CANADA CENTRE FOR INLAND WATERS

FINAL FIELD REPORT

TECHNICAL OPERATIONS SECTION

1968

GREAT LAKES STUDIES

INTRODUCTION

This report is intended to cover the work in which Operations Section was involved during 1968. It also contains brief descriptions of the ships and launches and lists most of the major equipment used.

The report has been divided into three sections:

Section 1

Operations staff - CCIW, and scientific and support staffing agencies.

Section 2

Field programs, ships, launches and equipment.

Section 3

Station positions and charts, and summaries of cruises, analyses made and observations carried out by the major ships.

SECTION 1

Operations Staff - CCIW

Student Assistants

Scientific and Support Staffing Agencies

Operations Staff - CCIW

H.B. Macdonald	Head, Technical Operations Section
D.J. Cooper	C.S.S. Limnos
A. Holler	M.V. Theron
H.W. MacPhail	Special Assignments
D. Hanington	Field (Ships)
D. Mehlman	" "
P. Youakim	" "
H. Cho	" "
M. Quraishi	" "
H. Ng	" "
H. Gschwind	" "
F. de Vree	" "
P. Seidenberg	" "
R. Lee	" "
L. Benner	" "

Student Assistants

D. Anthony, R. Sharkey, R. James, D. Cavan.

Scientific and Support Staffing Agencies

Great Lakes Division, I.W.B., Dept. of Energy, Mines and Resources

Water Quality Division, I.W.B., Dept. of Energy, Mines and Resources

Geological Survey of Canada, " " " " " "

Dominion Observatory, " " " " " "

Public Health Engineering, Dept. of National Health and Welfare

Fisheries Research Board

Royal Ontario Museum

SECTION 2

Field Programs

Ships, Launches, Equipment

TABLE 1

SHIPS & LAUNCHES - C.C.I.W.

VESSEL	DATES FROM	DATES TO	AREA OF OPERATION	SECTION	SCIENTIST OR O-1-C	MASTER OR COXSWAIN	RADAR	TELEPHONE	ECHO SOUNDER
LIMNOS	May 3	Oct. 15	L. Ontario L. Erie	Technical Operations	D.J. Cooper	Captain D.W. Butler	Decca 429	CMC CH 25 VHF	KH 26 B Simrad
THERON	Apr. 1	Dec. 5	L. Ontario L. Erie L. Huron L. Superior	Technical Operations	A.M. Holler	Captain H. Maro	Decca RM 416 Decca 212	VHF AM Apelco	KH 26 B
LAC ERIE	May 13	Sept.30	L. Ontario Georgian Bay	Limnogeology	Dr. P.G. Sly	Captain B. Kennedy	KH 202	Marconi VHF Clipper 1 AM Seaway	KH MS 32 B KH MS 36 F
LEMOYNE	July 15	Sept. 9	L. Ontario	Limnogeology	Dr. R. Thomas Dr. A. Kemp	Williams	Decca RM 416 W/accurate ranging	CMC CH 25	KH MS 32 M
SWIFT	Apr. 1	Oct. 17	Niagara-on-the-Lake	Physical Limnology	Dr. R. Murthy	Acker	KH 17/9	CMC CH 25	KH 36 F/B
SURGE	DELIVERED ON SITE JULY 16 - NOT ACCEPTED								
SORA	June 1	Nov. 26	Western L. Ontario	Physical Limnology	Dr. H. Weiler	Morrison	Decca 217	MRT 400	KH 21 B
BRUCE	May 15	Nov. 20	Niagara-on-the-Lake	Physical Limnology	M. Nunez	Smith	LN 55 Marconi	CMC CH 25	EDO 9040
GOSLING	May 1	Sept. 8	Burlington - Toronto	Limnogeology	Dr. N. Rukavina	Dickson	-	VHF	KH 26 F Ross Surveyor
OLD SQUAW	July 9	Sept.15	Western L. Ontario	Limnogeology	J. Coakley	Webber	LN 55 Marconi	MRT 400	MS 21 A
BOSTON WHALER	May 1	Sept.15	Burlington - Toronto	Limnogeology	J. Coakley	Dolan	-	-	KH 39 F/A
BOSTON WHALER	May 1	Oct. 15	- ONBOARD LIMNOS -						
BOSTON WHALER	May 1	Dec. 1	- ONBOARD THERON -						

TABLE

MAJOR CRUISES - 1968

LAKES	SHIPS	MONITOR	MOORING	GEOLOGY	GRAVITY	SPECIAL	TOTAL
Ontario	Theron	6	6	1	-	2	15
	Limnos	3	1	4	2	-	10
	Total	9	7	5	2	2	25
Erie	Theron	6	4	1	-		11
	Limnos	-	1	-	1		2
	Total	6	5	1	1		13
Huron	Theron	1					1
	Limnos	-					-
	Total	1					1
Superior	Theron	1					1
	Limnos	-					-
	Total	1					1
	Theron	14	10	2	-	2	28
	Limnos	3	2	4	3	-	12
	TOTAL	17	12	6	3	2	40

Periods and Areas of Observations - Major Ships

Ship	Lake	From	To
C.S.S. Limnos	Ontario	May 13	June 19
		Aug. 6	Oct. 9
	Erie	June 20	July 27
M.V.Theron	Ontario	Apr. 26	May 3
		May 27	June 8
		June 24	July 20
		Sept. 9	Sept. 13
		Oct. 5	Oct. 31
		Nov. 17	Nov. 26
	Erie	May 12	May 24
		June 9	June 20
		July 21	Aug. 3
		Aug. 31	Sept. 3
		Sept. 15	Oct. 4
		Nov. 4	Nov. 14
	Huron	Aug. 5	Aug. 13
	Superior	Aug. 18	Aug. 28

Field Programs 1968 - Major Ships

Lake	Ship	Cruise	Dates	Type of Cruise
Ontario	Theron		Apr. 26 -	Retr. Winter Mooring
		68-0-01	Apr. 29 - May 3	Monitor
		68-0-02	May 6 - May 10	Moorings
	Limnos	68-0-03	May 13 - May 15	Geology
		68-0-04	May 21 - May 29	Geology
	Theron	68-0-05	May 27 - May 30	Monitor
		68-0-06	June 3 - June 8	Moorings
	Limnos	68-0-07	June 10 - June 11	Gravity
	Theron	68-0-08	June 24 - June 28	Special
		68-0-09	July 2 - July 6	Monitor
		68-0-10	July 8 - July 12	Special
		68-0-11	July 15 - July 20	Moorings
	Limnos	68-0-12	July 23 - July 27	Monitor
		68-0-13	Aug. 6 - Aug. 7	
			Aug. 9 - Aug. 15	Geology
		68-0-14	Aug. 19 - Aug. 23	Monitor
		68-0-15	Sept. 3 - Sept. 6	Moorings
		68-0-16	Sept. 8 - Sept. 13	Monitor
	Theron	68-0-17	Sept. 9 - Sept. 13	Geology
	Limnos	68-0-18	Sept. 16 - Sept. 20	Geology
	Theron	68-0-19	Oct. 5 - Oct. 9	Monitor
	Limnos	68-0-20	Oct. 6 - Oct. 9	Gravity
	Theron	68-0-21	Oct. 15 - Oct. 19	
			Oct. 22 - Oct. 23	
			Oct. 24 - Oct. 25	Moorings
		68-0-22	Oct. 27 - Oct. 31	Monitor
		68-0-23	Nov. 17 - Nov. 22	Monitor
		68-0-24	Nov. 23 - Nov. 26	Moorings

Field Programs 1968 - Cont'd.

Lake	Ship	Cruise	Dates	Type of Cruise
Erie	Theron	68-1-01	May 12 - May 17	Moorings
		68-1-02	May 17 - May 24	Monitor
		68-1-03	June 9 - June 14	Moorings
		68-1-04	June 15 - June 20	Monitor
	Limnos	68-1-05	June 20 - June 21	
			June 24 - June 26	
			July 4 - July 7	Gravity
		68-1-06	July 14 - July 18	Moorings
	Theron	68-1-07	July 21 - July 27	Geology
		68-1-08	July 29 - Aug. 3	Monitor
		68-1-09	Aug. 31 - Sept. 3	Monitor
		68-1-10	Sept. 15 - Sept. 20	
			Sept. 23 - Sept. 26	Moorings
		68-1-11	Sept. 28 - Oct. 4	Monitor
		68-1-12	Nov. 4 - Nov. 10	Monitor
		68-1-13	Nov. 11 - Nov. 14	Moorings
Huron	Theron	68-2-01	Aug. 5 - Aug. 13	Monitor
Superior	Theron	68-3-01	Aug. 18 - Aug. 28	Monitor

ACTIVITIES

Major Ships

Two major ships, the C.S.S. Limnos and the charter vessel M.V. Theron, were used for the Great Lakes Studies in 1968. The C.S.S. Limnos is owned by the Department of Energy, Mines & Resources and operated by the Marine Sciences Branch. She arrived at C.C.I.W. on May 3rd, and after completing the installation of scientific equipment she commenced operations on May 13. The M.V. Theron is owned by Christensen Canadian Enterprises of New York and Montreal, operated by K. Karlsen Shipping Co. of Halifax. She was chartered by the Department for the Great Lakes program. The original charter period was from April to October, however, this was later extended until early December. Before leaving Halifax the vessel was fitted out with oceanographic winch and platform, davits, temporary deck housing, and laboratory facilities. She arrived at C.C.I.W. on April 21st, and after completing the installation of scientific equipment she commenced regular operations on April 29th.

The schedules for both vessels had been planned prior to the beginning of the season. However, due to operational breakdowns of the C.S.S. Limnos and the Sea-Way strike from June 21 to July 15 their schedules were changed considerably. On October 15th the C.S.S. Limnos departed C.C.I.W. for Port Weller Shipyard for repairs. In order to complete the remainder of the planned scientific programs, the "Theron's" charter had to be extended. The "Theron" departed C.C.I.W. on Nov. 29th for Halifax.

Operational Table

Ship	Arr. CCIW	Dep. CCIW	Total Days	Away on Operations	%
C.S.S. Limnos	May 3	Oct. 15	166	86	51.8%
M.V. Theron	April 21	Nov. 29	223	170	76.2%

The pattern of operations was changed from the previous year when one ship was assigned to Lake Ontario and the other to Lake Erie. During 1968 the Limnos was assigned to both Lake Ontario and Lake Erie. The Theron, in addition to operating in Lake Ontario and Lake Erie, also carried out a monitor cruise on Lake Huron, and a monitor cruise on Lake Superior. Personnel from the Operations Section at C.C.I.W. were assigned to both ships on a continuing basis throughout the season. Scientific and technical personnel from various agencies joined the vessels in accordance with a pre-arranged schedule. The Operations Group was generally responsible for all the technical deck operations, entailing the sampling procedures, measurements and recordings of physical parameters, and mooring operations. The manual chemistry determinations and routine weather observations and reports were also carried out by this group.

Monitor Cruises

The monitor programs in Lakes Ontario and Erie were continuations of previous year's observations. The station positions, sampling procedures and physical parameters were essentially the same. The few changes that were

made as a result of the experiences gained during the previous year were designed to obtain better and more comprehensive coverage of the lakes.

Two "special" cruises were carried out in Lake Ontario in the vicinity of the Niagara River. One cruise was primarily designed to support the current studies in the area, and the other to support the infra-red studies carried out from an aircraft.

Lake Huron and Lake Superior were monitored for the first time and these programs are expected to continue in the future.

Mooring Cruises

Several mooring cruises were carried out in Lake Ontario and Lake Erie. The moorings were checked during the monitor cruises and special cruises were scheduled for servicing and re-establishing malfunctioning instruments and/or disturbed moorings. Meteorological buoys were placed in both lakes using large Geodyne do-nut floats fitted with sensing instruments and equipped with Plessey data storage units. In Lake Ontario the areas under study were off Thirty Mile Point and off Niagara River and in Lake Erie the moorings were placed in various positions in the eastern end of the lake. Temperature observations and drogue trackings were carried out in support of the current studies. One winter mooring remains in the western end of Lake Ontario and one in the eastern end of Lake Erie. Both these moorings are equipped with a time mechanism set to release in April, 1969.

The proper authorities were always informed about the placing and recovery of moored instruments and shipping was warned through "Notice to Mariners". In spite of such precautions, losses of equipment did occur in both lakes. In Lake Ontario barges were seen moving between some of the

inshore moorings and large "Lakers" were seen steaming between the offshore positions. In Lake Erie a number of fishing vessels were observed between the moorings in addition to the large "Lakers". Major equipment lost during the year in each lake was as follows:

Lake Ontario

1 - current meter from winter mooring 1967/68

1 - " " " Niagara area

1 - Met. Pack

2 - Nun surface buoys

Lake Erie

1 - current meter from winter mooring 1967/68

1 - " " " the eastern part of the lake

1 - sub/surface float.

Coring Cruises

A number of geological sampling cruises were made in Lake Ontario and one in Lake Erie. A 1200 lb. piston corer with up to 90 feet of pipe and also regular gravity corers were used in various locations in both lakes. Numerous sediment samples were collected with Shipek grabs. In order to obtain a picture of the sediment layers in the lakes, large areas were track-sounded using the echo sounders on the ships.

Gravity Cruises

These cruises were parts of continuing surveys in both Lakes Ontario and Erie to obtain regional gravity measurements for geological and geodetic investigations.

The operation consists of lowering an underwater gravimeter (La Coste & Romberg) to the lake bed on a 10 Km grid. Readings are taken at each station while the vessel keeps position over the gravimeter and its connecting cables.

The Hi-fix electronic navigation system was used for positioning the vessel and consisted of two mobile "Slave Stations" operated from selected sites and the "Master" aboard ship.

During the second gravity cruise in October a Satellite Navigator Receiver (Magnavox 702 CA) was used in conjunction with the ship's radar for obtaining positions. The system was monitored continuously with the initial navigation being done by radar and results computed later from the navigator for comparison with the radar fixes.

Accurate water depths are required for the computation of gravity data. Two echo sounders were used at each station, together with a pressure gauge, within the gravimeter to achieve optimum results. The echo sounders were also operated continuously and monitored while the survey was under Hi-fix control.

Major Ships and Equipment

C.S.S. LIMNOS

Type of vessel:	Research vessel also designed for hydrography, steel hull, twin screw.
Year built:	1968.
Dimensions:	Length 147', beam 32', draft 8' 0".
Speed:	Max. 11 knots, cruising 10 knots.
Range:	2000 nautical miles.
Complement:	Scientific - 12, ship - 16.
Fuel capacity:	45 tons.
Fr. water capacity:	60 tons.
Propulsion:	2 - 12 cylinder Paxman Diesel, model 12 RPHM, each 500 B.H.P., 1250 r.p.m. with direct drive to twin 360° rotatable Harbour Master units made by Murray and Tregurthe, geared to 450 r.p.m. Fixed pitch propellers, right angle drive gears and vertical shafting. Bridge controlled.
Ships power:	3 - phase, 60 cycle A/C, 460 volts. Transformed requirements: 240 V., 3 phase 120 V., 3 phase. Supplied by: 2 - 4 cylinder Cummings Diesels, Model N NH, each 150 K.W. and 2 Siemens generators. 1 - Cummings Diesel Emergency Generator, automatic - 100 K.W. 2 - laboratory controlled frequency stablized units rated at 5 KVA, 115 volts, single phase, 60 cycles.

Deck Machinery and Equipment:

1 - crane, Austin Western Model 410-P, electro-hydraulic, 40 H.P., 6000 lbs. lift at 26 feet working radius and 10,000 lbs. lift at 12 feet working radius. (Max. radius 35 feet). Capable of 360 degrees rotation. Drum capacity 270 ft. of ½" dia. wire. Located amidship.

1 - crane, HIAB Model 177S marine articulated with double acting hydraulic rams, 20 H.P. Max. outreach 18 feet. Capable of lifting 2000 lbs. at 25 ft/min. with 17 feet radius. 360° rotation. Drum capacity 250 ft. of 3/8" dia. wire. Located on after deck, starboard side.

2 - fixed "A" frames, cap. 1000 lbs.

2 - portable "A" frames, cap. 3000 lbs.

2 - portable gallows, cap. 3000 lbs.

