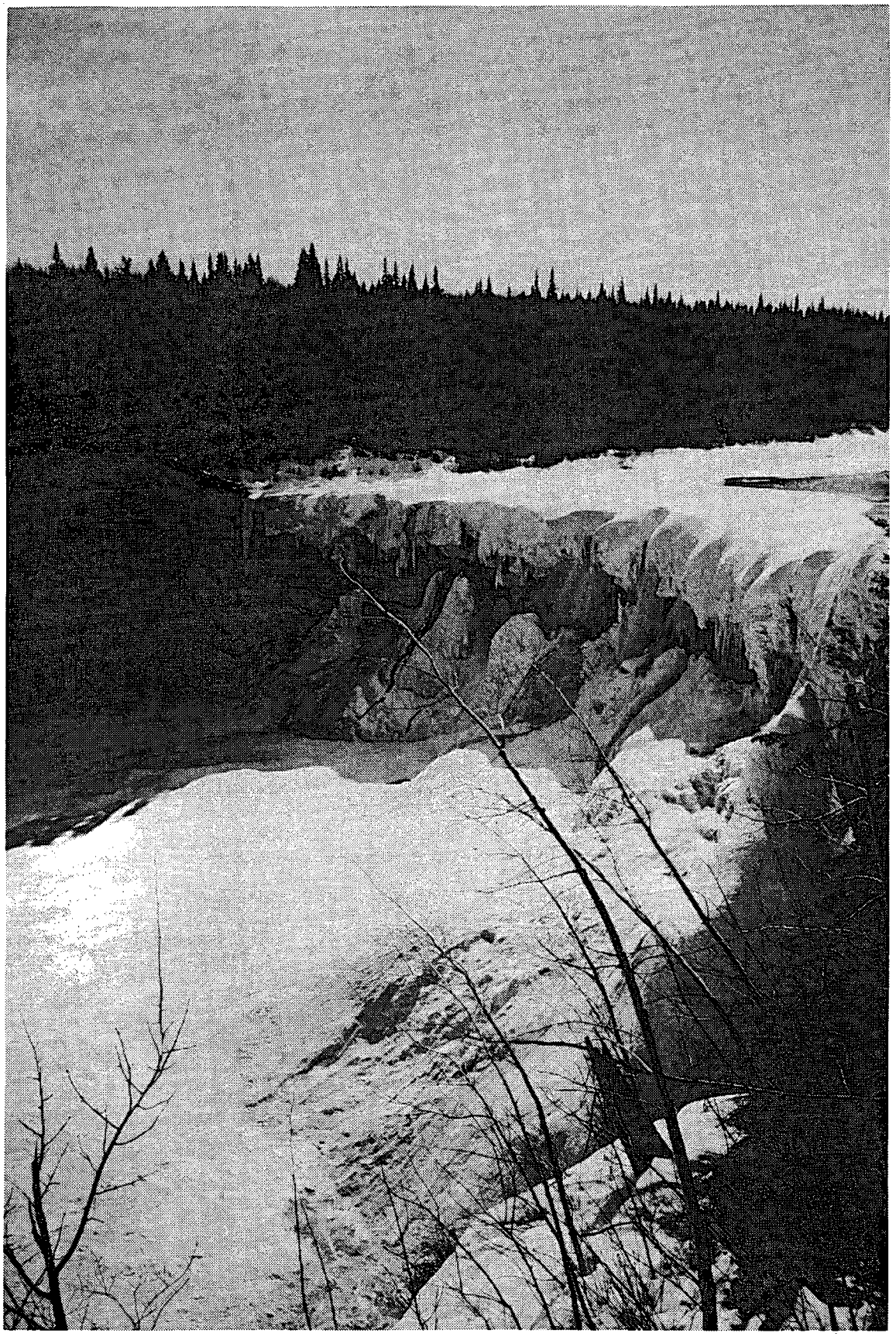
NWRI - Annual Reports
2000 Activity Summary

Environment Canada / Environnement Canada

Canada

NATIONAL WATER RESEARCH INSTITUTE
INSTITUT NATIONAL DE RECHERCHE SUR LES EAUX

2000
ANNUAL ACTIVITY SUMMARY
TECHNICAL OPERATIONS SERVICES
RESEARCH SUPPORT BRANCH
NATIONAL WATER RESEARCH INSTITUTE



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INTRODUCTION

The mandate of Technical Operations Services at the National Water Research Institute at CCIW in Burlington, Ontario 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 service 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 into field situations from coast to coast in North America, into the high Arctic and more recently overseas. As the scientific component of this institute embraces global environmental problems and increasingly lends its resources and expertise to third world and other countries, this service finds itself conducting field programs on other continents. This unusual opportunity—to work and gain valuable field related experience in such a varied sphere of operation, develops within the service a tremendous collective wealth of technical expertise unique to this support group.

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 digital underwater video capability, including the edit and manipulation of both analog and digital video material. Annual diver training and certification courses are also conducted to maintain a high level of competence among CCIW divers.

Rigging Shop personnel provide for the repair and maintenance of the NWRI fleet of vehicles, as well as for trailers and mechanical field gear. They also handle heavy equipment transport to field sites, operate Field Stores and when required assist as members of field parties.

This report is intended as an overview of the field activities of this group during the 2000 field season.

STAFF LIST

RESEARCH SUPPORT BRANCH

Director (Acting)	P.M. Healey
Secretary	S.R. Mitchell
Branch Finance and Administrative Officer	C. Kennedy
Administrative Assistant	C. Perry

TECHNICAL OPERATIONS SERVICES

Manager	M.R. Mawhinney
(Acting [Rotating])	B.H. Moore
	S.B. Smith
	F.H. Don

OPERATIONS OFFICERS

M.R. Mawhinney	Dryden, Rice Lake, Thunder Bay, Turkey Lakes, Ontario; Goose Bay, Newfoundland; Rouyn-Noranda, Quebec; Duluth, Minnesota
B.H. Moore	OIC CCGS LIMNOS; Great Slave Lake, Northwest Territories
S.B. Smith	OIC CCGS LIMNOS; Midland/Penetanguishene, Cornwall, Ontario
F.H. Don	Diving; OIC CCGS LIMNOS; Bay of Quinte, Severn Sound, Ontario; Lake Erie; Lake Michigan, North Carolina, U.S.A.; Japan

MARINE TECHNOLOGISTS

E.H. Walker	CSS LIMNOS; Miramichi River, New Brunswick
G.G. LaHaie	OIC Turkey Lakes Watershed
J.A. Kraft	OIC CCGS LIMNOS; Big Creek, Detroit/St. Clair rivers, Ontario; Whitecourt, Alberta; Miramichi, New Brunswick
K.J. Hill	CCGS LIMNOS; Detroit/St. Clair rivers, Ontario; Rouyn-Noranda, Quebec; Lake Michigan, U.S.A.
R.J. Hess	OIC CCGS LIMNOS; Big Creek, Detroit/St. Clair rivers, Turkey Lakes, Ontario; Miramichi River, New Brunswick
B.L. Gray	OIC CCGS LIMNOS; OIC CCGC SHARK; Hamilton Harbour; Diving; Big Creek, Humber Bay, Ontario; Rouyn-Noranda, Quebec
R.D. Neureuther	CCGS LIMNOS; Big Creek, Hamilton Harbour, Ontario; Fort McMurray, Alberta

MARINE TECHNOLOGISTS (Continued)

C.H. Talbot	Groundwater; Red Lake, Ontario
T.G.D. Breedon	Diving; CCGS LIMNOS; Lake Erie; Severn Sound, Cornwall, Detroit River, Bay of Quinte, Ontario; Rouyn-Noranda, Quebec; Great Slave Lake, Northwest Territories; Lake Michigan, North Carolina, U.S.A.

ASSISTANT MARINE TECHNOLOGISTS

D.A.D. Gilroy	Diving; CCGS LIMNOS; Cobourg, Detroit River, Severn Sound, Trenton, Ontario
L.M. Benner	Diving; CSS LIMNOS; Cobourg, Detroit River, Hamilton Harbour, Severn Sound, Turkey Lakes, Ontario
S.C. Barrett	(on assignment January to October, 2000) CCGS LIMNOS; Rice Lake, Ontario; Rouyn-Noranda, Quebec

RIGGING UNIT

C.J. Lomas	Senior Rigger; Ship Support
T.C. Gilliss	Vehicle Maintenance Co-ordinator; Clean Lab, Rouyn-Noranda, Quebec

NWRI FIELD STORES

C.J. Lomas
T.C. Gilliss

TERM EMPLOYEE

D.P. Walsh	On strength October, 2000

SUMMER STUDENTS

B. Cober	CCGS LIMNOS; Groundwater, Red Lake, Ontario
M. Crichton	CCSS LIMNOS; Big Creek, Ontario; Hamilton Harbour
J. DeBruyn	CCGS LIMNOS
A. Raun	CCGS LIMNOS; Dryden, Thunder Bay, Turkey Lakes, Ontario; Duluth, Minnesota

CCGS LIMNOS

2000 JANUARY

SUN	MON	TUE	WED	THUR	FRI	SAT
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23 / 30	24 / 31	25	26	27	28	29

FEBRUARY

SUN	MON	TUE	WED	THUR	FRI	SAT
		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				

MARCH 2000

SUN	MON	TUE	WED	THUR	FRI	SAT
			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	

APRIL

SUN	MON	TUE	WED	THUR	FRI	SAT
						1
2	3 Lake Ontario Moorings Schertzer Charlton Johannsson	4	5	6	7	8 CCIW
9 CCIW	10 CCIW Down for Repairs	11	12	13	14 CCIW	15 Transit
16 Lake Erie Surveillance L'Italien	17	18	19	20	21 Port Colborne	22 Port Colborne
23 Port Colborne Sarnia / 30	24 Port Colborne	25 L Erie Grapentine Charlton Detroit R. Marvin Moorings	26	27	28	29 Sarnia

MAY

SUN	MON	TUE	WED	THUR	FRI	SAT
	1 L.Huron Geo. Bay Surveillance L'Italien	2	3	4	5	6
7	8	9	10	11	12	13
14 Port Colborne	15 Lake Erie L. Grapentine Lake Erie Charlton Moorings	16	17	18	19	20 Sarnia
21 Sarnia	22 Sarnia	23	24 Detroit R. Marvin Moorings	25	26	27 Amherstburg
28 Amherstburg	29	30 Lake Erie Charlton	31			

JUNE

SUN	MON	TUE	WED	THUR	FRI	SAT
				1 Lake Erie	2	3 CCIW
4 CCIW	5 CCIW	6 Lake Ontario Rukavina	7	8	9	10 CCIW
11 CCIW	12	13 St. Lawrence R. NSERC	14	15	16	17 CCIW
18 Port Colborne	19 L Erie Charlton Moorings Detroit R. Marvin Moorings	20	21	22	23	24 Sarnia
25 Amherstburg	26 Lake Erie Charlton Grapentine	27	28	29	30	

JULY

SUN	MON	TUE	WED	THUR	FRI	SAT
						1 Port Colborne
2 Port Colborne	3 Port Colborne	4 Lake Erie Bourbonniere UVB &	5	6	7	8
9 Microbial Communities Bourbonniere	10	11	12	13	14	15 Port Colborne
16 Port Colborne	17 Lake Erie Charlton Lake Erie Charlton Moorings	18	19	20	21	22 Sarnia
23 Sarnia Port Colborne / 30	24 / 31	25 Lake Erie Grapentine Detroit R. Marvin	26	27	28 Port Colborne	29

AUGUST

SUN	MON	TUE	WED	THUR	FRI	SAT
		1 Lake Erie Reynoldson	2	3	4	5 Port Colborne
6 Port Colborne	7 Port Colborne	8	9 Lake Erie Charlton Lake Erie Charlton Moorings	10	11	12
13	14 Sarnia Down for Repairs	15	16	17 L.Huron Geo. Bay	18	19
20 Surveillance. L'Italien	21	22	23 L.Huron G.Bay	24	25 Transit	26 Transit
27 Port Colborne	28 L Erie Surveillance L'Italien L Erie Charlton Grapentine	29	30	31		

SEPTEMBER

SUN	MON	TUE	WED	THUR	FRI	SAT
					1	2 Sarnia
3 Sarnia	4 Sarnia	5 Lake Erie Charlton Detroit R C. Marvin	6	7	8 CCIW	9 CCIW
10 CCIW	11	12 Lake Ontario Brownlee Charlton	13	14	15	16 CCIW
17 CCIW	18	19 Lake Ontario Reynoldson	20	21	22	23 CCIW
24 Transit	25 L. Erie Grapentine Detroit River C. Marvin	26	27	28 L. Huron Reynoldson	29	30

OCTOBER

SUN	MON	TUE	WED	THUR	FRI	SAT
1 Lake Superior & Lake Huron Reynoldson	2	3	4	5	6	7 Sarnia
8 Sarnia	9 Sarnia	10 Lake Erie Charlton Moorings	11	12	13 Sarnia	14 Sarnia
15 Sarnia	16 Detroit R. Marvin Moorings Lake Erie L. Grapentine	17	18	19	20 CCIW	21 CCIW
22 CCIW	23 Lake Ontario GLLFAS Johannsson Lake Ontario Reynoldson	24	25	26	27	28 CCIW
29 CCIW	30 Lake Ontario	31				

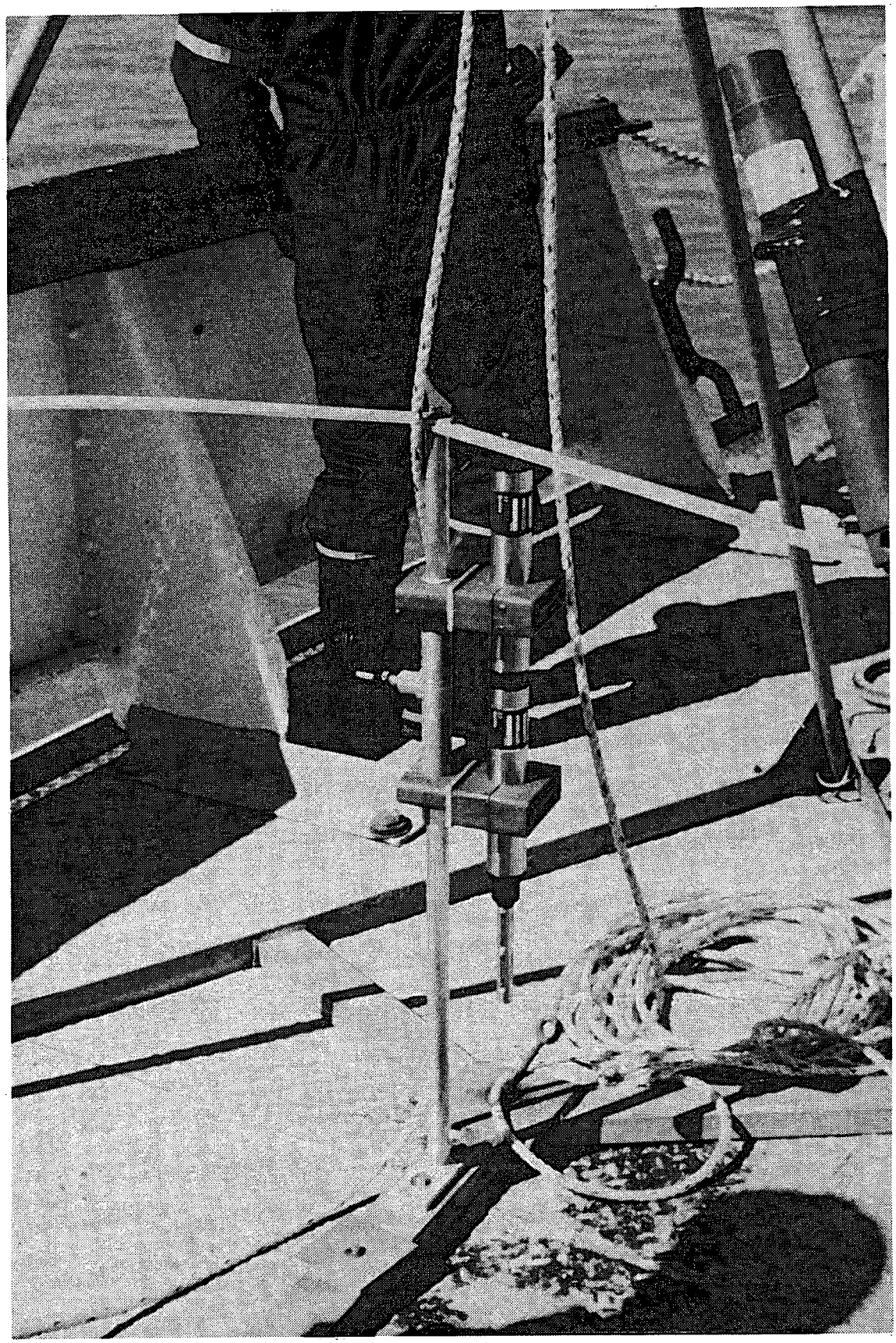
NOVEMBER

SUN	MON	TUE	WED	THUR	FRI	SAT
			1 Schertzer Charlton L. Ontario Moorings	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		

DECEMBER

SUN	MON	TUE	WED	THUR	FRI	SAT
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24 / 31	25	26	27	28	29	30

AERB AEIB AEPB ECB-OR AECB NSERC GLLFAS



GREENSPAN DO LOGGER

SHIPBOARD PROGRAMS

AQUATIC ECOSYSTEM MANAGEMENT RESEARCH BRANCH

BENTHIC COMMUNITY STRUCTURE, LAKE ERIE
AEMRB STUDY 12211, DR. L. GRAPENTINE

Seven cruises were carried out onboard the CCGS LIMNOS: April 25 - 28, May 15 - 19, June 19 - 23, July 24 - 27, August 28 - September 1, September 25 - 29 and October 16 - 19. The cruises were piggybacked with the Detroit River Contaminant Study and Lake Erie Zebra Mussel Effects mooring cruises.

At stations 23, 84 and 357 in Lake Erie, a mini box core was collected and five 6.7 cm diameter cores 10 cm in length were subsampled. These cores were extruded into plastic cups and stored at 4°C until sieved through a 250µ mesh screen. Residue was placed in the containers provided and preserved until returned to CCIW for analysis. A water sample was collected from a depth of bottom -1 m for dissolved oxygen and pH measurements.

At stations 23, 84 and 357, a DO logger mooring was installed. These three moorings were retrieved and reinstalled several times during the field year to clean zebra mussels from the oxygen membrane.

Phytoplankton samples at stations 23, 84 and 357 were collected for Dr. M.A. Zarull, AEMRB whenever samples were collected for Dr. Grapentine.

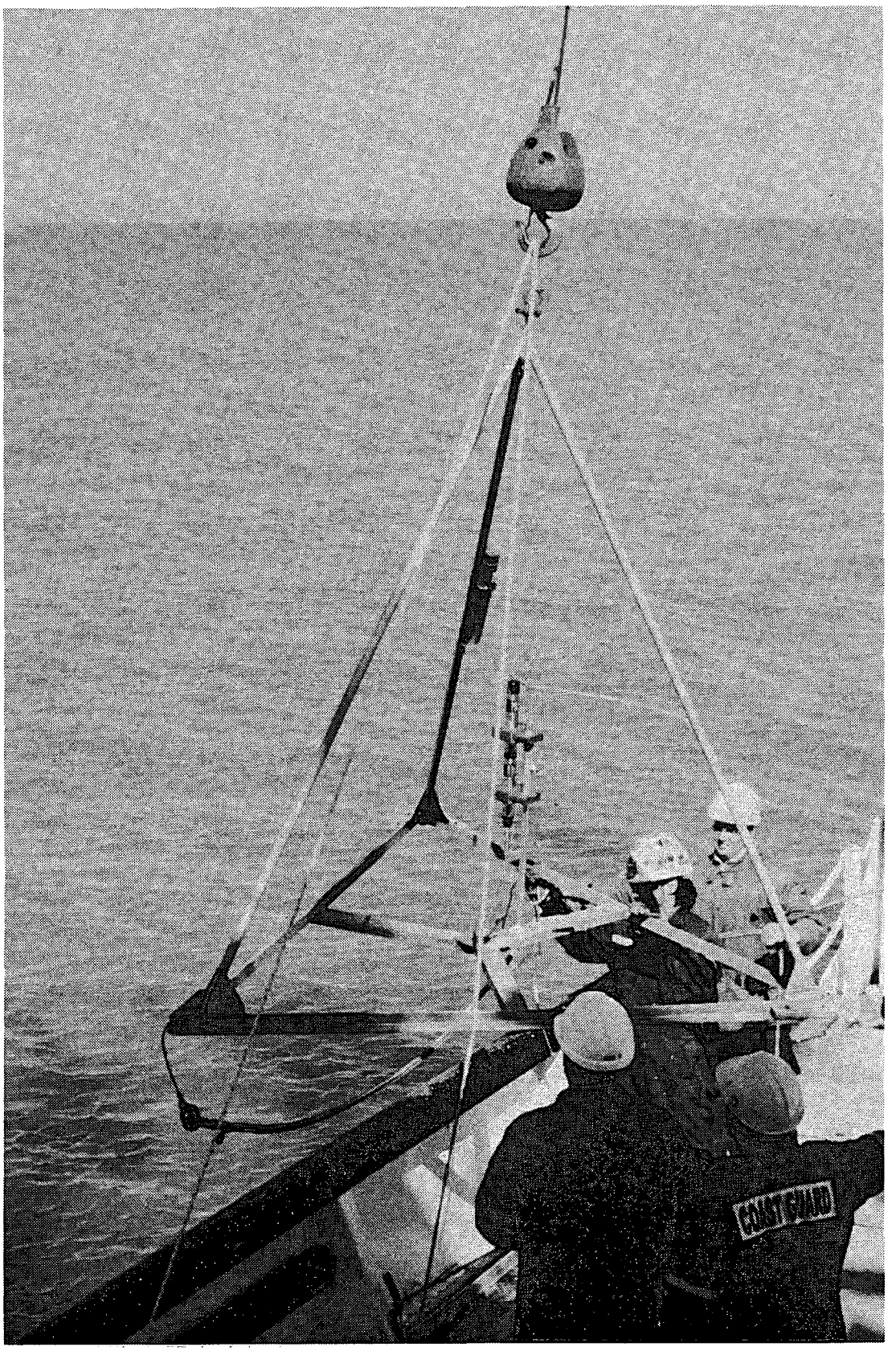
At stations 196, 254, 357, 873, 1164 and 1165, a Greenspan logger was installed at bottom minus 1 metre for Dr. J. Cibrowski of the University of Windsor.

MOORING POSITIONS

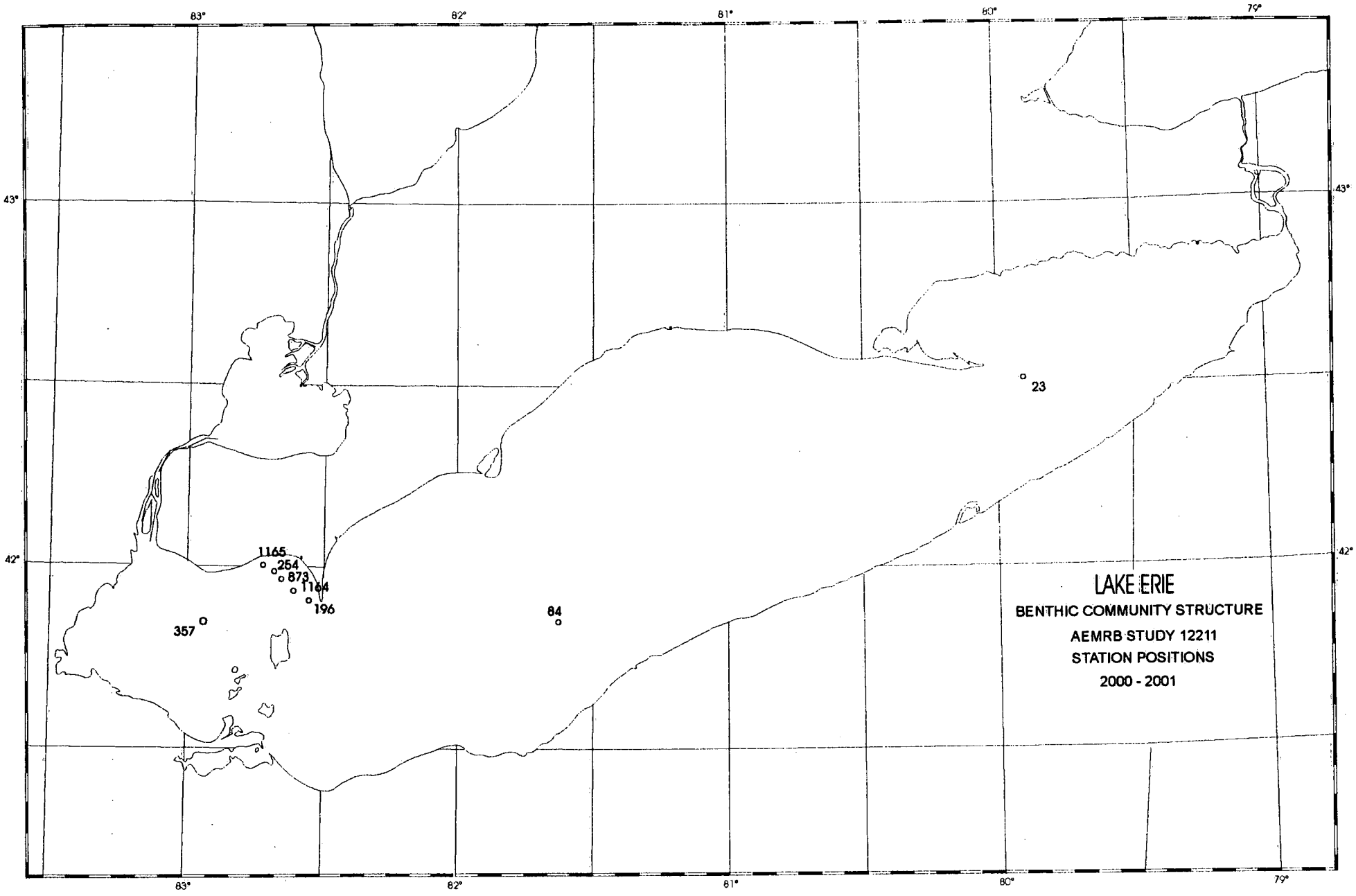
LAKE ERIE

2000 - 2001

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
23	2000-01S-01A	42° 29' 49"	79° 53' 25"	DO (BTM -1 m)
	2000-01A-02A	42° 30' 06"	79° 53' 24"	ST(30,40,50, 60 m)
84	2000-01S-03A	41° 56' 03"	81° 39' 19"	DO (BTM -1 m)
	2000-01A-04A	41° 56' 04"	81° 39' 33"	ST(18,21 m)
196	2000-01S-12A	41° 51' 09"	82° 31' 35"	Temp (1.75, BTM -1 m)
254	2000-01S-08D	41° 57' 13"	82° 41' 03"	DO (1.75, BTM -1 m)
357	2000-01S-05A	41° 48' 49"	82° 59' 05"	DO (BTM -1 m)
	2000-01A-06A	41° 48' 51"	82° 59' 17"	ST(BTM -1 m)
873	2000-01S-09D	41° 55' 01"	82° 37' 08"	DO (1.75, BTM)
1164	2000-01S-10D	41° 54' 02"	82° 35' 52"	DO (1.75, BTM -1 m)
1165	2000-01S-11D	41° 00' 00"	82° 43' 51"	DO (1.75, BTM -1 m)



DEPLOYING THE GREENSPAN LOGGER


83°
82°
81°
80°
79°
43°
42°
1165
254
873
1164
196
357
84
23
LAKE ERIE
BENTHIC COMMUNITY STRUCTURE
AEMRB STUDY 12211
STATION POSITIONS
2000 - 2001

ROXANN SEABED CLASSIFICATION STUDY
AEMRB STUDY 12218, DR. N.A. RUKAVINA

One cruise was carried out in order to perform shipboard trials of the RoxAnn seabed classification system for basin mapping of bottom sediment types in Lake Ontario. The development of this system of bottom-mapping will provide a digital record of bottom sediment types in the deep basins and nearshore areas of Lake Ontario.

Installation and testing of the RoxAnn system took place at dockside in Burlington. The RoxAnn transducer was installed on the bottom of the hull mounted in an aluminum frame about midships with two magnets and four strap clamps. The frame was positioned under the direction of TOS divers by adjusting the straps that were fastened to the ship's rails fore and aft on each side of the ship. Magnets were then affixed to the hull by the divers and the straps tightened. The system was tested the next day in the Western Basin of Lake Ontario prior to commencement of the cruise.

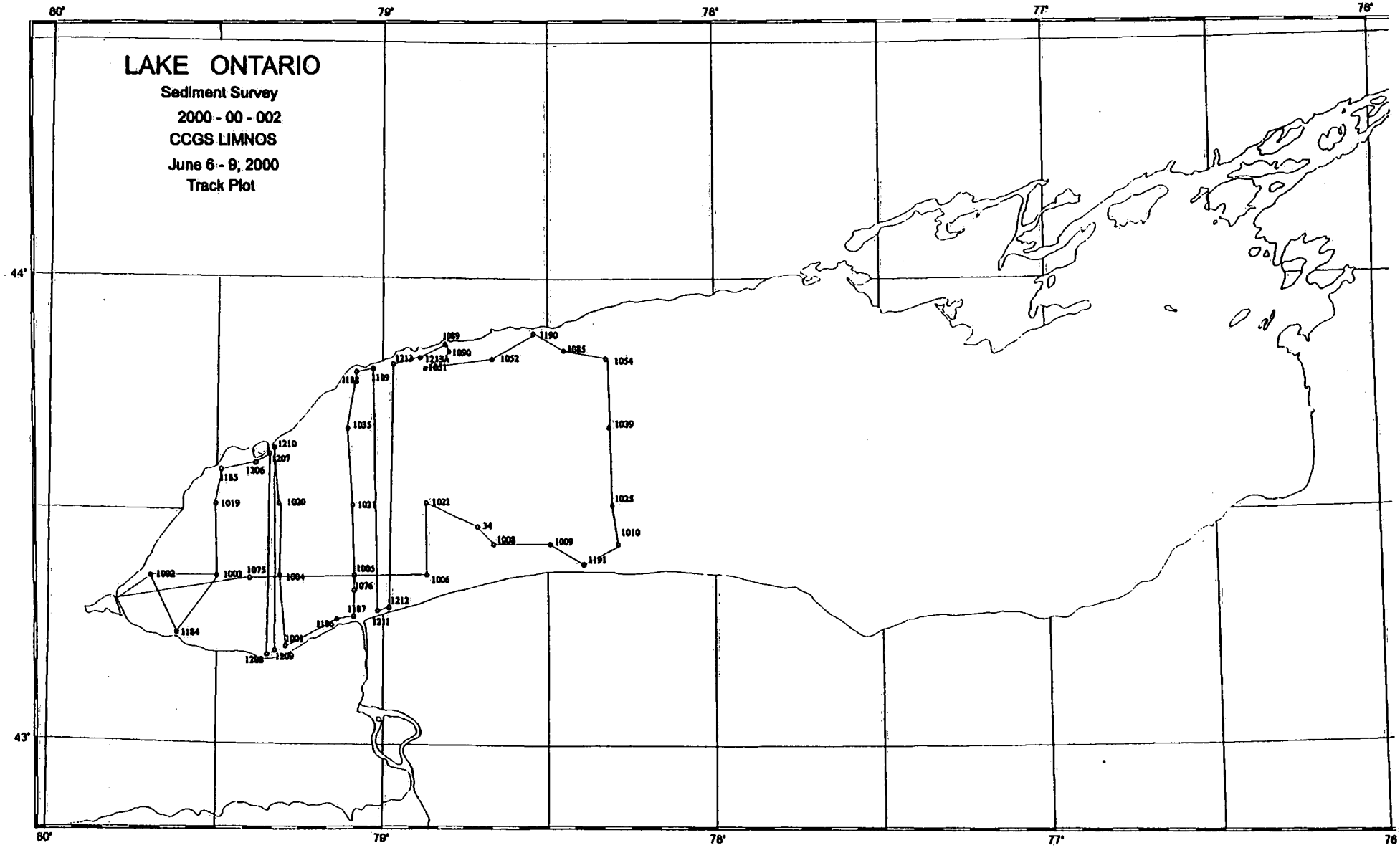
A series of survey lines was run in a generally north-south direction across the lake through some of the box core sites of the Charlton-Reynoldson 1998 cruise. The cruise was run from west to east and covered as much of the 1998 survey track as time permitted. Survey speed was limited to 6 kts to reduce stress on the transducer rigging onboard the vessel. The cross-lake lines were run as far inshore as safely possible. An electronic bathythermograph/transmissometer profile was done at one station, determined by the study leader, during the cruise.

Upon arrival in Burlington at the completion of the cruise, a diver inspection was made to check the condition of the transducer prior to its removal. This indicated some minimal wear and tear to the aluminum mounting frame and the straps.

STATISTICS SUMMARY

CRUISE NO. _____ **SHIP** CCGS LIMNOS
DATE _____ **REGION** LAKE ONTARIO
CRUISE TYPE RoxAnn Seabed Classification Survey **N.MI. STEAMED** 406.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	1	Moorings Established	
EBT/Transmissometer Casts	1	Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disk Observations		Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls 64µ			
Zooplankton Hauls 100µ			
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles			
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	
Water Samples Collected (D.O.)		Cores Taken, Piston	
Water Samples Collected (Cond/pH)		Cores Taken, Benthos	
Water Samples Collected (TP uf)		Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected (Ciliate)		Bulk Centrifuge Samples	
Water Samples Collected (Microbial Loop)			
Water Samples Collected (Primary Productivity)		Observations, Weather	
Water Samples Filtered (Chlorophyll a)			
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)			
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major Ions)		**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	
Water Samples Filtered ( )			
Water Samples Filtered ( )			


LAKE ONTARIO
Sediment Survey
2000 - 00 - 002
CCGS LIMNOS
June 6 - 9, 2000
Track Plot
80°
79°
78°
77°
76°
44°
43°
1089
1190
1090
1213
1213A
1052
1054
1035
1039
1210
207
1206
185
1019
1020
1021
1022
1025
34
1008
1009
1010
1191
1002
1003
1075
1004
1005
1006
1076
1187
1212
1211
1184
1186
1001
1208
1209

STATION POSITIONS

LAKE ONTARIO
NAD83

2000-2001

STATION NUMBER	LATITUDE N.	LONGITUDE W.
34	43° 27' 43"	78° 45' 38"
1001	43° 12' 59"	79° 17' 55"
1002	43° 21' 40"	79° 42' 00"
1003	43° 21' 39"	79° 29' 59"
1004	43° 21' 41"	79° 17' 58"
1005	43° 21' 39"	79° 05' 57"
1006	43° 21' 41"	78° 53' 59"
1007	43° 26' 01"	79° 23' 59"
1008	43° 26' 04"	78° 41' 56"
1009	43° 26' 01"	78° 29' 58"
1010	43° 25' 57"	78° 17' 51"
1019	43° 30' 17"	79° 30' 00"
1020	43° 30' 18"	79° 18' 00"
1021	43° 30' 20"	79° 05' 57"
1022	43° 30' 15"	78° 54' 04"
1025	43° 30' 18"	78° 17' 58"
1035	43° 39' 00"	79° 05' 59"
1051	43° 47' 40"	78° 54' 00"
1052	43° 47' 39"	78° 41' 57"
1054	43° 47' 38"	78° 18' 01"
1075	43° 20' 35"	79° 23' 44"
1076	43° 20' 12"	79° 05' 58"
1085	43° 48' 00"	78° 26' 55"
1089	43° 51' 46"	78° 48' 54"
1090	43° 50' 57"	78° 48' 24"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1184	43° 14' 07"	79° 37' 29"
1185	43° 34' 58"	79° 29' 43"
1186	43° 16' 23"	79° 08' 30"
1187	43° 17' 51"	79° 06' 08"
1188	43° 48' 00"	79° 04' 54"
1189	43° 48' 24"	79° 02' 00"
1190	43° 52' 54"	78° 33' 33"
1191	43° 22' 59"	78° 23' 35"
1206	43° 36' 17"	79° 23' 06"
1207	43° 36' 41"	79° 20' 00"
1207A	43° 36' 41"	79° 20' 00"
1208	43° 11' 28"	79° 20' 00"
1209	43° 12' 00"	79° 19' 00"
1210	43° 38' 17"	79° 19' 00"
1211	43° 16' 59"	79° 02' 00"
1212	43° 17' 31"	78° 58' 00"
1213	43° 49' 19"	78° 58' 00"
1213A	43° 50' 05"	78° 52 55"

GREAT LAKES AREAS OF CONCERN
AEMRB STUDY 12220, DR. T.B. REYNOLDSON

This study was undertaken to collect mini box cores from representative stations in Lake Ontario, Lake Erie and Lake Superior to verify the reference database related to assessment techniques used to include biological and chemical measures. The areas of concern were the Bay of Quinte and Presqu'ile Bay in Lake Ontario and Peninsula Harbour in Lake Superior. Samples were collected from Long Point Bay and Rondeau Bay in Lake Erie as part of the Benthic Community Structure program. Samples collected verified the reference database created to select key species and toxicity tests that show the most resilient predictive response for use in developing numerical biological sediment guidelines. These guidelines are in turn used to determine the need for sediment remediation based on the invertebrate fauna and bioassay responses. Work was done from the CCGS LIMNOS and from one or the other of the launches PETREL or PELICAN carried onboard the LIMNOS during the cruises September 18 - October 6 and October 23 - 27. At each station the following work was performed:

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

The box core was subsampled using five 6.7 cm diameter tubes from which the top 10 cm were extruded into plastic cups. Samples were sieved using a 250 micron mesh sieve. Residue was placed in the containers provided and preserved in 5% Formalin.

At all stations, the remainder of the top 5 cm of sediment in the box core was removed and placed in a glass dish. This sample was homogenized and sampled in the following manner:

a) 125 ml were sampled for organic analysis in a hexane-rinsed glass bottle covered with a hexane-rinsed piece of tin foil before the lid was placed on.

b) 100 ml were sampled for particle size.

c) 500 ml were sampled for major ions, metals, loss on ignition, total organic carbon, total Kjeldahl nitrogen and total phosphorus.

At all stations in the Bay of Quinte, additional sediment samples—two 250 ml amber containers for PAH's and PCB's, were obtained from the homogenized sample.

At all AOC stations in Peninsula Harbour, additional sediment samples—two 250 ml amber containers for PAH's and PCB's, a second 100 ml container for sulfur/sulfide analysis and a 125 ml amber container for methylmercury, were obtained from the homogenized sample.

At all AOC stations in the Bay of Quinte and Peninsula Harbour and at stations 436, 437, 438, 439 and 440 in Lake Superior, stations 1203 and 1205 in Lake Erie and stations 1406, 1417, 1418, 1419, 1420 and 1421 in Lake Ontario, five mini PONAR samples were obtained for bioassay experiments. Samples were placed in the bags.

At stations 437, 442, 444, 447 and 455 in Lake Superior, station 1205 in Lake Erie and stations 1406, 1420, 1430, 1438, 1447 and 1452 in Lake Ontario, triplicate samples were collected for Quality Assurance/Quality Control.

At stations 1400, 1415, 1422A, 1423, 1425, 1427, 1429, 1434, 1437, 1455 and 1456 in Lake Ontario, stations 110 and 288 in Lake Erie, stations 324, 407, 439, 445, and 465 in Lake Superior, additional mini box cores or PONAR grab samples were obtained, the top 10 cm of sediment removed and placed in the container provided. This sediment sample was sieved and organisms removed for tissue analysis.

Several additional tasks were performed on these cruises, as follows:

At stations 1464 to 1476 in the Bay of Quinte, a mini box core was collected and two 40 dram vials of surface sediment was collected for particle size in support of Dr. N.A. Rukavina, AEMRB.

At stations 1423, 1425, 1427, 1429, 1434, 1437 and 1455 in Lake Ontario, Bay of Quinte, an additional 6.7 cm diameter tube, 30 cm in length, were obtained from the mini box core for H. Biberhofer, RPD, ECB-OR. The core was capped, sealed and stored at 4°C.

