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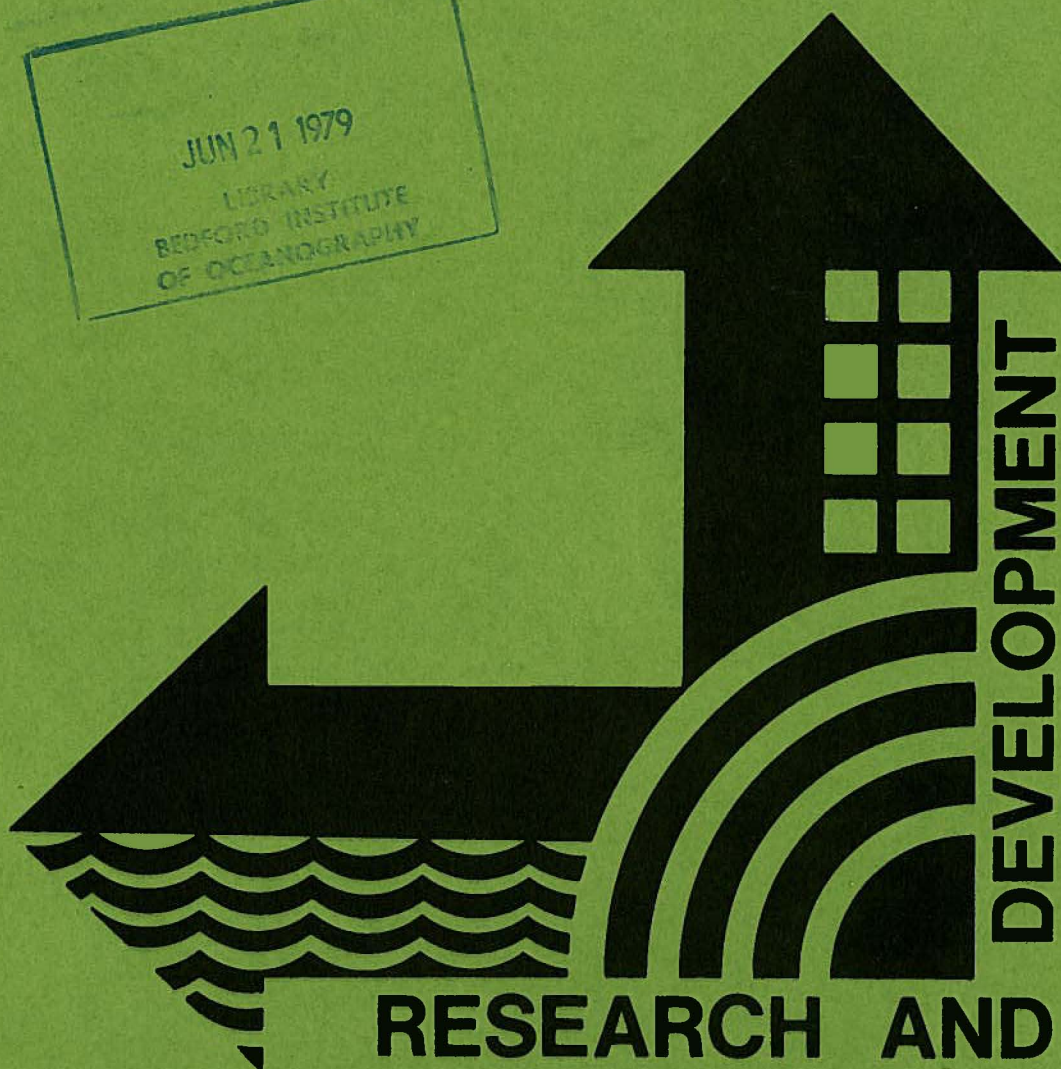
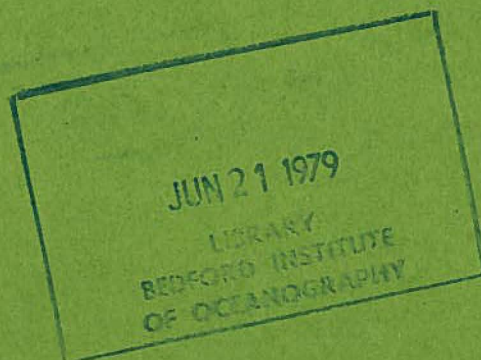


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# ARCTIC OCEANOGRAPHIC SURVEY

1978

S.J. PRINSENBERG, D.J. BROOKS



*/ Canada* OCEAN AND AQUATIC SCIENCES  
CENTRAL REGION

CANADA CENTRE FOR INLAND WATERS  
BURLINGTON, ONTARIO

## ARCTIC OCEANOGRAPHIC SURVEY 1978

by

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and

D.J. Brooks

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The authors would like to thank Mr. S. Peck for the scientific planning of the project; Messrs. S. Baird and F. Deys for the hardware and software development of the CTD system; Captain W. Corkum (O&AS) for providing the project with a boatswain during the retrieval of the current meters; and Mr. B. Thorson and Mrs. C. Kennedy for the cartographic and editorial work of the report.

## OVERVIEW

The 1978 Arctic Oceanographic Survey investigated the vertical and horizontal salinity and temperature distribution of the area surrounding the Barrow Sill. The CTD Survey covered that part of the North West Passage between the eastern side of Melville Island ( $105^{\circ}$  W longitude) and the center of Cornwallis Island ( $94^{\circ}$  W longitude) (Figure 1). The main emphasis was placed on the four channels of the Barrow Sill area where repeated CTD transects were obtained. The centers of the four channels were also the locations at which 13-hour CTD data and surface (2m) and mid-depth (50m) current meter data were obtained. In addition, surface current meter data were obtained from each side of Keene Bank (south end of Austin Channel), and surface and mid-depth data were obtained from upstream of Keene Bank in support of the ARCTEC project. The current meter length varied from 4 to 5 weeks.

The survey was carried out from the Polar Continental Shelf Project base camp in Resolute Bay and used their helicopter support for the CTD program and their fixed-wing support for the current meter and 13-hour CTD station work.

The CTD data will be used to compute the relative vertical geostrophic currents of the four channels and to investigate the exchange properties of the Arctic and Atlantic surface waters. The time-series data will be subjected to harmonic and power spectral analysis in order to study the decomposition and causes of the total currents. The mean currents will be used in conjunction with the relative geostrophic currents obtained from the CTD data. The final analyzed data will be used in a general circulation model of the high Arctic as well as in the M.O.T.-sponsored studies relating to the shipping of fossil fuels from the Arctic by means of tankers.

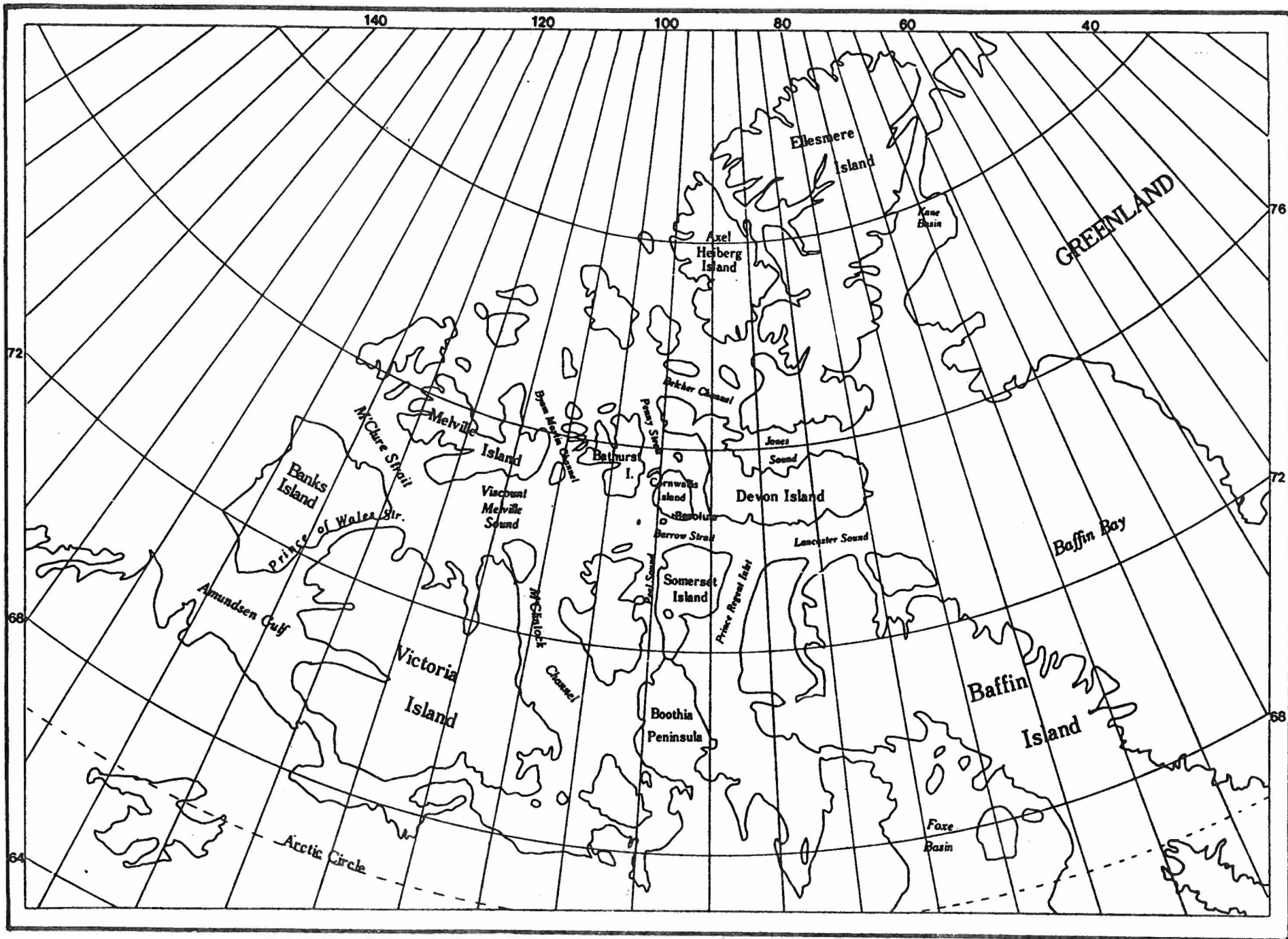


Figure 1: The Canadian Arctic

PERSONNEL

S.J. PRINSENBURG	Scientist-In-Charge	March 20 - April 18
D.J. BROOKS	O.I.C., Ocean Operations	March 3 - March 20 April 20 - April 29
D. ROBERTSON	Ocean Instrumentation	March 3 - April 18
G. ROGERS	Ocean Operations	March 3 - April 18
C. CROTHERS	Instrumentation Technician	March 14 - March 24
G. HERRIOT	Instrumentation Technician	March 14 - March 24
J. McCOMISKEY	Ocean Operations	April 20 - April 29
R. MARTIN	Boatswain	April 20 - April 29
R. BRADING	Helicopter Pilot	March 20 - March 23
J. LESAGE	Helicopter Pilot	March 25 - April 15



## EQUIPMENT

### Aircraft

- 1) Bell 206B Jet Ranger (Okanagan Helicopters Ltd.) equipped with Decca Receiver; and
- 2) de Havilland DHC-6 Twin Otter (Bradley Air Service).

### Instrumentation

- 1) Two (2) Guildline Mark IV CTD Probe and Deck Units c/w TEAC PC-10 cassette tape recorders;
- 2) Two (2) lightweight, portable winches c/w sliprings;
- 3) Fourteen (14) Aanderaa RCM-4 current meters c/w surface-referenced mooring equipment;
- 4) Two (2) Applied Microsystems tide gauges;
- 5) Hewlett-Packard data reduction system c/w 9825 programmable calculator, printer, and plotter;
- 6) Five (5) Jiffy ice augers (9");
- 7) Two (2) Cell Arctic tents; and
- 8) Prototype of next Guildline CTD probe and deck unit.

### CHRONOLOGY OF EVENTS

March 3 - Arrive at Resolute  
March 4 - 7 - Setting up equipment  
March 8 - 9 - Starting of current meters  
March 10 - 15 - Deployment of 14 current meters and 2 tide gauges  
March 16 - 19 - Testing of CTD system at ice station  
March 20 - Commence CTD sampling  
March 21 - CTD sampling  
March 22 - Helicopter grounded, no radio  
March 23 - Helicopter fuel pump problem, CTD sampling 1/4 day  
March 24 - Grounded by weather  
March 25 - CTD sampling  
March 26 - 13-hour station #838, equipment problems  
March 27 - 13-hour station #838 completed  
March 28 - Moved equipment to station #835, sampling stopped  
after 4 hours  
March 29 - Equipment maintenance  
March 30 - 31 - CTD sampling  
April 1 - 13-hour station #835 completed  
April 2 - Grounded by weather and maintenance  
April 3 - CTD sampling  
April 4 - 13-hour station #845, stopped after 5 profiles  
April 5 - 13-hour station #845 completed  
April 6 - 7 - CTD sampling  
April 8 - Grounded by weather  
April 9 - CTD sampling, place ice station out  
April 10 - 13-hour station #842 completed  
April 11 - CTD sampling  
April 12 - Grounded by weather  
April 13 - Recover current meters (2) at station #828  
April 14 - 15 - CTD sampling

April 16 - 17 - Packing of CTD equipment  
April 22 - Commence current meter and tide gauge retrieval  
April 23 - Current meter retrievals  
April 24 - Unable to retrieve tide gauge  
April 25 - No flying (weather down) - equipment packing  
April 26 - Current meter retrieval  
April 27 - Additional attempts at tide gauge retrieval  
unsuccessful  
April 28 - Return to Burlington

## PROGRAM FIELD OPERATIONS

The 1978 winter field program consisted of two parts:

- 1) the deployment and retrieval of 14 Aanderaa current meters and 2 Applied Microsystems tide gauges; and
- 2) CTD oceanographic sampling including four 13-hour CTD stations.