2 - capstans - manufacturer, J. Swann, Series 368, No. 1624, 7½ H.P.

2 - mooring winches, manufacturer, J. Swann, Series 488, No. 1615, 20 H.P.

Bridge Equipment:

- Decca radar, Model 429, range 48 miles.
- Arma-Brown Gyro Compass MK.1C with 8 repeaters.
- Automatic pilot.
- Standard magnetic compass.
- Bergen Nautic retractable log type FEU-2, No. 671.
- Wind speed and direction indicators.
- Searchlight.
- Gyro compass course recorder.

- Marconi CH 25 IF/AM transceiver.
- Marconi DN 30 VHF/FM transceiver.

1 - Echo Sounder, Kelvin Hughes, Model MS 26 B, MK7, range 710 feet or 710 fathoms.

2 - Echo Sounders, Simrad Panel, Model EP 2 BN, range 600 ft. or 600 fathoms.

Laboratories:

1 - Dry lab, 670 sq. ft. amidship.

1 - Wet lab, 90 sq. ft. on starboard side connecting to dry lab. Equipment in laboratories includes: Alden P.G.R. Model 418, Series CA, connected to Simrad transducer; Gyro repeater, repeater for wind force and direction.

- Photo copier, 3M Model 202.

Deck:

Provision for carrying portable laboratories on deck. Provision for carrying 4 - 26 foot hydrographic sounding launches on deck if portable laboratories not carried.

1 - 17 foot Boston Whaler - outboard engine.

Vessel equipped for continuous recording of solar radiation, relative humidity, air temperature. Near surface water temperature and meteorological equipment as required for complete surface weather observation.

Laboratory equipment installed as required depending on the type of cruise in which the vessel is engaged.

Oceanographic Winches (installed as and when required):

1 - single drum heavy duty electro-hydraulic winch. Manufacturer, J. Swann, Series 'O'-329 MK2, Model 80, 40 H.P., two speed. Rating 4 tons on low

speed and 2 tons on high speed. Drum cap. 5000 ft. of ½" dia. wire. Fixed and portable read-out. Automatic spooling gear and remote controls.

1 - wire winding winch, electro-hydraulic. Manufacturer, J. Swann, Series 'O'-325, 5 H.P. Various drum capacities from 30,000 ft. of 3/32" dia. to 2500 ft. of 5/8" dia. wire. Drums detachable. Automatic spooling.

1 - oceanographic winch, electro-hydraulic or diesel powered. Manufacturer, J. Swann, Series 'O'-365, 10 H.P. Two speed. Rating 800 lbs. on low speed and 400 lbs. on high speed. Drum cap. 2500 ft. of 5/32" dia. wire. Automatic spooling and remote control.

2 - light duty B.T. winches, electro-hydraulic. Manufacturer, J. Swann, Series 'O'-315, 5 H.P. Drum capacity 4000 ft. of 3/32" dia. wire. Speed 540 ft. per minute at 300 lbs. One winch is fitted with automatic spooling.

- Other winches may be installed as required.

M.V. THERON

Type of vessel:	Sealing and expeditions vessel, steel hull. Fully reinforced for ice. Single screw.
Year built:	1950.
Dimensions:	Length 198.8', beam 33.1', draft 16' 03".
Tonnage:	Displacement 820 tons, gross 849.82 tons, net 391.92 tons.
Speed:	Max. 12½ knots, cruising 11 knots, min. 4 knots.
Range:	10,000 nautical miles.
Endurance:	45 days.
Complement:	Scientific - 22, ship - 19.
Fuel capacity:	205 tons.
Fr. water capacity:	78 tons.
Propulsion:	1 - 8 cylinder Polar Atlas diesel engine, 1310 B.H.P. at 250 r.p.m.
Ship's power:	220 Volts D.C. Main generator: 1 - 3 cylinder Burmeister Wain - 100 K.W. Auxiliaries: 1 - 4 cylinder Paxman - 60 K.W. 1 - 6 cylinder G.M. - 60 K.W. 1 converter 10 K.W. A/C. Facilities for shore power hook-up - 220 V. D.C.
Deck Machinery and equipment:	4 - 4 ton hydraulic winches. 4 - 5 ton cargo derricks. 1 - Kelvin sounding winch.
Cargo holds:	3 cargo holds. #1 & #3 available for storing equipment and instruments.

#2 converted into laboratory space.

Pollution control tank installed in #3 hold.

Bridge equipment: Radars - 1 Decca RM 416, 48 mile range.

- 1 Decca 212, 32 mile range.

Echo Sounder, 1 Kelvin Hughes 26 B.

Gyro Compass, Sperry Minor MR 17 with 2 repeaters.

Standard magnetic compass.

Automatic pilot, Sperry MK 'E'.

Log, Walkers Cherub III.

Loran - Kelvin Hughes, CA - 1000 A.

W.T. - Marconi, Oceanspan.

R.T. - V.H.F. Marconi

AM Apelco AE - 176 M.

Laboratories: Temporary laboratories constructed in #2 hold and on top of #2 hatch with stairway and dumbwaiter connections.

Departmental Equipment and Installations:

Deck:

1 - light duty oceanographic winch, electro-hydraulic or diesel hydraulic. Manufacturer, J. Swann, Series 'O'-365, 10 H.P. Two speed, rating 800 lbs. at low speed and 400 lbs. at high speed. Drum capacity 2500 ft. of 5/32" dia. wire. (2000' max. practical). Automatic spooling gear and remote control.

1 - diesel engine with pumping unit for above winch.

1 - oceanographic platform (chains).

1 - Torpedo davit with meter wheel.

1 - Boston Whaler - 17 feet, outboard engine.

Meteorological Sensing Instrumentation: Vessel equipped for continuous recording of solar radiation, relative humidity, near surface water temperature and for complete surface weather observations.

Laboratory Equipment:

Upper Lab

Plankton nets, chemicals for biology, fluorimeters, water sampling bottles, reversible thermometers, bathythermographs, also recorders for chlorophyll, solar radiation, relative humidity and near surface water temperature.

Lower Lab

2 - autoanalysers with recorders.

2 - refrigerators.

Incubator, manual chemistry equipment and various other instruments required for chemistry and biology. Both laboratories equipped with bench units, A/C power and running water.

Mooring & Coring Equipment: Stored in #1 & #3 cargo holds as required, and in both lab. spaces.

M.V. LAC ERIE (small charter vessel)

On charter - May 13, 1968.

Off charter - Sept. 30, 1968.

On standby charter from Dec. 1, 1968 to March 31 for a guaranteed minimum period of 16 days.

May 14	Arr. CCIW.
May 14 - May 25	CCIW. Fitted transducers and other scientific equipment.
May 25 - July 21	Based at Niagara-on-the-Lake.
July 21 - July 23	CCIW. Unload and load.
July 23 - Sept. 12	Georgian Bay.
Sept. 15 - Sept. 21	Prince Edward Bay (Kingston area).
Sept. 21 - Sept. 30	Eastern end of Lake Ontario.
Dec. 1 - Dec. 4	CCIW. Prepare for winter operations.
Dec. 4 - Dec. 9	Hamilton Harbor and western Lake Ontario.

The M.V. Lac Erie was assigned to the Limnogeology Section, who made full use of the vessel during the season. In addition to the regular survey work off Niagara and in Georgian Bay, she assisted in the removal of the island installations of the radio navigation aids. In Prince Edward Bay diver controlled equipment trials were carried out. At the end of the regular charter period she was used for Geochemical Studies in the eastern end of Lake Ontario.

The vessel returned to CCIW on Dec. 1st. to begin the second charter period. From Dec. 4 to 9 she was engaged in sampler trials in Hamilton Harbor and western Lake Ontario. Due to unfavourable weather conditions, the trials were not as successful as hoped for.

Equipment

Minifix navigation (in Georgian Bay).

30 kc. K.H. MS 26 F echo sounder.

14.25 kc. K.H. MS 32 M echo sounder.

Radar.

A.M. & V.H.F. radios.

Other equipment used onboard:

E.G.& G. side scan sonar

Underwater television, and underwater camera

Gravity corers

Shipek and other bottom grabs.

Complement

Ship's personnel	-	2
CCIW personnel	-	3 to 5

Scientists in Charge

Dr. P.G. Sly (May 13 - Sept. 30)

Mr. W.F. Warwick (Dec. 4 - Dec. 9).

LAUNCHES

A brief summary of the assignments and operations of the launches are included in Table 1, Section 2. The launches in use were:

Launches	Length	Power
C.S.L. Lemoyne	40 feet	Twin 140 H.P. Perkins Diesel - inboard.
Swift	35 "	Twin engines - inboard, 150 G.M.
Surge	34 "	Twin engines - inboard, 170 Cummings.
Sora	31 "	Single 85 H.P. Perkins Diesel.
Bruce	25 "	Twin 150 H.P. Volvo - inboard/outboard.
Gosling	30 "	Twin 40 H.P. - outboard.
Old Squaw	32 "	Single 85 H.P. diesel.
Boston Whalers	17 "	Outboards.

C.S.L. LEMOYNE

Assigned to the Limnogeology Section.

The survey work, undertaken by the Lemoyne, commenced on the 20th of July and continued through until the 9th of September, and consisted of the bottom sampling of the sediments of Lake Ontario on an 8 kilometre grid. Initially, samples were taken from the periphery of the lake, east of Scotch Bonnet, recovering samples left over from the first and second cruises of the Limnos. The remaining sampling was sub-divided as follows:

(a) Completion of the 8 kilometre grid west of a line from Scotch Bonnet to Rochester, including the Kingston basin.

(b) The initiation of a 2 kilometre grid sampling pattern in the Kingston Basin.

Equipment

(a) Sampling, Shipek sampler, 150 lb. Alpine Gravity Corer, Toronto Grab.

(b) Navigational, Decca 416 Radar, Kelvin Hughes MS 32 B. Sounder, through the hull log, and Magnetic Compass.

(c) Sample preparation, Eh and pH meters, freeze drier and shell freezer.

Total Sample Stations - 152.

Nautical Miles Steamed - 2201.9.

Personnel (crew): 1 coxswain, 2 summer students, and in addition, a third student was used on shore as a logistic support to the program.

Scientists-in-Charge: Dr. R.L. Thomas

Dr. A.L.W. Kemp.

C.S.L. SWIFT

The launch was assigned to the Physical Limnology Section, and based at Niagara-on-the-Lake from May 15 to Oct. 17. The purpose of the survey was to study the dispersion of the water from the Niagara River into Lake Ontario by tagging the river water with a solution of Rhodamine BA dye.

She was also used by the Limnogeology Section for a few days (July 17 - 19) for collection of benthic faunal material off Grimsby.

Equipment:

Fluorometers - Model 111, G.K. Turner.

Strip chart recorders - Hewlett & Packard.

H.R. Flow Inducers - Watson Marlow.

A.C. Generator.

Braincon V-Fin.

Bathythermograph.

Radar, depth sounder, radio/telephone, compass.

Personnel (crew):

1 coxswain

2 technicians

2 summer students

Scientist-in-Charge: Dr. C.R. Murthy.

C.S.L. SORA

Assigned to the Physical Limnology Section from June 1 to November 26. She was used as a tender for the scientific instrumentation tower placed near Hamilton Beach.

Equipment:

Radar, radio, compass, echo sounder.

Personnel (crew):

1 coxswain

Scientist-in-Charge: Dr. H.S. Weiler.

C.S.L. BRUCE

Assigned to the Physical Limnology Section, and based at Niagara-on-the-Lake from May 15 to November 20.

The survey work consisted of:

Assisting with the installation and dismantling of the scientific instrumentation tower off Niagara.

Daily servicing of the equipment on the Niagara Tower.

Tracking drogues from the mouth of the Niagara River.

Assisting in the dye project carried out by the C.S.L. Swift.

Equipment:

1 sextant,

drogues,

monitor equipment for checking sensors on the tower,

bathythermograph,

radar, compass, radio telephone, portable echo sounder.

Personnel (crew):

1 coxswain

1 seaman

1 technician

Technicians-in-Charge: M. Nunez, D. Beesley.

C.S.L. GOSLING

Assigned to the Limnogeology Section from May 1 to September 8. From May 22 to May 30th she was used to obtain bottom profiles and samples in the vicinity of Burlington. From June 10 to September 5 she was engaged in sampling and observations of nearshore bottom sediments, beach sediments and bluff materials in Lake Ontario from Niagara-on-the-Lake to Port Whitley.

Equipment:

Shipek sampler.

Hydroproducts underwater television system.

Nikonos 35 mm. underwater camera.

Kodak super 8 mm. movie camera with underwater housing.

Kelvin Hughes echo sounder 26 F with standard and G.D. transducers.

Ross Surveyor.

Minifix (hyperbolic mode) cubic autotape.

Radio, compass.

Personnel (crew):

1 coxswain

3 student assistants

1 shore-based technician to maintain Minifix Autotape.

Scientists-in-Charge: Dr. N.A. Rukavina (June 10 - Sept. 5)

Mr. J.P. Coakley (May 22 - May 30).

C.S.S. OLD SQUAW

Assigned primarily to the Limnogeology Section. From July 9 to Sept. 15 the nearshore studies were carried out at intervals along the shores of western Lake Ontario. Included in this work was diver tending and studies using fluorescent tracer sand in three areas.

Equipment:

Kelvin Hughes echo sounder MS 21 A.

Minifix Navigation (July 9 - July 30).

Grab samplers.

Personnel (crew):

1 coxswain

1 seaman

1 student assistant.

Scientist-in-Charge: Mr. J.P. Coakley.

BOSTON WHALERS

Three Boston Whalers were in use during the season, all equipped with 35 H.P. Chrysler outboard engines.

Two of the Whalers were assigned to the major ships, one to the M.V. Theron and one to the C.S.S. Limnos. These two were used mainly on work connected with moored buoys and instruments and manned as required.

The third Whaler was used mostly for local work, primarily by the Limnogeology Section. From June 5 to 19 the near shore survey was extended to Toronto Harbour.

Equipment:

Kelvin Hughes echo-sounder MS 39 F/A

Minifix Navigation

Dietz La-Fond grab samplers.

Personnel:

1 coxswain

1 student assistant

Scientists-in-Charge: J.P. Coakley and other.

Scientific Instrumentation Towers (Platforms) - Lake Ontario

An eighty foot high tower was installed off Niagara in the position 43° 16' 56" N - 79° 08' 10" W. The equipment was in operation from July 8th to November 14th. During this period it was serviced by technical personnel based at Niagara-on-the-Lake. The launch "Bruce" was used for this purpose.

A sixty foot high tower was also installed near Hamilton Beach in the position 43° 16.31' N - 79° 45.96' W. The operational period was from August 3rd to November 26th. It was serviced by technical personnel based at Burlington. The launch "Sora" was used as a local tower tender.

