NWRI
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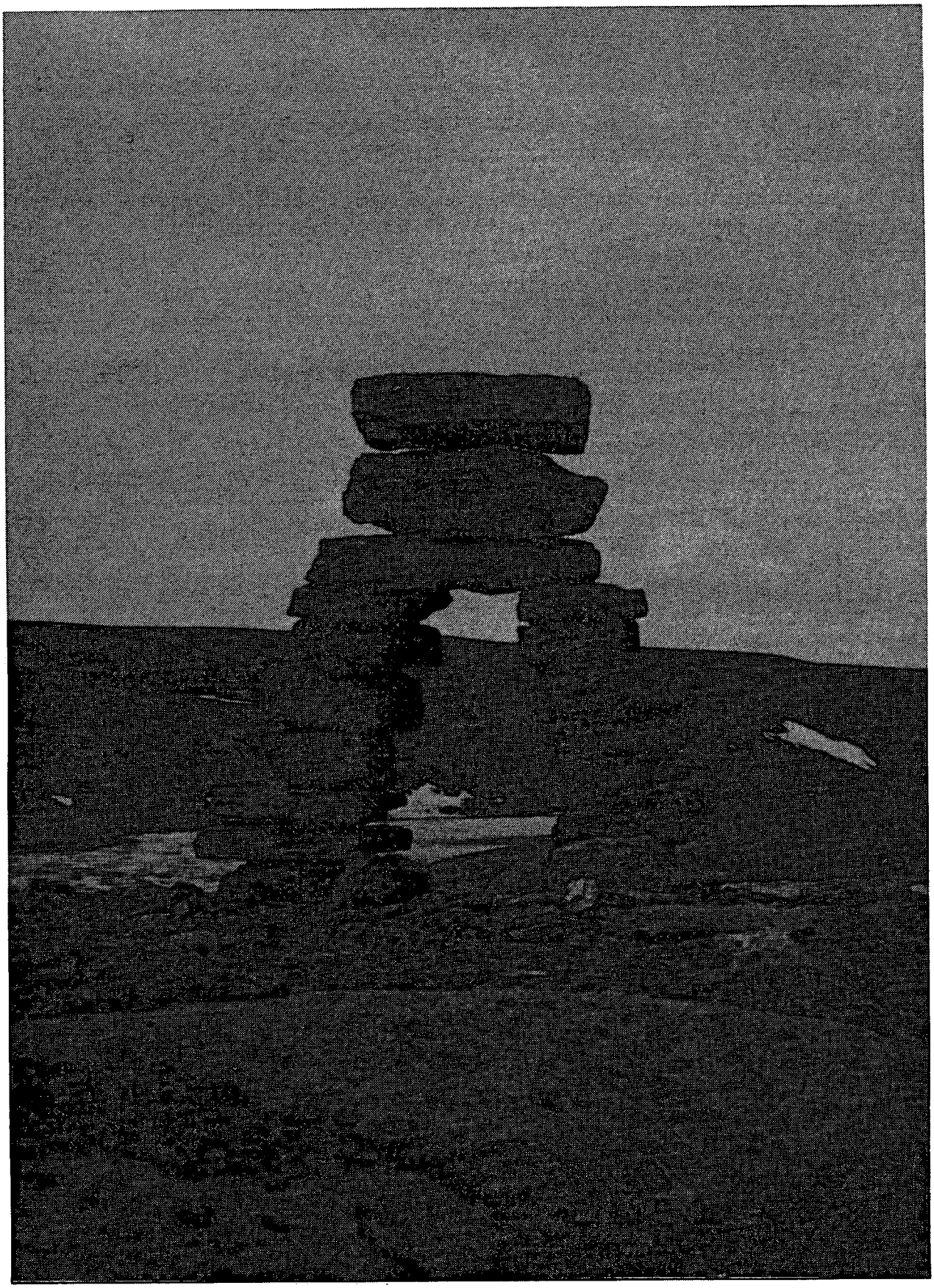
ACTIVITY SUMMARY
1994

NATIONAL WATER RESEARCH INSTITUTE

INSTITUT NATIONAL de RECHERCHE sur les EAUX

1994 ANNUAL ACTIVITY SUMMARY
TECHNICAL OPERATIONS SECTION
RESEARCH SUPPORT BRANCH
NATIONAL WATER RESEARCH INSTITUTE



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INTRODUCTION

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

The technical staff of this section is involved in shipboard programs which are carried out from major ships on the Great Lakes and St. Lawrence River and in shore-based field projects, which involve them in field situations from coast to coast and into the Arctic and United States. 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 group.

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

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

This report is intended as an overview of the field activities of this section during the 1994 field season.

STAFF LIST

RESEARCH SUPPORT BRANCH

Director	J.D. Smith
Operations Secretary	S.R. Mitchell
Administrative Officer	J. McAvella
Administrative Clerk	M.T. Solvason

TECHNICAL OPERATIONS SECTION

Head P.M. Healey	Amituk Lake, N.W.T.; Nova Scotia; Turkey Lakes Watershed

OPERATIONS OFFICERS

M.R. Mawhinney	OIC Field - Amituk Lake, N.W.T.; Fraser River, B.C.; Moosonee, Ontario; Ignace, Ontario
F.H. Don	OIC Diving - Cornwall, Ontario; Queen Charlotte Islands, B.C.; Tobermory, Ontario
S.B. Smith	OIC Ships/Field - Athabasca River, Alberta; Long Point, Lake Erie
B.H. Moore	OIC Ships - Fraser River, B.C.; Athabasca River, Alberta

SENIOR MARINE TECHNOLOGISTS

L.E. Benner	CWS; CSS LIMNOS; Cornwall, Ontario; Groundwater, Ontario; OIC RV HYDRA
P.R. Youakim	CSS LIMNOS
E.H. Walker	CSS LIMNOS; Athabasca River, Alberta; New Brunswick
G.G. LaHaie	Turkey Lakes Watershed
Y. Desjardins	New Brunswick
J.A. Kraft	OIC CSS LOUIS M. LAUZIER; Amituk Lake, N.W.T.; Fraser River, B.C.
K.J. Hill	Diving, Hamilton Harbour; Cornwall, Ontario; CSS LIMNOS
R.J. Hess	OIC CSS LOUIS M. LAUZIER; TLW Run-off; Great Lakes Basin
B.L. Gray	Diving, Hamilton Harbour; the Arctic

MARINE TECHNOLOGISTS

R.D. Neureuther	CSS LIMNOS; Wheatley, Ontario; Prince Albert, B.C.
M.F. Dahl	Diving, CSS LIMNOS
C.H. Talbot	Groundwater, Ontario; New Brunswick; Point Pelee

T.G.D. Breedon	CSS LIMNOS; Cornwall, Ontario; New Brunswick; Diving
J.E. Milne	Hamilton Harbour; Nova Scotia; New Brunswick

RIGGING UNIT

C.J. Lomas	Head, Rigging Unit, WAVES Tower; Ayr, Ontario
T.C. Gilliss	Vehicle Maintenance; Timmins, Ontario; Michigan, U.S.A.

NWRI FIELD STORES

Y. Desjardins

STUDENTS

D.A.D. Gilroy	CSS LIMNOS; Athabasca River, Alberta
M. de Groot	CSS LIMNOS
M. Stone	CSS LIMNOS; Turkey Lakes Watershed
D.J. Welch	CSS LIMNOS; Hamilton Harbour; Turkey Lakes Watershed

SHIPBOARD PROGRAMS

CSS LIMNOS
1994

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN							1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	31	1	2	3	4	5
FEB	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	1	2	3	4	5
MAR	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
APR	3	4	5	6	7	8	9
	10 CCIW	11 LAKE	12 ONTARIO	13 MOORINGS	14 LAKE ONTARIO	15 CCIW	16 CCIW
	17 CCIW	18 LAKE ONTARIO	19 BIOINDEX	20 LAKE ONTARIO	21 CCIW	22 CCIW	23 CCIW
	24 CCIW	25 LAKE ERIE	26 SURVEILLANCE	27 LAKE	28 ERIE	29 SURVEILLANCE	30 LAKE ERIE
MAY	1 SARNIA	2 LAKE	3 HURON	4 SURVEILLANCE	5 GEORGIAN BAY	6 SURVEILLANCE	7 LAKE HURON SURVEILLANCE
	8 LAKE HURON	9 LAKE ERIE BENTHIC	10 COMMUNITY STRUCTURE	11 LAKE ERIE	12 PT. COLBORNE	13 PT. COLBORNE	14 PT. COLBORNE
	15 PT. COLBORNE	16 LAKE	17 ERIE	18 TROPHIC	19 TRANSFER	20 LAKE ERIE	21 TROPHIC
	22 TRANSFER	23 LAKE ERIE	24 TROPHIC	25 TRANSFER	26 LAKE	27 ERIE	28 PT. COLBORNE
	29 PT. COLBORNE	30 LAKE ERIE	31 BENTHIC	1 COMMUNITY	2 STRUCTURE	3 LAKE ERIE	4 PT. COLBORNE
JUN	5 PT. COLBORNE	6 LAKE ERIE	7 MOORINGS	8 LAKE ERIE	9 PT. COLBORNE	10 PT. COLBORNE	11 PT. COLBORNE
	12 PT. COLBORNE	13 LAKE ERIE	14 BENTHIC	15 COMMUNITY	16 STRUCTURE	17 LAKE ERIE	18 PT. COLBORNE
	19 PT. COLBORNE	20 LAKE ERIE	21 BENTHIC COMMUNITY	22 STRUCTURE METAL CYCLE	23 LAKE ERIE	24 CCIW	25 CCIW
	26 CCIW	27 SCHEDULED	28 SELF	29 MAINTENANCE	30 SCHEDULED	1 SELF	2 MAINTENANCE
JUL	3 CCIW	4 LAKE ERIE	5 WATER	6 QUALITY	7 AND SEDIMENTATION	8 LAKE ERIE	9 PT. COLBORNE
	10 PT. COLBORNE	11 LAKE ERIE	12 CONTAMINANT	13 TRANSFER	14 STUDY	15 LAKE ERIE	16 PT. COLBORNE
	17 PT. COLBORNE	18 LAKE ERIE	19 BENTHIC	20 COMMUNITY	21 STRUCTURE	22 LAKE ERIE	23 PT. COLBORNE
	24 PT. COLBORNE	25 LAKE ERIE	26 SURVEILLANCE	27 LAKE ERIE	28 SURVEILLANCE	29 LAKE ERIE	30 PT. COLBORNE
	31 PT. COLBORNE	1 PT. COLBORNE	2 LAKE ERIE	3 BENTHIC COMMUNITY	4 STRUCTURE	5 LAKE ERIE	6 PT. COLBORNE
AUG	7 PT. COLBORNE	8 LAKE ERIE	9 TROPHIC	10 TRANSFER	11 LAKE	12 ERIE	13 SARNIA
	14 SARNIA	15 LAKE	16 HURON	17 SURVEILLANCE	18 LAKE HURON	19 GEORGIAN BAY	20 SURVEILLANCE
	21 GEORGIAN BAY	22 SURVEILLANCE	23 LAKE HURON	24 LAKE ERIE MOORINGS	25 LAKE ERIE	26 PT. COLBORNE	27 PT. COLBORNE
	28 PT. COLBORNE	29 LAKE ERIE	30 BENTHIC COMMUNITY	31 STRUCTURE	1 LAKE	2 ERIE	3 PT. COLBORNE
SEP	4 PT. COLBORNE	5 PT. COLBORNE	6 LAKE ERIE	7 BENTHIC COMMUNITY	8 STRUCTURE LAKE ERIE	9 PT. COLBORNE	10 PT. COLBORNE
	11 PT. COLBORNE	12 LAKE	13 ERIE	14 TROPHIC	15 TRANSFER	16 LAKE	17 ERIE
	18 TROPHIC	19 TRANSFER	20 LAKE ERIE	21 TROPHIC	22 TRANSFER	23 LAKE ERIE	24 PT. COLBORNE
	25 PT. COLBORNE	26 LAKE ERIE	27 BENTHIC COMMUNITY	28 STRUCTURE AND MOORINGS	29 LAKE ERIE	30 PT. COLBORNE	1 PT. COLBORNE
OCT	2 PT. COLBORNE	3 LAKE ERIE	4 WATER QUALITY	5 AND SEDIMENTATION	6 LAKE	7 ERIE	8 PT. COLBORNE
	9 PT. COLBORNE	10 PT. COLBORNE	11 LAKE	12 ERIE	13 SURVEILLANCE	14 LAKE	15 ERIE
	16 CCIW	17 LAKE	18 ONTARIO	19 MOORINGS	20 LAKE ONTARIO	21 CCIW	22 CCIW
	23	24	25	26	27	28	29
	30	31	1	2	3	4	5
NOV	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	1	2	3
DEC	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
	18	19	20	21	22	23	24
	25	26	27	28	29	30	31

LAKE ONTARIO SEDIMENT TRAP MOORING/SUSPENDED SEDIMENT SAMPLING
AERB STUDY 12240, M.N. CHARLTON

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

There were two cruises to support this project during the field season--April 11 - 14 and October 17 - 20. Sediment trap moorings were established at stations 403, 463, 464 and 465. Sediment trap depths for both cruises at each station were:

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

MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
41	94-00S-41A	43° 42' 59"	78° 01' 12"
64	94-00S-01A	43° 31' 39"	76° 56' 59"
403	94-00A-65A	43° 36' 24"	78° 13' 55"
463	94-00A-10A	43° 52' 13"	78° 14' 41"
464	94-00A-11A	43° 46' 05"	78° 14' 48"
465	94-00A-12A	43° 39' 48"	78° 13' 58"
718	94-00T-70A	43° 33' 37"	76° 43' 04"
	94-00W-06A	43° 50' 00"	77° 21' 57"

Several additional tasks were performed during these cruises. These included the retrieval and launching of thermograph moorings for the United States Fish & Wildlife Service, the retrieval of a Wave Rider mooring for MEDS, Ottawa and the installation and retrieval of anchor buoys for the CSS LOUIS M. LAUZIER on Long Term Biological Index Monitoring cruises.

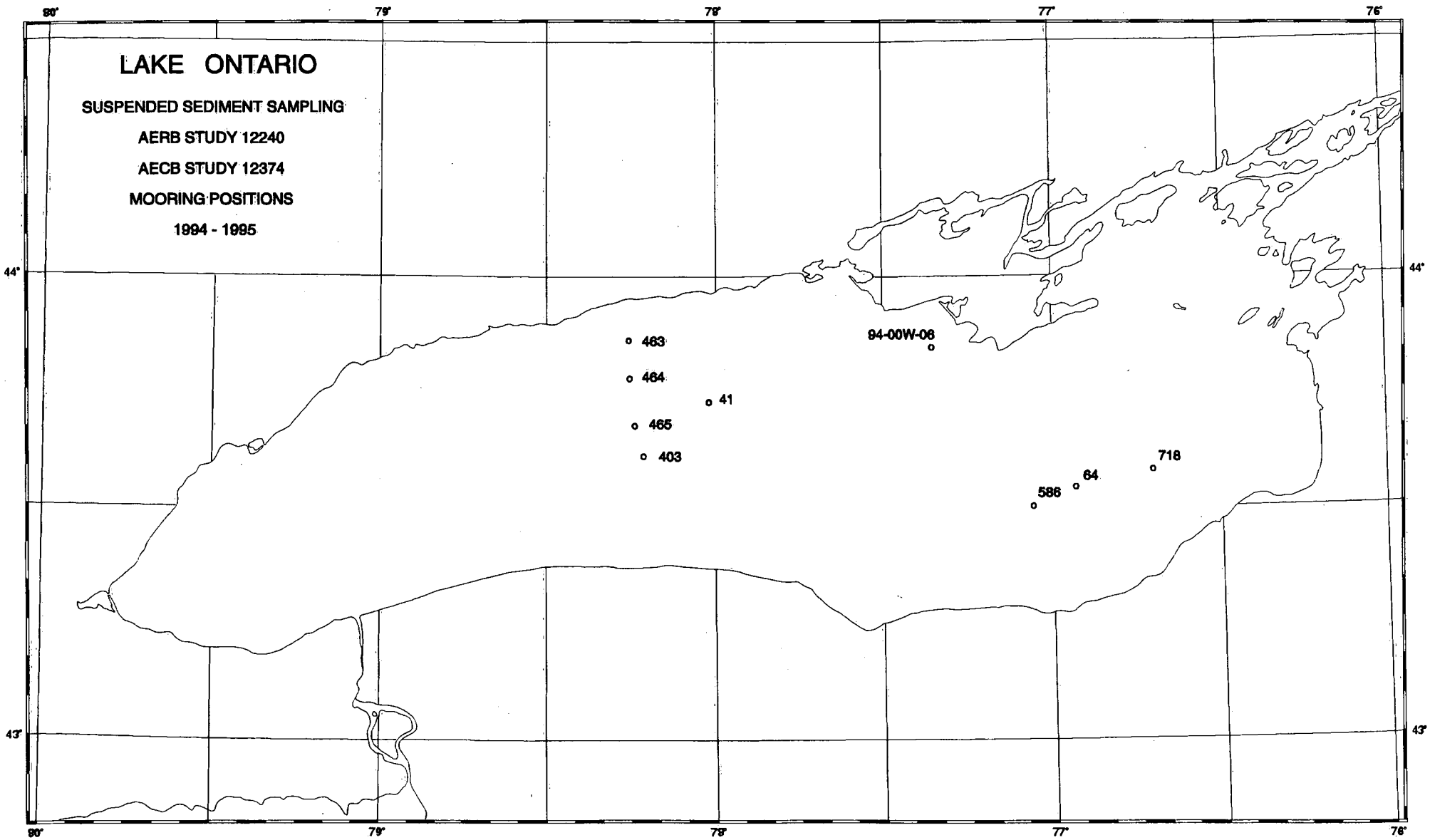
Samples were collected on the spring cruise in support of the Bioindex program from stations 41 and 81.

STATISTICS SUMMARY

CRUISE NO. _____
DATES FROM _____ TO _____
CRUISE TYPE Suspended Sediment Sampling

SHIP CSS LIMNOS
REGION LAKE ONTARIO
N.MI. STEAMED 693.8

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	19	Moorings Established, Sediment Trap	5
EBT/Transmissometer Casts	19	Moorings Retrieved, Sediment Trap	5
Rosette Casts		Moorings Established, Thermograph	5
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved, Thermograph	5
Secchi Disc Observations	5	Moorings Established, Meteorological	2
Transmissometer Casts		Moorings Retrieved, Meteorological	1
Zooplankton Hauls, 64µ		Moorings Established, Anchor	2
Zooplankton Hauls, 44µ		Moorings Retrieved, Anchor	2
Integrator 10 m		Moorings Retrieved, Wave Rider	1
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	13		
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-OR	
Water Samples Filtered ( )		Microbiology	


LAKE ONTARIO
SUSPENDED SEDIMENT SAMPLING
AERB STUDY 12240
AECB STUDY 12374
MOORING POSITIONS
1994 - 1995
80°
79°
78°
77°
76°
44°
43°
463
464
41
465
403
94-00W-06
718
64
586

LAKE ONTARIO METEOROLOGICAL AND TEMPERATURE MOORINGS
AECB STUDY 12374, W.M. SCHERTZER

The purpose of this study was to deploy meteorological and temperature moorings to give detailed vertical temperature measurements at the deep hole of Lake Ontario. To accomplish this, two meteorological and two temperature moorings were installed at station 586 during the cruise April 11 - 14. The meteorological buoys were retrieved on October 19. The temperature moorings were winter moorings installed in October of 1993, refurbished as U-shaped moorings in the spring of '94 and reinstalled in October '94 as winter moorings to be retrieved in the spring of '95.

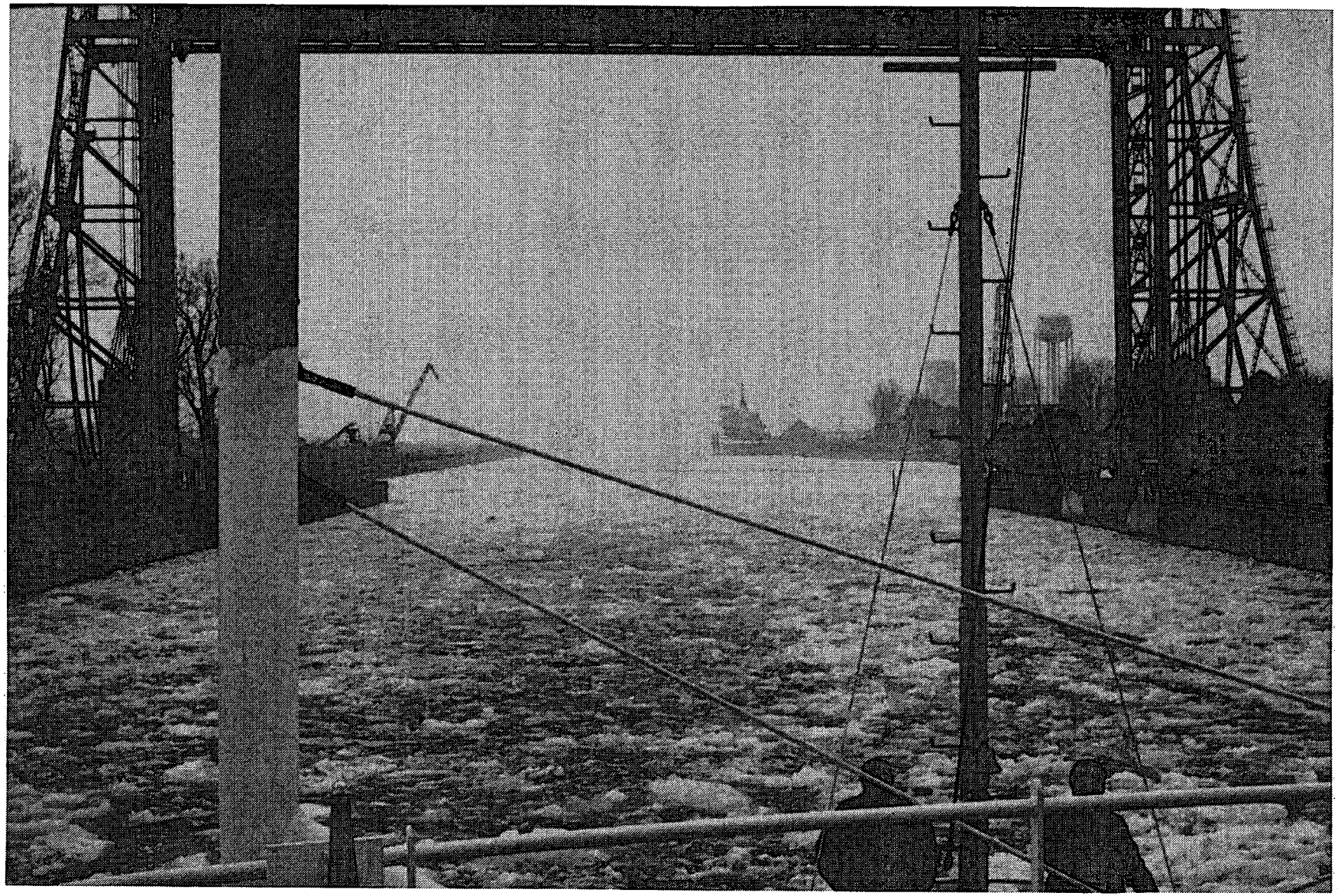
Both of the cruises utilized were piggybacked on M.N. Charlton's mooring cruises and all statistics were included on the sheets for those cruises.

MOORING POSITIONS

LAKE ONTARIO

1994-1995

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH M
586	94-00M-33A	43° 29' 05"	77° 04' 10"	MET (220)
	94-00M-34A	43° 29' 06"	77° 04' 09"	MET (220)
	94-00T-35A	43° 29' 06"	77° 03' 49"	T(4,6,8,10, 14,18,22,26, 35,50,150)
	94-00T-35B	43° 29' 18"	77° 03' 42"	T(10,16,26, 36,46,61, 101,181)
	94-00T-36A	43° 29' 19"	77° 03' 35"	T(12,16,20, 24,30,40, 100,221)
	94-00T-36B	43° 29' 19"	77° 03' 35"	T(12,16,20, 24,30,40, 100,221)
	94-00T-36C	43° 28' 57"	77° 04' 19"	T(12,21,31, 41,51,81, 141,218)



ENTERING LAKE ERIE AT PORT COLBORNE

OPEN LAKES SURVEILLANCE

LAKE ERIE

ENVIRONMENTAL CONSERVATION BRANCH, ONTARIO REGION, S.L'ITALIEN
RSB STUDY 12632, B.H.MOORE

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

Three cruises were conducted--April 25 - 29, July 25 - 29 and October 11 - 15 to support this program. All cruises were organized and completed by Technical Operations personnel for ECB-OR and were conducted from the CSS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C and GPS positioning systems and a variety of samplers and winches used for chemical and biological sampling.

The parameters sampled during 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, nitrite and nitrate, ammonia, reactive silicate, major ions, alkalinity, meteorological and Secchi disc observations.

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

Unstratified Conditions:	1 metre, 10 metres, 25 metres, bottom -10 metres and bottom -2 metres
Stratified Conditions:	1 metre, 1 metre above the knee of the thermocline, mid-thermocline, 1 metre below the thermocline, bottom -10 metres or mid-hypolimnion and bottom -2 metres

Some additional tasks performed during the cruises were: comparison of the SeaBird profiling system with existing procedures used onboard; vertical zooplankton and rotifer net hauls for Dr. O. Johannsson, GLLFAS; mini box cores; Shipek samples; phytoplankton samples and the collection of water samples for PCB's and CB's for the University of Windsor; chlorophyll samples for Mr. S. Millard, GLLFAS; the installation of a dissolved oxygen logger mooring for Dr. T. Reynoldson, AERB Study 12216 and the installation of a meteorologial buoy for Dr. F. Boyce, AECB Study 12375.

STATISTICS SUMMARY

CRUISE NO. _____
DATES FROM _____ TO _____
CRUISE TYPE Lower Lakes Surveillance

SHIP CSS LIMNOS
REGION LAKE ERIE
N.MI. STEAMED 2054.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	154	Moorings Established, DO Logger	3
EBT/Transmissometer Casts	154	Moorings Retrieved	
Rosette Casts	56	Moorings Established, Meteorological	1
Reversing Thermometer Obs. (No. of Therm)	38	Moorings Retrieved	
Secchi Disc Observations	68	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls, 64µ	23	Moorings Established	
Zooplankton Hauls,	1	Moorings Retrieved	
Integrator 10 m	69	Moorings Serviced, Meteorological	1
Integrator 20 m	88	Primary Productivity Moorings	
Phytoplankton Samples	13		
D.O. Profiles	52		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	336	Cores Taken, Mini-Box	8
Water Samples Collected (D.O.)	336	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	336	Cores Taken, Benthos	
Water Samples Collected (TP uf)	366	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)	80	Grab Samples Taken, PONAR	
Water Samples Collected ( )		Bulk Centrifuge Samples, 3000(	28
Water Samples Collected ( )			
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered (Chlorophyll a)	347		
Water Samples Filtered (POC/TPN)	243		
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)	386		
Water Samples Filtered (Nutrients)	386		
Water Samples Filtered (Major Ions)	386	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)	28	Manual Chemistry, Tech. Ops.	930
Water Samples Filtered ( )		Nutrients, EHD, ECB-OR	80
Water Samples Filtered ( )		Microbiology	

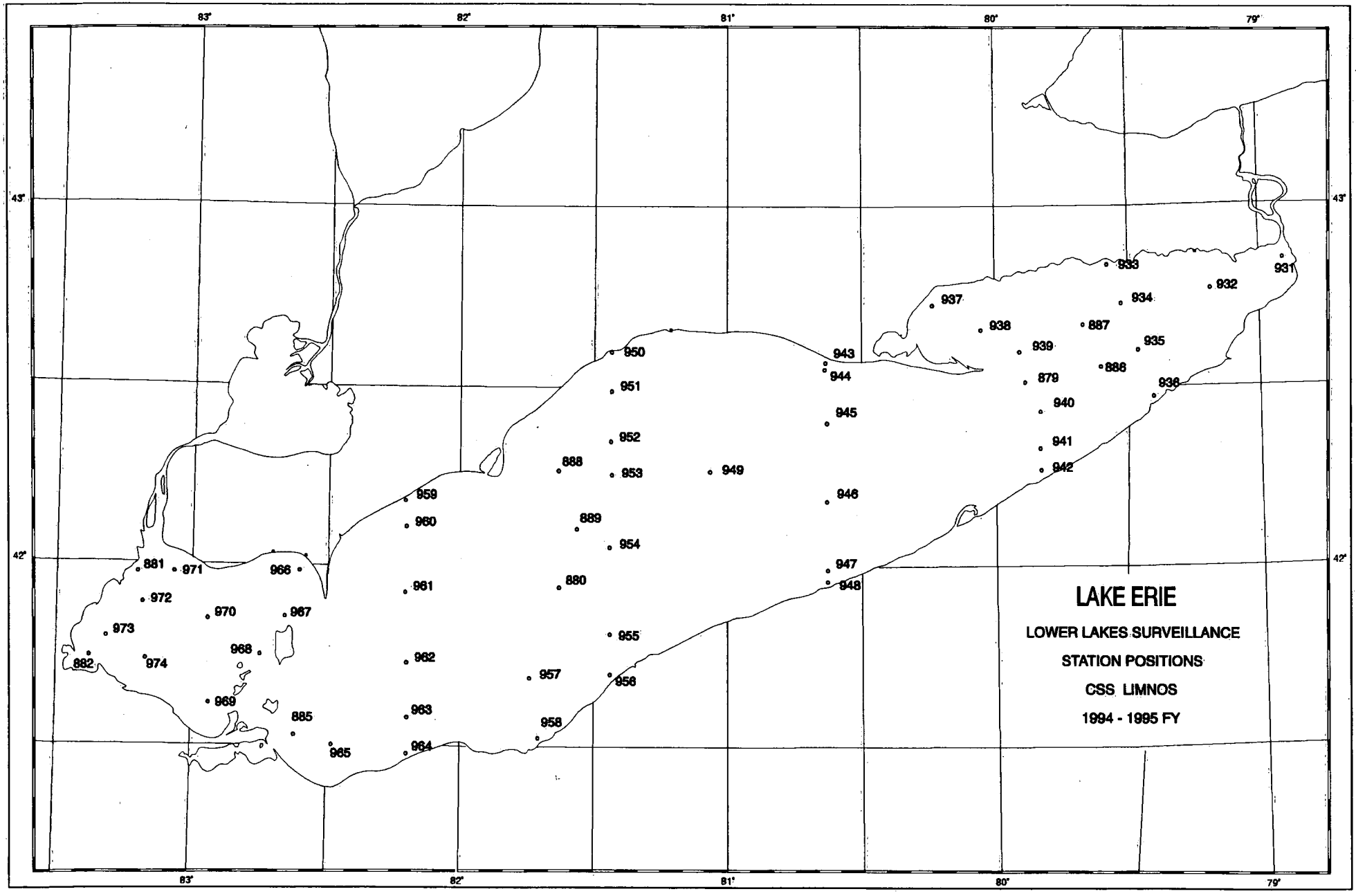
LAKE ERIE SURVEILLANCE

STATION POSITIONS

1994 - 1995

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° 48' 48"	79° 41' 30"
888	37	42° 06' 36"	81° 34' 30"
889	38	42° 16' 54"	81° 40' 18"
931	228	42° 51' 00"	78° 56' 30"
932		42° 47' 30"	79° 12' 30"
933	227	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"
949	221	42° 15' 00"	81° 06' 30"
950		42° 35' 18"	81° 26' 30"
951		42° 28' 30"	81° 26' 30"
952		42° 21' 30"	81° 26' 30"
953		42° 12' 30"	81° 26' 30"
954		42° 01' 30"	81° 26' 30"
955		41° 48' 00"	81° 26' 30"
956		41° 41' 30"	81° 26' 30"

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


83°
82°
81°
80°
79°
43°
42°
LAKE ERIE
LOWER LAKES SURVEILLANCE
STATION POSITIONS
CSS LIMNOS
1994 - 1995 FY
931
932
933
934
935
936
937
938
939
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941
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943
944
945
946
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LAKE HURON/GEORGIAN BAY
ENVIRONMENTAL CONSERVATION BRANCH, ONTARIO REGION, S. L'ITALIEN
RSB STUDY 12632, B.H. MOORE

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

Two cruises were conducted--May 2 - 8 and August 15 - 25 to support this program. Both cruises were organized and completed by Technical Operations personnel for ECB-OR and were conducted from the CSS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C positioning system and a variety of samplers and winches used for chemical and biological sampling.

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

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

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

Some additional tasks performed during the cruises included: the comparison of the SeaBird profiling system to existing onboard procedures; collection of micro bioloop; zooplankton and phytoplankton samples for Dr. M. Munawar of GLLFAS; collection of water samples for D. Dolan of the IJC in support of EMAP; the retrieval of current meter moorings for Dr. P. Hamblin, AERB Study 12243; the refurbishment of meteorologial buoys for Dr. F. Boyce, AECB Study 12375 and the collection of zooplankton and rotifer samples for Dr. O. Johannsson of GLLFAS.

