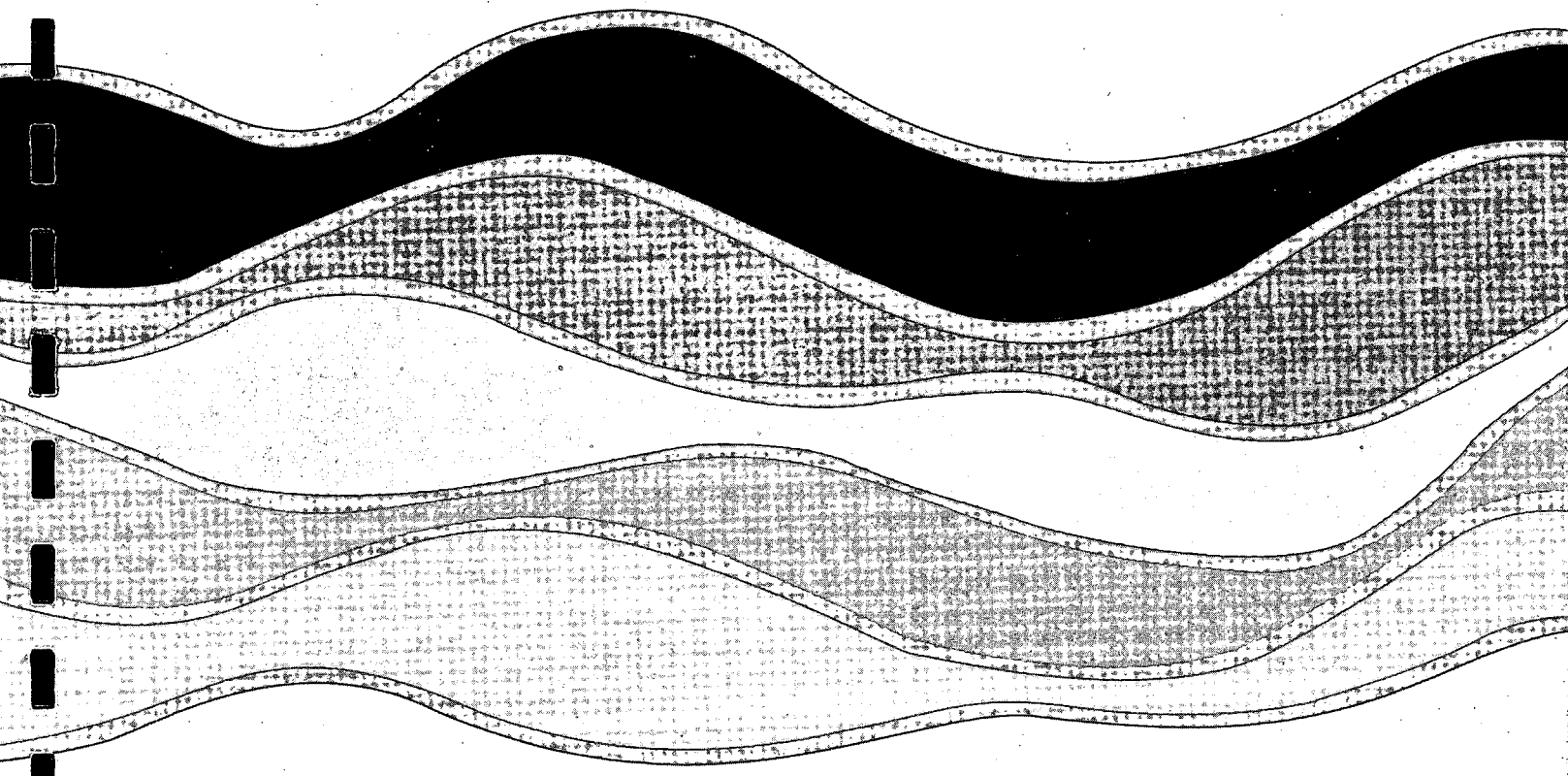
NATIONAL WATER RESEARCH INSTITUTE

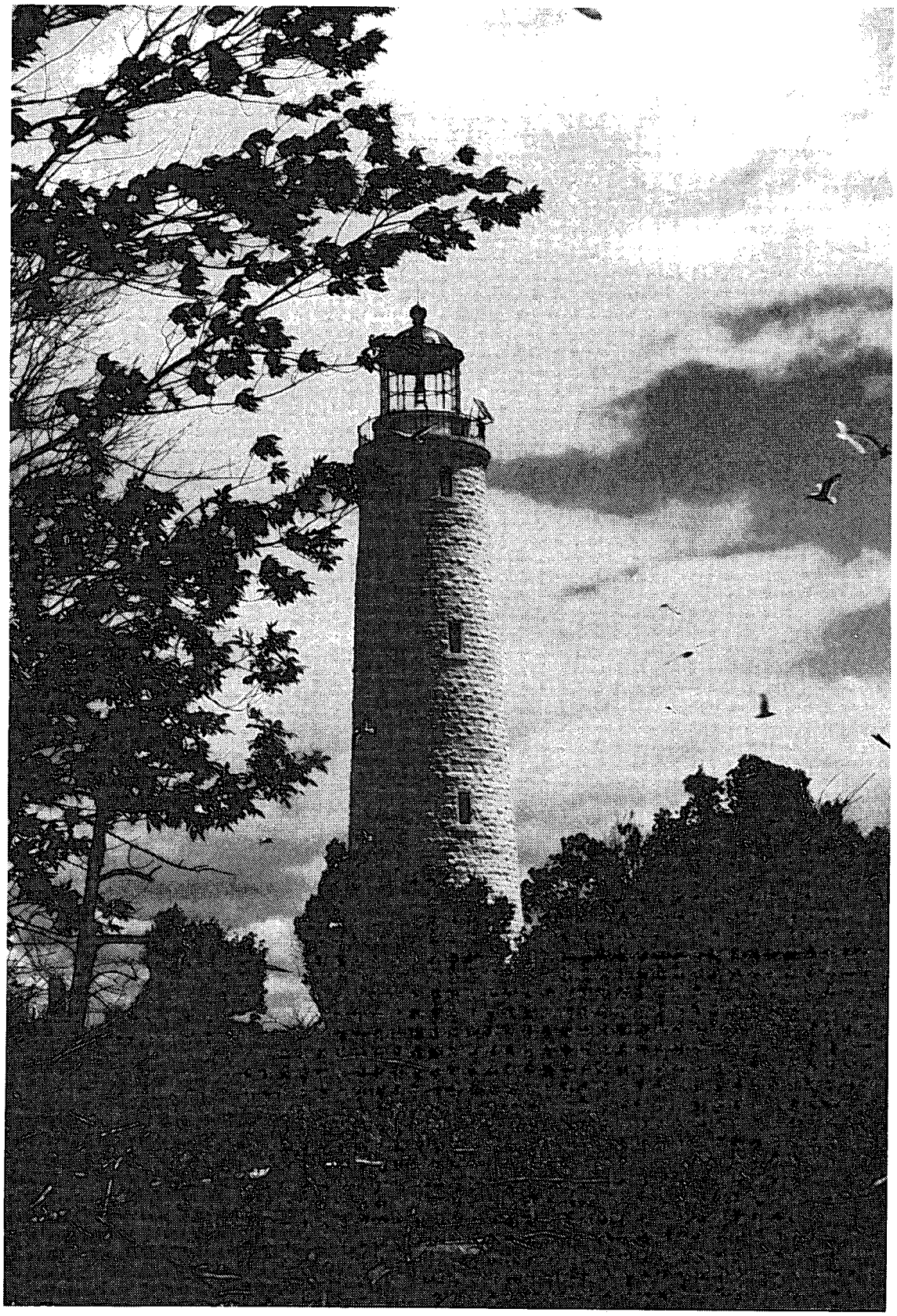
INSTITUT NATIONAL de RECHERCHE sur les EAUX



1991

ACTIVITY SUMMARY

Technical Operations Section
Research Support Division



NOTTAWASAGA ISLAND LIGHT

TABLE OF CONTENTS

INTRODUCTION

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

The technical staff of this section is involved in shipboard programs which are carried out from major ships on the Great Lakes and St. Lawrence River and in shore-based field projects which puts them in 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 underwater, the most recent advances being in underwater video capability and the refit and upgrade of the Mobile Underwater Reconnaissance Vehicle (MURV). Annual diver training and certification courses are also conducted to maintain a high level of competence among the divers at the Canada Centre for Inland Waters.

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

Of special mention this year is the retirement of three long-time members of this section. Messrs. John Lomas, Howard Greencorn and Bill Hunt left the section during the past field season. Along with our good-byes, we extend wishes of health and happiness to these friends during their well-earned retirement.

This report is intended as an overview of the field activities of this section during the 1991 field season.

STAFF LIST

RESEARCH SUPPORT DIVISION

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

TECHNICAL OPERATIONS SECTION

Head P.M. Healey

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

MARINE TECHNOLOGISTS

L.E. Benner	CWS, Groundwater, Cornwall
P.R. Youakim	CSS LIMNOS, Hamilton Harbour
E.H. Walker	Athabaska, Nearshore Survey, OIC CSS BAYFIELD
G.G. LaHaie	Turkey Lakes Watershed, Restigouche River, Thunder Bay
Y. Desjardins	Restigouche River, St. John River
J.A. Kraft	OIC CSS BAYFIELD, OIC CSS L.M. LAUZIER CSS LIMNOS, St. Lawrence River, St. Mary's River
K.J. Hill	Hamilton Harbour, Diving, Howe Sound
R.J. Hess	OIC CSS ADVENT, CSS LIMNOS, Hamilton Harbour, Turkey Lakes, Rainy River, LaTuque

ASSISTANT MARINE TECHNOLOGIST

B.L. Gray	Diving (MMIT), Hamilton Harbour, Grand/Nith Rivers, Dunkirk, N.Y.

MARINE TECHNICIANS

H.A. Lavoie	CSS LIMNOS, Hamilton Harbour, LaTuque
R.D. Neureuther	CSS LIMNOS, Turkey Lakes, Rice Lake, Honey Harbour, Grand River

M. Dahl	Whitehorse
C.H. Talbot	Secondment from DFO, 24 October 1991 Groundwater

VISITING TECHNOLOGIST

F.C. Dunnett	CSS LIMNOS

RIGGING UNIT

Head, L.J. Lomas	Retired 23 November 1991
Vehicle Co-ordinator, H.E. Greencorn	Retired 31 May 1991
S.D. Roberts	Vehicle Co-ordinator, rigging Secondment to DFO, 25 October 1991
C.J. Lomas	Vehicle Co-ordinator, rigging Secondment from DFO, 25 October 1991

NWRI FIELD STORES

W.D. Hunt	Retired 26 April 1991
Y. Desjardins	

STUDENTS

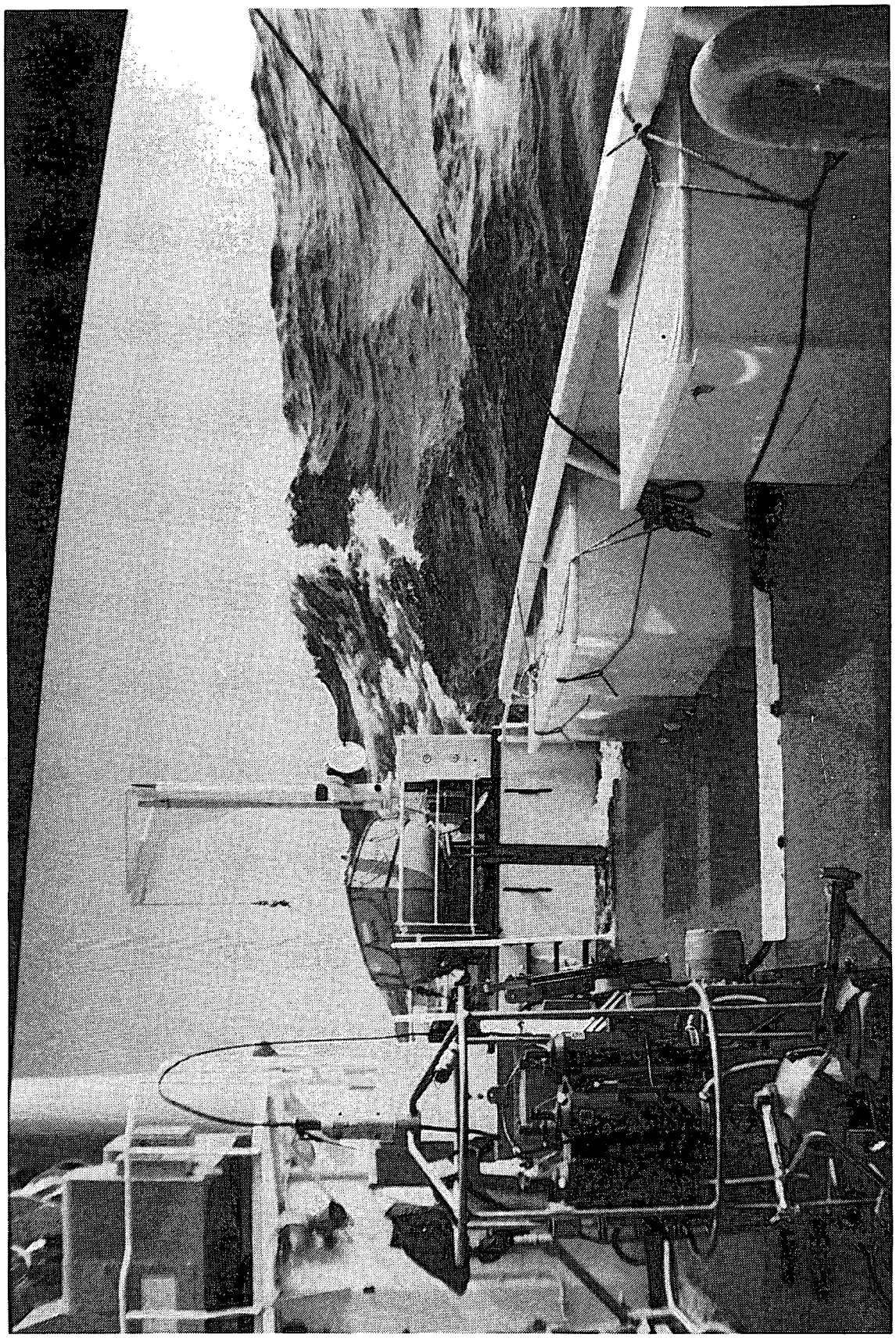
R.C. Brodie	CSS LIMNOS, Hamilton Harbour
C.J. Burgess	Hamilton Harbour, Rice Lake, Sault Ste. Marie, CSS LIMNOS
D.A.D. Gilroy	CSS LIMNOS
A.W. Purdy	CSS LIMNOS, Hamilton Harbour, Turkey Lakes

C S S L I M N O S

SHIPBOARD PROGRAMS

CSS LIMNOS
1991

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
FEB	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	1	2
MAR	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 LAKE	3 ONTARIO	4 SURVEILLANCE	5 LAKE	6 ONTARIO
APR	7 CCIW	8 CCIW	9 LAKE ONTARIO	10 MOORINGS	11 CCIW	12 CCIW	13 CCIW
	14 CCIW	15 LAKE ONTARIO	16 SUSPENDED	17 SEDIMENT	18 LAKE ONTARIO	19 CCIW	20 CCIW
	21 CCIW	22 LAKE ERIE	23 INTERNAL SEDIMENT	24 LOADINGS AND BENTHOS	25 SARNIA	26 SARNIA	27 SARNIA
	28 SARNIA	29 LAKE HURON	30 SURVEILLANCE	1 LAKE	2 HURON	3 SURVEILLANCE	4 GEORGIAN BAY
MAY	5 SURVEILLANCE	6 GEORGIAN BAY	7 SURVEILLANCE	8 LAKE HURON	9 SAULT SAINT MARIE	10 LAKE SUPERIOR	11 SURVEILLANCE
	12 LAKE	13 SUPERIOR	14 SURVEILLANCE	15 LAKE	16 SUPERIOR	17 SURVEILLANCE	18 LAKE SUPERIOR
	19 LAKE ERIE	20 BENTHIC COMMUNITY	21 LAKE ERIE	22 CCIW	23 CCIW	24 CCIW	25 CCIW
	26 CCIW	27 CCIW	28 CCIW	29 CCIW	30 LAKE ONTARIO DEMONSTRATION	31 CCIW	1 CCIW
JUN	2 CCIW	3 LAKE	4 ONTARIO	5 CONTAMINANT	6 TRANSPORT	7 LAKE ONTARIO	8 CCIW
	9 CCIW	10 LAKE ERIE	11 BENTHOS	12 PISTON CORING	13 LAKE	14 ERIE	15 CCIW
	16 CCIW	17 LAKE ONTARIO	18 SUSPENDED	19 SEDIMENT	20 LAKE ONTARIO	21 CCIW	22 CCIW
	23 CCIW	24 CCIW	25 HAMILTON HARBOUR	26 CORING AND MOORINGS	27 CCIW	28 CCIW	29 CCIW
	30 CCIW	1 CCIW	2 CCIW	3 HARBOUR MOORINGS	4 CCIW	5 CCIW	6 CCIW
JUL	7 CCIW	8 LAKE ONTARIO	9 CONTAMINANT	10 TRANSFER	11 LAKE	12 ONTARIO	13 CCIW
	14 CCIW	15 LAKE ONTARIO	16 SUSPENDED	17 SEDIMENT	18 LAKE ONTARIO	19 CCIW	20 CCIW
	21 CCIW	22 LAKE ONTARIO	23 METAL	24 CYCLE	25 LAKE ONTARIO	26 CCIW	27 CCIW
	28 CCIW	29 SCHEDULED	30 SELF	31 MAINTENANCE	1 SCHEDULED	2 SELF	3 MAINTENANCE
AUG	4 CCIW	5 CCIW	6 LAKE ONTARIO	7 SUSPENDED SEDIMENT	8 LAKE ONTARIO	9 CCIW	10 CCIW
	11 CCIW	12 LAKE	13 ONTARIO	14 SURVEILLANCE	15 LAKE	16 ONTARIO	17 CCIW
	18 CCIW	19 LAKE ERIE	20 SEDIMENT LOADING	21 LAKE HURON	22 SURVEILLANCE	23 LAKE	24 HURON
	25 GEORGIAN BAY	26 SURVEILLANCE	27 LAKE	28 HURON	29 LAKE	30 SUPERIOR	31 SURVEILLANCE
SEP	1 LAKE	2 SUPERIOR	3 SURVEILLANCE	4 LAKE	5 SUPERIOR	6 SURVEILLANCE	7 LAKE SUPERIOR
	8 LAKE ERIE	9 METAL	10 CYCLE	11 LAKE ERIE	12 CCIW	13 CCIW	14 CCIW
	15 CCIW	16 LAKE	17 ONTARIO	18 SUSPENDED	19 SEDIMENT	20 LAKE	21 ONTARIO
	22 CCIW	23 LAKE ONTARIO	24 CONTAMINANT	25 TRANSFER	26 LAKE	27 ONTARIO	28 CCIW
	29 CCIW	30 CCIW	1 CCIW	2 CCIW	3 CCIW	4 CCIW	5 CCIW
OCT	6 CCIW	7 LAKE ONTARIO	8 SUSPENDED	9 SEDIMENT	10 LAKE ONTARIO	11 CCIW	12 CCIW
	13 CCIW	14 CCIW	15 LAKE ONTARIO	16 MOORINGS	17 CCIW	18 CCIW	19 CCIW
	20 CCIW	21 LAKE ERIE	22 INTERNAL SEDIMENT	23 LOADING	24 AND BENTHOS	25 LAKE ERIE	26 CCIW
	27 CCIW	28 LAKE	29 ONTARIO	30 TROPHIC	31 TRANSFER	1 LAKE	2 ONTARIO
NOV	3 TROPHIC	4 TRANSFER	5 LAKE	6 ONTARIO	7 TROPHIC	8 TRANSFER	9 LAKE
	10 ONTARIO	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
DEC	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31				



CSS LIMNOS IN ROUGH SEAS

OPEN LAKES SURVEILLANCE

LAKE ONTARIO

RSD STUDY 86031, M. NEILSON, IWD-OR

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

Two cruises were conducted April 2 - 6 and August 12 - 16 to support this program. Both cruises were organized and completed by Technical Operations personnel for IWD-OR and were conducted from the CSS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C positioning system and a variety of samplers and winches used for chemical and biological sampling.

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

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

Unstratified Conditions:	1 metre, 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: retrieval of Hermes drifter buoys in support of Study 82046 and on the first cruise, the Lake Ontario Long Term Biological Index Monitoring Program, Study 82031 was supported.

STATISTICS SUMMARY

7

CRUISE NO. 91-00-001 / 91-00-011 CONSECUTIVE NO. 001 / 042 SHIP CSS LIMNOS

DATES FROM April 2 / August 12 TO April 6, 1991 / August 16, 1991 LAKE ONTARIO

CRUISE TYPE Lower Lakes Surveillance N. MILES STEAMED 1353.6

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	199	Moorings Established	
EBT Casts	199	" Retrieved, Drifter	1
Rosette Casts	197	" Established	
Transmissometer Casts	199	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	16	" Established	
Secchi Disc Observations	75	" Retrieved	
		" Refurbished	
Zooplankton Hauls	4	" Serviced, MET	1
Integrator 10 m		" Serviced	
Integrator 20 m	197	Primary Productivity Moorings	
Phytoplankton Samples	2		
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)	569	Cores Taken	
" " " ( )			
" " " (D.O.)	569	Grab Samples Taken	
" " " (Cond/pH)	569		
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	605		
" " " (TKN)	605	Observations, Weather	25
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	269	Solar Radiation	
" " " (POC/TPN)	279		
" " " (Seston)			
" " " (T P f)	605		
" " " (Nutrients)	605	ONBOARD ANALYSES	
" " " (Major Ions)	605		
" " " ( )		Manual Chemistry Tech. Ops.	1710
" " " ( )		Nutrients (WOB)	605
" " " ( )		Microbiology	
" " " ( )			

SURVEILLANCE STATIONS

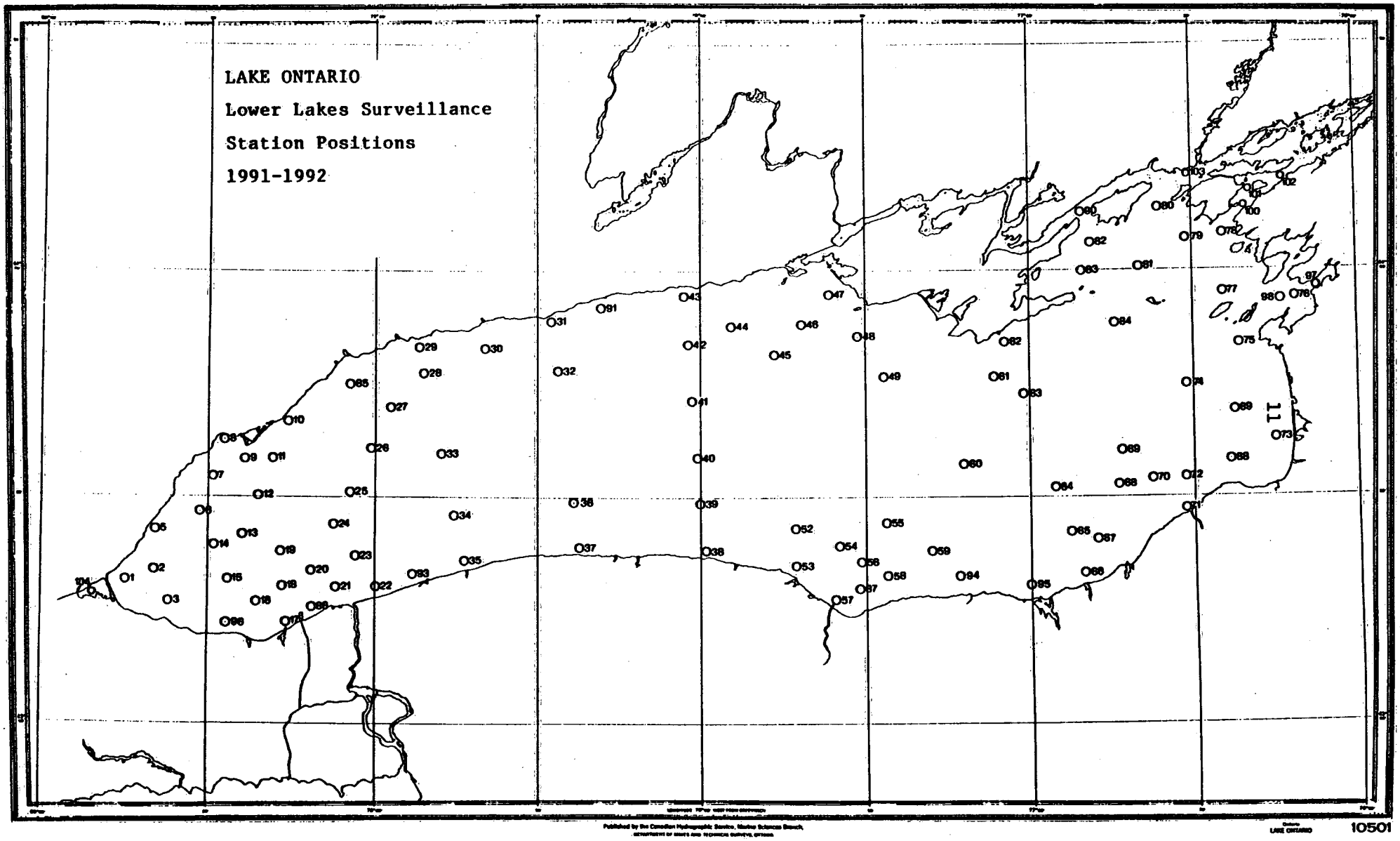
LAKE ONTARIO

1991-1992

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

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

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


LAKE ONTARIO
Lower Lakes Surveillance
Station Positions
1991-1992
10501

OPEN LAKES SURVEILLANCE

LAKE HURON/GEORGIAN BAY

RSD STUDY 86031, M. NEILSON, IWD-OR

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

Two cruises were conducted April 29 - May 8 and August 20 - 30 to support this program. Both cruises were organized and completed by Technical Operations personnel for IWD-OR and were conducted from the CSS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C positioning system and a variety of samplers and winches used for chemical and biological sampling.

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

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

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

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

Some of the additional tasks performed during the cruises were: Installation and retrieval of current meter and sediment trap moorings in the North Channel for F. Rosa, LRB Study 82016; Ponar and box core grab samples, Study 82015; phytoplankton and microbial loop samples for Dr. M. Munawar of GLLFAS; water samples for Dr. E. Fee of Regional Limnology of Winnipeg; water and sediment samples for the University of Waterloo.

STATISTICS SUMMARY

13
201
CRUISE NO. 91-02-001 / 91-02-002 CONSECUTIVE NO. 203

SHIP CSS LIMNOS

DATES FROM April 29 / August 21 TO May 8, 1991 / August 28, 1991

LAKE HURON

CRUISE TYPE Upper Lakes Surveillance

N. MILES STEAMED 2120.21

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	148	Moorings Established, Sediment Trap	4
EBT Casts	148	" Retrieved, Sediment Trap	4
Rosette Casts	68	" Established, Current Meter	3
Transmissometer Casts	148	" Retrieved, Current Meter	3
Reversing Thermometer Obs. (No. of Therm)	24	" Established	
Secchi Disc Observations	62	" Retrieved	
Van Dorn Casts	75	" Refurbished	
Zooplankton Hauls	16	" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	153	Primary Productivity Moorings	
Phytoplankton Samples			
Microbial Loop	34	Cores Taken, Box	
		Cores Taken, Gravity, Benthos	8
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)	350	Grab Samples Taken, Shipek	4
" " " (Cond/pH)	350		
" " " ( )		Bulk Centrifuge Samples, 1200L	8
" " " (T P uf)	411		
" " " (TKN)	106	Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	162	Solar Radiation	
" " " (POC/TPN)	184		
" " " (Seston)			
" " " (T P f)	411		
" " " (Nutrients)	411	ONBOARD ANALYSES	
" " " (Major Ions)	411		
" " " ( )		Manual Chemistry Tech. Ops.	1050
" " " ( )		Nutrients (WOB)	106
" " " ( )		Microbiology	
" " " ( )			

STATISTICS SUMMARY

CRUISE NO. 91-05-001 / 91-05-002 CONSECUTIVE NO. 14 / 501 / 502

DATES FROM May 4 / August 26 TO May 6, 1991 / August 27, 1991

CRUISE TYPE Upper Lakes Surveillance

SHIP CSS LIMNOS

GEORGIAN BAY

N. MILES STEAMED 739.0

DESCRIPTION	TOTAL
Stations Occupied	51
EBT Casts	51
Rosette Casts	24
Transmissometer Casts	51
Reversing Thermometer Obs. (No. of Therm)	12
Secchi Disc Observations	27
Van Dorn Casts	27
Zooplankton Hauls	9
Integrator 10 m	
Integrator 20 m	61
Phytoplankton Samples	10
Microbial Loop	14
Water Samples Collected (Microbiology)	
" " " (Water Quality)	
" " " ( )	
" " " (D.O.)	149
" " " (Cond/pH)	149
" " " ( )	
" " " (T P uf)	163
" " " (TKN)	37
" " " ( )	
" " " ( )	
Water Samples Filtered (Chlorophyll)	59
" " " (POC/TPN)	64
" " " (Seston)	
" " " (T P f)	163
" " " (Nutrients)	163
" " " (Major Ions)	163
" " " ( )	
" " " ( )	
" " " ( )	
" " " ( )	

DESCRIPTION	TOTAL
Moorings Established	
" Retrieved	
" Established	
" Retrieved	
" Established	
" Retrieved	
" Refurbished	
" Serviced	
" Serviced	
Primary Productivity Moorings	
Cores Taken, Box	
Cores Taken, Gravity	
Cores Taken, Piston	
Cores Taken	
Grab Samples Taken, Shipek	20
Bulk Centrifuge Samples	
Observations, Weather	
CONTINUOUS OBSERVATIONS (days)	
Solar Radiation	
ONBOARD ANALYSES	
Manual Chemistry Tech. Ops.	447
Nutrients (WOB)	37
Microbiology	

SAMPLING STATION POSITIONS

LAKE HURON

1991-1992

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

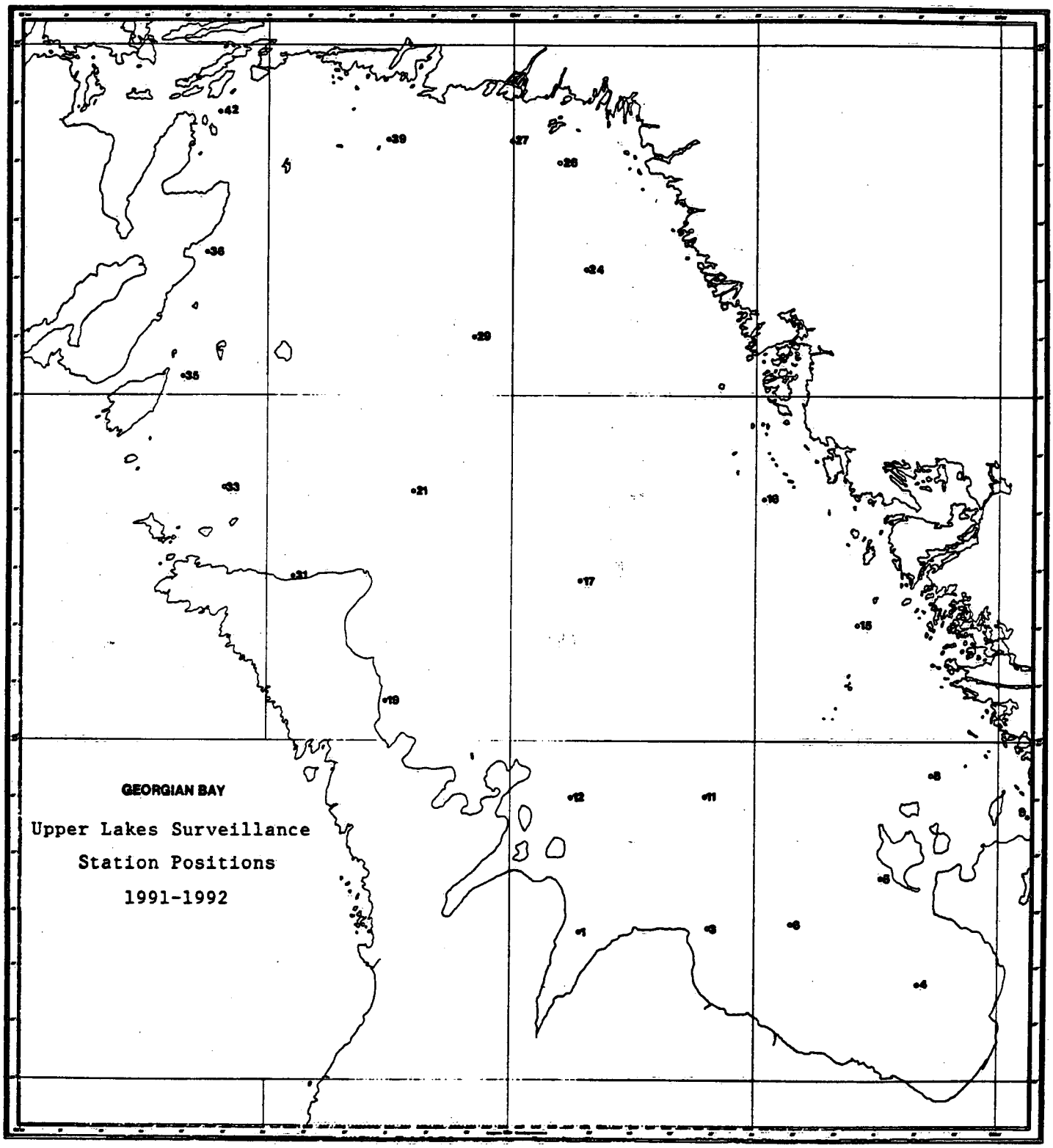
STATION NUMBER		LATITUDE N.	LONGITUDE N.
48		45° 16′ 42"	82° 27′ 06"
50		45° 32′ 06"	82° 02′ 42"
52		45° 39′ 06"	82° 38′ 54"
54		45° 31′ 00"	83° 25′ 00"
55		45° 23′ 30"	83° 39′ 06"
56		45° 31′ 00"	84° 05′ 00"
58		45° 52′ 06"	83° 16′ 00"
59		45° 46′ 00"	83° 01′ 42"
60		45° 54′ 06"	83° 31′ 06"
61		45°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

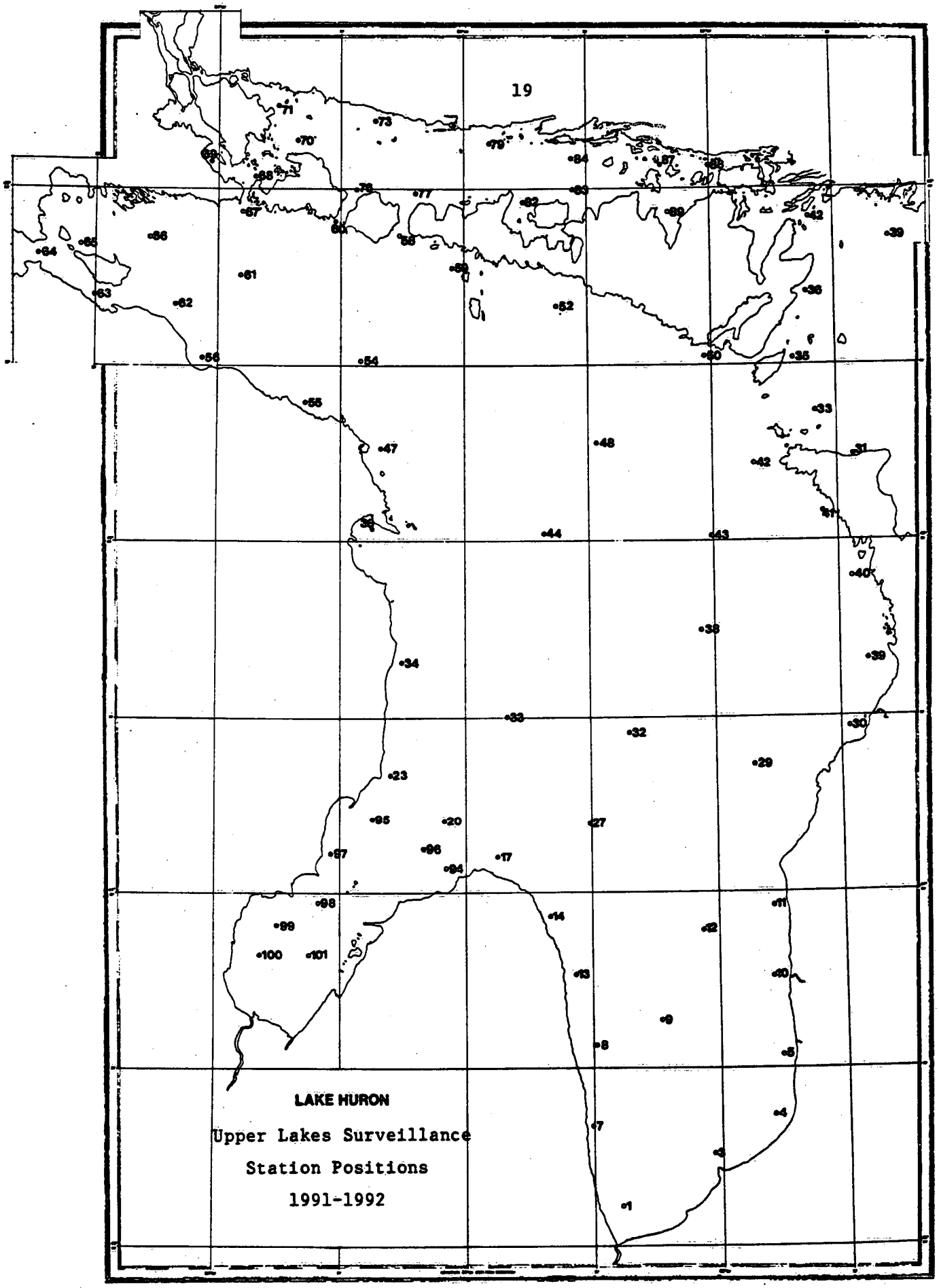
SAMPLING STATION POSITIONS

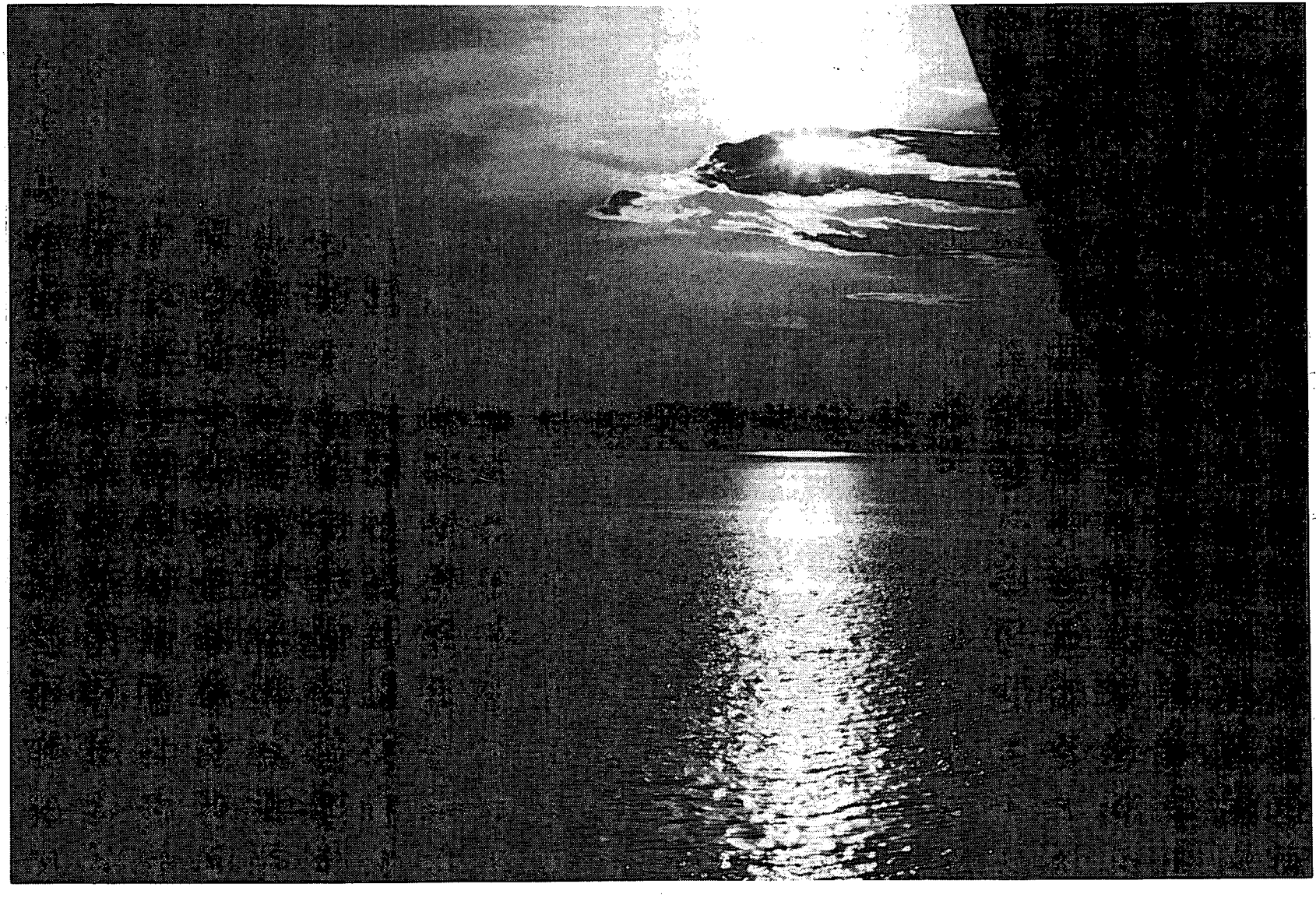
GEORGIAN BAY

1991-1992

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


GEORGIAN BAY
Upper Lakes Surveillance
Station Positions
1991-1992


LAKE HURON
Upper Lakes Surveillance
Station Positions
1991-1992



THE SLEEPING GIANT, THUNDER BAY

OPEN LAKES SURVEILLANCE

LAKE SUPERIOR

RSD STUDY 86031, M. NEILSON, IWD-OR

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

Two cruises were conducted during the season from the CSS LIMNOS on Lake Superior--one in the spring, May 10-21 and one in late summer, August 29 - September 7. As all surveillance cruises, this was organized and completed by Technical Operations Section, Research Support Division for IWD-OR. The vessel was equipped with the usual equipment: transmissometer/EBT system, rosette/EBT system, radar, Loran C positioning system and other necessary equipment needed to carry out chemical and biological sampling.

The parameters sampled during the cruise were: temperature and transmission 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, 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: phytoplankton and microbial loop samples for Dr. M. Munawar, Study 86034; water and sediment samples for the University of Waterloo; bulk water samples centrifuged for LRB Study 82051 and water samples for Dr. J. Nriagu, LRB Study 82057.