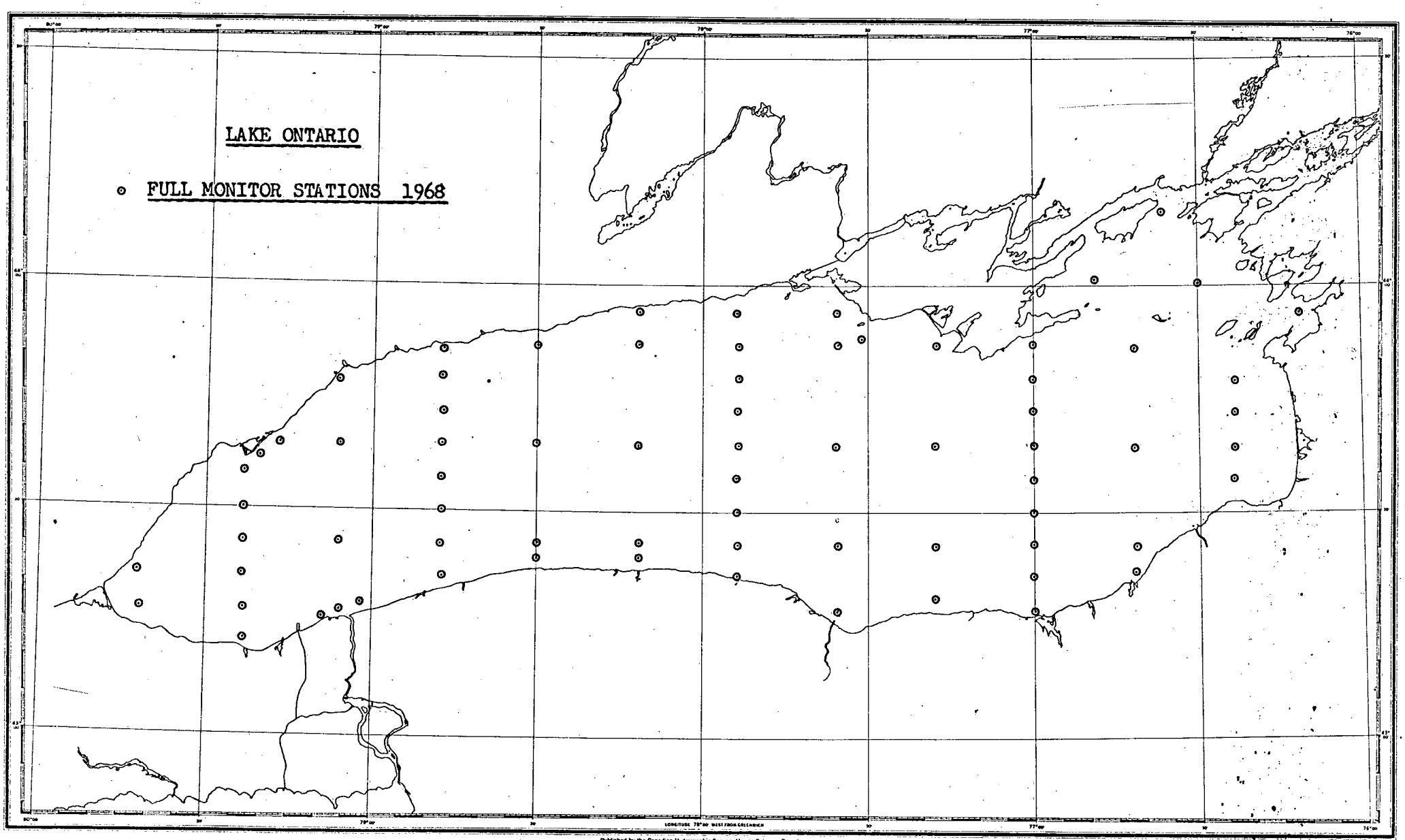
Instrumentation on the towers included:

facilities for recordings of

- currents
- water temperature
- relative humidity
- air temperature
- solar radiation
- wind speeds and directions.

SECTION 3

Station positions, charts and summaries of cruises, analyses made and observations carried out by the major ships.



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Ontario
LAKE ONTARIO

S-196

LAKE ONTARIO

FULL MONITOR POSITIONS 1968

Stn. No.	Longitude °W	Latitude °N	Stn. No.	Longitude °W	Latitude °N
1	79° 42.0'	43° 17.3'	25A	78° 12.0'	43° 56.0'
2	79° 42.0	43° 21.7	26	77° 54.0	43° 56.3
3	79° 24.0	43° 13.0	27	77° 54.0	43° 52.0
4	79° 24.0	43° 17.2	28	77° 54.0	43° 47.0
5	79° 24.0	43° 21.4	29	77° 54.0	43° 43.3
6	79° 24.0	43° 26.0	30	77° 54.0	43° 39.0
7	79° 24.0	43° 30.3	31	77° 54.0	43° 34.7
8	79° 24.0	43° 34.4	32	77° 54.0	43° 30.3
8A	79° 21.0	43° 36.4	33	77° 54.0	43° 26.0
8B	79° 18.0	43° 38.9	34	77° 54.0	43° 22.0
8C	79° 05.7	43° 47.4	34A	77° 36.0	43° 17.3
9	79° 06.0	43° 39.0	35	77° 36.0	43° 26.0
10	79° 06.0	43° 26.0	36	77° 36.0	43° 39.0
10A	79° 08.8	43° 16.2	37	77° 36.0	43° 52.0
11	79° 06.5	43° 17.7	37A	77° 36.0	43° 56.3
11A	79° 02.4	43° 18.2	37B	77° 32.0	43° 52.9
12	78° 48.0	43° 21.7	38	77° 18.0	43° 52.0
13	78° 48.0	43° 26.0	39	77° 18.0	43° 39.0
14	78° 48.0	43° 30.3	40	77° 18.0	43° 26.0
15	78° 48.0	43° 34.6	40A	77° 18.0	43° 18.7
16	78° 48.0	43° 39.0	41	77° 00.0	43° 17.2
17	78° 48.0	43° 43.3	42	77° 00.0	43° 21.7
18	78° 48.0	43° 47.6	43	77° 00.0	43° 26.0
19	78° 48.0	43° 51.0	44	77° 00.0	43° 30.3
20	78° 30.0	43° 52.0	45	77° 00.0	43° 34.7
21	78° 30.0	43° 39.0	46	77° 00.0	43° 39.0
22	78° 30.0	43° 26.0	47	77° 00.0	43° 43.3
22A	78° 30.0	43° 24.4	48	77° 00.0	43° 47.7
22B	78° 12.0	43° 24.4	49	77° 00.0	43° 52.0
23	78° 12.0	43° 26.0	50	76° 42.0	43° 52.0
24	78° 12.0	43° 39.0	51	76° 42.0	43° 39.0
25	78° 12.0	43° 52.0	52	76° 42.0	43° 26.0

Cont'd

L. ONT. FULL MON. POSITIONS 1968 Cont'd

Stn. No.	Longitude °W	Latitude °N
52A	76° 42.0'	43° 23.0'
52B	76° 32.1	43° 28.6
53	76° 24.0	43° 34.0
54	76° 24.0	43° 39.0
55	76° 24.0	43° 43.2
56	76° 24.0	43° 47.7
57	76° 24.0	43° 52.0
58	76° 12.0	43° 56.3
59	76° 30.0	44° 00.7
60	76° 36.0	44° 09.3
61	76° 48.0	44° 00.6

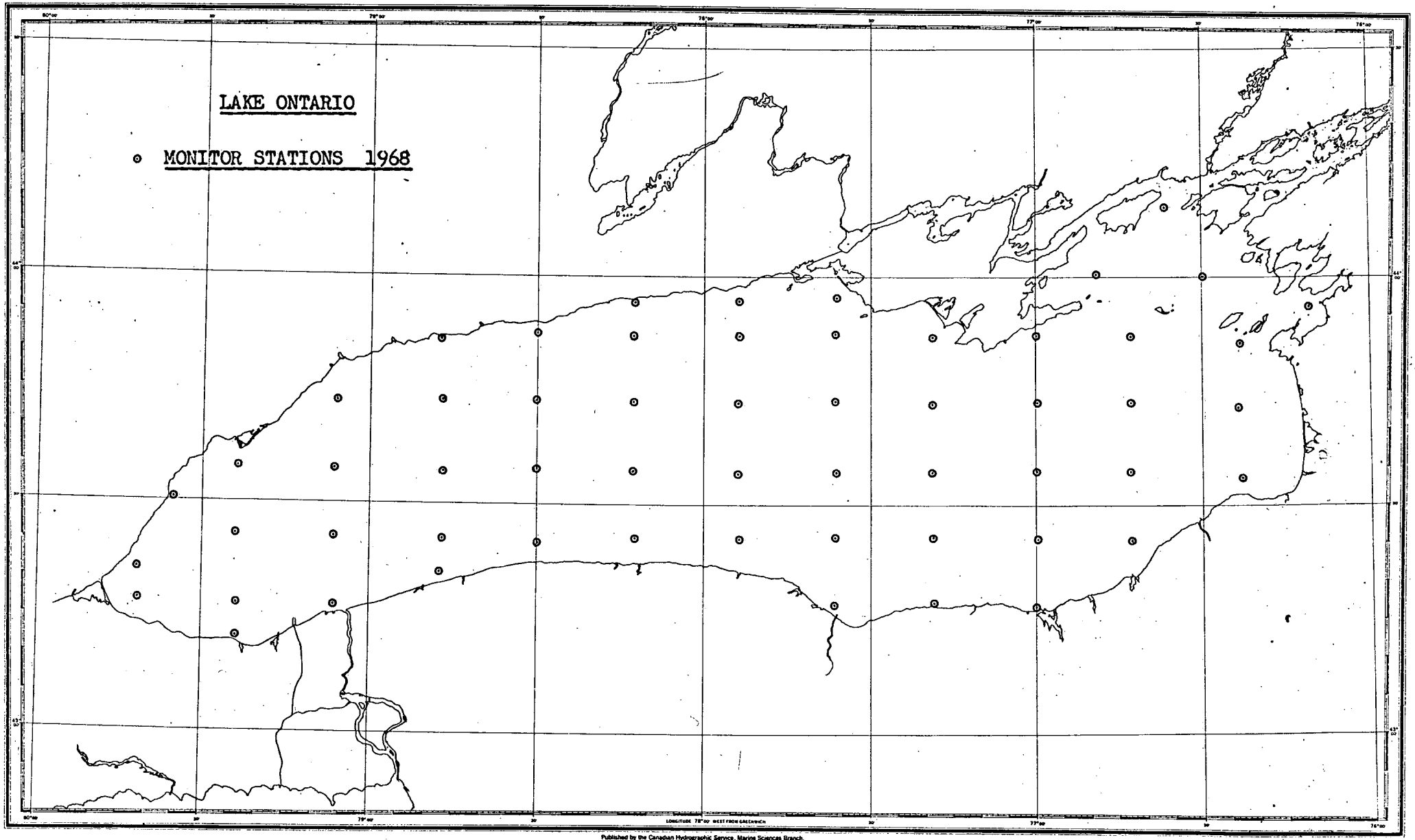

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Chart 20
LAKE ONTARIO

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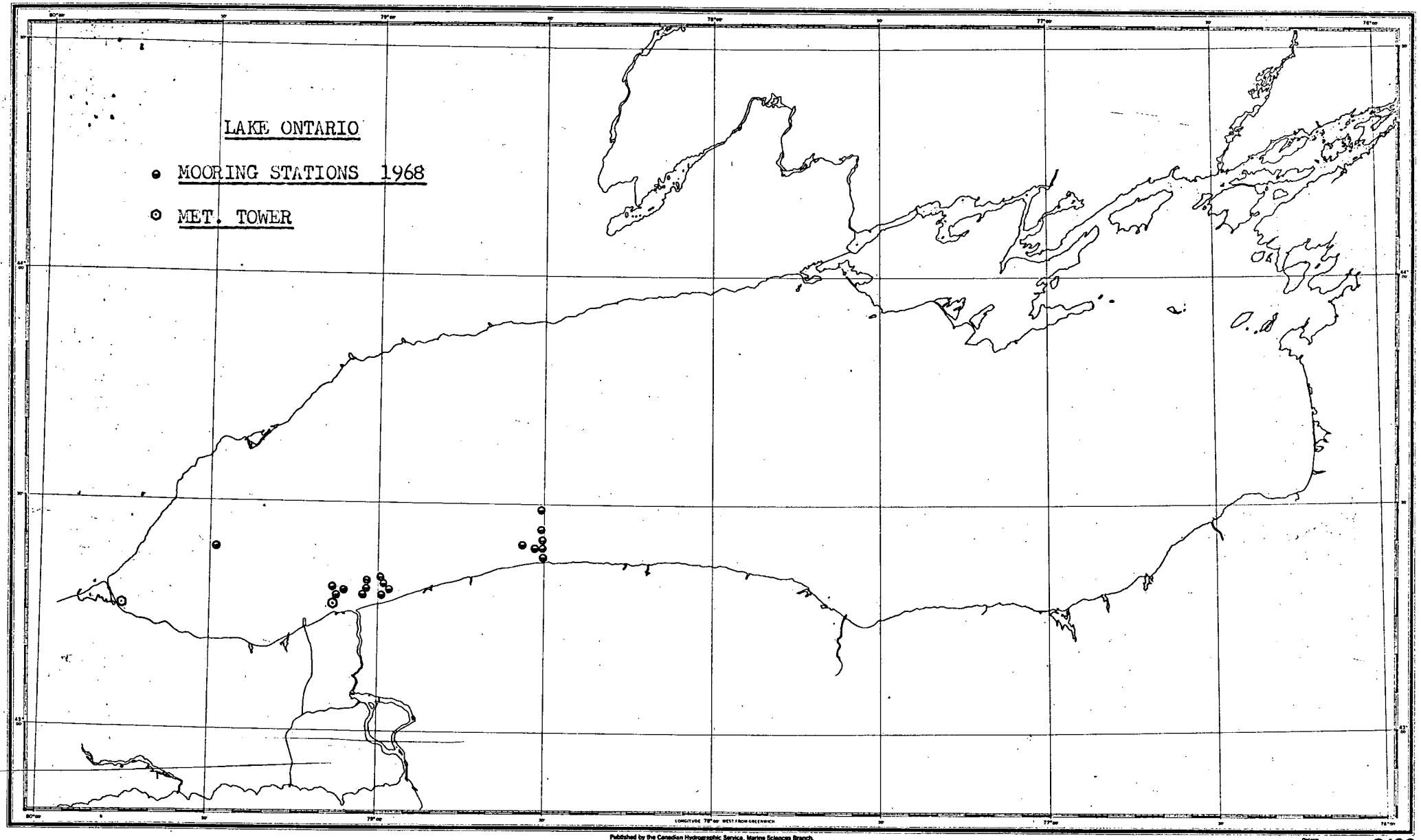
LAKE ONTARIO

MONITOR POSITIONS 1968

Stn. No.	Longitude °W	Latitude °N	Stn. No.	Longitude °W	Latitude °N
1	79° 42.0'	43° 17.3'	33	77° 36.0'	43° 43.3'
2	79° 42.0	43° 21.7	34	77° 36.0	43° 34.7
3	79° 36.0	43° 30.3	35	77° 36.0	43° 26.0
4	79° 24.0	43° 34.4	36	77° 36.0	43° 17.3
5	79° 24.0	43° 26.0	37	77° 18.0	43° 17.3
6	79° 24.0	43° 17.2	38	77° 18.0	43° 26.0
7	79° 24.0	43° 13.0	39	77° 18.0	43° 34.7
8	79° 06.0	43° 17.7	40	77° 18.0	43° 43.3
9	79° 06.0	43° 26.7	41	77° 18.0	43° 52.0
10	79° 06.0	43° 34.7	42	77° 00.0	43° 52.0
11	79° 06.0	43° 43.3	43	77° 00.0	43° 43.3
12	78° 48.0	43° 51.0	44	77° 00.0	43° 34.7
13	78° 48.0	43° 43.3	45	77° 00.0	43° 26.0
14	78° 48.0	43° 34.6	46	77° 00.0	43° 17.2
15	78° 48.0	43° 26.0	47	76° 42.0	43° 26.0
16	78° 48.0	43° 21.7	48	76° 42.0	43° 34.7
17	78° 30.0	43° 26.0	49	76° 42.0	43° 43.3
18	78° 30.0	43° 34.7	50	76° 42.0	43° 52.0
19	78° 30.0	43° 43.3	51	76° 48.0	44° 00.6
20	78° 30.0	43° 52.0	52	76° 36.0	44° 09.3
21	78° 12.0	43° 56.3	53	76° 30.0	44° 00.7
22	78° 12.0	43° 52.0	54	76° 12.0	43° 56.3
23	78° 12.0	43° 43.3	55	76° 24.0	43° 52.0
24	78° 12.0	43° 34.7	56	76° 24.0	43° 43.3
25	78° 12.0	43° 26.0	57	76° 24.0	43° 34.7
26	77° 54.0	43° 26.0			
27	77° 54.0	43° 34.7			
28	77° 54.0	43° 43.3			
29	77° 54.0	43° 52.0			
30	77° 54.0	43° 56.3			
31	77° 36.0	43° 56.3			
32	77° 36.0	43° 52.0			



