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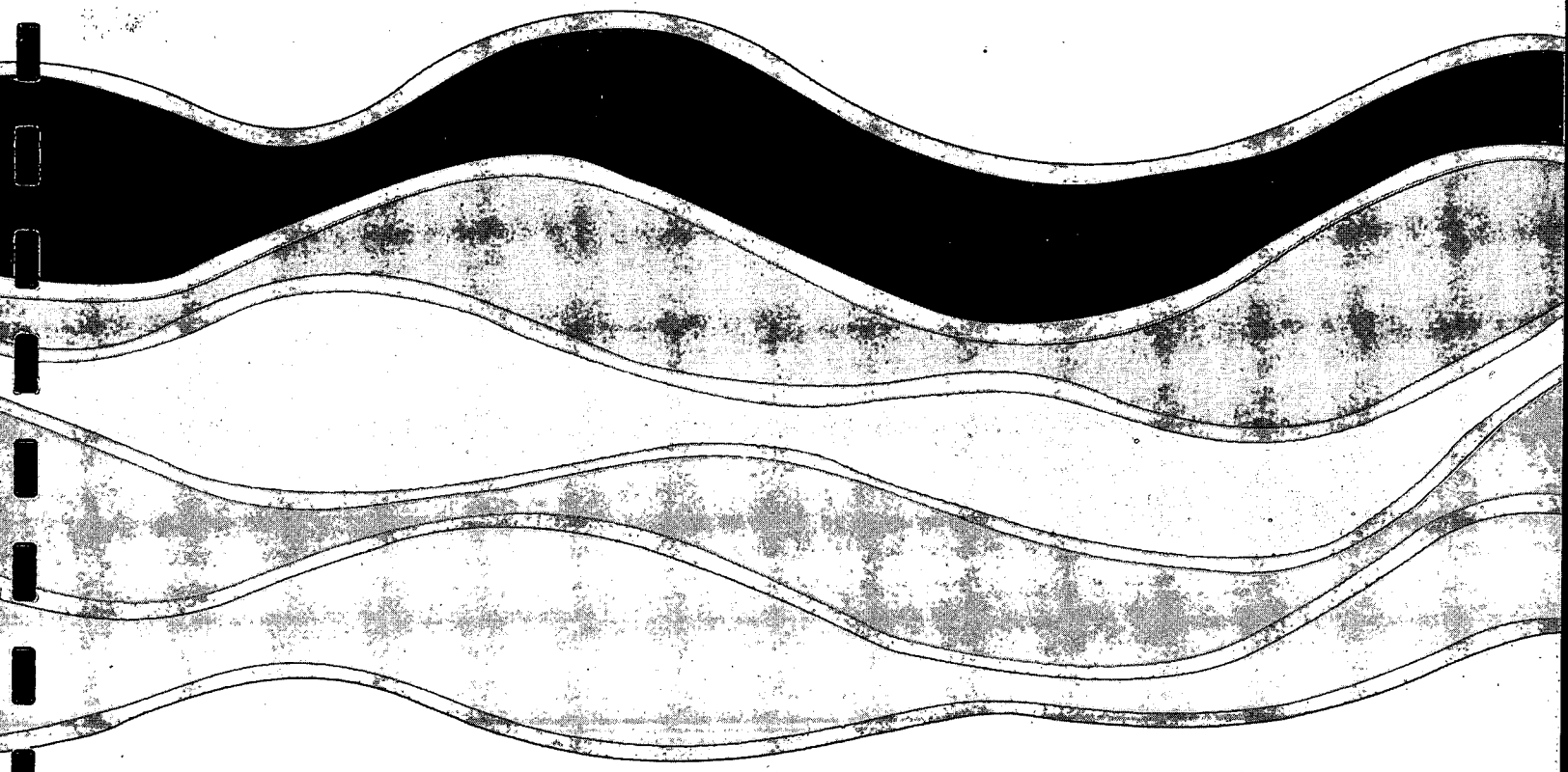
ACTIVITY SUMMARY

1992

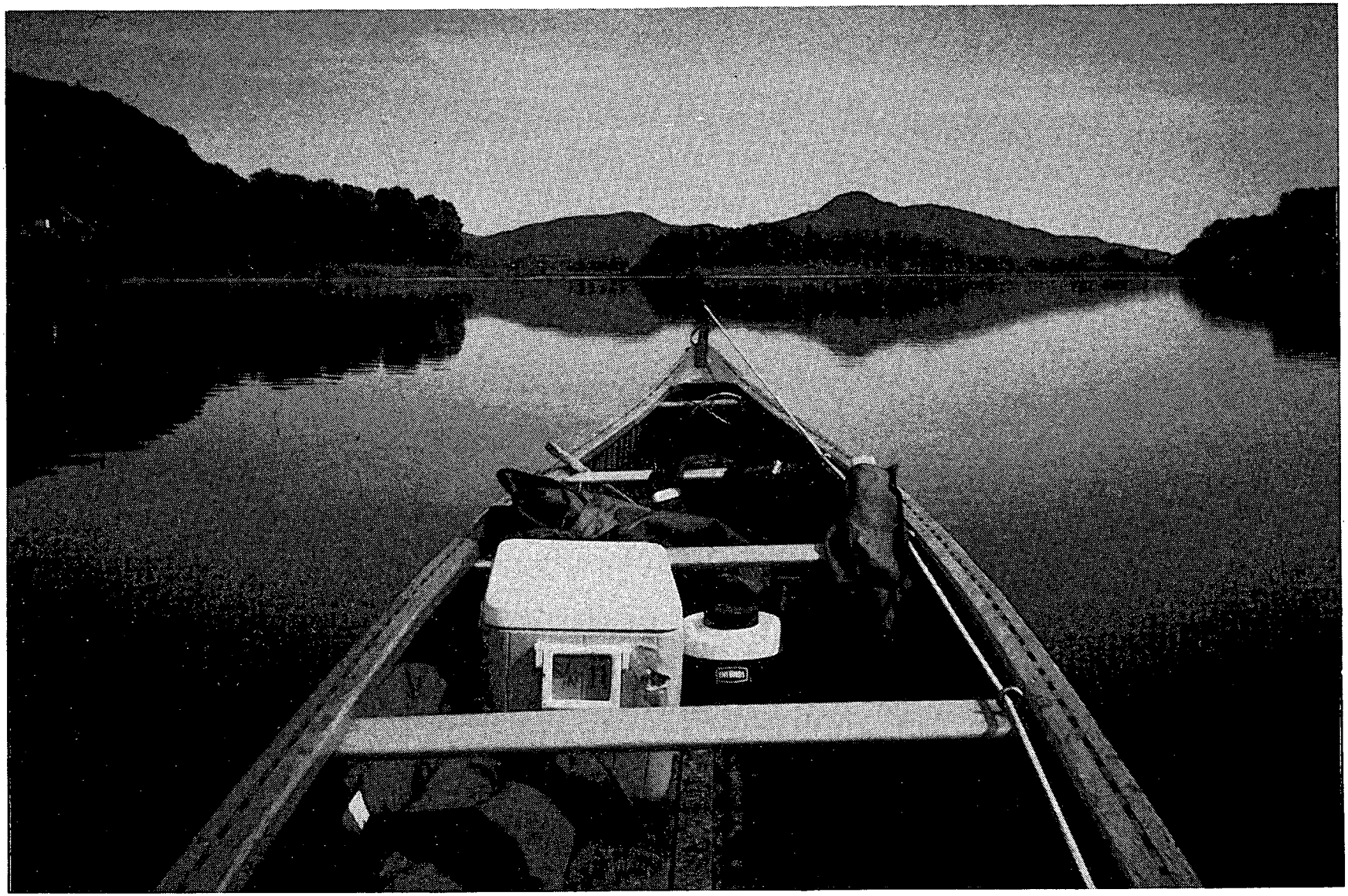
NATIONAL WATER RESEARCH INSTITUTE

INSTITUT NATIONAL de RECHERCHE sur les EAUX



1992
ACTIVITY SUMMARY

Technical Operations Section
Research Support Branch



RESTIGOUCHE RIVER

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INTRODUCTION

The Technical Operations Section of the Research Support Branch, National Water Research Institute has its headquarters at the Canada Centre for Inland Waters, 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 the country. This unusual opportunity, to work and gain valuable field-related experience in such a varied sphere of operation, develops within the section a vast storehouse of technical expertise.

The Diving Operations Unit is ever-expanding its capacity to give scientific programs the up-to-date technological support they require under water, including sampler and equipment installations, underwater construction and video documentation. Annual diver training and certification courses are also conducted to maintain a high level of competence among the Centre's divers.

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

Technical Operations was allowed to take several much needed staffing actions this year. Positions were filled which will enhance the section's technical capabilities and help meet future demands of the scientific community, especially in diving operations and rigging support.

This report is intended as an overview of the field activities of this section during the 1992 field season.

STAFF LIST

RESEARCH SUPPORT BRANCH

Director	J.D. Smith
Operations Secretary	S.R. Mitchell
Administrative Officer	J. McAvella

TECHNICAL OPERATIONS SECTION

Head P.M. Healey

Operations Officer, Field	M.R. Mawhinney
Operations Officer, Ships	B.H. Moore
Operations Officer, Ships/Field	S.B. Smith
Operations Officer, Diving	F.H. Don

SENIOR MARINE TECHNOLOGISTS

L.E. Benner	CWS, Groundwater
P.R. Youakim	CSS LIMNOS, Quinte
E.H. Walker	Athabasca River, Lake Athabasca, Groundwater, Severn Sound, CSS LIMNOS, St. John River
G.G. LaHaie	Turkey Lakes Watershed
Y. Desjardins	Restigouche River
J.A. Kraft	O-I-C CSS LOUIS M. LAUZIER, CSS LIMNOS, CSL SHARK-North Channel, Fraser River
K.J. Hill	O-I-C CSS ADVENT, Diving, Hamilton Harbour, Restigouche River, Athabasca River, Lake Athabasca
R.J. Hess	O-I-C CSS LOUIS M. LAUZIER, Turkey Lakes Watershed, New Jersey
B.L. Gray	Diving (AMM), Hamilton Harbour, Wolfe Island, Sault Ste. Marie

MARINE TECHNOLOGIST

M.F. Dahl	CSS LIMNOS, Sault Ste. Marie, Hamilton Harbour, Severn Sound, Diving

MARINE TECHNICIANS

R.D. Neureuther	CSS LIMNOS, Grand/Nith Rivers, Toronto
C.H. Talbot	On strength 23 April Kootenay Lake, Severn Sound, Midland, CSS LIMNOS, Diving
T.G.D. Breedon	Secondment from Materiel Management Section 22 July On strength 14 December CSS LIMNOS, Trent System
H.A. Lavoie	CSS LIMNOS Resigned position July

RIGGING UNIT

Foreman Rigger	C.J. Lomas on strength 20 January
Rigger/Vehicle	T.C. Gilliss (term 27 July)
Co-ordinator	On strength 16 November

NWRI FIELD STORES

Storesperson	Y. Desjardins

STUDENTS

D.A.D. Gilroy	CSS LIMNOS, Hamilton Harbour, Turkey Lakes
A.W. Purdy	CSS LIMNOS, Hamilton Harbour, New Jersey
C.J. Burgess	CSS LIMNOS, Hamilton Harbour, Trent System, Turkey Lakes
R.C. Brodie	CSS LIMNOS, Hamilton Harbour, Severn Sound

SHIPBOARD PROGRAMS

C S S L I M N O S

CSS LIMNOS
1992

	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
FEB	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
MAR	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 LAKE	31 ONTARIO	1 SURVEILLANCE	2 BIOINDEX	3 LAKE ONTARIO	4 CCIW
APR	5 CCIW	6 LAKE ONTARIO	7 SUSPENDED SEDIMENT	8 SAMPLING	9 CCIW	10 CCIW	11 CCIW
	12 CCIW	13 LAKE ONTARIO	14 MOORINGS	15 LAKE ONTARIO	16 CCIW	17 CCIW	18 CCIW
	19 CCIW	20 CCIW	21 LAKE ONTARIO	22 CONTAMINANTS	23 TRANSFER	24 LAKE ONTARIO	25 CCIW
	26 CCIW	27 LAKE ERIE	28 INTERNAL SEDIMENT	29 LOADING AND BENTHIC	30 COMMUNITY STRUCTURE	1 LAKE ERIE	2 SARNIA
MAY	3 SARNIA	4 LAKE HURON	5 MOORINGS	6 LAKE HURON	7 LAKE	8 SUPERIOR	9 SURVEILLANCE
	10 LAKE	11 SUPERIOR	12 SURVEILLANCE	13 LAKE	14 SUPERIOR	15 SAULT STE. MARIE	16 LAKE HURON MOORINGS
	17 LAKE ERIE BENTHIC	18 COMMUNITY STRUCTURE	19 CCIW	20 CCIW	21 CCIW	22 CCIW	23 CCIW
	24 CCIW	25 LAKE ONTARIO	26 TROPHIC	27 TRANSFER	28 LAKE	29 ONTARIO	30 CCIW
	31 CCIW	1 TROPHIC TRANSFER	2 CCIW	3 CCIW	4 CCIW	5 CCIW	6 CCIW
JUN	7 CCIW	8 LAKE ONTARIO	9 SUSPENDED	10 SEDIMENT	11 SAMPLING	12 LAKE ONTARIO	13 CCIW
	14 CCIW	15 LAKE ERIE	16 BENTHIC COMMUNITY	17 STRUCTURE	18 LAKE ERIE	19 CCIW	20 CCIW
	21 CCIW	22 LAKE ONTARIO	23 MOORINGS	24 LAKE ONTARIO	25 CCIW	26 CCIW	27 CCIW
	28 CCIW	29 LAKE ERIE	30 TROPHIC	1 TRANSFER	2 LAKE ERIE	3 TROPHIC	4 TRANSFER
JUL	5 LAKE ERIE	6 TROPHIC	7 TRANSFER	8 LAKE ERIE	9 TROPHIC	10 TRANSFER	11 PORT COLBORNE
	12 PORT COLBORNE	13 LAKE ERIE	14 BENTHIC	15 COMMUNITY	16 STRUCTURE	17 LAKE ERIE	18 CCIW
	19 CCIW	20 LAKE ONTARIO	21 SUSPENDED SEDIMENT	22 SAMPLING	23 MOORINGS	24 LAKE ONTARIO	25 CCIW
	26 CCIW	27 SCHEDULED	28 SELF	29 MAINTENANCE	30 SCHEDULED	31 SELF	1 MAINTENANCE
AUG	2 CCIW	3 CCIW	4 LAKE ONTARIO	5 CONTAMINANTS	6 TRANSFER	7 LAKE ONTARIO	8 CCIW
	9 CCIW	10 LAKE ONTARIO	11 CONTAMINANTS	12 TRANSFER	13 LAKE	14 ONTARIO	15 CCIW
	16 CCIW	17 LAKE ONTARIO	18 SURVEILLANCE	19 LAKE	20 ONTARIO	21 SURVEILLANCE	22 LAKE ONTARIO
	23 CCIW	24 LAKE ONTARIO	25 SUSPENDED SEDIMENT	26 SAMPLING	27 LAKE ONTARIO	28 CCIW	29 CCIW
	30 CCIW	31 LAKE ERIE BENTHIC	1 COMMUNITY STRUCTURE	2 LAKE HURON	3 MOORINGS	4 LAKE HURON	5 LAKE SUPERIOR
SEP	6 SURVEILLANCE	7 LAKE	8 SUPERIOR	9 SURVEILLANCE	10 LAKE	11 SUPERIOR	12 SURVEILLANCE
	13 LAKE	14 SUPERIOR	15 SURVEILLANCE	16 LAKE SUPERIOR	17 SAULT STE. MARIE	18 LAKE MICHIGAN	19 BIOLOGICAL SEDIMENT
	20 GUIDELINES	21 LAKE	22 MICHIGAN	23 BIOLOGICAL SEDIMENT	24 GUIDELINES	25 LAKE MICHIGAN LAKE ERIE	26 BENTHIC COMMUNITY
	27 STRUCTURE	28 LAKE ERIE	29 CCIW	30 CCIW	1 CCIW	2 CCIW	3 CCIW
OCT	4 CCIW	5 LAKE ONTARIO	6 SUSPENDED SEDIMENT	7 SAMPLING	8 CONTAMINANT TRANSFER	9 LAKE ONTARIO	10 CCIW
	11 CCIW	12 CCIW	13 LAKE ONTARIO	14 MOORINGS	15 LAKE	16 ONTARIO	17 CCIW
	18 CCIW	19 LAKE ONTARIO	20 SURVEILLANCE	21 LAKE	22 ONTARIO	23 SURVEILLANCE	24 LAKE ONTARIO
	25 CCIW	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 CCIW	31 CCIW
NOV	1 CCIW	2 CCIW	3 HAMILTON	4 DRY	5 DOCK	6 HAMILTON	7 DRY DOCK
	8 HAMILTON	9 DRY	10 DOCK	11 HAMILTON	12 DRY	13 DOCK	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	1	2	3	4	5
DEC	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31		

OPEN LAKES SURVEILLANCE

LAKE ONTARIO

RSB STUDY 86301, S. L'ITALIEN, 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 Great Lakes under the Canada/U.S. Agreement as input to the Water Quality Board Annual Report to the International Joint Commission.

Three cruises were conducted March 30 - April 4, August 17 - 22 and September 19 - 24 to support this program. All 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 and GPS positioning systems 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 and September cruises were:

Unstratified Conditions:	1 metre, 10 metres, 25 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: organic contaminant sampling for WQB-OR, metal samples using Go-Flow bottles and submersible pumps for LRB Study 82407, Benthos cores for Dr. J.P. Coakley, LRB Study 82308 and on the first cruise, the Lake Ontario Long Term Biological Index Monitoring Program, Study 86301 was supported.

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS
DATES FROM _____ TO _____ LAKE ONTARIO
CRUISE TYPE LOWER LAKES SURVEILLANCE N.MI. STEAMED 1761.32

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	303	Moorings Established, Acoustic	1
EBT/Transmissometer Casts	303	Moorings Retrieved, Anchor Station 41	1
Rosette Casts	193	Moorings Established, Anchor Station 41	1
Reversing Thermometer Obs. (No. of Therm)	32	Moorings Retrieved	
Secchi Disc Observations	87	Moorings Established	
		Moorings Retrieved	
Zooplankton Hauls	4	Moorings Refurbished	
Integrator 10 m	4	Moorings Serviced	
Integrator 20 m	291	Moorings Serviced	
Phytoplankton Samples	37	Primary Productivity Moorings	
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	1313	Cores Taken, Gravity	
Water Samples Collected (Micro Loop)	33	Cores Taken, Piston	
Water Samples Collected (D.O.)	985	Cores Taken, Benthos	9
Water Samples Collected (Cond./pH)	985		
Water Samples Collected ( )		Grab Samples Taken	
Water Samples Collected (TP uf)	1052		
Water Samples Collected (TKN)	1052	Bulk Centrifuge Samples, 1200 litres	30
Water Samples Collected ( )			
Water Samples Collected ( )		Observations, Weather	63
Water Samples Filtered (Chlorophyll a)	370		
Water Samples Filtered (POC/TPN)	427		
Water Samples Filtered (Seston)	8		
Water Samples Filtered (TP f)	1052		
Water Samples Filtered (Nutrients)	1052		
Water Samples Filtered (Major Ions)	1052	**ONBOARD ANALYSIS**	
Water Samples Filtered ( )		Manual Chemistry, Tech. Ops.	3079
Water Samples Filtered ( )		Nutrients, WQB-OR	154
Water Samples Filtered ( )		Microbiology	

SURVEILLANCE STATIONS

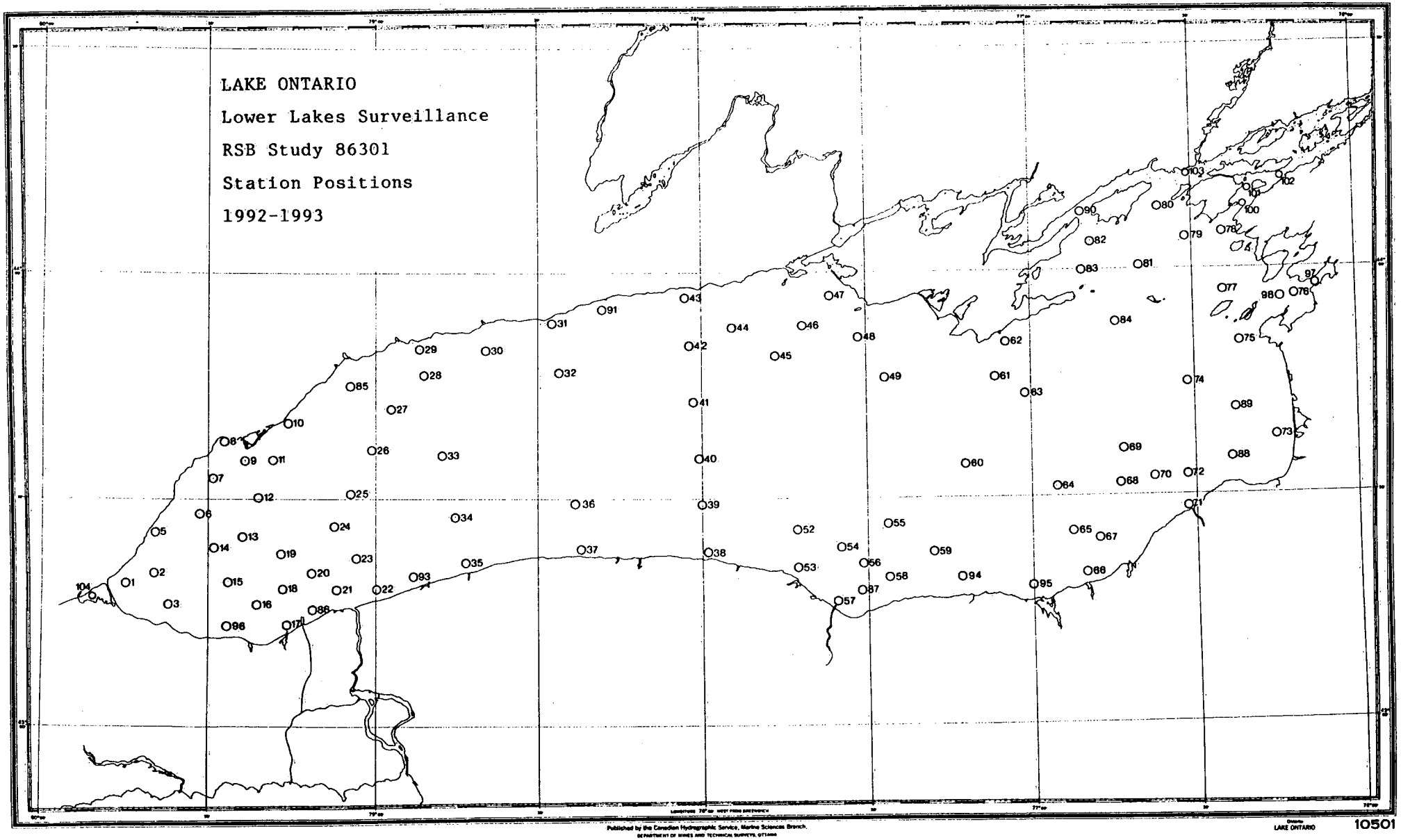
LAKE ONTARIO

1992-1993

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' 12"
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° 11' 36"	76° 18' 36"
103	44° 12' 12"	76° 32' 36"
104	43° 17' 15"	79° 50' 00"
9B	43° 38' 02"	79° 22' 02"


LAKE ONTARIO
Lower Lakes Surveillance
RSB Study 86301
Station Positions
1992-1993
Published by the Canadian Hydrographic Service, Marine Sciences Branch,
DEPARTMENT OF MINES AND TECHNICAL SURVEYS, OTTAWA
LAKE ONTARIO
10501

UPPER LAKES SURVEILLANCE

LAKE SUPERIOR

RSB STUDY 86301, S. L'ITALIEN, 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 4-18 and one in late summer, August 31-September 16. As all surveillance cruises, this was organized and completed by Technical Operations Section, Research Support Branch for IWD-OR. The vessel was equipped with the usual equipment: transmissometer/EBT system, rosette/EBT system, radar, Loran C positioning system and other necessary equipment needed to carry out chemical and biological sampling.

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

During the May cruise all samples were collected from the 1-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: box cores for Dr. T.B. Reynoldson, LRB Study 82105; three current meter moorings and four sediment trap moorings were installed in the North Channel for F. Rosa, LRB Study 82106; sediment and water was collected for K. Aspila, RAB Study 84206; water was collected for H. Wong, LRB Study 82408; Shipek samples were collected for RSB Study 86301 and water samples were collected for Dr. J. Cornett, Atomic Energy Canada Limited.

STATISTICS SUMMARY

CRUISE NO. 93-03-001 and 92-03-002
DATES FROM May 7-14 and September 5-16
CRUISE TYPE UPPER LAKES SURVEILLANCE

SHIP CSS LIMNOS
LAKE Superior
N.MI. STEAMED 2913.36

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	201	Moorings Established	
EBT/Transmissometer Casts	201	Moorings Retrieved	
Rosette Casts	93	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)	24	Moorings Retrieved	
Secchi Disc Observations	103	Moorings Established	
		Moorings Retrieved	
Zooplankton Hauls		Moorings Refurbished	
Integrator 50 m	134	Moorings Serviced	
Integrator 20 m	20	Moorings Serviced	
Phytoplankton Samples		Primary Productivity Moorings	
		Cores Taken, Box	
Water Samples Collected (Microbiology)		Cores Taken, Gravity	
Water Samples Collected (Water Quality)	588	Cores Taken, Piston	
Water Samples Collected (A.E.C.L.)	4	Cores Taken, Box	37
Water Samples Collected (D.O.)	557	Cores Taken, Mini Box	20
Water Samples Collected (Cond/pH)	557	Grab Samples Taken, Shipek	4
Water Samples Collected (Alkalinity)	44	Grab Samples Taken, PONAR	52
Water Samples Collected (TP uf + blanks)	612	Bulk Centrifuge Samples	
Water Samples Collected (TKN)	612	Bulk Water Samples, 200ℓ	8
Water Samples Collected ( )		Observations, Weather	98
Water Samples Collected ( )			
Water Samples Filtered (Chlorophyll a)			
Water Samples Filtered (POC/TPN)	225		
Water Samples Filtered (Seston)	612		
Water Samples Filtered (TP f + blanks)	612		
Water Samples Filtered (Nut. + blanks)	612	**ONBOARD ANALYSIS**	
Water Samples Filtered (Maj.Ions+blanks)	612	Manual Chemistry, Tech. Ops.	1671
Water Samples Filtered ( )		Water Quality	130
Water Samples Filtered ( )			

SURVEILLANCE STATION POSITIONS

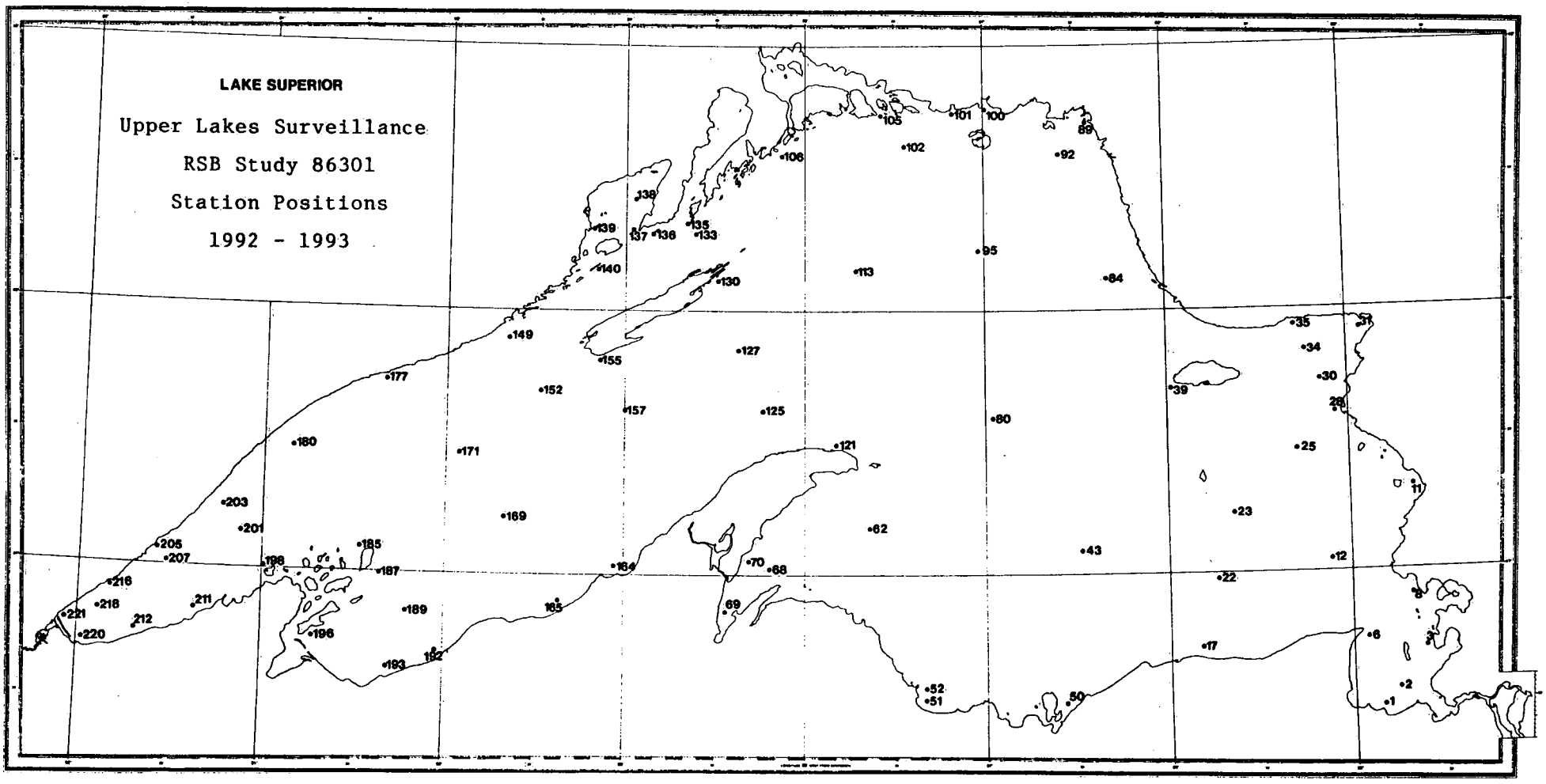
LAKE SUPERIOR

1991-1992

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° 56' 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' 00"	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
Upper Lakes Surveillance
RSB Study 86301
Station Positions
1992 - 1993
105
101
100
89
102
92
106
138
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135
137
136
133
95
140
113
84
130
149
155
127
177
152
157
125
80
180
171
121
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196
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182
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2
1

SUSPENDED SEDIMENT SAMPLING

LRB STUDY 82103, A MUDROCH

The purpose of this study was to evaluate the role of the nepheloid layer in the transport of contaminants across Lake Ontario. All work for the study was completed at station 625. Three cruises were carried out April 6-10, August 24-27 and October 5-9.

At station 625, 6000 litres of water were centrifuged from a depth of 3 metres and a depth below the thermocline determined by the study leader. Water was centrifuged at a flow rate of 3 litres/minute from each depth. Recovered suspended sediment was removed from the centrifuge bowls and returned to CCIW for analyses.

A continuous extraction of the centrifuged water at both depths was completed onboard using large volume extractors on all cruises. This was completed by LRB personnel.

Some additional tasks performed during these cruises were: retrieval and installation of moorings for Dr. C.R. Murthy, LRB Study 82306; collection of water samples for Atomic Energy Company Limited and the retrieval of an ADCP mooring for Great Lakes Environmental Research Laboratory in Ann Arbor, Michigan.

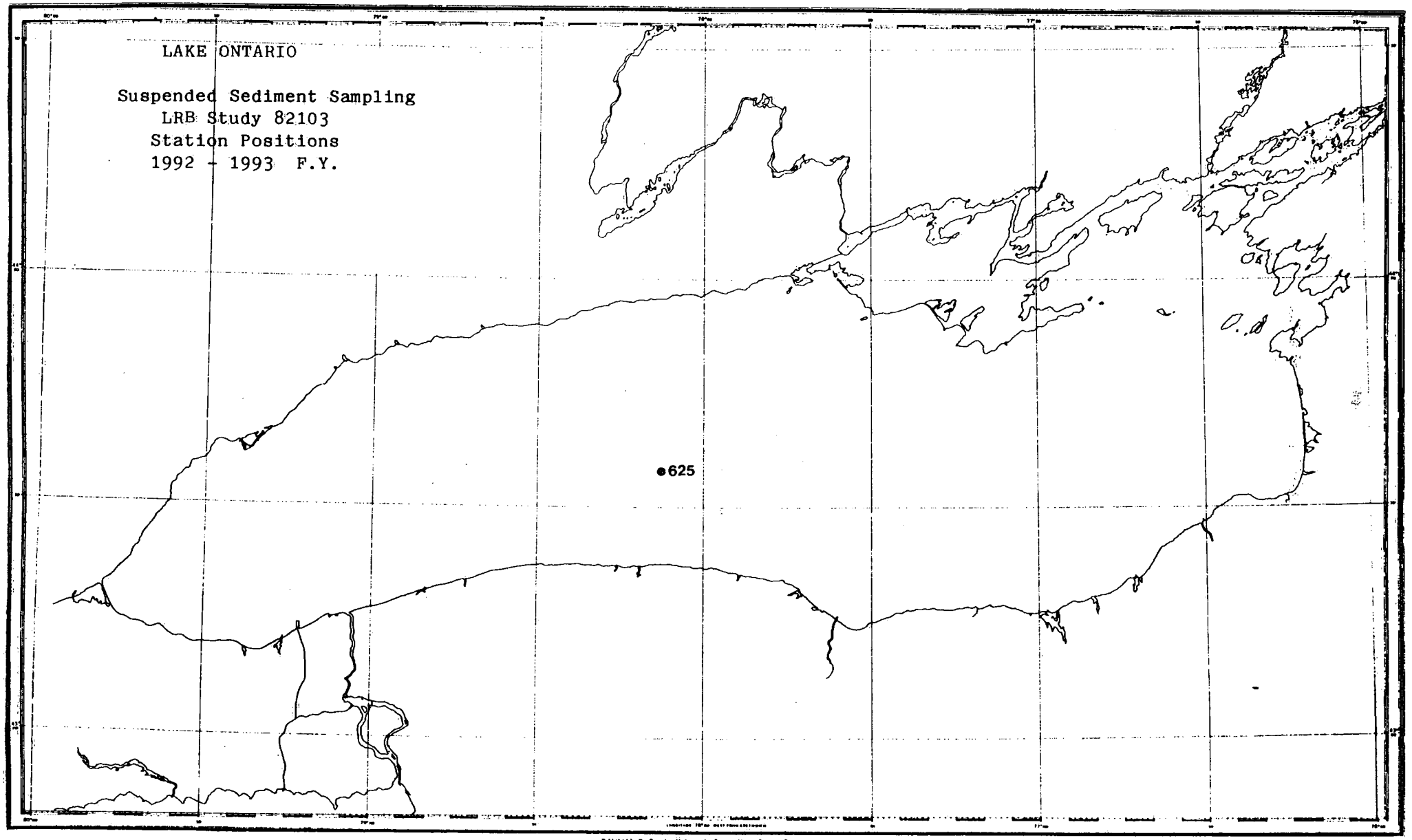
STATION POSITION

STATION NUMBER	LATITUDE N.	LONGITUDE W.
625	43° 35' 56"	78° 04' 43"

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS
DATES FROM _____ TO _____ REGION LAKE ONTARIO
CRUISE TYPE SUSPENDED SEDIMENT SAMPLING N.MI. STEAMED 640.08

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	28	Moorings Established Sed Trap	1
EBT/Transmissometer Casts	26	Moorings Retrieved Current Meter	1
Rosette Casts	13	Moorings Established Sed Trap	1
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved ADCP	1
Secchi Disc Observations	7	Moorings Established	
Van Dorn Casts		Moorings Retrieved Thermograph	1
Zooplankton Hauls	34	Moorings Refurbished Sed Trap	4
Integrator 10 m		Moorings Serviced Metrologial	2
Integrator 20 m		Moorings Serviced	
Phytoplankton Samples	8	Primary Productivity Moorings	
Mysis Net Hauls	8	Cores Taken, Mini Box	
		Cores Taken, Box	
Water Samples Collected (Microbiology)		Cores Taken, Gravity	
Water Samples Collected (Water Quality)	5	Cores Taken, Piston	
Water Samples Collected (Particle Size)	10	Cores Taken, Benthos	
Water Samples Collected (D.O.)	33		
Water Samples Collected (Cond./pH)	33	Grab Samples Taken, Ponar	
Water Samples Collected ( )		Grab Samples Taken, Mini Ponar	
Water Samples Collected (TP uf)	5	Bulk Centrifuge Samples 6000 litres	6
Water Samples Collected (TKN)		Bulk Centrifuge Samples 600 litres	10
Water Samples Filtered (ALK)		Observations, Weather	
Water Samples Filtered (Nitrogen)			
Water Samples Filtered (Chlorophyll a)	5		
Water Samples Filtered (POC/TPN)	5		
Water Samples Filtered (Seston)			
Water Samples Filtered (T P F)	5		
Water Samples Filtered (Nutrients)	5	**ONBOARD ANALYSIS**	
Water Samples Filtered (Major Ions)	5	Manual Chemistry, Tech. Ops	99
Water Samples Filtered (Trace Metals)	5	Nutrients, WOB	
		Microbiology	


LAKE ONTARIO
Suspended Sediment Sampling
LRB Study 82103
Station Positions
1992 - 1993 F.Y.
625
LAKE ONTARIO
10501

BENTHIC COMMUNITY STRUCTURE

LAKE ERIE

LRB STUDY 82105, DR. T.B. REYNOLDSON

Six Lake Erie cruises were carried out onboard the CSS LIMNOS April 27-31, May 17-18, June 15-19, July 13-17, August 31-September 2 and September 25-28. 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 stations 23 and 84 DO loggers were installed for the season. These were retrieved during the September cruise.

At the request of the study leader, additional stations were added to give additional information for LRB Study 82105. This was done on the June, July and September cruises. During the September cruise, Biological Sediment Guideline stations were sampled in addition to the regular stations.

Several additional requests were supported during the season. These included the collection of piston cores for Dr. J.S. Mothersill of Royal Roads Military College, Victoria, B.C.; Benthos and Shipek samples for the University of Waterloo; phytoplankton samples for Dr. M.A. Zarull of LRB and suspended sediment samples for F. Rosa, LRB Study 82106.

