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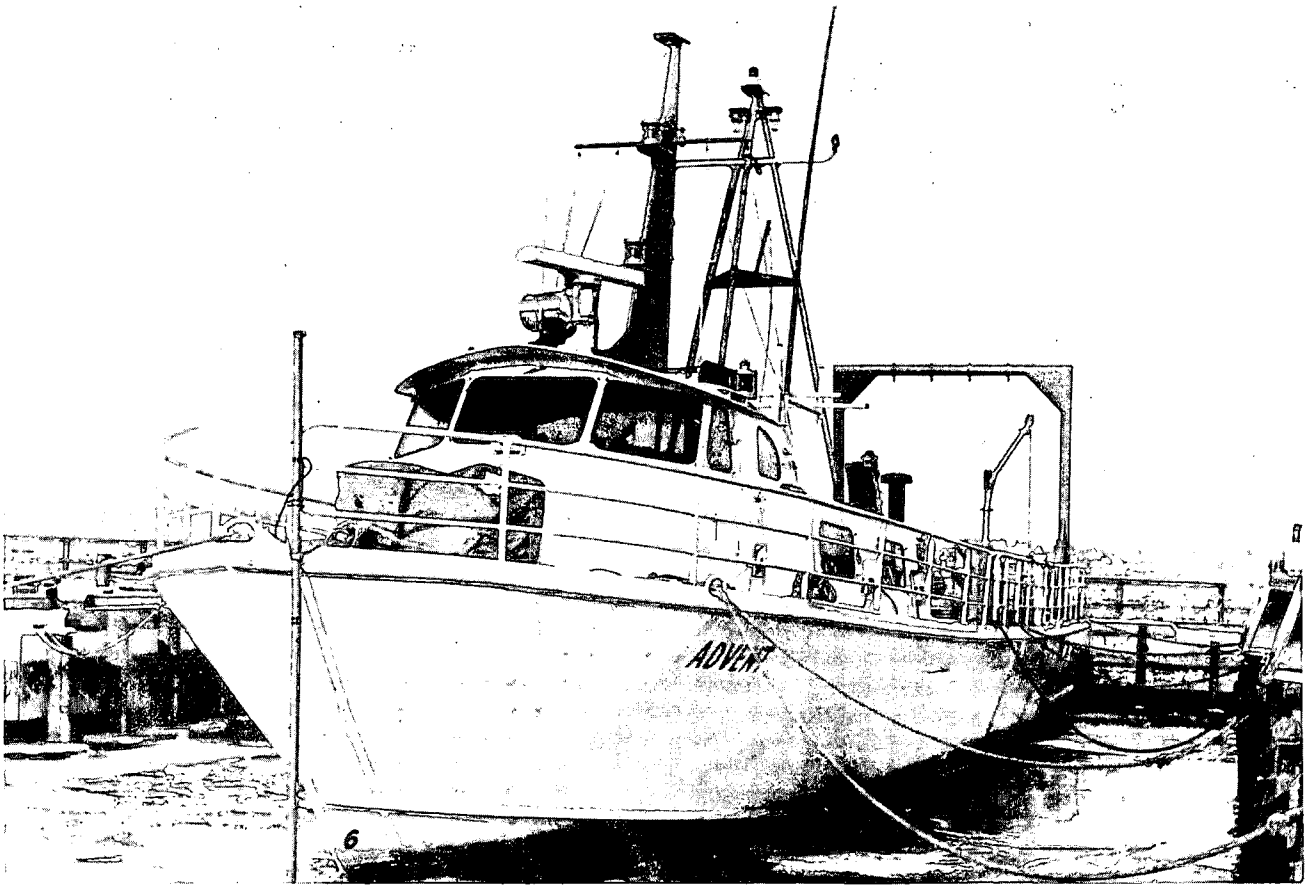
TECHNICAL OPERATIONS SECTION

ANNUAL REPORT

1973


ADVENT
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TECHNICAL OPERATIONS SECTION

ANNUAL REPORT

1973

This report was compiled for
H. Barrie Macdonald
by
Justin Carew and Garry Koteles
under the direction of
Don Williams

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1. TECHNICAL OPERATIONS SECTION 1973: 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 Descriptive Limnology Section.

TECHNICAL OPERATIONS SECTION

Head – H.B. Macdonald
Secretary – Mrs. L.C. Bouverat – on strength February/73
Secretary – Mrs. R. Wolkowski – resigned January/73
Senior Operations Officer – D.J. Cooper
Senior Diving Officer – J.T. Roe
Operations Officer, M.V. MARTIN KARLSEN – D.J. Brooks
Operations Officer, CSS LIMNOS – D.H. Hanington
Standards and Development Officer – D.J. Williams
P.R. Youakim – IFYGL Centre; Special Projects
L.E. Benner – LIMNOS and MARTIN KARLSEN
T.J. Carew – LIMNOS
H.K. Cho – Wave Climatology; Beach Stability Study
J. Compton-Smith – transferred from Hydraulics February/73; LIMNOS; Diving
B.E. Clemmens – LIMNOS and MARTIN KARLSEN
F.J. deVree – Marathon; LIMNOS; PORTE DAUPHINE
F.H. Don – LIMNOS and MARTIN KARLSEN; Diving
H. Greencorn – Rigger
P.M. Healey – Operations Officer – CSS ADVENT
J.R. Irwin – LIMNOS and MARTIN KARLSEN, resigned July/73
G.J. Koteles – LIMNOS and MARTIN KARLSEN
J. Lomas – Foreman Rigger
M.R. Mawhinney – MARTIN KARLSEN

B.H. Moore – Bay of Quinte
H.K. Nicholson – Shore Sensor Program.
G.M. Perigo – Rigger
J.E. Ross – LIMNOS and MARTIN KARLSEN; Diving; transferred to Hydraulics
S.B. Smith – MARTIN KARLSEN
W.B. Taylor – Electronics Technician; Meteorological Buoy Program.
M.R. Thompson – Special Projects
S.P. Withers – Operations Officer, LAC ERIE; MARTIN KARLSEN; LIMNOS
H.W. Zimmermann – LIMNOS and MARTIN KARLSEN – on strength October/73

Term Employees – Technical Operations Section

J. Bouwman – on strength November/73
J. Hill – on strength November/73
W. Jack – transferred to Microbiology Section, November/73
B. Killins – on strength November/73
J. Lloyd – transferred to Water Policy and Planning, February/73
R. McCrea – on strength December/73
D. Moore – on strength November/73
K. Salisbury – on strength November/73
D. Spry – on strength February/73
C. Timmins – on strength November/73
E. Walker – on strength November/73

Summer Students – Technical Operations Section

I. McConnachie
F. Moss
B. Moyles
B. Peeling
K. Roslyn
D. Scorgie
B. Wilson

2. FIELD ACTIVITIES

With the carry over of the IFYGL (International Field Year for the Great Lakes) program in Lake Ontario into 1973, the field season this year also proved to be long and arduous, with field operations commencing on January 3 and terminating on December 10. On completion of this program in March, the emphasis shifted, under the IJC Upper Lakes Reference, to work in the Upper Lakes, particularly Lake Superior. Those fortunate enough to escape assignment to the major vessels and consequent exposure to the 50 knot winds and 14 foot waves of Lake Superior, were assigned to launch and shore-based operations.

3. SUMMARY OF SHIP OPERATIONS

The two major vessels, CSS LIMNOS and M.V. MARTIN KARLSEN, were again used for carrying out the bulk of the Great Lakes Studies in 1973.

The LIMNOS is owned by the Department of the Environment (DOE) and is operated by Central Region, Marine Sciences Directorate (MSD) at CCIW. During 1973, she carried out a large variety of cruises including monitor, mooring, sediment survey and coring cruises and several "special" surveys (nutrient recycling in the water column; distribution of the isotopes of sulphur in the sediments) making a total of 32 for the season. They can be broken down as follows:

9 Heat Content Surveys	Lake Ontario
3 U.S. Biochemical Surveys	Lake Ontario
4 Mooring Cruises	Lake Ontario
1 Engineering/Water Quality Trials	Lake Ontario
4 Monitor Cruises (1 special)	Lake Erie
3 Water Column Studies	Lake Erie
1 Coring Cruise	Georgian Bay
1 Mooring Cruise	Lake Huron
3 Mooring Cruises	Lake Superior
3 Sediment Surveys	Lake Superior, Georgian Bay and North Channel, Lake Huron

The monitor cruises carried out in Lake Erie were the first for LIMNOS since 1968. The regional sediment surveys in Lake Superior, Georgian Bay and the North Channel of Lake Huron, as part of the IJC Upper Lakes Reference, completed the overall survey of the Great Lakes with the exception of Lake Michigan which is entirely within U.S. jurisdiction. The Georgian Bay cruise was conducted to define, more carefully, the sub-bottom strata observed in the echograms, and to dilineate the low level boundaries.

The Heat Content and the U.S. Biochemical Surveys were carried over as part of the IFYGL program in Lake Ontario.

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 was chartered on April 1, 1969. On May 6, last year, the charter was extended for at least another two-year period. She is presently scheduled to complete her charter in November 1974.

The KARLSEN continued to be the work horse of the fleet carrying out the bulk of the CCIW monitoring work in the Great Lakes. To meet the requirement of the increased emphasis on the Upper Lakes, a total of six monitor cruises were successfully completed in Lake Superior. In addition, the following cruises were also completed to make a total of 21 for 1973:

1 Heat Content Survey	Lake Ontario
2 OOPS Cruises	Lake Ontario
1 Buoy Retrieval	Lake Ontario
2 Geology Cruises	Lake Ontario
4 Monitor Cruises	Lake Ontario
2 Geology Cruises	Lake Superior
1 Monitor Cruise	Lake Erie
2 Monitor Cruises	Lake Huron

The combined total miles steamed for both ships in 1973 was an increase of 28% over last year.

Table 1. Operations Statistics Summary*

Ship	Started Operations	Completed Operations	No. of Cruises	Miles Steamed	Days at CCIW (%)	Days on Survey (%)
CSS LIMNOS	Jan. 8	Dec. 10	32	22,386	32	68
M.V. MARTIN KARLSEN	Jan. 3	Dec. 7	21	23,818	40	60

*Complete schedules for the vessels are given in separate tables.

Although not considered a major research vessel, the tug M.V. LAC ERIE chartered from McKiel Work Boats Ltd., played a very important role during her time at CCIW, not only in carrying out many "special" cruises, but also in supporting many of the "shore-based" field programs. Until the expiration of her charter in August of 1973, she was actively involved in the regional sediment surveys and geophysical studies in Lakes Ontario and Erie. She also completed numerous other tasks including launching and recovering moorings, servicing of the meteorological buoy network, NTA monitoring, and engineering field trials. The cruise types and locations are listed below:

5 NTA Cruises	Lake Ontario and Hamilton Harbour
2 Hydrosonde Trials	Lake Ontario
6 Geophysical (Sed.) Surveys	Lake Ontario
1 Met. Buoy Servicing	Lake Ontario
1 Geophysical Survey	Lake Erie

The CSS ADVENT, the new addition to the CCIW "fleet" is also owned by DOE and operated by Central Region, MSD. After experiencing a few teething problems during trials, and renovations to make her more suitable for limnological work in the lakes, she actively participated in a variety of programs on Lakes Ontario, Erie, St. Clair and Superior including:

1 Bathymetry/Trials Cruise	Lake Ontario
2 Virology Cruises	Lake Ontario

1 Mycology Cruise	Lake Ontario
1 Dredge Impact Study	Lakes Erie and St. Clair
1 Point Source Study	Lake Superior

The CCGS PORTE DAUPHINE, in addition to carrying out work for the Institute of Environmental Sciences and Engineering (IESE), University of Toronto, was under contract when our major ships were unavailable. During the greater part of 1973, she was based at CCIW and funded by MSD. This arrangement with MOT permitted the vessel to complete 14 programs. The cruises, (with the exception of the Hydrographic work in the St. Lawrence), staffed by personnel from IESE (until Mar. 31) and CCIW, were co-ordinated by Technical Operations and augmented the regular cruise schedule.

8 Heat Content Surveys	Lake Ontario
3 Hamilton/Scourge Searches	Lake Ontario
1 Coring Cruise	Lake Ontario
1 NTA	Lake Ontario and Hamilton Harbour
1 Remote Sensing	Lake Ontario
Hydrographic Work	Lower St. Lawrence River

The CSL SHARK, in addition to supporting several programs during 1973, provided support for all diving operations in Lakes Ontario, Erie and St. Clair.

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

4. SUMMARY OF CRUISE DESCRIPTIONS

Personnel from the Section were assigned to both 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 types, methods and techniques to meet the requirements of all these disciplines.

Cruise types for the 1973 season are listed below:

(A) Monitor Cruises
(B) Mooring Cruises
(C) OOPS Cruises
(D) Heat Content Surveys
(E) U.S. Biochemical Surveys
(F) Geological Cruises
(G) Water Column Studies
(H) Virology/Mycology Cruises
(I) Launch and Shore-based Operations

- (i) Meteorological Measurement Program
- (ii) NTA Surveys
- (iii) Lake Ontario Shore Sensor Program

(iv) Beach Stability Program
(v) Point Source Study
(vi) Dredge Impact Study
(vii) Bay of Quinte Program

(J) Miscellaneous Programs
(i) Wave Climatology
(ii) Controlled Oil Spill/Remote Sensing
(iii) Water Quality Studies
(iv) Port Feasibility Studies
(v) Hamilton/Scourge Search
(vi) Bathymetry
(vii) Engineering/Water Quality Trials

(A) Monitor Cruises

Monitor cruises can be looked upon as general limnological Surveys of the Great Lakes. Combined with mooring cruises, they represent one of the major roles of the Technical Operations Section and the CCIW in Great Lakes Water Quality Surveillance.

A total of seventeen monitor cruises were run during 1973 – four in Lake Ontario; five in Lake Erie (including one "special" monitor to determine the distribution of the isotopes of sulphur in the sediments); two in Lake Huron and six in Lake Superior. Station plots and latitude and longitude references are given in Appendix B.

The statistical evaluation program initiated in 1972 was continued in 1973. This program was aimed at comparing and evaluating analytical techniques and sampling methods (eg., pumped versus bottle samples) to determine the "representativeness" of analyzed samples.

Technical Operations staff also assumed the responsibility for preparing preliminary descriptive limnology reports on the lakes from the monitor cruise data. 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 Descriptive Limnology Section.

A new approach to the statistics form (filed at the end of each cruise) was also developed this year. The new form better represents the actual number of samples collected and analyses performed. Some reflection of this is indicated in the statistical data at the end of this report.

(B) Mooring Cruises

Extensive mooring operations were carried out in Lakes Superior, Huron and Ontario during 1973. The three mooring cruises into Lake Superior saw the establishment, refurbishment and successful recovery of eleven current meter and two meteorological moorings. Incorporated into these cruises were mooring cruises in Lake Huron, during which seven moorings were established, refurbished and recovered off Douglas Point. Current meters were also placed in Lake Ontario and the DECCA buoys used for navigational purposes during IFYGL were removed. During the final cruise of the year, seventeen winter current meter moorings and two inverted moorings were established in Lake Ontario.

All mooring systems were successfully recovered. Some Plessey Meters were lost, however, due to the mechanical failure of the swivel system on certain meters. Mooring locations for each lake are given in Appendix B.

(C) Ontario Organic Particle Study (OOPS) Cruises

The two OOPS cruises run during 1973 were a carry-over from the IFYGL program on Lake Ontario. These multidisciplinary cruises were aimed at determining the average settling velocities of particulate organic materials and suspended mineral materials at different depths below 15 metres. Coincident studies were aimed at determining primary production as well as nutrient distribution in the lake. The cruises were divided into two phases, each phase lasting one week. The first phase included "in depth" sampling of 32 stations along three transects, with a 24-hour stop at a mid-lake station for an intensive study of particle settling rates and biological productivity. The second phase called for occupying each of two stations for a 48-hour period for intensive study of daily variations in plankton distribution and migration. Station plots and latitude and longitude references are given in Appendix B.

(D) Heat Content and Eutrophication Cruises

These cruises were a part of the energy balance program for Lake Ontario. Eighteen were run during 1973.

Heat storage and its changes must be known to describe energy fluxes. The temperature field in the lake at a given time is an indication of many other lake processes such as water movements and vertical mixing. These surveys were aimed at determining the quantity of heat stored in the lake as a function of time, and at describing the seasonal change in temperature distribution in the lake by means of repeated temperature/depth profiles. The cruises also included a study of the surface particle and chlorophyll distribution as a function of time and space. Both purposes required that the surveys be completed as quickly as possible (within 48 hours).

Station plots and latitude and longitude references are given in Appendix B.

(E) U.S. Biochemical Surveys

Three such surveys were run by LIMNOS this year, during which U.S. Scientific teams from S.U.N.Y. and the University of Michigan collected physical, chemical and biological data from Lake Ontario.

(F) Geological Cruises

The geological cruises can be divided into two broad categories – coring and sediment sampling. As mentioned earlier in this report, 1973 saw the completion of the general sediment surveys of the Great Lakes. Samples were obtained using piston coring, gravity coring and grab sampling equipment.

The surveys dealing with the geochemistry of Lake Superior and Georgian Bay involved taking several Shipek samples and testing E_h, pH and temperature. Before subsampling for further shore analysis, the undisturbed layers were described and colour-coded.

Ponar samples for the examination of benthic fauna were taken whenever possible. These were screened and preserved in formalin. Samples were also freeze-dried and packaged for later analyses.

Appendix B refers to the areas covered.

(G) Water Column Studies

The three water column studies carried out in Lake Erie this year were much similar to the Hypo project carried out during 1970. The cruises were designed to determine the quantity, and the rate at which particulate carbon and phosphorus settled through the thermocline. Measurements included

transmissometry (to discern the amount of suspended matter in the water column especially during the triggering of the modified Van Dorn/Sedimentation bottles), temperature/depth profiles, dissolved oxygen, pH, conductivity and chlorophyll a.

Divers were used to observe the action of the sedimentation bottles. On several occasions, an actual blanket of suspended matter was observed above the thermocline. As a cross-check, a Coulter counter was used to determine the particle size distribution at various points in the water column.

(H) Virology/Mycology Cruises

The purpose of the mycology cruises was to determine the seasonal variation of fungi present in both oligotrophic and eutrophic waters. Samples from several depths were collected, stored and sent to the Microbiology laboratory for fungal and chemical analysis. Measurements of temperature, dissolved oxygen and pH were also made.

The virology cruises were aimed at comparing the viral content and culture suitability of several inflows in the Western Lake Ontario region. Samples were collected, stored and sent to the Microbiology laboratory for analysis by fecal streptococcus and virus enumeration techniques. Appendix B gives the locations from which samples were taken.

Table 2. 1973 Meteorological Systems

Station	Location	Scientist-in-Charge	Operating Period
3-3M-01	Superior Shoal	F.C. Elder	May 20 – Oct. 2
3-3M-02	Superior Shoal	F.C. Elder	May 20 – Oct. 2
3-2M-01	Macpherson Point	F.M. Boyce	June 12 – Nov. 18
3-2M-02	Macpherson Point	F.M. Boyce	June 12 – Nov. 18
3-0M-02	Bronte	C.R. Murthy	June 28 – Nov. 7
3-0M-03	Western Lake Ontario	F.C. Elder	Jan. 3 – Dec. 4
3-0M-04	Burlington	M. Donelan	Sept. 19 – Dec. 10
3-0M-07	Mid Lake Ontario	F.C. Elder	Apr. 18 – Aug. 9
3-0M-10	Bay of Quinte	R. Weiler	Aug. 14 – Sept. 25
3-LM-01	Wolfe Island	R. Ramsier	Feb. 14 – Mar. 7
3-LM-02	Main Duck Island	R. Ramsier	Dec. 11 –

(I) Launch and Shore-Based Programs

(i) Meteorological Measurement Program

A network of meteorological systems was operated in Lakes Superior, Huron and Ontario (see Figure 1 and Table 2) with measurements being taken for selected periods during the season. The systems provided atmospheric measurements of wind speed and direction, air temperature, relative humidity and surface water temperature. On the Lake Superior and Lake Ontario systems, atmospheric pressure and solar radiation were also measured.

These measurements will be used in the computation of wind stress, and evaporation and heat transfer rates over the lakes. The resultant values will then be used in lake energy budget calculation and as inputs to models of lake processes.

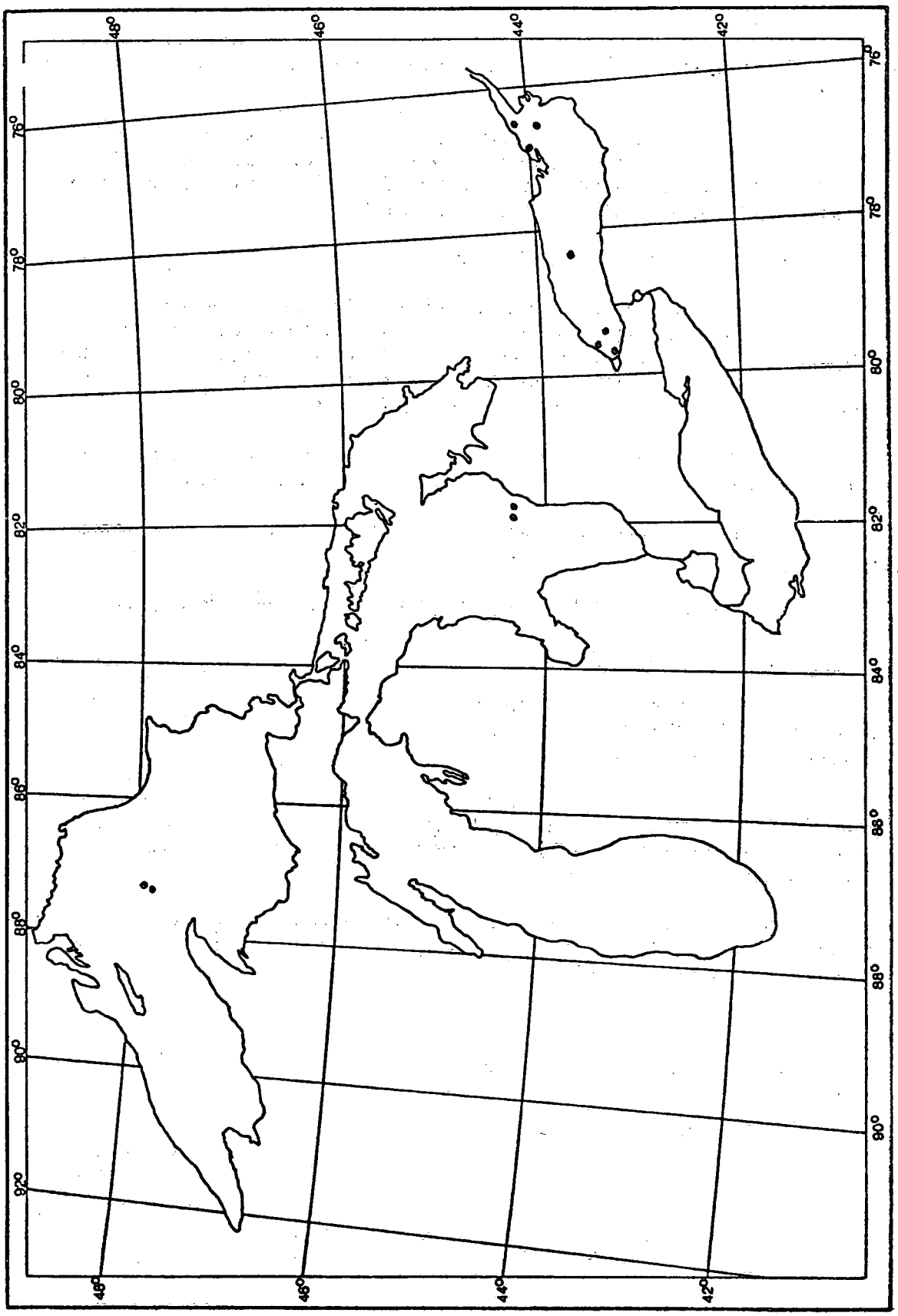


Figure 1. Location of Meteorological Systems.

(ii) NTA Surveys

The NTA program was national in scope and was a a continuation of work started during the 1972 field season.

The CCIW's contribution was to monitor the trends in the concentration of NTA in Hamilton harbour and the western end of Lake Ontario. A total of six such cruises were completed during 1973, on which Technical Operations staff collected and treated samples for analysis from seven stations in the harbour and seven stations in the lake (Appendix B).

(iii) Lake Ontario Shore Sensor Program

During the spring of 1972, seven shore stations for the continuous measurement of near surface and bottom lake water temperatures were established at various locations along the Canadian Shore of Lake Ontario. Complete instrumentation systems for these stations were re-installed for the 1973 field season (see Figure 2). At six of these locations a detachment from AES, in conjunction with LRD, erected weather stations for the collection of meteorological parameters.

Problems from dredging operations and major shoreline erosion in the site areas, as well as radio frequency interference from lightning, curtailed the recovery of data during the year.

Three stations – Burlington, Oshawa and Point Petre – have been fitted with new data collectors and will remain in operation during the winter months.

Technical Operations continued its responsibility for running the entire program.

(iv) Beach Stability Program

This program was also a continuation of work commenced during the 1972 field season. The program has as its aim the correlation between the seasonal changes in the three-dimensional beach profile and the net alongshore wave energy.

In order to determine the effects of waves and fluctuating water levels on the beach profile (see Figure 3), a series of six transverse beach profiles were established at Van Wagner's beach during the 1973 field season. Plotting of the profile changes and computations of the volume changes of sediment were done by computer.

One staff member from Technical Operations was seconded to the Geolimnology Section for the duration of this program to co-ordinate and carry out the field work as well as assist in the analysis and interpretation of the data.

(v) Point Source Study

The main objectives of this program carried out during July and August can be summarized as follows:

1. To determine whether the zone of impact of point-source effluents of toxic substances has any effects on a short- or long-term basis on the community. (This was also intended as a feasibility study to determine the design of future work).
2. To determine the zone of influence (mixing zone) of industrial discharge into the lake. To establish the rates of nutrient utilization and assimilation capacity of receiving waters.

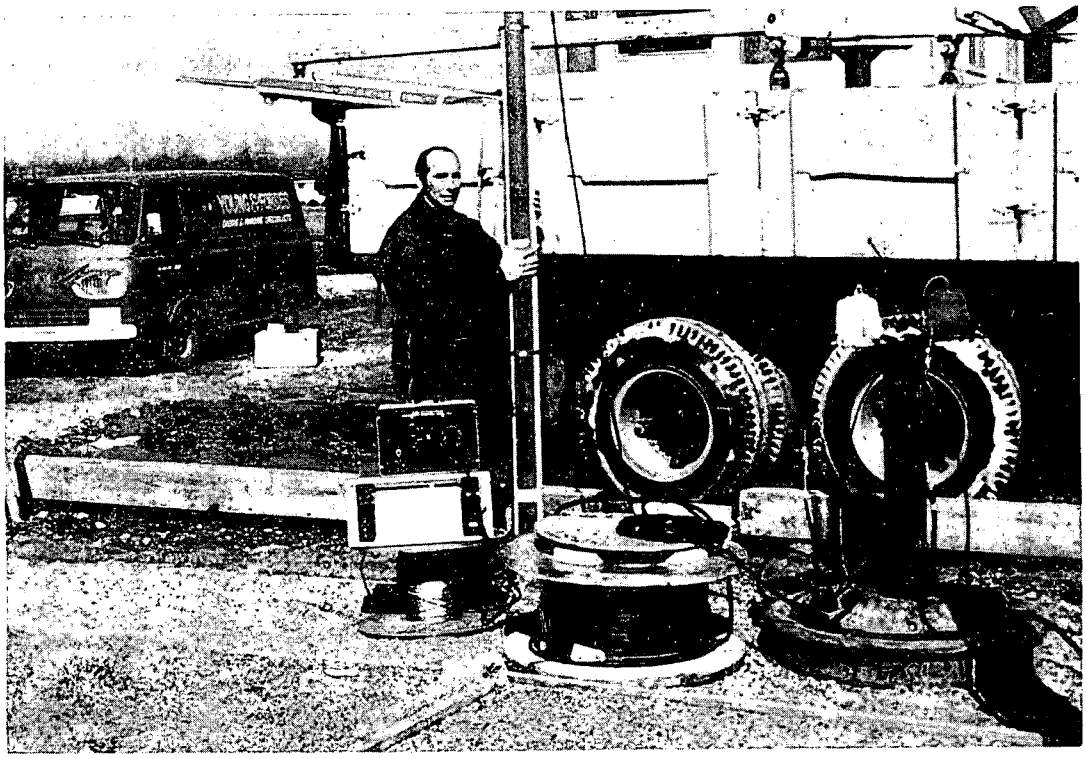


Figure 2. Shore Sensor Instrumentation.

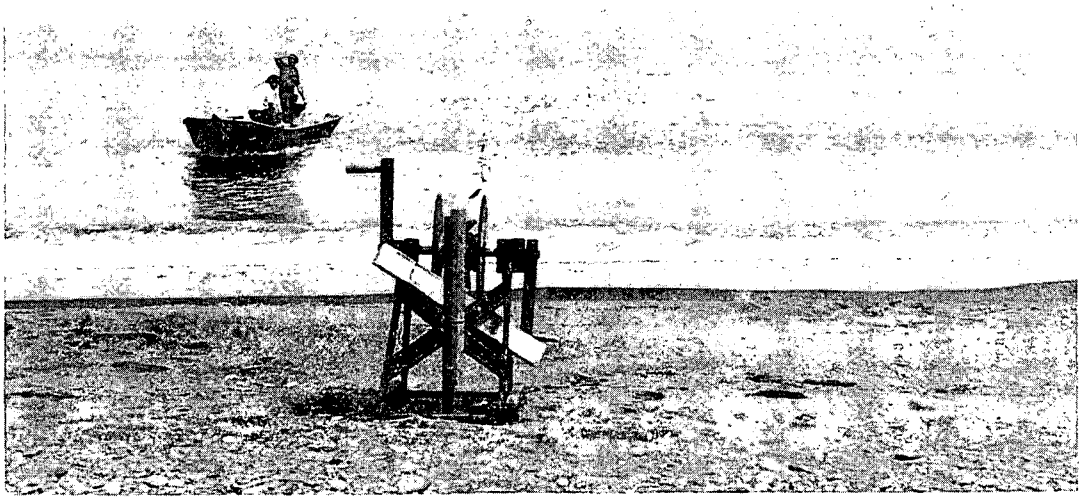


Figure 3. Beach Stability Program.

3. To dilineate the alterations of sediment geochemistry with reaction to the alteration of water chemistry as a function of space and time.

   This multidisciplinary project at Marathon, Ontario, (Lake Superior) was co-ordinated by two staff members from Technical Operations.

(vi) Dredge Impact Study

This program was contracted to Chemex Envirocon Ltd. and carried out at three separate sites:

1) Bronte Harbour, Lake Ontario
2) Port Stanley Harbour, Lake Erie
3) St. Clair Cut-offs, Lake St. Clair.

The objectives of this program were to interpret the effects of dredging, discharge, and dumping of bottom sediments at the mentioned sites on the Lower Great Lakes. This program was done on a Before–During–After basis with particular emphasis on the physical, geochemical, sedimentological, and mechanical properties at these locations.

Technical Operations personnel co-ordinated the data collection.

(vii) Bay of Quinte Program

During 1973, the Geochemical Limnology Sub-division of LRD conducted a study of nutrient dynamics in isolated columns of lake water as part of a program to investigate phosphorus, carbon and nitrogen dynamics in lake waters. To accomplish this, three triangular limnocorrals were installed in the Bay of Quinte. Each corral had 20-foot polyethylene sheet sides which extended from just above the surface down to the sediments in 14 feet of water. An adjacently-moored barge contained a hut for housing the scientific instrumentation.

One corral received P at a rate equal to that presently going into the Bay; the second received no extra P; and the third received both P and N at a rate equal to the natural additions to the Bay (see Figures 4, 5, and 6).

Technical Operations co-ordinated and supported the project. One staff member was seconded full time for this purpose. The site location including barge, limnocorrals, trailers, etc. was installed and removed by Technical Operations.

(J) Miscellaneous Programs

(i) Wave Climatology

This program was also a carry-over from IFYGL. The main purpose was the comparison of data obtained using visual wave estimates with those obtained from wave gauge records and estimates made by the SMB (Sverdrup, Munk, Bretschneider) wave hindcasting techniques based on lake surface wind records.

Technical Operations staff aboard the Canadian research vessels were responsible for taking the meteorological observations and one staff member has assumed the responsibility for analysis and interpretation of the data.

(ii) Controlled Oil Spill/Remote Sensing

Staff members co-ordinated a controlled oil spill operation at CCIW during which personnel from the Canada Centre for Remote Sensing attempted to detect the oil using an experimental laser fluorometer from altitudes up to 300 metres in a DC-3 aircraft (see Figure 7).

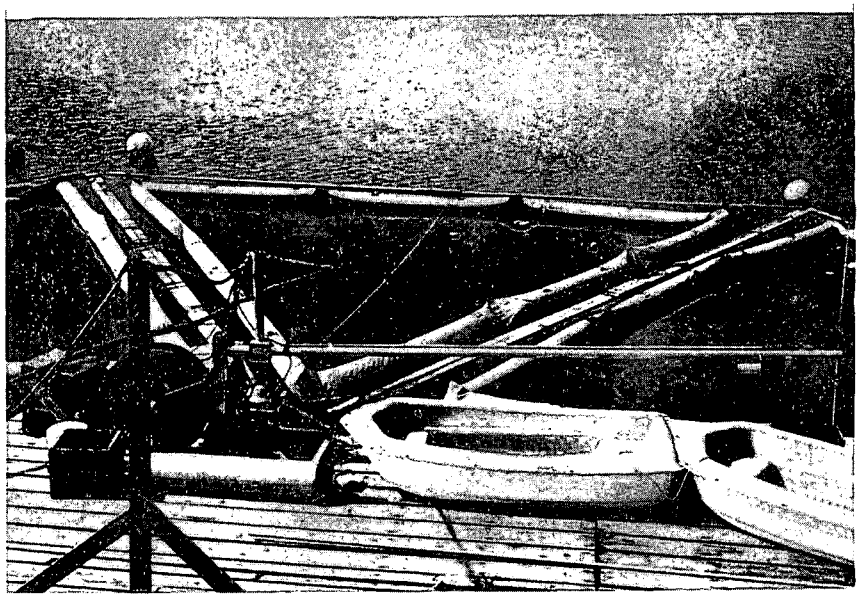


Figure 4.
Limnocorrals,
Bay of Quinte.

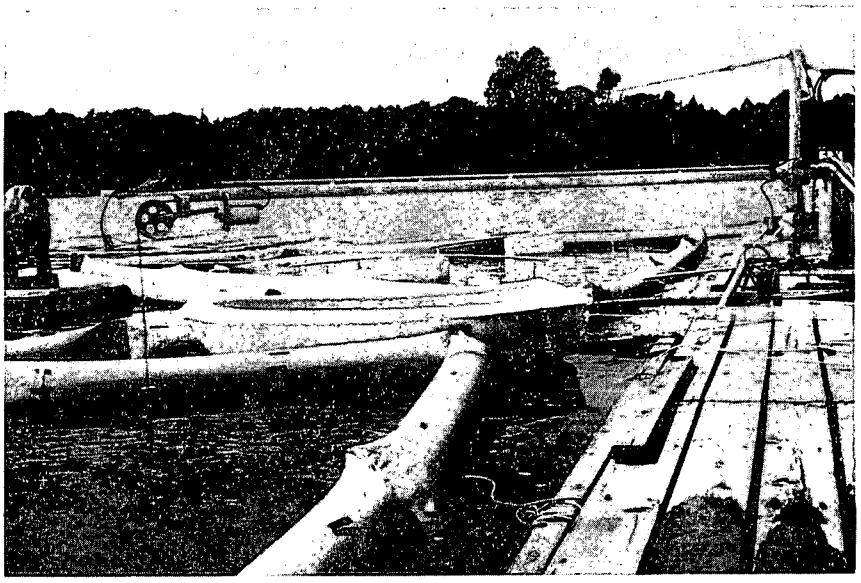


Figure 5.
Limnocorrals,
Bay of Quinte.

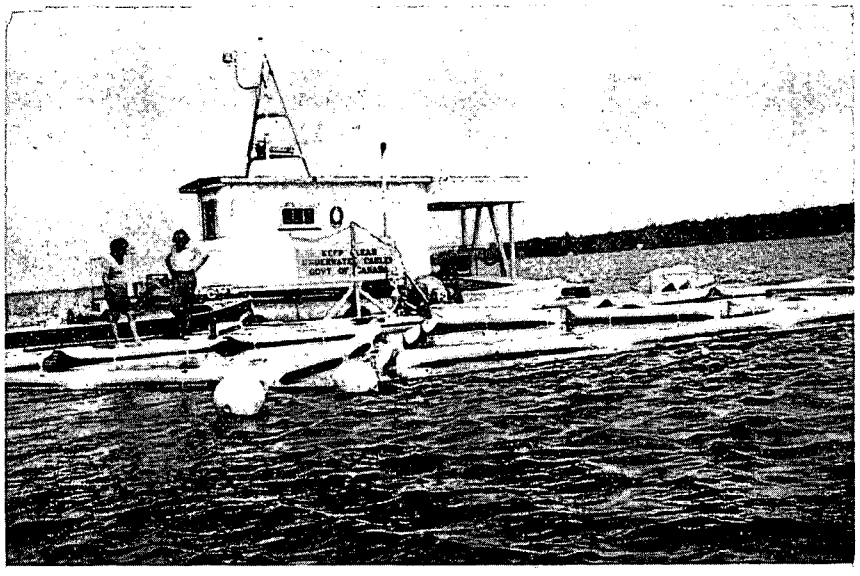


Figure 6.
Limnocorrals,
Bay of Quinte.

Figure 7. Controlled Oil Spill Clean-up Operations. (Photo courtesy of Dr. Sey Ross)

(iii) Water Quality Studies

Support from Technical Operations was given to the water quality studies of the International Sections of the St. Lawrence and St. Mary's Rivers. The purpose of these studies was to observe changes in the water quality and degree of transboundary movements of pollutants in Great Lakes connecting waters in conjunction with the International Joint Commission reference.

(iv) Port Feasibility Studies

This program, supported by Technical Operations Staff, was part of a joint project with MSD and H.G. Acres (consultants) to determine the feasibility of establishing a deep water port for the Ashland Oil Company of Kentucky in the Grande-Ile-Kamouraska, Quebec area.

(v) Hamilton/Scourge Search

A rather interesting side-light to the year was the search for two ships (Hamilton and Scourge) sunk in Lake Ontario during the war of 1812. This program was run by the Royal Ontario Museum and supported by Technical Operations.

(vi) Bathymetry

This program run by MSD and supported by Technical Operations was aimed at improving the quality of the navigational charts in the area around Rochester Harbour.

(vii) Engineering/Water Quality Trials

This single cruise had as its purpose the testing of a commercially available in situ water quality sensor system and the comparison of the data obtained with methods presently employed as standard procedures aboard the ships.

5. DIVING UNIT

During 1973, the diving unit actively supported eighteen (18) scientific programs in the Great Lakes and St. Lawrence River, with tasks ranging from cable laying and inspection to selective hand coring for chemical analysis. In 207 diving days, the unit logged 924 diving hours. Extensive use was made of the new diving system consisting of surface supplied air, unisuits, Kirby-Morgan masks and the underwater T.V. system with video tape and communications (see Figures 8 and 9).

The diving tender CSL SHARK supported all diving in Lakes Ontario, Erie and St. Clair.

6. RIGGERS/STORES

The rigging unit continued to equip and support all field parties with which staff from the section were associated. Instrument towers, trailers and modifications to various types of buoys were among the high priority committments along with the normal maintenance of winches and generators (see Figure 10).

