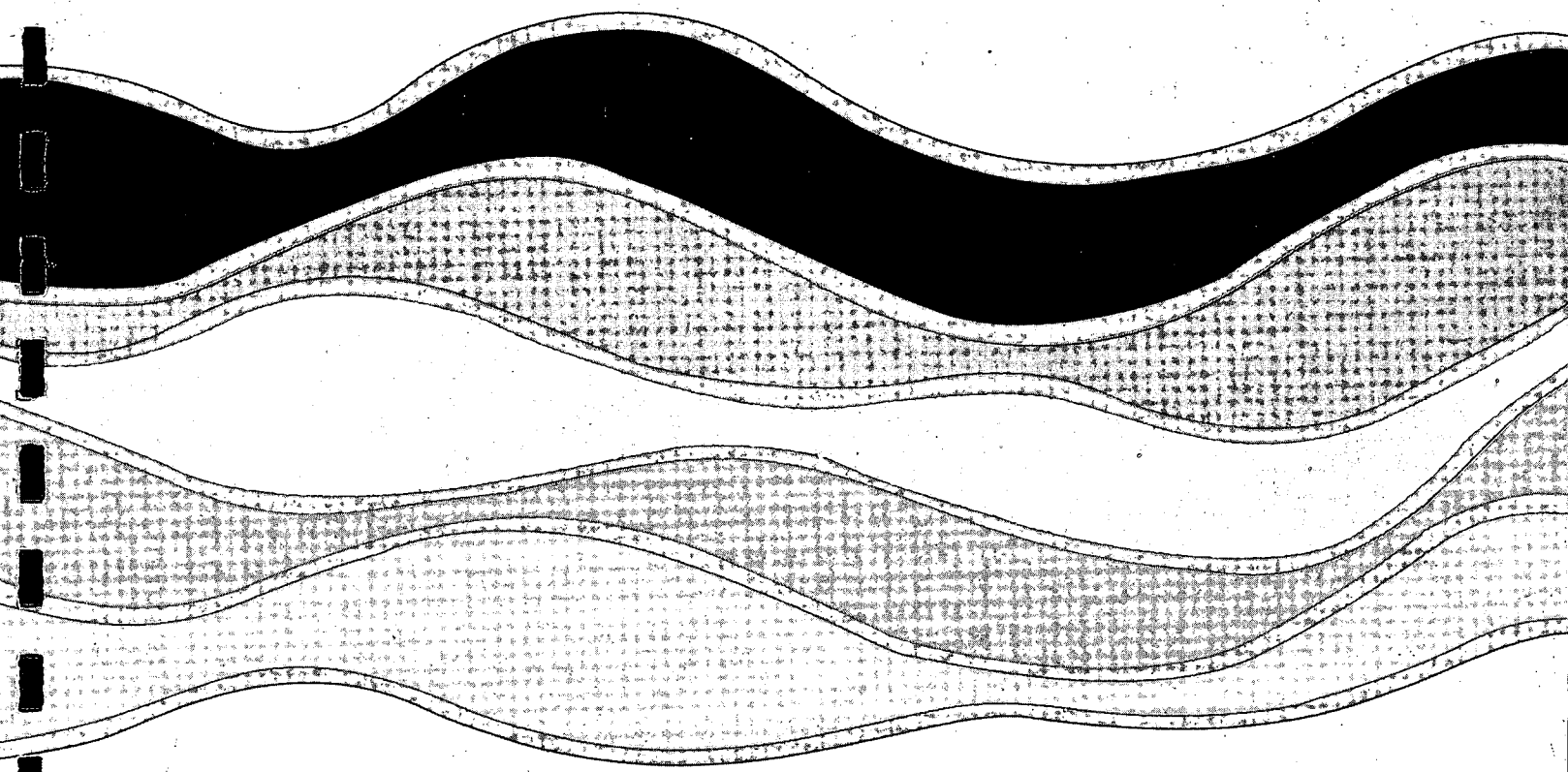
NWRI (CANADA)
Annual Report 1990
Activity Summary

NATIONAL WATER RESEARCH INSTITUTE

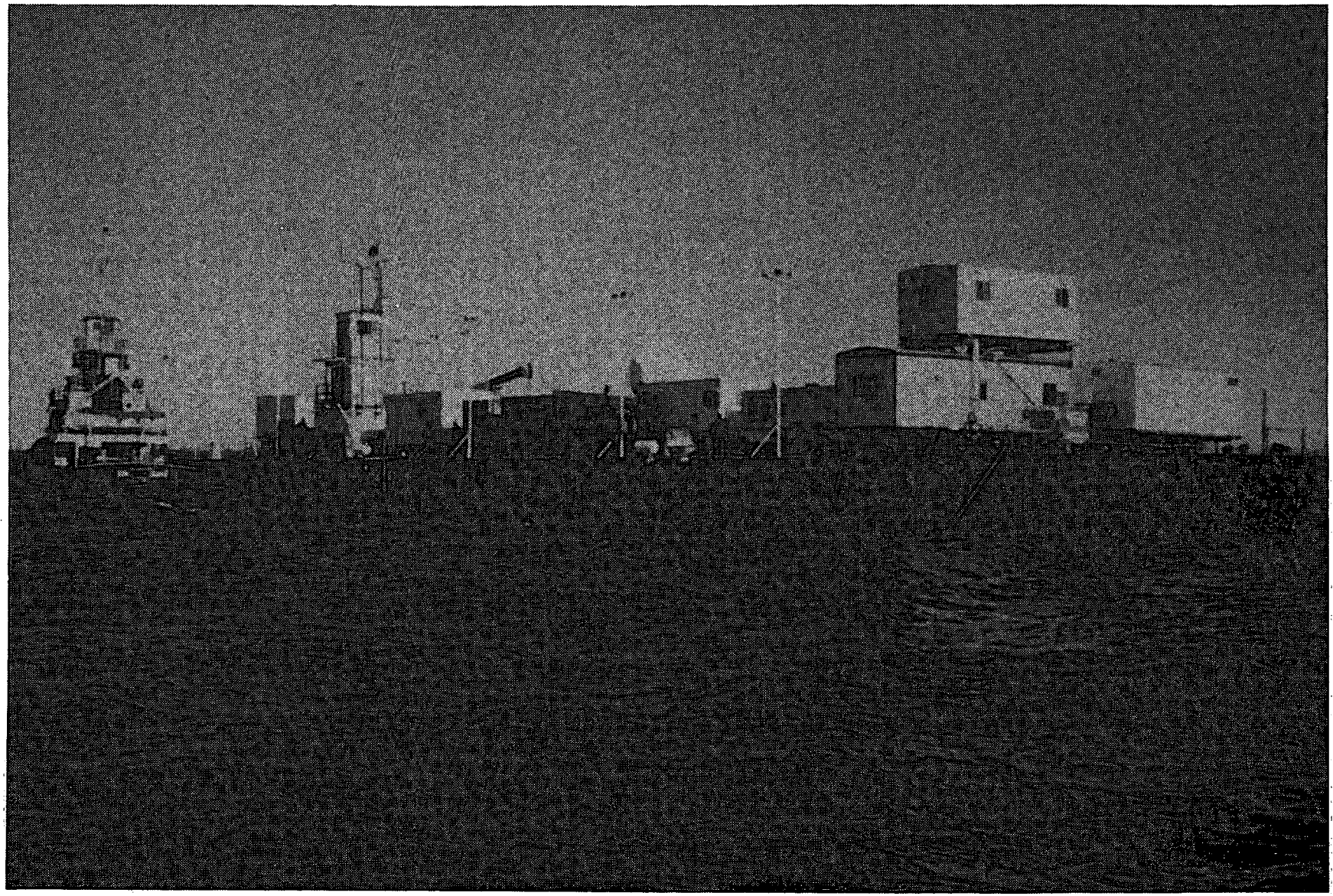
INSTITUT NATIONAL de RECHERCHE sur les EAUX



1990

ACTIVITY SUMMARY

Technical Operations Section
Research Support Division



FIELD SITE

HAMILTON-SCOURGE JASON PROJECT

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INTRODUCTION

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

The technical staff of this Section is involved in shipboard programs which are carried out from major ships on the Great Lakes and St. Lawrence River and in shore-based field projects which put them into a diverse range of field situations across the length and breadth of Canada. This unusual opportunity to work and gain valuable field-related experience in such a varied sphere of operations, develops within the Section a vast storehouse of technical expertise. The challenge in recent years in the face of an ever-increasing demand for support from the scientific community and a decline in personnel resources due to attrition and transfer, has been to maintain an effective level of support to this Institute, making the most of the available resources through efficient operation. The addition of three new members to the Operations team roster this year was a long awaited and welcome event and will go a long way towards extending the Section's ability to handle future demands.

The Diving Operations Unit is ever-expanding its capacity to give scientific programs the up-to-date technological support they require underwater--the most recent advances being in underwater video capability and the refit and upgrade of the Mobile Underwater Reconnaissance Vehicle (MURV). Annual diver training and certification courses are also conducted to maintain a high level of competence among the Institute's divers.

The Rigging Shop provides repair and maintenance of mechanical field gear, handles heavy equipment transport to field sites, operates the Field Equipment Stores and services the NWRI fleet of vehicles, trailers and campers.

The absence of Mr. John Lomas and Mr. Eric Tozer from our ranks for most of the field season was greatly felt. We wish Mr. Lomas a speedy recovery and Mr. Tozer the best of luck in his new business venture.

This report is intended as an overview of the field activities of this Section during the 1990 field season.

STAFF LIST

RESEARCH SUPPORT DIVISION

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

TECHNICAL OPERATIONS SECTION

Head	- P.M. Healey
Operations Officer, Shore	- M.R. Mawhinney
Operations Officer, Ship	- B.H. Moore
Operations Officer, Ship/Shore	- S.B. Smith

SENIOR MARINE TECHNOLOGISTS

L.E. Benner	- CWS, St. Lawrence River, Groundwater, Cornwall
P.R. Youakim	- CSS LIMNOS
E.H. Walker	- Athabaska, Espanola, Turkey Lakes Runoff, Groundwater
G.G. LaHaie	- Turkey Lakes Watershed
Y. Desjardins	- O-I-C CSS BAYFIELD, Restigouche River, CSS LIMNOS
J.A. Kraft	- O-I-C CSS BAYFIELD, Espanola, The Pas, La Tuque, CSS LIMNOS, Lake Ontario Rivermouths
K.J. Hill	- Diving, Hamilton Harbour, Cornwall, Alberta, Restigouche River
R.J. Hess	- O-I-C CSS ADVENT, CSS LIMNOS, Hamilton Harbour, Trent

MARINE TECHNICIANS

G.L. Gray	- Diving (MMIT), Hamilton Harbour, Alberta, Ayr, CSS LIMNOS, Wolfe Island, Port Severn
H.A. Lavoie	- CSS LIMNOS, St. Lawrence River
R.D. Neureuther	- CSS LIMNOS, Quinte

DIVING OPERATIONS

Head, F.H. Don	- Jason Project, Diving, Hamilton Harbour, Alberta, Wolfe Island

RIGGING UNIT

Head, L.J. Lomas
Vehicle Co-ordinator, H.E. Greencorn
S.D. Roberts, Term
A. Read, Term winter help
C. Lomas, Term winter help

NWRI FIELD STORES

W.D. Hunt

STUDENTS

K. Versteeg	- CSS LIMNOS, Hamilton Harbour, Athabaska
C. DiFrancesco	- CSS LIMNOS, Hamilton Harbour
A. Purdy	- Hamilton Harbour, Trent System, East Lake

SHIPBOARD PROGRAMS

C S S L I M N O S

CSS LIMNOS
1990

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN		1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31	1	2	3
FEB	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	1	2	3
MAR	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31
APR	1	2 LAKE ONTARIO	3 SURVEILLANCE	4 LAKE	5 ONTARIO	6 SURVEILLANCE	7 LAKE ONTARIO
	8	9 LAKE ONTARIO	10 MOORINGS	11 LAKE	12 ONTARIO	13 CCIW	14
	15 CCIW	16 CCIW	17 LAKE	18 ERIE	19 SED. LOADING	20 SARNIA	21 SARNIA
	22 LAKE	23 HURON	24 SURVEILLANCE	25 LAKE HURON	26 SURVEILLANCE	27 LAKE	28 HURON
	29 SURVEILLANCE	30 GEORGIAN	1 BAY	2 LAKE	3 SUPERIOR	4 SURVEILLANCE	5 LAKE
MAY	6 SUPERIOR	7 SURVEILLANCE	8 LAKE	9 SUPERIOR	10 SURVEILLANCE	11 LAKE	12 SUPERIOR
	13 SURVEILLANCE	14 LAKE SUPERIOR	15 SURVEILLANCE	16 LAKE	17 SUPERIOR	18 CCIW	19 CCIW
	20 CCIW	21 CCIW	22 LAKE ONTARIO	23 TROPHIC	24 TRANSFER	25 LAKE ONTARIO	26 TROPHIC
	27 TRANSFER	28 LAKE	29 ONTARIO	30 TROPHIC	31 TRANSFER	1 LAKE ONTARIO	2 CCIW
JUN	3 CCIW	4 LAKE	5 ONTARIO	6 SEDIMENT	7 SAMPLING	8 LAKE ONTARIO	9 CCIW
	10 CCIW	11 LAKE ERIE	12 BENTHOS	13 CORING	14 LAKE	15 ERIE	16 CCIW
	17 CCIW	18 CCIW	19 CCIW	20 CCIW	21 CCIW	22 CCIW	23 CCIW
	24 CCIW	25 ST LAWRENCE	26 RIVER	27 ORGANIC	28 CONTAMINANTS	29 ST LAWRENCE	30 RIVER
JUL	1 ORGANIC	2 CONTAMINANTS	3 ST LAWRENCE	4 RIVER	5 ORGANIC	6 CONTAMINANTS	7 ST LAWRENCE
	8 RIVER	9 ORGANIC	10 CONTAMINANTS	11 ST LAWRENCE	12 RIVER	13 ORGANIC	14 CONTAMINANTS
	15 ST LAWRENCE	16 RIVER	17 ORGANIC	18 CONTAMINANTS	19 CCIW	20 CCIW	21 CCIW
	22 CCIW	23 LAKE ONTARIO	24 SEDIMENT	25 SAMPLING	26 LAKE	27 ONTARIO	28 CCIW
	29	30 LAKE ONTARIO	31 TROPHIC	1 TRANSFER	2 LAKE	3 ONTARIO	4 CCIW
AUG	5 CCIW	6 CCIW	7 CCIW	8 CCIW	9 CCIW	10 CCIW	11 CCIW
	12 CCIW	13 LAKE ONTARIO	14 SURVEILLANCE	15 LAKE ONTARIO	16 SURVEILLANCE	17 LAKE ONTARIO	18 CCIW
	19 CCIW	20 LAKE ERIE	21 SEDIMENT LOADING	22 LAKE ERIE	23 LAKE HURON	24 SURVEILLANCE	25
	26 LAKE	27 HURON	28 AND	29 GEORGIAN	30 BAY	31 SURVEILLANCE	1 LAKE
SEP	2 SUPERIOR	3 SURVEILLANCE	4 SURVEILLANCE	5 LAKE	6 SUPERIOR	7 SURVEILLANCE	8 SURVEILLANCE
	9 LAKE	10 SUPERIOR	11 SURVEILLANCE	12 METALS	13 LAKE ERIE	14 DRY	15 DOCK
	16	17 DRY	18 DOCK	19 DRY	20 DOCK	21 DRY	22 DOCK
	23 DRY	24 DOCK	25 DRY	26 DOCK	27 DRY	28 DOCK	29 DRY
	30 DOCK	1 DRY	2 DOCK	3 DRY	4 DOCK	5 DRY	6 DOCK
OCT	7 DRY	8 DOCK	9 DRY	10 DOCK	11 DRY	12 DOCK	13 DRY
	14 DOCK	15 LAKE ERIE	16 LAKE	17 ERIE	18 SEDIMENT LOADING	19 BENTHOS	20 LAKE
	21 ERIE	22 LAKE	23 ONTARIO	24 MOORINGS	25 LAKE ONTARIO	26	27
	28	29 LAKE	30 ONTARIO	31 TROPHIC	1 TRANSFER	2 LAKE	3 ONTARIO
NOV	4 TROPHIC	5 TRANSFER	6 LAKE	7 ONTARIO	8 TROPHIC	9 TRANSFER	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	1
DEC	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31					

OPEN LAKES SURVEILLANCE

LAKE ONTARIO

RSD STUDY 86031, M. NEILSON, IWD-OR

The Lake Ontario Open Lakes Surveillance Program was designed to provide a continuing report and long-term trend information on water quality and eutrophication parameters in the 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 April 2 - 7 and August 13 - 17 to support this Program. Both cruises were organized and completed by Technical Operations personnel for IWD-OR and were conducted from the CSS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C positioning system and a variety of samplers and winches used for chemical and biological sampling.

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

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

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

Some of the additional tasks performed during the cruises were: EBT traces for Dr. G.K. Rodgers, Study 85021; an organic contaminant sample for WQB-OR; bulk water samples for Dr. J. Sherry of RAB; metal samples using Go-Flow bottles and submersible pumps for LRB Study 82057; and, on the first cruise, the Lake Ontario Bioindex Program, Study 82031 was supported.

SURVEILLANCE STATIONS

LAKE ONTARIO

1990-1991

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

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

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

STATISTICS SUMMARY

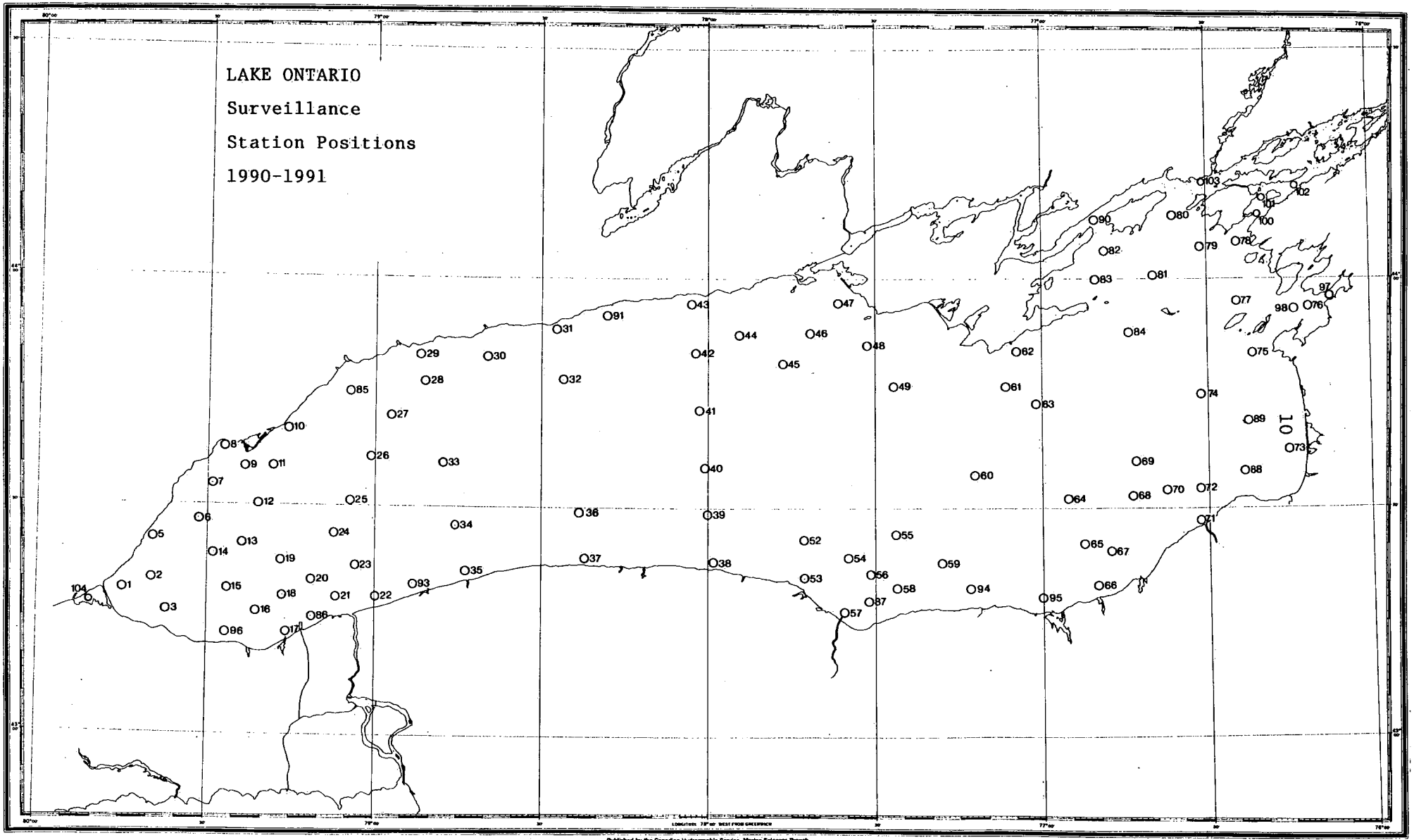
CRUISE NO. April 2 CONSECUTIVE NO. April 7, 1990 SHIP CSS LIMNOS

DATES FROM August 13 TO August 17, 1990 LAKE ONTARIO

CRUISE TYPE Lower Lakes Surveillance N. MILES STEAMED 1379.33

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	205	Moorings Established	
EBT Casts	203	" Retrieved	
Rosette Casts	160	" Established	
Transmissometer Casts	199	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	44	" Established	
Secchi Disc Observations	60	" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	204	Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )		-	
" " " (D.O.)	664	Grab Samples Taken	
" " " (Cond/pH)	668		
" " " ( )		Bulk Centrifuge Samples, 80L	1
" " " (T P uf)	664		
" " " (TKN)	114	Observations, Weather	44
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	229	Solar Radiation	
" " " (POC/TPN)	235		
" " " (Seston)			
" " " (T P f)	664		
" " " (Nutrients)	664	ONBOARD ANALYSES	
" " " (Major Ions)	664		
" " " ( )		Manual Chemistry Tech. Ops.	2000
" " " ( )		Nutrients (WOB)	342
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987



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Ontario
LAKE ONTARIO

10501

LAKE HURON/GEORGIAN BAY

RSD STUDY 86031, M. NEILSON, IWD-OR

The Lake Huron/Georgian Bay 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 April 23 - May 1 and August 20 - 30 to support this Program. Both cruises were organized and completed by Technical Operations personnel for IWD-OR and were conducted from the CSS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C positioning system and a variety of samplers and winches used for chemical and biological sampling.

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

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

Unstratified Conditions: 1 metre, mid-depth if station depth was greater than 50 metres, bottom -10 metres and bottom -2 metres

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

Some of the additional tasks performed during the cruises were: Collection of piston cores for Dr. R.L. Thomas, RRB Study 83001; installation of current meter and sediment trap moorings in the North Channel for R. Rosa, LRB Study 82016, and Ponar grab samples, Study 82015; as well as phytoplankton and microbial loop samples for Dr. M. Munawar of GLLFAS.

SAMPLING STATION POSITIONS

LAKE HURON

1990-1991

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

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

PISTON CORE POSITIONS

LAKE HURON

STATION NUMBER	LATITUDE N.	LONGITUDE W.
4A	43° 20′ 16"	81° 58′ 06"
4B	43° 28′ 49"	81° 15′ 00"

MOORING POSITIONS

LAKE HURON

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST. DEPTH m
110	90-02A-01A	46° 08′ 55"	82° 32′ 22"	ST 10, B-2
110	90-02C-02A	46° 09′ 03"	82° 32′ 22"	CM 10
111	90-02A-03A	46° 08′ 40"	82° 39′ 29"	ST 10, B-2
111	90-02C-04A	46° 09′ 01"	82° 39′ 28"	CM 10
112	90-02A-05A	46° 06′ 46"	82° 43′ 20"	ST 10, B-2
112	90-02C-06A	46° 06′ 49"	82° 43′ 09"	CM 10
113	90-02A-07A	46° 06′ 14"	82° 30′ 43"	ST 10

SAMPLING STATION POSITIONS

GEORGIAN BAY

1990-1991

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

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM April 28 TO April 30, 1990

August 26 August 28, 1990 GEORGIAN BAY

CRUISE TYPE Open Lakes Surveillance N. MILES STEAMED 722.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	48	Moorings Established	
EBT Casts	48	" Retrieved	
Rosette Casts	24	" Established	
Transmissometer Casts	28	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	16	" Established	
Secchi Disc Observations	24	" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	48	Primary Productivity Moorings	
Phytoplankton Samples	13		
Microbial Loop	13	Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)	165	Cores Taken	
" " " ( )			
" " " (D.O.)	165	Grab Samples Taken , Shipek	23
" " " (Cond/pH)	165		
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	165		
" " " (TKN)	28	Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	52	Solar Radiation	
" " " (POC/TPN)	56		
" " " (Seston)			
" " " (T P f)	165		
" " " (Nutrients)	165	ONBOARD ANALYSES	
" " " (Major Ions)	165		
" " " ( )		Manual Chemistry Tech. Ops.	495
" " " ( )		Nutrients (WOB)	84
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987

STATISTICS SUMMARY

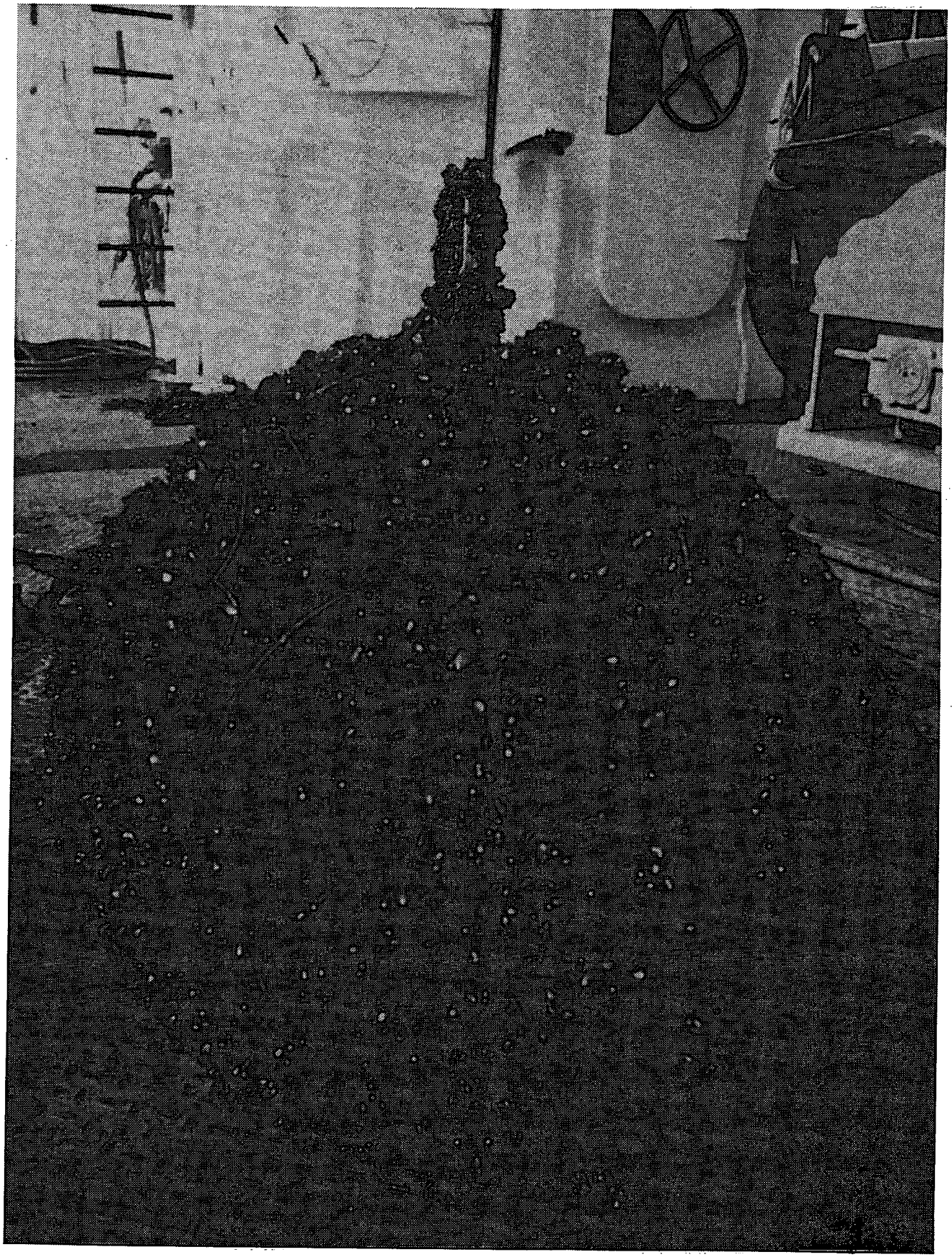
CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM April 23 / August 22 TO May 1, 1990 / August 30, 1990 LAKE HURON

CRUISE TYPE Open Lakes Surveillance N. MILES STEAMED 2154.5

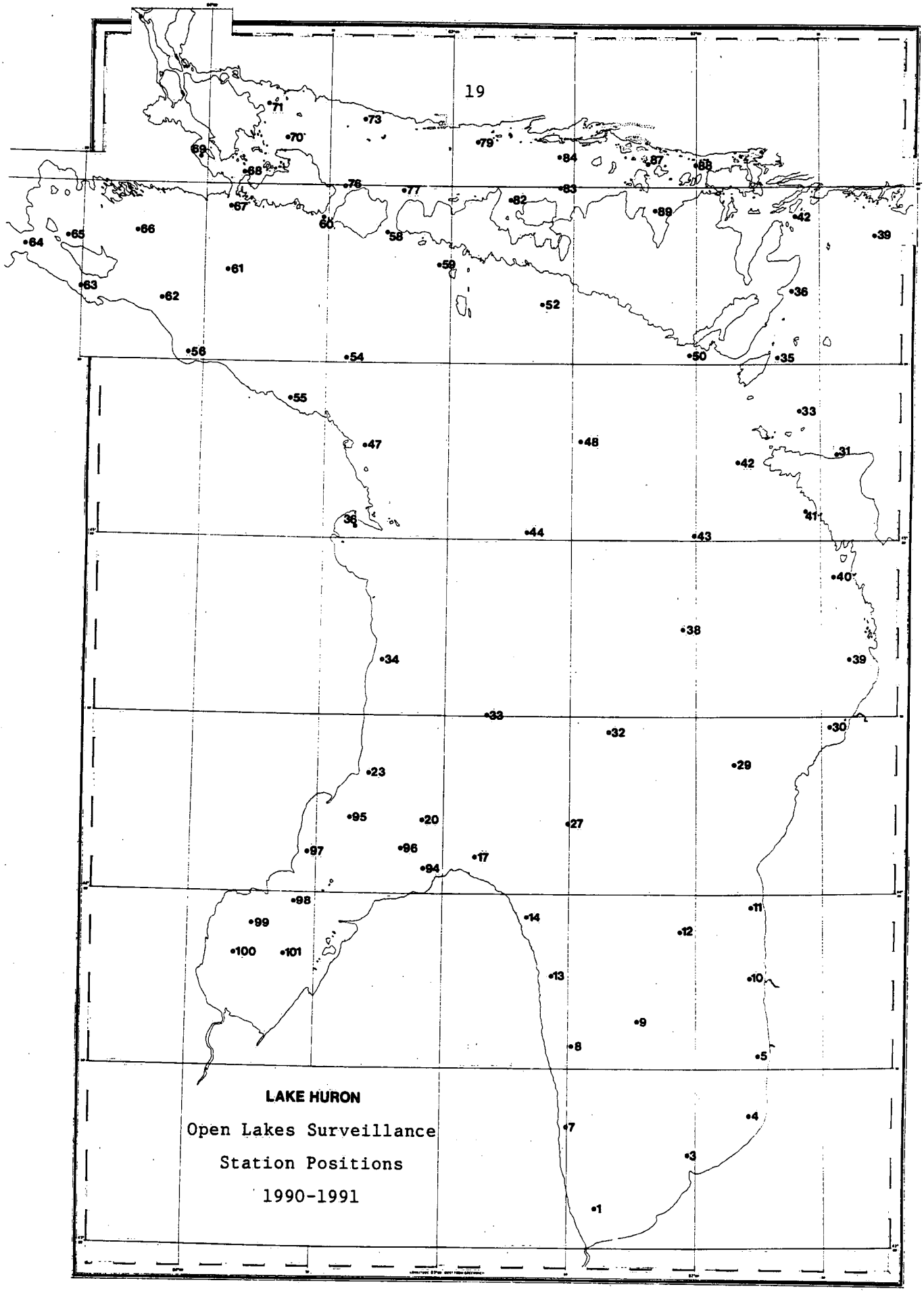
DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	147	Moorings Established, Sediment Trap	4
EBT Casts	146	" Retrieved, Sediment Trap	4
Rosette Casts	146	" Established, Current Meter	3
Transmissometer Casts	146	" Retrieved, Current Meter	3
Reversing Thermometer Obs. (No. of Therm)	32	" Established	
Secchi Disc Observations	64	" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	155	Primary Productivity Moorings	
Phytoplankton Samples	22		
Microbial Loop	22	Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	2
" " " (Water Quality)		Cores Taken, Benthos	9
" " " ( )		-	
" " " (D.O.)	394	Grab Samples Taken, Ponar	8
" " " (Cond/pH)	394		
" " " ( )		Bulk Centrifuge Samples, 1200L	4
" " " (T P uf)	394		
" " " (TKN)	81	Observations, Weather	61
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	81	Solar Radiation	
" " " (POC/TPN)	81		
" " " (Seston)			
" " " (T P f)	394		
" " " (Nutrients)	394	ONBOARD ANALYSES	
" " " (Major Ions)	394		
" " " ( )		Manual Chemistry Tech. Ops.	1182
" " " ( )		Nutrients (WOB)	243
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987



ZEBRA MUSSELS ON MOORING ANCHOR

LAKE ERIE

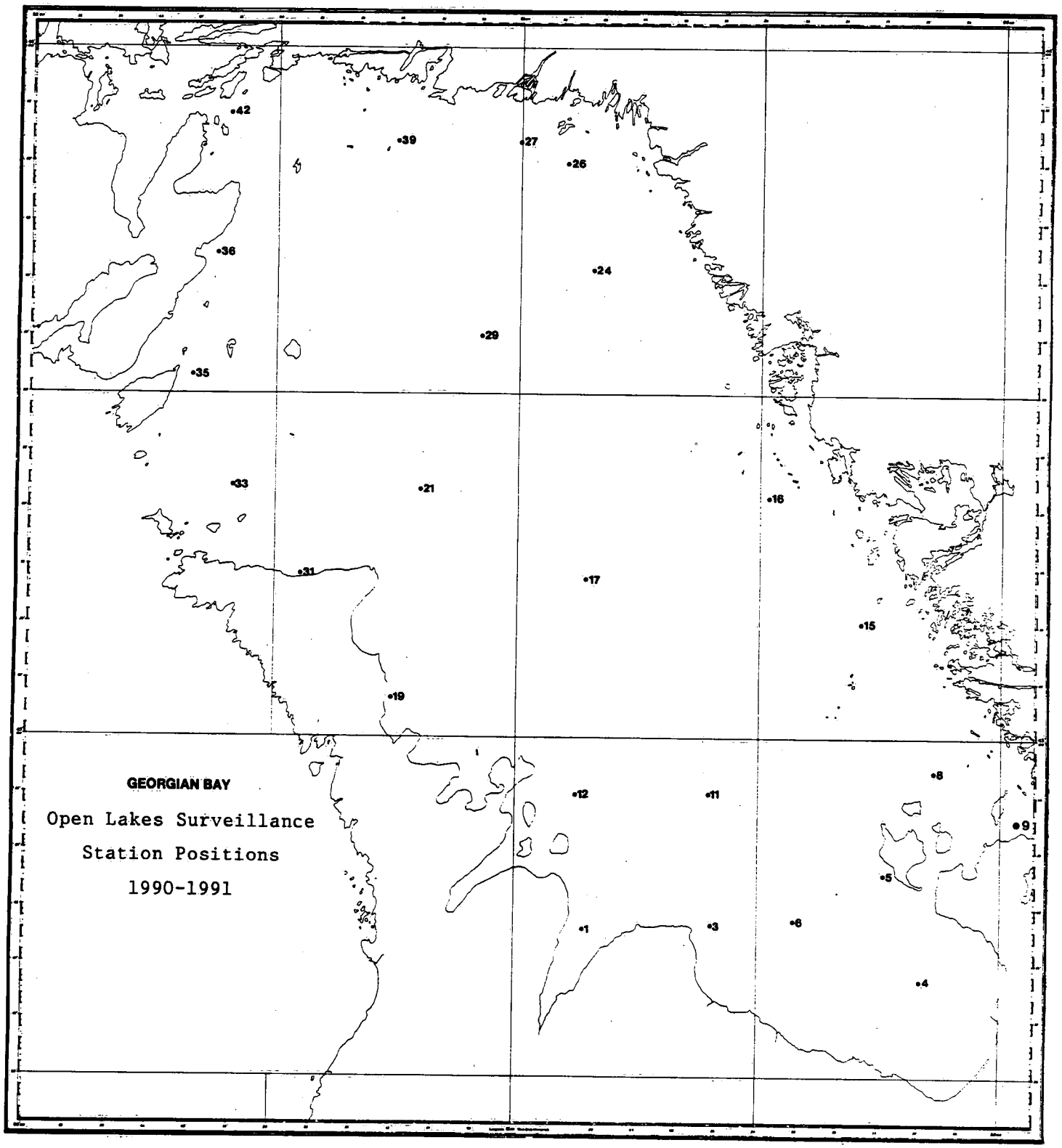


LAKE HURON

Open Lakes Surveillance

Station Positions

1990-1991


GEORGIAN BAY
Open Lakes Surveillance
Station Positions
1990-1991
42
39
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LAKE SUPERIOR

RSD STUDY 86031, M. NEILSON, IWD-OR

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

Two cruises were conducted during the season from the CSS LIMNOS on Lake Superior--one in the spring, May 2-12 and one in late summer, September 1-10. As all Surveillance cruises, this was organized and completed by Technical Operations Section, Research Support Division for IWD-OR. The vessel was equipped with the usual equipment: transmissometer/EBT system, rosette/EBT system, radar, Loran C positioning system and other necessary equipment needed to carry out chemical and biological sampling.

