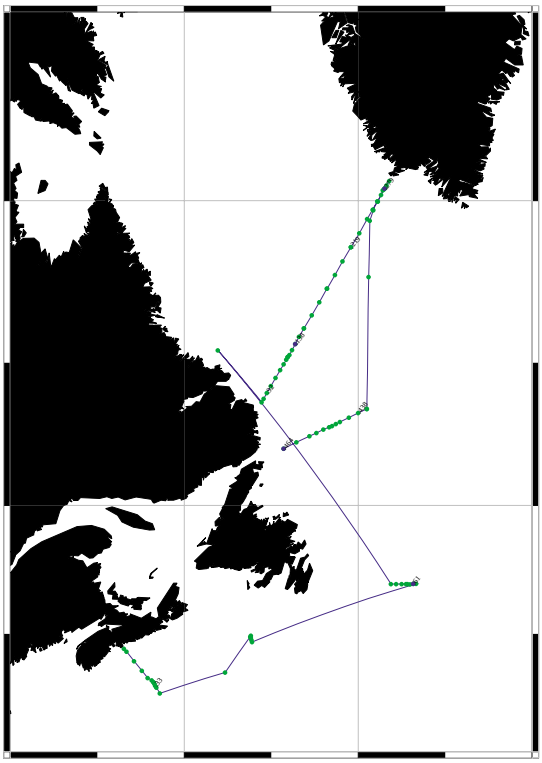
A. Cruise Narrative: AR07W_2003a *Last update: 2004.APR.07*

(Atlantic Circulation Experiment, Labrador Sea)



A.1. Highlights

WHP Cruise Summary Information

WOCE section designation	**AR07W_2003a**
Expedition designation (EXPOCODE)	**18HU2003038_1**
Chief Scientist/affiliation	**R. Allyn Clarke / BIO***
Dates	2003.JUL.13 - 2003.AUG.04
Ship	*CCGS Hudson*
Ports of call	July 13 BIO, Dartmouth, NS, Canada August 4 BIO, Dartmouth, NS, Canada
Number of stations	462
Geographic boundaries of the stations	60° 33.92' N 63° 38.49' W 46° 39.95' W 42° 31.89' N
Floats and drifters deployed	6 PROVOR floats deployed
Moorings deployed or recovered	6 deployed 7 recovered 4 release tests

Contributing Authors

Anning, J Bugden, J Clarke, A Dickie, P Harris, L. Harrison, G Jackson, J
Kepkay, P Li, Wm Perry, T Scotney, M Smith, J Yashayaev, I

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WHP Cruise and Data Information

Instructions: Click on headings below to locate primary reference or use navigation tools above. (Shaded headings are not relevant to this cruise or were not available when this report was assembled)

A.2. Cruise Summary Information

A.2.1. Cruise Track

A cruise track is shown in Figure A.2.1. The ship's position at 0000Z on each day of the cruise is indicated with a date label.

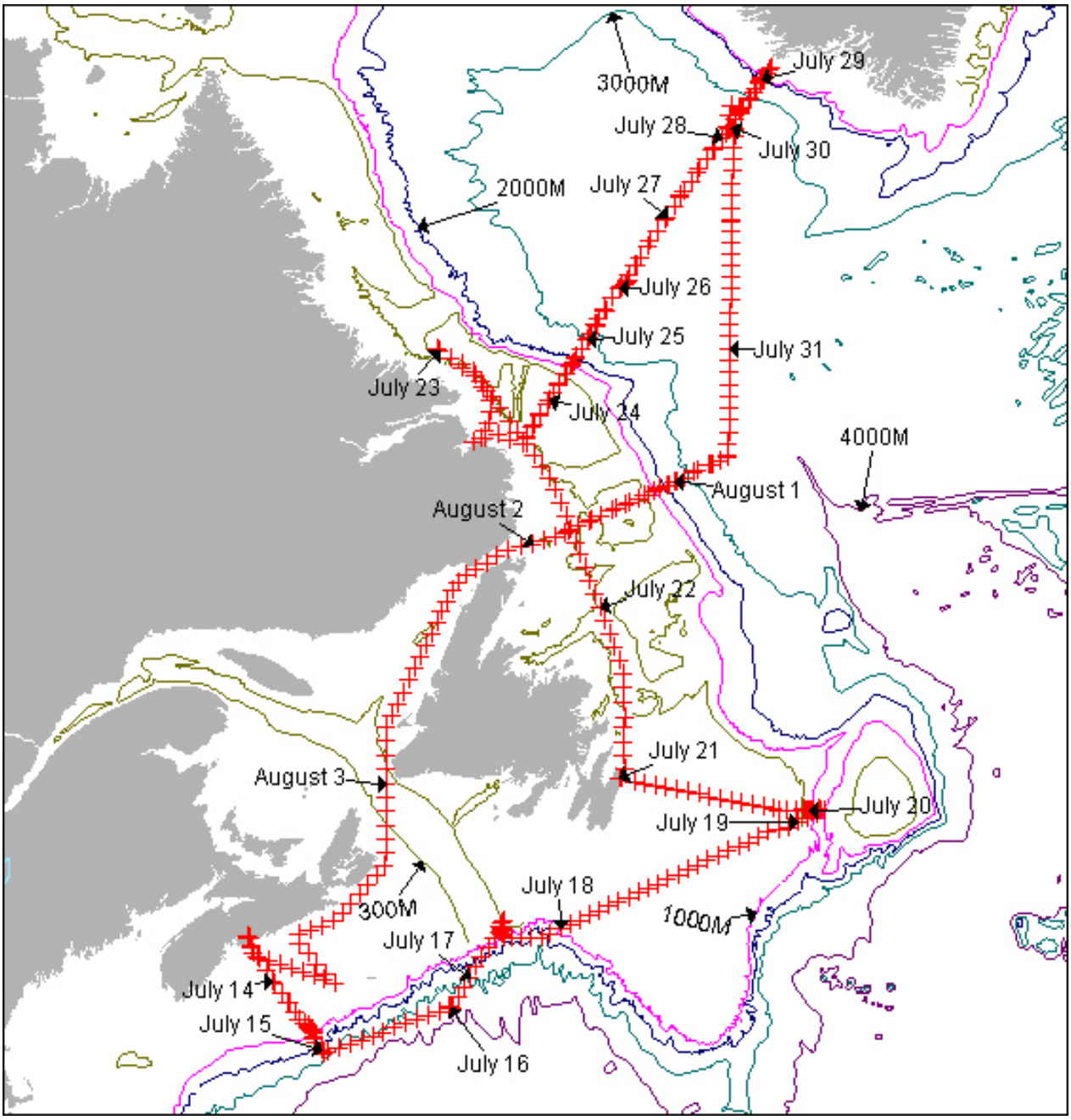
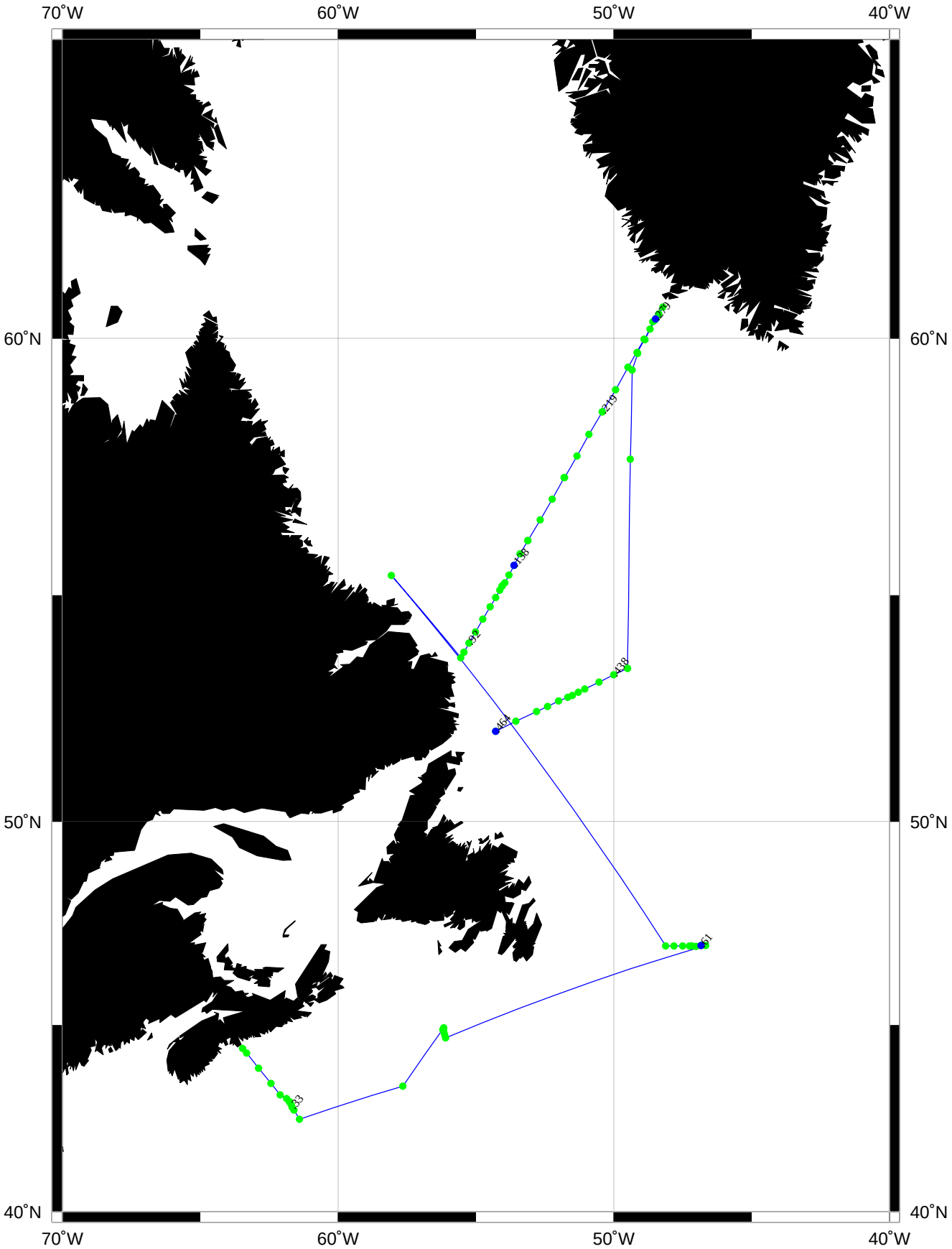


Figure A.2.1: Cruise track for 18HU2003038_1. The date labels indicate the ship's position at 0000Z.

Station locations for AR07W_2003a • Clarke • *CCGS Hudson*



Produced from .sum file by WHPO-SIO

A.2.2. Total Number of Stations Occupied

The CTD and ROS station positions are shown in Figure A.2.2. The WHP stations are all contained in the box defined by 50-62°N and 40-60°W. Table A.2.1 lists the science operations for 18HU2003038_1.

Cast Type	# of Ops	Detailed Division	Operation Numbers
Rosette & CTD		28 regular AR7W Sites (L3 line) plus Sites 8.5, 25.3 and 25.7	see Table A.2.2
		1 to profile cold LS Eddy	315
		7 Halifax Line Sites	See Table A.2.3
		10 Stations on L4 line, plus 6.5 and 5.7	See Table A.2.4
		7 Biology Casts not included in other tables	119, 152, 186, 219, 259, 290, 433
		1 Basin test	2
		20 as part of mooring work	21, 31, 32, 36, 42, 46 – 49, 56, 57, 59, 61, 62, 75, 76, 78 - 80, 83
Moorings	17	7 recoveries	45, 64, 66, 81, 82, 116, 160
		6 deployments	24, 27, 52, 67, 70, 118
		4 release tests	22, 50
Floats	6	6 PROVOR floats deployed	40, 58, 208, 271, 294, 318
Biology	126	64, 200 µm net tows	5, 7, 11, 13, 14, 19, 34, 38, 72, 74, 77, 84, 87, 90, 93, 96, 100, 105, 112, 120, 122, 124, 129, 131, 136, 142, 149, 151, 161, 163, 173, 175, 183, 185, 194, 205, 216, 218, 227, 229, 240, 242, 256, 268, 272, 275, 280, 284, 287, 289, 316, 352, 430, 432, 435, 437, 439, 442, 446, 450, 453, 456, 459, 462
		48, 76 µm net tows	6, 8, 12, 15, 20, 35, 39, 73, 85, 88, 91, 94, 97, 101, 106, 113, 121, 125, 130, 137, 143, 150, 162, 174, 184, 195, 206, 217, 228, 241, 257, 269, 273, 276, 281, 285, 288, 317, 431, 436, 440, 443, 447, 451, 454, 457, 460, 463
		14 deep stratified vertical tows with multi-net	43, 44, 60, 115, 133, 144, 164, 197, 231, 232, 258, 260, 282, 292
Chem-istry		^{129}I surface	86, 92, 98, 108, 114, 126, 132, 145, 153, 176, 187, 207, 220, 243, 270, 274, 277, 283, 286, 291
		^{129}I profile	138, 165, 196, 230, 261
Other		492 hrs Ship Board ADCP	No number assigned
		525 hrs. along 4track T, S, and fluorescence	No number assigned
		107 XBT Deployments	99, 103, 104, 109 - 111, 127, 128, 134, 135, 139 - 141, 146 - 148, 154 – 159, 167 – 172, 177 – 182, 188 – 193, 198 – 204, 209 – 215, 221 – 226, 233 – 239, 244 – 255, 262 – 267, 295 – 314, 320, 322
		109 MVP Deployments	1, 3, 319, 321, 323 - 351, 354 - 429

Table A.2.1: Science operations conducted on 18HU2003038_1.

The WOCE cruise station summary file (SUM) outlines the science operations conducted during the cruise. In the Comment section of the SUM file there is frequent mention of operation notes indicated by "Op Note". These notes are included in Appendix 1.

AR7W Site Number	2003038 Deep Cast Operation Number
1	86
2	89
3	92
4	95
5	98
6	102
7	108
8	114
8.5	123
9	126
10	132
11	138
12	145
13	153
14	165
15	176
16	187
17	196
18	207
19	220
20	230
21	243
22	291
23	261
24	286
25	270
25.3	278
25.7	279
26	283
27	274
28	277

Table A.2.2: AR7W sites and rosette and CTD operation numbers for 18HU2003038_1.

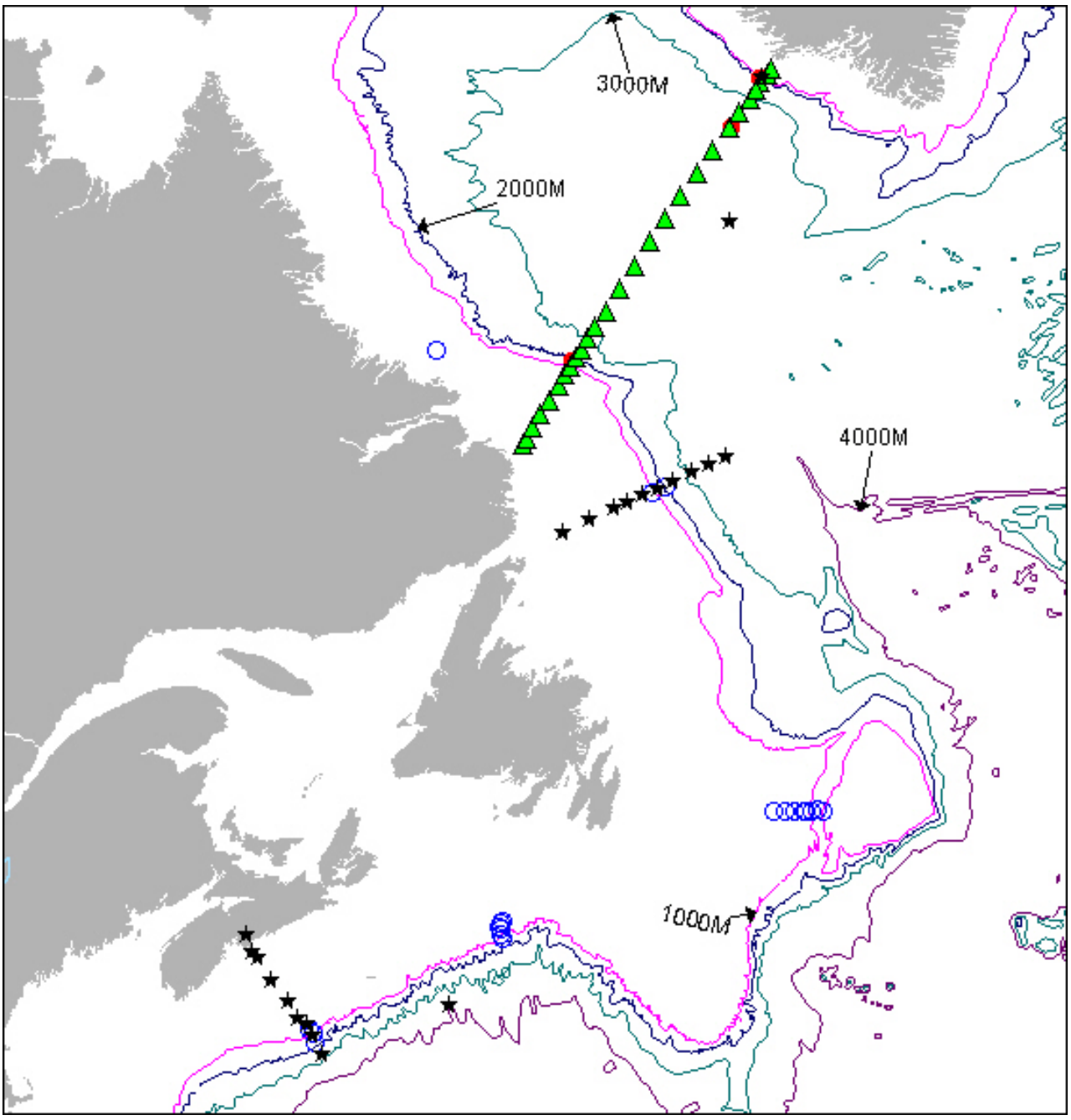


Figure A.2.2: This map shows the station positions for CTD only operations (blue hollow circles); CTD and LADCP operations (red filled circles); rosette, CTD and LADCP operations (green filled triangles); rosette and CTD operations (black star) for Hudson 18HU2003038_1.