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Ontario
LAKE ONTARIO

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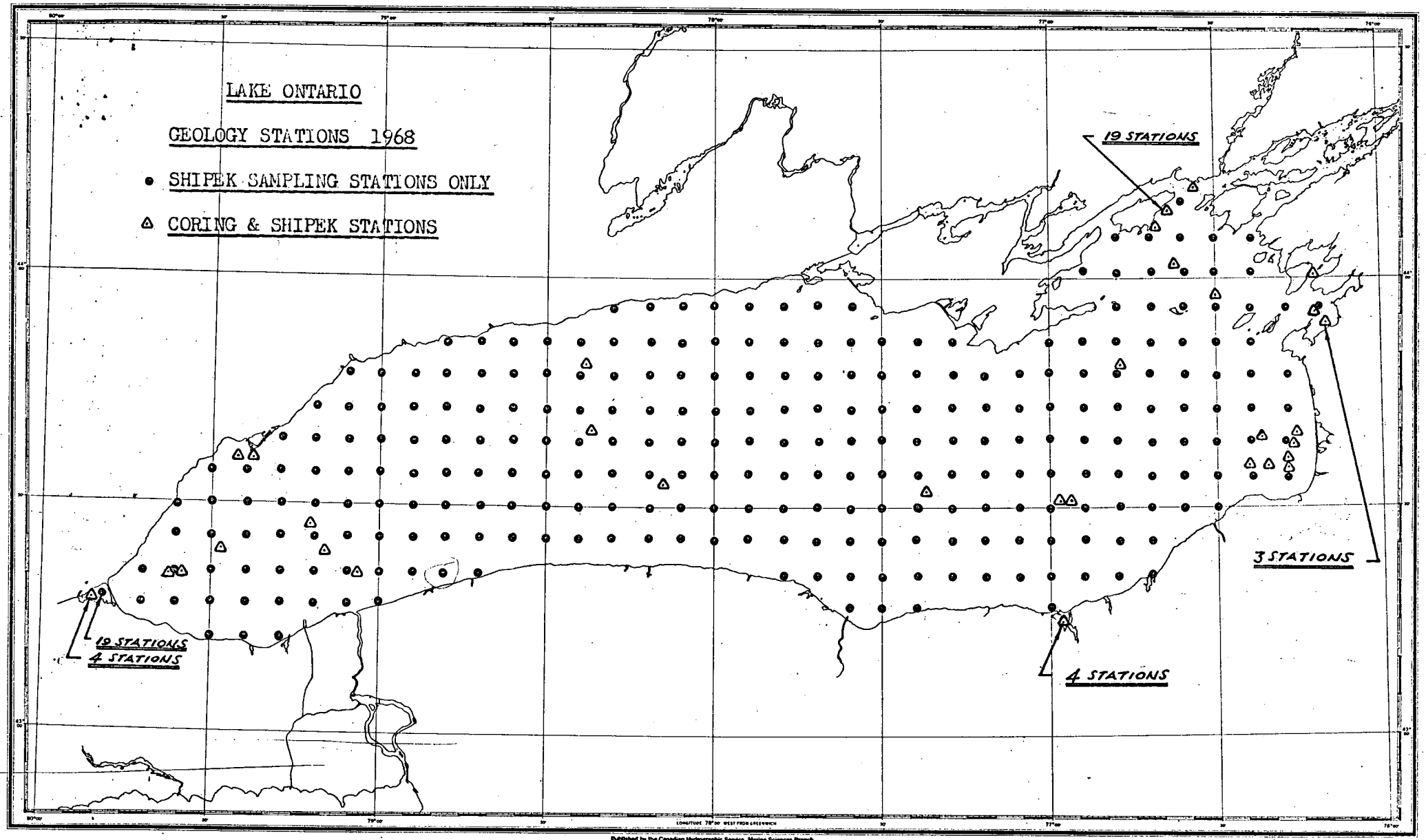
LAKE ONTARIO

MOORING POSITIONS 1968

Also included: two tower positions and one winter mooring position.

Stn. No.	Longitude °W	Latitude °N	
	78° 30.4'	43° 23.2'	
	78° 30.4	43° 24.2	
	78° 30.4	43° 25.3	
	78° 30.9	43° 26.7	
	78° 30.7	43° 29.4	
	78° 31.8	43° 24.2	
	79° 07.5	43° 18.0	
	79° 02.0	43° 19.7	
	79° 00.8	43° 19.0	
	78° 59.8	43° 18.0	
	78° 57.9	43° 18.7	
	78° 59.0	43° 19.5	
	79° 59.8	43° 20.1	
	78° 33.7	43° 24.1	
	79° 06.0	43° 18.9	
	79° 02.0	43° 19.0	
	79° 29.0	43° 24.0	(Winter Mooring)
	79° 04.0	43° 15.7	
	79° 08' 10"	43° 16' 56"	(Scientific Instrumentation Tower)
	79° 45.96'	43° 16.31'	(" " ")



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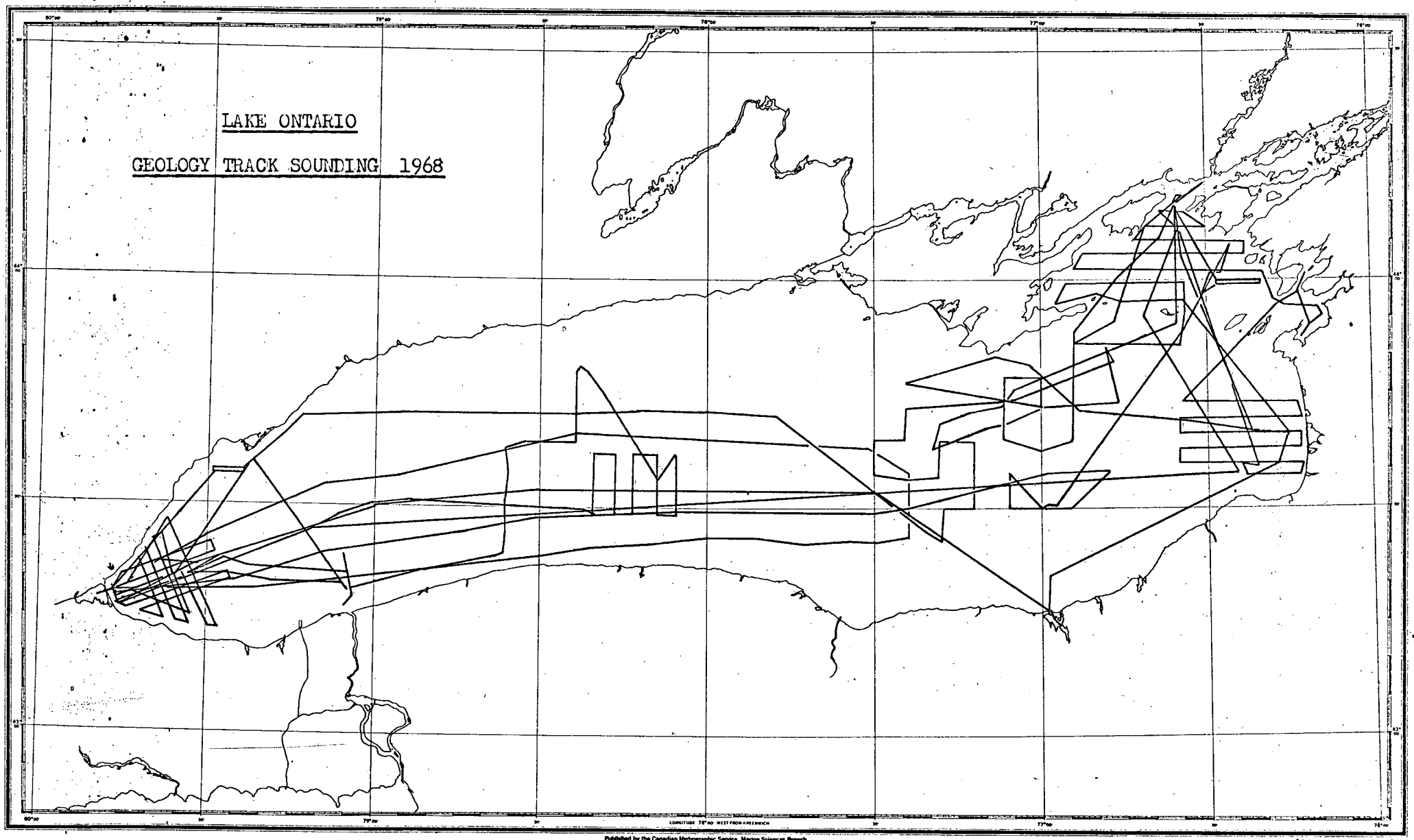

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Ontario
LAKE ONTARIO

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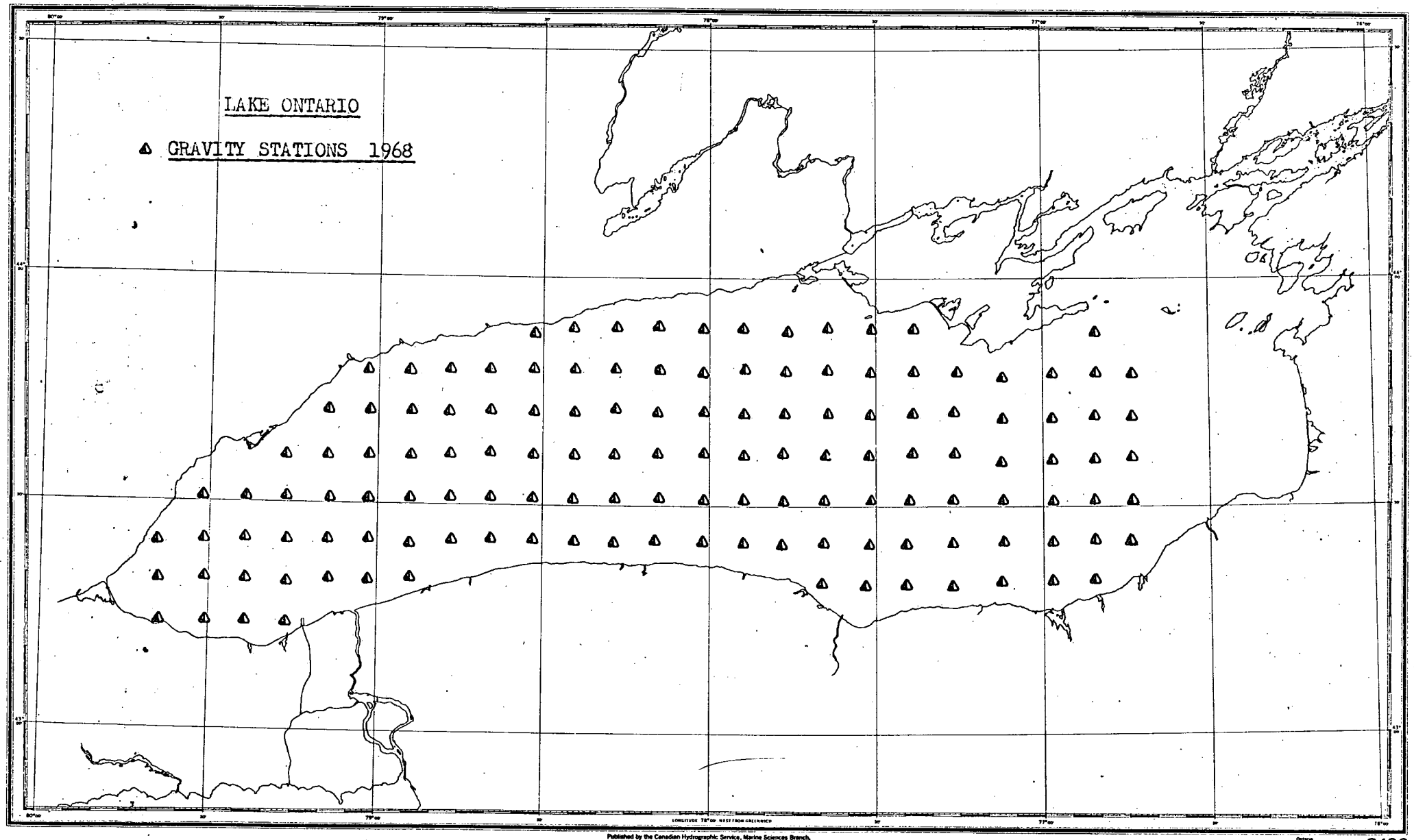
LAKE ONTARIO

CORING POSITIONS 1968

GRAVITY AND PISTON CORES

Stn. No.	Longitude °W	Latitude °N	Stn. No.	Longitude °W	Latitude °N
	76° 39.1'	44° 09.4'		76° 57.4'	43° 15.0'
	76° 39.0'	44° 09.4'		76° 57.3'	43° 14.9'
	76° 38.9'	44° 09.4'		76° 56.5'	43° 14.4'
	76° 38.9'	44° 09.5'		76° 58.6'	43° 15.6'
	76° 38.7'	44° 09.6'		79° 50.7'	43° 17.3'
	76° 38.8'	44° 09.5'		79° 48.6'	43° 17.0'
	76° 38.8'	44° 09.4'		79° 49.2'	43° 18.0'
	76° 38.9'	44° 09.4'		79° 50.6'	43° 16.9'
	76° 38.9'	44° 09.4'		79° 28.6'	43° 24.0'
	76° 38.9'	44° 09.5'		79° 37.8'	43° 20.7'
	76° 38.7'	44° 09.5'		79° 04.2'	43° 21.2'
	76° 39.1'	44° 09.4'		79° 52.2'	43° 16.5'
	76° 39.1'	44° 09.3'		78° 09.0'	43° 33.4'
	76° 39.1'	44° 09.3'		78° 23.1'	43° 48.8'
	76° 39.1'	44° 09.3'		78° 22.3'	43° 40.0'
	76° 39.0'	44° 09.3'		79° 35.5'	43° 20.9'
	76° 38.9'	44° 09.3'		76° 58.0'	43° 30.5'
	76° 38.9'	44° 09.4'		76° 56.8'	43° 30.6'
	76° 39.0'	44° 09.3'		76° 29.6'	43° 58.2'
	79° 12.1'	43° 26.2'		76° 47.3'	43° 49.0'
	76° 37.5'	44° 01.7'		76° 22.2'	43° 39.9'
	76° 11.1'	43° 53.7'		77° 22.6'	43° 32.1'
	76° 11.3'	43° 54.0'		79° 25.9'	43° 35.5'
	76° 11.3'	43° 53.3'		79° 23.6'	43° 35.6'
	76° 25.5'	43° 35.7'		76° 12.0'	44° 00.7'
	76° 18.4'	43° 36.0'		76° 12.0'	43° 56.3'
	76° 20.2'	43° 35.9'			
	76° 34.4'	44° 11.5'			
	76° 40.7'	44° 07.1'			
	76° 15.4'	43° 40.0'			
	76° 15.9'	43° 37.9'			
	76° 19.2'	43° 36.0'			