The parameters sampled during the cruise were: temperature and transmission, dissolved oxygen, conductivity, pH, total phosphorus filtered and unfiltered, soluble reactive phosphorus, nitrite and nitrate, TKN, ammonia, reactive silicate, alkalinity and major ions (Ca, SO_4, Cl). From the integrator sampler, samples were collected for POC, TPN and chlorophyll a.

During the May cruise, all samples were collected from the one metre depth, using the rosette system. Sampling depths for the September cruise were:

Unstratified Conditions: 1 metre, 50 metres if total depth was 70 m, 100 m if total depth was 130 m, 250 m if total depth was 300 m, bottom -10 and bottom -1 m

Stratified Conditions: 1 metre, 1 m above the thermocline, 1 m below the thermocline, 100 m if total depth was 130 m, 250 m if total depth was 300 m, bottom -10 m and bottom -1 m

Additional tasks completed during the cruises were: phytoplankton and microbial loop samples for Dr. M. Munawar, Study 86034; removal of clam cages from the Kaminisiquia River, RRB Study 83012; and box cores for Dr. T. Reynoldson, LRB Study 82015.

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM May 2 TO May 12, 1990 LAKE SUPERIOR

CRUISE TYPE Upper Lakes Surveillance N. MILES STEAMED 2861.66

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	154	Moorings Established	
EBT Casts	154	" Retrieved, Clam Traps	5
Rosette Casts	81	" Established	
Transmissometer Casts	154	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	36	" Established	
Secchi Disc Observations	60	" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 50 m	140	" Serviced	
Integrator 20 m	16	Primary Productivity Moorings	
Phytoplankton Samples	46		
		Cores Taken, Box	7
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)	507	Cores Taken	
" " " ( )			
" " " (D.O.)	507	Grab Samples Taken, Shipek	10
" " " (Cond/pH)	507	Grab Samples Taken, Ponar	5
" " " ( )		Bulk Centrifuge Samples, 2000L	1
" " " (T P uf)	507		
" " " (TKN)		Observations, Weather	96
" " " (Organic)	5		
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	174	Solar Radiation	
" " " (POC/TPN)	188		
" " " (Seston)			
" " " (T P f)	521		
" " " (Nutrients)	521	ONBOARD ANALYSES	
" " " (Major Ions)	521		
" " " ( )		Manual Chemistry Tech. Ops.	1101
" " " ( )		Nutrients (WOB)	261
" " " ( )		Microbiology Loop	22
" " " ( )			

Tech. Ops. 1987

SURVEILLANCE STATION POSITIONS

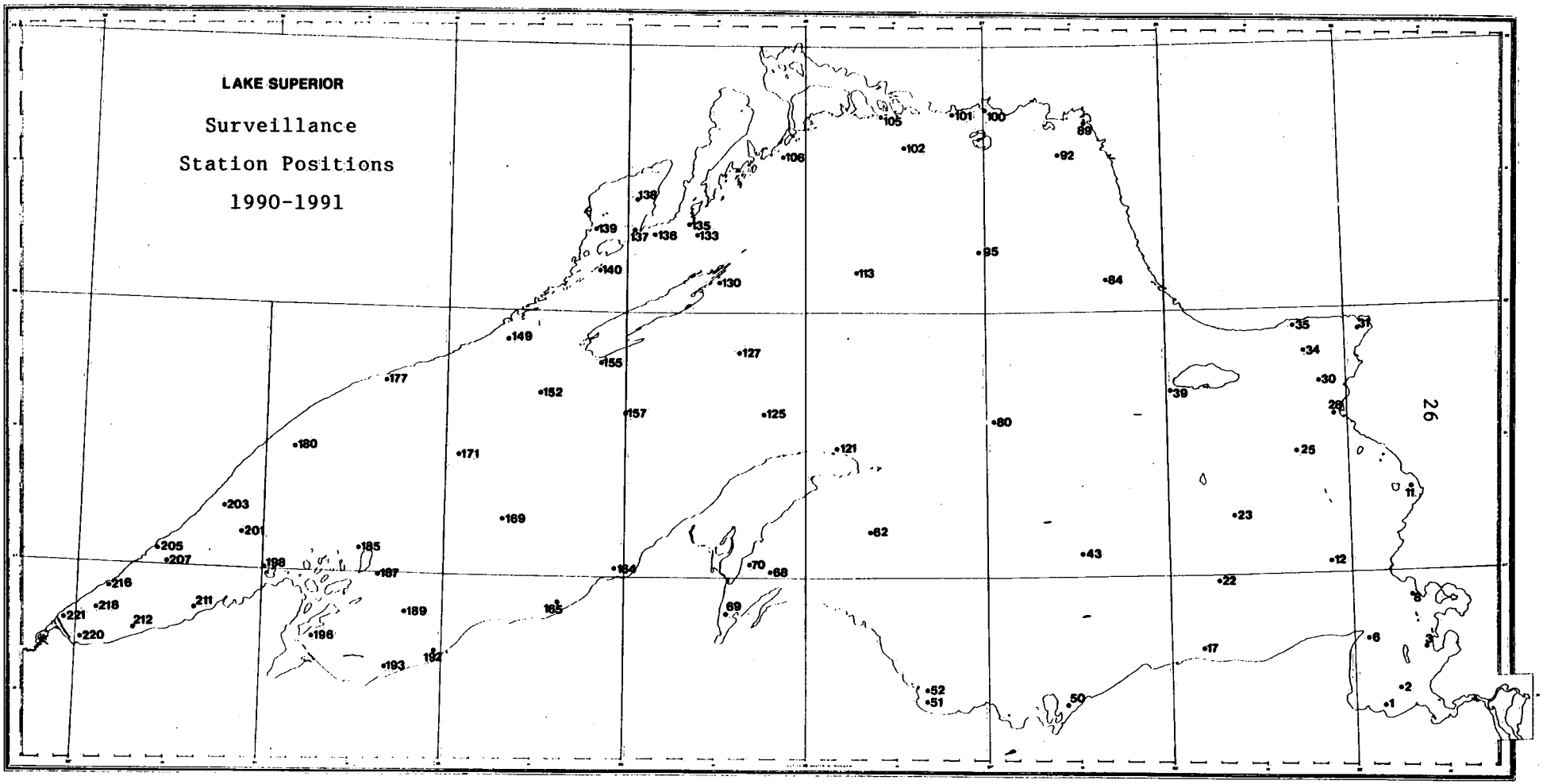
LAKE SUPERIOR

1990-1991

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

STATION NUMBER	LATITUDE N.	LONGITUDE N.
100	48° 45′ 24"	86° 58′ 33"
101	48° 44′ 06"	87° 10′ 00"
102	48° 36′ 54"	87° 26′ 09"
105	48° 44′ 00"	87° 33′ 48"
106	48° 34′ 30"	88° 07′ 00"
113	48° 08′ 42"	87° 42′ 12"
121	47° 29′ 00"	87° 50′ 00"
125	47° 36′ 18"	88° 13′ 00"
127	47° 50′ 54"	88° 20′ 30"
130	48° 06′ 30"	88° 27′ 30"
133	48° 17′ 00"	88° 35′ 50"
135	48° 19′ 48"	88° 38′ 00"
136	48° 17′ 24"	88° 49′ 48"
137	48° 18′ 06"	88° 57′ 00"
138	48° 25′ 00"	88° 56′ 00"
139	48° 17′ 54"	89° 10′ 48"
140	48° 09′ 00"	89° 08′ 54"
149	47° 53′ 00"	89° 38′ 24"
152	47° 41′ 18"	89° 28′ 00"
155	47° 48′ 12"	89° 08′ 48"
157	47° 36′ 48"	89° 00′ 00"
164	47° 01′ 36"	89° 02′ 18"
165	46° 53′ 30"	89° 20′ 51"
169	47° 12′ 24"	89° 40′ 00"
171	47° 27′ 00"	89° 55′ 15"
177	47° 43′ 00"	90° 20′ 00"
180	47° 28′ 00"	90° 51′ 18"
185	47° 06′ 00"	90° 27′ 45"
187	46° 59′ 05"	90° 20′ 26"
189	46° 50′ 42"	90° 11′ 20"
192	46° 42′ 00"	90° 01′ 54"
193	46° 38′ 00"	90° 18′ 00"
196	46° 44′ 54"	90° 42′ 12"
198	47° 00′ 36"	90° 59′ 00"
201	47° 07′ 54"	91° 06′ 42"
203	47° 13′ 18"	91° 12′ 18"
205	47° 03′ 12"	91° 34′ 00"
207	47° 00′ 12"	91° 30′ 54"
211	46° 50′ 12"	91° 20′ 42"
212	46° 45′ 00"	91° 40′ 30"

STATION NUMBER	LATITUDE N.	LONGITUDE N.
216	46° 54′ 24"	91° 49′ 12"
218	46° 49′ 00"	91° 53′ 06"
220	46° 42′ 18"	91° 57′ 54"
221	46° 46′ 54"	92° 03′ 15"


LAKE SUPERIOR
Surveillance
Station Positions
1990-1991
105
101
100
89
102
92
106
138
139
137
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133
95
140
130
113
84
149
155
127
177
152
157
125
80
180
171
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31
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30
28
26
25
11
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169
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23
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207
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198
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184
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68
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12
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ST. LAWRENCE RIVER ORGANIC AND INORGANIC CONTAMINANTS

LRB STUDY 82045, DR. K.L.E. KAISER

This was the sixth St. Lawrence River cruise conducted aboard the CSS LIMNOS since 1985. The initial cruise was completed from September 30 to October 18, 1985, the second from June 16 to July 11, 1986, the third from June 15 to July 11, 1987, the fourth from October 3 to 30, 1988, the fifth from June 26 to July 20, 1989 and this year's cruise from June 25 to July 18. The purpose of this year's cruise was:

> To determine the sources, pathways, sinks and effects of contaminants in the St. Lawrence River estuary between Quebec City and the Laurentian Trough with emphasis on the influence of the Saguenay River.
>
> To emphasize the partitioning and transport processes involving dissolved organic and suspended particulate matter in both the Saguenay and St. Lawrence regions.
>
> To determine hydrodynamic influences on the distribution and pathways of contaminants from the Saguenay and St. Lawrence rivers in the estuary and the Laurentian Trough.

Sampling for the cruise was conducted in four areas: the St. Lawrence River from Wolfe Island to Quebec City, the mouth of the Saguenay, the Saguenay Fjiord and the Laurentian Trough.

Several additional tasks were completed during the cruise. These included: collecting chlorophyll a samples for Dr. M. Hanna, Study 82026; collecting Benthos cores in the Saguenay Fjiord for Dr. André LeClerc of the University of Quebec at Chicoutimi; collecting box cores, piston cores and Lehigh cores for the University of Laval; collecting suspended sediment and Shipek samples for Dr. M. Munawar of GLLFAS, Study 86034.

The parameters sampled during the cruise were: EBT/transmission profile, conductivity, pH, POC/PON, chlorophyll a, polysaccarides, salinity, DOC, bulk water samples from 5 metres through Westfalia and Beckman centrifuges and 200-litre APLE samples.

At stations 430, 460 and 470, Seastar current meter moorings were installed and retrieved at the end of the cruise.

ST. LAWRENCE RIVER

SEASTAR MOORINGS

1990-1991

MOORING NUMBER	STATION NUMBER	LATITUDE N.	LONGITUDE W.
90-07SC-05A	430	48° 01′ 31"	69° 43′ 03"
90-07S-07A	460	48° 07′ 42"	69° 19′ 28"
90-07SC-06A	470	48° 14′ 03"	69° 28′ 36"

ST. LAWRENCE RIVER AND ESTUARY

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
29	44° 38′ 21"	76° 36′ 00"
44	45° 11′ 24"	74° 19′ 30"
112	46° 14′ 08"	72° 45′ 38"
252	44° 24′ 26"	73° 46′ 20"
257	46° 30′ 00"	72° 14′ 12"
430	48° 01′ 26"	69° 43′ 44"
440	48° 04′ 42"	69° 23′ 40"
460	48° 07′ 21"	69° 20′ 36"
470	48° 14′ 01"	69° 28′ 50"
529	48° 53′ 05"	68° 29′ 22"
531	48° 51′ 52"	68° 30′ 11"
532	48° 44′ 37"	68° 21′ 37"
540	48° 54′ 30"	68° 04′ 23"
541	49° 03′ 33"	67° 57′ 02"
542	48° 52′ 20"	67° 47′ 12"
550	49° 09′ 20"	67° 18′ 38"
551	49° 15′ 24"	67° 22′ 36"
552	49° 03′ 32"	67° 13′ 28"

SAGUENAY RIVER

ORGANIC AND INORGANIC CONTAMINANTS

STATION POSITIONS

1990-1991

STATION NUMBER		LATITUDE N.		LONGITUDE W.
S8		48° 20′ 57"		70° 49′ 40"
S50	Tied Alongside	48° 25′ 51"	Chicoutimi Dock	71° 03′ 30"
S100		48° 22′ 00"		70° 43′ 28"
S101		48° 24′ 57"		70° 47′ 15"
S120		48° 20′ 53"		70° 21′ 11"

SAGUENAY RIVER

MICROTOX STATION POSITIONS

1990-1991

STATION NUMBER		LATITUDE N.		LONGITUDE W.
S1		48° 15′ 13"		70° 07′ 24"
S2		48° 18′ 32"		70° 16′ 23"
S3		48° 21′ 18"		70° 24′ 15"
S4		48° 22′ 05"		70° 36′ 58"
S5		48° 22′ 45"		70° 43′ 34"
S6		48° 25′ 34"		70° 46′ 30"
S7		48° 24′ 56"		70° 50′ 16"
S8		48° 20′ 57"		70° 49′ 40"
S50	Tied alongside	48° 25′ 51"	Chicoutimi Dock	71° 03′ 30"
S100		48° 22′ 00"		70° 43′ 28"
S101		48° 24′ 47"		70° 47′ 28"
S103		48° 19′ 49"		70° 18′ 56"
S110		48° 24′ 35"		70° 48′ 46"
S111		48° 24′ 20"		70° 49′ 06"
S112		48° 24′ 57"		70° 46′ 08"
S113		48° 23′ 59"		70° 45′ 59"
S114		48° 22′ 04"		70° 43′ 22"
S115		48° 22′ 10"		70° 39′ 14"
S116		48° 21′ 46"		70° 32′ 00"
S120		48° 20′ 53"		70° 21′ 11"
S121		48° 23′ 43"		70° 44′ 30"
SM1		48° 23′ 06"		70° 43′ 16"
SM2		48° 22′ 54"		70° 44′ 51"
SM3		48° 22′ 24"		70° 46′ 27"
SM4		48° 21′ 45"		70° 46′ 24"
SM5		48° 21′ 09"		70° 46′ 36"
SM6		48° 21′ 12"		70° 48′ 09"
SM7		48° 20′ 57"		70° 51′ 36"
SM8		48° 20′ 54"		70° 52′ 08"
SM9		48° 20′ 48"		70° 52′ 33"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
SM10	48° 20′ 39"	70° 52′ 20"
SM11	48° 20′ 21"	70° 52′ 00"
SM12	48° 20′ 18"	70° 51′ 47"
SM13	48° 20′ 10"	70° 51′ 45"
SM14	48° 20′ 00"	70° 51′ 43"
SM15	48° 19′ 47"	70° 51′ 30"
SM16	48° 19′ 39"	70° 50′ 56"
SM17	48° 19′ 39"	70° 50′ 36"
SM18	48° 20′ 23"	70° 49′ 47"
SM19	48° 21′ 21"	70° 49′ 51"
SM20	48° 22′ 15"	70° 42′ 24"
SM21	48° 21′ 45"	70° 42′ 26"
SM22	48° 21′ 17"	70° 42′ 30"

SAGUENAY RIVER

UNIVERSITY OF QUEBEC, CHICOUTIMI

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
S1	48° 15′ 13"	70° 07′ 24"
S2	48° 18′ 32"	70° 16′ 23"
S3	48° 21′ 18"	70° 24′ 15"
S4	48° 22′ 05"	70° 36′ 58"
S5	48° 22′ 45"	70° 43′ 34"
S6	48° 25′ 34"	70° 46′ 30"
S7	48° 24′ 56"	70° 50′ 16"
S8	48° 20′ 57"	70° 49′ 40"

SAGUENAY RIVER

UNIVERSITY OF LAVAL

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
S110 (1L1)	48° 24′ 35"	70° 48′ 46"
S111 (1A1)	48° 24′ 20"	70° 49′ 06"
S112 (2L2)	48° 24′ 57"	70° 46′ 08"
S113 (4L4)	48° 23′ 59"	70° 45′ 59"
S114 (4A2)	48° 22′ 04"	70° 43′ 22"
S115 (5L5)	48° 22′ 10"	70° 39′ 14"
S116 (6L6)	48° 21′ 46"	70° 32′ 00"
S120 (7B2)	48° 20′ 53"	70° 21′ 11"
S121 (3L3,6B1)	48° 23′ 43"	70° 44′ 30"

NOTE: Numbers in brackets are University of Laval station numbers

GREAT LAKES LABORATORY FOR FISHERIES & AQUATIC SCIENCES

SHIPEK AND SUSPENDED SEDIMENT STATION POSITIONS

ST. LAWRENCE RIVER

1990-1991

STATION NUMBER	LATITUDE N.	LONGITUDE W.
SL4 (29)	44° 38′ 21"	75° 36′ 00"
SL6	45° 13′ 44"	74° 14′ 10"
SL17	45° 13′ 12"	74° 14′ 06"
SL22	45° 19′ 22"	73° 53′ 18"
SL27	45° 33′ 50"	73° 30′ 57"
SL30	44° 59′ 12"	74° 46′ 17"
SL34	45° 59′ 18"	73° 10′ 52"
SL35	46° 03′ 28"	73° 06′ 57"
SL53	47° 04′ 24"	70° 44′ 06"
SL53A	47° 01′ 18"	70° 46′ 33"
SL58	46° 21′ 26"	72° 30′ 18"

GREAT LAKES LABORATORY FOR FISHERIES & AQUATIC SCIENCES

SHIPEK STATION POSITIONS

SAGUENAY AND ST. LAWRENCE RIVERS

1990-1991

STATION NUMBER	LATITUDE N.	LONGITUDE W.
S8	48° 20′ 57"	70° 49′ 40"
S103	48° 19′ 49"	70° 18′ 56"
S100	48° 22′ 00"	70° 43′ 28"
S5	48° 22′ 45"	70° 43′ 34"
S101	48° 24′ 57"	70° 47′ 15"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
531	48° 51′ 52"	68° 30′ 11"
532	48° 44′ 37"	68° 21′ 37"
540	48° 54′ 30"	68° 04′ 23"
541	49° 03′ 33"	67° 57′ 02"
542	48° 52′ 20"	67° 47′ 12"
550	49° 09′ 20"	67° 18′ 38"
551	49° 15′ 24"	67° 22′ 36"
552	49° 03′ 32"	67° 13′ 28"

STATISTICS SUMMARY

CRUISE NO. 90-07-001 CONSECUTIVE NO. 701 SHIP CSS LIMNOS

DATES FROM June 25 TO July 18, 1990 RIVER ST. LAWRENCE AND SAGUENAY

CRUISE TYPE Organic & Inorganic Contaminants N. MILES STEAMED 1641.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	77	Moorings Established	3
EBT Casts	53	" Retrieved	2
Rosette Casts		" Established	
Transmissometer Casts	53	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations		" Retrieved	
		" Refurbished	1
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples	5		
		Cores Taken, Box	4
		Cores Taken, Benthos	28
Water Samples Collected (Microbiology)		Cores Taken, Piston	3
" " " (Water Quality)		Cores Taken, Lehigh	8
" " " (pH)	28	Schieder Extracts	30
" " " (D.O.)		Grab Samples Taken, Shipek	40
" " " (Cond/pH)	215	Beckman Centrifuge	13
" " " (Salinity)	84	Bulk Centrifuge Samples	53
" " " (TPuf)		APLE Neutral	49
" " " (TKN)		Observations, Weather	
" " " (Microtox)	43	APLE Base	18
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	24	Solar Radiation	
" " " (POC/TPN)	42		
" " " (Seston)			
" " " (TPf)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " (DOC)	108	Manual Chemistry Tech. Ops.	
" " " (Carbohydrate)	18	Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987