Halifax Line Number	2003038 Deep Cast Operation Number
1	4
2	9
3	10
4	17
5	18
6	33
7	37

Table A.2.3: Halifax Line sites and rosette operation numbers for 18HU2003038_1.

L4 Line Station Number	2003038 Deep Cast Operation Number
10	434
9	438
8	441
7	444
6.5	445
6	448
5.7	449
5	452
4	455
3	458
2	461
1	464

Table A.2.4: L4 Line sites and rosette operation numbers for 18HU2003038_1.

Along AR7W, the stations were full-depth WHP small volume rosette casts with up to 24 rosette bottles. Water samples were analyzed for CFCs, carbon tetrachloride, total carbonate, alkalinity, oxygen, salinity, and nutrients. On some casts, samples were collected for ^{129}I (iodine-129).

A.2.3. Floats and Drifters deployed

Listed in table A.2.5 are the six PROVOR floats that were deployed. The deployment logs are given in Appendix 2.

PROVOR Float #	WMO #	Event #	Launch Position		Start		Launch	
			Latitude	Longitude	Time	Date	Time	Date
MT-103	4900423	40	42 32.8 N	61 25.1 W	04:20	25 July 2003	04:32	25 July 2003
MT-104	4900422	271	60 19.0 N	48 35.1 W	18:13	28 July 2003	18:45	28 July 2003
MT-105	4900421	318	59 23.4 N	49 18.6 W	03:50	30 July 2003	04:12	30 July 2003
MT-112	4900414	58	44 39.5 N	54 57.8 W	21:50	17 July 2003	22:07	17 July 2003
MT-119	4900408	294	59 42.7 N	49 07.6 W	18:21	29 July 2002	19:00	29 July 2003
MT-120	4900407	208	58 13.3 N	50 53.8 W	06:22	27 July 2002	07:36	27 July 2003

Table A.2.5: PROVOR float deployments on Hudson 2003038

A.2.4. Moorings deployed or recovered

A total of seventeen mooring related operations, consisting of six deployments, seven recoveries and four release tests were conducted at five sites, the Scotian Slope south of Halifax, at the mouth of the Laurentian Channel, Flemish Pass, Makovik Bank and the Labrador Sea. The following summarizes the mooring operations. The mooring recovery and deployment logs are attached as Appendix 3.

Deployments:

M 1475	55 07.171 N 54 05.554 W	Standard mooring consisting of one current meter positioned 20m off bottom along AR7W on the Labrador Slope (12-month deployment) at the 1032 metres.
M 1491	42 59.145 N 61 44.924 W	Standard mooring consisting of three current meters and one Microcat at 300 m. on the Scotian Slope and Halifax Section. Six month deployment.
M 1492	44 49.885 N 56 10.585 W	Standard mooring consisting of five current meters, one Microcat and ADCP at 400 m at the mouth of the Laurentian Channel. Six month deployment. Three guard buoys were also set.
M 1493	46 59.954 N 47 17.085 W	Standard mooring consisting of five current meters and one Minilog on the western side of Flemish Pass at 400 metres. Two guard buoys were also set.
M 1494	46 59.89 N 45 02.10 W	Standard mooring consisting of four current meters and two Microcats set at 1123 m. on the western side of Flemish Pass on the 47 N Flemish Cap section. One guard-buoy also set. Six month deployment.
RALPH	42 59.496 N 61 44.722 W	Bottom boundary layer tripod containing current meters and video and still cameras. Instrument was deployed within a joint program between GSC Atlantic and Dalhousie Oceanography. It will be recovered in October 2004.

Recoveries

M 1452	56 40.45 N 52 29.21 W	Complex mooring consisting of two sediment traps, six current meters, seven Seacats and three releases that was set at 3518 meters depth near the OWS Bravo site on AR7W in the Labrador Sea in July 2002.
M 1453	55 07.171 N 54 05.554 W	Standard mooring consisting of one current meter positioned 20m off bottom along AR7W on the Labrador Slope along the 1000m isobath that was set in July 2002.
M 1457	47 00.069 N 47 16.947 W	Standard mooring consisting of two current meters, one ADCP and one Microcat that was set at 400 metres depth on the western flank of Flemish Pass in November, 2003. A Guard Buoy was also recovered at this site
M 1458	47 00.093 N 47 02.069 W	Standard mooring consisting of four current meters and two Microcats that was set at 1120 metres depth in Flemish Pass in November, 2003. A Guard Buoy was also recovered at this site
M 1466	55 24.487 N 58 03.548 W	Near bottom current meter mooring consisting of one ADCP
M 1467	55 24.559 N 58 03.804 W	Near bottom mooring consisting of an ice profiling sonar for the determination of ice draft.
M 1474	43 24.064 N 57 40.845 W	A complex mooring consisting of three sediment traps, 3 current meters and three Microcats that was set in April 2003 on the continental rise offshore of Louisburg, NS. The upper buoyancy package had been broken loose on June 18, 2003. Recovery of the rest of the mooring was accomplished through dragging.

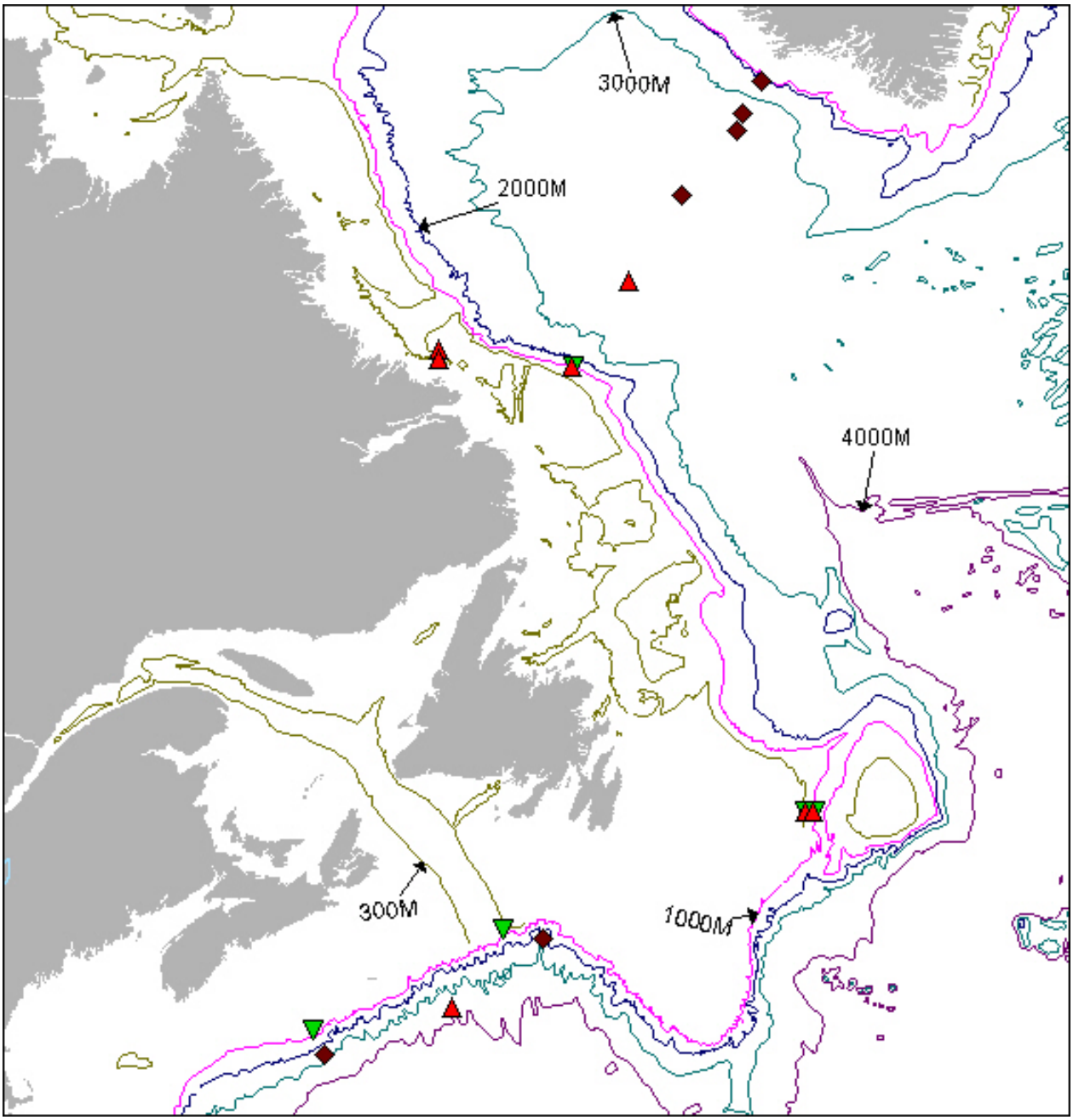


Figure A.2.3: Mooring operations (deployed - green filled triangles, recovered – red filled triangles) and float deployment locations (burgundy filled diamonds) for Hudson 18HU2003038_1.

A.3. List of Principal Investigators

Name / Affiliation	Responsibility
Allyn Clarke / BIO **clarkea@mar.dfo-mpo.gc.ca**	**Senior scientist** **Overall co-ordination**
Bob Gershey / BDR Research rgershey@fox.nstn.ns.ca	Alkalinity, carbonate, CFCs
Glen Harrison / BIO harrisong@mar.dfo-mpo.gc.ca	Coordinator biological program nitrate and ammonium utilization by phytoplankton, sediment traps Labrador Sea.
Erica Head / BIO heade@mar.dfo-mpo.gc.ca	Macrozooplankton distribution, abundance and metabolism
Paul S. Hill / Oceanography Dalhousie paul.hill@dal.ca	Bottom boundary layer, Ralph
Paul Kepkay / BIO kepkayp@mar.dfo-mpo.gc.ca	Dissolved organic carbon, colloid chemistry and plankton respiration
Peter Jones / BIO jonesp@mar.dfo-mpo.gc.ca	Alkalinity, carbonate, CFC's
John Lazier / BIO lazierj@mar.dfo-mpo.gc.ca	CTD data, moored instrument data
Bill Li / BIO lib@mar.dfo-mpo.gc.ca	Pico-plankton distribution and abundance, bacteria
John Loder / BIO LoderJ@mar.dfo-mpo.gc.ca	Moorings, Scotian Slope and Flemish Pass
Robert Pickart / WHOI pickart@rsp.whoi.edu	Lowered ADCP
Simon Prinsenberg / BIO PrinsenbergS@mar.dfo-mpo.gc.ca	Ice thickness and currents Labrador shelf
John Smith / BIO smithjn@mar.dfo-mpo.gc.ca	Chemistry isotopes
Igor Yashayaev / BIO YashayaevI@mar.dfo-mpo.gc.ca	Hydrography and XBTs

Table A.3.1: List of Principal Investigators. See Section 7 for addresses.

A.4. Physical - Chemical Program

A.4.1. Narrative

This expedition was conducting operations in support of four ongoing scientific initiatives.

The first initiative is in support of the North Atlantic Oscillation and the Atlantic Thermohaline Circulation Principal Research Areas of the Climate Variability and Predictability (CLIVAR) project of the World Climate Research Programme (WCRP). The occupation of the Labrador Sea section and the recovery of the two Labrador Sea moorings provide a measure of the winter cooling and water mass transformations over the winters of 2002/2003. The resetting of the mooring on the 1000 metre isobath on the Labrador slope continues a 20+ year observation program of the Labrador Current.

The second initiative is the continuation of the Labrador Sea project of the Canadian Joint Global Ocean Flux Study (JGOFS). The biological program is designed to characterize the late spring biological processes in the Labrador Sea and its shelf regions and is discussed in a later section of this document. A particular element of this year's program is the recovery of two moored sediment traps near the old OWS Bravo site in the Labrador Sea. These have been measuring the particle flux at 200 and 1000 metres over the past 12 months. The physical/chemical oceanographic program observes nutrients, total carbonate, alkalinity and CFCs over the entire water column in order to document the vertical transport of carbon via winter convection in the Labrador Sea as well as the changes in carbon storage in the deep waters of the North Atlantic.

The third objective is to observe the physical and chemical parameters at the various stations of the Halifax Section in support of DFO's Atlantic Zonal Monitoring Program.

The fourth objective is to recover and set moorings for various programs within the Ocean Sciences Division, BIO. Moorings were recovered and set on the continental slope at the end of the Halifax Section, at the mouth of the Laurentian Channel and in Flemish Pass. These moorings are designed to provide information on the structure of the current field to provide information related to the exploration and exploitation of oil and gas under the deeper areas of the continental slope. Two moorings were recovered from Makovik Bank on the Labrador Shelf. These moorings measured ice draft and water velocity profiles in support of the division's sea ice research program on the Labrador and Newfoundland shelves. A complex sediment trap mooring was recovered from the continental rise offshore of the Laurentian Channel. This mooring had been set as a contribution to the Canadian SOLAS program in April 2003. The mooring failed in June 2003; the failure is believed to be caused by the mooring being caught a trawl or a towed array.

The fifth objective was to deploy profiling floats as a Canadian contribution to the International GODAE/Argo program. Six floats were deployed; two in the Slope Water region and four in the Labrador Sea.

A.4.2. Radioisotope Sampling Program

(John Smith)

Near surface water samples were collected for ^{129}I from a near surface rosette bottle at 20 stations on the L3 (AR7W) line. Full depth sampling for ^{129}I was carried out at 5 stations on the same section. See table A.2.1 for the list of operations during which ^{129}I was sampled.

A.5. Biological Program

A.5.1. Narrative

The biological program conducted as part of cruise 2003038, with some modifications, was a continuation of studies began in 1994 to describe the large-scale (spatial and temporal) variability in plankton biomass, productivity and biogenic carbon inventories in the Labrador Sea.

The program has consisted of essentially five elements:

1) a phytoplankton biomass/primary productivity program conducted by Glen Harrison and Jeff Anning with assistance from Katherine Power (latter for Trevor Platt and Ed Horne),
2) a microbial program conducted by Paul Dickie (for Bill Li),
3) a mesozooplankton program conducted by Les Harris and Tim Perry (for Erica Head),
4) a dissolved organic carbon/community respiration program conducted by Jay Bugden (for Paul Kepkay), and
5) a sediment trap program conducted by Jeff Anning and Glen Harrison.

The ultimate aim of these studies is twofold:

1) to provide a description of the inventories in and export of biogenic carbon from the Labrador Sea, their turnover rates and variability in space and time as part of OSD's continuing climate-studies and
2) to provide a description of plankton life-cycles and productivity in the Labrador Sea and its influence or contribution to ecosystems downstream in support of OSD's fisheries-related research.

In addition to the Labrador Sea study, phytoplankton, mesozooplankton and nutrient samples were collected at the seven stations along the Halifax line in support of OSD's obligations to the Atlantic Zone Monitoring Program (AZMP).

A.5.2. Stable Isotope Studies of Carbon and Nitrogen (nitrate and ammonium) Utilization by Phytoplankton

(Glen Harrison)

This work represents a continuation of research begun in 1994 to determine the primary productivity (in terms of carbon and nitrogen) of phytoplankton in the Labrador Sea. Carbon dioxide (CO_2), nitrate (NO_3) and ammonium (NH_4) utilization rates from eight depths in the photic zone (i.e. the 1% light level ranged from 35-80 m) were determined using stable isotope tracer (^{13}C and ^{15}N) methods. Incubations experiments were carried out in on-deck 'simulated in-situ' incubators. A total of 9 experiments were conducted (see Table A.4.2.1). Carbon and nitrogen-based primary productivity rates along the L3 line will be related to vertical fluxes of particulate biogenic carbon and nitrogen derived from our sediment trap deployed on the “Bravo” mooring in 2002.

In addition to productivity measurements, samples from two deep casts (L3_14 & L3_15) were collected for determination of suspended particulate organic carbon (POC) and nitrogen (PON) 1,000 m.

Date	Site	Event #	Photic Depth (m)	^{15}N / ^{13}C	POC / PON
23-Jul-03	L3_01	86	45	x	
24-Jul-03	L3_08.5	119	35	x	
25-Jul-03	L3_13	152	50	x	
26-Jul-03	L3_14	165			x
26-Jul-03	L3_15	176			x
26-Jul-03	L3_16	186	40	x	
27-Jul-03	L3_19	219	55	x	
28-Jul-03	L3_23	259	80	x	
29-Jul-03	L3_22	290	65	x	
30-Jul-02	Transit	353	80	x	
31-Jul-03	L4_10	433	75	x	

Table A.4.2.1: Sampling for stable isotopes.

A.5.3. Zooplankton Sampling

(L. Harris, T. Perry)

The zooplankton sampling is part of an ongoing program, the aim of which is to investigate the distribution, abundance and life history of the major zooplankton groups found in the Labrador Sea and its associated shelf systems. Particular emphasis is placed on the copepod species of the *Calanus* genus, which dominate the zooplankton in this region.

Vertical net tows were taken at 50 stations, using both a 3/4 metre 200 μm mesh ring net and a 1/2 meter 76 um mesh ring net. At all stations, tows were made from 100 meters to the surface. Additional deep stratified tows (1000 meters to the surface) were taken at 11 of the stations in the Labrador Sea using a multi-net. Samples will be analysed for species composition, copepod stage structure and biomass. See Figure A.4.2.1 for station locations where nets were used.

A.5.4. Measurements Of Copepod Reproduction Rates

(L. Harris, T. Perry)

Egg production rates of *Calanus finmarchicus*, the dominant copepod species, were measured at 9 stations in the Labrador Shelf.