STATISTICS SUMMARY

22

CRUISE NO. 91-03-001 / 91-03-002 CONSECUTIVE NO. 301 / 302 SHIP CSS LIMNOS

DATES FROM May 10 / August 29 TO May 18, 1991 / September 7, 1991 LAKE SUPERIOR

CRUISE TYPE Upper Lakes Surveillance N. MILES STEAMED 3046.96

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	149	Moorings Established	
EBT Casts	149	" Retrieved	
Rosette Casts	149	" Established	
Transmissometer Casts	149	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	24	" Established	
Secchi Disc Observations	80	" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 50 m	141	" Serviced	
Integrator 20 m	32	Primary Productivity Moorings	
Phytoplankton Samples	24		
Microbial Loop	24	Cores Taken, Box	39
Primary Productivity Incubations	24	Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " (Metals)	57		
" " " (D.O.)	516	Grab Samples Taken, Shipek	39
" " " (Cond/pH)	516		
" " " ( )		Bulk Centrifuge Samples, 2400 Litres	13
" " " (T P uf)	573		
" " " (TKN)	116	Observations, Weather	45
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	175	Solar Radiation	
" " " (POC/TPN)	203		
" " " (Seston)			
" " " (T P f)	573		
" " " (Nutrients)	573	ONBOARD ANALYSES	
" " " (Major Ions)	573		
" " " ( )		Manual Chemistry Tech. Ops.	1638
" " " ( )		Nutrients (WOB)	116
" " " ( )		Microbiology	
" " " ( )			

SURVEILLANCE STATION POSITIONS

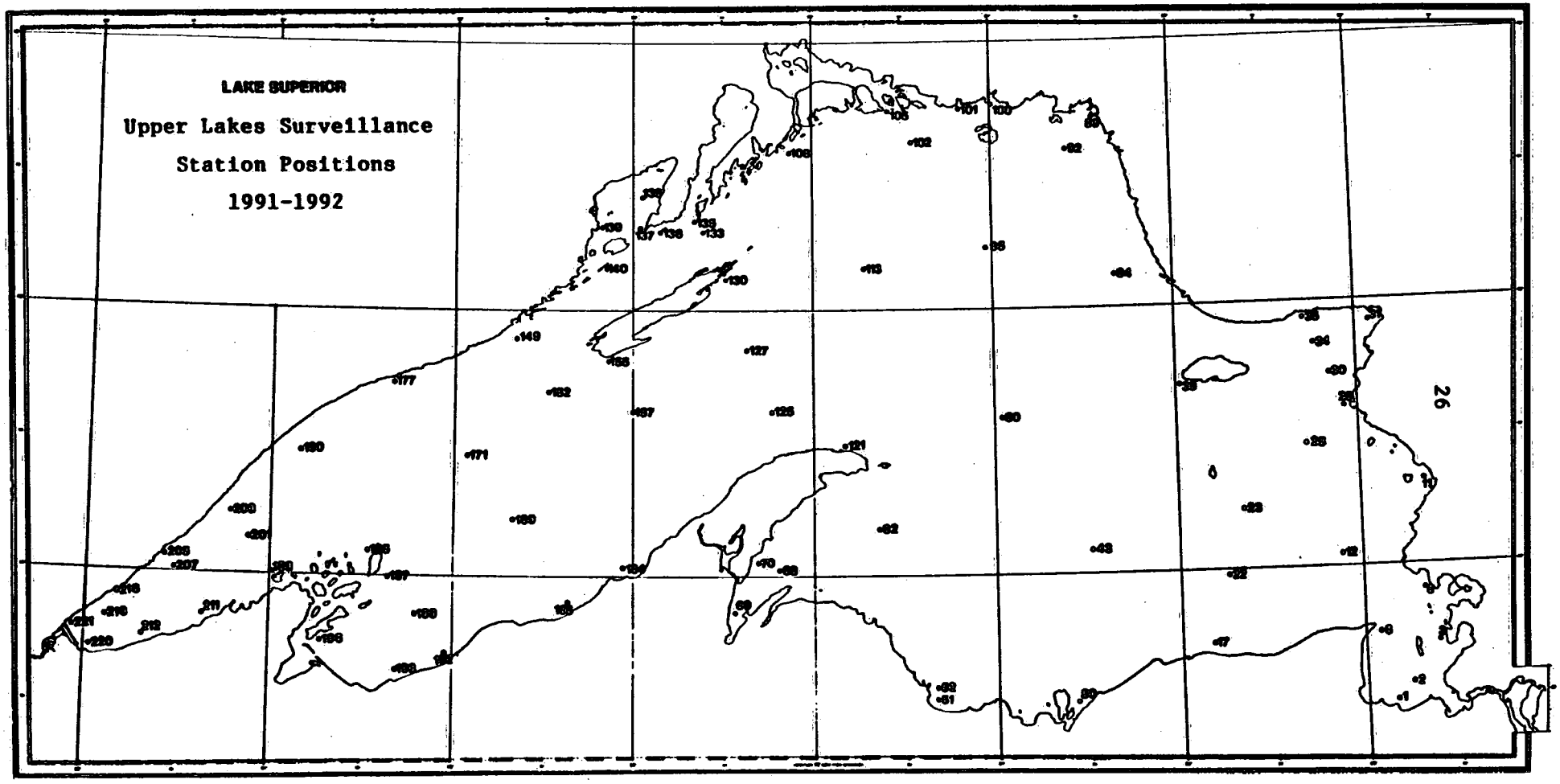
LAKE SUPERIOR

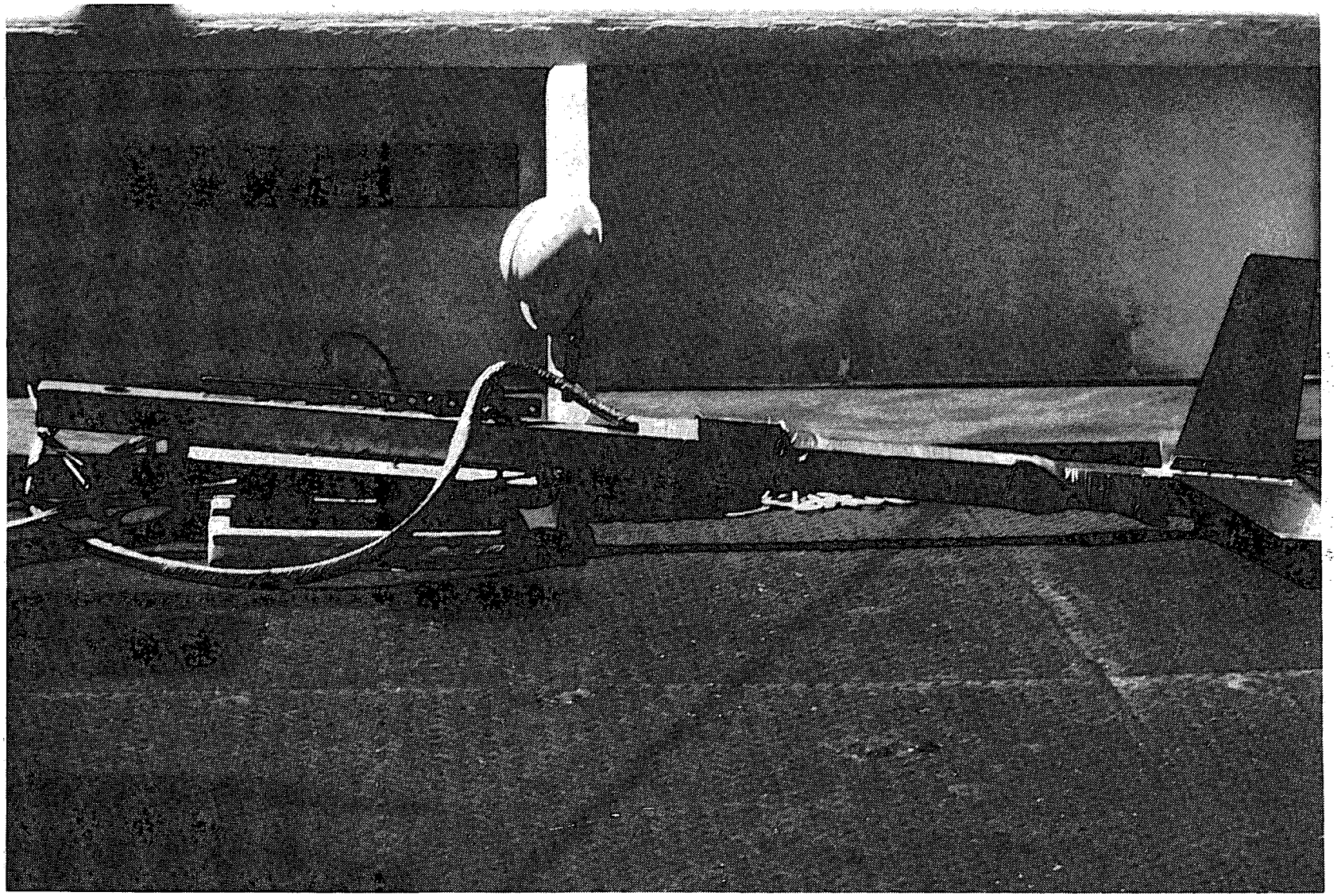
1991-1992

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° 57′ 06"
84	48° 06′ 48"	86° 18′ 00"
89	48° 42′ 00"	86° 25′ 06"
92	48° 35′ 00"	86° 33′ 54"
95	48° 13′ 06"	87° 01′ 00"

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

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


LAKE SUPERIOR
Upper Lakes Surveillance
Station Positions
1991-1992



TOWED ACOUSTIC FISH COUNTER

LAKE ONTARIO TROPHIC TRANSFER

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

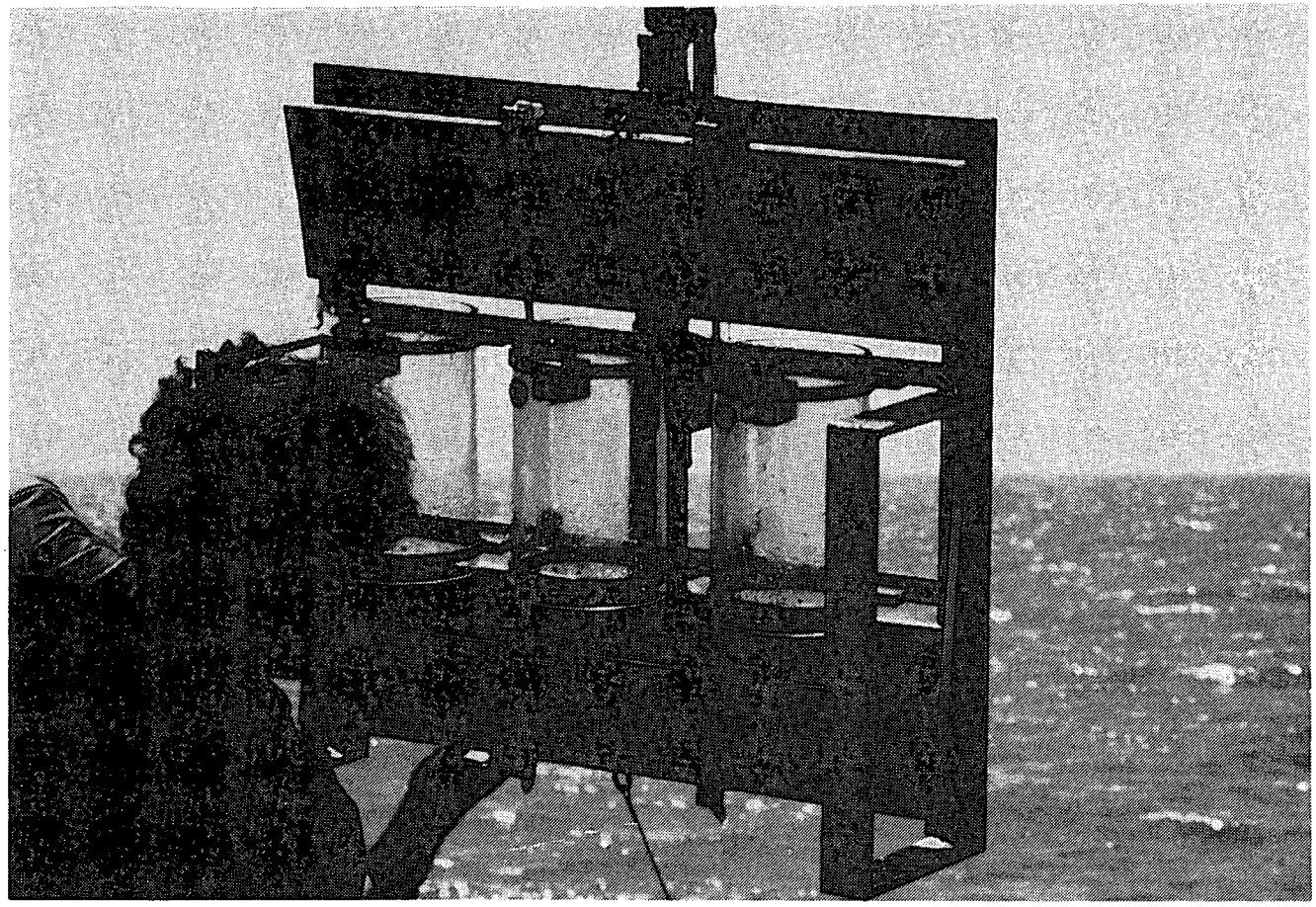
Since the International Field Year for the Great Lakes (IFYGL) in 1972, this project has been a major multidisciplinary and international initiative to characterize the Lake Ontario ecosystem by examining its biological structure at different levels. The results will: a) provide important baseline information about the status of Lake Ontario; b) provide a basis of computing estimates of growth and production of all component organisms; c) permit a rigorous test of particle size theory; d) contribute directly to the management of fish stocks in Lake Ontario.

One cruise to support this project was carried out onboard the CSS LIMNOS October 28 - November 10.

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

Several outside agencies were supported. These included: the University of Toronto, Chesapeake Biological Station, Dalhousie University and State University of New York, Rochester.

Six transects were distributed across Lake Ontario consisting of 62 stations. Some additional stations were occupied during the cruise. At station 718, a winter mooring was installed for the United States Fish & Wildlife Service and at stations 208 and 209, samples were collected for Dr. M. Munawar of GLLFAS.



TRIPLE GRAZING CHAMBER

STATISTICS SUMMARY

CRUISE NO. 91-00-016 CONSECUTIVE NO. 067 SHIP CSS LIMNOS

DATES FROM October 28 TO November 10, 1991 LAKE ONTARIO

CRUISE TYPE Lake Ontario Trophic Transfer N. MILES STEAMED 955

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	88	Moorings Established	1
EBT Casts	85	" Retrieved	2
Rosette Casts	4	" Established	
Transmissometer Casts	85	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations	32	" Retrieved	
		" Refurbished	
Zooplankton Hauls	38	" Serviced	
Integrator 10 m	1	" Serviced	
Integrator 20 m	39	Primary Productivity Moorings	
Phytoplankton Samples	125		
Mysis Hauls	27	Cores Taken, Box	2
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)	42	Cores Taken, Benthos	6
" " " (Microloop)	84		
" " " (D.O.)		Grab Samples Taken , Shipek and Ponar	36
" " " (Cond/pH)			
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	48		
" " " (TKN)	42	Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	164	Solar Radiation	
" " " (POC/TPN)	42		
" " " (Seston)			
" " " (T P f)	48		
" " " (Nutrients)	42	ONBOARD ANALYSES	
" " " (Major Ions)	42		
" " " ( )		Manual Chemistry Tech. Ops.	
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

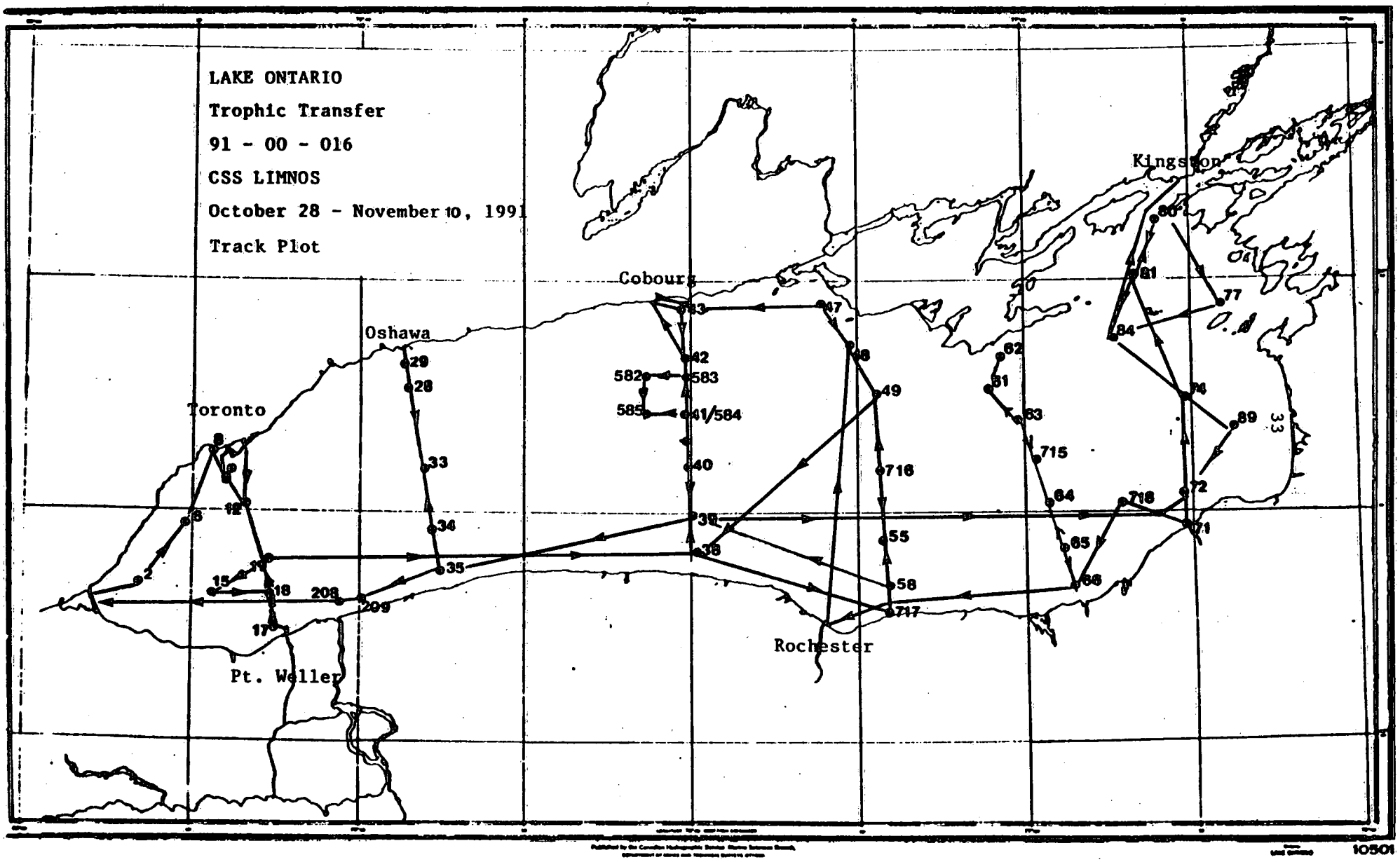
LAKE ONTARIO TROPHIC TRANSFER

STATION POSITIONS

1991-1992

STATION NUMBER	LATITUDE N.	LONGITUDE W.
2	43° 20′ 23"	79° 39′ 59"
6	43° 27′ 57"	79° 31′ 52"
8	43° 37′ 22"	79° 27′ 10"
9	43° 35′ 10"	79° 23′ 38"
12	43° 30′ 11"	79° 21′ 24"
15	43° 19′ 00"	79° 26′ 31"
17	43° 13′ 31"	79° 16′ 20"
18	43° 18′ 10"	79° 16′ 53"
19	43° 22′ 48"	79° 17′ 18"
28	43° 46′ 33"	78° 51′ 14"
29	43° 49′ 52"	78° 52′ 12"
33	43° 35′ 48"	78° 48′ 08"
33A	43° 33′ 10"	78° 40′ 41"
33B	43° 33′ 54"	78° 35′ 52"
33C	43° 34′ 31"	78° 32′ 01"
34	43° 27′ 43"	78° 45′ 35"
35	43° 21′ 40"	78° 43′ 53"
38	43° 23′ 01"	77° 59′ 26"
39	43° 29′ 10"	77° 59′ 59"
40	43° 35′ 23"	78° 00′ 42"
41	43° 42′ 57"	78° 01′ 36"
42	43° 50′ 24"	78° 02′ 24"
43	43° 57′ 00"	78° 02′ 51"
47	43° 57′ 04"	77° 35′ 19"
48	43° 51′ 45"	77° 31′ 31"
49	43° 46′ 15"	77° 26′ 20"
55	43° 26′ 34"	77° 26′ 19"
57	43° 16′ 28"	77° 35′ 28"
58	43° 19′ 41"	77° 26′ 15"
61	43° 47′ 19"	77° 09′ 23"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
62	43° 51′ 53"	77° 00′ 01"
63	43° 43′ 55"	77° 00′ 54"
64	43° 31′ 34"	76° 55′ 31"
65	43° 25′ 23"	76° 53′ 00"
66	43° 19′ 58"	76° 50′ 19"
71	43° 28′ 45"	76° 31′ 41"
72	43° 33′ 00"	76° 31′ 35"
74	43° 44′ 47"	76° 31′ 15"
77	43° 57′ 24"	76° 24′ 33"
80	44° 08′ 21"	76° 36′ 34"
81	44° 00′ 59"	76° 40′ 12"
84	43° 53′ 09"	76° 43′ 58"
89	43° 41′ 53"	76° 25′ 06"
208	43° 20′ 30"	79° 03′ 50"
209	43° 21′ 01"	78° 58′ 53"
582	43° 45′ 36"	78° 01′ 26"
583	43° 45′ 17"	78° 04′ 58"
584	43° 43′ 05"	78° 04′ 58"
715	43° 38′ 08"	78° 58′ 07"
716	43° 35′ 47"	77° 26′ 28"
717	43° 26′ 22"	77° 26′ 22"
718	43° 33′ 36"	76° 42′ 46"


LAKE ONTARIO
Trophic Transfer
91 - 00 - 016
CSS LIMNOS
October 28 - November 10, 1991
Track Plot
Kingston
Cobourg
Oshawa
Toronto
Pt. Weller
Rochester
10501

SUSPENDED SEDIMENT SAMPLING

LRB STUDY 82013, 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 this study was done at station 623. Six cruises were carried out from April to October.

At station 623, 6000 litres of water were centrifuged from depths of 3 metres (surface) and 124 metres (B-15 m). 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 for analysis.

A continuous extraction of the centrifuged water at both depths was done onboard using the large volume extractors.

A comparison was done on cruise 91-00-014 to determine if there was any difference between flow rates of 2 and 3 litres/minute.

STATION POSITION

STATION NUMBER	LATITUDE N.	LONGITUDE W.
623	43° 28′ 50"	78° 45′ 36"

NEPHELOID LAYER SAMPLING

LRB STUDY 82041, H.F.H. DOBSON

In order to determine the extent of the nepheloid layer on Lake Ontario, a transect of 15 stations was completed from Toronto to Oswego. At each station, water samples were collected at depths of 1, 5, 10, 15, 20, 30, 50, 75, 120, 150, 200, B-30, B-20, B-10, B-5 and B-2 m for turbidity measurements using a Hach turbidity meter. An EBT/transmissometer profile was also obtained at each station. This work was done as a piggyback on four suspended sediment sampling cruises from June to September.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
691	43° 36′ 30"	79° 19′ 30"
692	43° 35′ 50"	79° 07′ 40"
693	43° 35′ 20"	78° 56′ 00"
694	43° 34′ 50"	78° 45′ 00"
695	43° 34′ 00"	78° 33′ 00"
696	43° 33′ 30"	78° 21′ 00"
697	43° 33′ 00"	78° 10′ 15"
698	43° 32′ 15"	77° 58′ 15"
699	43° 31′ 45"	77° 47′ 00"
700	43° 31′ 10"	77° 35′ 30"
701	43° 30′ 30"	77° 24′ 00"
702	43° 29′ 40"	77° 12′ 30"
703	43° 29′ 00"	77° 01′ 00"
704	43° 28′ 30"	76° 49′ 30"
705	43° 28′ 00"	76° 38′ 00"

STATISTICS SUMMARY

36

DATES FROM April 15 - 18
June 17 - 20
July 15 - 18
August 6 - 9
September 16 - 20
October 7 - 10

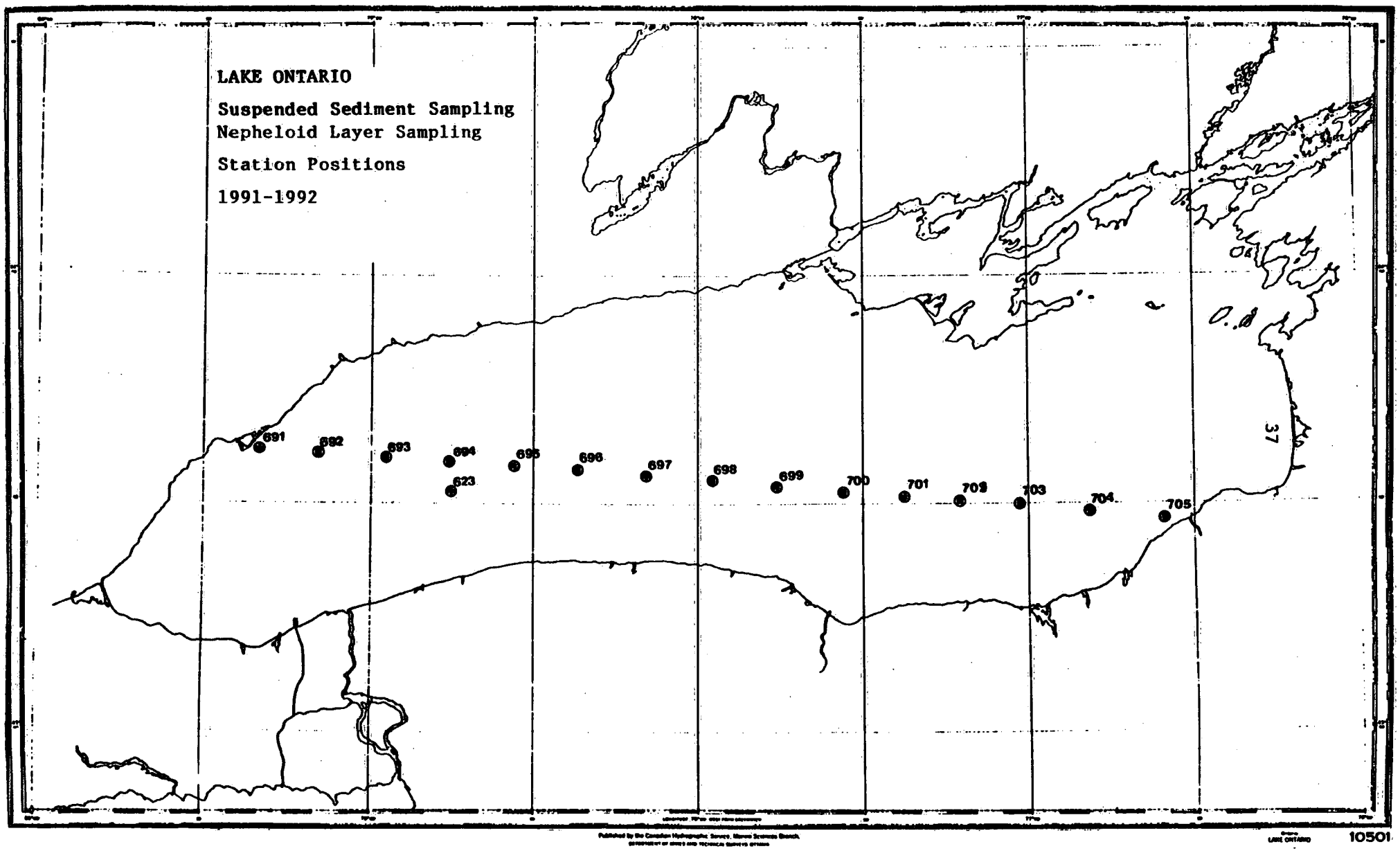
CRUISE TYPE Suspended Sediment Sampling and Nepheloid Layer Sampling

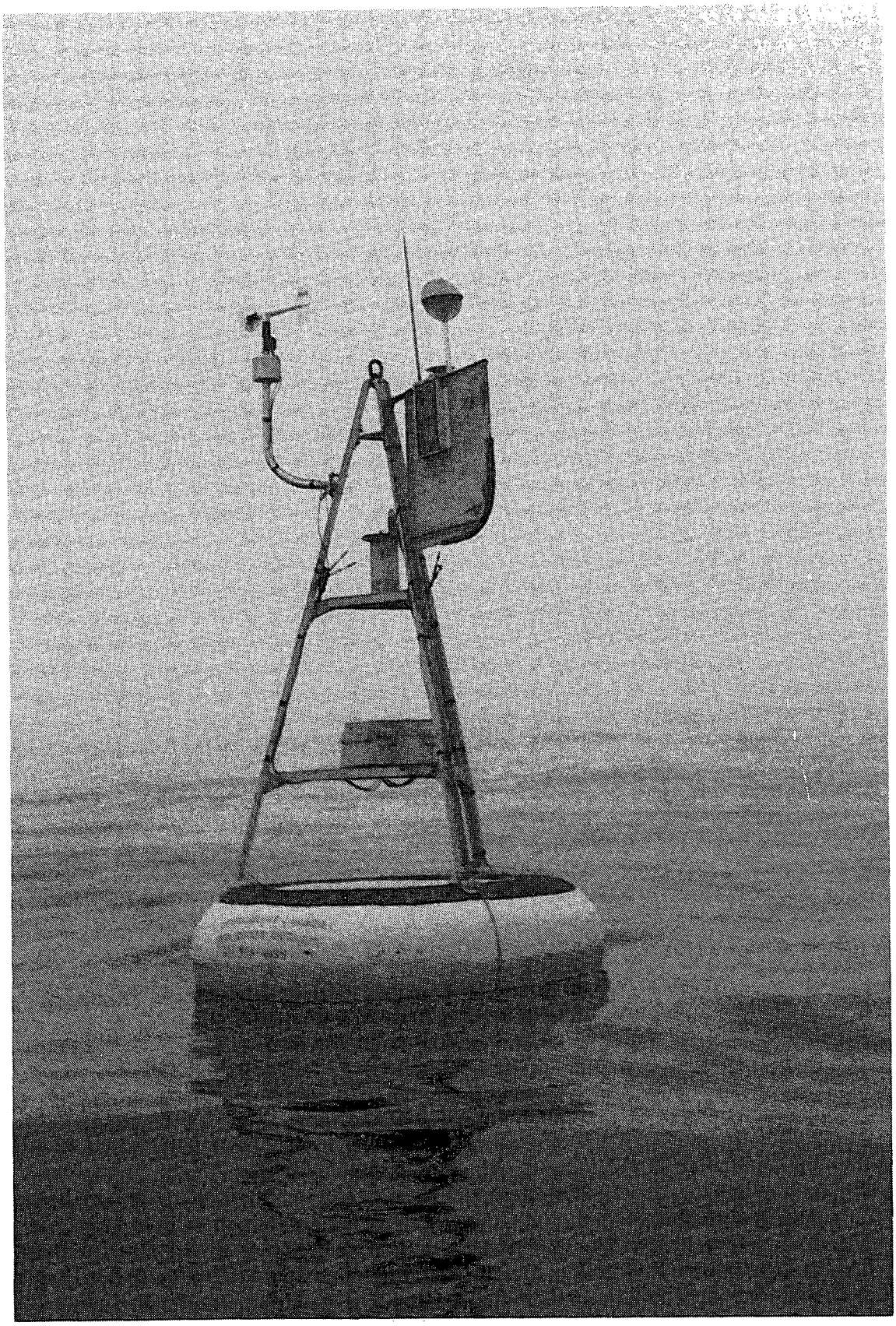
SHIP CSS LIMNOS

LAKE ONTARIO

N. MILES STEAMED 1726.8

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	92	Moorings Established	
EBT Casts	86	" Retrieved	
Rosette Casts	117	" Established	
Transmissometer Casts	85	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	6	" Established	
Secchi Disc Observations	26	" Retrieved	
Van Dorn Casts	23	" Refurbished	
Zooplankton Hauls		" Serviced, Meteorological	8
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)		Grab Samples Taken	
" " " (Cond/pH)			
" " " (Turbidity)	884	Bulk Centrifuge Samples, 6000L	14
" " " (T P uf)		Large Volume Extractions	14
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )		Turbidity	884


LAKE ONTARIO
Suspended Sediment Sampling
Nepheloid Layer Sampling
Station Positions
1991-1992
691
692
693
694
623
695
696
697
698
699
700
701
702
703
704
705
37
10501



MET III METEOROLOGICAL BUOY

LAKE ONTARIO MOORINGS

LRB STUDY 82046, DR. C.R. MURTHY

This study was in collaboration with Mrs. A. Mudroch, LRB Study 82013. The purpose of the study was to conduct physical transport experiments, time series experiments, current meter measurements and lagrangian measurements to evaluate the temporal transport of contaminants in the nepheloid layer of Lake Ontario.

Two current meter moorings were established at station 623 with four Neil Brown current meters on each mooring. Two meteorological buoys were also established at this site on cruise 91-00-002 in April. A third current meter mooring with two Neil Brown current meters was placed at this site on cruise 91-00-004 in June. An ADCP bottom-mounted current meter was established at this site on cruise 91-00-012 in September. All moorings were removed on cruise 91-00-015 in October.

Lagrangian experiments were carried out on each Suspended Sediment Sampling cruise for LRB Study 82013 on cruises 91-00-003, 91-00-005, 91-00-006, 91-00-008, 91-00-010, 91-00-012 and 91-00-014. At station 623 on each cruise, a satellite drifter buoy was released with the sail set in the epilimnion and a Loran C drifter buoy with the sail set at 60 m in the hypolimnion. These drifter buoys were retrieved at the end of each cruise.

STATION LOCATIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH m
623	91-00M-01A	43° 29′ 42"	78° 45′ 02"	
623	91-00M-02A	43° 29′ 37"	78° 45′ 03"	
623	91-00C-03A	43° 29′ 39"	78° 45′ 06"	CM (12, 34) CM (114,134)
623	91-00C-04A	43° 29′ 36"	78° 45′ 13"	CM (24, 44) CM (129,141)
623	91-00C-11A	43° 29′ 26"	78° 45′ 16"	CM (21, 60)
623	91-00C-31A	43° 29′ 40"	78° 45′ 20"	ADCP

STATISTICS SUMMARY

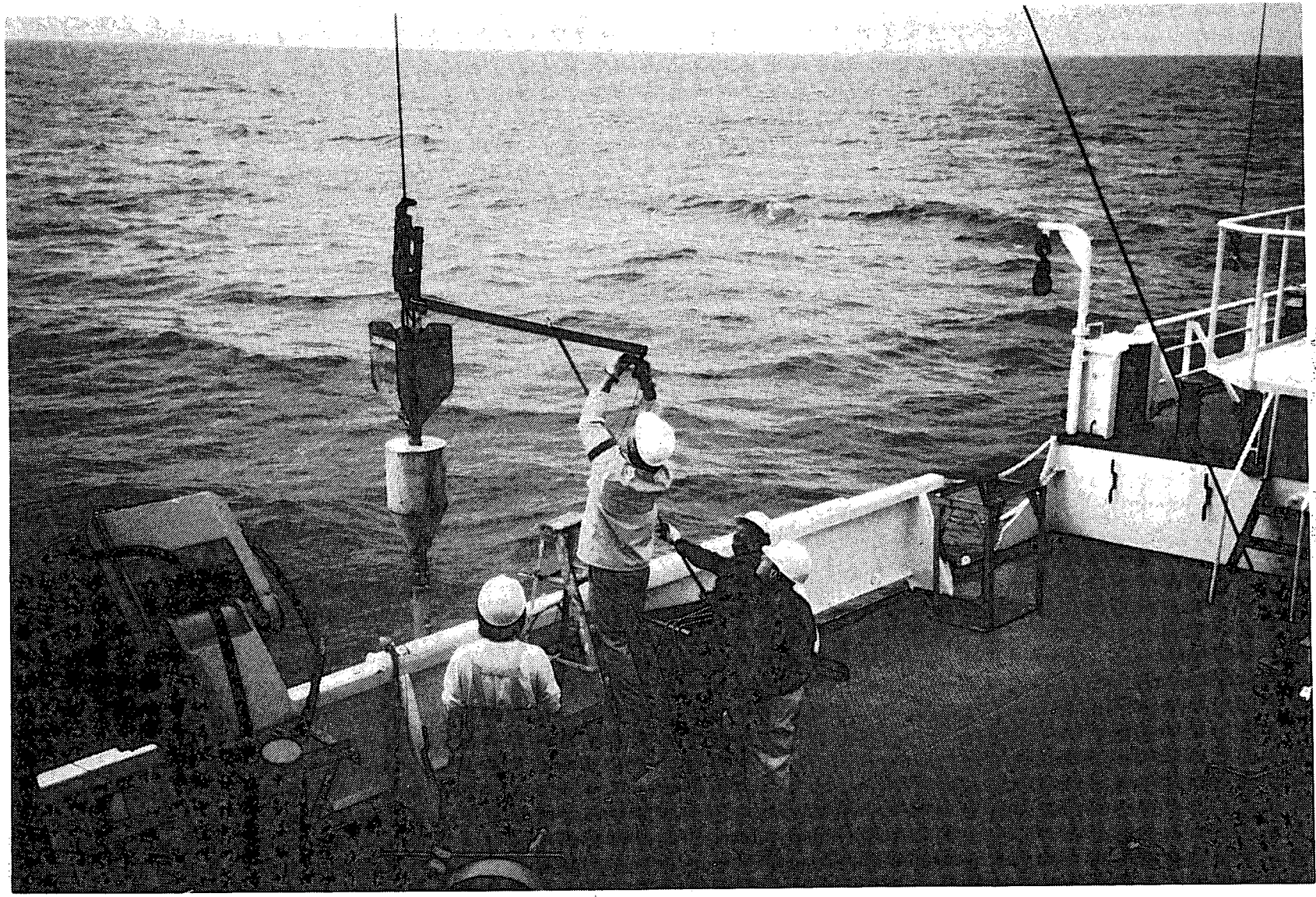
40

CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

DATES FROM April 9 October 15 TO April 10, 1991 October 16, 1991 LAKE ONTARIO

CRUISE TYPE Lake Ontario Moorings N. MILES STEAMED 302.35

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	8	Moorings Established , Current Meter	3
EBT Casts	8	" Retrieved , Current Meter	3
Rosette Casts		" Established , Meteorological	2
Transmissometer Casts	8	" Retrieved , Meteorological	2
Reversing Thermometer Obs. (No. of Therm)		" Established , ADCP	1
Secchi Disc Observations	1	" Retrieved , ADCP	1
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)		Grab Samples Taken	
" " " (Cond/pH)			
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)			
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			



ATTACHING PISTON CORER COUNTERWEIGHT

HAMILTON HARBOUR SEDIMENT CORES

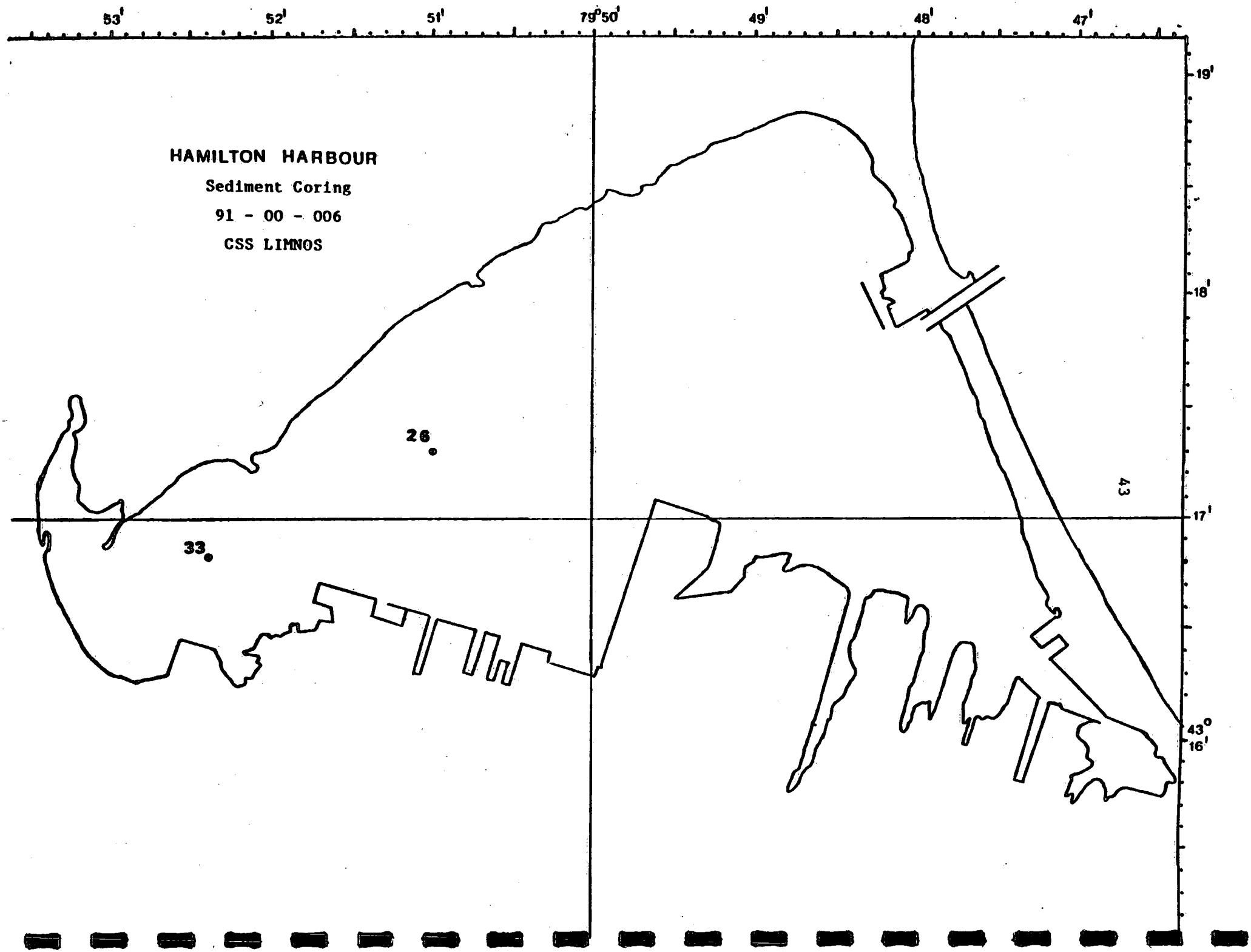
LRB STUDY 82012, DR. N.A. RUKAVINA

Long piston cores were required to obtain background data on the physical, chemical and biological properties of Hamilton Harbour. This work was done to provide a contribution to the Remedial Action Plan for Hamilton Harbour and to give a background in acoustics of sediments.

Cores were obtained at two sites in Hamilton Harbour--stations 26 and 33 on June 25 and 26. At each site, the CSS LIMNOS was anchored as close as possible to a marker placed by the CSL AGILE using a mini-ranger positioning with fore and aft anchors. After the LIMNOS was anchored, a benthos core was obtained to determine sediment stiffness before piston coring was done. Two piston cores were collected at each site with a benthos core used as a trigger weight. This enabled a benthos core to be obtained as close as possible to the piston core. A box core was also collected at the site and subsampled.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
26	43° 17′ 28"	79° 51′ 01"
33	43° 16′ 48"	79° 52′ 21"


53'
52'
51'
79°50'
49'
48'
47'
19'
18'
17'
43°
16'
HAMILTON HARBOUR
Sediment Coring
91 - 00 - 006
CSS LIMNOS
26
33
43

OPEN LAKES METAL CYCLE STUDY

LRB STUDY 82057, DR. J.O. NRIAGU

During the field season, the CSS LIMNOS supported this project twice. Fifteen stations were sampled on Lake Ontario during the week of July 22 - 25 and twelve stations were sampled in Lake Erie September 8 - 11.

Samples were collected using Go-Flo bottles and at selected sites a rubber raft was used to collect samples away from the influence of the LIMNOS. During this sampling, a pump was used. All samples were analyzed onboard the vessel using the portable clean laboratory secured to the main deck. Samples were collected from discrete depths determined from the EBT trace by the study leader.

