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1980

ACTIVITY SUMMARY

TECHNICAL OPERATIONS GROUP

NATIONAL WATER RESEARCH INSTITUTE

INLAND WATERS DIRECTORATE

UNPUBLISHED REPORT

RAPPORT NON PUBLIÉ

1980

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TECHNICAL OPERATIONS GROUP

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INLAND WATERS DIRECTORATE

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INTRODUCTION

The Technical Operations Group is a service-oriented team of field specialists, whose mission is to provide logistical support and field party manpower to National Water Research Institute Branch off-site research programs. Specifically, the Group is responsible for both shipboard and land-based data-gathering, including sampling, sample preparation and, where appropriate, sample analyses.

This is a coast-to-coast responsibility as the Group provides technical leadership and support to NWRI regions, other departments, agencies and universities.

The Group is responsible for and carries out the following field support services:

SHORE-BASED FIELD STUDIES

Nearly 30 such studies were supported this year. These included the Long Range Transport of Air Pollutants at Sault Ste. Marie; South Indian Lake, Manitoba for Western and Northern Region; Shoal Habitat Studies at Main Duck Island in Eastern Lake Ontario; Herring Gull Studies for Canadian Wildlife Service; support to Great Lakes Biolimnology Laboratory at Bay of Quinte, Dorset and Owen Sound, Ontario.

SHIPBOARD OPERATIONS

The Surveillance Program was carried out by the Research Vessel, CSS LIMNOS. In support of the intensive physical research being conducted in Lake Erie, this year the LIMNOS deployed and maintained current, temperature and meteorological moorings.

The CSS ADVENT provided full-time support to sampling and instrumentation programs on Lake Erie in 1980.

DIVING OPERATIONS

NWRI diving operations are authorized and conducted under the direction of the Senior Diving Officer. Diving tasks were numerous

and varied from erection of underwater towers to instrumentation, photography and sampling.

FIELD INSTRUMENTATION

Installation and field maintenance of a wide variety of environmental data collection systems was a continuing responsibility.

In addition, the Group holds responsibility for scheduling and maintaining NWRI vehicles, field equipment inventory, field instrumentation, warehousing and rigging shop services.

This well-diversified team of field specialists supported over 50 research studies with 30 persons in the 1980/81 fiscal year.

STAFF LIST - TECHNICAL OPERATIONS, 1980

H.B. Macdonald	- Head
Mrs. S.R. Mitchell	- Secretary
J.T. Roe	- Head, Dive Unit
W.B. Taylor	- Senior Operations Officer
P.M. Healey	- Operations Officer CSS LIMNOS
M.R. Mawhinney	- Operations Officer CSS LIMNOS
J.A. Diaz	- Head, Field Instrumentation
L.E. Benner	- Data
J.R. Brown	- Dive Unit, CWS
G.D. Bruce	- Dive Unit, Habitat Study
T.J. Carew	- Shore Parties, HD
F.J. deVree	- Dive Unit (L.O.A. March - August)
F.H. Don	- CSS LIMNOS, Shore Parties
H.E. Greencorn	- Rigging Unit
W.D. Hunt	- Field Stores
G.J. Koteles	- CSS LIMNOS, CSS BAYFIELD, HD
L.J. Lomas	- Foreman, Rigging Unit
B.H. Moore	- CSS LIMNOS, Shore Parties
H.K. Nicholson	- Data
G.M. Perigo	- Rigging Unit, Vehicles
S.B. Smith	- Sault Ste. Marie (GLBL)
E.G. Smith	- Electronic Maintenance
E.H. Walker	- CWS, LRTAP
J.A. Tyler	- Electronic Maintenance
P.R. Youakim	- Data, CSL SHARK

Term Employees

J.E. Tozer	- CSS LIMNOS, Elmira Study
R.J. Hess	- CSS LIMNOS
C. Bisutti	- CSS LIMNOS
T.F. MacLennan	- CSS LIMNOS, HD
J.A. Kraft	- Data

Resigned	- R.G. Chapil	- April - Winnipeg, Manitoba
	- M.R. Thompson	- July - Springville, Saskatchewan
Transferred	- B.G. Gillies	- September - Sault Ste. Marie, APSD

SHORE PARTIES

CANADIAN WILDLIFE SERVICE

The surveillance of toxic substances in Great Lakes Wildlife (primarily Herring Gulls) was continued by the Canadian Wildlife Service in 1980. Toxic levels are monitored by collecting the eggs of fish-eating birds and by monitoring the reproductive success rates of Herring Gulls on colonies throughout the Great Lakes.

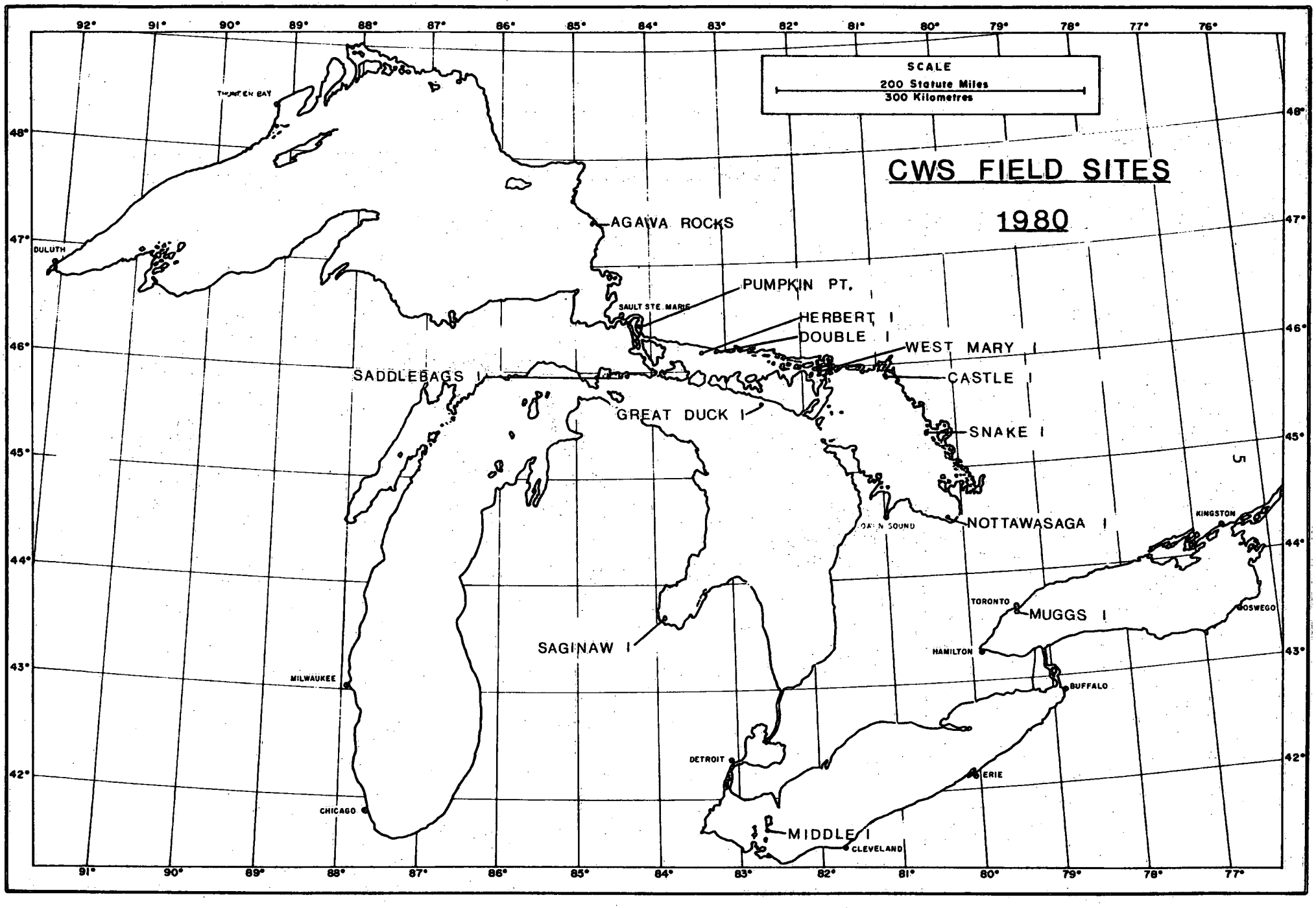
Lake Huron, Georgian Bay and the North Channel were chosen as intensive study areas for 1980 and also for a complete census of all fish-eating birds in these areas.

Technical Operations supplied two technicians and two vehicles to the CWS during the intensive Spring and early Summer field season. Three launches and other support craft were supplied by O&AS.

The intensive work of censusing and reproductive success rates was done by splitting CWS and Tech. Ops. personnel into three different field parties with responsibility for different parts of Lake Huron, Georgian Bay and the North Channel.

Other tasks carried out by all personnel were reproductive success rates on Muggs Island in Lake Ontario, Middle Island in Lake Erie and Agawa Rocks in Lake Superior. Also, reproductive success rates were carried out on Double Crested Cormorants throughout the lakes.

The nature of the field work required that a great deal of area and work be covered in a relatively short period of time. The three major launches logged 5200 miles between them and the two vehicles 23,060 km. The project was completed without major mishap, damage or injury.


SCALE
200 Statute Miles
300 Kilometres
CWS FIELD SITES
1980
AGAWA ROCKS
PUMPKIN PT.
HERBERT I
DOUBLE I
WEST MARY I
CASTLE I
SNAKE I
NOTTAWASAGA I
MUGGS I
SAGINAW I
MIDDLE I
SADDLEBAGS I
GREAT DUCK I
THUNDER BAY
DULUTH
SAULT STE. MARIE
MILWAUKEE
CHICAGO
DETROIT
CLEVELAND
ERIE
BUFFALO
HAMILTON
TORONTO
KINGSTON
OSWEGO
92° 91° 90° 89° 88° 87° 86° 85° 84° 83° 82° 81° 80° 79° 78° 77° 76°
48° 47° 46° 45° 44° 43° 42°

HABITAT STUDIES - GREAT LAKES REHABILITATION

This Project, No. 2109 was conducted under the leadership of Dr. P.G. Sly with assistance by R. Sandilands and field support from Technical Operations Group.

PURPOSE

To develop ways of improving Lake Trout and Whitefish rehabilitation in the Great Lakes.

METHOD

A joint effort by NWRI staff, OMNR staff and information exchanges with the New York State Department of Environmental Conservation is necessary to support this study.

During the 1979 field season, locations of known spawning in the Quinte area and Snow Shoe Bay, New York were surveyed. Consequently, in 1980 these and other areas were observed with the use of a sidescan sonar, echo sounder, Slugo (underwater TV and 35 mm camera system), divers and bottom sampling to characterize such spawning grounds and spawning habits. In addition, continuous temperature records were obtained at selected sites by the use of TRS systems to determine preferred spawning temperatures and corresponding dates.

Travel to areas such as Manitoulin Island, Georgian Bay and the Finger Lakes requires a crewcab truck fitted with a truck cap or camper lab and the 21' Misenark and trailer to make the study mobile and self-contained without local support.

RESULTS

A total of 18 underwater camera video tapes along with corresponding echo sounding records and colour slides were acquired. Substrate samples and sidescan sonar records were taken at various sites to determine bottom characteristics. Diver observations of the fish and eggs during the spawning season were not as successful as the previous year.

Profile surveys of the Snow Shoe Bay site were done on three occasions to determine any physical changes in the beach and offshore shoal as a result of wind/wave and ice action.

FUTURE STUDIES

Previously-visited sites of known spawning and new areas--primarily Upper Lakes and smaller inland lakes, may be surveyed during the 1981 season.

CHRONOLOGY OF EVENTS

February - Ostrander Pt., Pigeon Island (Diver observation)

April - Snow Shoe Bay, N.Y. (Profile survey)

May 6 - 8 - Hay Bay (TRS retrieval)

June 11 - 13 - Poplar Bar (TRS retrieval)

June 23 - 27 - Pt. Traverse (Slugo trials), Snow Shoe Bay, N.Y. (Profile survey)

July 3 - 4 - Nottawasga Bay, Owen Sound (Shoal survey)

July 7 - 10 - Colpoys Bay, Lions Head (Shoal survey)

Aug. 25 - 29 - Manitoulin Island (Shoal survey)

Oct. 2 - 5 - Seneca Lake, N.Y. (Shoal survey)

Nov. 3 - 7 - Snow Shoe Bay, N.Y. (Profile survey, TRS installation)

Nov. 12 - 14 - Pt. Traverse (TRS installation), Bay of Quinte (Shoal survey)

Nov. 20 - 24 - Manitoulin Island (Shoal survey, 2 TRS installations)

VEHICLE AND EQUIPMENT LIST

Crewcab truck

Truck cap or Camper Lab

21' Misenark and Trailer

Slugo (underwater camera system)

Raytheon Echo Sounder

Klein sidescan sonar

4 TRS systems and monitor

Profile Survey Gear

Honda Generator

Dive Gear

AQUATIC MACROPHYTE PROGRAM, AED 2477

(See Program Report by F.H. Don, 1980)

SUMMARY

The work area for this program centered around Buckhorn Lake. The main sampling program took place in Buckhorn Lake (15 stations) with excursions into Chemong Lake (3 stations) and Sandy Lake (1 station). A cottage located one-half mile North of Scollard Point on Buckhorn Lake served as the operations base. At each station, cores were taken, using the Brown's corer for subdivision and analysis. Groundwater collectors were installed at eight stations in Buckhorn Lake. Aquatic plant samples were collected at all stations.

PURPOSE

Investigation of the relationship between sediment and milfoil in the Kawartha Lakes.

INTRODUCTION

Nineteen stations were chosen, for varying amounts of milfoil, in three lakes. The nutrient conditions within the sediment were measured to determine if any relationship exists between milfoil abundance and sediment chemistry. Some areas have had severe declines in milfoil abundance and limiting nutrients within the sediment may be responsible.

OBSERVATIONS

1. Milfoil abundance at each station
2. Pore-water collection (peepers) at each station
3. Cores taken at each station
4. eH and pH profiles of cores at each station
5. Groundwater collection (volume measurement) at eight stations in Buckhorn Lake
6. Aquatic plant concentration at each station
7. Aquatic plant sample collection at each station
8. Peeper installation and retrievals, Jack Lake
9. Lightweight coring, Jack Lake

CHRONOLOGY OF EVENTS

May 26-30	- Prepared equipment for transportation - Transported equipment to Buckhorn Lake - Organized equipment at cottage - Arranged dockage for barge
June 2-6	- Peepers installed, Jack Lake - Lightweight coring, Jack Lake - Station selection and buoy installations, Buckhorn Lake and Chemong Lake
June 9-13	- Station selection and buoy installations, Buckhorn Lake and Sandy Lake - Groundwater collectors installed in Buckhorn Lake - Surveyed Sandy Creek by canoe - Peepers installed at all stations
June 16-20	- Peepers retrieved, Jack Lake - Coring commenced in Buckhorn Lake
June 23-27	- Coring, Buckhorn Lake and Chemong Lake - Peepers removed at all stations
June 30-July 4	- Peepers installed, Jack Lake - Lightweight coring, Jack Lake - Coring, Buckhorn Lake - Peepers installed at three stations in Buckhorn Lake and Chemong Lake
July 7-11	- Collected aquatic macrophyte samples at all stations - Sorted, oven-dried and weighed aquatic macrophyte samples - Water sample bags installed onto the groundwater collectors
July 14-18	- Peepers retrieved, Jack Lake - Peepers retrieved, Buckhorn Lake and Chemong Lake - Collected groundwater samples and measured the volume of each sample - Site clean-up - Transported equipment to CCIW

ALGONQUIN PARK LAKE SAMPLING, AED 2411

(See Project Report by F.H. Don, 1980)

PURPOSE

To study the "cycling" of trace metals in apparently "uncontaminated" lakes.