The total survey was completed during an eight-week period and lasted from March 3rd to April 29th. During the CTD portion of the survey, all incoming data was processed at the base camp.

### Part 1: Moorings

The 14 current meters and 2 tide gauges were used to obtain current and tidal height time-series data at 10-minute time intervals. The location of the instrument arrays are shown in Figure 2, and the data on the summary of the Launching and Retrieval logs (included in the Appendix) are shown in Table 1. The operational techniques of the deployment and retrieval of the instruments were as follows:

#### a) Deployment

The average ice thickness encountered was two (2) metres. A single nine-inch (9") hole was drilled using a Jiffy ice auger and ten-foot (10') sections of 1½" aluminum pipe were connected to the required depth (2 or 50 metres). The aluminum pipe was previously drilled at each end so that all connecting bolts would line up, thus permitting the current meter to be oriented with true north as established by the Twin Otter gyro compass.

The two tide gauges were installed, again using a nine-inch ice hole. A lead weight was used as an anchor and a cylindrical sub-surface buoy, 8" in diameter, was used to hold the instrument upright. For retrieval purposes, a line was attached to the surface from the sub-surface buoy up through a piece of aluminum pipe frozen in the ice hole.



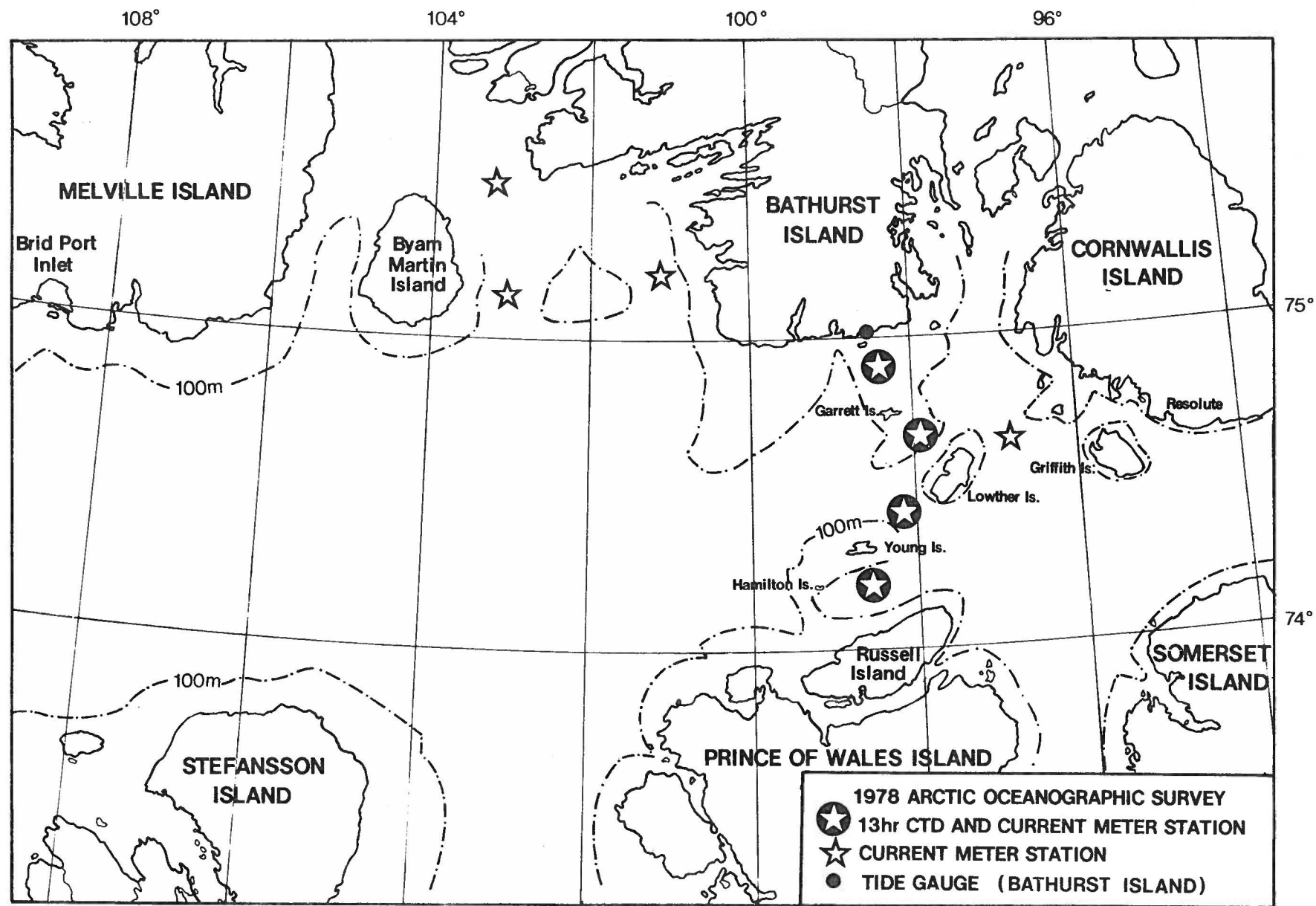


Figure 2: Location of Instrument Arrays

b) Retrieval

In order to retrieve the moorings, a pipe clamp was designed to grip the pipe in the lifting direction. An ice hole was drilled along the length of the pipe, and the mooring was centered in the hole. A tripod, complete with hand winch and block, was placed over the hole. The special pipe clamp connected to the winch was placed on the pipe and dropped to the lower connection. Each section of pipe was retrieved and disconnected in this manner until the instrument was recovered. This method proved very successful and made retrieval very easy. The tripod was also used to retrieve the tide gauge by taking the surface wire and hooking it through the block to the winch. The sub-surface buoy and instruments were then winched out of the hole with very little effort.

TABLE 1: Current Meters and Tide Gauges Summary

Station Number	Location		Depth (m)		Time (day-mth)		Recording Time(days)
	Lat.	Long.	Instr.	Bottom	Launching	Retrieval	
828	74 40.3	96 43.8	2	210	10-3	13-4	34
828	74 40.3	96 43.8	50	210	10-3	13-4	34
845	74 10.0	98 34.0	2	126	11-3	23-4	43
845	74 10.0	98 34.0	50	126	11-3	23-4	43
842	74 26.7	98 06.4	2	137	11-3	23-4	43
842	74 26.7	98 06.4	50	137	11-3	23-4	43
835	74 52.8	98 17.0	2	92	11-3	22-4	42
835	74 52.8	98 17.0	50	92	11-3	22-4	42
838	74 38.3	97 58.2	2	88	13-3	22-4	40
838	74 38.3	97 58.2	50	88	13-3	22-4	40
882	75 27.3	103 05.4	2	-	15-3	26-4	42
882	75 27.3	103 05.4	50	-	15-3	26-4	42
895	75 07.4	102 95.6	2	147	15-3	27-4	43
892	75 11.1	101 06.7	2	155	15-3	26-4	42
B.Bay	74 59.3	98 25.6	28	30	13-3	24-4	42
M.Is1.	74 11.9	99 10.0	8	10	13-3	-	-

## Part 2: CTD Survey

The CTD survey collected salinity (conductivity) and temperature profiles using the Guildline Mark IV probe, deck unit, and portable winch. The data collection program was designed to obtain a horizontal and vertical description of the salinity and temperature distribution to check on the horizontal mass transport of the Atlantic and Arctic surface water masses. The 13-hour station CTD work occupied stations located on the actual Barrow Strait sill and provides data on the time variation in the salinity and temperature field at the most active location of the area. Following are the operational techniques used in the CTD survey.

### a) Regional CTD Sampling

The CTD work consisted of obtaining CTD profiles at the stations shown in Figure 3. The stations on the Barrow Sill were repeated so that tidal variations could be averaged out. A total of 96 successful station locations were occupied, while at 4 locations the ice was too thick to complete the station.

Station work consisted of the following steps. The station was located using the helicopter Decca navigation system and a suitable landing spot was found in the area. Usually a fresh frozen lead or floe was chosen through which less ice would have to be drilled. Next, the 9" Jiffy auger was used to drill a hole through the ice, and the winch and probe were installed in place. Several up-and-down motions of the probe in the ice hole are required to properly flush the conductivity sensor. This was done in a manner that would least disturb the water structure of the surface layer. The deck unit was then switched on and the readings displaying depth, conductivity ratio, and temperature were checked. When they were in their expected value ranges, the probe was lowered while the cassette recorded the data sent up from the probe. Upon completion of the cast, the quality of the recorded data was displayed and checked on the deck unit before the probe was brought back up to the surface. Profiling on the way up can be done if the profiled data taken on the way down appears to be questionable. Several pictures in the Appendix show the operation procedure of the CTD profiling work. The Appendix also lists the station locations, times, and depths of the profile, bottom, and ice.

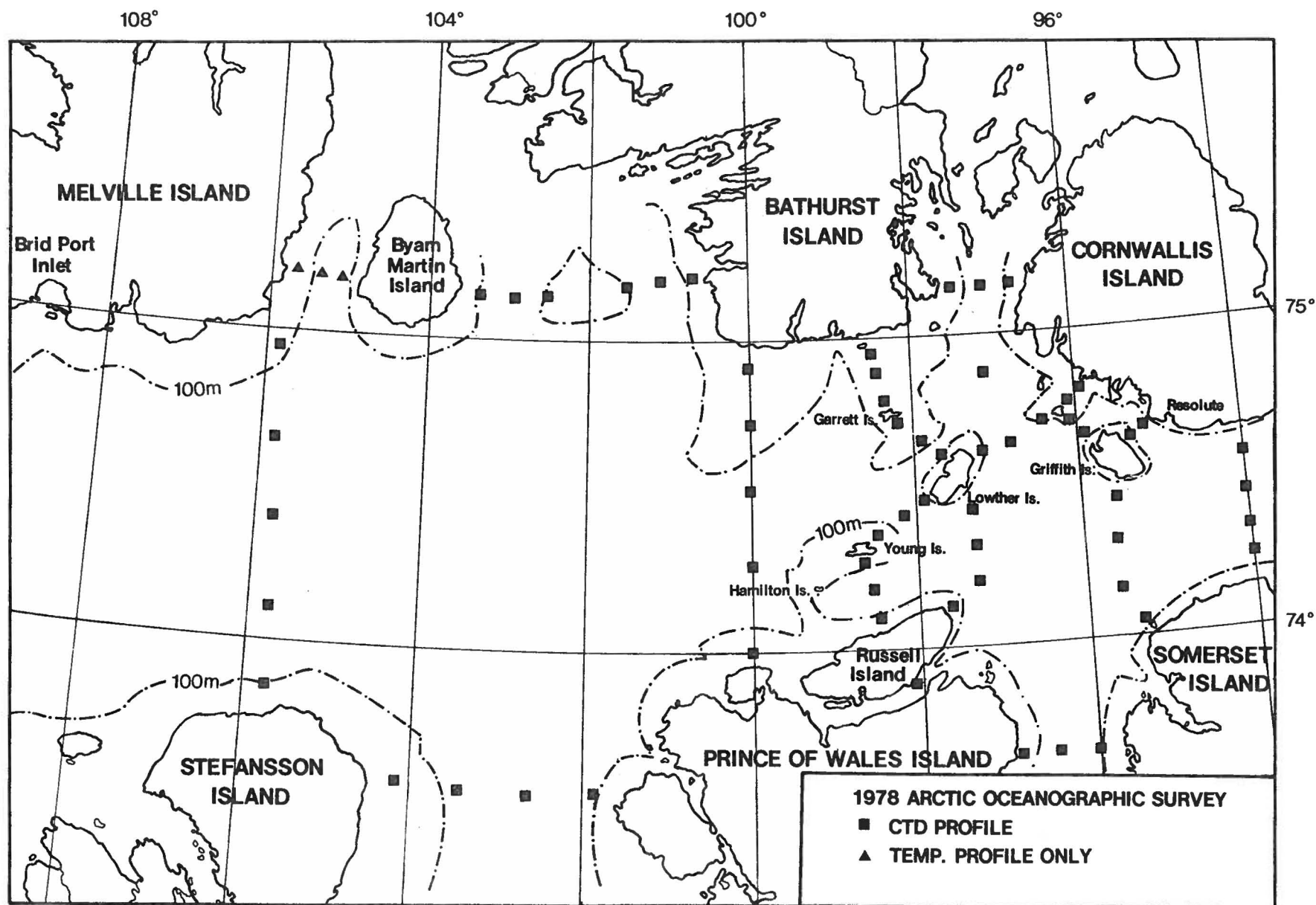


Figure 3: Location of CTD Stations



b) 13-Hour CTD Sampling

The 13-hour station work consisted of establishing an ice station camp at the required location and obtaining CTD profile data at one-hour intervals over a period of 13 hours. The Twin Otter was used to transfer the ice camp equipment which consisted of two Cell Arctic tents (connected by a tarp), heating and cooking stoves, cots, sleeping bags, food, and cooking utensils. The CTD equipment (similar to that of the helicopter CTD operations) and personnel were also brought out by Twin Otter. Later, as more daylight hours became available, they were ferried out by the helicopter the morning after the Twin Otter established the ice camp. After the camp was set up, CTD profiling commenced and lasted for the next 13 hours. For the first ice stations, the final profile was usually taken sometime in the late evening, and it was then too late to move the camp. Due to the severe low temperatures and long exposure while the camp was set up, the instruments did not operate as well as during the later ice stations. At these ice stations, the first two profiles were taken out of the helicopter while the tents were being heated. This meant profiling could start right away and, with the extra daylight in the latter part of the survey, enough light was available to pick up the whole camp in the early evening after the 13-hour sampling period was completed. Table 2 summarizes the location and time of the 13-hour stations, while Figure 2 is a map of the actual location of the stations.

