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1999
ANNUAL ACTIVITY SUMMARY
TECHNICAL OPERATIONS SECTION
RESEARCH SUPPORT BRANCH
NATIONAL WATER RESEARCH INSTITUTE

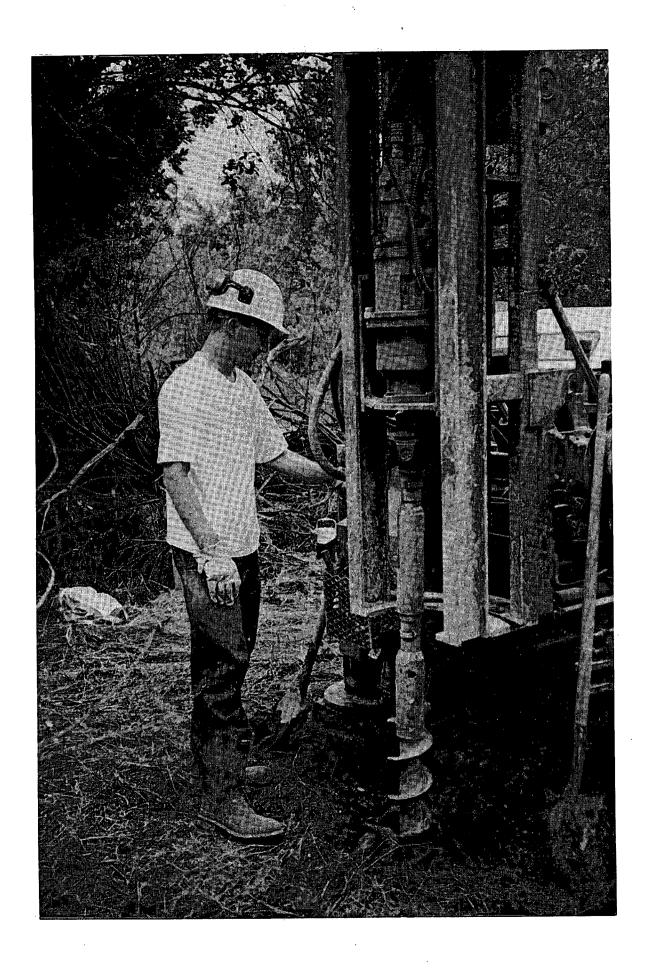


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INTRODUCTION

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

The technical staff of this section 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 have put them into field situations from coast to coast in North America, into the high Arctic and more recently overseas. As the scientific component of this Institute embraces global environmental problems and increasingly lends its resources and expertise to third world and other countries, this section finds itself conducting field programs on other continents. This unusual opportunity—to work and gain valuable field-related experience in such a varied sphere of operation, develops within the section a tremendous collective wealth of technical expertise unique to this support group.

The Diving Operations Unit is ever expanding its capacity to give scientific programs the up-to-date technological support they require underwater—the most recent advances being in digital underwater video capability, including the edit and manipulation of both analogue and digital video material. Annual diver training and certification courses are also conducted to maintain a high level of competence among CCIW divers.

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

Technical Operations Section welcomed Mr. L.M. Benner as a permanent member of the group in April of this year and will greatly benefit from his continued efforts in support of the Institute field programs.

The section also expresses its best wishes to Ms. J. Milne upon her acceptance in June of a position with the Aquatic Ecosystems Research Branch.

This report is intended as an overview of the field activities of this section during the 1999 field season.

STAFF LIST

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Director (Acting) P.M. Healey

J.A. Bull R.A. Duffield

Secretary S.R. Mitchell

A/Administrative Officer B.D. Titley
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S.B. Smith OIC CCGS LIMNOS; Malawi, Africa; Nova Scotia;

New Brunswick

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Little Current, ON

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CCGS LIMNOS; Fort McMurray, AB; Collins Bay, ON

Groundwater

Diving; Lake Michigan; Cornwall, Little Current,

Mississauga, Sarnia/Amherstburg, Turkey Lakes, ON

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L.M. Benner

Diving; CCGS LIMNOS; Calgary, Grande Prairie, AB; Detroit River, Little Current, Sarnia/Amherstburg, ON Diving; CCGS LIMNOS; Great Slave Lake, NWT;

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C.J. Lomas

T.C. Gilliss

Senior Rigger

Vehicle Maintenance Co-ordinator

NWRI FIELD STORES

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

CASUAL EMPLOYEE

D.P. Walsh

September to December

SUMMER STUDENTS

H.A. Crichton M.K.F. Crichton M.A. Nelson J.W. Schertzer D.P. Walsh

CCGS LIMNOS; Turkey Lakes

CCGS LIMNOS

CCGS LIMNOS; Turkey Lakes

CCGS LIMNOS

CCGS LIMNOS; Nova Scotia

CCGS LIMNOS

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SHIPBOARD PROGRAMS

AQUATIC ECOSYSTEMS RESTORATION BRANCH

BIOLOGICAL SEDIMENT GUIDELINES AERB STUDY 12211, DR. T.B. REYNOLDSON

One cruise was carried out September 13 - 27 aboard the CCGS LIMNOS on Lake Superior to support this program. The cruise was conducted to verify the reference database created to select key species and toxicity tests that show the most resilient predictive response for use in developing numerical biological sediment guidelines. These guidelines are in turn used to determine the need for sediment remediation based on the invertebrate fauna and bioassay responses. At each station the following work was performed:

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

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

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

- a) 125 ml were sampled for organic analysis in a hexane rinsed glass bottle covered with a hexane rinsed piece of tin foil before the lid was placed on.
- b) 100 ml were sampled for particle size.
- c) 500 ml were sampled for major ions, metals, loss on ignition, total organic carbon, total Kjeldahl nitrogen and total phosphorus.

Additional work was done on the cruise for Dr. D. Muir, AEPB to collect mysis, zooplankton and phytoplankton samples. Also, stable isotope samples were collected for Dr. A. Karim, University of Ottawa.

Six stations were sampled in Wheatley Harbour from the launch PELICAN. Samples obtained at each site were the same as those sampled from the CCGS LIMNOS.

STATISTICS SUMMARY

CRUISE NO.		SHIP	CCGS LIMNOS
DATE		REGION	LAKE SUPERIOR
CRUISE TYPE	Biological Sediment Guidelines	N.MI. STEAMED	1386.62
	and the second s		

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	52	Moorings Established	
EBTT/Transmissometer Casts	- 17.22.	Moorings Retrieved	
Rosette Casts	4	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disk Observations	34	Moorings Established	
Transmissometer Casts	15	Moorings Retrieved	
Zooplankton Hauls	10		
Van Dorn Casts	30		
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	52		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	12
Water Samples Collected (D.O.)	30	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	30	Cores Taken, Benthos	
Water Samples Collected (TP uf)	30	Grab Samples Taken, Shipek	2
Water Samples Collected (TKN)	30	Grab Samples Taken, PONAR	33
Water Samples Collected (Alkalinity)	30	Grab Samples Taken, Mini PONAR	95
Water Samples Collected (Stable Isotope)	27	Bulk Water Sample, 600 Litre	1
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.	90
Water Samples Filtered ()		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered (Microbiology	

STATION POSITIONS

LAKE SUPERIOR REFERENCE STATIONS

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
317	2500	48° 32' 00"	86° 16' 40"
318	2501	48° 35' 25"	86° 20' 35"
319	2502	48° 37' 39"	86° 19' 58"
321	2504	48° 43' 37"	86° 36' 59"
322	2505	48° 42' 40"	86° 38' 40"
323	2506	48° 46' 04"	86° 39' 39"
324	2507	48° 47' 13"	86° 41' 46"
349	2618	48° 25' 17"	86° 14' 40"
350	2619	48° 27' 34"	86° 15' 03"

STATION POSITIONS

LAKE SUPERIOR - PENINSULA HARBOUR

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
406	6957	48° 43' 12"	86° 23' 30"
407	6958	48° 43' 26"	86° 23' 50"
408	6959	48° 43' 03"	86° 25' 27"
409	6960	48° 43' 55"	86° 25' 17"
410	6961	48° 44' 46"	86° 27' 06"
411	6962	48° 43' 40"	86° 24' 37"
412	6963	48° 43' 46"	86° 24' 42"
413	69M276	48° 43' 17"	86° 23' 36"
414	69M289	48° 44' 38"	86° 25' 04"

STATION POSITIONS

LAKE SUPERIOR - JACKFISH BAY

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
415	6953	48° 47' 24"	86° 59' 26"
416	6954	48° 47' 17"	86° 59' 32"
417	6955	48° 48' 24"	86° 59' 54"
418	6956	48° 48' 48"	86° 57' 41"
419	69M701	48° 48' 38"	87° 00' 06"
421	69M288	48° 48' 06"	86° 59' 02"
422	69B1	48° 48' 37"	87° 00' 07"
423	69B2	48° 47' 51"	86° 59' 31"
424	69B3	48° 48' 58"	86° 57' 32"
425	69B4	48° 46' 31"	86° 59' 26"
426	69B5	48° 45' 39"	86° 54' 44"

STATION POSITIONS

LAKE SUPERIOR - MARATHON - FT. JAMES DIFFUSER

STATION NUMBER	REYNOLDSON NUMBER	LATITUDE N.	LONGITUDE W.
427	69M5	48° 40' 23"	86° 23′ 31″
428	69M6	48° 41' 02"	86° 24' 08"
429	69M7	48° 41' 33"	86° 24' 38"
430	69M8	48° 42' 18"	86° 24' 30"
431	69M9	48° 42' 59"	86° 24' 53"
432	69M3	48° 40' 03"	86° 23' 33"
433	69M4	48° 39' 41"	86° 24' 27"
434	69M2	48° 39' 17"	86° 23' 28"
435	69M1	48° 38' 41"	86° 23' 33"

STATION POSITIONS

LAKE SUPERIOR TOXAPHENE SAMPLING

STATION NUMBER	LATITUDE N.	LONGITUDE W.		
13	46° 54' 03"	85° 09' 59"		
80	47° 34' 59"	86° 57' 01"		
101	48° 44' 01"	87° 10' 10"		
102	48° 36' 54"	87° 26' 04"		
170	47° 20' 00"	89° 48' 00"		
201	47° 07' 54"	91° 06' 42"		

STATION POSITIONS LAKE SUPERIOR STABLE ISOTOPE SAMPLING

STATION NUMBER	LATITUDE N.	LONGITUDE W.
13	46° 54' 03"	85° 09' 59"
26	47° 36' 57"	88° 07' 55"
80	47° 34' 59"	86° 57' 01"
102	48° 36′ 54"	87° 26' 04"
117	47° 40' 59"	87° 35' 58"
133	48° 17' 02"	88° 35' 47"
142	48° 06' 00"	89° 04' 55"
152	47° 41' 20"	89° 27' 59"
170	47° 20' 16"	89° 44' 49"
177	47° 44' 43"	90° 14' 08"
182	47° 19' 03"	90° 42° 00"
201	47° 07' 54"	91° 07' 58"
248	47° 02' 01"	85° 31' 08"
249	47° 10' 29"	85° 52' 27"
250	47° 18' 27"	86° 13' 29"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
251	47° 26' 29"	86° 34' 58"
252	47° 36' 00"	88° 38' 32"
253	47° 25' 26"	89° 15' 05"
254	47° 16' 58"	90° 08' 03"
255	47° 13' 58"	90° 26' 33"
256	47° 10' 59"	90° 47' 03"

BENTHIC COMMUNITY STRUCTURE, LAKE ERIE AERB STUDY 12211, DR. T.B. REYNOLDSON

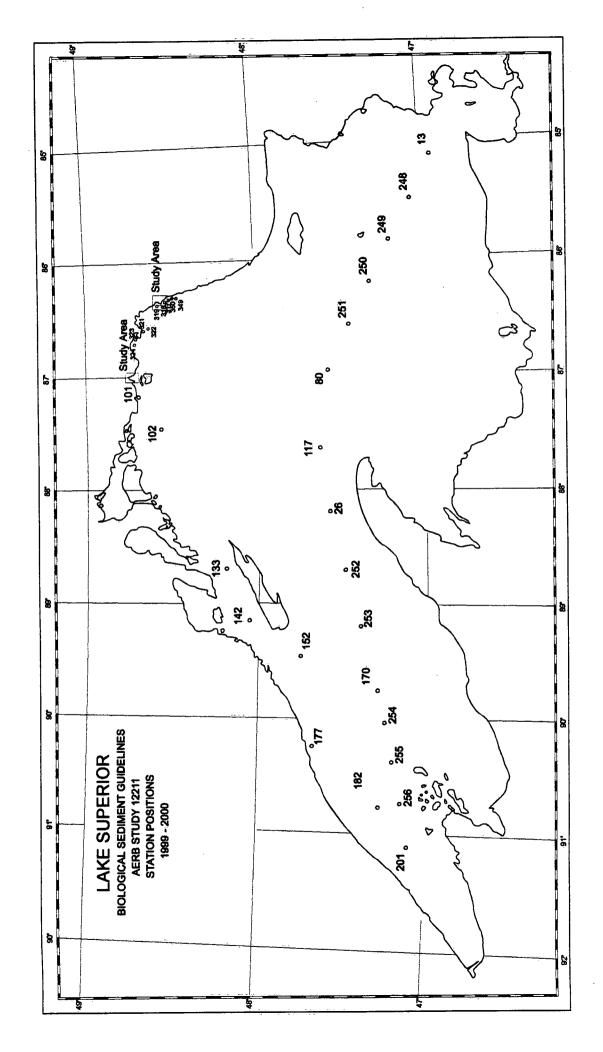
Seven cruises were carried out onboard the CCGS LIMNOS April 19 - 22, May 25 - 28, June 28 - July 1, July 26 - 28, August 30 - September 1, October 4 - 5 and October 18 - 20. The cruises were combined with the Detroit River Contaminant Study and Lake Erie Zebra Mussel Effects mooring cruises.

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

At each station, triplicate PONAR samples were collected. Samples were sieved through a sieve pail and the residue placed in the containers provided and preserved until returned to CCIW for analysis.

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

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



STATION POSITIONS

LAKE ERIE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 29' 06"	79° 52' 48"
84	41° 55' 48"	81° 39' 30"
357	41° 48' 48"	82° 59′ 12″
	ور د د د د د د د د د د د د د د د د د د د	

MOORING POSITIONS

LAKE ERIE

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
23	99-01S-01A	42° 29' 56"	79° 52' 54"	DO (BTM -1 m)
84	99-01S-03A	41° 55' 35"	81° 39′ 53"	DÓ (BTM -1 m)
357	99-01S-05A	41° 48' 51"	82° 59′ 28″	DO (BTM -1 m)

ZEBRA MUSSEL EFFECTS AERB STUDY 12240, M.N. CHARLTON

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

Five cruises were completed to support this study during the field season—May 17 - 20, June 21 - 25, July 19 - 23, August 9 - 13 and September 7 - 10. At each station, water samples were collected as follows: An integrated water sample from the surface to 1 m above the top of the thermocline or to 20 m if the epilimnion was deeper than 20 m or the water column was unstratified. Sampled to 2 m above the bottom in instances where the sampling depth extended to the substrate. Parameters measured were: conductivity, pH, chlorophyll a, seston weight, total phosphorus, total filtered phosphorus, soluble reactive phosphorus, nitrate + nitrite. At all stations in the Western Basin, West of longitude 82° 30' 00", chlorophyll a samples were obtained at discrete depths of 1, 3, 5, 7 and 9 m. Filtration was done as per GLLFAS filtration methods. EBT/transmissometer profiles, DO profiles, surface bucket temperatures taken and Secchi disk (30 cm) observations were made.

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

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

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

Sediment trap moorings were installed at stations 23, 84 and 357. Moorings were installed during the first cruise on Lake Erie, April 19 - 22 and serviced during the Reynoldson/Marvin cruises on Lake Erie, May 25 - 28, June 28 - July 1, July 26 - 28, August 30 - September 1, October 4 - 5 with final removal on October 18 - 20. Chlorophyll a and seston samples were collected at the trap depth during each cruise.

A sediment trap mooring with 6 sediment traps was serviced at station 403 in Lake Ontario. This mooring was refurbished in April from a winter mooring, refurbished again on the Lake Ontario Contaminant/Mooring cruise in June and refurbished as a winter mooring on the final cruise of the year in October.

STATISTICS SUMMARY

CRUISE NO.		SHIP	CCGS LIMNOS
DATE	A	REGION	LAKE ERII
CRUISE TYPE	Zebra Mussel Effects	N.MI. STEAMED	3026.
1 1 1 1			

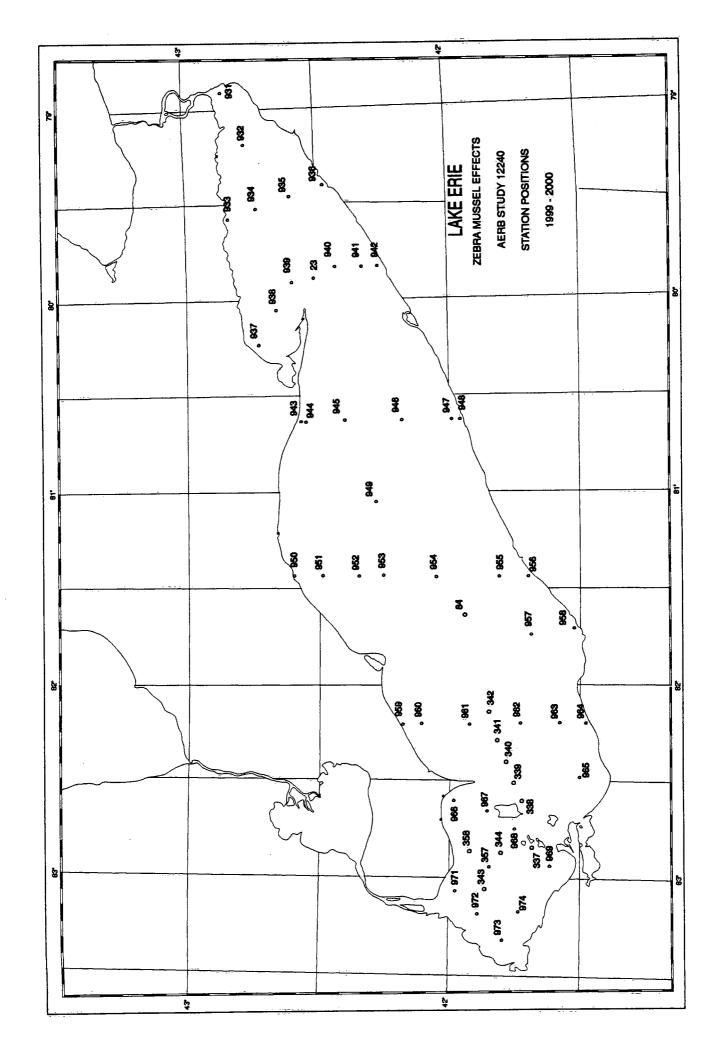
DESCRIPTION	N		TOTAL	DESCRIPTION	TOTAL
Stations Occupied	 		271	Moorings Established, Sediment Trap	3
EBTT/Transmissometer Casts			271	Moorings Refurbished, Sediment Trap	18
Rosette Casts			100	Moorings Established	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
Reversing Thermometer Obs. (N	o. of Therm)		· · · · · · · · · · · · · · · · · · ·	Moorings Retrieved	
Secchi Disk Observations			127	Moorings Established	
Transmissometer Casts		*		Moorings Retrieved	
Zooplankton Hauls			193		
Van Dorn casts			63		
Integrator 10 m			170		
Integrator 20 m			101	Primary Productivity Moorings	
Phytopiankton Samples	· · · · · · · · · · · · · · · · · · ·	. ===	100		
D.O. Profiles			271		
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	7
Water Samples Collected (D.O.	·)	53	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	295	Cores Taken, Benthos	
Water Samples Collected (TP uf)	272	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	1
Water Samples Collected (Protozoa)	100	Bulk Centrifuge Samples	
Water Samples Collected ()			
Water Samples Collected ()		Observations, Weather	
Water Samples Filtered (Chlorophyll <u>a</u>)		Fluorometer Profiles	271
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)	49		
Water Samples Filtered (TP f)	282		
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major lons)	282	ONBOARD ANALYSIS	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	862
Water Samples Filtered (71.7)		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()		Microbiology	

STATION POSITIONS

LAKE ERIE

		the state of the s
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"

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"



MOORING POSITIONS

LAKE ERIE

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

MOORING POSITIONS

LAKE ONTARIO

			INST/DEPTH
403 99-00A-6	5A 43° 36' 19"	78° 13' 19"	ST (20, 60, 100, 140, 165 173 m)

WESTERN LAKE ONTARIO AERB STUDY 12240, M.N. CHARLTON

Technical Operations supported a study led by M.N. Charlton of AERB and Dr. B. Brownlee of AEPB, addressing the problem of poor taste and foul odour in drinking water during the warmer summer months. Blue-green algae or cyanobacteria is a

genera that produces the algal metabolites geosmin—an earthy-smelling compound and 2-methylisoborneol (MIB)—a musty-smelling compound. After a particularly protracted event in 1998 that resulted in many complaints about the quality of drinking water, a research partnership was set up between the Ontario Clean Water Agency and the National Water Research Institute. The purpose of this was to investigate the formation of taste and odour compounds in the lake and to find out more about their variability in depth and distance from shore.

Sampling was conducted in Lake Ontario in the vicinity of the intakes for the Lakeview and Lorne Park WTP's in the Region of Peel. Stations LV1 and LP1 were sampled weekly from August 11 to September 13. Station LV2 was sampled from August 11 to September 8. Sampling was conducted at the deeper station LV3 and the inshore station LV4 on August 31 and September 7.

Samples were collected using Canadian Coast Guard "P-class" vessels. Sampling was restricted to moderate weather conditions. High waves precluded sampling on some days. A profile of temperature, dissolved oxygen, conductivity, pH and depth was obtained at each station using a Hydrolab H20 profiler. A logger (OS200) was used to obtain temperature profiles at the two deeper stations. A Van Dorn bottle was used to collect samples at 2 m and bottom minus 2 m at each station. Water collected with the Van Dorn bottle was used for geosmin and 2-methylisoborneol (MIB) analyses, algal counting and identification, seston and chlorophyll analyses. Sterilized, evacuated bulbs (when available) were used to collect water for actinomycetes analysis. Secchi depth was also recorded at each station.

STATION POSITIONS (WGS 84 DGPS)

STATION	NORTHING	EASTING	DEPTH (M)	DISTANCE FROM SHORE (KM)
Lakeview 1	4823350.0	618302.0	18	2
Lakeview 2	4822233.0	620884.0	40	4
Lakeview 3	4819594.0	620945.0	65-70	10
Lakeview 4	4824136.0	616395.0	2	0.02
Lorne Park 1	4820045.0	614116.0	11	1.3

MOORINGS, NORTH CHANNEL AERB STUDY 12245, DR. P.F. HAMBLIN

As part of a long-term study of the physical dynamics of the Eastern area of the North Channel, scientific moorings were installed by the CCGS LIMNOS (99-05-001) in early May.

ADCP Search and Recovery

On Monday, July 12, a TOS dive team (Breedon, Don and Gray) travelled to the McGregor Bay area of the North Channel to search for and retrieve an ADCP unit which had been lost during launching. On a previous search and recovery divers located the lost mooring, finding it buried over one metre into the soft clay bottom. Divers attached a lifting line to the base-plate sling and it was lifted to the surface by the LIMNOS. After mooring recovery, the ADCP unit was found missing and the hold-down clamps were tom off. Funding for a one-week search for the ADCP was provided by M. Charlton, AERB. The dive team returned to the site with the launch PINTAIL, the remotely operated vehicle (MURV) with forward looking sonar, a low frequency Atlas sounder and a DGPS receiver. The Harbour Vue Marina East of Little Current was used as a base of operations because it was outside town and offered excellent facilities for moving equipment between the truck and the launch.

A detailed working map was made of the search area. The plan was to begin with MURV and the forward-looking sonar to triangulate any target positions within the search area. If this failed, it could be assumed that the ADCP unit was completely buried. The Atlas sounder was used along predetermined track-lines to search the soft sediment.

A marker float was installed at the position where the base-plate was recovered. MURV descended to the depths to begin the search and then the problems began. The DGPS receiver could not keep locked onto the differential beacon at Wiarton. MURV had a flooded starboard thruster. The forward-looking sonar lost cable synchronization. It was decided to return to the marina to make repairs. It should be mentioned that due to the weight of all the equipment onboard, the PINTAIL could not plane—plowing along at 13 kph.