STATISTICS SUMMARY

CRUISE NO. 91-00-009 CONSECUTIVE NO. 033 SHIP CSS LIMNOS

DATES FROM July 22 TO July 25, 1991 LAKE ONTARIO

CRUISE TYPE Metal Cycle Study N. MILES STEAMED 394.8

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	15	Moorings Established	
EBT Casts	15	" Retrieved	
Rosette Casts	5	" Established	
Transmissometer Casts	15	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations	4	" Retrieved	
		" Refurbished	
Zooplankton Hauls	6	" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	8
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)		Grab Samples Taken	
" " " (Cond/pH)		Go-Flo Samples (casts)	15
" " " ( )		Bulk Centrifuge Samples, 600L	35
" " " (T P uf)		Zodiak surface H_2O samples	10
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

STATISTICS SUMMARY

CRUISE NO. 91-01-005 CONSECUTIVE NO. 105 SHIP CSS LIMNOS

DATES FROM September 8 TO September 11, 1991 LAKE ERIE

CRUISE TYPE Metal Cycle Study N. MILES STEAMED 461.8

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	12	Moorings Established	
EBT Casts	12	" Retrieved	
Rosette Casts	12	" Established	
Transmissometer Casts	12	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations	6	" Retrieved	
		" Refurbished	
Zooplankton Hauls	10	" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	8
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " (Metals)	29		
" " " (D.O.)		Grab Samples Taken	
" " " (Cond/pH)	28		
" " " ( )		Bulk Centrifuge Samples	21
" " " (T P uf)			
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)			
" " " (T P f)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	56
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			

METAL CYCLE STATION POSITIONS

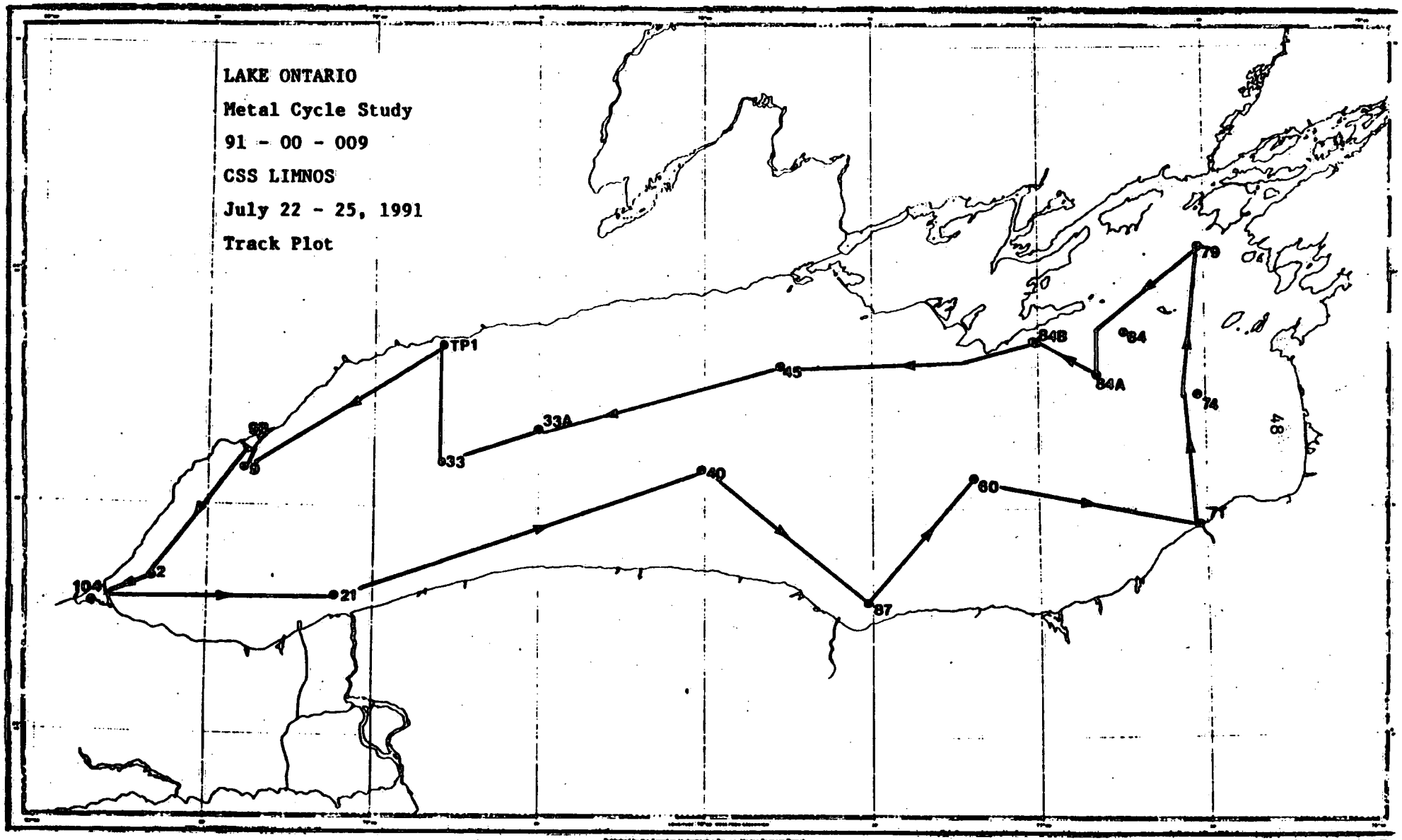
1991-1992

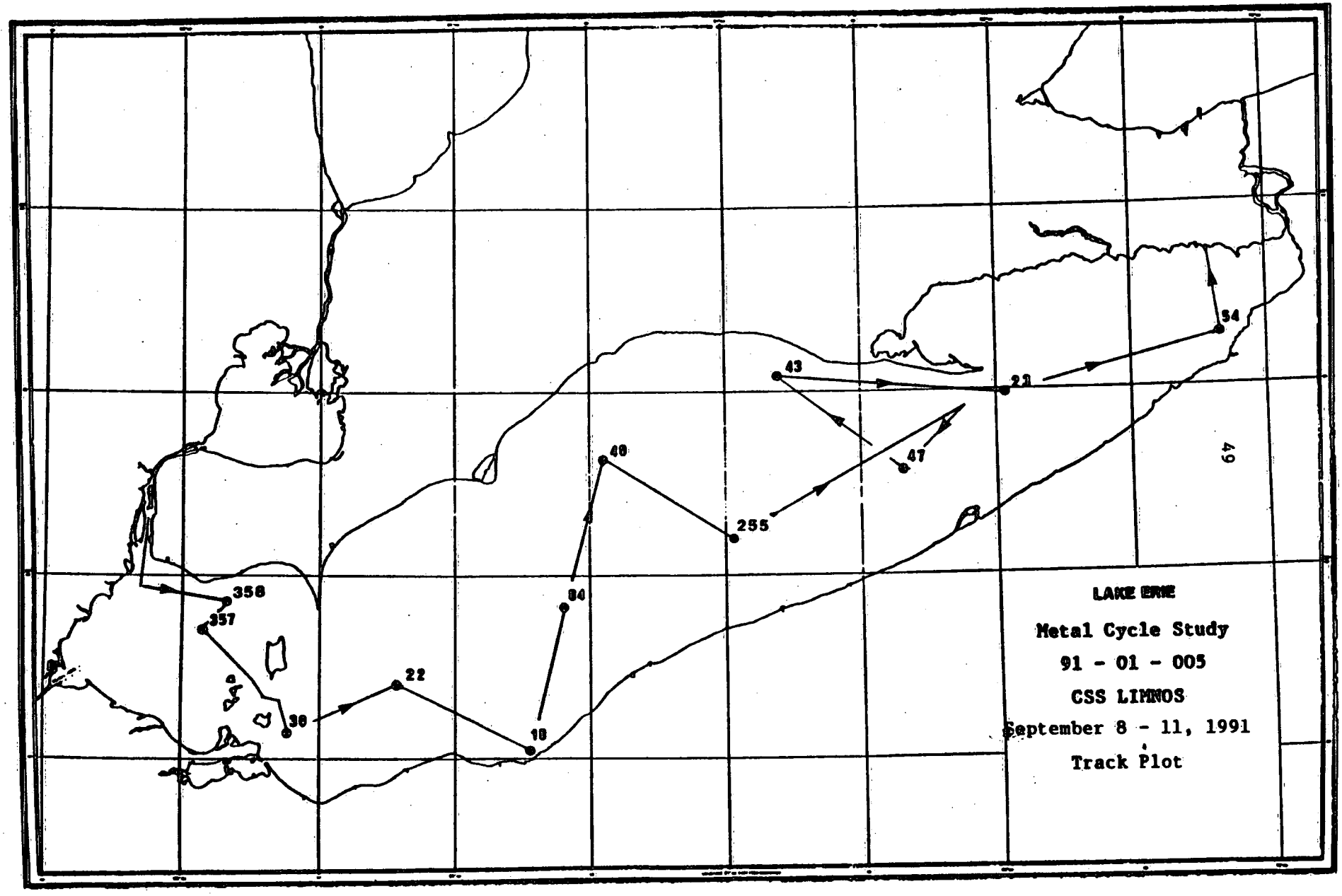
LAKE ONTARIO

STATION NUMBER	LATITUDE N.	LONGITUDE W.
2	43° 20′ 15"	79° 39′ 55"
9	43° 35′ 10"	79° 23′ 47"
9B	43° 38′ 02"	79° 22′ 02"
21	43° 18′ 00"	79° 07′ 12"
33	43° 35′ 49"	78° 48′ 17"
33A	43° 43′ 59"	78° 24′ 11"
40	43° 35′ 25"	78° 00′ 45"
45	43° 49′ 13"	77° 47′ 05"
60	43° 34′ 47"	77° 12′ 00"
71	43° 28′ 31"	76° 32′ 25"
79	44° 04′ 29"	76° 31′ 42"
84A	43° 46′ 09"	76° 45′ 28"
84B	43° 50′ 28"	76° 52′ 44"
87	43° 17′ 54"	77° 31′ 01"
104	43° 17′ 22"	79° 50′ 13"

LAKE ERIE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
18	41° 31′ 54"	81° 42′ 38"
22	41° 42′ 55"	82° 10′ 14"
23	42° 30′ 01"	79° 53′ 36"
30	41° 34′ 03"	82° 38′ 08"
40	42° 21′ 20"	81° 26′ 23"
43	42° 34′ 34"	80° 43′ 38"
47	42° 17′ 37"	80° 18′ 19"
54	42° 39′ 08"	79° 08′ 05"
84	41° 56′ 05"	81° 39′ 43"
255	42° 08′ 30"	89° 59′ 23"
357	41° 50′ 00"	82° 58′ 10"
358	41° 53′ 54"	82° 52′ 12"


LAKE ONTARIO
Metal Cycle Study
91 - 00 - 009
CSS LIMNOS
July 22 - 25, 1991
Track Plot
TP1
45
84B
84
84A
79
74
48
33A
33
40
60
71
87
21
2
104


358
357
30
22
18
84
48
255
43
47
22
54
46
LAKE ERIE
Metal Cycle Study
91 - 01 - 005
CSS LIMNOS
September 8 - 11, 1991
Track Plot

HAMILTON HARBOUR MOORINGS

LRB STUDY 82026, DR. F.M. BOYCE

This study will provide background data of current and temperatures in key areas of Hamilton Harbour for verification of numerical circulation models.

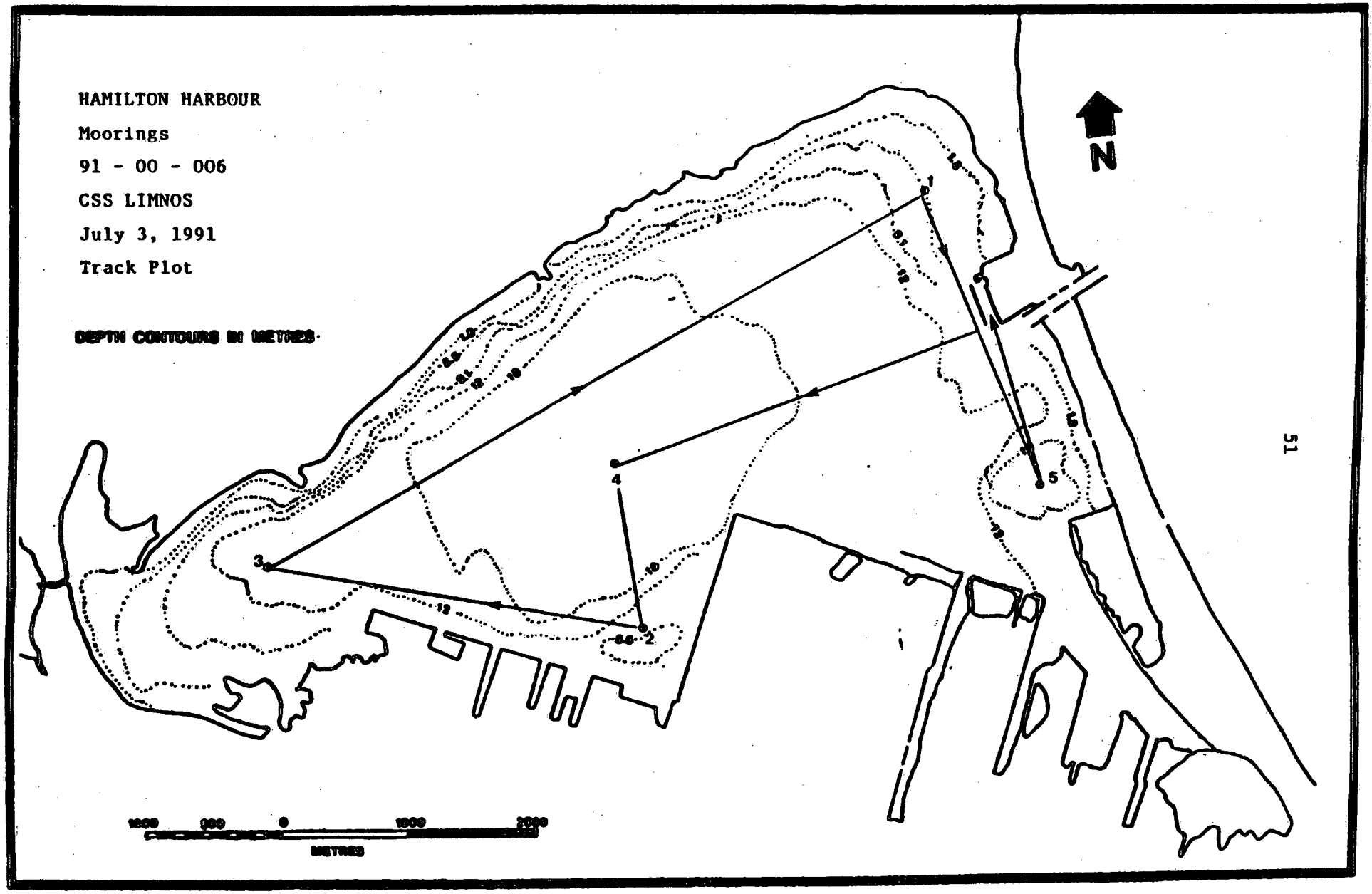
The CSS LIMNOS supported this program once during the field year on July 11. The vessel installed three current meter moorings, three tide gauge moorings, one bottom-mounted current meter and one meteorological buoy. The meteorological buoy was retrieved November 10 by the LIMNOS. All other moorings were retrieved by the CSL SHARK on December 9. All moorings were retrieved and cleaned of zebra mussels once during the installation period.

MOORING POSITIONS

HAMILTON HARBOUR

1991-1992

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
1	91-00C-16A	43° 18′ 18"	79° 48′ 44"
	91-00P-21A	43° 18′ 27"	79° 48′ 43"
2	91-00C-17A	43° 16′ 35"	79° 50′ 07"
3	91-00C-18A	43° 17′ 08"	79° 47′ 38"
	91-00P-22A	43° 16′ 45"	79° 53′ 32"
4	91-00CH-19A	43° 17′ 23"	79° 50′ 30"
	91-00P-20A	43° 17′ 22"	79° 50′ 29"
5	91-00P-23A	43° 17′ 08"	79° 47′ 38"


HAMILTON HARBOUR
Moorings
91 - 00 - 006
CSS LIMNOS
July 3, 1991
Track Plot
DEPTH CONTOURS IN METRES
N
1
2
3
4
5
METRES

CONTAMINANT TRANSFER STUDY

LAKE ONTARIO

LRB STUDY 82021, DR. D.R.S. LEAN

During the field season, the CSS LIMNOS supported this study twice. Both cruises were on Lake Ontario July 8 - 12 and September 23 - 27. Both cruises studied the transfer of contaminants through the trophic levels of Lake Ontario.

The parameters sampled during the cruises were: temperature transmission profiles, zooplankton grazing experiments, continuous global solar radiation, phytoplankton and microbial loop samples, micro layer samples; mysis and zooplankton net hauls and vertical fish net hauls were collected at night.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
2	43° 20′ 23″	79° 39′ 55″
26	43° 17′ 26″	79° 50′ 08″
38	43° 23′ 00″	77° 59′ 24″
38B	43° 24′ 20″	77° 59′ 18″
39	43° 29′ 12″	78° 00′ 00″
40	43° 35′ 24″	78° 00′ 42″
41	43° 42′ 51″	78° 01′ 42″
41A	43° 44′ 05″	78° 00′ 58″
41B	43° 42′ 13″	78° 00′ 53″
42	43° 50′ 24″	78° 02′ 18″
43	43° 56′ 51″	78° 03′ 04″
104	43° 17′ 17″	79° 49′ 55″

STATISTICS SUMMARY

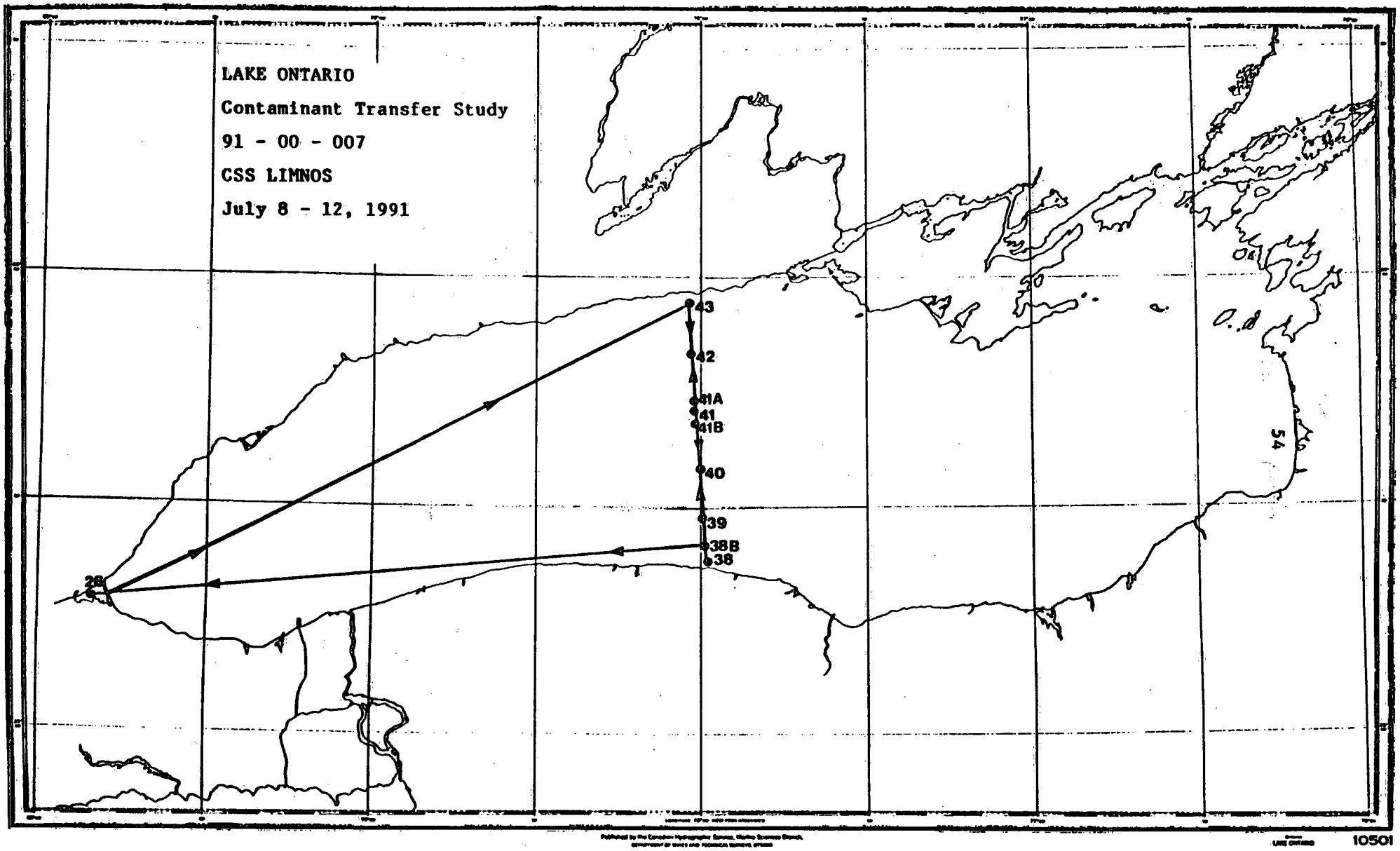
53

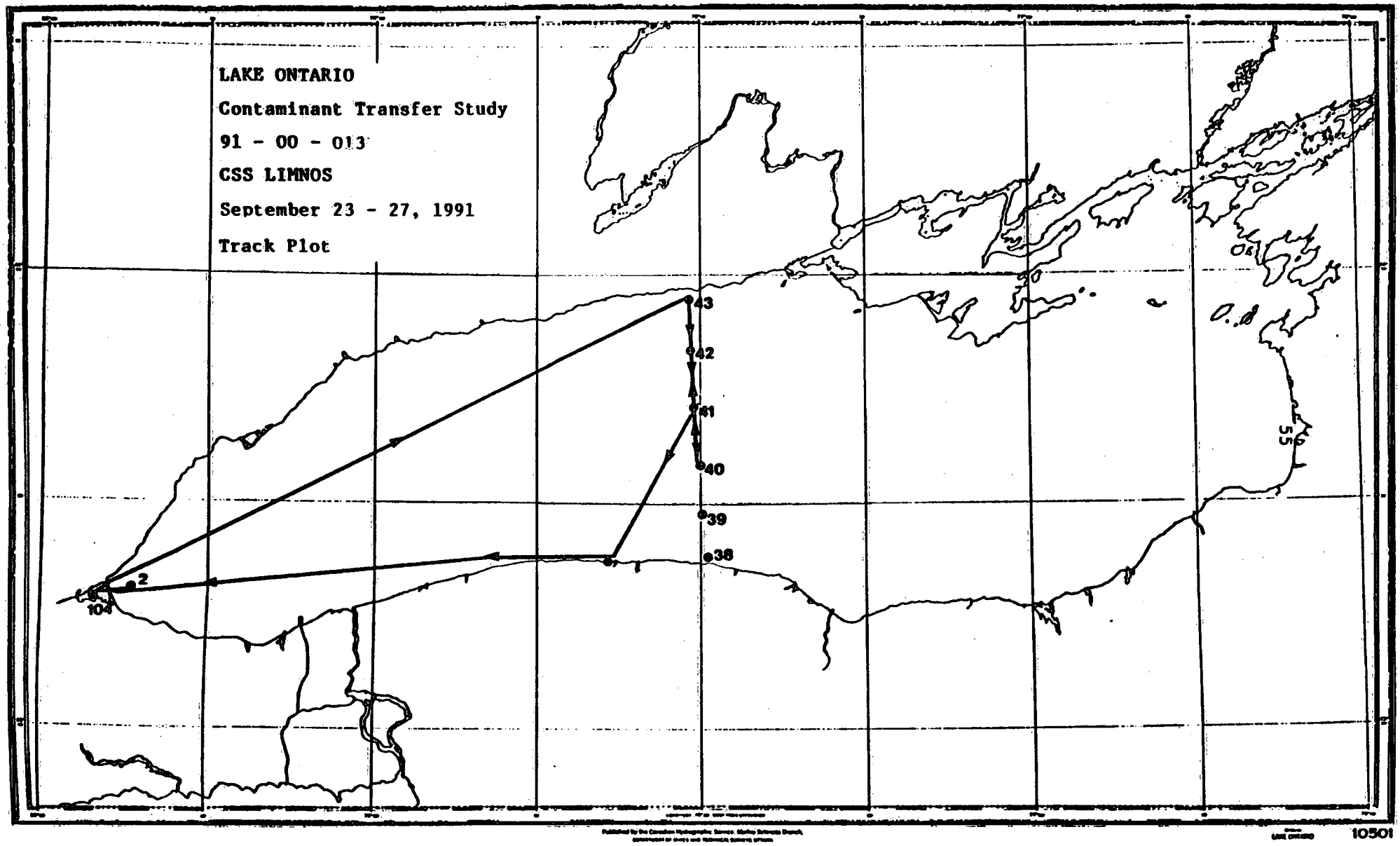
CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

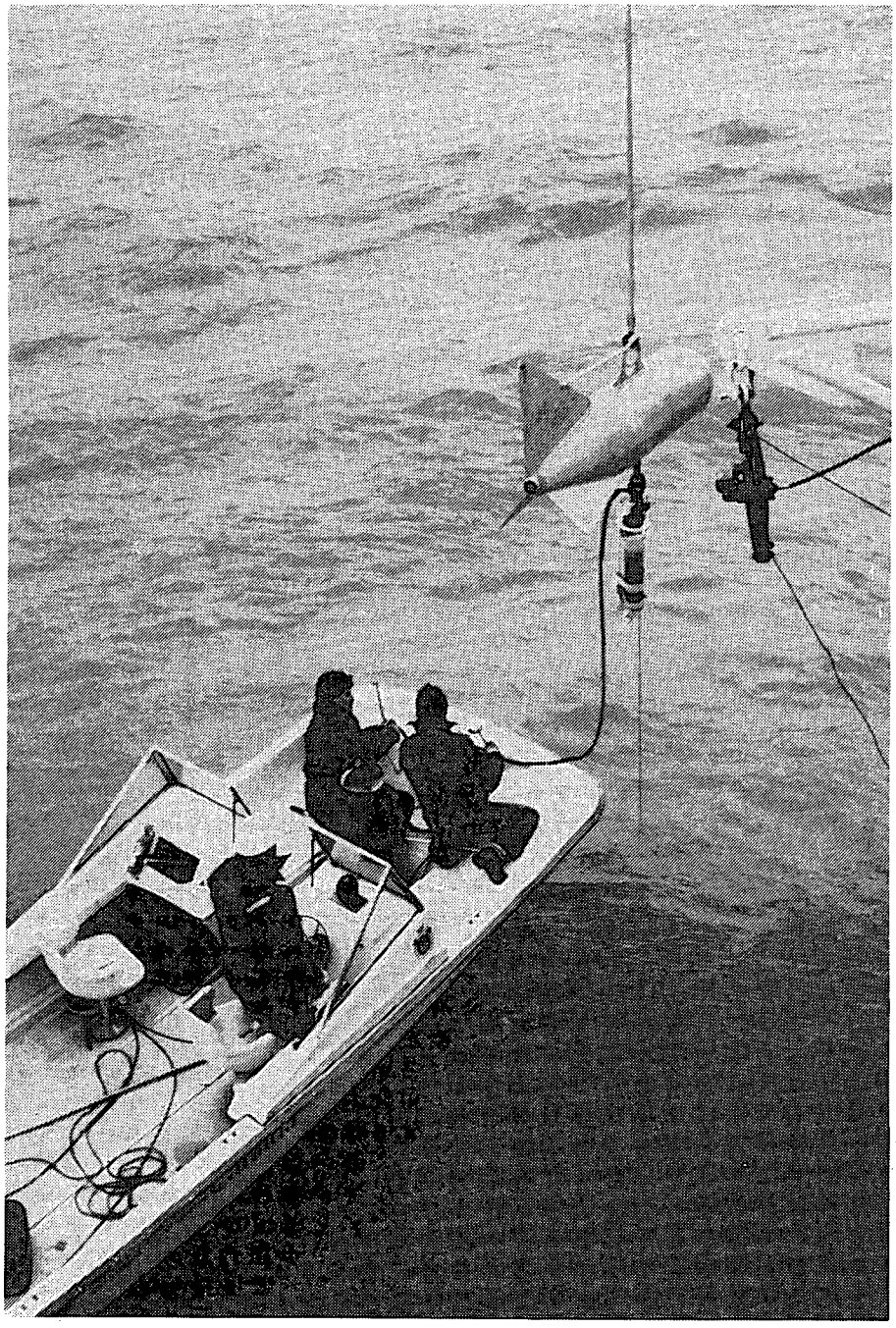
DATES FROM July 8 September 23 TO July 12, 1991 September 27, 1991 LAKE ONTARIO

CRUISE TYPE Contaminant Transfer Study N. MILES STEAMED 641.8

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	34	Moorings Established	
EBT Casts	33	" Retrieved, Drogue 5389	1
Rosette Casts	18	" Established	
Transmissometer Casts	33	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	8	" Established	
Secchi Disc Observations	4	" Retrieved	
Mysis Hauls	18	" Refurbished	
Zooplankton Hauls	22	" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m	6	Primary Productivity Moorings	
Phytoplankton Samples	6		
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)		Grab Samples Taken	
" " " (Cond/pH)	12		
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)	15		
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	19	Solar Radiation	4
" " " (POC/TPN)	19		
" " " (Seston)			
" " " (T P f)	3		
" " " (Nutrients)	15	ONBOARD ANALYSES	
" " " (Major Ions)	15		
" " " ( )		Manual Chemistry Tech. Ops.	
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			


LAKE ONTARIO
Contaminant Transfer Study
91 - 00 - 007
CSS LIMNOS
July 8 - 12, 1991
43
42
41A
41
41B
40
39
38B
38
28
54
10501


LAKE ONTARIO
Contaminant Transfer Study
91 - 00 - 013
CSS LIMNOS
September 23 - 27, 1991
Track Plot
43
42
41
40
39
38
2
104
55
10501



BOTTOM-MOUNTED DISSOLVED OXYGEN MOORING RETRIEVAL

BENTHIC COMMUNITY STRUCTURE

LAKE ERIE

LRB STUDY 82015, DR. T.P. REYNOLDSON

Six Lake Erie cruises were carried out onboard the CSS LIMNOS April 22 - 24, May 18 - 21, June 10 - 14, August 19 - 21, September 8 - 11 and October 21 - 25. 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, a DO logger was installed for the season. This was retrieved during the October cruise.

At the request of the study leader, additional stations were added to give additional information for LRB Study 82015. This was done on the June and October cruises. The September cruise was a piggyback on the Lake Erie Metal Cycle cruise.

Several additional requests were supported during the season. These included the collection of piston cores for Dr. R. Thomas of the University of Windsor, Benthos and Shipek samples for the University of Waterloo and phytoplankton samples for Dr. M. Zarrul of LRB

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29′ 53"	79° 53′ 59"
84	41° 55′ 51"	81° 39′ 16"
357	41° 49′ 45"	82° 58′ 17"
358	41° 53′ 40"	82° 52′ 00"

LAKE ERIE

APRIL 22 - 24

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST./DEPTH
23	90-01AC-03A	42° 30′ 08"	79° 53′ 55"	ST,15,40,61
84	90-01AC-04A	41° 56′ 06"	81° 39′ 39"	ST,15,20;CM,22.3
255		42° 08′ 34"	80° 59′ 31"	
257		42° 02′ 06"	81° 19′ 09"	
261		41° 46′ 14"	82° 07′ 44"	
357	90-01AC-05A	41° 49′ 46"	82° 58′ 11"	ST,9.8;CM,10.6
358		41° 53′ 38"	82° 52′ 06"	

DO/TEMPERATURE LOGGER

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST./DEPTH
23	91-01S-02A	42° 29′ 43"	79° 53′ 48"	DO, 61 m
84	91-01S-01A	41° 56′ 03"	81° 39′ 28"	DO, 23.7 m

STATISTICS SUMMARY

59

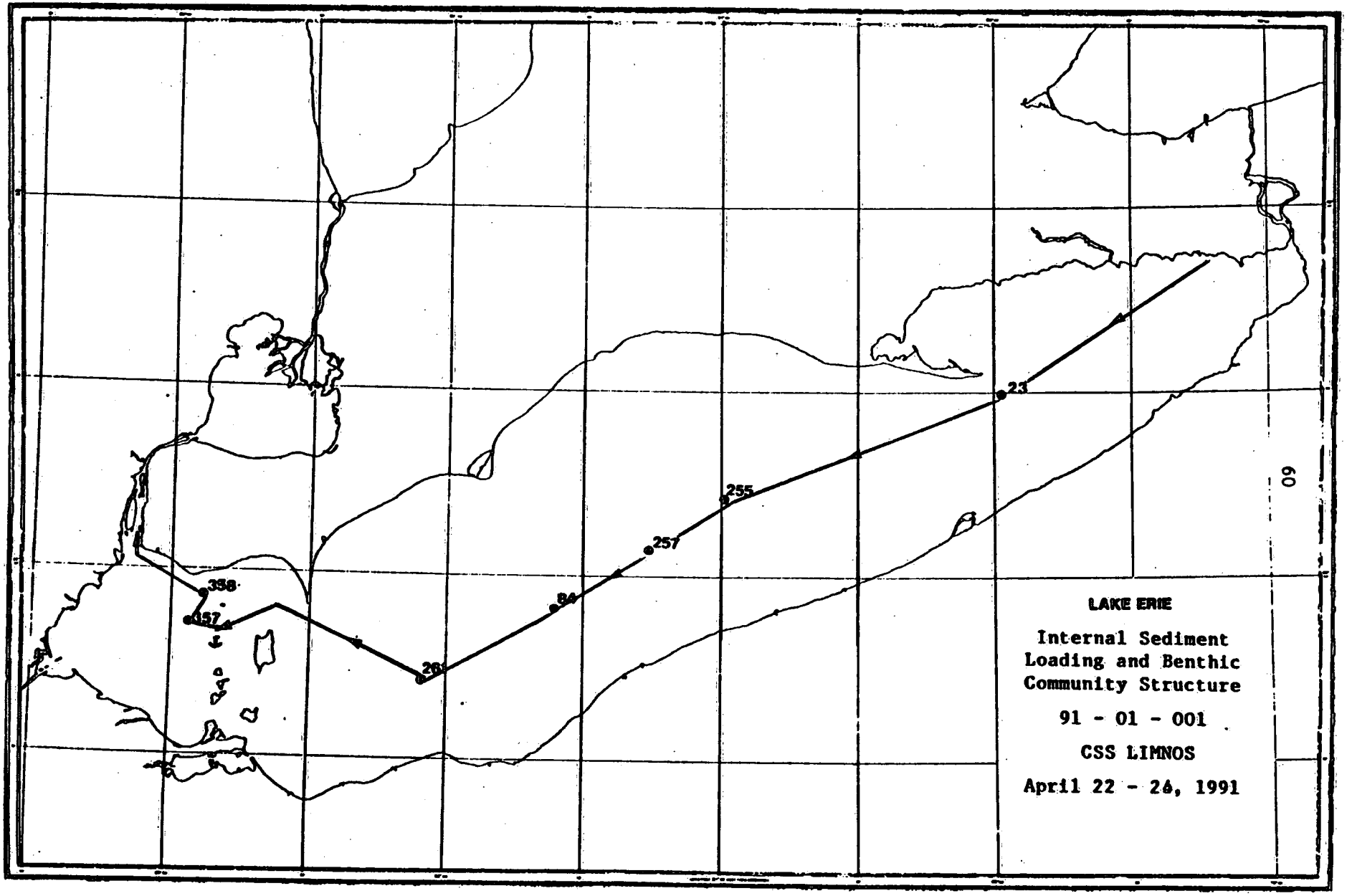
CRUISE NO. _____ CONSECUTIVE NO. _____ SHIP CSS LIMNOS

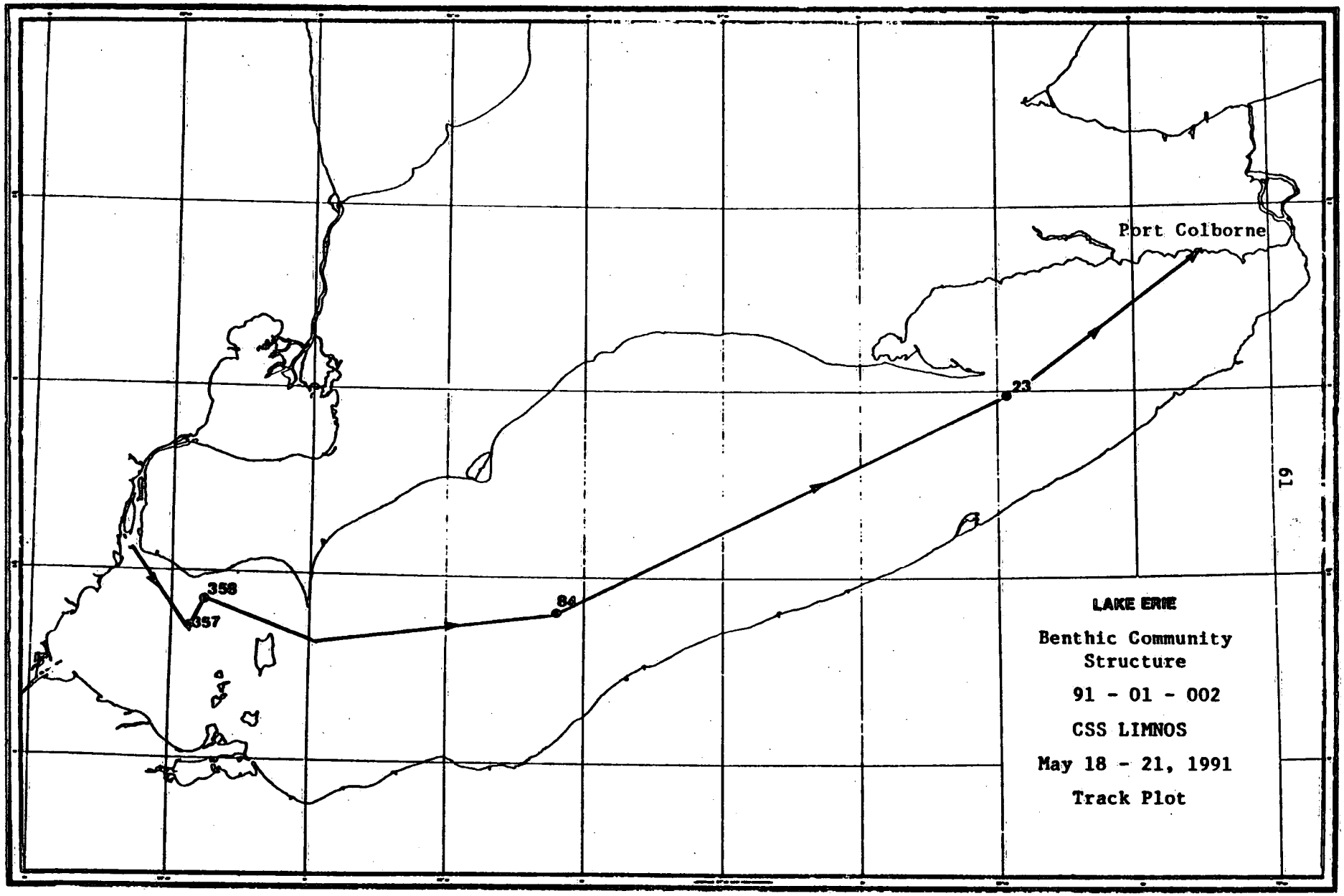
DATES FROM _____ TO _____ LAKE ERIE

CRUISE TYPE Benthic Community Structure N. MILES STEAMED 2460.46

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	86	Moorings Established, CM/Sediment Trap	3
EBT Casts	76	" Retrieved, CM/Sediment Trap	2
Rosette Casts	2	" Established, DO Logger	2
Transmissometer Casts	76	" Retrieved, DO Logger	2
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations	20	" Retrieved, RSS/CM	1
		" Refurbished	
Zooplankton Hauls	7	" Serviced	
Integrator 10 m	7	" Serviced	
Integrator 20 m	12	Primary Productivity Moorings	
Phytoplankton Samples	29		
		Cores Taken, Box	46
		Cores Taken, Gravity, Benthos	34
Water Samples Collected (Microbiology)		Cores Taken, Piston	4
" " " (Water Quality)	21	Cores Taken, Mini Box	2
" " " ( )			
" " " (D.O.)	45	Grab Samples Taken, Shipek	31
" " " (Cond/pH)	41		
" " " ( )		Bulk Centrifuge Samples, 1200L @ 5 m	6
" " " (T P uf)	33		
" " " (TKN)		Observations, Weather	
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	9	Solar Radiation	
" " " (POC/TPN)	9		
" " " (Seston)	9		
" " " (T P f)			
" " " (Nutrients)	21	ONBOARD ANALYSES	
" " " (Major Ions)	21		
" " " ( )		Manual Chemistry Tech. Ops.	123
" " " ( )		Nutrients (WOB)	21
" " " ( )		Microbiology	
" " " ( )			

Tech. Ops. 1987


358
157
84
257
255
23
LAKE ERIE
Internal Sediment
Loading and Benthic
Community Structure
91 - 01 - 001
CSS LIMNOS
April 22 - 24, 1991


Port Colborne
23
84
358
357
61
LAKE ERIE
Benthic Community
Structure
91 - 01 - 002
CSS LIMNOS
May 18 - 21, 1991
Track Plot

LAKE ERIE

JUNE 10 - 14

STATION NUMBER	LATITUDE N.	LONGITUDE W.
REYNOLDSON		
23	42° 29′ 47"	79° 53′ 50"
84	41° 55′ 51"	81° 39′ 16"
357	41° 49′ 43"	82° 58′ 48"
358	41° 53′ 42"	82° 51′ 56"
400	41° 59′ 07"	80° 33′ 19"
401	42° 04′ 02"	80° 33′ 20"
402	42° 08′ 42"	80° 33′ 30"
403	42° 13′ 44"	80° 33′ 48"
404	42° 18′ 40"	80° 33′ 47"
405	42° 23′ 41"	80° 34′ 00"
406	42° 28′ 20"	80° 34′ 21"
407	42° 33′ 28"	80° 34′ 09"
408	42° 25′ 25"	81° 01′ 23"
409	42° 27′ 00"	81° 28′ 15"
410	42° 12′ 58"	81° 47′ 30"
411	42° 10′ 52"	82° 11′ 18"
412	42° 05′ 59"	82° 11′ 23"
413	42° 00′ 33"	82° 11′ 19"
414	41° 54′ 13"	82° 11′ 20"
415	41° 49′ 15"	82° 11′ 20"
416	41° 44′ 29"	82° 11′ 18"
417	41° 39′ 29"	82° 11′ 19"
418	41° 34′ 23"	82° 11′ 16"
419	41° 29′ 14"	82° 11′ 18"
420	41° 39′ 30"	81° 49′ 28"
421	41° 49′ 01"	81° 26′ 20"
422	41° 57′ 28"	81° 55′ 29"

