NATIONAL WATER RESEARCH INSTITUTE

INSTITUT NATIONAL DE RECHERCHE SUR LES EAUX

1989

ANNUAL ACTIVITY SUMMARY

TECHNICAL OPERATIONS SECTION
RESEARCH SUPPORT DIVISION
NATIONAL WATER RESEARCH INSTITUTE

1989

ANNUAL ACTIVITY SUMMARY

TECHNICAL OPERATIONS SECTION
RESEARCH SUPPORT DIVISION
NATIONAL WATER RESEARCH INSTITUTE

WINTER SAMPLING

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RIVERS RESEARCH BRANCH

RESEARCH & APPLICATIONS BRANCH

RESEARCH SUPPORT DIVISION

INTRODUCTION

The Technical Operations Section of the Research Support Division has its headquarters at the Canada Centre for Inland Waters in Burlington, Ontario. The mandate of this Section is to provide logistical and technical support to the scientific community at the National Water Research Institute and to various other governmental and educational groups on a national scale.

The technical staff of this Section are involved in shipboard programs which are carried out from major ships on the Great Lakes and St. Lawrence River and in shore-based field projects which put them into a very diverse range of field situations. This unusual opportunity to work and gain valuable field-related experience in such a varied sphere of operation develops within the Section a tremendous storehouse of technical expertise. The Dive Unit is ever-expanding its capacity to give scientific programs the up-to-date technological support they require underwater--the most recent advances being in underwater video capability. Annual diver training and certification courses are conducted to maintain a high level of competence among the Centre's divers. The Rigging Shop provides for the repair and maintenance of mechanical field gear, handles heavy equipment transport to field sites, operates the Field Equipment Stores, and services the NWRI fleet of vehicles, trailers and campers.

The challenge in recent years, in the face of an ever-increasing demand for support from the scientific community and a decline in personnel resources due to attrition and transfer, has been to maintain an effective level of support to this Institute by improving efficiency and making the most of the available resources.

This report is intended as an overview of the field activities of this Section during the 1989 field season.

STAFF LIST

RESEARCH SUPPORT DIVISION

Chief - J.D. Smith
Secretary - S.R. Mitchell
Administrative Officer - J. McAvella

TECHNICAL OPERATIONS SECTION

Head - P.M. Healey
Operations Officer, Field - M.R. Mawhinney

SENIOR MARINE TECHNOLOGISTS

B.H. Moore - Operations Officer, CSS LIMNOS; Chain Lake, B.C.
L.E. Benner - CWS; St. Lawrence River; CSS LIMNOS
P.R. Youakim - CSS LIMNOS
E.H. Walker - OIC CSS BAYFIELD; Groundwater
S.B. Smith - OIC CSS LIMNOS; Athabaska; Lake Erie; Bay of Quinte
G.G. LaHaie - Turkey Lakes Watershed
Y. Desjardins - CSS LIMNOS; Quebec surveys; Restigouche River, N.B.
J.A. Kraft - OIC CSS BAYFIELD; CSS LIMNOS; Restigouche River, N.B.
K.J. Hill - Diving Operations, Hamilton Harbour, Cornwall, Alberta
R.J. Hess - OIC CSS ADVENT; CSS LIMNOS; Hamilton Harbour, Trent
J.E. Tozer - Grand River
G.D. Bruce - Diving Operations, Hamilton Harbour
Assumed a new position in WQB-OR September '89

MARINE TECHNICIANS

H.A. Lavoie - CSS LIMNOS; Quebec survey; Lake Erie
B.L. Gray - Diving Operations, Hamilton Harbour, Alberta
F. Mercure - CSS LIMNOS; Hamilton Harbour
Resigned his position in June '89

DIVING OPERATIONS

Head, F.H. Don - Diving operations, Hamilton Harbour, Alberta

RIGGING UNIT

Head, L.J. Lomas - Turkey Lakes; Cornwall
Rigger, H.E. Greencorn - Vehicles

STUDENTS - R. Neureuther, G. Ponton, K. Versteeg

SHIPBOARD PROGRAMS

CSS LIMNOS

LIMNOS
1989

	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	28
	29	30	31	1	2	3	4
FEB	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	1	2	3	4
MAR	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
APR	2	3 SURVEILLANCE	4 LAKE ONTARIO	5 SURVEILLANCE	6 LAKE ONTARIO	7 SURVEILLANCE	8
	9	10 MOORINGS	11 LAKE ONTARIO	12 MOORINGS	13 LAKE ONTARIO	14 MOORINGS	15
	16	17 SEDIMENT LOADING	18 LAKE	19 ERIE	20 BENTHOS	21 LAKE	22 ERIE
	23	24 SURVEILLANCE	25 LAKE	26 HURON	27 SURVEILLANCE	28 GEORGIAN	29 BAY
MAY	30 SURVEILLANCE	1 GEORGIAN BAY	2 SURVEILLANCE	3 LAKE	4 SUPERIOR	5 SURVEILLANCE	6 LAKE
	7 SUPERIOR	8 SURVEILLANCE	9 LAKE SUPERIOR	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 HARBOUR
JUN	4 CONTAMINANTS	5 ST. LAWRENCE	6 RIVER	7 HARBOUR	8 CONTAMINANTS	9 ST. LAWRENCE	10 RIVER
	11	12 MOORINGS	13 LAKE ONTARIO	14 MOORINGS	15 LAKE ONTARIO	16 MOORINGS	17
	18	19 SEDIMENT	20 LAKE ONTARIO	21	22	23	24
	25	26 ORGANIC	27 INORGANIC	28 CONTAMINANTS	29 ST. LAWRENCE	30 RIVER	1 ORGANIC
JUL	2 INORGANIC	3 CONTAMINANTS	4 ST. LAWRENCE	5 RIVER	6 ORGANIC	7 INORGANIC	8 CONTAMINANTS
	9 ST. LAWRENCE	10 RIVER	11 ORGANIC	12 INORGANIC	13 CONTAMINANTS	14 ST. LAWRENCE	15 RIVER
	16 ORGANIC	17 INORGANIC	18 CONTAMINANTS	19 ST. LAWRENCE	20 RIVER	21	22
	23	24 MOORINGS	25 LAKE ONTARIO	26 MOORINGS	27 LAKE ONTARIO	28 MOORINGS	29
AUG	30	31 SEDIMENT	1 TRANSPORT	2 LAKE ONTARIO	3 SEDIMENT	4 TRANSPORT	5
	6	7	8	9	10	11	12
	13	14 SURVEILLANCE	15 LAKE ONTARIO	16 SURVEILLANCE	17 LAKE ONTARIO	18 SURVEILLANCE	19
	20	21 LAKE ERIE	22 SURVEILLANCE	23 LAKE ERIE	24 SURVEILLANCE	25 LAKE	26 HURON
	27 SURVEILLANCE	28 LAKE	29 HURON	30 SURVEILLANCE	31 GEORGIAN	1 BAY	2 SEDIMENT LOADING
	3 LAKE ERIE	4 BENTHOS	5	6	7	8	9
	10	11 MOORINGS	12 LAKE ONTARIO	13 MOORINGS	14 LAKE ONTARIO	15 MOORINGS	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	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	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	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						

OPEN LAKES SURVEILLANCE

LAKE ONTARIO

RSD STUDY 86031, M. NEILSON, IWD-OR

The Lake Ontario Open Lakes Surveillance Program was designed to provide a continuing report and long-term trend information on water quality and eutrophication parameters in the Lower Great Lakes by Canada/U.S. Agreement as input to the Water Quality Board Annual Report to the International Joint Commission.

This ongoing program was supported during the field season by the completion of two cruises on Lake Ontario--April 3 - 7 and August 14 - 18. Both cruises were organized and completed by Technical Operations staff for IWD-OR and were conducted from the CSS LIMNOS operated by the Bayfield Institute, DFO. The vessel was supplied with EBT/transmissometer, EBT rosette sampler, radar, Loran C positioning system and a variety of samplers and winches used for chemical and biological water sampling.

The parameters sampled during the cruises were: temperature profile, transmission profile, dissolved oxygen, specific conductance, pH, chlorophyll a, particulate organic carbon, particulate nitrogen, total phosphorus filtered and unfiltered, nitrate and nitrite, ammonia, reactive silicate, major ions, alkalinity, meteorological observations and Secchi disc observations from the shaded side of the vessel.

During the April cruise, water samples were collected from the 1-metre depth only. Sampling depths for the August cruise were:

Unstratified conditions: 1 metre, 10 metres, 25 metres, bottom -10 metres, and bottom -2 metres

Stratified conditions: 1 metre, 1 metre above the thermocline, mid-thermocline, 1 metre below the thermocline, bottom -10, and bottom -2 metres

The Long Term Biological Index Monitoring Program in support of Great Lakes Laboratory for Fisheries & Aquatic Sciences, Bayfield Institute was piggybacked on the spring cruise. In support of this Program, at Surveillance stations 41 and 81, additional samples were collected for: dissolved oxygen, specific conductance, pH, total phosphorus filtered and unfiltered, ammonia, chloride, soluble reactive phosphorus, nitrate and nitrite, total Kjeldahl nitrogen, alkalinity, chlorophyll a, particulate organic carbon, phytoplankton, zooplankton, and ash free weight determination.

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP C.S LIMNOS

DATES FROM April 3 August 14 TO April 6, 1989 August 18, 1989 LAKE ONTARIO

CRUISE TYPE Lower Lakes Surveillance N. MILES STEAMED 1373.4

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	199	Moorings Established	
EBT Casts	204	" Retrieved	
Rosette Casts	204	" Established	
Transmissometer Casts	204	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	24	" Established	
Secchi Disc Observations	102	" Retrieved	
		" Refurbished	
Zooplankton Hauls	10	" Serviced	
Integrator 10 m	9	" Serviced	
Integrator 20 m	190	Primary Productivity Moorings	
Phytoplankton Samples	5		
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)	626	Cores Taken	
" " " ( )			
" " " (D.O.)	600	Grab Samples Taken	
" " " (Cond/pH)	1090		
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	626		
" " " (TKN)	626	Observations, Weather	40
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	232	Solar Radiation	
" " " (POC/TPN)	232		
" " " (Seston)			
" " " (T P f)	626		
" " " (Nutrients)	626	ONBOARD ANALYSES	
" " " (Major Ions)	626		
" " " ( )		Manual Chemistry Tech. Ops.	1697
" " " ( )		Nutrients (WOB)	136
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987

SURVEILLANCE STATIONS

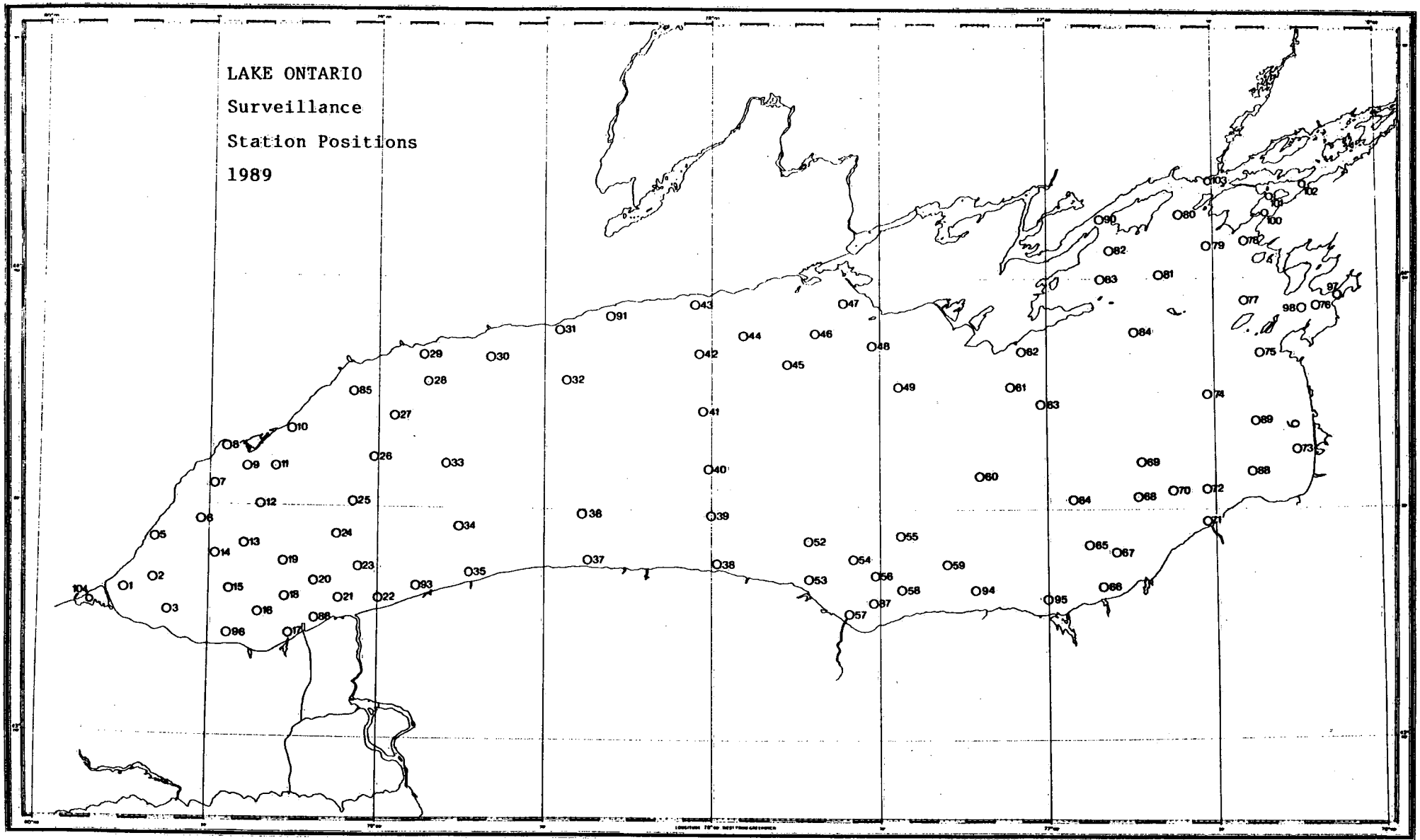
LAKE ONTARIO

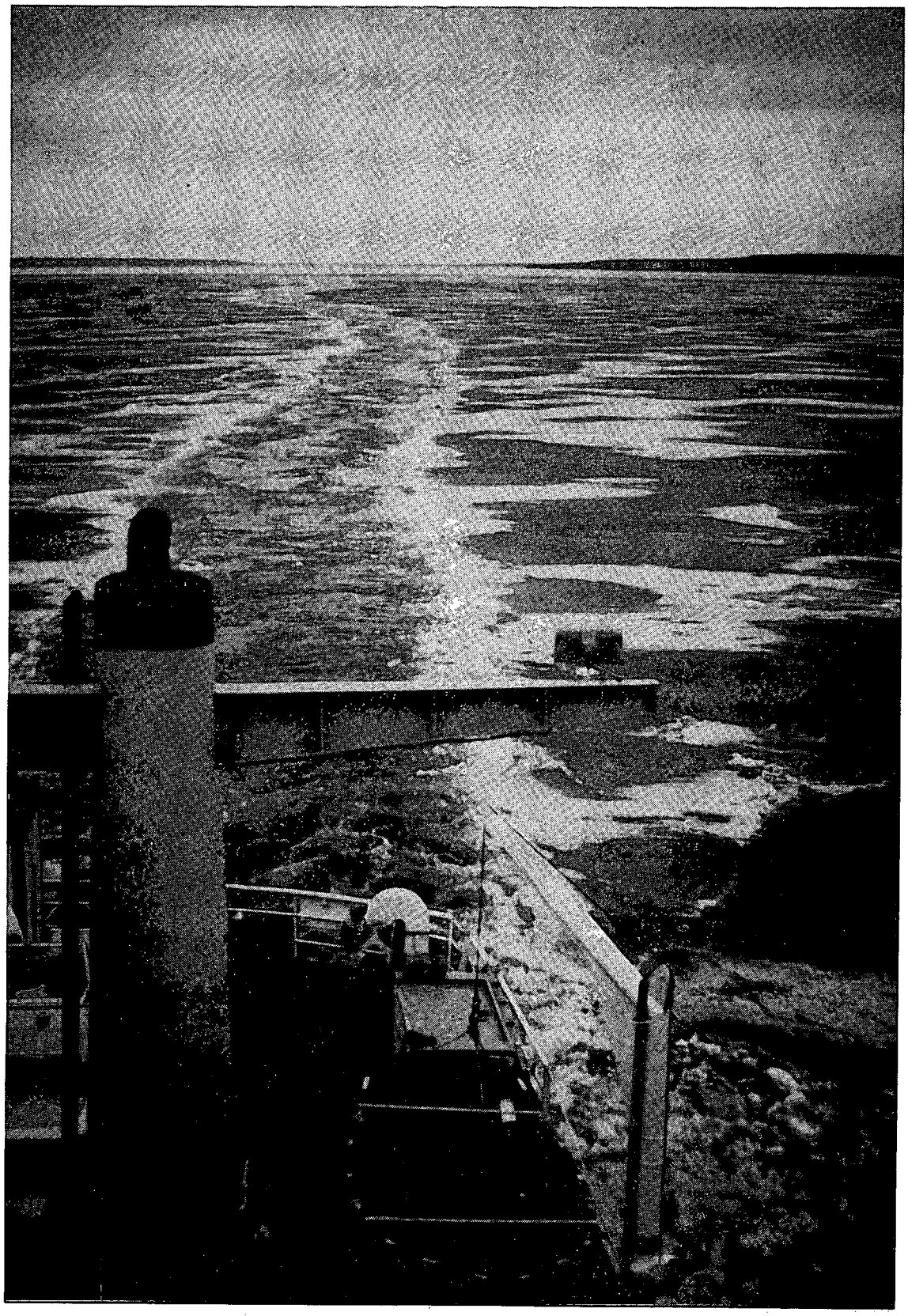
1989-1990

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

STATION NUMBER	LATITUDE N.	LONGITUDE W.
32	43° 47′ 00"	78° 26′ 18"
33	43° 35′ 48"	78° 48′ 06"
34	43° 27′ 42"	78° 45′ 36"
35	43° 21′ 36"	78° 43′ 48"
36	43° 29′ 30"	78° 23′ 12"
37	43° 23′ 30"	78° 22′ 12"
38	43° 23′ 00"	77° 59′ 24"
39	43° 29′ 12"	78° 00′ 00"
40	43° 35′ 24"	78° 00′ 42"
41	43° 43′ 00"	78° 01′ 36"
42	43° 50′ 24"	78° 02′ 18"
43	43° 57′ 00"	78° 03′ 00"
44	43° 52′ 54"	77° 54′ 30"
45	43° 49′ 12"	77° 47′ 00"
46	43° 53′ 06"	77° 41′ 24"
47	43° 57′ 06"	77° 35′ 18"
48	43° 51′ 42"	77° 31′ 30"
49	43° 46′ 18"	77° 26′ 18"
52	43° 26′ 00"	77° 42′ 42"
53	43° 21′ 00"	77° 42′ 42"
54	43° 24′ 48"	77° 34′ 30"
55	43° 26′ 36"	77° 26′ 18"
56	43° 21′ 36"	77° 30′ 54"
57	43° 16′ 30"	77° 35′ 30"
58	43° 19′ 42"	77° 26′ 18"
59	43° 22′ 54"	77° 17′ 54"
60	43° 34′ 48"	77° 12′ 00"
61	43° 47′ 12"	77° 09′ 30"
62	43° 52′ 48"	77° 00′ 00"
63	43° 43′ 54"	77° 01′ 00"
64	43° 31′ 30"	76° 55′ 36"
65	43° 25′ 24"	76° 53′ 00"
66	43° 20′ 00"	76° 50′ 24"
67	43° 24′ 30"	76° 47′ 42"
68	43° 31′ 48"	76° 43′ 54"
69	43° 36′ 24"	76° 42′ 48"
70	43° 32′ 30"	76° 37′ 06"
71	43° 28′ 36"	76° 31′ 36"
72	43° 33′ 00"	76° 31′ 30"
73	43° 38′ 00"	76° 17′ 18"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
74	43° 45′ 00"	76° 31′ 06"
75	43° 50′ 36"	76° 21′ 18"
76	43° 57′ 00"	76° 10′ 30"
77	43° 57′ 24"	76° 24′ 30"
78	44° 05′ 00"	76° 24′ 24"
79	44° 04′ 30"	76° 31′ 18"
80	44° 08′ 30"	76° 36′ 36"
81	44° 01′ 00"	76° 40′ 18"
82	44° 04′ 00"	76° 48′ 42"
83	44° 00′ 00"	76° 50′ 36"
84	43° 53′ 12"	76° 44′ 00"
85	43° 45′ 00"	79° 05′ 00"
86	43° 15′ 18"	79° 11′ 42"
87	43° 17′ 54"	77° 31′ 06"
88	43° 35′ 18"	76° 25′ 00"
89	43° 41′ 54"	76° 25′ 00"
90	44° 08′ 11"	76° 49′ 30"
91	43° 55′ 12"	78° 18′ 24"
93	43° 19′ 36"	78° 52′ 06"
94	43° 19′ 30"	77° 13′ 00"
95	43° 18′ 48"	77° 00′ 00"
96	43° 13′ 24"	79° 26′ 48"
97	43° 57′ 42"	76° 07′ 18"
98	43° 56′ 06"	76° 13′ 54"
100	44° 08′ 12"	76° 19′ 48"
101	44° 11′ 36"	76° 18′ 36"
102	44° 12′ 12"	76° 14′ 12"
103	44° 12′ 12"	76° 32′ 36"
104	43° 17′ 15"	79° 50′ 00"


LAKE ONTARIO
Surveillance
Station Positions
1989
10501



SPRING CRUISE, CSS LIMNOS

LAKE HURON/GEORGIAN BAY

RSD STUDY 86031, M. NEILSON, IWD-OR

The Lake Huron/Georgian Bay Open Lakes Surveillance Program was designed to provide a continuing report and long-term trend information on water quality and eutrophication parameters in the Upper Great Lakes under the Canada/U.S. Agreement and input to the Water Quality Board Annual Report to the International Joint Commission.

Two cruises were conducted in April 24 - May 1 and August 21 - 30 to support this Program. Both cruises were organized and completed by Technical Operations personnel for IWD-OR and were conducted from the CSS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C positioning system and a variety of samplers and winches used for chemical and biological sampling.

The parameters sampled during both cruises were: temperature and transmission profiles, dissolved oxygen, specific conductance, pH, chlorophyll a, particulate organic carbon, particulate nitrogen, total phosphorus filtered and unfiltered, soluble reactive phosphorus, nitrite and nitrate, ammonia, reactive silicate, major ions and alkalinity. Meteorological and Secchi disc observations were done.

During the May cruise, samples were collected from the 1-metre depth only. Sampling depths for the August cruise were:

Unstratified conditions:	1 metre, mid-depth if station depth was greater than 50 metres, bottom -10 metres, and bottom -2 metres
Stratified conditions:	1 metre, 1 metre above the knee of the thermocline, mid-thermocline, 1 metre below the thermocline, bottom -10 metres, and bottom -2 metres

Some of the additional tasks performed during the cruise were: phytoplankton sampling for Dr. M. Munawar Study 86031. Total phosphorus samples, both filtered and unfiltered, were collected from 1 m and bottom -1 m for the Great Lakes Commission Program, EPA, Chicago.

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM April 24 / August 23 TO May 1, 1989 / August 28, 1989 LAKE HURON

CRUISE TYPE Upper Lakes Surveillance N. MILES STEAMED 2032.8

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	138	Moorings Established	
EBT Casts	140	" Retrieved	
Rosette Casts	140	" Established	
Transmissometer Casts	140	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	24	" Established	
Secchi Disc Observations	73	" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	138	Primary Productivity Moorings	
Phytoplankton Samples, 250 ml	95		
Preserved samples, 10 ml	95	Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)	370	Cores Taken	
" " " ( )			
" " " (D.O.)	380	Grab Samples Taken, Shipek	5
" " " (Cond/pH)	380		
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	380		
" " " (TKN)	380	Observations, Weather	31
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	181	Solar Radiation	
" " " (POC/TPN)	193		
" " " (Seston)			
" " " (T P f)	380		
" " " (Nutrients)	380	ONBOARD ANALYSES	
" " " (Major Ions)	380		
" " " ( )		Manual Chemistry Tech. Ops.	1060
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987

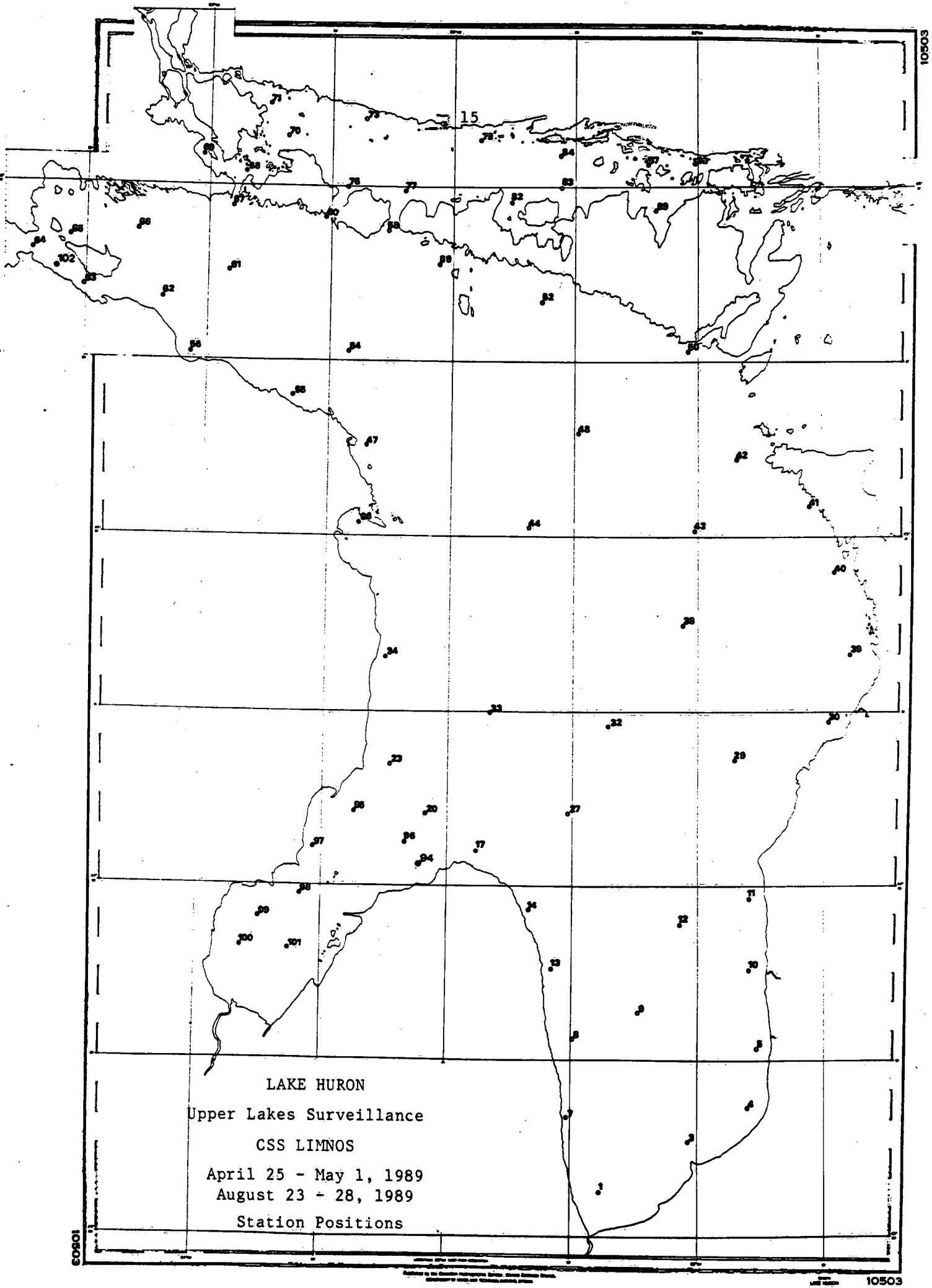
SAMPLING STATION POSITIONS

LAKE HURON

1989

STATION NUMBER	LATITUDE N.	LONGITUDE N.
1	43° 05′ 24"	82° 23′ 30"
3	43° 15′ 25"	82° 02′ 18"
4	43° 19′ 30"	81° 47′ 18"
5	43° 32′ 54"	81° 44′ 42"
7	43° 20′ 30"	82° 30′ 24"
8	43° 34′ 00"	82° 29′ 06"
9	43° 38′ 00"	82° 13′ 00"
10	43° 45′ 12"	81° 46′ 54"
11	43° 57′ 24"	81° 47′ 12"
12	43° 53′ 24"	82° 03′ 24"
13	43° 45′ 12"	82° 34′ 06"
14	43° 56′ 30"	82° 40′ 00"
17	44° 06′ 00"	82° 52′ 00"
20	44° 13′ 00"	83° 05′ 00"
23	44° 20′ 00"	83° 18′ 00"
27	44° 11′ 54"	82° 30′ 12"
29	44° 22′ 00"	81° 50′ 00"
30	44° 28′ 00"	81° 27′ 12"
32	44° 27′ 12"	82° 20′ 30"
33	44° 30′ 00"	82° 50′ 00"
34	44° 38′ 24"	83° 13′ 54"
36	45° 02′ 06"	83° 22′ 42"
38	44° 44′ 24"	82° 03′ 36"
39	44° 39′ 24"	81° 22′ 42"
40	44° 53′ 54"	81° 26′ 12"
41	45° 05′ 00"	81° 32′ 18"
42	45° 13′ 18"	81° 49′ 12"
43	45° 00′ 48"	82° 00′ 30"
44	45° 01′ 00"	82° 41′ 06"
47	45° 15′ 18"	83° 20′ 48"

