CRUISE REPORT

HUDSON 2002032

LABRADOR SEA

WOCE LINE AR7W

23 June - 19 July, 2002

A. CRUISE NARRATIVE

1. Highlights

a. WOCE Designation:	WOCE Line AR7W Atlantic Circulation Experiment
b. Expedition Designation:	Hudson 2002032
c. Chief Scientist:	R. Allyn Clarke Ocean Sciences Division Department of Fisheries and Oceans Bedford Institute of Oceanography PO Box 1006 Dartmouth, NS, Canada B2Y 2A4 Internet clarkea@mar.dfo-mpo.gc.ca
d. Ship:	CCGS Hudson
e. Ports of Call:	June 23 BIO, Dartmouth, NS, Canada July 19 BIO, Dartmouth, NS, Canada
f. Cruise Dates:	June 23 to July 19, 2002

2. Cruise Summary Information

a. Cruise Track

A cruise track is shown in Figure 1. The ship's position at 0000Z on each day of the cruise is indicated with a date label.

The WOCE cruise station summary file outlines the science operations conducted during the cruise. Note that two additional cast types have been defined as: MNT – Biological multinet tow and BUY – guard buoy deployment. Finally, 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.

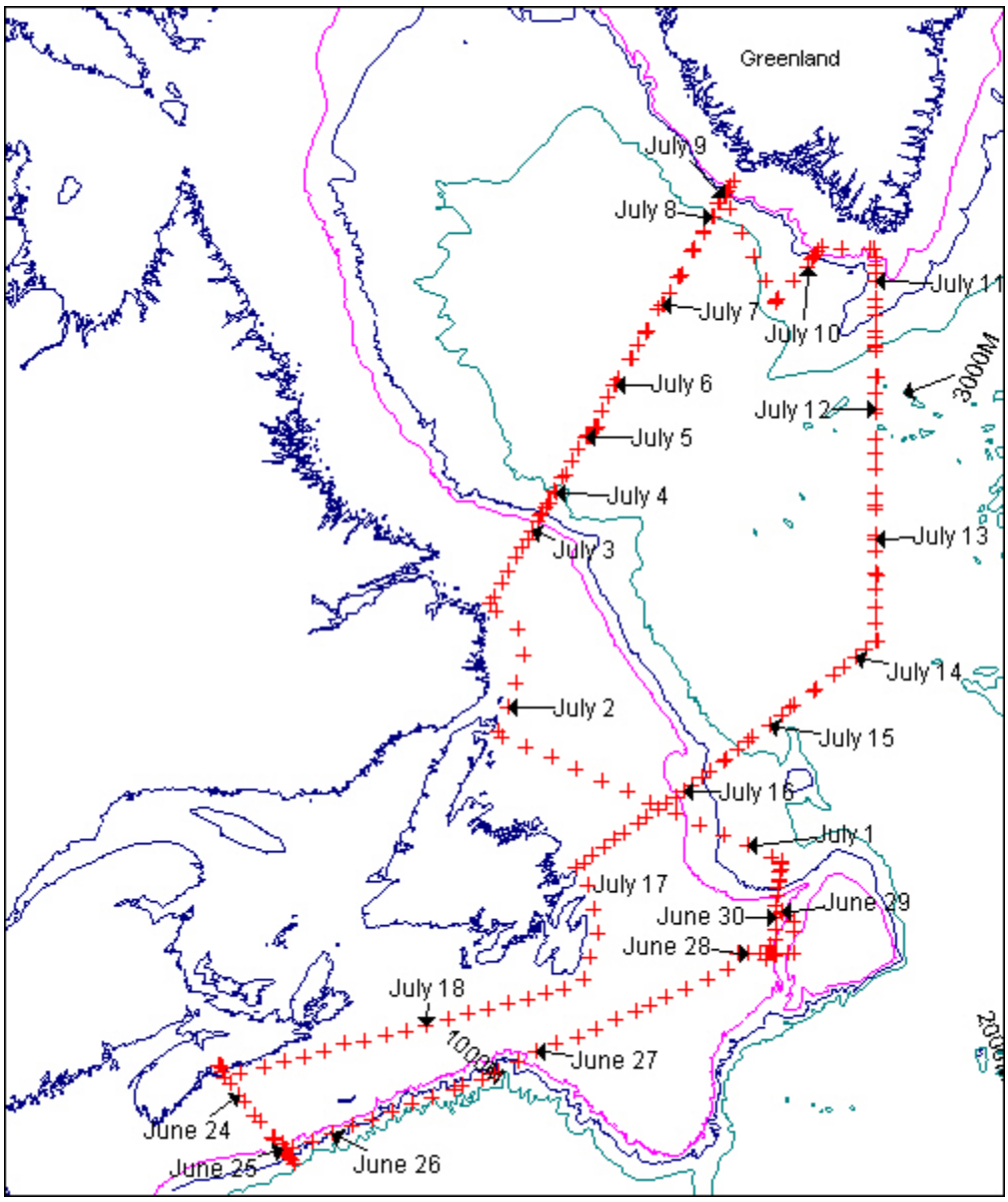


Figure 1. Cruise track for 18HU2002032/1. The date labels indicate the ship's position at 0000Z.

One additional parameter code was defined and appears in the parameter column of the WOCE SUM file. This code is "518 – sulfur hexafluoride (SF_6)". A section that follows in the cruise report describes this measurement.

b. Total Number of Stations Occupied

The CTD and ROS station positions are shown in Figure 2.1. The WHP stations are all contained in the box defined by 50-62°N and 40-60°W. Table 2.1 lists the science operations for 18HU2002032.

Cast Type	Number of Operations	Detailed Division	Operation Numbers
Rosette & CTD	126	28 regular AR7W Sites plus Sites 8.5, 25.3 and 25.7, also sites 16 and 25 were broken up into two casts to collect enough water for sampling.	see Table 2.2
		7 Halifax Line Sites	see Table 2.3
		8 on Flemish Cap Line	45, 48, 49, 52, 53, 54, 59, 60
		9 on Orphan Knoll Line	63, 66, 68, 78, 80, 82, 85, 90, 94
		7 on Eirik Ridge Line	264, 268, 270, 272, 273, 276, 278
		17 on L5 (44 W) Line	See Table 2.4
		21 on Bonavista Line	See Table 2.5
		16 Biology Casts not included In other tables	32, 36, 44, 56, 86, 128, 138, 155, 182, 211, 262, 310, 334, 349, 365, 380
		1 cast for calibrating 4 Seacats	131
		1 Basin test	No operation number assigned.
		6 Failed Casts	35, 137, 140, 142, 144, 154
Moorings	22	5 recoveries	15, 16, 17, 18, 123
		7 deployments	71, 73, 124, 141
		5 release tests 5 Buoy operations	19, 20, 58, 88, 89 69, 70, 72, 74, 75
Floats	7	6 Apex floats deployed	40, 91, 120, 157, 195, 260
		1 surface meteorological drifter deployed	158
Biology	194	145, 200 μm net tows	2 - 4, 6, 9 – 13, 23 – 26, 29, 30, 37, 39, 41, 42, 46, 47, 50, 51, 55, 57, 61, 62, 64, 67, 76, 77, 79, 81, 83, 84, 87, 93, 95, 97, 99, 101, 103, 105, 108, 110, 112, 114, 115, 117, 121, 125, 127, 130, 133, 136, 139, 146, 148, 149, 151, 153, 163, 172, 174, 183, 190, 192, 202, 204, 212, 214, 219, 221, 227, 228, 232, 234, 241, 242, 245, 247, 255, 257, 263, 265, 267, 269, 271, 274, 275, 277, 279, 283, 285, 286, 293, 295, 300, 302, 306, 311 - 313, 320, 322, 326, 328, 330, 332, 336, 338, 340, 342, 344, 346, 347, 351, 353, 355, 357, 359, 361, 363, 367, 369, 371, 374, 376, 378, 384, 387, 393, 394, 399, 403, 404, 408, 411, 412, 415, 418, 421, 423,

			425, 427
		31, 76 μm net tows	5, 38, 96, 106, 109, 126, 147, 152, 173, 191, 203, 213, 220, 233, 248, 256, 266, 280, 284, 294, 321, 329, 337, 343, 352, 356, 362, 370, 377, 424, 428
		1 net tow aborted	65
		17 deep stratified vertical tows with multi-net	92, 119, 135, 143, 145, 165, 194, 206, 223, 236, 261, 288, 333, 348, 364, 379, 388
Chemistry		^{129}I surface	104, 107, 111, 113, 116, 118, 134, 156
		^{129}I profile	132, 150, 175, 205, 229
		^{129}I deep	314, 323, 358, 366, 372, 375
		SF_6	118, 132, 134, 150, 175, 205, 215, 222, 229, 235, 259, 303, 307, 314, 323, 327, 331, 354
Other		575 hrs Ship Board ADCP	no number assigned
		598 hrs. along 4track T, S, and fluorescence	no number assigned
	80	80 XBT Deployments	159, 160, 161, 162, 167, 168, 169, 170, 171, 176, 177, 178, 179, 180, 181, 185, 186, 187, 188, 189, 196, 197, 198, 199, 200, 201, 207, 208, 209, 210, 216, 217, 218, 224, 225, 226, 230, 231, 237, 238, 239, 240, 244, 250, 251, 252, 289, 290, 291, 292, 297, 298, 301, 304, 305, 308, 309, 315, 316, 317, 318, 319, 324, 325, 373, 382, 383, 386, 390, 392, 396, 398, 401, 402, 406, 407, 410, 414, 417, 420
	1	1 MVP Deployment	430

Table 2.1 Science operations conducted on 18HU2002032/1.

AR7W Site Number	2002032 Deep Cast Operation Number
1	98
2	100
3	102
4	104
5	107
6	111
7	113
8	116
8.5	129
9	122
10	118
11	132
12	134
13	137
14	150
15	156
16	164, 166
17	175
18	184
19	193
20	205
21	215
22	222
23	229
24	235
25	258, 259
25.3	254
25.7	253
26	243
27	249
28	246

Table 2.2. AR7W sites and rosette and CTD operation numbers for 18HU2002032/1.