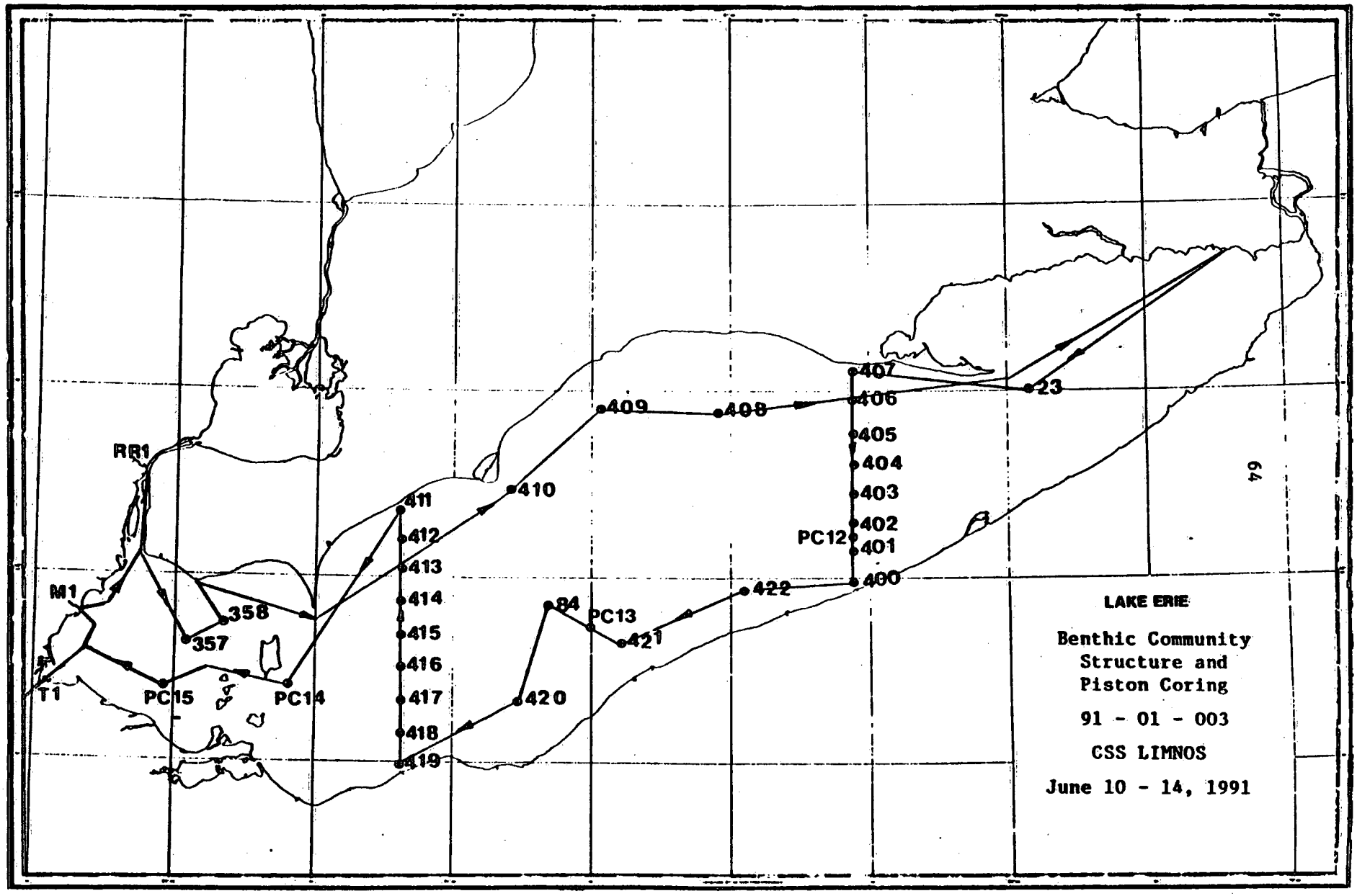
LAKE ERIE

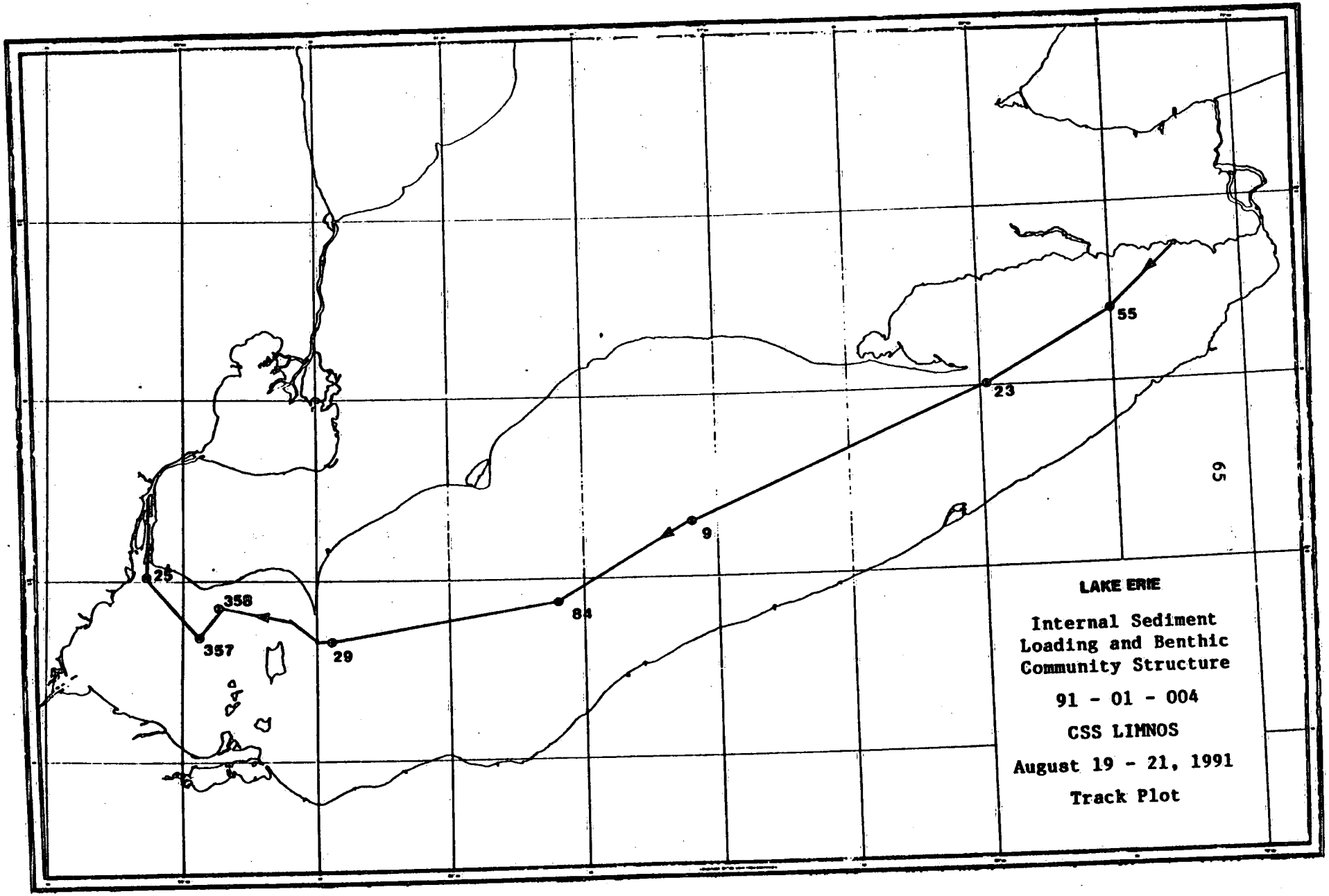
JUNE 10 - 14

STATION NUMBER		LATITUDE N.	LONGITUDE W.
PISTON CORE			
PC-12		42° 07′ 37"	80° 33′ 19"
PC-13		41° 53′ 48"	81° 35′ 22"
PC-14		41° 42′ 57"	82° 33′ 26"
PC-15		41° 46′ 39"	83° 02′ 00"
SHIPEK			
T-1	Toledo	41° 41′ 27"	83° 28′ 00"
SH-1		41° 46′ 32"	83° 17′ 45"
SH-2		41° 50′ 12"	83° 17′ 25"
SH-3		41° 52′ 27"	83° 16′ 53"
SH-4		41° 53′ 42"	83° 15′ 59"
M-1	Monroe	41° 53′ 56"	83° 21′ 31"
RR-1	Rouge River	42° 16′ 25"	83° 06′ 39"

AUGUST 19 - 21

STATION NUMBER	LATITUDE N.	LONGITUDE W.
9	42° 04′ 30"	81° 11′ 24"
23	42° 29′ 53"	79° 53′ 59"
25	42° 00′ 09"	83° 08′ 16"
29	41° 48′ 46"	82° 24′ 37"
55	42° 42′ 26"	79° 30′ 02"
84	41° 55′ 51"	81° 39′ 09"
357	41° 49′ 51"	82° 58′ 13"
358	41° 53′ 40"	82° 52′ 00"


RR1
M1
T1
358
357
PC15
PC14
411
412
413
414
415
416
417
418
419
410
409
408
407
406
405
404
403
402
401
400
PC12
84
PC13
421
422
420
23
LAKE ERIE
Benthic Community
Structure and
Piston Coring
91 - 01 - 003
CSS LIMNOS
June 10 - 14, 1991


55
23
9
84
29
357
358
25
65
LAKE ERIE
Internal Sediment
Loading and Benthic
Community Structure
91 - 01 - 004
CSS LIMNOS
August 19 - 21, 1991
Track Plot

LAKE ERIE

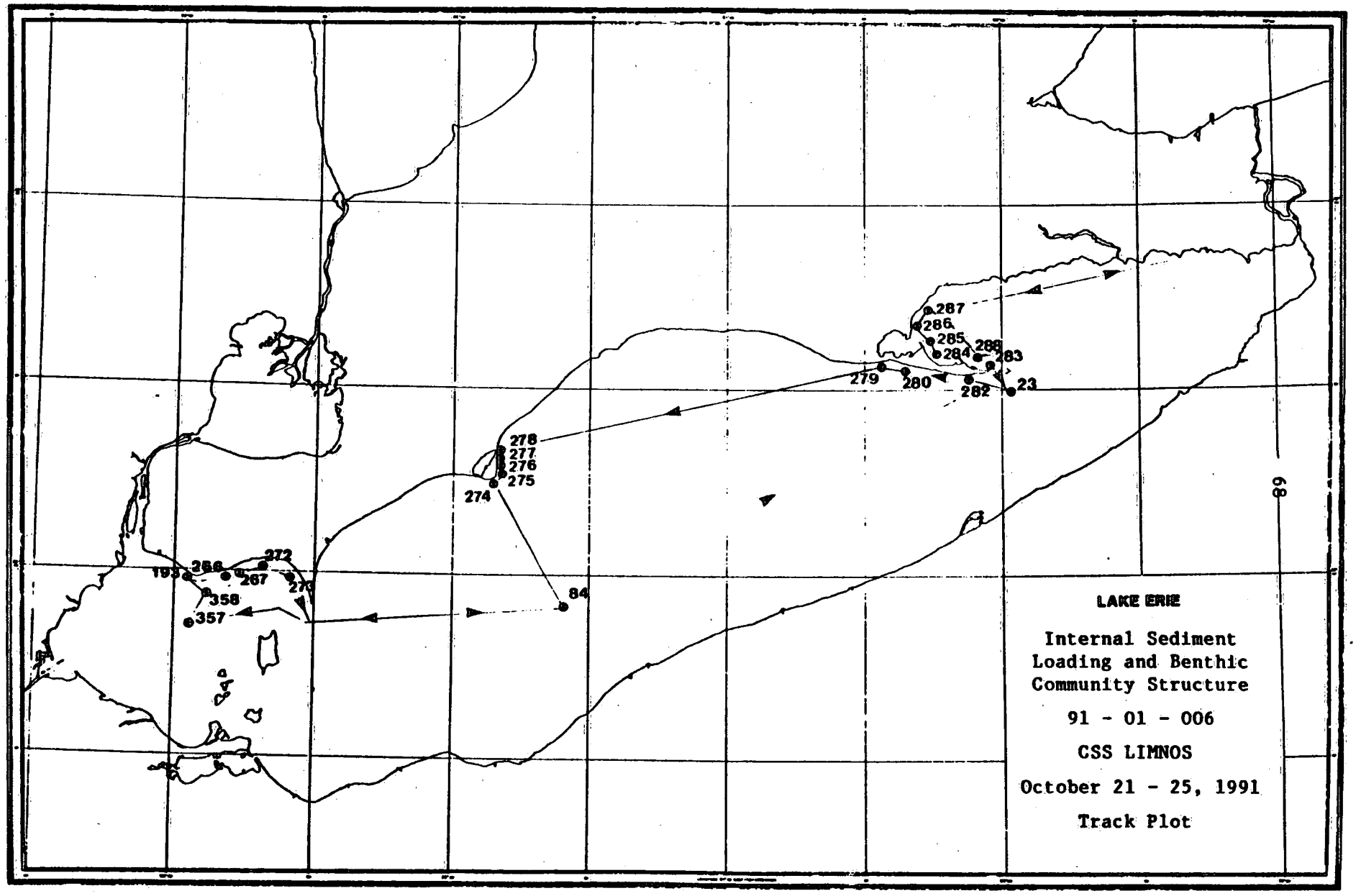
OCTOBER 21 - 24

STATION NUMBER	LATITUDE N.	LONGITUDE W.	REYNOLDSON NUMBER
23	42° 30′ 08"	79° 53′ 26"	
84	41° 56′ 22"	81° 39′ 34"	
193	41° 58′ 12"	82° 57′ 26"	0104
266	41° 59′ 24"	82° 50′ 22"	0105
267	41° 59′ 21"	82° 47′ 15"	0106
272	42° 01′ 17"	82° 40′ 18"	0107
273	41° 59′ 24"	82° 35′ 23"	0108
274	42° 13′ 01"	81° 50′ 58"	0111
275	42° 15′ 05"	81° 48′ 58"	0112
276	42° 17′ 02"	81° 49′ 00"	0113
277	42° 18′ 00"	81° 48′ 54"	0114
278	42° 20′ 01"	81° 48′ 50"	0115
279	42° 32′ 11"	80° 31′ 23"	
280	42° 32′ 40"	80° 21′ 04"	0301
282	42° 30′ 21"	80° 06′ 59"	0302
283	42° 33′ 52"	80° 02′ 17"	0303
284	42° 36′ 02"	80° 14′ 00"	0307
285	42° 38′ 03"	80° 16′ 02"	0308
286	42° 41′ 01"	80° 17′ 58"	0312
287	42° 42′ 10"	80° 15′ 01"	0313
288	42° 36′ 04"	80° 06′ 28"	0300
357	41° 49′ 33"	82° 58′ 16"	
358	41° 53′ 39"	82° 52′ 02"	

LAKE ERIE

OCTOBER 21 - 25

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST./DEPTH
23	91-01S-02A	42° 29′ 43"	79° 53′ 48"	DO (61)
	91-01AC-03A	42° 30′ 09"	79° 53′ 25"	ST (15, 40, 57) CM (58.7)
84	91-01A-01A	41° 56′ 03"	81° 39′ 28"	DO (23.7)
	91-01AC-04A	41° 56′ 07"	81° 39′ 29"	ST (15, 20) CM (21.7)
357	91-01AC-05A	41° 49′ 33"	82° 58′ 16"	ST (8, 8.8) CM (8.5)


287
286
285
284
288
283
279
280
282
23
278
277
276
275
274
84
272
266
193
267
270
358
357
89
LAKE ERIE
Internal Sediment
Loading and Benthic
Community Structure
91 - 01 - 006
CSS LIMNOS
October 21 - 25, 1991
Track Plot

INTERNAL SEDIMENT LOADING

LAKE ERIE

LRB STUDY 82016, F. ROSA

Two Lake Erie cruises were carried out onboard the CSS LIMNOS--April 22 - 24 and October 21 - 25. These cruises were piggybacked on the Lake Erie Benthic Community Structure cruises on these dates. On each cruise, meteorological observations were made and EBT/transmissometer profiles to the bottom taken. The following sampling was also performed:

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

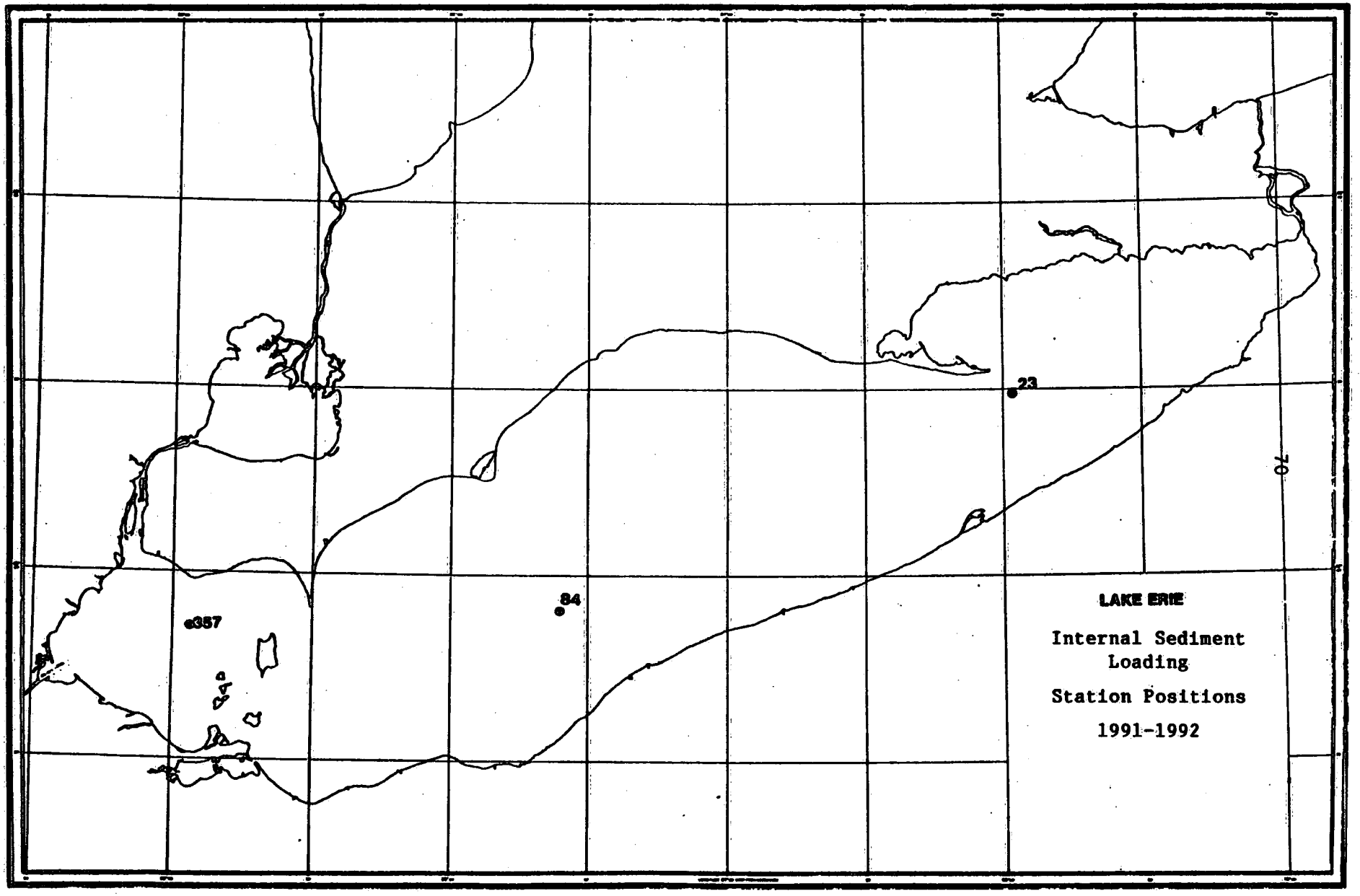
2. Bulk water samples (120OL) were collected from the 5-metre depth and centrifuged for particulate material.

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

4. At stations 23, 84 and 357, combination current meter/sediment trap moorings were retrieved on the first cruise and reinstalled on the October cruise for the winter of 1992.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29′ 53″	79° 53′ 59″
84	41° 55′ 51″	81° 38′ 59″
357	41° 49′ 45″	82° 58′ 17″


23
84
e357
LAKE ERIE
Internal Sediment
Loading
Station Positions
1991-1992

TRANSPORT OF CONTAMINANTS

LAKE ONTARIO

LRB STUDIES 82047, 82046, DRS. S.R. JOSHI, C.R. MURTHY

On cruise 91-00-004, the CSS LIMNOS was utilized to collect benthos cores at five stations in the Eastern Basin of Lake Ontario. A current meter mooring (91-01C-11A) with two current meters (21 and 61 m) was installed at station 623.

As an additional task for the University of Waterloo and Bedford Institute of Oceanography, sidescan profiles and reflection seismic profiles along with piston cores and benthos cores were collected in the southeastern basin, Central Basin and Western Basin. Throughout the cruise, surface water samples were collected for tritium analysis.

STATION POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
623	91-00C-11A	43° 29′ 48"	78° 44′ 53"
55		43° 26′ 33"	77° 26′ 15"
63		43° 43′ 47"	77° 00′ 58"
64		43° 31′ 28"	76° 55′ 33"
83		43° 59′ 57"	76° 50′ 36"
PC-1		43° 28′ 55"	76° 45′ 55"
PC-2		43° 32′ 26"	76° 50′ 40"
PC-3		43° 32′ 50"	76° 51′ 21"
PC-4		43° 23′ 31"	76° 52′ 04"
PC-5		43° 21′ 19"	78° 49′ 13"
PC-6		43° 21′ 16"	78° 50′ 29"
PC-7		43° 21′ 10"	78° 52′ 00"
PC-8		43° 20′ 53"	78° 53′ 42"
PC-9		43° 22′ 59"	78° 47′ 25"
PC-10		43° 22′ 46"	78° 48′ 54"
PC-11		43° 22′ 39"	78° 50′ 20"

C S S B A Y F I E L D

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

CSS BAYFIELD
1991

	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
FEB	27	28	29	30	31	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
MAR	24	25	26	27	28	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
APR	31	1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15 LAKE ONTARIO	16 BIOINDEX	17 LAKE	18 ONTARIO	19	20
	21	22 LAKE ONTARIO	23 BIOINDEX	24 LAKE ONTARIO	25	26	27
MAY	28	29 LAKE ONTARIO	30 BIOINDEX	1 LAKE ONTARIO	2	3	4
	5	6 LAKE ONTARIO	7 BIOINDEX	8 QUINTE	9 LAKE ONTARIO	10	11
	12	13 LAKE ONTARIO	14 BIOINDEX	15 LAKE ONTARIO	16	17	18
	19	20	21 LAKE ONTARIO	22 BIOINDEX	23 QUINTE	24 LAKE ONTARIO	25
JUN	26	27 LAKE ONTARIO	28 BIOINDEX	29 LAKE ONTARIO	30	31	1
	2	3 LAKE ONTARIO	4 BIOINDEX	5 QUINTE	6 LAKE ONTARIO	7	8
	9 OPEN HOUSE OAKVILLE	10 LAKE ONTARIO	11 BIOINDEX	12 LAKE	13 ONTARIO	14	15
	16	17 LAKE ONTARIO	18 BIOINDEX	19 QUINTE	20 LAKE ONTARIO	21	22
	23	24 LAKE ONTARIO	25 BIOINDEX	26 LAKE	27 ONTARIO	28	29
JUL	30	1	2 LAKE ONTARIO	3 BIOINDEX	4 QUINTE	5 LAKE ONTARIO	6
	7	8 LAKE ONTARIO	9 BIOINDEX	10 LAKE	11 ONTARIO	12	13
	14	15 LAKE ONTARIO	16 BIOINDEX	17 QUINTE	18 LAKE	19 ONTARIO	20
	21	22 LAKE ONTARIO	23 BIOINDEX	24 LAKE	25 ONTARIO	26	27
AUG	28	29 LAKE ONTARIO	30 BIOINDEX	31 QUINTE	1 LAKE ONTARIO	2	3
	4	5	6 LAKE ONTARIO	7 BIOINDEX	8 LAKE	9 ONTARIO	10
	11	12 LAKE ONTARIO	13 BIOINDEX	14 QUINTE	15 LAKE ONTARIO	16	17
	18	19 LAKE ONTARIO	20 BIOINDEX	21 LAKE ONTARIO	22	23	24
	25	26 LAKE ONTARIO	27 BIOINDEX	28 QUINTE	29 LAKE	30 ONTARIO	31
SEP	1	2	3 LAKE ONTARIO	4 BIOINDEX	5 LAKE	6 ONTARIO	7
	8	9 LAKE ONTARIO	10 BIOINDEX	11 QUINTE	12 LAKE ONTARIO	13	14
	15	16 LAKE ONTARIO	17 BIOINDEX	18 LAKE ONTARIO	19	20	21
	22	23 CHANGE OVER	24 CSS BAYFIELD	25 TO	26 CSS LOUIS M	27 LAUZIER	28
OCT	29	30	1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
NOV	27	28	29	30	31	1	2
	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
DEC	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				

CSS LOUIS M. LAUZIER
1991

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
FEB	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	1	2
MAR	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
APR	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
MAY	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
JUN	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	1	2	3	4	5	6
JUL	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
AUG	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
SEP	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23 CHANGE OVER	24 CSS DAYFIELD	25 TO	26 CSS LOUIS M.	27 LAUZIER	28
	29	30 LAKE ONTARIO	1 BIOINDEX	2 LAKE	3 ONTARIO	4	5
OCT	6	7 LAKE ONTARIO	8 BIOINDEX	9 QUINTE	10 ONTARIO	11	12
	13	14	15 LAKE ONTARIO	16 BIOINDEX	17 LAKE ONTARIO	18	19
	20	21 LAKE ONTARIO	22 BIOINDEX	23 QUINTE	24 LAKE ONTARIO	25	26
	27	28 LAKE ONTARIO	29 BIOINDEX	30 LAKE ONTARIO	31	1	2
NOV	3	4	5 LAKE ONTARIO	6 TROPHIC	7 TRANSFER	8 LAKE ONTARIO	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
DEC	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23	24	25	26	27	28
	29	30	31				

CSS LOUIS M. LAUZIER

near Pointe de Saint-Vallier, Quebec

BIOINDEX AND QUINTE

GLLFAS NO. 9011, DR. O.E. JOHANNSSON
GLLFAS NO. 9118, E.S. MILLARD

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

The CSS BAYFIELD was decommissioned in September of this year. The ship, CSS LOUIS M. LAUZIER, transferred to Ontario from the Quebec Region, was pressed into service to complete the Bioindex and Quinte sampling programs. The cruise scheduled for the week of September 16 was cancelled and all sampling equipment was transferred from the BAYFIELD to the LAUZIER at that time. The rest of the season was completed, commencing the week of September 23, by the new ship with little disruption to the sampling program.

There were 28 Bioindex cruises completed by the research vessels CSS BAYFIELD and CSS LOUIS M. LAUZIER on Lake Ontario. The first cruise began the week of April 15 and the last was completed during the week of October 28. One additional set of samples was collected from the CSS LIMNOS during the Open Lake Surveillance cruise early in April.

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

The Project Quinte sampling program began the week of May 6. Five stations in the Bay of Quinte were sampled in support of GLLFAS Project 9118 on a biweekly basis. This work served as a continuation of the long-term monitoring program carried out since 1972 for Project Quinte. The five stations were T (Trenton), B (Belleville), HB (Hay Bay), C (Conway) and N (Deseronto). Typical sampling on these stations included a temperature/depth profile, a transmissometer cast and an integrated water sample for chlorophyll a, particulate organic carbon, water quality and seston. A dissolved oxygen profile, a light extinction profile and primary productivity and P kinetics experiments were done. Zooplankton samples were collected using a Schindler-Patalas trap. At station B, zooplankton grazing experiments were carried out using a Haney grazing chamber and radio-labelled algae. At all stations, water samples were collected for the Ministry of the Environment, including samples of metals, reactive soluble phosphorus, algae and nutrients.

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

1. Benthos samples were collected for Mr. R.M. Dermott, GLLFAS from Lake Ontario stations 41, 81A, 93 and 93A on several occasions and once at several stations in the Bay of Quinte area (Belleville, Big Bay, Glenora, Conway, LOX, 13A - 13F and C2).

2. Six benthos cores were collected in Big Bay in the Bay of Quinte for Dr. P. Manning (Study 82025) on May 8.

3. On two occasions during the season, zooplankton samples were collected for the Ontario Ministry of Natural Resources from stations at Poplar Point (PP), Wellington (W), Presqu'ile (P), Cobourg (CB), Burlington Beach (HB) and Port Credit (PC).

4. Open House onboard the BAYFIELD was held on June 9 for the Heritage Days celebration in Oakville.

5. In conjunction with the Lake Ontario Trophic Transfer cruise undertaken aboard the CSS LIMNOS, the CSS LOUIS M. LAUZIER was tasked to collect one Shipek bottom grab and one zooplankton net haul for Mysis reticulata at each station on LOTT transects 2 and 7. Shipek grab samples were collected from each of stations 33A, 33B, 33C, 34 and 35. Net hauls and grabs were collected at stations 28, 29 and 33. Only Shipek grabs were collected from each of stations 64D, 64E, 64F, 64G, 64H and 64I.

6. Integrated water samples from the epilimnion were collected for Ms. J. LeBlanc (University of Waterloo) on several cruises from station 41.

7. Net hauls were done by Ms. R. Demelo (University of Guelph) at stations 41, B, N and HB during the week of October 22.

STATISTICS SUMMARY

77

CRUISE NO. 91-00-301 TO 91-00-329 SHIP CSS BAYFIELD / CSS LOUIS M. LAUZIER

DATES FROM April 15 TO November 8, 1991 LAKE ONTARIO

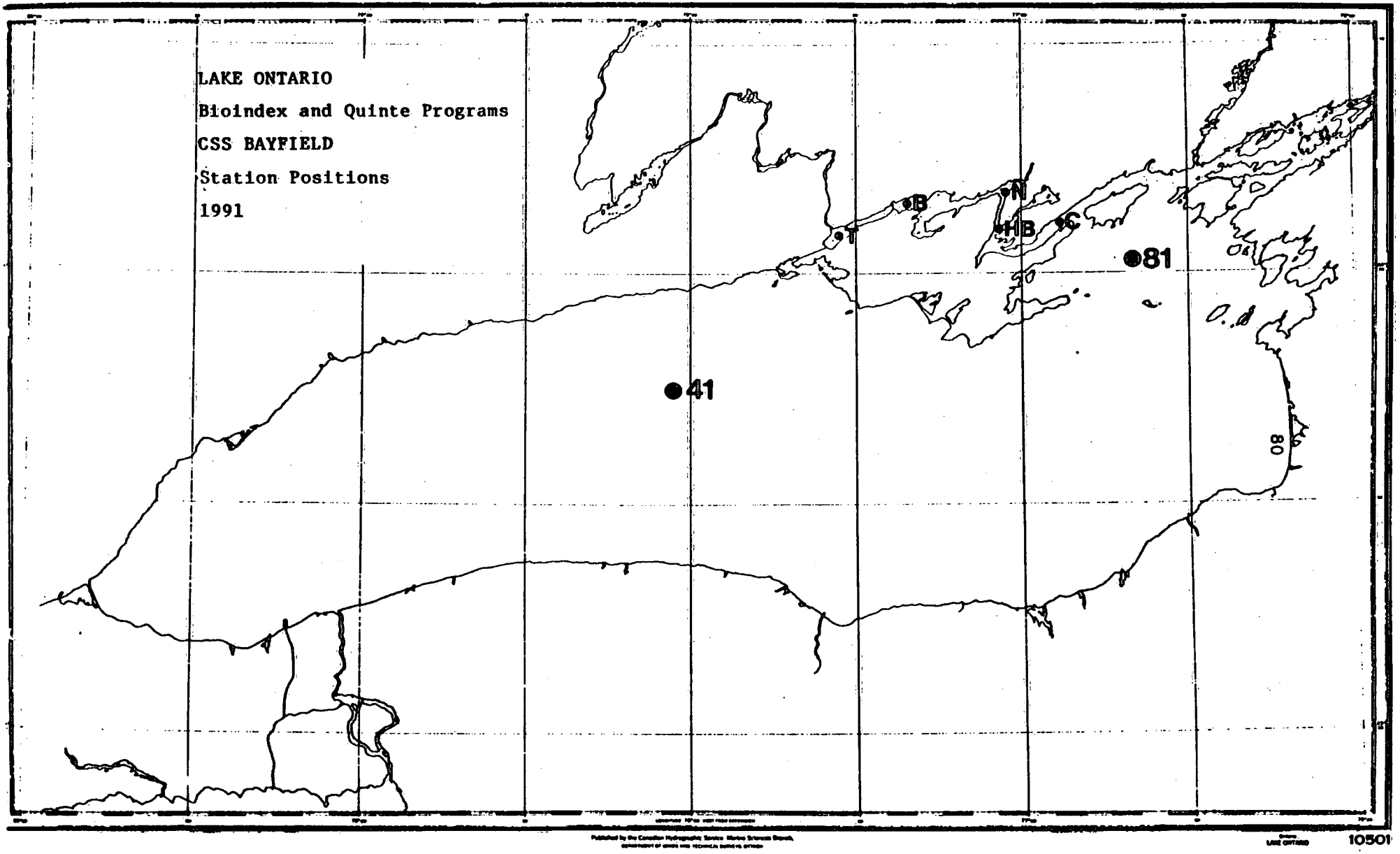
CRUISE TYPE Bioindex - Quinte N. MILES STEAMED 10339

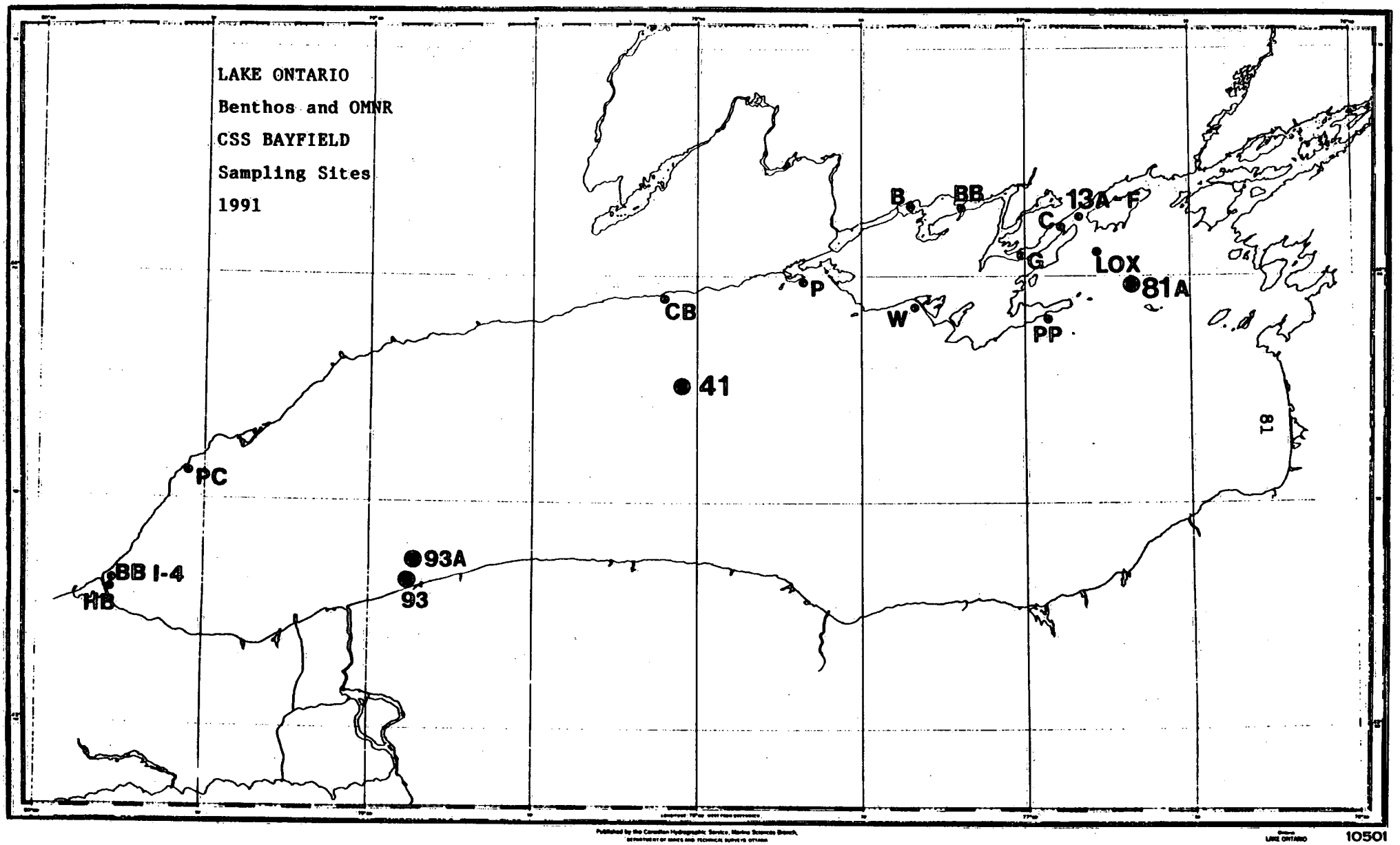
DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	212	Moorings Established , Marker	4
EBT Casts	156	" Retrieved, Marker	4
Rosette Casts	106	" Established	
Transmissometer Casts	105	" Retrieved	
Reversing Thermometer Obs. (No. of Therm)	8	" Established	
Secchi Disc Observations	169	" Retrieved	
Closing Nets	16	" Refurbished	
Zooplankton Hauls	77	" Serviced	
Integrator 10 m	16	" Serviced	
Integrator 20 m	44	Primary Productivity Moorings	5
Phytoplankton Samples	110		
Zooplankton-Pump	178	Cores Taken, Box	
Schindler	260	Cores Taken, Gravity	
Water Samples Collected (MOE Nutrients)	103	Cores Taken, Piston	
" " " (MOE Algae)	60	Cores Taken	
" " " (MOE RSP)	103	Shipek	14
" " " (D.O.)	245	Grab Samples Taken , Ponar	86
" " " (Cond/pH)	231	Mysids Net Haul	133
" " " (MOE Metals)	103	Bulk Centrifuge Samples	
" " " (T P uf)	167	Grazing	26
" " " (Hanna)	60	Observations, Weather	
" " " ( )		Licor Light Profile	111
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)	694	Solar Radiation	
" " " (POC/TPN)	173		
" " " (Seston)	116		
" " " (T P f)	169		
" " " (Nutrients)	169	ONBOARD ANALYSES	
" " " (Major Ions)	116		
" " " (TP (part.))	64	Manual Chemistry Tech. Ops.	476
" " " ( )		Nutrients (WOB)	
" " " (MOE Nylon)	64	Microbiology	
" " " ( )			

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"
N	Quinte	44° 10′ 30"	77° 02′ 54"
T	Quinte	44° 05′ 12"	77° 32′ 42"
19	LOTT	43° 22′ 58"	79° 17′ 01"
28	LOTT	43° 46′ 35"	78° 50′ 59"
29	LOTT	43° 49′ 47"	78° 52′ 10"
33A	LOTT	43° 33′ 02"	78° 40′ 29"
33B	LOTT	43° 33′ 58"	78° 35′ 48"
33C	LOTT	43° 34′ 24"	78° 32′ 06"
34	LOTT	43° 27′ 24"	78° 45′ 39"
35	LOTT	43° 21′ 44"	78° 43′ 44"
49A	LOTT	43° 38′ 24"	77° 25′ 23"
55A	LOTT	43° 31′ 13"	77° 25′ 39"
64	LOTT	43° 31′ 30"	76° 55′ 36"
64D	LOTT	43° 29′ 27"	76° 57′ 23"
64E	LOTT	43° 28′ 48"	76° 59′ 54"
64F	LOTT	43° 28′ 14"	77° 02′ 20"
64G	LOTT	43° 27′ 39"	77° 05′ 14"
64H	LOTT	43° 26′ 56"	77° 07′ 53"
64I	LOTT	43° 26′ 30"	77° 09′ 48"
715	LOTT	43° 38′ 04"	76° 58′ 06"
716	LOTT	43° 35′ 48"	77° 26′ 30"
41	Benthos	43° 43′ 00"	78° 01′ 36"
81A	Benthos	43° 58′ 54"	76° 39′ 18"
93	Benthos	43° 19′ 36"	78° 52′ 06"
93A	Benthos	43° 21′ 48"	78° 51′ 24"
B	Benthos	44° 09′ 02"	77° 20′ 36"
BB	Benthos	44° 09′ 19"	77° 10′ 19"
G	Benthos	44° 02′ 30"	77° 01′ 24"
C	Benthos	44° 06′ 18"	76° 53′ 42"
C2	Benthos	44° 06′ 17"	76° 56′ 42"

STATION NUMBER	PROJECT	LATITUDE N.	LONGITUDE W.
LOX	Benthos	44° 03′ 36"	76° 46′ 36"
13A	Benthos	44° 07′ 53"	76° 50′ 18"
13B	Benthos	44° 08′ 09"	76° 50′ 28"
13C	Benthos	44° 08′ 10"	76° 50′ 43"
13D	Benthos	44° 07′ 55"	76° 50′ 08"
13E	Benthos	44° 07′ 31"	76° 49′ 51"
13F	Benthos	44° 07′ 25"	76° 49′ 46"
BB1	Mysis	43° 19′ 49"	79° 44′ 17"
BB2	Mysis	43° 19′ 18"	79° 45′ 26"
BB3	Mysis	43° 18′ 08"	79° 45′ 02"
BB4	Mysis	43° 18′ 13"	79° 47′ 04"
PP	OMNR	43° 54′ 14"	76° 54′ 02"
W	OMNR	43° 56′ 24"	77° 19′ 50"
P	OMNR	43° 59′ 27"	77° 40′ 49"
CB	OMNR	43° 57′ 03"	78° 10′ 15"
HB	OMNR	43° 17′ 31"	79° 48′ 05"
PC	OMNR	43° 32′ 08"	79° 34′ 59"


LAKE ONTARIO
Bioindex and Quinte Programs
CSS BAYFIELD
Station Positions
1991
T
B
N
HB
C
81
41
80
10501


LAKE ONTARIO
Benthos and OMNR
CSS BAYFIELD
Sampling Sites
1991
B
BB
13A-F
C
G
Lox
81A
P
CB
W
PP
41
81
PC
93A
BB I-4
HB
93
10501

C S S A D V E N T

CSS ADVENT
1991

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
FEB	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	1	2
MAR	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
APR	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
MAY	5	6	7	8	9	10	11
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	27	28 ST LAWRENCE	29 RIVER	30 ESTUARINE	31 SEDIMENT	1 TRANSPORT
JUN	2 STUDY	3 ST LAWRENCE	4 RIVER	5 ESTUARINE	6 SEDIMENT	7 TRANSPORT	8 ST LAWRENCE RIVER
	9 ESTUARINE	10 SEDIMENT	11 TRANSPORT	12 ST LAWRENCE	13 RIVER	14 ESTUARINE	15 SEDIMENT
	16 TRANSPORT	17 STUDY	18 ST LAWRENCE	19 RIVER	20	21	22
	23	24 LAKE ONTARIO	25 ZEBRA	26 MUSSEL	27 STUDY	28 LAKE ONTARIO	29
	30	1	2	3	4	5	6
JUL	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29 LAKE ONTARIO	30 ZEBRA	31 MUSSEL	1 STUDY	2 LAKE ONTARIO	3
AUG	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26 LAKE ONTARIO	27 ZEBRA	28 MUSSEL	29 STUDY	30 LAKE ONTARIO	31
SEP	1	2	3	4	5	6	7
	8	9	10	11	12	13	14
	15	16	17	18	19	20	21
	22	23 LAKE ONTARIO	24 ZEBRA	25 MUSSEL	26 STUDY	27 LAKE ONTARIO	28
OCT	29	30	1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15 HAMILTON HARBOUR	16 LAKE ONTARIO	17 LIMDANE STUDY	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
NOV	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	30
DEC	1	2	3	4	5	6	7
	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 ZEBRA MUSSEL STUDY

LRB STUDY 82022, M.N. CHARLTON

The purpose of this project is to evaluate the western portion of Lake Ontario that may be affected by colonization of zebra mussels. Since they can cause severe problems in water intakes, it is important to understand if depth, temperature and currents can affect their rate of growth.

This initial study, led by M.N. Charlton, utilized the CSS ADVENT to sample transects on Lake Ontario on the following dates:

June 24 - 28
July 29 - August 2
August 26 - 30
September 23 - 27

At stations 209, 674, 690 and 906, zebra mussel moorings were installed in late April and retrieved in October. Aluminum radar reflectors were clamped to the wire at various depths to determine the ability of zebra mussels to colonize at certain depths. A temperature recorder was attached at a depth of 20 m, except in Hamilton Harbour where the depth was 15 m. Sampling stations were located off the Niagara River, the Burlington piers and on transect lines starting from the north shore and extending several miles southward. The transects ranged from Humber Bay to the Burlington water intake.

At all stations, a water quality profile was taken and samples were collected for total phosphorus, seston, nutrients and chlorophyll a. The sampling depths were 2 m and bottom -2 m if the station depth was greater than 10 m. A Secchi disc observation was made at each station and water was pumped from the sampling depths through a zooplankton net to collect zebra mussel larvae.