STATION NUMBER		LATITUDE N.	LONGITUDE N.
48		45° 16′ 42"	82° 27′ 06"
50		45° 32′ 06"	82° 02′ 42"
52		45° 39′ 06"	82° 38′ 54"
54		45° 31′ 00"	83° 25′ 00"
55		45° 23′ 30"	83° 39′ 06"
56		45° 31′ 00"	84° 05′ 00"
58		45° 52′ 06"	83° 16′ 00"
59		45° 46′ 00"	83° 01′ 42"
60		45° 54′ 06"	83° 31′ 06"
61		45° 45′ 00"	83° 55′ 00"
62		45° 40′ 30"	84° 11′ 12"
63		45° 42′ 12"	84° 30′ 42"
64		45° 48′ 48"	84° 45′ 18"
65		45° 50′ 42"	84° 34′ 00"
66		45° 51′ 48"	84° 17′ 42"
67		45° 56′ 06"	83° 54′ 00"
68		46° 02′ 30"	83° 51′ 12"
69		46° 04′ 42"	84° 01′ 42"
70		46° 08′ 12"	83° 40′ 18"
71		46° 14′ 00"	83° 44′ 48"
73		46° 11′ 12"	83° 21′ 18"
76		46° 00′ 00"	83° 26′ 00"
77		45° 58′ 12"	83° 11′ 54"
79		46° 07′ 24"	82° 53′ 09"
82		45° 56′ 18"	82° 45′ 30"
83		46° 00′ 00"	82° 33′ 00"
84		46° 05′ 30"	82° 33′ 24"
87		46° 03′ 40"	82° 11′ 50"
88		46° 03′ 20"	82° 00′ 00"
89		45° 55′ 00"	82° 09′ 40"
94)		44° 04′ 10"	83° 04′ 50"
95)		44° 12′ 45"	83° 22′ 15"
96)		44° 07′ 35"	83° 10′ 15"
97)		44° 06′ 55"	83° 31′ 45"
98)		43° 58′ 35"	83° 34′ 32"
)	Saginaw Bay		
99)		43° 54′ 30"	83° 44′ 30"
100)		43° 49′ 30"	83° 49′ 02"
101)		43° 49′ 15"	83° 37′ 30"
102		45° 45′ 30"	84° 36′ 30"


15
LAKE HURON
Upper Lakes Surveillance
CSS LIMNOS
April 25 - May 1, 1989
August 23 - 28, 1989
Station Positions
10503
10503

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM April 28 August 28 TO April 30, 1989 August 30, 1989 GEORGIAN BAY

CRUISE TYPE Upper Lakes Surveillance N. MILES STEAMED 664.4

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	48	Moorings Established	
EBT Casts	48	" Retrieved	
Rosette Casts	48	" Established	
Transmissometer Casts	48	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	4	" Established	
Secchi Disc Observations	26	" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	48	Primary Productivity Moorings	
Phytoplankton Samples, 250 ml	22		
Preserved Samples	22	Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)	765	Cores Taken	
" " " ( )			
" " " (D.O.)	153	Grab Samples Taken	
" " " (Cond/pH)	153		
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	153		
" " " (TKN)	153	Observations, Weather	12
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	153	Solar Radiation	
" " " (POC/TPN)	157		
" " " (Seston)			
" " " (T P f)	153		
" " " (Nutrients)	153	ONBOARD ANALYSES	
" " " (Major Ions)	153		
" " " ( )		Manual Chemistry Tech. Ops.	432
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

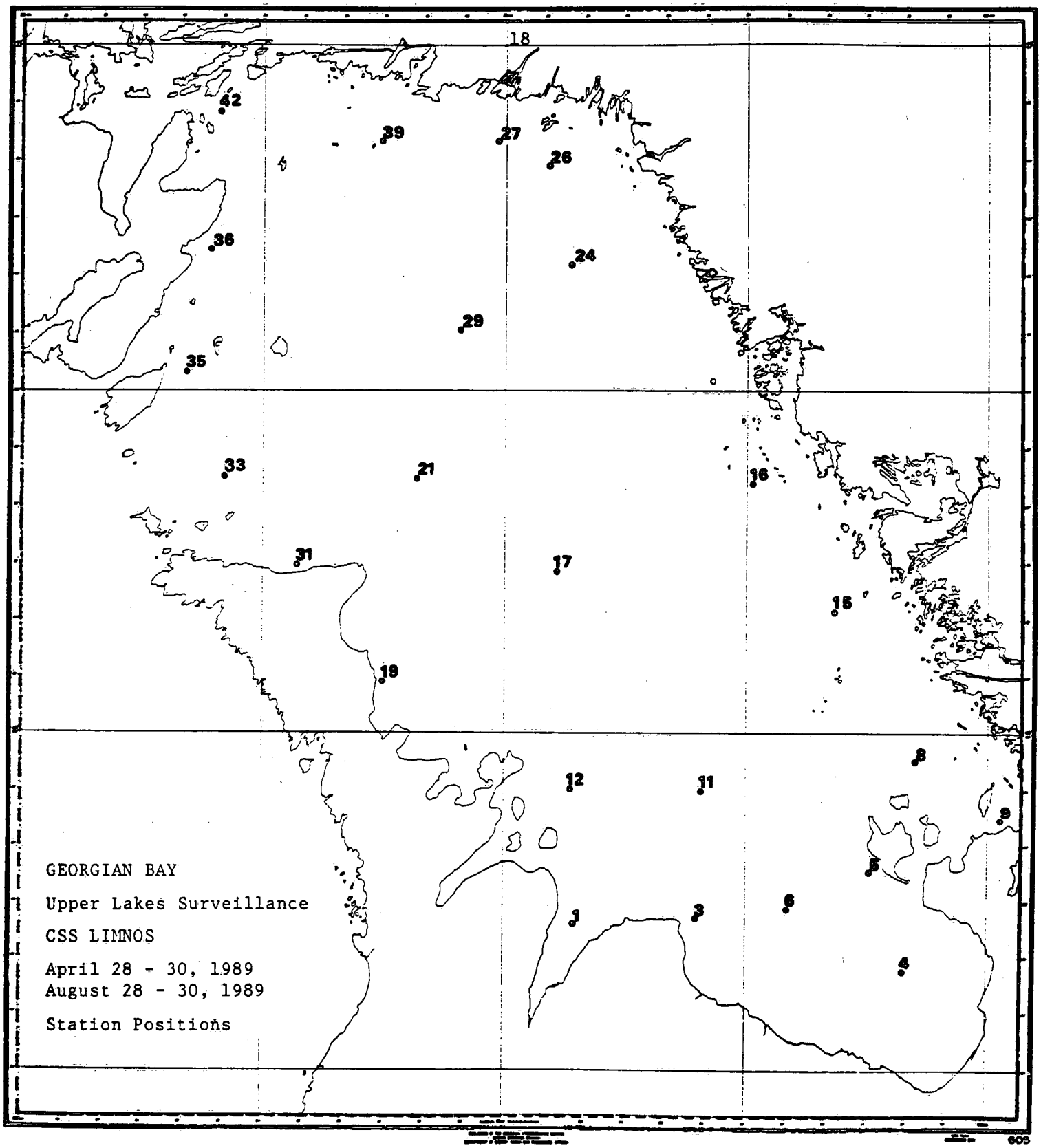
Tech. Ops. 1987

SAMPLING STATION POSITIONS

GEORGIAN BAY

1989

STATION NUMBER	LATITUDE N.	LONGITUDE N.
1	44° 43′ 03"	80° 51′ 24"
3	44° 43′ 30"	80° 37′ 00"
4	44° 38′ 45"	80° 10′ 00"
5	44° 47′ 48"	80° 14′ 36"
6	44° 44′ 12"	80° 26′ 06"
8	44° 57′ 10"	80° 08′ 06"
9	44° 52′ 18"	79° 58′ 05"
11	44° 55′ 15"	80° 36′ 21"
12	44° 55′ 12"	80° 52′ 30"
15	45° 10′ 00"	80° 17′ 48"
16	45° 21′ 13"	80° 29′ 12"
17	45° 14′ 42"	80° 52′ 30"
19	45° 04′ 00"	81° 15′ 14"
21	45° 21′ 54"	81° 11′ 24"
24	45° 40′ 44"	80° 50′ 20"
26	45° 50′ 00"	80° 54′ 00"
27	45° 52′ 00"	81° 00′ 00"
29	45° 35′ 00"	81° 05′ 00"
31	45° 14′ 18"	81° 26′ 24"
33	45° 22′ 13"	81° 35′ 06"
35	45° 31′ 39"	81° 40′ 10"
36	45° 42′ 30"	81° 37′ 12"
39	45° 52′ 24"	81° 15′ 30"
42	45° 54′ 46"	81° 35′ 42"
43	44° 31′ 48"	80° 09′ 06"
44	44° 35′ 00"	80° 15′ 30"
45	44° 37′ 18"	80° 55′ 18"


18
42
39
27
26
36
24
29
35
33
21
16
31
17
15
19
12
11
8
9
5
6
3
1
4
GEORGIAN BAY
Upper Lakes Surveillance
CSS LIMNOS
April 28 - 30, 1989
August 28 - 30, 1989
Station Positions
605

LAKE SUPERIOR

RSD STUDY 86031, M. NEILSON, IWD-OR

The Lake Superior Open Lakes Surveillance Program was designed to provide a continuing report and long-term trend information on water quality and eutrophication parameters in the Upper Great Lakes by Canada/U.S. Agreement as input to the Water Quality Board Annual Report to the International Joint Commission.

One cruise was conducted during the month of May from the CSS LIMNOS on Lake Superior. This cruise was organized and completed by Technical Operations Section, Research Support Division for IWD-OR. The vessel was equipped with the usual equipment: transmissometer/EBT system, rosette/EBT system, radar, Loran C positioning system, and other necessary equipment needed to carry out chemical and biological sampling.

The parameters sampled during the cruise were: temperature and transmission profiles, dissolved oxygen, conductivity, pH, total phosphorus filtered and unfiltered, soluble reactive phosphorus, nitrite and nitrate, TKN, ammonia, reactive silicate, alkalinity, and major ions (Ca, SO_4, Cl). At selected stations, samples were collected for Mg, K and Na. From the integrator casts, samples were collected for POC, TPN, and Chl$\underline{a}$.

One additional task was performed during the cruise: phytoplankton sampling was done from selected stations for Dr. M. Munawar Study 86031.

At all stations, samples were collected from the one-metre depth, using the rosette/EBT system or a Van Dorn bottle cast.

STATISTICS SUMMARY

CRUISE NO. 89-03-001 CONSECUTIVE NO. 301 SHIP CSS LIMNOS

DATES FROM May 2 TO May 9, 1989 LAKE Superior

CRUISE TYPE Upper Lakes Surveillance N. MILES STEAMED 1458.8

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	74	Moorings Established	
EBT Casts	74	" Retrieved	
Rosette Casts	43	" Established	
Transmissometer Casts	74	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	12	" Established	
Secchi Disc Observations	38	" Retrieved	
Van Dorn Casts	31	" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 50 m	50	" Serviced	
Integrator 20 m	21	Primary Productivity Moorings	
Phytoplankton Samples	25		
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)	88	Cores Taken	
" " " (Phytoplankton)	21		
" " " (D.O.)	88	Grab Samples Taken	
" " " (Cond/pH)	88		
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	88		
" " " (TKN)	88	Observations, Weather	34
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	88	Solar Radiation	
" " " (POC/TPN)	88		
" " " (Seston)			
" " " (T P f)	88		
" " " (Nutrients)	88	ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	88
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987

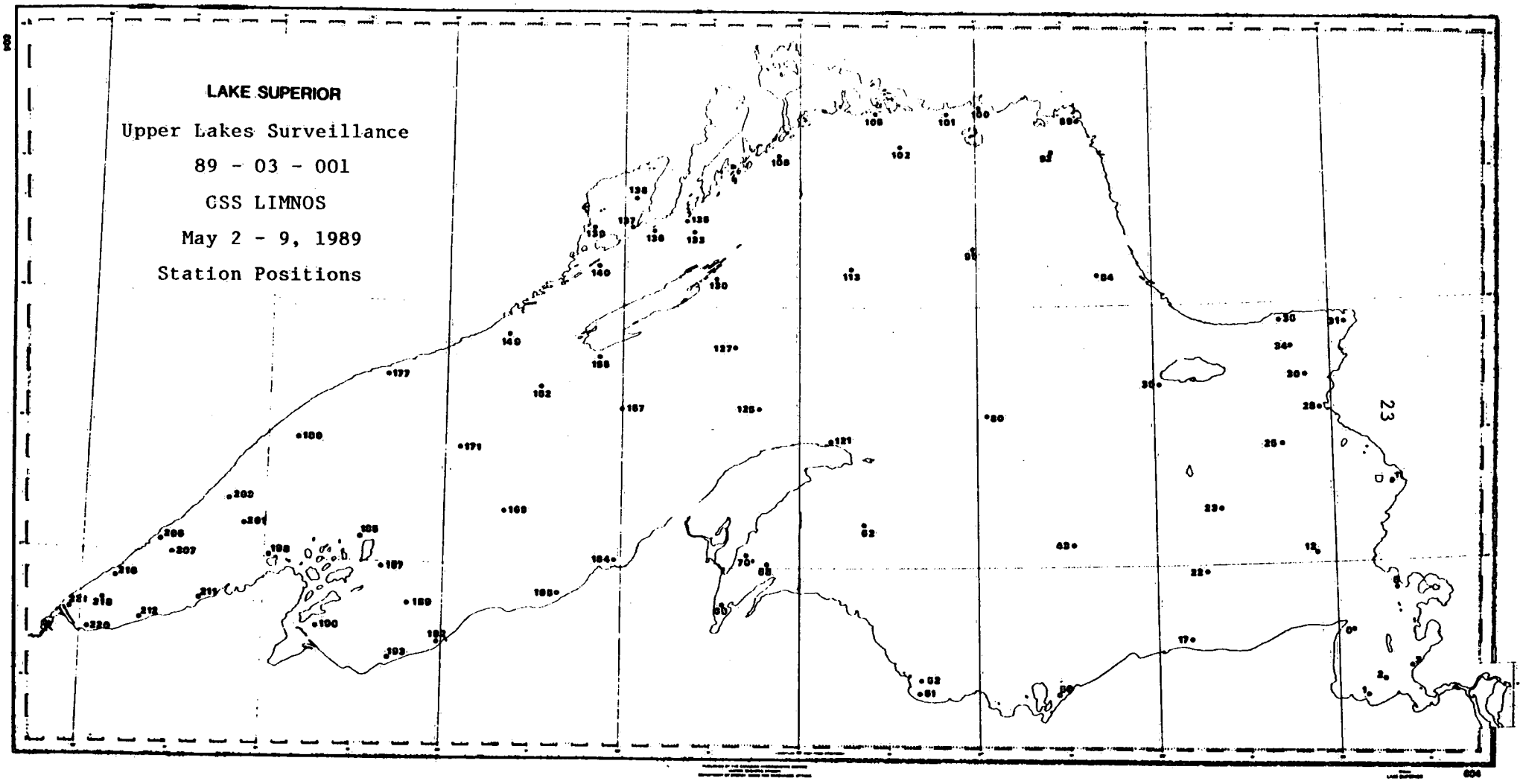
SURVEILLANCE STATION POSITIONS

LAKE SUPERIOR

1989

STATION NUMBER	LATITUDE N.	LONGITUDE N.
1	46° 29′ 06"	84° 50′ 00"
2	46° 32′ 36"	84° 44′ 54"
3	46° 36′ 00"	84° 35′ 30"
6	46° 44′ 36"	84° 55′ 00"
8	46° 53′ 36"	84° 40′ 03"
11	47° 18′ 36"	84° 39′ 30"
12	47° 02′ 12"	85° 06′ 12"
17	46° 42′ 48"	85° 49′ 06"
22	46° 58′ 06"	85° 43′ 40"
23	47° 12′ 48"	85° 38′ 00"
25	47° 27′ 18"	85° 16′ 30"
28	47° 35′ 06"	85° 03′ 54"
30	47° 43′ 12"	85° 08′ 20"
31	47° 55′ 06"	84° 54′ 46"
34	47° 50′ 00"	85° 12′ 30"
35	47° 55′ 54"	85° 16′ 12"
39	47° 41′ 24"	85° 58′ 00"
43	47° 04′ 48"	86° 28′ 40"
50	46° 30′ 30"	86° 34′ 06"
51	46° 31′ 00"	87° 20′ 12"
52	46° 34′ 00"	87° 19′ 56"
62	47° 10′ 00"	87° 38′ 36"
68	47° 01′ 00"	88° 11′ 00"
69	46° 51′ 42"	88° 25′ 48"
70	47° 03′ 00"	88° 18′ 00"
80	47° 35′ 00"	86° 57′ 06"
84	48° 06′ 48"	86° 18′ 00"
89	48° 42′ 00"	86° 25′ 06"
92	48° 35′ 00"	86° 33′ 54"
95	48° 13′ 06"	87° 01′ 00"
100	48° 45′ 24"	86° 58′ 33"
101	48° 44′ 06"	87° 10′ 00"
102	48° 36′ 54"	87° 26′ 09"
105	48° 44′ 00"	87° 33′ 48"
106	48° 34′ 30"	88° 07′ 00"

STATION NUMBER	LATITUDE N.	LONGITUDE N.
113	48° 08′ 42"	87° 42′ 12"
121	47° 29′ 00"	87° 50′ 00"
125	47° 36′ 18"	88° 13′ 00"
127	47° 50′ 54"	88° 20′ 30"
130	48° 06′ 30"	88° 27′ 30"
133	48° 17′ 00"	88° 35′ 50"
135	48° 19′ 48"	88° 38′ 00"
136	48° 17′ 24"	88° 49′ 48"
137	48° 18′ 06"	88° 57′ 00"
138	48° 25′ 00"	88° 56′ 00"
139	48° 17′ 54"	89° 10′ 48"
140	48° 09′ 00"	89° 08′ 54"
149	47° 53′ 00"	89° 38′ 24"
152	47° 41′ 18"	89° 28′ 00"
155	47° 48′ 12"	89° 08′ 48"
157	47° 36′ 48"	89° 00′ 00"
164	47° 01′ 36"	89° 02′ 18"
165	46° 53′ 30"	89° 20′ 51"
169	47° 12′ 24"	89° 40′ 00"
171	47° 27′ 00"	89° 55′ 15"
177	47° 43′ 00"	90° 20′ 00"
180	47° 28′ 00"	90° 51′ 18"
185	47° 06′ 00"	90° 27′ 45"
187	46° 59′ 05"	90° 20′ 26"
189	46° 50′ 42"	90° 11′ 20"
192	46° 42′ 00"	90° 01′ 54"
193	46° 38′ 00"	90° 18′ 00"
196	46° 44′ 54"	90° 42′ 12"
198	47° 00′ 36"	90° 59′ 00"
201	47° 07′ 54"	91° 06′ 42"
203	47° 13′ 18"	91° 12′ 18"
205	47° 03′ 12"	91° 34′ 00"
207	47° 00′ 12"	91° 30′ 54"
211	46° 50′ 12"	91° 20′ 42"
212	46° 45′ 00"	91° 40′ 30"
216	46° 54′ 24"	91° 49′ 12"
218	46° 49′ 00"	91° 53′ 06"
220	46° 42′ 18"	91° 57′ 54"
221	46° 46′ 54"	92° 03′ 15"


LAKE SUPERIOR
Upper Lakes Surveillance
89 - 03 - 001
CSS LIMNOS
May 2 - 9, 1989
Station Positions

ORGANIC AND INORGANIC CONTAMINANTS

ST. LAWRENCE RIVER

LRB STUDIES 82041, 82045, 92032, 82011
DR. P.F. HAMBLIN, DR. K.L.E. KAISER,
DR. M. HANNA, DR. J.P. COAKLEY

This was the fifth St. Lawrence River cruise conducted aboard the CSS LIMNOS in as many years. The initial cruise was completed from September 30 - October 18, 1985, the second June 16 - July 11, 1986, the third June 15 - July 11, 1987, the fourth October 3 - 30, 1988 and this year's cruise was completed June 26 - July 20. The purpose of this year's cruise was:

> To determine the distribution, partitioning, transport pathways, bioavailability and dynamics of the cycling organics and inorganics in the St. Lawrence River with special reference to the Upper Estuary. A complementary objective of this project is to derive flux estimates of toxic chemicals in the following sectors of the river:
>
> a) into and out of the riverine lakes
> b) into and out of the upper estuary

Four different studies were carried out during the cruise: sampling of the St. Lawrence River from Wolfe Island to the Montmagny area (Study 82045); bivalve sampling from Lac St. Louis to Tadoussac (Study 82032); contaminated fine sediment sampling in the Upper Estuary (Study 82011); and physical experiments for currents, transmission and conductivity, using the SKIM profiler at stations E100 and E400 (Study 82041).

Due to the number of sampling sites for bivalves and the time restriction to catch the tides at E100 and E400, sampling was conducted on the downbound and upbound transits. A total of 8 master stations were occupied between Wolfe Island and the Montmagny area in the Upper Estuary. While the vessel was sampling the master stations, additional sediment stations were occupied, utilizing the Lab II for the collection of bivalve samples. In Lac St. Francois, the Lab II was utilized to run a transect and centrifuge bulk water (800L) through the portable centrifuge.

Because of the late arrival of the SCAM profiling system, the measurement of high tides at E100 on July 3rd were missed. The

profiling system arrived in time to complete tidal cycles at E400 on July 10 and 11 and station E100 on July 12 and 13.

Several scientific personnel from outside agencies visited the vessel at different periods to observe the sampling procedures and assist in the selection of sampling sites in the estuary. The institutes involved were: Centre Saint-Laurent, Laval University and Université de Québec à Montréal.

One additional task was performed during the cruise. On the downbound transit, seven sediment trap moorings were installed in Lac St. Francois and retrieved on the upbound transit. This was in support of LRB Study 82022.

LAC ST. FRANCOIS

SEDIMENT TRAP MOORINGS

1989

MOORING NUMBER	LATITUDE N.	LONGITUDE W.
89-07A-09A	45° 01′ 17"	74° 40′ 28"
89-07A-10A	45° 00′ 20"	74° 39′ 38"
89-07A-11A	45° 01′ 54"	74° 36′ 10"
89-07A-12A	45° 02′ 39"	74° 35′ 37"
89-07A-13A	45° 09′ 55"	74° 20′ 15"
89-07A-14A	45° 11′ 13"	74° 20′ 11"
89-07A-15A	45° 12′ 59"	74° 13′ 08"

LAC ST. FRANCOIS

SUSPENDED SEDIMENT TRANSECT

1989

STATION NUMBER	LATITUDE N.	LONGITUDE W.
41A	45° 03′ 37"	74° 31′ 54"
41B	45° 03′ 05"	74° 32′ 00"
41C	45° 02′ 22"	74° 32′ 06"

STATISTICS SUMMARY

CRUISE NO. 89-07-002 CONSECUTIVE NO. 702 SHIP CSS LIMNOS

DATES FROM June 26 TO July 20, 1989 ST. LAWRENCE RIVER

CRUISE TYPE Organic and Inorganic Contaminants N. MILES STEAMED 1358.9

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	497	Moorings Established	7
EBT Casts	32	" Retrieved	7
Rosette Casts		" Established	
Transmissometer Casts	32	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations		" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)		Grab Samples Taken, Ponar	1923
" " " (Cond/pH)	232	Shipek	19
" " " ( )		Bulk Centrifuge Samples, 1200L Westfalia	8
" " " (T P uf)		1000L Beckman	3
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)	50		
" " " (Seston)	50		
" " " (T P f)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	232
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987

ST. LAWRENCE RIVER AND ESTUARY

STATION POSITIONS

1989

STATION NUMBER	LATITUDE N.	LONGITUDE W.
28	44° 07′ 14"	76° 22′ 08"
29	44° 38′ 19"	75° 36′ 02"
44	45° 11′ 19"	74° 19′ 26"
252	45° 24′ 28"	73° 46′ 18"
112	46° 14′ 02"	72° 45′ 46"
243	45° 58′ 43"	73° 10′ 36"
E100	47° 02′ 30"	70° 48′ 31"
E250	47° 09′ 48"	70° 38′ 42"
E300	47° 29′ 22"	70° 04′ 48"
E400	48° 08′ 24"	69° 36′ 18"
257	46° 30′ 00"	72° 14′ 10"
350	45° 20′ 33"	73° 56′ 03"

