ANNUAL REPORT

1974

TECHNICAL OPERATIONS SECTION

Scientific Operations Division

Inland Waters Directorate

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Canada Centre for Inland Waters

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APPENDICIES

1. TECHNICAL OPERATIONS SECTION 1974: AN OVERVIEW

The Technical Operations Section has the responsibility for the multi-disciplinary field measurements carried out from major and minor vessels in support of the scientific projects conducted at CCIW, the Pacific and Western Regions. It is the intention of the Section to provide as requested, the expertise required to support all scientific field research undertaken by departmental and interservice groups from CCIW.

Personnel are assigned to the major vessels on a continuing basis in support of all monitor, surveillance and survey projects, as well as small craft involved with regional shore-based parties conducted in support of CCIW goals and objectives. Field operations are mainly undertaken by Technical Operations staff; where more specialized field analyses are required, the Technical Operations staff form the back-up group assisting the appropriate scientists performing those more specialized tasks.

In addition to the versatility required in all phases of sampling procedures, the Section provides expertise, through the Assignment of Vessels Committee in planning ship, launch and support programs, and in the design of operational facilities aboard new vessels. Technical Operations is responsible for ensuring that the various programs and projects proposed by the scientific community and outside agencies are co-ordinated and logically arranged to suit the availability of research vessels.

Expertise in underwater diving has built up with the need to erect scientific towers and conduct underwater studies in support of the research projects carried out by various Divisions and interservice groups at CCIW.

Technical Operations Section has assumed the responsibility of preparing preliminary descriptive limnology reports on the lakes. These reports, although not very detailed in format, provide a cursory summary of lake conditions on a cruise to cruise basis, and are complementary to the responsibilities of the Applied Limnology and Physical Processes Section.

TECHNICAL OPERATIONS SECTION

Head - H. B. Macdonald
Secretary - Mrs. A. Stern - on strength March/74
Secretary - Mrs. L. C. Bouverat - transferred to GLBL February/74
Senior Operations Officer - D. J. Cooper
Operations Officer, CSS LIMNOS - D. J. Brooks
Operations Officer, M/V MARTIN KARLSEN - D. H. Hanington
Senior Diving Officer - J. T. Roe
Standards and Development Officer - D. J. Williams - transferred to GLBL December/74
Program Co-ordinator - P. R. Youakim
L. E. Benner - Sensor Network Unit
T. J. Carew - HMCS PORTE DAUPHINE

R. G. Chapil - Sensor Network Unit
H. K. Cho - Resigned, May/74
B. E. Clemmens - Pacific Region
J. R. Compton-Smith - MARTIN KARLSEN/Diving
F. J. DeVree - MARTIN KARLSEN
F. H. Don - Diving/MARTIN KARLSEN
H. E. Greencorn - Shop
P. M. Healey - MARTIN KARLSEN
G. J. Koteles - Point Source Studies
L. J. Lomas - Shop Foreman
M. R. Mawhinney - PORTE DAUPHINE
B. H. Moore - LIMNOS
H. K. Nicholson - Sensor Network Unit
G. M. Perigo - Shop
S. B. Smith - Project Quinte - Biochemical Processes in Lakes
W. B. Taylor - Sensor Network Unit
M. R. Thompson - LIMNOS
S. P. Withers - Western Region
H. W. Zimmermann - MARTIN KARLSEN

Term Employees - Technical Operations Section

J. D. Bouwman - Resigned, August/74
W. A. Carney - on strength September/74 - PORTE DAUPHINE
J. C. Hill - LIMNOS
B. Killins - Physical Processes Unit, LRD
R. C. McCrea - Transferred to Water Quality Division, July/74
D. F. Moore - MARTIN KARLSEN
A. E. Rothwell - on strength September/74 - MARTIN KARLSEN
K. F. Salisbury - Virology and Water Quality (Rivers) Surveys
D. J. Spry - PORTE DAUPHINE - transferred to GLBL, November/74
C. A. Timmins - Point Source Studies
E. H. Walker - MARTIN KARLSEN

Summer Students - Technical Operations Section

P. Atkison
G. Bota
G. Laing
B. Logan
R. McGuffin
K. Roslyn - transferred to GLBL, July/74
D. Scorgie

2. SUMMARY OF SHIP OPERATIONS

The three major vessels, CSS LIMNOS, M/V MARTIN KARLSEN and HMCS PORTE DAUPHINE, carried out the bulk of the Great Lakes Studies in 1974.

The LIMNOS, owned by Environment Canada, is operated by Central Region, Marine Sciences Directorate (MSD) at CCIW. During 1974, she carried out a large variety of cruises including survey and surveillance curises, mooring cruises, sedimentation velocity studies, toxic materials cruises and coring work. In addition, several special cruises such as dynamic mooring analysis, side-scan sonar and engineering trials were conducted, making a total of 27 for the season. They can be listed more completely as follows:

Lake Ontario	1 Mooring Cruise 2 Dynamic Mooring Analysis 1 Side Scan Survey 4 Sediment Velocity Studies 2 Lower Lakes Surveillance 1 Engineering Trials
Lake Erie	1 Sediment Inventory
Lake Huron	4 Mooring/FTP 1 Sediment/Coring 1 Toxic materials 1 Survey
Georgian Bay	4 Mooring/FTP 1 Seismic/Coring 1 Toxic materials 1 Survey
Lake Superior	1 Toxic materials

A new innovation in fixing the ship's position was used during 1974. A Magnavox Satellite Navigation System was installed on board LIMNOS in early July for evaluation by MSD personnel for possible use on Hydrographic Surveys in the Arctic. However, as the system was to be left on board LIMNOS for a full year, it was decided to study the feasibility of making practical use of it in the installation of winter moorings in Lake Huron. The mooring launch positions and retrieval information in the spring will provide data on positioning accuracy over a period of several months.

Very few problems were encountered during the year and those that did arise were quickly rectified by Ship's and/or Engineering Systems personnel.

The MARTIN KARLSEN has continued to carry out the major portion of the survey work on the Great Lakes. In support of the IJC Upper Lakes Reference, surveys were conducted by the vessel in both Lake Huron and Georgian Bay; these were the first multi-disciplinary limnological surveys conducted in Georgian Bay and the North Channel of Lake Huron for CCIW. A total of six surveys were completed prior to the cancellation of the ship's charter.

In addition, two Lake Ontario surveys, two surveillance cruises (Lake Ontario and Lake Erie), and geology cruises were conducted in Lakes Superior, Erie, and Ontario. One week was spent in Lake Superior supporting Lakehead University's geochemistry program.

The MARTIN KARLSEN'S charter was completed on October 31, after nearly six years of working on the Great Lakes for CCIW programs. During this time, which was spent mostly on survey (monitor) type programs, she steamed a total of 128,936 miles and has supported nearly all CCIW programs as well as those of most of the other agencies located at CCIW.

Summary of cruises:

Lake Ontario	2 Survey 1 Surveillance 1 Geolimnology
Lake Erie	1 Surveillance 1 Geolimnology
Lake Huron	6 Survey
Georgian Bay	6 Survey
Lake Superior	1 Geolimnology & Geochemistry Cruise

The PORTE DAUPHINE during the greater part of 1974 was based at CCIW and funded by MSD. With the commencement of the field year in March, she was assigned to the newly implemented Lower Lakes Surveillance Program, successfully completing 12 cruises on Lake Ontario and 1 Cruise on Lake Erie. During the greater part of July and August, she participated in the Point Source Studies in Lake Superior.

On November 8, she was transferred back to the Department of National Defence and recommissioned as a training ship for the Naval Reserve. The name CCGS PORTE DAUPHINE was changed to HMCS PORTE DAUPHINE.

The CSS ADVENT is also owned by Environment Canada and operated by Central Region, MSD. She participated in a variety of programs including Engineering Trials and Mycology, Microbiology, and Surveillance Cruises.

The CSL SHARK, in addition to supporting several programs during 1974, provided support for diving operations in Lakes Ontario and Erie.

OPERATIONAL TABLE 1974

Ship	Started Operations	Completed Operations	Miles Steamed	Days at CCIW (%)	Days on Duty (%)
CSS LIMNOS	Mar. 18	Dec. 18	10,430.8	42	58
M/V MARTIN KARLSEN	Apr. 1	Oct. 18	19,650.6	13	87
HMCS PORTE DAUPHINE	Apr. 16	Dec. 19	9,063.8	58	42

Detailed information on cruise and vessel descriptions have been included in separate sections of this report.

3. SUMMARY OF CRUISE DESCRIPTIONS

Personnel from the Section were assigned to the major ships on a continuing basis. Other scientific and technical personnel from various agencies joined the vessels for much briefer periods in accordance with pre-arranged schedules drawn up by Technical Operations staff.

The cruise descriptions that follow attest to the multi-disciplinary work supported and, in many cases, carried out by staff of this Section. In the process, they had to be familiar with a wide variety of sampling equipment, methods and techniques to meet the requirements of all these disciplines.

Cruise types for 1974 are summarized below:

(1) Survey Cruises (Monitor Cruises)
(2) Surveillance Cruises
(3) Mooring Cruises
(4) Geological Cruises
(5) Toxic Materials Cruises
(6) Sedimentation velocity Studies
(7) Virology/Mycology Cruises
(8) NTA Surveys

(1) Survey Cruises

The term "survey" has replaced the older term "monitor", but the cruise format has remained essentially unchanged and consists of a multi-disciplinary limnological investigation of the lakes.

This year emphasis was placed on Lake Huron (including the North Channel) and Georgian Bay, in order to complete the investigation required to support the IJC Upper Lakes Reference. (Lake Superior was surveyed in 1973.) A reduced survey was conducted in December by the LIMNOS to complete the study of Lake Huron and Georgian Bay, but all the previous survey cruises were conducted by the MARTIN KARLSEN.

Technical Operations Personnel, as well as staffing the MARTIN KARLSEN, co-ordinated the survey program on board and were assigned the responsibility for preliminary data quality control. Personnel from other sections were on board to carry out individual projects. Support was provided for the descriptive, physical, chemical and biological limnology disciplines, meteorology, and other sciences by Technical Operations Personnel.

A total of 16 survey cruises were conducted in 1974 - two in Lake Ontario, seven in Lake Huron, and seven in Georgian Bay.

(2) Surveillance Cruises

The aim of the Surveillance Cruise Program implemented on the Lower Great Lakes this year was to provide values of selected impact parameters over specific regions of Lakes Ontario and Erie of sufficient statistical reliability to allow the assessment of trends with time. The data from the cruises will be used as input to Task 12, Canada-U.S. Agreement and the Water Quality Board Annual Report to the International Joint Commission.

The program on Lake Ontario consisted of 17 cruises conducted between April and December on an approximately bi-weekly basis, covering 85 stations on the lake, most of which were concentrated in the 2-10 km region from shore. The positions were arranged to place the main sampling emphasis on the regions of major materials input (e.g., Toronto-Hamilton-Niagara, Rochester, Oswego) and to permit reasonably representative contouring of the measured parameters in these areas, while still retaining sufficient open lake sampling to determine the overall picture.

The Lake Erie program consisted of two cruises - one in April and one in August - covering 73 stations on the lake. In general, the station positions corresponded to those sampled by the U. S. Environmental Protection Agency, which had a very extensive program of 14 cruises on this lake. It was for this reason that the Canadian sampling emphasis for this year was placed on Lake Ontario.

Four Technical Operations Staff were assigned on a permanent basis to the program.

(3) Mooring Cruises

Extensive mooring operations were carried out in Lake Huron and Georgian Bay during 1974 to satisfy the following requirements:

1) United States-Canada Great Lakes Water Quality Agreement;
2) International Joint Commission Upper Lakes Reference
   a) Open Lake Studies
   b) Nearshore Activity Studies;
3) Atmospheric Loading of Great Lakes Waters Project

The successful mooring operations were again heavily dependent on the skill of the LIMNOS' personnel and on the alertness and awareness of Technical Operations staff. The difficult lake-bottom conditions and uncertain weather patterns of the area under study added to the problems indigenous to the art of launching and retrieving moored scientific equipment.

Technical Operations technologists were responsible for handling all scientific instruments associated with moorings such as fixed temperature profilers, current meters, and meteorological equipment. The majority of the hardware (swivels, A-frames, etc.) associated with each mooring is supplied and checked by Technical Operations Section. The important job of rigging each array of instruments is performed by Technical Operations personnel with the assistance of the ship's crew, and the actual launch and recovery of a mooring is carried out by LIMNOS personnel under the direction of the Technical Operations Officer.

(4) Geological Cruises

Geology-oriented cruises were performed from two of the major vessels and included excursions in all of the Great Lakes except Michigan. The programs were broad in scope yet specific in objectives and ranged from methods of determining the most viable seismic technique to determination of migration trends in trace elements to investigation of fine-grained modern sediments.

Technical Operations Section responsibility on geological cruises is to assist in the procurement of a great assortment of sampling equipment and - the main task - collection of the bottom samples. Coring and grab-sampling work is always dirty, and often hazardous because of the great weight of equipment used; working from the side of a ship in rough weather increases the hazard.

When practical, Technical Operations staff assisted the geologists in sample preparation, treatment, and storage.

(5) Toxic Materials Cruises

The Environmental Toxicology program studies selected metals and organic compounds for toxicity on organisms, particularly the accumulation of hazardous materials in the aquatic food chains. A baseline study will be developed to provide information on toxic materials in the Upper Lakes for the Upper Lakes Reference Group of the IJC.

In the summer cruise on Lake Huron, Georgian Bay and Lake Superior, staff from Technical Operations Section collected sediment samples, took plankton hauls and integrated samples, and other water samples for analysis of dissolved organic compounds; the staff also helped with the fish trawls.

(6) Sedimentation Velocity Studies

The purpose of this study is to test the settling bottle technique for measuring trans-thermocline transport of chemical and biological components. Unique sediment-collecting instruments have been developed by Lakes Research Division. The in-water system comprises two parts - a Sedimentation Trap and a Settling Bottle Mooring array.

Migrant sediments have been collected in the near-shore area where a SCUBA diver can check out the system before the experiment begins, and at the same time the diver will take samples of the water and sediment by hand.

Technical Operations Section supports these experiments by assisting and supervising the mooring operations being carried out by LIMNOS personnel, and by performing manual chemistry on some of the samples collected. As well, divers from this Section participate in the study.

(7) Virology/Mycology Cruises

One of the functions of the Microbiological Laboratories, SOD, is to develop and evaluate mycological (fungal) and virological (viral) methodology and criteria for "monitoring, assessing and maintaining water quality from the viewpoint of health hazards and eutrophication". To this end, Technical Operations personnel participated in collection of lake water samples between Toronto and Niagara, and delivered same to laboratories as required.

(8) NTA Surveys

Technical Operations Section staff continued the monthly sampling of Hamilton Harbour for the analysis of NTA (nitrilotriacetic acid), the substance which has replaced phosphates in detergents. Samples were also collected from stations in western Lake Ontario, but less frequently.

Hamilton Harbour sampling takes less than one-half day, and is normally done from a small MSD vessel. Surface waters, or one metre below, are collected either by a Van Dorn bottle or by simply immersing the supplied one-litre container beneath the surface. Five mls. of formaldehyde solution are added to each of the seven (7) samples, which are subsequently delivered promptly to Water Quality Laboratory and Network along with a copy of a covering memorandum.

4. LAUNCH AND SHORE-BASED OPERATIONS

(1) Sensor Network Unit

The Sensor Network Unit was formed in 1974 to conduct most of the meteorological measurements, and some limnological measurements, from CCIW. Four technologists from Technical Operations Section installed, monitored and retrieved the instruments, and supervised the data processing performed by two clerks from Data Management Section.

Meteorological buoys and towers were established and maintained at Bay of Quinte, Main Duck Island, Lake Simcoe, Georgian Bay, Tobermory, Douglas Point, mid-Lake Huron, Morson Lake and Kamloops Lake. Wind speed and direction, air temperature, and relative humidity were recorded at all of these locations, and at some stations, records of solar radiation and surface water temperature were obtained. Water temperature records at 18 or 21 levels in a water column were recorded by the Fixed Temperature Profile (FTP) system. This system constitutes a large portion of the work of the Unit - four such stations were installed near Douglas Point and three at Kamloops. The FTPs at Kamloops were complemented by Temperature Recording Systems for measuring water temperature one metre below the surface.

Solar radiation records were obtained from ten stations between the Bay of Quinte in the east and Kamloops in the west. At two of these stations, CCIW and Kamloops, net (total) radiation was also recorded. As well, recording solarimeters were installed aboard three major research vessels; the ships collected wind, temperature, and humidity data for use in conjunction with the solar information.

A special rain sampling configuration with an alter shield was mounted on a Geodyne buoy near Tobermory to collect samples for the analysis of rain chemistry over the lake surface.

Measurements continued at Burlington Pier. Data were collected on wind speed and direction, air temperature, and surface and bottom water temperature.

Under ice current studies are being supported by the establishment of winter moorings (inverted FTPs) in Lakes Ontario and Huron.

The Kamloops Lake project, supported by the Sensor Network Unit, is part of a continuing federal-provincial co-operative small lake program.

Engineering Services (Scientific Support Division, CCIW) provided maintenance and calibration for most sensors and recorders used, and they built the Temperature Recording Systems for Kamloops.

Data return for most stations has been well above average, with some stations recording 100% useable data.

(2) Project Report - Red Rock and Nanticoke, 1974

Introduction: The Nanticoke and Red Rock Project was primarily an ongoing fish experimentation study utilizing Hydro-Generating and Pulp and Paper Mill "Plants" as a heat and effluent source study. Experiments were run to find out how point source heat could effect plant life, animal life and thus fish life.

The Red Rock Study would provide insights on the effects of paper mill wastewater discharges to the upper Great Lakes, as part of the work now being carried out for the International Joint Commission within the plan of the IJC Upper Lakes Reference Group.

Scientific equipment and experiments used to indicate trends of the various parameters measured were: Fish counter and Towed Temperature Profiler, Fish telemetry, Bottom Temperature Thermographs, Algal productivity and speciation via collection of same on substrates, Benthic Fauna Studies, Chlorophyll Productivity Studies, Dye Dispersion Studies, Aircraft Overflights, Transmissometry, Fish Tainting, GCS measurements, Water Quality measurements, Bacteriology, Climatology, Larval Fish, Grazing chamber and Shindler traps.

The two projects were slated to study the effects on the aquatic environment of point source heat input containing energy, nutrients and toxic and taste/odour producing components.

Activities carried out by EMS were to study:

i) Short-term kinetics of dissolved organics in plumes

This was done via extraction of organics XAD_2 resin columns. Separation and tentative identification could be done by GLS and MS methods. Also larger samples measured for dissolved organic carbon.

ii) Fish-tainting compounds, particularly chlorinated organics

Fish specimens were ground up and analyzed for deterpene compounds and fatty acids. Mostly suckers and perch were collected in the hoop nets that were set up. Benthos cores and sediment samples were also taken for sludgeworms.

iii) Degradation of resin acids

Lab examinations were done of persistence of resin acids and breakdown products based partly on the Nipigon Bay sediment samples collected.

iv) Absorption of dissolved compounds on particulate matter

Samples were filtered and the particulate matter was kept on GF filters for identification of dissolved compounds.

v) Long-term persistence of organics

From longer periods of breakdowns for various chemicals, different parts of the Bay were measured for residual products and by-products.

vi) Sediment mapping

Throughout the Nipigon Bay area, samples were collected to determine texture, fibre, organic content and heavy metal concentration.

vii) Bacterial metabolism and rates of growth were studied from the use of varying substrates. Bacterial degradation of wastes were studied using continuous culture, dissolved oxygen and batch type fermenter methods.

viii) Remote sensing of plume characteristics

Forty-two hours of overflights were made of the dye releases and grid patterns set up for transmissometer profiles to give structure and extent of the effluent.

The Nanticoke Project took place at the new development site on Lake Erie. A new coal-burning Hydro-Generating Plant was built there and it was felt that a study of Point Source Heat would fulfill the requirements of the program.

Types of studies carried out by the GLBL involved:

ix) Fish distribution and behaviour

Fish movement studies were conducted using temperature and frequency stabilized sonic tags attached to different species of fish.

x) Larval fish

Sampling with a towed net, 1 metre square, was done to determine the density and species of larval in various areas of the Point Source Area. Along with this, temperature, O_2, pH and conductivity readings were taken.

xi) Zooplankton

To continue the study of feeding habits of zooplankton gauged filters, "Haney" grazing chamber and radioactive algae were used at various stations. From the feeding of differing radioactive algae, we could determine how much algae the zooplankton required; zooplankton

quantities were measured by Coulter Counter and gravimetric methods. Also, preserved samples of zooplankton were collected in various zones of influence in order to show effects of effluent on species composition and abundance.

xii) Attached algae

Cladophora growth on different substrates were studied to see the effect of effluent on productivity and speciation.

xiii) Algal plankton

Planktonic Algal studies were done by measuring the rate of photosynthesis via the uptake of C^{14} by the samples collected.

xiv) Sediment sampling

Mud samples were collected throughout the Nanticoke area and sieved. These samples were then preserved for later shore analysis at CCIW.

FISH COUNTER, TOWED TEMPERATURE PROFILER AND CONTINUOUS CONDUCTIVITY

An acoustic system for counting fish was purchased and tested by the Centre during the 1974 season. The system consisted of an over-the-side, stern-mounted, precision transducer. Ideally, the transducer had to be placed away from the disturbance of the stern-outdrives and any other interferences. The temperature profiler was connected to a towed thermistor array which had five breakouts down to the depressor fin.

An echogram could also be kept of the bottom layers. On the starboard side forward a continuous conductivity pump was mounted on a boom at about one metre depth, and pumped water through a sensor on deck. All of this data could be compiled on the recorder. The essential parameters recorded were the number of fish targets (size of fish targets, whether or not they were fish), temperature at five predetermined levels, an echogram readout, and a continuous conductivity graph. Also on the echogram was a visual record of the targets in the water column so that the nature of these contacts could later be collated to other data. Most of the data were compiled on punched paper tape which could be either decoded immediately or later in the laboratory trailer by teletype reader.

All in all, this acoustic system proved a little too sensitive to engine noises and changing ship's power supply as well as other breakdowns.

This system is capable of handling magnetic tape as well as video tape compiling recorders and will be improved over the winter season.

Support from Technical Operations Section and Ships Division

Input into these projects involved the use of the PORTE DAUPHINE, the CSL AQUA, and three smaller craft. The DAUPHINE was utilized for its laboratory space and as a vehicle to move buoys, boats and various gear to the survey site. She was also the radar-position control vessel and accommodations vessel.

The AQUA was used for mud sampling, fish studies and buoy placement on a grid system. Three smaller craft were used for water sampling and transportation to and from the PORTE DAUPHINE.

All cables, ropes, buoys and assemblies were supplied by Technical Operations. All field equipment was loaded and transported by Technical Operations vehicles and personnel.

Two trailers, one 38 ft. by 10 ft. and the other 36 ft. by 8 ft. were moved and set up by Operations personnel.

(3) Bay of Quinte

During 1974, the Impacts and Pathways Section of LRD continued the study of nutrient dynamics in isolated columns of lake water. This is the second half of a two year program to investigate phosphorus, carbon and nitrogen dynamics in lake waters. A study of non-ionic detergents and their rate of degradation was also conducted in the latter part of 1974.

The three limnocorrals from the 1973 study remained in position and three new limnocorrals were added as a comparison for the 1974 field program. The barge GOOSE was moored adjacent to the limnocorrals and was used to house scientific instruments and to provide an on-the-site laboratory.

Two corrals received P and N at a rate equal to that presently going into the Bay of Quinte; two others received P only, at a rate equal to the natural additions to the Bay; and the last two received no extra P or N and were used as control corrals.

Tehcnical Operations again co-ordinated and supported the project with one staff member assigned full time for this purpose. The limnocorral position and the trailer site remained the same and will be removed by Technical Operations upon completion of the project.

(4) Microbiology

The Microbiology Laboratories (SOD) received full-time support from Technical Operations Section early in 1974.

In the interest of evaluating a methodology for fungal isolation, water samples from western Lake Ontario were collected and processed by the "membrane filtration technique" for examination of types of nutrient media, types & quantities of anti-bacterial agents incorporated in the media, and colour and area of membrane filter used. As well, the DuPont luminescence biometer was successfully tested for its accuracy and precision as a viable method of microbial biomass estimation.

Laboratory assistance was also provided for identification and classification of isolated fungi.

(5) Lake Simcoe Ice-Piling Program

In January, Technical Operations personnel established an Ice Reconnaissance Station at Big Bay Point, Lake Simcoe. A 60-foot tower was erected for meteorological instruments, and a trailer was stationed nearby for an office area.

On a pre-determined grid on the ice surface, 150 holes were drilled and marked; lead line soundings were taken at each hole. At one separate hole, a current meter mooring was established.

Five men worked for five days to establish the station for Hydraulics Division.

(6) Launch Support of Virology Program - 1974

See following report (six sheets)

LAUNCH SUPPORT OF VIROLOGY PROGRAM - 1974

Keith F. Salisbury

A. VIRUS WATER SAMPLE COLLECTION SITES

Lake Erie - Detroit River - Niagara River

Twenty stations were selected for water collection sites for a virus isolation study. These stations were visited twice during a six month period. For sampling consideration, stations 1 to 8, 9 to 14 and 15 to 20 were considered as separate sampling areas.

Listed below are the dates when the samples were collected:

	Date	Stations	Vessel Used
May	23 - 30	1 - 8	Boston Whaler
June	19 - 21	9 - 14	Boston Whaler
July	23 - 26	15 - 20	Boston Whaler
August	15 - 16	9 - 14	MARTIN KARLSEN
September	23 - 25	1 - 8	Monark (18 ft.)
October	16 - 17	15 - 20	Monark (18 ft.)

All these samples were collected in 13 (US) gallon containers. After these containers were filled at the stations, they were later cooled and delivered to Dr. Medzon's laboratory at the University of Western Ontario within 24 hours after collection.

Bacteriological samples were collected at the same time as the virus samples, cooled and returned to Microbiology Laboratories, CCIW, within 24 hours for analysis.

B. VIRUS WATER SAMPLE COLLECTION SITES

Lake Ontario - St. Lawrence River

Nineteen stations were selected for water collection sites for a virus isolation study. The samples were collected from May to September from Lake Ontario and the St. Lawrence River. For sampling consideration, stations 1 to 6, 7 to 13, and 14 to 19 were considered as separate sampling areas.

During the June 4 - 6 period, a concentrator was used. It took approximately 2 hours per sample to filter 100 gallons of water. All other samples were collected in 13 gallon containers. Each group of stations were completed usually in one day.

After collection, the samples were kept cool and delivered to Dr. Sattar at the University of Ottawa within 24 hours after collection. Samples for bacteriological analysis were also collected at the same time as the virus samples, cooled and returned to the Microbiology Laboratories, CCIW, within 24 hours for processing.

Listed below are the dates when the samples were collected:

	Date	Stations	Vessel Used
May	6 - 10	1 - 6	Boston Whaler
June	4 - 6	7 - 13	Sea Truck
July	2 - 4	14 - 19	Boston Whaler
August	7 - 8	7 - 13	Boston Whaler
September	10 - 11	1 - 6	Monark (18 ft.)

RECOMMENDATIONS

1. The samples are extremely hard to keep cool during the warm summer months because of their size. A refrigerated truck would probably be more suitable for cooling and delivering the samples than the present station wagon, boat and trailer.

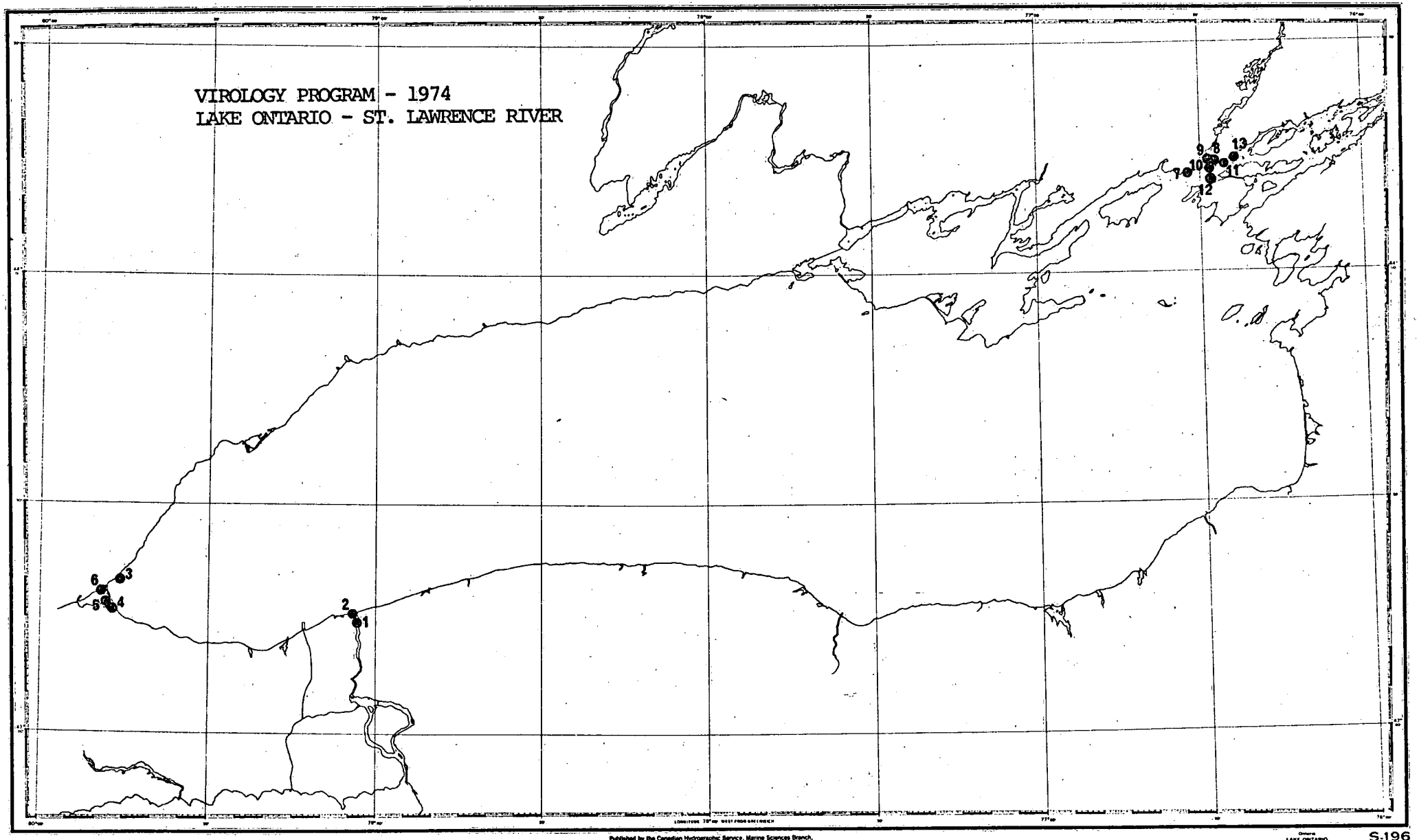
2. The container was tossed overboard and when filled, it was pulled aboard by hand. A hand pump would make filling the container a lot easier than the present method.

3. Monark (18 ft.) equipped with 50 hp. motor proved to be an ideal vessel for this type of support. This vessel is stable and easy to handle, but the only drawback was that the boat was underpowered when loaded.