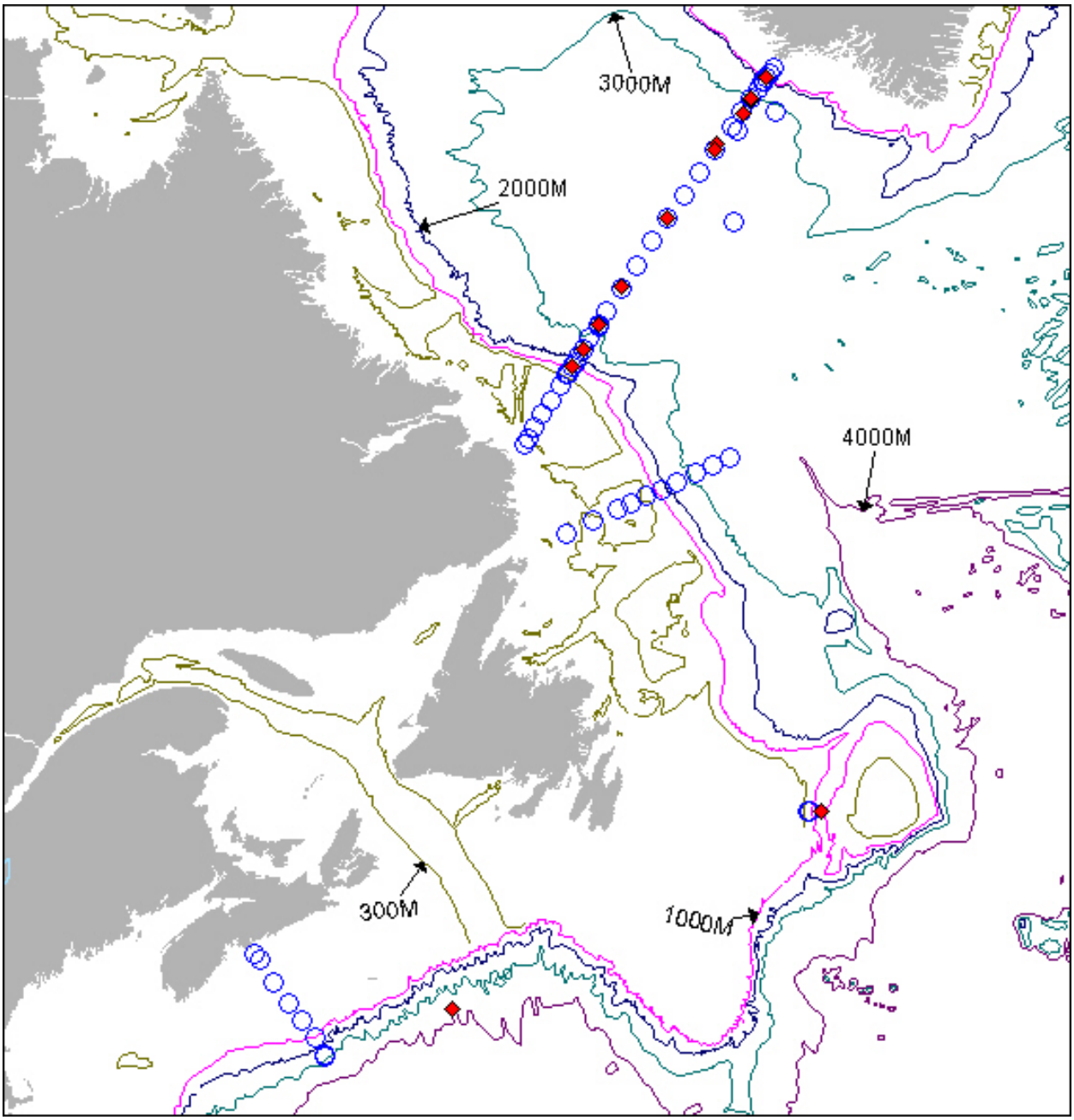


Figure A.4.2.1: Net tow (blue open circle) and multi-net tow (red filled diamond) locations for 18HU2003038_1.

A.5.5. Total Organic Carbon (TOC) and Microbial Community Respiration

(Jay Bugden / Paul Kepkay)

To better understand the cycling of carbon and the mechanisms controlling it in the Labrador Sea, it is necessary to examine the pool of total organic carbon (TOC), and look at the activity of the microbial community in the water column. By examining the rate of respiration and by size fractionating the TOC, information on the fate of carbon in this marine environment may be elucidated.

During CCGS Hudson cruise 2002-038 seven stations were sampled at the surface and at the chlorophyll maximum (usually between 3 and 50m depth) for gross microbial community respiration, and for the same stations only the surface was sampled for size fractionation of TOC (ultrafiltration). The stations sampled are listed below. TOC depth profiles were also collected from the stations indicated in the table below.

Station	Respiration	Ultrafiltration	TOC Profile
AR7W site 1	X	X	X
AR7W site 2			X
AR7W site 3			X
AR7W site 4			X
AR7W site 5			X
AR7W site 6			X
AR7W site 7			X
AR7W site 8			X
AR7W site 8.5	X	X	
AR7W site 9			X
AR7W site 10			X
AR7W site 11			X
AR7W site 12			X
AR7W site 13	X	X	X
AR7W site 14			X
AR7W site 15			X
AR7W site 16	X	X	X
AR7W site 17			X
AR7W site 18			X
AR7W site 19	X	X	X
AR7W site 20			X
AR7W site 21			X
AR7W site 22	X	X	X
AR7W site 23	X	X	X
AR7W site 24	X	X	X
AR7W site 25			X
AR7W site 26			X
AR7W site 27			X
AR7W site 28			X

Table A.4.2.2: Ultrafiltration, respiration and TOC sampling on CCGS Hudson cruise 2003-038.

A.5.6. Primary Production Measurements

(Jeff Anning)

Water samples for primary production experiments were collected from the rosette at 10 stations. For each incubation, 33 aliquots were inoculated with 14C as sodium bicarbonate and then incubated at in situ temperatures at 30 light levels (+ 3 dark bottles) for approximately 3 hours. At the end of the incubation period the cells were harvested onto GF/F glass fiber filters for later counting in a scintillation counter. Duplicate chlorophyll, duplicate particulate organic carbon, one HPLC, and one Absorption Spectra sample were collected for all incubations.

Photosynthesis/irradiance incubations were conducted at the following stations:

Station	Event	Lat.	Long.	Date	Time	Depth	ID
L3-01	86	53.676	-55.546	23-Jul-03	15:52	2	265706
						20	265703
L3-08.5	119	55.187	-54.059	24-Jul-03	13:17	4	265818
						21	265814
L3-13	152	56.115	-53.116	25-Jul-03	00:52	4	265924
						10	265921
L3-16	186	57.377	-51.792	26-Jul-03	15:22	3	266013
						30	266008
L3-19	219	58.640	-50.416	27-Jul-03	10:56	4	266102
						29	266097
L3-23	259	59.985	-48.899	28-Jul-03	10:25	4	266215
						49	266208
L3-22	290	59.744	-49.155	29-Jul-03	13:16	3	266341
						21	266337
L3-L4	353	57.738	-49.404	30-Jul-03	13:03	4	266382
						30	266377
L4-10	433	53.449	-49.499	31-Jul-03	10:12	4	266399
						29	266394
L4-05	452	52.733	-51.999	01-Aug-03	10:22	3	266528
						27	266523

Table A.4.2.3: Sampling for primary production.

A.5.7. Bacterial Abundance and Production of Microbial Plankton

(William Li and Paul Dickie)

Seawater samples were collected from the water sample bottles at all stations and all depths for subsequent Flow Cytometric analysis. They were preserved with a final concentration of 1% filtered paraformaldehyde and frozen in liquid Nitrogen. Dr. Bill Li will look at these for enumeration of pico-phytoplankton, bacteria and viruses. At 17 stations on the Labrador- Greenland transect, incubations were conducted on water from the surface to 150 meters for uptake of tritiated leucene into bacterial cells. This gave an estimate of the rate of increase of marine heterotroph biomass in the photic zone. An additional experiment was performed at station L3-16 using 21 water depths from surface to 3499 meters. A Dilution experiment was done to test the effects of predation on the experiment. Water samples were also collected from near the surface at most stations, preserved with a 1% final concentration of formaldehyde, stained with Dapi dye and filtered onto .8(m black polycarbonate filters. These will be kept frozen in the dark until they can be counted under a fluorescent microscope for nano-zooplankton.

A.5.8. Mooring Sediment Traps

(Glen Harrison and Jeff Anning)

Two sediment traps (from 175 m and 1,053 m) were successfully recovered at the “BRAVO” mooring site (M1349) on 25 July, 2003. The trap design employed was developed at BIO (Bioflux traps), it has a 24-cup capacity and internal Tattletale computer for programming particle collection intervals. Cups were programmed to collect material for 15-day intervals starting 12:01 (GMT), 15 July, 2002 and ending at 24:00 (GMT), 10 July, 2003. The shallow trap carousel worked properly through the first 14 cycles at which point rotation stopped. The cause of this malfunction, whether power or mechanical, is unknown at this point. It was noted that the PVC cover for the carousel was warped but this could have resulted from water pressure in the funnel upon recovery. The deep trap appeared to function properly for all 24 cycles. A preliminary inspection of the trap contents (Fig. 4.2.2) revealed a preponderance of diel-migrant crustacean “swimmers” in the shallow traps and numerous deep sea shrimp, jellies and other large organisms (e.g. fish) in the deep traps. Sedimenting phyto-detritus was detected only in the first (shallow and deep traps) and last (deep traps) few cups of the series. Note the excessive accumulation of biogenic material in cup #14 of the shallow trap, the point at which the carousel stopped rotating. This cup would have collected material for six months (26 January – 25 July, 2003). The material was highly decomposed (as evidenced by black appearance of the material and presence of H2S) as opposed to the other cups where the Hg preservative was adequate to retard decomposition. The small amount of biogenic material in cups #15-24 of the shallow trap was likely cross-contamination after the carousel seized.

Figure A.4.2.2: Sediment trap cup contents from 175 m and 1,050 m, “Bravo” mooring (M1349) deployed 4 July, 2002 and recovered, 25 July 2003. Cup collected material for 15-day intervals; starting 15 July, 2002 and ending 10 July, 2003.

A.6. Major Problems and Goals Not Achieved

The pump on the Autoanalyzer system failed early during the sampling of the AR7W section. The appropriate spares were not on board so all remaining nutrient samples were frozen and were brought back to BIO for subsequent analysis.

A.7. Other Incidents of Note

The biological sensors were left on the CTD package on station 22 (operation 291) of the AR7W section. The Wet Labs flourometer flooded around 1500 metres and this caused a data transmission failure on the CTD. When the CTD was recovered and the biological sensors were removed, the CTD unit worked fine. The light sensor survived its cast to about 1600 metres without damage although it is only rated to 400 metres.

We had considerable difficulty with the instrumented blocks on the CTD boom early in the trip. After trying both of the CTD blocks (equipped with wire tension sensors) without resolving all the problems, we went to the spare block from the multi-net system. This block worked fine although it does not measure tension. Fortunately the seas were extraordinarily calm and hence tension measurements were not necessary.

A.8. List of Cruise Participants

Name	Responsibility	Affiliation
Jeff Anning	Primary Production	BIO
Carol Anstey	Nutrients	BIO
Victoria Burdett-Coutts	CO_2, Alkalinity and O_2 analysis	BDR
Jay Bugden	DOC Levels, respiration rates	BIO
Rick Boyce	Salts, moorings	BIO
Derek Brittain	MVP, moorings	BIO
Allyn Clarke	Senior Scientist	BIO
Paul Dickie	Bacterial activity	BIO
Bob Gershey	Scientist, CO_2, O_2, CFCs, Alkalinity	BDR
Les Harris	Zooplankton, Net Tows	BIO
Glen Harrison	Assistant Scientist	BIO
Jeff Jackson	Data management	BIO
Matt Mazloff	Student, computer room	WHOI
Tim Perry	Zooplankton, vertical net hauls	BIO
Katherine Power	Biological analysis	BIO
Murray Scotney	Moorings, instrumentation	BIO
Igor Yashayaev	Scientist	BIO
Frank Zemlyak	Technician, CO_2, O_2, CFCs, Alkalinity	BIO

BIO Bedford Institute of Oceanography
PO Box 1006
Dartmouth, NS, B2Y 2A4
Canada

BDR BDR Research Ltd.
Box 652, Station 'M'
Halifax, NS, B3J 2T3
Canada

WHOI Woods Hole Oceanographic Institution
Woods Hole, MA 02543
USA

B. UNDERWAY MEASUREMENTS

B.1. Navigation and Bathymetry
(Jeff Jackson)

The navigation system onboard CCGS Hudson consists of a differential GPS receiver and AGCNAV. The receiver is one of many NMEA feeds into a multiplexer that provides all the NMEA strings to a PC on the bridge. The PC, which is running AGCNAV software, then rebroadcasts the NMEA strings to distribution units in the computer room, which provide 16 output lines for the working labs. The resulting broadcast navigation strings are at about 1 Hz. The navigation data are then logged at 10 second intervals on a PC.

AGCNAV is a PC based display and waypoint setting software package, developed at the Atlantic Geoscience Centre at BIO. This software graphically displays ship position, waypoints, course, speed, etc. to the various science working areas.

The echo sounder system used for collecting bathymetric data at station locations consisted of a Raytheon Line Scan Recorder, Model LSR 1811-1 (serial number A101) connected to a 12kHz transducer. The transducer beam width is 15 degrees. The sweep rate of the record was adjusted throughout the course of data collection to aid in identifying the bottom signal. One transducer is positioned on a Ram that can be lowered or raised depending on conditions. When the ram is up, the waterline to transducer offset is 6 m. When the ram is down, the offset is 8 m.

B.2. Vessel Mounted Acoustic Doppler Current Profiler
(Murray Scotney)

The Hudson was equipped with a hull mounted RDI Acoustic Doppler Current Profiler (ADCP). The transducer (serial number 177) had VM ADCP electronics (serial number 172). Logging, using Transect software on a 486 PC, was started on July 13 at 1739 Z off the coast off the Nova Scotia while performing operations on the Halifax Line.

The configuration used for logging resulted in 10-minute averages in 4 meter bins. The averaged data are stored to disk and backed up every few days. ADCP logging was stopped on August 5 at 11:13 Z in Halifax Harbour.

B.3. Continuous Flow Multisensor Package (CFMP)

(Jeff Anning)

Water from approximately a depth of 4m was continuously pumped to the forward lab. The temperature, conductivity and fluorescence was measured and logged every 30 sec. The temperature and conductivity were measured with Seabird sensors (SBE 3F temperature sensor S.N. 032169 and SBE 4 conductivity sensor S.N. 040817) and the fluorescence by a Wetlabs flow through fluorometer (WSIS-621PSS). Incident Photosynthetically Active Radiation was measured with a Li-Cor Spherical Quantum Sensor and this data was merged with the sea water parameters. Exact time and positions were provided by a Northstar GPS unit and logged with the other data. In addition, discrete water samples were collected at regular intervals by an auto sampler for later analysis for nitrate and silicate. The computer logged the time and position of these discrete samples.

B.4. XBT and XCTD

(Igor Yashayaev)

Expendable Bathythermographs were routinely deployed along the AR7W line on the way from Labrador to Greenland and in the area shown in figure B.4.2. The XBTs were model T4 and T7 from Sparton of Canada. These types of probes are capable of measuring to maximum depths of 500 m (T4) and 800 m (T7) at the full cruising speed 15 knots. The vertical resolution of the measurements was about 0.6-0.8 m. 107 XBTs were launched during the cruise (Table A.2.1 lists the operation numbers when these were deployed).

Continuous deployment of XBTs along the AR7W line at 2-4 kilometer intervals revealed inhomogeneities in the thermal structure of the upper layer. Dominant scales appear to be between 20 and 40 kilometers. Preliminary data are shown in Figure B.4.1. A couple miles to the east of the site 21 (according to the standard AR7W/L3 station notation) XBT measurements revealed an intense cold eddy. This eddy was resurveyed with XBTs soon after completion of AR7W line. This XBT survey helped us to locate the center of the eddy. Figure B.4.2 demonstrates the average temperature between 100 m and 700 m from all XBT and CTD profiles in the area where we found the eddy. In addition, we conducted a full depth CTD station, some net tows and we deployed a profiling float at the location identified from the XBT survey as the center of the eddy.

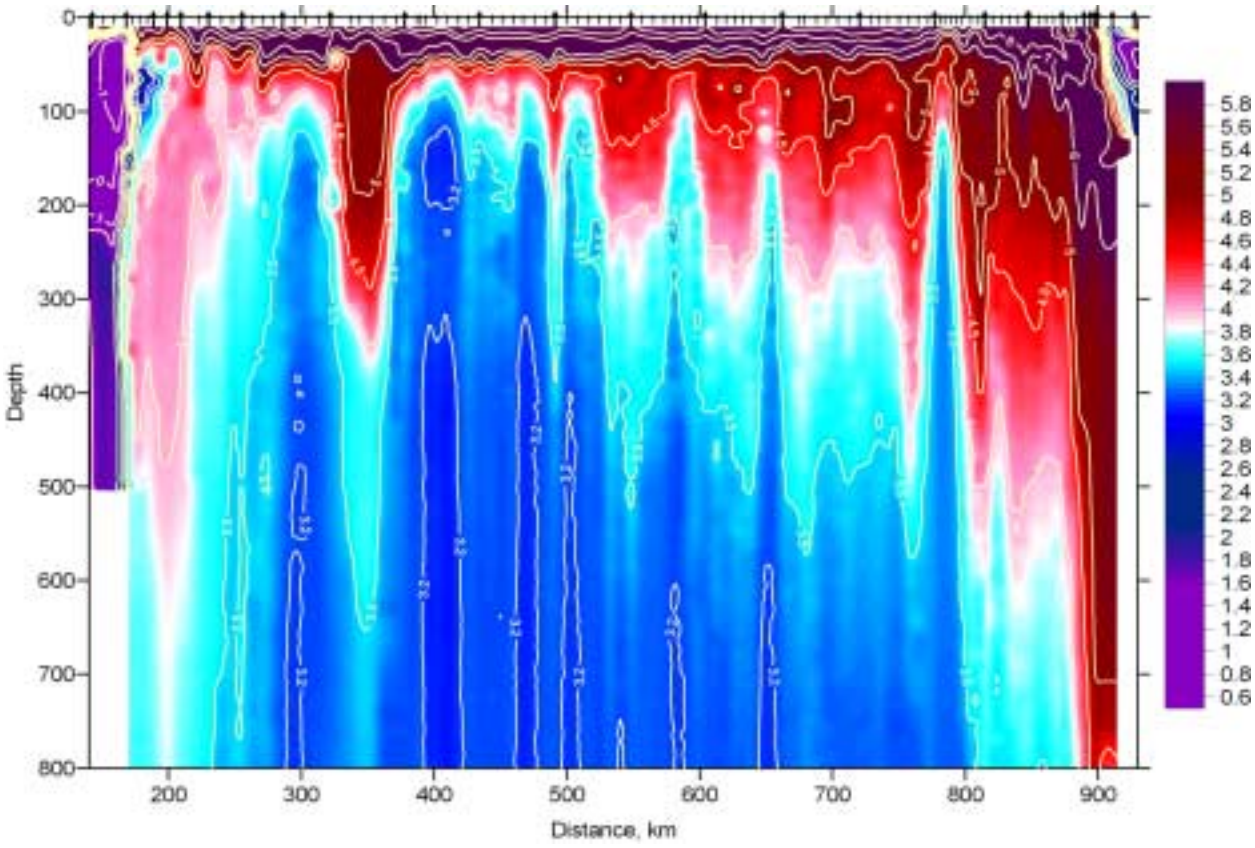


Figure B.4.1: Temperature in the upper 800 metres along the AR7W section. Bold arrows mark the positions of the CTD stations; vertical bars the positions of XBT drops.