ST. LAWRENCE RIVER AND ESTUARY

SEDIMENT AND BIVALVE STATIONS

1989

STATION NUMBER	LATITUDE N.	LONGITUDE W.
G 1	45° 26′ 00"	73° 45′ 06"
G 2	45° 25′ 54"	73° 44′ 54"
G 3	45° 25′ 48"	73° 44′ 48"
G 4	45° 25′ 12"	73° 44′ 00"
G 5	45° 25′ 06"	73° 43′ 54"
G 6	45° 24′ 59"	73° 43′ 42"
G 7	45° 24′ 42"	73° 43′ 42"
G 8	45° 24′ 36"	73° 43′ 13"
D 9	45° 21′ 36"	73° 48′ 36"
D 8	45° 22′ 38"	73° 49′ 48"
D 7	45° 23′ 18"	73° 50′ 33"
D10	45° 21′ 30"	73° 48′ 28"
D11	45° 21′ 13"	73° 48′ 10"
G 9	45° 24′ 16"	73° 43′ 09"
G10	45° 24′ 12"	73° 43′ 07"
F12	45° 24′ 13"	73° 44′ 28"
B10	45° 19′ 11"	73° 52′ 45"
B 9	45° 19′ 35"	73° 52′ 29"
B11	45° 19′ 15"	73° 52′ 40"
B12	45° 19′ 03"	73° 52′ 38"
F11	45° 24′ 58"	73° 45′ 27"
B 8	45° 19′ 34"	73° 53′ 11"
F10	45° 25′ 56"	73° 46′ 39"
F 9	45° 26′ 28"	73° 47′ 29"
B 7	45° 20′ 28"	73° 54′ 10"
F 8	45° 26′ 38"	73° 47′ 53"
B 6	45° 20′ 37"	73° 54′ 17"
C10	45° 20′ 46"	73° 52′ 51"
C 9	45° 20′ 51"	73° 51′ 01"
C 8	45° 21′ 33"	73° 51′ 46"
C 7	45° 21′ 37"	73° 51′ 51"
C 6	45° 21′ 39"	73° 51′ 46"
E12	45° 22′ 21"	73° 46′ 47"
C 3	45° 23′ 16"	73° 53′ 38"
E11	45° 22′ 38"	73° 46′ 57"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
E10	45° 23′ 37"	73° 48′ 06"
C 4	45° 22′ 52"	73° 53′ 10"
E 9	45° 23′ 52"	73° 48′ 28"
K 1	45° 37′ 48"	73° 29′ 02"
K 2	45° 37′ 46"	73° 28′ 53"
L 2	45° 38′ 28"	73° 29′ 03"
L 1	45° 38′ 29"	73° 29′ 08"
J 1	45° 36′ 22"	73° 27′ 44"
M 5	45° 38′ 38"	73° 26′ 47"
M 4	45° 38′ 41"	73° 27′ 01"
M 1	45° 39′ 14"	73° 29′ 08"
M 3	45° 39′ 00"	73° 28′ 23"
M 6	45° 39′ 54"	73° 28′ 23"
N 5	45° 40′ 03"	73° 28′ 08"
O 1	45° 40′ 35"	73° 27′ 12"
O 2	45° 40′ 30"	73° 26′ 56"
O 3	45° 40′ 26"	73° 26′ 39"
N 6	45° 39′ 38"	73° 26′ 54"
N 7	45° 39′ 36"	73° 26′ 48"
P 5	45° 41′ 25"	73° 26′ 45"
P 4	45° 41′ 29"	73° 26′ 56"
R 4	45° 44′ 21"	73° 26′ 08"
S 5	45° 44′ 39"	73° 24′ 36"
S 4	45° 44′ 42"	73° 24′ 46"
T 5	45° 46′ 37"	73° 22′ 18"
T 4	45° 46′ 40"	73° 22′ 26"
T 6	45° 46′ 31"	73° 22′ 00"
U 6	45° 48′ 00"	73° 20′ 06"
U 7	45° 47′ 52"	73° 19′ 40"
U 6	45° 48′ 48"	73° 18′ 34"
V 7	45° 48′ 47"	73° 18′ 28"
W 6	45° 52′ 45"	73° 14′ 37"
W 7	45° 52′ 39"	73° 14′ 23"
W 5	45° 52′ 56"	73° 15′ 06"
X 1	45° 54′ 34"	73° 14′ 52"
X 2	45° 54′ 26"	73° 14′ 27"
X 3	45° 54′ 20"	73° 14′ 12"
Z 1	46° 00′ 56"	73° 10′ 54"
Z 2	46° 00′ 54"	73° 10′ 49"
Z 3	46° 00′ 53"	73° 10′ 43"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
AA 1	46° 02′ 16"	73° 10′ 18"
AB 1	46° 02′ 59"	73° 09′ 36"
W 1	45° 53′ 22"	73° 15′ 42"
AC 1	46° 04′ 28"	73° 05′ 42"
AC 2	46° 04′ 20"	73° 05′ 16"
W 2	45° 53′ 12"	73° 15′ 45"
AD 1	46° 04′ 48"	73° 04′ 31"
W 3	45° 52′ 58"	73° 15′ 21"
AD 2	46° 04′ 32"	73° 04′ 05"
AC 3	46° 04′ 14"	73° 05′ 00"
AC 4	46° 04′ 01"	73° 04′ 26"
Y 4	45° 56′ 52"	73° 12′ 24"
Y 1	45° 57′ 15"	73° 13′ 49"
Y 2	45° 57′ 08"	73° 13′ 23"
Y 3	45° 57′ 14"	73° 13′ 09"
Y 4	45° 57′ 05"	73° 13′ 02"
AE 3	46° 09′ 10"	72° 58′ 49"
AE 4	46° 08′ 50"	72° 58′ 23"
AE 5	46° 08′ 36"	72° 58′ 04"
AF 1	46° 10′ 50"	72° 57′ 00"
AF 2	46° 10′ 44"	72° 56′ 48"
AF 3	46° 10′ 12"	72° 56′ 10"
AG 1	46° 12′ 45"	72° 54′ 56"
AG 2	46° 12′ 19"	72° 54′ 25"
AG 3	46° 12′ 02"	72° 50′ 46"
AH 1	46° 13′ 47"	72° 51′ 36"
AH 2	46° 13′ 29"	72° 51′ 13"
AH 3	46° 13′ 07"	72° 50′ 45"
AI 1	46° 15′ 00"	72° 47′ 30"
AI 2	46° 14′ 44"	72° 47′ 10"
AI 3	46° 14′ 20"	72° 46′ 39"
AJ 1	46° 16′ 36"	72° 43′ 46"
AJ 2	46° 16′ 09"	72° 43′ 11"
AF 1	46° 16′ 18"	72° 39′ 51"
AK 2	46° 15′ 58"	72° 39′ 27"
AL 6	46° 15′ 54"	72° 37′ 52"
AL 5	46° 15′ 57"	72° 37′ 55"
AM 1	46° 19′ 03"	72° 32′ 22"
AN 4	46° 21′ 22"	72° 29′ 19"
AN 6	46° 21′ 17"	72° 29′ 13"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
AN 5	46° 21′ 19"	72° 29′ 15"
AO 5	46° 23′ 32"	72° 23′ 54"
AO 4	46° 23′ 38"	72° 24′ 04"
AO 3	46° 23′ 44"	72° 24′ 11"
AP 1	46° 25′ 52"	72° 20′ 15"
AP 2	46° 24′ 34"	72° 21′ 44"
AQ 5	46° 26′ 18"	72° 15′ 08"
AQ 4	46° 26′ 25"	72° 15′ 18"
AR 5	46° 28′ 27"	72° 14′ 03"
AR 1	46° 29′ 18"	72° 14′ 57"
AR 2	46° 29′ 08"	72° 14′ 47"
AS 5	46° 31′ 15"	72° 12′ 03"
AS 4	46° 31′ 19"	72° 12′ 07"
AS 3	46° 31′ 36"	72° 12′ 23"
AS 2	46° 31′ 41"	72° 12′ 30"
AS 1	46° 31′ 57"	72° 12′ 47"
AT 5	46° 33′ 27"	72° 07′ 07"
AT 4	46° 33′ 32"	72° 07′ 11"
AT 2	44° 34′ 00"	72° 07′ 41"
AT 1	44° 34′ 04"	72° 07′ 47"
AU 1	44° 34′ 21"	72° 03′ 42"
AK 2	44° 34′ 14"	72° 03′ 36"
AU 3	44° 33′ 58"	72° 03′ 19"
AU 4	44° 33′ 53"	72° 03′ 13"
AV 4	44° 40′ 41"	71° 50′ 57"
AV 5	44° 40′ 25"	71° 50′ 52"
BK25	46° 56′ 33"	70° 43′ 28"
G120	47° 04′ 27"	70° 35′ 24"
BJ25	46° 55′ 56"	70° 46′ 12"
G121	47° 03′ 02"	70° 37′ 54"
BJ24	46° 55′ 05"	70° 47′ 03"
B125	46° 54′ 40"	70° 49′ 05"
BH25	46° 53′ 03"	70° 54′ 35"
BH24	46° 53′ 05"	70° 54′ 36"
BH10	46° 52′ 57"	70° 56′ 30"
BG25	46° 52′ 02"	70° 56′ 38"
G124	46° 57′ 30"	70° 40′ 43"
BG24	46° 51′ 03"	70° 58′ 13"
G125	46° 56′ 40"	70° 42′ 39"
G126	46° 56′ 21"	70° 44′ 11"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
BI20	46° 56′ 13"	70° 52′ 07"
G127	46° 55′ 18"	70° 46′ 09"
BL10	47° 01′ 07"	70° 47′ 33"
BN 1	47° 07′ 10"	70° 42′ 22"
BM 1	47° 05′ 17"	70° 44′ 24"
BM 2	47° 05′ 07"	70° 44′ 42"
BK15	47° 01′ 45"	70° 48′ 36"
BK14	47° 02′ 40"	70° 48′ 48"
BK 1	47° 02′ 30"	70° 50′ 36"
BJ 5	47° 02′ 30"	70° 50′ 49"
BK 2	47° 02′ 28"	70° 50′ 47"
BJ 1	47° 01′ 50"	70° 53′ 12"
BI10	47° 01′ 10"	70° 55′ 23"
BI 9	47° 00′ 44"	70° 56′ 12"
BH25	46° 59′ 57"	70° 57′ 32"
BH24	46° 58′ 38"	70° 59′ 30"
BH23	46° 57′ 40"	71° 01′ 00"
BG15	46° 56′ 24"	71° 01′ 18"
BG 1	46° 55′ 00"	71° 04′ 31"
BG 2	46° 54′ 50"	71° 04′ 21"
BG 3	46° 54′ 42"	71° 04′ 10"
BF30	46° 54′ 19"	71° 04′ 48"
BF29	46° 54′ 40"	71° 05′ 11"
BF27	46° 54′ 10"	71° 06′ 05"
BF28	46° 53′ 57"	71° 05′ 38"
BF26	46° 53′ 20"	71° 06′ 48"
BE30	46° 52′ 43"	71° 08′ 36"
BE31	46° 52′ 20"	71° 08′ 39"
BF10	46° 50′ 47"	71° 07′ 24"
BF11	46° 50′ 48"	71° 07′ 00"
BF12	46° 50′ 50"	71° 06′ 35"
BE 1	46° 50′ 33"	71° 11′ 18"
BE 2	46° 50′ 50"	71° 10′ 30"
BE 3	46° 51′ 13"	71° 09′ 36"
BE 5	46° 50′ 00"	71° 08′ 55"
BE 4	46° 50′ 01"	71° 09′ 40"
BD10	46° 49′ 38"	71° 10′ 39"
BC25	46° 46′ 44"	71° 14′ 08"
BC 5	46° 45′ 54"	71° 15′ 15"
BC 1	46° 45′ 10"	71° 16′ 26"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
BB23	46° 44′ 49"	71° 18′ 16"
BA25	46° 44′ 29"	71° 20′ 22"
BA23	46° 43′ 52"	71° 22′ 06"
BA22	46° 43′ 43"	71° 23′ 34"
BA21	46° 43′ 44"	71° 24′ 34"
BA20	46° 42′ 46"	71° 22′ 48"
BB24	46° 44′ 33"	71° 17′ 38"
BB25	46° 44′ 35"	71° 17′ 30"
BB26	46° 44′ 39"	71° 16′ 58"
BC 2	46° 44′ 52"	71° 16′ 05"
BD 5	46° 46′ 25"	71° 13′ 16"
BD 6	46° 46′ 24"	71° 12′ 46"
AS25	46° 32′ 25"	72° 12′ 04"
AS20	46° 32′ 48"	72° 11′ 00"
AR25	46° 30′ 54"	72° 14′ 02"
AP 2	46° 26′ 02"	72° 21′ 25"
AO 6	46° 25′ 08"	72° 22′ 41"
AN25	46° 23′ 38"	72° 25′ 33"
AN24	46° 24′ 06"	72° 25′ 34"
AN 1	46° 21′ 52"	72° 30′ 05"
AL25	46° 17′ 08"	72° 37′ 16"
AL24	46° 16′ 57"	72° 38′ 03"
AL 1	46° 16′ 45"	72° 38′ 54"
AL 2	46° 16′ 42"	72° 38′ 51"
AL 3	46° 16′ 39"	72° 38′ 48"
AJ 5	46° 16′ 49"	72° 41′ 20"
AJ 6	46° 16′ 38"	72° 41′ 13"
AJ 7	46° 16′ 31"	72° 41′ 11"
AB 2	46° 02′ 39"	73° 08′ 25"
AA 2	46° 01′ 59"	73° 09′ 26"
Z25	46° 01′ 46"	73° 09′ 32"
Y 5	45° 56′ 50"	73° 12′ 16"
V 5	45° 48′ 05"	73° 19′ 02"
S 1	45° 44′ 58"	73° 25′ 47"
S 6	45° 46′ 05"	73° 24′ 43"
T 1	45° 47′ 08"	73° 24′ 51"
T25	45° 48′ 06"	73° 22′ 49"
T26	45° 49′ 06"	73° 21′ 58"
V 1	45° 49′ 38"	73° 21′ 01"
SL 1	45° 26′ 02"	73° 45′ 14"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
SL 2	45° 24′ 53"	73° 49′ 24"
E 2	45° 25′ 15"	73° 48′ 58"
E 1	45° 25′ 26"	73° 49′ 10"
C 2	45° 24′ 17"	73° 54′ 43"
C 1	45° 24′ 24"	73° 54′ 50"
A 5	45° 19′ 09"	73° 55′ 31"
A 4	45° 20′ 09"	73° 56′ 34"
A 1	45° 20′ 57"	73° 57′ 27"
A 2	45° 20′ 53"	73° 57′ 24"
A 3	45° 20′ 49"	73° 57′ 21"
AV 6	46° 40′ 17"	71° 50′ 44"
AW 4	46° 39′ 36"	71° 44′ 43"
AW 5	46° 39′ 24"	71° 48′ 20"
AW 6	46° 39′ 06"	71° 47′ 58"
AW 7	46° 38′ 34"	71° 47′ 24"
AX 1	46° 39′ 39"	71° 40′ 36"
AX 2	46° 39′ 27"	71° 40′ 25"
AX 3	46° 39′ 19"	71° 40′ 15"
AX 4	46° 38′ 42"	71° 39′ 36"
AY 1	46° 40′ 27"	71° 37′ 17"
AY 2	46° 40′ 13"	71° 37′ 01"
AZ 5	46° 40′ 57"	71° 32′ 54"
AZ 2	46° 41′ 40"	71° 33′ 50"
BA 1	46° 43′ 26"	71° 25′ 51"
BA 2	46° 43′ 12"	71° 25′ 35"
BA 3	46° 42′ 38"	71° 24′ 59"
BJ 2	47° 01′ 42"	70° 53′ 28"
BJ 3	47° 01′ 21"	70° 53′ 02"
BJ 4	47° 01′ 13"	70° 52′ 51"
BI 1	47° 00′ 47"	70° 56′ 14"
BI 2	47° 00′ 30"	70° 56′ 03"
BI 3	47° 00′ 20"	70° 55′ 48"
BH 3	46° 57′ 17"	71° 00′ 36"
BH 2	46° 57′ 26"	71° 00′ 46"
BH 1	46° 57′ 33"	71° 00′ 53
BK 3	47° 02′ 11"	70° 50′ 17"
BK 4	47° 02′ 04"	70° 50′ 08"
BK 6	46° 59′ 45"	70° 47′ 17"
BK 5	46° 59′ 52"	70° 47′ 31"
J11	47° 00′ 27"	70° 55′ 18"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
BL 5	47° 01′ 43"	70° 46′ 59"
BL 4	47° 02′ 02"	70° 47′ 24"
BL 2	47° 02′ 37"	70° 48′ 06"
BL 1	47° 02′ 45"	70° 48′ 13"
BH 3	46° 57′ 19"	71° 00′ 36"
G15	46° 56′ 30"	71° 00′ 29"
G18	46° 56′ 53"	71° 00′ 01"
G20	46° 57′ 28"	70° 59′ 45"
G21	46° 57′ 22"	70° 59′ 36"
G22	46° 57′ 17"	70° 59′ 28"
G26	46° 58′ 00"	70° 58′ 47"
G27	46° 58′ 47"	70° 58′ 05"
G31	46° 59′ 38"	70° 58′ 15"
G32	46° 59′ 42"	70° 58′ 21"
G33	47° 00′ 38"	70° 56′ 43"
G34	47° 01′ 00"	70° 55′ 54"
G38	47° 01′ 56"	70° 52′ 56"
G39	47° 01′ 58"	70° 53′ 12"
G40	47° 02′ 12"	70° 51′ 49"
G41	47° 01′ 34"	70° 49′ 55"
G42	47° 01′ 40"	70° 48′ 09"
BM 4	47° 05′ 18"	70° 43′ 36"
BN 2	47° 06′ 51"	70° 41′ 24"
G44	47° 01′ 12"	70° 41′ 20"
G45	47° 01′ 02"	70° 40′ 21"
G46	47° 01′ 15"	70° 39′ 31"
G47	47° 01′ 23"	70° 38′ 55"
G48	47° 01′ 25"	70° 38′ 33"
G49	47° 01′ 38"	70° 37′ 46"
BO 4	47° 08′ 30"	70° 38′ 24"
BO 1	47° 09′ 40"	70° 39′ 57"
BO 2	47° 09′ 58"	70° 39′ 41"
BO 3	47° 10′ 10"	70° 39′ 28"
BOS4	47° 11′ 45"	70° 38′ 01"
BOS3	47° 11′ 48"	70° 38′ 09"
BOS5	47° 11′ 57"	70° 38′ 00"
BP 1	47° 14′ 31"	70° 35′ 18"
BP 2	47° 15′ 12"	70° 34′ 39"
G51	47° 11′ 48"	70° 38′ 12"
BP 3	47° 15′ 25"	70° 34′ 27"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
G53	47° 10′ 05"	70° 39′ 48"
BP 4	47° 16′ 30"	70° 33′ 42"
BQ 1	47° 17′ 58"	70° 33′ 21"
G54	47° 08′ 13"	70° 41′ 33"
BQ 2	47° 19′ 54"	70° 31′ 36"
G55	47° 08′ 02"	70° 41′ 37"
G59	47° 07′ 14"	70° 42′ 27"
BQ 3	47° 18′ 26"	70° 33′ 07"
G60	47° 06′ 51"	70° 42′ 48"
G61	47° 06′ 06"	70° 43′ 45"
BV 1	47° 35′ 19"	70° 10′ 31"
BV 2	47° 34′ 18"	70° 11′ 37"
BT10	47° 30′ 09"	70° 13′ 12"
BS10	47° 28′ 41"	70° 15′ 41"
BT20	47° 29′ 18"	70° 01′ 42"
BT19	47° 28′ 58"	70° 02′ 00"
BT18	47° 28′ 16"	70° 02′ 36"
BT17	47° 26′ 58"	70° 03′ 14"
BT16	47° 25′ 58"	70° 03′ 59"
BT15	47° 22′ 32"	70° 04′ 07"
BT14	47° 22′ 18"	70° 05′ 33"
BS20	47° 21′ 21"	70° 06′ 14"
BS19	47° 20′ 51"	70° 06′ 20"
BS18	47° 19′ 43"	70° 08′ 29"
BS17	47° 19′ 11"	70° 10′ 12"
BS16	47° 18′ 30"	70° 12′ 09"
BS15	47° 17′ 19"	70° 13′ 06"
BV10	47° 29′ 16"	70° 01′ 42"
BV15	47° 29′ 38"	70° 00′ 47"
BV14	47° 30′ 04"	70° 00′ 03"
BV13	47° 30′ 44"	69° 58′ 41"
BV12	47° 31′ 15"	69° 57′ 52"
BV11	47° 31′ 56"	69° 57′ 13"
G65	47° 29′ 16"	70° 01′ 30"
CA12	48° 06′ 10"	69° 39′ 25"
CA12	48° 06′ 10"	69° 39′ 25"
CA11	48° 06′ 11"	69° 40′ 18"
CA10	48° 06′ 42"	69° 40′ 39"
CA13	48° 06′ 30"	69° 43′ 10"
G70	48° 09′ 18"	69° 39′ 25"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
G72	48° 08′ 15"	69° 40′ 35"
G73	48° 08′ 00"	69° 41′ 06"
CB25	48° 01′ 54"	69° 26′ 35"
CB24	48° 00′ 46"	69° 28′ 01"
CB23	47° 59′ 52"	69° 29′ 02"
CB22	47° 57′ 36"	69° 29′ 39"
G74	48° 08′ 03"	69° 41′ 36"
BZ25	47° 54′ 58"	69° 31′ 21"
BZ24	47° 54′ 22"	69° 31′ 42"
G77	48° 08′ 21"	69° 42′ 36"
BZ23	47° 53′ 31"	69° 32′ 32"
G79	48° 06′ 38"	69° 43′ 33"
BZ22	47° 52′ 05"	69° 33′ 28"
G80	48° 06′ 22"	69° 42′ 33"
G81	48° 04′ 01"	69° 42′ 36"
G82	48° 04′ 12"	69° 44′ 01"
G83	48° 04′ 06"	69° 45′ 06"
G84	48° 03′ 15"	69° 45′ 45"
G85	48° 01′ 51"	69° 45′ 42"
BY25	47° 50′ 08"	69° 35′ 12"
BY26	47° 50′ 10"	69° 34′ 30"
BY24	47° 49′ 30"	69° 34′ 52"
BY23	47° 48′ 39"	69° 35′ 23"
BY22	47° 48′ 00"	69° 36′ 18"
BY21	47° 46′ 34"	69° 37′ 21"
BX25	47° 44′ 42"	69° 39′ 18"
BX24	47° 44′ 15"	69° 40′ 48"
BX23	47° 43′ 57"	69° 41′ 01"
BW25	47° 42′ 55"	69° 42′ 12"
BW24	47° 40′ 23"	69° 45′ 27"
BW23	47° 38′ 44"	69° 47′ 05"
BW22	47° 37′ 57"	69° 48′ 19"
BW21	47° 37′ 39"	69° 49′ 00"
BV20	47° 34′ 34"	69° 54′ 00"
G103	47° 03′ 13"	70° 32′ 03"
G104	47° 02′ 46"	70° 32′ 42"
G105	47° 02′ 16"	70° 34′ 22"
B010	47° 01′ 48"	70° 30′ 24"
BM25	47° 01′ 20"	70° 31′ 40"
BM24	47° 01′ 02"	70° 33′ 48"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
BM23	47° 00′ 50"	70° 34′ 12"
G107	47° 03′ 06"	70° 35′ 09"
G108	47° 03′ 20"	70° 34′ 48"
G109	47° 04′ 33"	70° 34′ 01"
BN25	46° 59′ 00"	70° 38′ 32"
BO15	47° 02′ 38"	70° 29′ 06"
G110	47° 06′ 11"	70° 32′ 12"
BO14	47° 03′ 24"	70° 28′ 15"
BO13	47° 04′ 42"	70° 26′ 57"
BO12	47° 05′ 42"	70° 25′ 57"
G111	47° 06′ 58"	70° 31′ 36"
BP25	47° 07′ 03"	70° 24′ 01"
G112	47° 07′ 35"	70° 30′ 33"
G113	47° 08′ 25"	70° 29′ 23"
BP24	47° 07′ 05"	70° 22′ 57"
BP23	47° 08′ 46"	70° 21′ 54"
G114	47° 09′ 03"	70° 28′ 07"
BP22	47° 10′ 05"	70° 20′ 12"
BP21	--	--
G115	47° 10′ 12"	70° 26′ 05"
G116	47° 08′ 05"	70° 27′ 12"
G118	47° 06′ 47"	70° 28′ 49"
G122	47° 02′ 18"	70° 38′ 52"
G123	47° 01′ 23"	70° 40′ 12"
BN24	47° 00′ 15"	70° 36′ 07"
BL25	46° 58′ 02"	70° 40′ 17"
BL24	46° 57′ 42"	70° 41′ 48"
C 5	45° 22′ 32"	73° 52′ 50"
E 7	45° 25′ 21"	73° 50′ 04"
D 1	45° 24′ 52"	73° 52′ 21"
H 2	45° 35′ 42"	73° 30′ 01"
H 3	45° 35′ 41"	73° 29′ 54"
I 1	45° 35′ 51"	73° 30′ 06"
I 2	45° 35′ 49"	73° 30′ 01"

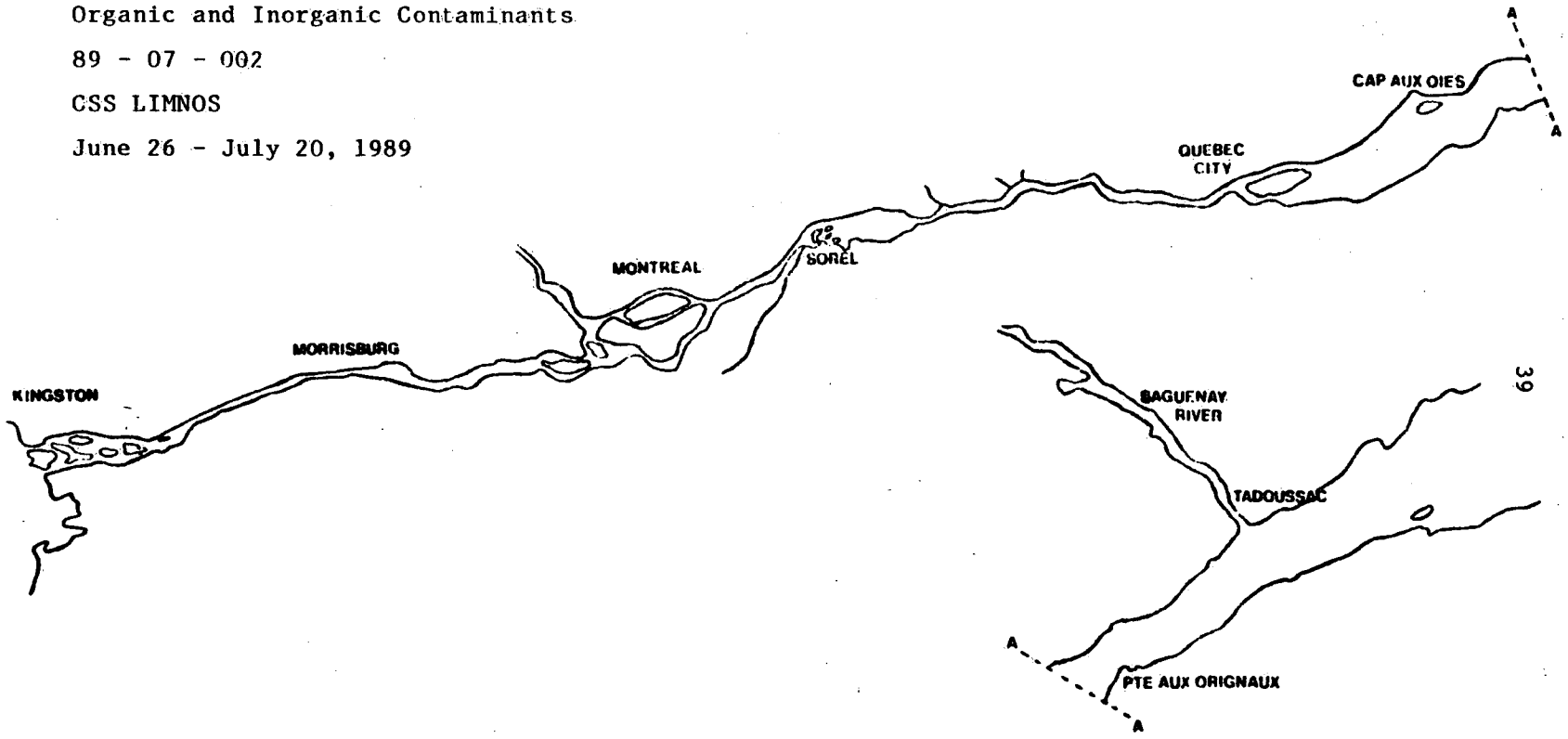
ST. LAWRENCE RIVER

Organic and Inorganic Contaminants

89 - 07 - 002

CSS LIMNOS

June 26 - July 20, 1989



BENTHIC COMMUNITY STRUCTURE

LAKE ERIE

LRB STUDY 82015, DR. T. REYNOLDSON

Four Lake Erie cruises were carried out onboard the CSS LIMNOS April 17 - 22, May 27 - 29, August 21 - 23 and September 1 - 5. As in previous years, four stations were occupied--one in the Eastern Basin, one in the Central Basin and two in the Western Basin. A box core was collected at each site and 5 10 cm cores subsampled. These were stored at 4°C until returned to CCIW for analysis. During the April cruise, 45 additional stations were sampled, using a benthos corer or a box corer, depending on the bottom structure. These samples were stored at 4°C until returned to CCIW for analysis. During the September cruise, eight additional stations were sampled for the University of Indiana. A box core was collected and subsampled by university personnel.

One additional cruise was carried out October 29 - November 2, utilizing the CSL WREN. During this period, all stations were sampled using a Tech. Ops. corer or an Ekman dredge.

BENTHIC COMMUNITY STRUCTURE

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29′ 53"	79° 53′ 59"
84	41° 29′ 49"	81° 39′ 16"
357	41° 49′ 45"	82° 58′ 17"
358	41° 53′ 40"	82° 52′ 00"

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM April 17 TO September 5, 1989 LAKE ERIE

CRUISE TYPE Benthic Community Structure N. MILES STEAMED 1590.3

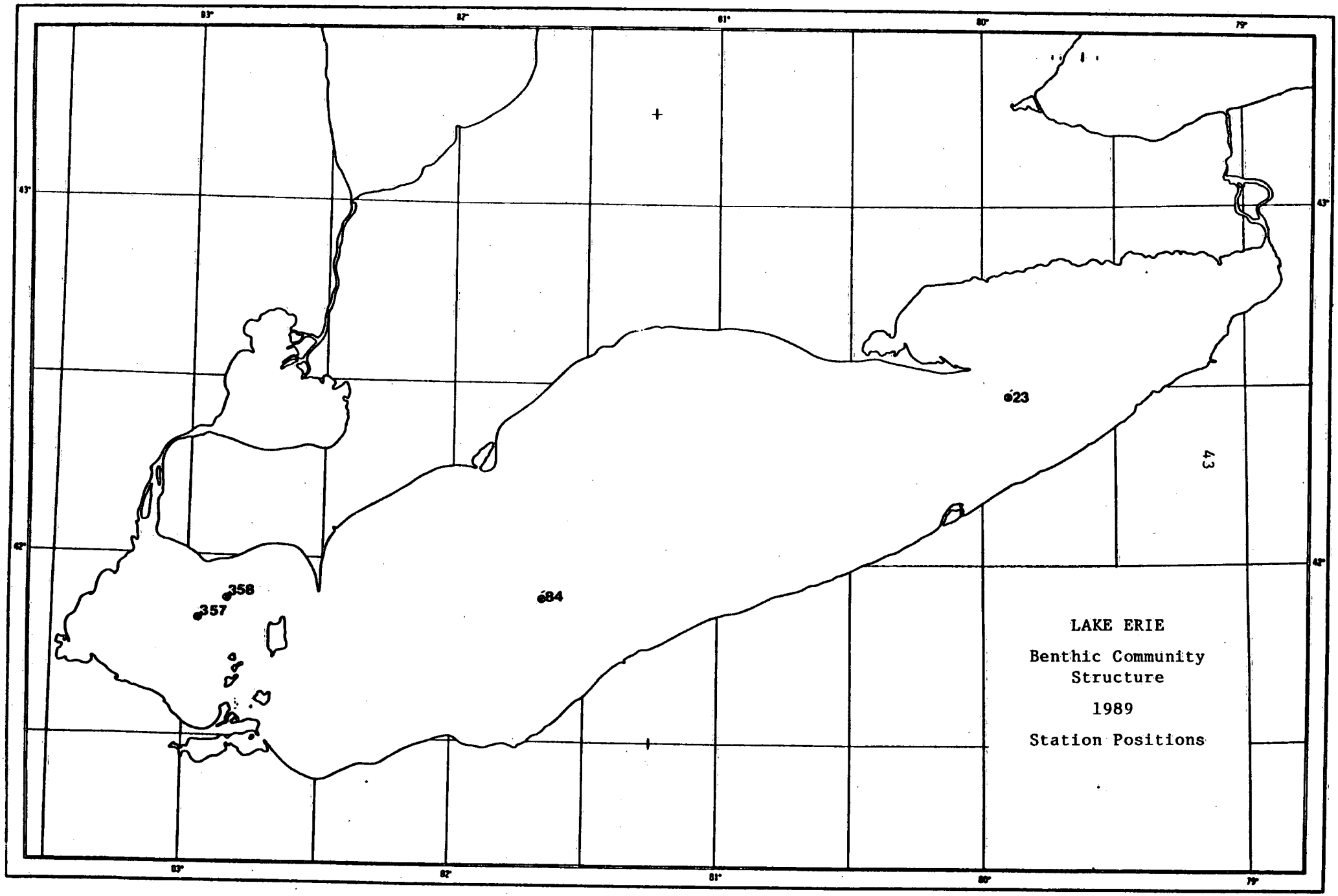
DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	63	Moorings Established	
EBT Casts	63	" Retrieved	
Rosette Casts		" Established	
Transmissometer Casts	63	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations	8	" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	23
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken, Benthos	56
" " " ( )			
" " " (D.O.)		Grab Samples Taken, Shipek	4
" " " (Cond/pH)			
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)			
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

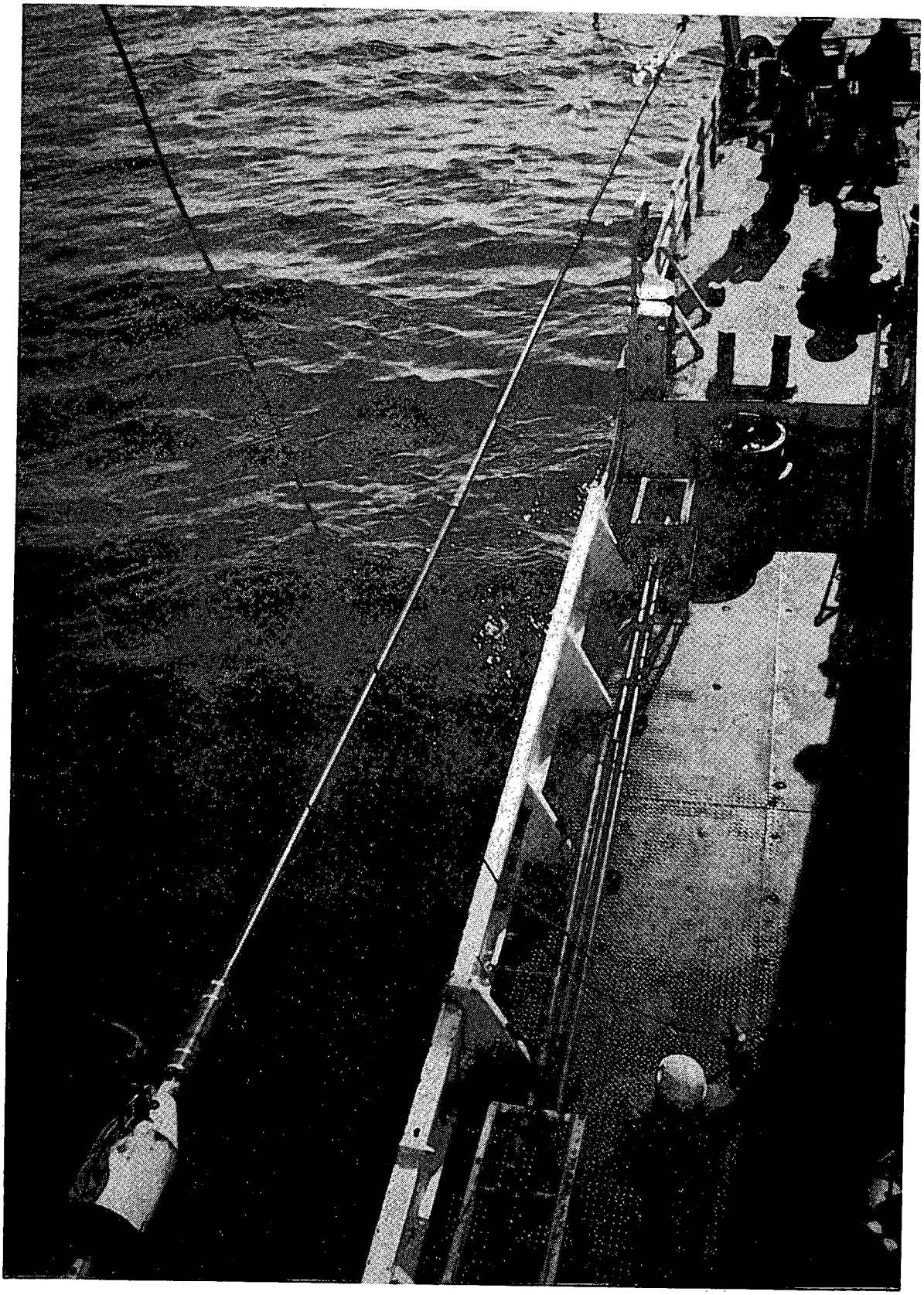
Tech. Ops. 1987

UNIVERSITY OF INDIANA

BOX CORE STATIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
262	41° 57′ 57"	81° 54′ 02"
263	42° 11′ 28"	81° 39′ 04"
266	42° 05′ 07"	81° 20′ 51"
268	42° 08′ 04"	80° 52′ 03"
269	42° 42′ 31"	79° 29′ 59"
270	42° 31′ 00"	79° 38′ 01"
271	42° 37′ 58"	79° 19′ 02"


83°
82°
81°
80°
79°
43°
42°
358
357
84
23
43
LAKE ERIE
Benthic Community
Structure
1989
Station Positions



PISTON CORE, LAKE ONTARIO

MOORINGS

LAKE ONTARIO

LRB STUDY 82046, DR. C.R. MURTHY

Four mooring cruises were conducted onboard the CSS LIMNOS. The purpose of these cruises was to understand the circulation features at the mouth of the St. Lawrence River and Kingston Basin in support of loading and transport of persistent contaminant studies in the St. Lawrence River system.