4. Two people are required for collection and delivery of samples.

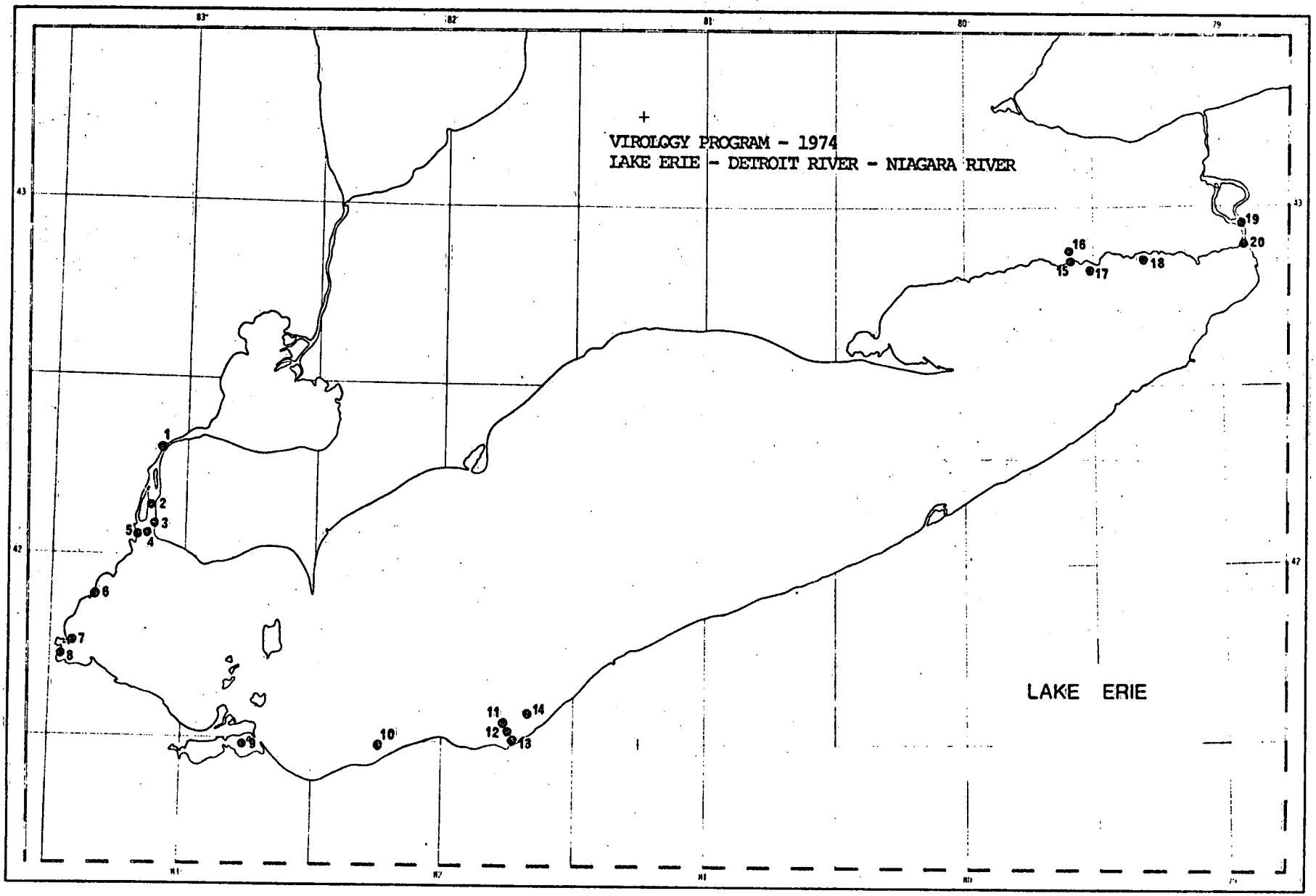
CONCLUSION

The virology launch support was very successful with the help of D.J. Cooper, E.H. Walker and summer students involved.



Published by the Canadian Hydrographic Service, Marine Sciences Branch,
DEPARTMENT OF MINES AND TECHNICAL SURVEYS, OTTAWA

LAKE ONTARIO


VIROLOGY PROGRAM - 1974
LAKE ERIE - DETROIT RIVER - NIAGARA RIVER
LAKE ERIE
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LAKE ERIE, DETROIT RIVER AND NIAGARA RIVER

VIRUS SAMPLING POINTS

Station	Latitude N.	Longitude W.
1	42° 16' 12"	83° 06' 30"
2	42° 15' 30"	83° 07' 00"
3	42° 02' 48"	83° 07' 00"
4	42° 02' 30"	83° 08' 42"
5	42° 02' 30"	83° 10' 30"
6	41° 53' 12"	83° 19' 06"
7	41° 43' 24"	83° 23' 54"
8	41° 41' 12"	83° 28' 27"
9	41° 28' 18"	82° 44' 36"
10	41° 28' 30"	82° 11' 18"
11	41° 31' 42"	81° 44' 06"
12	41° 31' 00"	81° 43' 18"
13	41° 30' 06"	81° 42' 30"
14	41° 32' 42"	81° 39' 00"
15	42° 51' 00"	79° 34' 42"
16	42° 52' 06"	79° 34' 18"
17	42° 50' 42"	79° 30' 30"
18	42° 51' 48"	79° 16' 36"
19	42° 56' 18"	78° 54' 42"
20	42° 53' 18"	78° 54' 36"

LAKE ONTARIO AND ST. LAWRENCE RIVER

VIRUS SAMPLING POINTS

Station	Latitude N.	Longitude W.
1	43° 15' 06"	79° 03' 24"
2	43° 15' 48"	79° 04' 24"
3	43° 20' 12"	79° 46' 06"
4	43° 15' 54"	79° 47' 48"
5	43° 16' 54"	79° 47' 48"
6	43° 18' 39"	79° 48' 42"
7	44° 13' 00"	76° 32' 12"
8	44° 14' 48"	76° 28' 00"
9	44° 14' 48"	76° 28' 36"
10	44° 14' 24"	76° 28' 42"
11	44° 13' 54"	76° 28' 24"
12	44° 13' 30"	76° 28' 42"
13	44° 14' 18"	76° 24' 48"
14	45° 00' 24"	74° 45' 30"
15	45° 01' 18"	74° 41' 00"
16	45° 00' 06"	74° 38' 18"
17	44° 59' 54"	74° 38' 30"
18	44° 59' 24"	74° 41' 24"
19	44° 59' 12"	74° 46' 12"

5. MISCELLANEOUS PROGRAMS

(1) Engineering Trials

The purpose of this brief cruise was to test and evaluate "Batfish", a towed instrument for measuring temperature and for defining internal waves.

The "Batfish" was towed with various settings on the servo controller and with different weights attached to the towed body. Parameters measured included roll and pitch, cable tension and depth; these data were recorded on strip charts for later analysis by Engineering staff.

(2) Electron Microscopy

Technical Operations personnel prepared and examined samples of water and mud for asbestos fibres. Water samples came from Lake Superior and from rivers flowing into the upper Great Lakes; as well, samples supplied by Water Quality Division were examined. The mud samples were taken from Lake Superior.

The water samples (250 ml) were first ultra-centrifuged and the fibres were then re-suspended in 1 ml of water by sonification. A one microlitre drop of water was then placed on a carbon-coated specimen grid and dried in a desiccator. The sample was then examined under the electron microscope and the fibres counted; size distribution was calculated by measuring approximately fifty fibres.

(3) Remote Sensing of a Controlled Oil Spill

Technical Operations section co-ordinated and supported a night-time controlled oil spill with staff from Scientific Operations Division, Environmental Protection Service, and Canada Centre for Remote Sensing, Ottawa.

A DC-3 aircraft with CCRS personnel aboard was dispatched from Ottawa on a calm night in July. Inside the plane was a laser fluorometer designed to detect oil on the water surface at night. The wind and waves had to be relatively still so that the crude oil used in the experiment would not build up in any one corner of the 1,000-foot oil boom. The good weather would also lessen the chances of oil escaping from the boom.

The oil boom was deployed on the day of the experiment; absorbent material was placed at places where leaks could possibly occur, such as at the corners. Clean-up equipment such as pumps and skimmers were tested on the same day.

The site of the spill was marked by red lights for the aircraft. As the plane made its passes at an altitude of approximately 300 metres, western crude oil obtained from Shell Refinery was introduced to the water within the boom. Amounts spilled were regulated through constant air-to-ground contact with the personnel aboard the plane. Oil was added in small quantities for evaluating the detection equipment; in all, 65 gallons of oil was used in the experiment.

When the overflights were finished - it took about 80 minutes to complete the passes - the clean-up operation began. Working well into the night, staff were able to recover the larger portion of the oil used. A device called the Self-Levelling Unit for the Removal of Pollution (SLURP) proved to be most effective.

On the following day in daylight, the balance of the oil was removed by applying absorbent pads on the oil, which by this time was very thin. It is estimated that 90% of the oil was recovered.

(4) Dynamic Mooring Analysis

LIMNOS participated in an anchor testing program for this MSD project; Technical Operations riggers and divers provided the support. The object of the program was to learn the capability of variously configured anchors on different types of bottoms.

After confirmation of the bottom composition, an anchor was dropped and towed or dragged by LIMNOS. After the towing, the stop/start tensions were noted and divers inspected the track that the anchor made. The testing was successful in that it revealed the type of anchor most desirable for the mooring evaluation which followed.

The dynamic mooring evaluation took place in the Niagara River. The configuration of the mooring equipment is such that the measuring devices would remain at a fixed distance below the water surface (especially required in tidal areas and in rivers or lakes having a great water level variation). Consequently, the mooring is more complex and time-consuming to install than the more common rigid U-shaped mooring.

The entire mooring analysis proved workable, and MSD have plans for using the system in the Lower St. Lawrence.

(5) Side Scan Sonar Survey

The purpose of the cruise was to utilize the EG&G side scan sonar and seismic profiler to examine the lake bottom sediment structures at designated areas in Lake Ontario. Technical Operations staff monitored echo sounders and took Shipek samples when requested.

(6) Land Drainage Program

The object of the Land Drainage Program was to study the use of water and effluents. All major flows were sampled and processed to obtain suspended solids and water samples of the drainage area. Qualitatively and quantitatively, sediment input could then be deduced.

Technical Operations personnel provided full field support. The LAC MANITOBA, a minor charter ship, was fitted out with boats and a laboratory with a centrifuge.

Large volumes of water were collected - 500 to 900 litres, depending on the yield in solids - and centrifuged at a constant flow of approximately four litres per minute. Accumulations of at least five grams of solid precipitate had to be gathered and freeze-dried for subsequent shore analysis. Accompanying field observations at the sampling sites were Secchi disc readings, stream flow measurements, and Shipek grab samples. Ten-litre water samples were collected separately and filtered through pre-weighed filters for quantitative estimates.

The precipitated solids and the water from the outflow of the centrifuge were analysed on shore for nutrients, trace metals, phosphorus, organic and inorganic carbon, nitrogen, mercury and pesticides.

(7) U. S. Winter Moorings

Co-operation between researchers from Canada and the United States continued, currently in the form of water movement studies in Lake Huron.

Technical Operations Section loaned equipment, staff and expertise to the Great Lakes Environmental Research Laboratory for the establishment of winter current meter moorings in western Lake Huron. Ten moorings were launched from the U. S. Research Vessel ROGER R. SIMONS.

(8) Physical Processes Unit

Technical Operations Section assigned one individual to the Physical Processes Unit to work in the Waste Heat program. There was a substantial amount of computer programming required to edit, manipulate, and plot various measured parameters. For example, a program to produce lineprinter character maps of isotherm depth and surface temperature, and a program to produce progressive vector wind stress diagrams, have been written. A survey of power plant heat rejection into Lake Ontario in 1972 has also been done.

The Fixed Temperature Profile (FTP) system has been developed by Applied Limnology and Physical Processes Section. It is a central strain member cable with 18 or 21 thermistor breakouts along its length and records temperature at as many levels at 10 minute intervals for up to six weeks. Computer programs have been written to edit and plot this data. The data from the four stations in Lake Ontario in 1972 and two at Douglas Point in 1973 are now processed to the final edited state, and more importantly, the software is now complete for processing future data. Responsibility for the FTP system passed to the Sensor Network Unit in 1974.

Physical Processes Unit also required development of programs to present current meter and meteorological data in page size, 11-day plots. Specifically, the programs have been used to produce a data report for the ice studies carried out last winter in eastern Lake Ontario.

(9) Program Co-ordination

Program co-ordination is a key major task in Technical Operations Section. This job involves the gathering of all project forecasts and their translation into field tasks. Budget estimates are made to reflect on the various projects requiring field support. Ships' and launches' schedules are formed, and cruise plans are prepared.

The intensive co-ordinating begins before the end of one field season and often carries on into the next. Much effort and concentration is required. One senior staff member is assigned full-time to these duties; and his time is occupied in liason with project leaders and with the Head, Technical Operations Section. As many as six junior staff members assist with the co-ordinating.

PARTICIPATION IN SHORT PROGRAMS

VESSEL	PROGRAM	PERSONNEL
ADVENT	Mycology	Spry
	Mycology	B. Moore
	Microbiology	Koteles
	Engineering Trials	B. Moore/Thompson/Hill
AGILE	U/W Current Meter	Don
BAYFIELD	Seismic, Side-Scan	Mawhinney
	U/W Moorings	Roe/Compton-Smith
LAC MANITOBA (Charter Vessel)	Land Drainage	deVree/Thompson
LEMOYNE	NTA	Carew
	Sediment Survey	Don/Compton-Smith
	Engineering Trials	Don/Compton-Smith
	Moorings	B. Moore
	Sediment Survey	McGuffin
	Virology	Compton-Smith
S.A.B. #1	Ice Survey	Withers
	L. Winnipeg Survey	Roe/Don
SHARK	NTA	Carew
	Coring Equipment Trials	Compton-Smith
VEDETTE	Wrecks	Don
WHALER/MONARK	Water Quality, Rivers	Salisbury
WHALERS	Virology	Compton-Smith
	NTA	Compton-Smith
	NTA	deVree

Many small boats were used for a variety of scientific programs by personnel from Technical Operations Section.

BRIEF DESCRIPTIONS OF SMALL BOATS USED IN SHORT PROGRAMS

All boats are owned, maintained and operated by Marine Sciences Directorate.

AQUA

Aluminum Hull, Shallow Vee
Length - 44 feet
Beam - 11.8 feet
Draft - 3 feet
Approximate Maximum Speed - 15 knots
Special Equipment - Sounder, Radio, Radar, Gyro-Compass, Mini-ranger Positioning System

AGILE

Same as AQUA, without positioning system

LEMOYNE

Steel Hull, Displacement
Length - 40 feet
Beam - 11 feet
Draft - 5 feet
Approximate Maximum Speed - 10 knots
Special Equipment - Sounder, Radio, Radar, Gyro-Compass

S. A. B. #1

Aluminum Hull, Cathedral
Length - 20.5 feet
Beam - 7.5 feet
Draft - 3.5 feet

VEDETTE

Steel Hull, Planing
Length - 46.6 feet
Beam - 16 feet
Draft - 6.8 feet
Approximate Maximum Speed - 13 knots
Special Equipment - Sounder, Radio, Radar, Gyro-Compass

BAYFIELD

Steel Hull, Displacement
Length - 105.8 feet
Beam - 21 feet
Draft - 8 feet
Approximate Maximum Speed - 11 knots
Special Equipment - Sounder, Radio, Radar, Gyro-Compass

LAC MANITOBA - (Charter Vessel)

Steel Hull, Harbour Tug
Length - 65 feet
Beam - 16.5 feet
Draft - 7 feet
Approximate Maximum Speed - 11 knots
Special Equipment - Sounder, Radio, Radar, Gyro-Compass

BOSTON WHALER

Glass-Reinforced Plastic Hull
Length - 16.5 feet
Beam - 6 feet
Draft - 2 feet
Speed varies with outboard motor used
Special Equipment - Sounder, if required

MONARK

Aluminum Hull, Work Boat
Length - 17.2 feet
Beam - 7.2 feet
Draft - 2 feet
Speed varies with outboard motor used.
Special Equipment - Sounder, if required

6. DIVE UNIT

The Dive Unit supported 24 projects in the 1974 field season. These programs are summarized in the table on page 24. In addition to work on the Great Lakes, diving support was given to projects in Lake Simcoe, Lake Winnipeg and the St. Lawrence River. Altogether over 400 underwater hours were logged by diving personnel.

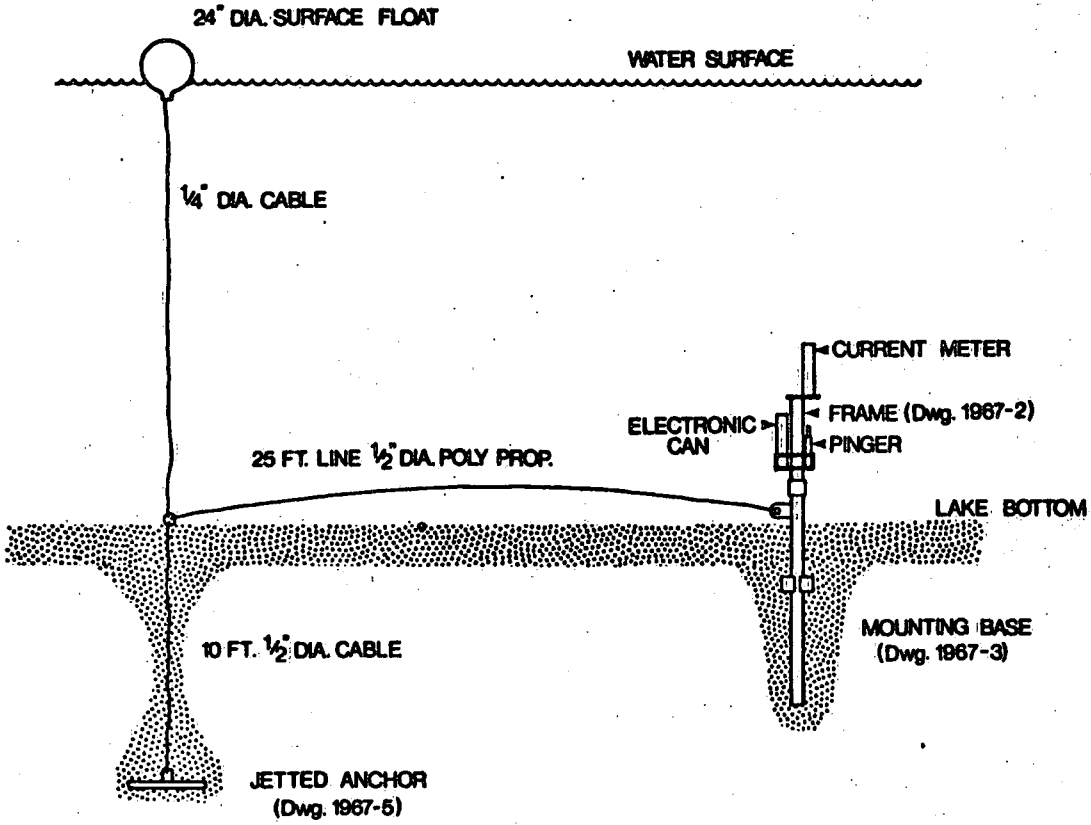
The closed circuit underwater television system is now fully operational and has been installed on board the diving tender, CSL SHARK. A Motorola Mini-Ranger System has also been installed and will be fully operational for use in the CCIW area for the 1975 field season.

The accompanying figure shows a new type of current meter installation used, for the first time, this year, at four stations in the Pt. Pelee area. The sensor is an electromagnetic current meter with the data being stored on board in the standard CCIW Submersible Battery Package. The pile which supports the station is installed by jetting the pipe into the bottom. Diver connectible electrical fittings were used to facilitate servicing the station without removing it.

1974 DIVE UNIT FIELD SEASON

LOCATION	AGENCY	PROGRAM	LEADER
CCIW	T. OPS	Training & Checkout	Roe
Big Bay Point Lake Simcoe	HYDRAULICS	Ice Movement Program	Tsang
Oshawa	T. OPS	Near Shore Temperature Sensor Recovery	Nicholson
Oshawa	T. OPS	Winter Geodyne Moorings Locate & Recovery	Bennett
L. Ontario	CHS	Hydrodynamic Anchor Trials	Barfoot
L. Ontario	LRD	Sedimentation Velocity Program	Burns
Pt. Petre	T. OPS	Near Shore Temperature Sensor Recovery	Nicholson
Douglas Point	LRD	Television Survey	Bennett
Niagara River	CHS	Install, Maintain & Recover Hydrodynamic Mooring	Barfoot
L. Winnipeg	REMOTE SENSING	Site Survey	MacPhail
Burlington Bay	LRD/ENG	Interstitial Water Sampler Trials	Nriagu
Pt. Pelee	LRD	Installation of Electromagnetic Current Meters	Coakley
Pt. Pelee	LRD	Television Survey and Coring	Coakley
Pt. Pelee	LRD	Current Meter Maintenance	Coakley
Pt. Pelee	LRD	Install and Recover Sand Traps	Coakley
Bay of Quinte	LRD	Impacts and Pathways - Limnocorrals	Lean
L. Huron	CHS	Wreck Investigation and Survey	DeGrasse
L. Ontario	LRD	Acoustic Transponders and Side Scan Sonar	Rukavina
Niagara River	WQLN/ENG	Automatic Water Sampler	Brady
Douglas Point	T. OPS	Locate and Recover Lost Current Meters	Brooks
L. Ontario	ENG	Install and Maintain 2 Towers	Gibson
Various		Locate and Recover Lost Equipment	
St. Lawrence River	CHS	Current Meter Recovery	Marshall
CCIW	MSD	Hull Inspection - CSS LIMNOS	Keeping

PARTS LIST		
PART NO.	DESCRIPTION	QTY.



NO	DATE	DESCRIPTION	DRWN. BY	APPD. BY
		REVISION		

UNLESS OTHERWISE SPECIFIED

TOLERANCE ON THREE PLACE DIMENSIONS	±
TOLERANCE ON TWO PLACE DIMENSIONS	±
TOLERANCE ON ANGLES	±
EXTERNAL CORNER CHAMFER	.018 - .025
INTERNAL CORNER RADIUS	.010 - .020
SURFACE FINISH	AA MICRO INS.

MATERIAL SPECIFICATIONS

Environment Canada / Environnement Canada

Canada Centre for Inland Waters / Centre Canadien des Eaux Interieures

TITLE

ELECTROMAGNETIC CURRENT METER ARRANGEMENT

DESIGNED BY	CHECKED BY	APPROVED BY
DRAWN BY APG	CHECKED BY	DRAWING NO. 1967-1
SCALE	DATE NOV 74	SHEET OF

R.B.P.

7. RIGGING SHOP

A rigging foreman and a staff of two riggers maintained and supported all equipment used by Technical Operations. During the winter months all buoys, sampling equipment, winches, generators, and a variety of materials were overhauled and made ready for the survey season. Support was also given to the Ice-piling program at Lake Simcoe, where a tower was erected and assistance in a topographic survey was given to the Hydraulics Section.

In the summer, a considerable amount of support was given to the ship and shore-based surveys which involved the delivery of equipment to ships, which operated mainly on the Upper Lakes, and the towing of out-size and normal trailers to various locations including Kingston, Nanticoke, Sault Ste. Marie, and Red Rock.

Considerable strides were made to increase working areas and storage space. An enclosed area outside the rigging shop was completed and a heating system installed which will enable fibreglass operations to be continued during the winter months. In addition to the outside storage area at the northwestern corner of the complex, a buoy storage building has been erected and a loft built for storage of pallets of equipment.

APPENDIX A

LAKE ONTARIO

74 - 00 - 104

SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
01	43° 19' 48"	79° 42' 36"
02	43° 26' 26"	79° 34' 30"
03	43° 16' 45"	79° 34' 30"
04	43° 14' 03"	79° 24' 31"
05	43° 17' 33"	79° 24' 30"
06	43° 24' 44"	79° 24' 27"
07	43° 30' 37"	79° 24' 27"
08	43° 37' 30"	79° 27' 48"
T.P.	43° 35' 54"	79° 23' 00"
09	43° 36' 12"	79° 21' 24"
T.P.	43° 39' 30"	79° 14' 48"
10	43° 42' 24"	79° 13' 06"
T.P.	43° 44' 54"	79° 08' 06"
11	43° 47' 42"	79° 05' 18"
12	43° 39' 24"	79° 06' 00"
13	43° 30' 36"	79° 06' 00"
14	43° 25' 15"	79° 04' 24"
15	43° 21' 55"	79° 15' 27"
16	43° 16' 19"	79° 13' 01"
T.P.	43° 19' 45"	79° 05' 06"
17	43° 18' 30"	79° 02' 22"
18	43° 22' 00"	78° 48' 00"
19	43° 30' 18"	78° 48' 00"
20	43° 39' 30"	78° 48' 00"
21	43° 48' 00"	78° 48' 00"
22	43° 51' 24"	78° 48' 00"
T.P.	43° 50' 30"	78° 47' 43"
23	43° 52' 48"	78° 30' 06"
24	43° 49' 38"	78° 30' 04"
25	43° 39' 06"	78° 30' 00"
26	43° 27' 20"	78° 30' 03"
27	43° 23' 18"	78° 30' 00"
28	43° 24' 30"	78° 17' 00"
29	43° 32' 54"	78° 17' 00"
66	43° 39' 00"	78° 17' 00"

LAKE ONTARIO

74 - 00 - 104

SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
30	43° 45' 41"	78° 17' 00"
31	43° 52' 00"	78° 16' 45"
32	43° 56' 06"	78° 16' 51"
33	43° 52' 09"	77° 53' 55"
34	43° 38' 48"	77° 54' 00"
35	43° 26' 20"	77° 53' 54"
36	43° 17' 30"	77° 36' 00"
37	43° 21' 33"	77° 36' 00"
38	43° 26' 06"	77° 36' 10"
39	43° 30' 45"	77° 36' 07"
40	43° 39' 25"	77° 35' 03"
41	43° 47' 49"	77° 36' 04"
42	43° 52' 27"	77° 36' 08"
43	43° 56' 24"	77° 36' 07"
T.P.	43° 53' 00"	77° 33' 00"
44	43° 48' 42"	77° 18' 06"
45	43° 39' 00"	77° 18' 00"
46	43° 20' 33"	77° 17' 30"
47	43° 17' 20"	77° 00' 00"
48	43° 22' 30"	77° 00' 00"
49	43° 30' 30"	76° 57' 28"
50	43° 39' 17"	76° 57' 00"
51	43° 47' 44"	76° 59' 57"
52	43° 52' 30"	77° 00' 00"
53	43° 52' 00"	76° 42' 00"
T.P.	43° 55' 36"	76° 42' 42"
65	44° 00' 18"	76° 48' 00"
T.P.	44° 05' 54"	76° 38' 24"
64	44° 09' 06"	76° 36' 00"
T.P.	44° 03' 45"	76° 34' 15"
63	44° 00' 48"	76° 30' 20"
T.P.	43° 56' 09"	76° 18' 00"
62	43° 55' 36"	76° 12' 29"
T.P.	43° 56' 09"	76° 18' 00"
61	43° 52' 15"	76° 24' 00"

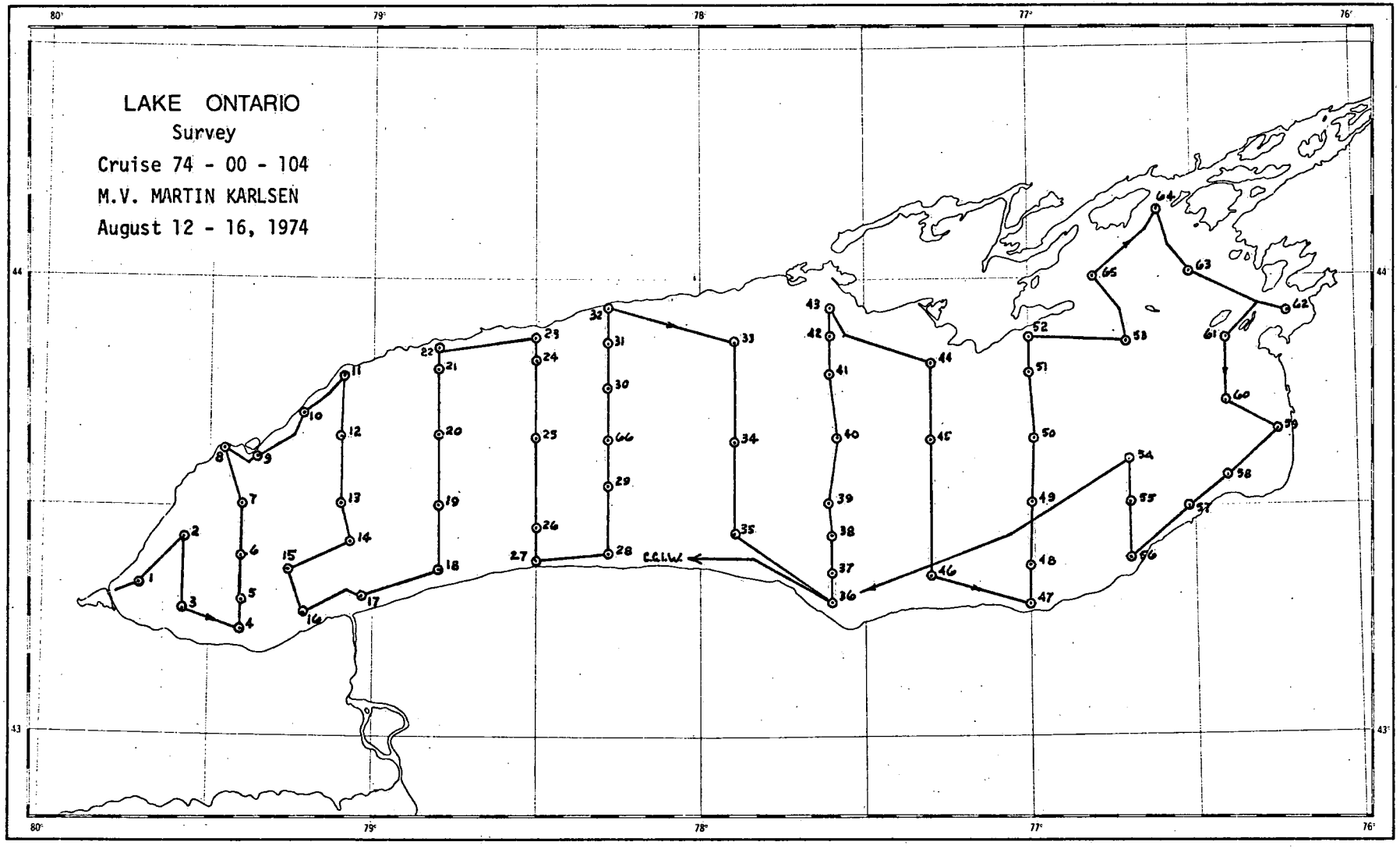
LAKE ONTARIO

74 - 00 - 104

SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
60	43° 43' 38"	76° 24' 04"
59	43° 39' 38"	76° 15' 02"
58	43° 34' 12"	76° 24' 00"
57	43° 30' 00"	76° 31' 06"
56	43° 23' 18"	76° 42' 00"
55	43° 30' 24"	76° 42' 00"
54	43° 36' 03"	76° 42' 02"
T.P.	43° 26' 41"	77° 03' 32"
36	43° 17' 36"	77° 36' 03"
T.P.	43° 23' 24"	77° 47' 12"
T.P.	43° 25' 00"	78° 29' 06"

END OF CRUISE


LAKE ONTARIO
Survey
Cruise 74 - 00 - 104
M.V. MARTIN KARLSEN
August 12 - 16, 1974
80°
79°
78°
77°
76°
44°
43°
C.C.I.W.

