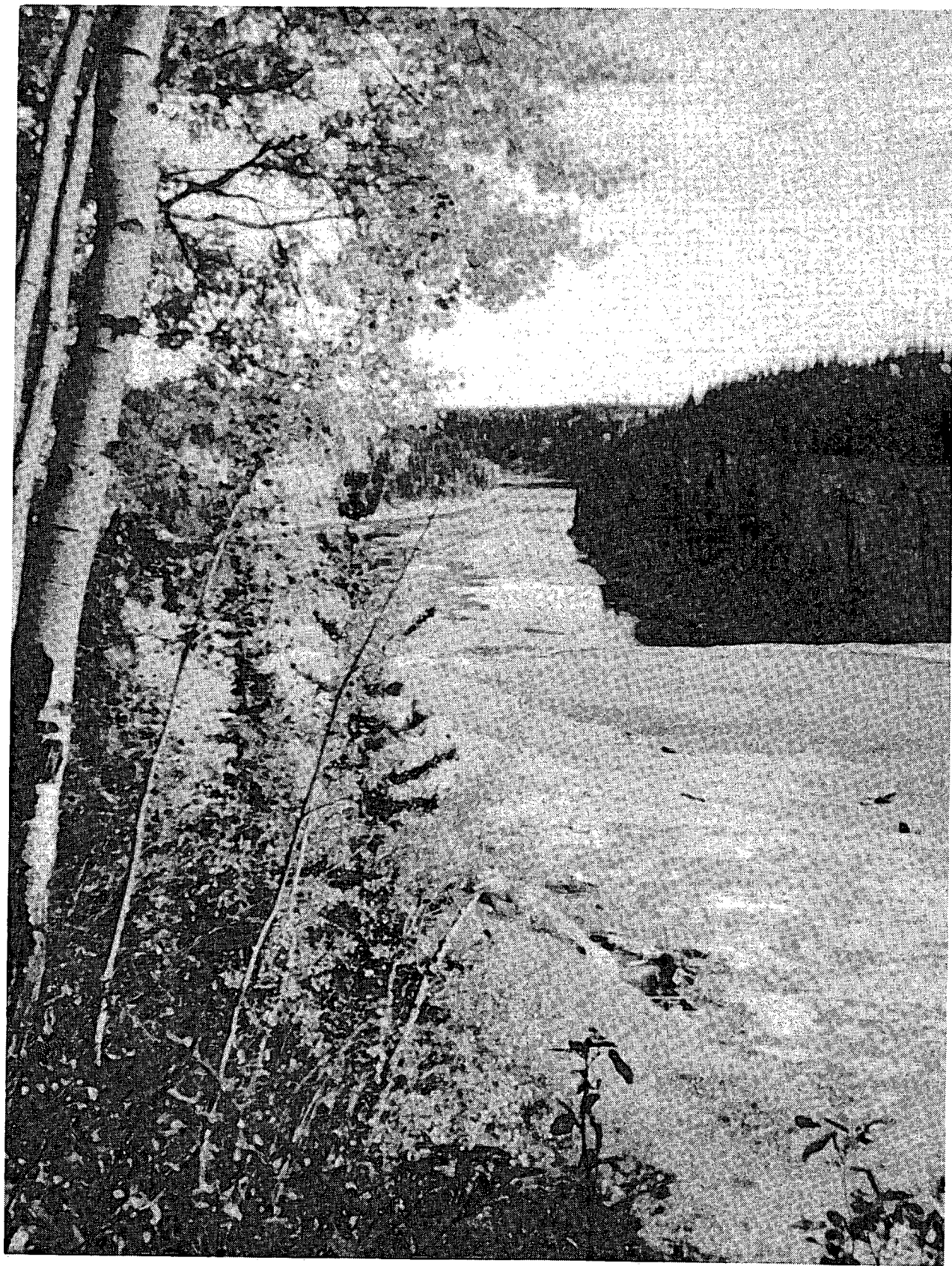
The logo features a stylized sun or moon with wavy lines inside, set against a background of larger wavy lines representing water.

**NATIONAL WATER  
RESEARCH INSTITUTE**

**INSTITUT NATIONAL DE  
RECHERCHE SUR LES EAUX**

**1998  
ANNUAL ACTIVITY SUMMARY  
TECHNICAL OPERATIONS SECTION  
RESEARCH SUPPORT BRANCH  
NATIONAL WATER RESEARCH INSTITUTE**



# TABLE OF CONTENTS

INTRODUCTION.....	1
STAFF LIST.....	2
SHIPBOARD PROGRAMS	
CCGS LIMNOS.....	4
DIRECTOR'S OFFICE	
AIR-WATER EXCHANGE OF TOXIC CONTAMINANTS.....	5
AQUATIC ECOSYSTEM RESTORATION BRANCH	
BIOLOGICAL SEDIMENT GUIDELINES.....	10
BENTHIC COMMUNITY STRUCTURE.....	21
SEDIMENT SURVEY.....	26
ZEBRA MUSSEL EFFECTS.....	33
AQUATIC ECOSYSTEM CONSERVATION BRANCH	
TOXIC METALS, LAKE HURON AND GEORGIAN BAY.....	38
TOXAPHENE SAMPLING, LAKE HURON AND LAKE SUPERIOR.....	44
UV AND MICROBIAL COMMUNITY EXAMINATION, LAKE ERIE.....	53
AQUATIC ECOSYSTEM IMPACTS BRANCH	
METEOROLOGICAL AND TEMPERATURE MOORINGS.....	56
RESEARCH SUPPORT BRANCH	
OPEN LAKES SURVEILLANCE, LAKES ONTARIO AND ERIE.....	60
SHORE PROGRAMS	
NATIONAL LABORATORY FOR ENVIRONMENTAL TESTING	
SAMPLING RIVERS IN ALBERTA, SASKATCHEWAN,	
MANITOBA AND ONTARIO.....	70
AQUATIC ECOSYSTEM RESTORATION BRANCH	
SANDCAP STUDY, HAMILTON HARBOUR.....	72
SEDIMENT REMEDIATION, HAMILTON HARBOUR.....	72
BIOLOGICAL SEDIMENT GUIDELINES SAMPLING.....	73
SANDCAP SEDIMENT CHEMISTRY, HAMILTON HARBOUR.....	74
SEDIMENT REMEDIATION.....	74
POREWATER CHEMISTRY STUDY, ROUYN-NORANDA.....	76
METAL EFFECTS IN SUDBURY AND NORTH BAY.....	76
SEDIMENT TREATMENT.....	78
ABANDONED GOLDMINE TAILINGS SURVEY, NOVA SCOTIA.....	85

<b>AQUATIC ECOSYSTEM RESTORATION BRANCH, continued</b>	
ROXANN SEDIMENT SURVEYS, HAMILTON HARBOUR, SCARBOROUGH, CORNWALL, ONTARIO; PULASKI, N.Y.;	
GRAND HAVEN, MICHIGAN.....	86
COASTAL GEOLOGY.....	87
RIVERBED SEDIMENTATION STUDY.....	88
LAKE REMEDIATION, HAMILTON HARBOUR.....	89
BENTHIC PHOTOSYNTHESIS, LAKE ERIE.....	91
DRIFTER EXPERIMENTS, WESTERN LAKE ONTARIO.....	92
CCIW/NWRI CONTRIBUTION TO EPISODIC EVENTS, GREAT LAKES EXPERIMENT (EEGLE).....	92
PHYSICAL DYNAMICS STUDY, LAKE ONTARIO.....	94
METEOROLOGICAL STATIONS AND THERMOGRAPH MOORINGS, LAKE MALAWI/NYASA, MALAWI, AFRICA.....	94
CESIUM TRACER SAMPLING.....	97
ZEBRA MUSSEL SURVEY, LAKE ERIE.....	98
GROUNDWATER REMEDIATION PROJECT.....	100
<b>AQUATIC ECOSYSTEM CONSERVATION BRANCH</b>	
LONG RANGE TRANSPORT OF AIRBORNE CONTAMINANTS SURVEY, LAKE NIPIGON, ONTARIO.....	105
AIRBORNE ORGANICS SAMPLING, LAKE OPEONGO, ALGONQUIN PARK.....	108
TURKEY LAKES WATERSHED.....	110
PRECIPITATION SAMPLING FOR HALOACETIC ACID.....	114
HALOACETIC ACID SAMPLING, LAKE MALAWI/NYASA, MALAWI, AFRICA.....	115
SEWAGE TREATMENT PLANT SAMPLING, THURSO, QUEBEC.....	115
ESTROGENIC EFFECTS OF INDUSTRIAL AND MUNICIPAL EFFLUENTS ON FISH.....	116
<b>AQUATIC ECOSYSTEM PROTECTION BRANCH</b>	
IRGAROL SAMPLING, HALIFAX, NOVA SCOTIA; SOREL, MONTREAL, QUEBEC.....	117
IRGAROL SAMPLING, VANCOUVER AND VICTORIA, B.C. ....	117
SEWAGE OUTFALL SEDIMENT SAMPLING, VANCOUVER, B.C. ....	117
TRIBUTYLTIN UPTAKE STUDY, SOUTHERN ONTARIO.....	118
MALVERN PARTICLE SIZE SURVEY, KINGSTON POND.....	119
ROADSIDE SNOW SAMPLING, LOCAL.....	119
SEDIMENT RESUSPENSION STUDY, HAMILTON HARBOUR.....	119
SEDIMENT COLLECTION, HUMBER BAY.....	119
HIGHWAY RUNOFF.....	120
STORMWATER DRAINAGE POND SAMPLING.....	120
LONG-TERM MONITORING OF MUSSEL POPULATIONS, LAKE ONTARIO REGION.....	121



<b>AQUATIC ECOSYSTEM IMPACTS BRANCH</b>	
<b>METEOROLOGICAL AND TEMPERATURE MOORINGS,</b>	
<b>GREAT SLAVE LAKE .....</b>	<b>123</b>
<b>MIRAMICHI RIVER.....</b>	<b>126</b>
 <b>RESEARCH SUPPORT BRANCH</b>	
<b>LONG-TERM SENSING SITES (LTSS), CORNWALL REGION .....</b>	<b>127</b>
<b>PRODUCTIVE CAPACITY OF FISH HABITAT.....</b>	<b>128</b>
<b>ROYAL BOTANICAL GARDENS CARP BARRIER.....</b>	<b>129</b>
<b>STREAM CONSERVATION PROJECT MAPPING SURVEY .....</b>	<b>129</b>
<b>WATER SAMPLE COLLECTION .....</b>	<b>130</b>
<b>SEDIMENT SAMPLING, OSHAWA HARBOUR .....</b>	<b>130</b>
<b>WIND-WAVE INTERACTION STUDY.....</b>	<b>132</b>
<b>MINE WASTE TECHNOLOGY PROGRAM, BUTTE, MONTANA .....</b>	<b>134</b>
<b>WATER QUALITY SAMPLING STATIONS .....</b>	<b>137</b>
<b>CONSERVATION STRATEGIES DIVISION, ECB, OR.....</b>	<b>139</b>
<b>VEHICLE SUMMARY .....</b>	<b>140</b>
<b>DIVING OPERATIONS .....</b>	<b>141</b>

## INTRODUCTION

The mandate of the Technical Operations Section, Research Support Branch, National Water Research Institute at the Canada Centre for Inland Waters 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 section are involved in shipboard programs which are carried out from major ships on the Great Lakes and St. Lawrence River and in shore-based field projects which put them into field situations from coast to coast in North America, in 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 section 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 operations, develops within the section 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 editing and manipulation of both analogue and digital video material. Annual diver training and certification courses are also conducted to maintain a high level of competence among Institute 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 the Field Equipment Stores and when required assist as members of field parties.

In the absence of Mr. M.F. Dahl this season—who is on leave without pay for relocation of his spouse to Yellowknife, NWT, Mr. L.M. Benner was added to the staff of Technical Operations. Mr. Benner's skills have proven quite valuable to this section in support of several scientific programs this past season.

This report is intended as an overview of the field activities of this section during the 1998 field season.

STAFF LIST
------------

**RESEARCH SUPPORT BRANCH**

Director (Acting )	P.M. Healey J.A. Bull R.A. Duffield
Secretary	S.R. Mitchell
Administrative Officer	J. McAvella
Administrative Clerk	M.T. Solvason

**TECHNICAL OPERATIONS SECTION**

Head, P.M. Healey	Ann Arbor, Michigan; Prairie rivers
-------------------	-------------------------------------

**OPERATIONS OFFICERS**

M.R. Mawhinney	Ann Arbor, Michigan; Butte, Montana; Rouyn-Noranda, Quebec; Sudbury, Opeongo Lake, Ontario; Vancouver, Victoria, British Columbia
B.H. Moore	OIC CCGS LIMNOS; Great Slave Lake; Lake Michigan; Halifax, Nova Scotia
S.B. Smith	OIC CCGS LIMNOS; Malawi, Africa
F.H. Don	Diving; Lake Michigan; Rouyn-Noranda, Quebec; Cornwall, Sarnia, Ontario; Western Lake Erie; Manitoba; Alberta

**MARINE TECHNOLOGISTS**

E.H. Walker	CCGS LIMNOS; Miramichi River, New Brunswick; Balsam Lake, Ontario; Southern Ontario Rivers
G.G. LaHaie	OIC Turkey Lakes Study Area
J.A. Kraft	CCGS LIMNOS; Lake Michigan; Lake Nipigon; Nova Scotia; Great Slave Lake; Oshawa, Ontario
K.J. Hill	Miramichi River, New Brunswick; Halifax, Nova Scotia
R.J. Hess	CCGS LIMNOS; Oakville, Ontario
B.L. Gray	Diving; Western Lake Erie; Manitoba; Alberta; Rouyn-Noranda, Quebec; Pt. Dover, Ontario; Lake Michigan

**ASSISTANT MARINE TECHNOLOGISTS**

R.D. Neureuther	CCGS LIMNOS; Wildlife Service
M.F. Dahl	On leave without pay for relocation of spouse
C.H. Talbot	Groundwater
T.G.D. Breedon	Diving; CCGS LIMNOS; Lake Michigan; Quebec
J.E. Milne	Hamilton Harbour

**MARINE TECHNICIANS**

D.A.D. Gilroy	Diving; Cornwall, Oakville, Sarnia, Toronto, Pt. Dover, Ontario; Grand Haven, Michigan
L.M. Benner	Diving; CCGS LIMNOS; Sudbury, Turkey Lakes, Ontario

**RIGGING UNIT**

C.J. Lomas	Senior Rigger; Cornwall, Ontario
T.C. Gilliss	Vehicle Maintenance Co-ordinator

**NWRI FIELD STORES**

K.J. Hill	
C.J. Lomas	
T.C. Gilliss	

**STUDENTS**

H.A. Crichton	CCGS LIMNOS; Nova Scotia
M.A. Nelson	CCGS LIMNOS
F. Chen	CCGS LIMNOS
M.K.F. Crichton	CCGS LIMNOS
D.P. Walsh	CCGS LIMNOS, Turkey Lakes
J.W. Schertzer	CCGS LIMNOS

# CCGS LIMNOS

1998 JANUARY							FEBRUARY							MARCH 1998						
SUN	MON	TUE	WED	THUR	FRI	SAT	SUN	MON	TUE	WED	THUR	FRI	SAT	SUN	MON	TUE	WED	THUR	FRI	SAT
				1	2	3	1	2	3	4	5	6	7	1	2	3	4	5	6	7
4	5	6	7	8	9	10	8	9	10	11	12	13	14	8	9	10	11	12	13	14
11	12	13	14	15	16	17	15	16	17	18	19	20	21	15	16	17	18	19	20	21
18	19	20	21	22	23	24	22	23	24	25	26	27	28	22	23	24	25	26	27	28
25	26	27	28	29	30	31								29	30	31				
APRIL							MAY							JUNE						
SUN	MON	TUE	WED	THUR	FRI	SAT	SUN	MON	TUE	WED	THUR	FRI	SAT	SUN	MON	TUE	WED	THUR	FRI	SAT
			1	2	3	4						2			1	2	3	4	5	6
			L. Ont Surveillance									L. Superior			Limnos in Port Colborne for repairs					
5	6	7	8	9	10	11	3	4	5	6	7	8	9	7	8	9	10	11	12	13
CCIW	Schertzer Charlton L. Ontario Moorings			CCIW	CCIW	CCIW	W. Strachan D. Muir Lake Huron Trace Metals Box Core				Samia	Port Colborne	Lake Erie Charlton U of W							CCIW
CCIW	CCIW	Lake Erie Reynoldson				Port Colborne	10	11	12	13	14	15	16	14	15	16	17	18	19	20
								Samia	L. Erie Reynoldson		CCIW	CCIW	CCIW	CCIW	CCIW	Lake Ontario Reynoldson Charlton			CCIW	
19	20	21	22	23	24	25	17	18	19	20	21	22	23	21	22	23	24	25	26	27
Port Colborne		L. Italian Lake Erie Surveillance				Samia	CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	Lake Ontario Reynoldson Charlton			CCIW	
26	27	28	29	30			24	25	26	27	28	29	30	28	29	30				
Samia	Lake Superior D. Muir						CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	L. Erie Charlton Reynoldson					
JULY							AUGUST							SEPTEMBER						
SUN	MON	TUE	WED	THUR	FRI	SAT	SUN	MON	TUE	WED	THUR	FRI	SAT	SUN	MON	TUE	WED	THUR	FRI	SAT
			L. Erie Charlton U of W		4								1			1	2	3	4	5
			Lake Erie Reynoldson		Port Colborne								CCIW			W. Strachan Lake Huron Trace Metals			Samia	
5	6	7	8	9	10	11	2	3	4	5	6	7	8	6	7	8	9	10	11	12
Port Colborne	S. Wilhelm Lake Erie UVB Microbial					Port Colborne	CCIW		Lake Erie Reynoldson				Port Colborne	Samia		Lake Erie Reynoldson				CCIW
12	13	14	15	16	17	18	9	10	11	12	13	14	15	13	14	15	16	17	18	19
Port Colborne	Lake Erie Charlton U of W					Port Colborne	Port Colborne		Lake Erie Charlton U of W				CCIW	CCIW	St. Lawrence R. D. Lean NSERC					CCIW
19	20	21	22	23	24	25	16	17	18	19	20	21	22	20	21	22	23	24	25	26
Port Colborne	Lake Erie Reynoldson					CCIW	CCIW		L. Italian Lake Ontario Surveillance				CCIW	CCIW	Great Lakes Reynoldson					
26	27	28	29	30	31		23	24	25	26	27	28	29	27	28	29	30			
CCIW	St. Lawrence R. D. Lean NSERC						CCIW	Lake Erie Charlton U of W					Samia		Reynoldson					
OCTOBER							NOVEMBER							DECEMBER						
SUN	MON	TUE	WED	THUR	FRI	SAT	SUN	MON	TUE	WED	THUR	FRI	SAT	SUN	MON	TUE	WED	THUR	FRI	SAT
				1	2	3	1	2	3	4	5	6	7			1	2	3	4	5
					CCIW	CCIW														
4	5	6	7	8	9	10	8	9	10	11	12	13	14	6	7	8	9	10	11	12
CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	CCIW														
11	12	13	14	15	16	17	15	16	17	18	19	20	21	13	14	15	16	17	18	19
CCIW	CCIW	CCIW	CCIW	CCIW	CCIW	CCIW														
18	19	20	21	22	23	24	22	23	24	25	26	27	28	20	21	22	23	24	25	26
CCIW		Lake Erie Reynoldson				CCIW														
25	26	27	28	29	30	31	29	30						27	28	29	30	31		
CCIW	Schertzer Charlton Lake Ont Moorings			CCIW	CCIW	CCIW														

NWRI EC-OR NSERC U of T AERB U of W



**SHIPBOARD PROGRAMS****DIRECTOR'S OFFICE****AIR-WATER EXCHANGE OF TOXIC CONTAMINANTS**

UNIVERSITY OF OTTAWA, DR. D.R.S. LEAN

D.O. STUDY 12002, DR. J.H. CAREY

Two cruises were carried out on Lake Ontario and the St. Lawrence River to support this study—July 27 - 31 and September 14 - 18, to measure the air-water exchange of organochlorine contaminants and mercury. On the July 27 - 31 cruise, the CCGS LIMNOS circled the lake in a counterclockwise direction on the 30 to 40 m contour. Several sampling locations were picked by the Study Leader and the vessel stopped to take in situ water samples. The LIMNOS also transited the St. Lawrence River almost as far downstream as Brockville. On the September 14 - 18 cruise, the LIMNOS circled the lake and transited the St. Lawrence River as far downstream as Cornwall.

On both cruises, the air-water exchange of mercury was measured and the overall objectives of this aspect of the research were to: a) measure total gaseous mercury (TGM) during the cruise; b) measure the mercury gradient above the surface of the water; c) calibrate the two-layer model for mercury; and d) develop insights regarding mercury water-air exchange in Lake Ontario and the Upper St. Lawrence River.

Water samples were also obtained for dissolved gaseous mercury, total mercury in surface water, taste and odour, stable isotopes, plankton, organochlorine contaminants and mirex to photomirex on the cruises.

# STATISTICS SUMMARY

CRUISE NO. \_\_\_\_\_

DATE: \_\_\_\_\_

SHIP  
REGION

CCGS LIMNOS  
LAKE ONTARIO and  
ST. LAWRENCE RIVER  
1025.7

CRUISE TYPE Air-Water Exchange of Toxic Contaminants N.MI. STEAMED

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	28	Moorings Established	
EBT/Transmissometer Casts	18	Moorings Retrieved	
Rosette Casts	14	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	15	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls, 64µ	8		
Zooplankton Hauls, 110µ	10		
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples	11		
D.O. Profiles	10		
Water Samples Collected ( Microbiology )	111	Cores Taken, Box	
Water Samples Collected ( Water Quality )	12	Cores Taken, Mini Box	
Water Samples Collected ( D.O. )		Cores Taken, Piston	
Water Samples Collected ( Cond/pH )		Cores Taken, Benthos	2
Water Samples Collected ( TP uf )		Grab Samples Taken, Shipek	
Water Samples Collected ( DGM )	138	Grab Samples Taken, PONAR	
Water Samples Collected ( Taste & Odour )	38	Bulk Centrifuge Samples	
Water Samples Collected ( Total Mercury )	16		
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered ( Chlorophyll a )	60		
Water Samples Filtered ( POC/TPN )		Toxic Organic Air Sample	8 Days
Water Samples Filtered ( Seston )		Mercury Air Sample	8 days
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 ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

## STATION POSITIONS

## LAKE ONTARIO

JULY 17 - 31

STATION NUMBER	LATITUDE N.	LONGITUDE W.
403	43° 36' 18"	78° 12' 31"
982	43° 22' 04"	79° 33' 12"
983	43° 24' 01"	78° 19' 54"
984	43° 18' 26"	77° 23' 26"
985	43° 36' 48"	76° 16' 59"
986	43° 49' 48"	76° 37' 37"
987	43° 54' 51"	78° 13' 17"
988	43° 46' 58"	79° 02' 29"
998	43° 24' 54"	79° 22' 46"
1068	44° 00' 39"	76° 29' 58"

## STATION POSITIONS

## ST. LAWRENCE RIVER

JULY 27 - 31

STATION NUMBER	LATITUDE N.	LONGITUDE W.
66	44° 30' 21"	75° 46' 51"
67	44° 13' 30"	76° 10' 13"

## STATION POSITIONS

## LAKE ONTARIO

SEPTEMBER 14 - 18

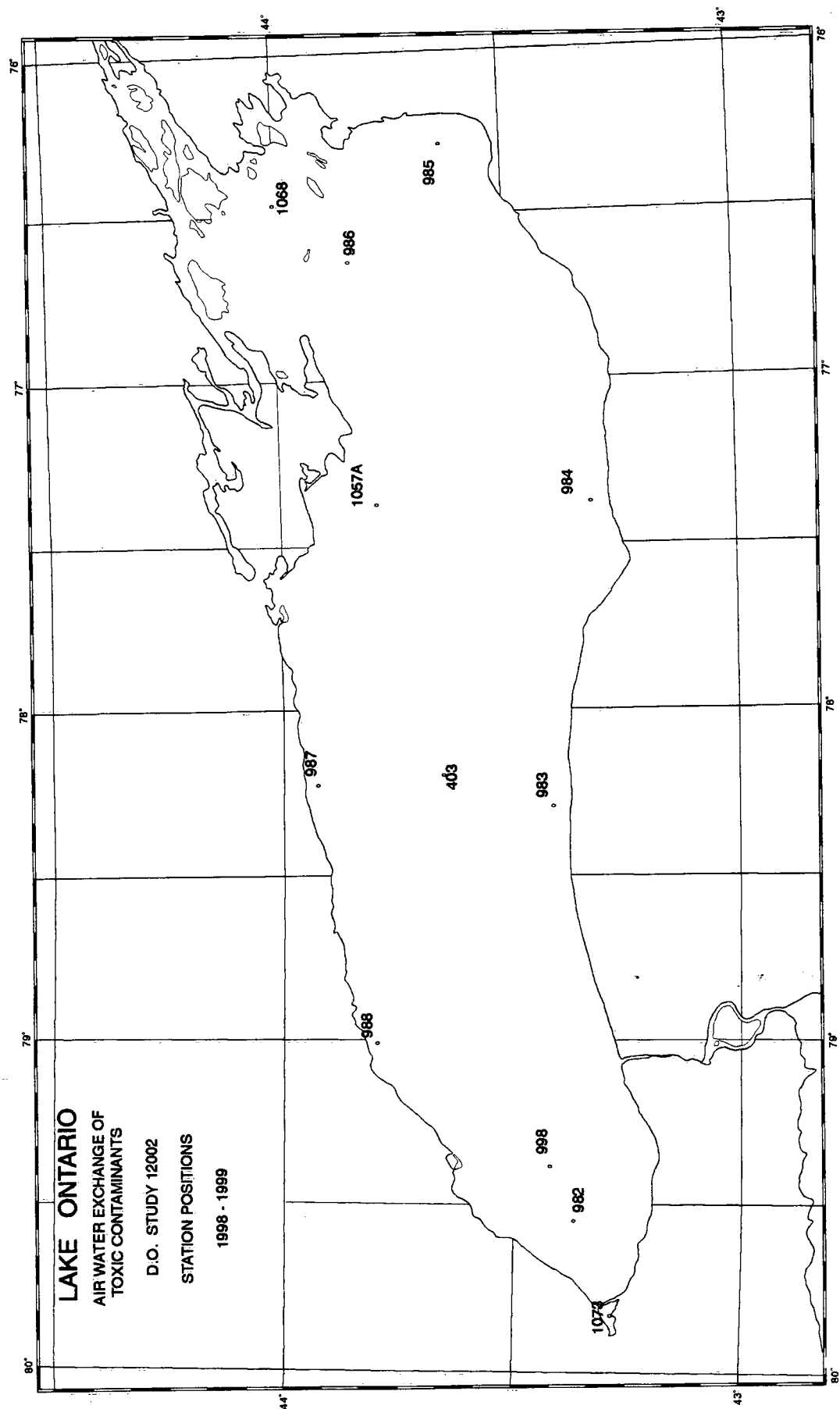
STATION NUMBER	LATITUDE N.	LONGITUDE W.
21	43° 15' 25"	79° 03' 37"
983	43° 24' 04"	78° 19' 49"
984	43° 18' 27"	77° 23' 27"
987	43° 54' 51"	78° 13' 19"
988	43° 46' 58"	79° 02' 32"
1057A	43° 45' 58"	77° 21' 00"
1068	44° 00' 38"	76° 29' 59"
1073	43° 17' 19"	79° 50' 17"
Toronto	43° 40' 01"	79° 14' 38"

## STATION POSITIONS

## ST. LAWRENCE RIVER

SEPTEMBER 14 - 18

STATION NUMBER	LATITUDE N.	LONGITUDE W.
66	44° 29' 40"	75° 46' 32"
67	44° 13' 24"	76° 10' 12"
967A	45° 01' 17"	74° 40' 59"
Brockville	44° 35' 02"	75° 40' 49"
Prescott	44° 42' 14"	75° 30' 56"
Morrisburg	44° 53' 23"	76° 10' 30"





**AQUATIC ECOSYSTEM RESTORATION BRANCH****BIOLOGICAL SEDIMENT GUIDELINES****AERB STUDY 12216, DR. T.B. REYNOLDSON**

One cruise was carried out on the Great Lakes to support this program September 21 - October 1. The cruise 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. Stations were sampled on lakes Erie, Huron, North Channel and Georgian Bay. At each station the following work was performed: A mini box core was collected and subsampled in the following manner:

The box core was subsampled using ten 6.7 cm diameter tubes from which the top 10 cm were extruded into plastic cups. Five samples were sieved using a 250 micron mesh sieve and the remaining five samples were sieved using a 500 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 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 sampled for particle size.
- c) 500 ml sampled for major ions, metals, loss on ignition, total organic carbon, total Kjeldahl nitrogen and total phosphorus.

Additional tasks performed during the cruise included:

At stations 520, 521, 522, 524, 525, 526, 529, 530, and 531 in Lake St. Clair the DO profiler was used to obtain a profile from the surface to the bottom. This was at the request of Mr. M.N. Charlton AERB, study 12240.

# STATISTICS SUMMARY

CRUISE NO.  
DATE: FROM  
CRUISE TYPE

Biological Sediment Guidelines

SHIP  
REGION  
N.MI. STEAMED

CCGS LIMNOS  
LAKE ERIE  
628.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	12	Moorings Established	
EBT/Transmissometer Casts	12	Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	10	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	12		
Water Samples Collected ( Microbiology )		Cores Taken, Box	
Water Samples Collected ( Water Quality )		Cores Taken, Mini Box	12
Water Samples Collected ( D.O. )	12	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	12	Cores Taken, Benthos	
Water Samples Collected ( TP uf )	12	Grab Samples Taken, Shipek	
Water Samples Collected ( TKN )		Grab Samples Taken, PONAR	
Water Samples Collected ( )		Bulk Centrifuge Samples	
Water Samples Collected ( )			
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 )	12		
Water Samples Filtered ( Major Ions )		ONBOARD ANALYSIS	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	36
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

# STATISTICS SUMMARY

CRUISE NO.  
DATE: FROM  
CRUISE TYPE

Biological Sediment Guidelines

SHIP  
REGION  
N.MI. STEAMED

CCGS LIMNOS  
LAKE HURON  
485.0

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	9	Moorings Established	
EBT/Transmissometer Casts	9	Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	8	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	5		
Water Samples Collected ( Microbiology )		Cores Taken, Box	
Water Samples Collected ( Water Quality )		Cores Taken, Mini Box	9
Water Samples Collected ( D.O. )	9	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	9	Cores Taken, Benthos	
Water Samples Collected ( TP uf )	9	Grab Samples Taken, Shipek	
Water Samples Collected ( TKN )		Grab Samples Taken, PONAR	
Water Samples Collected ( )		Bulk Centrifuge Samples	
Water Samples Collected ( )			
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 )	9		
Water Samples Filtered ( Major Ions )		ONBOARD ANALYSIS	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	27
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

# STATISTICS SUMMARY

CRUISE NO.  
DATE: FROM  
CRUISE TYPE

Biological Sediment Guidelines

SHIP  
REGION  
N.M.I. STEAMED

CCGS LIMNOS  
LAKE ST. CLAIR  
83.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	9	Moorings Established	
EBT/Transmissometer Casts		Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	9	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	9		
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 ( )		Bulk Centrifuge Samples	
Water Samples Collected ( )			
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 ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

# STATISTICS SUMMARY

CRUISE NO.  
DATE: FROM  
CRUISE TYPE

Biological Sediment Guidelines

SHIP  
REGION  
N.MI. STEAMED

CCGS LIMNOS  
GEORGIAN BAY  
206.4

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	13	Moorings Established	
EBT/Transmissometer Casts	10	Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	5	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	10		
Water Samples Collected ( Microbiology )		Cores Taken, Box	
Water Samples Collected ( Water Quality )		Cores Taken, Mini Box	13
Water Samples Collected ( D.O. )	13	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	13	Cores Taken, Benthos	
Water Samples Collected ( TP uf )	13	Grab Samples Taken, Shipek	
Water Samples Collected ( TKN )		Grab Samples Taken, PONAR	
Water Samples Collected ( )		Bulk Centrifuge Samples	
Water Samples Collected ( )			
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 )	13		
Water Samples Filtered ( Major Ions )		ONBOARD ANALYSIS	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	39
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	



## STATION POSITIONS

## LAKE ERIE

1998-1999

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
108	108	41° 58' 59"	82° 35' 00"
110	110	42° 18' 45"	81° 52' 54"
193	104	41° 58' 01"	82° 57' 04"
267	106	41° 59' 01"	82° 47' 02"
275	112	42° 14' 59"	81° 48' 59"
278	115	42° 20' 00"	81° 49' 00"
283	303	42° 33' 52"	80° 02' 26"
284	307	42° 36' 01"	80° 14' 03"
285	308	42° 38' 00"	80° 16' 00"
287	313	42° 42' 02"	80° 16' 00"
1200	306	42° 37' 13"	80° 26' 48"
1201	310	42° 38' 42"	80° 20' 42"

## STATION POSITIONS

## LAKE HURON AND NORTH CHANNEL

1998-1999

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
200	2200	46° 08' 13"	82° 36' 43"
201	2201	46° 09' 07"	82° 37' 03"
308	503	43° 22' 01"	82° 00' 02"
310	507	43° 54' 18"	81° 52' 30"
317	604	45° 04' 58"	81° 35' 40"

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
352	1403	46° 16' 46"	83° 36' 33"
353	1413	45° 51' 30"	82° 36' 30"
500	1500	46° 00' 01"	81° 10' 59"
508	1508	46° 00' 00"	82° 11' 00"
513	1513	46° 05' 12"	82° 14' 00"

## STATION POSITIONS

## LAKE ST. CLAIR

1998-1999

STATION NUMBER	LATITUDE N.	LONGITUDE W.
520	42° 21' 28"	82° 54' 11"
521	42° 21' 47"	82° 54' 26"
522	42° 22' 08"	82° 54' 26"
524	42° 25' 37"	82° 47' 55"
525	42° 25' 46"	82° 48' 15"
526	42° 25' 58"	82° 48' 32"
529	42° 29' 59"	82° 42' 16"
530	42° 30' 03"	82° 42' 40"
531	42° 30' 15"	82° 42' 54"