At stations 1422, 1423, 1424, 1425, 1427, 1429, 1432, 1437, 1439, 1442, 1454, 1455, 1456 and 1457 in the Bay of Quinte, mini-PONAR samples were collected for analysis of: a) particle size and %LOI; b) metals: Al, As, Cd, Cu, Cr, Fe, Mn, Ni, Pb and Zn; c) nutrients: Total P, Total Kjeldahl Nitrogen and Total Organic Carbon; d) PCB/organochlorines and e) PAH's for the Ontario Ministry of Energy and Environment.

Five Mysid net hauls were done from bottom -2 m to surface at stations 41, 56A and 64 for Dr. O. Johannsson, GLLFAS.

PONAR grab samples were obtained at stations 19, 41 and 81 for benthic invertebrates in support of R. Dermott, GLLFAS. Samples were sieved through a 250µ screen and the residue stored in the jar provided and preserved with 8% Formalin.

STATISTICS SUMMARY

CRUISE NO.		**SHIP**	CCGS LIMNOS
DATE: FROM		**REGION**	LAKES ONTARIO, ERIE & SUPERIOR
CRUISE TYPE	Areas of Concern	**N.MI. STEAMED**	2195.2

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	139	Moorings Established	
EBT/Transmissometer Casts	66	Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disk Observations	21	Moorings Established	
Hydrolab Readings	87	Moorings Retrieved	
Zooplankton Hauls			
Niskin Bottle Casts	88	Particle Size & %LOI Sediment Samples	28
Integrator 10 m	9	Metals (Al,AS,Cd,Cu,Cr,Fe,Mn,Ni,Pb,Zn)	28
Integrator 20 m	2	TP, TKN, TOC Sediment Samples	28
Phytoplankton Samples	19	PCB/Organochlorine Sediment Samples	28
D.O. Profiles		PAH Sediment Samples	28
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	121
Water Samples Collected (D.O.)	43	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	43	Cores Taken, Benthos	
Water Samples Collected (TP uf)	152	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	433
Water Samples Collected (Nutrients)	152	Grab Samples Taken, mini PONAR	523
Water Samples Collected (Alkalinity)	152	PAH and PCB Sediment Samples	172
Water Samples Collected ( )		Organic Sediment Samples	164
Water Samples Filtered (Chlorophyll a)		Particle Size Sediment Samples	172
Water Samples Filtered (POC/TPN)		Major Ion, TOC, TKN, TP Sediment Samples	172
Water Samples Filtered (Seston)		Metals, Loss on Ignition Sediment Samples	172
Water Samples Filtered (TP f)		Tissue Analysis	19
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major Ions)		**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	129
Water Samples Filtered ( )			
Water Samples Filtered ( )			

STATION POSITIONS

LAKE ONTARIO, BAY OF QUINTE AOC

2000 - 2001

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
1400	0400!	44° 01' 03"	77° 41' 52"
1401	0401	44° 00' 48"	77° 42' 30"
1402	0402	44° 00' 18"	77° 41' 42"
1403	0403	44° 00' 30"	77° 43' 00"
1404	0404	44° 00' 38"	77° 41' 52"
1405	0405	43° 59' 41"	77° 43' 45"
1406	0407*#	44° 00' 00"	77° 33' 00"
1407	1302!	43° 55' 56"	77° 01' 28"
1408	1303	43° 56' 58"	77° 01' 03"
1409	1304	43° 58' 11"	76° 57' 44"
1410	1306	43° 56' 32"	76° 56' 08"
1411	1307	43° 57' 56"	76° 53' 01"
1412	1310	44° 04' 22"	77° 04' 45"
1413	1311	44° 03' 21"	77° 02' 47"
1414	1312	44° 05' 52"	77° 02' 33"
1415	1313!	44° 07' 33"	76° 50' 00"
1416	1318	44° 11' 59"	76° 40' 32"
1422	2001	44° 09' 29"	77° 22' 51"
1422A	2001!	44° 09' 29"	77° 22' 51"
1423	2002!	44° 09' 22"	77° 22' 58"
1424	2003	44° 09' 04"	77° 22' 23"
1425	2004!	44° 09' 09"	77° 22' 22"
1426	2005	44° 09' 10"	77° 22' 08"
1427	2006!	44° 08' 54"	77° 23' 21"
1428	2007	44° 08' 54"	77° 23' 40"

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
1429	2008!	44° 09' 44"	77° 20' 11"
1430	2009#	44° 09' 42"	77° 20' 08"
1431	6545	44° 09' 06"	77° 21' 07"
1432	2011	44° 09' 04"	77° 20' 38"
1433	2012	44° 09' 19"	77° 21' 58"
1434	2013!	44° 09' 26"	77° 21' 55"
1435	2014	44° 09' 24"	77° 21' 36"
1436	2015	44° 09' 05"	77° 22' 26"
1437	2016!	44° 09' 47"	77° 21' 05"
1438	2017#	44° 09' 34"	77° 21' 14"
1439	2018	44° 09' 36"	77° 21' 27"
1440	2020	44° 08' 28"	76° 59' 50"
1441A	2021A	44° 06' 20"	77° 01' 52"
1442	2022	44° 10' 23"	77° 15' 19"
1443	2023	44° 10' 25"	77° 14' 18"
1444	2024	44° 09' 27"	77° 15' 48"
1445	2025#	44° 08' 10"	77° 16' 58"
1446	2026	44° 06' 29"	77° 18' 14"
1447	2027#	44° 08' 59"	77° 13' 35"
1448	6544	44° 09' 17"	77° 10' 27"
1449	6542	44° 05' 45"	77° 03' 53"
1450	6541	44° 02' 45"	77° 06' 54"
1451	2031	44° 01' 36"	77° 07' 42"
1452	6540#	44° 02' 47"	77° 00' 35"
1453	6539	44° 06' 25"	76° 53' 54"
1454	6546	44° 05' 25"	77° 31' 58"
1455	2035!	44° 05' 18"	77° 32' 38"
1456	2036!	44° 05' 39"	77° 33' 43"
1457	2037	44° 06' 25"	77° 34' 51"
1458	2038	44° 07' 11"	77° 27' 31"

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
1459	2039	44° 07' 55"	77° 25' 05"
1460	2040	44° 08' 40"	77° 03' 37"
1461	2041	44° 03' 34"	77° 04' 52"
1462	6543	44° 11' 02"	77° 02' 48"
1463	2043	44° 11' 46"	76° 59' 43"

* New reference stations
! Tissue stations
QA/QC stations

STATION POSITIONS

LAKE ERIE REFERENCE STATIONS

2000 - 2001

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
110	0110!	42° 18' 54"	81° 52' 49"
288	0311!	42° 37' 47"	80° 25' 52"
309	0309	42° 36' 28"	80° 26' 07"
310	0310	42° 38' 50"	80° 20' 46"
1200	0306	42° 37' 09"	80° 18' 16"
1202	0109	42° 16' 46"	81° 54' 25"
1203	0116*	42° 17' 36"	81° 53' 30"
1205	0315*#	42° 36' 42"	80° 21' 42"

* New reference stations
! Tissue stations
QA/QC stations

STATION POSITIONS

LAKE SUPERIOR

2000 - 2001

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
317	2500	48° 31' 55"	86° 16' 33"
318	2501	48° 35' 28"	86° 19' 40"
319	2502	48° 37' 35"	86° 19' 35"
321	2504	48° 43' 36"	86° 36' 56"
322	2505	48° 42' 31"	86° 38' 42"
323	2506	48° 46' 06"	86° 39' 39"
324	2507!	48° 47' 23"	86° 41' 48"
347	2616	48° 20' 59"	86° 11' 51"
349	2618	48° 25' 06"	86° 14' 43"
350	2619	48° 27' 35"	86° 15' 16"
436	2401*	46° 36' 32"	84° 56' 05"
437	2402*#	46° 41' 58"	84° 27' 56"
438	2403*	46° 52' 25"	84° 24' 22"
439	2404*!	46° 55' 30"	84° 29' 05"
440	2405*	46° 55' 48"	84° 41' 07"

* New reference stations
! Tissue stations
QA/QC stations

STATION POSITIONS

LAKE ONTARIO

2000 - 2001

STATION NUMBER	LATITUDE N.	LONGITUDE W.
19	43° 22' 47"	79° 17' 18"
38C	43° 24' 14"	77° 59' 06"
41	43° 43' 41"	78° 01' 37"
56A	43° 21' 22"	77° 33' 48"
64	43° 31' 35"	76° 55' 31"
81A	43° 58' 50"	76° 39' 21"

STATION POSITIONS

LAKE SUPERIOR, PENINSULA HARBOUR AOC

2000 - 2001

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
406	6957	48° 43' 12"	86° 23' 30"
407	6958!	48° 43' 26"	86° 23' 50"
408	6959	48° 43' 01"	86° 25' 25"
409	6960	48° 43' 56"	86° 25' 14"
410	6961	48° 44' 45"	86° 27' 13"
411	6962	48° 43' 39"	86° 24' 37"
412	6963	48° 43' 45"	86° 24' 40"
414	69M289	48° 44' 38"	86° 25' 04"
441	6964 #	48° 42' 42"	86° 25' 31"
442	6965	48° 42' 22"	86° 26' 19"

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
443	6966	48° 42' 51"	86° 26' 11"
444	6967	48° 43' 15"	86° 25' 09"
445	6968!	48° 43' 41"	86° 25' 11"
447	6970	48° 43' 31"	86° 24' 12"
448	69BA1	48° 43' 38"	86° 23' 45"
449	69BA2	48° 43' 36"	86° 23' 48"
450	69BA5	48° 43' 31"	86° 23' 56"
451	69BB5 #	48° 43' 28"	86° 23' 54"
452	69BC3	48° 43' 30"	86° 23' 45"
453	69BC6	48° 43' 25"	86° 23' 54"
454	69BD1	48° 43' 53"	86° 23' 59"
455	69BD4	48° 43' 26"	86° 23' 45"
456	69BD5	48° 43' 24"	86° 23' 48"
457	69BE3	48° 43' 26"	86° 23' 33"
458	69BE5	48° 43' 22"	86° 23' 45"
459	69BF2	48° 43' 26"	86° 23' 33"
460	69BF4	48° 43' 22"	86° 23' 39"
461	69BG3	48° 43' 22"	86° 23' 33"
462	69BG5	48° 43' 18"	86° 23' 39"
463	69BG6!	48° 43' 16"	86° 23' 42"
464	69BH3	48° 43' 20"	86° 23' 30"
465	69BH5!	48° 43' 16"	86° 23' 36"
466	69BI5	48° 43' 14"	86° 23' 39"
467	6971	48° 44' 48"	86° 24' 11"
468	69BA3	48° 43' 36"	86° 23' 52"

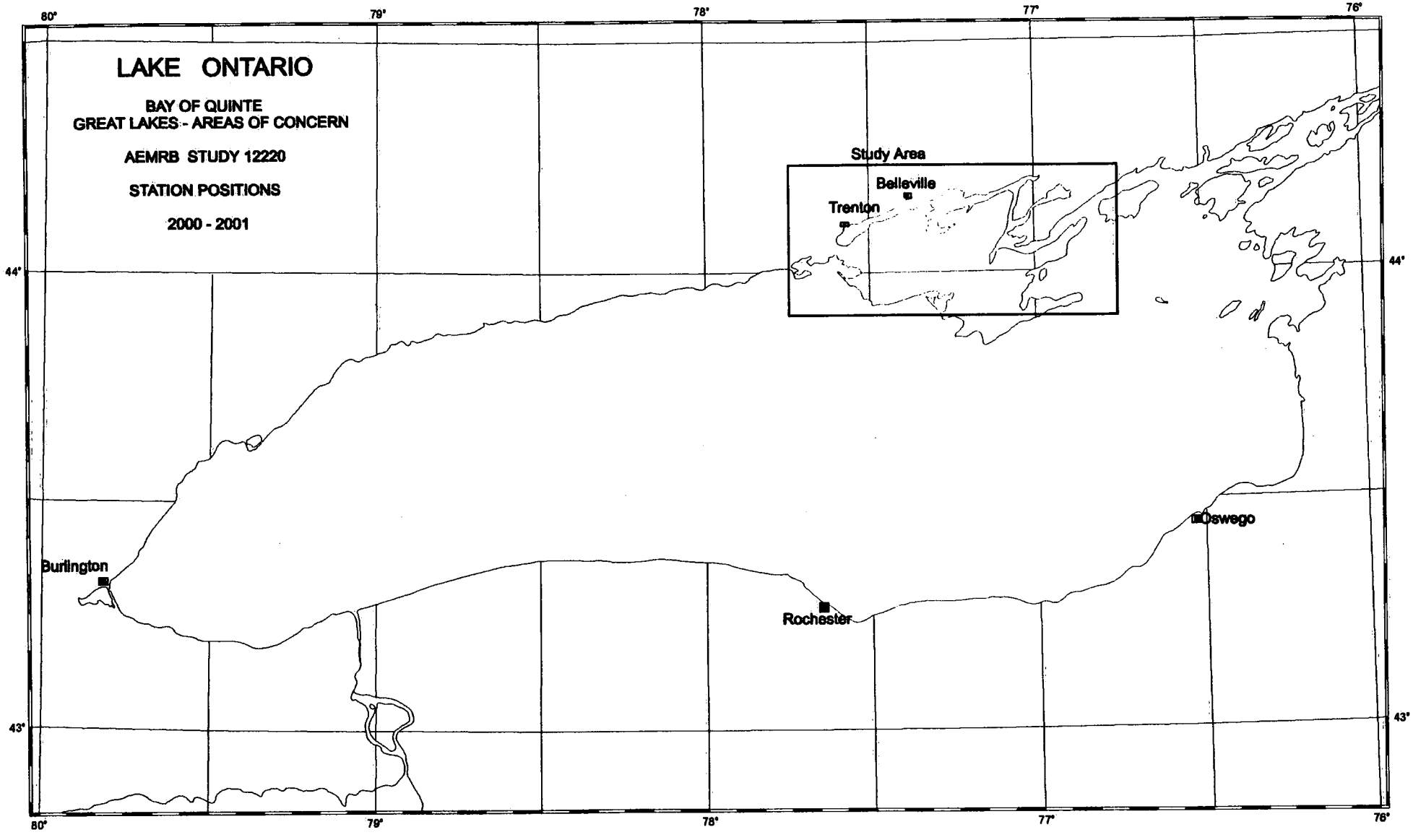
* New reference stations
! Tissue stations
QA/QC stations

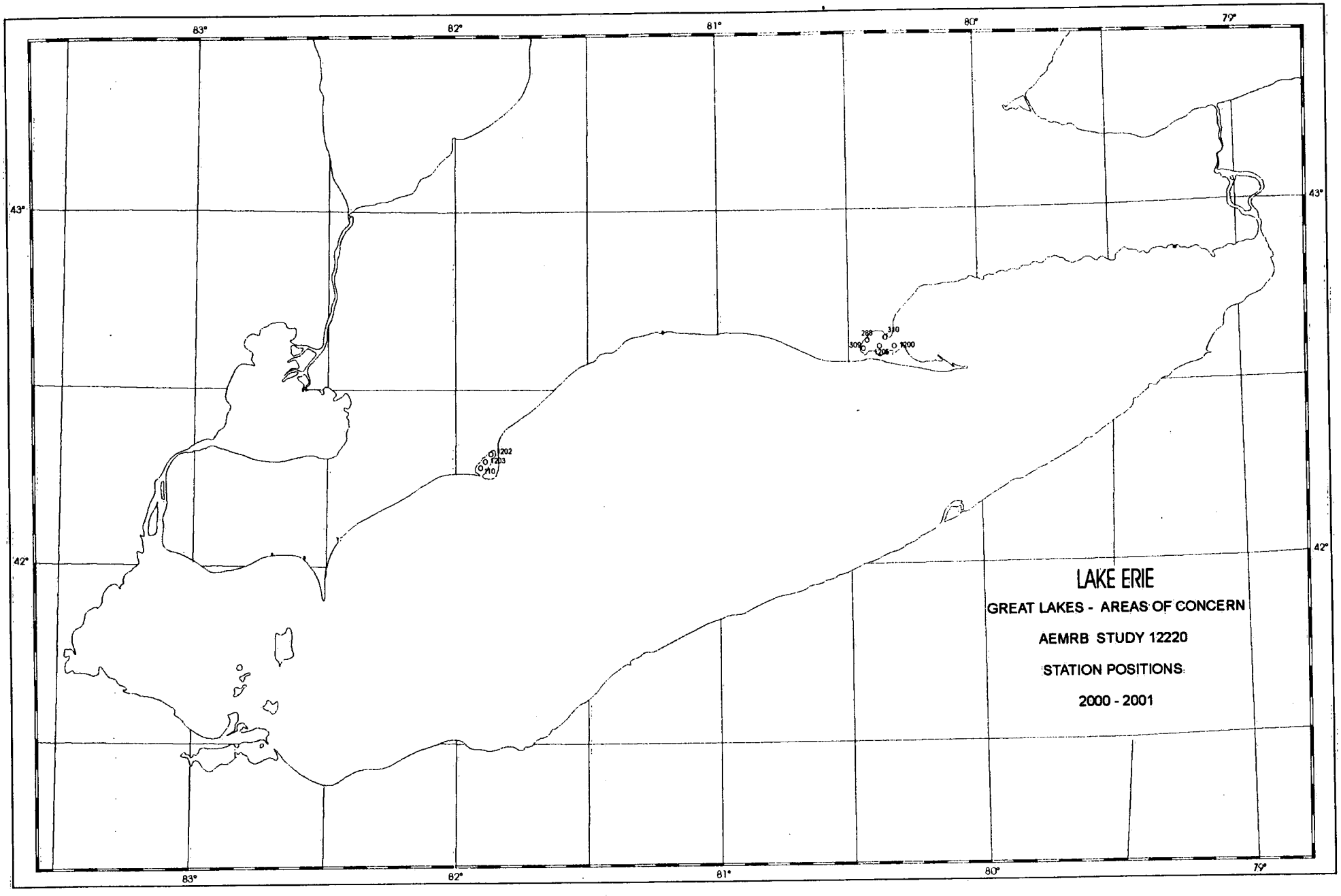
STATION POSITIONS

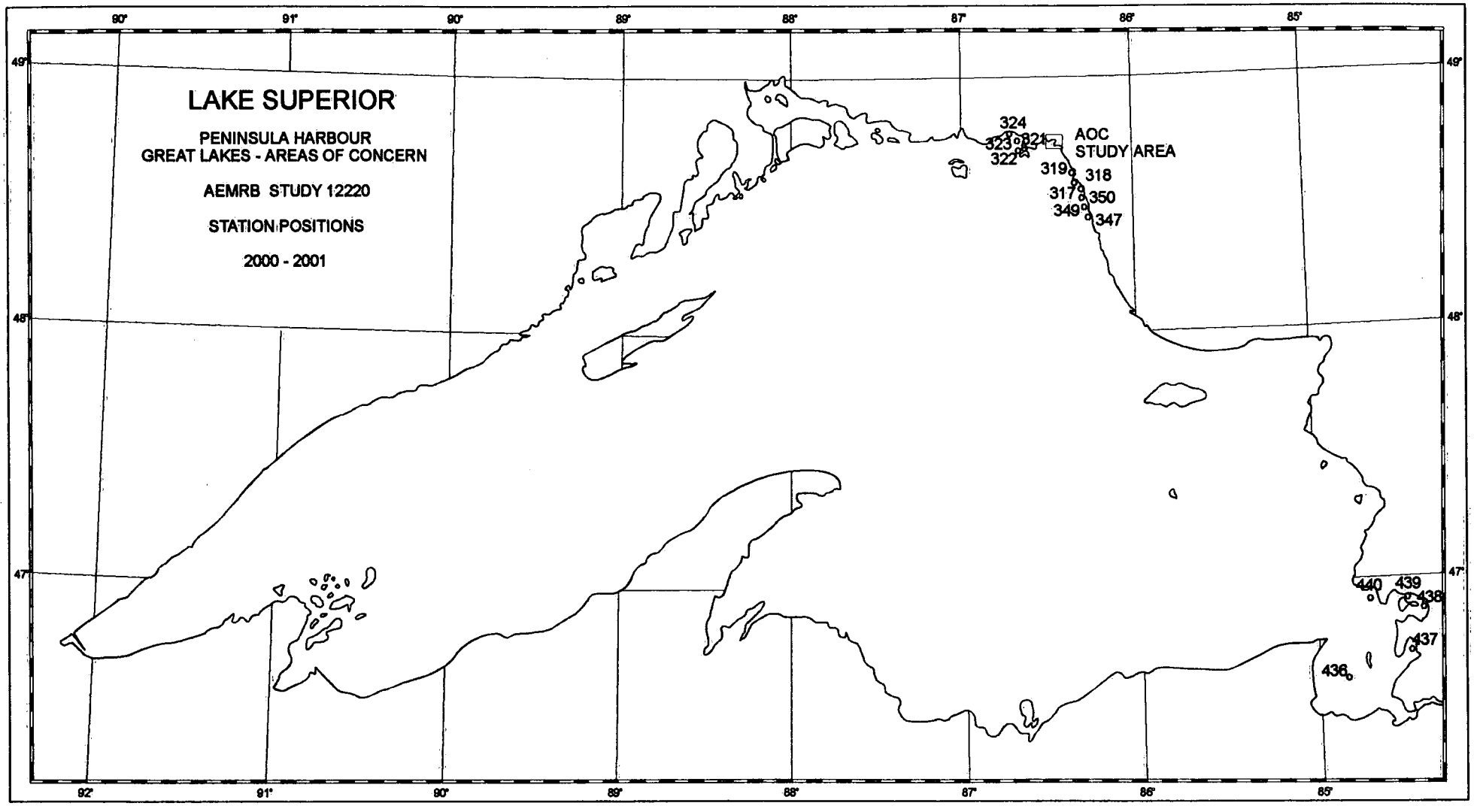
BAY OF QUINTE ROXANN

2000 - 2001

STATION NUMBER	RUKAVINA NUMBER	LATITUDE N.	LONGITUDE W.
1464	10	44° 01' 51.632"	77° 07' 20.880"
1465	11	44° 01' 52.595"	77° 07' 28.349"
1466	12	44° 01' 53.954"	77° 07' 41.538"
1467	14	44° 06' 01.856"	77° 04' 45.415"
1468	13	44° 05' 08.229"	77° 04' 43.783"
1469	5	44° 06' 44.310"	76° 53' 49.474"
1470	6	44° 02' 56.529"	77° 02' 19.739"
1471	7	44° 02' 58.469"	77° 02' 20.003"
1472	8	44° 02' 59.480"	77° 02' 19.656"
1473	9	44° 03' 00.634"	77° 02' 19.425"
1474	4	44° 07' 15.625"	76° 53' 07.962"
1475	3	44° 06' 16.687"	76° 52' 13.668"
1476	2	44° 06' 15.432"	76° 52' 05.189"
1477	1	44° 06' 09.705"	76° 52' 11.563"


LAKE ONTARIO
BAY OF QUINTE
GREAT LAKES - AREAS OF CONCERN
AEMRB STUDY 12220
STATION POSITIONS
2000 - 2001
Study Area
Belleville
Trenton
Oswego
Burlington
Rochester
80°
79°
78°
77°
76°
44°
43°


83°
82°
81°
80°
79°
43°
42°
202
203
210
288
310
309
206
200
LAKE ERIE
GREAT LAKES - AREAS OF CONCERN
AEMRB STUDY 12220
STATION POSITIONS
2000 - 2001


LAKE SUPERIOR
PENINSULA HARBOUR
GREAT LAKES - AREAS OF CONCERN
AEMRB STUDY 12220
STATION POSITIONS
2000 - 2001
AOC
STUDY AREA
324
323
321
322
319
318
317
350
349
347
440
439
438
437
436
90°
91°
90°
89°
88°
87°
86°
85°
49°
48°
47°
92°

TASTE AND ODOUR, CREDIT RIVER AND LAKE ONTARIO
AEMRB STUDY 12240, M.N. CHARLTON

In recent years, Lake Ontario has generated high concentrations of odiferous compounds associated with certain types of algae. This late-summer phenomena has caused users to complain about drinking water quality and express concerns about water safety. As such, this "taste and odour" problem has been targeted as a research priority within NWRI.

Participants in the survey were M.N. Charlton and Dr. B. Brownlee of NWRI-Burlington; Dr. S. Watson, NWRI-Calgary; J. Ridal, St. Lawrence River Institute of Environmental Sciences; S. Siciliano, University of Ottawa; C. Allen, University of Waterloo and M. Meding, University of Calgary. Researchers hope that the combination of physical, chemical and biological data gathered this year compared to that of past and future years will shed light on the taste and odour formation process and suggest possible mitigation strategies. This work is supported by the ongoing research consortium of NWRI and the Ontario Ministry of Energy & Environment, partially funded by several regional municipalities that draw their water from the lake. The Ontario Clean Water Agency co-ordinates the consortium. Working with partners from universities and the Ontario government, NWRI recently conducted a lakewide research survey onboard the CCGS LIMNOS

a) to determine if there is an inshore-offshore gradient of the offending compounds that may indicate a link to eutrophication

b) to confirm low levels of the offending compounds in deep water; and

c) to delineate spatial differences in types of compounds and types of algal assemblages.

Researchers are also focusing on Actinomycetes, as part of a larger study that is investigating the major zones and biota that may be contributing to or causing taste and odour events. The lower Credit River and inshore/offshore area at the mouth are already part of the program and have been sampled by MOEE. So far researchers have identified 22 different strains of Actinos from these samples and found that most are associated with suspended sediment. This may suggest that they originated from a terrestrial environment and have been washed into the system. About half of these produce the taste/odour compounds, geosmin or Methylisoborneol (MIB). Laboratory experiments are being carried out to determine under what conditions they produce odour and if in fact they can grow in the Credit River water or need a more enriched substrate; e.g., littoral or benthic zones. Preliminary results show that some strains of Actinos grow in unenriched river water resulting in exceptional odour production. In support of this work, TOS personnel carried out small boat surveys from the mouth of

the Credit River, out into Lake Ontario to determine if an inshore-offshore gradient could be demonstrated and linked to inputs of algae from the Credit River.

Nearshore surveys consisted of 5 stations—4 running along a transect from the river mouth to an offshore station and a 5th inshore station offset to the southwest. TOS personnel carried out surveys on the following dates: July 10th, 24th, 31st, August 8th, 14th, 21st, 29th, September 19th, 26th. Sampling consisted of a Hydrolab profile, water samples collected from discrete depths based on profile characteristics, Secchi depth and a bucket thermometer. Water samples from surface -1 m were taken for E. Coli and fecal coliform analysis. A single 4-station survey of the Credit River was carried out on October 19th. Water samples were taken offshore at station LV3, the mouth of the Credit River and at 2 upstream stations.

A single lakewide cruise was carried out on the CCGS LIMNOS September 11 - 15, to determine the spatial distribution of these taste and odour compounds in Lake Ontario. At each station, water samples were collected by rosette sampler from depths of 1 m and bottom -3 m for Geosmin and MIB analysis, chlorophyll a, total phosphorus (filtered and unfiltered), soluble reactive phosphorus, nitrate + nitrite. An integrated water sample was also collected from the surface to 1 m above the top of the thermocline or to 20 m if the epilimnion was deeper than 20 m or the water column was unstratified. In instances where the sampling depth extended to the substrate, 2 m above the bottom were sampled for phytoplankton, picoplankton and bacterioplankton. Discrete samples were also obtained at selected stations for phytoplankton, picoplankton and bacterioplankton analysis, comparative actinomycete analysis and light attenuation. Water samples were also collected by submersible pump from a depth of 5 m at selected stations for Geosmin, MIB, Hexachlorocyclohexane analysis and zebra mussel larvae. Water samples were also collected by Go-Flo bottle at discrete depths at selected stations for dissolved elemental mercury, mercury speciation, RNA extraction and enzyme extraction.

STATION POSITIONS
NEARSHORE TASTE & ODOUR
2000 - 2001

STATION NUMBER	CHARLTON NUMBER	LATITUDE N.	LONGITUDE W.
749	LP1	43° 31' 31"	79° 35' 17"
750	LV1	43° 33' 15"	79° 32' 09"
751	LV2	43° 32' 36"	79° 30' 07"
752	LV3	43° 29' 55"	79° 28' 58"
660	LV4	43° 33' 44"	79° 33' 32"

STATISTICS SUMMARY

CRUISE NO. _____ **SHIP** CCGS LIMNOS
DATE: FROM _____ **REGION** LAKE ONTARIO
CRUISE TYPE Taste and Odour in Drinking Water **N.MI. STEAMED** 613.4

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	68	Moorings Established, Sediment Trap	6
EBT/Transmissometer Casts	34	Moorings Retrieved, Sediment trap	6
Rosette Casts	68	Moorings Established	
Reversing Thermometer Observations		Moorings Retrieved	
Secchi Disk Observations	34	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls, 64µ, Toxins	9	Moorings Serviced, Meteorological	2
Van Dorn Casts			
Integrator 10 m	29		
Integrator 20 m	38		
Phytoplankton Samples	107		
D.O. Profiles	59		
Water Samples Collected (Geosmin and MIB)	187	Cores Taken, Box	
Water Samples Collected (Actinomycete)	19	Cores Taken, Mini Box	
Water Samples Collected (D.O.)	57	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	54	Cores Taken, Benthos	
Water Samples Collected (TP uf)	133	Grab Samples Taken, Shipek	
Water Samples Collected (Picoplankton)	107	Grab Samples Taken, PONAR	
Water Samples Collected (Bacterioplankton)	107	Grab Samples Taken, mini PONAR	
Water Samples Collected (Hexachlorocyclohexane)	12	Continuous Air Sample, Days	4
Water Samples Collected (University of Waterloo)	8	Observations, Weather	34
Water Samples Collected (Zebra Mussel Larvae)	11	Elemental Mercury	28
Water Samples Filtered (POC/TPN)	27	Mercury Speciation	36
Water Samples Filtered (Chlorophyll a)	120	RNA Extraction	51
Water Samples Filtered (TP f)	133	Enzyme Extraction	26
Water Samples Filtered (Nutrients)	133		
Water Samples Filtered (Major Ions)		**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	165
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

STATION POSITIONS

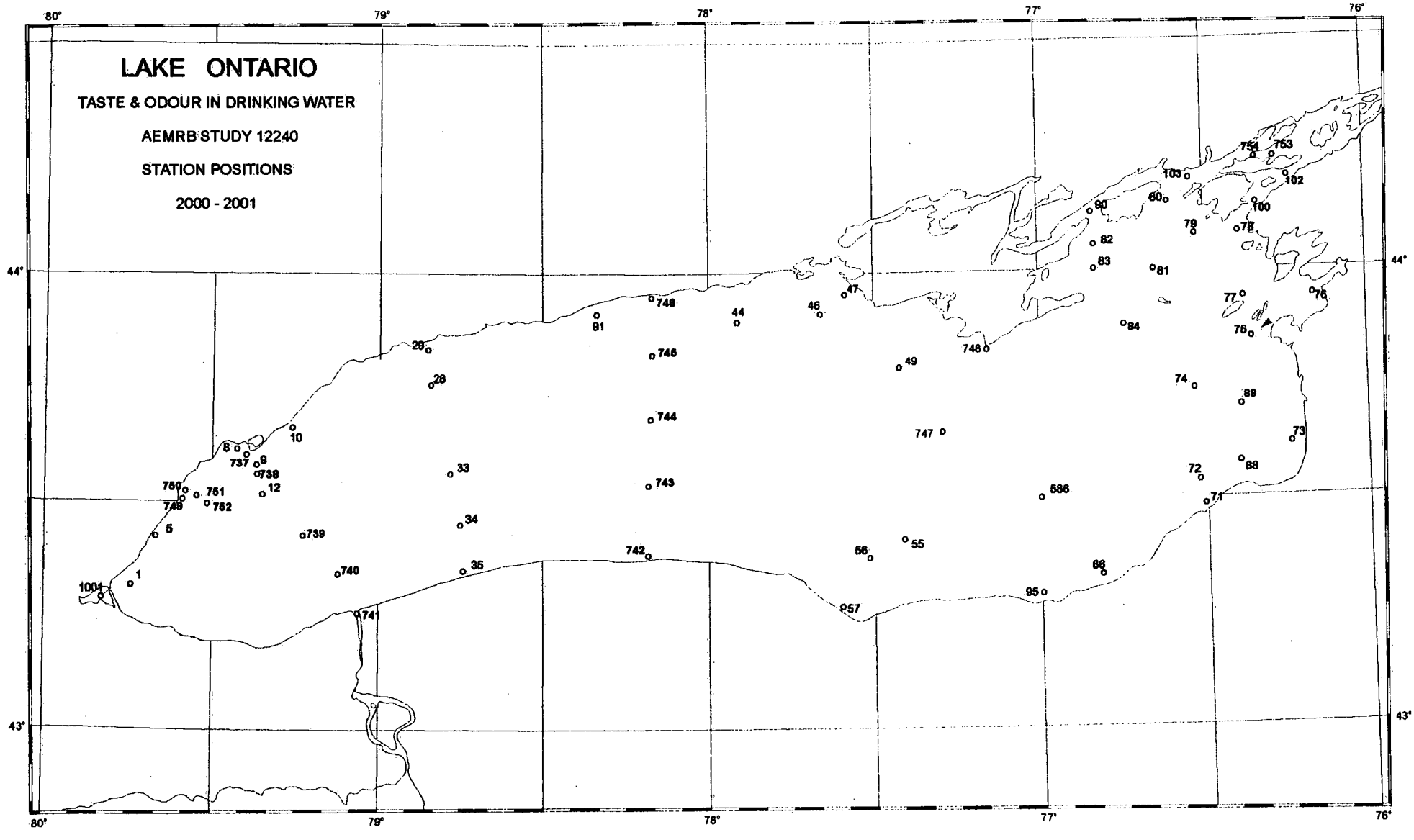
LAKE ONTARIO

2000 - 2001

STATION NO.	SECCHI DISC DEPTH/COLOUR	XMS % @ 1 M	LATITUDE N.	LONGITUDE W.
1	4.5/18	70	43° 18' 47"	79° 45' 05"
5	5.5/18	73	43° 26' 31"	79° 39' 29"
8	3.5/18	66	43° 37' 25"	79° 27' 13"
9	4.0/18	68	43° 35' 13"	79° 23' 42"
10		77	43° 39' 58"	79° 16' 00"
12		67	43° 30' 13"	79° 21' 08"
28		66	43° 46' 29"	78° 51' 19"
29		69	43° 49' 49"	78° 52' 13"
33		68	43° 35' 48"	78° 48' 05"
34		64	43° 27' 44"	78° 45' 34"
35		68	43° 21' 37"	78° 43' 47"
44		75	43° 52' 53"	77° 54' 28"
46		75	43° 53' 03"	77° 41' 07"
47		80	43° 57' 07"	77° 35' 18"
49	4.0/18	75	43° 46' 16"	77° 26' 19"
55		67	43° 26' 37"	77° 26' 18"
56		67	43° 21' 34"	77° 30' 51"
57		74	43° 17' 14"	77° 35' 43"
66	7.0/12	83	43° 20' 01"	76° 50' 24"
71	7.0/8	82	43° 28' 37"	76° 31' 37"
72	2.5/15	67	43° 33' 01"	76° 31' 28"
73		72	43° 38' 01"	76° 17' 18"
74		77	43° 45' 01"	76° 31' 08"
75		75	43° 50' 39"	76° 21' 20"
76		85	43° 56' 59"	76° 10' 29"

STATION NO.	SECCHI DISC DEPTH/COLOUR	XMS % @ 1 M	LATITUDE N.	LONGITUDE W.
77		74	43° 57' 25"	76° 24' 29"
78		76	44° 04' 59"	76° 24' 20"
79		79	44° 04' 30"	76° 31' 23"
80	4.5/16	75	44° 08' 30"	76° 36' 38"
81		74	44° 00' 59"	76° 40' 20"
82	6.0/9	79	44° 04' 00"	76° 48' 42"
83		77	44° 00' 00"	76° 50' 37"
84		72	43° 53' 13"	76° 44' 01"
88		68	43° 35' 19"	76° 25' 00"
89		77	43° 41' 57"	76° 24' 56"
90	5.0/9	79	44° 08' 11"	76° 49' 30"
91		80	43° 55' 11"	78° 18' 26"
95	6.5/18	83	43° 18' 49"	76° 59' 59"
100		84	44° 08' 13"	76° 19' 48"
102	6.0/14	82	44° 12' 13"	76° 14' 10"
103	6.0/16	70	44° 12' 10"	76° 32' 35"
586	3.0/18	66	43° 29' 03"	77° 02' 47"
737	3.5/18	66	43° 36' 29"	79° 25' 46"
738	4.0/14	69	43° 33' 50"	79° 23' 14"
739		59	43° 25' 23"	79° 15' 31"
740		67	43° 20' 24"	79° 09' 30"
741		74	43° 15' 32"	79° 03' 41"
742	4.0/14	70	43° 22' 59"	78° 11' 41"
743	3.5/15	68	43° 31' 20"	78° 11' 19"
744	3.5/15	68	43° 39' 59"	78° 10' 43"
745	3.0/15	63	43° 48' 21"	78° 10' 27"
746	4.5/15	77	43° 56' 53"	78° 10' 05"
747		66	43° 37' 56"	77° 17' 32"
748		78	43° 49' 42"	77° 08' 34"
749 (LP1)	3.5/18	63	43° 31' 31"	79° 35' 14"

STATION NO.	SECCHI DISC DEPTH/COLOUR	XMS % @ 1 M	LATITUDE N.	LONGITUDE W.
750 (LV1)	3.5/18	67	43° 33' 14"	79° 32' 08"
751 (LV2)	3.3/18	68	43° 32' 36"	79° 30' 08"
752 (LV3)	3.5/18	71	43° 29' 54"	79° 28' 57"
753	7.0/12	85	44° 14' 29"	76° 17' 59"
754	4.0/14	82	44° 14' 12"	76° 24' 24"
1001	3.0/18	67	43° 17' 17"	79° 50' 23"


LAKE ONTARIO
TASTE & ODOUR IN DRINKING WATER
AEMRB STUDY 12240
STATION POSITIONS
2000 - 2001
80°
79°
78°
77°
76°
44°
43°
1001
1
5
760
749
751
752
8
737
9
738
12
10
29
28
33
739
34
740
35
741
748
91
44
46
47
745
49
744
747
743
742
56
55
586
957
95
66
754
753
103
102
60
100
90
79
78
82
83
81
77
76
84
75
74
89
73
72
88
71

ZEBRA MUSSEL EFFECTS, LAKES ERIE AND ONTARIO
AEMRB STUDY 12240, M.N. CHARLTON

This was an ongoing study to determine the effects of zebra mussels on water quality in Lake Erie.

Five cruises were completed to support this study during the field season—May 15-19, June 19-23, July 17-21, August 8-12 and August 28-September 1. At each station, water samples were collected as follows: an integrated water sample from the surface to 1 m above the top of the thermocline or to 20 m if the epilimnion was deeper than 20 m or the water column was unstratified. Two metres above the bottom were sampled in instances where the sampling depth extended to the substrate. Parameters measured were: conductivity, pH, chlorophyll a, seston weight, total phosphorus, total filtered phosphorus, soluble reactive phosphorus, nitrate + nitrite. At all stations in the Western Basin, West of longitude 82° 30' 00", chlorophyll a samples were obtained at discrete depths of 1, 3, 5, 7 and 9 m. Filtration was done as per GLLFAS filtration methods. EBT/transmissometer profiles, DO profiles, fluorometer profiles, surface bucket temperature and Secchi disc (30 cm) observations were made.

At stations 23, 343, 344, 358, 933, 936, 937, 942, 943, 948, 950, 956, 959, 964, 966 and 972, duplicate metered 64u zooplankton net hauls were taken from bottom -1 m to the surface and preserved in sugared Formalin. Seston samples, phytoplankton samples preserved with 5 mls of Lugol's solution and protozoa samples preserved with 10 mls of a glutaraldehyde solution were collected from the integrated sample for Dr. D. Culver, Ohio State University.

At selected stations, samples were collected for the University of Waterloo. Samples collected were for primary production experiments, UVB measurements, fluorescence experiments and 33p uptake for bacteria and protozoa.

Sediment trap moorings were installed at stations 23, 84 and 357. Moorings were deployed on Lake Erie April 7-20 and serviced during the Charlton/Grapentine cruises on Lake Erie May 15-19, June 19-23, July 17-21, August 8-12, September 5-8 with final removal on October 11 and 16-20. Chlorophyll a and seston samples were collected at the trap depth during each cruise.

A sediment trap mooring with 6 sediment traps was also serviced at station 403 in Lake Ontario. This mooring was refurbished in April from a winter mooring and refurbished as a winter mooring on the final cruise of the year at the end of October.