TABLE 2: 13-Hour Station Summary

Station Number	Location (Deg.)		GMT (day/hr/min)		Number of Profiles
	Lat.	Long.	Start	Finish	
838	74 38.16	97 57.23	86 17 0	87 6 0	14
835	74 53.90	98 22.00	87 19 0	87 22 0	4
835	74 53.90	98 22.00	91 12 30	91 24 0	14
845	74 10.00	98 34.00	94 12 30	94 15 0	5
845	74 10.00	98 34.00	95 14 0	96 1 0	12
842	74 27.68	98 4.89	100 14 0	100 24 0	12

The CTD survey portion of the Arctic 1978 project took place from March 3rd to April 15th. During this 26-day period, 5 days were lost due to instrument breakdown and maintenance,  $3\frac{1}{2}$  days due to adverse weather conditions, and  $1\frac{3}{4}$  days for helicopter maintenance for a total of  $10\frac{1}{4}$  down days. A breakdown of the profiles obtained and down days encountered during the CTD survey is shown in Table 3.

TABLE 3: CTD Profiles and Down Days

Date	Number of Profiles		Ice Station Number	Down Days	
	Successful	Unsuccessful		Weather (W) Helicopter (H)	Instruments
20-3*	4	1			
21-3	9	-			
22-3	-	-		1, H	
23-3	2	-		3/4, H	
24-3	-	-		1, W	
25-3	9	1			
26-3	-	-	838		1
27-3	14	-	838		
28-3	4	-	835		1/2
29-3	-	-			1
30-3	5	-			1/4
31-3	8	-			
1-4	14	-	835		
2-4	-	-		1/2, W	1/2
3-4	9	-			
4-4	5	-	845		1/2
5-4	12	-	845		
6-4	10	-			
7-4	7	-			1/2
8-4	-	-		1, W	
9-4	6	-			1/4
10-4	12	-	842		
11-4	6	-			1/2
12-4				1, W	
14-4	9	2			
15-4	12	-			
26 days	157	4	4 13-hour stations	5 1/4 days	5 days

\* During 13th April, current meters at station #288 were recovered.

### IN-THE-FIELD DATA REDUCTION

The back-up Guildline deck unit and TEAC cassette tape recorder were used with the Hewlett-Packard 9825 calculator, printer, and plotter to reduce the CTD profile data. The data reduction system (see photograph in Appendix) was in daily operation in the sleeping quarters of the O.I.C. at the PCSP base camp. The O.I.C. was able to keep up with the amount of incoming data as he could process the same amount or more data daily as was obtained during a normal CTD field or 13-hour station day.

The data stored on the cassette tape was replayed through the deck unit and transmitted to the calculator. A set of programs was specially written (F. Deys) to filter and select a set of temperature and conductivity values at specified depths. The first program (Data Reduction) selects 45 sets of values at the first pass and an additional 5 sets of values at the second pass through a particular profile tape recording. After the first 45 sets of values are obtained, they are listed and plotted to provide the operator with a means to select (if necessary) the last 5 depth values at depths where large variations in the first 45 sets of data values appear. After the second pass through the profile tape recording is completed, pairs of data values can be deleted before the data are stored with the appropriate station header information on a HP tape. A second program (Edit) could then be run on the HP calculator. This program edits individual data values of the HP tape before final copies of the listing and plot are run. Examples of a final data listing and plot are shown in Table 4 and Figure 4, respectively.

In the field, the plots were run on graph paper using coloured pens which gave the operator an easier task of picking the extra 5 depth values and doing the individual editing. Most of the required editing involved the top or bottom values of the profile where sometimes contamination in the conductivity cell, due to ice (surface) or sediments (bottom), caused questionable values. A complete set of black and white plots was also run for the use of data publication (for example, see Figure 4).



TABLE 4: Final Data Listing

Station Number.....	845	3	47
GMT.....	2023	93/78	
Latitude.....	74	11.00	
Longitude.....	98	34.00	
Sounded Depth(m).....	128.5		
Ice Thickness(m).....	2.4		

	DEPTH	TEMP.	SAL.	SIGMA T
1	4.1	-1.727	31.530	25.383
2	5.1	-1.727	31.531	25.384
3	6.1	-1.728	31.533	25.386
4	7.1	-1.728	31.532	25.385
5	8.1	-1.728	31.535	25.387
6	9.1	-1.727	31.534	25.387
7	10.0	-1.727	31.535	25.388
8	11.1	-1.728	31.538	25.390
9	12.1	-1.727	31.537	25.389
10	13.0	-1.728	31.541	25.392
11	14.0	-1.728	31.543	25.394
12	15.1	-1.729	31.547	25.397
13	17.5	-1.728	31.549	25.399
14	20.1	-1.728	31.551	25.401
15	22.5	-1.728	31.552	25.402
16	25.0	-1.728	31.554	25.403
17	27.5	-1.717	31.622	25.458
18	30.1	-1.684	31.940	25.714
19	32.6	-1.674	32.035	25.792
20	35.1	-1.672	32.097	25.841
21	37.6	-1.658	32.228	25.947
22	40.1	-1.640	32.311	26.015
23	42.6	-1.643	32.336	26.035
24	45.0	-1.644	32.380	26.070
25	47.5	-1.635	32.494	26.163
26	50.1	-1.637	32.575	26.228
27	52.6	-1.642	32.641	26.282
28	55.6	-1.637	32.680	26.314
29	57.5	-1.634	32.724	26.349
30	60.1	-1.632	32.744	26.365
31	62.5	-1.646	32.794	26.406
32	65.0	-1.648	32.836	26.440
33	67.5	-1.653	32.867	26.465
34	70.0	-1.662	32.891	26.485
35	72.5	-1.652	32.910	26.500
36	75.1	-1.633	32.927	26.514
37	80.1	-1.609	32.995	26.568
38	85.1	-1.605	33.033	26.599
39	90.1	-1.602	33.040	26.604
40	95.1	-1.595	33.041	26.605
41	100.1	-1.596	33.045	26.608
42	105.0	-1.594	33.043	26.606
43	110.1	-1.598	33.048	26.611
44	115.1	-1.598	33.049	26.611
45	120.0	-1.599	33.051	26.613
46	125.1	-1.596	33.051	26.613

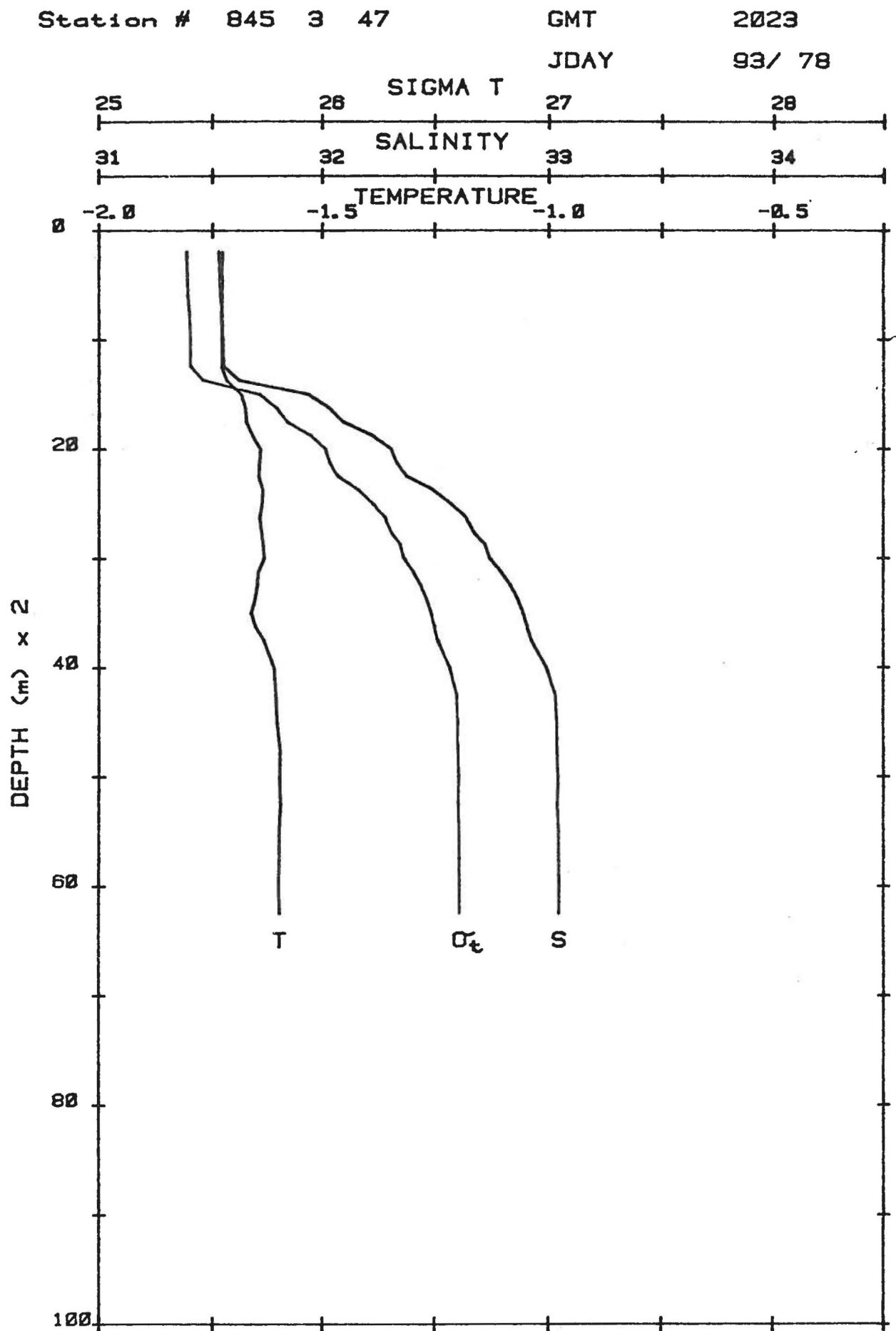


Figure 4: Salinity, Temperature, Sigma-t Profiles

## RECOMMENDATIONS

Although the 1978 Arctic survey was very successful and accomplished its main objectives, the following recommendations could help improve future Arctic surveys.

### 1) Logistics

Due to the variety of equipment (CTD, mooring, ice station) and the high demand for heated space, it is necessary to organize the instruments needed for distinct sections of the survey so that only those instruments that are needed are in the heated working space. Other instruments should be stored and their boxes should be distinctly marked as to whether they require heated or cold storage. Proper space and attention can then be given to each instrument before its use in the field. One individual should be responsible for the packing, shipping, and logistics in the field. This person should be made aware of these responsibilities during the time of refurbishment of the equipment.

### 2) Deployment and Retrieval of Current Meters

The makeshift tripod with power-boat trailer winch, used during the retrieval of the current meters and tide gauges, worked well and a similar set-up will be used in the future for both deployment and retrieval of instruments. Although this will make the deployment even simpler, it is still suggested that the poles are marked on both sides to minimize the possibility of a 180° orientation error of the current meter placement.

### 3) CTD System

Two carrying cases for the CTD deck units should be obtained for shipment as well as for in-the-field transportation between base camp and the ice station location.

### 4) 13-Hour Station

To solve the lack-of-heat problem encountered during the 1978 survey, larger space heaters (2) should either be purchased or requested from PCSP. Minor modifications and repairs to the ice tent are required. These include weighted flaps on the awning, second doors on the tents made out of sleeping bag material for day use (no zippers), and a rack or

hanger for the guns and CTD probe.

5) Augers

The auger manufacturers should be contacted to see if a stronger Jiffy-type auger is on the market. No second-year, used augers should be sent up to any survey except for use as spare parts.