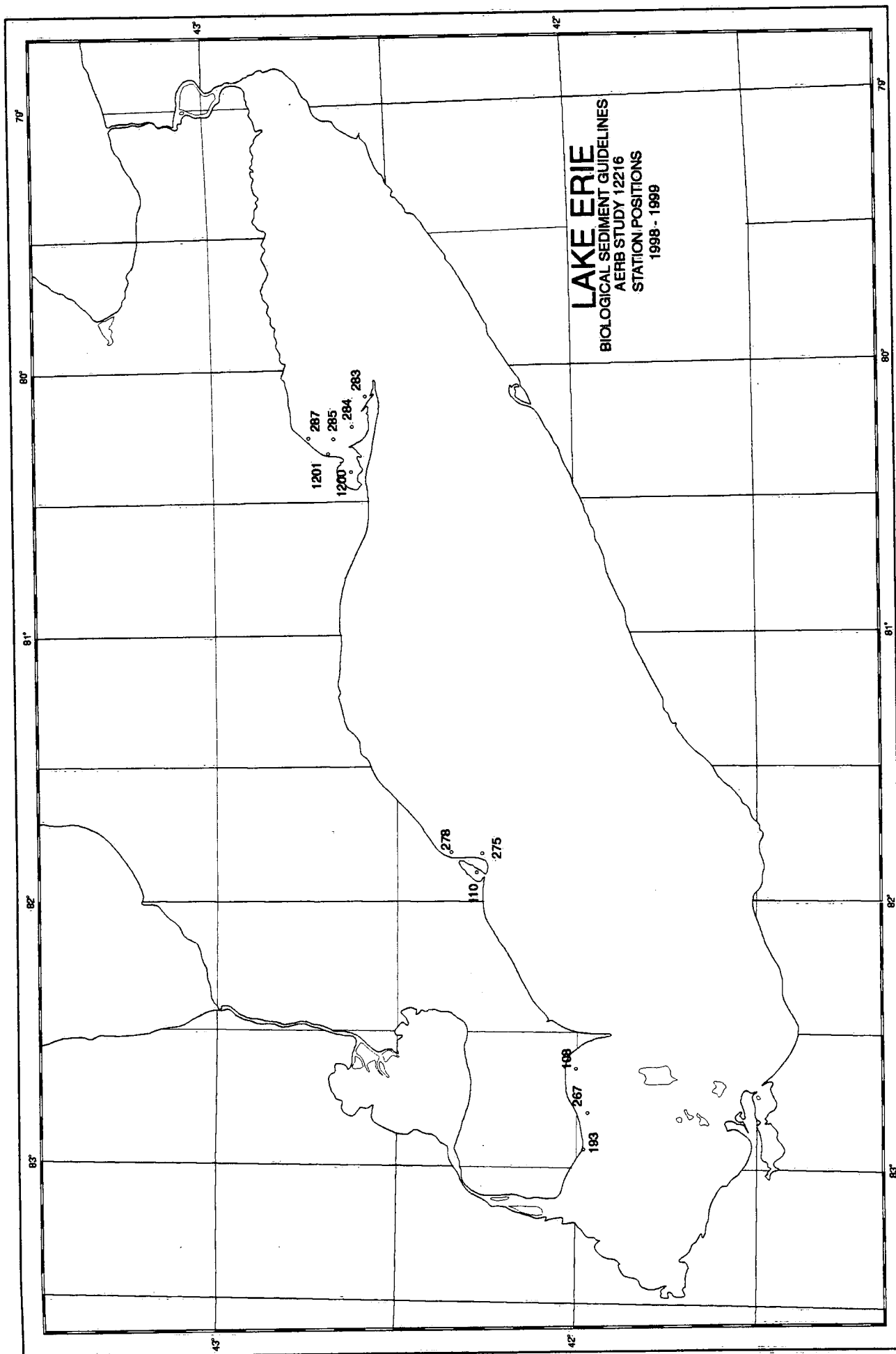
## STATION POSITIONS

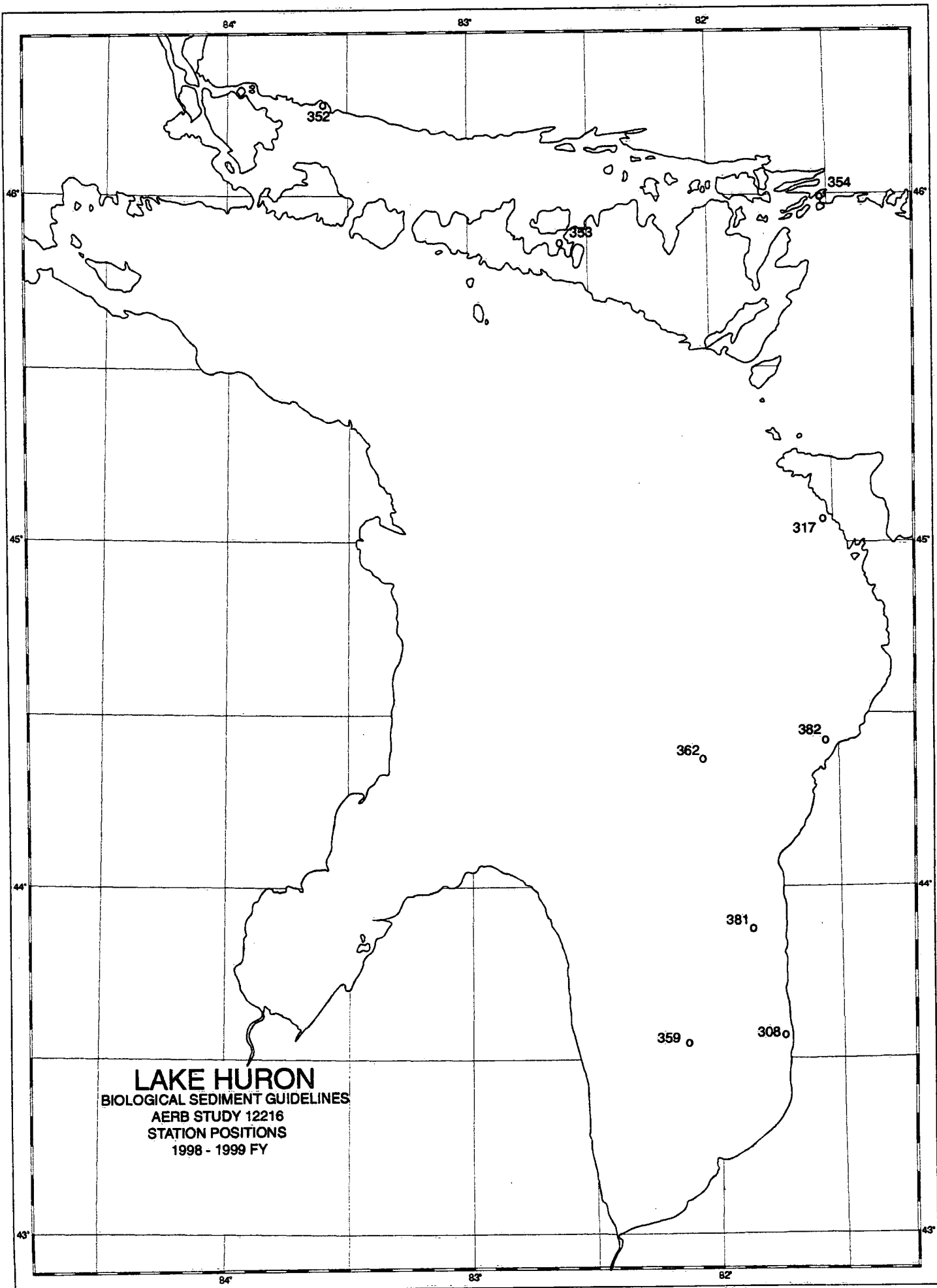
## GEORGIAN BAY

1998-1999

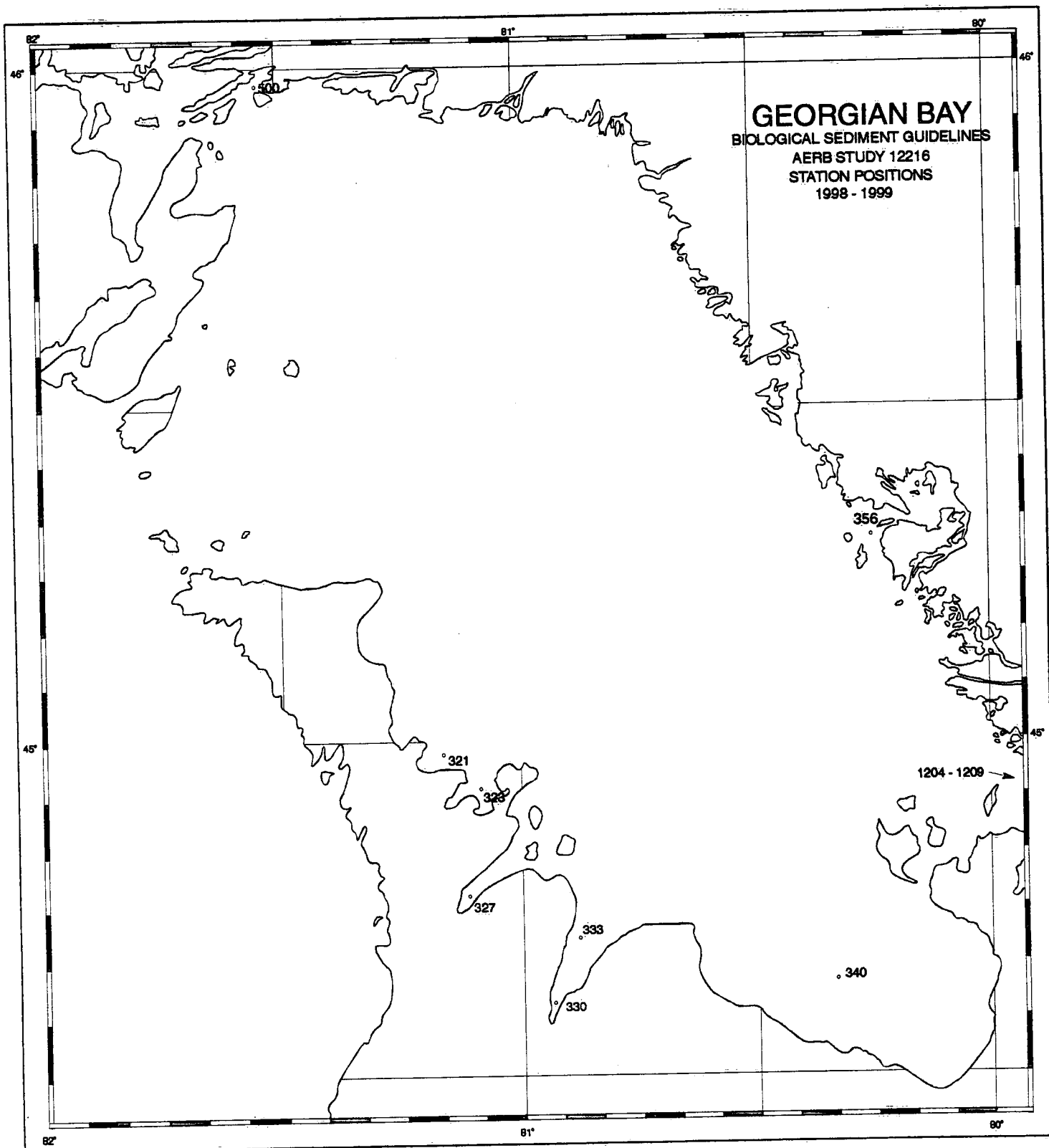
STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
321	610	44° 58' 10"	81° 11' 54"
323	612	44° 56' 09"	81° 07' 12"
327	616	44° 46' 58"	81° 05' 55"
330	702	44° 38' 22"	80° 53' 29"
333	705	44° 42' 57"	80° 52' 59"

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
340	712	44° 40' 57"	80° 25' 00"
355	1214	44° 46' 23"	79° 50' 17"
500	1500	45° 57' 18"	81° 31' 10"
1204	1207	44° 48' 28"	79° 56' 18"
1205	1213	44° 47' 21"	79° 49' 30"
1207	1601	44° 48' 06"	79° 48' 56"
1208	1602	44° 50' 24"	79° 50' 49"
1209	1603	44° 52' 56"	79° 56' 06"









**BENTHIC COMMUNITY STRUCTURE, LAKE ERIE**  
**AERB STUDY 12216, DR. T.B. REYNOLDSON**

Seven cruises were carried out on Lake Erie aboard the CCGS LIMNOS: April 14 - 17, May 11 - 13, June 29 - July 3, July 20 - 24, August 4 - 7, September 8 - 10 and October 19 - 24. The cruise June 29 - July 3 was piggybacked on the Zebra Mussel Effects cruise and the cruise July 20 - 24 was piggybacked on the Surveillance cruise.

At each station, a mini box core was collected and five 10 cm cores were subsampled. These cores were extruded into plastic bags and stored at 4°C 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, AERB whenever samples were collected for Dr. Reynoldson. Sediment trap moorings were also installed for M. Charlton in support of his Zebra Mussel Effects cruises. These were refurbished once a month on cruises when time was available.

Additional tasks performed during these cruises included the collection of mini box cores for a joint project between AERB, NWRI; ECB-OR and Ohio State University; the installation and retrieval of sediment trap moorings in the Western Basin for the University of Windsor and the collection of water samples for Dr. B. Scott, AECB study 12317.

# STATISTICS SUMMARY

CRUISE NO.  
DATE: FROM  
CRUISE TYPE

Benthic Community Structure

SHIP  
REGION  
N.M.I. STEAMED

CCGS LIMNOS  
LAKE ERIE  
1849.6

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	49	Moorings Established Sediment Trap	10
EBT/Transmissometer Casts	49	Moorings Retrieved Sediment trap	16
Rosette Casts		Moorings Established Infiltrax	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved Infiltrax	
Secchi Disc Observations	17	Moorings Established DO Logger	3
Transmissometer Casts	36	Moorings Retrieved DO Logger	3
Zooplankton Hauls	4	Moorings Serviced Meteorological	
Van Dom Casts		Organic Sediment Samples	84
Integrator 10 m	9		
Integrator 20 m	2	Primary Productivity Moorings	
Phytoplankton Samples	19	Phenoxy Acid Herbicides	
D.O. Profiles		Neutral Herbicides	
Water Samples Collected ( Microbiology )		Cores Taken, Box	
Water Samples Collected ( Water Quality )		Cores Taken, Mini Box	40
Water Samples Collected ( D.O. )	9	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	9	Cores Taken, Benthos	
Water Samples Collected ( TP uf )		Grab Samples Taken, Shipek	
Water Samples Collected ( TKN )		Grab Samples Taken, PONAR	25
Water Samples Collected ( Ciliate )		Bulk Centrifuge Samples 50 Litre	
Water Samples Collected ( Microbial Loop )			
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered ( Chlorophyll a )		Golden Sampler Extractions	
Water Samples Filtered ( POC/TPN )			
Water Samples Filtered ( Seston )			
Water Samples Filtered ( TP f )			
Water Samples Filtered ( Nutrients )			
Water Samples Filtered ( Major Ions )		<b>ONBOARD ANALYSIS</b>	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	15
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

## STATION POSITIONS

## LAKE ERIE

1998-1999

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 30' 09"	79° 53' 09"
84	41° 56' 06"	81° 39' 28"
357	41° 49' 40"	82° 58' 11"
947	41° 59' 33"	80° 38' 26"
973	41° 47' 48"	83° 19' 03"
1051	42° 16' 32"	80° 38' 10"
1055	41° 54' 41"	80° 59' 56"
1056	42° 00' 12"	81° 07' 11"
1057	42° 21' 47"	81° 07' 25"
1059	42° 10' 59"	81° 14' 27"
1066	41° 39' 35"	81° 43' 19"
1069	41° 54' 31"	81° 50' 35"
1075	41° 43' 18"	82° 19' 17"
1080	41° 32' 22"	82° 40' 41"
1082	41° 51' 15"	82° 44' 46"
1081	41° 59' 20"	82° 41' 26"
1084	41° 37' 25"	82° 55' 02"
1086	41° 42' 43"	83° 02' 33"
1088	41° 48' 04"	83° 10' 02"
1091	41° 32' 04"	82° 55' 01"
1096	41° 57' 57"	83° 11' 16"
1097	41° 58' 54"	82° 03' 00"
1099	41° 59' 56"	80° 31' 12"
1100	42° 05' 08"	81° 57' 59"
1105	42° 32' 22"	81° 14' 20"
1106	42° 32' 22"	80° 45' 21"
1111	41° 35' 31"	81° 36' 15"

## MOORING POSITIONS

## LAKE ERIE

1998-1999

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
23	98-01S-01A	42° 29' 09"	79° 52' 03"	DO (BTM -1 m)
	98-01A-02A	42° 30' 06"	79° 53' 18"	ST (30, 40, 50, 60 m)
84	98-01S-03A	41° 56' 12"	81° 39' 39"	DO (BTM -1 m)
	98-01A-04A	41° 56' 08"	81° 39' 26"	ST (18, 21 m)
357	98-01S-05A	41° 49' 44"	82° 58' 12"	DO (BTM -1 m)
	98-01S-06A	41° 49' 48"	82° 58' 12"	ST (BTM -1 m)

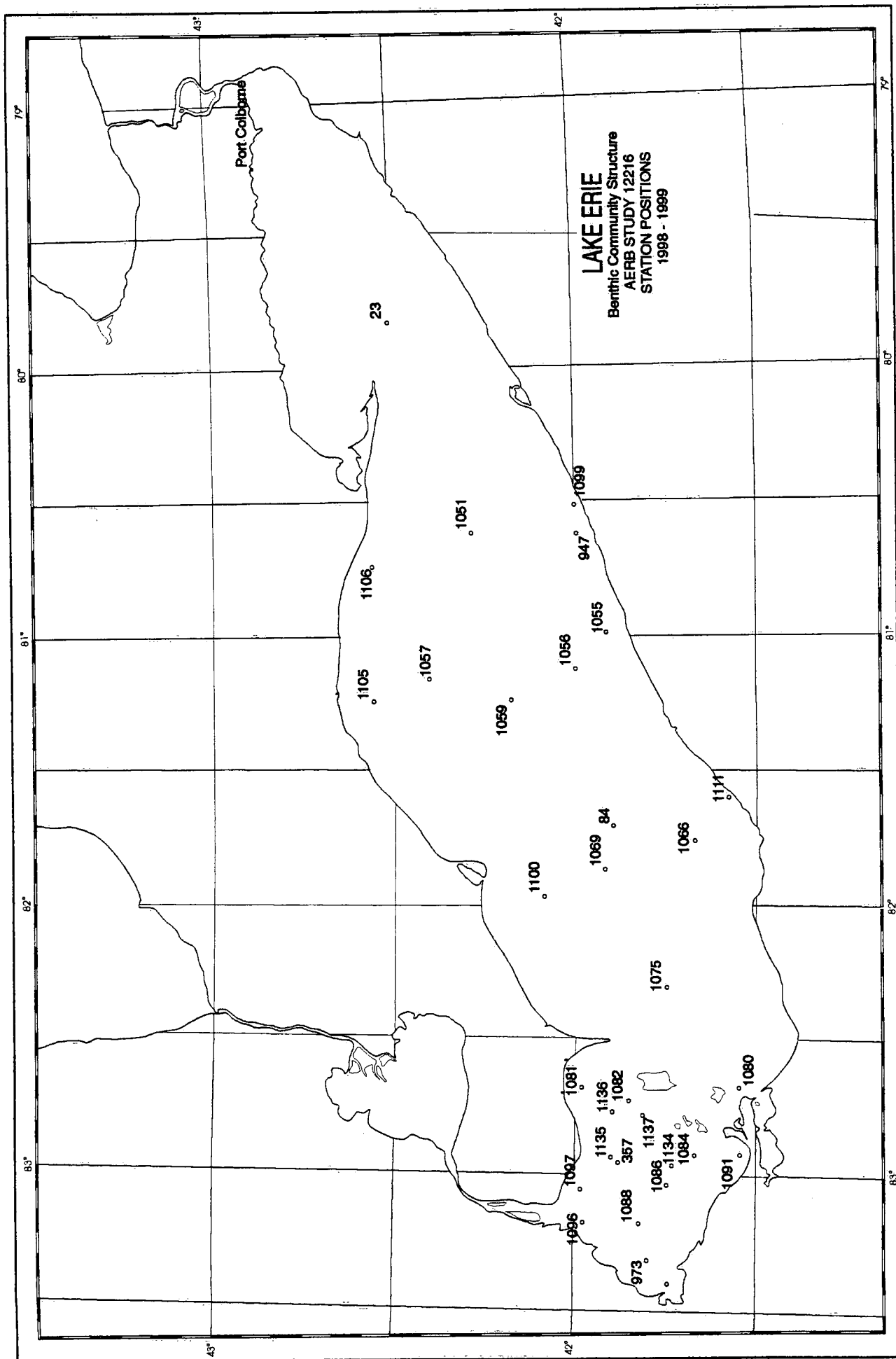
## MOORING POSITIONS

## UNIVERSITY OF WINDSOR

## LAKE ERIE

1998-1999

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
1134	98-01A-34A	41° 43' 55"	82° 58' 00"	ST (8.9 m)
1135	98-01A-35A	41° 55' 20"	82° 57' 43"	ST (9.0 m)
1136	98-01A-36A	41° 54' 19"	82° 46' 03"	ST (10.7 m)
1137	98-01A-37A	41° 50' 52"	82° 43' 21"	ST (10.2 m)



<b>SEDIMENT SURVEY</b> <b>AERB STUDY 12217, F. ROSA</b>
--

One cruise was carried out on Lake Ontario to support this program—June 15 - 26. The cruise was to define the present status of the surficial sediment contaminants (most of Tier I and II) and to determine temporal changes that may have occurred since the 1970's sediment surveys.

Station sampling for this program was completed in the following manner: At all stations a mini box core was collected and subsampled as follows:

The box core was subsampled using six 6.7 cm diameter tubes from which the top 3 cm were collected. Two 3 cm sections were combined to form three samples as follows:

- a) Organic contaminants (OC): were collected in prewashed 250 ml screw top Nalgene containers.
- b) Metals (M): were collected in cleaned 250 ml plastic beakers with lids.
- c) Grain size and nutrients (GSN): were collected in 250 ml plastic beakers with lids.

At master stations, the following tasks were performed:

- a) Three mini box cores were collected and subsampled resulting in triplicate samples for OC, M and GSN.
- b) From another mini box core, two 6.7 cm diameter tubes were used to obtain 30 to 40 cm cores for OC, M and GSN profiles. These cores were extruded onboard in 1cm sections—every 1 cm from 0 to 15 cm, every other cm from 16 to 30 and every 5 cm thereafter.
- c) Two Benthos gravity cores (~1.5 m long) were collected for OC, M and GSN profiles. The cores were extruded and the following 1 cm sections—0-1, 9-10, 14-15, 19-20, 29-30 and every 10 cm thereafter were collected; i.e., 39-40, 49-50, etc.
- d) Two Shipek samples were collected and subsampled using six 6.7 cm diameter tubes from which the top 3 cm were collected. Two 3 cm sections were combined to form three samples, resulting in duplicate samples for OC, M and GSN.

At selected stations a mini box core was collected for community structure and subsampled in the following manner:

The box core was subsampled using five 6.7 cm diameter tubes from which the top 10 cm was extruded into plastic bags. Samples were sieved onboard and preserved with Formalin.

The Atlas Deso 10 echosounder in the laboratory was run continuously on the track plot during the cruise. Sounding records were marked with a fix number and time. Fixes were obtained using DGPS on a 10-minute basis and stored on a laptop computer. The Roxann system was run simultaneously with the echosounder.

Additional tasks performed during the cruise included refurbishment of the sediment trap mooring at station 403 and collection of water samples at sediment trap depths.

# STATISTICS SUMMARY

CRUISE NO.

DATE:

CRUISE TYPE

SHIP

REGION

N.MI. STEAMED

CCGS LIMNOS

LAKE ONTARIO

1077.01

Sediment Survey

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	108	Moorings Established, Sediment Trap	1
EBT/Transmissometer Casts	108	Moorings Retrieved, Sediment Trap	1
Rosette Casts	22	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	65	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls		Moorings Serviced, Meteorological	2
Integrator 10 m			
Integrator 20 m	22	Primary Productivity Moorings	
Phytoplankton Samples		Sediment Cores Collected, Subsample, Muir	6
D.O. Profiles	85	Sediment Cores Collected, Subsample, Wong	3
Water Samples Collected ( Halo Acetic Acid )	36	Cores Taken, Box	
Water Samples Collected ( Alkalinity )	25	Cores Taken, Mini Box	130
Water Samples Collected ( D.O. )	25	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	25	Cores Taken, Benthos	9
Water Samples Collected ( TP uf )	133	Grab Samples Taken, Shipek	36
Water Samples Collected ( TP uf Reynoldson )	25	Grab Samples Taken, PONAR	75
Water Samples Collected ( Nutrients )	25	Sediment Samples Collected, Muir	40
Water Samples Collected ( )		Sediment Samples Collected, Mudroch	4
Water Samples Collected ( Chlorophyll a )	25	Sediment Samples Collected, Borgman	177
Water Samples Filtered (Chlorophyll a Charlton )	6	Sediment Samples Collected, Metals	211
Water Samples Filtered ( POC/TPN )	30	Sediment Samples Collected, OC's	213
Water Samples Filtered ( Seston )	6	Sediment Samples Collected, GSN	211
Water Samples Filtered ( TP f )	133	Sediment Samples Collected, Bioassays	25
Water Samples Filtered ( Nutrients )		Sediment Samples Collected, Wong	17
Water Samples Filtered ( Major Ions )		<b>ONBOARD ANALYSIS</b>	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	5
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Miles of Sounding Record	1050	Microbiology	



## STATION POSITIONS

## LAKE ONTARIO

1998 - 1999

STATION NUMBER	GRID NUMBER	LATITUDE N.	LONGITUDE W.
8		43° 37' 23"	79° 27' 13"
19		43° 23' 01"	79° 17' 08"
24		43° 26' 25"	79° 07' 43"
25		43° 31' 02"	79° 04' 53"
26		43° 36' 28"	79° 01' 02"
33		43° 35' 48"	78° 48' 06"
34		43° 27' 43"	78° 45' 39"
36		43° 29' 31"	78° 23' 10"
39		43° 29' 10"	77° 59' 59"
40		43° 35' 24"	78° 00' 42"
41		43° 42' 57"	78° 01' 34"
52		43° 26' 02"	77° 42' 42"
64		43° 31' 31"	76° 55' 36"
65		43° 25' 24"	76° 53' 00"
69		43° 36' 23"	76° 42' 47"
84		43° 53' 10"	76° 44' 00"
94		43° 19' 30"	77° 12' 57"
403		43° 36' 07"	78° 13' 59"
1001	A-6	43° 12' 59"	79° 17' 56"
1002	C-2	43° 21' 40"	79° 42' 01"
1003	C-4	43° 21' 39"	79° 30' 00"
1004	C-6	43° 21' 41"	79° 17' 59"
1005	C-8	43° 21' 39"	79° 05' 58"
1006	C-10	42° 21' 41"	78° 54' 00"
1007	D-5	43° 26' 01"	79° 24' 00"
1008	D-12	43° 26' 04"	78° 41' 57"
1009	D-14	43° 26' 01"	78° 29' 59"
1010	D-16	43° 25' 57"	78° 17' 52"
1011	D-18	43° 26' 00"	78° 05' 55"
1012	D-20	43° 25' 58"	77° 53' 59"

STATION NUMBER	GRID NUMBER	LATITUDE N.	LONGITUDE W.
1013	C-22	43° 21' 39"	77° 41' 52"
1014	C-24	43° 21' 43"	77° 30' 02"
1015	C-26	43° 21' 36"	77° 17' 58"
1016	C-28	43° 21' 40"	77° 05' 58"
1017	C-30	43° 21' 41"	76° 54' 00"
1018	D-31	43° 25' 58"	76° 47' 59"
1019	E-4	43° 30' 17"	79° 30' 01"
1020	E-6	43° 30' 18"	79° 18' 01"
1021	E-8	43° 30' 20"	79° 05' 58"
1022	E-10	43° 30' 15"	78° 54' 05"
1023	E-12	43° 30' 20"	78° 41' 56"
1024	E-14	43° 30' 20"	78° 29' 59"
1025	E-16	43° 30' 18"	78° 17' 59"
1026	E-18	43° 30' 20"	78° 06' 00"
1027	E-20	43° 30' 19"	77° 53' 59"
1028	E-22	43° 30' 20"	77° 42' 00"
1029	E-24	43° 30' 21"	77° 30' 06"
1030	E-26	43° 30' 16"	77° 17' 57"
1031	E-28	43° 30' 21"	77° 05' 58"
1032	E-30	43° 30' 21"	76° 53' 59"
1033	E-32	43° 30' 19"	76° 42' 00"
1034	F-17	43° 34' 39"	78° 11' 58"
1035	G-8	43° 39' 00"	79° 06' 00"
1036	G-10	43° 39' 01"	78° 54' 01"
1037	G-12	43° 38' 58"	78° 42' 01"
1038	G-14	43° 39' 00"	78° 29' 59"
1039	G-16	43° 39' 00"	78° 17' 59"
1040	G-18	43° 39' 00"	78° 05' 59"
1041	G-20	43° 38' 57"	77° 54' 01"
1042	G-22	43° 39' 00"	77° 42' 01"
1043	G-24	43° 39' 01"	77° 29' 56"
1044	G-26	43° 39' 01"	77° 18' 00"
1045	G-28	43° 38' 58"	77° 06' 00"
1046	G-30	43° 39' 01"	76° 54' 00"
1047	G-32	43° 39' 00"	76° 41' 59"

STATION NUMBER	GRID NUMBER	LATITUDE N.	LONGITUDE W.
1048	G-33	43° 38' 58"	76° 35' 59"
1049	G-34	43° 39' 00"	76° 30' 00"
1050	G-36	43° 39' 00"	76° 18' 00"
1051	I-10	43° 47' 40"	78° 54' 01"
1052	I-12	43° 47' 39"	78° 41' 58"
1053	I-14	43° 47' 38"	78° 29' 56"
1054	I-16	43° 47' 38"	78° 18' 02"
1055	I-18	43° 47' 41"	78° 06' 01"
1056	I-20	43° 47' 38"	77° 54' 01"
1057	I-22	43° 47' 40"	77° 42' 02"
1058	I-24	43° 47' 38"	77° 30' 00"
1059	I-26	43° 47' 39"	77° 18' 00"
1060	I-30	43° 47' 40"	76° 53' 58"
1061	I-32	43° 47' 37"	76° 41' 58"
1062	I-34	43° 47' 41"	76° 30' 01"
1063	I-36	43° 47' 41"	76° 18' 00"
1064	K-30	43° 58' 31"	76° 52' 58"
1065	K-32	43° 56' 19"	76° 42' 00"
1066	K-34	43° 56' 21"	76° 30' 00"
1067	L-32	44° 00' 42"	76° 42' 03"
1068	L-34	44° 00' 35"	76° 30' 07"
1069	F-34	44° 34' 41"	76° 30' 00"
1070	J-36	43° 52' 00"	76° 17' 59"
1071	K-36	43° 56' 04"	76° 18' 08"
1072	K-37	43° 55' 59"	76° 12' 00"
1073	HH (deep)	43° 17' 19"	79° 50' 30"
1074	HH (west basin)	43° 16' 49"	79° 52' 20"
1075	198	43° 20' 35"	79° 23' 45"
1076	71	43° 20' 12"	79° 05' 59"
1077	68	43° 25' 57"	79° 31' 58"
1078	170	43° 30' 28"	79° 08' 52"
1079	36	43° 30' 40"	77° 02' 04"
1080	148	43° 33' 52"	78° 18' 20"
1081	48	43° 34' 45"	78° 51' 03"
1082	133	43° 38' 56"	78° 13' 26"

STATION NUMBER	GRID NUMBER	LATITUDE N.	LONGITUDE W.
1083	23	43° 39' 37"	76° 57' 41"
1084	19	43° 39' 29"	76° 38' 11"
1085	28	43° 48' 00"	78° 26' 56"
1086	112	43° 42' 25"	77° 33' 29"
1087	5	43° 53' 39"	76° 33' 57"
1088	2	44° 02' 23"	76° 44' 50"
1089	AM10	43° 51' 46"	78° 48' 55"
1090	AM20	43° 50' 57"	78° 48' 25"

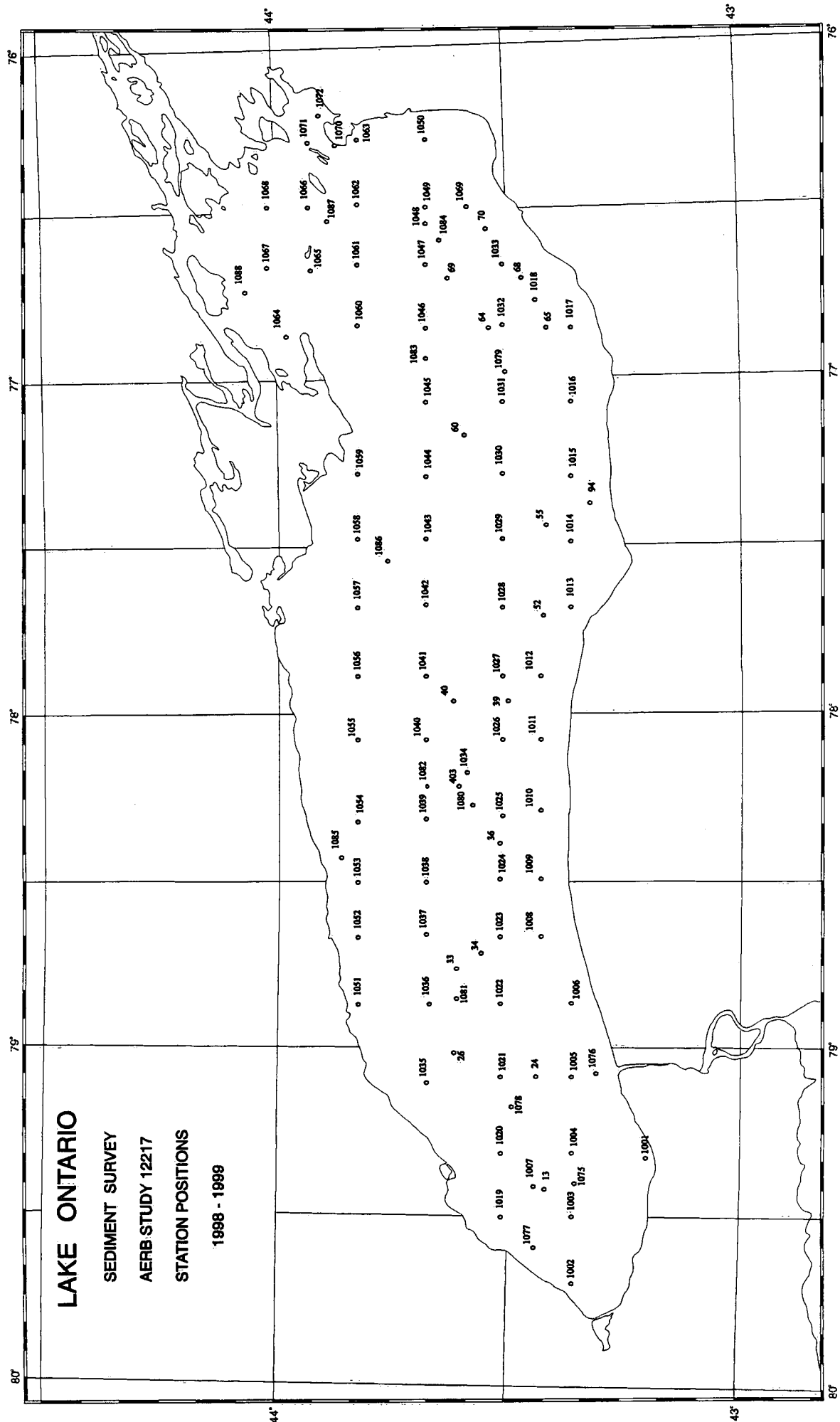
## MOORING POSITIONS

## LAKE ONTARIO

1998-1999

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
403	98-00A-65A	43° 36' 08"	78° 13' 57"	ST(19,59,99, 139,65,173)
403	98-00A-65B	43° 36' 24"	78° 13' 28"	ST(19,59,99, 139, 165,173)

## 1998 - 1999



<b>ZEBRA MUSSEL EFFECTS</b> <b>AERB STUDY 12240, M.N. CHARLTON</b>
---

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—June 8 - 12, June 29 - July 3, July 13 - 17, August 10 - 14 and August 24 - 28. 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. Sampling was done to 2 m above the bottom 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, 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 64µ 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.

Fluorometer profiles were also collected at stations 23, 84, 340, 341, 343, 344, 935, 946, 953, 954, 957, 958, 961, 963, 964, 965 and all stations in the Western Basin.

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

# STATISTICS SUMMARY

CRUISE NO.  
DATE  
CRUISE TYPE

Zebra Mussel Effects

SHIP  
REGION  
N.MI. STEAMED

CCGS LIMNOS  
LAKE ERIE  
3248.09

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	269	Moorings Established, Sediment Trap	5
EBT/Transmissometer Casts	186	Moorings Retrieved, Sediment Trap	9
Rosette Casts	184	Moorings Refurbished, D.O. Logger	2
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	128	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls, 64µ	191		
Zooplankton Hauls, 75µ	3		
Integrator 10 m	157		
Integrator 20 m	116	Primary Productivity Moorings	
Phytoplankton Samples	109		
D.O. Profiles	263		
Water Samples Collected ( Microbiology )		Cores Taken, Box	
Water Samples Collected ( Water Quality )		Cores Taken, Mini Box	12
Water Samples Collected ( D.O. )	350	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	433	Cores Taken, Benthos	
Water Samples Collected ( TP uf )	333	Grab Samples Taken, Shipek	
Water Samples Collected ( Protozoa )	94	Grab Samples Taken, mini PONAR	28
Water Samples Collected ( Plankton Count )	20	Bulk Centrifuge Samples	
Water Samples Collected ( Fraction Chl a )	10		
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered ( Chlorophyll a )	608	Fluorometer Profiles	213
Water Samples Filtered ( POC/TPN )		Licor Profiles	71
Water Samples Filtered ( Seston )	358	Hydrolab Profiles	2
Water Samples Filtered ( TP f )	333		
Water Samples Filtered ( Nutrients )	333		
Water Samples Filtered ( Major Ions )	333	ONBOARD ANALYSIS	
Water Samples Filtered ( McKay )	22	Manual Chemistry, Tech. Ops.	918
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

## STATION POSITIONS

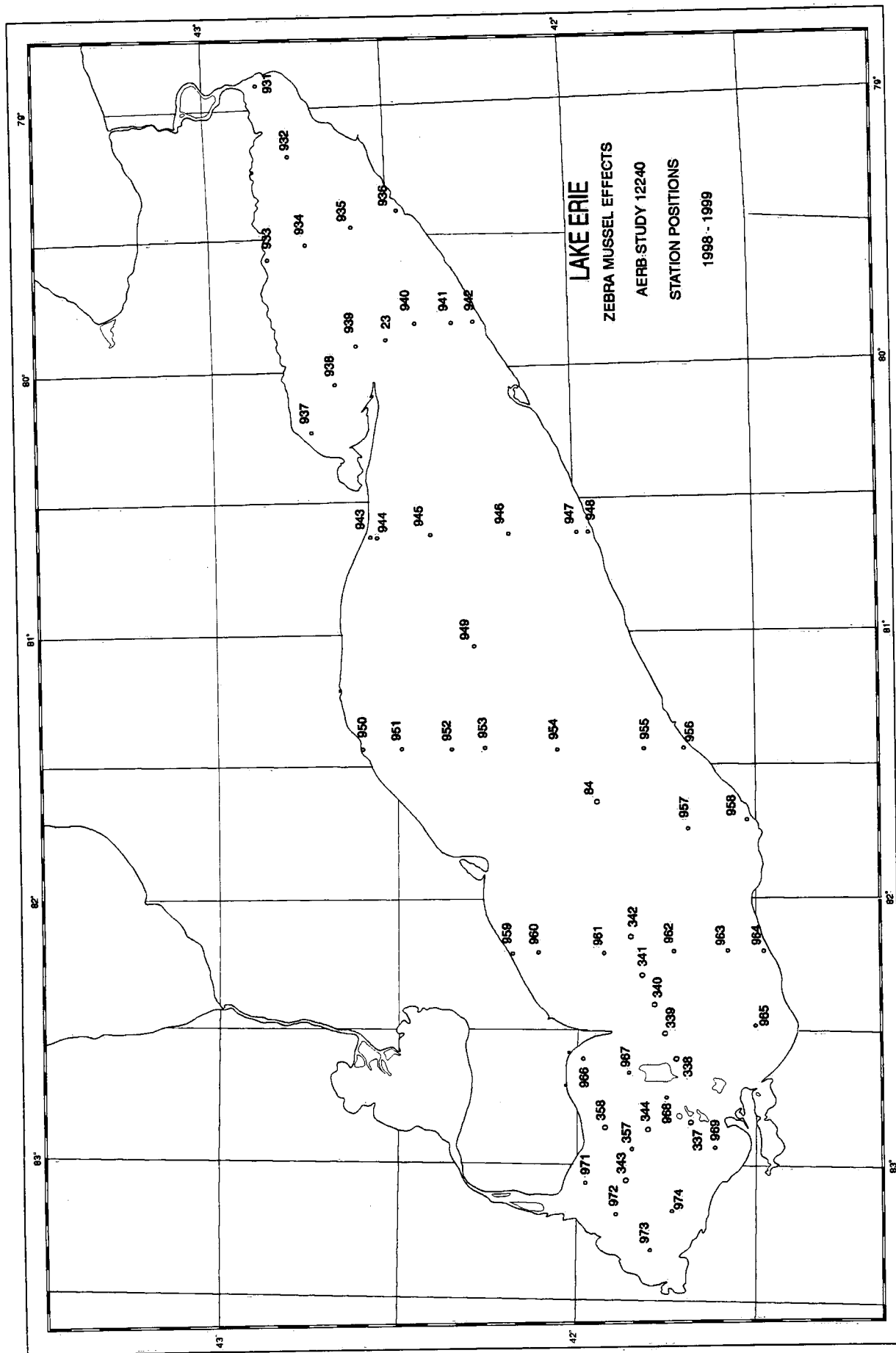
## LAKE ERIE

1997-1998

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° 49' 36"	82° 58' 12"
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"
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"



STATION NUMBER	LATITUDE N.	LONGITUDE W.
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"



**AQUATIC ECOSYSTEM CONSERVATION BRANCH****TOXIC METALS, LAKE HURON AND GEORGIAN BAY**  
**AECB STUDY 12310, DR. W.M.J. STRACHAN**

One cruise was carried out this season to support this program, August 31 - September 4. The cruise was used to collect water samples for a preliminary study of trace metals and organics in Lake Huron and Georgian Bay.