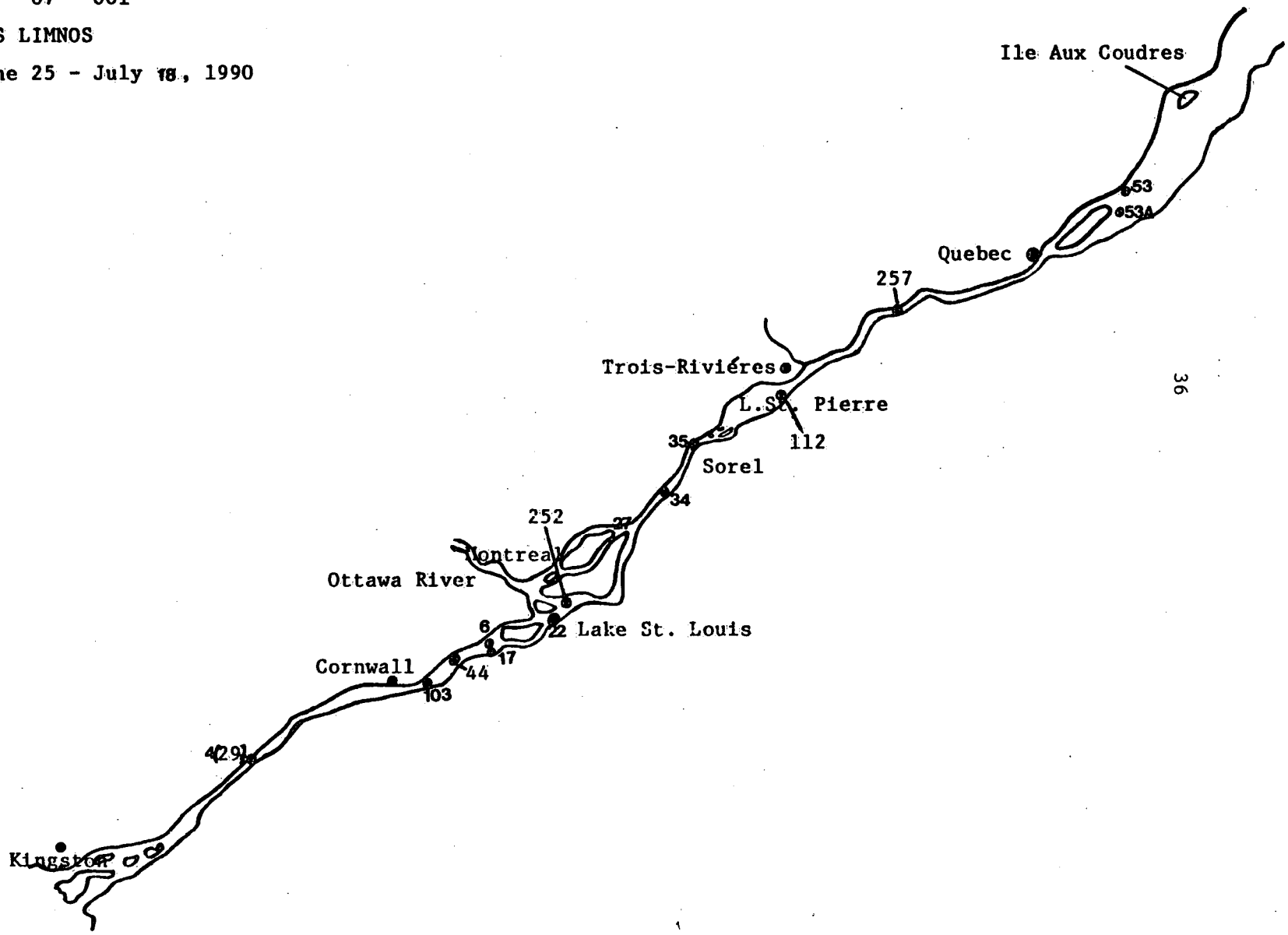
ST. LAWRENCE RIVER

Organic and Inorganic Contaminants

90 - 07 - 001

CSS LIMNOS

June 25 - July 18, 1990



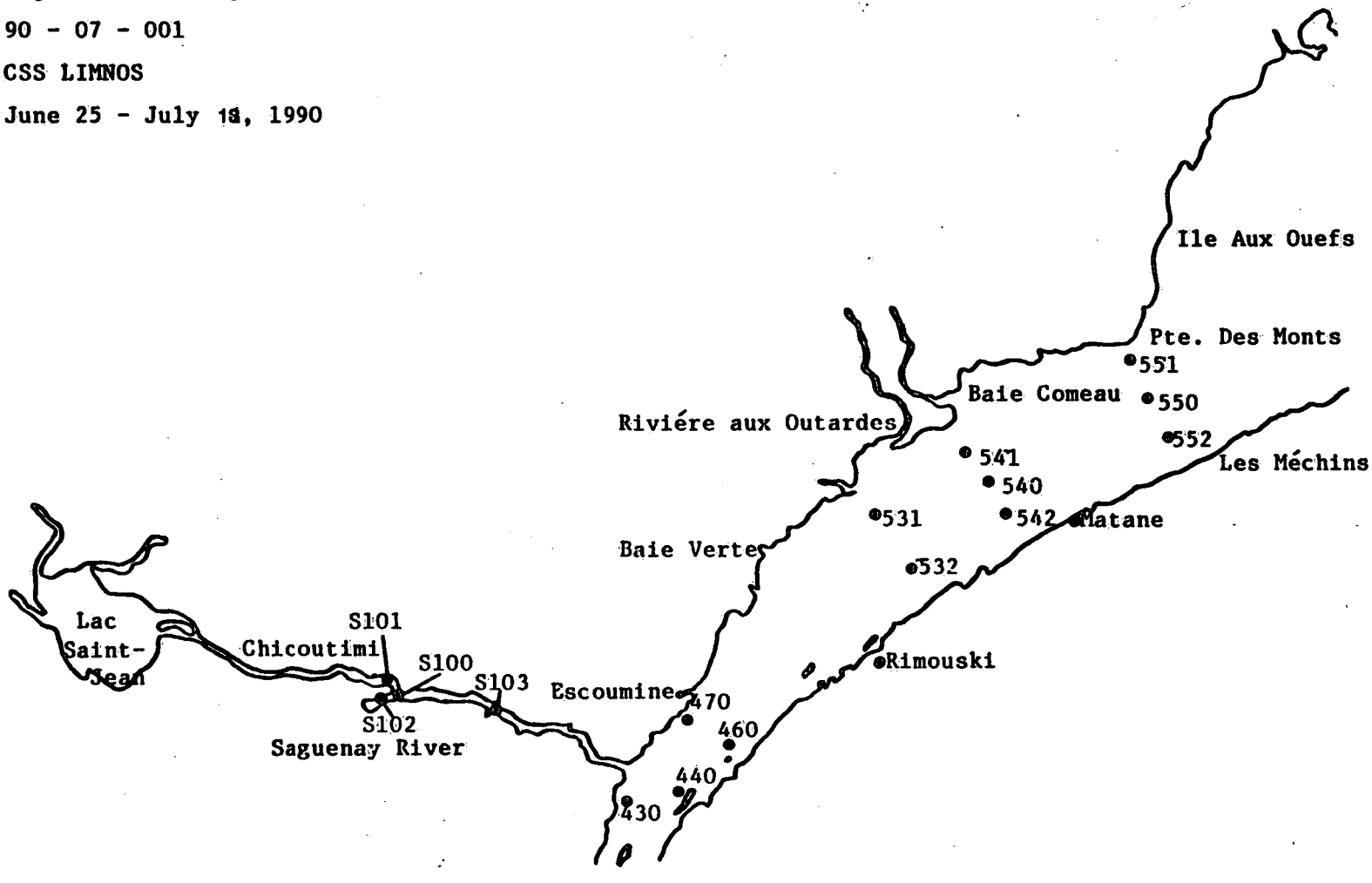
ST. LAWRENCE RIVER

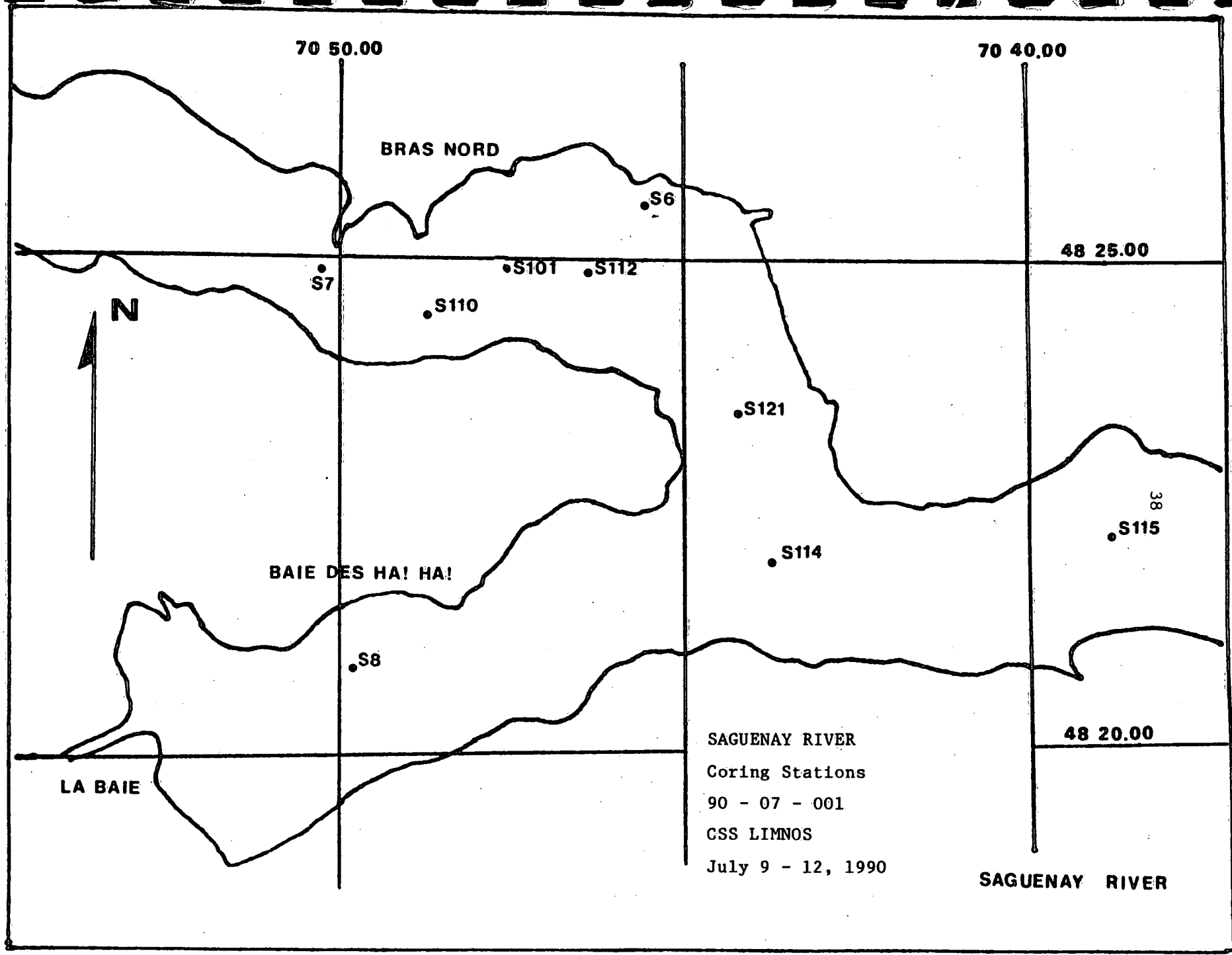
Organic and Inorganic Contaminants

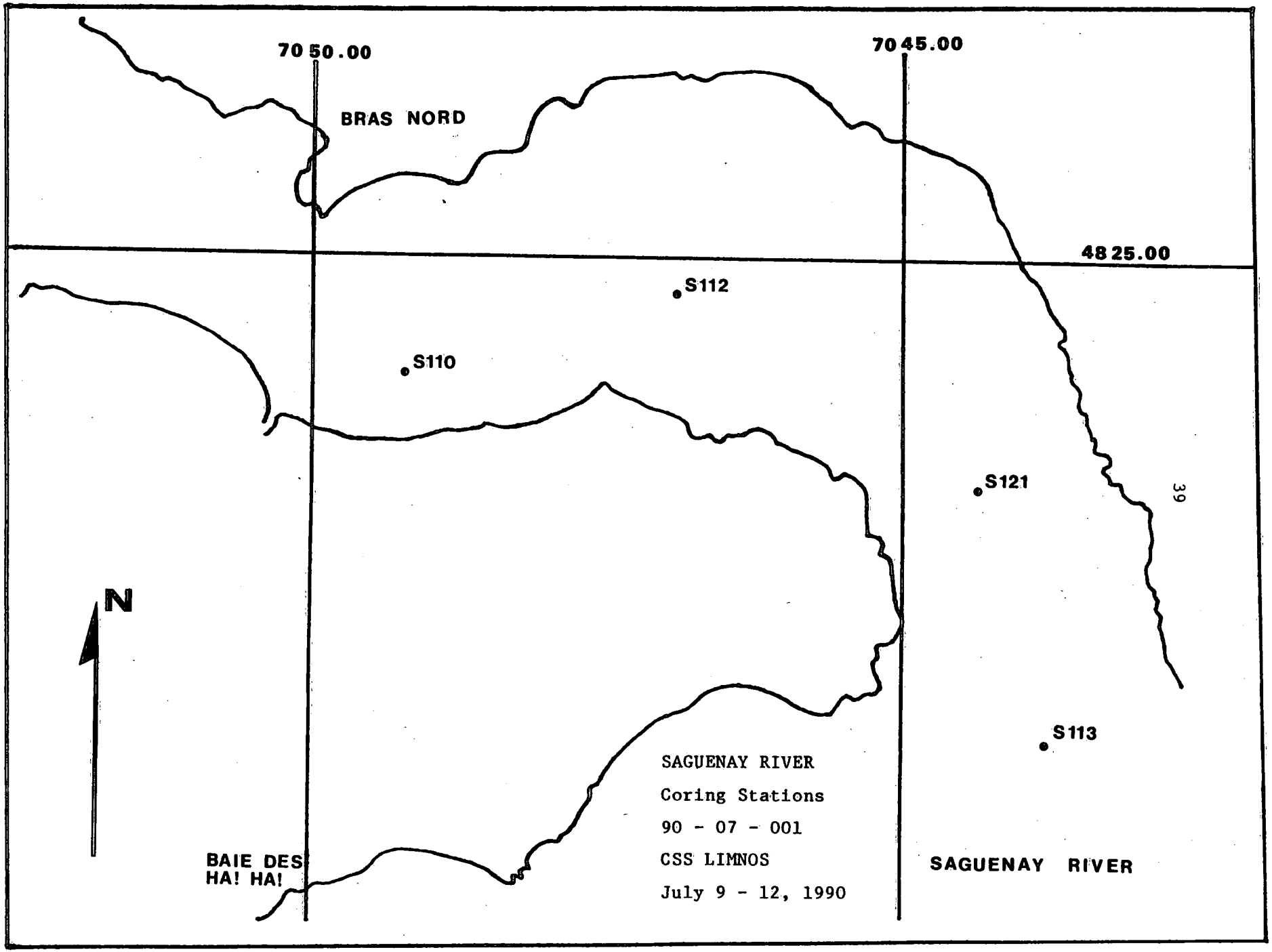
90 - 07 - 001

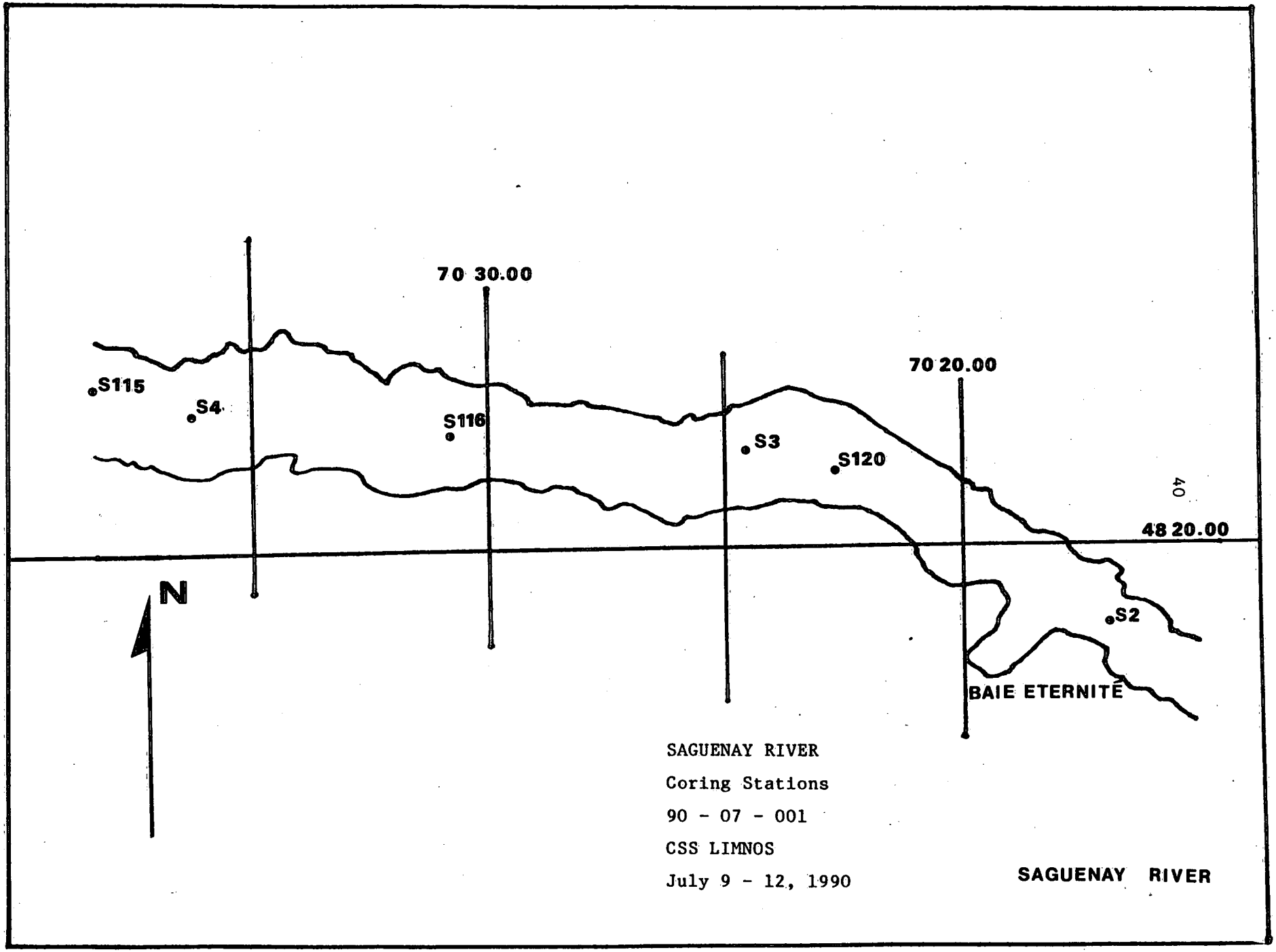
CSS LIMNOS

June 25 - July 18, 1990




70 50.00
70 40.00
BRAS NORD
S6
48 25.00
S7
S101
S112
S110
N
S121
S115
S114
BAIE DES HA! HA!
S8
48 20.00
LA BAIE
SAGUENAY RIVER
Coring Stations
90 - 07 - 001
CSS LIMNOS
July 9 - 12, 1990
SAGUENAY RIVER


70 50.00
70 45.00
BRAS NORD
48 25.00
S112
S110
S121
S113
N
SAGUENAY RIVER
Coring Stations
90 - 07 - 001
CSS LIMNOS
July 9 - 12, 1990
BAIE DES
HA! HA!
SAGUENAY RIVER


70 30.00
70 20.00
48 20.00
40
S115
S4
S116
S3
S120
S2
N
BAIE ETERNITÉ
SAGUENAY RIVER
Coring Stations
90 - 07 - 001
CSS LIMNOS
July 9 - 12, 1990
SAGUENAY RIVER

LAKE ONTARIO TROPHIC TRANSFER

GLLFAS STUDY 86034, DR. M. MUNAWAR, DR. O.E. JOHANNSSON,
E.S. MILLARD, R.M. DERMOTT, DR. G. SPRULES

Since the International Field Year for the Great Lakes (IFYGL), this project has been a major multidisciplinary and international initiative to characterize the Lake Ontario ecosystem by examining its biological structure at different levels. The results will: a) provide important baseline information about the status of Lake Ontario; b) provide a basis of computing estimates of growth and production of all component organisms; c) permit a rigorous test of particle size theory; d) contribute directly to the management of fish stocks in Lake Ontario.

There were three cruises to support this project carried out onboard the CSS LIMNOS May 22 - 31, July 30 - August 3 and October 29 - November 9.

The parameters sampled during the cruise were: EBT/transmission profiles, conductivity, pH, chlorophyll a, phytoplankton, zooplankton, microbial loop, primary productivity, quantum meter light profiles, Secchi disc, mysis net hauls, Ponar grab samples, towed acoustics and fluorometer systems and mid-water fish trawls.

Several outside agencies were supported. These included: University of Toronto, Chesapeake Biological Station, Dalhousie University and Illinois Natural History Survey.

A total of six transects were distributed across Lake Ontario, consisting of 67 stations. A reduced station pattern was completed on the July 30 - August 3 cruise to fit in with other studies that the CSS LIMNOS was supporting.

Several additional stations were occupied during the first and third cruises to collect microbial loop samples for Dr. M. Munawar of GLLFAS. These stations were in the areas of Oswego Harbour, Rochester Harbour, Hamilton Harbour and the Ashbridges Bay area of Toronto. Primary production moorings were also installed at station 41 to support this project.

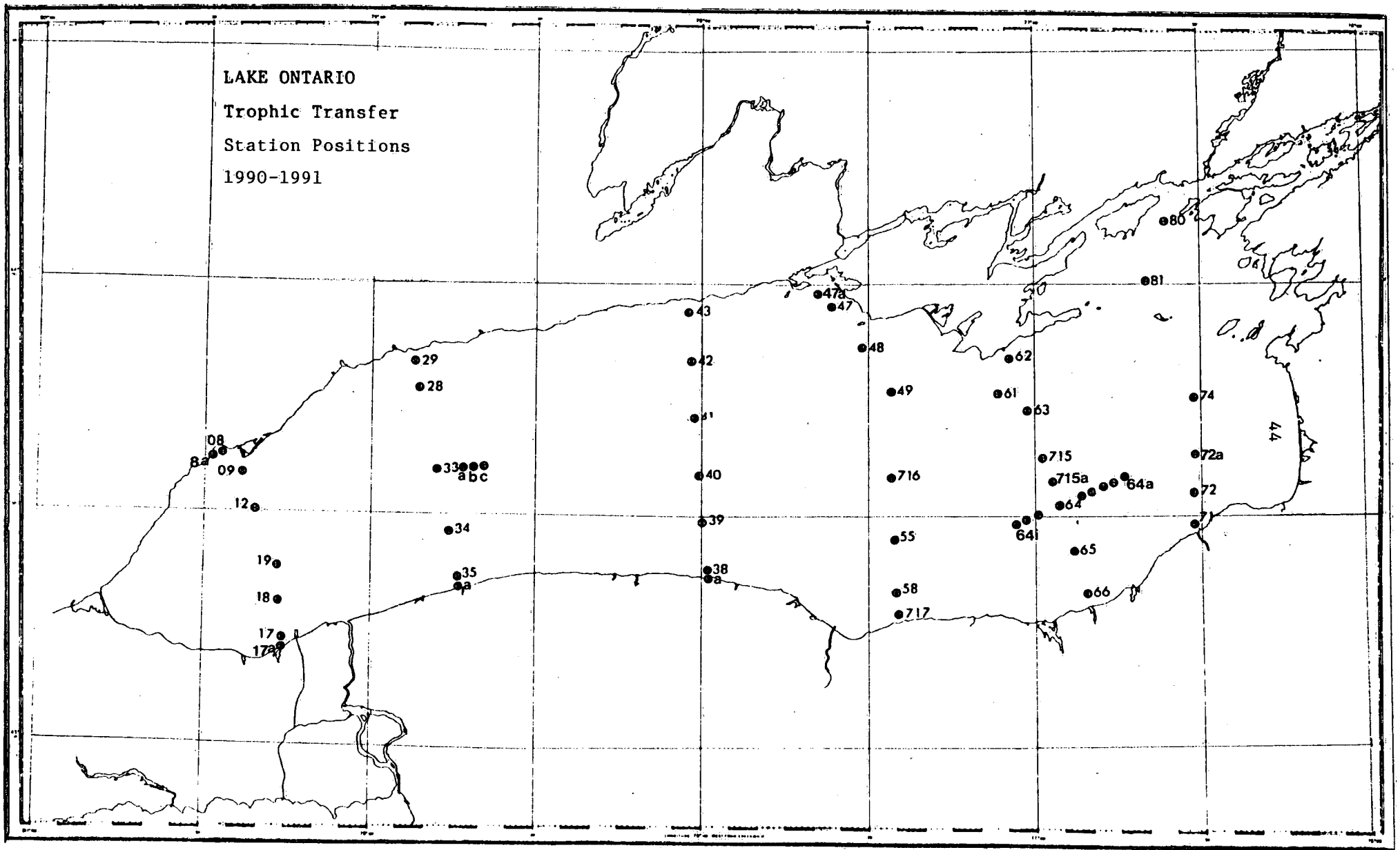
LAKE ONTARIO TROPHIC TRANSFER

STATION POSITIONS

1990-1991

STATION NUMBER	LATITUDE N.	LONGITUDE W.
8	43° 37′ 22"	79° 27′ 10"
8A	43° 38′ 03"	79° 27′ 04"
9	43° 35′ 10"	79° 23′ 38"
12	43° 30′ 12"	79° 21′ 11"
17	43° 13′ 29"	79° 16′ 17"
17A	43° 12′ 51"	79° 16′ 38"
18	43° 18′ 09"	79° 16′ 38"
19	43° 22′ 55"	79° 17′ 03"
19A	43° 26′ 12"	79° 18′ 58"
28	43° 46′ 29"	78° 51′ 20"
29	43° 49′ 51"	78° 52′ 17"
29A	43° 50′ 37"	78° 52′ 27"
33	43° 35′ 48"	78° 48′ 09"
33A	43° 33′ 06"	78° 40′ 41"
33B	43° 33′ 54"	78° 35′ 52"
33C	43° 34′ 30"	78° 31′ 58"
34	43° 27′ 39"	78° 45′ 37"
35	43° 21′ 37"	78° 43′ 45"
35A	43° 20′ 46"	78° 43′ 21"
38	43° 22′ 57"	77° 59′ 23"
38A	43° 22′ 31"	77° 58′ 50"
39	43° 29′ 08"	77° 59′ 58"
39A	43° 26′ 16"	77° 59′ 44"
40	43° 35′ 22"	78° 00′ 36"
40A	43° 32′ 56"	78° 00′ 36"
41	43° 42′ 58"	78° 01′ 40"
42	43° 50′ 26"	78° 02′ 18"
43	43° 56′ 58"	78° 03′ 00"
47	43° 57′ 06"	77° 35′ 17"
47A	44° 00′ 01"	77° 38′ 42"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
48	43° 51′ 44"	77° 31′ 30"
49	43° 46′ 20"	77° 26′ 18"
49A	43° 38′ 27"	77° 25′ 23"
55	43° 26′ 33"	77° 26′ 17"
55A	43° 31′ 07"	77° 25′ 35"
58	43° 19′ 39"	77° 26′ 20"
61	43° 47′ 11"	77° 09′ 37"
62	43° 52′ 47"	76° 59′ 58"
63	43° 43′ 54"	77° 01′ 01"
64	43° 31′ 30"	76° 55′ 35"
64A	43° 33′ 06"	76° 45′ 35"
64B	43° 32′ 00"	76° 49′ 16"
64C	43° 31′ 09"	76° 52′ 04"
64D	43° 29′ 30"	76° 57′ 23"
64E	43° 28′ 49"	76° 59′ 54"
64F	43° 28′ 15"	77° 02′ 22"
64G	43° 27′ 41"	77° 05′ 13"
64H	43° 26′ 58"	77° 07′ 52"
64I	43° 26′ 32"	77° 09′ 47"
65	43° 25′ 30"	76° 53′ 05"
65A	43° 27′ 36"	76° 52′ 58"
66	43° 20′ 01"	76° 50′ 27"
66A	43° 19′ 03"	76° 50′ 05"
71	43° 28′ 45"	76° 31′ 41"
72	43° 33′ 01"	76° 31′ 29"
72A	43° 38′ 08"	76° 30′ 00"
74	43° 44′ 55"	76° 31′ 12"
80	44° 08′ 32"	76° 36′ 35"
81	44° 00′ 59"	76° 40′ 19"
715	43° 38′ 08"	76° 58′ 07"
715A	43° 35′ 00"	76° 56′ 59"
716	43° 35′ 50"	77° 26′ 25"
717	43° 16′ 54"	77° 26′ 26"


LAKE ONTARIO
Trophic Transfer
Station Positions
1990-1991
08
8a
09
12
19
18
17
17a
29
28
33
a
b
c
34
35
a
43
42
41
40
39
38
a
47a
47
48
49
55
58
717
62
61
63
715
716
715a
64a
64
64i
65
66
80
81
74
72a
72
71
44
1050

BENTHIC COMMUNITY STRUCTURE

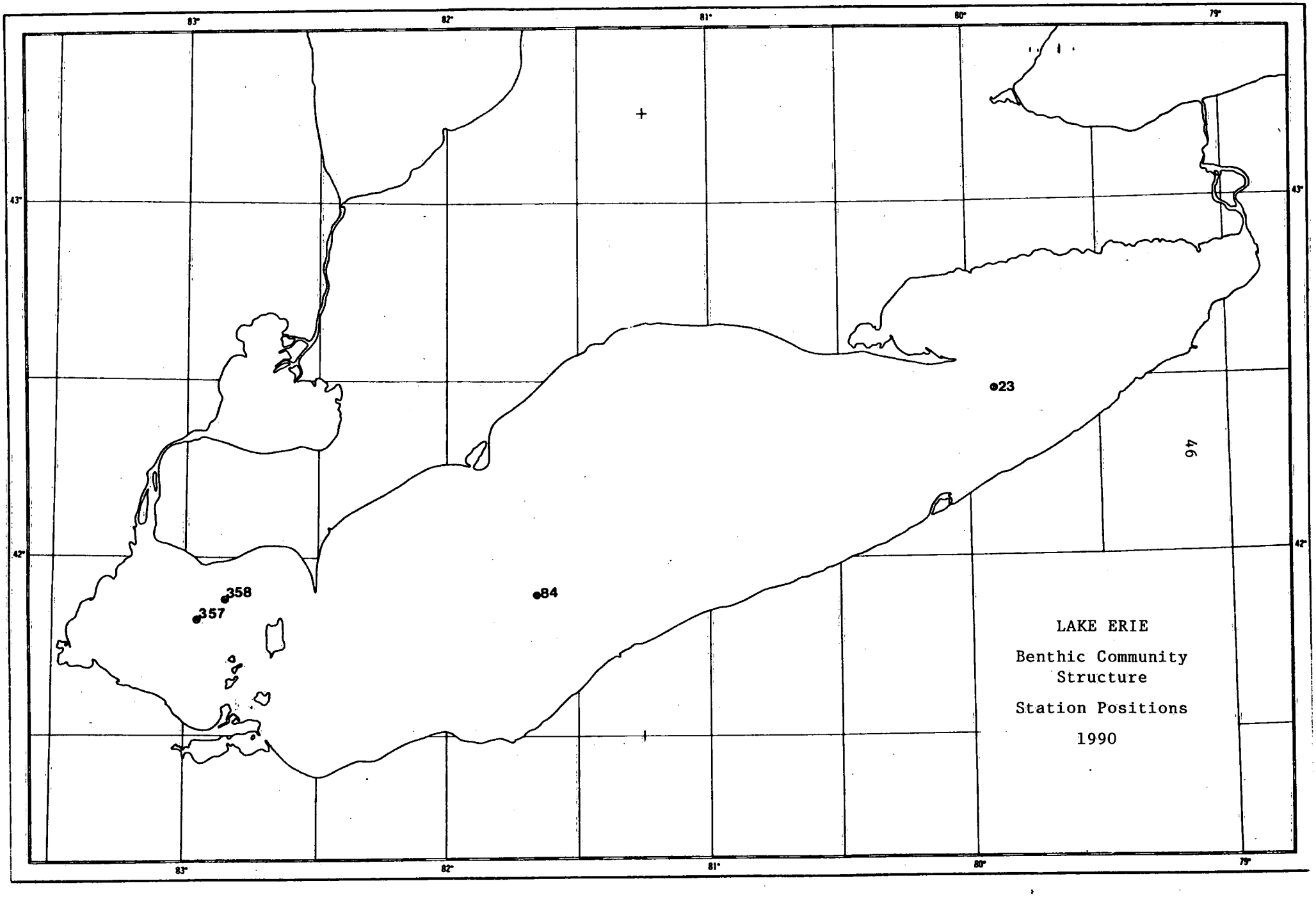
LRB STUDY 82015, DR. T. REYNOLDSON

Five Lake Erie cruises were carried out onboard the CSS LIMNOS April 17 - 22, May 17 - 19, August 20 - 22, September 10 - 13 and October 16 - 21. As in previous years, four stations were occupied--one in the Eastern Basin, one in the Central Basin and two in the Western Basin. A box core was collected at each site and 5 10-cm cores subsampled. These were stored at 4°C until returned to CCIW for analyses. At station 357, a DO logger was installed for the season. This was replaced during the October cruise for the winter months.

Additional samples were collected for Dr. M. Munawar of GLLFAS during the May and August cruises. During the October cruise, samples were collected for the University of Waterloo.

STATION POSITIONS

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


83°
82°
81°
80°
79°
43°
42°
358
357
84
23
46
LAKE ERIE
Benthic Community
Structure
Station Positions
1990

INTERNAL SEDIMENT LOADING

LAKE ERIE

LRB STUDY 82016, F. ROSA

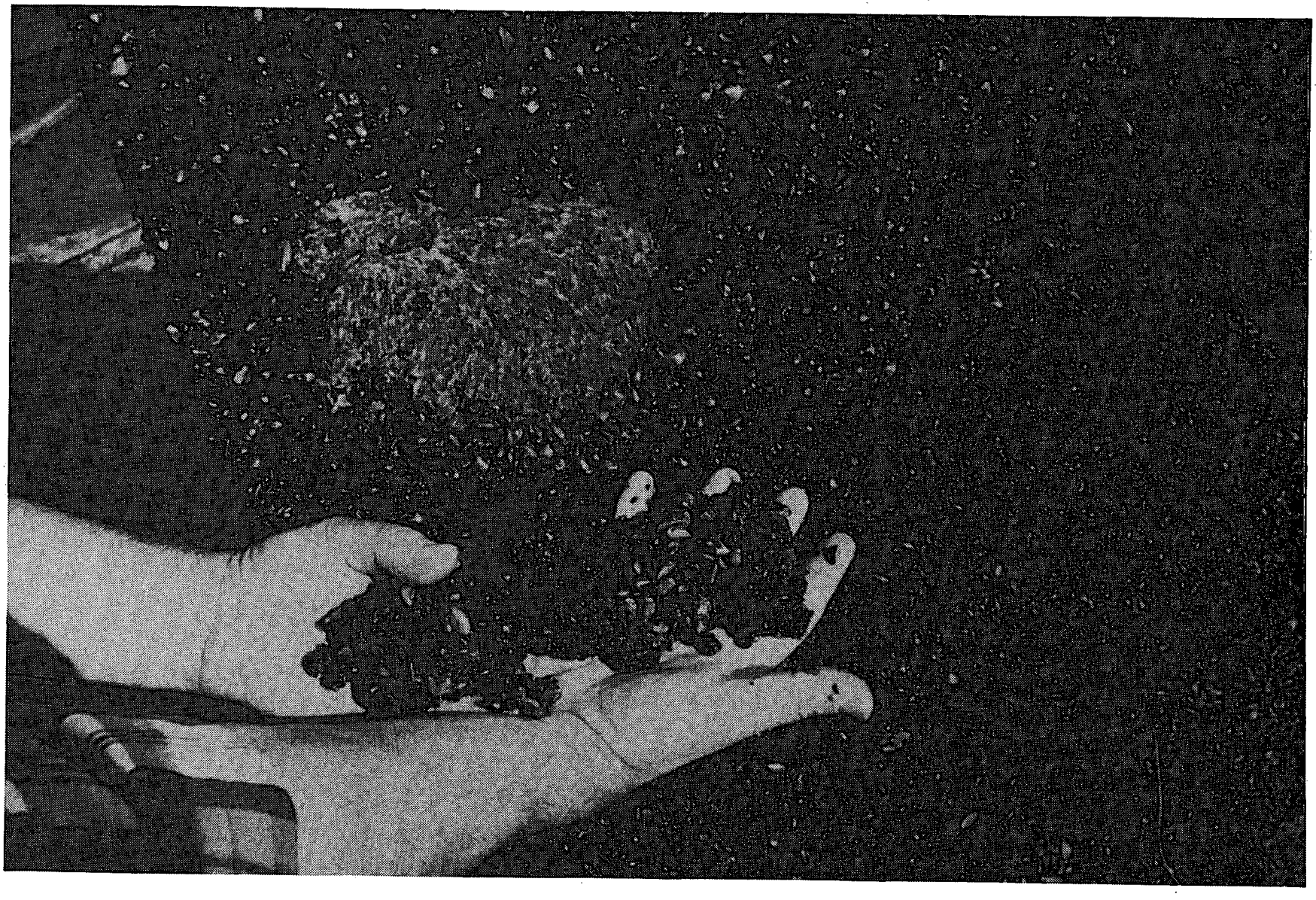
Two Lake Erie cruises were carried out onboard the CSS LIMNOS--April 17 - 22 and October 16 - 21. On each cruise, meteorological observations were made and EBT/transmissometer profiles to the bottom were taken. The following sampling was also performed:

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

2. Bulk water samples (1200L) were collected from the 5-metre depth and centrifuged for particulate material.

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

4. At stations 23, 84 and 357, combination current meter/sediment trap moorings were retrieved on the first cruise and re-installed on the October cruise for the winter of 1991.



ZEBRA MUSSELS

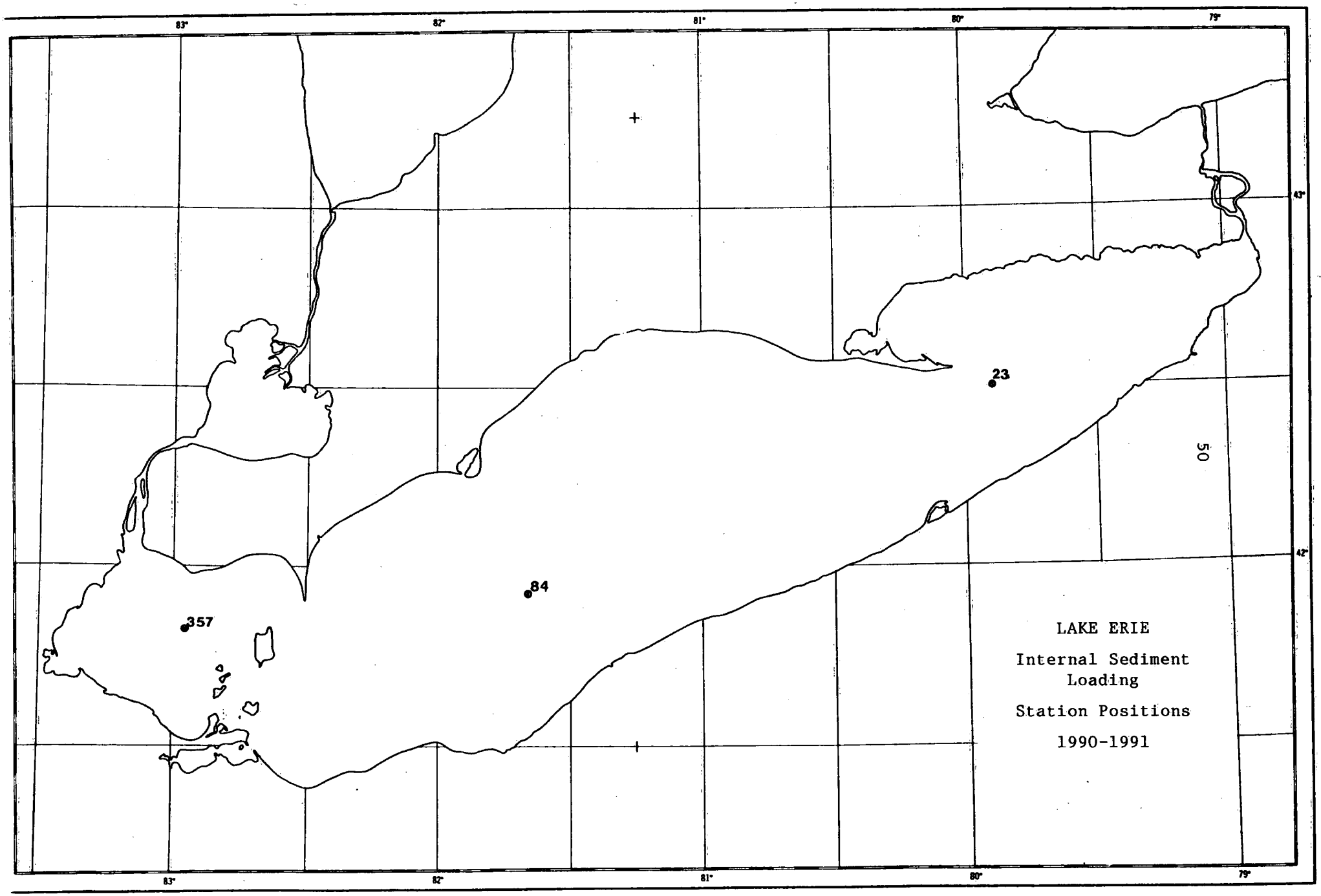
WESTERN LAKE ERIE

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	90-01AC-03A	42° 30′ 08"	79° 53′ 55"
84	90-01AC-04A	41° 56′ 06"	81° 39′ 39"
357	90-01ACS-05A	41° 49′ 44"	82° 58′ 11"


83°
82°
81°
80°
79°
43°
42°
23
84
357
50
LAKE ERIE
Internal Sediment
Loading
Station Positions
1990-1991

ATMOSPHERIC LOADING

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

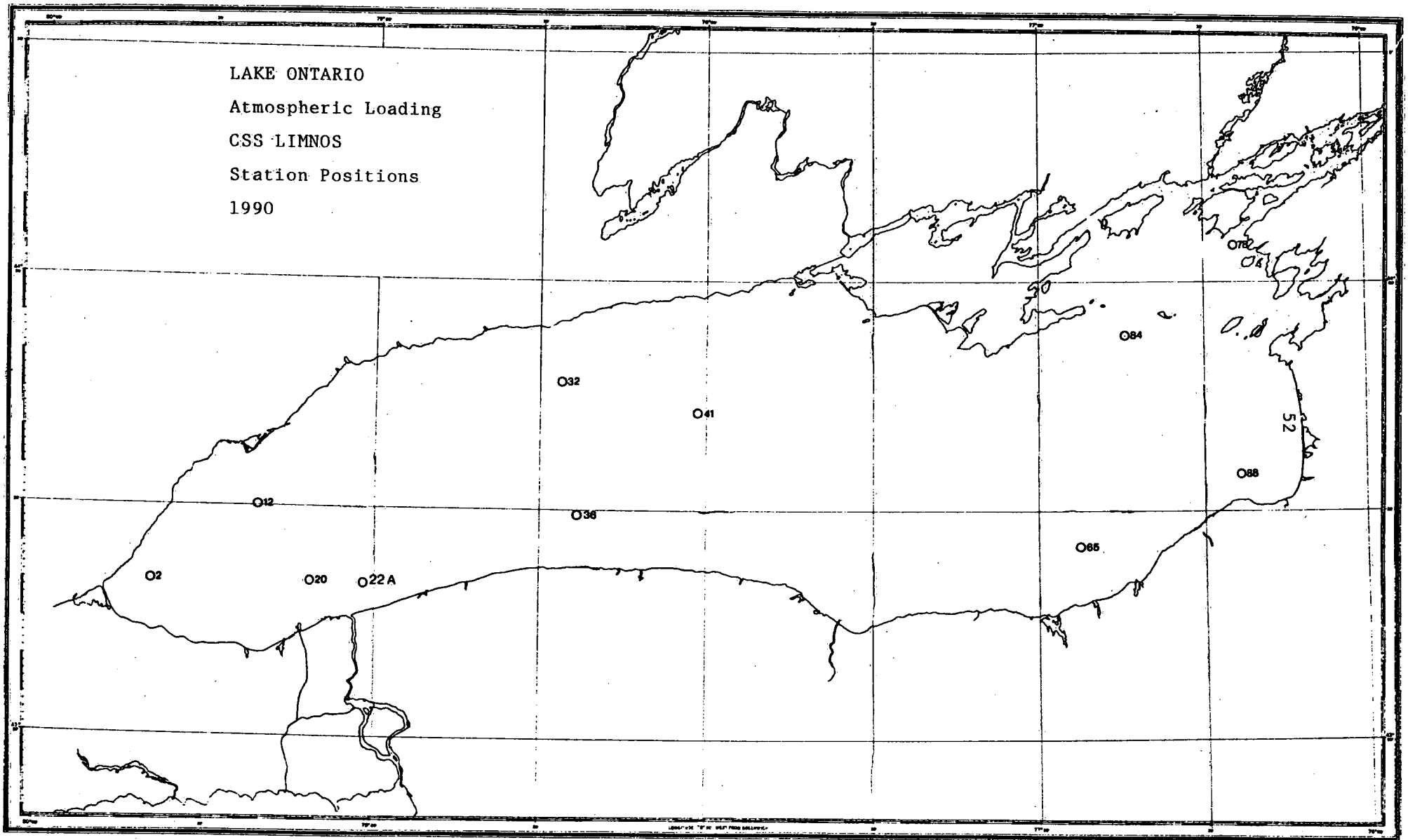
The CSS LIMNOS was utilized on 3 cruises on Lake Ontario--90-00-002, 90-00-005 and 90-00-010, to sample 11 stations in the lake to investigate the role of the atmosphere in loading toxic chemicals to Canadian surface waters. At each station, a bulk water sample of 1800 litres was obtained and centrifuged through a Westfalia centrifuge at a flow rate of 4L/sec. The particulate was collected and frozen until returned to CCIW for analysis. Duplicate 80-litre water samples were collected and processed through large volume water extractors onboard the vessel. Duplicate Shipek grab samples were also obtained at each site with the top 1 cm of the Shipek being retained and frozen for analysis.

