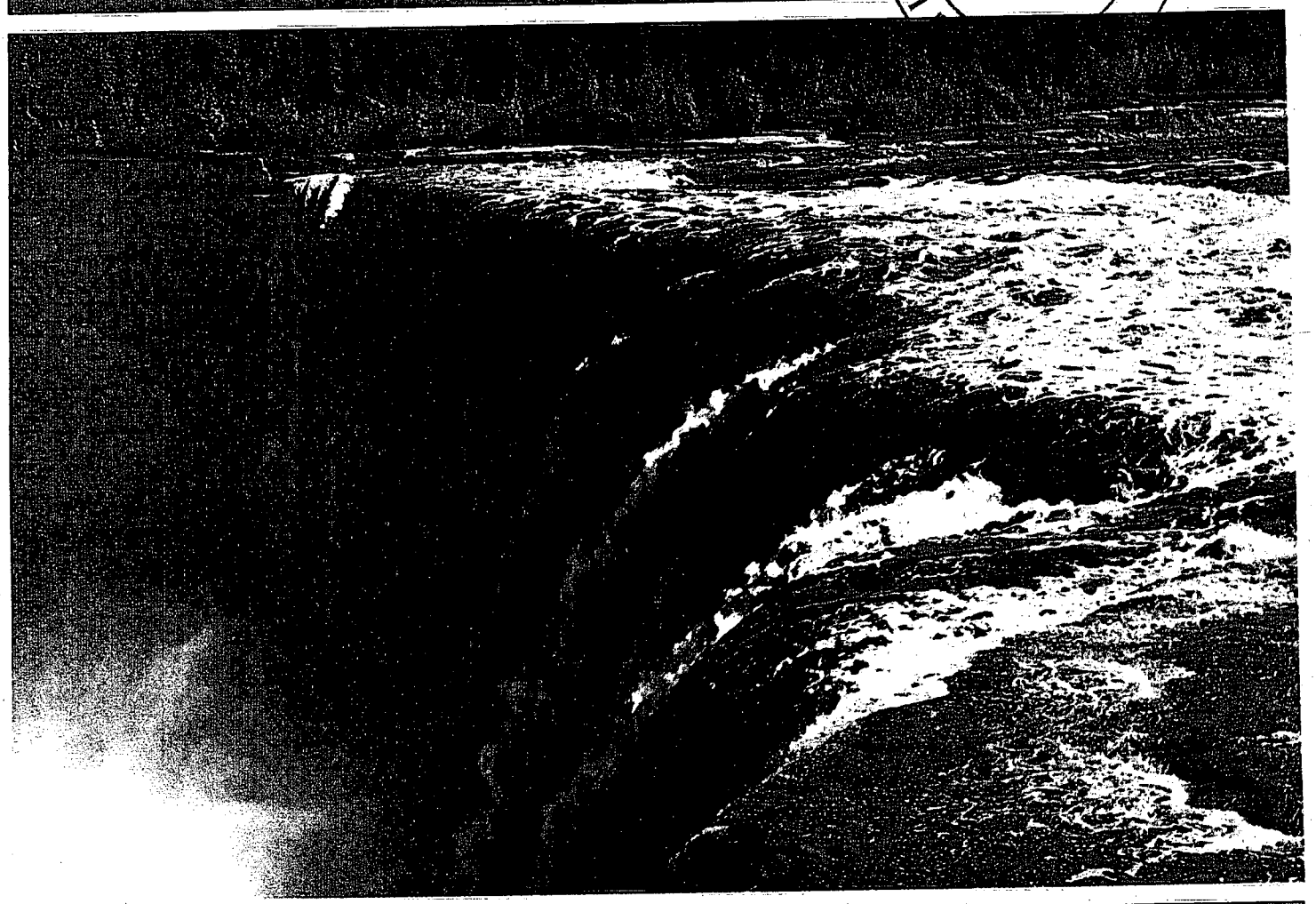
Surveillance Methodology – 1974

T. J. Carew and D. J. Williams



Locator No: WQMS75-001
Contribution No: 75-92

Environment Canada
Environnement Canada

Surveillance Methodology—1974

T. J. Carew and D. J. Williams

TECHNICAL BULLETIN NO. 92
(Résumé en français)

INLAND WATERS DIRECTORATE,
CANADA CENTRE FOR INLAND WATERS,
BURLINGTON, ONTARIO, 1975.

Cat. No.: En 36-503/92

Contract No. KL 398-5-8029
THORN PRESS LIMITED

Contents

Illustrations

Illustrations (cont.)

Abstract

In 1974, a pilot surveillance program was implemented on Lake Ontario to meet the requirements of the International Joint Commission for information on areas of improving or deteriorating water quality, general lake-wide conditions and responses to the impact of management procedures. This report entails documentation and discussion of parameters, analytical methodology and shipboard procedures.

Résumé

On a mis en oeuvre en 1974 un programme pilote de surveillance pour le lac Ontario, afin de fournir des renseignements à la Commission mixte internationale sur des sujets comme l'amélioration ou la détérioration de la qualité de l'eau, les conditions générales qui affectent l'ensemble du lac et les résultats des mesures de gestion. Ce rapport documente et discute certains paramètres, les modes d'analyse et les méthodes utilisées à bord des bateaux.

Surveillance Methodology –1974

T. J. Carew and D. J. Williams

INTRODUCTION

The surveillance cruises implemented in 1974 at Canada Centre for Inland Waters were designed to provide a continuing report and long-term trend information on water quality and eutrophication parameters in the lower Great Lakes (Watson and Williams, unpublished). The data collected are to be used as input to Task 12, Canada-United States Agreement on Great Lakes Water Quality and the Annual Report to the International Joint Commission.

The sampling and analytical methods used in surveillance work were basically the same as those employed in survey (monitor) work described in the IFYGL Technical Plan, Volume 3, Annex K (IHD, 1972), although improved technology and factors such as available laboratory space dictated some changes. Equipment and procedures outlined in this report pertain to surveillance cruises on Lake Ontario carried out in 1974 aboard the Canadian Coast Guard Ship PORTE DAUPHINE (Fig. 1).

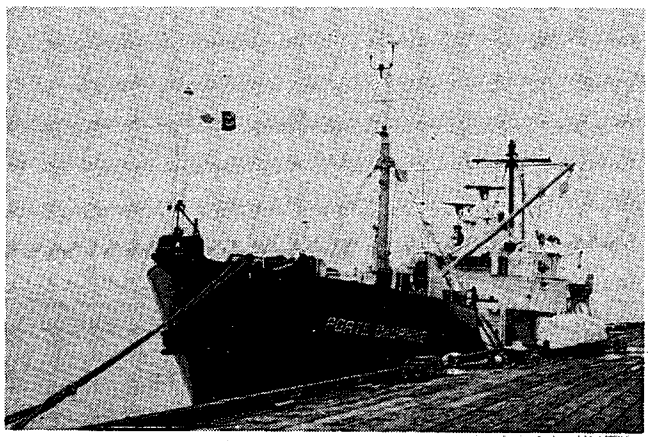


Figure 1. CCGS PORTE DAUPHINE.

MEASUREMENT OF WATER TEMPERATURE

Electronic Bathythermograph

The electronic bathythermograph (EBT) provides a direct instantaneous readout and graphical record of the temperature-depth profile. The data system provides convenience, speed and accuracy in the accumulation of temperature-depth profiles(Fig. 2).

The system consists of a light-weight probe sensor lowered over the side with a winch and cable and transmits continuous analog data from two transducers (temperature and depth) to an X-Y recorder on deck.

A multi-range depth facility with depth ranges of 50 m, 100 m and 400 m produces a full-scale recorder display, eliminating the necessity of using different sensor heads for varying station depths while retaining the resolution desired. Accuracy of the system (CCIW Engineering specifications) is ±0.01°C for temperature and ±1% of full scale for depth. Practical temperature accuracy (i.e., readability) is probably closer to ±0.05°C.

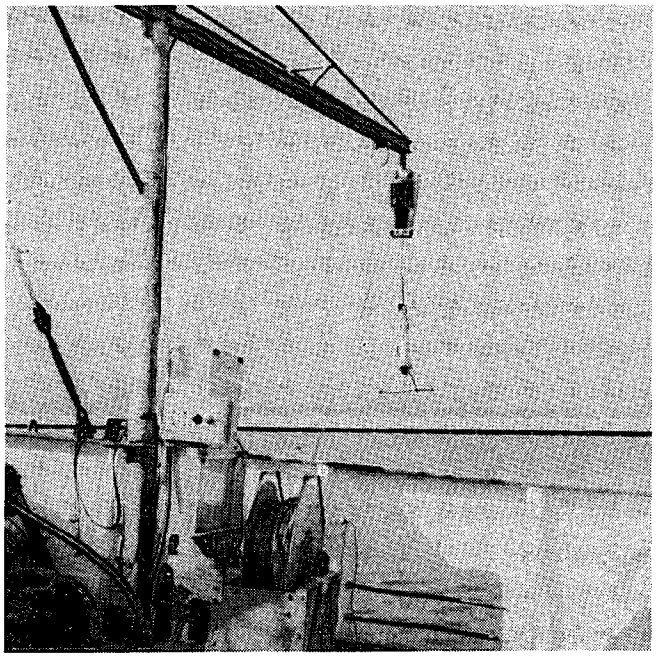
The recorder was mounted starboard side forward in the upper laboratory space, and the EBT winch was mounted starboard side forward on the well deck to be used in conjunction with a boom that had been mounted in this area.