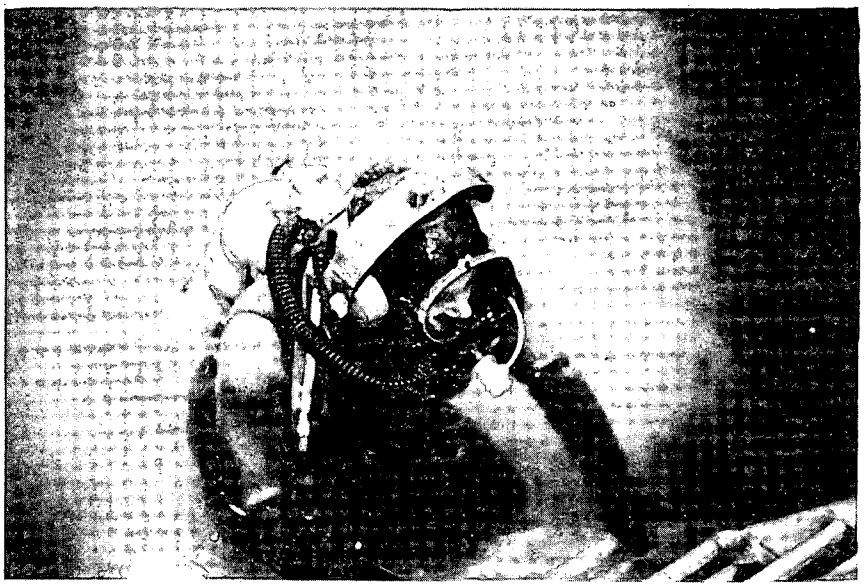


Figure 8. Diver wearing new Sub-Com U/W Communications Equipment.

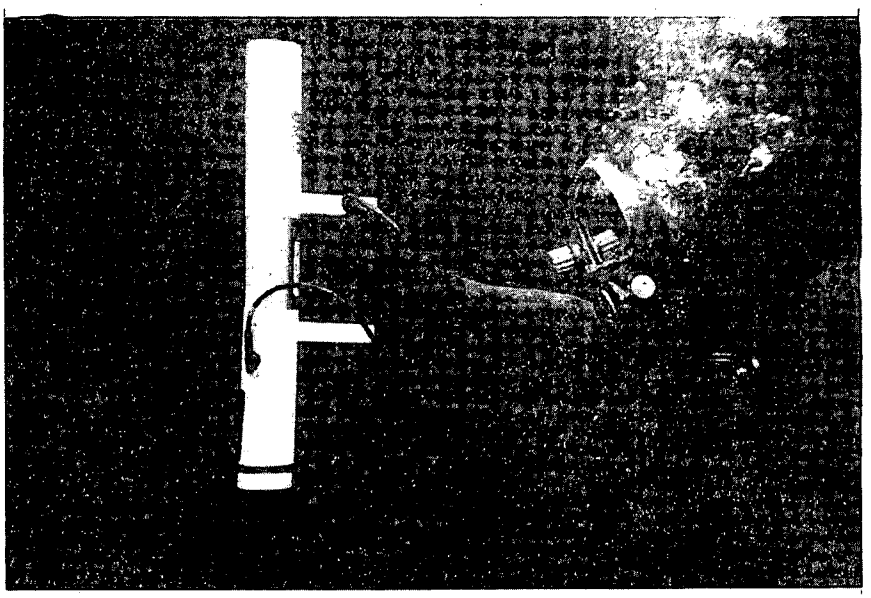


Figure 9. Underwater Communications Equipment.

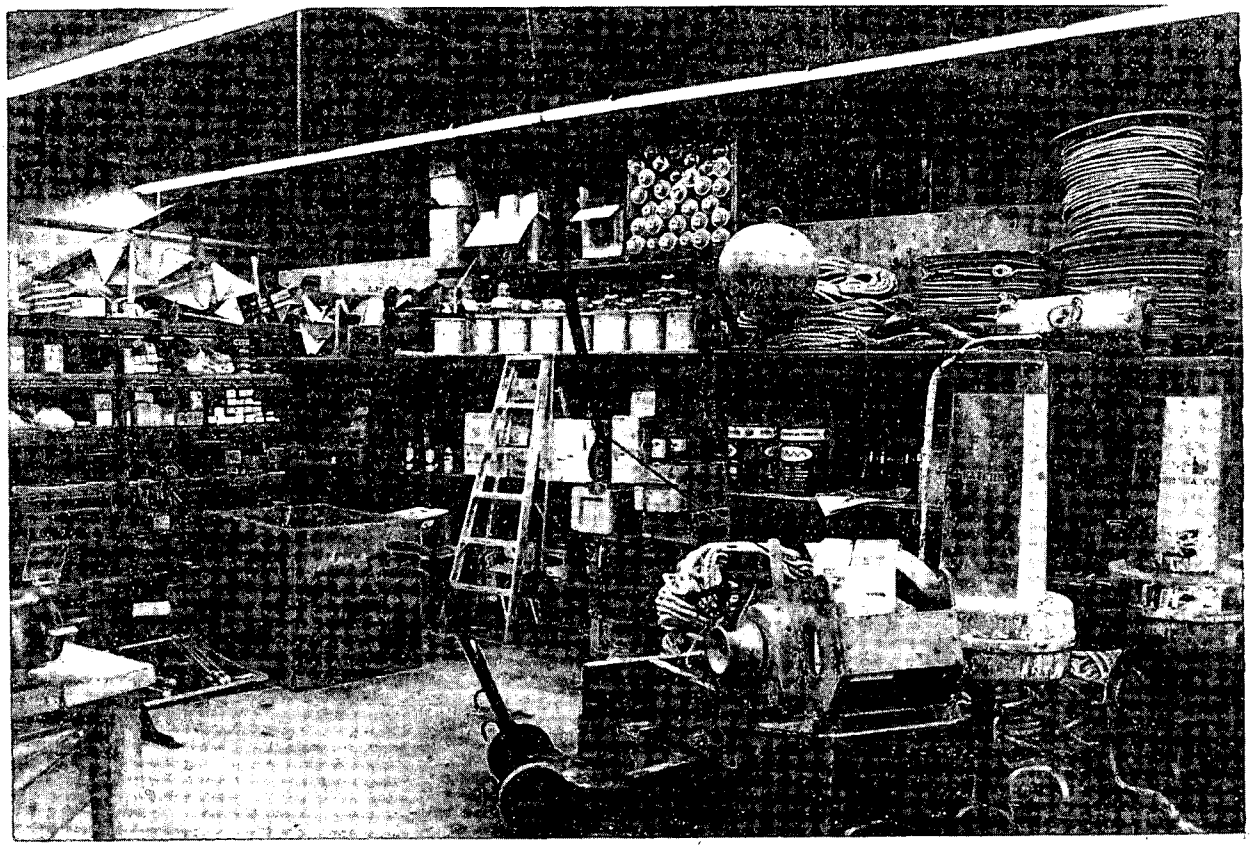


Figure 10. Stores and Workshop.

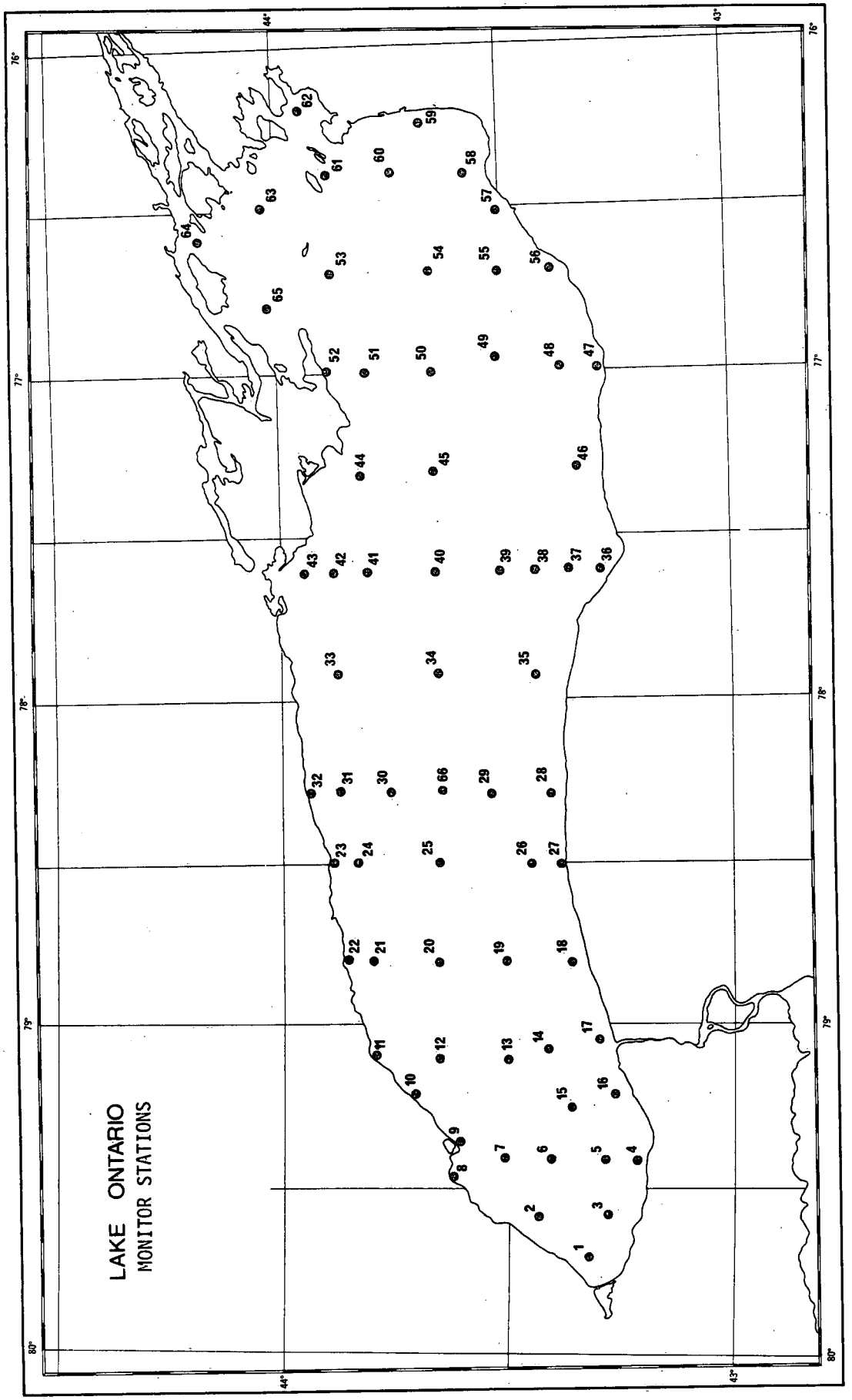
APPENDIX A

STATION POSITIONS AND PLOTS

LAKE ONTARIO
1973
MONITOR STATIONS

Station Number	Latitude N.	Longitude W.
1	43° 19′ 48″	79° 42′ 24″
2	43° 26′ 24″	79° 34′ 30″
3	43° 16′ 48″	79° 34′ 30″
4	43° 13′ 42″	79° 24′ 00″
5	43° 17′ 36″	79° 24′ 30″
6	43° 24′ 42″	79° 24′ 30″
7	43° 30′ 42″	79° 24′ 30″
8	43° 27′ 24″	79° 27′ 48″
T.P.	43° 35′ 42″	79° 23′ 00″
9	43° 36′ 12″	79° 21′ 24″
T.P.	43° 36′ 24″	79° 20′ 00″
10	43° 42′ 24″	79° 13′ 06″
T.P.	43° 45′ 00″	79° 07′ 48″
11	43° 47′ 42″	79° 05′ 18″
12	43° 39′ 24″	79° 06′ 00″
13	43° 30′ 30″	79° 06′ 00″
14	43° 25′ 12″	79° 04′ 42″
15	43° 21′ 54″	79° 15′ 24″
16	43° 16′ 18″	79° 13′ 00″
T.P.	43° 20′ 12″	79° 03′ 12″
17	43° 18′ 30″	79° 02′ 24″
18	43° 22′ 00″	78° 48′ 00″
19	43° 30′ 24″	78° 48′ 00″
20	43° 39′ 30″	78° 48′ 00″
21	43° 48′ 00″	78° 48′ 00″
22	43° 51′ 30″	78° 48′ 00″
T.P.	43° 51′ 00″	78° 42′ 00″
23	43° 52′ 42″	78° 30′ 00″
24	43° 49′ 42″	78° 30′ 00″
25	43° 39′ 06″	78° 30′ 00″
26	43° 27′ 18″	78° 30′ 00″
27	43° 23′ 18″	78° 30′ 00″
28	43° 24′ 30″	78° 17′ 00″
29	43° 32′ 48″	78° 17′ 00″
30	43° 45′ 42″	78° 17′ 00″
31	43° 52′ 00″	78° 17′ 00″
32	43° 56′ 00″	78° 17′ 00″
33	43° 52′ 06″	77° 54′ 00″
34	43° 38′ 48″	77° 54′ 00″
35	43° 26′ 24″	77° 54′ 00″

Station Number	Latitude N.	Longitude W.
36	43° 17′ 30″	77° 36′ 00″
37	43° 21′ 36″	77° 36′ 00″
38	43° 26′ 06″	77° 36′ 00″
39	43° 30′ 06″	77° 36′ 00″
40	43° 39′ 06″	77° 36′ 00″
41	43° 47′ 54″	77° 36′ 00″
42	43° 52′ 30″	77° 36′ 00″
43	43° 56′ 12″	77° 36′ 00″
T.P.	43° 51′ 30″	77° 31′ 00″
44	43° 48′ 42″	77° 18′ 00″
45	43° 39′ 00″	77° 18′ 00″
46	43° 20′ 06″	77° 17′ 30″
47	43° 17′ 18″	77° 00′ 00″
48	43° 22′ 06″	77° 00′ 00″
49	43° 30′ 24″	76° 57′ 24″
50	43° 39′ 00″	77° 00′ 00″
51	43° 17′ 42″	77° 00′ 00″
52	43° 52′ 30″	77° 00′ 00″
53	43° 52′ 00″	76° 42′ 00″
54	43° 39′ 06″	76° 42′ 00″
55	43° 30′ 24″	76° 42′ 00″
56	43° 23′ 12″	76° 42′ 00″
57	43° 30′ 00″	76° 31′ 06″
58	43° 34′ 12″	76° 24′ 00″
59	43° 39′ 42″	76° 15′ 00″
60	43° 43′ 42″	76° 24′ 00″
61	43° 52′ 18″	76° 24′ 00″
T.P.	43° 55′ 48″	76° 18′ 48″
62	43° 55′ 36″	76° 12′ 30″
T.P.	43° 56′ 18″	76° 17′ 18″
63	44° 00′ 48″	76° 30′ 18″
T.P.	44° 03′ 12″	76° 34′ 24″
64	44° 09′ 12″	76° 36′ 12″
T.P.	44° 04′ 42″	76° 38′ 30″
65	44° 00′ 18″	76° 48′ 00″
T.P.	43° 55′ 06″	76° 42′ 06″
66	43° 39′ 06″	78° 17′ 00″

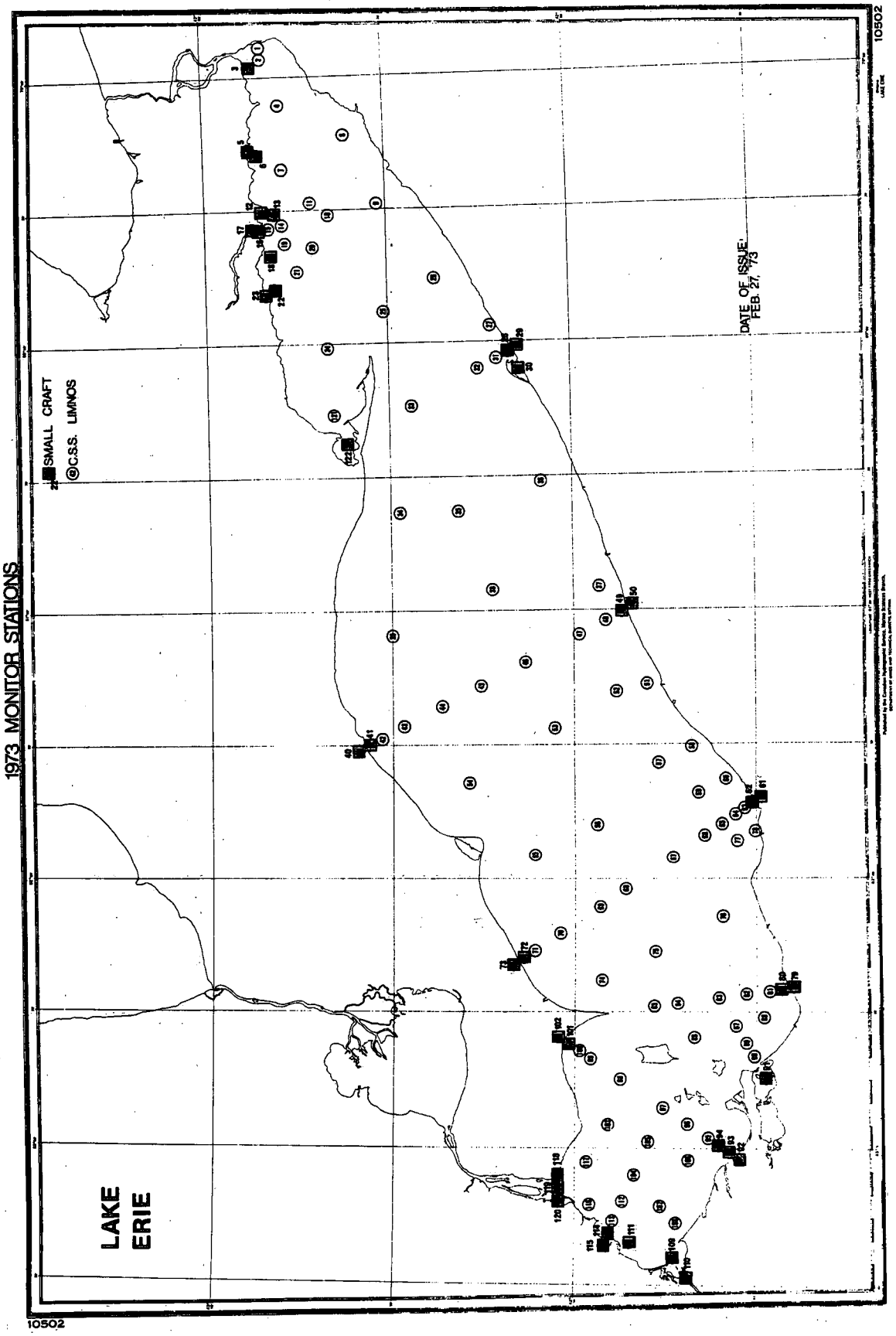

LAKE ONTARIO
MONITOR STATIONS
80°
79°
78°
77°
76°
44°
43°

LAKE ERIE
1973
MONITOR STATIONS

Station Number	Latitude N.	Longitude W.
1	42° 50′ 24″	78° 53′ 12″
2	42° 50′ 18″	78° 55′ 42″
3	42° 52′ 06″	78° 57′ 42″
4	42° 47′ 18″	79° 06′ 18″
5	42° 52′ 00″	79° 16′ 36″
6	42° 51′ 36″	79° 16′ 50″
7	42° 47′ 12″	79° 20′ 42″
8	42° 36′ 48″	79° 13′ 12″
9	42° 31′ 36″	79° 28′ 48″
10	42° 39′ 42″	79° 31′ 06″
11	42° 42′ 36″	79° 28′ 30″
12	42° 51′ 06″	79° 31′ 12″
13	42° 49′ 05″	79° 31′ 09″
14	42° 47′ 24″	79° 33′ 24″
15	42° 49′ 36″	79° 34′ 00″
16	42° 51′ 05″	79° 34′ 48″
17	42° 52′ 06″	79° 34′ 30″
18	42° 48′ 57″	79° 39′ 48″
19	42° 46′ 54″	79° 37′ 24″
20	42° 42′ 24″	79° 38′ 18″
21	42° 44′ 54″	79° 13′ 42″
22	42° 47′ 57″	79° 57′ 06″
23	42° 48′ 42″	79° 57′ 06″
24	42° 40′ 12″	80° 01′ 06″
25	42° 30′ 48″	79° 52′ 54″
26	43° 22′ 12″	79° 45′ 36″
27	42° 13′ 12″	79° 56′ 24″
28	42° 10′ 06″	80° 02′ 00″
29	42° 09′ 45″	80° 01′ 42″
30	42° 08′ 30″	80° 05′ 42″
31	42° 12′ 18″	80° 03′ 42″
32	42° 15′ 24″	80° 06′ 00″
33	42° 26′ 30″	80° 14′ 12″
34	42° 28′ 36″	80° 38′ 00″
35	42° 19′ 00″	80° 37′ 48″
36	42° 05′ 18″	80° 31′ 24″
37	41° 55′ 42″	80° 54′ 42″
38	42° 13′ 30″	80° 55′ 24″
39	42° 30′ 00″	81° 05′ 36″
40	42° 34′ 54″	81° 30′ 48″

Station Number	Latitude N.	Longitude W.
41	42° 34′ 00″	81° 30′ 06″
42	42° 31′ 54″	81° 28′ 48″
43	42° 28′ 12″	81° 26′ 00″
44	42° 21′ 54″	81° 21′ 30″
45	42° 15′ 30″	81° 17′ 00″
46	42° 08′ 06″	81° 11′ 48″
47	41° 59′ 12″	81° 05′ 36″
48	41° 54′ 48″	81° 02′ 12″
49	41° 52′ 00″	81° 00′ 36″
50	41° 51′ 18″	80° 59′ 54″
51	41° 47′ 54″	81° 16′ 30″
52	41° 53′ 06″	81° 18′ 12″
53	42° 04′ 24″	81° 26′ 24″
54	42° 17′ 30″	81° 38′ 36″
55	42° 07′ 36″	81° 54′ 48″
56	41° 56′ 24″	81° 47′ 54″
57	41° 46′ 06″	81° 34′ 06″
58	41° 40′ 36″	81° 30′ 48″
59	41° 38′ 30″	81° 41′ 00″
60	41° 34′ 54″	81° 37′ 48″
61	41° 30′ 18″	81° 43′ 54″
62	41° 31′ 18″	81° 43′ 42″
63	41° 31′ 54″	81° 44′ 06″
64	41° 33′ 12″	81° 45′ 48″
65	41° 35′ 42″	81° 47′ 48″
66	41° 38′ 30″	81° 50′ 12″
67	41° 43′ 48″	81° 55′ 00″
68	41° 51′ 30″	82° 02′ 06″
69	41° 55′ 54″	82° 06′ 12″
70	42° 02′ 30″	82° 12′ 18″
71	42° 06′ 54″	82° 16′ 24″
72	42° 08′ 24″	82° 17′ 54″
73	42° 09′ 06″	82° 18′ 36″
74	41° 55′ 30″	82° 22′ 54″
75	41° 46′ 42″	82′ 16′ 42″
76	41° 35′ 30″	82° 08′ 30″
77	41° 33′ 00″	81° 51′ 30″
78	41° 30′ 06″	81° 49′ 06″
79	41° 25′ 00″	82° 24′ 48″
80	41° 25′ 06″	82° 25′ 00″
81	41° 27′ 06″	82° 25′ 12″
82	41° 31′ 42″	82° 25′ 54″
83	41° 36′ 06″	82° 26′ 42″
84	41° 42′ 48″	82° 27′ 54″
85	41° 46′ 48″	82° 28′ 36″

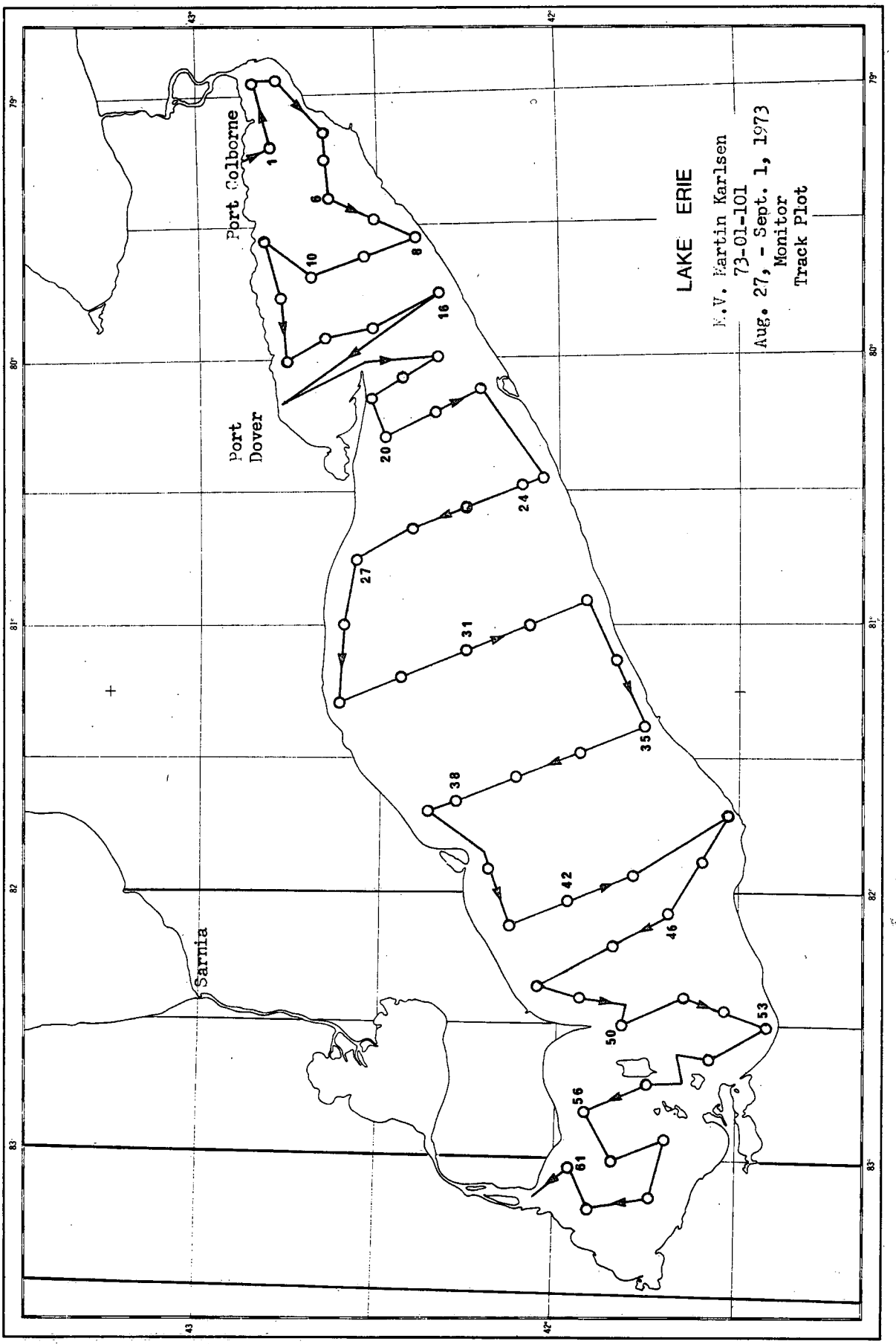
Station Number	Latitude N.	Longitude W.
86	41° 40′ 12″	82° 35′ 42″
87	41° 33′ 24″	82° 33′ 00″
88	41° 28′ 36″	82° 31′ 24″
89	41° 31′ 36″	82° 37′ 00″
90	41° 30′ 24″	82° 39′ 48″
91	41° 28′ 30″	82° 44′ 42″
92	41° 33′ 18″	83° 01′ 36″
93	41° 33′ 48″	83° 01′ 06″
94	41° 34′ 54″	83° 00′ 06″
95	41° 37′ 54″	82° 57′ 48″
96	41° 41′ 18″	82° 54′ 42″
97	41° 45′ 24″	82° 51′ 06″
98	41° 52′ 30″	82° 45′ 00″
99	41° 57′ 24″	82° 40′ 30″
100	41° 59′ 36″	82° 38′ 24″
101	42° 01′ 30″	82° 37′ 06″
102	42° 01′ 54″	82° 36′ 48″
103	41° 54′ 30″	82° 55′ 00″
104	41° 50′ 06″	83° 06′ 00″
105	41° 47′ 54″	82° 57′ 48″
106	41° 41′ 06″	83° 02′ 54″
107	41° 45′ 48″	83° 12′ 54″
108	41° 43′ 12″	83° 16′ 42″
109	41° 43′ 36″	83° 24′ 06″
110	41° 41′ 06″	83° 28′ 48″
111	41° 50′ 42″	83° 20′ 54″
112	41° 52′ 06″	83° 11′ 54″
113	41° 53′ 12″	83° 16′ 30″
114	41° 54′ 18″	83° 19′ 18″
115	41° 54′ 32″	83° 19′ 54″
116	41° 57′ 30″	83° 12′ 24″
117	41° 58′ 00″	83° 03′ 12″
118	42° 02′ 54″	83° 06′ 48″
119	42° 02′ 57″	83° 08′ 56″
120	42° 02′ 54″	83° 11′ 06″
121	42° 39′ 24″	80° 16′ 12″
122	42° 37′ 12″	80° 22′ 18″


1973 MONITOR STATIONS
LAKE ERIE
SMALL CRAFT
C.S.S. LIMNOS
DATE OF ISSUE:
FEB. 27, '73
10502
10502

LAKE ERIE
1973
MONITOR STATIONS
(SPECIAL)

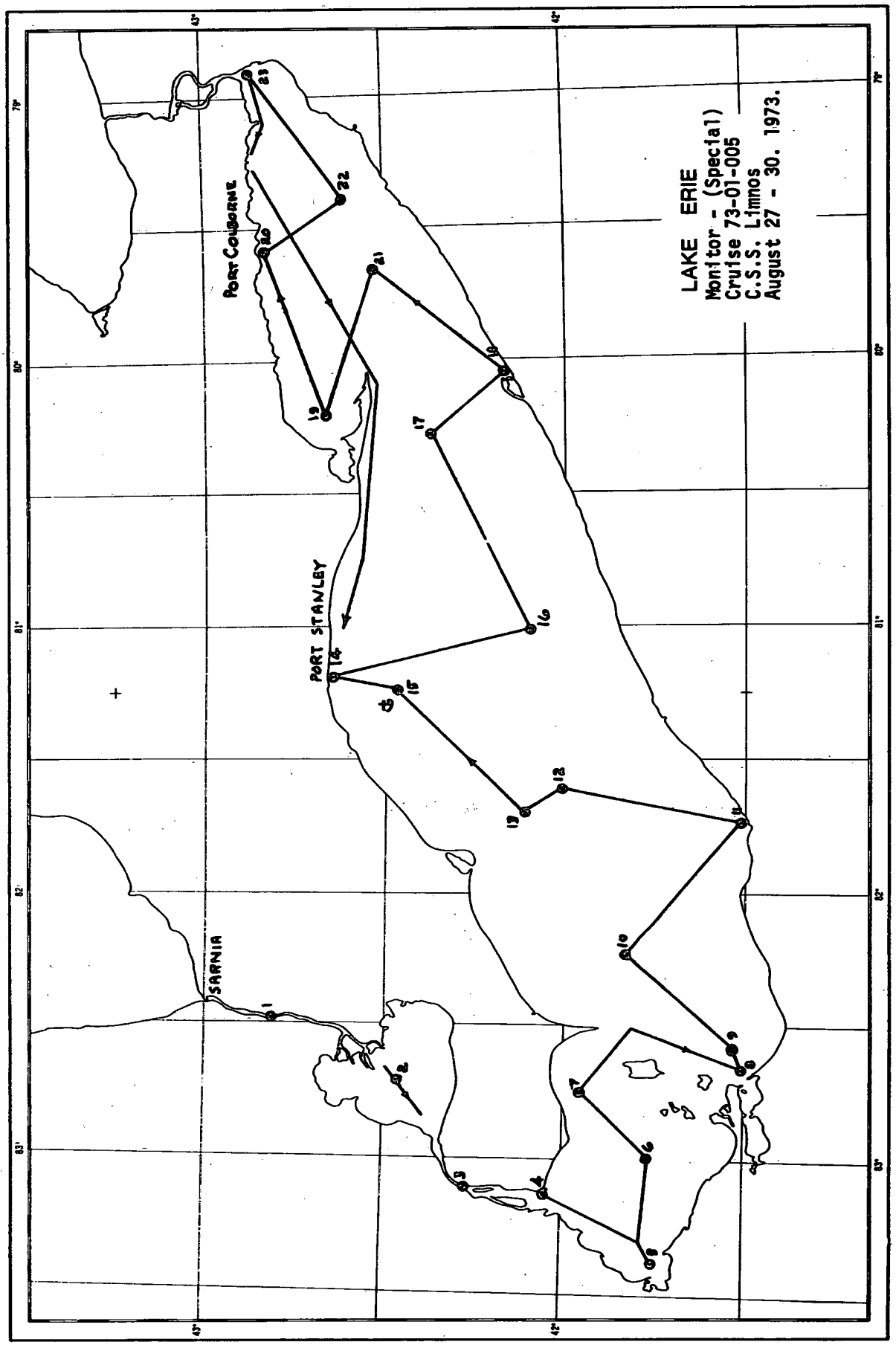
Station Number	Latitude N.	Longitude W.
1	42° 47′ 24″	79° 12′ 06″
2	42° 50′ 36″	78° 57′ 30″
3	42° 46′ 54″	78° 57′ 36″
4	42° 39′ 06″	79° 08′ 00″
5	42° 38′ 30″	79° 16′ 18″
6	42° 37′ 54″	79° 24′ 00″
7	42° 30′ 48″	79° 28′ 42″
8	42° 23′ 54″	79° 32′ 48″
9	42° 32′ 18″	79° 37′ 00″
10	42° 40′ 48″	79° 41′ 30″
11	42° 48′ 12″	79° 33′ 30″
12	42° 46′ 12″	79° 47′ 30″
13	42° 45′ 12″	80° 00′ 48″
14	42° 38′ 30″	79° 56′ 00″
15	42° 31′ 00″	79° 53′ 36″
16	42° 20′ 00″	79° 45′ 30″
17	42° 19′ 48″	80° 00′ 00″
18	42° 25′ 18″	80° 04′ 48″
19	42° 30′ 54″	80° 09′ 12″
20	42° 29′ 06″	80° 18′ 18″
21	42° 20′ 18″	80° 12′ 48″
22	42° 12′ 48″	80° 07′ 42″
23	42° 02′ 48″	80° 27′ 06″
24	42° 05′ 54″	80° 29′ 00″
25	42° 14′ 54″	80° 33′ 36″
26	42° 24′ 00″	80° 38′ 12″
27	42° 32′ 54″	80° 45′ 30″
28	42° 35′ 30″	81° 01′ 00″
29	42° 36′ 18″	81° 17′ 54″
30	42° 25′ 48″	81° 12′ 18″
31	42° 15′ 12″	81° 06′ 24″
32	42° 04′ 54″	81° 00′ 42″
33	41° 55′ 54″	80° 55′ 00″
34	41° 50′ 00″	81° 08′ 54″
35	41° 45′ 48″	81° 23′ 00″
36	41° 56′ 06″	81° 28′ 42″
37	42° 06′ 36″	81° 34′ 30″
38	42° 16′ 54″	81° 40′ 18″
39	42° 21′ 30″	81° 42′ 24″
40	42° 11′ 30″	81° 55′ 18″

Station Number	Latitude N.	Longitude W.
41	42° 08′ 06″	82° 08′ 24″
42	41° 57′ 54″	82° 02′ 30″
43	41° 47′ 18″	81° 56′ 42″
44	41° 31′ 48″	81° 42′ 30″
45	41° 36′ 24″	81° 53′ 48″
46	41° 40′ 54″	82° 05′ 12″
47	41° 50′ 18″	82° 12′ 48″
48	42° 02′ 48″	82° 21′ 54″
49	41° 55′ 54″	82° 24′ 30″
50	41° 48′ 48″	82° 30′ 06″
51	41° 38′ 30″	82° 24′ 12″
52	41° 31′ 54″	82° 27′ 12″
53	41° 25′ 12″	82° 30′ 12″
54	41° 34′ 00″	82° 38′ 06″
55	41° 44′ 18″	82° 44′ 00″
56	41° 54′ 42″	82° 50′ 24″
57	41° 49′ 54″	83° 01′ 06″
58	41° 41′ 06″	82° 56′ 00″
59	41° 43′ 36″	83° 09′ 00″
60	41° 53′ 30″	83° 11′ 48″
61	41° 56′ 48″	83° 02′ 42″


LAKE ERIE
M.V. Martin Karlsen
73-01-101
Aug. 27, - Sept. 1, 1973
Monitor
Track Plot
Port Colborne
Port Dover
Sarnia
1
6
8
10
16
20
24
27
31
35
38
42
46
50
53
56
61
43°
42°
79°
80°
81°
82°
83°

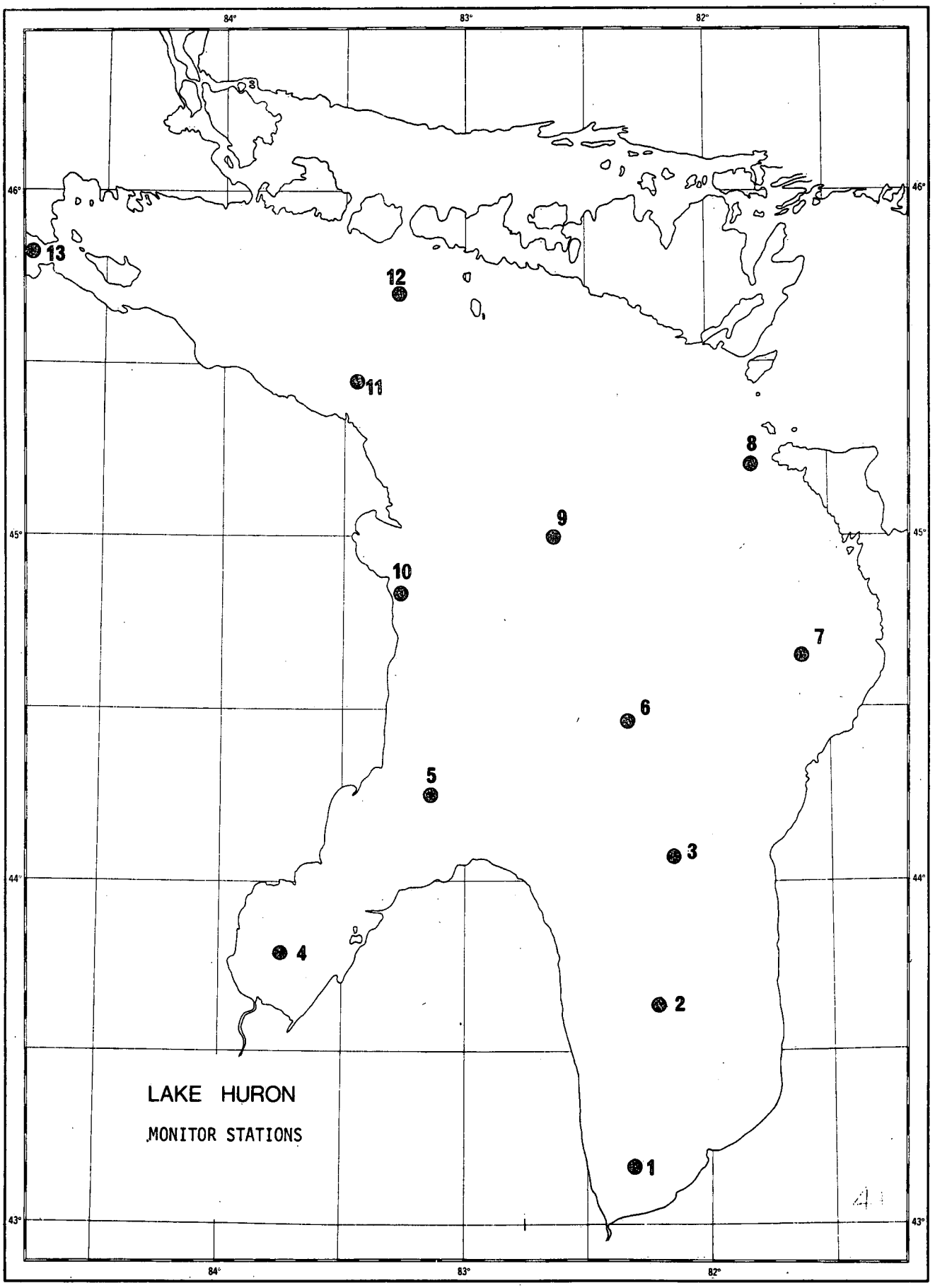
LAKE ERIE
1973
SPECIAL MONITOR STATIONS

Station Number	Geolimnology Number	Latitude N.	Longitude W.
1		42° 48′ 24″	82° 28′ 24″
2		42° 27′ 54″	82° 45′ 06″
3		42° 16′ 00″	83° 06′ 30″
4		42° 03′ 06″	83° 07′ 54″
5		41° 44′ 48″	83° 21′ 40″
6	U-42	41° 45′ 42″	82° 58′ 59″
7	W-44	41° 56′ 42″	82° 45′ 00″
8		41° 30′ 48″	82° 39′ 00″
9	B-8	41° 32′ 35″	82° 33′ 30″
10	E-11	41° 49′ 03″	82° 12′ 14″
11		41° 30′ 42″	81° 43′ 24″
12	G-16	42° 00′ 08″	81° 36′ 00″
13		42° 05′ 00″	81° 39′ 48″
14		42° 39′ 08″	81° 12′ 42″
15	L-19	42° 27′ 14″	81° 14′ 36″
16	H-21	42° 05′ 38″	81° 00′ 00″
17		42° 22′ 48″	80° 17′ 00″
18		42° 10′ 30″	80° 03′ 30″
19		42° 40′ 30″	80° 12′ 30″
20		42° 51′ 00″	79° 34′ 48″
21	M-32	42° 32′ 11″	79° 39′ 38″
22	N-34	42° 37′ 24″	79° 24′ 53″
23		42° 52′ 18″	78° 55′ 54″