On the initial cruise, April 10 - 15, a total of 10 current meter moorings and 2 meteorological buoys were installed. During the next two cruises June 12 - 16 and July 24 - 28, drifters were released and tracked during daylight hours. When this was not being done, a dissolved oxygen/EBT grid in the Kingston Basin was conducted. On the last cruise September 11 - 16, all instrumentation that had been placed in April was recovered successfully.

Several additional tasks were performed during the season: piston cores were collected for RRB Study 83001, organic extractions were completed for RSD Study 86031, EBT/% Transmission profiles were taken for SLD Study 85021, and a wave and tide recorder was placed at Port Hope for LRB Study 82011.

STATION	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
1	89-00C-01A	43° 18′ 43"	76° 59′ 06"	CM(8,20,30)
2	89-00C-02A	43° 23′ 04"	77° 00′ 32"	CM(8,50,100)
3	89-00C-03A	43° 28′ 53"	77° 02′ 30"	CM(8,50,100,170,210)
4	89-00C-04A	43° 33′ 35"	77° 04′ 08"	CM(8,50,100,170)
	89-00M-19A	43° 33′ 22"	77° 04′ 04"	MET Buoy
	89-00M-20A	43° 33′ 40"	77° 03′ 50"	MET Buoy
5	89-00C-05A	43° 40′ 30"	77° 06′ 01"	CM(8,50,100)
6	89-00C-06A	43° 45′ 00"	77° 07′ 32"	CM(8,50,66.5)
7	89-00C-07A	43° 48′ 42"	77° 08′ 47"	CM(8,20,30)
8	89-00C-08A	44° 13′ 20"	76° 26′ 15"	CM(12,17.5)
9	89-00C-09A	44° 06′ 38"	76° 22′ 14"	CM(12)
10	89-00C-10A	44° 11′ 50"	76° 14′ 07"	CM(13)

STATISTICS SUMMARY

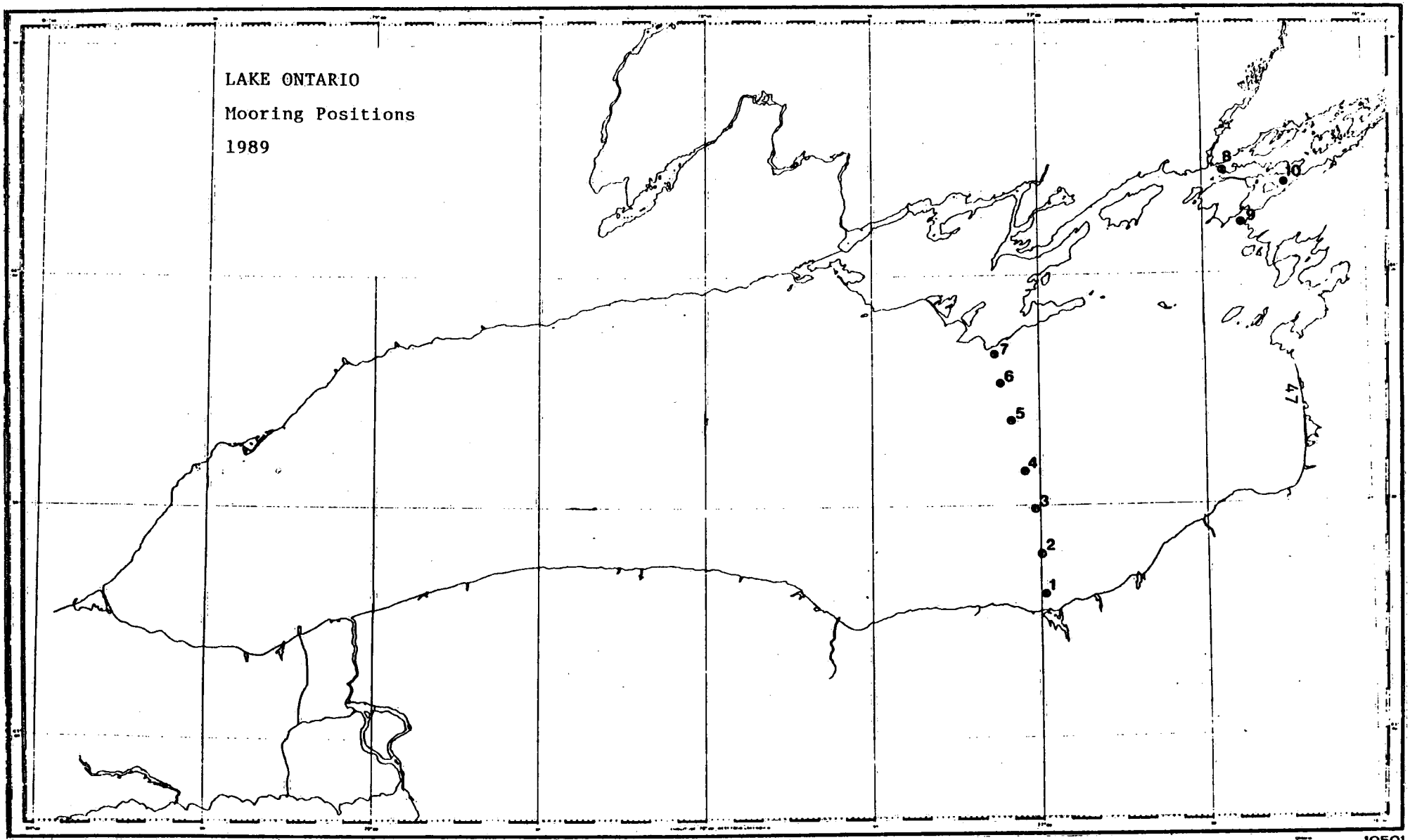
CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM _____ TO _____ LAKE ONTARIO

CRUISE TYPE Moorings N. MILES STEAMED 2421.75

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	296	Moorings Established, Current Meter	10
EBT Casts	249	" Retrieved, Current Meter	10
Rosette Casts	13	" Established, Drifter	36
Transmissometer Casts	232	" Retrieved, Drifter	3
Reversing Thermometer Obs. (No. of Therm)		" Established, Meteorological	2
Secchi Disc Observations		" Retrieved, Meteorological	2
Van Dorn Bottles	17	" Established, Wave Rider	1
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	37	Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " (Organics)	12		
" " " (D.O.)	37	Grab Samples Taken	
" " " (Cond)	12		
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)			
" " " (TKN)		Observations, Weather	
" " " (Mercury)	12		
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)			
" " " (Nutrients)	12	ONBOARD ANALYSES	
" " " (Major Ions)	12		
" " " ( )		Manual Chemistry Tech. Ops.	57
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987


LAKE ONTARIO
Mooring Positions
1989
1
2
3
4
5
6
7
8
9
10
47
10501

SEDIMENT CORES

BAY OF QUINTE

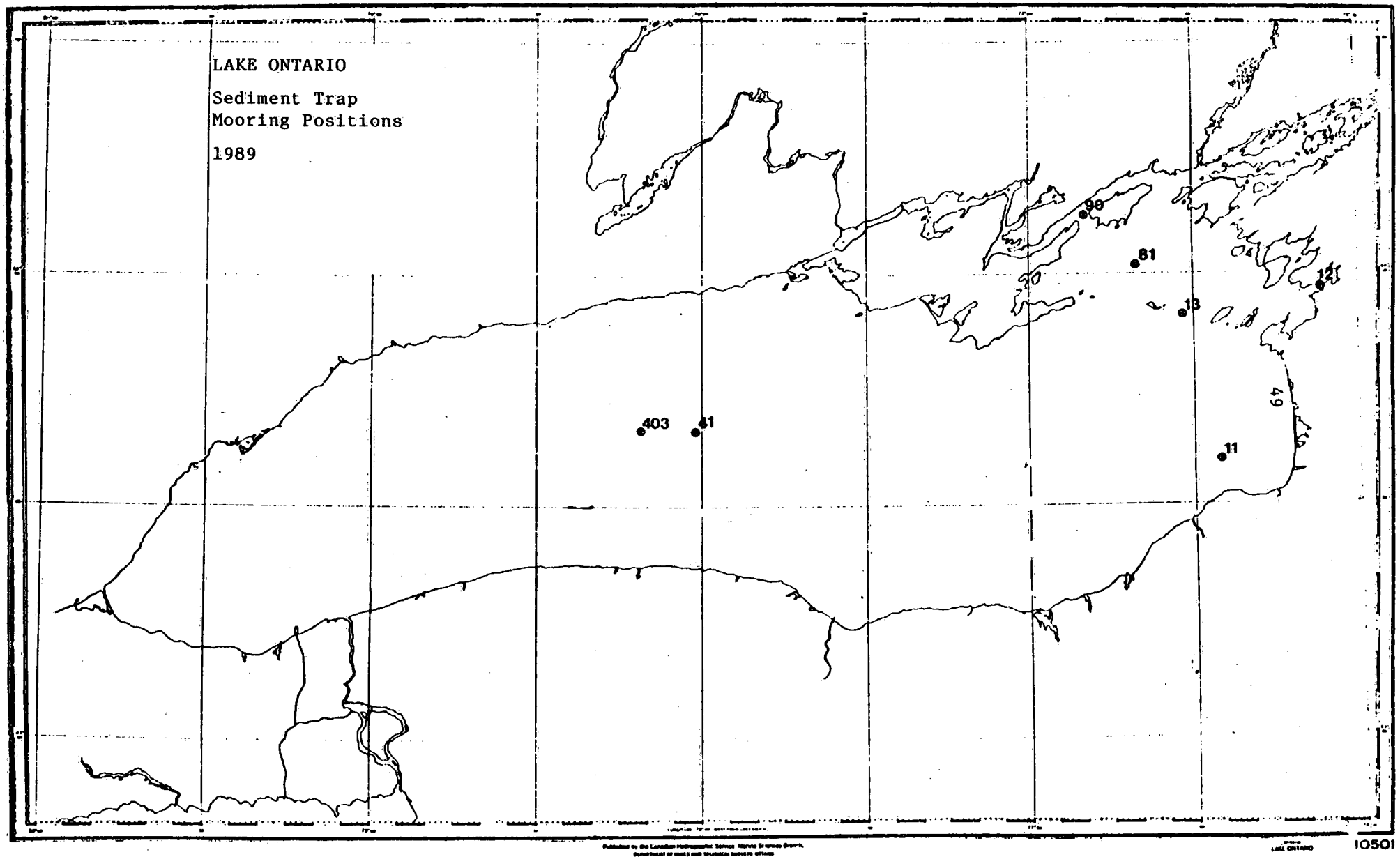
LRB STUDY 82025, DR. P.G. MANNING

Sediment cores were collected from the Bay of Quinte in the area from Glenora to the Upper Gap from the CSL SHARK on Cruise 89-00-701, May 29 - June 2. Cores were subsectioned onoard and the sections frozen.

Centrifuged water samples for total phosphorus and suspended sediment samples were collected at station 864, Moira River at Belleville and at station 867, Trent River at Trenton on April 4 and 5 as well as on October 26 and 27.

BIOAVAILABILITY OF PHOSPHORUS

The bioavailability and geochemistry of iron phosphorus and heavy metals was studied in twenty-four sampling sites in the Trent River and Bay of Quinte. Three sites were located in the upper bay of Quinte and twenty-one were situated between Trenton and Sturgeon Lake. Bulk water samples (600L) were collected and centrifuged at a flow rate of 6L/min. The particulate matter collected from the centrifuge bowl was frozen before being transported to CCIW for analysis. At each sampling depth, samples were collected for filtered and unfiltered total phosphorus. At Rice Lake and Pigeon Lake, a benthos core was collected and extruded.


LAKE ONTARIO
Sediment Trap
Mooring Positions
1989
403
41
98
81
13
11
49
10501

INTERNAL SEDIMENT LOADING

LAKE ERIE

LRB STUDY 82016, F. ROSA

Two Lake Erie cruises were carried out onboard the CSS LIMNOS--April 17 - 22 and September 1 - 5. On each cruise, meteorological observations were made and EBT/transmissometer profiles to the bottom taken. The following sampling was also performed:

1. Water samples were collected from the rosette water sampler for dissolved oxygen, conductivity, pH, chlorophyll a, particulate organic carbon, seston weight, and total phosphorus, filtered and unfiltered. Samples were collected from 1 metre, sediment trap depths and bottom minus 1 metre.

2. Bulk water samples (1200L) were collected from 5 metres and centrifuged for particulate material.

3. A box core was collected and the top 1 cm removed and preserved.

4. At stations 23, 84 and 357, a combination current meter/sediment trap winter mooring was retrieved. These moorings were re-installed in September for the winter of 1990.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29′ 48"	79° 53′ 56"
84	41° 55′ 51"	81° 38′ 59"
357	41° 49′ 47"	82° 58′ 09"

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM April 17 TO September 5, 1989 LAKE ERIE

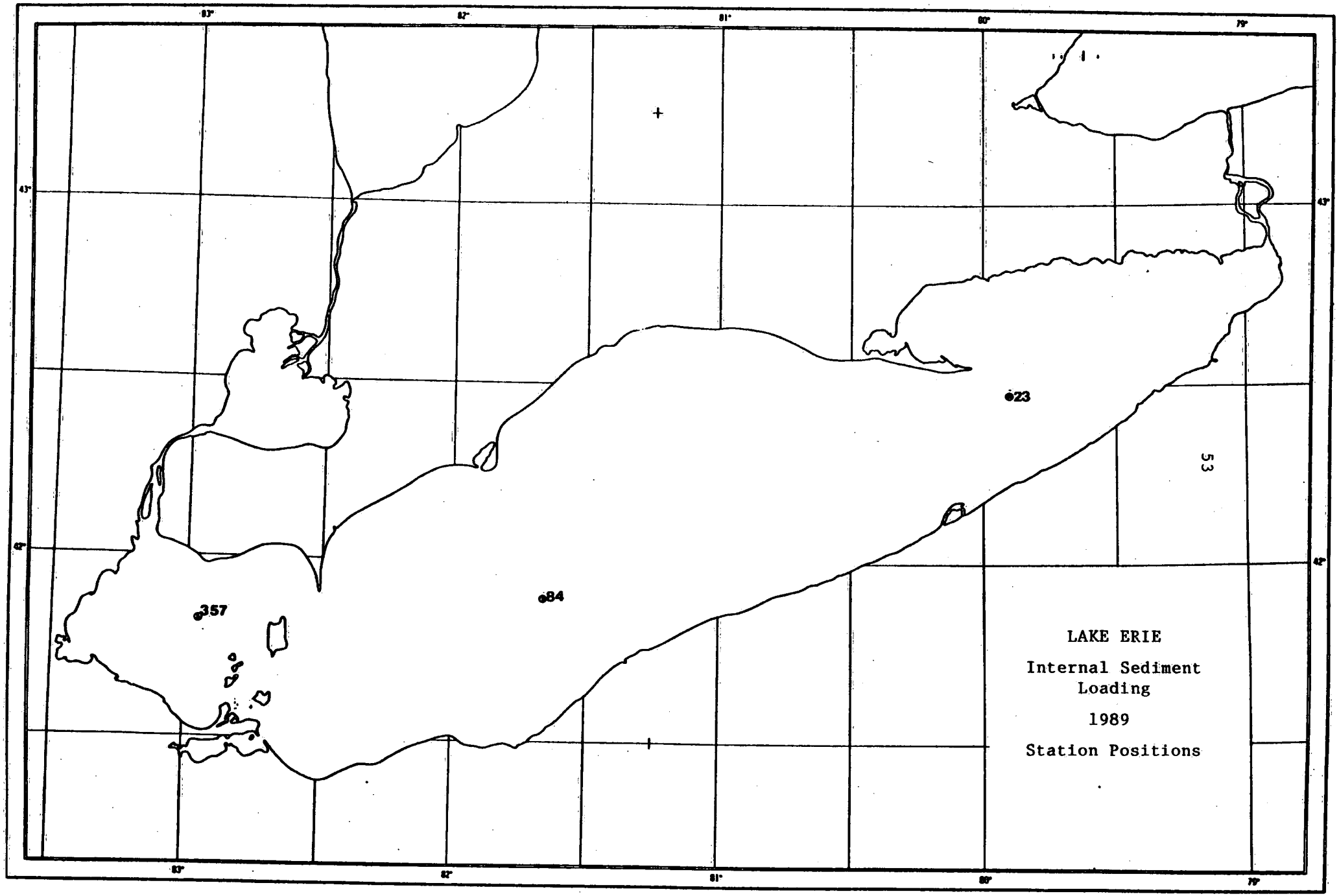
CRUISE TYPE Internal Sediment Loading N. MILES STEAMED 753.6

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	20	Moorings Established	3
EBT Casts	20	" Retrieved	3
Rosette Casts	20	" Established	
Transmissometer Casts	20	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations		" Retrieved	
		" Refurbished	1
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)	20	Grab Samples Taken	
" " " (Cond/pH)	20		
" " " ( )		Bulk Centrifuge Samples , 1200L	6
" " " (T P uf)	45		
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	38	Solar Radiation	
" " " (POC/TPN)	9		
" " " (Seston)	9		
" " " (T P f)	45		
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	60
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987

MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
23	89-01A-06A	43° 29′ 53"	79° 53′ 59"
84	89-01AC-07A	41° 56′ 04"	81° 39′ 38"
357	89-01SC-08B	41° 50′ 00"	82° 58′ 12"


357
84
23
53
LAKE ERIE
Internal Sediment
Loading
1989
Station Positions

SEDIMENTARY TRANSPORT OF RADIONUCLIDES

LAKE ONTARIO

LRB STUDIES 82012, 82013, DR. S.R. JOSHI, A MUDROCH

During the week of July 31 to August 4 aboard the CSS LIMNOS, an investigation into the role of the nepheloid layer in the transport and cycling of radionuclides was completed. This was the third such cruise in as many years to be conducted on Lake Ontario. This year's cruise consisted of five stations being sampled during the period. At each station, the following tasks were completed: an EBT/transmissometer profile to the bottom and suspended particulate matter centrifuged from 6000 litres of water from the nepheloid layer. At one station, 6000 litres were also centrifuged from 1 metre. In addition, at each station, a box core was collected and subsampled. All samples were refrigerated and returned to CCIW for analysis.

At five additional sites, piston cores were taken. Each core was sectioned onboard by RRB personnel. These cores were refrigerated and returned to Dr. R. Thomas of RRB for analysis.

SEDIMENT TRANSPORT STATIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
973	43° 28′ 01"	77° 10′ 57"
974	43° 44′ 59"	76° 56′ 58"
975	43° 29′ 03"	76° 47′ 17"
976	43° 48′ 04"	76° 32′ 56"
999	43° 30′ 12"	76° 57′ 05"

STATISTICS SUMMARY

CRUISE NO. 89-00-006 CONSECUTIVE NO. 022 SHIP CSS LIMNOS

DATES FROM July 31 TO August 4, 1989 LAKE ONTARIO

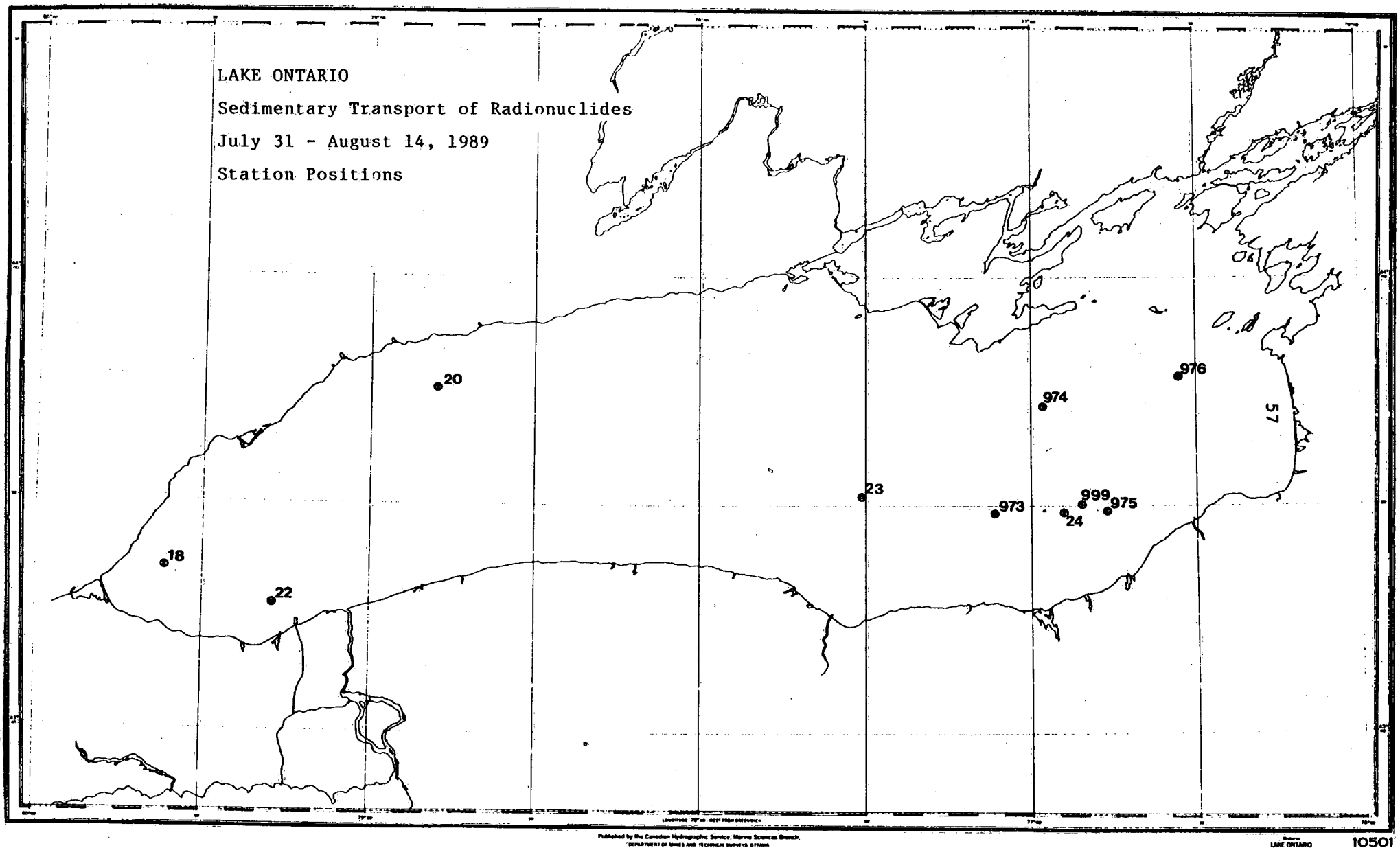
CRUISE TYPE Sedimentary Transport of Radionuclides N. MILES STEAMED 501.0

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	11	Moorings Established	
EBT Casts	13	" Retrieved	
Rosette Casts		" Established	
Transmissometer Casts	13	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations		" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	4
		Cores Taken, Gravity	5
Water Samples Collected (Microbiology)		Cores Taken, Piston	6
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)		Grab Samples Taken, Shipek	2
" " " (Cond/pH)			
" " " ( )		Bulk Centrifuge Samples	5
" " " (T P uf)		5 x 6000L = 30,000L	
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987

PISTON CORING STATIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
18	43° 22′ 00"	79° 36′ 12"
20	43° 36′ 44"	78° 46′ 08"
22	43° 17′ 17"	79° 19′ 26"
23	43° 33′ 07"	77° 49′ 38"
24	43° 29′ 45"	76° 59′ 07"


LAKE ONTARIO
Sedimentary Transport of Radionuclides
July 31 - August 14, 1989
Station Positions
20
976
974
57
23
973
999
975
24
18
22
Published by the Canadian Hydrographic Service, Marine Sciences Branch,
LAKE ONTARIO
10501

BULK SEDIMENT SAMPLE COLLECTION

LAKE ONTARIO

RAB STUDY 84021, K. ASPILA

The CSS LIMNOS was utilized to collect a bulk sediment sample from station 23, north of the Niagara Bar June 19 and 20. A total of 44 pails of sediment were collected, using the box corer and a double Shipek.

STATION POSITION

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	43° 22′ 12"	79° 04′ 00"

CSS BAYFIELD

BAYFIELD
1989

	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	28
	29	30	31	1	2	3	4
FEB	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	1	2	3	4
MAR	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
APR	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18 L.T.B.I.M.	19 LAKE ONTARIO	20 L.T.B.I.M.	21	22
	23	24 L.T.B.I.M.	25 LAKE ONTARIO	26 L.T.B.I.M.	27	28	29
	30	1 QUINTE	2 LAKE	3 ONTARIO	4 L.T.B.I.M.	5	6
MAY	7	8 L.T.B.I.M.	9 LAKE ONTARIO	10 L.T.B.I.M.	11	12	13
	14	15 QUINTE	16 LAKE	17 ONTARIO	18 L.T.B.I.M.	19	20
	21	22	23 L.T.B.I.M.	24 LAKE ONTARIO	25 L.T.B.I.M.	26	27
	28	29 QUINTE	30 LAKE	31 ONTARIO	1 L.T.B.I.M.	2	3
JUN	4	5 L.T.B.I.M.	6 LAKE ONTARIO	7 L.T.B.I.M.	8	9	10 OPEN HOUSE TORONTO
	11 OPEN HOUSE OAKVILLE	12 QUINTE	13 LAKE	14 ONTARIO	15 L.T.B.I.M.	16	17
	18	19 L.T.B.I.M.	20 LAKE ONTARIO	21 L.T.B.I.M.	22	23	24
	25	26 QUINTE	27 LAKE	28 ONTARIO	29 L.T.B.I.M.	30	1
JUL	2	3	4 L.T.B.I.M.	5 LAKE ONTARIO	6 L.T.B.I.M.	7	8
	9	10 QUINTE	11 LAKE	12 ONTARIO	13 L.T.B.I.M.	14	15
	16	17 L.T.B.I.M.	18 LAKE ONTARIO	19 L.T.B.I.M.	20	21	22
	23	24 QUINTE	25 LAKE ONTARIO	26 L.T.B.I.M.	27 LAKE ONTARIO	28 L.T.B.I.M.	29
	30	31 L.T.B.I.M.	1 LAKE ONTARIO	2 L.T.B.I.M.	3	4	5
AUG	6	7	8 QUINTE	9 LAKE	10 ONTARIO	11 L.T.B.I.M.	12
	13	14	15 L.T.B.I.M.	16 LAKE ONTARIO	17 L.T.B.I.M.	18	19
	20	21 QUINTE	22 LAKE	23 ONTARIO	24 L.T.B.I.M.	25	26
	27	28 L.T.B.I.M.	29 LAKE ONTARIO	30 L.T.B.I.M.	31	1	2
SEP	3	4	5 QUINTE	6 LAKE	7 ONTARIO	8 L.T.B.I.M.	9
	10	11 L.T.B.I.M.	12 LAKE	13 ONTARIO	14 L.T.B.I.M.	15	16
	17	18 QUINTE	19 LAKE	20 ONTARIO	21 L.T.B.I.M.	22	23
	24	25 L.T.B.I.M.	26 LAKE	27 ONTARIO	28 L.T.B.I.M.	29	30
OCT	1	2 QUINTE	3 LAKE	4 ONTARIO	5 L.T.B.I.M.	6 LAKE ONTARIO	7
	8	9 L.T.B.I.M.	10 LAKE	11 ONTARIO	12 L.T.B.I.M.	13	14
	15	16 QUINTE	17 LAKE	18 ONTARIO	19 L.T.B.I.M.	20	21
	22	23	24	25	26	27	28
	29	30	31	1	2	3	4
NOV	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
DEC	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						

BIOINDEX AND QUINTE

RSD STUDIES 86032, 86042, DR. O.E. JOHANNSSON, E.S. MILLARD

The International Joint Commission accepted a broader definition of lake health encompassing all components of the ecosystem in 1978. The Bioindex Program was initiated in 1981 to provide time-intensive chemical and biological data on selected stations in Lake Ontario for the long-term monitoring of the biological community and the physical-chemical environment. The program is aimed at regularly sampling the open water pelagic and benthic communities and provides input to an integrative Lake Ontario Biological Index Monitoring Program carried out by Great Lakes Laboratory for Fisheries & Aquatic Sciences.