During the cruise the following work was performed:

- a) Eighty litres of centrifuged water were collected from 2 metres for organic sampling
- b) Eighty litres of raw water were collected from 2 metres for organic sampling
- c) A surface sediment sample was collected, using a Shipek sampler
- d) The rubber raft was utilized to collect a surface water sample for inorganic analysis
- e) Five-litre Go-Flo bottles were utilized to collect inorganic samples at selected depths
- f) Bulk water (1500 litres) was collected from 2 metres. This sample was centrifuged at 6 litres/minute for suspended sediment
- g) Continuous air sampling was done for organic contaminant analysis. Air samplers were mounted above the bridge deck

Additional tasks performed during the cruise included: collecting water samples for Haloacetic Acids using Go-Flo bottles for Dr. B. Scott, AECB study 12317; collecting two 200-litre barrels of water for H. Alkema, NLET study 12180 and a SeaBird profile was taken for M.N. Charlton, AERB study 12240.

# STATISTICS SUMMARY

CRUISE NO. 98 - 02 - 002  
 DATE: FROM August 31 TO September 4, 1998  
 CRUISE TYPE Toxic Metals

SHIP  
 REGION  
 N.MI. STEAMED

CCGS LIMNOS  
 LAKE HURON  
 342.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	7	Moorings Established	
EBT/Transmissometer Casts	7	Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	5	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
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	6
Water Samples Collected ( TKN )		Grab Samples Taken, PONAR	
Water Samples Collected ( Trace Metals )	31	Bulk Centrifuge Samples, 1500 litres	6
Water Samples Collected ( Organics )	6	Bulk Centrifuge Samples, 80 litres	6
Water Samples Collected ( Haloacetic Acid )	8	Observations, Weather	
Water Samples Filtered ( Chlorophyll a )		Bulk Water Sample, 200 litres	1
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 ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

# STATISTICS SUMMARY

<b>CRUISE NO.</b>	98 - 05 - 001	<b>SHIP</b>	CCGS LIMNOS
<b>DATE: FROM</b>	September 2 TO September 3, 1998	<b>REGION</b>	GEORGIAN BAY
<b>CRUISE TYPE</b>	Toxic Metals	<b>N.MI. STEAMED</b>	122.0

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	6	Moorings Established	
EBT/Transmissometer Casts	6	Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	3	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
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	3
Water Samples Collected ( TKN )		Grab Samples Taken, PONAR	
Water Samples Collected ( Trace Metals )	11	Bulk Centrifuge Samples, 1500 litres	4
Water Samples Collected ( Organics )	8	Bulk Centrifuge Samples, 80 litres	4
Water Samples Collected ( Haloacetic Acid )	3	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 )		<b>ONBOARD ANALYSIS</b>	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

## STATION POSITIONS

## LAKE HURON

1998-1999

---

STATION NUMBER	LATITUDE N.	LONGITUDE W.
121	43° 31' 01"	82° 10' 00"
122	44° 15' 00"	82° 14' 58"
123	44° 40' 02"	82° 49' 56"
124	44° 55' 00"	81° 50' 00"
125	45° 15' 00"	82° 49' 59"
126	45° 44' 59"	83° 55' 01"
131	43° 05' 04"	82° 23' 42"

---

## STATION POSITIONS

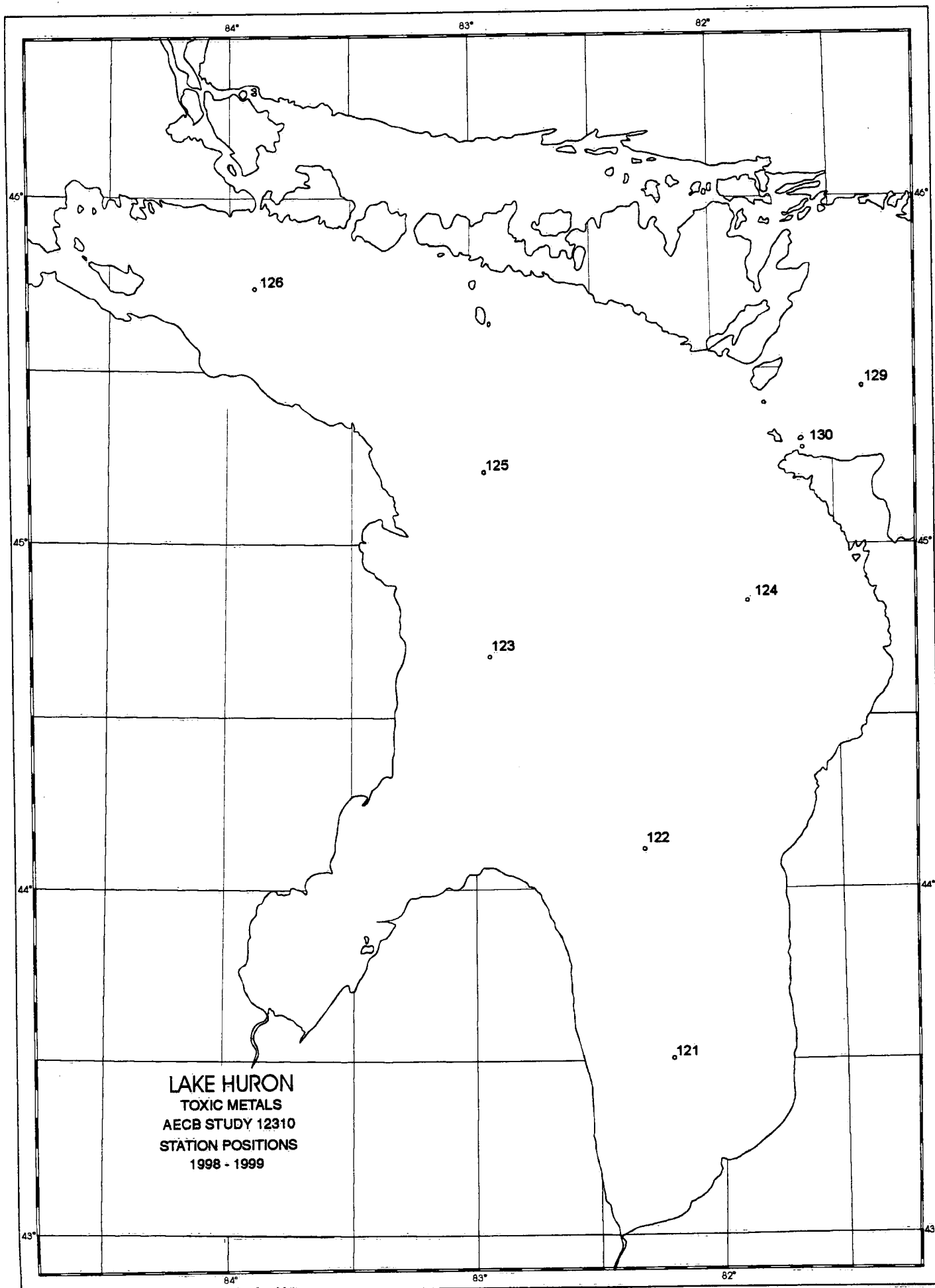
## GEORGIAN BAY

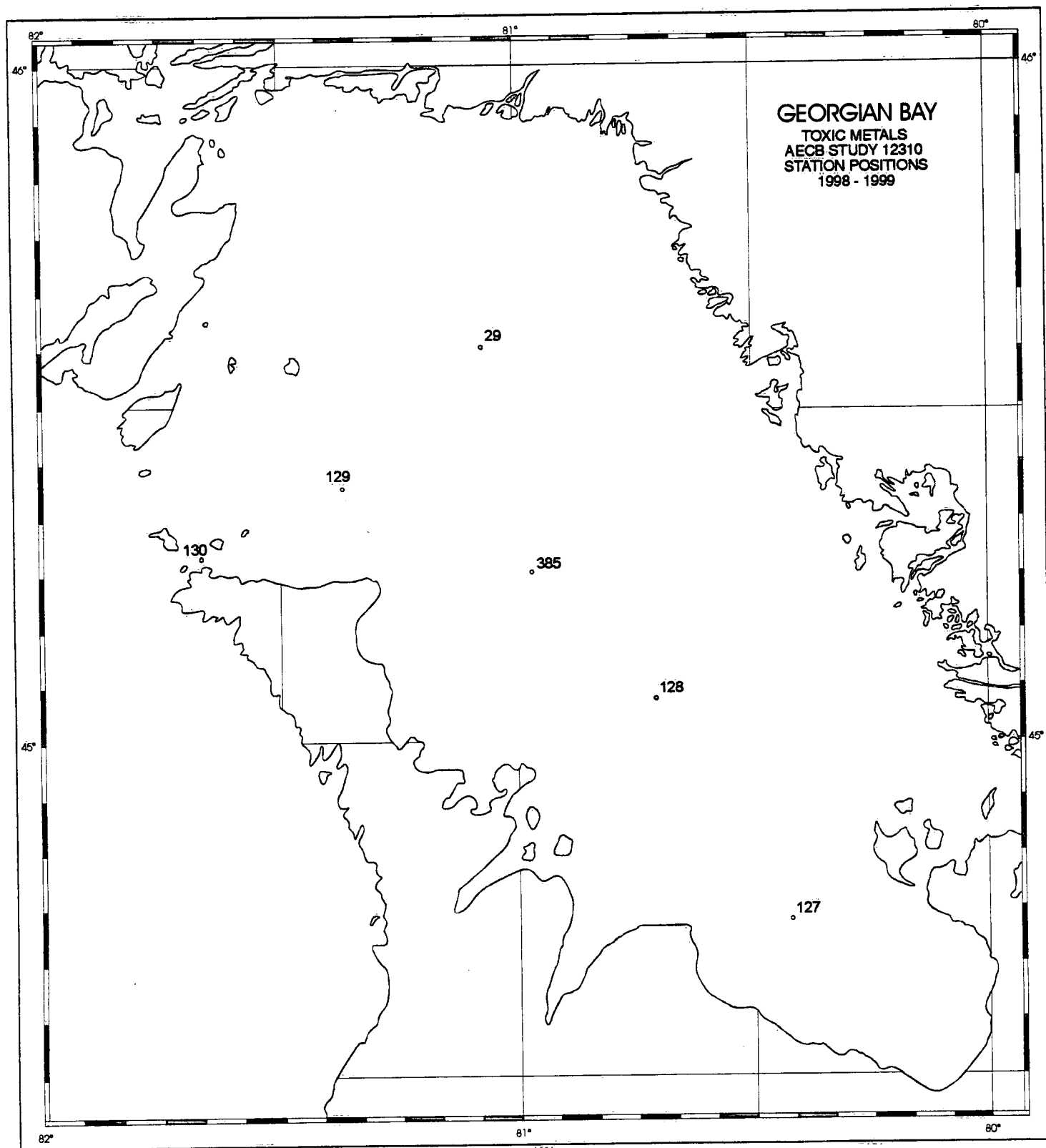
1998-1999

---

STATION NUMBER	LATITUDE N.	LONGITUDE W.
29	45° 34' 55"	81° 06' 06"
127	44° 43' 57"	80° 26' 00"
128	45° 07' 58"	80° 47' 05"
129	45° 27' 00"	81° 19' 58"
130	45° 16' 30"	81° 40' 00"
385	45° 20' 59"	80° 58' 57"

---







<b>TOXAPHENE SAMPLING, LAKE HURON AND LAKE SUPERIOR</b> <b>AECB STUDY 12315, DR. D. MUIR</b>
---

One cruise was carried out on Lake Superior and Lake Huron to support this program, April 27 - May 08. The project was to collect sediment and water samples to determine Toxaphene concentrations.

Toxaphene is the most abundant organochlorine in Lake Superior fish and there is presently a Health Canada fishery advisory on the Eastern Basin lake trout fishery due to high levels of this contaminant. Levels of toxaphene have not declined in Lake Superior lake trout despite banning of the use of this chemical in the mid 1980's. The reasons for this lack of decline are not known. At all stations the following work was performed:

An EBT/% transmission profile to the bottom was taken. The 0.25 metre path length transmissometer was used on this system.

A surface bucket temperature observation was taken.

During daylight hours, a Secchi disc (30 cm) observation was taken from the shaded side of the vessel

At stations 5, 13, 22, 31, 39, 80, 90, 95, 117, 133, 142, 170, 201, 301 and 403, a March pump was used to collect a 100-litre water sample from 4 metres. This sample was run through an XAD resin column for organic analyses. At stations 13 and 80, samples were also collected from 100 metres.

At stations 5, 22, 31, 39, 80, 90, 95, 117, 133, 142, 170, 201, 301 and 403, a 102 $\mu$  1 metre diameter zooplankton net was used to collect samples from 2 metres above the bottom to the surface. Net hauls were repeated until 5 grams of wet weight was collected. The material from successive net hauls was composited in a clean, covered container. The final sample was isolated by pouring the slurry through a piece of 102 $\mu$  Nitex netting supported by a funnel. The material on the netting was removed by spatula to a cleaned glass jar, labelled and frozen for storage until analysis. At each of these stations an additional metered zooplankton net haul was taken. Samples were preserved in 10% sugared Formalin.

Phytoplankton samples were collected at stations 5, 22, 31, 39, 80, 90, 95, 117, 133, 142, 170, 201, 301 and 403. Samples were collected by two different methods:

#### 1. Filtration

At each station, 20 litres of water were collected from 4 metres, using the rosette sampler. After collection, a 1-litre sample was preserved with 10 ml of Lugol's, a 100 ml sample preserved with 2 ml of 5% paraformaldehyde solution and a 100 ml sample preserved with 10% glutaraldehyde solution.

From the 20-litre samples, four litres were poured through a 200 $\mu$ , 20 $\mu$  and 2 $\mu$  filter. From each of the fractionations, 1-litre samples were filtered for chlorophyll a, particulate carbon and

phosphorus. A 100 ml sample was also filtered through a 0.2 $\mu$  filter for silica. All filters were desiccated away from the light and frozen until returned for analyses.

## 2. Centrifugation

Fifteen hundred litres of water were pumped from 4 metres through a 100 $\mu$  net into onboard tanks. The water was centrifuged at 6 litres/minute and the centrifugate transferred to a clean glass bottle and brought to a known volume with filtered lake-water. From the centrifugate, a sub-sample 10 ml was collected for particulate C, N, P, silica and chlorophyll *a*.

At stations 22, 39, 80, 301 and 404, mysis samples were collected at night using a 500 $\mu$  net hauled from 1 metre above the bottom to the surface. Mysis were hand-picked from the net samples to fill a clean 500 ml glass jar. Samples were labelled and frozen until returned to CCIW for analyses.

There were seven transects completed for air sampling. Samples were collected on PUF's 300 m<sup>3</sup> and pre-ashed filters using a sampler mounted above the bridge. Samples were collected only when the vessel was moving. A blank PUF was collected at 2 stations by placing a clean PUF in the apparatus for 10 seconds then into a sample container.

At stations 5, 80, 170 and 403, ½ metre box cores were collected. The box core was subsampled using three 10 cm diameter core tubes. The cores were extruded at 0.5 cm intervals (0 - 5), 1 cm intervals (5 - 20) and 2 cm intervals (20 - 30). Slices were stored in plastic bags, sealed, labelled and refrigerated at 4°C. Each sectioned core was placed in a larger bag for storage and shipping.

At station 403, one additional core was collected from the box corer and not extruded. This core was transported to CCIW for analysis.

At all Biological Sediment Guideline stations, the following work was completed:

- a) A D.O. profiler was used to obtain a profile from surface to the bottom. The winch speed was reduced in the thermocline and hypolimnion areas.
- b) A water sample was obtained from a depth of bottom -0.5 m from which samples were obtained for nitrate + nitrite, total Kjeldahl nitrogen, total unfiltered phosphorus, alkalinity, pH, conductivity and dissolved oxygen.
- c) 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 jars. The samples were preserved with 5% Formalin.
- d) The remainder of the top 5 cm of the sediment in the box core was removed and placed in a glass dish. This sample was homogenized and sampled in the following manner:
  - i) 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.

- ii) 100 ml were sampled for particle size.
- iii) 500 ml were sampled for major ions, metals, loss on ignition, total organic carbon, total Kjeldahl nitrogen and total phosphorus.

Samples were collected at Biological Sediment Guidelines station 301 (5101) for QA/QC. At this station, all work was done in triplicate. Three separate mini box cores and three separate bottle casts were collected for this work.

At stations 5, 13, 22, 42, 59, 113, 127, 152, 170 and 404, samples were collected from 4 metres using Go-Flow bottles for Haloacetic Acids in support of Dr. B. Scott, AECB study 12317. At stations 80 and 170, samples were collected at 30-metre intervals.

# STATISTICS SUMMARY

CRUISE NO. 98 - 02 - 001

DATE: FROM 27 April 1998 TO 8 May 1998

CRUISE TYPE Toxaphene Study

SHIP

REGION

N.MI. STEAMED

CCGS LIMNOS

LAKE HURON

264.5

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	15	Moorings Established	
EBT/Transmissometer Casts	15	Moorings Retrieved	
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	3	Moorings Established	
Transmissometer Casts	15	Moorings Retrieved	
Zooplankton Hauls			
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles			
Water Samples Collected ( Microbiology )		Cores Taken, Box	3
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 ( HAA )	12	Bulk Centrifuge Samples	
Water Samples Collected ( )			
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 ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

# STATISTICS SUMMARY

<b>CRUISE NO.</b>	98 - 03 - 001	<b>SHIP</b>	CCGS LIMNOS
<b>DATE: FROM</b>	29 April 1998	<b>REGION</b>	LAKE SUPERIOR
<b>CRUISE TYPE</b>	Toxaphene Study	<b>N.MI. STEAMED</b>	694.6

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	31	Moorings Established	
EBT/Transmissometer Casts	31	Moorings Retrieved	
Rosette Casts	6	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)	6	Moorings Retrieved	
Secchi Disc Observations	17	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls	50		
Mysid Hauls	19		
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples	32		
D.O. Profiles	10		
Water Samples Collected ( Microbiology )		Cores Taken, Box	5
Water Samples Collected ( Water Quality )		Cores Taken, Mini Box	13
Water Samples Collected ( D.O. )	12	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	25	Cores Taken, Benthos	
Water Samples Collected ( TP uf )	12	Grab Samples Taken, Shipek	
Water Samples Collected ( TKN )	12	Grab Samples Taken, PONAR	
Water Samples Collected ( Alkalinity )	12	Bulk Centrifuge Samples, 1500 litres	16
Water Samples Collected ( )			
Water Samples Filtered ( CN )	15	Observations, Weather	
Water Samples Filtered ( Chlorophyll a )	15		
Water Samples Filtered ( POC/TPN )			
Water Samples Filtered ( Seston )			
Water Samples Filtered ( TP f )			
Water Samples Filtered ( Nutrients )	12		
Water Samples Filtered ( Major Ions )		ONBOARD ANALYSIS	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	
Water Samples Filtered ( Si )	15	Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( Particulate Phosphorus )	15	Microbiology	

## STATION POSITIONS

## LAKE HURON

1998-1999

STATION NUMBER	LATITUDE N.	LONGITUDE W.
9	43° 38' 35"	82° 13' 00"
12A	43° 58' 58"	82° 10' 04"
20	44° 13' 00"	83° 05' 14"
29	44° 21' 58"	81° 49' 56"
32	44° 27' 10"	82° 20' 25"
33	44° 30' 00"	82° 50' 01"
38	44° 44' 29"	82° 03' 37"
38A	44° 50' 00"	82° 30' 00"
48	45° 16' 47"	82° 27' 11"
54	45° 31' 00"	83° 24' 52"
61	45° 44' 58"	83° 54' 55"
76A	46° 05' 31"	83° 26' 00"
77	45° 58' 13"	83° 12' 07"
83A	46° 00' 00"	82° 30' 02"
110	42° 09' 02"	82° 32' 22"

## STATION POSITIONS

## LAKE SUPERIOR

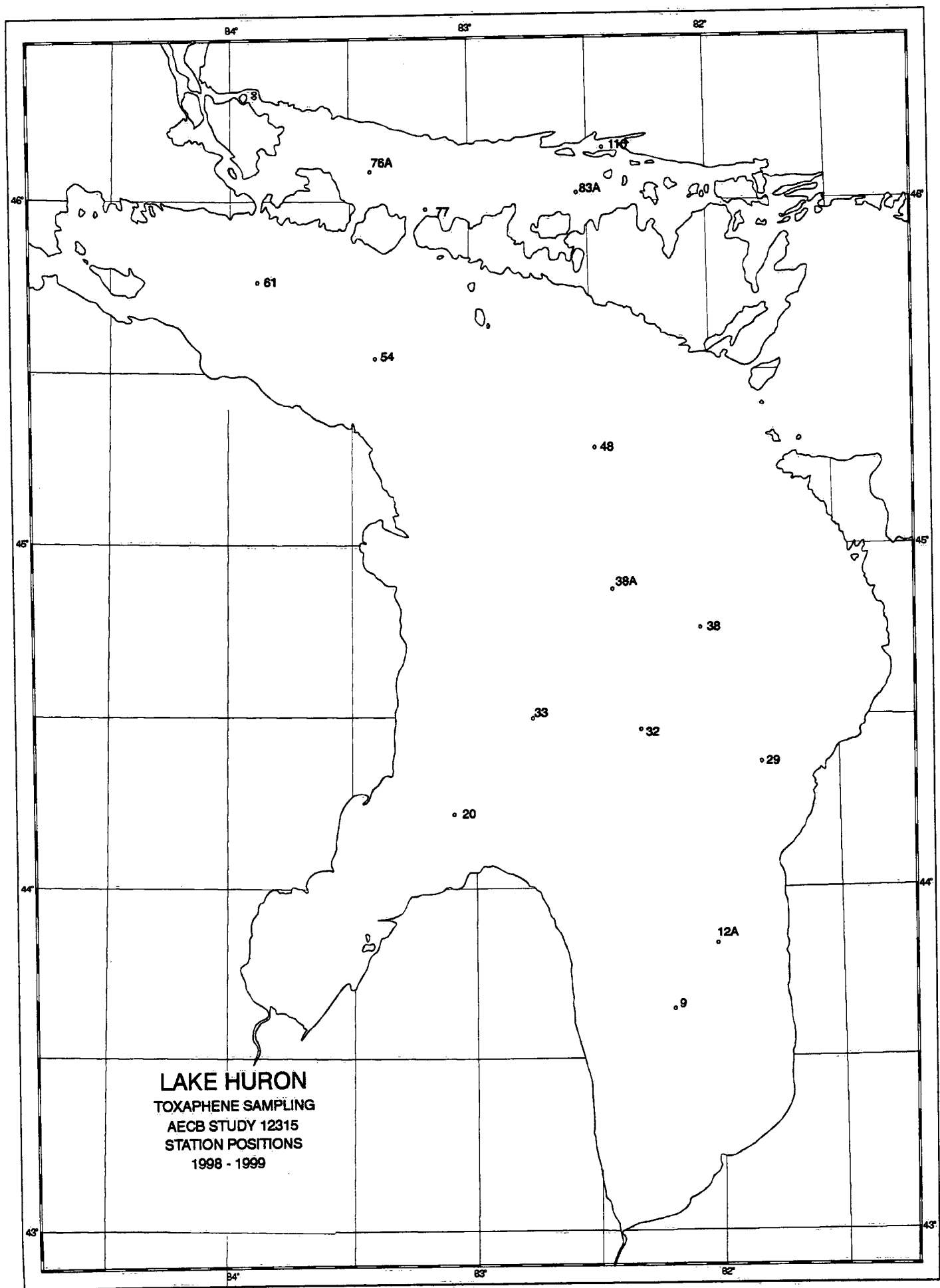
1998-1999

STATION NUMBER	LATITUDE N.	LONGITUDE W.
5	46° 43' 59"	84° 47' 37"
13	46° 53' 58"	85° 09' 56"
22	46° 58' 05"	85° 43' 40"
31	47° 55' 06"	84° 54' 45"
34	47° 50' 25"	85° 12' 29"

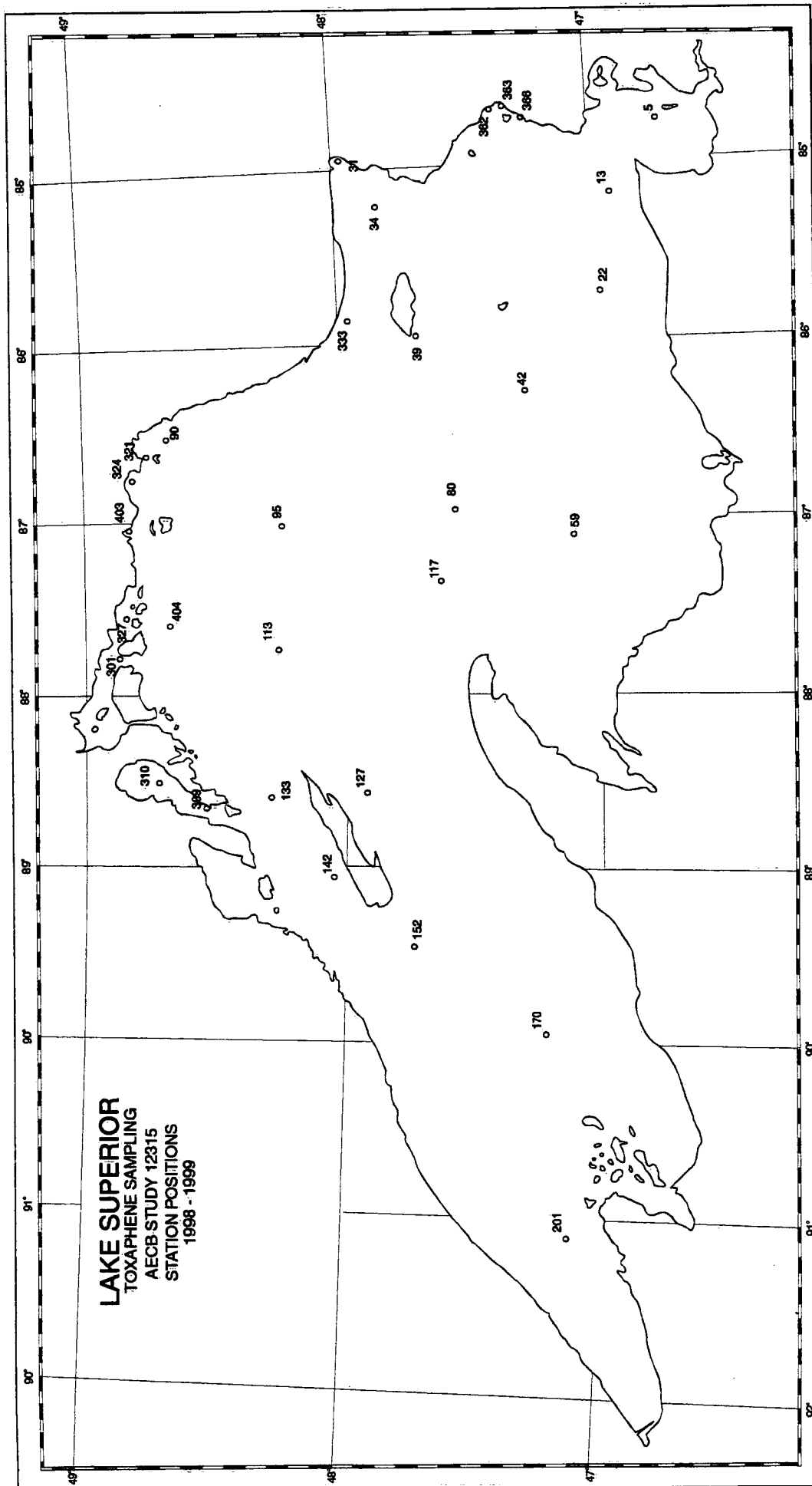
STATION NUMBER	LATITUDE N.	LONGITUDE W.
39	47° 41' 25"	85° 58' 01"
42	47° 19' 31"	86° 22' 20"
59	47° 09' 30"	87° 16' 59"
80	47° 34' 51"	86° 56' 32"
90	48° 39' 59"	86° 27' 02"
95	48° 13' 06"	87° 01' 00"
113	48° 08' 44"	87° 42' 11"
117	47° 41' 01"	87° 36' 01"
127	47° 50' 54"	88° 20' 13"
133	48° 17' 01"	88° 35' 52"
142	48° 06' 00"	89° 04' 59"
152	47° 41' 19"	89° 27' 59"
170	47° 19' 59"	89° 48' 03"
201	47° 07' 55"	91° 06' 41"
301	48° 50' 12"	87° 44' 58"
403	48° 47' 49"	86° 59' 31"
404	48° 34' 02"	87° 34' 01"

BIOLOGICAL SEDIMENT GUIDELINES STATION POSITIONS  
LAKE SUPERIOR  
1998-1999

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
301	5101	48° 50' 09"	87° 44' 58"
309	5109	48° 28' 03"	88° 35' 35"
310	5110	48° 35' 48"	89° 30' 52"
321	2504	48° 43' 37"	86° 36' 56"
324	2507	48° 47' 20"	86° 41' 44"
327	2512	48° 50' 46"	87° 38' 45"
331	2600	47° 55' 57"	85° 52' 38"
362	2410	47° 23' 00"	84° 43' 13"
363	2411	47° 21' 12"	84° 40' 35"
366	2414	47° 15' 40"	84° 37' 30"







**UV AND MICROBIAL COMMUNITY EXAMINATION, LAKE ERIE**  
**AECB STUDY 12372, DR. S. WILHELM**

One cruise was carried out onboard the CCGS LIMNOS for Dr. S. Wilhelm, July 6 - 10 to examine the natural microbial community and the impact of UV radiation on these systems in the Central and Western basins of Lake Erie.

**STATION POSITIONS****LAKE ERIE**

1998-1999

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 30' 03"	79° 53' 17"
84	41° 56' 08"	81° 39' 31"
337	41° 41' 45"	82° 51' 18"
342A	41° 51' 30"	82° 00' 17"
932A	42° 51' 18"	79° 15' 54"
968	41° 44' 30"	82° 43' 58"
969	41° 36' 32"	82° 55' 30"

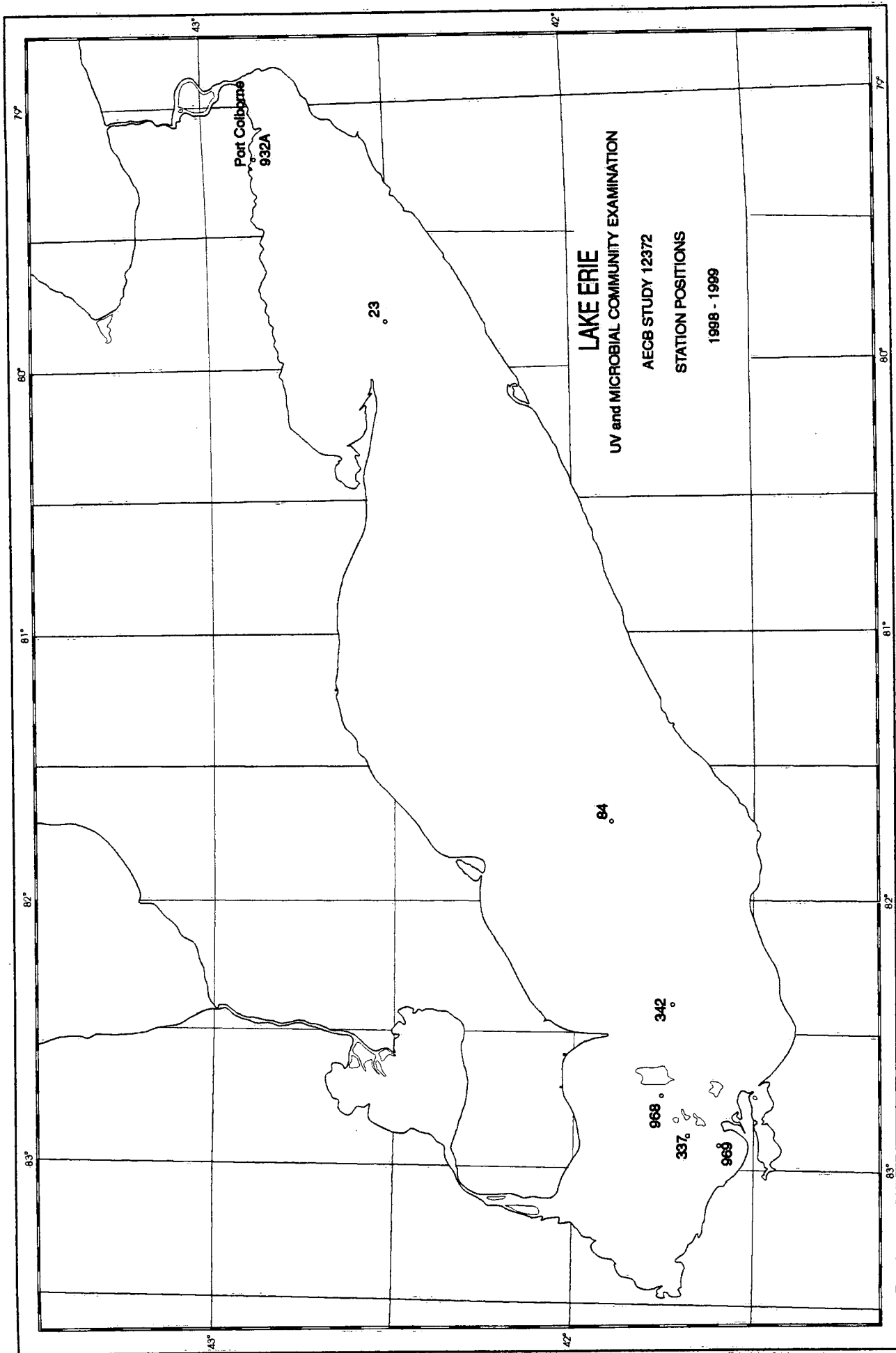
# STATISTICS SUMMARY

**CRUISE NO.** 98 - 01 - 006  
**DATE: FROM** July 6 **TO** July 10, 1998  
**CRUISE TYPE** UV and Microbial Community Examination

**SHIP**  
**REGION**  
**N.MI. STEAMED**

**CCGS LIMNOS**  
**LAKE ERIE**  
373.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	9	Moorings Established	
EBT/Transmissometer Casts	27	Moorings Retrieved	
Rosette Casts	27	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	12	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls			
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples	27		
D.O. Profiles	28		
Water Samples Collected ( Microbiology )		Cores Taken, Box	
Water Samples Collected ( Water Quality )		Cores Taken, Mini Box	
Water Samples Collected ( D.O. )	10	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )		Cores Taken, Benthos	
Water Samples Collected ( TP uf )		Grab Samples Taken, Shipek	
Water Samples Collected ( Viral )	27	Grab Samples Taken, PONAR	
Water Samples Collected ( Bacterial )	27	Bulk Centrifuge Samples	
Water Samples Collected ( )			
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered ( Chlorophyll a )	27	Fluorometer Profiles	27
Water Samples Filtered ( POC/TPN )			
Water Samples Filtered ( Seston )			
Water Samples Filtered ( TP f )			
Water Samples Filtered ( Nutrients )	27		
Water Samples Filtered ( Major Ions )		<b>ONBOARD ANALYSIS</b>	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	10
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	



**AQUATIC ECOSYSTEM IMPACTS BRANCH****METEOROLOGICAL AND TEMPERATURE MOORINGS**

AEIB 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 6 - 8 and retrieved on the cruise October 26 - 28. The two temperature moorings had been winter moorings installed in October of 1997, refurbished as U-shaped moorings in April of 1998 and then reinstalled as winter moorings in October to be retrieved in the spring of 1999. On the October cruise, Mysis net hauls were done at station 64 in the deep hole and at station 41. In April at station 403 a sediment trap mooring was installed for M. Charlton on the October cruise the mooring was retrieved and installed as a winter mooring.

