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ACTIVITY SUMMARY

TECHNICAL OPERATIONS SECTION
RESEARCH SUPPORT DIVISION
NATIONAL WATER RESEARCH INSTITUTE

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ACTIVITY SUMMARY

**TECHNICAL OPERATIONS SECTION
RESEARCH SUPPORT DIVISION
NATIONAL WATER RESEARCH INSTITUTE**

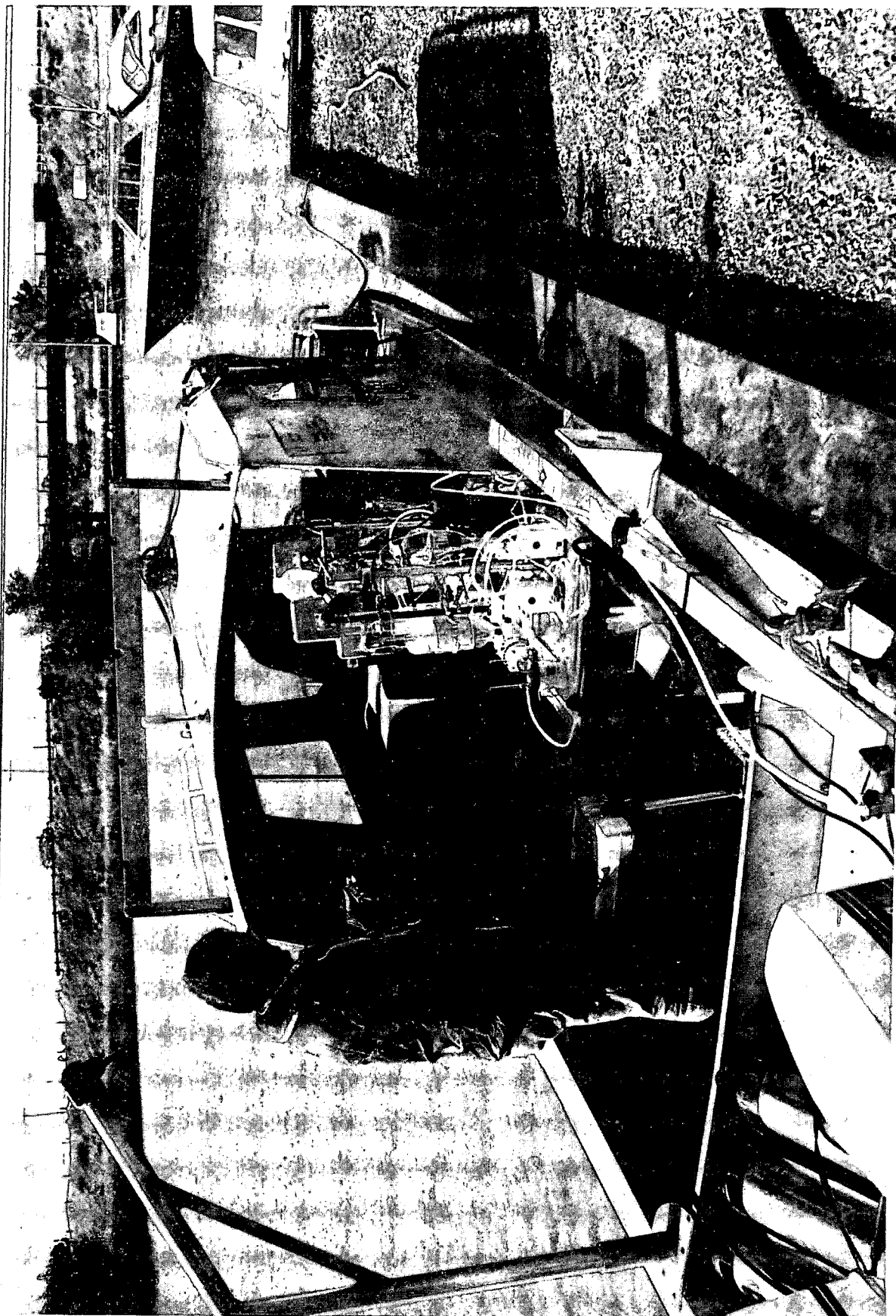


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INTRODUCTION

Technical Operations Ship and Field Sections have the mandate, as part of the Research Support Division at the National Water Research Institute, to provide logistical and technical support to the scientific community on a national scale. Technical Operations sections support field programs across the country and shipboard programs from major ships on the Great Lakes and St. Lawrence River on a continuing basis.

As personnel resources decline due to attrition and transfer, the sections continue to meet an ever increasing demand for support and services head on.

The Diving Operations Unit is ever expanding its capabilities to give scientific programs the up-to-date technological support they require underwater. Annual diver certification and training programs are also conducted to maintain a high level of competence among the Institute's divers. The Rigging Shop provides for the maintenance and repair 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.

This report is an overview of the field activities of this Section during the 1988 field season.

STAFF LIST

RESEARCH SUPPORT DIVISION

A/Chief - J.D. Smith
Secretary - S.R. Mitchell
Administrative Clerk - J. McAvella

TECHNICAL OPERATIONS SHIP SECTION

Head - P.M. Healey

SENIOR MARINE TECHNOLOGISTS

B.H. Moore - OIC CSS LIMNOS
S.B. Smith - OIC CSS ADVENT, Atmospheric Deposition,
Restigouche River
P.R. Youakim - OIC CSS BAYFIELD, CSS LIMNOS
T.J. Carew - Turkey Lakes Watershed, CSS LIMNOS, OIC CSS
BAYFIELD
E.H. Walker - Groundwater

MARINE TECHNOLOGISTS

R.J. Hess - OIC CSS ADVENT, Ashbridges Bay
J.E. Tozer - Jack Lake, Hamilton Harbour
J.A. Kraft - CSS LIMNOS, Spanish River, Turkey Lakes
Watershed, Rainy River
Y. Desjardins - CSS LIMNOS, Restigouche River, Parry Sound

TECHNICAL OPERATIONS FIELD SECTION

A/Head - B.H. Moore (January - March)
A/Head - F.H. Don (April - June)
A/Head - P.M. Healey (July - December)
Senior Field Officer - M.R. Mawhinney

SENIOR MARINE TECHNOLOGISTS

L.E. Benner - Canadian Wildlife Service, CSS LIMNOS
G.G. LaHaie - Turkey Lakes Watershed

DIVING OPERATIONS

Head, F.H. Don - Hamilton Harbour

MARINE TECHNOLOGISTS

G.D. Bruce - Diving, Hamilton Harbour
K.J. Hill - Diving, Hamilton Harbour

RIGGING UNIT

Head, L.J. Lomas - St. Lawrence River
H.E. Greencorn - Vehicles

NVRI FIELD STORES

W.D. Hunt

STUDENTS

May to September - M.B. Marshall, G. Ponton, R. Neureuther

SHIPBOARD PROGRAMS

LIMNOS

1988

	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
FEB	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
MAR	28	29	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
APR	27	28	29	30	31	1	2
	3	4	5 LAKE	6 ONTARIO	7 SURVEILLANCE	8 LAKE	9 ONTARIO
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
MAY	24	25 LAKE	26 ERIE	27 SEDIMENT	28 LOADING	29 LAKE	30 ERIE
	1	2 LAKE	3 HURON	4 SURVEILLANCE	5 LAKE	6 HURON	7 SURVEILLANCE
	8 SURVEILLANCE	9 GEORGIAN	10 BAY	11	12	13 LAKE ERIE	14 SEDIMENT
	15	16	17	18	19	20	21
	22	23	24	25 L.T.B.I.M.	26	27	28
JUN	29	30	31	1	2	3	4
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20 LAKE	21 ERIE	22 BENTHOS	23 CORING	24 BENTHOS	25 CORING
JUL	26 LAKE	27 ERIE	28	29	30	1	2
	3	4	5 LAKE ONTARIO	6 HOORINGS	7	8	9
	10	11 LAKE ONTARIO	12 SEDIMENT	13 TRANSPORT	14 LAKE	15 ONTARIO	16
	17	18 LAKE	19 ERIE	20 NUTRIENTS	21 CONTAMINANTS	22 LAKE	23 ERIE
	24 NUTRIENTS	25 CONTAMINANTS	26 LAKE	27 ERIE	28 LAKE	29 ERIE	30
AUG	31	1	2	3	4	5	6
	7	8 LAKE ONTARIO	9 NUTRIENTS	10 CONTAMINANTS	11	12	13
	14	15 LAKE	16 ONTARIO	17 SURVEILLANCE	18 LAKE	19 ONTARIO	20
	21	22 LAKE ONTARIO	23 SURVEILLANCE	24 LAKE ERIE	25 SURVEILLANCE	26 LAKE	27 HURON
SEP	28 SURVEILLANCE	29 LAKE	30 HURON	31 SURVEILLANCE	1 GEORGIAN	2 BAY	3
	4	5	6	7 LAKE ONTARIO	8 SEDIMENT	9 BENTHIC	10 STUDIES
	11 LAKE ONTARIO	12	13	14	15	16	17
	18	19 LAKE ONTARIO	20 HOORINGS	21 LAKE	22 ONTARIO	23	24
OCT	25	26 LAKE ONTARIO	27 SEDIMENT LOAD	28 BENTHOS	29 LAKE	30 ERIE	1
	2	3 ST. LAWRENCE	4 RIVER	5 ORGANIC AND	6 INORGANIC	7 CONTAMINANTS	8 ST. LAWRENCE
	9 RIVER	10 ORGANIC AND	11 INORGANIC	12 CONTAMINANTS	13 ST. LAWRENCE	14 ORGANIC AND	15 INORGANIC
	16 CONTAMINANTS	17 ST. LAWRENCE	18 RIVER	19 CONTAMINANTS	20 ST. LAWRENCE	21 RIVER	22 ORGANIC AND
	23 INORGANIC	24 CONTAMINANTS	25 ST. LAWRENCE	26 RIVER	27 LAKE ONTARIO	28 HOORINGS	29 LAKE
NOV	30 ONTARIO	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
DEC	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 86041, R. STEVENS, 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 5-9 and August 15-19. 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 equipped with electronic bathythermograph, rosette/EBT water sampler, transmissometer, 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 minus 10 metres and bottom minus 2 metres

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

On two of the Surveillance cruises, the Long Term Biological Index Monitoring Program in support of Great Lakes Laboratories for Fisheries & Aquatic Sciences, Bayfield Institute, DFO was piggybacked. In support to 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, nitrite and nitrate, total Kjeldahl nitrogen, alkalinity, chlorophyll a, particulate organic nitrogen, phytoplankton, zooplankton and ash free weight determination.

STATISTICS SUMMARY

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DATES FROM April 5
August 15 TO April 9
August 19, 1988

SHIP CSS LIMNOS
LAKE ONTARIO
CRUISE TYPE Lower Lakes Surveillance
N. MILES STEAMED 1399.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	202	Moorings Established	
EBT Casts	202	" Retrieved	
Rosette Casts	202	" Established	
Transmissometer Casts	202	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	28	" Established	
Secchi Disc Observations	101	" Retrieved	
		" Refurbished	
Zooplankton Hauls	4	" Serviced	
Integrator 10 m	4	" Serviced	
Integrator 20 m	198	Primary Productivity Moorings	
Phytoplankton Samples	8		
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ()			
" " " (D.O.)	568	Grab Samples Taken	
" " " (Cond/pH)	568		
" " " ()		Bulk Centrifuge Samples	
" " " (T P u f)	600		
" " " (TKN)	600	Observations, Weather	40
" " " (Contaminants)	41		
" " " (QAM's 100L)	2	CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	262	Solar Radiation	
" " " (POC/TPN)	279		
" " " (Seston)	30		
" " " (T P f)	600		
" " " (Nutrients)	600	ONBOARD ANALYSES	
" " " (Major Ions)	600		
" " " ()		Manual Chemistry Tech. Ops.	2304
" " " ()		Nutrients (WOB)	620
" " " ()		Microbiology	
" " " ()			

SURVEILLANCE STATIONS

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

STATION NUMBER	LATITUDE N.	LONGITUDE W.
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"
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"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
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 HURON/GEORGIAN BAY

RSD STUDY 86041, 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 as input to the Water Quality Board Annual Report to the International Joint Commission.

Two cruises were conducted May 2-10 and August 22-September 1 to support this program. Both cruises were organized and completed by Technical Operations staff for IWD-OR and were conducted from the CSS LIMNOS. The vessel was equipped with the usual equipment: electronic bathythermograph, rosette water sampler, transmissometer, radar, Loran C positioning system and a variety of samplers and winches used for chemical and biological water sampling.

The parameters sampled during both cruises were: temperature profile, transmission profile, 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, alkalinity, meteorological observations and Secchi disc observations.

During the August cruise, the following parameters were not sampled: soluble reactive phosphorus, ammonia and nitrite and nitrate.

During the May cruise, samples were collected from the 1 m 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 upper knee of the thermocline, mid-thermocline, 1 m below lower knee of the thermocline, bottom -10 metres, and bottom -2 metres

Some of the additional tasks supported during the program included: Phytoplankton sampling for Dr. M. Munawar Study 86042; Dissolved organic carbon samples Study 82015; Box cores Study 82015; Benthos cores Study 82025; and Shipek samples Study 82015.

STATISTICS SUMMARY

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SHIP CSS LIMNOS
 DATES FROM May 2 August 24 TO May 8, 1988 August 30, 1988 LAKE HURON
 CRUISE TYPE Upper Lakes Surveillance N. MILES STEAMED 2261.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	147	Moorings Established	
EBT Casts	147	" Retrieved	
Rosette Casts	139	" Established	
Transmissometer Casts	147	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	24	" Established	
Secchi Disc Observations	59	" Retrieved	
Van Dorn Casts	8	" Refurbished	
Zooplankton Hauls	46	" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	255	Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken, Benthos	8
" " " ()			
" " " (D.O.)	394	Grab Samples Taken, Shipek	6
" " " (Cond/pH)	394		
" " " ()		Bulk Centrifuge Samples , Suspended Sediment	4000 L
" " " (T P uf)	439		
" " " (TKN)	439	Observations, Weather	72
" " " ()			
" " " ()		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	197	Solar Radiation	
" " " (POC/TPN)	209		
" " " (Seston)			
" " " (T P f)	439		
" " " (Nutrients)	439	ONBOARD ANALYSES	
" " " (Major Ions)	439		
" " " ()		Manual Chemistry Tech. Ops.	1299
" " " ()		Nutrients (WOB)	363
" " " ()		Microbiology	
" " " ()			

STATISTICS SUMMARY

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SHIP CSS LIMNOS
 DATES FROM May 8 August 30 TO May 10, 1988 September 1, 1988 GEORGIAN BAY
 CRUISE TYPE Upper Lakes Surveillance N. MILES STEAMED 695.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	57	Moorings Established	
EBT Casts	57	" Retrieved	
Rosette Casts	33	" Established	
Transmissometer Casts	57	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations	20	" Retrieved	
Van Dorn Casts	24	" Refurbished	
Zooplankton Hauls	18	" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	73	Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	7
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ()			
" " " (D.O.)	173	Grab Samples Taken, Shipek	2
" " " (Cond/pH)	173		
" " " ()		Bulk Centrifuge Samples	
" " " (T P uf)	189		
" " " (TKN)	189	Observations, Weather	24
" " " ()			
" " " ()		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	79	Solar Radiation	
" " " (POC/TPN)	86		
" " " (Seston)			
" " " (T P f)	189		
" " " (Nutrients)	189	ONBOARD ANALYSES	
" " " (Major Ions)	189		
" " " ()		Manual Chemistry Tech. Ops.	519
" " " ()		Nutrients (WOB)	135
" " " ()		Microbiology	
" " " ()			

SAMPLING STATIONS

LAKE HURON

STATION NUMBER	LATITUDE N.	LONGITUDE W.
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"
48	45° 16' 42"	82° 27' 06"
50	45° 32' 06"	82° 02' 42"
52	45° 39' 05"	82° 38' 54"
54	45° 31' 00"	83° 25' 00"
55	45° 23' 30"	83° 39' 06"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
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) Saginaw Bay	43° 58' 35"	83° 34' 32"
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"
103	45° 47' 00"	84° 53' 12"

SAMPLING STATIONS

GEORGIAN BAY

STATION NUMBER	LATITUDE N.	LONGITUDE W.
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° 33' 48"	80° 09' 06"
44	44° 35' 00"	80° 15' 30"
45	44° 37' 18"	80° 55' 18"

LAKE ONTARIO

SEDIMENTARY TRANSPORT OF RADIONUCLIDES

LRB STUDY 82012, DR. S.R. JOSHI, A. MUDROCH

During the week of July 11-14 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 second such cruise in as many years to be conducted on Lake Ontario. This year's cruise consisted of four stations being sampled during the period. At each station, the following tasks were completed: an EBT/transmissometer profile to the bottom, suspended particulate matter centrifuged from 6000 litres of water from the nepheloid layer, 50 litres of raw water sample from the nepheloid layer and 250 litres of centrifuged water from the nepheloid layer. In addition, at each station, sediment samples were collected using either the Shipek or Ponar grab sampler. At one station in the Central Basin, 2 box cores were collected and subsampled. All sediment samples were refrigerated and returned to CCIW for analysis.

In support of LRB Study 82055, a box core was collected approximately 8 kilometers off the Burlington Canal. The core was subsectioned by Dr. Delorme and samples taken to CCIW for analysis.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
623 Whitby/Olcott Sill	43° 29' 48"	78° 44' 53"
624 Port Hope	43° 51' 02"	78° 15' 12"
625 Central Basin (Centre)	43° 35' 56"	78° 04' 43"
626 Scotch Bonnet Sill	43° 26' 54"	77° 29' 58"
DD-1 Western Basin	43° 19' 32"	79° 40' 48"

STATISTICS SUMMARY

16

CRUISE NO. 88-00-004 CONSECUTIVE NO. 020
 DATES FROM July 11 TO July 14, 1988
 CRUISE TYPE Sedimentary Transport of Radionuclides

SHIP CSS LIMNOS
 LAKE ONTARIO
 N. MILES STEAMED 226.9

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	5	Moorings Established	
EBT Casts	5	" Retrieved	
Rosette Casts		" Established	
Transmissometer Casts	5	" 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	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " (Radionuclides)	4		
" " " (D.O.)		Grab Samples Taken	6
" " " (Cond/pH)			
" " " ()		Bulk Centrifuge Samples	5
" " " (T P u f)		Bulk Centrifuge Samples 20 x 50L	20
" " " (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	
" " " ()			

LAKE ONTARIO

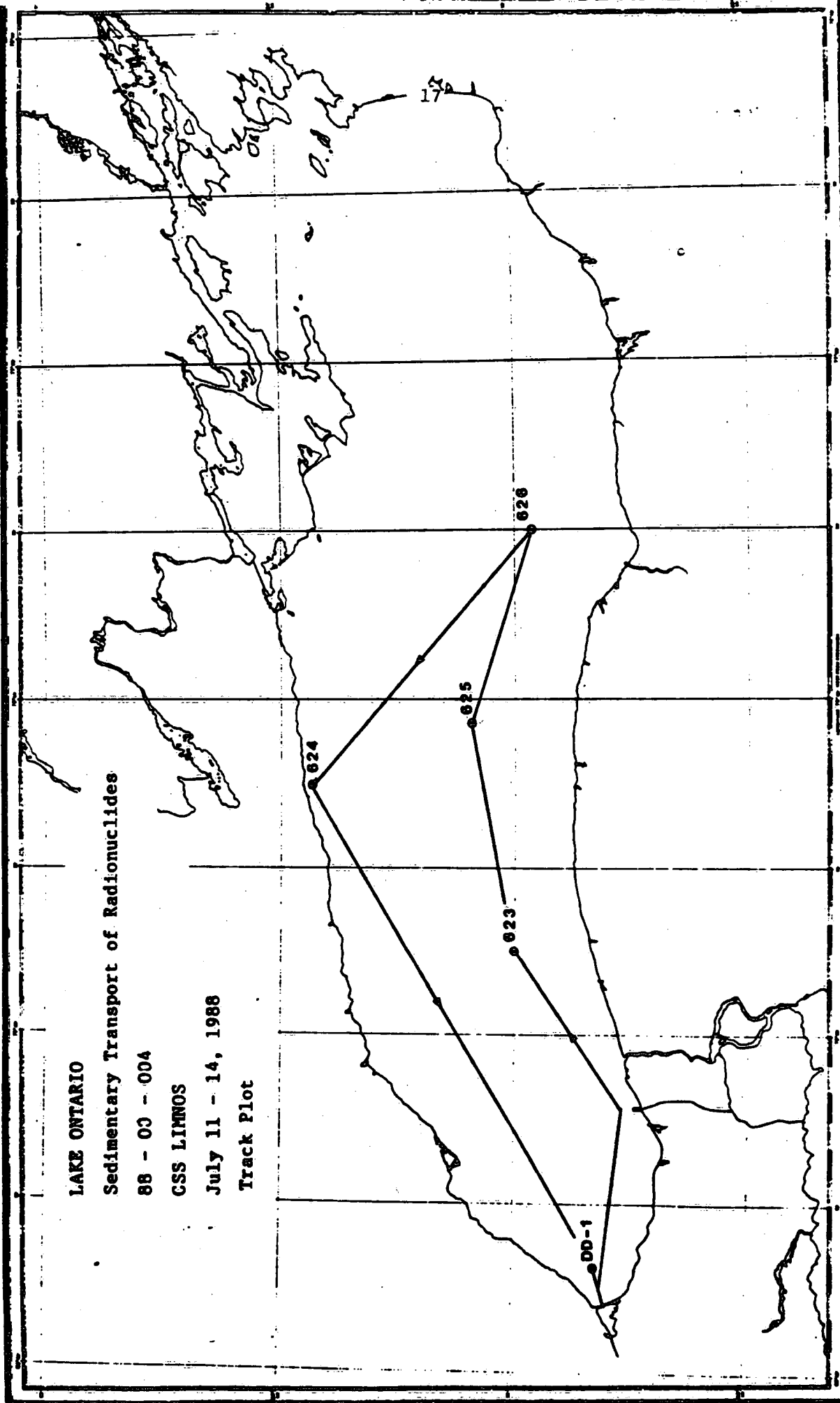
Sedimentary Transport of Radionuclides

88 - 03 - 004

CSS LINNOS

July 11 - 14, 1988

Track Plot



LAKE ERIE

BENTHIC COMMUNITY STRUCTURE

LRB STUDY 82015, DR. T. REYNOLDS

Three Lake Erie cruises were carried out onboard the CSS LIMNOS--April 25-30, June 20-27, and September 26-30. On the June cruise, an additional 64 stations were occupied in the Western Basin. On each cruise, box cores were collected and subsampled onboard. On the June cruise, stations 599 too shallow for the LIMNOS to occupy were sampled from the McKEE and a Tech. Ops. corer along with a Ponar grab were used to collect the samples. A temperature/transmissometer profile to the bottom was obtained at all stations occupied by the LIMNOS.

A major additional task during the June cruise was completed in support of LRB Study 82017. Fourteen stations were sampled during the cruise, representing the three basins of Lake Erie. At each station, two box cores were collected from which four subsamples each were taken. Each subsample was taken to the maximum depth of the box core using a 5 cm diameter core liner (Benthos). All subsamples were stored at 4°C until returned to CCIW Sedimentology Laboratory for geotechnical testing.