BENTHIC COMMUNITY STRUCTURE

STATION POSITIONS

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

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS
DATES FROM _____ TO _____ REGION LAKE ERIE
CRUISE TYPE BENTHIC COMMUNITY STRUCTURE N.MI. STEAMED 2538.17

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	108	Moorings Established DO Logger	2
EBT/Transmissometer Casts	108	Moorings Retrieved DO Logger	2
Rosette Casts	5	Moorings Established Anchor Station 41	1
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved CM/Sed Trap	3
Secchi Disc Observations	25	Moorings Established	
Van Dorn Casts	13	Moorings Retrieved	
Zooplankton Hauls		Moorings Refurbished	
Integrator 10 m	9	Moorings Serviced	
Integrator 20 m	4	Moorings Serviced	
Phytoplankton Samples	30	Primary Productivity Moorings	
		Cores Taken, Mini Box	61
		Cores Taken, Box	34
Water Samples Collected (Microbiology)		Cores Taken Gravity	
Water Samples Collected (Water Quality)		Cores Taken, Piston	
Water Samples Collected ( )		Cores Taken, Benthos	13
Water Samples Collected (D.O.)	85		
Water Samples Collected (Cond/pH)	85	Grab Samples Taken, Ponar	11
Water Samples Collected ( )		Grab Samples Taken, Mini Ponar	36
Water Samples Collected (T P uf)	31	Bulk Centrifuge Samples 1200 litres	9
Water Samples Collected (TKN)	1	Bulk Centrifuge Samples 2400 litres	7
Water Samples Filtered (ALK)	25	Observations, Weather	
Water Samples Filtered (Nitrogen)	6		
Water Samples Filtered (Chlorophyll a)	6		
Water Samples Filtered (POC/TPN)	6		
Water Samples Filtered (Seston)	6		
Water Samples Filtered (T P f)		**ONBOARD ANALYSIS**	
Water Samples Filtered (Nutrients)	17		
Water Samples Filtered (Major Ions)		Manual Chemistry, Tech. Ops.	117
Water Samples Filtered ( )		Nutrients, WOB	
		Microbiology	

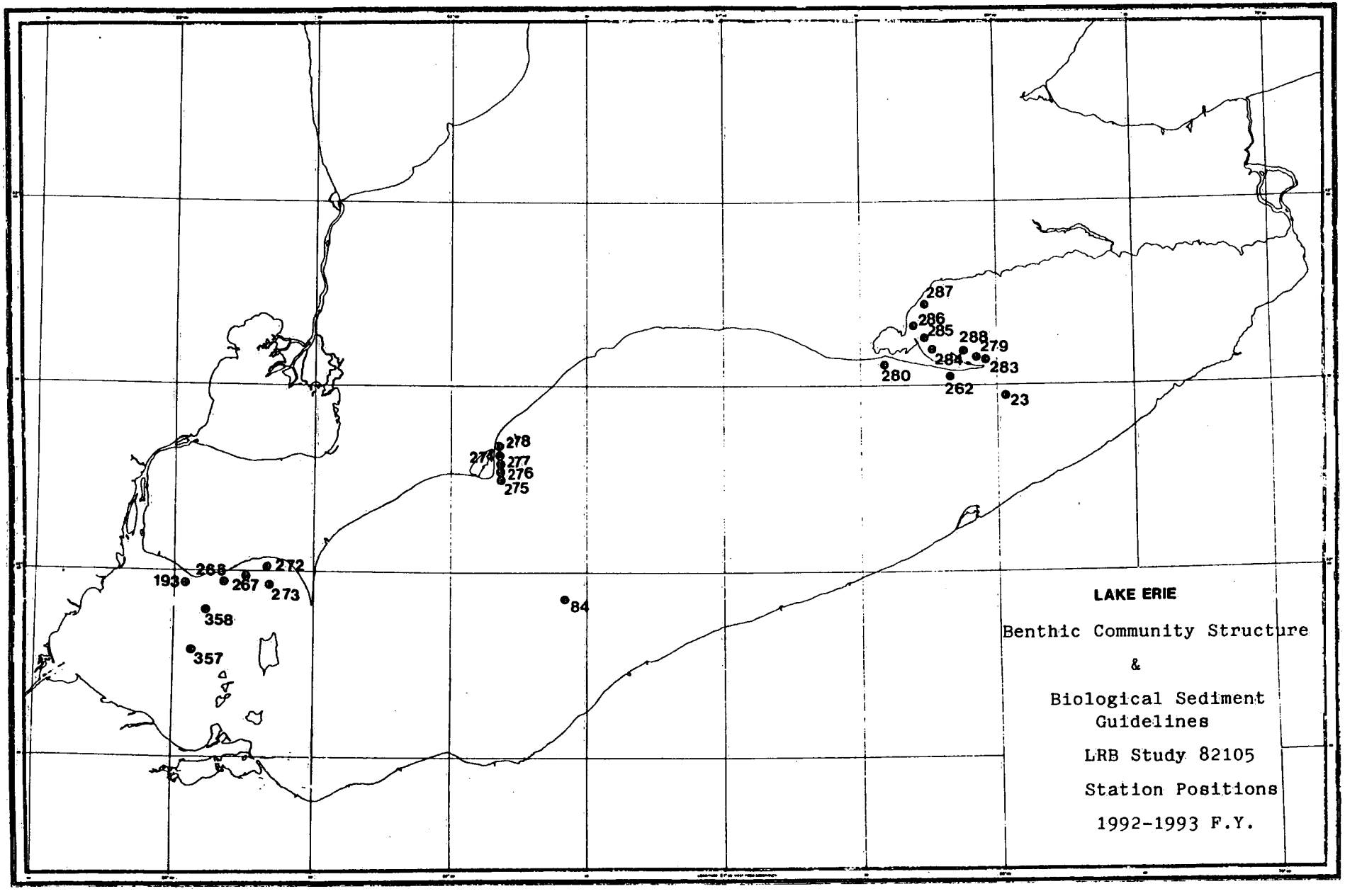
BIOLOGICAL SEDIMENT GUIDELINE

STATION POSITIONS

LAKE ERIE

1992-1993

STATION NUMBER	LATITUDE N.	LONGITUDE W.
193 Reynoldson 0104	41° 57' 57"	82° 57' 00"
266 Reynoldson 0105	41° 58' 59"	82° 50' 04"
267 Reynoldson 0106	41° 59' 00"	82° 47' 04"
272 Reynoldson 0107	42° 01' 07"	82° 39' 55"
273 Reynoldson 0108	41° 59' 55"	82° 40' 01"
274 Reynoldson 0111	42° 18' 53"	81° 48' 58"
275 Reynoldson 0112	42° 14' 57"	81° 48' 58"
276 Reynoldson 0113	41° 17' 06"	81° 49' 02"
277 Reynoldson 0114	42° 18' 06"	81° 49' 05"
278 Reynoldson 0115	42° 20' 07"	81° 48' 55"
279 Reynoldson 0300	42° 36' 06"	80° 06' 26"
280 Reynoldson 0301	42° 32' 36"	80° 21' 03"
282 Reynoldson 0302	42° 30' 48"	80° 07' 01"
283 Reynoldson 0303	42° 33' 49"	80° 02' 30"
284 Reynoldson 0307	42° 35' 57"	80° 14' 01"
285 Reynoldson 0308	42° 37' 52"	80° 16' 01"
286 Reynoldson 0312	42° 41' 00"	80° 18' 08"
287 Reynoldson 0313	42° 42' 12"	80° 15' 43"
288 Reynoldson 0311	42° 36' 26"	80° 09' 32"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272
268
193
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273
358
357
84
LAKE ERIE
Benthic Community Structure
&
Biological Sediment Guidelines
LRB Study 82105
Station Positions
1992-1993 F.Y.

BIOLOGICAL SEDIMENT GUIDELINES

LAKE MICHIGAN

LRB STUDY 82105, DR. T.B. REYNOLDSON

One Lake Michigan cruise was completed by the CSS LIMNOS September 18-25. The cruise was utilized to develop sediment guidelines based on biological and chemical measures as part of ecological mapping.

At all stations the following parameters were sampled: temperature and transmission profiles, dissolved oxygen, PH, conductivity, total phosphorus filtered and unfiltered, nutrients and alkalinity. All water samples were collected from the bottom -0.5 m depth.

At all stations a box core or a mini box core was collected and subsampled in the following manner:

a) The box core was subsampled using 5 Benthos cores from which the top 10 cm were extruded. The material was sieved through a 250μ mesh to retain live animals. Material was placed in a scintillation vial and preserved with 4% Formalin

b) An additional 10-cm core was taken for pore water analyses. The core was capped with care taken to have 1-2 cm of water above the interface before capping

c) A 10-litre sample of the top 10 cm was collected

d) Sediment chemistry samples were taken from the top 2 cm of sediment and divided as follows:

   i) Organic contaminants
   ii) Particle size distribution
   iii) Metal and Nutrients

STATISTICS SUMMARY

CRUISE NO. 92-06-001 CONSECUTIVE NO. _____ SHIP CSS LIMNOS
DATES FROM September 18 TO September 25, 1992 REGION Lake Michigan
CRUISE TYPE BIOLOGICAL SEDIMENT GUIDELINES N.MI. STEAMED 1179.89

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	51	Moorings Established	
EBT/Casts	51	Moorings Retrieved	
Rosette Casts		Moorings Established	
Transmissometer Casts	51	Moorings Retrieved	
Reversing Thermometer Obs. (No. of Therm)		Moorings Established	
Secchi Disc Observations	11	Moorings Retrieved	
		Moorings Refurbished	
Zooplankton Hauls		Moorings Serviced	
Integrator 10 m		Moorings Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples		Cores Taken, Box	3
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	71
Water Samples Collected ( )		Cores Taken, Shipek	2
Water Samples Collected (D.O.)	49	Grab Samples Taken, Ponar	162
Water Samples Collected (Cond/pH)	49	Grab Samples Taken, Mini Ponar	4
Water Samples Collected ( )		Bulk Centrifuge Samples	
Water Samples Collected (TP uf)	49		
Water Samples Collected (TKN)	49	Observations, Weather	
Water Samples Collected (ALK)	49		
Water Samples Filtered (NUT)	49		
Water Samples Filtered (Chlorophyll a)			
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)		**ONBOARD ANALYSIS**	
Water Samples Filtered (Nutrients)		Manual Chemistry, Tech. Ops.	
Water Samples Filtered (Major Ions)		Nutrients, WOB	
Water Samples Filtered ( )		Microbiology	
Water Samples Filtered ( )			

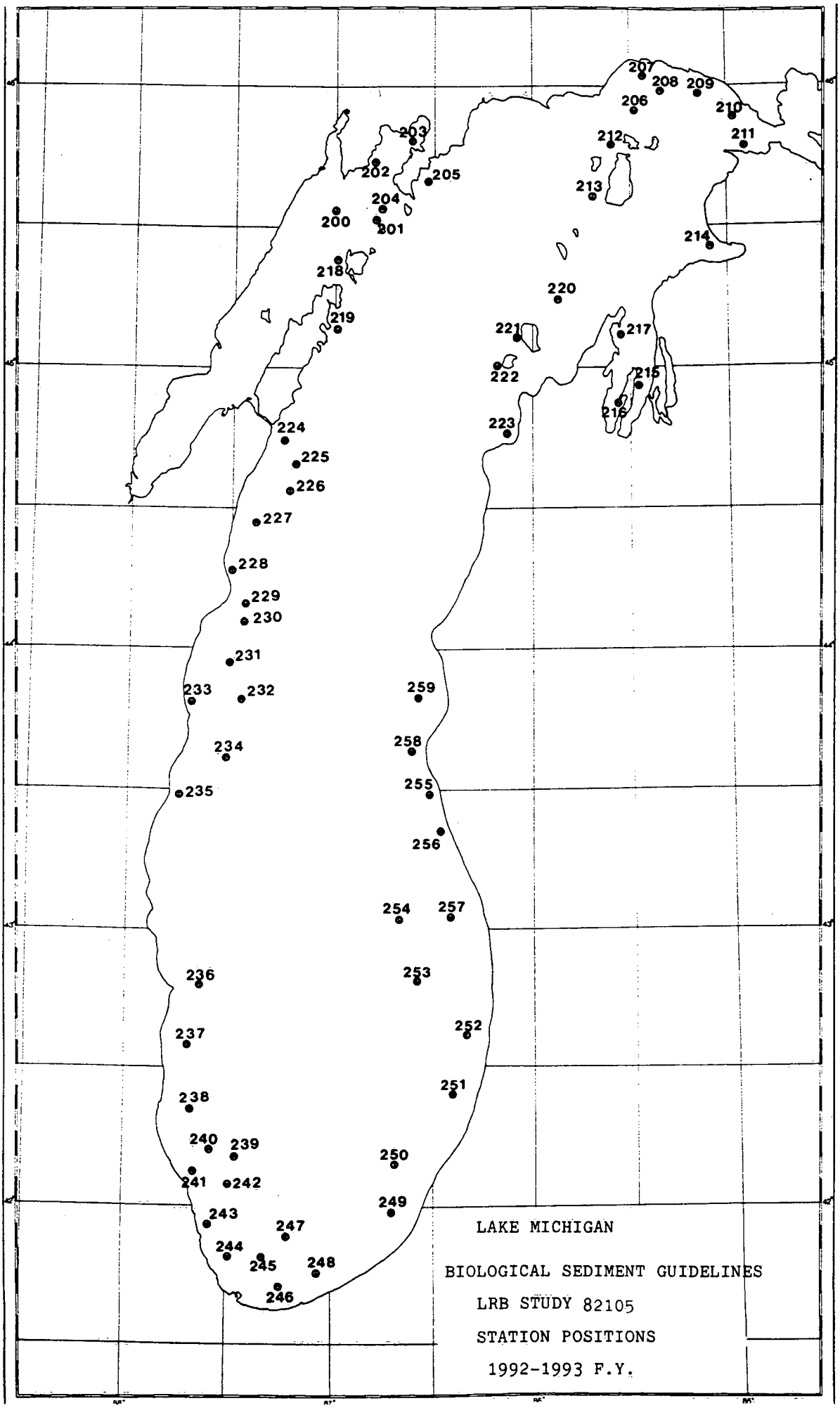
STATION POSITIONS

LAKE MICHIGAN

1992-1993

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
200	2000	45° 31' 55"	87° 02' 32"
201	2001	45° 31' 51"	86° 46' 41"
202	2002	45° 45' 57"	86° 48' 22"
203	2003	45° 48' 27"	86° 35' 59"
204	2004	45° 33' 42"	86° 44' 05"
205	2005	45° 38' 44"	86° 35' 47"
206	2006	45° 55' 38"	85° 26' 41"
207	2007	46° 02' 44"	85° 25' 59"
208	2008	46° 00' 40"	85° 21' 19"
209	2009	45° 58' 07"	85° 08' 34"
210	2010	45° 53' 36"	84° 58' 26"
211	2011	45° 46' 45"	84° 56' 40"
212	1900	45° 46' 22"	85° 36' 39"
213	1901	45° 36' 27"	85° 42' 32"
214	1902	45° 24' 30"	85° 05' 19"
215	1903	45° 01' 05"	85° 31' 58"
216	1904	44° 53' 39"	85° 32' 23"
217	1905	45° 06' 25"	85° 33' 27"
218	1906	45° 22' 42"	86° 59' 01"
219	1907	45° 20' 17"	85° 22' 03"
220	1908	45° 14' 56"	85° 52' 08"
221	1909	45° 04' 47"	85° 56' 28"
222	1910	45° 00' 21"	86° 03' 50"
223	1911	44° 45' 02"	86° 07' 02"
224	1800	44° 44' 45"	87° 14' 18"
225	1801	44° 40' 03"	87° 12' 52"
226	1802	44° 35' 35"	87° 15' 22"
227	1803	44° 29' 21"	87° 24' 37"
229	1805	44° 06' 12"	87° 27' 18"
230	1806	44° 02' 30"	87° 28' 24"

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
231	1807	43° 57' 25"	87° 31' 19"
232	1808	43° 49' 59"	87° 30' 08"
233	1809	43° 50' 48"	87° 42' 22"
234	1810	43° 38' 27"	87° 37' 06"
235	1811	43° 16' 17"	87° 46' 42"
236	1700 (C-7)	42° 47' 06"	87° 25' 24"
237	1701 (H-11)	42° 33' 08"	87° 36' 40"
238	1701 (EG-12)	42° 20' 51"	87° 37' 16"
246	1710	41° 42' 08"	87° 16' 07"
247	1711	41° 50' 00"	87° 10' 06"
248	1600	41° 44' 21"	87° 02' 09"
249	1601 (H-19)	41° 59' 45"	86° 41' 33"
250	1602 (H-22)	42° 08' 11"	86° 39' 05"
251	1603 (B-2)	42° 23' 41"	86° 25' 51"
252	1604 (H-29)	42° 37' 50"	86° 18' 19"
253	1605 (C-3)	42° 49' 00"	86° 29' 12"
254	1606 (EG-22)	43° 06' 30"	86° 33' 13"
255	1607	43° 31' 11"	86° 33' 36"
256	1608	43° 24' 33"	86° 30' 30"
257	1609	43° 07' 07"	86° 24' 03"
258	1610	43° 38' 32"	86° 39' 05"
259	1611	43° 46' 24"	86° 36' 04"



LAKE MICHIGAN

BIOLOGICAL SEDIMENT GUIDELINES

LRB STUDY 82105

STATION POSITIONS

1992-1993 F.Y.

NEARSHORE SEDIMENT SURVEY

LAKE SUPERIOR

LRB STUDY 82105, DR. T.B. REYNOLDSON

Sampling for this study was piggybacked on the September Lake Superior surveillance cruise, August 31 to September 16. Nearshore stations along the Canadian shoreline were sampled with many stations being dropped due to lack of sediment. At each station the following work was completed:

At all stations, a mini box core or box core was obtained. The core was subsampled in the following manner for benthic community structure:

i) The box core was subsampled using 5 Benthos cores from which the top 10 cm was extruded into separate bags for screening.

ii) An additional 10-cm Benthos core was obtained for pore water analysis. The core was capped, sealed with tape and stored.

iii) Sediment chemistry samples were taken from the top 2 cm of sediment: 125 ml in a hexane washed glass bottle, 50 ml in a plastic pill jar and a 500 ml plastic container.

iv) A 10-litre sample of the top 10 cm of sediment was collected for bioassay work.

At 4 stations, samples were collected in triplicate for items i) and ii) above for QA/QC analyses.

All samples were stored at 4°C.

At all stations, bottom water temperature was obtained as well as a water sample collected by Van Dorn bottle for dissolved oxygen probe measurement, PH, alkalinity, nutrients and total phosphorus (unfiltered).

At all stations in the deeper portion of the lake a mini box core or box core was collected for a Pontoperia hoyi study. The box core was subsampled using 5 Benthos cores from which the top 10 cm were extruded into separate bags for screening. At one other deep station, 2 PONAR grab samples were obtained due to rough sea conditions.

At 13 stations, 5 mini-PONARS or 3 PONARS were collected for bioassay work. Each PONAR was bagged separately and the PONARS were divided equally in the bags provided.

BIOLOGICAL SEDIMENT GUIDELINES

STATION POSITIONS

LAKE SUPERIOR

1992-1993

STATION NUMBER	LATITUDE N.	LONGITUDE W.	REYNOLDSON NO.
300	48° 54' 09"	87° 56' 24"	5100
301	48° 44' 29"	87° 42' 54"	
302	48° 46' 18"	87° 43' 40"	5102
303	48° 48' 18"	87° 44' 57"	5103
304	48° 43' 13"	87° 55' 31"	5104
305	48° 36' 25"	88° 11' 13"	5105
306	48° 30' 17"	88° 25' 44"	5106
307	48° 25' 58"	88° 29' 29"	5107
308	48° 23' 43"	88° 35' 27"	5108
309	48° 28' 04"	88° 35' 36"	5109
310	48° 35' 48"	88° 30' 51"	5110
311	48° 31' 38"	88° 37' 25"	5111
312	48° 25' 28"	88° 40' 18"	5112
313	48° 21' 38"	88° 39' 32"	5113
314	48° 22' 09"	88° 52' 22"	5114
315	48° 32' 07"	88° 54' 19"	5115
316	48° 13' 11"	89° 08' 36"	5116
317	48° 31' 55"	86° 16' 29"	2500
318	48° 35' 30"	86° 19' 39"	2501
319	48° 37' 29"	86° 20' 05"	2502
320	48° 44' 11"	86° 31' 55"	2503
321	48° 43' 37"	86° 36' 57"	2504
322	48° 42' 31"	86° 38' 39"	2505
323	48° 46' 02"	86° 39' 39"	2506
324	48° 47' 24"	86° 41' 49"	2507
325	48° 41' 23"	86° 58' 13"	2508
327	48° 51' 00"	87° 36' 29"	2512
328	48° 53' 06"	87° 40' 32"	2513
329	48° 54' 04"	87° 48' 55"	2514
330	48° 54' 18"	87° 52' 25"	2515

STATION NUMBER	LATITUDE N.	LONGITUDE W.	REYNOLDSON NO.
331	47° 55' 57"	84° 52' 38"	2600
332	47° 56' 01	85° 12' 12"	2601
333	47° 55' 30"	85° 20' 19"	2602
334	47° 54' 41"	85° 26' 03"	2603
336	47° 46' 55"	85° 40' 06"	2605
347	48° 20' 58"	86° 11' 43"	2616
349	48° 25' 06"	86° 14' 28"	2618
350	48° 27' 33"	86° 15' 05"	2619
351	48° 30' 17"	86° 15' 29"	2620
352	47° 55' 12"	84° 52' 20"	2400
362	47° 23' 01"	84° 43' 13"	2410
363	47° 21' 13"	84° 40' 34"	2411
365	47° 18' 07"	84° 37' 11"	2413
366	47° 15' 39"	84° 37' 28"	2414
371	48° 50' 06"	87° 45' 01"	5101

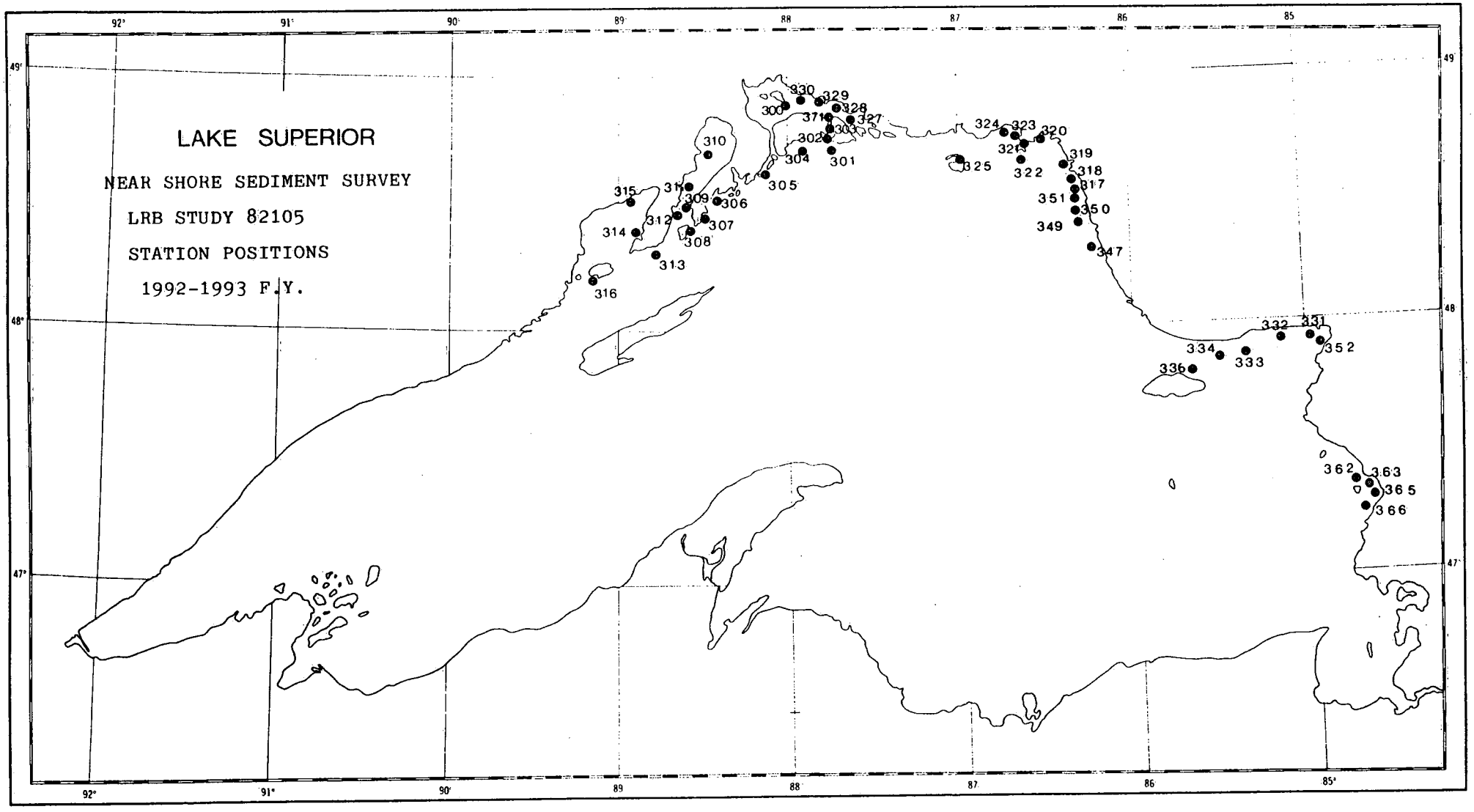
BENTHIC COMMUNITY STRUCTURE

STATION POSITIONS

LAKE SUPERIOR

1992-1993

STATION NUMBER	LATITUDE N.	LONGITUDE W.
6	46° 44' 45"	84° 55' 13"
12	47° 02' 12"	85° 06' 12"
35	47° 55' 19"	85° 17' 29"
92	48° 34' 52"	86° 33' 56"
106	48° 34' 28"	88° 06' 58"
125	47° 36' 29"	88° 12' 51"
127	47° 51' 01"	88° 20' 21"
133	48° 16' 58"	88° 36' 11"
152	47° 41' 23"	89° 27' 52"
192	46° 42' 06"	90° 01' 44"
196	46° 44' 56"	90° 42' 07"
203	47° 13' 10"	91° 12' 16"


LAKE SUPERIOR
NEAR SHORE SEDIMENT SURVEY
LRB STUDY 82105
STATION POSITIONS
1992-1993 F.Y.
92°
91°
90°
89°
88°
87°
86°
85°
49°
48°
47°
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
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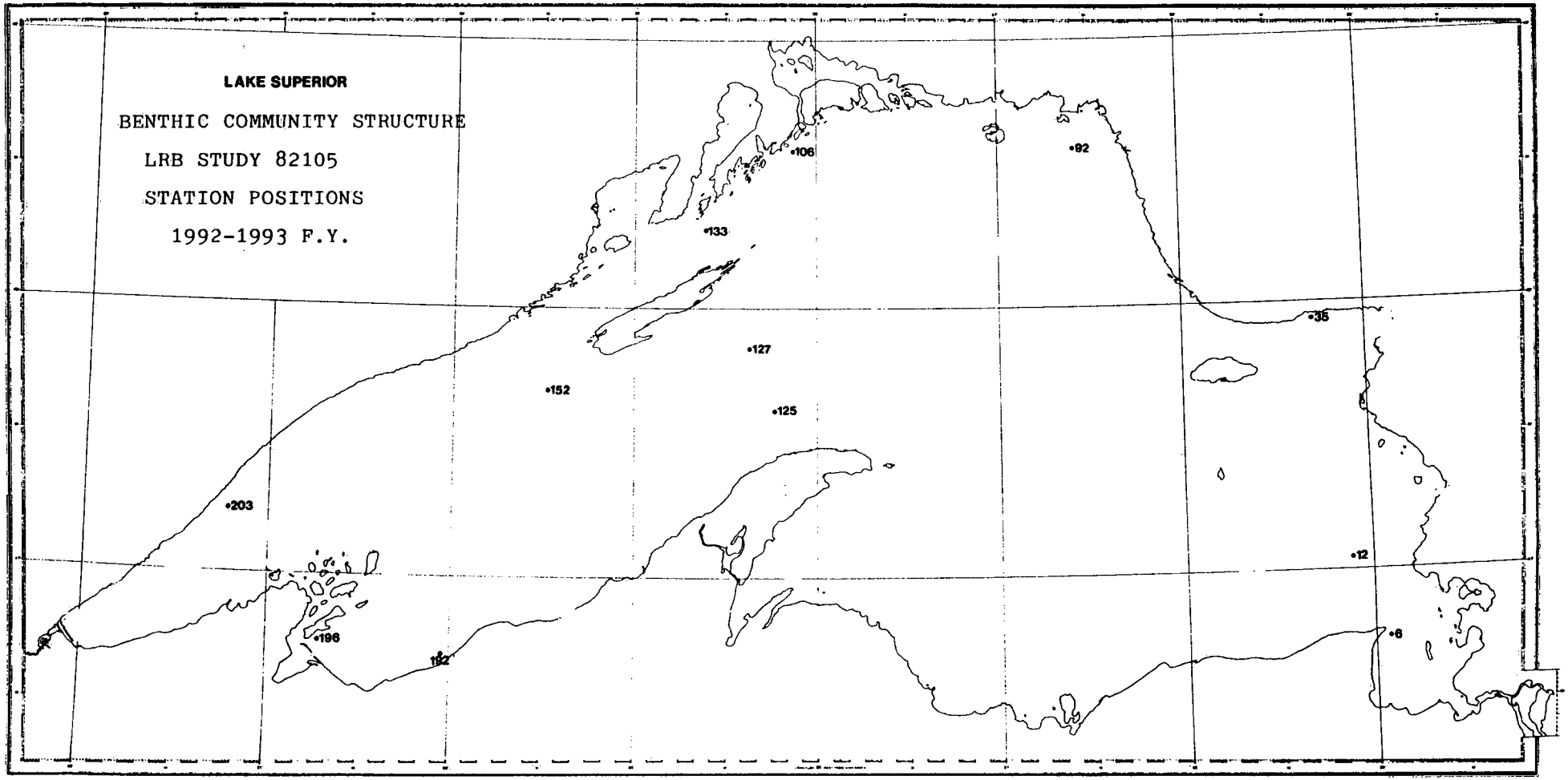
366


LAKE SUPERIOR
BENTHIC COMMUNITY STRUCTURE
LRB STUDY 82105
STATION POSITIONS
1992-1993 F.Y.
106
92
133
35
127
152
125
203
12
196
192
6

INTERNAL SEDIMENT LOADING

LAKE ERIE

LRB STUDY 82106, F. ROSA

One Lake Erie cruise was carried out onboard the CSS LIMNOS April 27 - May 1. During the 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 a Van Dorn water sampler for dissolved oxygen, conductivity, PH, chlorophyll a, particulate organic carbon, Seston weight and total phosphorus unfiltered. Samples were collected from 1 metre and bottom minus 1 metre at stations 23, 84 and 357.

2. Bulk water samples (120$0\ell$) were collected from the 5 metre depth and centrifuged for particulate material. These samples were collected at stations 23, 84 and 357.

3. At stations 23, 84 and 357, combination current meter/sediment trap moorings were retrieved.

4. At stations 268, 269, 270, 281, 290, 293 and 298, bulk water samples (2400 litres) were collected and at station 289, 1200 litres were collected. All water was stored in tubs on deck and centrifuged at 6 litres/minute. Suspended sediment was retained and stored at 4°C. Sample depths were 1 m at station 289 and 5 m at the remaining stations.

STATION POSITIONS

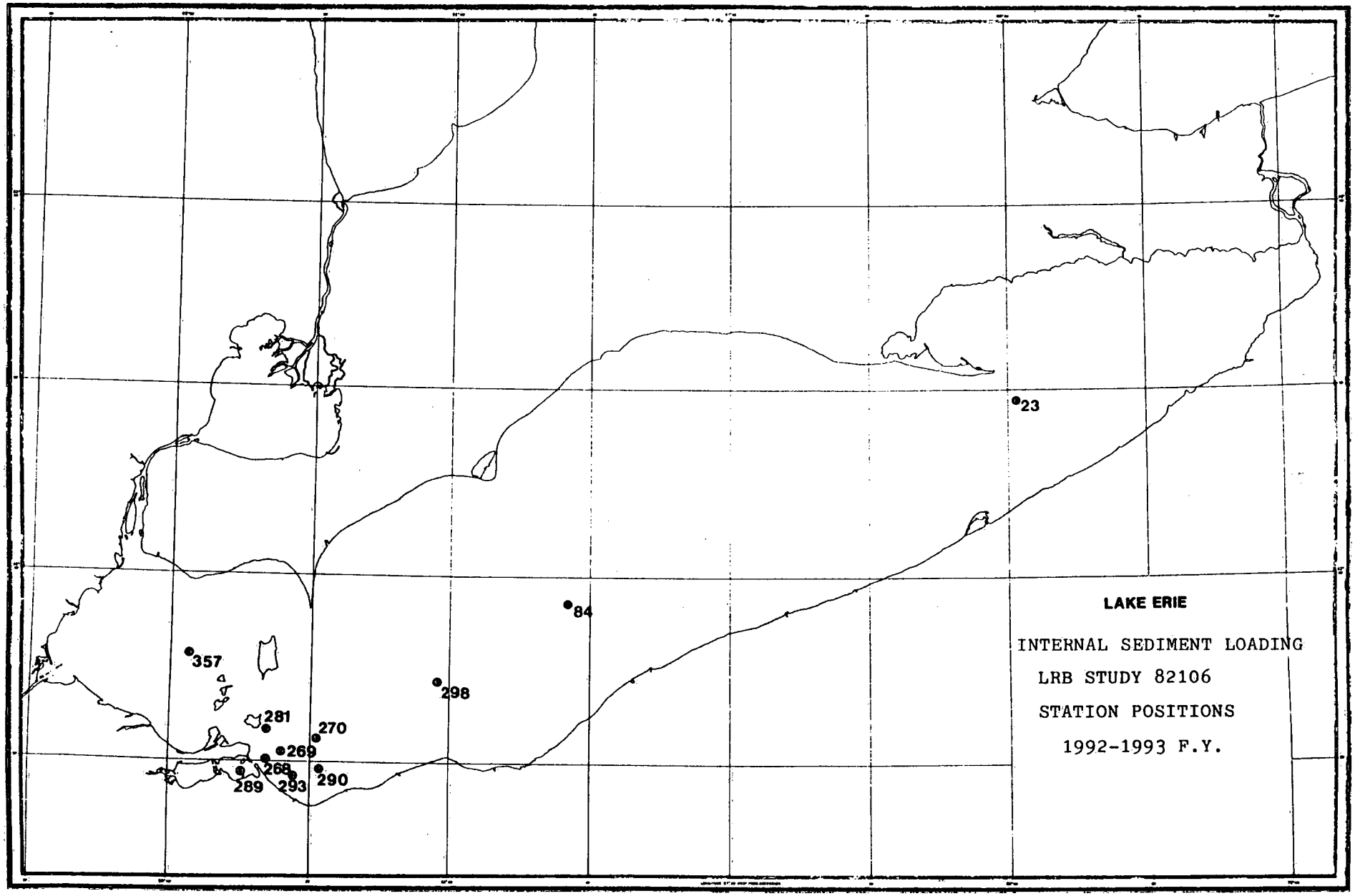
STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29' 48"	79° 53' 56"
84	41° 55' 51"	81° 38' 59"
268	41° 30' 51"	82° 37' 52"
269	41° 31' 35"	82° 36' 42"
270	41° 33' 59"	82° 29' 44"
281	41° 35' 39"	82° 40' 20"
289	41° 28' 01"	82° 43' 57"
290	41° 29' 23"	82° 31' 15"
293	41° 27' 58"	82° 34' 12"
298	41° 43' 36"	82° 10' 36"
357	41° 49' 47"	82° 58' 09"

WINTER MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
23	91-01AC-03A	42° 30' 09"	79° 53' 25"
84	91-01AC-04A	41° 56' 07"	81° 39' 29"
357	91-01AC-05A	41° 49' 37"	82° 58' 12"

DO LOGGER MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
23	92-01S-03A	42° 30' 11"	79° 53' 30"
84	92-01S-04A	41° 56' 09"	81° 39' 21"


23
84
298
357
281
270
269
268
289
293
290
LAKE ERIE
INTERNAL SEDIMENT LOADING
LRB STUDY 82106
STATION POSITIONS
1992-1993 F.Y.

INTERNAL SEDIMENT LOADING

LAKE HURON

LRB STUDY 82106, F. ROSA

There were two cruises carried out in the North Channel of Lake Huron during the field season. These were completed while the CSS LIMNOS was in transit to Lake Superior for an Upper Lakes Surveillance cruise. Four sediment trap and three current meter moorings were installed May 4-6 and retrieved September 2-4. While at each sediment trap site, 1200 litres of water were pumped into tubs on deck and centrifuged at 6 litres/minute through Westfalia centrifuges.

NORTH CHANNEL MOORING POSITIONS

LAKE HURON

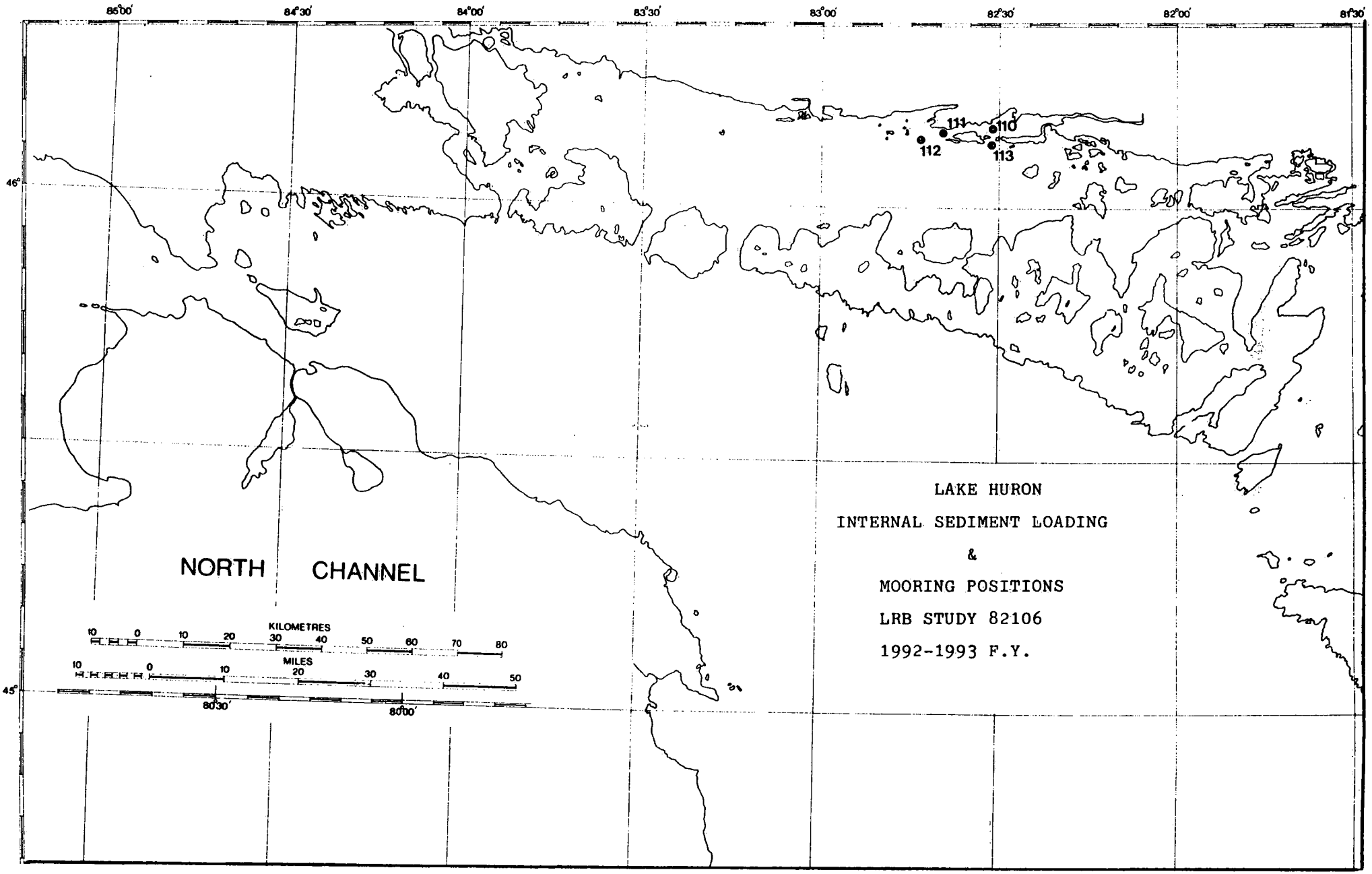
1992-1993

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST.DEPTH m
110	92-02A-01A	46° 08' 57"	82° 32' 28"	ST 10, 29
110	92-02C-02A	46° 08' 45"	82° 32' 28"	CM 10
111	92-02A-03A	46° 08' 44"	82° 39' 21"	ST 10, 17
111	92-02C-04A	46° 09' 06"	82° 39' 16"	CM 10
112	92-02A-05A	46° 07' 37"	82° 46' 21"	ST 10, 26
112	92-02C-06A	46° 07' 36"	82° 46' 51"	CM 10
113	92-02A-07A	46° 06' 20"	82° 30' 41"	ST 10

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS
DATES FROM _____ TO _____ REGION NORTH CHANNEL
CRUISE TYPE LAKE HURON MOORINGS N.MI. STEAMED 1031.4

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	9	Moorings Established Sediment Trap	4
EBT/Transmissometer Casts	9	Moorings Retrieved Sediment Trap	4
Rosette Casts		Moorings Established Current Meter	3
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved Current Meter	3
Secchi Disc Observations	7	Moorings Established	
		Moorings Retrieved	
Zooplankton Hauls		Moorings Refurbished	
Integrator 10 m		Moorings Serviced	
Integrator 20 m		Moorings Serviced	
Phytoplankton Samples		Primary Productivity Moorings	
		Cores Taken, Box	
Water Samples Collected (Microbiology)		Cores Taken, Gravity	
Water Samples Collected (Water Quality)		Cores Taken, Piston	
Water Samples Collected (AECL)	4	Cores Taken	
Water Samples Collected (D.O.)			
Water Samples Collected (Cond/pH)		Grab Samples Taken	
Water Samples Collected ( )			
Water Samples Collected (TP uf)		Bulk Centrifuge Samples 1200 litres	6
Water Samples Collected (TKN)			
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered (Chlorophyll a)			
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)			
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major Ions)			
Water Samples Filtered ( )			
Water Samples Filtered ( )			
Water Samples Filtered ( )			


85°00'
84°30'
84°00'
83°30'
83°00'
82°30'
82°00'
81°30'
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111
110
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113
NORTH CHANNEL
KILOMETRES
10 0 10 20 30 40 50 60 70 80
MILES
10 0 10 20 30 40 50
80°30'
80°00'
LAKE HURON
INTERNAL SEDIMENT LOADING
&
MOORING POSITIONS
LRB STUDY 82106
1992-1993 F.Y.