LAKE HURON

74 - 02 - 103

SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
✓	45° 15' 45"	81° 40' 15"
65	45° 21' 12"	81° 44' 39"
T.P.	45° 19' 15"	81° 47' 18"
T.P.	45° 13' 12"	81° 47' 18"
64	45° 12' 47"	81° 45' 54"
T.P.	45° 11' 21"	81° 46' 12"
63	45° 05' 04"	81° 38' 06"
62	45° 00' 01"	81° 30' 30"
61	45° 09' 30"	81° 52' 18"
60	45° 14' 12"	81° 51' 30"
59	45° 22' 54"	81° 56' 06"
57	45° 29' 36"	81° 53' 24"
58	45° 27' 31"	81° 59' 41"
T.P.	45° 32' 13"	82° 01' 45"
13	45° 32' 55"	82° 01' 21"
T.P.	45° 32' 15"	82° 02' 12"
14	45° 34' 25"	82° 19' 12"
15	45° 42' 37"	82° 42' 15"
T.P.	45° 35' 13"	82° 53' 47"
17	45° 35' 24"	82° 55' 29"
20	45° 43' 48"	83° 17' 54"
21	45° 52' 42"	83° 15' 00"
44	45° 58' 12"	83° 11' 48"
T.P.	46° 00' 39"	83° 20' 17"
43	46° 00' 00"	83° 26' 06"
42	46° 05' 06"	83° 25' 00"
37	46° 08' 13"	83° 40' 13"
38	46° 14' 10"	83° 44' 42"
39	46° 13' 36"	83° 35' 20"
40	46° 11' 12"	83° 21' 18"
41	46° 08' 54"	83° 12' 12"
45	46° 02' 06"	83° 00' 00"
46	46° 07' 24"	82° 53' 00"
47	46° 00' 06"	82° 51' 12"
48	46° 04' 30"	82° 44' 48"

LAKE HURON

74 - 02 - 103

SURVEY STATIONS

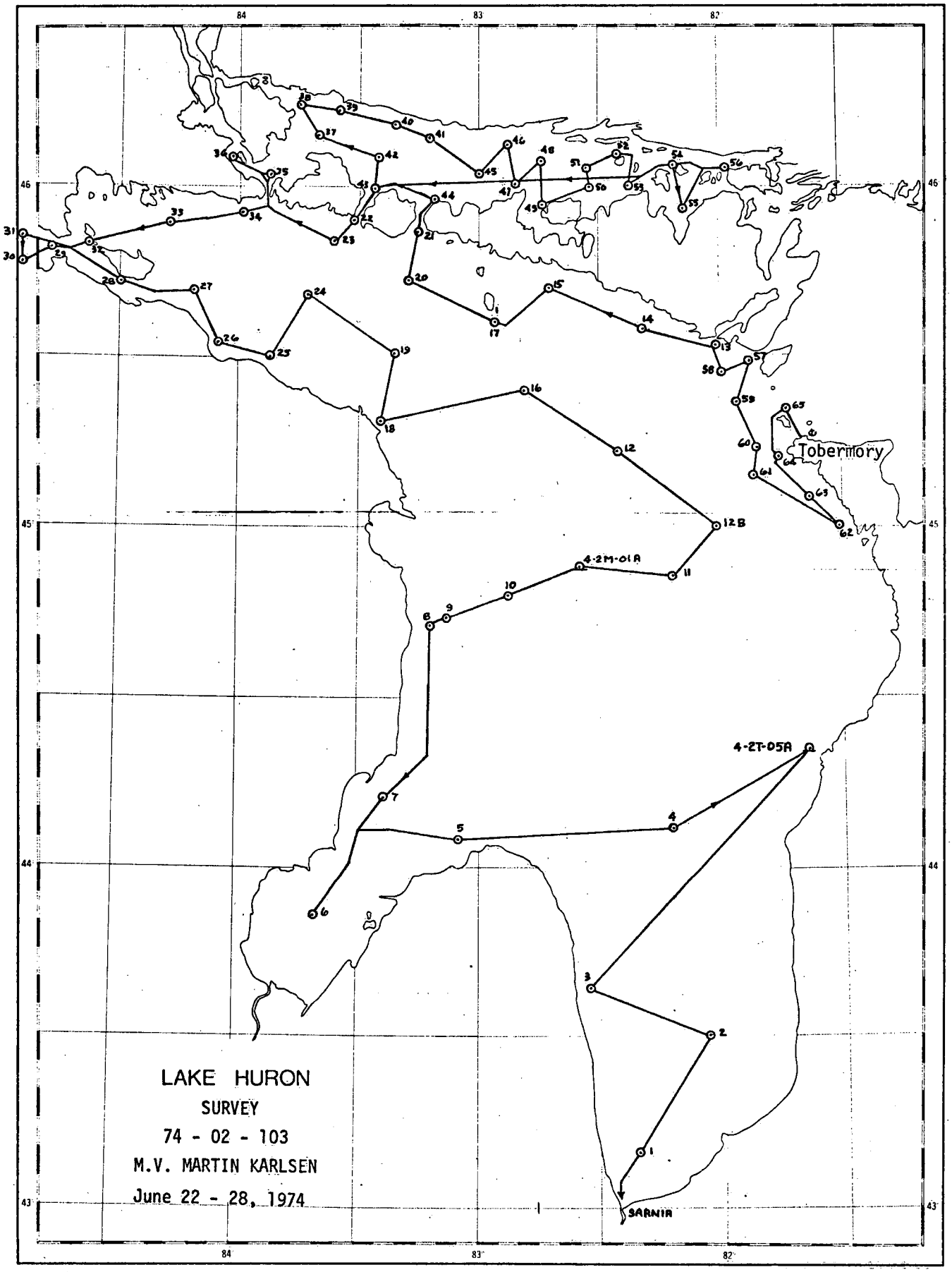
Station Number	Latitude N.	Longitude W.
49	45° 57' 17"	82° 44' 33"
50	46° 00' 00"	82° 32' 55"
51	46° 05' 19"	82° 33' 37"
52	46° 05' 54"	82° 25' 36"
T.P.	46° 05' 24"	82° 22' 00"
53	46° 00' 18"	82° 23' 18"
T.P.	46° 03' 30"	82° 14' 54"
54	46° 03' 48"	82° 11' 36"
55	45° 55' 42"	82° 09' 30"
T.P.	46° 03' 00"	82° 04' 17"
56	46° 03' 12"	81° 58' 58"
T.P.	46° 03' 33"	82° 04' 12"
T.P.	46° 04' 38"	82° 07' 06"
In-situ mooring site	46° 03' 50"	82° 11' 40"
T.P.	46° 03' 24"	82° 13' 18"
T.P.	46° 03' 24"	82° 14' 13"
T.P.	46° 01' 49"	82° 19' 54"
T.P.	46° 00' 00"	83° 26' 00"
22	45° 54' 00"	83° 31' 48"
23	45° 50' 30"	83° 36' 00"
T.P.	45° 55' 30"	83° 52' 00"
T.P.	45° 56' 30"	83° 53' 24"
35	46° 02' 18"	83° 52' 12"
T.P.	46° 02' 09"	83° 53' 28"
36	46° 04' 51"	84° 01' 48"
T.P.	46° 02' 38"	83° 56' 12"
T.P.	46° 00' 30"	83° 53' 32"
T.P.	45° 56' 12"	83° 53' 28"
34	45° 55' 13"	83° 59' 27"
T.P.	45° 54' 47"	84° 08' 45"
33	45° 53' 36"	84° 18' 00"
T.P.	45° 50' 35"	84° 36' 28"
32	45° 50' 00"	84° 38' 39"
T.P.	45° 48' 54"	84° 42' 54"
31	45° 51' 18"	84° 55' 00"

LAKE HURON

74 - 02 - 103

SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
30	45° 46' 36"	84° 55' 00"
29	45° 49' 00"	84° 48' 00"
T.P.	45° 48' 54"	84° 42' 54"
28	45° 43' 00"	84° 30' 00"
T.P.	45° 41' 18"	84° 21' 30"
27	45° 42' 00"	84° 11' 12"
26	45° 32' 24"	84° 05' 16"
25	45° 30' 06"	83° 52' 00"
24	45° 41' 12"	83° 42' 42"
19	45° 31' 06"	83° 21' 00"
18	45° 18' 54"	83° 24' 06"
16	45° 24' 24"	82° 49' 18"
12	45° 14' 18"	82° 25' 35"
12B	45° 01' 00"	82° 01' 15"
11	44° 52' 18"	82° 12' 00"
4-2M-01A	44° 53' 12"	82° 35' 00"
10	44° 47' 54"	82° 52' 28"
9	44° 44' 43"	83° 08' 09"
8	44° 43' 18"	83° 12' 17"
T.P.	44° 20' 00"	83° 12' 30"
7	44° 12' 24"	83° 23' 00"
T.P.	44° 06' 36"	83° 29' 50"
T.P.	44° 01' 12"	83° 31' 48"
6	43° 51' 32"	83° 40' 15"
T.P.	44° 01' 12"	83° 31' 48"
T.P.	44° 06' 36"	83° 29' 50"
T.P.	44° 07' 00"	83° 22' 30"
5	44° 04' 14"	83° 04' 57"
4	44° 07' 12"	82° 12' 15"
4-2T-05A	44° 20' 54"	81° 39' 55"
3	43° 38' 27"	82° 32' 29"
2	43° 30' 00"	82° 04' 18"
1	43° 09' 37"	82° 20' 30"
Sarnia	Alongside	


84
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Tobermory
4-2M-01A
4-2T-05A
SARNIA
LAKE HURON
SURVEY
74 - 02 - 103
M.V. MARTIN KARLSEN
June 22 - 28, 1974

GEORGIAN BAY

74 - 05 - 103

SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
01	44° 37' 24"	80° 55' 24"
02	44° 43' 03"	80° 51' 24"
03	44° 48' 30"	80° 52' 18"
04	44° 43' 30"	80° 37' 00"
05	44° 34' 43"	80° 24' 25"
T.P.	44° 37' 58"	80° 20' 35"
06	44° 38' 45"	80° 14' 58"
07	44° 30' 25"	80° 06' 15"
08	44° 43' 00"	80° 05' 30"
09	44° 47' 48"	80° 14' 36"
10	44° 44' 12"	80° 26' 06"
11	44° 53' 20"	80° 17' 50"
T.P.	44° 54' 50"	80° 14' 30"
12	44° 57' 10"	80° 08' 06"
T.P.	44° 52' 12"	80° 01' 15"
13	44° 52' 18"	79° 58' 05"
T.P.	44° 52' 12"	80° 01' 18"
T.P.	44° 55' 55"	80° 10' 25"
15	44° 55' 15"	80° 36' 21"
T.P.	44° 51' 42"	80° 57' 00"
17	44° 47' 12"	81° 05' 30"
T.P.	44° 45' 48"	81° 07' 00"
16	44° 55' 12"	80° 52' 30"
T.P.	45° 02' 50"	81° 02' 35"
25	45° 04' 00"	81° 15' 14"
24	45° 09' 10"	81° 04' 03"
18	45° 01' 36"	80° 52' 36"
19	45° 01' 48"	80° 38' 36"
20	45° 08' 30"	80° 31' 24"
T.P.	45° 06' 30"	80° 16' 12"
14	45° 03' 15"	80° 11' 28"
21	45° 10' 00"	80° 17' 48"
22	45° 21' 13"	80° 29' 12"
23A	45° 14' 42"	80° 52' 30"
23B	45° 17' 42"	80° 52' 30"

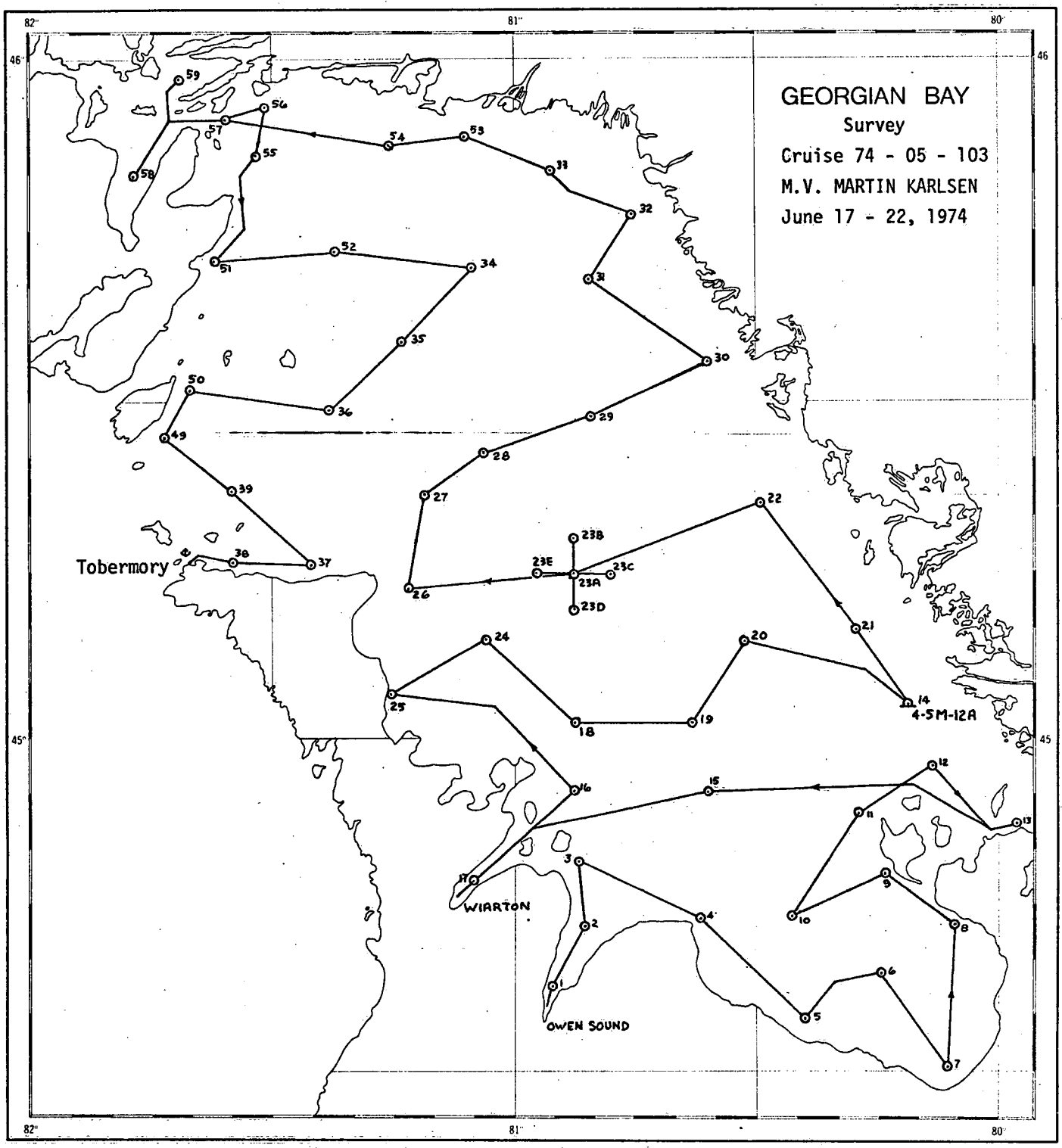
GEORGIAN BAY

74 - 05 - 103

SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
23C	45° 14' 42"	80° 48' 13"
23D	45° 11' 42"	80° 52' 30"
23E	45° 14' 52"	80° 56' 48"
26	45° 13' 00"	81° 13' 36"
27	45° 21' 54"	81° 11' 24"
28	45° 25' 35"	81° 04' 10"
29	45° 28' 50"	80° 50' 15"
30	45° 33' 35"	80° 36' 38"
31	45° 40' 44"	80° 50' 20"
32	45° 46' 40"	80° 45' 15"
T.P.	45° 48' 15"	80° 53' 30"
33	45° 50' 06"	80° 55' 24"
53	45° 53' 00"	81° 06' 30"
54	45° 52' 24"	81° 15' 30"
57	45° 55' 00"	81° 36' 00"
T.P.	45° 54' 48"	81° 43' 06"
59	45° 58' 20"	81° 41' 55"
58	45° 49' 52"	81° 47' 19"
T.P.	45° 54' 46"	81° 43' 05"
57	45° 54' 46"	81° 35' 42"
56	45° 56' 00"	81° 31' 04"
55	45° 51' 52"	81° 32' 08"
T.P.	45° 49' 51"	81° 34' 06"
T.P.	45° 45' 18"	81° 33' 30"
51	45° 42' 30"	81° 37' 12"
52	45° 43' 00"	81° 22' 30"
34	45° 42' 12"	81° 05' 24"
35	45° 35' 15"	81° 14' 25"
36	45° 28' 40"	81° 23' 10"
50	45° 31' 39"	81° 40' 10"
49	45° 27' 10"	81° 43' 46"
39	45° 22' 13"	81° 35' 06"
37	45° 15' 18"	81° 26' 24"
38	45° 16' 12"	81° 35' 00"
	45° 15' 45"	81° 40' 15"

END OF CRUISE


GEORGIAN BAY
Survey
Cruise 74 - 05 - 103
M.V. MARTIN KARLSEN
June 17 - 22, 1974
82°
81°
80°
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45°
Tobermory
WIARTON
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LAKE ONTARIO

1974

SURVEILLANCE STATIONS

Station Number	Latitude N.	Longitude W.
1	43° 18' 48"	79° 45' 06"
2	43° 20' 24"	79° 39' 54"
3	43° 16' 06"	79° 37' 12"
4	43° 22' 00"	79° 34' 36"
5	43° 25' 30"	79° 39' 30"
6	43° 28' 00"	79° 31' 48"
7	43° 32' 48"	79° 29' 18"
8	43° 37' 24"	79° 27' 12"
9	43° 35' 12"	79° 23' 42"
10	43° 40' 06"	79° 16' 00"
11	43° 35' 06"	79° 18' 42"
12	43° 30' 12"	79° 21' 12"
13	43° 25' 00"	79° 24' 00"
14	43° 23' 36"	79° 29' 12"
15	43° 19' 00"	79° 26' 36"
16	43° 16' 18"	79° 21' 36"
17	43° 13' 30"	79° 16' 18"
18	43° 18' 12"	79° 16' 42"
19	43° 23' 00"	79° 17' 06"
20	43° 20' 18"	79° 11' 48"
21	43° 18' 00"	79° 07' 12"
22	43° 17' 48"	79° 00' 18"
23	43° 22' 12"	79° 04' 00"
24	43° 26' 24"	79° 07' 42"
25	43° 31' 00"	79° 04' 48"
26	43° 36' 30"	79° 01' 00"
27	43° 42' 12"	78° 57' 24"
28	43° 46' 30"	78° 51' 18"
29	43° 49' 48"	78° 52' 12"
30	43° 49' 48"	78° 39' 42"
31	43° 53' 12"	78° 27' 36"
32	43° 47' 00"	78° 26' 18"
33	43° 35' 48"	78° 48' 06"
34	43° 27' 42"	78° 45' 36"
35	43° 21' 36"	78° 43' 48"

LAKE ONTARIO

1974

SURVEILLANCE STATIONS

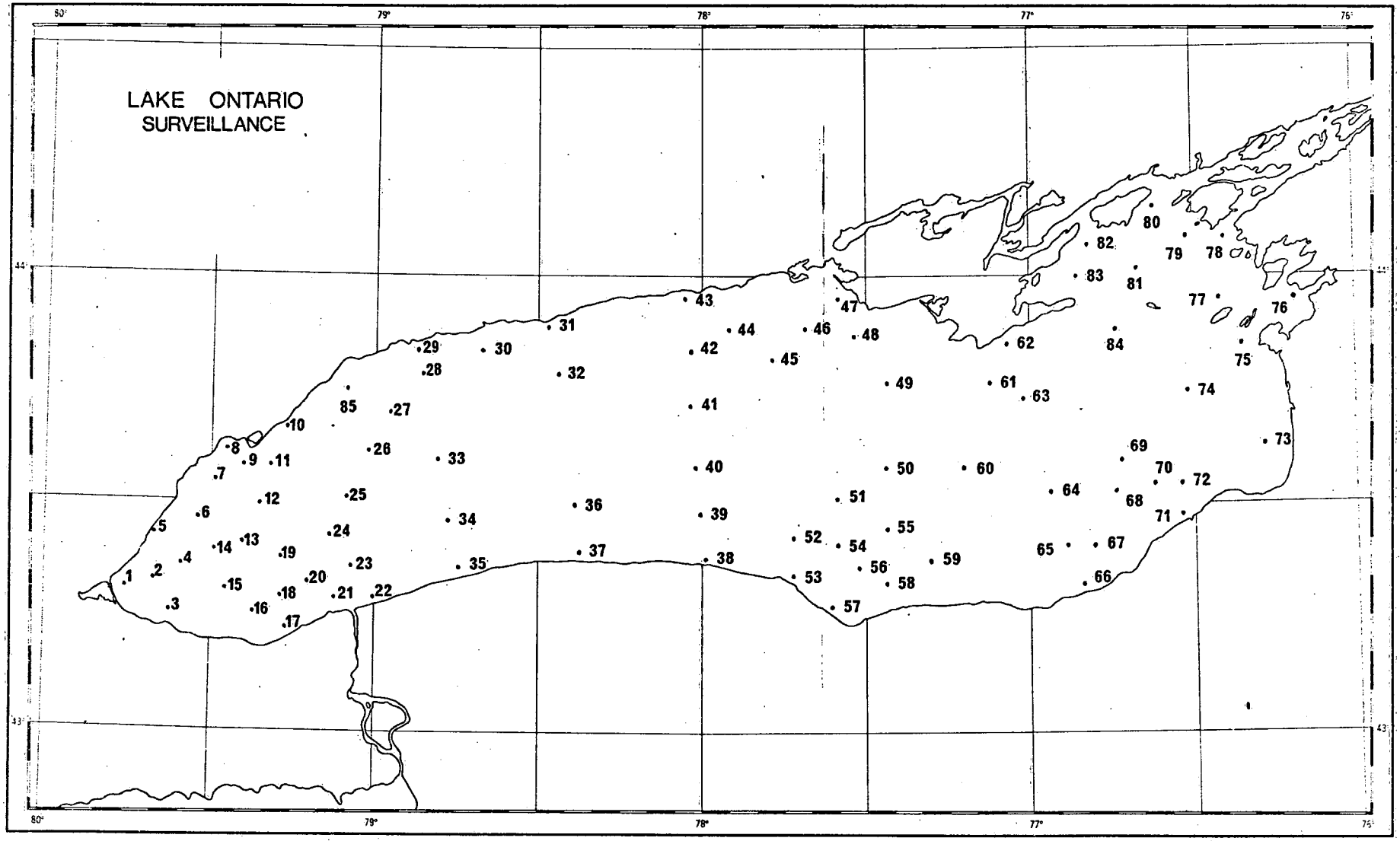
Station Number	Latitude N.	Longitude W.
36	43° 29' 30"	78° 23' 12"
37	43° 23' 30"	78° 22' 12"
38	43° 23' 00"	77° 59' 24"
39	43° 29' 12"	78° 00' 00"
40	43° 35' 24"	78° 00' 42"
41	43° 43' 00"	78° 01' 36"
42	43° 50' 24"	78° 02' 18"
43	43° 57' 00"	78° 03' 00"
44	43° 52' 54"	77° 54' 30"
45	43° 49' 12"	77° 47' 00"
46	43° 53' 06"	77° 41' 24"
47	43° 57' 06"	77° 35' 18"
48	43° 51' 42"	77° 31' 30"
49	43° 46' 18"	77° 26' 18"
50	43° 35' 00"	77° 26' 18"
51	43° 30' 30"	77° 34' 30"
52	43° 26' 00"	77° 42' 42"
53	43° 21' 00"	77° 42' 42"
54	43° 24' 48"	77° 34' 30"
55	43° 26' 36"	77° 26' 18"
56	43° 21' 36"	77° 30' 54"
57	43° 16' 30"	77° 35' 30"
58	43° 19' 42"	77° 26' 18"
59	43° 22' 54"	77° 17' 54"
60	43° 34' 48"	77° 12' 00"
61	43° 46' 06"	77° 06' 30"
62	43° 50' 42"	77° 04' 24"
63	43° 43' 54"	77° 01' 00"
64	43° 31' 30"	76° 55' 36"
65	43° 25' 24"	76° 53' 00"
66	43° 20' 00"	76° 50' 24"
67	43° 24' 30"	76° 47' 42"
68	43° 31' 48"	76° 43' 54"
69	43° 36' 24"	76° 42' 48"
70	43° 32' 30"	76° 37' 06"

LAKE ONTARIO

1974

SURVEILLANCE STATIONS

Station Number	Latitude N.	Longitude W.
71	43° 28' 36"	76° 31' 36"
72	43° 33' 00"	76° 31' 30"
73	43° 38' 00"	76° 17' 18"
74	43° 45' 00"	76° 31' 06"
75	43° 50' 36"	76° 21' 18"
76	43° 57' 00"	76° 10' 30"
77	43° 57' 24"	76° 24' 30"
78	44° 05' 00"	76° 24' 24"
79	44° 04' 30"	76° 31' 18"
80	44° 08' 30"	76° 36' 36"
81	44° 01' 00"	76° 40' 18"
82	44° 04' 00"	76° 48' 42"
83	44° 00' 00"	76° 50' 36"
84	43° 53' 12"	76° 44' 00"
85	43° 45' 00"	79° 05' 00"


LAKE ONTARIO
SURVEILLANCE
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LAKE ERIE

1974

SURVEILLANCE STATIONS

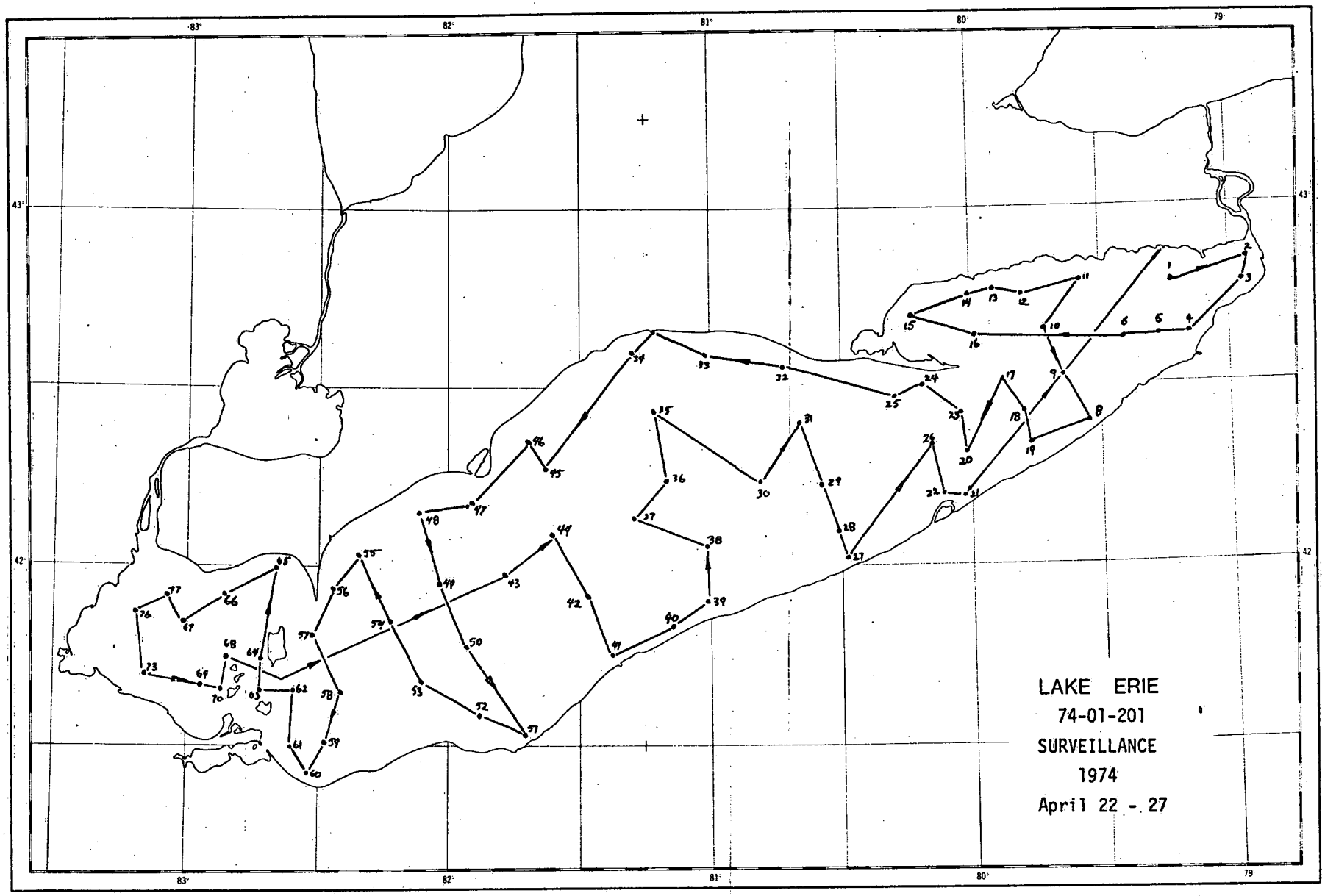
Station Number	Latitude N.	Longitude W.
1	42° 47' 24"	79° 12' 06"
2	42° 50' 36"	78° 57' 30"
3	42° 46' 54"	78° 57' 36"
4	42° 39' 06"	79° 08' 00"
5	42° 38' 30"	79° 16' 18"
6	42° 37' 54"	79° 24' 00"
8	42° 23' 54"	79° 32' 48"
9	42° 32' 18"	79° 37' 00"
10	42° 40' 48"	79° 41' 30"
11	42° 48' 12"	79° 33' 30"
12	42° 46' 12"	79° 47' 30"
13	42° 45' 00"	79° 54' 00"
14	42° 45' 12"	80° 00' 48"
15	42° 42' 42"	80° 14' 54"
16	42° 38' 30"	79° 56' 00"
17	42° 31' 00"	79° 53' 56"
18	42° 25' 00"	79° 48' 00"
19	42° 20' 00"	79° 45' 30"
20	42° 19' 48"	80° 00' 00"
21	42° 12' 00"	80° 03' 00"
22	42° 12' 48"	80° 07' 42"
23	42° 25' 18"	80° 04' 48"
24	42° 30' 54"	80° 09' 12"
25	42° 29' 06"	80° 18' 18"
26	42° 20' 18"	80° 12' 48"
27	42° 02' 48"	80° 27' 06"
28	42° 05' 54"	80° 29' 00"
29	42° 14' 54"	80° 33' 36"
30	42° 15' 00"	80° 48' 00"
31	42° 24' 00"	80° 38' 12"
32	42° 32' 54"	80° 45' 30"
33	42° 35' 30"	81° 01' 00"
34	42° 36' 18"	81° 17' 54"
35	42° 25' 48"	81° 12' 18"
36	42° 15' 12"	81° 06' 24"
37	42° 07' 00"	81° 15' 00"
38	42° 04' 54"	81° 00' 42"
39	41° 55' 54"	80° 55' 00"
40	41° 50' 00"	81° 08' 54"

LAKE ERIE

1974

SURVEILLANCE STATIONS

Station Number	Latitude N.	Longitude W.
41	41° 45' 48"	81° 23' 00"
42	41° 56' 06"	81° 28' 42"
43	41° 58' 40"	81° 45' 25"
44	42° 06' 36"	81° 34' 30"
45	42° 16' 54"	81° 40' 18"
46	42° 21' 30"	81° 42' 24"
47	42° 11' 30"	81° 55' 18"
48	42° 08' 06"	82° 08' 24"
49	41° 57' 54"	82° 02' 30"
50	41° 47' 18"	81° 56' 42"
51	41° 31' 48"	81° 42' 30"
52	41° 36' 24"	81° 53' 48"
53	41° 40' 54"	82° 05' 12"
54	41° 50' 18"	82° 12' 48"
55	42° 02' 48"	82° 21' 54"
56	41° 55' 54"	82° 24' 30"
57	41° 48' 48"	82° 30' 06"
58	41° 38' 30"	82° 24' 12"
59	41° 31' 54"	82° 27' 12"
60	41° 25' 12"	82° 30' 12"
61	41° 28' 58"	82° 38' 06"
62	41° 40' 00"	82° 35' 00"
63	41° 39' 00"	82° 44' 00"
64	41° 44' 18"	82° 44' 00"
65	41° 58' 00"	82° 40' 00"
66	41° 54' 42"	82° 50' 54"
67	41° 49' 54"	83° 01' 05"
68	41° 45' 00"	82° 51' 00"
69	41° 41' 06"	82° 56' 00"
70	41° 40' 00"	82° 52' 00"
73	41° 43' 36"	83° 09' 00"
76	41° 53' 30"	83° 11' 48"
77	41° 56' 48"	83° 02' 42"