The search continued the next day with all systems working. Again MURV searched with the sonar, identifying targets and "flying" to them to check them out. A SCUBA tank was lowered to the bottom to act as a position target for MURV. Range and bearing were taken from MURV to the tank to calculate MURV UTM co-ordinates. The positions were plotted manually to track MURV's progress. Most of the targets turned out to be mounds of clay. Problems started with the GFI cutting power to the system. The cause could not be isolated so the solution was to station a person at the GFI switch and after it triggered, immediately activate it again. This worked long enough for

MURV to find the ADCP unit. It was found 7 metres WSW of the base-plate location, in a hole next to a large clay mound. The head end was buried with the connector end one foot above the bottom. As MURV held position, providing lighting, divers descended 35 metres to attach a lift line. The ADCP unit was recovered at 1910Z on July 14. It appeared to be undamaged and the connector was intact. As the dive team was cleaning up the launch prior to leaving the site, winds increased to 40 kph SSW and the anchors started dragging.

As additional tasks, two tide gauge moorings were installed in the Little Current channel and a MET buoy (99-05M-01A) was serviced. One tide gauge was installed 500 metres West of the bridge and the other, 700 metres East of the bridge. Both tide gauges sit on base-plates without surface markers or ground-lines. At the MET buoy (99-05M-01A), the light and light battery were changed. The logger was monitored and replaced. All system parameters were reading accurately.

Mid Season Mooring Refurbishment

On August 9, a TOS dive team (Gray and Don) travelled to Little Current on Manitoulin Island to refurbish moorings installed by the LIMNOS in May. Mr. J. Gabriele of RSB Engineering Services accompanied the team to download the data and refurbish the electronic hardware. The CCGC SHARK was utilized to retrieve and install all moorings. The weather for the week varied between warm days and cool nights with rain during two of the four working days. Winds were moderate from the South and West. Three hours were lost on Wednesday afternoon when the SHARK responded to a call for assistance and subsequently towed the stranded boater into Kilarney.

All temperature and transmissometer loggers were successfully refurbished. Three of the four tide gauges were reinstalled. One tide gauge from mooring 99-05P-11A was found flooded. The mooring was reinstalled without instruments in order that divers could install the tide gauge when one became available. One Hydrolab from mooring 99-05ATS-03B was found flooded as a result of a tangled wire. The mooring was reinstalled with the Hydrolab frame in place. Divers would reinstall the Hydrolab when one was available. Sediment trap samples were collected from three of the four stations. At mooring 99-05ATS-03B the sediment trap was tangled upside down in the mooring wire and samples were not collected. Hydrolab casts were taken at each mooring location.

In summary, twelve moorings were retrieved, twelve refurbished and thirteen launched. A total of thirteen Hydrolab casts were taken and fifteen sediment trap samples were collected from three moorings. The MET buoy at mooring 99-05M-01A was serviced and a new logger installed.

November Mooring Retrievals

On November 11, a TOS dive team (Breedon and Don) travelled to Little Current to meet with the crew of the CCGC SHARK. The purpose of this trip was to retrieve the scientific moorings prior to the winter freeze-up and collect sediment samples near five fish farm operations.

Weather conditions—not unexpected at this time of year, slowed down operations. Predominantly North and Northwest winds gusting to 45 knots and cold temperatures made the decks icy. As mooring equipment was retrieved, ice formed quickly but by working slowly all scientific data recorders were safely recovered.

The spar buoys from two tide gauge moorings near the Burnt Island Bank had released from the anchors. Both spar buoys were recovered. It was interesting to note that both buoys were rigged with stainless steel wire to the anchors. As the spar moved with the waves, the wire had little stretch and all the tensile forces were applied directly to the hardware. Perhaps the inclusion of three metres of poly buoy line into the lifting line would cushion some of the forces? Tide gauge mooring 10C had been dragged out of position. Divers searched on two occasions without success. The bottom in this area is flat rock. A decision was made to recover the instrument in the spring, using MURV with a forward-looking sonar.

Fourteen moorings were retrieved, five Shipek samples and five benthos cores were collected. All mooring hardware was loaded onto the crane truck for return transport. TOS staff returned to CCIW on November 17.

MOORING LAUNCH SUMMARY GEORGIAN BAY/NORTH CHANNEL

May

STN	SITE M	OORING NO. L	ATITUDE N.	LONGITUDE W	INST/DEPTH
45	Manitowaning Bay	99-05M-01A	45° 53' 28"	81° 46' 17"	MET(Monitor)
46	Manitowaning Bay	99-05C-02A 99-05ATS-03A	45° 45' 53" 45° 45' 51"	81° 48' 20" 81° 48' 17"	ADCP ST TEMP HYDROLAB
47	Fisher Harbour	99-05ATS-05A	45° 59' 01"	81° 47' 18"	ST TEMP
48	Eagle Rock	99-05C-06A 99-05ATS-07A	46° 00' 40" 46° 00' 26"	81° 43' 15" 81° 44' 01"	ADCP ST TEMP TRANS
49	Badgeley Island Passage	99-05C-08A 99-05ATS-09A	45° 54' 29" 45° 54' 10"	81° 37' 45" 81° 37' 54"	ADCP ST TEMP TRANS
50	Indian Dock	99-05P-10A	45° 54' 29"	81° 40' 34"	TG
51	Burnt Isl. Bank	99-05P-11A	45° 54' 41"	81° 36' 43"	TG
52	Goat Isl. Channel	99-05C-12A	45° 59' 14"	81° 55' 14"	CM
53	Little Current Chnl.	99-05C-13A	45° 58' 37"	81° 54′ 02"	СМ
54	Little Current Chni.	99-05P-15A	45° 58' 57"	81° 55' 22"	TG
55	Little Current Chnl.	99-05P-14A	45° 58' 49"	81° 54' 26"	TG

MOORING LAUNCH SUMMARY GEORGIAN BAY/NORTH CHANNEL

June

STN	SITE M	100RING NO. L	ATITUDE N.	LONGITUDE W.	INST/DEPTH
45	Manitowaning Bay	99-05M-01A	45° 53' 28"	81° 46' 17"	MET(Monitor)
46	Manitowaning Bay	99-05ATS-03B	45° 45′ 51"	81° 48' 17"	ST TEMP
47	Fisher Harbour	99-05ATS-05B	45° 59' 01"	81° 47' 18"	ST TEMP
49	Badgley Island Passage	99-05ATS-09B	45° 54′ 10"	81° 37' 54"	ST TEMP TRANS
50	Indian Dock	99-05P-10B	45° 54' 29"	81° 40' 34"	TG
51	Burnt Isl. Bank	99-05P-11B	45° 54' 41"	81° 36′ 43″	TG

MOORING LAUNCH SUMMARY GEORGIAN BAY/NORTH CHANNEL

August

STN	SITE M	OORING NO.	LATITUDE N.	LONGITUDE W	INST/DEPTH
45	Manitowaning Bay	99-05M-01A	45° 53' 28"	81° 46' 17"	MET(Monitor)
46	Manitowaning Bay	99-05C-02B 99-05ATS-03C	45° 45' 52" 3 45° 45' 52"	81° 48' 20" 81° 48' 28"	ADCP ST TEMP
47	Fisher Harbour	99-05C-04B 99-05ATS-05C	45° 59' 06" 2 45° 58' 52"	81° 43' 27" 81° 43' 18"	ADCP ST TEMP
48	Eagle Rock	99-05ATS-07E	3 45° 58' 53"	81° 43' 26"	ST TEMP TRANS
49	Badgley Island Passage	99-05C-08B 99-05ATS-090	45° 54' 29" 3 45° 54' 38"	81° 37' 42" 81° 37' 54"	ADCP ST TEMP TRANS
50	Indian Dock	99-05P-10C	45° 54' 30"	81° 40' 29"	TG
51	Burnt Isl. Bank	99-05P-11C	45° 54' 41"	81° 36' 42"	no instrument
52	Goat Isl. Channel	99-05C-12B	45° 59' 14"	81° 55' 14"	СМ
53	Little Current Chl.	99-05C-13B	45° 58' 37"	81° 54' 02"	СМ
54	Little Current Chl.	99-05P-15B	45° 58' 57"	81° 55' 22"	TG
55	Little Current Chl.	99-05P-14B	45° 58' 49"	81° 54' 26"	TG

SEDIMENT CORING STATIONS GEORGIAN BAY/NORTH CHANNEL

November

STATION NUMBER	SITE	LATITUDE N.	LONGITUDE W.
45	Manitowaning Bay	45° 45' 31"	81° 47' 42"
47	Fisher Harbour	45° 59' 30"	81° 43' 44"
58	Eagle Rock	46° 00' 33"	81° 43' 53"
	Eastern Island	45° 04' 53"	81° 57' 44"
	Bedford Harbour	45° 01' 59"	82° 00' 27"

CONTAMINANT STUDY, DETROIT RIVER AERB STUDY 12246, DR. C. MARVIN

Seven cruises were carried out onboard the CCGS LIMNOS April 19 - 22, May 25 - 28, June 28 - July 1, July 26 - 28, August 30 - September 1, October 4 - 5 and October 18 - 20. The cruises were combined with the Lake Erie Benthic Community Structure and Lake Erie Zebra Mussel Effects mooring cruises.

Sediment traps were installed for Dr. C. Marvin at 9 sites in the Detroit River and Lake St. Clair. Moorings were installed during the April cruise and serviced monthly as per the dates listed above.

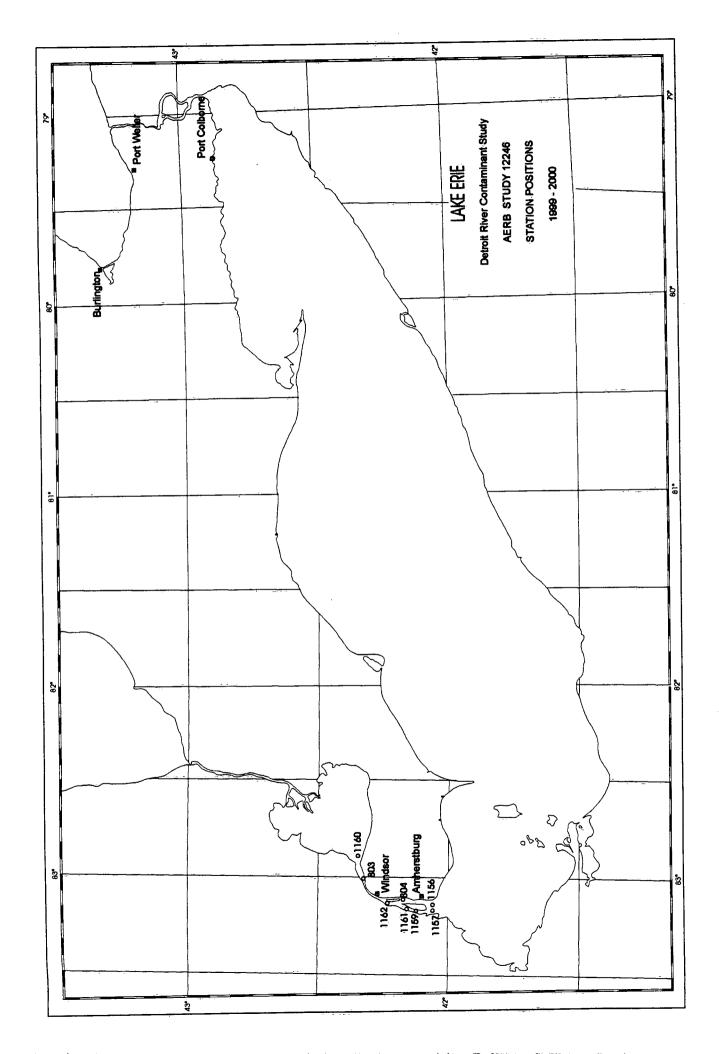
During cruises June 28 - July 1 and August 30 to September 1, water samples for Haloacetic Acid analysis were collected for Dr. B. Scott, AEPB at all mooring positions.

Two T-frame moorings were installed in the Detroit River for Dr. N.A. Rukavina, AERB Study 12218, on September 30.

STATISTICS SUMMARY

CRUISE NO.		SHIP	CCGS LIMNOS
DATE		REGION	DETROIT RIVER
CRUISE TYPE	Contaminant Study	N.MI. STEAMED	602.64

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	54	Moorings Established, Sediment Trap	8
EBT/Transmissometer Casts	54	Moorings Retrieved, Sediment trap	8
Rosette Casts		Moorings Serviced, Sediment Trap	36
Reversing Thermometer Obs. (No. of Therm)		Moorings Established	
Secchi Disk Observations	30	Moorings Retrieved	1
Transmissometer Casts			n, v v.
Zooplankton Hauls			
Van Dorn Casts	28		
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	54		
Water Samples Collected (Microbiology)	Cores Taken, Box	
Water Samples Collected (Water Quality)	Cores Taken, Mini Box	
Water Samples Collected (D.O.) 30	Cores Taken, Piston	
Water Samples Collected (Cond/pH) 30	Cores Taken, Benthos	
Water Samples Collected (TP uf)	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)	Grab Samples Taken, PONAR	15
Water Samples Collected (Metal Salts) 10		
Water Samples Collected (Microbial Loop)		
Water Samples Collected (Halo Acetic Acid) 16	Observations, Weather	
Water Samples Filtered (Chlorophyll a) 22		
Water Samples Filtered (POC/TPN)		
Water Samples Filtered (Seston) 22		
Water Samples Filtered (TP f)		
Water Samples Filtered (Nutrients)		
Water Samples Filtered (Major Ions)	ONBOARD ANALYSIS	
Water Samples Filtered (DOC)	Manual Chemistry, Tech. Ops.	90
Water Samples Filtered ()	Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()	Microbiology	



MOORING POSITIONS DETROIT RIVER

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
803	99-01A-07A	42° 20' 20"	82° 57' 14"	ST (11.7m)
804	99-01A-08A	42° 08' 53"	83° 07' 22"	ST (5.2m)
1156	99-01A-09A	42° 02' 53"	83° 08' 16"	ST (4.5m)
1157	99-01A-10A	42° 03' 01"	83° 09' 41"	ST (3.3m)
1159	99-01A-12A	42° 07' 55"	83° 10' 15"	ST (6.6m)
1160	99-01A-13A	42° 21' 43"	82° 53' 58"	ST (3.7m)
1161	99-08A-24A	42° 10' 13"	83° 09' 51"	ST (6.5m)
1162	99-08A-25A	42° 14' 19"	83° 08' 01"	ST (6.0m)

PISTON CORING, LAKE ERIE AERB STUDY 12247, DR. J.P. COAKLEY

One cruise was conducted for Dr. J.P. Coakley to collect piston and Benthos cores for radiocarbon dating at four stations in Lake Erie. At stations 23, 353, 354 and 355, piston cores—either 40 or 60 foot, were obtained as well as a Benthos core and a mini box core. This work was done in conjunction with personnel from the University of Akron, Akron, Ohio.

STATISTICS SUMMARY

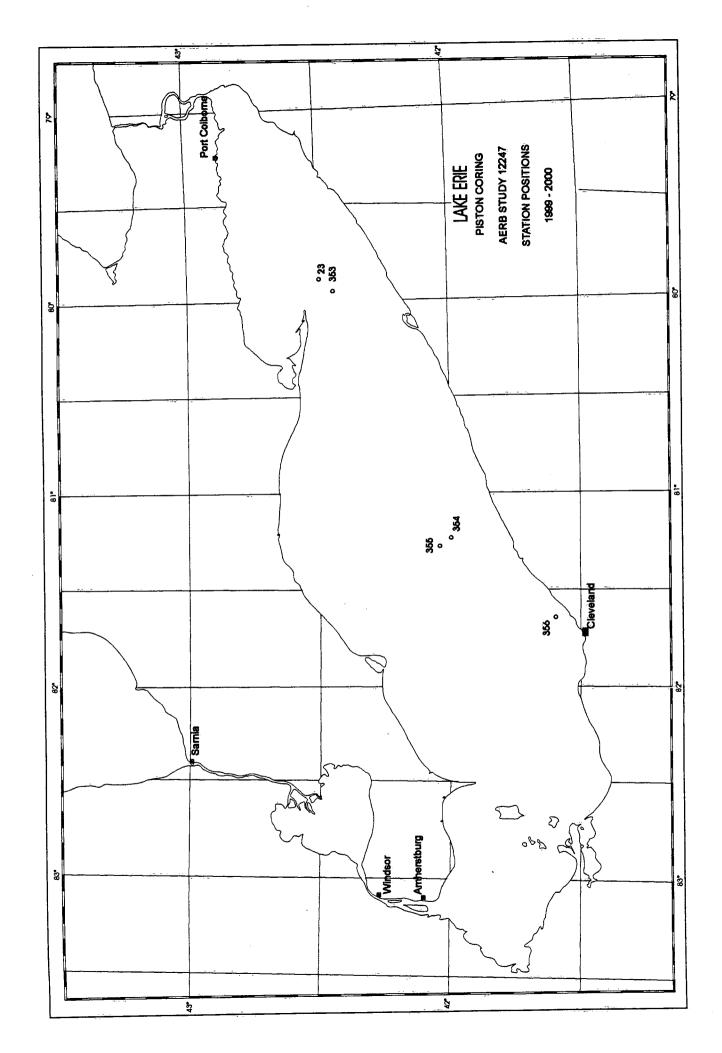
CRUISE NO.			SHIP	CCGS LIMNOS
DATE		<u>,</u>	REGION	LAKE ERIE
CRUISE TYPE	Piston Coring		N.MI. STEAMED	304.7

DESCRIPTION		TOTAL	DESCRIPTION	TOTAL
Stations Occupied	· 1	5	Moorings Established	
EBTT/Transmissometer Casts		5	Moorings Retrieved	
Rosette Casts			Moorings Established	
Reversing Thermometer Obs. (No. of Therm)			Moorings Retrieved	
Secchi Disk Observations		2	Moorings Established	
Transmissometer Casts	-		Moorings Retrieved	
Zooplankton Hauls				
Integrator 10 m				
Integrator 20 m			Primary Productivity Moorings	
Phytoplankton Samples				
D.O. Profiles				
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	4
Water Samples Collected (D.O.)	10	Cores Taken, Piston	4
Water Samples Collected (Cond/pH)	10	Cores Taken, Benthos	4
Water Samples Collected (TP uf)		Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	1
Water Samples Collected ()"		Bulk Centrifuge Samples	
Water Samples Collected (Stable Isotope)	10		
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.	30
Water Samples Filtered ()	-	Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()		Microbiology	

STATION POSITIONS

LAKE ERIE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	43° 30' 28"	79° 52' 28"
353	42° 27' 05"	80° 00' 03"
354	41° 57' 46"	81° 13' 27"
355	42° 03' 25"	81° 15' 25"



AQUATIC ECOSYSTEMS CONSERVATION BRANCH

ORGANIC CONTAMINANTS AECB STUDY 12310, DR. D. MUIR

One Cruise was conducted for Dr. D. Muir, AECB, May 31 - June 2. During this cruise aboard the CCGS LIMNOS, water and suspended sediment were collected from stations 1007, 1032 and 1034 in Lake Ontario for organic contaminant analysis. Sediment cores were collected at station 1007 for chlorinated paraffin analysis.

As additional tasks, sediment cores were collected and subdivided at station 20 for Dr. T.A. Jackson, AERB Study 12217 and a sediment trap was refurbished at station 403 for M.N. Charlton, AERB Study 12240.

STATION POSITIONS

LAKE ONTARIO

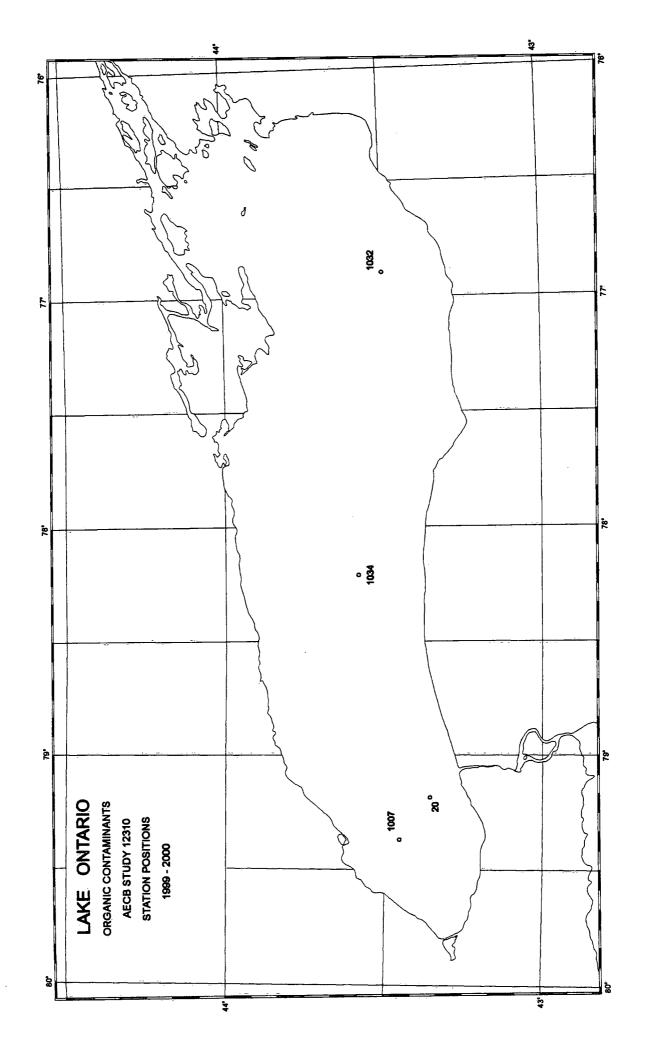
STATION NUMBER	LATITUDE N.	LONGITUDE W	
20	43° 20' 12"	79° 11′ 45"	
1007	43° 26' 00"	79° 24' 00"	
1032	43° 30' 16"	76° 54' 01"	
1034	43° 34' 40"	78° 12' 01"	

METAL CYCLE, LAKE ERIE AECB STUDY 12337, Dr. W.M.J. STRACHAN

One cruise was carried out onboard the CCGS LIMNOS for Dr. Strachan June 7 - 11 to observe any changes in the trace metals in surface water and/or profiles of Lake Erie. Previous sampling for trace metals was done in 1993 - 1994 using the portable clean lab facility and the CCIW clean analytical lab.

CRUISE NO.		SHIP	CCGS LIMNOS
DATE		REGION	LAKE ONTARIO
CRUISE TYPE	Organic Contaminants	N.MI. STEAMED	261.4

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	6	Moorings Established, Sediment Trap	1
EBTT/Transmissometer Casts	6	Moorings Retrieved, Sediment Trap	1
Rosette Casts	1	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disk Observations	5	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls		Moorings Serviced, Meteorological	2
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	2		
Water Samples Collected (Microbiology)		Cores Taken, Box	2
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	
Water Samples Collected (D.O.)		Cores Taken, Piston	
Water Samples Collected (Cond/pH)	9	Cores Taken, Benthos	
Water Samples Collected (TP uf)		Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected ()		Bulk Centrifuge Samples, 100 Litre	6
Water Samples Collected ()			
Water Samples Collected ()		Observations, Weather	
Water Samples Filtered (Chlorophyll <u>a</u>)	6		
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)	6		
Water Samples Filtered (TP f)			
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major lons)		ONBOARD ANALYSIS	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	18
Water Samples Filtered ()	1	Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()		Microbiology	



CRUISE NO.		SHIP	CCGS LIMNOS
DATE		REGION	LAKE ERIE
CRUISE TYPE	Metal Cycle Study	N.MI. STEAMED	434.3

DESCRIPTION		TOTAL	DESCRIPTION	TOTAL
Stations Occupied		12	Moorings Established	
EBTT/Transmissometer Casts		12	Moorings Retrieved	
Rosette Casts		12	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)			Moorings Retrieved	
Secchi Disk Observations		7	Moorings Established	12.000
Transmissometer Casts			Moorings Retrieved	
Zooplankton Hauls				
Integrator 10 m			<u> </u>	
Integrator 20 m			Primary Productivity Moorings	
Phytoplankton Samples		97		
D.O. Profiles	,	11		
Water Samples Collected (Trace Metals)	44	Cores Taken, Box	
Water Samples Collected (Mercury)	49	Cores Taken, Mini Box	
Water Samples Collected (D.O.)		Cores Taken, Piston	
Water Samples Collected (Cond/pH)		Cores Taken, Benthos	
Water Samples Collected (TP uf)		Grab Samples Taken, Shipek	6
Water Samples Collected (TKN)	22	Grab Samples Taken, PONAR	
Water Samples Collected (Trace Metals RPU)	. 30	Bulk Centrifuge Samples, 1200 Litre	20
Water Samples Collected (Trace Metals EHD)	77	Resin Column Extractions	20
Water Samples Collected ()		Observations, Weather	
Water Samples Filtered (Chlorophyll <u>a</u>)			
Water Samples Filtered (POC/TPN)			
Water Samples Filtered (Seston)	40		
Water Samples Filtered (Trace Metals)	43		
Water Samples Filtered (Nutrients)			
Water Samples Filtered (Major Ions)		ONBOARD ANALYSIS	
Water Samples Filtered (DOC)		Manual Chemistry, Tech. Ops.	
Water Samples Filtered (Mercury)	49	Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()	. ,, ,	Microbiology	

STATION POSITIONS

LAKE ERIE

STATION NUMBER	LATITUDE N.	LÔNGITUDE W.
18	41° 31' 50"	81° 42' 32"
22	41° 42' 55"	82° 10' 15"
23	42° 30' 07"	79° 53' 19"
30	41° 33′ 59"	82° 38' 04"
40	42° 21' 46"	81° 26' 27"
43	42° 34' 31"	80° 43' 59"
47	42° 17' 33"	80° 17' 59"
54	42° 39' 06"	79° 08' 00"
84	41° 56′ 06″	81° 39' 30"
357	41° 48′ 428	82° 59' 08"
974	41° 43' 31"	83° 08' 58"
1156	42° 02' 08"	83° 08' 04"

UV & MICROBIAL COMMUNITY EXAMINATION, LAKE ERIE AECB STUDY 12382, Dr. R.A. BOURBONNIERE

One cruise was carried out onboard the CCGS LIMNOS for Dr. Bourbonniere July 5 - 16 to examine natural microbial community and the impact of UV radiation on these systems in the Central Basin of Lake Erie.