BULK SEDIMENT COLLECTION

LRB STUDY 82107, A.J. ZEMAN

As a piggyback on a Lake Ontario Suspended Sediment/Mooring cruise on the CSS LIMNOS July 20-24, a bulk sediment sample of 1.5 cubic metres of bottom sediment was collected at station 500 in the western end of Lake Ontario. This sediment was collected by both box corer and Shipek and placed in containers provided. This sediment was then used to aid in the proposed sand capping experiment in Hamilton Harbour.

STATION POSITION

STATION NUMBER	LATITUDE N.	LONGITUDE W.
500	43° 20' 03"	79° 43' 44"

CONTAMINANT TRANSFER STUDY

LAKE ONTARIO

LRB STUDY 82201, DR. D.R.S. LEAN

This project was supported during the field season with three cruises on the CSS LIMNOS. All cruises were on Lake Ontario, April 21-24, August 4-7, 10-14 and October 5-9. This project was multidisciplinary to characterize the Lake Ontario ecosystem by examining its contaminant and biological structure at different trophic levels and the rates of transport between trophic levels (from bacteria to humans).

Parameters collected included temperature/transmission profiles, global solar radiation, size fractionation for particles of phosphorus and total phosphorus, phytoplankton, zooplankton grazing, mysis and zooplankton net hauls, organochlorine analyses, ambient and maximum rate of phosphorus uptake, benthic invertebrates, POC, PON, chla, nutrients, major ions, trace metals, total phosphorus, UVB, UVA and visible spectrum light.

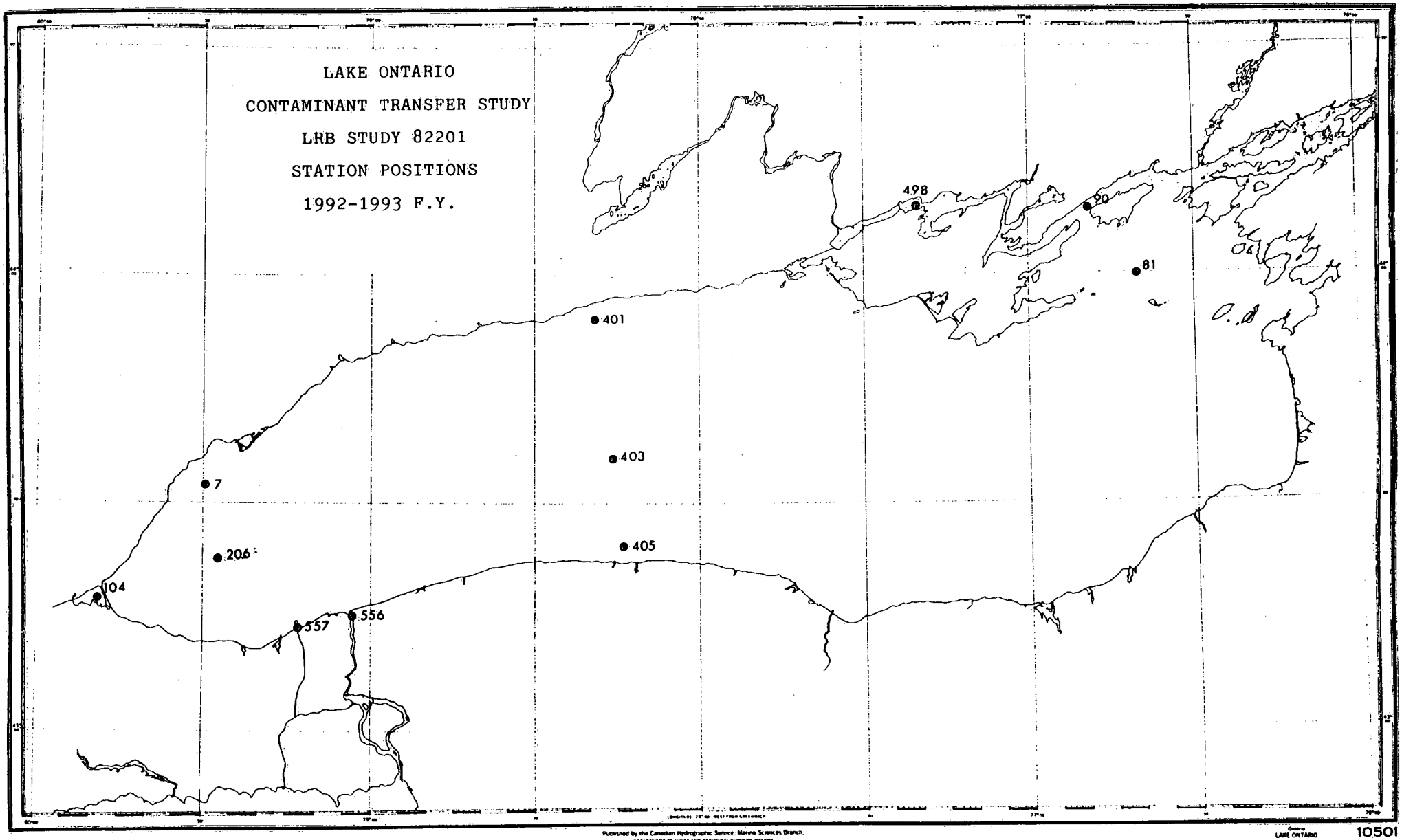
STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
7	43° 32' 54"	79° 29' 18"
81	44° 01' 01"	76° 40' 16"
90	44° 08' 01"	76° 49' 31"
104	43° 17' 12"	79° 50' 02"
104A	43° 17' 26"	79° 49' 53"
206	43° 23' 54"	79° 27' 42"
401	43° 53' 24"	78° 15' 52"
402	43° 36' 42"	78° 13' 47"
403	43° 24' 08"	78° 12' 06"
498	44° 09' 07"	77° 20' 12"
556	43° 15' 09"	79° 03' 24"
557	43° 14' 12"	79° 12' 59"

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS
DATES FROM _____ TO _____ REGION LAKE ONTARIO
CRUISE TYPE CONTAMINANT TRANSFER STUDY N.MI. STEAMED 1259.09

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	28	Moorings Established	
EBT/Transmissometer Casts	28	Moorings Retrieved	
Rosette Casts	69	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	19	Moorings Established	
		Moorings Retrieved	
Zooplankton Hauls	137	Moorings Refurbished	
Integrator 10 m		Moorings Serviced	
Integrator 20 m		Moorings Serviced	
Phytoplankton Samples	31	Primary Productivity Moorings	
Mysid Net Hauls	22		
		Cores Taken, Box	2
Water Samples Collected (Microbiology)		Cores Taken, Gravity	
Water Samples Collected (Water Quality)	17	Cores Taken, Piston	
Water Samples Collected ( )		Cores Taken	
Water Samples Collected (D.O.)	62		
Water Samples Collected (Cond/pH)	38	Grab Samples Taken (Ponar)	112
Water Samples Coll. (Size Fractionation)	35		
Water Samples Collected (TP uf)	41	Bulk Centrifuge Samples	
Water Samples Collected (TKN)	10		
Water Samples Coll. (Zooplankton Grazing)	32	Observations, Weather	
Water Samples Filtered ( )			
Water Samples Filtered (Chlorophyll a)	41	CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (POC/TPN)	27	Solar Radiation	18.5
Water Samples Filtered (Seston)	10		
Water Samples Filtered (TP f)	41	**ONBOARD ANALYSIS**	
Water Samples Filtered (Nutrients)	27		
Water Samples Filtered (Major Ions)	27	Manual Chemistry, Tech. Ops.	144
Water Samples Filtered (Trace Metals)	27	Nutrients, WOB	
Water Samples Filtered (DCM Extracts)	78	Microbiology	


LAKE ONTARIO
CONTAMINANT TRANSFER STUDY
LRB STUDY 82201
STATION POSITIONS
1992-1993 F.Y.
498
20
81
401
403
7
206
405
104
357
556
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DEPARTMENT OF MINES AND TECHNICAL SURVEYS OTTAWA
LAKE ONTARIO
10501

SEDIMENTATION RATES

LAKE ONTARIO

LRB STUDY 82202, M.N. CHARLTON

This study was used to measure sedimentation and regeneration rates of nutrients and contaminants in Lake Ontario by the use of sediment trap moorings.

There were five cruises to support this project, April 13-15, June 8-12, July 20-24, August 24-27 and October 13-16. Sediment trap moorings were established at stations 430, 463, 464 and 465. The sediment trap depths at each station were:

Station 403: 20, 60, 100, 140, 166 and 173 m
Station 463: 20, 30, 40, 45 and 48 m
Station 464: 20, 60, 70, 80, 90 and 98 m
Station 465: 20, 60, 120, 130, 140 and 148 m

SEDIMENT TRAP MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
403	92-00A-65A	43° 36' 12"	78° 13' 08"
463	92-00A-10A	43° 51' 38"	78° 15' 47"
464	92-00A-11A	43° 45' 48"	78° 14' 41"
465	92-00A-12A	43° 39' 05"	78° 14' 36"

Several additional tasks were performed during these cruises. These included the collection of piston cores for the University of Waterloo; water samples for RAB Study 84206; centrifuging bulk water samples for Atomic Energy Company Limited and the retrieval of a mooring for the Great Lakes Environmental Research Laboratory in Ann Arbor, Michigan.

As an additional project to this study, four zebra mussel moorings were installed in Lake Ontario and Hamilton Harbour to evaluate the colonization of zebra mussels in Western Lake Ontario. These moorings were installed at stations 209, 674, 690 and 906.

ZEBRA MUSSEL MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
209	92-00S-13A	43° 19' 41"	79° 00' 03"
674	92-00S-14A	43° 26' 05"	79° 37' 18"
690	92-00S-15A	43° 16' 37"	79° 34' 34"
906	92-00S-16A	43° 17' 20"	79° 50' 21"

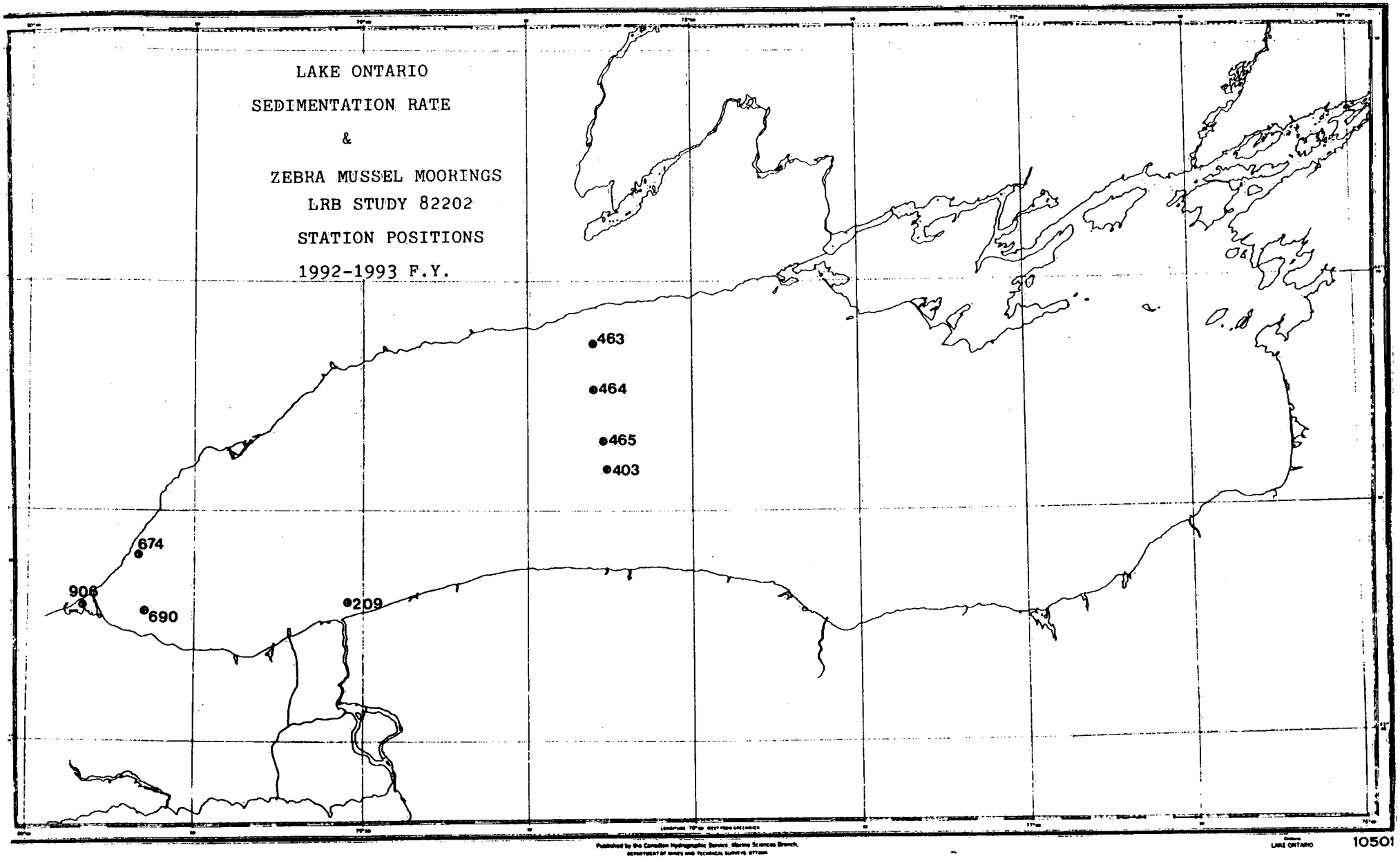
The zebra mussel depths at each station were:

Station 209: 10, 15, 20, 25, 30 and 35 m
Station 674: 10, 15, 20, 25, 30 and 35 m
Station 690: 10, 15, 20, 25, 30 and 35 m
Station 906: 10, 12.5, 15, 17.5, 20 and 22.5 m

STATISTICS SUMMARY

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS
DATES FROM _____ TO _____ REGION LAKE ONTARIO
CRUISE TYPE SEDIMENTATION RATE/MOORINGS N.MI. STEAMED 1598.02

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	76	Moorings Established Sed Trap	5
EBT/Transmissometer Casts	65	Moorings Retrieved Sed Trap	5
Rosette Casts	10	Moorings Established Current Meter	3
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved Current Meter	3
Secchi Disc Observations	21	Moorings Established Meteorological	3
Van Dorn Casts		Moorings Retrieved Meteorological	3
Zooplankton Hauls		Moorings Refurbished Sed Trap	4
Integrator 10 m		Moorings Serviced Metrologial	2
Integrator 20 m		Moorings Serviced	
Phytoplankton Samples		Primary Productivity Moorings	
Mysis Net Hauls		Cores Taken, Mini Box	
		Cores Taken, Box	21
Water Samples Collected (Microbiology)		Cores Taken, Gravity	
Water Samples Collected (Water Quality)		Cores Taken, Piston	7
Water Samples Collected (Quality Assur.)	2	Cores Taken, Benthos	24
Water Samples Collected (Cond)	38	Grab Samples Taken, Ponar	
Water Samples Collected ( )		Grab Samples Taken, Shipek	7
Water Samples Collected (TP uf)		Bulk Centrifuge Samples 1200 litres	8
Water Samples Collected (TKN)		Bulk Centrifuge Samples 600 litres	11
Water Samples Collected (ALK)		Observations, Weather	
Water Samples Collected (Dissolved Gases)	38	Bulk Centrifuge Samples 900 litres	1
Water Samples Filtered (Chlorophyll a)		Moorings Established Thermograph	5
Water Samples Filtered (POC/TPN)		Moorings Retrieved Thermograph	4
Water Samples Filtered (Seston)	28	Moorings Established/Retrieved ADCP	2
Water Samples Filtered (TP f)		Moorings Established/Retrieved %T	1
Water Samples Filtered (Nutrients)	5	**ONBOARD ANALYSIS**	
Water Samples Filtered (Major Ions)	5	Manual Chemistry, Tech. Ops.	38
Water Samples Filtered (Trace Metals)	5	Nutrients, WOB	
Water Samples Filtered ( )		Microbiology	
Water Samples Filtered ( )			


LAKE ONTARIO
SEDIMENTATION RATE
&
ZEBRA MUSSEL MOORINGS
LRB STUDY 82202
STATION POSITIONS
1992-1993 F.Y.
463
464
465
403
674
906
690
209
10501

HAMILTON HARBOUR AND WESTERN LAKE ONTARIO MOORINGS

LRB STUDY 82206, F.M. BOYCE

This study was to provide more information for background data on circulation and temperatures in Western Lake Ontario as well as meteorological information from Hamilton Harbour.

The CSS LIMNOS supported this study for the installation of moorings. A meteorological buoy was installed in Hamilton Harbour on April 27 and a meteorological buoy to be used as a marker/guard buoy and two current/temperature moorings on June 1. The CSS ADVENT was utilized to retrieve all of these moorings on November 30.

MOORING POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
712	43° 16' 57"	79° 42' 10"
713	43° 16' 14"	79° 44' 02"
906	43° 17' 18"	79° 50' 29"

LAKE ONTARIO MOORINGS

LRB STUDY 82306, DR. C.R. MURTHY

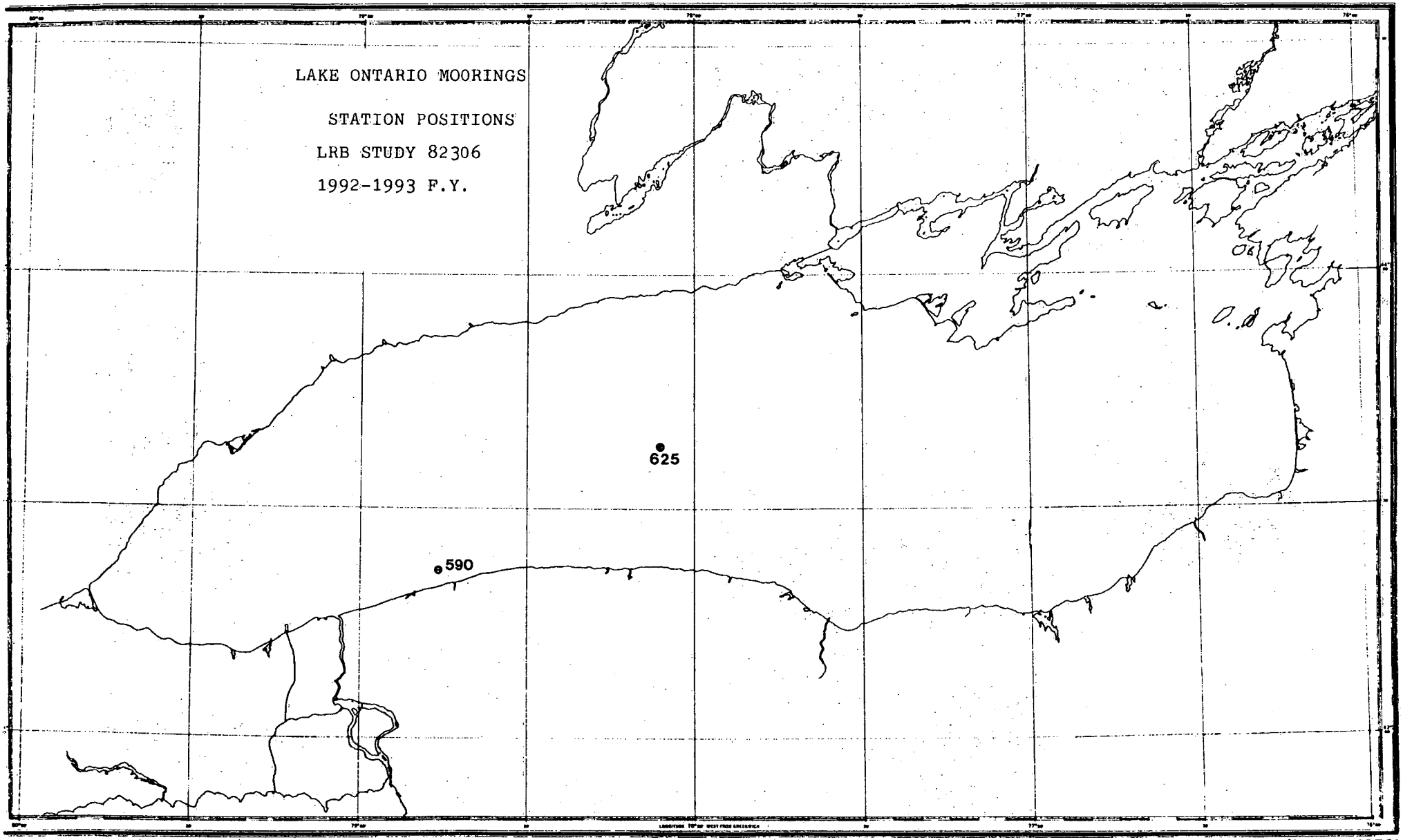
This study examined the pathways and transport of toxic contaminants in the nepheloid layer of Lake Ontario. To accomplish this, several moorings were installed in Lake Ontario at stations 625 and 590.

MOORING POSITIONS

LAKE ONTARIO

1992-1993

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH M
625	92-00M-01A	43° 35' 52"	78° 04' 39"	MET
	92-00M-02A	43° 35' 52"	78° 04' 42"	MET
	92-00C-03A	43° 35' 12"	78° 05' 26"	CM(12,131, 151,166, 176)
	92-00C-04A	43° 35' 36"	78° 04' 52"	CM(24,141, 161,171, 180)
	92-00T-05A	43° 35' 20"	78° 04' 43"	T(12,25,35, 45,55,65,75, 85,95.105)
	92-00A-06A	43° 35' 22"	78° 04' 19"	ST(55,170)
	92-00S-17A	43° 35' 38"	78° 04' 37"	ST(166,176)
	92-00C-30A	43° 35' 24"	78° 05' 25"	ADCP(176)
590	92-00C-31A	43° 22' 28"	78° 46' 04"	ADCP(61.7)
	92-00C-32A	3° 22' 28"	78° 46' 23"	CM(60)



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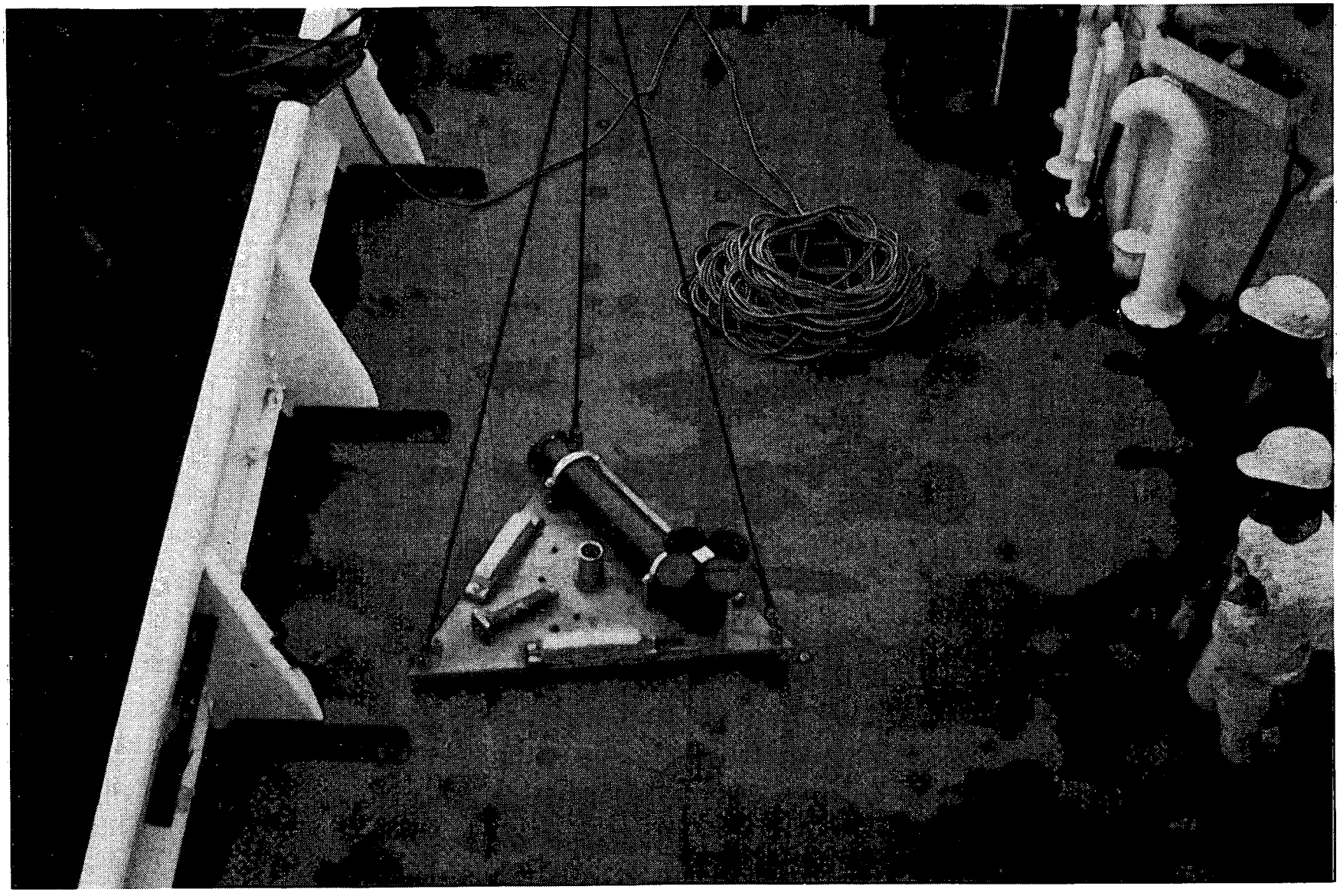
LAKE ONTARIO

10501



BOTTOM MOUNTED ACOUSTIC DOPPLER CURRENT PROFILER ON DECK

LAKE ONTARIO MOORINGS

LRB STUDY 82406, W.M. SCHERTZER

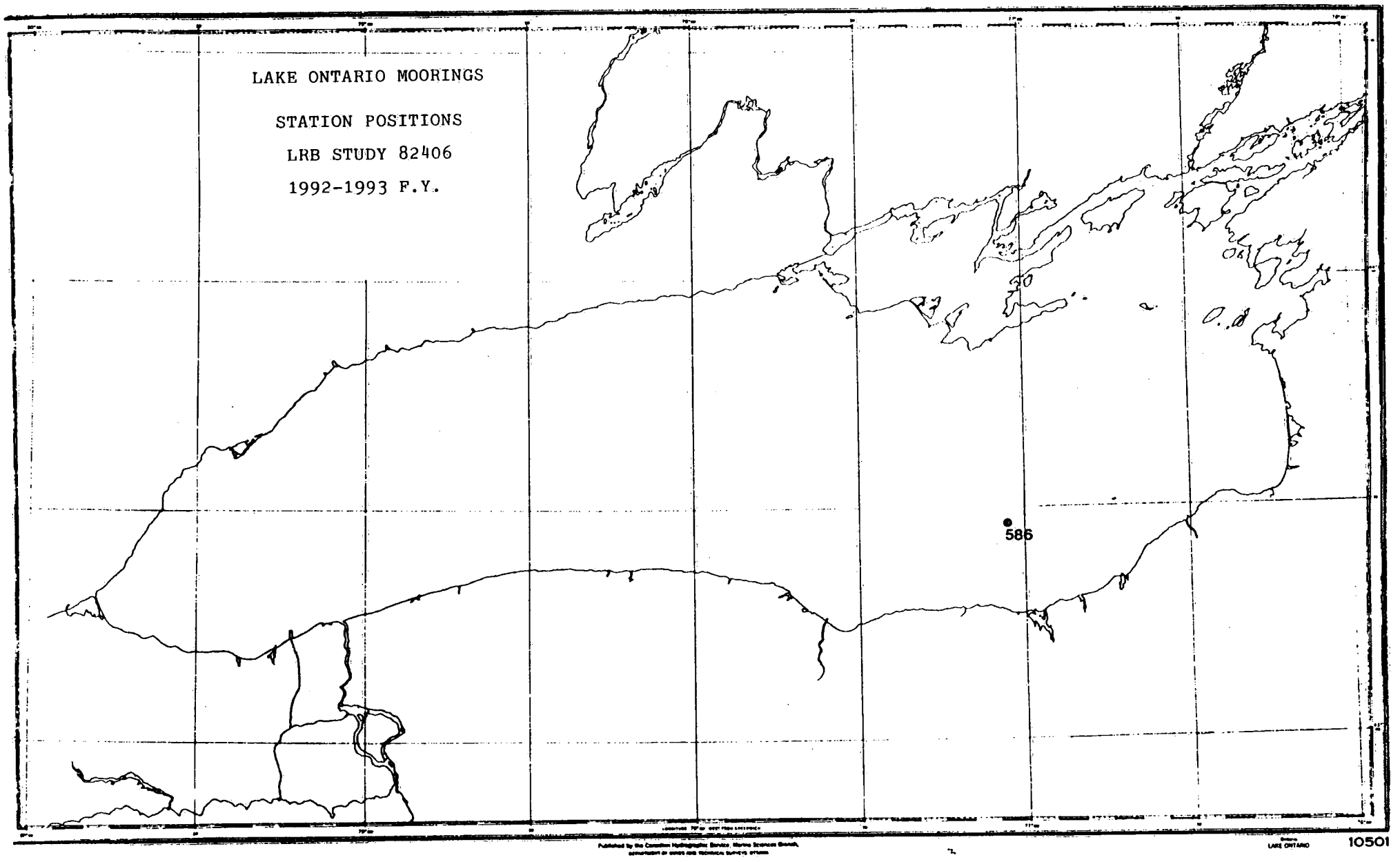
The purpose of this study was to deploy meteorological and temperature moorings to give detailed vertical temperature measurements at the deep hole of Lake Ontario. To accomplish this, two meteorological and two temperature moorings were installed at station 586. The two temperature moorings were reinstalled in October as winter moorings and will be retrieved in the spring. There were only eight loggers installed on mooring 92-00T-35A for the winter at 10, 16, 26, 36, 46, 61, 101 and 181 metres.

MOORING POSITIONS

LAKE ONTARIO

1982-1983

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE	INST/DEPTH M
586	92-00M-33A	43° 29' 31"	77° 03' 23"	MET,T(2)
	92-00M-34A	43° 29' 39"	77° 03' 24"	MET
	92-00T-35A	43° 29' 36"	77° 03' 09"	T(4,6,8,10, 16,26,36,46, 61,101,181)
	92-00T-36A	43° 29' 22"	77° 03' 35"	T(12,21,31, 41,51,81,141, 219)


LAKE ONTARIO MOORINGS
STATION POSITIONS
LRB STUDY 82406
1992-1993 F.Y.
586
10501

OPEN LAKES METAL CYCLE STUDY

LRB STUDY 82407, DR. J.O. NRIAGU

During the field season, the CSS LIMNOS supported this project twice. Eight stations were sampled on Lake Ontario during the week of August 17-22 and three stations were sampled October 19-24. Samples were collected using GoFlow bottles. Samples were collected from discrete depths determined from the EBT trace by the study leader.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
9	43° 35' 12"	79° 23' 45"
17	43° 13' 31"	79° 16' 24"
33	43° 35' 55"	78° 48' 02"
57	43° 16' 31"	77° 35' 35"
60	43° 34' 46"	77° 12' 00"
71	43° 28' 38"	76° 31' 36"
90	44° 08' 16"	76° 49' 27"
102	44° 12' 19"	76° 14' 39"

C S S L O U I S M. L A U Z I E R

CSS LOUIS M. LAUZIER
1992

	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
FEB	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
MAR	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	1	2	3	4
APR	5	6 LAKE ONTARIO	7 BIOINDEX BENTHOS	8 LAKE ONTARIO	9	10	11
	12	13 LAKE ONTARIO	14 BIOINDEX	15 LAKE ONTARIO	16	17	18
	19	20 DOWN	21 WEEK	22	23	24	25
	26	27 LAKE ONTARIO	28 BIOINDEX	29 ACOUSTIC SURVEY	30 LAKE ONTARIO	1	2
MAY	3	4 LAKE ONTARIO	5 BIOINDEX	6 QUINTE	7 LAKE ONTARIO	8	9
	10	11 LAKE ONTARIO	12 BIOINDEX	13 LOTT	14 LAKE ONTARIO	15	16
	17	18	19 LAKE ONTARIO	20 BIOINDEX	21 QUINTE	22 LAKE ONTARIO	23
	24	25 DOWN	26 WEEK	27	28	29	30
	31	1 LAKE ONTARIO	2 BIOINDEX	3 QUINTE	4 LAKE ONTARIO	5	6
JUN	7	8 LAKE ONTARIO	9 BIOINDEX	10 LAKE ONTARIO	11	12	13
	14	15 LAKE ONTARIO	16 BIOINDEX	17 QUINTE	18 LAKE ONTARIO	19	20
	21	22	23 LAKE ONTARIO	24 BIOINDEX	25 LAKE ONTARIO	26	27
	28	29 LAKE ONTARIO	30 BIOINDEX	1 QUINTE	2 LAKE ONTARIO	3	4
JUL	5	6	7 LAKE ONTARIO	8 BIOINDEX	9 LAKE ONTARIO	10	11
	12	13 LAKE ONTARIO	14 BIOINDEX	15 QUINTE	16 LAKE ONTARIO	17	18
	19	20 LAKE ONTARIO	21 BIOINDEX	22 LAKE ONTARIO	23	24	25
	26	27 LAKE ONTARIO	28 BIOINDEX	29 QUINTE	30 LAKE ONTARIO	31	1
AUG	2	3 DOWN	4 WEEK	5	6	7	8
	9	10 LAKE ONTARIO	11 BIOINDEX	12 QUINTE	13 LAKE ONTARIO	14	15
	16	17 LAKE ONTARIO	18 BIOINDEX	19 LAKE	20 ONTARIO	21	22
	23	24 LAKE ONTARIO	25 BIOINDEX	26 QUINTE	27 LAKE ONTARIO	28	29
	30	31 LAKE ONTARIO	1 BIOINDEX	2 ACOUSTIC SURVEY	3 LAKE ONTARIO	4	5
SEP	6	7	8 LAKE ONTARIO	9 BIOINDEX	10 QUINTE	11 LAKE ONTARIO	12
	13	14 LAKE ONTARIO	15 BIOINDEX	16 LAKE ONTARIO	17	18	19
	20	21 DOWN	22 WEEK	23 REPAIRS	24	25	26
	27	28 LAKE ONTARIO	29 BIOINDEX	30 QUINTE	1 LAKE ONTARIO	2	3
OCT	4	5 LAKE ONTARIO	6 BIOINDEX	7 QUINTE	8 LAKE ONTARIO	9	10
	11	12	13 LAKE ONTARIO	14 BIOINDEX BENTHOS	15 LAKE ONTARIO	16	17
	18	19 LAKE ONTARIO	20 BIOINDEX	21 QUINTE	22 LAKE ONTARIO	23	24
	25	26	27	28	29	30	31
NOV	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
DEC	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31		

LONG TERM BIOLOGICAL INDEX MONITORING

AND QUINTE PROJECT

GLLFAS PROJECT 9211, DR. O.E. JOHANNSSON
GLLFAS PROJECT 9218, E.S. MILLARD

The International Joint Commission accepted a broader definition of lake health encompassing all components of the ecosystem in 1978. The Long Term Biological Index Monitoring 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 open water pelagic and benthic communities and providing input to an integrated Lake Ontario Biological Monitoring Program.

Twenty-five cruises were completed by the research vessel CSS LOUIS M. LAUZIER. The first cruise commenced the week of April 6 and the final cruise ended October 22. Sampling for the Quinte Program during the week of September 21 was completed utilizing a launch while the LAUZIER underwent engine repair. During this week, sampling was co-ordinated with a program of remote sensing from a small aircraft.

Biological and chemical data were 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 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. 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.

The Project Quinte sampling program began the week of May 4. Six stations in the Bay of Quinte were sampled in support of GLLFAS Project 9218 on a biweekly basis. This work is a continuation of the long term monitoring program carried out since 1972 for Project Quinte. The six stations are: T (Trenton), B (Belleville), G (Glenora), HB (Hay Bay), C (Conway), N (Deseronto). Typical sampling of these stations included a temperature/depth profile, a transmissometer cast and an integrated water sample for chlorophyll a, particulate organic carbon, water quality and seston. A dissolved oxygen profile, a light extinction profile and primary productivity and P kinetics experiments were done. Zooplankton samples

were collected using a Schindler-Patalas trap. At all stations, water samples were collected for the Ministry of the Environment, including samples for metals, reactive soluble phosphorus, algae and nutrients.