STATISTICS SUMMARY

CRUISE NO. _____ **SHIP** CCGS LIMNOS
DATE: FROM _____ **REGION** LAKE ERIE
CRUISE TYPE Zebra Mussel Effects **N.MI. STEAMED** 2703.4

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	222	Moorings Established, Sediment Trap	6
EBT/Transmissometer Casts	223	Moorings Retrieved, Sediment trap	6
Rosette Casts	52	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disk Observations	99	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls, 64µ	147		
Van Dorn Casts	112	Organic Sediment Samples	84
Integrator 10 m	114		
Integrator 20 m	110	Fluorometer Profiles	163
Phytoplankton Samples	76		
D.O. Profiles	176		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	217	Cores Taken, Mini Box	8
Water Samples Collected (D.O.)	56	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	224	Cores Taken, Benthos	
Water Samples Collected (TP uf)	217	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected (Ciliate)		Grab Samples Taken, mini PONAR	48
Water Samples Collected (Haloacetic Acid)	12		
Water Samples Collected (Protozoa)	112	Observations, Weather	
Water Samples Filtered (Chlorophyll a)	468		
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)	222		
Water Samples Filtered (TP f)	217		
Water Samples Filtered (Nutrients)	217		
Water Samples Filtered (Major Ions)		**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	513
Water Samples Filtered ( )			
Water Samples Filtered ( )			

STATION POSITIONS

LAKE ERIE

2000 - 2001

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 30' 06"	79° 53' 24"
84	41° 56' 06"	81° 39' 30"
337	41° 41' 00"	82° 51' 18"
338	41° 42' 00"	82° 38' 00"
339	41° 43' 42"	82° 31' 00"
340	41° 45' 24"	82° 24' 00"
341	41° 47' 06"	82° 17' 00"
342	41° 48' 48"	82° 10' 00"
343	41° 50' 48"	83° 05' 00"
344	41° 47' 00"	82° 50' 30"
357	41° 48' 45"	82° 59' 00"
358	41° 53' 39"	82° 52' 00"
931	42° 51' 00"	78° 56' 30"
932	42° 47' 30"	79° 12' 30"
933	42° 49' 30"	79° 34' 00"
934	42° 42' 30"	79° 30' 30"
935	42° 35' 30"	79° 28' 00"
936	42° 28' 30"	79° 24' 30"
937	42° 43' 00"	80° 15' 00"
938	42° 38' 00"	80° 03' 30"
939	42° 34' 00"	79° 55' 00"
940	42° 26' 30"	79° 50' 00"
941	42° 19' 30"	79° 50' 00"
942	42° 15' 30"	79° 50' 00"
943	42° 34' 30"	80° 38' 30"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
944	42° 32' 00"	80° 38' 30"
945	42° 24' 00"	80° 38' 30"
946	42° 10' 00"	80° 38' 30"
947	41° 59' 30"	80° 38' 30"
948	41° 57' 24"	80° 38' 30"
950	42° 35' 18"	81° 26' 30"
951	42° 28' 30"	81° 26' 30"
952	42° 21' 30"	81° 26' 30"
953	42° 12' 30"	81° 26' 30"
954	42° 01' 30"	81° 26' 30"
955	41° 48' 00"	81° 26' 30"
956	41° 41' 30"	81° 26' 30"
957	41° 41' 00"	81° 44' 30"
958	41° 31' 30"	81° 42' 30"
959	42° 11' 42"	82° 11' 00"
960	42° 06' 00"	82° 11' 00"
961	41° 54' 30"	82° 11' 00"
962	41° 43' 00"	82° 11' 00"
963	41° 34' 30"	82° 11' 00:
964	41° 29' 00"	82° 11' 00"
965	41° 30' 00"	82° 30' 00"
966	41° 59' 00"	82° 37' 30"
967	41° 53' 30"	82° 40' 00"
968	41° 44' 30"	82° 44' 00"
969	41° 36' 30"	82° 55' 30"
971	41° 57' 00"	83° 03' 00"
972	41° 52' 00"	83° 12' 00"
973	41° 47' 30"	83° 20' 00"
974	41° 43' 30"	83° 09' 00"

MOORING POSITIONS

LAKE ONTARIO

2000 - 2001

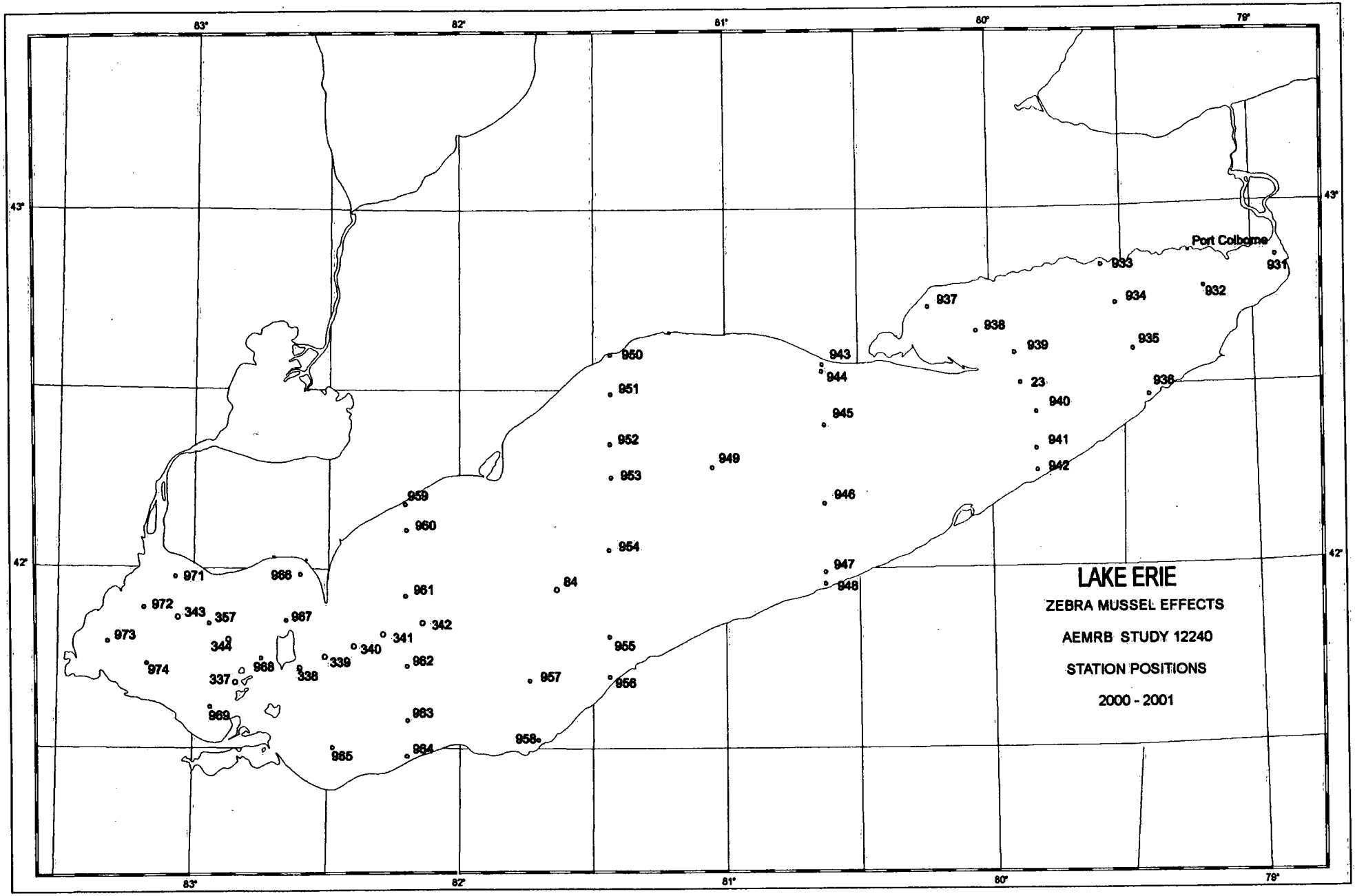
STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
403	99-00A-65A	43° 36' 19"	78° 13' 19"	ST (20, 60, 100, 140, 165 173 m)

MOORING POSITIONS

LAKE ERIE

2000 - 2001

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
23	99-01A-02A	42° 30' 03"	79° 52' 52"	ST (30, 40, 50, 60 m)
84	99-01A-04A	41° 55' 34"	81° 39' 38"	ST (18, 21 m)
357	99-01A-06A	41° 48' 44"	82° 59' 14"	ST (B -1 m)


83°
82°
81°
80°
79°
43°
42°
Port Colborne
931
932
933
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937
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343
344
357
LAKE ERIE
ZEBRA MUSSEL EFFECTS
AEMRB STUDY 12240
STATION POSITIONS
2000 - 2001

CONTAMINANT STUDY, DETROIT RIVER
AEMRB STUDY 12246, DR. C.H. MARVIN

Six cruises were carried out onboard the CCGS LIMNOS April 25 - 28, May 23 - 26, June 19 - 22, July 24 - 28, September 27 - 28 and October 16 - 19 as well as one aboard the CCGC SHARK, August 14 - 16. The cruises were piggybacked with the Lake Erie Benthic Community Structure and Lake Erie Zebra Mussel Effects Mooring cruises.

Sediment traps were installed for Dr. C. Marvin at 9 sites in the Detroit River, one site in Lake St. Clair, five sites in the St. Clair River and at one site in Lake Huron. Moorings were installed during the April cruise and serviced monthly as per the dates listed above. Mooring 2000-09A-18 at station 1171 was moved on the June 19 - 22 cruise and established as mooring 2000-09A-11 at station 1172 due to the amount of sand in the sample.

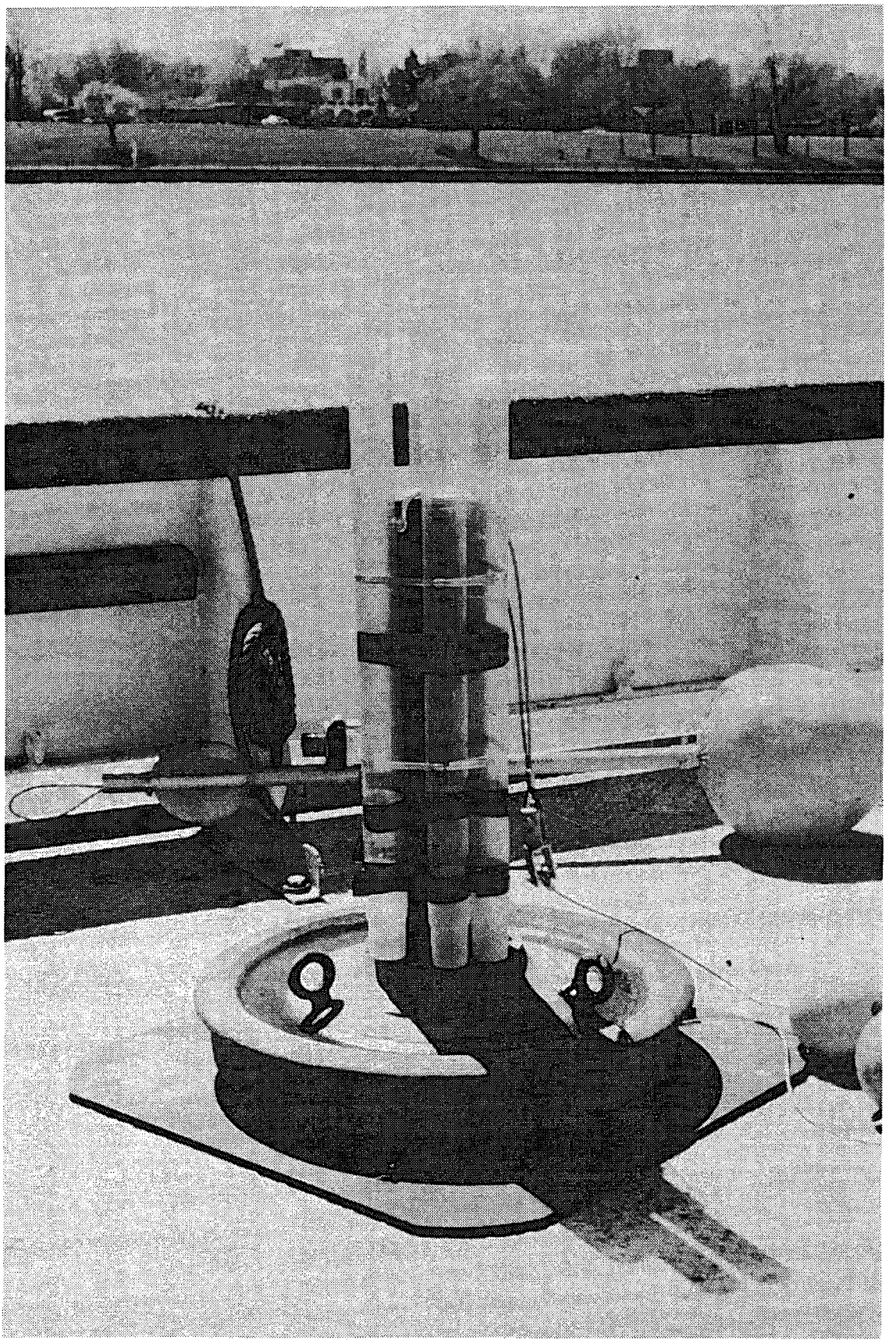
During the August cruise on the SHARK, sediment cores were collected at stations 1004 and 1173 for nutrient and organic analysis.

STATION POSITIONS

LAKE ERIE

2000 - 2001

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1004	42° 27' 26"	82° 44' 58"
1173	42° 34' 57"	82° 27' 54"



BOTTOM-MOUNTED SEDIMENT TRAP

STATISTICS SUMMARY

CRUISE NO.		**SHIP**	CCGS LIMNOS
DATE: FROM		**REGION**	LAKE HURON TO LAKE ERIE
CRUISE TYPE	Contaminant Study	**N.MI. STEAMED**	931.3

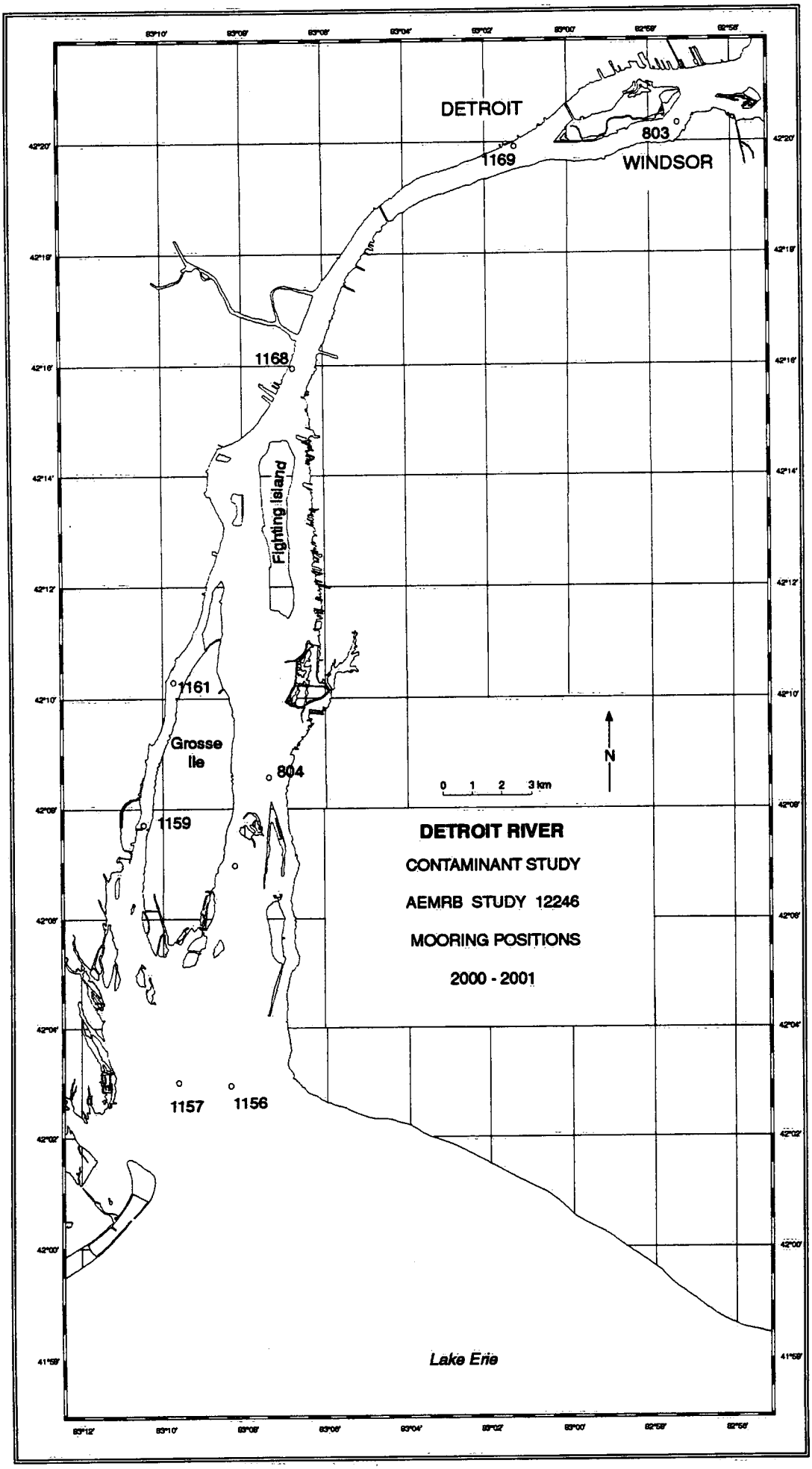
DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	128	Moorings Established, Sediment Trap	18
EBT/Transmissometer Casts	128	Moorings Retrieved, Sediment Trap	18
Rosette Casts		Moorings Serviced, Sediment Trap	114
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disk Observations	128	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
Van Dorn Casts	17		
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	96		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	
Water Samples Collected (D.O.)		Cores Taken, Piston	
Water Samples Collected (Cond/pH)		Cores Taken, Benthos	8
Water Samples Collected (TP uf)		Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected (Metal Salts)		Bulk Centrifuge Samples	
Water Samples Collected (Microbial Loop)			
Water Samples Collected (Halo Acetic Acid)		Observations, Weather	
Water Samples Filtered (Chlorophyll a)	17		
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)	17		
Water Samples Filtered (TP f)			
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major Ions)		**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	
Water Samples Filtered ( )			
Water Samples Filtered ( )			

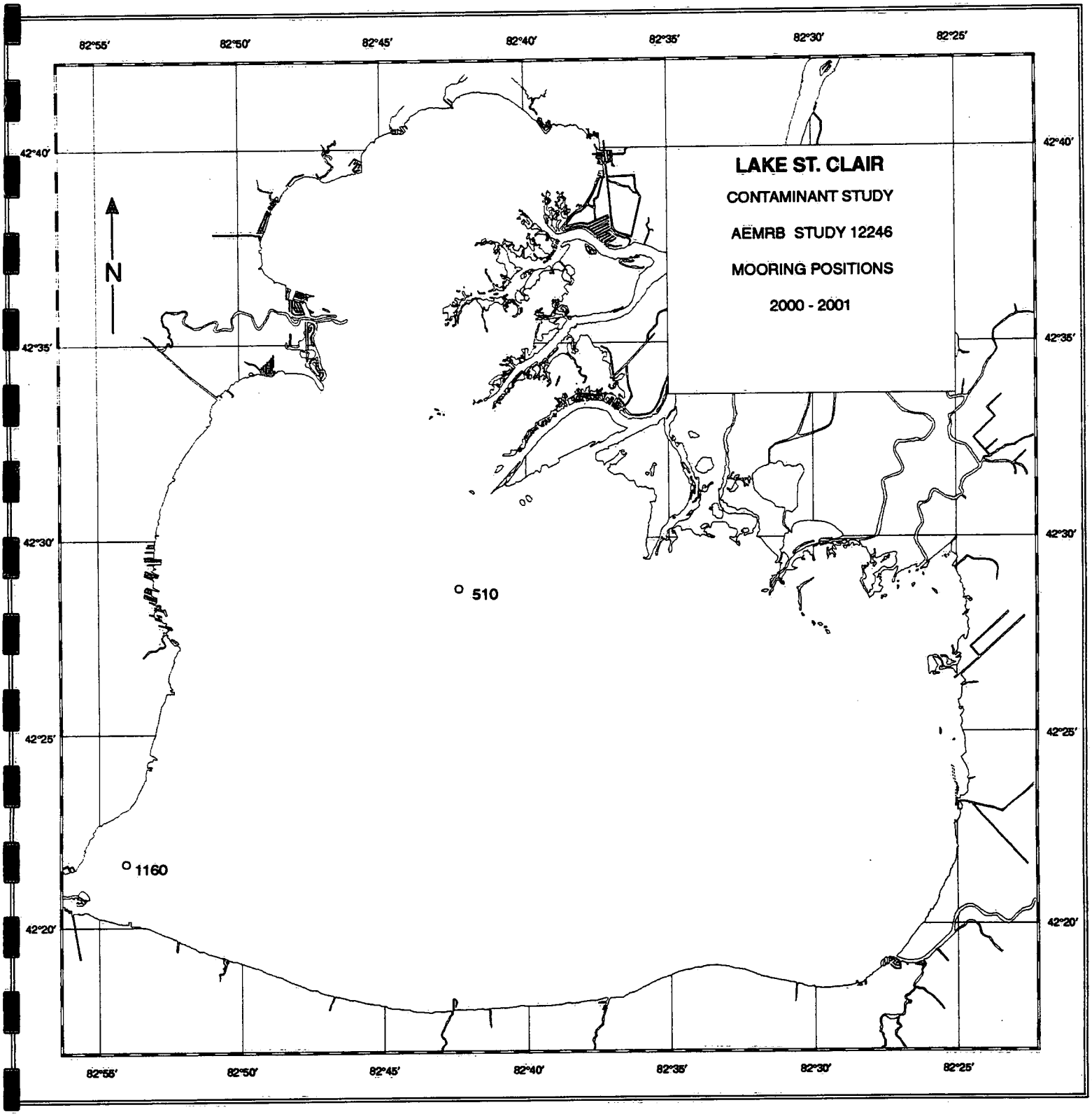
MOORING POSITIONS

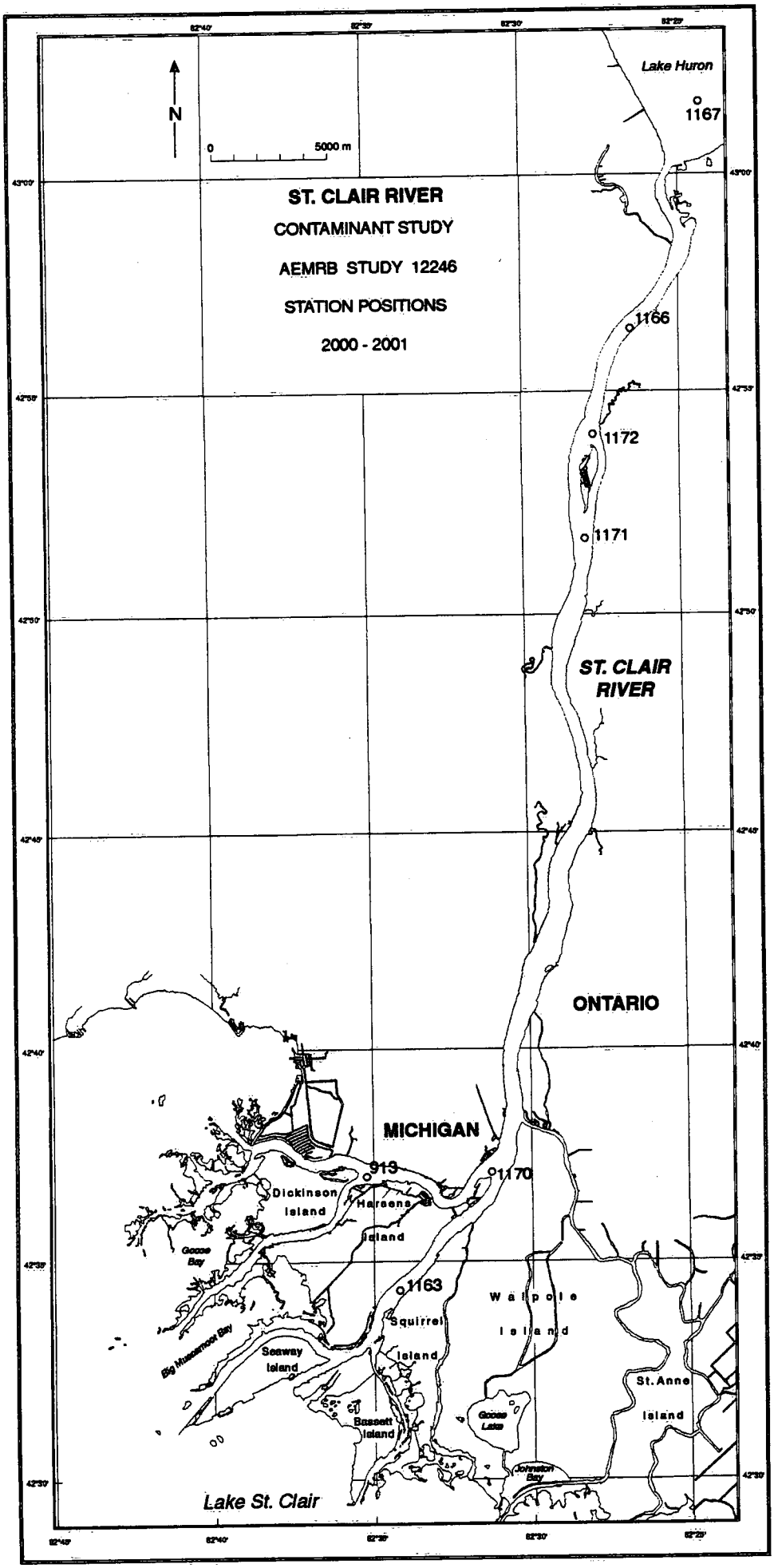
LAKE HURON
LAKE ST. CLAIR/ST. CLAIR RIVER
DETROIT RIVER

2000-2001

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
510	2000-04A-29	42° 28' 46"	82° 42' 23"	ST (4.5 m)
803	2000-08A-07	42° 20' 12"	82° 57' 23"	ST (8.6 m)
804	2000-08A-08	42° 08' 34"	82° 07' 17"	ST (4.9 m)
913	2000-09A-28	42° 37' 03"	82° 35' 05"	ST (6.6 m)
1156	2000-08A-09	42° 02' 50"	83° 08' 14"	ST (4.6 m)
1157	2000-08A-10	42° 02' 53"	83° 09' 41"	ST (3.1 m)
1159	2000-08A-12	42° 07' 45"	83° 10' 29"	ST (4.6 m)
1160	2000-08A-13	42° 21' 37"	82° 54' 10"	ST (3.8 m)
1161	2000-08A-24	42° 10' 20"	83° 09' 51"	ST (6.7 m)
1163	2000-09A-16	42° 34' 13"	82° 34' 21"	ST (8.5 m)
1166	2000-09A-19	42° 56' 31"	82° 26' 18"	ST (8.0 m)
1167	2000-02A-20	43° 02' 40"	82° 24' 48"	ST (5.3 m)
1167	2000-02A-21	43° 02' 47"	82° 24' 44"	ST (5.4 m)
1168	2000-08A-25	42° 15' 58"	83° 06' 45"	ST (6.6 m)
1169	2000-08A-22	42° 19' 58"	83° 01' 15"	ST (6.4 m)
1170	2000-09A-17	42° 37' 16"	82° 31' 10"	ST (6.5 m)
1171	2000-09A-18	42° 51' 31"	82° 28' 02"	ST (5.9 m)
1172	2000-09A-11	42° 54' 16"	82° 27' 47"	ST (7.8 m)


DETROIT
803
1169
WINDSOR
1168
Fighting Island
1161
Grosse Ile
804
1159
1157
1156
Lake Erie
N
0 1 2 3 km
DETROIT RIVER
CONTAMINANT STUDY
AEMRB STUDY 12246
MOORING POSITIONS
2000 - 2001


LAKE ST. CLAIR
CONTAMINANT STUDY
AEMRB STUDY 12246
MOORING POSITIONS
2000 - 2001
N
510
1160
82°55'
82°50'
82°45'
82°40'
82°35'
82°30'
82°25'
42°40'
42°35'
42°30'
42°25'
42°20'


ST. CLAIR RIVER
CONTAMINANT STUDY
AEMRB STUDY 12246
STATION POSITIONS
2000 - 2001
N
0
5000 m
Lake Huron
1167
1166
1172
1171
ST. CLAIR RIVER
ONTARIO
MICHIGAN
913
1170
1163
Dickinson Island
Harsens Island
Goose Bay
Big Muscamoot Bay
Seaway Island
Squirrel Island
Walpole Island
St. Anne Island
Goose Lake
Bassett Island
Johnston Bay
Lake St. Clair

AQUATIC ECOSYSTEM IMPACTS RESEARCH BRANCH

METEOROLOGICAL AND TEMPERATURE MOORINGS
AEIRB STUDY 14145, W.M. SCHERTZER

The purpose of this study was to deploy meteorological and temperature moorings to give detailed vertical temperature measurements at the deep hole of Lake Ontario. To accomplish this, two meteorological buoys were installed at station 586 during the cruise April 3 - 7 and retrieved on the cruise October 30 - November 3. The two temperature moorings had been winter moorings installed in October of 1999, refurbished as U-shaped moorings in April of 2000 and then reinstalled as winter moorings in October to be retrieved in the spring of 2001. In April, at station 403, a sediment trap mooring was installed for M.N. Charlton. On the October cruise the mooring was retrieved and installed as a winter mooring.

Additional tasks completed on the cruises included: PONAR grab samples for R. Dermott, GLLFAS; Mysid net hauls for Dr. O. Johannsson, GLLFAS; phytoplankton and zooplankton samples for Dr. M. Munawar, GLLFAS on the April cruise; on the October cruise, Mysis net hauls at station 64 in the deep hole for Dr. O. Johannsson, GLLFAS; water samples for Dr. D. Muir, AEPRB study 12320; air samples for H. Wong, AEPRB study 12216 on the October cruise.

STATISTICS SUMMARY

CRUISE NO.		**SHIP**	CCGS LIMNOS
DATE		**REGION**	LAKE ONTARIO
CRUISE TYPE	Lake Ontario Moorings	**N.MI. STEAMED**	620.8

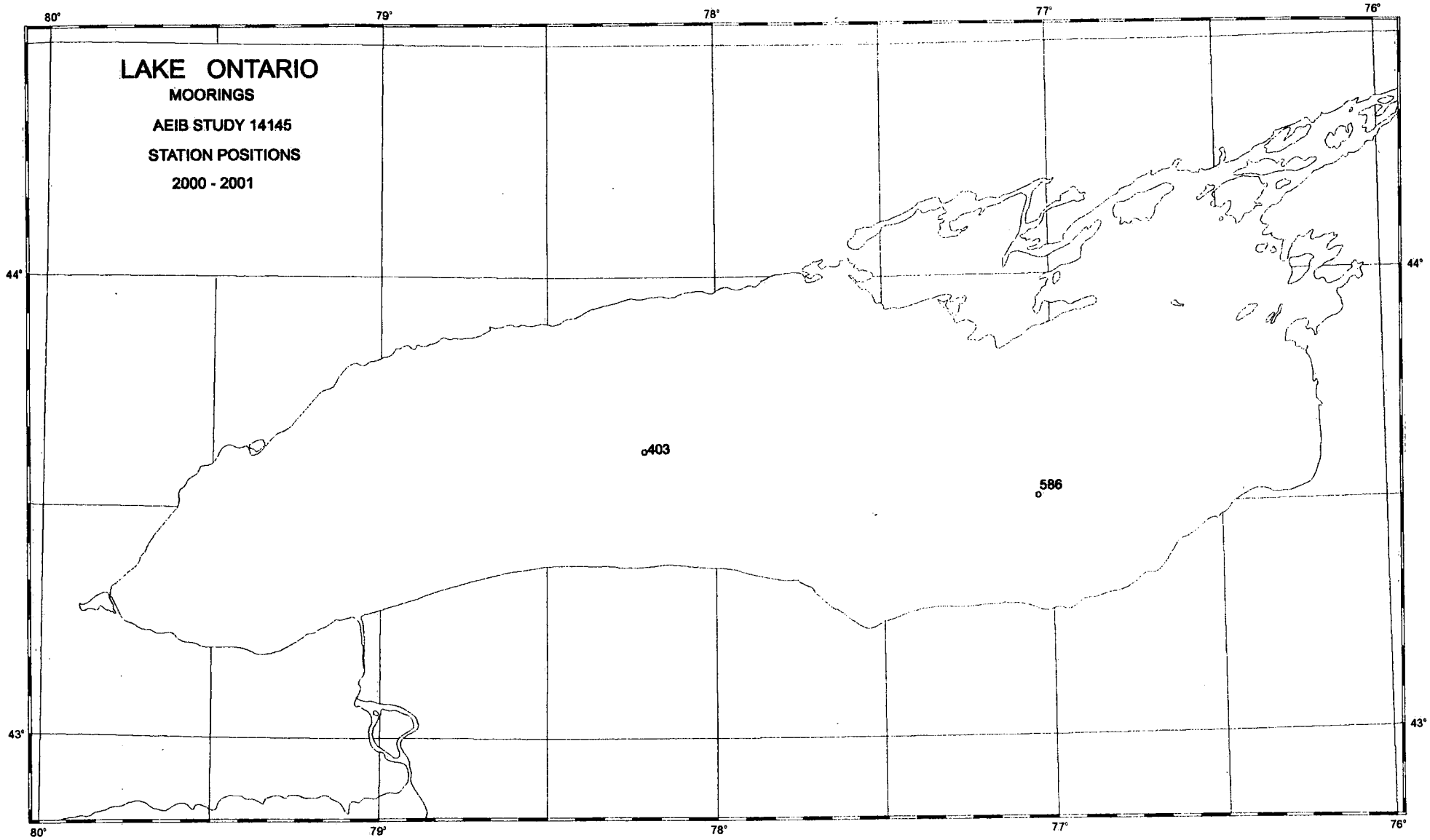
DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	18	Moorings Established, Meteorological	2
EBT/Transmissometer Casts	18	Moorings Retrieved, Meteorological	2
Rosette Casts	1	Moorings Established, Temperature Loggers	4
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved, Temperature Loggers	4
Secchi Disk Observations	6	Moorings Established, Sediment Trap	2
Transmissometer Casts		Moorings Retrieved, Sediment trap	2
Zooplankton Hauls 64µ	6		
Zooplankton Hauls 100µ	13		
Integrator 10 m			
Integrator 20 m	6	Primary Productivity Moorings	
Phytoplankton Samples	8	Mysid Net Hauls	10
D.O. Profiles			
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	
Water Samples Collected (D.O.)		Cores Taken, Piston	
Water Samples Collected (Cond/pH)	6	Cores Taken, Benthos	
Water Samples Collected (TP uf)		Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	16
Water Samples Collected (Ciliate)	6	Bulk Centrifuge Samples, 1500 litres	3
Water Samples Collected (Microbial Loop)	9		
Water Samples Collected (Primary Productivity)	6	Observations, Weather	
Water Samples Filtered (Chlorophyll a)		Air Transects	3
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)	6		
Water Samples Filtered (TP f)			
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major Ions)		**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	12
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

MOORING POSITIONS

LAKE ONTARIO

2000-2001

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
403	2000-00A-65A	43° 36' 01"	78° 13' 27"	ST(20,60,100 140,166,174)
	2000-00A-65B	43° 35' 38"	78° 13' 37"	ST(20,60,100 140,166,174)
586	2000-00M-33A	43° 29' 08"	77° 02' 57"	MET
	2000-00M-34A	43° 28' 59"	77° 02' 53"	MET T(2 m)
	2000-00T-35A	43° 29' 10"	77° 03' 32"	T(12,16,20, 24,30,40,100, 214)
	2000-00T-35B	43° 29' 13"	77° 03' 38"	T(12,16,20, 24,30,40,100, 214)
	2000-00T-36A	43° 29' 00"	77° 02' 58"	T(4,6,8,10, 14,18,22,26, 35,50,150,
	2000-00T-36B	43° 29' 03"	77° 02' 36"	T(10,16,26, 36,46,61,101, 181 m)


LAKE ONTARIO
MOORINGS
AEIB STUDY 14145
STATION POSITIONS
2000 - 2001
80°
79°
78°
77°
76°
44°
43°
403
586

CARBON CYCLE: CHEMICAL, BIOLOGICAL AND PHYSICAL ASPECTS, LAKE ERIE
AEIRB STUDY 14150, DR. R.A. BOURBONNIERE

One cruise was carried out onboard the CCGS LIMNOS for Dr. Bourbonniere July 4 - 13 to examine natural microbial community and the impact of UV radiation on these systems in the Central Basin of Lake Erie.

STATION POSITIONS

LAKE ERIE

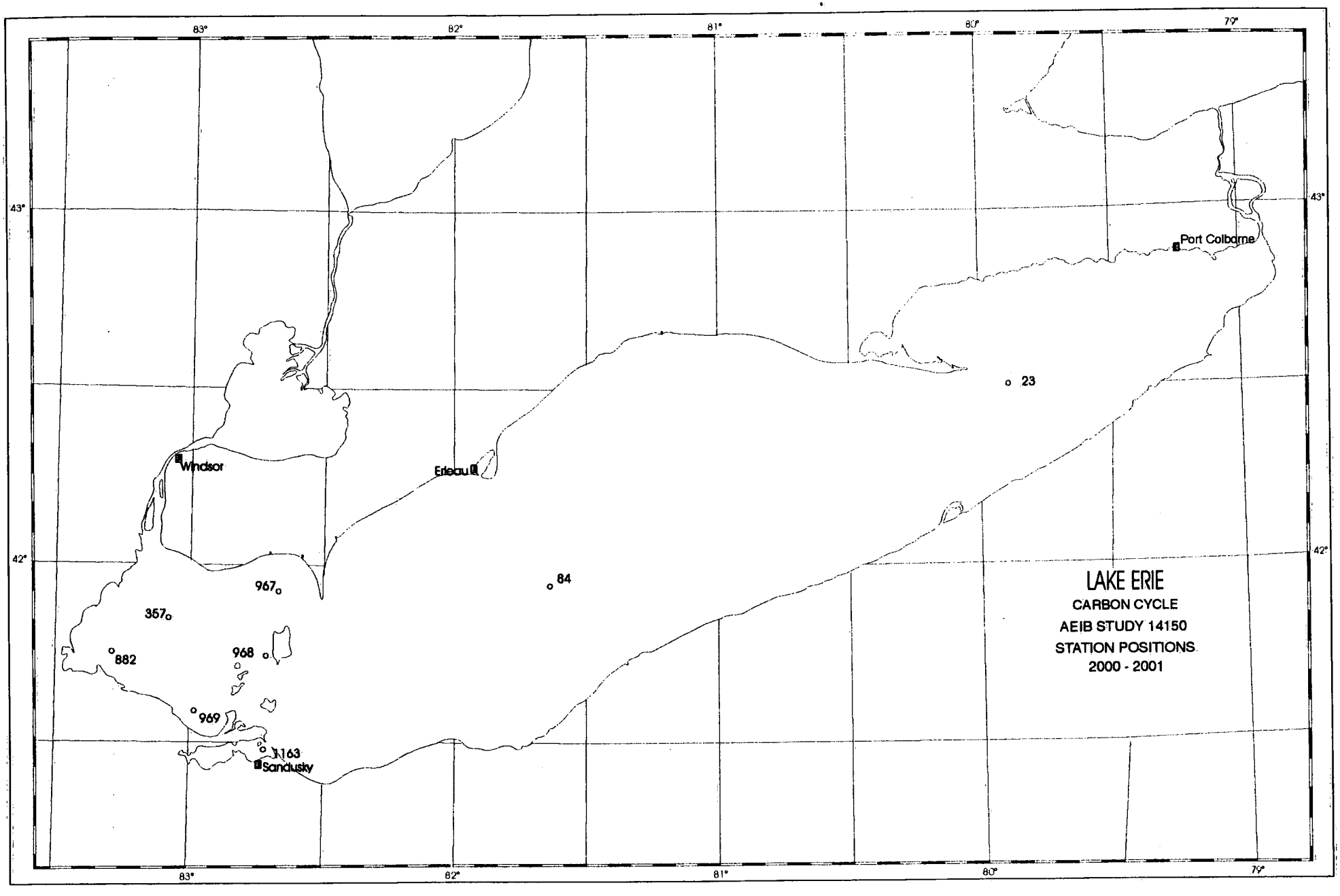
2000-2001

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 30' 04"	79° 53' 21"
84	41° 56' 22"	81° 39' 27"
357	41° 48' 44"	82° 59' 02"
882	41° 45' 57"	83° 18' 34"
967	41° 53' 33"	82° 40' 03"
968	41° 42' 30"	82° 44' 01"
969	41° 36' 29"	82° 55' 34"
1163	41° 28' 20"	82° 42' 58"

STATISTICS SUMMARY

CRUISE NO. _____ **SHIP** CCGS LIMNOS
DATE: FROM _____ **REGION** LAKE ERIE
CRUISE TYPE Carbon Cycle **N.MI. STEAMED** 580.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	29	Moorings Established, C^{14}	2
EBT/Transmissometer Casts	29	Moorings Retrieved, C^{14}	2
Rosette Casts	27	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disk Observations	21	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls	7	Moorings Serviced	
Fluorometer Casts	18		
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Go - Flo Casts	7		
D.O. Profiles	29		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	
Water Samples Collected (D.O.)		Cores Taken, Piston	
Water Samples Collected (Cond/pH)		Cores Taken, Benthos	
Water Samples Collected (TP uf)		Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected (Ciliate)		Bulk Centrifuge Samples 50 Litre	
Water Samples Collected (Microbial Loop)			
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered (Chlorophyll a)			
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)			
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major Ions)		**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	
Water Samples Filtered ( )			
Water Samples Filtered ( )			


83°
82°
81°
80°
79°
43°
42°
Windsor
Erieau
Port Colborne
23
84
967
357
882
968
969
1163
Sandusky
LAKE ERIE
CARBON CYCLE
AEIB STUDY 14150
STATION POSITIONS
2000 - 2001

RESEARCH SUPPORT BRANCH

OPEN LAKES SURVEILLANCE, LAKES ERIE, HURON AND GEORGIAN BAY
ECOSYSTEM HEALTH DIVISION, ECB, EC-OR
RSB STUDY 12632, B.H. MOORE

The 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.