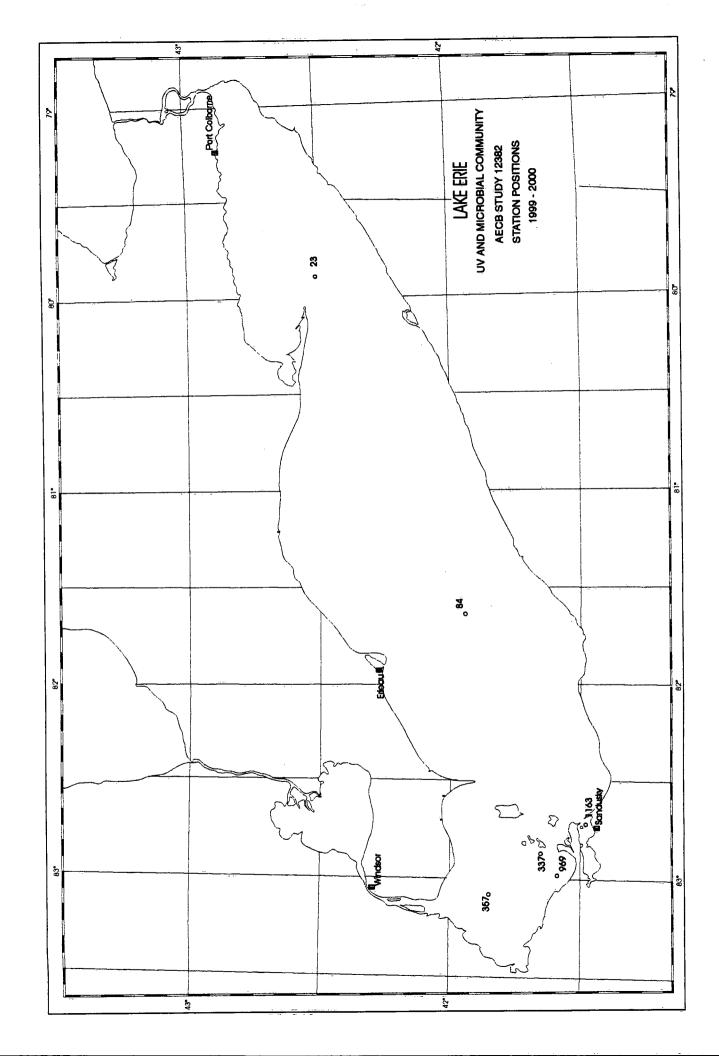
CRUISE NO.		SHIP	CCGS LIMNOS
DATE		REGION	LAKE ERIE
CRUISE TYPE	UV&Microbial Community Examination	N.MI. STEAMED	406.3

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	6	Moorings Established, C 14	1
EBT/Transmissometer Casts	48	Moorings Retrieved, C 14	1
Rosette Casts	44	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)		Moorings Retrieved	
Secchi Disk Observations	22	Moorings Established	
Transmissometer Casts	48	Moorings Retrieved	
Zooplankton Hauls	5		
Fluorometer Casts	44		
Integrator 10 m			
Integrator 20 m		Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	25		
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 ()		
Water Samples Collected ()		
Water Samples Collected ()	Observations, Weather	
Water Samples Filtered (Chlorophyll a)		
Water Samples Filtered (POC/TPN)		
Water Samples Filtered (Seston)		
Water Samples Filtered (TP f)		· · · · · · · · · · · · · · · · · · ·
Water Samples Filtered (Nutrients)		
Water Samples Filtered (Major Ions)	ONBOARD ANALYSIS	
Water Samples Filtered (DOC)	Manual Chemistry, Tech. Ops.	
Water Samples Filtered ()	Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()	Microbiology	

STATION POSITIONS

LAKE ERIE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
23	42° 30' 06"	79° 53' 24"
23 84	41° 56' 06"	81° 39' 30"
337	41° 41' 02"	82° 52' 29"
35 <i>7</i>	41° 48' 44"	82° 59' 09"
969	41° 36′ 29″	82° 55′ 34"
1163	41° 28' 20"	82° 42' 58"



RESEARCH SUPPORT BRANCH

OPEN LAKES SURVEILLANCE, LAKES ONTARIO, HURON AND GEORGIAN BAY ECOSYSTEM HEALTH DIVISION, ECB, EC-OR, S. L'ITALIEN RSB STUDY 12632, B.H. MOORE

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

Three cruises were conducted—one on Lake Ontario April 12 - 16 and two on Lake Huron and Georgian Bay May 3 - 12 and August 16 - 25 to support this program. All cruises were organized and completed by Technical Operations personnel for ECB-OR and were conducted from the CCGS LIMNOS. The vessel was equipped with the usual equipment: EBT, rosette water sampler, transmissometer, radar, Loran C, GPS positioning systems and a variety of samplers and winches used for chemical and biological sampling.

The parameters sampled during both cruises were: temperature and transmission profiles, dissolved oxygen, specific conductance, pH, chlorophyll <u>a</u>, particulate organic carbon, particulate nitrogen, total phosphorous filtered and unfiltered, soluble reactive phosphorous, total Kjeldahl nitrogen, alkalinity, SO₄, chloride, reactive silicate, major ions (Mg, K, Ka), meteorological and Secchi disk observations.

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

Unstratified Conditions: 1 metre

50 metres if total depth was greater than 70 m 100 metres if total depth was greater than 130 m 250 metres if total depth was greater than 300 m

bottom -10 metres bottom -2 metres

Stratified Conditions:

1 metre

1 metre above the knee of the thermocline

mid-thermocline

1 metre below the knee of the thermocline

100 metres if total depth was greater than 130 m 250 metres if total depth was greater than 300 m

bottom -10 metres bottom -2 metres Some of the additional tasks performed during the cruises were: Collection of water samples for Phenoxy acid herbicides and neutral herbicides for J. Struger, EHD, ECB-OR; chlorophyll <u>a</u>, total phosphorus filtered and unfiltered, nitrogen and SRP'S for Dr. P.F. Hamblin, AERB Study 12445; mooring installations for Dr. P.F. Hamblin, AERB Study 12445 and stable isotope samples for Mr. A. Karim University of Ottawa.

CRUISE NO.		SHIP	CCGS LIMNOS
DATE		REGION	LAKE HURON
CRUISE TYPE	Open Lakes Surveillance	N.MI. STEAMED	1032.1

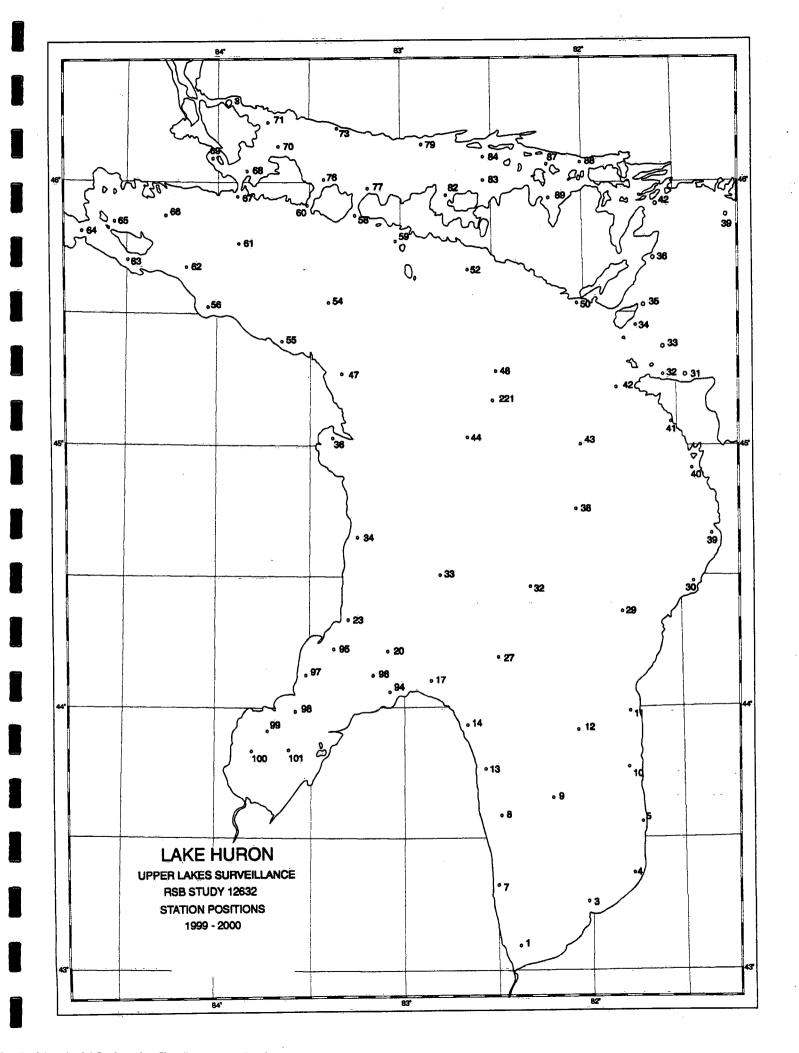
DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	137	Moorings Established	
EBT/Transmissometer Casts	136	Moorings Retrieved	
Rosette Casts	68	Moorings Established	
Reversing Thermometer Obs. (No. of Therm)	10	Moorings Retrieved	
Secchi Disk Observations	64	Moorings Established	
Transmissometer Casts	69	Moorings Retrieved	
Zooplankton Hauls			
Integrator 10 m	32		
Integrator 20 m	104		
Van Dorn casts	81	Primary Productivity Moorings	
Phytoplankton Samples			
D.O. Profiles	68		
Water Samples Collected (Microbiology)		Cores Taken, Box	_
Water Samples Collected (Water Quality)	396	Cores Taken, Mini Box	
Water Samples Collected (D.O.)	389	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	389	Cores Taken, Benthos	
Water Samples Collected (TP uf)	396	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)	48	Grab Samples Taken, PONAR	
Water Samples Collected ()			
Water Samples Collected ()		Bulk Centrifuge Samples, 10/	14
Water Samples Collected ()	<u> </u>	Observations, Weather	
Water Samples Filtered (Chlorophyll <u>a</u>)	162	Phenoxy Acid Herbicides	4
Water Samples Filtered (POC/TPN)	187		
Water Samples Filtered (Seston)	7		
Water Samples Filtered (TP f)	396		
Water Samples Filtered (Nutrients)	396		
Water Samples Filtered (Major Ions)	396	ONBOARD ANALYSIS	
Water Samples Filtered (DOC)	81	Manual Chemistry, Tech. Ops.	1167
Water Samples Filtered ()	<u> </u>	Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()		Microbiology	

OPEN LAKE SURVEILLANCE STATION POSITIONS LAKE HURON

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

STATION NUMBER	LATITUDE N.	LONGITUDE W.
48	45° 16' 42"	82° 27' 06"
50	45° 32' 06"	82° 02' 42"
52.	45° 39' 06"	82° 38' 54"
54	45° 31' 00"	83° 25' 00"
55	45° 25′ 30″	83° 39' 06"
56	45° 31' 00"	84° 05' 00"
58	45° 52' 00"	83° 16' 00"
59	45° 46' 00"	83° 01' 42"
60	45° 54' 06"	83° 31' 06"
61	45° 45' 00"	83° 55' 00"
62	45° 45' 30"	84° 11' 12"
63	45° 42' 12"	84° 30' 42"
64	45° 48' 48"	84° 45' 18"
65	45° 50' 42"	84° 34' 00"
66	45° 51' 48"	84° 17' 42"
67	45° 56' 06"	83° 54' 00"
68	46° 02' 30"	83° 51' 12"
69	46° 04' 42"	84° 01' 42"
70	46° 08' 12"	83° 40' 18"
71	46° 14' 00"	83° 44' 48"
73	46° 11′ 12"	83° 21' 18"
76	46° 00' 00"	83° 26' 00"
77	45° 58' 12"	83° 11' 54"
 79	46° 07' 24"	82° 53' 09"
82	45° 56' 12"	82° 45' 30"
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"

STATION NUMBER	LATITUDE N.	LONGITUDE W.
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		
100)	43° 49' 30"	83° 49' 02"
101)	43° 49' 15"	83° 37' 30"
101)	40 40 IS	0,0 0,7 0,0

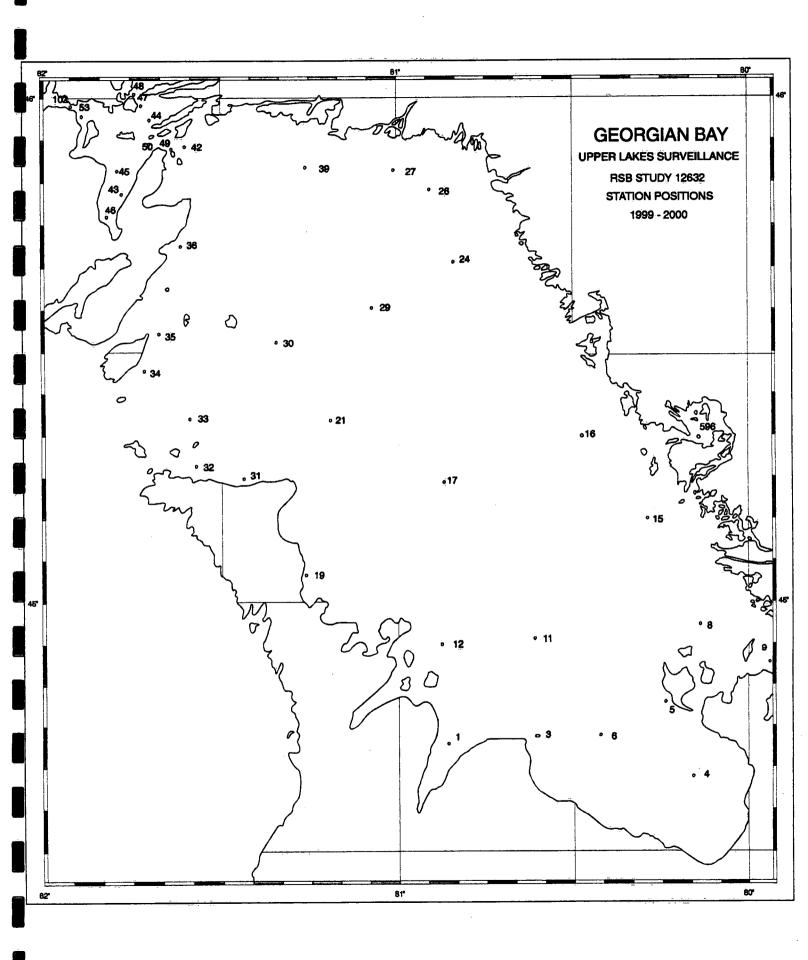


CRUISE NO.		SHIP	CCGS LIMNOS
DATE		REGION	GEORGIAN BAY
CRUISE TYPE	Open Lakes Surveillance	N.MI. STEAMED	989.0

			-
DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	72	Moorings Established, ST, TEMP, %T	2
EBTT/Transmissometer Casts	71	Moorings Established, ST, TEMP, DO	2
Rosette Casts	36	Moorings Established, Meteorological	1
Reversing Thermometer Obs. (No. of Therm)	4	Moorings Established, ADCP	4
Secchi Disk Observations	34	Moorings Established, Current Meter	1
Transmissometer Casts		Moorings Established, Tide Gauge	2
Zooplankton Hauls		Moorings Serviced, Meteorological	1
Van Dorn Casts	32		
Integrator 10 m			
integrator 20 m	56	Primary Productivity Moorings	.,
Phytoplankton Samples			
D.O. Profiles			
Water Samples Collected (Microbiology)	<u> </u>	Cores Taken, Box	
Water Samples Collected (Water Quality)		Cores Taken, Mini Box	
Water Samples Collected (D.O.)	190	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	190	Cores Taken, Benthos	
Water Samples Collected (TP uf)	204	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected ()		Bulk Centrifuge Samples, 1200 Litre	8
Water Samples Collected ()			
Water Samples Collected ()		Observations, Weather	
Water Samples Filtered (Chlorophyll a)	88		
Water Samples Filtered (POC/TPN)	79		
Water Samples Filtered (Seston)	16		
Water Samples Filtered (TP f)	204		
Water Samples Filtered (Nutrients)	215		
Water Samples Filtered (Major Ions)	190	ONBOARD ANALYSIS	
Water Samples Filtered (DOC)	32	Manual Chemistry, Tech. Ops.	540
Water Samples Filtered (Mercury)	49	Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()		Microbiology	

OPEN LAKE SURVEILLANCE STATION POSITIONS GEORGIAN BAY

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° 06' 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' <u>1</u> 2"
39	45° 52' 24"	81° 15' 30"
42	45° 54' 46"	81° 35' 42"
43	45° 49' 52"	81° 47' 19"
44	45° 58' 20"	81° 41' 55"
46	45° 45' 42"	81° 47' 41"
47	45° 59' 27"	81° 43' 58"
48	46° 00' 26"	81° 44' 00"
594	46° 20' 35"	80° 07' 38"



CRUISE NO.		SHIP	CCGS LIMNOS
DATE		REGION	LAKE ONTARIO
CRUISE TYPE	Open Lakes Surveillance	N.MI. STEAMED	662.8

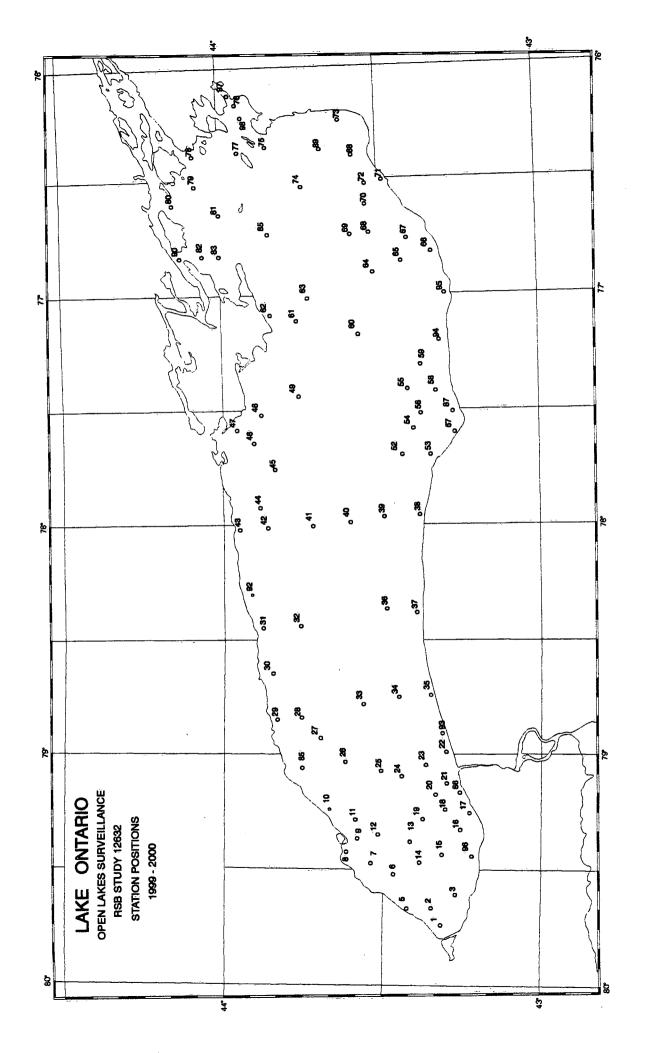
DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	94	Moorings Established, Sediment Trap	1
EBT/Transmissometer Casts	94	Moorings Retrieved, Sediment trap	1
Rosette Casts		Moorings Established	
Reversing Thermometer Obs. (No. of Therm)	12	Moorings Retrieved x	
Secchi Disk Observations	33	Moorings Established	
Transmissometer Casts		Moorings Retrieved	
Zooplankton Hauls	2	Moorings Serviced	
Van Dom Casts	93		
Integrator 10 m	3		
Integrator 20 m	90	Primary Productivity Moorings	
Phytoplankton Samples	***************************************	Phenoxy Acid Herbicides	3
D.O. Profiles		Neutral Herbicides	3
Water Samples Collected (Microbiology)		Cores Taken, Box	
Water Samples Collected (Water Quality)	146	Cores Taken, Mini Box	
Water Samples Collected (D.O.)	106	Cores Taken, Piston	
Water Samples Collected (Cond/pH)	106	Cores Taken, Benthos	
Water Samples Collected (TP uf)	146	Grab Samples Taken, Shipek	
Water Samples Collected (TKN)		Grab Samples Taken, PONAR	
Water Samples Collected ()			
Water Samples Collected ()			
Water Samples Collected ()		Observations, Weather	
Water Samples Filtered (Chlorophyll <u>a</u>)	117	Golden Sampler Extractions	22
Water Samples Filtered (POC/TPN)	129		
Water Samples Filtered (Seston)	6		
Water Samples Filtered (TP f)	146		
Water Samples Filtered (Nutrients)	146		
Water Samples Filtered (Major lons)	146	ONBOARD ANALYSIS	
Water Samples Filtered (DOC)	20	Manual Chemistry, Tech. Ops.	318
Water Samples Filtered ()		Nutrients, EHD, ECB, EC-OR	
Water Samples Filtered ()		Microbiology	

OPEN LAKE SURVEILLANCE STATION POSITIONS LAKE ONTARIO

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

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

STATION NUMBER	LATITUDE N.	LONGITUDE W.
71	43° 28' 36"	76° 31' 36"
71	43° 33' 00"	76° 31' 30"
72	43° 38' 00"	76° 17' 18"
73 74	43° 45′ 00″	76° 31′ 06″
7 4 75	43° 50' 36"	76° 21' 18"
7 6	43° 57' 00"	76° 10' 30"
77	43° 57' 24"	76° 24' 30"
	44° 05' 00"	76° 24' 24"
	44° 04' 30"	76° 31' 18"
80	44° 08' 30"	76° 36′ 36″
81	44° 01' 00"	76° 40' 18"
82	44° 04' 00"	76° 48' 42"
83	44° 00' 00"	76° 50' 36"
84	43° 53' 12"	76° 44' 00"
85	43° 45' 00"	79° 05' 00"
86	43° 15' 18"	79° 11' 42"
87	43° 17' 54"	77° 31' 06"
88	43° 35′ 18″	76° 25' 00"
89	43° 41' 54"	76° 25' 00"
90	44° 08' 11"	76° 49' 30"
91	43° 55' 12"	78° 18' 24"
93	43° 19' 36"	78° 52' 06"
94	43° 19' 30"	77° 13' 00"
95	43° 18' 48"	77° 00' 00"
96	43° 13' 24"	79° 26′ 48″
97	43° 57' 42"	76° 07' 18"
98	43° 56' 06"	76° 13' 54"



SHORE PROGRAMS

NATIONAL LABORATORY FOR ENVIRONMENTAL TESTING

SAMPLING OF ONTARIO/QUEBEC RIVERS NLET STUDY 12180, H. ALKEMA

During the weeks of June 1 and June 7, water samples were collected from various rivers across the provinces of Ontario and Quebec. The samples were to be used for Quality Control and Quality Assurance of analytical laboratories that require certification of their methodologies. Sampling was conducted during two trips. The Ontario portion was carried out using a 3-ton truck and six 200-litre barrels. For travel to Quebec a dual-wheel crewcab and 4 barrels were required. At each site one barrel of water was collected using a number 5 March pump. All samples were sealed and returned to CCIW without preservative and placed in the large walk-in cooler on the main floor. Sampling locations were as follows:

- 1. Shelter Valley Creek at Newtonville, Ontario: The sample was collected from the upstream side of a small bridge. The site is adjacent to a cattle farm.
- 2. Cataraqui River at Kingston, Ontario: The sample was collected from the Northwest corner of the Highway 2 bridge in Kingston.
- 3. Raison River at Comwall, Ontario: The site was located at the Hwy. 183 bridge in St. Andrews. The sample was collected from a parking lot on the southeast side of the river bank. The river was shallow with minimal flow.
- 4. Gatineau River at Hull, Quebec: The site was the bridge on Pont Avenue off road #307. The sample was collected from the bank of a parking lot on the northeast corner of the bridge.
- 5. Skootamatta River: A bridge which crosses Hwy. #7 was the site location. The sample was collected from the bank on the northeast side of the river.
- 6. Mississauga River: The site was located on Hwy. #36 one km from the intersection at Buckhorn. The sample was collected under the bridge.
- 7. Lake Magog at Deauville, Quebec: The site was located off Hwy. #112 East. The sample was collected from a sandy beach behind a condominium complex.
- 8. Yamaska River at Sainte Cesaire, Quebec: The location of the site is North of Hwy. #10 to 233 (Sainte Cesaire). The sample was collected at a launch ramp on the west bank of the river beside a foot bridge.
- 9. Richelieu River at Chambly, Quebec: The site was located on Bourgoge St. at a boat launch facility on the west bank. The sample was collected off the docks.
- 10.Lac Des Deux Montagnes at Sainte-Anne-de-Bellevue, Quebec: The site was just above the locks in Sainte-Anne-de-Bellevue, beside the tourist information centre. The sample was collected along the wall.