STATISTICS SUMMARY

CRUISE NO. _____
DATES FROM _____ TO _____
CRUISE TYPE Upper Lakes Surveillance

SHIP CSS LIMNOS
REGION LAKE HURON
N.MI. STEAMED 1992.6

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	136	Moorings Established	
EBT/Transmissometer Casts	136	Moorings Retrieved, Current Meter/Trans.	3
Rosette Casts	68	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)	36	Moorings Retrieved	
Secchi Disc Observations	69	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls, 64µ	8	Moorings Established	
Zooplankton Hauls, 44µ		Moorings Retrieved	
Integrator 10 m	13	Moorings Serviced, Meteorological	2
Integrator 20 m	116	Primary Productivity Moorings	
Phytoplankton Samples	16		
D.O. Profiles	68		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	597	Cores Taken, Mini-Box	
Water Samples Collected (D.O.)	343	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	343	Cores Taken, Benthos	
Water Samples Collected (TP uf)	387	Grab Samples Taken, Shipek	16
Water Samples Collected (TKN)	97	Grab Samples Taken, PONAR	
Water Samples Collected (Micro Loop)	16	Bulk Centrifuge Samples	
Water Samples Collected ( )			
Water Samples Collected ( )		Observations, Weather	16
Water Samples Filtered (Chlorophyll a)	141		
Water Samples Filtered (POC/TPN)	153		
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)	387		
Water Samples Filtered (Nutrients)	387		
Water Samples Filtered (Major Ions)	331	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	929
Water Samples Filtered ( )		Nutrients, EHD, ECB-OR	485
Water Samples Filtered ( )		Microbiology	

STATISTICS SUMMARY

CRUISE NO. _____
DATES FROM _____ TO _____
CRUISE TYPE Upper Lakes Surveillance

SHIP CSS LIMNOS
REGION GEORGIAN BAY
N.MI. STEAMED 685.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	58	Moorings Established	
EBT/Transmissometer Casts	58	Moorings Retrieved	
Rosette Casts	28	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)	8	Moorings Retrieved	
Secchi Disc Observations	28	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls, 64µ	8	Moorings Established	
Zooplankton Hauls, 44µ		Moorings Retrieved	
Integrator 10 m		Moorings Serviced	
Integrator 20 m	58	Primary Productivity Moorings	
Phytoplankton Samples	14		
D.O. Profiles	28		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	636	Cores Taken, Mini-Box	
Water Samples Collected (D.O.)	177	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	177	Cores Taken, Benthos	
Water Samples Collected (TP uf)	198	Grab Samples Taken, Shipek	8
Water Samples Collected (TKN)	48	Grab Samples Taken, PONAR	
Water Samples Collected (Micro Loop)	14	Bulk Centrifuge Samples	
Water Samples Collected ( )			
Water Samples Collected ( )		Observations, Weather	5
Water Samples Filtered (Chlorophyll a)	74		
Water Samples Filtered (POC/TPN)	74		
Water Samples Filtered (Seston)			
Water Samples Filtered (TP f)	198		
Water Samples Filtered (Nutrients)	198		
Water Samples Filtered (Major Ions)	198	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	531
Water Samples Filtered ( )		Nutrients, EHD, ECB-OR	240
Water Samples Filtered ( )		Microbiology	

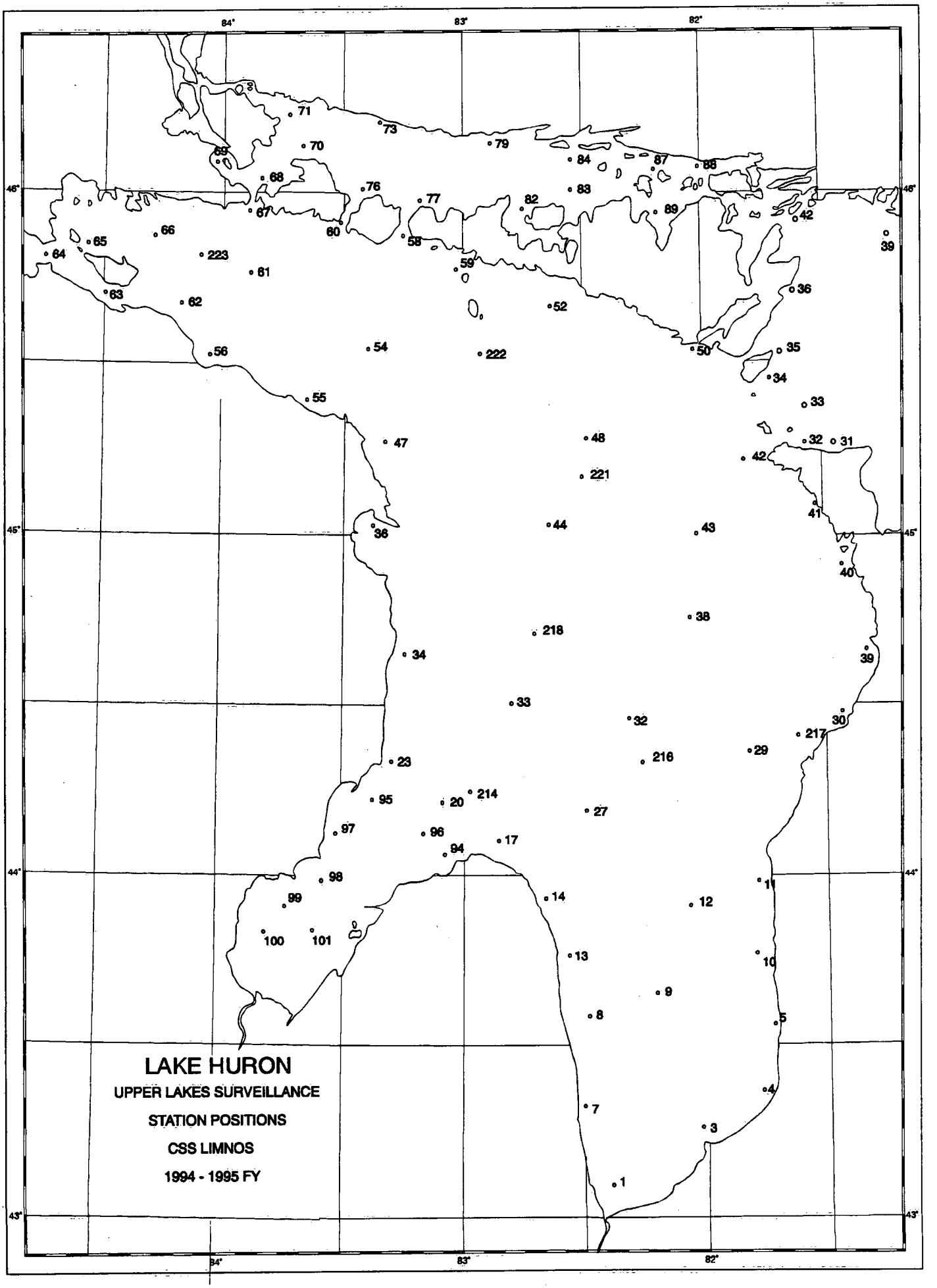
STATION POSITIONS

LAKE HURON

1994 - 1995

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	43° 05' 24"	82° 23' 30"
3	43° 15' 25"	82° 02' 18"
4	43° 19' 30"	81° 47' 18"
5	43° 32' 54"	81° 44' 42"
7	43° 20' 30"	82° 30' 24"
8	43° 34' 00"	82° 29' 06"
9	43° 38' 00"	82° 13' 00"
10	43° 45' 12"	81° 46' 54"
11	43° 57' 24"	81° 47' 12"
12	43° 53' 24"	82° 03' 24"
13	43° 45' 12"	82° 34' 06"
14	43° 56' 30"	82° 40' 00"
17	44° 06' 00"	82° 52' 00"
20	43° 13' 00"	83° 05' 00"
23	44° 20' 00"	83° 18' 00"
27	44° 11' 54"	82° 30' 12"
29	44° 22' 00"	81° 50' 00"
30	44° 28' 00"	81° 27' 12"
32	44° 27' 12"	82° 20' 30"
33	44° 30' 00"	82° 50' 00"
34	44° 38' 24"	83° 13' 54"
36	45° 02' 06"	83° 22' 42"
38	44° 44' 24"	82° 03' 26"
39	44° 39' 24"	81° 22' 42"
40	44° 53' 54"	81° 26' 12"
41	45° 05' 00"	81° 32' 12"
42	45° 13' 18"	81° 49' 12"
43	45° 00' 48"	82° 00' 30"
44	45° 01' 00"	82° 41' 06"
47	45° 15' 18"	83° 20' 48"
48	45° 16' 42"	82° 27' 06"
50	45° 32' 06"	82° 02' 42"
52	45° 39' 06"	82° 38' 54"
54	45° 31' 00"	83° 25' 00"
55	45° 23' 30"	83° 39' 06"

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


LAKE HURON
UPPER LAKES SURVEILLANCE
STATION POSITIONS
CSS LIMNOS
1994 - 1995 FY
84°
83°
82°
46°
45°
44°
43°

SAMPLING STATION POSITIONS

GEORGIAN BAY

1994-1995

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	44° 43' 03"	80° 51' 24"
3	44° 43' 30"	80° 37' 00"
4	44° 38' 45"	80° 10' 00"
5	44° 47' 48"	80° 14' 36"
6	44° 44' 12"	80° 26' 06"
8	44° 57' 10"	80° 08' 56"
9	44° 52' 18"	79° 58' 05"
11	44° 55' 15"	80° 36' 21"
12	44° 55' 12"	80° 52' 30"
15	45° 10' 00"	80° 17' 48"
16	45° 21' 13"	80° 29' 12"
17	45° 14' 42"	80° 52' 30"
19	45° 04' 00"	81° 15' 14"
21	45° 21' 54"	81° 11' 24"
24	45° 40' 44"	80° 50' 20"
26	45° 50' 00"	80° 54' 00"
27	45° 52' 00"	81° 00' 00"
29	45° 35' 00"	81° 05' 00"
31	45° 14' 18"	81° 26' 24"
33	45° 22' 13"	81° 35' 06"
35	45° 31' 39"	81° 40' 10"
36	45° 42' 30"	81° 37' 12"
39	45° 52' 24"	81° 15' 30"
42	45° 54' 46"	81° 35' 42"

EMAP SAMPLING STATIONS

LAKE HURON

1994 - 1995

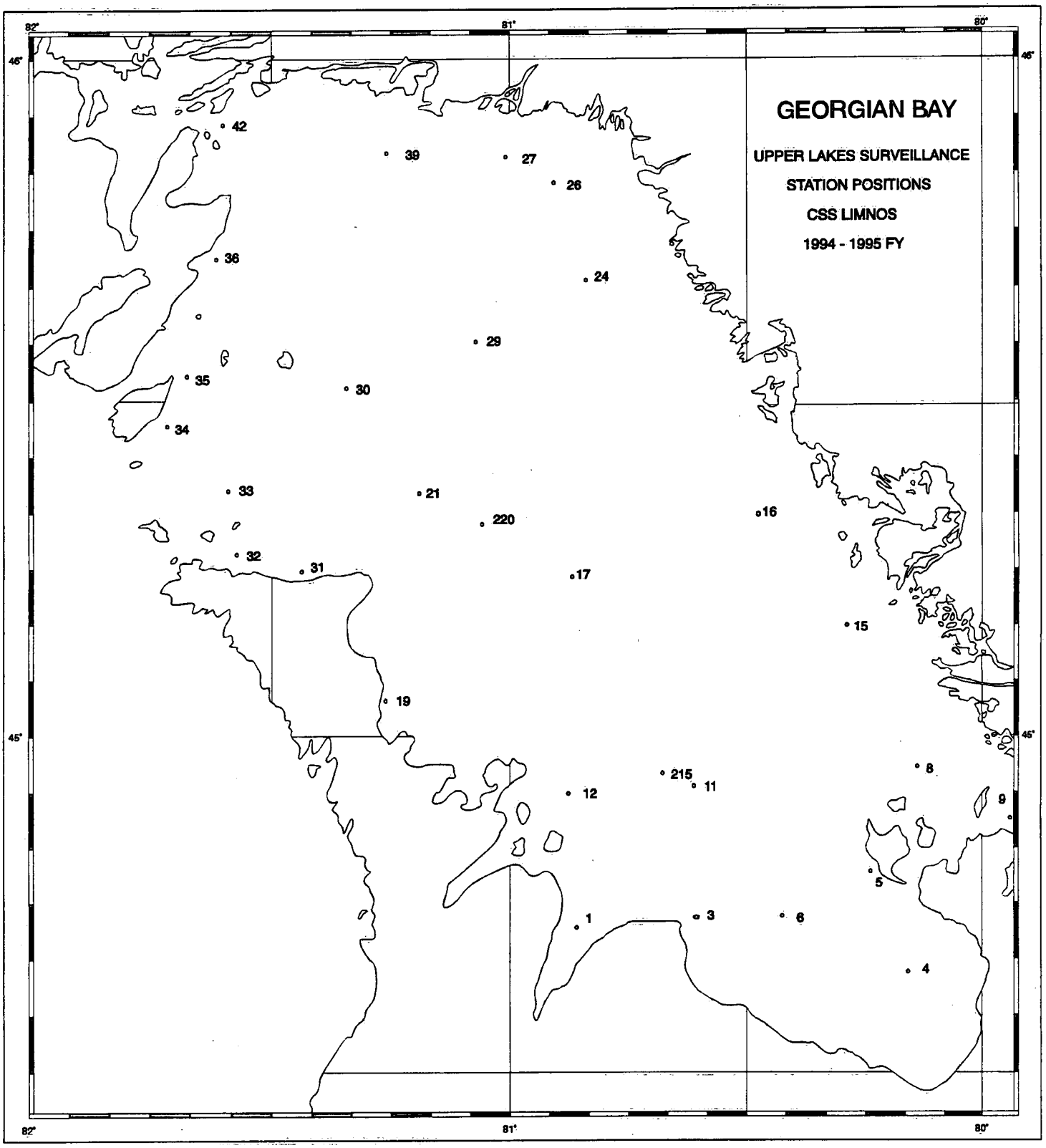
STATION NUMBER	LATITUDE N.	LONGITUDE W.
214	44° 14' 10"	82° 59' 10"
216	44° 19' 09"	82° 18' 22"
217	44° 23' 55"	81° 37' 26"
221	45° 09' 21"	82° 30' 14"
222	45° 31' 52"	82° 56' 57"
223	45° 49' 08"	84° 05' 53"

EMAP SAMPLING STATIONS

GEORGIAN BAY

1994 - 1995

STATION NUMBER	LATITUDE N.	LONGITUDE W.
215	44° 55' 44"	80° 41' 02"
220	45° 18' 36"	81° 06' 55"


GEORGIAN BAY
UPPER LAKES SURVEILLANCE
STATION POSITIONS
CSS LIMNOS
1994 - 1995 FY
82°
81°
80°
46°
45°
42
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26
36
24
29
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215
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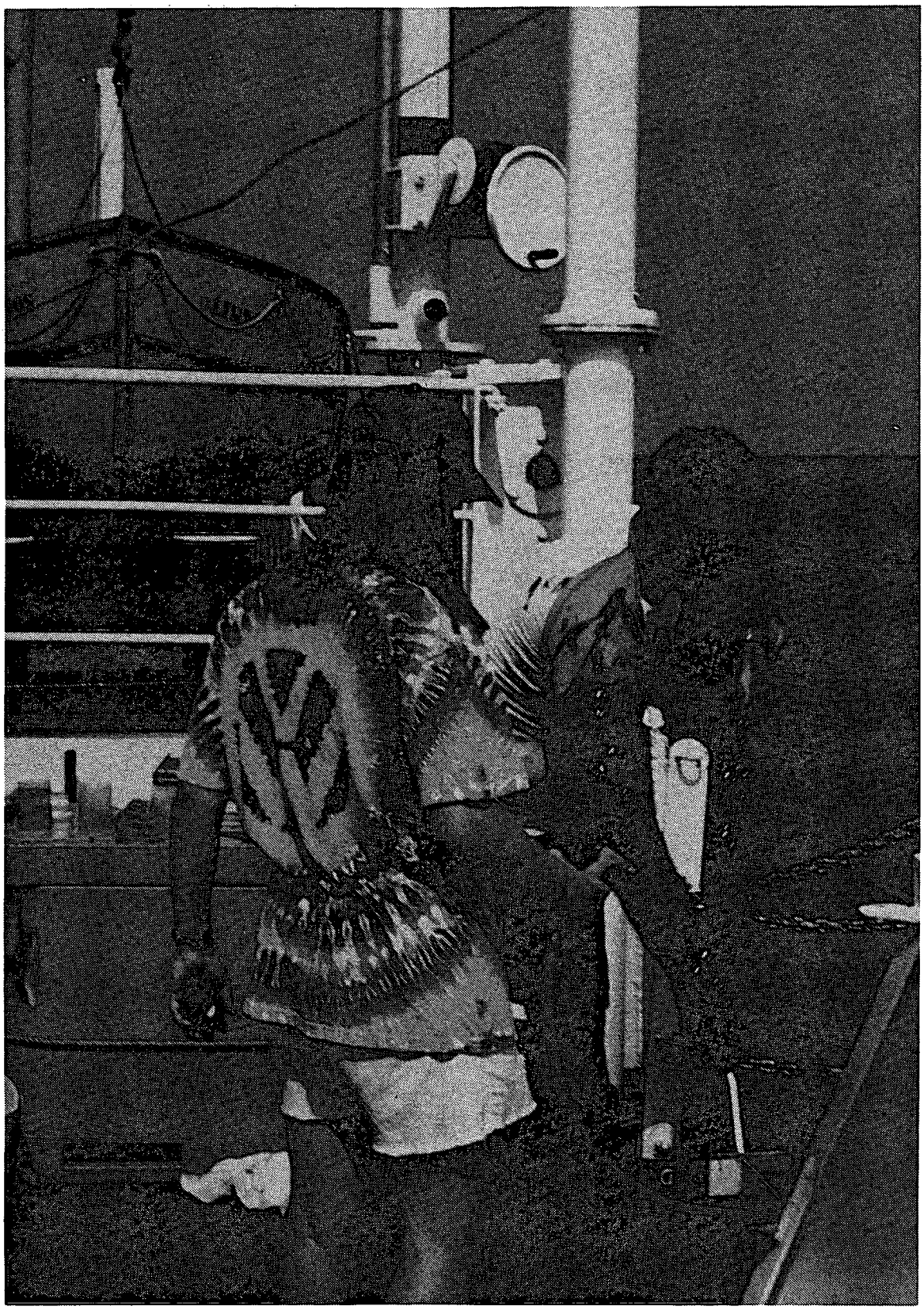
4



SUBSAMPLING THE MINI BOX CORE

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

Ten cruises were carried out onboard the CSS LIMNOS--April 25 - 30, May 9 - 11, May 30 - June 3, June 13 - 17, July 4 - 8, July 18 - 22, August 2 - 5, August 29 - September 2, September 26 - 29 and October 3 - 7. These cruises were piggybacked on Lake Erie Suspended Sediment cruises. As in previous years, four stations were occupied--one in the Eastern Basin, one in the Central Basin and two in the Western Basin.

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 station 23, a winter D.O. logger mooring was retrieved and reinstalled. D.O. logger moorings were also installed at stations 84 and 357. These two moorings were retrieved and reinstalled several times during the field year to clean Zebra mussels from the oxygen membrane. Moorings at stations 23 and 84 were reinstalled as winter moorings to be retrieved in the spring of 1995.

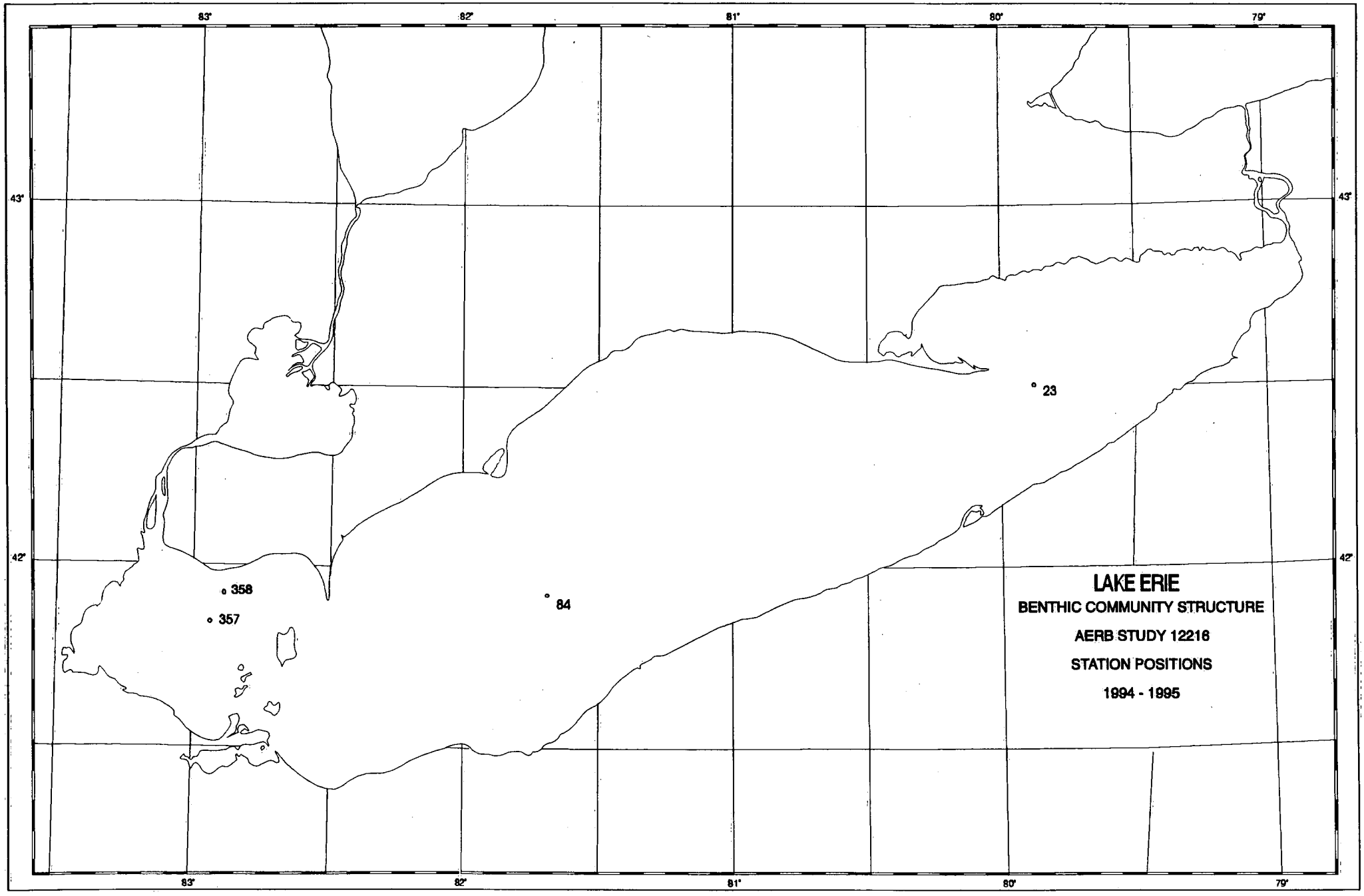
Phytoplankton samples at stations 23, 84 and 357 were collected for Dr. M.A. Zarull, AERB whenever samples were collected for Dr. Reynoldson.

Sampling was piggybacked on cruises for M.N. Charlton or F. Rosa and all statistics were included on sheets for those cruises.

STATION POSITIONS

BENTHIC COMMUNITY STRUCTURE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29' 54"	79° 54' 00"
84	41° 29' 48"	81° 39' 18"
357	41° 49' 48"	82° 58' 18"
358	41° 53' 42"	82° 52' 00"


83°
82°
81°
80°
79°
43°
42°
23
84
358
357
LAKE ERIE
BENTHIC COMMUNITY STRUCTURE
AERB STUDY 12216
STATION POSITIONS
1994 - 1995

LAKE ERIE SUSPENDED SEDIMENT SAMPLING
AERB STUDY 12240, M.N. CHARLTON

This study was used to measure the sedimentation and regeneration rates of nutrients and contaminants in Lake Erie utilizing sediment traps.

There were eight cruises to support this project during the field season--May 9 - 11, May 30 - June 3, June 13 - 17, July 4 - 8, July 18 - 22, August 29 - September 2, September 26 - 29 and October 3 - 7. Sediment trap moorings were established at stations 23, 84, 357 and 946.

MOORING POSITIONS

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH M
23	94-01A-14A	42° 30' 04"	79° 53' 34"	ST(30,40,50,60)
84	94-01A-11A	41° 56' 00"	81° 39' 10"	ST(18,21)
357	94-01A-12A	41° 49' 37"	82° 58' 33"	ST(9.4)
946	94-01A-13A	42° 09' 58"	80° 38' 32"	ST(18,21)
1023	94-01S-17A	41° 50' 06"	82° 51' 59"	
	94-01S-18A	41° 50' 02"	82° 51' 57"	
	94-01S-19A	41° 50' 05"	82° 51' 59"	

In addition to the sediment trap samples, water samples were collected at predetermined station locations throughout the lake. At each station, an integrated water sample was collected from the surface to 1 m above the top of the thermocline or to 20 m if the thermocline was deeper than 20 m or the water was unstratified. Samples were taken from surface 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, chlorides and silicate.

During stratified conditions, a discrete sample was obtained from a depth of bottom -1 m from stations in the Central Basin of Lake Erie for the same parameters as listed above.

The oxygen profiler system was also utilized at all stations.

Several additional tasks were performed during these cruises. These tasks included sediment samples for Memorial University of Newfoundland; water, sediment and benthic samples for Dr. W. Taylor, University of Waterloo, and Dr. E. Bentzen, Trent University; water samples for Dr. F. Pick, University of Ottawa; sediment and benthic samples for Dr. L. Corkum, University of Windsor; zooplankton samples for Dr. O. Johannsson, GLLFAS, water samples for Mr. M. Fox, AERB and mooring installation, refurbishment and retrieval for Dr. P. Hamblin, AERB and Dr. M. Loewen, University of Toronto.

STATISTICS SUMMARY

CRUISE NO. _____
DATES FROM _____ TO _____
CRUISE TYPE Suspended Sediment Sampling

SHIP CSS LIMNOS
REGION LAKE ERIE
N.MI. STEAMED 4889.2

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	332	Moorings Established, Sediment Trap	4
EBT/Transmissometer Casts	332	Moorings Retrieved, Sediment Trap	3
Rosette Casts	111	Moorings Refurfished, Sediment Trap	14
Reversing Thermometer Obs. (No. of Therm)		Moorings Established, Thermograph	2
Secchi Disc Observations	200	Moorings Retrieved, Thermograph	2
Zooplankton Hauls, 200µ	63	Moorings Established, Meteorological	4
Zooplankton Hauls, 64µ	40	Moorings Retrieved, Meteorological	3
Zooplankton Hauls, 44µ	8	Moorings Serviced, Meteorological	12
Integrator 10 m	206	Moorings Established, CM/Thermograph	2
Integrator 20 m	128	Moorings Retrieved, CM/Thermograph	2
Phytoplankton Samples	119	Moorings Refurbished, CM/Thermograph	3
D.O. Profiles	245	Moorings Established, WOTAN	1
Water Samples Collected (Microbiology)		Moorings Retrieved, WOTAN	1
Water Samples Collected (Metals)	35	Cores Taken, Mini-Box	63
Water Samples Collected (D.O.)	58	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	401	Cores Taken, Benthos	
Water Samples Collected (TP uf)	364	Grab Samples Taken, Shipek	7
Water Samples Collected (Primary Prod.)	9	Grab Samples Taken, PONAR	46
Water Samples Collected (DCM Extracts)	38	Bulk Centrifuge Samples, 2000ℓ	1
Water Samples Collected (Plankton Filt.)	22	Moorings Established, CM/W&T	1
Water Samples Collected (Grazing)	57	Moorings Retrieved, W&T	1
Water Samples Filtered (Chlorophyll a)	479	Moorings Established, CM/XMS	1
Water Samples Filtered (POC/TPN)		Moorings Retrieved, CM/XMS	1
Water Samples Filtered (Seston)	415	Moorings Established, D.O. Logger	3
Water Samples Filtered (TP f)	404	Moorings Retrieved, D.O. Logger	5
Water Samples Filtered (Nutrients)	404	Moorings Refurbished, D.O. Logger	3
Water Samples Filtered (Major Ions)	404	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	
Water Samples Filtered ( )		Nutrients, EHD, ECB-OR	
Water Samples Filtered ( )		Microbiology	
Zooplankton Grazing Experiments	39		

STATION POSITIONS

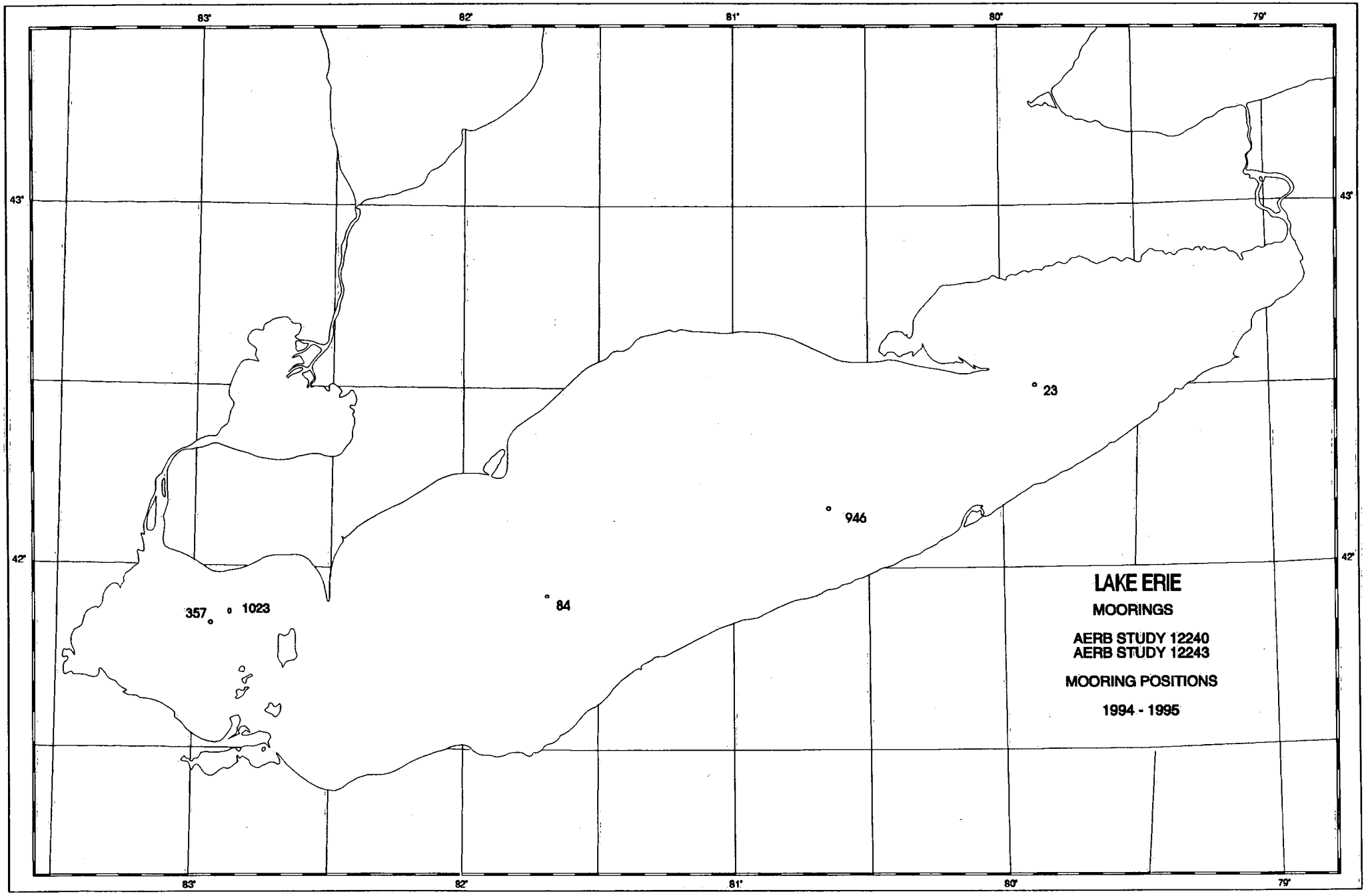
WATER QUALITY AND SEDIMENTATION

LAKE ERIE

1994 - 1995

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"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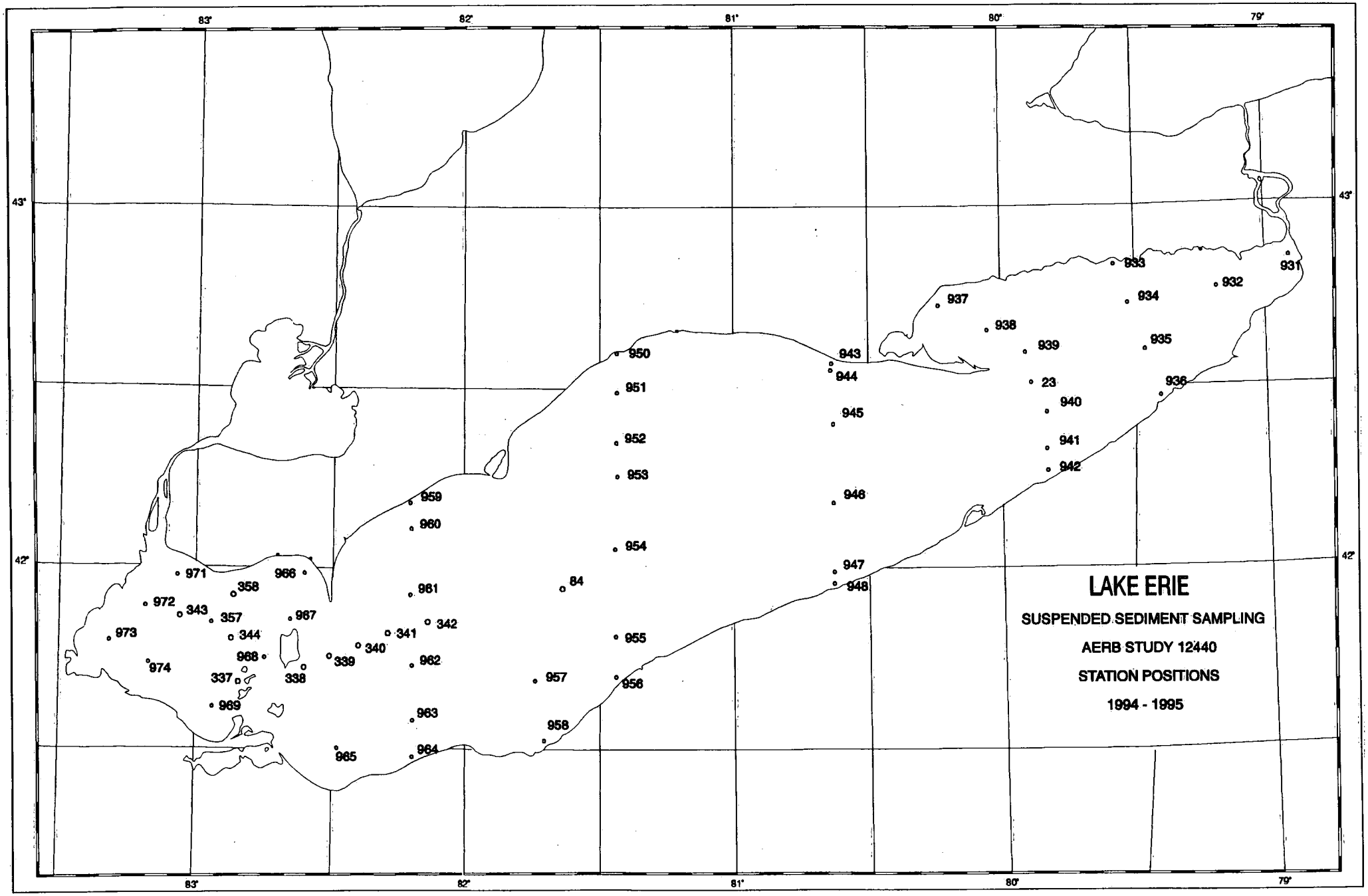
LAKE ERIE
MOORINGS
AERB STUDY 12240
AERB STUDY 12243
MOORING POSITIONS
1994 - 1995


LAKE ERIE
SUSPENDED SEDIMENT SAMPLING
AERB STUDY 12440
STATION POSITIONS
1994 - 1995
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LAKE ERIE METEOROLOGICAL, TEMPERATURE AND CURRENT METER MOORINGS
AECB STUDY 12375, F.M. BOYCE

This study involved the installation of meteorological and thermograph moorings at stations 23 and 357 in the Eastern and Western basins of Lake Erie and of meteorological and current meter/thermograph/transmissometer moorings at station 84 in the Central Basin. These moorings were used to measure winds, horizontal currents, water temperature and other parameters at representative sites in all three basins of Lake Erie and provided essential physical background information for the monitoring program carried out on Lake Erie. Moorings were installed May 9 - 11 with a refurbishment of current meters and Brancker loggers at station 84 on August 3. Moorings were removed during the period of September 26 - October 7.