Four cruises were conducted—two on Lake Erie April 16 - 20, August 28 - September 1 and two on Lake Huron and Georgian Bay May 1 - 9 and August 17 - 24, to support this program. All cruises were organized and completed by Technical Operations personnel for ECB-OR and were conducted from the CCGS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C, GPS positioning systems and a variety of samplers and winches used for chemical and biological sampling.

The parameters sampled during all cruises were: temperature and transmission profiles, dissolved oxygen, specific conductance, pH, chlorophyll a, particulate organic carbon, particulate nitrogen, total phosphorous filtered and unfiltered, soluble reactive phosphorous, total Kjeldahl nitrogen, alkalinity, SO_4, chloride, reactive silicate, major ions (Mg, K, Ka) as well as meteorological and Secchi disc observations.

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

Unstratified Conditions:
- 1 metre
- 50 metres if total depth was greater than 70m
- 100 metres if total depth was greater than 130m
- 250 metres if total depth was greater than 300m
- bottom -10 metres
- bottom -2 metres

Stratified Conditions:
- 1 metre
- 1 metre above the knee of the thermocline
- mid-thermocline
- 1 metre below the knee of the thermocline
- 100 metres if total depth was greater than 130m
- 250 metres if total depth was greater than 300m
- bottom -10 metres
- bottom -2 metres

Some of the additional tasks performed during the cruises were: Water samples collected for pharmaceutical analyses for J. Struger, EHD, ECB-OR; total suspended solids for Mr. C. Allen, University of Waterloo; mini box cores for Dr. U. Borgmann, AEPRB; Mysid net hauls for Dr. O. Johannsson, GLLFAS and phytoplankton samples for Dr. M. Munawar, GLLFAS.

STATISTICS SUMMARY

CRUISE NO. _____ **SHIP** CCGS LIMNOS
DATE _____ **REGION** LAKE ERIE
CRUISE TYPE Open Lakes Surveillance **N.MI. STEAMED** 1370.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	104	Moorings Established, Sediment trap	1
EBT/Transmissometer Casts	107	Moorings Retrieved, Sediment Trap	1
Rosette Casts	58	Moorings Established, DO logger	5
Reversing Thermometer Obs. (No. of Therm)	20	Moorings Retrieved, DO Logger	5
Secchi Disk Observations	46	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
Niskin Bottle Casts	40		
Integrator 10 m	50		
Integrator 20 m	52	Primary Productivity Moorings	
Phytoplankton Samples	48	Phenoxy Acid Herbicides	3
D.O. Profiles	65	Neutral herbicides	3
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	1004	Cores Taken, Mini Box	8
Water Samples Collected (D.O.)	231	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	283	Cores Taken, Benthos	
Water Samples Collected (TP uf)	317	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	48
Water Samples Collected (Ciliate)	15	Bulk Centrifuge Samples, 50-litre	3
Water Samples Collected (Microbial Loop)	15	Bulk centrifuge Samples, 100-litre	3
Water Samples Collected (Primary Productivity)	15	Observations, Weather	
Water Samples Filtered (Chlorophyll a)	191		
Water Samples Filtered (POC/TPN)	138		
Water Samples Filtered (Seston)	62		
Water Samples Filtered (TP f)	317		
Water Samples Filtered (Nutrients)	317		
Water Samples Filtered (Major Ions)	63	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)	17	Manual Chemistry, Tech. Ops.	797
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	144
Water Samples Filtered ( )			

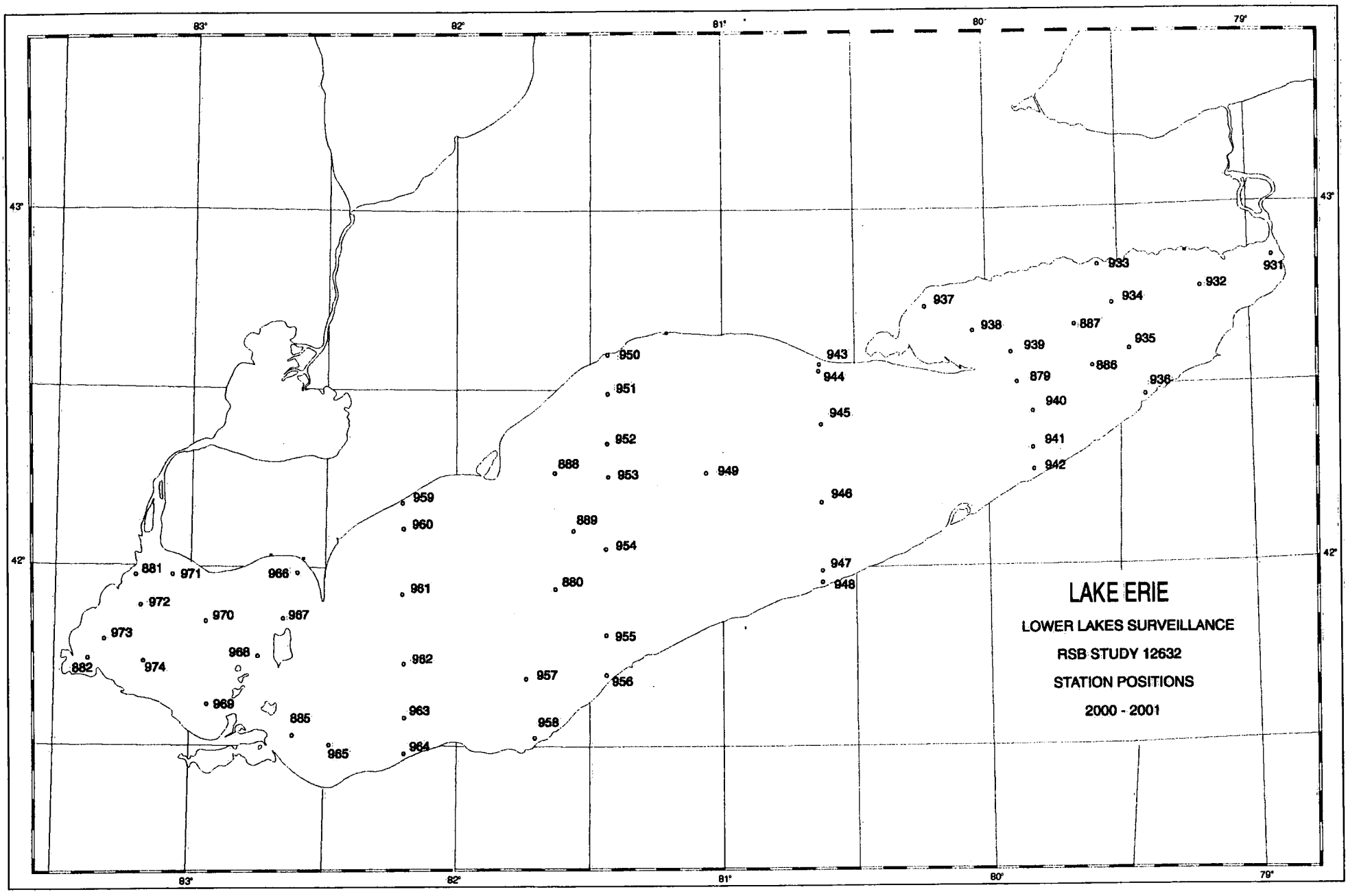
STATION POSITIONS

LAKE ERIE

2000-2001

STATION NUMBER	LATITUDE N.	LONGITUDE W.
879	42° 30' 25"	79° 53' 59"
880	41° 56' 09"	81° 39' 16"
881	41° 58' 08"	83° 12' 30"
882	41° 44' 02"	83° 23' 08"
885	41° 31' 10"	82° 38' 27"
886	42° 32' 18"	79° 37' 00"
887	42° 48' 48"	79° 41' 30"
888	42° 06' 36"	81° 34' 30"
889	42° 16' 48"	81° 40' 18"
931	42° 51' 00"	78° 56' 30"
932	42° 47' 30"	79° 12' 30"
933	42° 49' 30"	79° 34' 00"
934	42° 42' 30"	79° 30' 30"
935	42° 35' 30"	79° 28' 00"
936	42° 28' 30"	79° 24' 30"
937	42° 43' 00"	80° 15' 00"
938	42° 38' 00"	80° 03' 30"
939	42° 34' 00"	79° 55' 00"
940	42° 26' 30"	79° 50' 00"
941	42° 19' 30"	79° 50' 00"
942	42° 15' 30"	79° 50' 00"
943	42° 34' 30"	80° 38' 30"
944	42° 32' 00"	80° 38' 30"
945	42° 24' 00"	80° 38' 30"
946	42° 10' 00"	80° 38' 30"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
947	41° 59' 30"	80° 38' 30"
948	41° 57' 24"	80° 38' 30"
949	42° 15' 00"	81° 06' 30"
950	42° 35' 18"	81° 26' 30"
951	42° 28' 30"	81° 26' 30"
952	42° 21' 30"	81° 26' 30"
953	42° 12' 30"	81° 26' 30"
954	42° 01' 30"	81° 26' 30"
955	41° 48' 00"	81° 26' 30"
956	41° 41' 30"	81° 26' 30"
957	41° 41' 00"	81° 44' 30"
958	41° 31' 30"	81° 42' 30"
959	42° 11' 42"	82° 11' 00"
960	42° 06' 00"	82° 11' 00"
961	41° 54' 30"	82° 11' 00"
962	41° 43' 00"	82° 11' 00"
963	41° 34' 30"	82° 11' 00"
964	41° 29' 00"	82° 11' 00"
965	41° 30' 00"	82° 30' 00"
966	41° 59' 00"	82° 37' 30"
967	41° 53' 30"	82° 40' 00"
968	41° 44' 30"	82° 44' 00"
969	41° 36' 30"	82° 55' 30"
970	41° 49' 30"	82° 58' 30"
971	41° 57' 00"	83° 03' 00"
972	41° 52' 00"	83° 12' 00"
973	41° 47' 30"	83° 20' 00"
974	41° 43' 30"	83° 09' 00"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LAKE ERIE
LOWER LAKES SURVEILLANCE
RSB STUDY 12632
STATION POSITIONS
2000 - 2001

STATISTICS SUMMARY

CRUISE NO.		**SHIP**	CCGS LIMNOS
DATE		**REGION**	LAKE HURON
CRUISE TYPE	Open Lakes Surveillance	**N.MI. STEAMED**	1932.5

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	137	Moorings Established, ADCP	1
EBT/Transmissometer Casts	137	Moorings Retrieved	
Rosette Casts	66	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)	8	Moorings Retrieved	
Secchi Disk Observations	69	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls 500µ	6	Moorings Serviced, Sediment Trap	2
Niskin Bottle Casts	66		
Integrator 10 m	30		
Integrator 20 m	101	Primary Productivity Moorings	3
Phytoplankton Samples		Phenoxy Acid Herbicides	3
D.O. Profiles	40		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	384	Cores Taken, Mini Box	6
Water Samples Collected (D.O.)	358	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	358	Cores Taken, Benthos	
Water Samples Collected (TP uf)	410	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected (Trace Metals)	16	Bulk Centrifuge Samples, 100-litre	14
Water Samples Collected (University of Waterloo)	16		
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered (Chlorophyll a)	157		
Water Samples Filtered (POC/TPN)	196		
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)	410		
Water Samples Filtered (Nutrients)	410		
Water Samples Filtered (Major Ions)	410	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)	14	Manual Chemistry, Tech. Ops.	1074
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	312
Water Samples Filtered ( )		Microbiology	

STATION POSITIONS

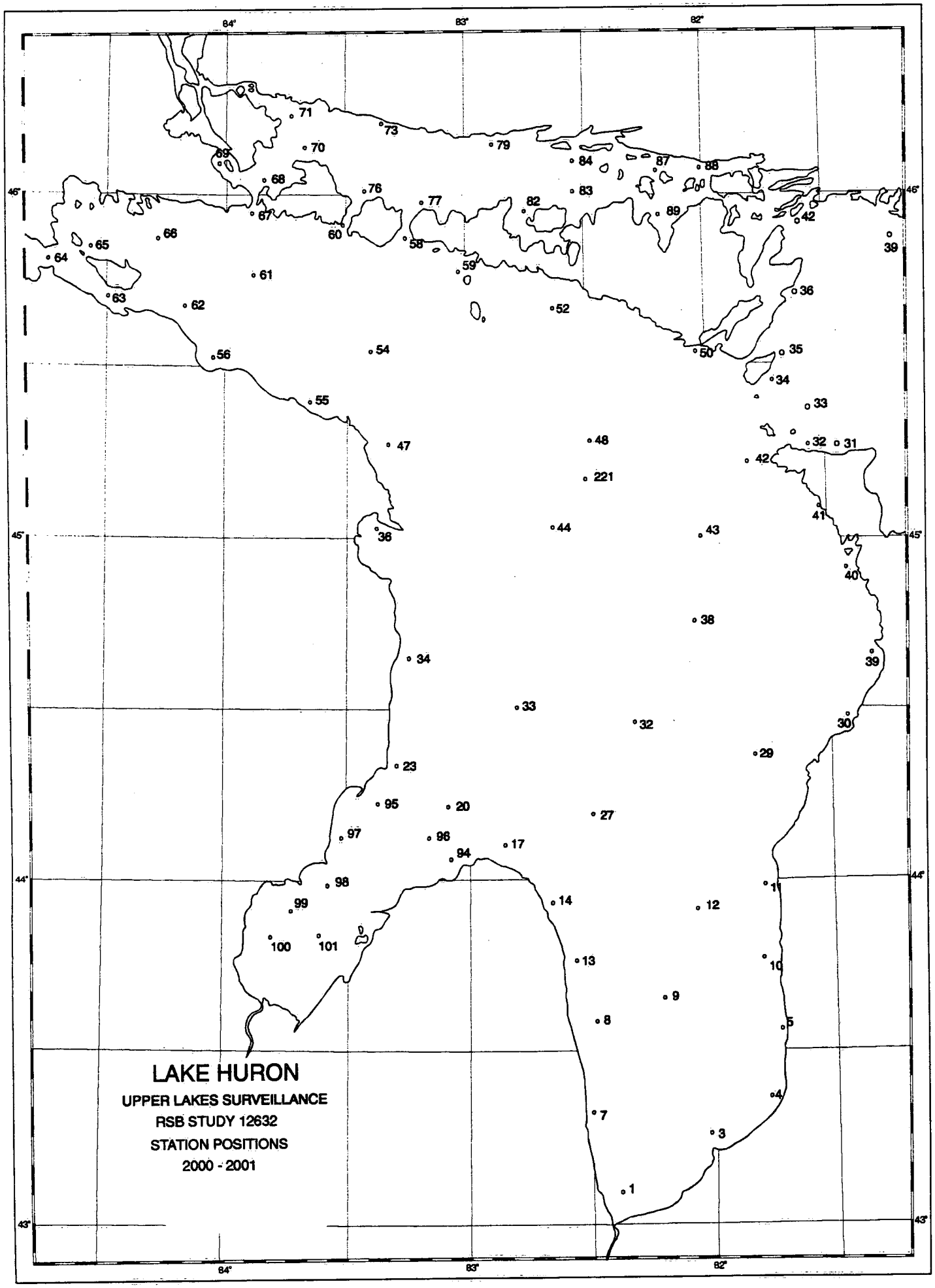
LAKE HURON

2000-2001

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

STATION NUMBER	LATITUDE N.	LONGITUDE W.
41	45° 05' 00"	81° 32' 12"
42	45° 13' 18"	81° 49' 12"
43	45° 00' 48"	82° 00' 30"
44	45° 01' 00"	82° 41' 06"
47	45° 15' 18"	83° 20' 48"
48	45° 16' 42"	82° 27' 06"
50	45° 32' 06"	82° 02' 42"
52	45° 39' 06"	82° 38' 54"
54	45° 31' 00"	83° 25' 00"
55	45° 25' 30"	83° 39' 06"
56	45° 31' 00"	84° 05' 00"
58	45° 52' 00"	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° 45' 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' 12"	82° 45' 30"

STATION NUMBER		LATITUDE N.	LONGITUDE W.
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"
100)		43° 49' 30"	83° 49' 02"
101)		43° 49' 15"	83° 37' 30"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LAKE HURON
UPPER LAKES SURVEILLANCE
RSB STUDY 12632
STATION POSITIONS
2000 - 2001

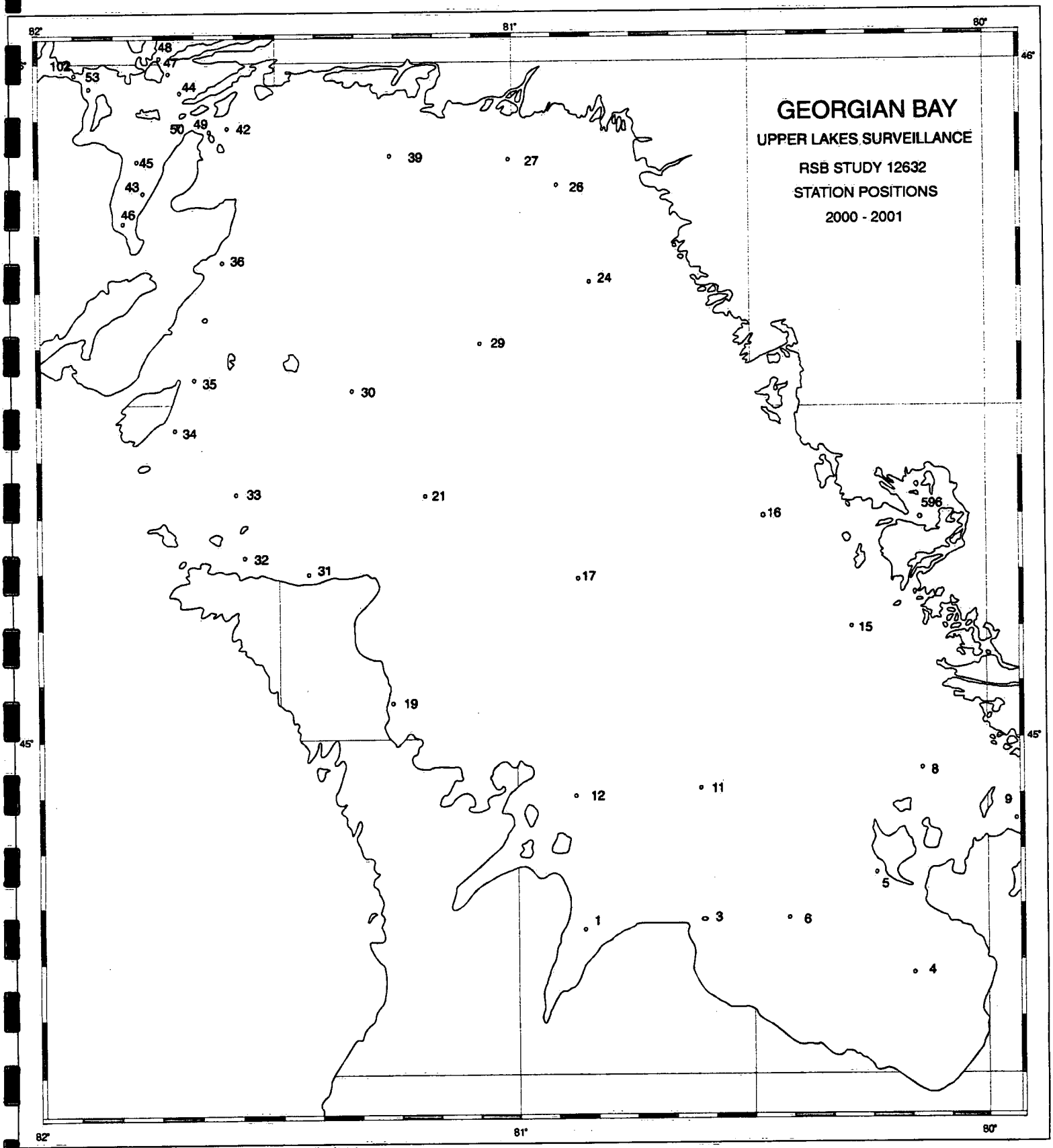
STATISTICS SUMMARY

CRUISE NO.		**SHIP**	CCGS LIMNOS
DATE		**REGION**	GEORGIAN BAY
CRUISE TYPE	Open Lakes Surveillance	**N.MI. STEAMED**	823.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	58	Moorings Established	
EBTT/Transmissometer Casts	60	Moorings Retrieved, Tide Gauge	1
Rosette Casts	27	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)	12	Moorings Retrieved	
Secchi Disk Observations	27	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls 500 µ	5		
Niskin Bottle Casts	29		
Integrator 10 m			
Integrator 20 m	56	Primary Productivity Moorings	
Phytoplankton Samples		Phenoxy Acid Herbicides	3
D.O. Profiles		Neutral Herbicides	3
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	187	Cores Taken, Mini Box	
Water Samples Collected (D.O.)	178	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	178	Cores Taken, Benthos	
Water Samples Collected (TP uf)	197	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected (Trace metals)	11	Bulk Centrifuge Samples 100-litre	8
Water Samples Collected (University of Waterloo)	5		
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered (Chlorophyll a)	66		
Water Samples Filtered (POC/TPN)	85		
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)	197		
Water Samples Filtered (Nutrients)	197		
Water Samples Filtered (Major Ions)	197	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)	8	Manual Chemistry, Tech. Ops.	531
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	132
Water Samples Filtered ( )		Microbiology	

STATION POSITIONS
GEORGIAN BAY
2000 - 2001

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	44° 43' 03"	80° 51' 24"
3	44° 43' 30"	80° 37' 00"
4	44° 38' 45"	80° 10' 00"
5	44° 47' 48"	80° 14' 36"
6	44° 44' 12"	80° 26' 06"
8	44° 57' 10"	80° 08' 56"
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° 56' 00"
31	45° 14' 18"	81° 26' 24"
33	45° 22' 13"	81° 35' 06"
35	45° 31' 39"	81° 40' 10"
36	45° 42' 30"	81° 37' 12"
39	45° 52' 24"	81° 15' 30"
42	45° 54' 46"	81° 35' 42"
43	45° 49' 52"	81° 47' 19"
44	45° 58' 20"	81° 41' 55"
46	45° 45' 42"	81° 47' 41"
47	45° 59' 27"	81° 43' 58"
48	46° 00' 26"	81° 44' 00"
594	46° 20' 35"	80° 07' 38"


GEORGIAN BAY
UPPER LAKES SURVEILLANCE
RSB STUDY 12632
STATION POSITIONS
2000 - 2001
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SHORE PROGRAMS

NATIONAL LABORATORY FOR ENVIRONMENTAL TESTING

CENTRIFUGING QA/QC WATER AT CCIW
NLET STUDY 12180, H. ALKEMA

In late October Technical Operations staff supported a centrifuging operation for half a day in the QA/QC cold room on the first floor. A Westfalia centrifuge was set up in the cold room to run at about 4 litres per minute. The QA/QC group also had a pump and filter system set up in the cold room. The water to be centrifuged was pumped out of a large container and through both the centrifuge and filtering system at 4 litres per minute. A total of 300 litres of water were centrifuged during the morning. All of the equipment was constantly monitored, was packed up and returned to stores on completion of the job.

HAMILTON HARBOUR QA/QC
NLET STUDY 12180, H. ALKEMA

Hamilton Harbour sediments are typically contaminated with a variety of trace elements (TE). On April 11th sediments were collected from one station several kilometers off the canal in Lake Ontario. On April 14th samples were collected from 4 stations in the harbour. These samples will be used in Canada-wide interlaboratory proficiency testing studies as ideally contaminated natural sediments to challenge the analytical capabilities of Environment Canada and MITE laboratories (Metals in the Environment). As a new venture, the proficiency studies for TE in sediments complement those for TE in natural waters.

The MITE research network addresses important research on metals in an integrated, holistic manner. The network includes laboratories from universities, Environment Canada, Natural Resources Canada and Fisheries and Oceans. Financial support is provided by various agencies, including the Mining Association and government agencies. The Institute is providing support through timely, comprehensive analytic proficiency studies for all participating laboratories.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
Lake Ontario	43° 20' 26"	79° 41' 19"
1	43° 16' 41"	79° 53' 05"
2	43° 16' 48"	79° 52' 20"
3	43° 17' 12"	79° 51' 56"
4	43° 17' 43"	79° 48' 26"

AQUATIC ECOSYSTEMS MANAGEMENT RESEARCH BRANCH

BENTHIC COMMUNITY STRUCTURE, HAMILTON HARBOUR
AEMRB STUDY 12211, DR. L. GRAPENTINE

TOS personnel deployed a Datasonde3 logger in the Western Basin and one in the Deep Basin of Hamilton Harbour to monitor dissolved oxygen from May 9th to November 7th. These deployments provide data for a long-term monitoring project of Profundal Benthic Invertebrate Communities of Lake Erie and Hamilton Harbour. This data is helpful in characterizing seasonal and annual variability of deep-water benthic invertebrate communities and their relationship to temperature and oxygen levels. Benthic invertebrate communities from three locations in Lake Erie and two locations in Hamilton Harbour have been sampled continuously since 1987. Each year from April to October, monthly collections have been obtained, accompanied by measurements of temperature and oxygen concentrations. Oligochaetes are the main constituents of these communities. Two of the most important environmental variables affecting community structure are expected to be temperature and oxygen. With a time-stamped data array it is also possible to correlate benthic community structure with weather, lake production and contaminant loadings.

STATION NUMBER	LATITUDE N.	LONGTITUDE W.
HH3 West End	43° 17' 21"	79° 50' 33"
HH19 Deep Hole	43° 16' 55"	79° 52' 23"

BENTHIC COMMUNITY SAMPLING, ROUYN-NORANDA, QUEBEC
AEMRB STUDY 12211, DR. L. GRAPENTINE

This research study in the Rouyn-Noranda area of Quebec was supported by sampling several lakes throughout the region during the weeks of August 21 and 28. Sampling was completed in support of the assessment of benthic invertebrate communities in lakes that were metal-contaminated and lakes that were relatively uncontaminated. Ten lakes were selected for sampling which included the following: Bousquet, Dasserat, Dufault, Heva, Ollier, Opasatica, Duprat, Joannès, Flavrian and Beauchastel. Other lakes visited and found inaccessible or unsuitable were: Caron, Dufay, Defresnoy, Osiska, Vaudray, Evain and Petite Defresnoy. Profundal benthic samples were collected from three locations in each lake. Sampling depths were standardized at the 10-metre contour wherever possible. Some lakes' depths were less than the 10 m

standardized depth; these included lacs Duprat, Flavrian and Heva. Access to lacs Beauchastel and Ollier is restricted since they are on private land and permission is required prior to launching the boat. Dr. Grapentine has the land owner's name in case further access is required. A four-wheel drive vehicle is needed to launch and retrieve boats from the above-named lakes since there are no proper launching facilities. With the exception of Opsatica—a very shallow lake with a good, paved ramp, the P-boat was launched from fields or beaches.

Lakes sampled were divided into three sections of roughly equal area if the bathymetry permitted. In each section within the lake, a collection site was randomly selected. At each site the following collections were to be made: Hydrolab water column profiles of temperature, conductivity, dissolved oxygen and pH; water samples were collected from 1 m above the bottom with a Van Dorn sampler for major ions, total metals, dissolved metals and DOC/DIC.

All sediment samples were collected using a mini box corer. The corer was subsampled as requested by the study leader for benthic invertebrates, metals analyses, grain size analyses and toxicity tests. Quality control and quality assurance samples were collected from stations on Lacs Duprat, Dasserat and Joannès.

CONTAMINANT STUDY, ROUYN-NORANDA AND HAMILTON HARBOUR
AEMRB STUDY 12212, F. ROSA

ROUYN-NORANDA

Results from previous reconnaissance surveys of sediments from approximately 100 lakes in the vicinity of the Horne smelter in Rouyn-Noranda, Quebec indicate that metal concentrations are elevated in modern-day sediments in comparison with pre-industrial layers. Similar patterns of metal enrichment in surface sediments have been widely reported in the literature and have been attributed to increased anthropogenic metal loading and/or to diagenetic metal remobilization.

The rationale for studying early diagenesis in freshwater systems is to increase our ability to interpret geochemical profiles of lake sediments. The metal distributions observed in sediment cores may not necessarily represent the order of their initial deposition. Results of this study will help to identify the natural processes (e.g., driven by oxidation-reduction reactions) that control metal redistribution.

This field sampling was in support of a collaborative study in the Rouyn-Noranda region by AEMRB and the Geological Survey of Canada.

During the week of July 10 - 14, Technical Operations divers travelled to and completed the following sampling at Lac Perron (Blue Lake) 2 hours East of Rouyn-Noranda and Lac Pepiniere (Meteor Lake) 2 hours Northeast of Rouyn-Noranda.

- Set up a temporary field laboratory (glove box, extruding equipment) to extrude and carry out extensive subsampling of diver sediment cores by Geological Survey of Canada personnel
- Located and marked discrete deep holes in each lake
- Sampled water quality parameters using a Hydrolab
- Retrieved (8) diver cores for sediment characterization
- Deployed (4) peepers for pore water characterization

During the week of July 31st to August 4th TOS personnel returned and successfully retrieved and sampled 4 peepers at each Lake. Additional Hydrolab profiles were taken at each site.

STATION POSITIONS

LAKE	LATITUDE N.	LONGTITUDE W.	DEPTH (M)
Lac Perron	47° 50' 29"	78° 16' 45"	16
Lac Pepiniere	48° 35' 35"	78° 16' 36"	11

HAMILTON HARBOUR

In 1995, the Hamilton Harbour Remediation Program targeted a 100 square metre test site West of the LaSalle Marina. The sediment at this site was chosen for "sandcapping"—a method of containing and isolating contaminated sediment by applying a covering layer of clean sand. The effectiveness of this technology has been monitored since then. The long-term assessment of contaminant migration through the sand layer has been continued with peeper installation and staggered removals.

One dialysis chamber (peeper) that was modified to measure porewater profiles over a water/sediment/sand depth of 100 cm for the Hamilton Harbour "Sand Capping Project" was successfully retrieved by TOS divers in May 1999. Upward migration by molecular diffusion of porewater contaminants will determine the efficiency of the sand cap as a remediation technique. Some upward migration seems to be occurring through the first 15 to 20 cm of the 35 cm thick sand cap. Porewater profiles also show that lowest concentrations occur toward the middle (10 to 15 cm) of the sand cap and increase toward the surface. This clearly shows that downward diffusion is also occurring. This may be due to a net sediment accumulation of contaminated harbour sediments over the sand layer of the cap. To monitor the rate of sediment accumulation at the sand

cap site (R9), sediment traps were refurbished monthly from April to November and re-deployed to measure the winter (November to April) sediment accumulation. Results indicate that a net sediment accumulation over the sand cap is occurring with concentrations of inorganic contaminants which are similar to the mean concentrations of surficial harbour sediments.

On April 26th one large peeper was removed from the Northwest corner of the sand cap. Diver hand-cores were taken at the time.

Unfortunately, 1999-2000 winter samples were lost on retrieval from the resuspension tripod at station R9. Monthly sampling of this mooring over the field season was uneventful.

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGTITUDE W.
R9	2000-50A-01A	43° 17' 43"	79° 50' 49"

IN SITU SEDIMENT TREATMENT, LAKE BIWA, JAPAN
AEMRB STUDY 12214 DR. T.P. MURPHY

As part of an ongoing program, Technical Operations had been requested by Dr. T.P. Murphy to assist with field operations for the Lake Biwa studies. Lake Biwa is located close to the centre of the Japanese archipelago, in the Shiga Prefecture. Lake Biwa is the largest lake in Japan and one of the oldest lakes in the world, occupying one sixth of the area of the prefecture. It also serves as a significant water resource, providing water for industry and the drinking water supply for thirteen million residents. Lake Biwa suffers from an excess of nutrients within its sediments which in turn enhance the growth of toxin-producing algae. Sediment treatment can block the growth of toxic algae and oxidation of the sulfide within the sediments can greatly reduce the porewater phosphorus. The purpose of the two trips was to continue sediment studies and treatment options by:

- Installing peepers at two stations to measure the pore water chemistry
- Collecting a core at each mooring site, extruding and sampling
- Collecting box core liners of sediment, chemically treating the sediments and returning them to the lake bottom for incubation
- Capping sediment, within an enclosure, using reactive clay
- Lecturing on CCIW diving operations and demonstrating diving equipment

The work was completed with the assistance of the Lake Biwa Research Institute(LBRI), Shinsu Co. and Mikuniya Corp.

LAKE BIWA RESEARCH INSTITUTE AND MUSEUM
OTSU, JAPAN

TRIP #1 - JUNE 2000

Moorings

The peepers were assembled and bubbled at the LBRI lab. The work area provided was very small. Only one tub could be used during peeper assembly. On arrival the requested double-distilled water was not available delaying the start of the assembly. The regulators provided had the wrong connection fitting. Only half of the double-distilled water required arrived Friday afternoon. Modifications to the procedures were made until enough water was available. A still, in another lab, provided 20 litres of water every eight hours.

Peeper A was assembled with difficulty. The peeper was assembled dry and then flooded. The lower water level made it difficult to fill cells and remove bubbles. A syringe was used to slowly fill cells and remove the air bubbles. This method worked but was very slow. For the remaining peepers, the assembly was wet, including the membrane. This method was more efficient and faster. Due to the lack of water and tub size, only two peepers fit into the tub for assembly. As the water supply built up, the peepers were moved into the transport chambers. A total of four large Nitrogen bottles were required for bubbling. Three were used in the lab and one used during transport onboard the vessel, *Hakkin*. The name "Hakkin" means discovery in the Japanese language.

The North basin mooring (station 11) was installed on June 19, at a depth of 70 metres in position 35° 14' 03.0" N., 136° 00' 03.6" W. The mooring configuration was standard "U" shape (190 metre ¾" braided poly groundline) with a pinger and current meter mounted on the frame. Peepers A, B and C were attached to the frame. The frame was installed vertically but was pulled slightly with delays in the installation of the spar buoy anchor. Sediment interface traces on the peeper membranes confirm this.

The South basin mooring (station 16) was installed on June 20 at a depth of 5 metres in position 35° 03' 35.3" N., 135° 54' 18.0" W. The mooring configuration was standard "U" shape (25 metre ¼" wire groundline) with a pinger and current meter mounted on the frame. Peepers D, E and F were attached to the frame. Again, the frame was installed vertically but was pulled slightly with delays in the installation of the spar buoy anchor. Sediment interface traces on the peeper membranes confirm this.

Both moorings were retrieved on July 3. Peepers were removed from the frames. Sample bottles were removed from the peepers and capped. One set of samples from each frame was "pickled" with 0.6 ml of 50% HNO3. These samples will be analyzed for Fe, Mn, and TP. Samples were placed in a cooler with cold packs. The two remaining sets of peeper samples were placed in a cooler. One set will be analyzed for anions at CCIW and the third set is spare samples.

Coring

One TOS core was collected from each peeper mooring site after the mooring was retrieved. Both cores were returned to LBRI and were immediately extruded. Each core was extruded in 2 cm intervals. Measurements were taken for pH and redox from each section. Samples were placed in plastic bags and placed in the freezer. Mr. Sakai of Shinsu Co. was shown the storage location of the water and sediment samples at LBRI and arranged for shipment to CCIW.

Akanoi Bay

Akanoi Bay is located in the South basin of Lake Biwa eight miles north of Otsu along the Eastern shore. The limnocorral (enclosure) used for the reactive clay treatment demonstration was one of four enclosures used by LBRI for field experiments. The enclosures are presently anchored within the fence of a local pearl farm. Each corral is surrounded by a one-metre wide steel deck and the curtains can be raised or lowered with small hand winches.

On June 20, a work crew went to the site to mix a batch of reactive clay in preparation for spreading on the enclosure later in the week. The Bentonite clay and chemicals were mixed and circulating between the pump and mixing tub. A sudden movement by personnel on the enclosure deck caused the deck to tip. This was similar to a group of people moving to the edge of a swimming raft. This tipped the mixing tub just enough to allow the return hose from the pump to slip off the tub and into the enclosure. Approximately 600 litres of the mixture was pumped into a corner of the enclosure. An emergency plan was put in place to salvage the experiment. First, the enclosure was cleaned. Chemicals were ordered in Japan and a date set for the second attempt for a treatment.

The enclosure was cleaned by using the pump intake hose as an underwater vacuum cleaner. A diver was hired for the task. An underwater platform was positioned one foot above the sediment. The diver laid on the platform to work without disturbing the sediment. This vacuum technique cleaned the reactive clay from the enclosure in two hours. The waste material was pumped to an area 8 metres outside the West fence. Both Shinsu and the divers were impressed enough with the use of the platform that they intend to use it for future sampling.

On June 29, the reactive clay experiment continued. Three 25 kg bags of sodium Bentonite were mixed with 850 litres of water. Once the mixture was homogeneous the chemicals were added and the mixture began to thicken. The pump bogged down. The pump and hoses were cleaned out and a third of the mixture was taken out of the tub and spread into the enclosure. Additional water and chemicals were added to improve the flow characteristics and pH of the mixture. After circulating the mixture for an hour,

the clay was spread over the surface of the enclosure. The use of a fire nozzle on the end of the spreader hose greatly improved the control of the mixture flow.

Hiroshima

On Monday, June 26, Dr. T. Murphy and I met Mrs. R. Tanimoto (our interpreter) in Otsu and travelled to Hiroshima on the "Shinkansen" (Bullet train). The purpose of the trip was to provide information and demonstrate procedures in diving safety and sediment porewater chemistry. After arrival on Monday evening, a presentation was given on diving at CCIW with particular emphasis on diving safety. In attendance were employees of the Mikaniya Corp. and three members of a contract dive team. A set of CCIW diving equipment was displayed. Each piece of equipment was identified with a discussion as to its purpose and its affects on diver safety. Attendees had the opportunity to handle the equipment and lively discussions ensued.

On Tuesday morning we were taken on a tour of the Chugoku National Industrial Research Institute (CNIRI). Of particular interest was the Hydraulics building which housed a scale model of the Seto Inland sea. This is the world's largest hydraulic model which holds 5000 cubic metres of water with functional tide-generating capabilities. On Tuesday afternoon, Dr. T. Murphy lectured on Sediment Remediation in Lake Biwa to an audience from CNIRI and Mikaniya Corp. Later, demonstrations of the proper handling and assembly techniques for the six cell peepers were made to a group of field personnel from the Mikaniya Corp.

