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GREAT LAKES BIOLIMNOLOGY LABORATORY  
SAULT STE. MARIE

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Technical Operations Division  
National Water Research Institute

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## INTRODUCTION

The Great Lakes Biolimnology Laboratory (GLBL) of the Department of Fisheries and Oceans in Sault Ste. Marie, Ontario carried on an intensive program of study in the Turkey Lakes Forested Watershed in 1981 associated with the LRTAP Project (Long Range Transport of Air-Borne Pollutants).

The Turkey Lakes study area is situated approximately 50 km East of Coppermine Point on Lake Superior. The watershed contains a chain of five lakes, a headwater lake with two basins, a second headwater lake and two lower lakes. The lowest lake is the largest (approx. 54 ha) and drains directly into the Batchewana River. The site was found suitable for this type of study for several reasons: The underlying shield-type bedrock limits the buffering capacity of the lakes. The area has not been recently disturbed by lumber or mining activities and is easily accessible by conventional land travel throughout most of the year. The proximity of the site to existing laboratory facilities in Sault Ste. Marie facilitates the analyses of samples coming in from the field. The site was chosen and released for use as a scientific research area in the Fall of 1979 by the Ministry of Natural Resources. Many agencies of both the Federal and Provincial Governments, as well as several outside user groups, were involved in studies in the watershed requiring considerable logistic and equipment co-ordination.

## SUMMARY

In this, the second year of a five-year investigation into the effects of acid rain on the environment, GBLB endeavoured to gain a better understanding of how exactly acid and other stresses alter the composition and workings of aquatic communities.

Several sampling programs were designed and implemented to analyze as many elements of the aquatic community as possible. Primary productivity experiments using  $C_{14}$  assimilation as a measure of productivity, were conducted in an effort to describe the dynamics of the phytoplankton populations. Benthic invertebrates were collected from each of the lakes in the study area to examine the composition and biomass of the major taxa in an effort to determine what pH-related effects occur over the study period.

An attempt was made to estimate the population size of the different fish species present in the Turkey Lakes. A capture, tag and release program was undertaken to accomplish this in the Spring and a later recapture program in the Fall gave information on growth rates and age-class structure. Sacrifices from this program as well as samples collected by gill net from other sensitive headwater systems were analyzed for heavy metals and selected ions to provide a comparison of body burdens in the different systems.

Larval fish were collected from the Turkey Lakes and several lakes in the Sudbury area to determine if acid-induced mortality in the early life stages may be the cause of impaired recruitment.

### PRIMARY PRODUCTIVITY

Incubated  $C_{14}$  primary productivity experiments were conducted every second week between May 20 and September 17.

A mooring was installed near the deepest spot in each of the five lakes in the study area. The moorings consisted of a dumbbell-shaped buoy from which 150 ml samples bottles were suspended at various depths. Water was collected at each selected depth with a two-litre horizontal Van Dorn bottle. Two sample bottles were filled with water from each depth, inoculated with .1 ml of a  $C_{14}$  solution and incubated in the lake for 2 - 3 hours. Upon retrieval, the samples were fixed with 1 ml of formalin and prepared for shipment to Burlington.

### BENTHOS COLLECTION

Sampling for benthic invertebrates was carried on at two-week intervals between May 12 and October 20.

A sampling site was chosen in each of the four upper lakes in the watershed, near shore and in less than one metre of water. The samples were collected by stirring up 1 sq. metre of substrate and catching any suspended material in a pond net. Four replicate samples were collected at each site, placed into glass jars and preserved with 20% neutral sugared formalin. The samples were then shipped to Burlington for classification and biomass analysis.

At the same time as the benthos samples were collected, the zooplankton communities of each lake were sampled by plankton net haul. The samples were preserved with 10% neutral sugared formalin and retained for future analysis.

### STREAM SAMPLING

An attempt was made to describe the species' composition and to estimate the population growth rate of attached algae at four stream locations in the watershed. This was accomplished by placing microscope slides in a wooden holder, mounted on a brick, in water deep enough that the slides would not become exposed if the stream flow declined. The slides were removed and replaced at two-week intervals. The samples were preserved with Lugol's solution in glass jars of stream water and retained for future analysis.