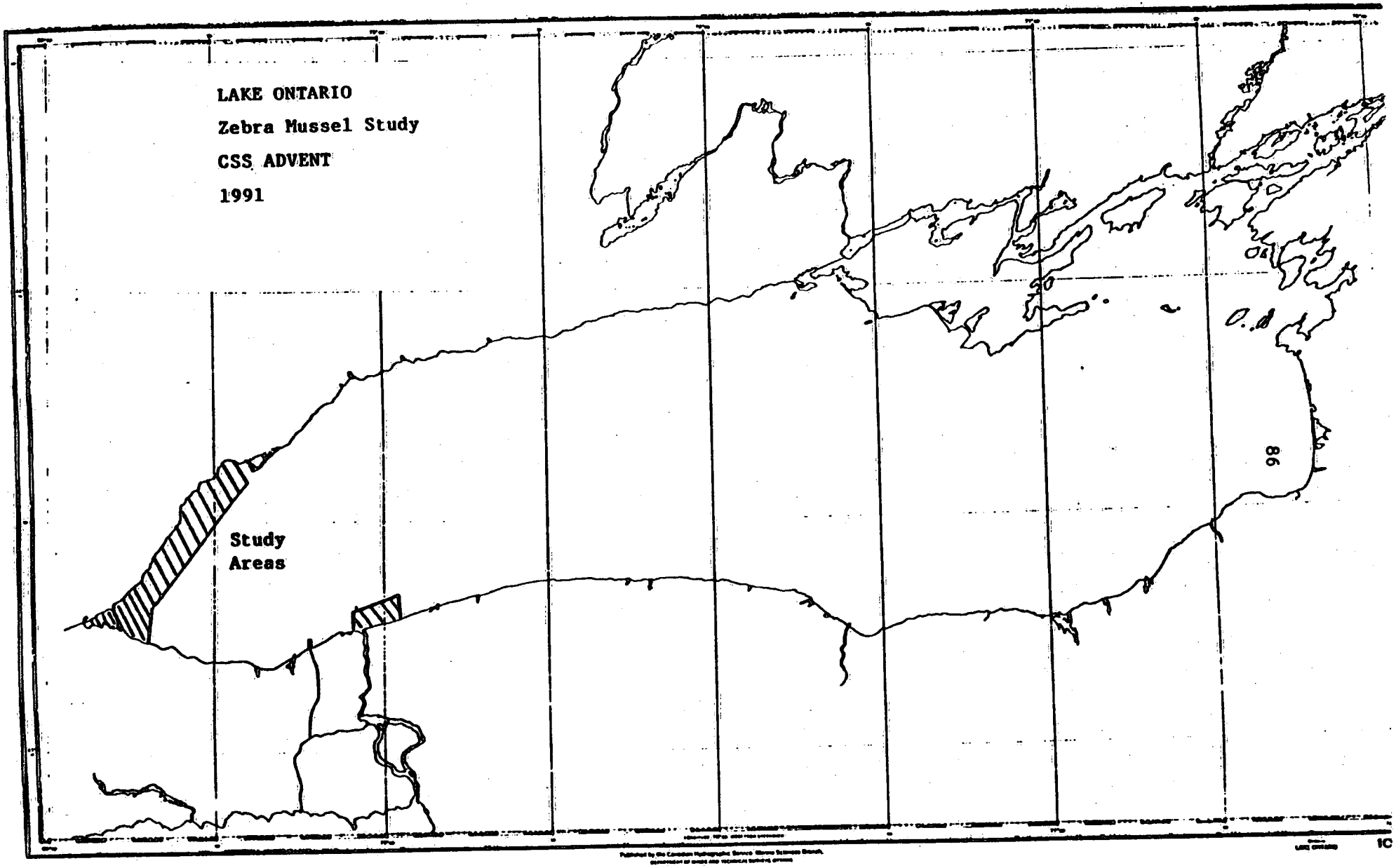
MOORING POSITIONS

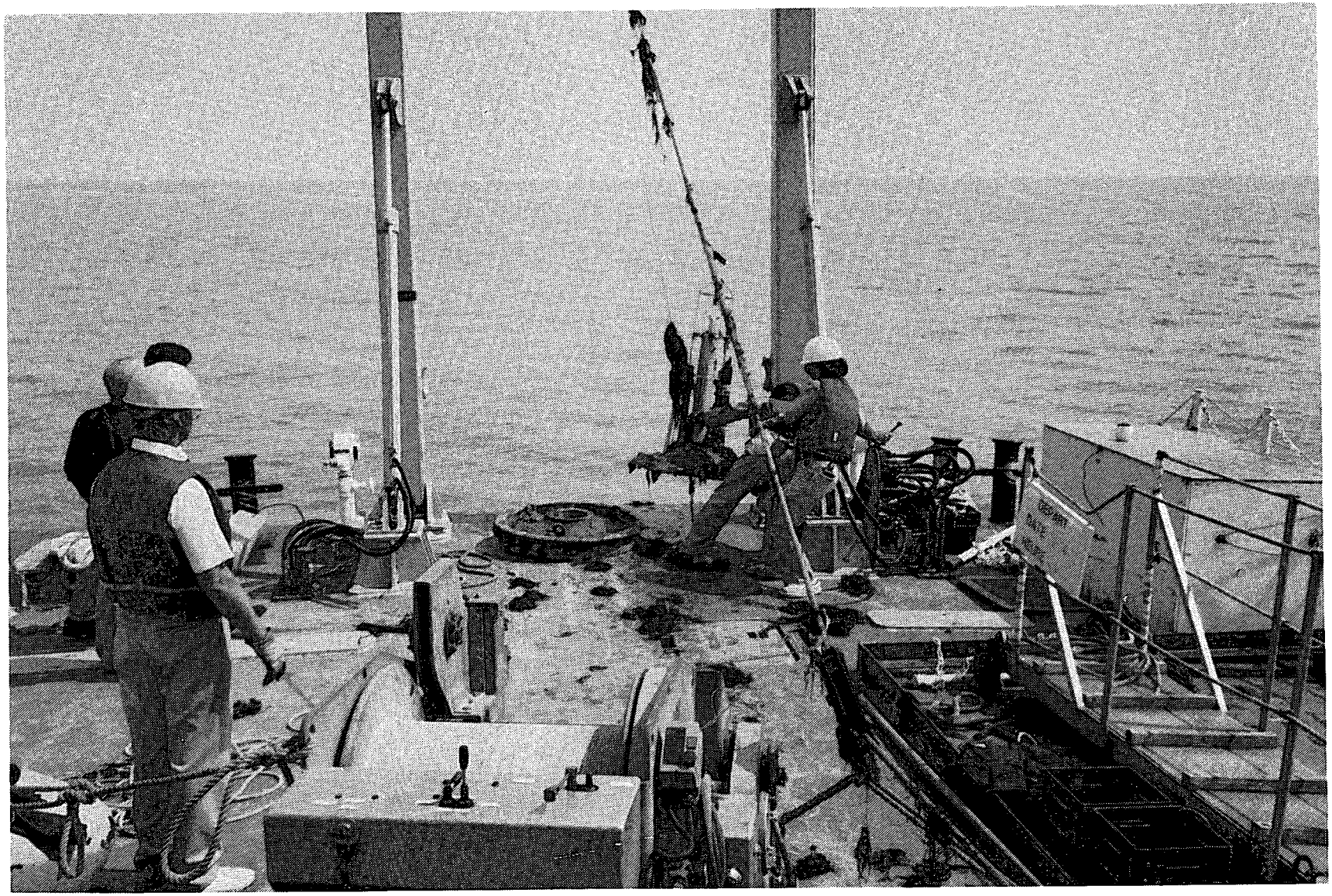
STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	COLONY DEPTH
209	91-00S-06A	43° 20′ 38"	78° 59′ 43"	5,10,15,20, 25,30,35,40, 45,50,55,60
690	91-00S-07A	43° 17′ 30"	79° 41′ 24"	5,10,15,20, 25,30
674	91-00S-08A	43° 26′ 48"	79° 37′ 15"	5,10,15,20, 25,30
906	91-00S-10A	43° 17′ 15"	79° 50′ 18"	2.5,5,7.5, 10,12.5,15, 17.5,20, 22.5,25

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
206	43° 23′ 54"	79° 27′ 42"
209	43° 20′ 38"	78° 59′ 43"
276	43° 15′ 09"	79° 03′ 25"
600	43° 16′ 03"	79° 45′ 45"
627	43° 16′ 42"	79° 44′ 45"
628	43° 17′ 17"	79° 43′ 33"
629	43° 17′ 48"	79° 42′ 55"
630	43° 17′ 49"	79° 42′ 25"
631	43° 18′ 45"	79° 41′ 24"
632	43° 20′ 09"	79° 45′ 42"
633	43° 20′ 00"	79° 45′ 11"
634	43° 19′ 54"	79° 45′ 02"
635	43° 19′ 45"	79° 44′ 36"
636	43° 19′ 36"	79° 44′ 08"
637	43° 19′ 22"	79° 43′ 18"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
638	43° 24′ 10"	79° 41′ 08"
639	43° 24′ 02"	79° 40′ 58"
640	43° 23′ 56"	79° 40′ 37"
641	43° 23′ 43"	79° 40′ 16"
642	43° 23′ 27"	79° 39′ 42"
643	43° 26′ 35"	79° 39′ 31"
644	43° 26′ 31"	79° 39′ 20"
645	43° 26′ 20"	79° 39′ 05"
646	43° 26′ 07"	79° 38′ 48"
647	43° 25′ 55"	79° 38′ 33"
648	43° 25′ 37"	79° 37′ 50"
649	43° 27′ 47"	79° 38′ 23"
670	43° 27′ 31"	79° 38′ 00"
671	43° 27′ 36"	79° 37′ 50"
672	43° 27′ 18"	79° 37′ 33"
673	43° 27′ 07"	79° 37′ 08"
674	43° 26′ 48"	79° 37′ 15"
675	43° 26′ 47"	79° 36′ 30"
676	43° 29′ 54"	79° 35′ 43"
677	43° 29′ 46"	79° 35′ 30"
678	43° 29′ 38"	79° 35′ 19"
679	43° 29′ 28"	79° 35′ 06"
680	43° 29′ 22"	79° 34′ 49"
681	43° 29′ 14"	79° 34′ 36"
682	43° 28′ 55"	79° 34′ 03"
683	43° 37′ 33"	79° 28′ 07"
684	43° 37′ 25"	79° 28′ 03"
685	43° 37′ 07"	79° 27′ 42"
686	43° 36′ 48"	79° 27′ 18"
687	43° 36′ 35"	79° 26′ 55"
688	43° 36′ 17"	79° 26′ 33"
689	43° 35′ 42"	79° 25′ 59"
690	43° 17′ 30"	79° 41′ 24"
906	43° 17′ 15"	79° 50′ 18"


LAKE ONTARIO
Zebra Mussel Study
CSS ADVENT
1991
Study
Areas
86



BOTTOM-MOUNTED CURRENT METER RETRIEVAL

ABOARD CSS LOUIS M. LAUZIER

ST. LAWRENCE RIVER ESTUARY CURRENT STUDY

LRB STUDY 82045, DR. P.F. HAMBLIN

The development of a mathematical model of estuarine circulation would provide valuable insight into sedimentation and contaminant movement in the St. Lawrence River Estuary by providing baseline data from which to plan future studies in these areas. The purpose of this study is to produce data on current and suspended sediment movement in several areas in the St. Lawrence estuary for use in the initialization and verification of the results of a three-dimensional mathematical model of estuarine circulation. An Acoustic Doppler Current Profiler (ADCP) was installed aboard the CSS ADVENT and used to measure current speed and direction and sediment flux in the estuary by linking it via computer to the shipboard gyrocompass and Global Positioning System (GPS).

The study was run jointly with the Institut Maurice Lamontagne in Mont Joli, Quebec. The CSS LOUIS M. LAUZIER, based in Rimouski, was equipped with a GPS positioning system and an ADCP and assigned the task of running current measurement transects downstream of Ile aux Coudres concurrent with the ADVENT's work upstream in shallower water.

The CSS ADVENT departed Burlington for cruise 91-07-401 on the St. Lawrence River at 1400 hours on May 28 and transitted to its berth in the Louise Basin at Quebec City. Scientific personnel joined the ship on June 3 having travelled to the study area by crewcab with the ADCP and the Profiler for Estuarine Sediment Transport (PEST) onboard.

The ADCP and PEST were installed onboard the vessel and tested while underway on transect #1 between the Gulf Oil and Ultramar terminals and at anchor in the Charles River Basin. An SACM bottom-mounted current meter mooring equipped with transmission/backscattering, pressure and conductivity recording capability was then launched at station 601 in the Chenal Traverse Du Milieu. ADCP and PEST profiles were done on station 601 to give comparative data to the SACM results.

Several transects of the river were run with the ADCP in operation. PEST profiles were done at the beginning and end of each transect and a seston sample collected from the bottom depth. In order to ensure that the data collected by the two vessels was comparable, the ships ran two transects in tandem. These transects ran from Point de Saint-Vallier to Pointe a Blaye and from red buoy HP #8 to Rocher Casault. Another ADCP profile was run downstream against the flood tide from station 605, twelve miles upstream of the Sainte-Foy bridge to the Louise Basin Marina. Transect #4 runs from Rocher Casault through the Passe Patience

to Cap Tourmente. Four passes were made of this transect with the ADCP over a 12-hour period in an effort to sample a complete tidal cycle.

Scientific personnel made the return trip to Burlington on June 13 by crewcab with the ADCP and PEST onboard. The CSS ADVENT began the trip home the same day and arrived at the dock in Burlington on June 19.

Experience gained handling the ADCP and the GPS link during the cruise will prove quite valuable in future applications of the ADCP.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
601	47° 09′ 59"	70° 30′ 19"
602	46° 55′ 31"	70° 51′ 21"
603	47° 00′ 46"	70° 41′ 52"
604	47° 04′ 24"	70° 44′ 26"
605	46° 42′ 45"	71° 26′ 04"
606	46° 59′ 00"	70° 39′ 45"

STATISTICS SUMMARY

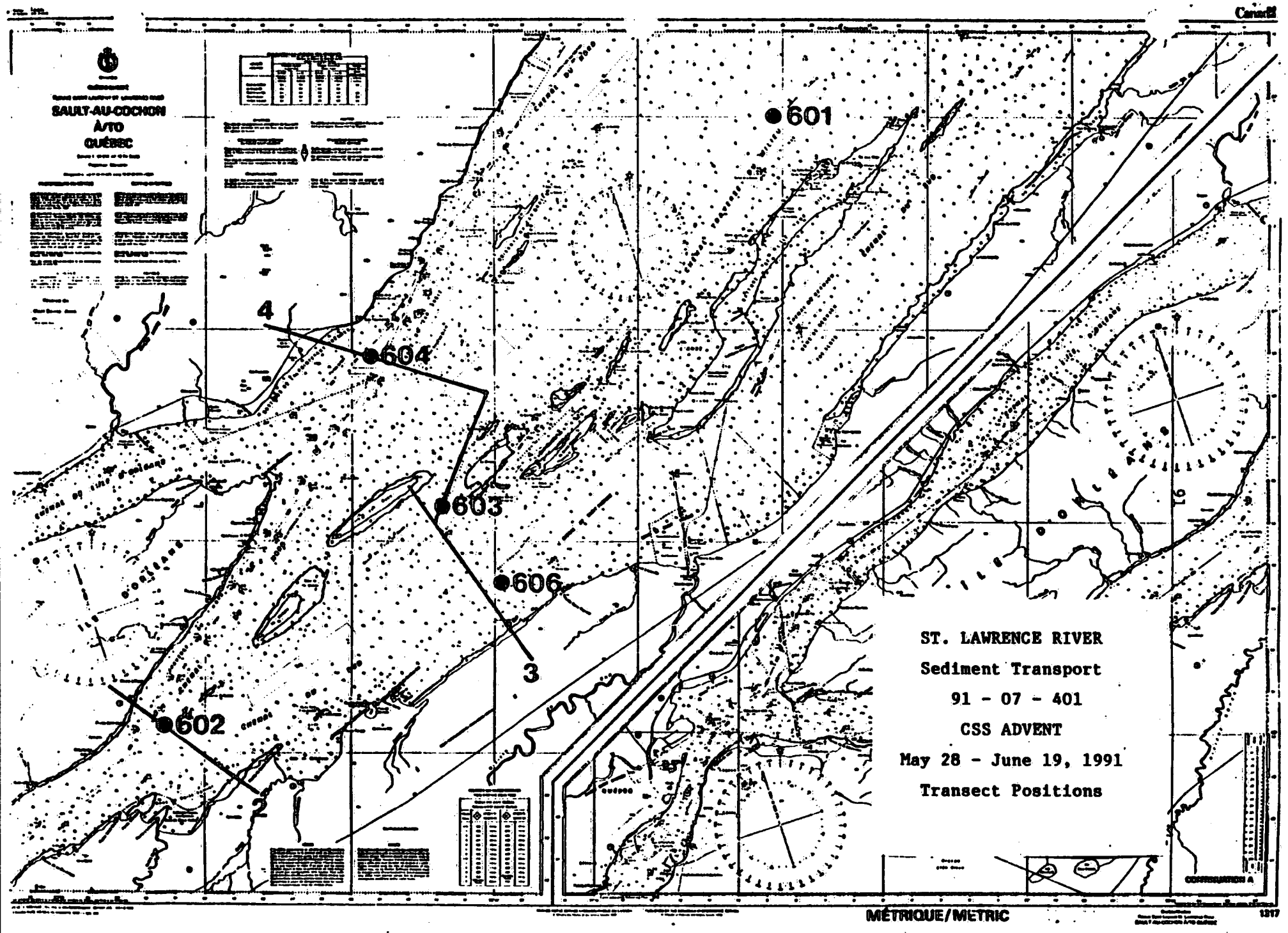
90

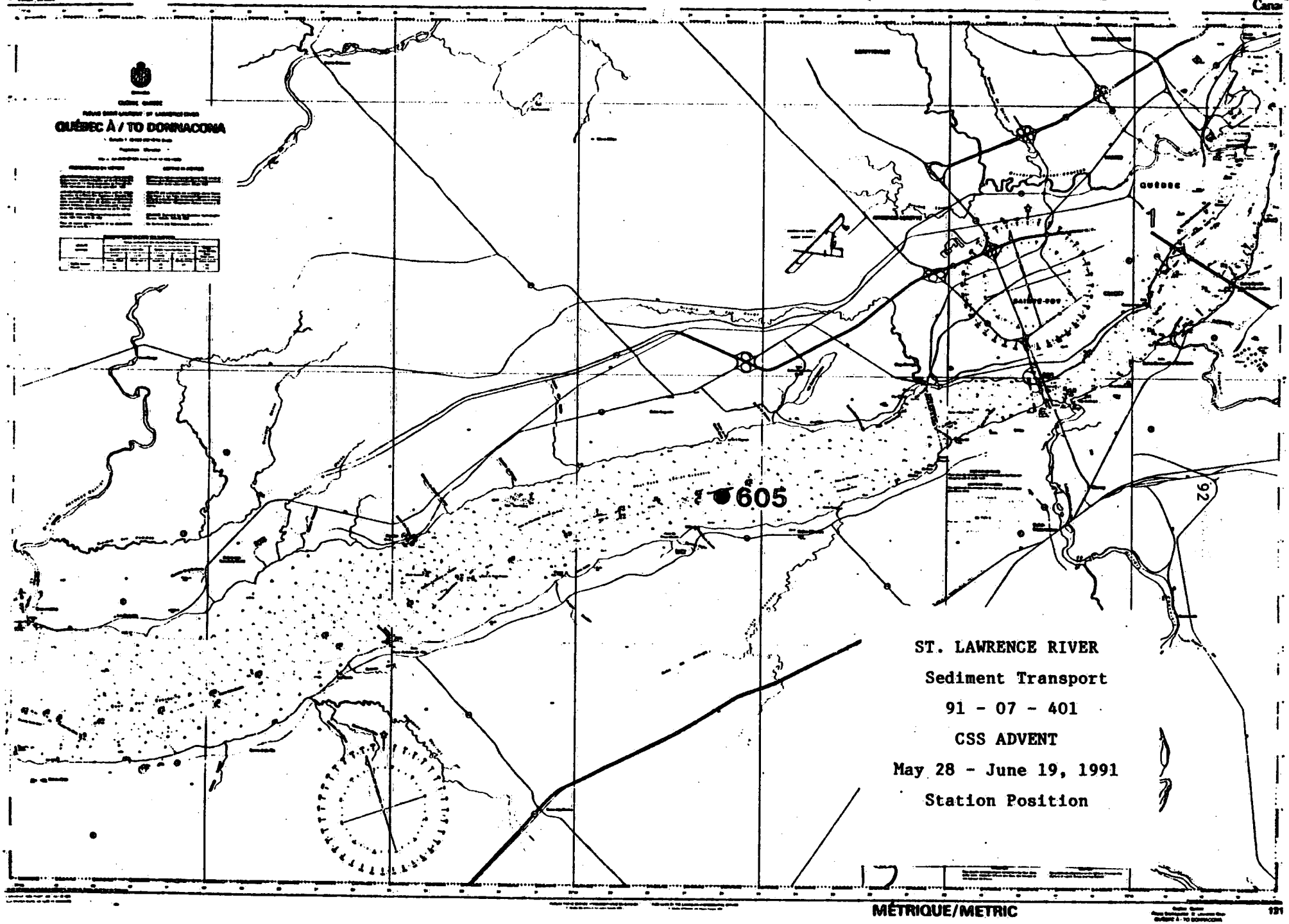
CRUISE NO. 91-07-401 CONSECUTIVE NO. 701 SHIP CSS ADVENT

DATES FROM May 28 TO June 19, 1991 LAKE ST. LAWRENCE RIVER

CRUISE TYPE Sediment Transport N. MILES STEAMED 586.2

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	13	Moorings Established , SACM	1
EBT Casts		" Retrieved	
Rosette Casts		" Established	
Transmissometer Casts		" Retrieved	
Reversing Thermometer Obs. (No. of Therm)		" Established	
Secchi Disc Observations		" Retrieved	
		" Refurbished	
Zooplankton Hauls		" Serviced	
Integrator 10 m		" Serviced	
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
		Cores Taken, Box	
		Cores Taken, Gravity	
Water Samples Collected (Microbiology)		Cores Taken, Piston	
" " " (Water Quality)		Cores Taken	
" " " ( )			
" " " (D.O.)		Grab Samples Taken	
" " " (Cond/pH)			
" " " ( )		Bulk Centrifuge Samples	
" " " (T P uf)			
" " " (TKN)		Observations, Weather	13
" " " ( )			
" " " ( )		CONTINUOUS OBSERVATIONS (days)	
Water Samples Filtered (Chlorophyll)		Solar Radiation	
" " " (POC/TPN)			
" " " (Seston)	13		
" " " (T P f)			
" " " (Nutrients)		ONBOARD ANALYSES	
" " " (Major Ions)			
" " " ( )		Manual Chemistry Tech. Ops.	
" " " ( )		Nutrients (WOB)	
" " " ( )		Microbiology	
" " " ( )			


SAULT-AU-COCHON
À/TO
QUÉBEC
601
604
603
606
602
4
3
2
ST. LAWRENCE RIVER
Sediment Transport
91 - 07 - 401
CSS ADVENT
May 28 - June 19, 1991
Transect Positions
MÉTRIQUE/METRIC


QUÉBEC À / TO DOMINACONA
605
ST. LAWRENCE RIVER
Sediment Transport
91 - 07 - 401
CSS ADVENT
May 28 - June 19, 1991
Station Position
MÉTRIQUE/METRIC

SHORE PROGRAMS

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

HAMILTON HARBOUR STUDIES

Hamilton Harbour was identified as an area of concern by the International Joint Commission in 1985. It was recommended that the harbour be used as a Canadian site for implementing a rehabilitation plan. During the last 19 years, the Ministry of the Environment has concentrated on monitoring water and sediment quality in terms of oxygen depletion and the sources and fates of contaminants. This is the sixth year of NWRI involvement in a major thrust to answer questions related to harbour rehabilitation. Six studies were supported by Technical Operations and organized into a single program to collect the data required to answer these questions. Technical Operations co-ordinated the following activities:

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

The vessels utilized to support the Hamilton Harbour Project included the CSS LIMNOS, CSL SHARK, CSL AGILE, CSL CORMORANT, GOOSE II and Mason #4.

STUDY PROGRAMS

1.	82026	Boyce	Hamilton Harbour Physical Studies
2.	82022	Charlton	Lake Ontario/Hamilton Harbour Study
3.	82028	Fox	Persistent Organic Contaminants
4.	82072	Murphy	Hamilton Harbour Restoration
5.	82015	Reynoldson	Benthic Invertebrates
6.	82012	Rukavina	Acoustics of Sediments

BENTHIC INVERTEBRATES

LRB STUDY 82015, DR. T.B. REYNOLDSON

Sediment samples were collected from Hamilton Harbour throughout the field season to study the temporal changes in benthic community structure. An IJC protocol to classify the degree of sediment

contamination and the potential for bioaccumulation of contaminants was evaluated. On eight occasions, cores and Ekman dredge samples were collected at two stations in Hamilton Harbour (Western Basin and Deep Basin, fig. 4).

Samples were collected on the following dates: May 9, 22; June 6, 17; July 13; August 21; September 24; October 28.

HAMILTON HARBOUR SEDIMENTATION REGIME

LRB STUDY 82022, DR. M.N. CHARLTON

Four sediment trap moorings were installed in Hamilton Harbour to measure sedimentation and, indirectly, the extent of resuspension by wind and currents. The organic metal content of the sediment samples was also measured. The barge GOOSE II was utilized for all sediment trap mooring operations (fig. 2).

The four sediment trap moorings, which had been left in the harbour for the winter, were located and refurbished during the month of May. Subsequent refurbishments took place: June 17 - 19, July 19, August 22 - 23, September 25 - 26 and December 2 - 6.

An additional sediment trap was suspended from the Windemere bridge on May 28 to collect suspended sediment from the Red Hill Creek. The trap was refurbished on July 30, September 5, October 2 and removed on December 5.

HAMILTON HARBOUR OXYGEN REGIME

LRB STUDY 82022, M.N. CHARLTON

The digital dissolved oxygen profiler was used throughout the field season (May - September) to monitor changes in oxygen concentration 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. Five cruises were conducted with the profiler, occupying 26 stations per cruise (fig. 3).

Profiler cruises were conducted on the following dates: May 23, June 11, July 17, August 14 and September 20.

HAMILTON HARBOUR WATER QUALITY

LRB STUDY 82022, M.N. CHARLTON

Six water quality cruises, each occupying 26 stations, were conducted between April and September (fig. 3). Water samples were collected from 1 m and bottom -2m and analyzed for total phosphorus, filtered and unfiltered, chlorophyll a and nutrients.

Water quality cruises were conducted on the following dates: April 12, May 16, June 10, July 16, August 13 and September 16.

HAMILTON HARBOUR SEDIMENT NITRIFICATION

LRB STUDY 82022, R. ROY

Four cruises, each occupying 21 stations, were conducted during the summer on which sediment samples were collected, using an Ekman dredge (fig. 5). Samples were returned to CCIW for nitrification and denitrification analyses.

HAMILTON HARBOUR PHYSICAL STUDIES

LRB STUDY 82026, F.M. BOYCE

The purpose of this study was to determine the current flow patterns in Hamilton Harbour, using four Neil Brown current meter moorings as well as surface drogue tracking. The data collected will be used to form a data bank of hydrodynamical information for Hamilton Harbour models.

Current meters were installed on July 3 and removed on December 9 (fig. 1). The moorings were removed for cleaning of zebra mussels on September 3, 4 and replaced immediately.

The CSL AGILE was utilized to support the drogue-tracking exercises which used the Falcon mini-ranger positioning system to display drogue positions as UTM co-ordinates. Drogue tracking was carried out: July 31; August 1, 2; September 11, 12, 13, 24, 25.

The ADCP current meter was installed on the bottom from August 21 to September 9 to collect detailed measurements of water movement.

Water levels in Hamilton Harbour were recorded using tide gauges placed on the bottom in three different locations (fig. 6). Gauges were installed and removed on the following dates:

INSTALLATION	REMOVAL
July 3	August 6
August 8	September 4
September 6	November 1
November 4	December 9

A meteorological buoy was placed in the harbour on July 3 and decommissioned November 7. Data return was 100%!

PERSISTENT ORGANIC CONTAMINANTS

LRB STUDY 82028, M.E. FOX

Surface water samples were collected on two occasions at the four sediment trap sites to provide information on current input of organic contaminants into Hamilton Harbour. The water samples were used in conjunction with data from the sediment traps to determine point sources for these contaminants as well as the degree of mixing taking place.

In addition, the ADCP current profiler was installed at the bottom of the Burlington Canal from December 1990 to April 1991. Measurements were taken to determine the net export of harbour water into Lake Ontario.

HAMILTON HARBOUR RESTORATION

LRB STUDY 82072, DR. T.P. MURPHY

This study was initiated to investigate the toxicity of recent sediments in Hamilton Harbour. Samples were collected from 27 different sites in the harbour (fig. 7), using a Shipek grab sampler, and after subsectioning with a short piece of core tube, the top 1 cm of sediment was extruded into sample bags for later analysis. Samples were collected from the CSL AGILE using the Falcon mini-ranger for positioning.

MINI-RANGER SHORE STATIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
CCIW-CORN	43° 18′ 00"	79° 48′ 16"	4794605.	596971.
HARB.COMM.	43° 16′ 41"	79° 51′ 42"	4792097.	592364.
STELCO	43° 17′ 06"	79° 49′ 33"	4792908.	595260.
CHOP	43° 17′ 50"	79° 48′ 05"	4794294.	597226.

CHARLTON OXYGEN/WATER QUALITY SURVEY

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
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.
926	43° 18′ 27"	79° 48′ 28"	4795438.	596693.

CHARLTON SEDIMENT TRAP MOORINGS

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
91-00A-50A	43° 18′ 22"	79° 48′ 51"	4795288.	596183.
91-00A-51A	43° 16′ 46"	79° 52′ 26"	4792237.	591364.
91-00A-52A	43° 17′ 21"	79° 50′ 27"	4793370.	594048.
91-00A-53A	43° 17′ 08"	79° 47′ 45"	4793015.	597697.

REYNOLDSON INVERTEBRATE STATIONS

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

ROY SEDIMENT NITRIFICATION SURVEY

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
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.
915	43° 16′ 18"	79° 47′ 15"	4791482.	598396.
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.
926	43° 18′ 27"	79° 48′ 28"	4795438.	596693.
929	43° 18′ 11"	79° 50′ 00"	4794930.	594618.
933	43° 17′ 30"	79° 51′ 20"	4793632.	592852.
934	43° 16′ 37"	79° 50′ 30"	4792000.	594000.

BOYCE CURRENT METER MOORINGS

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
91-00C-16A	43° 18′ 18"	79° 48′ 44"	4795155.	596337.
91-00C-17A	43° 16′ 35"	79° 50′ 07"	4791951.	594511.
91-00C-18A	43° 16′ 47"	79° 52′ 23"	4792279.	591441.
91-00C-19A	43° 17′ 23"	79° 50′ 30"	4793425.	593972.

BOYCE TIDE GAUGES

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
91-00P-21A	43° 18′ 27"	79° 48′ 43"	4795433.	596355.
91-00P-22A	43° 16′ 45"	79° 52′ 32"	4792215.	591239.
91-00P-23A	43° 17′ 08"	79° 47′ 38"	4793017.	597855.

BOYCE METEOROLOGICAL BUOY

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
91-00M-20A	43° 17′ 22"	79° 50′ 29"	4793394.	593995.

BOYCE ADCP CURRENT METER

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
91-00C-20A	43° 17′ 21"	79° 50′ 29"	4793363.	593995.

FOX ADCP CURRENT METER

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
90-00C-23A	43° 17′ 52"	79° 47′ 53"	4794369.	597497.

MURPHY SEDIMENT TOXICITY SURVEY

STATION NUMBER	LATITUDE N.	LONGITUDE W.	UTM N.	UTM E.
1	43° 18′ 27"	79° 48′ 28"	4795437.779	596693.244
2	43° 18′ 20"	79° 48′ 22"	4795223.770	596831.504
6	43° 17′ 08"	79° 47′ 52"	4793012.379	597539.357
9	43° 16′ 14"	79° 47′ 09"	4791360.583	598532.653
15	43° 17′ 20"	79° 48′ 11"	4793376.412	597105.851
19	43° 18′ 31"	79° 49′ 15"	4795546.140	595632.643
25	43° 16′ 49"	79° 48′ 17"	4792418.177	596984.316
28	43° 17′ 39"	79° 49′ 13"	4793942.658	595700.356
29	43° 18′ 08"	79° 49′ 26"	4794833.132	595394.820
33	43° 17′ 16"	79° 49′ 12"	4793233.464	595732.911
36	43° 17′ 26"	79° 49′ 54"	4793528.646	594782.077
37	43° 17′ 50"	79° 50′ 11"	4794263.660	594388.667
41	43° 17′ 17"	79° 50′ 08"	4793246.606	594470.454
45	43° 16′ 50"	79° 49′ 48"	4792419.998	594932.839
47	43° 16′ 35"	79° 50′ 00"	4791953.492	594668.832
48	43° 16′ 19"	79° 49′ 57"	4791460.864	594743.349
53	43° 17′ 16"	79° 50′ 30"	4793208.866	593975.088
55	43° 17′ 46"	79° 50′ 55"	4794126.529	593398.929
57	43° 17′ 17"	79° 50′ 57"	4793231.306	593366.186
58	43° 16′ 50"	79° 50′ 38"	4792404.312	593805.896
61	43° 16′ 18"	79° 50′ 30"	4791419.664	593999.889
74	43° 16′ 32"	79° 51′ 16"	4791837.248	592957.032
75	43° 16′ 25"	79° 51′ 02"	4791625.643	593275.571
76	43° 16′ 34"	79° 51′ 48"	4791889.095	592234.891
79	43° 16′ 50"	79° 52′ 19"	4792373.200	591529.473
80	43° 17′ 04"	79° 52′ 17"	4792805.684	591568.718
90	43° 16′ 48"	79° 53′ 18"	4792293.682	590200.503