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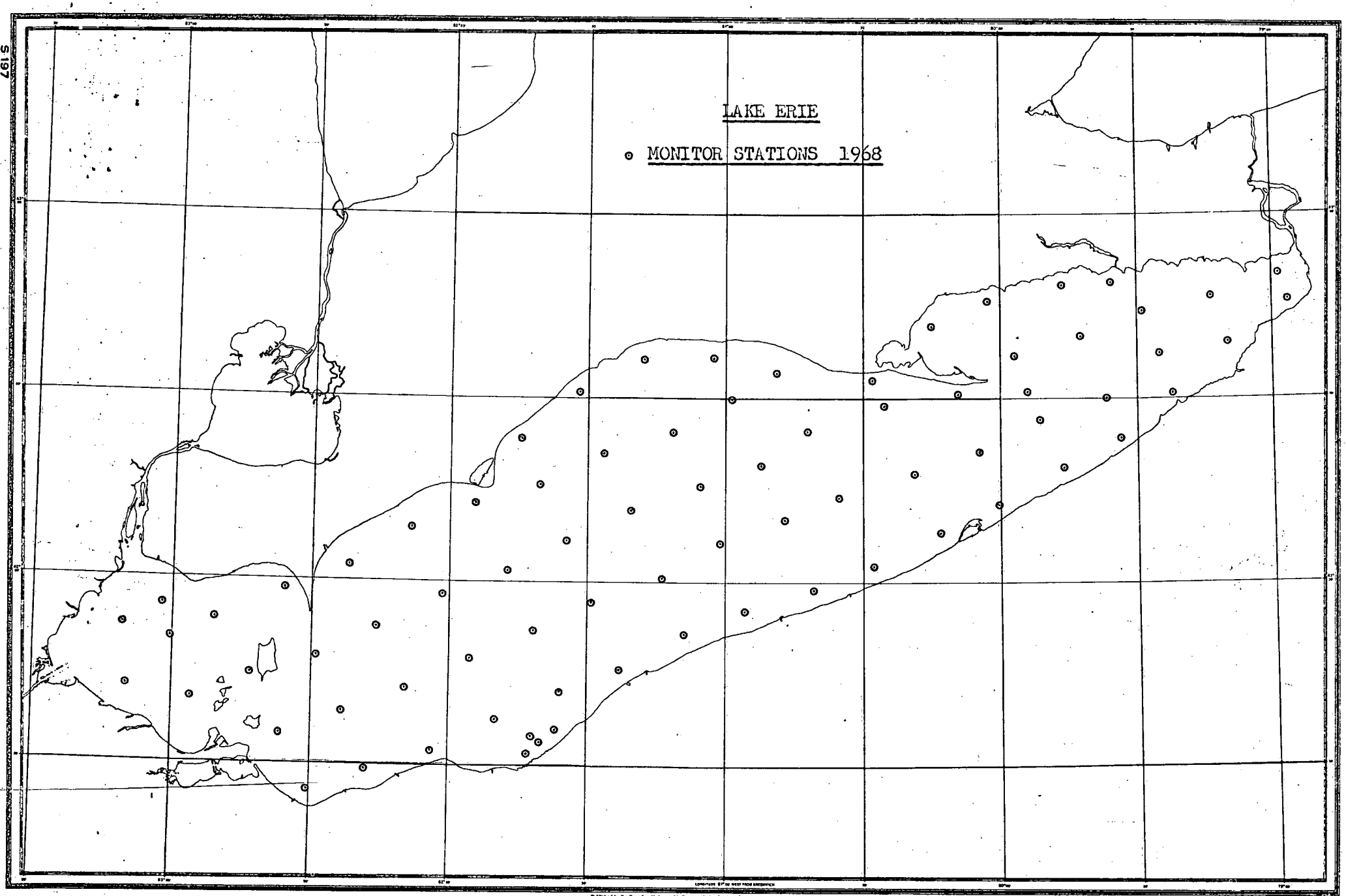

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Series
LAKE ERIE

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LAKE ERIE

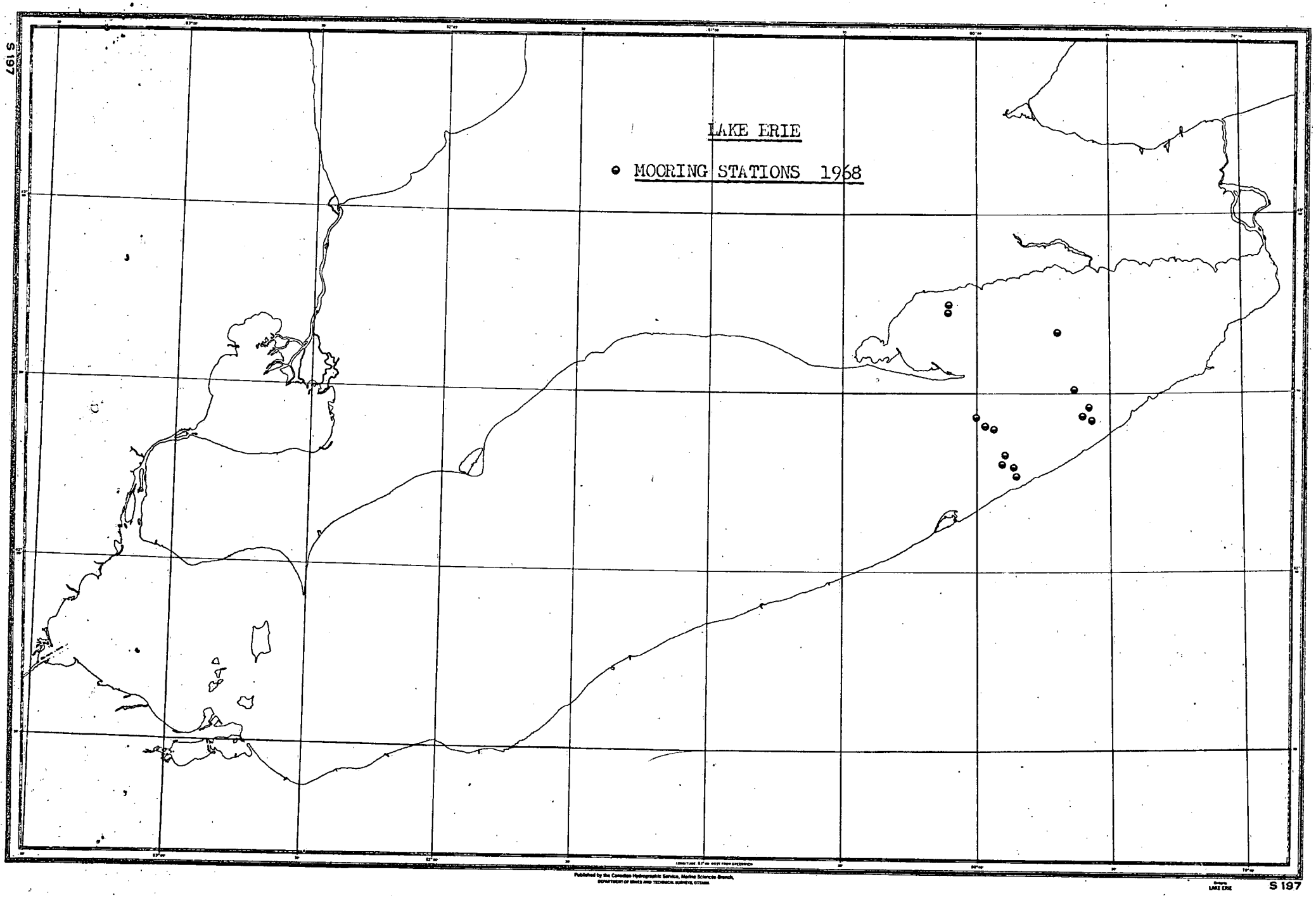
FULL MONITOR POSITIONS 1968

Stn. No.	Longitude °W	Latitude °N	Stn. No.	Longitude °W	Latitude °N
1	79° 12.1'	42° 47.4'	33	80° 58.4'	42° 30.0'
2	78° 57.5	42° 50.6	34	81° 02.6	42° 37.9
3	78° 55.5	42° 46.7	35	81° 17.9	42° 36.3
4	79° 08.0	42° 39.1	36	81° 12.3	42° 25.8
5	79° 20.6	42° 31.5	37	81° 06.4	42° 15.2
6	79° 24.6	42° 37.9	38	81° 00.7	42° 04.9
7	79° 27.1	42° 44.1	39	80° 55.0	41° 54.4
8	79° 34.6	42° 49.5	40	81° 08.9	41° 50.1
9	79° 45.8	42° 48.9	41	81° 14.6	42° 00.5
10	79° 41.5	42° 40.8	42	81° 20.8	42° 11.0
11	79° 36.0	42° 30.1	43	81° 26.4	42° 21.4
12	79° 32.8	42° 23.9	44	81° 32.1	42° 31.7
13	79° 45.8	42° 18.0	45	81° 44.0	42° 23.8
14	79° 50.0	42° 26.0	46	81° 40.3	42° 16.9
15	79° 53.4	42° 31.1	47	81° 34.5	42° 06.6
16	79° 56.1	42° 36.6	48	81° 28.7	41° 56.1
17	80° 00.8	42° 45.2	49	81° 23.0	41° 45.8
18	80° 14.9	42° 42.7	50	81° 36.7	41° 41.4
19	80° 09.2	42° 30.9	51	81° 36.1	41° 34.7
20	80° 04.4	42° 21.8	52	81° 39.5	41° 33.1
21	79° 59.5	42° 12.4	53	81° 42.5	41° 31.8
22	80° 12.7	42° 07.0	54	81° 42.5	41° 33.8
23	80° 18.3	42° 17.6	55	81° 42.5	41° 51.8
24	80° 24.4	42° 28.2	56	81° 48.7	42° 02.2
25	80° 27.2	42° 33.5	57	81° 54.4	42° 12.2
26	80° 44.0	42° 34.5	58	82° 08.4	42° 08.1
27	80° 38.2	42° 24.0	59	82° 02.5	41° 57.9
28	80° 32.7	42° 13.3	60	81° 56.7	41° 47.3
29	80° 27.1	42° 02.8	61	81° 50.8	41° 36.9
30	80° 40.8	41° 58.6	62	82° 04.4	41° 32.7
31	80° 46.5	42° 09.1	63	82° 10.2	41° 42.9
32	80° 52.7	42° 19.7	64	82° 16.2	41° 53.3

Cont'd

LAKE ERIE FULL MON. POS. 1968 Cont'd.

Stn. No.	Longitude °W	Latitude °N
65	82° 22.4'	42° 03.8'
66	82° 30.1	41° 48.8
67	82° 24.2	41° 38.5
68	82° 18.3	41° 28.1
69	82° 30.2	41° 25.2
70	82° 38.1	41° 34.0
71	82° 44.0	41° 44.3
72	82° 56.0	41° 41.1
73	83° 10.4	41° 43.9
74	83° 11.8	41° 53.5
75	83° 02.7	41° 56.8
76	83° 01.1	41° 49.9
77	82° 50.4	41° 54.7
78	82° 36.2	41° 59.2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MOORING STATIONS 1968
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LAKE ERIE
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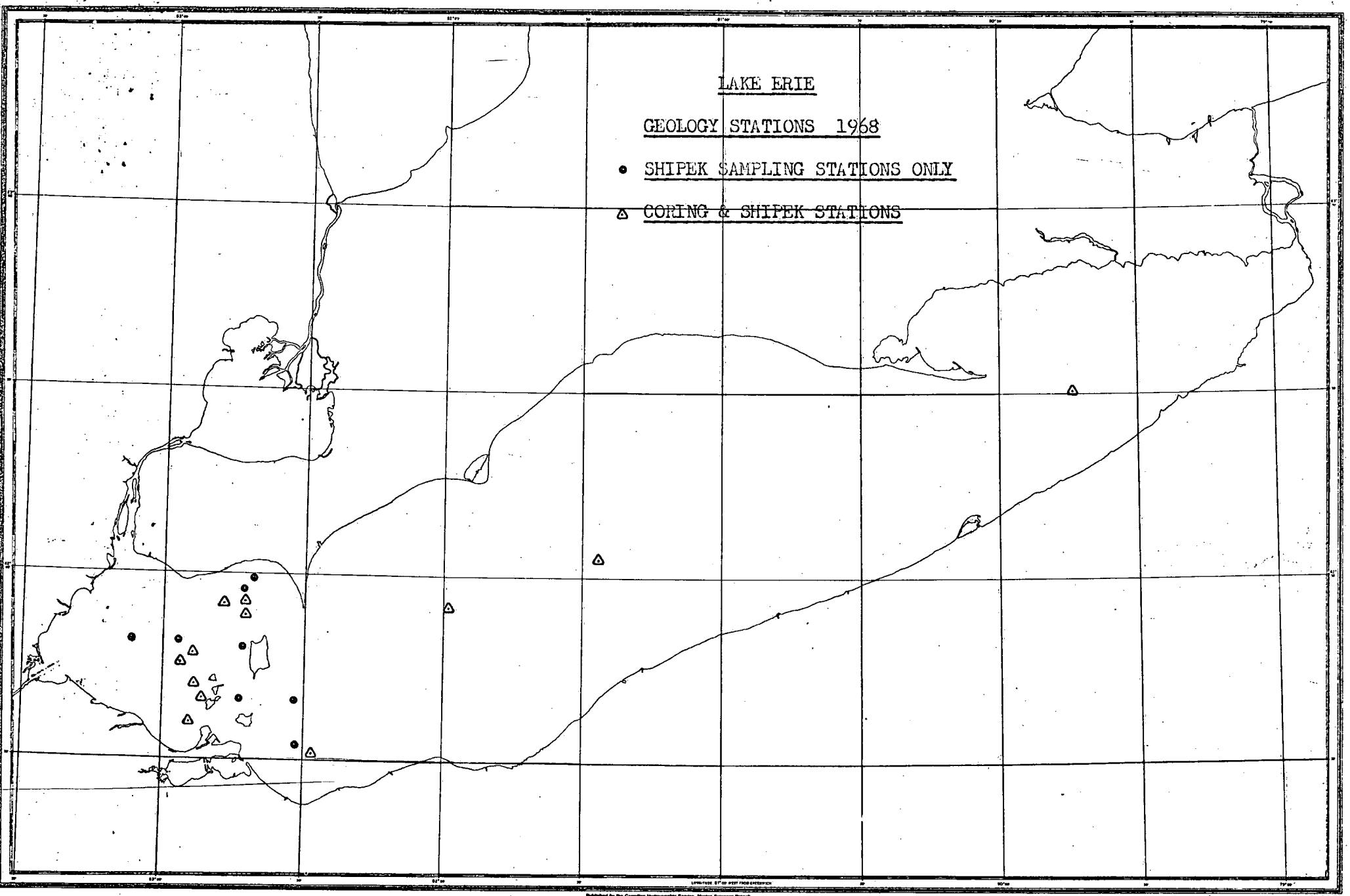
LAKE ERIE

MOORING POSITIONS 1968

Including One Winter Mooring

Stn. No.	Longitude °W	Latitude °N	
	80° 00.0'	42° 26.4'	
	79° 56.5	42° 24.3	
	79° 54.0	42° 19.6	
	79° 52.3	42° 17.9	
	79° 51.5	42° 16.3	
	79° 54.8	42° 18.0	
	80° 06.1	42° 44.9	
	79° 41.4	42° 40.0	
	79° 38.0	42° 30.4	
	79° 35.0	42° 27.8	
	79° 34.0	42° 25.6	
	79° 36.5	42° 26.1	
	80° 07.3	42° 44.6	
	79° 58.0	42° 24.6	(Winter Mooring)



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LAKE ERIE

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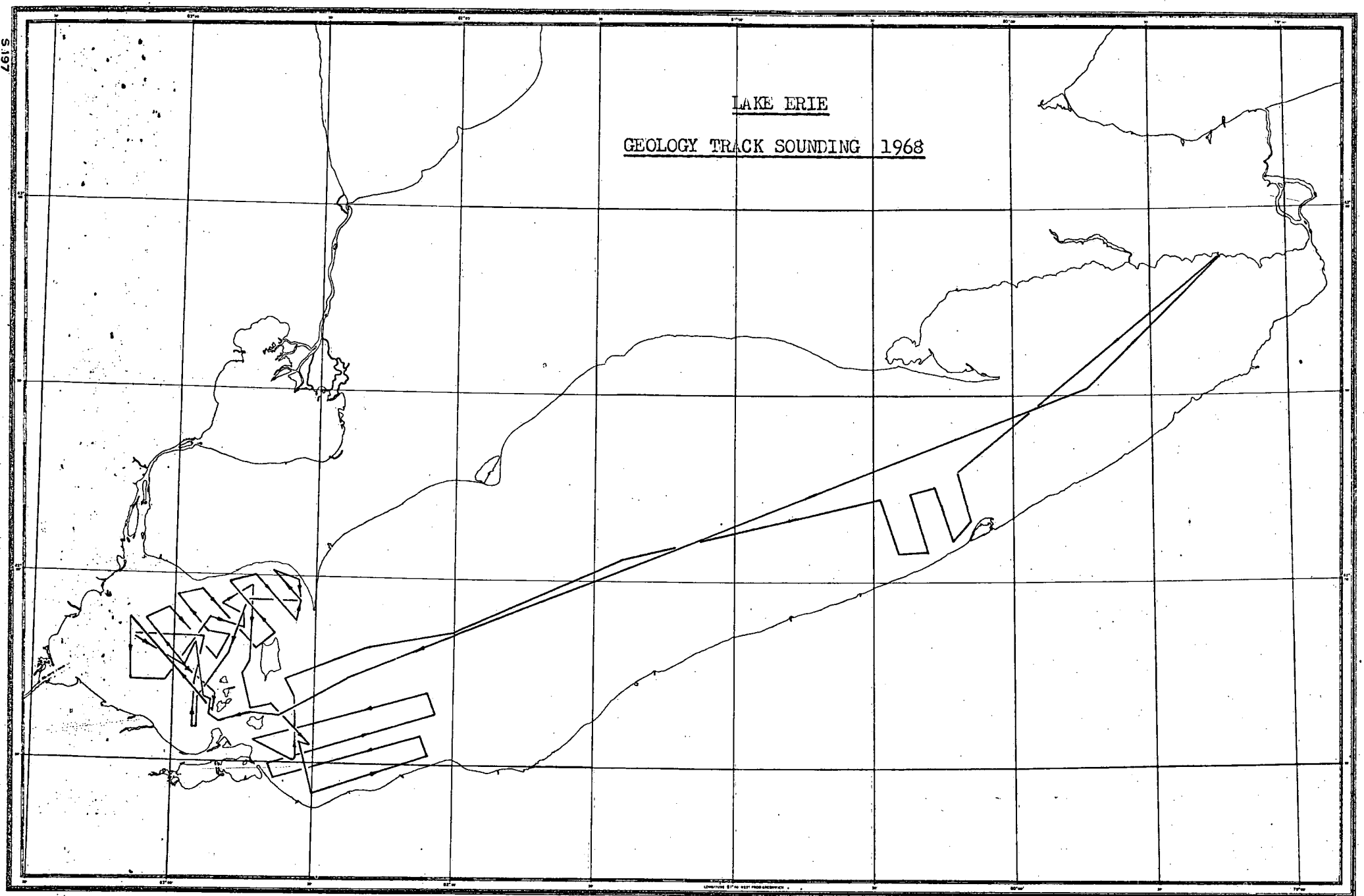