BENTHIC COMMUNITY STRUCTURE

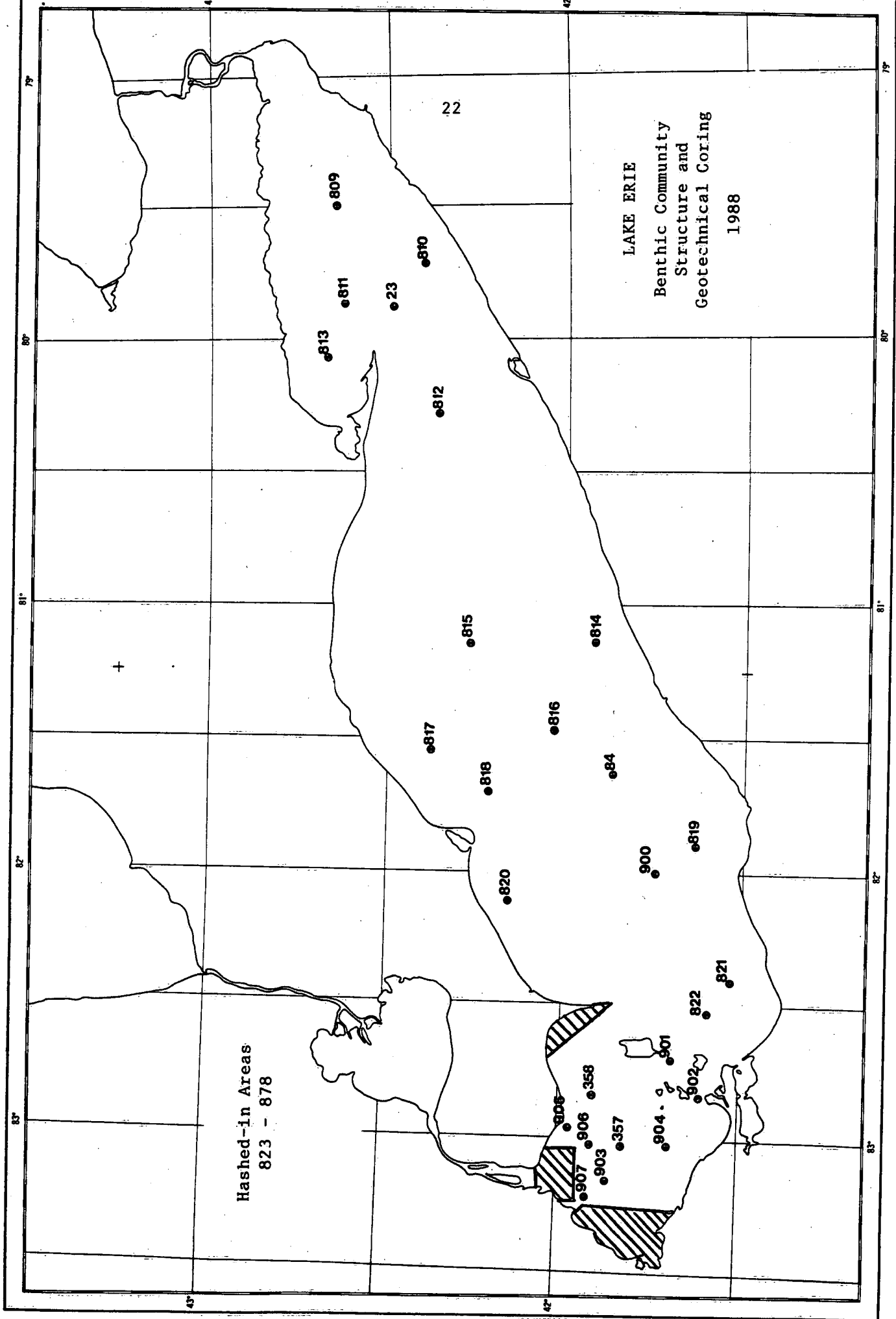
LAKE ERIE STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29' 53"	79° 53' 59"
84	41° 55' 49"	81° 39' 16"
357	41° 49' 45"	82° 58' 17"
358	41° 53' 40"	82° 52' 00"
823 (5D)	41° 57' 29"	83° 11' 38"
824 (8D)	41° 57' 13"	83° 06' 47"
825 (9D)	41° 58' 10"	83° 09' 10"
826 (10D)	41° 58' 20"	83° 09' 50"
827 (11D)	41° 59' 07"	83° 07' 46"
828 (12D)	41° 58' 48"	83° 05' 27"
829 (13D)	42° 00' 30"	83° 09' 10"
830 (14D)	42° 00' 29"	83° 06' 08"
831 (15D)	42° 02' 00"	83° 09' 10"
832 (16D)	42° 01' 30"	83° 04' 08"
833 (1M)	41° 42' 50"	83° 25' 30"
834 (2M)	41° 43' 40"	83° 23' 20"
835 (3M)	41° 44' 30"	83° 21' 20"
836 (4M)	41° 45' 18"	83° 19' 07"
837 (6M)	41° 42' 49"	83° 16' 16"
838 (7M)	41° 44' 02"	83° 17' 51"
839 (8M)	41° 47' 21"	83° 19' 26"
840 (2R)	41° 50' 42"	83° 19' 25"
841 (3R)	41° 53' 10"	83° 19' 50"
842 (4R)	41° 52' 50"	83° 17' 50"
843 (5R)	41° 52' 24"	83° 15' 45"
844 (6R)	41° 54' 03"	83° 17' 15"
845	42° 02' 10"	83° 11' 00"
846	42° 02' 09"	83° 07' 14"
847	42° 02' 10"	83° 05' 49"
848	42° 01' 30"	83° 09' 54"
849	42° 01' 35"	83° 08' 09"
850	42° 01' 38"	83° 05' 59"
851	42° 00' 30"	83° 10' 24"
852	42° 00' 38"	83° 07' 29"
853	42° 00' 25"	83° 03' 46"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
854	41° 59' 10"	83° 11' 54"
855	41° 59' 23"	83° 04' 47"
856	42° 00' 25"	83° 03' 53"
857	41° 57' 55"	83° 11' 49"
858	41° 57' 38"	83° 06' 02"
859	41° 57' 28"	83° 04' 07"
860	41° 57' 28"	83° 02' 43"
861	41° 53' 53"	83° 16' 37"
862	41° 52' 34"	83° 19' 50"
863	41° 50' 46"	83° 18' 29"
864	41° 49' 06"	83° 19' 26"
865	41° 45' 38"	83° 21' 46"
866	41° 44' 40"	83° 23' 34"
867	41° 42' 47"	83° 18' 37"
868	41° 42' 18"	83° 21' 38"
869	42° 00' 03"	82° 44' 55"
870	42° 00' 02"	82° 38' 35"
871	41° 59' 14"	82° 35' 59"
872	41° 56' 36"	82° 42' 16"
873	41° 55' 47"	82° 37' 17"
874	41° 55' 49"	82° 32' 59"
875	41° 49' 06"	82° 29' 33"
876	41° 49' 03"	82° 27' 13"
877	41° 47' 50"	82° 27' 10"
878	41° 47' 48"	82° 29' 38"
900	41° 46' 31"	82° 03' 03"
901	41° 43' 42"	82° 45' 06"
902	41° 37' 10"	82° 50' 34"
903	41° 52' 25"	83° 09' 48"
904	41° 44' 01"	83° 00' 00"
905	41° 58' 34"	82° 59' 04"
906	41° 55' 32"	83° 02' 54"
907	41° 55' 52"	83° 11' 42"

GEOTECHNICAL CORING
LAKE ERIE STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
809	42° 36' 59"	79° 28' 03"
810	42° 25' 58"	79° 45' 59"
811	42° 38' 26"	79° 51' 56"
812	42° 25' 00"	80° 13' 04"
813	42° 38' 58"	80° 03' 59"
814	41° 56' 29"	81° 07' 01"
815	42° 13' 59"	81° 07' 30"
816	42° 03' 01"	81° 23' 04"
817	42° 22' 02"	81° 32' 29"
818	42° 10' 00"	81° 42' 59"
819	41° 42' 02"	81° 51' 59"
820	42° 06' 00"	82° 07' 00"
821	41° 31' 59"	82° 28' 01"
822	41° 37' 30"	82° 32' 31"



LAKE ONTARIO

SEDIMENT AND BENTHIC FAUNA SURVEY

LRB STUDY 82015, DR. T. REYNOLDSON

In order to update data on both surficial sediment and benthic fauna of Lake Ontario, a cruise was conducted aboard the CSS LIMNOS during the period September 7-11. This cruise was a continuation and completion of sampling commenced last year during Cruise 87-00-010 which was delayed because of inclement weather. Again this year, the grid pattern previously sampled in 1977 was sampled. At each station, both a Shipek and Ponar grab sample was collected. The Shipek sample was subsampled for surficial sediments and stored at 4°C until returned to CCIW for analysis. The Ponar grab sample was subsampled for benthic fauna, sieved, the residue placed in a container and preserved with 4% Formalin. At six stations which had been sampled during the previous cruise, additional samples were collected for comparison of sampling techniques.

STATISTICS SUMMARY

24

CRUISE NO. 88-00-008 CONSECUTIVE NO. 037
 DATES FROM September 7 TO September 11, 1988
 CRUISE TYPE Sediment and Benthic Fauna Survey

SHIP CSS LIMNOS
 LAKE ONTARIO
 N. MILES STEAMED 667

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	121	Moorings Established	
EBT Casts		" Retrieved	
Rosette Casts		" Established	
Transmissometer Casts		" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations		" Retrieved	
H ₂ O Surface Temperature	121	" 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	
" " " (Eh)	108		
" " " (D.O.)		Grab Samples Taken, Shipek	132
" " " (Cond/pH)		Grab Samples Taken, Ponar	133
" " " ()		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	
" " " ()			

LAKE ONTARIO STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
A-04	43° 13' 00"	79° 29' 38"
A-05	43° 12' 59"	79° 23' 39"
A-06	43° 13' 00"	79° 18' 00"
B-02	43° 17' 01"	79° 42' 05"
B-03	43° 17' 02"	79° 36' 00"
B-04	43° 17' 01"	79° 30' 03"
B-05	43° 17' 00"	79° 23' 11"
B-06	43° 17' 00"	79° 17' 58"
B-07	43° 17' 06"	79° 12' 03"
B-08	43° 17' 15"	79° 05' 57"
B-23	43° 17' 03"	77° 35' 58"
B-24	43° 17' 02"	77° 29' 00"
C-02	43° 21' 03"	79° 42' 03"
C-03	43° 21' 06"	79° 36' 00"
C-04	43° 21' 03"	79° 29' 59"
C-05	43° 21' 05"	79° 24' 00"
C-06	43° 21' 03"	79° 18' 01"
C-07	43° 21' 06"	79° 12' 01"
C-08	43° 21' 02"	79° 06' 00"
C-09	43° 21' 02"	78° 59' 56"
C-10	43° 21' 00"	78° 53' 54"
C-11	43° 21' 04"	78° 48' 01"
C-12	43° 21' 10"	78° 42' 00"
C-21	43° 21' 31"	78° 47' 29"
C-22	43° 21' 05"	77° 42' 02"
C-23	43° 21' 02"	77° 35' 57"
C-24	43° 21' 05"	77° 30' 00"
C-25	43° 21' 03"	77° 23' 58"
C-26	43° 21' 04"	77° 18' 01"
C-27	43° 21' 00"	77° 11' 52"
C-28	43° 21' 03"	77° 06' 30"
C-29	43° 21' 04"	77° 00' 00"
C-30	43° 21' 07"	76° 53' 14"
C-31	43° 21' 02"	76° 48' 04"
D-03	43° 25' 07"	79° 36' 01"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
D-04	43° 25' 06"	79° 29' 54"
D-05	43° 25' 08"	79° 24' 03"
D-06	43° 26' 02"	79° 18' 05"
D-07	43° 26' 00"	79° 12' 00"
D-08	43° 25' 57"	79° 06' 08"
D-09	43° 25' 59"	78° 59' 59"
D-10	43° 25' 06"	78° 53' 09"
D-11	43° 26' 09"	78° 48' 01"
D-12	43° 26' 00"	78° 41' 59"
D-13	43° 26' 00"	78° 36' 00"
D-14	43° 26' 05"	78° 30' 00"
D-15	43° 26' 06"	78° 23' 54"
D-16	43° 25' 07"	78° 17' 09"
D-17	43° 26' 00"	78° 12' 01"
D-18	43° 26' 00"	78° 05' 06"
D-19	43° 25' 59"	77° 59' 11"
D-20	43° 26' 01"	77° 54' 00"
D-21	43° 26' 01"	77° 47' 57"
D-22	43° 26' 04"	77° 41' 59"
D-23	43° 25' 57"	77° 35' 55"
D-24	43° 25' 07"	77° 29' 02"
D-25	43° 26' 02"	77° 23' 58"
D-26	43° 25' 05"	77° 18' 03"
D-27	43° 25' 58"	77° 12' 00"
D-28	43° 26' 05"	77° 05' 58"
D-30	43° 25' 08"	76° 53' 03"
D-31	43° 26' 06"	76° 48' 06"
E-04	43° 30' 02"	79° 30' 00"
E-05	43° 30' 01"	79° 24' 02"
E-06	43° 30' 01"	79° 17' 59"
E-07	43° 29' 59"	79° 11' 59"
E-08	43° 30' 00"	79° 06' 03"
E-09	43° 30' 02"	78° 59' 58"
E-10	43° 30' 01"	78° 54' 03"
E-11	43° 30' 03"	78° 48' 09"
E-12	43° 30' 02"	78° 42' 02"
E-13	43° 30' 02"	78° 36' 00"
E-14	43° 30' 04"	78° 30' 02"
E-15	43° 30' 01"	78° 24' 00"
E-16	43° 30' 02"	78° 18' 04"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
E-17	43° 30' 02"	78° 11' 11"
E-18	43° 30' 01"	78° 05' 57"
E-19	43° 30' 00"	78° 00' 00"
E-20	43° 30' 00"	77° 54' 00"
E-21	43° 30' 00"	77° 47' 53"
E-23	43° 29' 59"	77° 36' 01"
E-24	43° 30' 02"	77° 30' 01"
E-25	43° 30' 03"	77° 24' 09"
E-26	43° 29' 56"	77° 17' 58"
E-27	43° 29' 52"	77° 11' 52"
E-28	43° 30' 00"	77° 04' 59"
E-29	43° 30' 02"	77° 00' 01"
F-05	43° 34' 04"	79° 23' 55"
F-07	43° 34' 01"	79° 11' 02"
F-09	43° 34' 00"	79° 00' 00"
F-11	43° 34' 01"	78° 48' 00"
F-13	43° 34' 01"	78° 36' 15"
F-15	43° 34' 04"	78° 23' 09"
F-17	43° 34' 05"	78° 11' 56"
F-19	43° 34' 00"	78° 00' 05"
F-23	43° 33' 59"	77° 35' 50"
G-06	43° 38' 58"	79° 17' 08"
G-08	43° 38' 56"	79° 05' 56"
G-10	43° 39' 05"	78° 53' 06"
G-12	43° 39' 01"	78° 41' 57"
G-14	43° 39' 03"	78° 29' 58"
G-16	43° 39' 03"	78° 17' 59"
G-18	43° 38' 03"	78° 06' 01"
G-20	43° 39' 00"	77° 54' 03"
H-07	43° 43' 04"	79° 11' 02"
H-09	43° 42' 58"	78° 59' 58"
H-11	43° 43' 01"	78° 47' 11"
H-13	43° 43' 02"	78° 36' 03"
H-15	43° 42' 58"	78° 23' 58"
H-17	43° 43' 03"	78° 12' 01"
I-08	43° 46' 47"	79° 05' 54"
I-10	43° 47' 02"	78° 54' 02"
I-12	43° 47' 04"	78° 42' 00"
I-14	43° 47' 02"	78° 30' 00"
I-16	43° 47' 01"	78° 18' 03"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
I-18	43° 47' 04"	78° 05' 59"
I-20	43° 47' 08"	77° 54' 03"
J-11	43° 51' 12"	78° 48' 00"
J-13	43° 51' 58"	78° 36' 02"
J-15	43° 51' 57"	78° 23' 56"
J-17	43° 52' 00"	78° 12' 01"

LAKE ONTARIO

Sediment and Benthic Fauna Survey

88 - 00 - 008

CSS LIMNOS

September 7 - 11, 1988

Track Plot

29

Leaf 2 of 2

LAKE ERIE

INTERNAL SEDIMENT LOADING

LRB STUDY 82016, F. ROSA

Two Lake Erie cruises were carried out onboard the CSS LIMNOS--April 25-30 and September 26-30. On each cruise, meteorological observations were made and EBT/transmissometer profiles to the bottom collected. 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 -1 m.
2. Bulk water samples (1200L) were collected from 5 m and centrifuged onboard for suspended particulate.
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 again during the September cruise for the winter of 1989.

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"

MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
23	88-01AC-06A	42° 29' 25"	79° 54' 22"
84	88-01AC-07A	41° 55' 45"	81° 39' 37"
357	88-01AC-08A	41° 49' 43"	82° 58' 42"

LAKE ONTARIO

MOORINGS

LRB/RSD STUDIES 82031/86041, M.N. CHARLTON

Five Lake Ontario cruises were carried out onboard the CSS LIMNOS as follows: May 24-26, July 4-6, August 8-12, September 19-21, and piggybacked on the St. Lawrence River cruise.

Sediment trap moorings were installed at stations 41 and 81. Traps were placed at 15, 20, 40 and 124 metres at station 41 and 15, 20, 40, and 33.5 metres at 81. A temperature profile and a surface bucket temperature were taken at each station.

STATION POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST. DEPTH
41	88-00A-13A	43° 42' 57"	78° 01' 40"	15,20,40,124
81	88-00A-14A	44° 01' 00"	76° 40' 16"	15,20,40,33.5

LAKE ONTARIO

NUTRIENT-CONTAMINANT INTERACTIONS

LRB STUDY 82061, DR. J.H. CAREY

This was a dual purpose cruise, the first of which was to collect dissolved organic matter to determine pesticide partitioning, and the second was to collect organisms and sediment for contaminant analysis. These will help to characterize and quantify the critical processes that control interaction of nutrients and contaminants in lakes.

On Cruise 88-00-005 from August 8 to 10, the CSS LIMNOS was utilized to sample three stations in the Bay of Quinte. Water samples of 60 litres were collected at stations 825, 826 and 827 and delivered to LRB personnel in Trenton for preliminary filtering and return to CCIW. At stations 826 and 827, bottom sled hauls to obtain benthic fauna samples were obtained along with zooplankton hauls and bottom sediment cores.

As an additional task, sediment trap moorings were refurbished at stations 41 and 81 in Lake Ontario to support LRB Study 82031. Benthic fauna, zooplankton and bottom sediment samples were also collected at these stations.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
41	43° 43' 18"	78° 00' 53"
81	44° 00' 56"	76° 40' 21"
825	44° 05' 15"	77° 32' 00"
826	44° 09' 07"	77° 15' 26"
827	44° 06' 38"	76° 53' 06"

STATISTICS SUMMARY

33

CRUISE NO. 88-00-005 CONSECUTIVE NO. 027 SHIP CSS LIMNOS
 DATES FROM August 8 TO August 10, 1988 LAKE ONTARIO
 CRUISE TYPE Nutrient-Contaminant Interactions and Moorings N. MILES STEAMED 391.5

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	7	Moorings Established , Sediment Trap	1
EBT Casts	6	" Retrieved	
Rosette Casts	8	" Established	
Transmissometer Casts	6	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations		" Retrieved	
		" Refurbished	2
Zooplankton Hauls	12	" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples	12		
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	8
" " " ()			
" " " (D.O.)		Grab Samples Taken, Ekman and Ponar	10
" " " (Cond/pH)	6		
" " " ()		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.	6
" " " ()		Nutrients (WOB)	
" " " ()		Microbiology	
" " " ()			

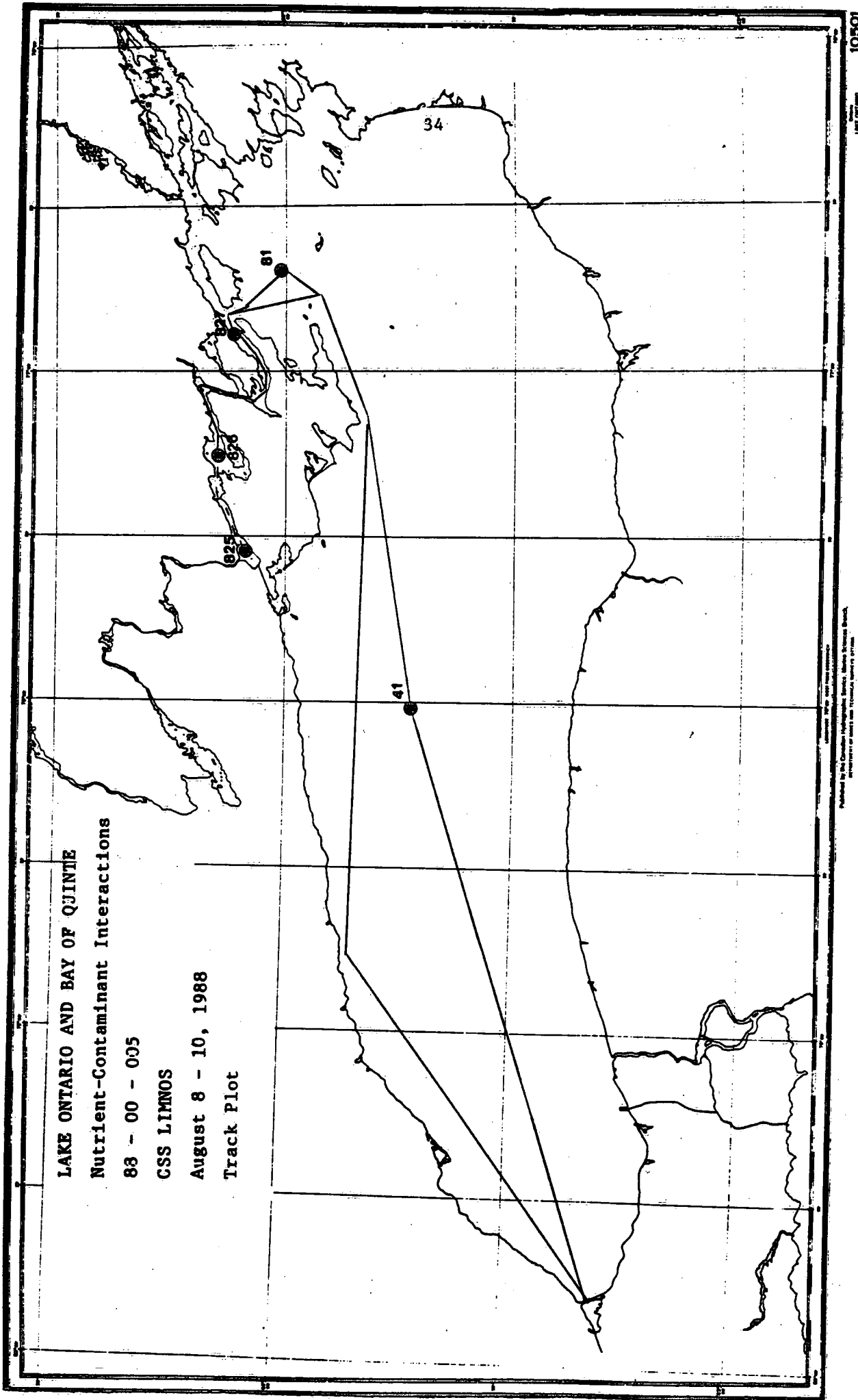
LAKE ONTARIO AND BAY OF QUINTE
Nutrient-Contaminant Interactions

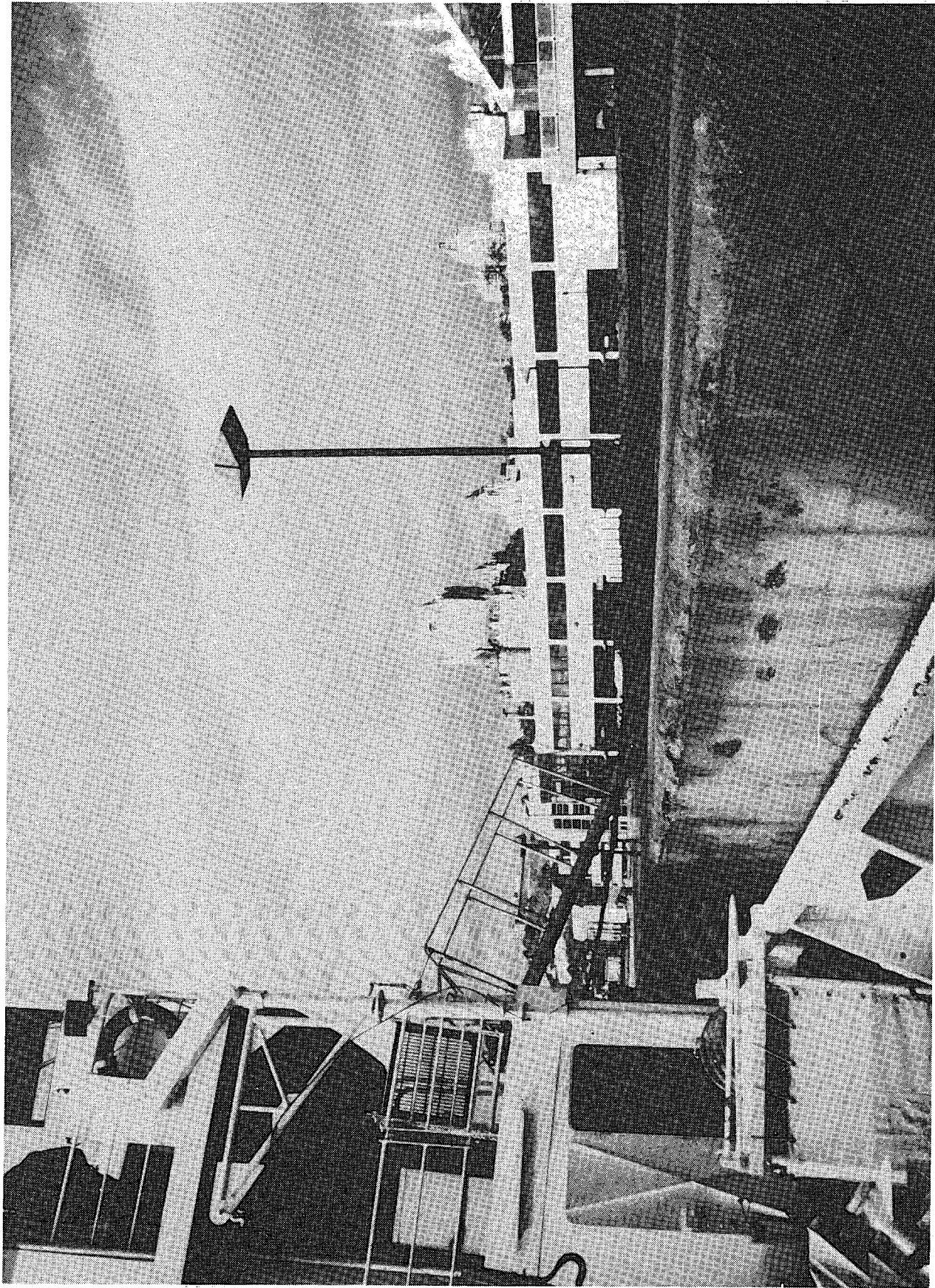
83 - 00 - 005

CSS LIMNOS

August 8 - 10, 1988

Track Plot





HIGH TIDE, QUEBEC CITY

LAKE ERIE

NUTRIENT CONTAMINANT INTERACTIONS

LRB STUDY 82066, DR. D.R.S. LEAN

One Lake Erie cruise was carried out onboard the CSS LIMNOS July 18-28 to determine the critical processes that control the interactions of nutrients and contaminants. The parameters sampled during this cruise were: temperature profile, transmission profile, dissolved oxygen, specific conductance, pH, chlorophyll a, major ions, total phosphorus filtered and unfiltered, total Kjeldahl nitrogen, continuous solar radiation.