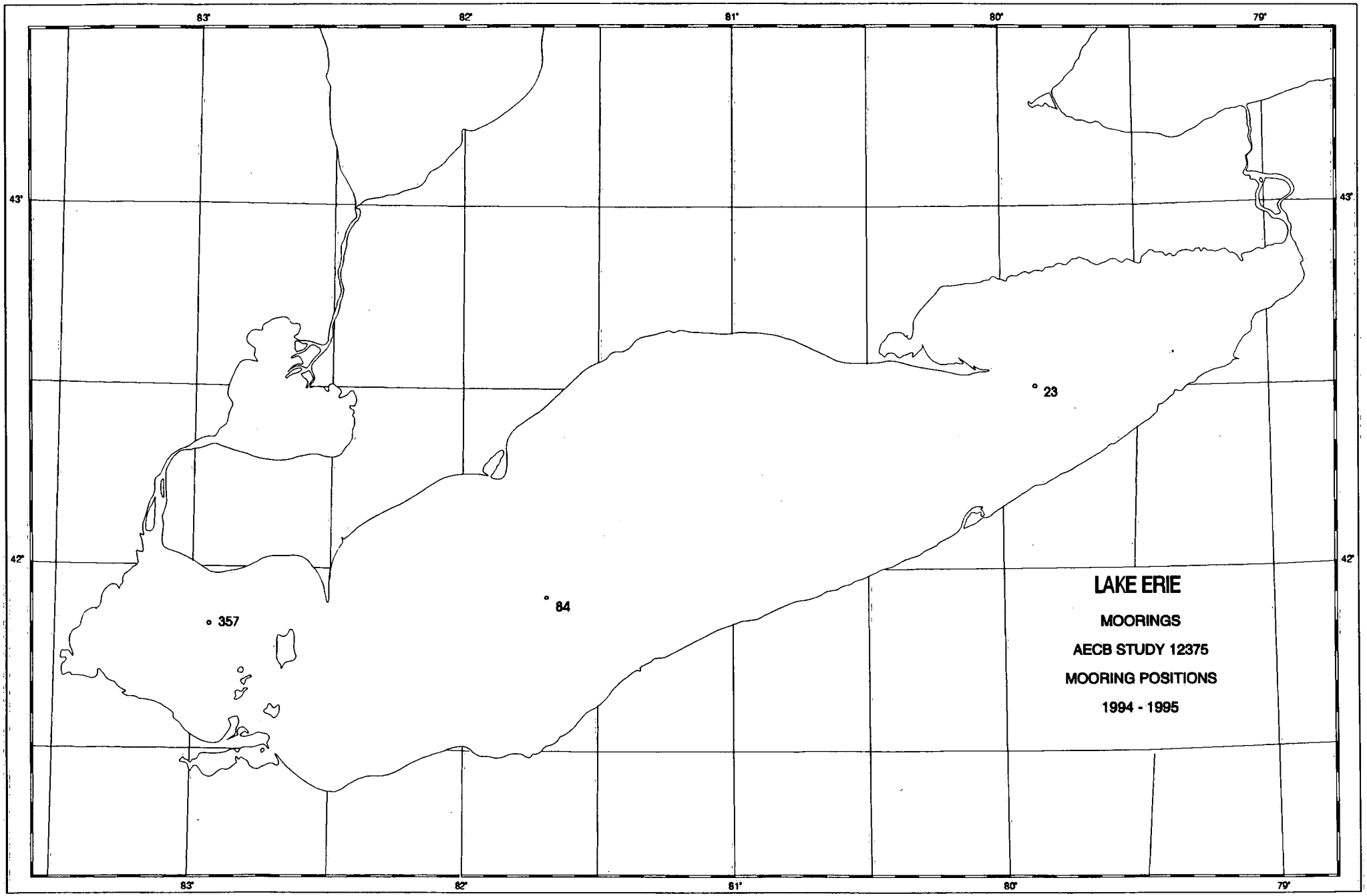
This work was done as additional tasks on Suspended Sediment Sampling cruises and all statistics were included on the sheets for those cruises.

MOORING POSITIONS

LAKE ERIE

1994-1995

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH M
23	94-01T-10A	42° 30' 11"	79° 53' 36"	T(10,20,35,50, 61.2)
23	94-01M-15A	42° 29' 59"	79° 53' 38"	MET (62.5)
84	94-01M-05A	41° 56' 03"	81° 39' 18"	MET (24.5)
84	94-01CT-07A	41° 56' 06"	81° 39' 18"	CM(3,8,14,17) T (5,11)
84	94-01CT-07B	41° 56' 07"	81° 39' 18"	CM(3,8,14,17) T (5,11)
84	94-01S-09A	41° 56' 01"	81° 39' 24"	CM/TRANS(24.1)
84	94-01S-09B	41° 56' 01"	81° 39' 25"	CM/TRANS(24.1)
357	94-01M-06A	41° 49' 51"	82° 58' 33"	MET (10.4)
357	94-01T-08A	41° 49' 39"	82° 58' 31"	T(5,9.4)


83°
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42°
23
84
357
LAKE ERIE
MOORINGS
AECB STUDY 12375
MOORING POSITIONS
1994 - 1995

LAKE ERIE CONTAMINANT TRANSFER STUDY
AECB STUDY 12379, DR. D.R.S. LEAN

This study was supported with one cruise on the CSS LIMNOS on Lake Erie, July 11 - 15. This project was multidisciplinary and included scientists from Waterloo, Trent, York universities and INRS-Eau, Quebec working in support of the Green Plan Initiative on environmental effects of increased UV-B resulting from stratospheric ozone depletion. This project also provided information on the internal loading of nutrients for an important contribution to the Lake Erie nutrient budget. As an additional task, TOS divers installed "peepers" to determine nutrient flux from sediment pore waters.

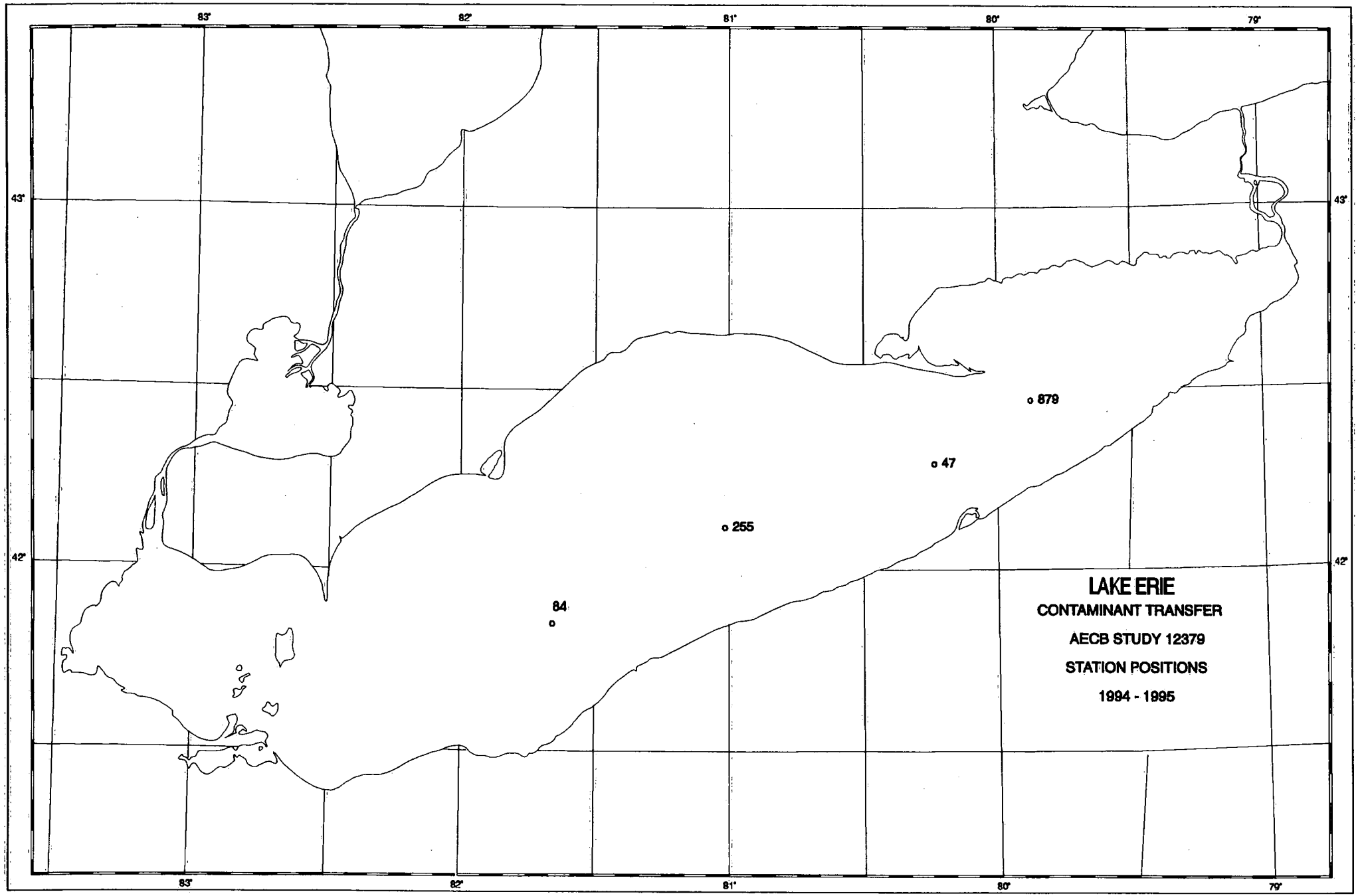
Parameters collected included EBT/Transmissometer profiles, global solar radiation, surface bucket temperature, Secchi disc (30 cm), D.O. profiles, sediment hand cores, size fractionation for particles of phosphorus and total phosphorus, phytoplankton, total phosphorus (filtered and unfiltered), nutients, major ions, POC, chlorophyll a, seston, in situ C^{14} primary production rates, UV-B, Nitrifying bacteria, iron enrichment on phytoplankton growth, trace metal regeneration in the microbial food loop, concentrations of gaseous mercury and diel patterns of hydrogen peroxide.

STATION POSITIONS

LAKE ERIE CONTAMINANT TRANSFER

1994 - 1995

STATION NUMBER	LATITUDE N.	LONGITUDE W.
47	42° 17' 39"	80° 18' 19"
84	41° 56' 27"	81° 39' 50"
255	42° 08' 39"	80° 59' 27"
879	42° 30' 30"	79° 53' 59"


83°
82°
81°
80°
79°
43°
42°
879
47
255
84
LAKE ERIE
CONTAMINANT TRANSFER
AECB STUDY 12379
STATION POSITIONS
1994 - 1995

LAKE ERIE TROPHIC TRANSFER

UNIVERSITY OF TORONTO, DR. G. SPRULES
GLLFAS, DR. M. MUNAWAR, DR. O.E. JOHANNSSON, E.S. MILLARD, R.M. DERMOTT
RSB STUDY 12631, P.M. HEALEY

This was the third year of a multi-year, major multi-trophic initiative proposed to characterize the Lake Erie ecosystem at different trophic levels, including the zebra mussel invasion. This project plans to simultaneously estimate for the first time the biomass of all pelagic organisms from bacteria to fish on a lakewide basis. The results will: a) provide important baseline information about the status of Lake Erie; b) provide a basis of computing estimates of growth and production of all component organisms; c) permit a rigorous test of particle size theory; d) contribute directly to the management of fish stocks in Lake Erie; e) assess the impact of the zebra mussel on the Lake Erie ecosystem.

Three cruises to support this study were carried out onboard the CSS LIMNOS. The first was a two-week lakewide cruise--May 16 - 27; the second was a one-week reduced cruise with transects done in each basin and the third a full cruise September 12 - 23.

Seven transects were distributed across Lake Erie with six additional stations between transects consisting of 44 stations in total. Transects 1 and 2 were located in the Western Basin, transects 3, 4 and 5 were located in the Central Basin and transects 6 and 7 were located in the Eastern Basin.

Parameters sampled during the cruises were: EBT/transmission profiles, SeaBird oxygen profiles, pH, conductivity, chlorophyll a, particulate organic carbon, particulate organic nitrogen, total phosphorus, total filtered phosphorus, soluble reactive phosphorus, nitrate + nitrite, chlorides, dissolved inorganic carbon, silicate, primary productivity, ^{32}P-kinetics, phytoplankton, ciliates, microbial loop (bacteria, autotrophic picoplankton), size fractionated primary productivity, quantum meter light profiles, Secchi disk, zooplankton, towed acoustics and fluorometer system, bottom and mid-water fish trawls, PONAR grab samples and mini box core samples.

The study leader for this program was Dr. G. Sprules, University of Toronto, through GLURF funding. Other agencies involved in this study were Department of Environment, Department of Fisheries & Oceans, University of Guelph and the State University of New York.

Some additional tasks performed during these cruises were the collection of metal cycle samples for Dr. W. Strachan; the installation and servicing of meteorological buoys for F.M. Boyce and the installation and refurbishment of current meter, wave and tide recorder and transmissometer moorings for Dr. P. Hamblin.

STATISTICS SUMMARY

CRUISE NO. _____
DATES FROM _____ TO _____
CRUISE TYPE Lake Erie Trophic Transfer

SHIP CSS LIMNOS
REGION LAKE ERIE
N.MI. STEAMED 2926.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	218	Moorings Established, CM and %T	3
EBT/Transmissometer Casts	218	Moorings Retrieved, Meteorological	1
Rosette Casts		Moorings Established, CM/Wave and Tide	1
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disc Observations	110	Moorings Established	
Zooplankton Hauls, 44 µ	3	Moorings Retrieved	
Zooplankton Hauls, 110 µ	229	Moorings Established	
		Moorings Retrieved	
Integrator 10 m	64	Moorings Serviced, Meteorological	2
Integrator 20 m	69	Primary Productivity Moorings	
Phytoplankton Samples	174		
Fish Trawl, Bottom	14		
Fish Trawl, Mid-Water	2	Cores Taken, Box	
Water Samples Collected (Water Quality)	264	Cores Taken, Mini-Box	
Water Samples Collected (Metal Cycle)	33	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	155	Cores Taken, Benthos	
Water Samples Collected (TP uf)	129	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, Mini PONAR	3
Water Samples Collected ( )		Acoustic and OPC Tow, Miles	28
Water Samples Collected ( )		SeaBird D.O. Profiles	56
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered (Chlorophyll a)	404		
Water Samples Filtered (POC/TPN)	129		
Water Samples Filtered (Seston)	127		
Water Samples Filtered (TP f)	129		
Water Samples Filtered (Nutrients)	144		
Water Samples Filtered (Major Ions)	129	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)	129	Manual Chemistry, Tech. Ops.	266
Water Samples Filtered (Ciliates)	129	Nutrients, EHD, ECB-OR	
Water Samples Filtered ( )		Microbiology	

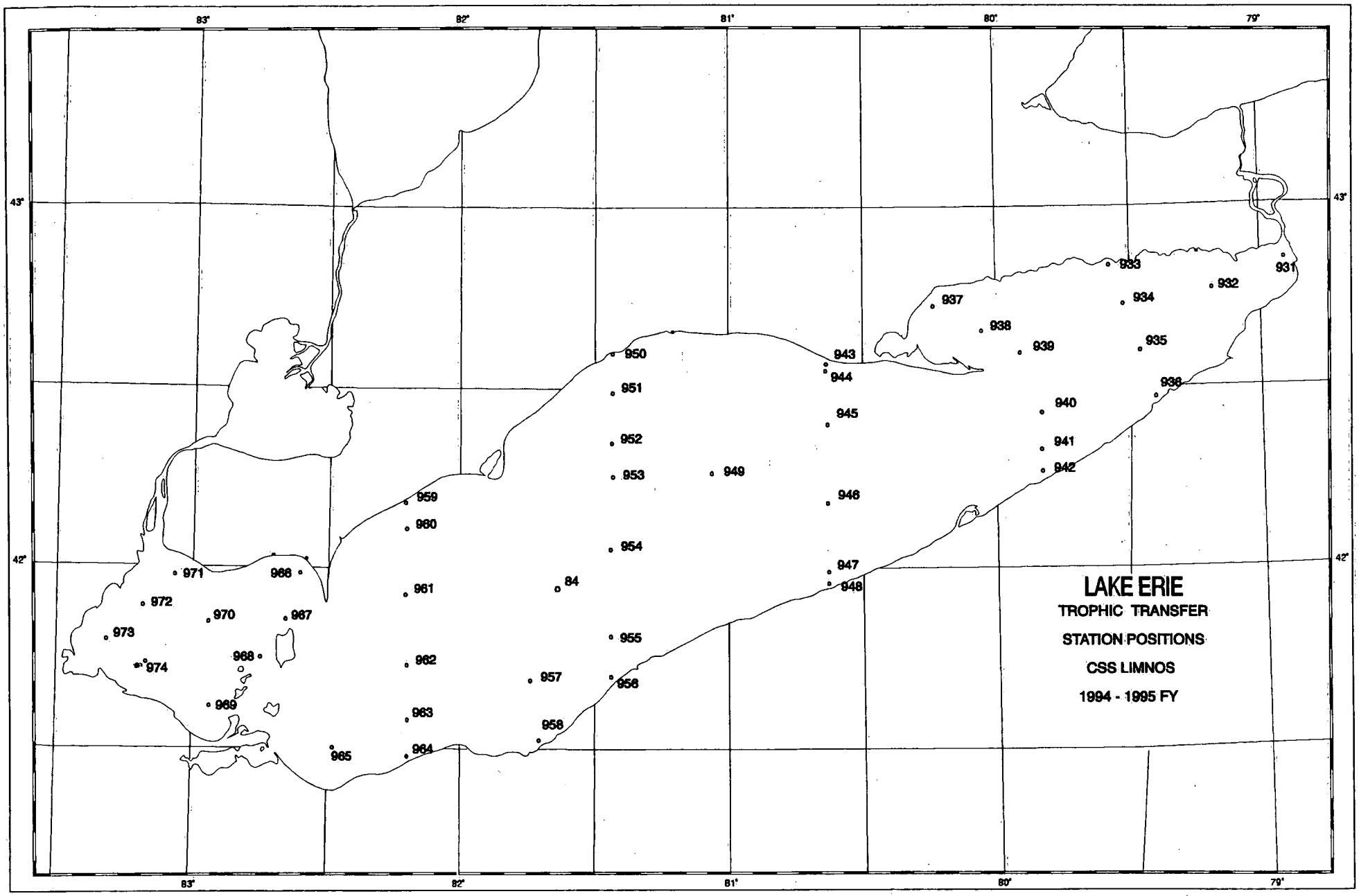
STATION POSITIONS

LAKE ERIE TROPHIC TRANSFER

1994 - 1995

STATION NUMBER	LATITUDE N.	LONGITUDE W.
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"
949	42° 15' 00"	81° 06' 30"
950	42° 35' 18"	81° 26' 30"
951	42° 28' 30"	81° 26' 30"
952	42° 21' 30"	81° 26' 30"
953	42° 12' 30"	81° 26' 30"
954	42° 01' 30"	81° 26' 30"
955	41° 48' 00"	81° 26' 30"
956	41° 41' 30"	81° 26' 30"
957	41° 41' 00"	81° 44' 30"
958	41° 31' 30"	81° 42' 30"
959	42° 11' 42"	82° 11' 00"
960	42° 06' 00"	82° 11' 00"
961	41° 54' 30"	82° 11' 00"
962	41° 43' 00"	82° 11' 00"
963	41° 34' 30"	82° 11' 00"
964	41° 29' 00"	82° 11' 00"
965	41° 30' 00"	82° 30' 00"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
966	41° 59' 00"	82° 37' 30"
967	41° 53' 30"	82° 40' 00"
968	41° 44' 30"	82° 44' 00"
969	41° 36' 30"	82° 55' 30"
970	41° 49' 30"	82° 58' 30"
971	41° 57' 00"	83° 03' 00"
972	41° 52' 00"	83° 12' 00"
973	41° 47' 30"	83° 20' 00"
974	41° 43' 30"	83° 09' 00"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LAKE ERIE
TROPHIC TRANSFER
STATION POSITIONS
CSS LIMNOS
1994 - 1995 FY

CSS LOUIS M. LAUZIER
1994

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

LONG TERM BIOLOGICAL INDEX MONITORING AND PROJECT QUINTE
GLLFAS PROJECT 9011, DR. O.E. JOHANNSSON
RSB STUDY 12632, P.M. HEALEY
GLLFAS PROJECT 9018, E.S. MILLARD
RSB STUDY 12631, P.M. HEALEY

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

Twenty cruises were completed by the research vessel CSS LOUIS M. LAUZIER. The first cruise commenced the week of April 18 and the final cruise ended October 28.

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

The Project Quinte sampling program began the week of April 18. Four stations in the Bay of Quinte were sampled in support of GLLFAS on a biweekly basis. The stations located near Trenton and Glenora were omitted this year due to lack of funds for sample analysis. This work is a continuation of the long term monitoring program carried out since 1972 for Project Quinte. The four stations are: B (Belleville), N (Deseronto), HB (Hay Bay) and C (Conway). Typical sampling of these stations included a temperature/depth profile, a transmissometer cast and an integrated water sample for chlorophyll a, particulate organic carbon, water quality and seston. A dissolved oxygen profile, a light extinction profile and primary productivity and P kinetics experiments were done. Zooplankton samples were collected using a Schindler-Patalas trap. At all stations, water samples were collected for the Ministry of the Environment, including samples for metals, reactive soluble phosphorus, algae and nutrients.

Several additional tasks were accomplished during the field season:

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

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

3. On three occasions during the season, a benthic sled was used at stations 41, BS1 and 843 to collect a large volume of mysids near the lake bottom.

4. A wave rider buoy and a bottom-mounted seismometer were launched at station 55A for Dr. B. Kerman of AES.

5. On a bi-weekly basis, a vertical zooplankton sampling series was completed at stations 41 and 81 during day and night hours. Personnel from Erindale College, University of Toronto were onboard each time.

6. During an August cruise of the CSS LOUIS M. LAUZIER, in support of A. Mudroch, AERB, two scientists from the Institute of Freshwater and Fish Ecology near Berlin, Germany were aboard for sampling in Lake Ontario.

Dr. R. Koschel is studying the interactions of lake trophic state, carbonate equilibrium and the intensity of calcite precipitation. Dr. P. Casgur is researching the cycles of sulphur and methane and the distribution of heavy metals in lake sediment.

At surveillance station 19 and both Bioindex stations, transmissometer profiles were obtained for observing the nepheloid layer. Water samples were obtained throughout the water column and sediment was collected by PONAR grab samples.

STATISTICS SUMMARY

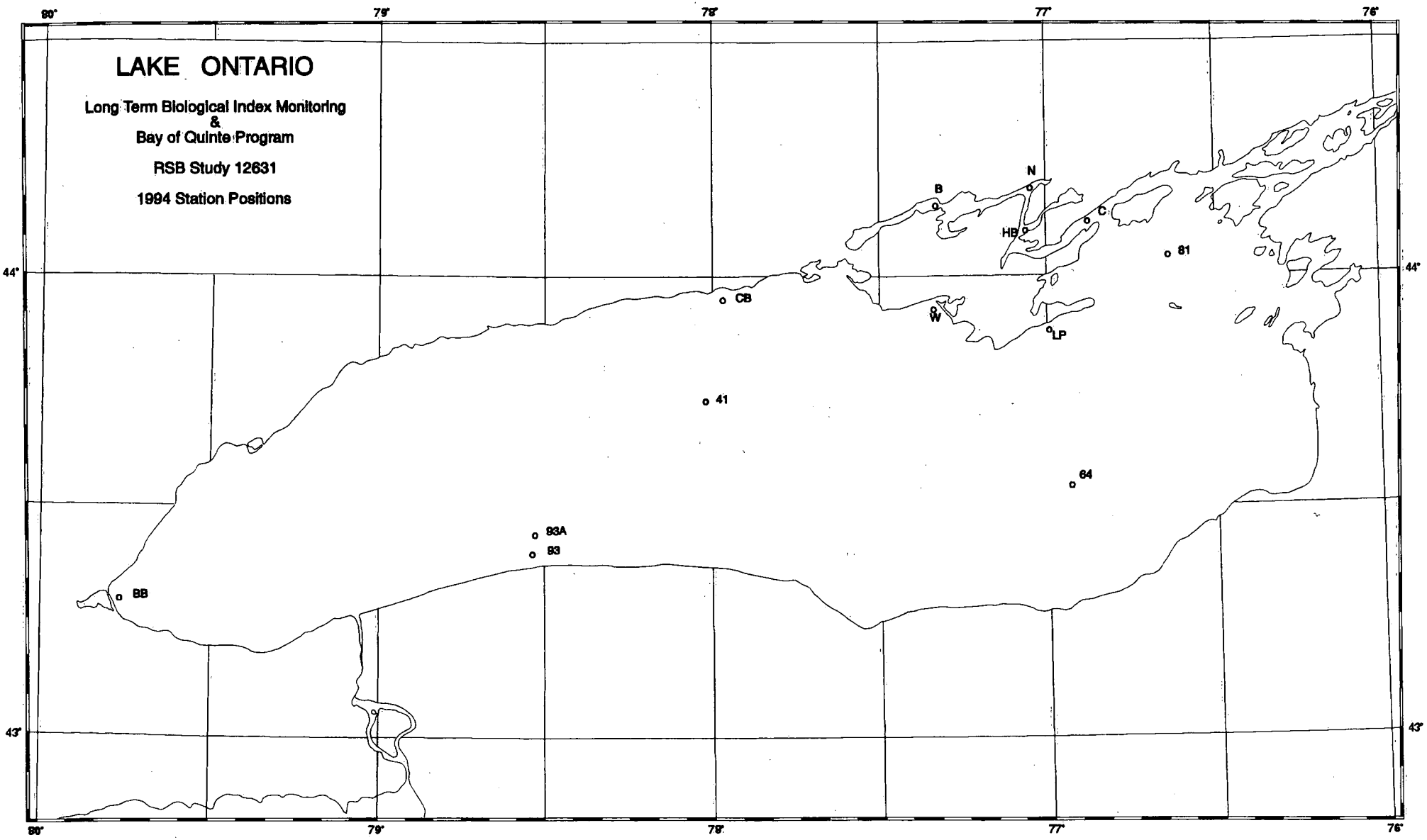
CRUISE NO. 94 - 00 - 301 - 94 - 00 - 320
DATES FROM April 18 TO October 20, 1994
CRUISE TYPE Bioindex and Quinte

SHIP CSS LOUIS M. LAUZIER
REGION LAKE ONTARIO
N.MI. STEAMED 4881

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	122	Moorings Established, Marker	4
EBT/Transmissometer Casts	72	Moorings Retrieved, Marker	4
Rosette Casts	98	Moorings Established, OBS	1
Reversing Thermometer Obs. (No. of Therm)	4	Moorings Retrieved, OBS	1
Secchi Disc Observations	114	Moorings Established, SPMD	1
Transmissometer Casts	70	Moorings Retrieved, SPMD	1
Zooplankton Hauls, 64µ	354	Moorings Established	
Zooplankton Hauls, Schindler	128	Moorings Retrieved	
Integrator 10 m	254	Moorings Serviced, Meteorological	6
Integrator 20 m	143	Primary Productivity Moorings	
Phytoplankton Samples	96		
D.O. Profiles		LiCor Profiles	63
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini-Box	2
Water Samples Collected (D.O.)	175	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	39	Cores Taken, Benthos	
Water Samples Collected (TP uf)	135	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)	95	Grab Samples Taken, PONAR	54
Water Samples Collected (MOE)	150	Bulk Centrifuge Samples	
Water Samples Collected ($CaCO_3$)	17		
Water Samples Collected ( )		Observations, Weather	
Water Samples Filtered (Chlorophyll a)	397		
Water Samples Filtered (POC/TPN)	95		
Water Samples Filtered (Seston)	80		
Water Samples Filtered (TP f)	95		
Water Samples Filtered (Nutrients)	95		
Water Samples Filtered (Major Ions)	95	**ONBOARD ANALYSIS**	
Water Samples Filtered (DOC)	95	Manual Chemistry, Tech. Ops.	
Water Samples Filtered ( )		Nutrients, EHD, ECB-OR	
Water Samples Filtered ( )		Microbiology	

STATION POSITIONS

STATION NUMBER	PROJECT	LATITUDE N.	LONGITUDE W.
41	Bioindex	43° 43' 00"	78° 01' 36"
81	Bioindex	44° 01' 00"	76° 40' 18"
B	Quinte	44° 09' 02"	77° 20' 40"
HB	Quinte	44° 05' 36"	77° 04' 13"
C	Quinte	44° 06' 28"	76° 53' 54"
N	Quinte	44° 10' 30"	77° 02' 54"
81A	Benthos	43° 58' 54"	76° 39' 18"
93	Benthos	43° 19' 36"	78° 52' 06"
93A	Benthos	43° 21' 48"	78° 51' 24"
BB	OMNR	43° 17' 31"	79° 48' 05"
W	OMNR	43° 56' 24"	77° 19' 50"
LP	OMNR	43° 54' 14"	76° 54' 02"
C	OMNR	43° 57' 03"	78° 10' 15"
K3	AES	43° 49' 59"	77° 21' 55"
55A	AES	43° 49' 39"	77° 23' 17"


LAKE ONTARIO
Long Term Biological Index Monitoring
&
Bay of Quinte Program
RSB Study 12631
1994 Station Positions
80°
79°
78°
77°
76°
44°
43°
B
N
HB
C
81
CB
W
LP
41
64
93A
93
BB

SHORE PROGRAMS

A Q U A T I C E C O S Y S T E M S R E S T O R A T I O N B R A N C H

MINE TAILINGS MONITORING STUDY
AERB STUDY 12210, A. MUDROCH

This study was a continuation of a study initiated in 1993. The study monitored the effects of submerged mine tailings on an aquatic environment in an open pit mine(Crown Pillar pit) which has been filling with water for the past few years.

Two trips were completed this year to refurbish the instrumentation and collect water and sediment samples. Crown Pillar Pit was chosen because of its chemistry and temperature structure--it is both meromictic and anoxic in the bottom waters year round. The site is located on Mattabi Mines property (a subsidiary of Noranda Mines - Lyons Lake Division) 19 km southeast of the Hamlet of Silverdollar which is 60 km east of Ignace, Ontario on Highway 544.

Crown Pillar pit was profiled utilizing a Hydrolab profiler and water samples were collected before the Datasonde 3 sampler and sediment trap were refurbished. These samplers were refurbished in May and November.

In addition to sampling the pit, samples were collected from Lyons Lake, Lyons Creek and Bell Creek. Samples from Lyons Creek and Lyons Lake were collected in conjunction with the Provincial Ministries of Environment and Natural Resources.

MUDDY CREEK, WHEATLEY
AERB Study 12211, A. Mudroch

Suspended sediment and water was collected in late June near Wheatley in Southwestern Ontario. Sampling consisted of collecting 360 litres of centrifugate and 240 litres of raw water. Centrifuges were operated at a flow rate of 4 litres per minute. All the water was stored in 60-litre soda cans and returned to CCIW for analysis.

This field trip completed the study begun in 1992 by the late Dr. Bernard Bourgoin.