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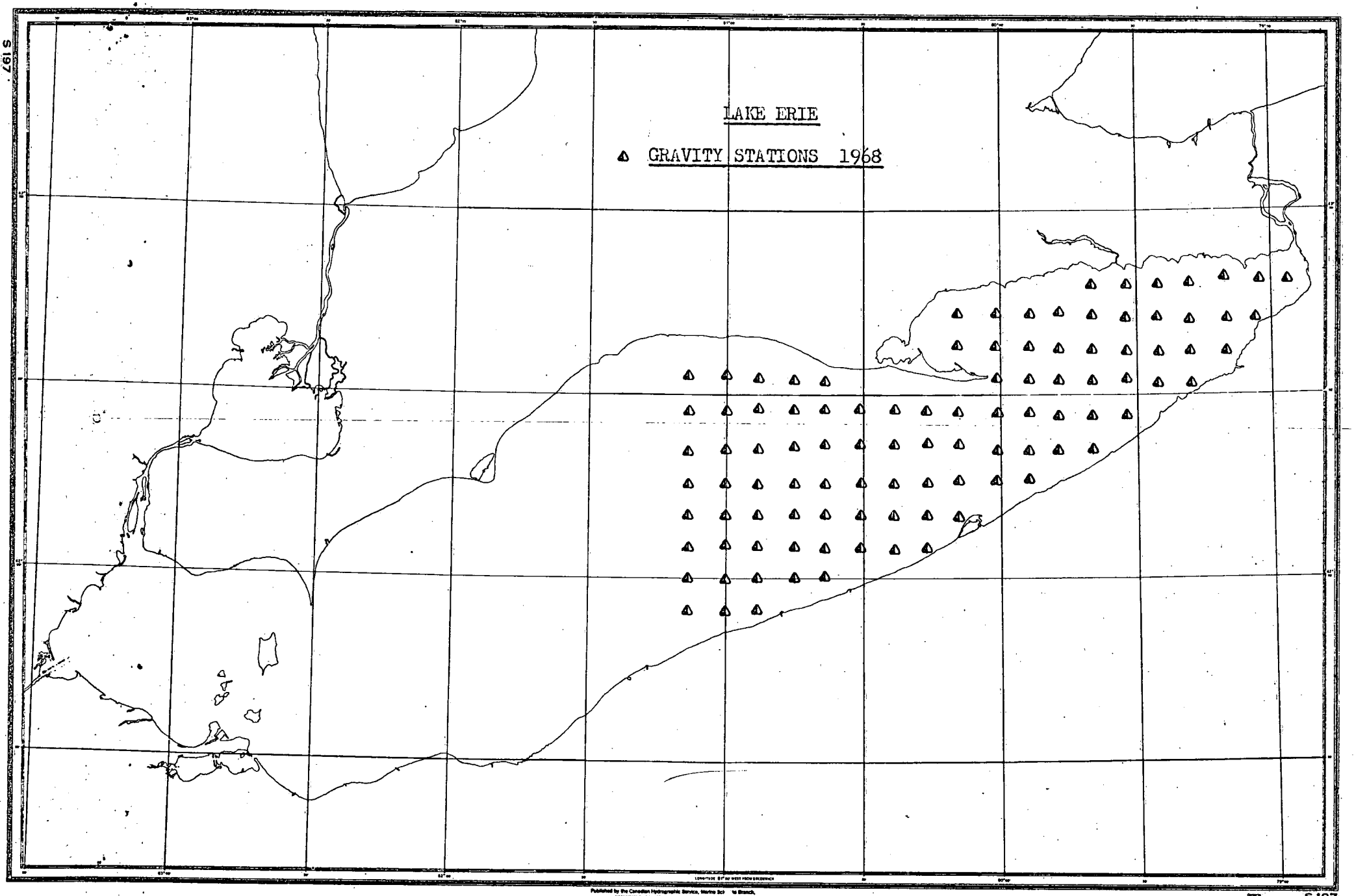
LAKE ERIE

CORING POSITIONS 1968

GRAVITY AND PISTON CORES

Stn. No.	Longitude °W	Latitude °N
	79° 43.5'	42° 31.6'
	81° 23.5	42° 05.3
	81° 58.8	41° 50.9
	82° 45.4	41° 55.0
	82° 45.4	41° 51.7
	82° 50.2	41° 54.3
	82° 55.1	41° 48.5
	82° 57.3	41° 45.9
	82° 53.9	41° 42.4
	82° 50.8	41° 40.0
	82° 53.5	41° 36.6
	82° 29.6	41° 31.3



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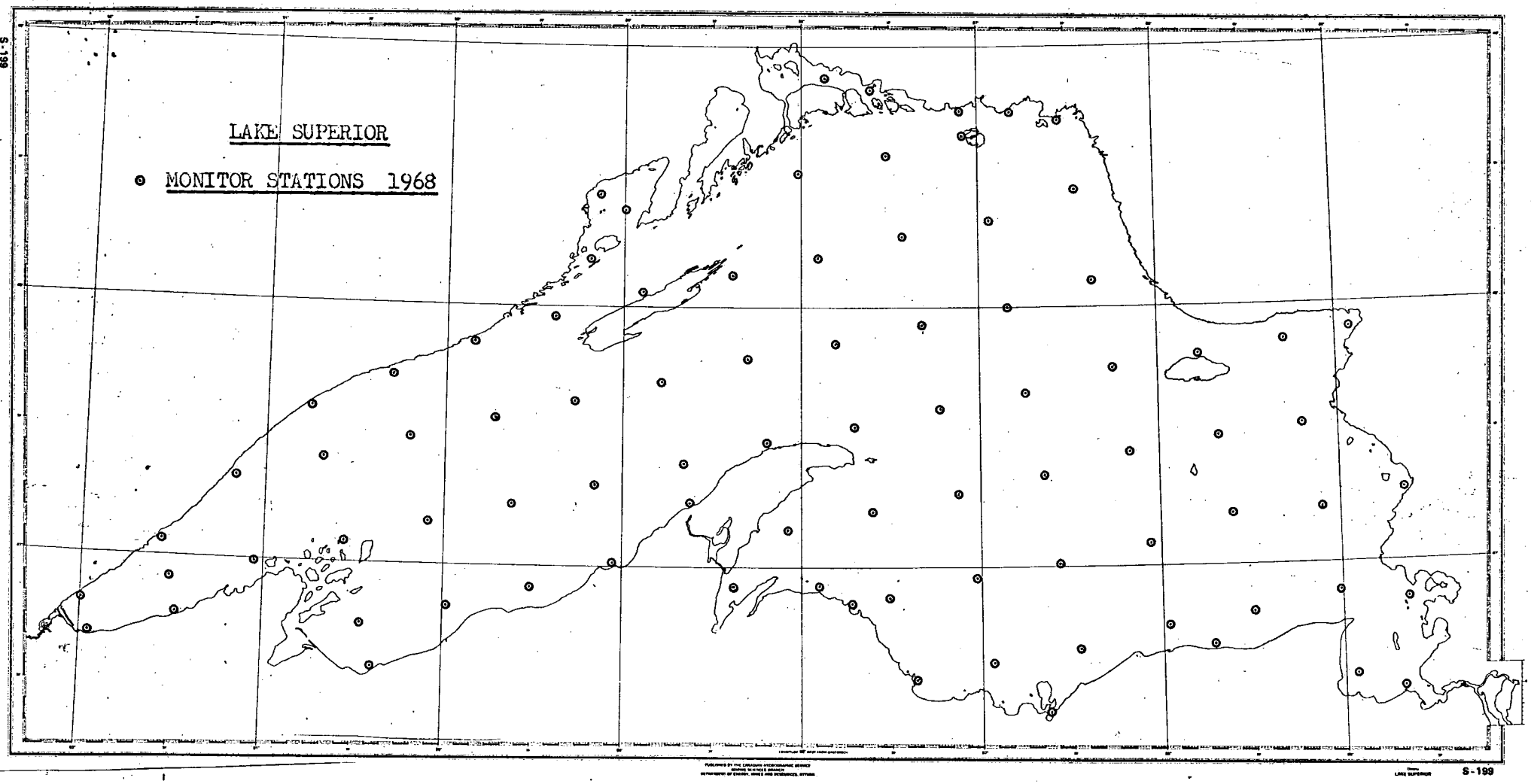
LAKE SUPERIOR
MONITOR STATIONS 1968
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LAKE SUPERIOR

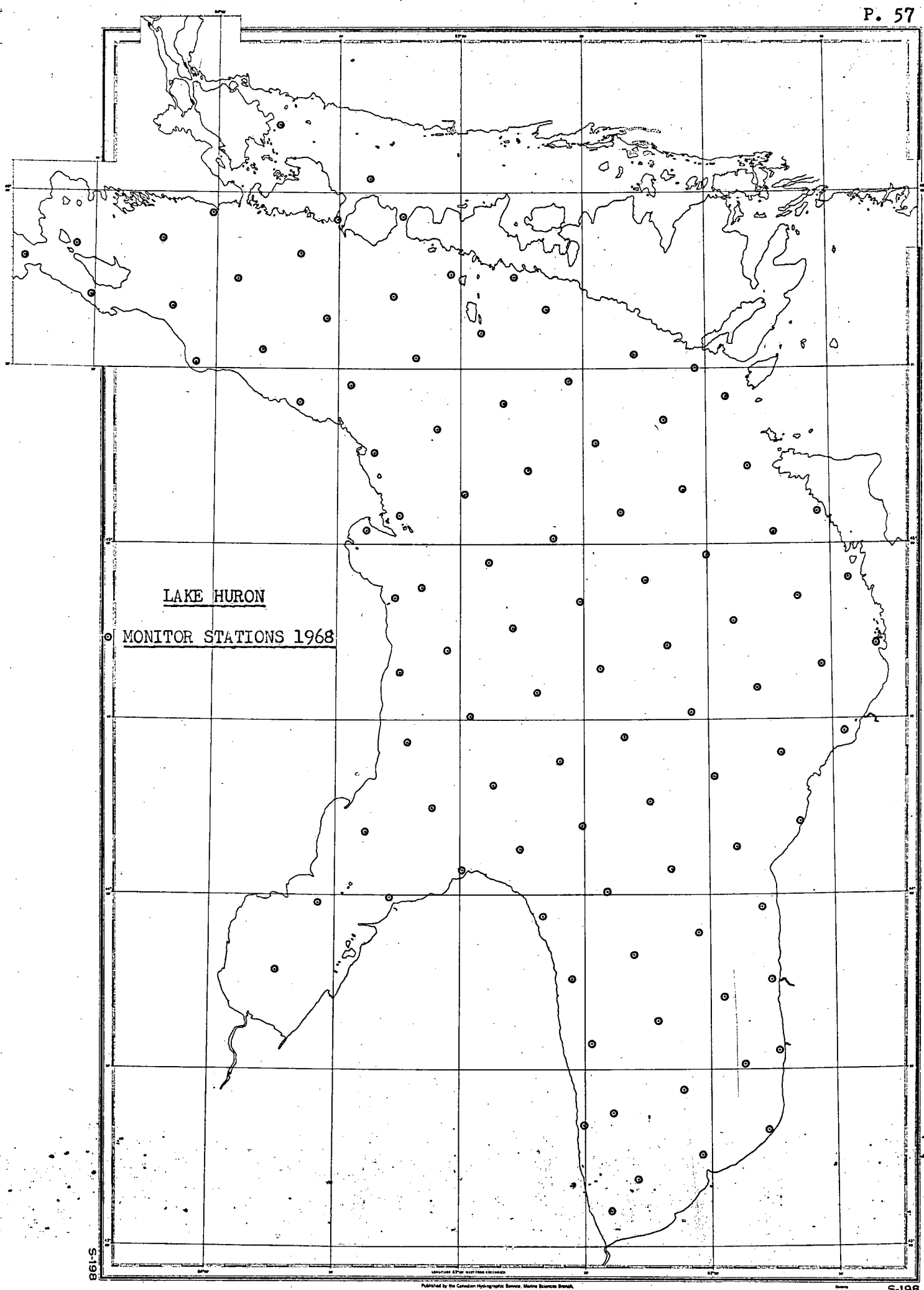
FULL MONITOR POSITIONS 1968

Stn. No.	Longitude °W	Latitude °N	Stn. No.	Longitude °W	Latitude °N
1	84° 40.7'	46° 30.7'	33	87° 01.8'	46° 57.1'
2	84° 56.0	46° 33.1	34	87° 07.6	47° 16.8
3	84° 38.5	46° 50.7	35	87° 13.1	47° 36.4
4	85° 01.6	46° 52.9	36	87° 19.6	47° 56.0
5	85° 06.3	47° 12.5	37	87° 25.5	48° 15.8
6	84° 37.8	47° 16.1	38	87° 31.4	48° 35.1
7	85° 11.9	47° 32.2	39	87° 36.0	48° 49.8
8	84° 54.8	47° 54.7	40	87° 52.5	48° 52.5
9	85° 17.1	47° 52.0	41	88° 07.6	48° 50.3
10	85° 45.9	47° 48.1	42	88° 01.0	48° 31.0
11	85° 40.4	47° 28.6	43	87° 54.5	48° 11.3
12	85° 35.0	47° 08.9	44	87° 48.5	47° 51.8
13	85° 30.0	46° 49.1	45	87° 42.3	47° 32.1
14	85° 42.7	46° 40.9	46	87° 36.2	47° 12.7
15	85° 58.7	46° 45.5	47	87° 30.2	46° 53.0
16	86° 03.9	47° 05.0	48	87° 22.3	46° 33.8
17	86° 09.7	47° 24.9	49	87° 43.5	46° 51.1
18	86° 14.9	47° 44.3	50	87° 53.3	46° 56.0
19	86° 20.6	48° 04.0	51	88° 23.0	46° 55.3
20	86° 26.6	48° 23.8	52	88° 04.9	47° 08.3
21	86° 32.6	48° 42.8	53	88° 11.2	47° 28.0
22	86° 48.5	48° 44.9	54	88° 17.4	47° 47.3
23	87° 04.1	48° 45.7	55	88° 23.7	48° 07.0
24	87° 02.3	48° 39.8	56	88° 30.6	48° 26.4
25	86° 56.3	48° 19.8	57	88° 52.7	48° 02.9
26	86° 50.3	48° 00.1	58	88° 59.8	48° 22.0
27	86° 44.3	47° 40.4	59	89° 08.8	48° 25.8
28	86° 38.5	47° 21.0	60	89° 10.8	48° 10.1
29	86° 33.5	47° 01.2	61	89° 22.5	47° 58.0
30	86° 27.1	46° 41.7	62	89° 15.3	47° 38.3
31	86° 37.9	46° 26.3	63	88° 46.5	47° 43.1
32	86° 55.9	46° 37.8	64	88° 39.9	47° 23.6

Cont'd.