ATMOSPHERIC LOADING STATIONS

LAKE ONTARIO

1990-1991

STATION NUMBER	LATITUDE N.	LONGITUDE W.
2	43° 20′ 24"	79° 39′ 54"
12	43° 30′ 12"	79° 21′ 12"
20	43° 20′ 18"	79° 11′ 48"
22A	43° 20′ 30"	79° 02′ 00"
32	43° 47′ 00"	78° 26′ 18"
36	43° 29′ 30"	78° 23′ 12"
41	43° 43′ 00"	78° 01′ 36"
65	43° 25′ 24"	76° 53′ 00"
78	44° 05′ 00"	76° 24′ 24"
84	43° 53′ 12"	76° 44′ 00"
88	43° 35′ 18"	76° 25′ 00"



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DEPARTMENT OF FISHERIES AND TECHNICAL SURVEYS OTTAWA

LAKE ONTARIO 10501

OPEN LAKES METAL CYCLE

LRB STUDY 82057, DR. J.O. NRIAGU

The CSS LIMNOS supported this project twice. Twelve stations were sampled in Lake Ontario during the week of August 13 and five stations were sampled in Lake Erie September 10 - 13. Samples were collected using GoFlow bottles. At selected sites, a rubber raft was used to collect samples away from the influence of the LIMNOS. During this sampling a pump was used. All samples were analyzed onboard the vessel using the portable clean laboratory secured to the main deck. Samples were collected from discrete depths determined from the EBT trace by the Study Leader.

HAMILTON HARBOUR BOX CORING

LRB STUDY 82017, A. ZEMAN

As an additional task on Cruise 90-00-010, a benthos core and a box core were collected at stations M14, C14 and C26 in the Western Basin of Lake Ontario and Hamilton Harbour for geochemical testing.

CORING POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
M14 (WB)	43° 19′ 58"	79° 43′ 39"
C14 (HH)	43° 17′ 37"	79° 49′ 11"
C26 (HH)	43° 17′ 18"	79° 51′ 01"

ECHOSOUNDING, SEISMIC AND SIDESCAN SURVEY

RRB STUDY 83001, DR. R.L. THOMAS

On Cruise 90-00-004, the CSS LIMNOS was utilized to conduct an echosounding, Seismic and sidescan survey of selected areas of Lake Ontario. Seismic profiles were collected in the Eastern, Central and Western basins in an attempt to identify bedrock structures. Sidescan profiles were obtained in the Burlington-Toronto area along the North shore of the lake in an attempt to map lake bottom geological features. A continuous echosounding of the vessel's track was recorded simultaneously with the Seismic and sidescan profiles with position fixes at start and end of lines as well as at specific intervals along the lines.

LAKES ONTARIO AND ERIE PISTON CORING

RRB STUDY 83001, DR. R.L. THOMAS

The CSS LIMNOS was utilized on Cruise 90-01-003 June 11 - 15 and Cruise 90-00-005 July 23 - 27 to collect nine piston cores from selected stations in Lake Erie and twenty piston cores in Lake Ontario. Cores were obtained to characterize the groundwater flow into the lakes as tectonic lines of weakness may be affecting groundwater influx to the lakes. Cores were sectioned and stored at 4°C until returned to CCIW.

PISTON CORE POSITIONS

LAKE ERIE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
252	41° 55′ 15"	83° 04′ 50"
253	41° 34′ 10"	82° 33′ 32"
254	42° 01′ 38"	81° 00′ 13"
255	42° 38′ 56"	80° 05′ 52"
256	42° 40′ 56"	79° 44′ 15"
257	42° 44′ 04"	79° 21′ 21"
258	41° 39′ 59"	82° 00′ 57"
263	42° 04′ 18"	81° 39′ 34"
264	42° 43′ 13"	79° 58′ 26"

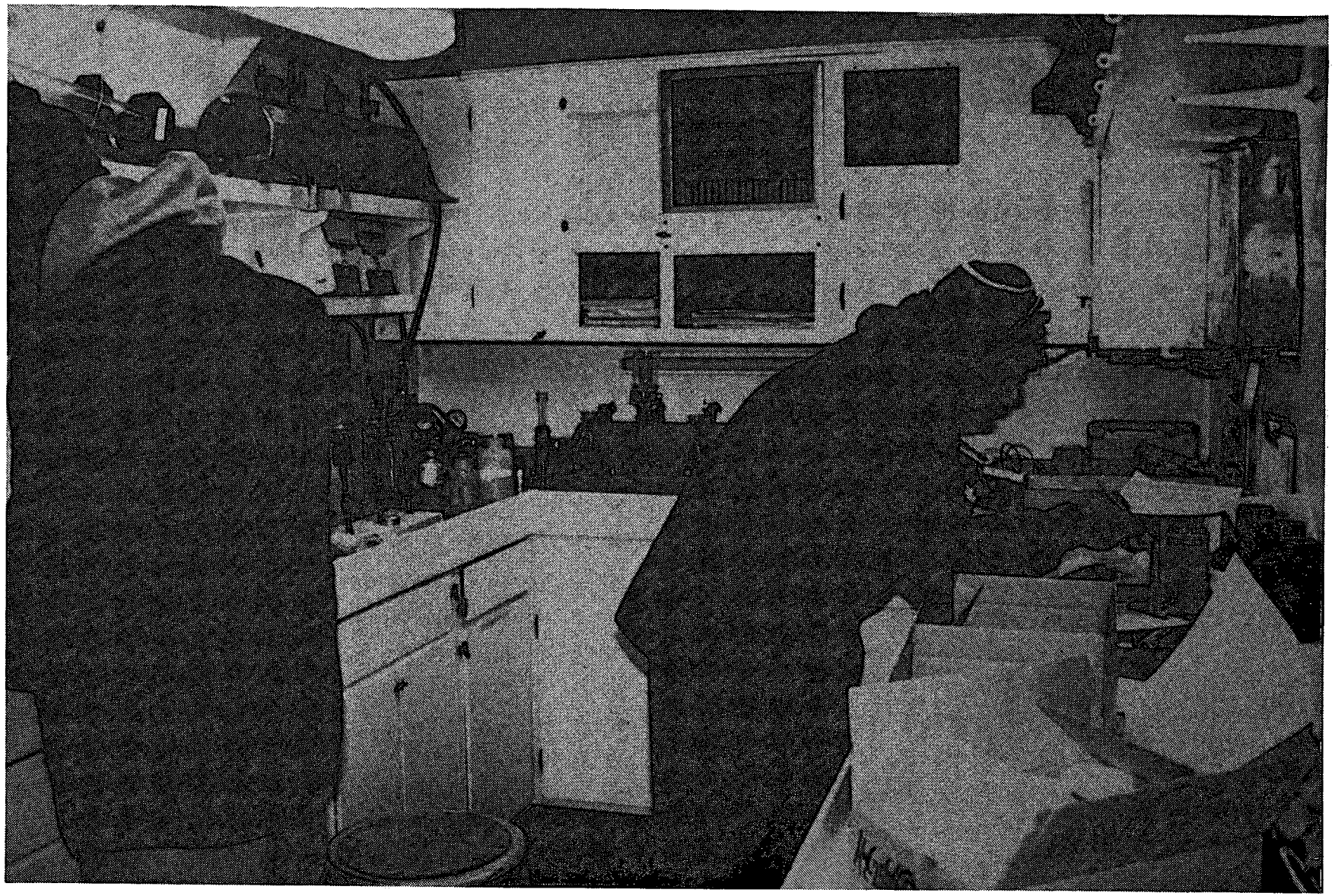
LAKE ONTARIO

STATION NUMBER	LATITUDE N.	LONGITUDE W.
J1	43° 18′ 16"	79° 18′ 48"
W1	43° 21′ 17"	78° 50′ 25"
W1A	43° 22′ 31"	78° 49′ 05"
W2	43° 23′ 41"	78° 47′ 35"
W3	43° 25′ 47"	78° 45′ 29"
W4	43° 27′ 39"	78° 43′ 53"
W5	43° 29′ 32"	78° 42′ 05"
W6	43° 31′ 32"	78° 40′ 16"
W7	43° 36′ 42"	78° 35′ 28"
W8	43° 40′ 23"	78° 31′ 52"
D1	43° 51′ 22"	78° 43′ 49"
D2	43° 44′ 17"	78° 46′ 59"
CB1	43° 45′ 37"	78° 17′ 57"
KB2	44° 03′ 21"	76° 25′ 06"
OS1	43° 29′ 13"	76° 40′ 09"
258	43° 17′ 11"	79° 50′ 20"
FOX	43° 18′ 57"	79° 24′ 58"

C S S B A Y F I E L D

CSS BAYFIELD
1990

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



SAMPLE ANALYSES

CSS BAYFIELD

BIOINDEX AND QUINTE

GLLFAS NO. 9011, DR. O.E. JOHANNSSON
GLLFAS NO. 9018, E.S. MILLARD

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

There were 29 Bioindex cruises completed by the research vessel CSS BAYFIELD on Lake Ontario. The first cruise began the week of April 16th and the last was completed during the week of October 29th. One additional set of samples was collected from the CSS LIMNOS during the Open Lakes Surveillance cruise early in April.

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

During the week of April 30 and every second week from then to the end of the season, four additional stations in the Bay of Quinte were sampled in support of GLLFAS Project No. 9018. This work served as a continuation of the Long Term Biological Index Monitoring Program carried out since 1972 for Project Quinte. The four stations were: B (Belleville), HB (Hay Bay), C (Conway) and N (Deseronto). On five

occasions during the season, station T (Trenton) was sampled. Typical sampling on these stations included a temperature/depth profile, a transmissometer cast and an integrated water sample for chlorophyll a, particulate organic carbon, water quality and Seston. A dissolved oxygen profile, a light extinction profile as well as primary productivity and P kinetics experiments were done. Zooplankton samples were collected using a Schindler-Patalas trap. At station B, zooplankton grazing experiments were carried out using a Haney grazing chamber and radio-labelled algae. At all stations, various water samples were collected for the Ministry of the Environment, including samples of metals, reactive soluble phosphorus, algae and nutrients.

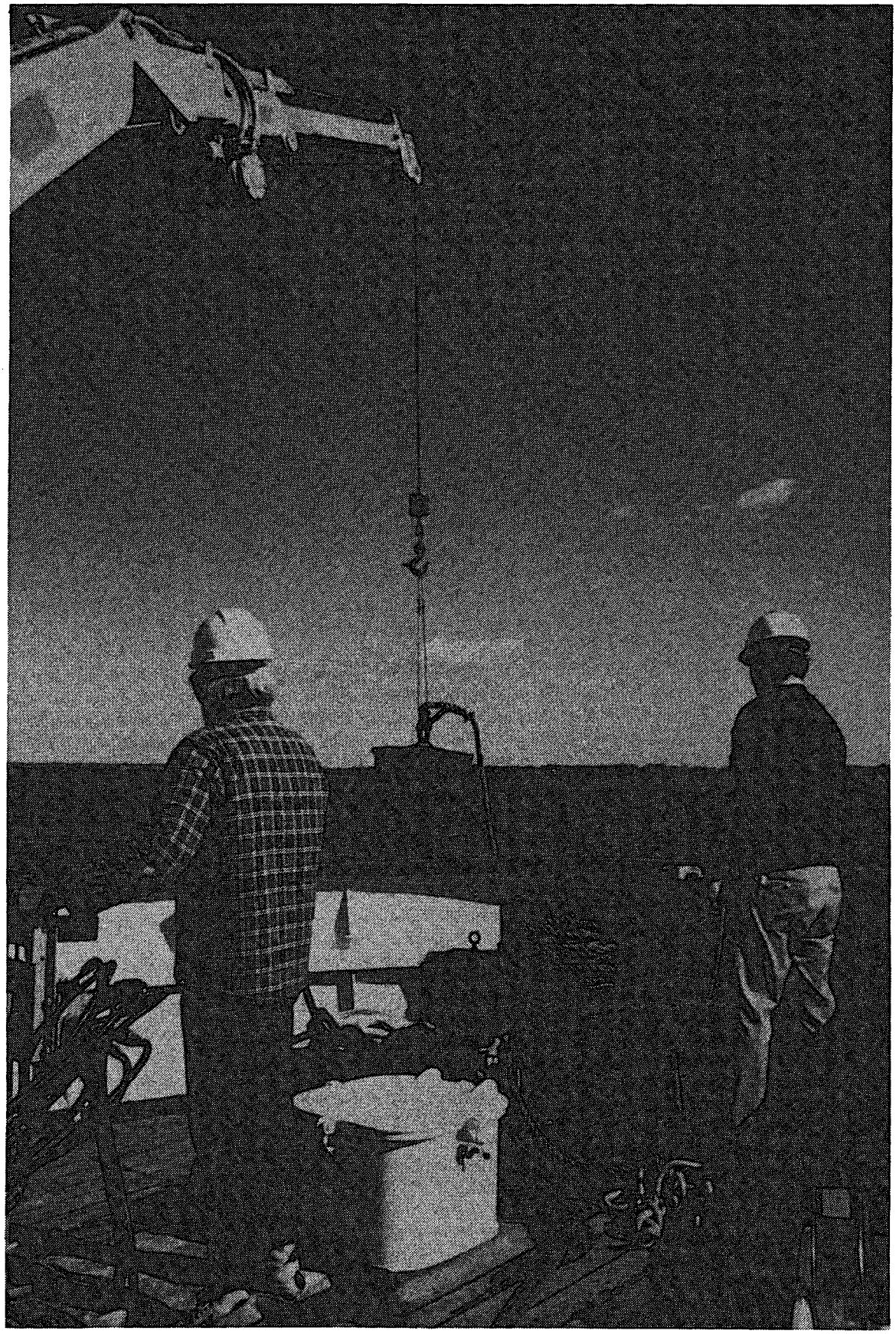
Several additional tasks were piggy-backed on the Bioindex cruises, as follows:

1. In support of NWQL Project No. 115-90, Lake Ontario Surveillance stations 102 and 103 were sampled for various water quality parameters on a bi-weekly basis (a total of fourteen cruises).

2. Benthos samples were collected for R.M. Dermott, GLLFAS from Lake Ontario stations 41, 81A, 93 and 93A on several occasions and once at several stations in the Bay of Quinte area (Belleville, Big Bay, Glenora, Conway and LOX.

3. Open House onboard the BAYFIELD was held June 10 for the Heritage Days celebration in Oakville, Ontario.

4. Considerable effort was put into the collection of mysis during the latter part of this season, largely in support of the LOTT cruises being done on Lake Ontario aboard the CSS LIMNOS. During the fifteenth Bioindex cruise, samples were collected from station 64 and on the sixteenth BAYFIELD cruise, they were taken from LOTT transect #1 for the second LOTT cruise. At the end of the season, two additional cruises were done to collect mysis samples for the third LOTT cruise from station 41. On the first one, Bioindex and water quality work was done, and on the second cruise, water quality and mysis samples only were collected.



RETRIEVING ANCHORS

CSS BAYFIELD

STATISTICS SUMMARY

CRUISE NO. 90-00-301 TO 90-00-329 SHIP CSS BAYFIELD

DATES FROM April 16 TO November 1, 1990 LAKE ONTARIO

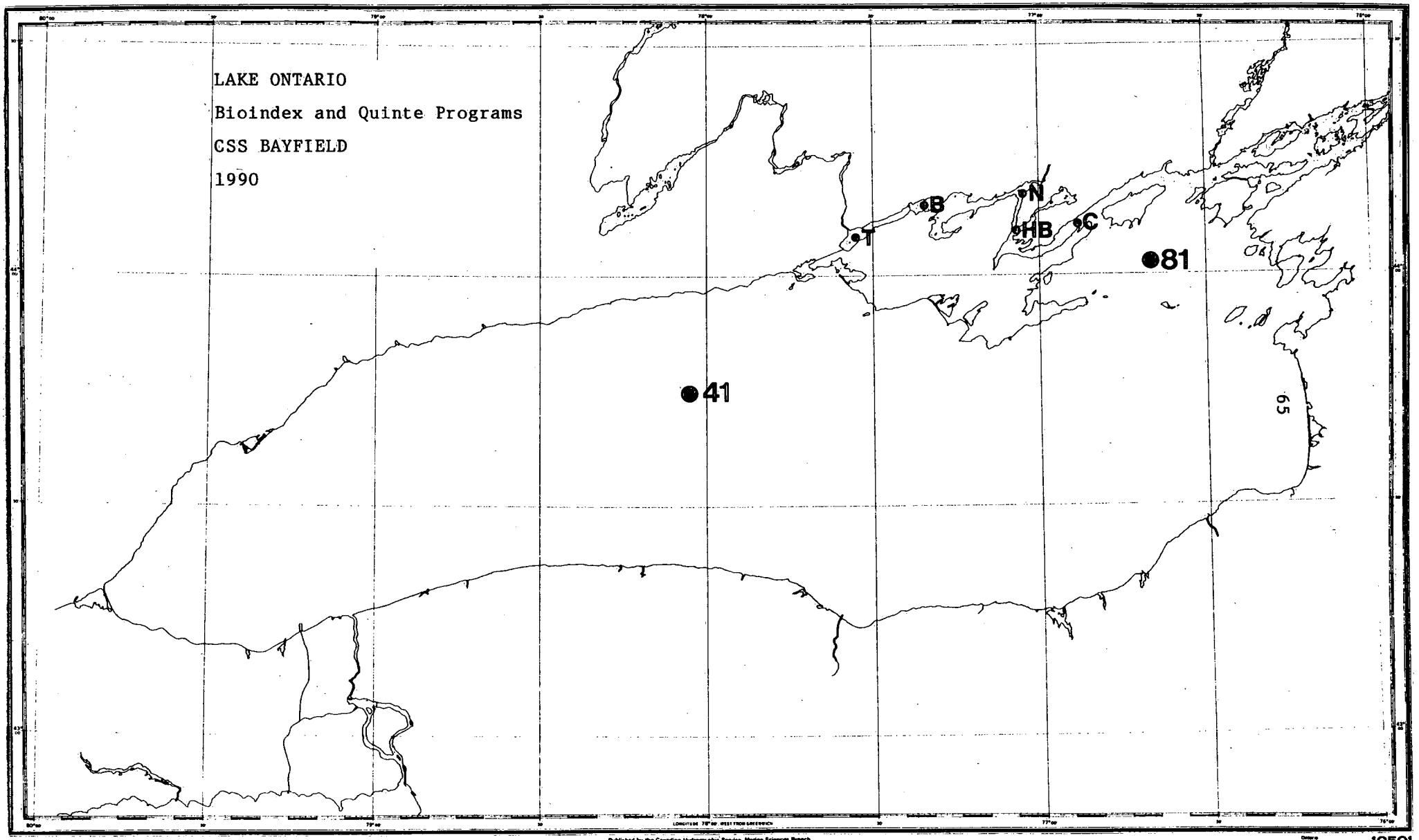
CRUISE TYPE Bioindex - Quinte - Water Quality N. MILES STEAMED 11525

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	228	Moorings Established, Marker	4
EBT Casts	211	" Retrieved, Marker	4
Rosette Casts	145	" Established	
Transmissometer Casts	146	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	4	" Established	
Secchi Disc Observations	161	" Retrieved	
Closing Nets	13	" Refurbished	
Zooplankton Hauls	222	" Serviced	
Integrator 10 m	56	" Serviced	
Integrator 20 m	162	Primary Productivity (C14) Incubations	101
Phytoplankton Samples	148	Phosphorus, Kinetics (P32) Incubations	65
Zooplankton - Pump	253	Cores Taken, Box	
Schindlers	251	Cores Taken, Gravity	
Water Samples Collected (Nutrients)	71	Cores Taken, Piston	
" " " (Water Quality)	244	Cores Taken	
" " " (Major Ions)	71	-	
" " " (D.O.)	365	Grab Samples Taken, Ponar	96
" " " (Cond/pH)	263	Mysids Net Haul	105
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	365	Grazing (C14)	78
" " " (MOE RSP)	96	Observations, Weather	
" " " (MOE Algae)	42	Licor Light Profile	117
" " " (MOE Nut.)	96	CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	960	Solar Radiation	
" " " (POC/TPN)	213		
" " " (Seston)	177		
" " " (T P f)	294		
" " " (Nutrients)	294	ONBOARD ANALYSES	
" " " (Major Ions)	294		
" " " (TP. Part. P)	55	Manual Chemistry Tech. Ops.	891
" " " (Ni/TV Part. P)	78	Nutrients (WOB)	
" " " ( )		Microbiology	
" " " (MOE Nylon)	55		

Tech. Ops. 1987

STATION POSITIONS

STATION NUMBER	PROJECT	LATITUDE N.	LONGITUDE W.
41	Bioindex	43° 43′ 00"	78° 01′ 36"
81	Bioindex	44° 01′ 00"	76° 40′ 18"
64	LOTT	43° 31′ 30"	76° 55′ 36"
B	Quinte	44° 09′ 02"	77° 20′ 40"
HB	Quinte	44° 05′ 36"	77° 04′ 13"
C	Quinte	44° 06′ 28"	76° 53′ 54"
N	Quinte	44° 10′ 30"	77° 02′ 54"
T	Quinte	44° 05′ 12"	77° 32′ 42"
41	Benthos	43° 43′ 00"	78° 01′ 36"
81A	Benthos	43° 58′ 54"	76° 39′ 18"
93	Benthos	43° 19′ 36"	78° 52′ 06"
93A	Benthos	43° 21′ 48"	78° 51′ 24"
B	Benthos	44° 09′ 02"	77° 20′ 36"
BB	Benthos	44° 09′ 19"	77° 10′ 19"
G	Benthos	44° 02′ 30"	77° 01′ 24"
C	Benthos	44° 06′ 18"	76° 53′ 42"
LOX	Benthos	44° 03′ 36"	76° 46′ 36"
102	WQ	44° 12′ 12"	76° 14′ 12"
103	WQ	44° 12′ 12"	76° 32′ 36"


LAKE ONTARIO
Bioindex and Quinte Programs
CSS BAYFIELD
1990
B
N
HB
C
T
81
41
65
LONGITUDE 78° 00' WEST FROM GREENWICH
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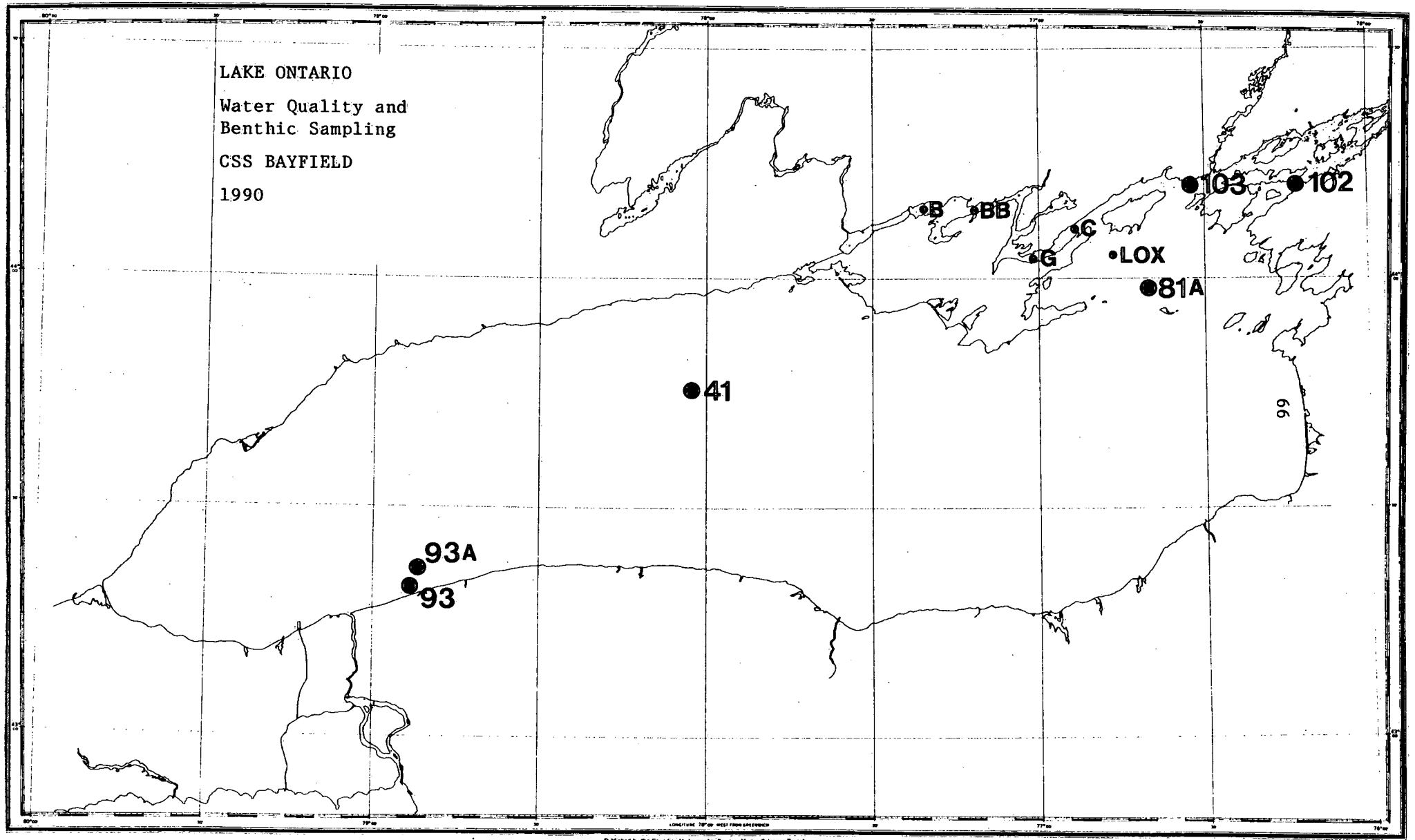
LAKE ONTARIO
10501



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DEPARTMENT OF MINES AND TECHNICAL SURVEYS, OTTAWA

LAKE ONTARIO

10501

C S S A D V E N T

CSS ADVENT
1990

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

LAKE ERIE SURVEILLANCE CONTINUITY

LRB STUDY 82022, M.N. CHARLTON

This study investigated the pronounced environmental changes in Lake Erie and proposed objectives to reduce phosphorus loading and deoxygenation in the Central Basin. The water quality parameters measured during these 1990 cruises will add to the data collected from Project Hypo and similar surveys of the 1980's. The data should provide a clearer picture of Lake Erie's response to remedial strategies over the last twenty years.

Fifteen stations were selected for sampling on four cruises during the season. The CSS ADVENT was utilized for each cruise. At each site, a profile was obtained using the water quality profiler. Samples were collected from 2 m and bottom minus 2 m for total phosphorus, nutrients and Seston. A Secchi disc observation was obtained at each station, and an integrated water sample was collected from 10 metres or 1 metre above the bottom for POC and chlorophyll a. Poor weather conditions, which included tornado warnings and flooding, prevailed during each cruise. For this reason, each cruise was incomplete to some extent.

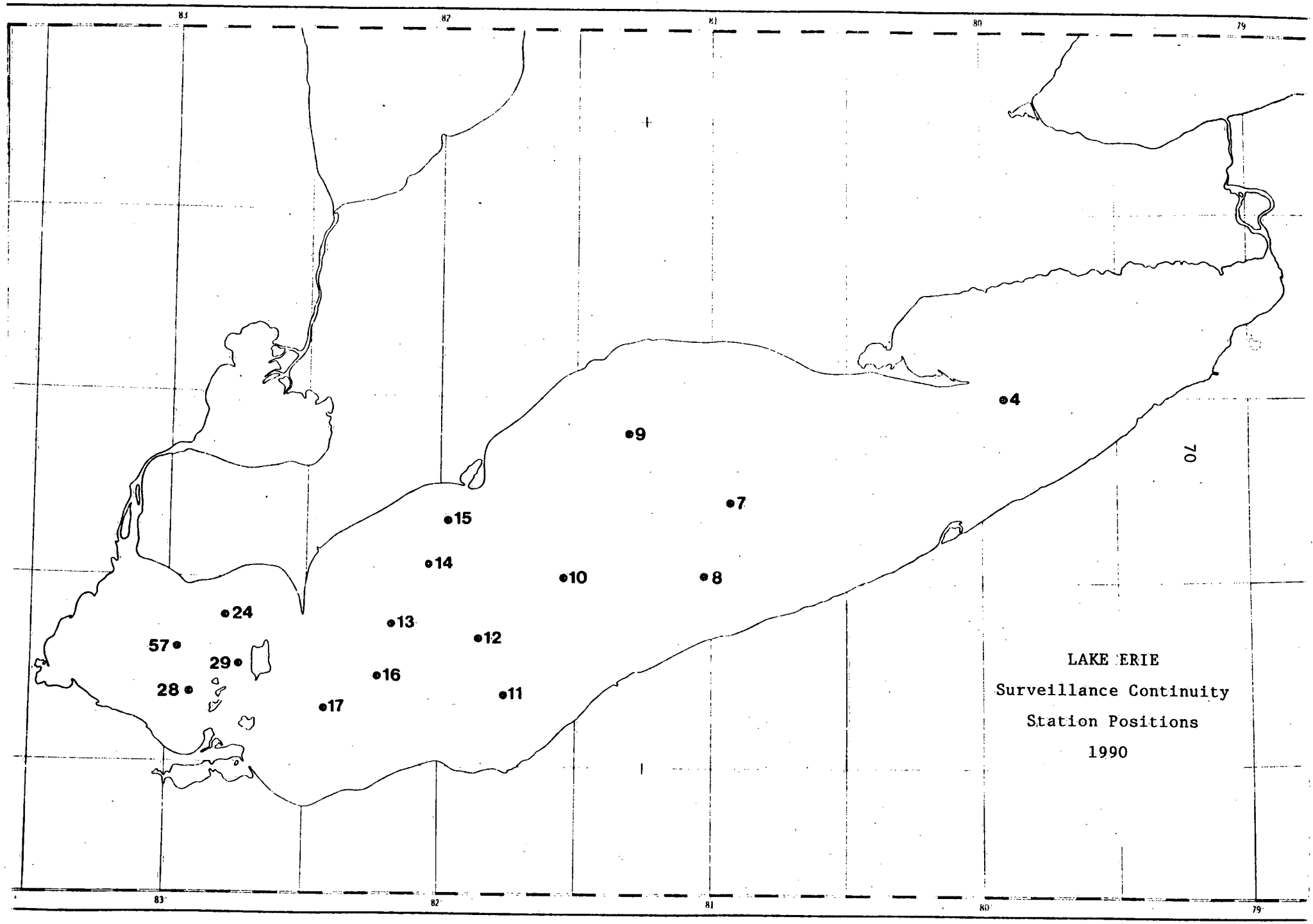
SURVEY SCHEDULE

June 4 - 8
July 3 - 8
July 30 - August 5
August 27 - September 8

STATION POSITIONS

LAKE ERIE SURVEILLANCE CONTINUITY

STATION NUMBER	LATITUDE N.	LONGITUDE W.
4	42° 31′ 03"	79° 53′ 09"
7	42° 14′ 09"	80° 51′ 39"
8	42° 01′ 41"	80° 57′ 58"
9	42° 25′ 04"	81° 15′ 52"
10	42° 01′ 56"	81° 29′ 30"
11	41° 43′ 06"	81° 44′ 10"
12	41° 51′ 39"	81° 50′ 12"
13	41° 52′ 52"	82° 09′ 58"
14	42° 03′ 13"	82° 00′ 24"
15	42° 09′ 37"	81° 50′ 06"
24	41° 54′ 42"	82° 50′ 24"
28	41° 41′ 06"	82° 56′ 00"
29	41° 44′ 18"	82° 44′ 00"
57	41° 47′ 00"	83° 00′ 00"
84	41° 55′ 58"	81° 39′ 34"


83
82
81
80
79
70
4
9
7
15
14
10
8
24
13
12
57
29
16
28
11
17
LAKE ERIE
Surveillance Continuity
Station Positions
1990

NEARSHORE/OFFSHORE EXCHANGE EXPERIMENT

LRB STUDY 82046, DR. C.R. MURTHY

This study is a collaboration among NOAA, Ontario Hydro and NWRI personnel. The purpose is to determine the coastal current climatology, coastal boundary layer characteristics, Lagrangian properties of coastal water movements and thermal bar and coastal upwelling characteristics near the Darlington Nuclear Generating Station on the north shore of Lake Ontario (NWRI/Ontario Hydro). The second objective is to determine the kinematic properties, particle trajectories and diffusion characteristics of the mixed surface layer of a large lake by conducting Lagrangian cluster experiments (NWRI/NOAA).

Ten moorings were deployed by the CSS LIMNOS on April 10 on a perpendicular to the shoreline off Raby Head. Eight of these were single Neil Brown current meters set at 10 m. At the last mooring site, 2 meteorological buoys were established.

The CSS ADVENT was utilized to conduct the drogue experiments and collect EBT profiles at all mooring stations and at positions midway between the moorings. At the beginning of each cruise, 6-to-7 Argos/ Loran C drifters were released at the farthest offshore station in a cluster. EBT profiles were collected at each station as the ADVENT moved shoreward and an Argos drifter only was released at each mooring station. Throughout the cruise, drifter movement was monitored by either shore or cellular phone. When possible during the cruise, outbound and inbound transects of EBT profiles at each station were done. All drifters were retrieved at the end of each cruise.