Mechanical Bathythermograph

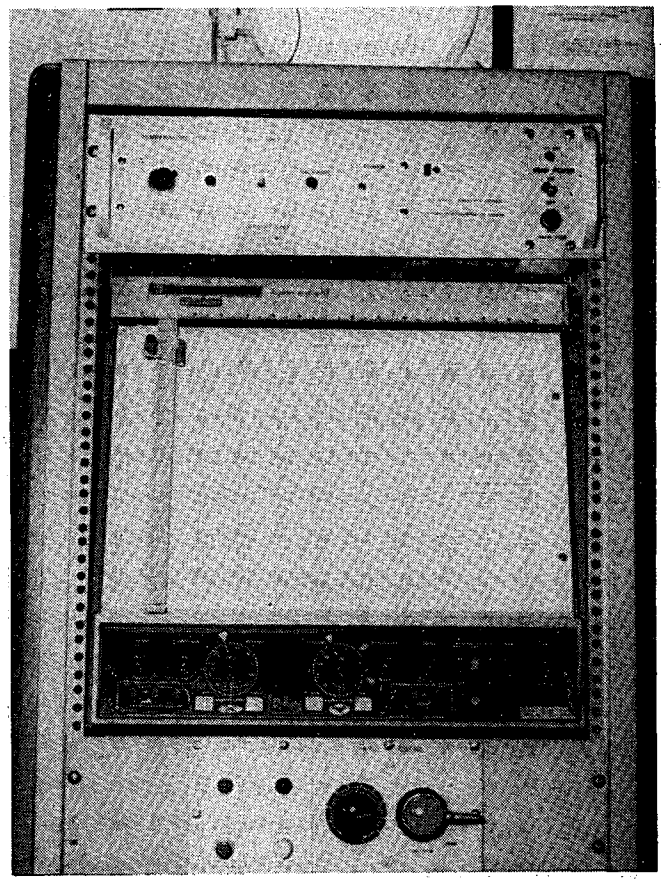
The mechanical bathythermograph (mBT) is used to take essentially the same measurements as the EBT. In 1974, it was used as a back-up system for the EBT system whenever the latter failed. The temperature-depth profile is recorded on a gold-coated glass slide as the instrument is lowered through the water column. The mBT's (manufactured by Wallace and Tiernan) are calibrated in four depth ranges with maximums of 30 m, 60 m, 140 m and 275 m. Temperature accuracy is ±0.05°C (or 0.1°C in any one direction), and depth accuracy is ±1% of the calibrated depth range.

Reversing Thermometers

Deep-sea, protected reversing thermometers (manufactured by Richter and Weise) measure water temperature at a predetermined depth (Fig. 3). They were used for calibration checks of the EBT temperature traces at selected stations and, when necessary, in support of



a



b

Figure 2. Electronic bathythermograph (a) sensor and (b) recorder.

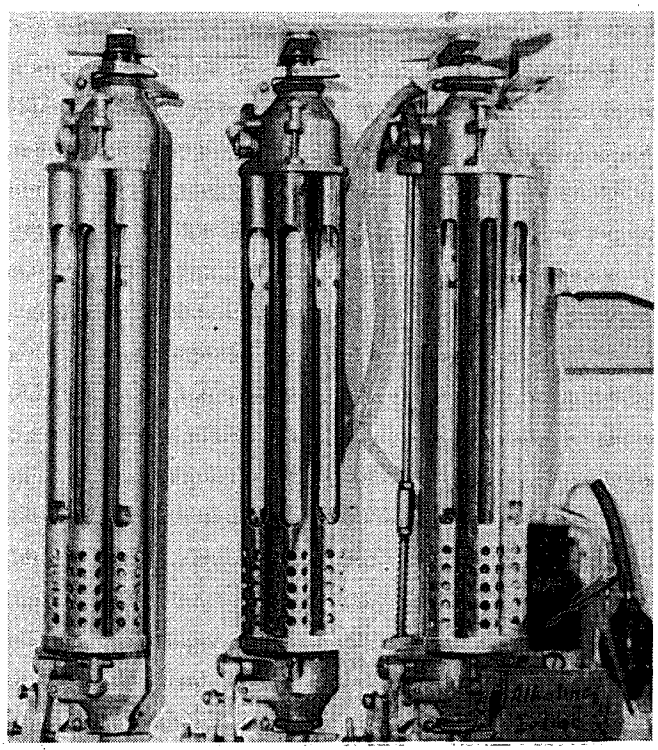


Figure 3. Reversing thermometers in Knudsen bottles.

mechanical BT traces. The thermometers are fitted into the brackets on Knudsen water sampling bottles in such a manner that as the bottle reverses on the wire, the thermometers are also inverted. The main thermometer can be read to the nearest 0.01°C. The error associated with accurately determining the depth of the bottle using the meter wheel (especially when there is a significant wire angle) is much greater than that associated with reading the temperature. Therefore the reading is taken where the water is essentially isothermal over a relatively great depth (e.g., the hypolimnion).

Bucket Thermometer

The surface water temperature is taken by the sea bucket thermometer, which consists essentially of a laminated rubber cylinder with a wooden bottom inside of which there is a second rubber sheath containing a brass shield that encases the thermometer (Fig. 4). The bucket thermometer reading is always taken from the same side of the ship as the EBT, and as close as possible to the "down time" of the EBT. The temperature reading (read to nearest 0.1°C) is compared each time with that obtained by the EBT (or mBT) at the surface. The difference in readings on most occasions should be less than 1°C, although during periods of extreme surface warming and subsequent disturbance by the ship differences greater than 1°C have been observed.

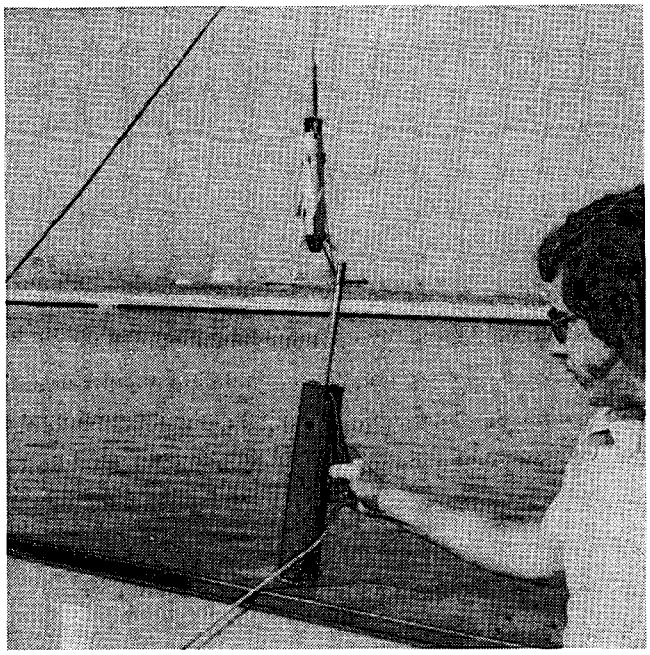
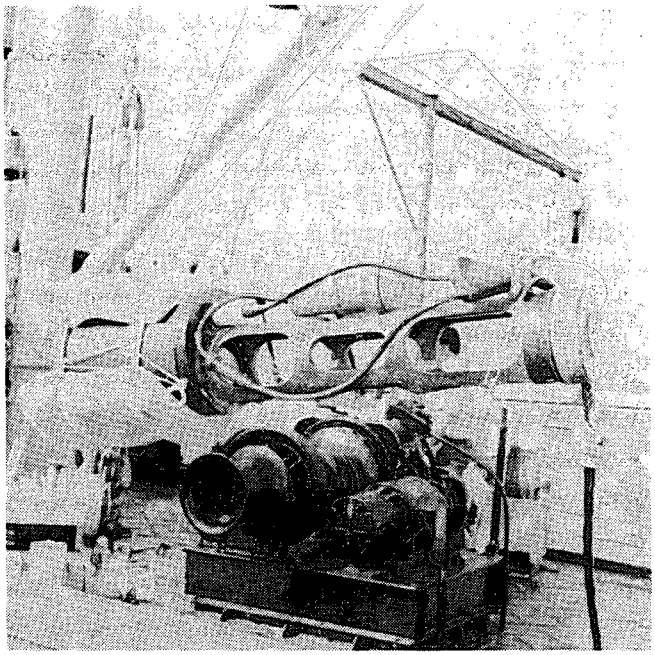


Figure 4. Bucket thermometer, EBT in background.



MEASUREMENT OF WATER TRANSPARENCY AND COLOUR

Beam Transmissometer

The beam transmissometer (Model XMS manufactured by Martek Instruments), which came into prominent use in 1973, is a rugged, portable instrument specifically designed for *in situ* measurements of "turbidity" by determining the percent transmission of a light beam through a known path length in the water (Fig. 5). The sensor head has a collimated detector positioned in the beam of a self-contained collimated light source. The optics are arranged so that the light transmission path between the source and detector can be set for a distance of one-quarter metre to several metres through the underwater body. The path length in any one instrument, however, is fixed. The standard instrument used in the surveillance program had a one-metre folded path length and was equipped with a Wratten No. 45 filter (peak near 470 nm) and a 20-watt tungsten-iodine light source.