Some additional tasks performed during this cruise included box cores for LRB Study 82015 and Shipek samples for Dr. M. Munawar Study 86042.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29' 52"	79° 53' 52"
84	41° 55' 12"	81° 39' 16"
357A	42° 43' 03"	81° 54' 48"

ST. LAWRENCE RIVER

ORGANIC AND INORGANIC CONTAMINANTS

RRB STUDY 83017, DR. K.R. LUM

This was the fourth St. Lawrence River cruise to be 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 and this year's cruise was completed October 3-30. The purpose of this year's cruise was:

1. To determine the distribution, partitioning, transport pathways, bioavailability and dynamics of the cycling of 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

2. To define the role of the major tidal flats in the seasonal retention and re-injection of particle-bound contaminants of the Upper Estuary and their relationships to the food web dynamics in the maximum turbidity zone (MTZ).

This cruise was divided into four segments: sampling of the St. Lawrence River from Kingston area to Quebec City during the downbound transit; participation in the International Symposium on the Fate and Effects of Toxic Chemicals in Large Rivers and their Estuaries at Quebec City; sampling of the estuary from the Ile D'Orleans to Tadoussac/Ile Verte area; and the retrieval of moorings from Lac St. Pierre and Lake Ontario on the upbound transit to CCIW, Burlington.

Sampling of the river from the Wolfe Island area to Quebec City was conducted on the downbound transit. A total of six master stations were occupied during the seven-day transit period. At each of these stations, an EBT/transmissometer profile was obtained along with water samples for: conductivity, pH, chlorophyll *a*, particulate organic carbon, Seston, suspended particles, organic and inorganic contaminants, trace metal analyses, and the particulate speciation of mercury and particulate-bound PAH's. While the vessel was sampling the master stations or in transit between stations, additional sediment sampling stations were occupied using the MonArk for the collection of bivalve samples. In Lac St. Pierre, the MonArk was again utilized to refurbish four current, temperature, transmission and sedimentation moorings in support of LRB Study 82045. At these four sites, bivalve samples were also collected.

At station 253, a camera crew from CCIW came aboard the vessel to document the work being conducted on this cruise. The camera crew, headed by Mr. G. Sivell of the Science Liaison Division, NWRI, remained aboard the vessel for approximately 5.5 hours filming all aspects of the work plus taking shots of the vessel underway from the MonArk. After completion of this exercise, the ship docked in Quebec City on the afternoon of October 10th to participate in the Symposium.

During the period from October 11 to 13, the vessel was alongside at Quebec City where an Open House for personnel of the International Symposium on the Fate and Effects of Toxic Chemicals in Large Rivers and their Estuaries was conducted. On October 14, two demonstration cruises of the vessel's operational capabilities were conducted in the Quebec City area for selected Symposium personnel.

On October 13, while the vessel was alongside at Quebec City, a field party visited the Cap Tourmente National Wildlife area near Saint-Joachim. The object of this field trip was to confirm that the migrating snow geese combined with the tidal action was resulting in erosion of the particulate matter accreted on the tidal flats during the May-September period. CWS records show that this year's snow geese count as of October 13 was 115,000 and another 285,000 birds were expected to stop in the Cap Tourmente area for feeding before the snow geese migrating period was completed. From the observations made at Cap

Tourmente, and at the request of the CWS Program Manager at the reserve, the small boat sampling of the tidal flats area was cancelled to avoid disruption to the snow geese program.

The estuary portion of the cruise began on October 15 when conventional type drifters were released near station 8E-100 in the Chanel de l'Ile D'Orleans. The MonArk was utilized to follow and identify the drogues while the CSS LIMNOS was used to fix the position of the MonArk when alongside and identify the individual drogues. The drogues were tracked during daylight hours from the point of release to the Pointe D'Alliance area during the ebb tide and for part of the flood tide until darkness caused the completion of this day's experiment. The drifters were not retrieved in the hope that they would be sighted and tracking could be continued the following day. These drogues were never retrieved because inclement weather conditions and time restrictions caused cancellation of the completion of this experiment.

Five master stations were sampled in the estuary portion of the cruise. At each of the stations, the vessel anchored for at least one complete tidal cycle at which time water samples were collected for: conductivity, pH, particulate organic carbon, Seston, suspended particles, organic and inorganic contaminants, trace metal analyses, and particulate speciation of mercury and particulate-bound PAH's. In addition, an EBT/transmission profile plus zooplankton net hauls were collected at each station. At station 8E-450--the fifth estuary station, inclement weather caused the cancellation of sampling. The vessel departed the Tadoussac/Ile Verte area and proceeded upriver. The plan to resample station 8E-300 for 12 hours on the upbound transit also had to be aborted because of the high sea state in the area.

During the upbound transit of the river through Lac St. Pierre, five moorings were retrieved without incident using the MonArk. These moorings were originally installed in September by the CSS ADVENT and serviced by the MonArk on the downbound transit of this cruise in support of LRB Study 82045. The retrieval of these moorings was completed in a four-hour period on the morning of October 25th. After completion of the mooring retrieval, the ship continued on its transit to Lake Ontario. At station 81 in Lake Ontario, a sediment trap mooring was retrieved in support of RSD Study 86041. Upon completion of the mooring retrieval, the vessel anchored in Prince Edward Bay because of deteriorating weather conditions. The ship remained anchored in Prince Edward Bay for 55 hours when weather conditions diminished allowing transit to station 41 and the retrieval of the mooring from that station.



SAMPLING AT ANCHOR--SEVERE WIRE ANGLE

STATISTICS SUMMARY

40

88 - 00 - 011
JISE NO. 88 - 07 - 001 CONSECUTIVE NO. 703
DATES FROM October 3 TO October 30, 1988
CRUISE TYPE Organic and Inorganic Contaminants

SHIP CSS LIMNOS
LAKE AND ST. LAWRENCE RIVER
N. MILES STEAMED 1226.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	105	Moorings Established	
EBT Casts	90	" Retrieved CTT	8
Rosette Casts		" Established CTT	4
Transmissometer Casts	90	" Retrieved Wave & Tide Recorder	1
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations		" Retrieved Sediment Trap	2
		" Refurbished	
Zooplankton Hauls	53	" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
BGM Extraction	72	Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ()			
" " " (D.O.)		Grab Samples Taken Shipek	11
" " " (Cond/pH)	640	Ponar & min.-Ponar	120
" " " ()		Bulk Centrifuge Samples - 600L	51
" " " (T P uf)		- 720L	69
" " " (TKN)		-1080L	63
" " " ()		-1440L	57
" " " ()		- Beckman	3120.9L
Water Samples Filtered (Chlorophyll)	32		
" " " (POC/TPN)	83		
" " " (Seston)	252		
" " " (T P f)			
" " " (Nutrients)			
" " " (Major Ions)			
" " Centrifuged (Trace Metals)	113	Manual Chemistry Tech. Ops.	1280
" " " (Mercury)	30	Nutrients (WOB)	
" " " ()		Microbiology	
" " " ()			

ONBOARD ANALYSES

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.	TYPE
27	44° 14' 31"	76° 19' 21"	M
28	44° 07' 17"	76° 22' 03"	M
29	44° 38' 25"	75° 36' 07"	S
30	44° 59' 15"	74° 46' 15"	S
37	45° 01' 09"	74° 37' 01"	S
41	45° 02' 21"	74° 35' 46"	M
42	45° 10' 39"	74° 18' 43"	S
44	45° 11' 19"	74° 19' 26"	S
47	45° 12' 44"	74° 11' 45"	S
51	45° 13' 32"	74° 08' 16"	M
55	45° 20' 14"	73° 53' 00"	S
59	45° 24' 43"	73° 49' 39"	S
95	46° 07' 41"	72° 56' 56"	S
107	46° 12' 36"	72° 55' 08"	S
112	46° 14' 11"	72° 45' 38"	S
115	46° 14' 53"	72° 44' 03"	S
243	45° 58' 43"	73° 10' 36"	M
253	46° 42' 56"	71° 22' 39"	M
8E-100A	47° 02' 59"	70° 46' 46"	D
8E-250	47° 09' 37"	70° 38' 37"	M
8E-300	47° 29' 19"	70° 05' 02"	M
8E-350	47° 53' 19"	69° 43' 48"	M
8E-400	48° 08' 24"	69° 36' 18"	M
8E-450	48° 06' 28"	69° 21' 12"	M
88-07S-20C	46° 15' 26"	72° 45' 00"	CTT
88-07S-21B	46° 14' 40"	72° 43' 59"	CTT
88-07S-22A	46° 14' 39"	72° 43' 54"	W&T
88-07S-23B	46° 14' 04"	72° 45' 29"	CTT
88-07S-24B	46° 14' 51"	72° 46' 25"	CTT
88-00A-13D	43° 43' 21"	78° 01' 57"	SED
88-00A-14D	44° 01' 23"	76° 40' 24"	SED

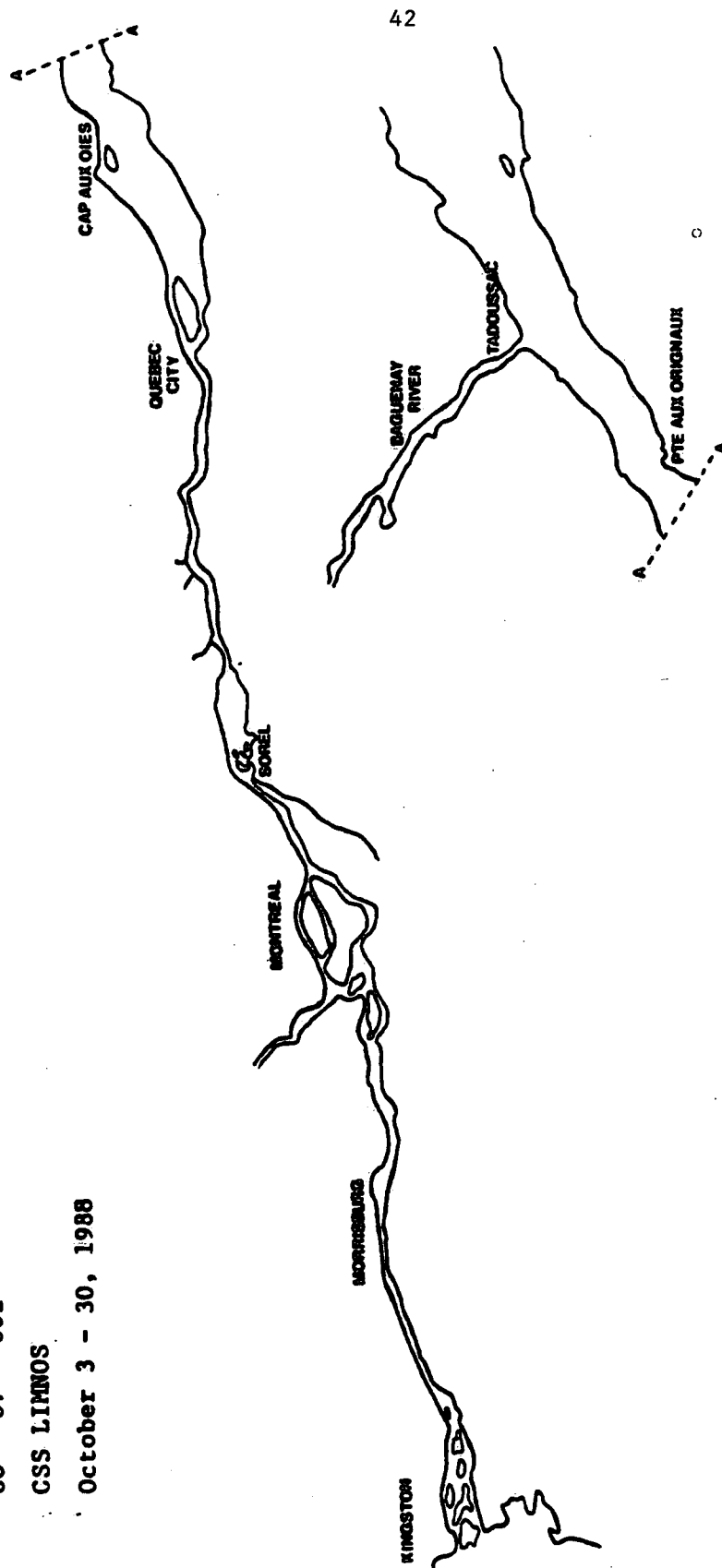
M Master Station
 S Sediment Sampling
 D Drogue Release

ST. LAWRENCE RIVER
Organic and Inorganic Contaminants

88 - 07 - 001

CSS LIMNOS

October 3 - 30, 1988



BAYFIELD

1988

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

GLLFAS 423 AND IWD-OR 86041

International Joint Commission	- IJC
Great Lakes Laboratory for Fisheries & Aquatic Sciences	- GLLFAS
Department of Fisheries & Oceans	- DFO
Ontario Ministry of Natural Resources	- OMNR
Ontario Ministry of the Environment	- OME
Lakes Research Branch	- LRB
Water Quality Branch-Ontario Region	- WQB-OR

The IJC accepted, in 1978, a broader definition of the health of Lake Ontario, encompassing all components of the ecosystem. The Bioindex Program, initiated in 1981 by what is now GLLFAS of DFO, is aimed at regularly sampling the open-water pelagic and benthic communities; thereby providing valuable input to an integrative Biological Monitoring Program.

Another IJC area of concern is the Bay of Quinte. Project Quinte is a multi-agency study (OMNR, OME, DFO, Queen's University) investigating the ecosystem response to phosphorus reductions at sewage treatment plants. Primary production and P Kinetics experiments were carried out by GLLFAS personnel aboard CSS BAYFIELD. The new laboratory on the stern of the vessel provides more space and improved efficiency. There were 25 cruises on BAYFIELD and two on CSS LIMNOS.

Additional work on station and in the laboratories was conducted for investigators, including:

- | | |
|-----------------------------------|--------------------|
| 1. Biberhofer, WQB-OR | - nutrients, etc. |
| 2. Dermott, GLLFAS | - benthic fauna |
| 3. Manning, LRB | - dissolved oxygen |
| 4. Shelske, University of Florida | - calcite, silica |
| 5. Brian Eaddie, et al | - Seston |
| 6. Lean, et al | - lipid analysis |

Deck logs show some examples of work performed on two stations. In the examples, Station B was occupied by BAYFIELD for 2 hours and 5 minutes and Station 41 for 2 hours and 13 minutes.

Public Awareness

June - Visit by Dr. Michio Kumagai, Japan
June - Open House, Oakville Historical Society
July - Visit by Dr. D. Polton, OME
August - Cabinet Ministers McMillan and Jelinek onboard
August - Visit by Mr. M. McMullen, DFO, Winnipeg
October - Participation by Mr. M. Foster, L.B. Pearson High School

QUINTE

Vessel		NWRI DECK LOG				EBT	Rosette	XMS	W.Q.				
BAYFIELD		EBT/BT Serial No.		Surface Temp.				20%	✓				
Cruise No. 88.00.324		Trace No.		Time Down		Mooring	Sed.	Phyto.					
Date (GMT) 4 Day / 10 Month / Year 88				1220 Z		Wire Angle	D.O. Profile no.	Bottles	Micro				
Station No.		Cons. Stn.	30 cm Secchi Disc		Sounding (m)	Observers							
B (M.O.E.#1)		2	Depth 1.1 m Colour 21 forel		5	JC DM MD							
Depth (m)	Chloro a	POC	DO	CON pH	TP f	uf	Algae	WQ	LEAN X 6	Sest.	MYLON	SCHN-DLER	PUMP
Int. 0-2	GF/CX2 100ml			1	1	1	M.O.E.	1	781 to 786	250ml	250ml		
1				1 (9.18 mg/l)								1	3-1 Phyto
4				2 (9.18 mg/l)								2/3	3-1 Zoop
0-1	M.O.E.	Nutrients, Algae and Contaminants											
Remarks													
B+W Secchi: 1.0													
Light Profile													
Composite Sampler													
New pH probe in use, calibrated													

[illegible]

STATION POSITIONS

STATION NUMBER	PROJECT	LATITUDE N.	LONGITUDE W.
41	Bioindex	43° 43' 00'	78° 01' 86"
81	Bioindex	44° 01' 00"	76° 40' 18"
B	Quinte	44° 08' 42"	77° 20' 24"
HB	Quinte	44° 05' 42"	77° 04' 07"
C	Quinte	44° 06' 30"	76° 53' 54"
844	Mysis	43° 47' 48"	78° 01' 36"
846	and	43° 41' 18"	78° 01' 36"
54A		43° 22' 54"	77° 33' 36"
81A	Benthos	43° 58' 54"	76° 39' 18"
102	WQB-OR	44° 12' 12"	76° 14' 22"
103	WQB-OR	44° 11' 48"	76° 32' 24"
855	Manning	43° 50' 00"	76° 50' 00"
861		44° 03' 02"	76° 59' 45"
862		44° 05' 32"	77° 04' 31"
863		44° 08' 50"	77° 12' 19"
866		44° 03' 12"	77° 06' 00"
872		44° 08' 50"	77° 22' 25"
873		44° 09' 10"	77° 20' 42"
874		44° 09' 03"	77° 18' 38"
875		44° 09' 11"	77° 14' 46"
876		44° 09' 22"	77° 09' 28"
877		44° 02' 08"	77° 07' 27"
878	Manning	44° 08' 46"	77° 17' 06"

ADVENT 1988

	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
FEB	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
MAR	28	29	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
APR	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
MAY	24	25	26	27	28	29	30
	1	2	3	4	5	6	7
	8	9	10	11 LAKE ONTARIO	12 SUSPENDED SEDIMENT	13	14
	15	16	17	18	19	20	21
	22	23	24 LAKE ONTARIO	25 PRIMARY	26 PRODUCTION	27 LAKE ONTARIO	28
JUN	29	30 LAKE	31 ERIE	1 PRIMARY	2 PRODUCTION	3 DETROIT	4 RIVER
	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22 LAKE ONTARIO	23 SEDIMENT TOXICITY	24	25
JUL	26	27	28	29	30	1	2
	3	4 LAKE ONTARIO	5 SEDIMENT	6 SAMPLING	7 LAKE	8 ONTARIO	9
	10	11	12 LAKE ONTARIO	13 PRIMARY PRODUCTION	14	15	16
	17	18	19 SEDIMENT TOXICITY	20 LAKE	21 ERIE	22 PRIMARY	23 PRODUCTION
	24 LAKE	25 ERIE	26 PRIMARY	27 PRODUCTION	28 LAKE	29 ERIE	30
AUG	31	1	2	3	4	5	6
	7	8	9 LAKE ONTARIO	10 SEDIMENT	11 SAMPLING	12	13
	14	15	16 LAKE ONTARIO	17 SEDIMENT TOXICITY	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31	1	2	3
SEP	4	5	6 LAKE ONTARIO	7 PRIMARY	8 PRODUCTION	9	10
	11	12	13	14 ST. LAWRENCE	15 RIVER	16 ROORING	17 INSTALLATION
	18 ST.	19 LAWRENCE	20 RIVER	21	22 LAKE ONTARIO	23 SEDIMENT	24 SAMPLING
	25 LAKE ONTARIO	26	27	28	29	30	1
OCT	2	3	4 LAKE ONTARIO	5 PRIMARY PRODUCTION	6	7	8
	9	10	11 ST. LAWRENCE	12 RIVER	13 PRIMARY	14 PRODUCTION	15 ST. LAWRENCE
	16 RIVER	17 PRIMARY	18 PRODUCTION	19 ST.	20 LAWRENCE	21 RIVER	22
	23	24	25	26	27	28	29
	30	31	1	2	3	4	5
NOV	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
DEC	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

MUNICIPAL/INDUSTRIAL STRATEGY FOR ABATEMENT
PRIMARY PRODUCTIVITY AND SEDIMENT TOXICITY

RSD STUDY 86042, DR. M. MUNAWAR, GLLFAS

PURPOSE

To assess the toxicological impact of effluent-bound contamination originating from the Ashbridges Bay Sewage Treatment Plant on the primary productivity of indigenous phytoplankton of the receiving waters for use as an indicator of ecosystem health.

To do an evaluation of the effluent toxicity to the edible fisheries food resource, ultraplankton-picoplankton, from offshore Lake Ontario.

RELEVANCE

To provide input to the Canada-Ontario Agreement (COA) concerning Great Lakes water quality with emphasis on the control of toxic substances. To help in the development of the Remedial Action Plan for the Toronto Waterfront.

PERSONNEL

Dr. M. Munawar, Study Leader, Great Lakes Laboratory for Fisheries & Aquatic Sciences

L. McCarthy

W. Page

R.J. Hess, Tech. Ops. Ship Section, RSD, NWRI

Six cruises were conducted in Ashbridges Bay using the CSS ADVENT. Primary productivity was measured by ¹⁴C uptake and algal fractionation bioassays were carried out to pinpoint the impact of effluent-bound contamination on offshore plankton communities. Integrated water samples were collected for water quality analysis and sediment was collected at selected sites for organics analysis. Additional sampling was conducted according to the direction of the effluent plume at that particular time. In conjunction with this study, phytoplankton and zooplankton samples were collected during each cruise at six offshore and selected MISA stations in support of an Erindale College project studying plankton communities in the Great Lakes.

This schedule of sampling was used in cruises throughout the year in Hamilton Harbour, Lake Erie/Detroit River and the St. Lawrence River. Bulk samples of water were also centrifuged for suspended solids at the following sites throughout the year: Toronto STP outfall, the mouth of the Rouge River and four sites on the St. Lawrence River.