INTERACTIONS OF LAKE TROPHIC STATE
AERB Study 12211, A. Mudroch

During August the CSS LOUIS M. LAUZIER and CSS LIMNOS supported two scientists from the Institute of Freshwater and Fish Ecology near Berlin, Germany who were onboard for sampling in Lake Ontario and Lake Erie. Dr. R. Koschel studies interactions of lake trophic state, carbonate equilibrium and the intensity of calcite precipitation. Dr. P. Casgur researches the cycles of sulphur and methane and the distribution of heavy metals in lake sediment.

At surveillance station 19 and both Bioindex stations, transmissometer profiles were obtained for observing the nepheloid layer. Water samples were obtained throughout the water column and sediment was collected by PONAR grab samples.

In Lake Erie, sampling procedures were the same with samples collected at stations 23, 84, 934 and 946.

PORT STANLEY HARBOUR SEDIMENT COLLECTION
AERB Study 12212, DR. M.G. SKAFEL

Technical Operations staff supported this study with the collection of water and bottom sediment from five locations in Port Stanley Harbour.

The field party had the use of a dual wheel crewcab and the crane truck. A total of five sample collection sites along the harbour wall had been previously identified by Dr. Skafel as being suitable sampling locations. At each site several 100-litre plastic barrels were filled with a mixture of water and surficial bottom sediment using submersible pumps fitted with special screens in order to exclude large particles such as zebra mussels. Three sites were sampled along the east wall and two along the west wall. A total of 28 barrels were filled and transported to Burlington with the field party the same day.

DISTRIBUTION OF THALLIUM
AERB STUDY 12213, V. CHEAM

Water samples were collected from several sites across Canada for V. Cheam's study of the distribution of Thallium--a very toxic rare earth element. All samples collected were piggybacked on other studies and were collected on an 'as time permits' basis.

Samples were collected from the following areas of Canada: Nova Scotia from the Gegogan watershed; Port Stanley Harbour; St Clair River at Sarnia and Lake St. Clair; Niagara River and surveillance station 21; British Columbia from the Fraser River, Stuart River, Clearwater River, Pitt River, Salmon River and Chilcotin River; Turkey Lakes watershed; Crown Pillar Pit, Lyons Creek, Bell Creek at Mattabi Mines and Kelly Lake at Sudbury.

SEDIMENT REMEDIATION, NOVA SCOTIA
AERB STUDY 12215, H. WONG

Extensive gold mining occurred in the late 1930's and early 1940's in the Gegogan watershed area of Nova Scotia. Large quantities of Arsenic and Mercury were used in the extraction of gold. Four areas in the watershed were chosen as sampling

FRASER RIVER ACTION PLAN FIELD PARTY

sites. One site was above the mine and three sites in different areas below the mine. Sampling took place October 26 to October 28. Centrifuging occurred at the first three sites. The particulate matter from the centrifuged water was collected for analysis of trace elements, specifically Arsenic and Mercury. Centrifuged water was also collected for K. Aspila. Two Tech. Ops. cores were taken at the fourth site in Gegogan Lake. These were extruded on shore and later analyzed for trace elements.

FRASER RIVER ACTION PLAN
AERB STUDY 12216, DR. T.B. REYNOLDSON

This project was conducted for the Fraser River Action Plan. It was to investigate the mainstream River and several tributaries with different types of terrain and usages to determine the condition with respect to the salmon habitat and rehabilitation of the rivers /streams.

During the month of October six tributaries of the Fraser River were sampled as well as the mainstream of the Fraser between Shelley and Chilliwack. The six tributaries sampled were: the Stuart River system; the Clearwater system; the Pitt River system; the Chilcotin River system; the Willow River system and the Salmon River system. The Stuart, Clearwater, Chilcotin and Pitt rivers were relatively undisturbed, remote river systems while the Salmon and Willow were disturbed by farming and extensive logging.

Fifty-one sites were occupied over the period--10 sites on the Stuart River, 8 sites on the Clearwater River, 10 sites on the Chilcotin River, 8 sites on the Pitt River, 10 sites on the Fraser River, 4 sites on the Salmon River and 1 site on the Willow River. Triplicate sites were done on all the rivers.

At each site samples were collected for total phosphorous, nitrates, major ions, periphyton, benthic fauna, particle size analysis and total suspended solids. Measurements were done for full bank and slope as well as gauging the stream/river for flow through the sampling site, photographs were taken to log the site and identify the substrate.

Due to the remoteness of all rivers, with the exception of the Salmon River, all sampling was conducted from an Aerospatiale AS Ecureuil 2/Twinstar helicopter chartered from Canadian Helicopters in Vancouver.

This field trip was the pilot year and it is anticipated that the project for the 1995/96 field year will be four times the size it was this year. The study will require four separate field crews in different locations and will be conducted earlier. This year some sites were finished as ice was forming on the streams. On completion of all sampling a heavy snow blanketed the whole of British Columbia, shutting down sampling activities for the year which indicated that the sampling program had been extended to the last possible moment.

The following page provides a complete list of all sites occupied with station numbers and positions in latitude and longitude.

Site	Date	Lat	Lon	River	Basin
CHI01	20/10/94	52 33 15.4	124 44 30.0	U. Punkutlgenkut Ck	Chilcotin
CHI02	20/10/94	52 33 14.8	124 40 34.1	U. Punkutlgenkut Ck	Chilcotin
CHI03	21/10/94	52 53 38.9	124 26 38.8	Chilcotin R.	Chilcotin
CHI04	21/10/94	52 27 44.2	124 04 36.4	Clusko R	Chilcotin
CHI05	21/10/94	52 21 22.1	124 09 57.9	Palmer Ck	Chilcotin
CHI06	21/10/94	52 12 40.5	123 50 49.8	Chilcotin R	Chilcotin
CHI07	22/10/94	52 18 52.2	123 58 35.3	Chilcotin R	Chilcotin
CHI08	22/10/94	52 36 9.6	124 07 59.0	Clusko R	Chilcotin
CHI09	22/10/94	52 37 29.2	124 24 0.0	Moore Ck	Chilcotin
CHI10	22/10/94	52 38 31.1	124 34 56.5	Downton Ck	Chilcotin
CLR01	18/10/94	52 24 59.0	120 26 17.2	Lickskillet Ck	Clearwater
CLR02	18/10/94	52 25 56.8	120 16 08.6	Goat Ck	Clearwater
CLR03	20/10/94	52 38 53.0	120 09 19.4	Hobson's Ck	Clearwater
CLR04	19/10/94	52 02 33.4	120 09 52.0	Clearwater R	Clearwater
CLR05	19/10/94	52 03 37.6	119 55 47.7	Murtle River	Clearwater
CLR06	19/10/94	51 57 29.3	120 01 12.1	Hemp Ck	Clearwater
CLR07	19/10/94	51 52 17.0	119 55 21.8	Phillip Ck	Clearwater
CLR08	19/10/94	51 47 22	120 01 43.3	Clearwater R	Clearwater
FRA01	16/10/94	54 02 01.2	122 35 43.6	Fraser R.	Fraser
FRA02	16/10/94	54 02 1.2	122 35 43.6	Fraser R.	Fraser
FRA03	17/10/94	53 28 16.4	122 40 59.4	Fraser R.	Fraser
FRA04	17/10/94	53 28 16.4	122 40 59.4	Fraser R.	Fraser
FRA05	17/10/94	53 05 23	122 33 22.9	Fraser R.	Fraser
FRA06	17/10/94	53 05 23	122 33 22.9	Fraser R.	Fraser
FRA07	17/10/94	52 47 18.4	122 27 31.8	Fraser R.	Fraser
FRA08	17/10/94	52 47 18.4	122 27 31.8	Fraser R.	Fraser
FRA09	24/10/94	49 12 46.2	121 55 31.0	Fraser R.	Fraser
FRA10	24/10/94	49 12 46.2	121 55 31.0	Fraser R.	Fraser
PIT01	24/10/94	49 51 21.7	122 51 25.2	W. Fork	Pitt
PIT02	24/10/94	49 50 46.8	122 48 07.3	E. Fork	Pitt
PIT03	24/10/94	49 49 25.3	122 46 33.5	U. Pitt R.	Pitt
PIT04	24/10/94	49 52 02.8	127 40 28.1	Iceworm Ck	Pitt
PIT05	25/10/94	49 46 53.3	122 41 39.2	Misty Ck	Pitt
PIT06	25/10/94	49 45 17.9	122 44 43.3	Pitt R.	Pitt
PIT07	25/10/94	49 36 31.7	122 38 14.6	Pitt R.	Pitt
PIT08	25/10/94	49 33 48.2	122 37 30.2	Pitt R.	Pitt
SAL01	27/10/94	50 19 .13	119 57.78	Salmon R.	S. Thompson
SAL02	27/10/94	50 33.1	119 50.2	Salmom R.	S. Thompson
SAL03	27/10/94	50 33.74	119 21.2	Salmon R.	S. Thompson
SAL04	27/10/94	50 37.17	119 21.91	Salmon R.	S. Thompson
STU01	15/10/94	55 49 34.3	126 44 06.9	Kotsine Ck	Stuart
STU02	15/10/94	55 53 49.8	126 48 59.7	Condit Ck	Stuart
STU03	14/10/94	55 59 11.2	126 17 59.2	Kaza Ck	Stuart
STU04	14/10/94	56 01 18.0	126 22 03.0	Lion Ck	Stuart
STU05	14/10/94	55 48 06.5	126 30 51.3	Kotsine R.	Stuart
STU06	14/10/94	55 46 31.9	126 20 32.1	Lion Ck	Stuart
STU07	13/10/94	55 54 23	126 32 46.6	Driftwood R	Stuart
STU08	13/10/94	55 49 51.1	126 27 49.2	Driftwood R	Stuart
STU09	13/10/94	55 47 31.2	126 24 23.3	Driftwood R	Stuart
STU10	14/10/94	55 44 05	126 19 19	Driftwood R	Stuart
WIL01	18/10/94	53 20 53.1	121 42 56.9	Stephanie Ck	Willow

SEDIMENT SAMPLING, PORT STANLEY, ST. CLAIR RIVER
AERB STUDY 12216, DR. T.B. REYNOLDSON

During the month of September sediment samples for Benthic Fauna and Bioassays were collected from Port Stanley Harbour and the St. Clair River. Seven stations were occupied in Port Stanley and 15 sites on the St. Clair River. The positions were as follows:

STATION POSITIONS

PORT STANLEY

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	42° 39' 57"	81° 12' 49"
3	42° 39' 50"	81° 12' 48.7"
5	42° 39' 47"	81° 12' 49"
7	42° 39' 41"	81° 12' 48"
9	42° 39' 33"	81° 12' 45"
10	42° 39' 29"	81° 12' 47"

STATION POSITIONS

ST. CLAIR RIVER

STATION NUMBER	LATITUDE N.	LONGITUDE W.
6A	42° 58' 49"	82° 24' 52"
8	42° 54' 40"	82° 24' 42"
11	42° 58' 12"	82° 25' 11"
13	42° 58' 05"	82° 24' 40"
29	42° 54' 34"	82° 27' 27"
56A	42° 44' 51"	82° 28' 19"
58	42° 44' 03"	82° 28' 50"
69	42° 38' 21"	82° 30' 49"
72	42° 37' 11"	82° 31' 40"
74	42° 37' 16"	82° 36' 20"
75	42° 36' 20"	82° 35' 56"
76	42° 35' 40"	82° 38' 48"
77	42° 34' 00"	82° 34' 38"
78	42° 37' 59"	82° 29' 20"

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--Western Basin (HH3) and the deep basin (HH19), to study community structure in the area. Samples were collected at the beginning of the month from May to December with a total of 8 samples being collected. Buckets of sediment were collected periodically throughout the summer to sieve out Oligochaete for Porphyrin analyses.

STATION POSITIONS

HAMILTON HARBOUR

STATION NUMBER	LATITUDE N.	LONGITUDE W.
HH3	43° 16' 50"	79° 52' 20"
HH19	43° 17' 16"	79° 50' 03"

LAKE REMEDIATION, HAMILTON HARBOUR
AERB STUDY 12240, M.N. CHARLTON

Five sediment trap moorings were deployed in different areas of Hamilton Harbour on May 12 and 13--stations 50, 51, 52, 53 and 54. This is an ongoing long-term project to study the effects of the Randle Reef cleanup. The traps were refurbished monthly and were reinstalled as winter moorings in early December. Each sample was analyzed for inorganic/organic content, metals and organic contaminants.

A second set of traps was deployed in the west end of Hamilton Harbour August 18 --stations 70, 71, 72 and 73. They were located in an area between the LAX property and the railroad tracks, at the new Pier 4 beach, Macassa Bay and at the WAVES tower. This project was funded by the Hamilton-Wentworth Health Department and was initiated to analyze sediment particulate and water in public beach areas for organic contaminants, specifically PAH's. The traps were refurbished weekly until their retrieval on September 30. Twenty-three Ekman's were taken in the same area as stations 70, 71 and 72 and were analyzed for organic contaminants. Water was also collected for organic contaminant analyses at the above sites for Dr. J. Rosenfeld of McMaster University.

A third set of traps was deployed on November 24 in two areas of Hamilton Harbour --stations 83 to 85 and 87 to 94. Four traps were installed at the capping site (600 m south of LaSalle Park) and seven traps were installed in the Randle Reef area. One current meter(station 86) was installed at the capping site and Randle Reef (station 95). One meteorological buoy was deployed at mid-harbour (station 96). Positions were taken with differential GPS. A Hydrolab profile was taken at each trap on November 30. The traps were refurbished weekly until their retrieval on December 13. On December 5, 9 and 12, a mud slurry, made up of sediment from the west end of the harbour, was released around both current meters. The slurry was then tracked with the ADCP on a small boat.

Water samples were taken at 11 stations from mid-harbour to inside LaSalle Park to study the effects of Zebra Mussels on the water quality. The samples were taken every two weeks from April 20 to October 17. Total phosphorus filtered and unfiltered, chlorophyll a, nutrients, Seston and Secchi were analyzed. Temperature, oxygen, pH, and conductivity were also monitored using the Hydrolab profiler at each site. Oxygen and conductivity were monitored approximately every two weeks in Windermere Basin using the Hydrolab profiler. The Hydrolab profiler was used to monitor oxygen and conductivity in the Windermere arm. An area with high conductivity was observed at approximately the 8.0-metre depth. Further profiling data will be collected to determine the flow direction of the high conductivity from the Windermere arm into the rest of the harbour.

Dr. W. Morris of McMaster University collected 35 Benthos cores in the DoFasco and Randle Reef area to study the history of bottom sediments of Hamilton Harbour.

SEDIMENT TRAP STATION POSITIONS

HAMILTON HARBOUR

STATION NUMBER	LATITUDE N.	LONGITUDE W.
50	43° 18' 22"	79° 48' 51"
51	43° 16' 45"	79° 52' 30"
52	43° 17' 16"	79° 50' 26"
53	43° 17' 08"	79° 47' 42"
54	43° 16' 25"	79° 46' 15"
73	43° 16' 13"	79° 45' 35"
1001	43° 17' 16"	79° 50' 26"
1002	43° 17' 27"	79° 50' 42"
1003	43° 17' 37"	79° 50' 41"
1004	43° 17' 51"	79° 50' 40"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1005	43° 17' 57"	79° 50' 26"
1006	43° 18' 02"	79° 50' 39"
1007	43° 18' 07"	79° 50' 26"
1008	43° 18' 05"	79° 50' 34"
1009	43° 18' 03"	79° 50' 33"
1010	43° 18' 01"	79° 50' 32"
1011	43° 17' 59"	79° 50' 30"
WIND	43° 16' 25"	79° 46' 15"

STATION NUMBER	NORTHING	EASTING
70	4791341	591007
71	4791402	591233
72	4791630	591790

BENTHOS CORING STATION POSITIONS

HAMILTON HARBOUR

SEPTEMBER 26 AND 28

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	43° 16' 11"	79° 47' 05"
2	43° 16' 14"	79° 47' 13"
3	43° 16' 21"	79° 47' 19"
4	43° 16' 13"	79° 47' 58"
5	43° 16' 26"	79° 47' 53"
6	43° 16' 35"	79° 47' 45"
7	43° 16' 56"	79° 47' 43"
8	43° 17' 07"	79° 47' 45"
9	43° 17' 29"	79° 47' 54"
10	43° 17' 41"	79° 48' 03"
1L	43° 16' 57"	79° 53' 13"
2L	43° 16' 44"	79° 52' 56"
3L	43° 17' 02"	79° 52' 35"
4L	43° 16' 32"	79° 52' 22"
5L	43° 16' 33"	79° 51' 39"
6L	43° 16' 47"	79° 52' 13"
7L	43° 17' 05"	79° 52' 13"
8L	43° 17' 16"	79° 51' 55"

STATION NUMBER	NORTHING	EASTING
1K	4792047	594804
2K	4791905	594675
3K	4791732	594539
4K	4791711	594473
5K	4791731	594473
6K	4792013	594672
7K	4792080	594607
8K	4791970	594517
9K	4791811	594317
10K	4791931	594339

STATION NUMBER	NORTHING	EASTING
11K	4792021	594299
12K	4791940	594244
13K	4791773	594209
14K	4791763	594313
15K	4790543	593205
16K	4792196	594890
17K	4792078	596124

EKMAN STATION POSITIONS

HAMILTON HARBOUR

STATION NUMBER	NORTHING	EASTING
1	4791145	591500
2	4791157	591462
3	4791192	591383
4	4791218	591313
5	4791234	591225
6	4791298	591112
7	4791395	591139
8	4791436	591148
9	4791421	591180
10	4791408	591214
11	4791401	591251
12	4791377	591268
13	4791527	591139
14	4791556	591635
15	4791617	591770
16	4791635	591813
17	4791632	591841
18	4791676	591815
19	4791723	591806
20	4791778	591765
21	4791731	591696
22	4791669	591696
23	4791601	591560

CAPPING SITE AND RANDLE REEF STATION POSITIONS

HAMILTON HARBOUR

STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	SPAR NUMBER
83	94-00A-83A	43° 17' 31"	79° 50' 26"	19
84	94-00A-84A	43° 17' 26"	79° 50' 33"	22
85	94-00A-85A	43° 17' 24"	79° 50' 29"	18
86	94-00C-86A	43° 17' 24"	79° 50' 31"	42
87	94-00A-87A	43° 17' 21"	79° 50' 32"	14
88	94-00A-88A	43° 16' 34"	79° 49' 52"	
89	94-00A-89A	43° 17' 24"	79° 50' 24"	
90	94-00A-90A	43° 16' 29"	79° 49' 58"	24
91	94-00A-91A	43° 16' 29"	79° 50' 09"	
92	94-00A-92A	43° 16' 29"	79° 50' 19"	
93	94-00A-93A	43° 16' 23"	79° 49' 57"	12
94	94-00A-94A	43° 16' 19"	79° 49' 58"	9
95	94-00C-95A	43° 16' 29"	79° 50' 09"	
96	94-00M-96A	43° 17' 10"	79° 50' 28"	

WESTERN LAKE ERIE
AERB STUDY 12243, DR. P.F. HAMBLIN

During the week of July 11 - 15 support was given to Dr. P. Hamblin, AERB and Dr. M. Loewan of the University of Toronto. The area sampled was North Harbour Island Shoal in the Western Basin of Lake Erie.

The purpose of this study was to measure the variations in the water chemistry and chlorophyll caused by the zebra mussel population as a body of water passed over the small reef and the colony.

The support conducted was in the form of several days of Acoustic Doppler Current Profiler (ADCP) profiles over the reef. Each day the transects were run in an southeast-northwest direction followed by a transect in a northeast-southwest direction forming a grid pattern at the end of the passes. On completion of the transects several sites marked by U of T floats were visited and Hydrolab profiles were conducted simultaneously with water sampling from the chartered U of T vessel.

The small launch sampling study was operated from Kingsville. The CSS LIMNOS installed numerous sediment and current meter/transmissometer moorings

throughout the area. The mooring installation was aforementioned in the major ship section of this summary.

SEDIMENT SAMPLING, MOOSONEE
AERB STUDY 12247, DR. J.P. COAKLEY

During the week of July 18 - 22 sediment samples were collected from several sites on the Moose River and its tributaries near the town of Moosonee Ontario. The sampling was in support of Dr. J.P. Coakley, AERB and Ms. T. Puhlman of the University of Guelph. The purpose of the field study was to collect sediment samples from various locations on the river where contaminants could be affecting the water quality of the Moose River as it flows through the Moosonee/Moose Factory area.

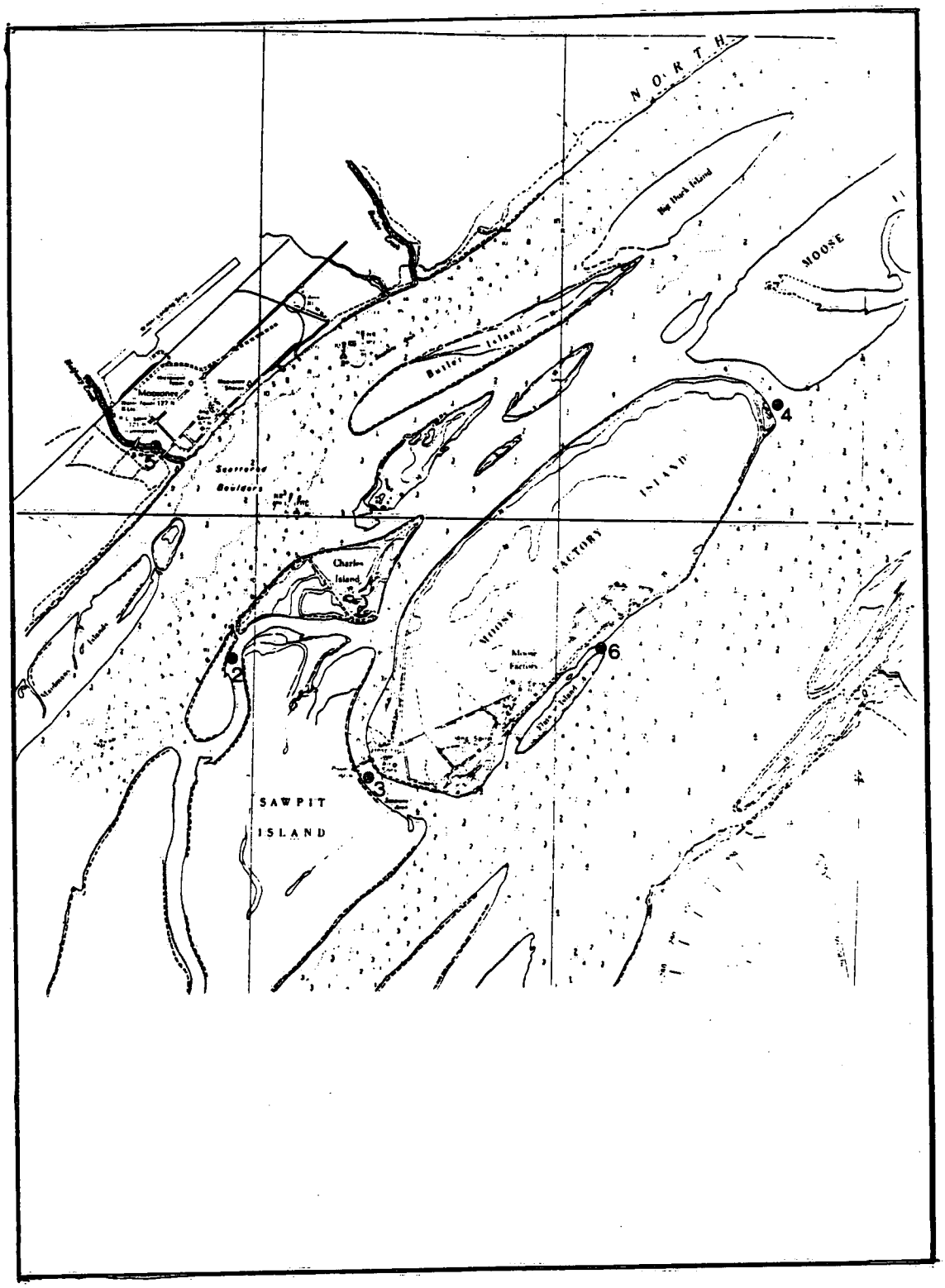
A total of five cores and seven PONAR's were collected throughout the area. The cores were transported to CCIW for subdivision and analysis. The PONAR samples were taken directly to the University of Guelph for further testing. The following copies of Hydrographic charts show the actual positions sampled.

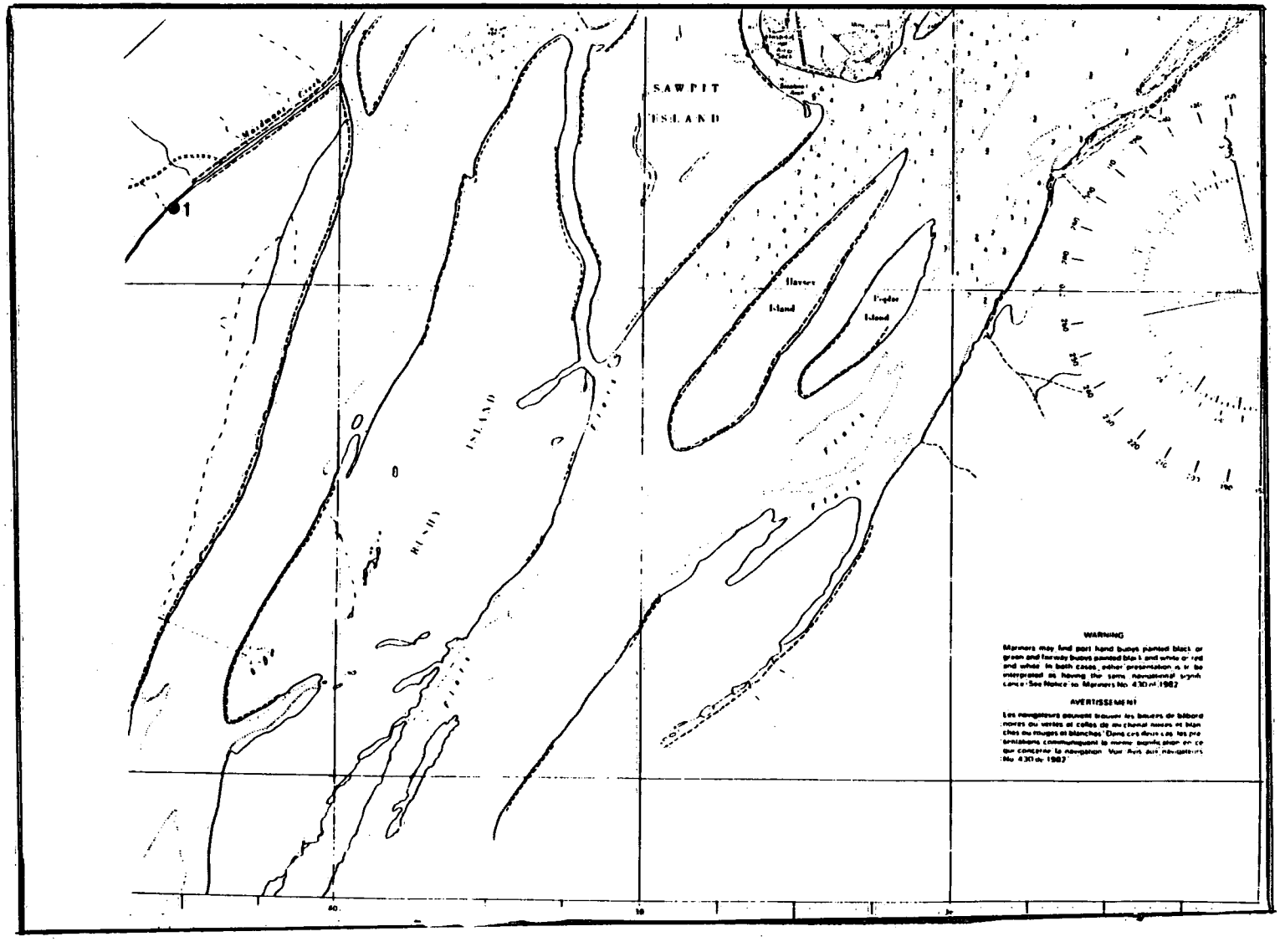
HAMILTON HARBOUR SEDIMENTOLOGY
AERB STUDY 12247, DR. J.P. COAKLEY

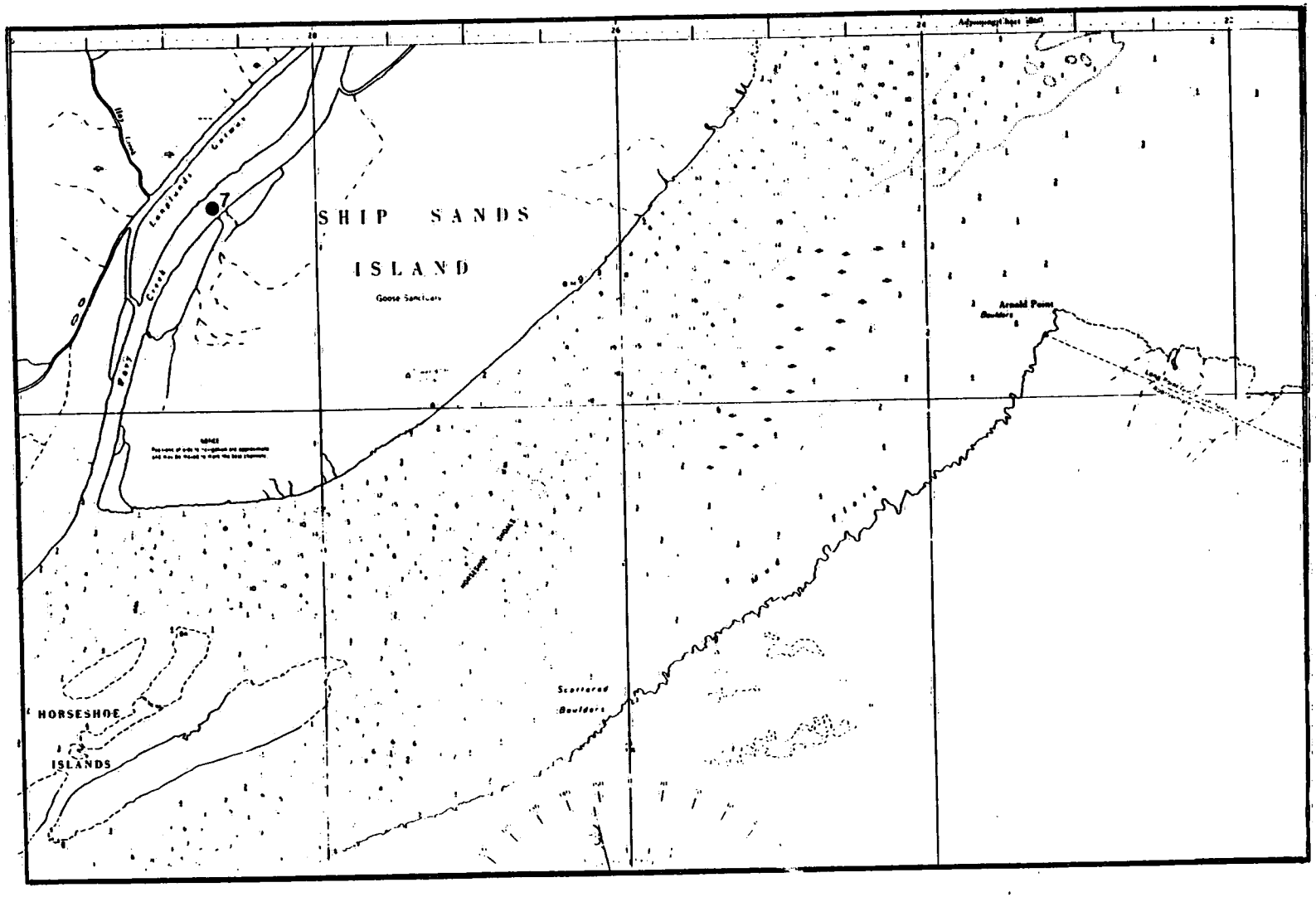
On June 29 and 30, TOS divers collected four hand cores in Hamilton Harbour. The soft substrate required the use of the large stage suspended below the launch PINTAIL about 1 foot above the interface. Divers pushed 2-metre benthos core tubes into the bottom. Using a specially designed core pounder, the core tubes were gently hammered into the bottom. The cores were retrieved using standard methods.

STATION SUMMARY

Outfall Buoy	-	Position:	N 4795411.	E 596722.		
Station JPC94-STP-D1	-	Position:	N 4795402.	E 596725.	Depth:	7.3 m
Station JPC94-STP-D2	-	Position:	N 4795246.	E 596785.	Depth:	7.6 m
Station JPC94-STP-D3	-	Position:	N 4794958.	E 596915.	Depth:	10.0 m
Station JPC94-STP-D4	-	Position:	N 4794053.	E 596098.	Depth:	16.5 m


NORTH
MOOSE
Big Shark Island
Butler Island
Scattered Boulders
Charles Island
FACTORY
ISLAND
Mission Factory
Pine Island
SAWPIT
ISLAND
1
2
3
4
5
6


SAWPIT
ISLAND
Eagles
Island
WARNING
Mariners may find port hand buoys painted black or green and starboard buoys painted black and white or red and white. In both cases, either presentation is to be interpreted as having the same navigational significance. See Notice to Mariners No. 43 of 1982
AVERTISSEMENT
Les navigateurs pourront trouver les bouées de bâbord peintes en noir ou vertes et celles de tribord peintes en blanc et noir ou rouges et blanches. Dans ces deux cas, les présentations communiquent le même signifiant en ce qui concerne la navigation. Voir Avis aux navigateurs No. 43 de 1982


SHIP SANDS
ISLAND
Goose Sanctuary
Arnold Point
Boulders
Scattered
Boulders
HORSESHOE
ISLANDS
7

LAKE ERIE SIDESCAN SURVEY
AERB STUDY 12247, DR. J.P. COAKLEY

This project was part of an EPA study investigating zebra mussels in the Western Basin of Lake Erie. Their objective was to compare sonar data with zebra mussel population.