# STATISTICS SUMMARY

CRUISE NO. \_\_\_\_\_

DATE: \_\_\_\_\_

CRUISE TYPE \_\_\_\_\_

Moorings

SHIP

REGION

N.MI. STEAMED

CCGS LIMNOS

LAKE ONTARIO

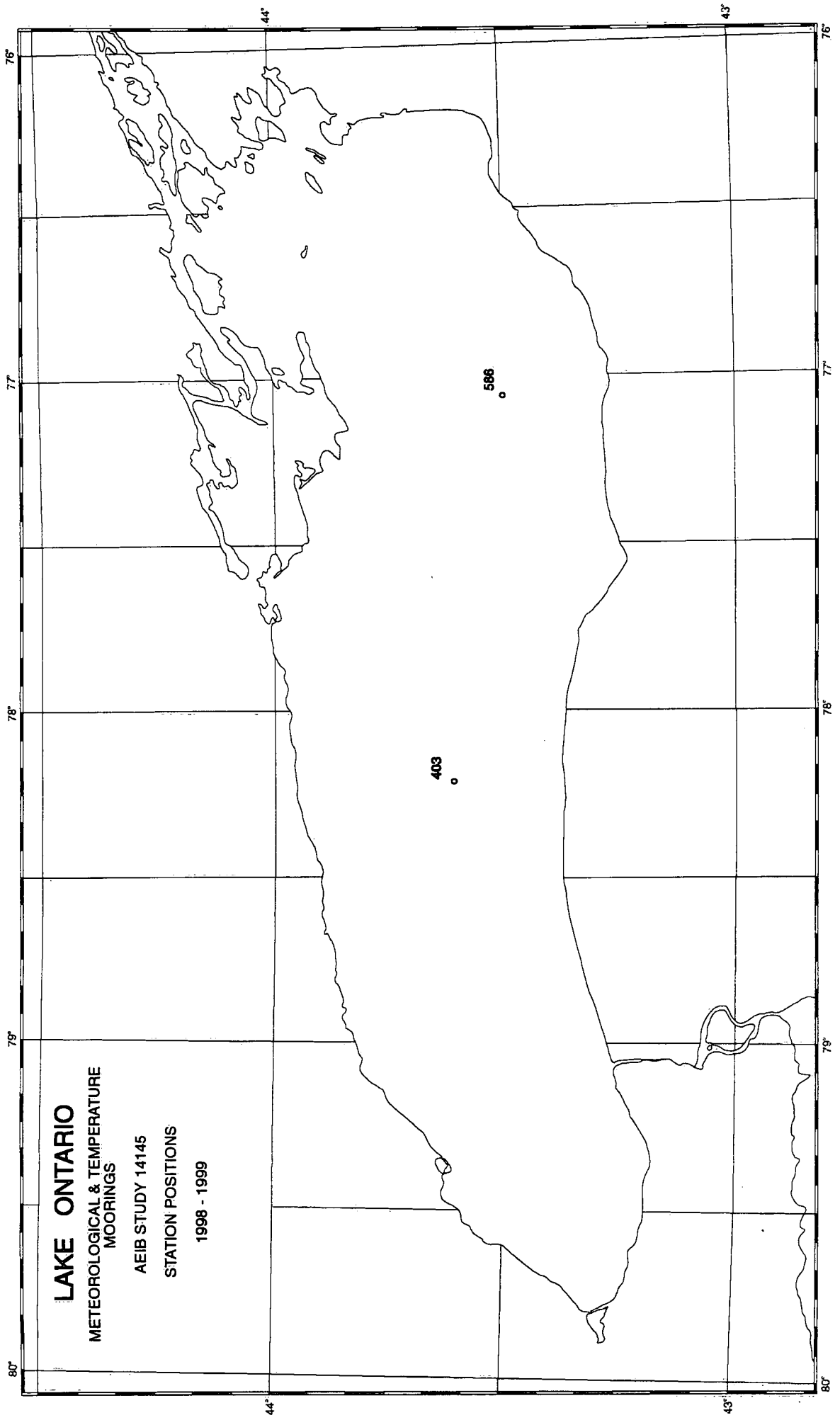
536.0

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	8	Moorings Established, Sediment Trap	2
EBT/Transmissometer Casts	8	Moorings Retrieved	
Rosette Casts		Moorings Established, Meteorological	2
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved, Meteorological	2
Secchi Disc Observations	2	Moorings Established	
Transmissometer Casts		Moorings Retrieved, Infiltrax	4
Zooplankton Hauls		Moorings Refurbished, Temperature Logger	4
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples		Mysid Net Hauls	14
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	
Water Samples Collected ( Halo Acetic Acid )	18	Bulk Centrifuge Samples	
Water Samples Collected ( Organotin )	13		
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered ( Chlorophyll a )	12		
Water Samples Filtered ( POC/TPN )			
Water Samples Filtered ( Seston )	12		
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

1997 - 1998

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
586	98-00M-33A	43° 29' 04"	77° 03' 10"	MET T (2 m)
	98-00M-34A	43° 28' 54"	77° 03' 07"	MET
	97-00T-35B	43° 29' 01"	77° 03' 10"	T (12,21,31, 41,51,81,141, 223 m)
	98-00T-35A	43° 28' 58"	77° 03' 13"	T (4,6,8,10, 14,18,22,26, 35,50, 150 m)
	97-00T-36A	43° 28' 59"	77° 03' 01"	T (12,16,20, 24,30,40,100, 221 m)
403	97-00T-36B	43° 29' 07"	77° 03' 10"	T (10,16,26, 36,46,61,101 181 m)
	98-00A-65A	43° 36' 08"	78° 13' 57"	ST(20,60, 100,140,166, 174 m)
	97-00A-65D	43° 36' 01"	78° 13' 30"	ST(20,60, 100,140,166, 174 m)





## RESEARCH SUPPORT BRANCH

### OPEN LAKES SURVEILLANCE, LAKES ONTARIO AND ERIE ENVIRONMENTAL CONSERVATION BRANCH, ONTARIO REGION, S. L'ITALIEN 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 Ontario, March 30 - April 3, August 17 - 21 and two on Lake Erie, April 20 - 24, July 20 - 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 and GPS positioning systems and a variety of samplers and winches used for chemical and biological sampling.

The parameters sampled during the 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<sub>4</sub>, chloride, reactive silicate, major ions (Mg, K, Ca), meteorological and Secchi disc observations.

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

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

Some of the additional tasks performed during the cruises were: Water samples collected for Phenoxy acid herbicides for J. Struger EHD, ECB-OR; Microbial Loop samples for Dr. M. Munawar, GLLFAS; PONAR grab samples for R. Dermott, GLLFAS; zooplankton net hauls for Dr. O. Johannsson, GLLFAS; sediment trap moorings and mini box cores for the University of Windsor.

# STATISTICS SUMMARY

CRUISE NO.

DATE

CRUISE TYPE

SHIP

REGION

N.MI. STEAMED

CCGS LIMNOS

LAKE ONTARIO

1319.8

Lower Lakes Surveillance

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	190	Moorings Established Sediment Trap	1
EBT/Transmissometer Casts	193	Moorings Retrieved Sediment trap	1
Rosette Casts	99	Moorings Established Infiltrax	4
Reversing Thermometer Obs. (No. of Therm)	36	Moorings Retrieved Infiltrax	4
Secchi Disc Observations	77	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls		Moorings Serviced Meteorological	1
Van Dorn Casts	91		
Integrator 10 m	3		
Integrator 20 m	186	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. )	573	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	573	Cores Taken, Benthos	
Water Samples Collected ( TP uf )	573	Grab Samples Taken, Shipek	
Water Samples Collected ( TKN )		Grab Samples Taken, PONAR	
Water Samples Collected ( )		Bulk Centrifuge Samples 50 Litre	23
Water Samples Collected ( )			
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered ( Chlorophyll a )	234	Goulden Sampler Extractions	23
Water Samples Filtered ( POC/TPN )	279		
Water Samples Filtered ( Seston )			
Water Samples Filtered ( TP f )	573		
Water Samples Filtered ( Nutrients )	461		
Water Samples Filtered ( Major Ions )	106	ONBOARD ANALYSIS	
Water Samples Filtered ( DOC )		Manual Chemistry, Tech. Ops.	1749
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ( )		Microbiology	

# STATISTICS SUMMARY

CRUISE NO.  
DATE  
CRUISE TYPE

Lower Lakes Surveillance

SHIP  
REGION  
N.MI. STEAMED

CCGS LIMNOS  
LAKE ERIE  
1335.9

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	109	Moorings Established Sediment Trap	
EBT/Transmissometer Casts	109	Moorings Retrieved Sediment trap	
Rosette Casts	52	Moorings Established Infiltrax	
Reversing Thermometer Obs. (No. of Therm)	4	Moorings Retrieved Infiltrax	
Secchi Disc Observations	50	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls		Moorings Serviced Meteorological	
Van Dorn Casts	62		
Integrator 10 m	52		
Integrator 20 m	53	Primary Productivity Moorings	
Phytoplankton Samples	5	Phenoxy Acid Herbicides	4
D.O. Profiles		Neutral Herbicides	12
Water Samples Collected ( Microbiology )		Cores Taken, Box	
Water Samples Collected ( Water Quality )		Cores Taken, Mini Box	15
Water Samples Collected ( D.O. )	312	Cores Taken, Piston	
Water Samples Collected ( Cond/pH )	312	Cores Taken, Benthos	
Water Samples Collected ( TP uf )	345	Grab Samples Taken, Shipek	
Water Samples Collected ( TKN )	345	Grab Samples Taken, PONAR	7
Water Samples Collected ( Ciliate )	11	Bulk Centrifuge Samples 50 Litre	40
Water Samples Collected ( Microbial Loop )	11		
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered ( Chlorophyll a )	124	Goulden Sampler Extractions	
Water Samples Filtered ( POC/TPN )	167		
Water Samples Filtered ( Seston )			
Water Samples Filtered ( TP f )	345		
Water Samples Filtered ( Nutrients )	345		
Water Samples Filtered ( Major Ions )	345	ONBOARD ANALYSIS	
Water Samples Filtered ( DOC )	20	Manual Chemistry, Tech. Ops.	710
Water Samples Filtered ( )		Nutrients, EHD, ECB, EC-OR	83
Water Samples Filtered ( )		Microbiology	

## STATION POSITIONS

## LAKE ONTARIO

1998-1999

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

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

---

STATION NUMBER	LATITUDE N.	LONGITUDE W.
<hr/>		
71	43° 28' 36"	76° 31' 36"
72	43° 33' 00"	76° 31' 30"
73	43° 38' 00"	76° 17' 18"
74	43° 45' 00"	76° 31' 06"
75	43° 50' 36"	76° 21' 18"
76	43° 57' 00"	76° 10' 30"
77	43° 57' 24"	76° 24' 30"
78	44° 05' 00"	76° 24' 24"
79	44° 04' 30"	76° 31' 18"
80	44° 08' 30"	76° 36' 36"
81	44° 01' 00"	76° 40' 18"
82	44° 04' 00"	76° 48' 42"
83	44° 00' 00"	76° 50' 36"
84	43° 53' 12"	76° 44' 00"
85	43° 45' 00"	79° 05' 00"
86	43° 15' 18"	79° 11' 42"
87	43° 17' 54"	77° 31' 06"
88	43° 35' 18"	76° 25' 00"
89	43° 41' 54"	76° 25' 00"
90	44° 08' 11"	76° 49' 30"
91	43° 55' 12"	78° 18' 24"
93	43° 19' 36"	78° 52' 06"
94	43° 19' 30"	77° 13' 00"
95	43° 18' 48"	77° 00' 00"
96	43° 13' 24"	79° 26' 48"
97	43° 57' 42"	76° 07' 18"
98	43° 56' 06"	76° 13' 54"

---

## STATION POSITIONS

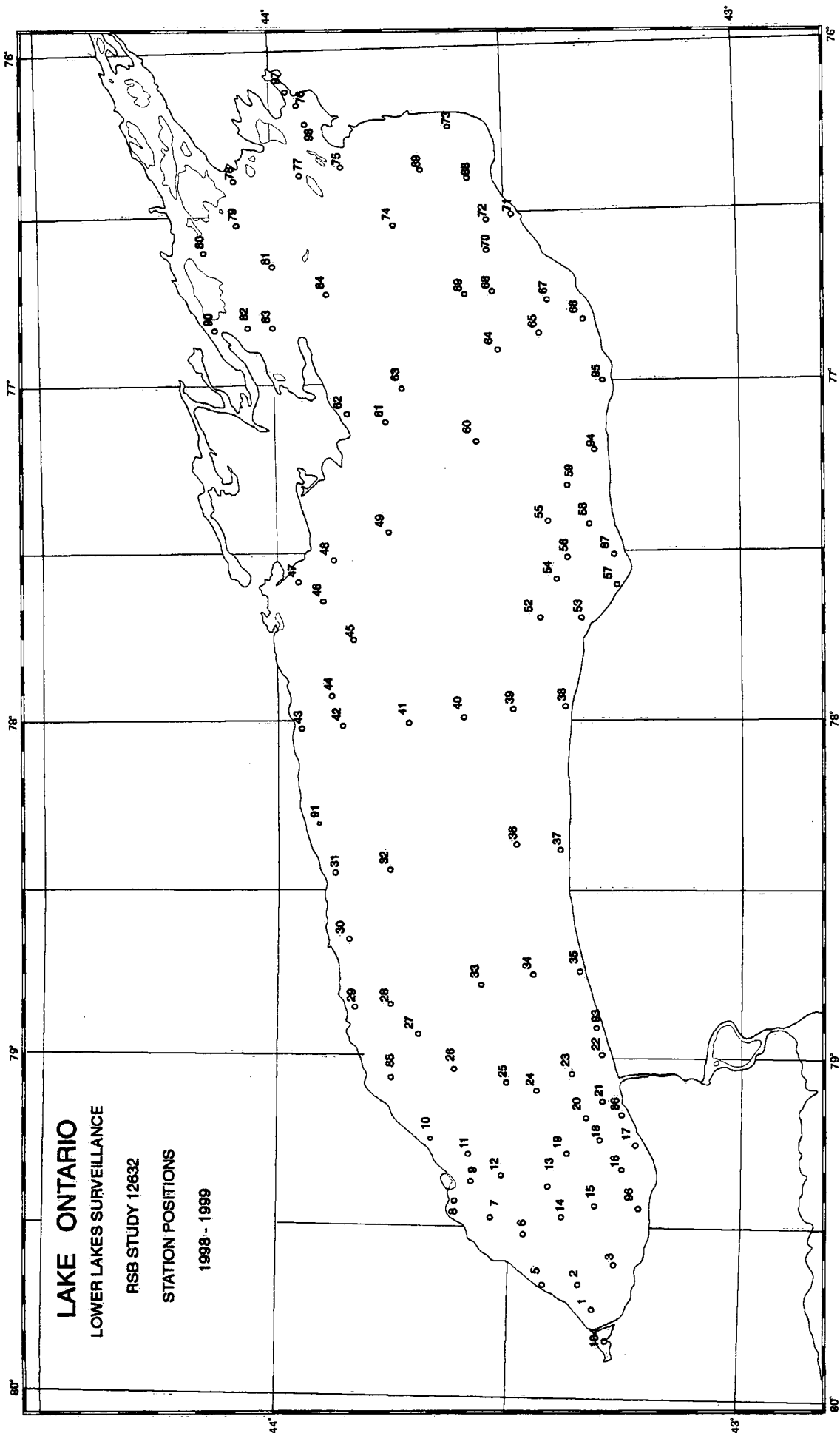
## LAKE ERIE

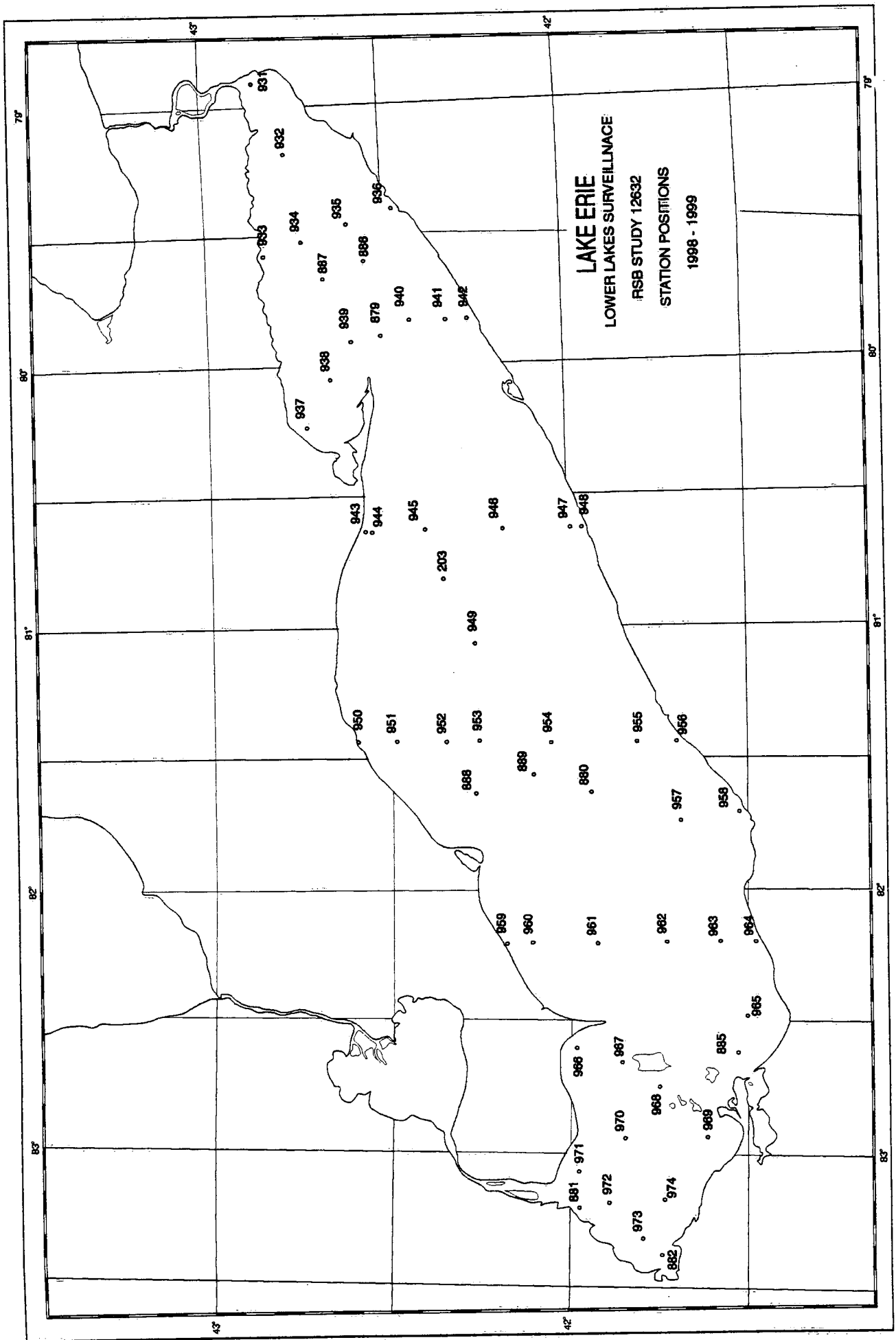
1998-1999

STATION NUMBER	L'ITALIEN NUMBER	LATITUDE N.	LONGITUDE W.
879	23	42° 30' 25"	79° 53' 59"
880	84	41° 56' 09"	81° 39' 16"
881	213	41° 58' 08"	83° 12' 30"
882	215	41° 44' 02"	83° 23' 08"
885	268	41° 31' 10"	82° 38' 27"
886	9	42° 32' 18"	79° 37' 00"
887	10	42° 38' 48"	79° 41' 30"
888	37	42° 16' 48"	81° 40' 18"
889	38	42° 06' 36"	81° 34' 30"
931	228	42° 51' 00"	78° 56' 30"
932	227	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"
947	221	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"

STATION NUMBER	L'ITALIEN NUMBER	LATITUDE N.	LONGITUDE W.
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	357	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"







**SHORE PROGRAMS****NATIONAL LABORATORY FOR ENVIRONMENTAL TESTING****SAMPLING RIVERS IN ALBERTA, SASKATCHEWAN, MANITOBA AND ONTARIO  
NLET STUDY 12180, H. ALKEMA**

Water samples were collected from several rivers throughout the three prairie provinces and from Northern Ontario during the weeks of May 18 and May 26 on a return trip from the West. The samples are to be used for Quality Control and Quality Assurance of analytical laboratories that require certification of their analytical methodologies. A dual-wheel crew cab and a 14-foot box trailer were used to transport the water collected from each site to CCIW in Burlington. Samples at each site consisted of one barrel (200 litres) of water. The samples were sealed and returned without any preservative. On return to CCIW the samples were stored in the large walk-in cooler until they were centrifuged in August '98 to remove any particulates. The sampling sites are described as follows:

1. Wascana River at Regina, Saskatchewan: The sampling site was located at the service parking lot opposite public parking lot #4. The sample was collected from the shoreline of the river/lake.
2. Frenchman River at Eastend, Saskatchewan: The sampling site was at a suspension bridge that crosses the river at the Eastend golf course. The sample was collected from mid-stream.
3. Bow River at Calgary, Alberta: The site was located at the Bownes Municipal Park below Stoney Trail Bridge on the right bank.
4. Athabasca River at Hinton, Alberta: The site was located above Highway 40 Bridge upstream of Hinton. The river access was through a ranch on a gravel road which was the first left turn after crossing the bridge. The sample was collected from the left bank.
5. North Saskatchewan River between Edmonton and Fort Saskatchewan, Alberta: The site was located at the Capital Region Sewage Treatment Plant accessed from Highway 21. The samples were collected from the right bank.
6. Beaver River at Beaver Crossing, Alberta (near Cold Lake, Alberta): The site was located at the water level gauging station upstream of Highway 28. The sample was collected from the right bank.
7. Eagle River (Creek) near Asquith, Saskatchewan. The sampling site was situated at the Eagle Creek Recreational Park. The Eagle Creek Park was accessed from a gravel road 1 km West of the highway bridge as it crosses Highway 376. The sample was collected from the left bank.
8. Swan River at Swan River, Manitoba: The sampling site was situated below the bridge at Highway 10A. The sample was collected from the right bank.
9. Fisher River, West of the village of Hodgson, Manitoba: The site is located at the highway bridge as it crosses Secondary Road 325. Hodgson is located 150 km North of Winnipeg. The sample was collected from the right bank.

10. Whitemouth River at Hadashville, Manitoba: The sampling site was at the Whitemouth River Campground. The campground is located South of Hadashville on Highway 11 East of Winnipeg, Manitoba. The sample was collected from the left bank.
11. Aux Sable River at Massey, Ontario: Sampled at Rivermouth Park at the town of Massey. The sample was collected from the right bank. The flow of the river at the sampling site was minimal and may have been mixed with water from the Spanish River since the sampling site was very close to the confluence of the two rivers.

Two sediment samples were collected for Dr. V. Cheam of AERB to verify samples collected in 1996 for his Thallium study. The samples were collected from the bridge at Highway 39 as it crossed the Souris River and at the bridge at Highway 18 as it crossed the outflow river of Boundary Reservoir.

# **AQUATIC ECOSYSTEM RESTORATION BRANCH**

## **SANDCAP STUDY, HAMILTON HARBOUR** AERB STUDY 12214, A. ZEMAN

As an alternative method of sediment remediation, sandcapping an area of contaminated sediments has been tested in the USA. As part of the Hamilton Harbour Remediation Program, a test site was chosen just West of the LaSalle Marina. The test area is 100 metres square and was covered with a layer of clean sand approximately 35 cm thick during the summer of 1995. Technical Operations provided support in the areas of moorings, silt thickness measurements and diving operations.

The corner marker spars were installed around the sandcap on April 16 and removed for the winter on November 20. Silt thickness measurements were taken on April 17 at six locations on the sandcap.

### **STATION POSITIONS (DGPS - WGS 84)**

STATION	THICKNESS	NORTHING	EASTING
1	4.0 cm	4794307.	593424.
2	3.8 cm	4794288.	593468.
3	3.8 cm	4794297.	593501.
4	4.0 cm	4794227.	593431.
5	3.0 cm	4794252.	593474.
6	3.7 cm	4794220.	593500.

## **SEDIMENT REMEDIATION, HAMILTON HARBOUR** AERB STUDY 12216, Dr. T.B. Reynoldson

Mini box core samples and Hydrolab profiles were collected at two stations in Hamilton Harbour. Stations HH3 (Western Basin) and HH19 (Deep Basin) were chosen to study community structure in the area. Samples were collected in the middle of the month from April to November with a total of 8 samples collected.

Two Datasonde3 loggers were deployed in the Western Basin and one in the deep basin to monitor dissolved oxygen during the months of April to October.

### **DATASONDE3 LOGGER POSITIONS**

STATION NUMBER	LATITUDE N.	LONGITUDE W.
98-50E-30A	43° 16' 44"	79° 52' 27"
98-50E-31A	43° 17' 18"	79° 50' 22"

**BIOLOGICAL SEDIMENT GUIDELINES SAMPLING**  
**AERB STUDY 12216, DR. T.B. REYNOLDSON**

Technical Operations Section supported this project by assisting with the collection of bottom sediment samples by small boat from the Bay of Quinte, Prince Edward Bay and Presqu'ile Bay areas of Lake Ontario.

The Collins Bay Boat Ramp was used to launch the PETREL and four stations were sampled. These included three previously sampled sites in the vicinity of Amherst Island (1313, 1317, 1318) and a new site near the Glenora ferry terminal (1319). At each site a Secchi disk observation was done and a water sample was collected from the B-5-metre depth for water quality parameters. A mini box core sample was collected from which five 10 cm subcores were taken for benthos enumeration. A sample of the top 5 cm was collected and homogenized for organic analysis, particle size, major ions, metals, loss on ignition, total organic carbon, total Kjeldahl nitrogen and total phosphorus.

The PETREL was launched at the Waupoos Marina and site #1303 in the West end of Prince Edward Bay was sampled. Six mini PONAR grabs were collected in place of the mini box core here because of safety concerns due to rough sea conditions. The boat was trailered to Brighton and launched in Presqu'ile Bay. Five sites were sampled (401, 402, 403, 404, 405)—all by mini box core.

**STATION POSITIONS**

STATION NO.	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
1210	401	44° 00' 47.2"	77° 42' 30.4"
1211	402	44° 00' 20.9"	77° 41' 17.4"
1212	403	44° 00' 25.1"	77° 42' 47.0"
1213	404	44° 00' 39.9"	77° 43' 36.5"
1214	405	43° 59' 48.4"	77° 42' 57.7"
1216	1303	43° 57' 13.8"	77° 00' 53.9"
1219	1313	44° 07' 30.9"	76° 49' 54.2"
1220	1317	44° 08' 59.0"	76° 38' 04.5"
1221	1318	44° 12' 00.0"	76° 40' 30.0"
1222	1319	44° 02' 52.2"	77° 02' 10.8"

**SANDCAP SEDIMENT CHEMISTRY, HAMILTON HARBOUR**  
**AERB STUDY 12217, F. ROSA**

As part of a long-term assessment of the migration of contaminants up through the sand layer, peepers were installed on and near the northwest corner of the sandcap. On April 16, a TOS dive team accompanied by Mr. F. Rosa, travelled to the Hamilton Harbour sandcap site. Four large peepers and two small peepers were installed. Five peepers were placed on the sandcap and the sixth (larger) was installed as a control site in undisturbed sediment, twenty feet northwest of the corner spar buoy. Since the installation of the peepers, the sand had packed tightly around them, combined with their fragile construction, making retrieval difficult. One peeper was removed from the cap on June 3<sup>rd</sup> and another on September 24<sup>th</sup>. For the winter of 98/99 there remains one large peeper and two small peepers on the sandcap as well as the single control peeper. The remaining peepers will be sampled in April '99.

**STATION POSITION (DGPS WGS 84)**

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
98-50S-72A	43° 17.75'	079° 50.90'	4794325.	593413.

**SEDIMENT REMEDIATION**  
**AERB STUDY 12217, F. ROSA**

This study is a continuation from 1997. The sediment resuspension sampler—station R9 (in the middle of the sand capping area) and station R3 (deep basin) were refurbished on April 28<sup>th</sup>. Both were winter moorings and were redeployed as summer moorings. Both stations were refurbished once a month from April until November and then redeployed as winter moorings. The samples were analyzed for carbon content, metals, and organics. The purpose of the study is to determine if there is any resuspension and movement of sand or silt away from the sandcapping area.

**SEDIMENT TRAP MOORINGS**

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
R3	98-50A-77A	43° 17' 14"	79° 50' 25"
R9	98-50A-83A	43° 17' 43"	79° 50' 53"



SAMPLING ON A RAINY DAY AT GRAVEL PIT LAKE NEAR ROUYN-NORANDA



**POREWATER CHEMISTRY STUDY, ROUYN-NORANDA, QUEBEC**  
**AERB STUDY 12217, F. ROSA**

This field sampling activity was a co-operative study between AERB and the Geological Survey of Canada to study porewater chemistry, especially Mercury, in small lakes in the area. Support was given by installing six peepers in the deep holes of Green Lake and Gravel Pit Lake located near Rouyn-Noranda, Quebec. The peepers were installed during the week of September 14 and retrieved during the week of October 5.

On arrival at Green Lake (located 75 km southeast of Rouyn-Noranda) the following sampling was conducted: Hydrolab profile to bottom; water samples at 1 metre and bottom -1 metre (15 m) were collected for H. Wong utilizing a Go-Flow bottle; two cores were collected using a Tech. Ops. corer with a 6.66 cm core tube; and one small peeper and two large peepers were retrieved. The peepers were drained and the samples preserved as per the protocol provided by H. Wong. One core was subdivided into 1 cm sections and the second core was returned to CCIW intact.

Gravel Pit Lake, which is located approximately 15 km northeast of the smelter in Rouyn-Noranda, was visited next and sampling at that lake was akin to the work conducted on Green Lake.

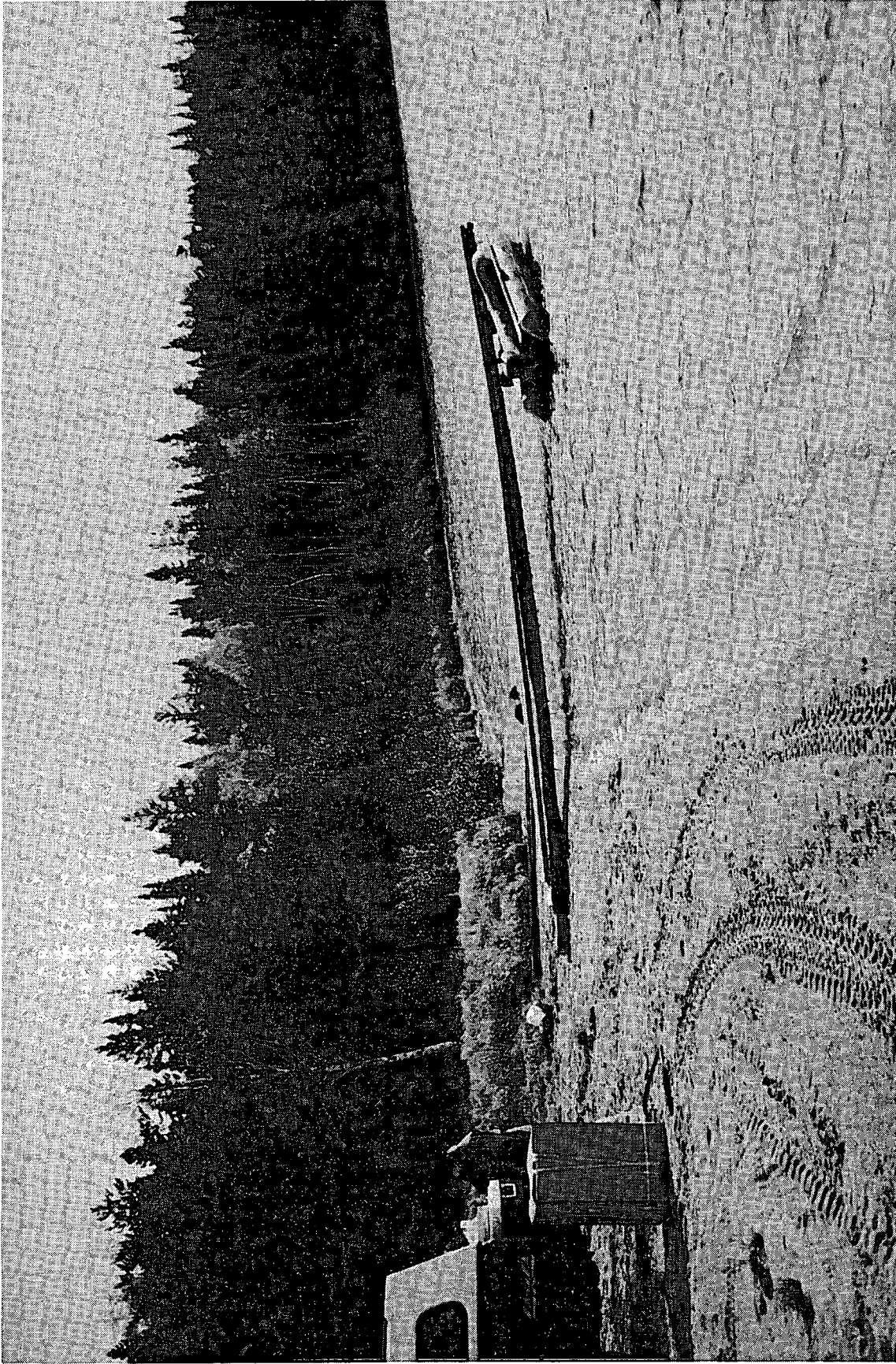
While in the area, sediment samples (using a PONAR sampler) were collected for Dr. Borgmann, AERB study 12220 from Lac Dufault on the northern edge of Rouyn-Noranda. The samples were collected from the same site that was visited for Dr. Reynoldson in 1997.

**METAL EFFECTS IN SUDBURY AND NORTH BAY**  
**AERB STUDY 12220, DR. U. BORGMANN**

The purpose of this study was to compare Benthic community structures, phosphate, metals, particle size and metal speciation (especially Mercury) in the sediments and water columns of the same lakes that were sampled in 1996. Water, sediments and Benthic fauna were collected during the weeks of August 10 and 17 to study the effects of metals from lakes at varying distances away from a known point source.

The following lakes in the Sudbury and North Bay area were revisited: McFarlane, Ramsey, Richard and Raft in the Sudbury area; Lower Sturgeon, Trout, Nepewessi, Kakakiwaganda (approximately 50 km southeast of Sudbury), Tomiko, Talon, Nosbonsing and Restoule in the North Bay area. Each lake was sampled at the 10-metre depth and the deep hole if greater than 10 metres. Ramsay (although deeper than 10 metres) was sampled in the deep hole only.

At each station located by Lowrance sounder and visual bearings, a Hydrolab profile was conducted to obtain water temperature, pH, oxygen (ppm and %saturation), conductivity and depth. Water samples were collected from 1 metre and bottom -1 metre for nutrients, major ions, metals, chlorophyll a, Seston and phosphate. PONAR samples were collected for bioassays and Benthic speciation for Dr. Borgmann. PONAR samples were collected for Dr. Jackson, AERB study 12224 for mercury investigations. Metals and phosphate samples were



GREEN LAKE BOAT RAMP

collected for Mr. F. Rosa, AERB study 12217. All samples were frozen or kept at 4°C as requested by the researchers.

Staff supporting this project were: Mr. W. Norwood of AERB; Messrs. M. Benner and M. Mawhinney of Technical Operations, Research Support Branch.

Mohammed Shouhami Othman from the University of Wales, Cardiff, accompanied staff to observe sampling techniques and to collect *Hyaella* which was taken back to Europe for further studies. *Hyaella* is not found naturally in Europe and all research on those plankton must be done utilizing imported and lab-raised specimens. All previous *Hyaella* specimens used in Mohammed Othman's studies were purchased in Germany so it was an enlightening experience for the student to actually collect his own samples.

#### **SEDIMENT TREATMENT**

**AERB STUDY 12221, DR. T.P. MURPHY**

The injection of liquid and solid calcium nitrate into the bottom sediments to act as an oxidant is being tested as an alternative to dredging operations. The intent of this project is to develop in situ bioremediation of organic contaminants in sediments for about 20% of the cost of dredging and storage in a confined disposal facility (Murphy et al, 1994). The addition of calcium nitrate will increase microbial activity, creating an oxic environment to assist the biodegradation of oil and coal tar. Two sites in the prairies (Whitewater Lake, Manitoba and Pukowki Lake, Alberta) were surveyed for pre-treatment data collection as part of an ongoing program.

On May 11, Messrs. B. Gray and H. Don departed CCIW for Whitewater Lake, Manitoba and Pukowki Lake, Alberta. Both regions are experiencing a problem with wildfowl dying. Through the efforts of Dr. T. Murphy, TOS was asked to carry out a pre-injection sampling program. Two trips were planned for and set up but prior to the second trip, Dr. Murphy dropped TOS support in favour of staff from the State University of New York (SUNY). It should be noted that the SUNY personnel could not have participated without TOS training and equipment. It is hoped that the analysis of the samples will determine if these areas could be helped with sediment treatment techniques developed at CCIW. All sampling was carried out from air boats supplied by Ducks Unlimited. A DGPS base station was used to obtain accurate positions for all sampling stations.

On arrival at the lakes, many differences were noticed. At Whitewater Lake the spring snow melt was lower than normal but water levels were high from heavy spring rains. There was a large number of ducks, geese, pelicans, terns and gulls populating the area. Only six dead birds were picked up—all near Site #5. The weeds had not started to grow yet.

At Pakowki Lake, water levels were down nearly two feet as a result of little snow melt and an almost total lack of rainfall during the spring. There were fewer numbers of birds on the lake and most were seen in the western arm. Because of the warmer temperatures the weed growth was advanced. The area of the west arm near the bridge on highway 885 was already choked with milfoil.

### WHITEWATER LAKE:

The air boat used for the sampling program was provided by Ducks Unlimited and driven by Mr. Dave Clayton. Weather during the sampling period was wet and windy. On the first sampling day when the six major stations were sampled, the wind was northwest at 60 kph for the entire day. The lake water was very turbid at all stations. The high turbidity of the samples greatly increased the filtering time at the motel. Stream samples were not collected due to a lack of time to process the samples at the motel and no noticeable flow was observed. At stations where some weed growth was observed, a search for snails was made but none were found. During sampling, a stringy, filamentous algae was observed at Site #1. No cattle were observed near the lake but grazing pastures were recorded along the northwest shoreline, south-central shoreline and a small area in the northeast corner of the lake.

### Positioning:

A differential base station was established on the county line north of the lake. Survey information was provided by the Manitoba Natural Resources Land Information Centre. Permission to operate the radio beacon at the base station was granted by Industry Canada, Winnipeg, Manitoba. In order to better manage the additional time required to set up the base station each morning, a new survey marker was installed at the base camp. Intermittent problems were encountered with the system at the receiver end. Original thinking seemed to indicate the vibration of the airboat and the magnetos on the engine were the cause of the problem. Later at Pakowki Lake the problem was found to be a broken wire at the base of the receiver's radio antenna. All station positions were recorded by GPS.