OBSERVATIONS

1. Temperature profile at each station
2. Conductivity profile at selected stations
3. pH measurement of sample at the time of collection
4. Lightweight core at selected stations
5. Subdivide core on site

CHRONOLOGY OF EVENTS

August 5 - Departed CCIW 0900 hours
- Travelled to Whitney

August 6 - Sampled Lake Louisa and Harry Lake
- Attempted Rence Lake and Welcome Lake (inaccessible)

August 7 - Sampled Animoosh Lake
- Attempted White Partridge Lake (1/2-mile portage over very rough terrain)

August 8 - Sampled Proulx Lake, Wright Lake and the East Arm of Opeongo Lake

August 9 - Sampled Hogan Lake

August 10 - Sampled Cauliflower Lake

August 11 - Sampled Basin Lake and McCauly Lake

August 12 - Sampled Brûle Lake and Scott Lake
- Travelled to Huntsville

August 13 - Sampled Tim Lake and Rain Lake

August 14 - Departed Huntsville 0800 hours
- Sampled Kioshkokwi Lake
- Attempted Three Mile Lake (thunderstorms)
- Arrived Mattawa 2000 hours

August 15 - Sampled Three Mile Lake and Erables Lake
- Attempted Maple Lake (too shallow) and Mouse Lake (3/4-mile portage over rough terrain)

August 16 - Sampled Radiant Lake and Traverse Lake

August 17 - Sampled Cedar Lake

August 18 - Departed Mattawa 0900 hours
- Arrived CCIW 1700 hours

SUMMARY

Coring

During the survey, twelve cores were collected in eleven lakes using the CCIW lightweight corer. The use of a single aluminum boat for coring proved to be too dangerous. The solution was to core using two aluminum boats tied together to create greater stability. The cores were subdivided onshore using the tailgate of the crewcab as a working platform. The core samples were stored in a cooler and returned to CCIW for analysis.

Water Sampling

A total of sixty-two water samples (4 gallons each) were collected during the survey for each station. One sample was collected from the epilimnion and the other from the hypolimnion. Isothermal stations were sampled at one depth (mid-water column). The water samples were obtained using vinyl hose and either an electric "Little Giant" pump with a Honda generator or a hand pump. The water samples were stored in plastic containers.

During the water sampling, a temperature and conductivity profile was taken. At the completion of filling a water sample container, the pH was taken immediately.

Vehicles

Two crewcabs (79-005 and 80-125) were used for the survey. Both were fitted with wooden racks to support the aluminum boats. The roads used during the survey varied from two-lane paved to rabbit trails. Both trucks performed well under these conditions. The winch installed on crewcab 80-125 was used on several occasions to move dead falls off the road or, as in one instance, to pull the crewcab out of a broken bridge. All Tech. Ops. trucks should be fitted with these winches. The cost is more than justified.

BENTHIC SURVEY OF THE NORTH CHANNEL, LAKE HURON, GLBL

An extensive survey of the benthic community of the North Channel and a portion of the Northern end of Georgian Bay was conducted from July 28 to September 5. The study will serve as a baseline from which the impact of acid rain upon the area can be assessed and the cores taken may indicate changes which have already occurred in the benthic community.

The project was under the direction of Dr. M. Johnson of the Great Lakes Biolimnology Laboratory (GLBL) with the field party consisting of a technician from GLBL and one from Technical Operations. Extensive sediment, bottom fauna and water sampling was conducted utilizing the Tug, LAC ERIE. Specific areas studied included Manitowaning, Frazer, MacGregor, Killarney and Smith Bay's Collins Inlet and Baie Finn.

A total of 223 stations was completed including 30 special stations involving a detailed chemical and biological sampling of the water column. The survey was concluded as planned with only two days lost in the study area due to bad weather.

TURKEY LAKES WATERSHED PROGRAM

It has been recognized for many years, in Canada, that the long range transport of pollutants may cause serious environmental and health problems. Federal activities toward "acid rain" have been organized under the Long Range Transport of Air Pollutants (LRTAP) program and include Department of Environment, Department of Fisheries & Oceans, Atmospheric Environmental Service and the Canadian Forestry Service.

The Turkey Lakes Watershed in the Algoma District was chosen as an intensive study site because it has lakes and geology that are sensitive to atmospheric pollutants and its remoteness leaves little chance of being affected by pollutants other than air-borne.

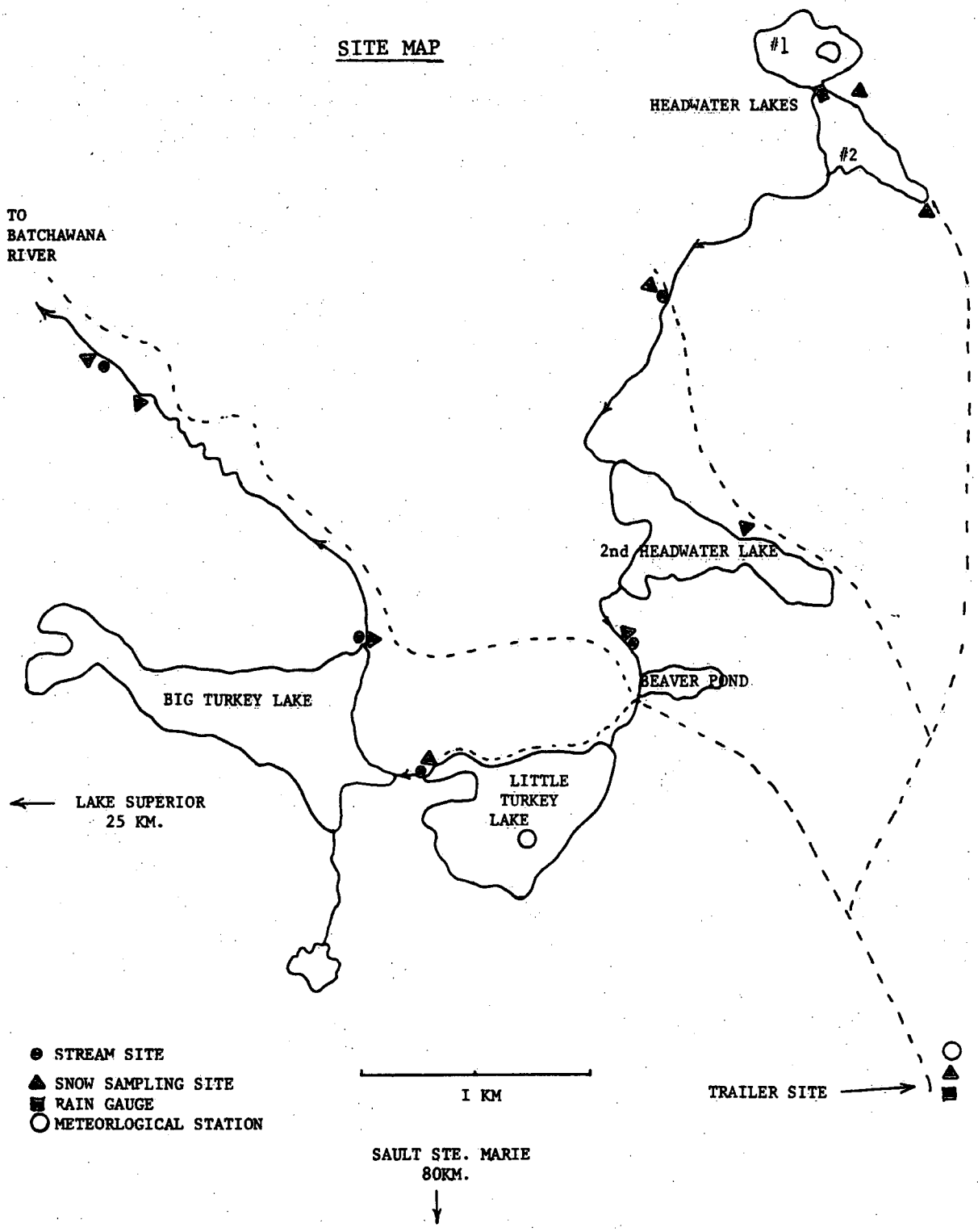
The watershed consists of five small lakes in a chain located in forests of the Great Lakes-St. Lawrence type. The area is located in rugged hills of Precambrian rock with elevations 466 metres above Lake Superior. The elevation rise and the fact that Lake Superior is only 25 kilometers due West causes considerable snow and rain to fall on the watershed.

Technical Operations supplied one vehicle and technician to the Aquatic Physics & Systems Division to study the affects of atmospheric precipitation on the hydro chemistry of the Turkey Lakes Watershed. The study monitored closely all precipitation by means of rain and snow gauges and two meteorological stations in the watershed. Stream and lake samples were collected on a weekly basis for chemistry and physical parameters. From this data, the chemical changes that occurred between the precipitation and when the water left the lake system were monitored throughout the year. Numerous other samples were taken for different parameters to gain more holistic understanding of the watershed.

An AES site was also made operational to collect air samples on a continuous basis.

The project was in its infancy during the 1980 season and many questions are still unanswered. Still, the project obtained a good set of basic data from which later analyses will determine what direction the 1981 and future field seasons should take.

SITE MAP


#1
HEADWATER LAKES
#2
TO
BATCHAWANA
RIVER
2nd HEADWATER LAKE
BEAVER POND
BIG TURKEY LAKE
LITTLE
TURKEY
LAKE
LAKE SUPERIOR
25 KM.
STREAM SITE
SNOW SAMPLING SITE
RAIN GAUGE
METEORLOGICAL STATION
1 KM
TRAILER SITE
SAULT STE. MARIE
80KM.

LONG RANGE TRANSPORT OF AIR POLLUTANTS (LRTAP)

GREAT LAKES BIOLIMNOLOGY LABORATORY (GLBL)

This project took place in the Turkey Lakes forested watershed study area North of Sault Ste. Marie, Ontario.

Technical Operations' support to GLBL was continuous from March 31 to November 27, 1980.

This many-faceted project included the capture, tagging and release of fish, the collection and mapping of macrophytes, primary productivity studies and the collection of benthic samples.

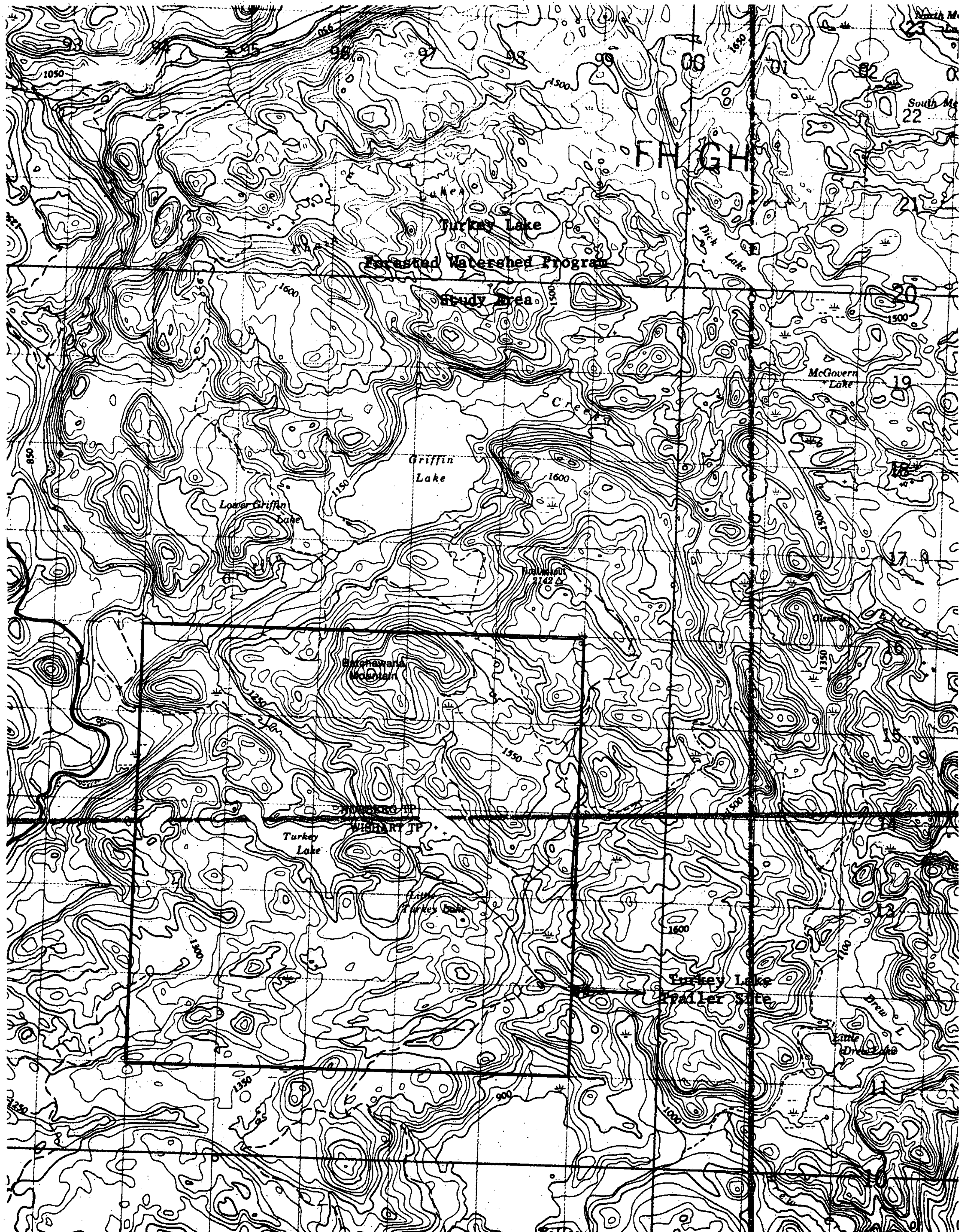
In addition, a bathymetric survey of the five lakes in the system was completed and charts showing depth contours were prepared.

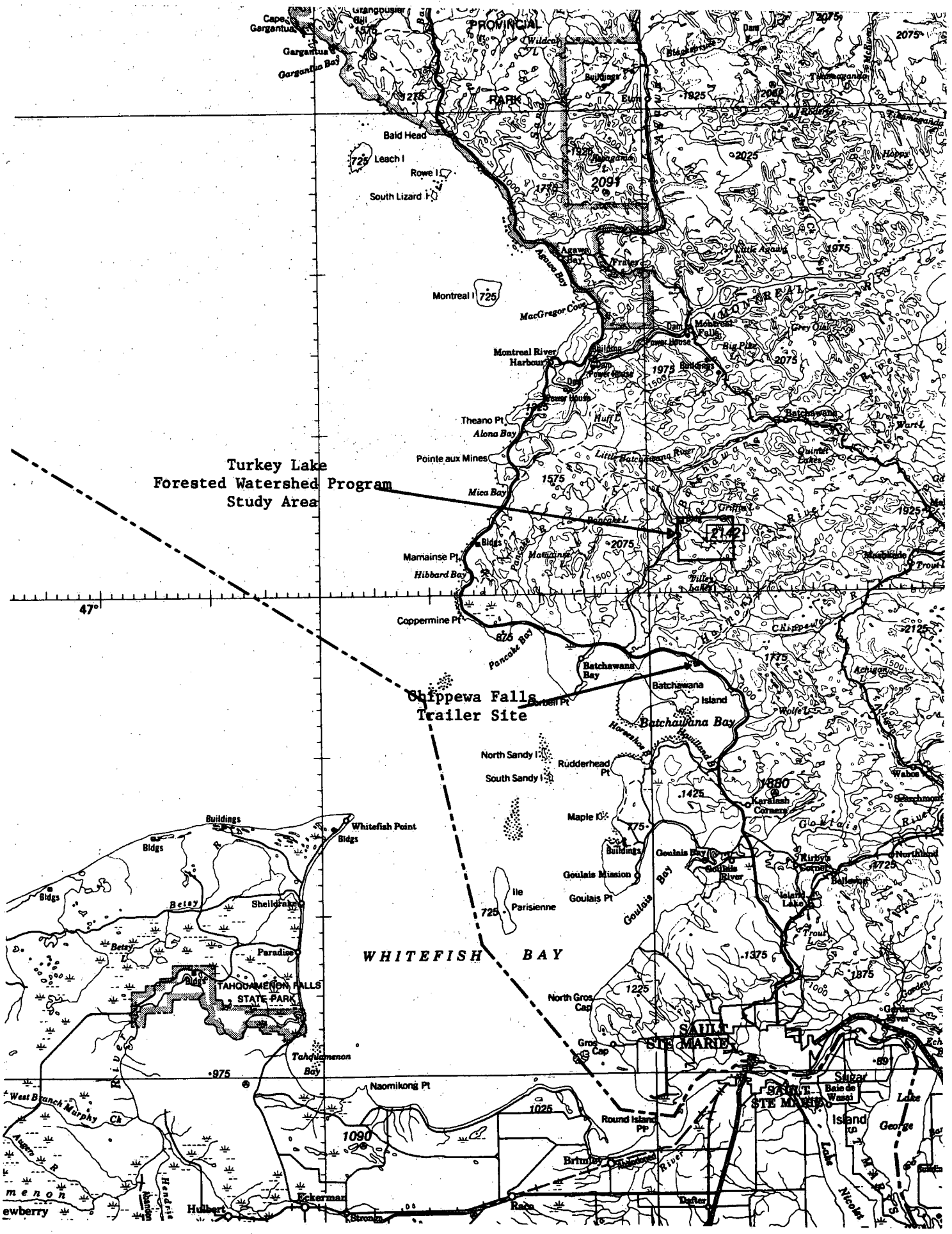
A survey of Headwater Lakes was undertaken in the October 3rd to November 6th period with one hundred and five (105) lakes sampled in the area from Aitikokan to Temagami. This survey was done by helicopter with lab work done in the Technical Operations mobile lab.