6) Sounder

Obtain a commercially-produced sounder and investigate the possibility of incorporating a "spike" sounder developed by Hydrography for use with the CTD helicopter system.

7) Development

There is a need to develop a profiling current meter to be used at "13- to 25-hour" ice stations. It should use the existing CTD winch and as much of the CTD recording system as possible.

## EQUIPMENT EVALUATION

### 1) Bell 206B Jet Ranger Helicopter

Due to its limited payload, this helicopter restricts the Arctic surveys to the use of a single operator. If a stronger machine could be made available through PCSP, then a second operator could be used. This would speed up the station work as well as extend the length of the working day. Better advantage could thus be made of the longer daylight hours during the latter part of the Arctic spring.

### 2) CTD System

The CTD system operated well throughout the survey. When extra heat is made available, most of the 13-hour station problems, which were encountered this year, will not occur. The winches should be overhauled using new lock washers and lock nuts, and their sliprings and drums should be tested. The plugs of the CTD probe and winches should be changed to a two-prong Oceanic connector with the stainless steel housing presently used. The ice buildup inside this year's connectors could not be flushed out.

### 3) Augers

The augers worked well while they lasted. They appear to be on the light side, and a new type or a beefed-up Jiffy auger is required for future Arctic programs. For instrumentation deployment and retrieval, a two-man auger could be used.

### 4) Sounder

The small sounder, designed in-house, did not operate in its third consecutive year of trial, and its development should therefore be scrapped.

### 5) Data Handling

The programs written on such short notice did exactly what was required of them. They will now be slightly modified to incorporate some of the additional requirements which became apparent during field use.

### PRELIMINARY CTD RESULTS

The edited CTD data were used in the field to obtain an idea of the horizontal variation in the temperature and salinity fields. A small linear interpolation program was used to obtain the average parametric (temperature or salinity) values between two depths. The values were then contoured and are shown in Figures 5, 6, and 7. The surface layer salinity (0 to 10 metres) distribution of Figure 5 shows that salinity values are found to be lower in the southern part than those in the northern part of the survey area.

High salinity surface water ( $>33^{\circ}/\text{oo}$ ) enters the area between Bathurst and Cornwallis Islands. The salinity and temperature distributions at the 100-metre depth level are shown in Figures 6 and 7. The salinity distribution at 100 metres and surface are similar to the east of the Barrow Sill; both show higher salinity values to the north. An intrusion of relative low salinity water ( $<32.8^{\circ}/\text{oo}$ ) enters the area at the 100-metre depth between Prince of Wales and Somerset Islands and appears to turn eastward in Barrow Strait. In the western part of the survey area, a small westward decrease in salinity values appears rather than a north-south gradient as found in the surface layer. Only stations at the boundary of the western half of the survey area are available for contouring. The temperature distribution at the 100-metre depth level shows an intrusion of cold water from the north ( $<-1.75^{\circ}\text{C}$ ) between Bathurst and Cornwallis Islands and an intrusion of relatively warm water from the south ( $>-1.40^{\circ}\text{C}$ ) between Prince of Wales and Somerset Islands. The western part of the survey area does not show too much structure; somewhat colder water is found in the center of the area.

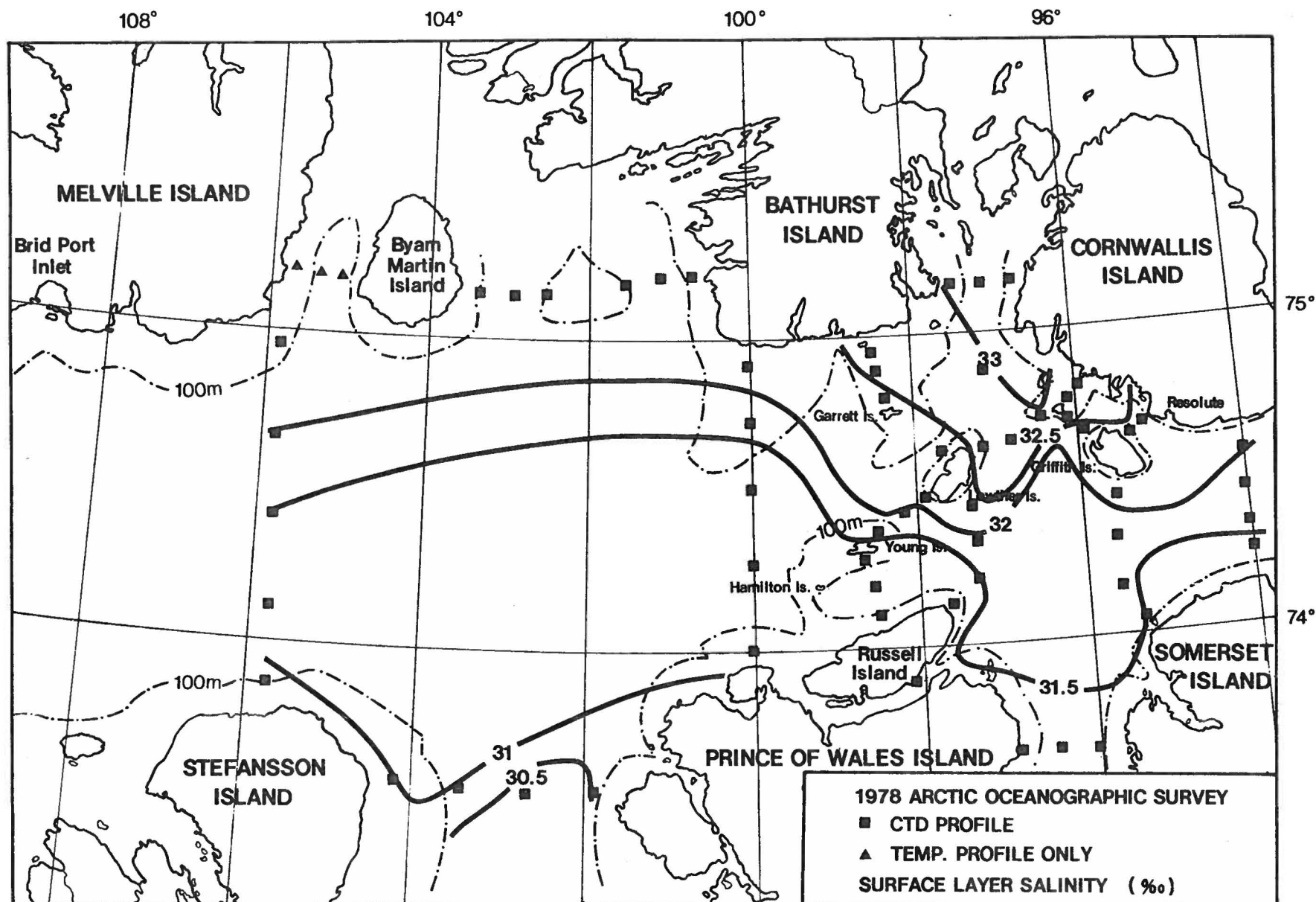


Figure 5: Surface Layer Salinity Distribution

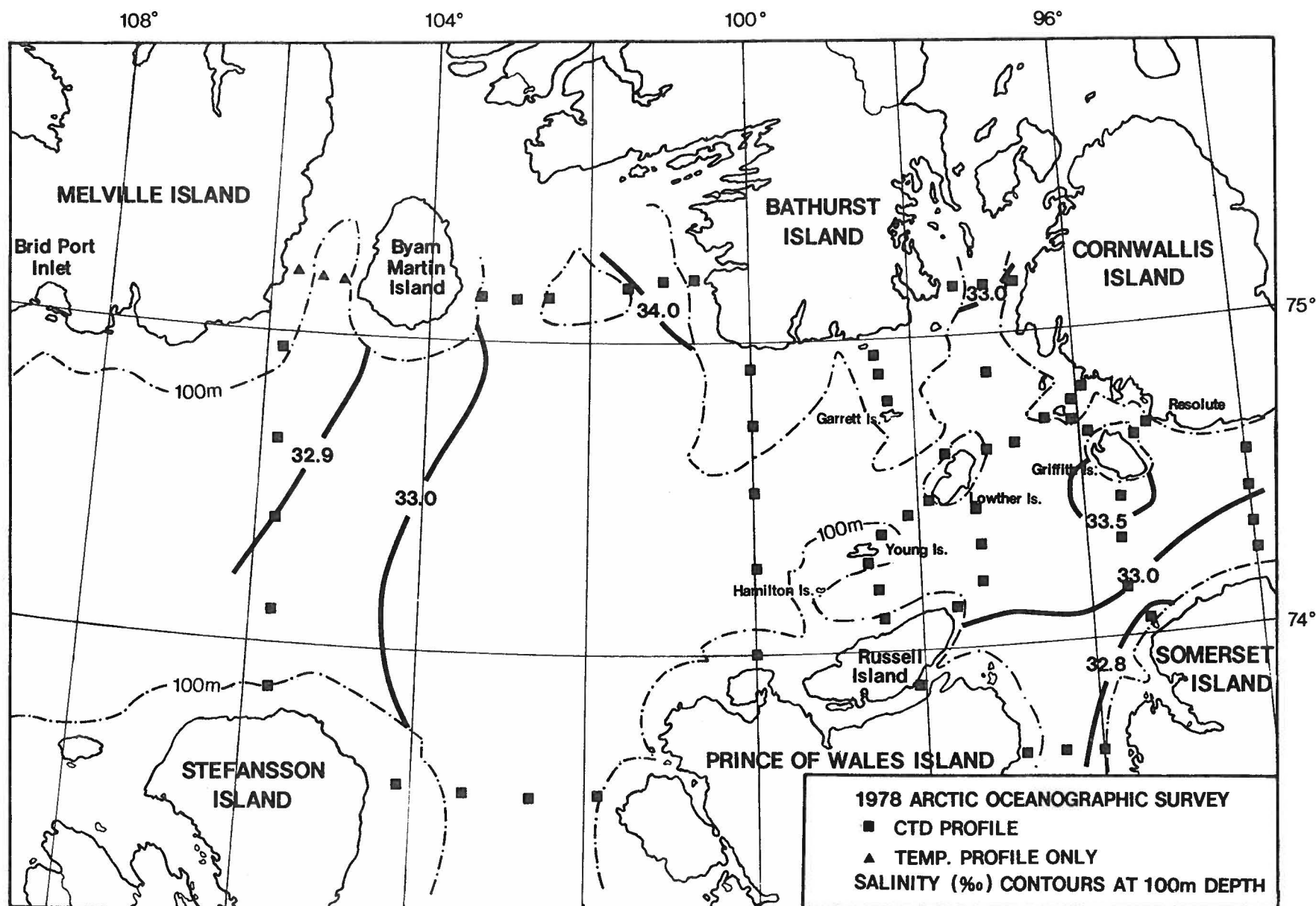


Figure 6: Salinity Distribution at 100-Metre Depth



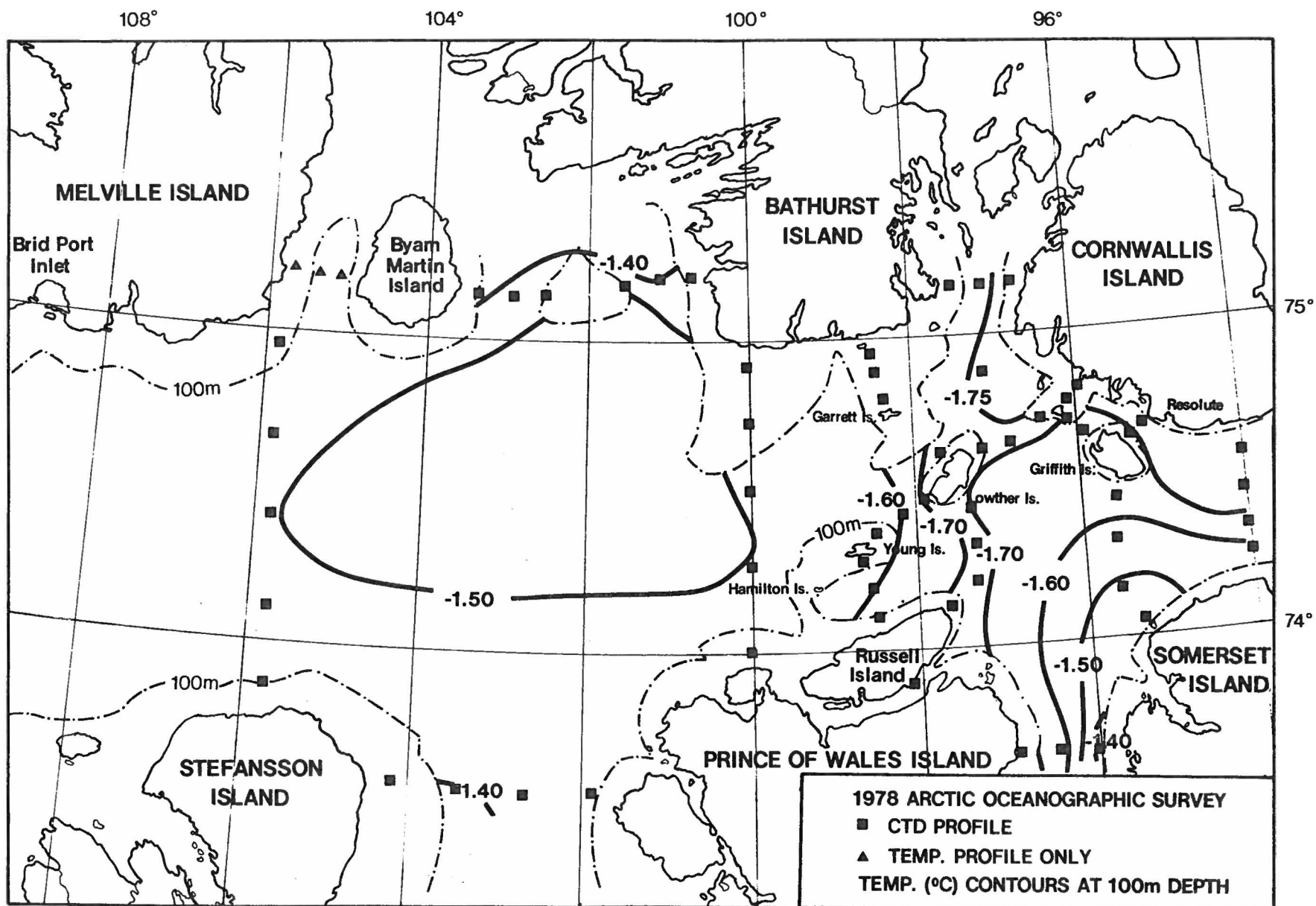


Figure 7: Temperature Distribution at 100-Metre Depth

## APPENDIX

The Appendix contains:

- 1) Listing of CTD stations;
- 2) Photographs; and
- 3) Deployment and Retrieval Log Sheets.