Sampling dates:

ASHBRIDGES BAY

April	5 - 8
May	24 - 27
July	12 - 13
August	16 - 17
September	6 - 8
October	4 - 5

HAMILTON HARBOUR

July	19
August	16 - 17
September	6 - 8
October	4 - 5

LAKE ERIE/DETROIT RIVER

May	30 - June 4
July	20 - 29

ST. LAWRENCE RIVER

October	11 - 21
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HAMILTON HARBOUR STATION POSITIONS

STATION NUMBER		LATITUDE N.	LONGITUDE W.
MOE	DFO		
270	1	43° 16.8'	79° 52.25'
258	2	43° 17.2'	79° 50.2'
255	3	43° 17.2'	79° 48.65'
268	4	43° 16.32'	79° 46.9'
4	5	43° 17.0'	79° 48.0'
252	6	43° 18.35'	79° 48.65'

ASHBRIDGES BAY STATION POSITIONS

3	43° 39' 03"	79° 18' 54"
4	43° 38' 53"	79° 19' 02"
204	43° 40' 05"	79° 14' 58"
209	43° 39' 32"	79° 17' 39"
289	43° 38' 52"	79° 18' 43"
419	43° 38' 57"	79° 18' 51"
431	43° 39' 06"	79° 18' 53"
734	43° 37' 56"	79° 19' 07"
877	43° 38' 42"	79° 18' 56"
878	43° 39' 06"	79° 18' 33"
909	43° 38' 27"	79° 18' 59"
910	43° 39' 15"	79° 18' 15"
911	43° 38' 50"	79° 18' 53"
912	43° 39' 02"	79° 18' 41"
Offshore Control (12)	43° 36' 57"	79° 18' 05"

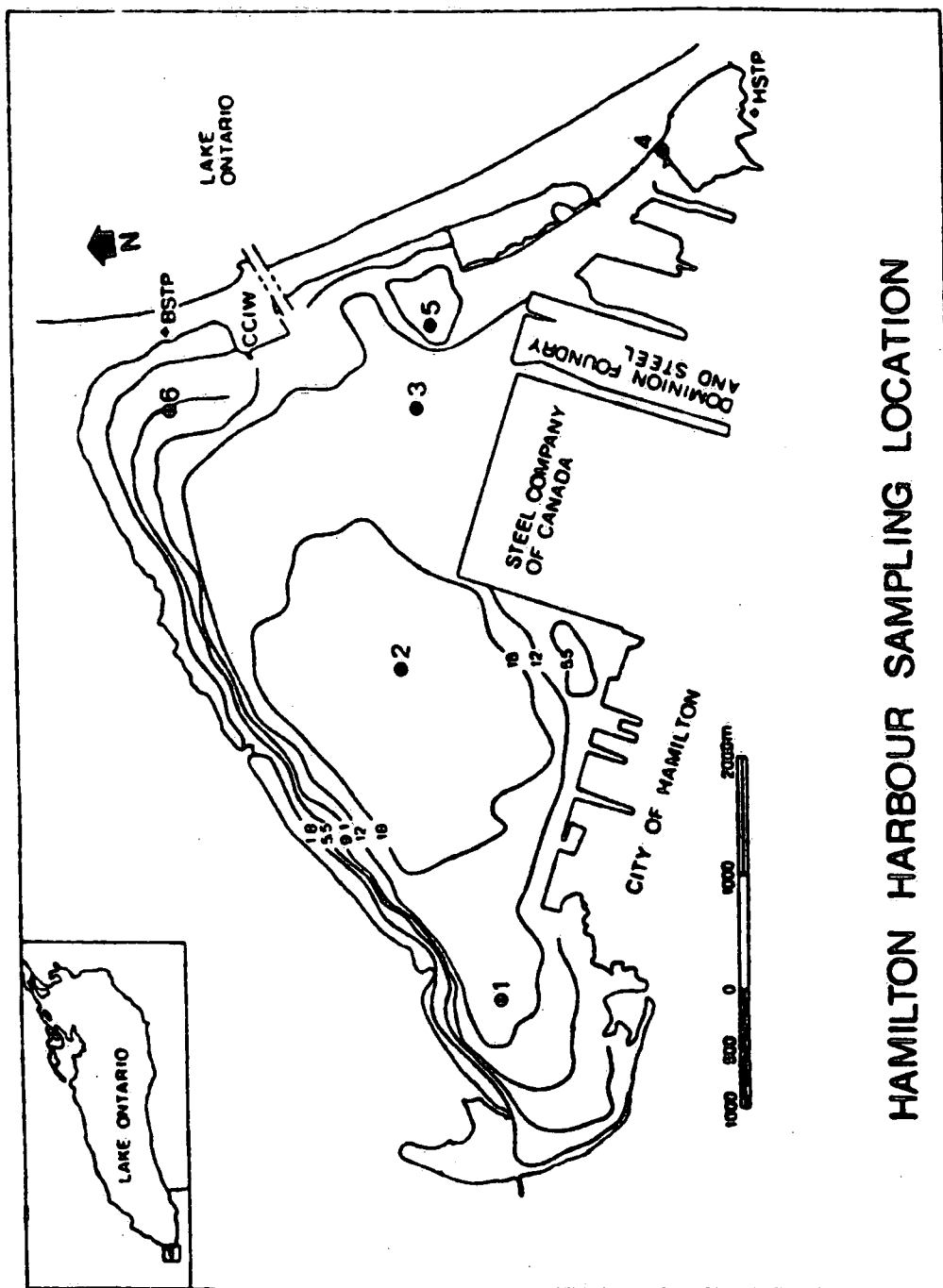
LAKE ONTARIO ZOOPLANKTON SAMPLING STATIONS

A	43° 31' 36"	79° 05' 50"
B	43° 32' 58"	79° 07' 53"
C	43° 34' 22"	79° 09' 47"
D	43° 35' 28"	79° 11' 58"
E	43° 36' 33"	79° 14' 15"
F	43° 38' 00"	79° 16' 27"

ST. LAWRENCE RIVER STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	44° 38' 24"	75° 35' 33"
2	44° 39' 40"	75° 34' 18"
3	44° 41' 24"	75° 31' 12"
4	44° 41' 50"	75° 30' 00"
5	44° 42' 24"	75° 29' 10"
13	45° 01' 03"	74° 41' 30"
9	44° 59' 14"	74° 46' 15"
10	44° 59' 24"	74° 44' 54"
14	45° 02' 06"	74° 36' 48"
15	45° 01' 45"	74° 36' 25"
A	45° 02' 36"	74° 34' 54"
11	44° 59' 12"	74° 41' 30"
12	45° 00' 03"	74° 41' 25"
16	45° 01' 09"	74° 36' 08"
17	45° 13' 54"	74° 10' 06"
20	45° 20' 06"	73° 54' 54"
22A	45° 20' 21"	73° 56' 48"
19A	45° 19' 24"	73° 52' 54"
26	45° 21' 30"	73° 50' 33"
29	45° 24' 31"	73° 46' 30"
32	45° 31' 21"	73° 32' 39"
32A	45° 31' 39"	73° 32' 34"
38	45° 43' 00"	73° 26' 03"
33	45° 34' 33"	73° 29' 24"
35	45° 42' 18"	73° 26' 15"
37	45° 43' 10"	73° 26' 33"
36	45° 43' 44"	73° 26' 48"
39	45° 42' 18"	73° 30' 00"
48	46° 09' 24"	72° 56' 36"
73B	46° 12' 00"	72° 51' 48"
43B	46° 13' 45"	72° 45' 50"
52	45° 21' 30"	73° 50' 33"
53A	46° 15' 44"	72° 41' 45"
57	46° 21' 18"	72° 30' 44"
58	46° 21' 27"	72° 30' 28"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
59	46° 22' 26"	72° 29' 19"
56	46° 20' 51"	72° 31' 44"
55	46° 19' 45"	72° 32' 50"
53A	46° 15' 54"	72° 39' 48"
49	46° 06' 56"	72° 56' 11"
50	46° 06' 24"	72° 54' 22"
45	46° 04' 11"	73° 05' 00"
44	46° 02' 50"	73° 08' 24"
43	46° 02' 36"	73° 09' 48"
C	45° 57' 42"	73° 11' 33"
8	44° 58' 50"	74° 50' 00"
7	44° 58' 20"	74° 52' 24"
6	44° 56' 50"	74° 56' 32"



HAMILTON HARBOUR SAMPLING LOCATION

LAKE ONTARIO

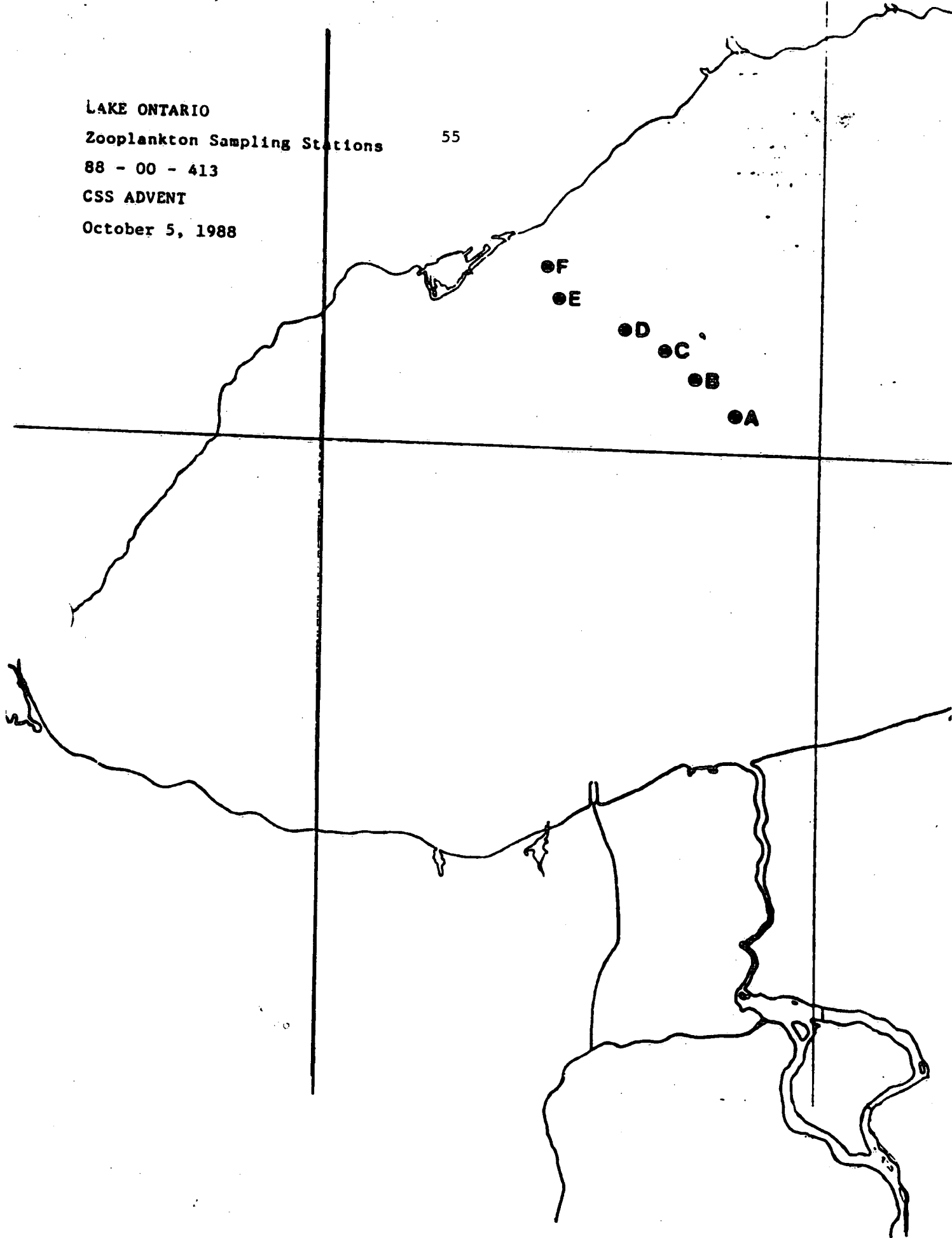
Zooplankton Sampling Stations

88 - 00 - 413

CSS ADVENT

October 5, 1988

55



EASTERN Kew Beach

456
See CAUTION NO 3
Vow ATTENTION NO 3

Ashbridges Bay
Ashbridges Bay Yacht Club
Coatsworth Cul

See CAUTION NO 3
Vow ATTENTION NO 3

910

431

878

912

419

911

280

877

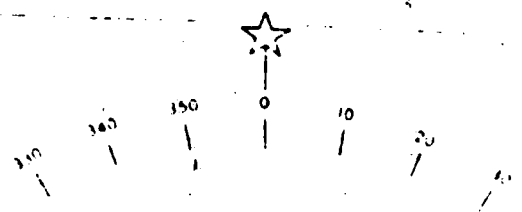
909

HARBOUR LIMIT
LIMITÉ DU PORT

ASHBRIDGES BAY
Primary Productivity
88 - 00 - 413
CSS ADVENT
October 5, 1988

734

12 (OFFSHORE)



BAY OF QUINTE AND LAKE ONTARIO
LAKE ERIE

SUSPENDED SEDIMENT SAMPLING

LRB STUDY 82025, DR. P.G. MANNING

Four cruises were conducted to collect suspended sediment samples for the determination of the bioavailabilities of iron and phosphorus in contaminated sediments. The first 2 cruises were a joint effort between the CSL SHARK (88-00-701) May 2-6 and the CSS ADVENT (88-00-401) May 9-12 on the Bay of Quinte and Lake Ontario. Cruise 88-01-002 was conducted from the CSS LIMNOS May 12-15 on the Central Basin of Lake Erie. The final cruise, No. 88-00-411, was conducted from the CSS ADVENT September 21-26 and involved a more intense study of the Bay of Quinte.

At all stations on all cruises, bulk water samples of 600 litres were collected and centrifuged through a Westfalia centrifuge at a flow rate of 6 litres/minute. The suspended solid sample was recovered, frozen and returned to CCIW for analysis. Benthos cores were also collected at several stations on each cruise and sectioned onboard immediately after collection. Core sections were frozen after sectioning.

LAKE ONTARIO AND BAY OF QUINTE STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
861	44° 03' 05"	77° 00' 03"
862	44° 05' 39"	77° 04' 27"
863	44° 08' 43"	77° 12' 30"
864	44° 09' 17"	77° 22' 54"
866	44° 03' 12"	77° 06' 02"
867	44° 06' 08"	77° 34' 26"

LAKE ONTARIO AND BAY OF QUINTE STATION POSITIONS

855	43° 50' 01"	76° 49' 58"
856	43° 59' 56"	76° 50' 20"
857	44° 09' 31"	76° 37' 23"
860	44° 09' 37"	76° 47' 09"
865	44° 11' 49"	76° 35' 51"
868	44° 04' 39"	76° 24' 41"

LAKE ERIE STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
84	41° 55' 42"	81° 38' 49"
84A	41° 55' 48"	81° 55' 00"
801	41° 45' 34"	81° 52' 54"
802	42° 12' 11"	81° 42' 25"
803	41° 55' 49"	81° 12' 02"
804	42° 08' 17"	81° 11' 58"
805	42° 20' 00"	81° 11' 59"
806	42° 26' 59"	81° 12' 00"
807	42° 10' 46"	80° 58' 02"
808	42° 14' 00"	80° 58' 02"

LAKE ONTARIO AND BAY OF QUINTE STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
861A	44° 02' 33"	77° 01' 12"
862	44° 05' 35"	77° 04' 24"
863	44° 08' 46"	77° 12' 26"
864	44° 09' 17"	77° 22' 57"
866	44° 03' 13"	77° 05' 59"
867	44° 06' 05"	77° 34' 30"
869	44° 05' 41"	77° 31' 41"
870	44° 07' 00"	77° 28' 19"
871	44° 08' 16"	77° 23' 54"
872	44° 08' 49"	77° 22' 23"
873	44° 09' 13"	77° 20' 44"
874	44° 09' 03"	77° 18' 34"
875	44° 09' 13"	77° 14' 52"
876	44° 09' 20"	77° 09' 26"
877	44° 02' 07"	77° 07' 26"
878	44° 08' 45"	77° 17' 03"

STATISTICS SUMMARY

59

CRUISE NO. 88-00-701 CONSECUTIVE NO. 004

SHIP CSL SHARK

DATES FROM May 2 TO May 6, 1988

LAKE ONTARIO AND BAY OF QUINTE

CRUISE TYPE Nearshore Suspended Sediment Sampling

N. MILES STEAMED 283.9

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	6	Moorings Established	
EBT Casts	6	" Retrieved	
Rosette Casts		" Established	
Transmissometer Casts	6	" 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	2
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ()			
" " " (D.O.)		Grab Samples Taken	6
" " " (Cond/pH)	7		
" " " ()		Bulk Centrifuge Samples 600L	7
" " " (T P uf)	7		
" " " (TKN)		Observations, Weather	
" " " ()			
" " " ()		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)	7		
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ()		Manual Chemistry Tech. Ops.	7
" " " ()		Nutrients (WOB)	
" " " ()		Microbiology	
" " " ()			

LAKE ONTARIO AND BAY OF QUINTE

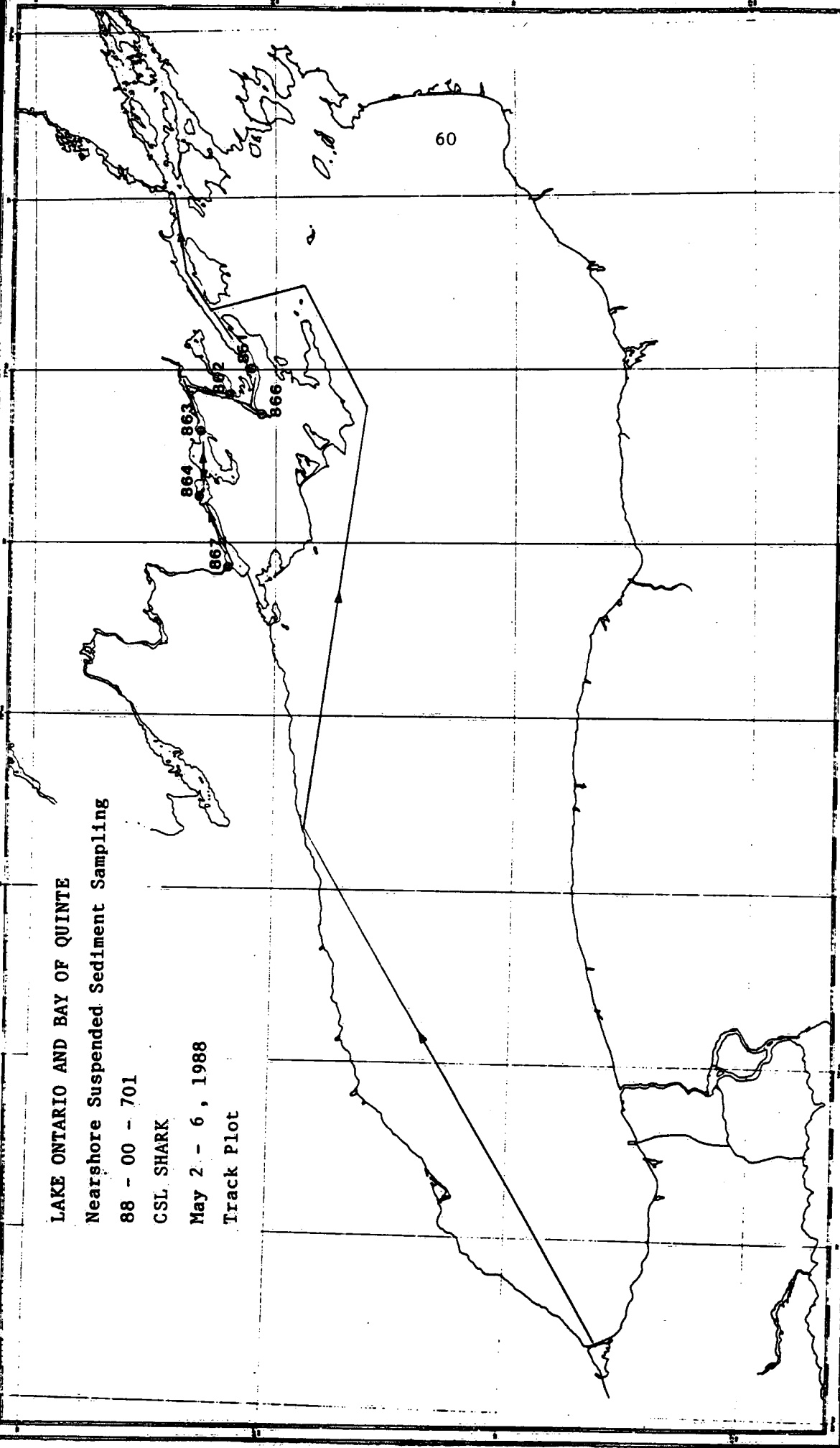
Nearshore Suspended Sediment Sampling

88 - 00 - 701

CSL SHARK

May 2 - 6, 1988

Track Plot



Published by the Canadian Hydrographic Service, Hydrographic Branch,
Bathymetry Section, 1000 Lakeshore Blvd., Toronto, Ontario M5H 1B6.

STATISTICS SUMMARY

61

CRUISE NO. 88-00-401 CONSECUTIVE NO. 006

SHIP CSS ADVENT

DATES FROM May 9 TO May 12, 1988

LAKE ONTARIO AND BAY OF QUINTE

CRUISE TYPE Nearshore Suspended Sediment Sampling

N. MILES STEAMED 520.5

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	6	Moorings Established	
EBT Casts	6	" Retrieved	
Rosette Casts		" Established	
Transmissometer Casts	6	" 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	2
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ()			
" " " (D.O.)		Grab Samples Taken	6
" " " (Cond/pH)	13		
" " " ()		Bulk Centrifuge Samples (600L)	11
" " " (T P uf)	13		
" " " (TKN)		Observations, Weather	
" " " ()			
" " " ()		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)	13		
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ()		Manual Chemistry Tech. Ops.	13
" " " ()		Nutrients (WOB)	
" " " ()		Microbiology	
" " " ()			

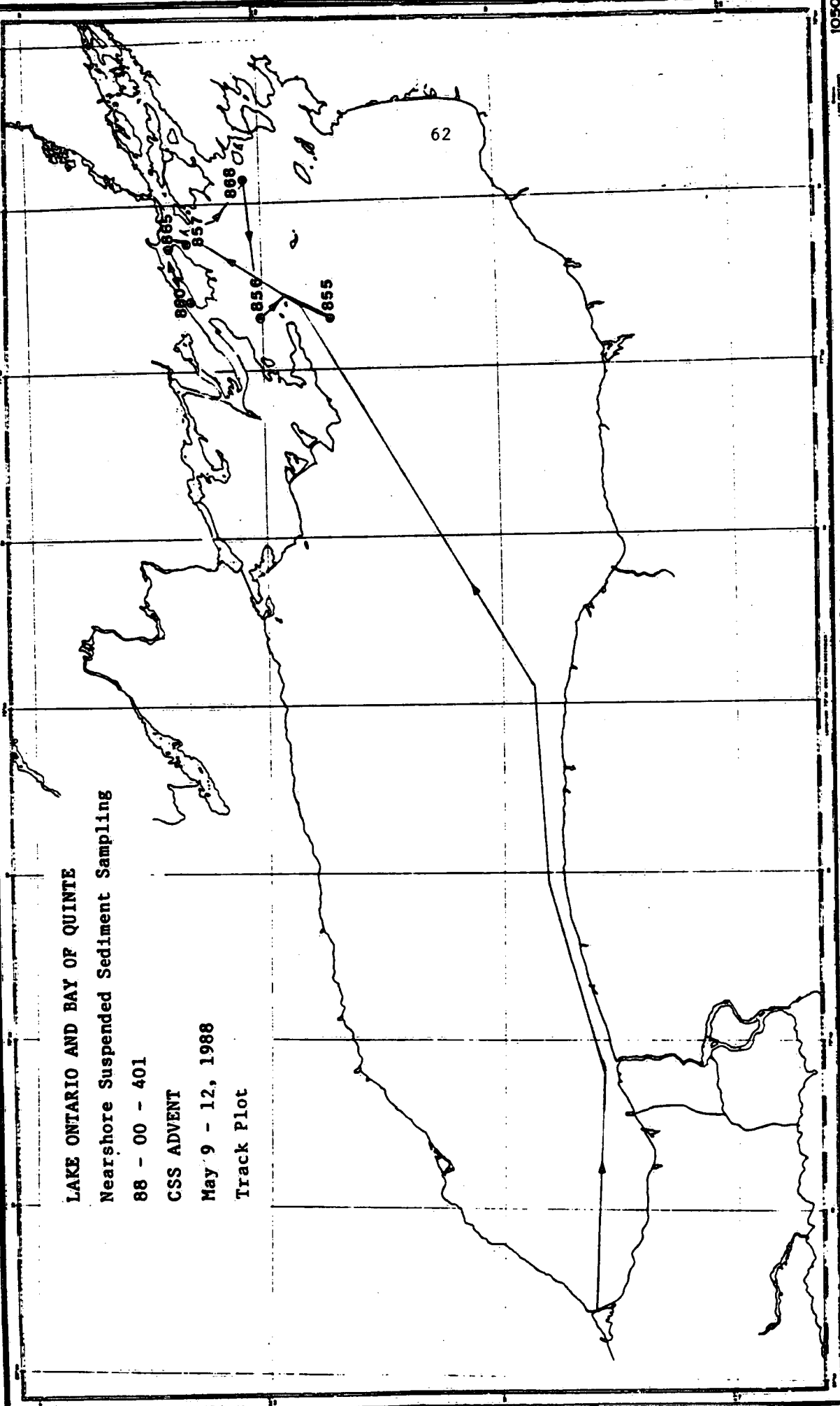
LAKE ONTARIO AND BAY OF QUINTE
Nearshore Suspended Sediment Sampling