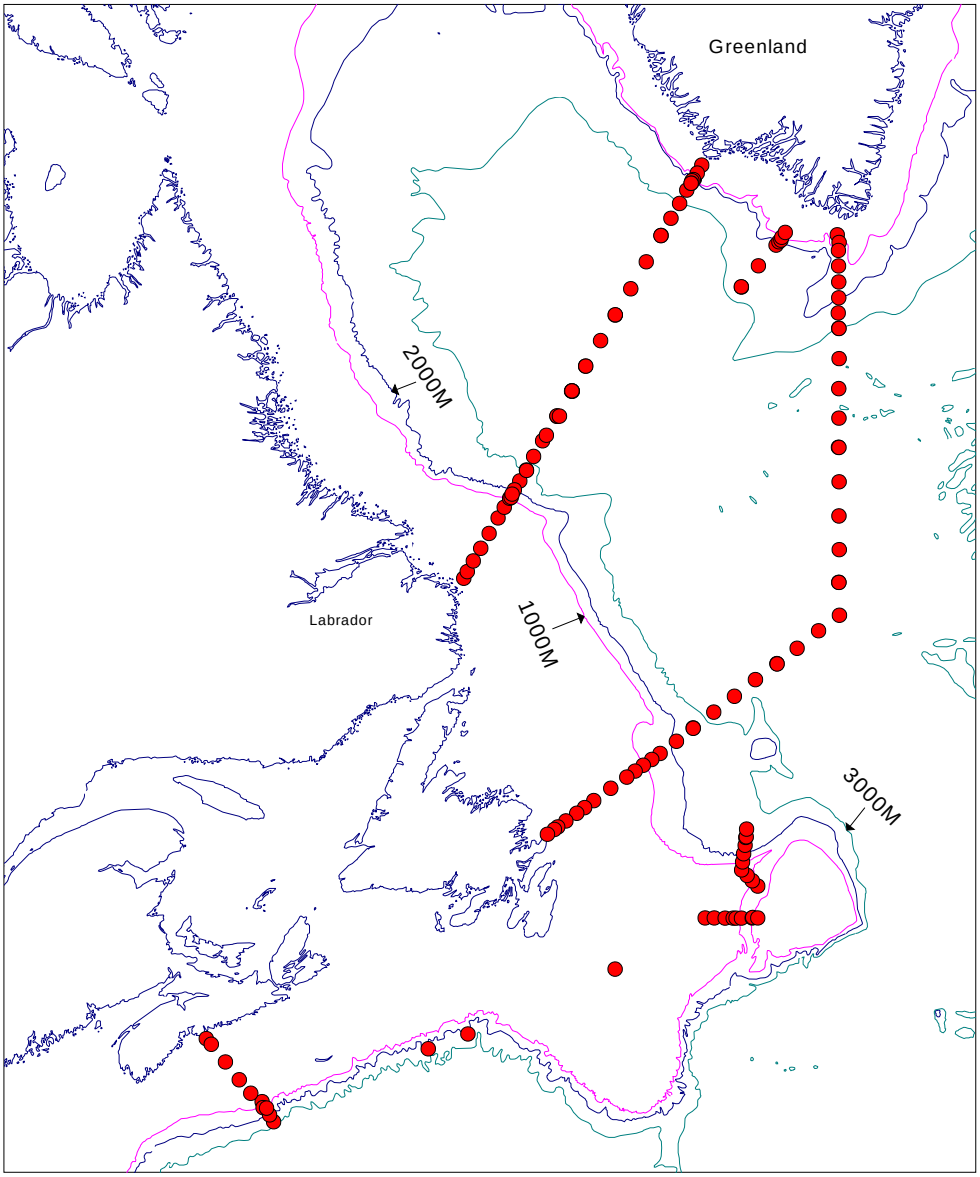


Figure 2.1 CTD and rosette station positions on for Hudson 18HU2002032/1.

Halifax Line Number	2002032 Deep Cast Operation Number
1	1
2	7
3	8
4	14
5	22
6	27
7	28

Table 2.3. Halifax Line sites and rosette operation numbers for 18HU2002032/1.

L5 Line Station Number	2002032 Deep Cast Operation Number
27	281
26.5	282
26	287
25	296
24.5	299
24	303
23.5	307
23	314
22	323
21	327
20	331
19	335
18a	339
17a	341
16a	345
15a	350
13	354

Table 2.4. Line L5 sites and rosette operation numbers for 18HU2002032.

Bonavista Line Station Number	2002032 Deep Cast Operation Number
19	358
18	360
17	366
16	368
15	372
14	375
13	381
12	385
11	389
10.5	391
10	395
9.5	397
9	400
8	405
7	409
6	413
5	416
4	419
3	422
2	426
1	429

Table 2.5 Bonavista Line sites and rosette operation numbers for 18HU2002032/1.

Along AR7W, the stations were full-depth WHP small volume rosette casts with up to 24 rosette bottles. Depending on the station, water samples were analyzed for CFCs, carbon tetrachloride, methyl chloroform, total carbonate, alkalinity, oxygen, salinity, nutrients, methyl halides and chlorinated compounds. On some casts, sampling was also conducted for ^{129}I (iodine-129) and SF^6 (sulfur hexafluoride).

c. Floats and Drifters deployed

Six APEX floats were deployed as in table 2.6; one surface meteorological drifter was deployed as in table 2.7. The deployment logs are given in Appendix 5.

APEX Float #	WMO #	Operation Number	Launch Position		Start Date / Time	Launch Date / Time
			Latitude	Longitude		
366	Q4900136	40	44 29.9 N	55 25.4 W	26 June 2002 14:21	26 June 2002 17:19
506	Q4900234	91	48 42.2 N	46 50.5 W	30 June 2002 12:41	30 June 2002 15:55
330	Q4900125	120	55 25.2 N	53 59.0 W	3 July 2002 04:12	3 July 2002 08:46
255	Q4900101	157	56 57.2 N	52 11.1 W	5 July 2002 19:31	5 July 2002 20:47
335	Q4900130	195	58 38.4 N	50 25.0 W	7 July 2002 00:20	7 July 2002 02:42
334	Q4900129	260	60 17.8 N	48 34.9 W	8 July 2002 23:50	9 July 2002 00:52

Table 2.6 APEX float deployments on Hudson 2002032

Drifter #	WMO #	Operation Number	Launch Position		Start Date / Time	Launch Date / Time
			Latitude	Longitude		
36363	Q4900136	158	56 57.1 N	52 10.9 W	5 July 2002 19:46	5 July 2002 20:47

Table 2.7 Surface meteorological deployments on Hudson 2002032

d. Moorings deployed or recovered

A total of 22 mooring related operations, consisting of seven deployments, five recoveries, five release tests and five buoy operations were conducted at three principal sites, the Scotian Slope south of Halifax, Flemish Pass and the Labrador Sea. The following tables details the deployments and recoveries. The mooring recovery and deployment logs are attached as Appendix 6. Also the operation ids for these 22 operations are given above in table 2.1.

Deployments:

1	M1429 multi-instrument mooring consisting of five current meters and three Microcats at 1965 m. on the Scotian Slope and Halifax Section. Six month deployment.
1	M1432 multi-instrument mooring consisting of five current meters, four Microcats and ADCP at 1120 m on the Scotian Slope and Halifax section. Six month deployment.
1	M1433 mooring consisting of one pressure gauge at 400 m isobath on Scotian Slope and Halifax Section. Six month deployment.
1	M 1450 standard mooring consisting of four current meters set at 398 m. on the western edge of Flemish Pass on the 47 N Flemish Cap section. Three guard-buoys also set. Six month deployment.
1	M 1451 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. Two guard-buoys also set. Six month deployment.
1	M 1452 complex mooring consisting of two sediment traps, six current meters, seven Seacats and three releases set at 3518 meters depth near the OWS Bravo site on AR7W in the Labrador Sea (12 month deployment)
1	M 1453 standard mooring consisting of one current meter positioned 20m off bottom along AR7W on the Labrador Slope (12-month deployment) at the 1032 metres.

Recoveries:

1	M1395 standard tide-gauge mooring consisting of one tide-gauge mounted on the anchor and positioned at 400 metres on the upper Scotian Slope on the Halifax Section.
1	M1396 standard mooring consisting of one current meter positioned 20m off bottom along AR7W on the Labrador Slope (12-month deployment) along the 1000m isobath.
1	M1412 multi-instrument mooring consisting of four Microcats and five Aanderaa current meters.
1	M1415 engineering mooring to test shackles
1	M1419 multi-instrument mooring consisting of three Microcats and four Aanderaa current meters

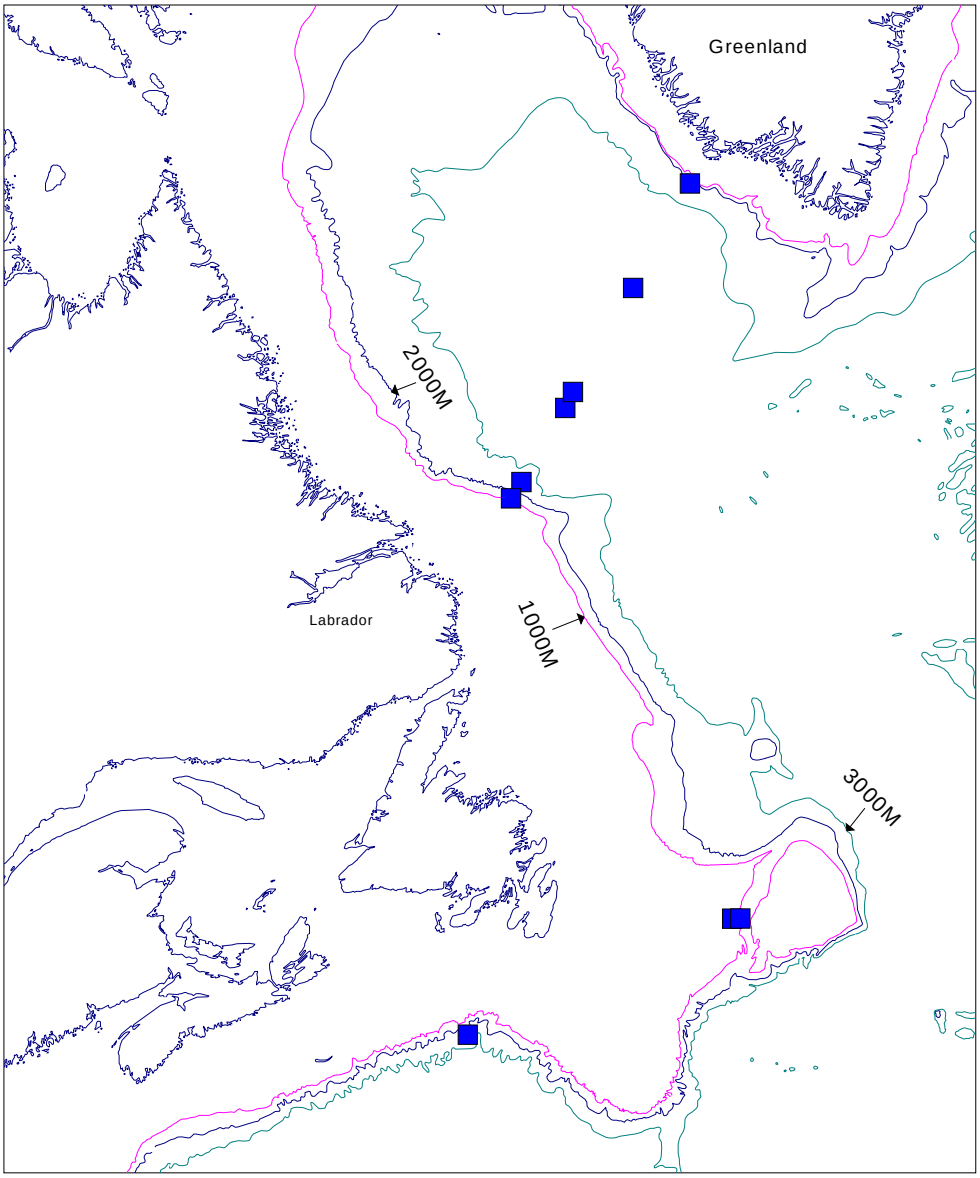


Figure 2.2 Mooring and float deployment locations for Hudson 18HU2002032/1.