Fig. 1
CURRENT METER
MOORING
LOCATIONS

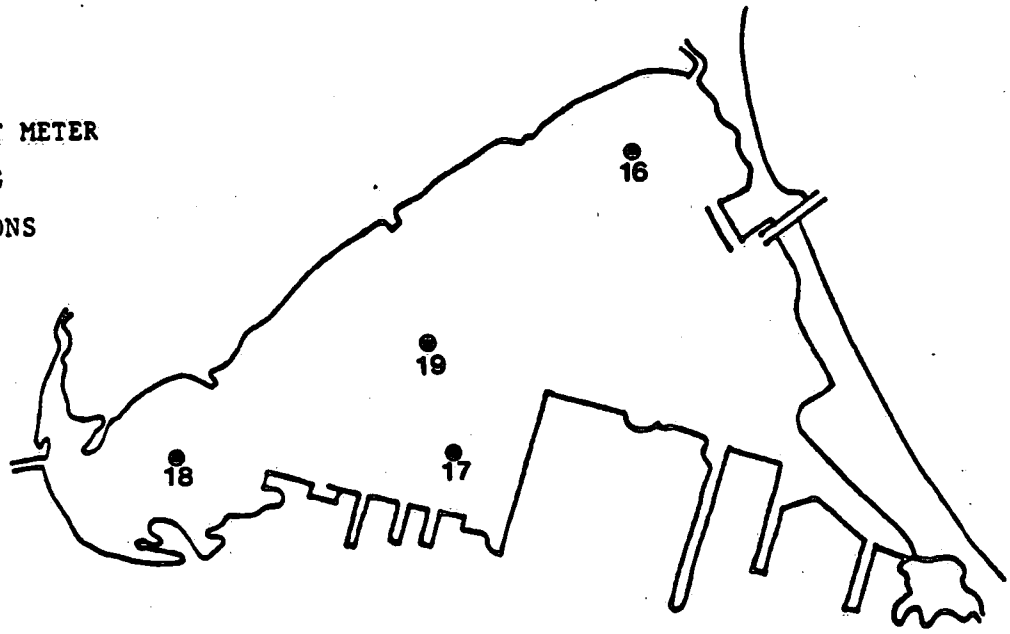


Fig. 2
SEDIMENT TRAP
MOORING
LOCATIONS

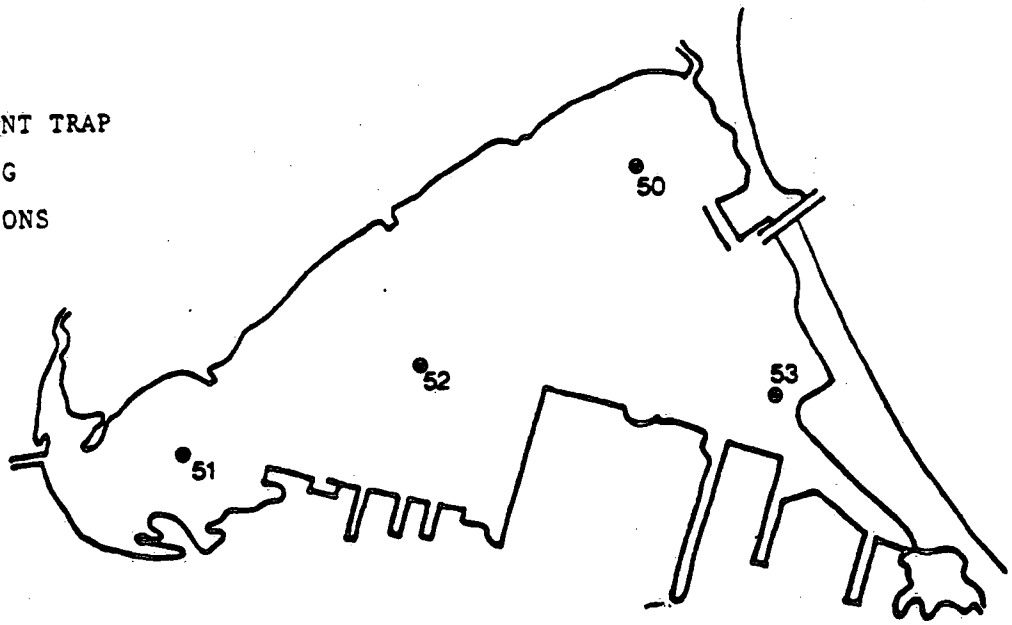


Fig. 3
D.O./W.Q. SURVEY
SAMPLING
STATIONS

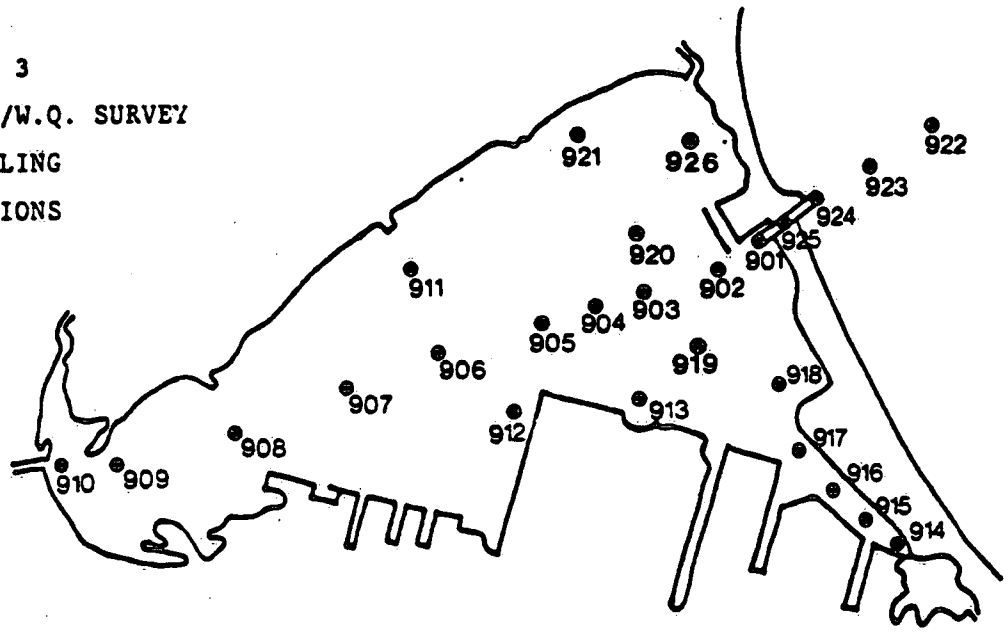


Fig. 4
BENTHIC INVERTEBRATE
SAMPLING
STATIONS

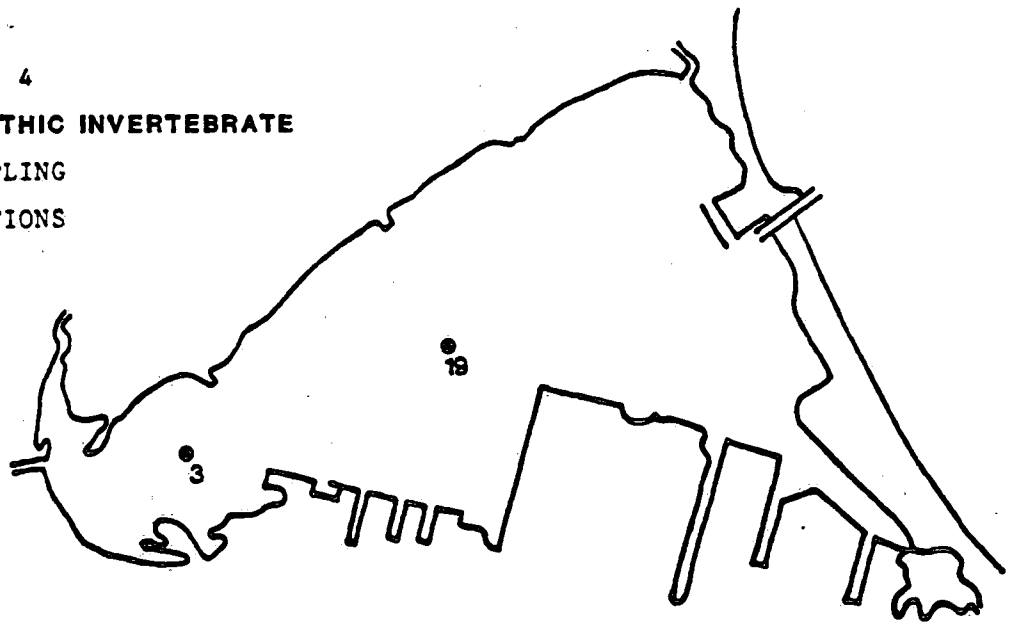


Fig. 5
NITRIFICATION SURVEY
SAMPLING
STATIONS

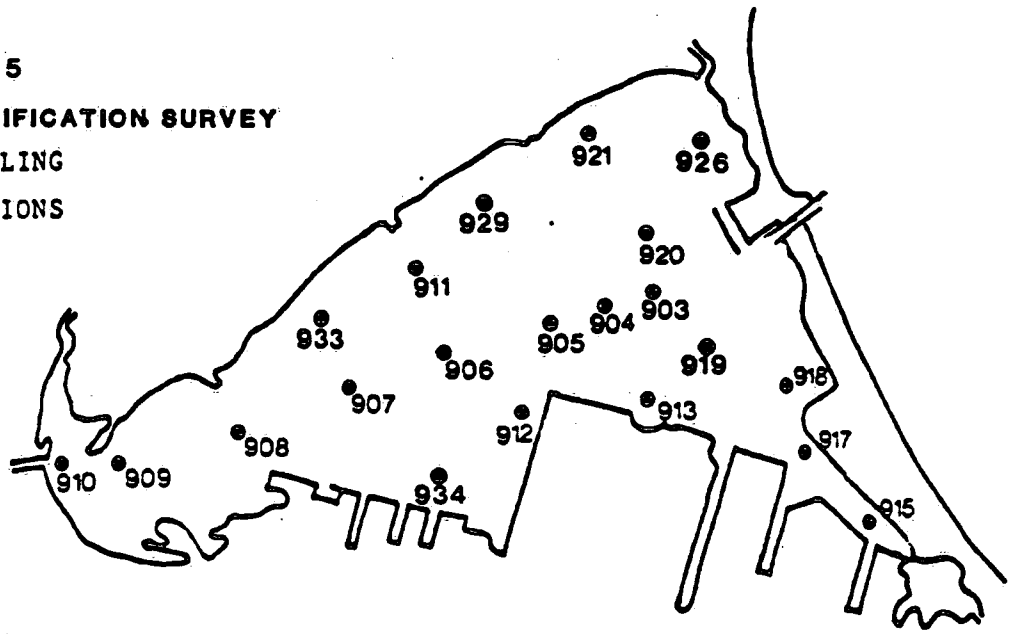


Fig. 6
TIDE GAUGE
MOORING
LOCATIONS

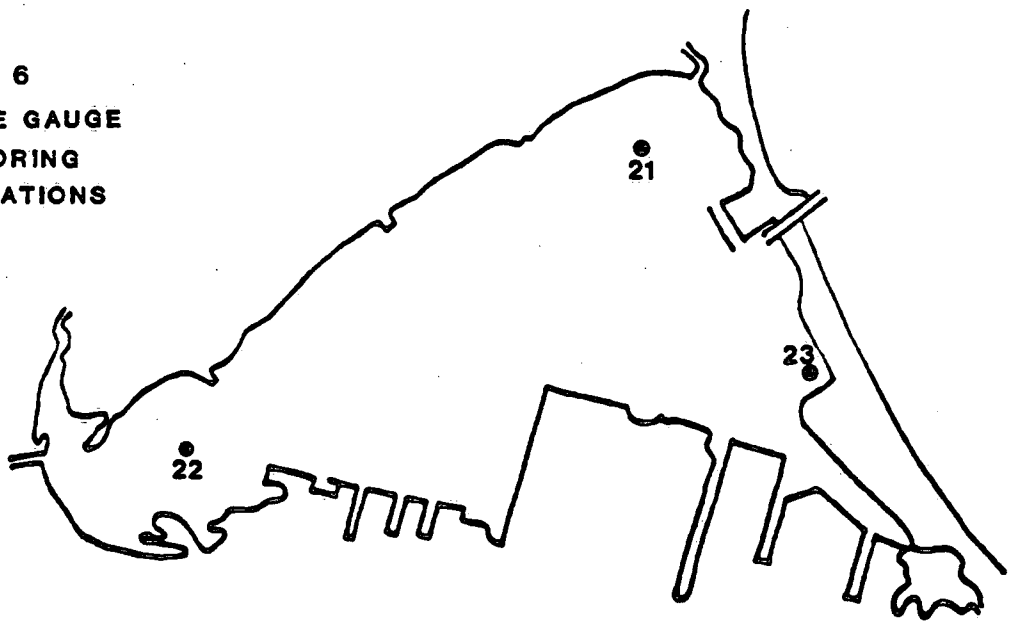
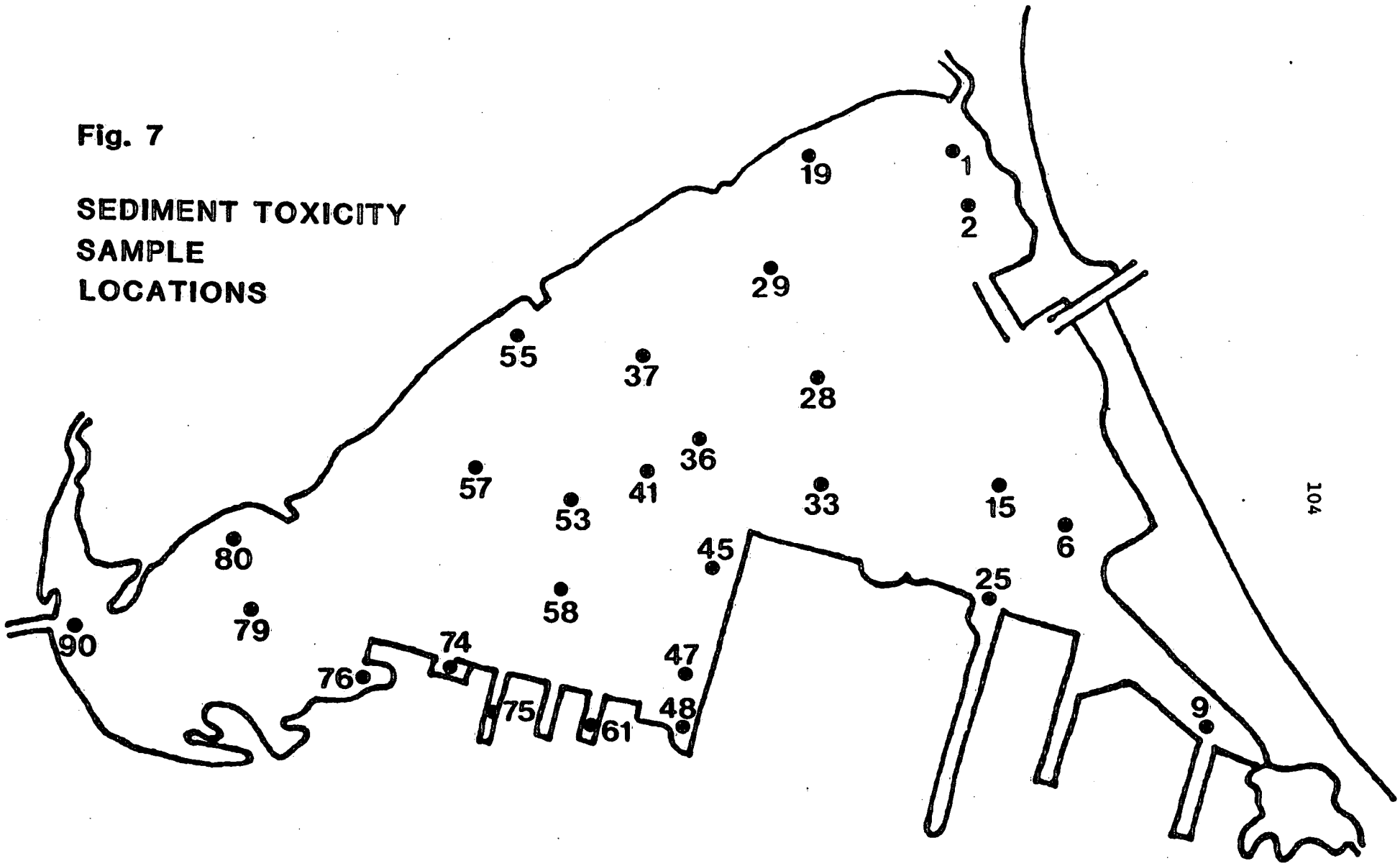
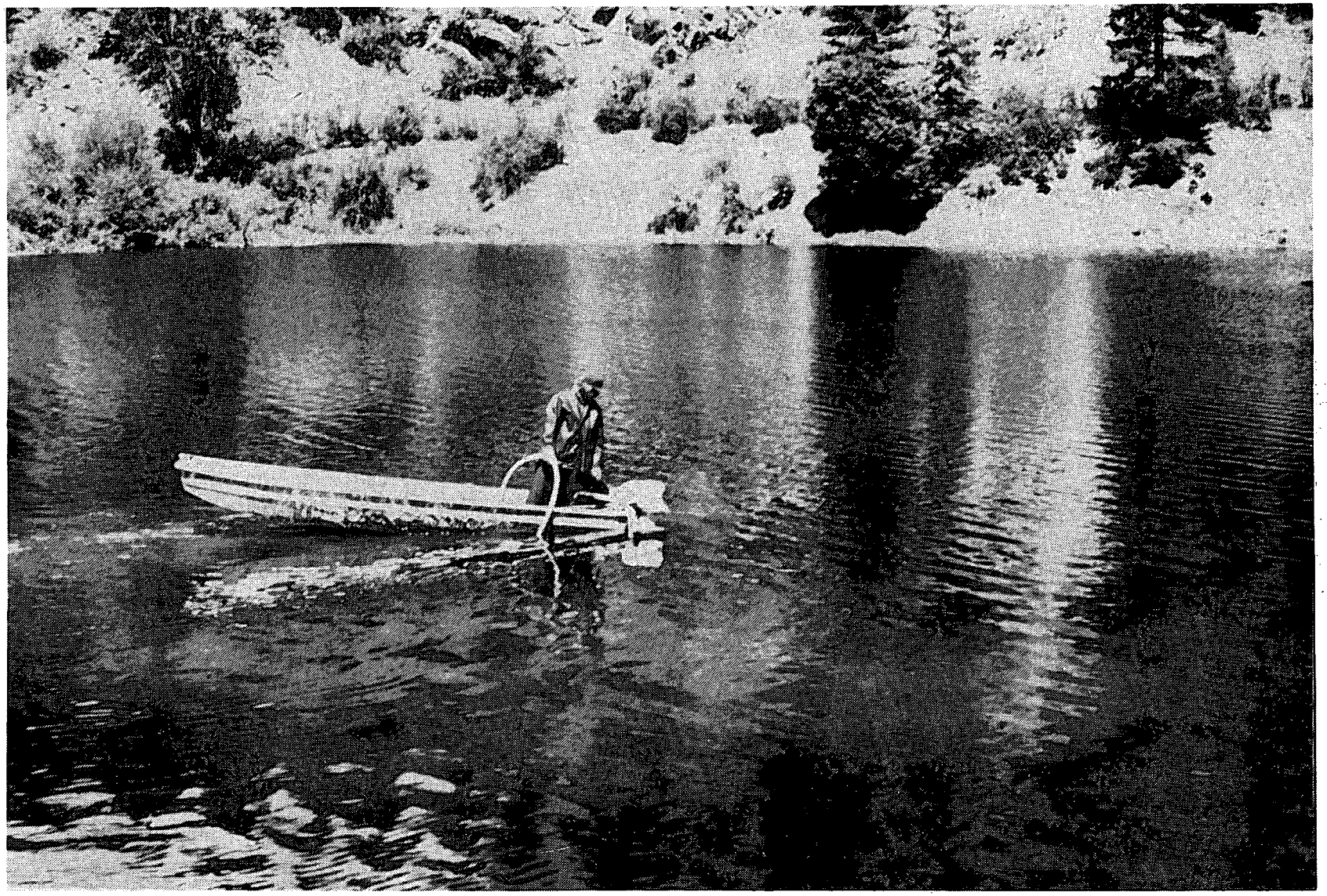


Fig. 7

SEDIMENT TOXICITY
SAMPLE
LOCATIONS





FERRIC CHLORIDE TREATMENT

AT BLACK LAKE, BRITISH COLUMBIA

CHAIN LAKE

LRB STUDY 82011, DR. T.P. MURPHY

The purpose of this project was to observe and document the efficiency of the portable dredge at Chain Lake; to promote plant growth on top of the 5 berms; remove dredged material from the berms; observe the effects of chemical treatment in Black Lake. The research was divided between Chain and Black lakes.

Three tonnes of ferric chloride was added to Black Lake in order to observe the restoration effects on the lake. In conjunction with the chemical injection, an aerator was run continuously for a five-day period. The lake was sampled every second day for two weeks after initial installation and every second week until September. The biweekly sampling was done in conjunction with Westwater Research--part of the University of British Columbia Engineering Department.

Sampling Chain Lake was conducted during the same period for water, sediment cores and sounding to check for any slumping into the dredged hole produced in 1988. Mr. D. Smith, a local resident was trained in the collection of water samples, the filtration methodologies and profiling for O_2 and temperatures. He was given a small honorarium to collect samples and ship them to CCIW on a biweekly basis from July to December.

The local association was assisted in dredging in the hole and other parts of the lake to assess the efficiency of the dredge. The Lake Association has now taken over all aspects of dredging being conducted on an annual basis. Berms 3, 4 and 5 are being filled in since berms 1 and 2 are capable of handling any material that the small dredge can pump into them.

AMISK LAKE

LRB STUDY 82011, DR. T.P. MURPHY

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

During the week of May 6 - 10, a Technical Operations dive team travelled to Amisk Lake, Alberta to inspect the new oxygen diffuser system installed in July 1990 and refurbished in October 1990. The mini-rover system (MURV) was used to inspect and record on video tape all underwater observations which included:

1. Ambient light disappeared at 25'
2. Visibility on bottom = 2' with lights
3. High levels of suspended solids
4. Chain slings were clear of the wands
5. All ceramic wands were bubbling and clear of algae
6. All Porex wands were bubbling but with algae growth
7. Oxygen supply line at the diffusers was in good condition

Edited copies of the underwater video of both operating diffuser systems were sent to Mr. J. Babin of the University of Alberta.

Two MET II meteorological system rafts were installed at either end of the narrows. The old raft was installed at the south end in 28 m of water using the same anchorage as last year and the new raft was installed at the north end in 12 m of water with new anchors. Meteorological sensors were not available at the time of departure and will be installed at a later date.

RAFT POSITIONS

Old raft	54° 35' 00" N., 112° 37' 00" W.
New raft	54° 35' 33" N., 112° 37' 00" W.

East-West sounding transects were made of the north end of the narrows. A flat bottom at 12 metres just north of the new raft was marked for future installation of the ADCP.

On June 27, the acoustic Doppler current profiler was deployed in Amisk Lake in support of T. Murphy and the University of Alberta. The profiler was to record any currents in the lake narrows as the water moved between basins due to the wind patterns. The profiler was removed the latter part of July by Engineering Services.

LARDER LAKE

LRB STUDY 82013, A. MUDROCH

This project was initiated to study the effects of submerged mine tailings on the aquatic environment. This year, more emphasis was placed on the water column (i.e., trace metal analysis) than on sediments. The lake is adjacent to the town of Larder Lake located 25 km east of Kirkland Lake.

Thirty-seven stations were occupied on Larder Lake. At each location, an EBT/XMS profile was taken to bottom, oxygen profiles were collected, as were pH and conductivity. Samples were collected for: trace metals, chlorophyll a, particulate organic carbon, total phosphorus (filtered and unfiltered) and seston. While the water sampling was being carried out on the lakewater, sediment samples were collected from numerous tailings' ponds around the lake. A motel unit was rented to be utilized as a lab/base. Due to the amount of support required, water sampling was conducted in the morning and sediment samples were collected in the afternoon and processed in the early evening.

A second lake was sampled adjacent to Larder Lake to act as a control site. Raven Lake was chosen since it is divided into two distinct basins--the southern basin being affected by Larder Lake and the northern basin being in a reasonably oligotrophic state. Samples were collected from Raven Lake as they were from Larder Lake.

Sampling was also conducted on both lakes for Dr. T. Jackson, LRB Study 82071. Samples were collected for benthic invertebrates and phytoplankton in the water column. These samples were preserved and returned to CCIW for further handling and analyses.

HOWE SOUND

LRB STUDY 82013, A. MUDROCH

Howe Sound, located north of Vancouver, B.C., has been identified as an area of concern due to increasing pollution from mining and logging activities in the area. A reconnaissance of the Howe Sound area was made in which potential pollution sources were identified and a variety of sediment and plant samples was collected for later analyses.

Work completed in Howe Sound included the following:

* Water samples were collected from all streams along the eastern shore of Howe Sound.

* Algae samples were collected every 5 km of shoreline in Howe Sound, including the islands.

* Sediment samples were collected, using a Ponar dredge at the Squamish River mouth as well as from selected bays and harbours in Howe Sound.

* Mine tailing samples were collected, using the Ponar at Britannia Beach--the site of a large copper mine in operation between 1900 and 1974.

All samples were returned to the Geological Survey in Ottawa for analyses.

GREAT LAKES SEDIMENT STUDY

LRB STUDY 82015, DR. T.B. REYNOLDSON

Support was given to Dr. T. Reynoldson of LRB in the collection of sediment samples from the 17 ecodistricts that are located along the Canadian shoreline of the Great Lakes.

The object of this sediment management study is the protection of a sustainable and reproducing aquatic community that is resistant to environmental fluctuations. This study defines these communities using the biological guidelines of sediment toxicity and benthic invertebrate community structure.

The sample sites had to meet the criteria of being in less than 30 metres of water and be less than 3 kilometers from shore. Sites also had to have at least 10 cm of sediment, an area of at least 1 ha. of fine sediment, an unexposed fetch and be away from outfalls and development.

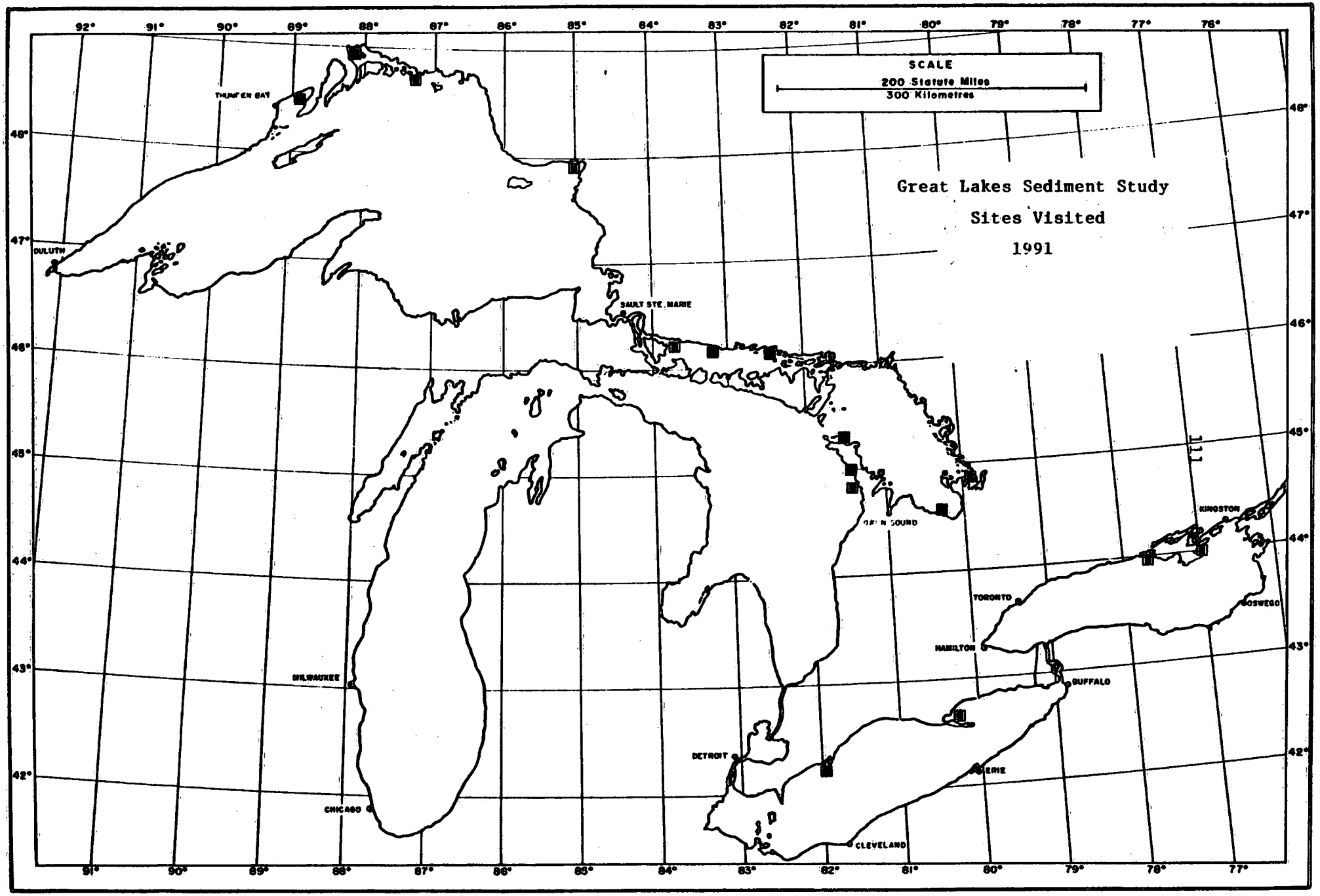
The sampling method was to use a lightweight box core and subsample these with small cores 10 cm deep. Some of these individual samples were sieved, preserved in Formalin and returned to CCIW for enumeration and identification of aquatic biota plus physical-chemical analysis and some for bioassays. All samples were kept cool until returned to CCIW.

The sampling periods were August 27 - September 10, September 23 - 27 and September 30 - October 3. Fall is the ideal time when a majority of non-aquatic species will be present in the samples. Eventually 5% of sites will be sampled during three seasons to consider seasonal variations.

Two-man crews, consisting of one Tech. Ops. and one LRB person, visited sites in various locations from Thunder Bay to the Kingston area. The CSL PUFFIN was trailered to suitable launching ramps near sample sites.

Some of the preselected sites were on sand or gravel bottoms and did not meet the criteria. Of 51 sites visited, 34 were sampled and 17 were unsuitable.

This project will be continued in the 1992 field season.


SCALE
200 Statute Miles
300 Kilometres
Great Lakes Sediment Study
Sites Visited
1991
THUNDER BAY
DULUTH
SAULT STE. MARIE
MILWAUKEE
CHICAGO
DETROIT
CLEVELAND
ERIE
BUFFALO
HAMILTON
TORONTO
OSWEGO
KINGSTON
92°
91°
90°
89°
88°
87°
86°
85°
84°
83°
82°
81°
80°
79°
78°
77°
76°
48°
47°
46°
45°
44°
43°
42°

SANDUSK CREEK

LRB STUDY 82016, F. ROSA

In early April 1990 a sediment trap was suspended from a highway bridge at the mouth of Sandusk Creek as it flows into Lake Erie. The trap was to collect all the particulates as they flowed from the creek thus trapping the organic chemicals, if any, from the Hagersville fire site. This creek drained the fire site as it flowed directly through the fire. The trap was removed permanently on December 19, 1991.

NORTH CHANNEL/SPANISH HARBOUR SEDIMENT SAMPLING

LRB STUDIES 82016, 82015, F. ROSA, DR. T.B. REYNOLDSON

The Spanish Harbour was designated an area of concern in 1980 due to nutrient enrichment, tainting of fish and elevated levels of metals and PCB's. A study was designed to determine the transport of contaminated harbour sediments into the North Channel proper in response to Annex 2, Great Lakes Water Quality Agreement. Sediment traps and current meters were deployed from April to September in strategic locations to measure sedimentation rates at two levels in the water column.

The CSL SHARK was utilized to sample 54 stations in the North Channel of Lake Huron for sediment toxicity, geochemistry and benthic invertebrate community structure as well as refurbishment of four sediment trap moorings installed on cruise 91-02-701 during the period July 8 - 14.

At each station, the following observations were obtained:

EBT/XMS profile to the bottom
Surface bucket temperature
Secchi disc (30 cm)

At each station, the following samples were collected:

Four benthos cores
One Ponar grab

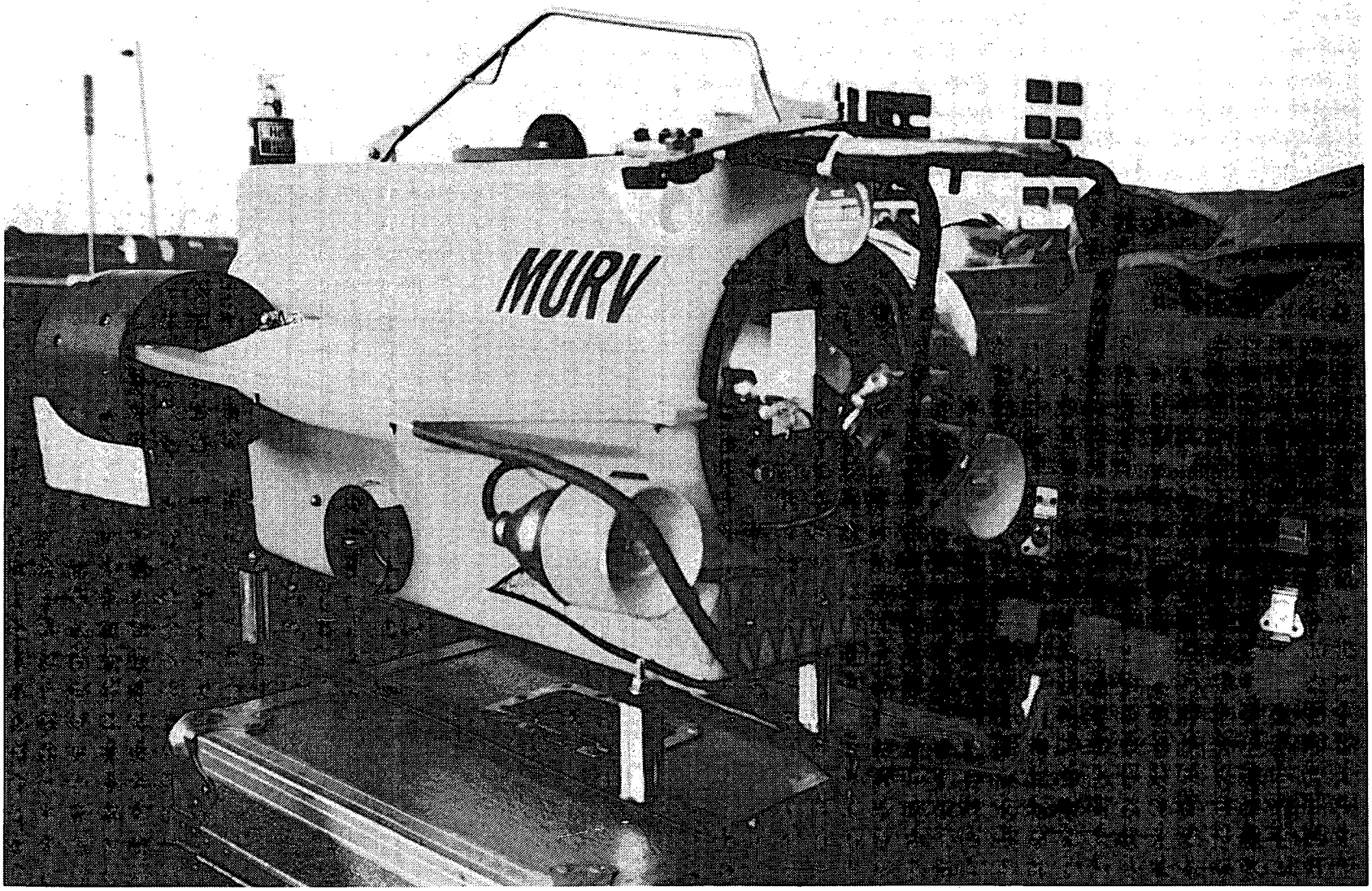
One benthos core was subdivided into 5 cm sections (0 - 5 and 5 - 10) for geochemistry while the remaining three cores had the top 10 cm removed, screened through a 1000µ screen and preserved with 4% Formalin for benthic invertebrate community structure. The Ponar grab samples were bagged and placed in coolers for future bioassay experiments at CCIW.

At some stations, the following additional samples were collected:

Five benthos cores and one Ponar for bioassay and benthic organism enumeration (12 stations)

Two benthos cores for sediment chemistry (5 stations)

Five Ponars and 36 litres of water (1 m) for metal spatiation analysis (3 stations)



MURV'S NEW LOOK

One full day was spent observing various bottom samplers and corers with MURV. Some interesting observations were made as the samplers hit bottom and during the return to the surface. All observations were recorded on video tape and sent to Dr. T. Reynoldson, LRB.

MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
110	91-02A-01B	46° 08′ 59"	82° 32′ 25"
111	91-02A-03B	46° 08′ 41"	82° 39′ 19"
112	91-02A-05B	46° 07′ 38"	82° 46′ 40"
113	91-02A-07B	46° 06′ 17"	82° 30′ 36"

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
620	46° 09′ 19"	82° 32′ 58"
625	46° 10′ 16"	82° 23′ 31"
627	46° 09′ 26"	82° 28′ 49"
632	46° 10′ 32"	82° 28′ 00"
634	46° 09′ 37"	82° 28′ 07"
636	46° 07′ 51"	82° 31′ 29"
637	46° 06′ 56"	82° 28′ 13"
641	46° 09′ 27"	82° 25′ 20"
650	46° 08′ 23"	82° 20′ 12"
651	46° 09′ 10"	82° 22′ 45"
652	46° 09′ 42"	82° 21′ 45"
653	46° 10′ 08"	82° 20′ 38"
654	46° 08′ 03"	82° 20′ 19"
655	46° 08′ 12"	82° 18′ 58"
656	46° 07′ 48"	82° 17′ 38"
657	46° 07′ 53"	82° 16′ 37"
658	46° 08′ 12"	82° 32′ 25"
659	46° 08′ 33"	82° 23′ 45"
660	46° 07′ 08"	82° 30′ 54"
661	46° 06′ 33"	82° 32′ 33"

TRANSECT LINE POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
WEST TO EAST TRANSECT:		
T1	46° 08′ 45"	82° 44′ 32"
T2	46° 08′ 54"	82° 42′ 47"
T3	46° 08′ 57"	82° 40′ 34"
T4	46° 08′ 56"	82° 38′ 42"
T5	46° 09′ 03"	82° 36′ 10"
T6	46° 09′ 13"	82° 34′ 04"
T7	46° 09′ 16"	82° 31′ 50"
T8	46° 09′ 25"	82° 29′ 57"
T9	46° 09′ 34"	82° 28′ 13"
T10	46° 09′ 50"	82° 25′ 48"
T11	46° 10′ 09"	82° 24′ 55"
T12	46° 10′ 10"	82° 24′ 02"
T13	46° 10′ 12"	82° 23′ 20"
T14	46° 10′ 12"	82° 22′ 29"
T15	46° 10′ 05"	82° 21′ 42"
T16	46° 10′ 10"	82° 21′ 02"
T17	46° 10′ 09"	82° 20′ 39"
T18	46° 10′ 07"	82° 20′ 05"
NORTH TO SOUTH TRANSECT:		
T19	46° 11′ 42"	82° 27′ 27"
T20	46° 11′ 27"	82° 27′ 45"
T21	46° 11′ 05"	82° 28′ 14"
T22	46° 10′ 22"	82° 29′ 02"
T23	46° 09′ 50"	82° 29′ 28"
T24	46° 09′ 26"	82° 29′ 47"
T25	46° 08′ 56"	82° 30′ 15"
T26	46° 08′ 21"	82° 30′ 56"
T27	46° 07′ 53"	82° 31′ 21"
T28	46° 07′ 08"	82° 31′ 05"
T29	46° 06′ 16"	82° 30′ 45"

BAY OF QUINTE SEDIMENT TRAPS

LRB STUDY 82022, M.N. CHARLTON

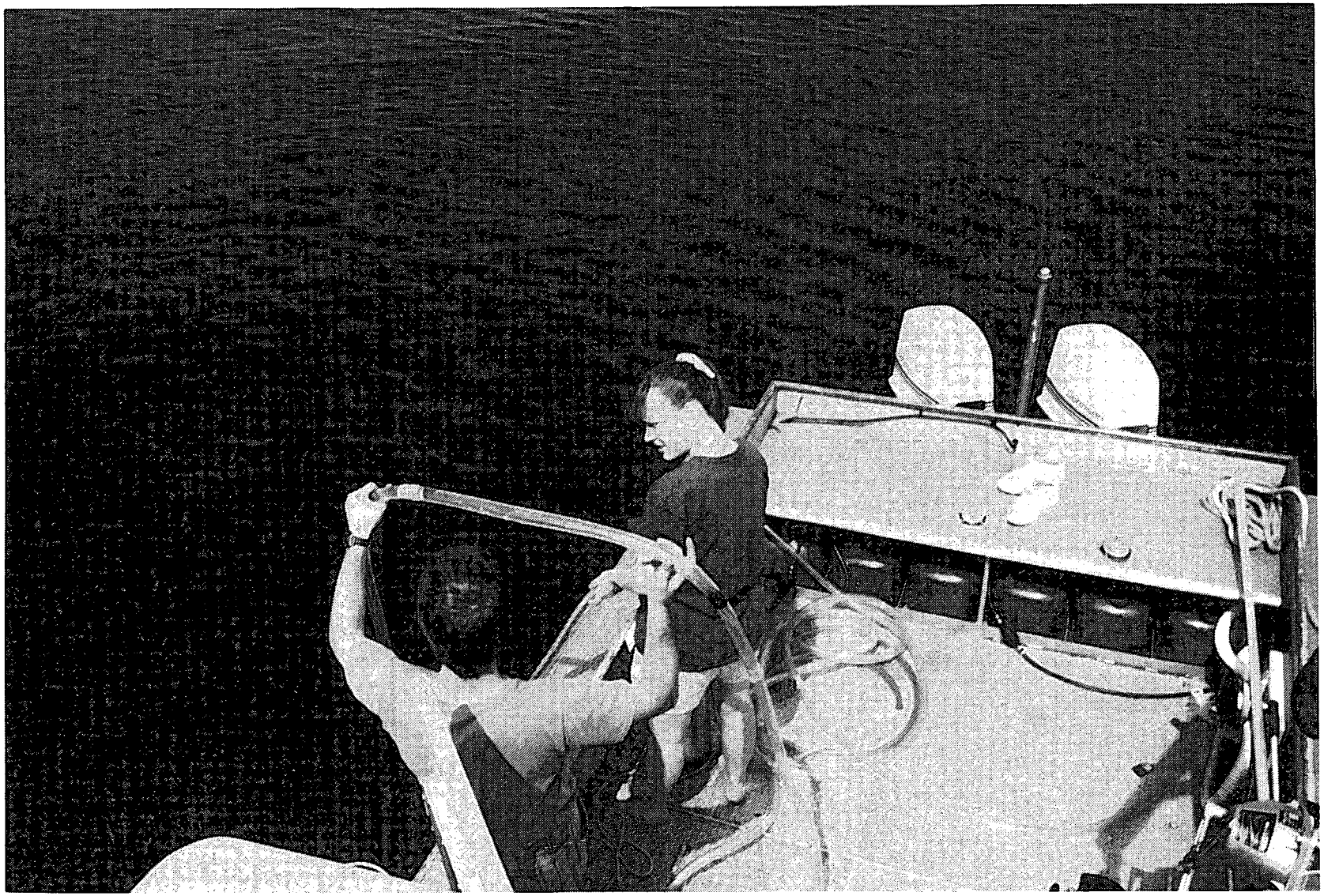
On May 1 sediment trap moorings were installed in the Bay of Quinte from Trenton to just east of Glenora in the Adolphus Reach.

This project was in co-operation with the Ontario Ministry of the Environment whose personnel refurbished the moorings on a two-week cycle until mid- October.

Two moorings (91-00A-11A and 91-00A-15A) had transmissometers attached to the traps. All traps were installed 2 metres off the bottom.

MOORING POSITIONS

MOORING NUMBER	LATITUDE N.	LONGITUDE W.
91-00A-11A	44° 05′ 52"	77° 30′ 33"
91-00A-12A	44° 07′ 59"	77° 15′ 51"
91-00A-13A	44° 06′ 23"	77° 02′ 00"
91-00A-14A	44° 03′ 43"	77° 05′ 48"
91-00A-15A	44° 03′ 27"	76° 58′ 10"



WATER SAMPLING AT RICE LAKE, ONTARIO

RICE LAKE

LRB STUDY 82023, DR. M. HANNA

Two stations on Rice Lake were sampled a total of 12 times for Dr. M. Hanna. At each site, 30 litres of integrated water was collected, utilizing a one-inch Tygon tube to within ½ metre of the bottom. During the first and last sampling trips, 60-litre water samples were collected. A light extinction profile was also conducted to the bottom on each station every trip. After the samples were collected they were packed in ice or stored in a refrigerator and returned to CCIW for analysis.

The two locations from which the samples were collected were: station 1 at Parks Canada Buoy TBB located at the west end of Rice Lake (44° 06′ 37" N., 78° 17′ 38" W.) and station 2 located at a CCIW mooring located 300 m north of Buoy T416 at the east end of Rice Lake (44° 15′ 28" N., 78° 03′ 42" W.).

The boat was launched at Holidea Holmes--a small marina located roughly at the mid-point of the lake. This made access easy to both stations and an interesting place to start the survey.

PENETANG HARBOUR

LRB STUDY 82025, DR. P.G. MANNING

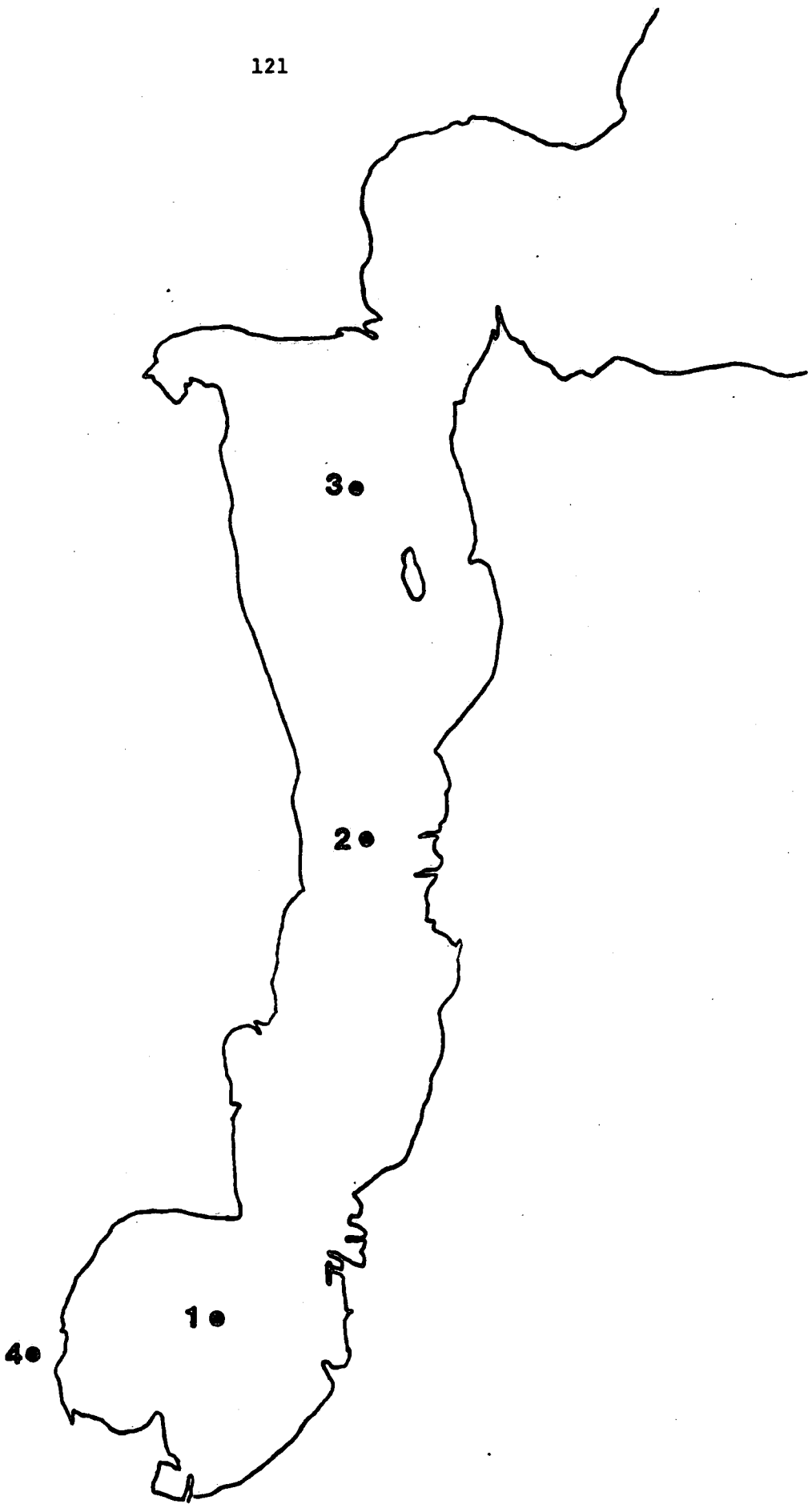
Water, sediment and suspended sediment samples were collected from Penetang Harbour during the periods May 21 - 23 and May 28.

Bulk water samples of 1000 litres were collected from 3 harbour stations at depths of 2 m and bottom -2 m if the water was stratified. A stream feeding into the harbour was also sampled. Temperature and oxygen profiles were obtained as well as total phosphorus filtered and unfiltered samples.

Staff from Centre Saint-Laurent were on hand to observe sampling procedures and techniques.

Bottom sediment cores were obtained using a Benthos corer at station 1 on May 28. Cores were sectioned before returning to CCIW.

PENETANG HARBOUR
Sediment Sampling
LRB Study 82025
May 21 - 28, 1991
Sampling Stations



BAY OF QUINTE CORING AND SUSPENDED SEDIMENT SAMPLING

LRB STUDY 82025, DR. P.G. MANNING

Technical Operations provided field support to Dr. P.G. Manning, LRB on two sampling trips to the Bay of Quinte as part of an ongoing investigation into the movement of certain metals (especially arsenic) and phosphorus levels in the Trent-Severn and Moira River systems.

The first trip to the Bay of Quinte was made April 22 - 23. The launch, PUFFIN was towed to the town of Trenton and the suspended sediment site at the first bridge on the Trent River. A 660-litre volume of water was centrifuged using a Westfalia separator. The sample was collected with a pump slung from the bridge approximately 10 m for shore. At the same time, a sample was collected for total phosphorus, both filtered and unfiltered.

The next day, the field party launched the boat in Trenton at the boat ramp on the west side of the river mouth. One core was then collected using the Technical Operations corer from site #870 and two from site PM1 and transported to the second suspended sediment site at the first bridge on the Moira River at Belleville. A 600-litre sample was collected and centrifuged in the same manner as at the Trent. While the centrifuge was running, the three cores were sectioned and frozen immediately using the portable freezer. Total phosphorus samples were collected here as well. Two more cores were collected from site #875 in Big Bay. The cores were sectioned at the government dock in Belleville. The PUFFIN was loaded on the trailer at the ramp in Belleville and the field party returned to Burlington on the evening of April 23.

