water

Depth	Station 1A*	Station 2A**
Surface	30	26
Mid-depth	10	2
Bottom	0	0

*Total depth 8 m, 10 ml subsamples used.
**Total depth 6 m, 50 ml subsamples used.

TABLE III-2 Counts of phytoplankton in Lac LaFêche, on 22 March, 1972
Counts are presented in number of cells per litre.

STATION 1A

Depth (in m.)	Euglenoids	Diatoms (single cells)	Diatom chains	Miscellaneous filaments	Micro-flagellates
0	3,000	30,000	17,000	30,000	3×10^6
0.5	2,000	40,000	4,500	20,000	3×10^6
1.0	2,000	30,000	7,500	40,000	2×10^6
1.5	3,000	10,000	3,000	30,000	2×10^6
2.0	2,000	10,000	4,500	10,000	2×10^6
4.0	1,000	5,000	0	10,000	1×10^6
6.5	0	30,000	24,000	10,000	3×10^6
7.0	500	30,000	10,500	10,000	3×10^6
7.5	4,000	200,000	35,000	15,000	5×10^6

STATION 2A

0	1,000	40,000	6,000	70,000	6×10^6
1.0	2,000	30,000	18,000	80,000	6×10^6
1.5	1,000	10,000	9,000	40,000	4×10^6
3.0	7,000	400,000	130,000	20,000	6×10^6
4.5	5,000	400,000	200,000	40,000	5×10^6
5.0	10,000	1,000,000	600,000	10,000	6×10^6
5.5	9,000	1,000,000	870,000	8,000	10×10^6

Fig. 9 Student (S. Tamlin) bringing up a net from the phytoplankton group during the field programme at Lac LaFêche, March, 1972. (Neg. No. 72-441)

IV. ZOOPLANKTON

Alan Gallery and Steve Tomlin

Introduction

The Zooplankton Group was assigned to determine the composition, distribution and abundance of zooplankton in Lac LaPêche. The zooplankton vertical distribution depends greatly on the location and abundance of food and other characteristics of the lake water.

Methods and Materials

The Hensen plankton nets were cone-shaped and terminated at the small end with a metal bucket with screening that caught the plankton. The stopper was released at the bottom of the bucket and the contents were poured into the sample jars. At its widest point the net is seven inches in diameter and thus a ten-inch diameter hole in the ice was required. The size of the openings in the mesh was 40 microns (0.04mm) - small enough to catch most of the smallest plankton. A small piece of nylon netting was brought along for possible repairs to the Hensen nets. For sorting and counting purposes 12X power was used. Both reflected and transmitted lights were used, whenever possible. When the weather is very cold and the nets freeze when brought out of the water, it would be wise to have a Coleman stove to heat a bucket of water in order to melt the ice.

We arrived at Lac LaPêche on the morning of Wednesday, 22 March, 1972. We lacked an accurate map showing the depths of the lake and so several holes were dug in order to find the deepest spot. In order to collect our samples, we had to first cut through the ice on the lake. We found that the surface of the lake was covered in the following several layers:

LAYER	DEPTH
Snow	0 to 6 inches
Ice	Approx. 1 inch
Water	Approx. 6 inches
Ice	1 to 2 feet

In order to get the plankton net into the lake holes in the ice had to be bored approximately nine to ten inches in diameter. It should be kept in mind that the hole must be bored evenly right through the ice since the net can easily catch on the jagged pieces of the ice. In addition when the ice is finally punched through, lake water rises up through the hole to the surface of the snow making the process of enlarging the hole very difficult.

The sequence of collecting and analyzing was as follows:

1. Bored holes in the ice big enough to get the net through.
2. Measured depth.
3. Took four samples at 3 metres by lowering net and emptying contents into an 8-oz. jar and adding a little formaldehyde.
4. Took four samples at 6 metres (bottom).
5. Used Wild microscope and petri dishes to identify plankton in each sample.
6. Sub-sampled each sample for counting (4cc. sample).