Several additional tasks were accomplished during the field season, including:

1. Benthic samples were collected for R.M. Dermott, GLLFAS from Lake Ontario stations 41, 81A, 93, 93A on two occasions

2. Sediment and water samples were collected at station PE on a monthly basis for Dr. T.B. Reynoldson, LRB

3. Each month, zooplankton samples were collected for the Ontario Ministry of Natural Resources at stations located at Van Wagner's Beach, Cobourg, Long Point, Wellington and Presqu'ile

4. During each cruise, dissolved gases samples and dissolved oxygen samples were collected at several depths for Dr. B. Kerman, AES at stations K1, K2 and 41

5. Personnel from Erindale College and University of Maryland conducted a survey of LOTT transect lines using a towed optical plankton counter and a computerized acoustical fish finding transducer to determine the spatial distribution and population density of small open water fish species

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"
B	Quinte	44° 09' 02"	77° 20' 40"
HB	Quinte	44° 05' 36"	77° 04' 13"
C	Quinte	44° 06' 28"	76° 53' 54"
GL	Quinte	44° 02' 42"	77° 01' 16"
N	Quinte	44° 10' 30"	77° 02' 54"
T	Quinte	44° 05' 12"	77° 32' 42"
814	Benthos	43° 58' 54"	76° 39' 18"
93	Benthos	43° 19' 36"	78° 52' 06"
93A	Benthos	43° 21' 48"	78° 51' 24"
G	Benthos	43° 17' 24"	79° 36' 45"
PE	Benthos	43° 59' 01"	76° 53' 04"
HB	OMNR	43° 17' 31"	79° 48' 05"
W	OMNR	43° 56' 24"	77° 19' 50"
LP	OMNR	43° 54' 14"	76° 54' 02"
C	OMNR	43° 57' 03"	78° 10' 15"
K1	Dissolved Gases	43° 30' 27"	78° 55' 34"
K2	Dissolved Gases	43° 37' 49"	77° 09' 13"
41	Dissolved Gases	43° 43' 00"	78° 01' 36"

C S S A D V E N T

CSS ADVENT
1992

	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
FEB	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
MAR	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31	1	2	3	4
APR	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
MAY	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
	31	1	2	3	4	5	6
JUN	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22 LAKE ONTARIO	23 IN/OFFSHORE PROCESSES	24	25	26	27
	28	29	30	1	2	3	4
JUL	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21 LAKE ONTARIO	22 IN/OFFSHORE PROCESSES	23	24	25
	26	27	28	29	30	31	1
AUG	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 LAKE ONTARIO	2 IN/OFFSHORE PROCESSES	3	4	5
SEP	6	7	8	9 IN/OFFSHORE PROCESSES	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	1	2	3
OCT	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
NOV	1	2	3	4	5	6	7
	8	9	10 LAKE ONTARIO IN/OFFSHORE	11	12	13	14
	15	16	17	18	19 HARBOUR WQ PROFILES	20	21
	22	23	24	25 HARBOUR SEDIMENT	26	27	28
	29	30 LAKE ONTARIO MOORINGS	:	2	3	4	5
DEC	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31		

LAKE ONTARIO INSHORE/OFFSHORE PROCESSES

LRB STUDY 82208, DR. M.E. FOX

The purpose of this study was to determine the loading of PCBs and PAHs in the nearshore/offshore transport of contaminants in the Hamilton-Toronto area of Lake Ontario. The study was a continuation of past work involving the transport of contaminants from Hamilton Harbour to Lake Ontario.

A total of 8 stations were visited in 1992 during four different cruises on the CSS ADVENT. Bulk water samples were collected using a submersible pump from 1 m and 1 m below the thermocline at all stations and chemical extractions were done immediately by the scientific personnel onboard. In addition, during the September cruise, water samples were collected for Lindane analysis using the rosette sampler and a dissolved gas profile to 20 m was done using a portable mass spectrometer.

At each station, up to 6 zooplankton net hauls were done and samples preserved in the jars supplied.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
206	43° 23' 54"	79° 27' 42"
664	43° 18' 18"	79° 27' 42"
665	43° 19' 38"	79° 42' 13"
676	43° 29' 48"	79° 35' 30"
682	43° 28' 56"	79° 34' 06"
683	43° 37' 36"	79° 28' 12"
689	43° 35' 39"	79° 25' 54"
906	43° 17' 15"	79° 50' 18"

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

LAKES RESEARCH BRANCH

HAMILTON HARBOUR STUDIES

Hamilton Harbour was identified as an area of concern by the International Joint Commission in 1985. It was recommended that the harbour be used as a Canadian site for implementing a rehabilitation plan. During the last 18 years, the Ontario 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 seventh year of NWRI involvement in a major thrust to answer questions related to harbour rehabilitation.

A total of eight studies were supported by Technical Operations and organized into a single program to collect the data required to answer questions. The following activities were co-ordinated:

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

Vessels utilized to support the Hamilton Harbour project included the CSS ADVENT, CSL SHARK, CSL AGILE, CSL CORMORANT, GOOSE II and Mason #4.

HAMILTON HARBOUR - PHYSICAL DYNAMICS

LRB STUDY 82206, F.M. BOYCE

The purpose of this study was to collect water level and meteorological data in Hamilton Harbour to be used to form a data bank for future computer models. Three tide gauges were installed --one in each location: the deep hole, Canal West and Canal East (see figure 1). A MET buoy was installed in the central harbour in the deep hole.

TIDE GAUGE ELEVATIONS

92-00S-37A:	Deep Hole	23.5 metres below chart datums
92-00S-38A:	Canal West	ladder 75.710 - wire 7.27 = 68.44 m (ASL)
92-00S-39A:	Canal East	ladder 76.065 - wire 7.38 = 68.685 m (ASL)

HAMILTON HARBOUR SEDIMENTATION REGIME

LRB STUDY 82202, 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 figure 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 refurbished for winter deployment on November 1 and were scheduled for refurbishment in the spring of 1992. All four moorings were retrieved April 8 and 9. Due to a shortage of traps for the Open Lakes Program, they were never re-installed in Hamilton Harbour.

HAMILTON HARBOUR OXYGEN REGIME

LRB STUDY 82202, M.N. CHARLTON

The digital dissolved oxygen profiler was used throughout the field season (April to November) to monitor changes in oxygen concentrations in Hamilton Harbour and Lake Ontario near the Burlington ship canal. On a typical cast of the profiler, the following parameters were measured: dissolved oxygen, temperature, light transmission, conductivity, PH and depth. A total of 8 cruises were carried out with the profiler, occupying 21 stations per cruise (see figure 3).

Also included was a total of 8 water quality cruises which collected samples from 1 m and bottom -2 m for total phosphorus filtered and unfiltered and chlorophyll a from 21 stations (see figure 5). The DO profiling and water quality sampling cruises were combined into a one-day survey.

DO profiler/water quality surveys: April 14; June 24, 25; July 21, 24; August 26; September 22, 23; October 22, 27; November 19.

In conjunction with this program, Mr. R. Roy studied depth variations of microbial processes and environmental factors. Tech. Ops. cores and Ekman samples were collected on five occasions: June 22; July 20, 23; September 28, 30; October 7 and November 4. Seven to ten cores were collected at each of the following stations: 906, 907, 908, 909 and 910.

SEDIMENTOLOGY OF HAMILTON HARBOUR

LRB STUDY 82308, DR. J.P. COAKLEY

On April 27 and 28, sediment samples were collected along transect lines centered on the Burlington Sewage Treatment Plant outfall buoy located in the northeast corner of Hamilton Harbour (see figure 5).

A total of 34 stations were occupied, collecting an Ekman dredge sample at each. Tech. Ops cores were collected at 6 stations. Co-operative analysis of the samples with McMaster University personnel will map faecal sterols and other chemical tracers.

CALCIUM NITRATE INJECTIONS - HAMILTON HARBOUR

LRB STUDY 82112, DR. T.P. MURPHY

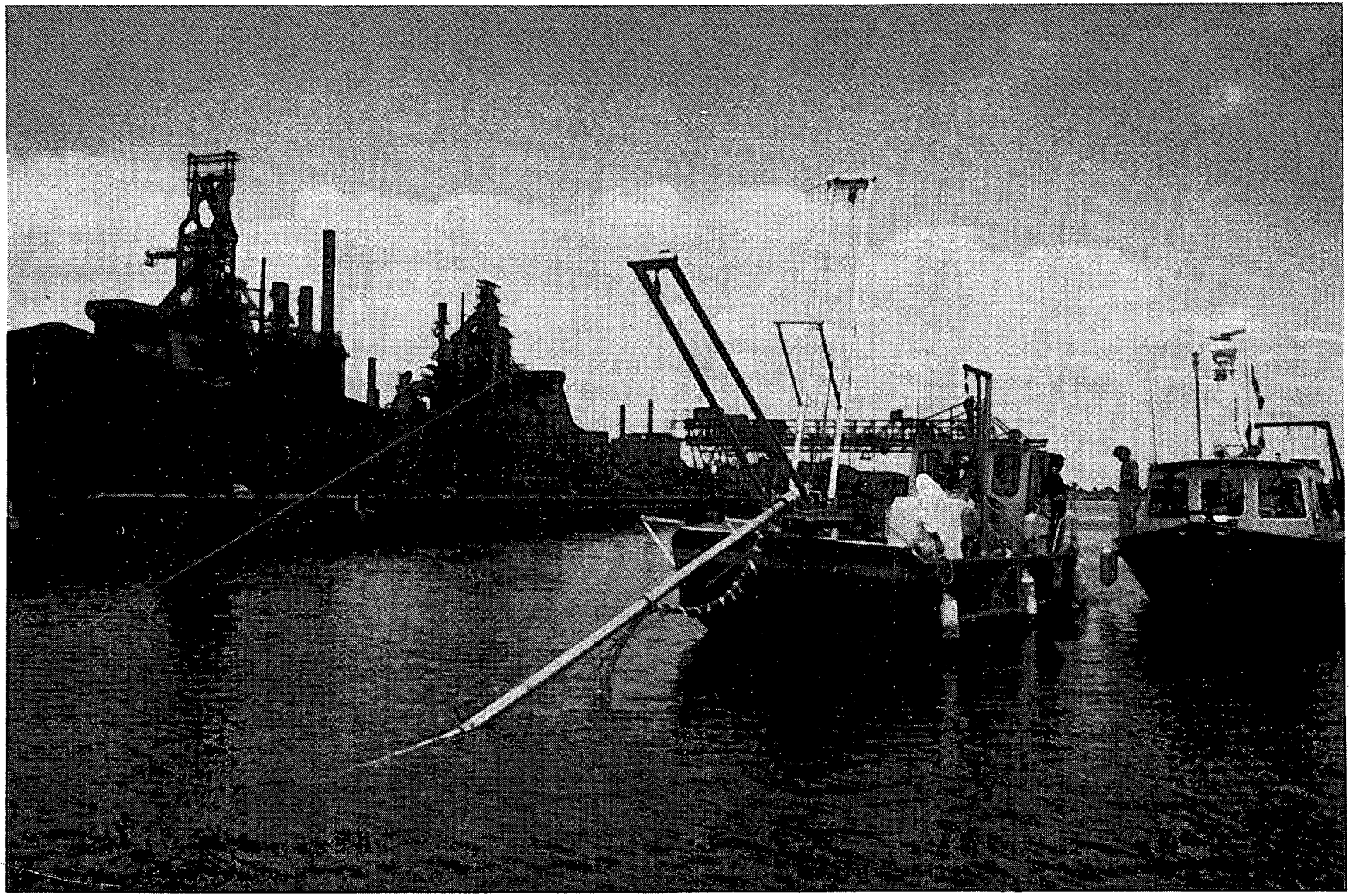
The injection of liquid agricultural grade calcium nitrate into bottom sediments to bind heavy metals such as zinc, copper and lead with iron thus accelerating the microbial breakdown of organic toxins has been proposed as an alternative to dredging operations. An injection system designed by Mr. J. Kruyer of Oleophilic Sieve Development Company of Canada Ltd. in Edmonton, Alberta was greatly modified at CCIW and used to inject an area of 18,200 square metres of sediment at three sites in Hamilton Harbour. This was the first series of injections at Stelco and Dofasco and the second injection of a site just north of the deep hole (see figure 6). The CSL GANDER was utilized to support the injection system while the CSL AGILE and CSL GOOSE II were utilized to transport the liquid calcium nitrate from CCIW to the work sites. The Mason #3 was utilized for coring both before and after injection.

The July calcium nitrate injections took place over a period of two weeks at three sites. The Randle Reef (Stelco) site was injected with 2,200 gallons of calcium nitrate over an area of 10,000 square metres during July 15-18. The Dofasco site (Pier 21) was injected with 1780 gallons of calcium nitrate over an area of 5,000 square metres during July 27-29. The deep hole site was injected with 850 gallons of calcium nitrate over an area of 3,200 square metres on July 30.

All liquid calcium nitrate batches were mixed to a concentration of 560 gm/litre (10 bags to 350 litres of water). The rate of injection was initially set at 10,000 litres/hour but since the nozzles began to plug, restricting the flow, the rate dropped as low as 7,500 litres/hour.

Randle Reef (Stelco)

Problems with the injection bar supply hose (split on deck), air compressor failure and plugged nozzles delayed the injections by three days. The air compressor was replaced with a water pump and a dual line filter was installed into the supply hose. On retrieval of the injection bar it was observed that approximately 10% of the bar was covered with coal tar deposits.



SEDIMENT INJECTION TREATMENT IN THE DOFASCO SLIP

Synopsis - gallons of calcium nitrate per line.

Trackline 1 - 240 gal.

2 - 170 gal., overlap line 1

3 - 145 gal., end of line 100 m (hose split)

4 - 112 gal., overlap line 3 end of line 90 m (compressor failure)

5 - 112 gal.

6 - 145 gal., overlap line 5

7 - 135 gal.

8 - 180 gal., overlap line 7

9 - 180 gal.

10 - 150 gal., overlap line 9

11 - 112 gal.

12 - 110 gal., overlap line 11

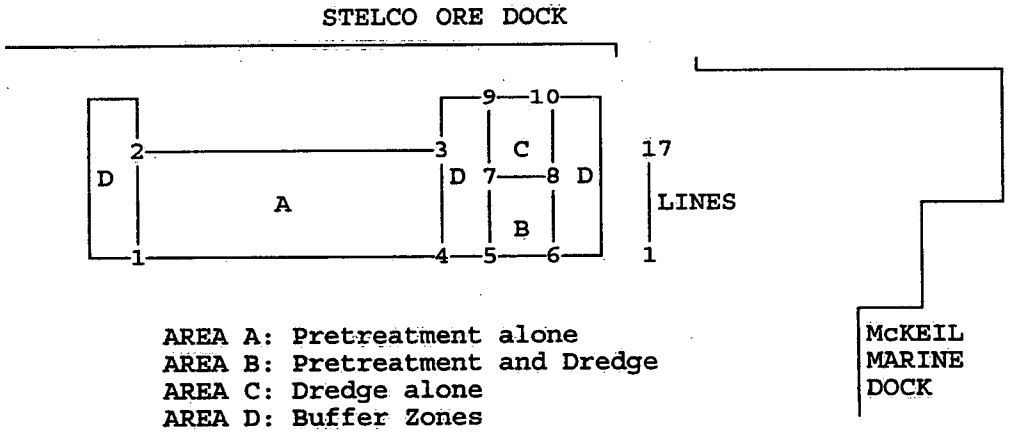
13 - 105 gal., overlap line 12

14 - 80 gal.

15 - 80 gal., overlap line 14

16 - 80 gal.

17 - 75 gal., overlap line 16



AREA A: Pretreatment alone
AREA B: Pretreatment and Dredge
AREA C: Dredge alone
AREA D: Buffer Zones

Perimeter Positions -

Position	Northing	Easting
1	4791832.	594754.
2	4791814.	594814.
3	4791692.	594777.

4	4791713.	594716.
5	4791680.	594707.
6	4791648.	594697.
7	4791664.	594755.
8	4791632.	594745.
9	4791649.	594800.
10	4791617.	594792.

Dofasco:

After eliminating most of the problems at Randle reef the work at Dofasco went remarkably smoother. The Mini-ranger positioning system could not be used at this site because the treatment area was relatively small and the transponders have a minimum range threshold of 100 metres. Also the considerable amount of steel buildings, cranes and walls created reflections of the signals. Range poles were used for tracklines and vessel speed was estimated.

Problems occurred with nozzles plugging with clay rather than calcium carbonate. To avoid this problem the suction hose was put over the side to pump water at a high flow rate through the nozzles during the initial phase. This procedure proved successful. Soundings indicated the bottom was very uneven at the injection site, indicating the possibility of the injection bar skipping in and out of the bottom sediments.

Synopsis - (gallons of calcium nitrate per line)

Trackline 1A - 150 gal., end of line 130m

1B - 180 gal., overlap line 1A

1C - 180 gal., overlap line 1B

2A - 125 gal.

2B - 120 gal., overlap line 2A

2C - 140 gal., overlap line 2C

3A - 165 gal.

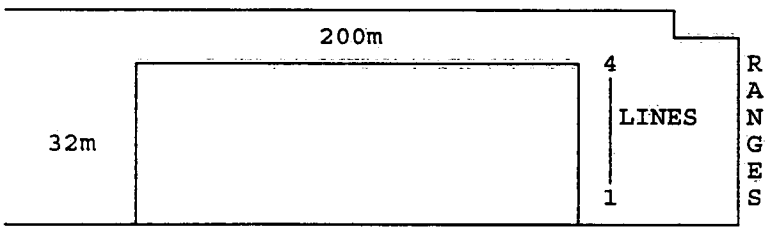
3B - 150 gal., overlap line 3A

3C - 145 gal., overlap line 3B

4A - 150 gal.

4B - 110 gal., overlap line 4A

4C - 165 gal., overlap line 4B



DOFASCO IRON ORE DOCK

Deep Hole:

The site selected was in 19m of water, located slightly north of the deep hole and south of the LaSalle Park Marina. The Mini-ranger system was used for positioning with the addition of an extra transponder on the Stelco ore dock(CHS 8).

Synopsis - (gallons of calcium nitrate per line)

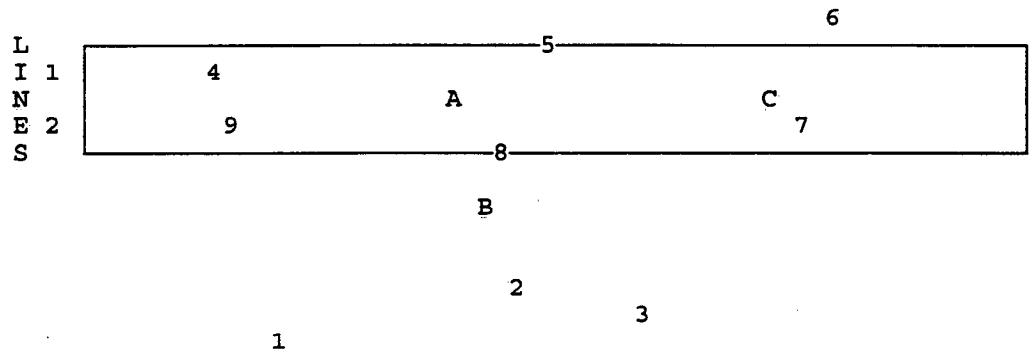
Trackline 1A - 210 gal.

1B - 225 gal., overlap line 1A

2A - 195 gal.

2B - 220 gal., overlap line 2A

DEF



STATION POSITIONS

	POSITION	NORTHING	EASTING
Peepers	A	4793814.	594002.
	B	4793794.	594011.
	C	4793841.	594076.
	DEF(control)	4793879.	593957.
Ferric Chloride Buoys			
	1	4793743.	593976.
	2	4793774.	594024.
	3	4793773.	594054.
Calcium Nitrate Site Pre-injection samples			
	4	4793805.	593964.
	5	4793833.	594019.
	6	4793859.	594087.
Post-injection Buoys			
	7	4793835.	594080.
	8	4793807.	594015.
	9	4793800.	593965.

On September 15 and 16, an area of 5,000 square metres at Dofasco (Pier 21) was injected with 1900 gallons of calcium nitrate. The injection plan was executed similarly to the July injection overlapping the same area. Range poles were used for tracklines and the vessel speed was estimated. The #20 nozzles were installed on the injection bar, immediately resulting in a lower back pressure and wider spray pattern. Flow rates were kept at 10,000 litres per hour and the calcium nitrate was mixed to the standard concentration of 560 mg/litre.

Previous problems with clay plugging the nozzles were resolved by pumping water through the system during the assembly stage. The injection bar was still skipping along the bottom--a result of bottom topography, causing the solution to enter the water. The barge GOOSE II was moored to the east shore at Dofasco and all mixing took place on the barge. The crane truck delivered the bags of calcium nitrate to the site and using the crane, lowered the pallets of chemical down to the barge. At the end of each injection run, the GANDER tied alongside the GOOSE II and refilled its reservoir.

SYNOPSIS

Trackline	1A - 112 gal.
	1B - 196 gal., overlap line 1A
	1C - 168 gal., overlap line 1B
	1D - 92 gal., overlap line 1C
	2A - 96 gal.
	2B - 144 gal., overlap line 2A
	2C - 144 gal., overlap line 2B
	3A - 155 gal.
	3B - 116 gal., overlap line 3A
	3C - 164 gal., overlap line 3B
	4A - 104 gal.
	4B - 152 gal., overlap line 4A
	4C - 152 gal., overlap line 4B
	5A - 150 gal.

UTILIZING BENTHIC INVERTEBRATES

LRB STUDY 82105, DR. T.B. REYNOLDSON

Core samples were collected to study the temporal changes in benthic community structure. An International Joint Commission 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 figure 4).

Samples were collected on April 15, May 13, June 9, July 14, August 5, October 8 and November 25. One hydrolab mooring was installed at each sampling station on May 21 and removed on November 23 and 24.

STATION POSITIONS

HAMILTON HARBOUR

1992-1993

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.
CCIW-ROOF	43° 17' 57"	79° 48' 05"	4794531.	597229.
ARTA	43° 17' 42"	79° 51' 30"	4793981.	592620.
HARB.COMM.	43° 16' 41"	79° 51' 42"	4791958.	592822.
STELCO	43° 17' 06"	79° 49' 33"	4792908.	595260.
CHS-8	43° 16' 50"	79° 49' 43"	4792408.	595055.

MOORING NUMBER	LATITUDE N.	LONGITUDE W.
BOYCE TIDE GAUGE/MET MOORINGS		
92-00S-37A	43° 18' 33"	79° 47' 09"
92-00S-38A	43° 17' 31"	79° 50' 08"
92-00S-39A	43° 17' 18"	79° 47' 54"
92-00M-19A	43° 17' 18"	79° 50' 29"

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
CHARLTON SEDIMENT TRAP WINTER 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.
REYNOLDSON - BENTHIC INVERTEBRATE STATIONS				
3	43° 16' 50"	79° 52' 20"	4792373.	591507.
19	43° 17' 16"	79° 50' 03"	4793217.	594584.

STATION NUMBER	UTM N.	UTM E.
COAKLEY - SEDIMENTOLOGY STATIONS		
1-1	4795403.	596717.
2-1	4795492.	596640.
2-2	4795679.	596554.
2-3	4795952.	596433.
4-1	4795614.	596773.
4-2	4795774.	596813.
6-1	4795386.	596774.
6-2	4795292.	596936.
6-3	4795287.	597000.
8-1	4795242.	596782.
8-1A	4794963.	596916.
8-2	4794856.	596972.
8-3	4794417.	597052.
8-4	No record	
10-1	4795295.	596670.
10-2	4795117.	596588.
10-3	4794756.	596422.
10-4	4794055.	596093.
10-5	4793106.	595699.
12-1	4795355.	596603.
12-2	4795257.	596432.
12-3	4795070.	596075.
12-4	4794762.	595326.
12-5	4794326.	594426.
13-1	4795409.	596365.
13-2	4795381.	595999.
13-3	4795366.	595491.
14-1	4795458.	596577.
14-2	4795559.	596397.
14-3	4795644.	596210.
14-4	4795753.	595943.

Fig. 1
TIDE GUAGE
MOORINGS

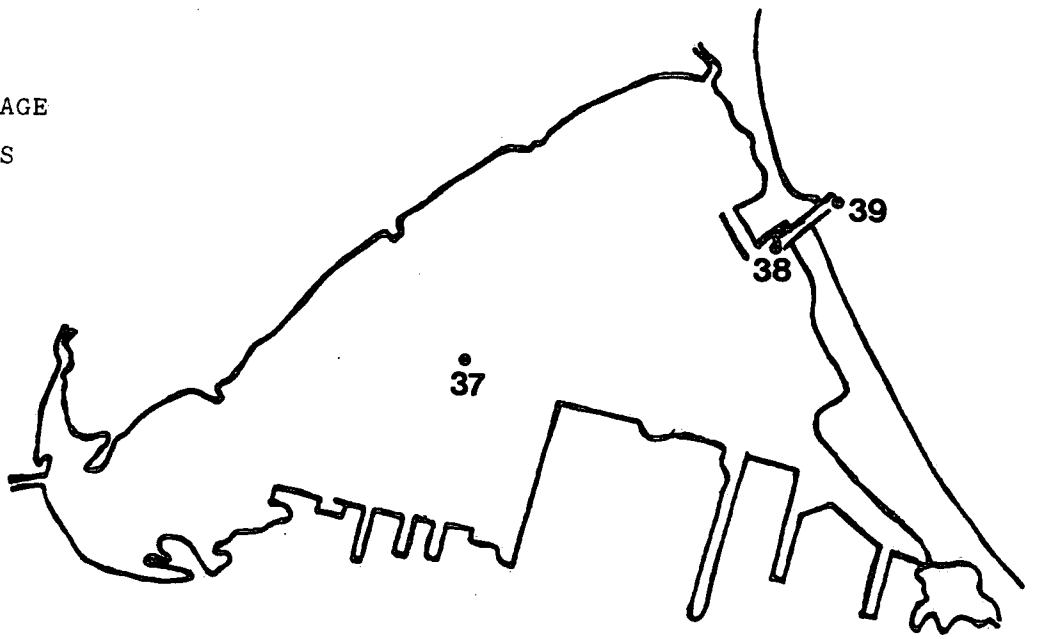


Fig. 2
SEDIMENT TRAP
WINTER MOORING
LOCATIONS

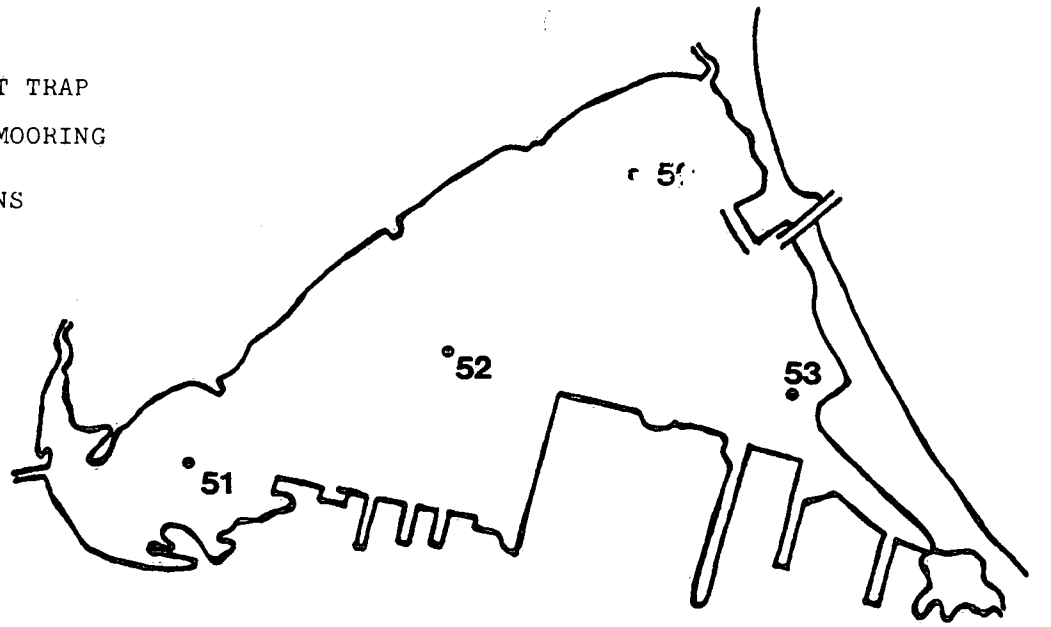


Fig. 3
D.O./W.Q. SURVEY
SAMPLING
STATIONS

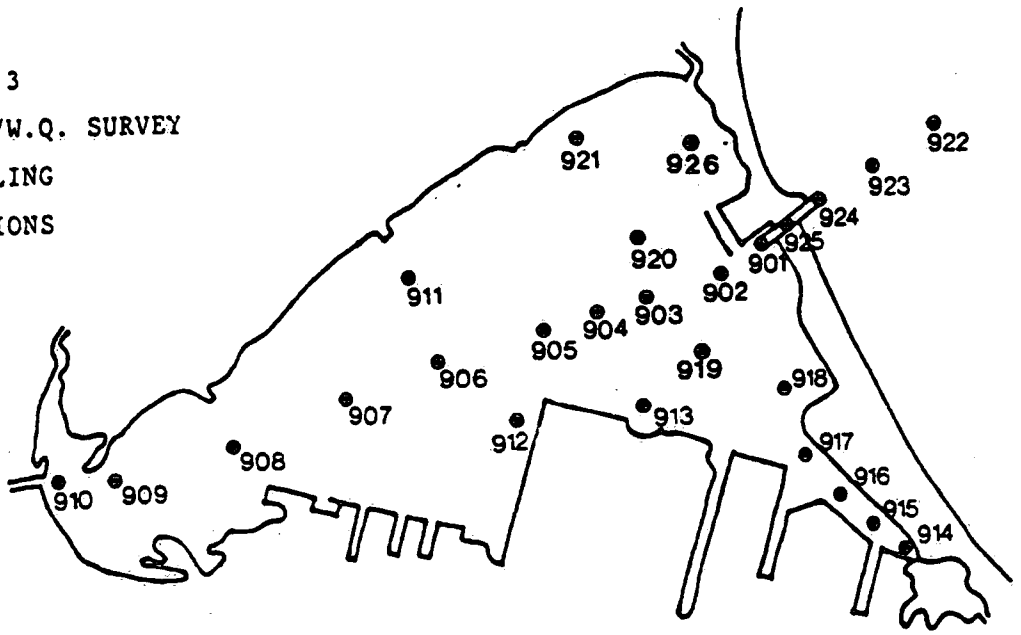


Fig. 4
BENTHIC INVERTEBRATE
SAMPLING
STATIONS

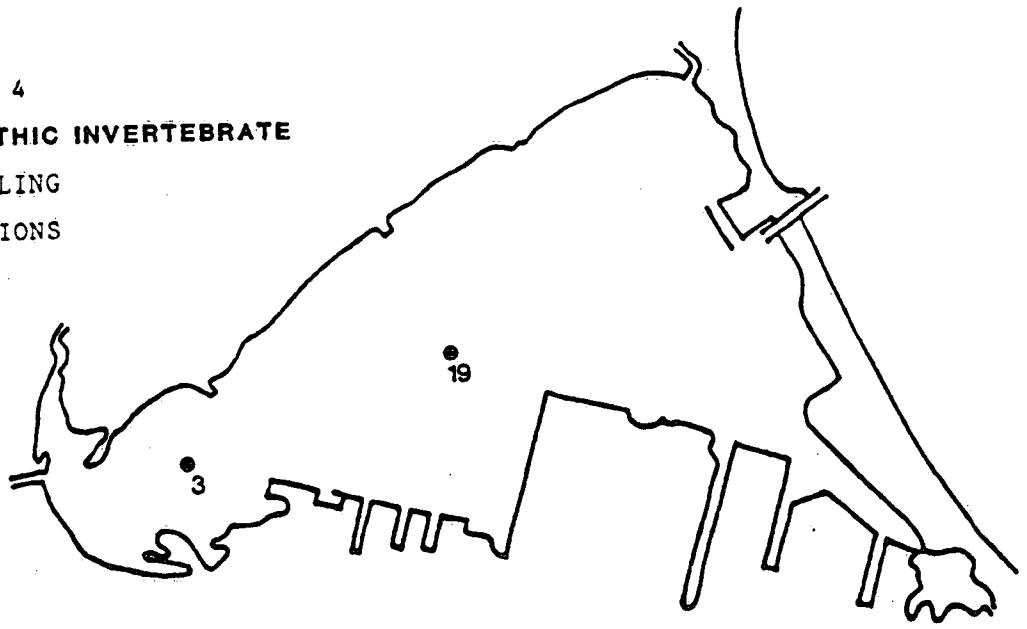


Fig. 5
SEDIMENTOLOGY
TRANSECTS

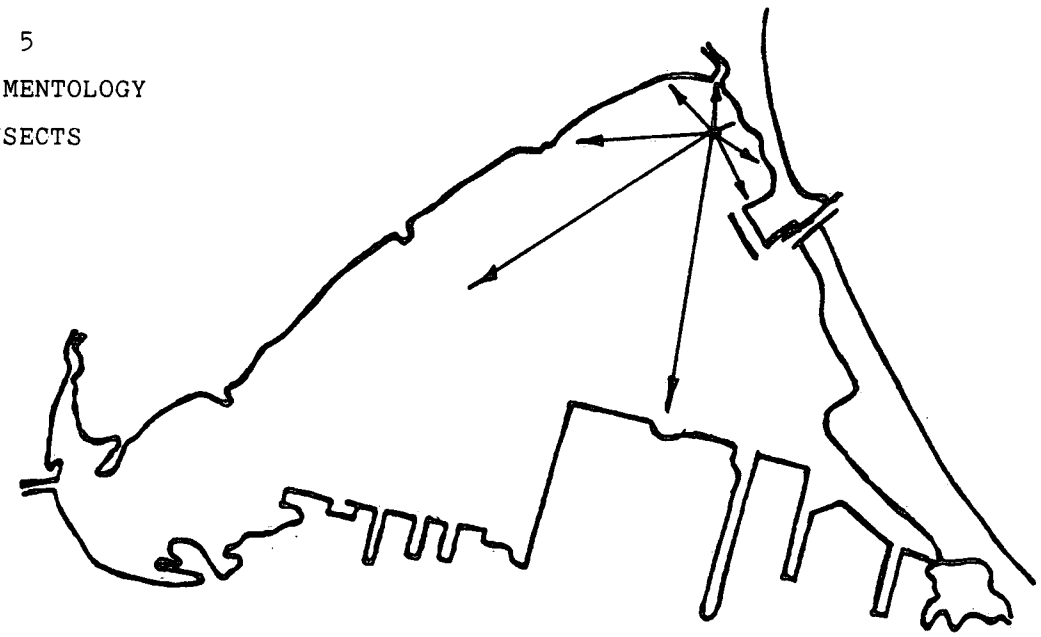
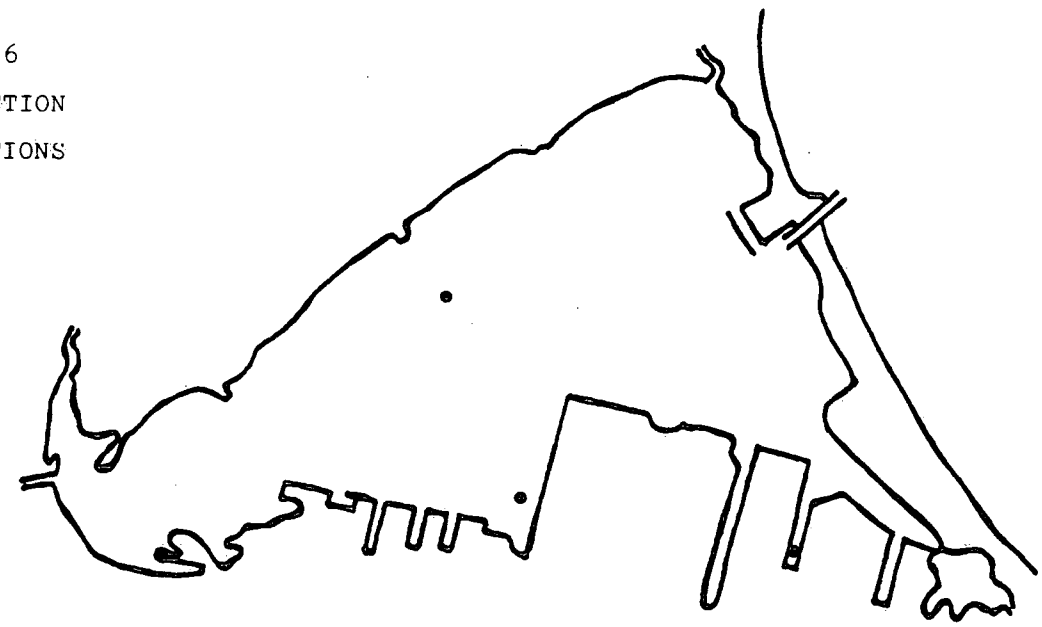


Fig. 6
INJECTION
LOCATIONS



CHAIN LAKE AND BLACK LAKE, BRITISH COLUMBIA

LRB STUDY 82101, DR. T.P. MURPHY

The purpose of this project was to promote plant growth on top of the berms and observe the effects of chemical treatment in Black Lake, B.C.

The project was supported during the first week of May when three tonnes of Ferric Chloride was added to Black Lake in order to observe the restoration effects on the lake. The lake was sampled every second day for the first week after initial installation and every second week until September. The bi-weekly sampling was done in conjunction with Westwater Research which is part of the University of British Columbia Engineering Department.

Sampling of Chain Lake, B.C. 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 residents association was assisted in the addition of Calcium Carbonate to the newly covered berms (3, 4 and 5) where any dredged sediment was exposed. This addition of carbonate will aid in the buffering of the acidic sediments and enhance plant growth.

FERRIC CHLORIDE INJECTION IN BLACK LAKE, B.C.

COASTAL GEOLOGY

LRB STUDY 82102, DR. N.A. RUKAVINA

As part of an ongoing coastal survey at the foot of Green's Road in the town of Stoney Creek, Technical Operations divers surveyed the site on two occasions. Stake measurements were recorded and a video was made to document any changes since the last inspection in December 1991.

During the April survey, stakes four and seven were discovered missing. Both stakes were replaced during the December inspection.

STATION POSITIONS

STATION NUMBER	UTM N.	UTM E.
1	4788351.	603598.
2	4788391.	603611.
3	4788406.	603615.
4	4788468.	603634.
5	4788546.	603662.
6	4788608.	603680.
7	4788713.	603714.

JACK OF CLUBS LAKE AND BOWRON LAKE, WELLS, B.C.