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
Bassam Ghaleb	GEOTOP, UQAM r13644@er.uqam.ca	Radiogenic isotopes, heavy elements
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 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
Jennifer McKay	GEOTOP, UQAM mckay.jennifer@uqam.ca	Stable and carbon isotopes
Robert Pickart	WHOI pickart@rsp.whoi.edu	Lowered ADCP
John Smith	BIO smithjn@mar.dfo-mpo.gc.ca	Chemistry isotopes

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

4.1 Physical - Chemical Program

a. 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 2001/2002. 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 mooring of two sediment traps near the old OWS Bravo site in the Labrador Sea. These will measure the particle flux at 200 and 1000 metres over the next 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. In addition, the Moving Vessel Profiler (MVP) was deployed on the homeward passage from Cape Race to Halifax. This will provide a T/S section over the upper 200 metres and will be an example of the type of data that could be obtained from this system if it was deployed on the container vessel that services this route on a weekly basis. A second system was also tested. This system samples surface temperature, salinity and florescence and automatically reports its data back to shore via cell phone modem whenever an appropriate cell tower is in range.

The fourth objective is to recover and set moorings on the continental slope at the end of the Halifax Section 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.

b. Radioisotope Sampling Program **John Smith**

Near surface water samples were collected for ^{129}I from the upper rosette bottle at eight stations on the AR7W line. Full depth sampling for ^{129}I was also carried out at five stations on the same section. Partial sampling of the three deepest depths was performed on six stations on the L5 and Bonavista lines. See Table 4.1 for operation numbers of the sampling locations.

c. SF^6 Sampling Program **Kumiko Azetsu-Scott**

SF6 is an industrial source transient tracer not found in nature. It can enter the ocean via the atmosphere (similar to CFCs), and it has been deliberately introduced in some ocean regions as a "purposeful tracer". In particular, it was seeded into the Greenland Sea in

1996, and has been traced as far as south of Iceland. We were looking to see if it has reached the Labrador Sea, which if it had would give a transit time for water from the Greenland Sea to reach the Labrador Sea.

Deep sampling for SF^6 was also carried out at ?? stations. See Table 2.1 for operation numbers of the sampling locations.

The samples that were collected were shipped to Goteborg University for analysis. Prof. Leif G. Anderson is the PI. His address is: Department of Analytical and Marine Chemistry, Goteborg University, SE-412 96 Goteborg, Sweden. His email is leif@amc.chalmers.se.

d. Dissolved Inorganic and Organic Carbon **Jennifer McKay**

Samples for the analysis of dissolved inorganic and organic carbon and its $\delta^{13}C$ content by the GEOTOP group were drawn at the following stations. Details concerning the depths sampled and the sample ID numbers are given in Appendix 2.

Date	Site	Operation number	[DIC] and $\delta^{13}C$ DIC	[DOC] and $\delta^{13}C$ DOC	^{14}C
30-Jun-02	OK 8	90	Yes	Yes	Yes
03-Jul-02	L3_08	116	Yes	Yes	
04-Jul-02	L3_12	134	Yes	Yes	
05-Jul-02	L3_16	164	Yes	Yes	Yes
05-Jul-02	L3_16	166	Yes	Yes	Yes
06-Jul-02	L3_19	193	Yes	Yes	
07-Jul-02	L3_22	222	Yes	Yes	
08-Jul-02	L3_25	258	Yes	Yes	Yes
08-Jul-02	L3_25	259	Yes	Yes	Yes
10-Jul-02	L5_27	281	Yes	Yes	
10-Jul-02	L5_26	287	Yes	Yes	
11-Jul-02	L5_21	327	Yes	Yes	

Table 4.1.1. GEOTOP sampling stations for dissolved carbon

e. Samples for Stable Isotope Analysis ($\delta^{18}O$, δD) **Jennifer McKay**

Samples for the analysis of dissolved oxygen and its $\delta^{18}O$ content by the GEOTOP group were drawn at the following stations.

Operation ID	Station	Samples ID for $\delta^{18}O$, δD Analysis
94	OK-9	253417 to 253440 (excluding 253417, 253422, 253427, 253431)
98	L3-01	253442, 253445, 253448, 253453, 253454
104	L3-04	253492, 253496, 253499, 253505
113	L3-07	253534, 253537, 253539, 253541, 253544, 253548
118	L3-10	253570 to 253593 (excluding 253570, 253573)
132	L3-11	253636 to 253659
150	L3-14	253701 to 253724
164	L3-16	253766, 253767, 253770, 253773, 253775, 253777, 253780
166	L3-16	253782, 253785, 253786, 253787, 253789, 253792, 253794, 253796, 253797, 253799, 253801, 253803
205	L3-20	253894 to 253917
222	L3-22	253959 to 253982
235	L3-24	254007 to 254030
243	L3-26	254031 to 254050 (excluding 254044, 254046, 254048)
246	L3-28	254051, 254052, 254055, 254060, 254062, 254066
282	L5-27	254236, 254240, 254244, 254251, 254256
303	L5-24	254290 to 254308
327	L5-21	254379 to 254402 (bottle 254402 did not trip)
335	L5-19	254444 to 254467 (every other starting with 254445, note 254467 did not trip so sampled 254466 instead)
345	L5-16a	255516 to 25539
358	Bon-19	255606 to 255629
368	Bon-16	255695 to 255718 (255711 did not trip)
381	Bon-13	255784 to 255803 (255802 did not trip)
395	Bon-10	255838 to 255854 (every other starting with 255838)
405	Bon-8	255870, 255872, 255874, 255877, 255880, 255883
419	Bon-4	255930, 255932, 255934, 255937, 255940, 255943

Table 4.1.2. GEOTOP sampling stations for oxygen isotopes

f. Radiogenic isotopes **Bassam Ghaleb**

A submersible pump (MacLane WTS-142 LV) was attached to the rosette. It was timed to start pumping at the estimated time for the rosette / CTD to reach the bottom of the cast. Particulate material was collected on a preweighed 142 mμ GFF filter. The dissolved radionucleids were adsorbed on two adsorption MnO_2 cartridges. The cartridges will be analyzed at GEOTOP. The pump was deployed at nine stations, seven of which were on the AR7W line. The detailed logs of each pumping operation are given in Appendix 3.

Station	Operation Number	Volume pumped (litres)	Time Pump Start	Time Pump End
HFX_6	27	200.02	22:00:00	22:28:34
OK_9	94	250.00	16:30:00	17:07:16
L3_10	118	250.00	02:50:00	03:32:05
L3_11	132	250.00	19:30:00	20:11:22
L3_16	166	250.00	01:05:00	01:47:13
L3_18	184	250.00	15:50:00	16:31:22
L3_21	215	250.00	11:50:00	12:33:15l
L3_24	235	250.00	02:15:00	02:55:04
L3_25	259	250.00	20:30:00	21:14:01

Table 4.1.3. GEOTOP sampling stations for pumped radiogenic isotopes

Five to ten litre water samples were also collected from a number of rosette casts for ^{226}Ra, ^{230}Th and ^{232}Th analysis by GEOTOP. In order to achieve the necessary volume, water from two and sometimes three adjacent rosette bottles were mixed together. The tables detailing which depths were sampled (and mixed) at these stations are given in Appendix 4.

Station	Operation Numbers	Number of samples
OK_9	94	12
L3_01	98	13
L3_02	100	7
L3_03	102	6
L3_04	104	7
L3_05	107	3
L3_06	111	6
L3_07	113	3
L3_08	116	8
L3_08.5	129	6
L3_09	122	6
L3_10	118	8
L3_11	132	9
L3_12	134	9
L3_14	150	11
L3_15	156	4
L3_16	166	25
L3_18	184	6
L3_19	193	6
L3_21	215	7
L3_22	222	6

L3_23	229	4
L3_24	235	7
L3_25	259	36
L3_26	243	18
L3_27	249	10
L3_28	246	10
L5_27	281	11
Bon_18	360	9
Bon_11	389	8
Bon_10	395	8
Bon_08	405	5
Bon_04	419	5
Bon_01	429	8

Table 4.1.4. GEOTOP sampling stations for radiogenic isotope water samples

4.2 Biological Program

a. Narrative

The biological program conducted as part of cruise 2002032, 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 Glen Harrison and Jeff Anning with assistance from Christine Riordan (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 Gretchen Fitzgerald (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).

b. 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 30-60 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 18 experiments were conducted (see Table 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 (M1452).

In addition to productivity measurements, samples from one deep cast were collected for determination of suspended particulate organic carbon (POC) and nitrogen (PON) from surface to ~1,000 m.