The second trip to the Bay of Quinte was made on May 7 - 8. Technical Operations assisted Dr. Manning with the collection and sectioning of six benthos cores collected from Big Bay in the Bay of Quinte. The cores were collected from six predetermined sites as an additional task for the CSS BAYFIELD while in the Bay of Quinte conducting the Project Quinte sampling program. The ship left the dock at Belleville at 0600 hours on May 8 and proceeded to Big Bay to collect the cores. The cores were immediately returned to the government dock where they were sectioned and frozen by field personnel on shore. The first 40 centimeters of each core were taken at one-centimeter intervals and the remainder at two-centimeter intervals to the bottom of the core. The BAYFIELD returned to her original sampling program and the field party transitted to Burlington with the cores after sectioning was complete later the same day.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	44° 08′ 01"	77° 17′ 14"
2	44° 08′ 13"	77° 15′ 49"
3	44° 08′ 51"	77° 15′ 54"
4	44° 08′ 51"	77° 14′ 49"
5	44° 09′ 27"	77° 15′ 06"
6	44° 09′ 27"	77° 14′ 30"
870	44° 07′ 00"	77° 28′ 10"
875	44° 09′ 20"	77° 14′ 32"
PM1	44° 07′ 45"	77° 25′ 12"

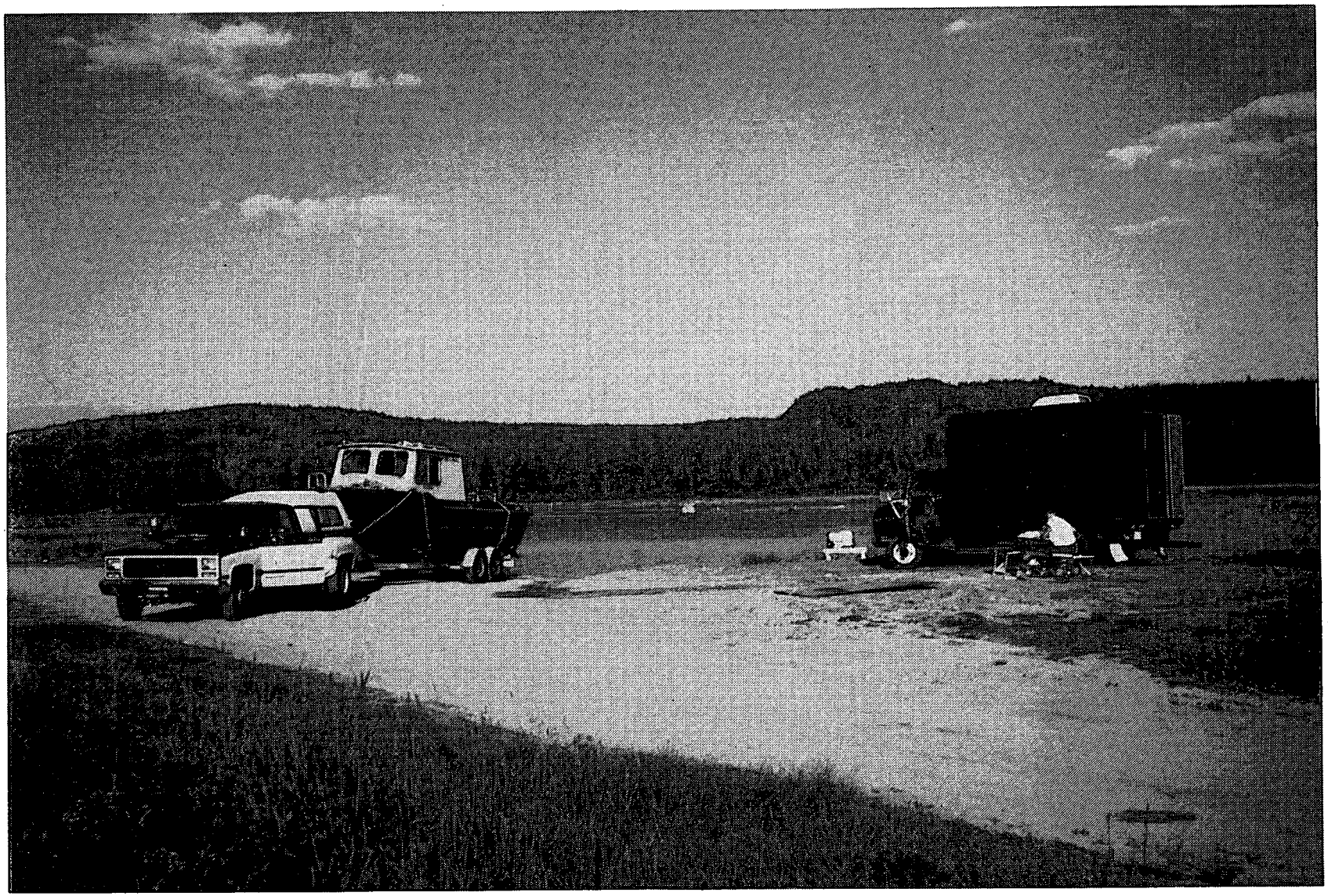
WHITBY HARBOUR SAMPLING

LRB STUDY 82048, DR. J.P. COAKLEY

Technical Operations personnel supported LRB Study 82048 for Dr. J. Coakley in Whitby Harbour on two separate occasions--May 14 and October 28.

The work consisted of taking 10 short push cores from sites along the west side of the harbour where a retaining berm keeps dredge spoils from entering the harbour waters. These spoils have had a Cesium tracer added to indicate any leakage.

The cores were taken a short distance from shore using a small boat and were returned to CCIW for subsectioning.



PIC RIVER BOAT RAMP

LAKE SUPERIOR INPUT SAMPLING

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

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

Technical Operations support was given to Dr. W.M.J. Strachan, LRB August 6 - 17 in the collection of water and sediment samples from the mouths of ten major rivers which flow into Lake Superior. Samples were collected in duplicate using two gas-powered Westfalia centrifuges. The suspended sediment, collected in the bowls, was frozen and returned to CCIW for analysis. The water samples were collected in four 40-litre stainless steel pressurized cans and extracted using a large-volume extractor on site. Bottom samples were collected using a mini-Shipek and the sediment samples frozen for transport to CCIW.

The "ice-cream" truck set up as a mobile lab, equipped with the large refrigerator unit, freezer and generators was used for on-site large volume extraction and analysis. A dual wheel crewcab was used to tow the PINTAIL and sampling equipment. Few problems were encountered with the dual wheel crewcab launching or retrieving the boat at eight sites. At the remaining two sites, both trucks were required to pull the boat and trailer out of the launching ramp.

After departing CCIW, the survey commenced at Sault Ste. Marie and proceeded around Lake Superior in a counter-clockwise direction to Ironwood, Wisconsin. Rivers were sampled in the following order:

St. Marys River, ramp at Airport Marina - fair
Montreal River, ramp at Trail's End Lodge - excellent
Michipicoten River, ramp at Michipicoten Marina - excellent
White River, ramp at Pic River mouth - fair
Pic/Black River, ramp at Pic River mouth - fair
Little Pic River, ramp at Neys Provincial Park - excellent but required backing down a steep hill
Nipigon River, ramp at Nipigon River Marina - excellent
Kamanistiquia River, ramp at Thunder Bay Marina - excellent
Pigeon River, ramp at Grand Portage Marina - excellent
St. Louis River, ramp at Beach Strip Municipal Marina - excellent

The trip was completed one day ahead of schedule. Due to poor access routes to the river mouths, sampling from the White and Montreal rivers in Wisconsin was cancelled.

ATMOSPHERIC DEPOSITION OF ORGANIC CONTAMINANTS IN THE CANADIAN ARCTIC

LRB STUDY 82053, D. GREGOR

This project was designed to investigate organic contaminant deposition in Arctic snow with the objective of estimating present day baseline contaminant loads. These baseline estimates will make it possible to monitor changes in contaminant input. Toward this aim, snow sampling sites have been established throughout the Northwest Territories and more recently in the Yukon. Large-volume snow collectors have been developed which are believed to give more realistic estimates of actual deposition than do bulk snow sampling methods. In order to compare these two methods, snow collectors have been built at 2 high Arctic sites and at one sub Arctic site.

Technical Operations personnel provided support for the construction of the snow collector and meteorological equipment in Whitehorse, Yukon. This support was in the form of one person for one week with the necessary tools. Local support was provided by Department of Indian and Northern Affairs personnel based in Whitehorse.

MOIRA LAKE

LRB STUDY 82057, DR. J.O. NRIAGU

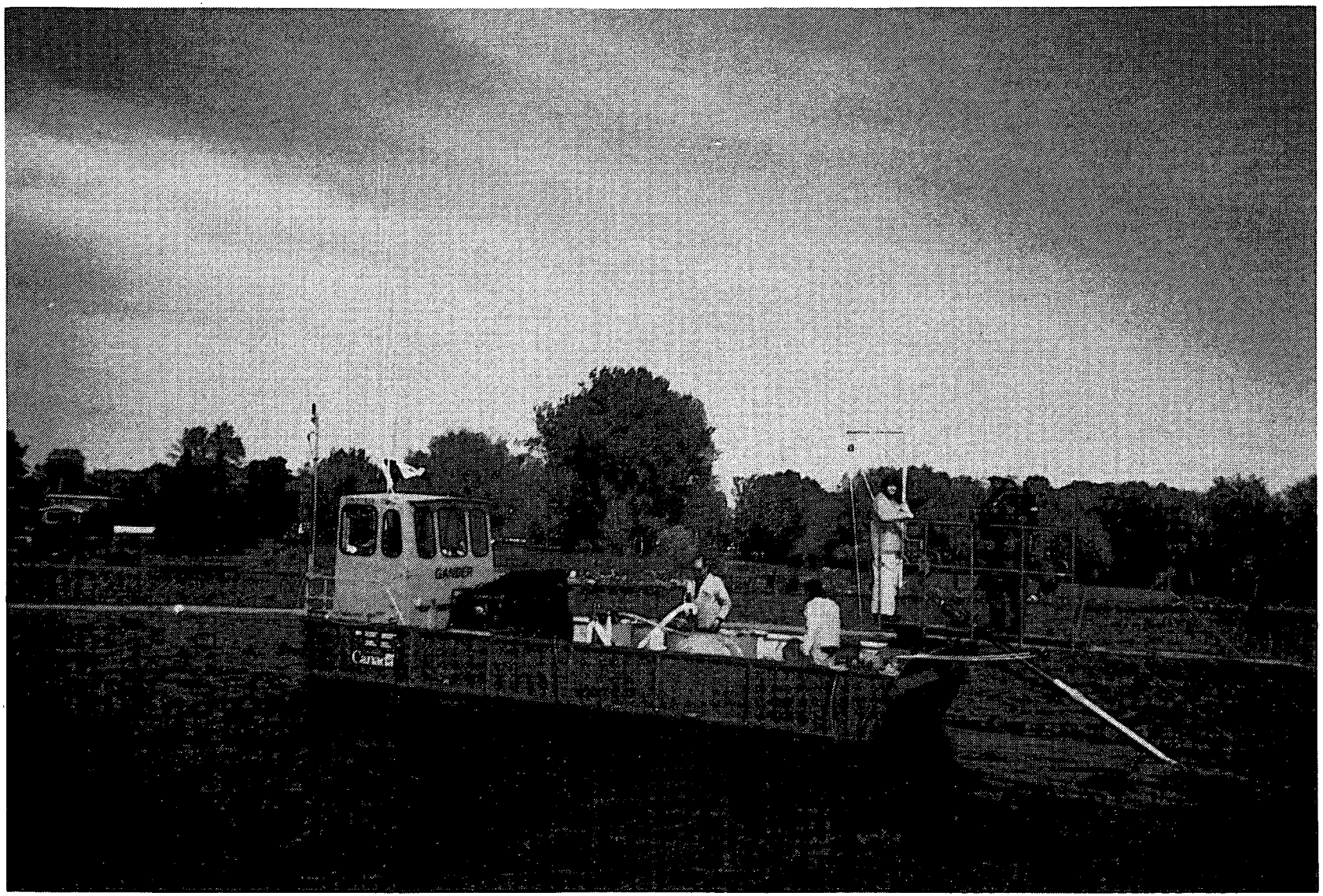
This year saw the completion of the research study on Moira Lake for the specific tracking of the arsenic found in the lake and river system.

Three trips were made to the system this year starting in late winter when the site was visited and the river sampled from all the major bridges along its length from its source to the mouth.

The second trip dealt with the lake proper when water samples and larval fish were collected from sites in both the east and west basins. To collect the fish, a beach seine was utilized by deploying the net parallel to shore and hauling both ends onto the beach before bringing in the rest of the net. This resulted in the capture of over 20 different species.

On the third trip, samples were collected only from the tailings site at Deloro. This is the area where the Ontario Ministry of the Environment spent a great deal of effort to contain any arsenic contamination. The site has been equipped with a very specific treatment plant to handle the contaminants and dispose of waste.

The final sampling trip occurred in early fall.



FERRIC CHLORIDE INJECTION

ON THE ST. MARYS RIVER

SAULT STE. MARIE FERRIC CHLORIDE INJECTION

LRB STUDY 82072, DR. T.P. MURPHY

The injection of high purity ferric chloride into bottom sediment 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 8,000 square metres of sediment. Two surveys (July 9 - 14 and October 6 - 11) were completed at a site on the St. Marys River just west of Bellview Marina and north of the Bayfield Dike Light (see site map). The first survey was a small-scale trial only; a much more extensive effort followed on the second survey.

A considerable amount of time was spent on both surveys setting up, launching boats, setting up the mini-ranger positioning system, setting up the injection system and the underwater television/video system, defining and marking the survey site and preparation of the dive equipment in order to ensure the accuracy of the survey.

The Coast Guard was assisted with the installation of an oil boom to protect the survey area during the second survey.

A series of sediment cores and Ponar grab samples was collected at the test site both before and after injection of the ferric chloride. Core samples were extruded, sectioned and stored in coolers for the return trip to CCIW. Two sediment trap moorings were installed before the injection--one upstream and one downstream of the test site. After injection, samples were removed from the sediment traps and both moorings were retrieved. All surface markers were removed from the site with the exception of three sampling stations buoys (7, 8, 9) and one control station buoy (4).

The vessel, CSL GANDER proved to be excellent for this type of work (deck space, power and twin screw for control). The Mason was used to support the divers. The launch, PINTAIL was utilized to assist with the reporters on media day and proved to be invaluable for collecting sediment samples and moorings.

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. Transponders were located at three sites, two of which had CHS horizontal control markers and one which was surveyed in. Six marker buoys were installed to mark

the limits of the test site (approximately 50 m x 200 m) and a total of nine track lines were injected using a four-metre offset at a velocity of 0.5 metres per second.

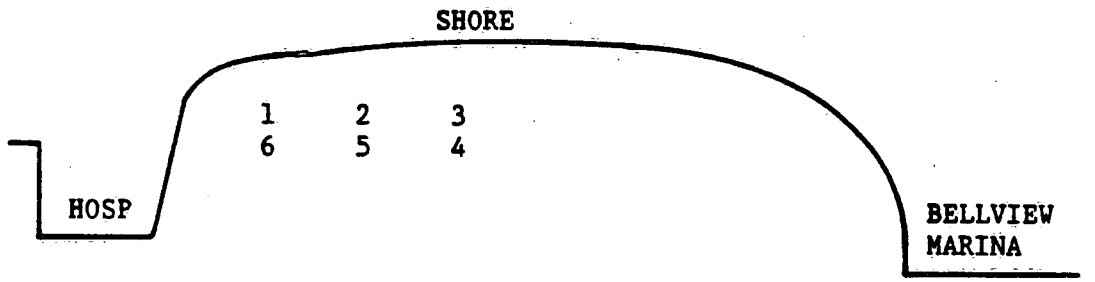
TRANSPONDER POSITIONS

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

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

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

PERIMETER BUOYS (Test Site)

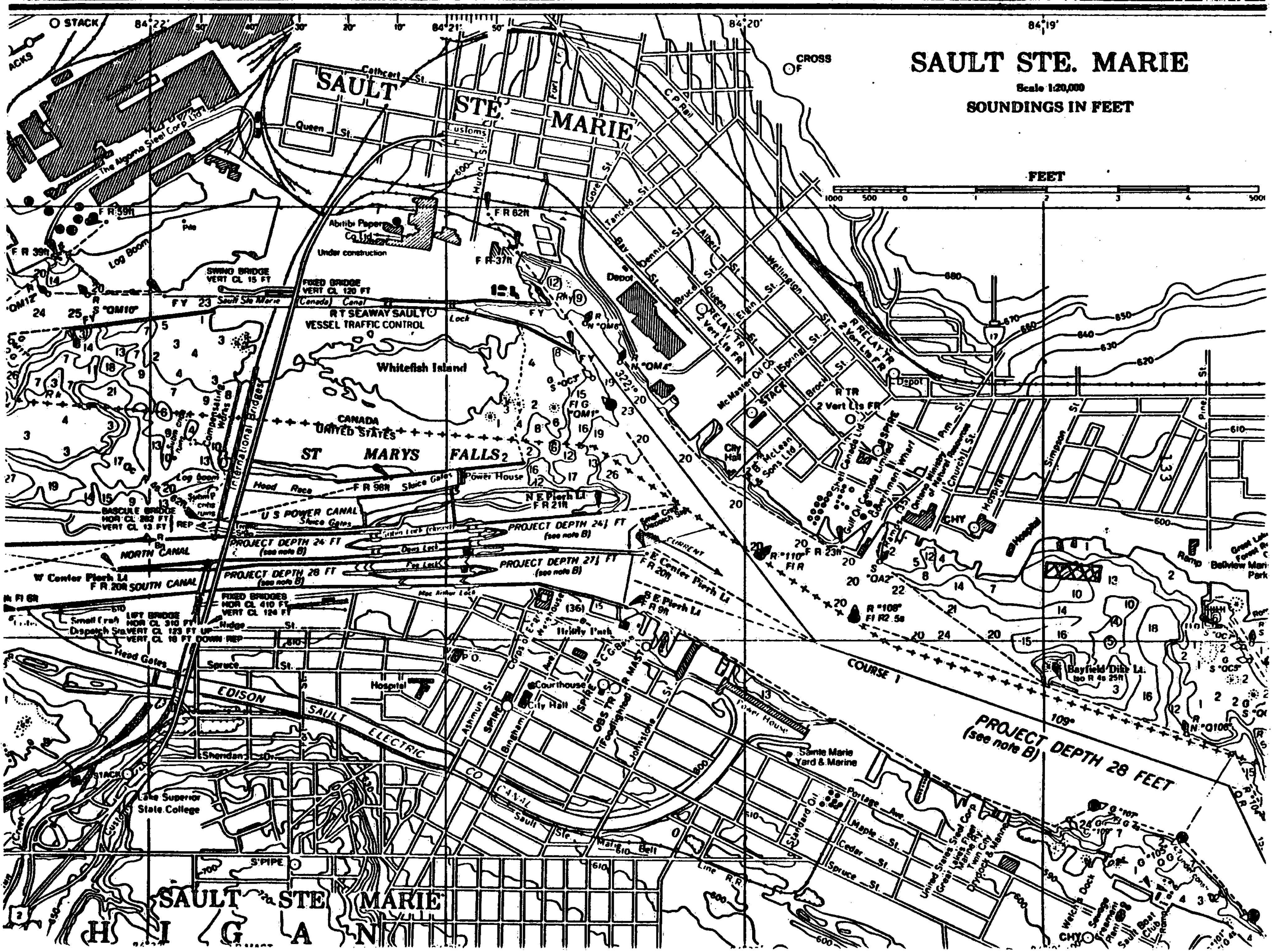


ST. MARYS RIVER

Buoy No. 1: N = 5153193.2 E = 705863.9
Buoy No. 2: N = 5153199.6 E = 705957.4
Buoy No. 3: N = 5153203.0 E = 706073.7
Buoy No. 4: N = 5153152.7 E = 706066.0 (control station)
Buoy No. 5: N = 5153147.0 E = 705948.9
Buoy No. 6: N = 5153147.2 E = 705848.9

The total area surveyed for injection covered 8800 square metres. During the injection runs, positions were fixed to accurately plot the actual track of the manifold. The final results indicate an 89% coverage (7800 square metres); 11% (1000 square metres) was missed and a total of 3% (240 square metres) overlapped.

COMMENCING PRE-INJECTION BOTTOM SURVEY


SAULT STE. MARIE
Scale 1:20,000
SOUNDINGS IN FEET
FEET
1000 500 0 1 2 3 4 5000
84°22'
84°21'
84°20'
84°19'
STACK
CROSS
Cathcart St.
Queen St.
Customs
Huron St.
Gore St.
Tancred St.
Bay St.
Dennis St.
Albert St.
Bruce St.
Queen St.
Elgin St.
Wellington St.
C P Rail
Depot
The Algoma Steel Corp Ltd
Abitibi Paper Co Ltd
Under construction
Log Boom
SWING BRIDGE VERT CL 15 FT
FIXED BRIDGE VERT CL 120 FT
Sault Ste Marie (Canada) Canal
R T SEAWAY SAULT
VESSEL TRAFFIC CONTROL
Lock
Whitefish Island
Compensating Works
International Bridges
CANADA
UNITED STATES
ST MARYS FALLS
Power House
Head Race
Sluice Gates
U S POWER CANAL
N E Pierhd Lt
BASCULE BRIDGE HOR CL 262 FT VERT CL 13 FT
NORTH CANAL
SOUTH CANAL
PROJECT DEPTH 24 FT (see note B)
PROJECT DEPTH 24½ FT (see note B)
PROJECT DEPTH 27½ FT (see note B)
PROJECT DEPTH 28 FT (see note B)
W Center Pierhd Lt
E Center Pierhd Lt
S E Pierhd Lt
CURRENT
FIXED BRIDGES HOR CL 410 FT VERT CL 124 FT
LIFT BRIDGE HOR CL 310 FT VERT CL 123 FT UP VERT CL 10 FT DOWN
Small Craft Dispatch Sta
Head Gates
Spruce St.
Ridge St.
Hospital
P.O.
Courthouse
City Hall
Ashmun St.
Bingham Ave.
Johnstone
EDISON SAULT ELECTRIC CO CANAL
Sheridan Dr.
Lake Superior State College
SAULT STE MARIE
M I C H I G A N
Sault Ste. Marie
Portage Ave.
Maple St.
Cedar St.
Spruce St.
Sainte Marie Yard & Marine
United States Steel Corp
Great Lakes Fleet
Twin City Marine Corp
Drydock & Marine
Welch's Dock
Sewage Treatment Plant
Sault Boat Club
Ramp
McMaster Oil Co
Spring St.
Brock St.
Pim St.
Churchill St.
Simpson St.
Hospital
City Hall
McLean Sons Ltd
Shell Canada Ltd
Gulf Oil Canada Limited
Government Wharf
Ontario Ministry of Natural Resources
Bayfield Dike Lt
Bellview Marine Park
COURSE 1
PROJECT DEPTH 28 FEET (see note B)
STACK
SPIRE
CHY
R RELAY TR 2 Vert Lts FR
R TR 2 Vert Lts FR
OBS TR
R MAST
S'PIPE

HAMILTON HARBOUR CHEMICAL INJECTION

LRB STUDY 82072, DR. T.P. MURPHY

During the last week of October, Ferric Chloride was injected into the bottom of Hamilton Harbour in two lines 220 metres long.

The GANDER, with the same injector system that was utilized in the St. Marys River, was tested in the harbour. It was noted that although the system worked, the boat had to move at a slower speed than that preferred; i.e., 2 m/s instead of 5 m/s. To ensure that the boom head remained in contact with the bottom, an additional 100 kgs of weight were added to the head. The chemical was injected in 22 m of water 10 metres north of the line with start and end positions of N4793711, E593964 and N4793793, E594168, respectively. The second line ran parallel and 4 metres north of the first line.

After the initial injection, sediment samples were collected from both lines on a biweekly basis until mid-December.

To ensure that the lines can be sampled next year, a mooring located by a pinger was positioned midway on the above-mentioned lines.

A second attempt to add chemicals (Calcium Nitrate) in the harbour was abandoned in early December when unfavourable weather caused unexpected delays.

HONEY HARBOUR/BEAUSOLEIL ISLAND, GEORGIAN BAY

MAYFLY AND SEDIMENT COLLECTION

LRB STUDY 82072, DR. T.P. MURPHY

A large quantity of mayfly larvae was again required to conduct bioassay experiments on Hamilton Harbour sediment. A single sample trip to a sample area near Beausoleil Island in Georgian Bay near Honey Harbour was required to collect between 7000 and 8000 larvae.

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

Bottom sediment was also collected using an Ekman dredge to allow the larvae to live in sediment to which they had become accustomed.

R I V E R S R E S E A R C H B R A N C H

LaTUQUE, QUEBEC, EFFLUENT AND SEDIMENT SAMPLING

RRB STUDY 83021, DR. R.M. BAXTER

The Canadian Pacific Forest Products building site is one of three mills selected for this study. This company is an example of the use of old technology which produces a bleached product.

Final effluent was centrifuged at four litres per minute for suspended material and a twenty-litre sample of centrifuged water was pressure filtered for APLE extractions. The filtered effluent was also concentrated by passing a large volume through a reverse osmosis unit at the site. An ISCO water sampler at the site collected final effluent samples over a 24-hour period. Sediment samples were also collected from the mixing pond. At selected sites on the river downstream of the mill, water samples were collected for organic extractions. Bottom sediments were collected with an Ekman dredge.

KAMINISTIQUIA RIVER CLAM STUDY

RRB STUDY 83012, DR. Y.K. CHAU

The project investigated genetic and biochemical effects of pulp and paper waste. The long-term objectives are to use genotoxicity and biochemical techniques to evaluate the toxic effects of pulp and paper wastes on aquatic organisms. The field work was completed over a period of 5 months, as follows:

June - 6
July 3 - 5
August 7 - 9
September 4 - 6
October 2 - 4

Five sites were set up on the Kaministiquia River. The installation took place in June and removal of the traps in October. The work was completed using the launch, Mason 3. On each trip, N. Ali flew to Thunder Bay, assisted in the sampling and returned the samples to Burlington. One of the traps (#4) was vandalized in July and as a result only water and sediment samples were collected during the remainder of the trips. Sampling at each site consisted of the following:

1. Two clam cages were installed at each site with 20 clams in each
2. Clams were removed at monthly intervals for toxic analysis
3. Sediment samples were collected for genetics, enzyme, organics and heavy metals
4. Water samples were collected for genetics, enzyme, organics and heavy metals

The clams were immediately frozen in liquid nitrogen upon removal and stored on dry ice. Liquid nitrogen was obtained from Lakehead University. The sediment and water samples were stored in a cooler packed with ice and, along with the clams, shipped to CCIW via air carrier.

All sampling equipment, sediment traps and the Mason were returned to CCIW on completion of the work.

ESPANOLA PULPMILL EFFLUENT

RRB STUDY 83021, DR. R.M. BAXTER

Tech. Ops. supported the pulpmill effluent study at Espanola by assisting in the logistics and sample collection at 17 sites along the Spanish River from 12 km upstream of Espanola to the mouth of the river at the town of Spanish, Ontario.

The object of this study is to complete the input of data for drafting legislation limiting the allowable concentration of certain components from pulpmill effluent to be released into the water system. Station locations were as follows:

Station 1 - The Spanish River at the Highway 17 bridge (12 km upstream of outfall
Station 2 - Below the confluence of the Spanish and Vermilion rivers
Station 2A - Mouth of Darkie Creek (Robinson sample only)
Station 3 - Under Highway 6 bridge, 30 metres below outfall (4 station transect)
Station 3A - At hydro wires 1.5 km below outfall (4 station transect)
Station 4 - At Webbwood concession bridge 9.5 km below outfall (4 station transect)
Station 5 - Twenty km below approximately 6 km upstream of the Massey Highway bridge at the large oxbow in the river (3 station transect)
Station 6 - 1 km upstream of the Massey Highway bridge (3 station transect)
Station 7 - 39 km below the outfall at Espanola (3 station transect)
Station 8 - 45 km below outfall
Station 9 - 51 km below outfall, downstream of Big Island where the river narrows at a large rock outcropping (3 station transect)
Station 11 - The Vermilion River downstream of the rapids
Station 12 - 200 m upstream in the Aux Sable River where it meets the Spanish River
Station 13 - 46° 11′ 06" N., 82° 20′ 27" W. (downstream of Spanish)
Station 14 - 46° 10′ 36" N., 82° 21′ 18" W. (Tomblinson Island)
Station 15 - 46° 10′ 19" N., 82° 22′ 35" W. (midway between Sproule and Whiteaves islands)
Station 16 - 46° 10′ 34" N., 82° 22′ 42" W. (north of Whiteaves Island)
Station 17 - 46° 10′ 42" N., 82° 23′ 06" W. (south of Buswell Point)

At each site, samples were collected for Crab APLE extraction, chlorophyll a, conductivity, oxygen and pH. The Crab APLE extractions were done at the parking lot of the motel from the back of Vehicle No.

90-212. This vehicle proved to be most useful as a central lab and tow vehicle. The launch, PUFFIN was utilized for all downstream sites where a boat was required and several sample sites were to be completed the same day.

Simultaneously, DFO personnel were collecting fish samples from the same sites to test for any pulpmill contaminants in the fish organs and flesh.

NEW BRUNSWICK ICE JAM STUDY

RRB STUDY 83033, DR. S. BELTAOS

For the fifth season, Technical Operations staff supported the Ice Jam Study for the Rivers Research Branch.

Support this year was split into two sections: The first was a continuation of the previous study on the Restigouche River in Campbellton, New Brunswick and the second, a new project on the St. John River near St. Leonard, New Brunswick. The field party travelled to the study area on August 19 and returned to Burlington on August 30.

At St. Leonard, eight cross-sections were surveyed and one kilometer of river levelled. Photos of all the lines and benchmarks were taken and water levels were determined twice daily at the downstream end of the survey area. Water levels were still low as a result of the summer drought and the 26-foot canoe proved to be ideal for completing the cross-sections. In Campbellton, two cross-sections were completed. Four kilometers were levelled and ice elevations taken from photos of the river at freshet time were surveyed.

Travelling time accounted for 4.5 days on this trip. Four and one-half days were spent on the St. John River and three days on the Restigouche River.

The planned six kilometer water level profile was not completed due to time constraints. It will be more easily accomplished next year with the use of the new electronic level. The work will be done from a minimum of points along the river with greater accuracy than the conventional method.

GRAND AND NITH RIVERS

RRB STUDY 83036, T. MAYER

An important component in the study and management of the Great Lakes as an "ecosystem" is tributary loading. In 1990-91, the monitoring program was redefined and new methodology for monitoring and load computations was developed on the Nith and Ayr rivers.

The program for 1991-92 utilized this methodology to study transport and loadings of bioavailable phosphorus and metals from point and non-point sources. The project's goal: to advance the understanding of pollutant transport (primarily in the particulate phase) in rivers.

The Nith River drains a largely agricultural watershed where the majority of pollutants are entering via diffuse sources.

The Grand River provided a chance to study mixed sources. It receives diffuse agricultural input as well as discrete input from municipal and industrial sources.

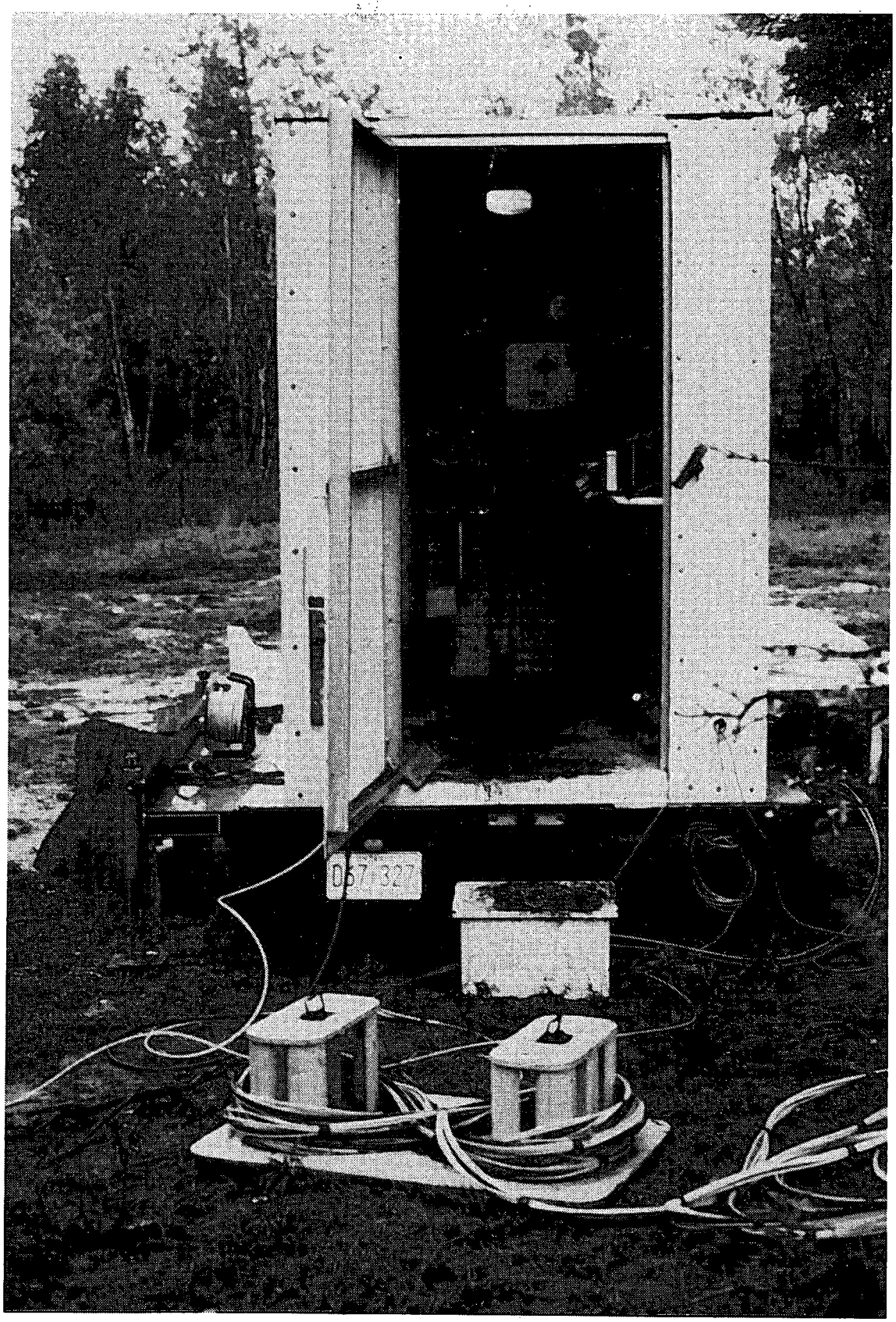
Two sites on the Nith were sampled to investigate downstream variance. Suspended sediments were collected using Westfalia centrifuges and sediment traps (for a comparison of sediment composition) and analyzed for phosphorus forms and metals. Water samples were collected and analyzed for total suspended solids concentrations, total phosphorus, filterable phosphorus and heavy metals. Turbidity, temperature, conductivity and pH were also measured to aid data interpretation.

Three sites were sampled on the Grand River, following the same sampling protocol. The location of these sites included an upstream control and two sites downstream of the Brantford Sewage Treatment Plant.

Technical Operations provided equipment and technical support in the field on the following dates:

Grand River: March 11, 12; April 4, 25; May 8; June 11, 27; July 8, 22; August 29, October 8, 23; December 2, 11.

Nith River: February 21; March 6, 19; April 17; May 1, 16; August 6; September 13, 27; November 13; December 11.



GROUNDWATER TRAILER ON FREELTON STUDY SITE

GROUNDWATER

RRB STUDY 83043, K. NOVAKOWSKI

Technical Operations supported Groundwater field research. Almost all of this was conducted at two main field sites in Clarkson, Ontario and Fletcher Creek at Freelton, Ontario. In general, research conducted at these sites was aimed at providing a better understanding of the movement and fate of groundwater through fractured rock.

Aside from a few days at the Clarkson site and a one-day survey at an Ontario Hydro bore hole at Nanticoke, most TOS support was utilized at the Fletcher Creek Fractured Rock Study. Technical Operations staff also spent several weeks during the winter working in the Groundwater Lab at CCIW in preparation for the field program.

Although research being conducted at the Clarkson test site of 25 bore holes was similar to that of the Freelton site, logistical and technical support was supplied by students and contract personnel hired by the Groundwater group. TOS supplied vehicles, generators and other equipment necessary for the study.

The Fletcher Creek, Freelton research site is located on a 125 hectare parcel of land owned by the Hamilton Conservation Authority. After receiving permission to conduct research on the conservation property, initial study work began in the summer of 1990. This location is ideal because it met several important criteria such as shallow overburden, large exposed area of rock fractures, site security and easy access, etc. It also worked well with respect to distance from the University of Waterloo and CCIW since there was collaboration between a University of Waterloo Masters student, Mr. Todd Reichart and Groundwater staff, Kent Novakowski and Pat Lapcevic.

Several preliminary investigative tests were conducted at the Freelton site during the 1990 field season. These were necessary to set the stage for the main experimental "pump test" that was conducted in the fall of 1991. These tests included mapping exposed fractures in an old quarry located on the property adjacent to the test site. Based on these findings, a diamond drilling program was carried out in the summer of 1990 to create the nine bore holes needed for the planned pump test in the fall of 1991. Drilling contractors created nine bore holes--all approximately 30 metres in depth and 3 inches in diameter. Six of the bore holes were drilled on an incline in order to intersect more of the rock fractures. The remainder were vertical and used as a control zone for the different pump tests.

A 3" protective steel casing lined the first few metres of each bore hole and was seated into the bedrock. The surface end of the steel jacket extended above the ground about 1 foot and was fitted with a protective locking cap that ensured bore hole protection while staff were not at the site. Groundwater was encountered in each hole at approximately 15 metres. After careful examination of the rock core that was extruded from the drill core barrel, fractures and possible fractures were logged and measured to determine their exact depth. Some of the fractures were misleading since they were caused when the core was removed from the barrel for storage into core boxes or during transport.

The first major set of pump tests was conducted in the fall of 1990. This set of tests was designed to stress known or assumed fractures in the vertical holes and measure response of pressure change in the inclined bore holes at the corresponding fractures. This change and rate of change was used to determine the real fractures from possible fractures and the larger ones from the smaller. Using a sophisticated water pressure system designed and built by Research Support Division staff, fractures from each vertical bore hole were compared to fractures at each set of angled bore holes to eventually show a network of interconnecting fractures. Because the pressure system was housed in a trailer, it could easily be moved from hole to hole or even site to site. Each fracture was stressed with a known water pressure forced between a set of inflatable glands that sealed off the hole above and below the fracture. Sensitive pressure transducers also mounted between the packer glands located at the fractures in the inclined bore holes sent back the pressure changes that were recorded in a data logger and later analyzed.

The 1991 fall experiments were very similar to past tests but much more intensive and took about 3 weeks to complete. Packers with transducers were installed in all the bore holes with all the sensor lines running into a van that was set up as a lab and office to house all of the recording and electronic equipment. The main difference between this series of experiments and the ones made in 1990 was that water was pumped from the test bore hole as opposed to injecting water under pressure. This allowed the scientists to collect pressure data from several bore holes at one time. The submersible pump that was down the main test hole pumped water out at 5 litres per minute and could be moved up or down to stress the different fractures. After each 12-hour pump test, it was necessary to allow the test zone to come back to equilibrium before another test could be run. This recovery period was also monitored until stable. Before another fracture could be tested, the packers were deflated, moved to the new elevation and then re-inflated to 170 psi with nitrogen via the inflation line that ran to the surface. The packers would again expand against the bore hole wall sealing off the new fracture that was to be tested. Tripods fitted with a small hand winch straddled the bore holes and were used for raising and lowering the packer systems. Water pumped from the test bore hole was diverted by hose 200 metres away from the research area to ensure

that it could not make its way back into the test zone groundwater and interfere with survey results. Pump rates and volumes necessary for accurate test results were made by installing an in-line electronic flow meter and backing it up with physical calibrations made at the end of the outflow line.

Because of the remote location of the survey site, there was no hydro available for running equipment, etc., necessitating the use of generators. There was one 5 kw, one 3.5 kw, one 1.5 kw and one 650 W. generator to handle the lights, heaters and pumps at the site.

All tests were successfully completed and the site cleaned by the end of November.

Similar tests and drilling are planned for the 1992 field season.

TURKEY LAKES WATERSHED

RRB LRTAP STUDY 83052, R.G. SEMKIN

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

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

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

A security system at the camp work site and a 2-way radio system were operated by Tech. Ops staff and maintained by the Communication Centre staff in Sault Ste. Marie. All roads and trails in the watershed were maintained by Tech. Ops. staff 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 and one canoe (14 - 16 ft.). One outboard motor and other items to make the boats safe and operational were also supplied. Tech. Ops. supplied 2 electric motors.

Tech. Ops. staff supported Rivers Research Branch staff in chemical and hydrological monitoring of the watershed. The hydrological monitoring consisted of gauging and sampling seven stream locations throughout the watershed on a weekly basis and the samples were analyzed for numerous chemical parameters. Five lakes were sampled on a biweekly schedule for the same chemical parameters with the exception of 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 until June. Samples were collected every 12 hours. In September, the CFS 47 site was put on line again and will continue sampling every 12 hours until June '92.

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

Technical Operations supplied additional support during intensive sampling periods. One 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 required travel to a sampling location on the Goulais River 80 km from Sault Ste. Marie. In the winter, the road to the site is not maintained and skidoos are required to travel 10 miles along this road to the sample site. Samples are collected for trace metals, major ions, nutrients, phosphorus, pH and mercury analysis. The samples are shipped to Burlington according to regulations required by the Transportation of Dangerous Goods Act for analysis by WQB personnel.

Two other projects were also supported during the year. These were: 1) RRB Study 83012, Thunder Bay and 2) LRB Study 82072, St. Marys River.

In October, 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 temperature and air temperature at the Batchawana lakes. This utilizes a Campbell datalogger and storage can. The system was monitored and data processed by TOS staff.

2. A large 2-metre static snow collector was set up at the MET Hill site along with a Campbell datalogger to record wind speed and direction at 3 heights: 0.5 m, 1.0 m and 2.0 m. The sampler was serviced by TOS and RRB personnel. The data was downloaded and processed by TOS staff.

3. An automatic organic sampler was installed on the MET deck and serviced by RRB and TOS staff.

4. Transmissometer data will now be provided along with digitized EBT data during lake sampling periods.

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

6. A snow melt cave was constructed at the Batchawana Lake location and will be put into service during the spring run-off period. Samples will be collected by an automatic ISCO sampler powered by a solar power panel.

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

SAMPLING AT MILE 82

ON THE ATHABASCA RIVER

ATHABASCA RIVER

RRB STUDY 83054, DR. B.G. BROWNLEE

This was a continuation of the sampling started in 1989 and carried on again in 1990. This study was designed to generate a predictive model which can be used to investigate options for the management of the presence, pathways and effects of polycyclic aromatic hydrocarbons (PAH's) which may be released from existing and planned oil sands development. This study will also help in the evaluation of the impact of such developments compared to that of other existing and planned upstream industrial activities such as pulpmills.

There were two sampling periods involved: The first was a winter sampling trip, March 4 - 19 on the Athabasca River from upstream of Hinton to Mile 82 upstream of the Firebag River. Samples were collected at Hwy. 40 upstream of Hinton; at the Obed bridge 20 km downstream of Hinton; at the bridge to Windfall Junction, km 177; at the Vega Ferry crossing, km 352; upstream of the town of Athabasca, km 534; upstream of the Horse River and Fort McMurray at mile 33 downstream of the tar sands plants and at mile 82, upstream of the Firebag River. At each site, five 20-litre samples were obtained by pump through the ice or by stainless steel bucket where there was open water. Four of these samples were base/neutral extracted and the other was acid extracted only. Four 1-litre samples were also collected for return to CCIW.

A suspended sediment sample was obtained from the deeper Southern Basin of Amisk Lake near the town of Athabasca for Dr. P.G. Manning, LRB. Two samples were obtained from a depth of 1 metre in the surface zone and a depth of 7 metres in the anoxic layer. Suspended sediment was frozen and returned to CCIW for analysis. A bottom core was also collected from this site and sectioned.

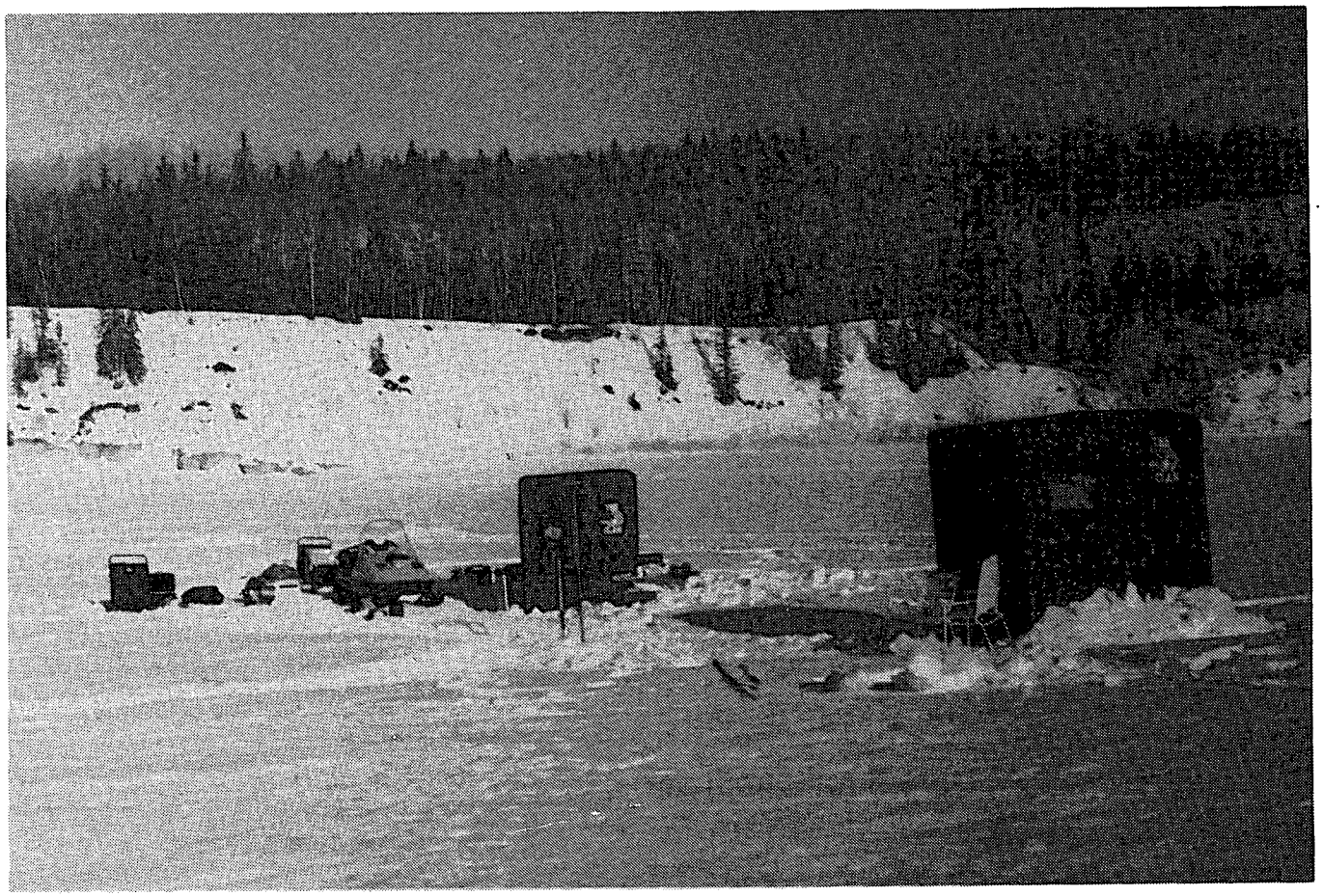
The second field trip was supported by one Technical Operations person during the period of August 18 to September 7.