### Peepers:

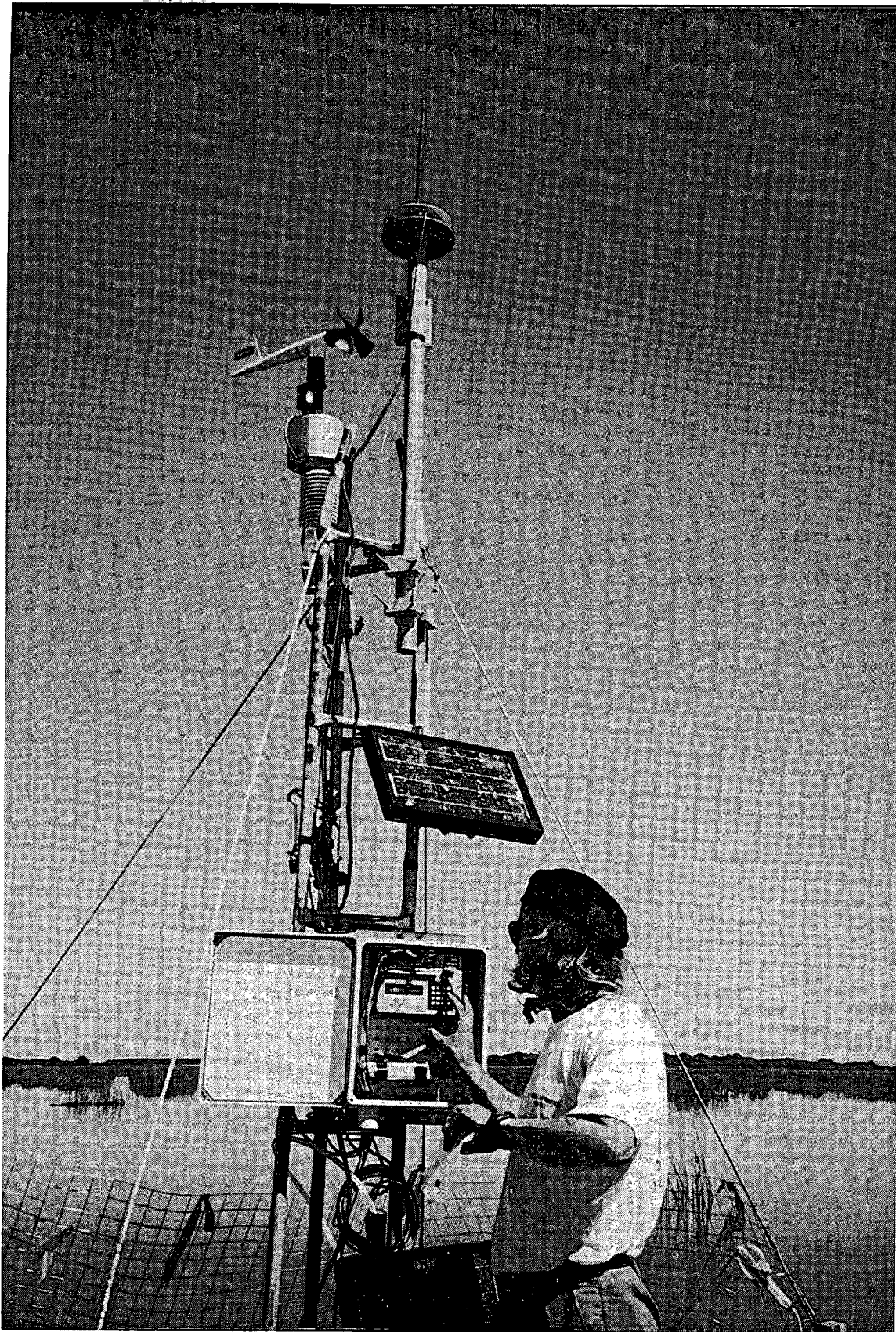
Peepers (18) were assembled on Wednesday evening at the motel. They were submerged in a tub and bubbled with nitrogen from a 300 cu. ft. cylinder. The peepers were installed on Friday in triplicate at the six major sampling sites. During transit to the lake and during the travel to each station the peepers were bubbled in a tub from a small nitrogen cylinder.

### Water Sampling:

Water samples were collected for Algal Toxins, Algal enumeration, Alkalinity, Major Ions, Total Phosphorus, Anions, Ammonia, Metals, Nutrients (DIC/DOC), and Chlorophyll *a*. Algal Toxins were collected in triplicate on station and placed in a cooler. All other samples were collected and placed in a cooler for transport to the motel for further preparation. At the motel the samples were handled as follows:

- Algal enumeration samples (2 100 ml bottles) were preserved with 1 ml Lugol's solution and placed in a cooler
- Alkalinity samples were poured into a 250 ml bottle and stored in the cooler
- Major Ion samples were placed in one 100 ml bottle and placed in the cooler
- Chlorophyll *a* samples were collected on GF/F filters. The volume filtered was recorded and samples placed in the cooler
- Filtered water from the chlorophyll *a* samples was filtered a second time using a 0.45 µm cellulose acetate filter. This water was split for TP, DIC/DOC and metals
- Total phosphorus samples were placed in a 100 ml bottle and preserved with 100 µL of concentrated sulfuric acid and placed in the cooler
- DIC/DOC samples were placed in a 100 ml bottle and preserved with 100 µL of concentrated sulfuric acid and placed in the cooler
- Metals samples were placed in a 250 ml bottle and preserved with 500 µL of concentrated nitric acid and placed in the cooler.





**MONITORING THE MET STATION AT WHITEWATER LAKE**

#### SeaBird Profiler Sampling:

The SeaBird unit—being too heavy and cumbersome to handle over the side of the air boat, was provided with a bath. Water was pumped into the bath from 10 cm below the surface and through an outflow back into the lake. This system worked extremely well but the high sediment content of the water kept clogging the bleed hole at the top of the "Y" tube. During the sampling of the second priority stations the A:\ drive of the computer crashed. All data was saved on the hard drive in the directory C:\seasoft\whitewat. The unit was very hard on batteries which had to be changed each morning prior to the start of the survey.

#### Hydrolab Sampling:

The Hydrolab unit worked well but once in awhile the water temperature appeared to show low readings when compared to that of the SeaBird. All station data was recorded in the data logger.

#### Videotaping:

To prevent damage to the new digital video camera, videotaping was postponed until the July trip. Videotaping was impractical due to high winds and rainfall.

#### MET Station:

On arrival at the lake, DU personnel had completed building the raft to support the met station. The raft was located on shore at Sexton Pt. The tower and instrumentation were installed there and the raft was towed into position with the air boat. The MET raft is presently located near Site #1 to the east of Sexton Pt. A two-inch steel mesh was installed around the guy wires to prevent birds from nesting on the raft. The water temperature probe was shielded with a flexible armored conduit to protect it from being eaten by the local muskrats.

#### Whitewater Lake Summary:

Many delays were encountered after arrival at the lake. Weather was a big problem—especially the rain, which made using the computer on station work a tough task. The GPS problems were intermittent and a solution could not be found. It was determined that the base station was operating properly and the fault was in the portable unit somewhere. After sampling, the filtering and lab work at the motel took a long time to complete. There always seemed to be some kind of problem with the air boat engine. One day it took two hours to start and another day the fuel was contaminated with water and sludge. At least a half day of time could be scheduled for breakdowns. A new tub should be designed and built to hold the peepers during transit to the stations.

### BASE STATIONS - WHITEWATER LAKE

#### 1. Manitoba Natural Resources T bar #82R407

Stake (metal T bar with yellow paint) is located on the county line, three roads east of the base camp access road. T bar is 10.6 m west of centre line of the road at a partially downed fence and 60 m south of two large trees on the east side of the road. (DGPS - WGS 84)

Lat. 49° 16.8667'	Long. 100° 18.5000' W		
• 404846.1 E	5459529.8 N	Zone 14	Elev. 497.325 m

## 2. Whitewater Lake Base Camp

Small wooden stake, 1 m west of southern green sign post marked "Manitoba Natural Resources" (DGPS - WGS 84)

- Lat. 49° 15.9477'      Long. 100° 21.1956' W
- 401547.4 E              5457884.6 N              Zone 14              Elev. 502.411 m

### STATION POSITIONS - WHITEWATER LAKE (GPS - WGS 84)

STATION NUMBER	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
WWL 1	49° 15.8945'	100° 21.1450'	5457783.2	401607.8
WWL 2	49° 13.0729'	100° 23.5782'	5452610.7	398559.0
WWL 3	49° 14.5027'	100° 14.6046'	5455070.2	409495.6
WWL 4	49° 16.0808'	100° 19.9809'	5458104.8	403026.3
WWL 5	49° 16.1462'	100° 15.7426'	5458139.3	408166.0
WWL 6	49° 14.8125'	100° 14.1465'	5455634.6	410061.7
WWL2B	49° 14.5300'	100° 22.4450'	5455285.4	399985.6
WWL4D	49° 13.7370'	100° 19.9200'	5453760.1	403090.7
WWL6D	49° 13.6870'	100° 17.4750'	5453617.3	405987.9
WWL7A	49° 16.1540'	100° 16.3000'	5458163.9	407490.6
WWL9B	49° 15.6810'	100° 13.7710'	5457236.8	410542.5
Met Raft	49° 15.7207'	100° 18.5528'	5456757.2	403036.2

### PAKOWKI LAKE:

The air boat used for the sampling program was provided by Ducks Unlimited and driven by Mr. Brian Pearce. The weather during the sampling period was warm, dry and windy. As a result of low water levels, three stations (Sites 2, 3 and 4) were moved. On the first sampling day, chlorophyll a samples were collected from the six major stations, DGPS was set up, two future base station sites near the lake were surveyed in and all videotaping was completed. During the second sampling day, the wind was southeast at 40 kph for the entire day. The lake water was very turbid at all lake stations. The water at station AB was collected at the bridge where the stream flows into the west arm of the lake. The high turbidity of the samples greatly increased the filtering time at the hotel. At stations where weed growth was observed, a search for snails was made but none were found.

### Positioning:

A differential base station was established at Hobb's Road west of the lake. Survey information was provided by the Alberta Environmental Protection Agency. Permission to operate the radio beacon at the base station was granted by Industry Canada, Calgary, Alberta. The base station was set up on Hobb's Road. Two additional survey markers were surveyed in for future base station sites, if required. One station is located at the end of Hobb's Road at the lake and the

second is located at the new air boat launching site at the point. The intermittent receiver problems encountered at Whitewater continued. Further troubleshooting revealed a broken wire at the base of the receiver's radio antenna. After field repairs were made, the DGPS system worked flawlessly with all sampling stations within the range of the beacon. All station positions were recorded by DGPS.

#### Peepers:

Peepers (18) were assembled on Wednesday evening at the motel. They were submerged in a tub and bubbled with nitrogen from a 300 cu. ft. cylinder. The peepers were installed on Friday, in duplicate, at stations AB, CD, EF, GH, IJ, KL, MN, OP and QR. During transit to the lake and during the travel to each station, the peepers were bubbled in a tub from a small Nitrogen cylinder.

#### Water Sampling:

Water samples were collected for Algal Toxins, Total Phosphorus, Metals, and Chlorophyll a. Algal Toxins were collected in triplicate on station and placed in a cooler. All other samples were collected and placed in a cooler for transport to the motel for further preparation. At the motel the samples were handled as follows:

- Chlorophyll a samples were collected on GF/F filters. The volume filtered was recorded and samples placed in the cooler.
- Filtered water from the chlorophyll a samples was filtered a second time using a 0.45  $\mu$ m cellulose acetate filter. This water was split for TP and Metals.
- Total phosphorus samples were placed in a 100 ml bottle and preserved with 100  $\mu$ L of concentrated Sulfuric acid and placed in the cooler.
- Metals samples were placed in a 250 ml bottle and preserved with 500  $\mu$ L of concentrated Nitric acid and placed in the cooler.
- The remainder of the two-litre water sample was placed in a cooler and returned to CCIW for further analysis.

Two litre stream samples were collected at stations AB, CD and EF. Samples were placed in a cooler. At the motel, each sample was processed for metals, TP and suspended solids. The remainder of the sample was placed in a cooler and returned to CCIW.

#### SeaBird Profiler Sampling:

The SeaBird unit was used in the reservoir. All data was saved on the hard drive in the directory C:\seasoft\pakowki. Batteries were changed before the start of the sampling program.

#### Hydrolab Sampling:

The Hydrolab unit worked well but once in a while the water temperature appeared to show low readings when compared to that of the SeaBird. All station data was recorded in the data logger.

#### Videotaping:

All videotaping was completed. DGPS positions of the areas being videotaped were not obtained since the DGPS base station was being set up at the time of taping.



**MET Station:**

On arrival at the lake, DU personnel had completed building the raft to support the MET station. The tower and instrumentation were installed at the launching site at the point and the raft was towed into position with the air boat. The MET raft is presently located near station MN. This location was as close to the west arm that the raft could be moored and hopefully still float during the summer. A two-inch steel mesh was installed around the guy wires to prevent the birds from nesting on the raft. The water temperature probe was shielded with a flexible armored conduit to protect it from being eaten by the local muskrats.

**Pakowki Lake Summary:**

The work at Pakowki went smoothly. In order to maximize our time, Bruce sampled and videotaped while I set up the DGPS system. After sampling, the filtering and lab work at the motel took a long time to complete. The air boat at Pakowki Lake had an automobile engine for power and little downtime for repairs.

**BASE STATION POSITIONS - PAKOWKI LAKE**

1. DGPS Station: Alberta Geodetic Survey marker
  - On the W to E road which is between Highway 885 and Hobb's farm. After turning left onto Hobb's Road, the station is found at the first intersection, in the ditch on the SW corner.
  - Lat. 49.34942833° N and Long. 111.08217508° W (DGPS - WGS 84)
2. Alberta Environment T bar #96-1
  - Stake (metal T bar with red paint) at the end of Hobb's Road, close to the west shore of the lake and 15 m south of the road. At the '96 air boat launch area.
  - Lat. 49° 20.9625' N and Long. 111° 01.2386' W (DGPS - WGS 84)
  - 498500.6 E    5466296.1 N    Zone 12    Elev. 860.1 m
3. Alberta Environment T bar #93-1A
  - Stake (metal T bar with red paint) near the '98 air boat launch area on the peninsula. Located in the centre of the peninsula within a group of three trees. The centre tree has a nail at its base. T-bar is located 3 m NE of centre tree.
  - Lat. 49° 20.2608' N and Long. 110° 58.1344' W (DGPS - WGS 84)
  - 502258.7 E    5464996.5 N    Elev. 857.25
4. Bridge on Highway 885 over the creek feeding the west arm of the lake.
  - Station is located on the concrete curb at the SE corner of the bridge at the black and yellow chevron sign.
  - Lat. 49° 23.5999' N and Long. 111° 06.2617' W
  - 492426.9 E    5471186.7 N    Elev. ?

**PUKOWKI LAKE SURVEY STATIONS (DGPS - WGS 84)**

STATION NUMBER	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
PL1	49° 20.7733'	110° 55.7130'	5465948.2	505189.5
PL2	49° 22.1593'	110° 57.5612'	5468513.7	502951.0

STATION NUMBER	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
PL3	49° 24.8426'	110° 57.1491'	5469779.7	503448.7
PL4	49° 22.5920'	111° 02.7473'	5469312.8	496677.3
PL5	49° 22.4350'	111° 03.6328'	5469026.0	495604.6
PL6	49° 20.3164'	110° 57.5941'	5465098.9	502912.9
PL-AB water	49° 23.6019'	111° 06.2579'	5471189.7	492429.9
PL-AB peepers			5471211.7	492431.9
PL-CD	49° 22.6499'	111° 04.2668'	5469423.6	494838.0
PL-EF	49° 22.4473'	111° 03.5849'	5469047.8	495662.4
PL-GH	same as Site PL5			
PL-IJ	same as Site PL4			
KL	49° 22.0594'	111° 02.5097'	5468330.3	496964.9
MN	49° 21.2792'	111° 01.1898'	5466873.1	498558.0
OP	same as Site PL6			
QR	same as Site PL1			
MET	49° 21.3585'	111° 01.4280'	5466703.4	498267.2

**ABANDONED GOLDMINE TAILINGS SURVEY, NOVA SCOTIA**  
**AERB STUDY 12223, DR. H. WONG**

Technical Operations supported this project, studying the presence and movement of heavy metals and arsenic species arising from gold mine tailings fields. Two gold mines in Nova Scotia—abandoned for upwards of seventy-five years, were chosen for study on this trip. It was undertaken in conjunction with a study led by Dr. Stephen Beauchamp (Atmospheric Science, Bedford Institute) quantifying the mercury vapour flux at the surface of these mine tailings.

The field party arrived in Sherbrooke, Nova Scotia on July 29<sup>th</sup> and was joined by the group from the Bedford Institute at the Goldenville Mine site. The Bedford crew set up their sampling equipment on the mine tailings and proceeded to collect data from the same location for the next 48-hour period.

Samples of plant material were collected from the tailings field. A core sample was collected from a site approximately half-way down the length of the tailings field, using the jackhammer corer but by driving the corer in by hand with a club hammer. The core was 60 cm in length. Two more cores were collected with the jackhammer corer—one adjacent to the mercury flux site which yielded 55 cm of core and the other from higher ground 70 metres closer to the mine site which was 110 cm in length. The cores were subsampled on site. Mr. André Gauthier from the Environment Canada office in Dartmouth supplied a small inflatable boat. The boat and a gill net was carried to Gegogan Lake, which receives runoff from the Goldenville Mine site, over a private access road, and fish samples were collected. These samples as well as any plant material collected were then frozen.

The other study site at the Montague Mine near Dartmouth could not be accessed by truck so the Caribou Mine was chosen as an alternate. Both field parties travelled to the Caribou mine site near Greenwood on Hwy 224 and set up on the tailings field. Two cores were collected—one near the mercury flux site and one 200 metres further down the tailings field. These cores were sampled immediately on site. Ten mini PONAR grab samples were collected from the lake at the base of the Caribou Mine tailings field for sediment toxicity testing. One tailings core was collected near the flux site using the jackhammer corer with a lexan liner and capped for transport to Burlington.

Water samples were also collected from the core holes at both mines for metals analysis.

**ROXANN SEDIMENT SURVEYS, HAMILTON HARBOUR, SCARBOROUGH, CORNWALL,  
ONTARIO; PULASKI, N.Y.; GRAND HAVEN, MICHIGAN  
AERB STUDY 12225, DR. N.A. RUKAVINA**

Bottom sediment mapping using the Roxann Seabed Classification System was conducted at five locations—the St. Lawrence River at Cornwall, the eastern shore of Lake Ontario (from Pulaski N.Y. to Stoney Point N.Y.), the Grand River Delta at Grand Haven, Michigan, Lake Ontario at the Scarborough Bluffs and both the Sandcap and Randle Reef in Hamilton Harbour. The CCGL PUFFIN equipped with both a Starlink Beacon GPS receiver and Sercel Base Station GPS receiver, along with the Microplot Navigation system was used again this year in all of the surveys. However, the Roxann portion of this year's surveys differed from previous years. Dual frequency surveys (both high and low) were run simultaneously at all survey sites this year. This dual frequency surveying was done using two complete Roxann systems: the existing CCIW system and a system on loan from the Pacific Geoscience Centre in Sydney, British Columbia. The first survey of the year took place at the Sandcap in Hamilton Harbour in early June. The standard 200mX200m grid was run using 10 m offsets, in both the East-West and North-South directions. This was the first of the dual frequency surveys to be run using both Roxann systems.

In mid-July, a follow-up survey to last year's Metro Toronto Region Conservation Authorities contract was completed at Scarborough over a three-day period. The survey area encompassed the nearshore zone of Lake Ontario running east from Port Union Road to just east of the mouth of the Rouge River. The survey was again contracted so that bottom sediment structure change could be accurately measured after both development and shoreline protection measures were installed. The survey was a continuation east from last year's survey. Transects were run at 20-metre offsets parallel to shore, beginning offshore and running inshore. The transects were roughly 3000 metres in length.

Two trips were made to Pulaski, New York to survey the eastern shore of Lake Ontario. The trip was made possible jointly by CCIW and Hobart and William Smith College of Geneva, New York. The first trip was in late August and was hampered by weather. The field party arrived to find near gale force winds directly out of the northwest. After trying to run transects near the marina entrance, the sea state was deemed unacceptable for surveying and the boat was pulled from the water. The GPS setup was run through to facilitate the ease of setup for the return trip in mid-September. On the return trip, a series of zig-zag transects was run throughout the week from the southern end of the area (Pulaski, N.Y.) to the northern end of

the area (Stoney Point N.Y.) which was an area of about 25 kilometres. After the priority transects were run, areas of particular interest were rerun in more detail. Ground-truthing was provided by a number of mini-Shipek samples taken of all the different bottom types identified by Roxann.

In mid-October a survey was completed for the United States Environmental Protection Agency in the Grand River at Grand Haven, Michigan. Four major areas of concern in the river were surveyed during the week-long survey. All of the sites were surveyed using 10 metre offsets. Priority thickness measurements were done at the four sites using an Acoustic Thickness Tripod. All four sites were also sampled for ground-truthing purposes by a mini-Shipek sampler. On the return trip to CCIW some zebra mussel beds were scheduled to be surveyed in the Western Basin of Lake Erie. However, severe weather prevented any work from being done.

The final survey in an ongoing study of sediment dynamics in the St. Lawrence River at Cornwall was completed in late October. An Imagenex Sub-Bottom Profiling system was borrowed from McQuest Marine in Burlington for trials during this trip. Most of the work during this trip took place in areas of historically thick sediments (Courtaulds, boat launch, north shore of Cornwall Island). A number of Shipek samples were taken at sites determined by their historical sediment thickness. These sites were also surveyed using the Imagenex Sub-Bottom Profiler to attempt to make an educated assumption of the sediment thickness. During the week, the final series of transects in the main survey area (downstream of Courtaulds) were run. The survey followed the same transects as have been run in all of the previous surveys.

The final survey of the year involved re-running a Roxann survey at Randle Reef in Hamilton Harbour. The survey was run using 5-metre offsets and extended from the Stelco Dock north to about the mouth of McKeil Marine's docks.

<b>COASTAL GEOLOGY</b> <b>AERB STUDY 12225, DR. N.A. RUKAVINA</b>
--

As part of an ongoing Lake Ontario coastal survey, Technical Operations divers surveyed the site at the foot of Green's Road in the town of Stoney Creek on one occasion (April 1). Only stakes 1, 2 and 3 were found. The groundline between stakes 3 and 4 was severed and the search for the remaining stakes was futile. Stake measurements were recorded and a video was made to document any changes since the last inspection.

**STATION POSITIONS - (DGPS - WGS 84)**

STAKE	NORTHING	EASTING
1	4788566.3	603595.1
2	4788606.3	603608.1
3	4788621.3	603612.1

<b>RIVERBED SEDIMENTATION STUDY</b> <b>AERB STUDY 12225, DR. N.A. RUKAVINA</b>
---

This study was designed to test bottom-mounted acoustic systems for high resolution monitoring of riverbed erosion or sedimentation. The system was used to measure sediment flux in the St. Lawrence River at the Courtaulds Corp. (Cornwall), Hamilton Harbour at LaSalle Park and the St. Clair River at Bayer Chemical (Sarnia). This study will provide data on the stability of the sediments in these areas.

During 1993, three bottom-mounted T-frames were installed downstream of the Courtaulds waterfront. For the first two-thirds of the field season, Site #2 was equipped with two transducers, an OBS. sensor and a Brancker datalogger. In September all hardware was transferred to Site #3. The transducers were mounted facing down on the outside arms of the T-frame. The OBS. optical sensor was mounted facing the current on the base of the T-frame 10 cm above the sediment.

Technical Operations divers visited the Cornwall site five times (March 4-6, April 6-9, July 28-29, September 28-29 and November 16-19) to change the Brancker datalogger, XDR electronics can and to collect measurements. Underwater video was obtained at each site during refurbishment to document changes in the site composition.

The Hamilton Harbour T-frame, installed in 1993, was equipped with hardware on August 26 and serviced on September 9, November 9 and November 26. Underwater video was obtained at each site during refurbishment to document changes in the site composition.

Technical Operations divers visited the Sarnia site five times (April 23-24, June 30, July 30, September 30 and November 23-24) to change the Brancker datalogger, XDR electronics can and to collect measurements. Only Site #1 was equipped with hardware. Underwater video was obtained at each site during refurbishment to document changes in the site composition.

#### CORNWALL STATION POSITIONS (DGPS - WGS 84)

STATION	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
1	45° 01' 04.5"	74° 41' 44.7"	4984985.	523971.
2	45° 01' 17.4"	74° 41' 17.3"	4985386.	524571.
3	45° 01' 25.7"	74° 40' 58.9"	4985640.	524978.

#### HAMILTON HARBOUR STATION POSITION (DGPS - WGS 84)

STATION	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
1	43° 17' 46.5"	79° 50' 57.8"	4794357.	593331.

## SARNIA STATION POSITIONS (DGPS - WGS 84)

STATION	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
1	42° 56' 33"	82° 26' 12"	4755431.	382790.
2	42° 56' 37"	82° 26' 05"	4755551.	382950.

<b>LAKE REMEDIATION, HAMILTON HARBOUR</b> <b>AERB STUDY 12240, M.N. CHARLTON</b>
---

One Hydrolab profile and one water sample were taken from 1, 3, 5, 7 and 19 m at station 1001 in Hamilton Harbour monthly from January until March. A water sample was also collected at the Burlington Water Intake Plant (station 1182). This will be an ongoing study until March 31, 1999 with the exception of station 1182. The purpose of this study is to monitor seston and phosphorus trends during the winter months because of the upgrades in the Burlington sewage treatment plant.

Twelve stations (940 to 947 and 914 to 917) in the harbour were chosen for an ammonia study. Water and Hydrolab profiles were collected once a week at each station from April to June. The study was expanded to include a full sampling of the entire harbour (stations 901 to 926, 929 and 933). Water samples from surface and bottom and a Hydrolab profile were collected every other week from mid-June until September. One full sampling was also done in April.

Water samples were collected at stations 901 to 926, 929 and 933, 940 to 947 on April 29, June 22, July 7/9, July 20/22, August 4 for bacteria analyses. The purpose of this study is to observe time trends in phosphorus and ammonia.

In April, sediment traps were deployed at 4 stations—50, 51, 52 and 53. Each sediment trap was refurbished once a month from May to November for a total of 7 sets of samples. Station 52 was replaced as a winter mooring. The purpose of this study is to determine sedimentation rates and %LOI (loss on ignition) in Hamilton Harbour.

On June 18, Tech. Ops. assisted visiting research scientist Henry Beuhrer at Wilcox Lake and Lake St. George. On June 18, an initial trip was taken to observe lake accessibility and ramp conditions. On June 25, one water sample was taken at the surface and bottom, one Hydrolab profile taken, and one sediment trap deployed at each lake. On July 2 at each lake, one water sample was taken at surface and bottom, one Hydrolab profile was collected and the sediment traps were refurbished. On July 9 at each lake, one water sample was taken at surface and bottom, one Hydrolab profile was collected and the sediment traps were removed.

On July 2, PONAR sediment grabs were collected at 11 stations in the Dofasco slip and the harbour. The sediment was used for bioassays and metal analyses. On July 3 and 5, sediment trap moorings were installed in the Dofasco slip. The traps were refurbished on July 27 and the tubes removed on August 25. On August 25 and 26, 2 clam cages, consisting of 10 clams in total, were added to all sediment traps in the harbour. These were removed on September 28.

Because of elevated levels of PAH compounds and metals found in sediment sampled in 1997, a follow-up sampling of the same area was done in 1998 to verify the results.

## STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
LAKE WILCOX/LAKE ST. GEORGE - NAD27				
LW	43° 59' 05"	79° 26' 07"	4871153	625485
LSG	43° 57' 21"	79° 25' 30"	4867954	626373
HAMILTON HARBOUR STATION POSITIONS - NAD27 ZONE 17				
901	43° 17' 50"	79° 47' 58"	4794306	597386
902	43° 17' 42"	79° 48' 13"	4794054	597051
903	43° 17' 35"	79° 48' 42"	4793829	596401
904	43° 17' 30"	79° 49' 06"	4793667	595862
905	43° 17' 25"	79° 49' 31"	4793505	595301
906	43° 17' 15"	79° 50' 18"	4793182	594246
907	43° 17' 05"	79° 51' 06"	4792858	593168
908	43° 16' 56"	79° 51' 54"	4792566	593090
909	43° 16' 46"	79° 52' 42"	4792243	591013
910	43° 16' 47"	79° 53' 18"	4792263	590201
911	43° 17' 43"	79° 50' 30"	4794042	593964
912	43° 17' 00"	79° 49' 48"	4792728	594929
913	43° 17' 00"	79° 48' 42"	4792749	596416
914	43° 16' 08"	79° 46' 58"	4791179	598783
915	43° 16' 18"	79° 47' 15"	4791482	598396
916	43° 16' 30"	79° 47' 27"	4791848	598120
917	43° 16' 40"	79° 47' 37"	4792153	597890
918	43° 17' 07"	79° 47' 52"	4792982	597540
919	43° 17' 26"	79° 48' 24"	4793557	596810
920	43° 17' 57"	79° 48' 50"	4794505	596211
921	43° 18' 24"	79° 49' 11"	4795331	595726
922	43° 18' 24"	79° 46' 48"	4795378	598947
923	43° 18' 14"	79° 47' 08"	4795371	598497
924	43° 18' 05"	79° 47' 27"	4794779	598077
925	43° 17' 57"	79° 47' 44"	4794527	597698

STATION NUMBER	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
926	43° 18' 28"	79° 48' 30"	4795468	596648
929	43° 17' 29"	79° 51' 18"		
933	43° 18' 14"	79° 49' 37"		
940	43° 16' 12"	79° 52' 30"	4791213	591299
941	43° 16' 11"	79° 52' 23"	4791180	591449
942	43° 16' 15"	79° 52' 13"	4791290	591681
943	43° 16' 17"	79° 52' 12"	4791364	591709
944	43° 16' 21"	79° 52' 11"	4791475	591725
945	43° 16' 36"	79° 51' 16"	4791974	592954
946	43° 16' 28"	79° 50' 41"	4791729	593748
947	43° 16' 14"	79° 47' 58"	4791347	597435
1001	43° 17' 16"	79° 50' 26"		

#### **BENTHIC PHOTOSYNTHESIS, LAKE ERIE**

##### **AERB STUDY 12241, DR. R. HECKY**

The purpose of this study was to develop methodologies to determine the net photosynthesis rates at the water sediment interface, in Eastern Lake Erie. Three trips were made (June 15, July 20 and August 17) to the Pt. Dover area of Lake Erie.

At the request of Dr. R. Hecky, AERB and Mr. J.M. Davies, FWI-DFO, TOS provided diving support, installed two sampling site moorings and a single transmissometer mooring. Dr. Hecky and Mr. Davies are both qualified divers who assisted with diving operations.

Two sampling sites were selected, just west of the Nanticoke Pier. Both sites were marked with a single spar buoy and a 15 m ½" poly groundline. The first site selected was 3 m deep and offered a range of bottom types from clear bedrock to thick cladophora. The second site, 250 m farther offshore, was 6 m deep with rocks covered in small zebra mussels. Ten clear Benthic chambers were installed at each site. Each chamber was sampled with a 100 ml numbered syringe and the height of the piston was measured. Some of the chambers were covered with a dark sleeve as a control. The basic sampling procedure took place at three intervals during the day—early morning, mid-day and pre-sunset. Sample syringes were placed in a cooler and returned to the lab in Pt. Dover for analysis by Mr. Davies. Cladophora samples were also collected at the inshore chamber site. A transmissometer/Brancker logger mooring was installed in close proximity to an MOE current meter mooring located 750 m south-southeast of Site 2.



## STATION POSITIONS (DGPS - WGS 84)

98-01S-07A Photo.	42° 47' 04" N	080° 06' 50" W	4737276. N	572469. E
98-01S-08A Photo.	42° 46' 58" N	080° 06' 45" W	4737059. N	572599. E
98-01S-09A XMS	42° 46' 21" N	080° 05' 50" W	4735953. N	573798. E

**DRIFTER EXPERIMENTS, WESTERN LAKE ONTARIO**  
**AERB STUDY 12242, DR. C.R. MURTHY**

This study examined the hydrodynamics of the western end of Lake Ontario. It was a continuation of the past year's coastal exchange and modelling study. Five drifter buoys were deployed at three stations in the Western Basin for two survey periods. These satellite-tracked buoys were used for the first time since being upgraded for better performance. The dates of the experiments were: May 25 - June 5 and August 10 - 21. As the drifters ran aground or travelled too far east, they were retrieved by launch and replaced at the sites. The same buoy was redeployed at the original station each time.

## DRIFTER DEPLOYMENT SITE

SITE	LATITUDE N.	LONGITUDE W.
1	43° 20' 49.8"	79° 44' 05"
2	43° 18' 52.8"	79° 46' 40.2"
3	43° 16' 33"	79° 44' 46.8"

**CCIW/NWRI CONTRIBUTION TO EPISODIC EVENTS, GREAT LAKES EXPERIMENT**  
**(EEGLE)**  
**AERB STUDY 12242, DR. C.R. MURTHY**

Technical Operations Section assisted this nearshore episodic current reversal study with logistical and field support in the Lake Michigan study area.

The National Water Research Institute has undertaken this investigation in collaboration with the U.S. Department of Commerce/National Oceanic and Atmospheric Administration/Great Lakes Environmental Research Laboratory (GLERL) in Ann Arbor, 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 current meters moored in nearshore areas and from shore-based meteorological stations.

The work plan included the installation of two meteorological stations—one at the Coast Guard Station in Michigan City and the other on the Lighthouse Pier in St. Joseph, MI. Eight bottom-

mounted Neil Brown SACM current meters were to be installed in nearshore waters at intervals between Michigan City and St. Joseph. This last task required the use of the NOAA R/V SHENEHON based at the Great Lakes Environmental Research Laboratory Field Station at Muskegon, MI. The NOAA R/V SHENEHON was scheduled to be working in the study area in June retrieving ADCP and VACM moorings placed in the lake the previous fall so this cruise was chosen to accomplish both mooring tasks. A bottom-mounted ADCP mooring was installed from the SHENEHON on August 25<sup>th</sup> during a later trip to the study area.

The current meters and MET instruments were registered with Canada Customs at Windsor, Ontario and then cleared U.S. Customs at the Ambassador Bridge in Detroit, MI on June 9<sup>th</sup>. The MET system setup was accomplished by NWRI personnel independently. The first system was installed on an existing tower on the wall near the entrance to the Yacht Basin in Michigan City. The tower is used by the U.S. Coast Guard to obtain wind speed and direction readings. The tower was instrumented in the usual manner with wind speed and direction, air temperature, relative humidity, global solar radiation and water temperature. The tower was also equipped with a solar panel to charge the Campbell 21X logger battery. The ten-metre tower on the Lighthouse Pier at St. Joseph was raised by block and tackle and considerable physical persuasion by NWRI personnel and fixed to the catwalk approximately 25 metres from the shoreline of the lake. The tower base was bolted securely to the concrete pier and clamped to the catwalk with aluminum angle stock and threaded rod. Guy wires from the 6-metre height were attached to the far side of the catwalk immediately opposite the tower and to the far side of the catwalk both up and down the pier from the tower. No guy wires were fastened to the pier itself or the pier railings. The bottom 3-metre section of tower was clad in 1/8 inch aluminum sheets to resist climbing and limit access to the tower except by ladder or by way of the catwalk itself. The station was instrumented in the same manner as the Michigan City system except that no water temperature sensor was installed.

The current meter installation took two days to complete. Four moorings were loaded onto the R/V SHENEHON and she steamed to the far end of the study area near St. Joseph, MI. Four ADCP instruments installed with acoustic releases in October of last year by GLERL personnel at sites A1, A2, A4 and A5 were retrieved and the four NBSACM's were installed in 12 metres of water at sites C8, C7, C6 and C5. The boat returned to Michigan City that evening. In the morning, the last four NBSACM's were loaded onboard and installed in the southern end of the study area at sites C4, C3, C2 and C1 in 12 metres of water. In all cases the moorings were installed without surface markers.

Technical Operations dive unit visited these nine moorings during the month of October to clean the ADCP, retrieve the current meters, download the data and install fresh batteries. They were then re-installed in the lake for the winter months.

#### MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
C1 NB	98-06C-01A	41° 45' 47.5"	086° 50' 21.6"
C2 NB	98-06C-02A	41° 49' 16.4"	086° 44' 01.7"
C3 NB	98-06C-03A	41° 53' 13.4"	086° 38' 42.2"

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
C4 NB	98-06C-04A	41° 59' 27.1"	086° 34' 31.2"
C5 NB	98-06C-05A	42° 05' 37.0"	086° 30' 46.6"
C6 NB	98-06C-06A	42° 09' 32.1"	086° 27' 25.1"
C7 NB	98-06C-07A	42° 11' 55.1"	086° 25' 00.8"
C8 NB	98-06C-08A	42° 14' 36.0"	086° 22' 37.4"
C9 ADCP	98-06S-09A	42° 10' 23.0"	086° 29' 22.0"

#### MET TOWER POSITIONS

STATION NAME	LATITUDE N.	LONGITUDE W.
98-06M-01A (Michigan City)	41° 43' 33"	086° 54' 30"
98-06M-02A (St. Joseph)	42° 06' 58"	086° 29' 24"

#### PHYSICAL DYNAMICS STUDY, LAKE ONTARIO AERB STUDY 12243, Dr. M.G. SKAFEL

On July 30, TOS divers deployed the new "hydra" current meter, mounted in a 2 m tripod. The unit was launched, utilizing the GOOSE II, to within 20 metres of the harbour T-frame to collect current data with reference to changing readings from the T-frame transducers. The mooring was removed on August 27 and returned to CCIW for refurbishment.

On September 21 the current meter tripod was successfully deployed on a habitat shoal in Lake Ontario near Stoney Creek. This location is a GLLFAS habitat study site (John Fitzsimons) used as a potential lake trout spawning shoal. Data on water movement over the shoal may provide a useful tool in characterizing "successful" spawning shoals. The site also provides a useful location to collect data on storm events in the Western Basin of Lake Ontario. Divers inspected and cleaned the current meter on two occasions. The mooring was removed on December 7 and returned to CCIW.

#### STATION POSITIONS (DGPS - WGS 84)

98-50C-65A	Harbour	43° 17' 48" N	79° 50' 58" W	4794353.N	593323.E
98-00C-37A	L. Ontario	43° 15' 34" N	79° 40' 43" W	4790477.N	607247.E

#### METEOROLOGICAL STATIONS AND THERMOGRAPH MOORINGS, LAKE MALAWI/NYASA, MALAWI, AFRICA AERB STUDY 12245, DR. P.F. HAMBLIN

This project involved the placement of five thermograph moorings and the installation of four meteorological monitoring stations in and on the shoreline of Lake Malawi. This project was

funded through the Global Environmental Facility (GEF), the Canadian International Development Agency (CIDA), the Department for International Development (DFID) and the National Science Foundation (NSF) and was called the Southern Africa Development Agency/Global Environmental Facility (SADC/GEF) Lake Malawi/Nyasa Biodiversity Conservation Project. The main purpose of this project was to do research to determine the condition of fisheries and the quality of water in Lake Malawi/Nyasa and in the rivers that flow into the lake. This project was broken down into three main studies: 1) Systematics, to determine the different types of fish in the lake; 2) Ecology, to determine where the different types of fish live, what they eat, when and where they breed and what their life history cycles are; and 3) Limnology, to determine the quality of water in the lake and in the rivers and to determine if the water is good for the fish and safe for humans.