TRIP #2 - OCTOBER 2000

The purpose of the October trip was to continue sediment studies by:

- Installing peepers at two stations to measure the porewater chemistry
- Collecting a core at each mooring site, extruding and sampling

The work was completed with the assistance of the Lake Biwa Research Institute and Shinsu Co.

Moorings

The peepers were assembled and bubbled at the LBRI storage room. The work area provided was very small and only one tub could be used during peeper assembly. On arrival, the requested double-distilled water was not available, delaying the start of the assembly. The regulators and Nitrogen cylinders arrived two days late. Only half of the double-distilled water required arrived on Friday afternoon. Modifications to the procedures were made until enough water was available. A still, in another lab, provided 20 litres of water every eight hours.

The peepers were assembled wet, including the membrane. This method was more efficient and faster. Due to the lack of water, small tub size and increased efficiency peepers were assembled, one at a time. As the water supply built up, the peepers were moved into the transport chambers. Six Vespos peepers were built. A total of four large Nitrogen bottles were required for bubbling. Three were delivered late Friday afternoon and the fourth was delivered to the vessel *Hakkin* on Tuesday morning. As a result of the delays caused due to the late arrival of supplies, the mooring installation was delayed for 24 hours to allow the peepers additional time to bubble.

The North basin mooring (station 11) was installed on October 17 at a depth of 70 metres in position 35° 14' 03.0" N., 136° 00' 01.2" W. The mooring configuration was standard "U" shape (190 metre ¾" braided poly groundline) with a pinger mounted on the frame. Peepers A, B and C were attached to the frame. The frame was installed vertically.

The South basin mooring (station 16) was installed on October 17 at a depth of 5 metres in position 35° 03' 35.4" N., 135° 54' 14.4" W. The mooring configuration was standard "U" shape (25 metre ¼" wire groundline) with a pinger mounted on the frame. Peepers D, E and F were attached to the frame. Again, the frame was installed vertically.

Both moorings were installed successfully.

Both moorings were retrieved on Tuesday, October 31 by Dr. T. Murphy.

Coring

One TOS core was collected from each peeper mooring site after the mooring was installed. Both cores were returned to LBRI and were extruded. Each core was extruded in 2 cm intervals. Measurements were taken for pH and redox from each section. Samples were placed in plastic bags and placed in the freezer. Mr. Sakai of Shinsu Co. was shown the storage location of the sediment samples at LBRI and arranged for shipment to CCIW.

SEABED TERMINAL IMPACT NEWTON GRADIOMETER SURVEY
AEMRB STUDY 12218, DR. N.A. RUKAVINA

Technical Operations staff supported Dr. Rukavina on a study related to the Randle Reef Dredging Project in Hamilton Harbour during the last two weeks of March.

This survey was a continuation of work completed with the Seabed Terminal Impact Newton Gradiometer (STING) last field season. Dr. Rukavina rented the STING from Coastal Geoscience Research Corp. for about one month. Last year the STING was

used to attempt to get a handle on the depth (thickness) of contaminated sediments in and around the area of Randle Reef. During the survey last year there were numerous software and logistical problems that required resolving with the STING. R. Linden of CGRC was at CCIW in late March to consult on any problems with the STING and to help interpret the data collected.

Approximately 10 sites were surveyed from the CCGL PUFFIN during the first day of work. The sites were chosen by Dr. Rukavina based on data that was previously collected by the STING or other sampling techniques. Another 30 sites were collected on the second day of surveying.

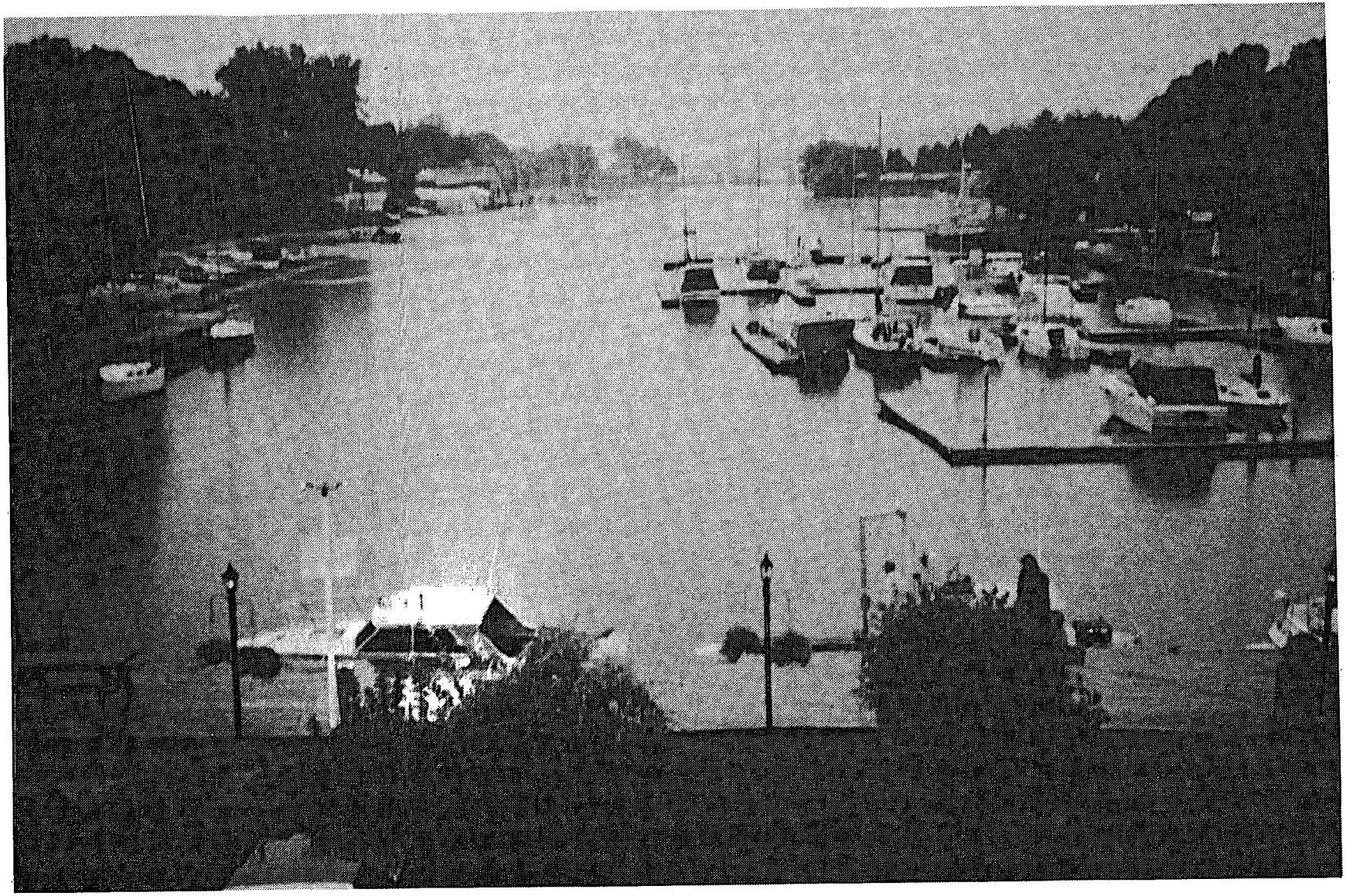
During the second week of the survey, poor weather conditions for the STING limited the amount of sampling completed. Moderate to strong winds are not favourable for sampling with the STING since three consecutive drops are needed at each site with minimal boat drift. The remaining sites were sampled when the weather settled down in early April.

ROXANN SEDIMENT SURVEYS, HAMILTON HARBOUR, LAKE ONTARIO, BAY OF QUINTE, DETROIT RIVER

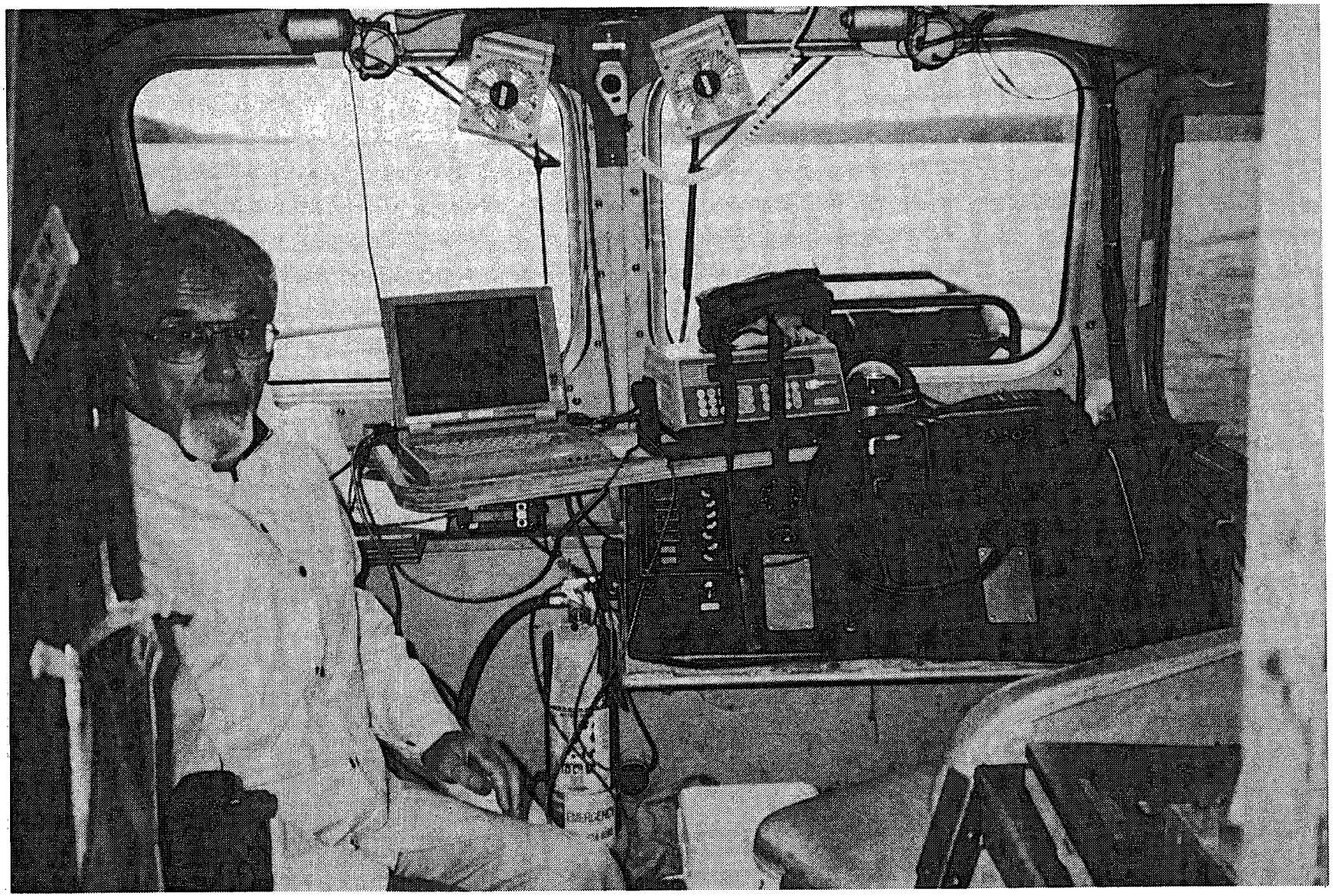
AEMRB STUDY 12218, DR. N.A. RUKAVINA

Bottom sediment mapping using the RoxAnn Seabed Classification System was conducted again this year at four main locations—Hamilton Harbour, Western Lake Ontario, Bay of Quinte and the Detroit River. The CCGL PUFFIN equipped with differential GPS through a Sercel receiver, along with the Microplot Navigation System was used again this year. The boat was also equipped full-time with a new Knudsen sounder to replace the aging Atlas sounders. Only high frequency RoxAnn data was collected this year, since the second system was loaned to NOAA in April for work on the Detroit River. Unfortunately the NOAA launch had a severe fire in the middle of the summer (no injuries) and the second RoxAnn, along with the launch and all of the NOAA gear, was lost in the blaze. Arrangements are still ongoing with respect to either replacement or reimbursement of the system.

The first survey of the year took place in late April on the Detroit River. This year's survey was a continuation of work completed last year on the river. The focus of this year's survey was to survey any areas not covered the previous year because of weeds fouling the system. The weeds had not yet matured so the areas missed last year could be surveyed with ease. There were also areas identified by Peter Kauss, MOEE; Arthur Ostaszewski, Michigan Department of Environmental Quality and Dr. Chris Marvin, NWRI that contained fine grain sediments with possible heavy contaminants that were also surveyed or re-surveyed. The entire survey lasted two full weeks and was run out of the Amherstburg Coast Guard Base.



PICTON HARBOUR



CONTROL CENTRE IN THE CABIN OF THE CCGL PUFFIN

The second trip of the year was to the Bay of Quinte during the last week of May and the first of June. A number of areas of concern were identified by H. Biberhofer, RPD, ECB-OR and K Minns, GLLFAS, DFO for both sediment contamination and fish habitat. During the week, a number of different detailed areas were surveyed in the Belleville and Trenton region of the Bay of Quinte. Following the survey portion of the week, UWTV and Shipek samples were conducted to ground truth data collected.

The following week was scheduled to run RoxAnn off the CCGS LIMNOS. A specially-designed harness to mount the transducer to the hull of the ship was installed by divers. The harness was designed and built by Engineering Services, RSB, NWRI. A number of transect lines to run nearshore and offshore with the LIMNOS in Lake Ontario were run throughout the week. During the week a number of dives were conducted to observe how the harness and transducer were sitting on the hull. All in all the test of the harness was a success and a number of recommendations for improving the system came out of the cruise.

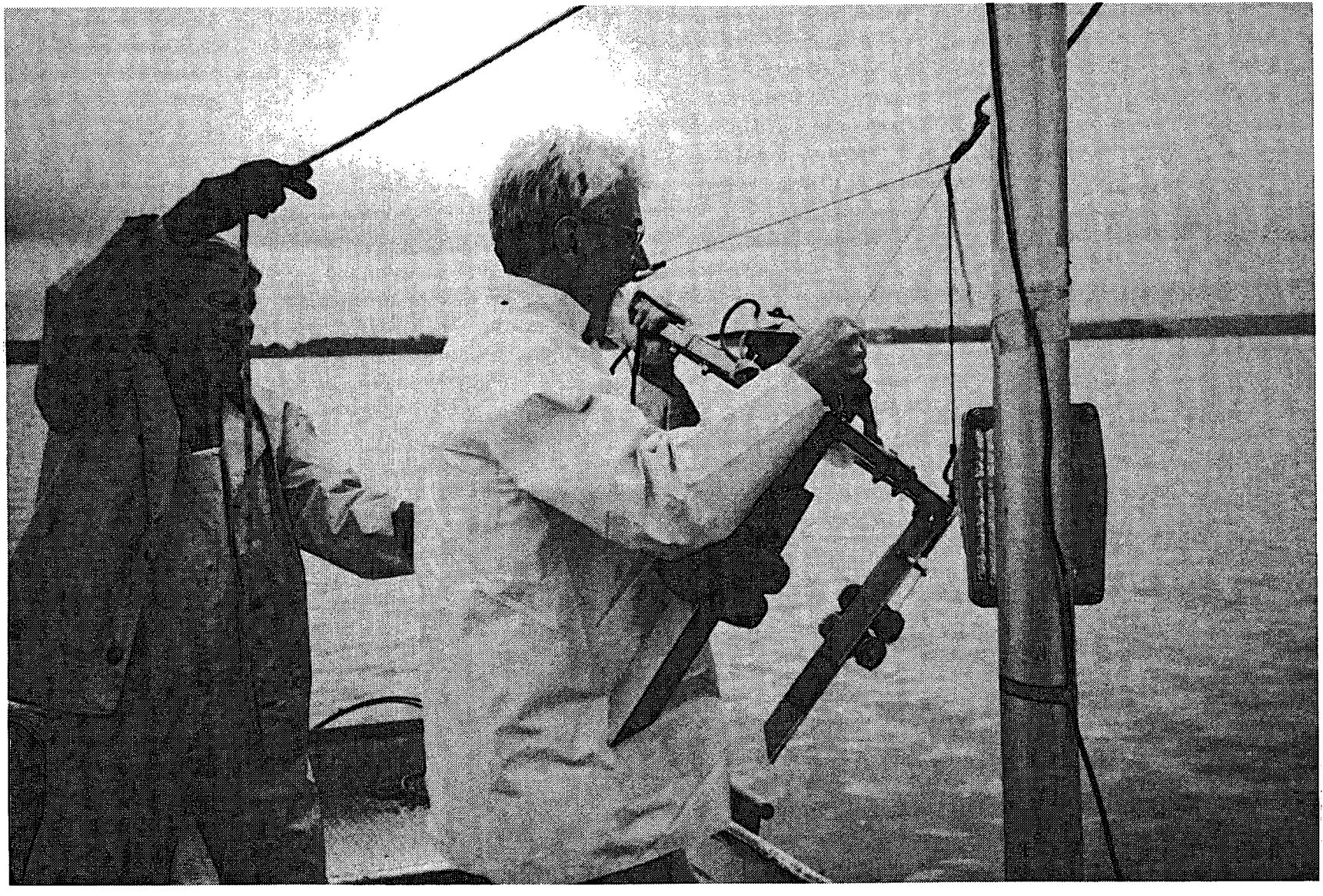
During the early part of September, Tim Siferd from the Freshwater Institute in Winnipeg came with a Quester Tangent Seabed Classification System to compare and contrast it with RoxAnn. A known survey area off Stoney Creek was run using both systems simultaneously. During the week the survey was run a number of different times with slight adjustments to settings and survey speeds every time. This process was very useful in showing both the strengths and weaknesses of both systems.

The last major survey of the year was during the first week of October in the Bay of Quinte. K. Minns of GLLFAS contracted Dr. Rukavina to survey a number of areas for fish habitat and macrophyte identification. The survey was run out of Picton Harbour and detail areas included Conway, Hay Bay, Glenora, Desoronto and Picton Bay. Following the survey lines being run, bottom types were chosen in all of the areas for UWTV groundtruthing. Some Shipek samples were also taken both during the survey week and a couple of weeks later from the CCGS LIMNOS.

During the field season a number of testing and trial trips were run in and around CCIW and the surrounding waters. The only change to equipment this year and into the next field season will be the upgrade of Microplot to a Windows based version. The trial and error of that system will be worked out in the lab over the winter.

DETROIT RIVER T- FRAMES
AEMRB STUDY 12218, DR. N.A. RUKAVANIA

In early April, a TOS dive team (Breedon, Gilroy and Don) travelled to Amherstburg to search for and recover instrumentation and refurbish two T-frame moorings located in the Detroit River. Personnel from Engineering, RSB accompanied the dive team to



DEPLOYING THE VIDEO CAMERA

assist with the refurbishment of the data loggers and external battery cans. The purpose of the study was to monitor the long-term movements of sediments in the lower Detroit River.

The T-frame located in the Trenton Channel was found and marked with a spar buoy. The search was made difficult by the lack of a pinger on the T-frame. Instrumentation was recovered, refurbished and deployed. Divers worked in higher-than-normal currents (2 kts) and visibility was reduced to less than one foot. NAR rod readings could not be obtained since the divers could not read the markings. Underwater video could not be obtained for the same reasons.

The mooring located in the Amherstburg Channel was found and marked with a spar buoy. The search was made difficult by the lack of a pinger on the T-frame. Instrumentation was recovered, refurbished and deployed. Divers worked in visibility reduced to less than one foot. NAR rod readings could not be obtained since the divers could not read the markings.

In early August, a TOS Dive Team travelled to the Detroit River (Amherstburg) to search for and recover two missing sediment trap moorings. As an additional task, the dive team was asked to check the T-frames in the Trenton Channel and in Amherstburg.

The T-frame located in the Trenton Channel had been the subject of some controversy with local organizers of a boat race who wanted the buoy removed because of its proximity to the race course. On arrival the position was noted and found that it had not been moved. The radar reflector was banged up a bit and the light was full of water, indicating that someone had been fooling with the spar buoy. After connecting a computer to the surface cable, the recorder unit would not respond. After calling Engineering staff at CCIW, it was decided to remove the recorder and external battery from the mooring and return it to CCIW for repairs. The battery was changed on the spar buoy light.

The T frame located in the Amherstburg Channel was serviced the next day. The spar buoy had been hit by something but there was minimum damage. Divers cleared the entangled monitor cable from the buoy line. The recorder responded to the computer commands and then downloaded a full data set. The battery was changed on the spar buoy light.

In October, the Technical Operations Services Dive Unit supported Dr. N.A. Rukavina's T-frame study in the Detroit River. Upon arrival at Amherstburg, the field party launched the CCGL PINTAIL and went to the T-frame on the Canadian side and downloaded the datalogger. The system was functioning and the battery had enough power to last until the next month when it would be winterized. No dive was done on the Canadian T-Frame.

T-FRAME VIDEO LOGGER, DETROIT RIVER, CORNWALL
AEMRB STUDY 12218, DR. N.A. RUKAVINA

A study led by Dr. N.A. Rukavina was supported by Technical Operations Services at Cornwall, Ontario. The study involved a field test of the new video logger system developed by the Engineering Services, RSB, NWRI. In late June, two field parties departed for Cornwall. The two field teams were working on different-but-related projects and helped each other with various levels of support throughout the week.

After arriving at Cornwall, the CCGL PUFFIN was launched and prepared for the week's work. The CCGL PETREL was needed in addition to the PUFFIN for equipment and personnel transportation. All of the field party went to T-frame site #3 to drag for the T-frame. An old mooring log was used to locate the position of the frame and a diver secured a temporary boat mooring to the frame. A Tech. Ops. Dive Team (Gilroy, Breedon and Benner) dived at the site to install the standard acoustic datalogger components, along with the new video logger system. The loss of a diver's weightbelt caused the dive to be terminated until the next day, without everything being completely installed.

The next day, the installation of the entire system was completed early in the morning. Some technical problems between both the original acoustics and the new video logger caused delays in allowing the system to run while other work scheduled was completed. The dive team made several dives to install and retrieve equipment. The problems persisted most of the day. The acoustic datalogger was retrieved for overnight repairs and the video logger was left in place.

During the next day, all the components of the acoustic and video loggers were installed on the T-frame. Video of the site was recorded by divers in both digital format and the Fisheye camera owned by Dr. Rukavina. The equipment was left in for the duration of the week and retrieved before departing for CCIW.

In October, the Technical Operations Services Dive Unit supported Dr. Rukavina's T-frame study in the Detroit River. Upon arrival at Amherstburg, the field party launched the CCGL PINTAIL and went to the T-frame on the Canadian side and downloaded the datalogger. The system was functioning and the battery had enough power to last until the next month when it would be winterized. No dive was done on the Canadian T-frame.

The following day, the field party went to the American T-frame in the Trenton Channel. The first task was to install the datalogger, OBS sensor, and temperature sensor on the T-frame. Visibility was unusually good at the site and made the job much easier than usual. After the logger was installed, the second task was to install all of the components for the video logger system. The components installed included a light and battery and video camera can along with a cable to connect it to the existing

datalogger. After the installation, the entire system was tested to see if it was working on manual mode. Following the successful manual mode test, the system was set to run on 20-minute intervals. The system was left connected to the boat for one 20-minute cycle. Divers then removed the connecting surface cable and the system was left to record automatically. The entire system will be retrieved when the T-frames are winterized.

SEDIMENT AND WATER SAMPLING, HAMILTON HARBOUR
AEMRB STUDY 12220, DR. T.B. REYNOLDSON

The research objective of this project was to provide an overall assessment of sediment contamination in Hamilton Harbour, based on biological sediment guidelines according to the BEAST methodology. The assessment process utilizes organisms present in the sediment (benthic invertebrates). A decision on the spatial extent and severity of contamination will be based on the type and number of species present in the harbour and the response (survival, growth and reproduction) of these animals in standard laboratory tests.

The results observed from Hamilton Harbour will be compared with Environment Canada guidelines that have been developed for both field populations and laboratory responses of benthic invertebrates. As a result of this, a study map will be generated that will define the areas where biological effects are observed and will relate any observed responses to specific contaminants. Finally, an assessment of the potential for food chain effects from contaminants associated with sediment will be made from measurement of the tissue concentrations of invertebrates at certain sites in the harbour.

Throughout the week of October 16 - 20 and finishing on October 24th, TOS and AEMRB personnel carried out a 45-station sediment survey from the Goose III. Sampling protocol consisted of the following: at *Regular* stations:

- A Van Dorn water sample from bottom -0.5 m for ammonia, nitrate + nitrite, total Kjeldahl nitrogen, total unfiltered phosphorus and alkalinity
- Water quality parameters (temperature, pH, conductivity and dissolved oxygen) from bottom -0.5 m and surface temperature using a Hydrolab
- Five mini PONAR's for bioassays
- One mini box core subsampled for community structure and sediment chemistry

at *Tissue* stations, the following additional work was carried out:

- 100ℓ of sediment using a PONAR

at *QA/QC* stations, the following additional work was carried out:

- Triplicate Van Dorn water samples
- Triplicate Mini box core samples

STATION POSITIONS

CONSECUTIVE STATION NO.	STATION NUMBER	EASTING	NORTHING
1	7056	590312	4792475
2	7036	590727	4791899
3	70M270	591495	4792528
4	7035	592727	4792418
5	7021	592032	4793408
6	70M258	594388	4793524
7	7025	593316	4793416
8	7030	592138	4792352
9	7024	593312	4794365
10	7008	595223	4795504
11	7019	594425	4794625
12	7015	594717	4795220
13	70M252	596557	4795559
14	7007	596202	4795443
15	7013	595715	4794176
16	70M4	597353	4793321
17	70M268	598843	4791397
18	7057	598352	4790892
19	7058	598430	4791209
20	7000	598447	4791537
21	70M20	598072	4791889
22	7055	598256	4791965
23	7054	597462	4791681
24	7002	597715	4792195
25	7004	597477	4792537

CONSECUTIVE STATION NO.	STATION NUMBER	EASTING	NORTHING
26	7014	597004	4792621
27	7053	597004	4792421
28	7047	596071	4792893
29	7045	594976	4793235
30	7022	594245	4792669
31	7049	593004	4792064
32	7038	593416	4792111
33	7050	593292	4791819
34	7039	593676	4792016
35	7051	593679	4791680
36	7052	594027	4791675
37	7040	594047	4791894
38	7043	594918	4792621
39	7060	594962	4792414
40	7062	594558	4792407
41	7061	594213	4792178
42	7059	594474	4791775
43	7063	594457	4791986
44	7064	594641	4792093
45	7065	594851	4791974

Hamilton Harbour, Benthic Community Structure

Within the framework of sediment remediation in the harbour, the community structure of benthic organisms has been monitored since 1987. Benthic communities have been monitored for seasonal and year-to-year changes.

Around the middle of each month, mini box core samples were taken at two representative sites in the harbour—stations HH3 (Western Basin) and HH19 (Deep Hole). Each box core was subsampled using five 6.7 cm short cores.

LIGHTWEIGHT CORING IN THE NORTH CHANNEL

AQUACULTURE SITE SAMPLING, NORTH CHANNEL
AEMRB STUDY 12240, M.N. CHARLTON

TOS staff were involved in a co-operative study on a decommissioned aquaculture site in March on La Cloche Island for Mr. M.N. Charlton, Dr. P.F. Hamblin, AEMRB, Mr. T. Heiman, GLLFAS and Mr. D. Glofcheskie, North Wind Fisheries Ltd. A sample grid was laid out on the ice on top of the area where the fish cages had been in position. Holes were drilled in the ice, using a 12" auger at grid positions. GPS positions of all holes were obtained using a local base station for corrections. Water samples were obtained for total phosphorus, ammonia, nitrite, nitrate and SRP analysis at several sites on the grid as well as sites away from the grid to get background information. Hydrolab profiles were obtained at each grid position.

After water samples and Hydrolab profiles had been collected, bottom sediment samples were collected using a 6" Ekman dredge or a mini PONAR sampler. Ammonia and total phosphorus analysis was done on sediment samples. Lightweight cores were collected at grid positions over the fish pen locations and the material siphoned off into containers for antibiotic resistant bacteria analysis by GLLFAS staff. GLLFAS staff also collected sediment samples at most grid locations for benthic organisms.

WATER QUALITY, HAMILTON HARBOUR
AEMRB STUDY 12240, M.N. CHARLTON

Hamilton Harbour, Water Quality Monitoring

Monitoring of a number of water quality parameters continued in Hamilton Harbour over the 2000 field season. This data is critical in effecting appropriate, focused policy for harbour remediation. A major focus is the study of temporal trends and the response of Hamilton Harbour to nutrient loading reductions. Weekly sampling continued at station 1001 and will be carried out over the winter months when weather permits. This station remains the primary monitoring site for the study. Water samples from 1, 3, 5, 7 and 19 m were taken on a weekly basis and analyzed for chlorophyll a, nutrients and total phosphorus filtered and unfiltered. Hydrolab casts provided temperature, pH, conductivity and dissolved oxygen profiles, helping to identify turnover events and harbour stratification. Secchi and bucket thermometer readings were also acquired. A separate 1 m water sample collected for E.Coli and fecal coliform analysis was added early in the summer.

In addition to weekly harbour sampling at station 1001, water was sampled from 2 stations on Spencer Creek; which provides the outfall for the Dundas STP and 1 station on Chedoke Creek. Algal bioassays run from these water samples provide data on

nutrient availability from sources destined for Cootes Paradise and eventually Hamilton Harbour.

A broader biweekly, 31-station survey was carried out on the harbour between May 15 and September 18. Data from this survey provided a more comprehensive snapshot of harbour conditions and supplements data from station 1001. It builds on similar studies from previous years. Sampling protocol followed that of weekly monitoring at station 1001, including E. Coli and Fecal Coliform sampling.

Hamilton Harbour Net Hauls

In response to concerns over the health of zooplankton in Hamilton Harbour, a brief monitoring program was undertaken between June 19th and September 25th in the harbour for Dr. M. Evans, AEPRB, NWRI, Saskatoon. Samples provided quantitative and qualitative data on harbour populations.

Duplicate net hauls were taken and samples were sieved and transported back to the laboratory for analysis. Stations HH19 and LO902 were sampled June 19th, July 5th, July 25th, August 1st, August 10th, August 15th, August 22nd, August 30th, September 13th and September 25th. Stations HH20, HH51 and HH53 were added to surveys on July 25th, August 10th and August 22nd.

Hamilton Harbour, Invading Species Awareness Program

Work continues to map out the distribution, dynamics of migration and population density of zebra mussels in Great Lakes waters. TOS personnel provided support for a program cosponsored by The Ontario Federation of Anglers and Hunters, Dr. G. Mackie and K. McNichols, Department of Zoology, University of Guelph and M.N. Charlton, AEMRB, NWRI. Static sampling was carried out at two stations—HH3 and HH19, in Hamilton Harbour. A standardized sampling coupon was deployed on two existing buoys. Sites were chosen for their potential to provide optimum conditions for settlement. Data from a number of sites will be compiled and used to estimate maximum zebra mussel settlement as it occurs across the lakes. TOS personnel deployed two collection units on existing moorings on July 7th and retrieved the collectors on September 25th.

Hamilton Harbour Randle Reef Sediment Survey

On July 7th, TOS personnel along with M. Lampi and X. Huey from the University of Waterloo carried out an 8-station sediment survey in the Randle Reef area. The samples were acquired for Dr. R. Smith of the University of Waterloo. Approximately one kilogram of sediment was collected at each site using a mini PONAR and were returned to the University for PAH and contaminant analysis.

HAMILTON HARBOUR WATER QUALITY SURVEY

STATION POSITIONS

STATION	WGS 1984 EASTING	NORTHING	GEODETIC WGS 1984 LATITUDE N.	LONGITUDE W.
901	597400	4794533	43° 17' 50.4"	79° 47' 57.2"
902	597069	4794265	43° 17' 41.8"	79° 48' 12.1"
903	596419	4794045	43° 17' 35.0"	79° 48' 41.1"
904	595880	4793885	43° 17' 30.1"	79° 49' 05.1"
905	595319	4793725	43° 17' 25.1"	79° 49' 30.1"
907	593186	4793075	43° 17' 05.0"	79° 51' 05.1"
908	592110	4792655	43° 16' 51.9"	79° 51' 53.1"
909	591034	4792215	43° 16' 38.1"	79° 52' 41.1"
910	590219	4792475	43° 16' 46.9"	79° 53' 17.1"
911	593982	4794255	43° 17' 42.9"	79° 50' 29.1"
912	594947	4792949	43° 17' 00.0"	79° 49' 47.1"
913	596434	4792865	43° 16' 56.8"	79° 48' 41.1"
914	598801	4791364	43° 16' 07.0"	79° 46' 57.1"
915	598414	4791695	43° 16' 17.9"	79° 47' 14.1"
916	598138	4792065	43° 16' 30.0"	79° 47' 26.1"
917	597908	4792365	43° 16' 39.9"	79° 47' 36.1"
918	597558	4793195	43° 17' 06.9"	79° 47' 51.1"
919	596828	4793775	43° 17' 29.1"	79° 48' 23.1"
920	596229	4794725	43° 17' 57.1"	79° 48" 49.1"
921	595744	4795545	43° 18' 23.9"	79° 49' 10.1"
922	598965	4795465	43° 18' 19.8"	79° 46' 47.2"
923	598593	4795265	43° 18' 13.5"	79° 47' 03.8"
924	598218	4795065	43° 18' 07.2"	79° 47' 20.6"
925	597716	4794745	43° 17' 57.1"	79° 47' 43.1"
926	596666	4795685	43° 18' 28.1"	79° 48' 29.1"

STATION	WGS 1984 EASTING	NORTHING	GEODETIC WGS 1984 LATITUDE N.	LONGITUDE W.
929	595018	4795105	43° 18' 10.0"	79° 49' 42.6"
933	593058	4793695	43° 17' 25.2"	79° 51' 10.4"
945	592972	4792185	43° 16' 36.3"	79° 51' 15.2"
946	593766	4791945	43° 16' 28.2"	79° 50' 40.1"
947	597453	4791565	43° 16' 14.2"	79° 47' 56.8"
1001	594264	4793395	43° 17' 14.9"	79° 50' 17.1"
1CH	594063	4793425	43° 17' 16"	79° 50' 26"
1SC	589727	4790590	43° 15' 46"	79° 53' 40"
2SC	585778	4790847	43° 15' 56"	79° 56' 35"

WEEKLY WATER QUALITY MONITORING POSITIONS

HAMILTON HARBOUR

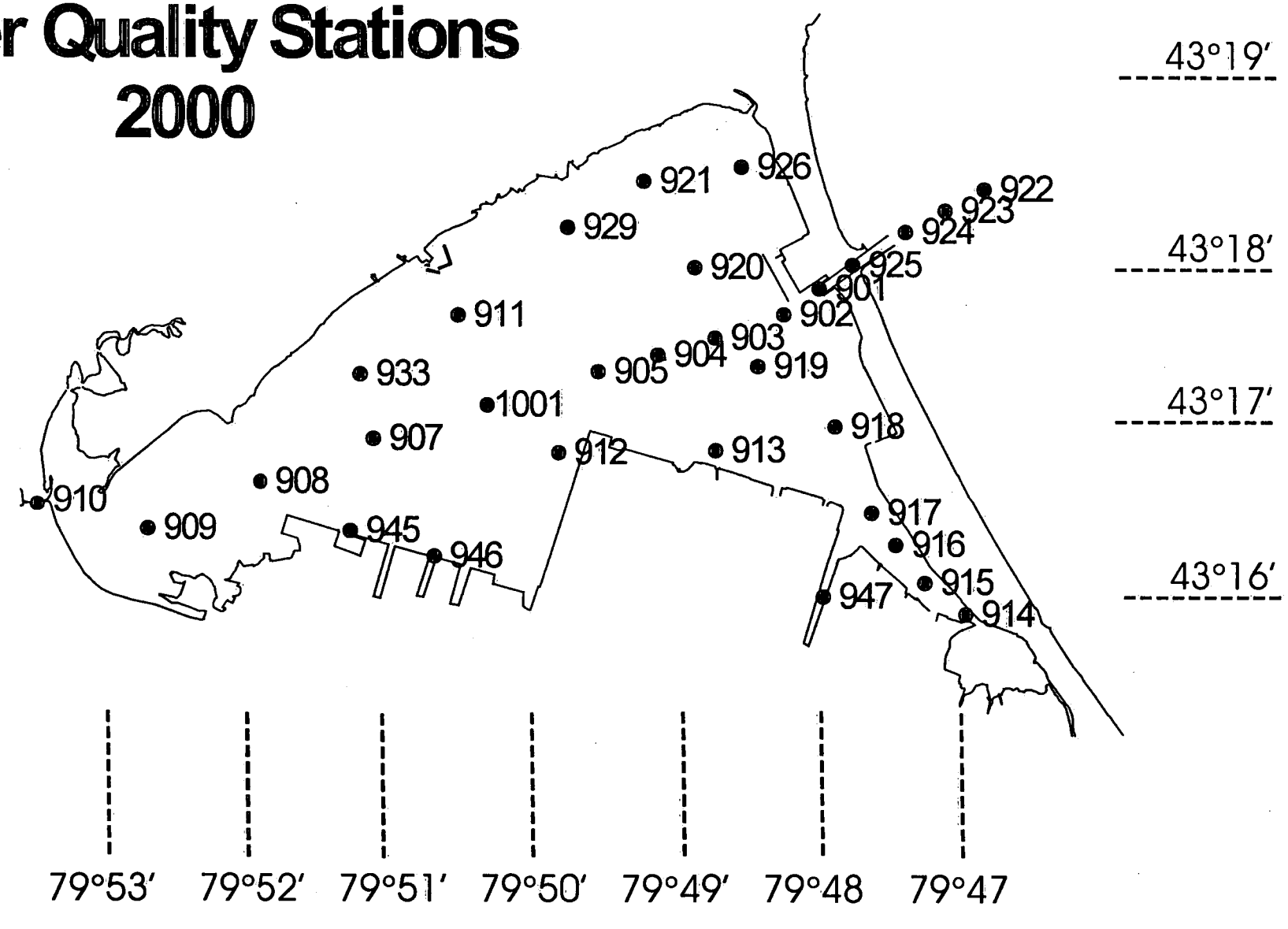
STATION NUMBER	LATITUDE N.	LONGITUDE W.
CHARLTON PROFILING, STUDY 12240		
1001 (Hamilton Harbour)	43° 17' 15"	79° 50' 17"
1CH (Chedoke Creek)	43° 15' 46"	79° 53' 40"
1SC (Spencer Creek)	43° 16' 05"	79° 56' 11"
2SC (Spencer Creek)	43° 15' 56"	79° 56' 35"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
CHARLTON NET HAULS, STUDY 12240		
HH19	43° 17' 16"	79° 50' 26"
HH20	43° 17' 53"	79° 50' 35"
HH51	43° 16' 50"	79° 52' 22"
HH53	43° 17' 08"	79° 47' 38"
LO902	43° 18' 33"	79° 46' 16"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
CHARLTON, INVADING SPECIES AWARENESS PROGRAM, STUDY 12240		
HH 3	43° 16' 55"	79° 52' 23"
HH19	43° 17' 21"	79° 50' 33"

SITE NUMBER	LATITUDE N.	LONGITUDE W.
CHARLTON SEDIMENT SAMPLING, STUDY 12240		
1	43° 16' 14"	79° 50' 01"
2	43° 16' 18"	79° 50' 02"
3	43° 16' 22"	79° 50' 04"
4	43° 16' 27"	79° 50' 11"
5	43° 16' 35"	79° 50' 23"
6	43° 16' 42"	79° 50' 35"
7 (Control)	43° 16' 49"	79° 52' 48"

Hamilton Harbour Water Quality Stations 2000



SEDIMENT SAMPLING, PENETANGUISHENE AND MIDLAND
AEMRB STUDY 12240, M.N. CHARLTON

This study was in co-operation with Mr. K. Sherman, RAP Co-ordinator for Severn Sound. Sediment cores were collected at 10 stations in Penetang Bay and at 4 stations in Midland Bay, using a 6.7 cm diameter Tech. Ops. corer. Cores were sectioned in 2 cm slices using the fry pan method. Slices were placed in Zip Lock bags and stored at 4°C. Core slices were analyzed for ammonia and total phosphorus levels to observe any improvements in the STP's since last sampled in 1996. Hydrolab profiles were also collected at the following Penetang Bay sites:

STATION #	DEPTH m	LATITUDE N.	LONGITUDE W.	ZONE	NORTHING	EASTING
1	5.2	44° 46' 25"	79° 56' 27"	17	4958359.6	583815.9
2	2.4	44° 46' 18"	79° 56' 25"	17	4958127.8	583852.6
2	Second	44° 46' 18"	79° 56' 23"	17	4958136.7	583890.3
3	3.5	44° 46' 16"	79° 56' 37"	17	4958083.3	583588.7
4A	6.0	44° 46' 41"	79° 56' 30"	17	4958853.5	583741.4
5	7.0	44° 47' 35"	79° 56' 22"	17	4960510.0	583895.3
6	7.6	44° 48' 01"	79° 56' 25"	17	4961295.5	583801.9
7	12.0	44° 48' 44"	79° 55' 37"	17	4962656.4	584849.2
8	4.25	44° 46' 18"	79° 56' 23"	17	4958145.3	583893.4
KS1 & KS2	4.2	44° 46' 18"	79° 56' 23"	17	4958139.0	583894.0
M1	8.2	44° 45' 30"	79° 53' 25"	17	4956703.7	587821.0
M2	10.0	44° 45' 25"	79° 51' 25"	17	4956489.5	590473.4
MA	12.2	44° 45' 36"	79° 52' 36"	17	4956914.8	588910.7
MB	8.2	44° 45' 37"	79° 53" 26"	17	4956913.0	587807.1

CURRENT METER RETRIEVAL, LAKE MICHIGAN
AEMRB STUDY 12242, DR. C.R. MURTHY

As part of a collaborative scientific effort between NWRI and NOAA, Environmental Research Laboratory, Ann Arbor, Michigan, a TOS dive team was assigned to remove current meters and their moorings from Lake Michigan after an over-winter deployment.