AQUATIC ECOSYSTEMS RESTORATION BRANCH

SEDIMENT REMEDIATION, HAMILTON HARBOUR AERB STUDY 12211, DR. T.B. REYNOLDSON

Mini box core samples and Hydrolab profiles were collected at two stations in Hamilton Harbour. Stations HH3 (Western Basin) and HH19 (Deep Hole) were chosen as representative areas in the harbour to study the benthic community structure. Samples were collected around the 15th of each month from April until November with a total of 8 samples being collected from each site. All positions were recorded utilizing DGPS and WGS 84.

Two DataSonde3 loggers were deployed in the Western Basin and in the deep hole to monitor dissolved oxygen during the months of May to November.

STATION POSITIONS

HAMILTON HARBOUR

STATION NUMBER	LATITUDE N.	LONGITUDE W.
HH3	43° 16' 46"	79° 52' 25"
HH19	43° 17' 19"	79° 51' 12"

DATASONDE

MOORING POSITIONS

STATION NO	MOORING NUMBER.	LATITUDE N.	LONGITUDE W
HH3	99 - 50E - 70A	43° 16' 45"	79° 52' 21"
HHI9	99 - 50E - 71A	43° 17' 21"	79° 50' 35"

SANDCAP SEDIMENT RESUSPENSION, HAMILTON HARBOUR AERB STUDY 12212, F. ROSA

This study is a continuation to the Sand Capping Study started in 1997. The sediment resuspension sampler at station R9 located in the middle of the sand capping area, and a sediment trap mooring at station R3 (Deep Hole) were retrieved in mid-April as winter moorings. The resuspension sampler was redeployed and refurbished on a monthly basis from mid-April until mid-December when it was again redeployed as a winter mooring. The sediment trap was not redeployed in the spring. The purpose of this study is to determine if there is any resuspension and movement of sand or silt away from the sand capping area.

STATION POSITIONS

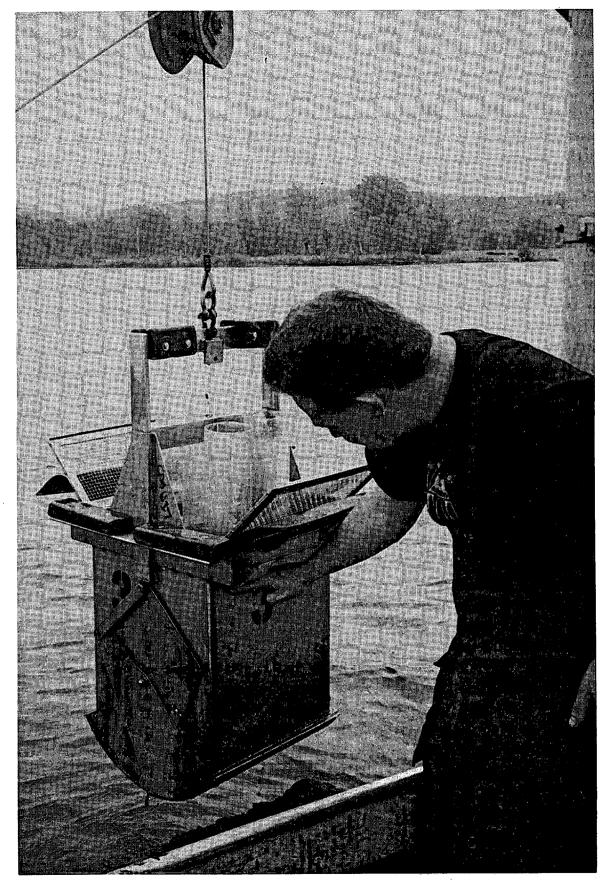
STATION NUMBER	MOORING NUMBER	LATITUDE N.	LONGITUDE W.
R3	98 - 50A - 77A	43° 17′ 14"	79° 50' 25"
R9	99 - 50A - 83A	43° 17′ 13"	79° 50' 23"

SEDIMENT SAMPLING AT SUDBURY AERB STUDY 12213, DR. U. BORGMANN

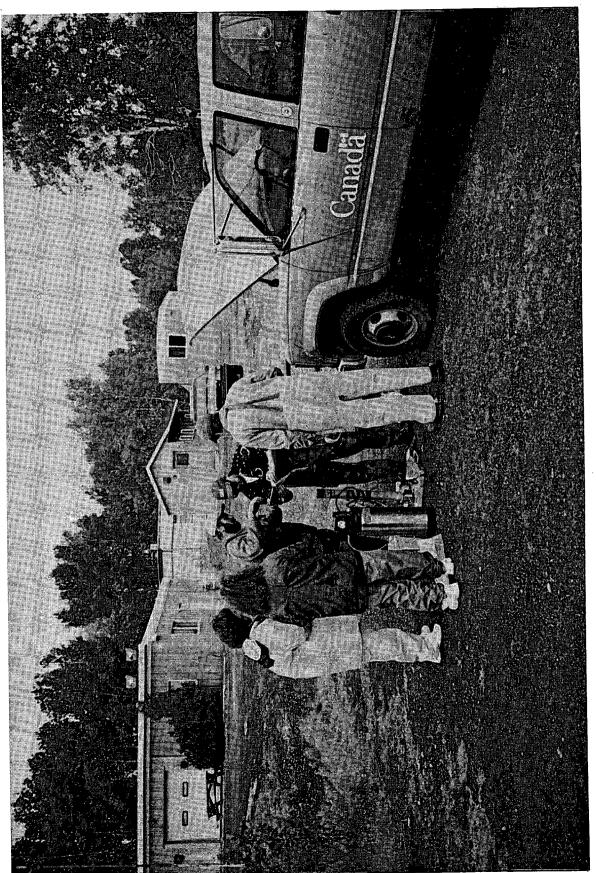
Technical Operations staff assisted this study with the collection of sediment samples from Richard and McFarlane lakes near Sudbury.

Richard lake was the first lake visited since it was the priority lake for this study. The boat was anchored in the deep hole in 9 metres of water. A Hydrolab H₂O profile was done for O₂, conductivity, pH, temperature and depth. A mini box core was taken to collect undisturbed sediment to be subsampled with four 10 centimetre cores. Several mini box cores were collected and the top ½ cm saved for oxidized material. Two mini box cores were collected for bioassays and three for benthic material. The bioassay samples were stored at 4°C and returned to CCIW for sectioning and experiments. The benthic samples were sieved on site and the animals preserved in 10% formalin for identification at CCIW.

McFarlane Lake was sampled the following day when the field party demonstrated sampling methodologies to two visitors from Argentina. Three benthos cores were



SUBSAMPLING A MINI BOX CORER ON RICHARD LAKE



SUBDIVIDING A CORE AT MCFARLANE LAKE

collected from the deep hole. Cores, ponar grabs and water samples were collected from the deep hole for the scientist form Argentina.

A shallow station was sampled near the dock at the Natural Resources base at McFarlane Lake to collect a large number of benthic animals for analysis at CCIW by the visiting scientist as part of the CCIW training program.

METAL AND ORGANIC SAMPLING, ALBERTA AERB STUDY 12215, DR. V. CHEAM

During the weeks of May 3 and 10, Technical Operations staff travelled to Alberta to collect sediment and water at coal mines and generating stations near Drumheller, Stoney Plains and Hinton. The samples collected were to verify results of sampling that occurred at the same locations in 1996. Permission was obtained to visit the sites and sample locations on all property prior to departing Burlington. Water samples were to be analyzed for various metals while the sediments were to be analyzed for organics, metals and toxicity. The sampling protocol was as follows:

- 1) The bioassay sediment for toxicity was collected by PONAR and stored in plastic bags at 4°C. At least 2 litres of sediment were required per sample.
- 2) Sediment samples for trace metals were collected by PONAR and stored in 500 ml plastic bottles at 4°C.
- 3) Sediment samples for organics were collected by PONAR and stored in 250 ml glass bottles at 4°C.
- 4) Water samples collected for trace metals were collected by immersing the 125 ml bottle in the body of water, rinsing 3 times, sealing and storing at 4°C. The water sample bottles were transported full of distilled water and were drained prior to filling.
- 5) Blanks for water samples were done by exchanging the water in the 125 ml bottle 3 times, sealing and storing at 4°C. A blank was done at each of the four sites.
- 6) All sampling locations were recorded with a written description and geographical position utilizing a hand held Trimble GPS

The locations sampled are described below under the name of the sites as follows:

Battle River Generating Station

The Battle River Generating Station is owned and operated by ACTO Electric. It is located on the Battle River North of Forestburg on highway #855. On visiting Battle River Generating Station and discussing the sampling locations with the engineer-incharge it was discovered that the sites to be sampled on the Battle River were on public domain and an escort was not required. The samples were collected at our discretion.

Battle River downstream location was at the bridge on secondary highway #861 South of the hamlet of Galahad. The geographical position was N. 52° 27' 16.5", W. 111° 55' 07.6". Samples were collected from the left bank of the river below the bridge. Samples were collected for all requested parameters.

Battle River upstream location was at the bridge at highway # 855 (Big Knife Provincial Park). The geographical location was N. 52° 29' 12.6", W. 111° 11' 03.1". Samples were collected from the right bank of the river 30 metres downstream of the bridge. Samples were collected for all requested parameters.

Paintearth Coal Mine

Paintearth Coal Mine—owned and operated by Luscar Mines Limited, is located on the Battle River North of Forestburg on highway #855. It is adjacent to the Battle River Generating Station and sends mined coal directly to the generating station. On arrival at the site a technician was assigned to guide us to all sampling locations due to safety concerns of the operating mine.

Impoundment Pond # 5 was located in geographical position N. 52° 24' 45.3", W. 112° 06' 56.1" at the edge of the impoundment pond as it drained the Paintearth property. Samples were collected beside the weir inside the earthen dam. Due to low water, the pond was quite dry and murky. There appeared to be less than 0.5 metres in the pond. Samples were collected for all requested parameters.

Paintearth Coal Mine downstream was located at the bridge at Paintearth Creek south of the abandoned Hamlet of Cordel. There is an Environment Canada water level monitoring station located beside the bridge. The geographic position was N. 52° 23' 08.4", W. 112° 08' 17.1". Samples were collected from the middle of the upstream side of the creek. Samples were collected for all requested parameters.

Paintearth Coal Mine upstream was located at the bridge on highway #855 as it crosses Slough Creek. The geographical position was N. 52° 24' 41.7", W. 112° 11' 16.9". Samples were collected from the right bank under the bridge. Samples were collected for all requested parameters.

Keephills Generating Station

Keephills Generating Station is owned and operated by Transalta Utilities. It is located on highway #627 West of the Hamlet of Keephills, Alberta. Keephills is southwest of Duffield, Alberta. On arrival at the site and signing in at the property an operator was assigned to guide us to all sampling locations. The Ash Lagoon Cenospheres were not sampled as requested because of lack of sample material due to the annual maintenance shutdown of the scrubber. The Cenospheres are produced as a byproduct of the stack scrubbing.

Cooling Pond Screen Waste was located on the property adjacent to the generator. Its geographical position was N. 53° 27' 00.2", W. 114° 27' 12.0". Samples were collected from the catwalk that ran along the south side of the pump-house approximately 15 metres from shore. Samples were collected for all requested parameters.

Ash Lagoon Slurry was sampled at a slightly different location than that in 1996 since the original site has been buried and reclaimed. The geographical location was N. 53° 27' 24.1", W. 114° 25' 46.7". The water sample was collected from the end of the discharge pipe as in 1996. The sediment (ash slurry) was collected from a safe location 6 metres from the end of the discharge pipe. Samples were collected for all requested parameters

Obed Mountain Coal Mine

Obed Mountain Coal Mine is located 15 km North of the Trans Canada highway, 25 km East of Hinton, Alberta. On arrival at the site we were met by the Environmental Officer and taken to the requested sampling sites.

East Conveyer Settling Pond is the second in a series of three ponds that eventually drain off the property. There was no drainage from the property at this time due to low water levels. The geographical location was N. 53° 35' 16.9", W. 117° 26' 39.5". Sediment samples were collected from the south berm of the pond 15 metres from the discharge pipe. The water sample was collected directly from the discharge pipe. Samples were collected for all requested parameters

Main Tailings Pond (Upper) is the uppermost settling pond for the tailings and has not had any tailings discharge into it for the last year. The location of the sample collection was at the southeast corner of the eastern berm. The geographical location was N. 53° 35′ 56.5″, W. 117° 27′ 44.2″. Samples were collected for all requested parameters.

<u>LSP2 - Coal Storage Drainage Pond</u> was located at the large storage dome at the end of a 13 km conveyor belt that is used for shipping the coal by rail to Japan. The geographic location was N. 53° 31′ 08.1″, W. 117° 20′ 36.4″. Samples were collected from the western berm of the drainage pond at the control weir. Samples were collected for all requested parameters.

All samples were stored at 4°C immediately after being sampled and during the return trip to Burlington.

THALLIUM SAMPLING, NEW BRUNSWICK AND NOVA SCOTIA AERB STUDY 12215, DR. V. CHEAM

One trip was made to sample for Thallium in New Brunswick and Nova Scotia, July 7 -



JACKHAMMER CORING AT THE GOLDENVILLE TAILINGS FIELD

14. Sediment and water samples were collected from the Belldune and Grand Lake generating stations as well as the Salmon Harbour mine in New Brunswick for metals analysis. Where sufficient sediment was found, samples were obtained for organic analysis and bioassays.

Samples were obtained in Nova Scotia from the Phalen and Prince mines as well as the Lingan, Point Aconi, Point Tupper and Trenton generating stations.

ABANDONED GOLD MINE TAILINGS SAMPLING, NOVA SCOTIA AERB STUDY 12216, H. WONG

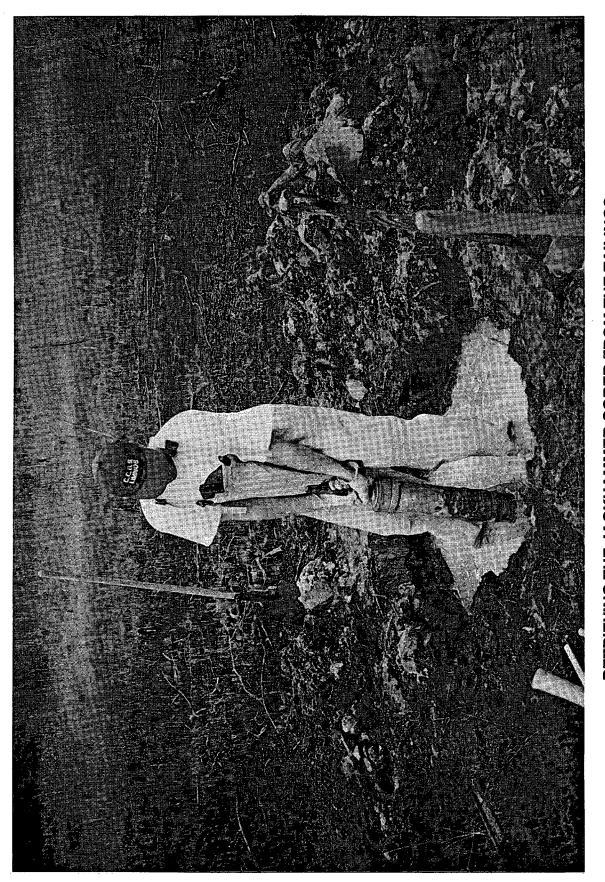
Technical Operations staff supported Henry Wong in Nova Scotia during the period of August 16 - 27. The purpose of this field work was to determine the dispersion and toxicity of metals from abandoned gold mine tailings. Two mines—Caribou and Goldenville, were large gold mines in Nova Scotia where large quantities of mercury and later arsenic were used in the gold recovery process. Previous analyses of stream water, stream and lake sediment, vegetation and tailings in and around the abandoned mines show a continuous release of metal contamination. Although the mines have been closed for over 50 years, sedimentary records of metal loadings show that the release of metals has not diminished. This release contaminates ecosystems downstream of the mines, including the Atlantic Ocean.

Sampling began at Caribou where five cores were taken in the mine tailings, using an impact corer. All cores were extruded into 2 cm sections on site and were approximately 1 m in length. Approximately 2200 litres of water were centrifuged from the outflow of Mud Lake and 1500 litres of inflow water from Long Lake. A Westfalia centrifuge was used and operated at 6L/min. Tech. Ops. cores were taken on both Long and Buckner lakes. Both cores were approximately 25 cm long and were extruded into 1 cm slices on site. Six mini PONAR's were taken at one site in both lakes.

The field party relocated to Sherbrooke to work at the Goldenville Mine site. Five cores were taken from the mine tailings, using the impact corer. Four were extruded into 2 cm slices and the other retained intact and returned to CCIW for future analysis. Twelve random surface sediment samples were collected from both mine sites, using a spade shovel.

SEDIMENT CORES, CLAY LAKE, ONTARIO AERB STUDY 12217, DR. T.A. JACKSON

On May 16, Technical Operations staff supported Dr. Jackson's study on metal speciation—especially mercury, in the Wabigoon River system. Samples were collected



RETRIEVING THE JACKHAMMER CORER FROM THE TAILINGS

from two of the major basins of Clay Lake. Clay Lake is located approximately 30 km north of Vermillion Bay in Northwestern Ontario. The sampling was done from an aluminum boat rented from North Star Lodge. Due to a winter with very little snow in the area, the lake level was down approximately 0.6 of a metre. Three cores were collected from both basins of the lake and subdivided into 1 cm sections to the bottom of the core, where applicable. Cores were collected, using a Technical Operations corer with 6.66 cm ID core tubes. The frying pan slicer was not utilized in any of the sectioning. All positioning was done using an Eagle GPS system.

Cores collected from the deep basin were labeled CLD 1, CLD 2 and CLD 3. The position of collection was N. 50° 03' 17.5", W. 93° 31' 43.5". The water depth of the cores was 18.6 metres. Visually the site was midway between Burnt Island and Gull Rock. Cores varied in length as follows: CLD 1 was 36 cm long and was sectioned to 34 cm; CLD 2 was 32 cm long and sectioned to 30 cm; CLD 3 was 33 cm long and sectioned to 30 cm.

All three cores from the deep basin were similar in appearance. The top 3 cm were very fluid, brownish, modern sediment; from 3 cm to approximately 10 cm, the sediment appeared to be a lighter brown in colour and the remainder of the core had a grayish brown colour to it.

The shallow station was located near the southwestern point of Harbour Island. The position was N. 50° 03' 02.3", W. 93° 26' 58.8", the water depth was 3.5 metres. The cores were labeled as CLS 1, CLS 2 and CLS 3. Their lengths were as follows: CLS 1 was 29 cm long and sectioned the whole length; CLS 2 was 28 cm long and sectioned the entire length and CLS 3 was 26 cm long and totally sectioned.

The sediment cores appeared similar in colour to the cores collected from the deep basin with the exception that they were stiffer in texture. After sectioning the cores, the sediment was stored at 4°C until returned to CCIW on May 17.

SEDIMENT CORES AND HYDROLAB PROFILES, WABAMUN LAKE, ALBERTA AERB STUDY 12217, DR. T.A. JACKSON

On August 22 four sediment cores and a Hydrolab profile were collected from Wabamun Lake, Alberta located 100 km west of Edmonton, Alberta.

Sampling equipment used on this project included a Hydrolab H20 profiler for the measurement of water temperature, oxygen content, pH and conductivity. Sediment samples were collected utilizing a Technical Operations corer with a 10 kg weight for penetration. The core tube used was 6.6 cm inside diameter and made of Cellulose Acetate Butyrate (CAB).

The field party rendezvoused with Wabamun Provincial Park staff on the morning of August 22 when Provincial Parks staff transported us to the vicinity of the deep hole basin of the lake. Due to strong winds, the exact deep hole (11.0 metres) could not be located since it was on the southern side of the lake and the winds were in excess of 25 knots, making for very large waves for that lake. The depth of the lake at the site sampled was observed to be 9.7 metres. The position of the station was latitude 53° 33' 15.1" N. and longitude 114° 40' 24.7" W.

The sediment cores collected were approximately 45 cm in length. When the cores were sub-divided there was considerable compression due to the consistency of the sediment collected. The final number of subsections per core was 35 one cm samples. The sediment was very fluid in the top 5 cm of the cores and gradually got firmer with depth. The last section of the core still had a high water content and was relatively fluid. There were no colour variations in the sediment which appeared to be olivebrown from top to bottom. The only exception was the 0 - 1 cm sub-section which appeared to have a slightly darker colour.

RIVERBED SEDIMENTATION STUDY AERB STUDY 12218, DR. N.A. RUKAVINA

On an ongoing basis, a number of bottom-mounted acoustic T-frames are being used in different locations around the Great Lakes Basin. The study was designed to monitor erosion and deposition of sediments at a very high resolution; i.e., millimetre accuracy. T-frames were located at four sites (for a different duration throughout the year). There was one system operating in the St. Clair River adjacent to the Dow Chemical Property at Samia, one system along the north shore of Hamilton Harbour, two systems were installed in the Detroit River late in the season and three T-frames were located in the St. Lawrence River at Cornwall.

One trip was made to the three T-frames located in the St. Lawrence River at Cornwall. On May 18, a Technical Operations dive team was in Cornwall to remove all of the winter markers from the frames. These frames will remain on the river floor until they are deemed not useful.

Technical Operations divers made a number of visits to the different T-frame locations over this past field season. The Sarnia T-Frame was visited 3 times this past year (April 8, August 24, and September 20). Each visit was to collect the standard diver observations (NAR rod readings, state of XDR fouling and to download data). Video documentation was made on each visit if the underwater visibility dictated it. The final trip of the year to Sarnia was to decommission the T-frames and remove any marker floats. The T-Frames will remain on the river floor until the study leader wants them removed.

Three visits to the Hamilton Harbour T-frame were made by the Technical Operations divers (May 5, August 13 and November 9). Again, the standard diver measurements were completed on each visit. Poor visibility at the harbour site made video logging of the frame almost impossible. This frame is also on the bottom, with no instrumentation on it (at the time of writing).

Two new T-frames were launched by the CCGS LIMNOS on September 30, in the Detroit River near Amherstburg. Technical Operations divers made the first visit to outfit the frames with instruments on October 4. During this visit both sites were outfitted with transducers, 1 thermistor, 1 OBS, a datalogger and a surface communication cable. Video at both sites was impossible due to poor visibility in the river. A second trip was made by a dive team on November 23. This was supposed to be the final trip and winterization of the two frames. However, the data can in the Trenton Channel location was not working and had to be pulled and repaired. The last trip is scheduled for December 7. The datalogger will be put back in place along with an external battery backup and the mooring will be winterized.

CORNWALL STATION POSITIONS (DGPS - WGS 84)

STATION	LATITUDE	LONGITUDE	NORTHING	EASTING
1	45° 01' 04.5"	74° 41' 44.7"	4984985.0	523971.0
2	45° 01' 17.4"	74° 41' 17.3"	4985386.0	524571.0
3	45° 01' 25.7"	74° 40' 58.9"	4985640.0	524978.0

HAMILTON HARBOUR STATION POSITION (DGPS WGS-84)

STATION	LATITUDE	LONGITUDE	NORTHING	EASTING
1	43° 17' 46.5"	79° 50' 57.8"	4794357.0	593331.0

SARNIA STATION POSITIONS (DGPS WGS-84)

STATION	LATITUDE	LONGITUDE	NORTHING	EASTING
1	42° 56' 33 "	82° 26' 12"	4755431.0	382790.0
2	42° 56' 37"	82° 26' 05"	4755551.0	382950.0

DETROIT RIVER STATION POSITIONS (DGPS WGS-84)

STATION	LATITUDE	LONGITUDE	NORTHING	EASTING
1	42° 06' 43"	83° 07' 07"	4664377.5	324845.4
2	42° 08' 49"	83° 10' 17"	4668373.5	320580.7

ROXANN SEDIMENT SURVEYS, HAMILTON HARBOUR, OSHAWA, LAKE ONTARIO, DETROIT RIVER AERB STUDY 12218, DR. N.A. RUKAVINA

Bottom sediment mapping using the Roxann Seabed Classification System was conducted at three main locations—Lake Ontario at Oshawa, Ontario; Hamilton Harbour/nearshore zone of Western Lake Ontario and the entire length of the Detroit River (both U.S. and Canadian waters). The CCGL PUFFIN equipped with both a Starlink beacon GPS receiver and Sercel base station GPS receiver, along with the Microplot Navigation System was utilized again this year in all of the surveys. As with last years' program, both high frequency and low frequency Roxann systems were run simultaneously during all of the surveying done this year. The transducers in the PUFFIN were also hull-mounted this year, eliminating the need for the port, sidemounted transducer bracket. This was a vast improvement over the previous design.