A pressure transducer (Martek Model DM3), which can be fastened to the main body of the transmissometer, permits coincident measurement of percent transmission vs depth. The entire *in situ* sensor package is connected by electrical cable to readout modules (both meters and X-Y recorder) in the upper laboratory space on deck.

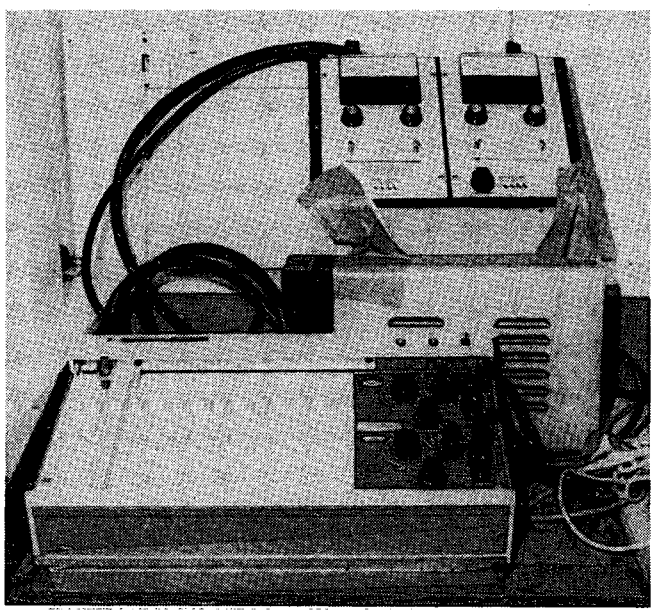


Figure 5. Transmissometer: sensor, power package and recorder.

Overall system accuracy is approximately ±1.0% full-scale calibration.

Secchi Disc

The Secchi disc, which gives an approximate index of water transparency, has been used as a basic tool in limnology for a number of decades (Fig. 6). There are several variations in Secchi disc design, but basically it is a circular plate made of metal, wood or plastic, approximately 30 cm in diameter (20-centimetre discs are also available). In the centre of the upper surface there is a ring with a rope line attached, 50 m long and graduated at one-metre intervals. Most discs are weighted on the underside and painted "flat" white on the upper surface.

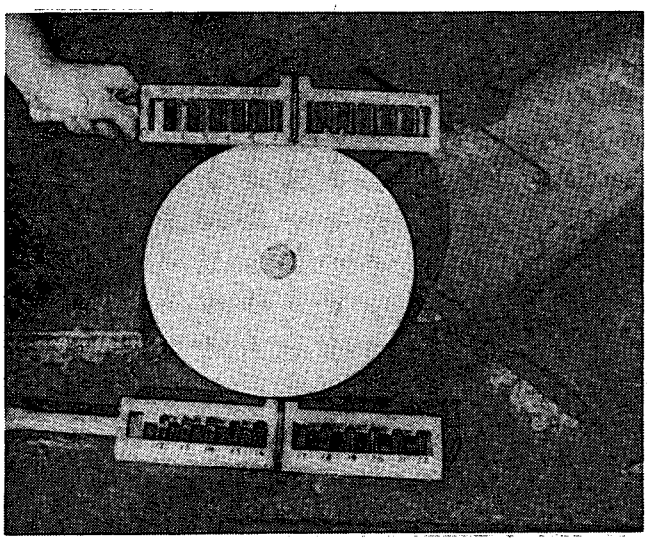


Figure 6. Secchi disc, Forel and Ule scales.

Although the Secchi disc measurement has never been standardized, it is widely used mainly because of the simplicity of the equipment and the method.

Forel-Ule Colour Scale

The Forel-Ule scale, a series of 22 vials with gradation in colour from dark blue (No. 1) to brown (No. 22) produced by mixing different proportions of ammoniacal copper sulphate and neutral potassium chromate solutions in each vial, was used to give an approximate index of water colour (Fig. 6).

The Secchi disc was lowered into the water on the shaded side of the ship until it just disappeared and then was brought up to a depth at which it was just visible again. The colour of the water against the white background was compared to the colour of the solutions in the vials.

COLLECTION OF WATER SAMPLES

Integrating Sampler (20 m)

The "integrator" (built by the Engineering Section, CCIW) is designed to collect approximately equal volumes of water from each of the "layers" from the surface to a depth of 20 m as it is lowered through the water column at a constant rate of about 1 m/sec (Fig. 7). While the sampler is slowly immersed, water enters the cylinder and interior cone through a one-way valve. The trapped air is compressed in relation to the depth or the prevailing ambient pressure. The height of the air column changes in accordance with the equation $h = \frac{hz}{d+1}$, hz being the overall cylinder height and d, the hydrostatic pressure.

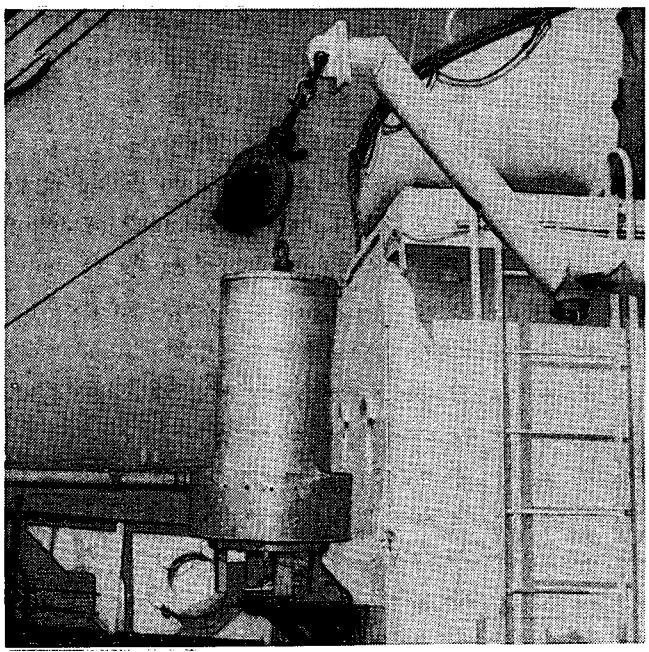


Figure 7. Integrated sampler (20 m).

As the cylinder is returned to the surface, the water inside the cone remains trapped by the one-way valve, while the excess water that has entered the cylinder, but not the cone, is pushed out by the compressed air inside the cone and cylinder or flows out by itself (Schröder, 1969).

Van Dorn Bottle

The Van Dorn bottle was the main water sampling device used for obtaining samples at discrete depths

(Fig. 8). It is basically a round, cylindrical tube made of PVC which can be sealed at either end by two force cups pulled together by a length of strong, flexible rubber tubing. The capacity of the bottle is 3 litres.

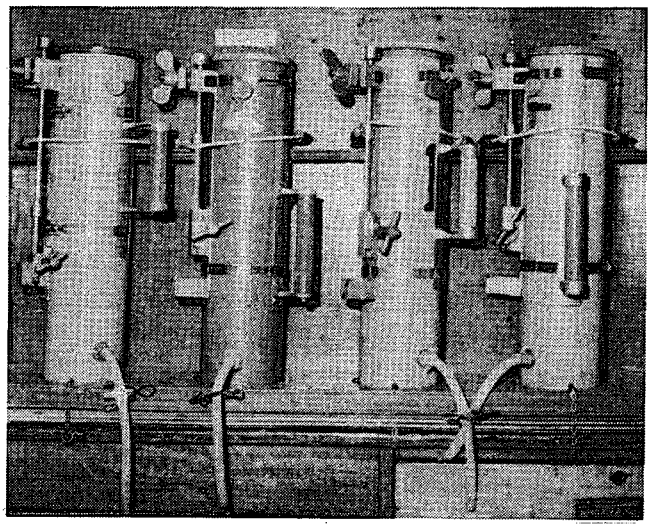


Figure 8. Van Dorn bottles.

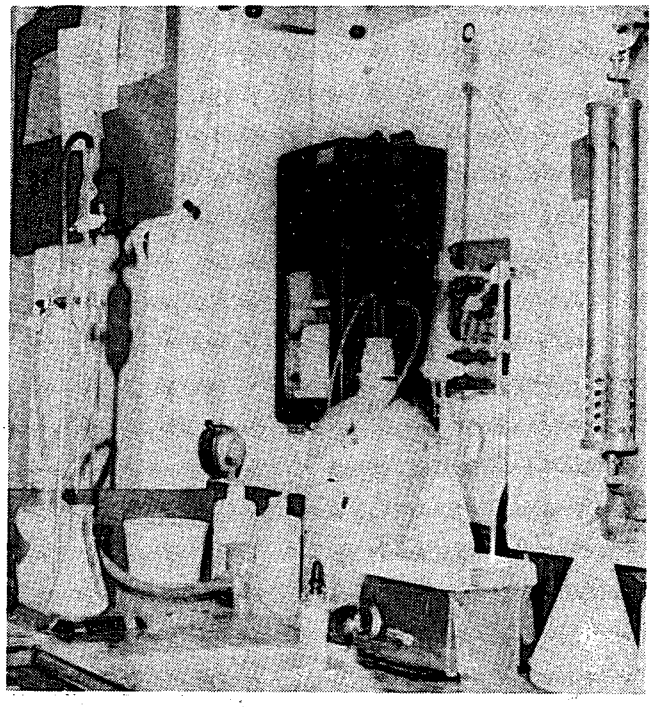


Figure 9. Winkler method apparatus for analysis of dissolved oxygen.