Assistance was provided to staff from the University of Toronto in the collection of sidescan sonar data. Additional ground truth data such as bottom grab samples and underwater video was collected to compare and verify sonar images. Five days of intensive research was conducted from Kingsville to Pelee Island during the period August 29 to September 2. All sampling was conducted from the U.S. Research Vessel, HYDRA, working out of the Port of Kingsville, Ontario.

BAY OF QUINTE SEDIMENT
AERB STUDY 12248, DR. P.G. MANNING

Sediment dialysis chambers (`peepers') were installed, refurbished and retrieved on two occasions in the Bay of Quinte region. Two moorings were located in Big Bay and the third was located one mile west of the Belleville Bridge. All three single point moorings, with a spar buoy, were held by three pieces of railway track. At each mooring a single, double-chamber peeper was installed by a diver, with the water-sediment interface at chamber number twelve. The first deployment was installed on August 22, refurbished on September 8 and removed on September 22. The second deployment was installed on November 8 and removed on November 18.

STATION POSITIONS

MOORING NUMBER	LATITUDE N.	LONGITUDE W.
94-00S-80A	44° 07' 45"	77° 25' 12"
94-00S-81A	44° 09' 20"	77° 14' 40"
94-00S-82A	44° 08' 46"	77° 17' 06"

DRILLING AT POINT PELEE PARK

GROUNDWATER REMEDIATION PROJECT
AERB Study 12260, K. Novakowski

Technical Operations Section supported the Groundwater Remediation Project throughout the year with one technician permanently assigned with additional personnel as required. It was a very busy and interesting year in Groundwater with many new and ongoing projects.

Clarkson was one ongoing project which required regular monitoring and maintenance. There were also several Point Dilution, Radially Divergent and Natural Gradient tests conducted out of various bore holes at the site.

Clarkson was also the site of a week-long Drilling and Coring seminar conducted by Keith Fickling of Sir Sandford Fleming College. This was attended by three Tech. Ops. personnel and numerous Groundwater people. Tech. Ops. and Groundwater personnel also attended a 40-hour Contaminated Site Health and Safety Course. It is hoped that with these courses and existing experience, a Ministry of Environment and Energy drilling licence or exemption will be obtainable.

Point Pelee was another ongoing project started in 1993 and continued this year. Eighty-one monitoring wells have been installed along two cross-sections and at two septic bed sites. This was part of a joint project between Parks Canada, EHD-OR, AEPB and AERB which is investigating high phosphate concentrations in the marsh. These sites are being monitored and sampled on a regular basis.

A new project this year is AQUEREF (Aquatic Ecosystem Restoration Experimental Facility) which has been installed at the east end of the Hydraulics Lab. Intended to simulate a groundwater remediaton site in sandy soils, it consists of seventy-two mini, multi-level piezometer bundles placed in a 1-foot grid and four 2-inch wells used for pumping and injecting. It is hoped it will be completed by late fall.

Technical Operations will continue to support these projects throughout the winter months.

GROUNDWATER REMEDIATION PROJECT, TRICK CREEK
MINISTRY OF ENVIRONMENT AND ENERGY, JEFF MARCO
AERB STUDY 12260, K. NOVAKOWSKI

Technical Operations Section supported Jeff Marco, MOEE with the continued refurbishing of a temperature logger mooring in the Trick Creek Quarry on County Road #31 east of the Town of Bayfield. A study by the Ontario Ministry of Environment and Energy is planned to determine the effects of the development of this gravel quarry on a nearby trout spawning bed.

Three Brancker loggers were installed on May 11 to replace existing ones and these were replaced October 28. This mooring has been in place since June 1993.

GROUNDWATER REMEDIATION PROJECT, HAMILTON HARBOUR
UNIVERSITY OF WATERLOO, E. HARVEY
AERB STUDY 12260, K. NOVAKOWSKI

Technical Operations staff supported F. Edwin Harvey of the University of Waterloo throughout the year with the installation and monitoring of twenty-five drive point piezometers in Hamilton Harbour. The piezometers were attached to poly balls and yacht club buoys, many of which were removed or sank before winter. Work with the deep lake pressure probe was also done to monitor groundwater pressure differentials. U of W drop hammer piston cores were also attempted with limited success.

The purpose of this project was to attempt to determine the groundwater influx into the harbour for a PhD thesis.

AQUATIC ECOSYSTEM CONSERVATION BRANCH

COASTAL CLIFFS ON CORNWALLIS ISLAND

AMITUK LAKE, NORTHWEST TERRITORIES
AECB STUDY 12315, R.G. SEMKIN

There were two periods in which Technical Operations supported the study at Amituk Lake in the Northwest Territories. The first period ran from May 31 to June 16. The second period was from July 11 to August 31. This period was shared between two staff members with a one-week overlap.

Amituk Lake is located approximately 40 miles northeast of Resolute Bay on Cornwallis Island. The lake, which lies in an east-west direction, is approximately 1.3 km long and drains into Reed Bay on Devon Strait.

The long-term objective of the study is: to quantify mass balances of organic contaminants and specific inorganic substances for the watershed; to investigate and quantify the key biotic and abiotic factors controlling the fate and dynamics of contaminants in an Arctic freshwater system; to utilize the study results from the basin for model development and calibration in order to estimate contaminant transport and flux in larger northern aquatic systems.

The sampling conducted was: coring for snow surveys; collecting sediment cores, collecting surficial sediment samples for benthic organisms; centrifuging large quantities of water for suspended materials and zooplankton; collecting water samples and installing several sediment trap moorings to collect particulates settling out of the water column.

Snow cores (50) were collected for organic and nutrient analysis throughout the watershed, the positions of the sites were logged by AECB personnel and compiled with the data collected last season.

A total of 5 sites were chosen on the lake (see the following chart) for suspended sediments. The sites were on a transit that ran in an east-west direction along the centre axis of the lake. The mooring numbers are as follows: 94-1, 94-2, 94-3, 94-4 and 94-5. 94-1 was located at the eastern end of the lake and the mooring numbers increased from east to west. Each mooring included 2 sets of sediment traps (all tubes are 10 cm diameter). The set depths were 3m and bottom -2m with the exception of mooring 94-3 where a third depth was added at 20 m. 94-3 also included ceramic bowls (for organic analysis) on the bottom of the tubes instead of nalgene cups.

Before installation of the sediment trap moorings, the drilled holes in the ice at the sites were utilized for the collection of sediments and benthic fauna. These samples were collected for the analysis of organics by M. Fox, AERB.

Sediment cores were collected from several sites throughout the lake and either subdivided or stored intact for later studies. Sites sampled were site F, site G, site MH, and site D. For locations, refer to the following bathymetric chart.

Three cores were collected at each site and subdivided into 1 cm sections with the exception of site D where the cores were stored for future reference. The Westfalia centrifuge was utilized to collect suspended sediments and a special attachment was incorporated to collect any zooplankton prior to the plankton

AMITUK LAKE N.W.T.

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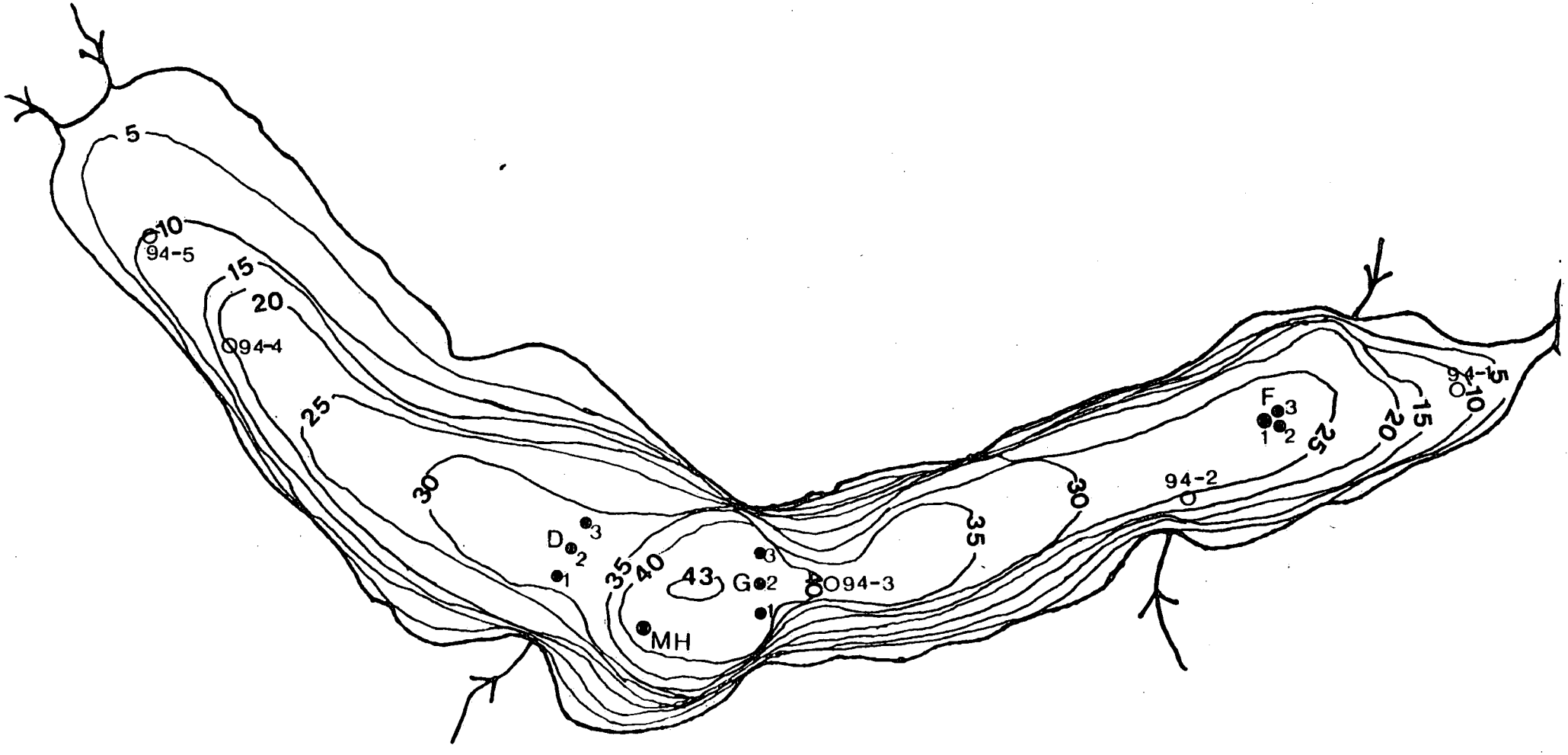
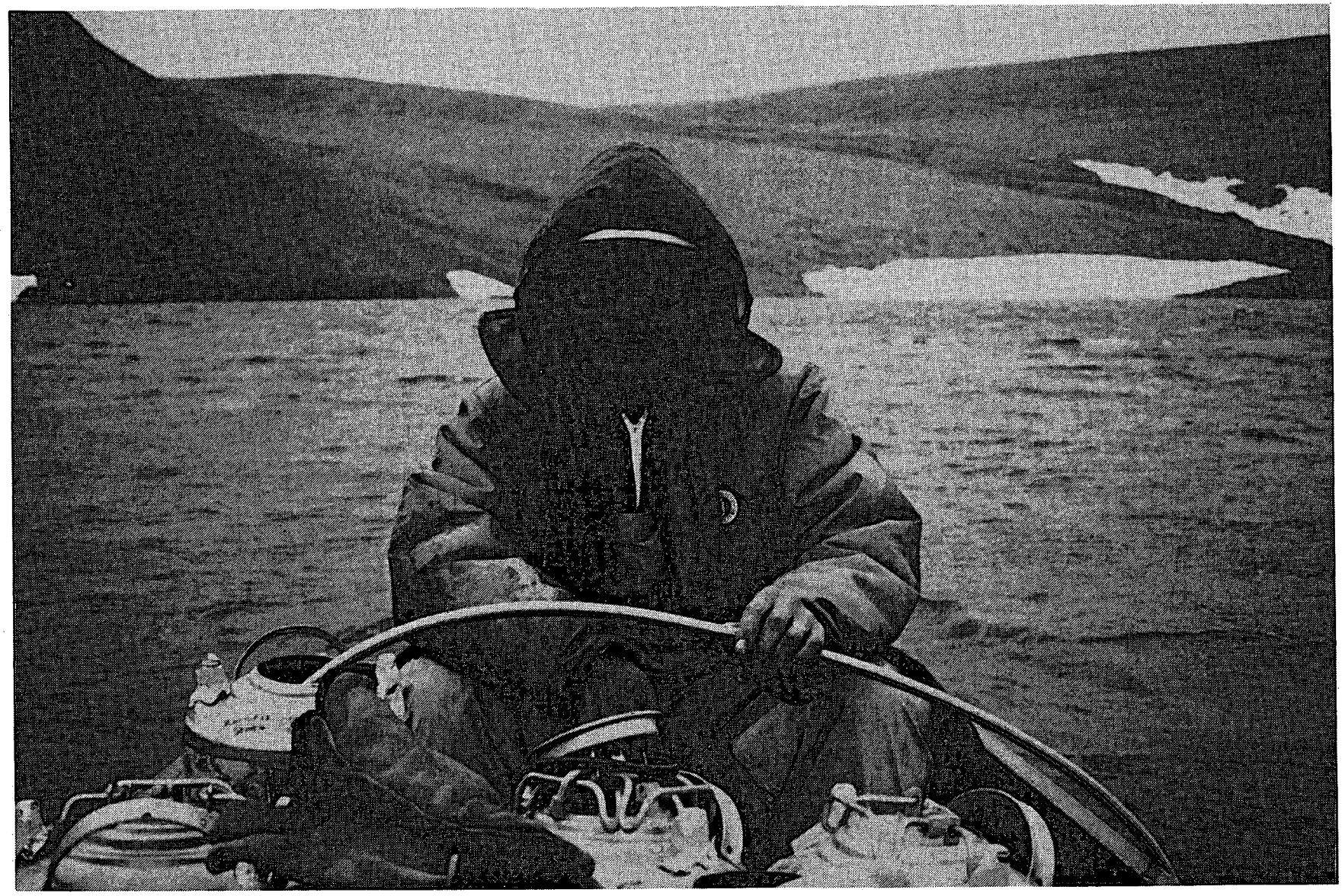


Contour Interval 5 m



COLLECTING WATER FOR ORGANICS EXTRACTION AT AMITUK LAKE

entering the centrifuge bowl. These samples were collected for Dr. M. Hanna, AECB.

Technical Operations Section continued to support this project with field assistance when Mr. J. Kraft travelled to the Amituk study site to relieve R. Semkin and R. Neureuther, who had been working at the site since the setup in early June. Mr. Kraft assisted with the routine sampling and camp operation from July 12 until mid August. The field party during this period consisted of:

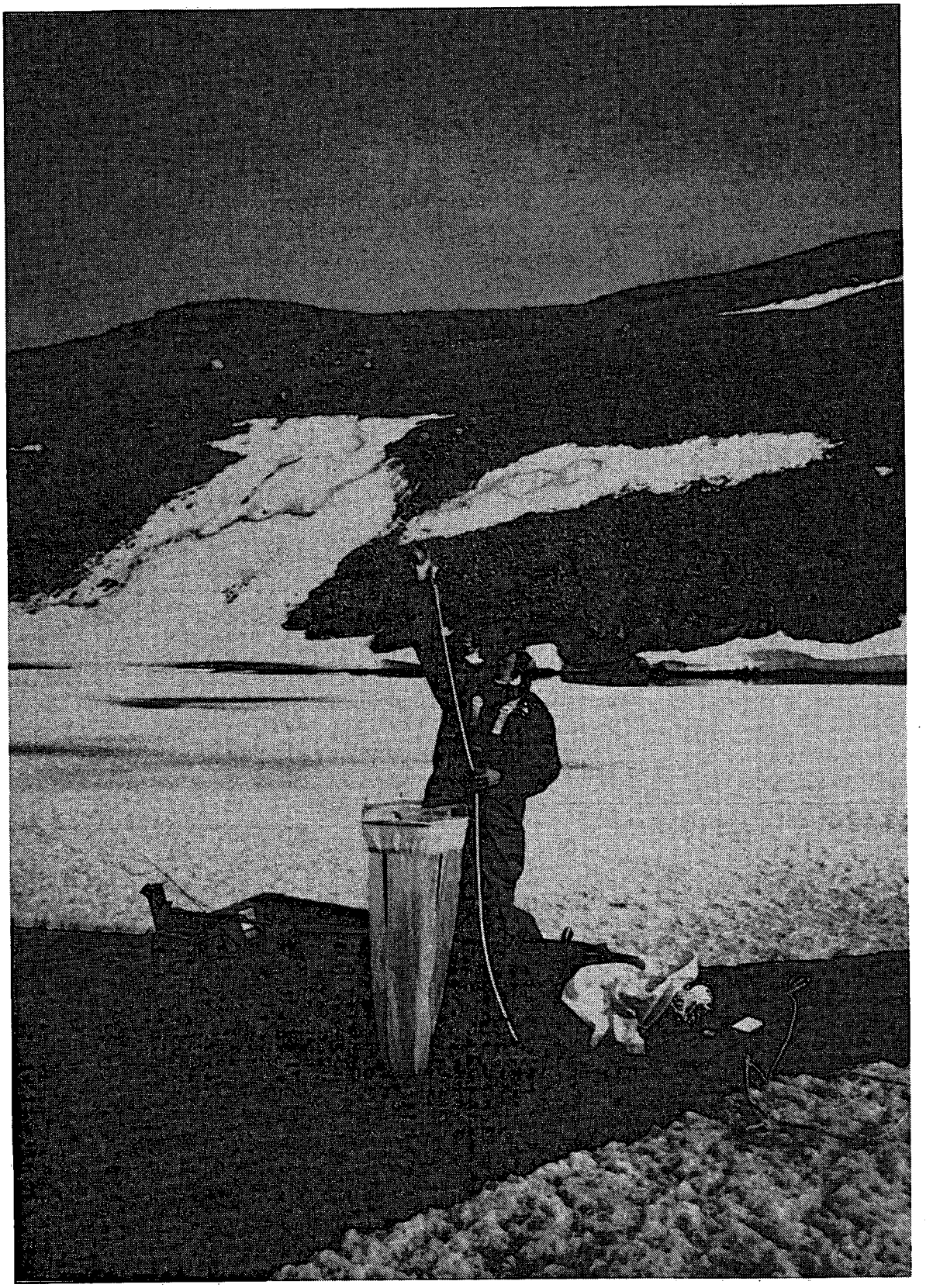
J.A. Kraft	Research Support Branch
Ms. B. Koenig	Under contract with
Ms. J. Gleed	Aquatic Ecology Conservation Branch
Mr. S. Kinney	
Mr. P. Amarualik	

The regular established routine of sampling was carried out continuously during this period. The six streams flowing into the lake were sampled for inorganics and gauged on a daily basis. A stilling well with a Stevens recorder to log water level was maintained at each stream. Samples were collected every other day from these streams for organic contaminants and mercury. Extensive weekly profiles were done at two stations on the lake, at the deep hole and at the east end for water chemistry, D.O., conductivity and organics. Biweekly profiles for mercury, organics and zooplankton (by net haul) were done. Two air samplers were maintained--one at the camp and the other at the far end of the lake. The air filter and puff was changed at the camp sampler every other day and every third day at the far end of the lake. Sediment samples were collected from several sites on the lake and sieved for benthic population studies and contaminant analysis.

Travelling to and from sampling sites was quite difficult. The first lead in the ice cover had just opened July 11. Within a period of several days it became impossible to run the tracked ATV down the length of the lake because of the patches of open water. Since the slopes leading to the plateau above the lake were still snow covered, the Suzuki ATC's could not be used to access the streams on the south side of the lake. This predicament required that most sampling and stream gauging be done by small boat, navigating through the shifting leads in the ice and dragging the boat and equipment across the ice when necessary. By July 22 the snow had melted enough to permit the use of the quad runners for stream gauging and organics sampling but the ice continued to be a problem for lake sampling until August 1 when the last of it melted.

Sampling the lake in most cases proved to be an interesting proposition given the length of the lake and the ineffectual electric outboat motor supplied to power the small cartop boat. The wind in these latitudes can increase dramatically in a matter of minutes and with the fetch available can produce white-capped waves surprisingly quickly. Combine this with the remoteness of the area, the sheer drop of most of the shoreline into the lake and the lack of any means to get to mid-lake quickly in case of an emergency and it would seem that a larger boat (perhaps an inflatable) with a gasoline-powered motor should have been used and would have made life a lot less stressful.

Weather conditions were cooler and wetter than usual for this area. High winds



ZOOPLANKTON COLLECTION AT AMITUK LAKE

and fog occurred most days and near freezing temperatures were the standard fare. The odd sunny day was greatly appreciated and when temperatures did rise to the mid teens it was cause for celebration.

On August 2, Mr. B. Gray from this section and Mr. M. Amyot, Trent University, arrived at the camp by helicopter--Mr. Amyot to conduct mercury analysis and Mr. Gray to take over camp operation after a one-week transition period, until shutdown at the end of August.

On August 9 Mr. Kraft left the camp with Mr. Amyot, who had further studies to conduct in Resolute Bay, departed the Polar Continental Shelf Project the next day and arrived in Burlington a day later.

The aforementioned routine sampling schedule continued until August 23 when camp cleanup and shutdown was initiated.

Abnormally calm weather over a 3-day period allowed 48 hours of centrifuging off Rock Creek. This exercise was unworkable under any other condition than flat calm with the equipment and boats available. This exercise is not recommended in the future.

Sediment traps (with the exception of 94-4) were retrieved on August 23-24 and the last of the samples were processed on August 24.

Visits to and from a geological camp on Sophia Lake provided a welcome break for everyone.

Equipment air lifts (13) ran from August 25 - 27. Remaining gear was packed into the trailer and the camp readied for removal this winter by Polar Continental Shelf Project personnel.

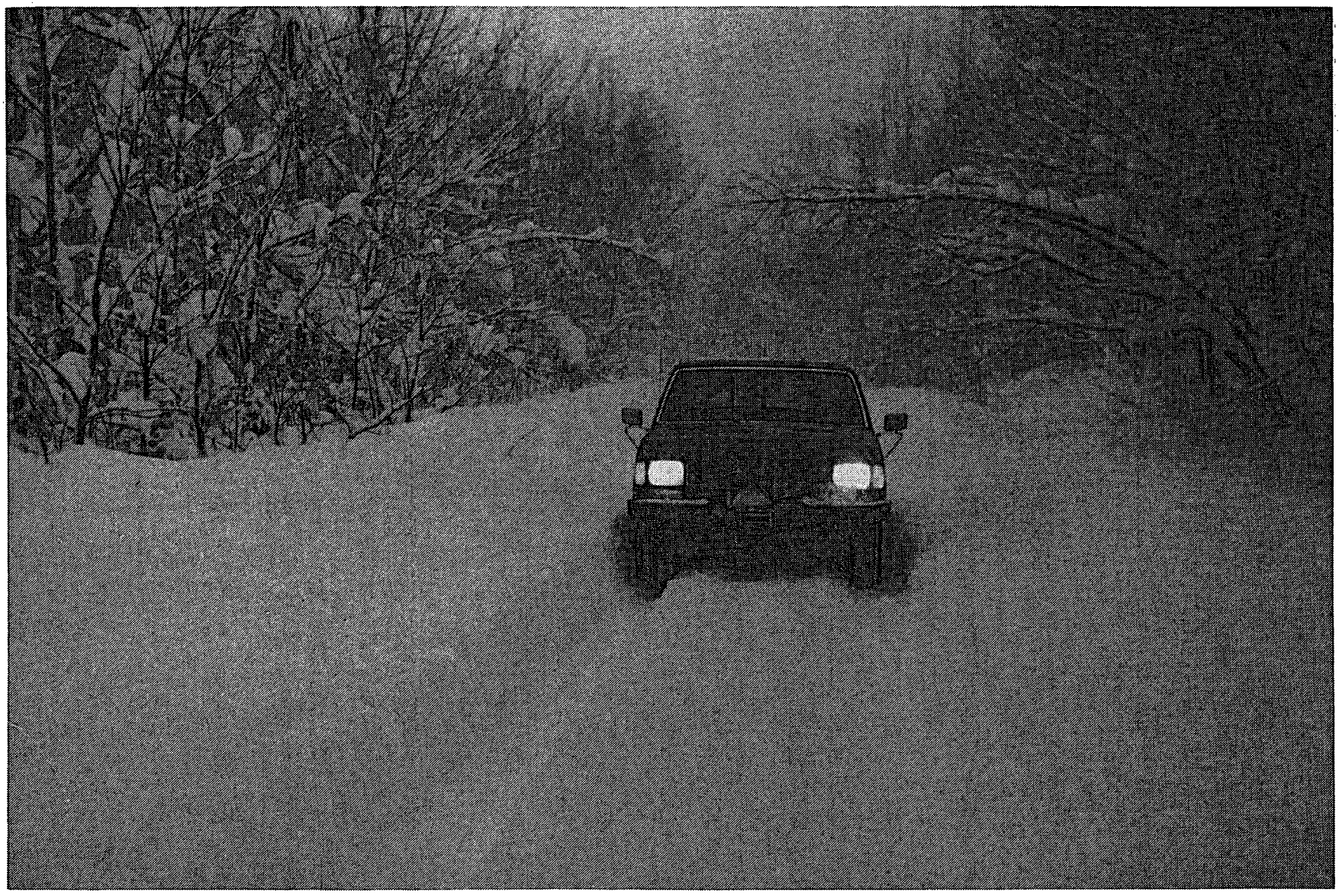
All personnel left the camp by 2000 hours August 27, spent the next 2 days organizing equipment in Resolute and returned to Burlington August 30 - 31.

TURKEY LAKES WATERSHED
AECB LRTAP STUDY 12316, R.G. SEMKIN

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

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

Support consisted of one full-time TOS technician stationed in Sault Ste. Marie.



ON THE WAY TO WORK IN THE TURKEY LAKES WATERSHED

Equipment support included one full-time 4-wheel-drive vehicle used for transport to the study area. A second 4-wheel-drive vehicle was utilized during the winter months. In addition, 4 snowmobiles and 4 all-terrain vehicles were supplied and maintained for use as transportation throughout the watershed. All tools, sampling and safety equipment for the study were also supplied.

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

Department of Fisheries & Oceans support consisted of six small 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 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 fourteen locations on a weekly basis. During the year, rain and snow volume samplers (Nipher) were measured and changed weekly. Isco samplers were installed at two locations in the watershed in early February and operated year round. Samples were collected every twelve hours.

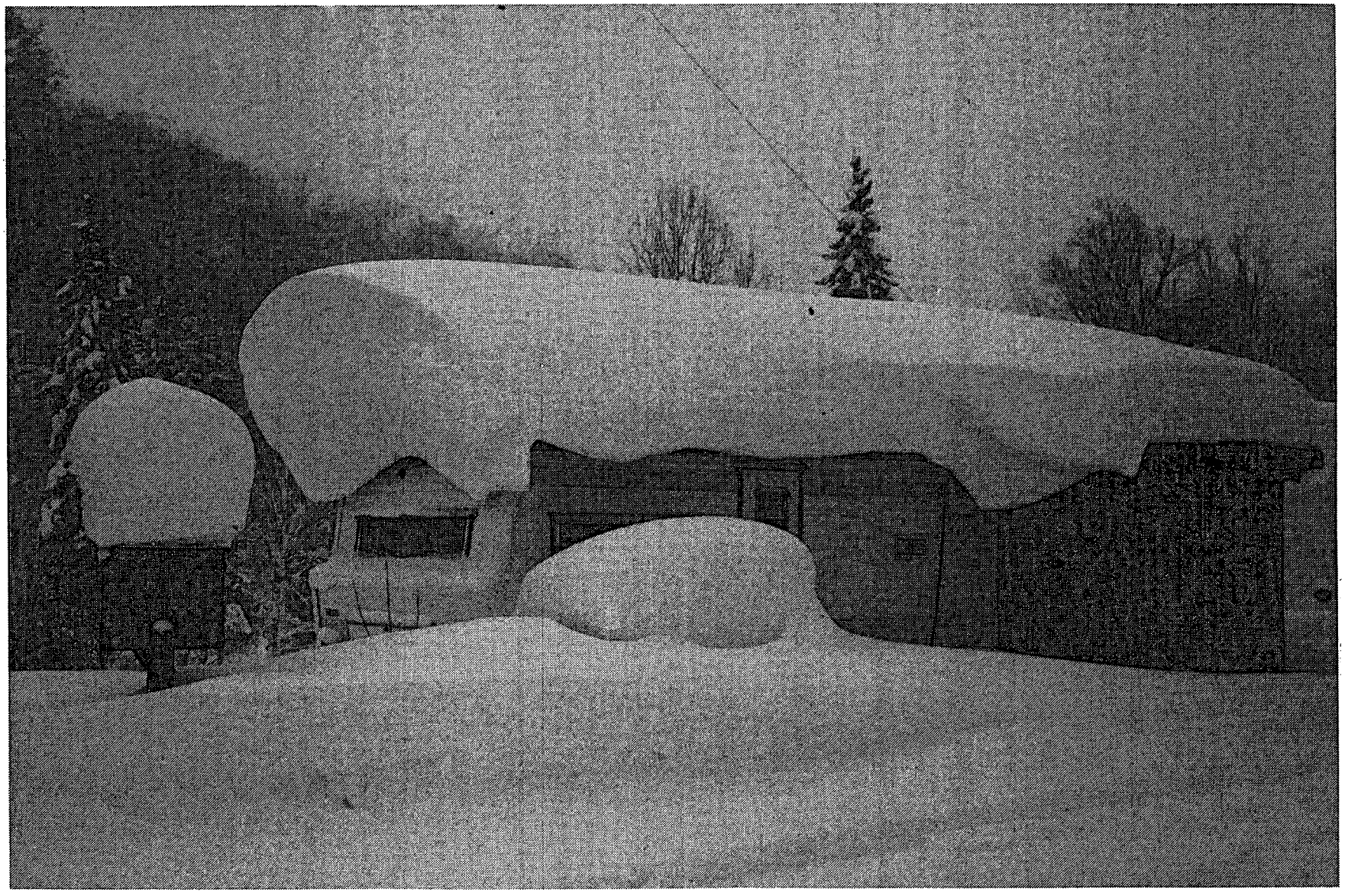
To supplement hydrological and chemical data, a full meteorological station and solar radiation unit were operated on a year round basis. A new MET III system is in operation. This system allows data to be dumped to a disc on site and generates a backup disc. The data disc is shipped to CCIW each month 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.

Additional staff support was provided during the intensive spring run-off period from March to April.

A camper lab has been set up at the Batchawana Lake site for storage of sampling equipment used in the area of the lake and a working space during the intensive run-off period. Solar power was provided to the camper to continuously charge a 12 volt battery which was used to power the furnace and the lights. The camper has been outfitted with dry food supplies, a portable cooking stove, candles, matches and a solar blanket which can be used in emergency situations.

A number of additional tasks have been added to the project. These include:

1. A monitoring station for soil temperatures, soil moisture and air temperature at the Batchawana lakes which utilizes a Campbell datalogger and storage can. The system is monitored and data processed by Tech. Ops. staff



TURKEY LAKES SURVIVAL TRAILER IN WINTER

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

3. A snow melt cave constructed at the Batchawana Lake location has been put into service. Samples were collected by an automatic Isco sampler powered by a solar power panel during spring run-off conditions. In addition, at this same location, a bulk precipitation sampler was installed and serviced year round on a weekly basis

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. During the summer months all snow bridges in the watershed were repaired and some rebuilt.

The large concrete weir at stream site S3 was removed and replaced since it was deteriorating and affecting the rating curve of this location.

Numerous research staff from the University of Toronto were once again working in the watershed this past summer. Accommodations for personnel were provided at the camp and ATC's were loaned to travel throughout the watershed. All their work and support was co-ordinated through Technical Operations on site.

ENVIRONMENTAL EFFECTS OF PULP MILL EFFLUENT
AECB STUDY 12340, DR. P. HODSON

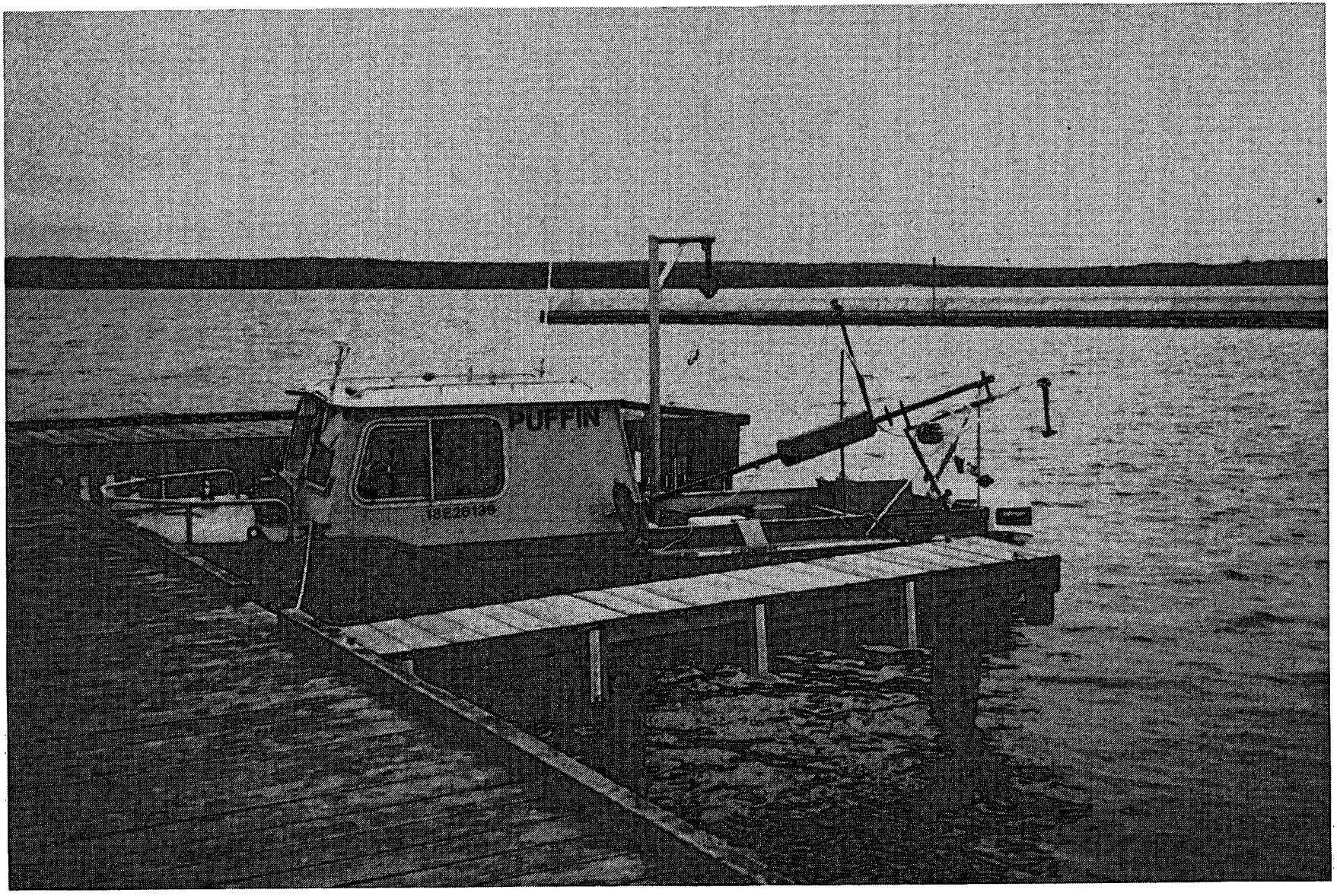
Technical Operations staff supported Dr. P. Hodson, AECB with the MEE survey of the Saint John River near Edmundston, N.B. from September 18 to October 3.