The CTD listings contain a Depth (m) column listing the bottom, ice, and obtained profile depths. A few stations show default values (999.9m in Bottom Depth and 3.5m in Ice Thickness) as the ice was too thick to drill through.

# LISTING OF STATIONS' INFORMATION AND LOCATION

STATION #	GMT			LATITUDE	LONGITUDE	DEPTH(m)		
	Day	Hr	Min			Bottom	Ice	STD
821	1	1	79 15 20	74 40.46	95 8.84	80.0	2.0	70.0
811	1	2	79 20 22	74 35.00	95 0.00	129.4	1.4	125.0
812	1	3	79 21 30	74 25.50	95 0.00	151.8	0.5	145.0
813	1	4	79 21 17	74 19.40	95 0.00	158.7	1.5	145.0
814	1	5	79 22 3	74 12.00	95 0.00	999.9	3.5	0.0
821	2	6	80 14 27	74 40.46	95 8.84	65.1	1.8	65.1
822	1	7	80 15 15	74 38.00	95 20.20	128.7	2.3	115.1
823	1	8	80 16 28	74 39.67	95 56.23	136.8	2.1	135.0
824	1	9	80 17 18	74 42.31	96 7.56	97.2	1.8	95.0
829	1	10	80 20 15	74 36.38	97 9.41	175.4	1.2	175.1
828	1	11	80 21 13	74 40.41	96 44.21	208.4	2.2	200.0
827	1	12	80 21 58	74 43.19	96 20.12	152.1	1.4	150.0
826	1	13	80 22 43	74 45.69	96 6.81	40.8	1.4	40.0
825	1	14	80 23 20	74 49.31	95 52.48	60.7	2.1	60.1
846	1	15	82 18 55	74 5.65	98 26.04	75.2	2.5	75.0
845	1	16	82 19 52	74 11.00	98 36.00	120.4	2.0	120.0
841	1	17	84 14 45	74 28.59	97 50.98	108.0	1.4	100.4
842	1	18	84 15 28	74 27.68	98 4.89	125.0	2.4	124.0
843	1	19	84 17 1	74 22.01	98 24.03	51.2	1.5	51.1
844	1	20	84 17 34	74 16.61	98 41.31	65.5	1.9	65.2
847	1	21	84 18 40	73 54.29	98 3.18	42.2	2.7	42.1
848	1	22	84 19 5	73 53.63	97 58.92	999.9	3.5	0.0
856	1	23	84 20 27	73 40.11	96 54.22	213.3	2.0	200.2
855	1	24	84 21 15	73 41.32	96 40.99	206.6	1.9	199.8
854	1	25	84 22 5	73 39.18	95 52.39	182.0	2.2	181.7
814	2	26	84 23 16	74 19.52	94 0.00	168.5	0.3	168.2
835	1	27	89 15 42	74 52.70	98 22.87	93.0	1.7	90.0
834	1	28	89 16 41	74 57.51	98 31.84	49.0	1.7	47.5
836	1	29	89 17 55	74 48.40	98 17.23	35.2	1.5	32.8
837	1	30	89 18 20	74 43.54	98 7.92	78.0	1.2	70.1
838	1	31	89 18 52	74 37.43	98 2.61	85.0	1.5	83.6
865	1	32	90 16 35	73 59.75	99 53.39	84.6	2.4	82.5
864	1	33	90 15 24	74 15.33	99 58.34	119.0	2.8	115.1
863	1	34	90 18 5	74 28.24	99 59.66	161.1	2.8	160.1
862	1	35	90 18 54	74 42.09	99 58.61	56.3	2.2	55.1
861	1	36	90 19 30	74 54.82	99 58.06	36.5	1.8	35.1
836	2	37	90 21 0	74 47.83	98 22.26	41.2	1.4	40.0
838	2	38	90 21 35	74 39.16	97 51.58	75.6	0.4	72.6
839	1	39	90 22 3	74 36.57	97 33.53	101.2	1.7	100.0
844	2	40	93 14 58	74 16.69	98 42.57	69.0	2.2	65.0

# LISTING OF STATIONS' INFORMATION AND LOCATION

STATION #	GMT			LATITUDE	LONGITUDE	DEPTH(m)		
	Day	Hr	Min			Bottom	Ice	STD
845	2	41	93 15 44	74 11.00	98 34.00	111.5	2.4	107.5
846	2	42	93 16 27	74 5.91	98 31.31	77.5	2.4	72.6
841	2	43	93 18 12	74 28.54	97 51.42	102.5	1.8	95.0
842	2	44	93 18 16	74 27.13	98 8.97	135.0	1.2	125.0
843	2	45	93 19 17	74 21.54	98 27.31	18.5	1.3	15.0
844	3	46	93 19 51	74 16.69	98 42.57	70.0	2.2	65.1
845	3	47	93 20 23	74 11.00	98 34.00	128.5	2.4	125.1
846	3	48	93 21 10	74 5.91	98 31.31	75.0	2.5	72.5
836	3	49	96 16 32	74 47.86	98 19.95	59.5	1.8	57.5
835	2	50	96 15 0	74 52.46	98 22.87	96.5	1.5	92.5
834	2	51	96 15 27	74 57.46	98 31.49	42.5	1.8	40.1
831	1	52	96 19 2	75 7.71	96 39.30	125.5	2.8	120.0
832	1	53	96 19 38	75 7.65	97 6.57	175.0	2.7	170.0
833	1	54	96 18 11	75 6.80	97 32.30	61.0	2.3	57.6
830	1	55	96 20 54	74 51.61	97 6.87	225.0	2.8	220.0
836	4	56	96 21 39	74 48.49	98 18.06	60.5	1.8	57.5
835	3	57	96 21 59	74 52.44	98 24.29	92.5	1.5	90.0
834	3	58	96 22 24	74 57.32	98 35.11	43.5	1.8	37.6
837	2	59	97 15 2	74 43.53	98 7.14	126.0	1.7	120.0
838	3	60	97 15 45	74 38.22	97 47.72	103.0	1.6	100.2
839	2	61	97 16 17	74 37.21	97 42.30	67.5	2.4	65.0
860	1	62	97 17 2	74 26.32	97 7.99	165.0	1.6	160.0
859	1	63	97 17 41	74 19.06	97 10.32	145.0	1.2	140.2
858	1	64	97 18 10	74 11.00	97 14.00	225.0	1.8	220.0
821	3	65	97 20 14	74 40.34	95 8.47	135.0	1.5	130.0
822	2	66	99 15 5	74 38.58	94 55.45	110.0	1.9	105.2
823	2	67	99 16 9	74 39.89	95 51.88	112.5	1.8	110.2
824	2	68	99 16 34	74 42.43	95 59.73	105.0	2.2	110.0
826	2	69	99 17 1	74 45.61	96 6.02	185.0	2.3	180.2
825	2	70	99 17 30	74 48.81	95 53.44	222.5	2.3	210.1
857	1	71	99 19 58	74 7.50	97 34.00	136.0	2.1	130.1
853	1	72	101 16 38	74 4.50	95 15.00	179.0	1.4	170.1
852	1	73	101 17 6	74 10.75	95 30.00	198.0	1.5	190.1
851	1	74	101 17 31	74 19.50	95 30.00	174.0	1.8	165.0
850	1	75	101 17 58	74 27.80	95 39.88	140.0	2.5	135.1
827	2	76	101 19 17	74 43.00	96 23.34	194.0	2.2	190.1
828	2	77	101 19 50	74 40.43	96 43.46	210.0	2.0	200.4
891	1	78	104 15 44	75 12.90	100 44.09	95.5	2.2	90.2
892	1	79	104 16 11	75 11.65	101 5.50	155.0	2.5	150.0
893	1	80	104 16 39	75 9.96	101 34.26	132.0	2.5	125.2

# LISTING OF STATIONS' INFORMATION AND LOCATION

STATION #			GMT			LATITUDE		LONGITUDE		Bottom	DEPTH(m)	
			Day	Hr	Min						Ice	STD
894	1	81	104	17	14	75	8.11	102	40.90	106.5	2.4	97.5
895	1	82	104	17	39	75	7.48	102	59.55	147.0	2.4	135.0
896	1	83	104	18	6	75	6.80	103	25.80	97.0	2.3	92.5
886	1	84	104	20	0	75	22.60	105	35.21	77.0	2.3	74.1
885	1	85	104	20	28	75	15.90	105	15.50	77.0	2.4	72.7
884	1	86	104	20	51	75	14.70	104	56.94	225.0	2.8	220.1
883	1	87	104	20	51	75	23.92	103	40.85	999.9	3.5	0.0
882	1	88	104	22	52	75	27.09	103	15.41	999.9	3.5	0.0
751	1	89	105	16	34	74	55.04	105	55.96	131.0	2.4	130.2
752	1	90	105	17	9	74	38.60	105	51.54	182.0	2.6	180.0
753	1	91	105	17	44	74	25.03	105	43.51	204.0	2.3	200.3
754	1	92	105	16	20	74	8.48	105	39.99	210.0	2.2	205.4
755	1	93	105	19	1	73	52.89	105	30.22	189.5	2.2	175.1
878	1	94	105	20	29	73	36.02	104	11.88	78.0	2.2	75.1
877	1	95	105	20	55	73	32.20	103	31.04	102.5	2.3	100.0
876	1	96	105	21	24	73	31.82	102	38.90	152.5	2.6	150.1
875	1	97	105	21	55	73	33.75	101	54.75	76.5	2.2	75.2
896	2	98	105	23	54	75	7.02	103	25.89	84.5	2.1	82.6
895	2	99	106	0	19	75	7.39	102	59.23	124.5	2.2	120.2
894	2	100	106	0	40	75	8.65	102	40.35	82.5	1.9	80.4



Figure A-1: Unloading of current meter equipment.



Figure A-2: Drilling of ice hole for current meter deployment.



Figure A-3: Completion of current meter deployments (at 2- and 50-metre depths).



Figure A-4: Flushing of CTD Probe before profiling.



Figure A-5: CTD Profiling.



Figure A-6: Checking recorded data on playback.





Figure A-7: Maintenance of CTD equipment.