SURVEY SCHEDULE

DATES	DESCRIPTION	VESSEL
April 10	Mooring installation	LIMNOS
May 14 - 25	Cluster exp., Coastal exp., Temp. surveys	ADVENT
June 18 - 29	Cluster exp., Coastal exp., Temp. surveys	ADVENT
July 16 - 27	Cluster exp., Coastal exp., Temp. surveys	ADVENT
August 13 - 24	Cluster exp., Coastal exp., Temp. surveys	ADVENT
September 17 - 28	Cluster exp., Coastal exp., Temp. surveys	ADVENT
October 22-November 2	Cluster exp., Coastal exp., Temp. surveys	ADVENT

NEARSHORE/OFFSHORE EXCHANGE

STATION POSITIONS

1990-1991

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
121	90-00C-01A	43° 51′ 40"	78° 42′ 48"
122	90-00C-02A	43° 50′ 16"	78° 42′ 24"
123	90-00C-03A	43° 49′ 10"	78° 42′ 11"
124	90-00C-04A	43° 48′ 02"	78° 42′ 03"
125	90-00C-05A	43° 47′ 00"	78° 41′ 48"
126	90-00C-06A	43° 44′ 21"	78° 41′ 25"
127	90-00C-07A	43° 41′ 40"	78° 41′ 08"
128	90-00C-08A	43° 38′ 17"	78° 40′ 05"
129		43° 50′ 51"	78° 42′ 44"
130		43° 49′ 42"	78° 42′ 32"
131		43° 48′ 34"	78° 42′ 25"
132		43° 47′ 36"	78° 42′ 06"
133		43° 45′ 41"	78° 41′ 46"
134		43° 43′ 00"	78° 41′ 18"
135		43° 40′ 18"	78° 40′ 36"

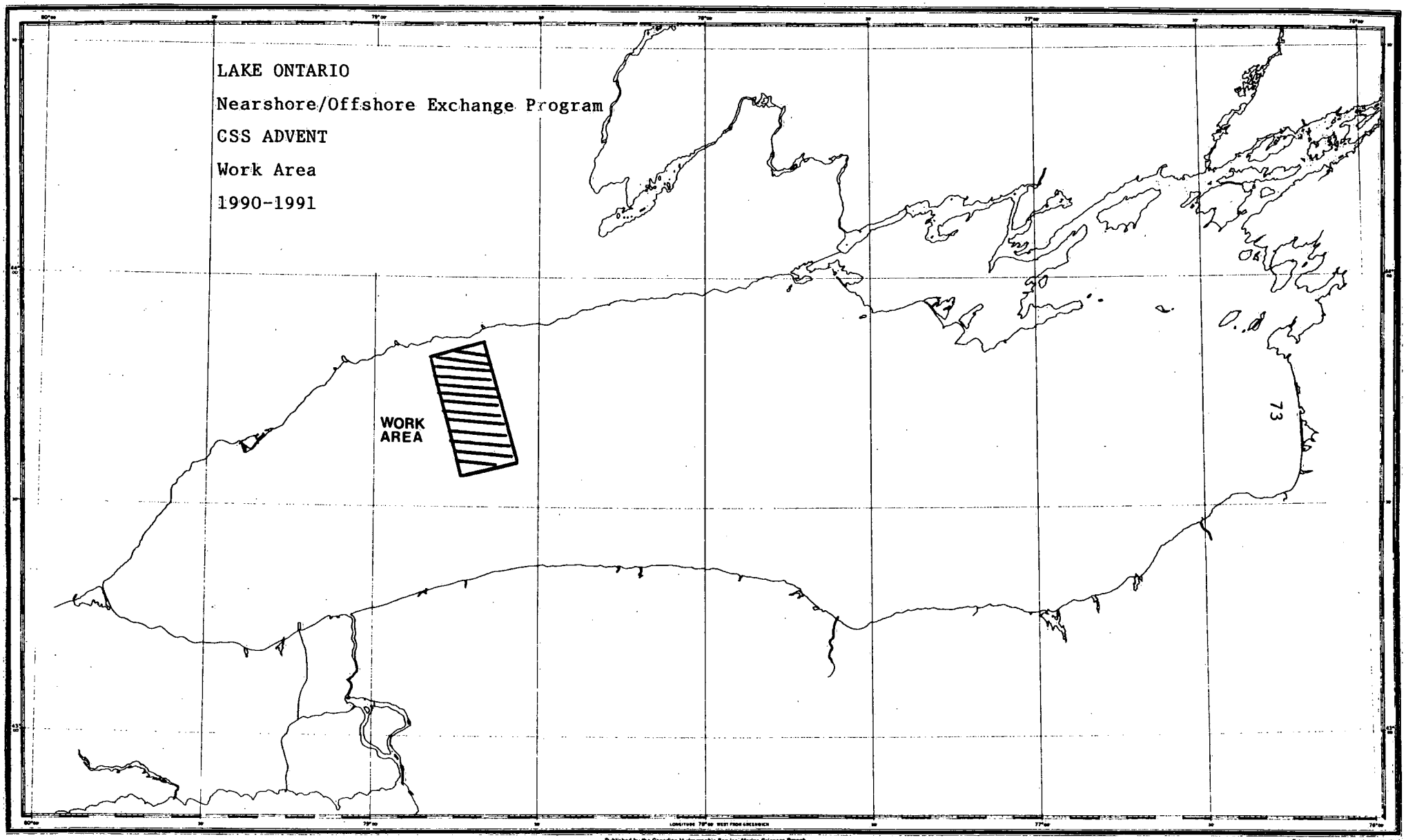


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Chart
LAKE ONTARIO

10501

SHORE PROGRAMS

L A K E S R E S E A R C H B R A N C H

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 18 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 fifth year of NWRI involvement in a major thrust to answer questions related to harbour rehabilitation. Eight studies were supported by Technical Operations and organized into a single program to collect the 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 vessels utilized to support the Hamilton Harbour Project included the CSL SHARK, CSL AGILE, CSL CORMORANT, GOOSE II and MASON #4.

STUDY PROGRAMS

1. 82063 - Boyce - Hamilton Harbour Physical Studies
2. 82031 - Charlton - Hamilton Harbour Oxygen Regime
3. 82028 - Fox - Persistent Organic Contaminants
4. 82027 - Murphy - Hamilton Harbour Restoration
5. 82024 - Painter - Water Clarity in Hamilton Harbour
6. 85021 - Rodgers - Conductivity/Plume Tracking
7. 82015 - Reynoldson - Utilizing Benthic Invertebrates
8. 82029 - Rukavina - Acoustics of Sediments
   - Coastal Geology

HAMILTON HARBOUR PHYSICAL STUDIES
LRB STUDY 82063, F.M. BOYCE

The purpose of this study was to determine the current flow patterns in Hamilton Harbour through the data collection of two Neil Brown current meter moorings and surface drogue tracking. The data collected will be

used to form a data bank of hydrodynamical information for Hamilton Harbour models.

One additional current meter mooring was installed in Lake Ontario 0.5 km northeast of the Burlington Ship Canal.

Current meters installed - April 10 removed - July 30
installed - August 7 removed - December 10

The CSL AGILE was utilized to support the drogue tracking exercises which used the mini-ranger Falcon positioning system to display drogue positions as UTM co-ordinates.

Drogue tracking - June 18 - 21, 28; July 4, 5, 19, 20;
August 13 - 17; September 5, 19 - 21, 26 - 28;
October 31; November 1, 2, 9, 14

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 (see fig. 2). The organic metal content of the sediment samples was also measured. The barge GOOSE II was utilized for all sediment trap mooring operations.

Four sediment trap moorings were installed on May 9. The moorings were scheduled to be refurbished at three-week intervals but weather conditions, equipment problems and personnel assignments disrupted plans. The actual refurbishment schedule follows:

Refurbish - May 9, 10; June 19; July 16, 17; August 14, 15;
September 4, 22; November 1

On November 1, all sediment trap moorings were refurbished and re-installed without surface markers for the winter.

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. Eight cruises were conducted with the profiler occupying 21 stations per cruise (see fig. 3).

Also included were eight Water Quality Branch cruises which collected samples from 1 m and bottom -2 m for total P filtered and unfiltered and

chlorophyll a from twenty-one stations (see fig. 5). The DO profiling and Water Quality Branch sampling cruises were combined into a one-day survey.

DO profiler/WQ Surveys: May 3; June 12, 27; July 13, 25; August 8, 21; September 12

On August 8, a special series of profiles/samples was collected during a concentrated survey of 22 stations near the Burlington wastewater outfall (station KA KA).

During the week of October 1, the DO profiler was used for an inter-comparison survey with a commercially available model named SeaBird. Preliminary results were encouraging but final results are not yet available.

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 is declining or increasing and the ultimate fate of these compounds.

Water samples (18 litres) were collected from five stations near the sediment trap moorings and canal (see fig. 2) on July 25 and November 20, samples were collected at 1 m and bottom -2 m. In November when the water column was well mixed, water samples were collected at 1 m. An additional sample was collected at the exit of Windemere Basin.

HAMILTON HARBOUR RESTORATION
LRB STUDY 82027, DR. 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 6 stations in the harbour, using an Ekman dredge and benthos corer.

Interstitial pore-water samplers (peepers) were installed in the deep hole (24 metres) of Hamilton Harbour on two occasions and retrieved after two weeks.

Installed: May 8 - Retrieved: May 22
Installed: August 24 - Retrieved: September 7

WATER CLARITY IN HAMILTON HARBOUR
LRB STUDY 82024, D.S. PAINTER

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

UTILIZING BENTHIC INVERTEBRATES
LRB STUDY 82015, DR. T. REYNOLDSON

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 seven occasions, cores and Ekman dredge samples were collected monthly at two stations in Hamilton Harbour (Western Basin and Deep Basin, see fig. 4).

Samples were collected on May 1, June 28, July 18, August 16, September 26, October 29 and November 22

During the weeks of May 14 - 18 and May 21 - 25, Tech. Ops. completed an intensive sampling program of sediment sampling at fifty stations in Hamilton Harbour. Sediment samples were collected using a mini-Ponar grab and placed in labelled plastic bags.

HAMILTON HARBOUR PLUME TRACKING
STUDY 85021, DR. G.K. RODGERS

Detailed conductivity surveys were carried out on several occasions to track the plumes of the Windemere Channel and Desjardin's Canal/ Grindstone Creek as they migrated into and mixed with the harbour water. Plume surveys were also conducted from the Burlington Ship Canal into Lake Ontario.

Plume Surveys - June 14, 15; July 17, 18: August 23; September 13, 14

SEDIMENTOLOGY OF HAMILTON HARBOUR
LRB STUDY 82029, DR. N.A. RUKAVINA

Acoustic surveys of harbour sediments were undertaken to determine the

methods required to estimate the thickness of modern sediments in the harbour and to compute the volumes required to dredge these contaminated sediments.

During the weeks of May 14 - 18 and May 21 - 25, Tech. Ops. completed an intensive sampling program of sediment sampling at fifty stations in Hamilton Harbour. Sediment samples were collected using a mini-Ponar grab and placed in labelled 40-dram vials.

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

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.COMM.	43° 16′ 41"	79° 51′ 42"	4792097.	592364.
STELCO	43° 17′ 06"	79° 49′ 33"	4792908.	595260.
CHOP	43° 17′ 50"	79° 48′ 05"	4794294.	597226.

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
BOYCE CURRENT METER MOORINGS:				
90-00C-13A	43° 18′ 33"	79° 47′ 09"	4795649.	598470.
90-00C-14A	43° 17′ 31"	79° 50′ 08"	4793678.	594464.
90-00C-15A	43° 17′ 18"	43° 47′ 54"	4793320.	597490.

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
CHARLTON SEDIMENT TRAP MOORINGS:				
90-00A-50A	43° 18′ 26"	79° 48′ 50"	4795181.	596302.
90-00A-51A	43° 16′ 49"	79° 52′ 19"	4792217.	591351.
90-00A-52A	43° 17′ 26"	79° 50′ 03"	4793339.	593965.
90-00A-53A	43° 17′ 09"	79° 47′ 48"	4792918.	597734.

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
CHARLTON OXYGEN/WATER QUALITY SURVEY:				
901	43° 17′ 50"	79° 47′ 58"	4794306.	597386.
902	43° 17′ 42"	79° 48′ 13"	4794054.	597051.
903	43° 17′ 35"	79° 48′ 42"	4793829.	596401.
904	43° 17′ 30"	79° 49′ 06"	4793667.	595862.
905	43° 17′ 25"	79° 49′ 31"	4793505.	595301.
906	43° 17′ 15"	79° 50′ 18"	4793182.	594246.
907	43° 17′ 05"	79° 51′ 06"	4792858.	593168.
908	43° 16′ 56"	79° 51′ 54"	4792566.	592090.
909	43° 16′ 46"	79° 52′ 42"	4792243.	591013.
910	43° 16′ 47"	79° 53′ 18"	4792263.	590201.
911	43° 17′ 43"	79° 50′ 30"	4794042.	593964.
912	43° 17′ 00"	79° 49′ 48"	4792728.	594929.
913	43° 17′ 00"	79° 48′ 42"	4792749.	596416.
914	43° 16′ 08"	79° 46′ 58"	4791179.	598783.
915	43° 16′ 18"	79° 47′ 15"	4791482.	598396.
916	43° 16′ 30"	79° 47′ 27"	4791848.	598120.
917	43° 16′ 40"	79° 47′ 37"	4792153.	597890.
918	43° 17′ 07"	79° 47′ 52"	4792982.	597540.
919	43° 17′ 26"	79° 48′ 24"	4793557.	596810.
920	43° 17′ 57"	79° 48′ 50"	4794505.	596211.
921	43° 18′ 24"	79° 49′ 11"	4795331.	595726.
922	43° 18′ 24"	79° 46′ 48"	4795378.	598947.
923	43° 18′ 14"	79° 47′ 08"	4795371.	598497.
924	43° 18′ 05"	79° 47′ 27"	4794779.	598077.
925	43° 17′ 57"	79° 47′ 44"	4794527.	597698.

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
CHARLTON KA KA SURVEY:				
D1	43° 18′ 30"	79° 48′ 35"	4795528.	596534.
D2	43° 18′ 34"	79° 48′ 40"	4795655.	596425.
D3	43° 18′ 38"	79° 48′ 45"	4795772.	596305.
E1	43° 18′ 26"	79° 48′ 32"	4795406.	596604.
E2	43° 18′ 25"	79° 48′ 39"	4795384.	596449.

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
E3	43° 18′ 25"	79° 48′ 46"	4795360.	596291.
E4	43° 18′ 24"	79° 48′ 53"	4795337.	596131.
F1	43° 18′ 24"	79° 48′ 32"	4795344.	596604.
F2	43° 18′ 21"	79° 48′ 37"	4795235.	596504.
F3	43° 18′ 17"	79° 48′ 41"	4795133.	596402.
F4	43° 18′ 14"	79° 48′ 46"	4795031.	596293.
G1	43° 18′ 20"	79° 48′ 31"	4795221.	596629.
G2	43° 18′ 14"	79° 48′ 32"	4795048.	596605.
G3	43° 18′ 09"	79° 48′ 34"	4794871.	596572.
G4	43° 18′ 03"	79° 48′ 35"	4794695.	596546.
H1	43° 18′ 24"	79° 48′ 29"	4795345.	596672.
H2	43° 18′ 19"	79° 48′ 26"	4795189.	596737.
H3	43° 18′ 14"	79° 48′ 23"	4795035.	596805.
H4	43° 18′ 09"	79° 48′ 21"	4794889.	596866.
H5	43° 18′ 04"	79° 48′ 18"	4794731.	596929.
I1	43° 18′ 22"	79° 48′ 23"	4795285.	596808.
I2	43° 18′ 19"	79° 48′ 17"	4795195.	596945.

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
FOX PERSISTENT ORGANIC CONTAMINENTS:				
50	43° 18′ 26"	79° 48′ 50"	4795181.	596302.
51	43° 16′ 49"	79° 52′ 19"	4792217.	591351.
52	43° 17′ 26"	79° 50′ 03"	4793339.	593965.
53	43° 17′ 09"	79° 47′ 48"	4792918.	597734.
CANAL	43° 17′ 55"	79° 47′ 46"	4794464.	597654.
WINDEMERE	43° 16′ 08"	79° 46′ 58"	4791179.	598783.

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

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
REYNOLDSON BENTHIC INVERTEBRATE/INTENSIVE SURVEY:				
1	43° 16′ 13"	79° 47′ 13"	4791335.	598452.
2	43° 18′ 13"	79° 48′ 21"	4795019.	596864.
3	43° 16′ 34"	79° 47′ 46"	4791972.	597699.
4	43° 17′ 13"	79° 47′ 42"	4793187.	597755.
5	43° 16′ 44"	79° 47′ 55"	4792274.	597476.
6	43° 17′ 21"	79° 48′ 11"	4793421.	597094.
7	43° 17′ 51"	79° 48′ 30"	4794336.	596659.
8	43° 18′ 21"	79° 48′ 49"	4795231.	596220.
9	43° 18′ 23"	79° 49′ 34"	4795303.	595210.
10	43° 17′ 59"	79° 49′ 01"	4794566.	595966.
11	43° 17′ 19"	79° 48′ 43"	4793341.	596381.
12	43° 16′ 59"	79° 48′ 21"	4792732.	596890.
13	43° 17′ 06"	79° 48′ 49"	4792942.	596248.
14	43° 17′ 40"	79° 49′ 13"	4793982.	595707.
15	43° 16′ 49"	79° 48′ 17"	4792406.	596982.
16	43° 55′ 30"	79° 48′ 01"	4795091.	594677.
17	43° 17′ 48"	79° 49′ 43"	4794212.	595022.
18	43° 17′ 17"	79° 49′ 23"	4793257.	595486.
19	43° 17′ 25"	79° 49′ 52"	4793497.	594838.
20	43° 17′ 55"	79° 50′ 09"	4794416.	594424.
21	43° 17′ 32"	79° 50′ 21"	4793719.	594169.
22	43° 17′ 17"	79° 51′ 56"	4793207.	592028.
23	43° 16′ 52"	79° 50′ 18"	4792460.	594256.
24	43° 17′ 10"	79° 50′ 30"	4793025.	593976.
25	43° 17′ 46"	79° 50′ 59"	4794138.	593315.
26	43° 17′ 16"	79° 50′ 59"	4793198.	593318.
27	43° 16′ 48"	79° 50′ 41"	4792341.	593730.
28	43° 16′ 55"	79° 51′ 10"	4792538.	593072.
29	43° 17′ 22"	79° 51′ 30"	4793379.	592611.
30	43° 17′ 00"	79° 51′ 37"	4792690.	592461.
31	43° 16′ 42"	79° 51′ 51"	4792142.	592163.
32	43° 17′ 04"	79° 52′ 22"	4792804.	591461.
33	43° 16′ 44"	79° 52′ 16"	4792191.	591591.
34	43° 16′ 29"	79° 52′ 32"	4791723.	591250.
35	43° 16′ 34"	79° 52′ 10"	4791870.	591748.

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
36	43° 16′ 44"	79° 51′ 28"	4792198.	592691.
37	43° 16′ 28"	79° 52′ 55"	4791685.	590728.
38	43° 17′ 04"	79° 50′ 51"	4792838.	593507.
39	43° 16′ 34"	79° 50′ 56"	4791899.	593407.
40	43° 16′ 31"	79° 50′ 44"	4791801.	593679.
41	43° 16′ 26"	79° 50′ 28"	4791680.	594050.
42	43° 16′ 29"	79° 49′ 58"	4791578.	594726.
43	43° 16′ 37"	79° 49′ 58"	4792022.	594722.
44	43° 16′ 50"	79° 49′ 49"	4792414.	594922.
45	43° 17′ 10"	79° 50′ 11"	4793017.	594411.
46	43° 17′ 09"	79° 49′ 46"	4793007.	594979.
47	43° 17′ 33"	79° 49′ 31"	4793752.	595293.
48	43° 16′ 58"	79° 48′ 57"	4792683.	596074.
49	43° 16′ 27"	79° 47′ 13"	4791760.	598432.

Fig. 1
CURRENT METER
MOORING
LOCATIONS

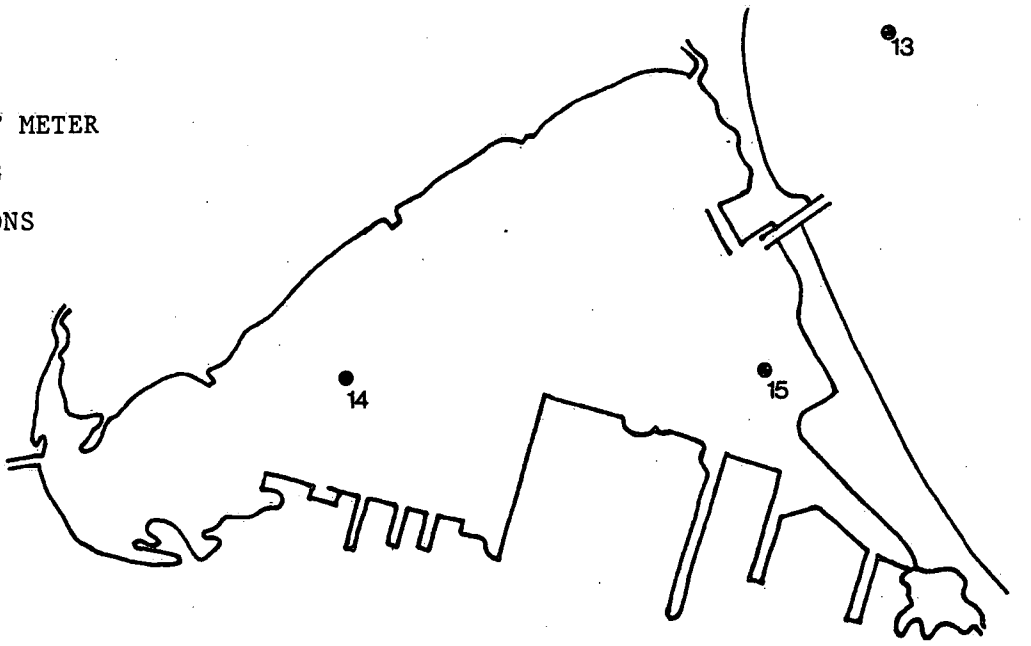


Fig. 2
SEDIMENT TRAP
MOORING
LOCATIONS

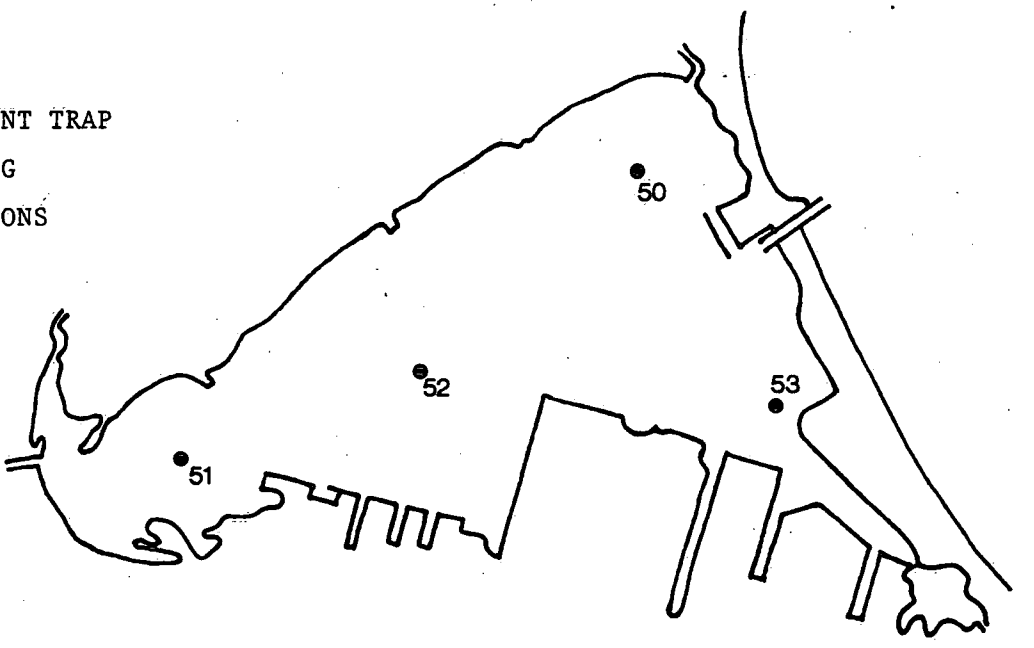


Fig. 3
D.O./W.Q. SURVEY
SAMPLING
STATIONS

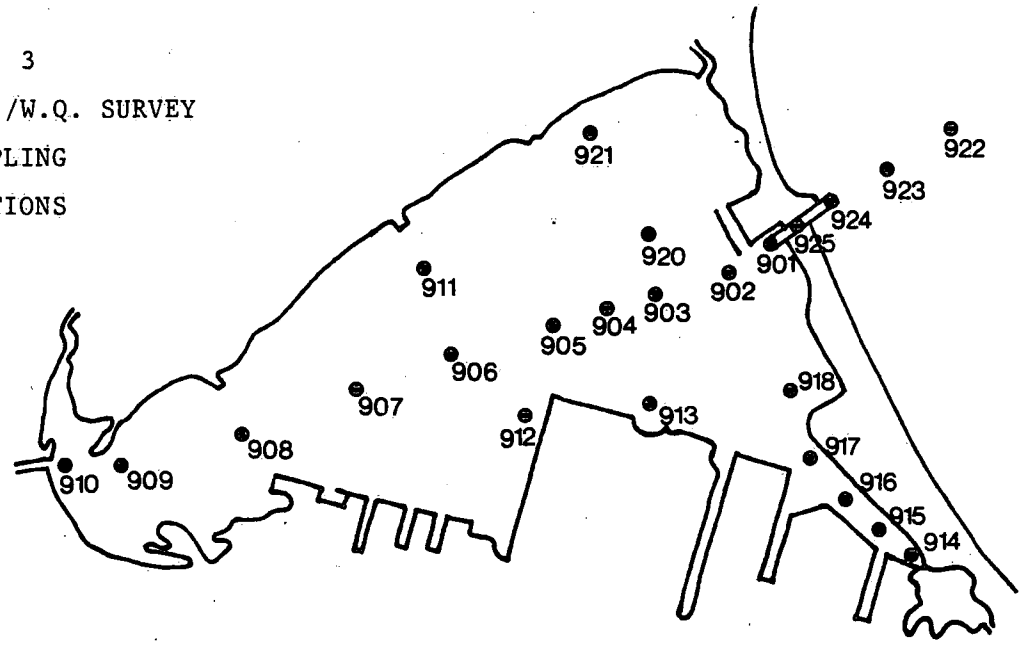
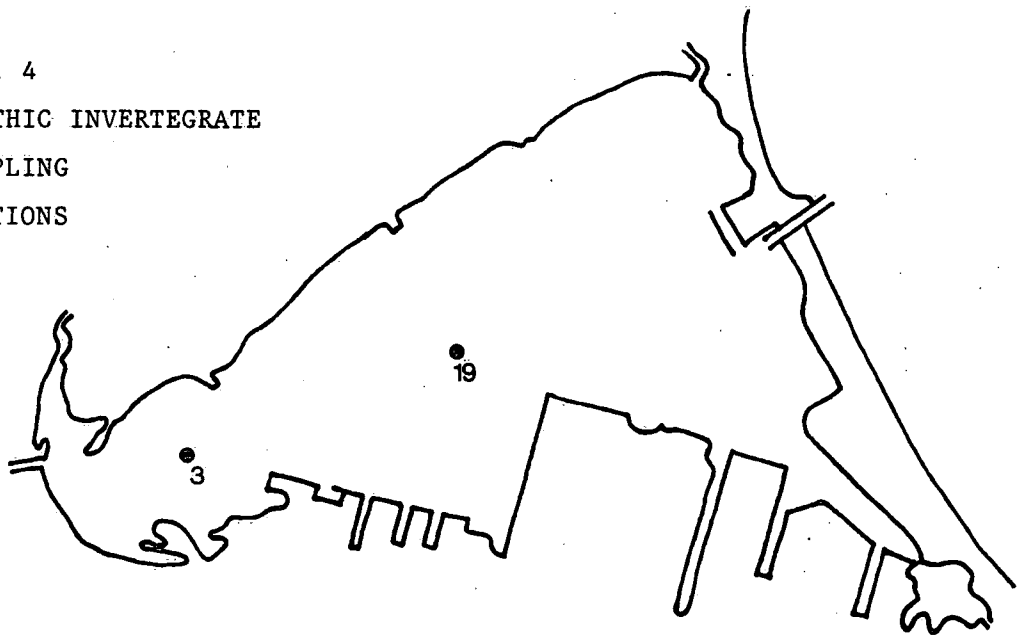


Fig. 4
BENTHIC INVERTEGRATE
SAMPLING
STATIONS



SEVERN SOUND ZOOPLANKTON COLLECTION

LRB STUDY 82002, DR. J.M. BARICA

Technical Operations support was given to Dr. J.M. Barica, LRB and Ms. Zuzana Stuchlikova (Charles University, Prague) with the collection of zooplankton samples and water chemistry measurements from twelve sites in the Severn Sound area.

The first trip took place during the week of July 23 - 27. The sites were spread out between Penetang Harbour and Sturgeon Bay. A Secchi disc observation was made at each site as well as measurements for dissolved oxygen, temperature, conductivity and pH at each sample depth which included the surface and at 2-metre intervals to the bottom minus 1 m depth. Phytoplankton samples were collected and zooplankton was collected using the Schindler-Patalas zooplankton trap and surface net hauls. The four stations located in Penetang Bay were sampled in a similar manner after dark to obtain comparative data on the zooplankton samples.

Additional sampling trips took place during the first and third weeks in August and September 5 - 6. On these trips, only the four stations in Penetang Harbour were sampled. The collections for zooplankton were done in the same manner as on the previous trip. The sites were visited 12 hours apart--one collection spanned the midnight hour starting at 2300 on September 5th and the other the noon hour starting at 1100 the next day. The samples were collected at 2-metre intervals from the surface to the bottom at each station. A Secchi disc reading and a plankton net tow was also done at each site during the daylight sampling series.

One further trip was made to these stations in the bay on October 10th. The sites were visited during the daylight only. The depths sampled were surface and two metres, at 5-metre intervals if the depth allowed and from bottom -1 m. Surface bucket temperature observations were made and Secchi disc readings taken at each site.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	44° 45′ 49"	79° 53′ 04"
2	44° 45′ 28"	79° 51′ 46"
3	44° 46′ 28"	79° 51′ 23"
4	44° 45′ 15"	79° 47′ 42"
5	44° 46′ 01"	79° 47′ 36"
6	44° 45′ 49"	79° 43′ 37"
7	44° 44′ 56"	79° 44′ 15"
8	44° 46′ 43"	79° 43′ 28"
9	44° 46′ 18"	79° 56′ 37"
10	44° 46′ 46"	79° 56′ 24"
11	44° 48′ 08"	79° 56′ 20"
12	44° 48′ 39"	79° 55′ 00"

ST. LAWRENCE RIVER/WHITBY HARBOUR

LRB STUDY 82011, DR. J.P. COAKLEY

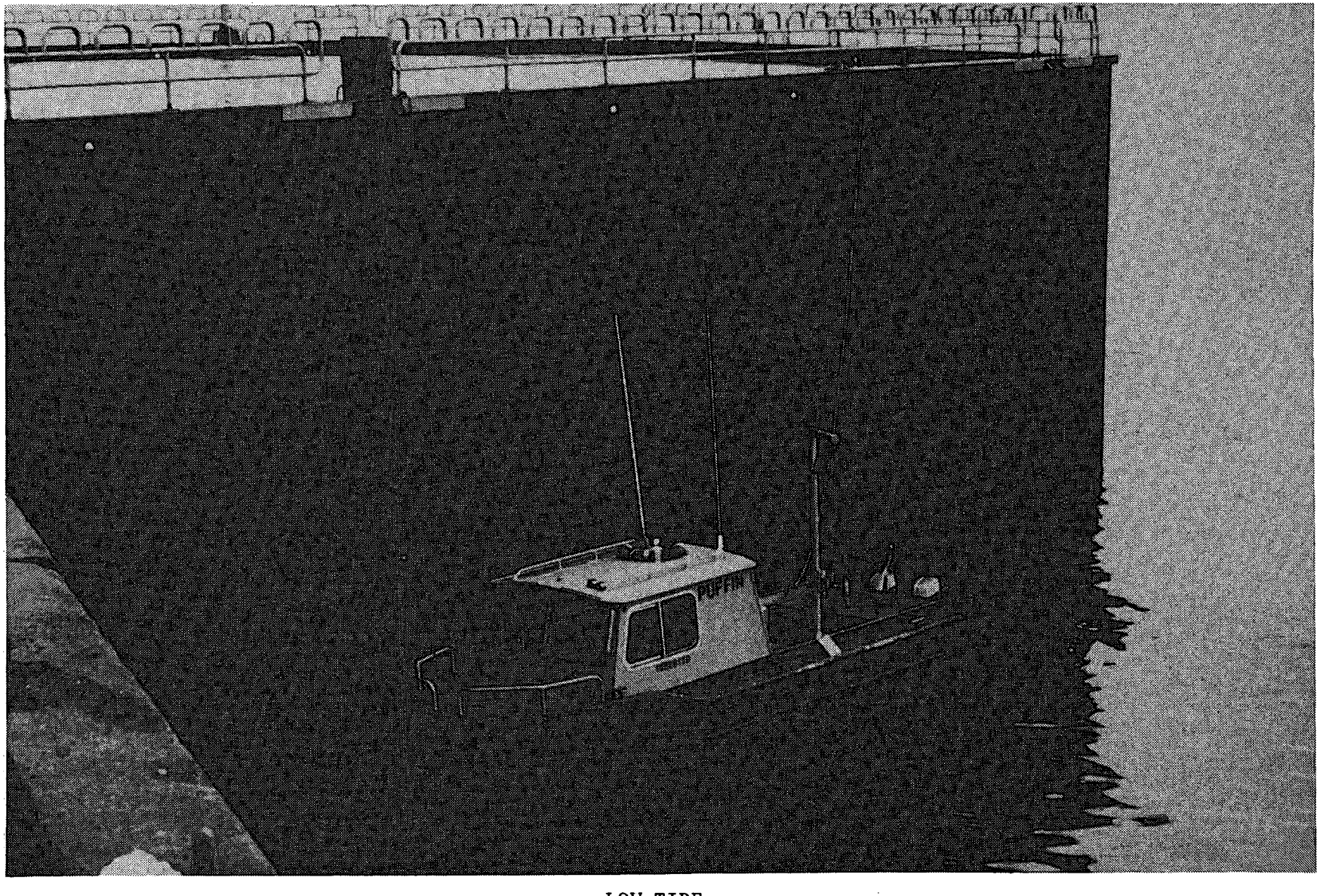
Technical Operations provided field support for Dr. Coakley's 1990 sampling program. Samples were collected at two different study areas--Whitby Harbour and several locations along a stretch of the St. Lawrence River between Quebec City east to Tadoussac.

Whitby Harbour was sampled twice--in the spring and again in the fall. Operating from a Boston Whaler, using a Tech. Ops. push corer, 10 cores were collected from the west side of the harbour. The cores were collected about 20 ft. off shore approximately 100 ft. apart--5 south of the new public ramp and 5 north of it. The cores, averaging between 4" and 12" in length, were capped, taped, labelled and transported in a vertical position to CCIW where they were immediately stored in the Hydraulics 4° walk-in cooler.

Two Technical Operations staff were needed for the two-week St. Lawrence River sampling program in September.

The CSL PUFFIN was trailered using a 4x4 crewcab for transport to the sampling areas then launched at the closest ramp that would accommodate. Because of the scarcity of adequate ramps along this stretch of the north shore, often several miles of steaming were necessary to reach the sampling stations. Tides as high as 15 ft. were also a major consideration and had to be taken into account when deciding on boat launching, removal and sampling. Most of the near shore stations could only be sampled from the boat at high tide. The portable King Loran C unit was used for navigation. Once in the general area of the sampling site, the boat's sonar was operated to determine the exact sampling site and produce a permanent paper output of the bottom depth, shape and structure. Bottom Ponar grab samples were collected at most stations. A few benthos cores were collected when the bottom sediments were right and at some stations no samples could be obtained because of rock or hard sand bottom.

Several sampling days were lost due to inclement weather that created conditions not conducive for safe small boat operations. On these days, samples were collected by walking out onto the mud flats at low tide. This method proved to be very effective for near shore station sampling, also allowing Dr. Coakley to get an accurate picture of the bottom at that site.