Technical Operations also set up and maintained two meteorological systems in the Turkey Lakes study area. One system was on a Met. buoy and operated from May to December monitoring wind speed and direction, air temperature, water temperature, relative humidity and solar radiation. The second system was on a tower and operated on a continuing basis from July onwards monitoring wind speed and direction, air temperature, relative humidity and solar radiation. The Met. can and solar radiation integrator for the tower were housed in a heated shed erected by Atmospheric Environment Service to house some of their equipment. A solar radiation station was also maintained at the Chippewa Falls trailer site from May to December.

Three tipping bucket rain gauges were set up and maintained during the year--one at Chippewa Falls, one near the Met. tower and the third on the Beaver Dam between lakes 1 and 2.

Full-time support was terminated in early December 1980. Further support will be supplied on an "as requested" basis.


Turkey Lake
Forested Watershed Program
Study Area
Turkey Lake
Trailer Site
FH GH
Griffin
Lake
Lower Griffin
Lake
Batchawana
Mountain
McGovern
Lake
Dick Lake
Turkey
Lake
Little
Turkey Lake
Little
Drew Lake
HOMBERG TP
WISHART TP
Creek
1600
1500
1350
1300
1250
1150
1050
850
900
1000


Turkey Lake
Forested Watershed Program
Study Area
Chippewa Falls
Trailer Site
PROVINCIAL
PARK
Cape Gargantua
Gargantua Bay
Bald Head
Leach I
Rowe I
South Lizard I
Agawa Bay
Montreal I
MacGregor Cove
Montreal River Harbour
Theano Pt
Alona Bay
Pointe aux Mines
Mica Bay
Mamainse Pt
Hibbard Bay
Coppermine Pt
Pancake Bay
Batchawana Bay
Batchawana Island
Corbell Pt
North Sandy I
South Sandy I
Rudderhead Pt
Maple I
Goulais Bay
Goulais Mission
Goulais Pt
Ile Parisienne
WHITEFISH BAY
Whitefish Point
Shelldrake
Paradise
TAHQUAMENON FALLS STATE PARK
Tahquamenon Bay
Naomikong Pt
Round Island Pt
North Gros Cap
Gros Cap
SAULT STE MARIE
Hulbert
Eckerman
Raco
Brimley
Dafter
47°

NEARSHORE PROFILE CHANGES, HD 4306

LITTORAL DRIFT RATES, HD 4308

PURPOSE

The relationship between nearshore sediment transport rates and wave parameters is poorly defined particularly in lakes where the process is complicated by seasonal water level changes. These projects shall develop and use techniques and procedures aimed at providing a direct measurement of actual littoral drift rates under all wave conditions. The measurements obtained shall be applied to tests of a mathematical predictor model of littoral drift and shall provide information useful to shore erosion control and design of shore structures.

BACKGROUND

These programs began in 1976 and Van Wagner's Beach, Hamilton was chosen as the site for experimental measurements of littoral drift because of its accessibility, existing meteorological data collection system and the Beach Stability Program conducted there in 1972-73. The results from that study were published in "Beach Stability Investigations at Van Wagner's Beach, Western Lake Ontario" by J.P. Coakley (HRD) and H.K. Cho (Technical Operations Section).

COMPLEMENTARY MEASUREMENTS FOR 1980

Onshore Surveys, HD 4306

Eleven surveys were carried out from June - December. Lines 12, 18, 19 were levelled at 2 m intervals from the baseline to the water's edge. On line 18, the levelling was extended to the first offshore stake. Cross-sections were plotted by HD personnel.

Bathymetric Surveys, HD 4308

In May, October and November, surveys were completed and charts of the area were drawn to measure sediment movement.

THAMES RIVER ICE SURVEY, HD 2324

Hydrometric Surveys

To better understand ice jams and flooding, surveys were conducted on the lower Thames River and upper Grand River. Reference bench marks had previously been made on the Thames River and cross-sections were taken from these. High ice marks were measured from photographs taken at the time of the Spring ice jams. These were fairly straight-forward surveys. Elevations were required to ice-scar marks and to bench-mark settings. Photo identification was difficult, it being necessary to choose distinct land marks, being particularly watchful of detail and size (scale). The main objective was to predict and control the ice break-up in the Spring and possibly diminish ice damage. For the Spring of 1980, a hovercraft was used to release the ice in the lower Thames River.

General Outline for Measurements at Each Site

Survey - waterline profile at or near 100-ft. intervals, plus upstream and downstream side of each temporary bench mark

- high ice marks at these same points
- several measurements of thickness of released ice jams from remnant scars along the banks in order to provide a fair average value

If existing ice cover was safe, soundings at five cross-sections were made; these were spaced to coincide with the bench marks.

Summary of Surveys

1. Thames River near Middlemiss - February 5 - 7

   A survey ran along a 1000-ft. reach--500 ft. upstream and 500 ft. downstream of the bridge centre line.

2. Thames River South of Bothwell

   Same as above

3. Thames River at Kent Bridge

   Same as above

   There were no high ice marks or evidence of released ice jams at this site.

4. Same procedure for the Thames River at Thamesville

   Water level measurement at the bridge and cross-sections at bench marks 7, 8 and 9; high ice marks visible between bench marks 7 and 8.

5. Thames River near the mouth

   Three cross-sections for water level measurements.

June 16 - 20 and June 24 - 27 hydrometric surveys were carried out at the following sites of the lower Thames River:

Middlemiss

Near Bothwell

Near Fairfield Museum

Thamesville

Above the Sherman Brown Bridge (near Chatham)

Above the river mouth

The surveys involved cross-sectional sounding; setting temporary bench marks and river slope surveys.

November 12 - 14 and 17 - 21, hydrometric surveys were completed at the above sites plus the Kent Bridge site. In addition, ice jam levels were identified and surveyed near the Fairfield Museum above Sherman Brown Bridge and above the river mouth.

A preliminary survey was carried out on the Grand River at Waldemar. The purpose and procedures were the same as for the Thames River.

These surveys are continuing and the next is due in January 5 - 9, 1981 with the Grand River being added for intensive survey.

Equipment Used for These Surveys

Punt or rubber raft
4 1/2 - 6 hp motor
Sounder with 12 volt batteries
Transducer
Level and legs
Level rod
Stakes
100 m tape
Axes, shovels, hammers, etc.
Previous photos and log books
Plate for water level measurements
Level record book
Flourescent spray paint for stake marking

SOLAR RADIATION

A total of 12 radiation sites supporting various projects was in operation during 1980. The CSS LIMNOS and two meteorological buoys were fitted with radiation systems while the remaining 9 stations were land-based. All stations used the Campbell integrator and Eppley pyranometer. In addition, the NWRI and CSS LIMNOS stations used the Swissteco sensor for measurement of temperature and net downward radiation.

These stations are maintained and serviced by Technical Operations staff or in some instances, by other agencies due to the physical distance from NWRI. Incoming charts and integrator tapes are reduced by data processing. The original charts and tapes along with the processed data are made available to corresponding project leaders and common users.

SUMMARY OF RADIATION STATIONS

Location	Project Leader	Period of Service
CCIW	Common User	Jan. 1 - Dec. 31
Dunnville	Lake Erie Studies	Jan. 1 - Dec. 31
Dorset	Dr. J.M. Cooley, GLBL	Jan. 1 - Dec. 31
Jack Lake	Dr. D.R.S. Lean, AED	Feb. - Dec. 31
CSS LIMNOS	Common User	Mar. 7 - Nov. 25
Chippewa Falls	LRTAP	Apr. 25 - Nov. 25
Turkey Lake	LRTAP	Apr. 25 - Dec. 31
Glenora	Dr. J.M. Cooley, GLBL	Apr. 16 - Oct. 8
Lake Erie Buoy 80-01M-01A	F.M. Boyce, APSD	July 16 - Aug. 28
Lake Erie Buoy 80-01M-03A	F.M. Boyce, APSD	July 28 - Aug. 28
Rawson Lake	D. Schindler, FWI	Jan. 1 - June 27
South Indian Lake	Dr. B. Hickey, FWI	Jan. 1 - Sept. 1

CORING EQUIPMENT SUPPORT

This year, as in the past, coring equipment was in great demand. Several new samplers were purchased in order to meet these demands.

The newest acquisition, the box corer, is able to collect a large (.5 m^3) sample of undisturbed sediment. Following a successful Lake Huron Sampling Cruise, this sampler was requested on several cruises by various research groups.

The box corer and the CCIW lightweight corer were demonstrated to several interested outside agencies, including McGill University, Wright State University (Ohio), Ontario Hydro and Water Quality staff from Montreal.

The lightweight corer was used in Algonquin Park, Turkey Lakes, Sudbury and as far East as Nova Scotia in support of the Acid Rain Studies.

DIVING SUMMARY

During the 1980 field season, the Dive Unit supported thirteen NWRI projects involving underwater work and sample collection. Two universities (one Canadian, one U.S.) required support for short, intensive periods and a co-operative project with D.O.T., Ottawa involved two weeks of intensive work in Northern Quebec.

The Unit used five Technical Operations divers for varying periods for a total underwater time of nine hundred hours in addition to surface support on all projects. Diving tasks took place from shore, ship and launch in Lakes Ontario, Erie, Huron and Georgian Bay and eight inland lakes in Ontario and Quebec.

Co-operative support from the Dive Unit through loan of personnel or equipment involved D.O.T., Ottawa, Trent-Severn Waterway, GLBL and O&AS.

SHIP PROGRAMS

CSS ADVENT

LAKE ERIE EXPERIMENT

The CSS ADVENT was assigned to support the main experiment in a number of ways.

PLAN

Because a component of flow is known to be a persistent upwelling and mixing of hypolimnion water, temperature/depth profiles and water samples were required in the vicinity of the CATTS and current meter moorings. Water samples from surface and bottom were analysed for dissolved oxygen; at one station, additional water from a series of depths was drawn for particulate organic carbon and chlorophyll a analyses.

Hourly meteorological observations were required.

During upwell events, it was required to sample with the EBT to learn how and where the two-layer open-lake stratification gave over to a vertically-mixed water column.

There was a requirement to establish whether there were significant chemical or biological gradients in the vicinity of the main Anchor Station.

Synoptic data sets were desirable and samples were collected for dissolved oxygen analysis and for splitting into subsamples aboard the LIMNOS.

Personnel and equipment transfers between ADVENT and LIMNOS were scheduled.

FIELD OPERATIONS

Water sampling in the vicinity of CATTS and current meter moorings came under the heading of Northshore Thermocline Contact Cruises. Seven (7) such cruises were carried out as follows:

TCC No.	No. of Stations	Date
1	11	July 29
2	18	August 6
3	10	August 8
4	33	August 12
5	25	August 21
6	25	August 27
7	30	August 28

Sampling during upwelling events to determine where the thermocline ended and where mixed water began (as close to shore as feasible) was carried out as often as possible during thermocline contact cruises.

Meteorological parameters were observed at all stations.

Water sampling in the vicinity of the main Anchor Station came under the heading of Mid-Lake Small Scale Surveys. Five (5) such cruises were carried out as follows:

ML Survey No.	No. of Stations	Date
1	16	August 13
2	2 (Rough Weather)	August 14
3	18	August 15
4	16	August 19
5	9	August 20

Large volume (4ℓ) samples for splitting aboard the LIMNOS were stored in ice in a rented, insulated stainless steel, used, bulk milk carrier.

Moorings

ADVENT installed, serviced and retrieved the CATTS moorings with assistance from the Dive Unit. ADVENT monitored, serviced and stripped FTP and Met. buoys and assisted in the VAPS experiment.

Chemistry

Dissolved oxygen samples were analysed in a rented laboratory on shore. Filtrations for POC and chlorophyll a were performed aboard the ADVENT.

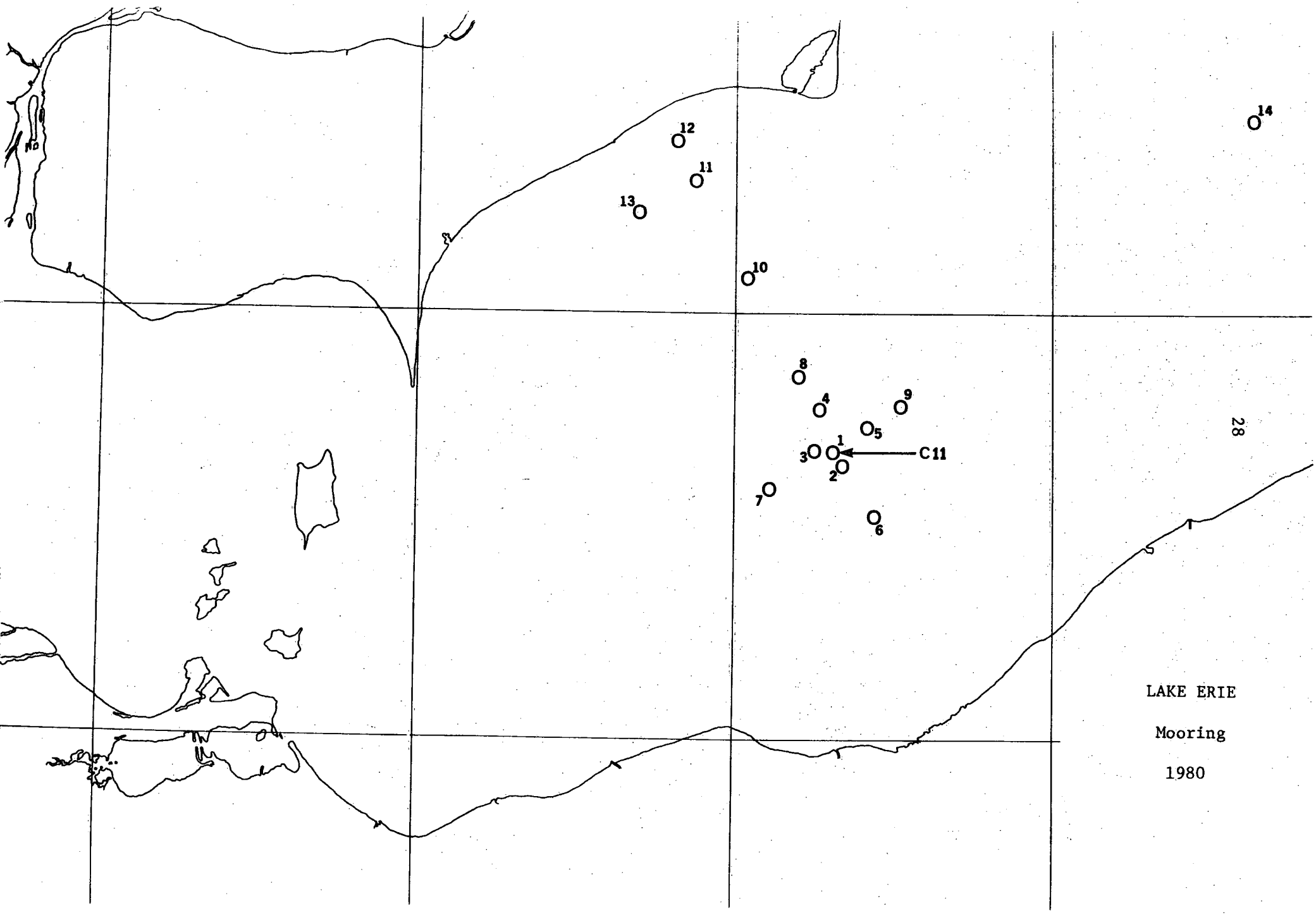
Personnel and Equipment Transfer

This phase of the field operation went well, showing foresight for the intensive period. On one trip, there was a total of seventeen (17) people aboard the ADVENT for most of the day; most days there were 12 to 15 persons aboard. On August 18, there were four vessels--LIMNOS, HYDRA, ADVENT and SHARK plus VAPS buoy and barge involved with this project; at the same time there were eight (8) project-associated vehicles on the wharf at Erieau and forty-four (44) persons working on the project, not including HYDRA personnel.