A small survey was run in the area of Randle Reef in Hamilton Harbour during the week of April 19. The survey was run to assist in selecting sites for sediment penetration testing using a piece of equipment borrowed from the west coast called the STING. Following the STING testing, sites were again sampled with the CCIW acoustic tripod for comparison. The purpose of the sampling was to attempt to gain an educated guess as to the thickness of contaminated sediments in the area. All of the sites were chosen to correspond to the TROW Engineering/Ontario Region Drilling Project on or near the Randle Reef.

The second survey of the year (June 1999) was to support a storm-water runoff project being led by Dr. Paul Mudroch of Ontario Region. The survey area was in the nearshore zone near the mouth of Oshawa Harbour. The survey lines consisted of 25 m offsets and ran from a point a little west of the harbour entrance, then running east until the furthest extent of Second Marsh. The area was ground-truthed using the acoustic tripod frame and uwTV, along with mini Shipek sampling at 20 sites chosen by the study leader. There were some unusual bottom types found during the ground-truthing so Dr. Rukavina wanted an additional divers' survey completed. During this time an additional 23 sites were sampled by divers. The results of the divers' survey were excellent and confirmed some of the unusual bottom types found with the Roxann.

The third main survey of the year took place during the month of July in the Detroit River. This survey was in support of a joint project being worked on by the University of Windsor and MOEE. The survey area included the entire length of the Detroit River on both the American and Canadian sides. Approximately 550 kilometres of survey work was completed during the project which lasted about 3½ weeks. A series of cross channel zigzag lines was run in most areas of the river into nearshore depths of about 2 m. Both uwTV and Shipek work were done in selected areas as ground-truthing. Poor visibility in the river due to high suspended material loading made the uwTV difficult. Following the main zigzag line completion, seven smaller areas were resurveyed in detail throughout the length of the river. These areas included one in Lake Erie, one in Lake St. Clair, two in the Trenton Channel, two along the stretch from Fighting Island to Belle Isle and one just east of Ballards Reef Channel.

The results of this survey led to the installation of two riverbed acoustic T-frames in the Detroit River.

Following the Detroit River survey a number of local trips based out of headquarters took place in Hamilton Harbour and the Western end of Lake Ontario. During the early fall, a new Knudsen sounder was installed on the CCGL PUFFIN to replace the aging Atlas sounders that had been used in the past. This change in equipment also led to having to order some newer generation head amps for the Roxann systems. The new sounder and head amp combination is in the midst of being tested for the next field season.

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

The Hamilton Harbour sampling program was reduced somewhat from last season. Station 1001 in Hamilton Harbour was sampled on a regular basis throughout the field season—weekly from April until the end of September and monthly for the last three months. Sampling depths for this station were 1, 3, 5, 7 and 19 metres. Water was collected for chlorophyll a, particulate organic carbon, nutrients, Seston, total phosphorus filtered and unfiltered, major ions, metals and chloride. A Hydrolab profile was done to measure oxygen, pH, conductivity, transmittance and depth.

Spencer Creek, Chedoke Creek and Grindstone Creek were sampled on an ongoing basis throughout the summer for the same parameters as those collected at station 1001. This was to measure the amount of input into Hamilton Harbour from other sources.

In April, sediment trap moorings were deployed at stations 50, 51 and 53. The winter mooring at station 52 was refurbished and deployed as a regular mooring. All moorings were refurbished mid-month on a regular basis. In November, moorings at stations 50,

51 and 53 were removed and the mooring at station 52 was re-established as a winter mooring.

Additional sediment sampling was conducted for this study in September. Sediment samples were collected from the Randle Reef area for M. Charlton and Dr. Greenburg of the University of Waterloo and from the Dofasco boat slip for a joint study with Mr. R. Jagamachi of MOEE. Positions were not critical and as such were not recorded.

As a training exercise, visiting scientists from Argentina were piggybacked on a harbour cruise to observe sampling methodologies. Sediment samples were collected for the scientists at the mouth of the Dofasco slip and the western end of the harbour. Positioning was not critical but positions were taken and logged with Mr. D. Anthony, NLET.

WATER SAMPLING STATIONS

LATITUDE N.	LONGITUDE W.	WGS84
43° 17' 16"	79° 50′ 26″	NAD27
43° 16' 05"	79° 56' 11"	WGS84
43° 15' 56"	79° 56' 35"	WGS84
43° 15' 46"	79° 53' 40"	WGS84
43° 16' 09"	79° 53' 35"	WGS84
43° 18' 21"	79° 51' 47"	WGS84
	43° 17' 16" 43° 16' 05" 43° 15' 56" 43° 15' 46" 43° 16' 09"	43° 17' 16" 79° 50' 26" 43° 16' 05" 79° 56' 11" 43° 15' 56" 79° 56' 35" 43° 15' 46" 79° 53' 40" 43° 16' 09" 79° 53' 35"

SEDIMENT TRAPS

79° 48' 59"
79° 52' 18"
79° 50' 31"
79° 47' 39"

SECCHI DISK SURVEY, HAMILTON HARBOUR AERB STUDY 12240, M.N. CHARLTON

On July 13 C. McIsaac and L.M. Benner conducted a Secchi disk survey in Hamilton Harbour. Tests were done throughout the entire harbour with a large concentration in the west end near the mouth of Grindstone Creek. The data was obtained with the use of the CCGL PELICAN and DGPS. The datum used was WGS-84 and the coordinates were displayed in degrees, minutes and decimal minutes. Depths were listed in metres. Using the software package Raison, the data will be arranged to create a contour map displaying the varying levels of turbidity throughout the harbour.

HAMILTON HARBOUR SECCHI DISK SURVEY

STATION NUMBER	LATITUDE N.	LONGITUDE W.	SECCHI DEPTH
Ï	43° 16.8405	79° 53.1178	0.25
2	43° 16.9408	79° 53.1520	0.25
3	43° 16.9451	79° 53.1178	0.25
4	43° 16.9052	79° 53.2586	0.25
5	43° 16.8186	79° 53.3089	0.10
6	43° 16.7934	79° 53.3290	0.10
7	43° 16.7688	79° 53.2320	0.10
8	43° 16.7800	79° 53.1410	0.25
9	43° 16.8360	79° 53.0865	0.25
10	43° 16.8081	79° 53.0565	0.75
11	43° 16.7818	79° 53.1600	1.00
12	43° 16.8018	79° 53.2857	1.00
13	43° 16.6856	79° 53.2322	1.00
14	43° 16.6651	79° 52.9843	0.75
15	43° 16.6243	79° 52.6974	0.75
16	43° 16.6224	79° 52.2100	1.00
17	43° 16.4572	79° 52.4545	1.00
18	43° 16.4530	79° 52.7338	0.75
19	43° 16.3505	79° 52.5563	1.25
20	43° 16.6700	79° 52.6377	0.75

STATION NUMBER	LATITUDE N.	LONGITUDE W.	SECCHI DEPTH
21	43° 16.9117	79° 52.4525	1.00
22	43° 17.1135	79° 52.1034	1.00
23	43° 17.0078	79° 51.9141	1.25
24	43° 16.8898	79° 52.3331	1.40
25	43° 16.8505	79° 51.8030	1.25
26	43° 16.7862	79° 51.4402	1.25
27	43° 16.6485	79° 50.9041	1.40
28	43° 16.4770	79° 50.4869	1.50
29	43° 16.3955	79° 50.2033	1.75
30	43° 16.3681	79° 50.0070	0.75
31	43° 16.5013	79° 49.8843	1.00
32	43° 16.8410	79° 49.7076	1.25
33	43° 16.7348	79° 50.0883	1.50
34	43° 17.0660	79° 50.6373	0.75
35	43° 17.4143	79° 51.2484	1.25
36	43° 17.7269	79° 50.8479	1.00
37	43° 17.4100	79° 50.4857	1.40
38	43° 17.2465	79° 50.0139	1.25
39	43° 17.5230	79° 49.9129	1.25
40	43° 18.1811	79° 49.6729	0.75
41	43° 18.1135	79° 48.2989	1.50
42	43° 18.4169	79° 48.4400	1.50
43	43° 18.4968	79° 48.4300	1.25
44	43° 18.4998	79° 48.8825	1.25
45	43° 18.3640	79° 48.9329	1.25
46	43° 18.1444	79° 49.0060	1.50
47	43° 17.8024	79° 49.0959	1.50
48	43° 17.4512	79° 49.1419	1.50
49	43° 17.0953	79° 49.1334	1.00
50	43° 17.0137	79° 48.6930	1.00

STATION NUMBER	LATITUDE N.	LONGITUDE W.	SECCHI DEPTH
51	43° 16.8479	79° 48.2143	1.25
51 52	43° 16.7071	79° 47.7511	1.50
53	43° 16.4208	79° 47.8659	1.25
54	43° 16.2378	79° 47.9477	1.25
55	43° 16.1447	79° 48.0094	1.25
56	43° 16.5367	79° 47.7121	1.25
57	43° 16.4412	79° 47.4504	1.00
58	43° 16.3266	79° 47.2943	0.75
5 9	43° 16.2220	79° 47.1717	0.75
60	43° 16.0300	79° 47.2560	1.25
61	43° 16.1595	79° 47.0244	0.75
62	43° 16.1343	79° 46.9356	0.75
63	43° 16.8421	79° 47.6537	1.50
64	43° 17.0658	79° 47.7613	1.25
65	43° 17.2136	79° 48.0532	1.40
66	43° 17.5143	79° 48.3777	1.40
67	43° 17.7755	79° 48.0222	0.75
68	43° 17.9060	79° 47.7876	1.00
69	43° 18.0976	79° 47.4431	1.25
70	43° 17.7602	79° 48.3473	1.50
71	43° 17.9626	79° 48.5114	1.50
72	43° 17.9298	79° 48.2610	1.25

MET MONITOR AND SENSOR EXCHANGE, LAKE MICHIGAN AERB STUDY 12242, DR. C.R. MURTHY

Technical Operations supported this study, led by Dr. C.R. Murthy, by assisting with the maintenance of two MET systems installed along the shore of Lake Michigan in support of the Episodic Events - Great Lakes Experiment (EEGLE). The MET systems were installed on 10-metre towers—one on the pier at St. Joseph, Michigan and the other on

the Coast Guard dock at Michigan City, Illinois in June of last year and have been recording meteorological data continuously since.

One technologist from this section accompanied Mr. E.G. Smith of the Instrument Maintenance Unit, Engineering Services Section, RSB to these field sites in June. The wind speed, wind direction, air temperature and relative humidity sensors were exchanged with fresh units and the systems monitored in preparation for another season of data collection. Both systems were found in excellent condition, remarkably free of any damage.

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

As part of a physical dynamics study in the nearshore zone, the Hydra current meter tripod was deployed at Randle Reef and the Burlington Wastewater outfall of Hamilton Harbour and Stoney Creek Shoal in Western Lake Ontario.

On April 12, TOS divers (Breedon and Don), accompanied by Mr. D. Doede, AERB travelled to the Randle Reef area of Hamilton Harbour. The purpose of the trip was to install the Hydra current meter. The launch PINTAIL was utilized to survey the intended mooring site to find a flat bottom location. The current meter mounted on a tripod (2 m high) was installed in a standard U-shaped mooring configuration using the barge, GOOSE III. The mooring (99-50C-02A) was installed safely without difficulty. TOS divers inspected the installation. The entire mooring was found to be in good order. The tripod was observed to be sitting almost level with a reading of 4° off horizontal, which is well within the tolerance of 15°.

As part of a short-term intercomparison of various current measuring instruments (Hydra, ADCP, MAVS and FSI), two moorings (99-50C-02A and 99-50C-03A) were installed on June 11. The moorings were located in the northeast comer of Hamilton Harbour near the STP outfall. Both moorings were retrieved by TOS staff on the morning of June 28. The current meter tripod and the ADCP were returned to the Engineering shop. The water depth at the site was confirmed as 7.5 metres.

On September 24, a TOS dive team (Breedon and Don), accompanied by Mr. C. Lomas travelled to the Stoney Creek shoal in Western Lake Ontario. The purpose of the trip was to install the Hydra current meter which will collect data for use in the lake trout habitat studies (GLLFAS). This location is a GLLFAS habitat study site (John Fitzsimons) as a potential lake trout spawning shoal. Data on water movement over the shoal may provide a useful tool in characterizing "successful" spawning shoals. The site also provides a useful location to collect data on storm events in the Western Basin of Lake Ontario. Divers surveyed the intended mooring site to find a flat bottom location. The current meter mounted on a tripod (2 m high) was installed in a standard

U-shaped mooring configuration using the barge, "GOOSE III". The mooring was installed safely without difficulty. Divers checked the mooring after launching and found it sitting level on the exact location as the 1998 deployment.

STATION POSITIONS (DGPS - WGS 84)

MOORING NUMBER	LATITUDE N.	LONGITUDE W	. NORTHING	EASTING
99-50C-01A Harbour 99-50C-02A Harbour 99-50C-03A Harbour 99-50C-02B Harbour 99-50C-03B Harbour 98-00C-37A LakeOnt.	43° 16' 39" N 43° 18' 20" N 43° 18' 21" N 43° 18' 25" N 43° 18' 21" N 43° 15' 34" N	79° 50' 17" W 79° 48' 41" W 79° 48' 40" W 79° 48' 45" W 79° 48' 40" W 79° 40' 43" W	4792314. N 4795471. N 4795471. N 4795578. N 4795569. N 4790477. N	594239. E 596413. E 596413. E 596322. E 596324. E 607247. E

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

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

This project involved two trips to Malawi by TOS staff January 3 - February 8 and May 1 - 30, 1999. On both trips, thermograph/sediment trap moorings and meteorological

stations were refurbished. A meteorological station was established during the January cruise at Kyela in Tanzania at the northern end of the lake.

After completing the January cruise to service the moorings and collect water samples, work was done with Mr. G. McCullough, University of Manitoba, using a leased ADCP mounted on a LeeCat and working off the mouth of the Linthipi River which flows into Lake Malawi south of Senga Bay. This work was to map the nearshore currents and sediment load coming from the river. A rain sampler was also set up to collect daily rainfall for Halo Acetic Acid analysis for Dr. B. Scott, AEPB.

During the May trip, mooring 98-SLAT-03A which had not been recovered during previous cruises was located by dragging and all instruments were recovered. This was the final trip for this project. All moorings were retrieved and meteorological stations at Chilumba and onboard the USIPA were dismantled. All equipment was returned to CCIW.

Sediment and vegetation samples were collected from several locations in rural and less populated areas for Drs. B. Scott and D. Muir, AEPB for Halo Acetic Acid analysis.

LAKE MALAWI/NYASA MOORING POSITIONS

MOORING NUMBER	LATITUDĒ S.	LONGITUDE E.	INSTRUMENT/ DEPTH IN METRES
99-SLAT-01	13° 52' 07"	34° 51' 57"	T(1,6,12,22,33,45,60, 75,90,115)
99-SLAT-02	13° 25' 58"	34° 44' 30"	T(1,6,12,18,24,32,40,50, 65,85,110,143,170,199) SED(100.140,180)
99-SLAT-03	11° 49′ 48″	34° 29' 42"	T(1,6,12,22,35,50,70,103, 142,200,260,320,361) SED(100,180,300)
99-SLAT-04	09° 42′ 18"	34° 03' 39"	T(1,6,12,22,35,50,70,102, 135,175,212) SED(100)

MOORING NUMBER	LATITUDE S.	LONGITUDE E.	INSTRUMENT/ DEPTH IN METRES
99-SLAT-05	11° 49' 48"	34° 29' 42"	T(1,6,12,22,35,50,65,85, 110,135,160,200,240) SED(100)

LAKE MALAWI/NYASA STATION LOCATIONS FOR WHOLE-LAKE LIMNOLOGICAL SAMPLING CRUISES

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

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

ADCP MOORINGS, TORONTO AREA, LAKE ONTARIO AERB STUDY 12247, DR. J.P. COAKLEY

Technical Operations supported Dr. Coakley's Humber Bay study by deploying ADCP current meter moorings in the Humber Bay and Ashbridges Bay area of Lake Ontario on December 7. The moorings, installed are to collect data to better understand the water movements in that area of Lake Ontario. Water movement is most important in case there is development of future water intakes and sewage outfalls since it can be associated with the transport of bottom sediments and particulate movements.

Current meters were programmed to start collecting data on December 9. All instruments were equipped with pingers. Positioning was done using Datum WGS 84 and were recorded in both Latitude/Longitude (Degrees, Minutes and Seconds) and UTMs (Northings and Eastings).

MOORING POSITIONS

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	ADCP S/N (TYPE)
JPC99-1 JPC99-2	99 - 00C - 02A 99 - 00C - 03A 99 - 00C - 04A	43° 37' 02.076" 43° 35' 59.172" 43° 37' 28.656"	79° 25' 58.326" 79° 27' 00.588" 79° 17' 57.750"	0842 (WH) 1177 (BB) 1039 (WH)
JPC99-3 JPC99-4	99 - 00C - 04A 99 - 00C - 05A	43° 39' 00.162"	79° 17' 57.756"	0432 (NB)

SEDIMENT SAMPLING, OAKVILLE AND BRONTE HARBOURS AERB STUDY 12247, DR. J.P. COAKLEY

Technical Operations supported this project on August 4th. Two staff members and Dr. Coakley departed CCIW in the launch PETREL and travelled first to Oakville Harbour and collected sediment samples from six predetermined sites using a full size Shipek. Some locations were moved short distances to obtain better samples. The PETREL then travelled to the Bronte Harbor area and collected four more samples from predetermined sites before returning to CCIW.

GROUNDWATER REMEDIATION PROJECT AERB STUDY 12260, DR. A. CROWE

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

Smithville Remediation Project

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

Twenty wells have been installed for GRP/AERB over the past four years. Technical Operations staff have assisted by logging, surveying, sampling, hydraulic testing and regular monitoring of the bore holes, as well as assisting in numerous tracer, point dilution, pumping and injection tests. This year five of the wells had Westbay multipacker systems installed for a total of eleven Westbay installed wells. This system permits more reliable and simplified sampling and long-term monitoring.

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

Point Pelee National Park Groundwater Study

Point Pelee is another ongoing project started in 1993 and continued into this year. Since its inception, one hundred and twenty-four monitoring wells have been installed

along two cross-sections and at four septic bed sites. This study is part of a joint project between Parks Canada and AERB which is investigating high nutrient concentrations in the marsh. These wells are being monitored and sampled on a regular basis. Cores and water samples have also been obtained from the lake and marsh periodically.

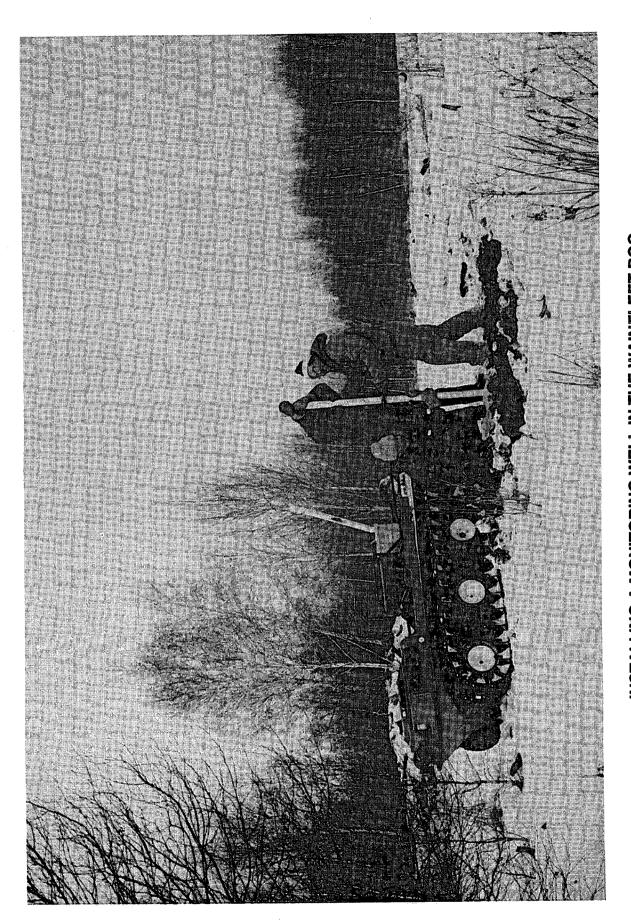
Wainfleet Bog Conservation Area Groundwater Study

Wainfleet Bog is another study undertaken by GRP/AERB this year. Wainfleet Bog is the largest remaining peat bog within Southern Ontario. Located close to Port Colborne, Wainfleet Bog covers 1,030 hectares (2,545 acres). This study is part of a joint project between Niagara Peninsula Conservation Authority and AERB, investigating the hydrology of the area in order to facilitate the natural regeneration of this important ecosystem.

Eleven wells were installed in and around the bog this year to varying depths from four to thirty metres using the NWRI Boa 3M drilling rig. These and all wells and test holes have been logged and surveyed with information recorded on the appropriate water well record form. These wells and local drains are being monitored and sampled on a regular basis with more shallow wells expected to be installed in the new year.

McMaster University

Technical Operations staff also assisted GRP and McMaster University in presenting a short course in monitoring well installations. Two monitoring wells were installed on university grounds using the NWRI Boa 3M drilling rig. The purpose was to provide students with the opportunity to get acquainted with well installation and to make wells available for future classes of hydrogeology students.



INSTALLING A MONITORING WELL IN THE WAINFLEET BOG

AQUATIC ECOSYSTEMS CONSERVATION BRANCH

PCB AND DDT SAMPLING, CAYUGA LAKE, N. Y. AECB STUDY 12310, DR, D. MUIR

On October 19 and 20, Technical Operations staff supported Dr. D. Muir's study of the waters of Cayuga Lake located in the Finger Lakes District of New York State. Sampling was done for the investigation of various organics such as PCB's and DDT's. Water and sediment sampling was to be done from the deep zone of the lake and a sediment sample collected from a site within 50 km of the lake on shore in a relatively undisturbed area away from forestry and agricultural use. The shore sample was for terrestrial dating.

Samples from an undisturbed area on shore for Pb_{210} dating of the terrestrial environment were not collected due to heavy agricultural use of the land throughout the area of the Finger Lakes District. The surrounding lands were either com fields, grain fields or vineyards. Any forested areas were dense growth of young deciduous trees with little if any visible clearings.

Two water samples were collected in 19-litre stainless steel cans from 4 metres as requested, using a Marsh pump. These water samples were collected at position 42° 39' 24" N. and 76° 41' 07" W., mid-lake, southeast of Sheldrake, N.Y.

Several attempts were made to collect sediment samples from the same location but because of the winds and wave action the site was abandoned and coring was attempted further south on the Lake.

Three cores were collected from the lake between positions 42° 32' 02" N., 76° 34' 00" W. and 42° 32' 36 N., 76° 34' 09" W. Due to the southerly winds the boat drifted in a northwesterly direction while the coring was being conducted. Because of the water depth and mechanical problems with the boat, it was decided to let the vessel drift rather than risk losing the second engine. The sediments collected were quite firm. Because of this the mini box corer penetrated to a depth of only 15 cm. Due to the lack of sediment in the box corer, washout occurred on several occasions so that method of sampling was abandoned after managing to collect 1 short core. The Technical Operations corer was utilized to collect 2 longer cores. All samples were returned to CCIW for subsequent analysis.

FREEHOLD LAKES SAMPLING, PLASTER ROCK, NEW BRUNSWICK AERB STUDY 12310, DR. D. MUIR

A preliminary study of water, sediment and suspended sediments was carried out from September 30 to October 4 in the Central Highland region in New Brunswick. Britt Brook Lake and Virgin Pond were chosen as sites to be studied. The area of these lakes is utilized for industrial purposes by Fraser Papers which also regulates a program of recreational fishing and forest management. Lakes are grouped into four categories. Britt Brook Lake is a Highly Managed Lake and Virgin Pond is a Blue Ribbon Lake. Lake surveys have been conducted in the past to enumerate fish populations and general lake productivity. On this survey, C. Teixeira of AECB and Tech. Ops. staff met with S. Young, the wildlife biologist with Fraser Papers. Mr. Young provided background and access information on the area.