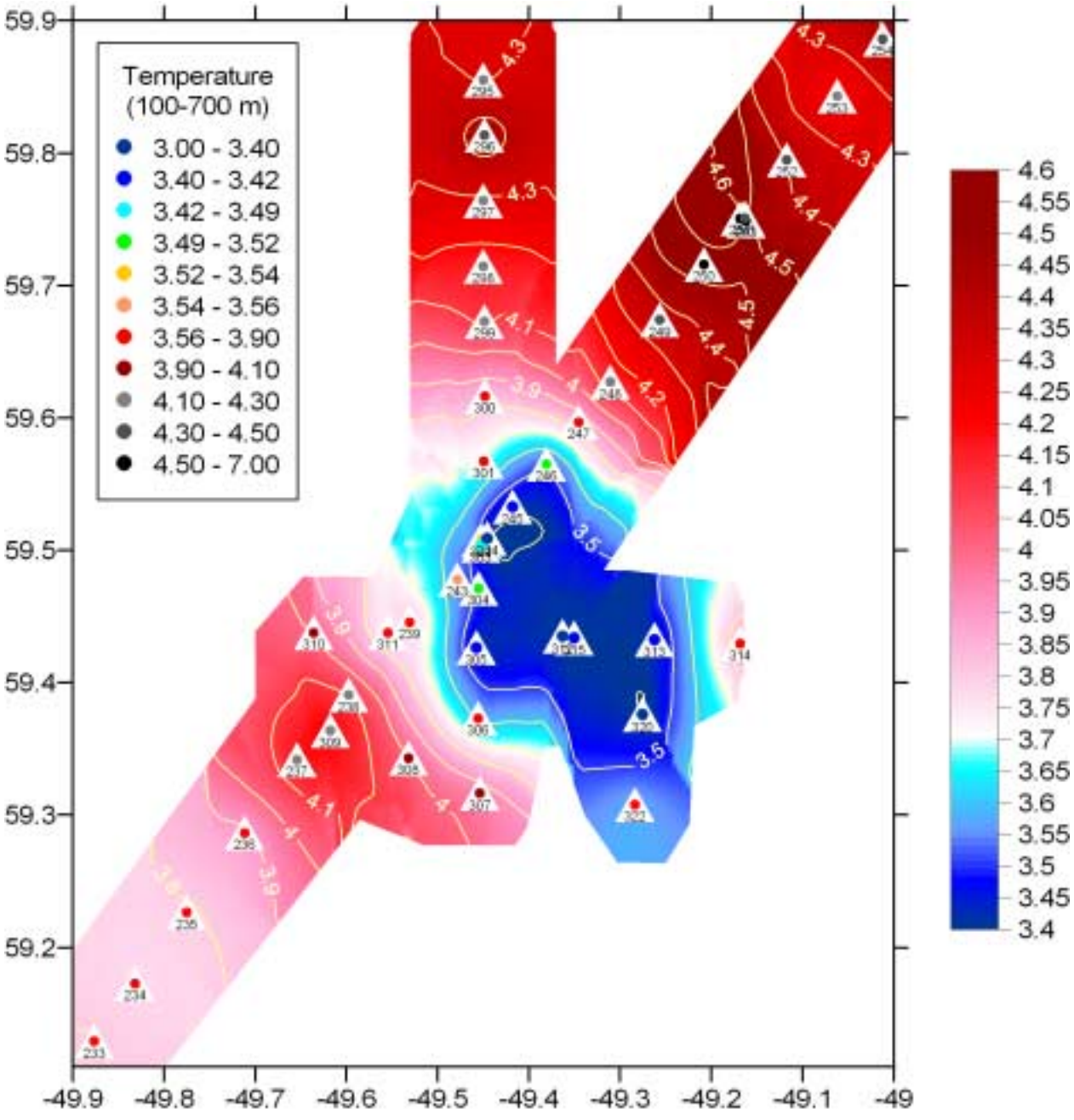


Figure B.4.2: Average Temperature for the 100-700 metre layer in the vicinity of the cold core eddy mapped on the eastern end of the AR7W section during Hudson 2003-038.

B.5. MVP

(Allyn Clarke)

The Moving Vessel Profiler (MVP) system was deployed while the vessel was in transit between near Station 21 on the AR7W section and station 10 on the L4 line. The system was activated every 15 minutes. The system cable had a fault around 480 metres, so for the vessel cruising speed of 12.4 knots, profiles were limited to a little better than 160 metres. The system was configured with an Applied Microsystems Ltd, CTD Microsensor Instrument with serial number 7013. This CTD is equipped with the following sensors.

Sensor	Type	Range	Accuracy
Pressure	Strain gauge	0 – 500 dbars	±0.15 dbars
Conductivity	Platinized electrode	0 – 7 (C Ratio)	±0.0001 (C Ratio)
Temperature	Thermistor	-2 to 32 ^{o}C	±0.0012 ^{o}C

The CTD sampled at 25 scans / second. The MVP was also equipped with a WetLabs Model WS1S-120.SS #9602010 fluorometer.

B.6. Meteorological observations

The ship's crew logged routine reporting of meteorological variables.

B.7. Atmospheric Chemistry

There was no atmospheric chemistry program.

Appendix 1: Operaton Notes Report
(sorted by Operation ID Number)

Note Number: 2 Entry Time: 14/Jul/2003 12:58:49 Note Made By: Jeff Jackson Operation ID: 16	There were problems with cables and connections during this cast, so it was aborted. No samples were collected.
Note Number: 1 Entry Time: 14/Jul/2003 9:07:01 Note Made By: Jeff Jackson Operation ID: 21	Allyn intended for this station to be a CTD only cast, but we did not know so we fired 4 bottles before he told us just to bring it up and out. No samples were taken from the fired bottles.
Note Number: 3 Entry Time: 27/Jul/2003 11:48:19 Note Made By: Allyn Clarke Operation ID: 220	Primary Salinity went to very high values from 15 to 50 metres on down cast of L3_19. Possibly a pump problem.
Note Number: 4 Entry Time: 27/Jul/2003 19:03:07 Note Made By: Jeff Jackson Operation ID: 230	Jeff did not remove hoses from CTD sensors, as he did not know to remove them. So there may have been a time delay problems within the data.
Note Number: 5 Entry Time: 28/Jul/2003 12:29:47 Note Made By: Allyn Clarke Operation ID: 261	When initiating the deployment of the LADCP on station L3_23, the LADCP failed to wake up. Tried re-plugging the cable a couple of times without success. Plugged the cable in the winch room directly into the LADCP pressure-case and successfully woke up the LADCP and initiated the deployment.
Note Number: 6 Entry Time: 29/Jul/2003 9:35:06 Note Made By: Allyn Clarke Operation ID: 286	There was a low salinity and oxygen feature on primary oxygen and salinity around 1300 metres on the down trace that was absent on the up. Looks like a pump failure if it was not on secondary line too.
Note Number: 7 Entry Time: 29/Jul/2003 14:36:47 Note Made By: Allyn Clarke Operation ID: 291	CTD began failing at about 1380 metres and failed completely at 1499. Error light on, data light flickering but no data. Recovering cast at 75 metres/min. Biological sensors going deeper than they should have gone actually caused the CTD problem.
Note Number: 8 Entry Time: 30/Jul/2003 13:12:35 Note Made By: Allyn Clarke Operation ID: 353	Primary salinity and primary oxygen failed several times on the down trace. Possibly the primary pump. Processing of the CTD records failed - could not open 038a353.con. Allyn accidentally mistyped 353 as 253 into the Seabird software.
Note Number: 9 Entry Time: 30/Jul/2003 17:28:11 Note Made By: Allyn Clarke Operation ID: 377	MVP failed on descent. Recovered fish. Wiggled all the wires. Opened the fish and cleaned the connections. Could not reproduce the fault. Returned to the water and sampling program. Derek and Rick worked on fish.

Table F.11: Operation Notes

Appendix 2: PROVOR Float Logs

PROVOR Float Launch Serial No. MT-103

System Argos ID dec.	30235	Hex:	D86E3
Buoyancy ID:	298	Sensor ID:	373
Argos PTT ID:	17	Buoyancy Controller:	32
Software Version:	SN1156 1.4		

Start Date: 15 July 2003	Time: 4:20 UT	Cycle Period: 10 days
Drift Depth: 2000 m	Profile Depth:	2000 m
Transmission Period:	45 seconds	Transmission Duration: 9 hours

Deployment Date: 15 July 2003 Time: 4:32 UT
By: Derek Britain

Vessel: Hudson Event No. 40
Latitude: 42 32.767 N Longitude: 61 25.071 W

Water Depth: 2700 m (Must be deeper than 2500 meters)

Nearest CTD Event:	Operation ID:	37		
Date:	15 July 2003	Time:	00:41 UT	
Latitude:	42 31.891 N	Longitude:	61 23.981 W	
Max Depth:	2700 m			

Any problems associated with the start up and deployment operation: No

PROVOR Float Launch Serial No. MT-104

System Argos ID dec.	29855	Hex:	D27ED
Buoyancy ID:	299	Sensor ID:	377
Argos PTT ID:	56	Buoyancy Controller:	39
Software Version:	SN1156 1.4		

Start Date: 28 July 2003	Time: 18:13 UT	Cycle Period: 10 days
Drift Depth: 2000 m	Profile Depth:	2000 m
Transmission Period:	45 seconds	Transmission Duration: 9 hours

<u>Deployment</u>	Date: 28 July 2003	Time: 18:45 UT
	By: Boyce / Clarke	

Vessel:	Hudson 2003-038	Event No. 271	
Latitude:	60 19.0321 N	Longitude: 48 35.1351 W	
Water Depth:	2630 m	(Must be deeper than 2500 meters)	

Nearest CTD	Event	Operation No.	270	
	Date:	28 July 2003	Time:	16:37 UT
	Latitude:	60 17.675 N	Longitude:	48 33.304 W
	Max Depth:	2630 m		

Any problems associated with the start up and deployment operation:

- First message sent at 3.5 minutes after magnet removed,
- 16 messages sent followed at least 8 clicks

PROVOR Float Launch Serial No. MT-105

System Argos ID dec.	30174	Hex:	D779F
Buoyancy ID:	303	Sensor ID:	427
Argos PTT ID:	16	Buoyancy Controller:	7
Software Version:	SN1156 1.4		

Start Date: 30 July 2003	Time: 03:50 UT	Cycle Period: 10 days
Drift Depth: 2000 m	Profile Depth:	2000 m
Transmission Period:	45 seconds	Transmission Duration: 9 hours

Deployment Date: 30 July 2003 Time: 04:12 UT
By: Brittain / Yashayaev

Vessel: Hudson Event No. 318
Latitude: 59 23.37 N Longitude: 49 18.580 W

Water Depth: 3320 m

Nearest CTD Event	Operation No.	315		
Date:	30 July 2003	Time:	01:16 UT
Latitude:	59 24 N	Longitude:	49 22 W
Max Depth:	3320 m		

Any problems associated with the start up and deployment operation:

- External pressure = 20 mbars
- Salinity = -45.000 psu

PROVOR Float Launch Serial No. MT-112

System Argos ID dec.	30182	Hex:	D7983
Buoyancy ID:	311	Sensor ID:	424
Argos PTT ID:	96	Buoyancy Controller:	24
Software Version:	SN1156 1.4		

Start Date: 17 July 2003	Time: 21:50 UT	Cycle Period: 10 days
Drift Depth: 2000 m	Profile Depth:	2000 m
Transmission Period:	45 seconds	Transmission Duration: 9 hours

<u>Deployment</u>	Date: 17 July 2003	Time: 22:07 UT
	By: Brittian	

Vessel:	Hudson	Event No. 58	
Latitude:	44 39.51 N	Longitude: 54 57.803 W	
Water Depth:	2515 m	(Must be deeper than 2500 meters)	
Nearest CTD Event:		Operation No.	57
	Date:	17 July 2003	Time: 17:18 UT
	Latitude:	44 40.0 N	Longitude: 56 6.0 W
	Max Depth:	1700 m	

Any problems associated with the start up and deployment operation:

- On checkout the following parameters were different from their optimal values as stated in the manual
- EXT. SALINITY READ –45 PSU RATHER THAN 0 PSU
- INT. VACUUM READ 675 NBAR RATHER THAN 700

PROVOR Float Launch Serial No. MT-119

System Argos ID dec.	30395	Hex:	DAEDA
Buoyancy ID:	326	Sensor ID:	619
Argos PTT ID:	4	Buoyancy Controller:	
Software Version:	SN1156 1.4		

Start Date: 29 July 2003	Time: 18:21:30 UT	Cycle Period: 10 days
Drift Depth: 2000 m	Profile Depth:	2000 m
Transmission Period:	45 seconds	Transmission Duration: 9 hours

Deployment	Date: 29 July 2003	Time: 19:00 UT
	By: Boyce / Clarke	

Vessel:	Hudson	Event No. 294	
Latitude:	59 42.682 N	Longitude: 49 07.558 W	

Water Depth: 3200 m

Nearest CTD Event:	Operation No.	293		
Date:	29 July 2003	Time:	17:32 UT	
Latitude:	59 43.887 N	Longitude:	49 8.374 W	
Max Depth:	3200			

Any problems associated with the start up and deployment operation:

- External Pressure 40 mbars
- Salinity – 45.00 psu
- Messages began at 18:24;50, 16 messages followed by 8 clicks

PROVOR Float Launch Serial No. MT-120

System Argos ID dec.	30408	Hex:	DB217
Buoyancy ID:	315	Sensor ID:	616
Argos PTT ID:	57	Buoyancy Controller:	10
Software Version:	SN1156 1.4		

Start Date: 27 July 2003	Time: 6:22 UT	Cycle Period: 10 days
Drift Depth: 2000 m	Profile Depth:	2000 m
Transmission Period:	45 seconds	Transmission Duration: 9 hours

Deployment Date: 27 July 2003 Time: 7:36:28 UT
By: Brittain / Yashayaev

Vessel: Hudson Event No. 208
Latitude: 58 13.274 N Longitude: 50 53.777 W

Water Depth: 3481 m (Must be deeper than 2500 meters)

Nearest CTD Event :	Operation No.	207		
Date:	27 July 2003	Time:	06:08 UT	
Latitude:	58 12.853 N	Longitude:	50 54.1076 W	
Max Depth:	3480 m			

Any problems associated with the start up and deployment operation:

- Not sure if the start time given for this float was the actual start time or the time the various parameters were modified in preparation for the starting of the float.

Appendix 3: Mooring Logs

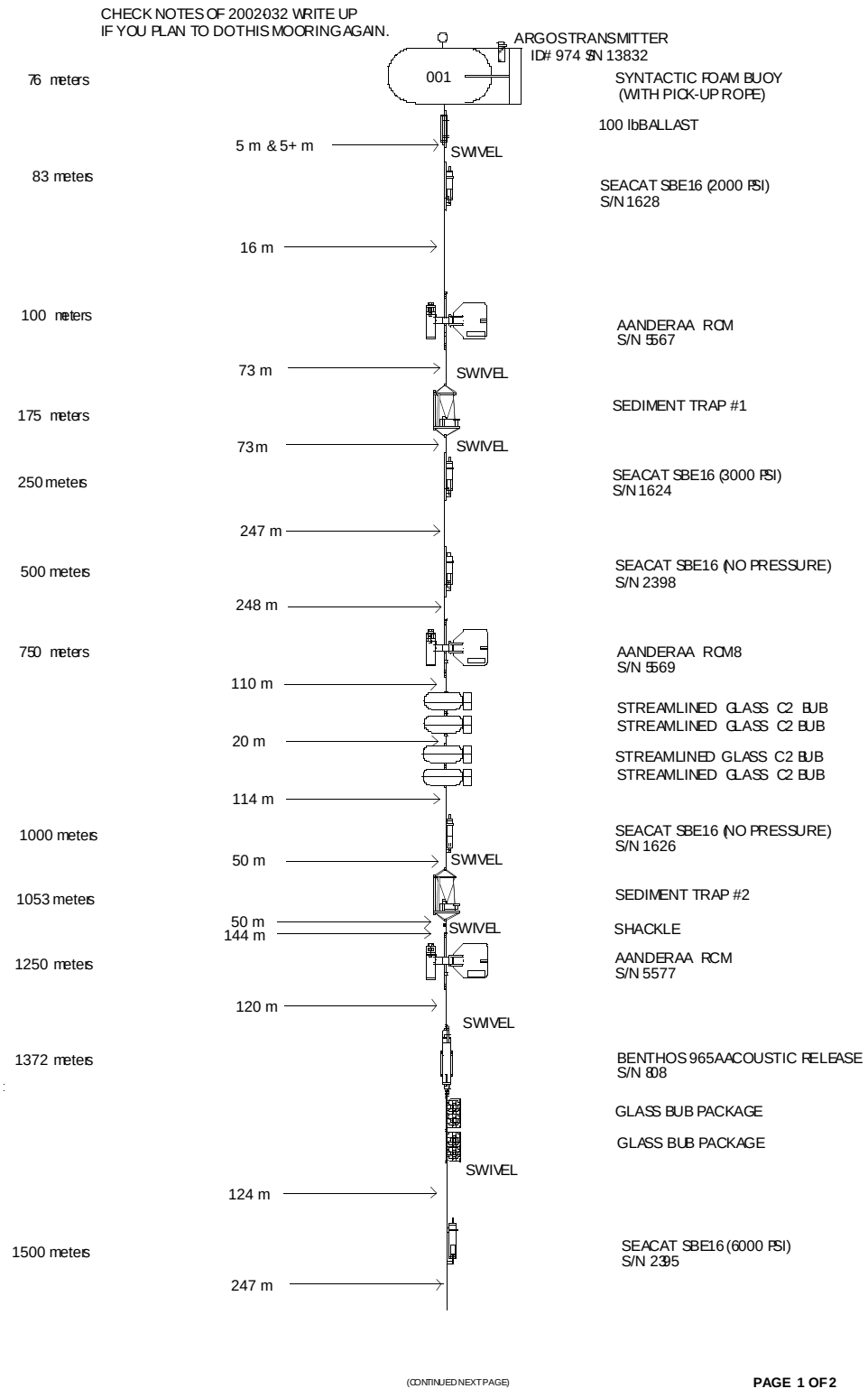
Recovery

Mooring No: 1452 Ship: Hudson
Cruise No: 2003-038 Date: July 25, 2003
Mooring Tech: Boyce / Brittain Type of Nav: GPS
Sea State: 1/2 m waves
Weather Conditions: S 10 knots clear until 20:25 then heavy fog until 21:30 when fog lifted
Cancel Notship: Yes _____ No