Date	Site	Operation #	Photic Depth (m)	$^{15}N/^{13}C$	POC/ PON
27-Jun-02	GrBank	35	55	x	
28-Jun-02	FP_07	50	65	x	
30-Jun-02	OK_08	86	40	x	
02-Jul-02	L3_02	100	40	x	
03-Jul-02	M1453	128	40	x	
04-Jul-02	L3_13.2	138	25	x	
05-Jul-02	L3_14	150	-		x
05-Jul-02	L3_15	155	25	x	
06-Jul-02	L3_18	182	30	x	
07-Jul-02	L3_21	211	35	x	
08-Jul-02	L3_28	246	50	x	
09-Jul-02	ER_6	261	40	x	
10-Jul-02	L5_27	282	50	x	
11-Jul-02	L5_23	310	60	x	
12_Jul-02	L5_19	334	50	x	
13-Jul-02	L5_15	349	50	x	
14-Jul-02	Bon_17	365	50	x	
15-Jul-02	Bon_13	380	40	x	
16-Jul-02	Bon_07	409	60	x	

Table 4.2.1. Sampling for stable isotopes.

c. Zooplankton Sampling — L. Harris, G Fitzgerald

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 (Figure 4) were taken at 97 stations, using a 3/4 metre 200 μm 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 16 of the stations in the Labrador Sea using a multi-net. Samples will be analysed for species composition, copepod stage structure and biomass. Thirty-five additional tows were made using a 30 cm 75 μm net.

d. Measurements Of Copepod Reproduction Rates — L. Harris, G Fitzgerald

Egg production rates of *Calanus finmarchicus*, the dominant copepod species, were measured at 23 stations from the Labrador Shelf/Labrador Sea.

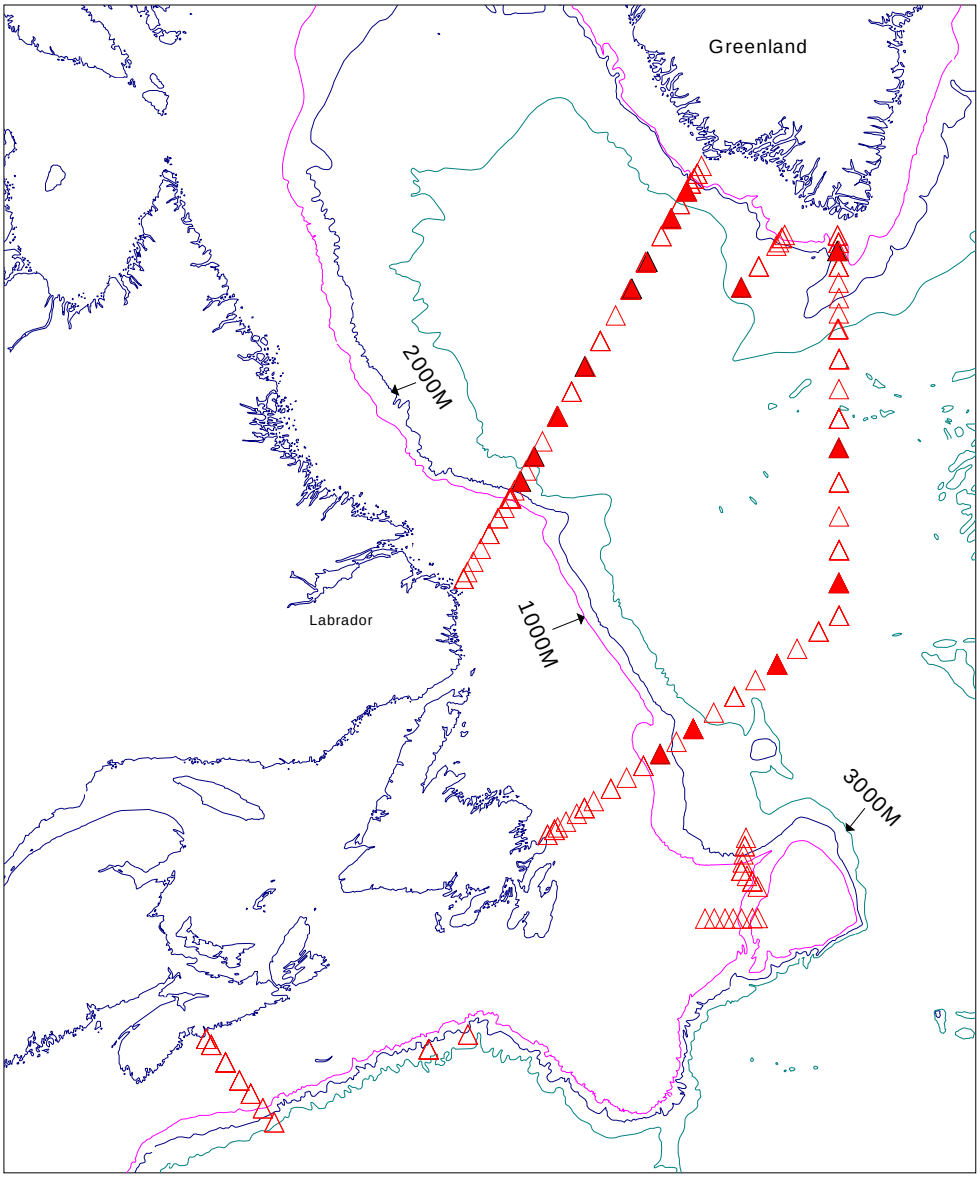


Figure 4.2.1. Net tow (open) and multinet tow (filled) locations for 18HU2002032/1.

e. Total Organic Carbon (TOC) and Microbial Community Respiration

Jay Bugden / Paul Kepkay

In order to try and 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 size fractionating the TOC, information on the fate of carbon in this marine environment may be elucidated.

During CCGS Hudson cruise 2002-032 fourteen (14) stations were sampled at 10m, and at the chlorophyll maximum (between 10 and 40m), for gross microbial community

respiration, and size fractionation of TOC (ultrafiltration) was performed at 10m only. The stations sampled are listed below. TOC depth profiles were collected from the twenty-eight (28) stations of the AR7W line listed below.

Station	Respiration	Ultrafiltration	DOC Profile
AR7W site 1			X
AR7W site 2	X	X	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
M1453	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	X	X
AR7W site 16			X
AR7W site 17			X
AR7W site 18	X	X	X
AR7W site 19			X
AR7W site 20			X
AR7W site 21	X	X	X
AR7W site 22			X
AR7W site 23			X
AR7W site 24			X
AR7W site 25			X
AR7W site 26			X
AR7W site 27			X
AR7W site 28	X	X	X
OK 8	X	X	
ER 6	X	X	
L5-27	X	X	
L5-23	X	X	
L5-19	X	X	
L5-15a	X	X	
Bon 17	X	X	

Table 4.2.2. Ultrafiltration, respiration and DOC sampling on CCGS Hudson cruise 2002-032. M1453 is a mooring site located on the AR7W line near site 8 (OK – Orphan Knoll; ER – Erik Ridge; Bon – Bonivista Line).

f. Primary Production Measurements **Jeff Anning**

Water samples for primary production experiments were collected from the rosette at 20 stations. For each incubation, 33 aliquots were inoculated with sodium bicarbonate 14C 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 fibre filters for later counting in a scintillation counter. Duplicate chlorophyll samples, one particulate carbon, one HPLC, and one Absorption Spectra were collected from each sample.

Photosynthesis/Irradiance incubations were conducted at the following stations:

Station Name	Event #	Date	Time UT	Lat.		Long		Depth (m)	ID
M1429	23	06/25/02	1330	42	41.26	61	31.29	1	253095
M1429	23	06/25/02	1330	42	41.26	61	31.29	50	253090
Enroute Scotian Slope	25	06/26/02	1230	44	10.49	56	38.05	1	253106
Enroute Scotian Slope	25	06/26/02	1230	44	10.49	56	38.05	50	253101
Enroute Grand Banks	35	06/27/02	1115	45	54.88	50	53.12	1	253138
Enroute Grand Banks	35	06/27/02	1115	45	54.88	50	53.12	40	253134
FPx7	50	06/28/02	1215	47	0.19	46	39.73	1	256226
FPx7	50	06/28/02	1215	47	0.19	46	39.73	50	253220
OK 8	86	06/30/02	1215	48	40.38	46	51.51	1	253391
OK 8	86	06/30/02	1215	48	40.38	46	51.51	40	253382
AR7W-2	99	07/02/02	1145	53	47.87	55	26.02	1	253427
AR7W-2	99	07/02/02	1145	53	47.87	55	26.02	30	253470
M1453	128	07/03/02	1515	55	7.93	54	5.19	1	253628
M1453	128	07/03/02	1515	55	7.93	54	5.19	40	253619
AR7W-13.2	138	07/04/02	1051	56	12.6	53	0.12	1	253699
AR7W-13.2	138	07/04/02	1051	56	12.6	53	0.12	40	253690
AR7W-15	155	07/05/02	1725	56	57.71	52	12.75	1	253740
AR7W-15	155	07/05/02	1725	56	57.71	52	12.75	40	253731
AR7W-18	182	07/06/02	1340	58	13	50	52.43	1	253844
AR7W-18	182	07/06/02	1340	58	13	50	52.43	40	253835
AR7W-21	211	07/07/02	1233	59	29.01	49	28.12	1	253933

AR7W-21	211	07/07/02	1233	59	29.01	49	28.12	40	253926
AR7W-28	246	07/08/02	1340	60	34.19	48	12.93	1	254057
AR7W-28	246	07/08/02	1340	60	34.19	48	12.93	40	254067
ER-6	262	07/09/02	1357	58	40.11	47	0.16	1	254138
ER-6	262	07/09/02	1357	58	40.11	47	0.16	20	254130
L5-27	282	07/10/02	1545	59	29.832	44	3.418	30	254247
L5-23	310	07/11/02	1103	57	59.918	44	0.462	1	254329
L5-23	310	07/11/02	1103	57	59.918	44	0.462	20	254329
L5-19	334	07/12/02	1130	56	0.214	44	1.125	1	254442
L5-19	334	07/12/02	1130	56	0.214	44	1.125	10	254436
L5-15A	349	07/13/02	1149	53	36.221	44	0.247	1	255556
L5-15A	349	07/13/02	1149	53	36.221	44	0.247	20	255549
BON-17	365	07/14/02	1246	52	5.235	45	54.243	1	255669
BON-17	365	07/14/02	1246	52	5.235	45	54.243	20	255662
BON-13	380	07/15/02	1126	50	51.327	48	29.325	1	255782
BON-13	380	07/15/02	1126	50	51.327	48	29.325	30	255774
BON 7	409	07/16/02	1203	49	24.748	51	32.673	1	255899
BON 7	409	07/16/02	1203	49	24.748	51	32.673	20	255895

Table 4.2.3. Sampling for primary production.

g. 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 15 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 heterotrophic biomass in the photic zone. An additional experiment was performed at station L3-15 using water depths from surface to 3569 meters (23 depths). Eleven additional transit stations were sampled for leucine uptake.

h. Mooring Sediment Traps **Glen Harrison and Jeff Anning**

Two sediment traps were deployed at the "BRAVO" mooring site (at 175 m and 1,053 m) as during the 2000-009 mission. 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 two-week intervals starting 12:01AM (GMT), 15 July, 2002.