This project involved two trips to Malawi by TOS staff—April 20<sup>th</sup> to May 14<sup>th</sup> and September 3<sup>rd</sup> to October 1<sup>st</sup>. On both trips, thermograph/sediment trap moorings and meteorological stations were refurbished. On the April/May trip, two east-west cross-lake transects were done with CTD profiles at up to six locations on the transect. Several of the Onset Stowaway loggers had flooded and were replaced by Onset Optic Stowaway's and Tidbits. Two sediment traps were added to mooring 98-SLAT-04 in the northern end of the lake.

During the September trip, mooring 98-SLAT-03A could not be recovered since the surface marker was missing. Attempts were made at dragging but lack of fuel and time did not allow for prolonged efforts at recovery. With slightly improved weather conditions in December, this mooring was located through use of a pinger locator but could not be retrieved. Retrieval will be attempted by dragging on the January 1999 cruise. All other moorings were refurbished and a fifth mooring—98-SLAT-05 was installed on the eastern side of the lake north of Likoma Island. Mooring 98-SLAT-03 will be relocated to the western side of the lake on the January 1999 cruise. Water samples were collected for Dr. B. Scott, AECB for Halo Acetic Acid analysis at several locations on the lake.

#### MOORING POSITIONS

MOORING NUMBER	LATITUDE S.	LONGITUDE E.	INSTRUMENT/DEPTH/M
98-SLT-01	13° 52' 07"	34° 51' 57"	T(1,6,12,22,33,45,60,75,90,115)
98-SLAT-02	13° 25' 58"	34° 44' 30"	T(1,6,12,18,24,32,40,50,65,85,110,143,170,199) SED(100,140,180)
98-SLAT-03	11° 49' 48"	34° 29' 42"	T(1,6,12,22,35,50,70,103,142,200,260, 320,361) SED(100,180,300)

MOORING NUMBER	LATITUDE S.	LONGITUDE E.	INSTRUMENT/DEPTH/M
98-SLAT-04	09° 42' 18"	34° 03' 39"	T(1,6,12,22,35,50,70,102, 135,175,212) SED (100)
98-SLAT-05	11° 49' 48"	34° 29' 42"	T(1,6,12,22,35,50,65,85, 110,135,160,200,240) SED(100)

STATION LOCATIONS FOR WHOLE-LAKE  
LIMNOLOGICAL SAMPLING CRUISES

STATION NUMBER	LATITUDE S.	LONGITUDE E.	DEPTH/M
900	13° 30' 00"	34° 44' 04"	170
901	14° 21' 12"	35° 13' 54"	22
902	14° 15' 30"	35° 09' 48"	43
903	14° 09' 18"	35° 06' 00"	56
904	14° 03' 00"	35° 01' 18"	72
905	13° 56' 34"	34° 57' 54"	93
906	13° 52' 20"	34° 47' 44"	122
907	13° 40' 34"	34° 44' 05"	148
908	14° 00' 00"	34° 42' 46"	93
909	14° 09' 11"	34° 40' 08"	47
911	13° 14' 14"	34° 37' 20"	205
912	13° 00' 04"	34° 33' 40"	255
913	12° 43' 00"	34° 30' 00"	285
914	12° 32' 27"	34° 30' 00"	286
915	12° 18' 23"	34° 30' 00"	365
916	12° 04' 26"	34° 30' 00"	360
917	11° 49' 44"	34° 29' 35"	362
918	11° 36' 30"	34° 30' 00"	440
919	11° 21' 02"	34° 28' 42"	530
920	11° 05' 17"	34° 27' 37"	685

STATION NUMBER	LATITUDE S.	LONGITUDE E.	DEPTH/M
921	10d 49' 13"	34d 26' 46"	560
922	10d 33' 35"	34d 25' 43"	460
923	10d 17' 54"	34d 24' 49"	500
924	10d 07' 11"	34d 18' 34"	466
925	09d 55' 59"	34d 12' 20"	340
926	09d 42' 25"	34d 04' 05"	254
927	09d 33' 58"	34d 00' 16"	112
940	11d 08' 32"	34d 19' 10"	686

**CESIUM TRACER SAMPLING**  
**AERB STUDY 12247, DR. J.P. COAKLEY**

This is the second year of this study to determine the dispersal patterns of a cesium tracer in the sediments of the Burlington Basin in Western Lake Ontario. TOS divers installed the cesium dispenser mooring on June 9<sup>th</sup> at a location ½ mile northeast of the Burlington piers.

**STATION POSITIONS (DGPS - WGS 84)**

98-00S-01A    Lake Ontario    43° 18' 33" N.    79° 47' 09" W.    4795890. N    598458. E

SAMPLE ID	SERIAL NO.	NORTHING	EASTING
1-1	1	4795860	598469
1-2	2	4795885	598480
1-3	3	4795960	598510
1-4	4	4796324	598667
2-1	5	4795874	598468
2-2	6	4795899	598509
2-3	7	4796015	598612
3-1	8	4795875	598494
3-2	9	4795901	598553
3-3	10	4796048	598932
4-1	11	4795867	598475
4-2	12	4795865	598524
4-3	13	4795862	598974
5-1	14	4795859	598476
5-2	15	4795855	598490
5-3	16	4795828	598555

SAMPLE ID	SERIAL NO.	NORTHING	EASTING
5-4	17	4795676	598923
6-1	18	4795855	598476
6-2	19	4795827	598507
6-3	20	4795735	598613
6-4	21	4795515	598825
6-5	22	4795153	599173
nr jetty 6-5A	23	4795163	598177
7-1	24	4795847	598475
7-2	25	4795769	598508
7-3	26	4795400	598661
8-1	27	4795851	598471
8-2	28	4795810	598471
8-3	29	4795669	598470
9-1	30	4795860	598469
9-2	31	4795844	598463
9-3	32	4795773	598446
9-4	33	4795415	598295
10-1	34	4795861	598467
10-2	35	4795832	598438
10-3	36	4795715	598321
11-1	37	4795869	598454
11-2	38	4795859	598447
11-3	39	4795828	598378
12-1	40	4795862	598460
12-2	41	4795863	598423
12-3	42	4795862	598264
13-1	43	4795866	598465
13-2	44	4795869	598454
13-3	45	4795903	598370
14-1	46	4795869	598456
14-2	47	4795893	598435
14-3	48	4796010	598324
15-1	49	4795867	598469
15-2	50	4795884	598464
15-3	51	4795960	598433
16-1	52	4795883	598471
16-2	53	4795912	598473
16-3	54	4796065	598473
Ground zero		4795864	598468

**ZEBRA MUSSEL SURVEY, LAKE ERIE**  
**AERB STUDY 12247, DR. J.P. COAKLEY**

On August 10, a TOS dive team (Breedon and Don) travelled to Kingsville, accompanied by Dr. J.P. Coakley. The study, led by Dr. Coakley, was aimed at providing a better estimation of

zebra mussel (ZM) infestation (population count and size distribution) and spatial distribution of ZM druses in soft, muddy offshore sediments in Western Lake Erie. Until recently these sediments were thought to be hostile to ZM colonization. The field survey was aimed at characterizing (using diver-held digital photography) and fixed-area quadrant sampling of ZM patterns on the bottom as well as targeting sites for later side-scan survey.

During the first week, the launch PINTAIL was utilized because the SHARK was laid up in Pt. Dover with engine repairs. The Shark was utilized during the second week. A total of twelve stations were occupied. At each station the video camera was lowered to determine the type of bottom conditions as well as being a preliminary indication of the amount of zebra mussels present. A diver descended to the bottom to collect close-up digital video of the bottom conditions and to collect samples. Samples of sediments were collected from under the zebra mussel colonies and from areas where no zebra mussels were present. DGPS positions (WGS 84) were obtained at each station using the Detroit Differential Beacon (319kHz, 200 bps).

Target buoys were installed at six stations. Each buoy was anchored with a single piece of railway track and was rigged with a Grimsby subsurface float located one metre above the bottom. It was hoped that the side-scan sonar would record the location of the float and match the records with that of the video tape.

On September 28, Mr. C. Lomas accompanied by Dr. J.P. Coakley and Mr. K. McMillan of McQuest Marine completed a side-scan survey of the established stations. Side-scan printouts appeared to map the zebra mussel beds with some consistency. During the winter months these printouts will be compared with the video tapes collected at each station. The use of the target floats was a failure. The sonar could not detect the target buoys, possibly because they were too small.

#### STATION POSITIONS

Station JPC-ZM-98-1:	E 344982.3	N 4639971.2
Station JPC-ZM-98-2:	E 340001.2	N 4634999.3
Station JPC-ZM-98-3:	E 350000.0	N 4634983.0
Station JPC-ZM-98-4:	E 354982.0	N 4639979.8
Station JPC-ZM-98-5:	E 359990.4	N 4649996.8
Station JPC-ZM-98-A	E 355500.0	N 4628480.0
Station JPC-ZM-98-B	E 355935.0	N 4628508.0
Station JPC-ZM-98-C	E 357000.0	N 4628460.0
Station JPC-ZM-98-D	E 358500.0	N 4628466.0
Station Pelee #1:	E 355975.5	N 4628460.2
Station Pelee #2:	E 356990.3	N 4628459.0
Station E Pelee:	E 355008.0	N 4628537.0



## VIDEO LOG

Tape No. 1	Station JPC-ZM-98-2	counter	00:00 - 15:00
	Station JPC-ZM-98-3	counter	15:00 - 23:30
	Station JPC-ZM-98-1	counter	0 - 1030 (reset)
	Station JPC-ZM-98-5	counter	0 - 8:10 (reset)
	Station JPC-ZM-98-4	counter	0 - ?
	Station JPC-ZM-98-A	counter	0 - 11:39 (reset)
	Station JPC-ZM-98-B	counter	11:39 - 14:29
	Station JPC-ZM-98-C	counter	14:29 - 17:37
	Station JPC-ZM-98-D	counter	17:37 - 21:18

New Video tape installed in the camera.

Tape No. 2	Station Pelee #1	counter	00:00 - 06:51
	Station Pelee #2	counter	07:00 - 12:53
	Station B Pelee	counter	12:53 - 16:39
	Station E Pelee	counter	16:39 - 19:53
	Station E Pelee	counter	19:53 - 21:15

<b>GROUNDWATER REMEDIATION PROJECT</b> <b>AERB STUDY 12260, DR. A. CROWE</b>
---

Technical Operations Section supported the Groundwater Remediation Project throughout the year with one technician being permanently assigned and additional personnel as required.

#### Smithville Remediation Project:

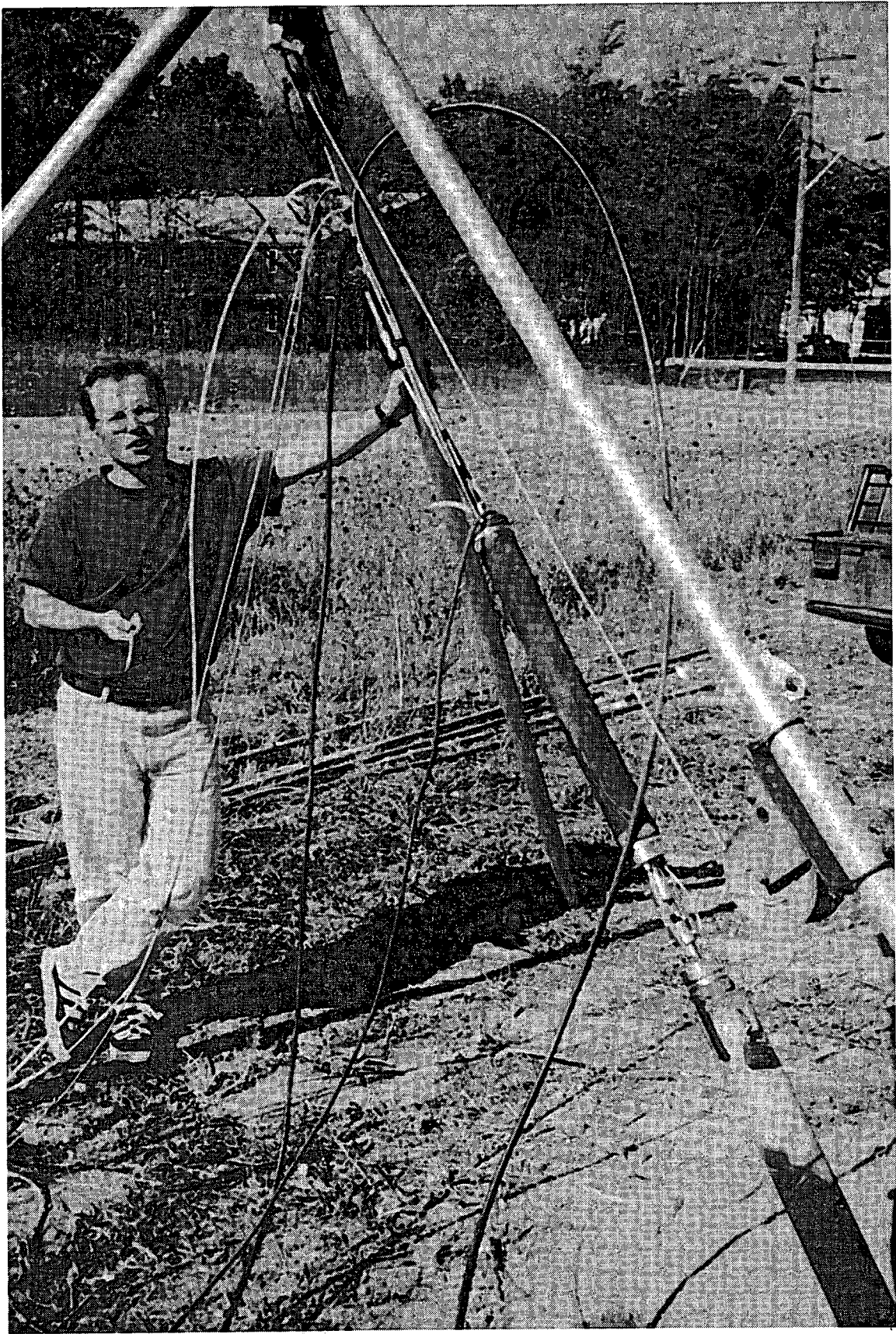
Most of this year was spent in Smithville, Ontario at the Chemical Waste Management site. This was a chemical waste storage and transfer facility which had been taken over by the Ministry of Environment and Energy. In 1985 it was discovered that PCB oils and associated solvents had been leaching into surrounding aquifers, resulting in the closure of the local water supply. Since 1989 a continual pump and treat technique has been used through eight shallow (approximately 10 m) wells. This has been very costly so a more permanent and economical remediation process would be advantageous.

This year, two additional angled boreholes were installed approximately 55 metres into the bedrock by Downing Estate Drilling. These holes were drilled closer to the contaminant plume for preliminary studies to assess the possibilities of natural biodegradation of PCB and VOC compounds.

A total of twenty wells have been installed for GRP/AERB over the past three years. Technical Operations staff assisted by logging, surveying, sampling, hydraulic testing and regular monitoring of the boreholes as well as assisting in numerous tracer, point dilution, pumping and injection tests.



SMITHVILLE DRILLING SITE



**POINT DILUTION PROBE AT SMITHVILLE**

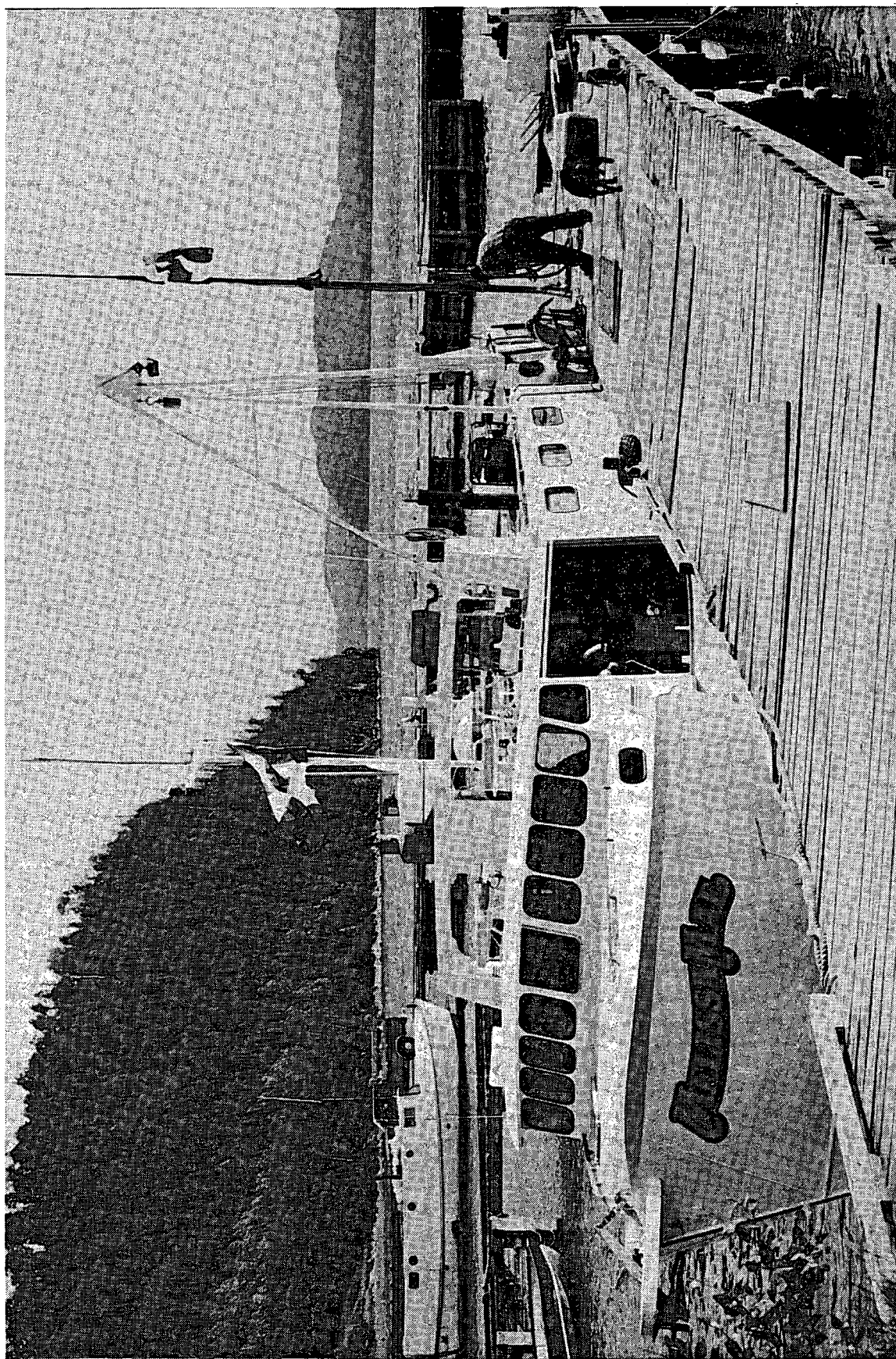
Two laboratory trailers, generators, ATV's, snowmobiles, an Argo and vehicles have been implemented to accommodate studies at this year-round field site.

#### Point Pelee National Park Groundwater Study:

Point Pelee was another ongoing project started in 1993 and continued into this year. Since then 124 monitoring wells have been installed along two cross-sections and at four septic bed sites, of which nine wells were completed this year. These and all wells and test holes have been logged and surveyed with the information recorded on the appropriate water well record form. This study is part of a joint project between Parks Canada and AERB which is investigating high nutrient concentrations in the marsh. These wells are being monitored and sampled on a regular basis. Cores and water samples have also been obtained from the lake and marsh periodically.

At the request of Parks Canada and the NWRI Executive Director, soil samples were obtained at Camp Henry and the Wardens Centre at Point Pelee when a highly sprayed orchard site in this area was suspected of high DDT levels. Soil samples were obtained using a grid pattern of suspected areas from surface (using a pick and shovel) to 2 metres, using the drill rig and spit spoons.





LOADING THE MELISSA MAE AT THE MACDIARMID DOCK

# **AQUATIC ECOSYSTEM CONSERVATION BRANCH**

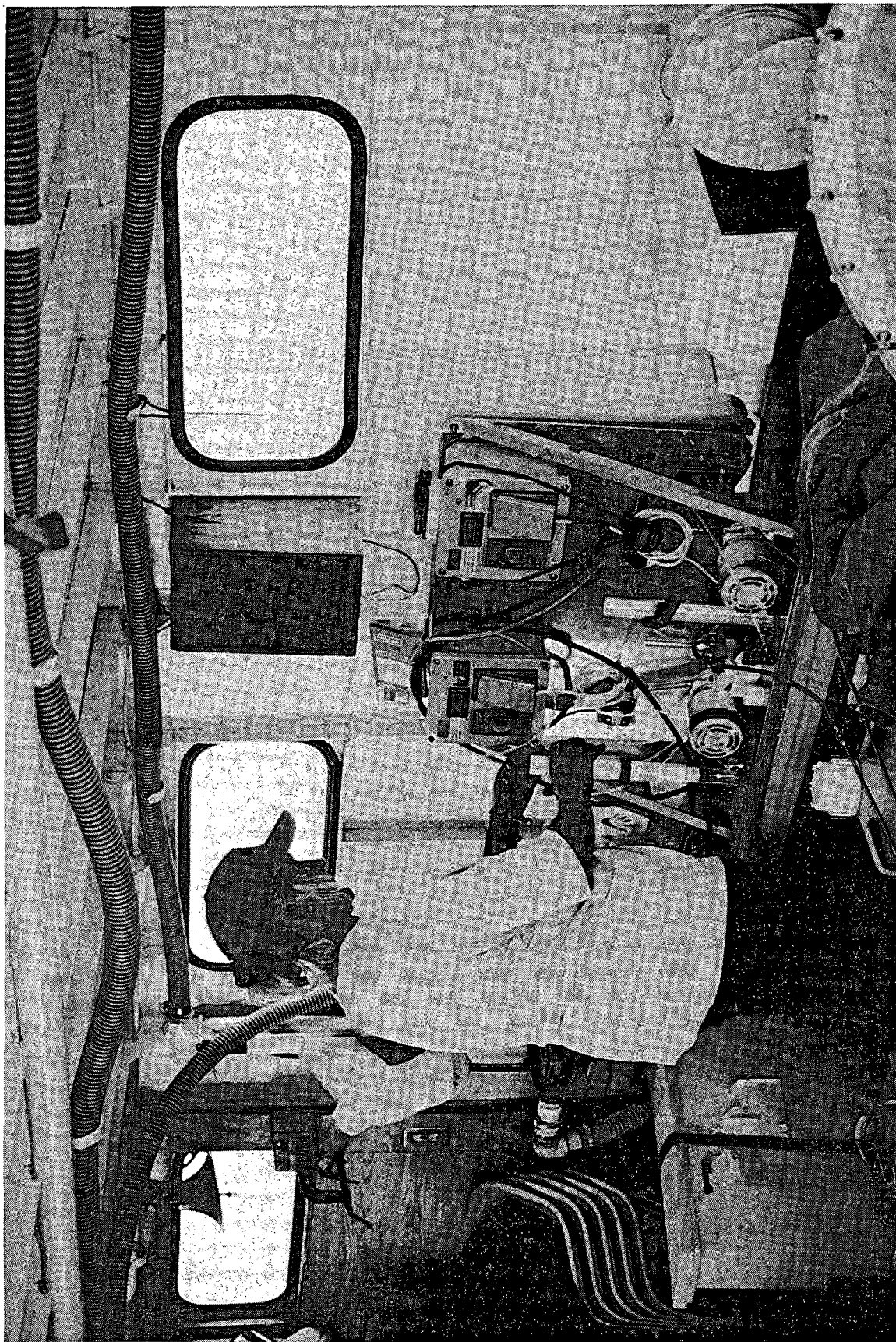
## **LONG RANGE TRANSPORT OF AIRBORNE POLLUTANTS SURVEY, LAKE NIPIGON, ONTARIO AECB STUDY 12315, DR. D. MUIR**

Technical Operations Section supported this study by assisting with sample collection relating to the deposition of airborne organic contaminants in the waters of Lake Nipigon. Lake Nipigon is approximately seventy statute miles long and fifty miles wide. Although the lake is uncharted there is a small commercial fishery and a rapidly expanding sport fishery. The lake is fairly deep with open water areas generally ranging from 60 - 120 metres and deep holes reportedly sounding deeper than 240 metres.

The LRTAP sampling was done in conjunction with the first contaminants surveillance sampling of Lake Nipigon by the Ecotoxicology Division, GLLFAS. Fisheries personnel arranged for the services of a commercial fishing operator based at Macdiarmid on Pijitawabik Bay and for the use of his sixty-foot tug between July 6<sup>th</sup> and 8<sup>th</sup>. During this three-day period stations were occupied and samples were collected co-operatively by the two field crews.

Four sites were sampled in support of the LRTAP program. The first site was located mid-channel west of Shakespeare Island in 108 metres of water. The sampling schedule included:

1. A Hydrolab/EBT profile and Secchi disk observation.
2. Water was pumped from the 4 metre depth through a 110u zooplankton net to fill a 1000 litre plastic tub. The water was then centrifuged using a Westfalia separator at the rate of six litres per minute. The resulting centrifugate was transferred to a clean glass bottle and brought to a known volume with filtered lake-water. Ten millilitre subsamples were then collected for particulate C, N, P, silica and chlorophyll *a*.
3. A 100 litre GFF prefiltered water sample was collected from the four-metre depth and from the top of the hypolimnion which was at the 28-metre depth. These samples of the contaminant dissolved phase were pumped through XAD resin columns and the columns were capped and retained cold for analysis in Burlington.
4. A twenty-litre water sample was collected from the four-metre depth and split into three different size fractions by filtering it through 200u, 20u and 2u filters. From each of the fractionations, one-litre samples were filtered for chlorophyll *a*, particulate carbon and phosphorus. A 100 ml sample was filtered through a 0.2u filter for silica. The filters were air dried in petri dishes in the dark and then frozen wrapped in aluminum foil. A one-litre sample of whole water from 4 metres was collected and preserved with 10 ml of Lugol's, a 100 ml sample was preserved with 2 ml of 5% paraformaldehyde and a 100 ml sample was preserved with 10% glutaraldehyde.
5. Three zooplankton net hauls using a 110u net were done from two metres above the bottom to a maximum of 70 metres and preserved with 4% neutral sugared Formalin.
6. A sediment core was collected using the 10 cm Tech. Ops. corer. The core was sectioned at 0.5 cm intervals for the first 5 cm, at 1 cm intervals for the next 15 cm and at 2 cm intervals to 30 centimetres. The sections were placed in Whirlpak bags and kept cold. The core was a medium gray color from top to bottom with no layers visible and 93 centimetres in length consisting of a very soft, extremely fine clay and a very thin layer of brown surficial sediment.



SETTING UP THE XAD COLUMN EXTRACTORS ABOARD THE *MELISSA MAE*





**FILTERING A WATER SAMPLE ON OPEONGO LAKE**



Site # 2 was located five kilometres north of Columbus Point near Lone Island in 72 metres of water. The full sampling program was completed here. The hypolimnion sampling depth was 28 metres. The sediment core was 70 centimetres in length and a medium gray colour all the way through. The sediment was a very soft, extremely fine clay with no layers evident other than a very thin layer of brown surficial sediment.

Site # 3 was located seven kilometres north of St. Paul Island. The water depth was 76 metres and the hypo sampling depth was 24 metres. The full sampling program was done here except that no core was collected.

Site # 4 was done on the return trip to the dock the evening of July 8<sup>th</sup>. It was located in the mouth of Pijitawabik Bay in 96 metres of water. The only sample collected at this station was the 100 litre water sample from 4 metres for aqueous phase extraction.

The fisheries sampling included horizontal zooplankton net tows, Benthic sled tows, gill netting and bottom trawling as well as the Hydrolab/EBT profiles, Secchi disc observations and vertical zooplankton hauls at the LRTAP sites.

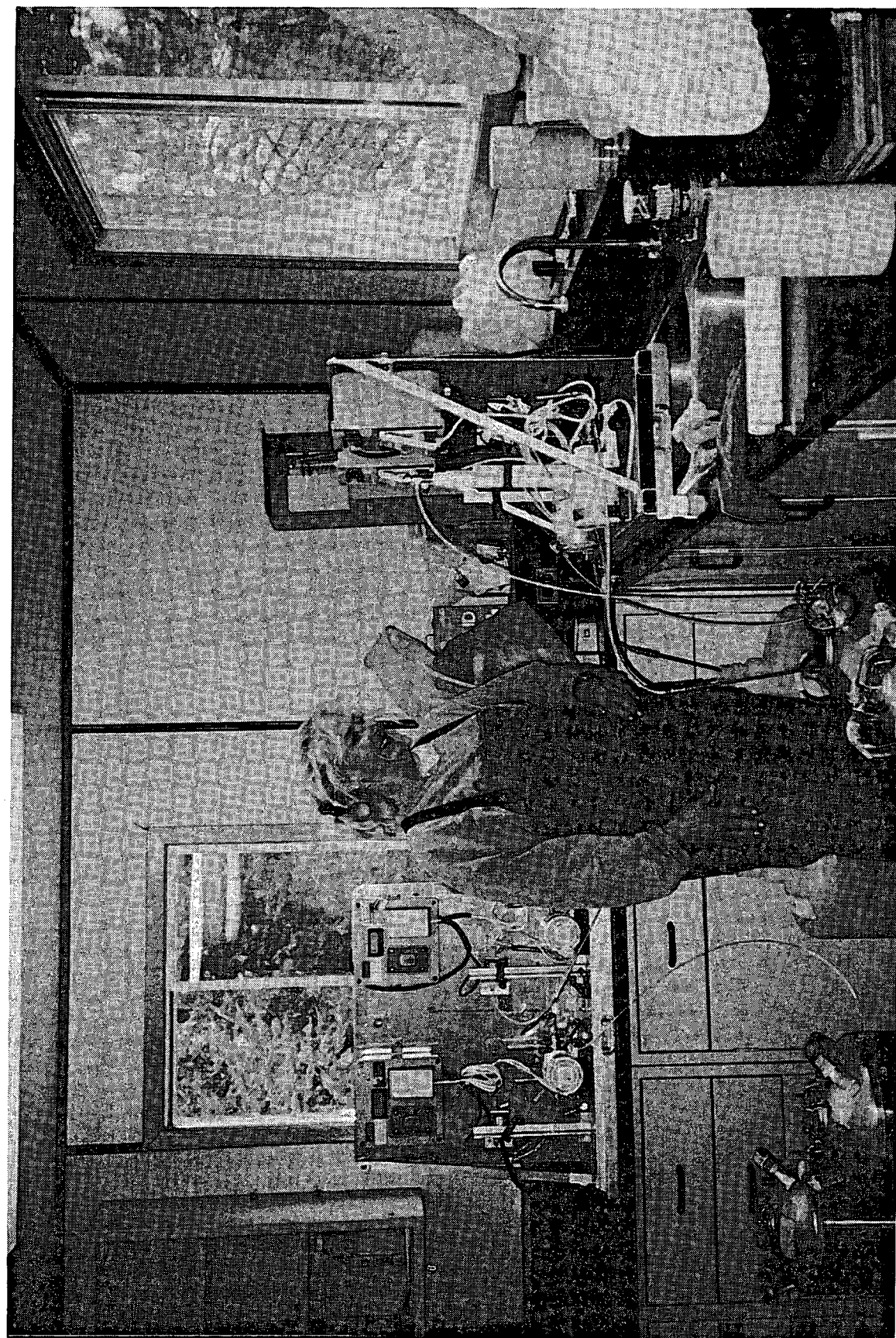
#### LAKE NIPIGON SAMPLING POSITIONS (LORAN C)

SITE NO.	STATION POSITION		CORE POSITION		DEPTH
	LATITUDE N.	LONGITUDE W.	LATITUDE N.	LONGITUDE W.	
1	49° 35' 42"	88° 30' 33"	49° 36' 52"	49° 30' 48"	108 m
2	49° 30' 28"	88° 20' 14"	49° 31' 00"	88° 19' 54"	72 m
3	49° 41' 53"	88° 36' 34"			76 m
4	49° 29' 46"	88° 12' 28"			96 m

#### AIRBORNE ORGANICS SAMPLING, LAKE OPEONGO, ALGONQUIN PARK AECB STUDY 12315, DR. D. MUIR

This sampling program investigating the long range airborne transport of Toxaphenes, Organic Chlorides and PCB's in water, sediment and plankton was supported during the week of Sept 21 - 25. A total of four stations were occupied in the deep holes of the four basins of Lake Opeongo situated in Algonquin Park. The Provincial Ministry of Natural Resources Harkness Lab was utilized as a lab and staging area for the sampling program. The DFO launch PELICAN was used to collect the samples.

At each station on the lake plankton net hauls to 2 metres above bottom were conducted to collect 10 - 15 grams wet weight of plankton. An additional net haul was done for Dr. S Guilford of the University of Waterloo for plankton identification and analysis. Eighty litres of water were collected through a glass fibre filter into large stainless steel cans for extraction through resin columns. These samples were collected from bottom -2 metres and 4 metres below the surface. Water samples for phosphorous, silica and phytoplankton identification were collected from 4 metres. One thousand litres of water were centrifuged from the 4 metre depth for suspended solids. To prevent plankton larger than 100 microns from being trapped, the sampling pump was encased in a 100 micron size mesh plankton net. The water was



XAD COLUMN EXTRACTORS AT THE HARKNESS LABORATORY

centrifuged at 6 litres per minute. Duplicate cores were to be collected from each site using the mini box corer. However, due to very soft sediments the corer penetrated the sediments below the interface making it impossible for the corer to work. A Tech. Ops. corer with 10 cm core tubes was used to collect three cores at sites B, C and D. Only one core was collected at site A. All cores were subdivided into 1 cm sections to twenty cm.

The sampling site locations that utilized DGPS (WGS 84) were as follows:

SITE	LATITUDE N.	LONGITUDE W
A	45° 41' 00"	78° 22' 06.6"
B	45° 43' 40.8"	78° 19' 51.6"
C	45° 41' 27.6"	78° 23' 32.4"
D	45° 43' 30.0"	78° 23' 58.8"

All water and sediment samples were either frozen or stored at 4°C until returned to CCIW for analysis.

<b>TURKEY LAKES WATERSHED</b> <b>AECB STUDY 12316, R.G. SEMKIN</b>
---

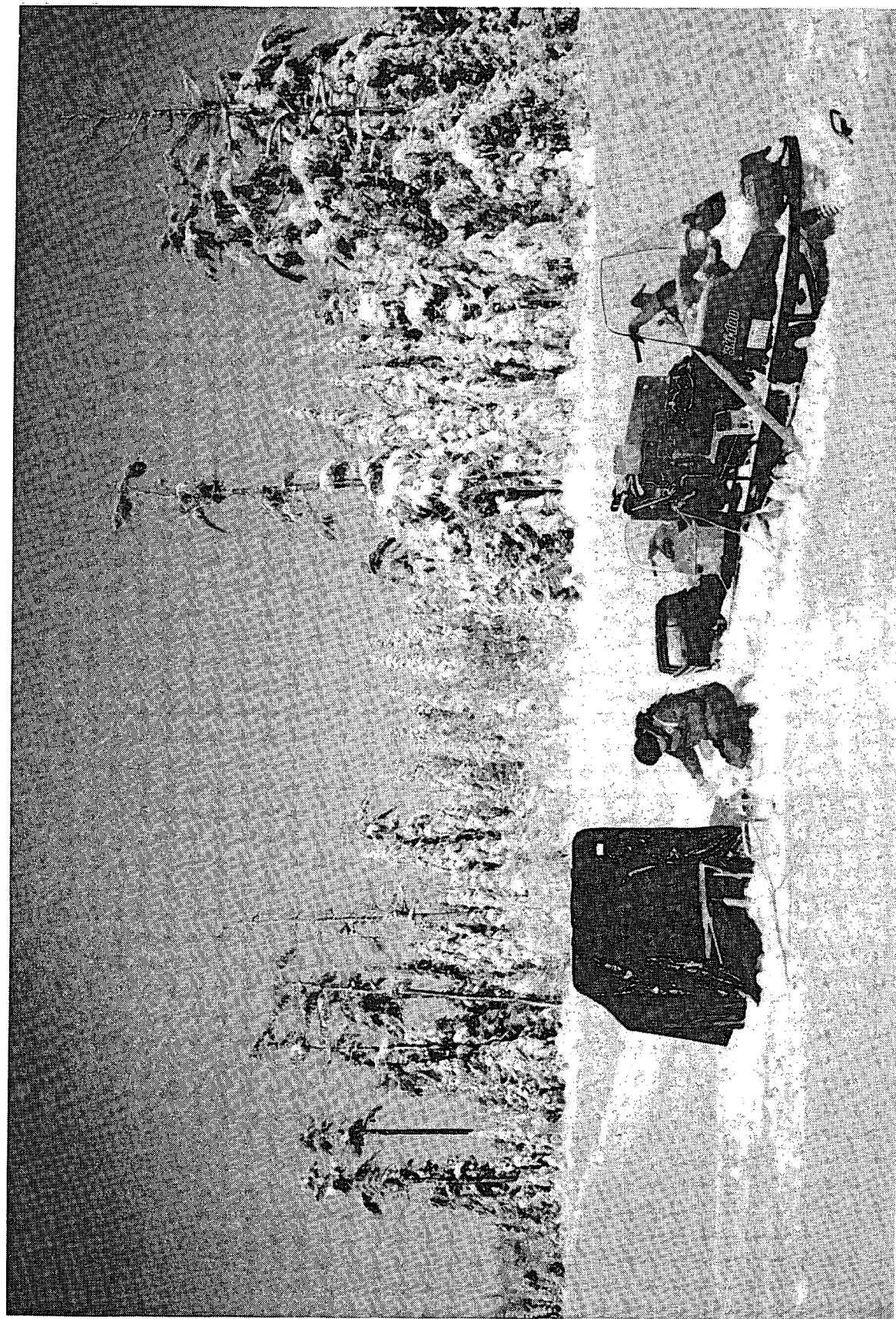
The Turkey Lakes Watershed Study is an ongoing project monitoring the movements and effects of Long Range Transport of Airborne Pollutants (LRTAP) on the sensitive aquatic ecosystems of the watershed. The chemical and hydrological monitoring of the study area was begun in 1980 and has been supported 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, 4 snowmobiles and 4 all-terrain vehicles were supplied and maintained for use as transportation throughout the watershed. All tools, sampling and safety equipment for the study were 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.