Recovery Log		
Time (Z)	**Instrument**	**Remarks**
16:47	Release 808	Sent enable command distance of 2.5 cables, no clear response but was getting transponder replies at a variety of ranges. Steadiest response was 4.5 km
16:52		More enable commands sent at distances of 320 – 340 metres. Still getting a wide variety of ranges from release 808
17:12	Release 888	Sent enable command, decided that we were transponding on both releases but at a far range ~ 5 km. Steaming slowly to WSW in search
18:05		3.3 km WSW of mooring site, still closing on release
18:22		Range of 1480 m on 808 at 56 38.8207 N 52 28.2214 W Range of 3559 m on deep release
18:28	Release 808	Release command sent / mooring on way up
18:31	Float 1	Float sighted on surface 2 cables to east of vessel
18:54		Buoy hooked on
19:00	Seacat 1628	On board
19:04	ACM 5567	Out of water / rotor free
19:15	Trap # 1	Draining water out of the top of the trap carousal On board, bottom bridle removed
19:20	Seacat 1624	Out of water, on board
19:25	Seacat 2398	Out of water, on board
19:30	ACM 5569	Out of water, on board
19:34	2 SUBs	Out of water – remained submerged throughout recovery
19:37	2 SUBs	Out of water – remained submerged throughout recovery
19:41	Seacat 1626	Out of water
19:45	Trap # 2	Out of water – draining through bottom of the carousal
19:54	ACM 5577	Out of water / rotor free
19:57	Release 808	On board

M 1452 Recovery Log (Continued)		
Time (Z)	**Instrument**	**Remarks**
20:20:11	Release 888	Closest approach 56 38.6421 N 52 28.0869 W 3544 m range
20:22	Release 888	Release command sent / mooring released
21:25		Sighted on surface after a bit of a search in the fog
21:31	2 BUB	Hooked on
21:38	Seacat 2395	On board
21:45	ACM 6402	Out of water / rotor free
21:45	3BUB	Out of water
21:54	Seacat 2393	Out of water
22:03	Seacat 1896	Out of water
22:05	ACM 6409	Out of water / rotor free
22:12	3BUB	Out of water
22:19	Release 885	Out of water
22:23	3BUB	Out of water
22:26	ACM 7134	Out of water / rotor free
22:29	3 BUB & release	Out of water / both balls & hardhats of bottom package were broken away

MOORING #1452 • CLARKE • LAB SEA • JUNE 2002



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PAGE 1 OF 2

Figure F.3.1

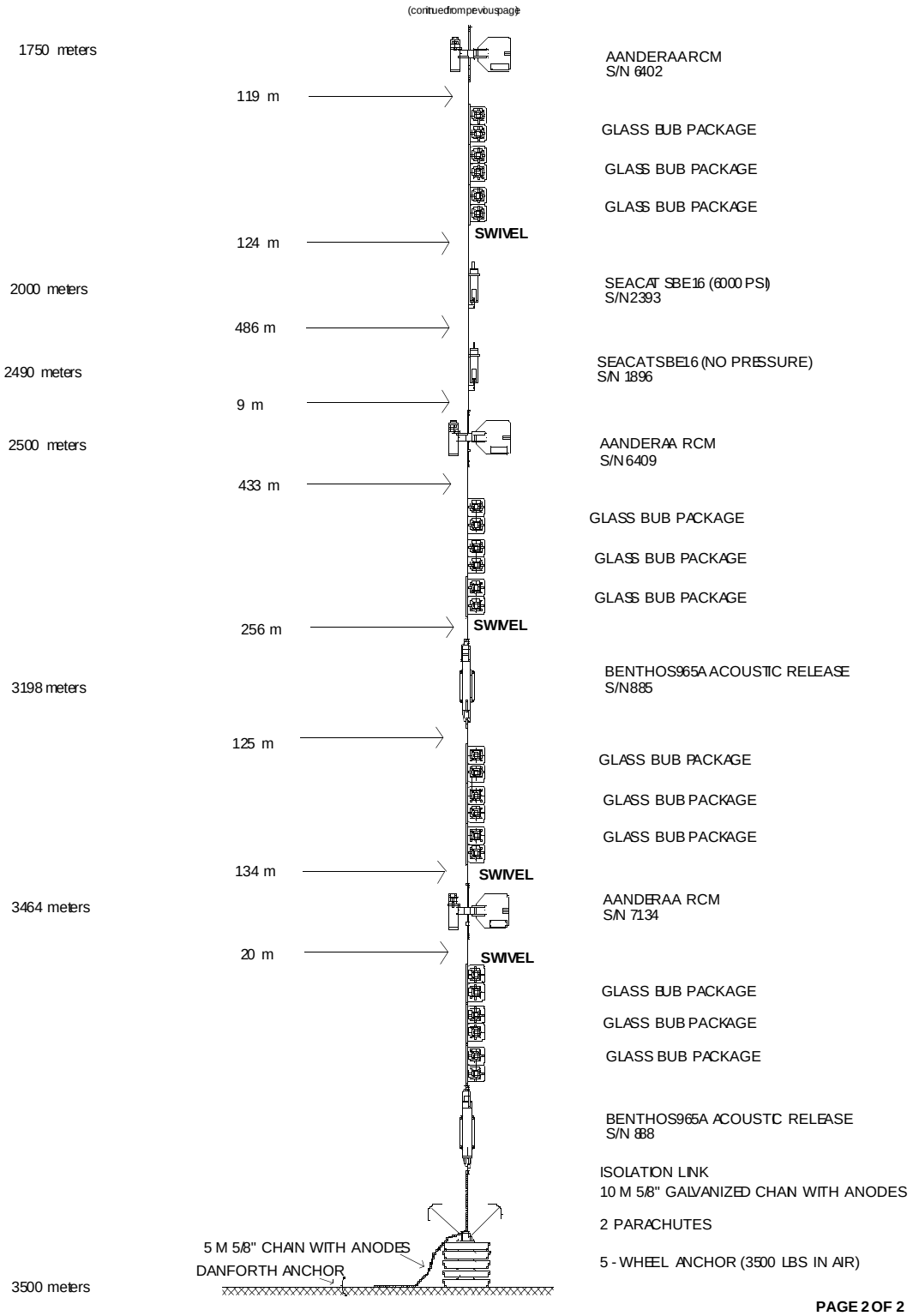

MOORING #1452 • CLARKE • LAB SEA • JUNE 2002
(continued from previous page)
1750 meters
AANDERAA RCM
S/N 6402
119 m
GLASS BUB PACKAGE
GLASS BUB PACKAGE
GLASS BUB PACKAGE
SWIVEL
124 m
2000 meters
SEACAT SBE16 (6000 PSI)
S/N 2393
486 m
2490 meters
SEACAT SBE16 (NO PRESSURE)
S/N 1896
9 m
2500 meters
AANDERAA RCM
S/N 6409
433 m
GLASS BUB PACKAGE
GLASS BUB PACKAGE
GLASS BUB PACKAGE
256 m
SWIVEL
3198 meters
BENTHOS 965A ACOUSTIC RELEASE
S/N 885
125 m
GLASS BUB PACKAGE
GLASS BUB PACKAGE
GLASS BUB PACKAGE
134 m
SWIVEL
3464 meters
AANDERAA RCM
S/N 7134
20 m
SWIVEL
GLASS BUB PACKAGE
GLASS BUB PACKAGE
GLASS BUB PACKAGE
BENTHOS 965A ACOUSTIC RELEASE
S/N 888
ISOLATION LINK
10 M 5/8" GALVANIZED CHAIN WITH ANODES
2 PARACHUTES
5 M 5/8" CHAIN WITH ANODES
DANFORTH ANCHOR
5 - WHEEL ANCHOR (3500 LBS IN AIR)
3500 meters
PAGE 2 OF 2

Figure F.3.2

Recovery

Mooring No:	1453	Ship:	Hudson
Cruise No:	2003-038	Date:	July 24, 2003
Mooring Tech:	Boyce / Brittain	Type of Nav:	GPS
Sea State:	calm	Weather Conditions:	calm
Cancel Notship:	Yes _____	No	

Recovery Log		
Time (Z)	**Instrument**	**Remarks**
10:22		Enabled release, distance 3.4 cables, range 1200 m
10:23		Release command at 2.73 cables, mooring released
10:35		On surface
10:44		Hooked on
10:47		Top float out of water / wire to ACM caught over top of float
10:50	ACM 4208	On board / rotor OK
10:53	Release & 2BUB	On board – release snarled

MOORING #1453 • CLARKE • LAB SEA • JUNE 2002

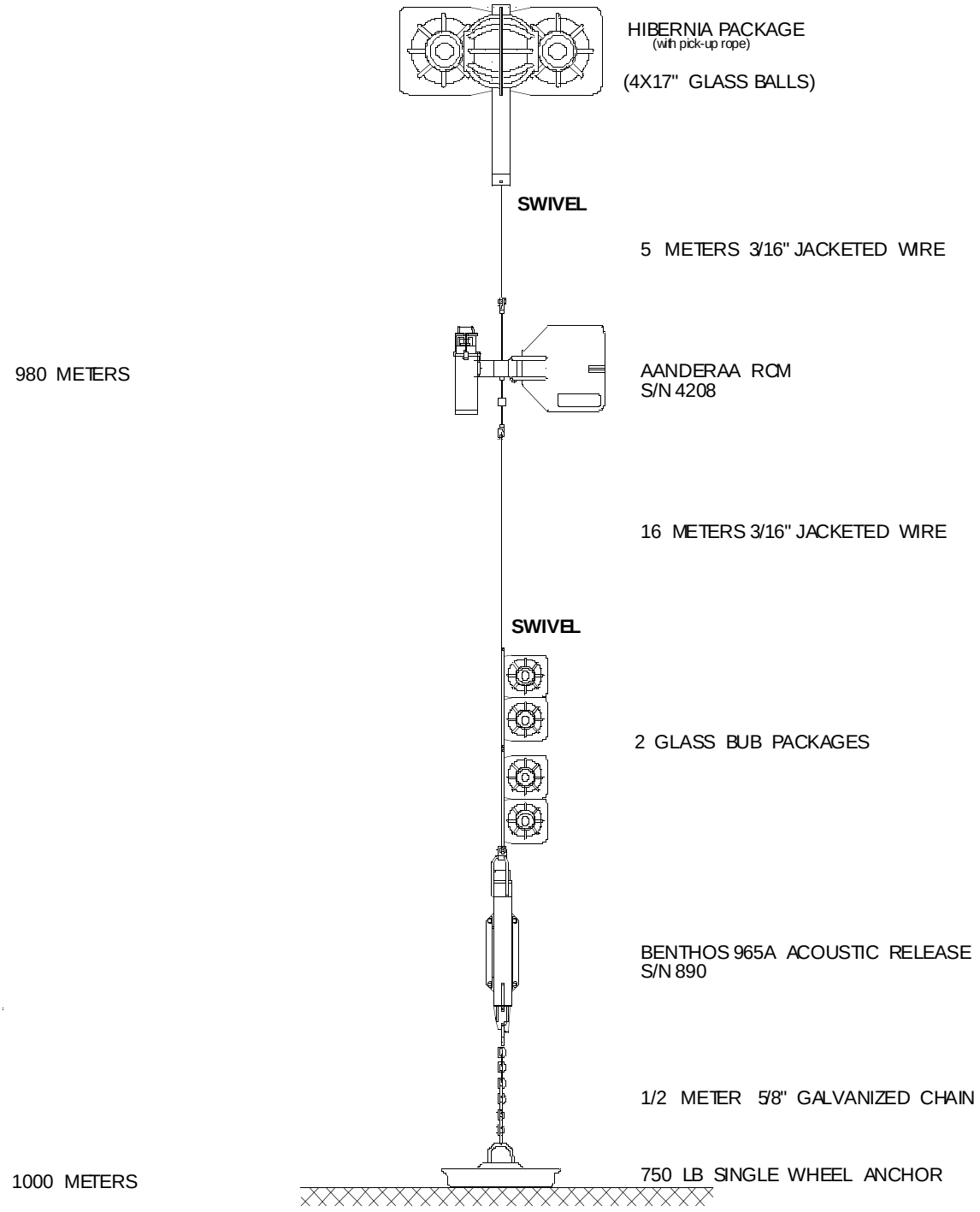


Figure F.3.3

Recovery

Mooring No:	1457	Ship:	Hudson
Cruise No:	2003-038	Date:	July 19, 2003
Mooring Tech:	Scotney / Boyce / Brittain	Type of Nav:	GPS
Sea State:	light ground swell		
Weather Conditions:	thick fog, visibility less than a cable, SSW 10		
Cancel Notship:	Yes _____	No	

Recovery Log		
Time (Z)	**Instrument**	**Remarks**
April 24, 2003		CCGS Teleost mooring interrogated successfully. Appears in position.
19 July 09:33	GB 'R'	Hooked on / lifted on deck
09:55	GB 'R'	Anchor on board
10:12	release	Finally responded to enable command at 3.3 cables. Difficulty locating release / eventually identified signal from 1 n.mile range
12:00	release	Release command sent / mooring released
12:16		Bridge sighted float on surface
12:18		Buoy hooked on
12:23		Buoy & MicroCat out of water
12:28	ADCP 0239	On board
12:30	2 BUB	On board
12:35	ACM 7650	On board – rotor spinning
12:39	ACM 4406	On board – rotor free
12:42	3 BUB & release	On board

MOORING #1457 • SITE FP-A • JOHN LODER • FLEMISH PASS • NOV 2003

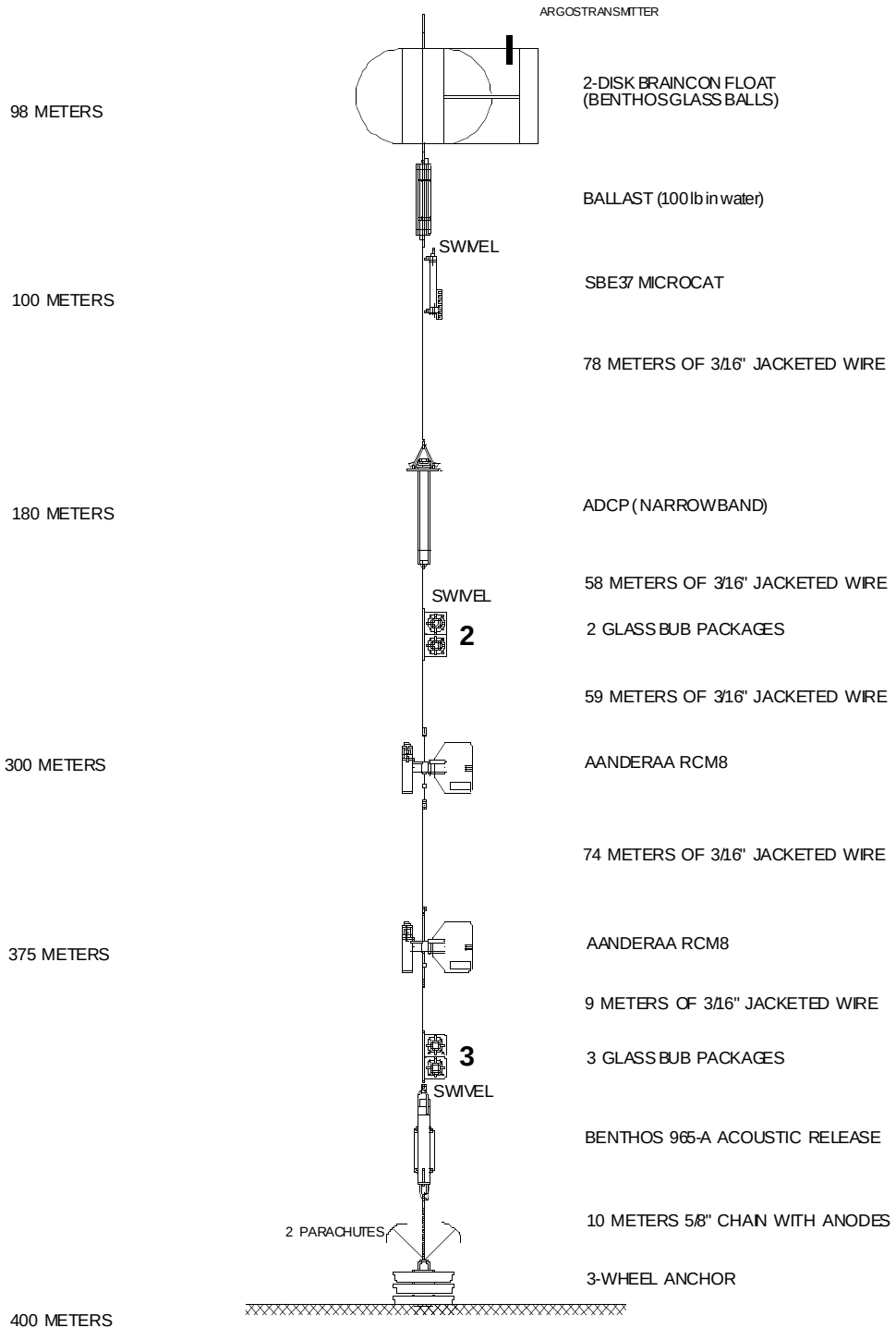


Figure F.3.4

Recovery

Mooring No:	1458	Ship:	Hudson
Cruise No:	2003-038	Date:	July 19, 2003
Mooring Tech:	Scotney / Boyce / Brittain	Type of Nav:	GPS
Sea State:	light ground swell		
Weather Conditions:	fog, SW 10		
Cancel Notship:	Yes _____		No