LAKE ERIE
Monitor - (Special)
Cruise 73-01-005
C.S.S. Limnos
August 27 - 30. 1973.
PORT COLBORNE
PORT STANLEY
SARNIA
79°
80°
81°
82°
83°
43°
42°

LAKE HURON
1973
MONITOR STATIONS

Station Number	Latitude N.	Longitude W.
1	43° 11′ 24″	82° 17′ 54″
2	43° 38′ 00″	82° 13′ 12″
3	44° 04′ 42″	82° 08′ 36″
4	43° 47′ 12″	83° 44′ 12″
5	44° 14′ 54″	83° 07′ 12″
6	44° 27′ 12″	82° 20′ 30″
7	44° 39′ 24″	81° 32′ 42″
8	45° 12′ 06″	81° 49′ 54″
9	45° 01′ 06″	82° 37′ 42″
10	44° 51′ 00″	83° 15′ 42″
11	45° 26′ 48″	83° 26′ 54″
12	45° 42′ 06″	83° 16′ 48″
13	45° 48′ 48″	84° 46′ 42″


84°
83°
82°
46°
45°
44°
43°
13
12
11
8
9
10
7
6
5
3
4
2
1
LAKE HURON
MONITOR STATIONS

LAKE SUPERIOR
1973
MONITOR STATIONS

Station Number	Latitude N.	Longitude W.
1	46° 29′ 06″	84° 50′ 00″
2	46° 32′ 36″	84° 44′ 54″
3	46° 36′ 00″	84° 35′ 30″
4	46° 42′ 00″	84° 36′ 00″
T.P.	46° 44′ 30″	84° 44′ 42″
5	46° 44′ 00″	84° 47′ 36″
6	46° 44′ 36″	84° 55′ 00″
7	46° 49′ 30″	84° 46′ 04″
8	46° 53′ 36″	84° 40′ 03″
T.P.	46° 58′ 54″	84° 48′ 48″
9	47° 02′ 40″	84° 48′ 48″
10	47° 02′ 54″	84° 52′ 00″
11	47° 02′ 45″	84° 58′ 02″
12	47° 02′ 12″	85° 06′ 12″
13	46° 54′ 48″	85° 10′ 00″
14	46° 51′ 30″	85° 11′ 18″
15	46° 49′ 00″	85° 12′ 12″
16	46° 46′ 48″	85° 13′ 06″
17	46° 42′ 48″	85° 49′ 06″
18	46° 44′ 48″	85° 48′ 22″
19	46° 47′ 30″	85° 47′ 24″
20	46° 50′ 06″	85° 46′ 30″
21	46° 54′ 24″	85° 44′ 54″
22	46° 58′ 06″	85° 43′ 40″
23	47° 12′ 48″	85° 38′ 00″
24	47° 21′ 18″	85° 25′ 00″
25	47° 27′ 18″	85° 16′ 30″
26	47° 30′ 06″	85° 12′ 12″
27	47° 32′ 06″	85° 09′ 00″
28	47° 35′ 06″	85° 03′ 54″
29	47° 38′ 57″	85° 06′ 00″
30	47° 43′ 12″	85° 08′ 20″
31	47° 55′ 06″	84° 54′ 46″
32	47° 53′ 30″	85° 00′ 20″
33	47° 51′ 48″	85° 06′ 24″
34	47° 50′ 00″	85° 12′ 30″
35	47° 55′ 54″	85° 16′ 12″
T.P.	47° 54′ 00″	85° 26′ 18″
36	47° 54′ 30″	85° 44′ 12″
37	47° 51′ 36″	85° 47′ 00″

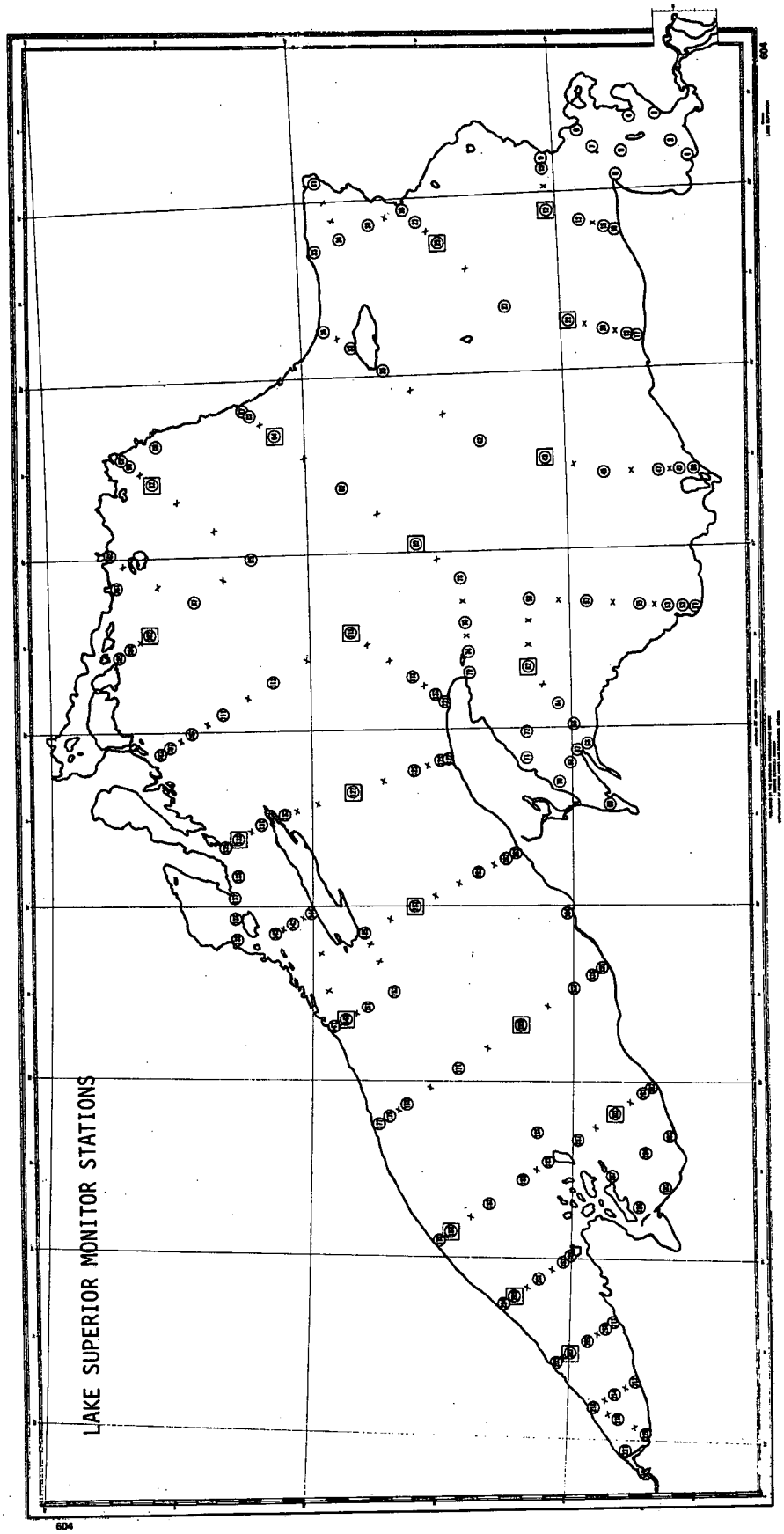
Station Number	Latitude N.	Longitude W.
38	47° 48′ 24″	85° 50′ 00″
T.P.	47° 46′ 00″	85° 59′ 54″
39	47° 41′ 24″	85° 58′ 00″
40	47° 35′ 00″	86° 05′ 00″
41	47° 28′ 00″	86° 13′ 00″
42	47° 19′ 30″	86° 22′ 18″
43	47° 04′ 48″	86° 28′ 40″
44	46° 58′ 00″	86° 31′ 24″
45	46° 51′ 24″	86° 34′ 06″
46	46° 45′ 00″	86° 34′ 06″
47	46° 38′ 48″	86° 34′ 06″
48	46° 36′ 00″	86° 34′ 06″
49	46° 34′ 00″	86° 34′ 06″
50	46° 30′ 30″	86° 34′ 06″
T.P.	46° 35′ 00″	86° 38′ 52″
51	46° 31′ 00″	87° 20′ 12″
52	46° 34′ 00″	87° 19′ 56″
53	46° 37′ 24″	87° 19′ 30″
54	46° 40′ 42″	87° 19′ 18″
55	46° 44′ 00″	87° 18′ 54″
56	46° 50′ 50″	87° 18′ 18″
57	46° 56′ 00″	87° 17′ 36″
58	47° 02′ 48″	87° 16′ 54″
59	47° 09′ 33″	87° 16′ 12″
60	47° 09′ 36″	87° 23′ 18″
61	47° 09′ 52″	87° 31′ 18″
62	47° 10′ 00″	87° 38′ 36″
63	47° 06′ 48″	87° 44′ 54″
64	47° 03′ 30″	87° 51′ 12″
65	47° 00′ 00″	87° 58′ 00″
66	46° 56′ 24″	88° 05′ 00″
T.P.	46° 58′ 40″	88° 05′ 00″
67	46° 58′ 54″	88° 07′ 00″
68	47° 01′ 00″	88° 11′ 00″
69	46° 51′ 42″	88° 25′ 48″
70	47° 03′ 00″	88° 18′ 00″
T.P.	47° 04′ 24″	88° 17′ 41″
71	47° 10′ 48″	88° 09′ 54″
72	47° 10′ 30″	88° 00′ 52″
73	47° 23′ 18″	87° 40′ 50″
74	47° 23′ 48″	87° 34′ 00″
75	47° 24′ 00″	87° 29′ 00″
76	47° 24′ 06″	87° 24′ 42″
77	47° 24′ 42″	87° 17′ 36″
78	47° 25′ 06″	87° 09′ 48″

Station Number	Latitude N.	Longitude W.
79	47° 30′ 18″	87° 02′ 48″
80	47° 35′ 00″	86° 57′ 06″
81	47° 43′ 54″	86° 47′ 00″
82	47° 51′ 30″	86° 38′ 00″
83	48° 00′ 18″	86° 26′ 00″
84	48° 06′ 48″	86° 18′ 00″
85	48° 10′ 00″	86° 14′ 00″
86	48° 12′ 24″	86° 11′ 00″
87	48° 14′ 00″	86° 09′ 00″
88	48° 34′ 06″	86° 20′ 48″
89	48° 42′ 00″	86° 25′ 06″
90	48° 40′ 30″	86° 27′ 00″
91	48° 37′ 56″	86° 30′ 06″
92	48° 35′ 00″	86° 33′ 54″
93	48° 29′ 36″	86° 40′ 30″
94	48° 21′ 30″	86° 50′ 48″
95	48° 13′ 06″	87° 01′ 00″
96	48° 19′ 30″	87° 07′ 42″
97	48° 26′ 18″	87° 15′ 12″
98	48° 34′ 42″	87° 09′ 30″
T.P.	48° 39′ 12″	87° 06′ 18″
99	48° 42′ 42″	87° 02′ 18″
100	48° 45′ 24″	86° 58′ 33″
101	48° 44′ 06″	87° 10′ 00″
102	48° 36′ 54″	87° 26′ 09″
103	48° 38′ 46″	87° 28′ 08″
104	48° 41′ 12″	87° 30′ 48″
105	48° 44′ 00″	87° 33′ 48″
106	48° 34′ 30″	88° 07′ 00″
107	48° 32′ 27″	88° 05′ 00″
108	48° 30′ 00″	88° 02′ 42″
109	48° 27′ 30″	88° 00′ 24″
110	48° 23′ 54″	87° 56′ 54″
111	48° 20′ 12″	87° 53′ 30″
112	48° 14′ 24″	87° 48′ 00″
113	48° 08′ 42″	87° 42′ 12″
114	48° 01′ 00″	87° 35′ 12″
115	47° 50′ 48″	87° 27′ 24″
116	47° 46′ 48″	87° 31′ 42″
117	47° 41′ 54″	87° 36′ 54″
118	47° 36′ 24″	87° 42′ 36″
119	47° 33′ 56″	87° 45′ 00″
120	47° 31′ 06″	87° 48′ 00″
121	47° 29′ 00″	87° 50′ 00″
T.P.	47° 29′ 12″	88° 00′ 00″

Station Number	Latitude N.	Longitude W.
122	47° 28′ 00″	88° 08′ 54″
123	47° 30′ 06″	88° 09′ 54″
124	47° 33′ 24″	88° 11′ 36″
125	47° 36′ 18″	88° 13′ 00″
126	47° 43′ 45″	88° 16′ 36″
127	47° 50′ 54″	88° 20′ 12″
128	47° 58′ 42″	88° 23′ 54″
129	48° 03′ 18″	88° 26′ 00″
130	48° 06′ 30″	88° 27′ 30″
T.P.	48° 11′ 48″	88° 22′ 36″
T.P.	48° 12′ 30″	88° 29′ 42″
131	48° 12′ 00″	88° 30′ 24″
132	48° 14′ 18″	88° 33′ 00″
133	48° 17′ 00″	88° 35′ 50″
134	48° 18′ 06″	88° 37′ 00″
135	48° 19′ 48″	88° 38′ 00″
136	48° 17′ 24″	88° 49′ 48″
T.P.	48° 17′ 00″	88° 54′ 18″
137	48° 18′ 06″	88° 57′ 00″
T.P.	48° 17′ 30″	88° 59′ 00″
138	48° 18′ 00″	89° 04′ 00″
139	48° 17′ 54″	89° 10′ 48″
T.P.	48° 12′ 00″	89° 12′ 00″
T.P.	48° 11′ 18″	89° 06′ 42″
140	48° 09′ 00″	89° 08′ 54″
141	48° 07′ 00″	89° 07′ 18″
142	48° 05′ 00″	89° 05′ 42″
143	48° 02′ 18″	89° 03′ 42″
144	48° 00′ 12″	89° 02′ 00″
145	47° 58′ 20″	89° 15′ 42″
146	47° 56′ 42″	89° 28′ 00″
147	47° 55′ 00″	89° 40′ 06″
148	47° 54′ 00″	89° 39′ 12″
149	47° 53′ 00″	89° 38′ 24″
150	47° 50′ 20″	89° 36′ 00″
151	47° 47′ 30″	89° 33′ 27″
152	47° 41′ 18″	89° 28′ 00″
153	47° 44′ 57″	89° 18′ 09″
154	47° 47′ 00″	89° 12′ 09″
155	47° 48′ 12″	89° 08′ 48″
156	47° 42′ 12″	89° 04′ 24″
157	47° 36′ 48″	89° 00′ 00″
158	47° 32′ 00″	88° 03′ 06″
159	47° 26′ 30″	88° 07′ 18″
160	47° 22′ 00″	88° 49′ 06″

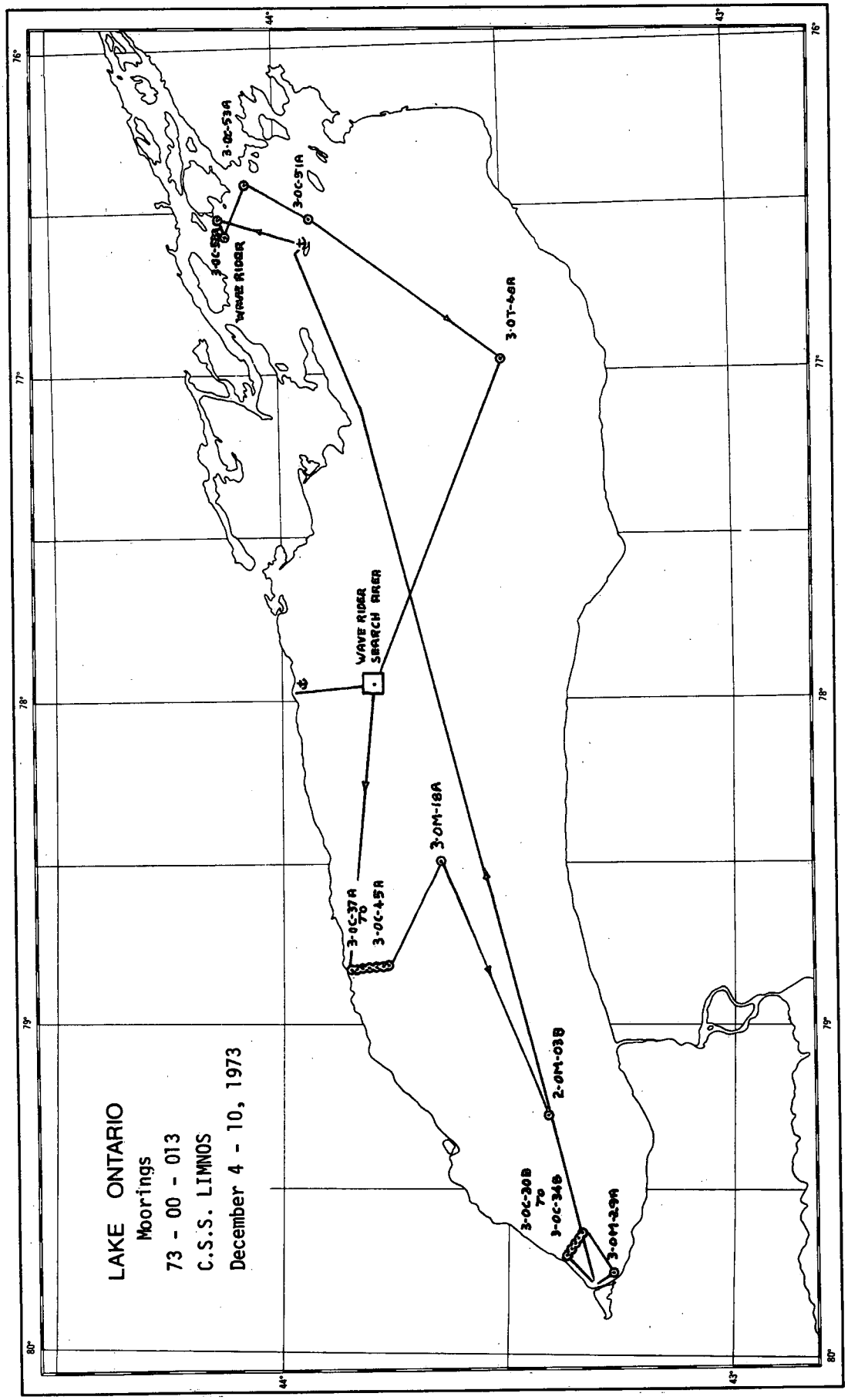
Station Number	Latitude N.	Longitude W.
161	47° 18′ 42″	88° 46′ 36″
162	47° 15′ 48″	88° 44′ 30″
163	47° 13′ 30″	88° 42′ 48″
164	47° 01′ 36″	89° 02′ 18″
T.P.	47° 01′ 00″	89° 07′ 06″
165	46° 53′ 30″	89° 20′ 51″
166	46° 55′ 42″	89° 23′ 06″
167	47° 00′ 00″	89° 27′ 30″
168	47° 05′ 54″	89° 33′ 24″
169	47° 12′ 24″	89° 40′ 00″
170	47° 20′ 12″	89° 48′ 09″
171	47° 27′ 00″	89° 55′ 15″
172	47° 33′ 18″	90° 01′ 53″
173	47° 38′ 24″	90° 07′ 18″
174	47° 40′ 12″	90° 09′ 06″
175	47° 42′ 12″	90° 11′ 18″
176	47° 43′ 24″	90° 12′ 36″
177	47° 44′ 48″	90° 14′ 06″
178	47° 30′ 36″	90° 54′ 12″
179	47° 29′ 18″	90° 52′ 45″
180	47° 28′ 00″	90° 51′ 18″
181	47° 23′ 24″	90° 46′ 21″
182	47° 19′ 24″	90° 42′ 00″
183	47° 11′ 48″	90° 34′ 00″
184	47° 08′ 48″	90° 30′ 48″
185	47° 06′ 00″	90° 27′ 45″
186	47° 08′ 36″	90° 17′ 00″
187	46° 59′ 00″	90° 20′ 24″
188	46° 55′ 00″	90° 16′ 06″
189	46° 50′ 42″	90° 11′ 20″
190	46° 47′ 00″	90° 07′ 18″
191	46° 44′ 00″	90° 04′ 06″
192	46° 42′ 00″	90° 01′ 54″
193	46° 38′ 00″	90° 18′ 00″
194	46° 43′ 30″	90° 24′ 00″
195	46° 38′ 48″	90° 36′ 00″
196	46° 44′ 54″	90° 42′ 12″
197	46° 51′ 00″	90° 32′ 18″
T.P.	46° 53′ 12″	90° 33′ 57″
T.P.	46° 44′ 30″	90° 44′ 57″
T.P.	47° 01′ 48″	90° 52′ 57″
198	47° 00′ 36″	90° 59′ 00″
199	47° 02′ 24″	91° 00′ 54″
200	47° 04′ 42″	91° 03′ 18″
201	47° 07′ 54″	91° 06′ 42″

Station Number	Latitude N.	Longitude W.
202	47° 10′ 33″	91° 09′ 30″
203	47° 13′ 18″	91° 12′ 18″
204	47° 15′ 48″	91° 15′ 00″
T.P.	47° 07′ 00″	91° 25′ 48″
205	47° 03′ 12″	91° 34′ 00″
206	47° 01′ 30″	91° 32′ 09″
207	47° 00′ 12″	91° 30′ 54″
208	46° 56′ 18″	91° 26′ 54″
209	46° 53′ 54″	91° 24′ 21″
210	46° 52′ 15″	91° 22′ 42″
211	46° 50′ 12″	91° 20′ 42″
212	46° 45′ 00″	91° 40′ 30″
213	46° 47′ 06″	91° 42′ 30″
214	46° 49′ 42″	91° 44′ 54″
215	46° 51′ 54″	91° 47′ 00″
216	46° 54′ 24″	91° 49′ 12″
217	46° 51′ 12″	91° 51′ 33″
218	46° 49′ 00″	91° 53′ 06″
219	46° 45′ 36″	91° 55′ 30″
220	46° 42′ 18″	91° 57′ 54″
221	46° 46′ 54″	92° 03′ 15″


LAKE SUPERIOR MONITOR STATIONS

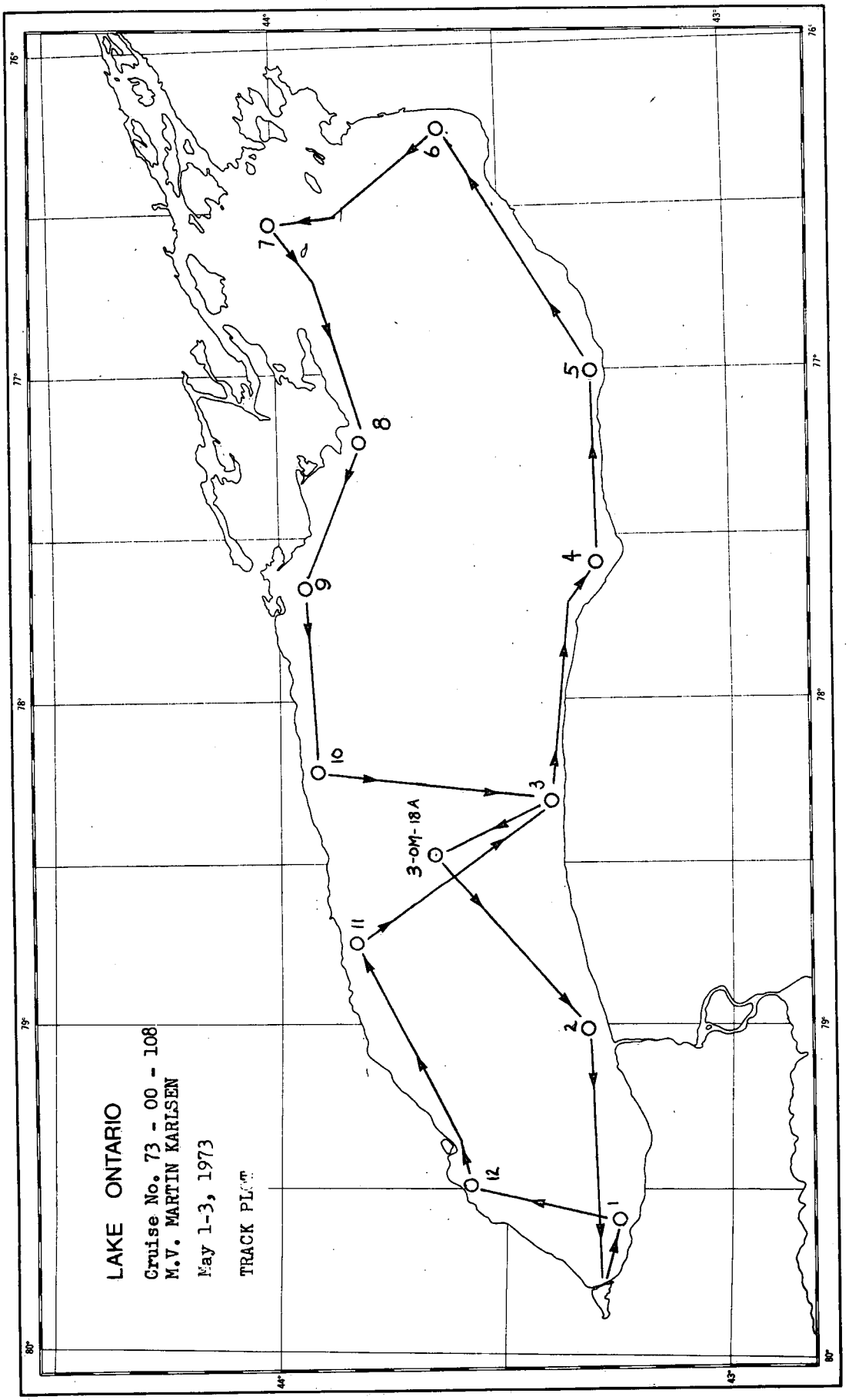
LAKE ONTARIO
1973
MOORING STATIONS

Station Number	Latitude N.	Longitude W.
3–0C–30A	44° 22′ 22″	79° 41′ 48″
3–0C–31A	43° 21′ 53″	79° 40′ 53″
3–0C–32A	43° 21′ 24″	79° 40′ 00″
3–0C–33A	43° 21′ 00″	79° 39′ 15″
3–0C–34A	43° 20′ 36″	79° 38′ 12″
3–0C–35A	43° 20′ 06″	79° 37′ 18″
2–0M–03A	43° 24′ 43″	79° 16′ 02″
3–0M–18A	43° 38′ 54″	78° 29′ 30″
3–0M–29A	43° 16′ 06″	79° 45′ 12″
WAVE RIDER	44° 06′ 06″	76° 35′ 00″
3–0C–30B	43° 22′ 18″	79° 41′ 51″
3–0C–31B	43° 21′ 56″	79° 40′ 54″
3–0C–32B	43° 21′ 33″	79° 40′ 00″
3–0C–33B	43° 21′ 00″	79° 39′ 06″
3–0C–34B	43° 20′ 32″	79° 38′ 12″
3–0C–37B	43° 50′ 42″	78° 49′ 54″
3–0C–38B	43° 49′ 52″	78° 49′ 44″
3–0C–39A	43° 49′ 04″	78° 49′ 36″
3–0C–40A	43° 48′ 12″	78° 49′ 30″
3–0C–41A	43° 47′ 28″	78° 49′ 36″
3–0C–42A	43° 46′ 42″	78° 49′ 24″
3–0C–43A	43° 45′ 58″	78° 49′ 15″
3–0C–44A	43° 50′ 41″	78° 49′ 54″
3–0C–45A	43° 51′ 31″	78° 49′ 06″
3–0T–48A	43° 30′ 12″	76° 58′ 06″
3–0C–51A	43° 55′ 12″	76° 31′ 22″
3–0C–52A	44° 07′ 17″	76° 31′ 15″
3–0C–53A	44° 04′ 08″	76° 25′ 18″


LAKE ONTARIO
Moorings
73 - 00 - 013
C.S.S. LIMNOS
December 4 - 10, 1973
3-OC-53A
3-OC-51A
3-OC-52A
WAVE RIDER
3-OT-4-6R
WAVE RIDER
SEARCH RIGER
3-OC-37A
TO
3-OC-45A
3-OM-18A
2-OM-03B
3-OC-30B
TO
3-OC-34B
3-OM-29A
76°
77°
78°
79°
80°
44°
43°

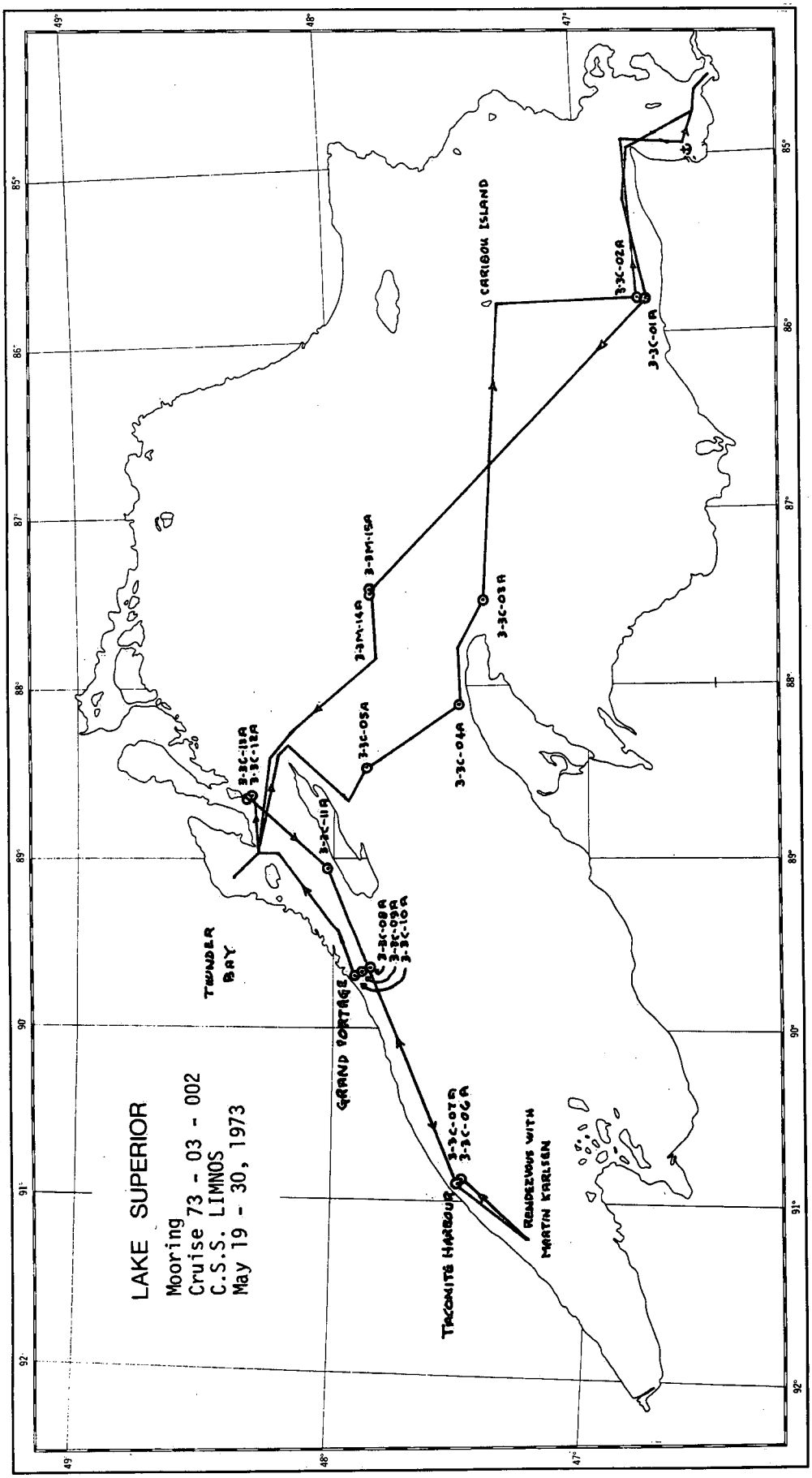
LAKE ONTARIO
1973
DECCA BUOY STATIONS

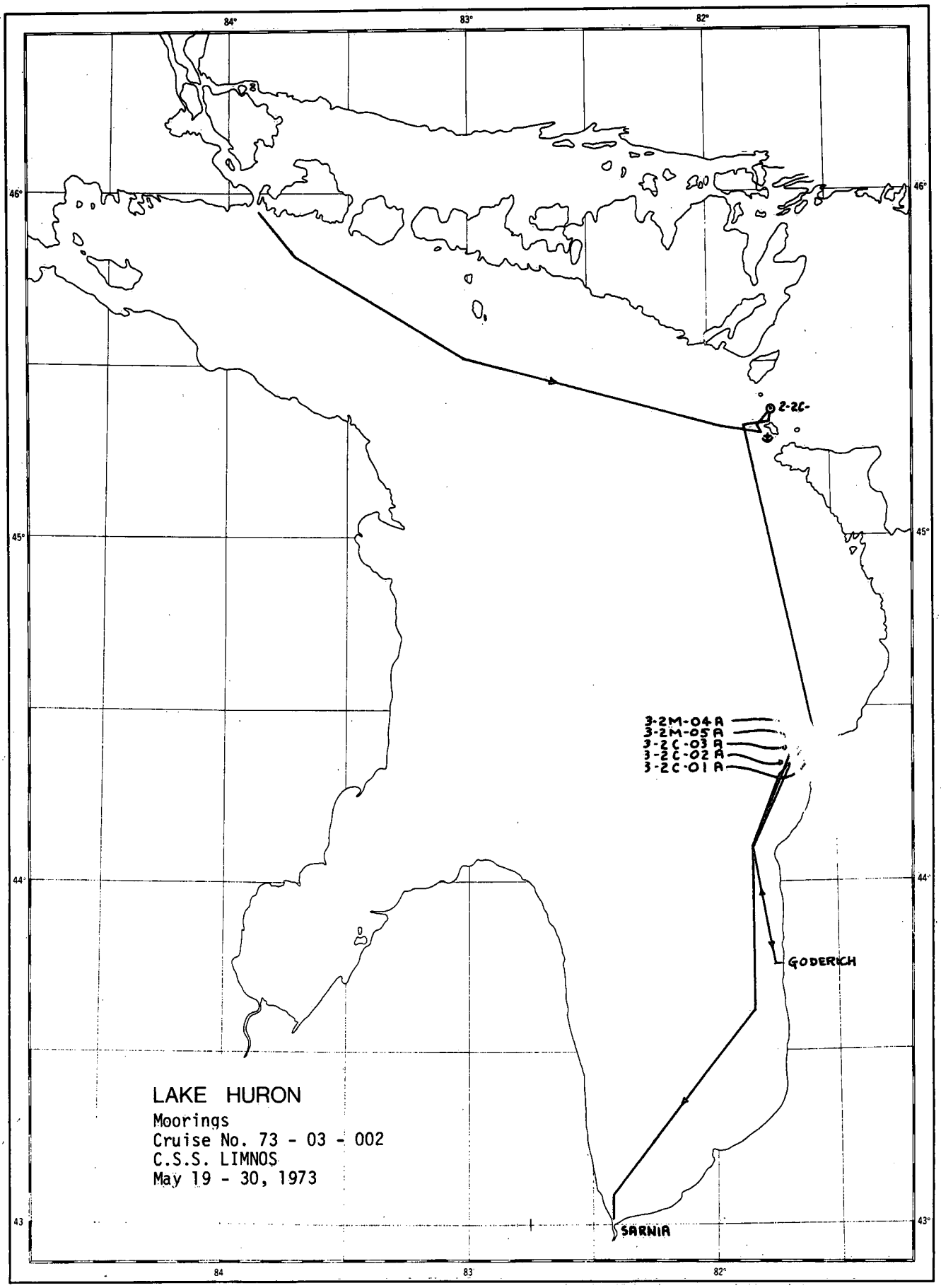
Station Number	Latitude N.	Longitude W.
2–0S– 1A	43° 15′ 09″	79° 35′ 06″
2–0S– 2A	43° 19′ 24″	79° 00′ 00″
2–0S– 3A	43° 23′ 30″	78° 18′ 24″
2–0S– 4A	43° 17′ 51″	77° 35′ 48″
2–0S– 5A	43° 17′ 54″	77° 01′ 39″
2–0S– 6A	43° 37′ 09″	76° 14′ 15″
2–0S– 7A	44° 01′ 36″	76° 33′ 12″
2–0S– 8A	43° 49′ 12″	77° 13′ 48″
2–0S– 9A	43° 56′ 30″	77° 40′ 12″
2–0S–10A	43° 55′ 24″	78° 13′ 00″
2–0S–11A	43° 50′ 36″	78° 44′ 54″
2–0S–12A	43° 35′ 36″	79° 28′ 30″


LAKE ONTARIO
Cruise No. 73 - 00 - 108
M.V. MARTIN KARLSEN
May 1-3, 1973
TRACK PLOT
1
2
3
4
5
6
7
8
9
10
11
12
3-OM-18A
76°
77°
78°
79°
80°
44°
43°

LAKES HURON AND SUPERIOR
1973
MOORING STATIONS

Station Number	Latitude N.	Longitude W.
3–3C–01A	46° 44′ 48″	85° 48′ 56″
3–3C–02A	46° 45′ 58″	85° 48′ 03″
3–3C–03A	47° 23′ 48″	87° 29′ 48″
3–3C–04A	47° 29′ 30″	88° 07′ 12″
3–3C–05A	47° 51′ 51″	88° 27′ 36″
3–3C–06A	47° 28′ 52″	90° 52′ 36″
3–3C–07A	47° 29′ 48″	90° 53′ 48″
3–3C–08A	47° 51′ 18″	89° 38′ 30″
3–3C–09A	47° 53′ 24″	89° 40′ 06″
3–3C–10A	47° 54′ 24″	89° 41′ 00″
3–3C–11A	48° 01′ 06″	89° 02′ 56″
3–3C–12A	48° 18′ 06″	88° 37′ 36″
3–3C–13A	48° 19′ 03″	88° 39′ 06″
3–2C–01A	44° 22′ 30″	81° 34′ 42″
3–2C–02A	44° 23′ 04″	81° 36′ 56″
3–2C–03A	44° 24′ 12″	81° 39′ 44″
73–0M–01	47° 50′ 48″	87° 27′ 24″
73–0M–02	47° 50′ 48″	87° 26′ 24″


LAKE SUPERIOR
Mooring
Cruise 73 - 03 - 002
C.S.S. LIMNOS
May 19 - 30, 1973
THUNDER BAY
GRAND PORTAGE
TACONITE HARBOUR
RENDEZVOUS WITH MARTIN KARLSEN
CARIBOU ISLAND
3-SC-01A
3-SC-02A
3-SC-03A
3-SC-04A
3-SC-05A
3-SM-14A
3-SM-15A
3-SC-11A
3-SC-12A
3-SC-11B
3-SC-08A
3-SC-09A
3-SC-10A
3-SC-07A
3-SC-06A