88 - 00 - 401

CSS ADVENT

May 9 - 12, 1988

Track Plot



STATISTICS SUMMARY

63

CRUISE NO. 88-01-002 CONSECUTIVE NO. 102

SHIP CSS LIMNOS

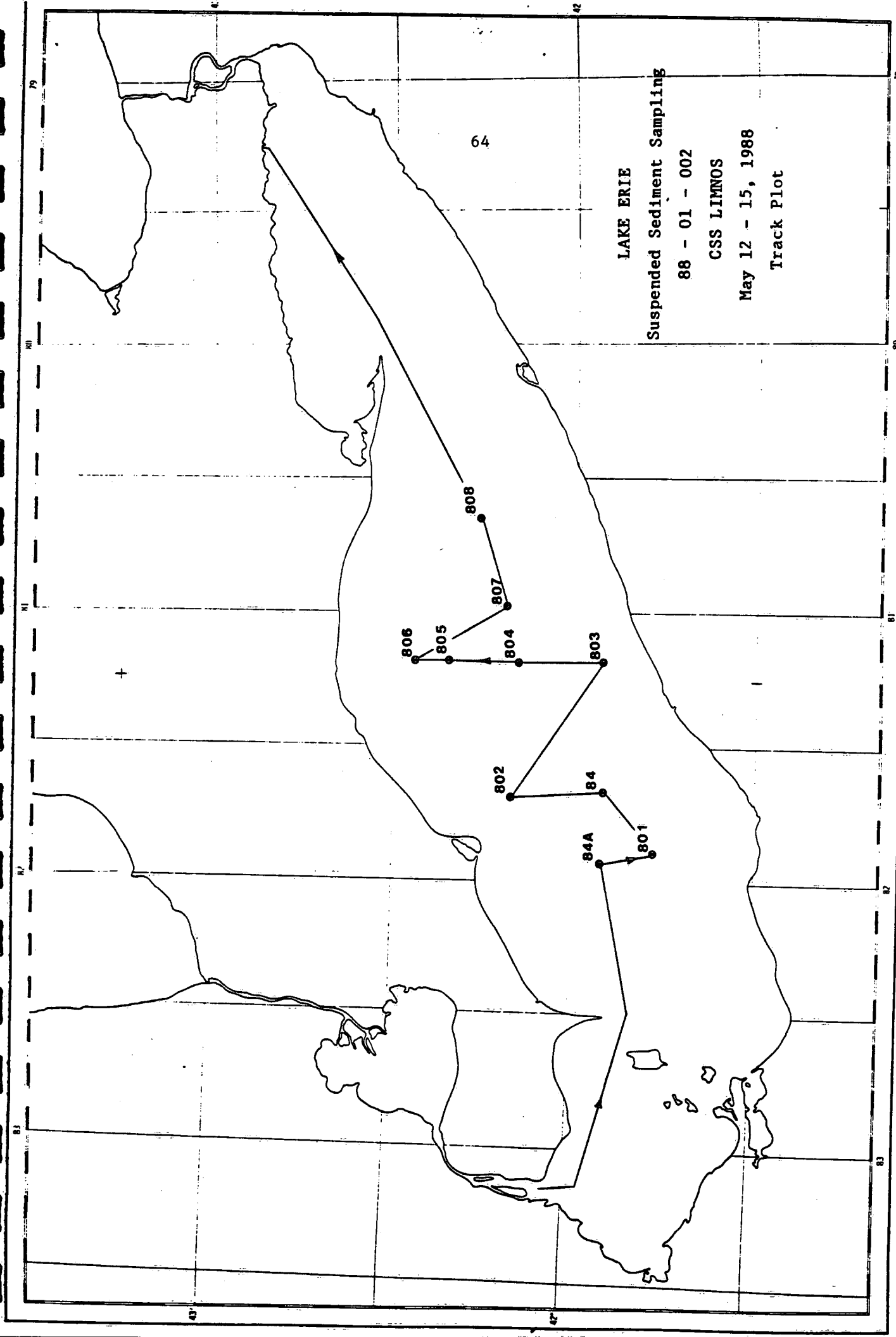
DATES FROM May 12 TO May 15, 1988

LAKE ERIE

CRUISE TYPE Suspended Sediment Sampling

N. MILES STEAMED 396.0

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	10	Moorings Established	
EBT Casts	10	" Retrieved	
Rosette Casts	10	" Established	
Transmissometer Casts	10	" 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	10
" " " ()			
" " " (D.O.)	20	Grab Samples Taken	
" " " (Cond/pH)	20		
" " " ()		Bulk Centrifuge Samples (600 litres)	20
" " " (T P u f)	20		
" " " (TKN)		Observations, Weather	
" " " ()			
" " " ()		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)	20		
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ()		Manual Chemistry Tech. Ops.	40
" " " ()		Nutrients (WOB)	
" " " ()		Microbiology	
" " " ()			



STATISTICS SUMMARY

65

CRUISE NO. 88-00-411 CONSECUTIVE NO. 042

SHIP CSS ADVENT

DATES FROM September 22 TO September 26, 1988

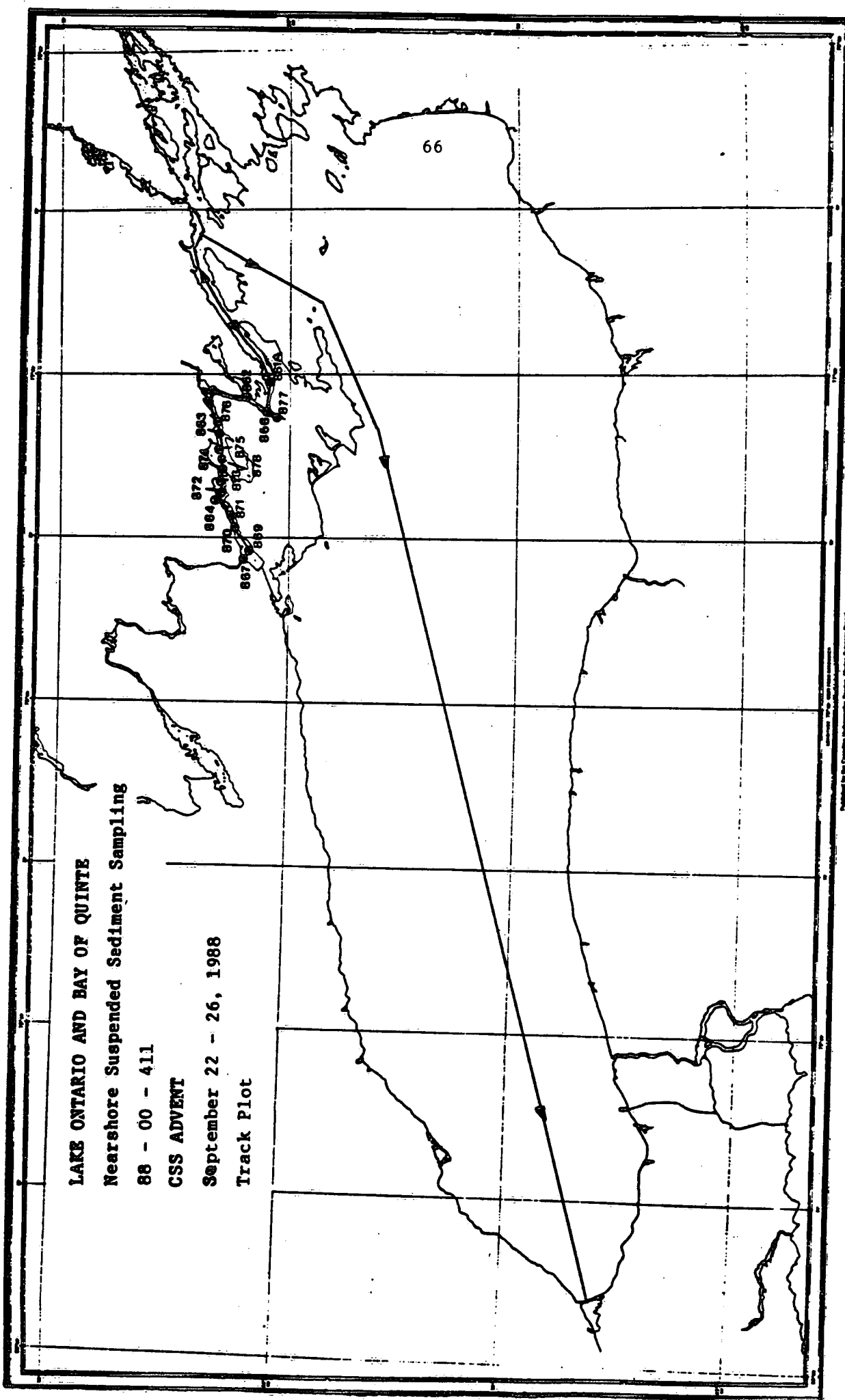
LAKE ONTARIO AND BAY OF QUINTE

CRUISE TYPE Nearshore Suspended Sediment Samples

N. MILES STEAMED 341.0

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	16	Moorings Established	
EBT Casts	16	" Retrieved	
Rosette Casts		" Established	
Transmissometer Casts	16	" 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	4
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ()			
" " " (D.O.)		Grab Samples Taken	
" " " (Cond/pH)	32		
" " " ()		Bulk Centrifuge Samples	16
" " " (T P uf)	16		
" " " (TKN)		Observations, Weather	
" " " ()			
" " " ()		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)	16		
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ()		Manual Chemistry Tech. Ops.	32
" " " ()		Nutrients (WOB)	
" " " ()		Microbiology	
" " " ()			

LAKE ONTARIO AND BAY OF QUINTE
Nearshore Suspended Sediment Sampling
88 - 00 - 411
CSS ADVENT
September 22 - 26, 1988
Track Plot



Produced by the Canadian Hydrographic Service, Marine Information Branch
 Date of Issue: 1988-10-12

10501

LAC ST. PIERRE, ST. LAWRENCE RIVER MOORINGS

LRB STUDY 82045, DR. P.F. HAMBLIN

This was a preliminary study to determine the physical structure of the water column to develop models to relate to the disbursement of contaminants.

A total of five moorings, four current, temperature and transmission (CTT) moorings and one wave and tide recorder were moored in Lac St. Pierre on September 17 and 18 from the CSS ADVENT on Cruise 88-07-401. The four CTT moorings were refurbished on October 8 from the Lab II working from the CSS LIMNOS on the downbound transit of Cruise 88-07-001. All moorings were retrieved on October 24 from the Lab II on the upbound transit of the LIMNOS from Cruise 88-07-001. At refurbishment and upon retrieval, EBT/Transmissometer profiles were taken, Seston samples were collected from transmissometer depths and a suspended sediment trap was cleaned.

S H O R E P R O G R A M S

LAKES RESEARCH BRANCH

HAMILTON HARBOUR STUDIES

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 16 years, the Ministry of the Environment has concentrated on monitoring water and sediment quality in terms of oxygen depletion and the sources and fates of contaminants. This is the third year of NWRI's involvement in a major thrust to answer questions related to harbour rehabilitation. Nine studies were supported by Technical Operations and organized into a single program to collect data required to answer these questions.

Technical Operations co-ordinated the following activities:

1. Supplied and maintained all sampling equipment
2. Installed and maintained a mini-ranger positioning system
3. Installed/retrieved all moorings
4. Provided all diving support
5. Scheduled all vessel requirements through DFO
6. Recorded observations as required and documented the field program in the form of a final report

The following studies included in the Hamilton Harbour Rehabilitation Program were supported:

1. 82002 - Barica - Nitrogen Regime of the Hamilton Harbour
- Ammonia Transects in Hamilton Harbour
2. 82031 - Charlton - Hamilton Harbour Oxygen and Sedimentation Regime
3. 82028 - Fox - Persistent Organic Contaminants
4. 82030 - Mayer - Effect of iron and steel mill effluents on reduction of the P availability in Hamilton Harbour
5. 82027 - Murphy - Hamilton Harbour Restoration
6. 82015 - Reynoldson - Utilizing Benthic Invertebrates
7. 85021 - Rodgers - Underwater Video, Hamilton Harbour
8. 82029 - Rukavina - Sedimentology of Hamilton Harbour
9. 82031 - Spigel - Hamilton Harbour Physical Processes

NITROGEN REGIME OF HAMILTON HARBOUR

LRB STUDY 82002, DR. J.M. BARICA

During the field season, 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 may provide an insight into the residence time of wastes in the harbour. Ten cruises were carried out.

Sampling program:

1. Bi-weekly: Nitrogen - 6 stations (fig. 1)
April 1 to June 16
2. Bi-weekly: Ammonia - 30 stations (fig. 2)
April 1 to June 16
3. Occasional nitrogen/ammonia sampling during late summer

Observations:

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

NOTE: The WQ Profiler was used to obtain these observations.

HAMILTON HARBOUR SEDIMENTATION REGIME

LRB STUDY 82031, M.N. CHARLTON

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

Sediment trap moorings were scheduled to be refurbished bi-weekly but weather conditions, equipment problems and personnel assignments disrupted plans. The actual refurbishment schedule follows:

Installation: May 11 and 15

Refurbishment: May 30; July 1, 19, 22; August 22; September 8;
October 19

On November 15, all surface markers were removed and the moorings left in position for the winter. One sediment trap was installed at the mid-point of the Stratherne Street bridge on November 4 which will be refurbished monthly throughout the winter. This trap, moored in two metres of water, will monitor the sediment outflow from Windermere Basin during the winter dredging operations.

HAMILTON HARBOUR OXYGEN REGIME

LRB STUDY 82031, M.N. CHARLTON

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 22 stations per cruise (fig. 3).

Also included was a total of 5 ammonia cruises to determine the spatial variation of ammonia in the harbour waters. Thirty stations were occupied with samples collected at surface -1 m and bottom -1 m in addition to a cast of the water quality profiler (fig. 2).

Respiration experiments were undertaken to measure oxygen consumption, determining the ammonia depletion rate. Sample collections consisted of 13 weekly trips, obtaining oxygen samples from two stations at depths of 1 m below the surface and bottom -1 m.

PERSISTENT ORGANIC CONTAMINANTS

LRB STUDY 82028, M.E. FOX

Surface water samples were collected to provide information on current inputs of contaminants (organochlorine contaminants including PCB's 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 (sediment trap moorings and canal) on two occasions. On August 24 when the water column was strongly stratified, samples were collected at 1 m and bottom -2 m. On November 9 when the water column was well mixed, water samples were collected at 1 m only. An additional sample was collected at the exit of Windermere Basin.

EFFECT OF IRON AND STEEL MILL EFFLUENTS ON REDUCTION OF THE PHOSPHORUS AVAILABILITY IN HAMILTON HARBOUR

LRB STUDY 82030, T. MAYER

The objective of this study is 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 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. Samples of effluent (3600 litres) were collected on two occasions (June 28 and August 9) 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

LRB STUDY 82027, T.P. MURPHY

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 65 stations in the harbour and Windermere Basin (fig. 4) using an Ekman dredge.

UTILIZING BENTHIC INVERTEBRATES

LRB STUDY 82015, DR. T. REYNOLDS

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) (fig. 5).

On September 23, a Hydrolab mooring was installed 20 m East of the MET buoy. The Hydrolab unit was mounted 0.5 m above the bottom to measure dissolved oxygen near the sediment/water interface. The mooring was removed November 21.

HAMILTON HARBOUR - VIDEO

SLD STUDY 85021, DR. G.K. RODGERS

On Friday, November 18, a Bell 206L Jet Ranger (on loan from CHS) was utilized to obtain aerial video and photographs of Hamilton Harbour and the surrounding watershed.

SEDIMENTOLOGY OF HAMILTON HARBOUR

LRB STUDY 82029, DR. N.A. RUKAVINA

Technical Operations support to this program was limited to the installation, maintenance, calibration and removal of the mini-ranger Falcon II positioning system.

HAMILTON HARBOUR PHYSICAL PROCESSES

LRB STUDY 82031, DR. R.H. SPIGEL

This study investigated the physical movement of the harbour water through the shipping canal and the return movement of lakewater into the harbour. This study was divided into four groups:

1. Meteorological measurements were collected from a MET buoy installed in the deep hole.
2. Weekly surveys (19) onboard the CSL AGILE using the water quality profiler at 22 stations (fig. 6).
3. Current meter profiling from five stations along the canal lift bridge to coincide with the weekly survey.
4. Time series of water levels and temperature profiles at either end of the shipping canal using FTP's, temperature loggers and tide gauges.

HAMILTON HARBOUR STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
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.COM.	43° 16' 41"	79° 51' 42"	4792098.	592375.
STELCO	43° 17' 06"	79° 49' 33"	4792908.	595260.
DOFASCO	43° 16' 43"	79° 47' 49"	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 E.
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"	4795346.	596740.
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-OXYGEN SURVEY

C 1	43° 17' 46"	79° 48' 41"	4794169.	596418.
C 2	43° 17' 38"	79° 49' 10"	4793913.	595768.
C 3	43° 17' 29"	79° 49' 40"	4793626.	595096.
C 4	43° 17' 21"	79° 50' 09"	4793370.	594446.
C 5	43° 17' 12"	79° 50' 39"	4793083.	593774.
C 6	43° 17' 04"	79° 51' 09"	4792827.	593101.
C 7	43° 16' 56"	79° 51' 39"	4792571.	592429.
C 8	43° 16' 47"	79° 52' 07"	4792284.	591801.
C 9	43° 16' 39"	79° 52' 36"	4792029.	591151.
C10	43° 16' 32"	79° 53' 06"	4791804.	590478.
C11	43° 17' 47"	79° 50' 27"	4794166.	594029.
C12	43° 17' 38"	79° 50' 15"	4793892.	594304.
9	43° 17' 26"	79° 50' 03"	4793526.	594579.
C13	43° 17' 18"	79° 49' 54"	4793282.	594786.
C14	43° 17' 11"	79° 49' 45"	4793069.	594991.

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
C15	43° 17' 46"	79° 48' 06"	4794180.	597207.
C16	43° 17' 55"	79° 47' 46"	4794464.	597654.
C17	43° 16' 08"	79° 46' 56"	4791179.	598783.
C18	43° 47' 22"	79° 16' 23"	4791732.	598288.
C19	43° 47' 36"	79° 16' 41"	4792169.	597957.
C20	43° 47' 43"	79° 17' 10"	4792993.	597703.
C21	43° 48' 06"	79° 17' 44"	4793894.	597228.

CHARLTON-SEDIMENT TRAP MOORINGS

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.

REYNOLDSOON-BENTHIC INVERTIBRATE STATIONS

3	43° 16' 50"	79° 52' 20"	4792373.	591507.
19	43° 17' 16"	79° 50' 03"	4793217.	594584.

SPIGEL-PHYSICAL PROCESS SURVEY

AM4	43° 18' 24"	79° 46' 48"	4795378.	598947.
AM3	43° 18' 14"	79° 47' 08"	4795371.	598497.
AM2	43° 18' 05"	79° 47' 27"	4794779.	598077.
AM1	43° 17' 57"	79° 47' 44"	4794527.	597698.
A 0	43° 17' 50"	79° 47' 58"	4794306.	597386.
A 1	43° 17' 42"	79° 48' 13"	4794054.	597051.
A 2	43° 17' 35"	79° 48' 42"	4793829.	596401.
A25	43° 17' 30"	79° 49' 06"	4793667.	595862.
A 3	43° 17' 25"	79° 49' 31"	4793505.	595301.
A 4	43° 17' 15"	79° 50' 18"	4793182.	594246.
A 5	43° 17' 05"	79° 51' 06"	4792858.	593168.
A 6	43° 16' 56"	79° 51' 54"	4792566.	592090.
A 7	43° 16' 46"	79° 52' 42"	4792243.	591013.
A 8	43° 16' 47"	79° 53' 18"	4792263.	590201.
B 1	43° 18' 24"	79° 49' 11"	4795331.	595726.

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
B 2	43° 17' 57"	79° 48' 50"	4794505.	596211.
B 3	43° 17' 26"	79° 48' 24"	4793557.	596810.
B 4	43° 17' 07"	79° 47' 52"	4792982.	597540.
B 5	43° 16' 40"	79° 47' 37"	4792153.	597890.
B 6	43° 16' 08"	79° 46' 58"	4791179.	598783.
B 7	43° 17' 38"	79° 48' 05"	4793934.	597233.
B 8	43° 17' 00"	79° 48' 42"	4792749.	596416.
B 9	43° 16' 18"	79° 47' 15"	4791482.	598396.
B10	43° 16' 30"	79° 47' 27"	4791848.	598120.
C 1	43° 17' 43"	79° 50' 30"	474042.	593964.
C 2	43° 17' 00"	79° 49' 48"	4792728.	594929.

Figure 1.
HAMILTON HARBOUR
NITROGEN REGIME STN. LOCATIONS

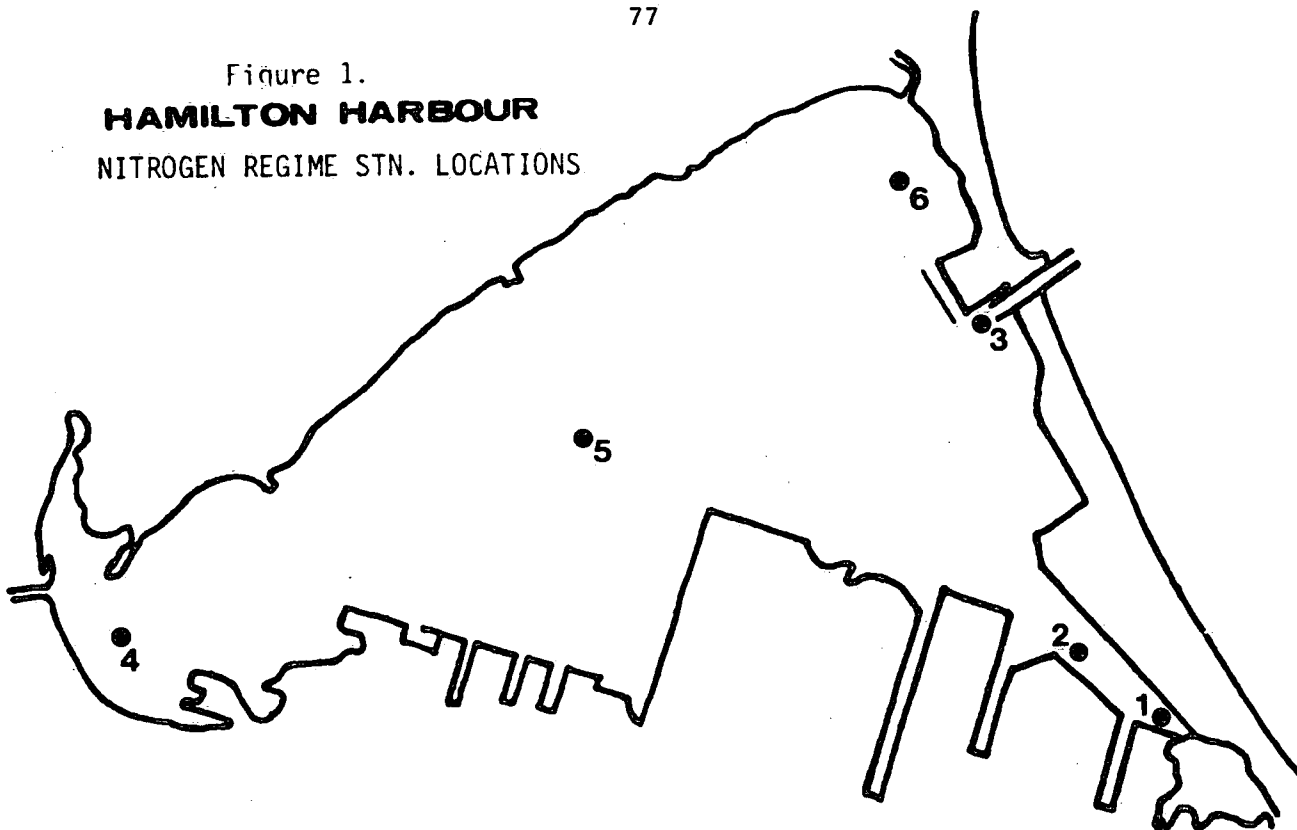


Figure 2.
HAMILTON HARBOUR
AMMONIA REGIME STN. LOCATIONS

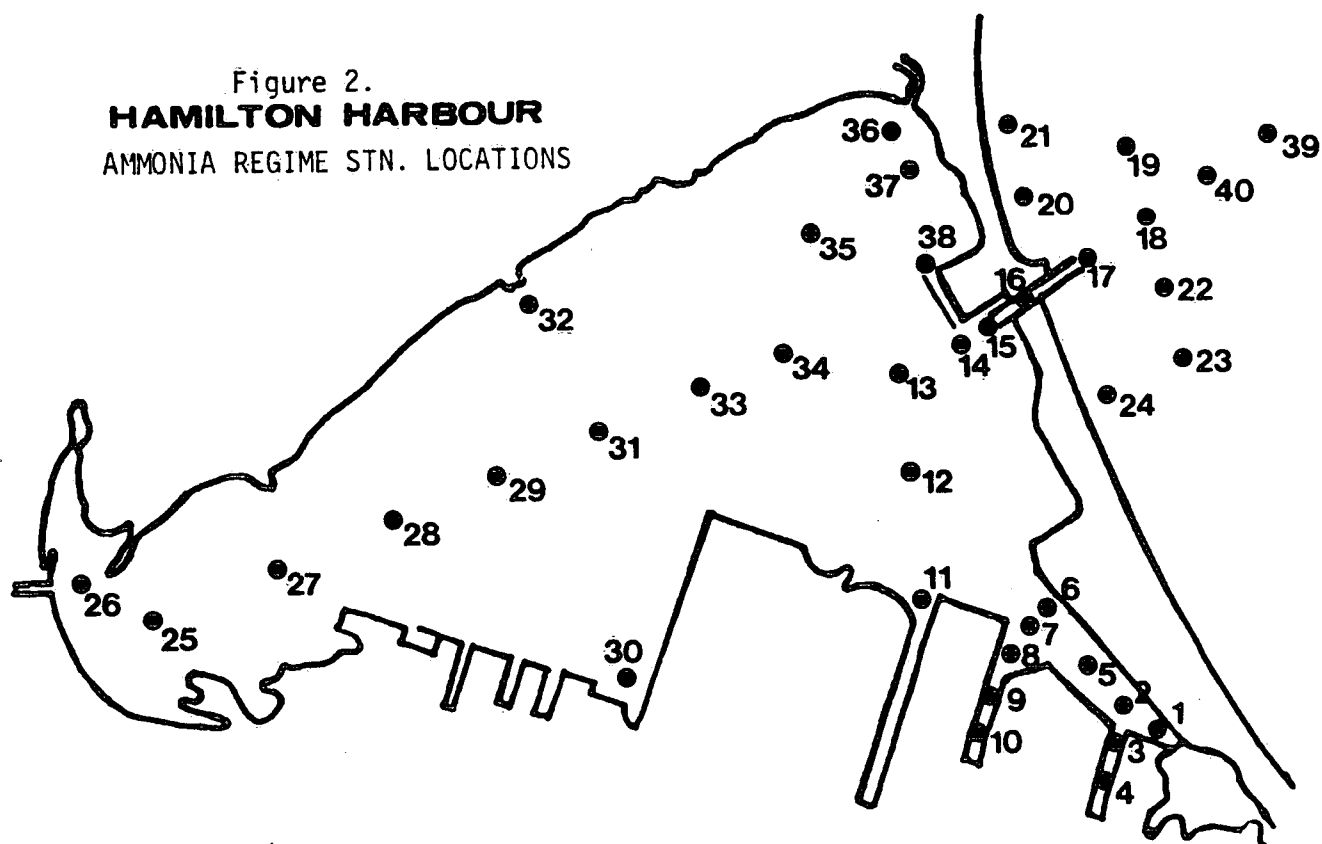


Figure 3.