83°
82°
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LAKE ERIE
74-01-201
SURVEILLANCE
1974
April 22 - 27

MOORING SUMMARY				LAUNCHING					
MOORING NO	INSTRUMENT POSITION	METER DEPTHS	METER TYPE SERIAL NO.	DEPTH SUB/SURF	DIST S-SS	BEARING S-SS	SURFACE BUOY POSITION	DATE TIME LAUNCHED	REMARKS
4-5C-02A	44° 47' 00" N 80° 14' 00" W	10 m 15 m	PC-6-422 GEO-015	7 m	183 m	310° T	44° 46' 57" N 80° 13' 57" W	19 1258 Z	
4-5C-03A	45° 46' 03" N 80° 46' 26" W	10 m 15 m	PC-6-450 GEO-034	7 m	183.0 m	350° T	45° 45' 59" N 80° 46' 25" W	19 0500 Z	
4-5C-04A	45° 43' 01" N 81° 34' 58" W	10 m 15 m	PC-6-225 GEO-014	7 m	180 m	255° T	45° 43' 03" N 81° 34' 49" W	15 1826 Z	
4-5C-05A	45° 31' 18" N 81° 47' 33" W	8 m 10 m	PC-6-444 GEO-046	5 m	180 m	255° T	45° 31' 21" N 81° 47' 25" W	15 1626 Z	

CRUISE NO. 74 - 05 - 001) Combined
74 - 02 - 001)

MOORING SUMMARY				LAUNCHING					
MOORING NO	INSTRUMENT POSITION	METER DEPTHS	METER TYPE SERIAL NO.	DEPTH SUB/SURF	DIST S-SS	BEARING S-SS	SURFACE BUOY POSITION	DATE TIME LAUNCHED	REMARKS
4-5C-06A	45° 25' 41" N 81° 46' 47" W	10 m 15 m 25 m	PC-6-226 PC-6-106 GEO-011	7 m	180 m	215° T	45° 25' 38" N 81° 46' 36" W	15 1408 Z	
4-5C-07A	45° 23' 35" N 81° 45' 03" W	10 m 15 m 25 m	PC-6-423 GEO-016 GEO-037	7 m	180 m	210° T	45° 23' 40" N 81° 44' 59" W	15 1320 Z	
4-5C-08A	45° 22' 01" N 81° 42' 20" W	10 m 15 m	PC-6-218 GEO-044	7 m	180 m	205° T	45° 22' 07" N 81° 42' 18" W	15 1215 Z	
4-5C-09A	45° 18' 52" N 81° 41' 26"	10 m 15 m 25 m	PC-6-138 PC-6-296 GEO-013	7 m	182 m	210° T	45° 18' 57" N 81° 41' 21" W	14 2305 Z	

CRUISE NO. 74 - 05 - 001)
74 - 02 - 001) Combined

MOORING SUMMARY				LAUNCHING					
MOORING NO	INSTRUMENT POSITION	METER DEPTHS	METER TYPE SERIAL NO.	DEPTH SUB/SURF	DIST S-SS	BEARING S-SS	SURFACE BUOY POSITION	DATE TIME LAUNCHED	REMARKS
4-5C-10A	45° 16' 32" N 81° 41' 43" W	10 m 15 m 25 m	PC-6-215 PC-6-221 GEO-049	7 m	182 m	210° T	45° 16' 37" N 81° 41' 37" W	15 1100 Z	
4-5C-11A	45° 15' 03" 81° 25' 00"	10 m 15 m	PC-6-425 GEO-028	7.0 m	183 m	030° T	45° 15' 00" N 81° 25' 03" W	19 0030 Z	
4-2C-08A	44° 21' 33" N 81° 42' 09" W	10 m 45 m	PC-6-313 PC-6-171	7 m	183 m	330° T	44° 21' 29" N 81° 42' 05" W	18 1715 Z	
4-2C-09A	44° 21' 00" N 81° 40' 33" W	10 m 35 m -2 m	PC-6-227 PC-6-212 GEO-006	7 m	183 m	350° T	44° 20' 55" N 81° 40' 28"	18 1607 Z	

CRUISE NO. 74 - 05 - 001)
74 - 02 - 001) Combined

MOORING SUMMARY				LAUNCHING					
MOORING NO	INSTRUMENT POSITION	METER DEPTHS	METER TYPE SERIAL NO.	DEPTH SUB/SURF	DIST S-SS	BEARING S-SS	SURFACE BUOY POSITION	DATE TIME LAUNCHED	REMARKS
4-2C-10A	44° 21' 31" N 81° 39' 30" W	10 m -2 m	PC-6-300 GEO-026	7 m	183 m	335° T	44° 20' 25" N 81° 39' 25" W	18 1513 Z	
4-2C-11A	44° 20' 18" N 81° 38' 51" W	10 m -2 m	PC-6-210 GEO-033	7 m	183 m	335° T	44° 20' 12" N 81° 38' 48" W	18 1425 Z	
4-2C-12A	44° 20' 02" N 81° 38' 17" W	10 m -2 m	PC-6-301 GEO-024	7 m	183 m	340° T	44° 19' 58" N 81° 38' 07" W	18 1330 Z	
4-2C-13A	44° 19' 54" N 81° 37' 38" W	10 m -2 m	PC-6-449 GEO-018	7 m	259 m	335° T	44° 19' 33" N 81° 37' 33"	18 1250 Z	

CRUISE NO. 74 - 05 - 001) Combined
74 - 02 - 001)

MOORING SUMMARY				LAUNCHING					
MOORING NO	INSTRUMENT POSITION	METER DEPTHS	METER TYPE SERIAL NO.	DEPTH SUB/SURF	DIST S-SS	BEARING S-SS	SURFACE BUOY POSITION	DATE TIME LAUNCHED	REMARKS
4-2C-14A	44° 19' 43" N 81° 37' 24" W	10 m -2 m	PC-6-291 GEO-043	7 m	183 m	325° T	44° 19' 42" N 81° 37' 16" W	18 1215 Z	
4-2C-15A	44° 19' 30" N 81° 36' 33" W	10 m -2 m	PC-6-224 GEO-003	7 m	45.7 m	225° T	44° 19' 41" N 81° 36' 57" W	18 1110 Z	Release Device # BEEG Pinger
4-2C-16A	44° 19' 37" N 81° 36' 53" W	10 m	GEO-007	7 m	45.7 m	218° T	44° 19' 26" N 81° 36' 30" W	18 1050 Z	Release Device # BCFH Pinger
4-2T-06A	44° 19' 55" N 81° 37' 33" W	-	FTP 001	-	183 m	FTP to Anchor 230° T	-	14 1252 Z	

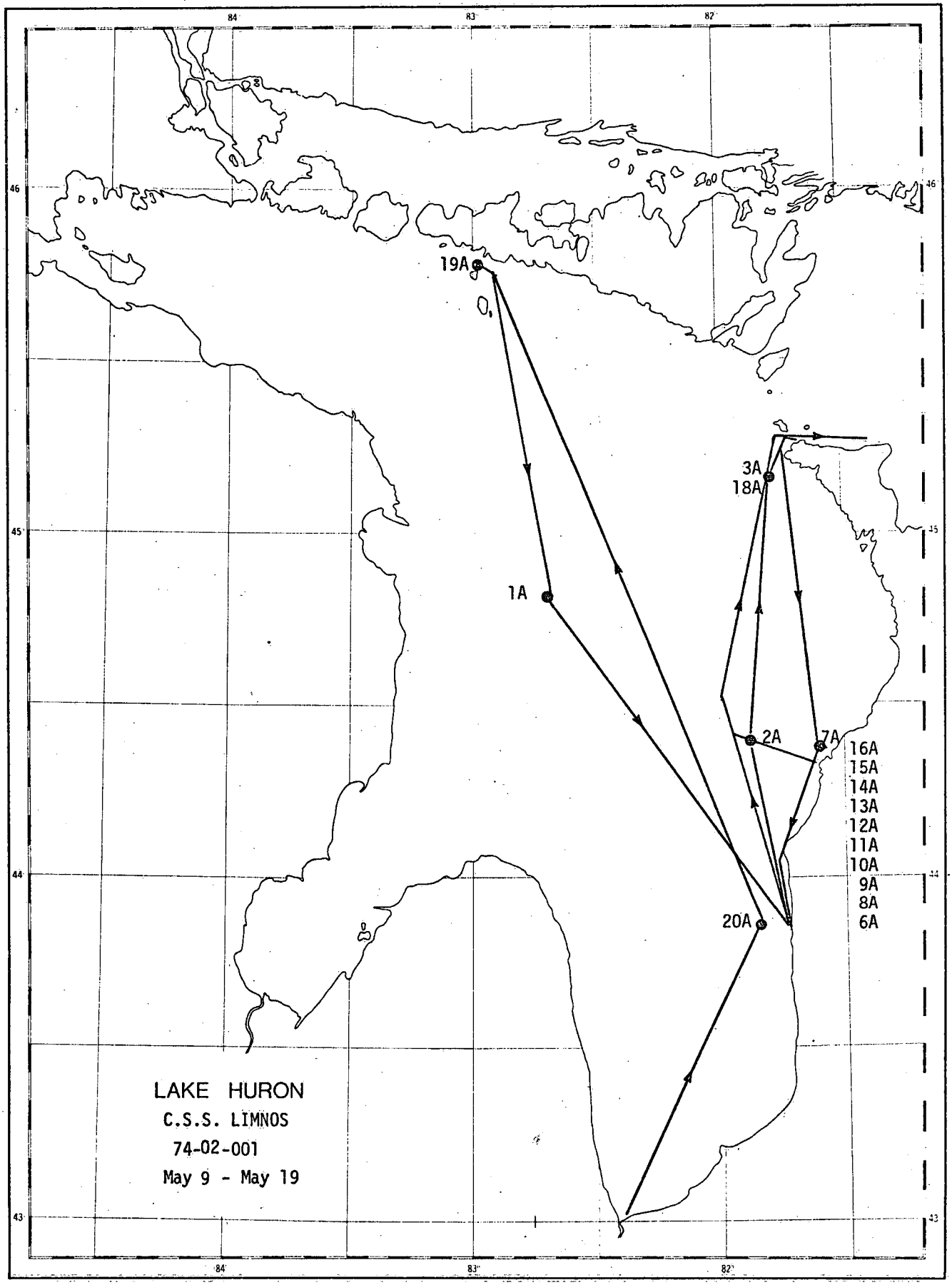
CRUISE NO. 74 - 05 - 001)
74 - 02 - 001) Combined

MOORING SUMMARY				LAUNCHING					
MOORING NO	INSTRUMENT POSITION	METER DEPTHS	METER TYPE SERIAL NO.	DEPTH SUB/SURF	DIST S-SS	BEARING ANCHOR TO FTP	SURFACE BUOY POSITION	DATE TIME LAUNCHED	REMARKS
4-2T-07A	44° 23' 23" N 81° 37' 26" W	-	-	-	183 m	155° T			
4-2M-02A	-	-	-	-	-	-	44° 21' 30" N 81° 42' 30" W	14 1200 Z	Met Buoy
4-5M-01A	-	-	-	-	-	-	45° 08' 33" N 80° 31' 31" W	19 1013 Z	Met Buoy
4-2M-01A	-	-	-	-	-	-	44° 50' 20" N 82° 35' 00" W	12 1800 Z	Met Buoy

CRUISE NO. 74 - 05 - 001 } Combined
74 - 02 - 001 }

MOORING SUMMARY				LAUNCHING					
MOORING NO	INSTRUMENT POSITION	METER DEPTHS	METER TYPE SERIAL NO.	DEPTH SUB/SURF	DIST S-SS	BEARING S-SS	SURFACE BUOY POSITION	DATE TIME LAUNCHED	REMARKS
4-2M-03A	-	-	-	-	-	-	45° 14' 18" N 81° 51' 36" W	14 2110 Z	Met Buoy
4-2S-18A	-	-	-	-	-	-	45° 13' 54" N 81° 51' 50" W	14 2030 Z	Geodyne Buoy Rain Gauge
4-2S-19A	-	-	-	-	-	-	45° 47' 03" N 82° 56' 21" W	12 1101 Z	Geodyne Buoy Rain Gauge
4-2S-20A	-	-	-	-	-	-	43° 18' 30" N 82° 01' 30"	11 2215 Z	Geodyne Buoy Rain Gauge

CRUISE NO. 74 - 05 - 001) Combined
74 - 02 - 001)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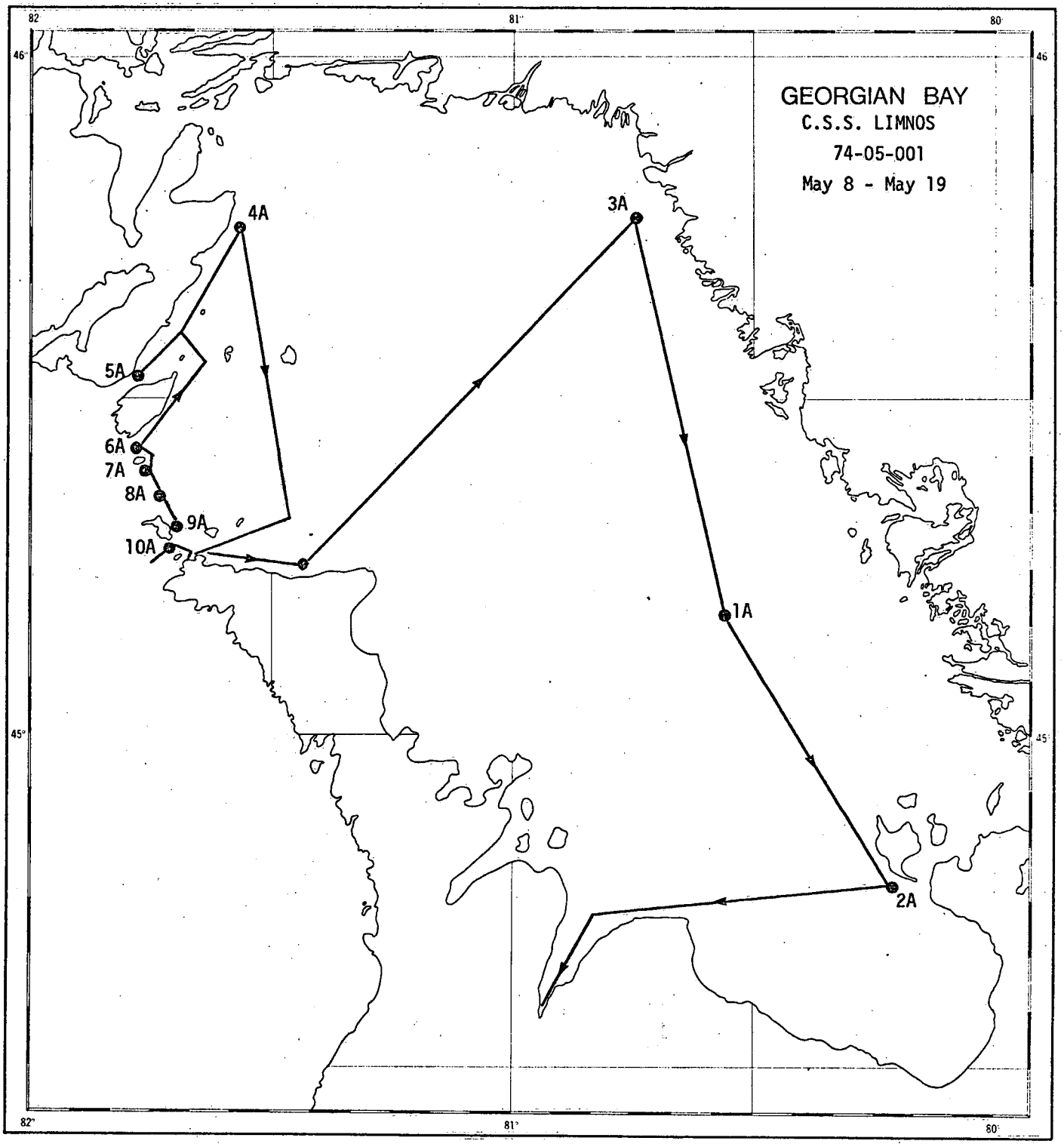
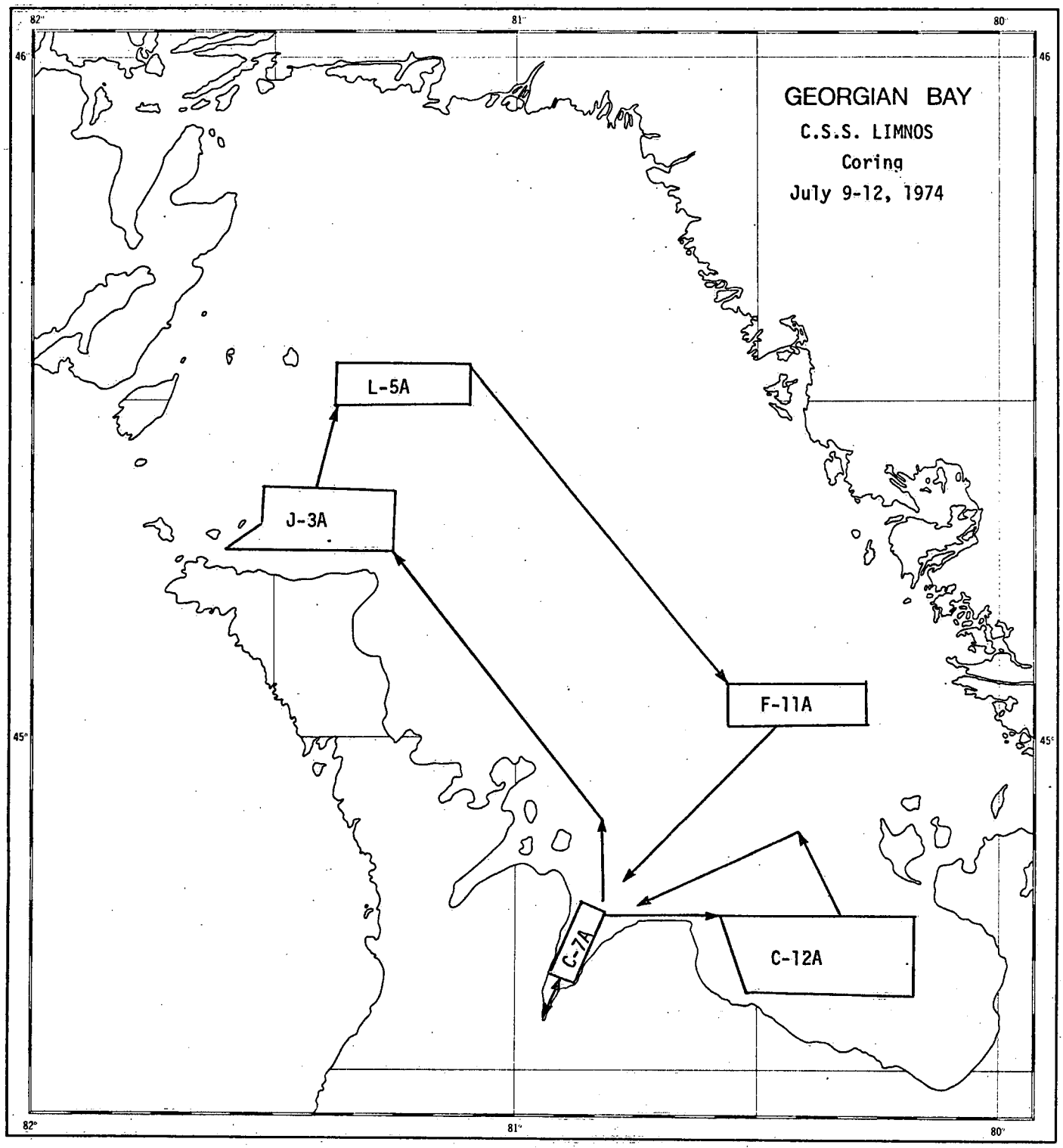
20A
LAKE HURON
C.S.S. LIMNOS
74-02-001
May 9 - May 19


GEORGIAN BAY
C.S.S. LIMNOS
74-05-001
May 8 - May 19
82°
81°
80°
46°
45°
1A
2A
3A
4A
5A
6A
7A
8A
9A
10A

STATION LOCATIONS

Upon completion of sounding lines in the general areas of the various stations, the following locations were selected as the final coring sites:

Station Number	Latitude N.	Longitude W.
C-7A	44° 42' 30"	80° 52' 00"
C-12A	44° 44' 00"	80° 24' 30"
J-3A	45° 20' 18"	81° 22' 42"
L-5A	45° 32' 54"	81° 02' 30"
F-11A	44° 56' 50"	80° 24' 06"


GEORGIAN BAY
C.S.S. LIMNOS
Coring
July 9-12, 1974
L-5A
J-3A
F-11A
C-7A
C-12A
82°
81°
80°
46°
45°

STATION LOCATIONS

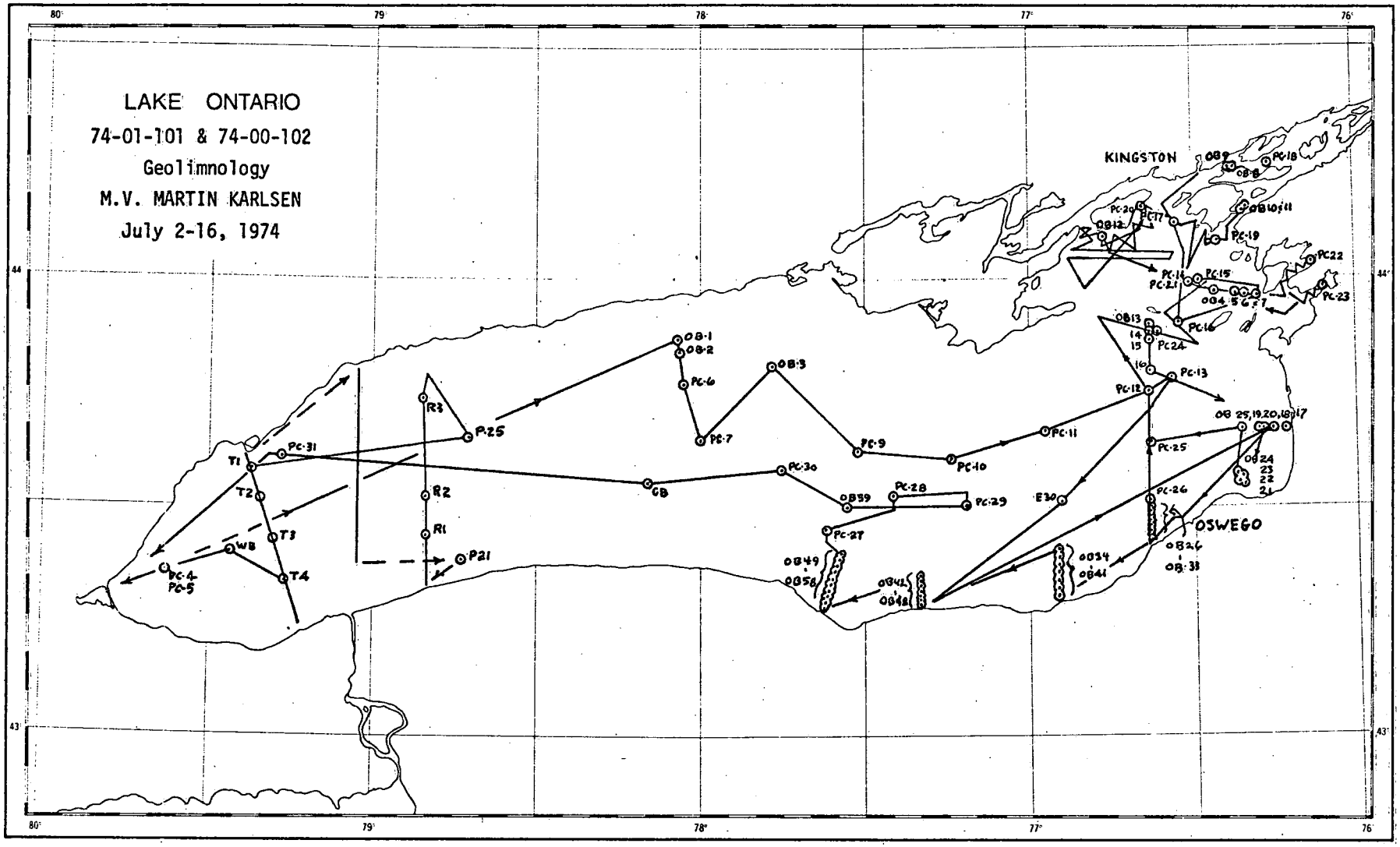
Station Number	Latitude N.	Longitude W.	Benthos Core	Shipek	Piston Core	25 lbs. Aspila	1200 lb. Gravity Core
T-2	43° 31' 20"	79° 21' 12"					X
T-3	43° 25' 32"	79° 18' 44"					X
T-4	43° 19' 36"	79° 16' 12"					X
WB	43° 24' 06"	79° 26' 30"	X				
PC-4	43° 21' 18"	79° 38' 04"	X	X	X		
PC-5	43° 21' 21"	79° 37' 57"			X		
OB-1	43° 51' 54"	78° 04' 20"	X				
OB-2	43° 50' 45"	78° 04' 00"	X				
PC-2	43° 46' 00"	78° 03' 28"	X	X			
PC-7	43° 38' 42"	78° 00' 00"	X	X	X		
OB-3	43° 48' 39"	77° 46' 57"	X	X			
PC-9	43° 37' 27"	77° 31' 10"	X	X	X		
PC-10	43° 36' 00"	77° 14' 18"	X	X	X		
PC-11	43° 40' 00"	76° 57' 20"	X	X	X		
PC-12	43° 45' 10"	76° 38' 30"	X	X	X		
PC-13	43° 47' 15"	76° 34' 38"	X	X	X		
E-30	43° 30' 42"	76° 54' 30"	X				
PC-14	43° 59' 28"	76° 30' 50"	X	X	X		
PC-15	43° 59' 42"	76° 29' 18"	X	X	X		
OB-4	43° 58' 12"	76° 26' 06"	X				
OB-5	43° 57' 42"	76° 22' 18"	X	X			
OB-6	43° 57' 50"	76° 20' 24"	X				
OB-7	43° 57' 24"	76° 18' 30"	X				
PC-16	43° 54' 06"	76° 32' 30"	X	X	X		
PC-17	44° 07' 10"	76° 33' 03"			X		
PC-18	44° 14' 52"	76° 15' 25"	X	X	X		
OB-8	44° 14' 30"	76° 22' 18"		X			
OB-9	44° 14' 20"	76° 23' 12"		X			
OB-10	44° 08' 54"	76° 20' 15"		X			
OB-11	44° 08' 42"	76° 19' 50"	X	X			
PC-19	44° 04' 59"	76° 25' 50"	X	X	X		
PC-20	44° 09' 18"	76° 39' 06"	X	X	X		
OB-12	44° 05' 12"	76° 46' 36"		X			

STATION LOCATIONS

Station Number	Latitude N.	Longitude W.	Benthos Core	Shipek	Piston Core	25 lbs. Aspila	1200 lb. Gravity Core
PC-21	43° 59' 24"	76° 31' 36"	X	X	X		
PC-22	44° 02' 32"	76° 08' 40"	X	X	X		
PC-23	43° 58' 29"	76° 06' 15"	X	X	X		
PC-24	43° 52' 48"	76° 36' 30"	X	X	X		
OB-13	43° 54' 18"	76° 38' 00"	X	X			
OB-14	43° 53' 00"	76° 38' 06"		X			
OB-15	43° 52' 16"	76° 37' 58"		X			
OB-16	43° 47' 38"	76° 38' 15"	X	X			
OB-17	43° 40' 03"	76° 13' 22"		X			
OB-18	43° 40' 06"	76° 15' 32"	X	X			
OB-19	43° 40' 09"	76° 18' 58"	X				
OB-20	43° 39' 53"	76° 16' 57"	X				
OB-21	43° 32' 11"	76° 20' 46"	X	X			
OB-22	43° 32' 48"	76° 21' 48"	X	X			
OB-23	43° 33' 19"	76° 21' 17"	X	X			
OB-24	43° 34' 06"	76° 22' 10"	X	X			
OB-25	43° 40' 12"	76° 21' 24"	X				
PC-25	43° 38' 12"	76° 38' 00"	X	X	X		
PC-26	43° 30' 43"	76° 38' 00"	X	X	X		
OB-26	43° 29' 43"	76° 37' 45"	X				
OB-27	43° 29' 30"	76° 37' 29"	X	X			
OB-28	43° 29' 10"	76° 37' 10"		X			
OB-29	43° 28' 46"	76° 37' 16"	X				
OB-30	43° 28' 24"	76° 37' 36"	X	X			
OB-31	43° 27' 13"	76° 38' 00"		X			
OB-32	43° 26' 15"	76° 38' 00"		X			
OB-33	43° 25' 18"	76° 38' 00"		X			
OB-34	43° 18' 18"	76° 54' 54"		X			
OB-35	43° 19' 24"	76° 54' 48"		X			
OB-36	43° 20' 30"	76° 54' 54"		X			
OB-37	43° 21' 18"	76° 55' 00"		X			
OB-38	43° 22' 00"	76° 55' 00"		X			