The Department of Fisheries & Oceans support consisted of six small aluminum 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.

Tech. Ops. staff supported Aquatic Ecosystem Conservation Branch staff in chemical and hydrological monitoring of the watershed. Hydrological monitoring consisted of gauging and



COLLECTING LAKE SAMPLES AT L2 IN THE TURKEY LAKES WATERSHED





ATV WITH CENTRIFUGE AND GENERATOR AT THE OUTLET OF LITTLE TURKEY LAKE

sampling seven 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.

To supplement hydrological and chemical data, a full meteorological station and solar radiation unit were operated on a year-round basis. A new 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 sensor with continuous data recorded on the Campbell datalogger.

Service was provided by Tech. Ops. to 1 Campbell datalogger, 1 storage module and 1 solar power panel.

A snow melt cave constructed at the Batchawana Lake location is in service during the winter months until the end of the spring runoff period.

An ongoing Nitrate study is proceeding on a weekly basis. A 2-litre filtered sample is obtained from Forestry site CFS 31 on a weekly schedule and a 2-litre filtered nitrate sample is collected on a two-week schedule from a bulk precipitation sampler installed on the meteorological sampling deck.

All maintenance and repairs to equipment, buildings and vehicles were performed by Tech. Ops. 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.

The 1998 spring melt was very fast and hectic this year. The melt lasted for a period of only 2½ weeks this year. Personnel were required to move into the camp on very short notice when the main road to the camp flooded overnight due to heavy rain. The scientist in charge was notified immediately and arrived from Burlington 2 days later. Staff arranged to move the scientist to the camp over the flooded road by transferring personnel and supplies utilizing a canoe along with having to portage the gear a short distance. This is the first time this mode of transportation has been used during a spring melt and everything went smoothly. The rains in the watershed were very heavy for 3 days and as a result the water levels rose significantly and most (90%) of the snow pack disappeared within 2 weeks. It was necessary to traverse the flooded access road once during this period to purchase additional food supplies. Overall everything went fast and smoothly this spring and no additional assistance was required from Tech. Ops. due to the shortness of the melt period.

For the first time since the study began, lakes were sampled in December using a boat. Normally they are inaccessible during the month of December.

Over the year equipment support and accommodations at the camp were provided to various Government agencies. This allowed personnel involved to continue their studies on a schedule particularly when timing between sampling events was very important.

New government approved diesel storage tanks were installed at the camp and have been put into service. The old tanks were disposed of in accordance with regulations governing such and contaminated soil from the old tank bed was removed and replaced with clean landfill. All aspects of this change and installation were monitored, inspected and approved by Ministry of the Environment staff.

The garage and lean-to roofs were re-shingled and new plywood sheeting was installed. This work was completed over the summer. Technical Operations provided 2 staff members in July to re-paint some of the infrastructure at the camp and what they couldn't complete due to time constraints was completed by TOS staff on site.

Staff members on site have taken on the work of operating the AES Capmon air and precipitation station on the MET hill on a daily schedule with the exception of weekends. The TOS staff member on site received training in the proper operating procedures from AES staff.

#### **PRECIPITATION SAMPLING FOR HALOACETIC ACID**

**AECB STUDY 12317, DR. B.F. SCOTT**

On July 14 a precipitation sampler was installed at the AES site on top of Mount Sutton at Sutton, Quebec and a cloud sampler was given to AES staff for installation. The samplers were installed to collect water from rain and fog events. The samples collected were analyzed for different forms of Haloacetic acid.

Due to the inaccessibility of the site, all equipment was transferred to the top of the hill via ski lift. The lift carried the equipment vertically 460 metres and 1 km diagonally to the top. The sampler was carried by hand an additional 100 metres from the lift to the site for deployment.

On arrival at the site the sampler was deployed in an open area that was exposed to precipitation from all directions rather than the suggested position under the trees. The instrumentation was assembled and the wiring to the sampler was modified to accommodate the AES electrical system. The sampling systems were demonstrated and AES staff were given the protocol that Dr. Scott wished followed in his sample collection.

The sampler was dismantled by AES staff in late August and returned to Downsview for subsequent retrieval by Dr. Scott in September.

**HALOACETIC ACID SAMPLING, LAKE MALAWI/NYASA, MALAWI, AFRICA**  
**AECB STUDY 12317, DR. B.F. SCOTT**

Water samples were collected for Haloacetic Acid analysis from selected stations in Lake Malawi/Nyasa during the September cruise. Samples were collected from a depth of 1 m at stations 902, 907, 908 and 912. Duplicate samples were collected from a depth of 1 m at stations 917, 927 and mooring location 5. Duplicate samples were also collected at station 915 from depths of 1, 100, 200, 300 and 360 m and at station 940 from depths of 1, 100, 200, 300, 400, 500, 600 and 683 m. Samples were frozen upon collection and returned to CCIW for analysis. All samples were collected by Hydro-Bios sample bottles.

**SEWAGE TREATMENT PLANT SAMPLING, THURSO, QUEBEC**  
**AECB STUDY 12341, M. McMASTER**

Technical Operations Section supported three separate trips to collect papermill effluent at the Maclaren-Noranda Mill in Thurso, Quebec. The mill employs a new method whereby photographic paper is processed through the line.

The field party travelled to Thurso on March 3<sup>rd</sup> and after a company safety course, collected samples at various, pre-selected points along the pulp mill process. These samples would provide for the initial analysis of the new process. Fifteen samples were collected in total in 20 litre plastic pails and labelled. Some samples were collected using a small Marsh pump, some were collected by dipping the pails and pulling them up with attached ropes and others were collected with a small lab pump provided by the company. The samples were delivered back to the Wet Lab cold room in Burlington for later analysis.

During the week of June 1 - 5<sup>th</sup> the photographic process was up and running at the plant and a more intensive sampling at the plant was made. On this trip the sampling was done three complete times through the entire process—from raw river water right through to final effluent. At selected key stations along the process, 200 litre barrels were collected. At other points the 20 litre pails were used. The TOS crane truck arrived on June 3 and was loaded with the water that had been collected to that point. This truck returned to Burlington on Thursday, June 4. The rest of the crew finished the third run sampling and returned to Burlington on Friday in the three-ton truck. Samples were delivered to the Wet Lab cold room and the 2<sup>nd</sup> floor cold room for later analysis.

On July 7<sup>th</sup>, the three-ton truck and the crane truck returned to the mill for one more trip. This time, 4600 litres of final effluent was collected in barrels using two 5 CMD March pumps. Sampling was completed, the loads were secured and personnel returned to CCIW on the 8<sup>th</sup> of July. The samples were taken via lift cart to the 2<sup>nd</sup> floor cold room for later analysis.



**ESTROGENIC EFFECTS OF INDUSTRIAL AND MUNICIPAL EFFLUENTS ON FISH**  
**AECB STUDY 12344 DR. J. SHERRY**

This project was a continuation of Dr. J. Sherry's study of endocrine disruption in wildlife via exposure to environmental estrogen's. On April 16<sup>th</sup>, three species of trout (speckled, rainbow and brown) were moored at six sites in Hamilton Harbour and one at the tower in Western Lake Ontario. At each site, three cages were suspended at a depth of two metres—one cage for each type of fish. Two sites along the southeast wall of Windermere Arm (W5 and W6) were lethal to the fish within several days. Site W6 was originally planned to be at the bridge at the end of Windermere Basin but due to high sedimentation and effluent flow, it immediately proved to be too toxic for fish survival. Hydrolab water quality parameters were measured at the time of placement and removal. The cages were removed on May 16<sup>th</sup>.

**MOORING POSITIONS**

SITE	LATITUDE N.	LONGITUDE W.
W1	43°17' 40"	79° 48' 50"
W2	43°17' 02"	79° 47' 19"
W3	43°16' 33"	79° 47' 36"
W4	43°16' 23"	79° 47' 25"
W5	43°16' 20"	79° 47' 11"
W6	43°16' 14"	79° 47' 02"
W7	43°16' 11"	79° 45' 34"

**AQUATIC ECOSYSTEM PROTECTION BRANCH****IRGAROL SAMPLING, HALIFAX, NOVA SCOTIA; SOREL, MONTREAL, QUEBEC**  
**AEPB STUDY 12421, DR. D. LUI**

Twelve sample locations in the Bedford Basin and Halifax Harbour were visited between July 31 and August 3. A 16-litre and an 80-litre water sample along with a PONAR sediment sample were taken at each site for testing of Irgarol 1051. The 16-litre samples for Irgarol were extracted with methylene chloride and the 80-litre samples were extracted through XAD resin columns. Sediment samples were frozen the same day.

At Sorel, Quebec on August 6, 2 sample locations were visited and sampled as in Halifax. On August 7 and 8 at Montreal, six sample locations were sampled as per the previous sampling.

**IRGAROL SAMPLING, VANCOUVER AND VICTORIA, B.C.**  
**AEPB STUDY 12421, DR. D. LUI**

Support was given to this study from August 24 to September 4 in Vancouver Harbour, Coal Harbour, Burrard Inlet, Victoria Harbour, False Creek, Esquimalt Harbour and Sydney Harbour. Sampling was completed with the assistance of Pacific and Yukon staff and the use of their jet boat and Zodiac rubber raft. Water and sediment samples were collected for Irgarol—a chemical used in anti-fouling paints on vessels from other parts of the world where its use is not regulated.

Twenty sites were visited to collect water (16 litres) from the 1-metre depth and sediment from the bottom, employing a mini PONAR grab sampler. At four stations (Coal Harbour, Burrard Inlet, False Creek, Victoria Harbour and Sydney Harbour), chosen by the study leader, large volumes of water were collected and the water pumped through resin columns to extract any organics. Sampling sites were the same as those visited in October of 1996 with the exception of the site in Sydney Harbour.

**SEWAGE OUTFALL SEDIMENT SAMPLING, VANCOUVER, B.C.**  
**AEPB STUDY 12422, D. BENNIE**

Support was given to this study from August 24 to September 4, collecting sediment samples for Mr. D. Bennie of AEPB. These samples were collected for nonylphenol polyethoxylates and their anaerobic degradation products; namely, nonylphenol and nonylphenol monodietoxylates. Because of their biodegradability, potential toxicity and persistence in sewage water and sediment, four major sewage treatment outfalls in the Vancouver area were sampled including: Capalano STP; Annis Island STP, Steveston STP and Iona STP. Three jars of surficial sediment were collected from each site and frozen for shipment to CCIW. Positions for the sampling sites were as follows:

SEWAGE TREATMENT SITE	LATITUDE N.	LONGITUDE W.
Capalano	49° 19' 00"	123° 13' 18"
Annis Island	49° 09' 35"	122° 59' 09"
Steveston	49° 06' 48"	123° 09' 10"
Iona	49° 12' 11"	123° 17' 40"

The positions at Steveston, Capalano and Annis Island were obtained by visual bearings and/or hand-held GPS. The position at Iona was obtained by DGPS.

<b>TRIBUTYLTIN UPTAKE STUDY, SOUTHERN ONTARIO</b> <b>AEPB STUDY 12425, F. YANG</b>
---

Technical Operations personnel assisted this study with the collection of water and sediment samples and the collection of mussels from cages for F. Yang. The study is monitoring the decline of Tributyltin compounds found in anti-fouling paints which were banned from Canada in 1989. Sampling began in late April and will continue into the spring of 1999.

One segment of the field work consisted of the collection of water samples from six locations around the western end of Lake Ontario which were collected on a weekly basis in the spring, then bi-weekly and eventually at more discrete times in the fall. The sample locations were at the 50 Point Marina, the Hamilton Police Dock, the Burlington Waterfront, Oakville Harbour, Port Credit Harbour and in Toronto Harbour at the HMS York dock. In total, eighteen of these day trips were made during the 1998 season.

The second part of the field work involved the collection of the mussel species, *Elliptio complanata* from Balsam Lake. These were collected during the last few days of April and then placed in wire cages located at six sites throughout Southern Ontario during the first week in May. The sites were located at the ferry dock in Toronto Harbour, the dry-dock in Kingston Harbour, the Wye Heritage Marina in Midland, the Harbour at Port Stanley, the Windsor Yacht Club and at the Kenilworth Slip in Hamilton Harbor. A control site with mussels was left in Balsam Lake and was visited once in mid-summer and will be visited again when the study ends.

These sites were visited once each month until November and will be sampled in January and March of 1999. Along with the collection of mussels, a water sample was collected and on some trips sediment samples were collected using a mini PONAR.

The field work was very successful with a complete survival rate for the caged mussels and no loss of any cages during the season. Following is a list of the 18 day trips: April 14, 27, May 4, 11, 19, 25, June 1, 15, 29, July 13, 27, August 7, 24, September 11, October 5, 29, November 16 and December 3. The monthly mussel collections occurred as follows: June 2 - 5, July 6 - 10, August 4 - 6, September 8 - 10, October 6 - 9 and November 17 - 19.

**MALVERN PARTICLE SIZE SURVEY, KINGSTON POND**  
**AEPB STUDY 12440, DR. J. MARSALEK**

Technical Operations supported this project by assisting with the collection of particle size measurements, using the Malvern instrument in the Stormwater Detention Pond near Cataraqui Mall in Kingston.

The seventeen-foot Zodiac inflatable was launched in the pond and used to carry the Malvern. The measurements were collected from the usual 15-metre grid locations where possible given the low water level in the pond. One particle size measurement was made at the surface at each site and a water sample was collected for suspended sediment analysis. A total of fourteen sites were sampled.

**ROADSIDE SNOW SAMPLING, LOCAL**  
**AEPB STUDY 12440, DR. J. MARSALEK**

Technical Operations supported this project by assisting with the collection of snow samples from several roadside areas in Burlington. The snow was required for analysis of metals deposited along the roadside as a result of vehicular traffic. The sites chosen were as follows:

1. Central Park in downtown Burlington
2. Smith Avenue in Burlington
3. Royal Motel near Waterdown and Plains Road
4. QEW ramp to Lakeshore Road in Burlington

Three 25-litre samples were collected from each site using a section of 10 cm core tube. The snow samples were stored in a chest freezer near the Rotating Flume in the Hydraulics Lab for analysis later.

**SEDIMENT RESUSPENSION STUDY, HAMILTON HARBOUR**  
**AEPB STUDY 12444, DR. I. DROPPO**

On June 11, five mini box core samples were collected in the Dofasco Slip. The samples were collected for a sediment flume to measure resuspension.

**SEDIMENT COLLECTION, HUMBER BAY**  
**AEPB STUDY 12444, DR. I. DROPPO**

Technical Operations Section supported this project on two occasions by assisting with the collection of bottom sediment samples from a series of sites located adjacent to stormwater outfalls along the north shore of Lake Ontario between the mouth of the Humber River and Ontario Place. The samples were needed to identify the contaminants entering the lake from storm drains carrying runoff from expressways in the area.

Three sites were sampled during the first trip in September. In each case a total of five samples were collected using a mini PONAR grab sampler and placed in plastic bags for transport to the Ryerson University for analysis. A reference site was chosen just off the south shore of Toronto Island away from any lakeshore influences and sampled the same way. A second trip was made in November and six sites were sampled along the lakeshore. An additional three sites chosen as control stations located in the Outer Harbour were sampled in the same manner.

#### **HIGHWAY RUNOFF**

AEPB STUDY 12464, T. MAYER

Highway rainwater runoff was collected under three local overpasses. The three bridges were: the Burlington Skyway, the bridge west of the main office of the Royal Botanical Gardens on Plains Road in Burlington and the bridge over Fairchild's Creek on Hwy 2 in Brantford. The water flowed through the road drainage vents and was collected in 45-gallon plastic drums. The drums were sub-sampled after a rain by removing approximately 4l of water which was returned to CCIW for analysis. The drums were emptied and cleaned prior to the next rain event.

The water was analyzed for the following parameters: temperature, pH, specific conductance, TSS, anions, TP, TFP, nutrients, nitrogen, TM-U, TM-F and PAH's. The data collected from this study will help to determine what volatile contaminants are washed off bridges during and immediately after a rain event.

#### **STORMWATER DRAINAGE POND SAMPLING**

AEPB STUDY 12464, T. MAYER

A stormwater drainage pond, which flows into the Rouge River in Toronto, was sampled in order to monitor the sediment and water quality. The pond is located next to the Rouge River and Hwy. 401 and accepts runoff from the roads in this area.

On August 19, a crew travelled to the pond and placed 5 peepers into the bottom sediment. The pond is approximately 3 metres deep so, using a small Zodiac boat, the peepers were deployed using a portable peeper placer built by the ESS Machine Shop which was attached to a 3-piece aluminum rod. The peepers were then attached to a surface marker with 1/4" rope for later retrieval.

On September 9, a crew returned to the pond to retrieve the peepers, which were immediately sampled on shore. In addition, water was collected using a 2-litre Van Dorn bottle, sediment was collected using a mini PONAR and 3 cores were taken with a Tech. Ops. corer.

On October 5 two more peepers were placed in the pond and subsequently recovered on October 26. In addition, more sediment and water was collected at this time.

It should be noted that the pond is surrounded by a fence with a locked gate. A key must be picked up from the Ministry of the Environment in Toronto to obtain access.

<b>LONG-TERM MONITORING OF MUSSEL POPULATIONS, LAKE ONTARIO REGION</b> <b>AEPB STUDY 12465, J. SMITH</b>
---

Technical Operations supported this continuing study with field staff, a vehicle and other related sampling equipment. The period of support was the last three weeks of August and the first week of September.

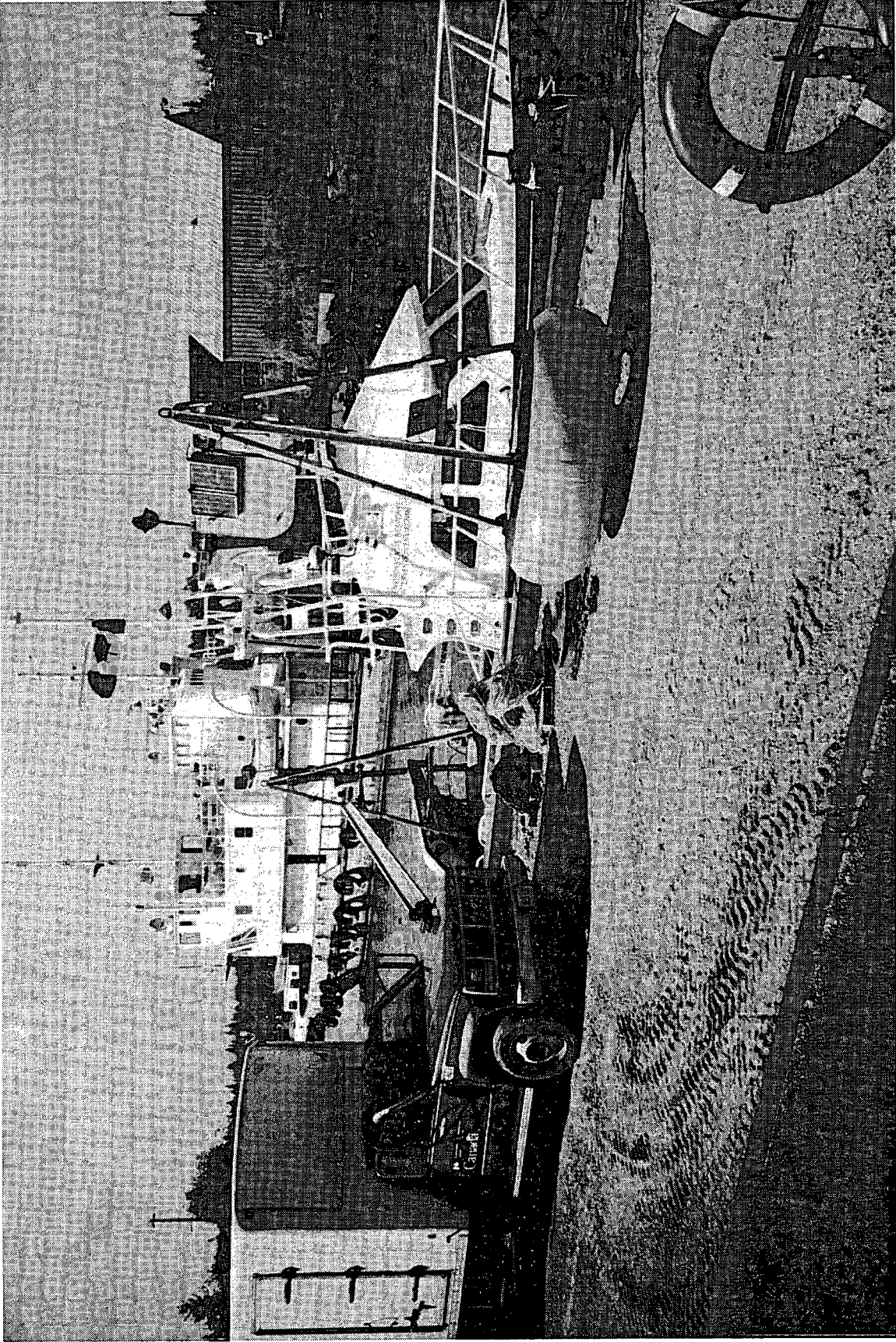
The Committee on the Status of Endangered Wildlife in Canada has recognized that mussels are one of the most endangered groups of invertebrates in Canada and have requested a national list of species at risk. This project examined trends in the biodiversity of freshwater mussels in the Lower Great Lakes drainage basin over the last 140 years. The data is revealing a pattern of species loss and the domination of siltation and pollution-tolerant species present in small numbers in the watersheds.

The sites chosen for the field work this summer were located on the Grand River, the Thames River, the Ausable River, the Sydenham River and one site on the Maitland River. A total of 23 sites were sampled on these rivers to complete sections and fill in areas that had not been investigated in previous years. These mussel-rich rivers contain 41 of the 54 species known in Canada.

The study sites were mostly located at shallow riffle areas in the various rivers which are the prime habitat of the mussels. Search techniques included the use of underwater viewers in areas of good visibility and by a hand search of bottom strata when water conditions were turbid. Each site was searched for one-and-a-half hours by a three-man team to keep all results compatible. Also, water temperature, turbidity measurements, pH, conductivity, flow rates, and a physical description of the sites were recorded. The mussels collected during the search were identified, numbers of each species recorded and the length of each specimen recorded before they were returned to the rivers.

In addition, TOS divers collected 400 clams from Balsam Lake to be used for winter experiments.

Study results indicate an alarming 30% to 40% loss of mussel species in the sampled rivers. Indications are that conservation efforts are urgently needed to maintain and recover these unique components of aquatic biodiversity.



CCGC 775 AT THE COAST GUARD DOCK IN HAY RIVER

# **AQUATIC ECOSYSTEM IMPACTS BRANCH**

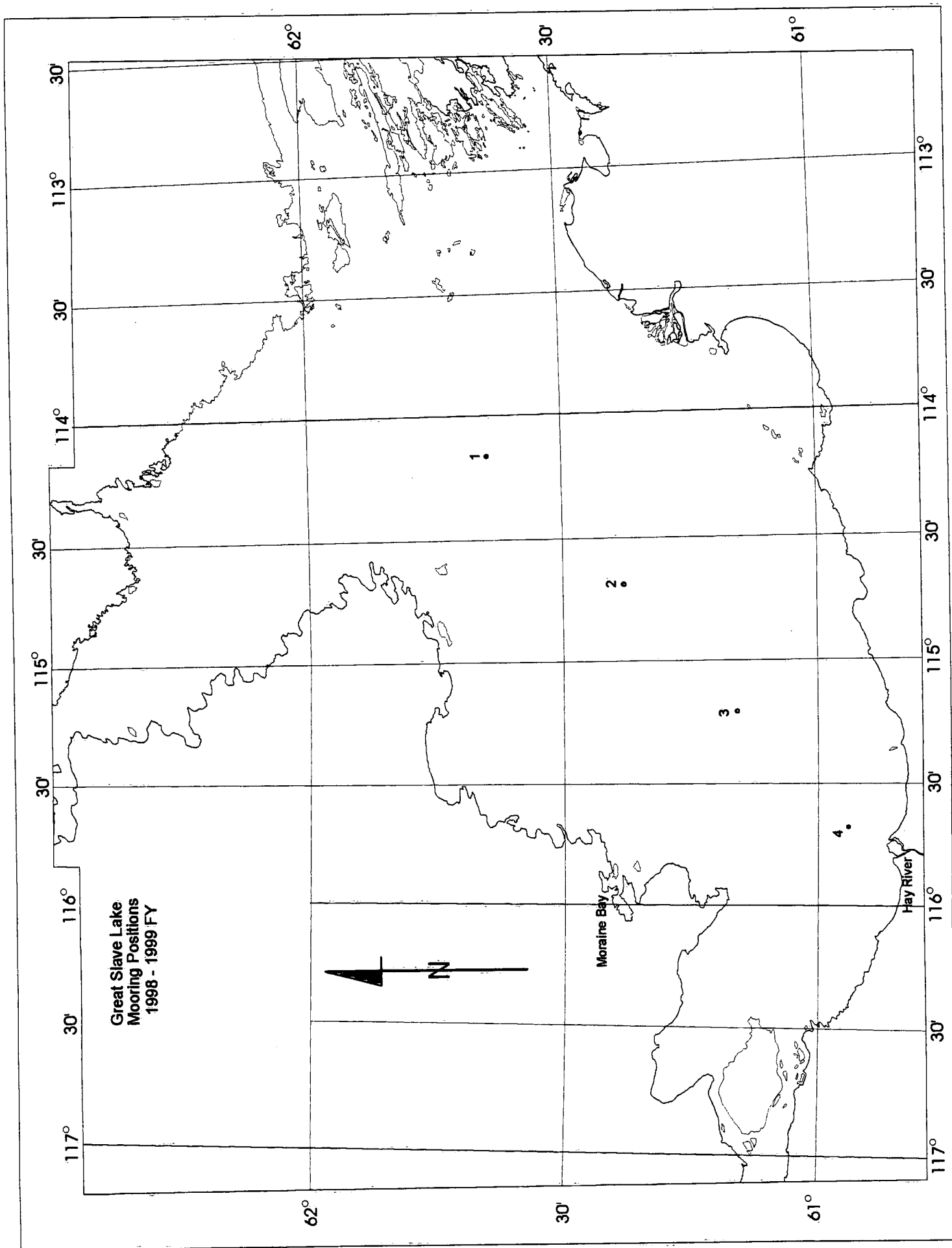
## **METEOROLOGICAL AND TEMPERATURE MOORINGS, GREAT SLAVE LAKE AEIB STUDY 14145, W.M. SCHERTZER**

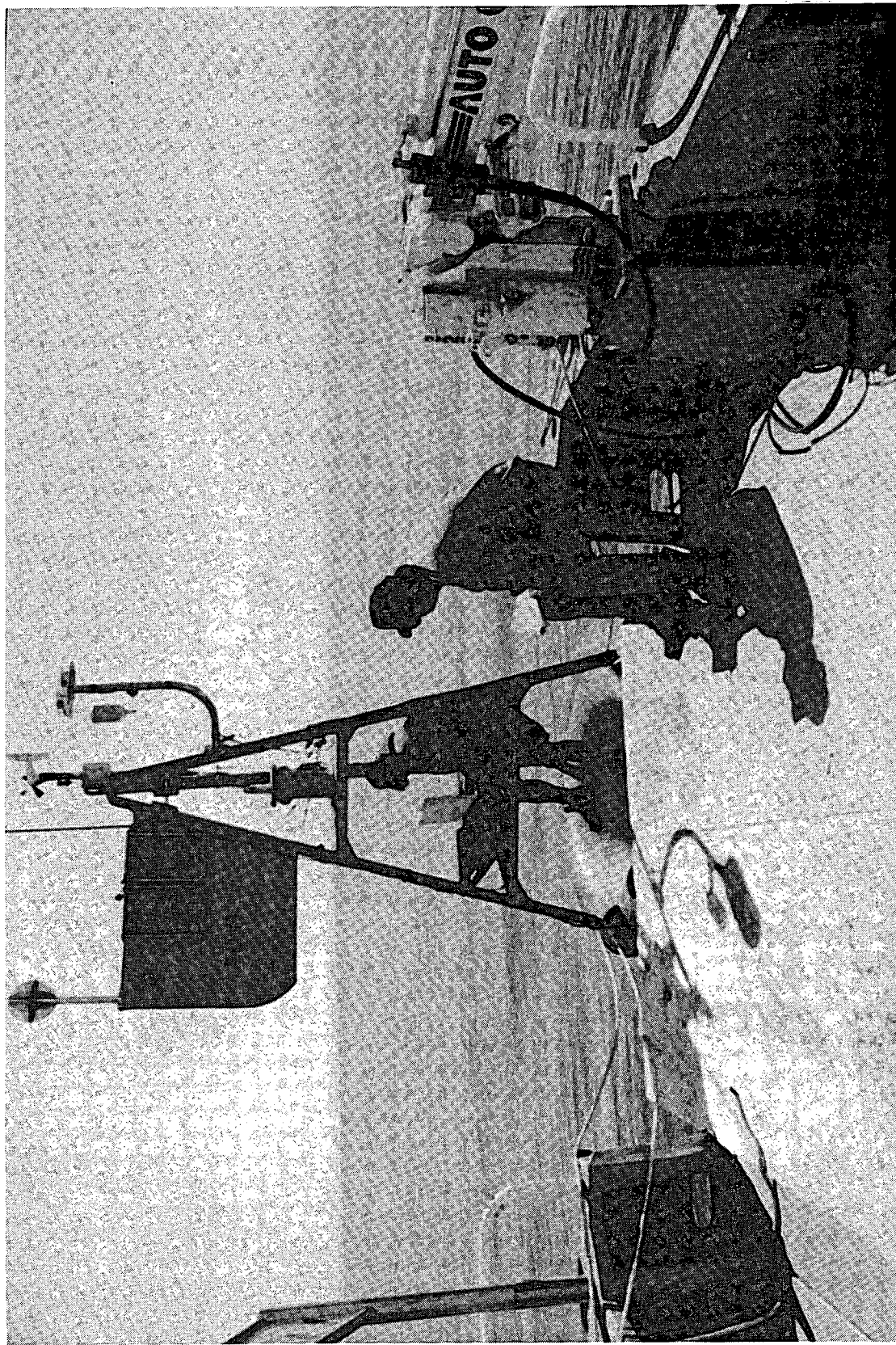
The purpose of this study was to deploy meteorological and temperature moorings to give detailed vertical temperature measurements on Great Slave Lake, NWT. To accomplish this, two meteorological buoys were installed at stations 1 and 2 during the cruise June 17 - 19 and retrieved on September 23. A shore-based station was also set up at Hay River in the NTCL storage area. Four temperature moorings were installed during the same time period at stations 1, 2, 3 and 4. The temperature moorings were retrieved during the cruise September 11 - 16 and one temperature mooring was reinstalled as a winter mooring at station 2. The shore-based meteorological station was dismantled September 14.

### **MOORING POSITIONS**

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
1	98 - 51T - 01A	61° 38' 48"	114° 10' 03"	T(2.5,7.5,10,13.5, 20,25,30,40,50, 75,100m)
	98 - 51M - 02A	61° 38' 33"	114° 09' 13"	Met
2	98 - 51M - 03A	61° 26' 18"	114° 46' 07"	Met
	98 - 51T - 04A	61° 26' 12"	114° 46' 36"	T(2.5,7.5,10,13.5, 20,25,30,40,50, 60m)
3	98 - 51T - 05A	61° 10' 24"	115° 18' 56"	T(2.5,7.5,10,13.5, 15,20,25,30,40, 56m)
	98 - 51T - 05B	61° 10' 28"	115° 18' 33"	T(12,14,16,20,25, 30,40,54.5m)
4	98 - 51T - 06A	60° 53' 08"	115° 40' 24"	T(5,7.5,10, 12m)
Hay River	98 - SLM - 03A	60° 53' 00"	115° 40' 00"	Met







MONITORING A MET BUOY FROM CCGC 775 ON GREAT SLAVE LAKE

**MIRAMICHI RIVER**

AEIB STUDY 14146, S. BELTAOS

Work on this project was part of a joint study by NWRI, New Brunswick Department of Environment and New Brunswick Department of Transport to measure the impact of ice on bridge structures.

On July 6, K.J. Hill and E.H. Walker travelled to Miramichi, New Brunswick with van 249937 and the 26' canoe. A total of 15 cross-sections of the Miramichi River were surveyed in areas where ice jams had occurred. The elevations were tied to existing bench marks so that real elevations in metres above sea level were measured. In addition, water levels along a 600 m stretch of the river were done at 2 locations.

Temporary bench marks (usually nails) at each cross-section were tied in to geodetic bench marks using the Wild NA-2000 electronic level. River cross-sections were done using the T-1600/DI3000 distomat system for the land portion of all sections. This system was also used for the river bottom at the sections upstream where the river depth was less than 1.5 m. The deeper river sections downstream were done using a measured rod for depth measurements and a Microfix positioning system borrowed from CHS for distance measurement.

**RESEARCH SUPPORT BRANCH****LONG-TERM SENSING SITES (LTSS), CORNWALL REGION**  
RESTORATION PROGRAMS DIVISION, ECB, OR, H. BIBERHOFER  
RSB STUDY 12631, S.B. SMITH

A program has been developed to assess the long-term effectiveness of remedial work in the region as a whole. For the past four years a network of Long Term Sensing Sites (LTSS) has been jointly monitored by Environment Canada (Quebec and Ontario regions), the Quebec Ministry of Environment and Wildlife and the Ontario Ministry of Environment and Energy. The objective of the program is to study the quality of the sediments and suspended solids in order to assess the transport of contaminated material downstream from Massena, New York sources. This program has been developed to assess the long-term effectiveness of remedial work in the region as a whole.

On April 6 - 9, a TOS dive team (Gray, Breedon and Don) travelled to Cornwall to search for and install surface buoys on eight scientific moorings in the Cornwall area. Six moorings or Long Term Sensing Sites (LTSS) for Environment Canada Ontario Region are located at three sites (one in Lake St. Lawrence, two downstream of Courtaulds and three in Lake St. Francis). All EC Ontario Region moorings consist of four sediment traps to monitor the quality of the sediments and suspended solids from Massena sources.

The search for all moorings required the use of the PINTAIL, divers, DGPS, pinger locator, sounder and a grapnel. Water visibility in the area averaged between ten and twenty feet.

All Ontario Region LTSS moorings were found successfully. Winter markers had been cut from some moorings but the use of DGPS minimized the search areas. The marina at Craig Quay was still frozen solid, requiring a launch from the Raisin River Marina. The water levels above the dam have been fluctuating greatly ( $\pm 2$  m), since the power dam regulates the flow of water to control flooding downstream. All moorings were equipped with a spar buoy and a poly ball at the subsurface buoy. At all mooring sites visited, divers inspected all mooring hardware and found it to be in excellent condition. The spar buoy lights were serviced during the field season by personnel from the Centre Saint-Laurent, Montreal.

On November 16 - 19, a TOS dive team (Gray, Breedon and Gilroy) travelled to Cornwall to remove spar buoys and install winter markers on all LTSS moorings in the Cornwall area.

**Trent River Water Sampling Station**

On September 17, a TOS dive team, (Gray, Breedon and Don) travelled to Trenton to remove a water intake mooring in the Trent Canal for MOEE Ontario. The mooring consisted of a 180 lb. anchor with a 70 lb. subsurface float and a sampling hose to shore. The mooring installed in June '97 was located 300 m upstream of Trenton Lock #1 on the west side of the Trent/Severn canal.

## CORNWALL STATION POSITIONS (DGPS - WGS 84)

MOORING NO	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
98-07S-07A	45° 01.4310'	74° 40.9459'	4985646.	525024.
98-07S-08A	45° 01.5189'	74° 39.5349'	4985819.	526870.
98-07S-13A	45° 00.9458'	74° 42.3897'	4984745.	523127.
98-07S-14A	45° 00.7480'	74° 43.6790'	4984372.	521436.

## LAKE ST. FRANCIS STATION POSITIONS (DGPS - WGS 84)

MOORING NO	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
98-07S-09A	45° 05.8471'	74° 26.0117'	4993934.	544573.
98-07S-10A	45° 07.1381'	74° 27.0036'	4996313.	543253.
98-07S-11A	45° 08.6624'	74° 25.8748'	4999145.	544713.

## LAKE ST. LAWRENCE STATION POSITION (DGPS - WGS 84)

MOORING NO	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
98-07S-12A	45° 05.8471'	74° 26.0117'	4993934.	544573.

**PRODUCTIVE CAPACITY OF FISH HABITAT**

GREAT LAKES LABORATORY FOR FISHERIES & AQUATIC SCIENCES,  
V. CAIRNS, J. FITZSIMONS  
RSB STUDY 12631, S.B. SMITH

This project was a continuation of past studies to investigate the factors which effect 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 a diver, diver equipment and underwater video support to this study. The long-term objectives of the work include:

1. To develop habitat assessment and analysis methods (based on GIS technology) which integrate biological, chemical and physical components of the ecosystem.
2. To develop predictive models of fish habitat requirements in relation to fish production for use as management tools in the assessment of proposed changes to fish habitats throughout the Great Lakes.
3. To evaluate fish habitat restoration methods.

## DIVE SUPPORT

DATE	LOCATION
April 21	Pt. Weller
May 19	Pt. Weller
June 5	Pt. Weller
September 21	Stoney Creek
November 20	Stoney Creek

**ROYAL BOTANICAL GARDENS CARP BARRIER**  
 GREAT LAKES LABORATORY FOR FISHERIES & AQUATIC SCIENCES, V. CAIRNS  
 RSB STUDY 12631, S.B. SMITH

On March 25, TOS divers travelled to the Carp Barrier located at the entrance to Cootes Paradise from Hamilton Harbour. The purpose of the trip was to provide underwater support to the maintenance plan for the structure. The Carp Barrier was constructed for the Royal Botanical Gardens at this location to prevent the passage of carp into Cootes Paradise as part of a long-term rehabilitation program.