Knudsen Bottle

Knudsen reversing water bottles were also used for the collection of water samples and water temperature data from discrete depths. Each bottle was equipped with a bracket capable of holding up to three reversing thermometers. Its capacity is 1.2 litres (Fig. 3).

METHODS AND ANALYSES

Dissolved Oxygen

Samples from each station were drawn off from either Van Dorn or Knudsen bottles into 300-millilitre BOD bottles and analyzed using the Winkler titration method (Fig. 9).

During 1974, a series of comparative measurements were made using a YSI Model 54 DO meter, manufactured by Yellow Springs Instruments. The coefficient of variation at a dissolved oxygen concentration of 4.1 mg/l was ±1.8% (Traversy, 1971).

The accuracy of the probe is yet to be determined (Fig. 10).

Readings were converted to percent saturation using the *in situ* sample temperature (i.e., the temperature

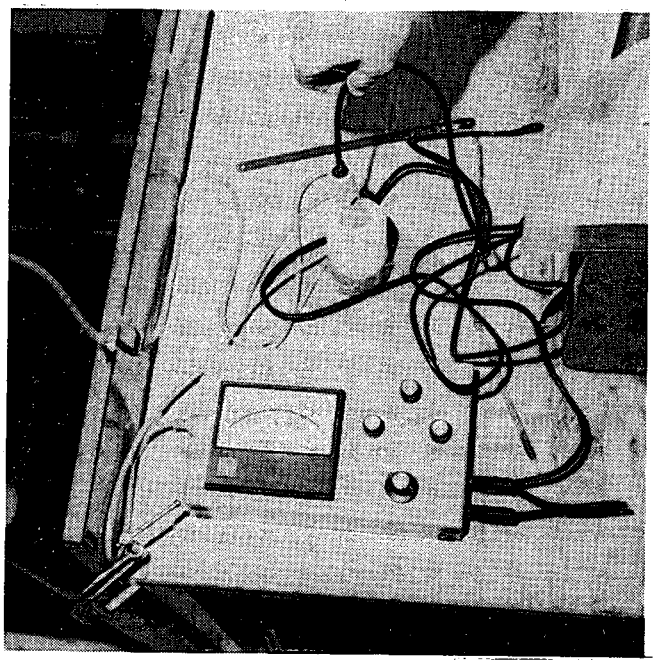


Figure 10. Dissolved oxygen probe.

recorded by the EBT at the depth at which the sample was collected) and the nomogram values (corrected for Lake Ontario) presented in *Principal Ions and Dissolved Oxygen in Lake Ontario* (Dobson, 1968). The program for this conversion is readily available on magnetic storage cards of Hewlett-Packard Models 9810 and 9820.

Specific Conductance

Samples from each station were drawn off from either Van Dorn or Knudsen bottles into 250-millilitre plastic bottles and analyzed using a Radiometer CDM2 conductivity meter (Fig. 11). Sample temperature was taken at the time of measurement using a Zeal thermometer (accuracy ±.05°C).

Figure 11. Conductivity meter.

Readings were converted to specific conductance at 25°C using the measured value, sample temperature, calculated cell constant, and conversion factors calculated by Rodgers in 1962 for the Great Lakes.

At a level of 520 μmhos/cm, the coefficient of variation was ±0.5% (Traversy, 1971).

Chlorophyll a

Samples from each station were collected in one-litre graduated cylinders from the integrator, filtered through a Whatman GF/C glass filter paper at a suction of 7 in. of mercury and stored frozen until reaching CCIW (Fig. 12). The pigments were extracted in 90% acetone and analyzed using a Unicam Model SP 1800 UV spectrophotometer. The accuracy of the method is about 5-10% (Ship's Support Laboratory, Water Quality Division, CCIW, 1974).

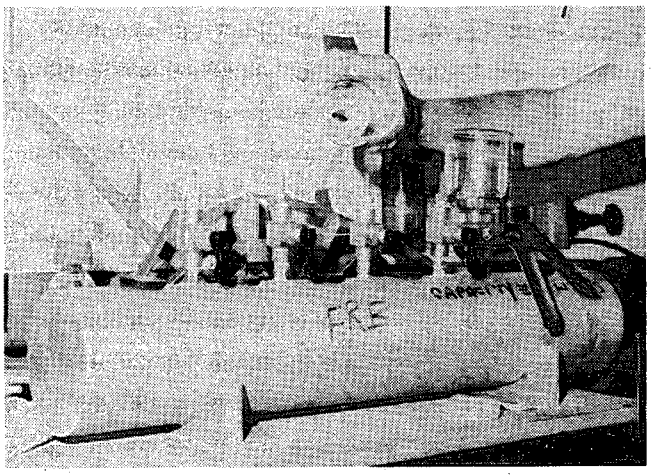


Figure 12. Filtering receiving chamber, rectangular slot in cup for POC samples.

Particulate Organic Carbon and Total Particulate Nitrogen

Samples were drawn from the integrator into one-litre graduated cylinders, filtered through pre-treated Whatman GF/C filters at a suction of 7 in. of mercury, acid-rinsed, then dried in open petri dishes in a vacuum desiccator maintained at 20 in. of mercury, and returned to CCIW (Fig. 13).

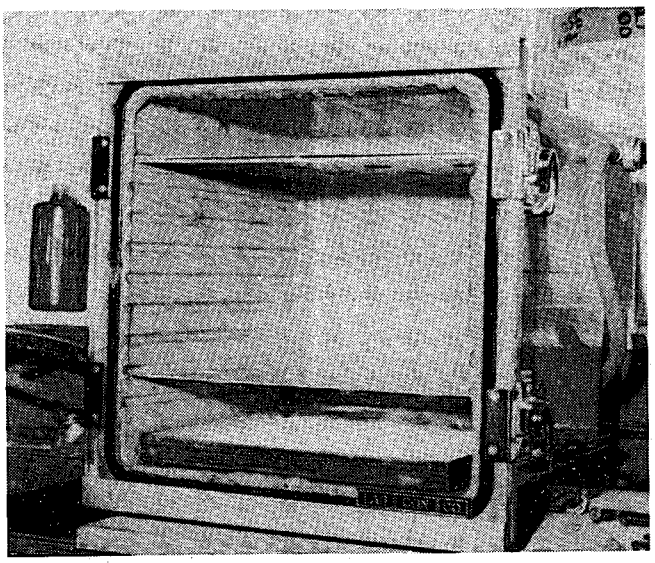


Figure 13. Desiccator.

Both parameters were analyzed by combustion in a Hewlett-Packard Model 185-B CHN analyzer. The accuracy of the particulate organic carbon and total particulate nitrogen analyses is yet to be firmly determined (Ship's Support Laboratory, Water Quality Division, CCIW, 1974).

Total Phosphorus

Samples were drawn from both the Van Dorn bottles and the integrator into 300-millilitre bottles to which 3 ml of concentrated H_2SO_4 had been added (Fig. 14).

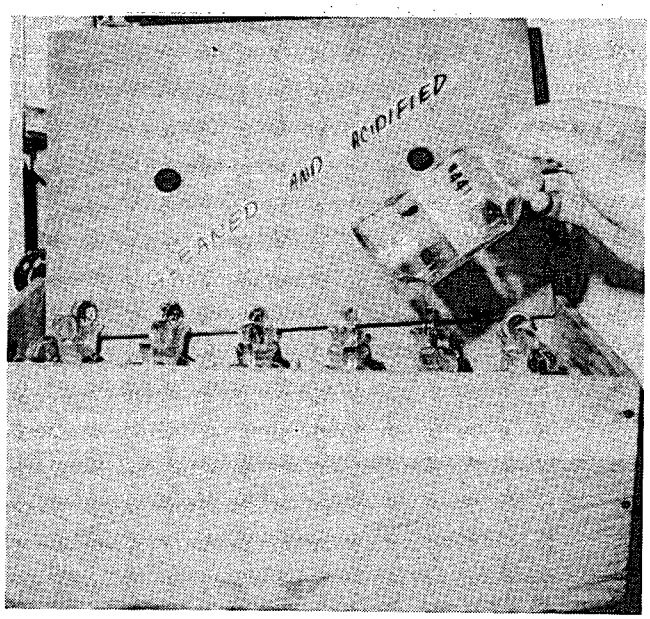


Figure 14. Bottles for total phosphorus.

The samples were then returned to CCIW for colorimetric analysis by the molybdenum blue method using a Technicon AutoAnalyzer. The detection limit of the analysis is 0.5 μg P/l in the range of 0.5 - 50 μg P/l (Ship's Support Laboratory, Water Quality Division, CCIW, 1974).

ADDITIONAL OBSERVATIONS

In conjunction with the measurement of algal biomass, continuous solar radiation data were collected with a precision Eppley solarimeter and a Hewlett-Packard strip chart recorder using a fixed paper speed of 1 in./hr (Fig. 15). The unit of measurement is the langley.

In addition to carrying out the surveillance work, technical staff also act as marine weather observers.