84°
83°
82°
46°
45°
44°
43°
2-2C-
3-2M-04A
3-2M-05A
3-2C-03A
3-2C-02A
3-2C-01A
GODERICH
SARNIA
LAKE HURON
Moorings
Cruise No. 73 - 03 - 002
C.S.S. LIMNOS
May 19 - 30, 1973

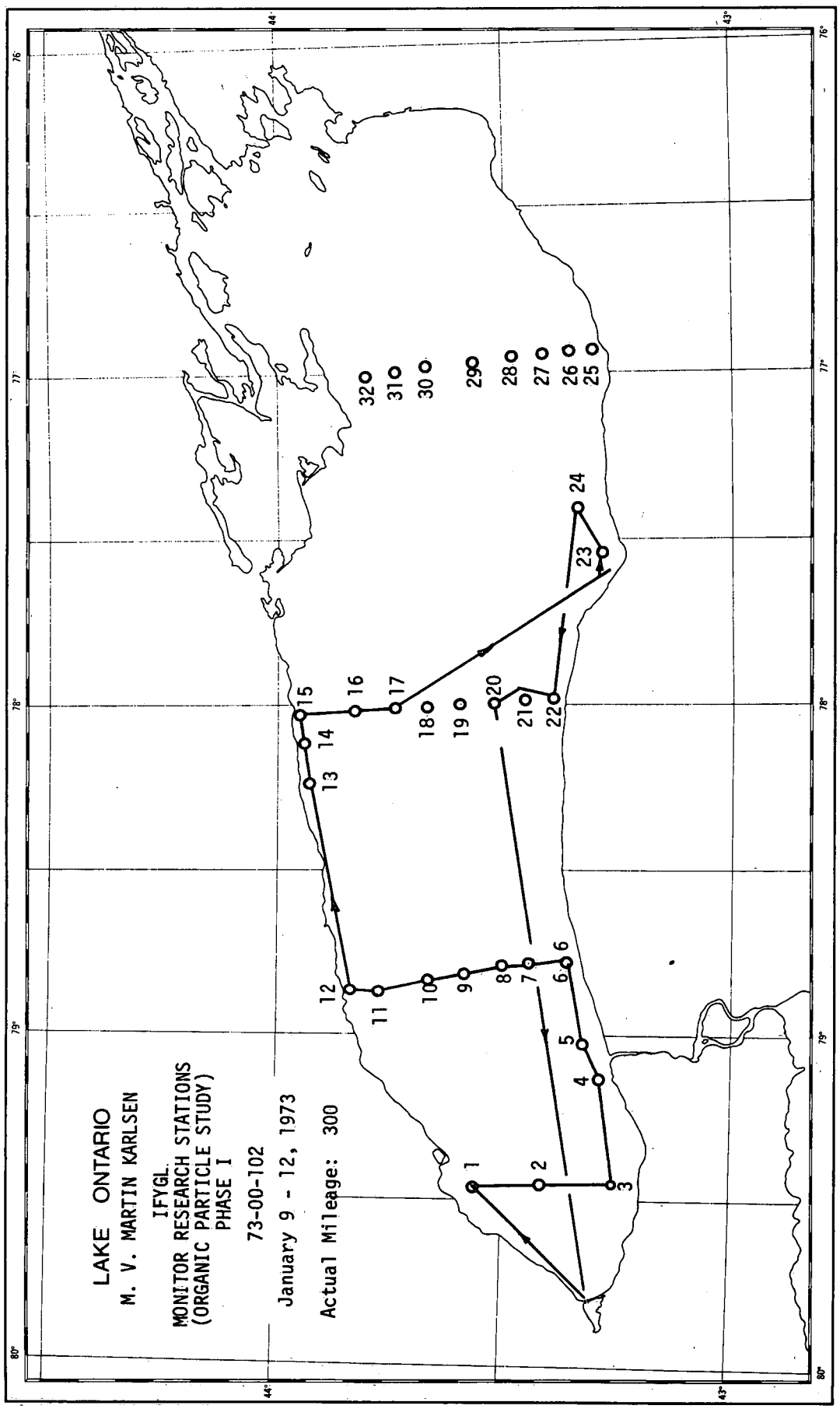
LAKE ONTARIO
1972–73
IFYGL
ORGANIC PARTICLE STUDY STATIONS

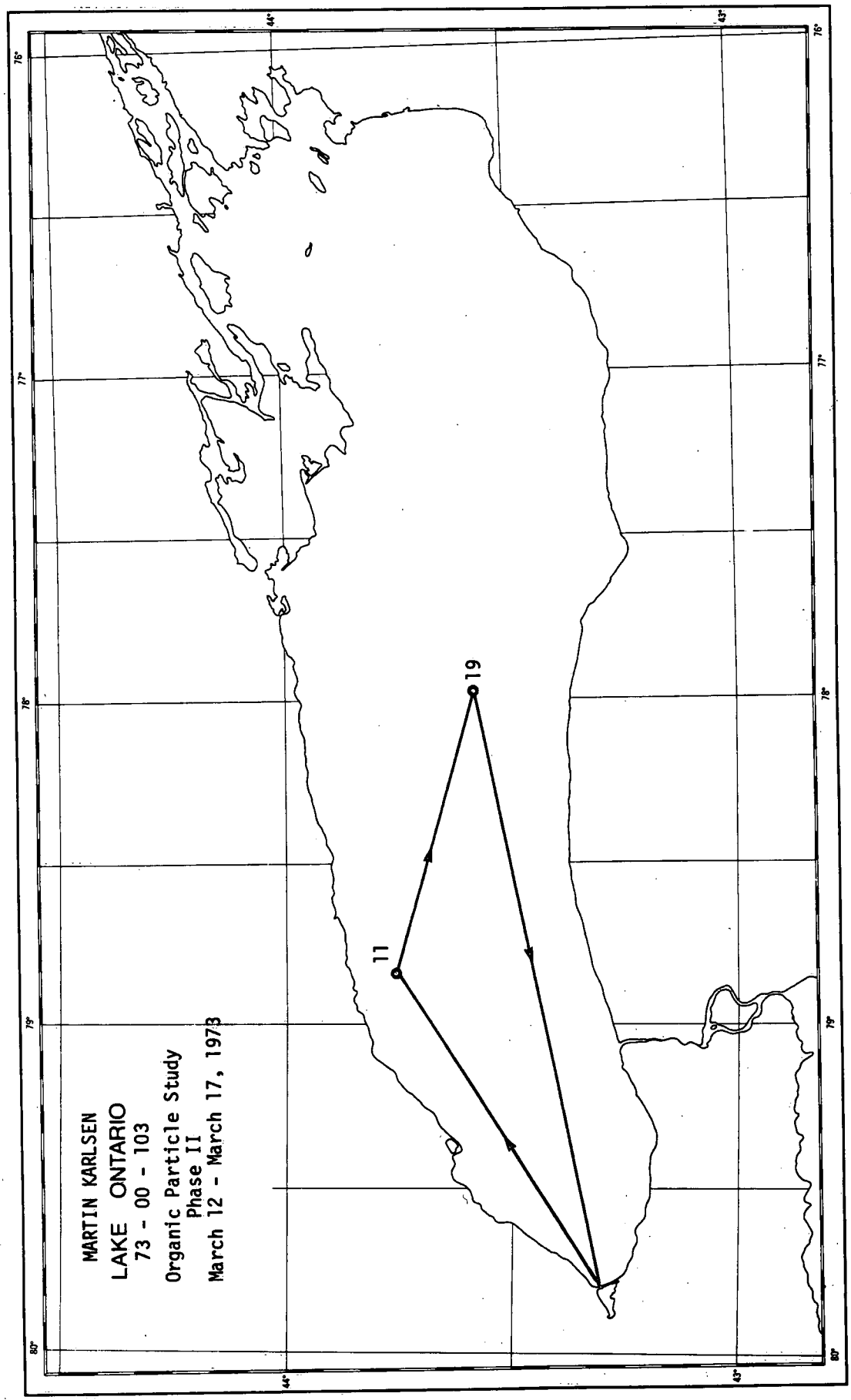
PHASE I:

Station Number	Latitude N.	Longitude W.
1	43° 34′ 24″	79° 24′ 00″
2	43° 25′ 54″	79° 24′ 00″
3	43° 17′ 18″	79° 24′ 00″
4	43° 17′ 24″	79° 07′ 24″
T.P.	43° 19′ 36″	79° 04′ 30″
5	43° 19′ 24″	79° 00′ 00″
6	43° 21′ 36″	78° 43′ 48″
7	43° 26′ 00″	78° 45′ 06″
8	43° 30′ 18″	78° 46′ 00″
9	43° 34′ 54″	78° 47′ 18″
10	43° 38′ 54″	78° 48′ 12″
11	43° 46′ 30″	78° 51′ 18″
12	43° 49′ 48″	78° 51′ 00″
13	43° 55′ 12″	78° 14′ 24″
14	43° 56′ 00″	78° 07′ 30″
15	43° 57′ 00″	78° 03′ 00″
16	43° 49′ 12″	78° 02′ 06″
17	43° 44′ 12″	78° 01′ 42″
18	43° 39′ 06″	78° 01′ 12″
19	43° 35′ 24″	78° 00′ 42″
20	43° 31′ 12″	78° 00′ 12″
21	43° 27′ 00″	77° 59′ 48″
22	43° 23′ 00″	77° 59′ 24″
T.P.	43° 21′ 54″	77° 46′ 00″
23	43° 17′ 30″	77° 32′ 54″
24	43° 21′ 12″	77° 26′ 00″
25	43° 18′ 00″	76° 56′ 24″
26	43° 21′ 30″	76° 57′ 18″
27	43° 25′ 12″	76° 58′ 00″
28	43° 29′ 24″	76° 58′ 48″
29	43° 34′ 06″	76° 59′ 42″
30	43° 40′ 12″	77° 00′ 54″
30	43° 44′ 24″	77° 01′ 48″
32	48° 48′ 00″	77° 02′ 24″

PHASE II:

11	43° 46′ 30″	78° 51′ 18″
19	43° 35′ 24″	78° 00′ 42″

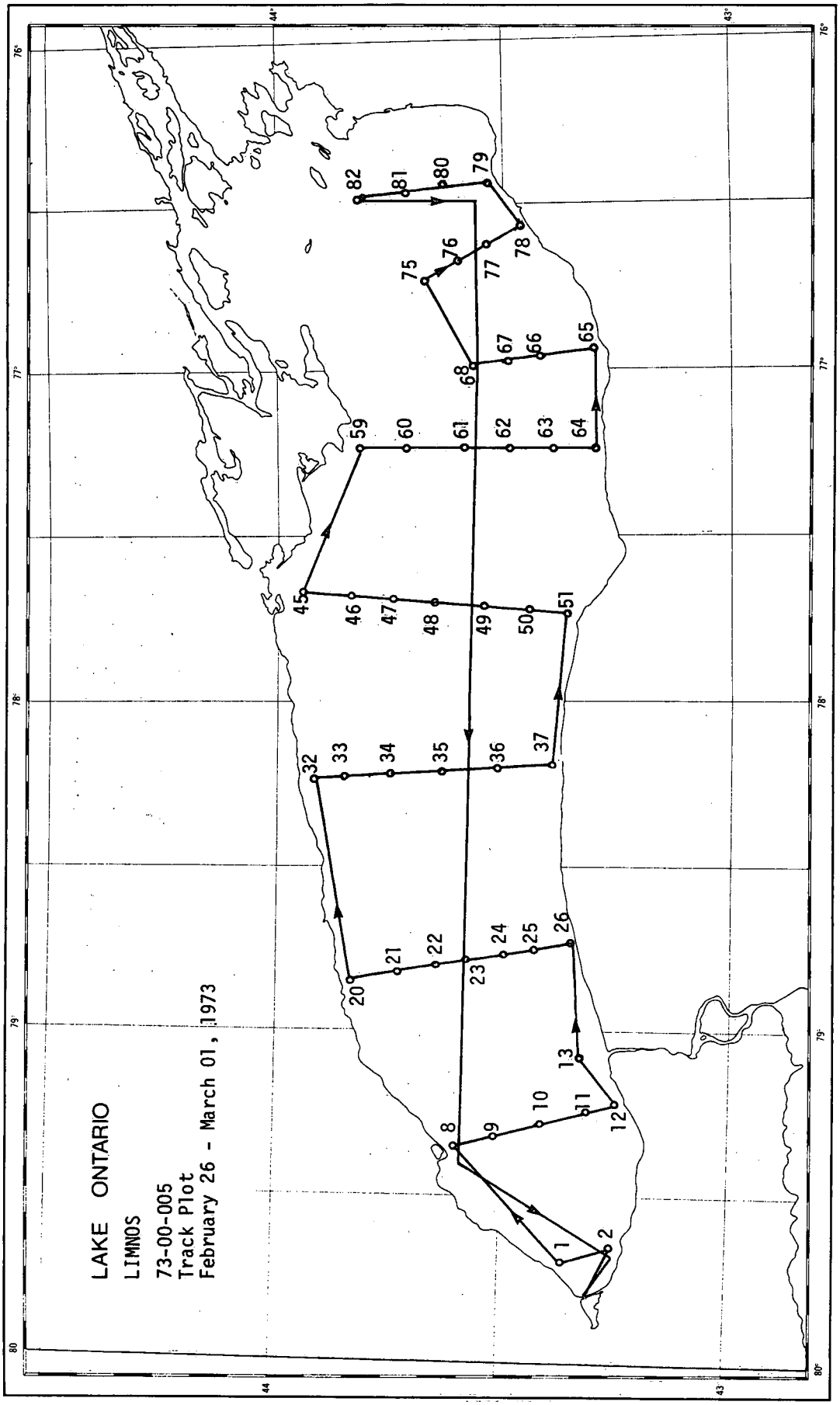

LAKE ONTARIO
M. V. MARTIN KARLSEN
IFYGL
MONITOR RESEARCH STATIONS
(ORGANIC PARTICLE STUDY)
PHASE I
73-00-102
January 9 - 12, 1973
Actual Mileage: 300
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
76°
77°
78°
79°
80°
44°
43°


MARTIN KARLSEN
LAKE ONTARIO
73 - 00 - 103
Organic Particle Study
Phase II
March 12 - March 17, 1973
11
19
44°
43°
76°
77°
78°
79°
80°

LAKE ONTARIO
1972–1973
IFYGL
TEMPERATURE SURVEY STATIONS
(Ship from CCIW)

Station Number	Latitude N.	Longitude W.
2	43° 15′ 36″	79° 38′ 12″
1	43° 22′ 42″	79° 40′ 36″
8	43° 35′ 54″	79° 21′ 06″
9	43° 31′ 18″	79° 19′ 12″
10	43° 25′ 00″	79° 16′ 30″
11	43° 19′ 06″	79° 14′ 12″
12	43° 15′ 36″	79° 13′ 00″
13	43° 19′ 12″	79° 04′ 12″
26	43° 21′ 36″	78° 43′ 36″
25	43° 26′ 24″	78° 44′ 18″
24	43° 30′ 36″	78° 45′ 48″
23	43° 34′ 48″	78° 46′ 48″
22	43° 39′ 00″	78° 48′ 00″
21	43° 43′ 48″	78° 49′ 12″
20	43° 49′ 54″	78° 51′ 00″
32	43° 55′ 12″	78° 14′ 24″
33	43° 51′ 36″	78° 14′ 18″
34	43° 45′ 36″	78° 13′ 48″
35	43° 38′ 54″	78° 13′ 12″
36	43° 31′ 42″	78° 12′ 36″
37	43° 23′ 24″	78° 12′ 00″
51	43° 21′ 30″	77° 44′ 42″
50	43° 26′ 54″	77° 44′ 00″
49	43° 33′ 06″	77° 43′ 12″
48	43° 39′ 36″	77° 43′ 06″
47	43° 45′ 00″	77° 42′ 30″
46	43° 49′ 48″	77° 41′ 48″
45	43° 56′ 24″	77° 40′ 54″
T.P.	43° 52′ 30″	77° 33′ 00″
59	43° 49′ 12″	77° 15′ 00″
60	43° 43′ 12″	77° 15′ 00″
61	43° 35′ 24″	77° 15′ 00″
62	43° 29′ 24″	77° 15′ 00″
63	43° 23′ 30″	77° 15′ 00″
64	43° 18′ 00″	77° 15′ 00″
79	43° 31′ 48″	76° 27′ 12″
93	43° 33′ 00″	76° 18′ 36″
80	43° 37′ 48″	76° 28′ 12″
92	43° 39′ 48″	76° 14′ 06″
91	43° 44′ 24″	76° 18′ 54″

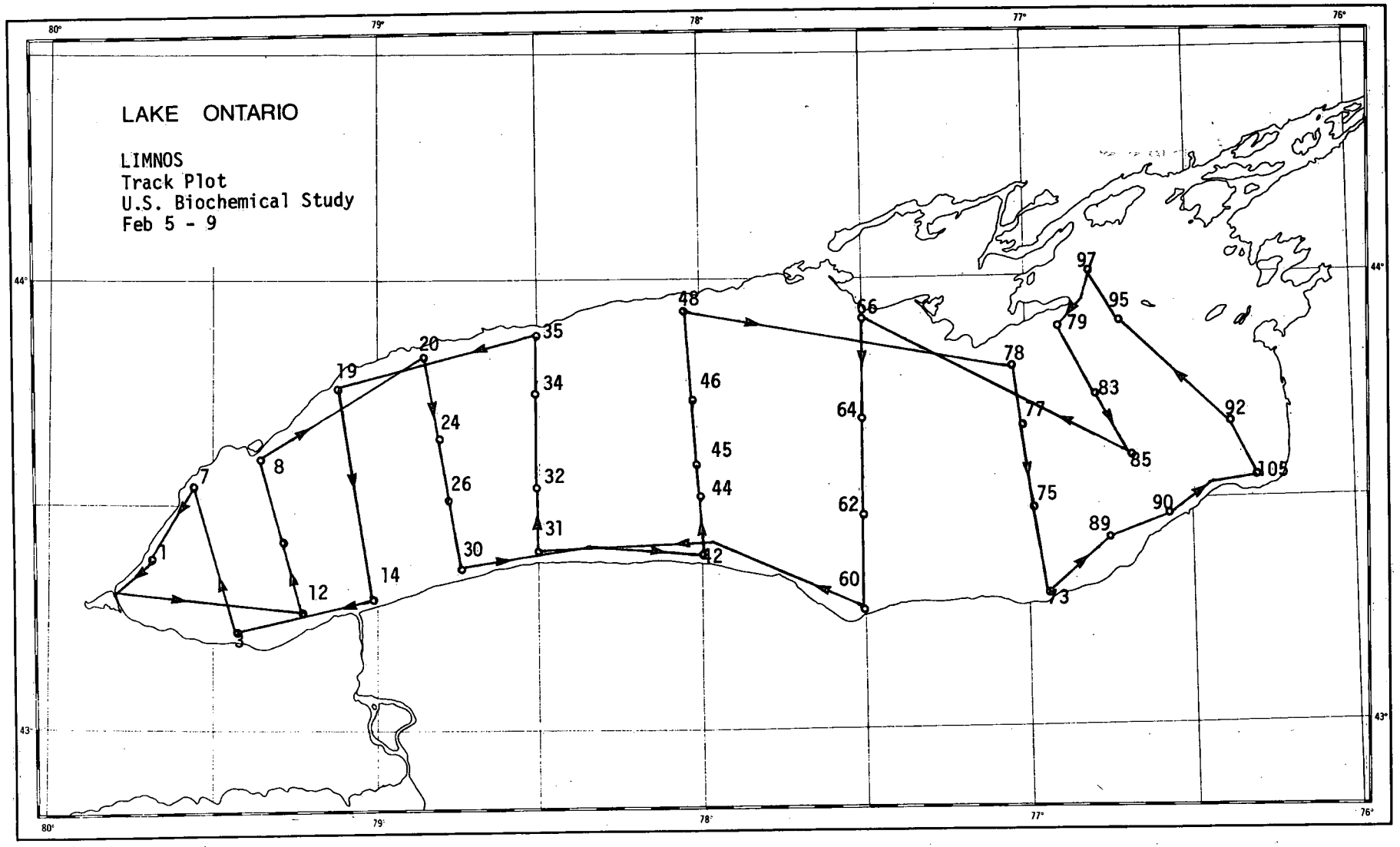
Station Number	Latitude N.	Longitude W.
81	43° 43′ 12″	76° 29′ 30″
82	43° 50′ 24″	76° 30′ 36″
90	43° 48′ 18″	76° 19′ 48″
89	43° 55′ 12″	76° 16′ 12″
88	43° 57′ 36″	76° 23′ 12″
87	44° 00′ 18″	76° 29′ 00″
86	44° 04′ 30″	76° 36′ 00″
85	44° 00′ 36″	76° 48′ 36″
84	43° 58′ 48″	76° 40′ 30″
83	43° 54′ 24″	76° 43′ 00″


LAKE ONTARIO
LIMNOS
73-00-005
Track Plot
February 26 - March 01, 1973

LAKE ONTARIO
1972–73
U.S. BIOCHEMICAL STATIONS

Station Number	Latitude N.	Longitude W.
1	43° 22′ 48″	79° 40′ 48″
2	43° 15′ 36″	79° 38′ 24″
3	43° 13′ 12″	79° 25′ 12″
5	43° 21′ 36″	79° 28′ 48″
7	43° 32′ 24″	79° 33′ 00″
8	43° 36′ 00″	79° 21′ 00″
10	43° 25′ 12″	79° 16′ 48″
12	43° 15′ 36″	79° 13′ 12″
12	43° 17′ 24″	79° 00′ 00″
15	43° 24′ 00″	79° 00′ 36″
17	43° 33′ 00″	79° 03′ 36″
19	43° 45′ 36″	79° 07′ 12″
20	43° 49′ 48″	78° 51′ 00″
24	43° 39′ 00″	78° 48′ 00″
26	43° 30′ 36″	78° 46′ 12″
30	43° 21′ 36″	78° 43′ 48″
31	43° 23′ 24″	78° 30′ 00″
32	43° 32′ 24″	78° 30′ 00″
34	43° 45′ 00″	78° 30′ 00″
35	43° 52′ 48″	78° 30′ 00″
36	43° 55′ 12″	78° 14′ 24″
38	43° 45′ 36″	78° 13′ 48″
40	43° 31′ 48″	78° 12′ 36″
41	43° 23′ 24″	78° 12′ 00″
42	43° 23′ 24″	77° 59′ 24″
44	43° 31′ 12″	78° 00′ 00″
45	43° 35′ 24″	78° 00′ 36″
46	43° 43′ 48″	78° 01′ 12″
48	43° 55′ 48″	78° 03′ 00″
49	43° 56′ 24″	77° 40′ 48″
52	43° 49′ 48″	77° 41′ 24″
54	43° 39′ 36″	77° 43′ 12″
56	43° 27′ 00″	77° 44′ 24″
59	43° 21′ 36″	77° 45′ 00″
60	43° 15′ 36″	77° 30′ 00″
62	43° 28′ 48″	77° 30′ 00″
64	43° 41′ 24″	77° 30′ 00″
66	43° 54′ 36″	77° 30′ 00″
67	43° 49′ 12″	77° 15′ 00″
69	43° 35′ 24″	77° 15′ 00″

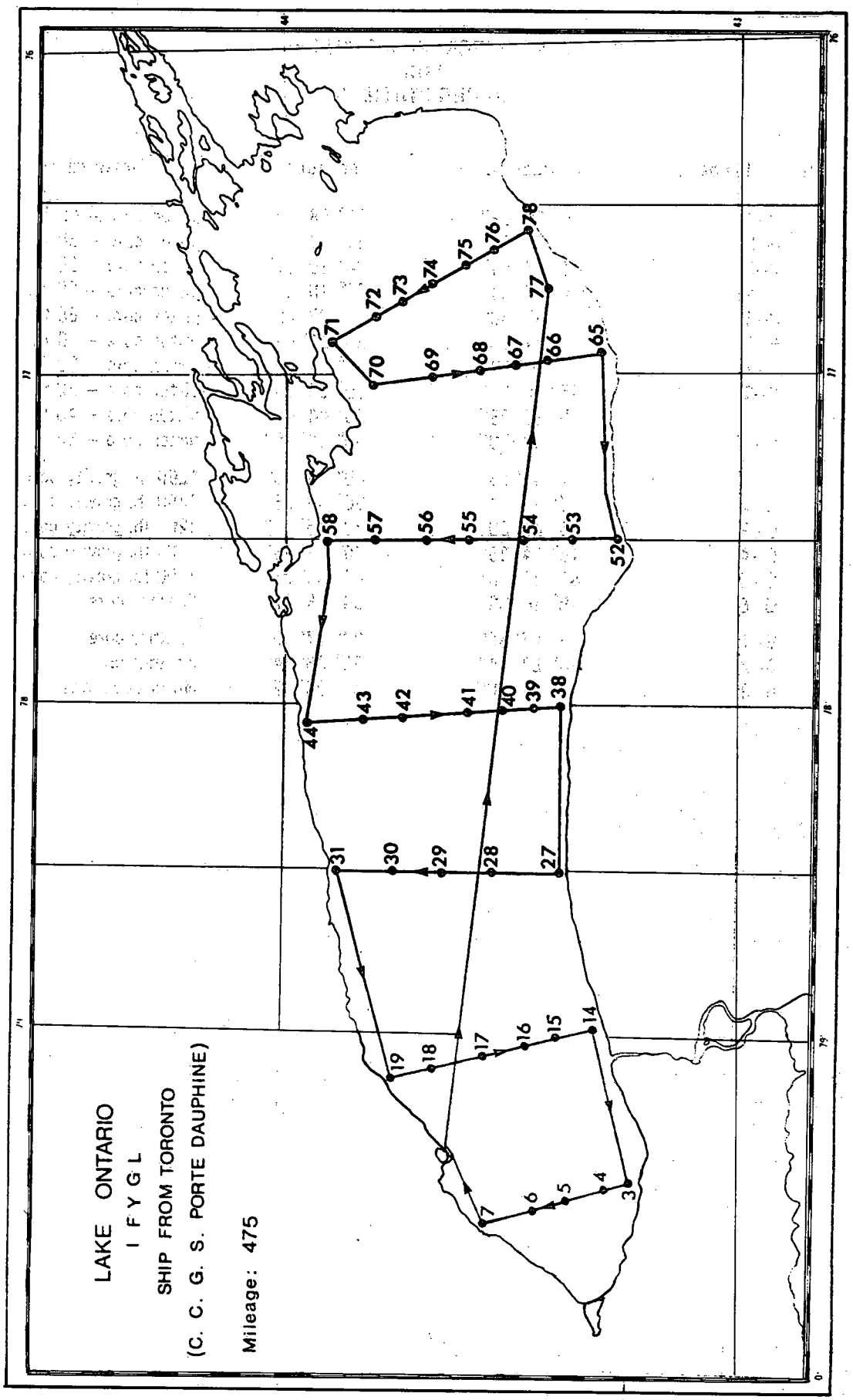
Station Number	Latitude N.	Longitude W.
71	43° 23′ 24″	77° 15′ 00″
72	43° 18′ 00″	77° 15′ 00″
73	43° 18′ 00″	76° 56′ 24″
75	43° 29′ 24″	76° 58′ 48″
77	43° 40′ 12″	77° 00′ 36″
78	43° 48′ 00″	77° 02′ 24″
79	43° 53′ 24″	76° 54′ 00″
83	43° 44′ 24″	76° 47′ 24″
85	43° 36′ 00″	76° 40′ 48″
89	43° 25′ 12″	76° 45′ 00″
90	43° 28′ 12″	76° 34′ 12″
92	43° 40′ 12″	76° 22′ 48″
94	43° 60′ 24″	76° 30′ 36″
95	43° 54′ 00″	76° 42′ 36″
96	43° 58′ 48″	76° 40′ 48″
97	44° 00′ 36″	76° 48′ 00″
98	44° 04′ 48″	76° 36′ 00″
99	44° 00′ 00″	76° 28′ 48″
103	43° 45′ 00″	76° 15′ 00″
105	43° 33′ 00″	76° 18′ 00″


LAKE ONTARIO
LIMNOS
Track Plot
U.S. Biochemical Study
Feb 5 - 9
80°
79°
78°
77°
76°
44°
43°
1
3
7
8
12
14
19
20
24
26
30
31
32
34
35
42
44
45
46
48
56
60
62
64
73
75
77
78
79
83
85
89
90
92
95
97
105

LAKE ONTARIO
1972–73
IFYGL
TEMPERATURE SURVEYS STATIONS
(Ship from Toronto)

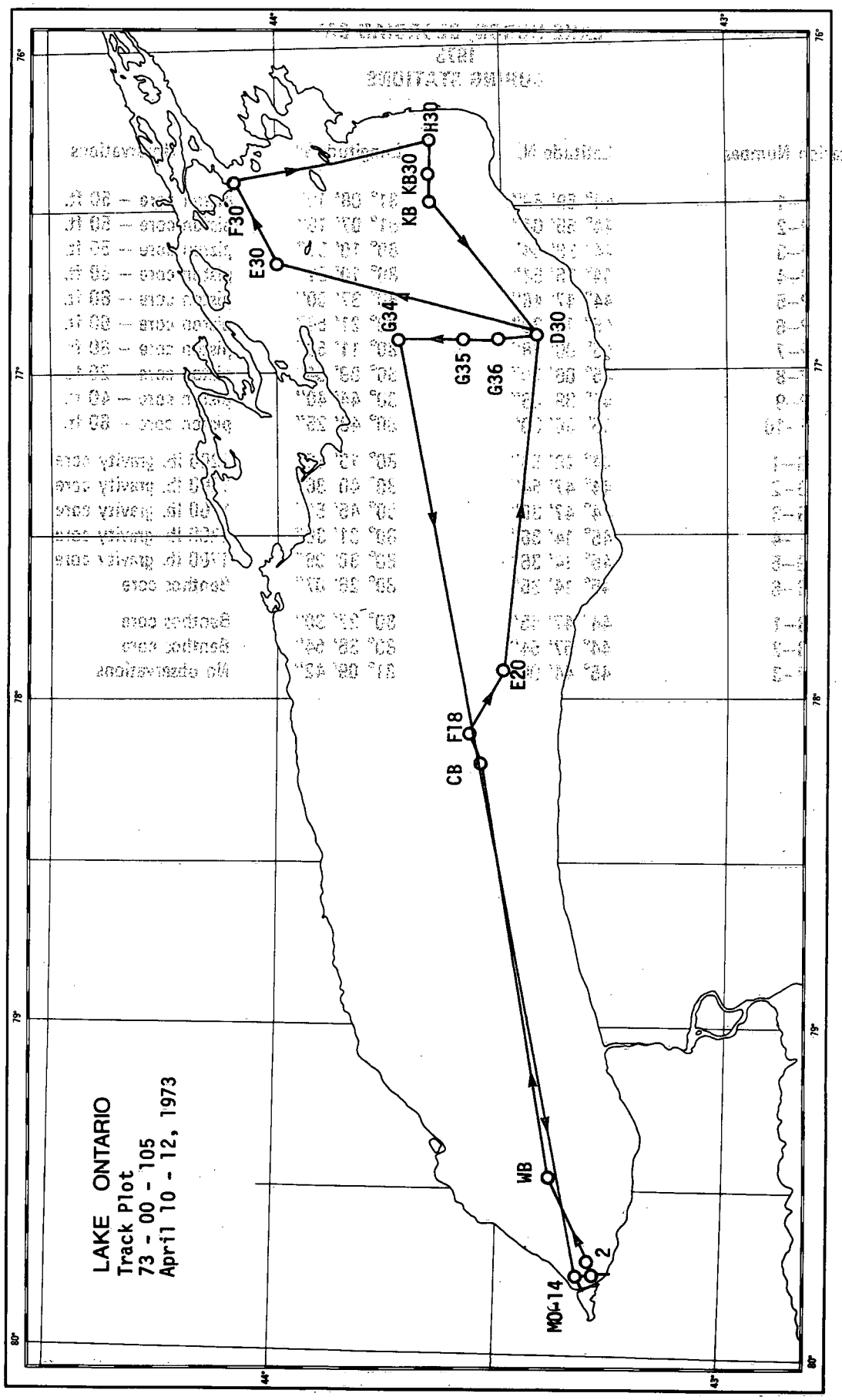
Station Number	Latitude N.	Longitude W.
77	43° 25′ 24″	76° 44′ 42″
78	43° 28′ 00″	76° 34′ 18″
76	43° 32′ 06″	76° 37′ 54″
75	43° 36′ 06″	76° 40′ 48″
74	43° 40′ 24″	76° 44′ 06″
73	43° 44′ 24″	76° 47′ 36″
72	43° 47′ 48″	76° 50′ 24″
71	43° 53′ 24″	76° 54′ 36″
70	43° 48′ 18″	77° 02′ 24″
69	43° 40′ 12″	77° 00′ 48″
68	43° 34′ 12″	76° 59′ 24″
67	43° 29′ 24″	76° 58′ 48″
66	43° 25′ 24″	76° 58′ 00″
65	43° 18′ 00″	76° 56′ 24″
T.P.	43° 17′ 30″	77° 26′ 06″
52	43° 15′ 54″	77° 30′ 00″
53	43° 22′ 00″	77° 30′ 00″
54	43° 28′ 48″	77° 30′ 00″
55	43° 35′ 24″	77° 30′ 00″
56	43° 41′ 24″	77° 30′ 00″
57	43° 48′ 00″	77° 30′ 00″
58	43° 54′ 36″	77° 30′ 00″
T.P.	43° 53′ 24″	77° 31′ 48″
44	43° 56′ 54″	78° 03′ 00″
43	43° 49′ 24″	78° 02′ 06″
42	43° 44′ 00″	78° 01′ 42″
41	43° 35′ 36″	78° 00′ 48″
40	43° 31′ 06″	78° 00′ 06″
39	43° 27′ 00″	78° 00′ 00″
38	43° 23′ 18″	77° 59′ 24″
27	43° 23′ 12″	78° 30′ 06″
28	43° 32′ 00″	78° 29′ 54″
29	43° 38′ 42″	78° 30′ 00″
30	43° 45′ 06″	78° 30′ 00″
31	43° 52′ 42″	78° 29′ 48″
19	43° 45′ 30″	79° 07′ 12″
18	43° 39′ 30″	79° 04′ 54″
17	43° 33′ 06″	79° 02′ 42″
16	43° 27′ 18″	79° 00′ 48″
15	43° 23′ 18″	78° 59′ 18″

Station Number	Latitude N.	Longitude W.
14	43° 18′ 00″	78° 57′ 42″
T.P.	43° 20′ 42″	79° 04′ 42″
3	43° 13′ 12″	79° 25′ 06″
4	43° 16′ 48″	79° 26′ 24″
5	43° 21′ 36″	79° 28′ 48″
6	43° 26′ 18″	79° 30′ 18″
7	43° 32′ 18″	79° 33′ 00″


LAKE ONTARIO
I F Y G L
SHIP FROM TORONTO
(C. C. G. S. PORTE DAUPHINE)
Mileage: 475

LAKE ONTARIO
1973
CORING STATIONS

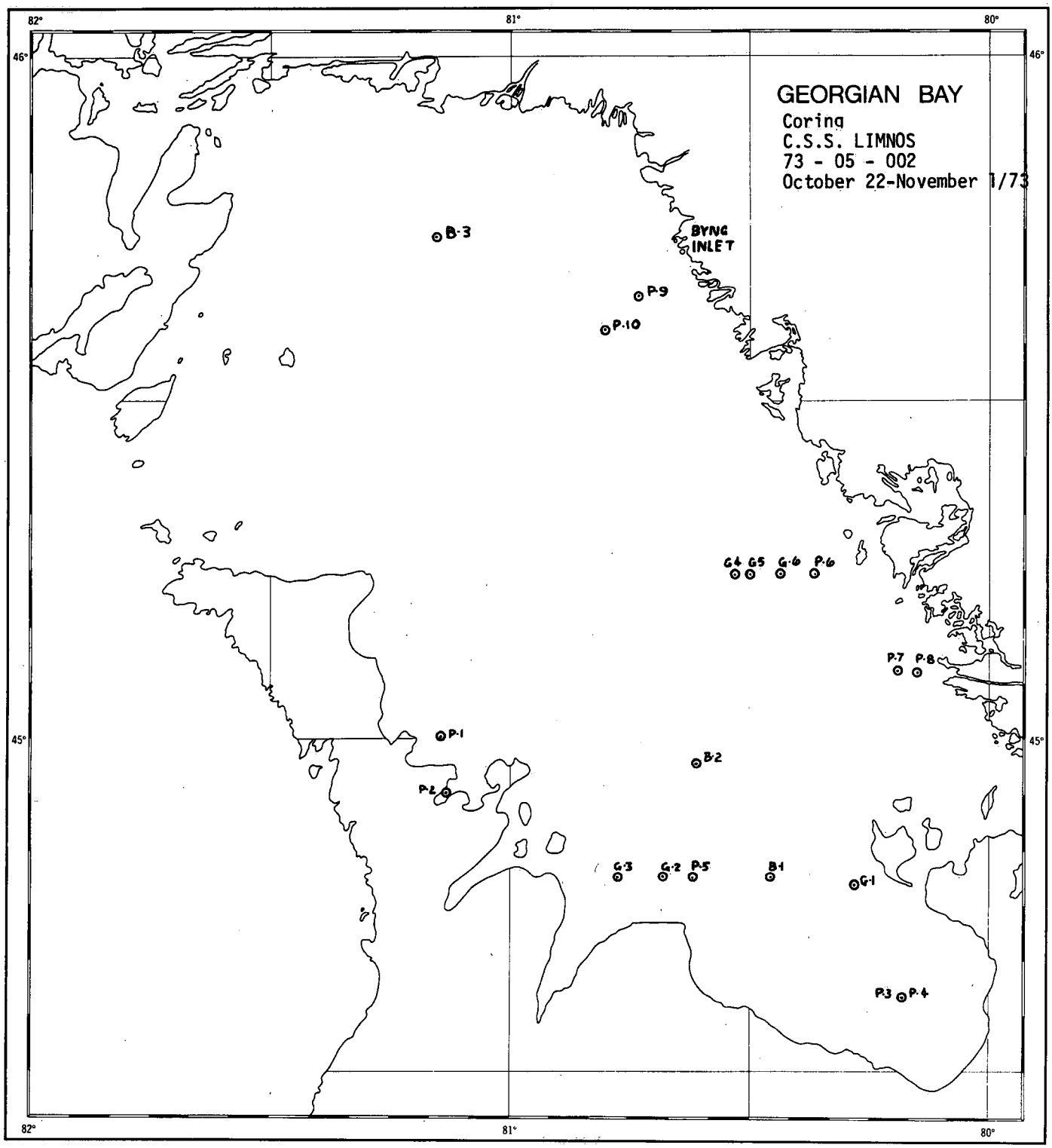
Station Number	Latitude N.	Longitude W.
Demonstration	43° 18′ 00″	79° 43′ 00″
"	43° 19′ 00″	79° 41′ 00″
"	43° 19′ 30″	79° 36′ 30″
"	43° 22′ 00″	79° 35′ 00″
"	43° 16′ 30″	79° 52′ 12″
"	43° 17′ 00″	79° 50′ 00″
MO–14	43° 19′ 58″	79° 43′ 36″
WB	43° 24′ 06″	79° 26′ 42″
CB	43° 33′ 00″	78° 10′ 24″
F 18	43° 34′ 24″	78° 05′ 30″
E 20	43° 30′ 12″	77° 54′ 00″
D 30	43° 25′ 48″	76° 53′ 30″
E 30	43° 30′ 42″	76° 54′ 00″
F 30	43° 34′ 48″	76° 54′ 00″
H 30	43° 43′ 18″	76° 54′ 00″
G 34	43° 38′ 30″	76° 28′ 54″
G 35	43° 38′ 54″	76° 24′ 00″
G 36	43° 39′ 00″	76° 18′ 06″
KB 3	43° 59′ 00″	76° 39′ 30″
K B	44° 04′ 43″	76° 24′ 43″


LAKE ONTARIO
Track Plot
73 - 00 - 105
April 10 - 12, 1973
H30
KB
KB30
F30
E30
G34
G35
G36
D30
E20
F18
CB
WB
MOG14
2
76°
77°
78°
79°
80°
44°
43°