There were 27 Bioindex cruises completed by the research vessel CSS BAYFIELD on Lake Ontario. The first cruise began the week of April 17th and the last was completed during the week of October 16. One additional set of samples was collected from the CSS LIMNOS during the Open Lakes Surveillance cruise early in April.

Biological and chemical data was collected from the two major Bioindex stations (41 and 81) until the week of June 5th when a south shore station (70A) off Oswego, N.Y. was added to the Program to be sampled every second week to broaden the data base. The biological work included the collection of integrated water samples and of temperature-related specified depth samples for phytoplankton, chlorophyll a, particulate organic carbon, particulate organic nitrogen, ash-free weight and the collection of zooplankton net hauls. A pump sampling system was used this season to collect zooplankton from a known volume of water at specific depths to augment the net haul samples. Primary productivity and phosphorus kinetics studies were carried out at each station. Zooplankton grazing experiments were completed alternately at stations 81 and 41 throughout the season, using the Haney grazing chamber. On station 41, two deep hypolimnetic closing zooplankton net hauls were completed at four-week intervals and four replicate hauls for Mysis reticulata were completed after dark on a monthly basis. The chemical parameters included the basic manual lab work of dissolved oxygen measurement, pH and conductivity and the processing of water samples for water quality analysis.

During the week of May 1 and on those weeks following when the BAYFIELD did not visit the south shore station, four additional stations in the Bay of Quinte were sampled in support of GLLFAS Project No. 4544. This work served as a continuation of the monitoring program carried out since 1972 for Project Quinte. The four stations were: B (Belleville), HB (Hay Bay), C (Conway) and N (Deseronto). Typical sampling on these

stations included a temperature/depth profile, a transmissometer cast, and an integrated water sample for chlorophyll a, particulate organic carbon, water quality, and seston. A dissolved oxygen profile, a light extinction profile and primary productivity and P kinetics experiments were done. Zooplankton samples were collected, using a Schindler-Patalas trap. At station B, zooplankton grazing experiments were carried out, using a Haney grazing chamber and radio-labelled algae. At all stations, various water samples were collected for the Ministry of the Environment, including samples for metals, reactive soluble phosphorus, algae and nutrients. At station N, only samples for nutrients and algae were required for MOE.

Several additional tasks were piggy-backed on the Bioindex cruises, as follows:

1. In support of National Water Quality Laboratory Project No. 114-89, Lake Ontario Surveillance stations 102 and 103 were sampled for various water quality parameters on a bi-weekly basis (a total of fourteen cruises).

2. Benthos samples were collected for Mr. R.M. Dermott, GLLFAS from Lake Ontario stations 81A and 41 on four occasions and once at several stations in the Bay of Quinte area (Belleville, Big Bay, Glenora, Conway and LOX).

3. Two meteorological buoys situated at Lake Ontario Surveillance station 4 were monitored on a monthly basis, from their installation in April until their removal in September.

4. A surface marker buoy was installed in Prince Edward Bay for Dr. P.G. Manning (Study 82025) to mark a peeper site (station 856) and was later removed.

5. Temperature/depth profiles and surface conductivity readings were taken at each of ten sites in a string at one-kilometer intervals, running from the end of the Burlington Ship Canal and heading in a northeasterly direction, at the beginning and end of four cruises during the month of August.

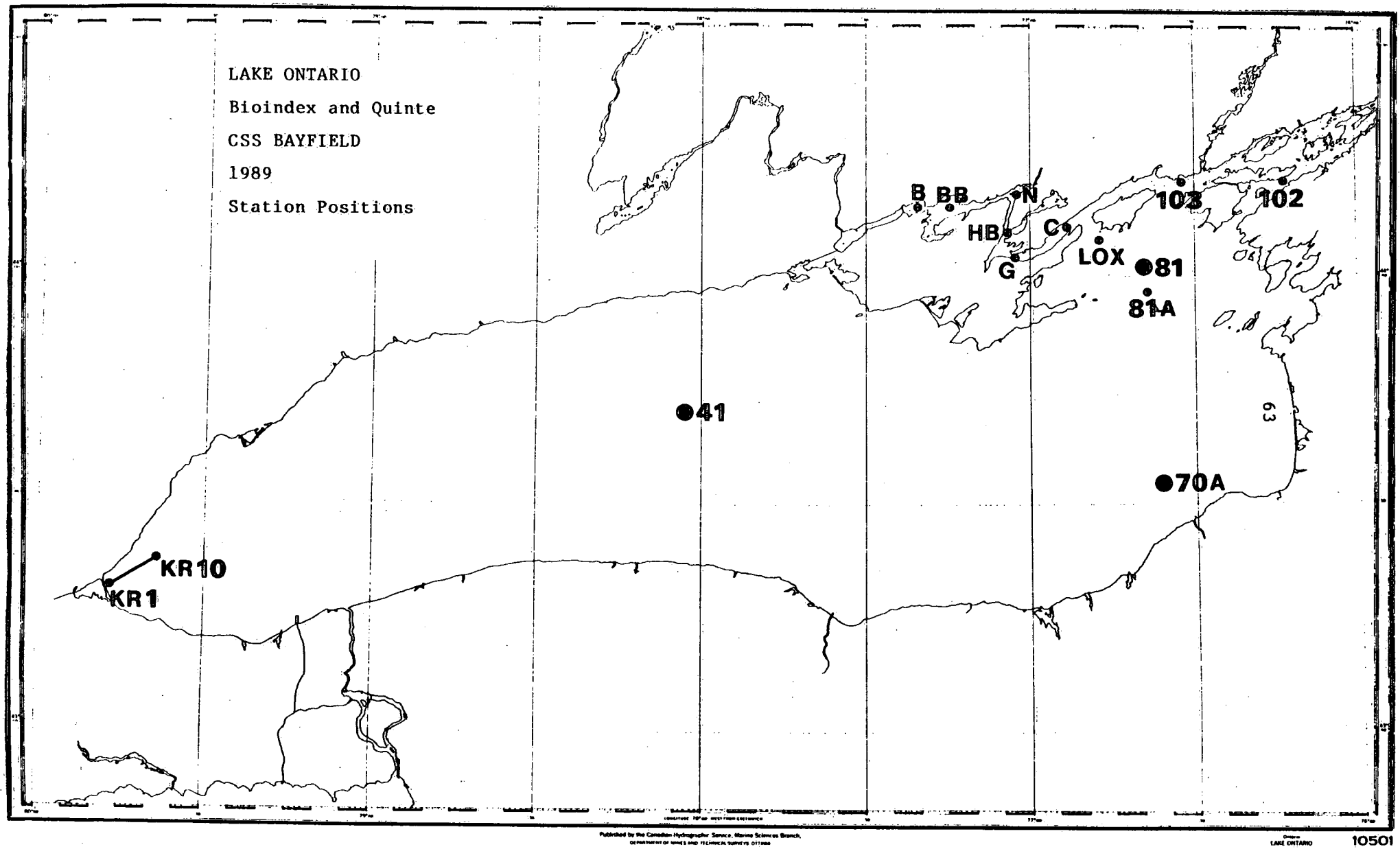
6. The North American Benthological Society toured the CSS BAYFIELD to investigate the benthos and plankton sampling equipment onboard. A tour of the vessel was also given to Dr. W. Kornicker, Earth Sciences, McMaster University, and a group of students interested in the use of the sampling equipment and the logistics involved in sample collection on our large ships.

7. Open House onboard the BAYFIELD was held on two occasions during the weekend of June 10-11. The first Open House was held in conjunction with Environment Week at Maple Leaf Quay in Toronto and the second was for the "Heritage Days" celebration in Oakville.

8. During the season, the staff of the BAYFIELD had the pleasure of hosting three visiting scientists: Ms. S. Gilford, DFO, Winnipeg, Ms. E. Bentzen, University of Waterloo, and Dr. Asit Muzumber, NWRI who made use of the lab facilities onboard to do primary production studies.

STATION POSITIONS

STATION NUMBER	PROJECT	LATITUDE N.	LONGITUDE W.
41	Bioindex	43° 43′ 00"	78° 01′ 36"
81	Bioindex	44° 01′ 00"	76° 40′ 18"
70A	Bioindex	43° 33′ 00"	76° 39′ 00"
B	Quinte	44° 09′ 02"	77° 20′ 40"
HB	Quinte	44° 05′ 36"	77° 04′ 13"
C	Quinte	44° 06′ 28"	76° 53′ 54"
N	Quinte	44° 10′ 30"	77° 02′ 54"
41	Benthos	43° 43′ 00"	78° 01′ 36"
81A	Benthos	43° 58′ 54"	76° 39′ 18"
B	Benthos	44° 09′ 02"	77° 20′ 36"
BB	Benthos	44° 09′ 19"	77° 10′ 19"
G	Benthos	44° 02′ 30"	77° 01′ 24"
C	Benthos	44° 06′ 18"	76° 53′ 42"
LOX	Benthos	44° 03′ 36"	76° 46′ 36"
102	WO	44° 12′ 12"	76° 14′ 12"
103	WO	44° 12′ 12"	76° 32′ 36"
4	MET	43° 33′ 40"	77° 03′ 50"
856	Peepers	44° 00′ 00"	76° 50′ 40"
KR01		43° 18′ 06"	79° 47′ 24"
KR02		43° 18′ 24"	79° 46′ 48"
KR03		43° 18′ 47"	79° 46′ 12"
KR04		43° 19′ 02"	79° 45′ 36"
KR05		43° 19′ 20"	79° 45′ 06"
KR06		43° 19′ 39"	79° 44′ 25"
KR07		43° 20′ 00"	79° 43′ 50"
KR08		43° 20′ 18"	79° 43′ 15"
KR09		43° 20′ 36"	79° 42′ 36"
KR10		43° 20′ 57"	79° 42′ 00"



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

LAKE ONTARIO

10501

CSS ADVENT

ADVENT
1989

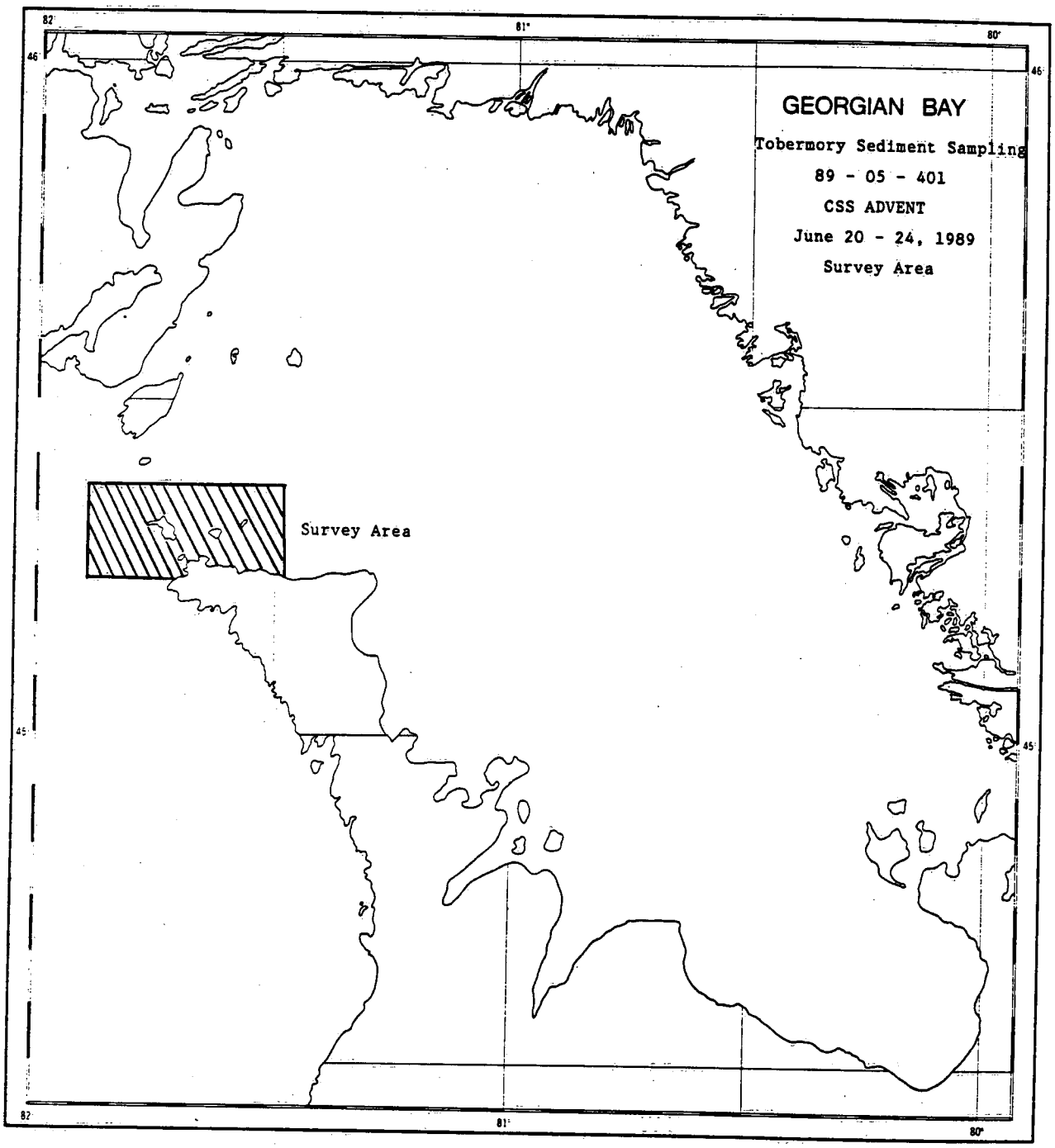
	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	1	2	3	4
FEB	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	1	2	3	4
MAR	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28	29	30	31	1
APR	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	4	5	6
MAY	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
JUN	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19 SEDIMENT	20 BENTHOS	21 LAKE	22 HURON	23 SEDIMENT	24 BENTHOS
	25	26	27 SEDIMENT LOADING	28 LAKE ERIE	29 BENTHOS	30	1
JUL	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	4	5
AUG	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
SEP	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
OCT	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	4
NOV	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
DEC	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						

TOBERMORY SEDIMENT SAMPLING

RRB STUDY 83001, DR. R.L. THOMAS

From June 20 to 24, the CSS ADVENT was utilized to collect bottom sediments by Shipek sampler to delimit the sediment distribution in the Tobermory area. Fifty-seven stations were sampled in the southwest portion of the survey area on June 21. On June 22, 53 stations were completed in the central and northwest portions. The eastern 11 stations were completed on the following day. Echo sounding records were not collected due to the poor quality produced by the Atlas-Deso 10 sounder onboard the ADVENT.

Due to the lengthy transit time for the ADVENT to reach the survey area and return to Burlington, the North Channel sounding survey was cancelled.


GEORGIAN BAY
Tobermory Sediment Sampling
89 - 05 - 401
CSS ADVENT
June 20 - 24, 1989
Survey Area
Survey Area
82°
81°
80°
46°
45°

SHORE PROGRAMS

LAKES RESEARCH BRANCH

HAMILTON HARBOUR

Hamilton Harbour was identified as an area of concern by the International Joint Commission in 1985. It was recommended that the harbour be used as a Canadian site for implementing a rehabilitation plan. During the last 17 years, the Ministry of the Environment has concentrated on monitoring of water and sediment quality in terms of oxygen depletion and the sources and fates of contaminants. This is the fourth year of NWRI's involvement in a major thrust to answer questions related to harbour rehabilitation. Technical Operations supported a total of fourteen studies organized into a single program to collect data required to answer these questions. The following activities were co-ordinated:

1. Supply and maintenance of all sampling equipment
2. Installation and maintenance of the mini-ranger positioning system
3. Installation and retrieval of all moorings
4. Provision of all diving support
5. Scheduling all vessel requirements through DFO
6. Recording observations as required and documentation of the field program in the form of a final report

Vessels utilized to support the Hamilton Harbour Project included the CSL AGILE, CSL CORMORANT, GOOSE II and Mason #4.

NWRI STUDIES

1.	82002 - Barica	- Nitrogen Regime of the Hamilton Harbour - Ammonia Transects in Hamilton Harbour
2.	82031 - Charlton	- Hamilton Harbour Oxygen Regime - Hamilton Harbour Sedimentation Regime
3.	82032 - Hanna	- Effect of Reoxygenation on the Recolonization and Survival Ability of Chironomids
4.	82028 - Fox	- Persistent Organic Contaminants
5.	82030 - Mayer	- Effect of Iron and Steel Mill Effluent on Reduction of the Phosphorus Availability in Hamilton Harbour
6.	82027 - Murphy	- Hamilton Harbour Restoration
7.	82024 - Painter	- Water Clarity in Hamilton Harbour
8.	82015 - Reynoldson	- Utilizing Benthic Invertebrates
9.	85021 - Rodgers	- Video, Hamilton Harbour
10.	82029 - Rukavina	- Resuspension of Modern Harbour Sediments - Acoustics of Sediments - Coastal Geology

Nitrogen Regime of Hamilton Harbour, Dr. J. Barica, LRB Study 82002

This program studied the effect of Hamilton Harbour on the nearshore area of Lake Ontario. Also included in the program was the study of the spatial variation of ammonia in the harbour waters, phytoplankton/ zooplankton species composition, and oxygen consumption. It is hoped that the spatial variation will provide insight into the residence time of wastes in the harbour. A total of 4 cruises were carried out.

Sampling Program: 1. Nitrogen - 6 stations (see figure 1)
May 9, August 17

2. Ammonia - 30 stations (see figure 2)
May 10, August 18

Observations:

a) Water samples were collected from: 1 m, 2 mid-depths, and B -1
b) EBT/XMS cast
c) Conductivity profile
d) Dissolved oxygen profile (YSI meter)
e) Dissolved oxygen, Winkler (sample depths)
f) pH
g) Secchi disc

NOTE: The water quality profiler was used to obtain these observations.

Interstitial water samplers (peepers) were installed at stations B5 and A4. One double chamber peeper was installed on July 7 at each site using the optically triggered peeper-placer and retrieved on July 18.

Hamilton Harbour Sedimentation Regime, M.N. Charlton, LRB Study 82031

Four sediment trap moorings were installed in Hamilton Harbour to measure sedimentation and indirectly the extent of resuspension created by wind, currents and dredging (see figure 3). The organic metal content of the sediment samples was also measured. The barge, GOOSE II was utilized for all sediment trap mooring operations.

Four sediment trap moorings were left in place during the previous winter; the moorings were scheduled to be refurbished at three-week intervals but weather conditions, equipment problems and personnel assignments disrupted plans. One single trap mooring was installed at the Stratherne Street bridge where the outflow from Windemere Basin flows into the harbour. The actual refurbishment schedule follows: May 3, 4, 29, 30; June 22; July 4; August 15; September 21, 22; October 19.

On November 10, all sediment trap moorings were removed from the harbour. The sediment trap at the Stratherne Street bridge was retrieved on November 27.

Hamilton Harbour Oxygen Regime, M.N. Charlton, LRB Study 82031

The digital dissolved oxygen profiler was used throughout the field season (May - November) to monitor changes in oxygen concentrations in Hamilton Harbour and Lake Ontario near the Burlington Ship Canal. On a typical cast of the profiler, the following parameters were measured: dissolved oxygen, temperature, light transmission, conductivity, pH and depth. A total of 13 cruises were carried out with the profiler, occupying 21 stations per cruise (see figure 4).

Also included was a total of 9 Water Quality cruises from which were collected samples from 1 m and B -2 m for Total P, filtered and unfiltered, and chlorophyll a from 21 stations (see figure 5).

DO Profiler Surveys:	May 13, 23; June 5, 21; July 4, 18; August 1, 15, 29; September 12; October 5, 25; November 6
WQ Surveys:	May 15, 31; June 29; July 14; August 22; September 5, 18; October 3, 23

Persistent Organic Contaminants, M.E. Fox, LRB Study 82028

Surface water samples were collected to provide information on current inputs of contaminants (organochlorine contaminants including PCBs and pesticides) from various point sources, the degree of mixing and export from the harbour. Bottom water samples provided information on water column loading by resuspension. The data, when compared to the sediment trap results, provides a short-term time-integrated picture, and sedimentation profiles which give the long-term time-integrated picture. Of major consideration is whether the input of individual contaminants of concern are declining or increasing and the ultimate fate of these compounds.

Water samples (18 litres) were collected from five stations near the sediment trap moorings and canal (see figure 7). On September 20, samples were collected at 1 m and bottom -2 m. In December, when the water column was well mixed, water samples were collected at 1 m. An additional sample was collected at the exit of Windemere Basin.

Effect of Reoxygenation on the Recolonization and Survival Ability of Chironomids, Dr. M. Hanna, LRB Study 82032

The objectives of this study were:

1. To determine the relationships between benthic invertebrate community structures and contaminants and how those relationships are effected by oxygen levels, and other physio-chemical variables, through a nearshore-offshore transect.

2. To determine the effect of oxygenation on the recolonization of Chironomids.

A total of six surveys were completed with twelve stations occupied (see figure 6) during each survey. Sediment samples were collected using an Ekman dredge filling one diaper pail per station. A cast of the WQ profiler was taken at each station as was a Secchi disc. Survey dates: May 11, 12; June 8, 22, 23; July 5, 6; August 2, 3; August 30, 31.

Effect of Iron and Steel Mill Effluent on Reduction of the Phosphorus Availability in Hamilton Harbour, T. Mayer, LRB Study 82030

The objective of this study was to learn whether industrial effluent can be used to remove phosphorus from the water column, consequently determining if the effluent is beneficial or detrimental to the harbour waters.

The shore sampling site was located on Stelco property at the foot of the Ottawa Street Slip where the discharge of the steel company's water enters the harbour, and the second site was located on the water at the outflow of the Ottawa Street Slip (see figure 8). Samples of effluent (3600 litres) were collected on two occasions (June 12, 13 ad August 29, 30) using a continuous flow Westfalia centrifuge.

Simultaneously, two-litre subsamples were obtained for determination of the concentrations of suspended solids, heavy metals and organic contaminants.

Hamilton Harbour Restoration, T.P. Murphy, LRB Study 82027

This study investigated alternative methods of treating contaminated harbour sediments. At present, the only procedure available for treating sediments is dredging which, when dealing with large volumes, becomes prohibitively expensive. Laboratory treatments include the use of alum, calcium hydroxide, ferric chloride, nitrate, oxygen, and a radioactive slag product.

Sediment samples were collected from 6 stations in the harbour (see figure 4) using an Ekman dredge.

Benthos core samples were collected at the southwest corner of the Stelco property. A total of 80 cores were collected at 80 stations using the SHARK and GOOSE II which were positioned from shore employing the Wild DI-3000.

Ekman Sampling: June 22, July 11 and October 31
Benthos Coring: April 6 and July 11

Water Clarity in Hamilton Harbour, D.S. Painter, LRB Study 82024

Support to this program was limited to the weekly scheduling of a small boat for sample collection.

Utilizing Benthic Invertebrates, Dr. T. Reynoldson, LRB Study 82015

Core samples were collected to study the temporal changes in benthic community structure. An IJC protocol to classify the degree of sediment contamination and the potential for bioaccumulation of contaminants was evaluated. On eight occasions, cores and Ekman dredge samples were collected monthly at two stations in Hamilton Harbour (Western Basin and Deep Basin (see figure 9)). Samples were collected on April 12, May 18, June 27, August 24, September 21 and October 24.

Hamilton Harbour Video, Dr. G.K. Rodgers, Study 85021

Support to this program was limited to the supply of video equipment to document ongoing processes around Hamilton Harbour.

Sedimentology of Hamilton Harbour, Dr. N.A. Rukavina, LRB Study 82029

Acoustic surveys of harbour sediments were undertaken on two occasions (mid-April and early October) to determine the methods required to estimate the thickness of modern sediments in the harbour and to compute the volumes required to dredge these contaminated sediments. An acoustic tripod used in combination with divers was tested to compare results with benthos cores taken on site and analyzed to obtain changes in the vertical structure of the sediments. Seven stations were selected for acoustic data collection (see figure 11). All stations were occupied in April but due to high winds in October, only one station (31) was occupied and the remainder of the trials took place at the CCIW dock.

Two transmissometer moorings were installed on April 21 to measure the amount of disturbance or resuspension of harbour sediments by ship traffic transiting the harbour. The transmissometers were refurbished on a 28-day cycle and moved to different stations (see figure 10). Refurbishment events follow:

April 21	Install A2	Install C2
May 17	Retrieve A2	Retrieve C2
May 18	Install A2	Install C2
June 14	Retrieve A2	Retrieve C2
June 15	Install A2	Install B2
July 12	Retrieve A2	Retrieve B2
July 13	Install A2	Install B2

August 16	Retrieve A2	Retrieve B2
August 17	Install A2	Install B2
September 13	Retrieve A2	Retrieve B2
September 15	Install A2	Install A4
October 11	Retrieve A2	Retrieve A4
	Install A2	Install A4
October 31	Retrieve A4	
November 10	Retrieve A2	

As part of an ongoing coastal survey at the foot of Green's Road in Stoney Creek, TOS divers took measurements and recorded on site changes with video on two occasions (April and December).

HAMILTON HARBOUR STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM N.
Mini-Ranger Shore Stations				
CCIW-CORN	43° 18′ 00"	79° 48′ 16"	4794605.	596971.
CCIW-HELI	43° 17′ 49"	79° 48′ 07"	4794268.	597193.
HARB.COMM.	43° 16′ 41"	79° 51′ 42"	4792098.	592375.
STELCO	43° 17′ 06"	79° 49′ 33"	4792908.	595260.
DOFASCO	43° 16′ 43"	79° 47′ 4"	4792228.	597617.
Barica-Nitrogen Survey				
1	43° 16′ 10"	79° 47′ 02"	4791239.	598692.
2	43° 16′ 30"	79° 47′ 35"	4791846.	597939.
3	43° 17′ 49"	79° 48′ 00"	4794275.	597341.
4	43° 16′ 35"	79° 53′ 00"	4791898.	590612.
5	43° 17′ 26"	79° 50′ 03"	4793526.	594579.
6	43° 18′ 24"	79° 48′ 26"	4795346.	596740.
Barica-Ammonia Survey				
1	43° 16′ 10"	79° 47′ 02"	4791239.	598692.
2	43° 16′ 14"	79° 47′ 09"	4791361.	598533.
3	43° 16′ 09"	79° 47′ 10"	4791206.	598512.
4	43° 15′ 57"	79° 47′ 15"	4790834.	598405.
5	43° 16′ 26"	79° 47′ 24"	4791726.	598189.
6	43° 16′ 44"	79° 47′ 34"	4792278.	597956.
7	43° 16′ 43"	79° 47′ 39"	4792245.	597843.
8	43° 16′ 29"	79° 47′ 44"	4791812.	597737.
9	43° 16′ 21"	79° 47′ 55"	4791562.	597493.
10	43° 16′ 07"	79° 48′ 02"	4791127.	597341.
11	43° 16′ 48"	79° 48′ 16"	4792388.	597007.
12	43° 17′ 21"	79° 48′ 18"	4793405.	596948.
13	43° 17′ 39"	79° 48′ 20"	4793960.	596895.
14	43° 17′ 44"	79° 48′ 08"	4794118.	597163.
15	43° 17′ 50"	79° 47′ 57"	4794306.	597408.
16	43° 17′ 55"	79° 47′ 46"	4794464.	597654.
17	43° 18′ 05"	79° 47′ 27"	4794779.	598077.
18	43° 18′ 13"	79° 47′ 09"	4795032.	598479.
19	43° 18′ 24"	79° 47′ 18"	4795368.	598272.
20	43° 18′ 20"	79° 47′ 43"	4795236.	597710.

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM N.
21	43° 18′ 33"	79° 47′ 50"	4795635.	597547.
22	43° 18′ 04"	79° 47′ 00"	4794757.	598686.
23	43° 17′ 48"	79° 46′ 54"	4794265.	598829.
24	43° 17′ 38"	79° 47′ 25"	4793947.	598134.
25	43° 16′ 35"	79° 53′ 00"	4791898.	590612.
26	43° 16′ 47"	79° 53′ 12"	4792265.	590336.
27	43° 16′ 49"	79° 52′ 04"	4792347.	591868.
28	43° 17′ 00"	79° 52′ 33"	4792677.	591210.
29	43° 17′ 15"	79° 50′ 44"	4793174.	593660.
30	43° 16′ 17"	79° 50′ 00"	4791398.	594677.
31	43° 17′ 26"	79° 50′ 03"	4793526.	594579.
32	43° 17′ 56"	79° 50′ 34"	4794442.	593868.
33	43° 17′ 37"	79° 49′ 26"	4793877.	595408.
34	43° 17′ 45"	79° 48′ 54"	4794134.	596126.
35	43° 18′ 36"	79° 48′ 57"	4795706.	596036.
36	43° 18′ 37"	79° 48′ 32"	4795745.	596599.
37	43° 18′ 24"	79° 48′ 26"	4795346.	596740.
38	43° 18′ 02"	79° 48′ 20"	4794669.	596885.
39	43° 18′ 35"	79° 46′ 28"	4795724.	599393.
40	43° 18′ 25"	79° 46′ 28"	4795724.	599393.