The skill, co-operation and especially tact of the ADVENT crew is gratefully acknowledged.

DATA

All documentation from ADVENT's support to the 1980 Lake Erie Experiment was sorted and checked for completeness and accuracy before passing to Data Management Section on October 31.


14
12
11
13
10
8
4
9
5
1
3
C11
2
7
6
28
LAKE ERIE
Mooring
1980

LIMNOS
1980

	SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
JAN			1	2	3	4	5
	6	7	8	9	10	11	12
	13	14	15	16	17	18	19
	20	21	22	23	24	25	26
	27	28	29	30	31	1	2
FEB	3	4	5	6	7	8	9
	10	11	12	13	14	15	16
	17	18	19	20	21	22	23
	24	25	26	27	28	29	1
MAR	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24 CCIN DEP 0852	25 LAKE	26 ONTARIO	27 SURVEILLANCE	28 CCIN ARR 0040	29 CCIN
APR	30 CCIN	31 CCIN DEP 0816	1 WINTER MOORING RETRIEVALS	2 CCIN ARR 1330	3 CCIN	4 CCIN	5 CCIN
	6 CCIN	7 CCIN	8 CCIN	9 CCIN	10 CCIN	11 CCIN	12 CCIN
	13 CCIN	14 CCIN	15 CCIN	16 CCIN	17 CCIN	18 CCIN	19 CCIN
	20 CCIN	21 CCIN DEP 0803	22 LAKE ONTARIO	23 SURVEILLANCE	24 CCIN ARR 2215	25 CCIN	26 CCIN
MAY	27 CCIN	28 CCIN	29 L ONT SEDIMENT TRAP INSTALLED	30 CCIN	1 CCIN	2 CCIN	3 CCIN
	4 CCIN	5 CCIN	6 L ONT M-CATTS INSTALLATION	7 CCIN	8 CCIN	9 CCIN	10 CCIN
	11 CCIN	12 CCIN DEP 0813	13 LAKE ONTARIO	14 TOXIC SUBSTANCE	15 CCIN ARR 1612	16 CCIN	17 CCIN
	18 CCIN	19 CCIN	20 ENGINEERING CRUISE	21 L ONTARIO PTP INSTALLATION	22 ENGINEERING CRUISE	23 CCIN	24 CCIN
	25 CCIN	26 CCIN DEP 0955	27 LAKE ERIE TRANSIT	28 PORT HURON ARR 1125 DEP 1355	29 DOUGLAS POINT	30 CURRENT METER	31 MOORING
JUN	1 INSTALLATIONS	2 AND	3 LAKE HURON	4 AND	5 GEORGIAN BAY	6 SURVEILLANCE	7 OWEN SOUND ARR 1825
	8 OWEN SOUND	9 OWEN SOUND	10 OWEN SOUND	11 OWEN SOUND	12 OWEN SOUND DEP 1147	13 LAKE	14 HURON
	15 AND	16 GEORGIAN	17 BAY	18 SEDIMENT SAMP	19 STUDY	20 CCIN ARR 0442	21 CCIN
	22 CCIN	23 CCIN	24 CCIN	25 LAKE ONTARIO	26 TOXIC SUBSTANCE	27 DAILY CRUISES	28 CCIN
JUL	29 CCIN	30 CCIN	1 CCIN	2 CCIN DEP 0900	3 L ONT TOXIC SUBSTANCES	4 CCIN ARR 1245	5 CCIN
	6 CCIN	7 CCIN DEP 0815	8 LAKE	9 ERIE	10 METABOLISM	11 STUDY	12 PORT STANLEY ARR 0745
	13 PORT STANLEY	14 PORT STANLEY DEP 1407	15 LAKE ERIE MOORING	16 INSTALLATIONS	17 PORT COLBORNE ARR 0242	18 PORT COLBORNE DEP 1030	19 GLBL
	20 GREAT LAKES	21 GLOBAL	22 HEALTH	23 SURVEILLANCE	24 GLBL	25 GREAT	26 LAKES
AUG	27 GLOBAL	28 HEALTH	29 SURVEILLANCE	30 CCIN ARR 0955	31 CCIN	1 CCIN	2 CCIN
	3 CCIN	4 CCIN	5 CCIN	6 CCIN	7 CCIN	8 CCIN	9 CCIN
	10 CCIN	11 CCIN DEP 0952	12 LAKE	13 ERIE	14 ANCHOR	15 STATION	16 LAKE ERIE
	17 ANCHOR	18 STATION	19 LAKE ERIE	20 ANCHOR	21 STATION	22 CCIN ARR 1825	23 CCIN
	24 CCIN	25 CCIN DEP 1051	26 LAKE ONTARIO	27 TOXIC	28 SUBSTANCES	29 CCIN ARR 1100	30 CCIN
SEP	31 CCIN	1 CCIN	2 CCIN DEP 1010	3 LAKE ERIE MOORING	4 RETRIEVALS	5 PORT STANLEY ARR 1555	6 PORT STANLEY DEP 2020
	7 BARRIA ARR 1945	8 BARRIA DEP 1524	9 LAKE	10 HURON	11 AND	12 GEORGIAN	13 BAY
	14 SURVEILLANCE	15 LAKE	16 HURON	17 AND	18 GEORGIAN	19 BAY	20 SURVEILLANCE
	21 TOBERMORY ARR 0850 DEP 0440	22 DOUGLAS POINT	23 CURRENT METER	24 MOORING	25 RETRIEVALS	26 CCIN ARR 1915	27 CCIN
OCT	28 CCIN	29 CCIN	30 CCIN	1 DEPLOY COUSTEAU ANCHORS L ONT	2 L ONT M-CATTS + PTP RETRIEVAL	3 CCIN	4 CCIN
	5 CCIN	6 RECOVER ANCHORS COUSTEAU	7 LAKE	8 ONTARIO	9 SURVEILLANCE	10 CCIN ARR 1157	11 CCIN
	12 CCIN	13 CCIN	14 CCIN DEP 0025	15 LAKE ONTARIO PISTON CORING	16 CCIN ARR 0930	17 CCIN	18 CCIN
	19 CCIN	20 CCIN DEP 0040	21 LAKE ERIE TRANSIT	22 BARRIA ARR 1330 DEP 1520	23 LAKE	24 HURON	25 AND
NOV	26 GEORGIAN	27 BAY	28 SURVEILLANCE	29 LAKE	30 HURON	31 AND	1 GEORGIAN
	2 BAY	3 SURVEILLANCE	4 OWEN SOUND ARR 0336 DEP 1947	5 BARRIA ARR 1400 DEP 1625	6 LAKE ERIE BOX AND PISTON	7 CORING FOR ONTARIO HYDRO	8 PT COLBORNE ARR 0330 DEP 1520
	9 CCIN ARR 0800	10 CCIN	11 CCIN	12 CCIN	13 CCIN	14 CCIN	15 CCIN
	16 CCIN	17 CCIN	18 L ONT SEDIMENT TRAP RETRIEVAL	19 CCIN	20	21	22
	23	24	25	26	27	28	29
DEC	30	1	2	3	4	5	6
	7	8	9	10	11	12	13
	14	15	16	17	18	19	20
	21	22	23	24	25	26	27
	28	29	30	31			

CSS LIMNOS

LAKE HURON CRUISE

TOXIC SUBSTANCES, DR. R.A. BOURBONNIERE, AED 495

This cruise on Lake Huron was the first of five such cruises to establish a bank of Great Lakes sediment samples to permit retroactive analysis of persistent toxic substances. The sediment bank will have a threefold purpose upon completion: (1) It will serve as a source for baseline material from which to reference future contamination problems, (2) It will serve as an integral part of an early warning system and (3) It will serve as an aid to the understanding of trends in contaminant loading.

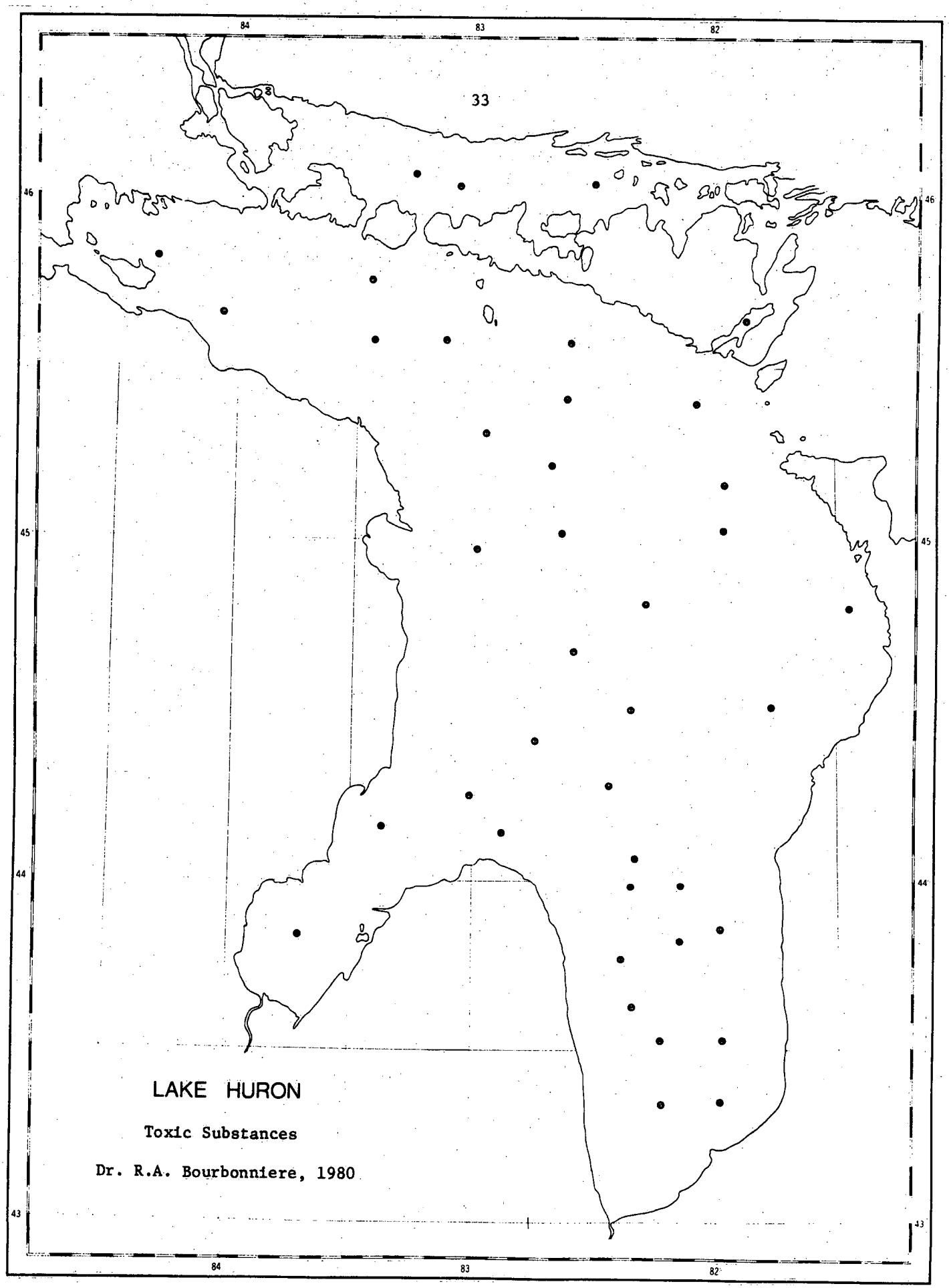
During the cruise in which 50 stations were occupied (see chart), a new sampler was used for the first time. The sampler is a box corer which collects up to a half metre cubed of the interface material. Although it was designed for ocean sampling, with slight modifications, it proved to be an excellent sampler. Since its introduction to Great Lakes field work, this sampler has been applied to several other sampling cruises from the CSS LIMNOS.

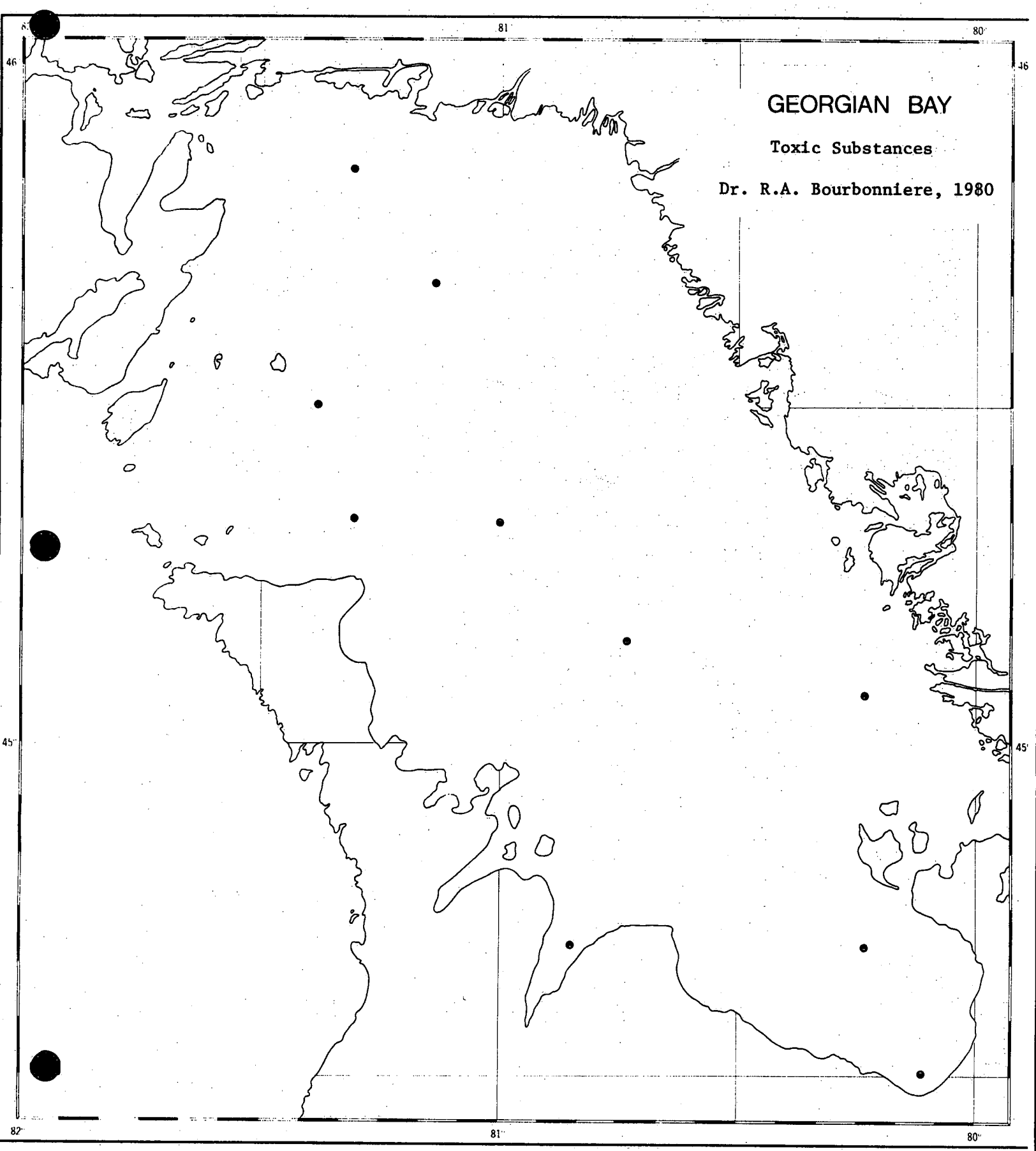
LAKE HURON/GEORGIAN BAY

SEDIMENT BANK STATIONS

Station Number	Latitude N.	Longitude W.
V 4	43° 21' 12"	81° 59' 13"
T 4	43° 20' 54"	82° 14' 08"
T 6	43° 31' 42"	82° 14' 15"
V 6	43° 31' 51"	81° 59' 28"
S 7	43° 37' 05"	82° 21' 43"
V 8	43° 42' 33"	81° 59' 31"
U 9	43° 48' 00"	82° 06' 56"
S 9	43° 47' 44"	82° 22' 11"
S11	43° 58' 43"	82° 22' 26"
U11	43° 58' 45"	82° 07' 20"
T12	44° 04' 10"	82° 14' 57"
S15	44° 20' 08"	82° 23' 19"
013	44° 08' 11"	82° 52' 11"
N14	44° 14' 11"	83° 00' 19"
K13	44° 08' 20"	83° 22' 28"
RB	43° 50' 56"	83° 43' 02"
P16	44° 25' 14"	82° 45' 08"
S17	44° 30' 52"	82° 22' 57"
W17	44° 31' 07"	81° 52' 07"
Z20	44° 47' 27"	81° 30' 18"
T20	44° 47' 14"	82° 15' 36"
Q19	44° 41' 25"	82° 38' 31"
N22	44° 57' 16"	83° 02' 03"
Q23	45° 02' 22"	82° 39' 03"
DH	45° 02' 06"	82° 01' 23"
V24	45° 08' 50"	82° 00' 52"
U27	45° 24' 57"	82° 09' 12"
SB	45° 38' 08"	81° 51' 52"
Q25	45° 13' 51"	82° 39' 04"
N26	45° 18' 29"	83° 02' 21"
Q27	45° 25' 33"	82° 40' 02"
Q29	45° 35' 54"	82° 40' 06"
M29	45° 35' 09"	83° 10' 37"
K29	45° 34' 53"	83° 25' 49"
K31	45° 45' 42"	83° 26' 42"