PHASE II

LAKE HURON, GEORGIAN BAY
1973
CORING STATIONS

Station Number	Latitude N.	Longitude W.	Observations
P–1	44° 59′ 59″	81° 08′ 10″	piston core – 50 ft.
P–2	44° 55′ 04″	81° 07′ 10″	piston core – 50 ft.
P–3	44° 36′ 54″	80° 10′ 51″	piston core – 50 ft.
P–4	44° 36′ 54″	80° 10′ 51″	piston core – 50 ft.
P–5	44° 47′ 46″	80° 37′ 00″	piston core – 60 ft.
P–6	45° 14′ 30″	80° 21′ 54″	piston core – 60 ft.
P–7	45° 06′ 28″	80° 11′ 50″	piston core – 60 ft.
P–8	45° 06′ 20″	80° 09′ 04″	piston core – 20 ft.
P–9	45° 39′ 06″	80° 44′ 40″	piston core – 40 ft.
P–10	45° 36′ 30″	80° 48′ 25″	piston core – 60 ft.
G–1	44° 46′ 54″	80° 16′ 15″	1200 lb. gravity core
G–2	44° 47′ 54″	80° 40′ 36″	1200 lb. gravity core
G–3	44° 47′ 30″	80° 45′ 54″	1200 lb. gravity core
G–4	45° 14′ 36″	80° 31′ 36″	1200 lb. gravity core
G–5	45° 14′ 36″	80° 30′ 06″	1200 lb. gravity core
G–6	45° 14′ 36″	80° 26′ 07″	Benthos core
B–1	44° 47′ 45″	80° 27′ 30″	Benthos core
B–2	44° 57′ 54″	80° 36′ 54″	Benthos core
B–3	45° 44′ 00″	81° 09′ 42″	No observations

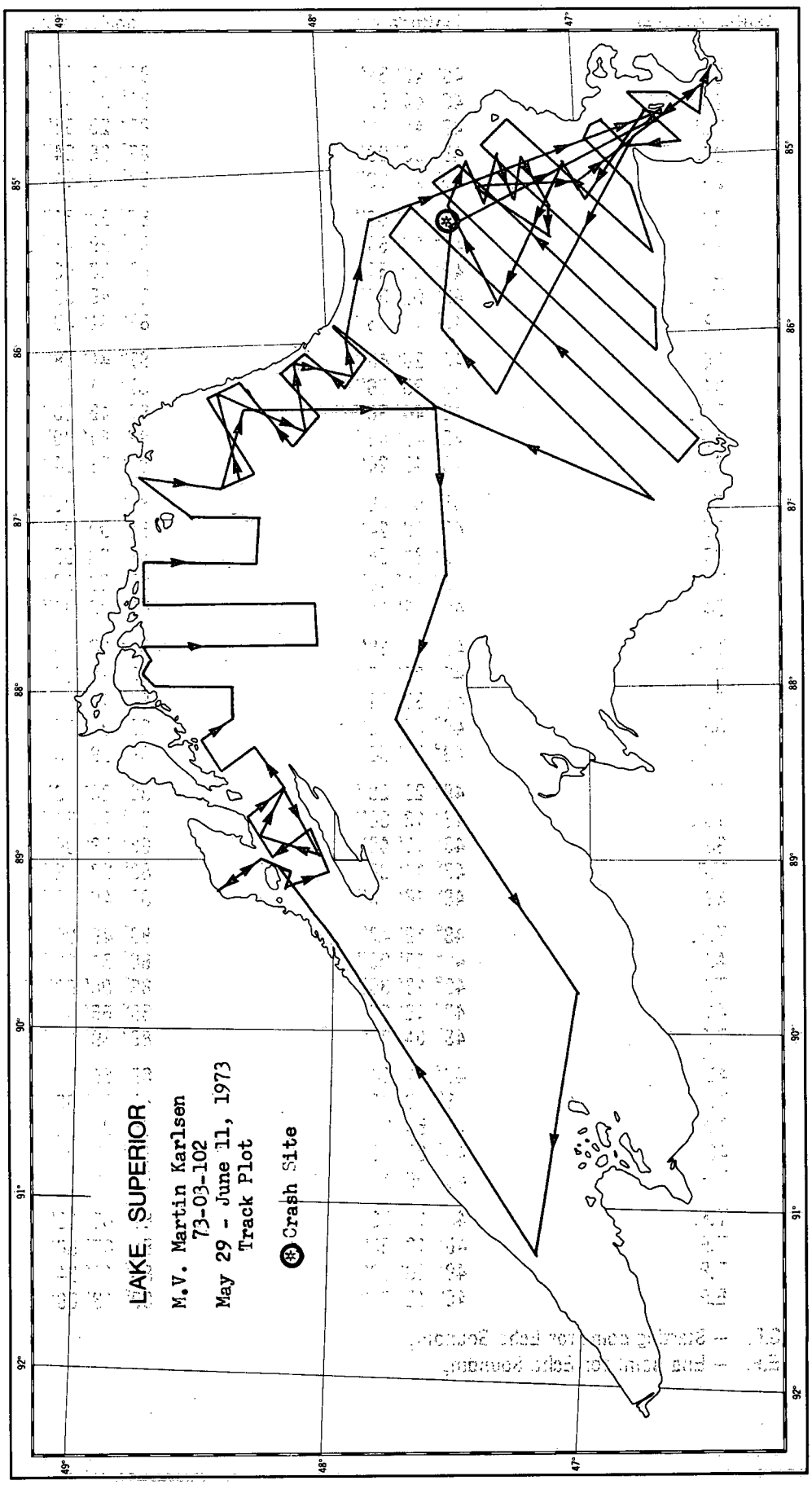

GEORGIAN BAY
Coring
C.S.S. LIMNOS
73 - 05 - 002
October 22-November 1/73
82°
81°
80°
46°
45°
B-3
BYNG INLET
P-9
P-10
G-4
G-5
G-6
P-6
P-7
P-8
P-1
P-2
B-2
G-3
G-2
P-5
B-1
G-1
P-3
P-4

LAKE SUPERIOR
1973
CORING STATIONS

Station Number	Latitude N.	Longitude W.
1	47° 09′ 42″	85° 21′ 00″
2	47° 31′ 48″	87° 01′ 48″
3	48° 29′ 12″	87° 38′ 00″
4	48° 13′ 18″	88° 56′ 30″
5	47° 29′ 00″	89° 29′ 18″
6	47° 18′ 12″	91° 10′ 36″
S.P.	47° 58′ 12″	85° 51′ 06″
7	47° 53′ 48″	86° 00′ 00″
T.P.	47° 50′ 18″	86° 06′ 12″
8	47° 53′ 42″	86° 11′ 18″
T.P.	47° 56′ 36″	86° 15′ 30″
9	48° 00′ 00″	86° 10′ 18″
T.P.	48° 04′ 54″	86° 03′ 00″
10	48° 07′ 00″	86° 07′ 00″
T.P.	48° 11′ 18″	86° 08′ 48″
11	48° 07′ 00″	86° 16′ 54″
T.P.	48° 03′ 30″	86° 23′ 24″
12	48° 06′ 18″	86° 28′ 18″
T.P.	48° 09′ 12″	86° 33′ 36″
13	48° 14′ 48″	86° 22′ 36″
T.P.	48° 20′ 06″	86° 12′ 42″
14	48° 24′ 48″	86° 15′ 24″
T.P.	48° 28′ 00″	86° 18′ 00″
15	48° 22′ 42″	86° 29′ 30″
T.P.	48° 16′ 48″	86° 42′ 48″
16	48° 19′ 48″	86° 46′ 00″
T.P.	48° 22′ 48″	86° 50′ 00″
17	48° 30′ 00″	86° 42′ 54″
T.P.	48° 39′ 24″	86° 33′ 36″
18	48° 41′ 12″	86° 39′ 30″
T.P.	48° 43′ 12″	86° 46′ 00″
19	48° 35′ 54″	86° 53′ 48″
T.P.	48° 30′ 06″	87° 00′ 00″
20	48° 23′ 12″	87° 00′ 00″
T.P.	48° 17′ 36″	87° 00′ 00″
21	48° 17′ 36″	87° 07′ 06″
T.P.	48° 17′ 36″	87° 13′ 12″
22	48° 22′ 00″	87° 13′ 18″
23	48° 33′ 54″	87° 14′ 00″
T.P.	48° 44′ 24″	87° 14′ 12″

Station Number	Latitude N.	Longitude W.
T.P.	48° 43′ 54″	87° 20′ 00″
24	48° 44′ 00″	87° 21′ 30″
T.P.	48° 44′ 18″	87° 29′ 54″
25	48° 33′ 00″	87° 29′ 54″
26	48° 21′ 00″	87° 29′ 54″
27	48° 11′ 06″	87° 29′ 54″
T.P.	48° 00′ 54″	87° 29′ 48″
28	48° 00′ 54″	87° 38′ 00″
T.P.	48° 00′ 54″	87° 45′ 00″
29	48° 10′ 18″	87° 44′ 00″
30	48° 20′ 48″	87° 44′ 48″
31	48° 33′ 26″	87° 44′ 48″
T.P.	48° 44′ 36″	87° 45′ 06″
T.P.	48° 42′ 48″	87° 51′ 00″
32	48° 43′ 24″	87° 53′ 24″
T.P.	48° 41′ 48″	87° 55′ 00″
T.P.	48° 40′ 24″	88° 00′ 00″
33	48° 31′ 54″	88° 00′ 00″
T.P.	48° 21′ 18″	88° 00′ 00″
34	48° 21′ 18″	88° 05′ 00″
T.P.	48° 21′ 18″	88° 10′ 18″
35	48° 25′ 42″	88° 14′ 06″
T.P.	48° 30′ 12″	88° 18′ 00″
36	48° 25′ 48″	88° 24′ 06″
T.P.	48° 23′ 06″	88° 29′ 30″
37	48° 20′ 06″	88° 26′ 00″
T.P.	48° 16′ 06″	88° 21′ 24″
38	48° 12′ 48″	88° 29′ 06″
T.P.	48° 11′ 00″	88° 33′ 12″
39	48° 16′ 15″	88° 40′ 18″
T.P.	48° 19′ 42″	88° 45′ 00″
40	48° 17′ 06″	88° 51′ 30″
T.P.	48° 13′ 36″	89° 00′ 00″
41	48° 10′ 00″	88° 55′ 42″
T.P.	48° 04′ 30″	88° 49′ 12″
42	48° 01′ 54″	88° 55′ 18″
T.P.	48° 02′ 12″	88° 58′ 06″
T.P.	47° 59′ 36″	89° 01′ 42″
43	48° 05′ 30″	89° 07′ 06″
T.P.	48° 09′ 18″	89° 10′ 30″
T.P.	48° 11′ 00″	89° 06′ 12″
T.P.	48° 12′ 00″	89° 07′ 06″
T.P.	48° 10′ 12″	89° 11′ 24″
E.P.	48° 12′ 06″	89° 13′ 06″

S.P. – Starting point for Echo Sounding.
E.P. – End point for Echo Sounding.


LAKE SUPERIOR
M.V. Martin Karlsen
73-03-102
May 29 - June 11, 1973
Track Plot
Crash Site
49°
48°
47°
92°
91°
90°
89°
88°
87°
86°
85°

LAKE HURON, GEORGIAN BAY
1973
REGIONAL SEDIMENT SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
A–13	44° 31′ 12″	80° 07′ 06″
B–13	44° 36′ 48″	80° 07′ 30″
B–12	44° 36′ 48″	80° 14′ 24″
B–11	44° 36′ 48″	80° 22′ 12″
B–10	44° 36′ 12″	80° 29′ 30″
C–9	44° 42′ 12″	80° 37′ 24″
C–10	44° 42′ 15″	80° 29′ 42″
C–11	44° 42′ 13″	80° 22′ 08″
C–12	44° 42′ 10″	80° 14′ 34″
C–13	44° 42′ 07″	80° 06′ 59″
D–12	44° 47′ 34″	80° 14′ 29″
D–11	44° 47′ 37″	80° 22′ 04″
D–10	44° 47′ 39″	80° 29′ 40″
D–9	44° 47′ 36″	80° 37′ 06″
D–8	44° 47′ 48″	80° 45′ 00″
D–7	44° 47′ 42″	80° 52′ 18″
E–6	44° 53′ 06″	80° 59′ 54″
E–7	44° 53′ 06″	80° 52′ 24″
E–8	44° 53′ 06″	80° 44′ 42″
F–8	44° 58′ 36″	80° 44′ 36″
F–7	44° 58′ 30″	80° 52′ 12″
F–5	44° 58′ 32″	81° 07′ 30″
G–4	45° 04′ 56″	81° 15′ 10″
G–5	45° 03′ 54″	81° 07′ 00″
H–5	45° 09′ 24″	81° 07′ 30″
H–4	45° 09′ 24″	81° 15′ 06″
F–6	44° 58′ 36″	81° 00′ 00″
G–6	45° 03′ 54″	81° 00′ 00″
H–6	45° 09′ 18″	81° 00′ 00″
H–7	45° 09′ 18″	80° 52′ 18″
G–7	45° 03′ 48″	80° 52′ 18″
G–8	45° 03′ 54″	80° 44′ 36″
G–9	45° 03′ 54″	80° 37′ 12″
F–9	44° 58′ 30″	80° 37′ 10″
E–9	44° 53′ 00″	80° 37′ 10″
E–10	44° 53′ 00″	80° 29′ 30″
E–11	44° 53′ 00″	80° 22′ 00″
E–13	44° 52′ 54″	80° 06′ 48″
E–14	44° 52′ 54″	79° 59′ 12″
F–13	44° 58′ 18″	80° 06′ 48″

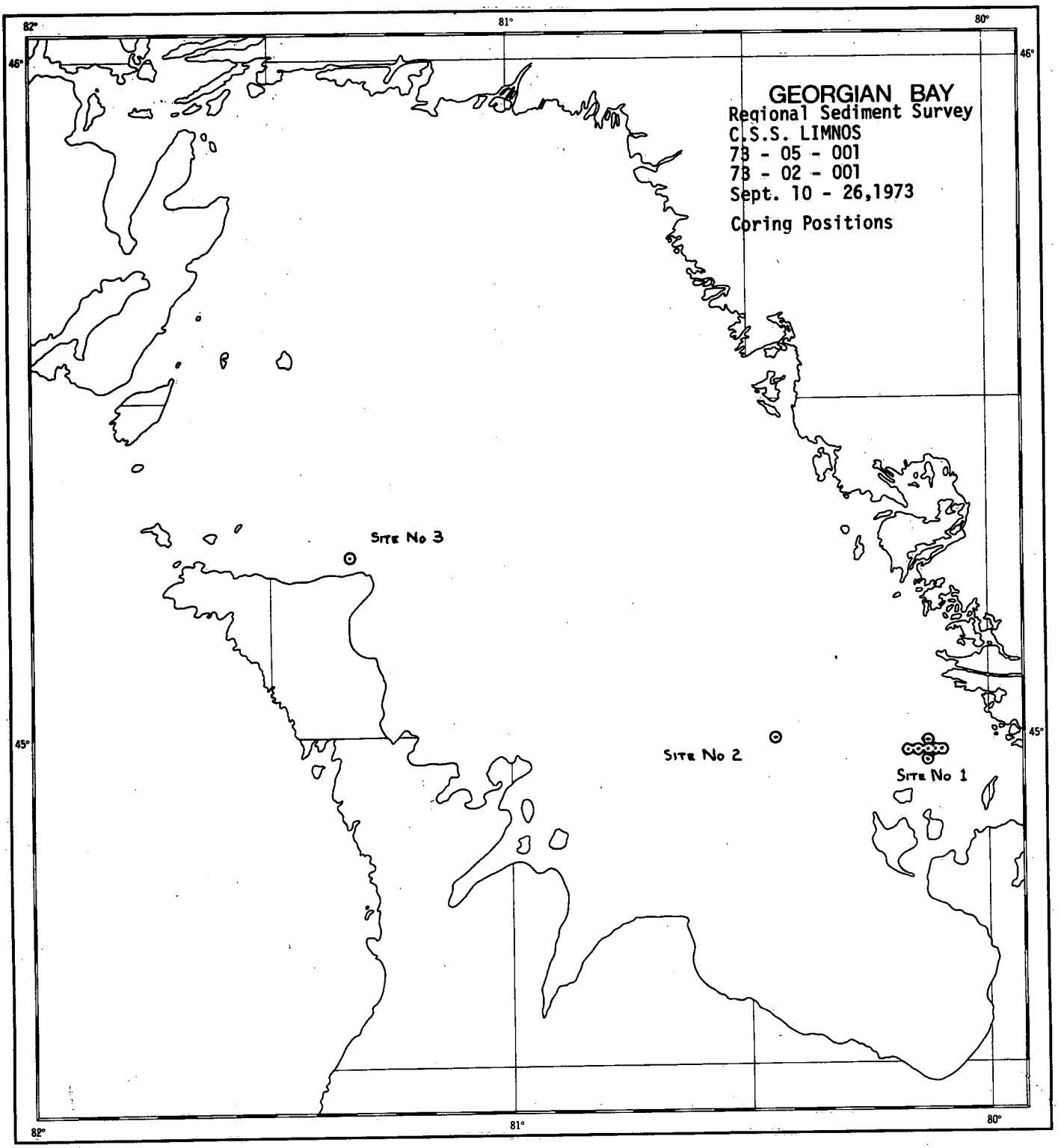
Station Number	Latitude N.	Longitude W.
F–12	44° 58′ 24″	80° 14′ 24″
F–11	44° 58′ 24″	80° 22′ 00″
F–10	44° 58′ 30″	80° 29′ 30″
G–10	45° 04′ 00″	80° 29′ 30″
G–11	45° 03′ 48″	80° 21′ 54″
G–12	45° 03′ 48″	80° 14′ 18″
G–13	45° 03′ 42″	80° 06′ 48″
H–12	45° 09′ 10″	80° 14′ 06″
H–11	45° 09′ 24″	80° 26′ 53″
H–10	45° 09′ 24″	80° 29′ 30″
H–9	45° 09′ 24″	80° 37′ 06″
H–8	45° 09′ 24″	80° 44′ 48″
I–8	45° 14′ 43″	80° 44′ 43″
I–7	45° 14′ 43″	80° 52′ 24″
I–6	45° 14′ 30″	81° 00′ 00″
I–5	45° 14′ 36″	81° 07′ 36″
I–4	45° 14′ 42″	81° 15′ 18″
I–3	45° 14′ 42″	81° 23′ 00″
I–2	45° 14′ 42″	81° 30′ 36″
J–1	45° 20′ 00″	81° 38′ 18″
J–2	45° 20′ 06″	81° 30′ 30″
J–3	45° 20′ 06″	81° 23′ 06″
J–4	45° 20′ 06″	81° 15′ 12″
J–5	45° 20′ 06″	81° 07′ 36″
J–6	45° 20′ 06″	81° 00′ 00″
J–7	45° 20′ 06″	80° 52′ 24″
J–8	45° 20′ 06″	80° 44′ 36″
I–9	45° 14′ 41″	80° 37′ 05″
I–10	45° 14′ 41″	80° 29′ 40″
I–11	45° 14′ 36″	80° 21′ 54″
J–10	45° 20′ 00″	80° 29′ 18″
K–10	45° 25′ 30″	80° 29′ 12″
J–9	45° 20′ 12″	80° 37′ 06″
K–9	45° 25′ 24″	80° 37′ 00″
K–8	45° 25′ 30″	80° 44′ 42″
K–7	45° 25′ 36″	80° 52′ 18″
K–6	45° 26′ 00″	81° 00′ 06″
K–5	45° 25′ 32″	81° 07′ 48″
K–4	45° 25′ 32″	81° 15′ 06″
K–3	45° 25′ 32″	81° 22′ 54″
K–2	45° 25′ 32″	81° 30′ 45″
K–1	45° 25′ 32″	81° 38′ 30″
L–1	45° 30′ 48″	81° 38′ 24″
L–2	45° 30′ 54″	81° 30′ 42″
L–3	45° 30′ 54″	81° 23′ 03″

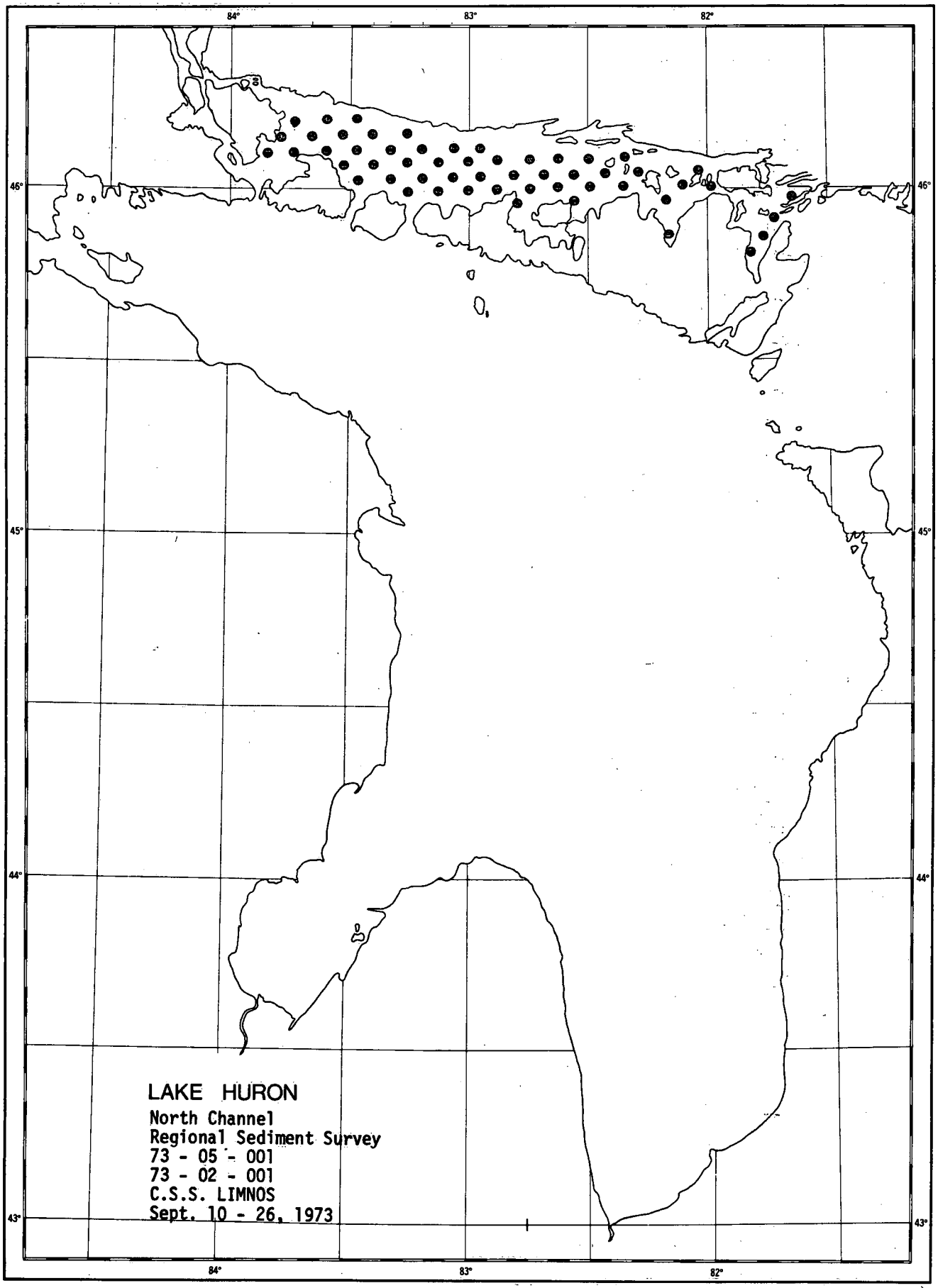
Station Number	Latitude N.	Longitude W.
L–4	45° 30′ 54″	81° 15′ 24″
L–5	45° 30′ 54″	81° 07′ 52″
L–6	45° 30′ 55″	81° 00′ 00″
L–7	45° 31′ 03″	80° 52′ 20″
L–8	45° 31′ 06″	80° 44′ 30″
L–9	45° 30′ 56″	80° 37′ 00″
M–9	45° 36′ 18″	80° 36′ 56″
M–8	45° 36′ 20″	80° 44′ 50″
M–7	45° 36′ 20″	80° 52′ 20″
M–6	45° 36′ 20″	81° 00′ 00″
M–5	45° 36′ 20″	81° 07′ 48″
M–4	45° 36′ 20″	81° 15′ 30″
M–3	45° 36′ 30″	81° 23′ 06″
M–2	45° 36′ 20″	81° 30′ 50″
M–1	45° 36′ 20″	81° 38′ 40″
N–1	45° 41′ 25″	81° 38′ 40″
N–2	45° 41′ 25″	81° 30′ 54″
N–3	45° 41′ 00″	81° 22′ 50″
N–4	45° 41′ 42″	81° 15′ 20″
N–5	45° 41′ 42″	81° 07′ 30″
N–6	45° 41′ 42″	81° 00′ 00″
N–7	45° 41′ 42″	80° 52′ 20″
N–8	45° 41′ 42″	80° 44′ 45″
O–8	45° 47′ 06″	80° 44′ 36″
O–7	45° 47′ 06″	80° 52′ 20″
O–6	45° 47′ 06″	81° 00′ 00″
P–6	45° 52′ 36″	81° 00′ 00″
P–5	45° 52′ 36″	81° 07′ 50″
O–5	45° 47′ 09″	81° 07′ 50″
O–4	45° 47′ 09″	81° 15′ 25″
P–4	45° 52′ 36″	81° 15′ 25″
P–3	45° 52′ 36″	81° 23′ 15″
O–3	45° 47′ 06″	81° 23′ 15″
O–2	45° 47′ 06″	81° 31′ 00″
P–2	45° 52′ 40″	81° 30′ 56″
J–13	45° 19′ 54″	80° 06′ 24″

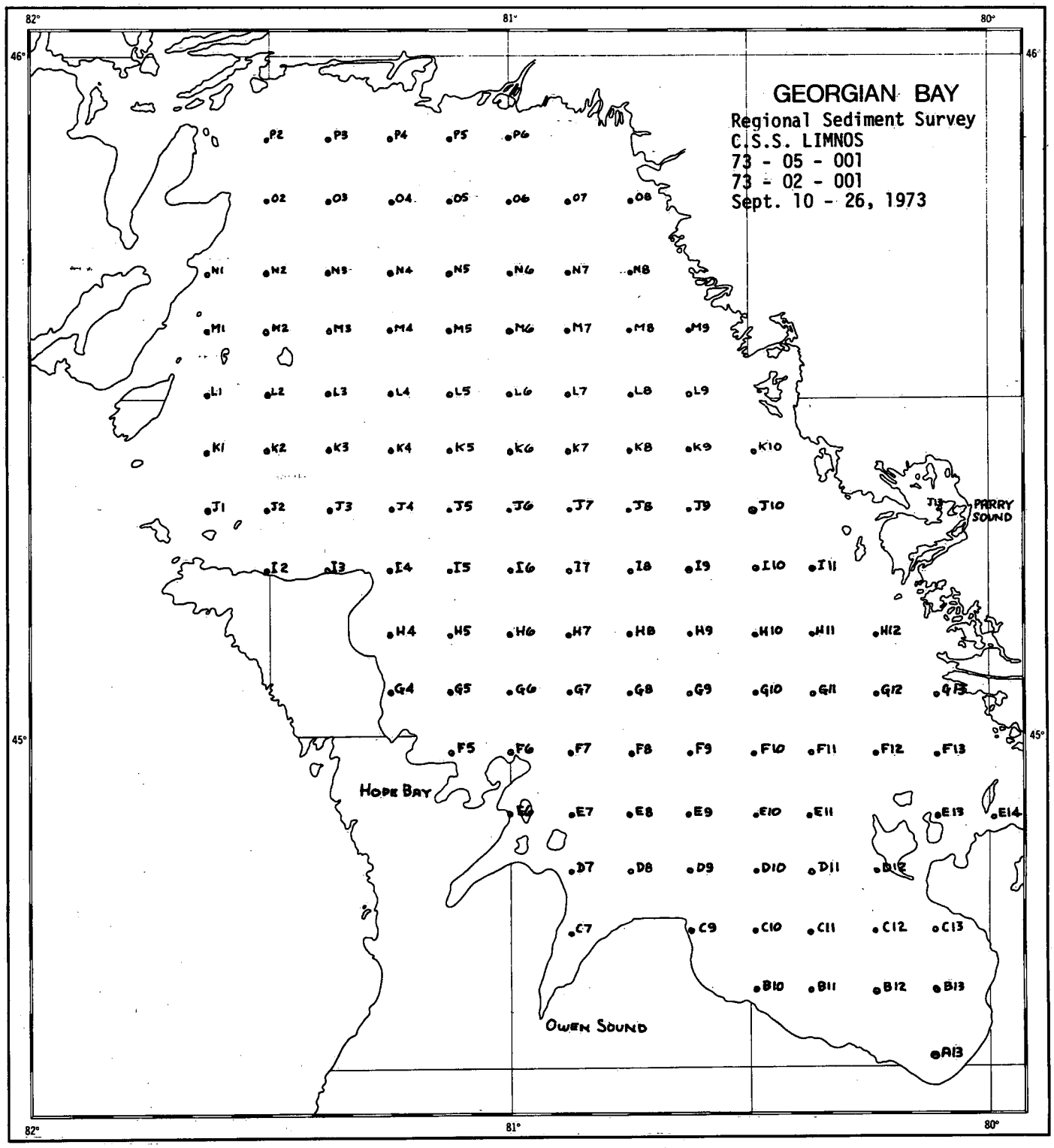
LAKE HURON, NORTH CHANNEL
1973
REGIONAL SEDIMENT SURVEY STATIONS

Station Number	Latitude N.	Longitude W.
C–34	45° 54′ 52″	81° 42′ 30″
D–35	45° 58′ 00″	81° 39′ 00″
B–33	45° 52′ 18″	81° 45′ 20″
A–32	45° 49′ 35″	81° 49′ 00″
E–31	46° 00′ 45″	81° 58′ 20″
F–30	46° 03′ 06″	82° 02′ 06″
E–29	46° 00′ 30″	82° 05′ 50″
B–28	45° 52′ 10″	82° 09′ 30″
D–28	45° 57′ 30″	82° 09′ 48″
F–26	46° 02′ 54″	82° 17′ 30″
G–25	46° 05′ 18″	82° 21′ 18″
E–25	46° 00′ 06″	82° 21′ 00″
F–24	46° 02′ 36″	82° 25′ 24″
E–23	46° 00′ 00″	82° 29′ 12″
D–22	45° 57′ 18″	82° 32′ 54″
E–21	46° 00′ 06″	82° 37′ 00″
F–22	46° 02′ 42″	82° 33′ 06″
G–23	46° 05′ 18″	82° 29′ 00″
G–21	46° 05′ 06″	82° 37′ 03″
G–19	46° 05′ 18″	82° 44′ 48″
E–20	46° 02′ 36″	82° 40′ 48″
E–19	45° 59′ 48″	82° 44′ 15″
D–18	45° 57′ 06″	82° 48′ 18″
F–18	46° 02′ 29″	82° 48′ 06″
E–17	45° 59′ 54″	82° 52′ 36″
E–15	45° 59′ 42″	83° 00′ 12″
F–16	46° 02′ 18″	82° 56′ 18″
G–17	46° 05′ 12″	82° 52′ 29″
H–16	46° 07′ 48″	82° 56′ 30″
G–15	46° 05′ 00″	83° 00′ 15″
F–14	46° 02′ 12″	83° 04′ 06″
E–13	45° 59′ 30″	83° 07′ 56″
E–11	45° 59′ 00″	83° 15′ 48″
F–12	46° 02′ 06″	83° 11′ 50″
G–13	46° 04′ 48″	83° 07′ 54″
H–14	46° 07′ 36″	83° 04′ 18″
H–12	46° 07′ 24″	83° 12′ 03″
I–11	46° 10′ 00″	83° 15′ 42″
H–10	46° 07′ 24″	83° 19′ 48″
G–11	46° 04′ 48″	83° 15′ 36″

Station Number	Latitude N.	Longitude W.
G–9	46° 04′ 27″	83° 23′ 18″
H–8	46° 07′ 12″	83° 27′ 36″
I–9	46° 09′ 54″	83° 23′ 18″
J–8	46° 12′ 36″	83° 27′ 48″
I–7	46° 09′ 48″	83° 31′ 36″
J–6	46° 12′ 30″	83° 35′ 39″
I–5	46° 09′ 36″	83° 39′ 48″
J–4	46° 12′ 12″	83° 43′ 12″
I–3	46° 09′ 15″	83° 47′ 00″
H–2	46° 06′ 36″	83° 50′ 48″
H–4	46° 06′ 48″	83° 43′ 03″
H–6	46° 07′ 06″	83° 35′ 14″
G–7	46° 04′ 18″	83° 31′ 12″
F–8	46° 02′ 35″	83° 27′ 18″
F–10	46° 01′ 54″	83° 19′ 54″


GEORGIAN BAY
Regional Sediment Survey
C.S.S. LIMNOS
73 - 05 - 001
73 - 02 - 001
Sept. 10 - 26,1973
Coring Positions
SITE No 3
SITE No 2
SITE No 1
82°
81°
80°
46°
45°


84°
83°
82°
46°
45°
44°
43°
LAKE HURON
North Channel
Regional Sediment Survey
73 - 05 - 001
73 - 02 - 001
C.S.S. LIMNOS
Sept. 10 - 26, 1973


GEORGIAN BAY
Regional Sediment Survey
C.S.S. LIMNOS
73 - 05 - 001
73 - 02 - 001
Sept. 10 - 26, 1973
82°
81°
80°
46°
45°
PARRY SOUND
HOPE BAY
OWEN SOUND

LAKE SUPERIOR
1973
REGIONAL SEDIMENT SURVEY STATIONS

Station Number	Latitide N.	Longitude W.
1 D	46° 42′ 30″	91° 59′ 12″
1 E	46° 48′ 00″	92° 00′ 06″
2 D	46° 43′ 00″	91° 51′ 42″
2 E	46° 48′ 24″	91° 52′ 30″
3 D	46° 43′ 36″	91° 43′ 54″
3 E	46° 48′ 42″	91° 44′ 42″
3 F	46° 54′ 00″	91° 45′ 00″
4 E	46° 49′ 00″	91° 37′ 06″
4F	46° 54′ 18″	91° 37′ 06″
4 G	47° 00′ 12″	91° 38′ 06″
5 E	46° 49′ 12″	91° 28′ 54″
5 F	46° 54′ 48″	91° 29′ 00″
5 G	47° 00′ 30″	91° 29′ 06″
5 H	47° 05′ 48″	91° 29′ 18″
6 E	46° 49′ 36″	91° 20′ 42″
6 F	46° 55′ 00″	91° 21′ 06″
6 G	47° 00′ 42″	91° 21′ 48″
6H	47° 06′ 36″	91° 22′ 00″
6 I	47° 11′ 00″	91° 22′ 06″
7 F	46° 55′ 36″	91° 13′ 00″
7 G	47° 01′ 00″	91° 13′ 48″
7 H	47° 06′ 24″	91° 13′ 54″
7 I	47° 11′ 12″	91° 14′ 00″
7 J	47° 16′ 42″	91° 14′ 12″
8 F	46° 55′ 48″	91° 05′ 42″
8 G	47° 01′ 18″	91° 05′ 42″
8 H	47° 06′ 42″	91° 06′ 30″
8 I	47° 11′ 36″	91° 06′ 30″
8 J	47° 17′ 06″	91° 07′ 18″
8 K	47° 22′ 36″	91° 07′ 42″
9 G	47° 01′ 18″	90° 54′ 42″
9 H	47° 06′ 54″	90° 58′ 24″
9 I	47° 12′ 00″	90° 58′ 48″
9 J	47° 17′ 24″	90° 59′ 00″
9 K	47° 23′ 00″	90° 59′ 06″
9 L	47° 28′ 12″	90° 59′ 54″
10 H	47° 07′ 00″	90° 50′ 24″
10 I	47° 12′ 12″	90° 50′ 56″
10 J	47° 17′ 54″	90° 51′ 12″
10 K	47° 23′ 12″	90° 52′ 00″

Station Number	Latitude N.	Longitude W.
10 L	47° 28′ 36″	90° 52′ 24″
11 D	46° 45′ 30″	90° 40′ 42″
11 H	47° 07′ 24″	90° 42′ 12″
11 I	47° 12′ 36″	90° 42′ 54″
11 J	47° 17′ 54″	90° 43′ 06″
11 K	47° 23′ 12″	90° 43′ 42″
11 L	47° 29′ 00″	90° 44′ 06″
11 M	47° 34′ 12″	90° 44′ 54″
12 I	47° 13′ 00″	90° 35′ 12″
12 K	47° 23′ 36″	90° 36′ 18″
12 M	47° 34′ 18″	90° 36′ 48″
13 D	46° 47′ 18″	90° 20′ 48″
13 H	47° 07′ 48″	90° 26′ 00″
13 J	47° 18′ 30″	90° 26′ 54″
13 L	47° 29′ 00″	90° 27′ 12″
14 C	46° 40′ 54″	90° 16′ 42″
14 E	46° 51′ 30″	90° 17′ 06″
14 G	47° 02′ 36″	90° 17′ 42″
14 I	47° 13′ 12″	90° 18′ 12″
14 K	47° 24′ 06″	90° 19′ 06″
14 M	47° 34′ 42″	90° 20′ 30″
15 D	46° 46′ 48″	90° 09′ 00″
15 F	46° 57′ 06″	90° 09′ 36″
15 H	47° 08′ 24″	90° 10′ 00″
15 J	47° 18′ 54″	90° 10′ 00″
15 L	47° 29′ 54″	90° 11′ 48″
15 N	47° 40′ 07″	90° 12′ 18″
16 C	46° 42′ 00″	90° 00′ 54″
16 E	46° 51′ 54″	90° 02′ 00″
16 G	47° 03′ 00″	90° 02′ 18″
16 I	47° 13′ 42″	90° 03′ 00″
16 K	47° 24′ 18″	90° 04′ 00″
16 M	47° 35′ 18″	90° 04′ 06″
16 O	47° 46′ 18″	90° 04′ 54″
17 D	46° 47′ 00″	89° 53′ 00″
17 F	46° 57′ 24″	89° 54′ 00″
17 H	47° 08′ 42″	89° 54′ 18″
17 J	47° 19′ 18″	89° 54′ 18″
17 L	47° 30′ 18″	89° 55′ 18″
17 N	47° 41′ 02″	89° 56′ 06″
18 E	46° 52′ 24″	89° 45′ 54″
18 G	47° 03′ 18″	89° 46′ 18″
18 I	47° 13′ 54″	89° 46′ 24″
18 K	47° 25′ 96″	89° 47′ 12″
18 M	47° 35′ 48″	89° 47′ 12″

Station Number	Latitude N.	Longitude W.
18 O	47° 46′ 48″	89° 48′ 18″
19 F	46° 57′ 48″	89° 38′ 00″
19 H	47° 08′ 54″	89° 38′ 36″
19 J	47° 19′ 54″	89° 39′ 06″
19 L	47° 30′ 06″	89° 39′ 12″
19 N	47° 41′ 48″	89° 40′ 42″
19 P	47° 52′ 12″	89° 40′ 00″
20 E	46° 52′ 48″	89° 29′ 24″
20 G	47° 03′ 42″	89° 30′ 00″
20 I	47° 14′ 30″	89° 30′ 48″
20 K	47° 25′ 12″	89° 31′ 06″
20 M	47° 36′ 06″	89° 31′ 06″
20 O	47° 47′ 00″	89° 33′ 00″
20 Q	47° 57′ 48″	89° 33′ 30″
21 F	46° 58′ 18″	89° 22′ 00″
21 H	47° 09′ 06″	89° 22′ 12″
21 J	47° 20′ 06″	89° 22′ 48″
21 L	47° 30′ 48″	89° 23′ 42″
21 N	47° 41′ 48″	89° 24′ 54″
21 P	47° 52′ 42″	89° 25′ 00″
21 Q	47° 58′ 00″	89° 25′ 24″
22 G	47° 03′ 48″	89° 14′ 06″
22 I	47° 14′ 42″	89° 14′ 48″
22 K	47° 25′ 06″	89° 15′ 06″
22 M	47° 36′ 36″	89° 16′ 00″
22 O	47° 47′ 33″	89° 16′ 36″
22 Q	47° 58′ 06″	89° 17′ 00″
22 R	48° 03′ 24″	89° 17′ 06″
23 H	47° 09′ 42″	89° 06′ 42″
23 J	47° 21′ 06″	89° 07′ 36″
23 L	47° 31′ 12″	89° 07′ 42″
23 N	47° 42′ 00″	89° 08′ 12″
23 Q	47° 58′ 12″	89° 08′ 48″
23 R	48° 03′ 48″	89° 08′ 42″
23 S	48° 09′ 00″	89° 08′ 54″
23 W	48° 25′ 18″	89° 09′ 12″
24 G	47° 04′ 18″	88° 59′ 00″
24 I	47° 15′ 06″	88° 59′ 54″
24 K	47° 26′ 00″	89° 00′ 00″
24 M	47° 37′ 00″	89° 00′ 00″
24 O	47° 47′ 48″	89° 00′ 54″
24 R	48° 03′ 54″	89° 01′ 06″
24 S	48° 09′ 12″	89° 01′ 24″
24 U	48° 20′ 12″	89° 02′ 00″
24 W	48° 24′ 36″	89° 02′ 00″