L. SUPERIOR FULL MON. POS. 1968 Cont'd.

Stn. No.	Longitude °W	Latitude °N
65	88° 37.1'	47° 14.9'
66	89° 08.9	47° 18.8
67	89° 02.8	47° 00.5
68	89° 30.6	46° 54.9
69	89° 37.1	47° 14.4
70	89° 43.8	47° 33.9
71	89° 50.7	47° 52.0
72	90° 18.2	47° 43.6
73	90° 12.6	47° 29.2
74	90° 06.0	47° 09.8
75	89° 59.0	46° 50.3
76	90° 23.5	46° 35.8
77	90° 27.4	46° 45.4
78	90° 34.5	47° 04.9
79	90° 41.6	47° 24.1
80	90° 45.7	47° 36.0
81	91° 10.2	47° 19.2
82	91° 02.9	46° 59.9
83	91° 28.1	46° 47.0
84	91° 31.3	46° 55.1
85	91° 34.5	47° 03.9
86	91° 59.5	46° 49.7
87	91° 56.4	46° 42.1



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LAKE HURON

FULL MONITOR POSITIONS 1968

Stn. No.	Longitude °W	Latitude °N	Stn. No.	Longitude °W	Latitude °N
1	82° 24.3'	43° 05.4'	33	83° 23.1'	44° 10.7'
2	82° 17.9	43° 11.4	34	83° 07.2	44° 14.9
3	82° 02.3	43° 15.4	35	82° 51.9	44° 19.1
4	81° 46.7	43° 19.5	36	82° 35.9	44° 23.2
5	81° 43.7	43° 32.9	37	82° 20.5	44° 27.2
6	81° 52.0	43° 30.8	38	82° 04.3	44° 31.2
7	82° 07.8	43° 26.7	39	81° 48.1	44° 35.3
8	82° 23.4	43° 22.6	40	81° 32.7	44° 39.4
9	82° 30.4	43° 20.8	41	81° 19.7	44° 42.7
10	82° 29.0	43° 34.0	42	81° 25.5	44° 54.0
11	82° 13.2	43° 38.0	43	81° 38.1	44° 50.8
12	81° 57.9	43° 42.1	44	81° 53.8	44° 46.8
13	81° 45.7	43° 45.2	45	82° 10.0	44° 42.8
14	81° 47.9	43° 57.4	46	82° 26.0	44° 38.7
15	82° 03.2	43° 53.4	47	82° 41.3	44° 34.6
16	82° 19.2	43° 49.2	48	82° 57.7	44° 30.3
17	82° 34.6	43° 45.2	49	83° 13.0	44° 26.1
18	82° 40.1	43° 56.5	50	83° 14.9	44° 38.4
19	82° 24.7	44° 00.6	51	83° 03.3	44° 41.7
20	82° 08.6	44° 04.7	52	82° 47.0	44° 45.7
21	81° 53.2	44° 08.7	53	82° 31.2	44° 39.9
22	81° 38.6	44° 12.3	54	82° 15.2	44° 54.0
23	81° 27.2	44° 28.0	55	82° 00.0	44° 58.0
24	81° 42.7	44° 24.1	56	81° 44.2	45° 02.1
25	81° 58.9	44° 20.1	57	81° 32.1	45° 05.0
26	82° 14.1	44° 16.0	58	81° 49.2	45° 13.3
27	82° 30.2	44° 11.9	59	82° 05.8	45° 09.3
28	82° 45.7	44° 07.9	60	82° 21.1	45° 05.2
29	83° 01.6	44° 03.7	61	82° 37.7	45° 01.1
30	83° 17.2	43° 59.6	62	82° 53.0	44° 57.0
31	83° 34.1	43° 58.9	63	83° 09.4	44° 52.9
32	83° 44.2	43° 47.2	64	83° 15.7	44° 51.0

Cont'd.

L. HURON FULL MON. POS. 1968 Cont'd.

Stn. No.	Longitude °W	Latitude °N.	Stn. No.	Longitude °W	Latitude °N
65	83° 22.7'	45° 02.1'	97	84° 17.7'	45° 51.8'
66	83° 15.3	45° 04.1	98	83° 55.0	45° 45.0
67	82° 59.0	45° 13.2	99	84° 01.2	45° 56.1
68	82° 43.6	45° 12.4	100	83° 44.5	46° 11.7
69	82° 27.1	45° 16.7			
70	82° 11.5	45° 20.7			
71	81° 55.1	45° 24.8			
72	82° 02.7	45° 32.1			
73	82° 16.8	45° 32.0			
74	82° 33.1	45° 27.9			
75	82° 48.9	45° 23.7			
76	83° 05.5	45° 19.5			
77	83° 20.8	45° 15.3			
78	83° 39.1	45° 23.5			
79	83° 26.9	45° 26.8			
80	83° 11.2	45° 30.9			
81	82° 54.9	45° 35.0			
82	82° 38.9	45° 39.1			
83	82° 46.8	45° 45.9			
84	83° 01.0	45° 40.3			
85	83° 16.8	45° 42.1			
86	83° 14.5	45° 55.5			
87	83° 22.6	46° 02.1			
88	83° 30.3	45° 55.1			
89	83° 39.1	45° 49.1			
90	83° 33.0	45° 38.0			
91	83° 48.9	45° 33.7			
92	84° 06.0	45° 31.0			
93	84° 11.2	45° 40.5			
94	84° 30.7	45° 42.2			
95	84° 45.3	45° 48.8			
96	84° 34.0	45° 50.7			

GREAT LAKES SURVEYS - 1968

SUMMARY OF ACTIVITIES

M.V. THERON AND C.S.S. LIMNOS

LAKES ONTARIO, ERIE, HURON, SUPERIOR

STATISTICS	
Total Number of Cruises	40
Distance Steamed - Cruises Only	26,356
Monitor Stations	1,099
Special Stations (Supporting Observation)	713
Total Number of Water Samples	12,871
Plankton Hauls	515
Chemical Analyses	27,092
Bacteriological Analyses	1,230
Bathythermograph Casts	1,799
Grab Samples	619
Cores (Piston and Gravity) - Samples Obtained	298
Drift Card Launched	3,631
Drogues Tracked	8
Moorings(Established)	66
Weather Observations Every 3 Hours	1,407
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	237

GREAT LAKES SURVEYS - 1968

M.V. THERON (Summary)

Dep. Halifax April 1, 1968
Arr. CCIW April 21, 1968
Dist. - Halifax - CCIW = 1,254 miles

STATISTICS	
Total Number of Cruises	28
Distance Steamed - Cruises Only	18,111
Monitor Stations	940
Special Stations (Supporting Observation)	130
Total Number of Water Samples	12,267
Plankton Hauls	505
Chemical Analyses	23,748
Bacteriological Analyses	1,230
Bathythermograph Casts	1,534
Grab Samples	38
Cores (Piston and Gravity)- Samples Obtained	102
Drift Card Launched	3,570
Drogues Tracked	8
Moorings(Established)	53
Weather Observations Every 3 Hours	995
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	NIL

M.V. THERON

LAKE ONTARIO

1968

STATISTICS	
Total Number of Cruises	15
Distance Steamed	6,734
Monitor Stations	352
Special Stations (Supporting Observation)	95
Total Number of Water Samples	2,314
Plankton Hauls	245
Chemical Analyses	5,661
Bacteriological Analyses	308
Bathythermograph Casts	873
Grab Samples	16
Cores (Piston and Gravity) - Samples Obtained	32
Drift Card Launched	1,440
Drogues Tracked	7
Moorings(Established)	33
Weather Observations Every 3 Hours	445
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	

M.V. THERON

LAKE ERIE

1968

STATISTICS	
Total Number of Cruises	11
Distance Steamed	7,715
Monitor Stations	402
Special Stations (Supporting Observation)	35
Total Number of Water Samples	6,300
Plankton Hauls	153
Chemical Analyses	10,341
Bacteriological Analyses	531
Bathythermograph Casts	475
Grab Samples	22
Cores (Piston and Gravity) - Samples Obtained	70
Drift Card Launched	1,230
Drogues Tracked	1
Moorings(Established)	20
Weather Observations Every 3 Hours	394
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	NIL

M.V. THERON

LAKE HURON

1968

STATISTICS	
Total Number of Cruises	1
Distance Steamed	1,332
Monitor Stations	100
Special Stations (Supporting Observation)	NIL
Total Number of Water Samples	1,666
Plankton Hauls	53
Chemical Analyses	3,427
Bacteriological Analyses	196
Bathythermograph Casts	100
Grab Samples	NIL
Cores (Piston and Gravity)	NIL
Drift Card Launched	480
Drogues Tracked	NIL
Mooring (Established)	NIL
Weather Observations Every 3 Hours	60
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	NIL

M.V. THERON

LAKE SUPERIOR

1968

STATISTICS	
Total Number of Cruises	1
Distance Steamed	2,330
Monitor Stations	86
Special Stations (Supporting Observation)	NIL
Total Number of Water Samples	1,987
Plankton Hauls	54
Chemical Analyses	4,319
Bacteriological Analyses	195
Bathythermograph Casts	86
Grab Samples	NIL
Cores (Piston and Gravity)	NIL
Drift Card Launched	420
Drogues Tracked	NIL
Mooring (Established)	NIL
Weather Observations Every 3 Hours	96
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	NIL

GREAT LAKES SURVEYS - 1968

C.S.S. LIMNOS (Summary)

Dep. CCIW May 3, 1968
Arr. CCIW Oct. 15, 1968

STATISTICS	
Total Number of Cruises	12
Distance Steamed	8,245
Monitor Stations	159
Special Stations (Supporting Observation)	583
Total Number of Water Samples	604
Plankton Hauls	10
Chemical Analyses	3,344
Bacteriological Analyses	NIL
Bathythermograph Casts	265
Grab Samples	581
Cores (Piston and Gravity) - Samples Obtained	196
Drift Card Launched	61
Drogues Tracked	NIL
Moorings (Established)	13
Weather Observations Every 3 Hours	412
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	237

C.S.S. LIMNOS

LAKE ONTARIO

1968

STATISTICS	
Total Number of Cruises	10
Distance Steamed	6,948
Monitor Stations	159
Special Stations (Supporting Observation)	478
Total Number of Water Samples	604
Plankton Hauls	10
Chemical Analyses	3,344
Bacteriological Analyses	NIL
Bathythermograph Casts	253
Grab Samples	581
Cores (Piston and Gravity) - Samples Obtained	196
Drift Card Launched	NIL
Drogues Tracked	NIL
Moorings (Established)	7
Weather Observations Every 3 Hours	324
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	136

C.S.S. LIMNOS

LAKE ERIE

1968

STATISTICS	
Total Number of Cruises	2
Distance Steamed	1,297
Monitor Stations	NIL
Special Stations (Supporting Observation)	105
Total Number of Water Samples	NIL
Plankton Hauls	NIL
Chemical Analyses	NIL
Bacteriological Analyses	NIL
Bathythermograph Casts	12
Grab Samples	NIL
Cores (Piston and Gravity)	NIL
Drift Card Launched	61
Drogues Tracked	NIL
Moorings(Established)	6
Weather Observations Every 3 Hours	88
Continuous Recording of Surface Water Temperature	
Continuous Recording of Solar Radiation	
Total Gravity Observations	101

LAKE ONTARIO 1968

FULL MONITOR CRUISE

CHEMICAL PARAMETERS OBSERVED

DEPTHS	SHIPBOARD ANALYSES		* SHORE ANALYSES	
	MANUAL	AUTO ANALYSER	MANUAL	CHEMICAL
1, 30 metres and bottom	dissolved oxygen conductivity turbidity pH (Cruise 68-0-01 only)	inorganic phosphate nitrate ammonia reactive silica	Hellige colour turbidity pH conductivity suspended material dissolved solids * (these analyses done on a selected basis)	total phosphate total nitrogen major ions trace metals alkalinity hardness
	Continuous surface chlorophyll measurement. Bacteriological samples at selected depths and stations. Plankton haul (50 m) and surface sample at selected stations. Temperature (in situ) at all sampling depths. Secchi disc at all daylight stations. B.T. cast at all stations. Water surface temperature at all stations.			

LAKE ONTARIO 1968

MONITOR CRUISE

CHEMICAL PARAMETERS OBSERVED

DEPTHS	SHIPBOARD ANALYSES		SHORE ANALYSES	
	MANUAL	AUTO ANALYSER		
All standard depths	dissolved oxygen turbidity conductivity	NIL	NIL	NIL
	Temperature (in situ) at all sampling depths. Secchi disc at all daylight stations. B.T. cast at all stations. Surface chlorophyll measurements on selected cruises. Water surface temperature at all stations.			

Standard Depths: 1, 5, 10, 20, 30, 50, 75, 100, 150, 200, 250, and 300 metres.

LAKE ERIE 1968

FULL MONITOR CRUISE

CHEMICAL PARAMETERS OBSERVED

DEPTHS	SHIPBOARD ANALYSES		* SHORE ANALYSES	
	MANUAL	AUTO ANALYSER	MANUAL	CHEMICAL
All standard depths	dissolved oxygen conductivity turbidity	NIL	NIL	NIL
1, 10 metres and bottom	NIL	inorganic phosphate nitrate ammonia reactive silica	Hellige colour turbidity pH conductivity suspended material dissolved solids * (these analyses done on a	total phosphate total nitrogen major ions trace metals alkalinity hardness selected basis)
	Continuous surface chlorophyll measurement. Bacteriological samples at selected stations. Plankton haul and surface sample at selected stations. In situ temperatures at all standard depths. Secchi disc at all daylight stations. B.T. cast at all stations. Water surface temperature at all stations.			
Standard Depths:	1,4,7,10,13,16,19,22,25,28,31,37,43,49,55, and 61 metres.			

LAKE HURON 1968

FULL MONITOR CRUISE

CHEMICAL PARAMETERS OBSERVED

DEPTHS	SHIPBOARD ANALYSES		SHORE ANALYSES	
	MANUAL	AUTO ANALYSER	MANUAL	CHEMICAL
Standard depths	dissolved oxygen conductivity turbidity	NIL	NIL	NIL
1, + * metres and bottom	NIL	inorganic phosphate nitrate reactive silica	Hellige colour turbidity pH conductivity suspended material dissolved solids	total phosphate total nitrate major ions trace elements deuterium alkalinity hardness
* - selected depth, just below thermocline (10 - 50 metres).				
	Continuous surface chlorophyll measurement. Bacteriological samples at selected depths and stations. Plankton haul and surface sample at selected stations. In situ temperature at all standard depths. Secchi disc at all daylight stations. B.T. cast at all stations. Water surface temperature at all stations.			
Standard Depths: 1,5,10,20,30,50,75,100,150,200,250,300,350, and 400 metres.				

LAKE SUPERIOR 1968

FULL MONITOR CRUISE

CHEMICAL PARAMETERS OBSERVED

DEPTHS	SHIPBOARD ANALYSES		SHORE ANALYSES	
	MANUAL	AUTO ANALYSER	MANUAL	CHEMICAL
Standard depths	dissolved oxygen conductivity turbidity	NIL	NIL	NIL
1, + * metres and bottom	NIL	inorganic phosphate nitrate reactive silica	Hellige colour turbidity pH conductivity suspended material dissolved solids	total phosphate total nitrate major ions trace elements deuterium alkalinity hardness
* - selected depth just below thermocline (10 - 50 metres).				
	Continuous surface chlorophyll measurement. Bacteriological samples at selected depths and stations. Plankton haul and surface sample at selected stations. In situ temperature at all standard depths. Secchi disc at all daylight stations. B.T. cast at all stations. Water surface temperature at all stations.			
Standard Depths: 1,5,10,20,30,50,75,100,150,200,250,300,350, and 400 metres.				