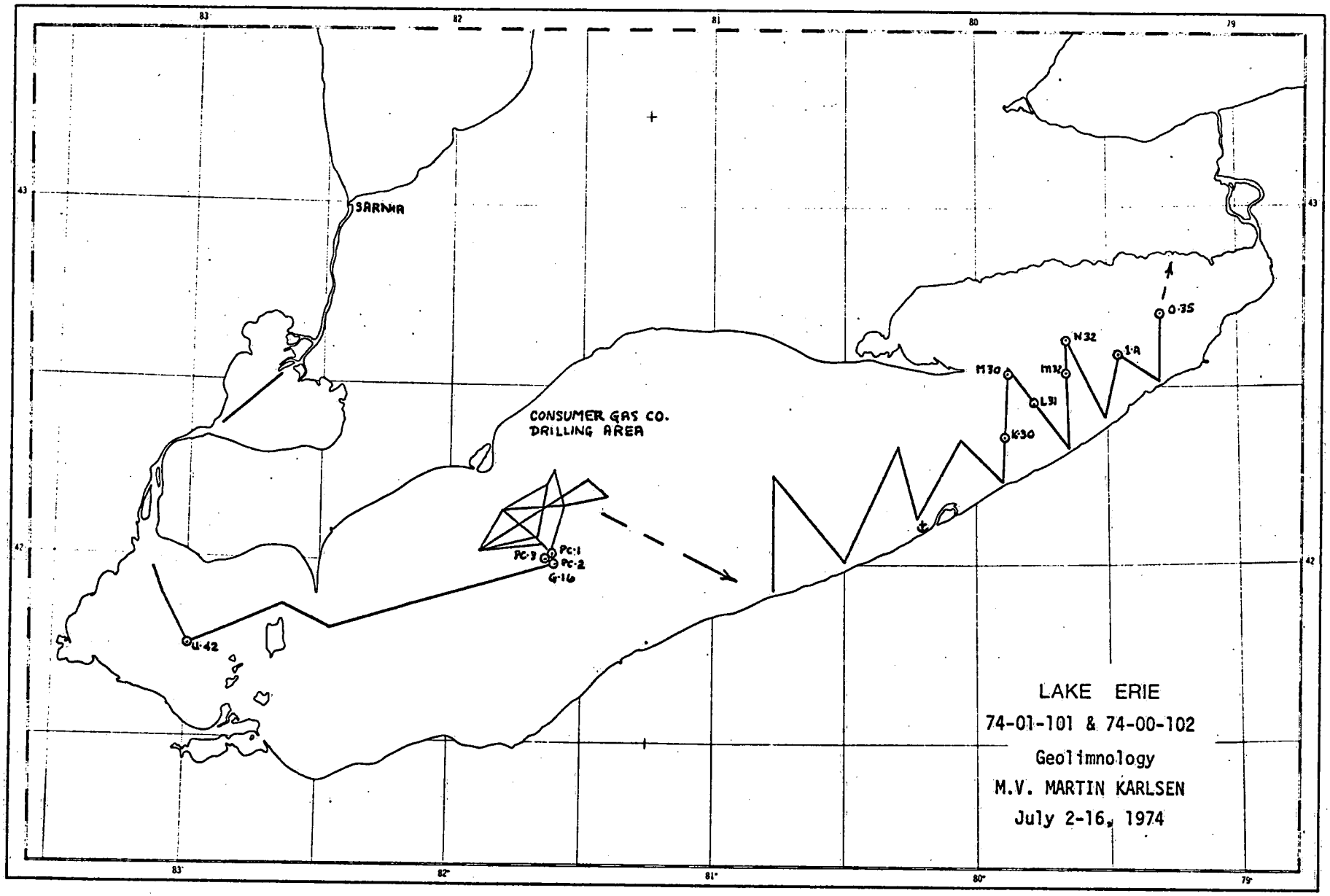
STATION LOCATIONS

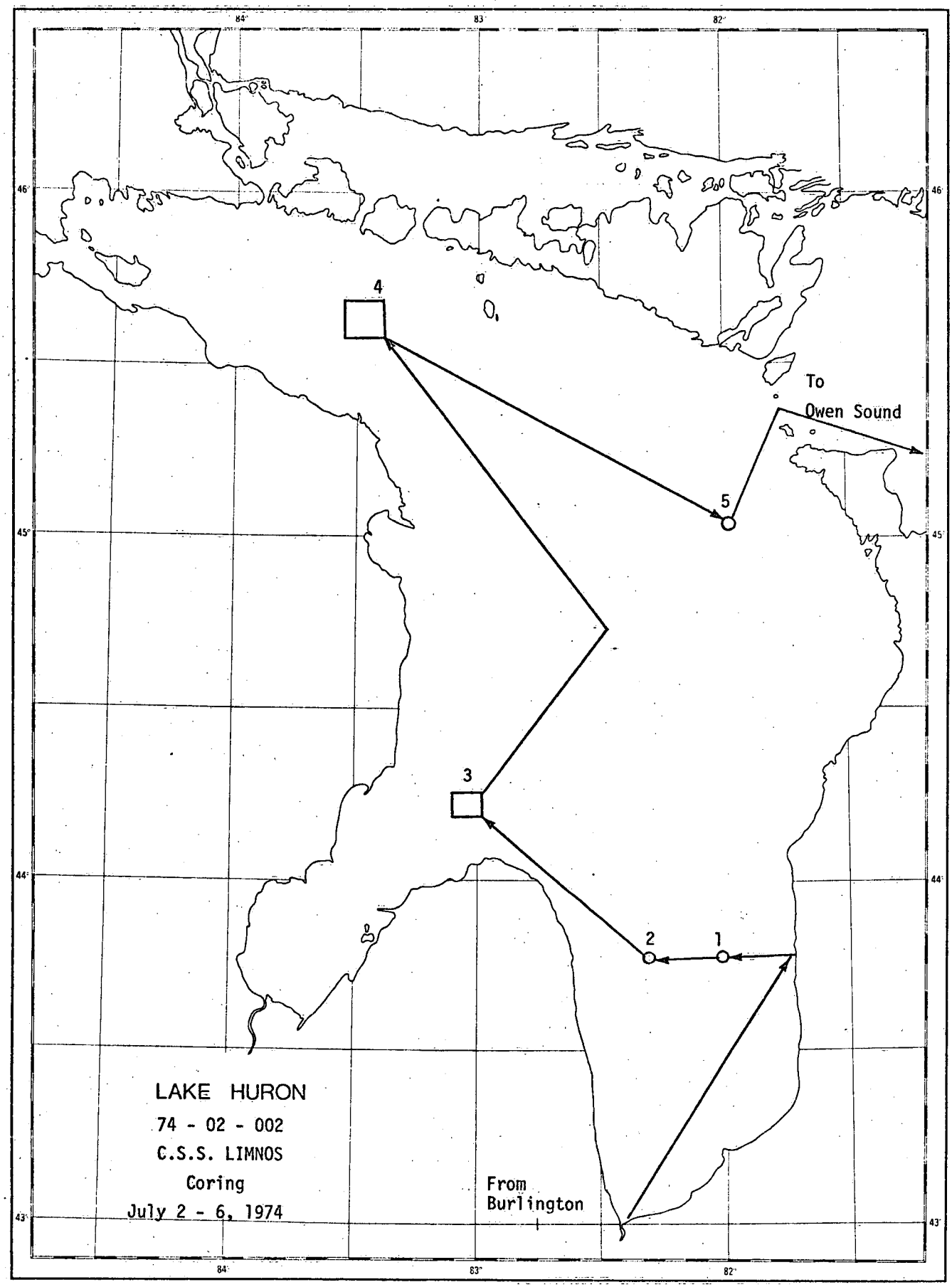
Station Number	Latitude N.	Longitude W.	Benthos Core	Shipek	Piston Core	25 lbs. Aspila	1200 lb. Gravity Core
OB-39	43° 23' 12"	76° 55' 00"	X	X			
OB-40	43° 23' 36"	76° 55' 00"	X	X			
OB-41	43° 24' 24"	76° 55' 06"	X	X			
OB-42	43° 17' 18"	77° 19' 50"	X	X			
OB-43	43° 18' 11"	77° 20' 04"	X				
OB-44	43° 18' 45"	77° 19' 45"	X				
OB-45	43° 19' 31"	77° 20' 02"	X				
OB-46	43° 20' 06"	77° 20' 04"	X				
OB-47	43° 20' 31"	77° 20' 05"	X				
OB-48	43° 20' 58"	77° 20' 04"	X				
OB-49	43° 17' 09"	77° 37' 28"	X				
OB-50	43° 19' 09"	77° 36' 40"	X				
OB-51	43° 20' 28"	77° 35' 37"	X				
OB-52	43° 21' 31"	77° 35' 59"	X				
OB-53	43° 22' 05"	77° 35' 45"	X				
OB-54	43° 22' 24"	77° 35' 38"	X				
OB-55	43° 23' 04"	77° 35' 24"	X				
OB-56	43° 23' 28"	77° 35' 23"	X				
OB-57	43° 23' 54"	77° 34' 43"	X				
OB-58	43° 24' 16"	77° 34' 33"	X				
PC-27	43° 27' 36"	77° 37' 09"	X	X	X		
PC-28	43° 31' 54"	77° 24' 54"	X	X	X		
PC-29	43° 30' 05"	77° 11' 20"	X	X	X		
OB-59	43° 30' 00"	77° 33' 00"	X	X			
PC-30	43° 35' 59"	77° 45' 12"	X	X	X		
CB	43° 33' 00"	78° 10' 00"	X				
PC-31	43° 36' 16"	79° 16' 44"	X	X	X		


LAKE ONTARIO
74-01-101 & 74-00-102
Geolimnology
M.V. MARTIN KARLSEN
July 2-16, 1974
80°
79°
78°
77°
76°
44°
43°
KINGSTON
OSWEGO
T1
T2
T3
T4
WB
GB
R1
R2
R3
P21
P25
Pc-4
Pc-5
Pc-6
Pc-7
Pc-9
Pc-10
Pc-11
Pc-12
Pc-13
Pc-16
Pc-17
Pc-18
Pc-19
Pc-20
Pc-21
Pc-22
Pc-23
Pc-24
Pc-25
Pc-26
Pc-27
Pc-28
Pc-29
Pc-30
Pc-31
E30
0859
0849
0856
0841
0848
0834
0841
0824
0838

STATION LOCATIONS

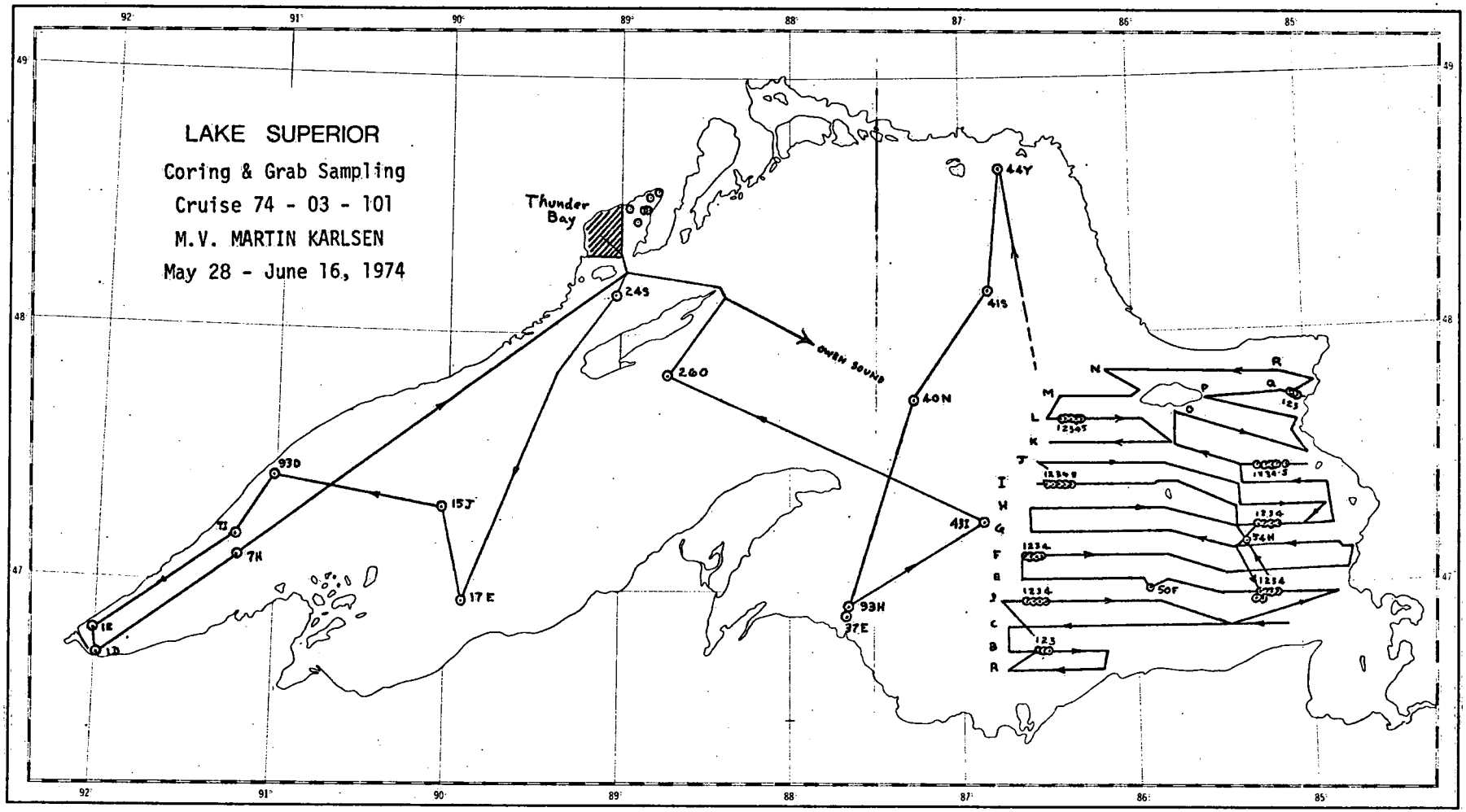
Station Number	Latitude N.	Longitude W.	Benthos Core	Shipek	Piston Core	25 lbs. Aspila	1200 lb. Gravity Core
U-42	41° 45' 36"	82° 59' 12"	X				
G-16	42° 00' 30"	81° 36' 12"	X				
PC-1	42° 02' 06"	81° 36' 36"	X	X	X		
PC-2	41° 59' 45"	81° 35' 50"			X		
PC-3	42° 01' 42"	81° 37' 00"			X		
K-30	42° 21' 30"	79° 54' 36"	X				
M-30	42° 32' 20"	79° 54' 20"	X			X	
L-31	42° 27' 00"	79° 47' 00"	X				
M-32	42° 32' 12"	79° 39' 24"	X				
N-32	42° 37' 48"	79° 39' 30"	X			X	
1-A	42° 35' 47"	79° 27' 30"				X	
O-35	42° 42' 40"	79° 17' 36"	X			X	
P-21A	43° 23' 00"	78° 43' 59"	X	X			
P-21B	43° 23' 00"	78° 43' 13"	X				
P-21C	43° 23' 00"	78° 42' 36"	X				
P-21D	43° 23' 00"	78° 44' 45"	X				
P-21E	43° 23' 00"	78° 45' 20"	X				
P-21F	43° 23' 30"	78° 44' 45"	X				
P-21G	43° 23' 30"	78° 44' 00"	X				
P-21H	43° 23' 30"	78° 43' 15"	X				
P-21I	43° 22' 30"	78° 43' 15"	X				
P-21J	43° 22' 30"	78° 44' 00"	X				
P-21K	43° 22' 45"	78° 44' 00"	X				
P-21L	43° 22' 51"	78° 43' 58"	X		X		
R-1	43° 26' 24"	78° 50' 06"					X
R-2	43° 31' 29"	78° 50' 09"	X				X
R-3	43° 44' 45"	78° 51' 23"					X
P-25A	43° 39' 18"	78° 42' 42"	X	X			
P-25B	43° 38' 48"	78° 41' 27"	X				
P-25C	43° 38' 56"	78° 40' 33"	X	X			
P-25D	43° 39' 24"	78° 40' 37"	X				
P-25E	43° 38' 46"	78° 42' 42"	X				
P-25F	43° 38' 00"	78° 41' 00"	X				
T-1	43° 34' 50"	79° 22' 37"					X

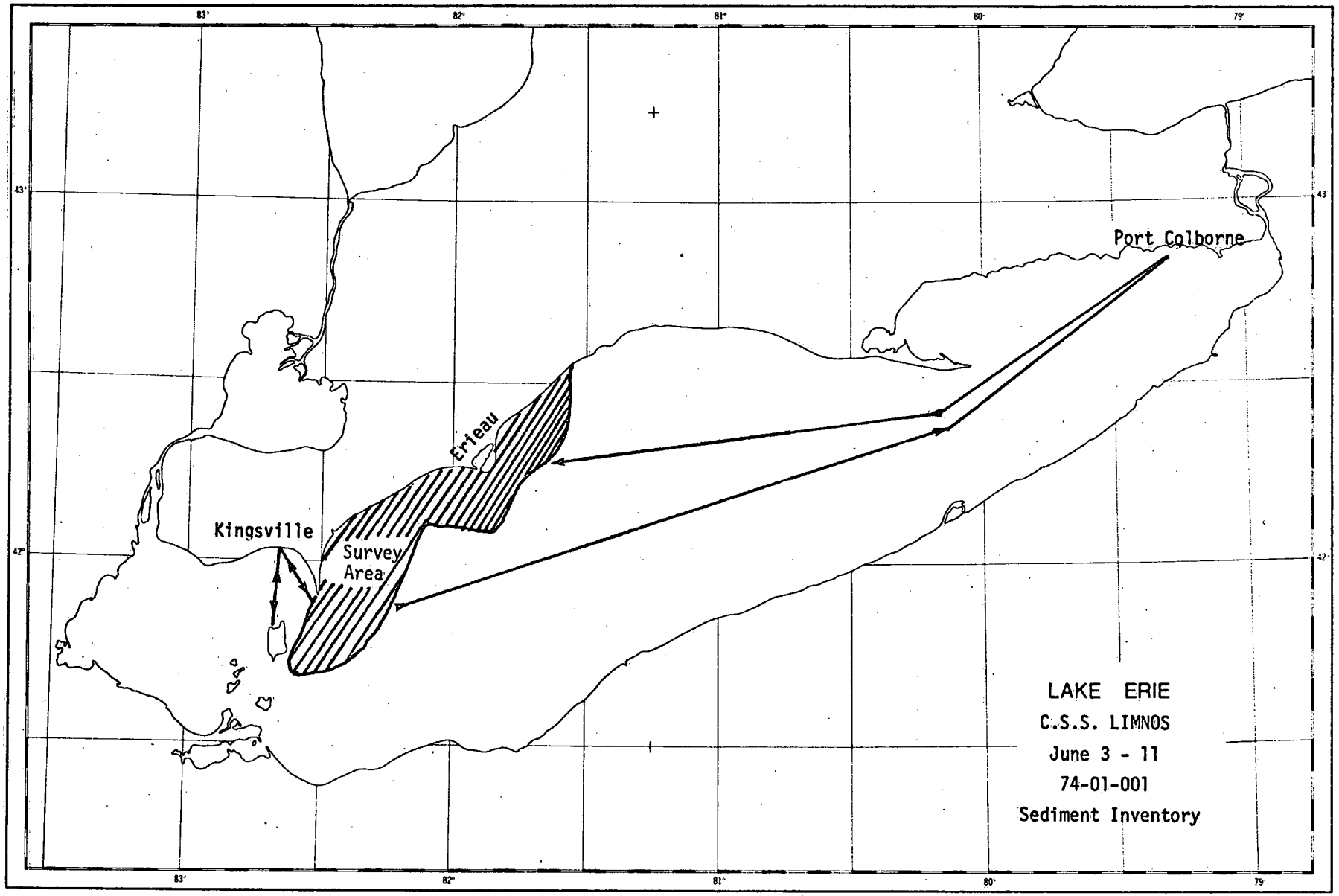

83
82
81
80
79
43
42
SARNIA
CONSUMER GAS CO.
DRILLING AREA
PC-3
PC-1
PC-2
G-16
L-42
M30
M31
N32
L31
K30
I-A
0-35
LAKE ERIE
74-01-101 & 74-00-102
Geolimnology
M.V. MARTIN KARLSEN
July 2-16, 1974

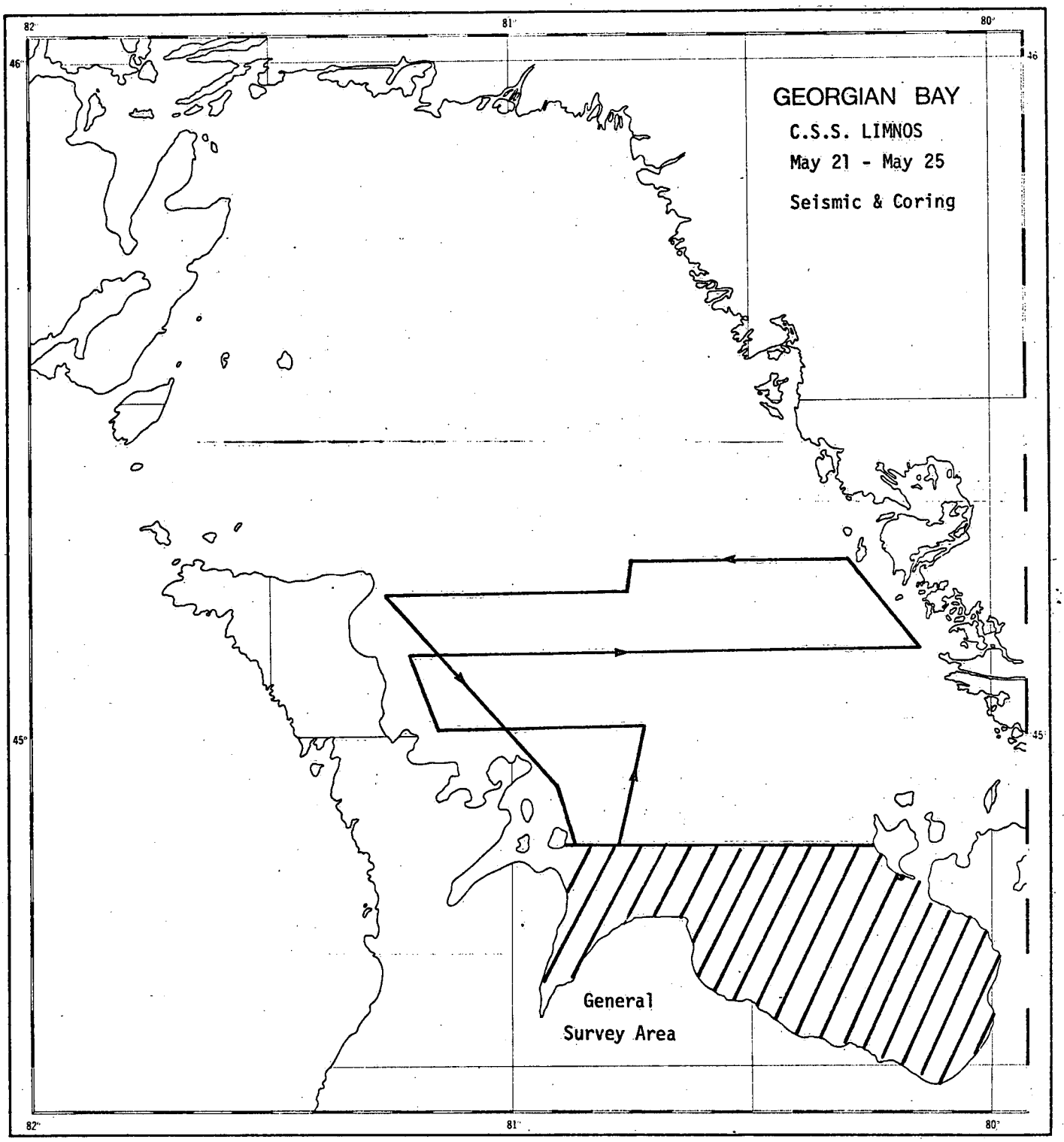

84°
83°
82°
46°
45°
44°
43°
4
5
3
2
1
To
Owen Sound
From
Burlington
LAKE HURON
74 - 02 - 002
C.S.S. LIMNOS
Coring
July 2 - 6, 1974

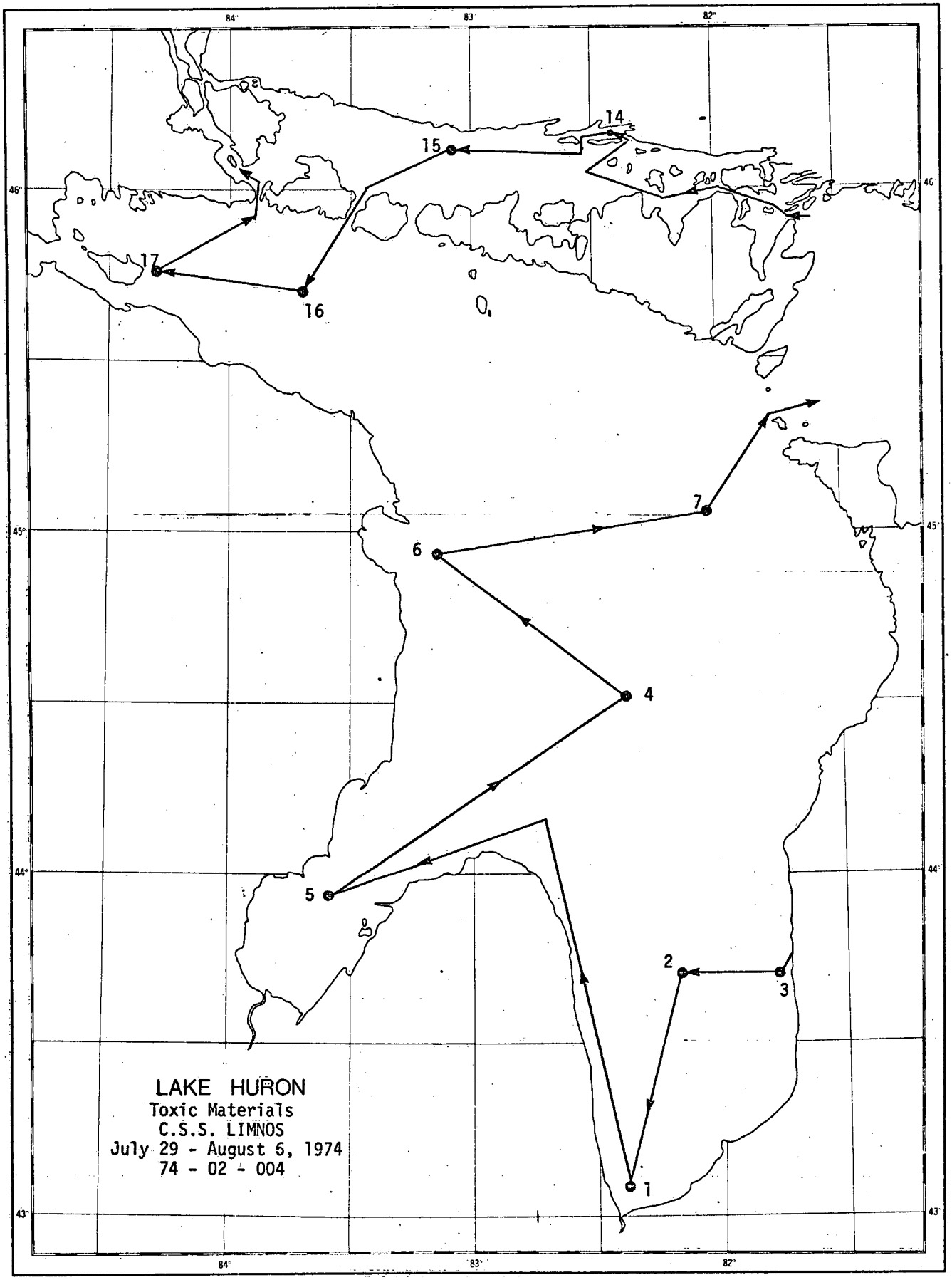
Station No.	Latitude N.	Longitude W.	Consecutive No. & Remarks
B1	46° 44' 30"	86° 36' 24"	01
B2	46° 44' 30"	86° 34' 10"	02
B3	46° 44' 30"	86° 31' 50"	03
D4	46° 56' 06"	86° 33' 48"	04
D3	46° 56' 06"	86° 35' 12"	05
D2	46° 56' 06"	86° 36' 36"	06
D1	46° 56' 06"	86° 39' 15"	07
50F	46° 58' 40"	85° 57' 15"	08
F4	47° 06' 30"	86° 36' 18"	09)
F3	47° 06' 30"	86° 37' 30"	10)
F2	47° 06' 30"	86° 38' 24"	11) corrected positions reported
F1	47° 06' 30"	86° 41' 18"	12)
E1A	46° 55' 54"	85° 20' 30"	13
E2A	46° 56' 00"	85° 17' 18"	14
E1	46° 57' 42"	85° 18' 42"	15
E2	46° 57' 42	85° 17' 00"	16
E3	46° 57' 48"	85° 15' 15"	17
E4	46° 57' 45"	85° 12' 45"	18
54H	47° 10' 12"	85° 24' 20"	19
H4	47° 13' 48"	85° 12' 00"	20
H3	47° 13' 48"	85° 15' 45"	21
H2	47° 13' 48"	85° 16' 30"	22
H1	47 13' 48"	85° 19' 30"	23
I1	47° 24' 06"	86° 32' 00"	24
I2	47° 24' 06"	86° 29' 06"	25
I3	47° 24' 06"	86° 27' 36"	26
I4	47° 24' 06"	86° 25' 30"	27
I5	47° 24' 06"	86° 23' 00"	28
K5	47° 30' 22"	85° 09' 37"	29
K4	47° 30' 05"	85° 13' 00"	30
K3	47° 30' 12"	85° 14' 30"	31
K2	47° 29' 54"	85° 15' 54"	32
K1	47° 30' 00"	85° 19' 03"	33
Q3	47° 43' 18"	85° 02' 24"	34
Q2	47° 43' 51"	85° 04' 30"	35
Q1	47° 44' 00"	85° 05' 18"	36
L4	47° 39' 30"	86° 18' 15"	37
L3	47° 39' 36"	86° 20' 54"	38
L2	47° 39' 30"	86° 23' 12"	39
L1	47° 39' 30"	86° 25' 42"	40

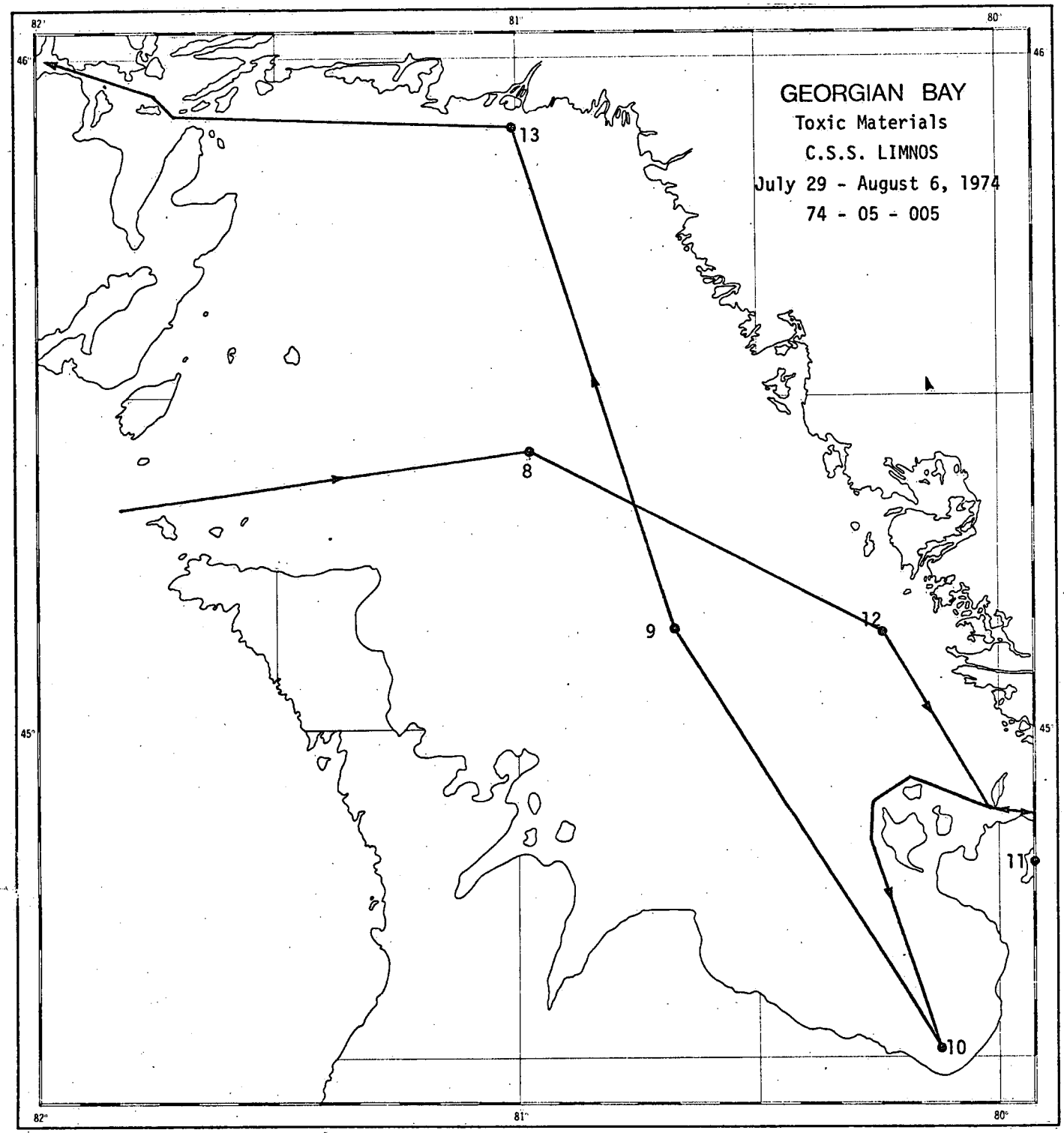
Station No.	Latitude N.	Longitude W.	Consecutive No. & Remarks
44Y	48° 38' 00"	86° 43' 42"	41
41S	48° 10' 00"	86° 51' 45"	42
40N	47° 43' 06"	87° 15' 18"	43
37E	46° 54' 12"	87° 40' 00"	44
93H	46° 56' 07"	87° 39' 00"	45 (alternate 37E-A)
43I	47° 16' 12"	86° 52' 06"	46
26O	47° 50' 10"	88° 43' 00"	47
24S	48° 09' 15"	89° 01' 25"	48
17F	46° 57' 30"	89° 54' 00"	49
15J	47° 18' 50"	90° 01' 00"	50
93D	47° 25' 00"	91° 00' 00"	51
7I	47° 11' 12"	91° 14' 00"	52
1E	46° 48' 00"	92° 00' 06"	53
1D	46° 42' 30"	91° 59' 12"	54
7H	47° 06' 24"	91° 13' 42"	55