Fish, benthic and SPMD studies were conducted. Fishing was carried out using various sized gill nets and an electro-fishing boat. Fish were processed in a mobile lab which was set up under a tarp between two vans. Approximately one thousand white sucker, perch and trout were processed.

SPMD's were installed for Dr. J. Parrot at various locations in the mill and river on both Canadian and U.S. sides. The SPMD's were strung in chicken BBQ baskets and hung in tanks in the mill or tie-wrapped to steel reinforcing rods driven into the river bed.

REFINERY EFFLUENT STUDY
AECB STUDY 12350, DR. B. SCOTT

The purpose of this study is to provide input to the Municipal Industrial Sewage Abatement program (MISA). Results of the analysis could be used to determine any



SPECTROPHOTOMETER BUOY MOUNTED ON THE CSL PUFFIN

changes in allowable discharges. On several occasions during the winter, effluent water from two Petro Canada refineries in Oakville and Clarkson, Ontario was collected. Two field trips were made to the Shell Refinery in Sarnia, Ontario.

At each site, water was collected for analysis of various organic compounds, including ammonia. Bulk samples were delivered to B.A.R. Environmental for toxicity testing and bioassays.

REMOTE SENSING, NORTHERN SASKATCHEWAN
AECB STUDY 12371, DR. R. BUKATA

Technical Operations staff supported this project twice during the 1994 field season. The trips were made between May 18 - June 10 and July 14 - August 1. Three lakes were sampled on each trip--Waskesiu, Candle and Christopher.

The objective of the Boreal atmospheric study is to provide preliminary ecological details of the study areas. A carbon budget of the Boreal lakes is the objective of the five spectrophotometers used in the field. The software used to run the spectrophotometers is called the WATERS Program. The five spectrophotometers measured the following: downwelling irradiance above and below the surface, upwelling irradiance in the water, and upwelling radiance above and below the surface of the water. From the data collected an attempt was made to determine the colour of the water which consists of chlorophyll, solids and DOC. From the colour of the water these three concentrations can be obtained and from them, other measurable parameters.

The following sampling was completed on all lakes on both trips:

1. GPS fixes on and off station
2. EBTT profile
3. GPS fixes on deployed buoy upon entering and exiting the water
4. Secchi disc measurement
5. Bucket thermometer reading
6. Van Dorn water sample from 2 metres

The five spectrophotometers were mounted on the buoy during sampling. Each spectrophotometer contained 5 spectrums which measured approximately 400 different wavelengths. On each station the spectrophotometers took 10 consecutive samples which were later averaged. The water collected was filtered for chlorophyll, seston and dissolved organic carbon. Raw water samples were also run through the UV analyzer which measured the absorption and scattering of molecules in the visible light spectrum.

A total of 38 stations on Waskesiu Lake, 50 stations on Candle Lake and 12 stations on Christopher Lake were visited. Lists of station positions follow.

STATION POSITIONS

1st TRIP

CANDLE LAKE

STATION NUMBER	NORTHING	EASTING	LATITUDE N.	LONGITUDE W.
CAX1	5957150	489000	53° 45' 53"	105° 10' 01"
CAX2	5957765	488225	53° 46' 13"	105° 10' 43"
CAX3	5958715	487060	53° 46' 44"	105° 11' 47"
CAX4	5959975	485480	53° 47' 24"	105° 13' 13"
CAX5	5961235	483920	53° 48' 05"	105° 14' 39"
CAX6	5962500	482365	53° 48' 46"	105° 16' 04"
CAX7	5963490	481135	53° 49' 18"	105° 17' 12"
CAX8	5964750	479575	53° 49' 58"	105° 18' 37"
CAX9	5966000	478015	53° 50' 38"	105° 20' 03"
CAX10	5967260	476460	53° 51' 19"	105° 21' 28"
CAX11	5968225	475250	53° 51' 50"	105° 22' 35"
CAX12	5968850	474475	53° 52' 10"	105° 23' 17"
CAY1	5956900	482200	53° 45' 45"	105° 16' 12"
CAY2	5958415	481960	53° 46' 34"	105° 16' 25"
CAY3	5960410	481635	53° 47' 38"	105° 16' 44"
CAZ1	5968190	481470	53° 51' 50"	105° 16' 54"
CAZ2	5967750	480520	53° 51' 35"	105° 17' 46"
CAZ3	5967100	479150	53° 51' 14"	105° 19' 01"
CAZ4	5966225	477275	53° 50' 46"	105° 20' 43"
CAZ5	5965450	475400	53° 50' 20"	105° 22' 26"
CAZ6	5964710	474035	53° 49' 56"	105° 23' 40"
CAZ7	5964280	473120	53° 49' 42"	105° 24' 30"

CHRISTOPHER LAKE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
CH01	53° 32' 51"	105° 49' 24"
CH02	53° 32' 57"	105° 48' 59"
CH03	53° 33' 32"	105° 49' 01"
CH04	53° 34' 37"	105° 49' 52"
CH05	53° 34' 15"	105° 50' 19"
CH06	53° 33' 25"	105° 49' 56"

WASKESIU LAKE

STATION NUMBER	NORTHING	EASTING	LATITUDE N.	LONGITUDE W.
WAX1	5976565	428715	53° 56' 04"	106° 05' 09"
WAX2	5976985	427815	53° 56' 17"	106° 05' 58"
WAX3	5977800	426025	53° 56' 43"	106° 07' 37"
WAX4	5978850	423710	53° 57' 16"	106° 09' 45"
WAX5	5979860	421465	53° 57' 47"	106° 11' 49"
WAX6	5980900	419165	53° 58' 19"	106° 13' 56"
WAX7	5981925	416900	53° 58' 51"	106° 16' 02"
WAX8	5982580	415470	53° 59' 12"	106° 17' 21"
WAX9	5983585	413250	53° 59' 43"	106° 19' 24"
WAX10	5984400	411000	54° 00' 08"	106° 21' 28"
WAX11	5985415	408750	54° 00' 39"	106° 23' 33"
WAX12	5986240	406935	54° 01' 05"	106° 25' 13"
WAY1	5973635	423425	53° 54' 27"	106° 09' 56"
WAY2	5974625	423475	53° 54' 59"	106° 09' 54"
WAY3	5976115	423560	53° 55' 47"	106° 09' 51"
WAY4	5977450	423625	53° 56' 30"	106° 09' 49"
WAY5	5978850	423710	53° 57' 16"	106° 09' 45"
WAY6	5980250	423785	53° 58' 01"	106° 09' 42"
WAY7	5981275	423835	53° 58' 34"	106° 09' 41"

CANDLE LAKE

2nd TRIP

STATION NUMBER	NORTHING	EASTING	LATITUDE N.	LONGITUDE W.
CAX1	5957150	489000	53° 45' 53"	105° 10' 01"
CAX2	5957765	488225	53° 46' 13"	105° 10' 43"
CAX3	5857615	476959	53° 46' 44"	105° 11' 47"
CAX4	5959975	485480	53° 47' 24"	105° 13' 13"
CAX5	5961235	483920	53° 48' 05"	105° 14' 39"
CAX6	5962500	482365	53° 48' 46"	105° 16' 04"
CAX7	5963490	481135	53° 49' 18"	105° 17' 12"
CAX8	5964750	479575	53° 49' 58"	105° 18' 37"
CAX9	5966000	478015	53° 50' 38"	105° 20' 03"
CAX10	5967260	476460	53° 51' 19"	105° 21' 28"
CAX11	5968225	475250	53° 51' 50"	105° 22' 35"
CAX12	5968850	474475	53° 51' 10"	105° 23' 17"
CAY1	5956900	482200	53° 45' 45"	105° 16' 12"
CAY2	5958415	481960	53° 46' 34"	105° 16' 25"
CAY3	5960410	481635	53° 47' 38"	105° 16' 44"
CAY4	5962400	481310	53° 48' 42"	105° 17' 02"
CAY5	5964285	481000	53° 49' 43"	105° 17' 19"
CAY6	5966250	480675	53° 50' 47"	105° 17' 37"
CAY7	5968240	480360	53° 51' 51"	105° 17' 55"
CAY8	5970230	480035	53° 52' 56"	105° 18' 13"
CAY9	5971725	479775	53° 53' 44"	105° 18' 28"
CAZ1	5968190	482470	53° 51' 50"	105° 16' 54"
CAZ2	5967750	480520	53° 51' 35"	105° 17' 46"
CAZ3	5967100	479150	53° 51' 14"	105° 19' 01"
CAZ4	5966225	477275	53° 50' 46"	105° 20' 43"
CAZ5	5965450	475400	53° 50' 20"	105° 22' 26"
CAZ6	5964710	474035	53° 49' 56"	105° 23' 40"
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WASKESIU LAKE

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WAX4	5978850	423710	53° 57' 16"	106° 09' 45"
WAX5	5979860	421465	53° 57' 47"	106° 11' 49"
WAX6	5980900	419165	53° 58' 19"	106° 13' 56"
WAX7	5981925	416900	53° 58' 51"	106° 16' 02"
WAX8	5982580	415470	53° 59' 12"	106° 17' 21"
WAX9	5983585	413250	53° 59' 43"	106° 19' 24"
WAX10	5984400	411000	54° 00' 08"	106° 21' 28"
WAX11	598415	408750	54° 00' 39"	106° 23' 33"
WAX12	5986240	406935	54° 01' 05"	106° 25' 13"
WAY1	5973635	423425	53° 54' 27"	106° 09' 56"
WAY2	5974625	423475	53° 54' 59"	106° 09' 54"
WAY3	5976115	423560	53° 55' 47"	106° 09' 51"
WAY4	5977450	423625	53° 56' 30"	106° 09' 49"
WAY5	5978850	423710	53° 57' 16"	106° 09' 45"
WAY6	5980250	423785	53° 58' 01"	106° 09' 42"
WAY7	5981275	423835	53° 58' 34"	106° 09' 41"

CHRISTOPHER LAKE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
CH1	53° 35' 06"	105° 49' 54"
CH2	53° 34' 06"	105° 49' 36"
CH3	53° 33' 30"	105° 49' 42"
CH4	53° 33' 24"	105° 48' 36"
CH5	53° 33' 06"	105° 48' 54"
CH6	53° 33' 00"	105° 49' 24"

SEDIMENT CORING
AECB STUDY 12373, DR. L.D. DELORME

Sediment cores were collected for Dr. Delorme at 2 locations--Long Point Bay, Lake Erie and at 3 small lakes in Southern Saskatchewan.

Cores were collected in Long Point Bay during the period of June 6 - 9. A short core--70 cm, was collected from Big Creek Marsh from a 14-foot aluminum boat. Two long cores--137 and 140 cm, were taken from a nearshore area of the bay south of the mouth of Big Creek. Cores were collected using two boats with a platform between and scaffolding erected on the platform. All cores were extruded in 1 cm slices after collection.

CORING POSITIONS

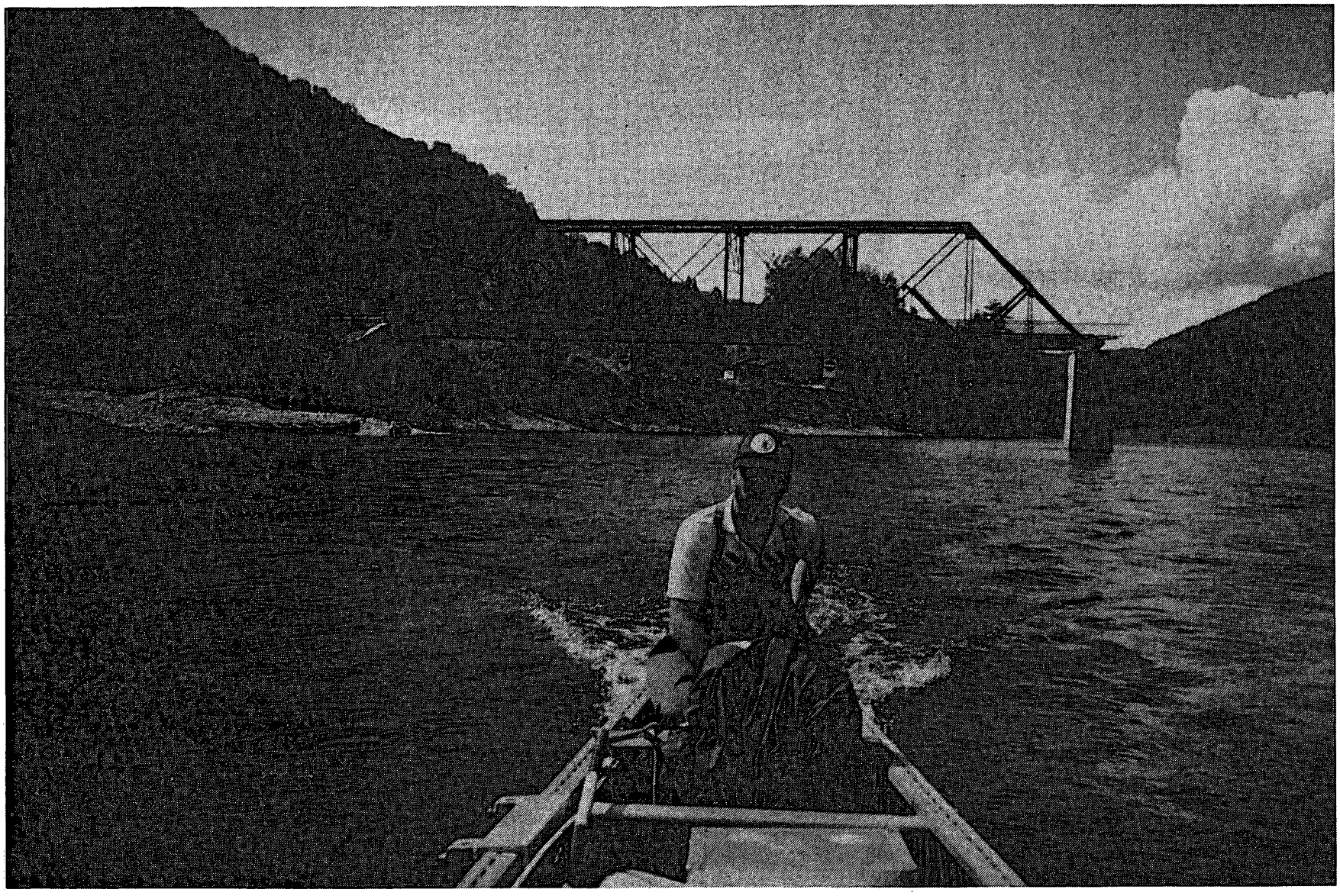
LONG POINT

LOCATION	LATITUDE N.	LONGITUDE W.
Big Marsh Creek	42° 35.764'	80° 27.594'
Long Pt. Bay Core 1	42° 36.132'	80° 26.266'
Long Pt. Bay Core 2	42° 35.679'	80° 26.415'

Coring in Saskatchewan was done during the period of February 7 - 13 in association with Dr. R.E. Vance, Geological Survey of Canada. Cores were collected using a 10 cm Tech. Ops. corer. Cores were obtained from Kenosee Lake at Moose Mountain Provincial Park east of Regina. Two cores were obtained and sectioned in 1 cm slices in a Park building. Three cores were obtained from Clearwater Lake north of Swift Current and two cores were obtained from Antelope Lake west of Swift Current. These cores were extruded in 1 cm slices in the hotel room. Sections from one core from each site were returned to CCIW for analysis. The remaining core sections were retained by Geological Survey of Canada.

HAMILTON HARBOUR
AECB STUDY 12376, F.M. BOYCE

Two meteorological rafts, constructed in the TOS shop, were placed in Cootes Paradise on May 25 and removed October 27. Data collected will be used in support of a fish rehabilitation study being done in conjunction with McMaster University.



AN ICE-DAMAGED BRIDGE ON THE MATAPEDIA RIVER

MOORING POSITIONS

MOORING NUMBER	LATITUDE N.	LONGITUDE W.
94-00M-14	43° 16' 41.5"	79° 53' 59"
94-00M-15	43° 16' 26"	79° 54' 41"

ICE JAM STUDIES, NEW BRUNSWICK
ACEB STUDY 12382, DR. S. BELTAOS

Two field trips to New Brunswick were made to study ice jams on the Saint John River. During the spring trip, a major jam formed on the Matapedia River in Quebec--a tributary of the Restigouche River near Campbellton, New Brunswick. This jam took off half a bridge and caused considerable damage along the banks, especially in the town of Matapedia.

The first trip started April 20. This year, the combination of a warm and sunny day followed by a rainy day, made for rapid occurrence as far as jams are concerned. The water level at Clair rose 3.36 m in less than 12 hours. A small dam upstream of Clair was formed and investigated during the spring and summer trip. Since no major jam had occurred on the Saint John River, Dr. Beltaos and Mr. Brian Burrel of the N.B. Ministry of Environment focused their attention on the Restigouche and Matapedia rivers. Several cross-sections were located on the Matapedia River and surveyed during the second trip.

The second trip was slated for the end of June. Because of a scheduling conflict, it was moved to the period of July 11 - 22. Tech. Ops. staff supported this project at Clair, N.B. for 1 week when 5 cross-sections and some levelling was done and at Campbellton, N.B. the second week to work on the Matapedia River. At that location 10 cross-sections and approximately 10 km were surveyed.

As in the past, the levelling was done with the Wild NA 2000, the Pentax levels and the T1600/DI3000 for cross-sectioning. The 26' canoe was used. A smaller 14' aluminum canoe was taken to replace the big canoe if the water had been too low, especially on the Matapedia River.

WAVES TOWER
AECB STUDY 12384, DR. M.A. DONELAN

WAVES tower operations began in mid-April with the construction of a new ladder

and supports to replace the one damaged by winter ice. In a joint effort by Engineering and Technical Operations staff, the ladder was installed and other repairs were made, such as putting the D.A.S. box back on its mounts and welding deck plates that had come loose. TOS divers dove on the tower base to inspect welds and scrap zebra mussels from mounting plates. Tech. Ops. and Rondar staff repaired the lights and electrical power to the D.A.S. box.

The week of May 2 - 6, Dr. David Long from Bigham Young University in Utah, U.S.A. and three of his staff--Dr. Dave Arnold, Ryan Reed and Scott Collyer, arrived to set up microwave equipment for collecting data on wave characteristics for comparison to data collected from remote earth sensing satellites during flights over bodies of water. Major funding for this project came from NASA. Dr. Donelan had arranged for the use of the tower for this project. Equipment was set up by Technical Operations and Engineering staff, utilizing the barge, GOOSE II and the launch, WAGTAIL. Approximately 2000 kg of equipment was installed during this period.

On June 3, TOS divers dove to the tower base to install the wave staffs and water temperature sensor and a 1/2" diameter cable with a bumper to serve as a mooring point for small launches.

Weekly support was provided to this project, changing data tapes from the two computers on the tower with a quick visual inspection of the equipment. Due to minor problems with their electronics, Brigham Young University staff returned to the tower twice all summer.

The week of June 27 a fresh coat of yellow paint was applied to the main structure of the tower.

A sediment trap placed on the tower for M.N. Charlton May 13 was removed in mid-September.

The week of November 28 was scheduled for cleanup. The weather did not co-operate for the first two days and tower access was impossible. On November 30, Engineering and Tech. Ops. staff as well as Ryan Reed and Bryan Jarrett from BYU travelled to the tower with the GOOSE II and WAGTAIL to remove the equipment for the winter. On December 1 the access ladder was removed and the tower winterized.

WAVES STUDIES, WESTERN LAKE ONTARIO
AECB STUDY 12384, DR. M.A. DONELAN

This study focused on the measurement of kinetic energy at the near surface wave zone which has important consequences for many physical and chemical processes including wave dynamics, gas transfer and the fate of nutrients and pollutants. The objectives are to measure the rate of dissipation in Lake Ontario at depths of 0 to 6 metres under various conditions which include low, moderate and strong wind speeds, air-water temperature differences up to 15°C and wave heights of up to 1.5 m.

The launch, AGILE was utilized for this survey throughout the season. A bowsprit was constructed with an adjustable mast to mount the instrumentation. The onboard equipment consisted of an ultrasonic anemometer, high frequency thermocouples, mean temperature and humidity sensors, a vessel motion sensor package, three wave staffs, a hot film velocity component sensor and acoustic current meters. A Licor carbon dioxide analyzer was used as part of an experiment studying the exchange and interaction of gases between water and the atmosphere. The Acoustic Doppler Current Profiler (ADCP) was mounted on the starboard side of the vessel. A differential global positioning system was used to record the boat's speed and position.

AQUATIC ECOLOGY PROTECTION BRANCH

TRIBUTYLTIN SURVEY
AEPB STUDY 12421, DR. R.J. MAGUIRE

Technical Operations supported this study on various occasions with personnel, vehicles and the necessary sampling equipment. A small boat--usually a Mason, was trailered to the various sites. Sediment samples were taken at each site using a PONAR dredge as well as 4ℓ surface water samples.

The survey was designed to determine the effects of 1989 regulations on Tributyltin which eliminated their use on boats under 25 metres in length. The survey was combined with ongoing studies of industrial effluent, sewage treatment plants and other industrial uses.

Sampling occurred between May 30 and June 3 when 27 sites were visited in Southern Georgian Bay, along the St. Clair and Detroit rivers and along the north shore of Lake Erie from Amherstburg to Fort Erie. Sampling was also completed between June 6 and 10 when twelve sites were sampled in Lake Superior at Thunder Bay, Marathon, Terrace Bay and Sault Ste. Marie. During the week of June 13 to 17, sites along the St. Lawrence River from Sorel, Quebec to Kingston, Ontario were sampled and the following week--June 20 to 24, sites between Kingston and Toronto, Ontario were sampled. Sites in Toronto Harbour, Hamilton Harbour and the Niagara Peninsula were sampled as day trips from CCIW on later dates.

REMEDIAL ACTION STRATEGIES, CORNWALL
AEPB STUDY 12423, J. SMITH

The purpose of this study was to collect samples for the development of a remedial action strategy for the restoration of a contaminated site in the Cornwall, Ontario/Mesenna, N.Y. area of the St. Lawrence River.

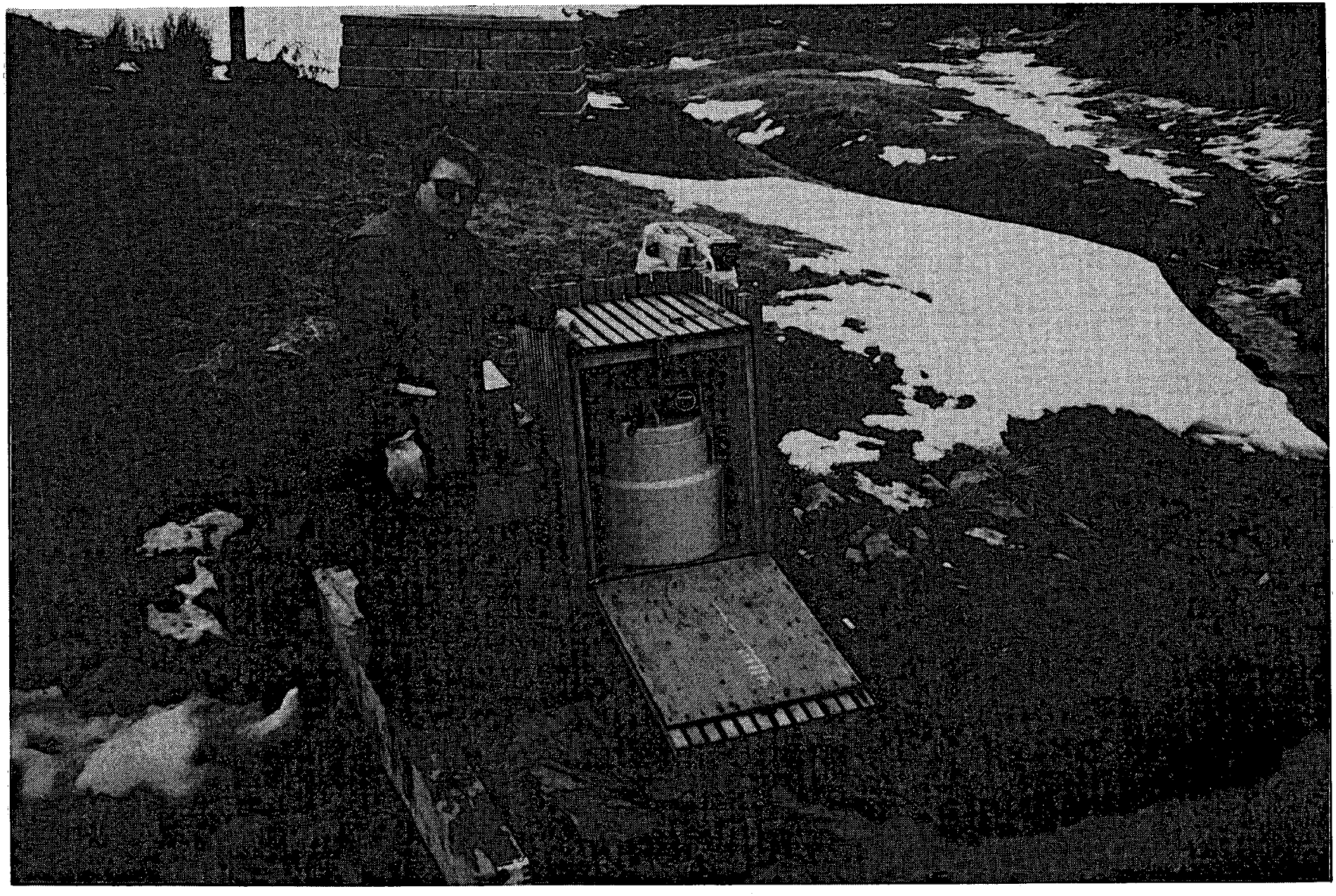
The single trip this year was conducted in July and the sampling occurred at the outfall of the Reynolds Aluminum plant on the American side of the river. Sampling was completed utilizing the following methods:

1. A Van Dorn bottle cast to bottom -.5 m for alkalinity, total phosphorus and nutrients.

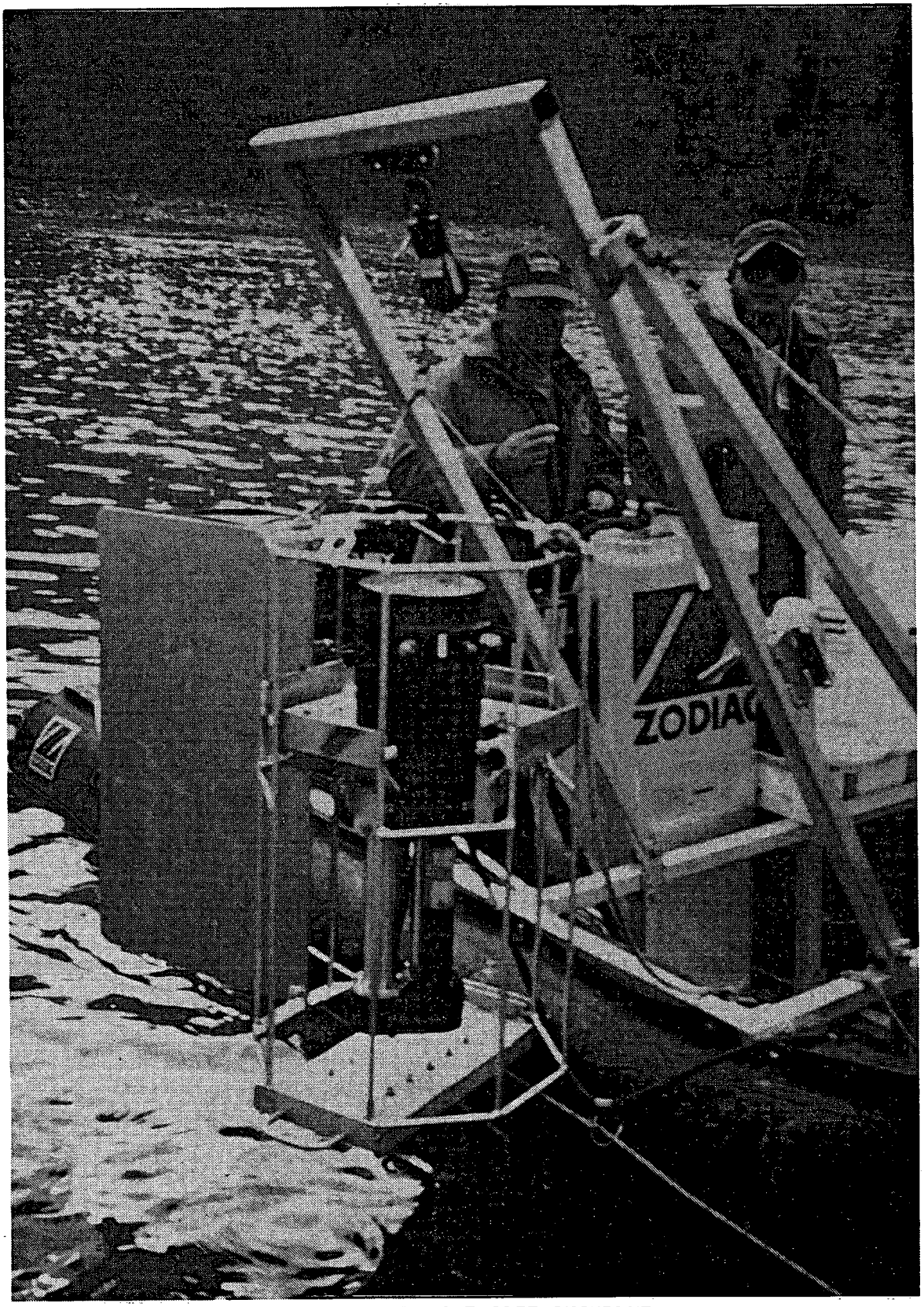
2. A Hydrolab profile to bottom for measurements of oxygen, conductivity, pH, temperature and depth.

3. Replicate bioassey samples were collected using PONAR grab samples. Each bioassay sample included 20ℓ of sediment. Ten samples were collected--five buckets from C9 and seven buckets from B2.

Station B2 position was approximately 49812355 North and 519585.0 East or 10 metres upstream of the cooling water outfall.



SIGMA WATER SAMPLER AT THE KINGSTON POND



THE MALVERN PARTICLE SIZE INSTRUMENT

READY FOR DEPLOYMENT

URBAN RUN-OFF RETENTION PONDS
AEPB STUDY 12441, DR. J. MARSALEK

Technical Operations Section staff supported this study with field support at a run-off retention pond behind Cataraqui Mall in Kingston, Ontario and at the sediment collection basin at Lake Aquitaine in Mississauga, Ontario.

In March a Hydrolab, three OBS probes and one Brancker conductivity logger were installed in the pond through the ice. Two Sigma water samplers were set up and all electronics were monitored and put in order for the coming season.

In April a series of current profiles were done at the Kingston site using the Minilab SD-12 ultrasonic current meter mounted on a stream gauging current meter rod. Current measurements were made along five transects at 15 metre intervals by placing the rod on the bottom and taking readings at several depths by sliding the current meter up and down the rod. A dye tracer experiment was done at this time to track the flow pattern through the pond. Rhodamine dye and a fluorometer were used to track the flow as well as visual observations.