LRB STUDY 82103, A. MUDROCH

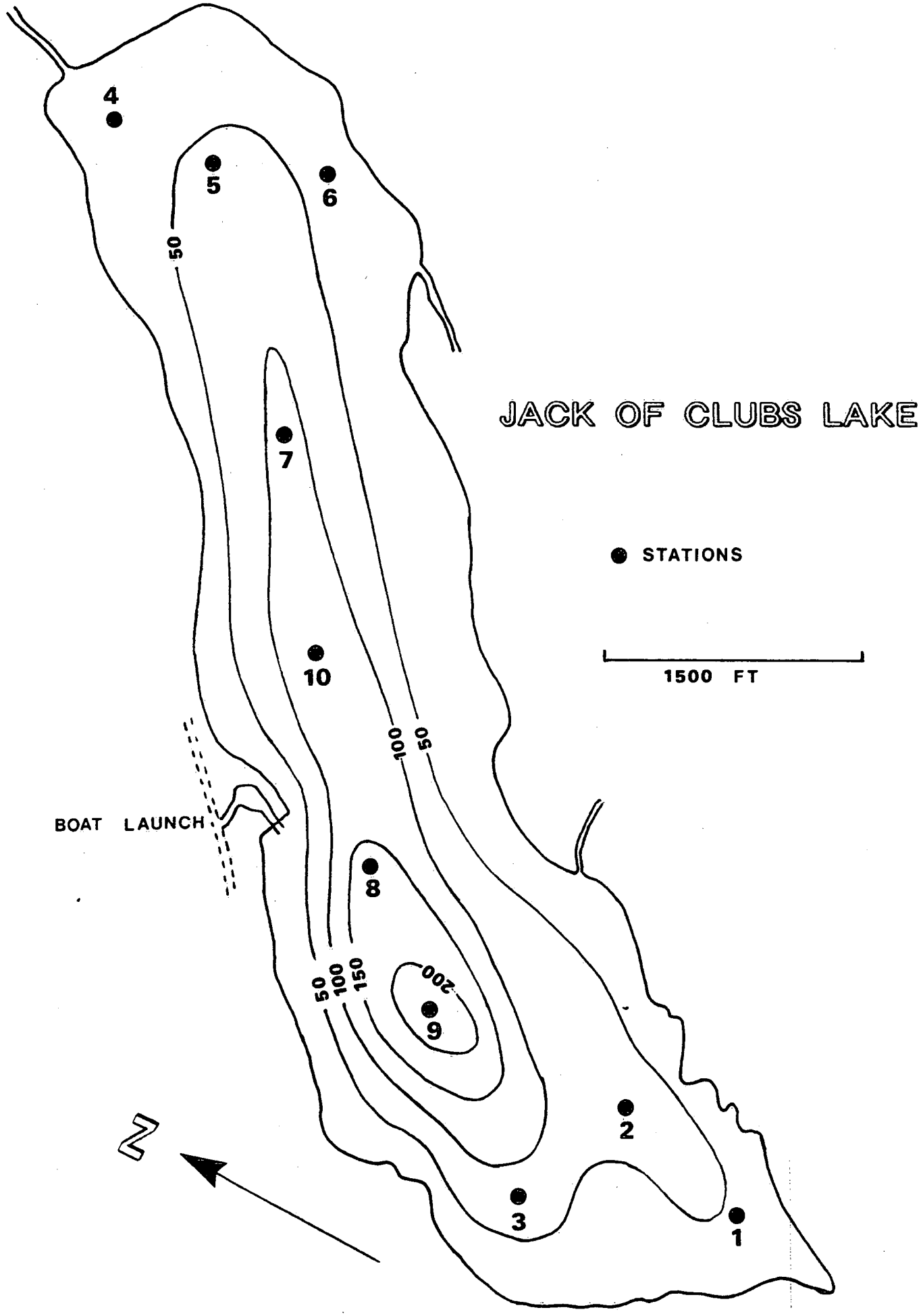
This was a reconnaissance survey of abandoned gold mines in British Columbia and may continue for a number of years. The first two weeks of August were spent sampling Jack of Clubs Lake at Wells, B.C. The lake and town are situated about 80 km east of Quesnel, B.C. The lake was a depository for tailings from two major gold mines which closed in the early 1960's, leaving material in the lake.

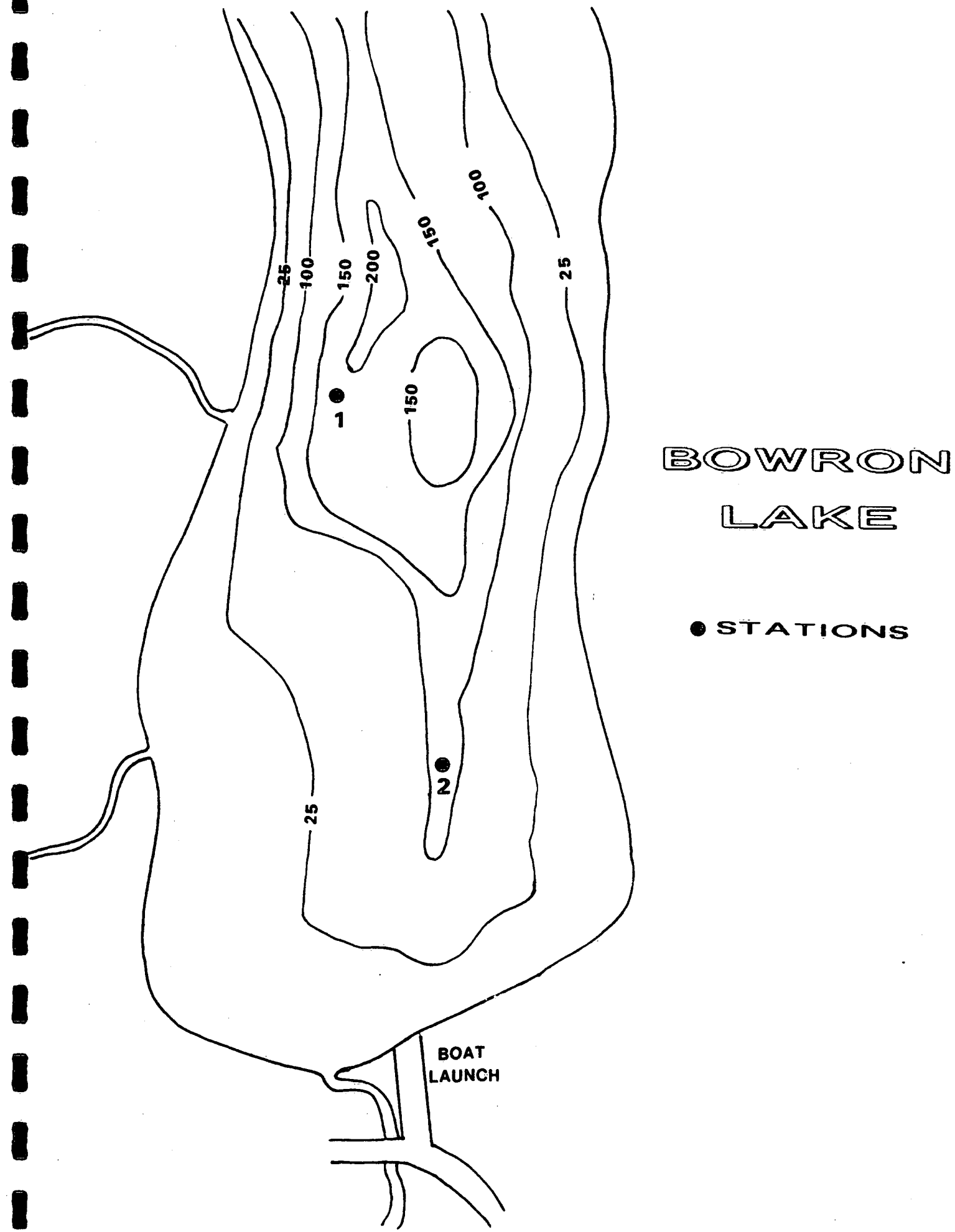
In support of this project, sediment and water samples were collected, including: a temperature/depth/transmission profile, POC, seston, phosphorus, filtered and unfiltered, chlorophyll a, nutrients, metals, bioassays, sediment size, geochemistry and benthic fauna and profiles utilizing the Hydrolab.

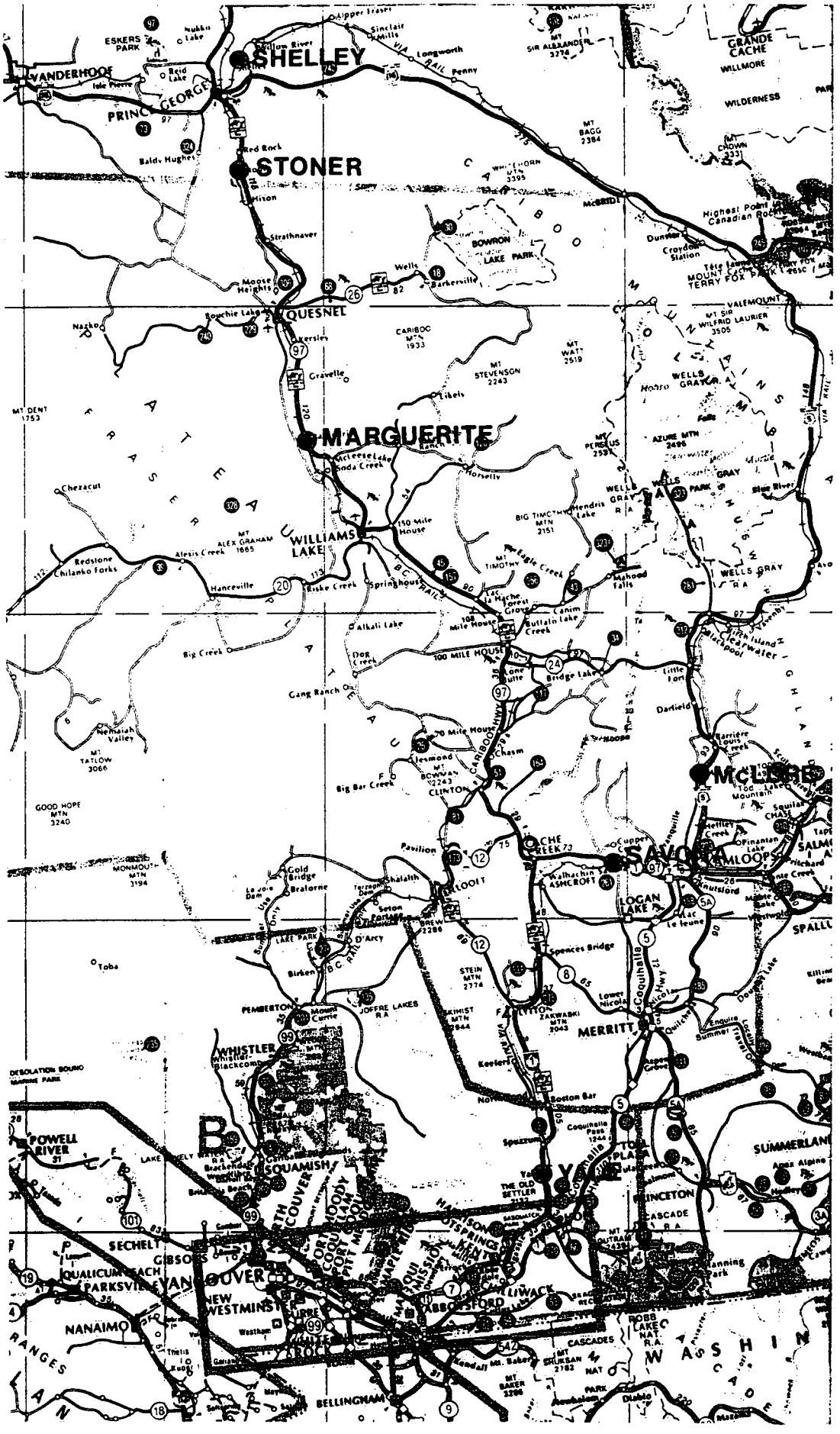
A Westfalia centrifuge was utilized to collect suspended sediments from the main lake proper, the outflow of Jack of Clubs Lake and downstream of the town to ensure that the tailings sites were sampled.

A total of ten stations were occupied on Jack of Clubs Lake arranged to cover all bathymetric areas of the lake. To make a comparison between Jack of Clubs Lake and a pristine lake, Bowron Lake in the next valley east of Wells was sampled in the deep hole and in a second deep basin at the western end of the lake close to the access point of Bowron Lake Provincial Park. The above listed sampling for Jack of Clubs Lake was also done at this lake.

Geological Surveys of Canada from Ottawa was involved with the study, sampling numerous types of fauna found at each lake and from stream inlets and outflows. These samples were analyzed for metals, including arsenic and mercury. The tailings sites were sampled for bioassays, small worms, metals, phosphorus filtered and unfiltered, nutrients, major ions, pore water, PH and conductivity. Cores were also collected from the tailings sites for GSC to be analyzed for metal speciation.


JACK OF CLUBS LAKE
STATIONS
1500 FT
BOAT LAUNCH
N
1
2
3
4
5
6
7
8
9
10
50
100
150
200


25
100
150
200
150
100
25
150
25
1
2
BOAT
LAUNCH
BOWRON
LAKE
STATIONS


SHELLEY
STONER
MARGUERITE
WILLIAMS LAKE
100 MILE HOUSE
QUESNEL
PRINCE GEORGE
VANDERHOOF
MCLURE
SAVONA
KAMLOOPS
MERRITT
WHISTLER
POWELL RIVER
SQUAMISH
VANCOUVER
NEW WESTMINSTER
NANAIMO
PENTICTON
SUMMERLAND
PRINCETON
LILLOOET
LOGAN LAKE
ASHCROFT
CLINTON
BARKERVILLE
WELLS
BARRIERE
CHASE
SALMON ARM
CHILLIWACK
ABBOTSFORD
BELLINGHAM
GRANDE CACHE
WILLMORE WILDERNESS
MT ROBSON PROV. PARK
MOUNT TERRY FOX PARK
BOWRON LAKE PARK
WELLS GRAY PARK
JOFFRE LAKES P.A.
GARIBALDI PROV. PARK
MOUNT ASSINIBOINE PROV. PARK
ROBS LAKE NAT. R.A.
CASCADE R.A.
JOFFRE LAKES R.A.
WELLS GRAY R.A.
CARIBOO MTS
CASCADE MTS
COAST MTS
RAILWAYS
CANADIAN NATIONAL
B.C. RAIL
CANADIAN PACIFIC
GREYHOUND

TRENT RIVER

LRB STUDY 82103, A. MUDROCH

During the period July 28-30, sampling was conducted on the Trent Severn Waterway from upstream of Burley Falls to Trenton for the Environmental Protection Service. Samples were collected to confirm a report about to be released by the Ontario Ministry of the Environment on PCB contamination in the sediments. It was believed that PCBs were entering the system from the Peterborough area and therefore the main sampling was downstream of Peterborough.

A total of 33 mini-PONAR grab samples and 20 modified Tech. Ops. cores were obtained. Cores were subsectioned into 5 cm slices and placed in pre-washed glass bottles for analysis of organic contaminants and in plastic vials for analysis of particle size, total organic carbon and other analyses if required. Grab samples were stored in the same manner. A total of 216 samples were collected and delivered to Zenon Environmental Laboratories for the organic analysis and to the NWRI sediment lab for particle size analysis.

The launch PUFFIN as well as several Parks Canada boats were utilized to conduct the sampling.

CENTRIFUGE SET-UP ON THE PINTAIL FOR THE TRENT RIVER SURVEY

GREAT LAKES BIOLOGICAL SEDIMENT GUIDELINES

LRB STUDY 82105, DR. T.P. REYNOLDSON

The purpose of the Great Lakes Biological Sediment Guidelines study was to respond to the Great Lakes Water Quality Agreement Annex #2 by sampling sediment reference sites for the development of biological sediment guidelines. A sampling trip utilizing the launch CSL SHARK during the period July 13-28 provided reference stations from the North Channel of Lake Huron.

Forty-two stations were sampled. At each station, a depth sounding and surface bucket water temperature was recorded. A 1-litre water sample was collected from the bottom -1 metre depth for total phosphorus, alkalinity, nutrients, Ph, dissolved oxygen and temperature. Six 10 cm sediment cores were collected either from the mini box corer or from six separate Tech. Ops. cores--one for pore water analysis and five for benthic community studies. Mini-PONAR grabs were made at each station and the top 2 cm sampled for organic contaminant analysis, particle size distribution, metals and nutrients. Additional sediment samples were collected at randomly selected stations for toxicity testing and for replicate analysis.

The cruise began at the port of Thessalon on July 14 and sampling proceeded in a generally easterly direction until completion of the cruise in Little Current on July 28.

An additional task completed on this trip was the refurbishment of four sediment trap moorings in support of study 82106 led by F. Rosa. These moorings are located at Lake Huron surveillance stations 110, 111, 112 and 113 in the Serpent River area both in and outside the Whalesback Channel. Twenty-nine sediment transport stations were visited in support of this study. The vessel worked three days out of Thessalon, four days out of Blind River, three days out of Gore Bay and three days out of Little Current. A total of 72 stations were visited.

A cube van was used to haul equipment to the study area in the North Channel and to carry the large incubator which was used during the trip to store sediment and water samples at 4°C. Personnel used a rented mini van for transport to and from Burlington and for local travel within the study area.

Technical Operations personnel also supported this study with monthly trips to Severn Sound to collect water and sediment samples. Six trips--May 4-6, June 1-2, June 29-30, August 6-7, August 31-September 3 and October 5-6, were made in conjunction with RRB, Y.K. Chau Study 83102 to collect samples from the same two sites in Severn Sound. Samples were collected first by PONAR grab and Tech. Ops. corer and later in the season with the mini box corer.

During the August 31-September 3 trip, a total of 7 sites were sampled throughout Severn Sound as well as 9 sites in Collingwood Harbour.

SEDIMENT GUIDELINE STATION POSITIONS

NORTH CHANNEL, LAKE HURON

1992-1993

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1400	46° 06' 54"	83° 20' 00"
1401	46° 10' 00"	83° 20' 00"
1402	46° 11' 42"	83° 32' 23"
1403	46° 16' 22"	83° 36' 48"
1404	46° 16' 28"	83° 44' 30"
1405	46° 14' 48"	83° 49' 30"
1406	46° 13' 30"	83° 48' 30"
1408	46° 08' 48"	83° 52' 00"
1409	46° 05' 15"	83° 52' 15"
1410	45° 56' 18"	82° 59' 00"
1411	45° 58' 24"	82° 53' 30"
1412	45° 51' 30"	82° 44' 00"
1413	45° 51' 30"	82° 36' 30"
1414	45° 50' 18"	82° 34' 12"
1415	45° 56' 00"	82° 16' 00"
1416	45° 49' 15"	81° 38' 50"
1500	45° 59' 55"	81° 31' 04"
1501	46° 00' 56"	81° 37' 43"
1502	45° 59' 00"	81° 38' 00"
1503	46° 01' 30"	81° 42' 00"
1504	46° 03' 58"	81° 52' 00"
1505	46° 05' 00"	82° 03' 00"
1506	46° 02' 00"	82° 00' 50"
1507	46° 02' 00"	82° 05' 00"
1508	46° 00' 00"	82° 11' 00"
1509	46° 00' 04"	82° 14' 21"
1510	45° 59' 32"	82° 20' 01"
1511	46° 08' 24"	82° 20' 24"
1512	46° 04' 00"	82° 18' 30"
1513	46° 05' 12"	82° 14' 00"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1514	46° 06' 40"	82° 17' 15"
1515	46° 07' 16"	82° 12' 36"
1516	46° 01' 10"	82° 26' 04"
2200	46° 08' 10"	82° 36' 55"
2201	46° 09' 40"	82° 37' 36"
2202	46° 06' 52"	82° 34' 20"
2203	46° 07' 54"	82° 31' 12"
2204	46° 09' 24"	82° 33' 00"
2205	46° 07' 00"	82° 28' 00"
2206	46° 11' 00"	82° 28' 50"
2208	46° 08' 44"	82° 23' 42"
2209	46° 10' 24"	82° 23' 43"

SEDIMENT GUIDELINE STATION POSITIONS

SEVERN SOUND AND COLLINGWOOD HARBOUR

1992-1993

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1210	44° 59' 00"	79° 54' 00"
1211	44° 46' 00"	79° 52' 00"
1212	44° 47' 48"	79° 51' 30"
1213*	44° 47' 48"	79° 49' 30"
1600	44° 46' 48"	79° 44' 00"
1601*	44° 49' 06"	79° 49' 06"
1602	44° 50' 29"	79° 50' 48"
1603	44° 52' 48"	79° 52' 48"
Collingwood Hbr.	44° 30' 24"	80° 13' 24"

*Master Stations - Visited each trip

LARDER AND RAVEN LAKES

LRB STUDY 82106, F. ROSA

The study of the effects of submerged mine tailings on the aquatic environment in Larder Lake was continued this year. The lake and town are located 25 km east of Kirkland Lake. Sampling this year was to confirm and fill in any results from previous data collected over the last two seasons.

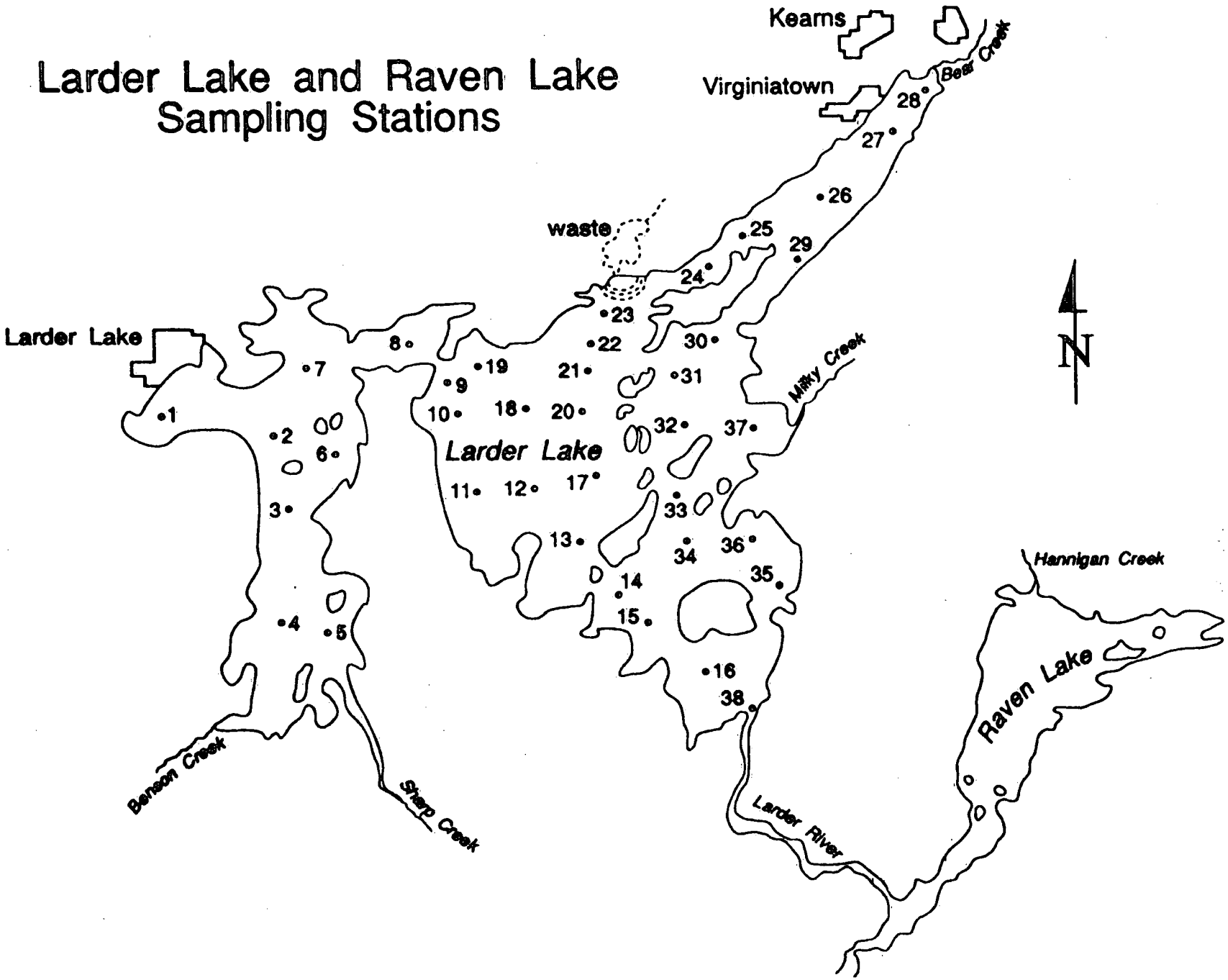
The stations occupied were: 3, 8, 13, 18, 21 and 30. Each station was profiled utilizing the Hydrolab profiler which measured oxygen, conductivity, pH, temperature and depth. Sediment samples for Dr. T. Jackson were collected at all stations with the exception of station 8.

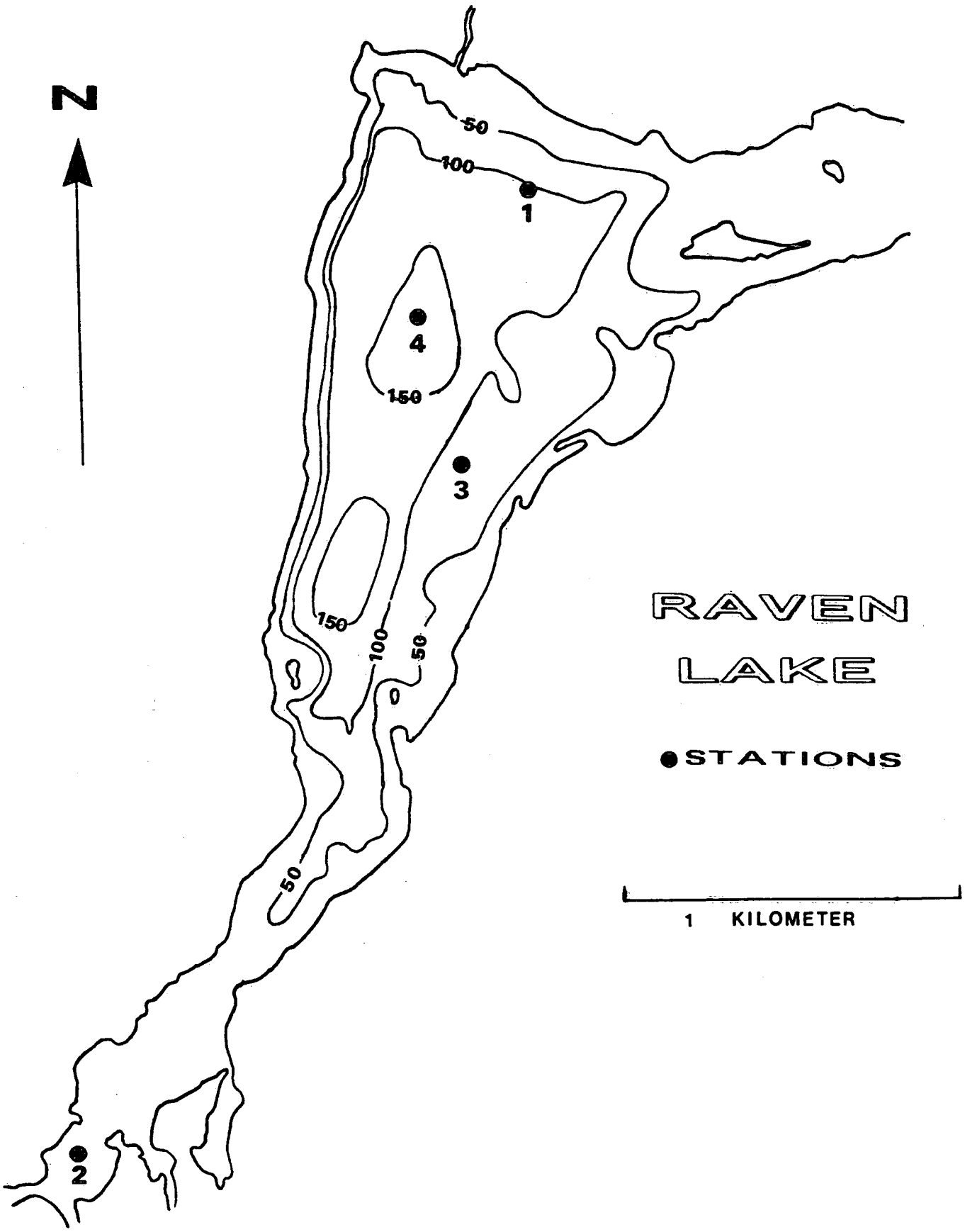
Two other lakes were sampled for the same parameters listed above. Four stations were visited in Raven Lake and 1 station sampled in Bear Lake. Larder Lake flows into Raven Lake and has deposited large quantities of mine tailings into the southern (outlet) end of Raven Lake. Due to Raven Lake being divided into three distinct basins, the north end of the lake is in an oligotrophic state. Bear Lake is in a separate drainage basin without tailings on a similar geological formation.

To ensure the lakes were not affected by metals from the shoreline of each lake, vegetation samples were collected from each study area.

The intercomparison of various types of lakes in the Larder Lake area that are exposed to mine tailings was completed this year.

Larder Lake and Raven Lake Sampling Stations




N
50
100
150
1
2
3
4
RAVEN
LAKE
STATIONS
1 KILOMETER

NORTH CHANNEL SEDIMENT TRANSPORT SURVEY

LRB STUDY 82106, F. ROSA

The purpose of this study was to assess contaminated sediment transport from the Spanish and Serpent river mouths into the North Channel of Lake Huron. Any metal concentration differences found in the sediments between nearshore impacted areas and offshore areas will be investigated to determine if any contaminant migration has occurred.

The sampling of 29 suspended sediment stations was completed in conjunction with the Great Lakes Biological Sediment Guidelines Study, LRB 82105 from the launch CSL SHARK during the period July 13-28. At each station, an EBT/transmissometer profile to the bottom was recorded. A water sample was collected by Van Dorn bottle for total phosphorus and total metal analysis and a bottom sediment sample was collected by mini-PONAR for metal analysis. Sediment trap moorings installed for this study at Lake Huron surveillance stations 110, 111, 112 and 113 were refurbished from the SHARK.

Technical Operations also supported this study by monitoring Sandusk Creek for any organic chemicals that may be entering Lake Erie. This is a continuing study that was begun in the spring of 1990. In April, a sediment trap was suspended from a highway bridge at the mouth of Sandusk Creek as it flowed into Lake Erie. The trap collected samples of particulate as they flowed from the creek for analysis of any organic chemicals arising from the Hagersville fire site. This creek drained the fire site since it flowed directly adjacent to the fire. The trap was removed for the winter in December.

SEDIMENT TRANSPORT STATION POSITIONS

NORTH CHANNEL, LAKE HURON

1992-1993

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	46° 12' 06"	82° 39' 00"
2	46° 11' 24"	82° 42' 30"
3	46° 11' 07"	82° 42' 42"
4	46° 10' 42"	82° 57' 02"
5	46° 10' 36"	82° 57' 48"
6	46° 09' 54"	82° 56' 52"
7	46° 09' 00"	82° 59' 12"
8	46° 08' 42"	83° 01' 50"
12	46° 14' 50"	83° 33' 32"
13	46° 13' 54"	83° 34' 00"
14	46° 13' 39"	83° 31' 00"
15	46° 13' 13"	83° 36' 00"
16	46° 16' 28"	83° 44' 30"
17	46° 17' 06"	83° 46' 00"
18	46° 17' 32"	83° 47' 06"
19	46° 16' 36"	83° 47' 20"
20	46° 16' 18"	83° 51' 24"
21	46° 16' 58"	83° 50' 15"
22	46° 06' 18"	83° 44' 18"
23	46° 07' 19"	83° 48' 30"
24	46° 02' 30"	83° 57' 33"
25	46° 03' 10"	83° 54' 30"
26	45° 58' 18"	83° 53' 36"
NC29	46° 15' 00"	83° 48' 00"
NC30/1402	46° 11' 42"	83° 32' 23"
NC31	46° 07' 38"	83° 15' 00"
NC32	46° 06' 33"	82° 58' 00"
NC33	46° 07' 48"	82° 46' 20"
NC34	46° 07' 10"	82° 39' 30"

SEDIMENT TRAP MOORING POSITIONS

NORTH CHANNEL, LAKE HURON

1992-1993

STATION NUMBER	LATITUDE N.	LONGITUDE W.
110	46° 09' 00"	82° 32' 13"
111	46° 08' 42"	82° 39' 17"
112	46° 07' 39"	82° 46' 22"
113	46° 06' 20"	82° 30' 37"

SMALL NORTHERN LAKES SEDIMENT STUDY

LRB STUDY 82109, DR. B. BOURGOIN

During the period August 17-26 Technical Operations personnel supported this study, sampling small lakes north of Lake Superior. Support consisted of one person, a vehicle and all the necessary sampling equipment.

The purpose of the field work was to collect sediment and water samples from four groups of isolated lakes north of Lake Superior. Samples were collected, using a PONAR and a Tech. Ops. corer, for analysis of benthic community structure as well as chemical and physical properties.

Samples using the PONAR and Tech. Ops. corer were also taken at each lake in conjunction with Dr. T. Reynoldson's study 82105 which is studying benthic community structure around the Great Lakes shoreline.

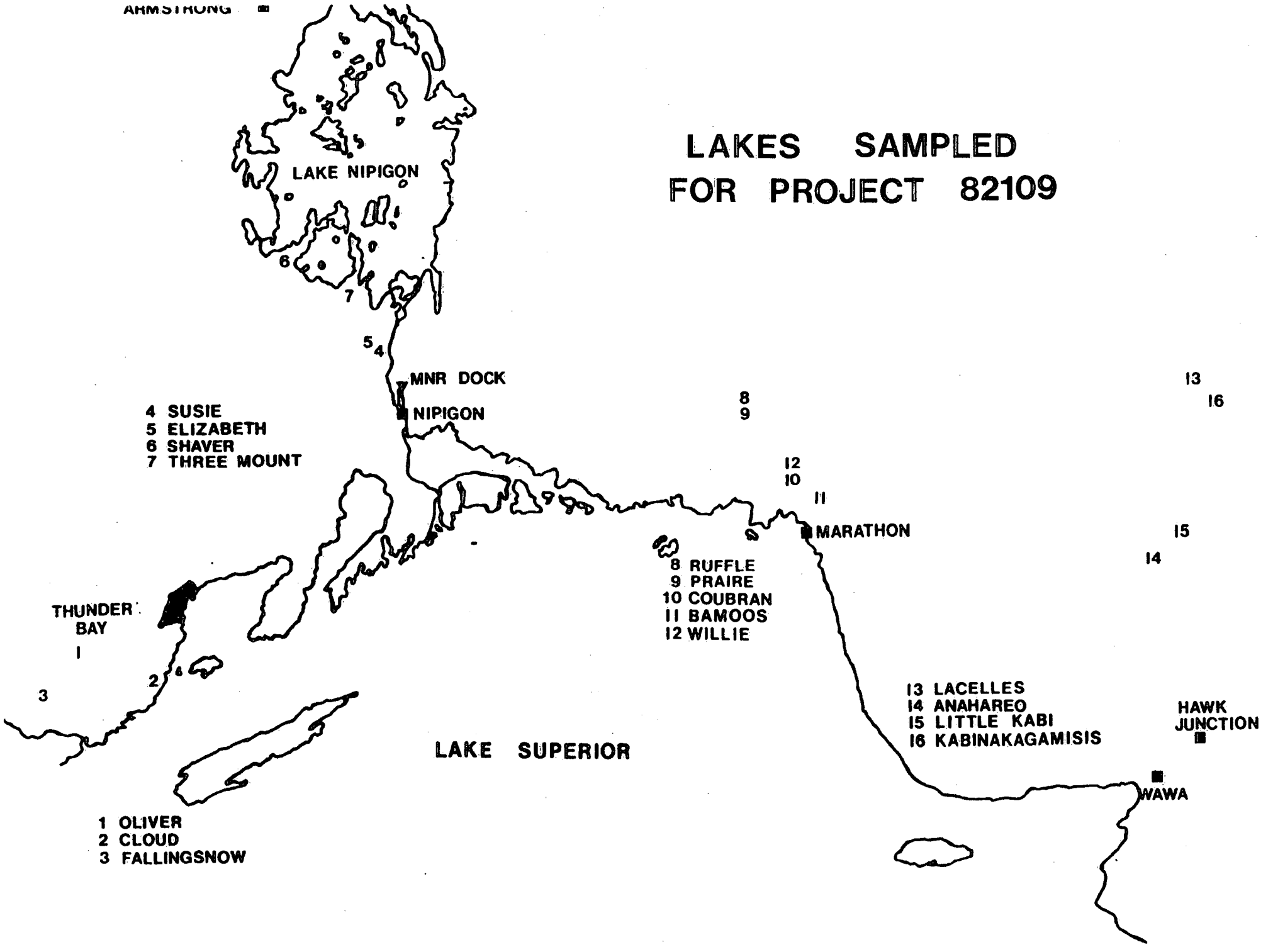
Cores, using the large diameter (10 cm) corer, were attempted at most lakes for Dr. J. Patterson from Concordia University in Montreal for subsectioning and eventual analysis of the accumulation of metals, particularly lead 210 which has built up due to airborne transport.

Using the town of Nipigon as a base, seven lakes were sampled in the Nipigon and Thunder Bay area in two days of flying in a chartered Beaver floatplane. After moving operations to Wawa, nine additional lakes were sampled in the Marathon and Wawa area during two days of flying in a chartered Beaver floatplane.

Water and sediment were collected from a total of sixteen lakes. Not all lakes were cored since bottom sediment or heavy human activity made cores unacceptable. All cores were subsectioned in the field and all PONAR samples were sieved for bottom fauna enumeration.

Other work for the Bourgoin project consisted of four short trips (June 10-11, June 29-30, September 8-10 and November 17-19) to an area in Southwest Ontario. Seven sites located around Wheatley were sampled for sediment using PONARs as well as centrifuging at each site for both effluent and suspended sediment.

One other trip occurred on November 24 when three sites in Humber Bay were sampled for sediment using a PONAR grab and for water using Van Dorn bottles.


ARMSTRONG
LAKE NIPIGON
LAKES SAMPLED
FOR PROJECT 82109
6
7
5
4
MNR DOCK
NIPIGON
4 SUSIE
5 ELIZABETH
6 SHAVER
7 THREE MOUNT
8
9
12
10
11
MARATHON
13
16
15
14
8 RUFFLE
9 PRAIRE
10 COUBRAN
11 BAMOOS
12 WILLIE
THUNDER
BAY
1
2
3
LAKE SUPERIOR
13 LACELLES
14 ANAHAREO
15 LITTLE KABI
16 KABINAKAGAMISIS
HAWK
JUNCTION
WAWA
1 OLIVER
2 CLOUD
3 FALLINGSNOW

CALCIUM NITRATE INJECTION, SAULT STE. MARIE

LRB STUDY 82112, DR. T.P. MURPHY

The injection of liquid agricultural grade calcium nitrate into bottom sediments to bind heavy metals such as zinc, copper and lead with iron thus accelerating the microbial breakdown of organic toxins, has been proposed as an alternative to dredging operations. An injection system designed by Mr. J. Kruyer of Oleophilic Sieve Development Company of Canada Ltd. in Edmonton, Alberta was modified and used to inject an area of 15,200 square metres of sediment (10,400 in May and 4,800 in June). This was the third and fourth survey at this site in Sault Ste. Marie on the St. Marys River just west of Bellview Marina and north of the Bayfield Dike Light (see site map).

The CSL GANDER was towed by the DFO STUBBY, the launch PINTAIL was towed by the crewcab, the Mason was towed by the van and the crane truck was used to carry heavy equipment. The first days were spent launching boats, setting up the mini-ranger Falcon positioning system, the injection system, and the underwater television/video system, defining and marking the survey site and preparing dive equipment. Also, a series of pre-injection sediment cores and Ekman grab samples were collected inside the injection areas. Core samples were extruded, sectioned and stored in coolers for the return trip to CCIW. Two sediment trap moorings were installed upstream and downstream of the test site.