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CHARLTON, OXYGEN SURVEY

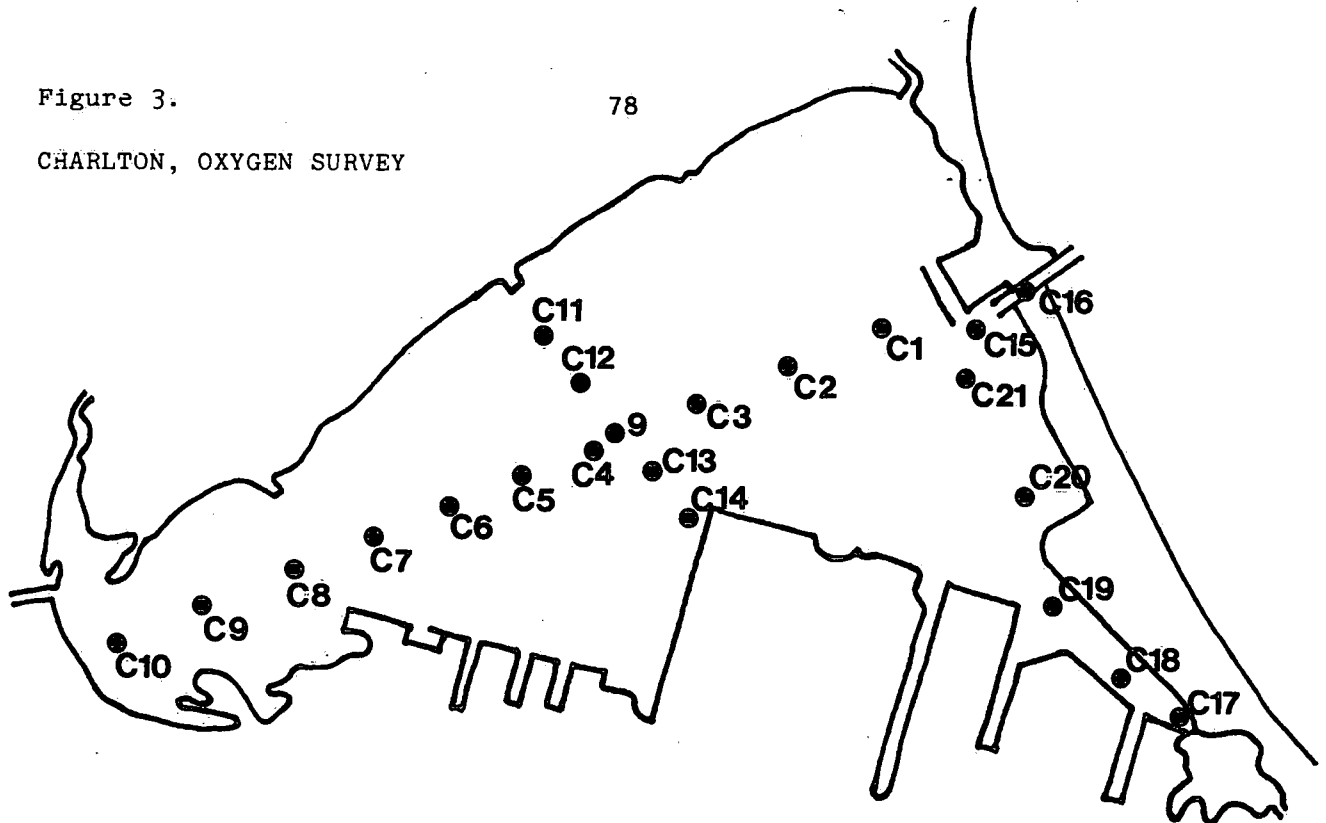


Figure 4.

MURPHY, RESTORATION STATIONS

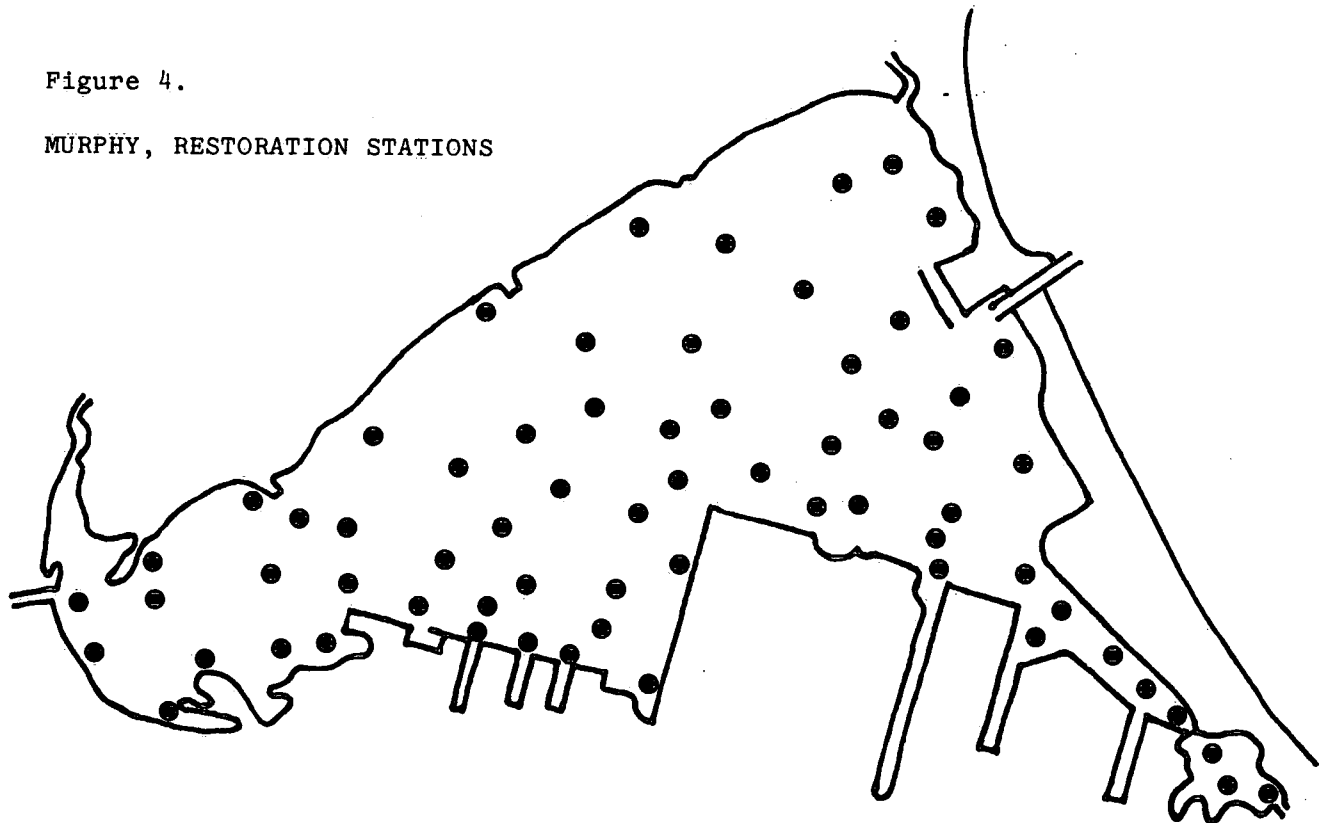


Figure 5.

79

REYNOLDSON, BENTHIC INVERTIBRATE STNS.

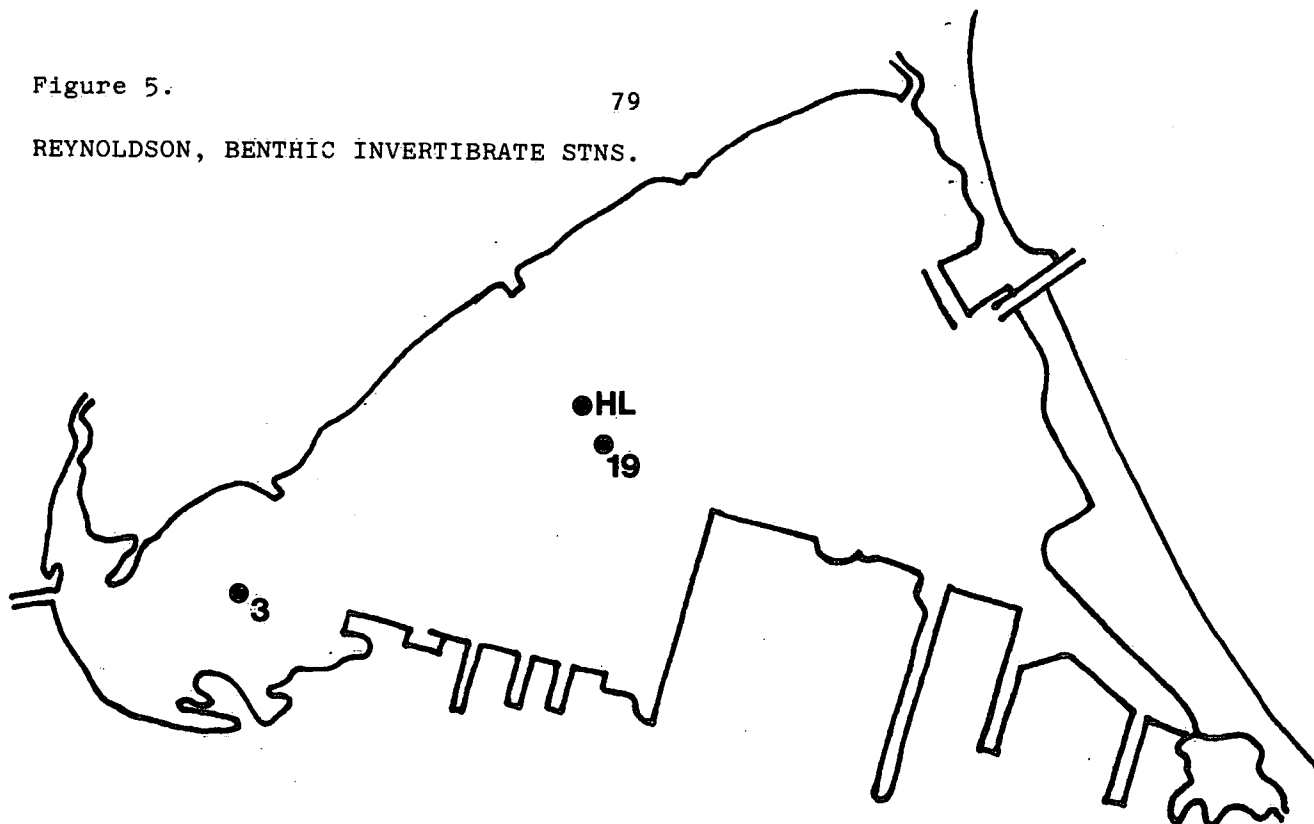
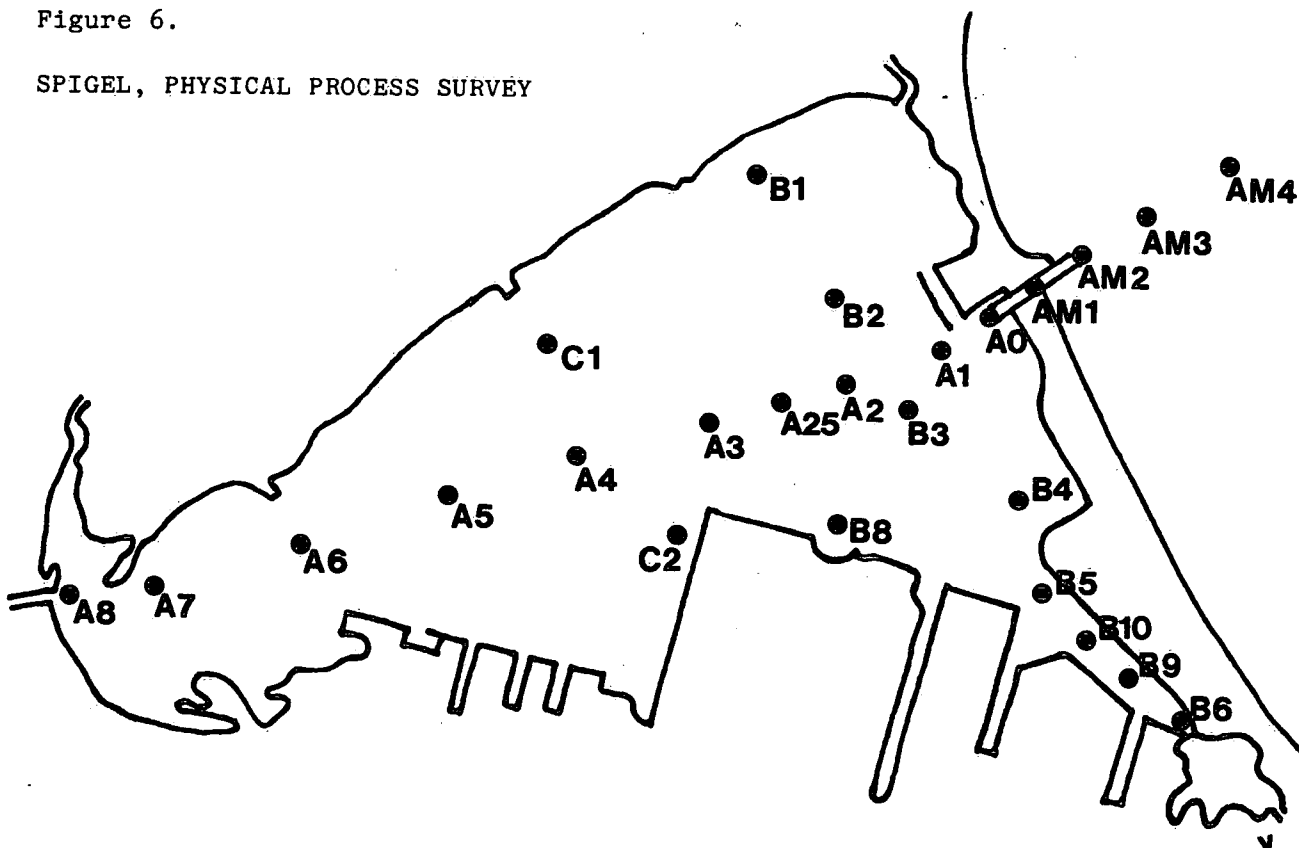


Figure 6.

SPIGEL, PHYSICAL PROCESS SURVEY



SEVERN SOUND NUTRIENT STUDIES

LRB STUDY 82002, DR. J.M. BARICA

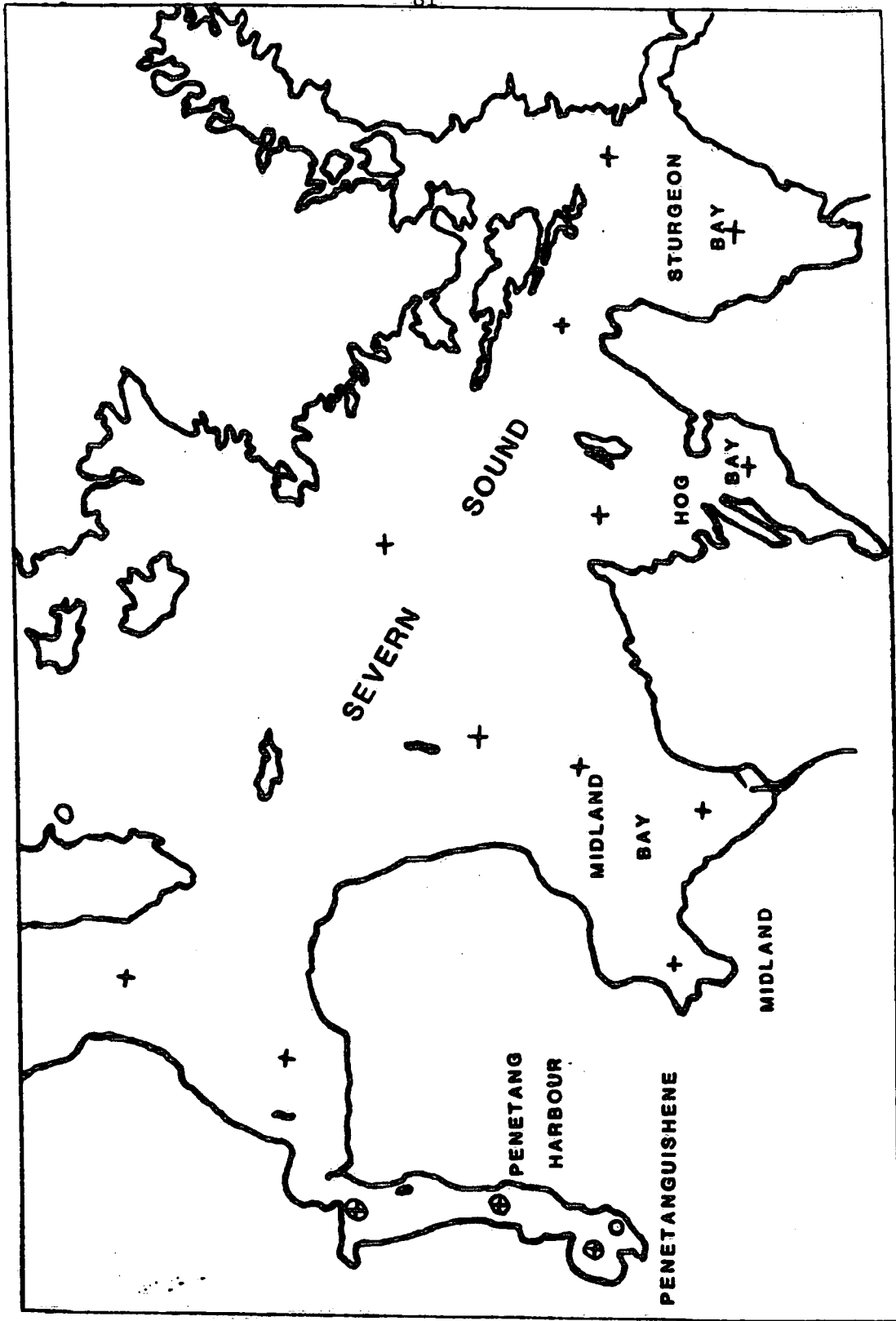
Study 82002 is part of the Severn Sound Remedial Action Plan and its purpose is to determine a nutrient budget for the Severn Sound area. At 15 stations (see chart), samples were taken to determine the nutrient availability in the water column. In addition, internal regeneration of nutrients in the sediment was measured using peepers at 5 sites.

Technical Operations support to this study included 3 trips to the Severn Sound area as follows: June 27-29, July 11-14, and August 2-5.

At 15 stations, a surveillance sampling program, including pH, EBT, dissolved oxygen, transmissometer, chlorophyll a and nutrients was undertaken using a MonArk as the support vessel.

During the week of July 11-14, Tech. Ops. divers installed peepers at 4 sites in Penatanguishene Bay and 1 control site near Beausoleil Island. The peepers were recovered and sampled on August 3.

Additional work in Penetanguishene Bay is planned for February, including the installation of more peepers, and the measurement of oxygen depletion under the ice.



+ sampling site
O peeper site

PORT HOPE SEDIMENT TRACER SAMPLING

LRB STUDY 82011, DR. J.P. COAKLEY

The purpose of this study was to develop techniques for measuring the availability, erosion and transport pathways of contaminated fine sediments in lakes and rivers.

At the mouth of Port Hope Harbour, prior to sampling, a compound containing cesium was deposited. Using cesium as a "tracer", surficial sediment samples were collected for analysis. This technique helps to determine the processes controlling erosion and transport of fine sediments. On July 7 and August 10, the CSS ADVENT was utilized to collect fifty Shipek samples in a radial station grid centering at the mouth of the harbour. Vessel position was determined by mini-ranger. On August 11, 15, sediment samples were collected in a Port Granby area dump site. During the August cruise, a wave motion sensor mooring, used as part of the study, was refurbished.

OTTAWA RIVER

LRB STUDY 82012, DR. S.R. JOSHI

To determine the impact of Atomic Energy of Canada Limited lab operations at Chalk River in the Ottawa River/St. Lawrence River aquatic system, cores were collected.

Three triplicate cores were collected at locations up and downstream of the Chalk River labs. A Tech. Ops. corer was used to collect cores of approximately 40 cm in length. These were sectioned at 1 cm intervals the length of the core.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
LH/WB	46° 12' 09"	77° 51' 32"
P1	45° 56' 56"	77° 17' 42"
DR	46° 07' 18"	77° 29' 26"

SPANISH RIVER SEDIMENT SURVEY

LRB STUDY 82013, A. MUDROCH

Technical Operations assisted Mrs. Alena Mudroch, LRB with sediment and porewater sampling of the Spanish River Mouth and the collection of sediment samples from the Whalesback Channel and Serpent River Mouth.

This study is an attempt to determine the distribution of organic contaminants and metals in the sediments of the Spanish and Serpent River mouths as well as the Whalesback Channel.

One technologist from Technical Operations assisted Mrs. Mudroch and Mr. Neil Kindlisides during the first week of the survey with depth sounding transects and the collection of Ponar grab samples from seventeen sites throughout the Whalesback Channel area using a 17-foot Mason. These Ponar grabs were sieved for benthic animals and portions were retained for particle size and grain distribution analysis.

The sounding survey and bottom sampling aided in the selection of several sites at which the porewater of the bottom sediments could possibly be sampled by the installation of peepers the following week.

Sediment cores were collected from all twenty coring sites using the Technical Operations corer and the top 5 cm only retained for metals and organic contaminant analysis. At the sites previously selected as possible peeper sites (i.e., SRC #1, 2, 8, 14), an additional core was collected to complement the peeper data and was subdivided at every centimetre to a depth of 10 cm, then every 2 centimetres to a depth of 20 cm and thereafter one centimetre only every 5 centimetres of depth to 40 cm.

The second week, the field party was joined by Dr. T. Reynoldson, LRB and Mr. Ken Hill, RSD for the installation of peepers and an intensive coring survey to obtain benthic organisms from each sediment site. Peepers were installed at sites SRC #1, 2, 8 and 14. Three sediment cores were collected and the top 10 cm sieved for benthic organisms from all twenty previously established coring sites.

A more intensive coring survey had been planned utilizing the CSL SHARK to complete more transects than could be done from the small boat. However, the SHARK was damaged by a channel obstruction while leaving the dock at Spanish River and was unable to be serviced before this survey was completed.