Recovery Log		
Time (Z)	**Instrument**	**Remarks**
April 24, 2003		CCGS Teleost. Release interrogated successfully. Appears on position.
July 19, 2003 13:41	GB 'U'	Hooked on, bottom shackle not on nylon bushing
14:06	GB 'U'	Snarl in bottom chain (about 15 m chain involved)
14:14		Anchor onboard
15:00		Positioned release – within 1 cable of position, then 4.9 cables from site – release command sent / released
15:02		Float on surface
15:14		Hooked on buoy
15:17	Buoy, AC 6403	Out of water, on deck, rotor free
15:26	ACM 6411	Out of water, rotor free
15:32	ACM 3584 & 3 BUB & Microcat	Out of water in a snarl, rotor free
15:40	ACM 3306	Out of water, rotor free
15:44	2 BUB	Snarl, out of water
15:49	ACM 2663 & Microcat	Out of water, rotor free
15:51	3BUB & release	Out of water

MOORING #1458 • SITE FP-B • JOHN LODER • FLEMISH PASS • NOV 2003

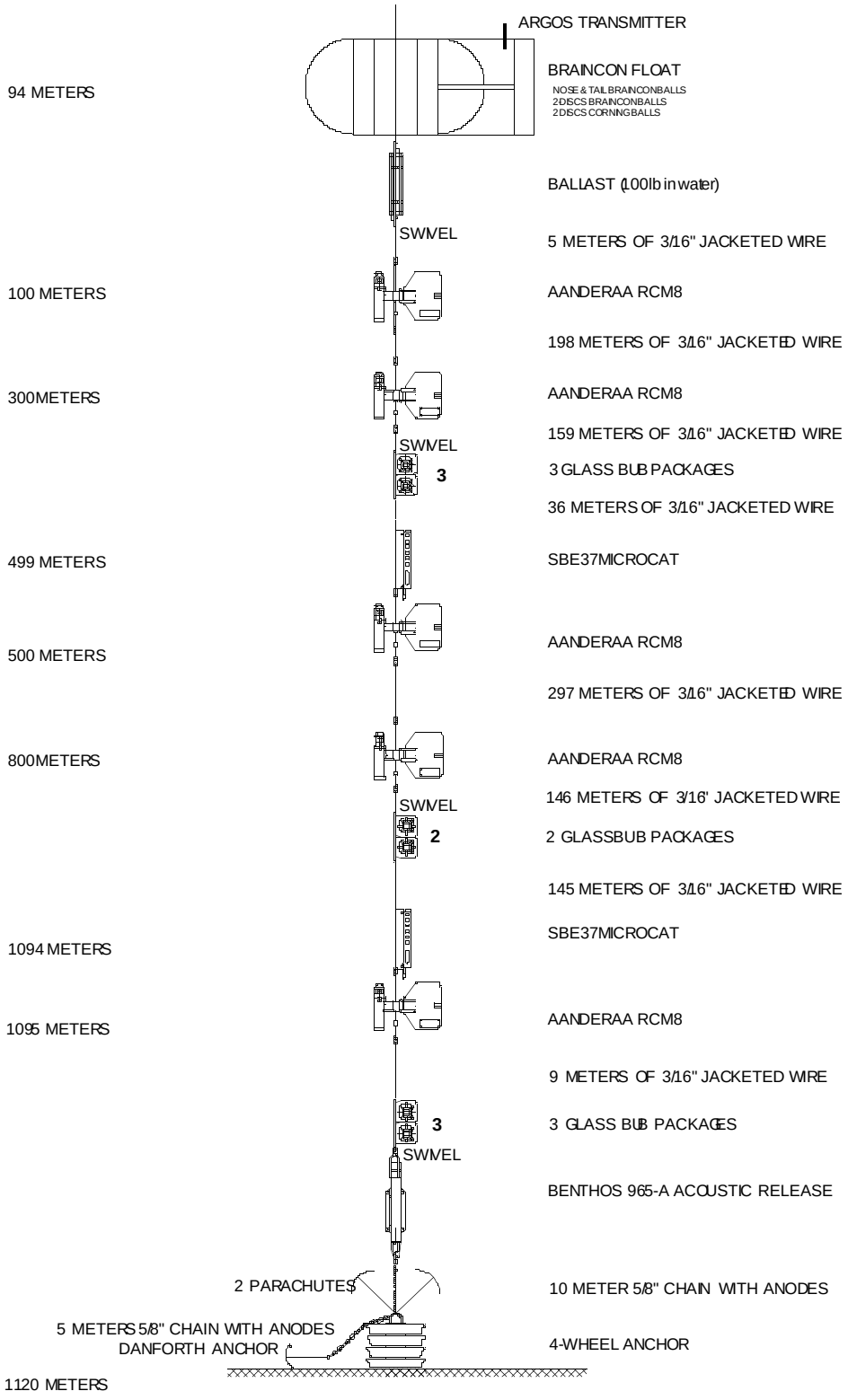


Figure F.3.5

Recovery

Mooring No:	1466	Ship:	Hudson
Cruise No:	2003-038	Date:	July 22, 2003
Mooring Tech:	Scotney / Boyce / Brittain	Type of Nav:	GPS
Sea State:	0.2 m waves		
Weather Conditions:	light airs		
Cancel Notship:	Yes _____	No	

Recovery Log		
Time (Z)	**Instrument**	**Remarks**
22:06	Release 809	Release enabled, slant range 175 m at distance of 0.7 cables from mooring site
22:10		Mooring is released
22:11		Sighted on surface
22:17		Hooked on
22:20		All on board

MOORING #1466 • PRINSENBERG MAKKOVIK BANK • FALL 2003

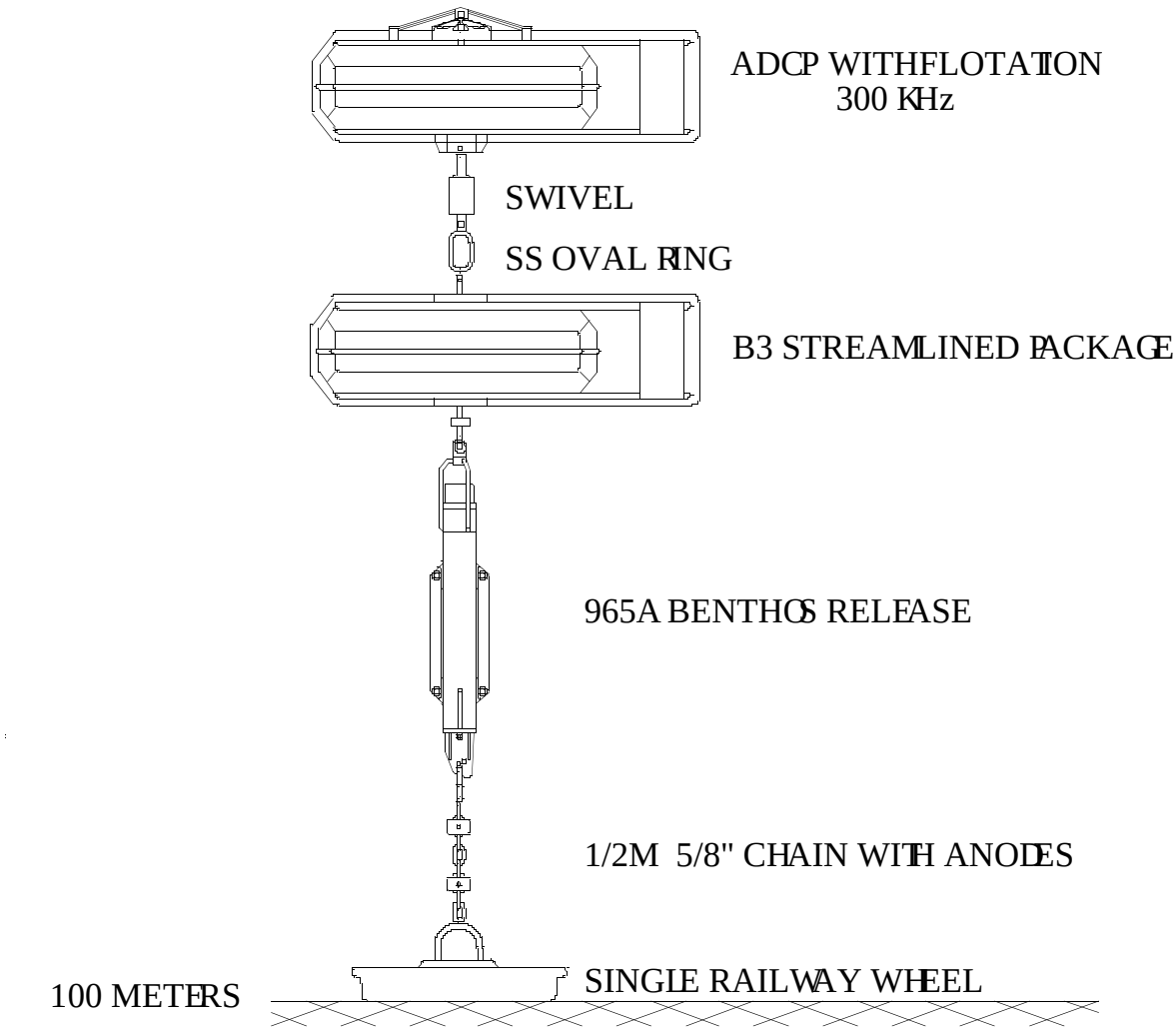


Figure F.3.5

Recovery

Mooring No:	1467	Ship:	Hudson
Cruise No:	2003-038	Date:	July 22, 2003
Mooring Tech:	Scotney / Boyce / Brittain	Type of Nav:	GPS
Sea State:	0.2 m waves		
Weather Conditions:	light airs		
Cancel Notship:	Yes _____		No

Recovery Log

Time (Z)	Instrument	Remarks
22:22	Release 889	Release not responding to enable command at distance of 2.6 cables from mooring site. After switching to over the side transducer it appeared that the release was responding to transponder commands
22:41		Release command sent, not sure if the command was received
22:50		Release command sent again with a positive reply. Slant range 118 metres at distance of 0.7 cables
22:52		Sighted by bridge
22:57		Hooked on
23:00		All on board

MOORING #1467 • PRINSENBERG MAKKOVIK BANK • FALL 2002

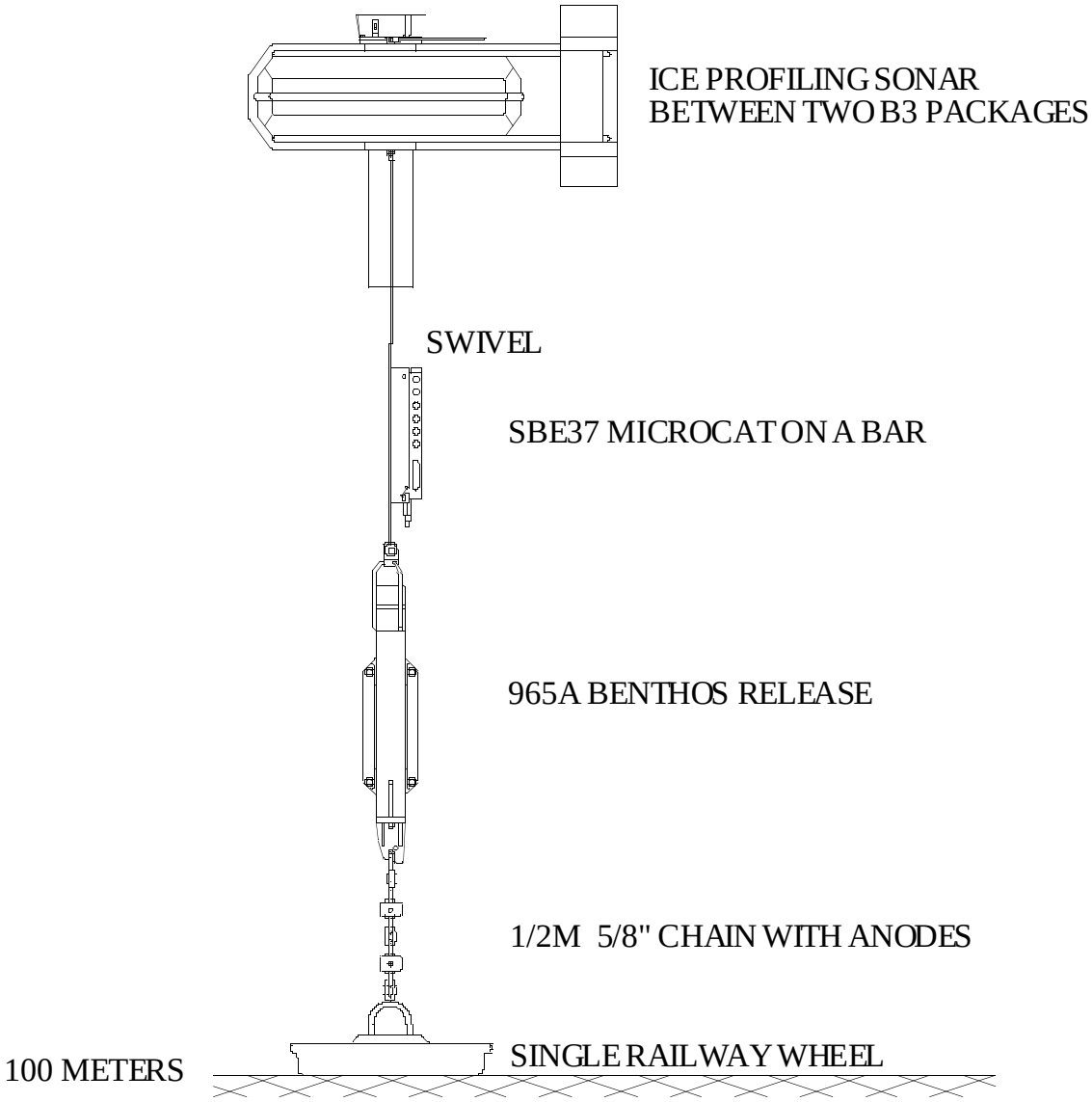


Figure F.3.6

Recovery

Mooring No: 1474 Ship: Hudson
Cruise No: 2003-038 Date: July 15, 2003
Mooring Tech: Scotney / Boyce / Brittain Type of Nav: GPS

15 July
Sea State: 1/2 m. sea/swell s
Weather Conditions: clear, SW 10-15

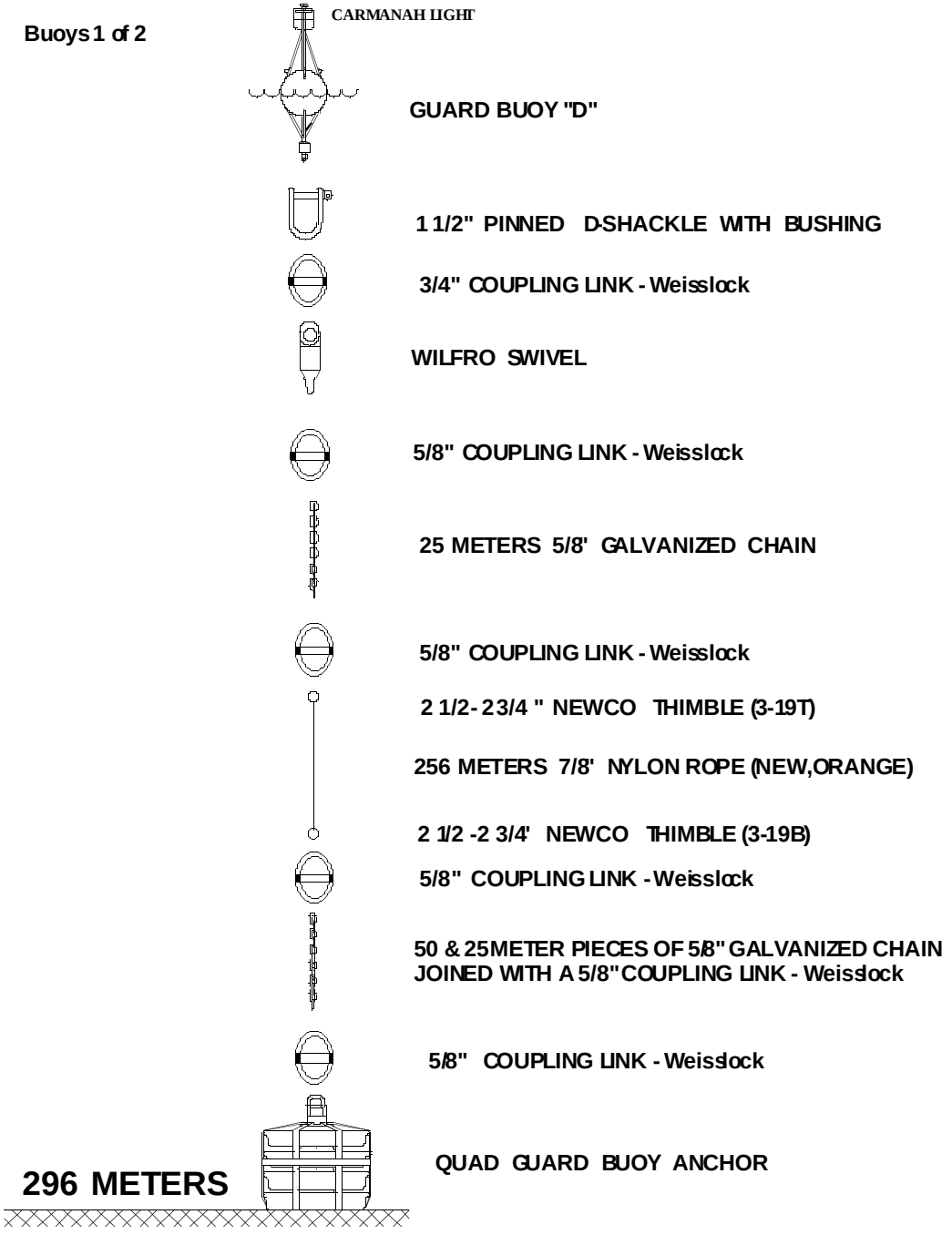
16 July
Sea State: 1 m seas
Weather Conditions: cloudy / rain showers then clear, S 15-20 dropping to 5-10