Divers installed three peepers at the July 1991 ferric chloride injection site and a second mooring with three peepers was installed 80 metres south, as a control station. Divers also surveyed the bottom at the two new proposed injection areas. Area A was found to be obstruction free but the southern half of area B was littered with boulders up to 2 metres in size. Area B contained a power cable which ran from shore to the Dike Rock. All batches of liquid calcium nitrate were mixed to a concentration of 560 gm/litre (10 bags to 350 litres of water). Batches were mixed on shore at an abandoned dock behind the Plummer Hospital, transferred into the holding tank on the PINTAIL and delivered to the GANDER where the suction pump would transfer the batch into the holding reservoir. During injection runs, the boat velocity was maintained at 0.5 metres per second. Post-injection sediment cores and Ekman grab samples were collected at both injection sites. Again, the cores were extruded, sectioned and placed in coolers.

Both sediment trap moorings were retrieved and surface water samples collected. All surface markers were removed from the site with the exception of nine sampling station buoys (XA, XB, XC, YA, YB, YC, ZA, ZB, ZC) and two peeper mooring buoys.

The total area surveyed for the May injection covered 10,400 square metres (Area A = 8000 plus Area B 2400). During the injection runs, positions were fixed to accurately plot the actual track of the manifold. The final results for Area A

were 92% coverage with 8% missed and 6% overlapped. Area B had 93% coverage with 7% missed.

In June, in Area C a total of 7 lines were injected at a rate of 9000 litres/hour at an average speed of 0.5 m/sec. and an offset of 8 metres on the tracklines. The lines were double treated: 1 and 2, 3 and 4 plus 5 and 6. Line 7 was injected as a single pass for a media demonstration. Three sampling floats (WA, WB, WC) were installed in the injection area by the Mason following behind the injection bar.

Dr. Murphy organized a media demonstration of the injection system for CBC Newsworld, local television stations, local newspapers and St. Marys River RAP Committee members. Two local boats were chartered to transport the media personnel to the site and document a successful deployment of the system.

Sediment cores and Ekman grab samples were collected at Area C (stations WA, WB, WC). The cores were extruded, sectioned and placed in coolers. The nine sampling station buoys (XA, XB, XC, YA, YB, YC, ZA, ZB, ZC) placed in May and two peeper mooring buoys at the ferric chloride '91 site were left in place.

The total area surveyed for the June injection covered 4,800 square metres. During the injection runs, positions were fixed to accurately plot the actual track of the manifold. The final results indicated 92% coverage with 8% missed and 6% overlap.

The GANDER proved to be excellent for this type of work (deck space, power and twin screw for control). The modifications to the cabin greatly enhanced the efficiency and control of the overall operation. Modifications to the injection handling system by H. Savile simplified the operation and made work safe. The Mason, towed to the Soo for G. LaHaie, was utilized for sediment sampling and installation of sampling buoys. The Mason was stored at the Forestry Centre compound. The launch PINTAIL was utilized to install/retrieve/calibrate the mini-ranger system, collect sediment samples, install/retrieve moorings, support diving operations and transport batches of liquid calcium nitrate from the shore mixing site to the GANDER.

The mini-ranger Falcon positioning system was used to establish the limits of the test site, track the course of the GANDER during injection runs and plot the position of sampling stations and moorings. Transponders were located at three sites--two of which had CHS horizontal control markers and one which was surveyed in. Marker buoys were installed to mark the limits of injection areas for visual assistance when maneuvering the GANDER.

SYNOPSIS
Gallons of calcium nitrate per line

Area A (May)

Line 1 - single pass, 6000 litres/hour
Line 2 - single pass, 6000 litres/hour
Line 3 - single pass, 9000 litres/hour
Line 4 - single pass, 9000 litres/hour
Line 5 and 6 - double pass, 6000 litres/hour

Area B (May)

Line 7 and 8 - double pass, 6000 litres/hour
Line 9 and 10 - double pass, 6000 litres/hour

Area C (June)

Line 1 - single pass, 9000 litres/hour
Line 2 - single pass, 9000 litres/hour
Line 3 - single pass, 9000 litres/hour
Line 4 - single pass, 9000 litres/hour
Line 5 - single pass, 9000 litres/hour
Line 6 - single pass, 9000 litres/hour
Line 7 - single pass, 9000 litres/hour

Transponder Positions

Station DIKE - Code 1:located on the Bayfield Dike Light
N = 5152690.6 E = 705982.8

Station DANO - Code 2:located on dock behind Plummer Hospital
N = 5153140.0 E = 705575.5

Station MARI - Code 3:located inside Bellview Marina
N = 5153065.0 E = 706585.2

Sampling Buoys

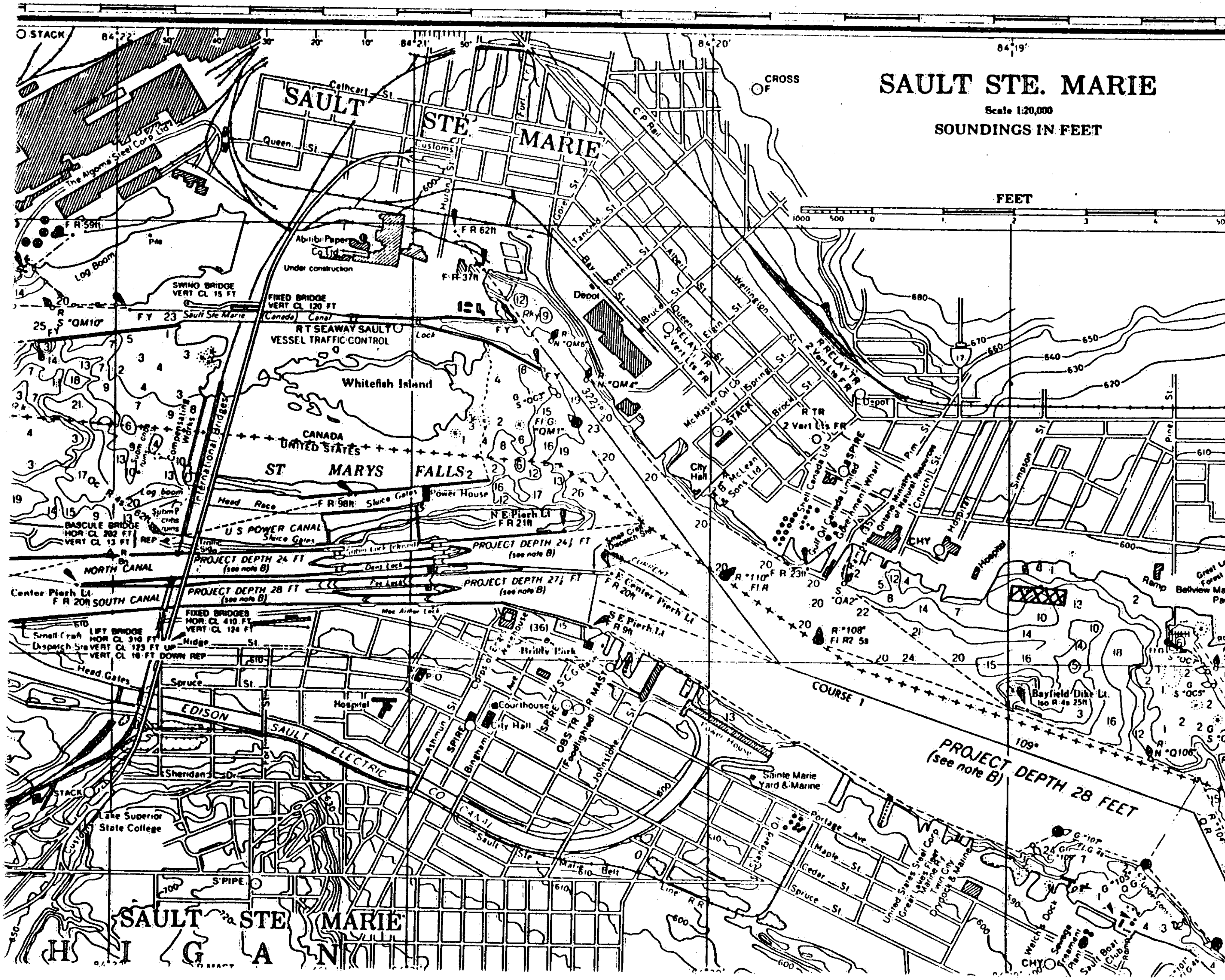
Buoy XA:N = 5153168.5 E = 706012.9
Buoy XB:N = 5153178.9 E = 705979.4
Buoy XC:N = 5153189.4 E = 705944.3
Buoy YA:N = 5153219.3 E = 706052.7
Buoy YB:N = 5153221.3 E = 706001.4
Buoy YC:N = 5153221.4 E = 705958.0
Buoy ZA:N = 5153242.3 E = 706021.2
Buoy ZB:N = 5153161.9 E = 706313.3
Buoy ZC:N = 5153143.8 E = 706310.1
Buoy WA:N = 5153131.0 E = 706306.0
Buoy WB:N = 5153110.0 E = 706280.0
Buoy WC:N = 5153123.0 E = 706257.0

Peeper Moorings

North:N = 5153118.4 E = 705935.2
South:N = 5153035.6 E = 705928.0

Sediment Trap Moorings

East:N = 5152928.9 E = 706395.6
West:N = 5153037.6 E = 705767.4


SAULT STE. MARIE
Scale 1:20,000
SOUNDINGS IN FEET
FEET
CROSS
SAULT STE MARIE
Whitefish Island
CANADA
UNITED STATES
ST MARYS FALLS
U S POWER CANAL
NORTH CANAL
SOUTH CANAL
PROJECT DEPTH 24 FT
PROJECT DEPTH 28 FT
PROJECT DEPTH 27 FT
PROJECT DEPTH 24½ FT
COURSE 1
PROJECT DEPTH 28 FEET
(see note B)
R T SEAWAY SAULT
VESSEL TRAFFIC CONTROL
The Algoma Steel Corp Ltd
Abitibi Paper Co Ltd
Under construction
International Bridges
Compensating Works
SWING BRIDGE
VERT CL 15 FT
FIXED BRIDGE
VERT CL 120 FT
BASCULE BRIDGE
HOR CL 282 FT
VERT CL 13 FT
FIXED BRIDGES
HOR CL 410 FT
VERT CL 124 FT
LIFT BRIDGE
HOR CL 310 FT
VERT CL 123 FT UP
VERT CL 16 FT DOWN
Power House
Sluice Gates
Head Race
Log Boom
Head Gates
Small Craft Dispatch Sta
Center Pierh Lt
N E Pierh Lt
E Center Pierh Lt
S E Pierh Lt
Bayfield Dike Lt
Lake Superior State College
EDISON SAULT ELECTRIC CO
Sainte Marie Yard & Marine
United States Steel Corp
Great Lakes Fish
Bellview Marine Park
Welch's Dock
City Hall
Courthouse
Hospital
Depot
Customs
C P Rail
McMaster Oil Co
Shell Canada Ltd
Gulf Oil Canada Limited
Government Wharf
Ontario Ministry of Natural Resources
H I G A N

SUSPENDED SEDIMENT, TRENT RIVER SYSTEM

LRB STUDY 82205, 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 Lakefield. There were two sampling trips on the system this season to ensure that all results collected from this year and on previous samplings were verified before publication.

The weeks of May 28 and June 4 were utilized for the first trip and the weeks of September 28, October 5 and October 12 were required to complete the second trip.

Water samples were collected for total phosphorus (filtered and unfiltered on the first trip only), metals and pH (first trip only). Suspended sediment samples were collected for phosphorus, organics and metals. A temperature profile was conducted at each station to establish the sampling depths. If there was a temperature structure, the samples were collected above and below the thermocline; if the temperature structure was isothermal, the sampling occurred at mid-water depth.

STATION POSITIONS

TRENT-SEVERN AREA

1992

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	44° 06' 12"	77° 34' 33"
2	44° 08' 15"	77° 34' 15"
3	44° 11' 20"	77° 35' 38"
4	44° 14' 51"	77° 34' 27"
4A	44° 15' 11"	77° 34' 08"
4B	44° 14' 09"	77° 37' 13"
5	44° 15' 31"	77° 42' 12"
5A	44° 15' 27"	77° 43' 10"
5B	44° 14' 34"	77° 44' 18"
5C	44° 14' 03"	77° 46' 47"
5CC	44° 13' 50"	77° 47' 09"
5D	44° 15' 09"	77° 48' 02"
6	44° 16' 48"	77° 47' 49"
6A	44° 19' 45"	77° 47' 18"
6AA	44° 18' 14"	77° 48' 08"
6B	44° 21' 03"	77° 46' 34"
6D	44° 21' 44"	77° 46' 00"
7	44° 21' 56"	77° 46' 14"
7A	44° 22' 32"	77° 47' 17"
8	44° 23' 21"	77° 52' 44"
9	44° 16' 00"	78° 02' 16"
10(1)	44° 10' 17"	78° 10' 12"
10(2)	44° 10' 17"	78° 10' 52"
11	44° 09' 31"	78° 14' 07"
11CCC	44° 15' 23"	77° 20' 12"
12A	44° 17' 38"	78° 18' 22"
12B	44° 17' 53"	78° 18' 39"
13	44° 21' 44"	78° 17' 29"
14	44° 26' 02"	78° 16' 28"

VOLATILES AND SEDIMENT SAMPLING

LRB STUDY 82301, DR. K.L.E. KAISER

Between April 6-10, the CORMORANT and WAGTAIL were utilized to sample 208 stations between Wilson, N.Y. and Pickering, Ontario in the Western Basin of Lake Ontario.

Surface water was collected at all stations for volatiles with sediment being obtained at 15 stations, using the mini-Shipek.

STATION POSITIONS

TRANSECT	STATION NUMBER	LATITUDE N.	LONGITUDE W.
A	1	43° 36.1'	79° 20.6'
A	2	43° 36.4'	79° 20.9'
A	3	43° 36.6'	79° 21.0'
A	4	43° 36.8'	79° 21.2'
A	5	43° 37.1'	79° 21.3'
A	6	43° 37.3'	79° 21.5'
B	1	43° 35.7'	79° 21.9'
B	2	43° 36.7'	79° 22.1'
B	3	43° 36.5'	79° 22.1'
B	4	43° 36.7'	79° 22.2'
B	5	43° 36.9'	79° 22.3'
C	1	43° 35.5'	79° 23.5'
C	2	43° 35.9'	79° 23.5'
C	3	43° 36.3'	79° 23.5'
C	4	43° 36.5'	79° 23.5'
C	5	43° 36.8'	79° 23.5'
D	1	43° 35.5'	79° 24.6'
D	2	43° 36.0'	79° 24.8'
D	3	43° 36.5'	79° 25.0'
D	4	43° 36.9'	79° 25.1'

TRANSECT	STATION NUMBER	LATITUDE N.	LONGITUDE W.
D	5	43° 37.5'	79° 25.3'
D	6	43° 37.7'	79° 25.4'
E	1	43° 34.4'	79° 25.7'
E	2	43° 35.1'	79° 26.7'
E	3	43° 35.8'	79° 27.5'
E	4	43° 36.2'	79° 28.1'
E	5	43° 36.7'	79° 28.6'
F	1	43° 33.3'	79° 27.6'
F	2	43° 34.1'	79° 29.0'
F	3	43° 34.6'	79° 29.8'
F	4	43° 35.2'	79° 30.9'
F	5	43° 35.3'	79° 31.2'
G	1	43° 31.9'	79° 29.3'
G	2	43° 33.0'	79° 30.9'
G	3	43° 33.4'	79° 31.5'
G	4	43° 33.9'	79° 32.3'
G	5	43° 34.0'	79° 32.5'
G	6	43° 34.2'	79° 32.7'
H	1	43° 30.5'	79° 31.0'
H	2	43° 30.9'	79° 32.4'
H	3	43° 31.7'	79° 32.8'
H	4	43° 32.6'	79° 34.2'
H	5	43° 32.9'	79° 34.6'
I	1	43° 29.5'	79° 32.1'
I	2	43° 30.2'	79° 33.3'
I	3	43° 30.6'	79° 34.2'
I	4	43° 31.3'	79° 35.3'
I	5	43° 31.6'	79° 35.8'
I	6	43° 31.8'	79° 36.0'
J	1	43° 28.3'	79° 33.4'
J	2	43° 29.0'	79° 34.7'
J	3	43° 29.3'	79° 35.3'
J	4	43° 29.6'	79° 35.8'
J	5	43° 29.8'	79° 36.2'
K	1	43° 31.5'	79° 35.7'
K	2	43° 32.1'	79° 36.8'
K	3	43° 32.4'	79° 37.5'
K	4	43° 32.7'	79° 37.9'
K	5	43° 33.0'	79° 38.3'
L	1	43° 25.0'	79° 37.5'

TRANSECT	STATION NUMBER	LATITUDE N.	LONGITUDE W.
L	2	43° 25.7'	79° 38.7'
L	3	43° 25.9'	79° 39.1'
L	4	43° 26.1'	79° 39.5'
L	5	43° 26.4'	79° 39.9'
M	1	43° 23.8'	79° 38.8'
M	2	43° 24.2'	79° 39.8'
M	3	43° 24.6'	79° 40.2'
M	4	43° 24.8'	79° 40.7'
M	5	43° 25.0'	79° 41.1'
N	1	43° 22.4'	79° 39.8'
N	2	43° 22.9'	79° 40.8'
N	3	43° 23.0'	79° 41.1'
N	4	43° 23.4'	79° 41.9'
N	5	43° 23.5'	79° 42.2'
N	6	43° 23.6'	79° 42.4'
O	1	43° 21.4'	79° 40.5'
O	2	43° 21.9'	79° 41.8'
O	3	43° 23.0'	79° 42.2'
O	4	43° 22.3'	79° 42.8'
P	1	43° 20.6'	79° 40.9'
P	2	43° 19.9'	79° 42.5'
P	3	43° 19.2'	79° 44.4'
P	4	43° 18.4'	79° 46.1'
P	5	43° 18.2'	79° 47.1'
Q	1	43° 19.5'	79° 40.4'
Q	2	43° 19.0'	79° 41.4'
Q	3	43° 18.2'	79° 42.5'
Q	4	43° 17.5'	79° 43.6'
Q	5	43° 16.9'	79° 44.6'
Q	6	43° 16.1'	79° 45.8'
Q	7	43° 16.0'	79° 46.0'
R	1	43° 18.8'	79° 39.1'
R	2	43° 18.1'	79° 39.5'
R	3	43° 17.1'	79° 40.6'
R	4	43° 16.1'	79° 41.6'
R	5	43° 15.2'	79° 42.3'
R	6	43° 14.5'	79° 43.0'
S	1	43° 16.4'	79° 42.7'
S	2	43° 15.8'	79° 43.4'
S	3	43° 15.2'	79° 43.9'

TRANSECT	STATION NUMBER	LATITUDE N.	LONGITUDE W.
S	4	43° 14.9'	79° 44.1'
T	1	43° 17.0'	79° 39.8'
T	2	43° 16.0'	79° 40.5'
T	3	43° 15.0'	79° 41.0'
T	4	43° 14.5'	79° 41.9'
U	1	43° 17.4'	79° 35.3'
U	2	43° 16.7'	79° 35.6'
U	3	43° 15.8'	79° 36.1'
U	4	43° 14.8'	79° 36.7'
U	5	43° 14.2'	79° 37.0'
U	6	43° 13.8'	79° 37.3'
V	1	43° 16.4'	79° 31.6'
V	2	43° 16.1'	79° 31.8'
V	3	43° 15.2'	79° 32.1'
V	4	43° 14.5'	79° 32.3'
V	5	43° 13.6'	79° 32.6'
V	6	43° 12.5'	79° 33.0'
W	1	43° 16.1'	79° 28.2'
W	2	43° 15.2'	79° 28.0'
W	3	43° 13.8'	79° 27.9'
W	4	43° 12.6'	79° 27.7'
W	5	43° 12.2'	79° 27.6'
X	1	43° 15.3'	79° 22.0'
X	2	43° 14.3'	79° 22.1'
X	3	43° 13.5'	79° 22.2'
X	4	43° 12.6'	79° 22.3'
X	5	43° 11.5'	79° 22.4'
Y	1	43° 15.5'	79° 17.2'
Y	2	43° 14.8'	79° 16.9'
Y	3	43° 14.2'	79° 16.6'
Y	4	43° 13.0'	79° 16.0'
Z	1	43° 16.9'	79° 14.2'
Z	2	43° 16.5'	79° 14.0'
Z	3	43° 15.8'	79° 13.6'
Z	4	43° 14.9'	79° 13.1'
AA	1	43° 18.8'	79° 08.1'
AA	2	43° 17.7'	79° 08.5'
AA	3	43° 16.7'	79° 08.1'
AA	4	43° 15.9'	79° 07.8'
AB	1	43° 19.5'	79° 07.4'

TRANSECT	STATION NUMBER	LATITUDE N.	LONGITUDE W.
AB	2	43° 18.6'	79° 06.7'
AB	3	43° 17.5'	79° 06.1'
AB	4	43° 16.7'	79° 05.5'
AB	5	43° 15.9'	79° 05.0'
AC	1	43° 20.1'	79° 03.5'
AC	2	43° 18.9'	79° 03.0'
AC	3	43° 18.2'	79° 02.7'
AC	4	43° 17.4'	79° 02.4'
AC	5	43° 16.7'	79° 02.1'
AD	1	43° 20.3'	79° 58.8'
AD	2	43° 18.9'	79° 58.3'
AD	3	43° 18.6'	79° 58.0'
AD	4	43° 17.8'	79° 57.7'
AD	5	43° 17.5'	79° 57.6'
AE	1	43° 45.3'	79° 01.5'
AE	2	43° 46.0'	79° 02.2'
AE	3	43° 46.5'	79° 02.5'
AE	4	43° 47.0'	79° 03.0'
AE	5	43° 47.7'	79° 03.6'
AE	6	43° 48.2'	79° 04.0'
AF	1	43° 44.5'	79° 04.1'
AF	2	43° 45.2'	79° 04.5'
AF	3	43° 46.1'	79° 05.8'
AF	4	43° 46.9'	79° 06.5'
AF	5	43° 47.2'	79° 06.8'
AG	1	43° 43.5'	79° 06.4'
AG	2	43° 44.3'	79° 07.1'
AG	3	43° 44.9'	79° 07.7'
AG	4	43° 45.2'	79° 08.2'
AH	1	43° 41.4'	79° 08.8'
AH	2	43° 42.2'	79° 09.1'
AH	3	43° 43.0'	79° 10.3'
AH	4	43° 43.7'	79° 10.9'
AH	5	43° 44.3'	79° 11.4'
AI	1	43° 39.8'	79° 12.2'
AI	2	43° 40.2'	79° 12.6'
AI	3	43° 40.7'	79° 13.0'
AI	4	43° 41.4'	79° 13.5'
AI	5	43° 41.9'	79° 14.0'
AJ	1	43° 38.0'	79° 14.6'

TRANSECT	STATION NUMBER	LATITUDE N.	LONGITUDE W.
AJ	2	43° 38.5'	79° 15.2'
AJ	3	43° 39.1'	79° 15.6'
AJ	4	43° 39.9'	79° 16.3'
AK	1	43° 37.4'	79° 16.8'
AK	2	43° 37.8'	79° 17.3'
AK	3	43° 38.6'	79° 18.0'
AK	4	43° 39.2'	79° 18.6'
AL	1	43° 35.7'	79° 19.3'
AL	2	43° 36.2'	79° 19.6'
AL	3	43° 36.6'	79° 20.1'
AL	4	43° 37.1'	79° 20.2'
AM	1	43° 36.7'	79° 20.7'
AM	2	43° 36.6'	79° 21.0'
AM	3	43° 36.5'	79° 21.5'
AM	4	43° 36.5'	79° 22.2'
AM	5	43° 36.4'	79° 22.8'
AM	6	43° 36.3'	79° 23.5'
HH	1	43° 17.6'	79° 47.0'
HH	2	43° 17.4'	79° 48.1'
HH	3	43° 17.3'	79° 49.6'
HH	4	43° 17.0'	79° 50.4'
HH	5	43° 16.7'	79° 51.0'
HH	6	43° 16.5'	79° 51.6'

NOTE: HH = Hamilton Harbour

TRANSPORT AND DISPERSION EXPERIMENT

KOOTENAY LAKE, B.C.

LRB STUDY 82305, DR. P.F. HAMBLIN

The purpose of this study was to determine dispersal patterns in Kootenay Lake between Kaslo and the Duncan River. Technical Operations staff supported this project from May 25 to June 25. During this time, three temperature moorings and one meteorological mooring were installed at three locations in the north arm of Kootenay Lake. The intensive part of this study ran from June 8-18 at four sites. At sites 1, 2 and 3 the following work was performed:

Upon arriving at each site, drogues were released at discrete depths determined by the study leader. These were tracked using a video system set up on the hills overlooking the sites. Drogue movement was recorded during the day. Dye was released in a column from 20 metres to the surface at a nearshore and a mid-lake position. The dye was tracked using a unit supplied by the contract company SeaConsult. All fixes were obtained using a mini-ranger system supplied and run by the consulting firm.

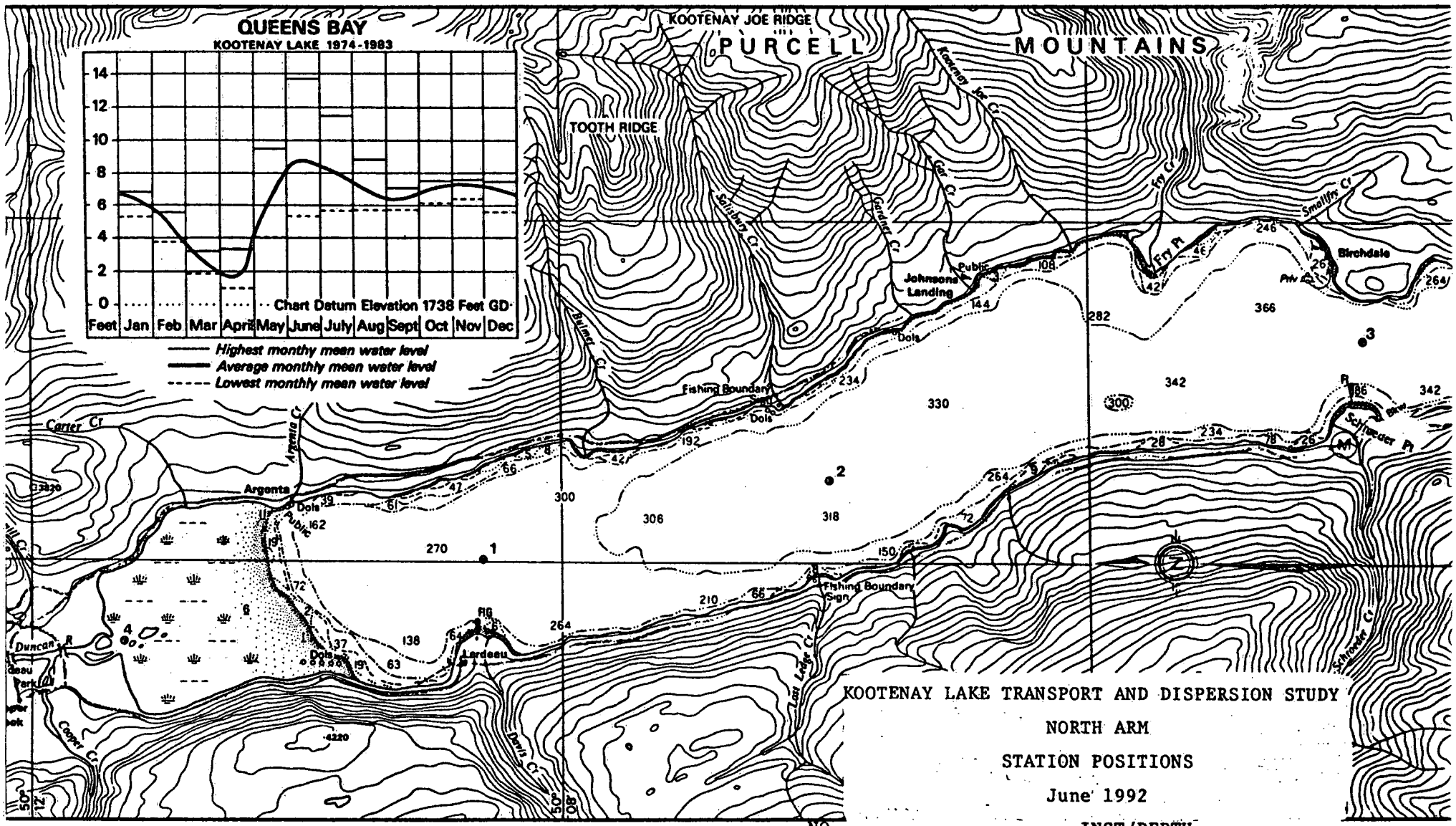
All of the dye work was completed out of the Searay--a boat supplied by UBC and the Ministry of Environment. While the Searay was running transects tracking the dye, the CSL PUFFIN ran alongside measuring currents by an ADCP system mounted in the sounding well of the PUFFIN. All of this work was performed at sites 1, 2 and 3.

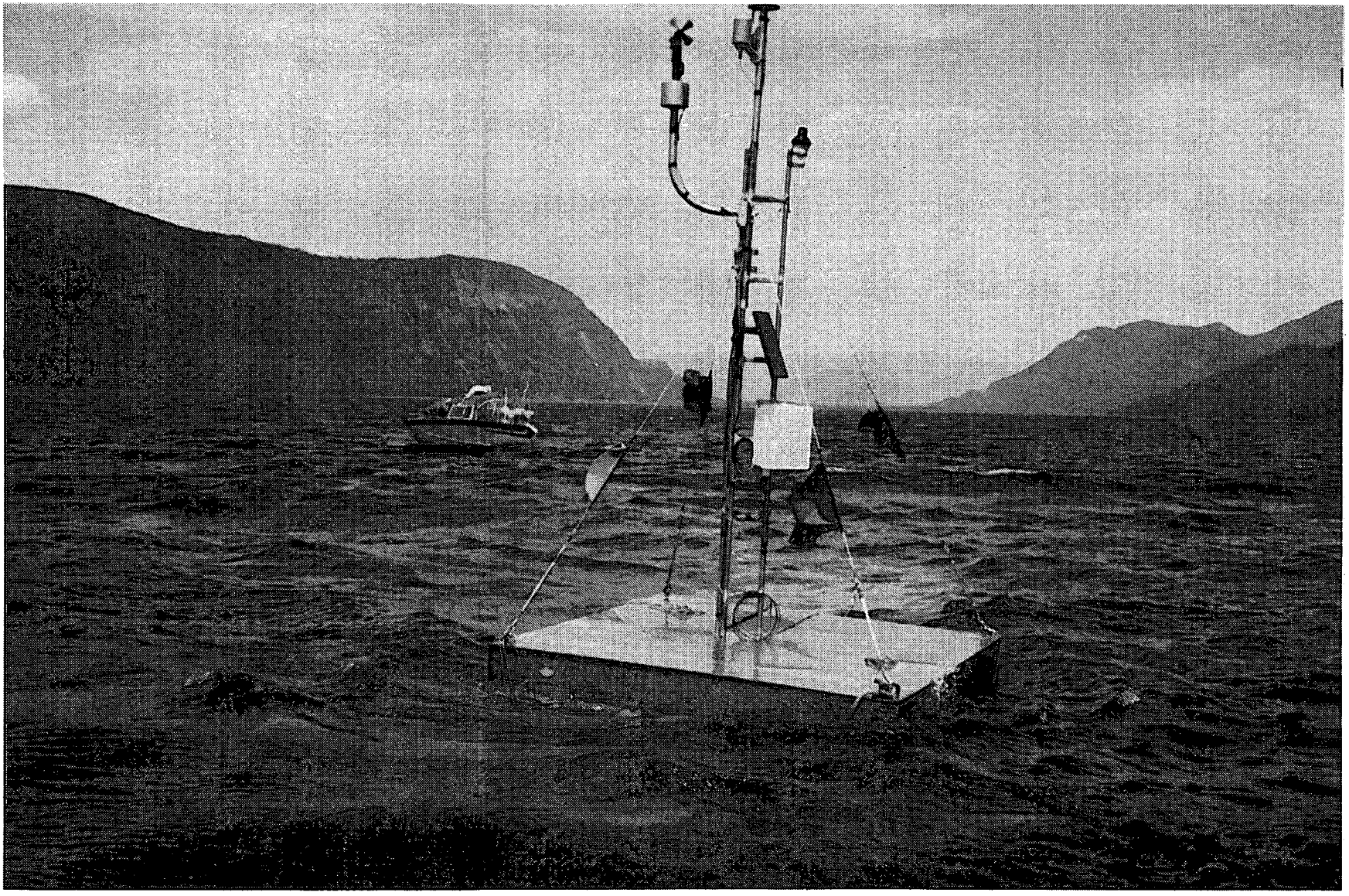
At site 4 at the mouth of the Duncan River, the dye was released upstream and tracked as it entered the lake by the Searay and PUFFIN as performed at the other three sites. Experiments were conducted at each site twice during this period.

On completion of the experiments, all equipment was removed from the lake and personnel arrived back in Burlington June 25.

KOOTENAY LAKE STATION POSITIONS

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST.DEPTH M
1	92-17T-01A	50° 08' 29"	116° 56' 03"	T(0,1,5,10, 15,20,25, 30,35,50)
2	92-17MT-02A	50° 06' 06"	116° 54' 59"	MT(1,5,10, 15,20,25, 30,35,50)
3	92-17T-03A	50° 02' 08"	116° 53' 40"	T(0,1,5,10, 15,20,25, 30,35,50)
4		50° 11' 55"	116° 56' 49"	Dye experiment only


QUEENS BAY
KOOTENAY LAKE 1974-1983
14
12
10
8
6
4
2
0
Feet
Jan
Feb
Mar
Apri
May
June
July
Aug
Sept
Oct
Nov
Dec
Chart Datum Elevation 1738 Feet GD
Highest monthy mean water level
Average monthly mean water level
Lowest monthly mean water level
KOOTENAY JOE RIDGE
PURCELL MOUNTAINS
TOOTH RIDGE
Kootenay Joe Cr.
Salisbury Cr.
Gardner Cr.
Gee Cr.
Fry Cr.
Smalliys Cr.
Fry Pt.
Birchdale
Johnsons Landing
Public
Dols
Fishing Boundary Sign
Billings Cr.
Carter Cr.
Argenta Cr.
Argenta
Duncan R.
Lardeau
Lardeau Park
Lost Lodge Cr.
Davis Cr.
Cooper Cr.
Schroeder Cr.
Schroeder Pt.
RG
1
2
3
4
270
300
306
318
330
342
366
KOOTENAY LAKE TRANSPORT AND DISPERSION STUDY
NORTH ARM
STATION POSITIONS
June 1992
NO. INST/DEPTH
1 Temp (0, 1, 5, 10, 15, 20, 25, 30, 35, 50 m)
2 MET/Temp (0, 1, 5, 10, 15, 20, 25, 30, 35, 50 m)
3 Temp (0, 1, 5, 10, 15, 10, 25, 30, 35, 50 m)
4
DYE EXPERIMENT ONLY



KOOTENAY LAKE MET STATION

MASS BALANCE STUDY, FT. LOUDOUN RESERVOIR, TENNESSEE

LRB STUDY 82401, DR. W.M.J. STRACHAN

The Fort Loudoun Reservoir is the uppermost reservoir on the Tennessee River, controlled by the Tennessee Valley Authority (TVA). The reservoir is approximately 44 miles long, varying in depth from 20 to 90 ft., while the width varies from approximately ¼ mile to over 1 mile. Total drainage area for the watershed is 9,550 square miles. Main tributaries are the Holston River and the French Broad River which feed into the head of the reservoir. The Little River enters about 10 miles below the head of the reservoir and minor tributaries are First, Spring, Knob, George, Canton, Floyd and Cloyd creeks.

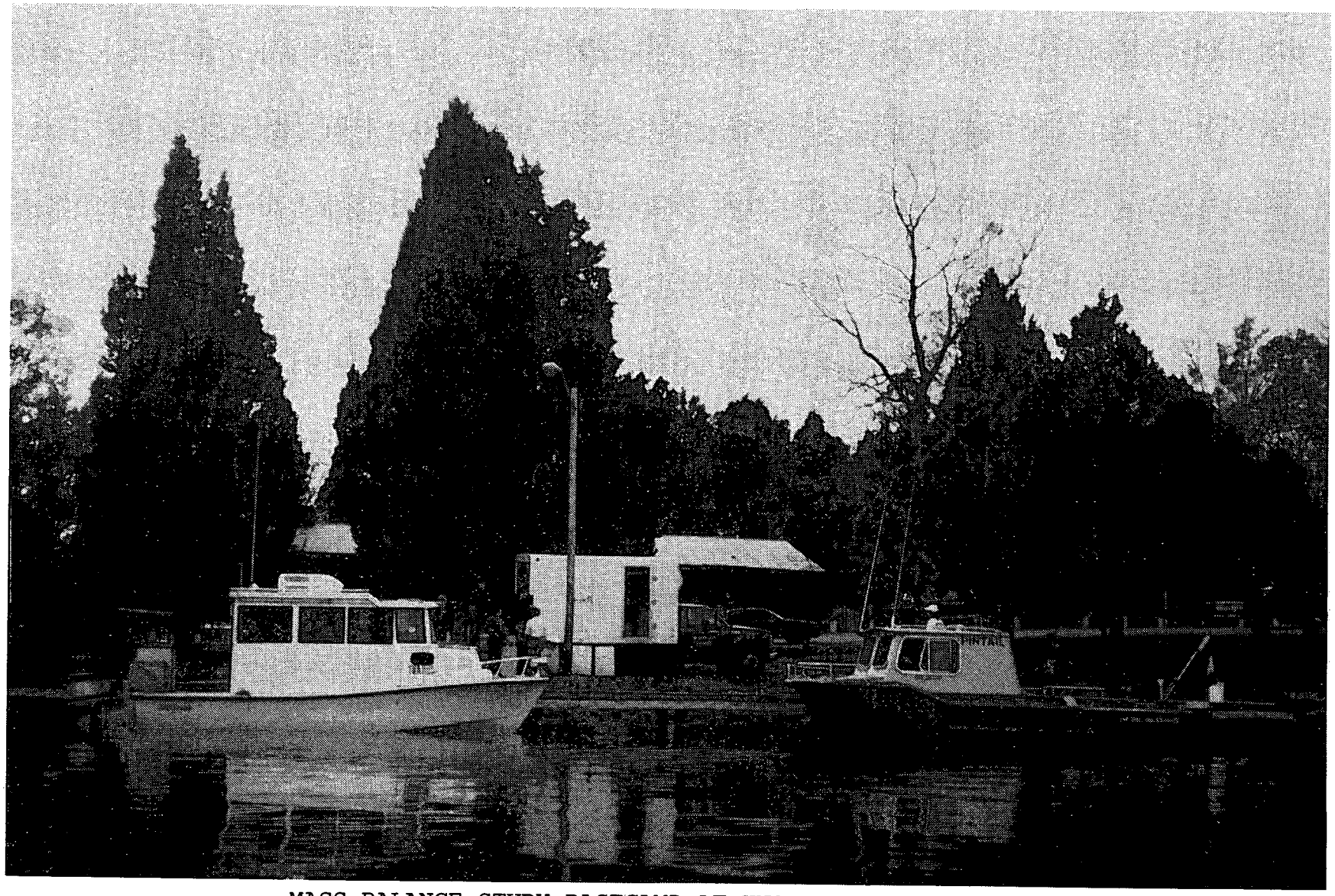
Samples were collected in duplicate using two gas-powered Westfalia centrifuges. Flow rates were adjusted for 4 litres/minute and checked every 15 minutes. After initial startup, four 40-litre stainless steel pop cans were filled with discharge water from the centrifuges. Pop cans were transported to the lab truck by the shuttle boat. The centrifuges continued to operate for a total of two hours. The suspended sediment, collected in the bowls, was returned to the mobile lab, frozen and returned to CCIW for analysis. One person from TVA collected water samples for Mercury analysis from the inflatable Avon.