CHAIN LAKE

LRB STUDY 82023, DR. T.P. MURPHY

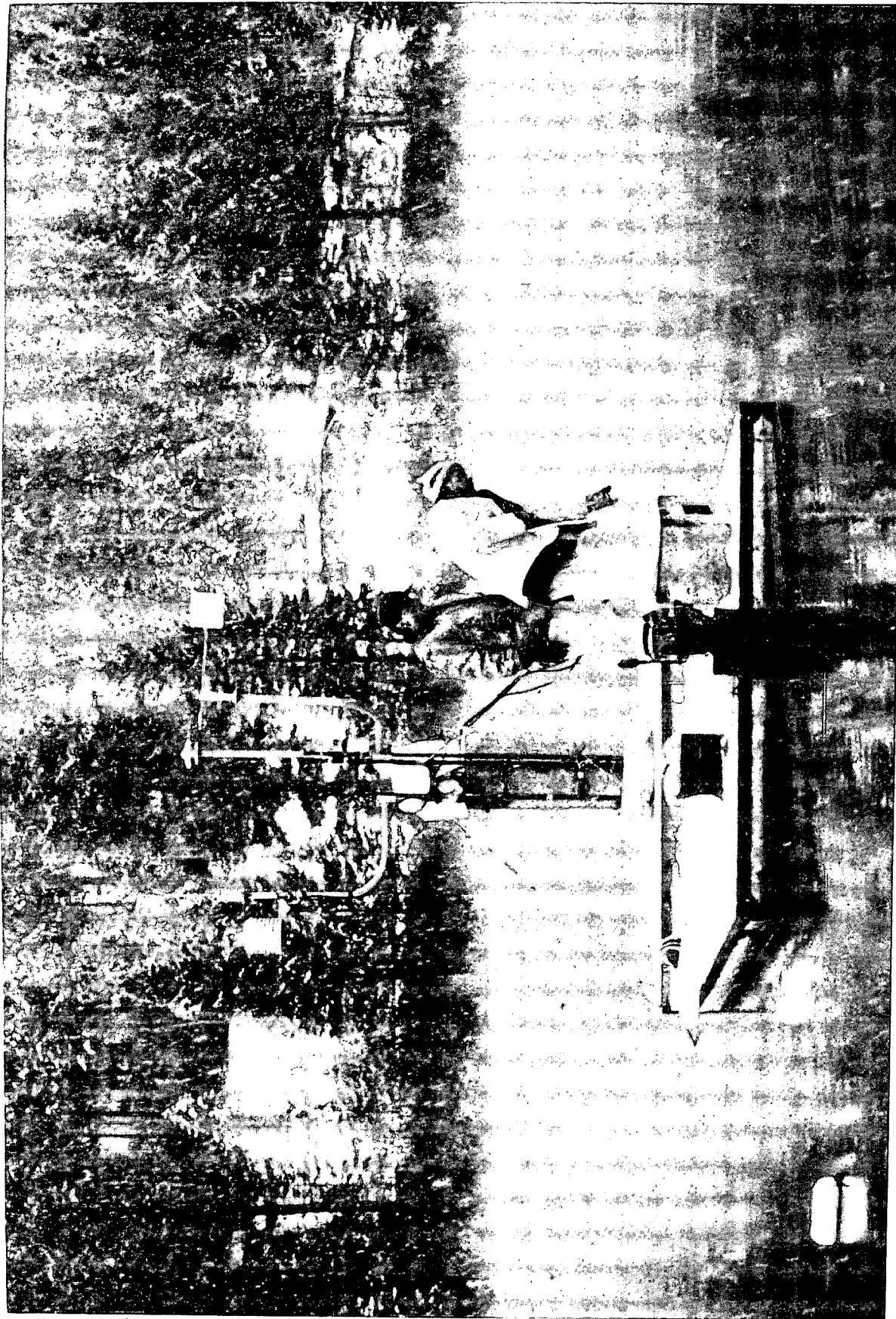
The purpose of this lake's restoration study was to observe and document the overall effect of various types of dredging on small lakes and to observe if the sediment would focus in the dredged hole for subsequent removal. The lake studied was Chain Lake, Northeast of Princeton, British Columbia.

Technical Operations supported this project in the early spring after the ice went out and in the late fall before freeze-up. The spring trip involved the transportation of a meteorological station, a solar radiation station, two acoustic current meters, 5 Brancker self-recording thermographs, an electronic bathythermograph/transmissometer system and additional ancillary equipment.

Due to the volume of equipment (including oxygen injection for Amisk Lake in Northern Alberta) a crewcab and trailer left CCIW on April 25, arriving at Chain Lake on April 30. After all equipment was deployed in the lake and all scientific sampling equipment demonstrated, instructions given as to the proper operation of the equipment, the equipment was signed over to R. Wiegand as part of the agreement between Environment Canada and R. Wiegand (unsolicited proposal involving Treasury Board) of North Vancouver, British Columbia.

The fall trip was more intensive since several types of dredging methodologies were attempted. The last two weeks of October were spent assembling irrigation pipe and large fire hose (3") to a Honda water pump; assembling floating docks to act as platforms from which to dredge; sounding the southern end of the lake; dredging; and removing all equipment installed in the spring. The dredge was an NWRI in-house design which proved to be as efficient as a dredge that is available on a commercial basis but is much more economical and easier to operate.

The MET system, solar radiation system, current meters, transmissometers and thermographs were monitored, dismantled and shipped to CCIW by CP Express. The T-frame which had been installed for Dr. Rukavina in the dredged site was monitored and the monitor cable was laid on the bottom until the spring of '89. The field site was cleaned up and all debris taken to the local dump. Later this fiscal, a protective fence will be installed by private contractor around the berms that were made to collect the dredging material.



METEOROLOGICAL STATION, CHAIN LAKE, B.C.

LAKE ONTARIO INPUT CONTAMINANT STUDY

LRB STUDY 82051, DR. W.M.J. STRACHAN

This study was an attempt to identify the contaminant inputs to Lake Ontario from the major rivers and streams entering the lake. This study was carried out during the period of May 24 to June 7. At each river or creek, two Westfalia centrifuges were run for a time period of three hours at a flow rate of 4 litres per minute. A 40-litre water sample was collected from the centrifuge outflow and passed through a Goulden extractor. Duplicate samples were done at all sample sites. The centrifuge bowls were cleaned and the suspended sediment samples were immediately frozen. Samples were collected at the Don River, Highland Creek, Duffins Creek, Rouge River, Oshawa Creek, Bowmanville Creek, Harmony Creek, Ganaraska River, the outflow from the Bay of Quinte at Conway, Black River, Sandy Creek, Salmon River, Oswego River, Oak Orchard Creek, Johnson Creek, Eighteen Mile Creek, Twelve Mile Creek, Bronte Creek, Sixteen Mile Creek, Humber River, Credit River and Etobicoke Creek.

Support to this study was provided by Dr. W.M.J. Strachan, Dr. M. Servos and Ms. D. Piche of Lakes Research Branch and by Mr. S.B. Smith of Tech. Ops. Ship Section.

Technical Operations assisted Dr. W.M.J. Strachan with the brushing of the future Pt. Petre atmospheric site adjacent to the existing Pt. Petre Lighthouse property. A technologist from this Section, ably assisted by Mr. Ross Neureuther, cleared the site of trees and brush to expose the area to the prevailing winds off the lake. Upon completion of the sampler deck and installation of the instruments, the site will have an unobstructed flow of air needed for accurate sample collection.

SEDIMENT CORING AT HIGH PARK AND TURKEY POINT

LRB 82055, DR. L.D. DELORME

Technical Operations Section assisted Dr. D. Delorme, LRB, with the collection of two sediment cores--one from Grenadier Pond in High Park, Toronto and the other from the marsh off the tip of Turkey Point.

The intent was to collect long cores from both locations but this was not possible. The Turkey Point site turned out to be a maze of narrow, shallow channels, making the use of the long corer impractical. At this location, a regular length lightweight corer was rigged and a 1-metre core was obtained. At Grenadier Pond, the long corer was assembled and, using two small boats, an aluminum platform and three sections of scaffold, a 2.5 metre core was collected.

This coring operation took two days to complete. In both cases, the cores were sectioned by Dr. Delorme and Ms. N. Harper, LRB. At the end of each day, staff returned to CCIW with the samples.

SEDIMENT MOBILITY IN HAMILTON HARBOUR

LRB STUDY 82063, F.M. BOYCE

Suspended particles play important roles in the harbour as mediators of subsurface light intensity and as substrate for the adsorption of various contaminants. Runoff and resuspension, dominant processes injecting particles into the water column are strongly weather-dependent. Retention of sediments as well as the export of them from the harbour via the ship canal are influenced by wind, thermal structure, water depth and precipitation (runoff). This experiment ran concurrently with an existing approved program (Charlton) and will provide a qualitative assessment of suspended sediment mobility at time scales more closely related to those of the meteorological forces. In addition to its contribution to the harbour investigations, the experiment will also provide an opportunity to evaluate and refine sediment trapping techniques.

On July 6, bottom-mounted arrays of sediment traps were located at six locations in the harbour. Five positions were within 600 feet of the existing Charlton moorings. The sixth was at the outflow of the Desjardins Canal.

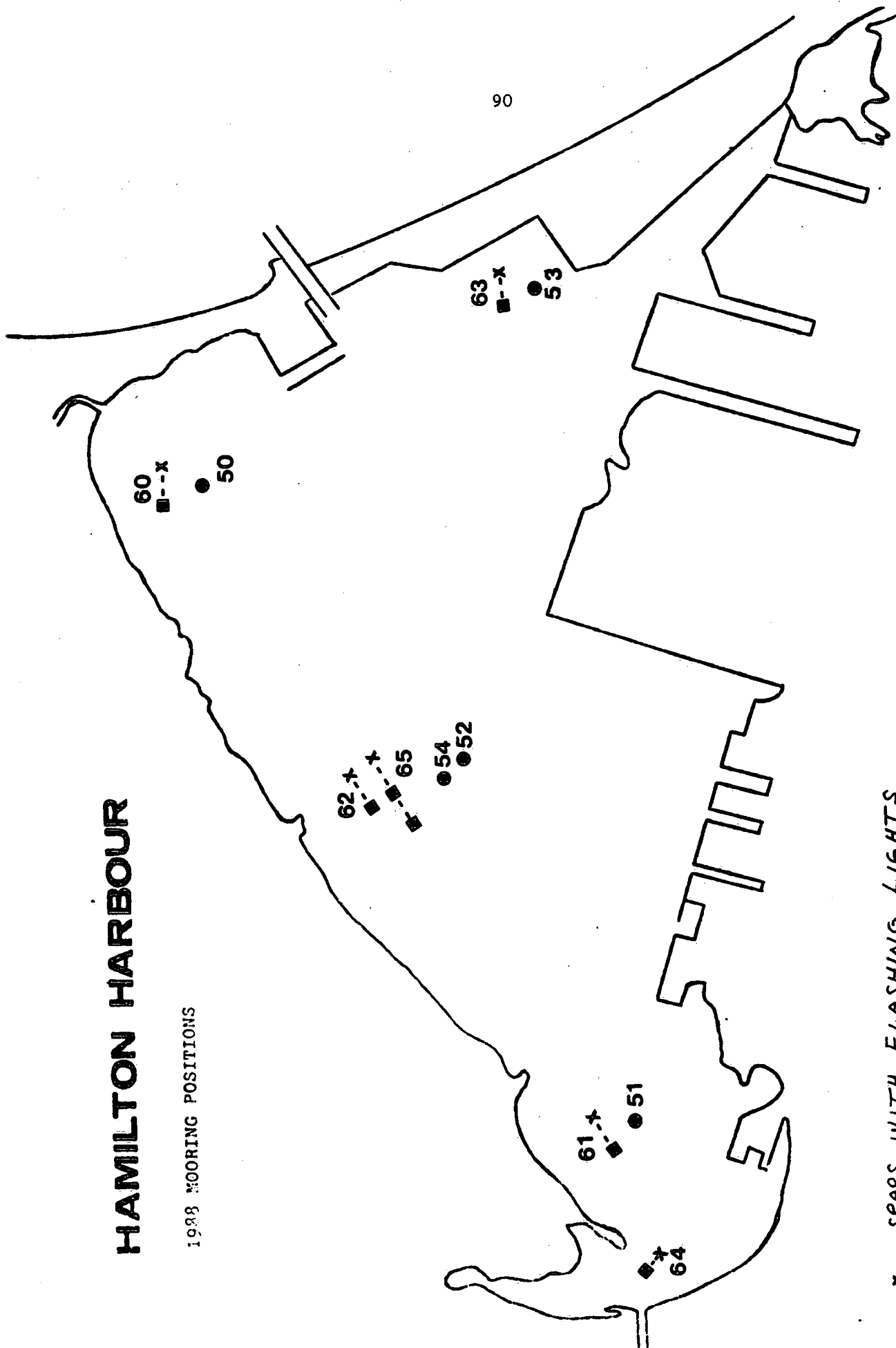
Mooring No. 65, installed near the deep hole, consisted of a bottom-mounted Neil Brown acoustic current meter linked by a 200-foot groundline to a combination bottom-mounted sediment trap/transmissometer array. A 25 cm pathlength Sea Tech optical transmissometer was used, recording on a Brancker solid state logger.

The sediment traps were refurbished twice a week until December 12. Wind and wave conditions made servicing difficult an impossible on more than one occasion during the late fall.

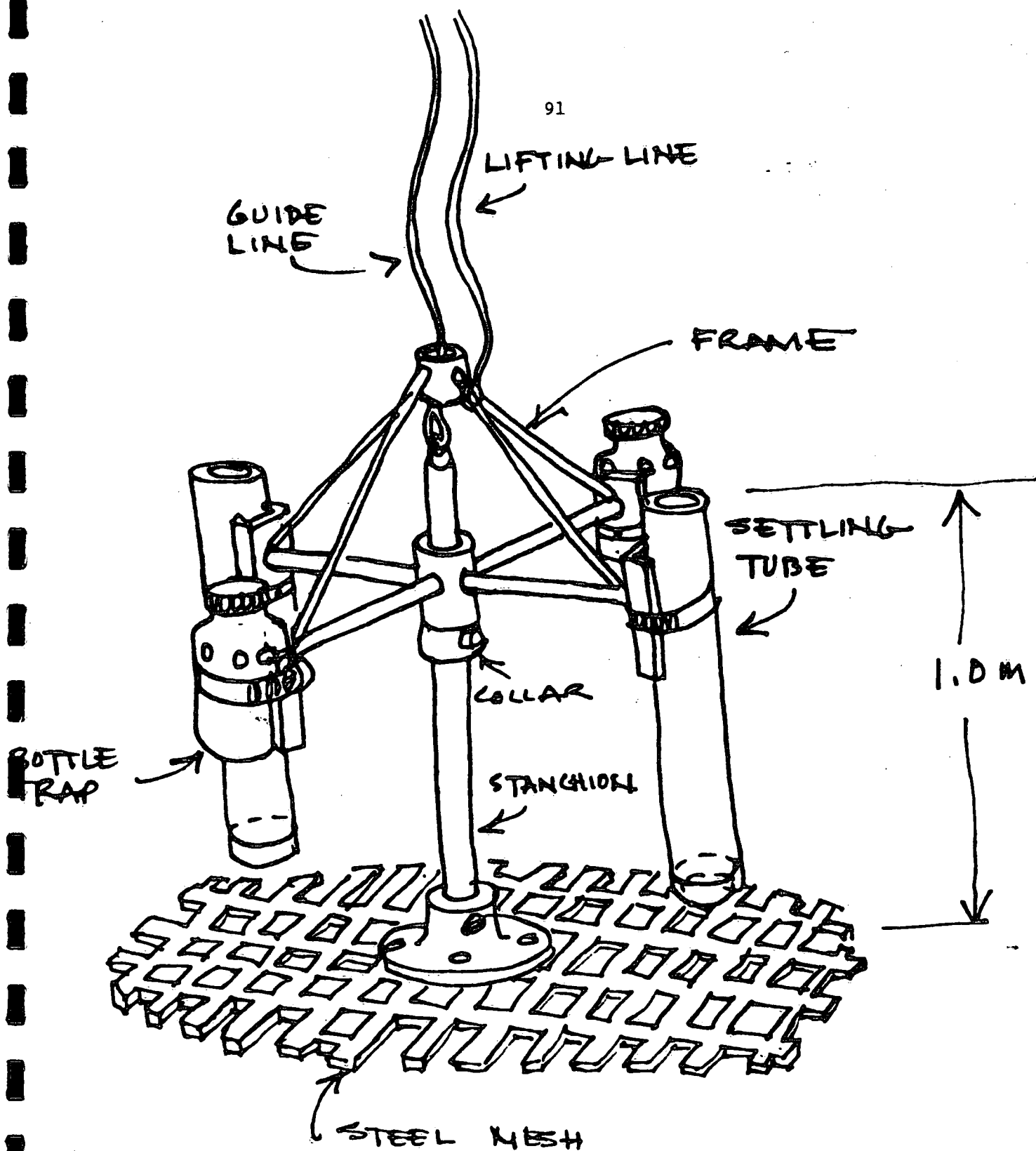
Technical Operations provided support to the study in the installation and retrieval of the moorings and with the trap refurbishments.

HAMILTON HARBOUR

1988 MOORING POSITIONS



- x - SPARS WITH FLASHING LIGHTS
- - CURRENT METER, XMS OR SEDIMENT TRAP
- - EXISTING MOORINGS



BOTTOM MOUNTED ARRAY OF SEDIMENT TRAPS

NUTRIENT/CONTAMINANT INTERACTIONS IN LAKE ECOSYSTEMS

LRB STUDY 82066, DR. D.R.S. LEAN

This project is examining the relationships between lake trophic status (productivity, nutrient levels, and biological structure) and toxic contaminant dynamics (bioaccumulation, biodegradation and removal rates) so as to quantify the factors controlling the vulnerability of lake ecosystems to contaminant inputs. Research and management of the eutrophication and contaminants issues have historically been undertaken separately. The result is the lack of a critical knowledge base to predict the effect that changes in one have on the other. For example, some recent evidence suggests that the accumulation of organic contaminants into lake biota, particularly at the higher levels of food webs, may be inversely related to the biological productivity and thus the nutrient status of a lake. The results have implications for lake management strategies for the Great Lakes and other lakes affected by both toxic chemical and nutrient pollution.

The LRB model lake study site is located in Apsley, Ontario on Jack Lake. A private cottage at the narrows of the lake has been leased for this purpose. The location provides easy access to the two major sampling sites on Jack Lake; namely, Sharpes Bay and Williams Bay. A trailer lab site has been established on a level area back from the lake. Three trailers make up the lab complex. The cottage doubles as an office and computer area as well as providing temporary accommodation for visiting scientists and staff.

Five other lakes in the area were chosen for intensive study in 1988. These lakes were: Anstruther Lake and Wolfe Lake just West of Apsley; Bay Lake and L'Amable Lake, South of Bancroft on Highway 62; and Salmon Lake (and, on occasion, Picard Lake) which are situated South of Gooderham on Highway 507.

Technical Operations provided support to this study by sampling these lakes every 2 weeks from May 1 to November 1. Each sampling consisted of the following:

1. Temperature/D.O./Depth profile
2. Light penetration profile
3. Total depth
4. Weather observations
5. Secchi disc reading

6. Six metered zooplankton net hauls from 15 or 20 metres, 5 m in Wolf Lake
7. Water samples from 5 discrete depths every 4 weeks and only the 2 m depth on the alternate weeks
8. Sediment traps in Sharpes Bay, Williams Bay, Anstruther Lake, Bay Lake and L'Amable Lake were refurbished every 4 weeks coinciding with the week of the 2 m water sample
9. Solar radiation was constantly monitored

The water samples were measured at the lab site for pH, conductivity, chlorophyll fluorescence (unfiltered) and humic substances (filtered). They were subsequently prepared for further analysis for total P, filtered P, nutrients, major ions, chlorophyll a (2 methods) and POC/PN.

Support was also provided to other scientific efforts, including 82061, 82064 and 82015 throughout the season by incorporating requests into the sampling schedule. In addition to this schedule, time was allocated to a site maintenance and upgrading program.

RIVERS RESEARCH BRANCH

MACKENZIE RIVER WATER SAMPLING

RRB STUDY 83000, DR. E.D. ONGLEY

This was a joint study between LRB and IWD-Yellowknife to determine if light hydrocarbons that are suspected of damaging fish populations in the Mackenzie River were present in winter conditions where the river is ice-covered.

Samples were collected on the Liard River where it meets the Mackenzie River at Fort Simpson and on the Mackenzie River at Fort Simpson, Wrigley, Fort Norman, upstream and downstream of Fort Good Hope, Arctic Red River and in the Oniac Channel downstream from Inuvik during the period from February 29 to March 8. Sampling was done from snow machines in the Fort Simpson area and from a single Otter aircraft at the remaining sites. At each sampling site, two 20-litre samples were collected and returned to a mobile lab set up on shore. From each sample set, measurements were taken for pH, conductivity and turbidity, a 1-litre Seston sample was filtered and the remaining 36 litres were pressure filtered through a 5.5 inch filter using nitrogen. After the pressure filtering was complete, the samples were pressured through a resin column. Filters and columns were stored and returned to CCIW.

Support for this study was provided by S.B. Smith, TOS, RSD, Ms. K. Simpson, IWD-Yellowknife, Mr. G. Wright, WSC-Fort Simpson and Mr. G. Lennie, WSC-Inuvik.



SAMPLING: MACKENZIE RIVER

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 area of the watershed is 10.5 Km² and consists of a chain 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 drive vehicle was utilized during the winter months. In addition, four snowmobiles and four 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 on the camp at the 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 boats and one canoe (14 - 16 ft.). One outboard motor, four electric motors and other items to make the boats safe and operational were also supplied.

Tech. Ops. staff supported Rivers Research Branch staff in chemical and hydrological monitoring of the watershed. The hydrological monitoring consisted of gauging seven stream locations throughout the watershed on a weekly basis and sampling these locations for a number of chemical parameters. Four lakes were sampled on a bi-weekly schedule and one lake was sampled weekly for the same chemical parameters with the exception of the spring and fall when they were all sampled once a week.

During the remaining seasons, rain volume samplers were measured and changed weekly. Isco samplers were installed in two locations in the watershed prior to and during "Spring Runoff" and 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.

Technical Operations supplied additional support during intensive sampling periods. Two TOS members supported the study during the intensive "Spring Runoff" period (April 5 - April 20).

Sediment trap moorings in two lakes were regularly maintained on a 6-week and 3-week time schedule in support of D. J. Nriagu's Study 83026 and Dr. W.M.J. Strachan, Study 82051. These traps were removed from the lakes in July.

An additional meteorological station was installed on the existing MET tower and operated, maintained by TOS staff.

In support of the project, all docks at the five lakes were completely rebuilt and a new MET Hill instrumentation deck was constructed. Numerous road repairs were completed on the watershed roads and main road to the camp.

A new stream gauging station with instrumentation was installed at Site S6.

YAMASKA RIVER

RRB STUDY 83032, B.J. DUTKA

As part of the Ecotoxicology Project, nine sites were sampled on the Yamaska River from August 2nd to the 6th.

At all sites, surface water and sediment samples were collected. At seven sites, triplicate biofilm collectors were refurbished.

GROUNDWATER STUDIES

RRB GRNWAT STUDY 83043, K. NOVAKOWSKI

Technical Operations supported different groundwater projects from May 2 until December 22. Support consisted of one full-time technician and vehicle for the CCIW area as well as a vehicle from May until October used at a study site in Prince Edward Island.

The main study site was located at Clarkson, halfway between Toronto and Burlington and is a continuation of work begun in 1987. The site is located on the Petro-Canada Refinery property and at the time consisted of thirteen bore holes, approximately 10 metres deep, arranged in a 15-metre square grid pattern.

The purpose of the project was to investigate the flow of water through continuous fractures in otherwise solid bedrock. From the results of last year's study and with further experimentation this season, a second fracture was located in several new wells.

This season, a new mini-packer system was utilized for the first time. These packers were developed and assembled in-house; the parts were manufactured in a local production machine shop.

There are now 13 groundwater wells located on the Petro-Canada Refinery property. They have been bored in a 15-metre square grid. Each well had either 2 or 3 mini-packers inflated in the well (depending on the number of fractures; i.e., if the well had 2 fractures, it had 3 packers). The mini-packers were utilized to isolate the fractures for various types of tests that were to be performed.

During the September testing, the following experiments were conducted: long-term pumping test (24 hours); pulse interference test; and gradient tests. To ensure very accurate results, each well had electronic pressure transducers located in such a manner as to allow measurement of pressures in the upper or lower fracture. It was discovered that some lower fractures in certain wells were connected to upper fractures in other wells.

The last test which is to be conducted this fiscal year is called a tracer test. A tracer chemical will be placed in a particular well and all the other wells will be monitored to see if the tracer can be recovered. This test has been done by other research facilities by applying pressure to the source well but the test being carried out at Clarkson will be attempted using the natural flow of the water in the fractures.