5. Major Problems and Goals Not Achieved

The Acoustic Doppler Current Profiler that was to have been part of the CTD/rosette package was damaged when it was being prepared for its initial deployment. The pins on one of the bulkhead connectors were broken when the heavy package was being inserted into the centre of the rosette package from below. With no spare instrument and no spare connector, the instrument could not be brought back into service in spite of considerable effort. The loss of the direct full depth lowered ADCP measurements will place a greater burden on the data from the vessel mounted ADCP.

We had considerable difficulties with the winch and conducting cable associated with the Multi-net system. The winch was loaded onto the vessel in an unacceptable state. It would not payout smoothly as the brake would not release and remain released during this process. After considerable work by the engineering department, including several jury- rigged modifications to replace the missing part that had been left in the winch shop at BIO, the winch was able to perform adequately through 0 to 1000 metres. Since this voyage was late in the spring, this restriction was not particularly harmful to the program, the target species being now nearly exclusively in the upper few hundred metres. It will be a more serious problem in the voyage planned for this December. Soon after the winch was made operational, the cable began exhibiting intermittent shorts. The upper two hundred metres of cable was cut off and the cable re-terminated without success. The final multi-net hauls were successfully completed using the CTD winch in the winch room.

6. Other Incidents of Note

None

7. List of Cruise Participants

Name	Responsibility	Affiliation
Jeff Anning		BIO
Carol Anstey	Nutrients	BIO
Kumiko Azetsu-Scott	CO_2 and Alkalinity analysis, CF_6 sampling	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
Gretchen Fitzgerald	Zooplankton, vertical net hauls	BIO
Bob Gershey	Scientist, CO_2, CFC's, Alkalinity	BDR
Bassam Ghaleb	Radiogenic isotopes, pump	UQAM
Les Harris	Zooplankton, Net Tows	BIO
Glen Harrison	Assistant Scientist	BIO
Jeff Jackson	Data management	BIO
Jennifer McKay	Stable and carbon isotopes	UQAM
Patrick Poulin	Radiogenic isotopes, pump	UQAM
Christine Riordan	Biological analysis	BIO
Sylvie Roy	Oxygen analysis	BDR
Murray Scotney	Moorings, instrumentation	BIO
Sandrine Solignac	Stable and carbon isotopes	UQAM
Igor Yashayaev	Scientist	BDR
Frank Zemlyak	Technician, CO_2, CFC's, 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
UQAM	Université du Québec à Montréal Centre GEOTOP-UQAM-McGill CP 8888, succursale Centre-Ville Montréal (Québec) H3C 3P8
WHOI	Woods Hole Oceanographic Institution Woods Hole, MA 02543 USA

B. UNDERWAY MEASUREMENTS

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 one 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.

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 June 24 at 1216 Z off the coast off the Nova Scotia while performing operations on the Halifax Line.

The configuration used for logging resulted in 5 minute averages in 4 metre bins. The averaged data was stored to disk and backed up every few days. ADCP logging was stopped on July 18 at 1053 Z in Halifax Harbour.

3. Continuous Flow Multisensor Package (CFMP) — Jeff Anning

Water from approximately 4m was continuously pumped to the forward lab. The temperature, conductivity and fluorescence were measured and logged every 30 sec. The temperature and conductivity were measured with Seabird sensors and the fluorescence by a Wetlabs flowthrough fluorometer. Incident Photosynthetically Active Radiation was measured wirh 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 and logged with the other data. In addition discrete water samples were collected every 15

minutes by an auto sampler for later analysis for nitrate and silicate. Time and position of these discrete samples were logged by the computer.

4. XBT and XCTD — Igor Yashayeav

Expendable Bathythermographs were deployed along the AR7W line on the way from Greenland to Labrador. The XBT's were model 7 from Sparton of Canada. This type of probe is capable of measuring to maximum depths of 800 m at the full cruising speed 15 knots). The vertical resolution of the measurements was about 0.6-0.8 m. 80 XBT's were launched during the cruise.

Continuous deployment of XBT 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.

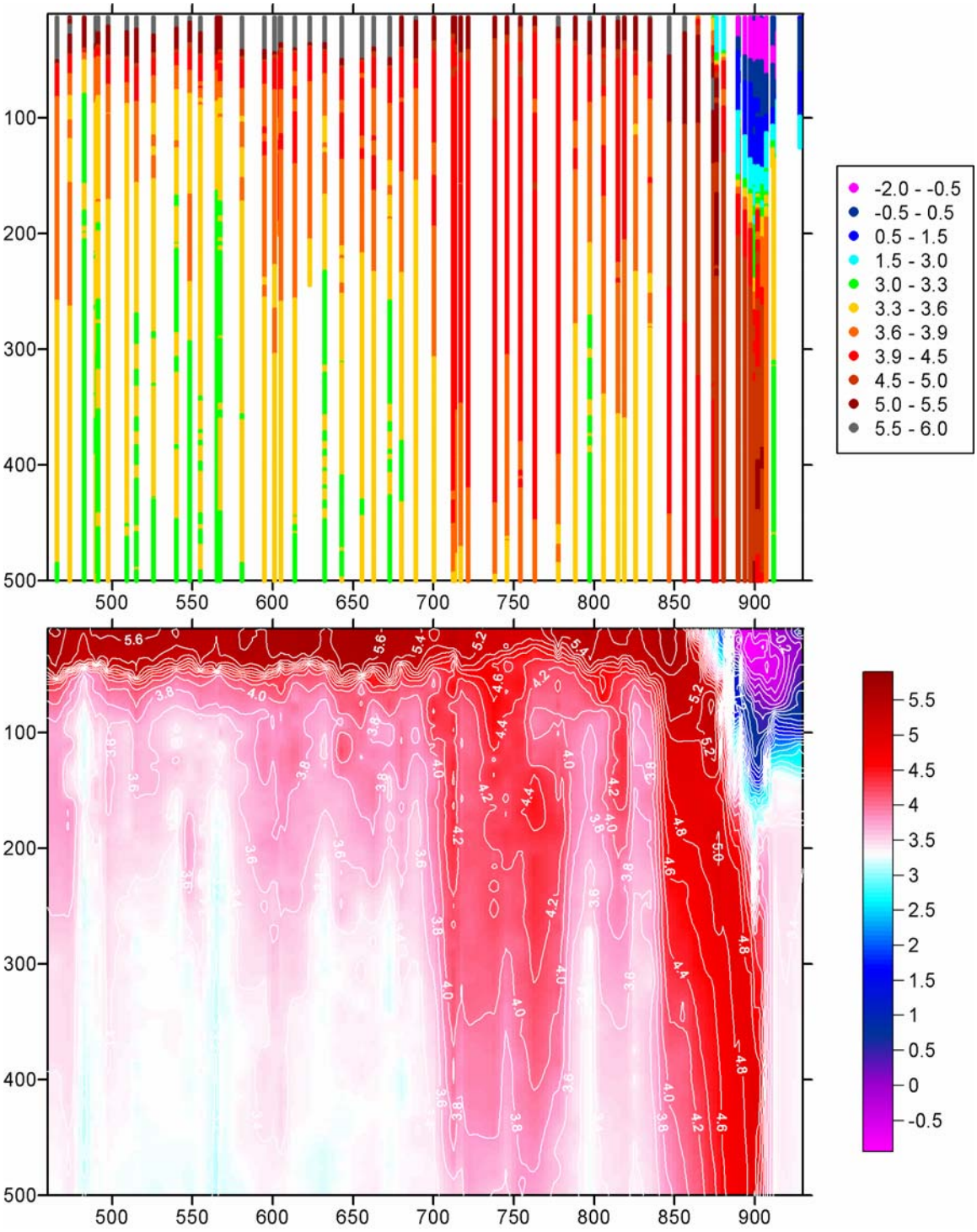


Figure B.4.1 Temperature in the upper 500 metres along the AR7W section.

5. Meteorological observations

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

6. Atmospheric Chemistry

There was no atmospheric chemistry program.

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

Note Number: 1	**Entry Time:** 24/Jun/2002 3:54:16	**Note Made By:** Jeff Jackson	**Operation ID**: 1
CTD Cast at site 1 of Halifax line			
Note Number: 2	**Entry Time:** 24/Jun/2002 3:54:44	**Note Made By**: Jeff Jackson	**Operation ID**: 2
Net tow at site 1 of Halifax line.			
Note Number: 3	**Entry Time:** 24/Jun/2002 3:55:05	**Note Made By:** Jeff Jackson	**Operation ID**: 3
Second net tow at site 1 of Halifax line.			
Note Number: 4	**Entry Time:** 24/Jun/2002 3:55:22	**Note Made By:** Jeff Jackson	**Operation ID**: 4
Net tow at site 2 of Halifax line.			
Note Number: 5	**Entry Time:** 24/Jun/2002 3:56:33	**Note Made By:** Jeff Jackson	**Operation ID**: 5
Second net tow at site 2 of Halifax line.			
Note Number: 6	**Entry Time:** 24/Jun/2002 3:55:57	**Note Made By:** Jeff Jackson	**Operation ID**: 6
Third net tow at site 2 of Halifax line.			
Note Number: 7	**Entry Time:** 24/Jun/2002 3:56:33	**Note Made By:** Jeff Jackson	**Operation ID**: 7
CTD cast at site 2 of Halifax line.			
Note Number: 8	**Entry Time:** 25/Jun/2002 19:22:30	**Note Made By:** Jeff Jackson	**Operation ID**: 35
CTD failure, cast aborted. CTD failed at 847 dbar. Was operating normally before it failed.			
Note Number: 9	**Entry Time:** 28/Jun/2002 14:25:26	**Note Made By:** Allyn Clarke	**Operation ID**: 59

Had problems with the block read out at the start of cast. When the IMS software was initiated, the readout in the computer room initially came up with information but then all the fields when blank except for tension and the two tilts. Could not correct by restarting or resetting the display from computer room. The system successfully worked after being shut down and restarted twice in the winchroom.

Note Number: 10	**Entry Time:** 07/Jul/2002 21:08:09	**Note Made By:** Igor Yashayaev	**Operation ID**: 78

Didn't remove a tube to the CTD before the cast. The upcast data seems to be better than downcast for this station.