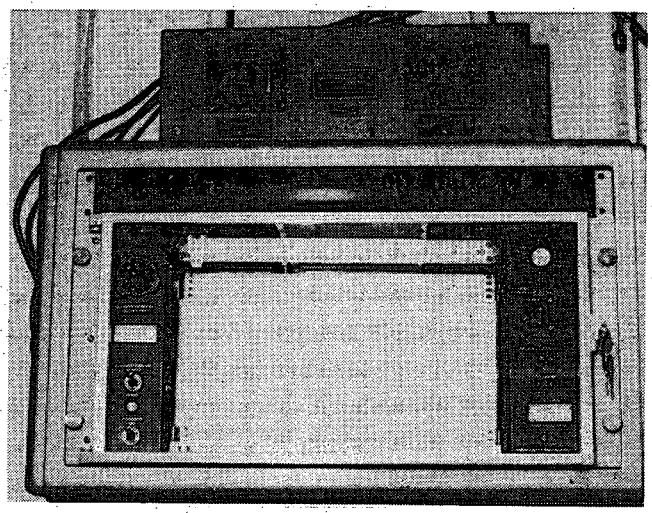


Figure 15. Solar radiation recorder.

Complete weather observations, for forecasting purposes, are taken every three hours and transmitted to the weather office in Toronto.

On several occasions, additional tasks were added to the cruises as requests from various individuals and organizations. A list of these tasks for 1974 includes the following items:

1) CCGS PORTE DAUPHINE participated in open house demonstrations,
2) Secchi disc measurements using the older and smaller 20-centimetre disc were taken to establish a conversion factor for the readings taken prior to the more recent usage of the 30-centimetre disc,
3) rain samples were collected for the assessment of atmospheric loading into the Great Lakes,
4) particulate carbon samples were collected and filtered for the University of Waterloo, to assist in determining C^{12}/C^{13} ratios,
5) replicate and duplicate chlorophyll *a* samples were obtained for statistical evaluation,
6) samples for the analysis of He ratios to determine water mass residence time in the epilimnion and hypolimnion were collected for McMaster University, and
7) grab samples of lake sediments were taken for the Special Analysis and Quality Control Laboratory, CCIW.

REFERENCES

Dobson, H.H. 1968. "Principal Ions and Dissolved Oxygen in Lake Ontario," *Proceedings* of 10th Annual Conference on Great Lakes Research, IAGLR, Ann Arbor, Michigan, pp. 337-356.

International Hydrological Decade. 1972. *Field Operations Plan,* IFYGL Technical Plan, published jointly by Canada and the United States, Vol. 3.

Rodgers, G.K. *Temperature Adjustment of Conductivity Measurements in Waters of the Great Lakes.* Unpublished.

Schröder, R. 1969. "Ein Summierender Wasserschöpfer," *Arch. Hydrobiol.,* Stuttgart.

Traversy, W. 1971. *Methods for Chemical Analysis of Waters and Wastewaters,* Water Quality Division, Inland Waters Branch, Department of Fisheries and Forestry, Ottawa.

Watson, N.H.F. and D.J. Williams. "Design and Operation of a Pilot Surveillance Program for Lake Ontario." Paper presented at 18th Annual Conference on Great Lakes Research, IAGLR, Albany, New York, 1975.

Appendix

APPENDIX

STATION PROCEDURE

For purposes of presenting a comprehensive view of what takes place when "on station," the entire sequence of events pertaining to surveillance station 64, cruise 74-00-208, September 5, 1974, is described.

Station 64, which is just prior to the midway point of the cruise, was reached on schedule by the ship at 0045 hr EDT on September 5. Prior to arrival at this station, the two surveillance team members on watch had completed the work from the previous station and were preparing for the upcoming station.

The preparation for the station consisted of the following work, some of which appears to be insignificant but is nevertheless necessary:

1) fill out deck log, i.e., by referring to the cruise plan list what tasks are to be performed,
2) note appropriate information on EBT and transmissometer sheets,
3) set up POC filtration apparatus and label petri dishes for filter storage,
4) set up chlorophyll *a* filtration apparatus and label Whatman filter,
5) inspect reversing thermometers in Knudsen bottles, and
6) select BOD bottles for oxygen and phosphorus samples and record numbers in log books and deck log.

After the vessel had stopped on station, the following sequence of events occurred.

Ship's officers recorded the ship's position (fixed by radar) in the bridge log along with the time and a brief weather observation including air temperature, wind direction and speed (see section on Data Quality Assurance, p. 12). The sounding was passed down to the laboratory.

Down on deck, the deckhand assisting the surveillance team turned on the deck lights and immersed the bucket thermometer in the water. The meter wheel on the port side davit was zeroed, as was the Hewlett-Packard recorder, and the transmissometer was lowered through the water column to obtain a transmission vs depth profile. The transmissometer was then raised and stored, the power pack and recorder were turned off and the percent transmission value at 1 m was recorded to the nearest whole percent on the Manual Chemistry Laboratory sheet.

While the transmissometer was being lowered from the port (windward) side of the ship, the bucket thermometer was read and the reading recorded in the deck log, and an EBT temperature vs depth profile was taken using the winch on the starboard side. Since station 64 is approximately 232 m deep, it took about six minutes to complete this measurement.

During this time, an integrated sample to 20 m had been obtained using the port side winch and samples had been collected for the following analyses:

1) chlorophyll *a*, one-litre sample in graduated cylinder,
2) two 500-millilitre samples in graduated cylinders for POC and TPN analyses, and
3) one BOD bottle for total unfiltered phosphorus.

Each graduated cylinder was rinsed prior to filling; the BOD bottles were not rinsed, since they had been prepared previously ashore and contained 3 ml of acid for sample storage. The water remaining in the integrator (approximately 2 litres) was drained.

The EBT trace was examined to determine sampling depths for dissolved oxygen and additional total phosphorus samples. Prescribed sampling depths were 1 m below the thermocline and 1 m from the bottom. Accordingly, depths of 76 m and 228 m were chosen. (The station depth was 231 m. There was a sea running and the ship was drifting slightly; to avoid the risk of sample contamination from sampling gear striking the bottom, the decision was made to sample no less than 3 m from the depth indicated by the EBT.)

Knudsen bottles complete with reversing thermometers were lowered to the depths mentioned from the port side and were kept at these depths for six minutes to ensure proper flushing and temperature stabilization.

By this time in the laboratory, the filtering of the chlorophyll *a* and POC/TPN samples was already underway.

After the six-minute period, the bottles were tripped, brought to the surface and stored in the racks (Fig. 3). At this stage, the on station work was completed and the bridge was informed to proceed to the next station. Before getting underway the officer of the watch took a second

radar fix and recorded this along with the off station time in the bridge log.

In the laboratory, sample handling and treatment continued. The filtered chlorophyll *a* and POC/TPN samples were documented and placed in the freezer and desiccator, respectively. The EBT trace was digitized and the reversing thermometers were read. During this time the second surveillance technologist had drawn off the samples for dissolved oxygen and total phosphorus analyses. Dissolved oxygen analyses were done by both Winkler titration and probe methods. The total P samples were stored for analysis ashore.

Since it was night-time, no Secchi disc or Forel-Ule colour measurements were taken.

A similar sequence of events took place at the next station. Van Dorn bottles, however, were used in place of the Knudsen bottles, since no reversing thermometer temperatures were required. Also, a full surface meteorological observation was made and transmitted to the Toronto Weather Office.

DATA QUALITY ASSURANCE

All of the members of the surveillance team are responsible for the production of a correct and accurate summary of each cruise. Detailed procedures for achieving such a summary, which is the basis for each cruise report and each synoptic report, are described in *Shipboard Data Handling and Data Quality Assurance* (Macdonald, unpublished report).

Data quality assurance begins with exacting completion of work forms throughout the cruise. Duplicate and replicate samples, all carefully documented, are regularly collected and treated on surveillance cruises; although some of the duplicate samples are pre-scheduled for analysis checks, any suspect observations are repeated or checked immediately. For example, at station 64 on cruise 74-00-208 a duplicate sample was collected for particulate organic carbon. Complete documentation for station 64 is given on pages 13 to 28.

REFERENCE

Macdonald, H.B. *Shipboard Data Handling and Data Quality Assurance.* Unpublished CCIW Internal Report.

THERMOCHECK DATA SUMMARY

VESSEL	B.T. Nº	BUCKET TEMP.
PORTE DAUPHINE	34241	19.4
CRUISE Nº 74-00-208	TRACE Nº	TIME DOWN
DATE (G.M.T.) 5-9	537	0446
MONITOR STN. Nº 64	SECCHI DISC	DEPTH / COLOUR
YR. 74 / INST. 22 / CRUISE Nº 02 1 / CONSEC. STN. Nº 037	SOUNDING	METRES 231

CAST	GREENWICH MEAN TIME DOWN	MESSENGER	START UP	WIRE ANGLE
1ST	0504	0510	0512	0°
2ND				
3RD				
4TH				
5TH				
OBSERVERS	JC	DS		

TRANSMISSOMETER Nº 37 | INTEGRATOR | DEPTH (M) 0-20

REMARKS

Reversing Thermometers - Oxygen samples drawn from Knudsens
P.O.C. + duplicate
Chlorophyll a
Total p
YSI Probe