A list of the equipment used is as follows:

2 Hensen Plankton Nets
9 Grid trays
Nylon rope--marked at 1 metre intervals for 33 metres
8-ounces jars
Probes and Forceps
Petri Dishes
Formalin--100%
Wild Microscope
Counter
Wash bottle
Nylon netting
Stemple pipette
subsampler

For identification we used *The Study of Fresh Water Biology* and *The Marine and Fresh Water Plankton.*

Results

Table *IV*-1 shows the actual numbers of zooplankton animals observed in the sample while Table *IV*-2 shows the estimate of numbers of zooplankton animals in the lake based on a basic unit of a cubic metre of water.

In all samples, both from the three metre level and the six metre level, the nauplius stages were relatively abundant. There were two different types, one type was larger than the other and parts of it were bright red. The smaller type was not as colourful but it showed a deeper speckled red.

It was also observed that some of the Cyclopoida copepods had red eyes instead of black eyes. This was also observed in the nauplius stages and so it may be assumed that these nauplii are cyclopoid larvae. Both the red-eyed Cyclopoida and nauplii were found more abundantly near the surface.

Suggested Readings For Zooplankton

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Pratt, H.S. 1935 Manual of the common invertebrate animals, Revised edition Philadelphia, Penn. 854 pp.

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Welch P.S. 1952 Limnology Revised edition N.Y., N.Y. 538 pp.

Table *IV*-1 A list of the zooplankton collected with a conical plankton net at Station 2 in Lac LaPêche, Gatineau Park, on March 22, 1972. Numbers are a mathematical estimate of the animals in the samples.

3 Metres to surface tows

	Tow A	Tow B	Tow C	Tow D	Ave.	Range	Standard Deviation
Rotifera 1	1200	3600	3000	600	2100	600 - 3600	14.3
Rotifera 2	-	-	600	-	150	0 - 600	3.8
Nauplius	1200	1800	1200	-	1050	600 - 1200	7.1
Cyclopoida	-	1200	600	1200	750	600 - 1200	6.3

6 Metres to surface tows

	Tow A	Tow B	Tow C	Tow D	Ave.	Range	Standard Deviation
Rotifera*	1800	600	600	-	750	0 - 1800	7.2
Cladocera	600	-	600	-	300	0 - 600	3.8
Cyclopoida	3000	-	3600	3000	2400	0 - 3600	16.24
Calanoida	-	-	-	1200	300	0 - 1200	11.3
Nauplius	3000	6000	-	-	-	0 - 6000	46.9

*Easily identifiable as two distinct shapes of rotifers, but not counted separately.

Table *IV*-2 A List of zooplankton collected with a conical plankton net at Station 2 in Lac LaPêche, Gatineau Park, on March 22, 1972. Numbers are a mathematical estimate of the animals found in one cubic metre of lake water.

3 metres to surface tows

	Tow A	Tow B	Tow C	Tow D	Ave.	Range
Rotifera 1	4.0×10^{4}	1.2×10^{5}	9.9×10^{4}	2.0×10^{4}	6.9×10^{4}	2.0×10^{4} - 1.2×10^{5}
Rotifera 2	-	-	2.0×10^{4}	-	4.9×10^{3}	0 - 2.0×10^{4}
Nauplius	4.0×10^{4}	5.9×10^{4}	4.0×10^{4}	-	3.5×10^{4}	2.0×10^{4} - 4.0×10^{4}
Cyclopoida	-	4.0×10^{4}	2.0×10^{4}	4.0×10^{4}	2.5×10^{4}	2.0×10^{4} - 4.0×10^{4}

6 metres to surface tows

	Tow A	Tow B	Tow C	Tow D	Ave.	Range
Rotifera*	3.1×10^{4}	1.0×10^{4}	1.0×10^{4}	-	1.3×10^{4}	0 - 3.1×10^{4}
Cladocera	1.0×10^{4}	-	1.0×10^{4}	-	5.1×10^{3}	0 - 1.0×10^{4}
Cyclopoida	5.1×10^{4}	-	6.1×10^{4}	5.1×10^{4}	4.1×10^{4}	0 - 6.1×10^{4}
Calanoida	-	-	-	2.0×10^{4}	5.1×10^{3}	0 - 2.0×10^{4}
Nauplius	5.1×10^{4}	1.0×10^{5}	-	-	3.8×10^{4}	0 - 1.0×10^{5}

*Easily identifiable as two distinct shapes of rotifers but not counted separately.

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