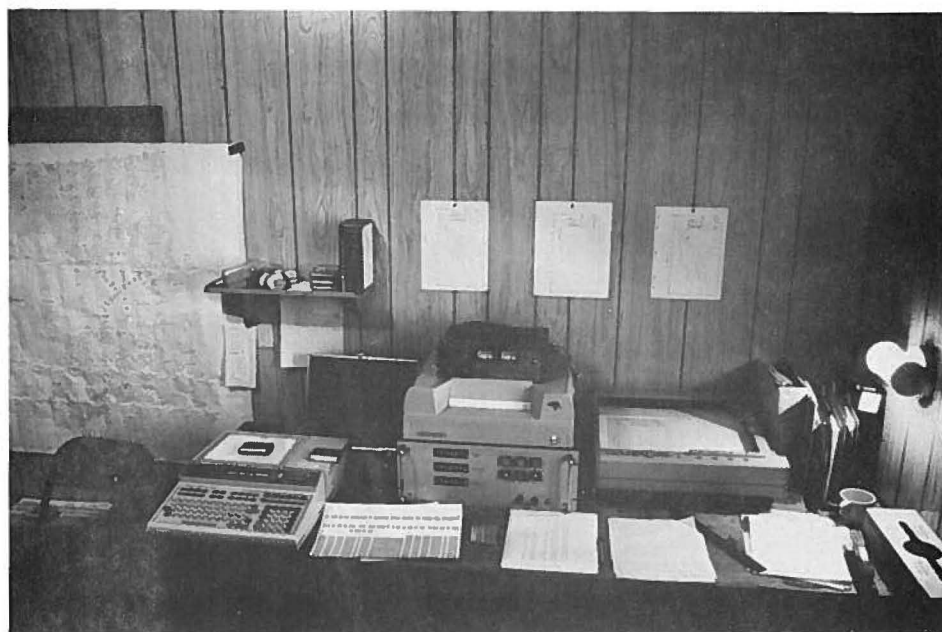
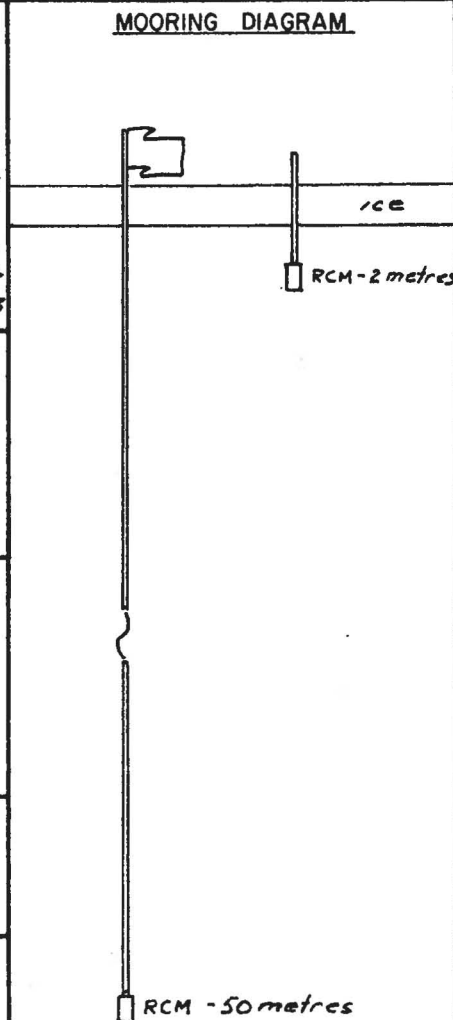
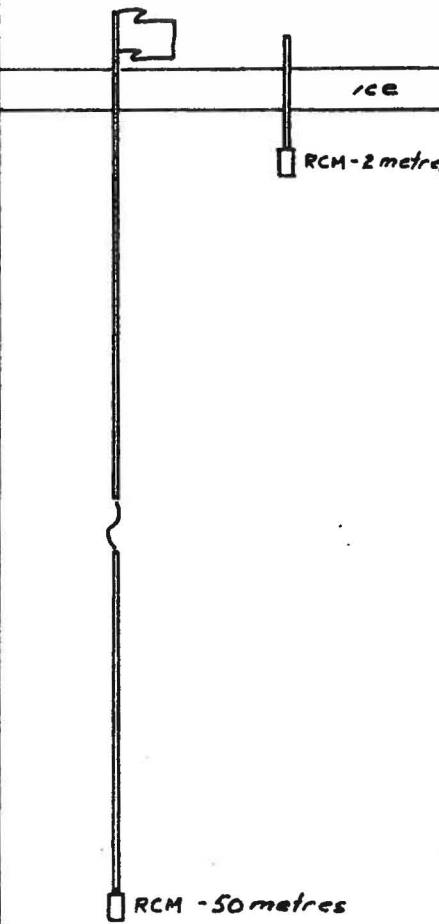


Figure A-8: Hewlett-Packard data processing system with Guildline deck unit and TEAC cassette recorder.

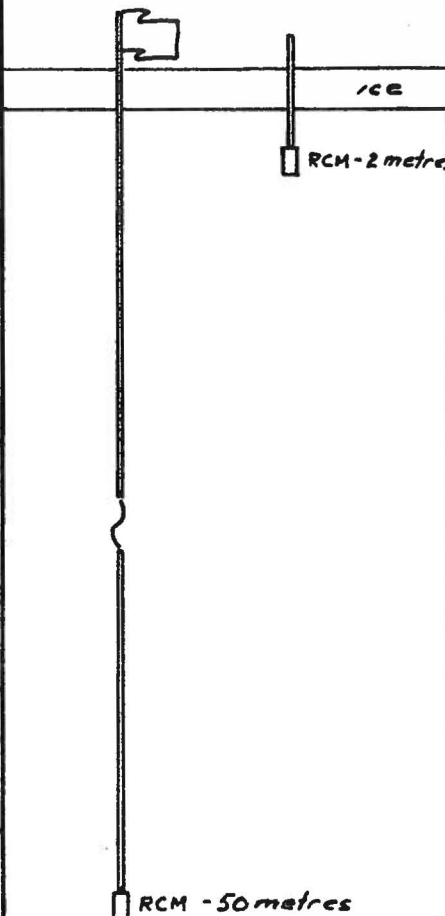
LAUNCHING		LAKE <u>BARROW STRAIT</u>		MOORING NO. <u>828</u>		CRUISE NO. _____		A.C. SNIP <u>C-FDHT</u>		DATE <u>MARCH 10, 1978</u>	
POSITION (Instruments) <u>GNS.</u>				BEARINGS				MOORING TYPE			
N <u>74° 40.3'</u> W <u>96° 43.8'</u>								CURRENT METER		WAVE RIDER	
SOUNDING _____ M.								MET. BUOY			
								F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS				MOORING DIAGRAM	
						<u>INITIAL READINGS</u>					
<u>2</u>	<u>RCM-4</u>	<u>1301</u>	<u>08/1905Z</u>		<u>1745Z</u>	# <u>1301</u>					
<u>50</u>	<u>RCM-4</u>	<u>2691</u>	<u>08/1705Z</u>		<u>2123Z</u>	<u>1925Z</u> 835 739 7 5 119 632 <u>1930Z</u> 834 0 41 10 171 713 <u>1935Z</u> 835 744 261 16 377 835					
						# <u>2691</u>					
						<u>1705Z</u> 402 493 68 4 80 0 <u>1710Z</u> 403 508 673 9 1004 76 <u>1715Z</u> 403 536 450 15 1018 53					
SURFACE BUOY NO. _____ TYPE _____						REMARKS					
EQUIPPED WITH LIGHT _____ R. REFL. _____						Instruments started on					
INSTRUMENTATION						March 8, 1978					
N.A.											
DIR. & DIST. TO SUBSUR _____ ° _____ M.											
OBSERVATIONS						REMARKS					
Wind Dir. _____ ° Air Temp. _____ °C											
Wind Speed _____ kts. Surf. Temp. _____ °C											
Wave Per. _____ sec. E.B.T. _____											
Wave Ht. _____ M _____											
Wave Dir. _____ ° _____											
SUBSURFACE BUOY NO. _____ at depth _____ M.						REMARKS					
TYPE OF MARKER FLOAT _____											
N.A.											
LAUNCHING COMPLETED AT <u>2123</u> HOURS (GMT)						<u>10</u>		<u>03</u>		<u>1978</u>	
IN CHARGE <u>D. BROOKS</u>						DAY		MO.		YEAR	
NOTICE TO MARINERS SENT ON						<u>N.A.</u>		<u>N.A.</u>		<u>N.A.</u>	
						DAY		MO.		YEAR	



RETRIEVAL		LAKE <u>BARROW</u> STRAIT		MOORING NO. <u>828</u>	CRUISE NO. <u>546</u>	DATE <u>APRIL 13, 1978</u>						
POSITION <u>G.A.S.</u> <u>N 74° 40.3' W 96° 43.8'</u> SOUNDING _____ M.				BEARINGS  				MOORING TYPE				
								CURRENT METER		WAVE RIDER		
								MET. BUOY				
								F.T.P.				
Depth Metres	Instr. Type	Instr. No.	Time Surfaced	Time Stop Recording	REMARKS							
<u>2</u>	<u>RCM-4</u>	<u>1301</u>	<u>1717Z</u>	<u>1940Z</u>	<u>#1301</u> <u>FINAL READINGS</u> 1930Z 827 1023 2 67 459 52 1935Z 834 249 2 72 436 52 1940Z 823 209 2 72 695 52							
<u>50</u>	<u>RCM-4</u>	<u>2691</u>	<u>1647Z</u>	<u>1940Z</u>	<u>#2691</u> 1930Z 402 1023 0 161 895 19 1935Z 768 274 0 167 896 0 1940Z 402 298 2 172 3 16							
OBSERVATIONS					REMARKS							
Wind Dir. _____ ° Wind Speed _____ kts Wave Per. _____ sec. Wave Ht. _____ M. Wave Dir. _____ °					Air temp. _____ Surf. temp. _____ E.B.T. _____							
					<u>#1301</u> Last readings may not be on tape as it was used up completely and last firings were made with instrument still in case.							
SURFACE BUOY					REMARKS							
UNDISTURBED _____ <u>N.A.</u> DISTURBED _____					<u>#2691</u> Screws and crevices have salt deposits. Approx. 3/4 of the tape used up.							
SURFACE BUOY NO. _____ at depth _____ M.					REMARKS							
TYPE OF MARKER FLOAT _____ <u>N.A.</u> LINE (Colour & Length) _____												
RETRIEVAL COMPLETED AT <u>1717</u> HOURS (GMT) on <u>13</u> DAY <u>04</u> MO. <u>1978</u> YEAR												
IN CHARGE <u>D. BROOKS</u>												
NOTICE TO MARINERS CANCELLED on _____ DAY <u>N.A.</u> MO. _____ YEAR												

LAUNCHING		LAKE <u>BARROW STRAIT</u>		MOORING NO. <u>845</u>		CRUISE NO. _____		A.C. SHIP <u>C-FDHT</u>		DATE <u>MARCH 11, 1978</u>	
<b>POSITION</b> (Instruments) <u>G.N.S.</u> <u>N 74° 10.0' W 98° 34.0'</u> SOUNDING _____ M.				<b>BEARINGS</b>				<b>MOORING TYPE</b>			
								CURRENT METER		WAVE RIDER	
								MET. BUOY			
								F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	<b>REMARKS</b> <u>INITIAL READINGS</u> #1735 0120Z 417 1011 7 53 499 63 0130Z 417 998 65 10 692 0 0140Z 417 1005 65 21 433 65 #2688 0120Z 367 707 6 18 598 17 0130Z 367 700 67 10 780 0 0140Z 367 705 67 21 547 72				<b>MOORING DIAGRAM</b> 	
2	RCM-4	1735	0120Z		1627Z						
50	RCM-4	2688	0120Z		1613Z						
<b>SURFACE BUOY</b> NO. _____ TYPE _____ EQUIPPED WITH LIGHT _____ R. REFL. _____ <b>INSTRUMENTATION</b> <u>N.A.</u> DIR. & DIST. TO SUBSUR _____° _____ M.						<b>REMARKS</b>					
<b>OBSERVATIONS</b> Wind Dir. _____° Air Temp. _____°C Wind Speed _____ kts. Surf. Temp. _____°C Wave Per. _____ sec. E.B.T. _____ Wave Ht. _____ M _____ Wave Dir. _____° _____						<b>REMARKS</b>					
SUBSURFACE BUOY NO. _____ at depth _____ M. TYPE OF MARKER FLOAT _____ <u>N.A.</u>						<b>REMARKS</b>					
LAUNCHING COMPLETED AT <u>1627</u> HOURS (GMT) <u>11</u> DAY <u>03</u> MO. <u>1978</u> YEAR IN CHARGE <u>D. BROOKS</u> NOTICE TO MARINERS SENT ON _____ DAY <u>N.A.</u> MO. _____ YEAR											

RETRIEVAL		LAKE BARROW STRAIT		MOORING NO. 845		CRUISE NO. SNR C.F.D.H.T.		DATE APRIL 23, 1978	
POSITION G.N.S. N 74° 10.0' W 98° 34.0'				BEARINGS				MOORING TYPE	
SOUNDING _____ M.								CURRENT METER	WAVE RIDER
								MET. BUOY	
								F.T.P.	
Depth Metres	Instr. Type	Instr. No.	Time Surfaced	Time Stop Recording	REMARKS				
2	RCM-4	1735	1744Z	24/0200Z	#1735 Instrument firing but unable to monitor.				
50	RCM-4	2688	1703Z	24/0149Z	Several firings in one direction. Turned 180° and shorted conductivity cell for last firing at 0200Z, April 24				
OBSERVATIONS					REMARKS				
Wind Dir. _____ ° Wind Speed _____ kts Wave Per. _____ sec. Wave Ht. _____ M. Wave Dir. _____ °					Air temp. _____ Surf. temp. _____ E.B.T. _____				
					#2688 FINAL READINGS -- April 24 0119Z 367 605 000 1023 42 606 0129Z 367 643 000 0010 41 606 0138Z 368 682 1023 021 936 606 0149Z - fired but not monitored				
SURFACE BUOY					REMARKS				
UNDISTURBED _____ DISTURBED _____									
N.A.									
SURFACE BUOY NO. _____ at depth _____ M.					REMARKS				
TYPE OF MARKER FLOAT _____									
N.A. LINE (Colour & Length) _____									
RETRIEVAL COMPLETED AT 1744 HOURS (GMT) on 23 DAY 04 MO. 1978 YEAR									
IN CHARGE D. BROOKS									
NOTICE TO MARINERS CANCELLED on N.A. DAY MO. YEAR									