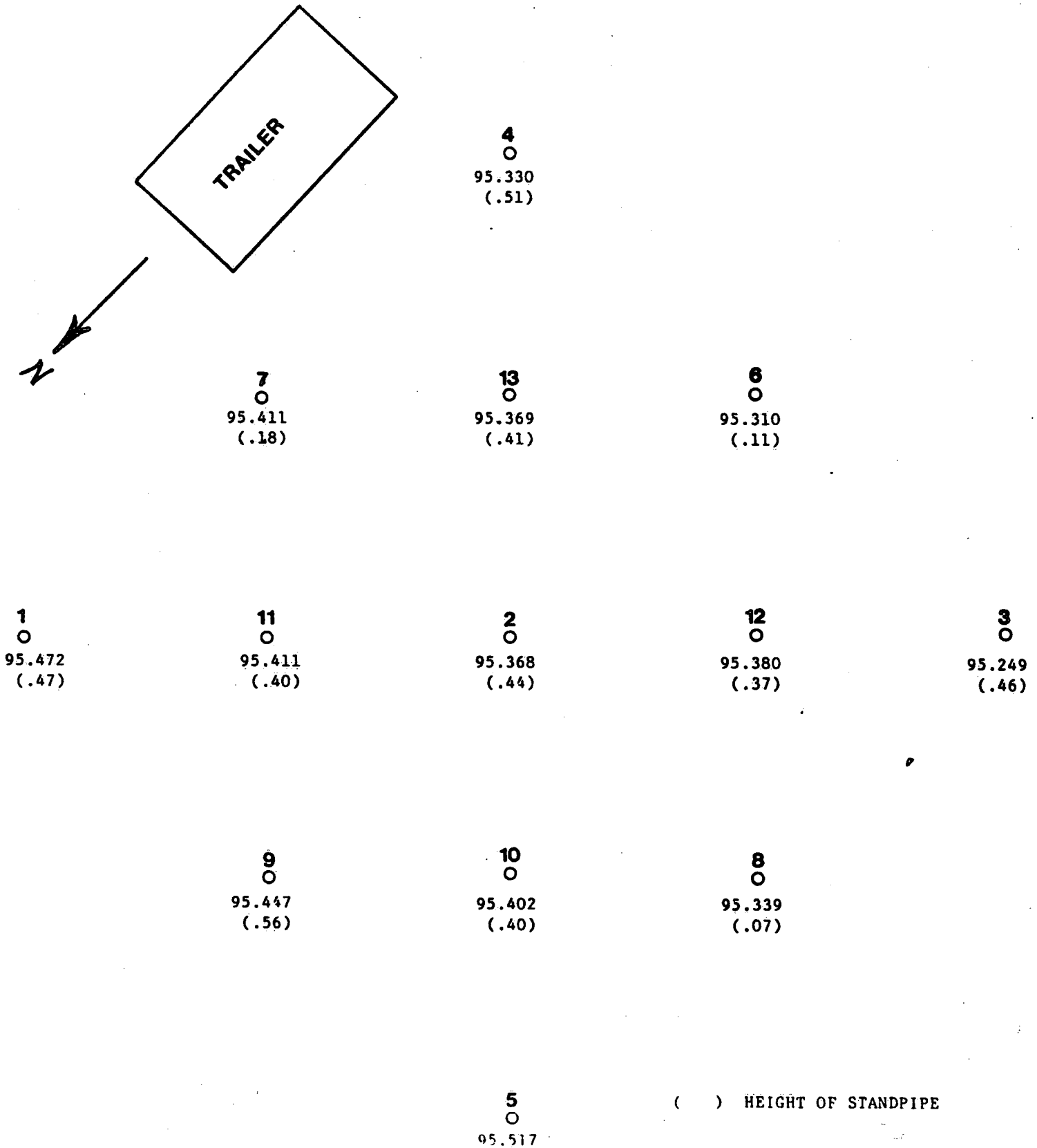
An opportunity to study 3 deep holes (70 m) in Niagara Falls, New York became available through the U.S. Geological Survey. These holes were profiled between June 8 and July 8 because the data gained corresponded to rock structure in holes located a few kilometers away on Navy Is. in Canada where groundwater measurements are taken.

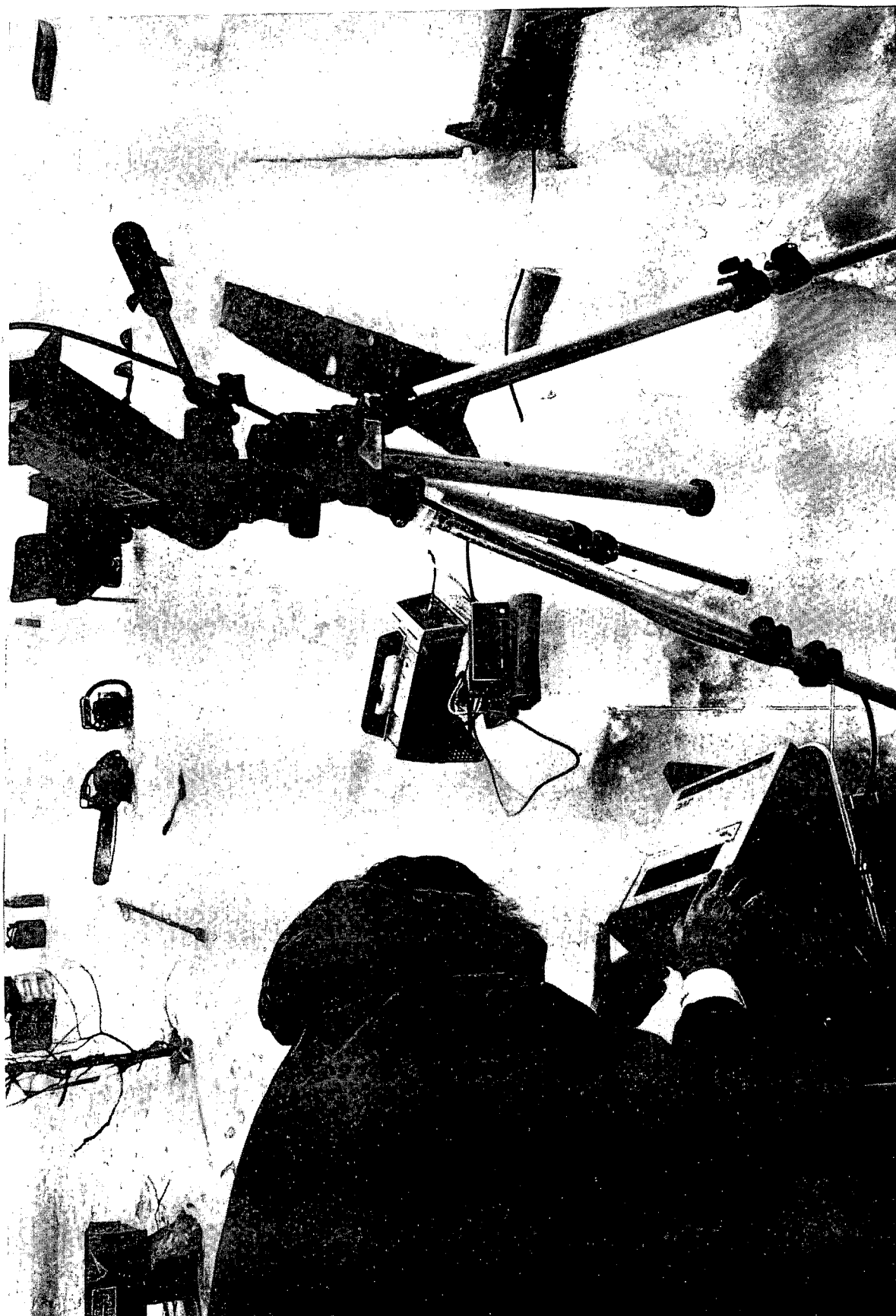
The Groundwater Group assisted Laval University of Quebec City in profiling rock structure in six holes at Ville Mercier near Montreal between October 17 - 28. This highly polluted groundwater site needed baseline data for a cleanup process which is now in operation.

Technical Operations still has a 20 ft. lab trailer located at the field site which will remain there through the 1989/90 fiscal year.

CLARKSON STUDY SITE

SURFACE ELEVATIONS





ICE FLEXURE EXPERIMENT, ROCKWOOD

ICE JAMS

ROCKWOOD PARK

RRB STUDY 83053, DR. S. BELTAOS

At Rockwood Park Conservation area, field tests were set up to obtain the flexural strength of ice. Beams of ice were cut and tests conducted on their breaking strength. Beams of ice of the following sizes: 2.5 x 0.5, 5 x 1, 10 x 2, 25 x 5, 50 x 10 metres, were cut and broken, using a hydraulic ram system.

These experiments were conducted January 14, January 21st, January 27, February 10 and February 17.

RESTIGOUCHE AND UPSALQUITCH RIVERS, NEW BRUNSWICK

This was the first work done on the Restigouche and Upsalquitch rivers in a continuing project to develop methods, theories and models to forecast, control and prevent ice jams. Work was carried out from July 9 - 28 by Mr. W.J. Moody, RAB and Mr. Y. Desjardins and Mr. S.B. Smith, Technical Operations Section.

Work involved establishing temporary bench marks (TBM) along the rivers by running levels from a point of known elevation and tying into other known elevations. A total of 25 TBM's were established on the Restigouche River and 6 TBM's on the Upsalquitch River. After all TBM's were established cross-sections of the river were done from the high point on one bank to the high point on the opposite bank. Twenty cross-sections were completed on the Restigouche River and 6 on the Upsalquitch River. The T2 theodolite with a DI-3000 distomat mounted were used to obtain distances and elevations on the cross-sections. A Lowrance sounder was used to obtain soundings on the river and the nearshore shallow sections were done by wading. Previous high water elevations were determined by examining photographs taken at breakup time and obtaining levels from the established TBM's of the areas in the photographs.



SURVEYING, RESTIGOUCHE RIVER, N.B.



CROSS-SECTIONING, RESTIGOUCHE RIVER, N.B.

THAMES RIVER AND BIG CREEK PESTICIDES TRANSPORT

RRB STUDY 83056, DR. B.G. BROWNLEE

The purpose of this project was to evaluate sites for proposed studies of pesticide transport in rivers.

To accomplish this, several sites were sampled throughout the field season. The first samples were collected in mid-May; the second set of samples were collected in early July; and the final sampling trip was in early October. Each site was sampled for suspended solids, sediment, Seston and particulate organic carbon. Teflon and stainless steel hoses and containers were the only substances allowed to come in contact with the samples, thus ensuring that there was no sample contamination. The sites sampled were as follows:

1. Kintore East (a small headwater tributary of the Thames River)
2. Kintore West (a small headwater tributary of the Thames River)
3. Big Creek at Vanessa
4. Big Creek at Walsingham
5. Thames River at Putnam
6. Thames River North of Thamesford
7. Canagagigue Creek at Elmira (CN#3)
8. Canagagigue Creek upstream of Elmira (CN#0)

It was originally intended that samples would be collected from Big Otter Creek. Due to the height of the bridges at the previously chosen sites situated on the creek, these sites had to be cancelled. (Sampling pumps could not lift the water at a reasonable rate or the water could not be pumped as high as the bridge deck.)

Weather conditions this year played havoc with the sampling at some sites, especially during the July period. Due to drought conditions, centrifuging at Kintore East had to be cancelled since the stream was nothing more than a trickle. Another side effect of the drought was the lack of suspended solids in the water column. In order for enough material to be centrifuged from some stations, the centrifuge would have to be operated for periods between 12 - 15 hours. Due to time constraints, the centrifuging was limited to 4 hours per station.

RESEARCH & APPLICATIONS BRANCH

ORGANIC ACID SAMPLING

ONTARIO - BRITISH COLUMBIA

RAB STUDY 84004, V. CHEAM

During the trip to British Columbia in support of Dr. T. Murphy in April, water samples were collected at several sites from Ontario to British Columbia. These samples were collected for organic acid analysis. A total of 16 samples were collected from the following areas of Canada:

1. Brooks, Alberta
2. Similkameen River at Bromley Rock, British Columbia
3. Okanogan River at Penticton, British Columbia
4. Woods Lake, British Columbia
5. Kicking Horse River at Field, British Columbia
6. Banff, Alberta
7. Amisk Lake, Alberta
8. North Saskatchewan River at Vinca Bridge
9. South Saskatchewan River at Saskatoon
10. Assinaboine River at Russel, Manitoba
11. Red River in Winnipeg, Manitoba
12. Lake of the Woods at Kenora, Ontario
13. Nipigon Bay, Lake Superior
14. Old Womans Bay, Lake Superior
15. North Channel at Blind River, Ontario
16. Parry Sound on Georgian Bay

All samples were return to CCIW for analysis.

QUALITY CONTROL WATER SAMPLES

RAB STUDY 84024, K.I. ASPILA

During the period June 14 - 16, bulk centrifuged water samples (800 litres) were collected from six lakes in the Huntsville-Dorset-Haliburton area. Samples were obtained at Harp Lake, Plastic Lake, Halls Lake, Eagle Lake, Twelve Mile Lake and at Moot Lake. Water was centrifuged at a flow rate of between 4 and 6 litres/minute depending on the water clarity. The 5-ton truck was used to carry the centrifuge and the sample barrels.

RESEARCH SUPPORT DIVISION

RAINY RIVER ORGANICS SAMPLING

RSD STUDY 86032

Technical Operations Section assisted Mr. J. Merriman, WQB-OR with sample collection from the Rainy River located along the Canada-U.S. border between Rainy Lake and Lake of the Woods on two occasions.

The purpose of these sampling trips was to establish sampling sites in the Rainy River both upstream and downstream of the Boise Cascade Pulp and Paper Mills located at Ft. Frances, Ontario and at International Falls, Minnesota to monitor various water quality parameters and determine the levels of various organic contaminants (i.e., chlorophenols, dioxins) found in the suspended sediment compartment of the river.

Four sites were established for suspended sediment collection. A control site was located upstream of the pulp mills near Pithers Point Park. Each of the second and third sites was located immediately downstream of a pulp mill effluent diffuser. The fourth site was approximately three miles downstream of the mills. Two modified 'Christmas Tree' sediment arrays were installed to collect suspended sediment during the following week at each station. Suspended sediment was collected at each station using two portable Westfalia separators operated from the Joe Boat anchored near the sediment traps. The centrifuges were run continuously for 9 hours on each site, sampling water pumped from a depth of 1.5 metres. Whole water samples (40L) and centrifuged water samples varying in volume from 80 litres to 200 litres were collected at this time depending on the concentration of effluent at the site for later extraction using the Goulden large sample extractor. In addition to the river stations, the final effluents from both mills were centrifuged simultaneously by operating one centrifuge at each mill at a point just before the effluent entered the river.

The water samples were extracted and the centrifuge sediment samples were pressure filtered in a cabin rented to serve as a lab.

Although the sampling was similar on both trips, due to a malfunction of one of the centrifuge bowls on the second trip, only one centrifuge could be run at each site. This resulted in reduced sample sizes from the river sites which was partially compensated for by extending the sampling period. The final effluent samples took two days to collect rather than one as on the first trip. Samples of young of the year Smallmouth Bass and Yellow Perch were collected on the second trip using a beach seine from a shallow area on Pithers Point and from two sites on opposite sides of the river adjacent to the downstream sediment trap site.

OWEN SOUND

GREAT LAKES LABORATORY FOR FISHERIES & AQUATIC SCIENCES

RSD STUDY 86032, DR. M.G. JOHNSON

This year, Technical Operations Field Section supported Dr. M.G. Johnson's Acid Rain Study in the Parry Sound area by supplying equipment, vehicles and technical staff. Three trips were made during the season--March 21 - 30, April 25 - 29 and May 2 - 13.

The purpose was to study the effects of airborne pollutants on several acid stressed lakes in the Parry Sound area. The study was to assess the changes that occur in water chemistry as well as in fish and benthic communities as the acidic waters pass through the watershed. The lakes studied this year included: Carruthers, Cochrane, Crow, Lady, Lane, Pender and Raven K7.

On the first trip, a total of ninety 9 x 9 Ekman dredges were collected from all the lakes for Chironamid identification. These samples were seived and preserved for transportation to Owen Sound for identification.

During the second trip, the following parameters were collected: temperature--top and bottom, zooplankton net haul, total phosphorus filtered and unfiltered, nitrite and nitrate, Seston and Secchi disc.

During the period May 2 to May 13, Technical Operations provided a vehicle and a technical staff member to conduct a Quantitative Larval Fish Study. This project is the continuation of a study started by the Ministry of Natural Resources. Due to limited time and resources, only two areas were surveyed: Stokes Bay and Pike Bay on Lake Huron.

The object of the study was to obtain the number of larval fish per 1000 cubic metres of water. A net was rigged to be towed beside a Boston Whaler. The net had an opening of 0.8 m dia. and a meshing size of 500 micron. It was towed at an ultimate speed of 0.7 m/sec. for a period of 5 minutes giving a volume of water sampled of 100 cu m.

At each of the two study areas, 9 lines were selected. The location of each line was selected either in a sheltered area, by sand or gravel bar or island or open to the Lake Huron winds and currents. Six (6) lines were on the open lake and 3 in the sheltered areas.

The selected lines were subdivided into 3 consecutive segments of 5 minutes tow. The net was then removed from the water and the sample transferred to a jar and preserved with Formalin. At each line, a zooplankton sample was collected using a Schindler-Patalas sampler and kept in Formalin. Three 1L bottles of water were also collected and the temperature of the surface water recorded.

HAMILTON HARBOUR

RSD STUDY 86032, GLLFAS

Hamilton Harbour has been identified as an area of concern by the International Joint Commission. This project will contribute to a remedial action plan for Hamilton Harbour by measuring and assessing fish habitat in the harbour. The extent and diversity of submerged plant growth and the factors limiting this growth were looked at so that we can identify areas for remedial action.

During the week of September 19 - 23, a survey of aquatic plants was completed by TOS and GLLFAS personnel. Species identification and plant densities were determined from direct observation using SCUBA. The survey area included much of the North shore of the harbour as well as the area behind the Lax property.

The survey indicated that submerged aquatic plants were not found at depths greater than 2 metres. It appears that light is a major factor limiting plant growth since no plants were found in areas of high turbidity (the mouth of Grindstone Creek) while sheltered areas such as LaSalle Park had abundant plant growth.

It appears that fish distribution and abundance is limited by the abundance and distribution of submerged plants. Restoration efforts in Hamilton Harbour will focus on factors affecting plant abundance and the creation of additional habitat.

LAKE TROUT REPRODUCTION

RSD STUDY 86032, GLLFAS

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.

The area chosen for this study was Yorkshire Island in Lake Ontario, a historical Lake Trout spawning area. The shoal is well documented and a similar type of study has been done here in the past.

On July 6 - 7, a shoal survey was completed using SCUBA and an area selected for the study. TOS and GLLFAS personnel returned to the site on October 6 - 7 and a series of 4 chains, to which the incubators will be attached, were put down on the shoal. On November 8 - 9, using the CORMORANT, we returned to the island and met with Ministry of the Environment personnel who were netting Lake Trout on the shoal. Five ripe fish were netted, their eggs were stripped and fertilized and subsequently loaded into incubators. Unfortunately, weather conditions prevented us from putting the incubators on the Yorkshire shoal, so we returned the incubators, complete with eggs, to CCIW where they were stored in water.

On November 22, utilizing the SHARK, 5 shoals in the Grimsby area were examined using SCUBA and a shoal located inside the 50 Point Rifle Range was selected as the best spot to place the incubators. On November 24, the incubators were placed on the shoal by divers. They were attached to a length of chain which was anchored to the bottom with railway track. Four sediment traps were also placed on the shoal and a pinger was left to mark the area. Retrieval of the incubators is scheduled for early April 1989.

CANADIAN WILDLIFE SERVICE

RSD STUDY 86041, DR. V.W. WESELOH

Technical Operations continued to support the Canadian Wildlife Service (CWS) field program on the Great Lakes for the 1988 field season.

Purpose

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:

- a) Egg collections: To determine long-term spatial and temporal trends in contaminant levels in Herring Gull and Double Crested Cormorant eggs
- b) Fighting Island: To determine the breeding biology factors of a suspected aberrant population of Herring Gulls and relate it to contaminant levels in eggs
- c) Walpole Island: To determine breeding biology factors of Ontario's largest and only significant colony of Forster's Terns and to evaluate them in light of comparative work done in the United States on larger populations
- d) Cormorant work: To determine stage and rate of occurrence of embryonic deformities in Cormorants, to determine contaminant levels in the Great Lakes and control populations of Cormorants, to census all Canadian Great Lakes colonies of Cormorants and assess productivity and population changes

Method

The largest percentage of the CWS field program was directed toward work on the eggs and chicks of the Double Crested Cormorant and Herring Gull. Scheduling of the field trips was critical because of varying ice conditions throughout the Great Lakes. Egg laying varied over a two-week period throughout the colonies with an incubation time of 26 - 28 days. 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 out over the Great Lakes.

Several of the colonies were visited at the three most important times:

1. Nest building and egg laying during the end of April and early May when eggs were collected from 3-egg nests within each of the annual monitoring colonies, then submitted for analysis
2. Egg hatching at mid to late-May when counts and embryonic viability tests were made on Gull and Cormorant eggs by means of a sensitive electronic instrument that detects movement within the egg. This measurement was made after approximately 20 days of natural incubation
3. Chicks at 2 - 3 weeks of age were banded and examined for obvious deformities to bills, feet and eyes. This data along with chick counts helped in making reproductive assessment for many of the Great Lakes colonies

Scheduling of field trips for monitoring and banding of Double Crested Cormorants did not interfere with the Gull survey because they lag 2 - 3 weeks behind in breeding and hatching. Also, the Cormorant egg laying is spread over a longer period than that of the Gulls.

Two 18' workboats (THUNDERBIRD and SAB 2) were utilized throughout the season to visit the many colonies located on several islands in the Great Lakes, Detroit, Niagara and St. Clair rivers, Lake Nipigon, Lake Winnipegosis and Lake of the Woods.

Over 2000 sea miles were logged along with over 25,000 land kms of boat trailering. 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 1989 field season.



GREAT BLUE HERON CHICK



RING BILL GULL AND CHICK

COMMON-USER/OUTSIDE AGENCIES SUPPORT

RSD STUDIES 86031/86032

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, there were more than 50 individual studies supported by Technical Operations staff, ranging from Halifax in the East to the interior of British Columbia in the West. Equipment and/or support was given to universities, other services of Environment Canada (CWS-Long Point, EPS-Ottawa), other government departments (EM&R, NRC, etc.), Hamilton Region Conservation Authority, Halton Region Conservation Authority, Greenpeace and consulting firms, in conjunction with government contracts. Study support varied from one week duration up to and including 3-week trips for the more further afield studies.

Again this year, Technical Operations supported Environment Week in Ottawa in conjunction with Water Quality Branch-Ottawa by demonstrating water sampling and equipment to the public while on a boat cruise between the dock at the entrance of the Rideau Locks to the mouth of the Gatineau River.

Field support was provided to the following outside agencies as follows:

1. GLLFAS - Owen Sound/Parry Sound, Dr. M.G. Johnson: Three periods of 2 weeks duration each
2. Halton Region Conservation Authority - Campbellville and Milton
3. Public Works - Diving in search of submerged barrels at Welland
4. GLLFAS - Yorkshire Island installing Lake Trout eggs
5. GLLFAS - Toronto Harbour/Hamilton Harbour, Dr. M. Munawar
6. DND/McMaster - NWRI Tower, Dr. M.G. Skafel

Rigging Shop

Due to the total number of requests for support in the field exceeding the number of staff on strength, the riggers had to spend 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 still had to be conducted whenever possible. The Rigging Shop was also responsible for the delivery of boats and laboratory trailers to field stations, delivering scientific equipment to major ships throughout the Great Lakes and the St. Lawrence River, erecting towers, operating boats, heavy trucks and forklifts.

L.J. Lomas had as an additional duty the responsibility of maintaining the outside storage compound and ensuring that the warehouse was kept in an orderly fashion.

H.E. Greencorn, when not assisting in the field, was responsible for the maintenance of the NWRI vehicle fleet, trailers, snowmobile and all-terrain vehicles. The vehicle fleet this year made 8 new purchases of vehicles to update the vans, station wagons and crane truck which were slowly deteriorating due to overuse.

Field Stores

The Field Stores, which supplies most of NWRI with sampling equipment, was manned on a full-time basis to issue and receive field gear. 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 DFO, EPS and GLWLCC was conducted on a year-round basis.

DIVING OPERATIONS

The Diving Operations Unit of Technical Operations Field 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 diver training. The Diving Operations Unit supported 18 divers located at Burlington. A significant decline in requests for diving services resulted in a total of only 75 hours (accident free) logged in support of projects for: NWRI, Water Quality Branch-Ontario Region, BINST and outside agencies (Canadian Aviation Safety Board and MOE). An additional 80 hours were logged during the pool training program.

The Head of the Diving Operations Unit, F.H. Don represented research/scientific diving as a member of the CSA 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 held in Halifax, Nova Scotia during April.

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 during 1988/89 included:

STUDY NUMBER

STUDY TITLE

82002	Port Severn - Dr. J.M. Barica
82011	Port Hope - Dr. J.P. Coakley
82013	Spanish River - A. Mudroch
82023	Chain Lake, Amisk Lake - T.P. Murphy
82025	Bay of Quinte - Dr. P.G. Manning
82027	Hamilton Harbour Restoration - T.P. Murphy
82029	Hamilton Harbour Sedimentology - Dr. N.A. Rukavina
82031	Hamilton Harbour - Spigel
84034	WAVES - Dr. M.G. Skafel
82011	50 Point/Sediment Transport - Dr. N.A. Rukavina
86041	Water Quality Stations at Ft. Erie, Wolfe Island
86033	Support to DFO:
	Clam Collection - S. Rhamey
	Fish Habitat - V.W. Cairns
	Hull Inspections

86033

Contingency - Aircraft Recovery - CASB Niagara Barrels
- MOE Search and Recovery

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