Cancel Notship: Yes _____ No

Recovery Log – 15 July		
Time (Z)	**Instrument**	**Remarks**
		June 18, 2003 06:55Z signal being received from Argos Beacon
		Syntatic float, microCat & 25 m of wire recovered by Edward Cornwallis at ~ 15:30 Z June 19, 2003, 43 29.685 N 57 00.090W
16:00	Release 892	Approaching mooring ranging on the release
16:03		Closest approach, range 3158 m. 43 23.60 N 57 40.861 W, about 1 cable west of best position when deployed
16:12		Closest approach, range 3196 m. 43 23.479 N 57 40.988 W
16:17		Closest approach, range 3164 m. 43 23.75 N 57 41.232 W
16:22		Closest approach, range 3172 m. 43 23.967 N 57 40.904 W
16:28		Closest approach, range 3196 m. 43 23.731 N 57 40.567 W
		Best estimated position 43 23.75 N 57 40.90 W
16:39		Release command sent / release activated / no movement off bottom
17:54		Start lowering drag 7.8 cables from best position
18:11		1000 metres of drag cable out, drag weight and release 811 added aqnd in the water
20:19		Pulling in cable, range 3182 metres, 2.44 cables from best position
00:06		Failed to hook mooring in two tries – will try again tomorrow morning

Recovery Log – 16 July		
Time (Z)	**Instrument**	**Remarks**
09:15	drag	Set drag, began a short tight drag within 2 cables of mooring
11:15		Began to pull back after a half moon tow past mooring site – no success
13:00	Drag	Start down again 8 cables NE of site.
14:10		Passed 1 cable SE of site
14:45		Mooring release appeared to descend closer to bottom
15:15		Commenced turn to starboard 22 cables SW of site steaming along reciprocal course
16:20		Passed site 1.3 cables to the NW
17:20		Stopped 20 cables NE of site and began hauling in cable. Mooring appears caught
19:25		Drag weight alongside rail with ACM 4350 & Microcat plus snarl. Shaft of ACM bent. BUB packages are off port quarter
19:53		Grapnels recovered
20:10		Removed ACM 4350 from wire, began hauling on line to BUB packages
20:15	ACM 3196 & 2SUBs	Out of water / rotor ok
	Sediment Trap C	Shroud is broken / on board
20:25	Release 742	On board
20:35	ACM 768 & sediment trap C	Out of water, rotor ok, shaft bent
20:44	3 BUB	On board
20:45	3 BUB & release 892	On board
20:48	3 SUBs	On board
20:54	MicroCat 2437	On Board Mooring recovery complete

GUARD BUOY FOR MOORING 1491 • SITE "C" • LODER SCOTIAN SLOPE • JULY 2003



SAMSON ROPE TECHNOLOGIES NYLON RP CTD ORANGE 7/8D(8230566)
ALL CHAIN COLUMBUS-McKINNON GRADE 30 CODE 9102355

Figure F.3.7

Placement

Mooring No:	1475	Geographic Area:	Labrador Slope
Intended Duration:	1year	Ship:	Hudson
Cruise No:	2003-038	Date:	July 24, 2003
Sea State:	calm	Weather Conditions:	calm
Mooring Tech:	Boyce / Brittain	Navigation Inst.	GPS
Notship #	_____		
Latitude:	55 07.171 N	Longitude:	54 05.554 W
Time of Fix:	12:36		
Depth: Raw:	571 fathoms	Corrected:	1050 meters
Main Float:	Type: Hibernia	Markings:	
Argo Beacon:	Type: _____	ID:	S/N
Light:	Type: none	Colour/Rate:	
Mooring Line:	Type: 3/16 jacket	Colour:	yellow
Release:	Type: 965 A	S/N:	883
Release Code:	A / C / B Id: 14	Rx: 11.0 Tx:	10.0

Placement Log		
Time (Z)	**Instrument**	**Remarks**
11:40	Anchor, release & 2 BUB	Over the rail, on slip line
11:42	ACM 5002	Float and ACM in water
11:44		Anchor away 55 07.2396 N 54 05.6028 W depth 571 fathoms = 1050 metres
12:16:25		Closest approach on north to south transect 55 07.1712 N 54 05.6027 W range 1086 metres
12:36:45		Closest approach on west to east transect 55 07.2153 N 54 05.5545 W range 1085 metres
		Best Position 55 07.171 N 54 05.554 W

MOORING #1475 • CLARKE • LAB SEA • JULY 2003

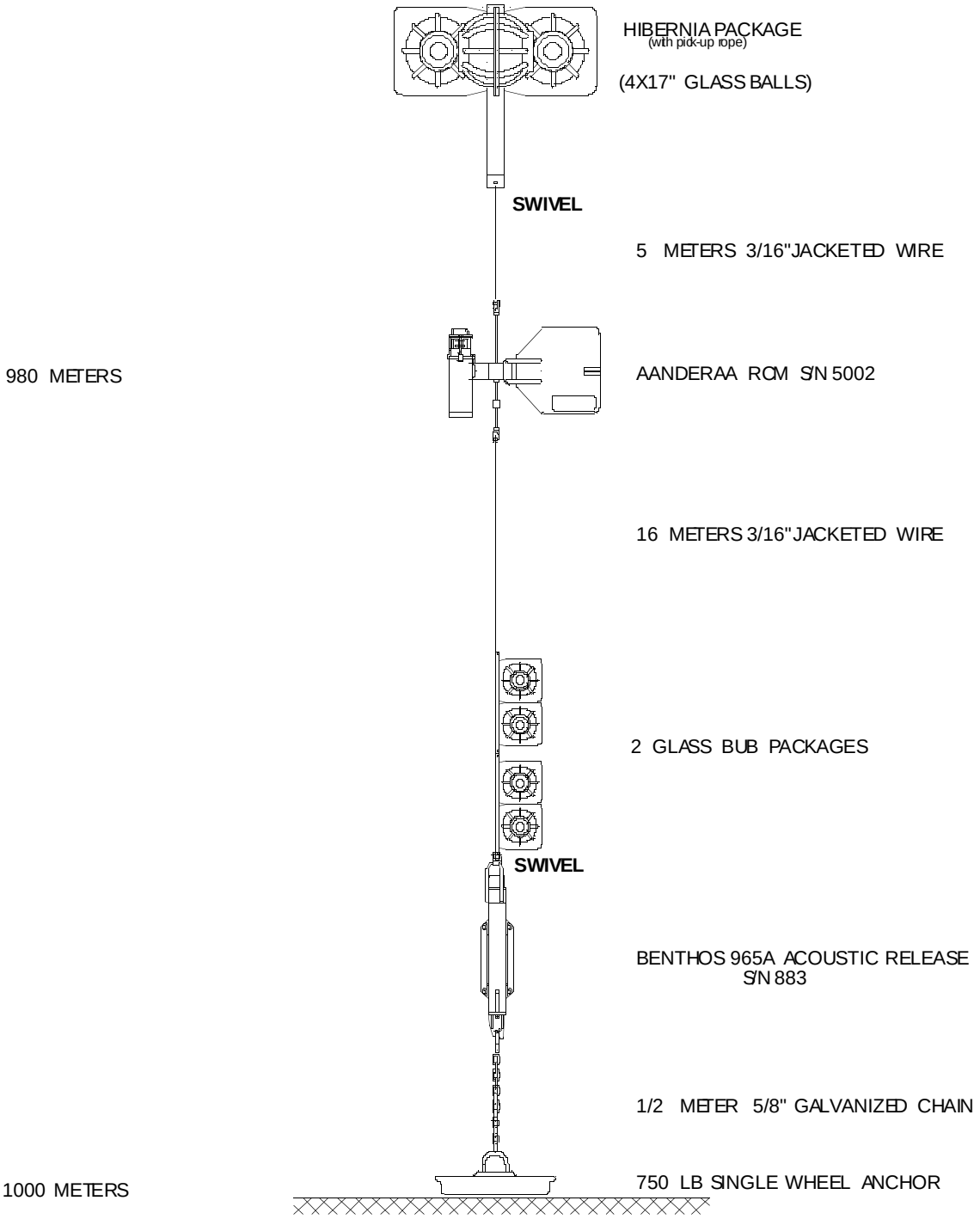


Figure F.3.8

Placement

Mooring No:	1491	Geographic Area:	Scotian Slope
Intended Duration:	10 months	Ship:	Hudson
Cruise No:	2003-038	Date:	July 14, 2003
Sea State:	0.5 m swell	Weather Conditions:	5-10 kts SW
Mooring Tech:	Scotney / Boyce / Brittain	Navigation Inst.	GPS
Notship #	_____		
Latitude:	42 59.145 N	Longitude:	61 44.924 W
Time of Fix:	14:03		
Depth: Raw:	160 fathoms	Corrected:	298 meters
Main Float Type:	Braincon	Markings:	002
Argo Beacon:	Type: Siemac	ID:	S/N 22191
Light:	Type: none	Colour/Rate:	
Mooring Line:	Type: 3/16 jacket	Colour:	yellow
Release:	Type: 965 A	S/N:	810
Release Code:	B / A / C	Rx: 12.0 Tx:	10.0

Placement Log		
Time (Z)	**Instrument**	**Remarks**
13:30	Streamlined BB, microCat 1548, 36 m	In water
13:32	Braincon 2	In water
13:31	ACM 5359	In water, 53 m
13:35	ACM 1607	37 m in water
13:38	2 BB	35 m
13:40	ACM 2664	90 m
13:45	3BB, release 810	Out board
13:50		Anchor away 42 59.1449 N 61 44.8803 W
14:04		Closest approach at 42 59.1449 N 61 44.9239 W range 315 m depth 298 m.
		Best Position 42 59.145 N 61 44.924 W

MOORING #1491 • SITE "C" • JOHN LODER • SCOTIAN SLOPE • JULY 2003

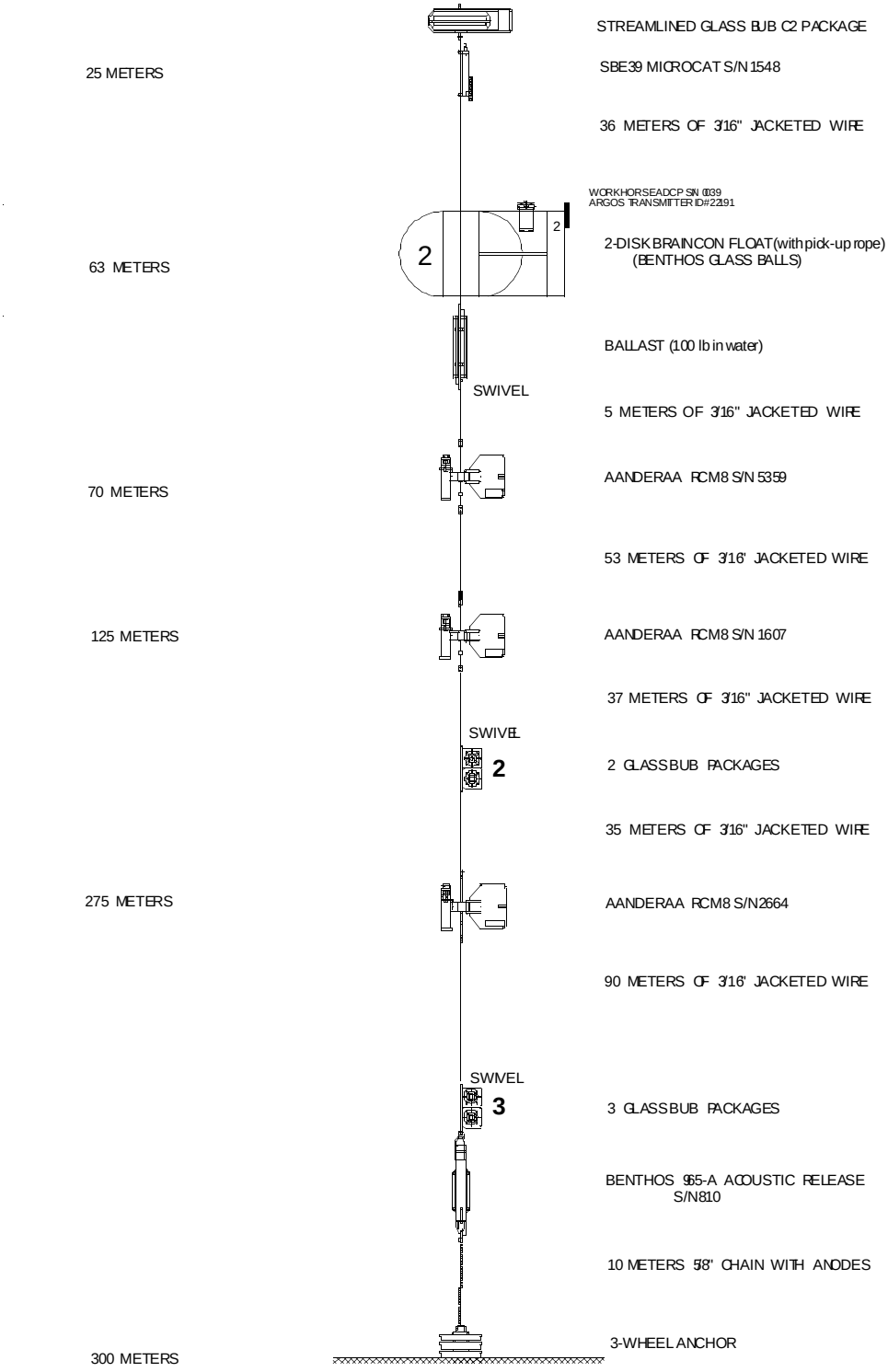


Figure F.3.9

Placement

Mooring No:	1492	Geographic Area:	Laurentian Channel
Intended Duration:	1 year	Ship:	Hudson
Cruise No:	2003-038	Date:	July 17, 2003
Sea State:	0.5-1 m swell, 0.5 m sea		
Weather Conditions:	5-10 kts SW decreasing and fog		
Mooring Tech:	Scotney / Boyce / Brittain	Navigation Inst.	GPS
Notship #	_____		
Latitude:	44 49.885 N	Longitude:	56 10.585 W
Time of Fix:	15:00		
Depth:	Raw: 212 fathoms	Corrected:	394 meters
Main Float:	Type: Brncon	Markings:	003
Beacon:	Type: Argo	ID: S/N	ID 978
Light:	Type: none	Colour/Rate:	
Mooring Line:	Type: 3/16 jacket	Colour:	yellow
Release:	Type: 965 A	S/N:	886
Release Code:	A / C / B	Rx: 9.5	Tx: 10.0

Placement Log		
Time (Z)	**Instrument**	**Remarks**
12:10	Float 3, ADCP 3469, Microcat 1711, 53 m	In water
12:13	ACM 7122, RCM 265, 73 m	In water
12:17	ACM 4355, 45 m	In water
12:20	3 BUB, 50 m	In water
12:23	ACM 5032, 74 m	In water
12:26	ACM 5572, 9 m	In and out of water
12:30	3 BUB, release 886	In water and weight transferred to anchor
12:34	Anchor away	44 49.78 N 56 10.49 W
13:18	Guard Buoy K	In water
13:24	Guard Buoy K	Anchor away at 44 49.689 N 56 11.034 W 390 metres
13:42	Guard Buoy W	In water
13:54	Guard Buoy W	Anchor away at 44 49.577 N 56 10.554 W 419 metres
14:22	Guard Buoy E	In water
14:37	Guard Buoy E	Anchor away at 44 49.949 N 56 10.365 W 390 metres
15:00	Release 886	Closest approach 44 49.885 N 56 10.585 W, range 401 metres
15:49	Release 886	Closest approach 44 49.846 N 56 10.593 W, range 450 metres
	Best Position	44 49.885 N 56 10.585 W

MOORING #1492 • JOHN LODER • LAURENTIAN CHANNEL • JULY 2003

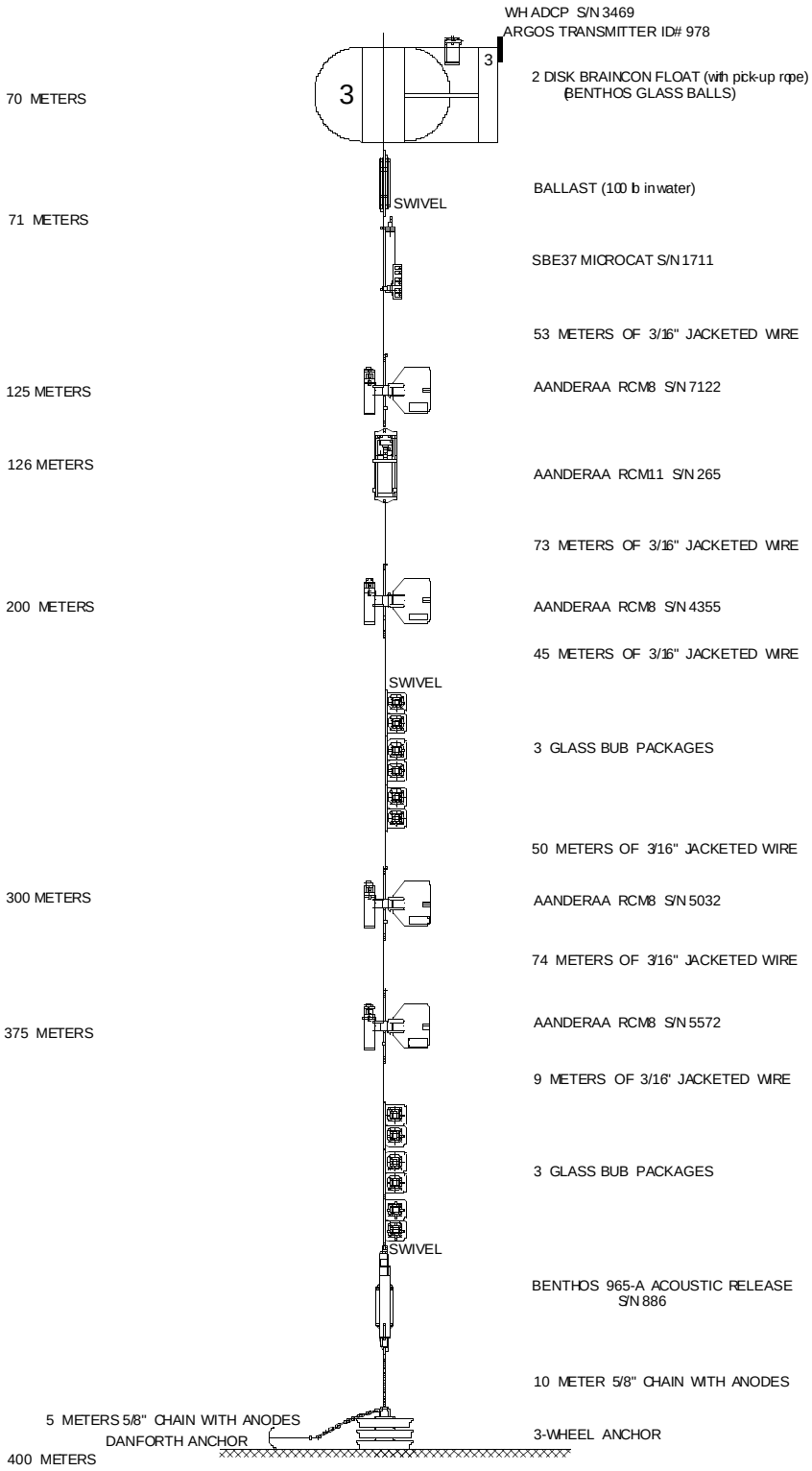


Figure F.3.10

Placement

Mooring No:	1493	Geographic Area:	Flemish Pass
Intended Duration:	1 year	Ship:	Hudson
Cruise No:	2003-038	Date:	July 19, 2003
Sea State:	0.5 m swell, 0.5 m sea	Weather Conditions:	10 kts SW fog
Mooring Tech:	Scotney / Boyce / Brittain	Navigation Inst.	GPS
Notship #	_____		
Latitude:	46 59.954 N	Longitude:	47 17.085 W
Time of Fix:	17:43		
Depth: Raw:	215 fathoms	Corrected:	399 meters
Main Float:	Type: Braincon	Markings:	004
Beacon:	Type: Argo	ID: S/N	ID 1054
Light:	Type: none	Colour/Rate:	
Mooring Line:	Type: 3/16 jacket	Colour:	yellow
Release: Type:	965 A	S/N:	807
Release Code:	E / D / F	Rx: 10.0	Tx: 11.5