Note Number: 29	**Entry Time:** 08/Jul/2002 9:29:06	**Note Made By:** Jeff Jackson	**Operation ID**: 95

Altimeter with serial number 975 was replaced by altimeter with serial number 222.

Note Number: 12	**Entry Time:** 03/Jul/2002 16:45:12	**Note Made By:** Jeff Jackson	**Operation ID**: 129

Sounding 1636 m.

Note Number: 13	**Entry Time:** 03/Jul/2002 21:07:47	**Note Made By:** Allyn Clarke	**Operation ID**: 131

This cast had 4 SeaCats mounted for calibration. At 1100 metres, Murray Scotney realized that on eof the SEaCats was equipped with a pressure sensor that was limited to 1300 metres. Stopped cast and returned to the surface. Stopped at 850 pressure for 5 minutes (T = 3.202, S = 34.812). Stopped at 400 db for 5 minutes. At 9:07 sent the CTD on board.

Note Number: 14	**Entry Time:** 03/Jul/2002 23:45:53	**Note Made By:** Igor Yashayaev	**Operation ID**: 132

Stopped at 250 for 5 minutes and at 20 db for 5 minutes to collect calibration points for the Seacats.

Note Number: 15	**Entry Time:** 04/Jul/2002 8:56:12	**Note Made By:** Igor Yashayaev	**Operation ID**: 137

Lost communication with the CTD when it was at 3006 db about 60 db away from the bottom. Terminated the cast and brought the package on board.

Note Number: 16	**Entry Time:** 04/Jul/2002 14:28:33	**Note Made By:** Allyn Clarke	**Operation ID**: 140

Secondary oxygen is noisy and low compared to primary oxygen.

Note Number: 17	**Entry Time:** 04/Jul/2002 15:38:33	**Note Made By:** Allyn Clarke	**Operation ID**: 140

CTD stopped operating at 2713 dbars in the same fashion as on station L3_13. Coming up.

Note Number: 18	**Entry Time:** 04/Jul/2002 15:48:23	**Note Made By:** Jeff Jackson	**Operation ID**: 140

The hose was off the top of the secondary pump.

Note Number: 19	**Entry Time:** 05/Jul/2002 0:31:49	**Note Made By:** Igor Yashayaev	**Operation ID**: 142

The CTD probe / Pressure was changed to #1 before the station. Changed the CTD settings in .con file. New .con file - 142onward.con

Note Number: 20	**Entry Time:** 05/Jul/2002 0:46:38	**Note Made By:** Igor Yashayaev	**Operation ID**: 142

At 390 db the CTD stopped sending the data. The cast was stopped and the CTD brought back to surface. At 130 db the CTD started working again. Sent the CTD down it stopped comunicating again. Kept sending it down (till stops) and up (till starts working again).

Note Number: 21	**Entry Time:** 05/Jul/2002 18:25:07	**Note Made By:** Igor Yashayaev	**Operation ID**: 144

Cut about 150 of cable and reconnected the CTD. Changed the CTD and pressure sensor back to #6. Used 95onward.con from this station (144) on.

Note Number: 22	**Entry Time:** 05/Jul/2002 4:03:15	**Note Made By:** Igor Yashayaev	**Operation ID**: 144

The CTD stopped communication at 373 m. Terminated the cast and brought the CTD on board.

Note Number: 23	**Entry Time:** 07/Jul/2002 9:44:52	**Note Made By:** Igor Yashayaev	**Operation ID**: 150

We unplugged auxiliary sensors plus both oxygen sensors. In the configuration on station 150 we used primary T, primary C, secondary T, secondary C plus pri. and sec. pumps plus the carousel. This configuration was saved in the file only_t-c.con. Since the order of IDs and positions of the sensors are the same as in 95 onward I later deleted only_t-c.con and used 95onward.con for processing.

Note Number: 24	**Entry Time:** 05/Jul/2002 16:45:32	**Note Made By:** Jeff Jackson	**Operation ID**: 154

CTD stopped responding at 85 m. Problem seems to be one of the biological sensors. We had the primary and secondary temperature and conductivity sensors, pressure sensor, along with the PAR, Chelsea fluorometer and Wetstar sensors on the CTD. A second ROS operation was performed using this same operation number. Before this second operation the PAR sensor was removed, but the CTD stopped responding at 125 m. This second operation had been 155, but it was removed from ODIN and the CTD data files were renamed as 032b154, in order to be consistent with the bridge log.

Note Number: 25	**Entry Time:** 05/Jul/2002 16:45:32	**Note Made By:** Jeff Jackson	**Operation ID**: 155

The Wetstar sensor was removed prior to this cast and the PAR sensor was placed back on the CTD. The CTD seemed to work fine except for a bit of flakiness in the PAR and fluorometer sensors. The CTD was taken to a maximum depth of 350 m to test the sensors and the CTD system. This operation had been 156, but it was renamed to 155 to be consistent with the bridge log.

Note Number: 26	**Entry Time:** 05/Jul/2002 18:25:07	**Note Made By:** Jeff Jackson	**Operation ID**: 156

This operation had been 157, but it was renamed to 156 to be consistent with the bridge log.

Note Number: 36	**Entry Time:** 14/Sepl/2004 16:05:00	**Note Made By:** Jeff Jackson	**Operation ID**: 157

According to the records in the science log, two ROS operations were performed using the same operation number (154). This caused the science log and ODIN to end up being conflicted. ODIN was missing the drifter operation (158 in the science log) since it had these two ROS operations listed as different operations (154 and 155). To correct this conflict. The original ROS operation 155 was removed from ODIN and its CTD data file name was changed from 032a155 to 032b154. Also, operation 156 was renamed as 155, operation 157 was renamed as 156 along with the appropriate changes to the CTD data file names and operation 158 was renamed 157. Then a new operation 158 was inserted into ODIN for the missing drifter operation.

Note Number: 27	**Entry Time:** 07/Jul/2002 9:44:52	**Note Made By:** Jeff Jackson	**Operation ID**: 182

The altimeter was added to the CTD package. But Jeff used the wrong con file during the cast. The 95onward.con file was copied to 182onward.con. When I entered the Seacon application to make changes I neglected to select the proper con file to update. Thus the incorrect con file was used. I stopped acquisition, modified the con file and restarted it at the bottom, so the cast was split in two. The con file confusion was sorted out after the cast was complete. I should have just used 95onward.con as the configuration file.

Note Number: 28	**Entry Time:** 07/Jul/2002 14:59:22	**Note Made By:** Allyn Clarke	**Operation ID**: 215
Holding between bottle 1 and 2, at 25 metres off the bottom for 25 minutes for pump sample.			
Note Number: 30	**Entry Time:** 10/Jul/2002 6:03:56	**Note Made By:** Igor Yashayaev	**Operation ID**: 255
The operation IDs are +1 from 256 to 260.			
Note Number: 31	**Entry Time:** 10/Jul/2002 8:00:31	**Note Made By:** Igor Yashayaev	**Operation ID**: 273
The bottom depth at ER 3 (ID=272) was > 2100 m, expected 1700 m. Since the sounding at 2.5 and 2 sec/scan was unclear we used 1 sec/scan and estimated that the station was about 1300 m deep. The CTD was stopped by the sounder (even if the CTD altimeter was showing 100). We were almost certain that we missed one lap, but decided not to risk the CTD and fired the bottles as if the station was 1300 m deep. While drawing the samples on the steam to ER 2, we watched the sounder and marked the position for 1700 m as was expected for ER 3. The new site was between the sites ER 2 and ER 3 (within 2-2.5 miles from each) and about 1900 m deep.			
Note Number: 32	**Entry Time:** 11/Jul/2002 5:26:41	**Note Made By:** Allyn Clarke	**Operation ID**: 287
Note Primary Oxygen under went shift on Down Trace between 150 and 250 metres. Seemed to recover original value for rest of down and for the up trace.			
Note Number: 33	**Entry Time:** 11/Jul/2002 5:26:43	**Note Made By:** Igor Yashayaev	**Operation ID**: 303
Similar to 287: Primary Oxygen had a broad shift on the down trace between 440 and 500 metres. At about 500 it returned back, but its readings were a bit lower than before the shift.			
Note Number: 34	**Entry Time:** 13/Jul/2002 9:29:32	**Note Made By:** Igor Yashayaev	**Operation ID**: 341

Station 341: samples IDs 255501 through 255515

Correction to sample IDs from station 341

The first sample ID on station 341 was 254492, next eight bottles were 254493 to 254500. Then instead of 254501, the sample IDs leaped increased to 255501, skipping 1000 counts. We couldn't find any labels for 254501-255500. The problem with IDs for station 341 was discovered after the sampling was completed.
To keep the processing at its simplest we suggest to change "5" to "4" in the third digit in the labels IDs - from 255501-255515 to the 254501-254515, accordingly. This will make the set consistent through the sampling queue.
Please distribute the note to those who sampled on the station with the sample IDs leaping over 1000. The station 345 has the sample IDs starting with 255516.

Thanks for your cooperation.
Igor Yashayaev

Note Number: 35	**Entry Time:** 15/Jul/2002 14:29:37	**Note Made By:** Allyn Clarke	**Operation ID**: 381

Secondary Oxygen sensor underwent some sort of cut-out at 475 dbars lasting over about 5 metres. The sensor then stabilzed at an offset of about 1 ml/l low and moved back towards its usual calibration over the next 60-80 dbars. No sign of any problems with secondary salinity. On the up trace, the net new offset of this sensor appears to be 0.05 ml/l lower. It should be noted that bottle SN S001 in rosette position 21 imploded during the downcast breaking of the spigots of two other bottles in rosette positions 19 and 23. This implosion was most likely the cause of the secondary oxygen being knocked out of sorts.