LOW TIDE

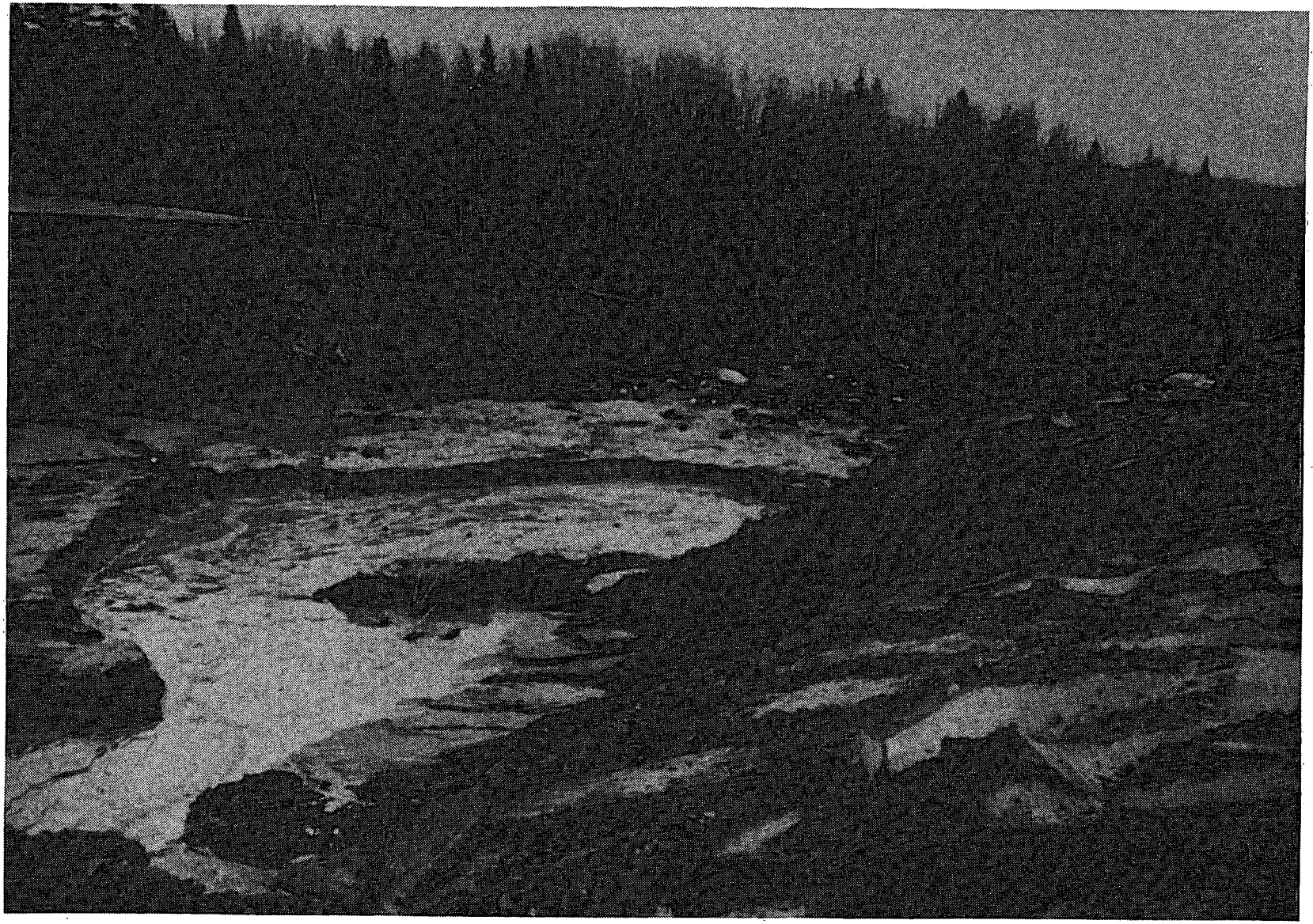
ST. LAWRENCE RIVER

MONTREAL RIVER

LRB STUDY 82013, A. MUDROCH

This project was in support of a special request from the Ministry of Natural Resources of Ontario.

Water and sediment samples were collected from Mountain and Bay lakes which are situated on the Montreal River system. A tailings spill occurred near the village of Matachewan, west of Kirkland Lake and contaminated the river. In order to observe how the sediments will be affected, samples were collected from the lakes before the tailings arrived that far downriver.



TAILINGS SPILL

MONTREAL RIVER

KIRKLAND LAKE

LRB STUDY 82013, A. MUDROCH

This study was organized to study the effects of submerged mine tailings on the aquatic environment. Particular reference to sediment contaminants was studied and their relationship with sediment pore water, chemical toxicity and benthic invertebrate community structures.

Date: August 13 - 18

Personnel: G.G. LaHaie
A. Mudroch
Dr. T.P. Reynoldson
F. Rosa
R.D. Coker

All personnel departed CCIW August 13 after loading two vehicles and a Boston Whaler. Monday was a travel day to Kirkland Lake. The survey work took place on Larder Lake which is approximately 25 km east of Kirkland Lake. This is a very large and deep lake with 45 miles of shoreline. Navigation was aided by an MNR fishing map. Arrangements to dock the whaler at the Municipal Marina were made with Robert Emmell, Clerk-Treasurer of Larder Lake. This was a very secure facility and a slip was given at no charge. Accommodations were at Kirkland Lake and a room was also rented in Larder Lake for use as a lab facility.

A total of 37 stations were sampled. At each location, 3 Ponar samples were taken along with 3 - 5 Tech. Ops. cores. Because of the depth of the lake, numerous extra casts were required to obtain these samples. In some locations, this was due also to the nature of the sediment--mine tailings, which has a consistency similar to silt. At selected sites, 6 litres of bottom -1 m water was collected. Because of the limited space on the whaler, the samples collected in the morning were dropped off at selected locations on shore and more containers picked up for the afternoon work.

All samples, with the exception of the water and core samples for 1 cm subsampling, were processed onboard. The biology samples were later sieved on shore. All the sediment samples and processed water samples were kept cold in coolers packed with ice.

On Friday, reconnaissance trips by boat and vehicle were made to the mine tailing sites. The whaler was loaded and an attempt to do work on

Raven Lake, 30 km away, was aborted because of poor launching facilities. A 4x4 vehicle would have been necessary to launch and retrieve the boat. This was not part of the regular work schedule. All samples and equipment were loaded at Larder Lake and transitted to CCIW on Saturday.

NORTH CHANNEL SEDIMENT SAMPLING

LRB STUDIES 82013, 82015, 82016

A. MUDROCH, DR. T.P. REYNOLDSON, F. ROSA

The CSL SHARK was utilized to sample 53 stations in the North Channel of Lake Huron for sediment toxicity, geochemistry and benthic invertebrate community structure as well as refurbishment of four sediment trap moorings on Cruise 90-02-701 during the period July 9 - 17. At each station, four benthos cores and a Ponar grab sample were obtained. One benthos core was subdivided into 5 cm sections--0 - 5 cm and 5 - 10 cm for geochemistry, while the remaining three cores had the top 10 cm removed and screened through a 1000µ screen and preserved with 4% Formalin for benthic invertebrate community structure. The Ponar grab samples were bagged or placed in plastic containers for use in bioassay experiments upon return to CCIW.

WAVES TOWER

LRB STUDY 82021, DR. N.A. RUKAVINA

During the 1990 field season, the WAVES Tower was not utilized to conduct research on air-water interaction.

In September, F.H. Don used the facility to set a mini-ranger transponder station while working on Study 82021 for Dr. Rukavina.

An inspection was conducted in December. At that time, it was discovered that two of the light fixtures needed attention. They were removed to CCIW where two new "magic eyes" were obtained and installed and a socket was replaced. The structure appears to be in good shape.

Long-term maintenance is being planned which, when carried out, will preserve the structure for many years.

BAY OF QUINTE MOORINGS

LRB STUDY 82022, M.N. CHARLTON

On July, 5 sediment traps were installed in the Bay of Quinte from Trenton to just east of Glenora in the Adolphus Reach. This project was in co-operation with the Ministry of the Environment of Ontario whose personnel refurbished the moorings on a two-week cycle until mid-October. Two moorings--90-00S-16A and 90-00S-20A, had transmissometers attached to the traps. All traps were installed 2 metres off the bottom. The moorings and their locations are as follows:

MOORING NUMBER	LATITUDE N.	LONGITUDE W.
90-00S-16A	44° 05′ 54"	77° 30′ 32"
90-00S-17A	44° 08′ 12"	77° 15′ 42"
90-00S-18A	44° 06′ 15"	77° 02′ 00"
90-00S-19A	44° 03′ 42"	77° 05′ 48"
90-00S-20A	44° 03′ 27"	76° 58′ 12"

BAY OF QUINTE

LRB STUDY 82028, M.E. FOX

During the week of July 16 - 20, water and sediment samples were collected from the Bay of Quinte for M. Fox. Each site had a 1-litre water sample collected from 0.5 m and an Ekman dredge was used to collect a bottom grab. Two cores were collected from stations at Trenton and Hay Bay. Station locations were as follows:

STATION NUMBER	LATITUDE N.	LONGITUDE W.
16A	44° 05′ 54"	77° 30′ 33"
17A	44° 08′ 12"	77° 25′ 42"
18A	44° 06′ 15"	77° 02′ 00"
19A	44° 03′ 42"	77° 05′ 48"
20A	44° 03′ 27"	76° 58′ 12"

AMISK LAKE

LRB STUDY 82023, Dr. T.P. MURPHY

Amisk Lake, Alberta (160 km north of Edmonton) is the site of a joint study begun in 1988 by the University of Alberta and NWRI to increase oxygen levels in the lake so as to support large numbers of game fish.

During the week of July 23 - 27, a Technical Operations dive team travelled to Amisk Lake, Alberta to install a new oxygen diffuser system. The existing diffuser was found to be inefficient in injecting oxygen into the water column so a new setup comprised of 2 different types of diffuser was installed.

On July 24, underwater video of the existing system was taken using the ROV. The diffuser was then raised to the surface and towed to shore where it was dismantled.

On July 25, 2 new diffusers were installed at the same location using a "T" junction on the oxygen supply hose. One diffuser was similar in design to the original system while a new diffuser containing ceramic bubblers made up the other system. The diffusers were rigged so they could be raised and lowered easily on a ¼" stainless steel wire to facilitate easier access to the bubblers in the event repairs are required.

On July 26, video of both operating diffusers was taken using the ROV and everything appeared to be working as expected.

Copies of the underwater video of the operating diffuser system were sent to Mr. J. Babin of the University of Alberta.

TRENT RIVER SYSTEM

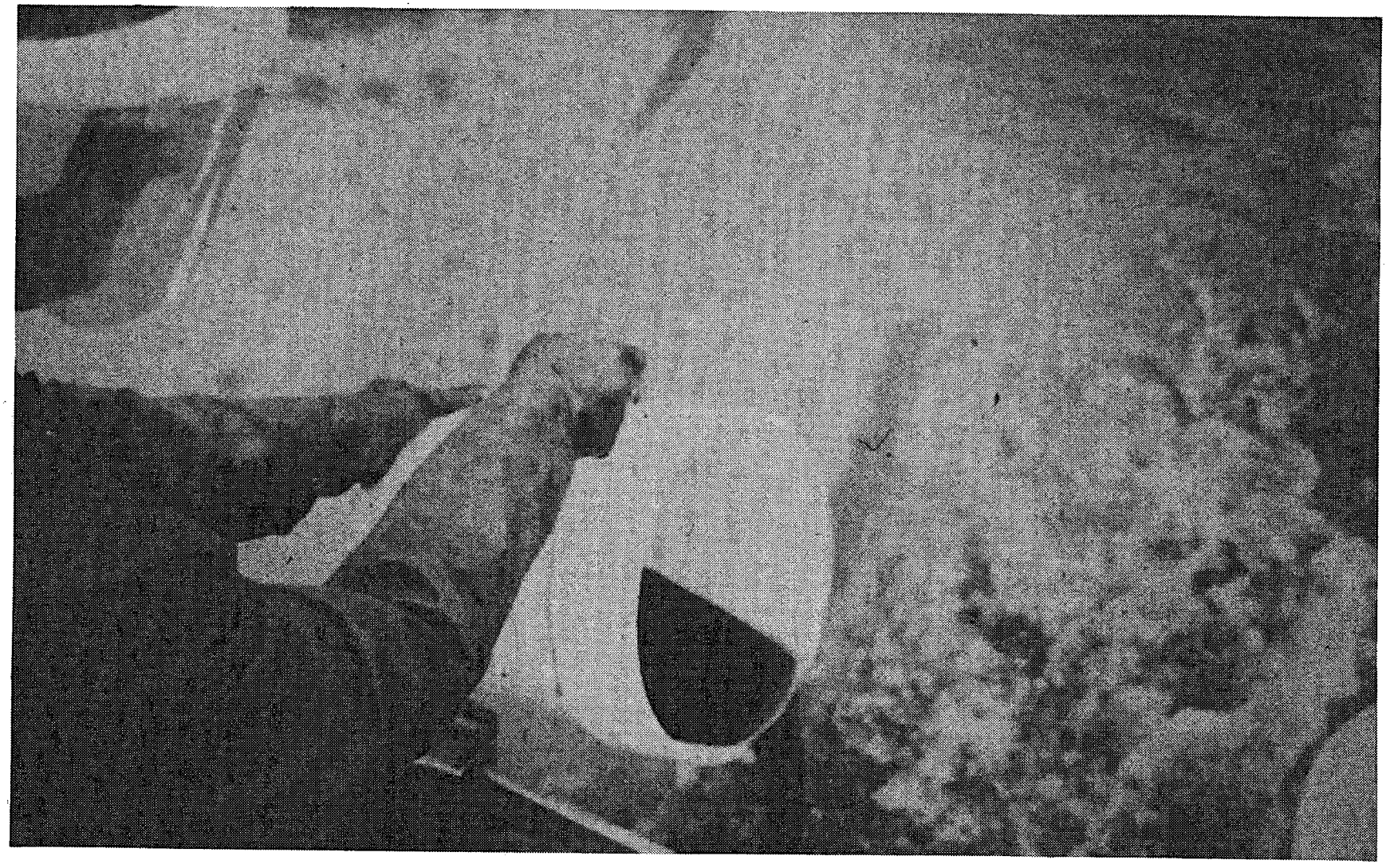
LRB STUDY 82025, DR. P.G. MANNING

The purpose of this project was to collect water, suspended solids and sediments from: the Trent Canal system between the Bay of Quinte and Burleigh Falls; Mississauga Lake and River north of Buckhorn; and from Eels Creek south of Apsley. Sampling was done during the weeks of May 28 and June 4.

Water samples were collected for total phosphorus filtered and unfiltered, metals and pH. Sediment samples were collected for phosphorus and iron. The suspended samples were analyzed for iron and phosphorus. An EBT was conducted at each station to establish the sampling depths if there was a temperature structure. A total of 19 stations were sampled on the Trent Canal at the following locations:

STATION	LOCATION
1	Mid-river above highway bridge (Hwy 2) at Trenton
2	Midway between locks 2 and 3
3	Above Lock 8
4	At mile 11 (Richardson Cove)
5	At mile 20 (west end Wilson Island)
6	At mile 29 (above Hagues Reach Lock)
6A	At mile 32 (Below Lock 13)
6B	At mile 34.6 (inlet of Mud Lake)
7	At Coles Point
8	At mile 43.5 (Green Point)
8A	At mile 48
9	At mile 56 (Morrow Point)
10	At mile 65.3 (midway between Paudash Island and Idylwilde Point
11	At mile 69.5 (entrance of Otonabee River)
11A	At mile 76.3 (downstream of Bensfort Bridge)
12	At mile 86 (Robinson Island)
13	At mile 93.5 (below Trent University)
13A	At mile 96.9 (below Lock 25)
14	At mile 100 (Haig Point)
15	At mile 113 (above Lock 28)
M1	At Mississauga Lake (between Pine Point and Collins islands)
M2	At Mississauga River as it passes under Highway 36
1E	Eels Creek as it passes under Highway 28

Four cores were collected from station 10 on Rice Lake and one core was collected from Mississauga Lake. A core from each lake was subdivided into 1 cm sections to 20 cm and 2 cm to the bottom of the core. One core from Rice Lake was profiled for pH to the bottom of the core.



FERRIC SULPHATE ADDITION

BLACK LAKE, BRITISH COLUMBIA

CHAIN LAKE

LRB STUDY 82023, DR. T.P. MURPHY

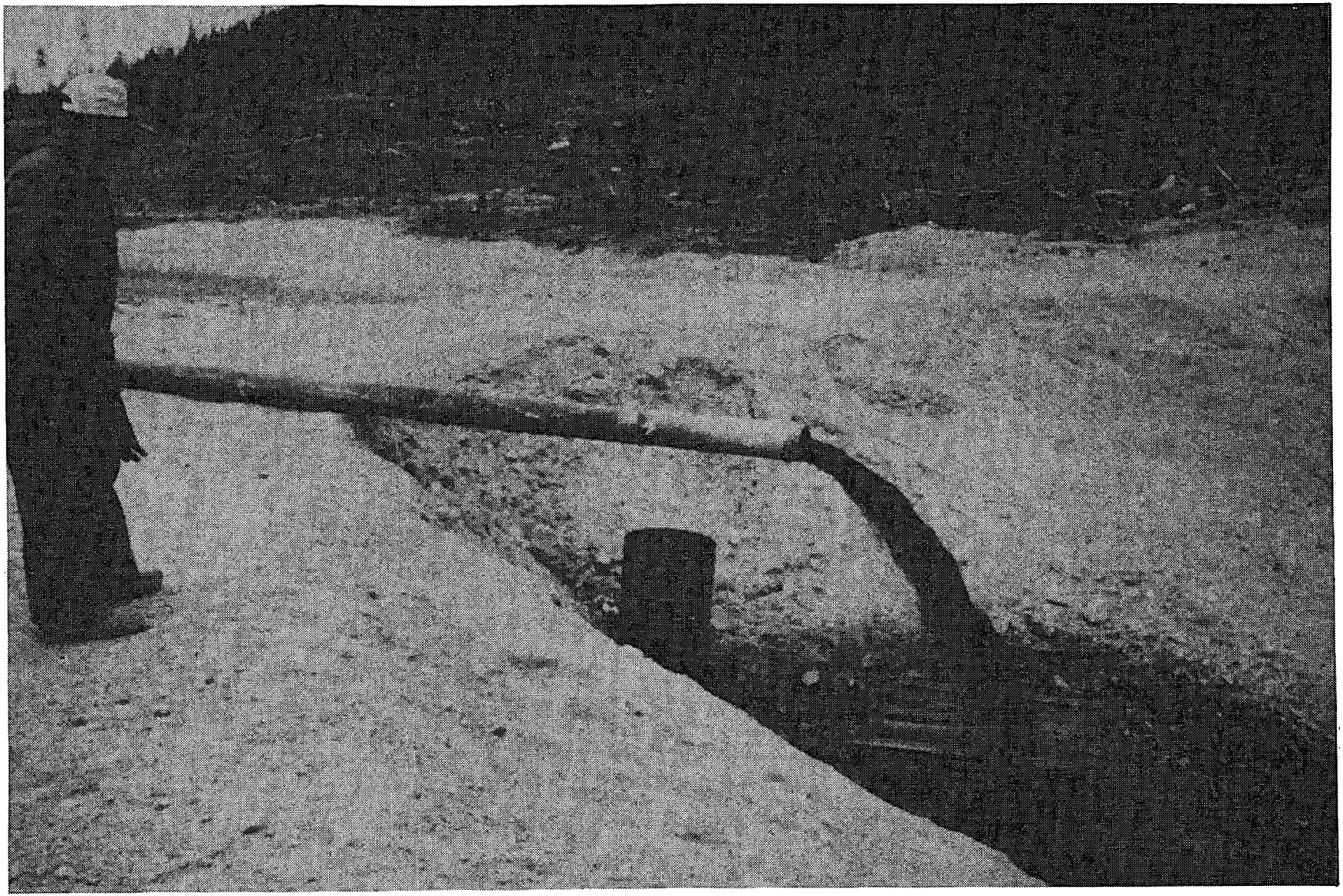
The purpose of this project was to observe and document the efficiency of the portable dredge at Chain Lake; to promote plant growth on top of the berms; remove dredged material from the berms; observe the effects of chemical treatment in Black Lake; sample several lakes which are similar in chemistry to Chain Lake. The project was supported on two separate occasions--June 18 - 29 and August 20 - 31.

In June, the research was divided between Chain and Black lakes. Three tonnes of ferric sulphate were added to Black Lake in order to observe the restoration effects on the lake. The lake was sampled every second day for two weeks after initial installation and every second week until September. The bi-weekly sampling was done in conjunction with Westwater Research--part of the University of British Columbia's Engineering Department.

Sampling of Chain Lake was conducted during the same period for water, sediment cores and sounding to check for any slumping into the dredged hole produced in 1988. The local association was also assisted in dredging in the hole and other parts of the lake to assess the efficiency of the dredge.

The August period was spent sampling several lakes throughout Southern British Columbia as well as continuing the project on Black and Chain lakes. The lakes sampled were: Boss, Davis, Friskin, Roe, Gardom, Osprey, Link and Kamloops. At each lake there was an oxygen/ temperature profile to the bottom conducted, a Secchi disc was done and 2 cores were collected using a Tech. Ops. corer. All cores were subdivided into 1 cm sections to the bottom of the core.

A Bobcat was rented to remove as much material from a berm as possible. The material was limed and spread on top of the berms to enhance plant growth. This freed much needed space for any new dredging material that was being pumped from Chain Lake.



DREDGING

CHAIN LAKE, BRITISH COLUMBIA

SANDUSK CREEK

LRB STUDY 82016, F. ROSA

On April 19, a sediment trap was suspended from a highway bridge at the mouth of Sandusk Creek as it flowed into Lake Erie. The trap was to collect all the particulates as they flowed from the creek thus trapping the organic chemicals (if any) from the Hagersville fire site. This creek drained the fire site as it flowed directly through the fire. The trap was removed permanently on November 27.

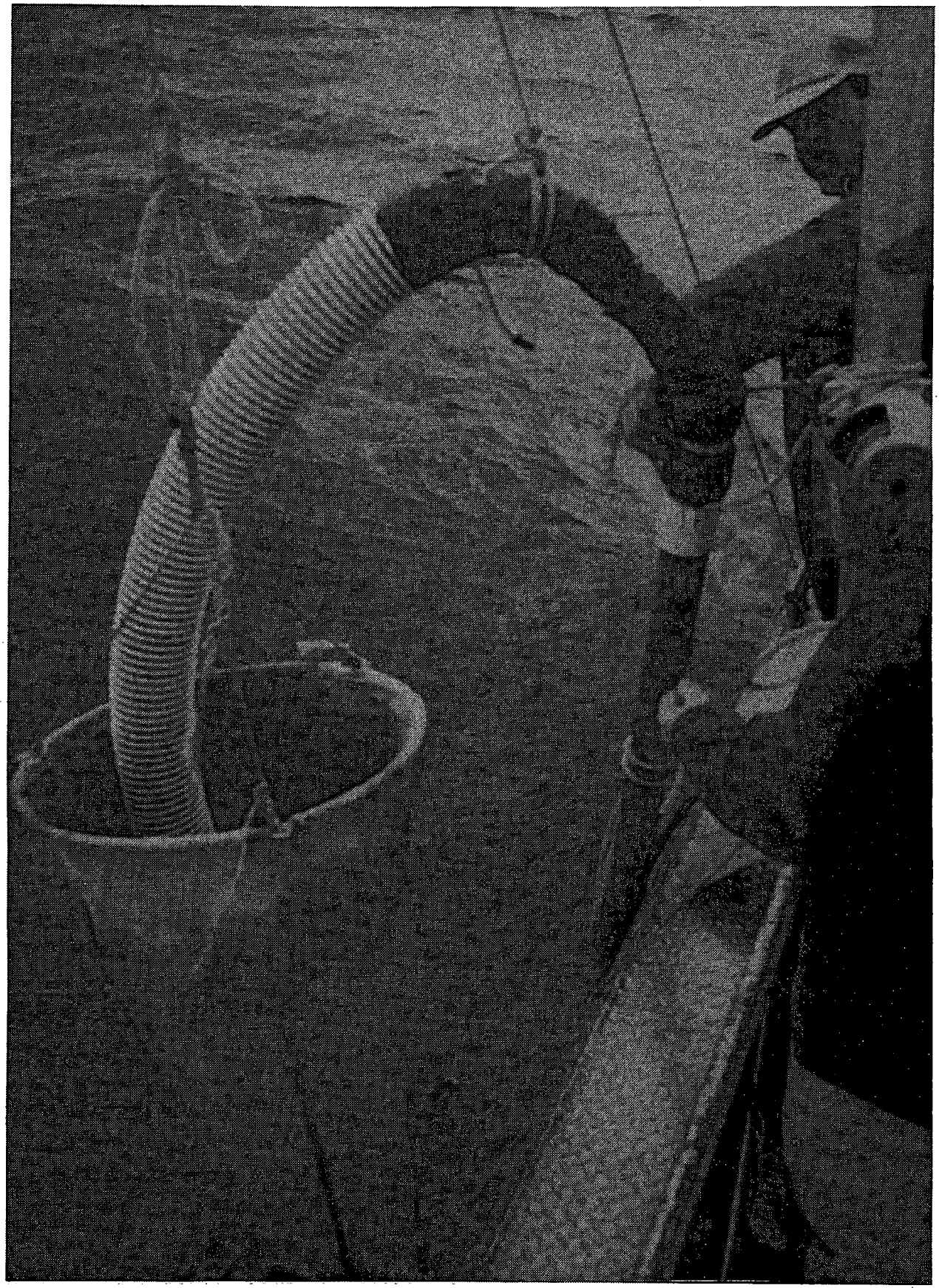
HONEY HARBOUR/BEAUSOLEIL ISLAND, GEORGIAN BAY

MAYFLY AND SEDIMENT COLLECTION

LRB STUDY 82027, DR. T.P. MURPHY

In order to collect a sufficient number of mayfly larvae and sediment to do bioassay experiments on Hamilton Harbour sediment, two trips were made to a sample site near Beausoleil Island in Georgian Bay near Honey Harbour. The first trip from September 24 - 28 resulted in the collection of approximately 1500 larvae. A second trip from October 21 - November 2 resulted in an additional 2500 larvae being collected. Bottom sediment was collected each time to allow the larvae to live in sediment that they had been accustomed to.

Larvae were collected using an airlift which pushed air under pressure down an air hose to a spreader at the bottom of a 4" PVC pipe. Sediment from the bottom was sucked up the pipe as the air rose. When the sediment reached the surface, it was dumped into a 1000μ mesh net which was rinsed. The remaining sediment, vegetation debris and mayfly larvae were dumped into a screen sieve and the larvae picked out and kept in buckets of water with a small amount of sediment until return to CCIW. A portable air compressor powered from a 5000 watt Honda generator was used as an air supply for the lift.



AIR LIFT

HONEY HARBOUR

INPUT SAMPLING

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

The purpose of this study is to develop a mathematical model for the prediction of the extent to which the water of Lake Ontario receives atmospheric deposition of a variety of organic contaminants such as toxophenes and PCB's. One essential part of this task is to determine the approximate input from streams and rivers.

Technical Operations supported this study by assisting in the collection of a set of centrifuged water and sediment samples from the mouths of sixteen major rivers and streams that input into Lake Ontario. On three separate occasions--April 17 - 27, July 30 - August 8 and October 31 - November 12, the shore-based field trips were done immediately following sample collection cruises for open lake data aboard the CSS LIMNOS. All samples were collected in duplicate. At each site, two gas-powered Westfalia centrifuges were run for varying periods of time, depending on sediment load, to collect the duplicate suspended sediment and centrifuged water samples. The water samples were collected in two forty-litre stainless steel cans from each centrifuge and were extracted by large-volume extractor on site. The suspended sediment was frozen and retained for analysis back in the lab. In addition, two samples of bottom sediment were collected from each site by mini-Shipek and frozen.

The sampling sites were visited in a clockwise direction around the Lake Ontario shoreline. The first four sites--the Don and Rouge rivers, Oshawa Creek and the Harmony River, were sampled from shore. The remainder of the sites, with the exception of Etobicoke Creek, were sampled utilizing the launches PUFFIN or PINTAIL anchored during the sampling period in the river mouths. These included the Ganaraska River and the Bay of Quinte in Ontario, the Black, Salmon, Oswego and Genesee rivers, Oak Orchard Creek and 18-Mile Creek in New York State. Twelve Mile Creek, Etobicoke Creek and the Credit and Humber rivers were sampled when the field parties returned to the western end of the lake. Whenever possible, two sites were sampled per day in order to minimize the length of time between the shipboard and shore-based segments of the program.

On each occasion, two vehicles were required. A dual-wheel four-wheel drive crewcab was used to tow, launch and retrieve the boat and a cube van was used as a mobile lab to extract and prepare samples and carry the refrigerator unit and freezer. The crewcab, while being a much better vehicle for launching and retrieving the boat, also saved a considerable amount of time since the boat handling could be done while the extractions were going on in the mobile lab.

SEDIMENT CORING

LRB STUDY 82055, DR. L.D. DELORME

Sediment cores were collected from the Eastern, Central and Western areas of East Lake during the week of June 25 - 29.

These cores were collected using the long lightweight corer utilizing two boats held together with a platform on which a 5-metre scaffolding was mounted.

In addition, two regular lightweight cores were collected from the Eastern area of the lake.

All cores were sectioned into 1 cm sections and returned to CCIW for freeze drying and analysis.

MOIRA LAKE

LRB STUDY 82057, DR. J.O. NRIAGU

Moira Lake, which is located north of Belleville, is part of the watershed which drains an area of recent gold mining activity. As a result, metal contamination, especially arsenic, has been found at elevated levels. This study will try to determine the level of metal contamination in the lake bottom sediments using porewater samplers "peepers" as well as bottom cores.

On October 1 - 2, Tech. Ops. divers installed 12 "peepers" at selected sites in Moira Lake. Depths of the 4 sites were: 10 m, 9 m, 5 m and 4 m. On October 15 - 16, Tech. Ops. divers refurbished the 12 "peepers" and these were sampled immediately. In addition, 2 hand cores were taken at each site and sectioned in 1 cm intervals immediately on shore. On November 5 - 6, Tech. Ops. personnel removed the 12 "peepers" and associated moorings. These were sampled again immediately upon removal.

PEEPER SAMPLING

MOIRA LAKE

LOW LEVEL METAL SAMPLING

WOLFE ISLAND AND LAKE ON THE MOUNTAIN

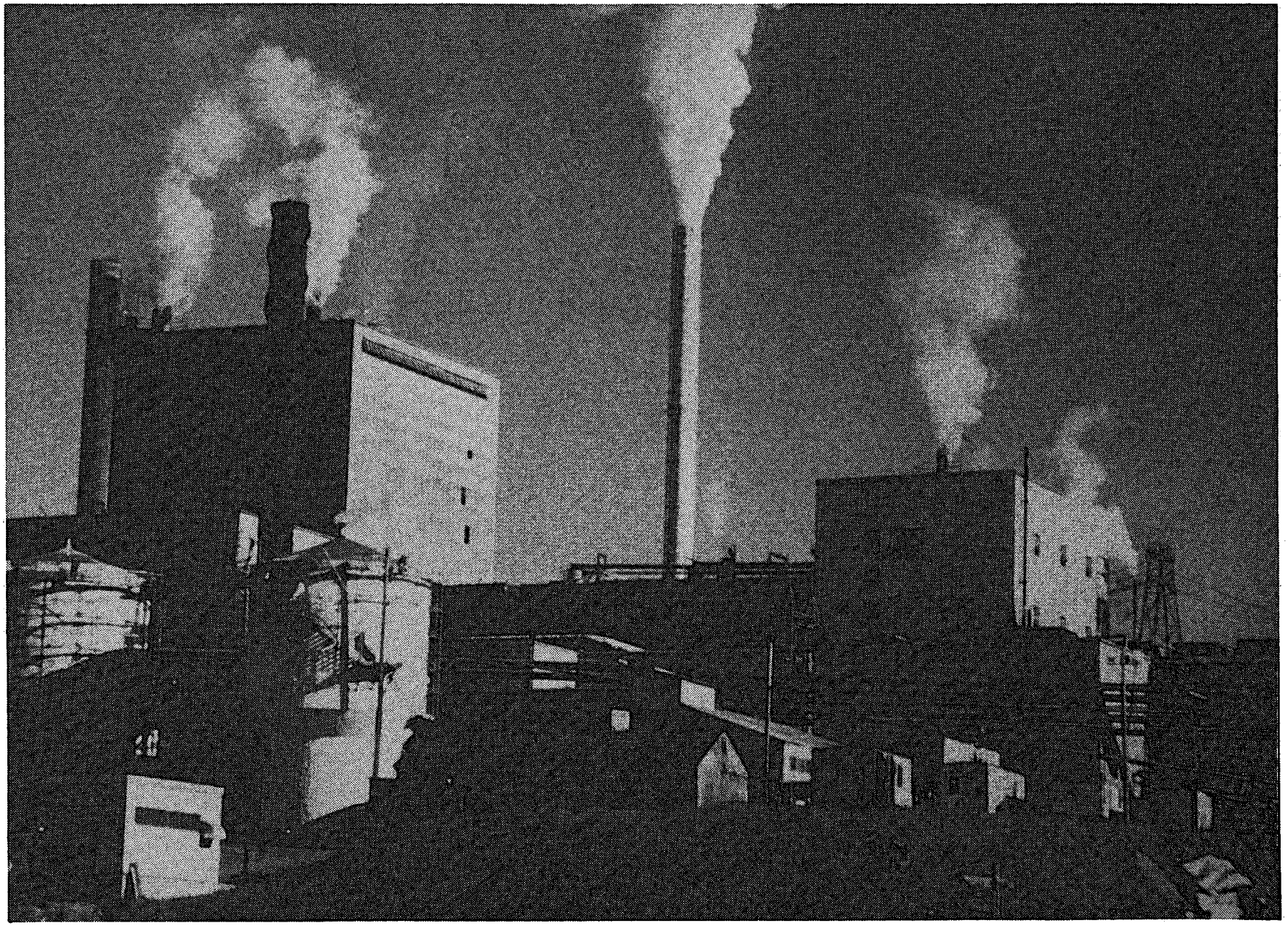
LRB STUDY 82058, H. WONG

Water samples were collected from Lake on the Mountain and the St. Lawrence River on November 6 - 7. Samples were collected using the AVON--an inflatable boat.

At Lake on the Mountain, the AVON was rowed to the sample site and the samples collected using a non-metal collecting apparatus.

The two channels of the St. Lawrence River at Wolfe Island were sampled using the launch WOODPECKER and the AVON. The AVON was allowed to drift approximately 30 m away from the launch before samples were obtained.

Samples were filtered in a nitrogen-filled glove box within 1 hour of collection.



CANADIAN PACIFIC INDUSTRIES PULPMILL

La TUQUE, QUEBEC

PULPMILL EFFLUENT SAMPLING

LRB STUDY 82061, DR. J.H. CAREY

Technical Operations supported this study, led by Dr. J. Carey, LRB, providing assistance with logistics and sample collection at three pulpmill study areas. The pulpmills chosen for this study were selected since they each use a different method of pulp treatment in their process. The E.B. Eddy Mill in Espanola, Ontario uses state-of-the-art techniques, such as chlorine substitution, in its process; the Repap Mill in The Pas, Manitoba produces an unbleached product and so does not use chlorine; and the Canadian Pacific Industries Mill in La Tuque, Quebec is an example of an old technology mill producing a bleached product. The results of this study will provide input for drafting legislation limiting the allowable concentration of certain components of pulpmill effluent (i.e., absorbable organohalides). Two field trips were made to the Espanola mill prior to the trip in August in which the E.B. Eddy and Repap mills were both sampled. The Canadian Pacific Industries Mill in Quebec was sampled in mid-September. The field party on the first Espanola trip consisted of:

E.H. Walker, Technical Operations Section, RSD

Dr. J.H. Carey, Study Leader, Lakes Research Branch
Dr. B.K. Burnison
Ms. K. Millar
Ms. L. Flaherty
T. Williams
A. Rosner
V. Martin

Several sites were sampled in the Spanish River both up and downstream of the E.B. Eddy Mill the week of June 18 - 23. A gas-powered Westfalia separator was run for approximately three hours at a rate of 4 litres per minute at each site to provide a suspended sediment sample as well as a twenty-litre volume of centrifuged water which was pressure-filtered for Crab APLE extraction on site. Centrifuge samples were collected at one site just upstream of the mill, one site downstream at the bridge at Webbwood and another near Massey. In addition, transects of the river were done for chlorophenol collection and Crab APLE extraction in both channels upstream of the mill, just below the mill dam, at two locations further downstream and at the river mouth itself. At each transect, a bottom sediment sample was collected by mini-Shipek.