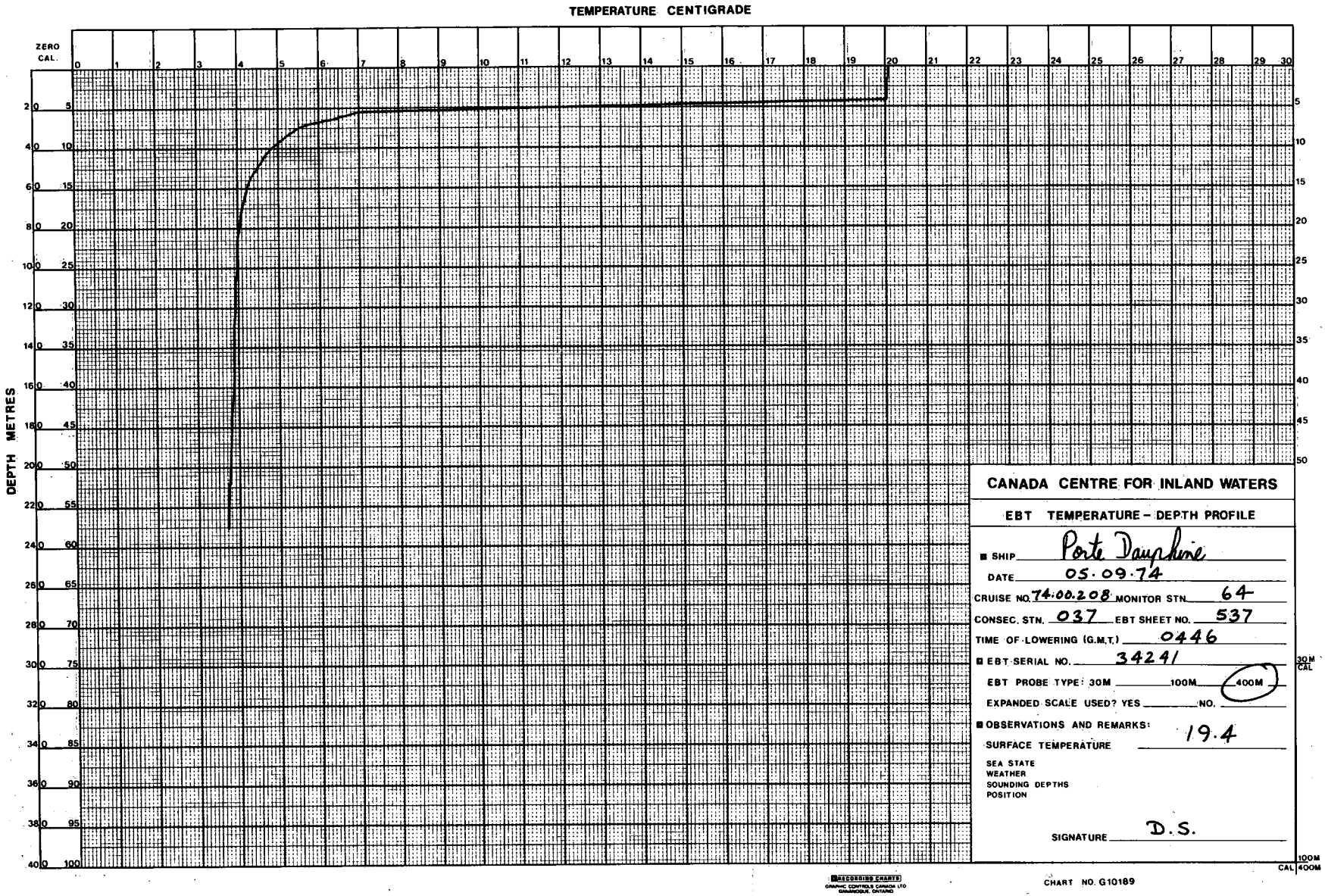
CAST		WIRE LENGTH (M)	LEFT THERMOMETER SERIAL Nº PU	M	LAST FOUR	AUX RDG.	MAIN RDG.	RIGHT THERMOMETER SERIAL Nº PU	M	LAST FOUR	AUX. RDG.	MAIN RDG.	ACC. DEPTH
1	1	0076	PR	3	122	159	0424	PR	2	947	158	0420	
	2					162	0424				160	0420	76
1	3	0228	PR	3	125	159	0389	PR	3	126	159	0389	
	4					161	0389				161	0389	228
	5												
	6												
	7												
	8												
	9												
	10												

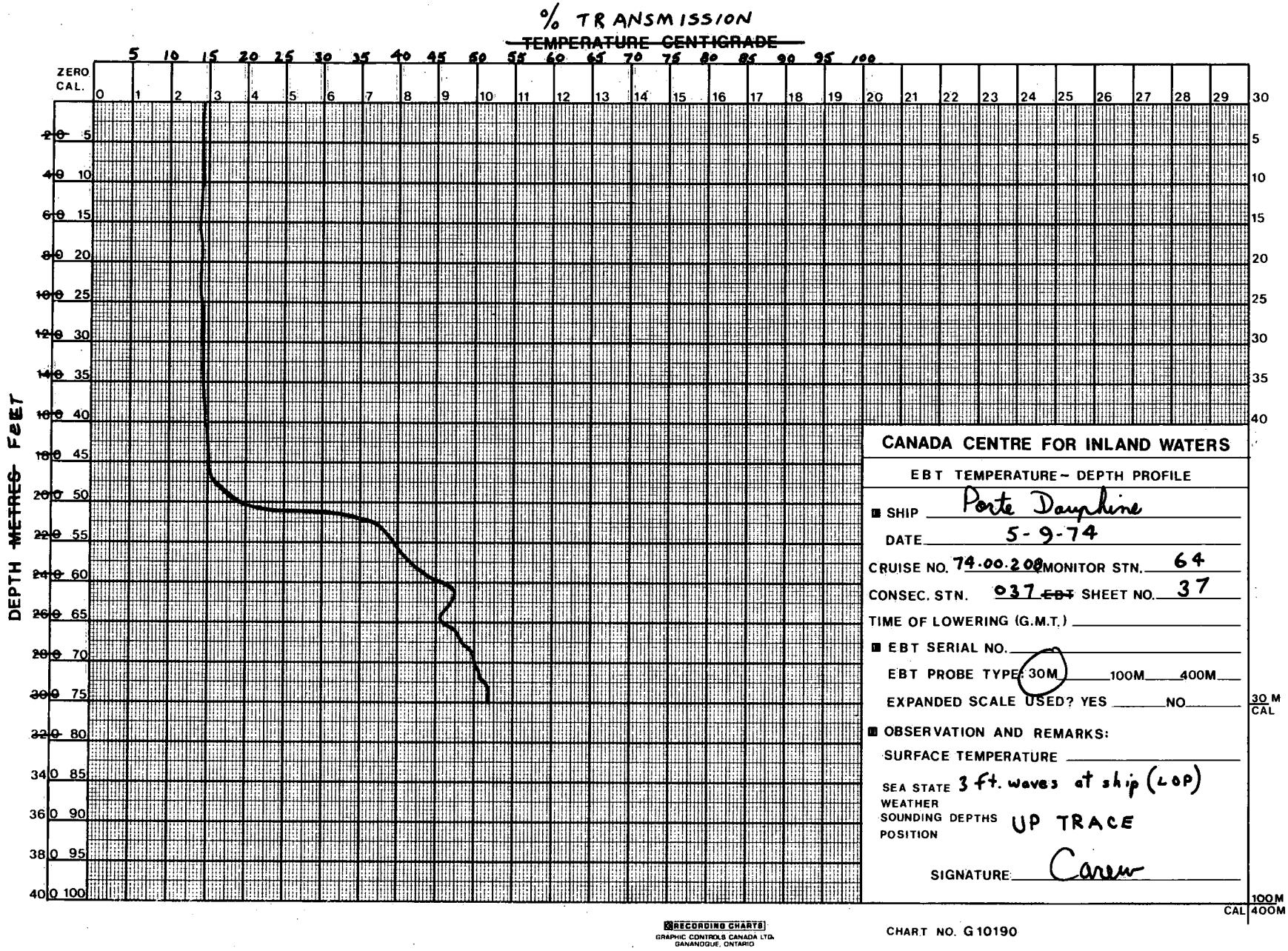
CCIW 1974

DECK LOG SHEET

VESSEL	REMARKS
PORTE DAUPHINE	Reversing Thermometers
CRUISE Nº 74-00-208	Oxygens drawn from Knudsens
MONITOR STN. Nº 64	P.O.C. + duplicate
CONSEC. STN. Nº 037	Chlorophyll a
TIME DATE (G.M.T.) 5-9-74	Total p
	YSI Probe
	OBSERVERS DS JC

NOM. DEPTH (M)	PARAMETER AND BOTTLE NUMBER D.O.	COND TURB	pH	ACC. DEPTH
76	32			
228	39			


TEMPERATURE CENTIGRADE
ZERO CAL.
0 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
DEPTH METRES
2 0 5
4 0 10
6 0 15
8 0 20
10 0 25
12 0 30
14 0 35
16 0 40
18 0 45
20 0 50
22 0 55
24 0 60
26 0 65
28 0 70
30 0 75
32 0 80
34 0 85
36 0 90
38 0 95
40 0 100
5 10 15 20 25 30 35 40 45 50
30M CAL
100M CAL 400M
CANADA CENTRE FOR INLAND WATERS
EBT TEMPERATURE – DEPTH PROFILE
SHIP Porte Dauphine
DATE 05·09·74
CRUISE NO. 74·00·208 MONITOR STN. 64
CONSEC. STN. 037 EBT SHEET NO. 537
TIME OF LOWERING (G.M.T.) 0446
EBT SERIAL NO. 34241
EBT PROBE TYPE: 30M 100M 400M
EXPANDED SCALE USED? YES NO.
OBSERVATIONS AND REMARKS:
SURFACE TEMPERATURE 19.4
SEA STATE
WEATHER
SOUNDING DEPTHS
POSITION
SIGNATURE D.S.
RECORDING CHARTS
GRAPHIC CONTROLS CANADA LTD
CAMBRIDGE, ONTARIO
CHART NO. G10189