The 3-ton truck was organized as a mobile lab and used for onsite analysis and extraction. Mobile lab equipment included four extractors with heaters, large cooler/lab bench, two 9-cubic ft. freezers and laminar flow fumehood. During the survey, the lab truck was located at the Star of Knoxville parking lot, PJ's Landing Marina and Lenoir City Marine Park. The lab truck also towed the PINTAIL from CCIW to Knoxville and back without a problem. A dual wheel crewcab was used to carry additional equipment, service the rain/air samplers on a daily basis and to tow the "P" boat in an emergency.

The PINTAIL was utilized to support the field sampling program. Equipped with two Westfalia centrifuges, pumps, generators, pop cans, Avon inflatable boat and a book of crossword puzzles. This boat proved to be the ideal sampling platform for this survey. A second boat, CHAOS, operated by the TVA was utilized as a shuttle craft to take samples from the PINTAIL back to the lab and returned with the empty pop cans/bowls.

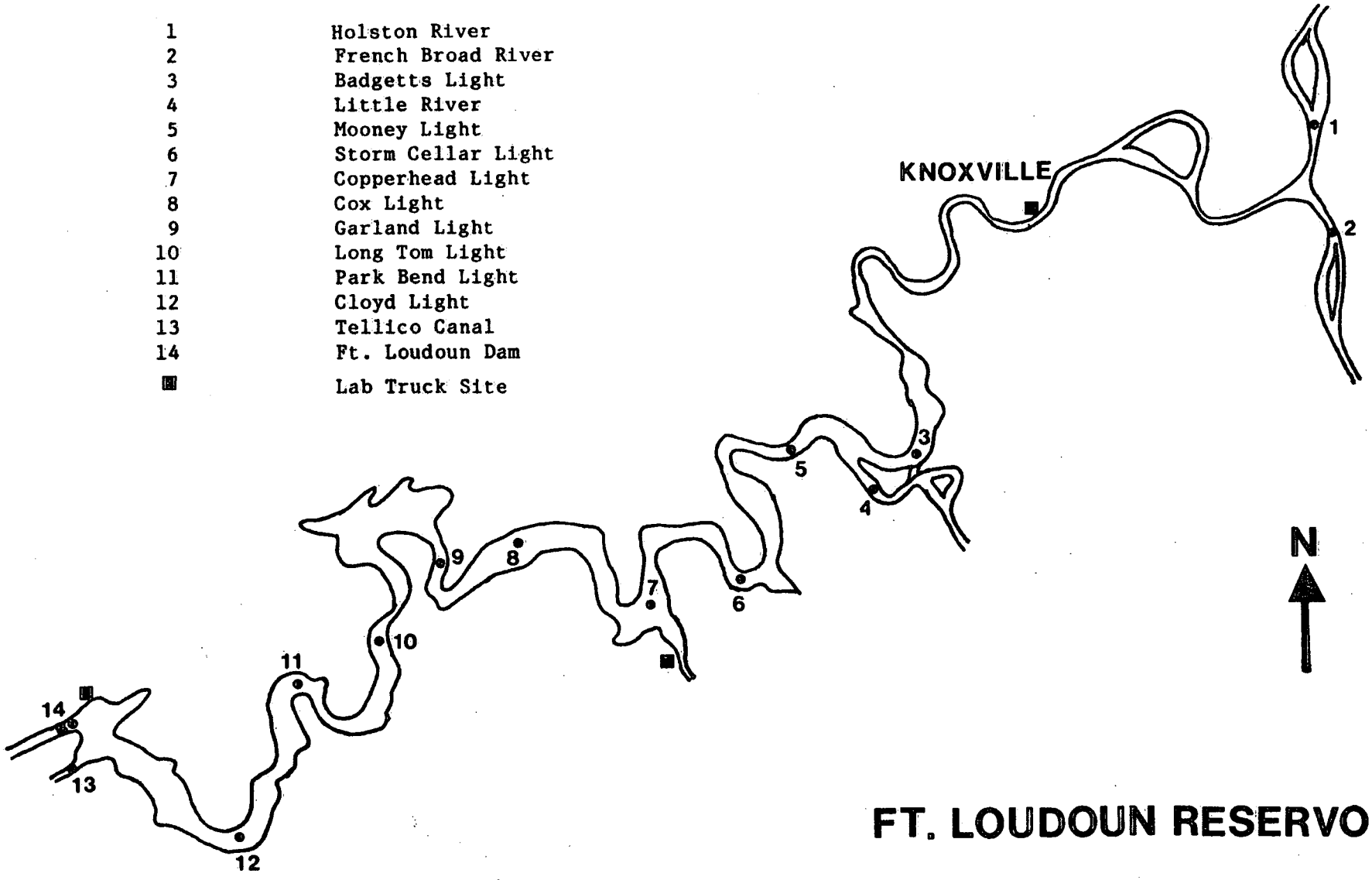
FT. LOUDOUN RESERVOIR SAMPLING STATIONS

STATION	LATITUDE N.	LONGITUDE W.
Holston River	35° 57' 55"	83° 51' 05"
French Broad River	35° 57' 24"	83° 50' 39"
Badgetts Light	35° 52' 35"	83° 58' 25"
Little River	35° 51' 00"	83° 58' 43"
Mooney Light	35° 52' 34"	84° 00' 32"
Copperhead Light	35° 50' 28"	84° 01' 17"
Storm Cellar Light	35° 50' 28"	84° 03' 03"
Cox Light	35° 50' 52"	84° 06' 10"
Garland Light	35° 05' 38"	84° 07' 19"
Long Tom Light	35° 04' 49"	84° 08' 31"
Park Bend Light	35° 48' 14"	84° 10' 24"
Cloyd Light	35° 45' 36"	84° 11' 08"
Ft. Loudoun Dam	35° 47' 25"	84° 14' 26"
Tellico Canal	35° 46' 43"	84° 14' 44"



MASS BALANCE STUDY BASECAMP AT KNOXVILLE, TENNESSEE

STATION	LOCATION
1	Holston River
2	French Broad River
3	Badgetts Light
4	Little River
5	Mooney Light
6	Storm Cellar Light
7	Copperhead Light
8	Cox Light
9	Garland Light
10	Long Tom Light
11	Park Bend Light
12	Cloyd Light
13	Tellico Canal
14	Ft. Loudoun Dam
■	Lab Truck Site



FT. LOUDOUN RESERVOIR

RAIN SAMPLER INSTALLATION

KEJIMKUJIK NATIONAL PARK, NOVA SCOTIA

LRB STUDY 82408, H. WONG

A rain sampler for metal analysis was installed at Kejimkujik National Park in May for Mr. H. Wong, LRB. This sampler was installed temporarily at the Atmospheric Environment site near the main entrance to the park. The sampler may be moved at a later date when additional samplers are installed by AES. A contract person was trained in the methodology to be used when changing the sample bottle and for cleaning the sampler.

After the sampler was installed, water was collected from the Mersey River at the outflow from Kejimkujik Lake for metal analysis. Water was also collected for K. Aspila, RAB Study 84206. A 100-litre sample was collected from the Mersey River at the outflow from Kejimkujik Lake and two 100-litre samples were collected from the Mersey River at Maitland Bridge upstream of Kejimkujik Lake.

Two rain samplers were delivered to Water Quality Branch-Moncton at the request of C.H. Chan, WQB-OR.

RIVERS RESEARCH BRANCH

TOXICITY STUDY IN SEVERN SOUND

LRB STUDY 83102, DR. Y.K. CHAU

Technical Operations personnel supported Dr. Y.K. Chau with field trips to the Severn Sound area of Georgian Bay. The sites in the Wye River and Wye Heritage Marina had been surveyed in 1989 and found to be high in Tributyltin (TBT). The present project investigated the biochemical and genetic effects of metal and organometal contamination on bacteria in the sediment and on Elliptio complanata clams incubated in wire traps.

Support consisted of two Technical Operations personnel, a vehicle to trailer the DFO launch PUFFIN and various sampling equipment on six separate occasions: May 4-6, June 1-2, June 29-30, August 6-7, August 31-September 1 and October 5-6.

Clams were collected from Balsam Lake Provincial Park by Tech. Ops. divers and 40 placed in each of five traps of which two were located in the Wye River and three in the Wye Heritage Marina. These were retrieved (8 clams per trip from each site) on the above-mentioned dates, frozen immediately and returned to CCIW along with sediment and water samples from each site. Sediment and water samples were also collected from a site in the middle of Severn Sound (44° 47' 48" N., 79° 49' 30" W.) to be used as a clean reference site.

The field work was very successful since all samples were collected and no traps were lost except at site 3 which came open late in the season with the loss of some clams.

ST. LAWRENCE RIVER SEDIMENT SAMPLING

RRB STUDY 83103, J.L. SMITH

Technical Operations personnel assisted Dr. K. Lum, Centre Saint-Laurent and Dr. S. Rao, RRB with the collection of sediment and water samples from Lac Saint-Louis and Lac Saint-François in the St. Lawrence River June 1-4. One technologist joined personnel from the Centre Saint-Laurent in Montreal, Quebec at the dock at Beauharnois where the survey launch POTAMUS II was berthed.

On the first day at station SL-26 on Lac Saint-Louis, two 12 cm diameter diver sediment cores were collected by Dr. R. Carignan, University of Quebec and Mr. S. Lorrain, CSL and four cores were collected using the Tech. Ops. 10 cm corer. In addition, a 2-litre bottom water sample was collected by Van Dorn bottle and three PONAR grabs were made to collect enough of the top 2 cm of bottom sediment to give a 3 kilogram sample. At station SL-27, divers installed three peepers for sediment pore water analysis. Once again a bottom water sample and PONAR grabs were collected. The POTAMUS II transitted the locks at Beauharnois and was tied up at the marina in Valleyfield that evening.

Two stations were sampled on Lac Saint-François the next day. Breezy conditions and choppy seas at station SL-28 combined with the slow speed of the hydraulic winch on the POTAMUS II made it impractical to use the Tech. Ops. corer. All six sediment cores were therefore taken by the divers. The usual water and sediment samples were collected. At SL-29 the water samples and PONAR grabs were the only samples collected.

Sediment cores were extruded immediately upon the return of the launch to the dock each afternoon. Dr. Carignan extruded the 12 cm cores and immediately froze the sections in coolers with dry ice for transport to the University of Quebec. The 10 cm cores were extruded by Technical Operations personnel using the standard extruder base and pop can method. Two cores were extruded in 1 cm intervals to 10 cm and then in 2 cm intervals to 18 cm for Dr. Lum. The remaining cores were extruded in 2 cm intervals to 18 cm for Dr. Rao. These sections were stored on ice along with the bottom grabs and water samples for transport to Burlington.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
SL-26	45° 20.35'	73° 55.78'
SL-27	45° 24.89'	73° 49.31'
SL-28	45° 14.60'	74° 11.54'
SL-29	45° 13.13'	74° 12.19'

MONITORING CONTAMINANTS, CORNWALL, ONTARIO

RRB STUDY 83103, J.L. SMITH

During the week of June 22-26, J.L. Smith, RRB, L. Grapentins, University of Western Ontario, M. Mawhinney and M. Dahl, TOS visited 12 sites in the Massena/Cornwall area of the St. Lawrence River. Samples of water, sediment and two species of fresh water mussels (Elliptio complonata, Lampcillus radiata) were collected at each site and the presence of either zebra or Quaggo mussels was noted. Water depth, temperature, pH and oxygen content were also recorded at each location. Once collected, sediment and water samples were stored at 4°C and mussels were kept alive until sorted and frozen for later analysis. Some mussels of both species were stored in situ in mesh bags at site SL-12 (Pilon I.) and retrieved on June 25 for live shipment to the University of Western Ontario. Station numbers and descriptions follow:

STATION NUMBER	LOCATION
SL-06*	North shore of St. Lawrence River at the `old boat launch ramp'
SL-07*	South shore of St. Lawrence River downstream of the Grassie River
SL-12	South side of Pilon I.
SL-13*	North side of Cornwall I. opposite Domtar
SL-14*	Downstream of General Motors (Biberhofer station #9)
SL-15	North shore of St. Lawrence River downstream of Courtland Fibres (at the closed marina)
SL-16	North side of Islet Green (Biberhofer station #2)
SL-17	South side of the St. Lawrence River between the highway bridge and General Motors
SL-18*	South side of St. Regis I. (Biberhofer station #12)
SL-19	North shore of St. Lawrence River downstream of the hydro dam (Biberhofer station #14)
SL-20	Downstream of the end of MacDonald I. at the submerged highway off the Long Sault Parkway

*Sites requiring scuba diving for mussel collection

In order to facilitate sample storage, a large freezer was installed at Marina 200 with the permission and assistance of the management and staff. A portable freezer was kept in the scientist's hotel room where mussels were sorted then frozen each evening. These samples were transferred to the large freezer at Marina 200 the morning after sorting.

ZEBRA MUSSEL INFESTED CLAMS AT CORNWALL

SAINT JOHN RIVER STUDY

RRB STUDY 83201, DR. J.H. CAREY

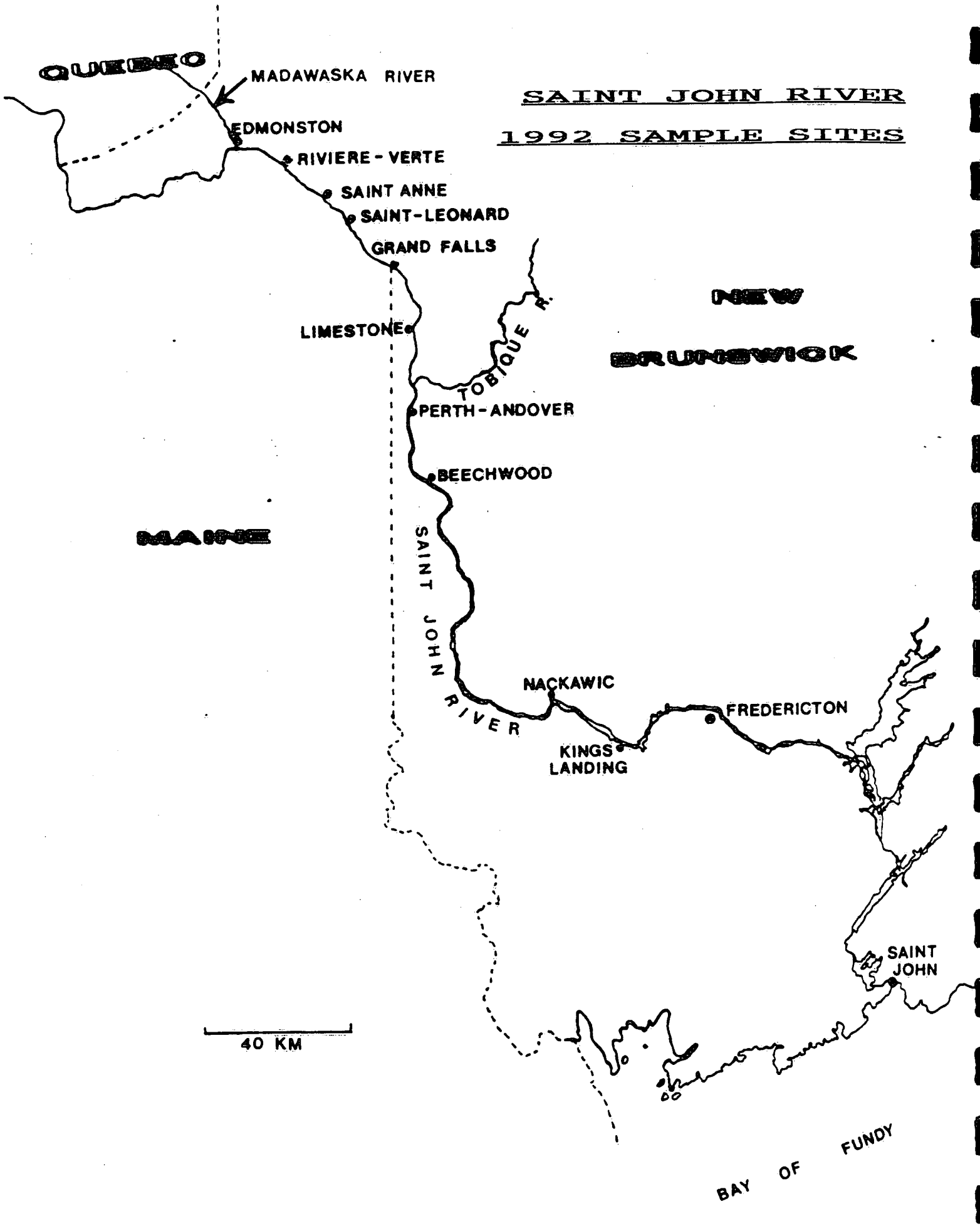
Technical Operations staff supported RRB Study 83201 from July 13-23 along the Saint John River in New Brunswick. Support consisted of one person, a four-wheel drive pickup truck, a van and all the necessary field sampling equipment. Also taken was a 17 ft. Boston Whaler from DFO.

The purpose of the work was to do an initial assessment of the effects on the water quality and subsequent loading of the sediments in the river by the effluent discharge of pulp and paper mills.

The field party consisted of one person from Tech. Ops, two from RRB and one observer from Environmental Protection Service located in Dartmouth, Nova Scotia.

Sampling sites were chosen above and below pulp and paper mills at Edmonston, Nackawic and Saint John, New Brunswick. Transects of five points were done across the river with water and sediment samples being collected. The water samples were processed each evening after collecting using an organic extraction method. The Boston Whaler was utilized at all locations except two where samples were taken from convenient bridges.

No major problems occurred during the trip. Future work may be required if results warrant.


SAINT JOHN RIVER
1992 SAMPLE SITES
QUEBEC
MADAWASKA RIVER
EDMONSTON
RIVIERE-VERTE
SAINT ANNE
SAINT-LEONARD
GRAND FALLS
LIMESTONE
TOBIQUE R.
NEW
BRUNSWICK
PERTH-ANDOVER
BEECHWOOD
MAINE
SAINT JOHN RIVER
NACKAWIC
FREDERICTON
KINGS
LANDING
SAINT
JOHN
40 KM
BAY OF FUNDY

MACKENZIE RIVER SAMPLING

RRB STUDY 83301, DR. D.S. JEFFRIES

Sampling was done on the Mackenzie River during the period August 20-28.

A charter boat was used to sample three sites on the river upstream of Arctic Red River, upstream of Aklavik and downstream of Inuvik. The Alpha Laval centrifuges were used to obtain suspended sediment at each location. Centrifuged water was collected and returned to the Inuvik Research Centre where large volume extractions using methylene chloride were done for contaminant analysis.

A raw water sample was collected from the Anderson River from a charter aircraft. Samples were filtered before doing a large volume extraction.

TURKEY LAKES WATERSHED

RRB LRTAP STUDY 83302, 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 personnel throughout.

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

Technical Operations' support consisted of one full-time technician stationed in Sault Ste. Marie. Equipment support consisted of one full-time 4-wheel drive vehicle used for transport to the study area. A second 4-wheel drive vehicle was utilized during the winter months. Four 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 buildings at the field site and a 2-way radio system were operated by field personnel and maintained by Quattra Communications in Sault Ste. Marie. All roads and trails in the watershed were maintained with assistance from staff at the Canadian Forestry Service at Sault Ste. Marie.

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

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

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

To supplement hydrological and chemical data, a full meteorological station and solar radiation unit were operated all year round. The new MET III system is in operation. This system allows data to be dumped to disc onsite and a backup disc is generated. The data disc is shipped to Burlington each month and onsite data processing is performed. The MET III system also allows MET program changes to be made onsite and the MET can is able to be erased to provide continued use with no interruption of data collection.

An additional TOS member supported the study during the intensive "Spring Run-off" period March - April.

Support to WQB-OR 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 analyses. The samples are shipped to Burlington according to regulations required by the Transportation of Dangerous Goods Act for analyses by WQB personnel.

In October 1991 a camper lab was delivered and set up at the Batchawana Lake site. This will be used for storage of sampling equipment used in the area of the lake and a working space during the intensive run-off period. Solar power is provided to the camper to continuously charge a 12 volt battery which is used to power the furnace and the lights in the camper.

A number of additional tasks have been added to the project and work will continue in the future. These include:

1. A monitoring station for soil temperatures and air temperature at the Batchawana Lakes. This utilizes a Campbell datalogger and storage can. The system was monitored and the data processed by TOS.

2. A large 2-metre static snow collector was set up at the MET Hill site and was sampled on a weekly basis during the winter months. The samples were chemically spiked and shipped to CCIW.

3. Transmissometer data was provided along with digitized EBT data during lake sampling periods.

4. Service was provided by TOS to 2 Campbell dataloggers, 3 storage modules and 5 solar power panels.

5. A snow melt cave constructed at the Batchawana Lake location was put into service. Samples were collected by an automatic Isco sampler powered by a solar power panel during spring run-off conditions.

Two portable radio systems were purchased for the TLW and were used by personnel when working alone. These radios allow calls to be made to Sault Ste. Marie from anywhere in the watershed.

Two soil moisture sensors were installed and added to the data collected at the Headwater location where ongoing soil temperatures were recorded year round.

During the summer, all docks and bridges were reinforced and a new dock added at Wishart Lake.

A 10 ft. x 16 ft. storage shed was jointly constructed at the camp by Environment Canada, Forestry Canada and Fisheries & Oceans personnel. This building will be shared by all three agencies.

Between May and October, two additional projects were supported: Study 82401, Dr. W.M.J. Strachan and Study 82406, W.M. Schertzer.

LRB STUDY 82401, Dr. W.M.J. STRACHAN

This project at the Turkey Lakes between May and October studied the mass transfer of pollutants from Little Turkey Lake. The work examined the air-water mass transfers of sulphur hexafluoride. This compound is a very inert gas both chemically and biologically with poor sorption to suspended matter.

To support this study, a weather station was installed on Little Turkey prior to the experiment taking place and was run until after the work was completed. Dr. Strachan and M. Alaee were at the site on three occasions to inject the gas into the lake and begin the initial sampling of water from points around the lake. There was a total of three sampling periods:

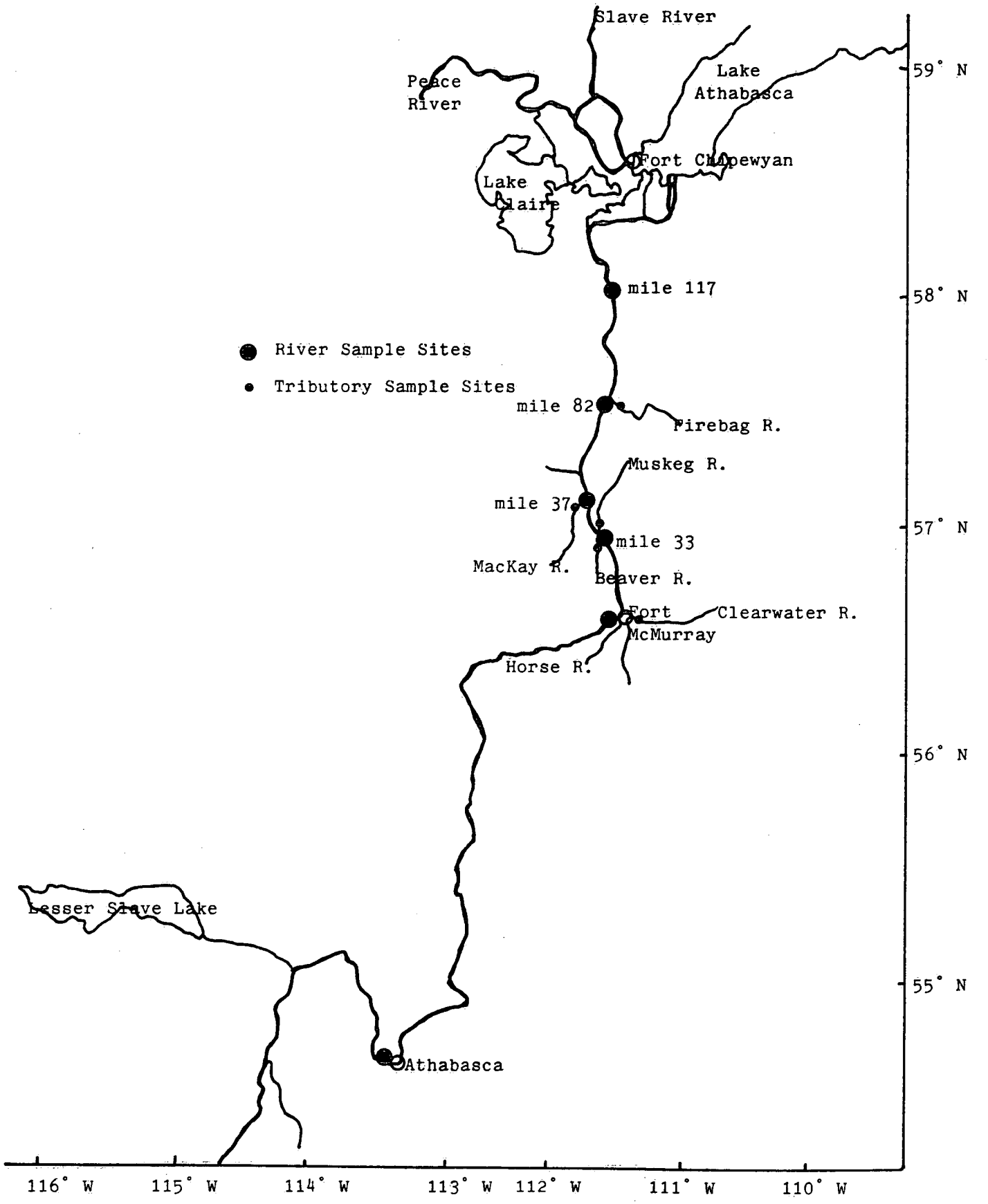
May 20 to June 12
July 30 to August 21
September 14 to October 28

One additional set of samples was taken through the ice over the winter months. Samples were collected at a depth of 1 metre from 4 locations around the lake plus a sample from the deep hole at 1, 3, 5 and 7-metre depths. An EBT was collected as many times as possible to complement the sampling. Sampling was done on a daily basis for a week following the injection of gas into the lake and then 2 to 3 times a week after that. After collection, all samples were kept refrigerated at the Turkey Lakes camp and shipped cooled to CCIW immediately after samples were completed.

LRB STUDY 82406, W.M. SCHERTZER

This project was performed in conjunction with Dr. Strachan's study on Little Turkey Lake. During the spring run-off, an 8 ft. x 8 ft. raft was constructed at the camp and delivered to Little Turkey Lake. During the week of May 12, E.G. Smith visited the site. A 10 ft. section of TV tower was mounted on the raft and supported by 4 guy wires. On this tower, a MET system was installed, the raft was towed to the deep hole on the lake (centre) and anchored on 4 points.

Several parameters were sampled throughout the study period and stored on a Campbell Scientific recorder. The data was monitored regularly, downloaded, processed and sent to CCIW monthly. Parameters sampled included: solar radiation, relative humidity, air temperature, wind speed at 1 and 4 metres, wind direction at 1 and 4 metres, water temperature at 0, 2, 4, 6, 8 and 10 metres, and buoy direction. To ensure data quality, the system was monitored frequently with EBTs taken to confirm water temperatures. 100% data recovery was achieved.


Slave River
Peace River
Lake Athabasca
Fort Chipewyan
Lake Claire
mile 117
River Sample Sites
Tributory Sample Sites
mile 82
Firebag R.
Muskeg R.
mile 37
mile 33
MacKay R.
Beaver R.
Fort McMurray
Clearwater R.
Horse R.
Lesser Slave Lake
Athabasca
59° N
58° N
57° N
56° N
55° N
116° W
115° W
114° W
113° W
112° W
111° W
110° W

ATHABASCA RIVER

RRB STUDY 83304, DR. B.G. BROWNLEE

RRB STUDY 83305, DR. R.A. BOURBONNIERE

This was a continuation of studies carried out from 1989. The 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.

The winter sampling period was from February 24 to March 12 from Athabasca to mile 117 on the Athabasca River. Suspended sediment samples (centrifuged) were collected from the Athabasca River at Athabasca, at Fort McMurray (upstream of the Horse River), at mile 34, at mile 37 (left bank [A], centre [B] and right bank [C]) and from the Clearwater River at Fort McMurray. Two centrifuges were run for approximately 24 hours at each sample site. At each of these sites, samples collected included two 18-litre soda cans of centrifuged water for millipore can extraction (base/neutral and ecotoxicology), centrifuged water for seston weight, POC, DOC and major ions. Raw water was collected for pH, seston weight, conductivity and DOC.

Raw water samples were collected from the Juskeg River, Beaver River, mile 37 (sites B and D), MacKay River, Firebag River and mile 82. Samples were analyzed for pH, conductivity, seston weight, POC, major ions, DOC and millipore can extraction. Raw water samples were also collected from Suncor waste water and the north mine drainage.

Samples were also collected at right bank, centre and left bank locations for pentane extractions for volatile hydrocarbons at all sites on the Athabasca River where the centrifuges were used as well as from mile 82 and mile 117.

A single bottom sediment core was obtained at mile 34 with the use of a Brown corer. This core was sectioned and the sections frozen for analysis at CCIW.

CORING OPERATIONS ON LAKE ATHABASCA

NORTHERN RIVERS BASIN STUDY

RRB STUDY 83305, DR. R.A. BOURBONNIERE

Technical Operations staff supported RRB Study 83305 on Lake Athabasca in Northern Alberta during the period March 8 - 15. The two Tech. Ops. personnel supporting the project drove two rented vehicles and all necessary equipment north from Fort McMurray, arriving on March 8 at Fort Chipewyan which became the base of operations for sampling. The lake had an ice covering of up to 1.5 metres which made an excellent platform for coring.

The purpose of this initial field work was to define the depositional history of sediment-bound contaminants throughout the lake. Sampling consisted of collecting bottom cores and PONARs along a line roughly down the middle of the lake from the western end towards the northeast corner near Uranium City. The western end nearest Fort Chipewyan was sampled using a chartered Bombardiere tracked vehicle while the more distant sites were done using a chartered helicopter. Some cores collected at the more distant sites were subsectioned on location. Due to time restrictions, remaining cores were returned to Fort Chipewyan to be subsectioned at Wood Buffalo National Park facilities.

The trip was successful with 12 cores in the 70-90 cm length being collected from all the desired locations as well as numerous PONARs. The cores were taken using a newly designed 10 cm corer which worked well under these conditions.

A NICE LONG 10 CM. DIAM. CORE FROM LAKE ATHABASCA

ICE JAM STUDY, RESTIGOUCHE RIVER, N.B.

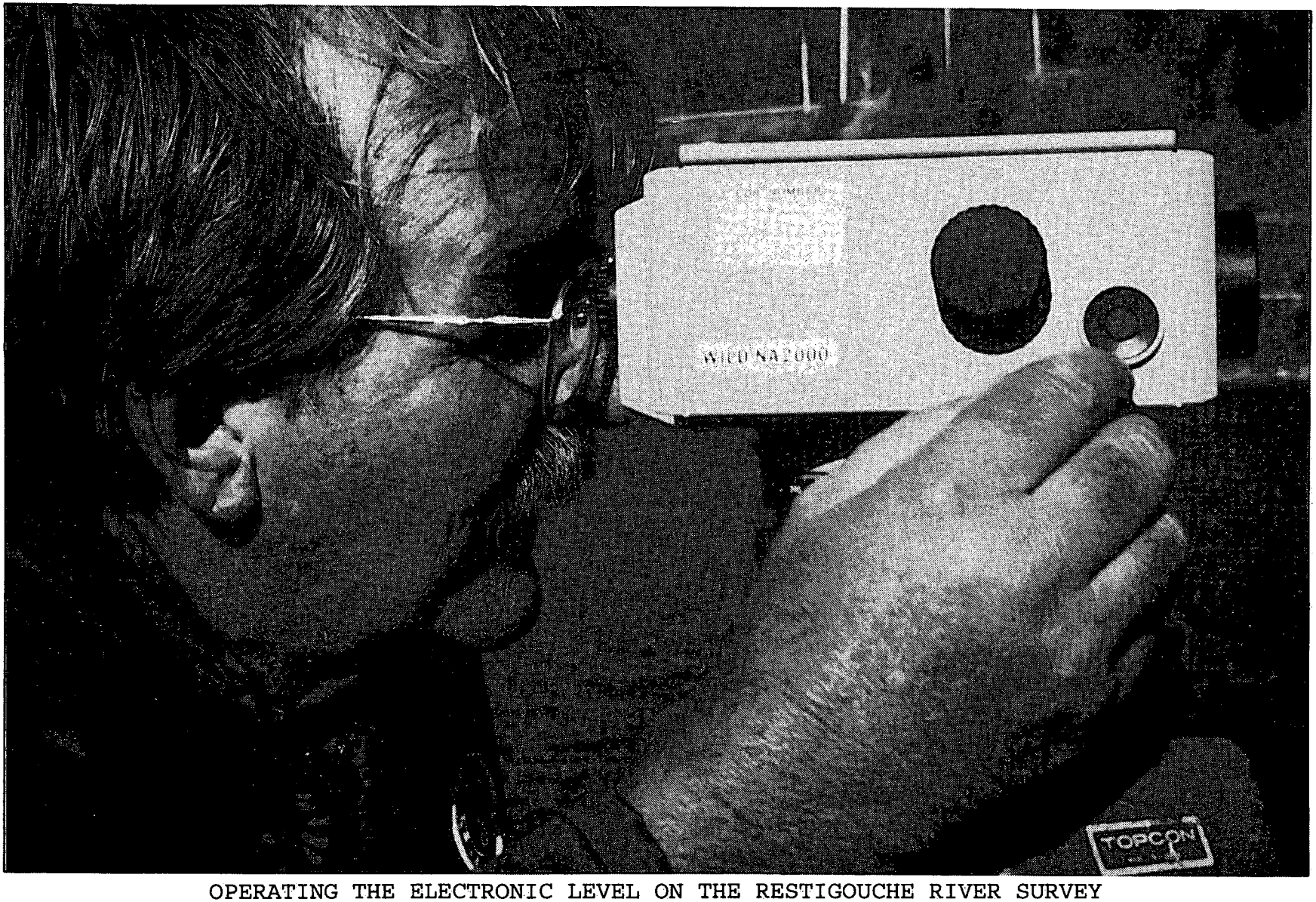
RRB STUDY 83309, DR. S. BELTAOS

This year marked the sixth year of work on the Restigouche River in Campbellton, New Brunswick on an ice jam study for Dr. S. Beltaos of the Research & Applications Branch. Mr. Robert Stephens, Dr. Beltaos' representative, Ken Hill and Yvon Desjardins of Technical Operations made the trip.

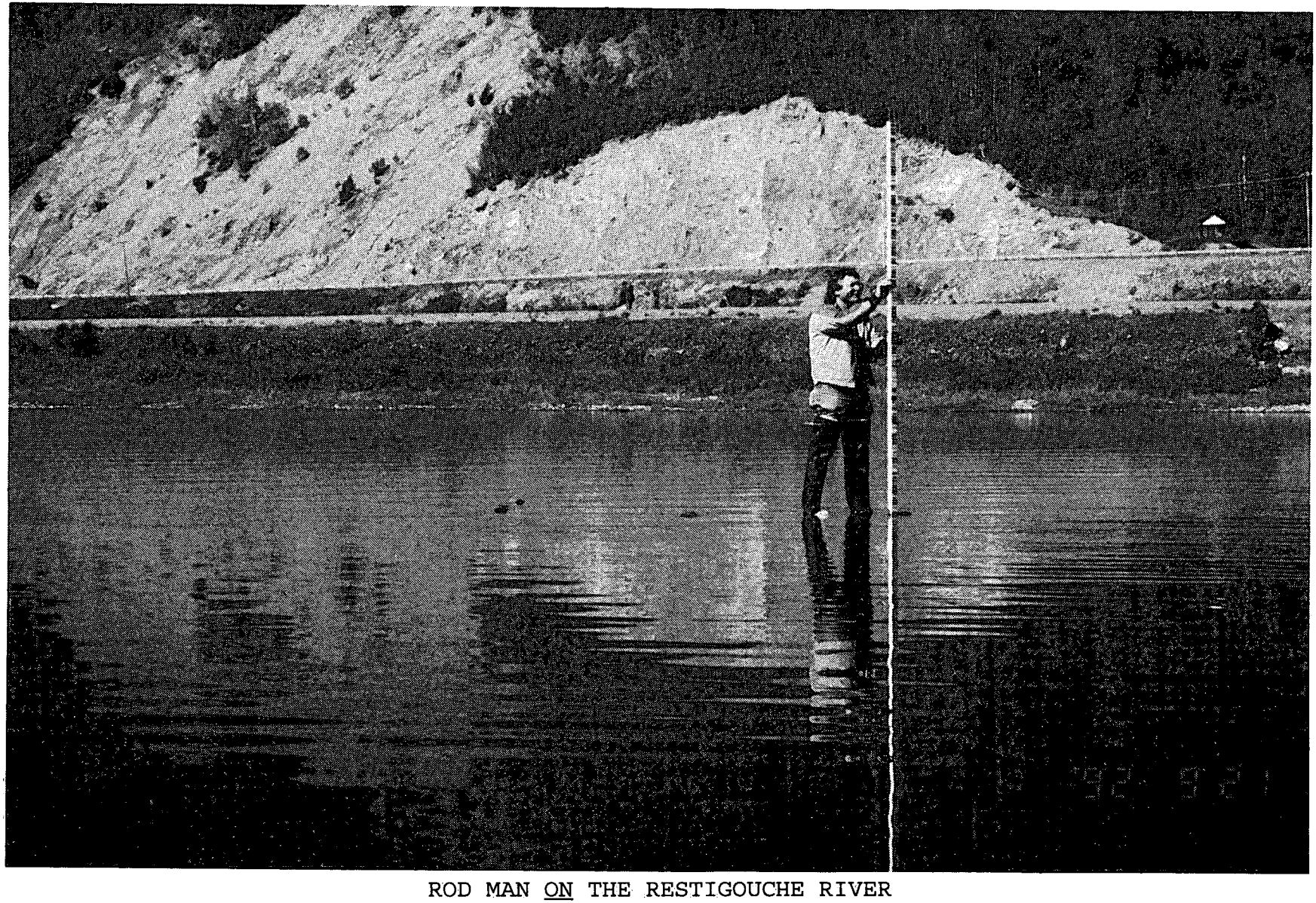
Two cross-sections and a river profile were made. The river profile was made to establish the water elevation of an area of the river that was not covered by cross-sections in the last five (5) years. It involved running a level line between chainnage 17 + 110 km and 11 + 099 km. The use of the new Wild NA 2000 electronic level made the run easy and accurate. Equipment used included the same as before: a Tl000 transit, DI 3000 O R, the 26 ft. canoe and sounder to do the cross-sections and the NA 2000 level to do the profile. The 26 ft. canoe was also utilized to move personnel during the river profile.