LAUNCHING		LAKE <sup>BARROW</sup> STRAIT		MOORING NO. <u>842</u>		CRUISE NO. <u>AS</u>		SPUR <u>C-EDHT</u>		DATE <u>MARCH 11, 1978</u>	
POSITION (Instruments) G.N.S. N <u>74° 26.7'</u> W <u>98° 06.4'</u> SOUNDING _____ M.				BEARINGS				MOORING TYPE			
								CURRENT METER		WAVE RIDER	
								MET. BUOY			
								F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS				MOORING DIAGRAM  	
					INITIAL READINGS						
					#802						
					0250Z 461 998 9 0 556 967						
					0300Z 461 1002 66 9 560 991						
					0310Z 461 1006 425 18 468 1002						
					#1305						
					0250Z 501 743 3 0 491 337						
					0300Z 501 748 38 10 490 359						
					0310Z 501 758 258 21 347 386						
SURFACE BUOY NO. _____ TYPE _____						REMARKS					
EQUIPPED WITH LIGHT _____ R. REFL. _____						-pipe slipped while installing					
INSTRUMENTATION						#1305 ∴ possibility that it is					
N.A.						180° out of phase - check					
DIR. & DIST. TO SUBSUR _____° _____ M.						upon retrieval					
OBSERVATIONS						REMARKS					
Wind Dir. _____° Air Temp. _____°C											
Wind Speed _____ kts. Surf. Temp. _____°C											
Wave Per. _____ sec. E.B.T. _____											
Wave Ht. _____ M											
Wave Dir. _____°											
SUBSURFACE BUOY NO. _____ at depth _____ M.						REMARKS					
TYPE OF MARKER FLOAT _____											
N.A.											
LAUNCHING COMPLETED AT <u>1753</u> HOURS (GMT)						<u>11</u>		<u>03</u>		<u>1978</u>	
						DAY		MO.		YEAR	
IN CHARGE <u>D. BROOKS</u>											
NOTICE TO MARINERS SENT ON						<u>N.A.</u>		<u>N.A.</u>		<u>N.A.</u>	
						DAY		MO.		YEAR	



LAUNCHING		LAKE <u>BARROW STRAIT</u>		MOORING NO. <u>835</u>		CRUISE NO. _____		A.C. SHIP <u>C-FDHT</u>		DATE <u>MARCH 11, 1978</u>	
POSITION (Instruments) <u>G.N.S.</u> <u>N 74° 52.8' W 98° 12.0'</u> SOUNDING _____ M.				BEARINGS  				MOORING TYPE			
								CURRENT METER		WAVE RIDER	
								MET. BUOY			
								F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS			MOORING DIAGRAM 		
<u>2</u>	<u>RCM-4</u>	<u>2686</u>	<u>09/2100Z</u>		<u>2123Z</u>	<u>INITIAL READINGS</u> <u>#2686</u> 2100Z 700 391 7 0 51 7 2110Z 700 440 67 10 36 96 2120Z 701 475 450 21 956 0					
<u>50</u>	<u>RCM-4</u>	<u>2692</u>	<u>09/2000Z</u>		<u>2113Z</u>	<u>#2692</u> 2000Z 47 157 7 0 132 0 2010Z 47 170 67 9 198 48 2020Z 48 185 451 18 900 71					
SURFACE BUOY NO. _____ TYPE _____ EQUIPPED WITH LIGHT _____ R. REFL. _____ INSTRUMENTATION <u>N.A.</u>						REMARKS <u>Instruments started on</u> <u>March 9, 1978</u>					
DIR. & DIST. TO SUBSUR _____° _____ M.											
OBSERVATIONS Wind Dir. _____° Air Temp. _____°C Wind Speed _____ kts. Surf. Temp. _____°C Wave Per. _____ sec. E.B.T. _____ Wave Ht. _____ M _____ Wave Dir. _____° _____						REMARKS					
SUBSURFACE BUOY NO. _____ at depth _____ M. TYPE OF MARKER FLOAT _____ <u>N.A.</u>						REMARKS					
LAUNCHING COMPLETED AT <u>2123</u> HOURS (GMT) <u>11</u> <u>03</u> <u>1978</u> DAY MO. YEAR IN CHARGE <u>D. BROOKS</u> NOTICE TO MARINERS SENT ON _____ <u>N.A.</u> _____ DAY MO. YEAR											



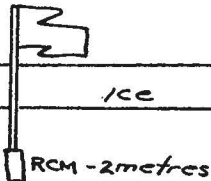


LAUNCHING		<del>LAKE</del> <sup>BARROW</sup> STRAIT		MOORING NO. <u>A38</u>	CRUISE NO. _____	A.C. SNR <u>C-FDHT</u> DATE <u>MARCH 13, 1978</u>	
POSITION (Instruments) <u>G.N.S.</u> <u>N 74°38.3' W 97°58.2'</u> SOUNDING _____ M.				BEARINGS			
				MOORING TYPE			
				CURRENT METER		WAVE RIDER	
				MET. BUOY			
				F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS	
						<u>INITIAL READINGS</u>	
<u>2</u>	<u>RCM-4</u>	<u>800</u>	<u>08/2200Z</u>		<u>1555Z</u>	<u>#800</u>	
<u>50</u>	<u>RCM-4</u>	<u>2687</u>	<u>08/2200Z</u>		<u>1633Z</u>	<u>2220Z 856 1023 421 0 24 23</u> <u>2230Z 856 1023 634 10 87 104</u> <u>2240Z 856 1023 3 21 87 104</u>	
						<u>#2687</u>	
						<u>2200Z 356 822 6 9 84 1</u> <u>2210Z 356 834 67 18 85 48</u> <u>2220Z 357 856 450 28 954 0</u>	
SURFACE BUOY NO. _____ TYPE _____ EQUIPPED WITH LIGHT _____ R. REFL. _____ <u>INSTRUMENTATION</u> <u>N.A.</u>						REMARKS <u>Instruments started on</u> <u>March 8, 1978</u>	
DIR. & DIST. TO SUBSUR _____° _____ M.							
<u>OBSERVATIONS</u> Wind Dir. _____° Air Temp. _____°C Wind Speed _____ kts. Surf. Temp. _____°C Wave Per. _____ sec. E.B.T. _____ Wave Ht. _____ M _____ Wave Dir. _____° _____						REMARKS	
SUBSURFACE BUOY NO. _____ at depth _____ M. TYPE OF MARKER FLOAT _____ <u>N.A.</u>						REMARKS	
LAUNCHING COMPLETED AT <u>1633Z</u> HOURS (GMT) <u>13</u> <u>03</u> <u>1978</u> IN CHARGE <u>D. BROOKS</u> DAY MO. YEAR NOTICE TO MARINERS SENT ON _____ DAY <u>N.A.</u> YEAR						MOORING DIAGRAM 	

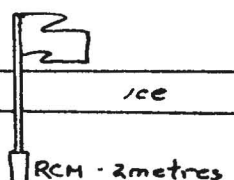


LAUNCHING		LAKE <sup>V. MELVILLE</sup> SOUND		MOORING NO. <u>882</u>		CRUISE NO. _____		A.C. SNR <u>C-EDHT</u>		DATE <u>MARCH 15, 1978</u>	
POSITION (Instruments) <u>G.N.S.</u> N <u>75°27.3'</u> W <u>103°05.4'</u> SOUNDING _____ M.				BEARINGS _____							
				MOORING TYPE _____							
				CURRENT METER				WAVE RIDER			
				MET. BUOY							
				F.T.P.							
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS <u>INITIAL READINGS</u> #2689 2150Z 666 205 6 0 618 0 2200Z 666 282 67 10 731 0 2210Z 666 352 451 21 489 98 #2693 2150Z 991 262 4 1 552 0 2200Z 991 346 65 12 706 33 2210Z 992 433 448 22 471 218					
<u>2</u>	<u>RCM-4</u>	<u>2689</u>	<u>14/2150Z</u>		<u>1800Z</u>						
<u>50</u>	<u>RCM-4</u>	<u>2693</u>	<u>14/2150Z</u>		<u>1825Z</u>	MOORING DIAGRAM 					
SURFACE BUOY NO. _____ TYPE _____ EQUIPPED WITH LIGHT _____ R. REFL. _____ INSTRUMENTATION <u>N.A.</u> DIR. & DIST. TO SUBSUR _____° _____ M.						REMARKS <u>Instruments started on</u> <u>March 14, 1978</u>					
OBSERVATIONS Wind Dir. _____° Air Temp. _____°C Wind Speed _____ kts. Surf. Temp. _____°C Wave Per. _____ sec. E.B.T. _____ Wave Ht. _____ M _____ Wave Dir. _____° _____						REMARKS _____					
SUBSURFACE BUOY NO. _____ at depth _____ M. TYPE OF MARKER FLOAT _____ <u>N.A.</u>						REMARKS _____					
LAUNCHING COMPLETED AT <u>1825</u> HOURS (GMT) <u>15</u> DAY <u>03</u> MO. <u>1978</u> YEAR IN CHARGE <u>D. BROOKS</u> NOTICE TO MARINERS SENT ON _____ DAY <u>N.A.</u> MO. _____ YEAR											

RETRIEVAL		<u>Lake Sound</u>		MOORING NO. <u>882</u>		CRUISE NO. <u>SAC C-EDHT</u>		DATE <u>April 26, 1978</u>																						
POSITION <u>G.N.S.</u> <u>N 75° 27' 3" W 103° 05' 4"</u>  SOUNDING _____ M.				BEARINGS		MOORING TYPE																								
						CURRENT METER		WAVE RIDER																						
						MET. BUOY																								
						F.T.P.																								
Depth Metres	Instr. Type	Instr. No.	Time Surfaced	Time Stop Recording	REMARKS <u>FINAL READINGS</u>  <u>#2689</u> <u>April 27</u> <table style="margin-left: auto; margin-right: auto;"> <tr> <td>0100Z</td><td>666</td><td>0</td><td>0</td><td>715</td><td>2</td><td>0</td></tr> <tr> <td>0110Z</td><td>667</td><td>444</td><td>1023</td><td>726</td><td>177</td><td>0</td></tr> <tr> <td>0120Z</td><td>512</td><td>499</td><td>-</td><td>736</td><td>-</td><td>0</td></tr> </table>					0100Z	666	0	0	715	2	0	0110Z	667	444	1023	726	177	0	0120Z	512	499	-	736	-	0
0100Z	666	0	0	715						2	0																			
0110Z	667	444	1023	726						177	0																			
0120Z	512	499	-	736						-	0																			
<u>2</u>	<u>RCM-4</u>	<u>2689</u>	<u>2034Z</u>	<u>27/0120Z</u>																										
<u>50</u>	<u>RCM-4</u>	<u>2693</u>	<u>1938Z</u>	<u>27/0051Z</u>																										
OBSERVATIONS					REMARKS <u>#2693</u> <u>Appeared to have not worked during survey</u> <u>- 1/12" of tape used</u> <u>Fired in shop when opened at 0027Z, April 27</u>  <table style="margin-left: auto; margin-right: auto;"> <tr> <td>0041Z</td><td>992</td><td>437</td><td>0</td><td>696</td><td>591</td><td>0</td></tr> <tr> <td>0051Z</td><td>992</td><td>485</td><td>1023</td><td>707</td><td>293</td><td>8</td></tr> </table>					0041Z	992	437	0	696	591	0	0051Z	992	485	1023	707	293	8							
0041Z	992	437	0	696						591	0																			
0051Z	992	485	1023	707						293	8																			
Wind Dir. _____ °      Air temp. _____																														
Wind Speed _____ kts      Surf. temp. _____																														
Wave Per. _____ sec.      E.B.T. _____																														
Wave Ht. _____ M.																														
Wave Dir. _____ °																														
SURFACE BUOY      UNDISTURBED _____					REMARKS																									
DISTURBED _____																														
<u>N.A.</u>																														
SURFACE BUOY NO. _____ at depth _____ M.					REMARKS																									
TYPE OF MARKER FLOAT _____																														
LINE (Colour & Length) _____																														
<u>N.A.</u>																														
RETRIEVAL COMPLETED AT <u>2034</u> HOURS (GMT) on <u>26</u> DAY <u>04</u> MO. <u>1978</u> YEAR IN CHARGE <u>D. Brooks</u> NOTICE TO MARINERS CANCELLED _____ on _____ DAY <u>N.A.</u> MO. _____ YEAR _____																														