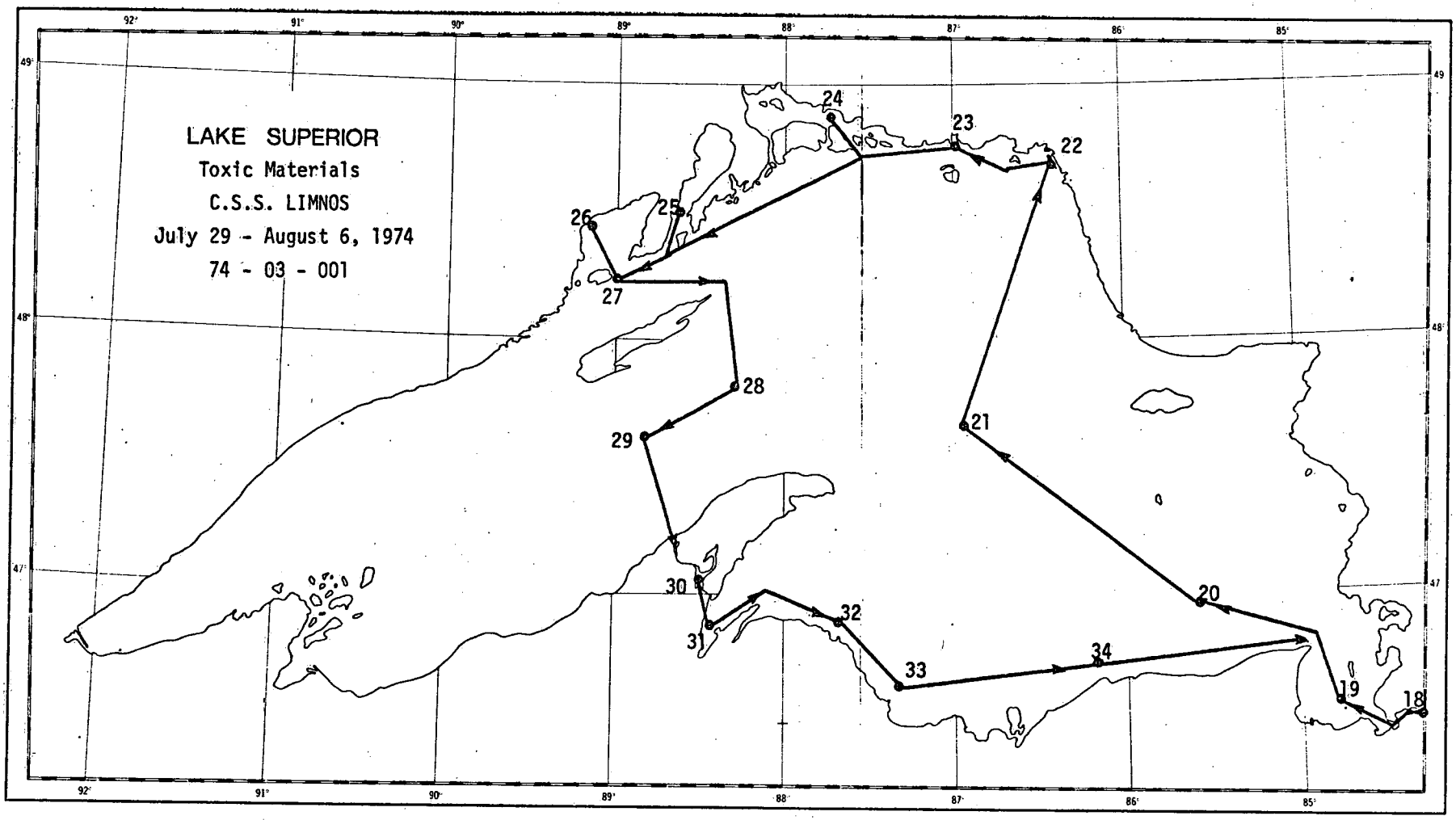

LAKE SUPERIOR
Coring & Grab Sampling
Cruise 74 - 03 - 101
M.V. MARTIN KARLSEN
May 28 - June 16, 1974
Thunder Bay
OWEN SOUND
44Y
41S
24S
26O
40N
43I
93H
37E
93D
15J
7H
17E
1E
1D
50F
74H
92
91
90
89
88
87
86
85
49
48
47


83°
82°
81°
80°
79°
43°
42°
Port Colborne
Erieau
Kingsville
Survey
Area
LAKE ERIE
C.S.S. LIMNOS
June 3 - 11
74-01-001
Sediment Inventory


GEORGIAN BAY
C.S.S. LIMNOS
May 21 - May 25
Seismic & Coring
General
Survey Area
82°
81°
80°
46°
45°


84°
83°
82°
46°
45°
44°
43°
1
2
3
4
5
6
7
14
15
16
17
LAKE HURON
Toxic Materials
C.S.S. LIMNOS
July 29 - August 6, 1974
74 - 02 - 004


GEORGIAN BAY
Toxic Materials
C.S.S. LIMNOS
July 29 - August 6, 1974
74 - 05 - 005
82°
81°
80°
46°
45°
13
8
9
12
11
10


LAKE SUPERIOR
Toxic Materials
C.S.S. LIMNOS
July 29 - August 6, 1974
74 - 03 - 001
92°
91°
90°
89°
88°
87°
86°
85°
49°
48°
47°
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34

J. Carew

Government of Canada / Gouvernement du Canada

MEMORANDUM **NOTE DE SERVICE**

TO / À: H.B. Macdonald
Head
Technical Operations Section

FROM / DE: T.J. Carew
Technical Operations Section

SECURITY CLASSIFICATION – DE SÉCURITÉ	
OUR FILE – N/RÉFÉRENCE	5895
YOUR FILE – V/RÉFÉRENCE	
DATE	November 14, 1974

SUBJECT / OBJET: NTA SAMPLING, HAMILTON HARBOUR

Seven 1 litre surface water samples were collected today, and treated with five mls. of formaldehyde solution.

Stations	Latitude N.	Longitude W.
6	43° 17' 34"	79° 50' 11"
7	43° 17' 53"	79° 50' 42"
1	43° 16' 48"	79° 52' 12"
2	43° 16' 50"	79° 50' 12"
3	43° 16' 54"	79° 48' 16"
4	43° 16' 15"	79° 47' 12"
5	43° 17' 41"	79° 48' 10"

Vessel: C.S.L. SHARK

Personnel: MSD — M. Bunting, C. Gammon
Tech. Ops. — T.J. Carew
LRD — Dr. S. Guppy

Dr. Guppy is on a one-year Fellowship, assigned to Sedimentary and Chemical Processes Section.

The cruise lasted 2 3/4 hours. Waves of up to three feet were generated by northwest winds of 20-25 knots.

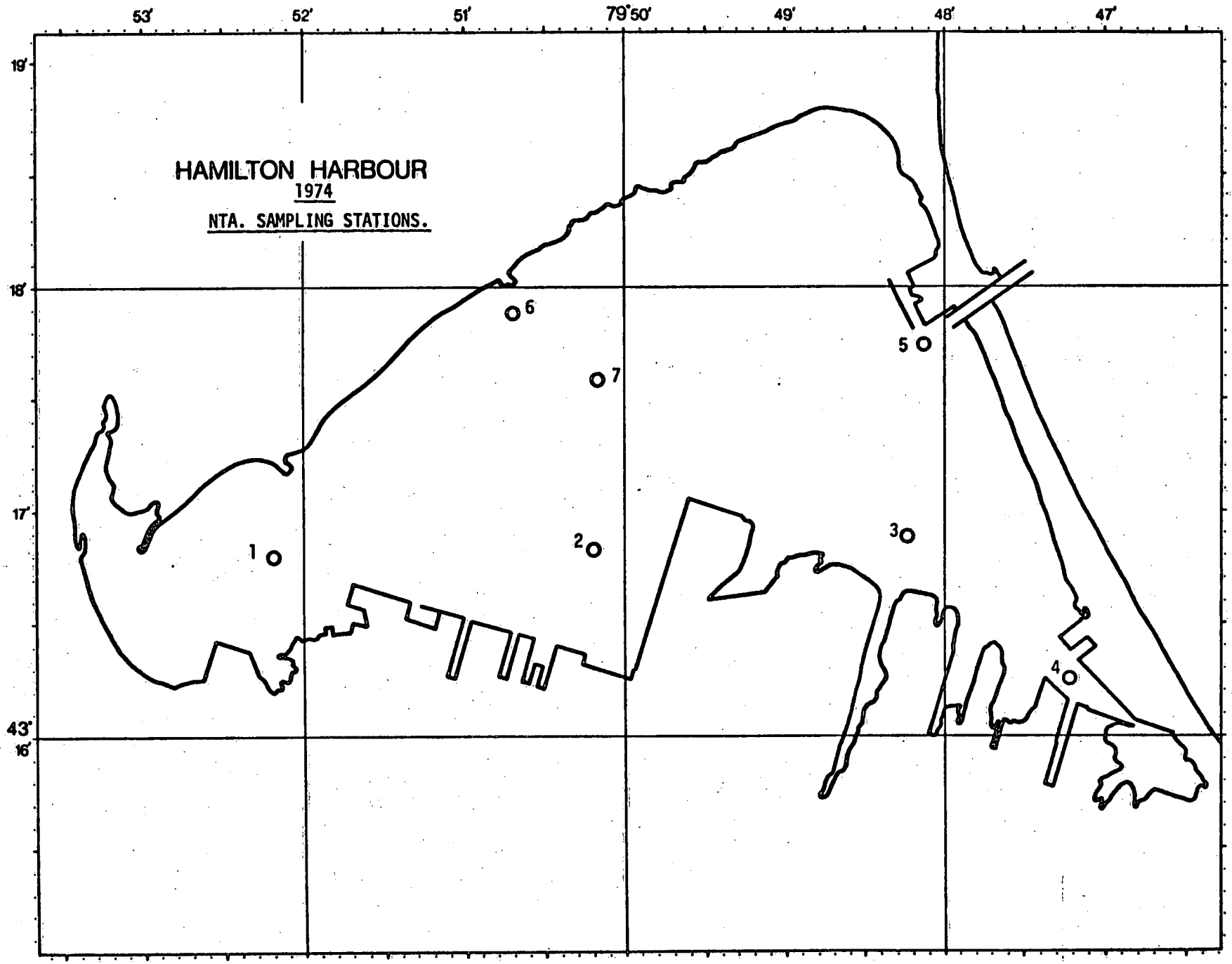
The samples were delivered promptly to D. Sturtevant.

T.J. Carew

✓
TJC/as

T.J. Carew
Technical Operations

cc: Dr. S. Guppy, LRD
D. Sturtevant


53'
52'
51'
79°50'
49'
48'
47'
19'
18'
17'
43°
16'
HAMILTON HARBOUR
1974
NTA. SAMPLING STATIONS.
1
2
3
4
5
6
7

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship LIMNOS

Dates From _____ to _____ Lake ONTARIO

Cruise Type _____ Miles Steamed 2243.8

Description	Total	Description	Total
Secchi	131	Moorings Established (Baffle)	12
Stations Occupied	192	Moorings Retrieved (Baffle)	12
Bathythermograph Casts	85	Moorings Established (Met.)	
E.B.T. Casts	101	Moorings Retrieved (Met.)	
Transmissometer Casts	162	Moorings Established (Sed. Bottle)	17
Reversing Thermometer Obs.	32	Moorings Retrieved (Sed. Bottle)	17
Water Samples Collected (Chemistry)	1	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected (FILTERED P.O.C.)	98	Cores Taken (Gravity).	
Water Samples Collected ( )		Cores Taken (Piston)	
Water Samples Collected ( )		Grab Samples Taken	9
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	189	Dye Releases	
Water Samples Treated (Phytoplankton)		Grab Samples taken Shipek	4
Zooplankton Hauls		Observations (Weather)	140
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)	85	Air Temperature	
Integrator (20m)	79	Relative Humidity	
Total Number of Depths Sampled		Water Temperature (In-Hull)	
Total Number of Water Samples Collected	573	Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	24
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)	270	Moorings Retrieved (CM)	20
Nutrients (W.Q.D.)		Moorings Established (Sed. Trap)	18
Microbiology		Moorings Retrieved (Sed. Trap)	18

REMARKS

Moorings Established (FTP) 1

Moorings Retrieved (FTP) 2

Moorings Established (Nun Buoy, Bronte) 2

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship LIMNOS

Dates From _____ to _____ Lake ERIE

Cruise Type GEOLOGY Miles Steamed 922.9

Description	Total	Description	Total
Secchi	78	Moorings Established (CM)	
Stations Occupied	366	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts		Moorings Retrieved (Met.)	
Transmissometer Casts		Moorings Established ( )	
Reversing Thermometer Obs.		Moorings Retrieved ( )	
Water Samples Collected (Chemistry)	78	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected ( )		Cores Taken (Gravity)	
Water Samples Collected ( )		Cores Taken (Piston)	
Water Samples Collected ( )		Grab Samples Taken Shipek	366
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)		Relative Humidity	
Total Number of Depths Sampled	78	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	78	Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	9
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)			
Nutrients (W.Q.D.)		Bottom Picture Profiles	250
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship LIMNOS

Dates From _____ to _____ Lake Huron & Georgian Bay

Cruise Type _____ Miles Steamed 5750.0

Description	Total	Description	Total
Secchi		Moorings Established (CM)	68
Stations Occupied	106	Moorings Retrieved (CM)	55
Bathythermograph Casts	6	Moorings Established (Met.)	4
E.B.T. Casts	85	Moorings Retrieved (Met.)	6
Transmissometer Casts		Moorings Established (F.T.P.)	7
Reversing Thermometer Obs.	30	Moorings Retrieved (F.T.P.)	3
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected (RAIN)	2	Cores Taken (Gravity). BENTHOS	64
Water Samples Collected (SILICA)	49	Cores Taken (Piston)	
Water Samples Collected (P.O.C.)	98	Grab Samples Taken SHIPEK	17
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	42
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)		Relative Humidity	
Total Number of Depths Sampled	47	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	147	Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	38
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)		Triple Benthos Cores	55
Nutrients (W.Q.D.)		Moorings Established (SONO BUOY)	3
Microbiology		Moorings Retrieved (SONO BUOY)	3

REMARKS

Three Special Rain Gauge Buoys

STATISTICS SUMMARY

74 - 02 - 004
74 - 05 - 005
Cruise No. 74 - 03 - 001 Consec. No. _____

Ship LIMNOS

Dates From July 29 to August 6, 1974

Lake HURON, GEO.BAY, SUPERIOR

Cruise Type Toxic Materials

Miles Steamed 568.2 Lake Huron; 268.2 Geo. Bay; 677.7 Lake Superior

Description	Total	Description	Total
Secchi	18	Moorings Established (CM)	
Stations Occupied	39	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	35	Moorings Retrieved (Met.)	
Transmissometer Casts		Moorings Established ( )	
Reversing Thermometer Obs.	6	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology) C^{14}	6	Moorings Serviced ( )	
Water Samples Collected (S.O.C.)	5	Cores Taken (Gravity). Benthos	1
Water Samples Collected (D.O.C.)	12	Cores Taken (Piston)	
Water Samples Collected (Pesticide)	36	Grab Samples Taken Shipek	47
Water Samples Collected (Asbestos)	68	Drogues Tracked	
Water Samples Filtered (Chlorophyll)	34	Dye Releases	
Water Samples Treated (Phytoplankton)	34		
Zooplankton Hauls	68	Observations (Weather)	55
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)		Relative Humidity	
Total Number of Depths Sampled	112	Water Temperature (In-Hull)	9
Total Number of Water Samples Collected	127	Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)		Rain Samples Collected	1
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

FOUR FISH TRAWLS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship LIMNOS

Dates From _____ to _____ Lake GREAT LAKES

Cruise Type _____ Miles Steamed 10,430.8

Description	Total	Description	Total
Secchi	225	Moorings Established (CM)	88
Stations Occupied	703	Moorings Retrieved (CM)	55
Bathythermograph Casts	198	Moorings Established (Met.)	4
E.B.T. Casts	221	Moorings Retrieved (Met.)	6
Transmissometer Casts	162	Moorings Established (SED. BOTTLE)	17
Reversing Thermometer Obs.	68	Moorings Retrieved (SED. BOTTLE)	17
Water Samples Collected (Chemistry)	79	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology) C^{14}	6	Moorings Serviced ( )	
Water Samples Collected (P.O.C.)	196	Cores Taken (Gravity). BENTHOS	65
Water Samples Collected (RAIN)	3	Cores Taken (Piston)	
Water Samples Collected (D.O.C.)	12	Grab Samples Taken	9
Water Samples Collected (S.O.C.)	5	Drogues Tracked	
Water Samples Filtered (Chlorophyll)	223	Dye Releases	
Water Samples Treated (Phytoplankton)	34	Grab Samples Taken SHIPEK	434
Zooplankton Hauls		Observations (Weather)	237
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)	85	Air Temperature	
Integrator (20m)	79	Relative Humidity	
Total Number of Depths Sampled	237	Water Temperature (In-Hull)	9
Total Number of Water Samples Collected	925	Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	71
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)	270		
Nutrients (W.Q.D.)		Water Samples Collected (SILICA)	49
Microbiology		Water Samples Collected (PESTICIDE)	36
		Water Samples Collected (ASBESTOS)	68
		Moorings Established (BAFFLE)	12
		Moorings Retrieved (BAFFLE)	12

REMARKS

.....2

2. **STATISTICS SUMMARY**

Cruise No. _____ Consec. No. _____

Dates From _____ to _____

Cruise Type _____

Ship LIMNOS

Lake GREAT LAKES

Miles Steamed 10,430.8

Description	Total
Secchi	
Stations Occupied	
Bathythermograph Casts	
E.B.T. Casts	
Transmissometer Casts	
Reversing Thermometer Obs.	
Water Samples Collected (Chemistry)	
Water Samples Collected (Microbiology)	
Water Samples Collected (Biolimnology)	
Water Samples Collected ( )	
Water Samples Collected ( )	
Water Samples Collected ( )	
Water Samples Collected ( )	
Water Samples Filtered (Chlorophyll)	
Water Samples Treated (Phytoplankton)	
Zooplankton Hauls	
Zooplankton Hauls (Mysis)	
Primary Productivity Moorings	
Bottom Samples (Fauna)	
Integrator (10m)	
Integrator (20m)	
Total Number of Depths Sampled	
Total Number of Water Samples Collected	
ONBOARD ANALYSIS	
Geolimnology	
Manual Chemistry (Tech. Ops.)	
Nutrients (W.Q.D.)	
Microbiology	

Description	Total
Moorings Established (CM)	
Moorings Retrieved (CM)	
Moorings Established (Met.)	
Moorings Retrieved (Met.)	
Moorings Established (F.T.P.)	8
Moorings Retrieved (F.T.P.)	5
Moorings Serviced (CM)	
Moorings Serviced (Met.)	
Moorings Serviced ( )	
Cores Taken (Gravity)	
Cores Taken (Piston)	
Grab Samples Taken	
Drogues Tracked	
Dye Releases	
Observations (Weather)	
Observations ( )	
Continuous Observations (Days)	
Air Temperature	
Relative Humidity	
Water Temperature (In-Hull)	
Water Temperature (Towed)	
Integrated Printout	
Solar Radiation	
Long Wave (IR) Radiation	
Moorings Established (SED. TRAP)	18
Moorings Retrieved (SED. TRAP)	18
Moorings Established (NUN BUOY, BRONTE)	2
Moorings Established (SONO BUOY)	3
Moorings Retrieved (SONO BUOY)	3
Bottom Picture Profiles	250
Triple Benthos Cores	55

REMARKS

Three Special Rain Gauge Buoys

Four Fish Trawls

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship MARTIN KARLSEN

Dates From _____ to _____ Lake ONTARIO

Cruise Type _____ Miles Steamed 3,492.2

SOME CRUISES COMBINED LAKES

Description	Total	Description	Total
Secchi	94	Moorings Established (CM)	
Stations Occupied	310	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	183	Moorings Retrieved (Met.)	
Transmissometer Casts	152	Moorings Established ( )	
Reversing Thermometer Obs.	23	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected ( )		Cores Taken (Gravity).	107
Water Samples Collected ( )		Cores Taken (Piston)	30
Water Samples Collected ( )		Grab Samples Taken	61
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls	3	Observations (Weather)	163
Zooplankton Hauls (Mysis)	6	Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	3½
Integrator (20m)	185	Relative Humidity	3½
Total Number of Depths Sampled		Water Temperature (In-Hull)	7½
Total Number of Water Samples Collected	746	Water Temperature (Towed)	7½
		Integrated Printout	16½
ONBOARD ANALYSIS		Solar Radiation	21½
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)	481		
Nutrients (W.Q.D.)	195		
Microbiology	408		

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship MARTIN KARLSEN

Dates From _____ to _____ Lake ERIE

Cruise Type _____ Miles Steamed 2,604.7

SOME CRUISES COMBINED LAKES

Description	Total	Description	Total
Secchi	44	Moorings Established (CM)	
Stations Occupied	199	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	73	Moorings Retrieved (Met.)	
Transmissometer Casts	73	Moorings Established ( )	
Reversing Thermometer Obs.	3	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected ( )		Cores Taken (Gravity)	107
Water Samples Collected ( )		Cores Taken (Piston)	30
Water Samples Collected ( )		Grab Samples Taken	61
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls	3	Observations (Weather)	119
Zooplankton Hauls (Mysis)	6	Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)	73	Relative Humidity	
Total Number of Depths Sampled		Water Temperature (In-Hull)	6
Total Number of Water Samples Collected	294	Water Temperature (Towed)	6
		Integrated Printout	13
ONBOARD ANALYSIS		Solar Radiation	19
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)	88		
Nutrients (W.Q.D.)	321		
Microbiology	540		

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____

Dates From _____ to _____

Cruise Type _____

Ship MARTIN KARLSEN

Lake HURON

Miles Steamed 5,662.4

Description	Total	Description	Total
Secchi	194	Moorings Established (CM)	
Stations Occupied	363	Moorings Retrieved (CM)	
Bathythermograph Casts	1	Moorings Established (Met.)	
E.B.T. Casts	355	Moorings Retrieved (Met.)	
Transmissometer Casts (INCLUDES 39 scatter meter)	360	Moorings Established (FTP)	1
Reversing Thermometer Obs.	31	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	2
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected (RAIN)	13	Cores Taken (Gravity).	
Water Samples Collected ( )		Cores Taken (Piston)	
Water Samples Collected ( )		Grab Samples Taken	4
Water Samples Collected ( )		Drogues Released	90
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls	142	Observations (Weather)	224
Zooplankton Hauls (Mysis)	18	Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	35½
Integrator (20m)	371	Relative Humidity	35½
Total Number of Depths Sampled		Water Temperature (In-Hull)	35½
Total Number of Water Samples Collected	2839	Water Temperature (Towed)	30½
		Integrated Printout	33½
ONBOARD ANALYSIS		Solar Radiation	35½
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)	4320		
Nutrients (W.Q.D.) (Available Figures)	7013		
Microbiology	2591		

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship MARTIN KARLSEN

Dates From _____ to _____ Lake GEORGIAN BAY

Cruise Type _____ Miles Steamed 5,087.9

Description	Total	Description	Total
Secchi	181	Moorings Established (CM)	
Stations Occupied	380	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	1
E.B.T. Casts	364	Moorings Retrieved (Met.)	1
Transmissometer Casts (Scatter meter, spectro meter)	400	Moorings Established ( )	
Reversing Thermometer Obs.	19	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	1
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected ( )		Cores Taken (Gravity)	
Water Samples Collected ( )		Cores Taken (Piston)	
Water Samples Collected ( )		Grab Samples Taken	9
Water Samples Collected ( )		Drogues Tracked	1
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls	524	Observations (Weather) approx.	244
Zooplankton Hauls (Mysis)	66	Observations (Remote Sensing, S.O.D.)	72
Primary Productivity Moorings	13		
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)	76	Air Temperature	21
Integrator (20m)	409	Relative Humidity	21
Total Number of Depths Sampled		Water Temperature (In-Hull)	21
Total Number of Water Samples Collected approx	3199	Water Temperature (Towed)	21
		Integrated Printout	17
ONBOARD ANALYSIS		Solar Radiation	38
Geolimnology		Long Wave (IR) Radiation	5
Manual Chemistry (Tech. Ops.)	4062		
Nutrients (W.Q.D.)	9175		
Microbiology	2766		

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship MARTIN KARLSEN

Dates From _____ to _____ Lake SUPERIOR

Cruise Type _____ Miles Steamed 2803.4

Description	Total	Description	Total
Secchi		Moorings Established (CM)	
Stations Occupied	250	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	20	Moorings Retrieved (Met.)	
Transmissometer Casts		Moorings Established ( )	
Reversing Thermometer Obs.		Moorings Retrieved ( )	
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected ( )		Cores Taken (Gravity).	207
Water Samples Collected ( )		Cores Taken (Piston)	2
Water Samples Collected ( )		Grab Samples Taken	309
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls	14	Observations (Weather)	96
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)	14	Relative Humidity	
Total Number of Depths Sampled		Water Temperature (In-Hull)	
Total Number of Water Samples Collected	377	Water Temperature (Towed)	
		Integrated Printout	8
ONBOARD ANALYSIS		Solar Radiation	8
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)			
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____

Dates From _____ to _____

Cruise Type _____

Ship MARTIN KARLSEN

Lake GREAT LAKES

Miles Steamed 19,650.6

SOME CRUISES COMBINED

Description	Total	Description	Total
Secchi	513	Moorings Established (CM)	
Stations Occupied	1502	Moorings Retrieved (CM)	
Bathythermograph Casts	1	Moorings Established (Met.)	1
E.B.T. Casts	995	Moorings Retrieved (Met.)	1
Transmissometer Casts scatter meter, spectro-meter	985	Moorings Established (FTP)	1
Reversing Thermometer Obs.	76	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	3
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected ( )		Cores Taken (Gravity).	421
Water Samples Collected ( )		Cores Taken (Piston)	62
Water Samples Collected ( )		Grab Samples Taken	444
Water Samples Collected ( )		Drogues Tracked 1;90 Drift Cards Released	91
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls	686	Observations (Weather)	846
Zooplankton Hauls (Mysis)	96	Observations (Remote Sensing, S.O.D.)	72
Primary Productivity Moorings	13		
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)	76	Air Temperature	60
Integrator (20m)	1052	Relative Humidity	60
Total Number of Depths Sampled		Water Temperature (In-Hull)	70
Total Number of Water Samples Collected approx.	7455	Water Temperature (Towed)	65
		Integrated Printout	88
ONBOARD ANALYSIS		Solar Radiation	122
Geolimnology		Long Wave (IR) Radiation	5
Manual Chemistry (Tech. Ops.)	8951		
Nutrients (W.Q.D.)	16704		
Microbiology	6305		

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____ Ship HMCS PORTE DAUPHINE

Dates From _____ to _____ Lake ONTARIO

Cruise Type SURVEILLANCE Miles Steamed 6407.8

Description	Total	Description	Total
Secchi	475	Moorings Established (CM)	
Stations Occupied	809	Moorings Retrieved (CM)	
Bathythermograph Casts	44	Moorings Established (Met.)	
E.B.T. Casts	765	Moorings Retrieved (Met.)	
Transmissometer Casts	773	Moorings Established ( )	
Reversing Thermometer Obs.	78	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)	1409	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)	898	Moorings Serviced ( )	
Water Samples Collected & Filtered (POC)	447	Cores Taken (Gravity).	
Water Samples Collected (TOTAL P)	436	Cores Taken (Piston)	
Water Samples Collected (SPECIAL)	10	Grab Samples Taken	
Water Samples Collected (RAIN)	3	Drogues Tracked	
Water Samples Filtered (Chlorophyll)	908	Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	269
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)	818	Relative Humidity	
Total Number of Depths Sampled	221	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	2933	Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	125
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)	1291	Water Samples Collected (U. of Waterloo)	6
Nutrients (W.Q.D.)	99		
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. No. _____

Dates From _____ to _____

Cruise Type SURVEILLANCE

Ship Porte Dauphine

Lake Erie

Miles Steamed 856.0

Description	Total	Description	Total
Secchi	29	Moorings Established (CM)	
Stations Occupied	72	Moorings Retrieved (CM)	
Bathythermograph Casts	1	Moorings Established (Met.)	
E.B.T. Casts	71	Moorings Retrieved (Met.)	
Transmissometer Casts	63	Moorings Established ( )	
Reversing Thermometer Obs.	6	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected (P.O.C.)	84	Cores Taken (Gravity)	
Water Samples Collected (Total P)	103	Cores Taken (Piston)	
Water Samples Collected ( )		Grab Samples Taken	
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	80	Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	34
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)	72	Relative Humidity	
Total Number of Depths Sampled	99	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	398	Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	7
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)	131		
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No. 74-00-401 Consec. No. _____ Ship CSS ADVENT

Dates From July 22 to July 28, 1974 Lake ONTARIO

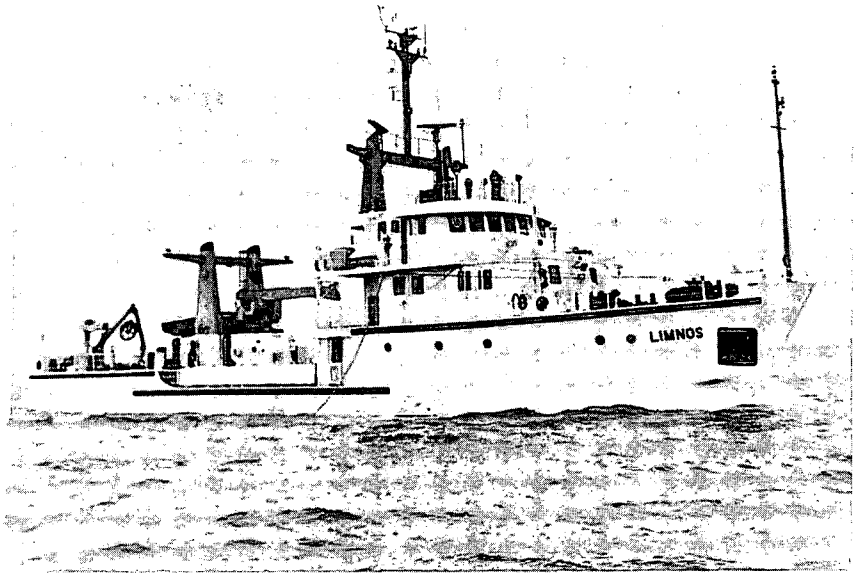
Cruise Type SURVEILLANCE Miles Steamed 650.0

Description	Total	Description	Total
Secchi	62	Moorings Established (CM)	
Stations Occupied	62	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	62	Moorings Retrieved (Met.)	
Transmissometer Casts	62	Moorings Established ( )	
Reversing Thermometer Obs.	6	Moorings Retrieved ( )	
Water Samples Collected (Chemistry) P.O.C.	32	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced ( )	
Water Samples Collected ( )		Cores Taken (Gravity)	
Water Samples Collected ( )		Cores Taken (Piston)	
Water Samples Collected ( )		Grab Samples Taken	
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	67	Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)	62	Relative Humidity	
Total Number of Depths Sampled	140	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	239	Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)			
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

"LIMNOS"

Derivation – "Lake" (Greek)



TYPE Limnology research vessel, also designed for Hydrographic Surveys. Steel hull

YEAR BUILT	*LENGTH*	*BEAM*	*DRAFT*	*DISPLACEMENT*	*TONNAGE*	
					GROSS	*NET*
1968	147′	32′	8′ 0′	Light 504 Loaded 615	459.94	173.04

PERFORMANCE

SPEED (KNOTS)			*RANGE*	*ENDURANCE*
CRUISING	*MAXIMUM*	*MINIMUM*		
10	11	2	2000 miles	14 days

COMPLEMENT

CREW	*SCIENTIFIC STAFF*
16	11

MAJOR SHIPS

CSS LIMNOS

Affiliation

Operated by Marine Sciences Directorate for Inland Waters Directorate, Department of the Environment, Canada Centre for Inland Waters, Burlington, Ontario.