The purpose of the project was to study the physics and sediment transport in Southeastern Lake Michigan. These episodic current reversals occur during the winter/spring and summer. They are responsible for the nearshore/offshore transport of Biologically Important Materials (BIM). The objectives of this study are to collect measurements in the high risk nearshore area in order to identify and quantify the physical transport processes and determine how climatic conditions contribute to the coastal energetics. Measurements of the magnitude of these events in physical size and duration will be made using data collected by five current meters and two ADCP's moored in six nearshore locations (between Michigan City, IN, to 15 km North of Benton Harbor, MI). One ADCP was located offshore, four miles North of Benton Harbour and a second was located in the nearshore zone one mile South of St. Joseph. Additional data was collected from two shore-based meteorological locations (Michigan City and Benton Harbor). The Benton Harbour MET station was dismantled. The current meters and ADCP units were all successfully recovered and returned to CCIW for data download.

The TOS dive team departed CCIW on May 15, travelling to St. Joseph, Michigan. Utilizing the dive launch PINTAIL, equipped with DGPS positioning and acoustic pinger receiver, divers located each mooring. Since the moorings were not equipped with marker buoys, the search required the use of accurate positioning, temporary markers and acoustic receivers. Wind and sea conditions dictated that some diving operations use a "liveboating" technique. At stations C1, C3, C4, C6 and C8, a Neil Brown SACM current meter was removed. At stations A4 and C5, an ADCP unit was removed. Underwater video was obtained at stations C1, C7 and C8. Poor underwater visibility conditions prevented the collection of video at the other sites. Heavy rainfall contributed to increased flows into the lake from the rivers, resulting in conditions of reduced diver visibility to less than one foot at some stations.

During the duration of the field work, a total of two weather days were experienced. The dive team used St. Joseph (Harbor Isle Marina) as a base of operations and drove south to New Buffalo (good ramp and marina) for moorings C1 to C3. This proved to be more efficient by reducing travel time. Stations were occupied in the following order: A4, C5, C6, C8, C3, C4, C7, C1 and C2. The DGPS beacon at Rock Island, IL (311 kHz @ 200 bps) was used for positioning and no problems were encountered. All moorings in the nearshore zone were heavily covered with zebra mussels. The 3/4" groundlines were covered 3" thick with zebra mussels. A new rope cleaner was tested and worked well, cleaning the zebra mussels from the groundlines during retrieval. Current meter frames were removed by divers attaching a lifting wire from the winch onboard the PINTAIL. The weight of the recovered mooring (700 lbs.) filled the boat and required a slow return to harbour for unloading after each recovery.

Mr. E. Smith, Engineering Services, RSB travelled to St. Joseph on May 16. He dismantled the sensors from the MET station on the St. Joseph pier. He returned to CCIW on May 18 with both ADCP units. The MET tower was dismantled by the dive

team. All equipment was loaded into the 3-ton truck for transport to CCIW. The 3-ton truck required $1600 U.S. in repairs to the clutch and flywheel.

The completion of the mooring retrievals brought to an end the TOS support to the physics and sediment transport studies for the NOAA, Environmental Research Laboratory (Ann Arbor, MI).

STATION POSITIONS

DATUM: WGS-84

DGPS Beacon: Rock Island, Illinois (311 kHz @ 200 bps)

STATION. NO.	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
C1	41° 45.7938'	086° 50.3587'	4623501.	513357.
C2	41° 49.2807'	086° 44.0281'	4629972.	522110.
C3	41° 53.2299'	086° 38.6940'	4637309.	529463.
C4	41° 59.4595'	086° 34.5182'	4648860.	535177.
C5	42° 05.5994'	086° 30.7806'	4660253.	540271.
C6	42° 09.5580'	086° 27.4241'	4667605.	544851.
C7	42° 11.8982'	086° 24.9966'	4671962.	548163.
C8	42° 14.5997'	086° 22.6240'	4676981.	551393.
A4	42° 10.3847'	086° 29.3800'	4669119.	542147.

MOORING SUMMARY - RETRIEVAL

STATION NO.	MOORING NO.	PINGER NO.	FREQ.	INST NO.	SURFACE	DATE
A4	99-06S-09B	876	27 kHz	0218	1350Z	May 17
C1	99-06C-01B	699	27 kHz	1046	1245Z	May 23
C2	99-06C-02B	698	27 kHz		1520Z	May 23
C3	99-06C-03B	697	27 kHz	1088	1719Z	May 20
C4	99-06C-04B	695	27 kHz	1037	1325Z	May 21

STATION NO.	MOORING NO.	PINGER NO.	FREQ.	INST NO.	SURFACE	DATE
C5	99-06C-05B	819	27 kHz	0182	1841Z	May 17
C6	99-06C-06B	811	27 kHz	1001	1409Z	May 18
C7	99-06C-07B	875	27 kHz		1745Z	May 21
C8	99-06C-08B	880	27 kHz	1045	1340Z	May 20

ADCP MOORINGS, HAMILTON HARBOUR
AEMRB STUDY 12243, DR. M.G. SKAFEL

The ability to characterize complex water movements in dynamic environments and provide descriptive data is critical to many of the institute's research and remediation projects. The following ADCP's and Hydra current meters were deployed and serviced by TOS personnel over the 2000 field season:

Two ADCP's were deployed in Lake Ontario near water treatment plant intakes to provide current information during taste and odour events. The current data will help in determining the likely source of the offending water mass (nearshore, offshore). One ADCP was deployed near the Burlington STP outfall as part of a study examining the fate of contaminants discharging from the outfall. One ADCP and one Hydra current meter were deployed near Randle Reef to provide background data on currents at Randle Reef in advance of any dredging activity there. One ADCP was deployed in the deep Central Basin of Hamilton Harbour. Data from the meters deployed in the harbour will be used to validate hydrodynamic models.

STATION POSITIONS

INSTRUMENT	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
ADCP/0218	2000-00C-01A	43° 15' 57"	79° 45' 14"
ADCP/0844	2000-00C-02A	43° 56' 49"	78° 09' 57"
HYDRA	2000-50C-07A	43° 16' 42"	79° 50' 18"
ADCP/0432	2000-50C-16A	43° 16' 40"	79° 50' 18"
ADCP/0182	2000-50C-19A	43° 18' 24"	79° 48' 44"
ADCP/1093	2000-50C-20A	43° 17' 15"	79° 50' 40"

TIDE GAUGE RECOVERY, NORTH CHANNEL
AEMRB STUDY 12245, DR. P.F. HAMBLIN

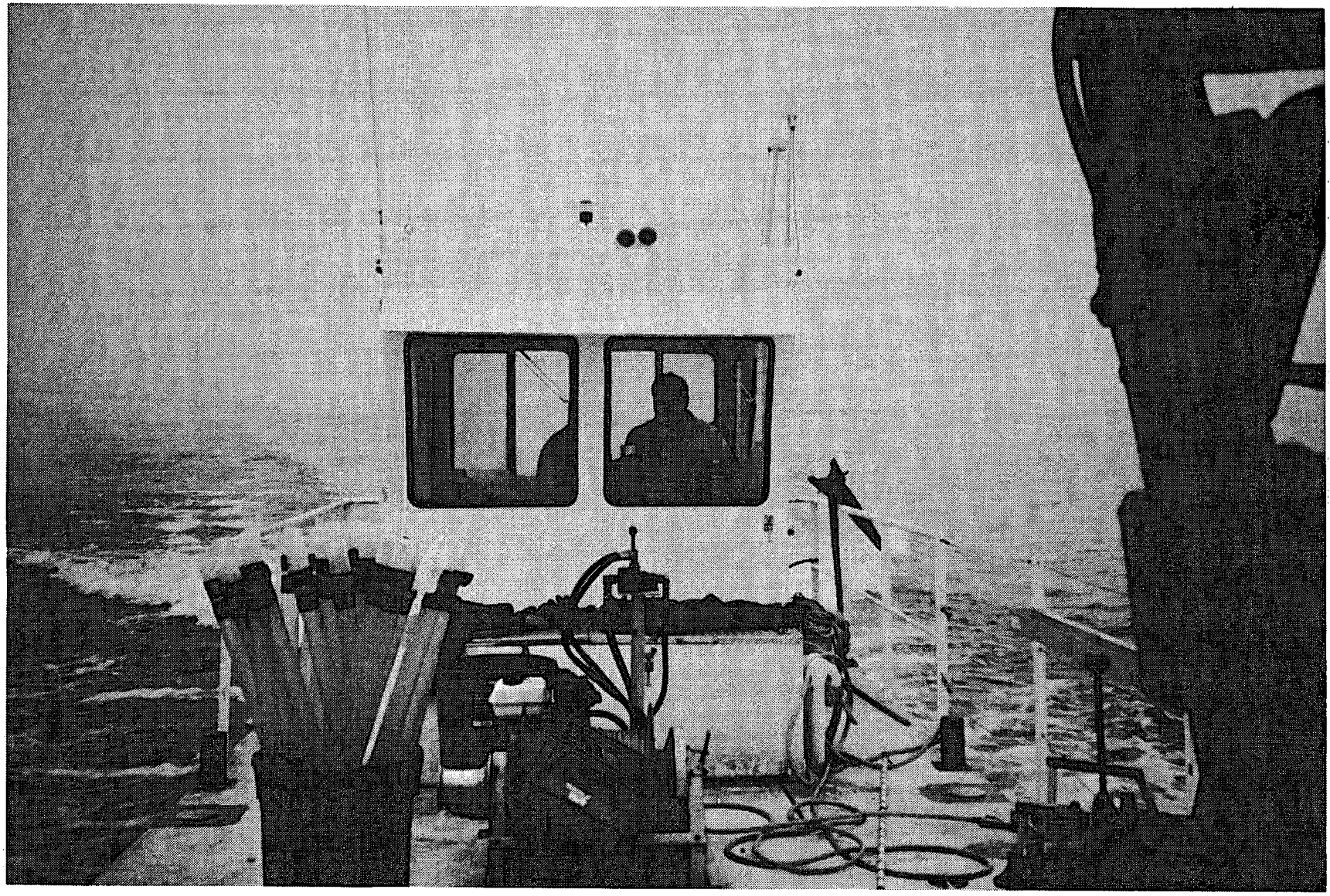
On May 1st a TOS dive team travelled to the Bold Point area of the North Channel to search for and retrieve a tide gauge unit which had been lost during the fall of 1999. During the fall mooring cruise (CCGC SHARK), half the mooring had been recovered after a mystery vessel had become entangled in the groundline. The dive team went to the site equipped with the launch PINTAIL, the remotely operated vehicle (MURV) with forward looking sonar and a DGPS receiver. The Harbour Vue Marina East of Little Current was used as a base of operations. The marina has an excellent launching ramp and with the low water levels (two feet lower than fall '99) was the only ramp in the area to allow launch/retrieval of the PINTAIL.

A detailed working map was made of the search area. The plan was to begin with MURV and the forward-looking sonar to triangulate any target positions within the search area. A marker float was installed at the position where the CCGS LIMNOS had installed the mooring. MURV descended to the depths to begin the search. The sonar showed a distinct trough, possibly an old stream bed, along the flat rock bottom. The trough varied between 20 - 30 metres wide with an east - west orientation. MURV searched the site using the sonar to measure distance from the trough walls and run tracklines. The bottom was strewn with small to medium size boulders which created a multitude of targets on the sonar screen. MURV "flew" to each target for confirmation. The tide gauge was found 90 metres East of the original position. The railway wheel stand was standing vertical on the bottom and undamaged. The groundline had been cut one metre from the swivel. Divers swam down MURV's umbilical cable, installed a buoy line with a spar buoy and removed the tide gauge.

The tide gauge was returned to CCIW for data download and the railway wheel anchor was retrieved by the LIMNOS in August.

On November 8, a TOS dive team travelled to the North Channel of Lake Huron to recover an ADCP mooring installed by the CCGS LIMNOS in August. The ADCP unit was installed to monitor the physical dynamics of the water near an aquaculture site on the western shoreline of Great LaCloche Island.

Utilizing the launch PINTAIL, divers, working at 32 metres, removed the buoy line from its anchor and brought the groundline to the surface. The groundline was retrieved and used to raise the ADCP into the launch. The ADCP unit was returned to CCIW for data download.



SEDIMENT TRAP CRUISE ABOARD THE GOOSE III

SUSPENDED SEDIMENT MONITORING, HAMILTON HARBOUR
AEMRB STUDY 12246, DR. C.H. MARVIN

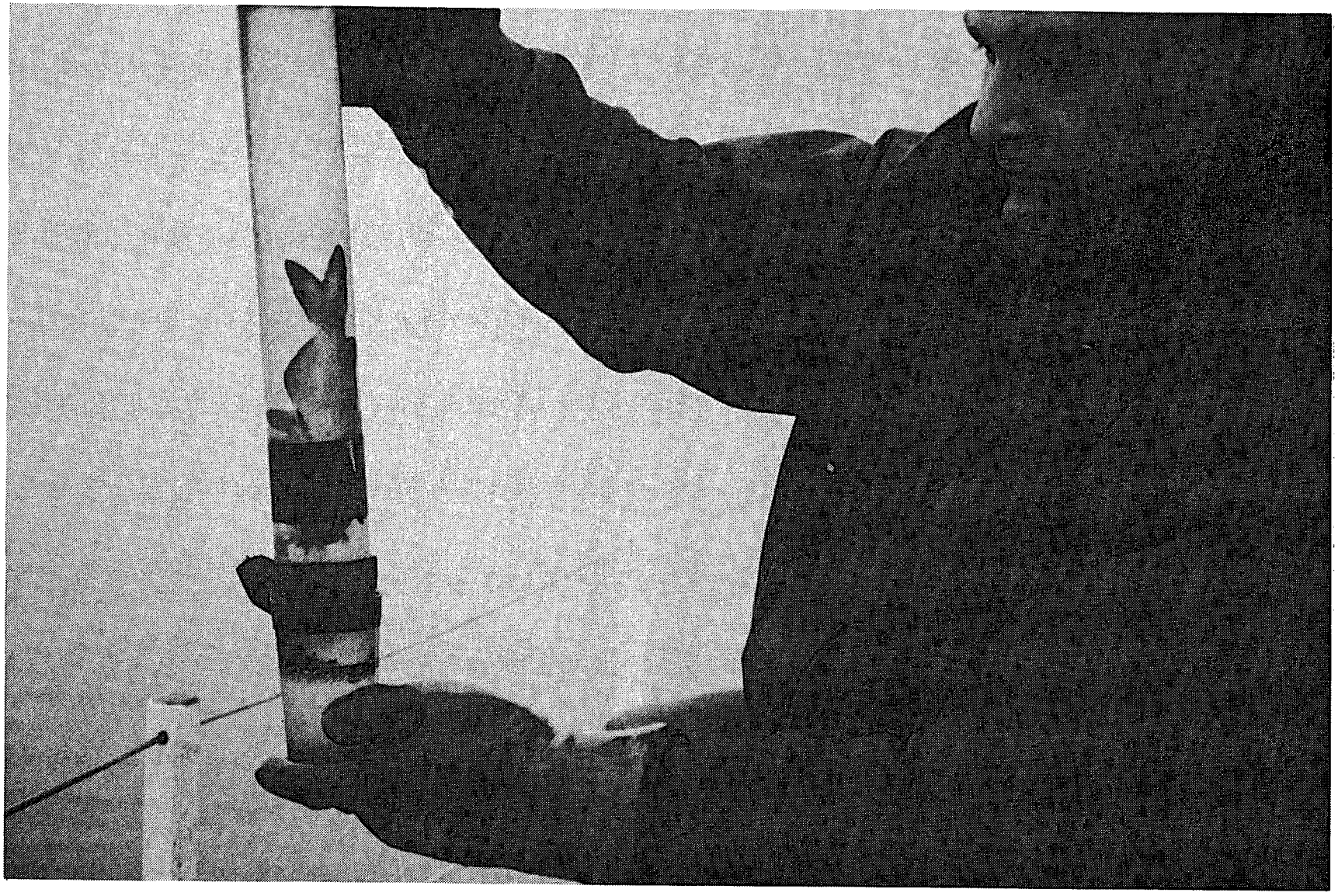
Intermittent monitoring of suspended sediment quality in Hamilton Harbour has been ongoing since 1987. Analysis of material collected at four index stations in the harbour provides a measure of the quality of particulate cycling in the water column, potential threats to aquatic biota and possible sources of contamination. Encouragingly, levels of contaminants such as PCB's and PAH's showed significant declines over the period 1987 to 1992. However, recent data indicates that current contaminant levels remain essentially unchanged since the early 1990's. This work represents a key component in the overall strategy for monitoring the state of the harbour and is important for assessment of remediation efforts in areas such as Randle Reef.

TOS personnel carried out monthly refurbishments of sediment trap moorings at stations HH50, HH51, HH52 and HH53 between April 17th and November 24th. As in previous years, the mooring at HH52—the Deep Hole, was deployed as a winter mooring to continue suspended sediment collection into 2001.

STATION NUMBER	LATITUDE N.	LONGTITUDE W.
HH50 NE Corner	43° 18' 17"	79° 48' 54"
HH51 West End	43° 16' 50"	79° 52' 22"
HH52 Deep Hole	43° 17' 12"	79° 50' 33"
HH53 SE Corner	43° 17' 08"	79° 47' 38"

ADCP MOORINGS, HUMBER BAY; SEDIMENT SAMPLING, HAMILTON HARBOUR
AEMRB STUDY 12247, DR. J.P. COAKLEY

The lack of good winter data on nearshore circulation in the vicinity of Toronto has impeded development of useful models of coastal circulation in Western Lake Ontario. This is critical in the Humber and Ashbridges Bay where large sewage treatment plants (STP) discharge millions of cubic metres of treated waste into these nearshore areas. On December 7,1999, ADCP current meters were deployed at 4 sites in these areas and over the winter currents were measured and data was stored in discrete 'bins' corresponding to depth intervals. This vertical profile is especially useful in obtaining a clear idea of changes in current characteristics with depth and allows identification of complex nearshore circulation. The models produced will be used to assist in the



CATFISH IN SEDIMENT TRAP TUBE

interpretation of natural tracer experiments in the area and in the understanding of dispersal patterns for sewage-related contaminants.

On April 11, 2000 TOS personnel recovered the aforementioned ADCP's.

STATION POSITIONS

MOORING NUMBER	ADCP S/N	LATITUDE N.	LONGITUDE W.
99-00C-02A	0842	43° 37' 02"	79° 25' 58"
99-00C-03A	1177	43° 35' 59"	79° 27' 01"
99-00C-04A	1039	43° 37' 29"	79° 17' 58"
99-00C-05A	0432	43° 39' 00"	79° 17' 58"

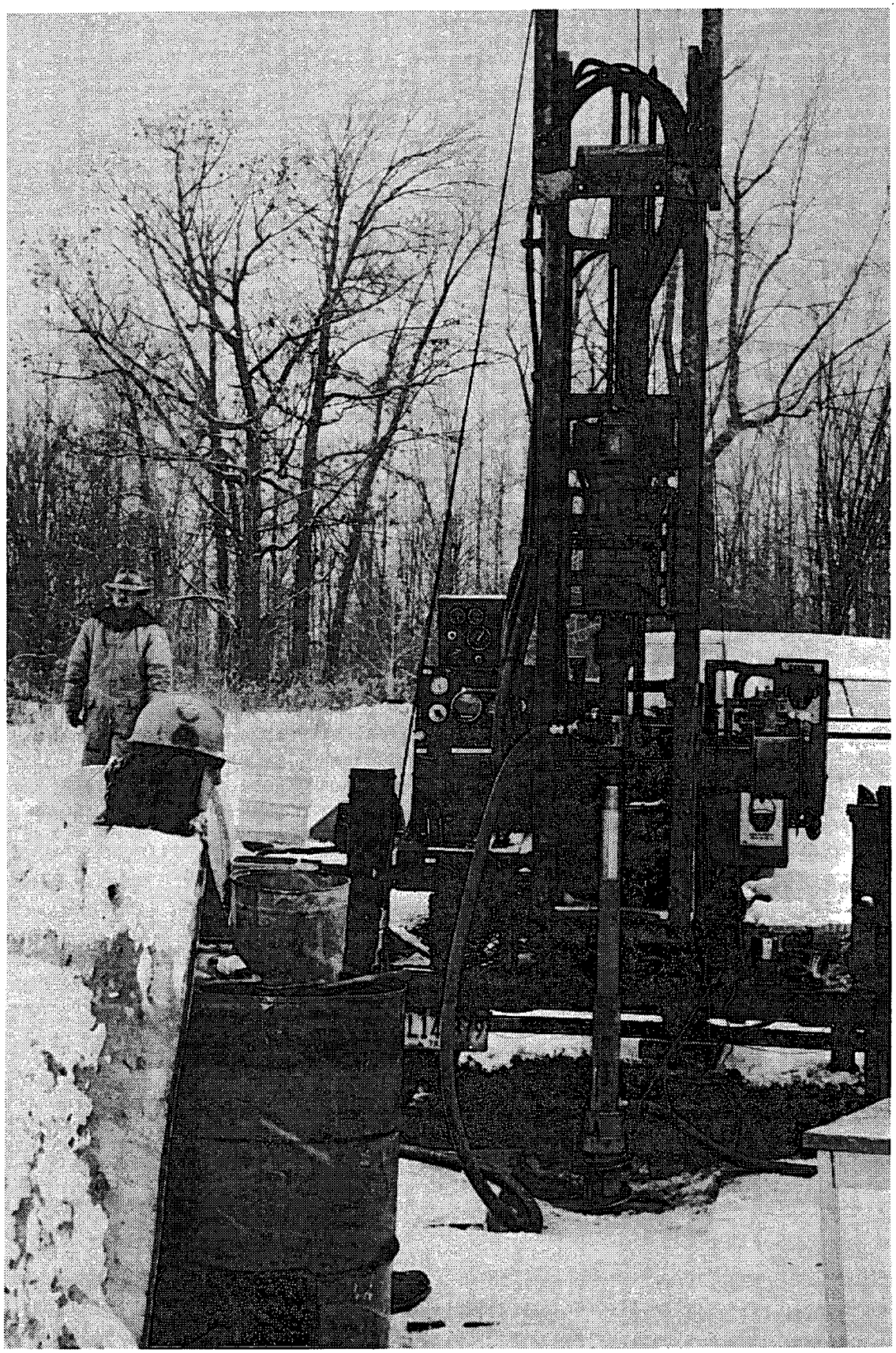
SEDIMENT SAMPLING, Hamilton Harbour

Tracer studies in the northeastern part of Hamilton Harbour have assisted in identifying patterns of dispersal for sediments contaminated by STP discharges from the Burlington Skyway STP. In the western end of the harbour, sewage-related contaminated sediments enter the harbour from both Grindstone Creek (Waterdown STP) and the Desjardins Canal (Dundas STP). In order to determine the patterns of dispersal for contaminants from these sources, 20 samples were collected in the western part of the harbour and another 6 were collected around the artificial islands at the eastern end. These will provide a clearer picture of the overall impact of STP discharges on the Hamilton Harbour ecosystem.

STATION POSITIONS

HAMILTON HARBOUR

STATION NUMBER	COAKLEY NUMBER	NORTHING	EASTING
	WESTERN END		
9000	JPC2000-HH-1	4793000	590100
9001	JPC2000-HH-2	4792600	590300
9002	JPC2000-HH-3	4792800	590600
9003	JPC2000-HH-4	4792450	590550
9004	JPC2000-HH-5	4792400	590200
9005	JPC2000-HH-6	4792000	590400
9006	JPC2000-HH-7	4792150	590800
9007	JPC2000-HH-8	4791750	590800
9008	JPC2000-HH-9	4791671	591228
9009	JPC2000-HH-10	4791850	591550
9010	JPC2000-HH-11	4792150	591300
9011	JPC2000-HH-12	4792650	591050
9012	JPC2000-HH-13	4793150	591500
9013	JPC2000-HH-14	4792700	591800
9014	JPC2000-HH-15	4792196	592030
9015	JPC2000-HH-16	4792700	592300
9016	JPC2000-HH-17	4793150	592250
9017	JPC2000-HH-18	4793850	592650
9018	JPC2000-HH-19	4793100	592800
9019	JPC2000-HH-20	4792500	592800
	EASTERN END		
9020	JPC2000-HH-21	4796891	595798
9021	HH22	4795553	597032
9022	HH23	4795372	597121
9023	HH24	4795199	597177
9024	JPC2000-HH-25	4795038	597120
9025	HH26	4795606	596962



DRILLING AT CLARKSON

PEAT SURVEY, LAKE ERIE
AEMRB STUDY 12247, DR. J.P. COAKLEY

On August 21, a TOS dive team accompanied by Dr. J. Coakley travelled to Pt. Colborne to commence an underwater survey for a peat deposit. At Pt. Colborne we were met by Mr. Steven Douglas, a Masters student at the University of Waterloo.

This survey was aimed at locating an offshore deposit of peat that occasionally washes up on beaches near Sherkston Bay, in Eastern Lake Erie. This peat deposit, when dated and referenced to the present lake datum, will provide a useful benchmark regarding a low-level stage in the post-glacial history of Lake Erie.

The survey was completed in two phases. The first day, MURV was used to survey tracklines and observe the bottom conditions. On the second day, a diver checked several sites and completed two tracklines while being towed by the launch, PINTAIL.

The search proved unsuccessful since the peat deposit was not found.

ECOSYSTEM REMEDIATION
AEMRB STUDY 12266, DR. S. LESAGE

Technical Operations staff supported the Aquatic Ecosystem Remediation Study at several field sites this year.

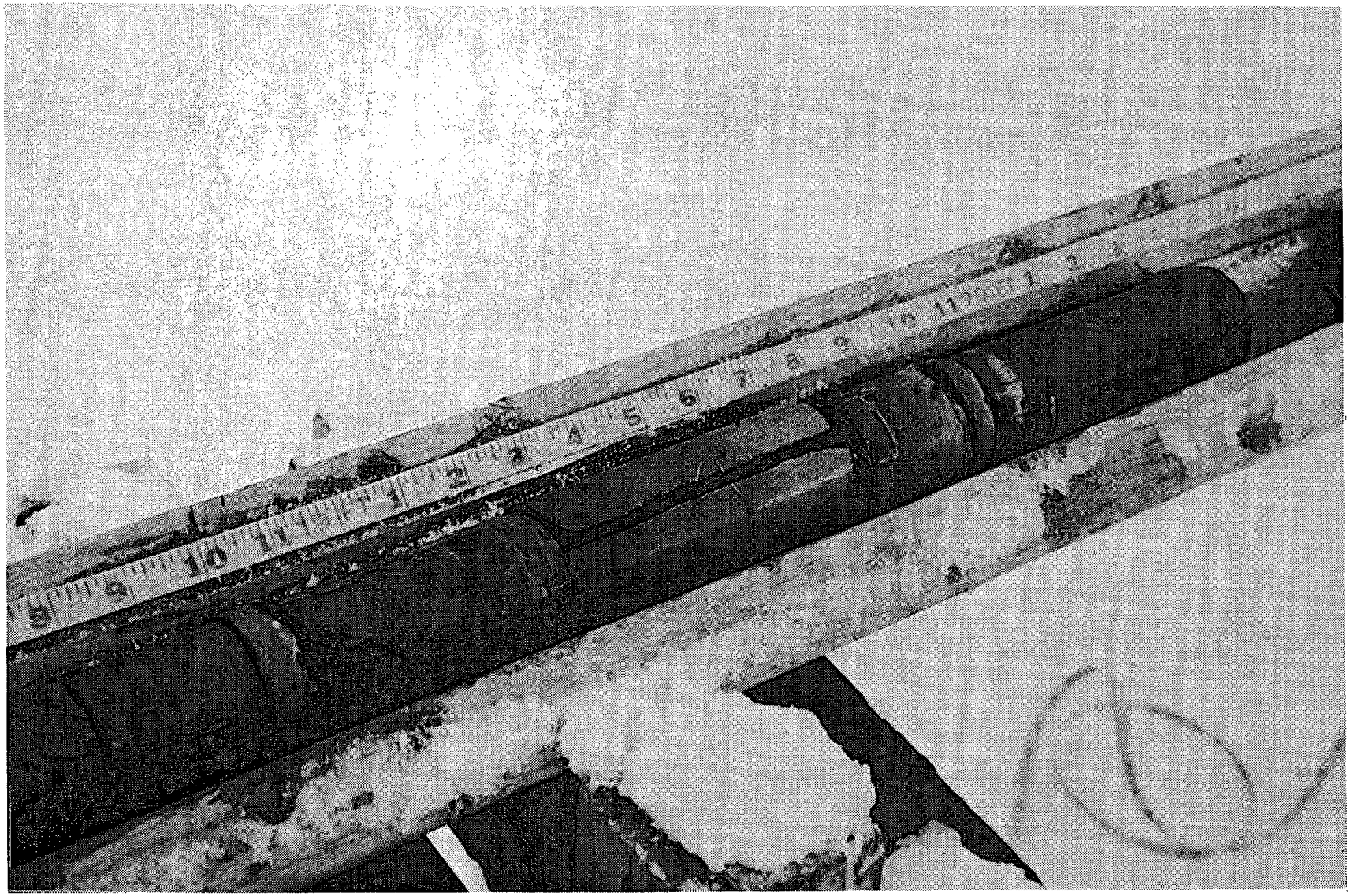
SMITHVILLE

Research at the Smithville PCB site was winding down this year. What began as weekly monitoring of packers, Westbay heads and water levels were done monthly since May. Most of the equipment used on site was returned to Burlington except for one laboratory trailer and the Argo (ATV) left on site to facilitate monthly monitoring and packer maintenance.

This is being done as part of a contract with Smithville Phase IV bedrock remediation project which, along with community partners and the Provincial Ministry of Environment, is looking at ways to remediate the site.

CLARKSON

After a few years of dormancy, resumption of activities at the Clarkson research site is being undertaken. The site is located on Petro-Canada property called the Eighty-acres on Southdown Road, Missisauga.



DRILL-CORE SAMPLE

Clean-up activities began in early summer with old packers being removed and rebuilt. The laboratory trailer needed major cleaning and fumigating as it had become infested with mice.

Vandalism continues to be a problem with the loss of a large tripod and fuel can even though equipment is in a locked compound. This is being addressed by removing anything interesting or valuable from the site or the trailer. Petro-Canada Security has been asked to keep watch on the area.

Hydraulic testing has been redone in most of the wells on site over the zone of interest (approximately 10 m), using 11 cm spaced packers.

Twenty-eight NQ (approximately 3") wells have been installed over time at the site with twenty-five of these on a five-metre spacing grid. Four more wells are expected to be completed before the end of the year to an approximate depth of sixty feet (fifty feet into the bedrock), using the NWRI drill rig. This is in support of Dr. N. Ross, AER, AEMRB whose biobarrier experiment is expected to be undertaken at Clarkson sometime next year.

RED LAKE

Three multi-level wells were installed at Placer Dome Campbell mine at Balmertown, Ontario. Wells were installed using the NWRI drill rig to an approximate depth of fifty feet. While there, cores were obtained from fifteen to fifty feet at three locations around the mine—two at the West dam side and one on the East dam by Balmer Lake.

Three peepers were installed in Balmer Lake at three different locations along the West side of the lake. These were installed at an approximate depth of fifteen feet from surface, using the manual peeper installer. University of Waterloo staff sampled them later. This support was to a joint project with the University of Waterloo to study the effects and possibilities of arsenic migrating to and affecting the water of the nearby lake.

WAINFLEET BOG CONSERVATION AREA

While at Wainfleet Bog monitoring water levels for Dr. A. Crowe AWRP, AEIRB, samples were obtained bimonthly from six drainage ditches in and around the bog. These samples were obtained for Dr. D. Van Stempvoort who is looking into Humic acid concentrations of seepage water at the bog.

CCIW

Technical Operations supported Aquatic Ecosystem Remediation, AEMRB at CCIW throughout the year at various activities in the office and laboratory.

A spreadsheet was started, logging all monitoring wells installed by RSB personnel to ease the tracking of records of wells.

LONG-RANGE TRANSPORT OF AIRBORNE POLLUTANTS, TURKEY LAKES WATERSHED
AEMRB STUDY 12333, 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 staff 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 staff support consisted of one full-time technician stationed in Sault Ste. Marie. Equipment support included one full-time 4-wheel-drive vehicle used for transport to the study area. In addition, 7 snowmobiles and 4 all-terrain vehicles were supplied and maintained for use as transportation throughout the watershed. All tools, sampling and safety equipment for the study were also supplied.

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

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

Technical Operations staff supported Aquatic Ecosystem Management Research Branch staff in chemical and hydrological monitoring of the watershed. Hydrological monitoring consisted of gauging and sampling eight stream locations throughout the watershed on a weekly basis. The samples were analyzed for numerous chemical parameters. Five lakes were sampled on a bi-weekly schedule for the same chemical parameters with the exception of the spring and fall when they were sampled once a week. During the winter, snow cores were collected at 14 locations on a weekly basis. During the year, rain and snow volume samplers (Nipher) were measured and changed

weekly. ISCO samplers at two locations in the watershed are operated year-round. Samples were collected every 12 hours. In addition, groundwater wells throughout the entire watershed were sampled in the late spring and early summer. This study is completed once per year and groundwater wells at basin CFS47 were sampled once per month.

To supplement hydrological and chemical data, a full meteorological station and solar radiation unit were operated on a year-round basis. A MET III system is in operation. This system allows data to be dumped to a disc on site and the generation of a backup disc. The data disc is shipped to CCIW each month and on site data processing is performed. The MET III system also allows MET program changes to be made on site and the MET datalogger can be erased to provide continued use with no interruption of data collection. This system also includes a UVB and UVA sensor with continuous data recorded on the Campbell datalogger CR23X.

The Batchawana Lake Basin CFS47 data logger site has been in operation all year. A Campbell datalogger records hourly measurements of snow temperature during the winter months and soil moisture and soil temperature values year-round. The datalogger is solar powered and the storage module is downloaded at the end of each month and the data is sent to CCIW for processing.

Service was provided by Technical Operations to 2 Campbell dataloggers, 3 storage modules and 2 solar power panels.

A snow melt cave constructed at the Batchawana Lake location will be in service during the winter months until the end of the spring runoff period. In addition, at this same location, a bulk precipitation sampler will be serviced year-round on a weekly basis. The snow cave collection site has been re-located this year approximately 100 feet from the original location and a new collection system for snow melt was constructed.

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

Two portable radio systems for the Turkey Lakes Watershed were used by personnel when working alone. These radios allow calls to be made to Sault Ste. Marie from anywhere in the watershed. New batteries for the radios and a spare battery for each were purchased in December 2000.

Over the summer, equipment support and accommodations at the camp were provided to various Government and university studies occurring in the watershed. In June of this year after ground preparation was completed Irena Creed, University of Western Ontario located 2 trailers at the camp to be used over the next 4 years. One is a 55-foot accommodation trailer and the other is a 35-foot laboratory trailer. Temporary power was supplied to the trailers until such time as the university purchases a new

30Kw generator with a catalytic converter. From May to August accommodation was provided to 2 University employees and another trailer for accommodation provided to one other staff member for 2½ months.

Trent University staff were supplied with accommodation on 2 occasions for 2 staff members for 1 week each trip. An ATV was loaned as well to Trent. During the Spring melt a trailer was provided to 2 staff members from Trent University for 2 months along with the loan of an ATV and Skidoo for 2 weeks.

John Spoelstra, University of Waterloo made two trips to the Turkey Lakes this year—1 Summer and 1 Fall and was provided with living quarters for 2 people for a period of 2 weeks on each trip. An ATV was also loaned to John to assist in his sampling. This study is being done in co-operation with R. Semkin, AEMRB.

Accommodation for 6 personnel from Queen's University was provided over a 2-week period this summer. This is part of the LIDAR study group completing remote sensing work over the watershed.

Accommodation for 2 Natural Resources Canada students for 2 weeks was provided this summer. There were also other short-stay demands for accommodation throughout the year.

A new groundwater sampling area (CFS50 upper) has been operational all year. An automated ISCO sampler is in service at this location and a number of larger well sites were installed this Fall at CFS 50 and CFS 50 Upper.

A reasonable Spring melt occurred this year (more normal) and TOS provided additional support during this intensive sampling period.

A lake shoreline manipulation experiment was completed on Wishart Lake by Fisheries and Oceans and MNR staff based in Sault Ste. Marie. Details of this experiment can be obtained from Dr. K. Smokorowski, Fisheries and Oceans, Sault Ste Marie. Prior to, during and after removal of the shoreline material, water was filtered at the outflow of the lake for suspended solids and sampled for organics, 9 x 40 litres, to be extracted through resin columns. Additional lake sampling was also completed for the same times and included filtering for suspended solids at each depth.

An organics study was ongoing this year in support of Dr. W.J. Strachan, AEPRB. A contractor is on staff by AEMRB to complete the additional workload required by this study. Samples are collected at sites CFS47, SO, L2, CFS31, S4, CFS49, CFS50 and the Batchawana River on a pre-determined schedule. At each site 3 x 40 litres of water are collected and extractions done through a resin column for organics along with mercury and trace metal samples collected at each site in support of this study. As well, a mercury and an organics precipitation sampler is operational on the MET deck

and is serviced according to a pre-determined schedule. Also, a high volume air (PUF) sampler is operational at the same location. Three snow collection trays were deployed just prior to the first snowfall at the MET hill site and will be sampled just prior to the Spring melt. A winter sediment trap was installed on L2 this Fall and will be retrieved when ice is off the lake.

The week of July 3 Technical Operations staff replaced all skirting on the trailers at the camp with new plywood and then painted.