For travel to and from New Brunswick, the extended cab 4x4 pickup No. 238560 was used. Due to a political party convention in Campbellton, accommodation was taken in Bathurst, 110 km from Campbellton, for two nights. For the first time since the project began, weather was rainy and foggy for most of the time. Even so, the party returned to Burlington one day ahead of schedule.

This is probably the last season of work on the Restigouche River. Next year the work could shift back to the Saint John River where cross-sections were made last year.



OPERATING THE ELECTRONIC LEVEL ON THE RESTIGOUCHE RIVER SURVEY



ROD MAN ON THE RESTIGOUCHE RIVER

SUSPENDED SEDIMENT SAMPLING, TORONTO/KINGSTON

RRB STUDY 83311, DR. J. MARSALEK

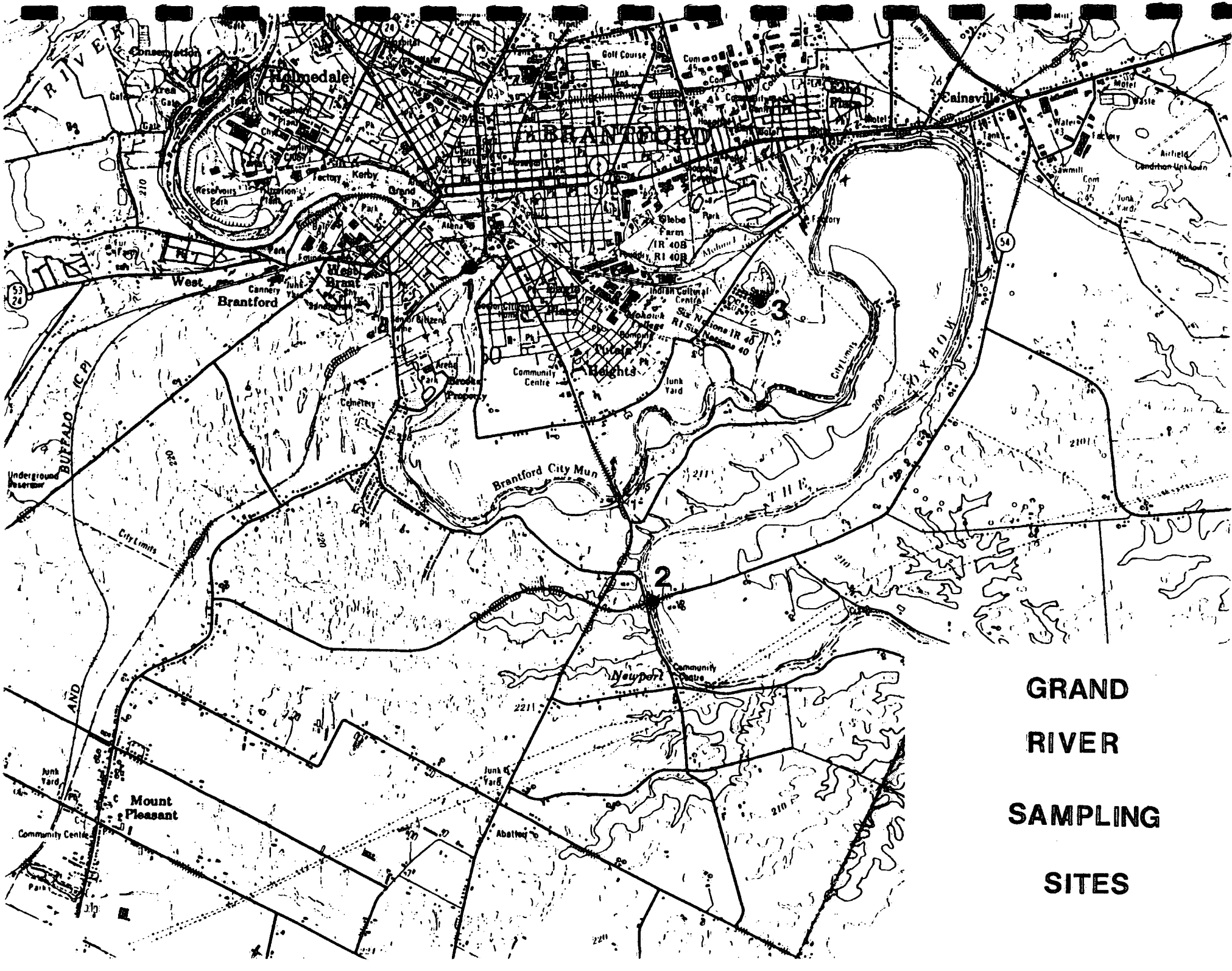
An urban water retention pond located next to the Cataraqui Town Centre at the junction of Gardiners Road and Hwy. 2 in Kingston Township was sampled twice--once in February and again in November. In February, 18 sediment core samples were collected at 15-metre intervals over the entire surface area of the pond. On the second trip, centrifuging took place at the inflow and at the outflow of the pond. The water was pumped from a depth of 1.5 m and the centrifuge ran approximately 2.5 hours. A bottom-mounted Hydrolab datalogger with an optical backscatter sensor and a Brancker logger was installed at the inflow in 1.5 metres of water. The instrument was deployed on November 5 and retrieved in December. A group of people from Queen's University was responsible for cleaning the Hydrolab/OBS equipment weekly until it was removed.

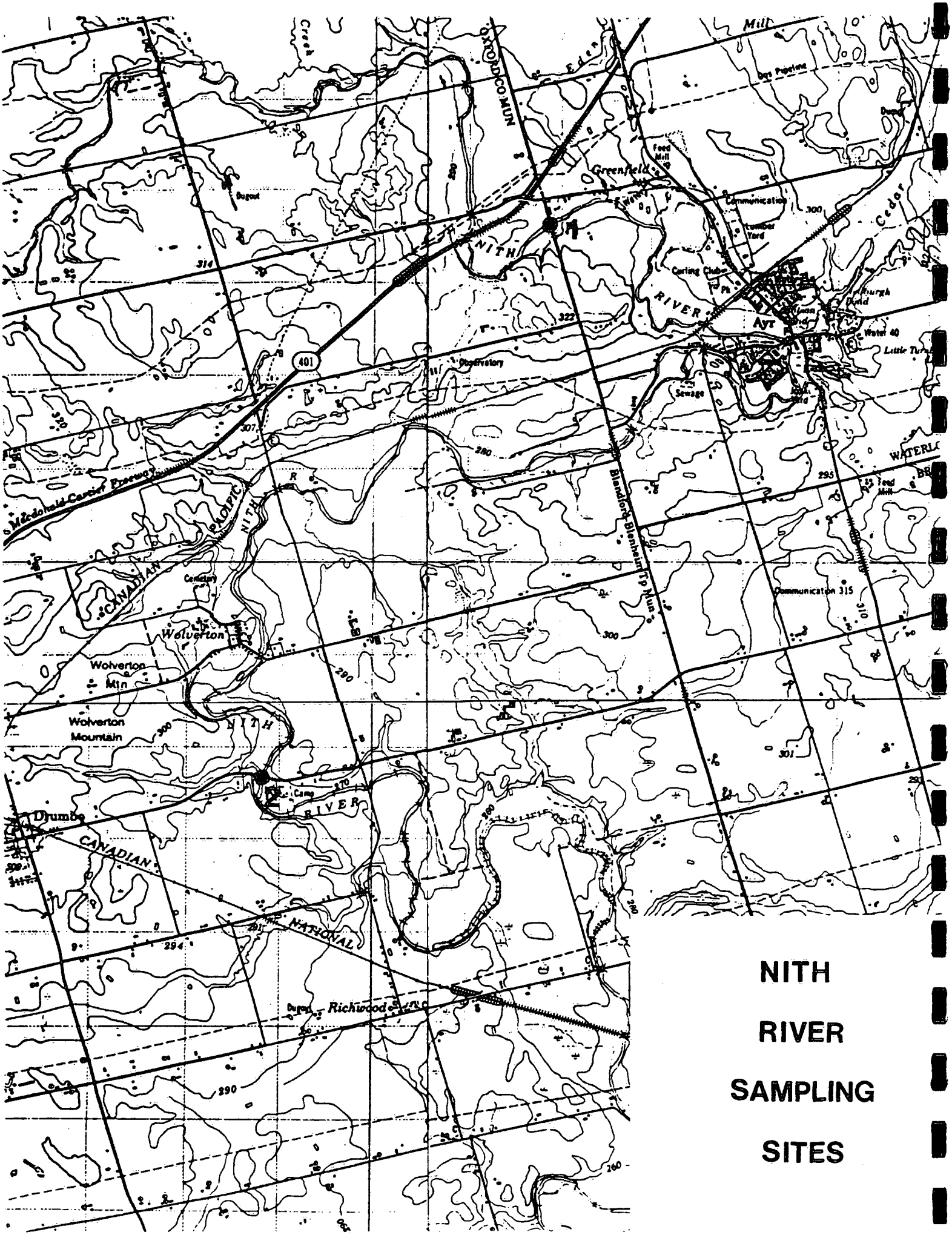
Four urban stormwater ponds located in the greater Metropolitan Toronto area were sampled in the autumn. This was the first phase of this study in which these ponds will be sampled during the four seasons (spring, summer, autumn and winter). One pond is located in the Colonel Samuel Smith Park Conservation Authority, Etobicoke. The second and third ponds--Tapscott and Unionville, are located in Scarborough and Markham, respectively. The last pond is located in the Heritage Estates vicinity of Richmond Hill. The following sampling occurred once at each pond between the months of October and November. At five randomly selected sites in each pond, approximately 2 kilograms from the top 2-4 cm of bottom sediment were collected with an Ekman dredge. The mud was stored in plastic bags and kept cool until it was returned to CCIW for analysis. At each pond, three sites were centrifuged using a Westfalia separator. The three sites chosen were at the inflow, the outflow and mid-pond. The centrifuges operated at a flow rate of 6 litres per minute until at least 15 grams of suspended sediments had collected in the bowl. Water was pumped using a submersible #5 March pump from approximately mid-water column.

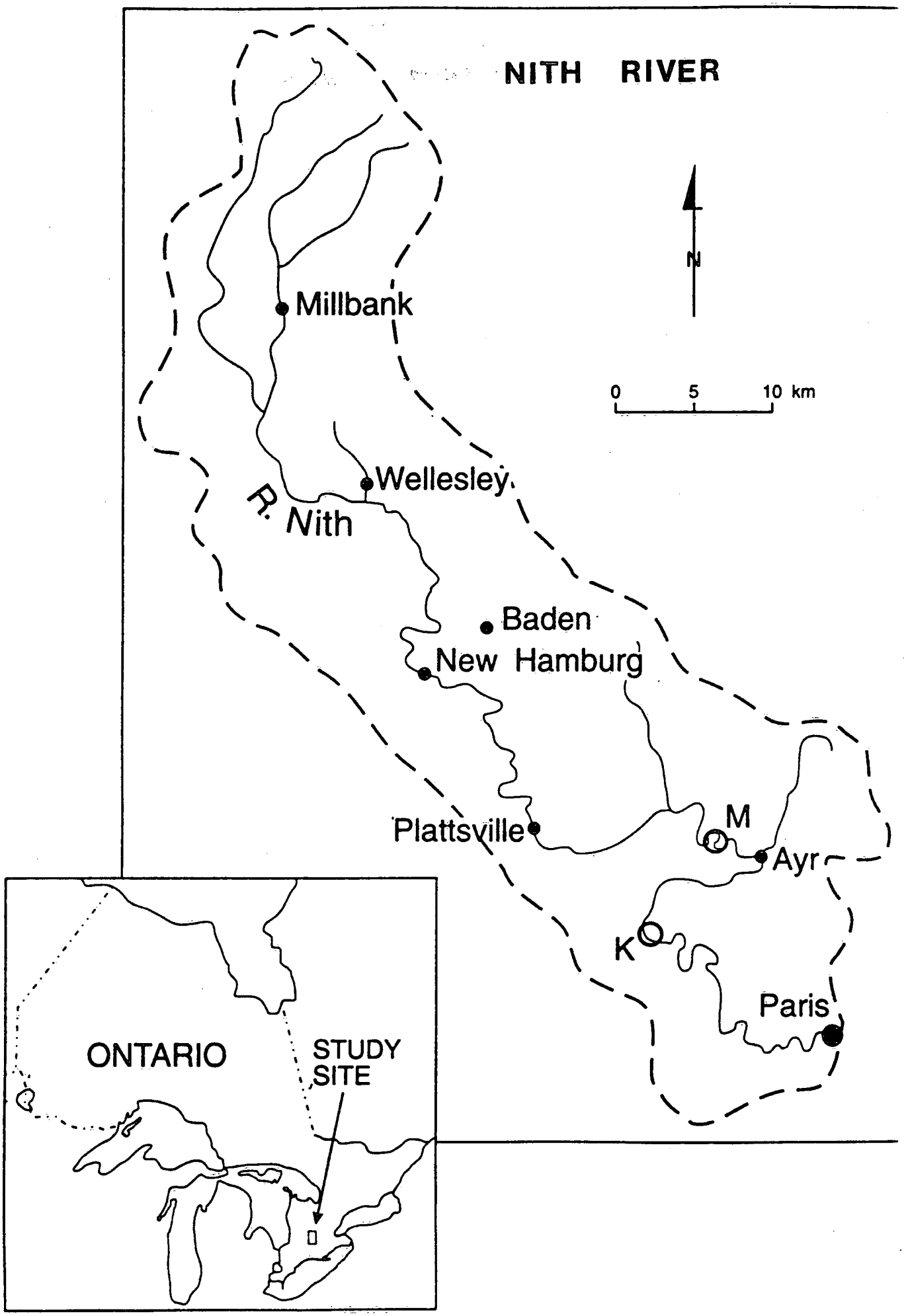
GRAND AND NITH RIVERS

RRB STUDY 83312, T. MAYER

The Grand and Nith rivers were sampled seven times between April and September by Technical Operations staff. The Grand River was sampled at three sites from bridges located in and around the Brantford area. The Nith River was sampled at two sites west of Paris. At all sites on both rivers the following tasks were completed: A submersible March pump was suspended from either a red buoy ball or tied directly from a bridge at mid-water column. Westfalia centrifuges operated approximately two hours in order to collect at least five grams of particulate matter. All samples were returned to CCIW and refrigerated prior to analyses.


RIVER
Holmedale
BRANTFORD
Cainsville
West Brantford
Brant Heights
Mount Pleasant
Newport
Brantford City Mun
BUFFALO (CP)
1
2
3
GRAND
RIVER
SAMPLING
SITES


NITH
RIVER
SAMPLING
SITES


NITH RIVER
N
0 5 10 km
Millbank
Wellesley
R. Nith
Baden
New Hamburg
Plattsville
M
Ayr
K
Paris
ONTARIO
STUDY SITE

GROUNDWATER

RRB STUDY 83403, K. NOVAKOWSKI

Technical Operations personnel supported Groundwater (hydrogeology) field research. Two TOS technologists spent two months during the spring working in the Groundwater Lab at CCIW. A variety of monitoring and testing equipment was readied for the field season.

A pressure testing survey was conducted in May at several bore holes at Niagara Falls, Chippewa and Navy Island.

Dye tracer experiments were made at the Groundwater trailer site at Clarkson in June where 10 of the 25 experimental bore holes were monitored. TOS staff were involved in this time intensive experiment with dye concentration readings being taken at 15-minute intervals and slowly increased in duration to only a few per day by the end of the two-week period. These dye tracer tests were used to collect data necessary to understand the movement of ground water through fractured rock.

TOS support was also given to a Groundwater term person, Dr. I. Noor for a pressure and water sampling survey at many bore holes in the Niagara Peninsula. In general, Dr. Noor's research program was designed to investigate ground water chemistry and movement within a network of subsurface faults and fractures in southwestern Ontario. This study is the first major investigation which will examine the natural loading processes and impact of hydrocarbon gas seeps and migration mechanisms and pathways within the shallow ground waters and aquifers. Also, to develop chemical fingerprints of natural hydrocarbons for use in differentiating these from those of anthropogenic (human) sources.

By using a sophisticated sampling technique developed by Westbay Systems in Vancouver, we were able to collect numerous gas and water samples from deep survey bore holes in the Niagara Peninsula. This system allowed us to accurately sample at a number of depths adjacent from known fractures intersected by each well. Each fracture along the bore hole was isolated by inflatable packers above and below but accessible from within the bore holes continuous plastic liner through tiny spring loaded ports. The sampling instrument was able to communicate with these ports for measurements of temperature and pressure or collection of gas and water samples. The monitoring wells were installed during previous studies in the Niagara Falls area by the United States Geological Survey, Environment Canada and Ontario Hydro.

A small portable (GC) gas chromatograph was used onsite to analyze gases such as methane, ethane, butane, etc. Water samples were taken back to CCIW for analyses

of aromatic hydrocarbons, benzene, toluene, ethylbenzene and xylene (BTEX) which constitute the soluble fraction of most hydrocarbon fluids. BTEX has a longer resident life in ground water compared to light aliphatic hydrocarbons and is therefore a good tracer of hydrocarbon contamination.

Also, a few gas and water samples were collected from shallow sampling wells located at several closed gas stations in Toronto and area.

The Groundwater group has purchased a small drill rig that will be used for future ground water research. Technical Operations technicians have been trained to operate the rig for continued support to the Groundwater group. Similar ground water research is scheduled for the 1993 field season.

ONTARIO HYDRO BORE HOLE AT NIAGARA FALLS

RESEARCH & APPLICATIONS BRANCH

QUALITY ASSURANCE

RAB STUDY 84206, K. ASPILA

Technical Operations was involved in support to the Quality Assurance Program with personnel, vehicles, centrifuges and the DFO launch, PUFFIN on three different occasions to collect and process water samples. Large volume water samples of 400 litres were collected November 18 from Lake Erie near Port Colborne and November 19 from Lake Huron near Goderich. The samples were returned to CCIW for centrifuging. Also centrifuged on November 30 was a 200-litre sample from the Athabasca River which had been delivered to CCIW. On June 19, a 100-litre sample was collected in Kootenay Lake, British Columbia and returned to CCIW for analyses.

WAVES TOWER

RAB STUDY 84303, DR. M.G. SKAFEL

The WAVES tower was installed in Lake Ontario one kilometre offshore from Van Wagner's Beach in Hamilton in 1976. Since the date of installation, maintenance of the structure has been limited to the above-water sections. During 1991/92, a plan was prepared to clean, inspect, repair as necessary and renew the protective coating of the underwater structure. Work commenced in mid-June 1991 and continued uninterrupted for three weeks and one additional week was added in mid-August when work was suspended with only 75% of the painting completed. The remainder was completed in two weeks in June 1992.

Underwater work was executed in three stages: the cleaning stage required the use of high pressure water hoses and hydraulic grinders to clean the entire underwater structure. The inspection stage began with a visual examination followed by a weld inspection technique called "Magna-flux". This process involved the use of magnets mounted on either side of the joint and sprinkling dyed iron filings over the weld. Any cracks in the weld would disturb the magnetic field through the joint which was reflected in the pattern of the iron filings. The painting stage provided a renewed protective coating on the main support columns. Annual inspections of the welds will be required. The painting should extend the life of the tower by five to eight years.

RESEARCH SUPPORT BRANCH

CANADIAN WILDLIFE SERVICE

RSB STUDY 86301, DR. V.W. WESELOH, CWS

Technical Operations staff supported the Canadian Wildlife Service. Although the CWS field program covered a huge research area with several different studies, TOS support again went to the main study of colonial water birds such as gulls, terns and cormorants nesting on the Great Lakes. The purpose of this program was to determine or aid in the determination of how various factors constitute biological effects of toxic chemicals in these species.

For obvious reasons, the majority of the research was done on eggs and chicks, creating a very short field season in which to collect the needed data. Budget restraints, limited staff and the huge research area to be covered also made for a short, high intensity field season of approximately 3 months (mid-April through mid-July). During this time, many colonies covering all of the Great Lakes were studied. Several visits to each colony during nest-building, egg laying and chick rearing were needed. This, plus the fact there were different colonies throughout the Great Lakes and different bird species start nesting at different times, added to the tight scheduling of field trips.

Chick enclosures constructed of chicken wire and wooden stakes were erected on several islands in Eastern Lake Ontario and one in the North Channel for the study of herring gulls and caspian terns. These enclosures encompassed a number of nests (approximately 20 to 40), confined the chicks after they hatched and allowed more accurate observations. Portable observation blinds constructed of 4 x 4s and plywood were also used at two locations to observe bird behaviour and movement.

Eighteen field trips supported by TOS were made during the season to the various colonies, requiring several thousand kilometres of trailering and 22 hundred nautical miles of boat steaming. The small (17') survey launch, THUNDERBIRD was utilized for transportation to the many bird colonies throughout the Great Lakes.

Although weather conditions during most of the field season were poor, all scheduled tasks were completed without mishap.

CWS BIRD BLIND ON PIGEON ISLAND, LAKE ONTARIO

WOLFE ISLAND WATER QUALITY SAMPLING STATION

RSB STUDY 86301, H. BIBERHOFER, WQB-OR

During September, TOS divers travelled to Kingston to work at the Water Quality sampling station on the south side of Wolfe Island. The purpose of the trip was the installation of a concrete cap over the existing sampling intake lines in the nearshore zone (35 ft.).

Forms were built using 2 x 4, 5/8" plywood and 6 x 6 reinforcing mesh. The forms were constructed on shore in 8 ft. sections, floated into position and sunk onto the bottom using 80 lb. pieces of railway track. Four sections were installed (32' x 2' x 4') and rocks were piled around the forms for lateral stability. The upstream side of the form was contoured to allow ice to deflect over the intakes. A total of 10 cubic metres of concrete was poured into the forms using a concrete pump and 80 ft. of hose to supply the divers. On a return trip one month later, divers removed all plywood forms and weights from the site.

A diving inspection of the pumps, hoses and intakes found the pump table overturned (possibly a result of entanglement with a boat anchor). All three pumps were identified with the plugs inside the shed and a mix-up in the hoses between the pumps and the intakes was unravelled.

BUILDING CONCRETE FORMS OVER WOLFE ISLAND WATER INTAKES

COMMON-USER SUPPORT/OUTSIDE AGENCIES

RSB STUDIES 86302, 86304, P.M. HEALEY, RSB

The purpose of this project was to provide logistical support equipment, instrumentation and field support (assistance) as resources permitted to studies within NWRI and non-NWRI agencies. There were more than 50 individual studies supported by Technical Operations staff, ranging from the Restigouche River in New Brunswick to Chain Lake, British Columbia and Resolute, Northwest Territories. Equipment or support was provided 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 by staff ranged from one day to one week's duration.

Assistance was provided to Inland Waters Directorate, Pacific & Yukon Region in repair and modification of a Westfalia centrifuge and in training as to proper setup and operation of the centrifuge. Repairs were completed by RSB staff at CCIW and training was provided at the beginning of a sampling trip on the Fraser River, British Columbia for staff of the Environmental Survey Branch, Water Quality Branch, IWD-P&YR.

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

1. GLLFAS, Habitat Study, Grimsby, Lake Erie
2. GLLFAS, Bay of Quinte, Lake Erie (zebra mussels)
3. Public Works, breakwater inspection
4. McMaster University, sample collection, Hamilton Harbour
5. University of Toronto, sample collection, Lake Ontario
6. Centre Saint-Laurent, mooring/sampling equipment loan/ technology transfer
7. Centre Saint-Laurent, vessel co-ordination with DFO
8. WQB-OR, water sampling, Goulais River
9. WTC (GOCO), water sampling, vehicle co-ordination, Burlington
10. University of Western Ontario, mooring equipment
11. University of Waterloo, Georgian Bay
12. Parks Canada, Trent-Severn Waterways, underwater support
13. WQB-Regina, equipment loan
14. NHRI, Saskatoon, technology transfer
15. WQB-P&YR, equipment loan and technology transfer
16. Ministry of Natural Resources, equipment loan, Port Dover

Rigging Shop and Vehicles

C.J. Lomas filled the position as Foreman Rigger in February and has since re-organized the shop, storage shed and outside stores. Several new acquisitions have improved the services available from the shop. The usual workload of maintaining all mooring equipment buoys, generators, power tools, winches and various other pieces of research equipment were maintained as required throughout the field year. The Rigging Shop staff were also responsible for the delivery of boats and laboratory trailers to field stations and delivering scientific equipment to major ships throughout the Great Lakes Basin.

T.C. Gilliss joined Technical Operations in a term position in July and filled the position as Rigger. He is also responsible for the maintenance of the NWRI vehicle fleet, trailers, snowmobiles, all-terrain vehicles. He is responsible for monthly reports for all NWRI vehicles to Ottawa utilizing the new fleet management system initiated by Environment Canada this fiscal year.

Field Stores

The Field Stores was supervised and operated by Y. Desjardins when not on field assignments. He was assisted by P. Youakim and T. Gilliss who issued and received sampling equipment in Mr. Desjardins' dearth. Field Stores staff are responsible for the issue and return of all field sampling equipment; the daily scheduling and issue of all day-use vehicles for NWRI staff. They also assumed the duty of issuing overhead and slide projectors for the building thus ensuring that good quality equipment is readily available at a moment's notice.

DIVING OPERATIONS

RSB STUDY 86303, F.H. DON, RSB

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 17 divers at Burlington. A total of 500 hours (accident free) was logged in support of scientific projects for: NWRI, Water Quality Branch-OR, BINST, CTAISB, DOE/C&P and GLLFAS. An additional 160 hours were logged during the winter training program in the pool.

A total of 35 hours was logged on MURV--the remotely operated miniROVER underwater camera system. MURV has the capability of operating to a depth of one thousand feet, improved low light level colour video camera and a two-function manipulator arm. Video signals are recorded on high resolution 8 mm metal video tape. The Dive Shop also has the capability to edit and copy all raw footage for scientific purposes into any format desired.

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

The annual meeting of the Department of Environment Diving Safety Committee was held in April in Vancouver, British Columbia. This meeting completed changes to the Departmental Diving Safety Directive. Printing of the new directive was completed in October with distribution to all DOE divers in December.

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

Projects supported this field year included:

STUDY NUMBER	STUDY TITLE
82012	Rukavina, Western Lake Ontario
82112	Murphy, Sault Ste. Marie
82112	Murphy, Hamilton Harbour
82202	Charlton, Hamilton Harbour
82105	Reynoldson, Hamilton Harbour
86303	Skafel, WAVES Tower
86301	Water Quality Station, Wolfe Island
86304	Outside Agencies: - GLLFAS, DFO Fitzsimons, Fish Habitat Dermott, Zebra Mussels - BINST, Hull inspections - Toronto Police Marine and Homicide Units

TECH. OPS DIVE SUPPORT - (GLLFAS)

DATE	LOCATION	DAYS						
		FIELD	PREP	TOS	GEAR	EXPS	SCPH	VIDEO
Apr. 9	50 Point	2	.5	1	1	0	1	0
		plus two single point moorings						
Apr. 24	Burl. Pier	2	.5	2	1	0	1	0
Aug. 10-14	Dunkirk, New York	4	.5	4	4	4	4	0
Aug. 17-21	Western L. Ont.	4	.5	8	5	8	4	4
Aug. 24-28	Eastern L. Ont.	5	1	10	5	10	5	5
Sept.24-25	Eastern L. Ont.	2	0	2	2	0	2	0
Sept.28-Oct.1	Eastern L. Ont.	8	.5	8	4	8	4	4
		Plus three pingers/temp. loggers						
Oct. 2	Pt. Weller	2	0	0	1	.5	1	1
Oct.6,7	Stoney Crk/50 Pt.	4	.5	4	2	0	2	2
Oct.13	Burl. Pier	2	0	2	1	0	1	1
Oct.21,22	Mazinaw Lake	2	.5	2	2	2	2	2
Nov. 4	Pt. Weller	4	0	2	1	.5	1	0
Nov. 6	Stoney Creek	2	0	2	1	0	1	0
Nov. 10	Dunkirk, N.Y.	2	.5	2	1	2	1	0
Nov. 3	Fifty Point	2	0	2	1	0	1	0
Nov. 4	Stoney Creek	2	0	2	1	0	1	0
Nov. 5	Pt. Weller	2	0	2	1	0	1	0
Nov. 16,17	50 Pt./Stoney Crk	2	0	4	1	0	1	0
Nov. 17,18	Pt. Weller	2	.5	2	1	.5	1	0
TOTALS TO DATE		55	5.5	61	36	35.5	35	15

DATE	LOCATION	DAYS						
		FIELD	PREP	TOS	GEAR	EXPS	SCPH	VIDEO
	Balance forward	55	5.5	61	36	35.5	35	15
Nov. 19	Pt. Weller	2	0	2	1	.5	1	0
Nov. 26	Pt. Weller	2	0	2	1	.5	1	0
Nov.30/Dec.3	Eastern L. Ont.	8	1	8	4	8	4	0
Dec. 4	Burl. Pier	1	0	1	1	0	1	0
Dec. 8,9	Eastern L. Ont.	4	.5	4	0	4	1	0
TOTALS FOR 1992		72	7	78	43	48.5	43	15

PRODUCTIVE CAPACITY OF FISH HABITAT

RSB STUDY 86304, V. CAIRNS, J. FITZSIMONS, GLLFAS

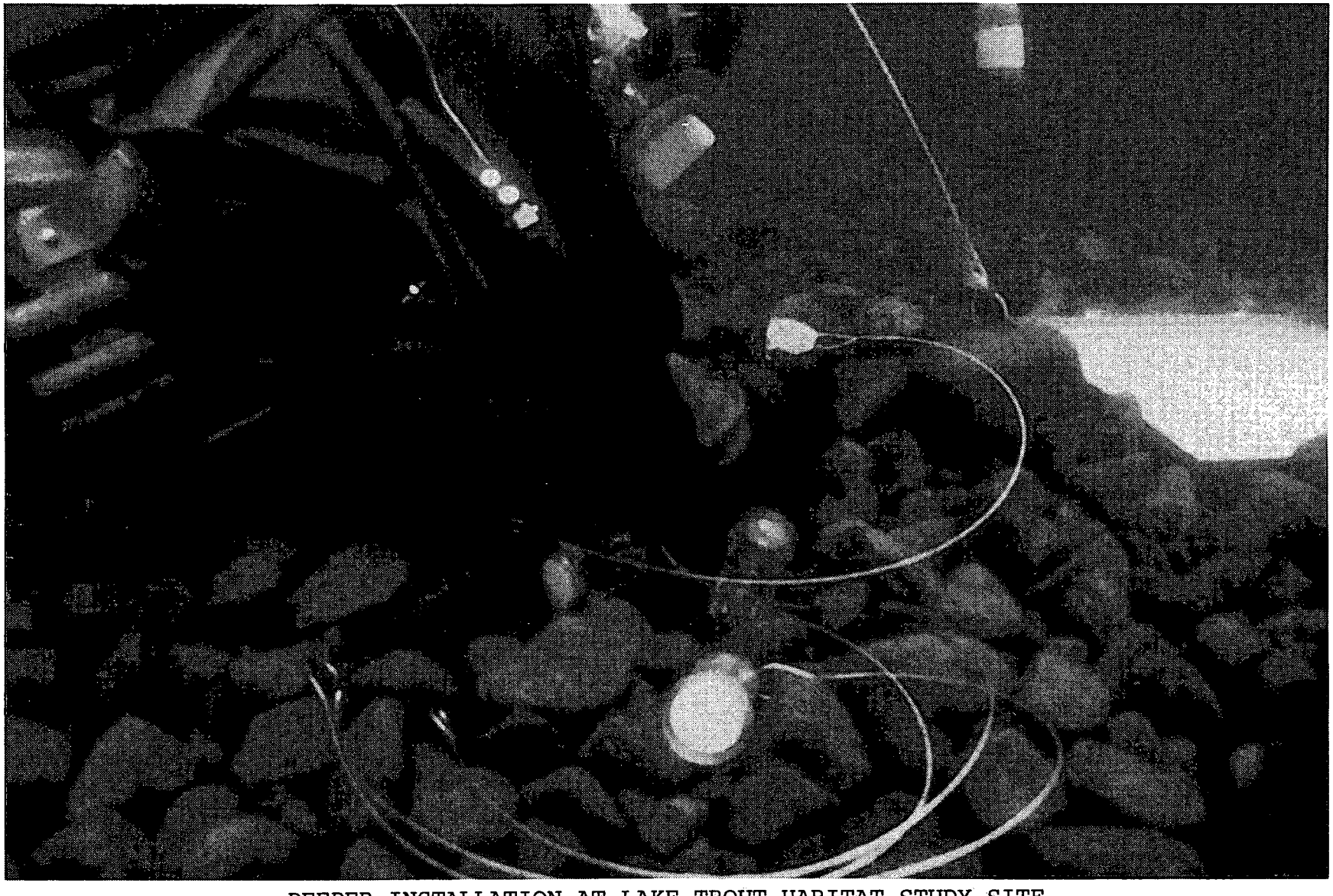
This project was a continuation of past studies to investigate the factors which affect fish and fish habitat associations in Great Lakes areas of concern; thereby addressing the terms of the 1988 Great Lakes Water Quality Agreement Annex 2. The long-term objectives of the work include:

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

2. 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.

3. To evaluate fish habitat restoration methods.

Technical Operations provided diver, diver equipment and underwater television/video support to this study.



PEEPER INSTALLATION AT LAKE TROUT HABITAT STUDY SITE

NWRI TECHNOLOGY TRANSFER TO ECD, P&YR

RSB STUDY 86304, P.M. HEALEY, RSB

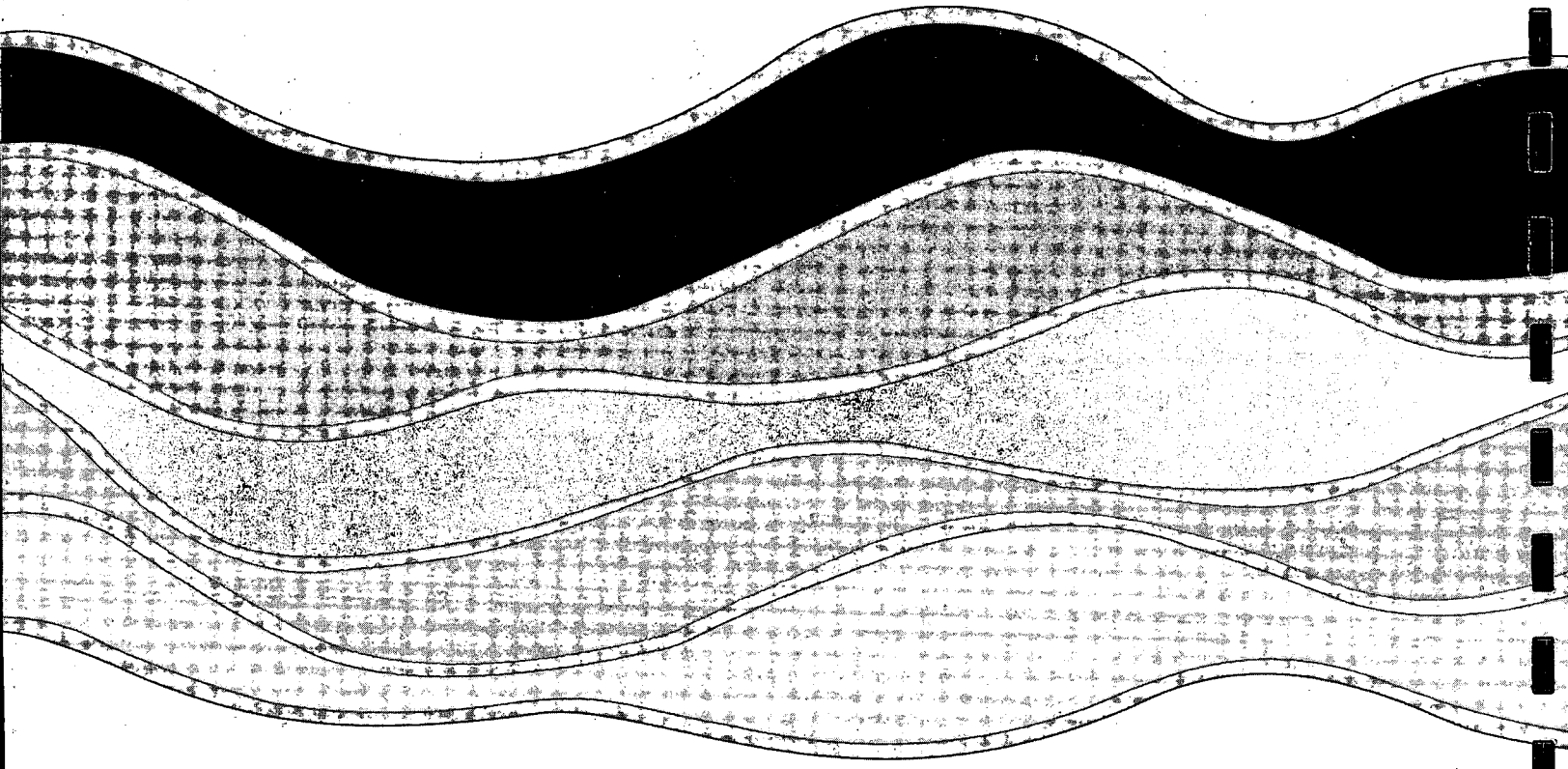
Technical Operations staff assisted the Environmental Conservation Directorate, Pacific & Yukon Region with sampling several sites on the North Thompson and Fraser rivers to supply baseline data on pulp mill related organic contaminants and metals as part of the Fraser River Remedial Action Plan. The support of a technologist from TOS with a Westfalia separator was provided for technology transfer between NWRI and P&YR.

Six sites were sampled on the Fraser and North Thompson rivers. On each river, a control or uncontaminated site was selected upstream of any major industrial activity with input to the river. On the Fraser River, the control site was located on the Indian Reserve near Shelley station. The downstream sites were located at Woodpecker station near Stoner, at the ferry dock at Marguerite and at the town of Yale, upstream of Hope. The control site on the North Thompson River was located at the ferry dock at McLure and the downstream site was at Savona at the outlet of Kamloops Lake.

The field party utilized three vehicles. A 4-wheel drive pickup with a camper lab was used as a field laboratory in which sample preparation and organics extraction was completed. A 4-wheel drive extended cab pickup was used to carry the bulk of the equipment including centrifuges and generators. Most of the clean equipment such as bottles and coolers was carried in a light duty van.

Sampling was accomplished in much the same manner at each site. Two submersible March pumps were suspended from a large marker ball moored in the river in strong flow to supply raw water to the centrifuges except at the Marguerite site where the pumps were suspended from the upstream face of the ferry dock. Two Westfalia centrifuges were set up on the river bank and run for a minimum of six hours to collect suspended sediment. At the McLure and Savona sites, the centrifuges were allowed to run overnight and shut down the next evening to collect sufficient sediment due to the very light sediment load in the North Thompson River. Centrifuged water was collected and extracted using both the Goulden large volume extractor and the Infiltrex II system. A Hydrolab water analyzing system was moored in the flow in the same manner as the pumps and collected water temperature, depth, pH, dissolved oxygen and conductivity data during the period the centrifuges were running. The data was logged on computer in the camper lab. Raw water was collected for chlorophenols, PAHs, specific metals such as arsenic, selenium and mercury and for total metals. At the McLure and Savona sites, phosphorus and nitrogen samples were collected using both filtered raw water and centrifuged water for comparison.

Accommodation was taken at the Coast Inn of the North in Prince George, the Good Knight Inn and the Tower Inn in Quesnel, the Hospitality Inn in Kamloops and the Inn Towne Motel in Hope as the field party moved about the study area.



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