Divers cleared the lower beams of rock rubble and debris, allowing the screens to seat properly without any gaps. A patch was installed at the joint between the structure and the sheet pile on the north side. The patch was constructed of heavy reinforced rubber and held in place with five 7/16" bolts. The work was accomplished in water visibility of less than one foot. The poor water visibility prevented the use of the video camera.

**STREAM CONSERVATION PROJECT MAPPING SURVEY**  
 RESTORATION PROGRAMS DIVISION, ONTARIO REGION, H. BIBERHOFER  
 RSB STUDY 12631, S.B. SMITH

Technical Operations supported this project, led by Mr. H. Biberhofer, by assisting the Raisin River Conservation Authority in Cornwall, Ontario with the GPS mapping of several conservation projects in the Sutherland Creek watershed and a wildlife observation site in the Summerstown Forest.

Differential GPS fixes were required to identify, for the purposes of a GIS database, manure pits and segments of fence along creeks and ditches in the Sutherland Creek watershed which were involved in stream conservation projects from 1995 to the present. Positions were also determined for five wildlife observation sites in the Summerstown Forest. The position fixes were in all cases taken using the portable Eagle Explorer GPS equipped with a Lowrance Differential Beacon Receiver. Differential corrections were received from the Canadian Coast Guard beacon at Cardinal, Ontario.

**WATER SAMPLE COLLECTION**

RESTORATION PROGRAMS DIVISION, ONTARIO REGION, H. BIBERHOFER  
RSB STUDY 12631, S.B. SMITH

Technical Operations Section assisted this project led by Mr. H. Biberhofer with the collection of a set of water samples from six rivers and streams flowing into Lake Ontario between Port Dalhousie and Trenton in January. The six sampling sites were:

1. Twelve mile Creek at the Hydro station in Port Dalhousie
2. Twenty mile Creek from the bridge above Ball's Falls
3. Credit River at the Mississauga Golf and Country Club
4. Humber River at Etienne Brule Park upstream of the bridge
5. Ganaraska River at Sylvan Glen Road
6. Trent River upstream of Lock #1

At each site, two twenty-litre stainless steel pop cans were filled with water for PAH analysis at CCIW and one twenty-litre can was lined with a plastic bag and half filled with water for metals analysis by MOEE staff at the Rexdale office. Samples were pumped using a 3 CMD March pump with a Teflon hose with the exception of the Humber River sample which was a dip sample from approximately 15 metres off the bank.

The metals samples were dropped off at the MOEE office on Resources Road in Rexdale.

**SEDIMENT SAMPLING, OSHAWA HARBOUR**

FEDERAL PROGRAMS DIVISION, EPB, OTTAWA, DR. P. MUDROCH  
RSB STUDY 12631, S.B. SMITH

Technical Operations supported this project, led by Dr. P. Mudroch (EC, EPB, FPD), on four occasions by assisting with the collection of bottom sediment and suspended sediment samples in the area of Oshawa Harbour. The samples were required to identify depositional areas and contaminant loading within the harbour and surrounding areas, including Oshawa and Montgomery creeks and the entrance to the harbour in Lake Ontario. This information can be related to the disposal of any dredged material derived from such operations in the harbour entrance channel.

The first trip took place in February. An attempt was made to collect two benthos cores using the Tech. Ops. corer from each of twenty sites. The sites were located throughout the harbour and entrance channel as well as in Oshawa and Montgomery creeks. In those areas where only coarse sand was found, mini PONAR grabs were taken to collect the sample. One core from each site was submitted to the Phillips-Xenon Analytical Laboratory for analysis of trace elements, PCB's and PAH's. The other core was delivered to CCIW for particle size, organic carbon and inorganic carbon analysis. The mini PONAR grabs were divided into 2 portions with one half going to the Phillips Lab and the other to CCIW for the same analysis as the cores sections.

Station positions were determined using a hand-held Eagle GPS equipped with the Lowrance DGPS Beacon Receiver using the NAD 27 datum.

In June, Oshawa and Montgomery creeks were sampled for suspended sediment. Oshawa Creek was sampled from the Simcoe Street bridge and Montgomery Creek from the Harbour Road. bridge. Water was pumped from mid-depth to a Westfalia separator and processed at the rate of six litres per minute at each site. The centrifuge was run for three hours at the Montgomery Creek site and for 3.5 hours at the Oshawa Creek site. A PONAR grab was done in Montgomery Creek for bottom sediments but because of the rocky hard bottom of Oshawa Creek at the sampling site no sediment could be collected. Montgomery Creek gave a good sample in three hours but Oshawa Creek had a very light sediment load. Oshawa Creek was sampled again in July with two centrifuges for 7 hours to yield enough sediment.

Bottom sediments were collected from the Oshawa City Marina using the seventeen-foot Zodiac in July. Five sites were sampled using a mini PONAR grab in the two boat slips at the north end of the marina. One sample was collected from the turning basin in the harbour.

In October, Technical Operations Section assisted with the collection of sediment samples from Oshawa Harbour and from an area surrounding the harbour entrance extending into Lake Ontario. The study area extended approximately 500 metres on either side of the entrance to Oshawa Harbour and 500 metres offshore into Lake Ontario. It included the entire harbour area as well as the Oshawa City Marina and upstream into both Oshawa Creek and Montgomery Creek. The sampling sites were laid out by the GeoSea Consulting Company using a 50-metre grid pattern. The sites were sampled either from the launch PETREL or from shore. At each site a position was recorded from the Magnavox DGPS navigator on the PETREL or a hand-held Garmin DGPS system from shore each using the NAD 27 chart datum. A depth sounding was made and a grab of bottom sediment was taken using a mini PONAR grab sampler. Some nearshore sites could not be reached by boat nor from shore so could not be sampled. Approximately 300 sites were visited. The description of the results of each grab was recorded whether it be rocks, zebra mussels, sand or fine sediment. Where sediments consisting of sand or fine sediment were found (about 200 samples), these were retained for particle size analysis. The samples were transported in the custody of Mr. Markovic to the laboratory at GeoSea Consulting Ltd. in Brentwood Bay, BC.

#### SEDIMENT CORE SITES (NAD 27) FEBRUARY

STATION NO.	LATITUDE N.	LONGITUDE W.	DESCRIPTION
1	43° 52' 06.30"	78° 49' 45.30"	2 cores
2	43° 52' 04.92"	78° 49' 42.48"	2 cores
3	43° 52' 02.46"	78° 49' 50.04"	4 mini PONAR's
4	43° 52' 03.78"	78° 49' 45.36"	4 mini PONAR's (coarse sand)
5	43° 52' 01.56"	78° 49' 35.76"	2 cores



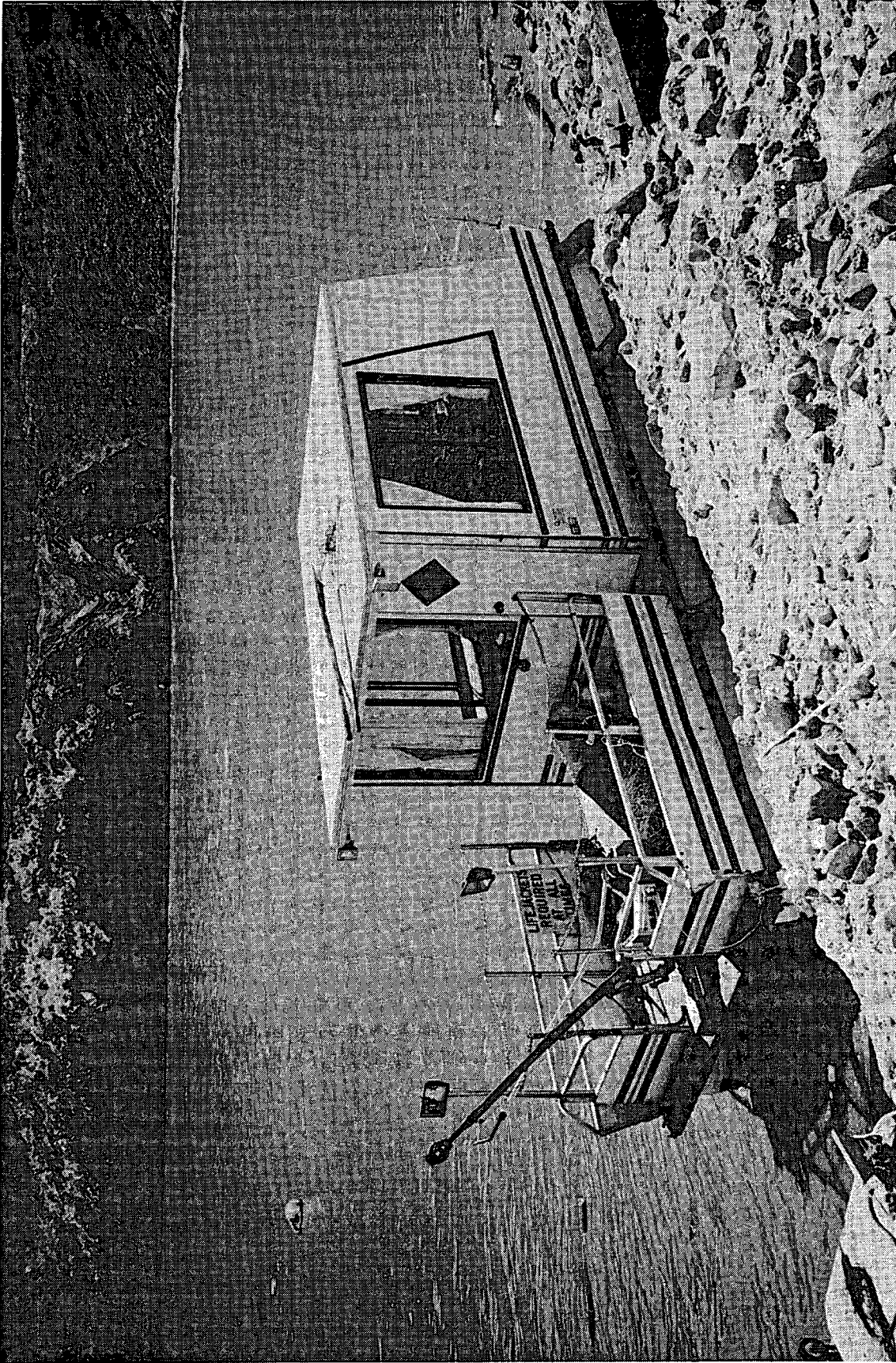
STATION NO.	LATITUDE N.	LONGITUDE W.	DESCRIPTION
6	43° 52' 02.52"	78° 49' 40.74"	2 cores
7	43° 51' 57.96"	78° 49' 35.76"	2 cores
8	43° 51' 59.64"	78° 49' 32.52"	2 cores (coarse sand)
9	not sampled		
10	43° 52' 10.14"	78° 49' 32.40"	5 mini PONAR's (sand)
11	43° 52' 07.74"	78° 49' 29.10"	2 mini PONAR's 2 cores (mud)
12	43° 52' 03.66"	78° 49' 26.52"	1 mini PONAR 2 cores (mud)
13	43° 51' 56.58"	78° 49' 19.98"	2 mini PONAR's (soft sand)
14	43° 51' 54.54"	78° 49' 23.34"	4 mini PONAR's (sand)
15	43° 51' 52.68"	78° 49' 16.80"	4 mini PONAR's (sand)
16	43° 52' 00.30"	78° 49' 30.66"	3 cores (1 for QC)
17	43° 51' 59.58"	78° 49' 37.50"	2 cores
18	43° 52' 01.26"	78° 49' 34.68"	3 cores (1 for QC)
19	43° 52' 03.12"	78° 49' 33.42"	2 cores
20	43° 52' 04.68"	78° 49' 31.98"	2 cores

**WIND-WAVE INTERACTION STUDY**

ROSENSTIEL SCHOOL OF MARINE & ATMOSPHERIC SCIENCE,  
UNIVERSITY OF MIAMI, DR. M.A. DONELAN  
RSB STUDY 12631, S.B. SMITH

A pilot experiment was carried out on the SWATH vessel, F.G. CREED October 12 - 22 at the Bedford Institute of Oceanography (BIO). Measurements were made first in the Bedford Basin—a large enclosed body of water next to BIO and later, in the open North Atlantic off the mouth of Halifax Harbour. Participants in the experiment were from BIO, the Rosenstiel School of Marine & Atmospheric Science, University of Miami (RSMAS/UM), CCIW, the Wood's Hole Oceanographic Institution (WHOI) and the Royal Military College (RMC).

The measurements from the CREED were of the air-sea interaction associated with growing wind waves. Mounted on the CREED were air turbulence sensors (sonic, propeller and cup anemometers and fast-response temperature sensors) and sensors designed to measure the energy and momentum fluxes to the wind waves (laser wave height gauges, Elliott static air pressure fluctuation sensors, pitot air speed sensors, and x-wire hot-film turbulence anemometers).



**MONTANA RESOURCES BOAT IN THE BERKELEY PIT**

TOS support involved the setup of the following equipment on two structures: a bow mast for the air turbulence sensors that could be folded down for access and repair, and a boom extending at right angles to the ship's starboard side at the bow which could be hydraulically retracted during steaming.

The experiment was designed to test all the instruments in open-sea conditions to ensure they would function as designed during the Shoaling Waves Experiment (SHOWEX) at Duck, North Carolina in the fall and winter of 1999. It was a complete success! A data set was collected, both in Bedford Basin and at the harbour mouth in significant wave heights up to 2 m in 25 knot winds, demonstrating that the CREED would be a suitable platform for the experiments.

After all testing was completed, the equipment was removed from the CREED and either stored at BIO or returned to CCIW for storage until it is used again in the fall of 1999.

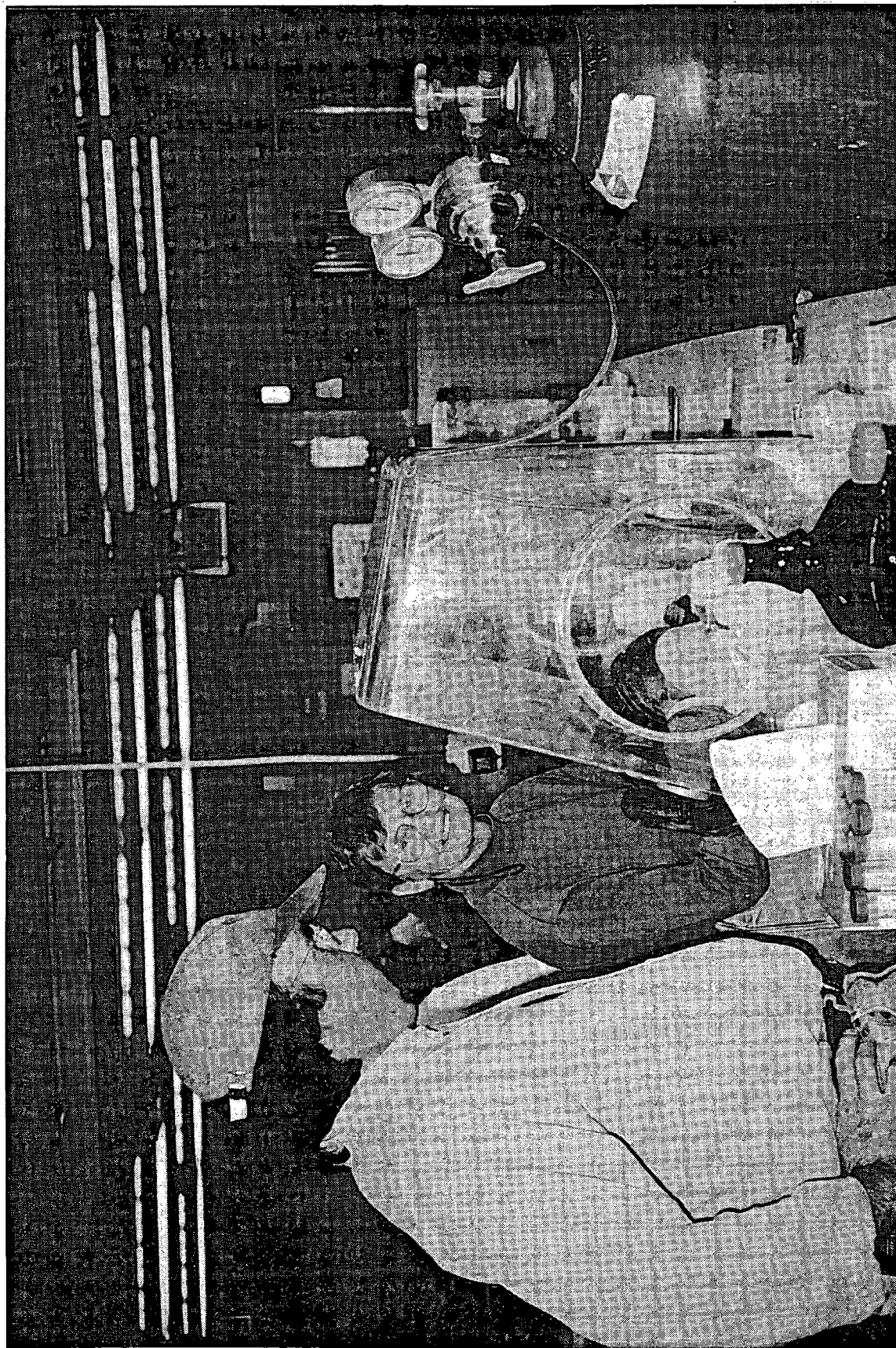
**MINE WASTE TECHNOLOGY PROGRAM, BUTTE, MONTANA**  
UNIVERSITY OF MONTANA, A. MUDROCH  
RSB STUDY 12631, S.B. SMITH

Ms. A. Mudroch, scientist emeritus, AERB and I travelled to Butte, Montana during the week of April 20 - 26 to demonstrate sampling equipment and collect samples from an open pit mine site that has been gradually filling with water since mining operations ceased. We departed Burlington on April 20<sup>th</sup>, flew to Calgary and drove to Shelby, Montana. The next day we drove to Butte. On arrival at Butte, a safety training course provided by Montana Resources was attended in order for us to access the Berkeley Pit. The pit is on the property of an active mine site and numerous pieces of very large earth-moving equipment were encountered when on site.

The Berkeley Pit is one of the largest open pit mines in the U.S. The dimensions of the pit are approximately 2 km by 1.5 km by 550 m deep; the water depth is 300 metres. It has a pH of 2.3, Copper is 2000 ppm and Zinc is 750 ppm so extra safety precautions must be followed when working on the pit waters.

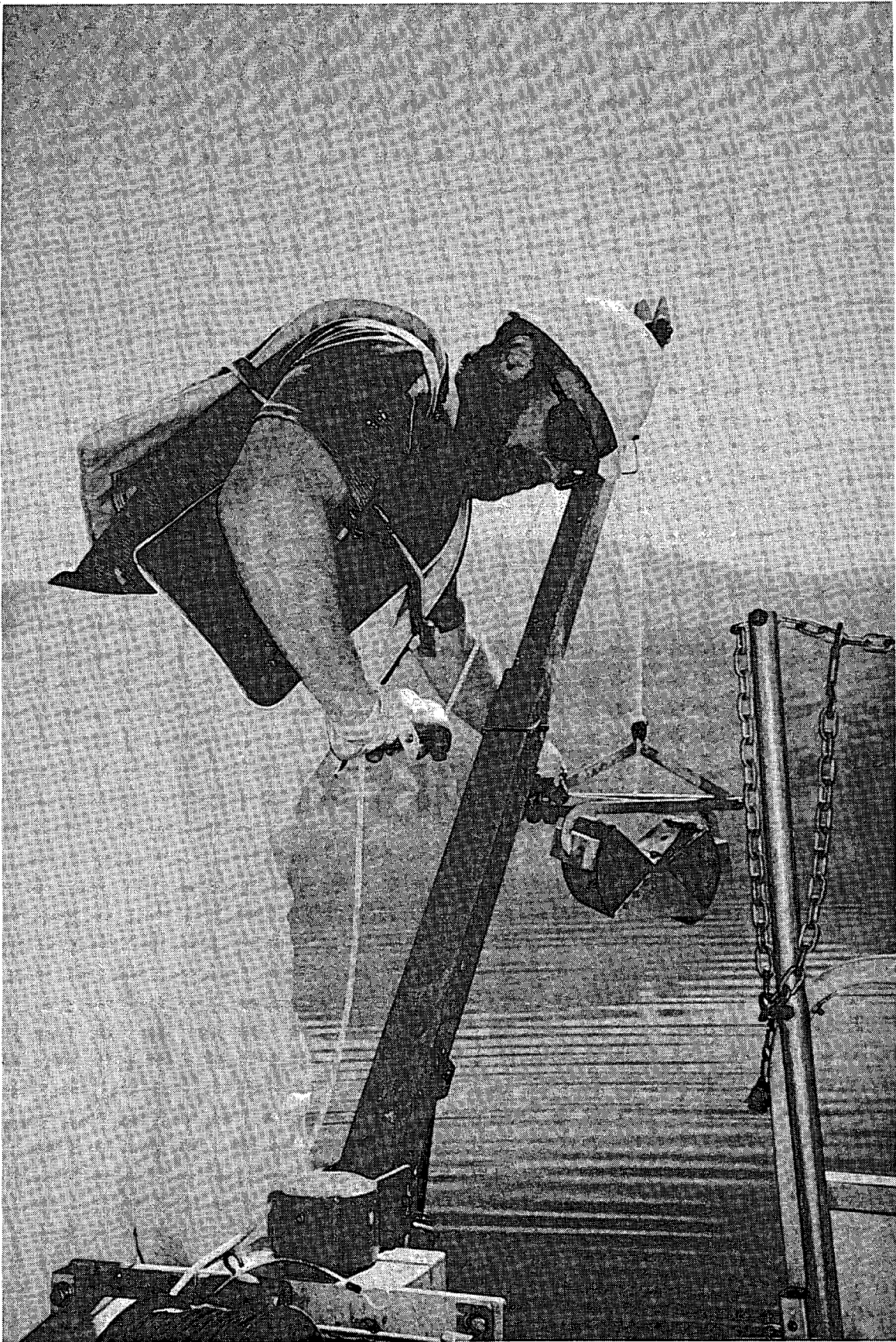
The next few days were spent outfitting the boat and collecting samples from three sites in the pit. The first site was in relatively shallow water (60 m). No sediment was located at the first site due to the bottom being covered with water only for the last 3 years. The deep area of the pit was sampled the following day. Bottom waters and surficial sediment as well as three cores ranging in length from 70 - 80 cm were collected. The depth of the deep area sampled was 275 metres. All water and surficial sediment grab sampling was done by hand lowering and retrieving the equipment. A portable hand winch was utilized to collect the cores due to the weight of the equipment and sediment. A third site was occupied to collect surficial sediments at a depth of 20 metres in a location that was forming a delta from the materials that are being washed from a tailings berm. All positioning was done by visual bearings as GPS could not receive the signals from satellites due to the shadowing affects of the pit walls.

All cores were sub-sectioned in 5 cm sections in a glove box with an Argon atmosphere to prevent metal oxidation. The cores were sectioned and the grab samples were stored at 4°C at



SUBDIVIDING CORES FROM THE BERKELEY PIT AT THE UNIVERSITY OF MONTANA LAB





**PONAR SAMPLING AT THE BERKELEY PIT NEAR BUTTE, MONTANA**

the university labs for further subdivision and experimentation at a later date. All the samples collected were given to University of Montana personnel for several graduate programs to investigate what could be done to improve the water quality of the pit which is expected to overflow its banks within the next ten to fifteen years.

The university and the Bureau of Mines were very pleased with the technology transfer of equipment and methodologies utilized in sampling!

<b>WATER QUALITY SAMPLING STATIONS</b> GREAT LAKES SURVEILLANCE, S. L'ITALIAN RSB STUDY 12632, B.H. MOORE
---

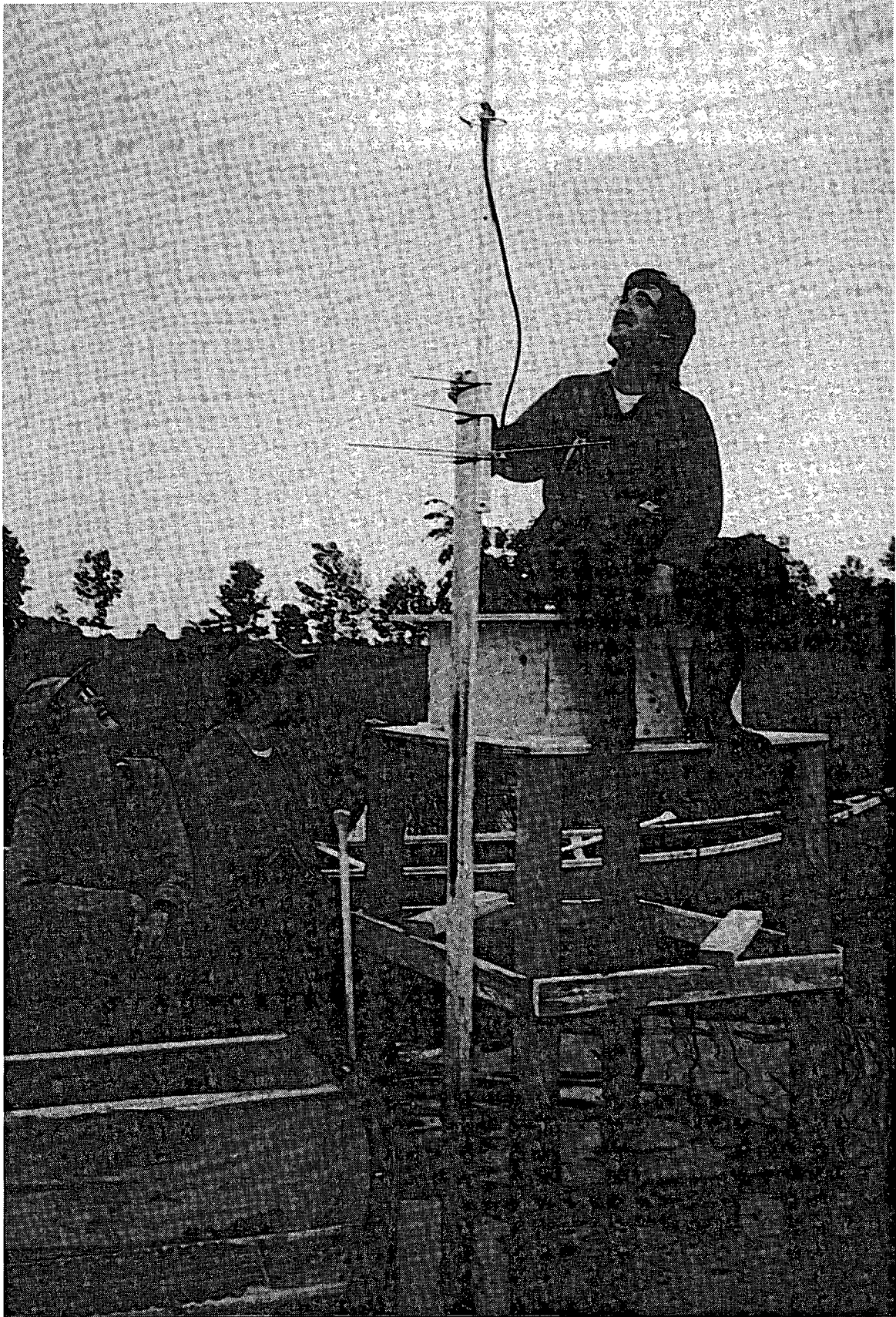
On July 6, a TOS dive team (Gray and Don) travelled to Niagara-on-the-Lake to inspect and clean the water intake mooring at the water quality sampling station.

The dive inspection revealed that the intake mooring which was installed in June, 1986 was in the original position and the anchor was buried 2 ft. into a sandy/clay bottom. All mooring hardware appeared to be in excellent condition and the tension exerted by the subsurface float was good. The hose bundle was fastened to the 1/4" stainless steel cable approximately 10 ft. above the bottom. The hose bundle was completely buried back to the town intake pipe. The intake wands were covered with a thin layer of cladophora and zebra mussel coverage was moderate. Zebra mussels were observed to be inside the intake wands.

The cladophora and zebra mussels were cleaned from the wands and the intake frame. The zebra mussels inside the wands could not be reached without a special tube cleaning brush. Pump flows to the centrifuge were still adequate so the intake wands were left in place. If there is a noticeable reduction in water flow through the intake pipe, divers will return to change the wands.

On July 7, a TOS dive team (Gray and Don) travelled to Ft. Erie to perform an underwater inspection of the water intake at the water quality sampling station in the Niagara River. The intake frame which was installed in June, 1986 is bolted to the rock bottom. The intake frame was measured to be 24 metres off the south corner of the old customs dock. The intake was found in excellent condition and there was no damage to the hoses or the wands. There was a small number of zebra mussels on the frame and very little on the wands. The entire frame and intake wands were cleaned. Divers noticed the current was much stronger than usual.

On October 5, TOS divers (Breedon and Gray) travelled to Niagara-on-the-Lake to meet with B. Harrison (Ontario Region). Mr. Harrison had reported sand in the inshore filter and all lines plugged, thus the need for an inspection and/or intake replacement. An inspection and video dive were undertaken. The (3) intake lines were found intact but buried in the sand bottom close to the former mooring location. What remained of the original mooring included the buried train wheel and a sheathed 5 m up-line terminating in a soft eye. It appeared the subsurface float, pump frame and wands had been struck by something large enough to sever the mooring wire. With the use of compressed air, divers were able to purge all 3 intake lines and determine that one pump needed replacement.



**INSTALLING A BIRD CALL LISTENING STATION AT BATH MARSH**



The following morning divers removed the old line and replaced it with a new (~10 ft) sheathed ground line. A wire loop was also spliced in close to the bottom to facilitate work on the mooring. After considerable difficulty with come-alongs, the subsurface float was eventually secured at a depth of 25 feet, approximately 10 feet off the bottom, thereby lowering the subsurface float 5 feet deeper than the previous installation. New intake wands were installed and secured to the up-line at a depth of 30 feet or 5 feet off the bottom. They were secured at the same depth and as close as possible onto Teflon lined Tridon clamps.

On September 28<sup>th</sup> TOS divers (Gilroy and Gray) drove to Wolfe Island and met with Mr. B. Harrison. The dive team carried out a standard intake inspection, cleaning and video dive. The four intake moorings were inspected and intake wands cleaned. Substantial zebra mussel coverage on all surfaces required comprehensive cleaning. The upstream (unused) mooring should probably be removed at a convenient date. The pump table was found overturned at the base of the slope. The table was lifted and leveled, cleaned and inspected for damage. The status of the pumps follows:

- pump #1 - operational
- pump #2 - exhaust fitting (to shore) broken and male fitting missing, pump status unknown
- pump #3 - exhaust fitting (to shore) not attached, pump status unknown

The video provides a more detailed record of pump and intake orientation and condition. Intake lines and conduit inshore from the pump frame appear undamaged and well buried. Lines from the pump frame out to the moorings are only marginally buried and for most of their travel can be followed by a trail of encrusted zebra mussels. The support cable to the upstream intake is looped up off the bottom at the mooring end of the installation. Future work will include replacement of pump and fittings at the pump frame.

**CONSERVATION STRATEGIES DIVISION, ECB, OR**  
**DR. C. WESELOH**  
**RSB STUDY 12632, B.H. MOORE**

Technical Operations Section continued to support the Conservation Strategies Division, ECB, OR (CWS) field program on the Great Lakes and connecting waterways. The purpose of this program was to determine or aid in the determination of the biological effects of toxic chemicals in Herring Gulls, Cormorants and Terns. The research involves eggs and chicks with a relatively short timespan between the nesting and fledging of the chicks. This, combined with the vast study area, keeps field personnel very busy. Depending on weather conditions, colonial birds begin to nest in late April and the chicks have normally abandoned the nesting area by early to mid-July. During this time, many colonies covering all of the Great Lakes and the Kawartha area were studied. Most colonies required several visits during the nest building, egg laying and chick rearing process.

Two field parties were normally required to carry out the work, each consisting of two or more full-time staff with the help of students and volunteers. This year, more intensive Caspian and Common Tern census were completed on Lake Huron, Georgian Bay and the North Channel. As in past years, Herring Gull monitoring and egg collection were completed to add to the



existing database of contaminant levels and to determine spatial and temporal trends of these birds. In addition, adult Herring Gulls were banded on Strachen Island near Cornwall for future monitoring programs.

The two field parties—often afield at the same time, utilized either the CCGC THUNDERBIRD or the CCGC McKEE #2. Work completed in shallow water or marsh conditions required the use of canoes. Gulls, Caspian and Common Terns usually nest on off-shore islands while Black Terns nest in marshes and swamps on floating vegetation.

<b>VEHICLE SUMMARY</b> COMMON-USER SUPPORT RSB STUDY 12633, M.R. MAWHINNEY
--

This field season was extremely busy. There was minimal downtime on the vehicles. The size of the fleet was decreased again due to Departmental budget restraints. The effects of these restraints were felt throughout the year when scheduling vehicles. Scheduling required several days to several weeks in advance, to ensure specialized vehicles were available for use during the desired period. Vehicle support was utilized for several different functions covering an extensive geographical range, consisting of transportation of various types of samples, equipment and personnel to common and remote field sites and for ship board operations. A combined total of 528,127 kilometres were travelled by the fleet this year. This field season also saw the replacement of some of the heavier off-road and towing vehicles due to harsh off-road four-wheel drive conditions as well as heavy long distance towing.

Since the introduction of the Alternate Fuels Act into the federal government, NWRI has set the standard for the remainder of Environment Canada, having the most converted vehicles within the shortest timeframe.

A.R.I. Canada "Automotive Rentals Incorporated" continues to handle credit cards which include fuel and repairs for the vehicle fleet. ARI Canada is responsible for upkeep and maintenance of all vehicle records which depends on monthly input from RSB staff. This company has greatly reduced the amount of time and effort spent on paperwork for each vehicle in the fleet. Records of mileage, fuel consumption, incidentals, repair costs, etc., are still kept internally by the Technical Operations Section.

The extensive geographical areas covered this field season ranged from Halifax, Nova Scotia; Prince Edward Island; Quebec and Northern Ontario to Edmonton, Banff and Jasper, Alberta. Some U.S. locations included Atlanta, Georgia; Niagara Falls, New York; Ann Arbor and Grand Haven, Michigan and Wood's Hole, Massachusetts.

<b>DIVING OPERATIONS</b> RSB STUDY 12634, F.H. DON
---

The Diving Operations Unit of Technical Operations Section, 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 Burlington. A total of 590.5 accident free hours were logged in support of scientific projects for: NWRI; DOE, OR, EHD and RPD; DFO, BINST, CCG and GLLFAS.

Four hours were logged on MURV—the remotely operated mini-rover underwater camera system. MURV is used for deep-water and long-duration video recording. Projects included wreck mapping, sonar surveys, documentation of geological formations and live educational documentaries. The Dive Shop has the capability to edit and copy all raw footage for scientific purposes into any desired format.

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 Chairman of the Contaminated Environment Working Group. Mr. Don is Chairman of the Federal Interdepartmental Committee for Diving Safety. The annual meeting of the Department of Environment Diving Safety Committee was held in April in Toronto, Ontario.

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 of sub-sea operations.

Projects supported included:

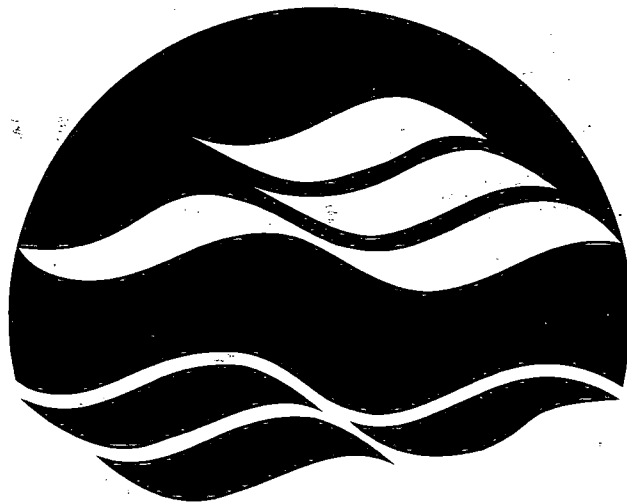
STUDY			STUDY TITLE
12214	Zeman -	AERB	Hamilton harbour Sandcap
12217	Rosa -	AERB	Hamilton Harbour, Rouyn-Noranda
12221	Murphy -	AERB	Manitoba and Alberta
12225	Rukavina -	AERB	Hamilton Harbour, Cornwall and Sarnia
12241	Hecky -	AERB	Lake Erie
12243	Skafel -	AERB	WAVES Tower, Hamilton Harbour/ L. Ont.
12247	Coakley -	AERB	Lake Ontario, Lake Erie
12465	Smith -	AEPB	Mussels, L. Ont. Region
12631	Outside Agencies:		DFO, GLLFAS, Fitzsimons, Fish Habitat Studies
			DFO, GLLFAS, Cairns, RBG Carp Barrier
			DFO, CCG, Hull inspections/repairs
			DOE, OR, RPD, Biberhofer, Cornwall
12632	Great Lakes Surveillance		WQ Stations, Ft. Erie, N-O-T-L, Wolfe Island

*Handwritten scribble*

## DATE DUE REMINDER

JUN 3 1999		
JUN 9 2000		

Please do not remove  
this date due slip.



---

**NATIONAL WATER  
RESEARCH INSTITUTE**

---

**INSTITUT NATIONAL DE  
RECHERCHE SUR LES EAUX**

---

**National Water Research Institute  
Environment Canada  
Canada Centre for Inland Waters  
P.O. Box 5050  
867 Lakeshore Road  
Burlington, Ontario  
Canada L7R 4A6**

**Institut national de recherche sur les eaux  
Environnement Canada  
Centre canadien des eaux intérieures  
Case postale 5050  
867, chemin Lakeshore  
Burlington; (Ontario)  
Canada L7R 4A6**

**National Hydrology Research Centre  
11 Innovation Boulevard  
Saskatoon, Saskatchewan  
Canada S7N 3H5**

**Centre national de recherche en hydrologie  
11, boulevard Innovation  
Saskatoon; (Saskatchewan)  
Canada S7N 3H5**



**Environment  
Canada**

**Environnement  
Canada**

**Canada**