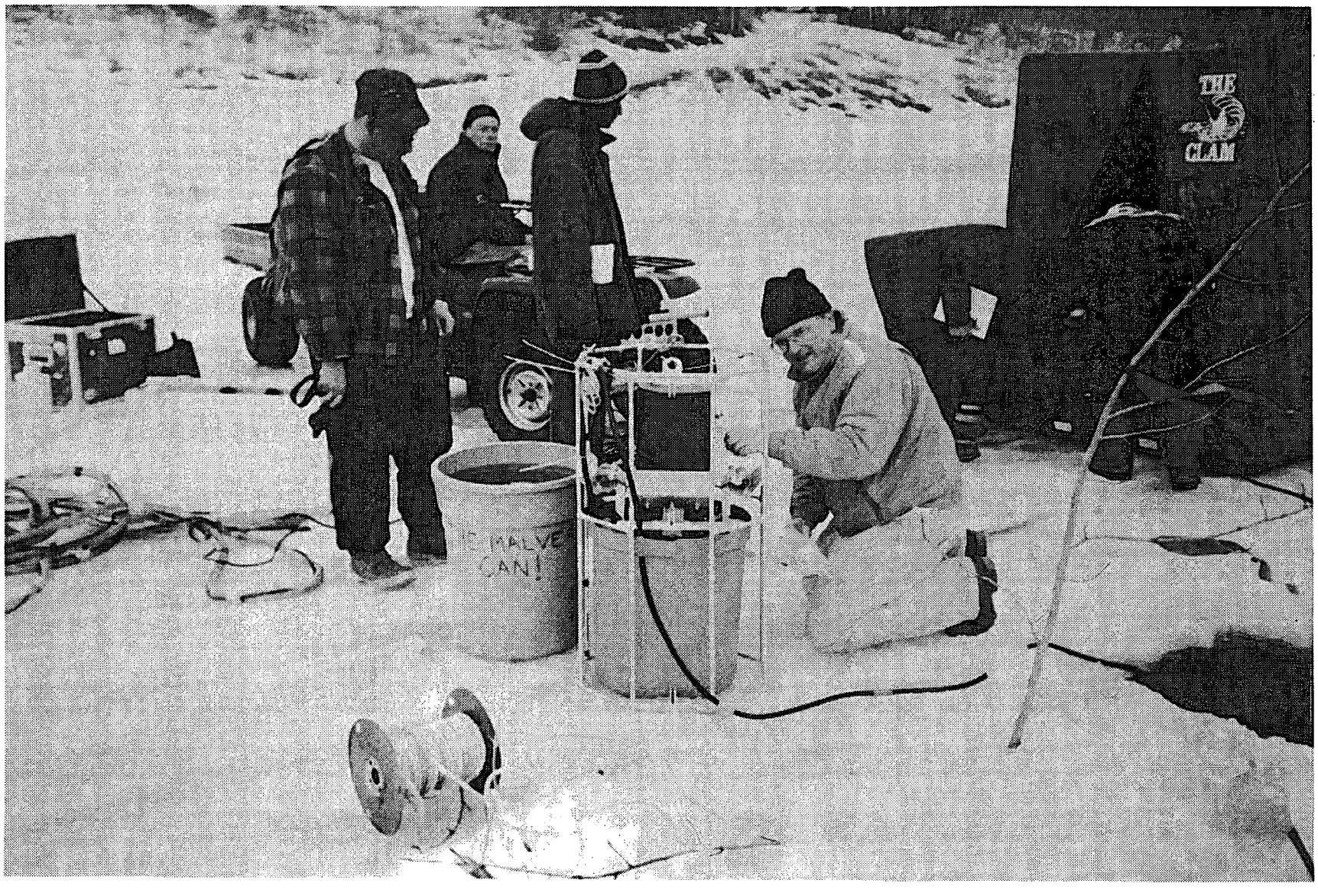
A new snow bridge en route to the Headwater was built this fall. The Batchawana survival cabin received a coat of stain this summer. A safety cover was placed around the first 10 feet of the MET tower to prevent unauthorized people from climbing the tower.

Work is in progress securing bids on the construction of a new 2-storey garage at the camp.

This year a Joint Turkey Lakes Safety Committee was formed at the request of the Turkey Lakes Steering Committee. The safety board consists of 1 representative each from Environment Canada, Fisheries and Oceans and Natural Resources Canada.

IN SITU EROSION FLUME
AEMRB STUDY 12442, DR. B.G. KRISHNAPPAN

The in situ erosion flume was utilized at several sites in the St. Lawrence River at Cornwall to determine the shear strength of different types of sediment. Three sample sites were preselected by Dr. N.A. Rukavina, AEMRB from previous RoxAnn surveys in the area to include soft-to-hard bottom types. The launch GANDER was utilized to carry all equipment for the survey and to raise and lower the flume. The GANDER was moored at each site with a 3-point anchor to allow only minimal movement from position. The flume was lowered to the bottom at each site with no flow through the flume. Once on the bottom, the bottom sediment was observed through an underwater video camera mounted on the flume. The water pump was then started and run at increasing flow rates over a period of time and the bottom sediment under the flume observed. All video images were recorded on VHS tape. Shipek samples were obtained at each site to obtain sediment for grain size analysis.



ALIGNING THE MALVERN LASER ON HAY RIVER, NWT

PARTICLE SIZE SURVEY, HAY RIVER, NWT
AEMRB STUDY 12442, DR. B.G. KRISHNAPPAN

Technical Operations supported this project by providing logistical and field support for this suspended sediment survey on the Hay River in the Northwest Territories.

This field study was in support of a current study being carried out by the Department of Indian and Northern Affairs (DIAND) investigating the transport of sediment in northern rivers immediately prior to and during the spring breakup. The data collected on this sampling trip will serve as input towards investigating the plume of sediment which has been observed to occur under the river ice immediately prior to breakup as flow velocities increase.

A series of twelve holes was drilled through the ice along a transect of the Hay River approximately 200 metres upstream of the Water Survey of Canada gauging station and 5 km upstream of the town of Hay River, NWT. Ice thickness along the transect varied from 0.7 to 1.0 metre and the water depth under the ice was found to be approximately 0.5 metres only, less at the edges.

Extensive current measurements were made at each of these holes with readings being recorded at 2 cm intervals, within the limitations of the Price current meter, in order to provide sufficient data points in those areas just below the ice and just above the bottom. Water samples were collected from each hole at top, middle and bottom depths for suspended solids and from top and bottom depths for CHN. Five of the holes along the transect were enlarged to allow the Malvern field particle size instrument to be set on the river bottom. The Malvern recorded particle size and concentration information along the transect. Slide samples were collected from each Malvern site for microscopic examination of suspended particles.

A large volume water sample was collected for further experiments in the rotating flume back at the Institute. Eight 100-litre barrels of river water and bottom sediment were collected using a surficial sediment resuspension cone developed at CCIW which gently resuspends fine sediment from the bottom by way of gentle water jets and pumps them to the surface. The cone was equipped with a video camera which provided a record of the bottom substrate as the sample was being collected.

The Rescue, Safety and Environmental Response Branch of the Canadian Coast Guard at CCG Hay River provided considerable logistical support to this study by providing and operating two trailer-equipped ATV's at critical times when equipment and samples had to be moved up and down the river banks and allowing the use of their warehouse facilities for equipment staging purposes.

The ice thickness was much reduced during the study period and was largely covered by flowing water as the study finished.

PROFILING OF KENILWORTH DRAIN AT DOFASCO
AEMRB STUDY 12450, DR. I. DROPPO

Technical Operations were involved in field work for Dr. I Droppo at the Kenilworth Drain located between Dofasco Steel Co. and National Steel Car in Hamilton. The work was carried out the week of October 31 to November 3.

The purpose of the work was to develop profiles along the drain so that its shape and depth could be incorporated into a computer model being developed. The study is investigating the outflow of sewage from the drain during heavy rainfall events.

The field work consisted of levelling in seventeen temporary bench marks along the edge of the drain using a known elevation at Dofasco. These points were then used to produced profiles across the drain and the small retention pond at its northern end using the total station Distomat.

SEDIMENT SAMPLING, TORONTO HARBOUR
AEMRB STUDY 12450, DR. I. DROPPO

Sediment was collected from eight sites in Humber Bay and Toronto Harbour on two occasions—April 18 and August 9. This sampling was to provide background data on sediment parameters prior to a new holding tank being implemented to catch sewage and storm water overflow during storm events. Samples were obtained using a Shipek sampler at sites 1 to 4 and a mini PONAR sampler at sites 5 to 8. Samples were placed in plastic bags for Ms. I. Jordan, Ryerson Polytechnic University who did the sample analysis. All positions were done using DGPS (WGS 84) at the following positions:

SITE #	LATITUDE N.	LONGITUDE W.	UTM NORTHING	UTM EASTING	DEPTH m
1	43° 38' 03"	79° 27' 53"	4832382	623858	4.0
2	43° 38' 09"	79° 27' 32"	4832570	624320	5.0
3	43° 38' 09"	79° 27' 08"	4832602	624841	7.5
4	43° 38' 00"	79° 26' 39"	4832330	625502	7.0
5	43° 37' 51"	79° 24' 33"	4832099	628336	4.0
6	43° 37' 36"	79° 20' 04"	4831756	634377	5.5
7	43° 37' 44"	79° 20' 03"	4832008	634387	5.0
8	43° 37' 41"	79° 20' 11"	4831926	634203	3.5

AQUATIC ECOSYSTEM PROTECTION RESEARCH BRANCH

AIRBORNE METALS STUDY, ROUYN-NORANDA
AEPRB STUDY 12216, H. WONG

Technical Operations staff assisted Mr. H. Wong in his airborne metals study at Rouyn-Noranda. Sampling was done in conjunction with Meteorological Service of Canada out of Downsview, Ontario.

Support provided was the delivery and retrieval of the portable clean lab to sampling sites at John C. Munroe Airport in Hamilton and Rouyn-Noranda Airport in Quebec. Sampling for airborne metals was completed utilizing the Transport Canada Twin Otter. The clean lab was situated in the aircraft hanger or beside the aircraft on the tarmac to affirm minimal exposure of the samples when transferring them from the aircraft to the lab and protect against contamination

Several trips were made to both locations throughout the year. During the winter while delivering the lab to the Rouyn-Noranda Airport, staff experienced remote, harsh, dangerous road conditions, involving dangerous black ice, extreme cold and heavy snow. The weight of the lab trailer added to the hazardous operational conditions.

SOURCES OF OLD AND NEW PESTICIDES IN BIG CREEK
AEPRB STUDY 12320, DR. D. MUIR

A study led by Dr. Muir was initiated in March this year on Big Creek, which flows into Lake Erie near Long Point. Big Creek was chosen because its watershed contains the major tobacco-growing area in Ontario. In the past there was heavy use of persistent organochlorine (OC) pesticides such as DDT in the tobacco-growing region within the watershed. The objectives of the study were to investigate retention of old OC pesticides in an Ontario agricultural watershed and compare levels of current use of OC pesticides—lindane and endosulfan, with losses of OC's like DDT and dieldrin that were banned in the 1970's. Funding for the study came from the Toxic Substances Research Initiative. Water sampling (dissolved and particle phase) was initiated by Technical Operations on March 8 at a site about 5 km upstream of the mouth of Big Creek and downstream of all major tributaries. Sampling continued every 1 or 2 weeks (depending on flow) during the spring, summer and fall. The plan is to continue sampling until June 30, 2001 to capture spring runoff events and May-June pesticide applications. Large samples of suspended sediment were collected using continuous centrifugation on site—1000ℓ at 6 ℓ/min. Water samples (100ℓ) were collected by pumping centrifuged water through XAD-2 resin columns. Passive air sampling was carried out using the XAD-2 resin column design of Frank Wania (University of Toronto)

at 8 locations in the watershed for a 12-month period. Water samples were also collected upstream near the town of Delhi for analyses of Haloacetic acids and fluorinated chemicals by Dr. Brian Scott. Hi-vol. air (PUF) air sampling was carried out from May to October at the CWS field station near the mouth of Big Creek and monthly wet only precipitation sampling was conducted at the same site. Air and precipitation sampling will recommence in March 2001 to cover the spring and early summer period.

SEDIMENT/WATER SAMPLING, NORTHWESTERN ONTARIO
AEPRB STUDY 12320, DR. D. MUIR

During the weeks of July 3 and 10 sediment and water samples were collected from several lakes in Northern Ontario. Sampling was done at the following lakes: Paguchi in the Ignace area; Sandy Beach and Thunder Lake, South of Dryden; Eva Lake, East of Atikokan and Batchawana Lake in the Turkey Lakes Watershed. Two 20-litre water samples were collected from 1 metre at all the lakes except Batchawana. Two cores were collected from each lake and subdivided into 1 cm sections, packaged and stored at 4°C. Positioning was done at each lake using an Eagle GPS system and all readings were taken in WGS 84. A description of each lake sampled follows:

Paguchi Lake

Paguchi Lake is situated 17.6 kilometers East of Ignace, Ontario on Logging Road 325. Access to the lake is on the North end of the lake on a Ministry of Natural Resources day use park at the launching access point. The lake was sampled on July 6 at the deep hole located in the Western Basin at 30 metres. The cores were approximately 25 cm long and consisted of light brown oxygenated modern mud about 2 cm thick over grey clay. Chironomids were observed in the sediment sections to a depth of 5 cm. At the time of sampling an algae bloom was in progress in the lake. Sampling position was 49° 33' 47.16" N., 91° 36' 41.4" W.

Sandy Beach Lake

Sandy Beach Lake is situated off Highway 72 East of Highway 17 at Dinorwic, Ontario. Access to the lake is through Clearwater Resort 20 km East of Dinowic. Sampling was conducted on July 7 in the morning. All sampling was curtailed for the remainder of the day due to high winds and thunderstorms in the area. The lake was sampled from the deep hole area of the lake at a depth of 40 m. The deep basin is located in the eastern end of the lake and covers over a third of the lake. Cores collected were very similar to those collected at Paguchi Lake and were approximately 25 cm long. Large volume water samples were collected for organics at 1 metre. Samples were collected at position 49° 48' 59.6" N., 92° 21' 13.4" W.

Thunder Lake

Thunder Lake is situated off Highway 17, approximately 25 km East of Dryden, Ontario. Access to the lake is through Aaron Provincial Park. The lake was sampled from the deep hole area of the lake at a depth of 21 m. The deep basin is located in the southern end of the lake and covers over half of the lake. Cores collected were very similar to those collected at Paguchi Lake (25 cm long). Large-volume water samples were collected for organics at 1 metre. Samples were collected at position 49° 46' 26.34" N., 92° 39' 56.58" W.

Eva Lake

Eva Lake is situated off Highway 11, approximately 25 km East of Atikokan, Ontario. Access to the lake is through Camp Quetico. The lake was sampled from the deep hole area of the lake at a depth of approximately 60 m. The deep basin is located in the central area of the lake and covers over half of the lake. Cores collected were very soft organic materials with a very high water content and were approximately 30 cm long. Large-volume water samples were collected for organics at 1 metre. The samples were collected at position 48° 42' 48.36" N., 91° 10' 31.68" W.

Batchawana Lake

Batchawana Lake (L2) is located in the Turkey Lakes Watershed and is the headwater lake of the drainage basin. The lake was sampled from the deep hole at approximately 9 m. Cores collected were very soft, organic materials with a very high water content. The cores collected were approximately 25 cm.

In addition, water samples were collected for the Haloacetic acid study on waters of the Great Lakes at Thunder Bay and Sault Ste Marie, Ontario and Duluth, Minnesota. Two-litre samples were collected from raw intake water, treated city water and from the final effluent as it is returned to Lake Superior. One observation was that the final effluent being discharged from the sewage treatment plant in Duluth is a combination of pulp-mill influent and regular sewage.

Contacts for the collection of samples are as follows:

Thunder Bay
Mr. Ross Chuchman
Chief Chemist Environment Division
500 Donald St. E.,
Thunder Bay, Ontario P7E 5V3
Phone 807 - 345 - 1909

Duluth
Mr. Joseph J. Stepun
Manager of Environmental Services
Western lake Superior Sanitary District
2626 Courtland Street, Duluth.
MN. 55806-1894
Phone 218 - 722 - 3336

Sault Ste Marie
Water Treatment Plant
2nd Line
905 - 759 - 6555
Sewage Treatment Plant
Queen Street
705 - 759 - 4339

SEDIMENT/WATER SAMPLING, NORTHWESTERN QUEBEC
AEPRB STUDY 12320, DR. D. MUIR

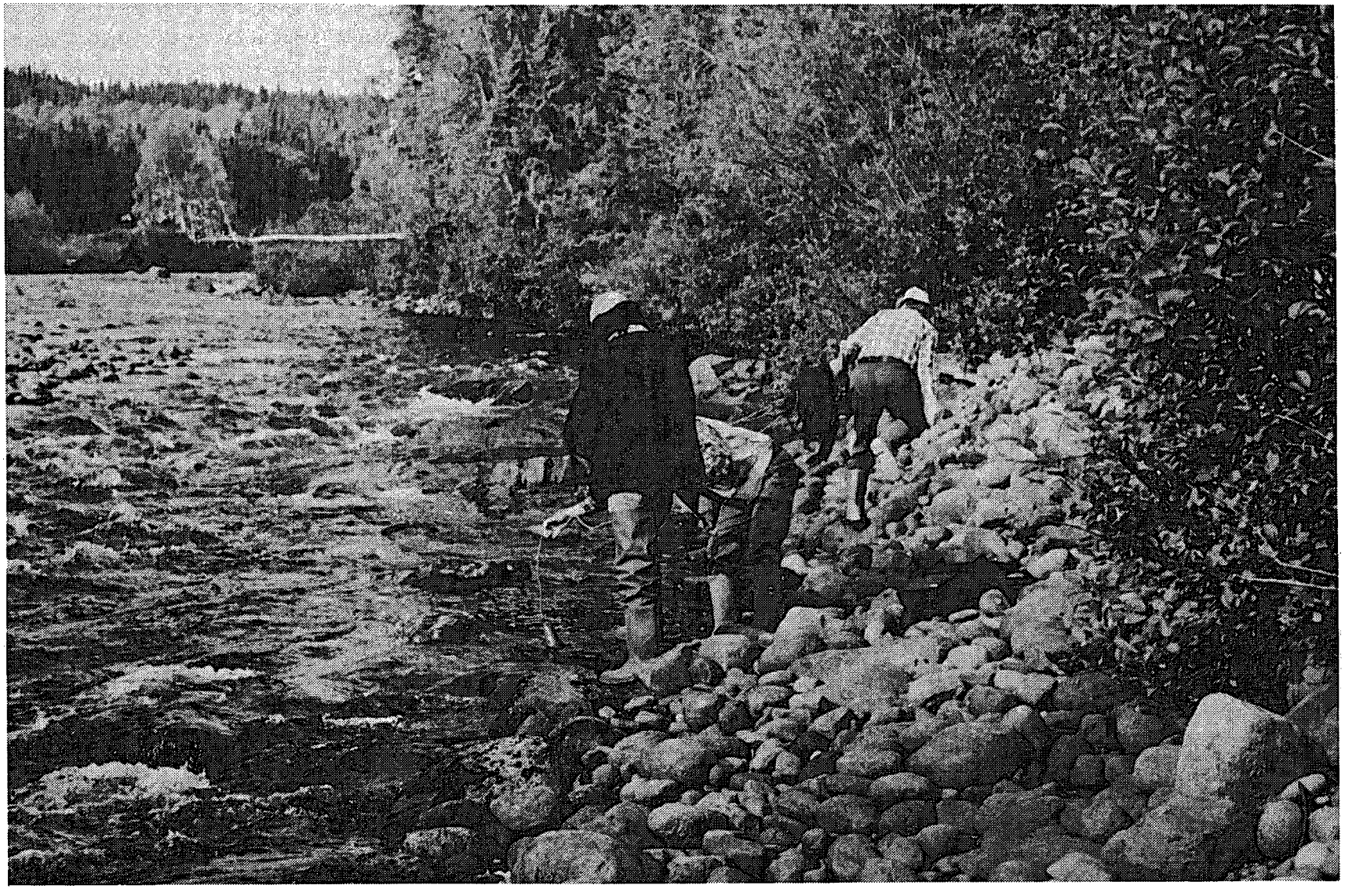
Water and sediment samples were collected from Lac Dasserat located 15 km East of the Ontario/Quebec border North of Highway 117. Samples were collected at 48° 16' 24" N., 79° 25' 48"

Access to the lake is at Kanasuta Marina followed by boat transit through Lac Desvaux. Sampling was done in the northwest basin of Lac Dasserat. Water samples were collected in 20-litre stainless steel cans and in plastic bottles by immersion under the water surface. Sediment cores were collected by sub-sampling the mini box corer. Sediment cores were approximately 25 cm long and consisted of 2 - 3 cm of modern, light brown oxygenated mud overlaying grey clays. At the 8 - 10 cm depth there appeared to be a layer of iron-manganese nodules; below the layer, sediments were a light grey with the consistency of powdered chalk. The cores were subdivided into 1 cm sections to 20 cm and stored at 4°C until analysis.

SEDIMENT/WATER SAMPLING, NORTHWESTERN LABRADOR
AEPRB STUDY 12320, DR. D. MUIR

Water and sediment sampling was conducted on lakes Shipiskan, Wuchuska, Seal and Lac Fourmont in Labrador during the week of September 10 - 15.

September 10 was spent travelling to Goose Bay, Newfoundland with Messrs. Pollock and Wilson of Ecosystems Science Branch, Atlantic Region, Environment Canada. September 11 was spent collecting the government vehicle; picking up sampling equipment held at the airport; meeting with Jack Selmo—an Innu co-researcher from the Innu Nation and discussing logistics to complete sampling requested by several researchers in Environment Canada and preparing for the next several days of sampling.



SAMPLING A RIVER IN LABRADOR

On September 12, four rivers between Goose Bay and Churchill Falls were sampled. A one-litre water sample for Haloacetic acid was collected from each of the following rivers: Pena's (Pinus), Cache, East Wilson and East Metchin. All samples were collected above the Trans Labrador highway bridges as they crossed the rivers. These sites were also sampled by the staff from ECB for major ions, phosphate, Chlorophyll and metals—especially mercury.

September 13 was spent travelling north by helicopter to sample Shipiskan Lake, Wuchuska Lake and Seal Lake to collect the following large water samples for: organics; Haloacetic acids; nutrients and major ions as well as sediment cores. Water samples for metals, especially mercury, were also collected.

September 14 was spent travelling south to Lac Fourmont to collect samples as on September 12. Large stainless steel sample containers were collected from Shipiskan, Wuchuska and Fourmont only. Soil samples were collected as a last moment request for an international intercomparison study from the river bank at the mouth of the Susan River as it enters Grand Lake.

To ensure the water samples were not contaminated by the helicopter, all water was collected from shore after the helicopter had left the area to collect sediments. To prevent surface contamination, sample bottles were kept sealed until they were immersed in the lake. Due to weather and wave conditions, helicopter sampling was done relatively close to the leeward shore (within ½ mile). Winds were close to 20 knots and the limiting wave height in a helicopter is 20 cm. Due to the wind, the helicopter had to be under power at all times when sampling. This complicated sampling further by making it impossible to collect plankton samples using a plankton net. Secchi disks were attempted with the disk supposedly submerged 5 m; (it was often 3 m in front of the aircraft and skipping across the water surface).

There are no bathymetric maps of these lakes. One had to depend on word of mouth from the people of the Innu Nation who knew that the lakes were "deep".

While sampling Shipiskan, coring was attempted in approximately 45 m of water but the pilot could not control the movement for the amount of time required to deploy and retrieve the samplers. In order to collect cores, the helicopter was positioned in water depths of up to 10 metres in order to accommodate the collection of sediments. Cores in Seal Lake were collected in approximately 5 metres of water in a large bay on the South shore of the lake. Cores from Wuchuska Lake were collected from a bay on the Eastern side of an island which divides the lake into two basins. Cores from Lac Fourmont were collected from mid-lake at the Eastern Basin of the lake. Although the lake is quite long it is very shallow and is basically a widening (flood plain) of the Mecatina River. Two cores were collected from each lake and returned to Goose Bay for sub-division.

The sediments in Seal Lake, Wuchuska Lake and Lac Fourmont contained a large quantity of sand overlaid with approximately one centimetre of modern organic materials. Due to the sand content, the cores collected ranged from 8 - 13 centimetres. The subdivided core from Shipiskan Lake was composed of organic material and was in excess of 20 centimetres.

SAMPLE LOCATIONS

LOCATION	LATITUDE N.	LONGITUDE W.	REMARKS
Pena's (Pinus) River	53° 02' 24"	61° 17' 46"	Above bridge
Cache River	53° 11' 34"	62° 12' 39"	Above bridge
East Wilson River	53° 18' 11"	62° 55' 06"	Above bridge
East Metchin River	53° 26' 07"	63° 14' 04"	Above bridge
Shipiskan Lake	54° 38' 50" 54° 39' 18"	62° 24' 24" 62° 24' 24"	Water Samples Sediment
Wuchuska Lake	54° 23' 52" 54° 23' 11"	61° 47' 08" 61° 43' 42"	Water Samples Sediment
Seal Lake	54° 19' 48" 54° 19' 46"	61° 38' 30" 61° 38' 10"	Water Samples Sediment
Lac Fourmont	52° 02' 30" 52° 02' 00"	60° 18' 36" 60° 18' 39"	Water Samples Sediment
Susan River	53° 44' 12"	60° 56' 48"	Soil Sample

ATMOSPHERIC CONTAMINATION, LAKE ONTARIO
AEPRB STUDY 12337, DR. W.M.J. STRACHAN

Technical Operations staff provided logistical and technical support to AEPRB in co-operation with the Centre for Atmospheric Research Experiments based in Egbert,

Ontario. Data collected from the 12-metre buoy located 22 km southwest of Toronto Island originated from a variety of experiments, including PUF air samplers, precipitation samplers, NOX gas analyzer, ozone gas analyzer and a mercury analyzer.

The CCGC SHARK and CCGL WAGTAIL were utilized to transport equipment and personnel from Burlington to the buoy, totalling 23 trips. Generator problems plagued the project, requiring many hours of diagnosis and repair. On the final trip, the generators were removed from the buoy and returned to Burlington.

CAGED FISH DEPLOYMENT, HAMILTON HARBOUR
AEPRB STUDY 12340, DR. R.J. SHERRY

Technical Operations staff supported this project throughout the month of June. The objective of this study is to evaluate a caging method for assessing the bioavailability of sediment-borne PAH's to fish. The field work laid the foundation to test the hypothesis that sediment PAH are not bioavailable to fish in cages. This work was a collaborative effort between NWRI staff and personnel at Queen's University. Groups of three moorings were installed in Hamilton Harbour at four locations. At each location, the three moorings were installed with the following work being completed:

1. Mooring #1 — 5 rainbow trout per cage and one cage at B-1, B-3 and 2 m below the surface
2. Mooring #2 — 5 rainbow trout per cage and one cage at B-1, B-3 and 2 m below the surface
   Semi-permeable membrane device (SPMD) installed at B-3 and 2 m below the surface
3. Mooring #3 — 15 rainbow trout per cage and one cage at B-1 and B-3 m

STATION POSITIONS
HAMILTON HARBOUR

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	43° 17' 08"	79° 50' 21"
2	43° 17' 12"	79° 50' 33"
3	43° 16' 37"	79° 51' 48"
4	43° 16' 41"	79° 49' 56"

The total length of this experiment was 16 days. At the experiment's end, fish were dissected and analyzed at CCIW by both Queen's University and NWRI staff.

ATHABASCA RIVER ENDOCRINE EFFECTS SURVEY, WHITECOURT, ALBERTA
AEPRB STUDY 12341, DR. M. McMASTER

Technical Operations provided field support to this study investigating endocrine disruption and tissue abnormalities in sentinel fish in the Athabasca River near the town of Whitecourt, Alberta. Four sampling sites were selected on the Athabasca River:

1. Upstream of the Alberta Newsprint Company
2. Downstream of ANC and upstream of the Millar Western Forest Products Limited
3. Downstream of MWFP and upstream of the Sewage Treatment Plant
4. Downstream of the STP

The sampling protocol required the collection of twenty large and twenty small fish of each sex from each site. Longnose Suckers (Catostomus catostomus) were chosen as the large fish species and Trout-perch (Percopsis sp.) as the small fish. The large fish were collected by personnel from Alberta Environment using their electrofishing boat and the small fish were collected by Smith Root backpack shocker by NWRI personnel.

The boat launch for the upstream site was located at the Windfall Bridge and the Riverboat Park ramp in Whitecourt at the forks of the Athabasca and McLeod rivers was used for all other sites. In all cases the large fish were caught and delivered to the boat ramp where sampling was done. The small fish collection areas were accessed by crewcab except for the site downstream of the sewage treatment plant which was visited by Zodiac. The small fish were held overnight in large aerated pails in the crewcab and sampled first thing the next morning in the workshop at the motel. The water depth in the Athabasca River in the study area was sufficient to run the jet-powered Zodiac to all sites but was dropping rapidly during the sampling period.

Samples were taken from the Longnose Suckers for the following analyses:

Blood steroids	Gonadal histology (all males and females)
In vitro steroids	Vitellogenin levels (in males and females)
Liver MFO	Hepatic oxidative stress
Gonadal oxidative stress	Blood gonadotropin
Pituitary gonadotropin	Sex Steroid Binding Proteins
Gonadal Apoptosis	Hepatic Estrogen Receptors
Gonadal Androgen Receptors	Fecundity

The Trout-perch were sampled for:

In vitro steroids
Liver MFO
Gonadal histology (all males and females)
Gonadal apoptosis
Hepatic estrogen receptors
Gonadal androgen receptors

The length, weight, age, gonad weight, liver weight and any abnormalities were recorded for all of the fish sampled.

The fish collection and sampling was completed in record time due to excellent river and weather conditions

MIRAMICHI NONYL PHENOL SURVEY, MIRAMICHI, NEW BRUNSWICK
AEPRB STUDY 12461, D. BENNIE

Technical Operations supported this ongoing co-operative study with the Department of Fisheries and Oceans, investigating possible endocrine effects of nonyl phenol type compounds on salmon smolts in the Miramichi River. This study will contribute data to complement that collected last year concerning concentrations of nonyl phenols found in the lower eleven kilometres of the Northwest Miramichi River, the lower Southwest Miramichi and as far down the Miramichi River as the Douglastown Bridge.

Two ISCO automatic water samplers were set up. A small unit provided by Technical Operations sampled the final effluent of the Strawberry Marsh Sewage Treatment Plant and a large refrigerated unit borrowed from the Wastewater Technology International Corporation sampled the final effluent of the Repap Pulpmill in town. Each unit was programmed to collect a 450 ml sample every hour. These were combined to provide a daily composite sample.

The launch PELICAN was utilized to conduct the river survey. Thirteen sampling sites were selected in the river. At each site a four-litre sample was collected using the subsurface dip sampler from the .5-metre depth and surface readings were taken for temperature, dissolved oxygen, potassium, pH, turbidity, salinity and specific conductance.

The four-litre samples were pressure filtered with nitrogen through GFC's and split into two samples in glass bottles—one preserved with formaldehyde and the other with sulphuric acid to a pH of 2.5. Three surveys were completed on three consecutive days. The composite samples collected from the ISCO samplers were processed in the

same manner for four days which covered the same three day-period as the river surveys.

Bottom sediments were collected once during the sampling program from each station using a mini PONAR grab sampler and frozen in 250 ml glass jars.

Site Number	Site Description	Site Position (NAD 83) Easting	Northing
1	LB - NW Miramichi - US of Hwy#8 Bridge	20E 302107	5204696
2	RB - NW Miramichi - US of Hwy#8 Bridge	302153	5204560
3	Mid - SW Miramichi - US of Train Bridge	303009	5203474
4	RB - SW Miramichi - opp. Beaubear Pt	305484	5205799
5	LB - NW Miramichi - opp. Beaubear Pt	304669	5206606
6	RB - NW Miramichi - opp. Beaubear Pt	305019	5206308
7	LB - Miramichi - DS of Bridge Rd	305268	5207484
8	Mid - Miramichi - DS of Bridge Rd	305509	5207600
9	RB - Miramichi - DS of Bridge Rd	305633	5207734
10	RB - NW Miramichi - DS of Cassilis	288019	5201631
11	LB - Miramichi - US of Hwy#11 Bridge	311293	5211404
12	Mid - Miramichi - US of Hwy#11 Bridge	311454	5211233
13	RB - Miramichi - US of Hwy#11 Bridge	311608	5211026

AQUATIC ECOSYSTEM IMPACTS RESEARCH BRANCH

POINT PELEE NATIONAL PARK
AEIRB STUDY 12260, DR. A. CROWE

Technical Operations supported this project with monthly monitoring of water levels in wells at the park gate, the Northwest Beach and Camp Henry areas. Monthly water levels of the marsh were also obtained as part of a continuing study of the groundwater at the Park.

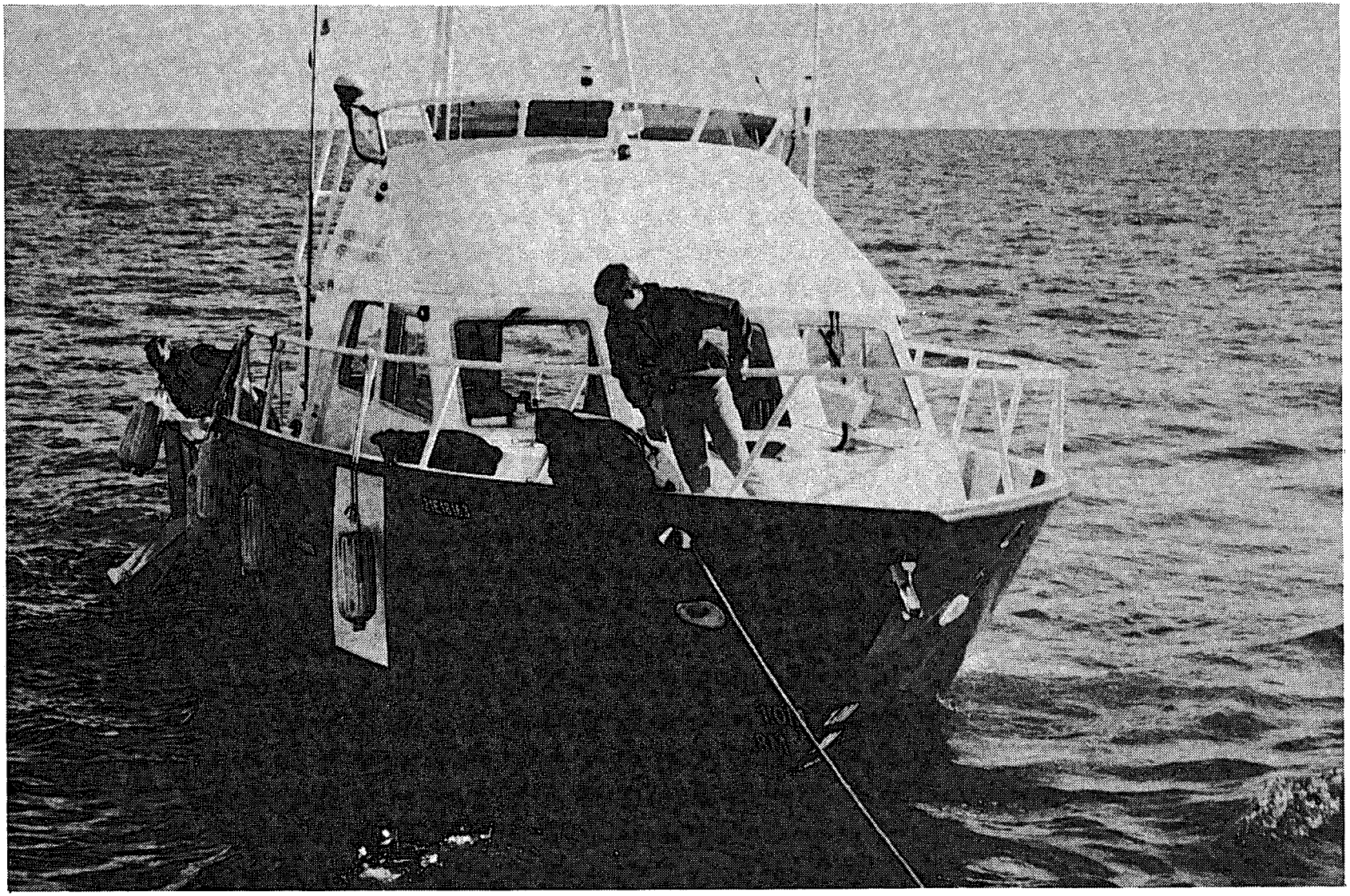
WAINFLEET BOG CONSERVATION AREA
AEIRB STUDY 12260, DR. A. CROWE

Technical Operations staff supported this project at the Wainfleet Bog and the Point Pelee National Park with monthly monitoring of water levels in previously installed wells and drainage ditches. Two water level loggers were installed in wells number fourteen and fifteen (installed in January of this year with post hole auger). These are recording water levels at fifteen-minute intervals and will continue indefinitely. Altogether fifteen wells and four drainage ditches are monitored.

This is being done as part of a continuing joint groundwater study of the bog with Niagara Regional Conservation Authority which is looking into the effects and possibility of restoring the bog to its original pre-drained state.

METEOROLOGICAL AND TEMPERATURE MOORINGS, GREAT SLAVE LAKE
AEIRB STUDY 14145, W.M. SCHERTZER

The purpose of this study was to deploy meteorological and temperature moorings to give detailed vertical temperature measurements on Great Slave Lake, NWT. To accomplish this, two meteorological buoys were installed at stations 1 and 2 during the June 14 - 19 cruise and retrieved by the CCGS ECAKLOO October 1 - 5. Six temperature moorings were installed during the same time period at stations 1, 2, 3, 4, 5 and 7. The temperature moorings were retrieved between September 5 and October 5, utilizing CCGC 775 and CCGS ECAKLOO. A shore-based station was also set up at Hay River in the NTCL storage area. This was dismantled September 11 and reinstalled at the Coast guard compound at the Hay River Airport for the winter.