Microbiological processes in the streams were examined at six locations in the watershed. The sampling consisted of the collection of water and stream sediment at each location and the installation of leaf packs at three of the sampling sites for decomposition testing. The leaf packs were placed on October 14 and it is hoped they can be retrieved in the Spring for analysis.



### LARVAL FISH

It is speculated that impaired recruitment of fish and acid-burdened lakes may be caused by stress-induced mortality of larval forms during or shortly after hatching.

Sampling of larval fish was accomplished by towing two large conical nets near the surface at a standard speed and measured distance. Samples were taken from the three lower lakes in the study area once a month from May until September. The larvae were preserved in formalin and retained for examination for signs of stress.

### SAMPLING OUTSIDE THE WATERSHED

During the months of June, July and August, integrated water samples to five metres were collected from eighteen headwater lakes in the Sault Ste. Marie area using a tube sampler. The samples were analyzed for pH, conductivity and alkalinity.

Gill nets were placed in seven of these lakes, left overnight and retrieved the next day to obtain samples for heavy metal and major ion analyses by lipid extraction.

Water samples were collected from thirty-six streams flowing into Lakes Huron and Superior between Sudbury and Thunder Bay on two occasions in order to monitor seasonal changes in pH, conductivity and alkalinity.

Larval fish were collected on a monthly basis from three acid-burdened lakes in the Sudbury area for acid stress determinations.

PERSONNEL

Dr. J.R.M. Kelso	Project Leader	GLBL
Ms. J. Gray	Biologist	GLBL
R. Love	Biologist	GLBL
R. Collins	Technologist	GLBL
J. Lipsit	Technologist	GLBL
Ms. M. Weija	Lab Technician	GLBL
Ms. K. Morrison	Summer Student	GLBL
G. Reider	Summer Student	GLBL
C. Sierzputowski	Summer Student	GLBL
J.A. Kraft	Technologist	Technical Operations Division

EQUIPMENT LIST

- 3 Vehicles: (4x4) Pickup (81-001), Van (78-010), Leased Pickup
- 1 17-foot Joe Boat
- 1 17-foot Grumman Canoe
- 1 25 hp Outboard Motor
- 1 9.9 hp Outboard Motor
- 1 4 hp Outboard Motor
- 3 5-gal. Fuel Tanks
- 1 Electric Outboard Motor
- 2 12V Car Batteries
- 1 Battery Charger
- 7 Life Jackets
- 2 Trap Nets
- 2 Hoop Nets
- 1 Minnow Hoop Net
- 6 Gill Nets
- 1 Ekman Dredge Sampler 9"
- 1 800 Watt Generator
- 2 2-litre Horizontal Van Dorn Bottles
- 1 Chainsaw

### CHRONOLOGY OF EVENTS

- May 12 - Start of field programs  
- Benthos collection  
- Installation of C<sub>14</sub> primary productivity moorings
- May 20 - C<sub>14</sub> primary productivity experiments
- May 22 - Installation of trap nets and hoop nets  
- Start of fish capture, tag and release program  
- Start of larval fish program
- June - Benthos collection  
- C<sub>14</sub> primary productivity experiments  
- Capture, tag and release program  
- Larval fish program  
- Water sampling from accessible surrounding headwater lakes
- June 14 - Start of gill netting program
- June 19 - Removal of trap and hoop nets
- July - Benthos collection  
- C<sub>14</sub> primary productivity experiments  
- Larval fish program  
- Gill netting  
- Water sampling in headwater lakes
- August - Benthos collection  
- C<sub>14</sub> primary productivity experiments  
- Larval fish program  
- Water sampling in headwater lakes
- August 13 - Stream sampling between Sault Ste. Marie and Sudbury
- September - C<sub>14</sub> primary productivity experiments  
- Benthos collection  
- Larval fish program
- September 9 - Stream sampling between Sault Ste. Marie and Thunder Bay
- September 23 - Installation of hoop and trap nets for capture, tag and release of fish program
- October - C<sub>14</sub> primary productivity experiment  
- Benthos collection  
- Capture, tag and release program

October 29 - Removal of trap and hoop nets

November 6 - All field programs ended

November 10 - Personnel and equipment returned to Burlington

CONCLUSION

All field work associated with projects initiated by the Sault Ste. Marie Office of the Great Lakes Biolimnology Laboratory was completed on November 6th. The field year was a complete success.

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