Station Number	Latitude N.	Longitude W.
F30	45° 39' 08"	84° 04' 37"
D32	45° 49' 37"	84° 21' 00"
G11B	46° 04' 48"	83° 15' 41"
F16B	46° 02' 02"	83° 04' 08"
F22B	46° 02' 10"	82° 33' 34"
P3A	45° 52' 22"	81° 23' 12"
N5A	45° 41' 40"	81° 07' 56"
L3A	45° 30' 34"	81° 23' 16"
J3A	45° 20' 13"	81° 23' 21"
J6A	45° 19' 55"	81° 00' 05"
H8A	45° 09' 17"	80° 44' 55"
G12A	45° 04' 48"	80° 14' 00"
C12A	44° 42' 12"	80° 14' 36"
A13A	44° 31' 14"	80° 06' 58"
C 7A	44° 42' 26"	80° 52' 25"


84
83
82
33
46
45
44
43
LAKE HURON
Toxic Substances
Dr. R.A. Bourbonniere, 1980


GEORGIAN BAY
Toxic Substances
Dr. R.A. Bourbonniere, 1980
82°
81°
80°
46°
45°

CSS LIMNOS

LAKE ONTARIO CRUISES

TOXIC SUBSTANCES, DR. K.R. LUM, ECD 223

Field support to Dr. Lum during the 1980/81 field season consisted of 3 5-day cruises aboard the CSS LIMNOS in the Western half of Lake Ontario.

A total of 17 stations were visited throughout the field season but all stations were not sampled each cruise.

Sampling at each station was composed of collection of large volume water samples (up to 1200ℓ). Several bottle casts were taken using Go Flo and Niskin bottles for vertical profiles of trace metals, oxygen, etc. EBT traces for temperature structures were made and sediment samples using double Shipek, box corer and benthos corers were taken.

Additional tasks performed on these cruises included: (1) refurbishment of M. Charlton's sedimentation mooring, (2) monitoring of the FTP mooring (No. 80-00T-05A) and collection of various other samples on a request basis.

Other Cruises Conducted on Lake Ontario During 1980/81 Field Season

There were several cruises conducted on Lake Ontario throughout the field season. In the early Spring, the Winter moorings off Pickering Nuclear Power Plant were retrieved in support of ARD-77-006.

An Engineering Cruise was conducted in June to field-test several new electronic sampling devices, including the new oxygen/temperature/depth profiler.

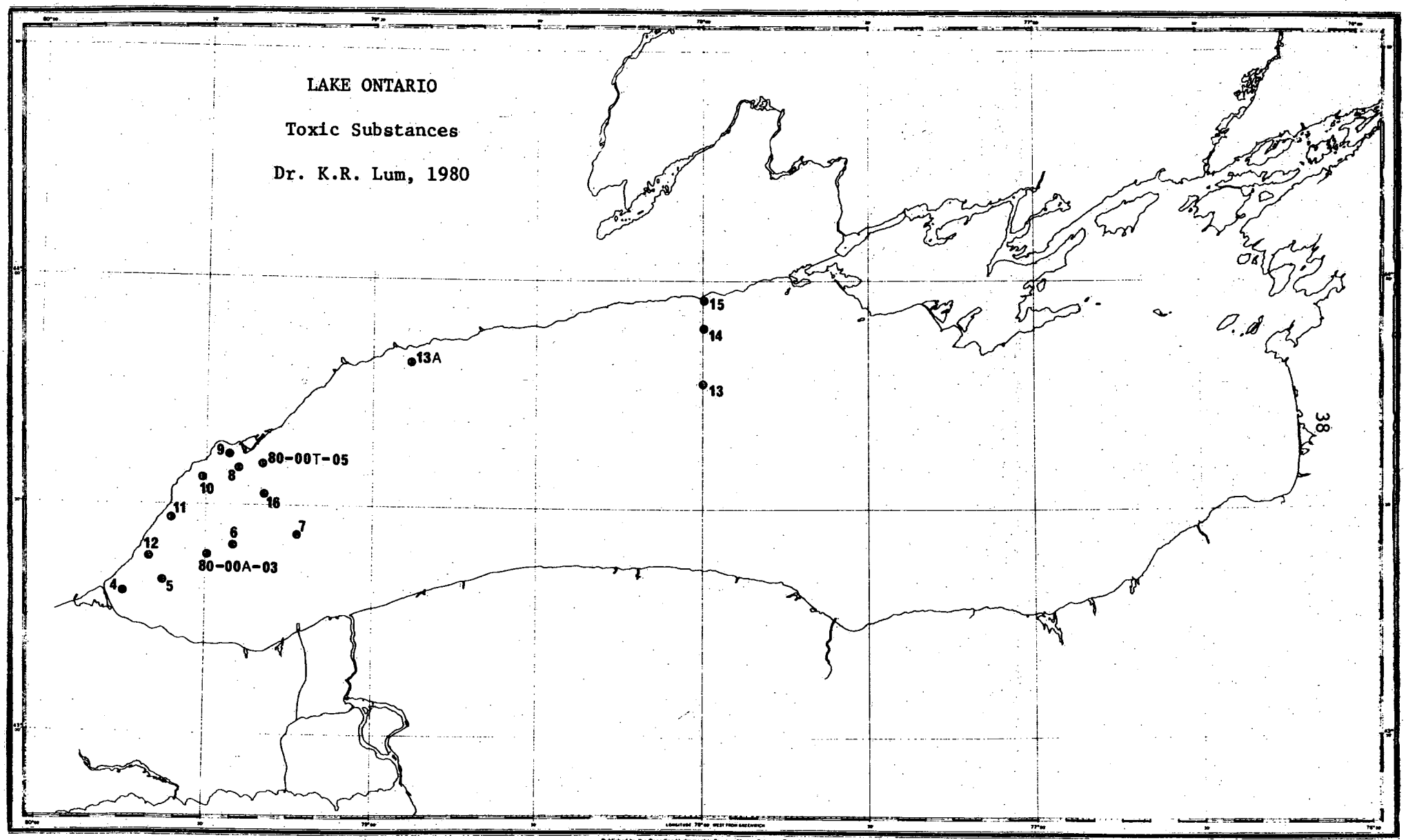
A Piston and Box Coring Cruise was conducted in mid-October for Dr. Carmichael of University of Western Ontario and Dr. Mothersill from Lakehead University.

Jacques Cousteau's filming of the 1812 Warship, HAMILTON was supported when Technical Operations installed proper anchorage for the research vessel, CALYPSO. Five heavy anchors were located around the wreck so that the CALYPSO could be held securely in position, allowing their submersible to be lowered for the filming of the HAMILTON. These moorings were recovered and returned to CCIW on completion of the Cousteau Project.

LAKE ONTARIO

TOXIC SUBSTANCES STATIONS

Station Number	Latitude N.	Longitude W.
1	43° 16' 49"	79° 52' 27"
2	43° 17' 35"	79° 49' 25"
3	43° 17' 10"	79° 48' 13"
4	43° 19' 07"	79° 44' 58"
5	43° 20' 49"	79° 37' 29"
6	43° 24' 05"	79° 24' 37"
7	43° 26' 36"	79° 13' 05"
8	43° 34' 21"	79° 25' 02"
9	43° 37' 27"	79° 27' 11"
10	43° 33' 40"	79° 29' 40"
11	43° 27' 49"	79° 36' 54"
12	43° 21' 26"	79° 42' 06"
13	43° 47' 05"	78° 00' 03"
14	43° 56' 12"	77° 59' 58"
15	43° 58' 00"	78° 00' 00"
16	43° 34' 13"	79° 21' 29"
17	43° 18' 18"	79° 49' 00"
80-00A-03	43° 24' 06"	79° 26' 58"
80-00T-05A	43° 33' 23"	79° 17' 21"



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LAKE ONTARIO

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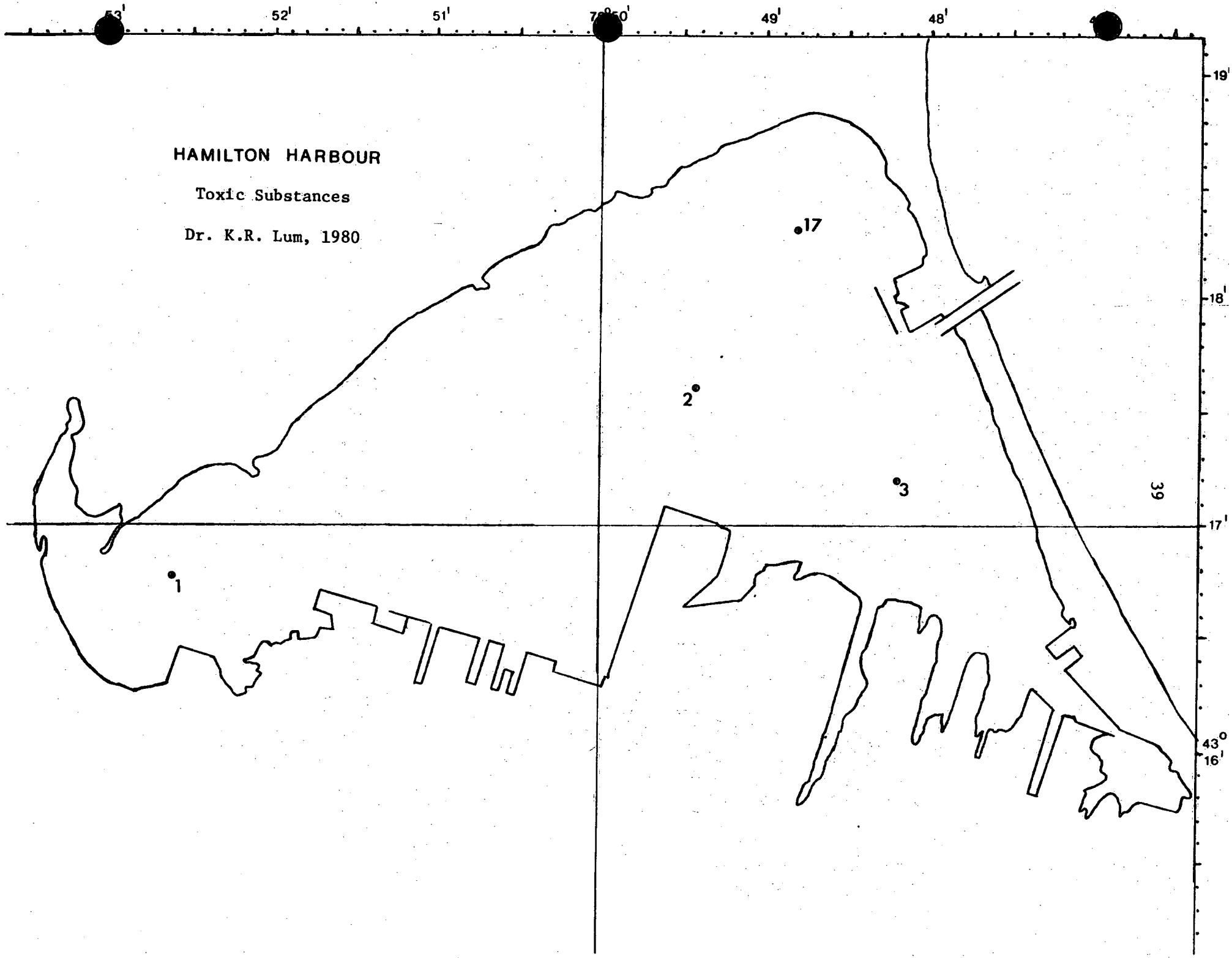
HAMILTON HARBOUR
Toxic Substances
Dr. K.R. Lum, 1980
53'
52'
51'
79°50'
49'
48'
19'
18'
17'
43°
16'
17
2
3
1
39

STATISTICS SUMMARY

CRUISE NO. _____ CONSEC. NO. 40 SHIP CSS LIMNOS

DATES FROM _____ TO _____ LAKE ONTARIO

CRUISE TYPE Toxic Substances and Coring MILES STEAMED 944

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	79	Moorings, Current Meter	8
Rosette EBT Casts	38	Moorings, CATTS	2
EBT Casts	55	Moorings, Tripod	2
Transmissometer Casts	27	Moorings, Sediment	2
Reversing Thermometer Obs.		Moorings, FTP	1
Secchi Disc Obs.	21	Moorings, Special	7
Disolved Oxygen Profile Casts	12	Moorings Serviced	1
Zooplankton Hauls	80	Moorings Serviced	
Zooplankton Hauls (Mysis)		Moorings Serviced	
Primary Productivity Moorings		Cores Taken (Gravity)	17
Bottom Samples (Fauna)	5	Cores Taken (Piston)	11
Integrator (10m) Integrator (20m)		Cores Taken (Triple Benthos)	12
Total Number of Depths Sampled	63	Cores Taken (Box)	13
Water Samples Collected (Chemistry)	61	Grab Samples Taken (Double Shipek)	2
Water Samples Collected (Microbiology)			
Water Samples Collected (GLBL)	4	Observations (Weather)	73
Water Samples Collected (Toxic Substances)	47	Observations ( )	
Water Samples Collected ( )			
Water Samples Filtered (POC)	164	Continuous Observations (Days)	
Water Samples Filtered ( )		Air Temperature	4
Water Samples Filtered, Chlorophyll	117	Relative Humidity	
Water Samples Treated, Phytoplankton	47	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	571	Water Temperature (Towed)	
ONBOARD ANALYSES		Solar Radiation	24
		Integrated Printout	24
Manual Chemistry (Tech. Ops.)	498	Net Radiation	24
Nutrients (WQB)			
Geolimnology			
Microbiology			

BM/78

REMARKS

CSS LIMNOS

LAKE ERIE CRUISES

During the 1980/81 field season, five (5) cruises were completed by the CSS LIMNOS on Lake Erie. These multidisciplinary cruises consisted of:

1 Lake Metabolism Study

2 Moorings: Current Meter, Meteorological Buoys, Fixed Temperature Profile, Tide Gauges

1 Lake Physics Study

1 Coring Cruise

Lake Metabolism Study, AED 438

This cruise was conducted for Dr. D.R.S. Lean. The ship anchored for a 3 1/2-day period on Station C11 situated in the Central Basin of Lake Erie.