At Britt Brook Lake, a Hydrolab profile was obtained. One thousand litres of water were centrifuged at 6 l/minute from a depth of one metre. One hundred and twenty litres of water were filtered into stainless steel cans for XAD extractions. Two 10 cm benthos cores were collected and extruded from the sampling site on the lake. These samples will be used for analysis of various organochlorines such as DDT and DDE. At the same location, zooplankton net hauls were collected for various interested parties for community structure and contaminate analysis. Water samples were collected with a Van Dorn bottle for total phosphorous, phytoplankton, nutrients and metals analyses.

At Virgin Pond, the same set of samples was collected. The centrifuged and filtered water sample site was chosen close to the shore due to accessibility to the deep site of the pond. Benthos cores were not obtained at the pond because of the soft sediments. A canoe was borrowed from Fraser Papers to complete the net hauls and water sampling.

A soil sample was collected in the Plaster Rock area.

SITE POSITIONS (DGPS USING WGS 84 DATUM)

Britt Brook Lake 47° 05' 32.2" N., 66° 52' 41.2" W. all samples

Virgin Pond 47° 08' 03.4" N., 67° 02' 14.6" W. water and suspended sediments

47° 08' 13.5" N., 67° 02' 05.5" W. zooplankton 46° 54' 32.6" N., 67° 24' 06.7" W. soil sample

URBAN RUNOFF SAMPLING OF HAMILTON AREA CREEKS AECB STUDY 12310, DR. D. MUIR

Technical Operations supported this project by collecting a set of water and suspended sediment samples from Hamilton Harbour and from three creeks which flow into the harbour. This was a continuation of a program started in November of last year and repeated on a periodic basis to give seasonal variability to the data concerning persistent organic contaminants (particularly some chlorinated paraffin compounds) in urban runoff. The five sites sampled were:

- 1. Indian Creek just downstream of the Northshore Boulevard culvert
- 2. Grindstone Creek at the bridge below Pond #4 on the Royal Botanical Gardens property accessed from the gate opposite the RBG Centre on Plains Road
- 3. Redhill Creek near the footbridge in the Hixon Bowl accessed from Mt. Albion Road
- 4. Hamilton Harbour from the CCIW dock
- 5. Redhill Creek below the Hamilton Sewage Treatment Plant outfall from the centre culvert below the old Woodward Avenue bridge deck

At each site, 80 litres of water were pressure-filtered into stainless steel cans for XAD extraction. Water was then passed through a 100µ net (except at the downstream Redhill Creek site) and continuously centrifuged using a Westfalia separator at the rate of 6 litres per minute. Field work associated with the sample collection was done by two technologists from this section. The aqueous phase extraction and preparation of the suspended sediment samples, filters and stainless steel cans was completed by Ms. C. Teixeira, AECB in the lab at CCIW. A sample size of 2 - 5 grams dry weight of suspended sediment was required.

Two centrifuges were run at Grindstone Creek, Redhill Creek and Indian Creek due to the light sediment load. The high sediment load found at the downstream Redhill Creek site was impossible to filter from whole water for the XAD extraction. Centrifuged water was filtered to collect the aqueous phase here.

WATER AND SEDIMENT SAMPLING, LAKE SIMCOE AECB STUDY 12310, DR. D. MUIR

As part of a preliminary study by Dr. D. Muir to evaluate contaminants in the outflow of Cook's Bay in Lake Simcoe, three stations were selected for sampling. C. Teixeira and a Tech. Ops. staff member arranged to utilize the facilities at the Fish Assessment Unit of the Ministry of Natural Resources at Sibbald Point for the week. On June 16 and 17 the launch PETREL was utilized for sampling. Prevailing winds on the lake dictated the available times for centrifuging and sediment coring. At stations 1, 2 and 3, 1000 litres of water from a depth of 4 metres was centrifuged at a flow rate of 5 litres/minute. The

water was filtered through a 100 micron Nitex screen before being centrifuged. One hundred litres of filtered water were collected from four metres and bottom minus two metres for organic extractions. At stations 1 and 2, a zooplankton net haul was taken from bottom minus two metres to the surface. At stations 1 and 4, a mini box core was taken and subsampled using four 10 cm core tubes. The sediment cores were later sectioned.

STATION POSITIONS

LAKE SIMCOE

STATION NUMBER	LATITUDE N.	LONGITUDE W.
1	44° 24' 00"	79° 27' 00"
2	44° 26' 30"	79° 24' 00"
3	44° 28' 36"	79° 22' 5 7 "
4	44° 25' 54"	79° 28' 21"

SNOW SAMPLING, LAKE PLACID, N.Y. AECB STUDY 12310, DR. D. MUIR

During the week of March 8 - 12 Technical Operations staff travelled to Lake Placid, New York to rendezvous with Dr. Muir. The purpose of the field trip was to collect snow cores from various elevations on Whiteface Mountain and at set distances on a transect along the length of Lake Placid. Sites along the lake were approximately 1 kilometre apart. Samples collected from the mountain were collected at elevation differences of approximately 150 metres between sites. At each site, up to 10 snow cores were collected to produce a water sample of approximately 1 litre. The samples were kept in a frozen state until returned to CCIW where they will be melted, extracted and analyzed for Halo Acetic acids. All snow collected was sampled from the last storm event only.

In order to access the top of Whiteface Mountain the Adirondack Mountain Research Center at North Pole, N.Y. was contacted and Mr. Douglas Wolf arranged for Environment Canada staff to accompany him to their sample observation site at the apex of the mountain. If any further sampling is to be conducted, Mr. Wolf should be contacted to arrange access to various sites throughout the region. The Adirondack Research Center phone number is 1-518-946-2142.

Samples were kept frozen and returned to CCIW March 8th.

CLI LAKE CORING SITE NEAR THE NAHANNI RANGE

SAMPLING, CLI LAKE AECB STUDY 12322, DR. M. EVANS

Technical Operations staff, working in conjunction with AECB staff from the Saskatoon office, carried out winter sampling operations during the period between March 25 and 31st for this study. The sampling was done at Cli Lake—a small mountain lake, located on the eastern edge of the Nahanni Mountains of the North West Territories, approximately 100 kilometres west of Fort Simpson.

Samples taken previously at Cli Lake showed high levels of mercury in the water and this field trip was utilized to gather water samples as well as snow and sediment cores from the lake to discover a possible cause.

Sediment cores, using the Tech. Ops. 4-inch corer, were collected from two sites in the lake. These cores were sub-sectioned on the ice into one centimetre slices for later analysis. Water was collected from the deepest site in the lake at five, forty and eighty metre depths.

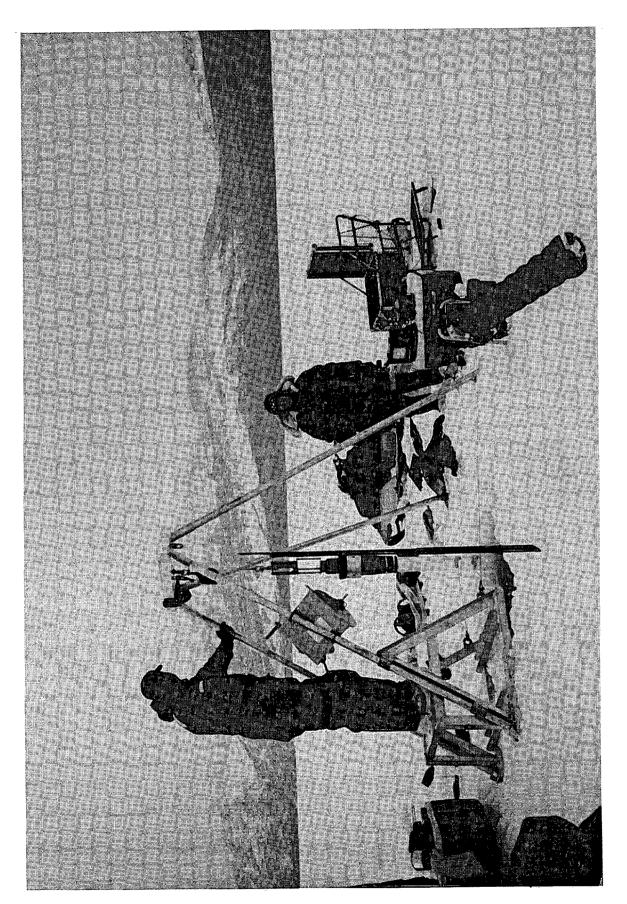
Snow was sampled from sites around the periphery of the lake as well as sites on the lake. These were chosen to represent deep and shallow locations as well as open areas and heavily forested locations.

SEDIMENT TRAP MOORINGS, GREAT SLAVE LAKE, NWT AECB Study 12322, Dr. M. EVANS

The purpose of this study was to deploy sediment trap moorings on Great Slave Lake, NWT. Sediment trap moorings were established at stations 2, 4, and 6. These were installed in June, refurbished in July and retrieved in September. All work was piggybacked on cruises being conducted by W. Schertzer, AEIB study 14145.

MOORING POSITIONS GREAT SLAVE LAKE

STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W.	INST/DEPTH
2	99 - 51A - 07B	61° 25′ 47"	114° 47' 12"	ST(10,51.9m)
4	99 - 51AT - 06B	60° 53′ 08"	115° 40' 24"	ST(6.5m)
6	99 - 51A - 08B	61° 22′ 03"	113° 49' 59"	ST(10,70.3m)



READY TO COLLECT A CORE AT CLI LAKE

SUSPENDED SEDIMENT SAMPLING, GRANDE PRAIRIE, ALBERTA AECB STUDY 12329, DR. M. ALAEE

The Technical Operations Section supported a suspended sediment sampling project in Northern Alberta. The study is part of a larger NREI study that is ongoing in the area. Technical Operations staff met with personnel of the Ecosystem Health Assessment Branch of Environment Canada (Calgary and Regina offices). Some preparation work was done at the Harry Hays Federal Building in Calgary before making the trip to Grande Prairie for the sampling program. Two vehicles with a jet boat were driven to Grande Prairie from Calgary.

Two types of sampling were done during this field trip: particle phase sampling and dissolved phase sampling. Some of the compounds being investigated included: endocrine disrupters (estradiol, estrone, nonyl phenols, butyl tins) and persistent organochlorines (PCB congeners, chlorinated diphenyl ethers and dioxin/furans).

Four sampling sites were chosen by the study leader, M. Alaee, AECB for suspended sediment sampling. Three sites were sampled on the Wapiti River and one site on Bear Creek. The first site sampled was the control site. This was at the junction of Alberta Highway 40 and the Wapiti River and was upstream of both the City of Grande Prairie Sewage Outfall and Weyerhaeuser Canada Pulpmill Effluent Outfall. Two Alfa-Laval centrifuges were set up on the bank of the Wapiti River with a submersible pump pumping water to both through 20 m of Teflon coated hosing. The centrifuges were run for about 24 hours at a sustained flow rate of 4 litres per minute. Following centrifuging, the bowls were cleaned and all of the centrifugate collected in 500 ml glass I-Chem jars for later analysis. During the 24-hour period, ten 20-litre Simgo cans were filled with centrifuged water. These samples were taken back to the hotel where they were extracted through XAD resin columns for trace contaminates. The two extraction units were set up in the back of a camperlab in the parking lot of the hotel. The extractions were run at 250 ml per minute with a total of about 90 litres of water being extracted through each of the two columns. A number of water samples were taken at the site during the 24-hour period as well. Four raw centrifuged water samples were taken and preserved, and two raw water mercury samples were taken and preserved. Following the sampling all of the gear was packed and moved down river to the next site.

The second site was below the City of Grande Prairie Sewage Outfall and above the Weyerhaeuser Effluent Outfall at a site known as MaGoo's Landing. The sampling protocol was the same at this site as it was for the previous site. Centrifugate was collected and the two extractions completed as well as some water samples collected. There were also some additional samples taken during the 24-hour centrifuging period. The field party met with Guy Wilson (Weyerhaeuser Canada Site Environmental Leader) to obtain some raw water samples from the final stage effluent pond at the pulp mill. Two 2-litre samples and four 1-litre samples were collected from the outfall of the

CENTRIFUGING ON THE WAPITI RIVER

last settling pond and preserved accordingly. The gear was taken down but not set up at the next site until the next morning.

The third site on the Wapiti River was below both outfalls at an area known as the CN Trestle. Due to the remote access to this site it was decided to load the gear onto a jetboat to run the equipment downriver from MaGoo's Landing to the site. Again the sampling protocol was the same as the previous two sites with all of the same sampling being done.

The final site to be sampled was closer to the city at a location on Bear Creek along Resources Road. Again the 24-hour sampling protocol was followed at this site. Additional samples were collected from the City of Grande Prairie Sewage Treatment Plant. Two 2-litre samples and four 1-litre samples were collected from the source of final effluent within the plant. The samples were preserved accordingly.

Upon completion of the sampling the gear was loaded into the vehicles and the field party returned to Calgary.

LONG RANGE TRANSPORT OF AIRBORNE POLLUTANTS, TURKEY LAKES WATERSHED AECB STUDY 12333, R.G. SEMKIN

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

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

Technical Operations' staff support consisted of one full-time technician stationed in Sault Ste. Marie. Equipment support included one full-time 4-wheel-drive vehicle used for transport to the study area. In addition, 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 at the camp at the work site and a 2-way radio system were operated by Tech. Ops. staff and maintained by Quattra Communications in Sault Ste. Marie. All roads and trails in the watershed were maintained with assistance from the Canadian Forestry Service at Sault Ste. Marie.

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

Tech. Ops. staff supported Aquatic Ecosystem Conservation Branch staff in chemical and hydrological monitoring of the watershed. Hydrological monitoring consisted of gauging and sampling eight stream locations throughout the watershed on a weekly basis. The samples were analyzed for numerous chemical parameters. Five lakes were sampled on a bi-weekly schedule for the same chemical parameters with the exception of the spring and fall when they were sampled once a week. During the winter, snow cores were collected at 14 locations on a weekly basis. During the year, rain and snow volume samplers (Nipher) were measured and changed weekly. Isco samplers at two locations in the watershed are operated year round. Samples were collected every 12 hours. In addition, groundwater wells throughout the entire watershed were sampled in the late spring and early summer. This study is completed once/year and groundwater wells at basin CFS47 were sampled once/month.

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 disk on site and generation of a backup disk. The data disk is shipped to CCIW each month and on site data processing is performed. The MET III system also allows MET program changes to be made on site and the MET datalogger can be erased to provide continued use with no interruption of data collection. This system also includes a UVB and UVA sensor with continuous data recorded on the Campbell datalogger CR23X.

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

A new 8 x 12 shelter was constructed this year at the Batchawana Lake site. The shelter will be used for emergencies and to process samples on site. The building has been wired for lights and AC power outlets and a Honda generator has been left at the building to provide the power requirements. A propane space heater was installed and will be left on "pilot" so it will always be available for heat without lighting the stove each time. A bunk is also available in the building along with some emergency equipment such as a sleeping bag, portable cooking stove, candles, a disposable lighter and an emergency survival package containing numerous items to be used in such cases.

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

A snow melt cave constructed at the Batchawana Lake location will be in service during the winter months until the end of the spring runoff period. In addition, at this same location, a bulk precipitation sampler will be serviced year round on a weekly basis. 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.

Over the summer, equipment support and accommodations at the camp were provided to various Government and private studies occurring in the watershed.

A new groundwater sampling area (CFS50 upper) was established this Fall with numerous wells installed for use this coming Spring during run-off. In the future an automated Isco sampler will be put into service at this location and until then staff continue to sample the site whenever they are in the immediate area.

Another fast spring melt was experienced this past year with the melt period lasting less than 4 weeks. TOS provided extra support during this critical sampling period.

A lake shoreline manipulation experiment was completed on Little Turkey Lake by Fisheries & Oceans and MNR staff based in Sault Ste. Marie. Details of this experiment can be obtained from Dr. K. Smokoroski, Fisheries & Oceans, Sault Ste Marie. Prior to the removal of shoreline materials, 3 sediment traps were installed in the lake. These traps were serviced immediately following the removal of shoreline materials and completely removed just prior to ice on the lake. Water was filtered at the lake outflow, S3, for suspended sediments during the experiment and for a short period after the experiment. This work was completed on behalf of AECB.

An organics study was begun this year in support of Dr. W.J. Strachan, AECB, and will continue until March 31, 2000. A contractor was hired on staff by AECB to complete the additional workload required by this study. Samples are collected at sites CFS47, SO, L2, CFS31, S4 and the Batchawana River on a pre-determined schedule. At each site 3 x 40 litres of water are collected and extractions done through a resin column for organics along with Mercury and trace metal samples collected at each site in support of this study. As well, a Mercury and an organics precipitation sampler was installed on the MET deck and is serviced according to a pre-determined schedule. Also, a high volume air (PUF) sampler was installed and is operational at the same location. During the winter season additional snow samples will be collected for organics and snow morphology on a snow event basis and bi-weekly for aged snow pack. Three visits to the Turkey Lakes by AECB and TOS personnel took place over the summer and fall seasons in support of this study. A sediment trap was installed on L2 and serviced on three occasions and reset as a winter mooring just before ice on the lake in October.

HAA'S FROM THE SEWAGE TREATMENT PROCESS, ONTARIO AECB STUDY 12335, DR. B. SCOTT

On June 8 - 9, water samples were collected from four municipalities. At each site raw water, treated water and STP final effluent were sampled for Haloacetic acid determinations or calculations. The purpose was to determine the increase in HAA's from the treatment process and the final amounts returned to the environment. Duplicate samples of raw water and treated water were also taken. The samples were stored in one-litre plastic bottles and frozen for the return trip to CCIW. The site locations were as follows:

- 1. Cornwall, Ontario: Water Purification Plant, 2nd St. W. just past Domtar, Sewage Treatment Plant, Montreal Rd.
- 2. Kingston, Ontario: Water Treatment Plant, King St. just past the hospital, Sewage Treatment Plant, Hwy. #2, east of Kingston
- 3. Belleville, Ontario: Water Treatment Plant, end of Sidney St. off Hwy. #2, Sewage Treatment Plant, St. Paul St. just off Hwy. #2
- 4. Durham (Oshawa, Ajax and Pickering): Water Treatment Plant, 75 Lake Driveway East in Ajax, Sewage Treatment Plant, 901 McKay Rd. in Pickering

CHLOROACETIC ACIDS, SOUTHERN ONTARIO AECB STUDY 12335, DR. B. SCOTT

As part of a study examining chloroacetic acids in fresh water, samples were collected for Dr. B. Scott in the following Southern Ontario cities: Cornwall, Kingston, Belleville, Durham, Ajax and Pickering. Unchlorinated raw water samples and sewage treatment plant effluent samples were taken at each city.

MERCURY IN ECOSYSTEMS AECB STUDY 12337, DR. W.M.J. STRACHAN

Technical Operations supported a mass balance study of contaminants entering and being retained in the Turkey Lakes Watershed. Organic and inorganic contaminants were examined. Trace metal and mercury analysis was completed. The sampling began in May and will continue throughout the next year.

On three separate trips—May 18 - 22, August 3 - 7 and October 18 - 22, equipment and technicians went to the site in a four-wheel drive truck.

On the first trip, two Automated Precipitation Samplers and a High Volume Air Sampler were set up on the existing deck on the MET Hill at the Turkey Lakes field site. A

sediment trap mooring was established in 9 metres of water at the deep hole of L2 which is the headwater lake. The traps were placed at a depth of 2 metres from the surface. A centrifuge and a generator were placed in a small boat and moored to the spar buoy at the deep hole. On a daily basis, a sample of centrifuged water was collected. After 6 hours of centrifuging, the bowls were removed and returned to the field lab where the suspended sediment was collected. Whole water samples from depths of 4 m and 9 m were also collected at this site. Other water samples were collected by the group at various sites on L2 and at various tributaries throughout the watershed. Samples were also obtained from the Batchawana River at the bridge on Highway 17 north. The samples collected in stainless steel cans were extracted though resin columns for PCB analysis at the on site Lab.

Field staff at the Turkey Lakes site continued to collect samples and maintain the precipitation and air samplers on a weekly basis for the study. Some water samples, were collected in advance of the group's return in August and in October.

On the second trip in August, one of the rain samplers was replaced at the MET Hill because it was functioning poorly. The sediment trap cups at L2 were collected to be returned for later analysis at CCIW in Burlington. The centrifuge was set up in the same manner as in the May trip and centrifuged water was again collected. The bowls were removed after 8 hours of centrifuging and again the suspended sediment was collected. Whole water samples were again collected at various sites on L2 and throughout the watershed. In addition, surface sediment, using a Mini-Shipek, was collected at various sites on L2. Leaves from various sites in the watershed were also collected for later analysis.

The third trip in October was similar to the previous two. The sediment trap mooring was refurbished and the water at the spar buoy at L2 was again centrifuged. Whole water was collected from the depths of 2 m, 4 m and 8m. Water samples were again taken from various locations on L2 and throughout the watershed.

Turkey Lakes on-site staff have continued to support the study for the remaining portion of 1999 and will into the year 2000. The sediment trap mooring has been winterized. Additional work may be done in the winter.

SAMPLING, HAMILTON HARBOUR AND REDHILL CREEK AECB STUDY 12340, DR. J. SHERRY

Water samples and Hydrolab data were collected by Technical Operations staff in Hamilton Harbour and Redhill Creek on December 8th and 13th. The purpose of the sampling is for use in a joint collaboration between the UFZ in Leipzig Germany and AECB, NWRI. The samples will be processed and tested for the ability to induce estrogenic responses in primary cultures of trout liver cells. The points of interest are

along a transect in an attempt to pin-point the approximate geographic source of major loading.

Samples consisted of one 4-litre and one 100-ml bottle being filled from a depth of 0.5 metres at each station. Samples in the harbour were obtained utilizing the vessel PELICAN and DGPS (WGS84). The Redhill Creek samples were collected from shore.

STATION POSITIONS

STATION NUMBER	LATITUDE N.	LONGITUDE W.	
1	43° 17' 39"	79° 47' 57"	
2	43° 16' 32"	79° 47' 30"	
3	43° 16' 17"	79° 47' 14"	

Station 4: Redhill Creek at Barton/Melvin St. bridge, upstream of bridge

Station 5: Windermere Basin/Hamilton Harbour bridge, harbour side of bridge

Station 6: Mouth of Redhill Creek were it flows into Windermere Basin Station 7: Sewage treatment plant outfall at the old Eastport Dr. bridge

Stations 1 - 4 were sampled on December 8th and sites 4 - 7 were sampled on December 13th. The samples were sealed without preservative and returned to CCIW in a cooler with ice.

REFINERY EFFLUENT ENDOCRINE EFFECTS, SARNIA, ONTARIO AECB STUDY 12340, DR. J. SHERRY

Technical Operations Section supported this project, led by Dr. J. Sherry, by providing field and laboratory support for a fish exposure experiment in the Sarnia, Ontario area. This study attempted to determine the estrogenicity (Vitellogenin induction, estrogen receptor binding) of the effluents from the Shell and the Nova Chemical refineries at Corunna, Ontario and from the main Wastewater Treatment Plant in Sarnia. It will compare the results obtained from these effluents to those from water taken from the St. Clair River upstream at the Purdy Fisheries Dock in Pt. Edward, Ontario.

Both ends of pipe effluents and impacted river water downstream of the respective effluent diffusers were tested during this experiment. In order to accomplish this,



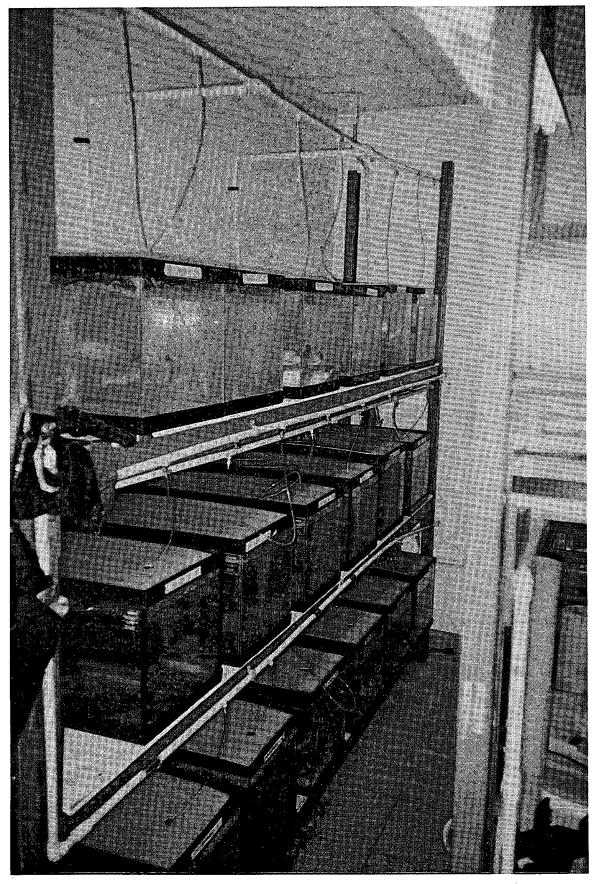
FISH CAGES SUSPENDED IN TALFORD CREEK AT THE SHELL REFINERY IN CORUNNA

rainbow trout were exposed to the various effluents in aquaria at 15°C in a temperature-controlled room at the Pollutech Enviroquatics Limited lab in Pt. Edward and were also held in cages moored on the St. Clair River bottom downstream of the effluent outfalls of the Sewage Treatment Plant, refineries and downstream of the Purdy fish plant property.