Propulsion

Two 500 B.H.P. at 1250 RPM Paxman Diesels, keel cooled, direct drive to twin 360 rotatable Harbourmaster units.

Fixed pitch propellers, right angle drive gears and vertical shafting.

Bridge controlled; the vessel is steered by turning the propeller assemblies, thus eliminating need for rudder.

Bunker capacity – 53.65 tons No. 2 Diesel.

Electrical Power

Ship's system, three phase 60 cycle a-c. All three phase power 460 volts.

Transformer requirements – 240v, three phase
120v, three phase.

Two laboratory controlled frequency stabilized units rated at 5 kva, output supply 115 volts, 1 phase, 60 cycles.

Ship's power – 2 Cummins Diesels – 150 kw each.

Emergency generator – Cummins Diesel – 100 kw. Arranged to start automatically in case of failure of either main generator which happens to be in use. (Can be paralleled with main generators). Summer Sea Load 110 kw, Winter Sea Load 168 kw.

Remainder can be used for scientific apparatus and instruments.

Type	Transformer Capacity	Available for Laboratory Purposes
460v–60Hz–3ϕ	–	100 kw
230v–60Hz–3ϕ	72 kw	10 kw
120v–60Hz–3ϕ	135 kw	30 kw

10 kw of 120v 60Hz, 1ϕ at 0.002% frequency regulation and 2% voltage regulation is available.

Navigation, Communication and Echo Sounding Equipment

Navigation

Decca Radar Model 429.
Decca Radar Model 426 with Alpine Precision Ranging System.
Arma-Brown Gyro-Compass MK. 1c, master compass in Operations Control Centre.

8 repeaters: 2 in radar displays, 3 steering repeaters in wheelhouse, remote control starboard bridge wing, and engine room control consol, 3 bearing repeaters on bridge, one repeater starboard laboratory.

Gyro compass course recorder.
Sperry automatic pilot.
Bergen-Nautik retractable Pitometer log, type FEN-2
Searchlight.
Wind speed and direction indicators on bridge and in laboratory.

Communications

2 – Marconi CH25 IF/AM Transceiver
1 – Marconi VHF/FM Raytheon Transceiver
1 – Marconi AM CN 86 Transceiver

Echo Sounders

1 – Kelvin Hughes Model MS26B
2 – Simrad Model EP2BN

Hydrographic Winches and Equipment

All winches are mounted on portable bases, which enables them to be positioned anywhere on the deck over the 22" centre, 1" diameter holes provided. The winches are placed on board as required.

One single drum heavy duty electro-hydraulic winch. J. Swann, Series '0'-329 MK. 2. Model 80. 40 hp. Two speed. Rating, 4 tons-low speed, 2 tons-high speed. Capacity 500 ft. 1/2" wire or equivalent. Twin readouts – one portable. Free-fall clutch with brake. May be fitted with slip rings (max. 10). Rotatable, automatic spooling, remote control available.

One wire winding winch, electro-hydraulic. J. Swann, Series '0'-325, 5 hp. Various drum capacities from 30,000 feet of 3/32" to 2,5000 feet of 5/8" wire. Detachable drum. May be used for light duty oceanographic work. Automatic spooling.

One light duty portable oceanographic winch, electro-hydraulic or diesel powered. J. Swann, Series '0'-365. 10 hp. Two speed. Rating, 800 lbs. – low speed, 400 lbs. – high speed. Drum capacity – 2,500 feet, 5/32" wire. Free-fall clutch with brake. May be fitted with slip rings. Rotatable, automatic spooling, remote control available.

J. Swann winch, Series '0'-315, 10 hp. Drum capacity – 4,000 feet of 3/32" wire, Speed-540 feet per radius (maximum radius 35 feet). Capable of 360° rotations, drum capacity 270 feet, of 1/2" wire. Located amidships.

Two Fixed "A" frames	1000 lbs.
Two portable "A" frames	3000 lbs.
Two portable Gallows	3000 lbs.

One Austin Western Model 410-P electro-hydraulic crane – 40 hp. 6000 lbs. lift at 26 feet working radius and 17,700 lbs. lift at 12 feet working radius (maximum radius 35 feet). Capable of 360° rotation, drum capacity 270 feet of 1/2" wire. Located amidships.

Acoustic Characteristics

Vessel cannot be put in noiseless condition for listening.

Laboratories

Laboratory amidships, 670 square feet with Alden P.G.R. gyro-repeater, wind speed and direction and access to port and starboard main deck. Storage limited. Wet lab. 90 square feet starboard side connecting to main lab.

Habitability

A system of high velocity air-conditioning is provided for all living and operational spaces, including labs, operations control centre and wheelhouse. Individual room thermostats for electric heating. One double cabin for female scientists. Double and single cabin accommodation for scientists and officers. Not more than two crewmen in any cabin. Limited recreational facilities.

Fresh water capacity – 60 tons. Chlorination system for treating lake water. No distillation capacity.

Other Features

Provision made for carrying portable labs on deck. Alternately, vessel may carry four 26 foot sounding launches for hydrographic work; 17 foot Boston Whaler, 35 hp. outboard motor.

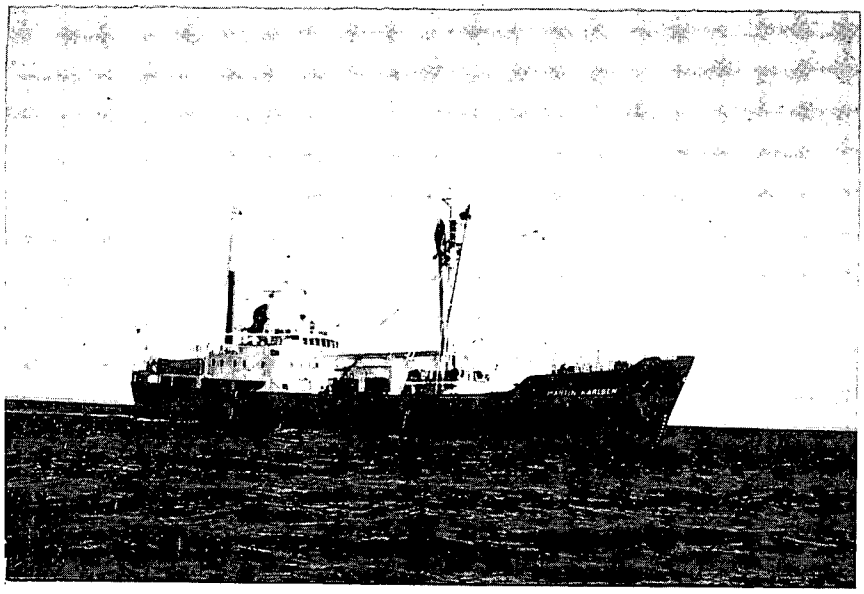
Type of Observations

Vessel equipped to carry out lake pollution research and surveillance including studies of lake bottom geology, geophysics, lake sediments, air-water interaction, temperatures, currents and other physical and chemical characteristics of the Great Lakes.

Remarks

Because of limited space, all disciplines cannot be performed simultaneously, but the vessel has been designed for rapid switching from one set of activities to another.

"MARTIN KARLSEN"



TYPE Sealing Vessel, Steel Hull, Fully Reinforced for Ice

YEAR BUILT	*LENGTH*	*BEAM*	*DRAFT*	*DISPLACEMENT*	*TONNAGE*	
					GROSS	*NET*
1952	212.9'	36.8	17' 0'	1890 tons	1244.06	585.45

PERFORMANCE

SPEED (KNOTS)			*RANGE*	*ENDURANCE*
CRUISING	*MAXIMUM*	*MINIMUM*		
11	12	1/2	15,000 miles	60 days

COMPLEMENT

CREW	*SCIENTIFIC STAFF*
22	24

M.V. MARTIN KARLSEN

Affiliation

Operated under charter by Marine Sciences Directorate for Inland Waters Directorate, Department of the Environment, Canada Centre for Inland Waters, Burlington, Ontario.

Propulsion

Single screw, reversible pitch and wheelhouse or crowsnest control. Powered by Burmeister and Wains diesel 6-cylinder engine to develop 1200 I.H.P.

Bunker capacity 260 tons.

Electrical Power

Two main generators: 120 kw at 240v d-c driven by 180 hp 3 cylinder Burmeister and Wains diesel engine – 150 kw at 240v d-c driven by 220 hp 6 cylinder D334 Caterpillar marine diesel engine.

One auxiliary generator: 26 kw at 110v a-c single phase driven by 4 cylinder lister Blackstone HW4 diesel.

Two converters; an 18 kw 110v a-c single phase and a 20 kw 110v a-c single phase (emergency).

Shorepower facilities: 220v a-c.

Navigational Equipment

Radar – Kelvin-Hughes marine radar Model 1912, 3cm. pulse length, range 64 miles.
– Decca relative motion marine radar Model RM 1226, 3 cm. pulse length, range 48 miles.
Anschutz Gyro Model K8051 with bridge wing and crowsnest repeaters
Anschutz Gyro automatic pilot
Standard magnetic compass
Wind speed and direction indicators
Searchlights

Communication Equipment

2-HF AM and single sideband Marconi CH 25 transceivers
1-VHF FM Marconi Clipper II transceiver
1-CN8 AM Marconi "Seaway" transceiver
1-Robertson Master 100 Duplex Simplex AM transmitter
1-all band tuneable Electromekano Model M97 AM receiver

Echo Sounders

2-Kelvin Hughes MS26B

Hydrographic Winches and Equipment

The ship can be fitted with various hydrographic and oceanographic winches. The following are carried routinely:

1 – Swann series 0 365, 10 hp two speed oceanographic winch rated 800 lbs. at low speed. Drum capacity of 5,000 ft. of 5/32 in. wire. Electrical pumping unit.
1 – Swann series 0 36B, and others
1 – HAP/2 articulate crane
1 – capstan, New England Trawler, single speed, two direction
4 – derricks – capacity 5 tons
1 – derrick – capacity 20 tons

Laboratories

Portable laboratories are constructed over # 2 hatch with 'tween deck below converted to laboratories, providing ample room for many limnological studies. Laboratories are connected by a stairway and a dumbwaiter-type lift of 1-ton capacity.

Habitability

Living accomodations consist of single, double, and multi-berth cabins, providing berthing for 24 scientific/technical personnel.

Types of Observations

The vessel is equipped to carry out lake pollution research and surveillance, including lake-bottom geology, geophysics, lake sediment, air-water interaction, temperature, currents and other physical, chemical and biological characteristics of the Great Lakes. Similarly, the vessel is equipped for many overside operations including the laying and retrieving of buoys, and piston coring.

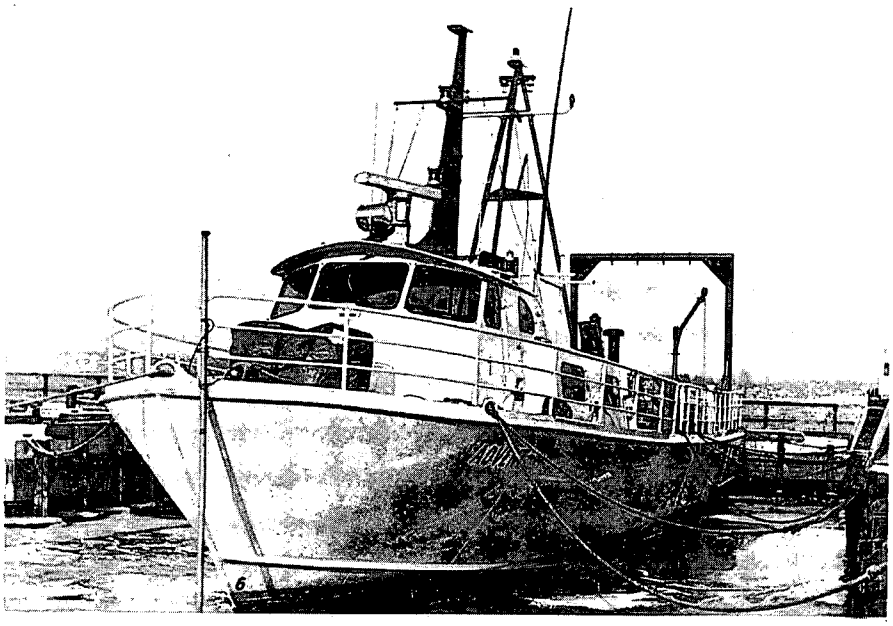
Scientific Equipment

The M/V MARTIN KARLSEN routinely has the following equipment on board for the following observations:

1. Analogue recorders for continuous measurement of
   a. near surface water temperature
   b. air temperature
   c. relative humidity
   d. solar radiation
   e. long-wave (infra-red) radiation
2. An electronic bathythermograph to obtain water temperature profiles to 400 metres.
3. An electronic bathythermograph in conjunction with a water pumping sampler, to 100 metres.
4. Knudsen bottles, fitted with reversing thermometers, to obtain water samples and temperatures.

5. Van Dorn bottles to obtain water samples.
6. Instruments for the analyses of dissolved oxygen, specific conductance, turbidity and pH.
7. Secchi disc for measurement of water transparency.
8. Auto-analyzers for the measurement of:
   a. soluble (filtered) phosphorus
   b. soluble (filtered) nitrate and nitrite
   c. soluble (filtered) silica
   d. ammonia (filtered)
   e. chloride (filtered)
   f. total alkalinity (filtered)
   g. total nitrogen (filtered)
9. Facilities for the preparation of samples for shore analyses of:
   a. total phosphorus (filtered)
   b. total phosphorus (unfiltered)
   c. particulate carbon and nitrogen
   d. trace elements (filtered and unfiltered)
10. Other samplers, for various observations, may be carried on board depending on the type of investigation required.

"ADVENT"



TYPE Limnological and Hydrographic Survey Vessel Aluminum Hull

Year Built	Length	Beam	Draft	Displacement	Tonnage	
					Gross	Net
1972	77′	17.6′	5′	Light 45T. Loaded 56T.	71.54	39.49

PERFORMANCE

Speed (Knots)			Range	Endurance
Cruising	Maximum	Minimum		
20	22	4	600 miles	30 hours

COMPLEMENT

Crew	Scientific Staff
4	8

CSS ADVENT

Affiliation

Operated by Marine Sciences Directorate for Inland Waters Directorate, Environment Canada, Canada Centre for Inland Waters, Burlington, Ontario.

Propulsion

Twin turbo-charged V-12 71 Detroit Diesel engines generating 1020 brake hp.
Twin screws; remote electric steering device.
Bunker capacity – 1100 imperial gallons

Electrical Power

2 Detroit Diesel generators – 30 kw at 230v a-c.
Facilities for shore power hookup 230v a-c.

Navigation, Communications, and Echo Sounding Equipment

Navigation:

Arma Brown Mk10 Gyro Compass; one repeater in pilot house
Magnetic Danforth Steering Compass
Magnetic Airguide Compass (for emergency use)
Kelvin Hughes Radar, Model 17/9
Trident Mk II Log
Searchlight

Communications:

AM/SSB Marconi CH25 Transceiver
VHF FM Raytheon Ray 50 (Sea Watch) Transceiver
Hose McCann Intercom System

Echo Sounders:

Atlas Sounder Deso 10
Ross Sounder

Hydrographic/Oceanographic Winches and Equipment

The vessel can be fitted with various winches at users' requests. The following are carried routinely:

One Deming Unit 30 hydraulic crane, SWL one ton at 20 feet, that rotates in an arc of 315°;

One Swann Model 467 vertical capstan, with a line pull of 1.5 tons at 100 ft./min.;

One Swann Model 261 hydraulic powered anchor winch.

A hydraulic operated A-frame is mounted on the stern; it is 13 feet high and has a lifting capacity of one ton and a towing capacity of 1,500 lbs. at 10 knots.

Laboratory

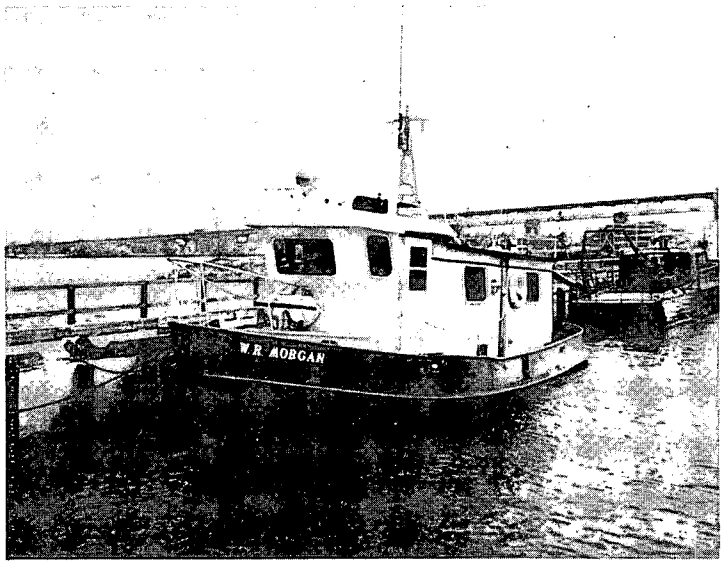
The laboratory has an area of approximately 120 square feet, with cupboards and counter-top work spaces attached to the bulkheads. It is equipped with a refrigerator, stove, and heater, and a sink supplied with hot and cold water which drains into a 500 gallon capacity fibreglass holding tank. The laboratory can be equipped to investigate physical, chemical, geological and biological characteristics of the Great Lakes region.

Remarks

The vessel operates on a day basis only; sleeping accommodation is limited.

"SHARK"

(formerly W.R. Morgan)



TYPE TECHNICAL OPERATIONS DIVING TENDER

REMODELED	*LENGTH*	*BEAM*	*DRAFT*	*TONNAGE*	
1967	40′	13′	5′	Gross 8.10	Net 5.98

PERFORMANCE

SPEED (Knots)			*RANGE*	*ENDURANCE*
CRUISING	*MAX.*	*MIN.*		
9	9	2	500 miles	3 days

COMPLEMENT

CREW	*SCIENTIFIC STAFF*
2	3

SHARK

Affiliation

Operated by Marine Sciences Directorate for Inland Waters Department of the Environment, Canada Centre for Inland Waters, Burlington, Ontario.

Propulsion

One GM Diesel 6.71
Bunkers 189 gal.
Endurance 72 hours
Deckhouse control
Single screw with bronze propeller 36 x 32 – 4 blades.

Electrical Power

All wiring 110v, 32v and 24v in aluminum conduit with breaker panels.
Wired for shore power.
Delco Remy Alternator with 32v standby generator on main engine.

Navigational Equipment

Magnetic compass.
Brown gyro compass.

Communications Equipment

Pye AM Ship to Shore Radiophone.
VHF/FM Marconi Clipper II

Sounding Equipment

Long range Ferrograph Marconi Echo sounder (Recorder & Dial Indicator).

Equipment

Electrical winch mounted on working platform on stern, 12v motor.
Large capacity compressor.
Spotlight (range 2 miles).
Vulcan Electric Rectifier battery charging system.

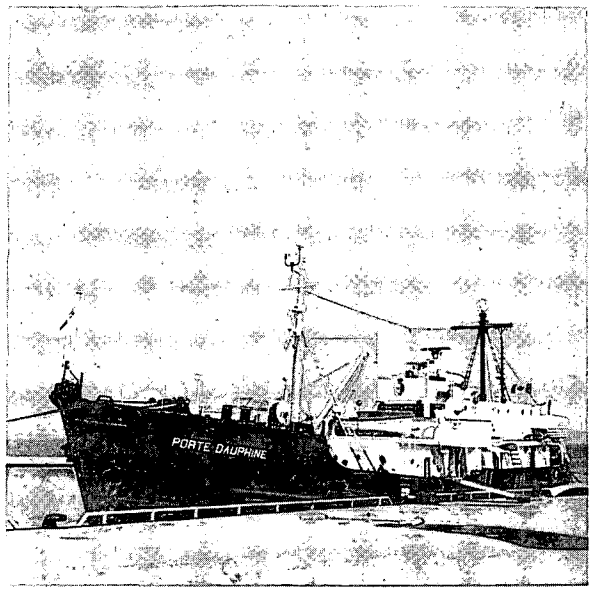
Habitability

Sleeps 5 comfortably.
2 fresh water tanks 200 imperial gallons.
Buchanan electric hot water system.
Stove and refrigerator.
Hot and cold water pressure system (with sink).

Type of Observations

This tug serves as a diving tender for scuba divers.

CCGS PORTE DAUPHINE



TYPE Royal Canadian Navy Gate Vessel, modified for Great Lakes research

YEAR BUILT	LENGTH	BEAM	DRAFT	DISPLACEMENT	TONNAGE	
					GROSS	NET
1952	125' 06"	26' 02"	13' 04"	474.5 tons	347	144

PERFORMANCE

SPEED (KNOTS)			RANGE	ENDURANCE
Cruising	Maximum	Minimum		
10.5	12.5	2	4,500 miles	16 days

COMPLEMENT

CREW	SCIENTIFIC STAFF
17	7

HMCS PORTE DAUPHINE

Affiliation

Owned by the Royal Canadian Navy and originally built as a gate vessel, PORTE DAUPHINE was operated by the Canadian Coast Guard (Ministry of Transport) and was assigned in 1974 to Inland Waters Directorate, Canada Centre for Inland Waters, Burlington, Ontario. In November, PORTE DAUPHINE returned to the Navy as a training vessel.

Propulsion

Dominion Alco diesel engine, 600 HP, driving single screw.

Electrical Power

Diesel driven generators: 110v, 220v, 440v three phase 60 cycle AC; 110v and 220v DC.

Navigational Equipment

Sperry Gyro Compass
Standard Magnetic Compass
Marconi Lodestar Direction Finder
Kelvin Hughes 14-9 R2 Radar
Kelvin Hughes 14-12 Radar

Communications Equipment

Marconi Seaway AM Transceiver
Marconi Clipper II VHF Transceiver

Echo Sounding Equipment

Kelvin Hughes 26B Sounder
Kelvin Hughes 29 Sounder
Fishfinder Sounder

Scientific Winches and Equipment

5 HP AC Sampling winch
3 HP DC EBT winch (silicon control rectified)
1 ton Capacity (approx.) Sampling boom

Other Features

PORTE DAUPHINE is fitted with rolling chocks and has strengthened bow structure for breaking ice.

Fresh water capacity - 15 tons.

Habitability

15 bunks in crew's quarters
5 bunks in scientific staff quarters
2 bunks in Chief Technician's cabin
6 bunks in Officers' cabins
1 bunk in Captain's cabin

Types of Observations

In 1974, PORTE DAUPHINE was the principal vessel used for the Surveillance program. Observations included temperature versus depth profiles, transmissometry versus depth profiles, transparency and conductivity measurements, dissolved oxygen determinations, collection and treatment of water samples for chlorophyll a, total phosphorus and particulate organic carbon, meteorological observations, and a variety of minor additional tasks. Solar radiation was recorded continuously.

Laboratories

Over 200 square feet of laboratory space was in constant use for the Surveillance program. The following equipment was standard on all cruises:

Electronic Bathythermograph
Mechanical Bathythermographs
Bucket Thermometer
Secchi Discs and Colour Scales
Transmissometer
Integrated Sampler
Filtration Bank for Chlorophyll and POC
Winkler Method Apparatus
Dissolved Oxygen Probe
Knudsen Bottles for Reversing Thermometers
Van Dorn Bottles
Freezer
Desiccator
Meteorological Equipment
Solarimeter
Conductivity Meter
Complete Tool Kit
Numerous Forms and Office Supplies

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
FEB	27	28	29	30	31	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
MAR	24	25	26	27	28	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18 Depart CCIW 0905	19 Lake Ontario	20 Moorings	21 Lake Ontario	22 Moorings	23 Lake Ontario Moorings
	24 Arrive CCIW 1216	25 CCIW	26 Dep. CCIW L. Ont 1000 Mooring	27 Arr. CCIW L. Ont. 1700 Analysis	28 CCIW	29 CCIW	30 CCIW
APR	31 CCIW	1 CCIW	2 Dep. CCIW L. Ont 0920 Side Scan &	3 Arr. CCIW L. Ont. 1500 Seismic Sur.	4 CCIW	5 CCIW	6 CCIW
	7 CCIW	8 CCIW	9 CCIW	10 CCIW	11 CCIW	12 CCIW	13 CCIW
	14 CCIW	15 CCIW	16 Dep. CCIW L. Ont 1025 Sedimentation	17 Arr. CCIW L. Ont. 1210 Velocity	18 CCIW	19 CCIW	20 CCIW
	21 CCIW	22 CCIW	23 CCIW	24 CCIW	25 CCIW	26 CCIW	27 CCIW
MAY	28 CCIW	29 CCIW	30 CCIW	1 CCIW	2 CCIW	3 CCIW	4 CCIW
	5 CCIW	6 CCIW	7 CCIW	8 Depart CCIW 0555	9 Georgian Bay &	10 Lake Huron	11 Moorings
	12 Georgian Bay &	13 Lake	14 Huron	15 Moorings	16 Georgian Bay &	17 Lake Huron	18 Moorings
	19 Arrive 1300 Owen Sound	20 Owen Sound	21 Depart 1442 Owen Sound	22 Georgian Bay	23 Seismic And.	24 Coring Survey	25 Arrive 0655 Owen Sound
	26 Owen Sound	27 Transit	28 Transit	29 CCIW	30 CCIW	31 CCIW	1 CCIW
JUNE	2 CCIW	3 Depart 1055 CCIW	4 Lake	5 Erie	6 Sediment	7 Inventory	8 Lake
	9 Erie	10 Sediment	11 Inventory	12 Arrive 0010 CCIW	13 CCIW	14 CCIW	15 CCIW
	16 CCIW	17 Depart 1004 Sediment	18 Arrive 1440 Velocity	19 CCIW	20 CCIW	21 CCIW	22 CCIW
	23 CCIW	24 CCIW	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW
JULY	30 CCIW	1 CCIW	2 Depart 0909 CCIW	3 Sediment	4 Coring	5 Lake	6 Huron
	7 Arrive Owen 0707 Sound	8 Owen Sound	9 Depart Owen 0745 Sound	10 Georgian Bay	11 Sediment Survey	12 Arrive Owen 0113 Sound	13 Owen Sound
	14 Owen Sound	15 Owen Sound	16 Depart Owen 0450 Sound	17 Huron and	18 Georgian Bay	19 Moorings	20 Huron and
	21 Georgian Bay	22 Moorings	23 Arrive 0945 Goderich	24 Goderich	25 Goderich	26 Goderich	27 Goderich
AUG	28 Goderich	29 Depart 1600 Goderich	30 Huron	31 Georgian	1 Bay	2 Lake	3 Superior
	4 Toxic	5 Materials	6 Arrive 0500 Sault Ste Marie	7 Transit	8 Transit	9 CCIW	10 CCIW
	11 CCIW	12 CCIW	13 CCIW	14 CCIW	15 Depart CCIW Sediment	16 Arrive CCIW Velocity	17 Open House Toronto
	18 Open House Toronto	19 Depart 0917 CCIW	20 Lake	21 Ontario	22 Surveillance	23 Arrive 1615 CCIW	24 ---
	25 ---	26 ---	27 ---	28 DOWN TIME	29 ---	30 ---	31 ---
SEPT	1 ---	2 ---	3 ---	4 DOWN TIME	5 ---	6 ---	7 ---
	8 CCIW	9 Depart 1010 CCIW	10 Sediment Velocity Studies	11 Arrive 1545 CCIW	12 CCIW	13 CCIW	14 CCIW
	15 CCIW	16 Depart 0900 CCIW	17 Transit	18 Arr. Douglas Pt. 1100 Area	19 Moorings	20 Lake Huron	21 Transit
	22 Transit	23 Arrive 2010 CCIW	24 CCIW	25 CCIW	26 CCIW	27 CCIW	28 CCIW
OCT	29 CCIW	30 CCIW	1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 CCIW
	6 CCIW	7 CCIW	8 CCIW	9 CCIW	10 CCIW	11 CCIW	12 CCIW
	13 CCIW	14 CCIW	15 Depart 0928 CCIW	16 Lake Ontario	17 Surveillance	18 Arrive 2120 CCIW	19 CCIW
	20 CCIW	21 Depart 1126 CCIW	22 Eng. Trials Lake Ontario	23 Arrive 0950 CCIW	24 CCIW	25 CCIW	26 CCIW
NOV	27 CCIW	28 CCIW	29 CCIW	30 CCIW	31 CCIW	1 CCIW	2 CCIW
	3 CCIW	4 CCIW	5 CCIW	6 CCIW	7 CCIW	8 CCIW	9 CCIW
	10 CCIW	11 Depart 1025 CCIW	12 Georgian Bay	13 Lake Huron	14 Moorings	15 Georgian Bay	16 Lake Huron
	17 Moorings	18 Georgian Bay	19 Lake Huron	20 Moorings	21 Georgian Bay	22 Lake Huron	23 Moorings
	24 Georgian Bay	25 Lake Huron	26 Moorings	27 Georgian Bay Lake Huron	28 Moorings	29 Arr. Goderich	30 Goderich
DEC	1 Goderich	2 Goderich	3 Goderich	4 Monitor	5 Georgian Bay &	6 Lake Huron	7 Monitor
	8 Georgian Bay	9 Lake Huron	10 Lake Erie	11 Lake Erie	12 Arr. CCIW	13 CCIW	14 CCIW
	15 CCIW	16 Dep. Lake 1400 Ontario.	17 Moorings	18 Arr. 0300 CCIW	19 CCIW	20 CCIW	21
	22	23	24	25	26	27	28

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Great Lakes Studies, CSS LIMNOS