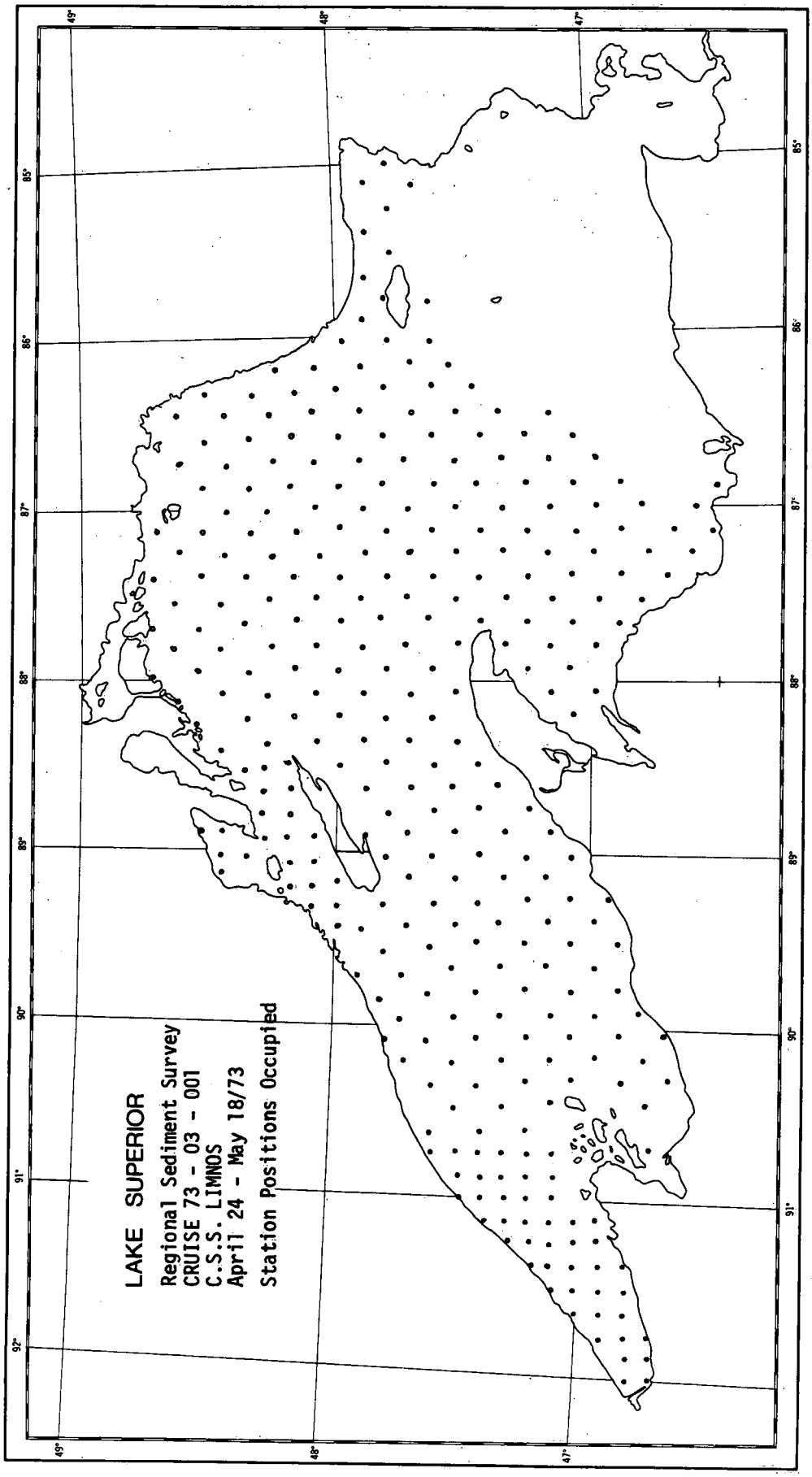
Station Number	Latitude N.	Longitude W.
25 H	47° 10′ 00″	88° 51′ 12″
25 J	47° 20′ 42″	88° 51′ 54″
25 L	47° 31′ 36″	88° 52′ 06″
25 N	47° 42′ 54″	88° 52′ 18″
25 P	47° 53′ 06″	88° 52′ 18″
25 R	48° 03′ 54″	88° 53′ 00″
25 S	48° 09′ 18″	88° 53′ 00″
25 T	48° 15′ 06″	88° 53′ 12″
25 W	48° 25′ 36″	88° 53′ 36″
25 X	48° 31′ 18″	88° 53′ 48″
26 I	47° 15′ 24″	88° 44′ 00″
26 K	47° 26′ 18″	88° 44′ 00″
26 M	47° 37′ 18″	88° 44′ 36″
26 O	47° 48′ 00″	88° 44′ 12″
26 S	48° 09′ 24″	88° 45′ 06″
26 T	48° 15′ 12″	88° 45′ 00″
28 J	47° 21′ 00″	88° 36′ 24″
28 L	47° 31′ 54″	88° 36′ 36″
28 N	47° 42′ 48″	88° 36′ 42″
28 P	47° 53′ 24″	88° 35′ 54″
28 S	48° 10′ 24″	88° 36′ 12″
28 T	48° 15′ 24″	88° 36′ 36″
28 U	48° 20′ 24″	88° 37′ 06″
29 K	47° 26′ 42″	88° 28′ 48″
29 M	47° 37′ 36″	88° 28′ 48″
29 O	47° 48′ 18″	88° 28′ 54″
29 Q	47° 58′ 54″	88° 28′ 48″
29 T	48° 15′ 18″	88° 28′ 12″
29 U	48° 20′ 42″	88° 27′ 42″
31 L	47° 32′ 12″	88° 19′ 36″
31 N	47° 43′ 00″	88° 20′ 00″
31 P	47° 53′ 42″	88° 20′ 54″
31 R	48° 04′ 24″	88° 20′ 54″
31 T	48° 15′ 18″	88° 21′ 06″
31 W	48° 26′ 12″	88° 21′ 06″
32 G	47° 04′ 54″	88° 11′ 12″
32 M	47° 37′ 42″	88° 11′ 24″
32 O	47° 48′ 24″	88° 11′ 54″
32 Q	47° 58′ 54″	88° 12′ 30″
32 S	48° 10′ 00″	88° 12′ 24″
32 U	48° 20′ 48″	88° 12′ 36″
32 X	48° 31′ 48″	88° 12′ 54″
33 F	46° 59′ 00″	88° 03′ 36″
33 H	47° 11′ 36″	88° 03′ 54″
33 L	47° 32′ 06″	88° 04′ 00″

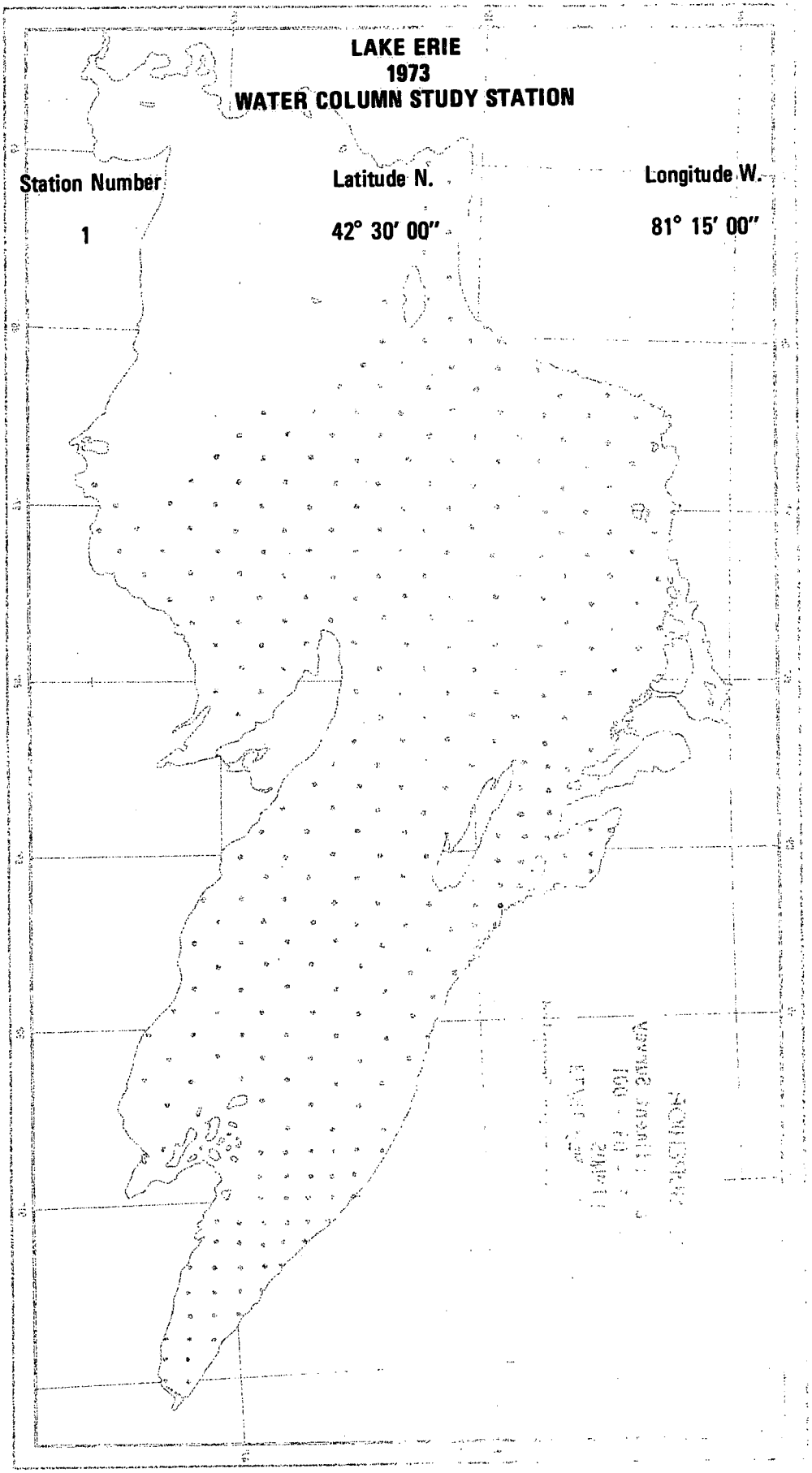
Station Number	Latitude N.	Longitude W.
33 N	47° 42′ 54″	88° 04′ 06″
33 P	47° 53′ 48″	88° 04′ 00″
33 R	48° 04′ 48″	88° 04′ 12″
33 T	48° 15′ 36″	88° 04′ 48″
33 W	48° 26′ 00″	88° 04′ 54″
33 Y	48° 36′ 54″	88° 04′ 48″
34 G	47° 05′ 00″	87° 55′ 54″
34 I	47° 15′ 48″	87° 56′ 00″
34 M	47° 37′ 24″	87° 56′ 12″
34 O	47° 48′ 36″	87° 56′ 00″
34 Q	47° 59′ 00″	87° 56′ 06″
34 S	48° 10′ 00″	87° 56′ 06″
34 U	48° 20′ 42″	87° 56′ 06″
34 X	48° 32′ 00″	87° 56′ 12″
34 Z	48° 42′ 30″	87° 55′ 42″
36 F	46° 59′ 06″	87° 47′ 54″
36 H	47° 10′ 24″	87° 47′ 48″
36 J	47° 21′ 24″	87° 47′ 54″
36 L	47° 32′ 18″	87° 47′ 42″
36 N	47° 43′ 24″	87° 48′ 12″
36 P	47° 53′ 42″	87° 48′ 00″
36 R	48° 04′ 36″	87° 47′ 42″
36 T	48° 15′ 36″	87° 48′ 00″
36 W	48° 26′ 06″	87° 48′ 48″
36 Y	48° 36′ 54″	87° 48′ 00″
37 E	46° 54′ 18″	87° 40′ 00″
37 G	47° 05′ 06″	87° 40′ 00″
37 I	47° 16′ 00″	87° 40′ 00″
37 K	47° 27′ 12″	87° 40′ 00″
37 M	47° 38′ 12″	87° 39′ 42″
37 O	47° 48′ 42″	87° 40′ 54″
37 Q	47° 59′ 06″	87° 39′ 30″
37 S	48° 10′ 06″	87° 40′ 00″
37 U	48° 20′ 54″	87° 40′ 00″
37 X	48° 31′ 54″	87° 40′ 00″
37 Z	48° 42′ 36″	87° 40′ 00″
38 D	46° 49′ 54″	87° 32′ 00″
38 F	46° 59′ 48″	87° 32′ 00″
38 H	47° 10′ 48″	87° 32′ 00″
38 J	47° 21′ 24″	87° 31′ 30″
38 L	47° 32′ 54″	87° 31′ 48″
38 N	47° 43′ 06″	87° 32′ 30″
38 P	47° 54′ 06″	87° 33′ 06″
38 R	48° 04′ 54″	87° 31′ 24″
38 T	48° 15′ 36″	87° 31′ 54″

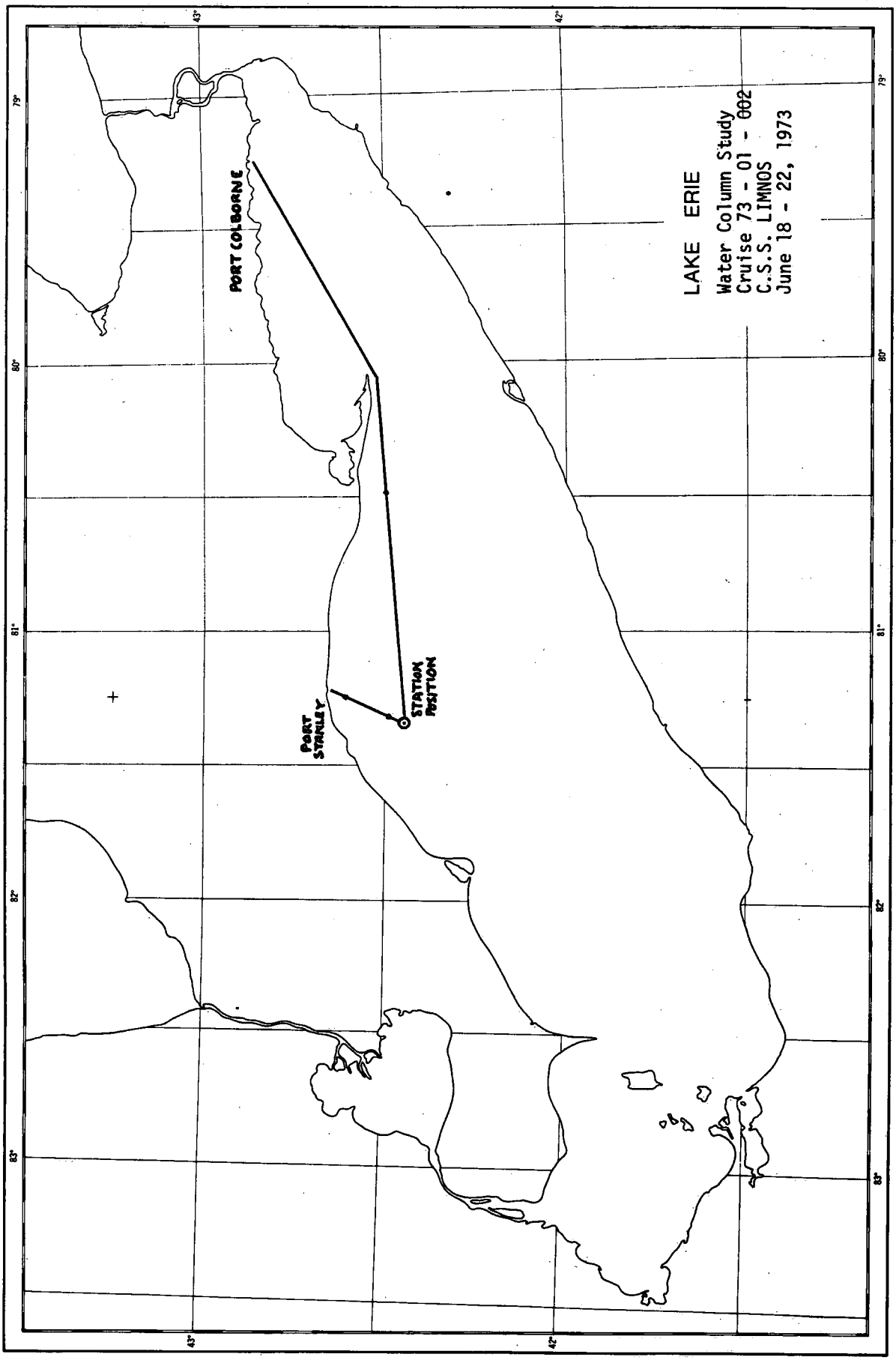
Station Number	Latitude N.	Longitude W.
38 W	48° 26′ 24″	87° 31′ 42″
38 Y	48° 37′ 00″	87° 32′ 00″
39 C	46° 43′ 48″	87° 23′ 54″
39 E	46° 54′ 24″	87° 23′ 48″
39 G	47° 04′ 54″	87° 23′ 42″
39 I	47° 16′ 00″	87° 23′ 54″
39 K	47° 26′ 48″	87° 24′ 00″
39 M	47° 37′ 54″	87° 22′ 48″
39 O	47° 48′ 36″	87° 24′ 36″
39 Q	47° 59′ 42″	87° 25′ 00″
39 S	48° 10′ 00″	87° 25′ 00″
39 U	48° 21′ 00″	87° 24′ 06″
39 X	48° 31′ 54″	87° 24′ 48″
39 Z	48° 42′ 30″	87° 24′ 54″
40 B	46° 36′ 48″	87° 17′ 24″
40 D	46° 49′ 06″	87° 15′ 42″
40 F	47° 00′ 00″	87° 15′ 48″
40 H	47° 10′ 54″	87° 16′ 00″
40 J	47° 21′ 42″	87° 16′ 06″
40 L	47° 32′ 30″	87° 16′ 00″
40 N	47° 43′ 06″	87° 15′ 18″
40 P	47° 54′ 00″	87° 16′ 18″
40 R	48° 04′ 42″	87° 16′ 36″
40 T	48° 15′ 54″	87° 16′ 00″
40 W	48° 26′ 12″	87° 16′ 30″
40 Y	48° 37′ 00″	87° 16′ 36″
41 A	46° 32′ 54″	87° 07′ 54″
41 C	46° 44′ 12″	87° 08′ 00″
41 E	46° 54′ 24″	87° 08′ 48″
41 G	47° 05′ 06″	87° 08′ 00″
41 I	47° 16′ 18″	87° 08′ 30″
41 K	47° 27′ 06″	87° 08′ 00″
41 M	47° 38′ 00″	87° 08′ 00″
41 O	47° 48′ 30″	87° 08′ 12″
41 Q	47° 59′ 00″	87° 08′ 00″
41 S	48° 10′ 00″	87° 08′ 06″
41 U	48° 20′ 54″	87° 08′ 00″
41 X	48° 32′ 00″	87° 07′ 55″
41 Z	48° 42′ 30″	87° 08′ 00″
42 B	46° 38′ 48″	87° 00′ 00″
42 D	46° 49′ 00″	87° 00′ 00″
42 F	47° 00′ 00″	87° 00′ 00″
42 H	47° 11′ 00″	87° 00′ 00″
42 J	47° 21′ 36″	87° 00′ 30″
42 L	47° 32′ 42″	87° 00′ 00″

Station Number	Latitude N.	Longitude W.
42 N	47° 43′ 42″	87° 00′ 00″
42 P	47° 54′ 00″	87° 00′ 00″
42 R	48° 05′ 00″	87° 00′ 00″
42 T	48° 15′ 30″	87° 00′ 00″
42 W	48° 26′ 24″	87° 00′ 00″
43 A	46° 32′ 54″	86° 52′ 06″
43 E	46° 54′ 42″	86° 52′ 00″
43 G	47° 05′ 00″	86° 52′ 12″
43 I	47° 16′ 12″	86° 52′ 06″
43 K	47° 26′ 54″	86° 52′ 24″
43 M	47° 38′ 00″	86° 52′ 36″
43 O	47° 48′ 48″	86° 52′ 18″
43 Q	47° 59′ 06″	86° 51′ 54″
43 S	48° 10′ 12″	86° 52′ 00″
43 U	48° 21′ 06″	86° 51′ 54″
43 X	48° 31′ 54″	86° 51′ 48″
44 F	47° 00′ 00″	86° 44′ 42″
44 H	47° 10′ 48″	86° 44′ 12″
44 J	47° 21′ 42″	86° 44′ 06″
44 L	47° 32′ 18″	86° 44′ 24″
44 N	47° 43′ 42″	86° 43′ 12″
44 P	47° 53′ 54″	86° 44′ 48″
44 R	48° 04′ 48″	86° 43′ 42″
44 T	48° 15′ 48″	86° 44′ 36″
44 W	48° 26′ 24″	86° 43′ 48″
44 Y	48° 38′ 00″	86° 43′ 42″
45 G	47° 05′ 00″	86° 37′ 00″
45 I	47° 16′ 06″	86° 37′ 00″
45 K	47° 27′ 00″	86° 35′ 30″
45 M	47° 37′ 36″	86° 35′ 12″
45 O	47° 48′ 18″	86° 37′ 00″
45 Q	47° 58′ 54″	86° 37′ 06″
45 S	48° 10′ 00″	86° 35′ 24″
45 U	48° 20′ 54″	86° 37′ 24″
45 X	48° 32′ 00″	86° 36′ 00″
46 H	47° 10′ 54″	86° 29′ 18″
46 J	47° 21′ 42″	86° 28′ 00″
46 L	47° 32′ 24″	86° 27′ 42″
46 N	46° 43′ 12″	86° 29′ 00″
46 P	47° 53′ 18″	86° 28′ 54″
46 R	48° 05′ 00″	86° 27′ 48″
46 T	48° 15′ 30″	86° 27′ 30″
46 U	48° 21′ 00″	86° 27′ 30″
46 W	48° 26′ 30″	86° 27′ 30″
46 Y	48° 37′ 00″	86° 27′ 24″

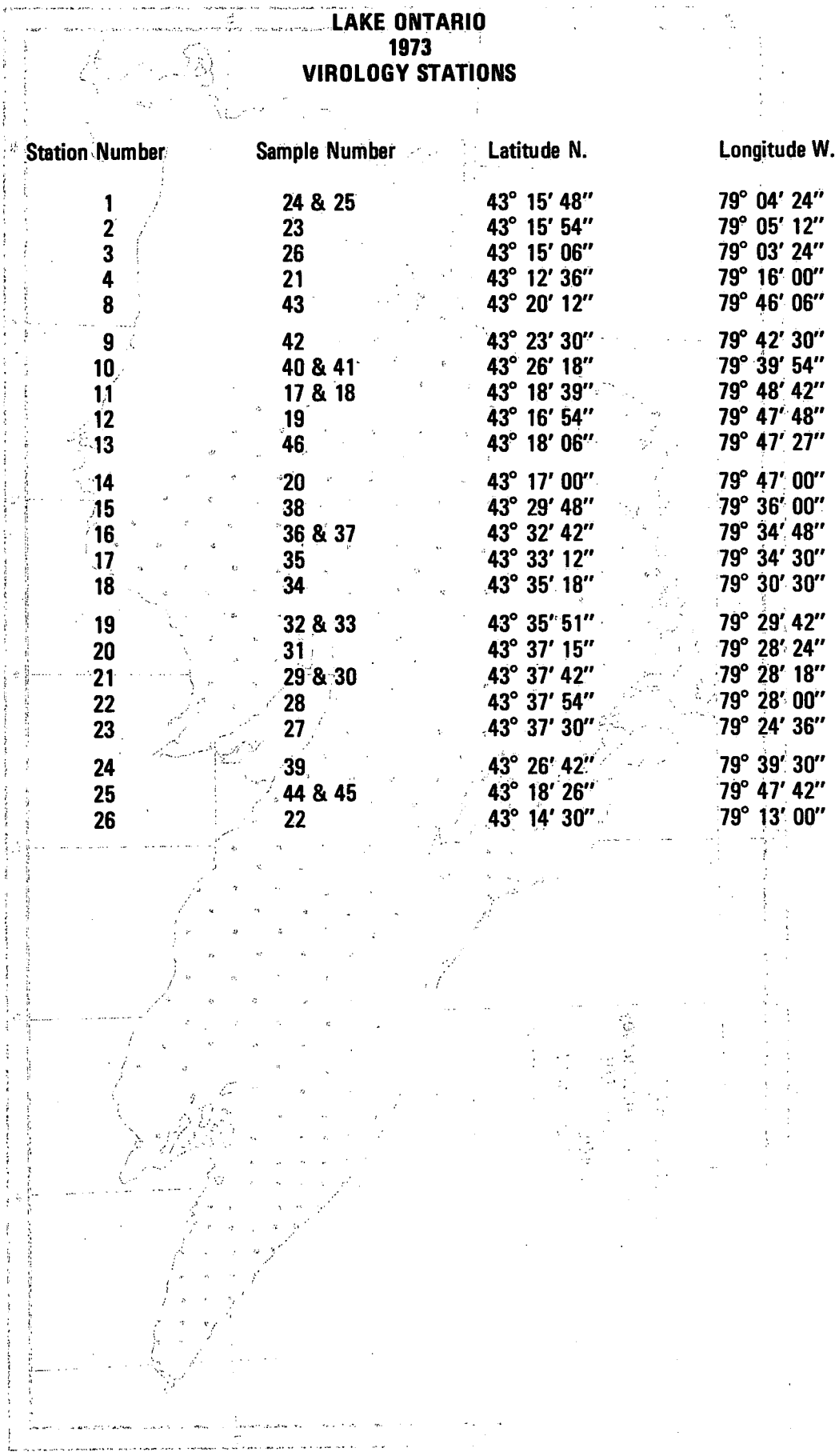
Station Number	Latitude N.	Longitude W.
47 K	47° 27′ 00″	86° 21′ 30″
47 M	47° 37′ 42″	86° 20′ 42″
47 O	47° 48′ 30″	86° 21′ 00″
47 Q	47° 58′ 54″	86° 20′ 18″
47 S	48° 10′ 06″	86° 20′ 30″
47 U	48° 20′ 48″	86° 20′ 36″
47 X	48° 32′ 06″	86° 20′ 36″
48 L	47° 31′ 54″	86° 12′ 18″
48 N	47° 43′ 18″	86° 12′ 30″
48 P	47° 53′ 36″	86° 12′ 24″
48 R	48° 04′ 36″	86° 12′ 30″
48 T	48° 15′ 18″	86° 12′ 36″
49 M	47° 37′ 54″	86° 04′ 06″
49 O	47° 48′ 30″	86° 03′ 54″
49 Q	47° 59′ 00″	86° 04′ 00″
50 P	47° 53′ 30″	85° 56′ 36″
51 M	47° 37′ 54″	85° 48′ 30″
51 O	47° 48′ 12″	85° 48′ 24″
52 P	47° 53′ 24″	85° 40′ 12″
53 O	47° 48′ 00″	85° 32′ 12″
54 P	47° 53′ 18″	85° 24′ 36″
55 O	47° 48′ 00″	85° 16′ 00″
56 N	47° 42′ 54″	85° 08′ 06″
56 P	47° 53′ 00″	85° 07′ 48″
57 O	47° 47′ 24″	85° 00′ 12″


LAKE SUPERIOR
Regional Sediment Survey
CRUISE 73 - 03 - 001
C.S.S. LIMNOS
April 24 - May 18/73
Station Positions Occupied
49°
48°
47°
92°
91°
90°
89°
88°
87°
86°
85°

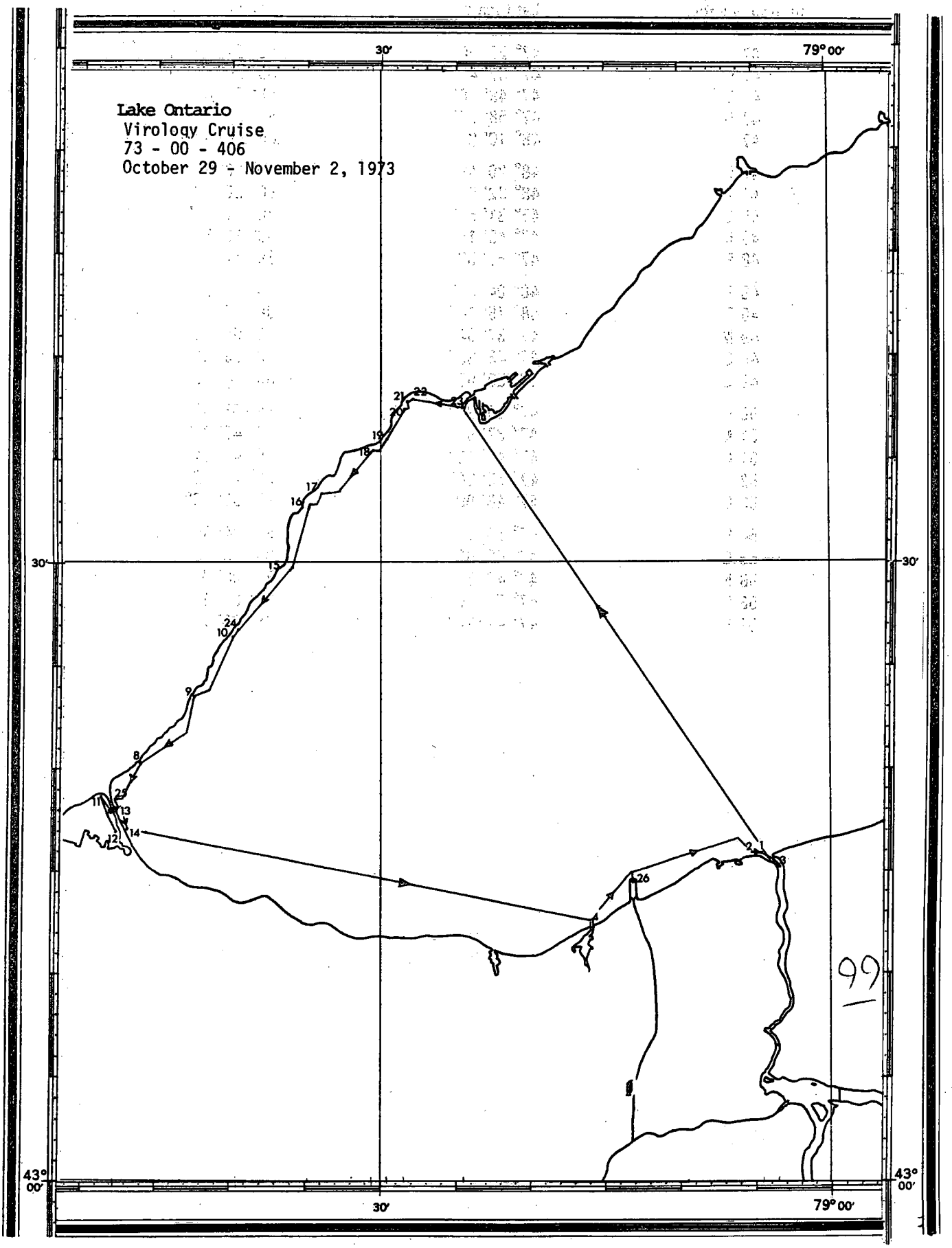

LAKE ERIE
1973
WATER COLUMN STUDY STATION
Station Number
1
Latitude N.
42° 30′ 00″
Longitude W.
81° 15′ 00″


LAKE ERIE
Water Column Study
Cruise 73 - 01 - 002
C.S.S. LIMNOS
June 18 - 22, 1973
PORT COLBORNE
PORT STANLEY
STATION POSITION
43°
42°
79°
80°
81°
82°
83°

LAKE ONTARIO
1973
VIROLOGY STATIONS

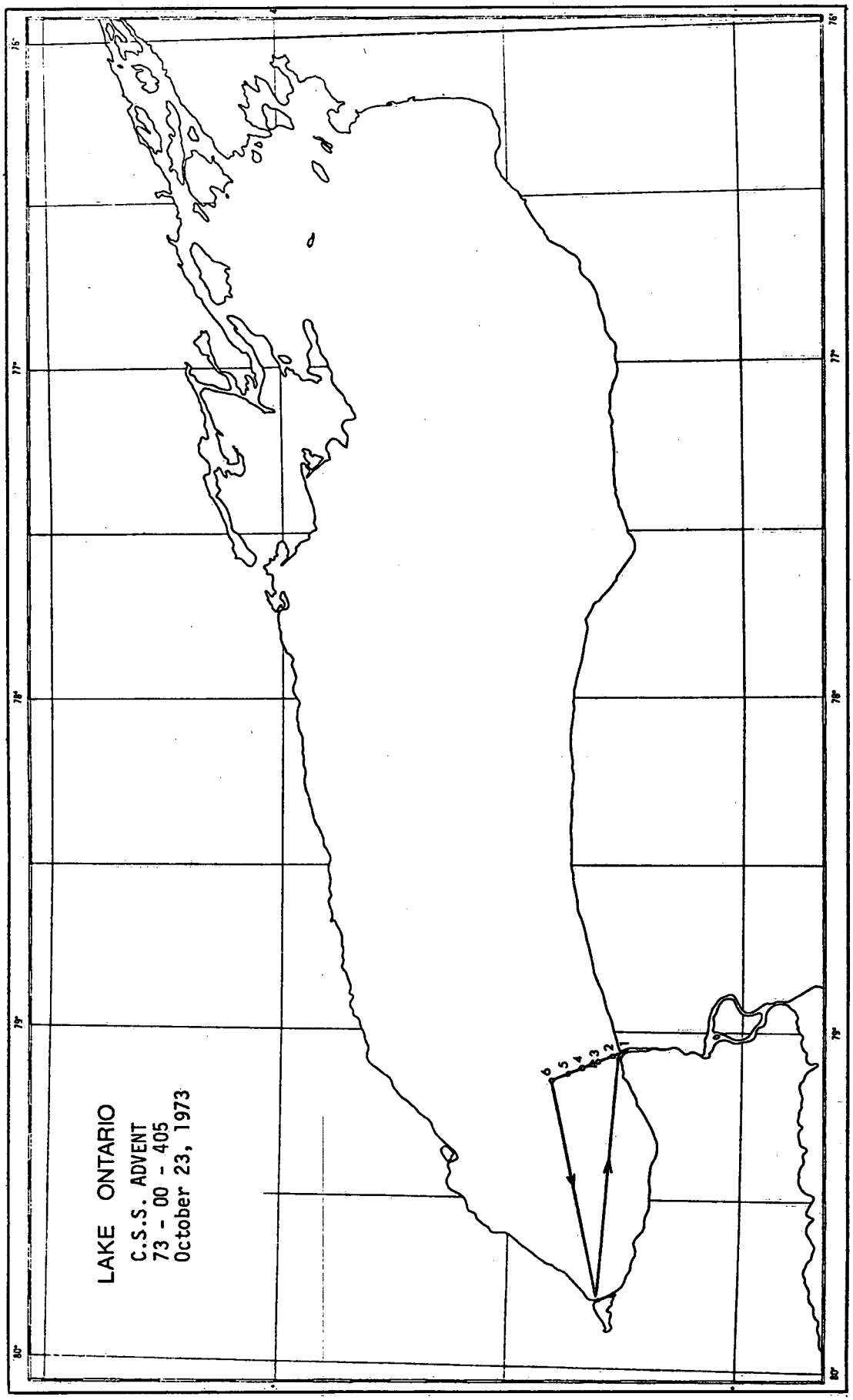


Station Number	Sample Number	Latitude N.	Longitude W.
1	24 & 25	43° 15′ 48″	79° 04′ 24″
2	23	43° 15′ 54″	79° 05′ 12″
3	26	43° 15′ 06″	79° 03′ 24″
4	21	43° 12′ 36″	79° 16′ 00″
8	43	43° 20′ 12″	79° 46′ 06″
9	42	43° 23′ 30″	79° 42′ 30″
10	40 & 41	43° 26′ 18″	79° 39′ 54″
11	17 & 18	43° 18′ 39″	79° 48′ 42″
12	19	43° 16′ 54″	79° 47′ 48″
13	46	43° 18′ 06″	79° 47′ 27″
14	20	43° 17′ 00″	79° 47′ 00″
15	38	43° 29′ 48″	79° 36′ 00″
16	36 & 37	43° 32′ 42″	79° 34′ 48″
17	35	43° 33′ 12″	79° 34′ 30″
18	34	43° 35′ 18″	79° 30′ 30″
19	32 & 33	43° 35′ 51″	79° 29′ 42″
20	31	43° 37′ 15″	79° 28′ 24″
21	29 & 30	43° 37′ 42″	79° 28′ 18″
22	28	43° 37′ 54″	79° 28′ 00″
23	27	43° 37′ 30″	79° 24′ 36″
24	39	43° 26′ 42″	79° 39′ 30″
25	44 & 45	43° 18′ 26″	79° 47′ 42″
26	22	43° 14′ 30″	79° 13′ 00″


Lake Ontario
Virology Cruise
73 - 00 - 406
October 29 - November 2, 1973
30'
79° 00'
30'
30'
43° 00'
30'
79° 00'
43° 00'
99

LAKE ONTARIO
1973
MYCOLOGY STATIONS

Station Number	Latitude N.	Longitude W.
1	43° 15′ 12″	79° 03′ 48″
2	43° 17′ 00″	79° 04′ 24″
3	43° 18′ 48″	79° 05′ 24″
4	43° 20′ 30″	79° 06′ 30″
5	43° 22′ 24″	79° 07′ 00″
6	43° 24′ 12″	79° 08′ 24″


LAKE ONTARIO
C.S.S. ADVENT
73 - 00 - 405
October 23, 1973
6
5
4
3
2
1
0
76°
77°
78°
79°
80°

APPENDIX B

STATISTICAL SUMMARIES

STATISTICS SUMMARY

Cruise No._____ Consec. #_____ Ship C.S.S. LIMNOS

Dates From_____ to_____ Lake ONTARIO

Cruise Type_____ Miles Steamed 6582

Description	Total	Description	Total
Secchi	144	Moorings Established (CM)	32
Stations Occupied	389	Moorings Retrieved (CM)	24
Bathythermograph Casts	5	Moorings Established (Met.)	
E.B.T. Casts	448	Moorings Retrieved (Met.)	3
Transmissometer Casts		Moorings Established (2 FTP, 1 Yacht)	3
Reversing Thermometer Obs.	196	Moorings Retrieved (1 Wave Rider,1 Yacht)	2
Water Samples Collected (Chemistry)	1,899	Moorings Serviced (CM)(2 Thermograph)	2
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)		Dye Releases	
Water Samples Treated (Phytoplankton)	487		
Zooplankton Hauls	328	Observations (Weather)	341
Zooplankton Hauls (Mysis)		Observations (Hourly)	521
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	56
Integrator (20 m)		Relative Humidity	56
Total number of Depths Sampled		Water Temperature (In-Hull)	54
Total Number of Water Samples Collected		Water Temperature (Towed)	12
		Integrated Printout	58
ONBOARD ANALYSIS		Solar Radiation	58
Geolimnology		Long Wave (IR) Radiation	58
Manual Chemistry (Tech. Ops.)	2,976		
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____ Ship C.S.S. LIMNOS