The laboratory exposures at the Pollutech facility were carried out in the following manner: Six separate exposures were done using a daily full renewal strategy six days each week. Five rainbow trout were held in each of three 50-litre aquaria containing 45 litres of water for each exposure. The trout were exposed to 100% concentration of the refinery effluents. Due to unexpected toxicity responses to the sewage treatment plant effluent, it was diluted to a 5% solution with dechlorinated tap water for this exposure. Three aquariums of fish were spiked daily with β -estradiol in an ethanol carrier to a concentration of 100 ng/L as a positive reference. Three others received water from the Purdy reference site as a negative reference and the last three aquaria were filled with dechlorinated tap water as an absolute control of the upstream St. Clair River water.

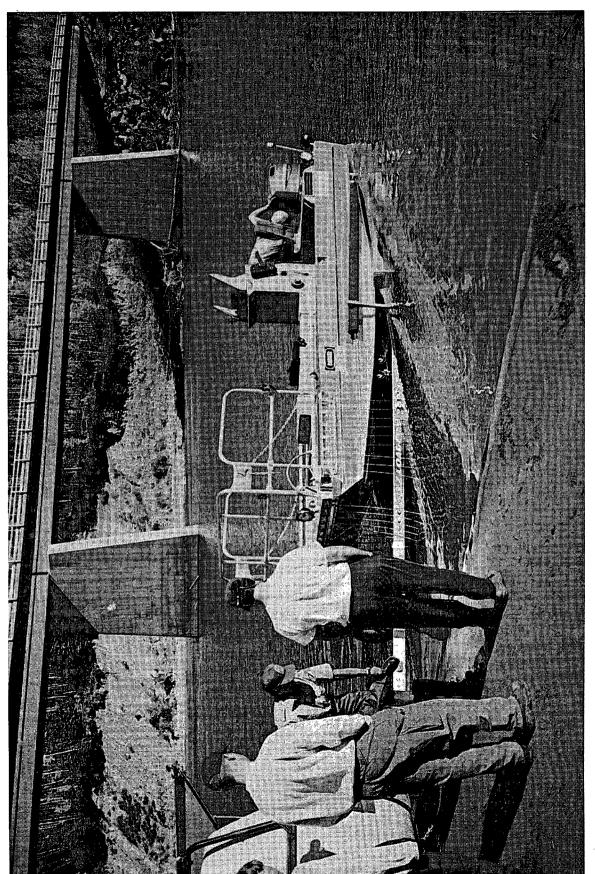
Several training sessions were required in order to be allowed access to the refinery properties. WHMIS training was a prerequisite to taking the Basic Safety Training Course and Respirator Fit Test from the Sarnia-Lampton Industrial Educational Cooperative. On-site training was required at both refineries prior to accessing the sites. Effluents were collected daily in 150-litre plastic barrels using the 3-ton truck and held overnight in the temperature-controlled room to come to 15°C. The samples were drawn from a tap near the MISA (Municipal/Industrial Stormwater Abatement) hut at the final effluent pond at the Nova Refinery, pumped from the final effluent weir beside the MISA hut at the Shell Refinery and pumped from the dock at the Purdy site at the 2-metre depth. The 10-litre sewage effluent sample was collected by bucket from the weir at the final effluent pond at the water treatment plant. The sewage exposure solution, β-estradiol solution and upstream control were all made up from dechlorinated dilution water held at 15°C in a header tank in the lab.

The exchanges were done first thing every morning every day except Sundays for 21 days. The fish were left in the aquariums as they were pumped out using a Little Giant self-priming pump leaving approximately 3 cm in the bottom of the tank and then refilling with fresh effluent to the 45-litre volume. The pumps were rinsed between each site. The aquariums were given a scrubbing twice per week to prevent scum buildup. The use of any disease treatments was not allowed during the experiment. If signs of disease became evident the aquarium was replaced with a clean unit. Any severely ill or dead fish were removed and substituted with a fresh fish in order to maintain biomass in the aquarium. These substitutes were marked with a hole punched in their caudal fin.



EXPOSURE SETUP AT THE POLLUTECH LAB IN PT. EDWARD

The caged fish exposure in the river was done as follows: The fish cages consisted of 106-litre Rubbermaid hinged plastic bins perforated with 5/8" holes to allow water exchange and held closed with plastic cable ties. Both ends of each cage were reinforced with stainless steel sheet metal bolted through and were drilled to accept two hose clamps. Two cages containing 15 fish each were moored with diver assistance to the river bottom at each site, with the exception of the Shell Refinery, by setting them on cement blocks and hose clamped between two T-bar fence posts in about 7 metres of water. At the Shell site two fish cages fitted with wire bridles and small concrete pavers for weight were hung by rope from the second bridge upstream of the river in Talford Creek just downstream of the Shell outfall. The duration of exposure of the caged fish was 21 days. After the first 14 days one cage was retrieved from each site and the fish injected with the β -estradiol hormone in peanut oil and then returned to the river for the duration of the exposure. This experiment will assess the ability of the ambient water to impair the production of vitellogenin in the fish induced by the β -estradiol.



LAUNCHING THE ELECTROFISHER AT MAGOO'S LANDING

ENDOCRINE EFFECTS ON THE WAPITI AND LITTLE SMOKY RIVERS, ALBERTA AECB STUDY 12341, DR. M. McMASTER

Technical Operations Section assisted this study, led by Dr. M. McMaster, by lending logistical and field support to this sampling program on the Wapiti and Little Smoky rivers in Alberta. The purpose of this trip was to identify any pulpmill effluent-related endocrine effects present in selected fish species in the Wapiti River downstream of the effluent diffuser at the Weyerhaeuser Canada Ltd. Pulpmill near Grande Prairie, Alberta. This study will contribute to the Northern Rivers Ecosystem Initiative (NREI).

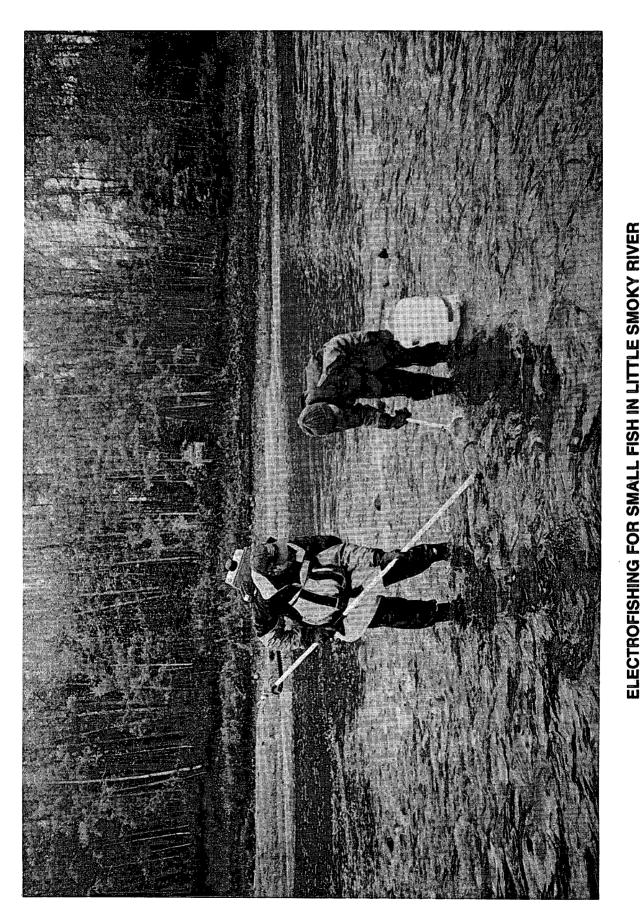
The field and laboratory equipment required for this survey was transported from CCIW, Burlington on September 10th by Technical Operations personnel using a dual wheel crewcab towing a 17-foot Zodiac inflatable boat, arriving in the study area on September 14th.

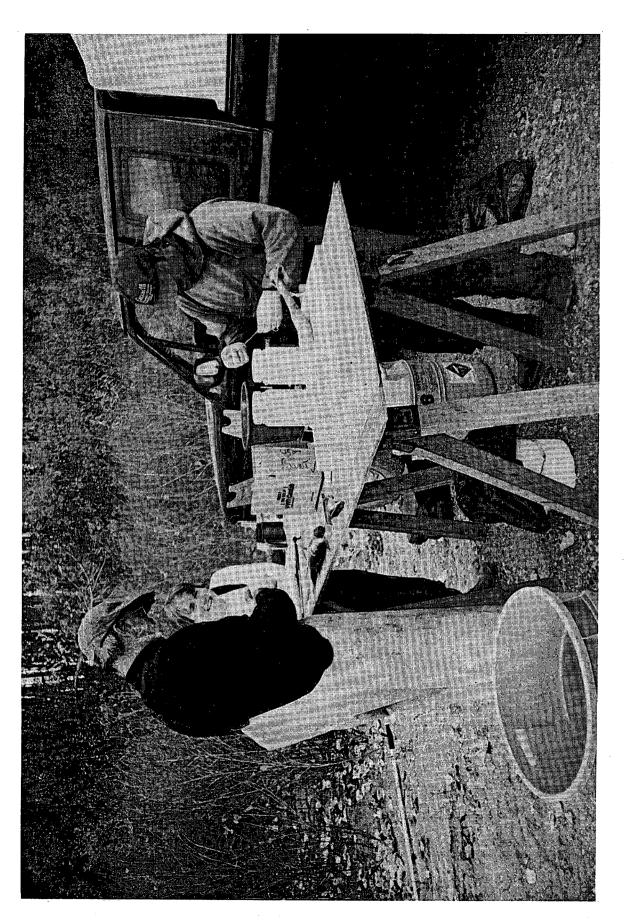
The field program involved the collection of Longnose Suckers and several forage fish species which included Longnose Dace, Slimy Sculpin, Spoonhead Sculpin, Lake Chub and Troutperch. The fish were in all cases collected by electrofishing. The suckers were collected from a 23-foot Smith Root electrofishing vessel operated by Alberta Environment personnel based in Grande Prairie, Alberta and Peace River, Alberta. The forage fish were collected using Smith Root Electrofisher 24 volt backpack shockers operated by NWRI personnel.

Five sites were sampled—four on the Wapiti River and one on Little Smoky River:

- 1. Wapiti Gardens a control site on the Wapiti River 65 km upstream of the Weyerhaeuser diffuser
- 2. Pipestone a control site about 35 km upstream of the diffuser on the Wapiti River near Pipestone Creek
- 3. MaGoo's Landing a site on the Wapiti River at the Weyerhaeuser Haul Bridge downstream of the sewage treatment plant outfall but upstream of the pulpmill diffuser as a control for sewage effluent effects
- 4. Downstream a site downstream of the Weyerhaeuser diffuser on the Wapiti River
- 5. Little Smoky a control site on the Little Smoky River to provide reference data from a similar river within the watershed

Twelve sexually mature specimens of each sex were required of the same species from each of the sites for the large fish species as well as for a forage fish species. Over the course of two weeks the sampling sites were each visited several times in an attempt to collect the required specimens. Several forage fish species were collected in hopes that one would give the coverage needed. The Zodiac inflatable boat was used to transport two teams of field personnel with backpack shockers to downstream riffle areas on several occasions. In the end, the Lake Chub proved to be found in the





SAMPLING SUCKERS ON THE WAPITI RIVER

highest concentration throughout the study area but even these had to be collected after dark to get the numbers required.

The Longnose Sucker was selected as the large fish species for this survey. The suckers were weighed, measured and sampled in the field. Operculums were taken for aging and blood was taken from the caudal vein for reproductive steroids (testosterone and 11-ketotestosterone in males and testosterone and 17B-estradiol in females), for vitellogenin, for gonadotropin steroids and for steroid binding protein levels. The blood was frozen in liquid nitrogen for transport to Burlington. Eggs were collected for fecundity and for in vitro egg incubations in the lab. These were frozen in liquid nitrogen and will be analyzed for testosterone and 17B-estradiol levels. Livers were sampled and frozen in liquid nitrogen. They will be analyzed for mixed function oxygenase activity (MFO), hepatic oxidative stress and hepatic estrogen receptors. Gonadal tissue and pituitary glands were collected and preserved in a dilute Formalin solution. Gonadal tissue will be examined histologically as well as for levels of apoptosis (programmed cell death) and for gonadal androgen receptor levels. Pituitaries will also be analyzed for gonadotropin content.

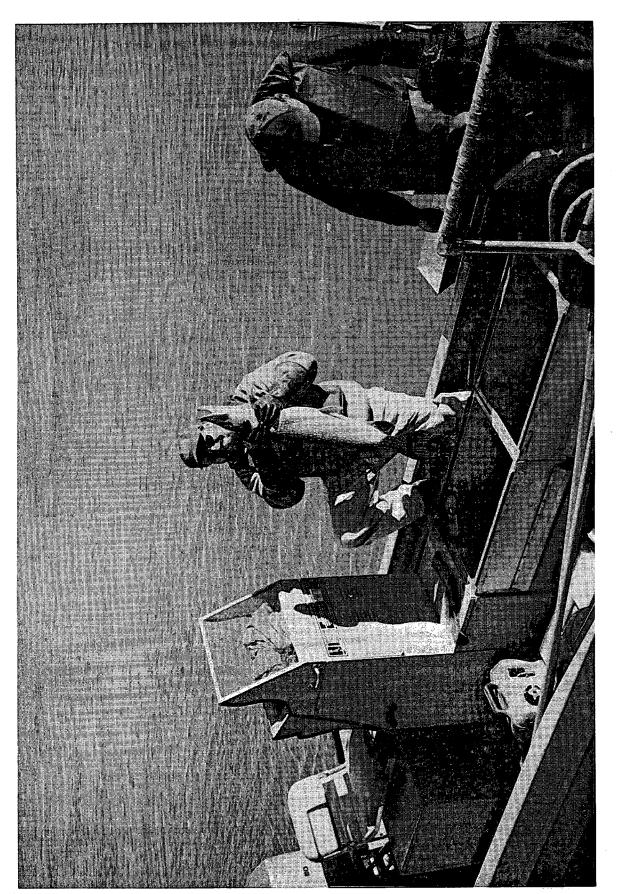
Lake Chub and the other forage species (sculpin sp. and Longnose Dace) were collected and sampled in the lab. Total lengths and weights were recorded, livers and gonads were weighed and scales or otoliths were taken for aging. In vitro incubations of male and female gonadal tissue were done and will be analyzed for reproductive steroids in the same manner as the blood from the large fish. Livers were sampled for MFO and potentially for estrogen receptors or oxidative stress. The gonads were sampled for histology or apoptosis.

In vitro, liver, blood and pituitary glands were frozen in liquid nitrogen. Histology and apoptosis samples were preserved in a dilute Formalin solution. Scales, otoliths and operculums were frozen.

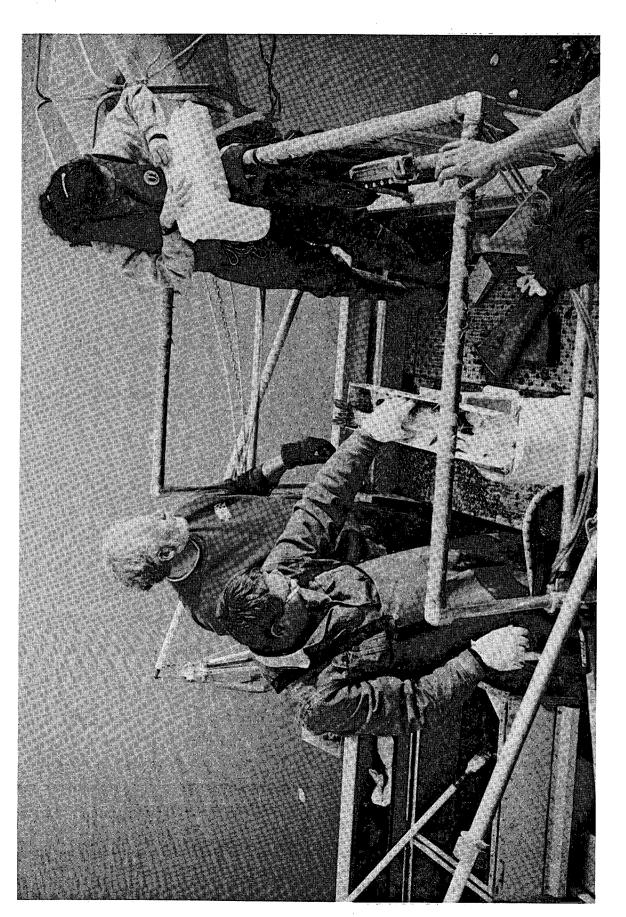
Additional tasks completed on this trip included the collection and delivery (frozen) of representative forage fish from each site for Dr. M. Evans, NWRI, Saskatoon and the pickup and return to CCIW of four peeper samplers and a peeper retriever from Ms. M. Waiser, NWRI, Saskatoon.

WILD FISH HEALTH ASSESSMENT, ATHABASCA RIVER, ALBERTA AECB STUDY 12345, Dr. J. PARROT

The objective of this study was to attempt to assess the potential danger of oil sands wastewater on wild fish in the Athabasca River. Little is known about the suitability of sublethal tests for the regulation of effluents from oil sands refineries. This study will attempt to determine whether fish in the receiving ecosystem are affected by the discharge of oil sands wastewater and whether current laboratory-based bioassays are



ELECTROFISHING ON THE ATHABASCA RIVER



SAMPLING FISH ON THE ELECTROFISHING BOAT

an adequate substitute for in situ field experiments. This is the first year of four consecutive field seasons to survey the fish upstream and downstream in the receiving ecosystem to determine if they are affected by long-term exposure to discharged wastewater from the oil sands mining and refining facility.

Small sentinel species on the Athabasca River and its tributaries downstream of Fort McMurray were collected. The tributaries sampled included the Ells, Steepbank, Muskeg and MacKay rivers. Semi-permeable membrane devices (SPMD's) were also deployed and retrieved from the tributaries. Small fish species were caught with either a seine or dip net. Longnose suckers were also captured by utilizing an electrofishing boat and sacrificed. The goal was to sample 20 adult males and 20 adult females from each of the following three sites: Athabasca upstream reference site located at Calling River 200 km upstream of Fort McMurray, the oil sands anthropogenic site located downstream of the Suncor outfall and last, the oil sands reference site located downstream of Fort McMurray.

The following samples were taken from each fish that was sacrificed. Blood plasma, liver, brain, muscle and bile if present. The gonads were weighed and a small sample of eggs retained for future analysis. All samples were immediately frozen in liquid nitrogen. Aging structures were also removed which consisted of the operculum, scales and pectoral fin rays. Each fish was weighed and measured—both total and fork length. Due to time constraints only the following number of fish were collected from the above three mentioned sites:

Site # 1: 20 females and 19 males Site # 2: 20 females and 15 males Site # 3: 20 females and 13 males

Noteworthy: It seems the Longnose Sucker population is heavily laden with females, requiring additional fishing time necessary to catch the required number of males.

SAMPLING BEVERLY SWAMP AECB STUDY 12382, Dr. R.A. BOURBONNIERE

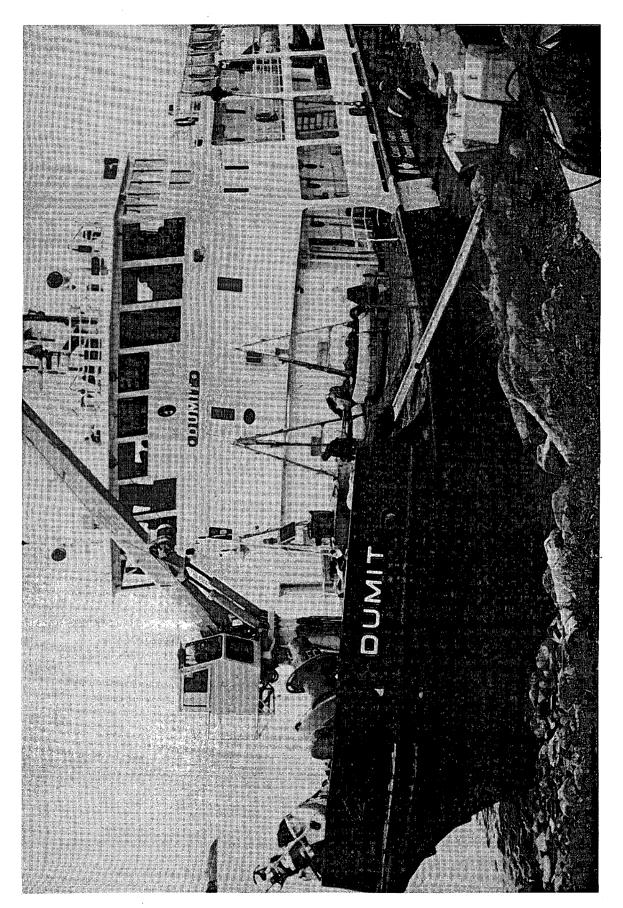
Technical Operations supported this study on two occasions throughout the year. The swamp is located near the Valens Conservation area in Strabane, Ontario. This is a joint study project between McMaster University and NWRI where a monitoring of carbon dioxide and other gases is measured as they are released from the swamp. In April lumber was hauled into the site by boat using Spencer Creek. It took 2 days to bring enough lumber into the site to build sampling platforms and boardwalks sufficient to cover the entire sampling area. In November centrifuging was done on the water from Spencer Creek. A Westfalia centrifuge was used and operated at 6 L/min. to collect approximately 1800 litres of water which was later extracted back at CCIW.

AQUATIC ECOSYSTEM IMPACTS BRANCH

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

The purpose of this study was to deploy meteorological and temperature moorings to give detailed vertical temperature measurements on Great Slave Lake, NWT. To accomplish this, two meteorological buoys were installed at stations 1 and 2 during the cruise aboard the CCGS DUMIT June 11 - 16 and retrieved between September 28 - October 2. Five temperature moorings were installed during the same time period at stations 1, 2, 3, 4 and 5. The temperature moorings were retrieved between September 21 and October 2 utilizing CCGC 775 and CCGS DUMIT. A shore-based station was also set up at Hay River in the NTCL storage area which was dismantled September 15 and reinstalled at the Coast Guard compound at the Hay River Airport for the winter.

An additional task performed this season was the installation of three sediment trap moorings for Dr. M. Evans, AECB Study 12322. These were installed in June, refurbished in July and retrieved in September.



UNLOADING CCGS DUMIT IN DEVILS CHANNNEL ON GREAT SLAVE LAKE

GREAT SLAVE LAKE MOORING POSITIONS

	<u> </u>			
STATION NO.	MOORING NUMBER	LATITUDE N.	LONGITUDE W. INST/DE	PTH
1	99-51T-01A	61° 38' 53"	114° 08' 55" T(2.5,7.5,10 13.5,20,25, 40,50,75,10	30,
	99-51T-01B	61° 38' 46"	114° 09' 04" T(12,14,16, 30,50,75,10	20,
	99-51M-02A	61° 38' 44"	114° 08' 34" MET	,
2	99-51M-03A 99-51T-04A	61° 26' 12" 61° 26' 02"	114° 46' 19" MET 114° 46' 35" T(2.5,7.5,10 13.5,20,25, 40,50,60m)	30,
	99-51A-07B	61° 25' 47"	114° 47' 12" ST(10,51.9	
3	99-51T-05A	61° 10' 34"	115° 16' 41" T(2,5,7.5,10 13.5,15,20, 30,40,56m)	25,
	99-51T-05B	61° 10' 45"	115° 16' 56" T(12,14,16, 25,30,40,55	20,
4	99-51AT-06B	60° 53 ⁷ 08"	115° 40' 24" T(S,2,5,7.5, 12m) ST(6.5m)	,10,
5	99-51T-09A	61° 55' 28"	113° 45' 35" (S,2,5,7.5,1 13.5,15,20, 30,40,50,)	
6	99-51A-08B	61° 22' 03"	113° 49' 59" ST(10,70.3	m)
Hay River	99-SLM-03A 99-SLM-03B	60° 53' 00" 60° 53' 00"	115° 40' 00" MET 115° 40' 00" MET	

ICE JAMS, MIRAMICHI RIVER, NEW BRUNSWICK AEIB STUDY 14146, DR S. BELTAOS

This a joint study between NWRI and the New Brunswick Departments of Environment and Transport to measure the impact of ice buildup on bridge structures.