GREAT LAKES STUDIES

1968

C.S.S. LIMNOS

	SUN.	MON.	TUES.	WED.	THURS.	FRI.	SAT.
APRIL		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	1	2	3 ARR. CCIW 2000 HRS.	4 CCIW
MAY	5 CCIW	6 CCIW	7 CCIW	8 CCIW	9 CCIW	10 CCIW	11 CCIW
	12 CCIW	13 DEPART CCIW 0830 HRS.	14 GEOLOGY L. ONTARIO	15 ARR. CCIW 1400 HRS.	16 CCIW	17 CCIW	18 CCIW
	19 CCIW	20 CCIW	21 DEPART CCIW 2000 HRS.	22 GEOLOGY L. ONTARIO	23 GEOLOGY L. ONTARIO	24 GEOLOGY L. ONTARIO	25 GEOLOGY L. ONTARIO
	26 GEOLOGY L. ONTARIO	27 GEOLOGY L. ONTARIO	28 GEOLOGY L. ONTARIO	29 ARR. CCIW 1800 HRS.	30 CCIW	31 OPEN HOUSE CCIW	1 OPEN HOUSE CCIW
JUNE	2 CCIW	3 DEPART CCIW 1600 HRS.	4 GRAVITY L. ONTARIO	5 GRAVITY L. ONTARIO	6 ARR. CCIW 0800 HRS.	7 CCIW	8 CCIW
	9 CCIW	10 DEPART 1000 GRAVITY L. ONTARIO	11 ARR. CCIW 1500 HRS.	12 CCIW	13 DEP. CCIW 0830 GRAVITY L. ONTARIO	14 ARR. CCIW 1300 HRS.	15 CCIW
	16 CCIW	17 DEP. CCIW 2200 GRAVITY L. ONTARIO	18 GRAVITY L. ONTARIO	19 GRAVITY L. ONTARIO	20 IN TRANSIT GRAVITY L. ERIE	21 ARR. P. COLBORNE 1530 HRS.	22 P. COLBORNE
	23 P. COLBORNE	24 DEP. P. COLBORNE 0900 GRAVITY L. ERIE	25 GRAVITY LAKE ERIE	26 ARR. P. COLBORNE 1030 HRS.	27 P. COLBORNE	28 P. COLBORNE	29 P. COLBORNE
JULY	30 P. COLBORNE	1 P. COLBORNE	2 P. COLBORNE	3 P. COLBORNE	4 DEP. P. COLBORNE 0800 GRAVITY L. ERIE	5 GRAVITY LAKE ERIE	6 GRAVITY LAKE ERIE
	7 ARR. P. COLBORNE 0930 HRS.	8 P. COLBORNE	9 P. COLBORNE	10 P. COLBORNE	11 P. COLBORNE	12 P. COLBORNE	13 DEP. P. COLBORNE 0800 HRS. RETURN 1200 HRS.
	14 DEP. P. COLBORNE 1300 HRS.	15 MOORING LAKE ERIE	16 MOORING LAKE ERIE	17 MOORING LAKE ERIE	18 ARR. P. COLBORNE 1700 HRS.	19 DEP. P. COLBORNE 0530 HRS. ARR. CCIW 2100	20 CCIW
	21 CCIW	22 CCIW	23 DEP. CCIW 0800 MONITOR L. ONTARIO	24 MONITOR LAKE ONTARIO	25 MONITOR LAKE ONTARIO	26 MONITOR LAKE ONTARIO	27 ARR. CCIW 0800 HRS.
	28 CCIW	29 CCIW	30 CCIW	31 CCIW	1 CCIW	2 CCIW	3 CCIW
AUGUST	4 CCIW	5 CCIW	6 DEP. CCIW 1000 CORING L. ONTARIO	7 ARR. CCIW 0845 HRS.	8 CCIW TRIALS	9 DEP. CCIW 1900 CORING - L. ONT.	10 CORING L. ONTARIO
	11 CORING LAKE ONTARIO	12 CORING LAKE ONTARIO	13 CORING LAKE ONTARIO	14 CORING LAKE ONTARIO	15 ARR. CCIW 1600 HRS.	16 CCIW	17 CCIW
	18 CCIW	19 DEP. CCIW 1000 HRS.	20 MONITOR LAKE ONTARIO	21 MONITOR LAKE ONTARIO	22 MONITOR LAKE ONTARIO	23 ARR. CCIW 1400 HRS.	24 CCIW
	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 CCIW	31 CCIW
SEPT.	1 CCIW	2 CCIW	3 DEP. CCIW 1600 HRS.	4 MOORING LAKE ONTARIO	5 MOORING LAKE ONTARIO	6 ARR. CCIW 2030 HRS.	7 CCIW
	8 DEP. CCIW 1530 HRS.	9 MONITOR LAKE ONTARIO	10 MONITOR LAKE ONTARIO	11 MONITOR LAKE ONTARIO	12 MONITOR LAKE ONTARIO	13 ARR. CCIW 0800 HRS.	14 CCIW
	15 CCIW	16 DEP. CCIW 1100 HRS.	17 CORING LAKE ONTARIO	18 CORING LAKE ONTARIO	19 CORING LAKE ONTARIO	20 CORING LAKE ONTARIO	21 ARR. CCIW 1700 HRS.
	22 DEP. CCIW 0830 RETURN 1530	23 CCIW	24 CCIW	25 DEP. CCIW 1530 RETURN 1630	26 CCIW	27 DEP. CCIW 1000 RETURN 1130	28 CCIW
OCT.	29 CCIW	30 CCIW	1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 CCIW
	6 DEP. CCIW 0830 HRS.	7 GRAVITY LAKE ONTARIO	8 GRAVITY LAKE ONTARIO	9 ARR. CCIW 0830 HRS.	10 CCIW	11 NO FURTHER OPERATIONS	12
	13 CCIW	14 CCIW	15 DEP. CCIW 1020 ARR. D. DOCK 1825	16 PORT WELLER	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
NOV.	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
DEC.	1	2	3	4	5	6	7

GREAT LAKES STUDIES

1968

M.V. THERON

	SUN.	MON.	TUES.	WED.	THURS.	FRI.	SAT.
APRIL		1 ON CHARTER 0800 HRS.	2 HALIFAX FITTING OUT	3 HALIFAX FITTING OUT	4 HALIFAX FITTING OUT	5 HALIFAX FITTING OUT	6 HALIFAX FITTING OUT
	7 HALIFAX FITTING OUT	8 HALIFAX FITTING OUT	9 HALIFAX FITTING OUT	10 HALIFAX FITTING OUT	11 HALIFAX FITTING OUT	12 HALIFAX	13 HALIFAX
	14 HALIFAX	15 HALIFAX FITTING OUT	16 DEP. 1530 FOR CCIW	17 ON PASSAGE	18 ON PASSAGE	19 ON PASSAGE	20 ON PASSAGE
	21 ARR. CCIW 1415 HRS.	22 CCIW FITTING OUT	23 CCIW FITTING OUT	24 CCIW FITTING OUT	25 CCIW FITTING OUT	26 RETR. W. MOORING LAKE ONTARIO	27 CCIW
	28 CCIW	29 DEP. CCIW 1100 HRS.	30 MONITOR LAKE ONTARIO	1 MONITOR LAKE ONTARIO	2 MONITOR LAKE ONTARIO	3 ARR. CCIW 1415 HRS.	4 CCIW
MAY	5 CCIW	6 DEP. CCIW 1030 HRS.	7 MOORING LAKE ONTARIO	8 MOORING LAKE ONTARIO	9 MOORING LAKE ONTARIO	10 ARR. CCIW 0800 HRS.	11 CCIW
	12 DEP. CCIW 1800 IN CANAL TRANSIT	13 MOORING LAKE ERIE	14 MOORING LAKE ERIE	15 MOORING LAKE ERIE	16 MOORING LAKE ERIE	17 P. COLBORNE ARR. 0745 - DEP.1155	18 MONITOR LAKE ERIE
	19 MONITOR LAKE ERIE	20 MONITOR LAKE ERIE	21 MONITOR LAKE ERIE	22 MONITOR LAKE ERIE	23 ARR. P. COLBORNE 1800 HRS. IN CANAL TRANSIT	24 ARR. CCIW 0930 HRS.	25 CCIW
	26 CCIW	27 DEP. CCIW 1030 HRS.	28 MONITOR LAKE ONTARIO	29 MONITOR LAKE ONTARIO	30 ARR. CCIW 1900 HRS.	31 CCIW OPEN HOUSE	1 CCIW OPEN HOUSE
JUNE	2 CCIW	3 DEP. CCIW 1200 HRS.	4 MOORING LAKE ONTARIO	5 MOORING LAKE ONTARIO	6 MOORING LAKE ONTARIO	7 MOORING LAKE ONTARIO	8 ARR. CCIW 1430 HRS.
	9 DEP. CCIW 1400 IN CANAL TRANSIT	10 MOORING LAKE ERIE	11 MOORING LAKE ERIE	12 MOORING LAKE ERIE	13 MOORING LAKE ERIE	14 ARR. P. COLBORNE 1215 HRS.	15 DEP. P. COLBORNE 1215 HRS.
	16 MONITOR LAKE ERIE	17 MONITOR LAKE ERIE	18 MONITOR LAKE ERIE	19 MONITOR-L. ERIE IN CANAL TRANSIT	20 ARR. CCIW. 0815 HRS.	21 CCIW	22 CCIW
	23 CCIW	24 DEP. 1000 HRS. SPECIAL - L. ONT.	25 ARR. CCIW 1500 HRS.	26 DEP. 0700 HRS. SPECIAL - L. ONT.	27 SPECIAL L. ONTARIO	28 ARR. CCIW 1340 HRS.	29 CCIW
JULY	30 CCIW	1 CCIW	2 DEP. CCIW 1000 HRS.	3 MONITOR LAKE ONTARIO	4 MONITOR LAKE ONTARIO	5 MONITOR LAKE ONTARIO	6 ARR. CCIW 1200 HRS.
	7 CCIW	8 DEP. CCIW 1000 SPECIAL - L. ONT.	9 SPECIAL L. ONTARIO	10 SPECIAL L. ONTARIO	11 SPECIAL L. ONTARIO	12 ARR. CCIW 1000 HRS.	13 CCIW
	14 CCIW	15 DEP. CCIW 1000 HRS.	16 MOORING LAKE ONTARIO	17 MOORING LAKE ONTARIO	18 MOORING LAKE ONTARIO	19 MOORING LAKE ONTARIO	20 ARR. CCIW 0800 HRS.
	21 DEP. CCIW 1300 IN CANAL TRANSIT	22 CORING LAKE ERIE	23 CORING LAKE ERIE	24 CORING LAKE ERIE	25 CORING LAKE ERIE	26 CORING LAKE ERIE	27 ARR. P. COLBORNE 1030 HRS.
	28 P. COLBORNE	29 DEP. P. COLBORNE 1200 HRS.	30 MONITOR LAKE ERIE	31 MONITOR LAKE ERIE	1 MONITOR LAKE ERIE	2 MONITOR LAKE ERIE	3 ARR. WINDSOR 1015 HRS.
AUGUST	4 WINDSOR	5 DEPART WINDSOR 1100 HRS.	6 MONITOR LAKE HURON	7 MONITOR LAKE HURON	8 MONITOR LAKE HURON	9 MONITOR LAKE HURON	10 MONITOR LAKE HURON
	11 MONITOR LAKE HURON	12 MONITOR LAKE HURON	13 ARR. SAULT ST. MARIE 1400 HRS.	14 SAULT ST. MARIE	15 SAULT ST. MARIE	16 SAULT ST. MARIE	17 SAULT ST. MARIE
	18 DEP. 0815 HRS.	19 MONITOR LAKE SUPERIOR	20 MONITOR LAKE SUPERIOR	21 MONITOR LAKE SUPERIOR	22 MONITOR LAKE SUPERIOR	23 MONITOR LAKE SUPERIOR	24 MONITOR LAKE SUPERIOR
	25 MONITOR LAKE SUPERIOR	26 MONITOR LAKE SUPERIOR	27 MONITOR LAKE SUPERIOR	28 SAULT ST. MARIE ARR. 2130 - DEP.2145	29 ARR. SARNIA 1945 HRS.	30 DEP. SARNIA 0315 ARR. WINDSOR 0840	31 DEP. WINDSOR 1000 HRS.
SEPT.	1 MONITOR LAKE ERIE	2 MONITOR LAKE ERIE	3 ARR. CCIW 1245 HRS.	4 CCIW	5 CCIW	6 CCIW	7 CCIW
	8 CCIW	9 DEP. CCIW 1030 HRS.	10 CORING LAKE ONTARIO	11 ARR. CCIW 0730 DEP. 1530 HRS.	12 CORING LAKE ONTARIO	13 ARR. CCIW 1500 HRS.	14 CCIW
	15 DEP. CCIW 1600 IN CANAL TRANSIT	16 MOORING LAKE ERIE	17 MOORING LAKE ERIE	18 CLEVELAND ARR. 0845 - DEP.1300	19 MOORING LAKE ERIE	20 ARR. P. COLBORNE 1530 HRS.	21 P. COLBORNE
	22 P. COLBORNE	23 DEP. P. COLBORNE 1100 HRS.	24 MOORING LAKE ERIE	25 MOORING LAKE ERIE	26 ARR. P. COLBORNE 1930 HRS.	27 P. COLBORNE	28 DEP. P. COLBORNE 1200 HRS.
	29 MONITOR LAKE ERIE	30 MONITOR LAKE ERIE	1 MONITOR LAKE ERIE	2 MONITOR LAKE ERIE	3 MONITOR LAKE ERIE	4 ARR. CCIW 0830 HRS.	5 DEP. CCIW 0800 HRS.
OCT.	6 MONITOR LAKE ONTARIO	7 MONITOR LAKE ONTARIO	8 MONITOR LAKE ONTARIO	9 ARR. CCIW 0830 HRS.	10 CCIW	11 CCIW	12 CCIW
	13 CCIW	14 CCIW	15 DEP. CCIW 1030 HRS.	16 MOORING LAKE ONTARIO	17 MOORING LAKE ONTARIO	18 MOORING LAKE ONTARIO	19 ARR. CCIW 2115 HRS.
	20 CCIW	21 CCIW	22 DEP. 0715 HRS. MOORINGS L. ONT.	23 ARR. CCIW 1200 HRS.	24 DEP. 0600 HRS. MOORINGS L. ONT.	25 ARR. CCIW 0930 HRS.	26 CCIW
	27 DEP. CCIW 1030 HRS.	28 MONITOR LAKE ONTARIO	29 MONITOR LAKE ONTARIO	30 MONITOR LAKE ONTARIO	31 ARR. CCIW 1730 HRS.	1 CCIW	2 CCIW
NOV.	3 CCIW	4 DEP. CCIW 1000 IN CANAL TRANSIT	5 MONITOR LAKE ERIE	6 MONITOR LAKE ERIE	7 MONITOR LAKE ERIE	8 MONITOR LAKE ERIE	9 MONITOR LAKE ERIE
	10 ARR. P. COLBORNE 1930 HRS.	11 DEP. P. COLBORNE 1015 HRS.	12 MOORING LAKE ERIE	13 MOORING LAKE ERIE	14 ARR. CCIW 1740 HRS.	15 CCIW	16 CCIW
	17 DEP. CCIW 1430 HRS.	18 MONITOR LAKE ONTARIO	19 MONITOR LAKE ONTARIO	20 MONITOR LAKE ONTARIO	21 MONITOR LAKE ONTARIO	22 ARR. CCIW 0730 HRS.	23 DEP. CCIW 0800 HRS.
	24 MOORING LAKE ONTARIO	25 ARR. CCIW 1730 HRS.	26 DEP. 1000 HRS. ARR. CCIW 1110 (RETR. TOWER)	27 DISMANTLE	28 DISMANTLE	29 DEPART CCIW FOR HALIFAX AT 1600 HRS.	30 ON PASSAGE TO HALIFAX
DEC.	1 ON PASSAGE TO HALIFAX	2 ON PASSAGE TO HALIFAX	3 ON PASSAGE TO HALIFAX	4 ARR. HALIFAX 0820 HRS.	5 OFF CHARTER 1700 HRS.	6	7