Dates From_____ to_____ Lake ERIE

Cruise Type_____ Miles Steamed 4,317

Description	Total	Description	Total
Secchi	109	Moorings Established (CM)	
Stations Occupied	411	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	267	Moorings Retrieved (Met.)	
Transmissometer Casts	61	Moorings Established	40
Reversing Thermometer Obs.	145	Moorings Retrieved	40
Water Samples Collected (Chemistry)	3,752	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced	
Water Samples Collected		Cores Taken (Gravity)	11
Water Samples Collected		Cores Taken (Piston)	
Water Samples Collected		Grab Samples Taken	
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	111	Dye Releases	
Water Samples Treated (Phytoplankton)	159		235
Zooplankton Hauls		Observations (Weather)	
Zooplankton Hauls (Mysis)		Observations	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10 m)	281	Air Temperature	41
Integrator (20 m)		Relative Humidity	41
Total number of Depths Sampled		Water Temperature (In-Hull)	41
Total Number of Water Samples Collected		Water Temperature (Towed)	13
		Integrated Printout	49
ONBOARD ANALYSIS		Solar Radiation	49
Geolimnology		Long Wave (IR) Radiation	49
Manual Chemistry (Tech. Ops.)	8,850		
Nutrients (W.Q.O.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____

Dates From_____ to_____

Cruise Type_____

Ship C.S.S. LIMNOS

Lake HURON, GEORGIAN BAY

Miles Steamed 5,121.3

Description	Total	Description	Total
Secchi		Moorings Established (CM)	6
Stations Occupied		Moorings Retrieved (CM)	6
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	6	Moorings Retrieved (Met.)	
Transmissometer Casts	14	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)	8
Water Samples Collected		Cores Taken (Piston)	10
Water Samples Collected		Grab Samples Taken	529
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)	3		
Zooplankton Hauls	3	Observations (Weather)	118
Zooplankton Hauls (Mysis)		Observations (Hourly)	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	22
Integrator (20 m)		Relative Humidity	22
Total number of Depths Sampled		Water Temperature (In-Hull)	
Total Number of Water Samples Collected		Water Temperature (Towed)	
		Integrated Printout	29
ONBOARD ANALYSIS		Solar Radiation	29
Geolimnology		Long Wave (IR) Radiation	29
Manual Chemistry (Tech. Ops.)			
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____

Dates From_____ to _____

Cruise Type_____

Ship C.S.S. LIMNOS

Lake SUPERIOR

Miles Steamed 6,365.7

Description	Total	Description	Total
Secchi	205	Moorings Established (CM)	13
Stations Occupied		Moorings Retrieved (CM)	13
Bathythermograph Casts		Moorings Established (Met.)	2
E.B.T. Casts	45	Moorings Retrieved (Met.)	2
Transmissometer Casts		Moorings Established	
Reversing Thermometer Obs.		Moorings Retrieved (U. of Wisconsin)	1
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	13
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	2
Water Samples Collected (Biolimnology)		Moorings Serviced	
Water Samples Collected		Cores Taken (Gravity)	
Water Samples Collected		Cores Taken (Piston)	
Water Samples Collected		Grab Samples Taken	1,002
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	274
Zooplankton Hauls (Mysis)		Observations (Hourly)	
Primary Productivity Moorings			
Bottom Samples (Fauna)	324	Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	58
Integrator (20 m)		Relative Humidity	58
Total number of Depths Sampled		Water Temperature (In-Hull)	58
Total Number of Water Samples Collected		Water Temperature (Towed)	
		Integrated Printout	79
ONBOARD ANALYSIS		Solar Radiation	79
Geolimnology	1,902	Long Wave (IR) Radiation	79
Manual Chemistry (Tech. Ops.)			
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____

Dates From_____ to_____

Cruise Type_____

Ship C.S.S. LIMNOS

Lake GREAT LAKES

Miles Steamed 22,386

Description	Total	Description	Total
Secchi	458	Moorings Established (CM)	
Stations Occupied	800	Moorings Retrieved (CM)	
Bathythermograph Casts	5	Moorings Established (Met.)	
E.B.T. Casts	766	Moorings Retrieved (Met.)	
Transmissometer Casts	61	Moorings Established	96
Reversing Thermometer Obs.	355	Moorings Retrieved	93
Water Samples Collected (Chemistry)		Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced	
Water Samples Collected (Total)	5,651	Cores Taken (Gravity)	19
Water Samples Collected		Cores Taken (Piston)	10
Water Samples Collected		Grab Samples Taken	1,531
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)		Dye Releases	
Water Samples Treated (Phytoplankton)	601		
Zooplankton Hauls	490	Observations (Weather)	968
Zooplankton Hauls (Mysis)		Observations (Hourly)	521
Primary Productivity Moorings			
Bottom Samples (Fauna)	324	Continuous Observations (Days)	
Integrator (10 m)	281	Air Temperature	177
Integrator (20 m)		Relative Humidity	177
Total number of Depths Sampled		Water Temperature (In-Hull)	153
Total Number of Water Samples Collected		Water Temperature (Towed)	25
		Integrated Printout	215
ONBOARD ANALYSIS		Solar Radiation	215
Geolimnology		Long Wave (IR) Radiation	215
Total	13,728		
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____ Ship MARTIN KARLSEN

Dates From_____ to _____ Lake ONTARIO

Cruise Type_____ Miles Steamed 5,234

Description	Total	Description	Total
Secchi	122	Moorings Established (CM)	
Stations Occupied	396	Moorings Retrieved (CM)	
Bathythermograph Casts	17	Moorings Established (Met.)	
E.B.T. Casts	344	Moorings Retrieved (Met.)	
Transmissometer Casts	75	Moorings Established	
Reversing Thermometer Obs.	290	Moorings Retrieved	12
Water Samples Collected (Chemistry)	8,313	Moorings Serviced (CM)	1
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced	
Water Samples Collected		Cores Taken (Gravity)	64
Water Samples Collected		Cores Taken (Piston)	
Water Samples Collected		Grab Samples Taken	22
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	93	Dye Releases	
Water Samples Treated (Phytoplankton)	422		
Zooplankton Hauls	371	Observations (Weather)	302
Zooplankton Hauls (Mysis)		Observations (Hourly)	469
Primary Productivity Moorings	6		
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	57
Integrator (20 m)		Relative Humidity	57
Total number of Depths Sampled		Water Temperature (In-Hull)	46
Total Number of Water Samples Collected		Water Temperature (Towed)	46
		Integrated Printout	62
ONBOARD ANALYSIS		Solar Radiation	62
Geolimnology		Long Wave (IR) Radiation	69
Manual Chemistry (Tech. Ops.)	19,818		
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No. _____ Consec. # _____

Dates From _____ to _____

Cruise Type _____

Ship MARTIN KARLSEN

Lake ERIE

Miles Steamed 732

Description	Total	Description	Total
Secchi	38	Moorings Established (CM)	
Stations Occupied	61	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	61	Moorings Retrieved (Met.)	
Transmissometer Casts	61	Moorings Established	
Reversing Thermometer Obs.	15	Moorings Retrieved	
Water Samples Collected (Chemistry)	185	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)	20	Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced	
Water Samples Collected		Cores Taken (Gravity)	
Water Samples Collected (S.O.C.)	3	Cores Taken (Piston)	
Water Samples Collected		Grab Samples Taken	
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	61	Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	39
Zooplankton Hauls (Mysis)		Observations	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	4
Integrator (20 m)		Relative Humidity	4
Total number of Depths Sampled		Water Temperature (In-Hull)	3
Total Number of Water Samples Collected		Water Temperature (Towed)	4
		Integrated Printout	4
ONBOARD ANALYSIS		Solar Radiation	4
Geolimnology		Long Wave (IR) Radiation	4
Manual Chemistry (Tech. Ops.)	555		
Nutrients (W.Q.D.)	1,665		
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____ Ship MARTIN KARLSEN

Dates From_____ to_____ Lake HURON

Cruise Type_____ Miles Steamed 1,360

Description	Total	Description	Total
Secchi	11	Moorings Established (CM)	
Stations Occupied	23	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	23	Moorings Retrieved (Met.)	
Transmissometer Casts	21	Moorings Established	1
Reversing Thermometer Obs.	12	Moorings Retrieved	
Water Samples Collected (Chemistry)	404	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)	23	Moorings Serviced	
Water Samples Collected (S.O.C.)	9	Cores Taken (Gravity)	
Water Samples Collected		Cores Taken (Piston)	
Water Samples Collected		Grab Samples Taken	10
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	23	Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	46
Zooplankton Hauls (Mysis)		Observations	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	10
Integrator (20 m)		Relative Humidity	10
Total number of Depths Sampled		Water Temperature (In-Hull)	10
Total Number of Water Samples Collected		Water Temperature (Towed)	10
		Integrated Printout	10
ONBOARD ANALYSIS		Solar Radiation	10
Geolimnology		Long Wave (IR) Radiation	10
Manual Chemistry (Tech. Ops.)	1,204		
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____ Ship MARTIN KARLSEN

Dates From_____ to _____ Lake SUPERIOR

Cruise Type_____ Miles Steamed 16,552

Description	Total	Description	Total
Secchi	350	Moorings Established (CM)	
Stations Occupied	1,129	Moorings Retrieved (CM)	
Bathythermograph Casts	4	Moorings Established (Met.)	
E.B.T. Casts	997	Moorings Retrieved (Met.)	
Transmissometer Casts	721	Moorings Established	
Reversing Thermometer Obs.	110	Moorings Retrieved	
Water Samples Collected (Chemistry)	13,557	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.) (Two)	4
Water Samples Collected (Biolimnology)		Moorings Serviced	
Water Samples Collected		Cores Taken (Gravity)	157
Water Samples Collected		Cores Taken (Piston)	33
Water Samples Collected		Grab Samples Taken	326
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	1,465	Dye Releases	
Water Samples Treated (Phytoplankton)	607		
Zooplankton Hauls	667	Observations (Weather)	765
Zooplankton Hauls (Mysis)		Observations	
Primary Productivity Moorings	10		
Bottom Samples (Fauna)	48	Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	112
Integrator (20 m)		Relative Humidity	112
Total number of Depths Sampled		Water Temperature (In-Hull)	112
Total Number of Water Samples Collected		Water Temperature (Towed)	112
		Integrated Printout	101
ONBOARD ANALYSIS		Solar Radiation	134
Geolimnology		Long Wave (IR) Radiation	116
Manual Chemistry (Tech. Ops.)	19,556		
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____ Ship MARTIN KARLSEN

Dates From_____ to _____ Lake GREAT LAKES

Cruise Type_____ Miles Steamed 23,878

Description	Total	Description	Total
Secchi	521	Moorings Established (CM)	
Stations Occupied	1,609	Moorings Retrieved (CM)	
Bathythermograph Casts	21	Moorings Established (Met.)	
E.B.T. Casts	1,425	Moorings Retrieved (Met.)	
Transmissometer Casts	878	Moorings Established	1
Reversing Thermometer Obs.	427	Moorings Retrieved (Decca)	12
Water Samples Collected (Chemistry)	22,459	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)	20	Moorings Serviced (Met.)	5
Water Samples Collected (Biolimnology)		Moorings Serviced	
Water Samples Collected		Cores Taken (Gravity)	221
Water Samples Collected		Cores Taken (Piston)	33
Water Samples Collected		Grab Samples Taken	358
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	1,642	Dye Releases	
Water Samples Treated (Phytoplankton)	1,029		
Zooplankton Hauls	1,038	Observations (Weather)	1,152
Zooplankton Hauls (Mysis)		Observations (Hourly Obs.)	469
Primary Productivity Moorings	16		
Bottom Samples (Fauna)	48	Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	183
Integrator (20 m)		Relative Humidity	183
Total number of Depths Sampled		Water Temperature (In-Hull)	171
Total Number of Water Samples Collected		Water Temperature (Towed)	172
		Integrated Printout	187
ONBOARD ANALYSIS		Solar Radiation	210
Geolimnology		Long Wave (IR) Radiation	199
Manual Chemistry (Tech. Ops.)	41,133		
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

STATISTICS SUMMARY

Cruise No._____ Consec. #_____ Ship PORTE DAUPHINE

Dates From_____ to _____ Lake ONTARIO

Cruise Type Hamilton/Scourge & Hydrographic omitted Miles Steamed 4,773

Description	Total	Description	Total
Secchi	66	Moorings Established (CM)	
Stations Occupied	413	Moorings Retrieved (CM)	
Bathythermograph Casts		Moorings Established (Met.)	
E.B.T. Casts	333	Moorings Retrieved (Met.)	
Transmissometer Casts		Moorings Established (1 FTP, 1 Wave Rider)	2
Reversing Thermometer Obs.	58	Moorings Retrieved	
Water Samples Collected (Chemistry)	179	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)		Moorings Serviced	
Water Samples Collected		Cores Taken (Gravity)	34
Water Samples Collected		Cores Taken (Piston)	
Water Samples Collected		Grab Samples Taken	1
Water Samples Collected		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	92	Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	134
Zooplankton Hauls (Mysis)		Observations (Hourly)	398
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10 m)		Air Temperature	
Integrator (20 m)		Relative Humidity	
Total number of Depths Sampled		Water Temperature (In-Hull)	
Total Number of Water Samples Collected		Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	25
Geolimnology		Long Wave (IR) Radiation	25
Manual Chemistry (Tech. Ops.)	179	Continuous Conductivity	7
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

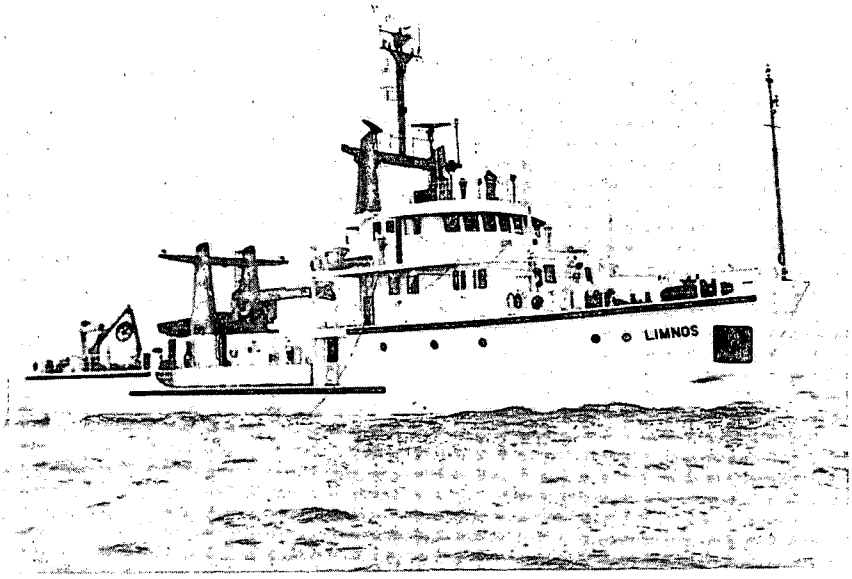
APPENDIX C

DESCRIPTION OF RESEARCH SHIPS, LAUNCHES AND EQUIPMENT

1. CSS LIMNOS
2. M.V. MARTIN KARLSEN
3. CSS ADVENT
4. CSL SHARK
5. M.V. LAC ERIE
6. LEMOYNE
7. STURDY
8. SURGE
9. AQUA
10. AGILE

"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.

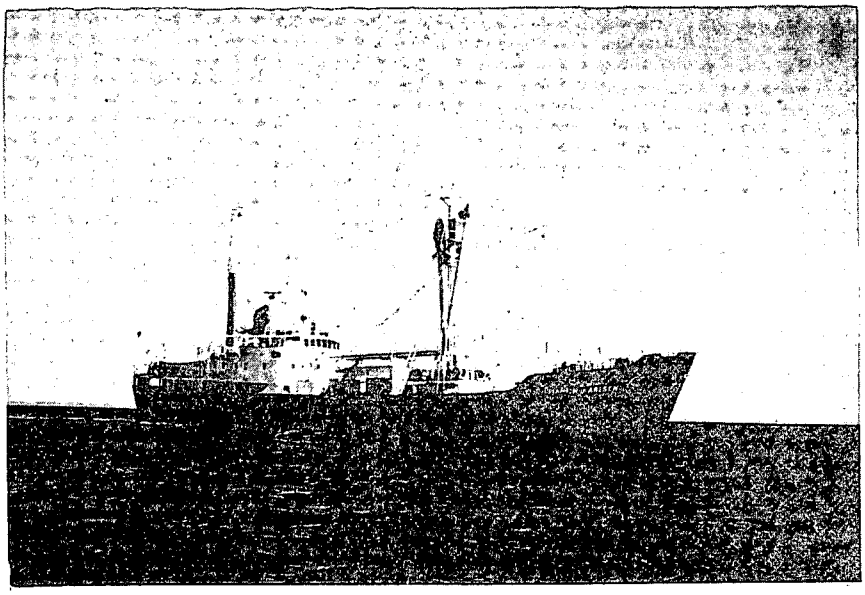
Type of Observations

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.

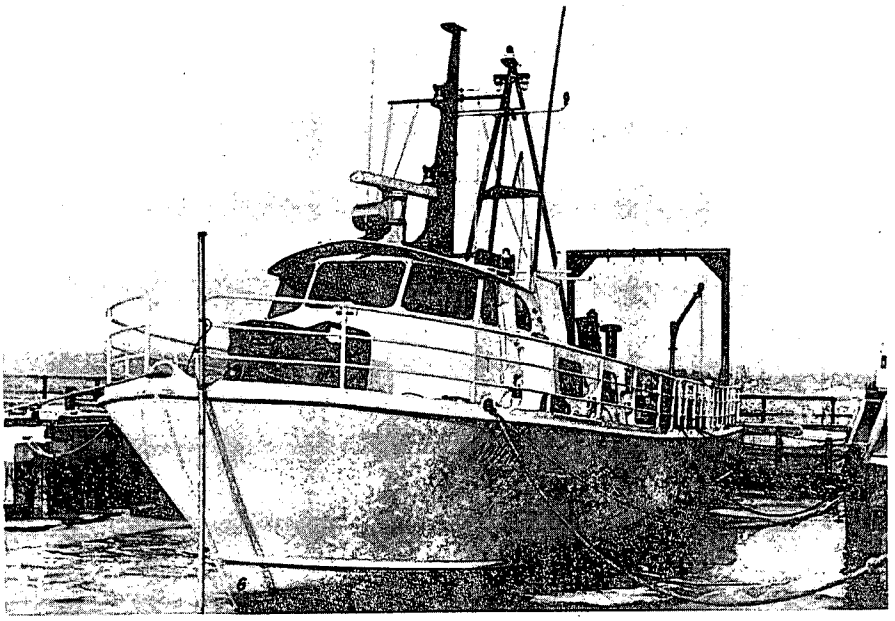
Scientific Equipment

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

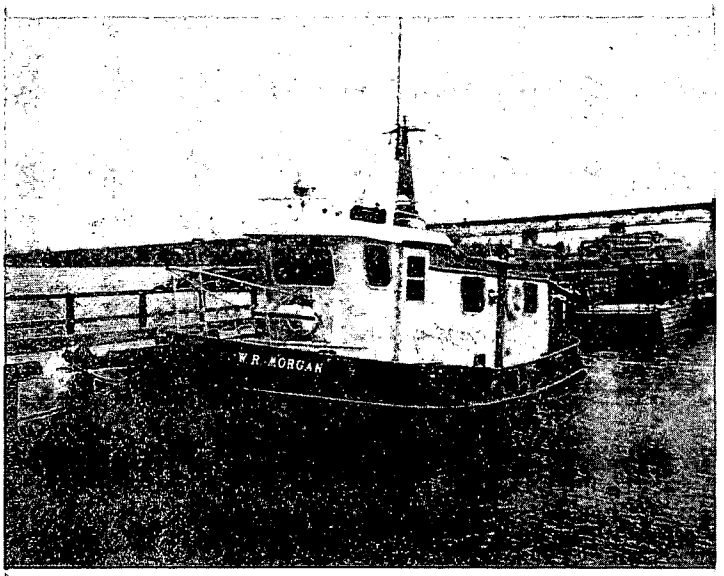
The laboratory has an area of approximately 120 square feet, with cupboards and counter-top work spaces attached to the bulkheads. It is equipped with a refrigerator, stove, and heater, and a sink supplied with hot and cold water which drains into a 500 gallon capacity fibreglass holding tank. The laboratory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

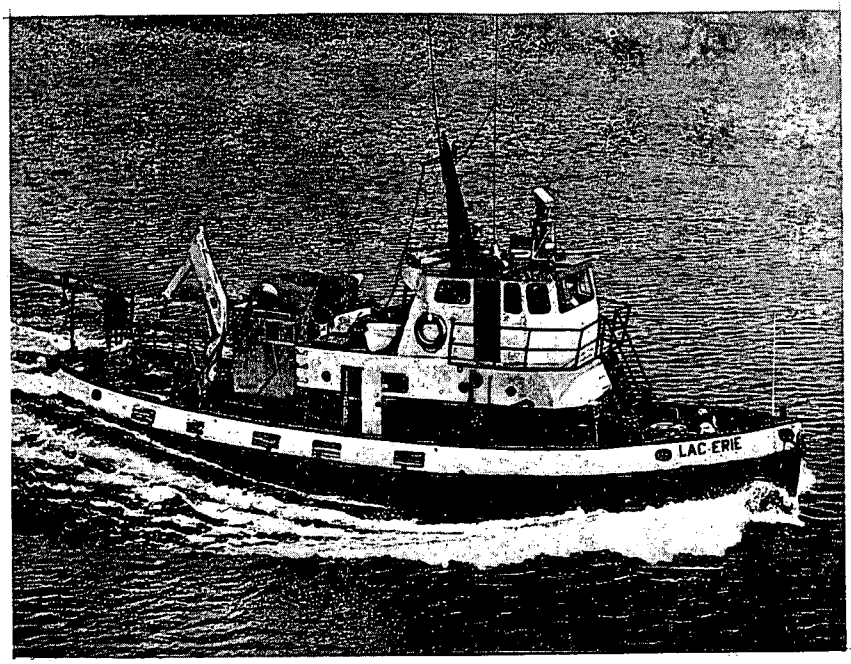
Habitability

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.

"LAC ERIE"



TYPE HARBOUR TUG

YEAR BUILT	*LENGTH*	*BEAM*	*DRAFT*	*DISPLACEMENT*	*TONNAGE*	
					GROSS	*NET*
1944	65	16.5	7		66.0	26.5

PERFORMANCE

SPEED (KNOTS)			*RANGE*	*ENDURANCE*
CRUISING	*MAXIMUM*	*MINIMUM*		
11	11.5	3	2,000 miles	200 hours (8 days)

COMPLEMENT

CREW	*SCIENTIFIC STAFF*
4	2

M.V. LAC ERIE

Affiliation

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

Propulsion

Single screw and wheelhouse control. Powered by GM V16 diesel engine generating 600 hp.

Bunker capcity 3000 gals.
Bridge Controls.

Electrical Power

2 Cummins generators – 30 kw at 220 a-c single phase, convertor to supply 12v and 24v d-c.

Facilities for shore power hookup 220v a-c.

Navigation, Communications, and Echo Sounding Equipment

Navigation

Gyro compass Anschutz (no repeaters).
Radar Kelvin Hughes model 17, 24 mile range.
Standard Magnetic Compass.
Searchlight.

Communications

VHF/FM Marconi Clipper II
AM Marconi CN 26

Echo Sounders

Kelvin Hughes model 32M
Kelvin Hughes model 26F

Hydrographic Winches and Equipment

Can be fitted with various hydrographic and oceanographic winches for cruises at user's request.

Boom capacity 2 tons.

Habitability

Living accommodation for a total of 6 people, heated cabins. Fresh water capacity 1200 gals.

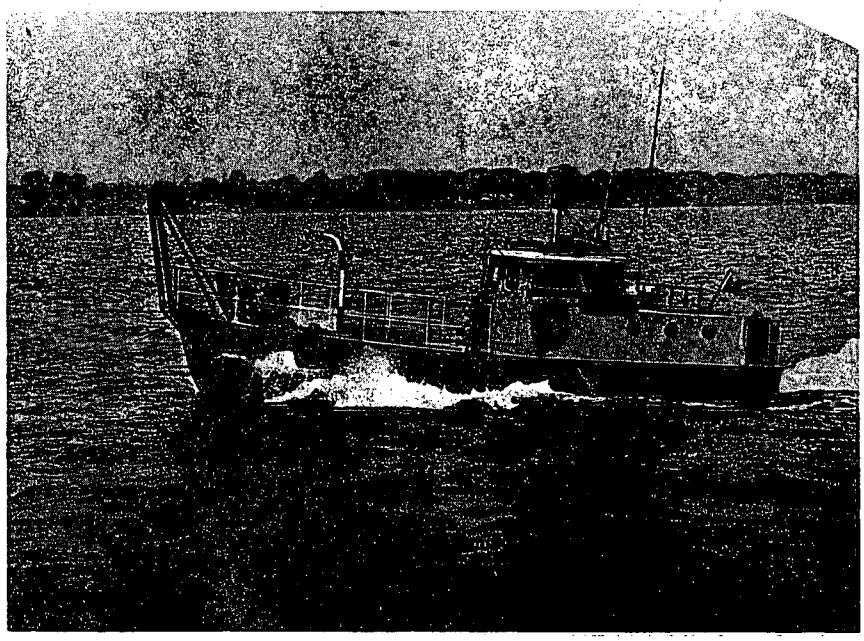
Type of Observations

Vessel equipped to carry out small lake pollution research and surveillance, including studies of lake bottom geology, geophysics, lake sediments, and other characteristics of the Great Lakes.

Remarks

Because of limited space, not all disciplines can be carried out simultaneously.

"LE MOYNE"



TYPE DISPLACEMENT, STEEL HULL

MANUFACTURER	*YEAR BUILT*	*LENGTH*	*BEAM*	*DRAFT*
Selkirk Boat Works	1959	40	11	5

PERFORMANCE

SPEED (KNOTS)	
CRUISING	*MAXIMUM*
10	11

COMPLEMENT

CREW	*SCIENTIFIC STAFF*
2	4

LEMOYNE

Affiliation

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

Propulsion

Twin screws driven by 2 – 354 Perkins diesel engines generating 260 hp.

4-blade propellers
Diameter 23 inches
Pitch 20 inches
Endurance 20 hours
Deckhouse controls

Electrical Power

Main generator – 120v a-c 3 kw diesel generator.
2 generators, from main engines (rectified a-c system)
to produce 36v d-c 3.5 kw each.
1 converter for sounder operating from main generator 24v d-c 32 amps.

Navigation, Communications and Echo Sounding Equipment

Navigation:

Radar: Decca RM 416 fitted with Decca Accurate Ranging Unit.
Standard Magnetic Compass.
A. Brown Gyro compass.

Communications:

IF/AM Radio Marconi CH25
VHF/FM Marconi Clipper II

Echo Sounders:

Kelvin Hughes MS32M Mk3
Kelvin Hughes MS36M

Hydrographic Winches and Equipment

Vessel has an "A" frame fitted over the bow and Reimann and Georger 1000 TT winch, gas powered 6 hp. Briggs and Stratton engine.

Can be fitted with small portable self-powered winches as required.

1 hydraulic winch
1 4-cylinder volvo.

Laboratory

There is a small laboratory (150 square feet) suitable for some physical and chemical measurements.

Type of Observations

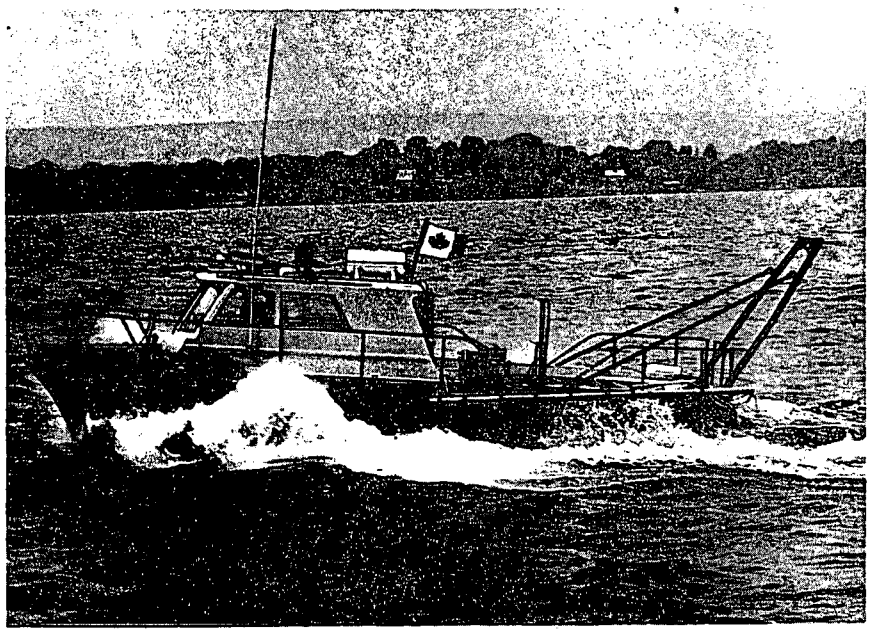
Vessel equipped to study near shore areas, lake bottom geology, geophysics, lake sediments and other physical characteristics of the Great Lakes Region.

Remarks

The launch operates near shore or in protected areas on a daylight basis. No sleeping accommodation.

Because of limited space, all disciplines cannot be carried out simultaneously.

"STURDY"



TYPE STEEL DEEP VEE HULL

MANUFACTURER	*YEAR BUILT*	*LENGTH*	*BEAM*	*DRAFT*
Ballantrae Boat Works	1967	34	11	3.5

PERFORMANCE

SPEED (KNOTS)	
CRUISING	*MAXIMUM*
11.5	12.5

COMPLEMENT

CREW	*SCIENTIFIC STAFF*
2	6

STURDY

Affiliation

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

Propulsion

Twin screws driven by 2 in-line 453 G.M.C. diesel engines, 140 hp. each.

4-blade propellers
Diameter 20 inches
Pitch 20 inches
Bunkers 200 gal.
Endurance 16 hrs.
Deckhouse control.

Electrical

Generators on main engines 7.5 kw at 24 d-c, or 11v a-c.

Navigational Equipment

Standard Magnetic compass.
Gyro compass – Arma Brown Mk3 with one repeater.
Radar – Kelvin Hughes 17/9.

Communications Equipment:

IF/AM Radio – Marconi CH25
VHF/FM Marconi Clipper II

Sounding Equipment

Ross 26A

Hydrographic Winches and Equipment

An "A" Frame is fitted across the stern, allowing the use of a winch such as a gas-powered Swann Series 490 for sampling.

Vessel may be fitted with additional navigational or electronic equipment at user's request.

One Hydro Products winch.

Type of Observations

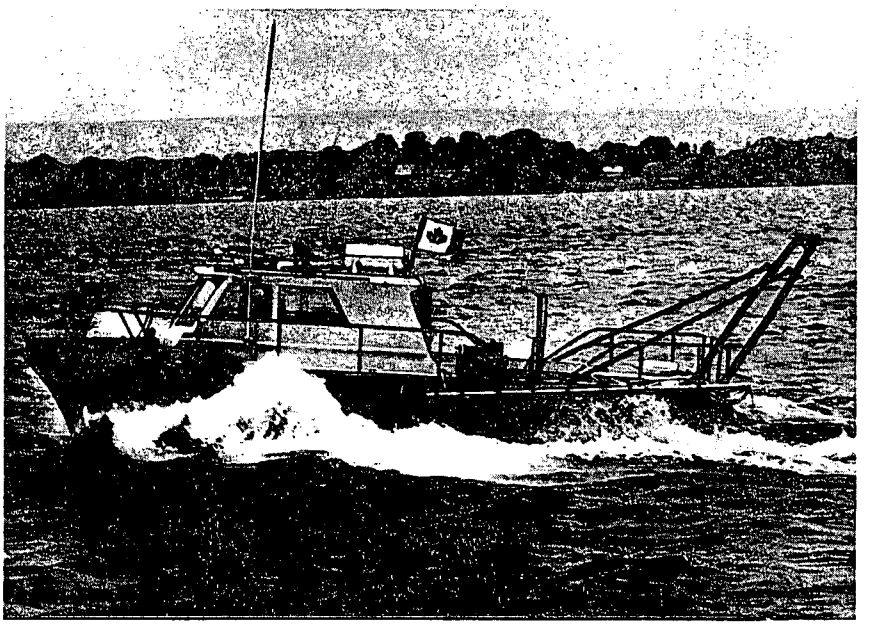
This launch is equipped to study near shore areas, lake bottom geology, geophysics, lake sediments, and other physical characteristics of the Great Lake Region.

Remarks

The launch operates in near shore or protected waters only on a daylight basis. No sleeping accommodations.

Because of limited space, all disciplines cannot be carried out simultaneously.

"SURGE"



TYPE STEEL DEEP VEE HULL

MANUFACTURER	YEAR BUILT	LENGTH	BEAM	DRAFT
Ballantrae Boat Works	1969	34	11	3.5

PERFORMANCE

SPEED (KNOTS)	
CRUISING	MAXIMUM
11.5	12.5

COMPLEMENT

CREW	SCIENTIFIC STAFF
2	6

SURGE

Affiliation

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

Propulsion

Twin screws driven by 2 – 185 V-8 Cummins engines.
Diameter 22 inches
Pitch 22 inches
Bunkers 200 gal.
Endurance 16 hours.
Deckhouse control.

Electrical

Generators on main engines 7.5 kw at 24v d-c, or 110v a-c.

Navigational Equipment

Standard magnetic compass.
Gyro compass – Arma Brown Mk3 with one repeator.
Radar – Decca 214.

Communications Equipment

IF/AM Radio – Marconi CH25
VHF/FM Marconi Clipper II

Sounding Equipment

Ross 36F
(Sidemount Hull)

Hydrographic Winches and Equipment

An "A" Frame is fitted across the stern, allowing the use of a winch such as a gas powered Swann Series 490 for sampling.

Vessel may be fitted with additional navigational or electronic equipment at user's request.

One Hydro Products winch.

Type of Observations

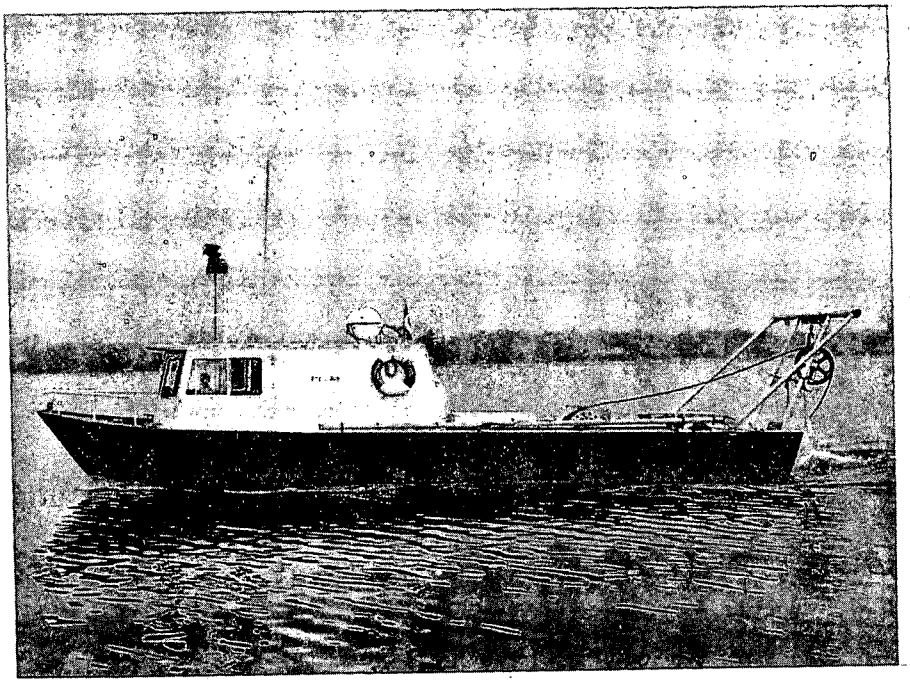
This launch can be equipped to study near shore areas, lake bottom geology, geophysics, lake sediments, and other physical characteristics of the Great Lakes Region.

Remarks

The launch operates in near shore or protected waters only on a daylight basis. No sleeping accommodation.

Because of limited space, all disciplines cannot be carried out simultaneously.

"AQUA"



TYPE: SHALLOW VEE

MANUFACTURER	YEAR BUILT	LENGTH	BEAM	DRAFT
Alcan	1969	44	11.8	3

PERFORMANCE

SPEED (KNOTS)	
CRUISING	MAXIMUM
17	18

COMPLEMENT

CREW	SCIENTIFIC STAFF
2	3

AQUA

Affiliation

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

Propulsion

Twin screws driven by 2 – 6 cylinder Perkins diesels generating 260 hp.
Diameter 20 inches
Pitch 20 inches
Bunkers – 200 gals.
Endurance – 20 hrs.
Deckhouse control.

Electrical Power

7.5 kw single phase at 110v a-c or 24v d-c.
Onan 110v a-c generator, 3.5 kw.

Navigational Equipment

Standard magnetic compass
Radar – Decca T217
Arma Brown Gyro compass Mk 3

Communications Equipment

IF/AM Radio – Marconi CH25
VHF/FM Marconi Clipper II

Sounding Equipment

Edo 9040

Hydrographic Winches and Equipment

The launch may be fitted with small self-powered winches at user's request. Additional electronic equipment may also be added as required.

1 Swann winch

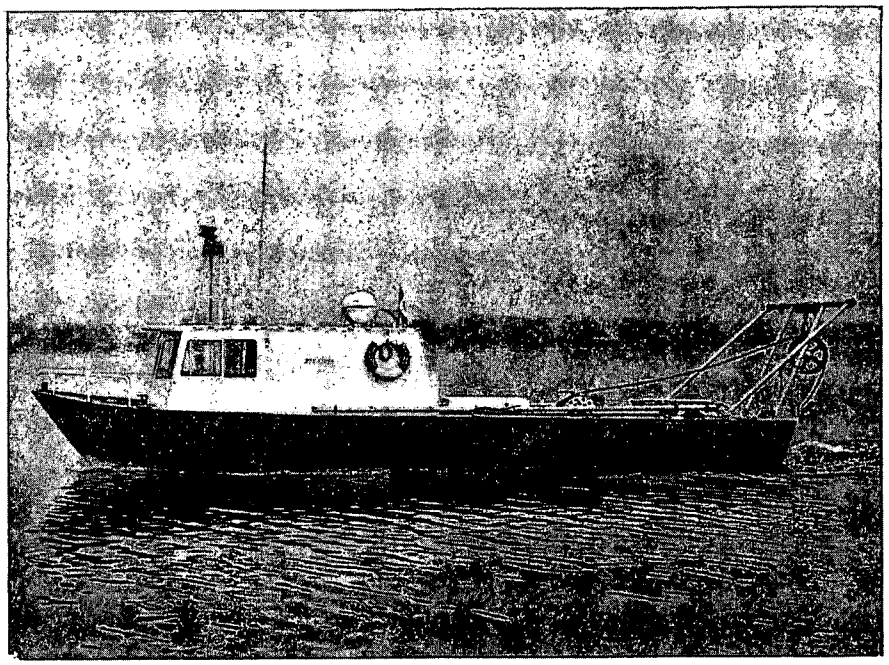
Type of Observations

This launch is used to study near shore lake bottom geology, geophysics, lake sediments, and other physical characteristics of the Great Lakes Region.

Remarks

The launch operates in near shore or protected waters only on a daylight basis. No sleeping accommodation.

"AGILE"



TYPE: SHALLOW VEE

MANUFACTURER	YEAR BUILT	LENGTH	BEAM	DRAFT
Alcan	1969	44	11.8	3

PERFORMANCE

SPEED (KNOTS)	
CRUISING	MAXIMUM
17	18

COMPLEMENT

CREW	SCIENTIFIC STAFF
2	3

AGILE

Affiliation

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

Propulsion

Twin screws driven by 2 V-8 Cummins diesels generating 270 hp.
4-blade propellers
Diameter-20 inches
Pitch-21 inches
Bunkers-200 gals.
Endurance-20 hrs.
Deckhouse control.

Electrical Power

7.5 kw single phase at 110v a-c or 24v d-c.
Onan 110v a-c generator, 3.5 kw.