% TRANSMISSION
~~TEMPERATURE CENTIGRADE~~
5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100
ZERO CAL.
0 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
~~DEPTH METRES~~ FEET
~~20~~ 5
~~40~~ 10
~~60~~ 15
~~80~~ 20
~~100~~ 25
~~120~~ 30
~~140~~ 35
~~160~~ 40
~~180~~ 45
~~200~~ 50
~~220~~ 55
~~240~~ 60
~~260~~ 65
~~280~~ 70
~~300~~ 75
~~320~~ 80
340 85
360 90
380 95
400 100
5
10
15
20
25
30
35
40
30 M CAL
100M CAL
400M
CANADA CENTRE FOR INLAND WATERS
EBT TEMPERATURE – DEPTH PROFILE
SHIP Porte Dauphine
DATE 5-9-74
CRUISE NO. 74.00.208 MONITOR STN. 64
CONSEC. STN. 037 ~~EBT~~ SHEET NO. 37
TIME OF LOWERING (G.M.T.)
EBT SERIAL NO.
EBT PROBE TYPE: 30M 100M 400M
EXPANDED SCALE USED? YES NO
OBSERVATION AND REMARKS:
SURFACE TEMPERATURE
SEA STATE 3 ft. waves at ship (LOP)
WEATHER
SOUNDING DEPTHS UP TRACE
POSITION
SIGNATURE Carew
RECORDING CHARTS
GRAPHIC CONTROLS CANADA LTD.
GANANOQUE, ONTARIO
CHART NO. G 10190

PORTE DAUPHINE
SURVEILLANCE
Ship

STAR FORMAT CODING SHEET

entered by SHIPS OFFICERS

Cruise no. 74.00.208

BRIDGE LOG

date 5.9.74 pg 5 of 10

	INST. (1–2)	CCIW cruise ref. no. (3–5)	consec. stn. no. (6–8)	country (9–10)	octant (11)	LAT. deg. min. sec. (12–17)	LONG. deg. min. sec. (18–24)	DATE (GMT) yr mo dy (30–35)	TIME OF EBT (GMT) (36–39)	SND DEPTH metres 1/10 (40–43)	no. of (levels) obs'd (44–45)	consc. bt trace no. (46–48)	mon. stn. no. α (49–52)	air temp. °C (53–55)	w.s. kt. (56–57)	rel. wind dir. ° (58–60)	ships head ° (61–63)	ON & OFF STN. TIME (GMT)	SHIPS COURSE	MILES steamed	REMARKS
	22			18	0			7													
	22			18	0			7											104		
ON	22	021	037	18	0	433130	0765542	740905	0446	2310	05	537	064	189	06	280	050	0445		12.4	
OFF	22		037	18	0	433124	0765536	740905					064					0517			
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													
	22			18	0			7													

verified by ______________ total miles steamed ______________

PORTE DAUPHINE SURVEILLANCE

CHLOROPHYLL DATA SHEET

CRUISE NUMBER 74-00-208

DATE	LOCAL TIME	STN. NO.	SAMPLE NO.	SAMPLE DEPTH	VOLUME	INITIAL	REMARKS
5-9-74	0042	64	53	0-20	1 litre	DS	

CANADA CENTRE FOR INLAND WATERS

TRANSMITTAL AND RECEIPT FORM

☐ COPY FOR SENDER'S FILE ☐ COPY FOR RECEIVER TO SIGN AND RETURN TO SENDER

TO (Postal Address)	FROM (Postal Address)
WES NAGEL DATA MANAGEMENT	D.J. WILLIAMS CCIW Ref. 74-22-021 Technical Operations SURVEILLANCE 74.00.208

MEANS OF TRANSMITTAL

☐ Ord. Mail ☐ Reg'd Mail ☐ Air Mail ☐ Express ☐ Gov't Truck ☑ By Hand ☐ Other (Specify)

RECEIVED BY (Signature)	DATE REC'D	SENT BY (Signature)	DATE SENT
E. THOMSON	12.9.74	D. J. WILLIAMS	12.9.74

ITEMS SENT

QUANTITY	DESCRIPTION
✓ 42	E B T SHEETS
✓ 43	M B T SLIDES
✓ 2	M B T DATA SUMMARY FORMS
✓ 85	TRANSMISSOMETER SHEETS
✓ 85	DECK LOG SHEETS AND COPY
✓ 10	BRIDGE LOG SHEETS
✓ 4	MET. OBSERVATION SHEETS
✓ 2	9 PT. BT DIGITIZATION SHEETS
✓ 18	MANUAL CHEMISTRY SHEETS
✓ 2	OXYGEN STANDARDIZATION SHEETS
	~~ROLL SOLAR RADIATION RECORD~~
✓ 1	TRACK PLOT

P.O.C., TPN and chlorophyll a results to follow.

DJW.

07 OCT 7]

TOTAL P

STATION	BOTTLE #	SAMPLE #	DEPTH
64	64	91	0-20
	253	92	76
	112	93	228

Hydro Form No. 23

PARTICULATE ORGANIC CARBON CRUISE: 74.00.208

DATE	TIME (Z)	STN. NO.	DEPTH	VOLUME FILTERED	DEPTH	INITIALS	REMARKS
5-9-74	0442	64	231	500 mls	0-20	DS	
"	0442	64	231	"	0-20	DS	Duplicate

PORTE DAUPHINE
SURVEILLANCE

CANADA CENTRE FOR INLAND WATERS
DEPARTMENT OF ENVIRONMENT
WATER QUALITY DIVISION
MANUAL LAB RESULTS

PORTE DAUPHINE SURVEILLANCE

LOCAL CRUISE NO. 74-00-208
CCIW CRUISE REF. NO. [1 2 3 4 5] 2 2 0 2 1

DATE 5-9-74
VESSEL Porte Dauphine
PAGE 9 OF 18

MON. STN. NO.	CONS. STN. NO. [6 7 8]	DEPTH [9 10 11] 001 [12-16]	TEMP. [17 18 19] 104 [20-24]	DISSOLVED OXYGEN bottle no.	DISSOLVED OXYGEN factor and analysts initials		DISSOLVED OXYGEN ml. of thio-sulphate	DISSOLVED OXYGEN [25 26 27] 245 [28-32]	% O_2 SAT. [33 34 35] 247 [36-40]	pH in SITU (temp) bottle no.	pH [41 42 43] 213 [44-48]	pH [49 50 51] 218 [52-56]	SPECIFIC CONDUCTANCE 25 °C bottle no.	micro-mhos	temp. °C	[57 58 59] 160 [60-64]	cell factor(s) analysts initials	TURBIDITY J.T. std.	range	[65 66 67] 123 [68-72]	T % [73 74 75] 124 [76-80]
64	037	11.0																			14
		76.0	4.05	32	4.87	3C	7.82	12.93	099												
		228.0	3.74	39	4.87	3C	7.25	12.00	091												

PORTE DAUPHINE
SURVEILLANCE

CRUISE # 74.00.208

STATION	WINKLER METHOD			Y S I PROBE		
	EBT T°C	PPM	% SAT	PROBE T°C	PPM	% SAT
64	4.05	12.93	99	8.5	12.5	108
64	3.74	12.00	91	8.0	11.6	99

9 Pt. Bt. Digitization

Entered by .....
Date Entered .....

Page 2 of 2
Cruise 74-00-208

SURVEILLANCE STATION USE ONLY

	Stn. No	Year	Month	Day	Hour (tenths)	Lat.	Long.	Bt Sfc Temp. t_1	Depth Temperature pairs (corrected) t_2 z_2	t_3 z_3	t_4 z_4	t_5 z_5	t_6 z_6	t_7 z_7	t_8 z_8	t_9 z_9	Corrected Stn. Depth	Indicies of Thermocline n_1 n_2	Bt Shape Codes k ka
	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	32 33 34 35 36 37	38 39 40 41 42 43	44 45 46 47 48 49	50 51 52 53 54 55	56 57 58 59 60 61	62 63 64 65 66 67	68 69 70 71 72 73	74 75 76	77 78	79 80
64	537	74	09	05	04	71	43315	765	572	200	200	017	010	023	056	028	048	040	042	058	040	038	154	037	231	231	12	72