Table F.1.1 Operation Notes

Appendix 2: GEOTOP Dissolved Inorganic and Organic Carbon Samples

Operation ID	Station	Sample	Pressure (dbars)	Analysis		
				[DIC] and $\delta^{13}C$ DIC	[DOC] and $\delta^{13}C$ DOC	^{14}C
90	OK-8	253394	2637	Yes	Yes	Yes
		253396	2317	Yes	Yes	-
		253398	2114	Yes	Yes	Yes
		253399	1914	Yes	Yes	-
		253401	1711	Yes	Yes	Yes
		253402	1509	Yes	Yes	-
		253405	1108	Yes	Yes	Yes
		253408	505	Yes	Yes	-
		253411	252	Yes	Yes	Yes
		253412	151	Yes	Yes	-
		253413	101	Yes	Yes	-
		253415	51	Yes	Yes	Yes
116	L3-08	253551	950	Yes	Yes	-
		253554	700	Yes	Yes	-
		253556	470	Yes	Yes	-
		253558	261	Yes	Yes	-
		253559	170	Yes	Yes	-
		253560	100	Yes	Yes	-
		253563	50	Yes	Yes	-
		253568	10	Yes	Yes	-
134	L3-12	253660	3157	Yes	Yes	-
		253664	2808	Yes	Yes	-
		253669	1990	Yes	Yes	-
		253670	1800	Yes	Yes	-
		253671	1600	Yes	Yes	-
		253673	1200	Yes	Yes	-
		253675	800	Yes	Yes	-
		253676	600	Yes	Yes	-
		253678	288	Yes	Yes	-
		253680	108	Yes	Yes	-
		253681	60	Yes	Yes	-
		253683	5	Yes	Yes	-

Operation ID	Station	Sample ID	Pressure (dbars)	Analysis		
				[DIC] and $\delta^{13}C$ DIC	[DOC] and $\delta^{13}C$ DOC	^{14}C
164	L3-16	253767	1070	Yes	Yes	-
		253770	680	Yes	Yes	Yes
		253773	240	Yes	Yes	-
		253775	140	Yes	Yes	Yes
		253777	40	Yes	Yes	Yes
		253780	15	Yes	Yes	-
166	L3-16	253782	3579	Yes	Yes	Yes
		253789	3020	Yes	Yes	Yes
		253792	2851	Yes	Yes	-
		253796	2479	Yes	Yes	-
		253799	2010	Yes	Yes	Yes
		253803	1529	Yes	Yes	Yes
193	L3-19	253870	3566	Yes	Yes	-
		253873	3300	Yes	Yes	-
		253875	3040	Yes	Yes	-
		253878	2501	Yes	Yes	-
		253880	2030	Yes	Yes	-
		253882	1529	Yes	Yes	-
		253884	1090	Yes	Yes	-
		253887	510	Yes	Yes	-
		253889	240	Yes	Yes	-
		253890	140	Yes	Yes	-
		253892	35	Yes	Yes	-
		253893	12	Yes	Yes	-
222	L3-22	253959	3250	Yes	Yes	-
		253962	3019	Yes	Yes	-
		253966	2460	Yes	Yes	-
		253968	2059	Yes	Yes	-
		253970	1640	Yes	Yes	-
		253973	1029	Yes	Yes	-
		253976	480	Yes	Yes	-
		253978	210	Yes	Yes	-
		253979	110	Yes	Yes	-
		253980	50	Yes	Yes	-
		253981	26	Yes	Yes	-
		253982	2	Yes	Yes	-

Operation ID	Station	Sample ID	Pressure (dbars)	Analysis		
				[DIC] and $\delta^{13}C$ DIC	[DOC] and $\delta^{13}C$ DOC	^{14}C
259	L3-25	254083	510	Yes	Yes	Yes
		254087	250	Yes	Yes	-
		254091	100	Yes	Yes	Yes
		254093	50	Yes	Yes	-
		254095	20	Yes	Yes	Yes
260	L3-25	254098	2785	Yes	Yes	Yes
		254104	2481	Yes	Yes	-
		254106	2340	Yes	Yes	-
		254108	2170	Yes	Yes	Yes
		254112	1811	Yes	Yes	-
		254116	1430	Yes	Yes	-
		254120	1030	Yes	Yes	Yes
282	L5-27	254236	189	Yes	Yes	-
		254240	100	Yes	Yes	-
		254244	50	Yes	Yes	-
		254251	10	Yes	Yes	-
		254256	3	Yes	Yes	-
287	L5-26	254258	1436	Yes	Yes	-
		254263	978	Yes	Yes	-
		254266	499	Yes	Yes	-
		254268	218	Yes	Yes	-
		254270	50	Yes	Yes	-
		254271	20	Yes	Yes	-
		254272	4	Yes	Yes	-
327	L5-21	254379	3494	Yes	Yes	-
		254383	3079	Yes	Yes	-
		254386	2600	Yes	Yes	-
		254389	1850	Yes	Yes	-
		254391	1450	Yes	Yes	-
		254393	1150	Yes	Yes	-
		354394	975	Yes	Yes	-
		354396	510	Yes	Yes	-
		354399	140	Yes	Yes	-
		254400	70	Yes	Yes	-
		254401	35	Yes	Yes	-

Operation ID	Station	Sample ID	Pressure (dbars)	Analysis		
				[DIC] and $\delta^{13}C$ DIC	[DOC] and $\delta^{13}C$ DOC	^{14}C
354	L5-13	255582	3862	Yes	Yes	-
		255587	3010	Yes	Yes	-
		255589	2593	Yes	Yes	-
		255592	1960	Yes	Yes	-
		255594	1539	Yes	Yes	-
		255596	1120	Yes	Yes	-
		255599	520	Yes	Yes	-
		255601	240	Yes	Yes	-
		255602	140	Yes	Yes	-
		255603	71	Yes	Yes	-
		255604	35	Yes	Yes	-
		255605	2	Yes	Yes	-
385	Bon-12	255804	2187	Yes	Yes	-
		255809	1550	Yes	Yes	-
		255812	1029	Yes	Yes	-
		255815	480	Yes	Yes	-
		255817	350	Yes	Yes	-
		255819	100	Yes	Yes	-
		255820	50	Yes	Yes	-
		255821	19	Yes	Yes	-
		255822	2	Yes	Yes	-
395	Bon-10	255838	940	Yes	Yes	-
		255842	500	Yes	Yes	-
		255844	221	Yes	Yes	-
		255845	100	Yes	Yes	-
		255848	50	Yes	Yes	-
		255851	20	Yes	Yes	-
		255854	3	Yes	Yes	-
405	Bon-8	255870	283	Yes	Yes	-
		255872	168	Yes	Yes	-
		255874	99	Yes	Yes	-
		255877	50	Yes	Yes	-
		255880	20	Yes	Yes	-
		255883	2	Yes	Yes	-

Appendix 3: GEOTOP Pump station Files

Data recording start time = 06/24/102 21:35:58
Data recording stop time = 06/24/102 22:28:34

Halifax 6 Depth 1000m Hudson 2002-032

Sample volume = 200 [liters] **Initial flow rate = 8000 [ml/min]**
Minimum flow rate = 4000 [ml/min] **Time limit = 51 [minutes]**
Pump data period = 1 [minutes] **Scheduled start 06/24/102 22:00:00**

DEPLOYMENT DATA

Event start: 06/24/102 22:00:00 32.9 Vb 11 °C
200.02 L delivered in 1713 seconds : Volume reached.
Event end: 06/24/102 22:28:34 29.7 Vb 17 °C

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.82	7.03	27.7
6.97	13.67	27.6
7.24	20.48	27.7
7.26	27.45	27.1
7.54	34.60	26.7
7.39	41.89	27.0
7.59	49.00	26.8
7.61	56.27	26.4
7.46	63.28	26.6
7.50	70.44	26.1
7.28	77.66	26.2
7.43	84.76	25.9
7.32	91.86	26.5
7.37	98.90	26.1

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
7.13	105.95	26.3
7.26	112.90	26.2
7.48	120.02	25.9
7.26	127.02	26.2
7.46	134.09	25.7
7.30	140.97	26.0
7.43	147.99	25.7
6.99	154.91	26.0
7.21	161.76	25.7
7.43	168.79	25.5
7.17	175.66	25.6
6.99	182.62	25.6
7.21	189.39	25.7
7.32	196.31	25.2

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 25.2
End of instrument data file.

Data recording start time = 06/30/102 15:36:40
Data recording stop time = 06/30/102 17:07:16

Station OK 9 Hudson 2002-032

Sample volume = 250 [liters] Initial flow rate = 7000 [ml/min]
Minimum flow rate = 4000 [ml/min] Time limit = 63 [minutes]
Pump data period = 1 [minutes] Scheduled start 06/30/102 16:30:00

DEPLOYMENT DATA

Event start: 06/30/102 16:30:00 32.6 Vb 4 øC
250.00 L delivered in 2235 seconds : Volume reached.
Event end: 06/30/102 17:07:16 29.0 Vb 14 øC

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
7.06	6.59	27.1
7.08	13.31	26.9
6.95	20.03	26.7
6.99	26.75	26.6
6.97	33.47	26.5
6.97	40.19	26.4
6.97	46.91	26.2
6.99	53.63	25.9
6.97	60.35	26.0
6.97	67.07	25.8
6.95	73.79	25.6
7.04	80.51	25.9
7.01	87.23	25.6
6.97	93.95	25.6
7.04	100.67	25.7
7.01	107.39	25.5
7.04	114.11	25.5
7.08	120.83	25.4
7.01	127.55	25.0

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.97	134.27	25.2
7.04	140.99	25.2
7.06	147.71	25.1
6.95	154.43	24.8
6.99	161.15	25.0
7.04	167.87	24.8
7.06	174.59	24.8
7.06	181.31	24.8
7.08	188.03	24.9
6.95	194.75	24.6
7.01	201.47	24.6
7.06	208.19	24.6
7.06	214.91	24.5
6.95	221.62	24.5
6.95	228.34	24.4
6.95	235.06	24.4
6.97	241.78	24.4
6.95	248.50	24.4

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 24.4
Lowest measured battery voltage is less than 25.0
Replacement of battery pack before next deployment is strongly recommended.

End of instrument data file.

Data recording start time = 07/03/102 01:59:15
Data recording stop time = 07/03/102 03:32:05

L3_10 HUDSON 2002-032

Sample volume = 250 [liters] **nitial flow rate = 8000 [ml/min]**
Minimum flow rate = 4000 [ml/min] **Time limit = 63 [minutes]**
Pump data period = 1 [minutes] **Scheduled start 07/03/102 02:50:00**

DEPLOYMENT DATA

Event start: 07/03/102 02:50:00 34.6 Vb 4 øC
250.00 L delivered in 2524 seconds : Volume reached.
Event end: 07/03/102 03:32:05 31.3 Vb 15 øC

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.57	6.99	30.5
6.29	12.93	30.6
6.42	19.00	30.6
6.22	24.86	30.6
6.35	30.86	30.1
6.51	37.00	29.9
6.29	43.19	30.1
6.07	49.20	30.2
6.22	55.06	30.3
6.33	61.06	29.8
6.13	67.08	30.0
6.26	73.02	29.5
6.07	78.93	29.9
6.18	84.81	29.6
6.35	90.83	29.5
6.15	96.80	29.6
6.18	102.73	29.5
6.09	108.62	29.3
6.13	114.48	29.5
6.46	120.51	29.1
6.13	126.40	29.6

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.40	132.35	29.2
6.31	138.45	29.2
6.29	144.34	29.0
6.42	150.37	29.1
6.13	156.22	29.1
6.38	162.16	28.9
6.18	167.92	28.9
6.18	173.80	28.8
5.87	179.55	29.2
6.18	185.32	28.8
6.35	191.24	28.8
6.04	197.25	28.6
6.24	203.12	28.6
6.02	209.07	28.6
6.13	214.87	28.6
5.98	220.72	29.0
6.02	226.46	28.9
6.18	232.33	28.6
5.91	238.01	28.5
6.07	243.76	28.5
6.29	249.65	28.4

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 28.4
End of instrument data file.