Navigational Equipment

1 Brown – Gyro comapss Mk 3
Radar – Decca 217
Motorola R.P.S. system

Communications Equipment

IF/AM radio – Marconi CH25
VHF/FM Marconi Clipper II

Sounding Equipment

Edo 9040

Hydrographic Winches and Equipment

This launch may be fitted with small self-powered winches at user's request. Additional electronic equipment may also be added as required.

"A" Frame at stern.

Type of Observations

This launch is used to study near shore lake bottom geology, geophysics, lake sediments, and other physical characteristics of the Great Lakes Region.

Remarks

The launch operates in near shore or protected waters only on a daylight basis. No sleeping accommodations.

"BOSTON WHALERS"

TYPE BOSTON WHALER

MANUFACTURER	YEAR BUILT	LENGTH	BEAM	DRAFT
Fisher-Pierce Co.	1968/69	16.5'	6	1

PERFORMANCE

SPEED (KNOTS)	
CRUISING	MAXIMUM
18	18

COMPLEMENT

CREW	SCIENTIFIC STAFF
1	2

APPENDIX D
1973 FIELD PROGRAM
MAJOR SHIPS

LAKE	SHIP	CRUISE	DATES	TYPE OF CRUISE
Ontario	KARLSEN	73-00-101	Jan. 3-5	Heat Content
		73-00-102	Jan. 8-19	OOPS
		73-00-103	Mar. 5-17	OOPS
		73-00-104	Mar. 19-24	Monitor
		73-00-105	Apr. 9-13	Coring
		73-00-106	Apr. 16-19	Terrestrial Heat Flow
		73-00-107	Apr. 24-28	Monitor/Bio./U.S.A.
		73-00-108	Apr. 30-May 3	Retrieve Decca Moorings
		73-00-109	Oct. 30-Nov. 3	Monitor
		73-00-110	Dec. 4-6	Monitor
Erie	KARLSEN	73-01-101	Aug. 28-31	Monitor
Huron	KARLSEN	73-02-101	May 9-12	Monitor
		73-02-102	Sept. 18-21	Monitor
Superior	KARLSEN	73-03-101	May 12-24	Monitor
		73-03-102	May 29-June 14	Limnogeology
		73-03-103	June 15-27	Monitor
		73-03-104	July 27-Aug. 7	Monitor
		73-03-105	Aug. 14-23	Coring/Seismic
		73-03-106	Sept. 6-16	Monitor
		73-03-107	Oct. 14-25	Monitor
		73-03-108	Nov. 14-28	Monitor
Ontario	LIMNOS	73-00-001	Jan. 8-10	Heat Content
		73-00-002	Jan. 15-18	Heat Content
		73-00-003	Jan. 29-31	Heat Content
		73-00-053	Feb. 5-9	U.S. Biochemical
		73-00-004	Feb. 12-14	Heat Content
		73-00-005	Feb. 26-Mar. 1	Heat Content
		73-00-006	Mar. 12-15	Heat Content
		73-00-056	Mar. 19-23	U.S. Biochemical
		73-00-007	Mar. 26-29	Heat Content
		73-00-008	Mar. 28-31	Moorings
		73-00-009	June 4-7	Heat Content
		73-00-059	June 11-15	U.S. Biochemical
		73-00-010	June 25-29	Heat Content/Moorings
		73-00-011	Oct. 18-19	Moorings
		73-00-012	Nov. 22-23	Eng./W.Q. Trials
		73-00-013	Dec. 4-10	Moorings
Erie	LIMNOS	73-01-001	Apr. 11-16	Monitor
		73-01-002	June 18-22	Water Column Study
		73-01-003	July 25-30	Monitor
		73-01-004	Aug. 1-4	Water Column Study
		73-01-005	Aug. 27-30	Monitor (Special)
		73-01-006	Sept. 4-7	Water Column Study
		73-01-007	Nov. 7-13	Monitor

LAKE	SHIP	CRUISE	DATES	TYPE OF CRUISE
Huron	LIMNOS	73-02-001	Sept. 8-26	Bottom Sediment
		73-02-002	Nov. 15-23	Moorings
Superior	LIMNOS	73-03-001	Apr. 27-May 18	Regional Sed. Survey
		73-03-002	May 20-30	Moorings
		73-03-003	Aug. 9-22	Moorings
		73-03-004	Oct. 1-10	Moorings
Georgian Bay & N. Channel	LIMNOS	73-05-001	Sept. 8-26	Bottom Sediment
		73-05-002	Oct. 22-Nov. 1	Coring
Ontario	PORTE DAUPHINE	73-00-201	Jan. 3-4	Heat Content
		73-00-202	Jan. 10-11	Heat Content
		73-00-203	Jan. 16-18	Heat Content
		73-00-204	Jan. 29-31	Heat Content
		73-00-207	Mar. 12-14	Heat Content
		73-00-208	Mar. 26-28	Heat Content
		73-00-209	Apr. 2-7	Heat Content
		73-00-210	Apr. 30-May 2	Heat Content
		73-00-212	Sept. 4-28	Ham./Scourge ROM
		73-00-213	Oct. 9-12	Coring
		73-00-214	Oct. 16-18	Ham./Scourge ROM
		73-00-215	Oct. 24-28	Remote Sensing
		73-00-216	Oct. 29-Nov. 2	Ham./Scourge ROM
		73-00-217		NTA
Ontario	LAC ERIE	73-00301	Jan. 15-16	NTA
		73-00-302	Feb. 19-20	NTA
		73-00-303	Mar. 19-21	NTA
		73-00-304	Apr. 206	Hydrosonde/Trials
		73-00-305	Apr. 9-13	Regional Sed. Survey
		73-00-306	Apr. 17-19	Sediment F/Trials
		73-00-307	Apr. 24-27	NTA/Wave Rider
		73-00-308	Apr. 30-May 4	Hydrosonde/Trials
		73-00-309	May 7-11	Met. Buoys
		73-00-310	May 14-June 8	Regional Sed. Survey
		73-00-312	June 12-15	Geophysical/Tor.
		73-00-313	June 19-20	NTA
		73-00-314	June 24-July 28	Geophysical/Scarb.
		73-00-316	Aug. 1-7	Geophysical/King.
Erie	LAC ERIE	73-01-301	July 30-Aug. 5	Geophysical
Ontario	ADVENT	73-00-402	May 22-25	Trials BT/Roch.
		73-00-403	Oct. 1-3	Virology
		73-00-405	Oct. 23	Mycology
		73-00-406	Oct. 29-31	Virology
Erie, St. Clair	ADVENT	73-01-403	Nov. 3-17	Dredge Impact Study
Superior	ADVENT	73-03-401	July 18-Aug. 22	Pt. Source Survey

Launch	Scientist	From	To	Date	Additional Equipment	Diving	Remarks
LEMOYNE	Henry	May 7 & June 8	June 4 June 29	April 24	Gyrocompass, repeater, radar, standard magnetic compass, searchlight, winch, echo sounder.	N/A	Geophysical and Geological Work.
	Kemp Thomas & Kemp Damiani	June 4 July 3 Aug. 13	June 8 Aug. 1 Aug. 31	" " "	" " "	" " "	" " "
AQUA	Kelso	May 14	Sept. 28	May 14	Compass, sextant, "A" Frame, Echo sounder, winch, plus trailer	As required.	Pickering-Whitby harbour. Lake Erie
CADET BERTRAM	Rukavina	April 30	Aug. 1		As equipped.		Lake Erie.
SEA TRUCK	J. Williams Gray & Carpenter	June 4 July 3	June 29 Aug. 31		As equipped. As equipped.		Bay of Quinte and other work sites.
SHARK	Roe	April 15	Dec. 3		As equipped.	Continuous for Diving as required.	Several work areas.
BRUCE	Nagy, Stadelman, Coakley, Stage	April 24	Oct. 12		As equipped.		Off Burlington area.
M-58	Rukavina	April 2	Sept. 28		As equipped.		
SLICKER	Nagy	On continuous basis			As equipped.		Oil contingency plans.
SORA & WASUCA	Murthy	April 24	May 7		As equipped.		
WHALER	J. Williams	May 15	Aug. 31				Geology
WHALER	Durham	June 25	Aug. 31				
WHALER	Donelan	Apr. 30	Dec. 30				
WHALER	Traversy	May 28	Aug. 31				Water Quality Division.
WHALER	Boyce	May 1	Octo. 31				Physical Limnology.
WHALER	Henry	June 1	Sept. 30				
WHALER	Traversy	May 14, July 23 Sept. 17	May 19, July 28 Sept. 22				Water Quality Division.
WHALER	Carpenter	June 11 July 23	June 29 Aug. 11				Great Lakes Biolimnology Laboratory

Table 3. LAUNCH SUMMARY

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN		1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 CCIW	6 CCIW
	7 CCIW	8 Depart CCIW 1212 hrs.	9 Lake Ontario	10 Heat Content	11 Survey	12 Arrive CCIW 0840 hrs.	13 CCIW
	14 CCIW	15 Depart CCIW 1124 hrs.	16 Lake Ontario	17 Heat Content Survey	18 Arrive CCIW 2225 hrs.	19 CCIW	20 CCIW
	21 CCIW	22 CCIW	23 CCIW	24 CCIW	25 CCIW	26 CCIW	27 CCIW
FEB	28 CCIW	29 Depart CCIW 1103 hrs.	30 Lake Ontario Heat Content Survey	31 Arrive Toronto 2345 hrs.	1 In Transit	2 CCIW	3 CCIW
	4 CCIW	5 Depart CCIW 1030 hrs.	6 Lake Ontario	7 U.S. Biochemical	8 Survey	9 Arrive CCIW 0800 hrs.	10 CCIW
	11 CCIW	12 Depart CCIW 1003 hrs.	13 Lake Ontario	14 Heat Content Survey	15 Arrive CCIW 1625 hrs.	16 CCIW	17 CCIW
	18 CCIW	19 CCIW	20 CCIW	21 CCIW	22 CCIW	23 CCIW	24 CCIW
	25 CCIW	26 Depart CCIW 0955 hrs.	27 Lake Ontario	28 Heat Content Survey	1 Arrive CCIW 0930 hrs.	2 CCIW	3 CCIW
MAR	4 CCIW	5 CCIW	6 CCIW	7 CCIW	8 CCIW	9 CCIW	10 CCIW
	11 CCIW	12 Depart CCIW 1057 hrs.	13 Lake Ontario Heat Content Survey	14 Arrive CCIW 2045 hrs.	15 CCIW	16 CCIW	17 CCIW
	18 CCIW	19 Depart CCIW 1052 hrs.	20 Lake Ontario	21 U.S. Biochemical	22 Survey	23 Arrive CCIW 0905 hrs.	24 CCIW
	25 CCIW	26 Depart CCIW 0955 hrs.	27 Lake Ontario Heat Content Survey	28 End of Cruise 1150 hrs.	29 Lake Ontario	30 Moorings	31 Arrive CCIW 1305 hrs.
APR	1 CCIW	2 Depart CCIW	3 Lake Ontario	4 Moorings	5 Arrive CCIW	6 CCIW	7 CCIW
	8 CCIW	9 Depart CCIW 1000 hrs.	10 Lake Erie	11 Monitor	12 Lake Erie	13 Monitor	14 Lake Erie
	15 Monitor	16 Lake Erie	17 Arrive CCIW 2330 hrs.	18 CCIW	19 CCIW	20 CCIW	21 CCIW
	22 CCIW	23 CCIW	24 Depart CCIW 1055 hrs.	25 Lake Superior	26 Regional	27 Sediment	28 Survey
MAY	29 Lake Superior	30 Regional	1 Sediment	2 Survey	3 Lake Superior	4 Regional	5 Sediment
	6 Survey	7 Lake Superior	8 Arrive Thunder Bay 0845 hrs.	9 Depart Thunder Bay 0700 hrs.	10 Lake Superior	11 Regional	12 Sediment
	13 Survey	14 Lake Superior	15 Regional	16 Sediment	17 Survey	18 Arrive Sault Ste. Marie 1023 hrs.	19 Depart Sault Ste. Marie 1855 hrs.
	20 Lake Superior	21 Moorings	22 Lake Superior	23 Moorings	24 Lake Superior	25 Moorings	26 Lake Superior
	27 Moorings	28 Lake Huron	29 Moorings	30 Arrive CCIW 0000 hrs.	31 CCIW	1 CCIW	2 CCIW
JUNE	3 CCIW	4 Depart CCIW 1055 hrs.	5 Lake Ontario	6 Heat Content Survey	7 Arrive CCIW 1620 hrs.	8 CCIW	9 CCIW
	10 CCIW	11 Depart CCIW 1110 hrs.	12 Lake Ontario	13 U.S. Biochemical	14 Survey	15 Arrive CCIW 0230 hrs.	16 CCIW
	17 In Transit	18 Depart Port Stanley 1212 hrs.	19 Lake Erie	20 Water Column	21 Study	22 Arrive Port Colborne 0558 hrs.	23 In Transit
	24 CCIW	25 Depart CCIW 1329 hrs.	26 Lake Ontario	27 Heat Content Survey	28 Moorings	29 Arrive CCIW 0945 hrs.	30 CCIW
JULY	1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 CCIW	6 CCIW	7 CCIW
	8 CCIW	9 ----------	10 ----------	11 DRY DOCK	12 ----------	13 ----------	14 ----------
	15 ----------	16 ----------	17 ----------	18 DRY DOCK	19 ----------	20 ----------	21 ----------
	22 CCIW	23 CCIW	24 Depart CCIW 0910 hrs.	25 Lake Erie	26 Monitor	27 Lake Erie	28 Monitor
AUG	29 Lake Erie	30 Arrive Port Stanley 1235 hrs.	31 Port Stanley	1 Depart Port Stanley 1420 hrs.	2 Lake Erie	3 Water Column Study	4 Arrive Port Stanley 1830 hrs.
	5 Port Stanley	6 In Transit	7 Depart Sarnia 2040 hrs.	8 Lake Superior	9 Moorings	10 Lake Superior	11 Moorings
	12 Lake Superior	13 Moorings	14 Lake Superior	15 Moorings	16 Lake Superior	17 Moorings	18 Lake Superior
	19 Moorings	20 Lake Superior	21 Moorings	22 Arrive Sarnia 2320 hrs.	23 Sarnia	24 Sarnia	25 Sarnia
	26 Sarnia	27 Depart Sarnia 1405 hrs.	28 Lake Erie	29 Special Monitor	30 Arrive Port Colborne 0025 hrs.	31 In Transit	1 Port Stanley
SEPT	2 Port Stanley	3 Port Stanley	4 Depart Port Stanley 1500 hrs.	5 Lake Erie	6 Water Column Study	7 Arrive Port Stanley 0626 hrs.	8 In Transit
	9 In Transit	10 Depart Owen Sound 1335 hrs.	11 Regional	12 Sediment Survey	13 Georgian Bay	14 Arrive Owen Sound 1107 hrs.	15 Owen Sound
	16 Owen Sound	17 Depart Owen Sound 0025 hrs.	18 Regional	19 Sediment Survey	20 Georgian Bay	21 Arrive Owen Sound 1222 hrs.	22 Owen Sound
	23 Owen Sound	24 Depart Owen Sound 1110 hrs.	25 Sediment Survey	26 Arrive Owen Sound 1520 hrs.	27 Owen Sound	28 Owen Sound	29 Depart Owen Sound 2353 hrs.
OCT	30 Lake Superior	1 Moorings	2 Lake Superior	3 Moorings	4 Lake Superior	5 Moorings	6 Lake Superior
	7 Moorings	8 Arrive CCIW 1010 hrs.	9 CCIW	10 CCIW	11 CCIW	12 CCIW	13 CCIW
	14 CCIW	15 CCIW	16 CCIW	17 CCIW	18 Depart CCIW 0805 hrs.	19 Lake Ontario Moorings, Arr.CCIW	20 CCIW
	21 CCIW	22 Depart CCIW 1055 hrs.	23 Georgian Bay	24 Coring	25 Georgian Bay	26 Coring	27 Georgian Bay
NOV	28 Coring	29 Georgian Bay	30 Coring	31 Georgian Bay	1 Arrive CCIW 0350 hrs.	2 CCIW	3 CCIW
	4 CCIW	5 Depart CCIW 1010 hrs.	6 Lake Erie	7 Monitor	8 Lake Erie	9 Monitor	10 Lake Erie
	11 Monitor	12 Lake Erie	13 Monitor	14 Arrive Sarnia 0328 hrs.	15 Depart Sarnia	16 Lake Huron	17 Moorings
	18 Lake Huron	19 Moorings	20	21 Arrive CCIW 1610 hrs.	22 Depart CCIW 1123 hrs.	23 Eng.Trials, Arr. CCIW 1345 hrs.	24 CCIW
	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 CCIW	1 CCIW
DEC	2 CCIW	3 CCIW	4 Depart CCIW 0800 hrs.	5 Lake Ontario	6 Moorings	7 Lake Ontario	8 Moorings
	9 Lake Ontario	10 Arrive CCIW 1325 hrs.	11 CCIW	12 CCIW	13 CCIW	14 CCIW	15 CCIW
	16 CCIW	17 CCIW	18 CCIW	19 CCIW	20 CCIW	21 CCIW	22 CCIW
	23 CCIW	24 CCIW	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN		1 CCIW	2 CCIW	3 Depart CCIW 1125 hrs.	4 Lake Ontario	5 Heat Content Survey	6 Arrive CCIW 1345 hrs.
	7 CCIW	8 CCIW	9 Depart CCIW 1010 hrs.	10 Lake Ontario	11 Organic Particle Study	12 Arrive CCIW 0820 hrs.	13 CCIW
	14 CCIW	15 Depart CCIW 1145 hrs.	16 Organic Particle Study	17 Lake Ontario	18 Organic Particle Study	19 Phase II	20 Arrive CCIW 0905 hrs.
	21 CCIW	22 CCIW	23 CCIW	24 CCIW	25 CCIW	26 CCIW	27 CCIW
	28 CCIW	29 CCIW	30 CCIW	31 CCIW	1 CCIW	2 CCIW	3 CCIW
FEB	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 CCIW	17 CCIW
	18 CCIW	19 CCIW	20 CCIW	21 CCIW	22 CCIW	23 CCIW	24 CCIW
	25 CCIW	26 CCIW	27 CCIW	28 CCIW	1 CCIW	2 CCIW	3 CCIW
MAR	4 CCIW	5 Depart CCIW 1540 hrs.	6 Lake Ontario	7 Organic Particle	8 Study	9 Arrive CCIW 0815 hrs.	10 CCIW
	11 CCIW	12 Depart CCIW 1110 hrs.	13 Lake Ontario	14 Organic Particle	15 Study	16 Phase II	17 Arrive CCIW 0830 hrs.
	18 CCIW	19 Depart CCIW 1145 hrs.	20 Lake Ontario	21 Monitor	22 Lake Ontario	23 Monitor	24 Arrive CCIW 1600 hrs.
	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 CCIW	31 CCIW
APR	1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 CCIW	6 CCIW	7 CCIW
	8 CCIW	9 Depart CCIW 1025 hrs.	10 Coring	11 Lake Ontario	12 Arrive CCIW 1755 hrs.	13 CCIW	14 CCIW
	15 CCIW	16 Depart CCIW 1105 hrs.	17 Lake Ontario Terrestial Heat	18 Arrive CCIW 1910 hrs.	19 CCIW	20 CCIW	21 CCIW
	22 CCIW	23 CCIW	24 Depart CCIW 1125 hrs.	25 Lake Ontario	26 Monitor	27 U.S. Biochemical	28 Survey
MAY	29 Arrive CCIW 0855 hrs.	30 CCIW	1 Depart CCIW 0915 hrs.	2 Lake Ontario Radon & Moorings	3 Arrive CCIW 1522 hrs.	4 CCIW	5 CCIW
	6 CCIW	7 Depart CCIW 1030 hrs.	8 Lake Huron	9 Monitor	10 Lake Huron	11 Monitor	12 Sault Ste. Marie
	13 Lake Superior	14 Monitor	15 Lake Superior	16 Monitor	17 Lake Superior	18 Monitor	19 Thunder Bay
	20 Lake Superior	21 Monitor	22 Lake Superior	23 Monitor	24 Arrive Sault Ste. Marie 0845 hr	25 Sault Ste. Marie	26 Sault Ste. Marie
	27 Sault Ste. Marie	28 Sault Ste. Marie	29 Depart Sault Ste. Marie 1437 hrs	30 Lake Superior	31 Coring	1 Geophysical	2 and
JUNE	3 Geochemical	4 Lake Superior	5 Lake Superior	6 Coring	7 Geophysical	8 and	9 Geochemical
	10 Lake Superior	11 Arrive Sault Ste. Marie 1300 hrs.	12 Sault Ste. Marie	13 Sault Ste. Marie	14 Sault Ste. Marie	15 Depart Sault Ste. Marie 1200 hrs.	16 Lake Superior
	17 Monitor	18 Lake Superior	19 Monitor	20 Lake Superior	21 Monitor	22 Lake Superior	23 Monitor
	24 Lake Superior	25 Monitor	26 Lake Superior	27 Monitor	28 Arrive Sault Ste Marie 1440 hrs.	29 In Transit	30 In Transit
JULY	1 In Transit	2 ----------	3 ----------	4 DOWN	5 TIME	6 ---------	7 ---------
	8 ----------	9 ----------	10 ----------	11 DOWN	12 TIME	13 ---------	14 ---------
	15 CCIW	16 CCIW	17 CCIW	18 CCIW	19 CCIW	20 CCIW	21 CCIW
	22 CCIW	23 In Transit	24 In Transit	25 In Transit	26 Depart Sault Ste Marie 2018 hrs.	27 Lake Superior	28 Monitor
	29 Lake Superior	30 Monitor	31 Lake Superior	1 Monitor	2 Lake Superior	3 Monitor	4 Lake Superior
AUG	5 Monitor	6 Lake Superior	7 Monitor	8 Arrive Sault Ste. Marie 1155 hrs.	9 Sault Ste. Marie	10 Sault Ste. Marie	11 Sault Ste. Marie
	12 Sault Ste. Marie	13 Depart Sault Ste. Marie 1645 hrs.	14 Lake Superior	15 Coring	16 Lake Superior	17 Coring	18 Lake Superior
	19 Coring	20 Lake Superior	21 Coring	22 Lake Superior	23 Arrive Sault Ste. Marie 0500 hrs.	24 In Transit	25 In Transit
	26 Depart Sarnia 0930 hrs.	27 Lake Erie	28 Monitor	29 Lake Erie	30 Monitor	31 Lake Erie	1 Arrive Sault Ste. Marie 0615 hrs.
SEPT	2 Sarnia	3 Sarnia	4 Depart Sarnia 1555 hrs.	5 Lake Superior	6 Monitor	7 Lake Superior	8 Monitor
	9 Lake Superior	10 Monitor	11 Lake Superior	12 Monitor	13 Lake Superior	14 Monitor	15 Lake Superior
	16 Monitor	17 Lake Superior	18 Sault Ste. Marie	19 Lake Huron	20 Monitor	21 Arrive Sarnia 0145 hrs.	22 In Transit
	23 In Transit	24 CCIW	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW
OCT	30 CCIW	1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 CCIW	6 CCIW
	7 CCIW	8 CCIW	9 Depart CCIW 1746 hrs.	10 In Transit	11 In Transit	12 In Transit	13 Lake Superior
	14 Monitor	15 Lake Superior	16 Monitor	17 Lake Superior	18 Monitor	19 Lake Superior	20 Monitor
	21 Lake Superior	22 Monitor	23 Lake Superior	24 Monitor	25 Lake Superior	26 In Transit	27 In Transit
	28 In Transit	29 Arrive CCIW 1140 hrs.	30 Depart CCIW 1120 hrs.	31 Lake Ontario	1 Monitor	2 Lake Ontario	3 Monitor
NOV	4 Arrive CCIW 0350 hrs.	5 CCIW	6 CCIW	7 CCIW	8 CCIW	9 CCIW	10 CCIW
	11 CCIW	12 CCIW	13 Depart CCIW 1108 hrs.	14 In Transit	15 In Transit	16 In Transit	17 In Transit
	18 Lake Superior	19 Monitor	20 Lake Superior	21 Monitor	22 Lake Superior	23 Monitor	24 Lake Superior
	25 Monitor	26 Lake Superior	27 Monitor	28 Lake Superior	29 Monitor	30 In Transit	1 In Transit
DEC	2 In Transit	3 Arrive CCIW 2145 hrs.	4 Depart CCIW 1250 hrs.	5 Lake Ontario	6 Monitor	7 Arrive CCIW 0135 hrs.	8 CCIW
	9 CCIW	10 CCIW	11 CCIW	12 CCIW	13 CCIW	14 CCIW	15 CCIW
	16 CCIW	17 CCIW	18 CCIW	19 CCIW	20 CCIW	21 CCIW	22 CCIW
	23 CCIW	24 CCIW	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW

Great Lakes Studies 1973, MV MARTIN KARLSEN

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN		1	2 Depart Toronto 2140	Lake Ontario	4 Heat Content Survey	5 Arrive Toronto 0900 hrs.	6 Toronto
	7 Toronto	8 Toronto	9 Depart Toronto 0955 hrs.	10 Heat Content Survey & Coring	11 Arrive Toronto 0007 hrs.	12 Toronto	13 Toronto
	14 Toronto	15 Depart Toronto 1140 hrs.	16 Lake Ontario	17 Heat Content Survey	18 Arrive Toronto 1104 hrs.	19 Toronto	20 Toronto
	21 ---	22 ---	23 ---	24 Toronto	25 ---	26 ---	27 ---
FEB	28 Toronto	29 Depart Toronto 1150 hrs.	30 Lake Ontario	31 Heat Content Survey	1 Arrive Toronto 0438 hrs.	2 Toronto	3 Toronto
	4 ---	5 ---	6 ---	7 Toronto	8 ---	9 ---	10 ---
	11 ---	12 ---	13 ---	14 Toronto	15 ---	16 ---	17 ---
	18 ---	19 ---	20 ---	21 Toronto	22 ---	23 ---	24 ---
	25 ---	26 ---	27 ---	28 Toronto	1 ---	2 ---	3 ---
MAR	4 ---	5 ---	6 ---	7 Toronto	8 ---	9 ---	10 ---
	11 Toronto	12 Depart Toronto 1552 hrs.	13 Heat Content Survey	14 Arrive Toronto 2017 hrs.	15 Toronto	16 Toronto	17 Toronto
	18 ---	19 ---	20 ---	21 Toronto	22 ---	23 ---	24 ---
	25 Toronto	26 Depart Toronto 0955 hrs.	27 Heat Content Survey	28 Arrive Toronto 1405 hrs.	29 Toronto	30 Toronto	31 Toronto
APR	1 Toronto	2 Depart Toronto 1105 hrs.	3 Lake Ontario	4 Heat Content	5 Survey	6 Arrive Toronto 0224 hrs.	7 Toronto
	8 ---	9 ---	10 ---	11 Toronto	12 ---	13 ---	14 ---
	15 ---	16 ---	17 ---	18 Toronto	19 ---	20 ---	21 ---
	22 ---	23 ---	24 ---	25 Toronto	26 ---	27 ---	28 ---
MAY	29 Toronto	30 Depart CCIW 1030 hrs.	1 Lake Ontario	2 Heat Content Survey	3 Arrive CCIW 0530 hrs.	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 CCIW	17 Depart CCIW	18 In Transit	19 Arrive Quebec
	20 Quebec	21 Depart Quebec	22 Quebec	23 Anchorage Site	24 Arrive Quebec	25 Quebec	26 Quebec
	27 Quebec	28 Arrive Anchorage	29 St. Lawrence	30 St. Lawrence	31 St. Lawrence	1 St. Lawrence	2 Point au Pic
JUNE	3 Point au Pic	4 St. Lawrence	5 St. Lawrence	6 St. Lawrence	7 St. Lawrence	8 St. Lawrence	9 Point au Pic
	10 Point au Pic	11 St. Lawrence	12 St. Lawrence	13 St. Lawrence	14 St. Lawrence	15 St. Lawrence	16 Point au Pic
	17 Point au Pic	18 St. Lawrence	19 St. Lawrence	20 St. Lawrence	21 St. Lawrence	22 St. Lawrence	23 St. Lawrence
	24 Depart Anchorage Area	25 Quebec	26 In Transit	27 In Transit	28 In Transit	29 Arrive CCIW	30 CCIW
JULY	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 CCIW	16 CCIW	17 Leave CCIW 1000 hrs.	18 In Transit	19 In Transit	20 In Transit	21 In Transit
	22 Arrive Quebec	23 Depart Quebec 1200 hrs.	24 Mooring Survey off St. Francois	25 Mooring	26 Mooring	27 Arrive Quebec 1430 hrs.	28 Quebec
AUG	29 Quebec	30 Survey Site Tower Location	31 Tower Site	1 Tower Site	2 Tower Site	3 Arrive Quebec 1400 hrs.	4 Quebec
	5 Quebec	6 Survey Site	7 Survey Site	8 Survey Site	9 Survey Site	10 Survey Site	11 Survey Site
	12 Survey Site	13 Survey Site	14 Survey Site	15 Survey Site	16 Survey Site	17 Arrive Quebec 1700 hrs.	18 Quebec
	19 Quebec	20 Survey Site	21 Survey Site	22 Survey Site	23 Survey Site	24 Arrive Quebec 1200 hrs.	25 Quebec
	26 Quebec	27 Depart Quebec 0800 hrs.	28 In Transit	29 In Transit	30 In Transit	31 In Transit	1 Arrive CCIW
SEPT	2 CCIW	3 Depart CCIW	4 Lake Ontario Hamilton-Scourge	5 Hamilton-Scourge	6 Hamilton-Scourge	7 Hamilton-Scourge	8 CCIW
	9 CCIW	10 Hamilton-Scourge	11 Hamilton-Scourge	12 ---	13 ---	14 ---	15 CCIW
	16 CCIW	17 ---	18 ---	19 Hamilton-Scourge	20 ---	21 ---	22 CCIW
	23 CCIW	24 ---	25 ---	26 Hamilton-Scourge	27 ---	28 ---	29 CCIW
OCT	30 CCIW	1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 CCIW	6 CCIW
	7 CCIW	8 CCIW	9 Depart CCIW 1100 hrs.	10 Lake Ontario Coring	11 Arrive CCIW 1600 hrs.	12 CCIW	13 CCIW
	14 CCIW	15 CCIW	16 Depart CCIW	17 Lake Ontario Hamilton-Scourge	18 Arrive CCIW	19 CCIW	20 CCIW
	21 CCIW	22 CCIW	23 CCIW	24 Depart CCIW 1550 hrs.	25 Remote Sensing ERTS	26 Remote Sensing ERTS	27 Remote Sensing ERTS
NOV	28 Arrive CCIW 1850 hrs.	29 Depart CCIW	30 Lake Ontario Hamilton-Scourge	31 Hamilton-Scourge	1 Hamilton-Scourge	2 Arrive 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 CCIW	16 CCIW	17 CCIW
	18 ---	19 ---	20 ---	21 CCIW	22 ---	23 ---	24 ---
	25 ---	26 ---	27 ---	28 CCIW	29 ---	30 ---	1 ---
DEC	2 ---	3 ---	4 ---	5 CCIW	6 ---	7 ---	8 ---
	9 CCIW	10 Depart CCIW 0800 hrs.	11 Monitor-NTA	12 Lake Ontario	13 Moorings Wolfe Island Area	14 Arrive CCIW 0300 hrs.	15 CCIW
	16 CCIW	17 Location of Buoys	18 Toronto Area	19 CCIW	20	21	22
	23	24	25	26	27	28	29

Great Lakes Studies 1973, CCGS PORTE DAUPHINE

	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 NTA Monitor	18 Arrive CCIW 1245 hrs.	19 CCIW	20 CCIW
	21 CCIW	22 CCIW	23 CCIW	24 CCIW	25 CCIW	26 CCIW	27 CCIW
FEB	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 CCIW	12 CCIW	13 CCIW	14 CCIW	15 CCIW	16 CCIW	17 CCIW
	18 CCIW	19 Depart CCIW 0900 hrs.	20 NTA Monitor Arr.CCIW 1710 hrs.	21 CCIW	22 CCIW	23 CCIW	24 CCIW
MAR	25 CCIW	26 CCIW	27 CCIW	28 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 CCIW	16 CCIW	17 CCIW
	18 CCIW	19 CCIW	20 Depart CCIW 0900 hrs.	21 NTA Monitor	22 Arrive CCIW 1005 hrs.	23 CCIW	24 CCIW
	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 CCIW	31 CCIW
APR	1 CCIW	2 Depart CCIW 1040 hrs.	3 Field Trials	4 Field Trials	5 Field Trials	6 Arrive CCIW 1100 hrs.	7 CCIW
	8 CCIW	9 CCIW	10 Depart CCIW 0830 hrs.	11 Regional Sediment	12 Regional Sediment	13 Arrive CCIW 1330 hrs.	14 CCIW
	15 CCIW	16 CCIW	17 Depart CCIW 0900 hrs.	18 Field Trials	19 Arrive CCIW 1305 hrs.	20 CCIW	21 CCIW
	22 CCIW	23 CCIW	24 Depart CCIW 0900 hrs.	25 NTA and Wave Rider	26 NTA and Wave Rider	27 Arrive CCIW 1110 hrs.	28 CCIW
MAY	29 CCIW	30 Depart CCIW 0830 hrs.	1 Seismic Survey	2 Seismic Survey	3 Arrive CCIW 1750 hrs.	4 CCIW	5 CCIW
	6 CCIW	7 Depart CCIW 0905 hrs.	8 Met. Buoys	9 Met. Buoys	10 Met. Buoys	11 Arrive CCIW 2100 hrs.	12 CCIW
	13 CCIW	14 Depart CCIW 1030 hrs.	15 Regional Sediment	16 Regional Sediment	17 Regional Sediment	18 Regional Sediment	19 Regional Sediment
	20 Regional Sediment	21 Regional Sediment	22 Regional Sediment	23 Regional Sediment	24 Regional Sediment	25 Regional Sediment	26 Regional Sediment
	27 Regional Sediment	28 Regional Sediment	29 Regional Sediment	30 Regional Sediment	31 Regional Sediment	1 Regional Sediment	2 Regional Sediment
JUNE	3 Regional Sediment	4 Regional Sediment	5 Regional Sediment	6 Regional Sediment	7 Regional Sediment	8 Arrive CCIW 2015 hrs.	9 CCIW
	10 CCIW	11 CCIW	12 Depart CCIW 0925 hrs.	13 Geophysical Survey	14 Geophysical Survey	15 Arrive CCIW 0145 hrs.	16 CCIW
	17 CCIW	18 CCIW	19 Depart CCIW 0850 hrs.	20 NTA Monitor,Arr CCIW 1410 hrs.	21 CCIW	22 CCIW	23 CCIW
	24 CCIW	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 CCIW
JULY	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 CCIW	16 CCIW	17 CCIW	18 CCIW	19 CCIW	20 CCIW	21 CCIW
	22 CCIW	23 CCIW	24 Depart CCIW 0700 hrs.	25 Geophysical Survey	26 Geophysical Survey	27 Geophysical Survey	28 Arrive CCIW 2220 hrs.
AUG	29 In Transit	30 In Transit	31 In Transit	1 In Transit	2 In Transit	3 Depart Port Stanley 1310 hrs.	4 Geophysical Survey
	5 Geophysical Survey	6 Geophysical Survey	7 Geophysical Survey	8 Arrive CCIW 0500 hrs.	9 Depart CCIW 0730 hrs.	10 Geological Survey	11 Geological Survey
	12 Geological Survey	13 Geological Survey	14 Geological Survey	15 Geological Survey	16 Geological Survey	17 Geological Survey	18 Geological Survey
	19 Geological Survey	20 Geological Survey	21 Geological Survey	22 Geological Survey	23 Geological Survey	24 Geological Survey	25 Arrive CCIW 1230 hrs.
	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 CCIW	31 CCIW	1
SEPT	2	3	4 OFF CHARTER	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
OCT	30	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	31	1	2	3
NOV	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	1
DEC	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

	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	27
FEB	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	24
MAR	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	31
APR	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
MAY	29	30	1	2	3	4	5
	6	7	8	9	10	11	12
	13 Outfitting	14 CCIW	15 CCIW	16 CCIW	17 CCIW	18 CCIW	19 CCIW
	20 CCIW	21 CCIW	22 Depart CCIW 1225 hrs.	23 Lake	24 Ontario	25 Bathymetric	26 Survey
	27 Arrive CCIW 1915 hrs.	28 CCIW	29 CCIW	30 CCIW	31 CCIW	1 CCIW	2 CCIW
JUNE	3 CCIW	4 CCIW	5 Equipment	6 Trials	7 CCIW	8 CCIW	9 CCIW
	10 CCIW	11 CCIW	12 Equipment	13 Trials	14 CCIW	15 Equipment Trials	16 CCIW
	17 CCIW	18 CCIW	19 CCIW	20 CCIW	21 CCIW	22 CCIW	23 CCIW
	24 CCIW	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 CCIW
JULY	1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 Equipment Trials	6 CCIW	7 CCIW
	8 CCIW	9 CCIW	10 CCIW	11 CCIW	12 CCIW	13 CCIW	14 CCIW
	15 CCIW	16 CCIW	17 Depart CCIW 0900 hrs.	18 In Transit	19 In Transit	20 In Transit	21 In Transit
	22 Arrive Sault Ste Marie 1545 hrs.	23 Downtime Sault Ste. Marie	24 Downtime Sault Ste. Marie	25 Downtime Sault Ste. Marie	26 Downtime Sault Ste. Marie	27 In Transit	28 Marathon
AUG	29 ----------	30 ----------	31 Marathon	1 Project	2 ----------	3 ----------	4 ----------
	5 ----------	6 ----------	7 Marathon	8 Project	9 ----------	10 ----------	11 ----------
	12 ----------	13 ----------	14 Marathon	15 Project	16 ----------	17 ----------	18 ----------
	19 ----------	20 ----------	21 Marathon	22 Project	23 ----------	24 ----------	25 Depart Marathon 0430 hrs.
	26 In Transit	27 In Transit	28 In Transit	29 Arrive CCIW 1400 hrs.	30 CCIW	31 CCIW	1 CCIW
SEPT	2 CCIW	3 CCIW	4 CCIW	5 CCIW	6 CCIW	7 CCIW	8 CCIW
	9 CCIW	10 CCIW	11 CCIW	12 CCIW	13 Depart CCIW 0900 hrs.	14 Arrive Port Stanley 1640 hrs.	15 Port Stanley
	16 Port Stanley	17 Dredge Impact Study	18 Lake Erie	19 In Transit	20 Dredge Impact Study	21 Lake St. Clair	22 Windsor
	23 Windsor	24 Dredge Impact Study	25 Lake St. Clair	26 Depart Windsor 1530 hrs.	27 In Transit	28 Arrive CCIW 1635 hrs.	29 CCIW
OCT	30 CCIW	1 Depart CCIW 1410 hrs.	2 Lake Ontario Virology	3 Arrive CCIW 1030 hrs.	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 CCIW	17 Hamilton Harbour NTA Monitor	18 CCIW	19 CCIW	20 CCIW
	21 CCIW	22 CCIW	23 Lake Ontario Mycology	24 CCIW	25 CCIW	26 CCIW	27 CCIW
	28 CCIW	29 CCIW	30 CCIW	31 Depart CCIW 1610 hrs.	1 Lake Ontario Virology	2 Arrive CCIW 1118 hrs.	3 Depart CCIW 0910 hrs.
NOV	4 Arrive Port Stanley 1530 hrs.	5 ----------	6 Dredge	7 Impact	8 Study	9 Lake Erie	10 ----------
	11 ----------	12 ----------	13 ----------	14 ----------	15 In Transit	16 Erieau	17 ----------
	18 ----------	19 Lake Erie Coring	20 In Transit	21 ----------	22 Port Colborne	23 ----------	24 ----------
	25 ----------	26 Lake Erie Coring	27 Depart Port Colborne 1200 hrs.	28 Arrive Niagara-on the-Lake 0230 hrs.	29 Niagara-on-the-Lake	30 In Transit	1 CCIW
DEC	2 CCIW	3 In Transit	4 Lake Ontario Coring	5 CCIW	6 CCIW	7 CCIW	8 CCIW
	9 END	10 OF	11 CRUISES	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29

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