The field party on the second trip to the E.B. Eddy Mill in Espanola from July 16 - 21 consisted of:

E.H. Walker, Technical Operations Section, RSD

Ms. K. Millar, Lakes Research Branch
T. Williams
V. Martin
A. Rosner

On this trip, the final pulpmill effluent and the effluent from the settling pond were sampled. The effluent was centrifuged at the rate of about two litres per minute and then pressure-filtered with nitrogen. The resulting filtered effluent was then concentrated with the use of a reverse osmosis unit capable of reducing a volume of 1000 litres down to 20 - 40 litres. Samples were collected at all stages of the process, including centrifugate, filters, filtrate, concentrate and permeate.

On August 12, another field party left Burlington to sample at Espanola and The Pas. It included:

J.A. Kraft, Technical Operations Section, RSD

Dr. J.H. Carey, Study Leader, Lakes Research Branch
Ms. K. Millar
Ms. L. Flaherty
T. Williams

The sampling required on this trip to Espanola was accomplished in much the same manner as the first trip in June. Only the river stations were sampled. On completion of this segment on August 16th, the field party was met by a vehicle from Burlington to transport the samples and most of the personnel back to CCIW. Several members of the field party transitted to The Pas, Manitoba with the field equipment by crewcab where they met the rest of the personnel on August 19. The field party at The Pas included:

J.A. Kraft, Technical Operations Section, RSD

Dr. B.K. Burnison, Lakes Research Branch
Ms. K. Millar
T. Williams
V. Martin
A. Rosner

There were no samples collected from the river at this site. All sampling was confined to the Repap Mill property. The settling pond and final effluents were sampled once again. Due to its high pulp fibre and wood chip content, the effluent from the settling pond had to be screened before entering the centrifuge to prevent clogging the volume control valve. At this site, the concentrate from the reverse osmosis unit was pumped through a tangential flow unit to remove the bacterial content which had caused delays in analysis upon return to the lab after the trip in June.

EFFLUENT CONCENTRATION

THE PAS, MANITOBA

Samples were collected for chlorophenols and bottom sediment from the settling pond and the lagoon as well as the ditch carrying the effluent to the river. Upon completion of the sample collection, the samples and some members of the field party travelled to Burlington by crewcab while the rest returned home by air. This trip was plagued by repeated mechanical problems with the crewcab and while it did add to the difficulty of the sample collection, it did not prevent the successful completion of all of the required work.

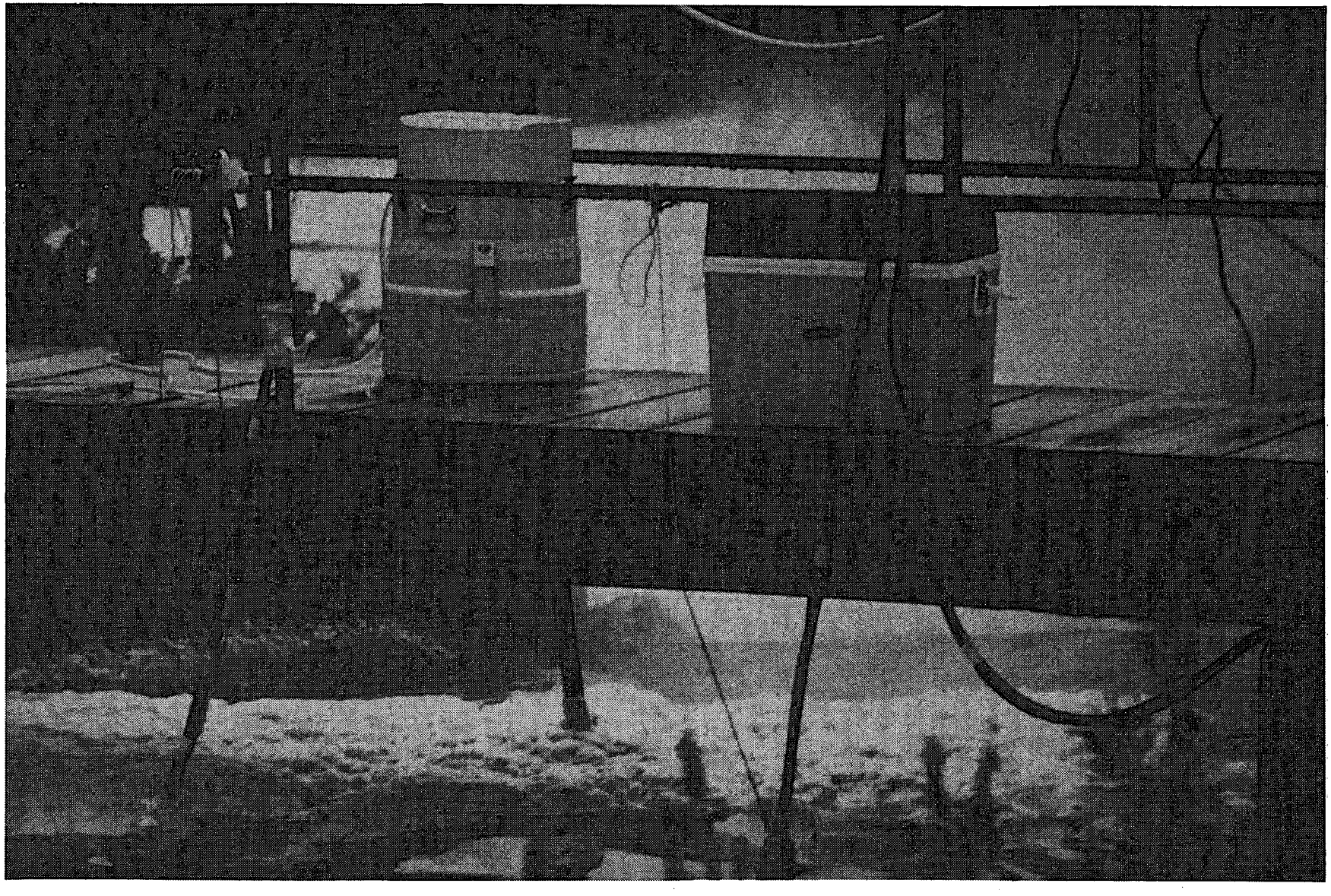
The third leg of this trip began on September 10th. The entire field party transitted to the La Tuque site by government vehicle and included the following personnel:

J.A. Kraft, Technical Operations Section, RSD

Dr. J.H. Carey, Lakes Research Branch
Dr. B.K. Burnison
Ms. K. Millar
T. Williams
V. Martin
R. Robinson
M. Hewitt

The final effluent from the Canadian Pacific Industries Mill in La Tuque, Quebec was sampled in the same manner as at the Repap Mill. Transects were done for chlorophenols and Crab APLE extraction at one site above the dam upstream of the mill reservoir and at six sites downstream of the mill dam on the Riviére Saint-Maurice. Bottom sediments were collected from each transect and the mixing pond by mini-Shipek. Samples of final effluent were collected at half-hour intervals by Isco water sampler for a 24-hour period along with 20-litre bulk samples from the transects for experimental use in the lab in Burlington. This last portion of the field program was accomplished with little difficulty and all personnel and samples returned to Burlington on schedule.

Process improvements are underway at the CPI Mill and it is projected that by the end of this year, a much more modern mill will stand in its place.



PULPMILL EFFLUENT SAMPLING

RIVERS RESEARCH BRANCH

KAMINISTIQUIA RIVER CLAM STUDY

RRB STUDY 83012, DR. Y.K. CHAU

The project investigated genetic and biochemical effects of pulp and paper waste. The long-term objective was to use genotoxicity and biochemical techniques to evaluate the toxic effects of pulp and paper wastes on aquatic organisms.

Technical Operations supported this project four times during the field season--June 11 - 15, July 4 - 6, August 8 - 10 and September 5.

Five sites were set up on Kaministiquia River. The installation took place June 11 - 15 and the removal was completed September 5th. The removal was completed utilizing the launch McKEE from the CSS LIMNOS while she was in Thunder Bay on the Lake Superior Upper Lakes Surveillance. Sampling at each site consisted of the following:

1. Two clam cages installed with 14 clams in each

2. Clams removal at monthly intervals for toxic analyses

3. Sediment samples taken for genetics, enzyme, organics and heavy metals

4. Water samples collected for genetics, organics and water quality

The July and August sampling was completed by personnel from the LRTAP Program in Sault Ste. Marie.

ST. LAWRENCE RIVER

RRB STUDY 83013, J. SMITH

RRB Study 83013 is concerned with water pollution problems in the St. Lawrence River and is being conducted by J. Smith in conjunction with Dr. R. Greene and L. Grapentine of the University of Western Ontario.

Support to this study involved the collection of freshwater mussels for contaminant analysis at various locations in the Bay of Quinte, Cornwall and Sorel, Quebec. Freshwater mussels have been found to be an effective indicator of water quality problems and an extensive collection of mussels, both upstream and downstream of known pollution sources in Cornwall and Sorel was conducted. Collection was done primarily by underwater operations divers except where strong currents were found. A 16′ clam rake was used for mussel collection in this case.

Each day after the samples were collected, dissections of the mussels were done and samples were weighed and frozen in liquid nitrogen. Dive support was provided by the CSL PUFFIN.

SURVEY DATES

June 18 - 19	Bay of Quinte
June 19 - 25	Cornwall, Ontario
June 25 - 27	Sorel, Quebec

TURKEY LAKES WATERSHED

RRB LRTAP STUDY 83021, R.G. SEMKIN

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

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

Technical Operations' support consisted of one full-time technician stationed in Sault Ste. Marie. Equipment support included 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, 4 snowmobiles and 4 all-terrain vehicles were supplied and maintained 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 field staff and maintained by the Communication Centre in Sault Ste. Marie. All roads and trails in the watershed were maintained with some assistance from the Canadian Forestry Service at Sault Ste. Marie.

The Department of Fisheries & Oceans' support consisted of six small aluminum boats and one canoe (14 - 16 ft.), as well as one outboard motor and other items to make the boats safe and operational. Technical Operations supplied 2 electric motors.

Technical Operations staff supported Rivers Research Branch staff in chemical and hydrological monitoring of the watershed. The hydrological monitoring consisted of gauging and sampling seven stream locations throughout the watershed on a weekly basis and analyzing the samples for numerous chemical parameters. Five lakes were sampled on a bi- weekly schedule for the same chemical parameters with the exception of the spring and fall when they were sampled once a week. During the winter, snow cores were collected at 14 locations on a weekly schedule.

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

To supplement hydrological and chemical data, a full meteorological station and solar radiation unit were operated on a year round basis by Technical Operations. The new MET III system is now in operation and the old Plessey system has been removed. The new system allows data to be dumped to a disk on site and generates a backup disk. The data disk is shipped to Burlington each month and some on site data processing is performed. The MET III system also allows MET program changes to be made on site and the MET can can be erased to provide continued use with no interruption of data collection.

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

In support of the project, approximately 4 miles of trails were brushed back during the fall, allowing easier vehicle, skidoo and ATC access throughout the year. Two bridges were also constructed across the streams to allow additional trail use in the winter months.

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

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

Two fog collectors have been installed at the site and these will begin operation in early spring and continue operating for a period of a year.

PORT ALMA

RAB STUDY 83033, DR. M.G. SKAFEL

During the week of October 9 - 12, 25 till samples were collected from a gravel pit west of Port Alma. Each till sample measured 35 cm x 35 cm x 1.0 metre and weighed approximately 225 kg. The sampling went smoothly but required numerous large pieces of heavy equipment; i.e., crane, backhoe bulldozer and trencher. The samples were returned to the wind/wave flume at CCIW where they will be installed for a lengthy period for erodeability studies.

NEWPORT BRIDGE SAMPLING SITE

GRAND RIVER, ONTARIO

NITH/GRAND RIVERS

RRB STUDY 83035, PROJECT EHLBS, DR. J. MARSALEK

The Technical Operations Section supported research that was conducted on the Nith and Grand rivers for Dr. Marsalek of RRB. Dr. Ellen Petticrew of Bedford Institute of Oceanography, Dartmouth, Nova Scotia, Ian Droppo and Tania Mayer of RRB were the field leaders for the study.

An important component in the study and management of the Great Lakes as an "ecosystem" is tributary loading. In the past, evaluation of these loadings has been confusing and the dynamics of the system (transport and related processes) not well understood. In order to redefine the monitoring program, the systematic development of a general methodology for monitoring and load computations was undertaken on the Nith and Grand rivers.

Technical Operations provided field support for the two main issues of the study: tributaries and non-point sources of pollution. The field program research investigated and evaluated data with respect to the following parameters:

1. Spatial variability in the cross-section
2. Seasonal variability at a site
3. Pollutant transport modes (dissolved and suspended)
4. Load distribution within sediment particle size
5. The relationship of concentration versus particle size
6. Point versus non-point load mixes
7. Stable versus event (storm) load response
8. Temperature, pH, conductivity and DO

These parameters will be related to suspended sediment phosphorus and metal contamination for the development of systematic monitoring methodology and load evaluation.

Technical Operations field support entailed extensive sampling, centrifuging, sounding and drogue tracking along with all necessary field logistics needed for the safe movement and operation of vehicles, boats and trailers, etc.

A trailer site base camp was established at Ayr on the Nith River and will be utilized for similar studies for the next three years. This functional base camp provided the study with a primary sampling site and lab space for analysis. Research on the two watersheds was conducted

between June and November and is planned to be continued for the next few years.

AYR SITE

Site evaluation plus logistical support from June to December: June 7; July 19, 20; September 5, 6; November 6, 20, 21; December 13

Biweekly sampling from July to November: July 5, 19, 20; August 1, 28, 29; September 13, 25; October 9, 10, 12, 24, 25; November 6, 8, 14, 22

An operational field lab was initially set up in September utilizing the TOS 5-ton truck and was eventually expanded and moved to the now existing trailer base camp. A contract "memo of agreement" was negotiated between the land owner, Mr. Walter Bildstien and NWRI for the use of his property, bridge, barn/garage and hydro power. The agreement also included provisions for necessary modifications to the bridge, barn and garage. The existing hydro in the garage and barn used for equipment storage was upgraded to a 75 amp service to facilitate an electric welder. Extensive welding to the bridge superstructure plus the addition of a large I-beam was needed to ready the site for year round sampling. These bridge modifications now provide researchers with a stable platform and trolley needed to operate heavy equipment such as current meters, Benthos, camera, etc., and other sampling equipment across the flow of the river. An estimate for future structural work to the bridge abutments was also provided to Mr. Bildstien.

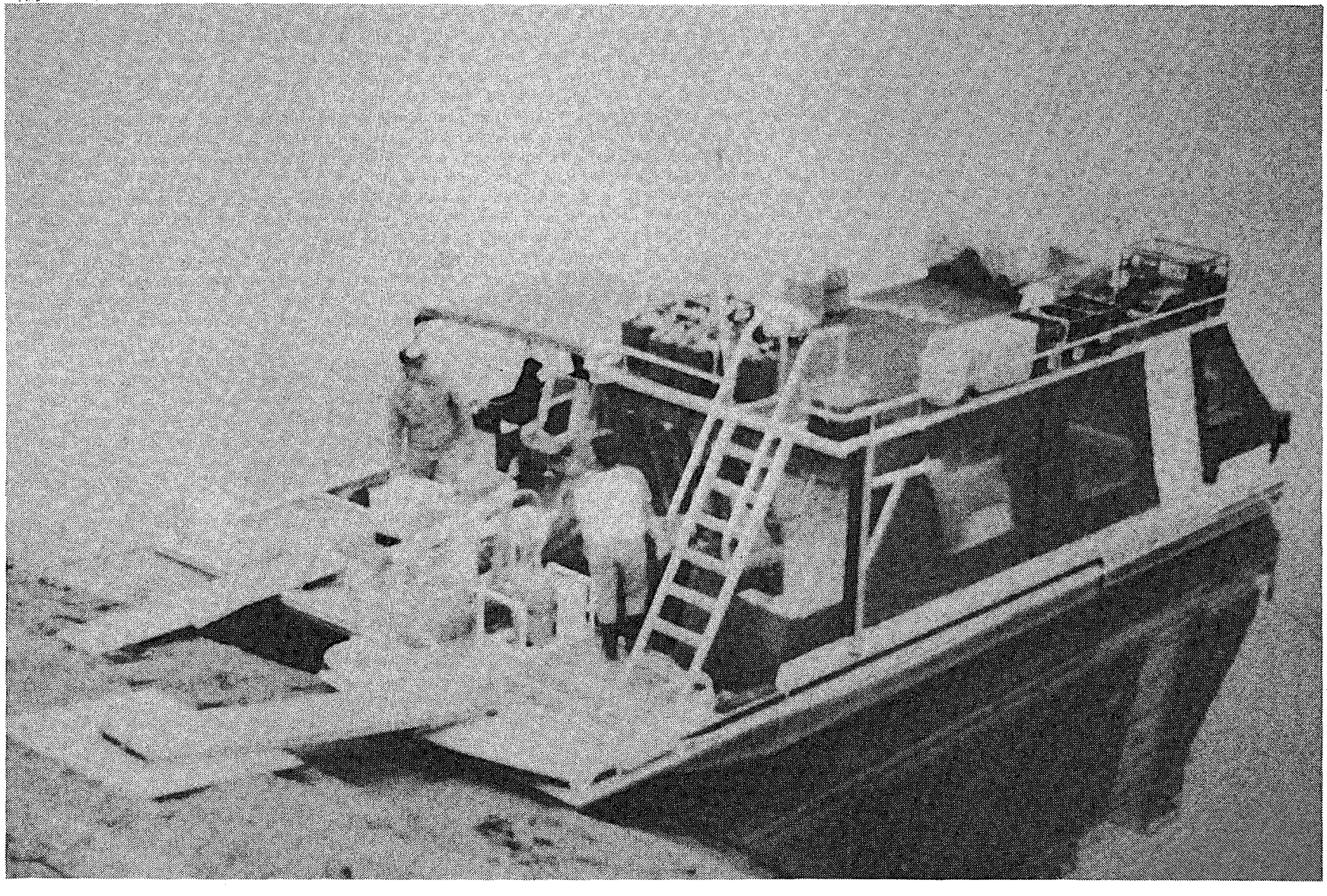
Two days of method evaluation was conducted on the Nith River for Dr. Petticrew. Shipeks and/or diver cores were collected at several sites to characterize bottom profiles. Dr. Petticrew's research was confined to a 6 km stretch of the Grand River from the Newport Bridge west. She was looking at particle size structure of suspended sediment in the water column over a series of different hydrological conditions in the Grand River, trying to ascertain change of this structure (size of flocculation) at a fixed point and as a water parcel moved downstream over the 6 km reach. Because the suspended sediment floc (made up of fine grain particles aggregated together) have the ability to absorb contaminants and nutrients, understanding settling structure, deposition behaviour, fate and delivery will be very important in predicting the movement and location of sediment transported pollutants.

In October, reconnaissance was carried out on the Grand River just downstream of the Ox Bow west of Brantford. This entailed surveys needed to establish and define Dr. Petticrew's research area on the river that would be studied over the next several weeks. Working from a Boston Whaler, current speeds, bottom topography and water depths were measured along several kms of the river downstream from the Newport Bridge. Current measurements were calculated by tracking oranges that simulated surface drifters along with small shop-made drogues with plastic sails set at approximately 1-metre depth. Using an echo sounder in conjunction with a measured and marked taut line strung across the river, 12 cross-sectional bottom contours were established over the 6 km

study area. These cross-sections were flagged using marker stakes along the river banks and were later used for more current measurements and spot water sampling. Fluctuating river water level data, needed for the calculation of water volumes and flow rates, were also recorded at the Newport Bridge by affixing a staff water level gauge to the pier of the bridge.

Most of Dr. Petticrew's experiments were conducted at the Newport Bridge transect where the 24' survey launch PUFFIN was utilized for the daily sampling regime. The PUFFIN proved to be ideal for the task, providing a stable, comfortable and protective work station housing the personnel and sampling equipment necessary for the all-day intensive sampling routines. This was especially true on the main sampling day that followed a major rain event when the effects of the rising limb of the storm could be observed and Dr. Krishnappan and Bob Stephens--both of RAB, were onboard to operate the portable Malvern particle size analyzer simultaneously with Dr. Petticrew's photo-based machine. Also at this time, Ian Droppo of RAB collected water samples and current measurements from the Boston Whaler trailing on a line 50 ft. astern of the PUFFIN.

Exceptionally fine fall weather was experienced at the right times during Dr. Petticrew's input to the research study. This, in combination with problem-free field work, led to the successful completion of her scheduled program.



ATHABASCA RIVER BOAT

ATHABASCA RIVER

RRB STUDIES 83037, 83038, DR. B.G. BROWNLEE, DR. R.A. BOURBONNIERE

Sampling on the Athabasca River began as in investigative study in 1989 and continued into 1990. This study was designed to generate a predictive model which can be used to investigate options for the management of the presence, pathways and effects of polycyclic aromatic hydrocarbons (PAHs) which may be released from existing and planned oil sands development. These studies will also help in the evaluation of the impact of such developments compared to that of other existing and planned upstream industrial activities such as pulpmills.

RRB Study 83037 for Dr. B.G. Brownlee involved 2 sampling periods. The first was a winter sampling--February 21 - March 18, of the Athabasca River from an area upstream of the oil sands plants to the delta as well as samples on the Peace and Slave rivers. The second sampling period was a low flow summer period--August 16 - September 7, of the Athabasca River from Hinton to the delta as well as the Peace River. This study was supported by Messrs. S.B. Smith and E.H. Walker, TOS, RSD and Dr. B.G. Brownlee and Ms. G.A. MacInnis, RRB. Mr. R. Crosley, Water Quality Branch, Calgary was involved in the winter sampling trip and Dr. W.G. Booty, RRB was present for the downriver portion of the summer trip.

On the winter sampling trip, samples were collected at mile 16, 34, 82 and 117 on the Athabasca River, at Carlson's Landing on the Peace River and at Fort Smith on the Slave River for Seston-raw water and centrifugate, major ions, toxicology, pentane extraction, chlorophenols, adsorbable organic halogen (AOX), millipore can extraction (base/neutral and acid fractions for ecotoxicology and base/neutral and acid fractions with an internal standard of surrogate compounds), dissolved organic carbon, suspended sediment and bottom sediment. Suspended sediment samples were collected from a mid-channel site at all sample sites with the exception of mile 82 where only raw water was collected and at mile 34 where 3 sites were sampled on a transect across the river. Samples were collected using Alpha Laval centrifuges set up in a portable shelter. Due to the clarity of the water, it was necessary to run the centrifuges for 20 to 24-hour periods to ensure the collection of a suitable sized suspended sediment sample for analysis.

Two snowmobiles and a trailer shipped to Fort McMurray were used to gain access to the sample sites from the winter road which is the only means of access to Fort Chipewyan and Fort Smith other than by aircraft during the winter months. This road is only open from mid-December to mid-March.

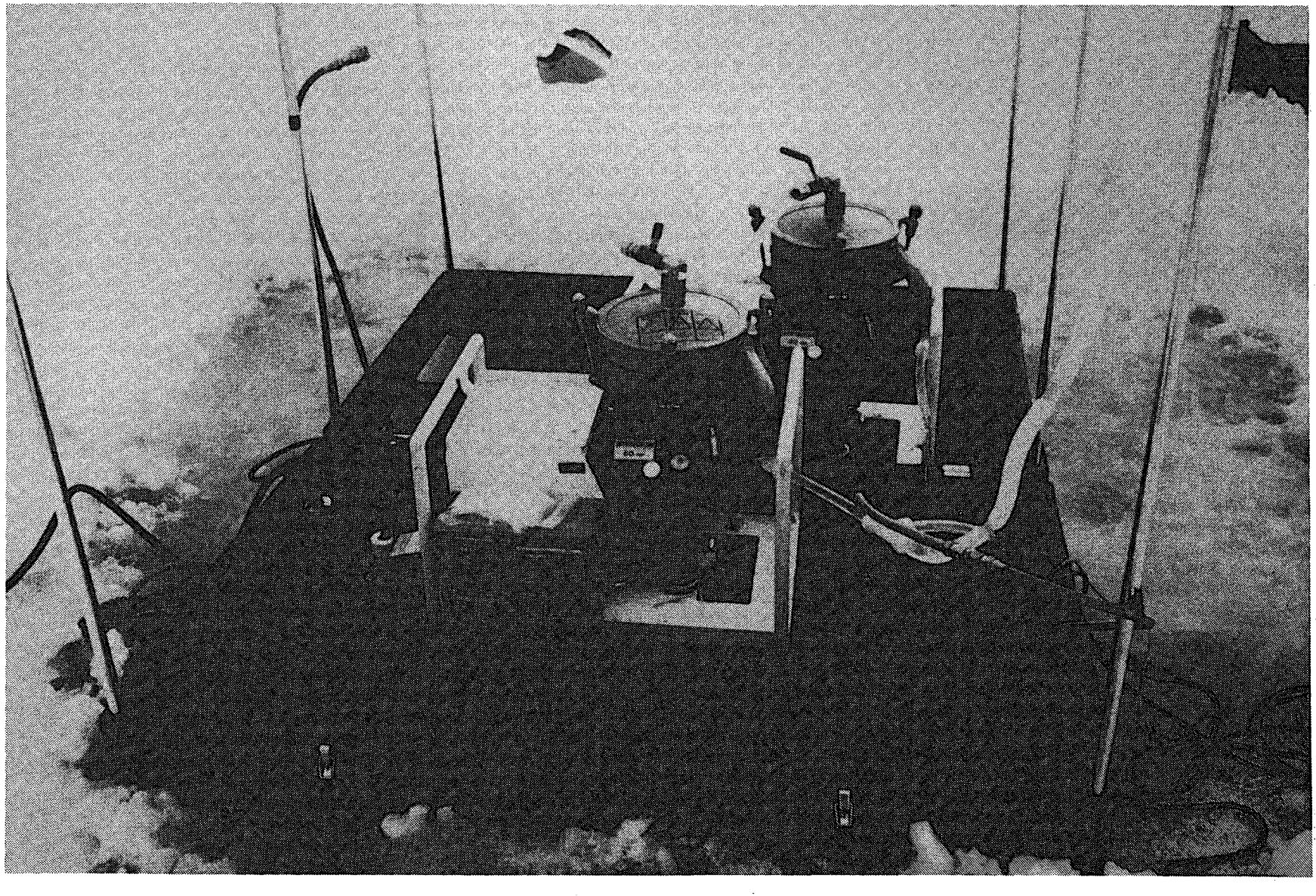
The summer sampling trip--August 16 - September 7, involved sampling of the Athabasca River from Hinton to the delta. Full-scale water sampling, Seston-raw and centrifugate, major ions, toxicology, chlorophenols, AOX, millipore can extractions, dissolved organic carbon, suspended sediment and bottom sediment was done at sample sites upstream of Hinton, at the Berland River junction (95 km downstream from Hinton), the Vega Ferry Crossing--km 352, at Athabasca--km 550, upstream of Horse River at Fort McMurray, at mile 33 downstream of Fort McMurray, mile 82 and at mile 116. Three stations were sampled on a transect at each site--left bank, centre and right bank. At mile 33, 5 stations were sampled on the transect. One site was sampled on the Peace River at Carlson's Landing with only two stations being sampled. Hands-on instruction was given to Water Quality Branch, Water Survey of Canada and Department of Indian Affairs and Northern Development personnel at the Peace River site to enable them to establish their own sampling regime using similar equipment and techniques.

Sampling for chlorophenols an AOX was also done at five stations on a transect at all sites as well as sites at km 1, km 20, km 45, km 132, km 177, km 235 and km 438. Alberta Environment personnel were present for sampling at the upstream of Hinton site to the site at km 177. This will provide a comparison of results from several agencies.

RRB Study 83038 for Dr. R.A. Bourbonniere also involved two sampling periods--May 18 - June 1 and September 7 - September 21. This study was also supported by Messrs. S.B. Smith and E.H. Walker, TOS, RSD and Dr. R.A. Bourbonniere. Ms. A. Koffeyberg, RRB participated in the spring sampling trip and Mr. J. Lee, RRB participated in the summer trip. This study involved sampling major tributaries of the Athabasca River from upstream of Fort McMurray downstream to the Firebag River at mile 83. The Athabasca River was also sampled downstream of several of the major tributaries and at a control station at Athabasca which is upstream of all tar sand deposits.

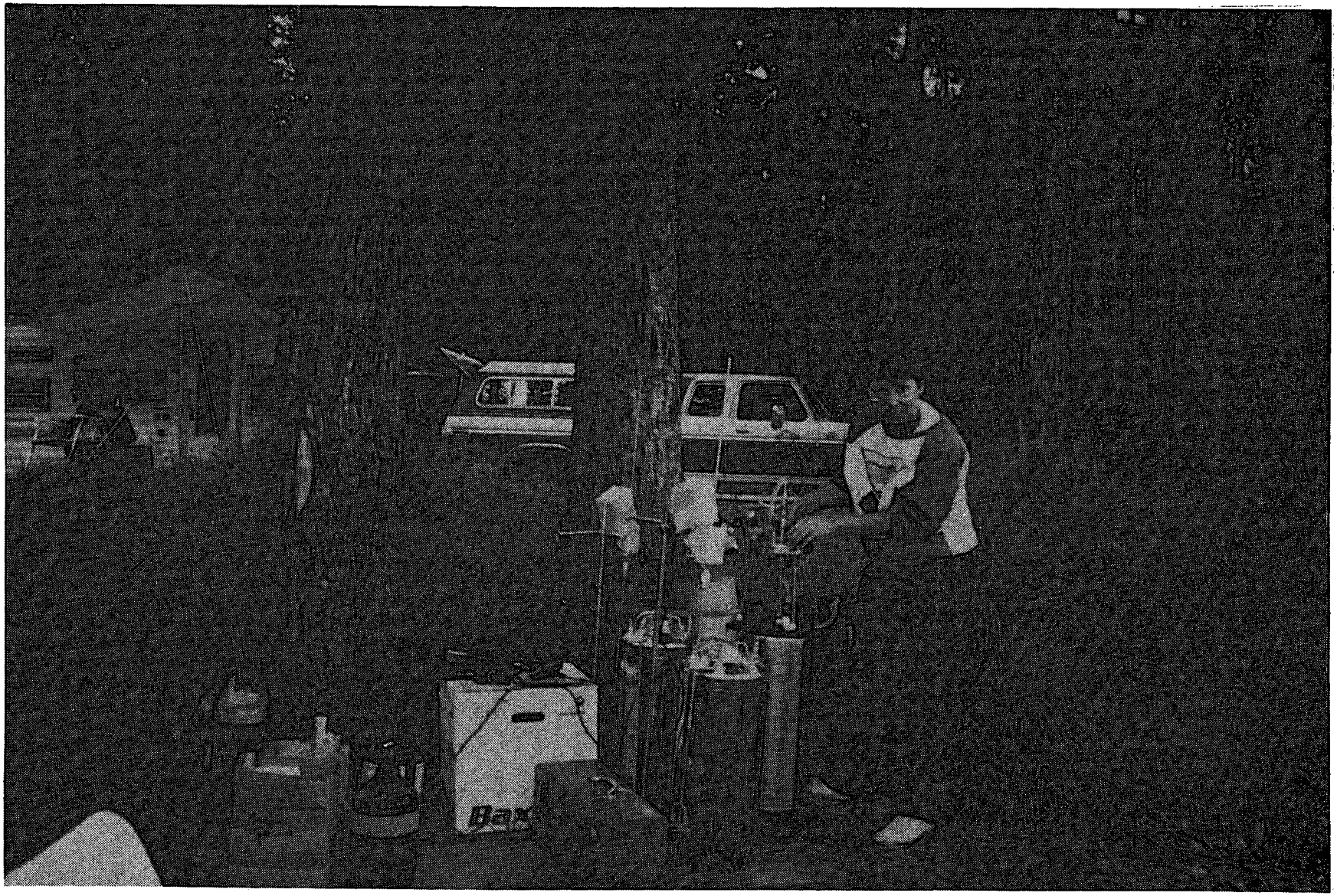
During the spring sampling period or high flow period, samples were obtained from the Clearwater River, Poplar Creek, Steepbank River, MacKay River, Muskeg River, Firebag River, Athabasca River above the Horse River, a five-station transect at mile 37 and a site at mile 82. Samples were obtained for Seston, POC, pH, conductivity and turbidity--raw and centrifuged, millipore can extraction, suspended sediment and bottom sediment.

On the summer or low flow sampling trip, samples were collected from the Clearwater River, Horse River, Athabasca River above the Horse River, a five-station transect at mile 37, the Steepbank River, Beaver Creek, Poplar Creek, Muskeg River, MacKay River Ells River, Hangingstone River, Firebag River as well as from the sedimentation pond, Mildred Lake and the Beaver Creek Reservoir on Syncrude Canada property. Sampling was the same as that taken in the spring.