Charlton-Sediment Trap Moorings

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM N.
87-00A-50A	43° 18′ 26"	79° 48′ 50"	4795181.	596302.
			Spar 4795211.	596129.
87-00A-51A	43° 16′ 49"	79° 52′ 19"	4792217.	591351.
			Spar 4792221.	591186.
87-00A-52A	43° 17′ 26"	79° 50′ 03"	4793339.	593965.
			Spar 4793325.	593776.
87-00A-53A	43° 17′ 09"	79° 47′ 48"	4792918.	597734.
			Spar 4792993.	597906.

Charlton-Oxygen Survey

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM N.
A0	43° 17′ 50"	79° 47′ 58"	4794306.	597386.
A1	43° 17′ 42"	79° 48′ 13"	4794054.	597051.
A2	43° 17′ 35"	79° 48′ 42"	4793829.	596401.
A25	43° 17′ 30"	79° 49′ 06"	4793667.	595862.
A3	43° 17′ 25"	79° 49′ 31"	4793505.	595301.
A4	43° 17′ 15"	79° 50′ 18"	4793182.	594246.
A5	43° 17′ 05"	79° 51′ 06"	4792858.	593168.
A6	43° 16′ 56"	79° 51′ 54"	4792566.	592090.
A7	43° 16′ 46"	79° 52′ 42"	4792243.	591013.
A8	43° 16′ 47"	79° 53′ 18"	4792263.	590201.
B1	43° 18′ 24"	79° 49′ 11"	4795331.	595726.
B2	43° 17′ 57"	79° 48′ 50"	4794505.	596211.
B3	43° 17′ 26"	79° 48′ 24"	4793557.	596810.
B4	43° 17′ 07"	79° 47′ 52"	4792982.	597540.
B5	43° 16′ 40"	79° 47′ 37"	4792153.	597890.
B6	43° 16′ 08"	79° 46′ 58"	4791179.	598783.
B8	43° 17′ 00"	79° 48′ 42"	4792749.	596416.
B9	43° 16′ 18"	79° 47′ 15"	4791482.	598396.
B10	43° 16′ 30"	79° 47′ 27"	4791848.	598120.
C1	43° 17′ 43"	79° 50′ 30"	4794042.	593964.
C2	43° 17′ 00"	79° 49′ 48"	4792728.	594929.

Fox-Persistent Organic Contaminants

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM N.
50	43° 18′ 26"	79° 48′ 50"	4795181.	596302.
51	43° 16′ 49"	79° 52′ 19"	4792217.	591351.
52	43° 17′ 26"	79° 50′ 03"	4793339.	593965.
53	43° 17′ 09"	79° 47′ 48"	4792918.	597734.
CANAL	43° 17′ 55"	79° 47′ 46"	4794464.	597654.

Reynoldson-Benthic Invertibrates

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM N.
3	43° 16′ 50"	79° 52′ 20"	4792373.	591507.
19	43° 17′ 16"	79° 50′ 03"	4793217.	594584.

Hanna-Chironomids

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM N.
1	43° 17′ 48"	79° 51′ 08"	479184.	593105.
2	43° 17′ 46"	79° 51′ 07"	4794123.	593129.
3	43° 17′ 45"	79° 51′ 07"	4794092.	593129.
4	43° 17′ 44"	79° 51′ 06"	4794061.	593152.
5	43° 17′ 43"	79° 51′ 02"	4794032.	593242.
6	43° 17′ 42"	79° 50′ 58"	4794002.	593333.
7	43° 17′ 41"	79° 50′ 57"	4793972.	593356.
8	43° 17′ 40"	79° 50′ 55"	4793941.	593401.
9	43° 17′ 38"	79° 50′ 51"	4793879.	593491.
10	43° 17′ 32"	79° 50′ 41"	4793699.	593720.
11	43° 17′ 25"	79° 50′ 34"	4793485.	593881.
12	43° 17′ 19"	79° 50′ 20"	4793305.	594199.

Figure 1.
HAMILTON HARBOUR
NITROGEN REGIME STN. LOCATIONS

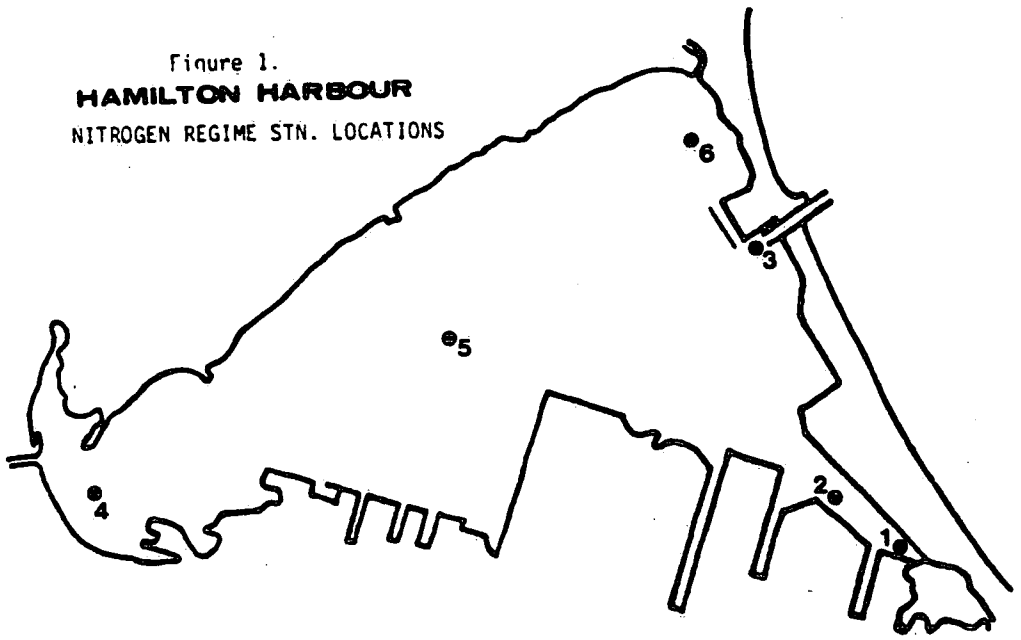
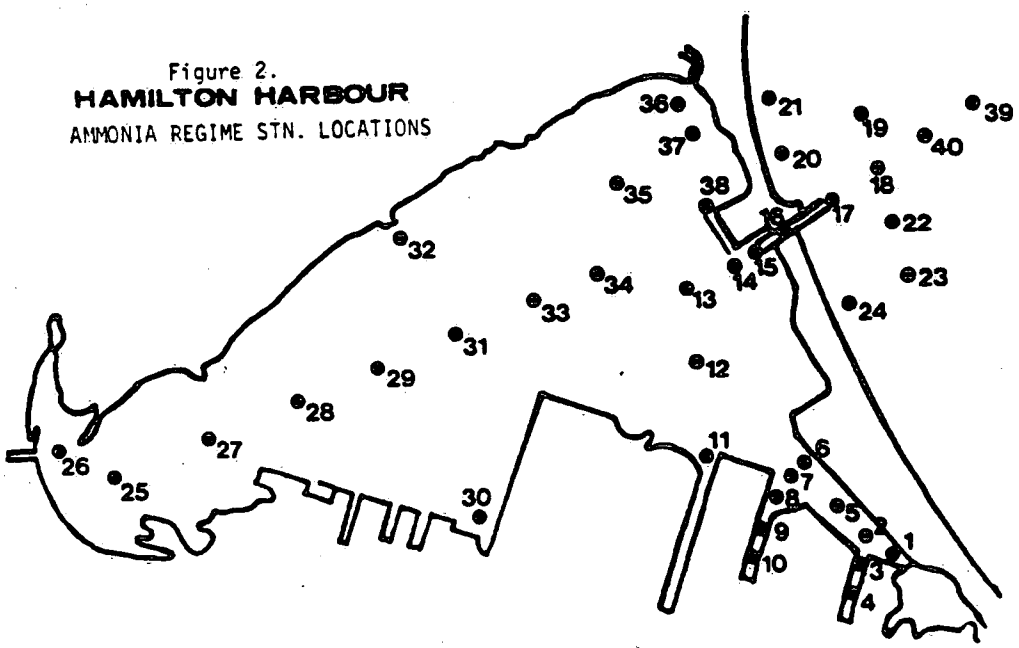


Figure 2.
HAMILTON HARBOUR
AMMONIA REGIME STN. LOCATIONS



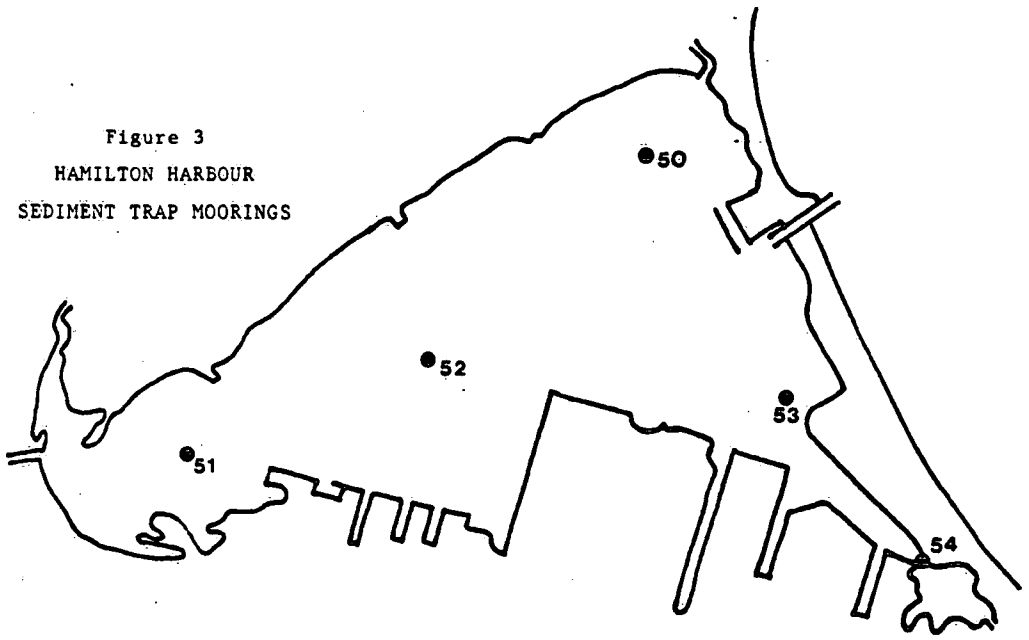


Figure 3
HAMILTON HARBOUR
SEDIMENT TRAP MOORINGS

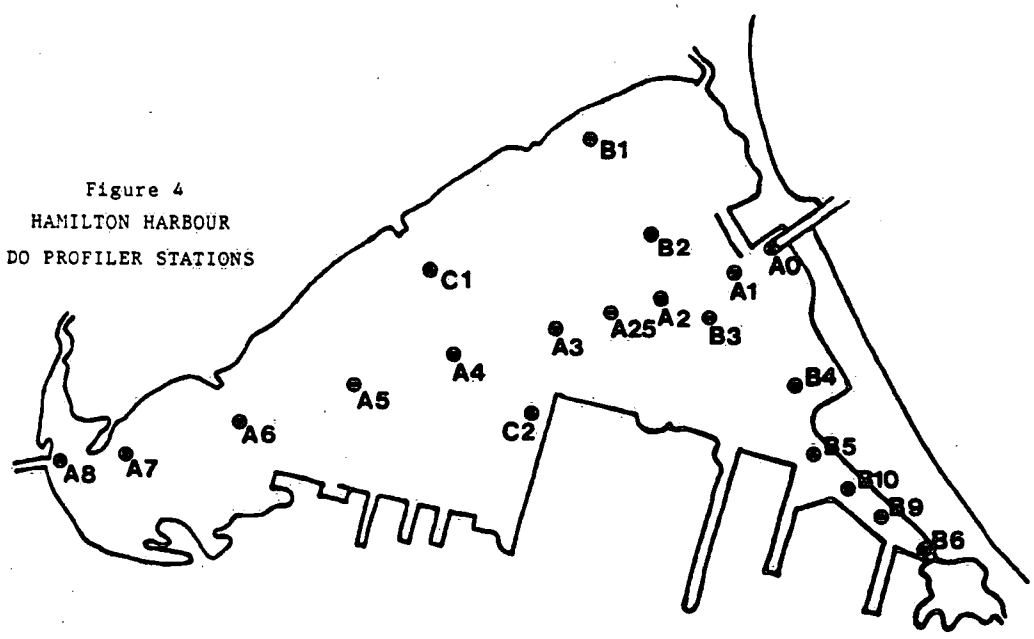


Figure 4
HAMILTON HARBOUR
DO PROFILER STATIONS

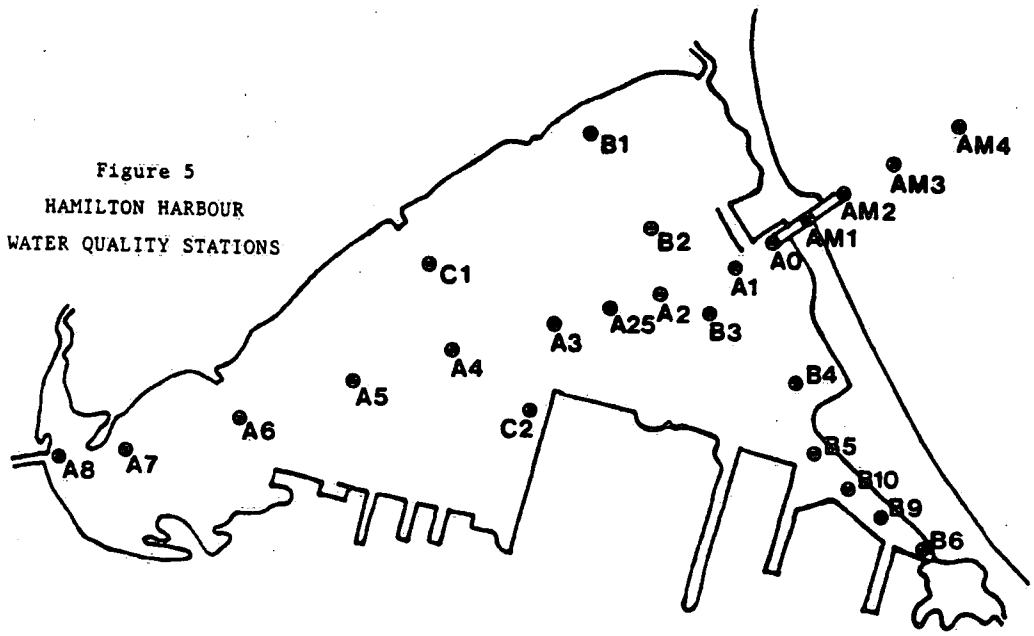


Figure 5
HAMILTON HARBOUR
WATER QUALITY STATIONS

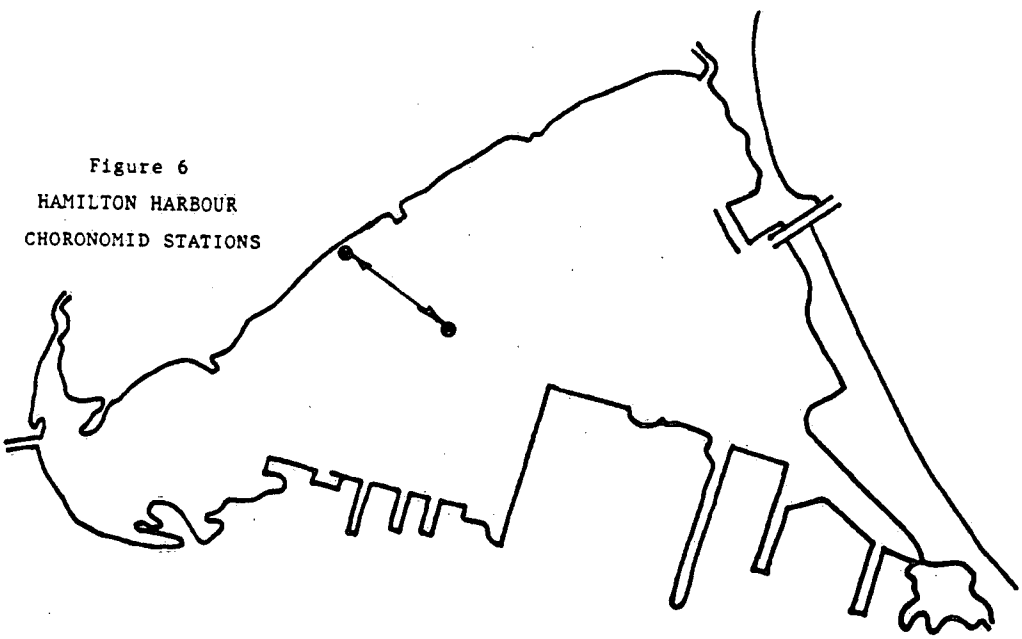


Figure 6
HAMILTON HARBOUR
CHORONOMID STATIONS

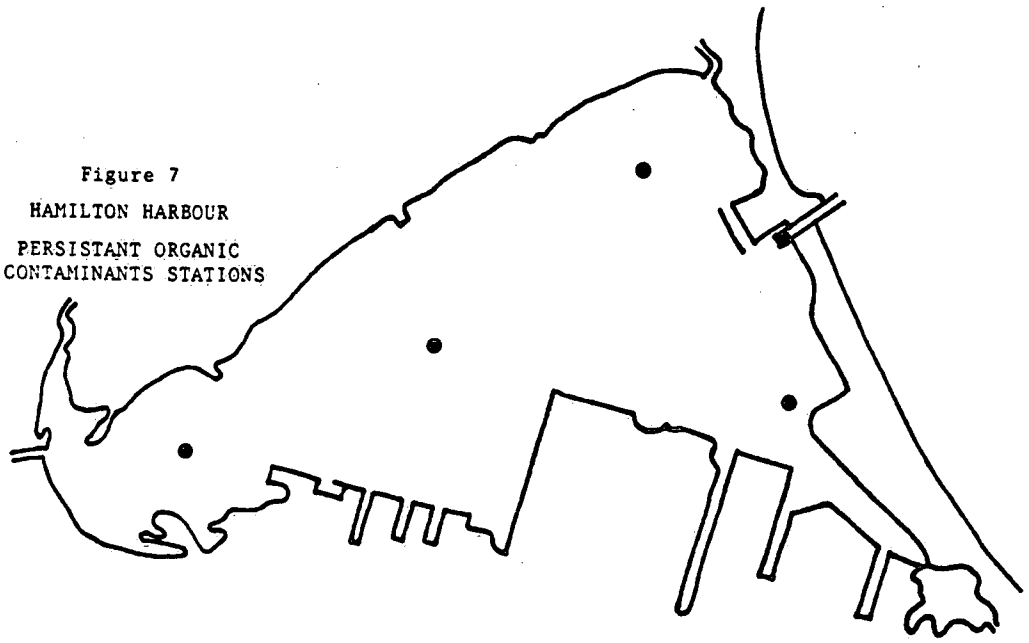


Figure 7

HAMILTON HARBOUR

PERSISTANT ORGANIC
CONTAMINANTS STATIONS

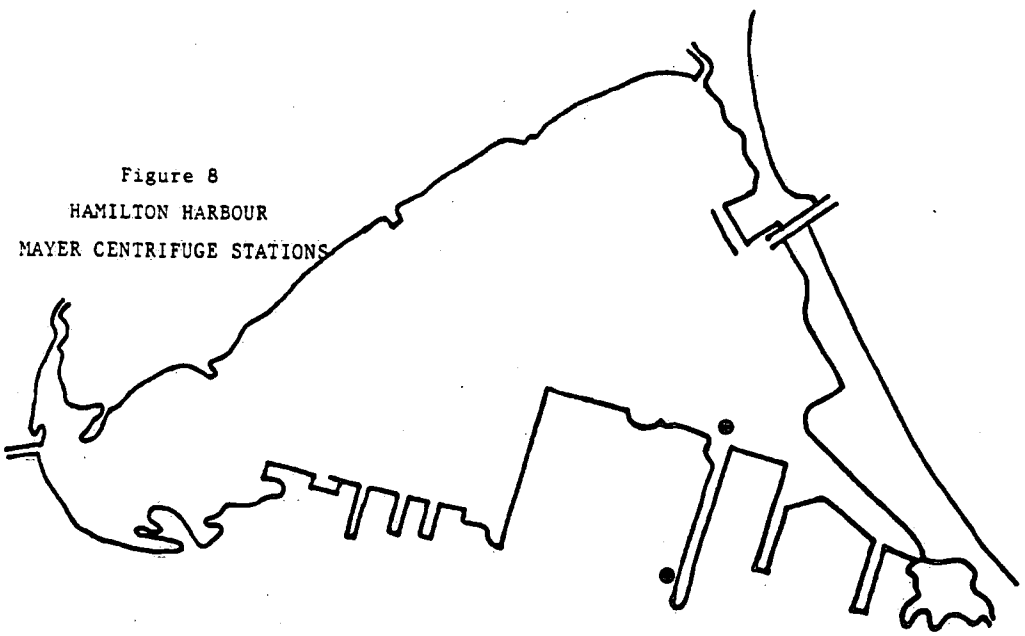


Figure 8

HAMILTON HARBOUR

MAYER CENTRIFUGE STATIONS

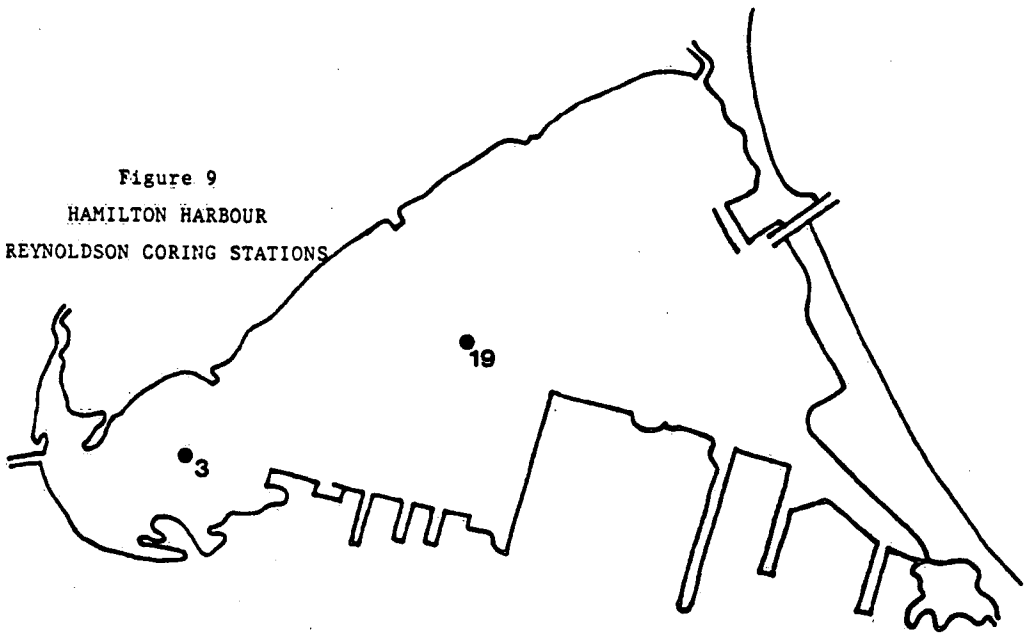
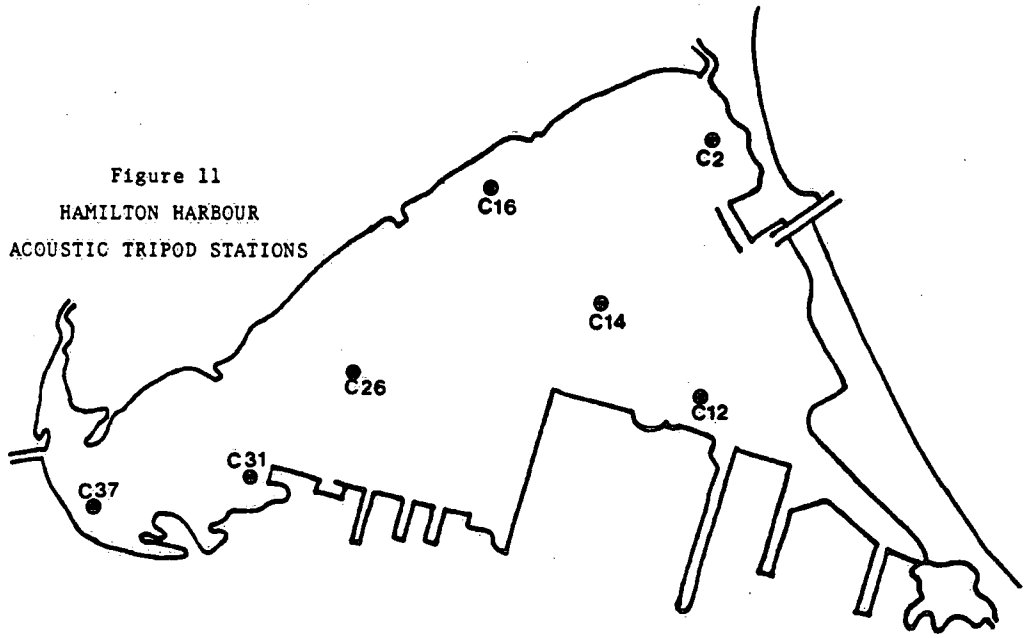


Figure 9
HAMILTON HARBOUR
REYNOLDSON CORING STATIONS

Figure 10
HAMILTON HARBOUR
XMS MOORINGS

Figure 11
HAMILTON HARBOUR
ACOUSTIC TRIPOD STATIONS



SEVERN SOUND

LRB STUDY 82002, DR. J.M. BARICA

Severn Sound has been identified as an International Joint Commission area of concern which has resulted in the establishment of a Remedial Action Plan Committee to study the area. The RAP Team will study environmental conditions and problems associated with this area by soliciting information from environmental groups, the scientific community and the general public. Several gaps in the data base were identified and the need for current research was determined necessary before deciding on remedial action.

A major requirement was to develop a nutrient supply budget for the Sound and selected bays. Dr. J. Barica, NWRI and RAP Committee member, undertook the study of nutrient parameters both by water quality sampling and by the use of interstitial porewater samplers (sediment peepers) to analyze the flux of nutrients from the sediment back into the water column. From the data acquired, information will be provided to complete a nutrient budget model and to determine loadings for STP's in the study area.

In addition to this, algae and aquatic macrophytes have been identified as problems in this area, impairing recreational usage. Since the area is widely used by boaters in the summer months, it was deemed necessary by the RAP Team to carry out the required research in this area.

During the winter months, under-ice oxygen depletion will be studied in order to check potential effects on fish populations and with respect to nutrient availability.

The Technical Operations Dive Unit undertook all field support for the Severn Sound Study. Four trips were made to the study area during the summer and two additional trips will be made during the late winter months.

A total of 17 water quality stations were occupied during each survey. Water samples were collected with a 3l Van Dorn bottle at surface -1, mid-water column or every 5 m, and bottom -1. Each sample was tested for pH, conductivity, temperature, total phosphorus (filtered and unfiltered), and chlorophyll. Additional work on station included an EBT/XMS cast, Secchi disc and a dissolved oxygen profile.

Interstitial porewater samplers (sediment peepers) were installed, refurbished and retrieved by divers at stations: P1, P2, P3 and B. Peepers were pushed into the bottom sediments until 10 cm remained above

the sediment/water interface and left for two weeks to stabilize before sampling.

Aquatic macrophytes were sampled in Sturgeon Bay (station BS1) and Penetanguishene Bay (station P1), using the Danforth method.

Chronology of Events

July 12 - 14 - Water quality sampling, 17 stations

July 24 - 28 - Water quality sampling, 17 stations
Peepers installed: stations P1 and P2

August 8 - 11 - Water quality sampling, 15 stations
Peepers removed: stations P1 and P2
Peepers installed: stations P2, P3 and B
Aquatic macrophyte samples: stations BS1 and P1

August 21 - 25 - Water quality sampling, 17 stations
Peepers removed: stations P2 and B

NOTE: The peeper mooring at station P3 had been removed and could not be found

Personnel

July 12 - 14 - F.H. Don, C. Vieira
July 24 - 28 - F.H. Don, K.J. Hill, C. Vieira
August 8 - 11 - F.H. Don, K.J. Hill, G.D. Bruce (1 day), C. Vieira
August 21 - 25 - F.H. Don, G.D. Bruce, C. Vieira

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
BS1	44° 45′ 00"	79° 44′ 20"
BS2	44° 46′ 00"	79° 43′ 25"
BS3	44° 46′ 24"	79° 45′ 36"
PM1	44° 45′ 00"	79° 47′ 18"
PM2	44° 46′ 10"	79° 47′ 54"
PM3	44° 47′ 48"	79° 48′ 24"
B	44° 50′ 40"	79° 51′ 42"
B1	44° 50′ 30"	79° 50′ 00"
M1	44° 45′ 24"	79° 51′ 39"
M2	44° 46′ 10"	79° 51′ 10"
M3	44° 47′ 00"	79° 50′ 45"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
M4	44° 48′ 42"	79° 50′ 12"
P1	44° 46′ 18"	79° 56′ 48"
P2	44° 47′ 15"	79° 56′ 20"
P3	44° 48′ 18"	79° 56′ 24"
P5	44° 51′ 12"	79° 53′ 54"
P6	44° 48′ 44"	79° 53′ 42"
P7	44° 46′ 16"	79° 56′ 40"

WHITBY, PORT HOPE

LRB STUDY 82011, DR. J.P. COAKLEY

There were three portions to this study: the Wave and Tide Recorder at Port Hope, the Dredge Site at Whitby and Sediment Sampling on the St. Lawrence River.

Port Hope Wave and Tide Recorder

A wave and tide recorder was installed from the CSS LIMNOS on Cruise 89-00-003 on June 16th in Lake Ontario south of the piers at Port Hope. A bottom-mounted Neil Brown current meter was also installed nearby at the same time to give current speed and direction. The data recording package on the wave and tide recorder was refurbished several times before retrieval by Technical Operations Section divers on December 11.