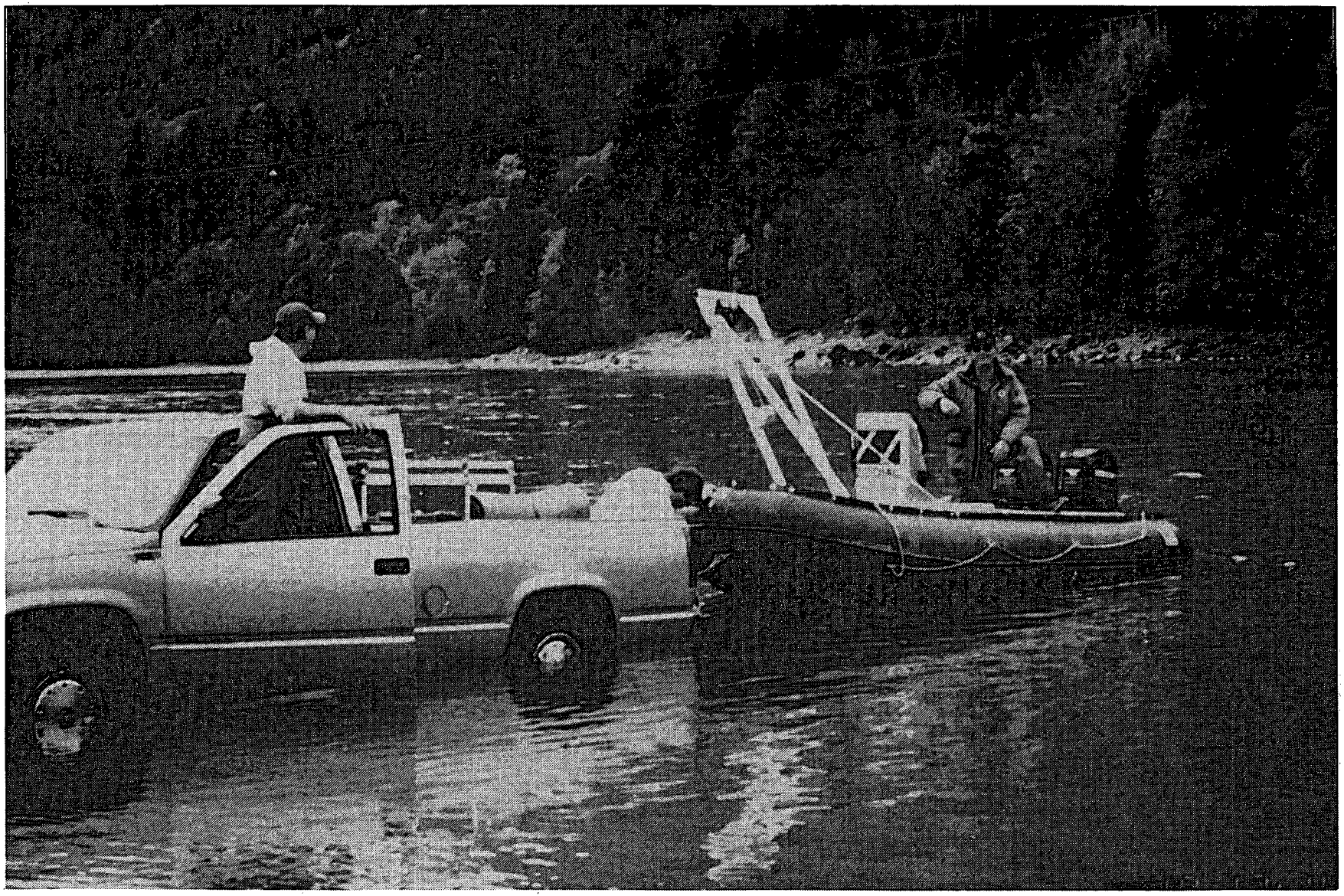
A visit was made to the pond in late November when five sites were sampled by Westfalia separator for suspended sediment and all data loggers were removed. All of the sampling equipment used on the site during the season was retrieved and returned to Burlington at this time.

At Lake Aquitaine, sediment samples were required prior to the removal of the accumulated settlings filling this basin. Although sediment removal had been largely completed before the sampling could be done, a representative sampling of five sites along the east wall of the basin was done. At each site a benthos push core was collected, a 2 kg sample of surface sediment was placed in a plastic bag and two 250 ml glass jars were filled. The samples were returned to Burlington and shared with Ontario Ministry of the Environment personnel.

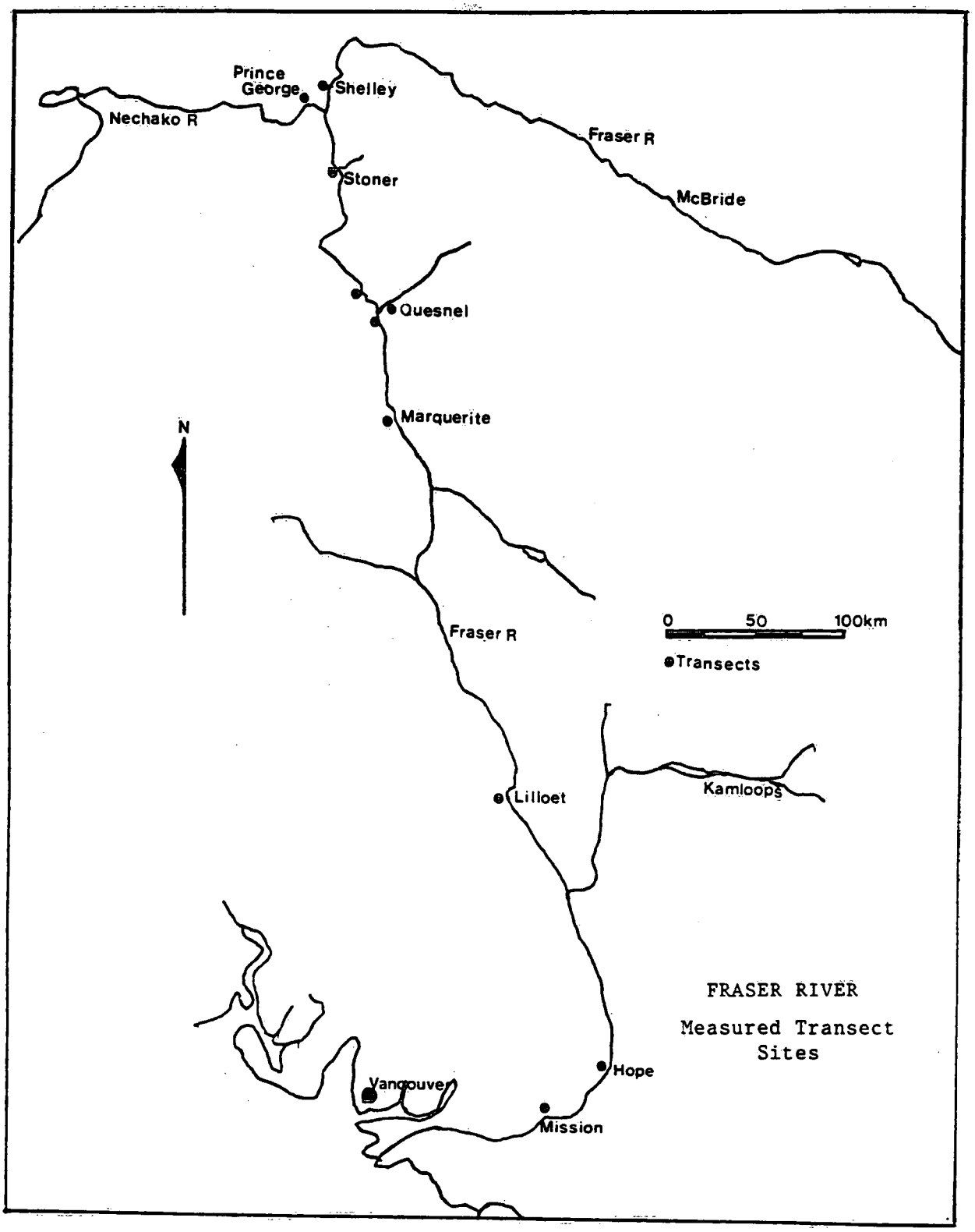
SUSPENDED SEDIMENT AND PARTICLE SIZE SURVEY, FRASER RIVER
AEPB STUDY 12445, DR. B.G. KRISHNAPPAN

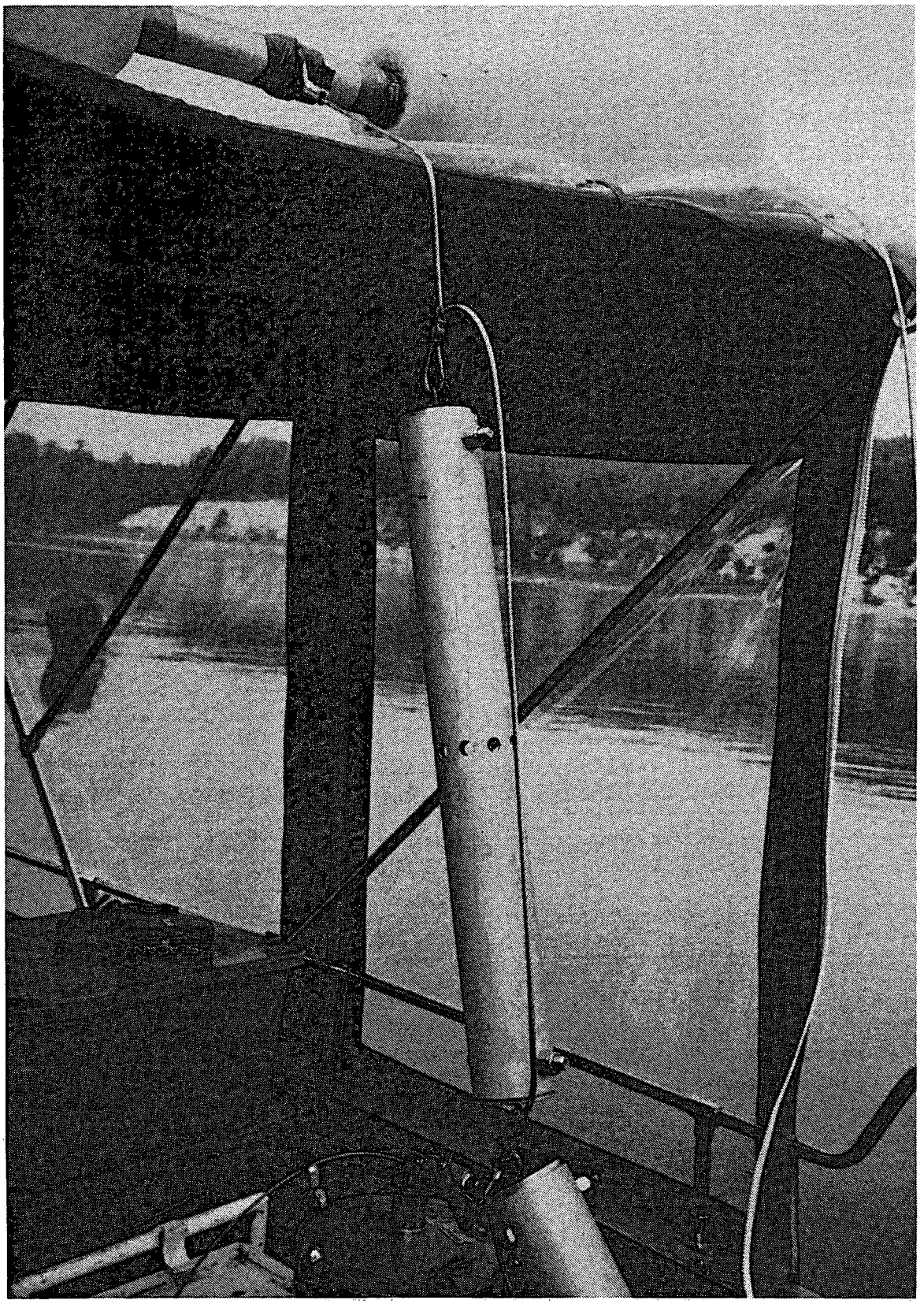
The purpose of this study was to determine the fate of wood fibre and organic contaminants generated by several pulpmills along the Fraser River in British Columbia. The survey was completed between September 27 and October 25. During the survey 14 sites were sampled between Prince George and Mission at the following locations:

1. Upstream of Northwood Pulp and Paper
2. 30 m downstream of Northwood outfall
3. 100 m downstream of Northwood outfall
4. 300 m downstream of Northwood outfall
5. 1000 m downstream of Northwood outfall
6. Nechako River upstream of Cameron Street bridge



RETRIEVING THE ZODIAC AT THE HOPE TRANSECT


Prince George
Shelley
Nechako R
Fraser R
Stoner
McBride
Quesnel
Marquerite
N
Fraser R
0
50
100km
Transects
Lilloet
Kamloops
FRASER RIVER
Measured Transect Sites
Hope
Vancouver
Mission



SEDIMENT TRAP SETUP USED ON THE ATHABASCA RIVER

7. Stoner below Stone Creek
8. Upstream of Quesnel at Longbar
9. Quesnel River at Weldwood bridge
10. Downstream of Quesnel at the end of Titson Street
11. Marquerite at ferry crossing
12. Lilloet above bridge at campground
13. Hope at the park above the bridge
14. Mission above the railway bridge

During the surveys at each transect the following sampling procedure was followed:

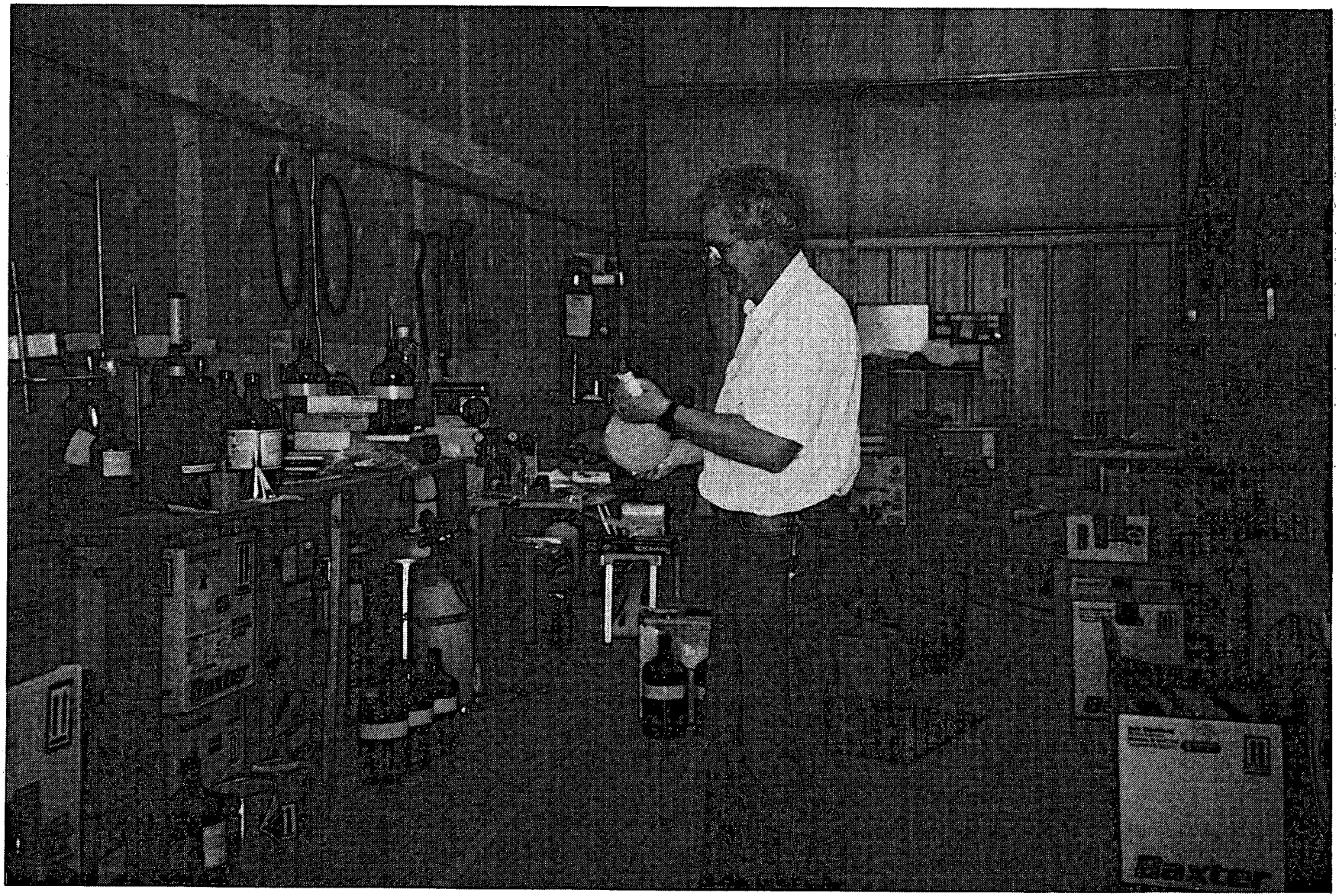
1. The micro fix was set up and the width of the river measured from bank to bank. This distance was divided into ten intervals where the verticals were taken.
2. Current flow measurements were taken at each interval as per water survey procedures.
3. A P72 water sampler was used at each interval to collect organics, particle size and suspended sediment samples. The depths for these samples were top, middle and bottom of the water column.
4. From the top P72 sample in mid stream a drop of sample was put on a microscope slide to be analyzed at a later date by I. Droppo of NTRB.
5. From the same position as item 4, 40 litres of water were collected as close to the bottom as possible using a peristaltic pump with the intake speed set at the same flow as the river. These samples were collected for Dr. M. Church of the University of British Columbia for suspended sediment loading.
6. The Malvern sampler was used at every second interval and measurements taken at surface and 1 m.
7. Before leaving the area, a sediment sample was collected from the beach area of each transect where it was determined that sediment had settled.
8. Water and air temperatures were collected at each transect.

ALBERTA OIL SANDS MANAGEMENT STUDY, ATHABASCA RIVER
AEPB STUDY 12446, DR. B.G. BROWNLEE

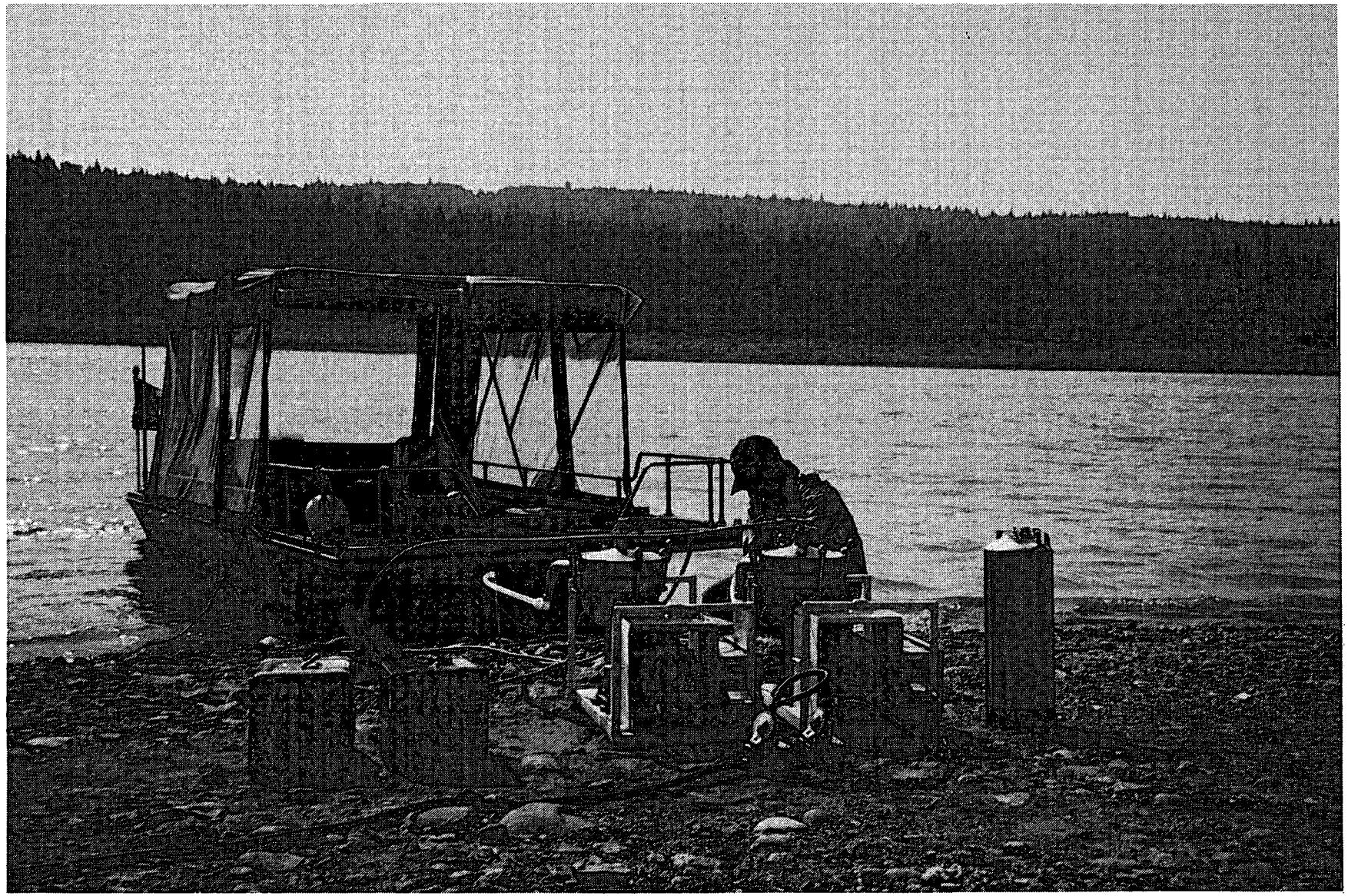
This was the final sampling series on the Athabasca River in support to the Panel of Energy Research and Development (PERD) project. This study was designed to generate a predictive model which can be used to develop ideas for the management of the Alberta Oil Sands. The objective of this work was to determine the presence, pathways and effects of polycyclic aromatic hydrocarbons (PAH's) which may be released from existing and planned oil sands development.

Sampling was carried out on the Athabasca River from upstream of the Horse River and downstream to mile 56 from August 8 - 24. Work was done in stages on several different parameters: sediment traps, suspended sediment, biodegradation experiments, major ion profiles and photo chemistry experiments.

Three sediment trap moorings with sediment traps at depths of 0.7 and 1.4 m were installed at mile 34 downstream of Beaver Creek. Moorings were on the left bank



THE WAREHOUSE AND LABORATORY AT FORT McMURRAY



CENTRIFUGING ON THE ATHABASCA RIVER

approximately 30 to 50 m from shore. Moorings were installed and retrieved with one refurbishment.

Suspended sediment samples were collected approximately 50 m downstream from the sediment trap sites. Samples were collected at installation, refurbishment and retrieval of the sediment traps. A total of three centrifuges were run for a period of 3 to 4 hours. Alfa Laval centrifuges were run at speeds of 4 and 6 litres/minute on each sampling. A Westfalia centrifuge was used in a comparison and was run at the same speed as one of the Alfa Laval's on each sampling trip. These samples were used to compare suspended sediment samples collected using a centrifuge to those collected using sediment traps.

Suspended sediment samples were also collected from a site on the Athabasca River upstream of the Horse River on August 16 and 17 for a toxicity experiment to be carried out by Dr. T. Reynoldson, AERB.

Biodegradation experiments were carried out on water and sediment samples in the warehouse. Water samples were collected from the Athabasca River upstream of the Horse River and sediment samples were collected from a site near the left bank at mile 33.

Major ion samples were collected in triplicate from the Clearwater River at the Forestry Dock and from the Athabasca River upstream of the Horse River. Across-river transects were done at mile 11, 21, 25, 34, 37, 48 and 56. A total of 11 samples were collected at each transect. A sounding profile was done at each transect as well.

Photo chemistry experiments were done in situ on the Clearwater River. Additional photo chemistry experiments in direct sunlight were carried out at the warehouse location.

Water Survey of Canada, Calgary staff did a flow measurement at the bridge south of Fort MacKay (mile 35) while samples were being collected upstream at mile 34. Results showed a very close measurement relationship to the gauge site downstream of Fort McMurray. Water Survey staff also collected a sediment sample from the Birch River.

Equipment used on this project since the initial sampling in 1989 and stored in the warehouse in Fort McMurray was packed and loaded aboard a rental truck and returned to CCIW.

ZEBRA MUSSELS, GRAND RIVER, LAKE ERIE
AEPB STUDY 12452, T. MAYER

During the latter part of June, samples were collected from Lake Erie and off the mouth of the Grand River. Zebra mussels were found along the shoreline of Lake Erie in approximately one to two feet of water. The mussels were found under rocks at the Long Beach Conservation Area and some were collected from Rock Point Provincial Park.

Water and sediment were sampled in Lake Erie approximately 2 kilometres off the mouth of the Grand River. The water was centrifuged at a flow rate of 6 litres per minute for a period of four hours. Three PONAR's containing soft, silty sediment were also collected.

POINT PELEE PEEPER PROJECT
AEPB STUDY 12452, T. MAYER

Staff supported T. Mayer, AEPB at various times throughout the year at Point Pelee National Park with the installation of peepers and taking push cores and water samples.

This was done as part of a joint project between Parks Canada, AEPB, Ecosystem Health Division, ECB-OR and Groundwater Remediation Project, AERB, which is investigating high phosphate concentrations in the marsh.

PULP MILL EFFLUENT SAMPLING
AEPB STUDY 12460, DR. K.L.E. KAISER

On two separate occasions, support was provided to Dr. K. Kaiser by collecting pulpmill effluent samples. Between September 18 and October 3, while en route to Edmundston, New Brunswick, seven one-litre samples were taken downstream of mills in the following cities: Beauharnois, Drummondville and Donnaconna, Quebec; Windsor, Trenton and Cornwall, Ontario and Edmundston, New Brunswick.

On the return trip from Saskatchewan, final effluents were sampled from four Ontario Pulp and Paper mills. Approximately 3 to 4 litres were collected from the following mills: Boise Cascade Ltd. in Kenora, Avenor Ltd. in both Dryden and Thunder Bay and Domtar Ltd. in Red Rock.

LABORATORY QUALITY ASSURANCE WATER COLLECTION
AEPB STUDY 12466, K. ASPILA

This study was supported by the delivery of a shipment of laboratory water standards to the U.S. Environmental Protection Agency in Chicago, Illinois and the collection of several bulk water samples from the cities of Chicago and Milwaukee, Wisconsin.

In January, two members of this section left Burlington in the 3-ton cube van with a shipment of 480 water samples which had been purchased by the U.S. EPA and intended for use as laboratory standards. The field party entered the U.S. by the Bluewater Bridge at Port Huron, Michigan and passed Customs with no difficulty. The samples were delivered into the hands of Mr. Mike Papp, EPA at

the Chicago Federal Building warehouse at 536 South Clark Street. At this point, four 100-litre plastic barrels were filled with Chicago tap water from the warehouse washroom. The transit to the University of Wisconsin Centre for Great Lakes Studies in Milwaukee, Wisconsin at 600 East Greenfield Street was made by the early afternoon. Dr. Arthur Brooks was contacted at his office there. Eight 100-litre barrels of Lake Michigan water that had been collected earlier by university personnel were loaded onto the truck and an additional four barrels were filled with Milwaukee tap water from the loading dock.

With all the required samples onboard, the return trip to Burlington began in the late afternoon. However, heavy snow and slippery roads brought on by a winter storm tracking east across Wisconsin and Indiana prevented any progress past Gurnee in the northern suburbs of Chicago that evening. In the morning, the field party continued on through the storm and re-entered Canada via the Bluewater Bridge at Sarnia only to be forced to seek accommodation in Strathroy as road conditions deteriorated again. The vehicle arrived safely in Burlington the next morning amid heavy lake effect snow and the samples were immediately delivered to AEPB personnel.

NEW TECHNOLOGIES RESEARCH BRANCH

SEDIMENT TREATMENT
NTRB STUDY 12920, 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 aerobic environment to assist the biodegradation of oil and coal tar.

An injection system designed by Mr. J. Kruyer of Oleophilic Sieve Development Company of Canada Ltd. in Edmonton, Alberta was greatly modified at CCIW and used to inject an area of 4,800 square metres of sediment at Dofasco, Pier 21.

Dofasco Injections

On April 26 an area of 4,800 square metres at Dofasco, Pier 21 was injected with 22,450 litres of liquid calcium nitrate/brewer's yeast and an additional 9 tons of agricultural grade calcium nitrate pellets. The injection plan was executed similarly to previous injections (July 28, September 15, 1992, April 27 and September 22, 1993). Range poles were used for tracklines and the vessel speed was estimated (0.5 metres/sec.). The #20 nozzles were installed on the injection bar and the in-line filter was removed after being clogged by the brewer's yeast. Flow rates averaged 16,000 litres per hour and the nursery grade calcium nitrate was mixed to the standard concentration of 560 mg/litre.

The mixing trailer was parked next to the crane truck. Initially both tubs were filled to the 500 litre mark with calcium nitrate and water. The mixture was recirculated by a pump until all the calcium nitrate had dissolved. Then 300 ml of canola oil was added to the mixture to reduce the foaming action of the brewer's yeast. Both tubs were topped up with brewer's yeast to the 1000-litre mark and with the filter removed, the pump recirculated the injection mixture until it was homogeneous. The injection mixture was pumped down to an offshore buoy where the CSL GANDER filled the onboard reservoir.

The barge GOOSE II was equipped with a spreader and was utilized to spread 9 tons of agricultural grade calcium nitrate over the injection area prior to the GANDER injection pass. The crane truck delivered the bags (16 tons) of calcium nitrate to the site and the crane was used to lower the pallets of calcium nitrate down to the GOOSE II.

On May 17 an area of 4,800 square metres at Dofasco, Pier 21 was injected with 29,100 litres of liquid calcium nitrate. The injection plan was executed similarly to previous injections (July 28, September 15, 1992, April 27, September 22, 1993, April 26, 1994). Flow rates averaged 17,000 litres per hour and the nursery grade calcium nitrate was mixed to the standard concentration of 560 mg/litre.

The delivery system (trailer) for supplying the GANDER with liquid calcium nitrate was unchanged from the previous deployments. The crane truck delivered

the bags (8 tons) of calcium nitrate to the site.

On October 18 an area of 4,800 square metres at Dofasco, Pier 21 was injected with 29,100 litres of liquid calcium nitrate. The injection plan was executed similarly to previous injections July 28, September 15, 1992, April 27, September 22, 1993, April 26 and May 17, 1994. Flow rates averaged 17,000 litres per hour and the nursery grade calcium nitrate was mixed to the standard concentration of 560 mg/litre.

The delivery system (trailer) for supplying the GANDER with liquid calcium nitrate was unchanged from the previous deployments. The crane truck delivered the bags (8 tons) of calcium nitrate to the site.

Previous problems with clay plugging the nozzles were resolved by pumping water through the system during the assembly stage and any time the boom was lowered to the bottom. The injection bar was still skipping along the bottom--a result of bottom topography, causing some of the solution to enter the water column.

Injection Summary - April 94

Area injected - 4800 square metres
Lines : 1 - 3 passes
2 - 3 passes
3 - 3 passes
4 - 3 passes
Concentration: 565 mg/l
Mixing: 2.5 bags (50#) per 100 litres of water
Average flow rate: 16,500 litres per hour
Volume of liquid injected: 11,225 litres
Volume of yeast injected: 11,225 litres
Total volume injected: 22,450 litres
Total weight used for mixing: 14,031 lbs. (7 tons)
Total weight used for spreading: 18, 500 lbs. (9.25 tons)
Total weight of calcium nitrate used: 16.25 tons

Injection Summary - May 94

Area injected - 4800 square metres
Lines : 1 - 2 passes
2 - 2 passes
3 - 2 passes
4 - 1 passes
Concentration: 565 mg/l
Mixing: 2.5 bags (50#) per 100 litres of water
Average flow rate: 14,000 litres per hour
Volume of liquid injected: 13,350 litres
Total weight used for mixing: 10,350 lbs.
Total weight of calcium nitrate used: 5 tons

Injection Summary - October 94

Area injected - 4800 square metres
Lines : 1 - 4 passes

2 - 4 passes
3 - 4 passes
4 - 4 passes
Concentration: 565 mg/l
Mixing: 2.5 bags 50#) per 100 litres of water
Average flow rate: 17,000 litres per hour
Volume of liquid injected: 29,100 litres
Total weight of calcium nitrate used for mixing: 15,950 lbs. (8 tons)

Sault Ste. Marie

During the weeks of May 30, July 18 and October 25, TOS divers returned to the St. Marys River injection site. The purpose of these trips was to collect core samples and to conduct tests on the gas retention of sediments in treated and untreated sites. Seven aluminum frames were laid on the bottom at one site for testing purposes. The mini-ranger Falcon system was used to position all sampling sites.

On the May trip, diver hand cores and one-litre bulk samples were collected at Site W (1993, post treatment), Site V (1993, post treatment), Control Site north of Site W, Control Site north of Site V and Control site south of Site V. Additional ten-litre bulk samples were collected at the control site north of site V and at Site V 1993 post treatment.

At the test frame site, cores (three hand cores per frame) were collected from the bottom left corner of frames 1 to 5. Frames 1, 2, 3 and 4 were injected with liquid calcium nitrate by divers and frame 5 was used as a control. After completion of the coring, two additional frames (6 and 7) were installed. Frames 1 and 2 were re-injected with calcium nitrate solution (5.68 Kg CaNO3 + 10 litres H_2O). Frames 3 and 4 were re-injected with a solution of calcium nitrate and brewer's yeast (5.68 Kg CaNO3 + 100 ml yeast + 10 litres H_2O). Frame number 5 remained untouched as the control. Frames 6 and 7 were injected with a solution of calcium nitrate (21.05 Kg CaNO3 + 20 litres of H_2O).

On the July trip, cores (three hand cores per frame) were collected at the test frame site. Frames 1 and 2 were sampled in the top left corner and frames 3 to 7 were sampled in the bottom right corner. After completion of the coring, frames 1 and 2 were re-injected with calcium nitrate solution (5.68 Kg CaNO3 + 10 litres H_2O). Frames 3 and 4 were re-injected with a solution of calcium nitrate and brewer's yeast (5.68 Kg CaNO3 + 100 ml yeast + 10 litres H_2O). Frame number 5 remained untouched as the control. Frames 6 and 7 were injected with a solution of calcium nitrate (21.05 Kg CaNO3 + 20 litres of H_2O).