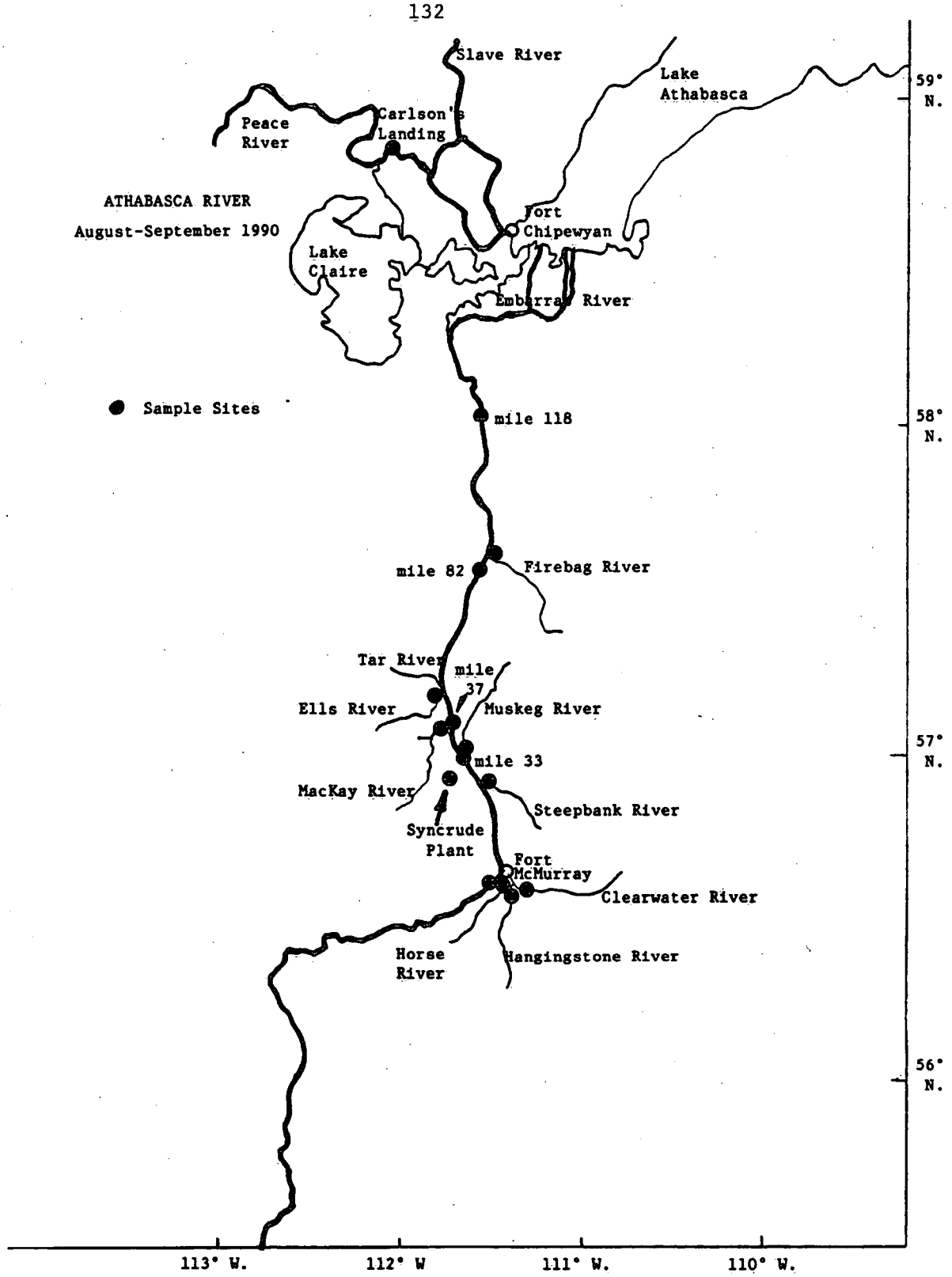
WINTER SAMPLING

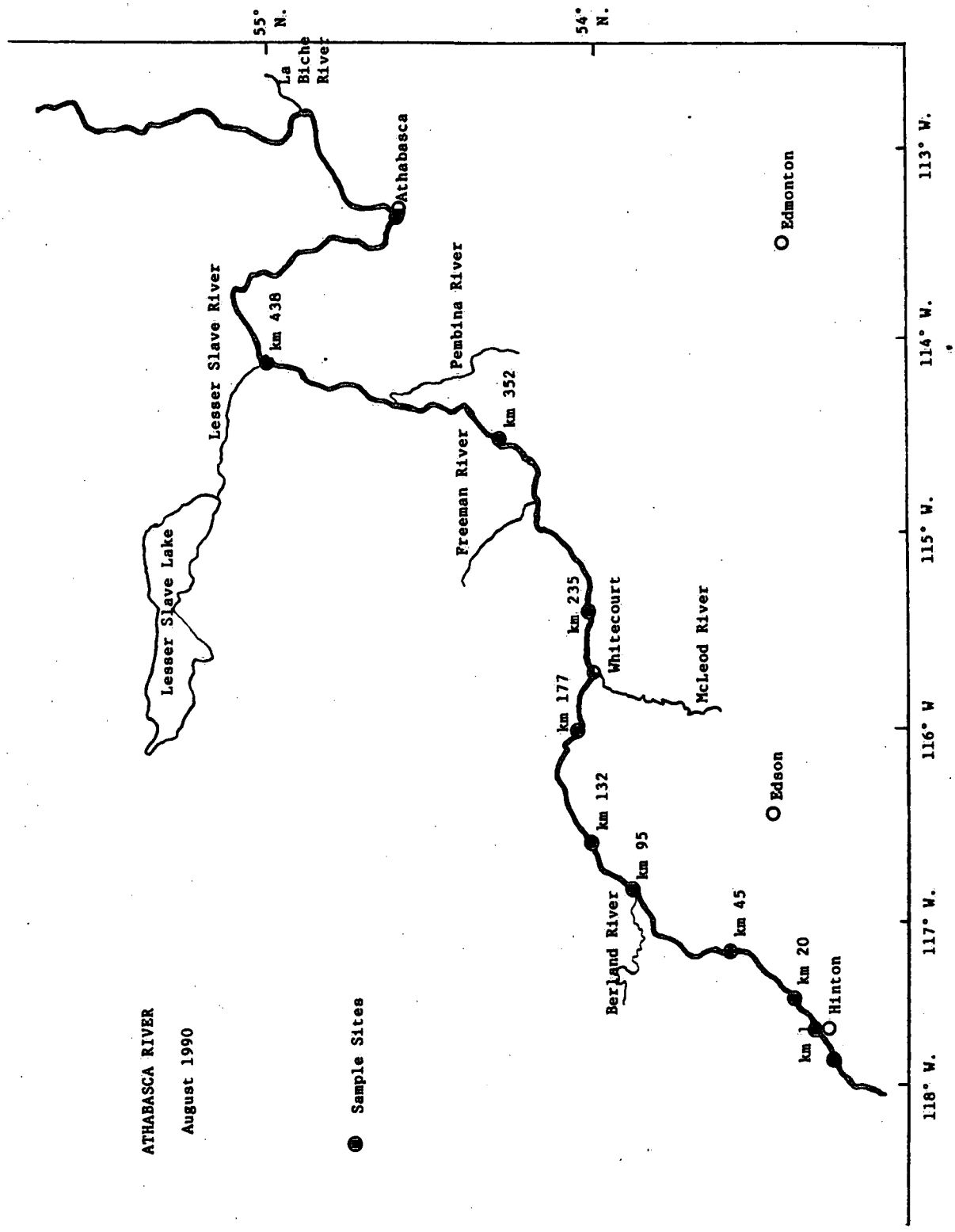
ATHABASCA RIVER, ALBERTA



MILLIPORE CAN EXTRACTION

ATHABASCA RIVER, ALBERTA


Slave River
Lake Athabasca
59° N.
Peace River
Carlson's Landing
ATHABASCA RIVER
August-September 1990
Fort Chipewyan
Lake Claire
Embarras River
Sample Sites
mile 118
58° N.
mile 82
Firebag River
Tar River
mile 37
Ells River
Muskeg River
57° N.
mile 33
MacKay River
Steepbank River
Syncrude Plant
Fort McMurray
Clearwater River
Horse River
Hangingstone River
56° N.
113° W.
112° W
111° W.
110° W.


ATHABASCA RIVER
August 1990
Sample Sites
55° N.
54° N.
118° W.
117° W.
116° W
115° W.
114° W.
113° W.
La Biche River
Athabasca
Lesser Slave River
km 438
Lesser Slave Lake
Pembina River
km 352
Freeman River
km 235
Whitecourt
McLeod River
km 177
km 132
km 95
Berland River
km 45
km 20
km
Hinton
Edson
Edmonton

GROUNDWATER

RRB STUDY 83043, K. NOVAKOWSKI

Technical Operations supported the ongoing field programs of the Groundwater Group during the field season. Support consisted of half a person/year spread throughout the entire year by various technicians as well as the necessary vehicles and other field equipment to operate two nearby field sites.

The main field site at Clarkson, consisting of 19 boreholes, was used to study the horizontal movement of groundwater in fractured rock. Six new boreholes were drilled in May to complete a 25-hole grid. New pressure sensors and packer systems were built for all the holes and an automatic data acquisition system was put in operation by July. The site was maintained and monitored throughout the balance of the year.

A new field site was begun near Freelton where nine holes were drilled on Hamilton Conservation Authority land in mid-July. This study is similar to Clarkson's except that it will be looking at the vertical movement of groundwater in fractured rock. The drilling and preliminary testing was completed.

Two trips were made to Navy Island in the Niagara River during the year to monitor six boreholes that have been in use for the last four years.

ICE JAMS

RRB STUDY 83053, DR. S. BELTAOS

The Ice Jams Study is a project of the Rivers Research Branch under the direction of Dr. S. Beltaos. During field operations, W. (Bill) Moody of RAB Hydraulics was the Field Project Leader. This was the 4th of a 5-year field investigation of the Restigouche River on the border between the provinces of Quebec and New Brunswick.

For the 3rd year, Technical Operations Section was involved in surveying cross-sections along the length of the Restigouche (3 km). This year, ten (10) sections were surveyed. This can be described as running level from bench marks to the start of the line, cutting line to the water line when necessary, measuring the distance and depths on the line using a Distomat and sounder and recording for future use. On two of the cross-sections, current metering was done.

Vehicle No. 86-035 was used for ground transport and the 26-ft. canoe utilized for water transportation. For the first time, the Distomat DI-OR 3000, bought by Technical Operations, was used with the Wild T-2.

Out of eleven days allocated for the work, four were taken for travel to and from the site and seven for surveying from May 22 to June 1.

RESEARCH & APPLICATIONS BRANCH

QUALITY ASSURANCE

RAB STUDY 84024, K. ASPILA

Technical Operations Section was involved with support for the Water Quality Assurance Project during the field season consisting of a technician, vehicles and centrifuges needed on three occasions to collect and process water samples.

Large-volume water samples were collected primarily from a greenhouse roof in Grimsby and also from Hamilton Harbour, the Burlington Sewage Plant and the groundwater wells of the Waterloo water supply. The first step in processing these samples was centrifuging out particulate matter which was carried out by Technical Operations staff. The remaining procedures were conducted by RAB personnel.

Eventually these samples will be used across Canada as standards and blanks by analytical laboratories.

RESEARCH SUPPORT DIVISION

HAMILTON-SCOURGE JASON PROJECT

In October 1989, the City of Hamilton and the Jason Foundation approached CCIW--specifically the Research Support Division, to ask for help in the form of a Project Manager who would be responsible to co-ordinate the various agencies involved. Mr. F.H. Don was assigned to the project in November 1989. The work involved the installation and maintenance of a mini-ranger Falcon positioning system for the site; the plan and execution of a sidescan sonar survey of the site prior to arrival of the barge; organization and loading of the barge; supervising the anchoring of the barge over each wreck; co-ordination of the daily operations of the barge such as galley, power, support tug, etc.; scheduling and supervising a shuttle service between Port Dalhousie and the barge; organization of emergency procedures for fire, abandon ship and medical evacuation; safety procedures; meetings with local organizations to provide services to the project and finally to unloading the barge and cleaning up.

CCIW has a history of assisting the City of Hamilton and the Royal Ontario Museum with the HAMILTON and SCOURGE. In 1975, after discovering their exact location, the CSS LIMNOS was utilized to obtain sidescan sonar records and later that same year TROV--a tethered remotely operated vehicle, recorded the first video pictures ever seen of the Hamilton. CCIW also assisted the Cousteau Expedition in 1979 but was not asked to participate during the 1982 National Geographic dives. CCIW and, in particular, the Research Support Division has a national reputation for technical expertise in the marine field, planning and operating large-scale programs with great success. It was this past involvement and reputation which caused CCIW to again play a leading role in the 1990 survey.

The HAMILTON-SCOURGE Jason Project 1990 was an outstanding success which involved a combined effort by the City of Hamilton, the Jason Foundation, Wood's Hole Oceanographic Institute, Turner Broadcasting, Electronic Data Systems, McKeil Marine and co-ordinated by CCIW. During the period April 30 - May 13, the survey photographed, photo-mosaiced, videotaped, laser imaged and mapped the 1812 warships HAMILTON and SCOURGE which sunk in August 1813 six miles north of Port Dalhousie in Lake Ontario. This survey had a dual purpose: first, to completely document the ships under the direction of Chief Archaeologist, Dr. Margaret Rule of Portsmouth, England and "Mary Rose" fame. The second, under the direction of Dr. Robert Ballard of "Titanic and Bismark" fame, to provide an educational stimulus to thousands of school children watching live telecasts transmitted from the site to fourteen auditoriums located throughout North America.

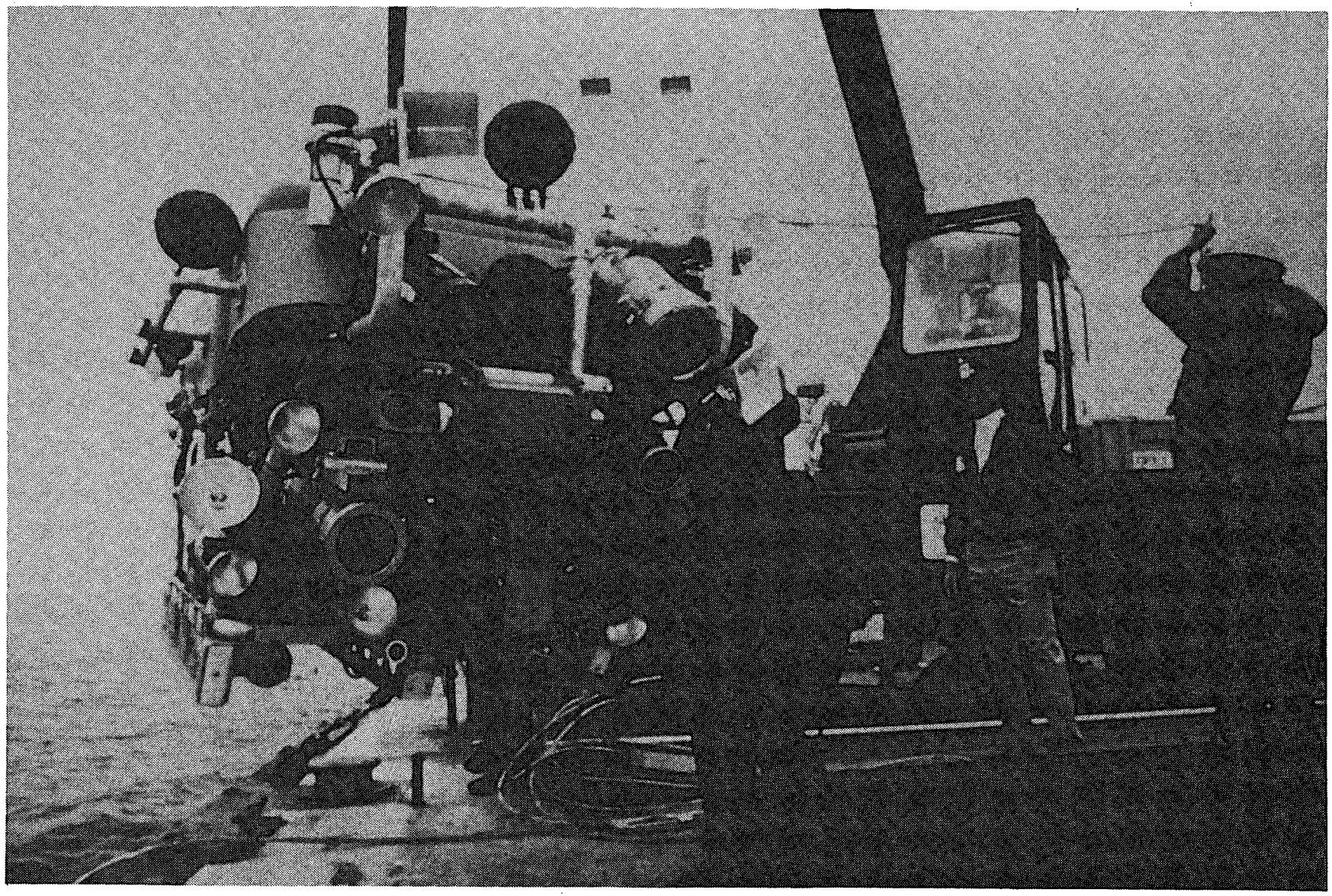
The HAMILTON-SCOURGE Jason Project brought a large amount of favourable publicity to CCIW. During each of the live telecasts (five daily), CCIW was given credit for its participation and once daily CCIW was highlighted during a live show with an on-deck interview detailing our involvement in the project.

During the program telecasts, students watched background video on the Great Lakes and the threat of pollution. These videos highlighted the studies of four scientists from CCIW and on one occasion Mr. M.N. Charlton appeared live with Dr. Ballard during the five daily telecasts as a guest speaker answering questions from the audience. Most local newspapers highlighted the involvement of CCIW playing a major role in an international project.

The barge ERIE WEST, accompanied by the tug W.N. TWOLON, was anchored over the HAMILTON for ten days and the SCOURGE for seven days. At both sites, a four-point mooring system was used utilizing five-ton anchors moored 1700 ft. from the barge. This anchorage system withstood two storms during the project: the first, a northeast wind of 25 - 30 kts. with 14-ft. seas and the second, a west-southwest wind of 40 - 50 kts. with 10-ft. seas. During the latter storm, everyone stayed onboard the barge for the night since transfer to a shuttle tug and transport to shore would have been too dangerous. JASON, the underwater vehicle, performed flawlessly, entering the water every day at 0930 and surfacing at 1800. During one storm, JASON stayed on the bottom for 36 hours rather than risk damage during retrieval.

A total of 62 live shows were transmitted from the barge and an approximate total of 250,000 students watched from 14 locations throughout North America. The highlight of each show was the opportunity for one of the students to "fly" JASON from a remote control panel via the satellite network. The conclusion of the project culminated in a live two-hour TV National Geographic Special on Sunday evening May 13 which was aired by the Turner Broadcasting Network but was unfortunately not picked up by any of the Canadian networks.

After successful completion of the project, a reception hosted by the City of Hamilton at Hamilton Place acknowledged CCIW with the presentation of a plaque for its participation both past and present.



J A S O N

ST. LAWRENCE RIVER/CORNWALL

RSD STUDY 86031, H. BIBERHOFER, IWD-OR

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

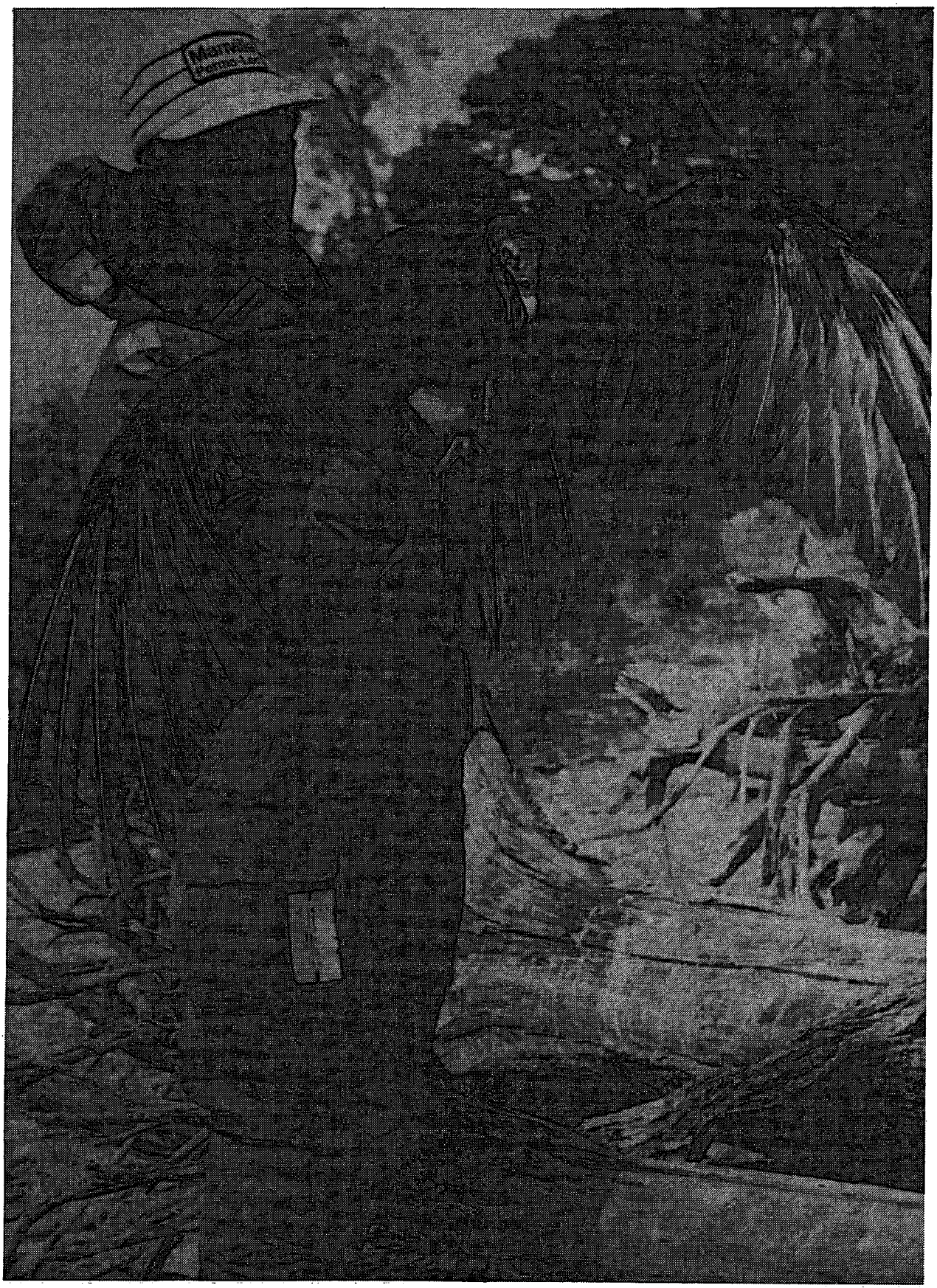
During the field season, five surveys were conducted on the St. Lawrence River at Cornwall. Before the surveys were begun, 5 SeaStar moorings were deployed on both sides of Cornwall and St. Regis Islands in order to collect representative samples of all waters as they pass through the various channels.

During each survey, SeaStar extractors were deployed and retrieved from the 5 Seastar moorings and at several Coast Guard navigation buoys from Cornwall Island to the east end of St. Regis Island. Water samples were collected at all extractor sites every cruise to better understand the flow of the river as it passes through the Cornwall area.

During the May survey, current measurements were conducted with Water Survey of Canada personnel to establish the flow rates of the various channels through the islands in the area.

During the September survey, freshwater clams were collected from all stations throughout the area and from below the Saunders Hydro Dam (Ontario Hydro).

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



CANADIAN WILDLIFE SERVICE

CENSUS PROJECT

CANADIAN WILDLIFE SERVICE

RSD STUDY 86031, DR. V.W. WESELOH

Technical Operations Section continued to support the Canadian Wildlife Service (CWS) field program on the Great Lakes and connecting waterways.

The purpose of this program 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 studies were undertaken:

ANNUAL HERRING GULL MONITORING

The objective of this study was to determine spatial and temporal trends of levels of contaminants such as organochlorines in Herring Gulls and their eggs collected from the Great Lakes and surrounding waterways. Ten of the annual sites as well as 3 additional sites in Lake Huron were monitored for contaminant levels in eggs. Further intensive study was done in Lake Huron where gulls from 25 - 30 sites were examined for population size, breeding success and/or diet. Biological parameters (bioeffects) of the nesting Herring Gulls were determined and related to contaminant levels.

WINTER FEEDING STUDY OF HERRING GULLS

Late winter field work is planned for February 1991. Herring Gulls move out to the ice edge during winter. In Eastern Lake Ontario, this takes them to the vicinity of Pigeon and Main Duck islands. Pellet (regurgitations) collections will be made from gulls that winter in these areas. Two staff from the TOS Dive Team with an inflatable raft, aided by a CWS biologist overhead in a helicopter, will make these collections.

DEFORMITIES IN DOUBLE CRESTED CORMORANTS IN THE GREAT LAKES

The objective of this co-operative CWS/U.S. Fish & Wildlife Service project was to determine the extent and cause of congenital anomalies (deformities) in Cormorants on the Great Lakes. Cormorant eggs and various biological parameters were collected from colonies in each of the Great Lakes and from control sites off the Great Lakes.

A census of approximately 20,000 Cormorant nests and 22,000 young Cormorants was taken in 1990. All of these were examined for deformities and only 4 were found. Population levels have increased approximately 25% since 1989. Contaminant levels were assessed in the eggs and related to the rates of deformities in each colony. Rates of deformities in the Great Lakes were elevated over off-the-lake areas and rates were particularly elevated in the Green Bay area of Lake Michigan.

CENSUS OF GREAT LAKES FISH-EATING BIRDS

The object of this joint Canada/U.S.A. study was to count the nesting populations of fish-eating birds on the entire Great Lakes. This was the second year of a three-year study. A previous census was completed in the 1970's and is now very much out-of-date.

Fish-eating birds in general are good indicator species of water quality. These censuses will help assess the effects of remedial actions on the fish-eating bird populations of the Great Lakes and provide important information on changes in population levels of the 8 - 10 species which nest there.

Intensive work was done on lakes Erie and Ontario this year. A major storm on 7 - 9 May stranded a working crew on Pelee Island. Work had to be rescheduled to 13 - 14 May with slightly different work crews.

HOLLAND MARSH

The objective of this 2 - 3-year study is to determine the effects of agricultural pesticides used in the Holland Marsh vegetable growing area on wildlife inhabiting the immediate vicinity or downstream wetlands. Red-winged Blackbirds and various amphibians were studied in 3 wetland areas utilizing a canoe and/or inflatables to move about the marsh.

CONTAMINANT LEVELS IN WATERFOWL FROM THE CANADIAN GREAT LAKES

The objective of this joint Federal-Provincial study was to determine the level of toxic chemical contamination in waterfowl from Ontario, particularly those from the Canadian Great Lakes. Waterfowl were collected in the summer and autumn from 8 sites in 1988 and from 8 - 15 additional sites in 1989-90. Collections were made this year for the third and final year, focusing primarily on sites in the far north. CWS relied mostly on the Ontario Ministry of Natural Resources staff for these collections.

CONCLUSION

The largest percentage of the CWS field work that Technical Operations supported was directed toward the Herring Gull and Cormorant studies. Also, an intensive three-week survey was carried out on Manitoulin Island and Georgian Bay collecting data to assess population changes during the last decade.

Scheduling field trips was critical because of varying ice conditions throughout the Great Lakes in the early part of the program and the two-week variation in nest building and egg laying throughout the colonies. The field program, although short in duration (April - July), was very intensive. A two field party system was used again for monitoring the many colonies that are spread out over the Great Lakes and connecting waterways. Because of the nesting habits of different species, some colonies had to be visited twice.

The two work boats (THUNDERBIRD and MASON #8) were utilized again throughout the season. They both performed well and are planned to be used again in 1991 for similar work. Over the intensive three-month program, several thousand kms were travelled by land and by water to reach the survey sites. Although the field program required this large amount of trailering and boating in a variety of conditions, it was again successfully completed without injury or damage.

Similar studies are planned for the CWS 1991 field program.

PRODUCTIVE CAPACITY OF FISH HABITAT

RSD STUDY 86034, V. CAIRNS, GLLFAS

This project was an attempt to investigate the factors which affect fish and fish habitat associations in Great Lakes areas of concern thereby addressing the terms of the 1988 Great Lakes Water Quality Act Annex 2. The long-term objectives of this work include:

1. To formulate and test hypotheses concerning the links between fish habitat features and the success of fish populations in nearshore Great Lakes ecosystems, especially Hamilton Harbour, Bay of Quinte and Severn Sound

2. To develop habitat assessment and analysis methods (based on GIS technology) which integrate biological, chemical and physical components of the ecosystem

3. To develop predictive models of fish habitat requirements in relation to fish production for use as management tools in the assessment of proposed changes to fish habitats throughout the Great Lakes

4. To evaluate fish habitat restoration methods

Technical Operations provided diver and dive equipment support to this project.

Field surveys were conducted in Severn Sound (August 20 - 24, 27 - 29), Hamilton Harbour (August 30 - 31) and Bay of Quinte (September 3 - 7). Sites surveyed corresponded to 100 m transects which had been electrofished in 1989 and again in the summer of 1990. Divers surveyed these transects to observe and characterize habitat. Of primary concern was macrophyte identification and density.

Divers swam 100 m transects and sampled at 10 regular intervals. An initial (anchor point) macrophyte was randomly chosen at each interval, identified and measured. From this "anchor point", the closest plant was identified and measured in four surrounding quadrats. Divers also provided approximate values for percent cover (integrated over each 100 m transect) along with any pertinent anomalies at each site.

COMMON-USER SUPPORT/OUTSIDE AGENCIES

RSD STUDIES 86032/86034

The purpose of this project is to provide logistic support equipment, instrumentation and field support (assistance) as resources permit 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 the Restigouche River in New Brunswick to Chain Lake in British Columbia. Equipment or support was given to universities, other services in Environment Canada (CWS, Long Point; EPS; WQB, Ottawa; NHRI, Saskatoon) and other government departments (DFO, EMR, etc.); provincial governments (B.C. Department of the Environment, B.C. Fish & Wildlife, Ontario Ministry of the Environment). Studies supported ranged from one day to one week's duration. Field support was provided to the following outside agencies as follows:

GLLFAS - Habitat Study (Grimsby), Lake Erie (Western Basin)
GLLFAS - Bay of Quinte, Lake Erie
Public Works Breakwater Inspection
McMaster University sample collection from Hamilton Harbour
University of Toronto sample collection from Lake Ontario
Centre Saint-Laurent mooring/sampling equipment loan
Centre Saint-Laurent vessel co-ordination with DFO
WQB-Ottawa equipment loan
WQB-Ontario Region water sampling Goulais River

Rigging Shop

Due to the number of requests for support in the field exceeding the number of staff on strength, the riggers spent more time in the field on scientific studies. The usual workload of maintaining all mooring equipment, buoys, generators, power tools, winches and various other pieces of research equipment was conducted whenever possible. The Rigging Shop was also responsible for delivery of boats and laboratory trailers to field stations, delivering scientific equipment to major ships throughout the Great Lakes and the St. Lawrence River, erecting towers, operating boats, heavy trucks and forklifts. Mr. S. Roberts filled a Term position in July and assisted in the Rigging Shop and on field assignments whenever required. J. Lomas was on Sick Leave since July.

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

Field Stores

Field Stores, which supplies most of NWRI with sampling equipment, was manned by Mr. W. Hunt on a full-time basis to issue and receive field gear. In conjunction with the Rigging Shop inventory, maintenance was conducted for all equipment on an as required basis. The daily scheduling of day-use vehicles for NWRI staff as well as DFO, EPS and National Water Quality Laboratory was conducted on a year round basis.

CLAM COLLECTION

WOLFE ISLAND

DIVING OPERATIONS

The Diving Operations Unit of Technical Operations Section provided national support to various scientific studies in areas of diver certification, inspections, installations and retrievals, sample collection, photography, television surveys with video documentation, equipment demonstrations/trials, search and recovery, lectures and diver training. The Diving Operations Unit supported 13 divers located at Burlington. A total of 550 hours (accident free) were logged in support of projects for: NWRI; Water Quality Branch, Ontario Region; Ship Division and Great Lakes Laboratory for Fisheries & Aquatic Sciences, Bayfield Institute. An additional 80 hours were logged during the pool training program.

A total of 75 hours were logged on MURV, the remotely operated mini-rover during the CCIW breakwater inspection for the Department of Public Works, Ottawa and the GLLFAS Habitat Program. MURV was shipped to Benthos Inc. for major repairs and will return to service with many additional capabilities for deep underwater work.

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 hosted by the Quebec Region on November 5 - 9 at Gaspé. Regional diving officers made amendments to the Departmental Diving Safety Directive and completed an equipment training dive at Parc Florrion.

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 sub-sea operations.

Projects supported during the field season included:

STUDY NUMBER	STUDY TITLE
82011	50 Point, Sediment Transport/Rukavina
82023	Amisk Lake, Hamilton Harbour/Murphy
82057	Peepers, Moira Lake/Nriagu
83012	Clam collection, Balsam Lake/Chau
83013	St. Lawrence River/Smith
85021	MURV, Hamilton Harbour/Rodgers

STUDY NUMBER	STUDY TITLE
86030	Rubber Tire Breakwall, CCIW/Skafel
86031	Water Quality Stations: Niagara-on-the-Lake, Ft. Erie, Wolfe Island clam collection, Wolfe Island/Cornwall
86033	Diver training Inventory and equipment maintenance Burlington Ship Canal/RSD Engineering HAMILTON-SCOURGE Jason Project
86034	CCIW breakwater inspection/MURV Support to DFO: Fish Habitat/Cairns/GLLFAS Fish Habitat/Fitzsimons/GLLFAS Hull inspections/Ship Division, MTSB Bottom fauna/Dermott/GLLFAS

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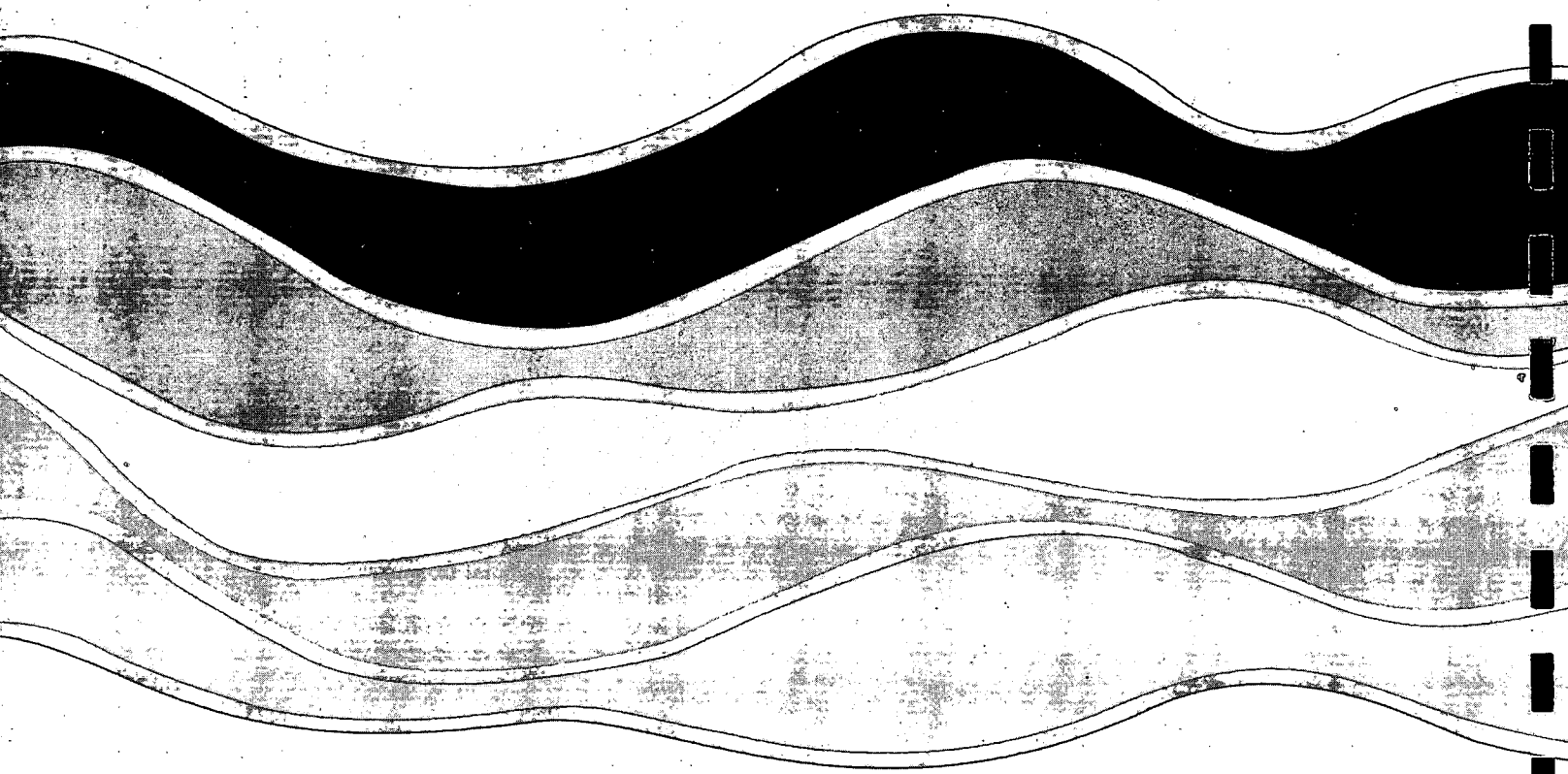

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