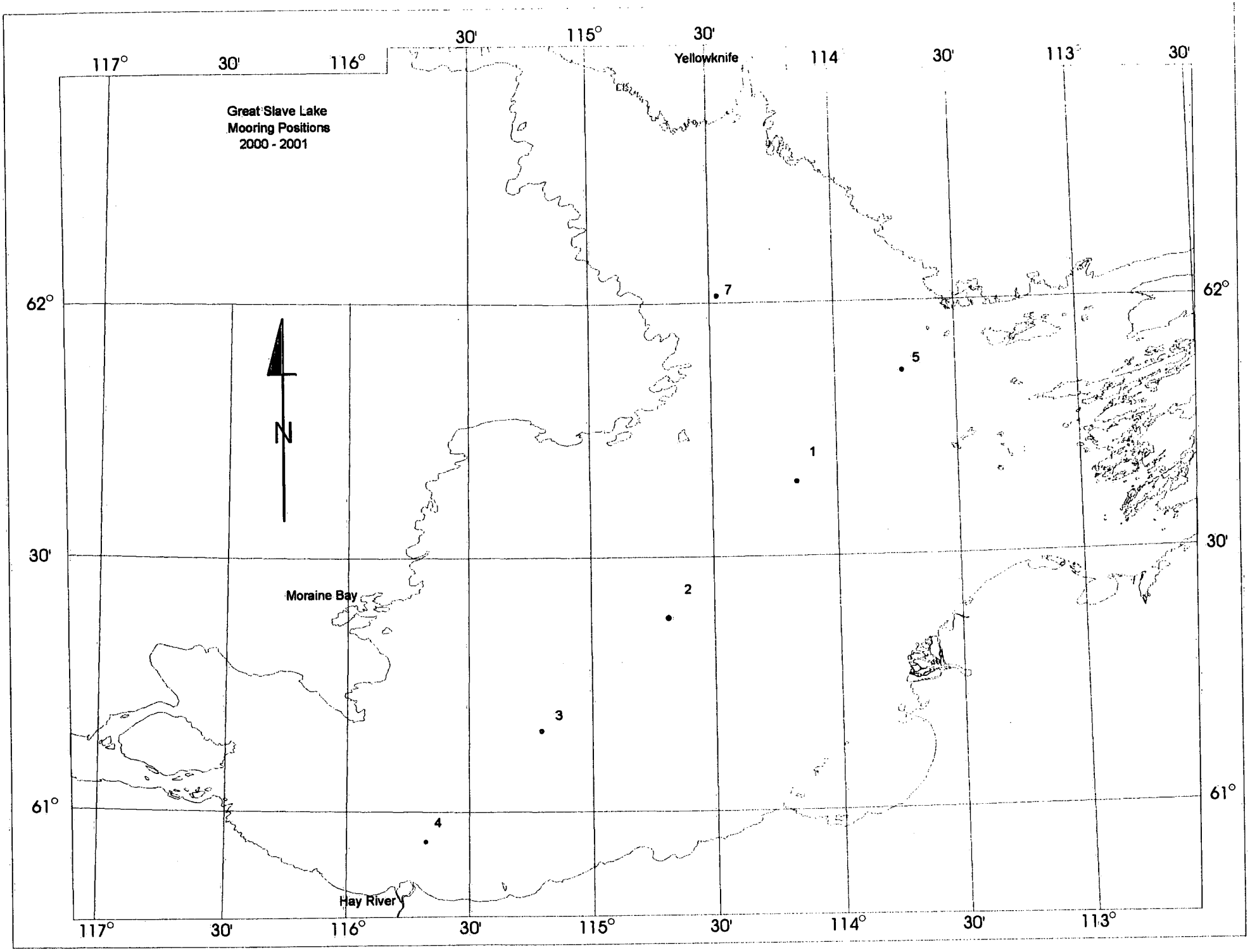


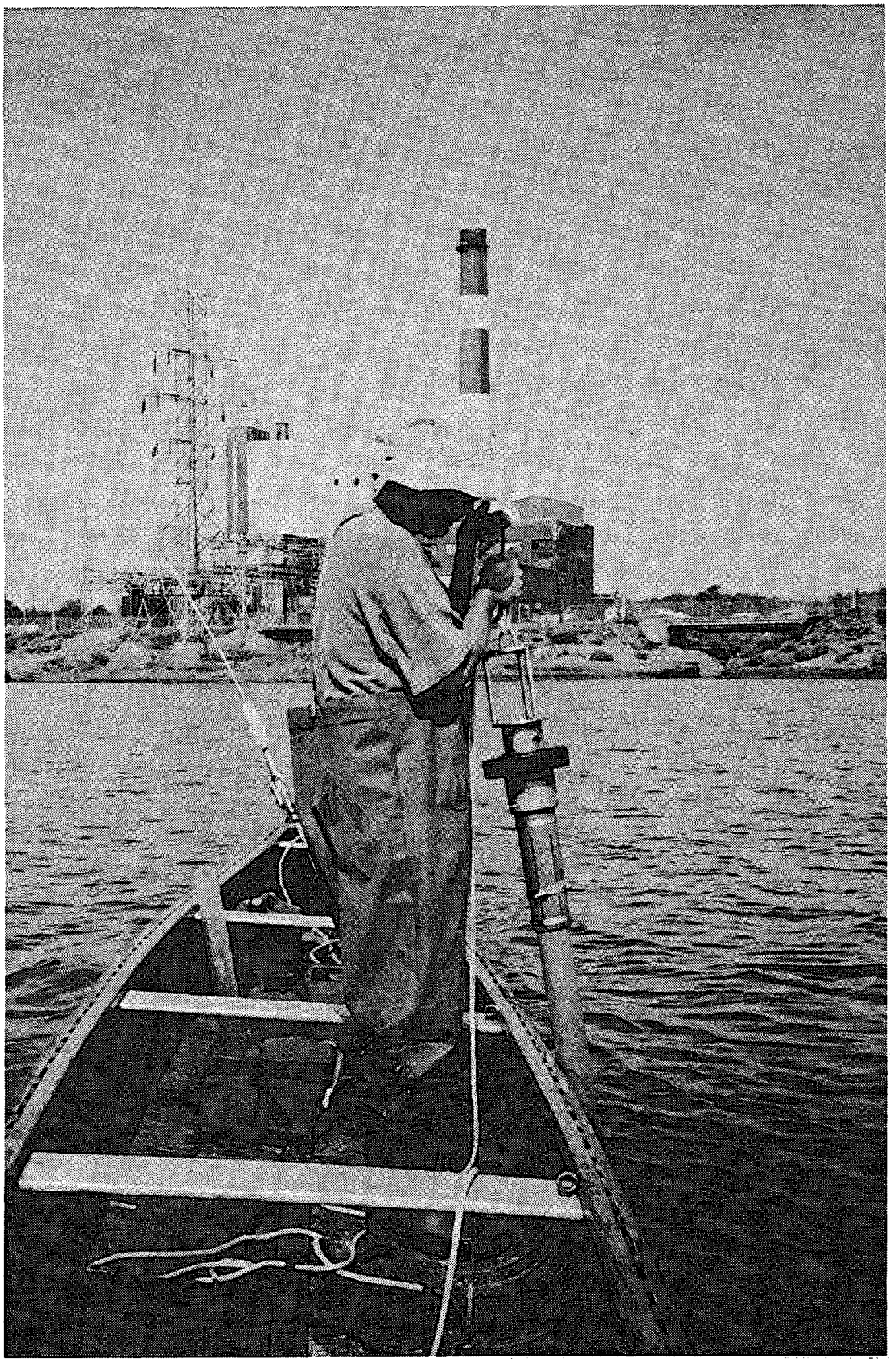
DIVE INSPECTION OF THE CCGS DUMIT FROM THE CCGC 775
GREAT SLAVE LAKE

GREAT SLAVE LAKE

MOORING POSITIONS

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
1	2000-51T-01A	61° 38' 37"	114° 08' 40"	T (2,5,7.5,10, 13.5,15,20, 25,30,40,50, 75,100 m)
	2000-51T-01B	61° 38' 18"	114° 08' 25"	T (12,14,16, 20,30,50,75, 100 m)
	2000-51M-02A	61° 38' 45"	114° 08' 30"	MET
2	2000-51M-03A	61° 26' 55"	114° 46' 29"	MET
	2000-51T-04A	61° 25' 50"	114° 46' 45"	T (2,5,7.5,10, 13.5,15,20, 25,30,40,50, 56 m)
3	2000-51T-05A	61° 10' 37"	114° 14' 57"	T (2,5,7.5,10, 13.5,15,20, 25,30,40, 56 m)
	2000-51T-05B	61° 10' 16"	115° 14' 00"	T (12,14,16, 20,25,30,40, 55 m)
4	2000-51T-06A	60° 53' 52"	115° 40' 04"	T (Surf,2,5, 7.5,10,12 m)
5	2000-51T-09A	61° 55' 28"	113° 45' 35"	T (Surf, 2,5, 7.5,10,13.5, 15,20,25,30, 40,50 m)
7	2000-51T-10A	61° 59' 57"	114° 29' 24"	T (Surf, 2,5, 7.5,10,13.5, 15,20, 25,30, 40,50,60 m)


Great Slave Lake
Mooring Positions
2000 - 2001
Yellowknife
Moraine Bay
Hay River
N
1
2
3
4
5
7
117°
30'
116°
115°
114
113°
62°
61°



CORING GRAND LAKE, NEW BRUNSWICK

ICE JAMS, MIRAMICHI AND SAINT JOHN RIVER, NEW BRUNSWICK
AEIRB STUDY 14146, DR. S. BELTAOS

Technical Operations supported Dr. Beltaos during the period July 4 - July 20. Support consisted of two personnel, a diesel van and the necessary survey equipment to carry out precise levelling and to produce new river transacts. The 26-foot Guide canoe was used for the on-water work.

Personnel departed CCIW on July 4 and drove to the city of Miramichi in New Brunswick, using it as a base of operations from July 6 until July 13. Work included the addition of seven transects across the river—four near the Quarryville bridge and three at the Howard Ferry Crossing. These sites were chosen to fill in gaps of information in areas where ice jams occurred during the 2000 spring ice breakup. Other work included tying in temporary bench marks to Geodetic elevations that were used during the spring breakup and a Thalweg from kilometre 17 to kilometre 38. Another task was a slope survey of the river from kilometre 48 up-river to kilometre 59.1.

On July 14, personnel moved to the Perth-Andover area on the Saint John River and carried out survey work until July 19 before returning to CCIW. The town of Perth-Andover has experienced serious ice jams in the past and this work will help to understand the causes and possible solutions. Fourteen transacts across the Beechwood Reservoir were completed and tied in to Geodetic elevations.

RESEARCH SUPPORT BRANCH

MACROPHYTE SAMPLING, BAY OF QUINTE
GREAT LAKES LABORATORY FOR FISHERIES & AQUATIC SCIENCE,
M. STONEMAN
RSB STUDY 12631, S.B. SMITH

A study led by M. Stoneman of GLLFAS was supported by the Technical Operations Dive Unit at a number of sites in the Bay of Quinte area during late August. The level of support included both diving gear and personnel. D. Gilroy of Tech. Ops. acted as dive officer during the week of diving. The study plan called for two weeks of sampling; however, due to a busy dive schedule, only one week of support could be given. The deep sites were sampled during the first week using divers and the shallow sites were sampled the following week via snorkeling.

The general process for the work involved the sounding boat running echotrace lines with a Lowrance X-16 sounder to locate macrophytes and then placing marker floats along the echotrace transect to mark the areas for divers to harvest the macrophytes. The dive boat then went to the markers and randomly threw three 50 cm x 50 cm quadrants in the area of the float. The diver then harvested all of the macrophytes within the quadrant and returned them to the boat. Each quadrant was collected as a separate sample from each of the marker floats along a given transect.

At the first transect two divers were in the water to collect the macrophytes. This method proved to be uneconomical on air consumption so a decision was made to put one diver in the water at each site. The macrophytes were taken back to the CWS field station on Point Traverse to be dried and processed for later analysis.

During the week a total of 7 sites was sampled—3 at Trenton, 2 at Belleville and 2 at Conway. The survey was run out of Picton and went very well. The snorkeling work the following week also went very well and all of GLLFAS and University of Toronto personnel involved in the survey were pleased with the work.

BOTTOM SEDIMENT CONTAMINANT SURVEY, TRENTON, ONTARIO
RESTORATION PROGRAMS DIVISION, ECB-OR, H. BIBERHOFER
RSB STUDY 12631, S.B. SMITH

Technical Operations supported this project by assisting with the collection of a set of bottom sediment samples in the Western end of the Bay of Quinte near the town of Trenton, Ontario. This survey will identify the presence of a contaminant inventory at

depths in the bottom sediments. Analyses will be done for compounds historically released in the area or found present in previous surveys. Climate change models predict lower water levels in the Great Lakes and therefore the probable requirement for dredging at some later date. This data will be of interest to any future proponent of dredging in the Trenton area.

The PELICAN was launched at the public ramp in Belleville and made the transit to the Trent River where sampling began. Twelve sites were visited in the river and the western end of the Bay. Two sediment cores were required from each site—one retained for x-radiography and the other to be sectioned. The cores to be sectioned were extruded of the top 5 cm and then at 10 cm intervals to the bottom of the core. All cores were measured and photographed. PONAR grabs were done at sites where cores could not be collected.

An additional task was accomplished while the field party was in the Trenton study area: Shipek samples were collected from fourteen sites to ground truth data from the RoxAnn survey conducted earlier in the season for Dr. N.A. Rukavina, AEMRB Study 12218. Each grab was photographed and sampled for the top 3 cm.

BAY OF QUINTE CORE SITES
NAD 83 Zone 18

STATION	EASTING	NORTHING
1	295199	4885604
2	295384	4885730
3	296159	4885360
4	297131	4885586
8	294555	4885836
9	295782	4885376
10	294216	4886424
11	293581	4886942
12	296661	4885408

BAY OF QUINTE SHIPEK SAMPLE POSITIONS
NAD 83 Zone 18

STATION	EASTING	NORTHING
1	E294420	N4886010
2	E294735	N4885723
3	E295096	N4885231
4	E295407	N4885898
5	E296172	N4885781
6	E295737	N4885650
7	E296142	N4885348
8	E295627	N4884348
9	E296304	N4885256
10	E296767	N4884970
11	E292930	N4883028
12	E294948	N4885642
13	E295783	N4884191
14	E294290	N4886268

CORING, COLLINS BAY
FEDERAL PROGRAMS, ENIVRONMENTAL PROTECTION BRANCH
DR. P. MUDROCH
RSB STUDY 12631, S.B. SMITH

Technical Operations supported Dr. Mudroch by collecting sediment cores in Collins Bay in May. Collins Bay was scheduled to be dredged this year and further background information was required prior to the dredging process. This sampling was a continuation of the field work which began in November 1999. Hydrolab profiles were taken at various locations throughout the harbour. Approximately 20 casts were completed. Two benthos cores were then taken—one in the channel and one outside the channel, using a Brown's corer. Both cores ranged between 70 - 80 cm in length. The cores were sub-sectioned into 5 cm sections.

SEDIMENT CORE COLLECTION, JOYCEVILLE, ONTARIO
FEDERAL PROGRAMS, ENIVRONMENTAL PROTECTION BRANCH
DR. P. MUDROCH
RSB STUDY 12631, S.B. SMITH

Technical Operations supported this survey by assisting with the collection of core samples from a marsh area adjacent to the Joyceville Penitentiary near Joyceville, Ontario and from the River Styx section of the Rideau Canal directly downstream of this marsh. The core samples were required to identify any areas which may have become contaminated by heavy metals leaching from a landfill on the penitentiary property.

Two cores were collected from the marsh by pushing core tubes into the sediment by hand. The cores penetrated the marsh sediment and into the clay layer below and were both approximately 30 cm long. The launch PELICAN was launched from the river bank on the penitentiary property. Four more cores were collected from the River Styx within 20 metres of the river bank by pushing the Tech. Ops. corer into the bottom. One core was collected upstream of the marsh and the other three approximately 50 metres apart downstream of the marsh outlet.

The cores were extruded in 5 and 10-centimetre intervals and split for metals and particle size analysis.

SEDIMENT CORE SAMPLES, OTONABEE RIVER AND RICE LAKE
FEDERAL PROGRAMS, ENIVRONMENTAL PROTECTION BRANCH
DR. P. MUDROCH
RSB STUDY 12631, S.B. SMITH

Dr. Mudroch was supported during the month of June by collecting sediment core samples from the Otonabee River and Rice Lake. The sediment samples were collected for intercomparison studies of metals and organics from data collected during the summer of 1992. Nineteen stations were visited on the lake and river during the two days actually spent sampling. All cores were subdivided into 5 cm sections and stored for delivery to AEMRB at CCIW and Phillips Environmental Lab in Burlington. Samples were collected from the following positions:

Station #1 (028) N4902880, E712555 located on the Otonabee River at mile 82.8 on the right bank at the mouth of the inlet downstream of Cavan Creek.

Station #2 (991) N4899145, E711448 located on the Otonabee River on the left bank at mile 80.1 at the mouth of the bay downstream of Wallace Point.

Station #3 (986) N4898644, E718237 located at mile 76.1 on the Otonabee River on the left bank at the mouth of the inlet downstream of Bensfort Bridge.

Station #4 (941) N4894122, E720782 located at mile 70.6 on the Otonabee River on the left bank of the river at the inlet into the cattail marsh.

Station #5 (917) N4891628, E723073 located at the southwest tip of Spook Island in Rice Lake.

Station #6 (921) N4892180, E726680 located at the western end of Golden Beach Marina on the South side of Rice Lake east of Goose Creek.

Station #7 (948) N4894868, E727456 located at the eastern tip of Idylwilde Pt on the Southern side of Rice Lake.

Station #8 (969) N4896958, E730405 located at the passage between Shearer Point and White Island on the Eastern shore of Shearer Point, West of the southern tip of White Island.

Station #9 (975) N4897568, E731455 located at the point of land at Dunnette Landing. The point of land is man-made and appears to have been an old abandoned dock. Dunnette Landing is located South of White Island on the Southern shore of Rice Lake.

Station #10 (989) N4899051, E731990. located at the Eastern end of Alpine Resort on the South shore of Rice Lake. This location is also South of White Island. Alpine Resort is the second marina East of Alderville Indian Reserve.

Station #11 (366-063) N4906353, E736592 located Asphodel Heights (Mile 55.8 of the Trent mileage system) on the North shore of Rice Lake East of Ouse River. The station is situated in front of a launching ramp at the North end of the dredged channel as it passes through a cattail marsh.

Station #12 (995) N4899602, E727701 located on the Northern shore of Rice Lake, North of Sugar Island and East of Serpents Mound Provincial Park. There are two marinas located at the site and the samples were collected at the Western abandoned marina in a man-made channel.

Station #13 (996) N4899521, E726163 located at the marina located on the Northern shore of McGregor Bay. McGregor Bay is situated North of Serpents Mound Provincial Park.

Station #14 (967) N4896635, E724391 located at the Eastern tip of Herkimer Point at the edge of the cattail marsh. Herkimer Point is on the Northern shore of Rice lake South of Hiawatha Indian Reserve.

Station #15 (925) N4892334, E719701 located at the private marina on the Northern shore North of Cow Island. The marina is situated East of the submerged cables as they enter Rice Lake.

Station #16 (907) N4890580, E717226 lLocated at Northern side of the bay North of Wallace point. The site was located close to the stream as it enters the bay on the Northwest shore.

Station #17 44° 06' 10.2" N., 78° 18' 06" W. located at the Western end of Rice Lake. The station is mid-lake Northwest of Ley Point.

Station #18 44° 10' 15.6" N., 78° 10' 10.2" W. located in the Central Basin of Rice Lake. Station is mid-lake Northwest of Idylwilde Point.

Station #19 44° 14' 30.6" N., 78° 05' 09.6" W. located at the Eastern end of Rice Lake Northwest of Margaret Island and Northeast of Grasshopper Island.

HABITAT STUDIES, PORT WELLER, NORTHERN LAKE MICHIGAN
GREAT LAKES LABORATORY FOR FISHERIES AND AQUATIC SCIENCES,
J. FITZSIMONS
RSB STUDY 12631, S.B. SMITH

This project is 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). Technical Operations provided divers, diver equipment and underwater video support to this study. The long-term objectives of the work include:

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

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

3. Evaluating fish habitat restoration methods.

<u>Pt. Weller/Stoney Creek</u>

Spring sampling of egg collectors and fry traps took place on three occasions during April/May at Pt. Weller. The site is located at the end of the East arm of the East side pier. Stoney Creek shoal is located three kilometres North of Fruitland Road.

STATION	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
Pt. Weller	43° 14' 40"	79° 12 26"	4789519.	645541.
Stoney Creek	43° 15' 35"	79° 40' 43"	4790488.	607257.

Lake Michigan

Historically Lake Michigan has had the highest production of lake trout of all the Great Lakes. Nearly half the catch came from the Northeast section of the lake—the area of study. Revised stocking strategies as well as the establishment of "fish refuge zones" have not produced the anticipated increase in natural reproduction. Current research suggests that the reason for the lack of lake trout recruitment is the excessive mortality which occurs between egg deposition in the fall and the first year of life. In 1999, numerous areas were visited and adult numbers measured in an attempt to characterize historical spawning reefs. It is hoped that examination of a number of these sites will provide data that will help identify potential bottlenecks in lake trout production and their relative importance.

It has long been speculated that egg and fry predation is an important contributing factor related to the lack of natural production by lake trout in the Great Lakes including Lake Michigan. This problem may be increasing due to recent addition of gobies and rusty crayfish to spawning reef fauna that already included native egg predators such as sculpin and crayfish. Modelling efforts have been undertaken; however they have been hampered by the lack of field verification. To address the impacts of egg and fry predators on lake trout recruitment in Lake Michigan, researchers have proposed to measure egg, fry and predator abundance at a number of nearshore and offshore spawning reefs in Northeastern Lake Michigan. Egg deposition and fry emergence at selected sites, relative to existing predator abundances and levels of physical disturbance will be assessed.

Installations

A study led by John Fitzsimons of GLLFAS was supported by the Technical Operations Dive Unit. The study is part of a joint United States and Canada fisheries study which involves placing Lake Trout egg traps and temperature loggers on spawning shoals of three distinctive types—inshore, nearshore and offshore. At each site, half of the installed nets were covered with a course mesh lid, designed to exclude predators. The traps will be collected later this year for analysis. The level of support included both dive gear and personnel. D. Gilroy of Tech. Ops. acted as dive supervisor and oversaw the diving practices of CCIW divers as well as Michigan Department of Natural Resources divers.

DIVER SUITED UP AT LITTLE TRAVERSE BAY, MICHIGAN

On September 18th, D. Gilroy along with B. Williston of DFO travelled to Charlevoix, Michigan with the CCGL PEEWEE. The study leader, J. Fitzsimons of GLLFAS, drove another vehicle to Michigan and arrived late that same night.

On September 19th, the field party met at the Michigan DNR station in Charlevoix to discuss the day's work with their divers. High winds on Lake Michigan prevented any work on the lake. Alternate sites had been chosen in nearby Lake Charlevoix in case of high winds. A total of three dives were completed by J. Fitzsimons, GLLFAS; J. Jonas MDNR and R. Claramunt, Little Traverse Band of Odawa Indians. The sites were investigated that day. Traps would go into these sites later in the week.

The next day the entire field party departed the DNR Station for a site at Little Traverse Bay. All diving was completed from the PEEWEE. All divers were in the water to place the traps on a crib very close to the Western shore of the bay. It took about 2 hours to bury the traps. Video of the site was then taken by D. Gilroy. The boat was loaded back onto trailer and the field party drove to Ironton to launch the boat at Lake Charlevoix. Again all divers were in the water to deploy the traps off a shoal near Stoney Point on Lake Charlevoix. Video was taken again after the installation was complete.

The next day, the second site in Lake Charlevoix was too rough to dive. The team packed up and drove to another site in Grand Traverse Bay. Permission was granted by the local Indian band to launch the boat at their marina. One set of traps was placed in a shoal known as New Mission. All the divers participated and video was taken after the installation.

Friday morning the divers met back at Ironton to place some traps at the shoal near Hemingway Point on Lake Charlevoix. The traps were placed by three divers (Gilroy, Fitzsimons and Jonas). Again video of the site was taken after the installation. The field party departed the dive site just before lunch to unload some of the gear and the boat at the DNR Station. B. Williston and D. Gilroy departed for Canada shortly after 1300 hours. J. Fitzsimons departed later in the other vehicle. The boat was left in Michigan for the following week.

The following week the first two days were spent at CCIW waiting for a window of weather so the offshore sites could be done. Gilroy, Williston and Fitzsimons left for Michigan on Wednesday of the second week in hope of working Thursday. On Thursday morning the CCIW dive team met the DNR support crew at the Charlevoix Coast Guard Base to go to the offshore site aboard the Michigan DNR boat STEELHEAD. The STEELHEAD is a 65-foot vessel similar to the CCGC SHARK. When the dive team arrived on site the weather was deteriorating rapidly. Once in the water, D. Gilroy cancelled the dive due to rough weather. No traps were set and the STEELHEAD returned to Charlevoix. The weather was looking bad for the next day as well so the field party left some of the gear in Michigan for a third try later the next

week. No TOS support could be provided the following week because of a busy dive schedule. The traps were finally totally installed the week of October 9 by both MDNR and GLLFAS personnel.

Retrievals

In September, DFO, TOS and Michigan DNR divers identified and installed egg collection nets at 7 sites in Lake Michigan and 2 sites in a connected lake, Lake Charlevoix.

Between November 26th and December 3rd, D. Gilroy and B. Gray, TOS, J. Fitzsimons and B. Williston, DFO, J. Jonas, Michigan DNR and R. Claramunt and P. Oneill, Little Traverse Band of Odawa Indians visited and retrieved the gear at 8 of the 9 sites. The field crew split into two groups and utilized the PEEWEE for nearshore work and the DNR boat the STEELHEAD for offshore work. At two sites, in Lake Charlevoix and site crib #1, 30 nets were covered with a fine mesh lid and left in the substrate over winter.

GLLFAS HABITAT STATION POSITIONS

DATE	AREA	SITE	LATITUDE N.	LONGITUDE W.
Dec. 2	Lake Michigan	Hog Island Shoal	45° 43' 34"	85° 20' 47"
Nov. 29	Lake .Michigan	Dahlia Reef	45° 37' 35"	85° 12' 36"
Nov. 29	L. Michigan	Fisherman's Reef	45° 17' 55"	85° 21' 16"
Dec. 14	L. Michigan	Middle Ground Shoal	45° 28' 38"	85° 41' 02"
Nov. 27	Grand Traverse Bay	New Mission Reef	45° 04' 23"	85° 34' 27"
Nov. 27	Little Traverse Bay	Crib #1	45° 25' 26"	85° 56' 24"
Nov. 29	Little Traverse Bay	Bay Harbour	45° 22' 20"'	84° 59' 52"
Nov. 28	L. Charlevoix	Hemmingway Point	45° 16' 02"	85° 10' 07"
Nov. 28	L. Charlevoix	Stoney Point	45° 15' 36"	85° 07' 20"

ZEBRA MUSSEL SURVEY, BAY OF QUINTE
GREAT LAKES LABORATORY FOR FISHERIES & AQUATIC SCIENCES,
R. DERMOTT
RSB STUDY 12631, S.B. SMITH

On October 23, a TOS dive team (Breedon and Don) travelled to the Bay of Quinte to support the GLLFAS zebra mussel survey. The purpose of the trip was to compare random bottom samples from nineteen sites with samples collected during previous surveys. Results will indicate any changes in distribution and population of zebra mussels within the Bay of Quinte.

Geographic station positions were moved as required in order to achieve the proper depth for sampling. Differential GPS was used with datum WGS-84.

The dive team returned to CCIW on Thursday, October 26.

STATION POSITIONS
BAY OF QUINTE ZEBRA MUSSEL SURVEY

SITE	STN.	DEPTH	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
Indian Pt.	2A	8m	44° 06.5431'	77° 51.5439'	4885665.	351224.
	2B	3m	44° 06.4855'	77° 51.5707'	4885560.	351187.
Conway	3A	8m	44° 06.1063'	77° 55.4242'	4884896.	346028.
	3B	3m	44° 06.1063'	77° 55.4431'	4884976.	346004.
Glenora	4A	8m	44° 02.6134'	77° 03.6538'	4878774.	334890.
	4B	3m	44° 02.5877'	77° 03.7231'	4878730.	334794.
Hogsback	5A	8m	44° 07.9113'	77° 03.9334'	4888603.	334760.
	5B	3m	44° 07.8828'	77° 03.7944'	4888534.	334946.
Foresters	6A	8m	44° 10.6245'	77° 04.2262'	4893625.	334502.
Island	6B	3m	44° 10.7056'	77° 03.8567'	4893762.	334994.
Big Island	7A	3.4m	44° 07.8036'	77° 16.6875'	4888842.	317751.
	7B	3m	44° 07.3843'	77° 16.1415'	4888045.	318459.
	7C	2m			4888037.	318456.

SITE	STN.	DEPTH	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
Muscote Bay	11	2m	44° 05.7069'	77° 17.5457'	4884993.	316499.
Potter Creek	8A	3.7m	44° 08.1000'	77° 25.5189'	4889733.	305991.
	8B	3m	44° 08.1800'	77° 25.5232'	4889877.	305995.
Indian Island	9	2.5m	44° 04.4197'	77° 33.9682'	4883254.	294515.
Trident Pt.	12	2.4m	44° 09.2068'	77° 12.9940'	4891304.	322747.
Makatewis Shoal	13	3m	44° 06.6587'	77° 29.6756'	4887226.	300370.

UNDERWATER VIDEO SURVEY, MIDLAND
FISH HABITAT MANAGEMENT, L. RUEMPERT
RSB STUDY 12631, S.B. SMITH

An MOU was agreed upon between Fish Habitat Management, DFO and Technical Operations, RSB, NWRI to provide diving and digital video support. Detailed sidescan sonar surveys in the Midland area of Severn Sound located numerous deposits of sunken logs. Many of these logs were salvaged by a private contractor during the autumn of 2000. Many of the sunken logs are embedded into the sediment and there was concern that the resuspension of sediments from the removal of these logs would effect the water quality. The purpose of this underwater survey was to document the Midland Bay site prior to the salvage operation and again after completion. Video records and accurate positioning of the embedded logs provided the Severn Sound RAP the information to monitor the salvage contractors.

A TOS dive team travelled to Midland in May. At the Severn Sound RAP office, a meeting was held to organize a work plan. In attendance were Ms. L. Ruempert, FHM, CCIW, Mr. K. Sherman, Severn Sound RAP and TOS divers. After viewing sidescan records and listening to the requirements of the program, it became apparent to the dive team that MURV was needed. The survey priority was to obtain video transects of two sunken log sites and an area of artificial habitat structures.

The digital video camera was rigged to operate in the remote mode and towed with the launch PINTAIL. One transect line was completed when the underwater lights malfunctioned.

During the single transect line ten logs were observed of which five were embedded. This trial run reaffirmed that the proper way to support this survey was to use MURV with accurate DGPS along a transect line. Copies of the sidescan records were provided to calculate the transect lines required. A VHS copy of the video tape was made and sent to Ms. L. Ruempert

TOS divers returned to the Midland area of Severn Sound in June. Detailed sidescan sonar surveys obtained in previous years located numerous deposits of sunken logs and were used to calculate transect lines. The original plan called for the placement of buoys at selected positions, towing MURV between them. Four areas along the North shore of Midland Bay were prepared in this manner. Additional video was obtained in the Western section of the harbour near known fish enclosures installed by a local angling club. All survey work took place in the H2 area of site overview.

The PINTAIL was utilized to support this survey. After all equipment was connected and functional, the PINTAIL went to the site on sidescan sonar sheet (SV1-5) where two pipelines (from the TRW plant) and a good deal of logs were evident on the sidescan record. The PINTAIL was anchored upwind of pipeline #1 co-ordinates. This site was used to confirm the positions of the previous sidescan survey and the PINTAIL DGPS. MURV was lowered to the bottom and many good targets appeared on the sonar screen. MURV investigated an area of 30 m in diameter and investigated and video-taped logs, the pipe and a cement piling. All equipment worked well.

On June 14th the TOS crew installed two buoys (A and B) at site SV2-3. Since the wind was from the northeast, MURV was deployed upwind of buoy B. MURV was towed past buoy B to buoy A at the slowest speed possible. After running this line it was determined that this method of video was not going to provide the desired results. The tannic nature of the water meant that MURV must be kept close to the bottom. The depth of MURV was difficult to control with the short range of vision. Another plan of action was made.

The DGPS positioning and the sidescan sonar information was used to anchor the boat upwind of a site that would supply a large number of anthropogenic targets. An area to the East of buoy A was chosen. The boat was anchored and the position of the boat recorded. MURV was lowered to the bottom and several targets were identified. MURV was navigated to the target and video and notes were taken. This worked well. The video was good quality and positions were recorded. After this site was video-taped, two additional sites were chosen from the other sonar records. Two dives were made at sites SV2-3 and SV2-5 when a multiple target site was found. Of interest on these dives was the soft nature of the sediment and the fact that the large size logs seemed to be buried beneath the surface. The divers video-taped with the hand-held digital camera these sites as best the visibility would allow. Near the end of MURV's last dive, electrical problems started to occur. This was probably caused by overheating of the surface unit (it was a warm day) or moisture in the camera area. MURV was dried out

that evening and worked well the next day. This completed the survey work at the North end of the harbour. The next day, the West end of the harbour was examined. Using directions provided by Keith Sherman, the crew attempted to locate the area where the fish structures offshore of Gawly Park were situated. When the team arrived at this area there was a series of white buoys and small red poly floats over a large area. Assuming some kind of experiment was taking place, a decision was made to anchor further North of the area but still within the H2 survey site. As with the day before, the PINTAIL was anchored, the position noted and MURV was sent to the bottom. At site WS1 as well as two others (WS-2 and WS-3) targets were video-taped. Keith Sherman met the TOS crew at the marina before leaving and the completed survey results were presented to him.

A future survey to repeat the video-taped tracklines after the logging contract was completed never materialized. The logging company extended the duration of the contract, causing delays in scheduling until finally the end of the field season arrived. An attempt will be made in the spring of 2001 to complete the survey.

ANCHOR POSITIONS
WGS-84

DATE	SITE	NORTHING	EASTING	LATITUDE N.	LONGITUDE W.
June 13/00	SV1-5	4956885	589204	44° 45' 35"	79° 52' 22"
June 13/00	SV2-3 Transect Start	4956850	589380	44° 45' 34"	79° 52' 14"
June 14/00	SV2-3 Transect End	4956930	589190	44° 45' 36"	79° 51' 55"
June 14/00	SV2-3	4956944	589237	44° 45' 37"	79° 52' 20"
June 14/00	SV2-5	4956929	588733	44° 45' 36"	79° 52' 43"
June 14/00	SV1-3	4956554	589659	44° 45' 24"	79° 52' 01"
June 15/00	WS-1	4957757	587721	44° 46' 04"	79° 53' 29"
June 15/00	WS-2	4957968	587917	44° 46' 10"	79° 53' 20"
June 15/00	WS-3	4958042	588242	44° 46' 13:	79° 53' 05"

WOLFE ISLAND WATER QUALITY STATION REPAIRS
RESTORATION PROGRAMS DIVISION, ECB-OR, H. BIBERHOFER
RSB STUDY 12632, B.H. MOORE

On July 24, a TOS Dive Team travelled to Kingston to inspect and repair the water intakes of the Wolfe Island Water Quality Station. This station is part of the Interconnecting Channels Monitoring Program.

An underwater video was taken of the pump table before the maintenance. The pump table, located at the bottom of the nearshore slope in 25 ft. of water, was stabilized with reinforcing rods hammered into the sediment. A ¼" stainless wire was installed between the pump table and the upper concrete cap to prevent any movement of the table down the slope. Three intake pumps were changed. The new pumps were mounted on the pump table. Pump #1 is on the upstream side, pump #2 in the middle and pump #3 on the downstream side. Hoses were identified using air from shore. The hoses were numbered with tags and matched with the correct pump power switches on shore.

HOSE NUMBER SETUP

INSHORE	PUMP	OFFSHORE	INTAKE
271	1	273	263
272	2	275	265
270	3	274	264
269	spare	268	

On the second day, divers worked offshore at the intakes. The PINTAIL was launched at Treasure Island marina and steamed 45 minutes to Banford Pt. Divers entered the water at the concrete cap nearshore and swam along the hose bundle out to the intakes. The hose bundle (four hoses) was laying on the surface of the sediment and appeared to be in excellent condition. There were four intakes in the 50' depth. Divers collected sediment samples from a position 500 metres upstream of the water intakes. Divers filled four 500 ml jars with samples from the water sediment interface.

The dive team returned to CCIW on July 28.

Intake locations from downstream to upstream.

Intake #1 is a single intake wand at 35' water depth with a spar type subsurface float. The shackle between anchor and the subsurface float was almost worn through and was replaced. The intake wand was cleaned.

Intake #2 is a single intake wand at 35' water depth with a spar type subsurface float. Intake wand was cleaned. Hardware was found in good condition.

Intake #3 is a multi-depth intake, between 25' and 48' water depth with a standard 500 lb. subsurface float. All the intake wands were cleaned. Hardware was found in good condition.

Intake #4 was a spare mooring without an intake hose. This mooring was removed.

Intake positions: (Datum WGS-84)

#1	401211.3 E	4895588.5 N
#2	401208.2 E	4895587.3 N
#3	401204.1 E	4895587.4 N
Sediment sampling position:	400710.0 E	4895590.0 N

COMMON-USER SUPPORT
RSB STUDY 12633, M.R MAWHINNEY

RIGGING SHOP

The Rigging Shop was operated by two shop personnel with the assistance of other Technical Operations staff members.

Rigging Shop staff are responsible for the care of shop facilities, warehouse storage, outside storage shed and long-term outside storage areas as well as maintaining all mooring equipment, buoys, generators, power tools, winches, forklifts, vehicles and various other pieces of research equipment.

Rigging Shop staff are responsible for the delivery of scientific equipment to major ships and field programs throughout the Great Lakes Basin and the St. Lawrence River. They erect towers, operate boats, forklifts and a heavy crane truck while assisting with scientific studies when required.

FIELD STORES

Field Stores is operated for the use of staff within the National Water Research Institute. Staff from other government departments and organizations such as Fisheries and Oceans Canada, EC-Ontario Region, Provincial and Municipal governments and universities also use the stores facility when authorized by the

Manager, Technical Operations Services and approved by the Executive Director, NWRI.

Field Stores personnel issue project chiefs and study leaders with a variety of specialty equipment such as safety clothing, sediment and water samplers, GPS, survey equipment, pH and conductivity meters, cameras and vehicles. On return, items are inspected for damage, repaired if necessary and re-issued. Repairs are made in house or at outside shops. A computer inventory database has been a more efficient service and record system. Over five hundred requisitions were processed during the season, from single items to 150 items for the CCGS LIMNOS.

During the 2000 field season, 25 vehicles were scheduled and issued through Technical Operations Stores. The vehicles included one mini-van, two sedans, four station wagons, four dual-wheeled pickup trucks, four 4 x 4 pickups, eight full size vans, one 3-ton truck and a large crane truck. Numerous trailers were also utilized during the field season for various tasks. An average 150 bookings were made each month for vehicles.

VEHICLE SUMMARY

The field season was extremely busy again this year. Mechanical downtime on any vehicle was very minimal.

Vehicle support was utilized for several different operational functions which ranged from the transportation of various types of scientific samples and equipment to the movement of personnel to and from common and remote field sites and for shipboard operations.

The Institute saw the replacement of some aging vehicles due to the need for extensive mechanical work and their poor overall condition. The Institute saw three more of its staff cars introduced to the closed loop natural gas system. This system will start on regular gasoline and immediately switch to natural gas. The same applies when the natural gas diminishes to a certain point—it converts to regular gasoline. This looped system is totally self sufficient and the operator has no concern about manually switching from fuel to fuel and having the vehicle stall out in the process of switching. The driver has only to drive the vehicle. The Institute also saw the introduction of three full-size diesel cargo vans, one extended cab 4 x 4 pickup that operates on propane as well as regular fuel, and a Ford Taurus station wagon that also operates on natural gas and regular gasoline.

A.R.I. Canada "Automotive Rentals Incorporated" are still handling all vehicle fleet repairs and billing. A.R.I. is responsible for the upkeep and maintenance of all vehicle records such as mileage, fuel consumption, incidentals and repair costs although

vehicle records are still kept internally by Technical Operations Services. Vehicle mileage is reported to A.R.I. on a monthly basis. This company continues to be a very efficient organization who have cut considerably the amount of time and effort spent on monthly paper work for each vehicle in the fleet.

The extensive geographical area covered this field season ranged from Miramichi, New Brunswick, Halifax, Nova Scotia, Prince Edward Island, Grande Prairie, Alberta to Hay River, NWT. Some U.S. destinations included Nashville Tennessee, Boston, Massachusetts and various areas of New York State and Michigan.

From April 1 to December 1, 2000, RSB vehicles travelled over a combined distance of 404,000 km. The vehicle fleet at the Institute will see over one million kilometres travelled this fiscal year. The above mileage was accomplished virtually accident free!

DIVING OPERATIONS
RSB STUDY 12634, F.H. DON

The Diving Operations Unit of Technical Operations Services provided national and international support to various scientific studies in areas of diver certification, inspections, installations and retrievals of hardware, sample collection, videography, television surveys with video documentation, equipment demonstrations/trials, search and recovery, lectures and diver training. The Diving Operations Unit supported 11 divers at CCIW, Burlington. A total of 429 hours (accident free) were logged in support of scientific projects for: NWRI EHD, ECB-OR; RPD, ECB-OR; CCG and GLLFAS, DFO. A total of 64 hours were logged on MURV—the remotely operated miniROVER underwater camera system. MURV is used for deep water and long duration video recording. Projects have included wreck mapping, sonar surveys, documentation of geological formations and live educational documentaries.

The Dive Shop video studio has the capability to edit and copy all raw footage for scientific purposes into any desired format. The Diving Operations Unit has a complete inventory of modern diving and diver support equipment which, when used and operated by highly skilled TOS divers can complete even the most difficult sub-sea operations. Using MURV equipped with forward looking sonar, TOS dive teams recovered four lost scientific moorings.

The Head of the Diving Operations Unit (F.H. Don) represented research/scientific diving as a member of the Canadian Standards Association Sub-committee on Diving Competency as Chairperson of the Contaminated Environment Working Group. Mr. Don is Chairperson of the Federal Interdepartmental Committee for Diving Safety. The annual meeting of the Department of Environment Diving Safety Committee was held in April of 2000 in Cornwall, Ontario.

Projects supported during 2000 included:

STUDY #			STUDY TITLE
12214	Murphy	AEMRB	Lake Biwa, Japan
12225	Rukavina -	AEMRB	Hamilton Harbour, Cornwall and Amherstburg
12242	Murthy	AEMRB	Lake Michigan
12243	Skafel	AEMRB	WAVES Tower, Hamilton Harbour/Lake Ontario
12245	Hamblin	AEMRB	North Channel
12247	Coakley -	AEMRB	Lake Erie
12631	Smith	RSB	Outside Agencies: GLLFAS, DFO Fitzsimons, Pt. Weller, Northern Lake Michigan GLLFAS, DFO, Dermott, Bay of Quinte GLLFAS, DFO, Stoneman, Bay of Quinte GLLFAS, DFO, Cairns, Cootes Paradise Fish Habitat Management, DFO Ruemper, Severn Sound CCG, DFO, Hull inspections/repairs
12632	Moore	RSB	Great Lakes Surveillance RPD, ECB-OR Biberhofer, Water Quality Station, Wolfe Island

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