On the October trip, cores (three hand cores per frame) were collected at the test frame site. All frames (1-7) were sampled in the bottom left corner. After completion of the coring, frames 1 and 2 were re-injected with calcium nitrate solution (5.68 Kg CaNO3 + 10 litres H_2O). Frames 3 and 4 were re-injected with a solution of calcium nitrate and brewer's yeast (5.68 Kg CaNO3 + 100 ml yeast + 10 litres H_2O). Frame number 5 remained untouched as the control. Frames 6 and 7 were injected with a solution of calcium nitrate (21.05 Kg CaNO3 + 20 litres of H_2O).

Sediment thickness measurements were taken at 32 stations within the work area.

Station positions were recorded using the mini-ranger Falcon. Thickness measurements were taken with a 3-metre long measuring rod. Divers were suspended below the boat on a platform during the work to minimize the up/down time, allowing a greater number of stations to be occupied.

St. Marys River Sediment Thickness Survey

STATION NUMBER	SEDIMENT THICKNESS (cm)	NORTHING	EASTING
1	60.	5152845.	705850.
2	150.	5152950.	705850.
3	300.+	5153050.	705850.
4	200.	5153140.	705850.
5	160.	5153200.	705850.
6	230.	5153225.	705850.
7	40.	5152850.	706000.
8	130.	5152950.	706000.
9	290.	5153050.	706000.
10	300.+	5153100.	706000.
11	250.	5153150.	706000.
12	190.	5153175.	706000.
13	150.	5153225.	706000.
14	230.	5153260.	706000.
15	20.	5152850.	706150.
16	10.	5152950.	706150.
17	40.	5153025.	706150.
18	240.	5153100.	706150.
19	250.	5153150.	706150.
20	250.	5153200.	706150.
21	240.	5153250.	706150.
22	150.	5152850.	706300.
23	300.+	5152950.	706300.
24	300.+	5153050.	706300.
25	270.	5153075.	706300.
26	270.	5153150.	706300.
27	190.	5153200.	706300.
28	200.	5153225.	706300.
29	240.	5153000.	706450.
30	180.	5153050.	706450.
31	240.	5153100.	706450.
32	140.	5153150.	706450.

Station Positions, Sault Ste. Marie

Transponder Positions:

Stn. DIKE - N = 5152691. E = 705983.
Stn. DANO - N = 5153140. E = 705576.
Stn. MARI - N = 5153065. E = 706585.

Sampling sites:

North Control Site - (north of site W)

Stn. NW94AX1-1	N = 5153186.	E = 706245.
Stn. NW94BX1-1	N = 5153180.	E = 706289.
Stn. NW94CX1-1	N = 5153175.	E = 706319.

Central Control Site - (north of site V and south of site W)

Stn. SW94AX1-1	N = 5153094.	E = 706247.
Stn. SW94BX1-1	N = 5153095.	E = 706286.
Stn. SW94CX1-1	N = 5153096.	E = 706322.

South Control Site - (south of site V)

Stn. SV94AX1-1	N = 5153041.	E = 706269.
Stn. SV94BX1-1	N = 5153041.	E = 706271.
Stn. SV94CX1-1	N = 5153041.	E = 706373.

Area W (post treatment) -

Stn. W94A1-1	N = 5153137.	E = 706242.
Stn. W94B1-1	N = 5153130.	E = 706282.
Stn. W94C1-1	N = 5153120.	E = 706308.

Area V (post treatment) -

Stn. V94A1-1	N = 5153094.	E = 706232.
Stn. V94B1-1	N = 5153085.	E = 706290.
Stn. V94C1-1	N = 5153079.	E = 706291.

Frame Stn. N = 5153063. E = 706299.

SEDIMENT RESUSPENSION STUDY
NTRB STUDY 12921, I. DROPPO

On November 3, a bulk centrifuge sample from the 5-metre depth was collected at the calcium nitrate treated area of the Dofasco Slip in Hamilton Harbour. The sample was taken in order to investigate the resuspension of sediment, mainly from ships, in the controlled area. The particulate matter was examined for granular particle size, chemical and metal analysis, and organics.

COASTAL GEOLOGY
NTRB STUDY 12922, DR. N.A. Rukavina

As part of an ongoing Lake Ontario coastal survey at the foot of Green's Road in the town of Stoney Creek, Technical Operations divers surveyed the site on two occasions (May and December). Stake measurements were recorded and a video was made to document any changes since the last inspection. During the May survey, stakes 6 and 7 were located and a new groundline was installed between stakes 1 and 7.

STATION POSITIONS

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

COURTAULDS SEDIMENT THICKNESS SURVEY
NTRB STUDY 12922, DR. N.A. RUKAVINA

At the request of Mr. H. Biberhofer, EHD-OR--a member of the Cornwall RAP Committee, TOS divers travelled to Cornwall on June 20 to undertake a sediment thickness survey in the St. Lawrence River at Courtaulds. The Cornwall RAP Committee required detailed information on the sediment thickness in a 200-metre square area of the St. Lawrence River at the Courtaulds pumphouse. The dive team was accompanied by Dr. N. Rukavina who co-ordinated the positioning software, organized and logged data provided by the divers.

Using CHS horizontal control station LOCK as a start point, a survey control station (COLL2) was established at Windmill Point. Almost 95 percent of the survey area was visible from this location. The area not visible was close to shore (<15 metres) in the northeast corner of the site. The Navtrac system, on loan from CHS, was used to provide sub-metre accuracy to the diver sample location. The shore unit, on a tripod located at COLL2, used a laser to track a prism mounted on the launch PINTAIL. Problems with the UHF radio link between

shore and launch required a rewrite of the software based on verbal input from shore and keyed into the computer onboard the PINTAIL. Using the screen plot, the PINTAIL was positioned both before and after samples were taken.

Due to contamination in the sediments, a new method of deploying the divers was developed to minimize exposure and maximize their bottom time without sacrificing position accuracy. The system used was a large stage suspended below the launch. The stage was raised or lowered as the diver called instructions, maintaining a safe distance above the sediment. The PINTAIL was positioned using a three point anchorage (one bow and two stern). The stern anchor lines were marked at 10-metre intervals, thus swinging an arc on the bow anchor in 10-metre segments.

The following observations were made by the diver at each sampling station:

a) Four measurements (one at each corner of the stage) using a measured rod of the sediment thickness

b) A description of the sediments and aquatic macrophytes

c) A depth gauge reading

A total of 69 stations were occupied during phase 1, covering approximately 80% of the survey area. Two weeks later, an additional 20 stations were occupied to complete the survey.

RIVERBED SEDIMENTATION STUDY
NTRB STUDY 12924, DR. N.A. RUKAVINA

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 Courtaulds Corp., Cornwall, Ontario. This study will provide data on the stability of the contaminated sediments in the area and will determine whether sediment remediation by injection, capping or dredging is required.

On April 11, three bottom-mounted T-frames were installed downstream of the Courtaulds waterfront. Two sites (1 and 3) were equipped with two transducers, an OBS sensor and a Brancker datalogger. 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. The T-frame at site number two was moved closer to shore in April and was not used for the remainder of the field year.

Technical Operations divers visited the site bi-monthly (May 3, July 5, September 7 and November 14) to change the Brancker datalogger and to collect measurements. Underwater video was obtained at each site during refurbishment to document the changes in the site composition.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	45° 01' 09"	74° 41' 33"
2	45° 01' 13"	74° 41' 12"
3	45° 01' 26"	74° 41' 00"

RESEARCH SUPPORT BRANCH

PRODUCTIVE CAPACITY OF FISH HABITAT

GREAT LAKES LABORATORY FOR FISHERIES AND AQUATIC SCIENCE,
V. CAIRNS, J. FITZSIMONS
RSB STUDY 12631, P.M. HEALEY

This project was a continuation of past studies to investigate the factors which affect fish and fish habitat associations in Great Lakes areas of concern thereby addressing the terms of the 1988 Great Lakes Water Quality Act (Annex 2). Technical Operations provided divers, dive equipment and underwater television/video support to this study. The long-term objectives of the work include:

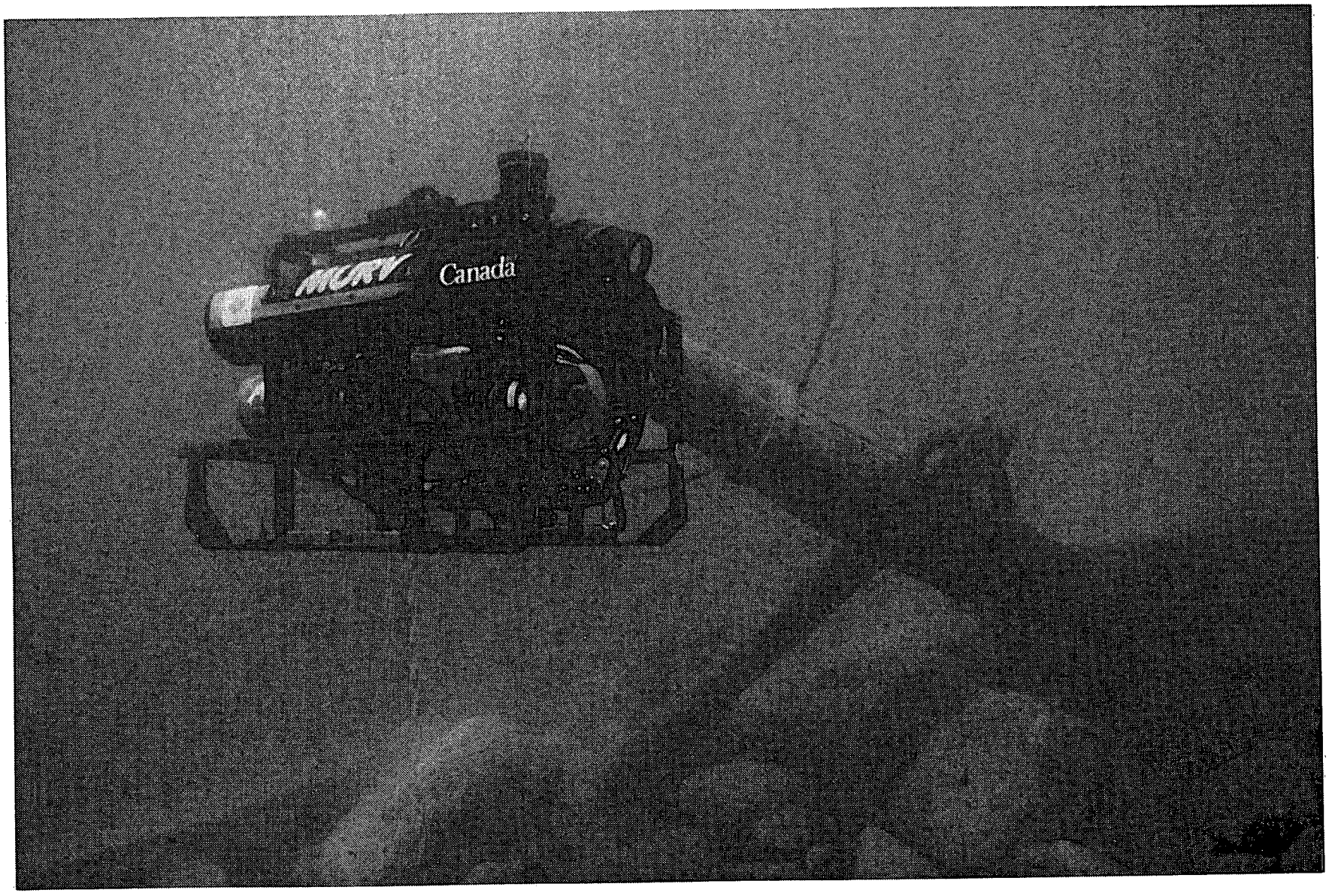
1. To develop habitat assessment and analysis methods (based on GIS technology) which integrate biological, chemical and physical components of the ecosystem.

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
May 18 - 20	Dunkirk, N.Y.
July 26	Aqua Park, Ontario
August 23 - 25	Dunkirk, N.Y.
September 12 - 16	Kingston, Ontario/Georgian Bay
September 27	Pt. Weller, Ontario
October 4	Stoney Creek, Ontario
October 11	Pt. Weller, Ontario
October 13	Owen Sound, Ontario
October 20	Pt. Weller, Ontario
October 26	Dunkirk, N.Y.
October 27	Pt. Weller, Ontario
November 4	Pt. Weller, Ontario
November 23	Suit repair
November 25	Owen Sound, Ontario
November 29 - December 2	Parry Sound
December 8	Dunkirk, N.Y.



MURV AT FATHOM FIVE NATIONAL MARINE PARK

MURV SUPPORT, PACIFIC GEOLOGICAL CENTRE, PARKS CANADA
RSB STUDY 12631, P.M. HEALEY

In August, the Dive Unit provided MURV support to the Pacific Geological Centre and Parks Canada in a survey onboard the CSS VECTOR in the region of the Queen Charlotte Islands, British Columbia. The CSS VECTOR based at the Institute of Ocean Sciences, Pat Bay was chartered to the Pacific Geological Centre of Natural Resources Canada. The purpose of the cruise was to document the existence of ancient streambeds on the ocean floor and record evidence of prehistoric native villages now submerged. MURV was used to provide deep-water video to record potential village sites and search for artifacts.

MURV and support equipment was shipped to Edmonton, Alberta by air cargo. A 1/2-ton pickup truck was rented and driven to Prince Rupert, B.C. and via ferry to Sandspit on the Queen Charlotte Islands.

During the course of the survey, MURV made seven dives at various locations and to depths of 630 feet. The object of the dives was similar. MURV would reach the bottom in an area of ancient riverbed to ground truth the sounder data, record any anomalies within 100 metres using the sonar and obtain video records of the site. At two dive sites, old Haida Indian villages (abandoned 100 years ago) were located on shore.

MURV SUPPORT, PARKS CANADA, MARINE ARCHAEOLOGY
RSB STUDY NUMBER, 12631, P.M. HEALEY

In the first week of June, MURV and a dive team travelled to Tobermory, Ontario to provide support to Parks Canada, Marine Archaeological Services, Ottawa. Previous side-scan sonar surveys in Fathom Five National Marine Park had identified targets in areas too deep for divers to confirm. MURV was used to video a shipwreck (Forest City) 48 metres deep for a period of six hours. As an additional task, MURV, using scanning sonar, searched a one-half mile square area near Cove Island lighthouse, looking for artifacts.

MURV SUPPORT, FATHOM FIVE NATIONAL MARINE PARK
RSB STUDY 12631, P.M. HEALEY

On August 15, MURV and a dive team travelled to Tobermory to assist Parks Canada with a deep water survey of shipwrecks within the boundaries of the Fathom Five National Marine Park. Divers attempted to obtain video of the shipwrecks located in water depths in excess of ninety feet with a minimum of success. Decompression times restricted divers' video times to approximately 15 minutes. MURV--a deep water remote system, can remain at depths recording video and stills for hours at a time.

Four shipwrecks were surveyed during the week (Arabia, James C. King, Philo Scoville and Sweepstakes). Each shipwreck was marked with twelve survey markers to monitor the deterioration of the wood and iron. Some stations included modern samples of wood and iron attached to the hull. One station on each site used a small (10" x 10") sheet of Lexan to measure the amount of abrasion at the site. A total of sixteen hours underwater time was logged on MURV while obtaining video documentation of each survey station. During the survey of the Scoville, MURV located and documented both ships' anchors which had been missing since the night of the sinking.

One day of the week was dedicated to the Ontario Marine Heritage Society to video-tape, sonar map and collect samples in the area of the Lucas Channel fifteen miles north of Tobermory. Prior to the rising water levels in the Great Lakes 8500 years ago the Lucas Channel was a major river flowing south into the lower lakes. At a depth of 130 feet MURV obtained video images of the never before seen steep walls of the old river bed and using sonar imaging, mapped 1200 feet of the main channel.

A Neil Brown current meter (#1096) was recovered from the shipwreck "Sweepstakes" and returned to CCIW.

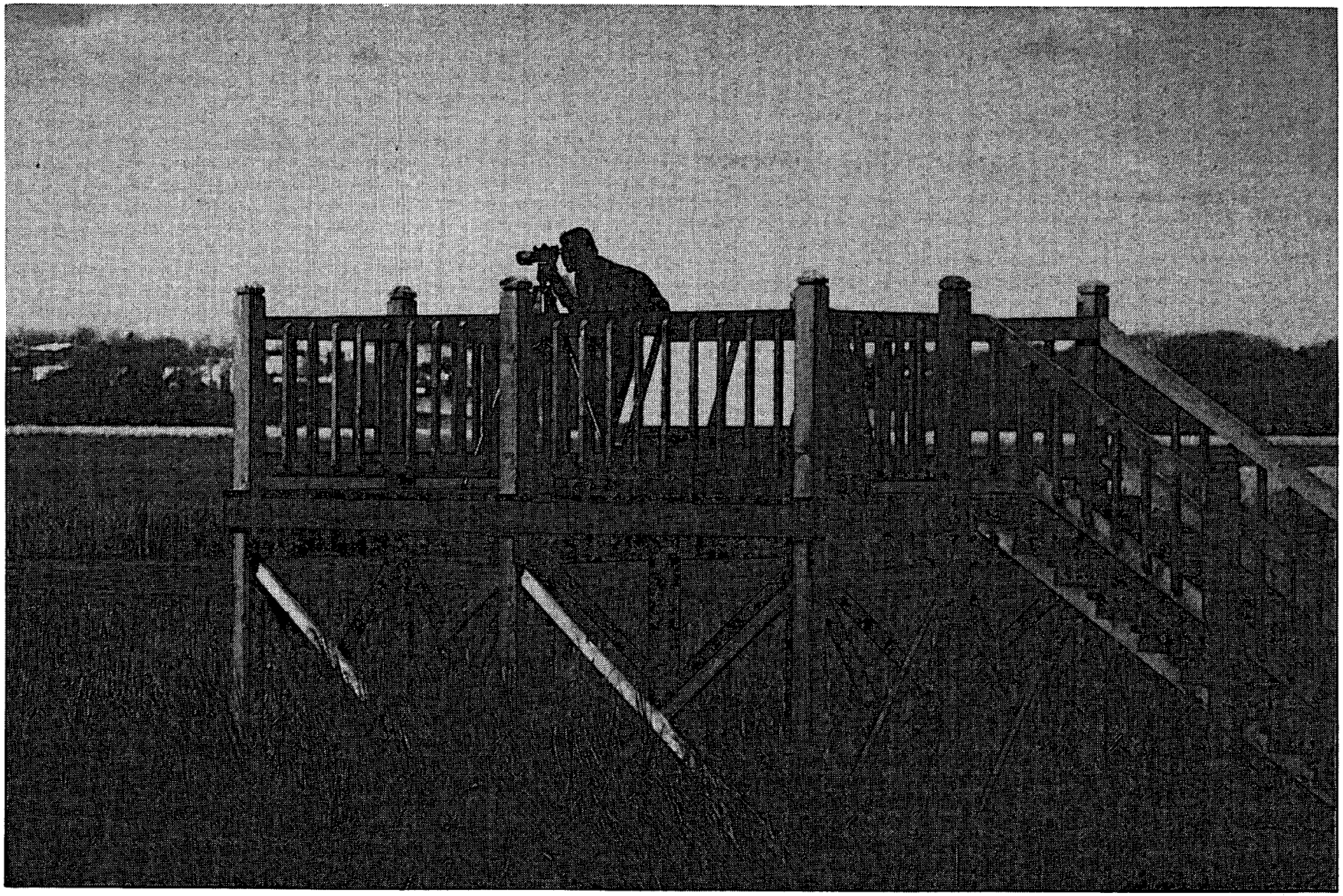
WOLFE ISLAND WATER QUALITY SAMPLING STATION
ECOSYSTEM HEALTH DIVISION, ENVIRONMENTAL CONSERVATION BRANCH, ONTARIO REGION,
H. BIBERHOFER
RSB STUDY 12631, P.M. HEALEY

On November 17, divers travelled to Kingston to inspect the Water Quality sampling station on the south side of Wolfe Island. A diving inspection of the pumps, hoses and intakes found the system covered with zebra mussels and cladophora. All three pumps were cleaned and identified with the plugs inside the shed. The offshore intake wands were given a major cleaning. The concrete cap installed in 1992 shows little sign of deterioration.

OTHER OUTSIDE AGENCIES
RSB STUDY 12631, P.M. HEALEY

During the field season, Technical Operations supported a number of other agencies on various NWRI joint projects. Following is a list of this support:

Hamilton Region Conservation Authority	Loan of sampling equipment
NHRI, Saskatoon	Loan of sampling equipment
State University New York, Dr. D. Stewart	Water samples, Lake Erie
University of Ottawa, Dr. F. Pick	Water samples, Lake Erie
Centre Saint-Laurent	Moorings, Lac St. Francois
University of Guelph	Sediment sampling, Moosonee
University of Toronto, Dr. M. Loewen	Profiling, Western Lake Erie
University of Waterloo, Mr. E. Harvey	Piezometer sampling, Hamilton Harbour
University of Waterloo, Dr. L. McCarthy	Sediment samples, Lake Erie, Hamilton Harbour
University of Windsor, Dr. D. Haffner	Water samples, Lake Erie
Limnological Institute of Berlin, Dr. Hoscher, Dr. P. Casper	Water/Sediment samples, Lake Erie Water/Sediment samples, Lake Ontario
University of B.C., Dr. M. Church	Water samples, Fraser River, B.C.
State University New York, Dr. S. Byrant	Acoustics and fish trawls, Lake Erie
University of Waterloo, Dr. W. Taylor	Water samples, Lake Erie
Trent University, Dr. E. Bentzen	Water samples, Lake Erie
University of Quebec, Dr. M. Twiss	Metal Cycle samples, Lake Erie
Parks Canada	Bottom survey using MURV
U.S. Fish and Wildlife	Moorings
University of Toronto, Dr. G. Sprules	Zooplankton net hauls, Lake Erie
York University, Mr. M. Amyot	Water samples, Lake Erie
GLLFAS, DFO, Dr. O. Johannsson	Anchor moorings for LOUIS M. LAUZIER
Memorial University Newfoundland	Sediment samples, Lake Erie



OSHAWA MARSH OBSERVATION PLATFORM

CANADIAN WILDLIFE SERVICE
DR. V.W. WESELOH
RSB STUDY 12632, B.H. MOORE

The CWS field program covered a huge research area with several different studies. The TOS support again went to their main study of colonial waterbirds like Gulls, Terns and Cormorants nesting on the Great Lakes and connecting waterways. The purpose of this program was to determine or aid in the determination of how various factors constitute biological effects of toxic chemicals in these species. The majority of the research was done on eggs and chicks from mid-April through mid-July. Field teams were kept very busy because of the very short field season in which to collect the required data and the large sampling area.

Many colonies were studied covering all the Great Lakes and connecting waterways such as the Bay of Quinte and the Niagara River. Several visits to each colony during nest building, egg laying and chick rearing were needed. This, plus the fact that different colonies and different bird species throughout the Great Lakes and connecting waterways start nesting at different times, added to the tight scheduling of field work. Several Lake Ontario north shore marshes were also studied over the season.

Twice a week, shoreline surveys of the Bay of Quinte were conducted to determine bird species, movement and feeding patterns. These surveys were made from a small launch about 200 metres out from shore, running from Belleville west along the north shore as far as Trenton, east along the south shore, south into Muscote Bay, north at Triden Pt. and along the north shore of Hungry Bay, then west back to the Belleville ramp. Each Quinte shoreline survey took approximately 6 hours at an average speed of 10 knots, covering 61 nautical miles of shoreline with an approximate observation area of 264 sq. miles.

The Niagara River survey was done by vehicle along the Niagara Parkway east from Fort Erie to Niagara-on-the-Lake--a distance of 40 kilometres. A spotting scope and binoculars were used to cover most of the river.

The large marsh area in Muskot Bay was also a major survey site for the entire field season. The marsh was divided into several sectors and marked off with flagged poles. A CWS contractor visited the marsh daily by canoe and made observations in each sector. A small trailer was set up in a farmer's field adjacent to the marsh and served as accommodation and office for the CWS contractor throughout the season. In agreement with the farmer, temporary sewage, hydro and water was run to the trailer. The trailer itself was loaned from the local Ministry of Natural Resources. Three other marsh areas: Oshawa Second Marsh, Whitby Cranberry Marsh and Pickering Corner Marsh along the north shore of Lake Ontario were also surveyed weekly throughout the season.

Many field trips were made during the season to the various colonies requiring several thousand kilometres of trailering and hundreds of nautical miles of boat steaming. The small (17') CSL THUNDERBIRD and Mason 2 and 4 were utilized for the survey work on the many bird colonies throughout the Great Lakes. All the survey work, with the exception of a few DCC colonies in the upper lakes, was successfully completed without mishap.

Note: Several DCC surveys of colonies in the upper lakes were missed because of continuous heavy fog. This problem will be addressed in the 1995 season by the scheduled mounting of a small portable radar to a tripod on the stern of the CSL THUNDERBIRD.

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

RIGGING SHOP

The Rigging Shop was operated by several Technical Operations staff members. During the winter the shop underwent a major reorganization and clean-up while still providing service and maintaining equipment.

The Rigging Shop staff are responsible for the care of shop facilities, warehouse storage, outside storage shed, WAVES research tower and long-term outside storage areas as well as maintaining all mooring equipment, buoys, generators, power tools, winches, forklifts and various other pieces of research equipment. Several new acquisitions have expanded the services of the Rigging Shop, including the purchase of a new forklift. The old forklift is being shared with ESS, RSB.

Rigging Shop staff are responsible for the delivery of scientific equipment to major ships and field programs throughout the Great Lakes Basin and St. Lawrence River, erecting towers, operating boats, heavy trucks, assisting in scientific studies when required and operating forklifts. This season a meteorological tower in Embro, Ontario was removed and all equipment returned to CCIW. The property was returned to its original condition.

VEHICLES

Each unit in the fleet has been utilized throughout a busy field season. Down-time on any vehicle has been minimal.

The extensive areas covered ranged from parts of Western Canada to Atlantic Canada. The U.S. destinations this year included Chicago, Illinois, Milwaukee, Wisconsin and Sodus Point, New York.

Present plans call for the replacement of NWRI vehicles due to extensive mileage or age.

Effective June 1994 a new fleet management program was put into effect for government vehicles. This program is operated by G.E. Capital Canada. G.E. is responsible for recording such things as oil and fuel consumption; dollars spent on fuel, oil and mechanical repairs, etc.

Along with the fleet program G.E. has introduced a new credit card which has been issued for each vehicle in the fleet. These cards have a $30.00 spending limit. Spending limits are for mechanical or any other type of purchase required other than gas. If a repair is required that is over the preset limit, the vehicle operator or the service personnel are required to call G.E. to obtain the proper spending authority. G.E. require a brief description of the repairs required. The above-mentioned records are forwarded to Materiel Management, FAB, OR at CCIW to be incorporated into individual vehicle files.

Effective January 1994 a bi-weekly vehicle inspection was implemented. These inspections include a brief exterior inspection for body damage, broken lights, windows, etc. The engine compartment is checked for leaks, belts and ensure all fluids are topped up. The vehicle is taken on a brief road test to ensure it is safe and roadworthy. This program has been useful to discover burnt out lights, day time running lights, cracked windshields that have not been reported by staff on returning vehicles keys to field stores. Any problems found during inspection are recorded. This program will continue throughout the 1995 field season.

FIELD STORES

Field stores is operated for use of the staff within the National Water Research Institute. Staff from other government departments and organizations such as Environment, Ontario Region, CWS, Fisheries & Oceans and outside agencies, such as Provincial and Municipal government departments and universities also use the stores facility when arrangements are made with the Head, Technical Operations Section and approval is granted by the Executive Director of NWRI.

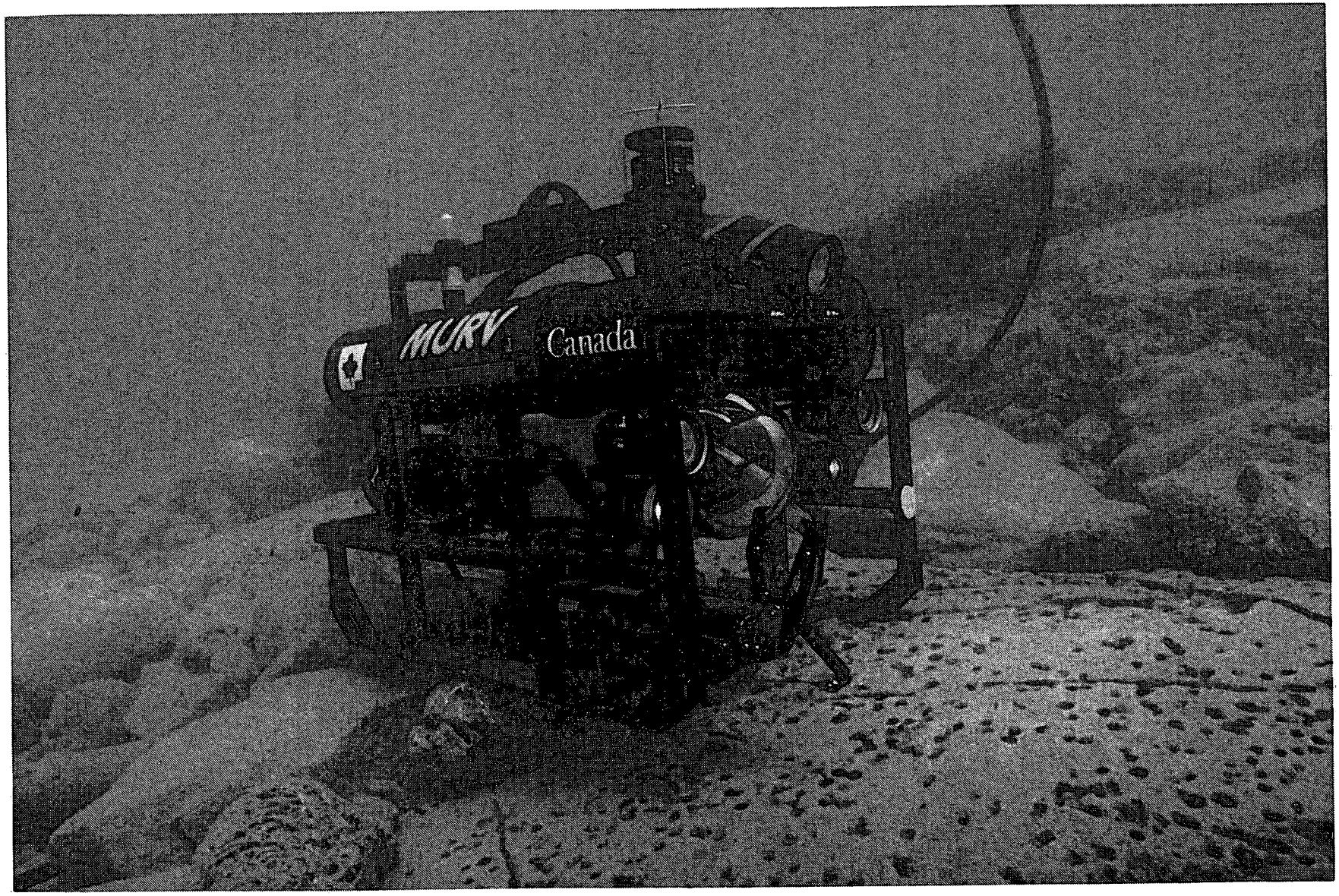
Field stores personnel issue project chiefs and study leaders with a variety of equipment such as: safety clothing, sediment and water samplers, surveying instruments, laboratory supplies, cameras, vehicles, etc. On return items are inspected for damage, repaired if necessary and re-issued. Repairs are made in-house or at outside shops. A complete equipment inventory was taken during the last year.

Passenger vehicles are scheduled and issued though stores. Eight station wagons, an 8-passenger van, 7 regular vans, 5 crewcabs, extended cab 4x4 pick-up trucks and a variety of other specialized vehicles are included in the fleet. Tracking involves an average of 150 computer entries each month.

Maintenance is the responsibility of the assistant rigger who ensures vehicles are in safe working order and maintains vehicle records. Assistance is given from field stores when vehicles are taken to repair shops.

DIVING OPERATIONS
RSB STUDY 12634, F.H. DON

The Diving Operations Unit provided national support to various scientific



MURV AT TOBERMORY

studies in areas of diver certification, inspections, installations and retrievals, sample collection, photography, television surveys with video documentation, equipment demonstrations/trials, search and recovery, lectures and diver training. The unit supported 19 divers at Burlington. A total of 406 hours (accident free) were logged in support of scientific projects for: NWRI; Environmental Conservation Branch; Canada Parks Service; BINST and GLLFAS, DFO. An additional 160 hours were logged during the winter training program in the pool. A total of 54 hours were logged on MURV--the remotely operated miniROVER underwater camera system. Since the rebuild, MURV has been in demand for deep-water video recording. Projects included wreck mapping, sonar surveys and documentation of geological formations. 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 CSA Standards Technical Committee on Diving Safety and the Ontario Construction Safety Association Task Force on "Diving in Contaminated Environments". Mr. Don is also a member of the Canadian Standards Association Sub-committee on Diving Competency and chairman of the Contaminated Environment working group.

The annual meeting of the Department of Environment Diving Safety Committee was held in April, in Toronto, Ontario. The meeting agenda included:

1. Proposed changes to the DOE Directive for Diving Safety
2. Interpretation and changes to the new Labour Canada Diving regulations
3. Review of diving accident investigations
4. Integration of Heritage Canada with DOE Diving regulations
5. Proposed changes from interdepartmental harmonization

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 NUMBER	STUDY TITLE	DESCRIPTION
12217	Rosa, SED REMD	Lake Erie
12248	Manning, L. REMD	Bay of Quinte
12247	Coakley, L. REMD	Hamilton Harbour
12920	Murphy, ART	Sault Ste. Marie, Hamilton Harbour
12924	Rukavina, ART	Hamilton Harbour, Cornwall
12632	Water Quality Station	Wolfe Island
12631	Outside Agencies:	
	GLLFAS, DFO	Fitzsimons, Fish Habitat
	BINST, DFO	Hull inspections
	Parks Canada	Fathom Five
		Pacific Geological Centre

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Environment Canada Environnement Canada

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