The major sampling was done on a 3-hourly cycle with samples taken every 2 1/2 metres throughout the water column. These samples were analysed for oxygen and several water quality chemical parameters.

Other water samples were collected on an "as required" basis. These samples were used primarily for C_{14} and primary productivity studies.

Several cores were collected for interface oxygen measurements using benthos and lightweight cores.

This cruise was also a first for the new YSI oxygen/temperature/depth profiler. With this instrument, results are immediately displayed in the same manner as an EBT trace. This style of oxygen profiler shows trends and anomalies which are not possible to duplicate by sampling bottle due to bottle size and water column interference.

Moorings: Current Meters, Meteorological Buoys, Fixed Temperature Profiler, Tide Gauges, APSD 509

Again this field season, there were only two mooring cruises on Lake Erie--one installation and one retrieval. The moorings were in the lake for a six-week period because the intense study period was confined to the month of August this year as compared to a much longer field season in 1979/80.

There was a total of thirteen current meter moorings, three meteorological buoys, four fixed temperature profilers and five tide gauge moorings installed (see chart) during the third week of July and they remained in position until the first week of September.

The study's basic goal was to detail the vertical and horizontal structure of water movement in the mid-Central Basin of Lake Erie during the stratified period. This was hoped to be accomplished by having a network of moorings radiate outward from Station C11 like the spokes of a wheel. In this manner, both vertical and horizontal water movement could be measured as it passed through a specific area of the Central Basin. This program was conducted in conjunction with the Lake Physics Study and each program was to compliment the other and was actually part of the same project forecast.

Lake Physics Study, APSD 509

There was only one Lake Physics Study Cruise conducted this year in comparison to three during the 1979/80 field season. The Lake Physics Study Cruise, the mooring cruises and the CSS ADVENT Surveys was a combined program headed by Mr. F.M. Boyce of Aquatic Physics & Systems Division. This program was a continuation of the program conducted in the Summer of 1979.

This study consisted of anchoring at one station for a period of 11 days and sampling intensively over this period.

Upon arrival at the site (C11), a wave rider mooring, M-CATS and a cluster of 12 drogues were deployed. The LIMNOS then anchored in close proximity to the installed systems. While at anchor, a sampling routine was initiated with samples being collected for physical, chemical and biological studies. These samples were collected every three hours with the exception of temperatures which were measured every 1/2 hour. Tracking of the drogues by ship's radar

began when the LIMNOS reached her anchor position and their positions were fixed every 1/2 hour. This data was then fed into a shipboard computer and plotted.

Temperature structure was measured by an array of 12 thermistors and one pressure transducer suspended from the starboard quarter of the ship. These data were recorded at two-second intervals on magnetic tape in the ship's laboratory.

Water samples were collected by rosette and Van Dorn water samplers throughout the water column for various physical, chemical and biological analyses.

Light measurements were also conducted using the new CCIW multi-band transmissometer system and spectrophotometer.

Several other projects were supported during this cruise, including the following:

1. McMaster University (Dr. W. Snodgrass)
2. U.S. Navy Underwater Systems (Dr. Shonting)
3. Settling Rates (Mr. F. Rosa)
4. Sedimentation Rates (Mr. M.N. Charlton)
5. VAPS (Harrison, Boyce)

Upon completion of the anchor station, all the drogues, the wave rider, the M-CATS and a sedimentation mooring were retrieved.

Box and Piston Coring

Several box and piston cores were collected during the second week of November. Box cores were collected for Ontario Hydro along their proposed cable corridor of Lake Erie. Piston cores were collected for Dr. Charmichael, University of Western Ontario for continuation of his paleomagnetic studies begun in 1979. Box and piston cores were collected for Dr. R.A. Bourbonniere, AED 410 for his Toxic Substances Studies.

Additional Task

During the 1980/81 field season, whenever the LIMNOS was in transit of Lake Erie, three "Hypo" stations were sampled for Dr. N.M. Burns, AED as part of the Canada/U.S. Surveillance Program on Lake Erie.

LAKE ERIE

MOORINGS

Site No.	Mooring Number	Latitude N.	Longitude W.
1	80-01M-01A	41° 50' 30"	81° 50' 31"
11	80-01M-02A	42° 09' 27"	82° 03' 41"
14	80-01M-03A	42° 13' 42"	81° 10' 26"
9	80-01T-04A	41° 53' 23"	81° 44' 03"
6	80-01T-05A	41° 45' 56"	81° 46' 51"
7	80-01T-06A	41° 47' 55"	81° 56' 41"
8	80-01T-07A	41° 55' 33"	81° 53' 49"
9	80-01C-09A	41° 53' 34"	81° 44' 14"
6	80-01C-10A	41° 46' 07"	81° 46' 57"
1	80-01C-11A	41° 50' 38"	81° 50' 16"
2	80-01C-12A	41° 49' 25"	81° 49' 46"
3	80-01C-13A	41° 50' 02"	81° 52' 03"
4	80-01C-14A	41° 53' 00"	81° 51' 57"
5	80-01C-15A	41° 51' 57"	81° 47' 13"
7	80-01C-16A	41° 48' 07"	81° 56' 43"
8	80-01C-17A	41° 55' 41"	81° 54' 00"
10	80-01C-18A	42° 02' 29"	81° 58' 41"
11	80-01C-19A	42° 09' 35"	82° 03' 36"
12	80-01C-20A	42° 12' 12"	82° 05' 31"
13	80-01C-21A	42° 07' 18"	82° 09' 03"
14	80-01P-24A	42° 14' 00"	81° 10' 15"
6	80-01P-25A	41° 46' 19"	81° 46' 10"
7	80-01P-26A	41° 47' 52"	81° 56' 29"
8	80-01P-27A	41° 56' 03"	81° 53' 32"
9	80-01P-28A	41° 53' 38"	81° 43' 48"

STATISTICS SUMMARY

CRUISE NO. _____ CONSEC. NO. 45 SHIP CSS LIMNOS

DATES FROM _____ TO _____ LAKE ERIE

CRUISE TYPE Various MILES STEAMED 1815.03

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	60	Moorings, M-CATS	1
Rosette EBT Casts	141	Moorings, Tide Gauge	5
EBT Casts	284	Moorings, Sediment Trap	1
Transmissometer Casts	208	Moorings, Wave Rider	1
Van Dorn Casts	105	Moorings, Current Meters	13
Secchi Disc Obs.	30	Moorings, Meteorological	3
		Moorings, FTP	4
Integrator (10 m)	24	Moorings Serviced	1
Integrator (15 m)	36	Moorings Serviced	
		Cores Taken (Gravity)	20
Total Number of Depths Sampled	794	Cores Taken (Piston)	3
Water Samples Collected (Alk.)	348	Cores Taken (Lightweight)	3
Water Samples Collected (Major Ions)	358	Cores Taken (Box)	5
Water Samples Collected (Chemistry)	794	Grab Samples Taken	20
Water Samples Collected (Microbiology)		Drogues Tracked	10
Water Samples Collected (T.N.)	113	Observations (Weather)	179
Water Samples Collected (T.P. uf)	555	Observations (Weather - Hourly)	66
Water Samples Collected ( )			
Water Samples Filtered (T.P.)	555	Continuous Observations (Days)	
Water Samples Filtered (POC)	638	Air Temperature	
Water Samples Filtered, Chlorophyll	590	Relative Humidity	
Water Samples Treated, Phytoplankton		Water Temperature (In-Hull)	
Total Number of Water Samples Collected	3951	Water Temperature (Towed)	
ONBOARD ANALYSES		Solar Radiation	22
		Integrated Printout	22
Manual Chemistry (Tech. Ops.)	794	Net Radiation	22
Nutrients (WQB)			
Geolimnology			
Microbiology			

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REMARKS

CSS LIMNOS

SURVEILLANCE

The Open Lake Surveillance Program was designed to provide a continuing report and long term trend information on water quality and eutrophication parameters in the Great Lakes. During the 1980/81 field season, data collected from surveillance cruises on the Upper Great Lakes (Lake Huron and Georgian Bay) and the Lower Great Lake (Lake Ontario) will serve as input to the Canada-U.S. Agreement for the Water Quality Board Annual Report to the International Joint Commission (IJC).

Technical Operations Group supported a total of nine surveillance cruises during the 1980 field season--three cruises each on Lake Ontario, Lake Huron and Georgian Bay. The Lake Ontario cruises were completed during the months of March, April and October while the Lake Huron/ Georgian Bay cruises were carried out during the months of May/June, September and October/November.

The basic surveillance parameters collected on the Upper and Lower Great Lakes cruises were similar. The Lake Huron/Georgian Bay cruises were carried out in conjunction with the United States Environmental Protection Agency Surveillance Program. Therefore, additional samples were collected on all cruises to support this program. The parameters sampled on both the Upper and Lower Lakes cruises were:

Upper Lakes (Lake Huron and Georgian Bay): temperature profile, transmission profile, Secchi disc during daylight hours, dissolved oxygen, specific conductance, pH, phytoplankton, chlorophyll a, particulate organic carbon, total particulate nitrogen, soluble reactive phosphorus, nitrate and nitrite, ammonia, total phosphorus filtered and unfiltered, total Kjeldahl nitrogen, soluble reactive silica, total alkalinity and suspended solids.

On two of the three cruises, microbiological samples were collected for the analysis of: fecal coliforms, fecal streptococci, aerobic heterotrophs, Pseudomonas, oligotrophic bacteria and total bacteria counts.

On all cruises, U.S. Environmental Protection Agency samples were collected for: phytoplankton, zooplankton and major ions.

Lower Lake (Lake Ontario): temperature profile, transmission profile, Secchi disc during daylight hours, dissolved oxygen, specific conductance, pH, phytoplankton, zooplankton, chlorophyll a, particulate organic carbon, total particulate nitrogen, soluble reactive phosphorus, nitrate and nitrite, ammonia, total phosphorus filtered and unfiltered, dissolved organic carbon, total nitrogen (UV), soluble reactive silica, calcium, magnesium, sodium, potassium, sulfate, chloride and total alkalinity.

In addition to the Surveillance Program, a Coastal Physics Process Study (APSD Project 2511) was supported while the vessel was on Lake Huron for the first two surveillance cruises. This program was supported by the installation and retrieval of thirteen current meter moorings, two fixed temperature profile moorings and two meteorological systems at the Douglas Point area. The goals of this program were to develop coastal flow, transportation and dispersion climatologies for specific coastal regions of large waters.

Numerous additional tasks were "piggy-backed" onto both the Upper and Lower Lakes surveillance cruises. Some of these tasks included: installation and retrieval of meteorological buoy at the Adolphus Reach/Picton Bay area, GLBL Project 2106; shipek sediment samples from thirteen stations on Lake Ontario, ECD Project 2224; benthos gravity cores from ten stations on Lake Ontario, ECD Project 2240; water and sediment samples from station 9 on Lake Ontario, ECD Project 2212; radiological water samples from three stations on Lake Ontario, ECD Project 2214; microbiological water samples from seven stations on Lake Ontario, AMD Project 2628; microbiological water samples from two stations on Lake Huron, AMD Project 2627; radiological water samples from four stations on Lake Huron, ECD Project 2214; microbiological water samples from three stations on Georgian Bay, AMD Project 2627; radiological water samples from station 17 on Georgian Bay, ECD Project 2214.

STATISTICS SUMMARY

CRUISE NO. 3 CONSEC. NO. 50 SHIP CSS LIMNOS

DATES FROM March 24 TO October 10, 1980 LAKE ONTARIO

CRUISE TYPE Lower Lake Surveillance MILES STEAMED 2,013.9

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	279	Moorings Established, Met.	1
Rosette EBT Casts	277	Moorings Retrieved, Met.	1
EBT Casts (Regular) 277 + 276 (MTTP)	553	Moorings Established	
Transmissometer Casts (MTTP) 276+Martek182	458	Moorings Retrieved	
Reversing Thermometer Obs.	33	Moorings Established	
Secchi Disc Obs.	137	Moorings Retrieved	
		Moorings Serviced	
Zooplankton Hauls	17	Moorings Serviced	
Zooplankton Hauls (Mysis)		Moorings Serviced	
Primary Productivity Moorings		Cores Taken (Gravity)	12
Bottom Samples (Fauna)		Cores Taken (Piston)	
Integrator (20m)	277	Grab Samples Taken, Double Shipek	24
Total Number of Depths Sampled	1101	Drogues Tracked	
Water Samples Collected (Chemistry)	1124	Dye Releases	
Water Samples Collected (Microbiology)	42		
Water Samples Collected (pH + Cond.)	1124	Observations (Weather)	84
Water Samples Collected (M. Fox)	1	Observations ( )	
Water Samples Collected (Radiology)	6		
Water Samples Filtered (POC + 18 Dup)	314	Continuous Observations (Days)	
Water Samples Collected (WQB)	1128	Air Temperature	
Water Samples Filtered, Chlorophyll	342	Relative Humidity	
Water Samples Treated, Phytoplankton	36	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	4117	Water Temperature (Towed)	
ONBOARD ANALYSES		Solar Radiation	13
		Integrated Printout	13
Manual Chemistry (Tech. Ops.)	3372	Long Wave (IR) Radiation	
Nutrients (WQB)	3384		
Geolimnology			
Microbiology			

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REMARKS

STATISTICS SUMMARY

CRUISE NO. 3 CONSEC. NO. 49 SHIP CSS LIMNOS

DATES FROM June 5 TO November 4, 1980 LAKE GEORGIAN BAY

CRUISE TYPE Upper Lakes Surveillance MILES STEAMED 1,474.1

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	132	Moorings Established	
Rosette EBT Casts	130	Moorings Retrieved	
EBT Casts	132	Moorings Established	
Transmissometer Casts, 47Martek+130MTTP	177	Moorings Retrieved	
Reversing Thermometer Obs.	22	Moorings Established	
Secchi Disc Obs.	74	Moorings Retrieved	
Van Dorn Bottle Casts	8	Moorings Serviced	
Zooplankton Hauls	11	Moorings Serviced	
Zooplankton Hauls (Mysis)		Moorings Serviced	
Primary Productivity Moorings		Cores Taken (Gravity)	
Water Samples Collected (WQB)	556	Cores Taken (Piston)	
Integrator (20m)	132	Grab Samples Taken	
Total Number of Depths Sampled		Drogues Tracked	
Water Samples Collected (Chemistry)	563	Dye Releases	
Water Samples Collected (Microbiology)	218		
Water Samples Collected (pH + Cond.)	563	Observations (Weather)	59
Water Samples Collected (Radiology)	2	Observations ( )	
Water Samples Collected (Trace Metals)	6		
Water Samples Filtered (POC)	156	Continuous Observations (Days)	
Water Samples Filtered (SS)	16	Air Temperature	
Water Samples Filtered, Chlorophyll	146	Relative Humidity	
Water Samples Treated, Phytoplankton	123	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	2349	Water Temperature (Towed)	
ONBOARD ANALYSES		Solar Radiation	9
		Integrated Printout	9
Manual Chemistry (Tech. Ops.)	1689	Long Wave (IR) Radiation	
Nutrients (WQB)	1668		
Geolimnology			
Microbiology	932		