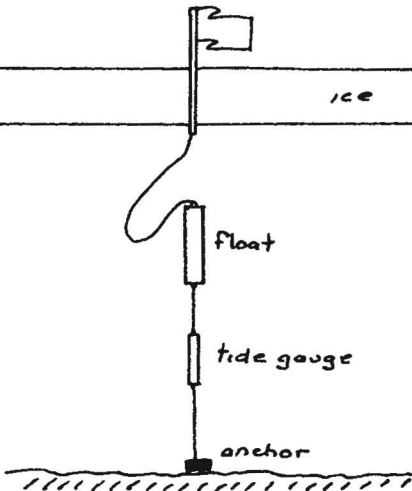
LAUNCHING		V. MELVILLE LAKE SOUND		MOORING NO. 895		CRUISE NO.		A.C. SMP C-EDHT		DATE MARCH 15, 1978	
POSITION (Instruments) Decca				BEARINGS				MOORING TYPE			
N 75° 07.4' W 102° 59.6'								CURRENT METER		WAVE RIDER	
SOUNDING _____ M.								MET. BUOY			
								F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS INITIAL READINGS			MOORING DIAGRAM		
2	RCH4	1736	14/2240		1902 Z	#1736 2240Z 323 481 382 0 1023 2 2250Z 323 530 260 10 1021 38 2300Z 319 567 39 21 196 137					
SURFACE BUOY NO. _____ TYPE _____						REMARKS					
EQUIPPED WITH LIGHT _____ R. REFL. _____						Instruments started on					
INSTRUMENTATION						March 14, 1978					
N.A.											
DIR. & DIST. TO SUBSUR _____ ° _____ M.											
OBSERVATIONS						REMARKS					
Wind Dir. _____ ° Air Temp. _____ °C											
Wind Speed _____ kts. Surf. Temp. _____ °C											
Wave Per. _____ sec. E.B.T. _____											
Wave Ht. _____ M _____											
Wave Dir. _____ ° _____											
SUBSURFACE BUOY NO. _____ at depth _____ M.						REMARKS					
TYPE OF MARKER FLOAT _____											
N.A.											
LAUNCHING COMPLETED AT 1902 HOURS (GMT)						15 DAY		03 MO.		1978 YEAR	
IN CHARGE D. BROOKS											
NOTICE TO MARINERS SENT ON						DAY		N.A. MO.		YEAR	



LAUNCHING		LAKE <u>P. MELVILLE SOUND</u>		MOORING NO. <u>892</u>		CRUISE NO. _____		A.C. SNR <u>C-EDHT</u>		DATE <u>MARCH 15, 1978</u>	
POSITION (Instruments) <u>Decca</u> N <u>75° 11.1'</u> W <u>101° 06.7'</u> SOUNDING _____ M.				BEARINGS  				MOORING TYPE			
								CURRENT METER		WAVE RIDER	
								MET. BUOY			
								F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS <u>INITIAL READINGS</u>  <u>#2046</u> 2240Z 576 757 635 0 47 3 2250Z 576 797 423 10 51 19 2300Z 576 833 65 21 278 143			MOORING DIAGRAM  		
<u>2</u>	<u>RCM-4</u>	<u>2046</u>	<u>14/2240Z</u>		<u>1940Z</u>						
SURFACE BUOY NO. _____ TYPE _____ EQUIPPED WITH LIGHT _____ R. REFL. _____ <u>INSTRUMENTATION</u>  <u>N.A.</u> DIR. & DIST. TO SUBSUR _____° _____ M.						REMARKS <u>Instruments started on</u> <u>March 14, 1978</u>					
<u>OBSERVATIONS</u> Wind Dir. _____° Air Temp. _____°C Wind Speed _____ kts. Surf. Temp. _____°C Wave Per. _____ sec. E.B.T. _____ Wave Ht. _____ M _____ Wave Dir. _____° _____						REMARKS					
SUBSURFACE BUOY NO. _____ at depth _____ M.  TYPE OF MARKER FLOAT _____ <u>N.A.</u>						REMARKS					
LAUNCHING COMPLETED AT <u>1940</u> HOURS (GMT) <u>15</u> <u>03</u> <u>1978</u> DAY MO. YEAR											
IN CHARGE <u>D. BROOKS</u>											
NOTICE TO MARINERS SENT ON _____ <u>N.A.</u> _____ DAY MO. YEAR											

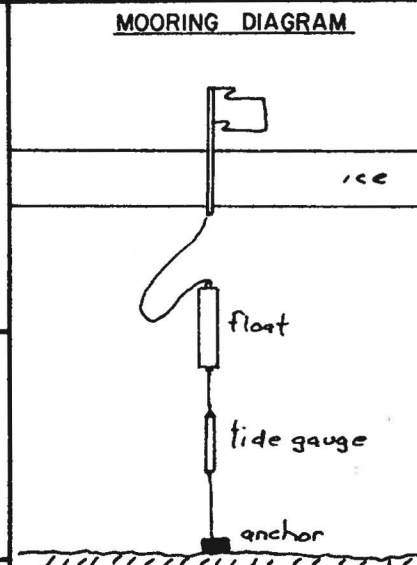


RETRIEVAL		<u>LAKE MELVILLE SOUND</u>		MOORING NO. <u>892</u>	CRUISE NO. <u>SAIR C-FD/IT</u>	DATE <u>APRIL 26, 1978</u>
POSITION <u>Decca</u> N <u>75°11.1'</u> W <u>101°06.7'</u> SOUNDING _____ M.			BEARINGS		MOORING TYPE	
					CURRENT METER	WAVE RIDER
					MET. BUOY	
					F.T.P.	
Depth Metres	Instr. Type	Instr. No.	Time Surfaced	Time Stop Recording	REMARKS <u>FINAL READINGS</u> <u>#2046</u> <u>April 27</u> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <span>0030Z 576 695 3 618 211 0</span> <span>0040Z 576 758 3 618 365 29</span> <span>0050Z 576 779 1023 618 344 0</span> </div>	
<u>2</u>	<u>PCM-4</u>	<u>2046</u>	<u>2223Z</u>	<u>27/0050Z</u>		
OBSERVATIONS					REMARKS	
Wind Dir. _____ °      Air temp. _____ Wind Speed _____ kts      Surf. temp. _____ Wave Per. _____ sec.      E. B. T. _____ Wave Ht. _____ M. Wave Dir. _____ °						
SURFACE BUOY      UNDISTURBED _____ DISTURBED _____ <u>N.A.</u>					REMARKS	
SURFACE BUOY NO. _____ at depth _____ M. TYPE OF MARKER FLOAT _____ <u>N.A.</u> LINE (Colour & Length) _____					REMARKS	
RETRIEVAL COMPLETED AT <u>2223</u> HOURS (GMT) on <u>26</u> <u>04</u> <u>1978</u> DAY      MO.      YEAR IN CHARGE <u>D. BROOKS</u> NOTICE TO MARINERS CANCELLED on <u>N.A.</u> DAY      MO.      YEAR						

LAUNCHING		LAKE <u>BEDFORD BAY</u>		MOORING NO. <u>801</u>		CRUISE NO. <u>AC SMP C-EDHT</u>		DATE <u>MARCH 13, 1978</u>	
POSITION (Instruments)  N <u>74°59.3'</u> W <u>98°25.6'</u>  SOUNDING _____ M.				BEARINGS		MOORING TYPE			
						CURRENT METER		WAVE RIDER	
						MET. BUOY			
						F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS  Tide Gauge  First 0054Z Second 0109Z  Tide Averaged 225 seconds previous to above times		MOORING DIAGRAM  	
SURFACE BUOY NO. _____ TYPE _____ EQUIPPED WITH LIGHT _____ R. REFL. _____ INSTRUMENTATION <p style="text-align: center;"><i>N.A.</i></p> DIR. & DIST. TO SUBSUR _____° _____ M.						REMARKS			
OBSERVATIONS Wind Dir. _____° Air Temp. _____°C Wind Speed _____ kts. Surf. Temp. _____°C Wave Per. _____ sec. E.B.T. _____ Wave Ht. _____ M _____ Wave Dir. _____° _____						REMARKS			
SUBSURFACE BUOY NO. _____ at depth _____ M. TYPE OF MARKER FLOAT _____ <p style="text-align: center;"><i>N.A.</i></p>						REMARKS			
LAUNCHING COMPLETED AT <u>2130</u> HOURS (GMT) <u>13</u> DAY <u>03</u> MO. <u>1978</u> YEAR									
IN CHARGE <u>D. Brooks</u>									
NOTICE TO MARINERS SENT ON _____ DAY <u>N.A.</u> MO. _____ YEAR									

RETRIEVAL		LAKE <u>Bedford</u>		MOORING NO. <u>BD1</u>		CRUISE NO. <u>SPR C-FDHT</u>		DATE <u>April 24, 1978</u>	
POSITION  N <u>74°59.3'</u> W <u>98°25.6'</u>  SOUNDING _____ M.				BEARINGS		MOORING TYPE			
						CURRENT METER		WAVE RIDER	
						MET. BUOY			
F.T.P.									
Depth Metres	Instr. Type	Instr. No.	Time Surfaced	Time Stop Recording	REMARKS  <u>Tide Gauge</u>				
	<u>T.G.</u>	<u>112</u>	<u>1625Z</u>	<u>25/04/08</u>					
OBSERVATIONS					REMARKS				
Wind Dir. _____ °		Air temp. _____							
Wind Speed _____ kts		Surf. temp. _____							
Wave Per. _____ sec.		E. B. T. _____							
Wave Ht. _____ M.									
Wave Dir. _____ °									
SURFACE BUOY					REMARKS				
UNDISTURBED _____ DISTURBED _____  <u>N.A.</u>									
SURFACE BUOY NO. _____ at depth _____ M.					REMARKS				
TYPE OF MARKER FLOAT _____									
LINE (Colour & Length) _____  <u>N.A.</u>									
RETRIEVAL COMPLETED AT <u>1625</u> HOURS (GMT) on <u>24</u> DAY <u>04</u> MO. <u>1978</u> YEAR									
IN CHARGE <u>D. Brooks</u>									
NOTICE TO MARINERS CANCELLED _____ on _____ DAY <u>N.A.</u> MO. _____ YEAR _____									

LAUNCHING		LAKE <sup>HAMILTON</sup> ISLAND		MOORING NO. <u>802</u>		CRUISE NO. <u>AS</u>		DATE <u>MARCH 13, 1978</u>	
POSITION (Instruments) <u>N 74° 11.2' W 99° 10.0'</u> SOUNDING _____ M.				BEARINGS		MOORING TYPE			
						CURRENT METER		WAVE RIDER	
						MET. BUOY			
						F.T.P.			
Depth Metres	Instr Type	Instr No.	Time Str. Recording	Time Subm.	Time in Position	REMARKS <u>Tide Gauge</u> <u>First 0054Z</u> <u>Second 0109Z</u> <u>Tide</u> <u>Averaged 225 seconds</u> <u>previous to above</u>			
SURFACE BUOY NO. _____ TYPE _____ EQUIPPED WITH LIGHT _____ R. REFL. _____ INSTRUMENTATION <u>N.A.</u> DIR. & DIST. TO SUBSUR _____° _____ M.						REMARKS			
OBSERVATIONS Wind Dir. _____° Air Temp. _____°C Wind Speed _____ kts. Surf. Temp. _____°C Wave Per. _____ sec. E.B.T. _____ Wave Ht. _____ M _____ Wave Dir. _____° _____						REMARKS			
SUBSURFACE BUOY NO. _____ at depth _____ M. <u>N.A.</u> TYPE OF MARKER FLOAT _____						REMARKS			
LAUNCHING COMPLETED AT <u>2240</u> HOURS (GMT) <u>13</u> <u>03</u> <u>1978</u> DAY MO. YEAR IN CHARGE <u>D. BROOKS</u> NOTICE TO MARINERS SENT ON _____ <u>N.A.</u> _____ DAY MO. YEAR									



RETRIEVAL		LAKE <u>HAMILTON ISLAND</u>		MOORING NO. <u>802</u>	CRUISE NO. <u>516</u>	SHIP <u>C-EDHT</u>	DATE <u>April 2, 1988</u>		
<b>POSITION</b> N <u>74° 11.9'</u> W <u>99° 10.0'</u>			<b>BEARINGS</b>		<b>MOORING TYPE</b> CURRENT METER MET. BUOY F.T.P.				
SOUNDING _____ M.			<b>REMARKS</b> <u>Tide Gauge.</u>  <u>Not recovered. Frozen in place due to rafting of ice.</u>						
Depth Metres	Instr. Type	Instr. No.						Time Surfaced	Time Stop Recording
	<u>T.G.</u>	<u>111</u>							
<b>OBSERVATIONS</b> Wind Dir. _____ °      Air temp. _____ Wind Speed _____ kts      Surf. temp. _____ Wave Per. _____ sec.      E. B. T. _____ Wave Ht. _____ M. _____ Wave Dir. _____ ° _____					<b>REMARKS</b>				
<b>SURFACE BUOY</b> <b>UNDISTURBED</b> _____ <b>DISTURBED</b> _____ <u>N.A.</u>					<b>REMARKS</b>				
SURFACE BUOY NO. _____ at depth _____ M.  TYPE OF MARKER FLOAT _____ <u>N.A.</u> LINE (Colour & Length) _____					<b>REMARKS</b>				
RETRIEVAL COMPLETED AT _____ HOURS (GMT) on _____ DAY _____ MO. _____ YEAR									
IN CHARGE <u>D. BROOKS</u>									
NOTICE TO MARINERS CANCELLED _____ on _____ DAY <u>N.A.</u> MO. _____ YEAR _____									