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
FEB	27	28	29	30	31	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
MAR	24	25	26	27	28	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
APR	31	1 Depart 1210 CCIW	2 Shakedown Cruise	3 Lake Ontario	4 Arrive 1017 CCIW	5 CCIW	6 CCIW
	7 CCIW	8 Coring for Uni Wat	9 CCIW	10 CCIW	11 CCIW	12 CCIW	13 CCIW
	14 CCIW	15 CCIW	16 CCIW	17 CCIW	18 CCIW	19 CCIW	20 Open House CCIW
	21 Depart 0905 CCIW	22 Transit	23 Arr. Sarnia 0200 Dep. Sarnia 1500	24 Lake Huron	25 Survey	26 Lake Huron	27 Survey
MAY	28 Georgian Bay	29 Survey	30 Georgian Bay	1 Arrive Owen Sound 2240	2 Depart Owen Sound 1030	3 Arrive Sarnia 0830	4 Sarnia
	5 Sarnia	6 Sarnia	7 Sarnia	8 Sarnia	9 Sarnia	10 Sarnia	11 Sarnia
	12 Sarnia	13 Depart Sarnia 0930	14 Lake Huron	15 Survey	16 Lake Huron	17 Survey	18 Georgian Bay
	19 Survey	20 Georgian Bay	21 Survey	22 Arrive Owen Sound 2200	23 Owen Sound	24 Owen Sound	25 Owen Sound
	26 Owen Sound	27 Owen Sound	28 Depart Owen Sound 1535	29 Transit	30 Lake Superior	31 Coring	1 Lake Superior
JUNE	2 Coring	3 Lake Superior	4 Coring	5 Lake Superior	6 Coring	7 Lake Superior	8 Arrive Thunder Bay 1610
	9 Thunder Bay	10 Thunder Bay	11 Depart Thunder Bay 1405	12 Lake Superior	13 Coring	14 Arrive Thunder Bay 0900	15 Transit
	16 Arrive Owen Sound 0845	17 Depart Owen Sound 2117	18 Georgian Bay	19 Survey	20 Georgian Bay	21 Survey	22 Georgian Bay
	23 Survey	24 Lake Huron	25 Survey	26 Lake Huron	27 Survey	28 Arrive Sarnia 0715	29 Sarnia
JULY	30 Sarnia	1 Sarnia	2 Depart Sarnia 1615	3 Lake Erie	4 Piston Coring	5 Lake Ontario	6 Piston Coring
	7 Lake Ontario	8 Arrive CCIW 1540	9 Depart CCIW 0917	10 Lake Ontario	11 Coring	12 Lake Ontario	13 Coring
	14 Lake Ontario	15 Coring	16 Arrive CCIW 0830	17 Depart CCIW 1700	18 Transit	19 Arrive Sarnia 1500	20 Sarnia
	21 Sarnia	22 Depart Sarnia 1510	23 Lake Huron	24 Survey	25 Lake Huron	26 Survey	27 Lake Huron
AUG	28 Lake Huron	29 Survey	30 Georgian Bay	31 Survey	1 Georgian Bay	2 Arr. 0405 Owen Dep. 1000 Sound	3 Transit
	4 Transit	5 Arrive CCIW 0200	6 Depart CCIW 1210	7 Lake Ontario	8 Survey	9 Arrive CCIW 0130	10 CCIW
	11 CCIW	12 Depart CCIW 1055	13 Lake Ontario	14 Monitor	15 Lake Ontario	16 Arrive CCIW 1820	17 CCIW
	18 CCIW	19 CCIW	20 Depart CCIW 1730	21 Lake Erie	22 Survey	23 Lake Erie	24 Survey
	25 Lake Erie	26 Arrive CCIW 0235	27 Lake Huron	28 Survey	29 Lake Huron	30 Survey	31 Georgian Bay
SEPT	1 Survey	2 Georgian Bay	3 Survey	4 Georgian Bay	5 Arr. 0905 Owen Dep. 1300 Sound	6 Arrive Sarnia 1500	7 Sarnia
	8 Sarnia	9 Sarnia	10 Sarnia	11 Sarnia	12 Transit	13 Transit	14 Transit
	15 Arrive CCIW 0200	16 CCIW	17 CCIW	18 CCIW	19 CCIW	20 CCIW	21 CCIW
	22 CCIW	23 CCIW	24 CCIW	25 Depart CCIW 0900	26 Transit	27 Arrive Sarnia 0200	28 Sarnia
OCT	29 Sarnia	30 Depart Sarnia 1400	1 Lake Huron	2 Survey	3 Lake Huron	4 Survey	5 Lake Huron
	6 Georgian Bay	7 Survey	8 Georgian Bay	9 Survey	10 Georgian Bay	11 Arr. 0830 Owen Dep. 1400 Sound	12 Transit
	13 Transit	14 Arrive CCIW 0230	15 Dismantle Ship	16 Dismantle Ship	17 Dismantle Ship	18 Depart CCIW 1930	19 Transit
	20 Transit	21	22	23	24	25	26
NOV	27	28	29	30 OFF CHARTER	31	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
DEC	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28

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Great Lakes Studies, MV MARTIN KARLSEN

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
FEB	27	28	29	30	31	1	2
	3	4	5	6	7	8	9
	1	11	12	13	14	15	16
	17	18	19	20	21	22	23
MAR	24	25	26	27	28	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	2	22	23
	24	25	26	27	28	29	30
APR	31	1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16 Depart 1220 CCIW	17 Lake Ontario	18 Surveillance	19 Lake Ontario	20 Arrive 0220 CCIW
	21	22 Depart 0930 CCIW	23 Lake Erie	24 Surveillance	25 Lake Erie	26 Surveillance	27 Arrive 2319 CCIW
MAY	28	29 Depart 1235 CCIW	30 Lake Ontario	1 Surveillance	2 Lake Ontario	3 Arrive 0230 CCIW	4
	5	6	7	8	9	10	11
	12	13 Depart 0930 CCIW	14 Lake Ontario	15 Surveillance	16 Lake Ontario	17 Arrive 0030 CCIW	18
	19	20	21	22	23	24	25
	26	27	28	29	30	31	1
JUNE	2	3 Depart 1010 CCIW	4 Lake Ontario	5 Surveillance	6 Lake Ontario	7 Arrive 1735 CCIW	8
	9	10	11	12	13 NTA Hamil. Harbour	14	15
	16	17 Depart 0908 CCIW	18 Lake Ontario	19 Surveillance	20 Lake Ontario	21 Arrive 1600 CCIW	22
	23	24 Dep. 0840 Arr. 1930 CCIW	25 NTA Western L. Ont.	26	27	28	29
JULY	30	1	2 Depart 0900 CCIW	3 Lake Ontario	4 Surveillance	5 Arrive 1500 CCIW	6
	7	8	9 Depart 0900 CCIW	10 Transit	11 Transit	12 Transit	13 Arrive 0900 Red Rock
	14 Point	15 Source	16 And	17 Heat	18 Studies	19 Lake	20 Superior
	21 Point	22 Source	23 And	24 Heat	25 Studies	26 Lake	27 Superior
AUG	28 Point	29 Source	30 And	31 Heat	1 Studies	2 Lake	3 Superior
	4 Point	5 Source	6 And	7 Heat	8 Studies	9 Lake Superior	10 Depart 0600 Red Rock
	11 Transit	12 Transit	13 Transit	14 Arrive 0100 CCIW	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31
SEPT	1	2	3 Depart 1400 CCIW	4 Lake Ontario	5 Surveillance	6 Arrive 2320 CCIW	7
	8	9	10	11	12	13	14
	15	16 Depart 0900 CCIW	17 Lake	18 Ontario	19 Surveillance	20 Arrive 0600 CCIW	21
	22	23	24	25	26	27	28
OCT	29	30 Depart 0935 CCIW	1 Lake Ontario	2 Surveillance	3 Lake Ontario	4 Surveillance	5 Arrive 0020 CCIW
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24 Depart 1230 CCIW	25 Dry Dock	26 Port Weller
NOV	27 Dry Dock	28 Port Weller	29 Dry Dock	30 Arrive 2050 CCIW	31	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25 Depart 1005 CCIW	26 Lake Ontario	27 Surveillance	28 Arrive 2125 CCIW	29	30
DEC	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16 Depart 0945 CCIW	17 Lake Ontario	18 Surveillance	19 Arrive 1540 CCIW	20	21
	22	23	24	25	26	27	28

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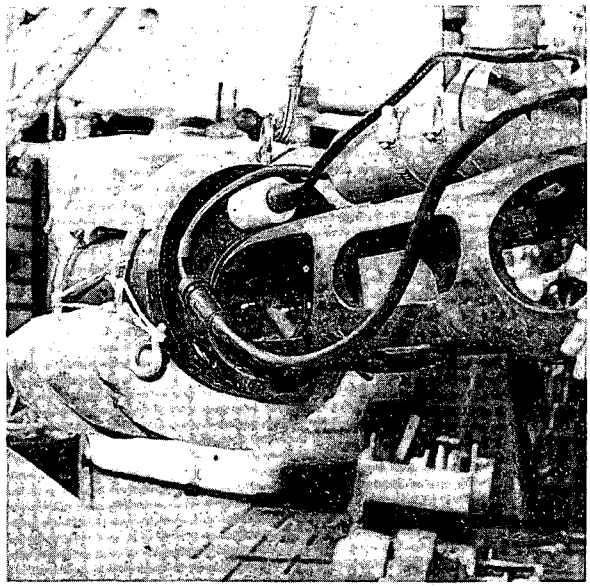
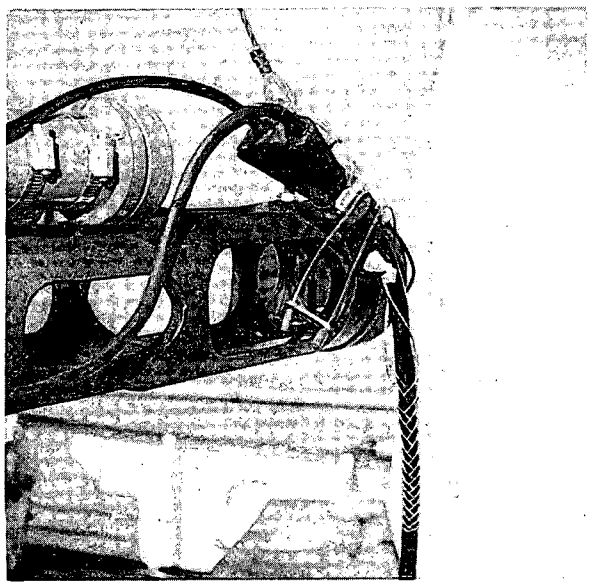
Great Lakes Studies, HMCS PORTE DAUPHINE

SURVEILLANCE



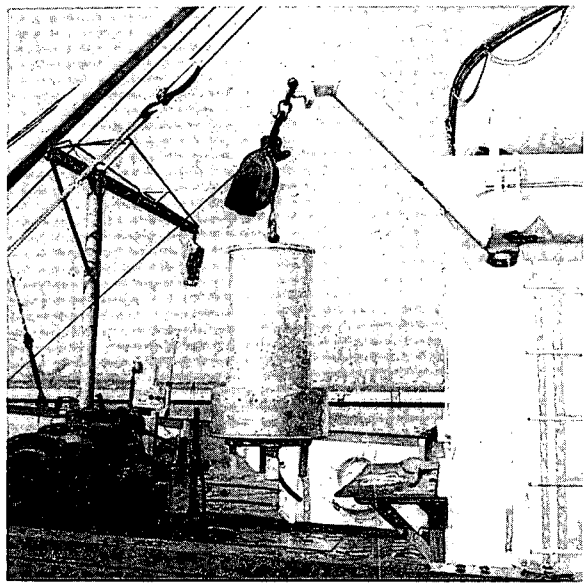


Transmissometer

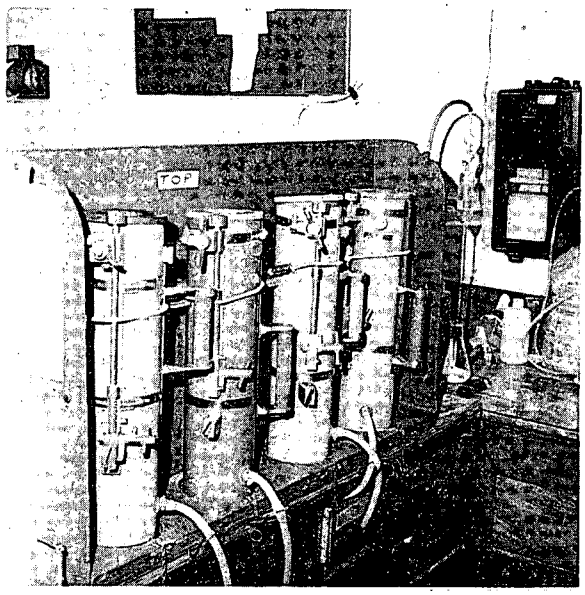
Top: Light Source and Detector System (padded)

Bottom: Reflecting Mirror for Folded Path Length

Pressure Transducer for Depth is Atop Instrument

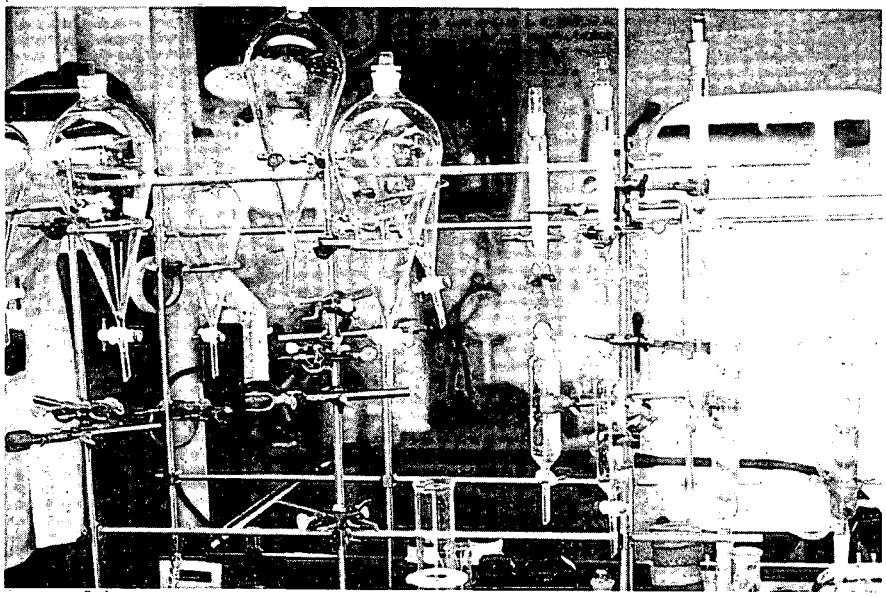


20 - Metre Integrating Sampler

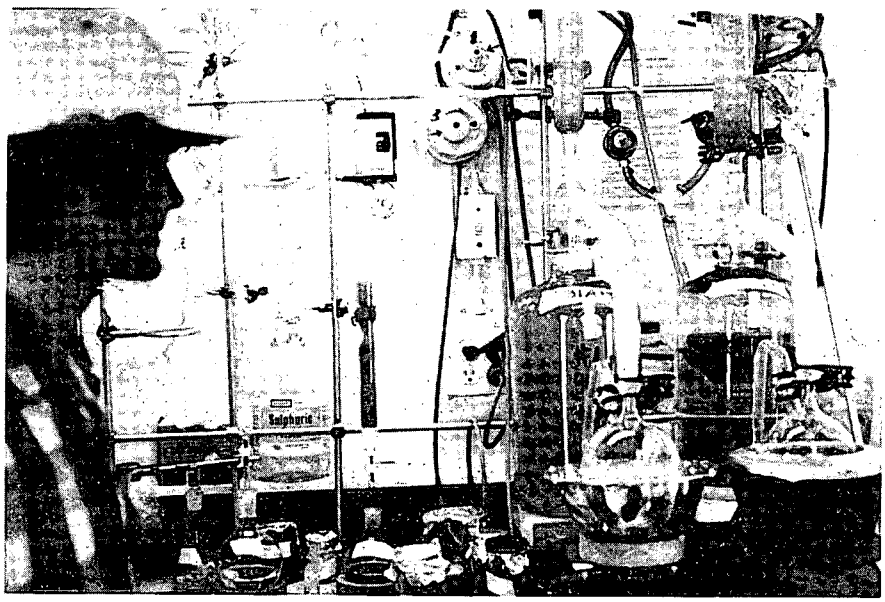


Van Dorn Bottles

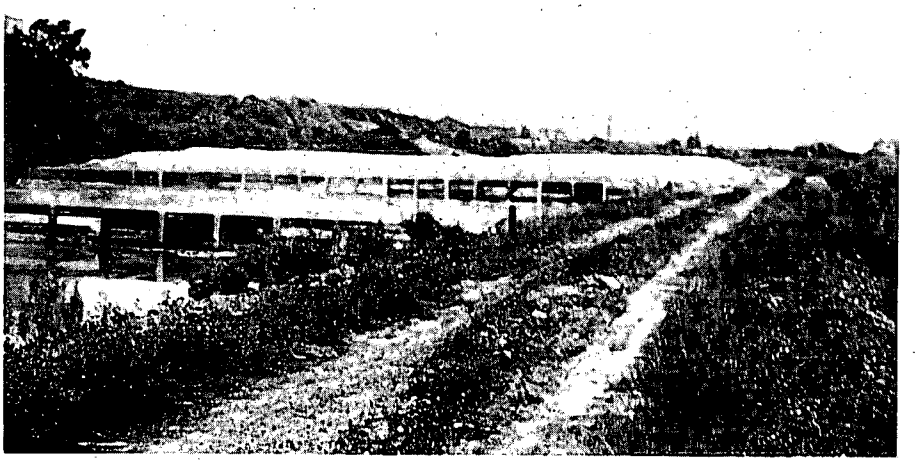
RED ROCK AND NANTICOKE



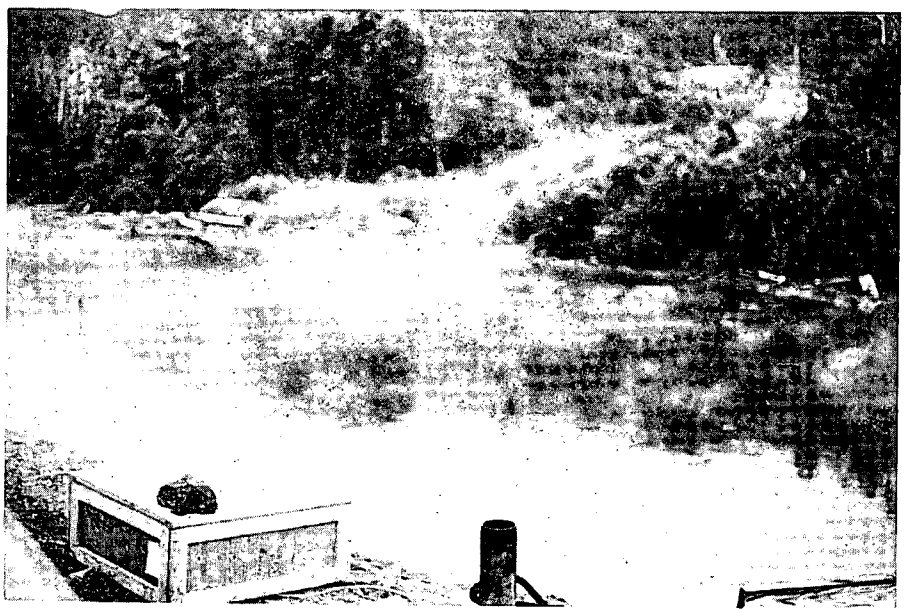
Resin column used for separating
organic compounds from effluent samples
in Red Rock. Porte Dauphine Lab.



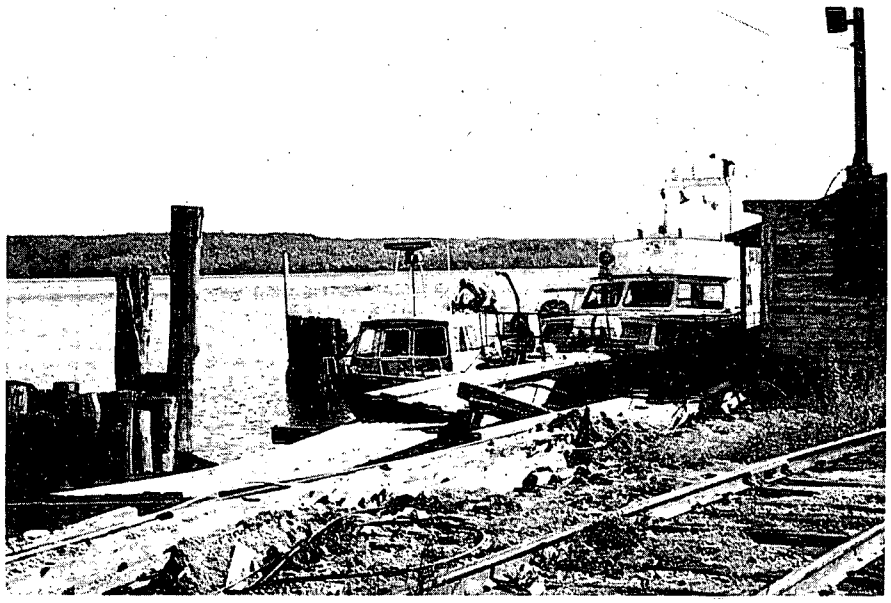
Extractors used to separate
compounds by boiling chloroform.



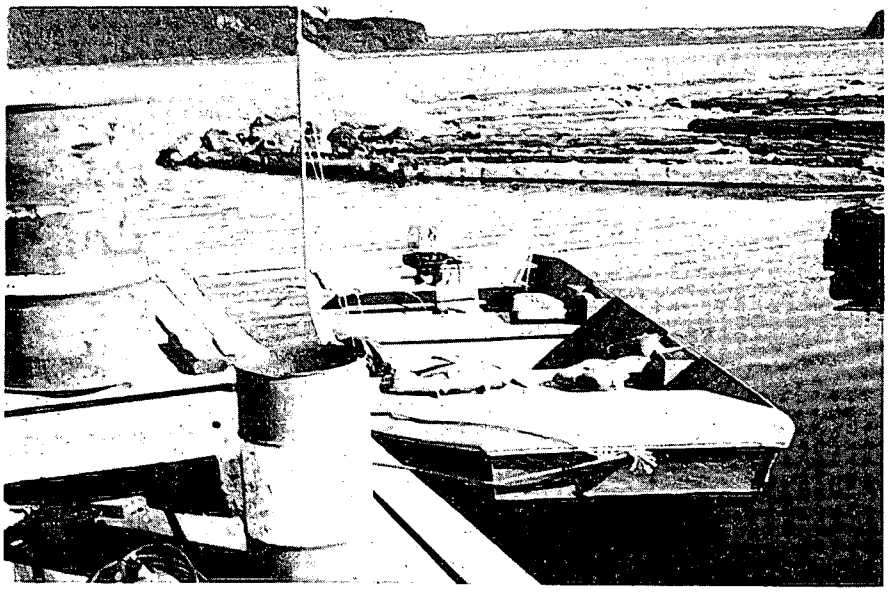
Effluent foam trying to pass
the barriers in the discharge channel, Red Rock.



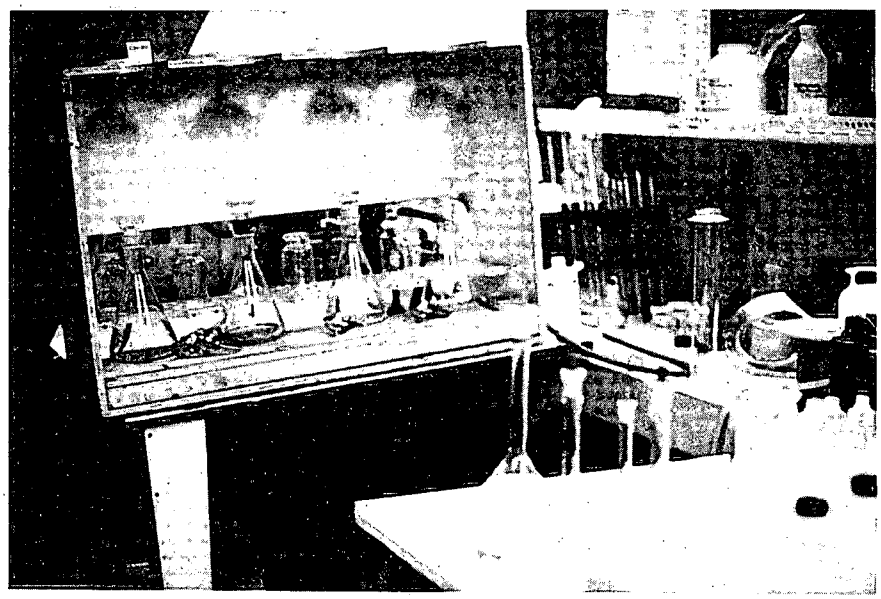
Conductivity meter set-up beneath box
farther down along the Kraft mill discharge, Red Rock.



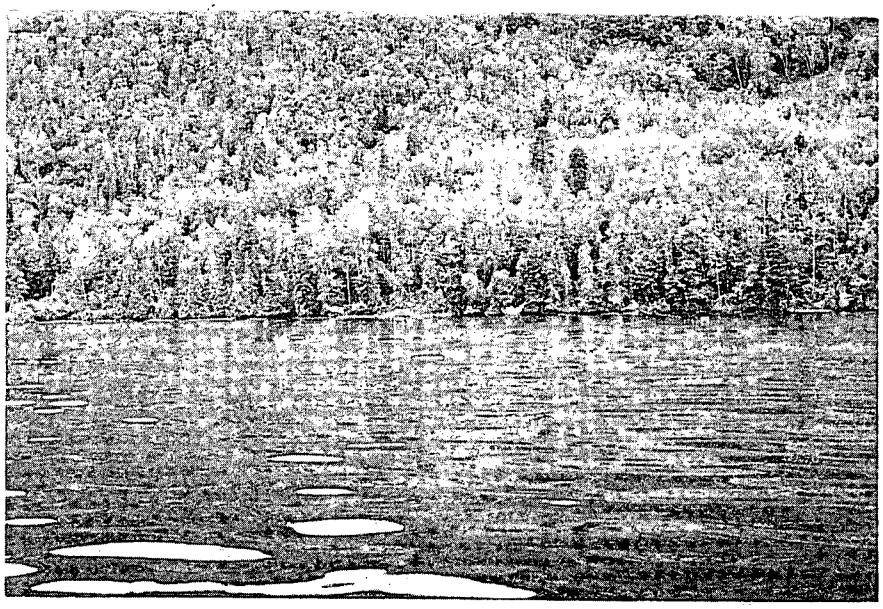
Red Rock Domtar Dock
C.S.L. Aqua and C.S.S. Vedette
Nipigon Bay in background



Smokercraft at Slasher building quay.
Equipped with Radar Reflector & Yellow
flag for quick identification.



W.Q.D. Lab set up for filtration
of P.O.C. in Lower Lab.



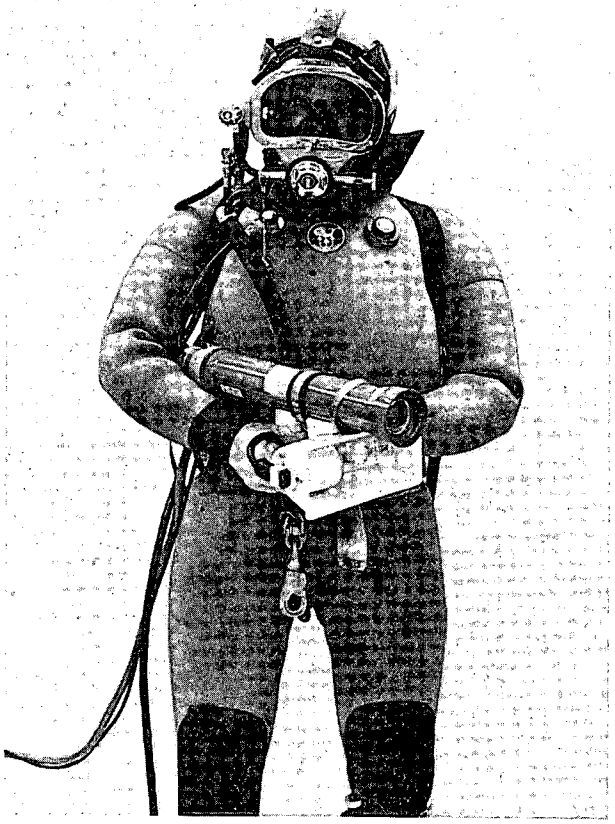
Substrates placed in direct contact
with the effluent to study
colonization on acetate sheets.

LAKE SIMCOE ICE-PILING PROGRAM

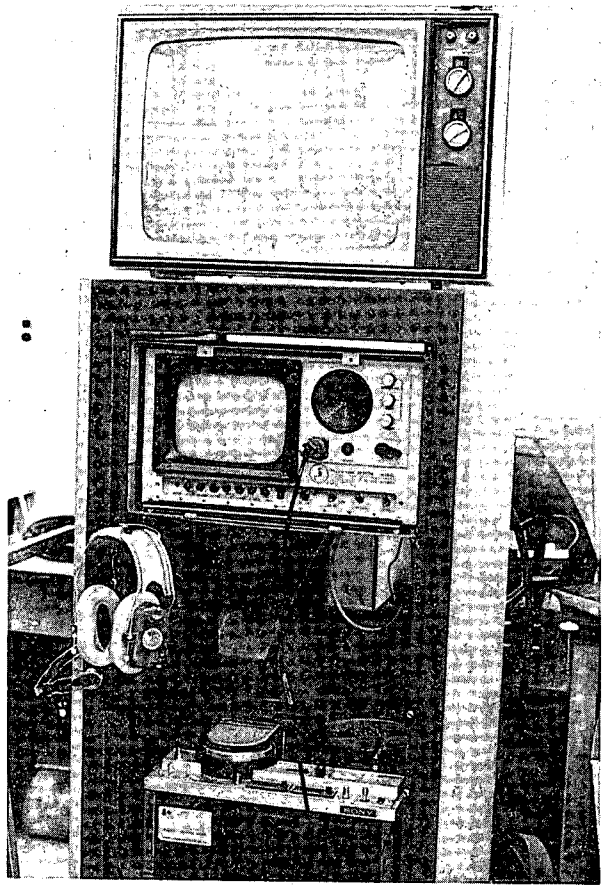
Lake Simcoe Ice Survey

Lake Simcoe Ice Survey - Technical Operations
Personnel Using the Ice-Auger

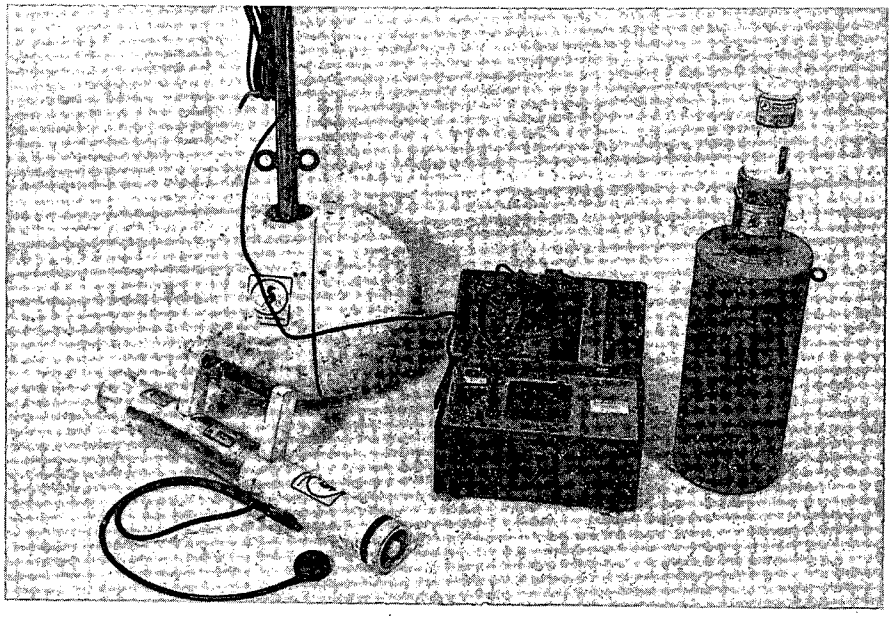
DIVE UNIT



Tech. Ops. Diver wearing a Unisuit, Kirby-Morgan Band Mask and holding the Underwater Television Camera



Underwater Closed Circuit Television System



Underwater Search and Recover Equipment - left to right: Diver-held Pinger Locator, Surface Pinger Locator, Surface Control Unit, and Pinger (top) with Battery (Bottom)