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REMARKS

STATISTICS SUMMARY

CRUISE NO. 3 CONSEC. NO. 48 SHIP CSS LIMNOS

DATES FROM May 26 TO November 2, 1980 LAKE HURON

CRUISE TYPE Upper Lakes Surveillance MILES STEAMED 5,507.6

DESCRIPTION	TOTAL	DESCRIPTION	TOTAL
Stations Occupied	322	Moorings Established, Current Meter	13
Rosette EBT Casts	305	Moorings Retrieved, Current Meter	13
EBT Casts	320	Moorings Established, FTP	2
Transmissometer Casts 257MTTP+282Martek	539	Moorings Retrieved, FTP	2
Reversing Thermometer Obs.	34	Moorings Established, Met.	2
Secchi Disc Obs.	152	Moorings Retrieved, Met.	2
		Moorings Serviced	
Zooplankton Hauls		Moorings Serviced	
Zooplankton Hauls (Mysis)	35	Moorings Serviced	
Primary Productivity Moorings		Cores Taken (Gravity)	
Water Samples Collected (WQB)	1343	Cores Taken (Piston)	
Integrator (20m)	328	Grab Samples Taken	
Total Number of Depths Sampled	1356	Drogues Tracked	
Water Samples Collected (Chemistry)	1374	Dye Releases	
Water Samples Collected (Microbiology)	360		
Water Samples Collected (pH + Cond.)	1375	Observations (Weather)	179
Water Samples Collected (TraceMetals)	17	Observations ( )	
Water Samples Collected (Radiology)	14		
Water Samples Filtered (SS)	154	Continuous Observations (Days)	
Water Samples Filtered (POC)	363	Air Temperature	
Water Samples Filtered, Chlorophyll	344	Relative Humidity	
Water Samples Treated, Phytoplankton	523	Water Temperature (In-Hull)	
Total Number of Water Samples Collected	5867	Water Temperature (Towed)	
ONBOARD ANALYSES		Solar Radiation	26
		Integrated Printout	26
Manual Chemistry (Tech. Ops.)	4157	Long Wave (IR) Radiation	
Nutrients (WQB)	4029		
Geolimnology			
Microbiology	1602		

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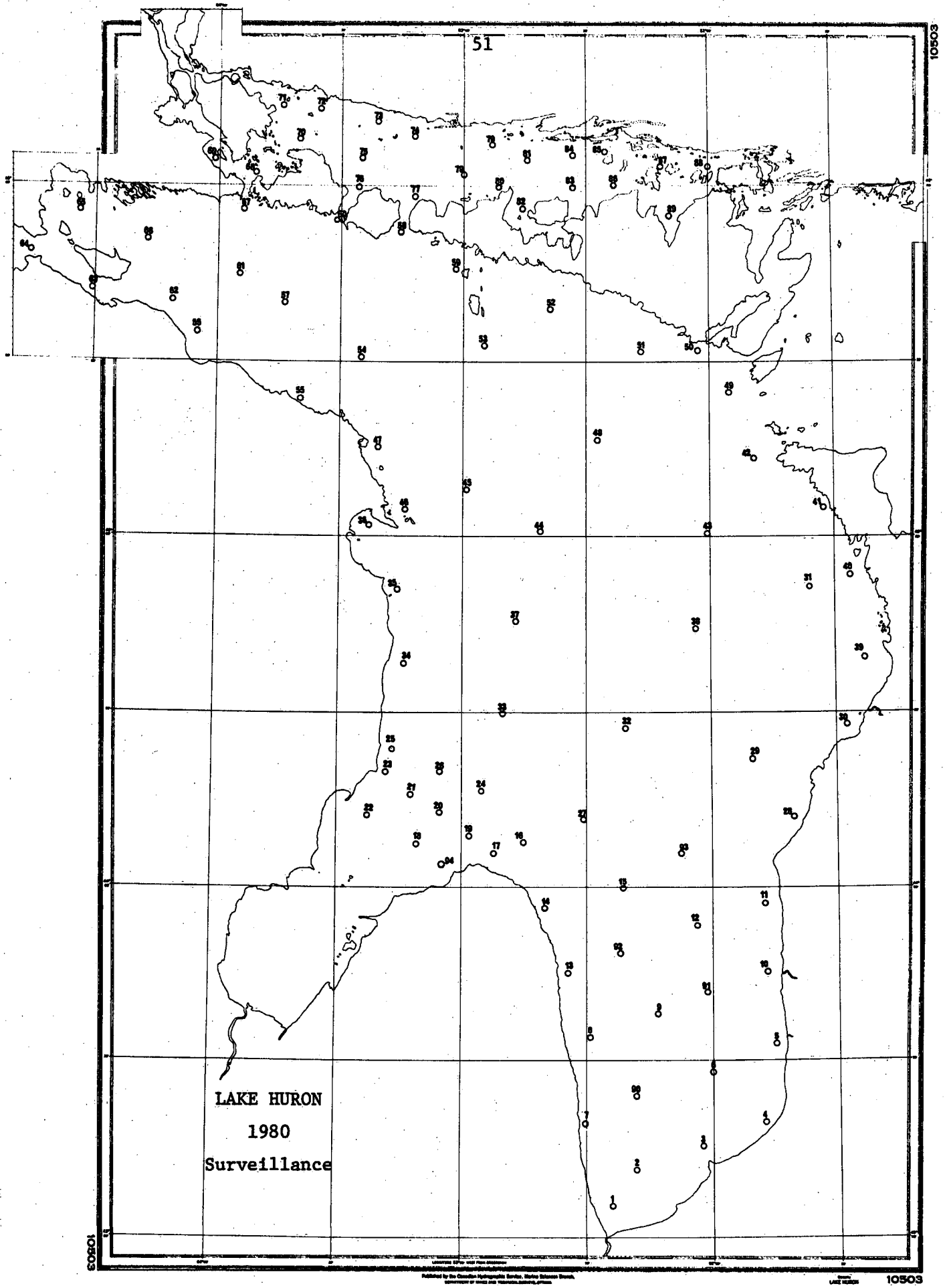
REMARKS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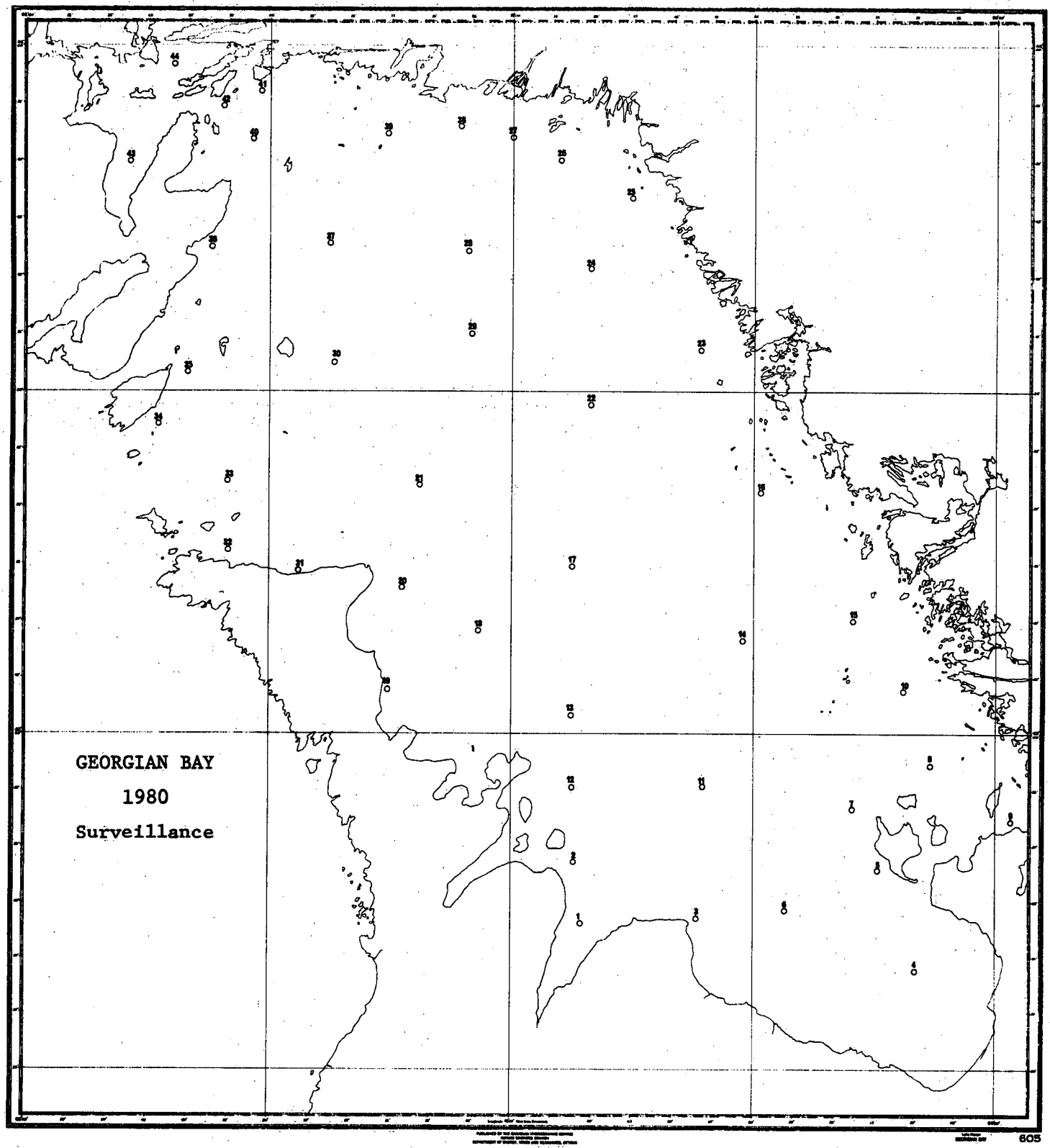
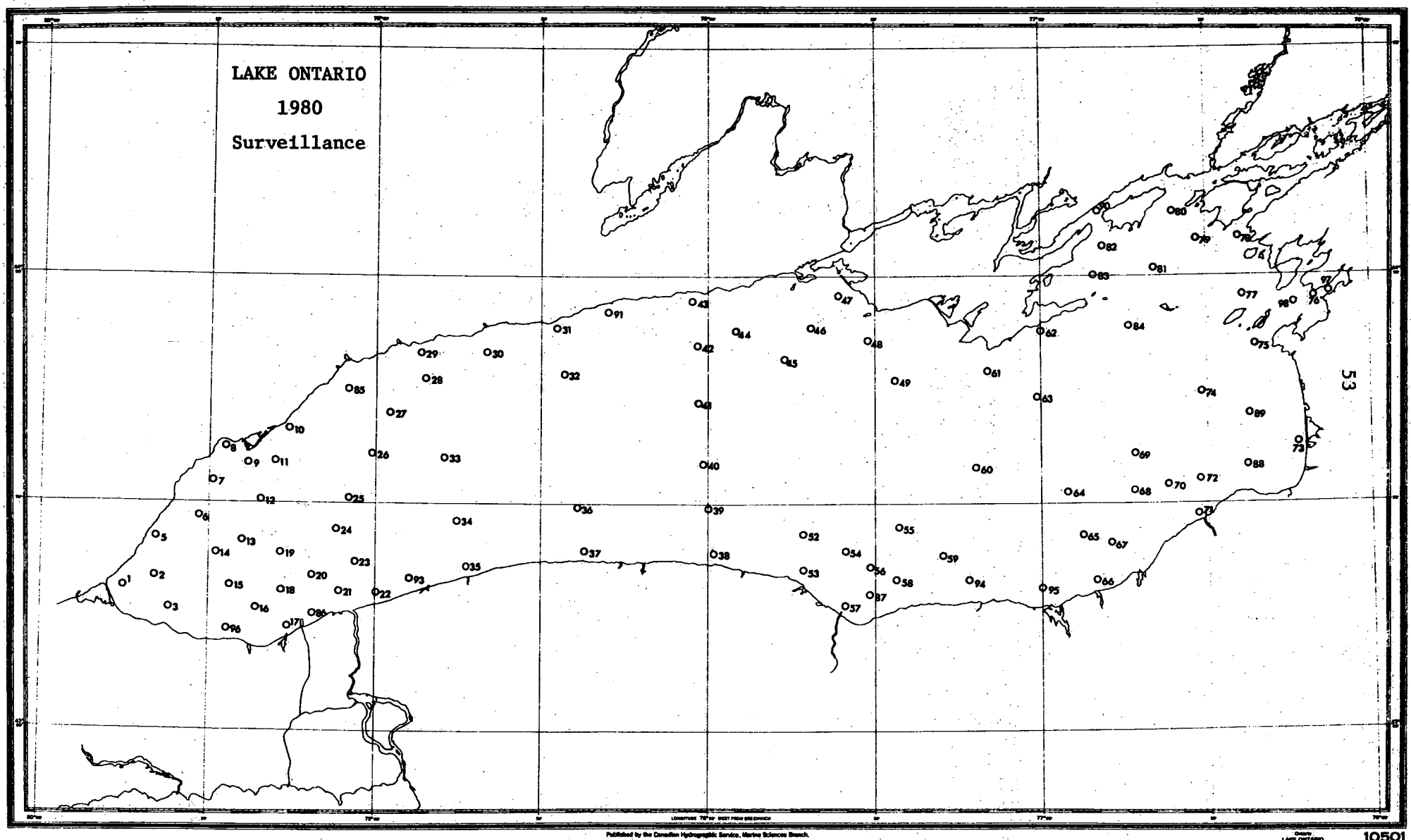
1980
Surveillance
10503


GEORGIAN BAY
1980
Surveillance
605


LAKE ONTARIO
1980
Surveillance
53
Published by the Canadian Hydrographic Service, Marine Sciences Branch,
DEPARTMENT OF MINES AND TECHNICAL SURVEYS, OTTAWA
LAKE ONTARIO
10501

ELECTRONIC INSTRUMENT MAINTENANCE

ELECTRONIC INSTRUMENT MAINTENANCE

The maintenance of electronic field instruments, current meters, digitizers, EBT's, transmissometers and associated ancillary equipment was transferred from Engineering systems to Technical Operations effective April 1, 1980.

After negotiations and final approval, three staff from Engineering systems along with related equipment were established in part of what was the Engineering system R&D lab. This additional workload and staff now joined the Technical Operations Group.

1. Twenty-eight Geodyne current meters were overhauled and sent out for field deployment
2. Thirty arisings of digitizers were overhauled and sent out for field deployment
3. Thirty-three Plessey current meters were overhauled and sent out for field deployment
4. Thirty-nine Hymet Met. systems were overhauled and sent out for field deployment
5. Eighteen acoustic release units were overhauled and sent out for field deployment
6. Four TRS systems were overhauled and sent out for field deployment
7. Four ships' EBT systems were overhauled and installed on ships; i.e.: LIMNOS, ADVENT and ROGER SIMONS
8. Five portable EBT's systems overhauled and handed over to field parties for their respective uses

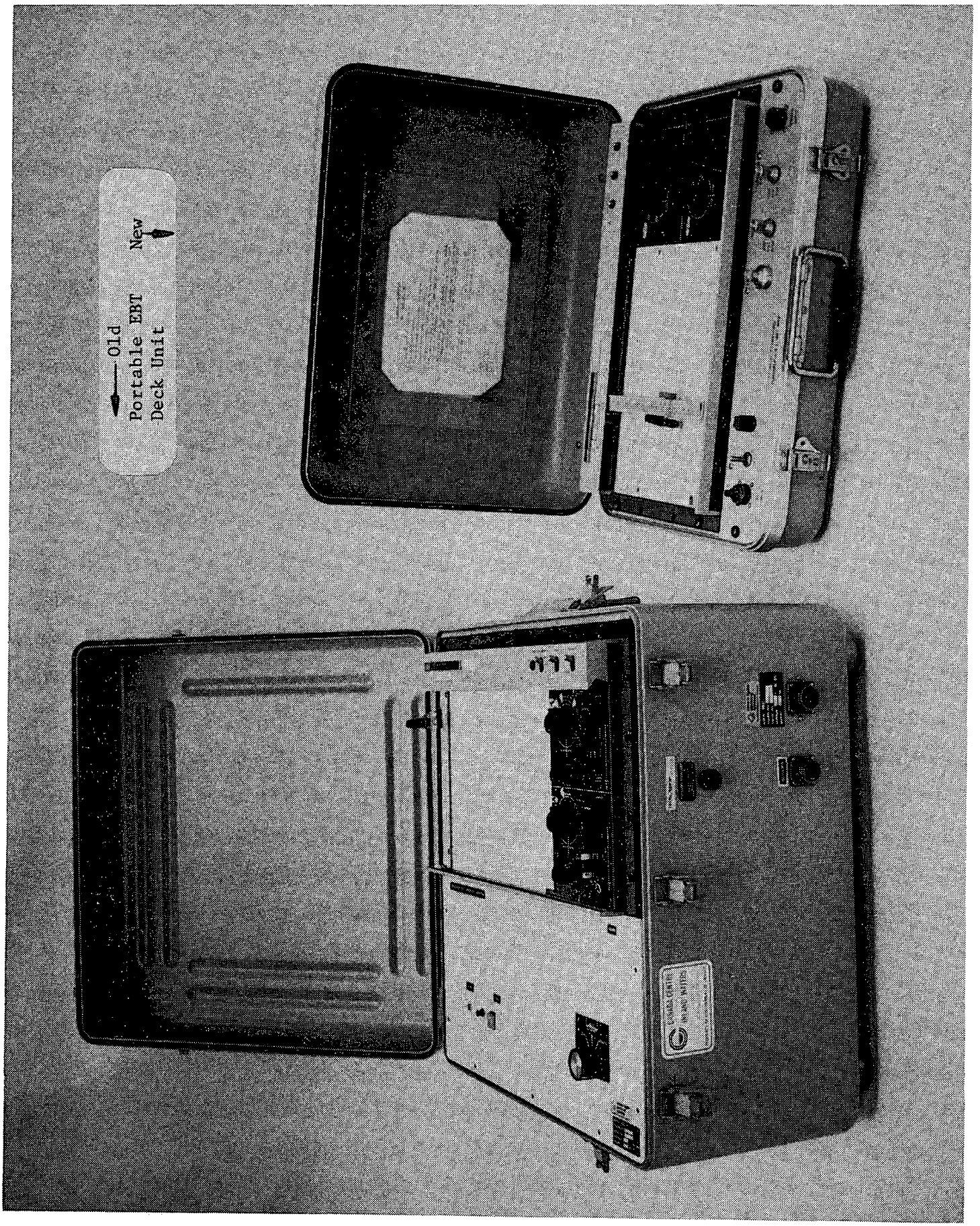
The winch controller for the rosette system was modified from straight SCR motor speed control to regenerative SCR speed control. This gives us a tighter control on drop rate of underwater packages under varying loads. Two TR's systems signal multiplex boards were modified. This establishes interchangeability of circuit boards between units.