Whitby Dredge Site

In order to study the effect of the dredging of contaminated sediments in Whitby Harbour, sediment cores were collected, using a Brown's corer on June 21 at ten randomly selected sites nearshore of the proposed landfill area prior to the commencement of dredging operations to get background information. Once dredging operations had commenced, Cesium was added to the dredged material being placed in the landfill area at three separate times from mid-July to mid-October. Sediment cores were again collected from the same sites, using the Brown's corer in mid-December after ice had formed on the harbour to see if any Cesium had leached out of the landfill site. Cores will also be collected from these sites in 1990/1991.

ST. LAWRENCE RIVER

LRB STUDY 82011, DR. J.P. COAKLEY

A two-week field trip was made to the St. Lawrence River for sample collection for Dr. John Coakley. These samples were needed to help tie together an area of the river that was not completed during the CSS LIMNOS cruise of 1989. Bottom samples (Shipeks and benthos cores) were collected at several key areas along the south shore of the St. Lawrence River between Berthier at Pointe Verte east to Riviére-Trois-Pistoles. These samples will be analyzed, supplying data that are needed for the mapping of sediment transport which carries contaminants from upstream industry to the lower St. Lawrence.

A four-man team of L.E. Benner and H.A. Lavoie of Technical Operations Section, RSD, NWRI; Dr. Coakley, Lakes Research Branch, NWRI and R. Gammon, Bayfield Institute, DFO worked the survey area from August 8 to August 18. Shipek and benthos bottom samples were collected from predetermined areas along the south shore. The new CSL GANDER (barge) was utilized for the sampling. The GANDER proved to be an excellent craft for the job. Its flat-bottom design (shallow draft) and high speed, delivered by its twin diesel engines, helped us contend with long distance steams and shallow water tide cycles. It was also fitted with a high aluminum davit, gas winch and side-mounting bracket to accommodate our sonar transducer. This made sampling easy and the transducer could quickly be brought inboard for high speed travel between sounding lines.

A mini-ranger system was used to accurately fix station positions after they were determined from sounder traces. The King Loran C proved to be invaluable for ball park fixes and navigating. Mini-ranger transponders were installed at several different old Hydrographic bench marks along the south shore. These transponder sites were installed from the road using the van since most were not readily accessible by boat because of low tide or rugged shoreline.

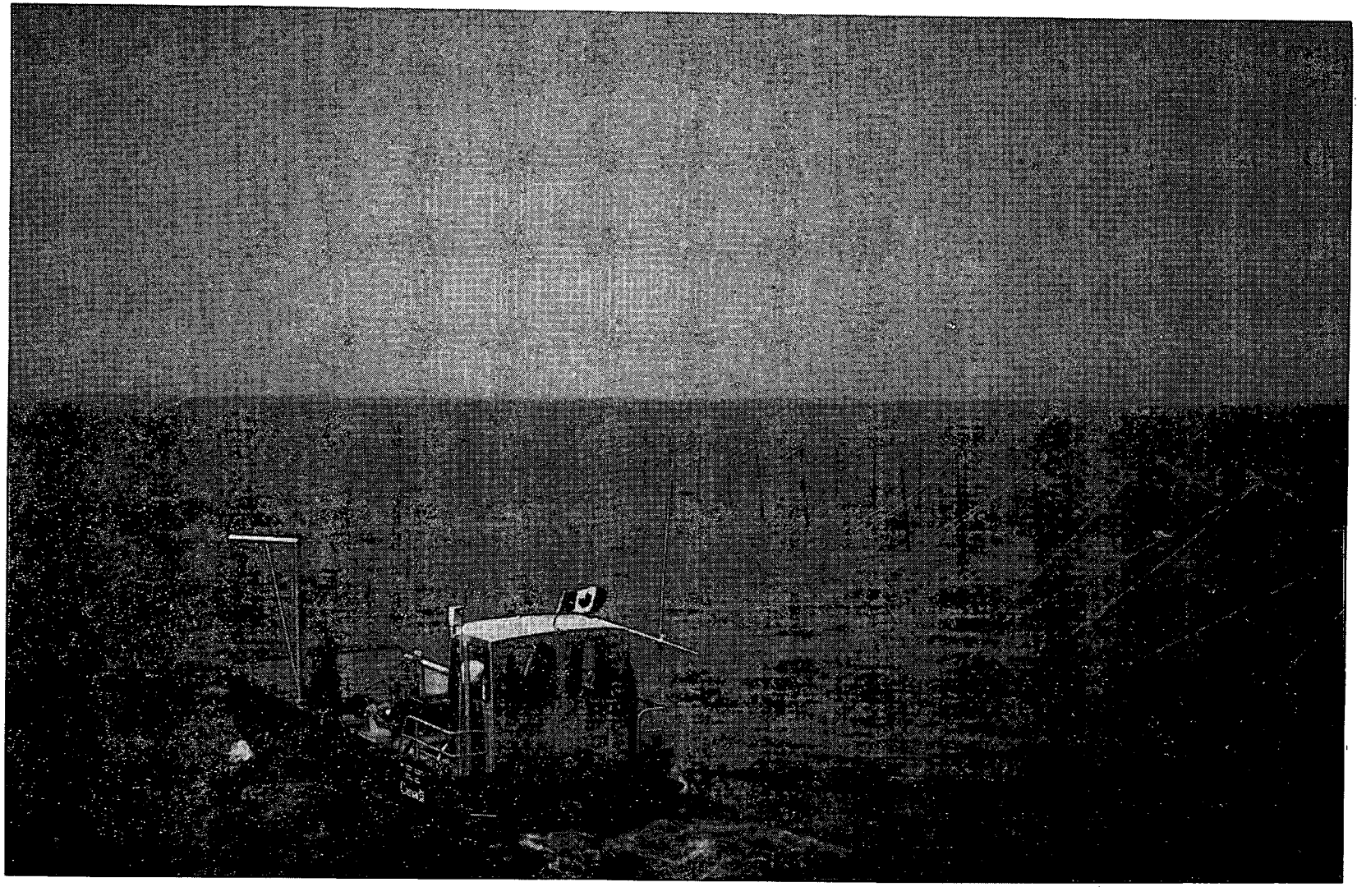
Small hand-held radios were used for communication between the van and boat when we split into two-man teams for transponder installation. On a couple of occasions, transponders were installed by boat on islands in the river.

Mr. Gammon trailered the launch, GANDER to the survey area using the DFO vehicle "Stubby". He also stayed and ran the launch during the survey. This worked out well since the extra set of hands made a big difference. Also, Mr. Gammon had worked extensively in this area in years past. The

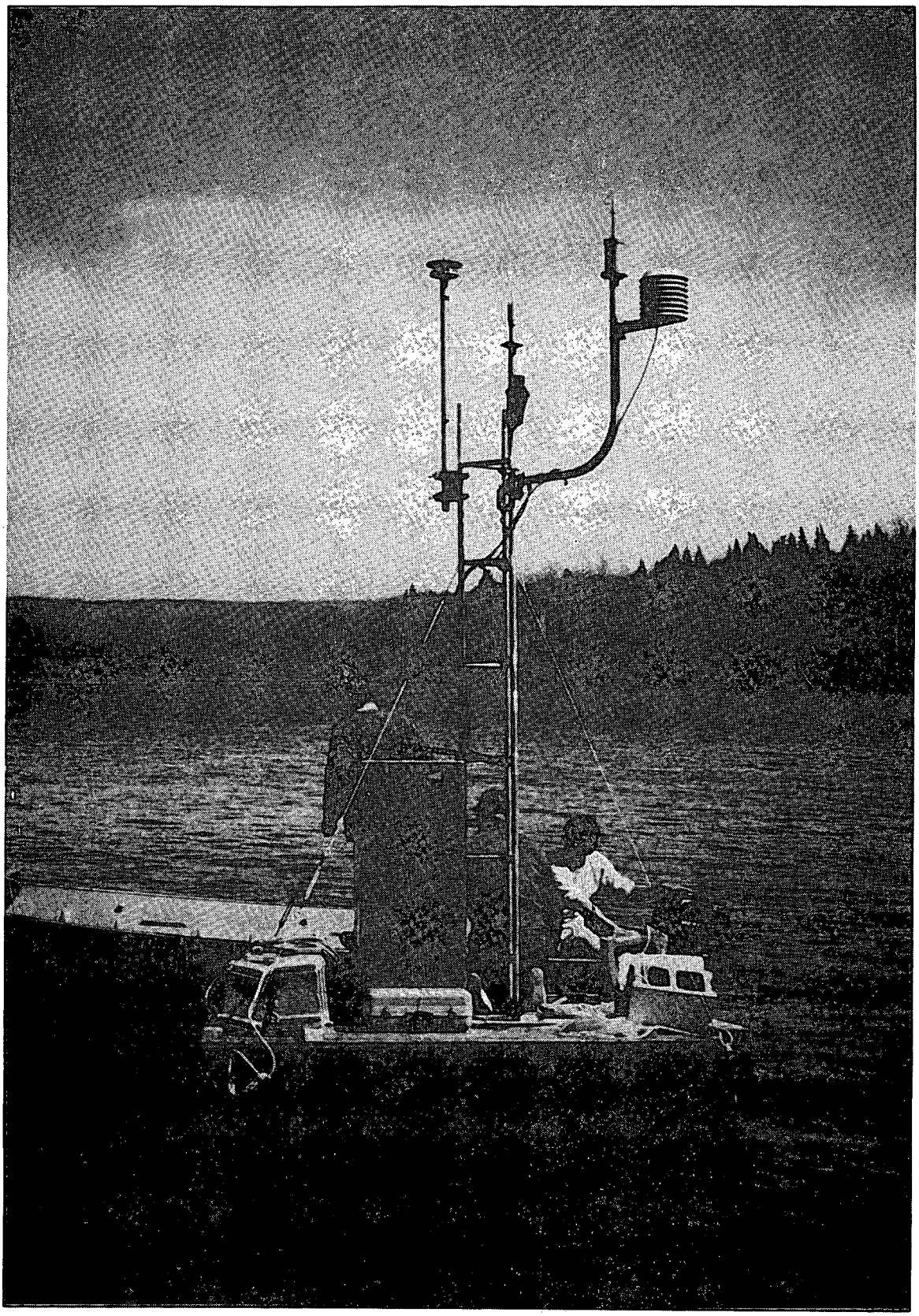
survey was completed without any launch problems and not even a scratch to the propellers.

We started the survey based at Riviére-du-Loup and then moved twice up the river to Saint-Jean-port-joli, and then to Montmagny.

Other than off-and-on adverse weather conditions (wind, rain and fog) throughout the survey, no major problems were encountered. However, survey logistics were difficult since this area of the river has very limited launch and tie-up facilities. Although many large docks were built in this area years ago with hopes of attracting new business with the opening of the St. Lawrence Seaway, this shot in the arm never materialized and most of the docks were never maintained and are now in disarray and unusable at low tide.



SEDIMENT SAMPLING, ST. LAWRENCE RIVER



MET STATION, AMISK LAKE, B.C.

PEACE RIVER, AMISK LAKE

LRB STUDY 82023, DR. T.P. MURPHY

PEACE RIVER, ALBERTA

On June 11, Technical Operations Section divers travelled from CCIW to Peace River, Alberta to provide technical and diving support to Dr. T. Murphy (Study 82023). The work involved the installation of a sea curtain across the mid-points of two dugouts (farm ponds) and tucking them into the bottom sediments to prevent the exchange of water between each half.

The curtains supplied resembled a standard plastic tarpaulin with a flotation collar along the top and a ¼" chain sewn into the lower seam. The seams in the curtain were "heat-bonded" and not sewn as is the standard practice for this type of installation. During the installation of the first curtain, it was noted that it could not touch the bottom in the middle. To compensate for the short curtain, it was decided to rent a water pump and lower the water level in the dugout by 16". As the pump worked, we commenced work at the second dugout. Again, the curtain was installed and found to be too short so we had to lower the water level in this dugout as well.

The next day, with the water levels down, we proceeded to tuck the curtains into the bottom, using boulders to hold down the buoyant curtain slack onto the bottom. At the near completion of this task, one of the seams in the curtain separated. The curtain at the second dugout had also separated at a seam. Both curtains were removed from the dugouts and returned to Edmonton for repair. Once the curtains had been repaired, contract divers installed them in the dugouts.

AMISK LAKE, ALBERTA

On Tuesday, October 10, a Technical Operations Section Dive Team (Don, Hill and Gray) travelled to Amisk Lake, Alberta (160 km north of Edmonton) to retrieve, refurbish and install an oxygen aeration system which was installed in 1988. The purpose of the aeration system is to increase the oxygen levels in the large volume deep basin to a quantity which will support large numbers of larger game fish. The oxygen levels have been rising but there are concerns over the efficiency of the distribution of the oxygen into the water column. During a previous trip (June 15, 1989), TOS divers inspected the aeration system and

reported that the grid frame was positioned nearly vertical and that only 20% of the surface area of the wands was functioning. Repairs and rigging were undertaken by TOS divers due to their experience operating in deep, dark waters and video documentation of the system, using MURV and diver-held cameras.

Prior to the start of the refurbishment, a series of current measurements were taken around the aeration site. A direct reading Neil Brown current meter was used from an anchored small boat. It would be reasonable to assume that the readings from the current meter would be less than accurate as a result of the inability to keep the boat in a stationary position. It is hoped that rather the readings would show some element of change in the before/after current patterns surrounding the aeration site. Current readings were collected at the four compass points around the site at horizontal distances of 10 m, 25 m and 50 m away from the centre and at depths of 1 m, 3 m, 5 m, B-5 m and B -1 m. A current profile was also obtained in the narrows between the two basins with readings collected at every metre of water depth.

The existing aeration grid was lifted to the surface and floats were attached for the tow back to shore. A total of 50 wands were replaced with new ones and a new chain lifting bridle was installed. Six "Grimsby" floats were attached with poly rope along each side of the grid. The grid was moved into shallow water for testing and ballasting. Concrete weights were positioned 2 ft. below each float. The buoyancy of each float was measured at 10 lbs., minus the 8 lb. weight in water of the concrete weights, leaving the grid frame in tension between the two with a net buoyancy of 2 lbs. This should add an additional 24 lbs. of dead weight to the frame when lifting but does not take into effect the suction of the weights in the sediments. Floats were re-attached to the frame and it was towed back to the site.

The floats were removed and the frame lowered to 10 ft. where the divers re-attached the weights, the main oxygen supply line and the strain relief support at the hose connection. The oxygen flow was turned on and observations were made of the oxygen flow from the wands. Most of the wands were functioning and some contained water which was being slowly purged. Both MURV and the divers recorded observations on video tape. The frame was lowered to the bottom and a final inspection and video documentation was undertaken by MURV. The frame was sitting level at 100 ft. on a soft silty bottom. The anchor weights had settled in 6 inches and the floats were holding the frame still. The oxygen supply hose departed the grid at an angle of 45° and could require more ballast to hold it down. The chain lifting bridle was partially laying on the wands and will require the replacement of the Styrofoam float with a "Grimsby" float. All sections of the frame were observed and all wands were functioning with at least 80% efficiency with a very fine bubble pattern. This value should increase as water is flushed from the system over time. A concern about the vertical forces created by the upward flow of bubbles appeared to be unfounded since large particles of algae drifting in the lake current continued through the bubbles, seemingly unaffected. The lifting lines were tied off with two foam-filled jugs

at 6 ft. below the surface. These jugs should also be replaced with "Grimsby" floats. Some of these floats will be sent to Jay as soon as the order is received.

The meteorological station was removed as divers disentangled the thermistors from the mooring wire. The raft was towed to the island and pulled up on shore. All meteorological hardware was shipped to CCIW. The TOS Dive Team returned to CCIW on October 15th.

CHAIN LAKE

LRB STUDY 82023, DR. T.P. MURPHY

The purpose of this project was similar to last year's, being: to observe the effects of various types of portable dredges on small lake and document the effectiveness of the dredges; to enhance plant growth in sediment berms; to monitor the effects of dredging on a small lakes; and to lime sediment berms to neutralize the natural acidification of the berms. The lake studied was Chain Lake northeast of Princeton, British Columbia.

Technical Operations supported this project in May and September. The spring trip involved driving all sampling and dredging equipment to Chain Lake via Amisk Lake in Alberta where a MET station was installed. Extensive dredging was to be conducted but due to a major breakdown in the dredging system, it was postponed until the fall. Several other areas of the study were completed during the spring visit, including: the planting of 2000 cattails to enhance the growth in the berms; surveying the southern end of the lake to better map the area and tie in the dredged site to the shoreline; sampling the lake for oxygen, conductivity, temperature, phosphate, and major ions. All dredging equipment was stored at the lake until September.

The September trip was occupied by: spraying lime on berms nos. 1, 2 and 3; sampling the lakes and berms for oxygen, pH, phosphate, major ions, temperature and copper; mapping the cattail growth in the berms; sounding the dredged site for any depth changes and continuing to test various dredges; monitoring the T-frame installed in the deep hole for Dr. Rukavina for any depositional changes. The T-frame was calibrated (physically measured and electronically read were very close) and several sets of readings were collected over a two-week period. It was noticed that any wave action occurring when a monitor was being conducted caused the reading to fluctuate indicating that the T-frame may be loose in the sediments. Due to design changes on the dredging system and time constraints, only one dredge head was tested. The dredge head was built locally and proved to be very efficient and much more portable than the head transported from CCIW.

On completion of the survey, all dredging material was left at the lake for the local people to employ to keep the dredged site as it was when the commercial contractors completed their work in 1988.

DREDGING, CHAIN LAKE, B.C.

SEDIMENT TRAP MOORINGS

BAY OF QUINTE

LRB STUDY 82028, M.E. FOX

Sediment trap moorings were placed in the Bay of Quinte area during the period May 29 - June 2 from the CSL SHARK. A single point bottom-mounted sediment trap mooring was placed in Big Bay while U-shaped sediment traps were placed near Glenora and near the Lennox-Addington Generating Station at the Upper Gap. Centrifuged water samples and sediment cores were also collected from the mooring sites at installation.

The moorings were removed during the week of Septemer 11 - 16. The moorings at Glenora and in Big Bay were removed by the CSL SHARK while the mooring at the Upper Gap was removed by the CSS LIMNOS.

SEDIMENT CORES

BAY OF QUINTE

LRB STUDY 82025, DR. P.G. MANNING

Sediment cores were collected from the Bay of Quinte in the area from Glenora to the Upper Gap from the CSL SHARK on Cruise 89-00-701, May 29 - June 2. Cores were subsectioned onoard and the sections frozen.

Centrifuged water samples for total phosphorus and suspended sediment samples were collected at station 864, Moira River at Belleville and at station 867, Trent River at Trenton on April 4 and 5 as well as on October 26 and 27.

BIOAVAILABILITY OF PHOSPHORUS

The bioavailability and geochemistry of iron phosphorus and heavy metals was studied in twenty-four sampling sites in the Trent River and Bay of Quinte. Three sites were located in the upper bay of Quinte and twenty-one were situated between Trenton and Sturgeon Lake. Bulk water samples (600L) were collected and centrifuged at a flow rate of 6L/min. The particulate matter collected from the centrifuge bowl was frozen before being transported to CCIW for analysis. At each sampling depth, samples were collected for filtered and unfiltered total phosphorus. At Rice Lake and Pigeon Lake, a benthos core was collected and extruded.

SOUNDER TRIALS

HAMILTON HARBOUR/JORDAN HARBOUR

LRB STUDY 82029, DR. N.A. RUKAVINA

During the weeks of June 12 - 17 and 26 - 30, tests were done on a dual frequency sounder system. This system utilized two Lowrance X-16 sounders equipped with high and low frequency transducers. There were two low frequency transducers with different beam widths. During the week of June 12 - 17, trials were done on the west end of Lake Ontario near the Burlington Canal Piers, in Hamilton Harbour, and at Jordan Harbour. These different locations provided a variation in bottom sediments.

During the week of June 26 - 30, the sounders were used on Lake St. Francis in conjunction with the Centre Saint-Laurent in Montreal. Poor weather conditions hampered this portion of the survey but most work was completed before staff returned to CCIW on June 30.

EAST LAKE SEDIMENT CORES

LRB STUDY 82055, DR. L.D. DELORME

Sediment cores were collected from East Lake at two sites on November 8 and 9. These cores were the long, lightweight type obtained utilizing two boats held together with a platform on which a 5-metre scaffolding was mounted. Cores of 2.5 an 3.7 metres were collected. After collection, they were extruded in 1 cm sections and returned to CCIW for freeze drying and analysis.

FATE AND EFFECTS OF PULP MILL RELATED CONTAMINANTS IN RECEIVING WATERS

LRB STUDY 82061, DR. J.H. CAREY

The Canadian International Paper Mill in La Tuque, P.Q. was chosen to study the fate and effects of pulp mill related contaminants in receiving waters. To conduct this Study, two trips were made--May 29 - June 2 and August 13 - 18.

This was a co-operative study between scientists of Environnement Quebec; Environment Canada's new Centre Saint-Laurent; NWRI; Great Lakes Laboratory for Fisheries & Aquatic Science, DFO; and Centre Maurice Lamontagne. Also present were scientists from Université Laval in Quebec City and staff from the consulting firm of Intrabec.

The first trip--May 29 - June 2, was a "reconnaissance" trip since nothing was known of the area north of Trois Riviére. Trips were made between Trois Riviére and La Tuque investigating access to the river and possible sites to set sediment traps. Five (5) sites were chosen--1 above the CIP mill and 4 below. At the 4 downstream sites, sediment traps were set, water centrifuged and sampled and sediment collected.

Sampling during the second trip was more intensive with the addition of biota sampling. DFO collected 143 fish that were dissected and organs sampled and preserved for later analysis. Other biota (invertabrates) were sampled from the shore. The sediment traps were revisited and two were retrieved and sampled; the other two were lost. Water was also centrifuged, and collected for: Crab-APLE extractions, D.O.C., chlorophenols, pH and conductivity.

Whereas 3 personnel were present during the first trip, as many as 19 were present during the second trip. Five vehicles were used--3 from Technical Operations Section and 2 from DFO.

All equipment was returned to the Centre along with the samples.

FISH DISSECTING, LA TOUQUE, P.Q.

ATHABASCA RIVER

RRB STUDY 83000, DR. E.D. ONGLEY

This study was a reconnaissance study for future studies on the Athabasca River to investigate the presence of Poly Aromatic Hydrocarbons (PAHs) as a result of natural sources and from the exploration of the tar sand areas through which the Athabasca River and many of its tributaries run.

This study was supported by Messrs. S.B. Smith and K. Versteeg of Technical Operations who departed CCIW on July 24 with two vehicles loaded with equipment and towing two specially equipped boats which were purchased to support this study. Rivers Research Branch staff: Dr. R.A. Bourbonniere, Dr. B.G. Brownlee, Ms. J. Metcalfe, Ms. G. MacInnis, and Ms. A. Koffyberg were met in Edmonton on July 30 and all staff continued on to Fort McMurray, Alberta.

While staff were preparing for sampling on the river, Ms. J. Metcalfe and staff from RL&L Environmental who were contracted to obtain fish samples, collected White Sucker, Goldeye, Walleye and Pike samples from the Beaver Creek Reservoir, the Sedimentation Pond, Mildred Lake and the Athabasca River between Syncrude and Fort McKay. These fish samples were disected and frozen for future analysis.

Once all equipment such as the Alfa Laval centrifuges, generators, pumps and sampling equipment has been mounted on the 26 ft. boat, Miss L'Ed, a trial site at mile 3 on the Athabasca River above the Clearwater River was sampled and the boats moved on down to the Syncrude Dock at mile 27. Samples were collected at mile 25 on August 3 and at mile 24 on August 5. Samples obtained were suspended sediment from the centrifuges with each centrifuge kept separate. Four soda can extractions were done using dichloromethane on centrifuged water--one base and one acid from each of two samples--one with a spike and one without. DOC samples were taken from the centrifuged water--filtered centrifuged water and filtered raw water. Duplicate Seston samples were obtained from raw and centrifuged water. Two resin column samples on centrifuged water and two bedload sediment samples were also obtained. The other boat--an 18 ft. vessel, Miss Fitz was utilized to obtain conductivity and sounding profiles and to act as a supply vessel for the Miss L'Ed which was at anchor.

Water Quality personnel--Messrs. R. Crosley and D. Donald, arrived on August 5 and 6 respectively to begin the downriver trip while Ms. J. Metcalfe and Ms. A. Koffeyberg departed for CCIW. Rising water levels and a large amount of debris floating downriver caused sampling to be

delayed until August 10. Samples were collected at mile 16, mile 34, mile 69 and at mile 133 before continuing on to Fort Chippewyan on August 12. Staff camped alongside the river at night. Samples collected were similar to those at mile 24 and mile 25 except that the resin columns were not done and a Large Volume Extraction (LVX) was done on acid and base spiked samples at each site. Acidified centrifuged water samples and bedload samples were also collected for Dr. Y.K. Chau. Fish samples were obtained at mile 133.

Dr. B.G. Brownlee departed from Fort Chippewyan and was replaced by Ms. J. Peddle, WQB-Yellowknife. Staff departed Fort Chippewyan on August 13 and transitted to Carlson's Landing on the Peace River. Samples were collected from near Peace Point at mile 69 on the Peace River on August 14 and staff returned to Carlson's Landing for the night. Samples collected on the Peace River were the same as those collected on the Athabasca River. On August 15, staff transitted from Carlson's Landing to Fort Fitzgerald on August 16 in the same manner as the Athabasca and Peace rivers.

On August 17, Dr. R.A. Bourbonniere and Technical Operations staff transitted upriver with the two boats to Fort Chippewyan. All other staff left Fort Smith by aircraft. Dr. E.D. Ongley joined staff at Fort Chippewyan for the upriver trip to Fort McMurray on August 18 and 19 with a stop overnight to camp at Clauson's Landing. Bulk sediment and water samples were collected at previous sample sites for B. Dutka, RRB on the upriver trip.

After packing equipment and samples for shipment to CCIW, winterizing the boats and cleaning up equipment and the warehouse, all staff returned to CCIW.

CLAM COLLECTIONS

ST. LAWRENCE RIVER

RRB STUDY 83013, J. METCALFE

This study was conducted jointly with Dr. R. Greene and L. Grapentine of the University of Western Ontario. They provided dive support under the supervision of the Research Support Division Diving Operations Unit.

From June 19 - 28, freshwater mussels were collected at eleven different sites in the St. Lawrence River. A control site at the Water Quality Sampling Station was chosen because of its upstream location. In the Cornwall area, six stations were sampled. Two sites were selected in the Montreal area--one on Lac St. Louis and one downstream of Montreal Harbour. Two more sites--one upstream and one downstream of Sorel, were sampled.

Different collection methods were used depending upon river current conditions, underwater visibility, boat traffic, sediment contamination levels and water depth. At a site near Cornwall the water depth and clarity allowed the use of only fins and snorkel for sample collection. Two other sites--one near the Grass River and one downstream of Sorel, required the use of an Ekman dredge and an oyster rake because of extreme turbidity and increased boat traffic. At all other sites, a "buddy" pair of divers with a safety diver and tender onboard was used to hand-pick a representative sample of mussels. Dive sites were all near shore and did not exceed 11 metres. Although river currents were present, they were not strong enough to abort any dive attempts but were beneficial in keeping the dive site clear of suspended sediment.

Each day after the samples were collected, dissections of the mussels were done. Various parts of each animal were subsampled, weighed and frozen in liquid nitrogen. Species identification, age and sex was also determined at this time. This process required a motel room to be temporarily set up as a laboratory.

CENTRIFUGE COMPARISON

RRB STUDY 83016, H. WONG

The Alfa Laval centrifuge was purchased for the Athabasca River Project. Compared to the Westfalia centrifuges, the Alfa Laval unit runs on 110 volts versus 220 volts, and is considerably lighter in weight.

A comparison test was set up to evaluate the efficiency of the units in the field and controlled conditions in removing sediments and organic materials. This test had been slated for the fall of 1988 or early spring 1989 but was postponed until October due to the late delivery date of the Alfa Laval and the fact that it was needed immediately for field projects.

The test consisted of a controlled run for each centrifuge at 4L/min. and at 6L/min., and 2 similar field tests. The controlled test involved mixing 20 gm dry weight of a premixed sediment sample with 600 litres of aged tap water. The mixture was kept in suspension using a small pump in the tub. At each flow rate, 600 litres of the standard mixture was passed through each centrifuge. A sample of the discharge was collected from each run to attempt to account for the total 20 gm input.

The field tests were run near Brantford on the Grand River. Both centrifuges were run simultaneously at 6L/min. for 3 hours and again at 4L/min. for 2½ hours. The river water was supplied by a single pump using a tee-connector. Samples of the discharge were again collected to compare efficiency.

The analysis of the samples collected is ongoing and the results will be forthcoming.

TURKEY LAKES WATERSHED

RRB LRTAP STUDY 83021, R.G. SEMKIN

The Turkey Lakes Watershed Study is an ongoing project monitoring the movements and effects of Long Range Transport of Airborne Pollutants (LRTAP) on the sensitive aquatic ecosystems of the watershed. The chemical and hydrological monitoring of the study area was begun in 1980 and has been supported by Technical Operations throughout this period.

The study site is located on the Canadian Shield 50 km north of Sault Ste. Marie and 25 km east of Lake Superior. The watershed consists of five small lakes from 6 ha to 52 ha in size. The area is in the very rugged Algoma Highlands, totally forested, uninhabited and receiving the highest amounts of precipitation in Canada, east of the Rockies.

Technical Operations' support consisted of one full-time technician stationed in Sault Ste. Marie. Equipment support consisted of one full-time 4-wheel drive vehicle used for transport to the study area. A second 4-wheel dive vehicle was utilized during the winter months. In addition, 4 snowmobiles and 4 all-terrain vehicles were supplied and maintained by Tech. Ops. for use as transportation throughout the watershed. All tools, sampling and safety equipment for the study were supplied by Technical Operations.