On July 5, K.J. Hill and E.H. Walker travelled to Miramichi, N.B. in van 249937 with the 26' canoe. During the next 2 weeks 16 cross-sections of the Miramichi River were surveyed in areas where ice jamming had occurred in the past. Elevations were tied to existing bench marks so that real elevations in metres above sea level were measured. In addition, water levels along a 2 kilometre stretch of the river in Blackville, N.B. were measured.

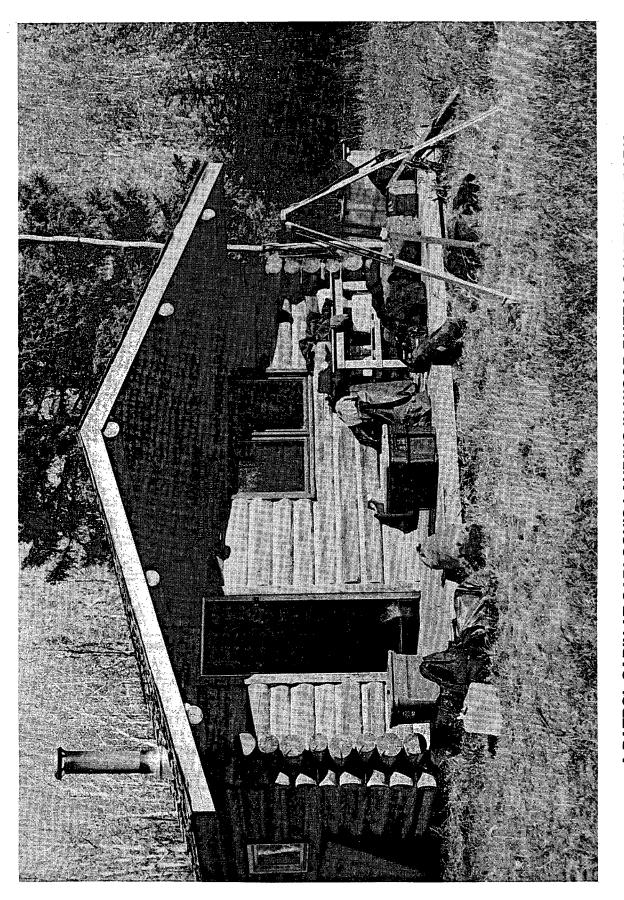
River cross-sections were measured using the Wild NA-2000 electronic level. Problems with the Distomat prevented using it for the cross-sections. Temporary bench marks (usually nails) were established at each cross-section and tied in to geodetic bench marks, again using the Wild NA-2000 electronic level. River bottom depths were measured using a measured rod with distance across the river determined using the Bushnell laser range-finder.

ICE JAMS, PEACE RIVER, ALBERTA AEIB STUDY 14146, DR. S. BELTAOS

Technical Operations supplied field support for Dr. S. Beltaos on the Peace River of Alberta during the period between September 25 and October 4.

Personnel from DOE offices in Burlington and Saskatoon worked together on the field work using the facilities and equipment of Wood Buffalo National Park in Fort Chipewyan as a base. The purpose of the work was to gather ground measurements for input into a model of the ice jam characteristics of the lower Peace and Slave rivers. This information will be used to better understand the causes and prediction of possible ice jams and consequential flooding which is of great benefit to the Delta area.

Field work consisted of eight profiles across the Peace River and two profiles across the Slave River over a river distance of one hundred and twenty kilometres. These profiles indicated the shape of the river basin and the slope between the different profiles. All profiles were then tied into known elevations of established bench marks, using the NA2000 digital level. Profiles were done with the Wild T2000 transit. Two water level gauges were installed at different locations to monitor the fall freeze up period.



A PATROL CABIN AT CARLSON'S LANDING IN WOOD BUFFALO NATIONAL PARK

RESEARCH SUPPORT BRANCH

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

A program was developed to assess the long-term effectiveness of remedial work in the region as a whole. For the past five years a network of Long-Term Sensing Sites (LTSS) has been jointly monitored by Environment Canada (Quebec and Ontario Regions), the Quebec Ministry of Environment and Wildlife and the Ontario Ministry of Environment and Energy.

The objective of the program was to study the quality of sediments and suspended solids in order to assess the transport of contaminated material downstream from Massena sources. Since program funding was terminated at Centre Saint-Laurent, all moorings were removed in May.

The mooring removal took place in two stages. First, the sampling and removal of scientific equipment and second, preparation of moorings for removal by the CCGC SHARK. Locating the moorings was made difficult by the loss of all but two winter markers. Moorings were located using DGPS to install a temporary marker before dragging for the groundline. Divers sampled and removed the sediment traps. Subsurface buoys were cut from the mooring and removed. All sediment traps and the clamping hardware were given to CSL personnel.

At five mooring sites where cesium tracers were installed in October 1996, an anchor was left in position with a Grimsby float marker one metre above the bottom. All moorings were prepared for removal by the CCGC SHARK. Divers rigged the groundlines to remove the current meter frames. Poly balls marked the spar buoy lines for pickup.

Personnel returned to CCIW for the long weekend. The TOS dive team (Breedon, Gray and Don) returned to Cornwall on May 25. The CCGC SHARK arrived in Cornwall on the evening of May 25. All moorings were safely removed during the next two days. Mooring anchors were placed on the CCG dock at Cornwall and returned to CCIW by the TOS crane truck. Current meter frames were returned to shore to be dismantled and transferred to CSL staff.

This brought to completion the TOS support to this program.

CORNWALL STATION POSITIONS (DGPS - WGS 84)

MOORING NUMBER	LATITUDE N.	LONGITUDE W.	NORTHING	EASTING
98-07S-07A	45° 01.4310'	74° 40.9459'	4985646.	525024.
98-07S-08A	45° 01.5189'	74° 39.5349'	4985819.	526870.
98-07S-13A	45° 00.9458'	74° 42.3897'	4984745.	523127.
98-07S-14A	45° 00.7480'	74° 43.6790'	4984372.	521436.
LAKE ST.	FRANCIS STATI	ON POSITIONS (DO	GPS - WGS 84)	
98-07S-09A	45° 05.8471'	74° 26.0117'	4993934.	544573.
98-07S-10A	45° 07.1381'	74° 27.0036'	4996313.	543253.
98-07S-11A	45° 08.6624'	74° 25.8748'	4999145.	544713.
LAKE ST. I	LAWRENCE STA	TION POSITION (D	GPS - WGS 84)	
98-07S-12A	45° 05.8471'	74° 26.0117'	4993934.	544573.

WIND WAVE INTERACTION STUDY UNIVERSITY OF MIAMI, DR. M.A. DONELAN RSB STUDY 12631, S. B. SMITH

This project involves the study of air-sea interaction associated with growing wind waves. The SWATH vessel, F.G.CREED was utilized for observations.

TOS support involved assisting personnel from the Engineering Systems & Development Unit of ESS in the setup of equipment on two structures—a bow mast for the air turbulence sensors that could be folded down for access and repair, and a boom extending at right angles to the ship's starboard side at the bow which could be hydraulically retracted during steaming.

Mounted on the CREED were air turbulence sensors (sonic, propellor and cup anemometers and fast response temperature sensors) and sensors designed to measure the energy and momentum fluxes to the wind waves (laser wave height gauges, Elliot static air pressure fluctuation sensors, pitot air speed sensors and x-wire hot-film turbulence anemometers).

RSB personnel travelled to the Bedford Institute of Oceanography (BIO) the week of October 25 to outfit the CREED and upon completion, the ship immediately sailed for Norfolk, Virginia. The Shoaling Waves Experiment (SHOWEX) took place during

November and early December off the outer banks of North Carolina using personnel from BIO, Wood's Hole Oceanographic Institute and the University of Miami.

PRODUCTIVE CAPACITY OF FISH GREAT LAKES LABORATORY FOR FISHERIES AND AQUATIC SCIENCES, DR. V.W. CAIRNS, J. FITZSIMONS

RSB STUDY 12631, S.B. SMITH

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 diver, diver equipment and underwater video support to this study. The long-term objectives of the work include:

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

Two sites selected for this program are located at Pt. Weller and the Stoney Creek shoal. At Pt. Weller the actual site is located at the end of the east arm of the east side pier. Stoney Creek shoal is located three kilometres north of Fruitland Road.

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

Tech. Ops Dive Support

Date	Location	
April 15	Pt. Weller	
May 4	Pt. Weller	
May 5	Stoney Creek	
May 31	Pt. Weller	
June 22	Pt. Weller	
September 22	Stoney Creek	

September 24 Stoney Creek
October 12 Stoney Creek and Pt. Weller

November 8 Stoney Creek
November 22 Stoney Creek
November 29 Stoney Creek
December 2 Stoney Creek

December 10 Pt. Weller

MERCURY IN ECOSYSTEMS SEDIMENT SAMPLING, COLLINS BAY, KINGSTON FEDERAL PROGRAMS, EPS, EC, DR. P. MUDROCH RSB STUDY 12631, S.B.SMITH

Technical Operations Section supported this project led by Dr. P. Mudroch, EC, EPS, Federal Programs, by assisting with the collection of bottom sediments from Collins Bay. A complete Benthic echo-sounding survey of the bay was conducted. North/South lines were navigated from shore to shore about every 50 - 75 metres apart creating a grid system across the bay. Ten mini-PONAR's were collected from random locations decided upon by the study leader. Three benthos cores were also collected and later extruded into 5 cm slices. Positions were taken at all sampling locations using the Magnavox DGPS positioning system. DGPS locations were also taken on the six buoys marking the channel entering the Collins Bay Marina. An attempt was made to collect Hydrolab profiles from various locations in the bay, however, after 4 casts the Hydrolab cable was partially severed and failed to communicate with the computer. Following is a list of the DGPS co-ordinates.

COLLINS BAY POSITIONS DGPS CO-ORDINATES

PONAR SAMPLES	DIFFERENTIAL GPS	MARKERS	DIFFERENTIAL GPS
CB1	18E 371 833.1 N4 889 688.0	1N	18E 371 068.0 N4 889 530.1
CB2	18E 371 790.5 N4 889 751.1	28	18E 371 089.0 N4 889 489.1
CB3	18E 371 720.6 N4 889 737.3	3N	18E 371 548.8 N4 889 774.2
CB4	18E 371 630.6 N4 889 757.3	48	18E 371 561.5 N4 889 744.6
CB5	18E 371 544.0 N4 889 755.5	5N	18E 371 734.8 N4 889 755.0
CB6	18E 371 230.4 N4 889 590.3	68	18E 371 722.9 N4 889 722.4

PONAR SAMPLES	DIFFERENTIAL GPS	CORE SAMPLES	DIFFERENTIAL GPS
CB7	18E 371 072.6 N4 889 503.3		
CB8	18E 370 708.5 N4 889 047.2	1	18E 371 421.9 N4 889 590.0
CB9	18E 371 174.5 N4 889 449.6	2	18E 371 615.8 N4 889 749.2
CB10	18E 371 427.1 N4 889 774.7	3	18E 371 816.4 N4 889 741.0

CENTRIFUGE SAMPLING IN OSHAWA HARBOUR FEDERAL PROGRAMS, EPS, EC, DR. P. MUDROCH RSB STUDY 12631, S.B. SMITH

Technical Operations assisted Mr. P. Mudroch, EP, PD, EC, Ottawa, with the collection of suspended sediment samples from Oshawa Creek and Montgomery Creek in the Oshawa Harbour area. Sampling trips were completed on a monthly basis from May through October.

The sampling program was completed in a similar manner on each trip. Oshawa Creek was sampled from the Simcoe Street bridge and Montgomery Creek from the Harbour Road bridge. Two centrifuges were run at each site. Water was pumped to each centrifuge from midstream at six litres per minute for approximately 9 hours at each site. Each centrifuge was equipped with a digital flowmeter to keep track of the volumes sampled. Two 5 kilowatt Honda generators powered the centrifuges and pumps.

Some additional tasks were completed on some of these trips. A bottom sediment grab was taken from Montgomery Creek in May. Six cores were collected from the city marina and harbour area in June and subdivided in 5 cm intervals for organics and particle size analysis. Three sites in the harbour were sampled by mini PONAR in October for particle size and organics—one at the mouth of each creek and one at mid harbour.

Sediment samples were delivered by Technical Operations personnel to the Phillips-Zenon Analytical Laboratory for organics analysis and to Mr. J. Dalton at CCIW for particle size after each trip.

SUPPORT TO RANDLE REEF DRILLING SURVEY CLEANUP FUND, EPB-OR, J. SHAW RSB STUDY 12631, S.B. SMITH

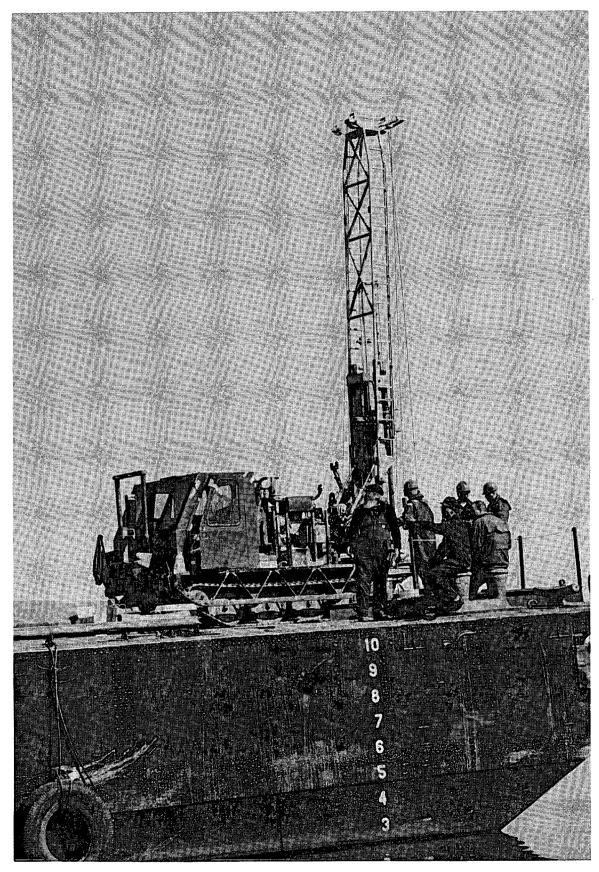
Technical Operations Section supported this study with field support at the Randle Reef Survey site. A bottom sediment survey of the area along the Stelco Steel dock behind Randle Reef was required to determine the sediment depth and composition in order that a contract could be let for the dredging of this part of Hamilton Harbour.

TROW Consulting Engineers of Thunder Bay, Ontario were hired to carry out this sediment survey. TROW was represented by Ms. Susan Cotyondy and Mr. Todd Barlow. A portable drill rig from Masters Soil operated by Mr. Dave Walker was positioned at the bow of the barge HENRY T (owned by McKeil Marine Ltd.). The barge was moved to each sampling site by the tug ARGUE MARTIN, another McKeil Marine boat. Technical Operations' role was to mark the position of each sampling site with a marker using DGPS corrections from the beacon on the roof of CCIW. The installation of the DGPS systems on the barge and launch was accomplished by Engineering Services staff. The drill rig was equipped with the suitcase DGPS unit to determine the exact location of the bore holes. The tug lowered its spuds into the bottom to anchor it in place. Technical Operations staff recorded the positions of the four corners of the barge and collected a Tech. Ops. core as near to the position of the bore hole casing as possible. The core was capped and handed over to Mr. Barlow.

Eight cores were collected. No core was obtained at site #28 because the bottom consisted of slag or rocks.

RANDLE REEF DRILLING SURVEY POSITIONS NAD 83

SITE	SAMPLE POSITION		
	EASTING 17 E	NORTHING	
28	594856.0	4791976.7	
13	594792.9	4791783.1	
14	594778.6	4791724.3	
154	594604.1	4791677.5	
6	594692.1	4791733.6	
18	594750.1	4791792.3	
11	594691.6	4791887.2	
22	594694.0	4791811.8	
21	594745.7	4791875.1	



DRILLING FROM THE BOW OF THE BARGE HENRY TON RANDLE REEF

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

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

Vehicle support was utilized for several different functions. These functions range from the transportation of various types of samples, equipment and personnel to and from common and remote field sites and for shipboard operations.

The Institute older vehicles were replaced due to the need for extensive repairs and overall poor condition. One of the vehicles replaced has come with a factory equipped dual fuel system that operates on propane and regular gasoline. The next was converted with a new closed loop natural gas system. This system allows the operator to start on regular gasoline and after the start up procedure has completed the vehicle computer system automatically switches the vehicle to natural gas. When the vehicle's natural gas capacity diminishes towards empty, the computer switches the system back to regular gasoline.

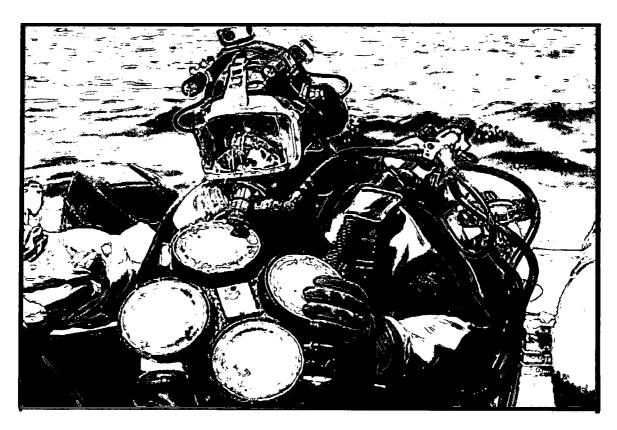
A.R.I. Canada "Automotive Rentals Incorporated" are still handling the procurement of all vehicle fleet repairs and billing. A.R.I. is responsible for the upkeep and maintenance of all vehicle records such as mileage, fuel consumption, incidentals and repair costs. Records are still kept internally by Technical Operations Section. Vehicle mileage is sent to A.R.I. on a monthly basis. This company continues to be a very efficient and satisfying organization to deal with. It has cut down considerably on the amount of time and effort spent on monthly paper work for each vehicle in the fleet.

The extensive geographical area covered this field season ranged from Miramichi, New Brunswick, Halifax, Nova Scotia, Prince Edward Island, Grande Prairie, Alberta and Hay River, NWT. Some U.S. destinations included Boston, Massachusetts, Miami, Florida, Maryland and Ann Arbor, Michigan.

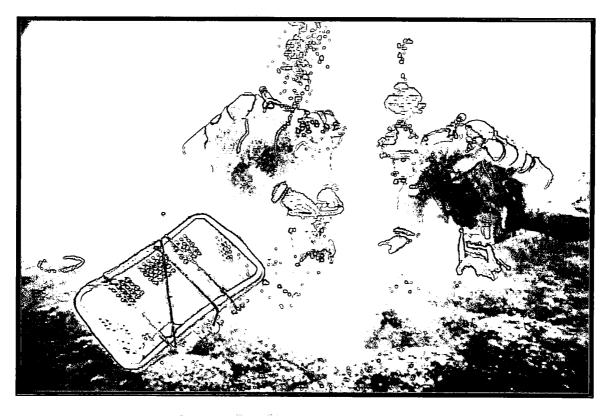
From April 1 to December 1, RSB vehicles travelled a combined distance at 765,935 km. The vehicle fleet at the Institute will see over one million kilometres travelled this fiscal year. The above distance was accomplished virtually incident free.

UNDERWATER OPERATIONSRSB STUDY 12634, F.H. DON

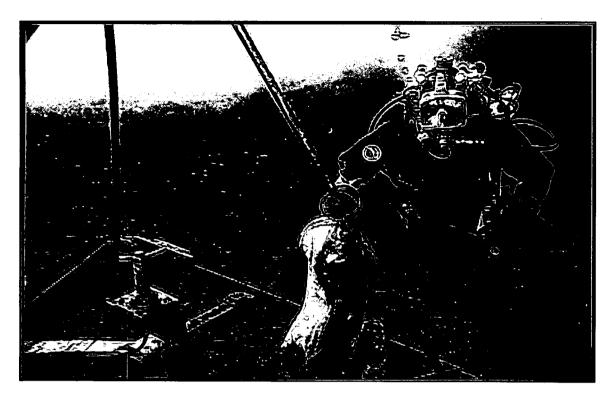
The Diving Operations Unit of Technical Operations Section provided national and international support to various scientific studies in areas of diver certification, inspections, installations and retrievals of hardware, sample collection, videography,



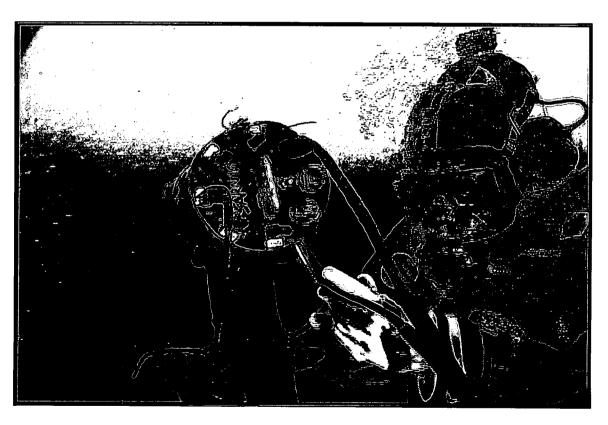
ADCP SEARCH AND RECOVERY



LAKE TROUT EGG COLLECTION



HYDRA CURRENT METER INSPECTION



T-FRAME REFURBISHMENT

television surveys with video documentation, equipment demonstrations/trials, search and recovery, lectures and diver training. The Diving Operations Unit supported 11 divers at Burlington. A total of 489.5 hours (accident free) were logged in support of scientific projects for: NWRI, DOE/EHD, ECB-OR; DOE/RPD, ECB-OR, DFO/BINST and DFO/GLLFAS. A total of 44 hours were logged on MURV—the remotely operated MiniROVER underwater camera system. MURV is used for deep water and long duration video recording. Projects included wreck mapping, sonar surveys, documentation of geological formations and live educational documentaries. The Dive Shop has the capability to edit and copy all raw footage for scientific purposes into any desired format.

The Head of the Diving Operations Unit, F.H. Don represented research/scientific diving as a member of the Canadian Standards Association Sub-committee on Diving Competency as chairman of the Contaminated Environment working group. Mr. Don is chairman of the Federal Interdepartmental Committee for Diving Safety. The annual meeting of the Department of Environment Diving Safety Committee was held in April of 1999 in Vancouver, British Columbia.

Highlights of the year would include the recovery of \$100,000.00 worth of lost scientific equipment. Using MURV equipped with forward looking sonar, a highly motivated TOS dive team recovered an ADCP unit and a Hydrolab profiler. Both were recovered in a minimum amount of time at a low cost.

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 during 1999 included:

STUDY	LOCATION
AERB 12242, Murthy	Lake Michigan
AERB 12243, Skafel	WAVES Tower, Hamilton Harbour/Lake Ontario
AERB 12245, Hamblin	North Channel
AERB 12225, Rukavina	Hamilton Harbour, Cornwall, Amherstburg and Sarnia
AEPB 12465, Smith	Lake Ontario Region Mussels
RSB 12631, Smith	Outside Agencies: DFO/GLLFAS, Fitzsimons, Fish Habitat Studies CCCG/BINST, Hull inspections/repairs DOE/RPD, ECB-OR, Biberhofer, Cornwall
RSB 12632, Moore	Great Lakes Surveillance: Water Quality Stations at Ft. Erie, Niagara-on-the-

Lake, Wolfe Island and Port Lambton

BUILDING TECHNOLOGY & ENVIRONMENTAL SYSTEMS

WAVES TOWER MAINTENANCE PROGRAM BTES STUDY 12702, S.C. PETTIT

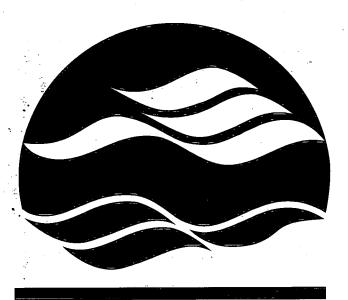
Inspection of the navigation and flood lights on the tower was performed in early spring and late fall by Technical Operations and Engineering Services staff. The tower required a complete cleaning and paint job this year, usually done at five year intervals. Visual inspections for cracks and damage to all structural joints above the waterline were carried out prior to painting. All joints and external surfaces were cleaned, primed (if required) and painted with high gloss safety yellow. A total of 9 days with up to 6 persons were required to complete the painting. Fall inspection was completed November 25 and the tower was secured for winter.

Minor maintenance to the Beach Trailer was required. An entrance door was installed and vinyl siding on the western side of the roof was repaired. Building Services has been informed that the new door requires a new door knob to be installed. A problem with the security sound system was investigated and it has not yet been resolved. The microphone of the tower cannot be heard at the CCIW security desk. This may be a phone line problem.

DATE DUE REMINDER

MAY 3 0 2000

Please do not remove this date due slip.



NATIONAL WATER RESEARCH INSTITUTE

INSTITUT NATIONAL DE RECHERCHE SUR LES EAUX

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