Three microprocessor controlled digital data monitors were manufactured for field use. Field reports on these units were very encouraging as units performed better than our expectations. Units have now been provided with canvas carrying cases for protection and storage of signal leads.

The acoustic release integrator was modified to operate off rechargeable GEL-SEL batteries. This provided field staff with more mobility in carrying and operating the system in the field.

Two portable EBT's manufactured by Engineering systems were used by field personnel and field reports suggested they could do with a smaller deck control unit and tighter control on depth, "range" and "span" controls.

One deck control unit was redesigned to accommodate a request from field staff. The redesigned deck units have extra range selection and tighter span control. The weight has been reduced by 66% and the physical size by 75%. The sensor heads are in the process of being redesigned. Field reports on the redesigned deck units have been excellent.


New
Old
Portable EBT
Deck Unit

Monitor Package
for Digitizers
Mfg. by Tech. Ops.

FIELD INSTRUMENTS AND DATA UNIT

Support in the form of logistics, instrument maintenance, data reduction and quality control was provided for ten meteorological systems and four temperature recording systems throughout 1980. Both systems are battery-driven and automatically record from sensors onto magnetic tape at predetermined time cycles, usually at 10 or 20-minute intervals.

Met. System

The meteorological system has an eight-channel recorder that has the ability to store data collected from several combinations of Met. sensors as well as time.

The standard parameters (recorded) by CCIW over the past few years, including 1980 were: wind speed, wind direction, air temperature, relative humidity, water temperature, solar radiation (sometimes), second wind direction or barometric pressure and time.

This data collection package is usually mounted on surface buoys or land towers and collects the data from the sensors located at 4 m and 10 m heights.

TRS System

The temperature recording system has a four-channel recorder. CHN #1 reference, CHN #2 and 3 temperatures and CHN #4 time.

The TRS system can be installed above or below the water surface and has successfully collected as much as 200 continuous days of water temperature data at 20-minute intervals as an under-the-ice bottom-mounted unit.

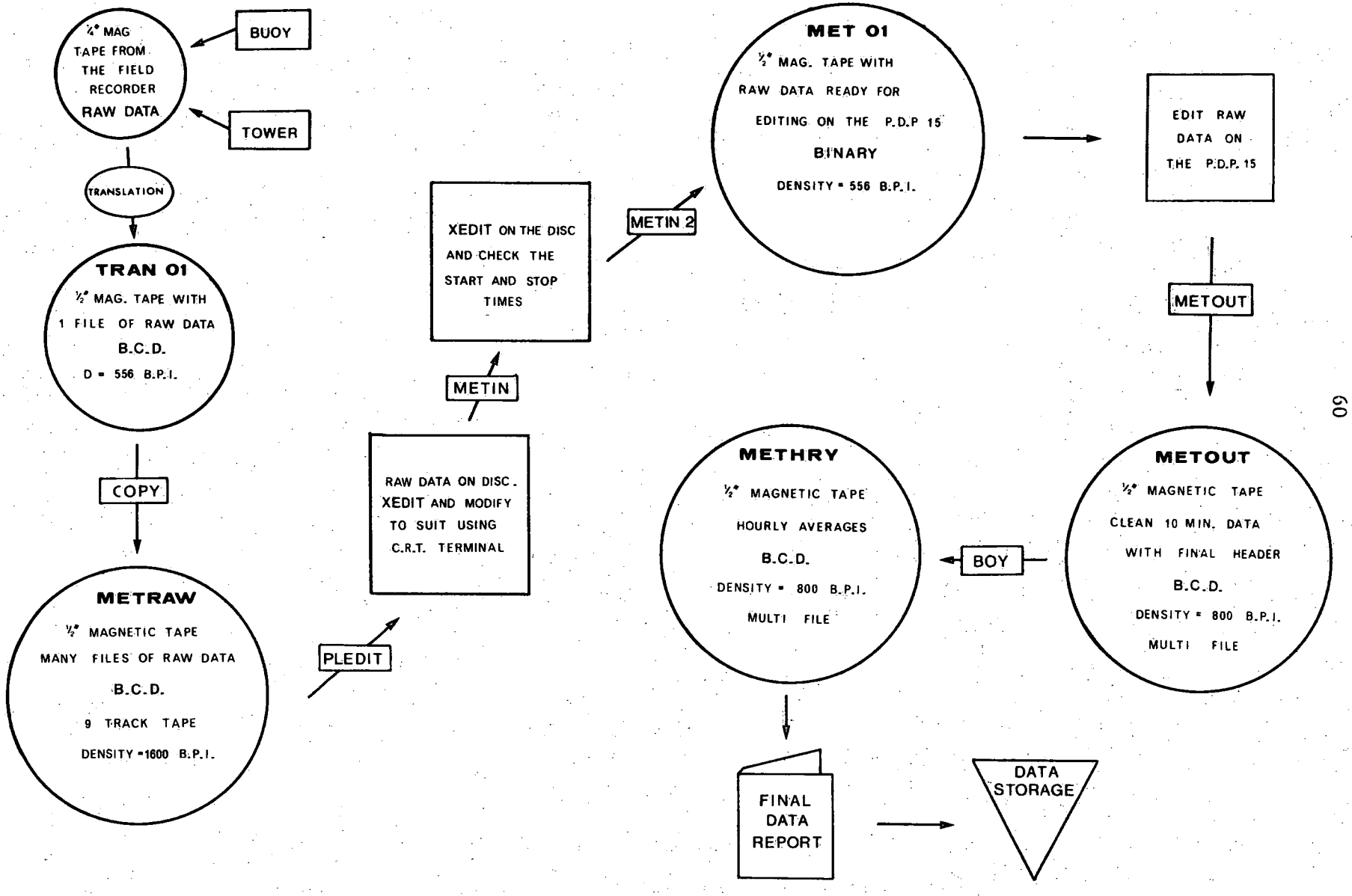
Data

Seven (7) Met. buoys and three (3) 10-metre towers were maintained throughout the 1980 field season, yielding 51 months of data. The data are then translated to 1/2" mag tape, edited on the PDP15 computer and converted into hourly averages. Hard copy data reports and mag tapes

are then made available to the project scientist. The data is also backed up and archived by CCIW's Data Management Archiving Unit.

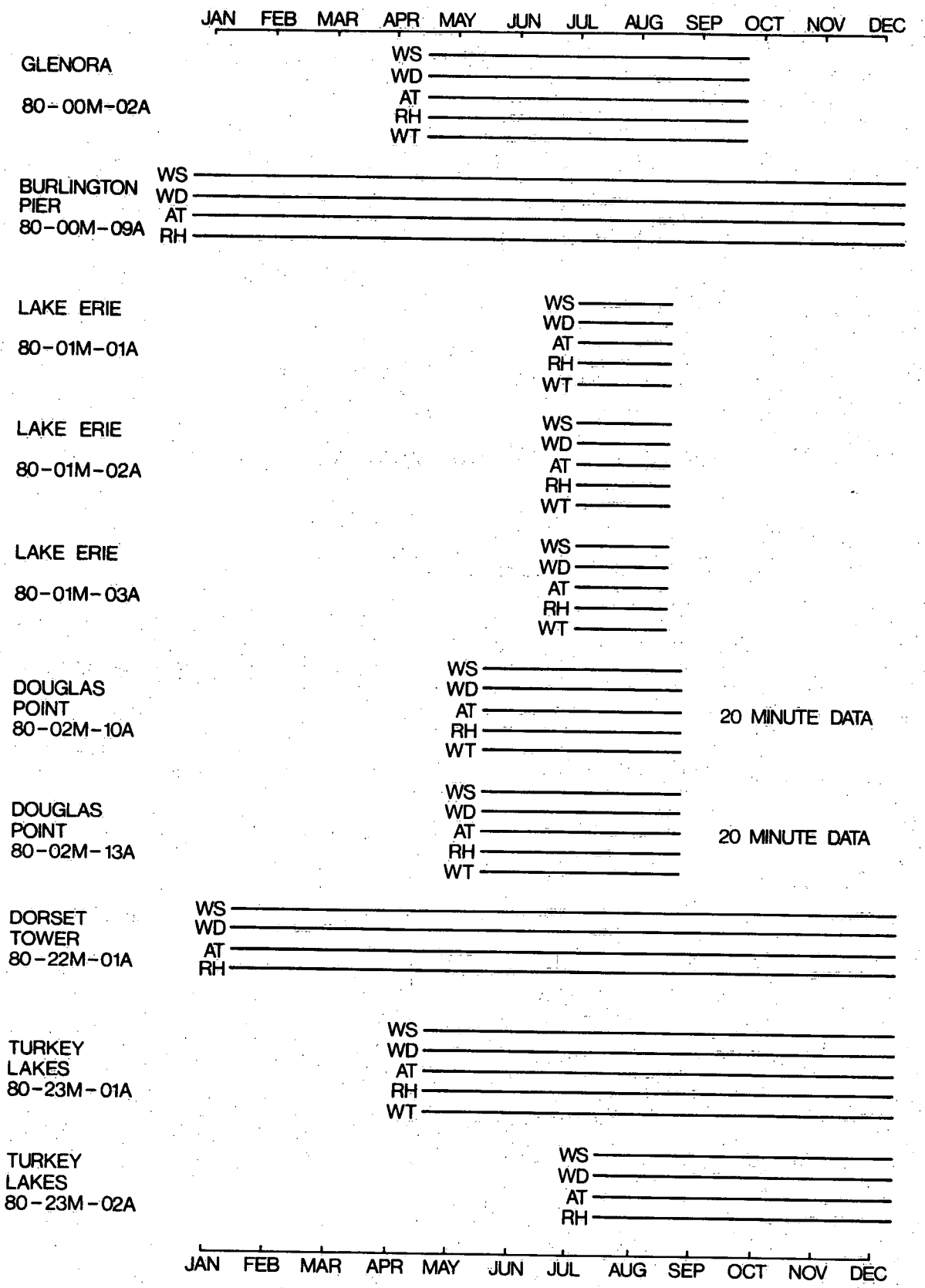
Most of the meteorological and water temperature data that are collected are used by the scientists for ground truth or support data for larger scientific projects such as the Acid Rain Study in Turkey Lakes area near Sault Ste. Marie.

MET - T.R.S. DATA PROCESSING SEQUENCE (1980)



METEOROLOGICAL SYSTEMS DATA SUMMARY

1980



SHOP SUPPORT

RIGGING SHOP

During this year, the Rigging Shop gave direct and indirect support to all groups within NWRI. Major support was shown in the following areas: during the Winter months--between January and May, all field hardware was refurbished. All subsurface floats were sand-blasted then modified and painted, Geodyne buoys required cleaning and painting, related components required repairs; i.e.: rigging repairs on upper "A" frame and pipe fitting repairs on lower tripod. Also, during this period, thirty expendable spar buoys were designed and constructed to replace the very costly nun buoy which we have found to be heavy and awkward to handle on the LIMNOS.

Over the years, anchors for the moorings have also proved to be a problem to store and handle. This year, there were twenty stands constructed to accommodate one hundred anchors for use on the LIMNOS and ashore during Winter storage. Repairing winches and generators was also on the Winter Works Program. This task usually takes about one month to complete, the largest portion being used on hydraulic winches. The remainder of the Winter was spent repairing hardware, splicing ground lines, repairing water sampling bottles and other related equipment.

From May through November, most of our time was spent assisting field parties (both ship and shore) in normal everyday work, trucking equipment back and forth and emergency repairs.

FIELD STORES

In the late Fall of 1979, NWRI Field Stores became part of Technical Operations and was relocated on the 1st floor at CCIW. The equipment on hand, along with the recall of the outstanding tools and field equipment on charge, was checked and inventoried. To supply and equip the field parties and technicians, nine hundred requisitions were processed. Additional material was acquired to cover the demand on some items. As the season and field projects came to a close, the equipment was recalled and refurbished for the coming projects of the Winter and Spring programs.

VEHICLES

The past year has been a demanding one. The addition of five new vehicles to maintain the fleet at twenty-two was instrumental in keeping downtime to a minimum and enabling NWRI to cope with the ever-increasing transportation demands of all Divisions.

The movement of staff and equipment to ships and various field parties accounted for nearly a quarter million miles of travel during the year. Placement of laboratory and office trailers at various locations was also handled by Technical Operations.

On December 15th, Technical Operations purchased a new diesel engine five-ton van specially equipped for handling the miriad of delicate instruments to vessels and shore installations.

CCIW ACRONYMS AND ABBREVIATIONS

CCIW ACRONYMS AND ABBREVIATIONS

BACH - Back Scatter and Absorption Chamber
ACM - Acoustic Current Meter
ART - Airborne Radiometry Temperature
CATTS - Current and Temperature, Turbidity System
CM - Current Meter
CODS - Canadian Ocean Data System
EBT - Electronic Bathythermograph Temperature
EM-CM - Electromagnetic Current Meter
FTP - Fixed Temperature Profiler
G-VAPS - Generalized Vertical Automatic Profiling System
LCB - Limited Capability Buoy
LRTAP - Long Range Transport of Airborne Pollutents
MBT - Mechanical Bathythermograph Temperature Profiler
M-CATS - Mobile Current and Temperature System (Xmas Tree)
MEMS - Multiple Environmental Memory System
MOPS - Multiple Optical Profiling System
MPB - Motion Package Buoy
MPU - Monitor Package Unit (for CM's and Met.)
MTTP - Multiband Transmissometer Temperature Profiler
NFV - Narrow Field of Vision
WFV - Wide Field of Vision
PLUARG - Pollution from Land Use Activities Reference Group
REBT - Rosette EBT
REX - Robot Experimenter
SAT. NAV. - Satellite Navigator
SCRIBE - System for Converting, Reformatting and Interactive Basic Editing
SOLIDS - Sampling of Littoral Drift in Suspension
TROV - Tethered Remotely Operated Vehicle
TRS - Temperature Recording System
TTCDF - Temperature, Turbidity, Conductivity, Depth, Fluorometer Profiler
STODS - Sediment, Temperature and Oxygen Demand and Settling
SWIM - Sediment, Water Interface and Microbes
VAPS - Vertical Automatic Profiling System
WAVES - Water, Air Vertical Exchange Studies