Placement Log		
Time (Z)	**Instrument**	**Remarks**
16:50	Float, ACM 7131, 24 m	In water
16:53	ACM 8695, 49 m	In water
16:55	ACM 5573, 45 m	In water
16:59	Minilog 2524, 3BUB, 99 m	In water
17:02	ACM 6405, 74 m	In water
17:05	ACM 7127, 9 m	In and out of water
17:06	3 BUB, release 807	In water and weight transferred to anchor
17:11	Anchor away	47 00.062 N 47 17.1226 W depth 215 fathoms
17:28	Closest approach	46 59.9538 N 47 17.1617 W slant range < 215 m
17:43:30	Closest approach	46 59.9669 N 47 17.085 W slant range 406 metres
	Best Position	46 59.954 N 47 17.085 W
18:27	Guard Buoy Y	In water
18:33	Guard Buoy Y	Anchor away
18:50	Guard Buoy A	In water
18:55	Guard Buoy A	Anchor away

MOORING #1493 • SITE FP-A • JOHN LODER • FLEMISH PASS • JULY 2003

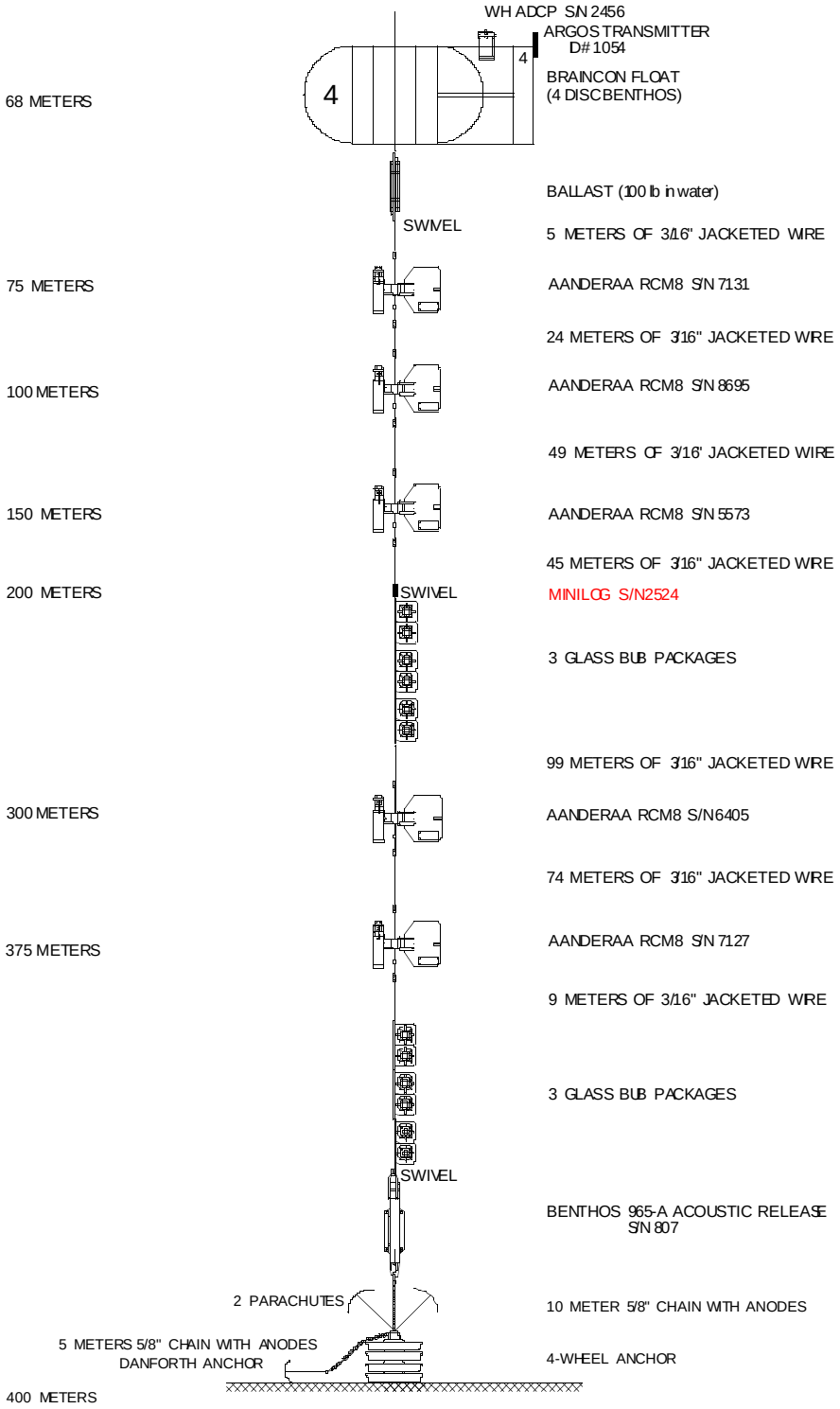


Figure F.3.11

Placement

Mooring No:	1494	Geographic Area:	Flemish Pass
Intended Duration:	1 year	Ship:	Hudson
Cruise No:	2003-038	Date:	July 19, 2003
Sea State:	0.5 m swell, 0.5 m sea	Weather Conditions:	10 knots, SW fog
Mooring Tech:	Scotney / Boyce / Brittain	Navigation Inst.	GPS
Notship #	_____		
Latitude:	46 59.89 N	Longitude:	47 02.1 W
Time of Fix:	22:56		
Depth: Raw:	608 fathoms	Corrected:	1118 metres
Main Float:	Type: Braincon	Markings:	001
Beacon:	Type: Argo	ID: S/N	ID 2342
Light:	Type: none	Colour/Rate:	
Mooring Line:	Type: 3/16 jacket	Colour:	yellow
Release:	Type: 965 A	S/N:	884
Release Code:	A / C / B	Rx: 9.0	Tx: 10.0

Placement Log		
Time (Z)	**Instrument**	**Remarks**
21:16	Float, Microcat 2305, 74 m	In water
21:19	ADCP 0239, 123 m	In water
21:24	ACM 8697, 159 m	In water
21:29	3BUB, 36 m	In water
21:32	Microcat 2307, ACM 3300, 297 m	In water
21:39	ACM 4154, 146 m	In water
21:43	2 BUB, 145 m	In water
21:45	Microcat 1918	Clamped at mark on wire, in water
21:50	ACM 4998, 9 m	In water
21:51	3 BUB, release	In water, towing on chain about 1 nautical mile to position
22:17	Anchor away	47 00.1103 N 47 02.0906 W 608 fathoms, 1118 metres
22:56:30	Closest approach	46 59.89 N 47 2.2125 W range < 1145 metres
	Best position	46 59.89 N 47 2.1 W
23:24	Guard Buoy B & Minilog	In water
23:43	Guard Buoy B	Anchor away

MOORING #1494 • SITE FP-B • JOHN LODER • FLEMISH PASS • JULY 2003

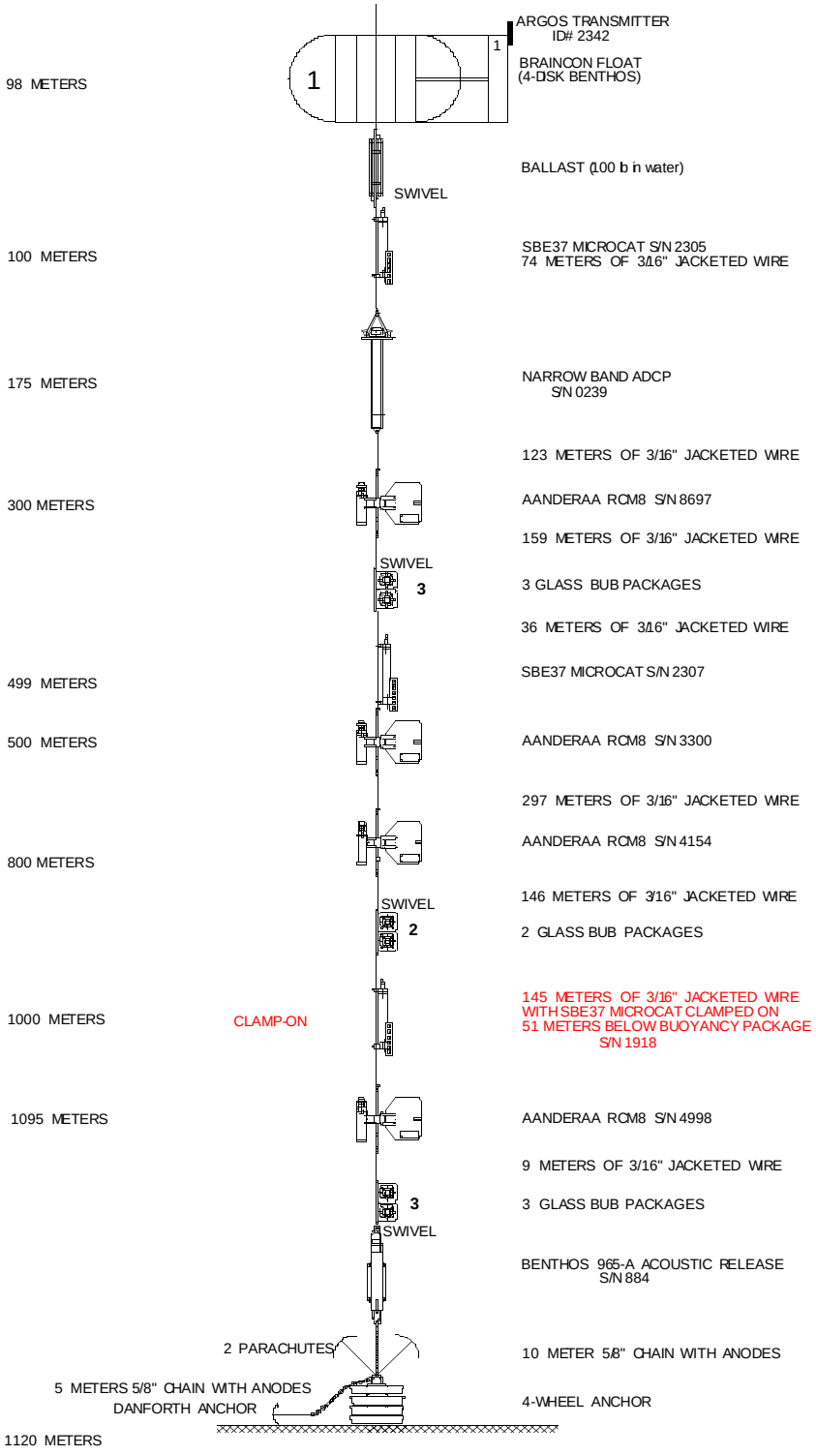


Figure F.3.12

Placement

Mooring No:	Ralph	Geographic Area:	Scotian Slope
Intended Duration:	2 months	Ship:	Hudson
Cruise No:	2003-038	Date:	July 14, 2003
Sea State:	0.5 m swell	Weather Conditions:	5-10 kts SW
Mooring Tech:	Scotney / Boyce / Brittain	Navigation Inst.	GPS
Notship #	_____		
Latitude:	42 59.496 N	Longitude:	61 44.722 W
Time of Fix:	10:37		
Depth: Raw:	152 fathoms	Corrected:	284 metres
Main Float:	Type: BB	Markings:	none
Argo Beacon:	Type: _____	ID: S/N	_____
Light:	Type: none	Colour/Rate:	
Mooring Line:	Type: synthtic	Colour:	blue
Release:	Type: 966 A	S/N:	337
Release Code:	_____	Rx: 9.75	Tx: 10.0

Placement Log

Time (Z)	Instrument	Remarks
10:26	Ralph	In water
10:37	Ralph	On bottom 42 59.4955 N 61 44.7220 W
10:51	Anchor away	42 59.5341 N 61 45.0632 W

"RALPH" • SCOTIAN SLOPE • SITE "C" • NEAR MOORING #1491 • JULY 2003

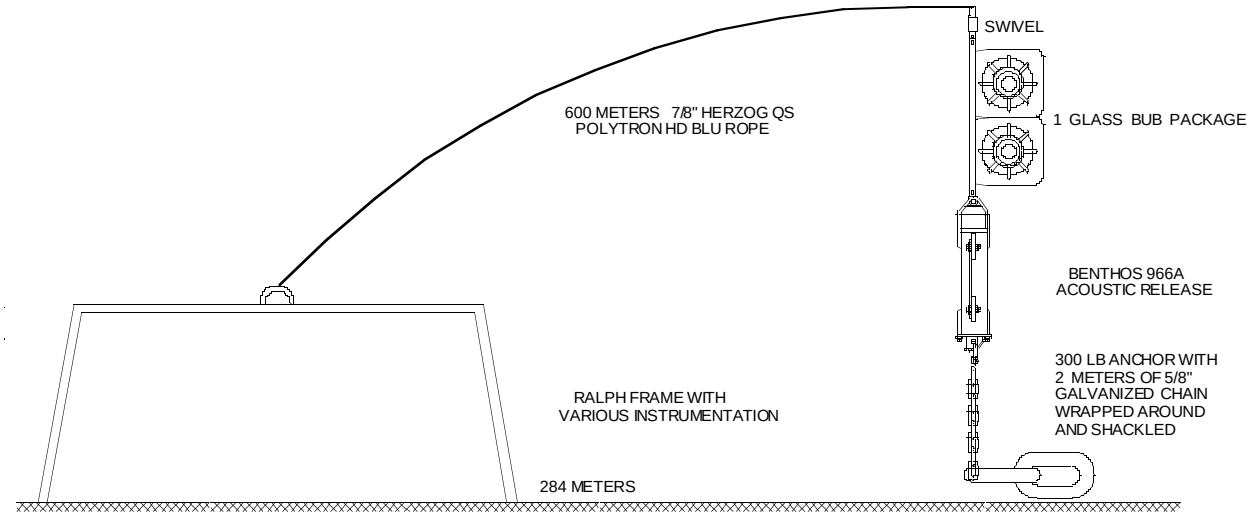


Figure F.3.13

Data Processing Notes

Date	Contact	Data Type	Data Status Summary
12/22/03	Jackson	SUM/DOC	Submitted/Public

The file format is:
WOCE Format (ASCII)

The archive type is:
Zip

The data type(s) is:
Summary (navigation)
Documentation

The file contains these water sample identifiers:
Cast Number (CASTNO)
Station Number (STATNO)

JACKSON, JEFF would like the following action(s) taken on the data:
Place Data Online

Any additional notes are:
none

Date	Contact	Data Type	Data Status Summary
12/23/03	Bartolacci	SUM	Data Update; Various changes, see note

Received summary and documentation files from Jeff Jackson. Made following edits to the sumfile:

· Edited first header line to include WOCE line number, ship name, cruise and leg no.
· Changed slash to underscore in expocode.
· Edited OPERATION NUMBER to STNNBR.
· Aligned all columns to conform to WOCE formatting.
· Ran sumchk. Did not recognize cast code EA or BD.

Date	Contact	Data Type	Data Status Summary
01/15/04	Jackson	SUM	Re-submission

The file: C:\Datasets\2003-038\sum_file\2003038sum.txt - 155572 bytes
has been saved as: 20040115.035943_JACKSON_HU2003038_2003038sum.txt
in the directory: 20040115.035943_JACKSON_HU2003038

The data disposition is:
Public

The file format is:
Plain Text (ASCII)

The archive type is:
NONE - Individual File

The data type(s) is:
Summary (navigation)

The file contains these water sample identifiers:
Cast Number (CASTNO)
Station Number (STATNO)

JACKSON, JEFF would like the following action(s) taken on the data:
Place Data Online

Any additional notes are:
This a resubmission An operation was missing from the first SUM file I sent

JACKSON, JEFF would like the following action(s) taken on the data:
Place Data Online

Data Processing Notes

01/16/04	Bartolacci	SUM	Data Update; Various changes, see note

Updated sumfile sent by Jeff Jackson needed reformatting. Following edits were made:

- Edited first header line to include line number cruise name and leg, ship name and date/name stamp.
- Changed WOCE SECT to read AR07W instead of various alphanumeric designations.
- Changed OPERATION ID TO STNNBR.
- Aligned all columns to correct WOCE spacing.
- Changed Lat. hemisphere designation from E to W on following stations:

15,119, 152, 158, 175, 180, 253, 365, 375, 412, 423, 433

as only one of 2 or more cast codes had erroneous hemishphere and none of the cast codes were near a hemisphere change. Ran file through sumchk Sumchk would not accept the cast codes BD and ED (begin descent and end ascent) for 65 stations. Other than those warnings file passed with no errors and was placed in parent directory to replace previously submitted sumfile.