NAME OF VESSEL PORTE DAUPHINE CAPTAIN B. J. DERRY PRINCIPAL OBSERVING OFFICER M. MAWHINNEY

YEAR 19 74

Month (G.M.T.)	Day of Month (G.M.T.)	Message Identifier	Latitude (Degrees and Tenths)	Quadrant of Globe	Longitude (Degrees and Tenths, Hundreds (0 or 1) Included.)	Day of Month (G.M.T.)	Time of Observation Nearest hour 00-23 (G.M.T.)	Wind Indicator (0-4)	Ship's Course at time of Obs. * (°True)	Ship speed * ☐ mph. ☑ kts.	Apparent Wind Direction Relative to Ship * (010°-360°)	Apparent Wind Speed * ☐ mph ☑ kts.	Total Cloud Amount (0-9)	Wind True Direction (00-36)	Wind True Speed (Knots)	Visibility (Coded 90-99)	Weather Present (Coded 00-99)	Weather Past (0-9)	Pressure Barometer as Read	Corrections	Sea Level Pressure Millibars and Tenths 09 or 10	Sea Level Pressure	Temperature Dry Bulb °C	Temperature Wet Bulb °C	Amt. of C_L (or C_M) Cloud	Type of Low Cloud	Height of Lowest Cloud	Type of Middle Cloud	Type of High Cloud	Ship's Course Made Good (3 Hrs.)	Ship's Av. Speed - Past 3 Hrs.	† 3-Hr Pressure Change Characteristic (0-8)	† 3-Hr Pressure Change Amount (Mbs. & Tenths)	‡ Significant Cloud Group(s) Group Indicator	Amount (Coded 1-9)	Type (Coded 0-9)	Height (Coded 00-89)
		Group 1: 99	$L_aL_aL_a$	Group 2: Q_c	$L_oL_oL_oL_o$	Group 3: YY	GG	i_w	These columns to be completed ONLY when wind is measured by means of an anemometer.				Group 4: N	dd	ff	Group 5: VV	ww	W				Group 6: PPP	TT		Group 7: N_h	C_L	h	C_M	C_H	Group 8: D_s	v_s	a	pp	Group 9: 8	N_s	C	h_sh_s
SEP	05	99					0·0																											8			
	05	99					0·6																											8			
	05	99	434	7	0769	05	06	4	160	09	350	05	3	35	04	98	03	0	1015.2	0.0 / 9.7	10	249	18.0 / 18	12.8	3	6	4	0	0	1	1	2	14	8			
		99					1·8																											8			
		99					0·0																											8			
		99					0·6																											8			
		99					1·2																											8			
		99					1·8																											8			
		99					0·0																											8			
		99					0·6																											8			
		99					1·2																											8			
		99					1·8																											8			
		99					0·0																											8			
		99					0·6																											8			
		99					1·2																											8			
		99					1·8																											8			
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	32	33	34	35	36	37	38

Supplementary Ships report only the data in columns indicated by this hatching

Shaded columns indicate data which do not form part of the transmitted weather message.

*Data in columns 10 to 13 required only from ships equipped with an anemometer.

† Provision is made in columns 31 to 34 for entering the extra group 99ppp when the 3-hour pressure change is 9.9mbs. or more.

‡ The groups $8N_sCh_sh_s$ and $1T_wT_wT_wt_T$ are optional for Selected Ships, but mandatory for Ocean Weather Ships.

VOYAGE FROM BURLINGTON TO LAKE ONTARIO

Height of barometer above sea level: 245 + 20 = 265 ft.

Method of taking sea temps.: ☑ Rubber Bucket ☐ Cond. Intake Other ______

SPECIAL PHENOMENA**			SEA TEMPERATURE								ICE ACCRETION				WAVES						ICE						REMARKS			
Group Indicator	General	Detail	Actual Temperature of sea water °C	Difference Dry Bulb minus sea temperature °C	Group Indicator	AIR-SEA TEMP. DIFF. IN HALF DEGREES CELSIUS (Coded)	DEW POINT TEMP. °C	Group Indicator	SEA TEMPERATURE Degrees and Tenths °C	Tenths Figure Of Air Temperature	Group Indicator	Cause of Ice Acc.	THICKNESS OF ICE ACC. (Cm.)	Rate of Ice Acc.	Group Indicator	SEA WAVES PERIOD Seconds	SEA WAVES MEAN MAX. HEIGHT (Coded)	SWELL WAVES DIRECTION FROM (°True 00-36)	SWELL WAVES PERIOD (Coded)	SWELL WAVES MEAN MAX. HEIGHT (Coded)	INDICATOR FOR ICE GROUP	Kind of Ice	Effect on Navigation	Bearing of Ice Limit	Distance from Ship	Orientation of Ice Edge	Enter times of beginning and ending of precipitation of any kind, fog (visibility less than 1100 yds.), and thunder: and times of windshifts. Enter details of special or unusual phenomena in the space provided at the end of the logbook.	Address to which sent, if transmitted by radio	Call sign of station to which sent, and time sent; G.M.T.	Initials of officer who made observation
GROUP 10					GROUP 11			GROUP 12			GROUP 13				GROUP 14			GROUP 15			ICE GROUP									
9	S_pS_p	s_ps_p			0	T_sT_s	T_dT_d	1	$T_wT_wT_w$	t_T	2	I_s	E_sE_s	R_s	3	P_wP_w	H_wH_w	d_wd_w	P_w	H_wH_w	ICE	c_2	K	D_i	r	e				
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9			19.4		0	//	09	1	194	0	2				3	03	01				ICE							METEO MALTON	VBH 0550	JC
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
9 9					0			1			2				3						ICE									
39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69

** For use by Ocean Weather Ships only.

If, for any reason, an observation is not to be transmitted, it should nevertheless be taken and logged, as it is required for climatological purposes. If one or more consecutive observations are not taken, leave the appropriate number of lines blank, up to a maximum of eight. Start a new page at the beginning of each month, and a new logbook at the beginning of each year.

1015.2
9.7
1024.9

METEOROLOGICAL BRANCH - DEPARTMENT OF TRANSPORT - CANADA

Form 63-9452
(Rev. 1967)

OBSERVING SHIPS' CODED WEATHER REPORT BY RADIO

PREFIX	OFFICE OF ORIGIN	NUMBER	NUMBER OF WORDS	DATE FILED	TIME FILED

SENT TO	FREQUENCY	DATE SENT	TIME SENT	TRANSMITTED BY

TO

NOTICE TO RADIO OFFICER:

(1) The printed symbols above each group space are for guidance only and are not to be transmitted.
(2) The message is to be transmitted in a continuous sequence of groups, in the order written.

$99L_aL_aL_a$	$Q_cL_aL_aL_aL_a$	YYGG i_w	Nddff	VVwwW	PPPTT	$N_hC_Lh_sC_MC_H$
99434	70769	05064	33504	98030	24918	36400
D_sv_sapp	99ppp	$8N_sC_sh_s$	$8N_sC_sh_s$	$8N_sC_sh_s$	$9S_pS_ps^ts_p$	$9S_pS_ps^ts_p$
11214						
$0T_sT_sT_dT_d$	$1T_wT_wT_wt_T$	$2I_sE_sE_sR_s$	$3P_wP_wH_wH_w$	$d_wd_wP_wH_wH_w$	$d_wd_wP_wH_wH_w$	ICE c_2KD_ire
0//09	11940		30301			ICE

No Government Administration, or company or person employed in the forwarding and delivery of this message shall be liable for any loss or damage arising from failure to transmit or to deliver the said message or from any neglect, delay, error or omission in the transmission thereof.

Signature of Master, or Officer deputed by Master _____

PROCES VERBAL

STATION PORTE DAUPHINE

TIME	REMARKS	INITIALS
0550 Z	05-09-74. Obs. Meteo Malton VBH Ch.26	JC

a

OFFICIAL RADIO LOG

FOR SHIP STATIONS

(Radiotelegraph)

PART II

NAME OF SHIP	OFFICIAL NUMBER AND INTERNATIONAL CALL SIGN	PORT OF REGISTRY	GROSS TONNAGE

Serial Number..... From..... To.....

NAME OF OPERATING COMPANY.....

Issued by

THE DEPARTMENT OF TRANSPORT

Telecommunications Branch

b

STATISTICS SUMMARY

Cruise No. 74-00-208 Consec. No. 74-22-021 Ship PORTE DAUPHINE

Dates From September 3 to September 6 Lake ONTARIO

Cruise Type Surveillance Miles Steamed 612.8

Description	Total	Description	Total
Secchi	41	Moorings Established (CM)	
Stations Occupied	85	Moorings Retrieved (CM)	
Bathythermograph Casts	43	Moorings Established (Met.)	
E.B.T. Casts	42	Moorings Retrieved (Met.)	
Transmissometer Casts	85	Moorings Established ( )	
Reversing Thermometer Obs.	24	Moorings Retrieved ( )	
Water Samples Collected (Chemistry)	199	Moorings Serviced (CM)	
Water Samples Collected (Microbiology)		Moorings Serviced (Met.)	
Water Samples Collected (Biolimnology)	95	Moorings Serviced ( )	
Water Samples Collected (P.O.C.)	49	Cores Taken (Gravity)	
Water Samples Collected (TOTAL P)	199	Cores Taken (Piston)	
Water Samples Collected ( )		Grab Samples Taken	
Water Samples Collected ( )		Drogues Tracked	
Water Samples Filtered (Chlorophyll)	106	Dye Releases	
Water Samples Treated (Phytoplankton)			
Zooplankton Hauls		Observations (Weather)	26
Zooplankton Hauls (Mysis)		Observations ( )	
Primary Productivity Moorings			
Bottom Samples (Fauna)		Continuous Observations (Days)	
Integrator (10m)		Air Temperature	
Integrator (20m)	95	Relative Humidity	
Total Number of Depths Sampled		Water Temperature (In-Hull)	
Total Number of Water Samples Collected		Water Temperature (Towed)	
		Integrated Printout	
ONBOARD ANALYSIS		Solar Radiation	11
Geolimnology		Long Wave (IR) Radiation	
Manual Chemistry (Tech. Ops.)	199		
Nutrients (W.Q.D.)			
Microbiology			

REMARKS

Date Due

BRODART, INC. Cat. No. 23 233 Printed in U.S.A.