The initial segment of work required the use of the larger 26-foot boat located at Fort McMurray to travel 185 kilometers down the Athabasca River to obtain six fish specimens each of Goldeye and Walleye from selected sites along the river. While at the mile 117 sample site, a 6-hour suspended sample was collected along with a Pentane extraction. This work was carried out August 20 - 22 after which all personnel returned to Fort McMurray for the second phase of the work.

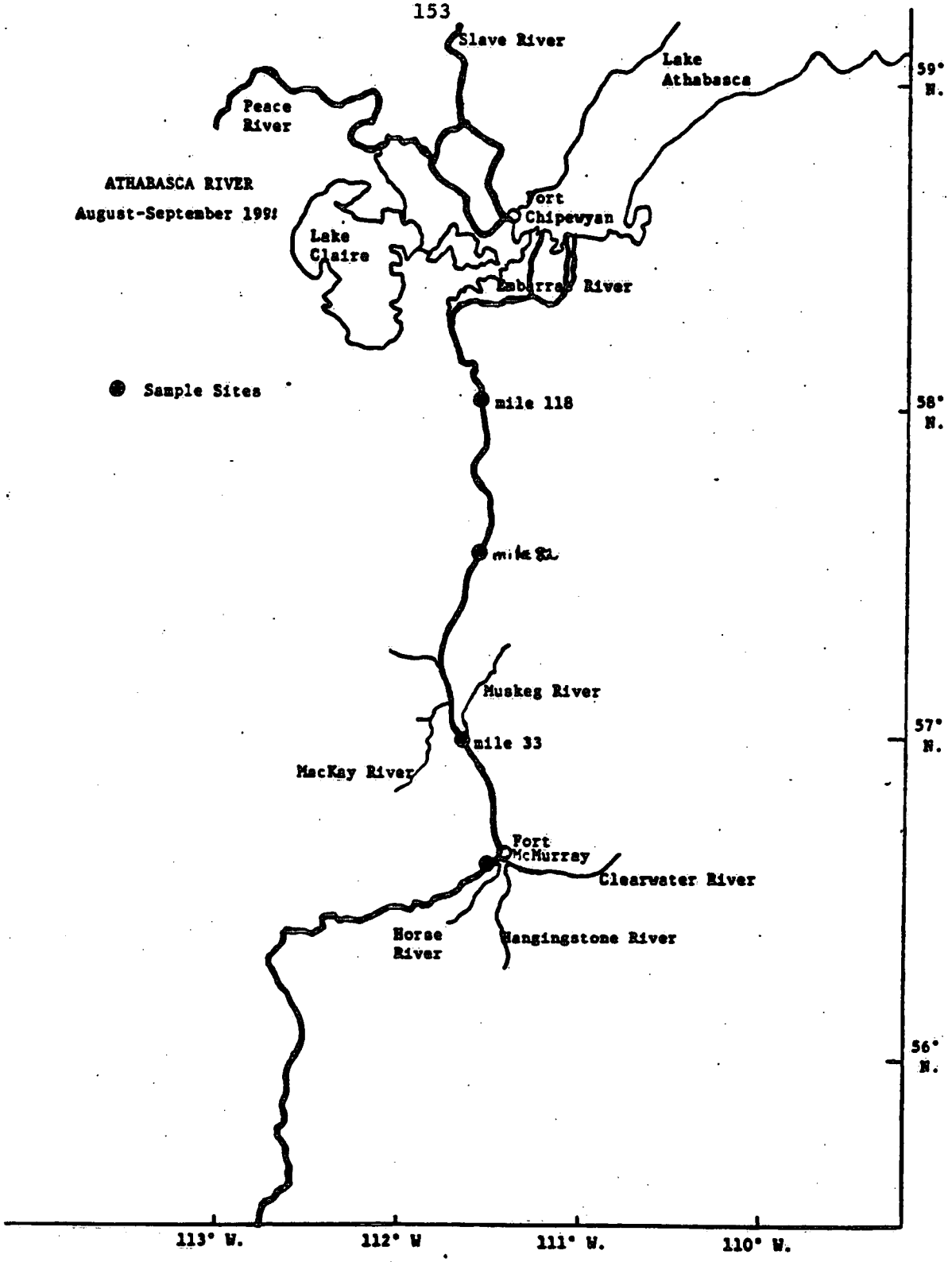
On August 26, an Alberta Environment representative, a Water Quality Western Region representative and CCIW personnel met in Hinton to begin

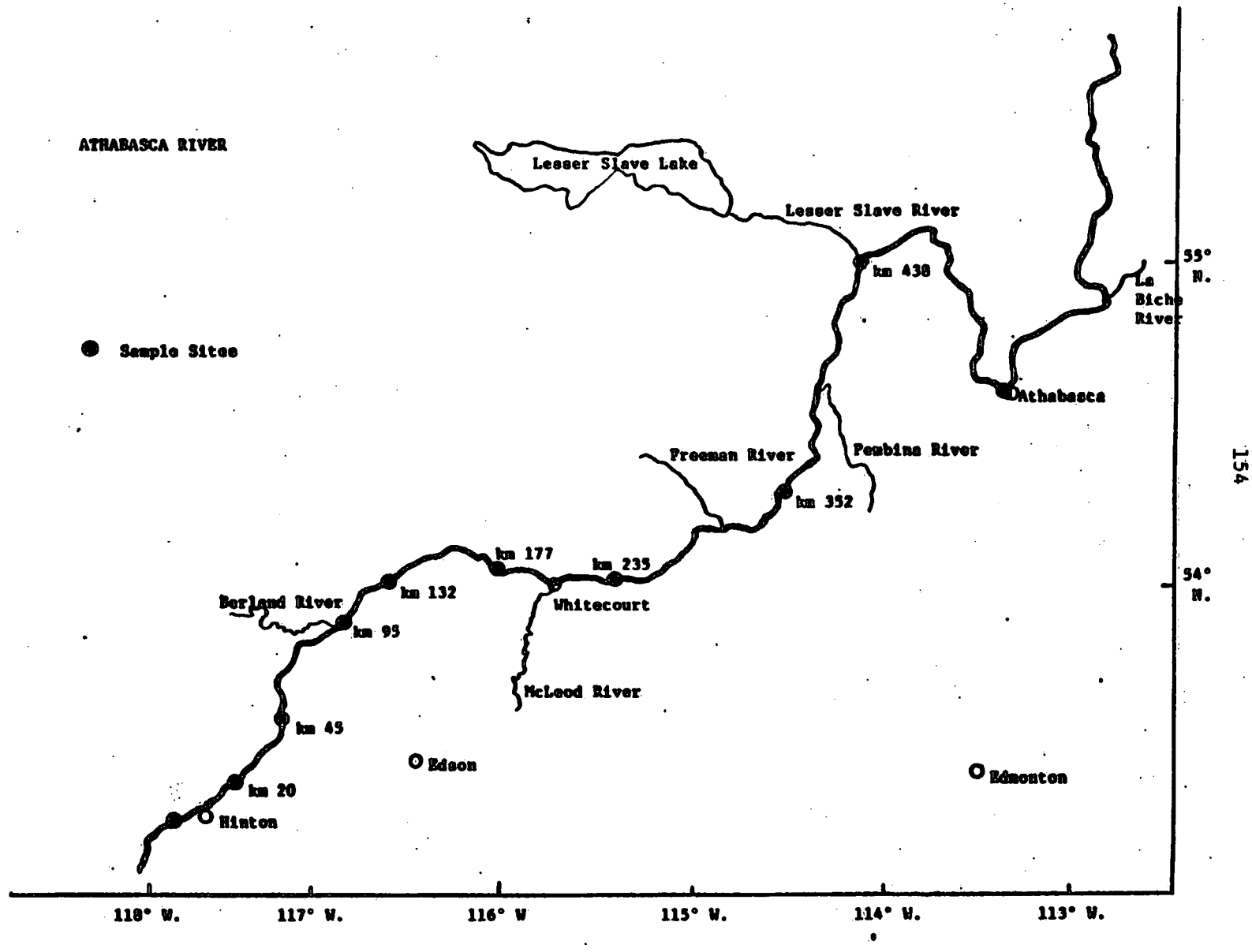
sampling the river from above the Weldwood Pulp and Paper Mill back down the river to Fort McMurray. Eleven sites were sampled from mid-river locations where bridges or ferries crossed the river. Pentane extractions were done at each as soon as possible after collection.

After finishing at Fort McMurray on September 2, the CCIW vehicle and personnel left Alberta, arriving in Burlington on September 7.



SAMPLING HUTS ON THE ATHABASCA RIVER


Slave River
Lake
Athabasca
59°
N.
Peace
River
ATHABASCA RIVER
August-September 1991
Fort
Chipewyan
Lake
Claire
Embarras River
Sample Sites
mile 118
58°
N.
mile 81
Muskeg River
57°
N.
mile 33
MacKay River
Fort
McMurray
Clearwater River
Horse
River
Hangingstone River
56°
N.
113° W.
112° W
111° W.
110° W.


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

RESEARCH & APPLICATIONS BRANCH

PRAIRIE PROVINCES WATER BOARD

RAB STUDY 84022, K. ASPILA

Water samples were collected from various rivers in the three prairie provinces from May 6 - 16. At each site, 400 litres of water were centrifuged and shipped or driven to CCIW for analysis. These samples are to be utilized as standards for interlab comparisons throughout North America and should last for several years. Stations where samples were collected are as follows:

Station 1 was located at the Provincial Park at Sand Bridge on the South Saskatchewan River at Alberta Hwy. 41. The sample was collected from the most upstream access to the park on the right bank. Flow rate was 5L/min.

Station 2 was located in a farmer's field on the left bank of the Red Deer River at Alberta Hwy. 41 approximately 200 m downstream of the highway bridge. Flow rate was 5L/min.

Station 3 was located on the left bank of the Battle River at Unwin Road. Unwin Road is accessible off Saskatchewan Hwy. 40 north of Marsden, Saskatchewan. Flow rate was 5L/min.

Station 4 was located on the right bank of Beaver River, west of Beaver Crossing, Alberta. A Water Survey of Canada gauging station is situated at the same location (upstream of the bridge at Alberta Hwy. 55). Flow rate was 5L/min.

Station 5 was located at the town park of Hudson Bay, Saskatchewan on the left bank of the Red Deer River, upstream of the highway bridge on Saskatchewan Hwy. 9. Flow rate was 5L/min.

Station 6 was located on the Assiniboine River at Sioux Benn Picnic Site south of the town of Miniota, Manitoba on Manitoba Hwy. 83. The sample was collected approximately 200 m upstream of the park on the right bank. Flow rate was 5L/min.

Station 7 was located at Victoria Park in the town of Souris, Manitoba. The sample was taken from the left bank approximately 150 m upstream of the highway bridge, Manitoba Hwy. 22. Flow rate was 5L/min.

Station 8 was located on Manitoba Road 211, 1 km east of Hwy. 11 near Pinawa, Manitoba. The sample was collected at a launching ramp/park 150 m upstream of the highway bridge on the right bank. Flow rate was 5L/min.

All samples were collected by electric Westfalia centrifuges.

Vehicle No. 90-212 was utilized to transport equipment and samples.

WAVES TOWER

RAB STUDY 84033, DR. M.G. SKAFEL

The WAVES tower was installed in Lake Ontario one kilometer offshore from Van Wagner's Beach in Hamilton. Since the date of installation in 1976, maintenance of the structure has been limited to the aforementioned water sections. During the past winter, a plan was prepared to clean, inspect, repair as necessary and renew the protective coating of the underwater structure. Work commenced in mid-June, continued uninterrupted for three weeks and one additional week was added in mid-August.

The work was executed in three stages. The cleaning stage required the use of high pressure water blasters 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. Both the first and second stages were completed and all welds checked out satisfactorily. The painting stage is 75% complete and will be completed in the 1992/93 season.

Divers worked on the subsurface structure, students completely painted the over-water structure.

RESEARCH SUPPORT DIVISION

CLAMMING AT CORNWALL, ONTARIO

ST. LAWRENCE RIVER, CORNWALL

RSD STUDY 86031, H. BIBERHOFER, IWD-OR

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

Six surveys and one dye study were conducted on the St. Lawrence River at Cornwall. Before the surveys were started, 5 Seastar and 1 sediment trap mooring were deployed on both sides of Cornwall and St. Regis Islands in order to collect representative samples of all water as it passes through the various channels.

During each survey, Seastar extractors were deployed and retrieved from the 5 Seastar moorings (3 fastwater buoys and several Coast Guard navigation buoys) from the channel below the Ontario Hydro (Saunder's) dam to a line of buoys on the south side of Cornwall Island upstream of St. Regis River. Water samples were to be collected at all extractor sites every cruise to better understand the flow of the river as it passes through the Cornwall area. Due to problems with supply, the extractors were not deployed every time.

During the November dye study, current measurements were conducted with Water Survey of Canada personnel to establish the flow rates of the various channels through the islands in the area. The dye study was a joint project with several organizations involved, including DFO (Hydrographic and BINST and 3 groups from WSC). The dye was released from the south abutment of the international bridge on the south side of Cornwall Island. The dye was tracked through the various channels of the river until it reached the downstream end of St. Regis Island.

During the September survey, freshwater clams were collected from 15 stations throughout the area from below the Saunder's Hydro dam (Ontario Hydro) to Stonehouse Point. At each site, 20 clams from both major species (Elliptio complanata and Lampcillus radiata) were collected, cleaned, frozen and returned to CCIW for analysis. The only station where clams could not be collected was 90-01 at Stonehouse point. The bottom is all rocks and the clam dredge would not pick up any clams. A diver would have been required to sample that location.

All equipment was returned to CCIW on completion of the survey.

IRATE OSPREY CHICK

CANADIAN WILDLIFE SERVICE

RSD STUDY 86031, DR. V.W. WESELOH

Technical Operations Section continued to support the Canadian Wildlife Service (CWS) field program on the Great Lakes and connecting waterways. The purpose of this program was to determine, or aid in the determination of, how various factors constitute biological effects of toxic chemicals in Herring Gulls, Double Crested Cormorants and other species of colonial waterbirds at several nesting colonies throughout the Great Lakes and connecting waterways. Other species such as red winged blackbirds, snapping turtles, etc., were also studied to acquire a better understanding of the effects and movements of manmade pollutants like pesticides and fertilizers that are used on fields.

Although Dr. Weseloh's CWS research covered a large area requiring several separate studies, Technical Operations support was confined to Lake Huron, Georgian Bay, North Channel and the Kawartha Lakes, collecting data on Ospreys, Herring Gulls, Caspian Terns, Double Crested Cormorants and observing duck populations in Severn Sound.

Chick enclosures constructed of chicken wire and wooden stakes were erected on 2 islands in Georgian Bay and one in the North Channel for the study of Caspian Terns. These enclosures encompassed a number of nests (approximately 20) confining the chicks after they hatched, allowing more accurate observations.

The Osprey (Pandion haliaetus) was a new study for the CWS group which received the bulk of TOS support. Dr. Peter J. Ewins, a CWS contractor is the study leader for the two-year Osprey program. The Osprey is an impressive bird of prey which feeds exclusively on fish by diving feet first into the water from a considerable height. Between April and August, Ospreys breed in scattered pairs near lakes and large rivers throughout many parts of Canada but in the fall they leave for the wintering areas in Central and South America. In the Great Lakes, the Osprey sits at the top of the freshwater food chain and so should be an excellent sensitive biological indicator of the contaminant levels in the aquatic environment. Therefore, the Canadian Wildlife Service, in conjunction with the Ontario Ministry of Natural Resources, initiated this study of Osprey ecology in relation to contaminants in the Canadian Great Lakes and adjacent waterways. Recent surveys conducted by wildlife staff at the Ministry of Natural Resources in Parry Sound documented the existence of over 25 active Osprey nests in the district. Based on the above and other history of Osprey populations and movements on and around the Great Lakes, three survey areas were studied during the field season.

Study Areas

Based on past information from several sources concerning Ospreys breeding within 10 km of the Great Lakes shoreline, two suitable breeding concentrations were identified in the Canadian Great Lakes--both in Lake Huron: the St. Marys River and the southeastern shoreline of Georgian Bay. A third site in the Kawartha Lakes was chosen as a reference or control site.

North Channel, St. Joseph Island area
Georgian Bay, Parry Sound to Victoria Harbour
Kawartha Lakes, Lindsay area (reference)

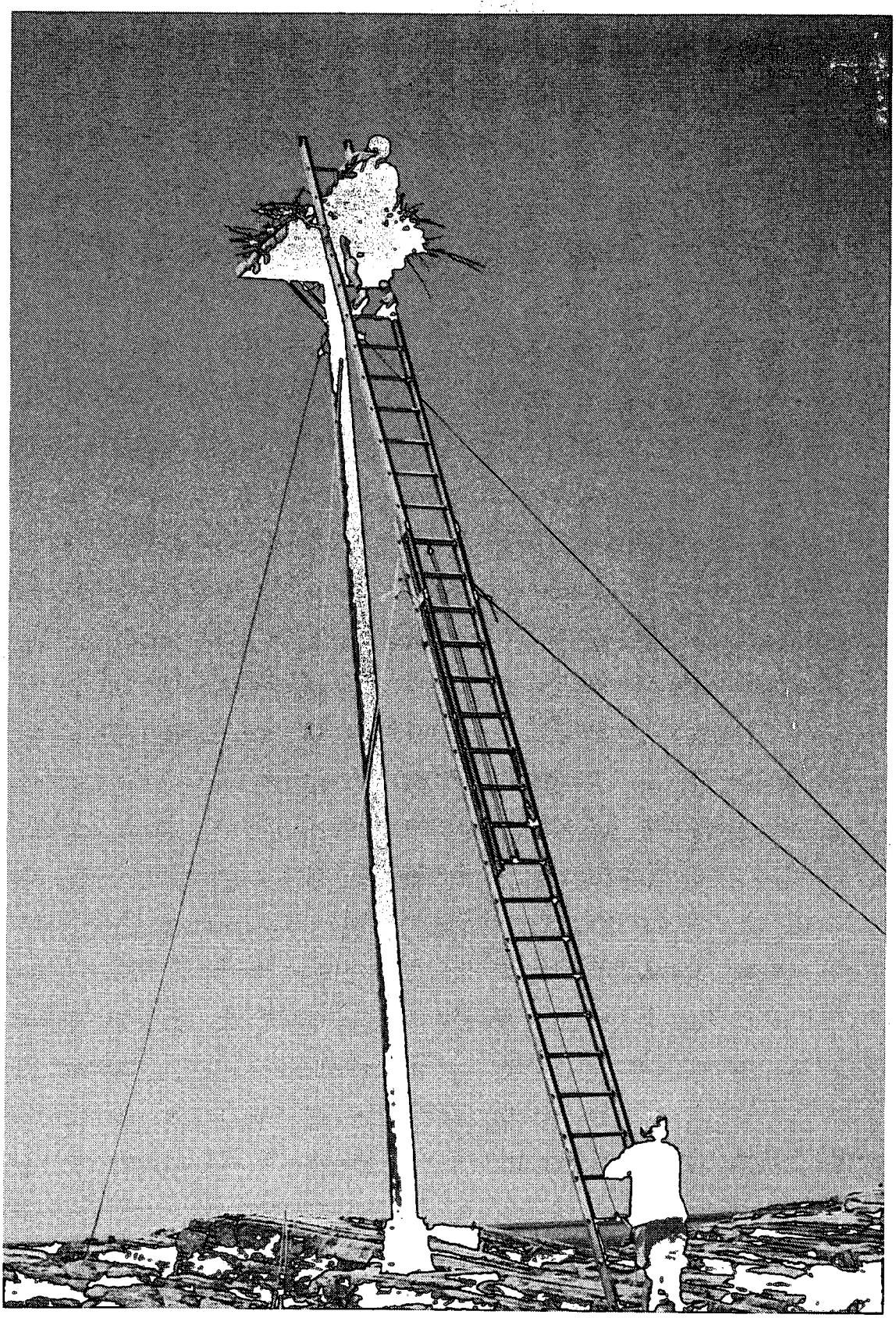
Study Site Criteria

- At least 20 occupied Osprey nests
- A reasonable number of accessible nests for collections and more detailed work
- Nests of sufficiently high density to be representative of a relatively discrete area of the Great Lakes which could be readily monitored by boat, land or plane
- The full agreement of any conservation groups and other organizations and individuals with an interest in Ospreys

Method

Dr. Ewins' design and approach to field logistics for the Osprey study came after careful examination of past data and data collection methods used by other researchers. After procuring relevant permits for the collection of biological samples and working with a listed threatened/endangered species (Michigan), the project began in earnest early in April. Intensive field work was necessary over the next three and one-half months to observe the Osprey and collect the needed samples. This often required long days and extended periods of time in the field. Aside from behavioural observations of the adult birds (as most other bird species studied by the CWS group at CCIW) most of the research was conducted on Osprey chicks. This entailed many visits to all three survey areas. In the early stages of the project fixed-wing and helicopter flights were used to pinpoint existing nests needed for mapping each study area. Also, prior to laying eggs and chick hatching, adult movement was observed at a distance with the aid of binoculars and/or telescope. This observed movement was important to assist in understanding behavioural patterns of the adults with respect to nest building, egg laying and chick rearing prior to their departure south.

Population surveys, detailed reproductive studies, collection of samples for contaminant analysis and egg shell thickness measurements and chick banding were conducted at each nest at the appropriate time. Because egg laying and chick hatching does not occur evenly throughout an area or areas, continuous nest observation was maintained throughout the program to ensure accurate data and sample collection.



MOTHER OF ALL LADDERS

As in past years with research conducted on colonial water birds on and about the Great Lakes, a small Department of Fisheries & Oceans launch, CSL THUNDER BIRD was utilized to reach the nest sites, usually located on off-shore islands.

The Osprey study was somewhat unique compared to similar studies conducted over the past several years by the Burlington CWS because this large fish-eating bird often nests high in trees and platforms as opposed to the ground nesters such as Gulls and Terns. This presented problems in reaching the number of nests necessary for the largest percentage of data collection. Other than a few precarious climbs by Dr. Ewins with the aid of climbing spikes, ropes and safety lines, a humungous 44' aluminum ladder (mother of all ladders) was employed to reach most of the nests in the Georgian Bay area. Even with this monster, some nests were too high to be reached! A three-man team was needed to extend the ladder at the Georgian Bay nest sites--one man at the base and two to control side guy lines.

All sites surveyed in the St Marys River area were situated on Canadian and U.S. navigational towers. Although several of these were very high (60'+), most had built-on ladders, making access much easier.

There was a significant difference between the nesting habits of Ospreys in the Kawarthas and the other two sites. Kawartha Osprey seemed to be comfortable nesting in old tree stumps and low, man-made platforms. Most of the large tree stumps utilized by the birds were left after flooding of huge areas of land during the creation of the Trent-Severn Canal waterway system that connects Lake Ontario to Georgian Bay. Many man-made platforms have been constructed over the past several years in Georgian Bay and the Kawarthas by MNR and groups such as the Georgian Osprey Society. Kawartha Lakes platforms are a low tripod type as opposed to the Georgian Bay high single telephone pole type structures with guy lines lagged to pins in the island rock. The Georgian Bay poles are mounted on small rock island where the Kawartha tripods are located in shallow off-shore areas with tripod poles extending into the bottom mud. These tripods are often assembled and installed during the winter over the ice. A CCIW flat-bottomed skiff, JO-BOAT was needed for the work in the Kawarthas because of the shallow water.

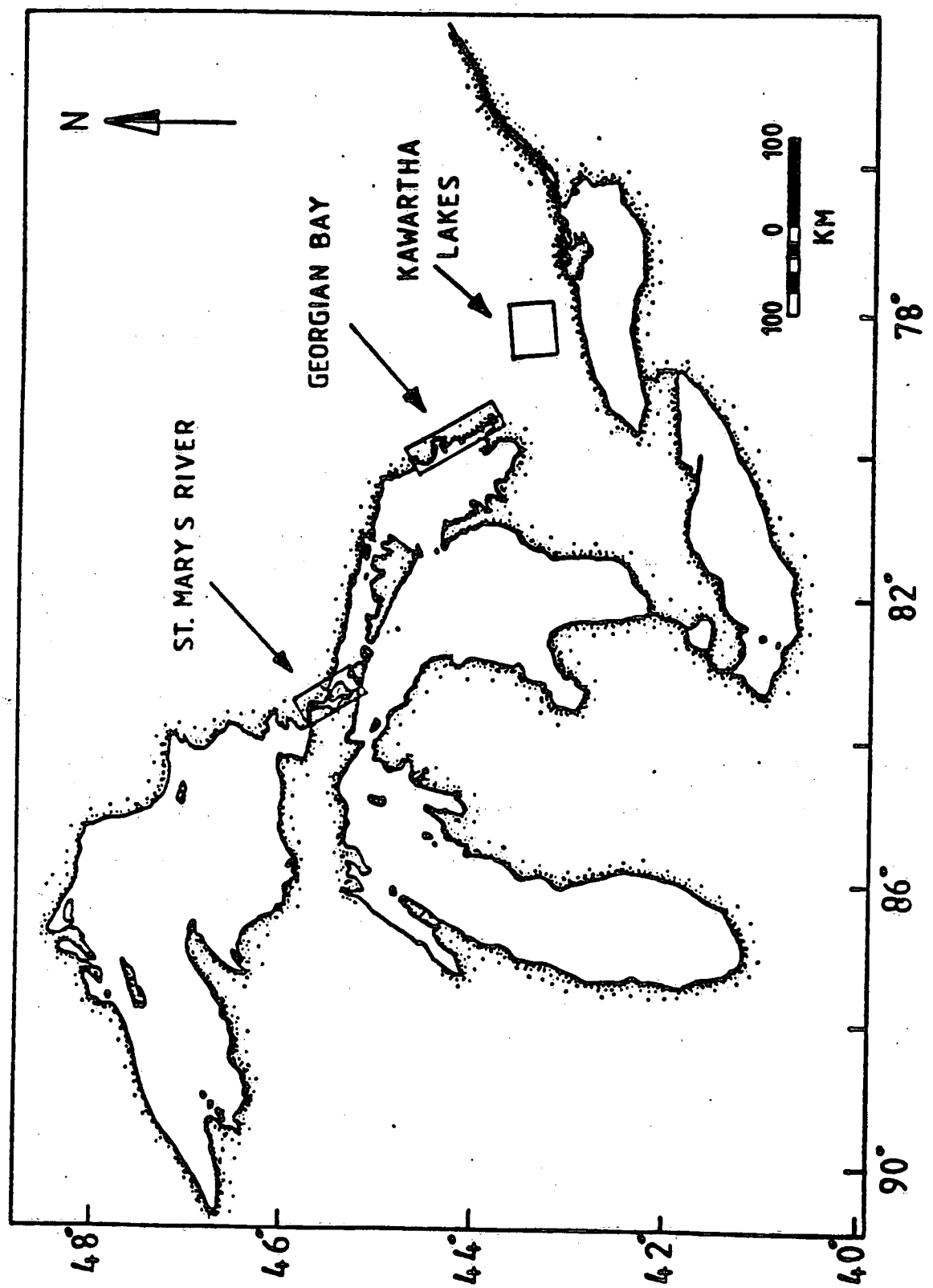
Most samples collected that required analysis were sent to CWS in Ottawa for processing. Dr. Ewins spent several days at the MNR research site on Manitoulin Island analyzing and comparing fish remains collected from the Osprey nests to determine fish species caught and consumed by this bird of prey.

Although support to this CWS field study required many boat and land trailering miles, it was successfully completed without mishap.

Note:

Dr. Ewins has completed a comprehensive interim report on the Osprey and contaminants in the Great Lakes that will soon be available. Also, considerable SVHS footage was collected during the study which eventually will be edited into an informative in-house video about the Great Lakes Osprey.

The location of the three study areas in 1991 in relation to the Great Lakes.



CANADIAN TRANSPORTATION ACCIDENT INVESTIGATION & SAFETY BOARD

RSD STUDY 86034, F.H. DON

On March 19, Technical Operations received a request from the Engineering Branch of the Canadian Transportation Accident Investigation and Safety Board to assist in the search and video documentation of the wreck, "CAPTAIN K". The fishing vessel, CAPTAIN K had sunk in 125 ft. of water in Lake Erie near Long Point after colliding with the Canadian Coast Guard vessel, GRIFFON.

After meeting investigators at the Simcoe airstrip and the dive supervisor for Pembina Explorations at Pt. Dover, all equipment was loaded onto the dive boat, ANDREA MARIE. On the trip to the wreck site, the video system was set up and a dive plan formulated.

Once on the site, the ANDREA MARIE was held on station while MURV went to the bottom to make a positive identification of the wreck and determine the locations of any nets or other potential hazards to the divers. The underwater picture clearly showed the name of the vessel. Once completed, the first diver entered the water, attached a line to the wreck and started a survey to find any bodies. During this dive, MURV followed along with the diver to record his field of view and conversation. During the diver's decompression time, MURV entered the wreck through an open door on the stern. Again, the area was checked prior to entry of the second diver inside the wreck.

The CAPTAIN K was heavily damaged midships on the port side and the wheelhouse had been crushed to within 3 ft. of the deck. There were no visible signs of the crew. During the survey, MURV performed flawlessly with a total of 3 hours of video tape submitted to the investigators.

UNDERWATER POSITIONING SYSTEM (SHARPS) TRIALS

RSD STUDY 86034, F.H. DON

During the week of August 26 - 30, TOS Divers travelled to Tobermory to participate in a series of equipment trials which could have an influence on future underwater surveys at CCIW. The purpose of the trials was to establish the effectiveness of operating a ROV (Remotely-Operated Vehicle) in combination with divers within a high accuracy subsea positioning system. Participants in the trials included the Marine Archaeology Branch, Parks Canada (Ottawa) which supplied the SHARPS system, Marine Telepresence (Marquest Group) and Bruce National Park which provided vessel support and diving equipment and NWRI provided MURV (miniROVER MK II) and dive support.

SHARPS (Sonic High Accuracy Ranging and Positioning System) is designed for very precise underwater survey, tracking and navigation. The system consists of three underwater transceivers connected through coax cables to a surface computer and a fourth transceiver (which may or may not be wireless) which is installed on the ROV or diver as they move inside the survey area. The system is intended for short baseline surveys and claims an accuracy of ±2 cm. As an option, the manufacturer will provide a telerobotic control function for the ROV to allow computer control over all ROV functions, creating a very precise mode of control for sensitive control surveys. All data is collected on disc and post survey data processing (when integrated with a CAD software package) will allow 3-D displays with rotation from any perspective.

These trials resulted in a number of conclusions which will benefit RSD when the time comes to purchase such a system.

As an additional task, support was provided to the University of Guelph for Dr. D.W. Larson, Department of Botany using MURV to survey a submerged area of the Niagara escarpment for old forest remains. Four hours of dive time were logged by MURV at depths as deep as 275 ft. in the area between Middle Island and Flowerpot Island without finding the tree stumps.

PRODUCTIVE CAPACITY OF FISH HABITAT

RSD STUDY 86034, V. CAIRNS, J.D. 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 Act Annex 2. The long-term objectives of the work include:

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

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

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

4. To evaluate fish habitat restoration methods.

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

TECH. OPS DIVE SUPPORT - (GLLFAS)

V.CAIRNS, J. FITZSIMONS, R. DERMOTT

DATE	LOCATION	DAYS						
		FIELD	PREP	TOS	GEAR	EXPS	SCPH	VIDEO
July 30-31	Dunkirk, N.Y.	2	1	3	6	2	2	2
		plus two single point moorings						
Aug. 26-29	Bay of Quinte	4	1	4	9	4	4	4
Aug. 28	Ham. Harbour	1	0	1	2	0	1	0
Sept. 3-4	Penetang Bay	2	1	2	8	2	2	0
Sept. 23-24	Burl. Pier	2	1	2	2	0	2	0
Sept. 25-26	50 Pt.	2	1	2	2	0	2	0
		Plus one single point mooring						
Oct. 1-4	Burl. Pier	4	3	6	4	0	4	4
		plus MURV for two days						
Oct. 8-11	Burl. Pier/50 Pt.	4	1	3	4	0	4	2
Oct. 15-18	Burl. Pier/50 Pt.	4	1	4	4	0	4	1
Oct. 23	Burl. Pier	1	0	1	1	0	1	0
Oct. 24-25	Mazinaw Lake	2	1	2	2	2	2	2
Oct. 29-30	Mazinaw Lake	2	1	2	2	2	2	2
Nov. 4-8	L. Erie/Quinte	4	1	8	0	6	4	4
Nov.12-14	Dunkirk, N.Y.	3	1	3	3	3	3	3
Nov. 14-16	50 Pt.	3	1	3	3	0	3	1
Nov. 18-20	Dunkirk, N.Y.	3	1	6	3	6	3	3
Nov. 18-20	Burl. Pier	3	1	3	3	0	3	1
Nov. 21-23	Mazinaw Lake	3	1	3	3	3	3	3
SUMMER/FALL TOTALS		49	18	58	58	30	49	32

TECH. OPS DIVE SUPPORT - (GLLFAS)

V.CAIRNS, J. FITZSIMONS, R. DERMOTT

DATE	LOCATION	DAYS					
		FIELD	TOS	GEAR	EXPS	SCPH	VIDEO
Mar. 20	Burl. pier	1	1	1	0	1	0
Apr. 2,3	Burl. Pier	2	2	2	0	2	0
Apr. 5	Rigging/setup		3				
Apr. 8,10	Chicken Island	3	6	9	6	0	0
Apr. 22-24	" "	3	3	6	3	0	1
May 7-10	" "	3	3	9	4	3	1
SPRING TOTALS (DAYS)		12	18	27	13	6	2

COMMON-USER SUPPORT/OUTSIDE AGENCIES

RSD STUDIES 86032, 86034, P.M. HEALEY

The purpose of this project was to provide logistic support equipment, instrumentation and field support (assistance) as resources permitted to studies within NWRI and 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 ranged from one day to one week 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 done by TOS and ESS staff at CCIW and training was done at the start of a sampling trip on the Columbia River at Castlegar, British Columbia by staff from 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-Ottawa, equipment loan
9. WQB-OR, water sampling, Goulais River
10. WTC (GOCO), water sampling, Burlington
11. University of Western Ontario, mooring equipment
12. Brock University, vessel co-ordination
13. Parks Canada, Trent-Severn Waterways, underwater support
14. WQB-Regina, equipment loan
15. St. Lawrence Seaway Authority, equipment loan
16. WQB-P&YR, equipment loan and technology transfer
17. Ministry of Natural Resources, equipment loan, Port Dover

RIGGING SHOP

Due to the number of requests for support in the field exceeding the number of staff on strength, riggers spent more time in the field on scientific studies. The usual workload of maintaining all mooring equipment, buoys, generators, power tools, winches and various other pieces of research equipment still had to be conducted whenever possible. Rigging shop staff were also responsible for the delivery of boats and laboratory trailers to field stations, delivering scientific equipment to major ships throughout the Great Lakes and the St. Lawrence River, erecting towers, operating boats, heavy trucks and forklifts.

Mr. S. Roberts filled a term position from April to October; C.J. Lomas filled the position from October to date. Both persons assisted in the rigging shop and on field assignments whenever required. L.J. Lomas was on disability leave from April and retired November 23. H.E. Greencorn retired after a long career (started at CCIW in 1967) in Tech. Ops. on May 31. Both employees were here over 20 years and their experience will be greatly missed and difficult to replace. H. Greencorn, when not assisting in the field, was responsible for the maintenance of the NWRI vehicle fleet, trailers, snowmobiles and all-terrain vehicles and monthly reports for all NWRI and NWQL vehicles. Three new vehicles were purchased to update the fleet's crewcabs, vans and station wagons.

FIELD STORES

The field stores, which supply NWRI with sampling equipment, was manned by Mr. W.D. Hunt on a full-time basis to issue and receive field gear. In conjunction with the rigging shop, inventory maintenance was conducted for all equipment on an as required basis. The daily scheduling of day-use vehicles for NWRI staff as well as DFO, EPS and WQNL was conducted on a year-round basis. W.D. Hunt retired from the position on April 26. Mr. Hunt's presence in field stores will be greatly missed. Y. Desjardins assumed the duties of field stores as well as conducting field support.

UNDERWATER ARTIST TAKING A BREAK

DIVING OPERATIONS

The Diving Operations Unit of Technical Operations Section provided national support to various scientific studies in areas of diver certification, inspections, installations and retrievals, sample collection, photography, television surveys with video documentation, equipment demonstrations/trials, search and recovery, lectures and diver training. Diving operations supported 13 divers located at Burlington. A total of 440 hours (accident free) was logged in support of projects for: NWRI, WQB-OR, MTSB-DFO, CTAISB, DOE-C&P and GLLFAS-DFO. An additional 160 hours were logged during the pool training program.

A total of 75 hours was logged on MURV--the remotely-operated miniROVER underwater camera system during the Amisk Lake, Alberta oxygen injection project, ferric chloride injection experiments in Sault Ste. Marie/ Hamilton Harbour and the GLLFAS fish habitat studies.

MURV was also used for a demonstration to Parks Canada staff at the Trent-Severn Waterway. The purpose of the demonstration was to show how using robotic cameras could compare to diver observations in hazardous locations such as dam intakes.

Since the March '90 refit, MURV now has the capability of operating to a depth of 1000 ft. and video signals are recorded on high resolution 8 mm video tape. The Dive Shop has the capability to edit and copy all raw footage for scientific purposes.

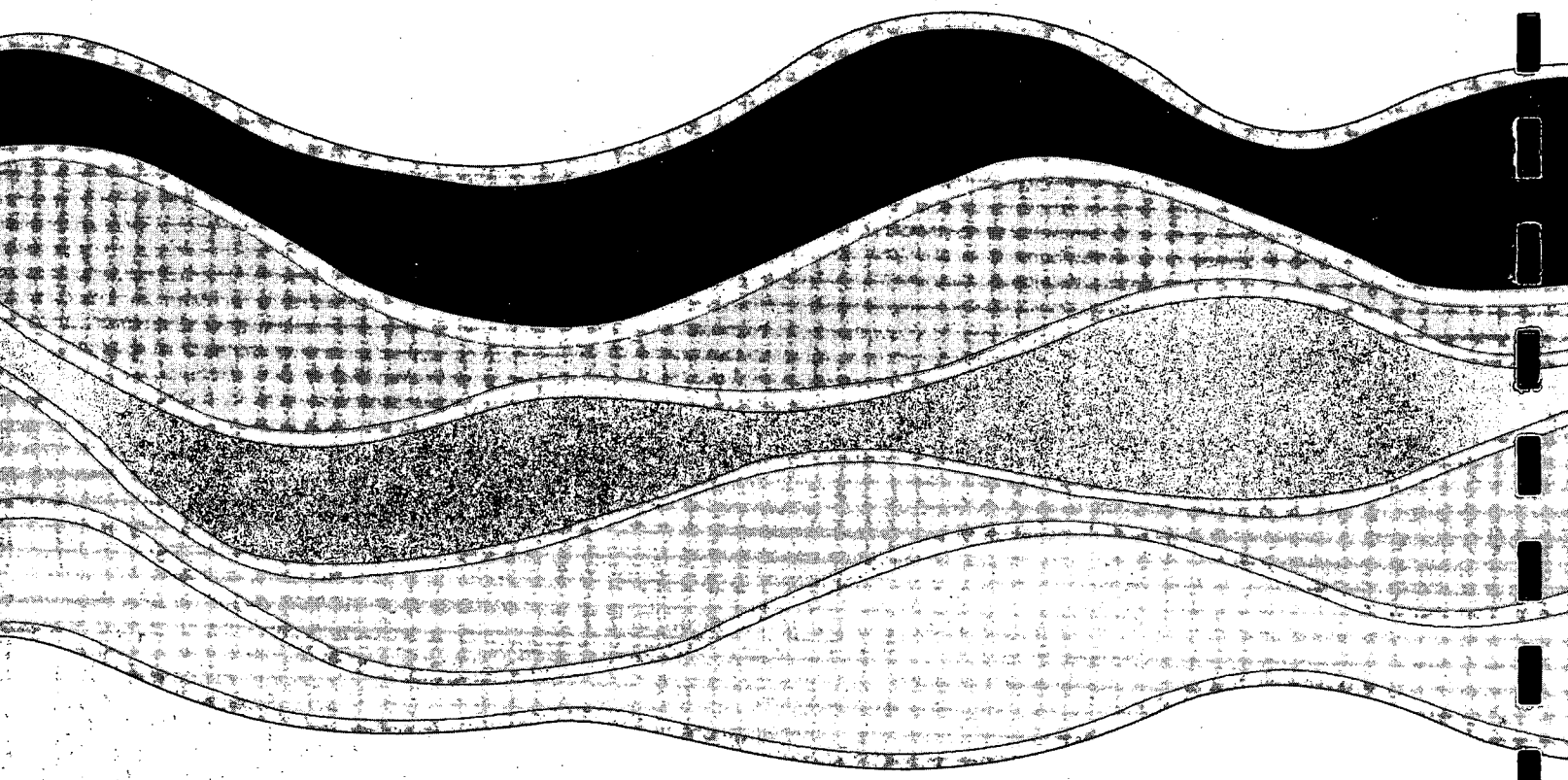
The Operations Officer, Diving, F.H. Don represented research/scientific diving as a member of the CSA Standards Technical Committee on Diving Safety and the Ontario Construction Safety Association Task Force on "Diving in Contaminated Environments".

The Annual Meeting of the Department of Environment Diving Safety Committee was held in April at the Transport Canada Training Centre in Cornwall, Ontario.

The Dive Shop has a complete inventory of modern diving and diver support equipment which, when used and operated by highly skilled divers, can complete even the most difficult subsea operations.

Projects supported included:

STUDY	DESCRIPTION
Lakes Research Branch	
82011	Murphy, Amisk Lake, Alberta
82012	Rukavina, West End Lake Ontario
82016	Rosa, Spanish River Basin
82072	Murphy, Sault Ste. Marie
Department of Fisheries & Oceans	
86034	GLLFAS, Cairns, Fish Habitat
	GLLFAS, Fitzsimons, Fish Habitat
	GLLFAS, Dermott, Zebra Mussels
	MTSB, Hull Inspections
	Parks Canada, Marine Archaeology



NATIONAL WATER RESEARCH INSTITUTE
P.O. BOX 5050, BURLINGTON, ONTARIO L7R 4A6

Environment Canada Environnement Canada

Canada

INSTITUT NATIONAL DE RECHERCHE SUR LES EAUX
C.P. 5050, BURLINGTON (ONTARIO) L7R 4A6

Think Recycling!

Pensez à recycler !