A security system at the camp work site and a 2-way radio system were operated by Tech. Ops. and maintained by the Communication Centre in Sault Ste. Marie. All roads and trails in the watershed were also maintained by Tech. Ops. with assistance from the Canadian Forestry Service at Sault Ste. Marie.

The Department of Fisheries & Oceans' support consisted of six small aluminum boats and one canoe (14 - 16 ft.). One outboard motor and other items to make the boats safe and operational were also supplied. Tech. Ops. supplied 2 electric motors.

Tech. Ops. staff supported Rivers Research Branch staff in chemical and hydrological monitoring of the watershed. The hydrological monitoring consisted of gauging and sampling seven stream locations throughout the watershed on a weekly basis and the samples were analyzed for numerous chemical parameters. Five lakes were sampled on a bi-weekly schedule for the same chemical parameters with the exception of the spring and fall when they were sampled once a week. During the winter, snow cores were collected at 13 locations on a weekly schedule.

During the year, rain volume and snow volume (Nipher) samples were measured and changed weekly. Isco samplers were installed at two locations in the watershed in early February and operated until June. Samples were collected every 12 hours.

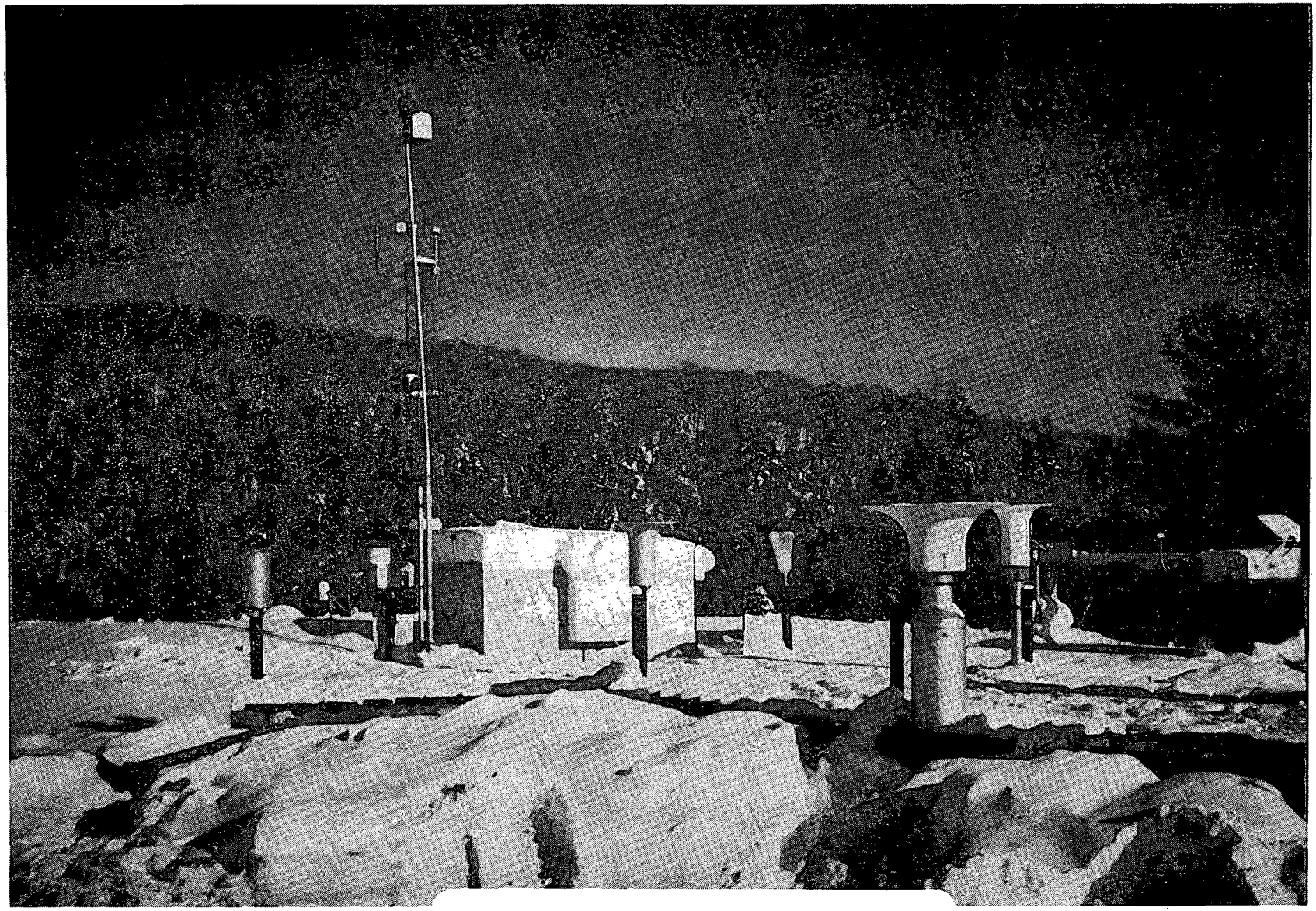
To supplement hydrological and chemical data, a full meteorological station and solar radiation unit were operated on a year-round basis by Technical Operations. This year, a modernized system was installed and operated on a parallel with the old MET system in the hope that this will be a permanent replacement once the data from both systems have been analyzed. The new MET version allows the data to be "dumped" at the site before the can is shipped to Burlington for analysis. It also allows the operator to make any necessary program changes.

Technical Operations supplied additional support during intensive sampling periods. One TOS member supported the study during the intensive "Spring Runoff" period (March 27 - April 27).

In support of the project, approximately 6 miles of trails were brushed back during the fall. This will allow easier vehicle, skidoo and ATC access throughout the year. Two bridges were constructed across the streams to allow for additional trail use in the winter months.

Support to Water Quality Branch-Ontario Region is ongoing on a monthly basis. This requires travel to a sampling location on the Goulais River 80 km from Sault Ste. Marie. In the winter, the road to the site is not maintained and skidoos are required to travel 10 miles along this road to the sample site. Samples are collected for trace metals, major ions, nutrients, phosphorus, pH and mercury analysis. The samples are then shipped to Burlington according to regulations required by the Transportation of Hazardous Goods Act for analysis by WQB personnel.

All maintenance and repairs to equipment, buildings and vehicles was performed by Technical Operations.



MET STATION, TURKEY LAKES

GROUNDWATER

RRB STUDY 83043, K. NOVAKOWSKI

As in the two previous seasons, Technical Operations supported the Groundwater Project with a full-time technician during the periods between May 1 to July 1, and in the fall from November 15 to December 31, as well as a lab trailer at the Clarkson site year-round and the required vehicle support.

The month of May was occupied at the Clarkson site located on the Petro-Canada Refinery site halfway between Oakville and Toronto. This site was begun in 1987 and had 13 bore holes in place and 6 new holes were added this year. These holes were tested for permeability. New packer systems were built at CCIW and installed in all 19 holes on site. This site was monitored once a week throughout the summer.

A second study site was located in Niagara Falls, New York where U.S. Geological Survey staff had drilled 4 new bore holes. These holes were part of a large American study to determine the flow of groundwater in the bedrock underlying the Niagara area. Work by CCIW staff to profile the permeability of these holes was begun June 12 and continued for four weeks until July 1. The data from these holes is applicable to rock formations and flow patterns across the border in Canada.

One trip in the spring and another in late fall was made to Navy Island in the Niagara River to monitor 6 bore holes drilled in 1987.

An old Tech. Ops. trailer that had been situated at the Clarkson site was replaced with a new laboratory trailer on November 29.

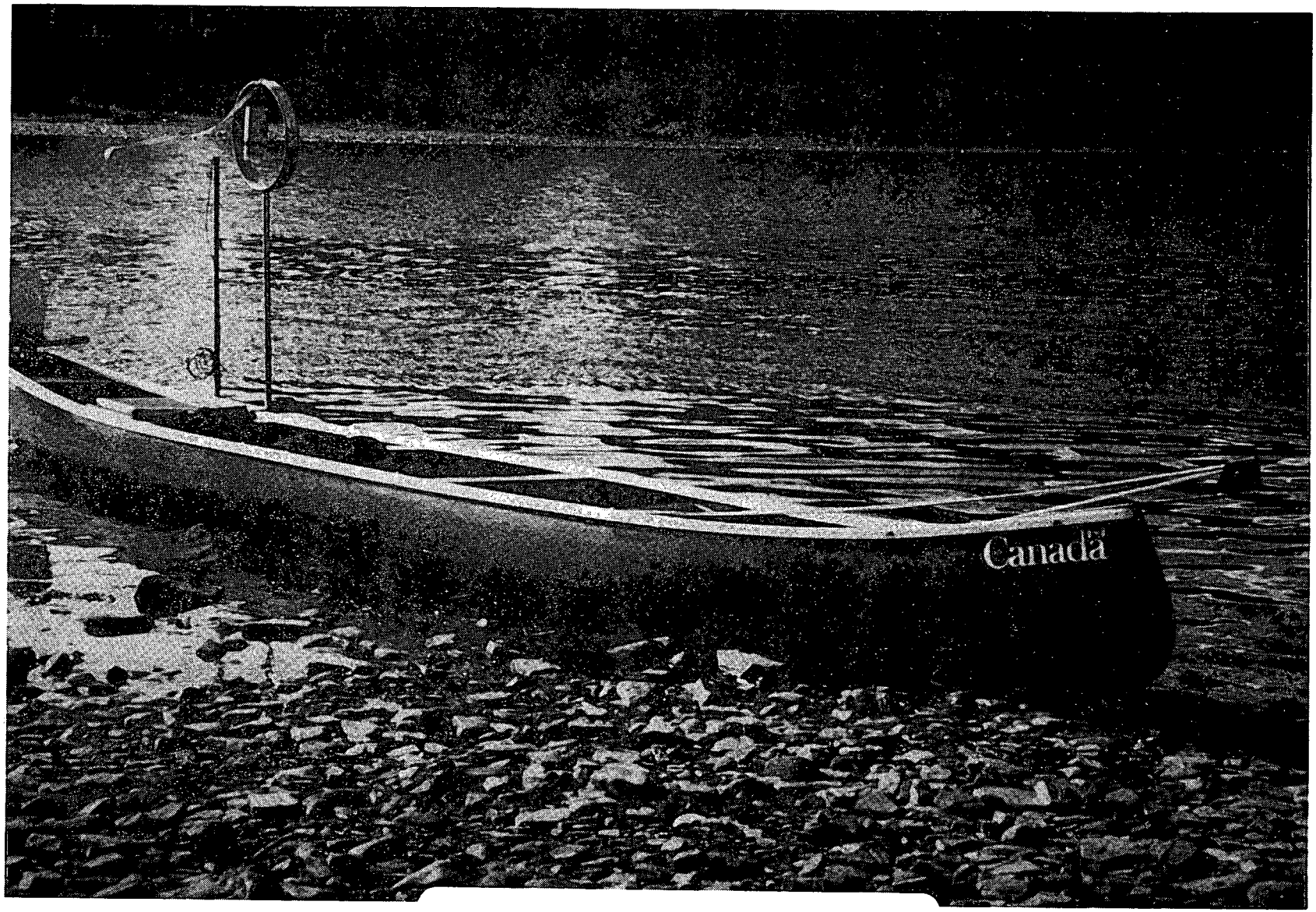
ICE JAMS

RRB STUDY 83053, DR. S. BELTAOS

In support of the Ice Jam Study, Messrs. Y. Desjardins and J.A. Kraft of Technical Operations and Bill Moody, Project Leader, RAB, left for Campbellton, New Brunswick in October to study the area where an ice jam was formed last spring. This was the third year of a multi-year study of ice jams on the Restigouche River in New Brunswick.

In the aftermath of a trip to the area taken by Dr. Beltaos and Mr. Moody last spring, nine cross-sections, a longitudinal cross-section and other related work; i.e., levelling in new bench marks, was planned. To minimize the presence of foliage, the trip was made in October--10 - 25. A new canoe was purchased and utilized. It proved to be better suited to work in fast and shallow water than the aluminum boat used last year. Also new this year was the T2000 Theodolite with the DI-3000 Distomat. The two instruments gave a total station package enabling reduction of all the field notes on site. The cold weather, combined with rain and high humidity, played havoc with the DI-3000. The work was completed with an older model Distomat, DI-4 AND T-2 Theodolite.

A total of 11 cross-sections, two longitudinal cross-sections, a video of both river banks, and one video of the surveying procedure to sound and cross-section the river were made. Also, a bottom photographic survey was made using an underwater camera. A typical rock bottom was sampled and returned to CCIW. Eleven days were spent on site and 4 days travelling. A 4x4 crewcab was used to launch and retrieve the canoe.



SURVEY VESSEL
RESTIGOUCHE RIVER, N.B.

SUSPENDED SEDIMENT SAMPLING

RAB STUDY 84017, K. ASPILA

During the week of October 2 - 5, bulk water samples were collected in the Turkey Lakes Watershed near Sault Ste. Marie.

At two sites--S-2 (inlet to Little Turkey Lake) and S-4 (outflow from Big Turkey Lake), bulk water samples (1400L) were centrifuged through two portable Westfalia centrifuges at a flow rate of 4L/min. The centrifuged water was collected and stored in fourteen 200L barrels and transported back to CCIW for analysis by the Research Applications Branch.

During the week of December 4 - 8, bulk centrifuged water samples (600L) were collected from the Grand River at Dunnville and from Spencer Creek south of Beverly Marsh.

RESEARCH SUPPORT DIVISION

ST. LAWRENCE RIVER

RSD STUDY 86031, H. BIBERHOFER, IWD-OR

The purpose of this Surveillance Program was to collect data for development of sampling strategies to assess the transboundary flux of contaminants in the Cornwall/Massena Reach of the St. Lawrence River.

Six surveys were conducted on the St. Lawrence River at Cornwall. Before the surveys were started, 3 Neil-Brown current meter and 4 Seastar moorings were deployed on both sides of Cornwall and St. Regis islands in order to collect representative samples of all waters as they pass through the various channels.

During each survey, Seastar extractors were deployed and retrieved from the 4 Seastar moorings and at Coast Guard navigation buoys nos. 5A and 6A south of Cornwall Island. In addition to the Seastar deployment, an extractor was installed at the Ontario Hydro (Saunders) Generating Station. Water samples were collected at all extractor sites and at Coast Guard navigation buoys nos. 92 and 93. This gave full coverage of all water as it flowed through the reach.

Drogues were tracked on several surveys in an attempt to better understand the flow of the river and to make a comparison of the drogue measurements to the current meters.

During the May, July and October surveys, Water Survey of Canada personnel assisted in current measurements by conducting moving boat profiles at 8 sites along the reach. These profiles were done from shore to shore at 1 metre depth and were calibrated to the standard vertical profiles done at three sites along the transect.

When the current meters were retrieved in October, dive support was needed since a groundline at one of the meters was cut almost at the bottom mount. Due to the way the line had been cut, it was next to impossible to retrieve the meter.

On completion of the field season, all equipment was returned to CCIW.

CANADIAN WILDLIFE SERVICE

RSD STUDY 86031, DR. V.W. WESELOH

Technical Operations Section continued to support the Canadian Wildlife Service (CWS) field program on the Great Lakes. The purpose of this study was to determine, or aid in the determination of, how various factors constitute biological effects of toxic chemicals in Herring Gulls, Double Crested Cormorants and other species of colonial waterbirds at several nesting colonies throughout the Great Lakes. The following was undertaken:

Annual Herring Gull Egg Monitoring

The objective of this study was to determine spatial and temporal trends in organochlorine contaminants in Herring Gull eggs from the Great Lakes. Herring Gull eggs were collected at 13 - 16 sites annually from throughout the Great Lakes and tested for an array of toxic chemicals. Temporal and spatial trends in contaminant levels in Herring Gull eggs were determined from analyses dating back to 1974. Biological parameters (bioeffects) of the nesting Herring Gulls were determined and related to contaminant levels.

Deformities in Double Crested Cormorants in the Great Lakes

The objective of this co-operative CWS/U.S. Fish & Wildlife Service project was to determine the extent and cause of congenital anomalies (deformities) in Cormorants on the Great Lakes. Cormorant eggs and various biological parameters were collected from colonies in each of the Great Lakes and from control sites off the Great Lakes. Contaminant levels were assessed in the eggs and related to the rates of deformities at each colony. Rates of deformities in the Great Lakes were elevated over off-the-lake areas and rates were particularly elevated in the Green Bay area of Lake Michigan.

Census of Great Lakes Fish-Eating Birds

The objective of this joint Canada/U.S. project was to census the nesting populations of fish-eating birds on the entire Great Lakes. This was the first year of a three-year project. A previous census was completed in the late 1970s but is now very much out of date. Fish-eating birds in general are a good indicator species of water quality. This census will help assess the effects of remedial actions on the fish-eating bird populations of the Great Lakes and provide important information on changes in population levels of the 8 - 10 species which nest there.

Contaminant Levels in Waterfowl from the Canadian Great Lakes

The objective of this joint Federal-Provincial project was to determine the level of toxic chemical contamination in waterfowl from Ontario and particularly the Canadian Great Lakes. Waterfowl were collected in the summer and autumn from 8 sites in 1988 and from 8 - 15 additional sites this year.

Other projects that looked at contaminant levels in American Kestrels on the Niagara Peninsula and effects of organophosphate pesticides on Bluebirds and Swallows in orchards in Southern Ontario were also conducted by the CWS group at CCIW. Technical Operations did not support these projects.

The largest percentage of the CWS field program that Tech. Ops. supported was directed towards work on the eggs and chicks of the Double Crested Cormorant and Herring Gull. Also, an intensive three-week survey was carried out on Manitoulin Island and Georgian Bay collecting data for the 1989 input to the Colonial Waterbirds Atlas. Another three weeks were spent working on many of the islands in the Upper Great Lakes and as far west as Lake Winnipegosis, Manitoba.

Scheduling of the field trips was critical because of varying ice conditions throughout the Great Lakes in the early part of the program and the two-week variation in nest building and egg laying throughout the colonies.

The field program, although short in duration (April - July), was very intensive. A two field party system was used to monitor the many colonies spread over the Great Lakes. Because of the nesting habits of the different species, some of the colonies had to be visited twice.

Two 18′ workboats (Thunderbird and Mason #8) were utilized throughout the season to visit the many colonies located on several islands in the Great Lakes and surrounding areas. Over 82 field days, 3,780 km were steamed in the Thunderbird and more than 20,000 land miles were driven trailering the boat to the different survey locations. Although the field work required a great deal of travel on land and water covering a large area under many types of conditions, it was again successfully completed without damage or injury. Similar surveys are planned for the 1990 field season.

HERRING GULL MONITORING

WAVES TOWER

RSD STUDY 86032, P.M. HEALEY

No major work was performed on the tower this year as in previous seasons. For the second year in a row, a small project by McMaster University, under contract to the departments of National Defence and Communications, was carried out.

The tower was used to set up a radar instrument aimed at another tower set up on shore at the old Shell Refinery now owned by Petro-Canada. This shore tower was equipped with a moving target/reflector. Six (6) trips were made to the WAVES tower to assemble, maintain and retrieve the equipment.

The work plan for maintenance this year was to have a full inspection made above and below the water to assess the remaining life of the structure. Due to circumstances beyond our control, this work was postponed until next year.

LAKE TROUT REPRODUCTION

RSD STUDY 86034, V.W. CAIRNS, J.D. FITZSIMONS, GLLFAS, BINST

A goal of the Great Lakes Fisheries Commission is the restoration of self-sustaining lake trout stocks throughout the Great Lakes. Studies have shown that little in the way of natural reproduction has occurred; therefore, research is needed to stimulate successful lake trout rehabilitation. The collection of physical/chemical data at historical spawning habitats is needed as well as a determination of whether water quality was potentially reducing the survivability of lake trout eggs and fry.

During the month of August, a diver survey of potential spawning sites in Lake Ontario between Burlington and St. Catharines was conducted. Three shoals were selected as being suitable and these were marked with spar buoys.

On October 31 and November 2, a total of 156 "incubators", each containing 50 fertilized lake trout eggs, were installed at the 3 chosen sites by divers. One hundred of the incubators were stocked with eggs from Lake Ontario while the remaining 56 contained eggs obtained in Lake Manitou on Manitoulin Island. Retrieval of the incubators is scheduled for April 1990 when a comparison of both sets of eggs will be made.

On November 22, lake trout eggs were recovered from the mouth of the Burlington Canal near the East Pier and these were returned to the GLLFAS Wet Lab for incubation and later study.

SHOAL LOCATIONS

LATITUDE N.	LONGITUDE W.
43° 15′ 35"	79° 40′ 49"
43° 12′ 28"	79° 31′ 49"
43° 14′ 10"	79° 35′ 24"

COMMON-USER SUPPORT/OUTSIDE AGENCIES

RSD STUDIES 86032/86034, P.M. HEALEY

The purpose of this project was to provide logistic support equipment, instrumentation and field support (assistance), as resources permitted, to studies within NWRI and agencies outside NWRI. Again this year, more than 50 individual studies were supported by Technical Operations staff, ranging from the Restigouche River in New Brunswick to Chain Lake in British Columbia. Equipment or support was provided to universities; other services in Environment Canada (Canadian Wildlife, Long Point; Environmental Protection; Water Quality Branch-Ottawa; Water Quality Branch-Regina); other government departments (Fisheries & Oceans, Energy Mines & Resources, etc.); and provincial governments (B.C. Department of the Environment, B.C. Fish & Wildlife, Ontario Ministry of the Environment). Studies supported ranged from one week's duration to 3-week trips for studies farther afield. Field support was provided to outside agencies as follows:

1. Great Lakes Laboratory for Fisheries and Aquatic Sciences - Habitat Study, Grimsby
2. GLLFAS, Bay of Quinte
3. Public Works - breakwater inspection
4. McMaster University - sample collection, Hamilton Harbour
5. University of Toronto - sample collection, Lake Ontario
6. Centre Saint-Laurent - mooring deployment, Lac St. Louis
7. Centre Saint-Laurent - sample collection, CSS LIMNOS, St. Lawrence River
8. Water Quality Branch-Ottawa - Environment Week
9. Water Quality Branch-Ontario Region - water sampling, Goulais River

Rigging Shop

Because the number of requests for support in the field exceeded staff resources, riggers spent more time in the field on scientific studies. The usual workload of maintaining all mooring equipment, buoys, generators, power tools, winches and various other pieces of research equipment was conducted whenever possible. The Rigging Shop was also responsible for delivery of boats and laboratory trailers to field stations; transport of scientific equipment to major ships throughout the Great Lakes and the St. Lawrence River; erecting towers; and operating boats, heavy trucks and forklifts. An additional duty for J. Lomas was maintenance of the outside storage compound, and ensuring the Warehouse was kept in an orderly fashion. Mr. C. Cunningham assisted in the Rigging Shop during the winter months to prepare mooring equipment for the 89/90 field season.

When not assisting in the field, H. Greencorn was responsible for maintenance of the NWRI vehicle fleet, trailers, snowmobiles and all-terrain vehicles. Four new vehicles were purchased to update vans and station wagons which were deteriorating due to over-use.

Field Stores

A position in Field Stores was occupied on a full-time basis to issue and receive field gear and sampling equipment for the Institute. In conjunction with the Rigging Shop, inventory maintenance was conducted on all equipment on an as-required basis. The daily scheduling of day-use vehicles for NWRI staff as well as for DFO, EPS and NWQL was conducted on a full-time basis. This year, Field Stores added the responsibility of issuing sediment sampling equipment to assist in the control of samplers.

DIVING OPERATIONS

RSD STUDY 86033, F.H. DON

The Diving Operations Unit of Technical Operations Section provided national support to various scientific studies in areas of diver certification, inspections, installations and retrievals, sample collection, photography, television surveys with video documentation, equipment demonstrations/trials, search and recovery, lectures, and diving training. The Diving Operations Unit supported 13 divers located at Burlington. A total of 240 hours (accident free) were logged in support of projects for the National Water Research Institute; Water Quality Branch; Management & Technical Services Branch and Great Lakes Laboratory for Aquatic Sciences, Bayfield Institute. An additional 80 hours were logged during the pool training program.

A total of 75 hours were logged on MURV, the remotely-operated miniROVER, during the CCIW breakwater inspection for the Department of Public Works, Ottawa and the Amisk Lake, Alberta oxygen injection project.

The Head of the Diving Operations Unit, F.H. Don represented research/ scientific diving as a member of the Canadian Safety Association Standards Technical Committee on Diving Safety and the Ontario Construction Safety Association Task Force on "Diving in Contaminated Environments".

The Annual Meeting of the Department of Environment Diving Safety Committee was hosted by the Technical Operations Section in April, using the facilities at the Venture Inn.

The Diving Operations Unit has a complete inventory of modern diving and diver support equipment which, when used and operated by highly skilled divers, can complete even the most difficult of sub-sea operations.

Projects supported this year included:

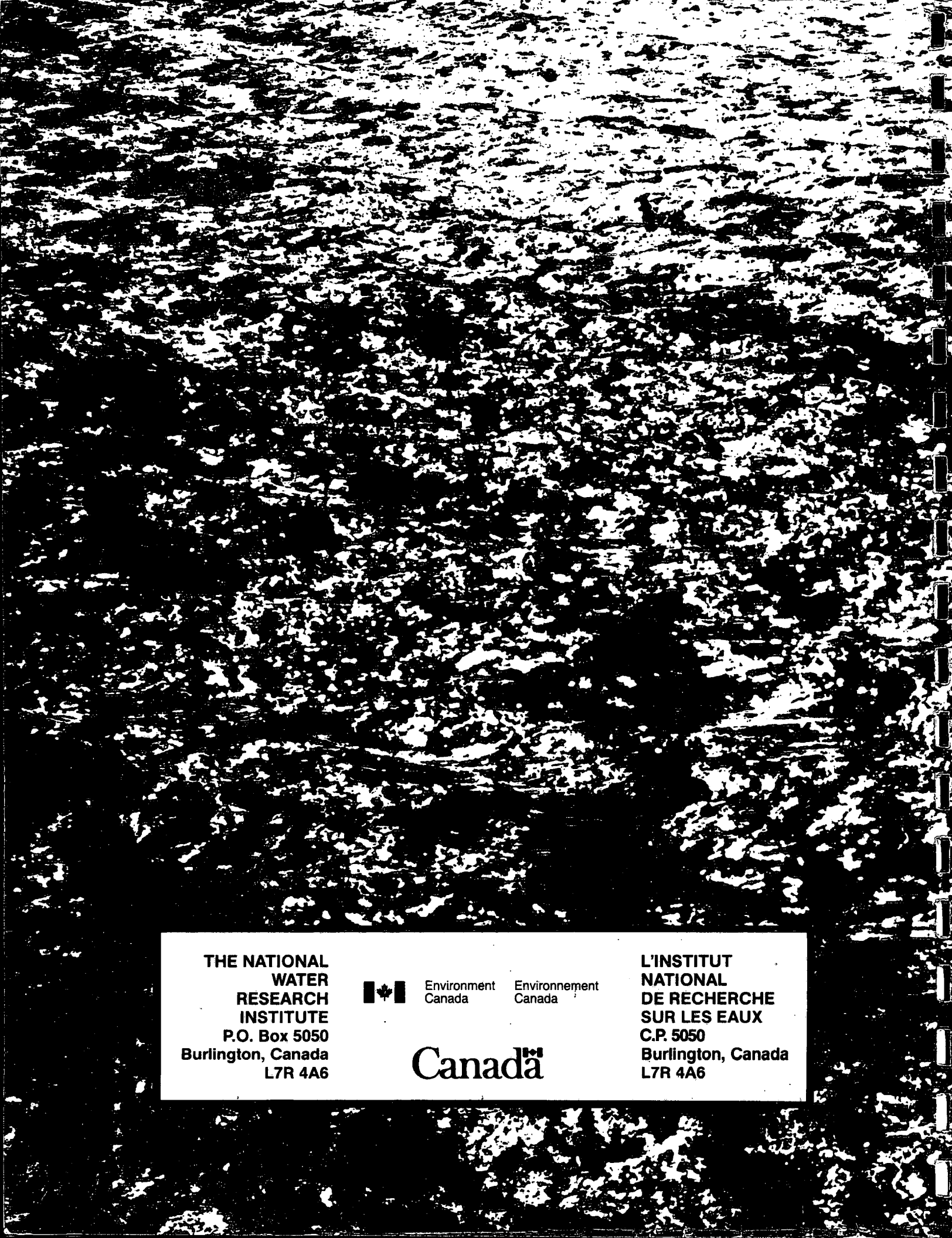
STUDY NUMBER	STUDY TITLE
82002	Port Severn, Barica
82011	Port Hope, Coakley
82023	Amisk Lake/Peace River, Murphy
82025	Bay of Quinte, Manning
82027	Hamilton Harbour Restoration, Murphy
82029	Hamilton Harbour Sedimentology, Rukavina
82031	Hamilton Harbour, Spigel
84034	WAVES, Skafel
82011	50 Point, Sediment Transport, Rukavina
86031	Water Quality Branch Stations: Niagara-on-the-Lake, Fort Erie, Wolfe Island Search and Recovery, Cornwall
83013	St. Lawrence River, Metcalfe
86033	Burlington Ship Canal, Engineering Services Section, Research Support Division
86033	Support to Department of Fisheries & Oceans: Clam collection, Rahmey, GLLFAS Fish Habitat, Cairns, GLLFAS Hull inspections, MTSB

WATER SAMPLING, OTTAWA RIVER

ADDITIONAL SUPPORT

Due to the early layup of the research vessels this season, several requests were made by scientists at NWRI for additional support. These requests could be accommodated since staff were available who would otherwise have been assigned to these vessels. The following is a list of projects supported since that time:

STUDY NUMBER	REGION	SCIENTIST
82011	Port Hope	Dr. J.P. Coakley
82011	Whitby	Dr. J.P. Coakley
82025	Quinte	Dr. P.G. Manning
82028	Hamilton Harbour	M.E. Fox
82032	St. Lawrence River	Dr. M. Hanna
82055	East Lake	Dr. L.D. Delorme
82061	Jack Lake	Dr. D.R.S. Lean
84026	Turkey Lakes	K. Aspila
84026	Grand River	K. Aspila
86031	St. Lawrence River	Dr. R.L. Thomas



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