Data recording start time = 07/03/102 18:42:42
Data recording stop time = 07/03/102 20:11:22

L3_11 HUDSON 2002-032

Sample volume = 250 [liters] **Initial flow rate = 8000 [ml/min]**
Minimum flow rate = 4000 [ml/min] **Time limit = 63 [minutes]**
Pump data period = 1 [minutes] **Scheduled start 07/03/102 19:30:00**

DEPLOYMENT DATA

Event start: 07/03/102 19:30:00 33.8 Vb 4 øC
250.00 L delivered in 2481 seconds : Volume reached.
Event end: 07/03/102 20:11:22 31.0 Vb 14 øC

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.55	6.98	29.7
6.62	13.26	29.7
6.31	19.38	29.6
6.60	25.54	29.4
6.33	31.64	29.7
6.38	37.69	29.4
6.62	43.90	29.4
6.46	50.26	29.1
6.53	56.43	29.1
6.68	62.74	29.1
6.44	68.83	28.8
6.13	74.82	29.3
6.24	80.78	29.2
6.57	86.90	28.9
6.18	92.97	29.0
6.33	98.97	28.7
6.60	105.13	28.6
6.20	111.19	28.7
6.42	117.27	28.4
6.22	123.34	28.7
6.31	129.30	28.6

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.49	135.42	28.5
6.26	141.48	28.6
6.40	147.52	28.4
6.20	153.51	28.5
6.22	159.47	28.5
6.11	165.43	28.4
6.22	171.30	28.6
5.96	177.15	28.3
6.15	182.97	28.4
6.31	188.93	28.1
6.09	194.82	28.5
6.13	200.69	28.2
6.46	206.72	28.0
6.26	212.60	28.3
6.42	218.57	28.3
6.20	224.35	28.3
6.24	230.26	27.9
6.11	236.23	28.1
6.24	242.09	28.1
6.02	248.02	28.2

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 27.9
End of instrument data file.

Data recording start time = 07/05/102 23:50:56
Data recording stop time = 07/06/102 01:47:13

L3_16 HUDSON 2002-032

Sample volume = 250 [liters] **Initial flow rate = 8000 [ml/min]**
Minimum flow rate = 4000 [ml/min] **Time limit = 63 [minutes]**
Pump data period = 1 [minutes] **Scheduled start 07/06/102 01:05:00**

DEPLOYMENT DATA

Event start: 07/06/102 01:05:00 33.7 Vb 4 øC
250.00 L delivered in 2532 seconds : Volume reached.
Event end: 07/06/102 01:47:13 30.8 Vb 14 øC

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.53	6.98	29.7
6.73	13.26	29.6
6.51	19.33	29.6
6.22	25.49	29.7
6.35	31.49	29.4
6.49	37.62	29.3
6.31	43.83	29.4
6.40	49.89	29.2
6.24	55.99	29.1
6.33	61.99	28.8
6.11	67.97	29.0
6.29	73.92	28.8
6.07	79.91	29.1
6.22	85.77	28.9
5.98	91.73	29.1
6.09	97.49	29.0
6.20	103.39	28.6
6.09	109.32	29.1
6.22	115.16	28.5
6.02	121.00	28.5
6.07	126.77	28.7
6.26	132.69	28.1

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.04	138.52	28.9
6.22	144.39	28.3
6.00	150.12	28.3
6.15	155.94	28.3
6.07	161.87	28.6
6.09	167.64	28.5
5.91	173.50	28.5
6.02	179.19	28.2
6.22	185.03	28.3
6.00	190.87	28.4
6.13	196.65	28.4
6.24	202.58	28.2
6.09	208.40	28.2
6.29	214.29	28.0
6.11	220.01	28.1
6.24	225.85	28.0
5.85	231.56	28.4
6.11	237.29	27.8
6.22	243.17	27.7
5.98	248.91	27.8

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 27.7
End of instrument data file.

Data recording start time = 07/06/102 14:45:42
Data recording stop time = 07/06/102 16:31:22

L3_18 Hudson 032-2002

Sample volume = 250 [liters] **Initial flow rate = 8000 [ml/min]**
Minimum flow rate = 4000 [ml/min] **Time limit = 63 [minutes]**
Pump data period = 1 [minutes] **Scheduled start 07/06/102 15:50:00**

DEPLOYMENT DATA

Event start: 07/06/102 15:50:00 33.2 Vb 4 øC
250.00 L delivered in 2482 seconds : Volume reached.
Event end: 07/06/102 16:31:22 30.7 Vb 14 øC

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.49	6.98	29.2
6.29	12.93	29.3
6.42	18.99	29.1
6.29	25.19	29.4
6.35	31.17	29.0
6.49	37.31	28.8
6.29	43.55	29.1
6.40	49.60	28.8
6.20	55.74	28.9
6.31	61.72	28.7
6.53	67.85	28.6
6.26	73.97	28.6
6.38	80.04	28.5
6.20	86.18	28.5
6.31	92.15	28.6
6.44	98.26	28.2
6.24	104.14	28.4
6.38	110.13	28.4
6.20	116.21	28.4
6.26	122.15	28.4
6.38	128.23	28.2

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.15	134.29	28.1
6.29	140.32	28.0
6.11	146.32	28.3
6.33	152.28	28.1
6.07	158.22	28.1
6.24	164.10	28.1
6.40	170.12	27.9
6.40	176.30	27.9
6.46	182.30	27.8
6.55	188.44	27.7
6.33	194.37	28.1
6.46	200.42	27.7
6.09	206.35	27.8
6.29	212.28	28.0
6.53	218.38	27.5
6.22	224.29	27.7
6.44	230.32	27.4
6.24	236.17	27.8
6.35	242.12	27.6
6.02	248.01	27.8

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 27.4
End of instrument data file.

Data recording start time = 07/07/102 10:50:12
Data recording stop time = 07/07/102 12:33:15

L3_21 Hudson 032-2002

Sample volume = 250 [liters] **Initial flow rate = 8000 [ml/min]**
Minimum flow rate = 4000 [ml/min] **Time limit = 63 [minutes]**
Pump data period = 1 [minutes] **Scheduled start 07/07/102 11:50:00**

DEPLOYMENT DATA

Event start: 07/07/102 11:50:00 33.2 Vb 4 øC
250.00 L delivered in 2595 seconds : Volume reached.
Event end: 07/07/102 12:33:15 30.5 Vb 14 øC

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.57	6.98	29.2
6.29	12.92	28.9
6.44	18.99	28.9
6.22	25.12	28.9
6.35	31.13	28.5
6.13	37.18	28.7
6.29	43.13	28.6
6.15	49.11	28.6
6.22	54.99	28.6
6.02	60.90	28.4
6.13	66.71	28.3
6.33	72.66	28.1
6.11	78.53	28.2
6.29	84.43	28.1
5.96	90.23	28.5
6.24	96.08	28.0
6.04	102.04	28.1
6.22	107.85	28.1
6.02	113.73	28.0
6.09	119.47	28.0
5.85	125.26	28.3

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.02	130.95	27.7
5.80	136.66	28.2
6.02	142.29	27.7
6.11	148.05	27.9
5.91	153.77	28.4
6.00	159.47	27.9
6.22	165.32	27.7
6.00	171.02	27.8
5.80	176.64	27.7
5.91	182.19	27.9
5.71	187.72	27.9
5.74	193.20	27.7
6.02	198.83	27.5
5.74	204.35	27.7
5.89	209.92	27.2
5.82	215.34	27.5
5.76	220.87	27.7
5.67	226.21	27.8
5.87	231.68	27.6
5.89	237.29	27.6
6.02	243.03	27.3
5.85	248.71	27.7

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 27.2
End of instrument data file.

Data recording start time = 07/08/102 01:21:59
Data recording stop time = 07/08/102 02:55:04

L3_24 Hudson 032-2002

Sample volume = 250 [liters] **Initial flow rate = 8000 [ml/min]**
Minimum flow rate = 4000 [ml/min] **Time limit = 63 [minutes]**
Pump data period = 1 [minutes] **Scheduled start 07/08/102 02:15:00**

DEPLOYMENT DATA

Event start: 07/08/102 02:15:00 32.9 Vb 4 øC
250.00 L delivered in 2403 seconds : Volume reached.
Event end: 07/08/102 02:55:04 30.4 Vb 14 øC

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.46	7.00	29.0
6.62	13.26	28.7
6.77	19.69	28.4
6.64	25.89	28.7
6.71	32.21	28.2
6.84	38.68	28.0
6.46	44.96	28.0
6.75	51.31	28.0
6.55	57.78	28.2
6.73	64.09	28.2
6.49	70.45	28.1
6.57	76.70	27.7
6.68	83.10	27.7
6.55	89.44	28.0
6.66	95.78	27.7
6.49	102.11	27.7
6.53	108.36	27.8
6.31	114.55	28.0
6.64	120.75	27.4
6.57	127.11	27.7

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.57	133.28	27.6
6.51	139.59	27.9
6.51	145.69	27.5
6.66	151.93	27.5
6.24	158.02	27.6
6.57	164.14	27.5
6.40	170.41	27.4
6.44	176.49	27.4
6.64	182.71	27.2
6.35	188.97	27.3
6.55	195.14	27.4
6.24	201.31	27.4
6.46	207.41	27.3
6.26	213.59	27.5
6.40	219.59	27.4
6.18	225.73	27.4
6.33	231.64	27.4
6.42	237.69	27.1
6.26	243.83	27.5
6.38	249.80	27.2

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 27.1
End of instrument data file.

Data recording start time = 07/08/102 19:44:34
Data recording stop time = 07/08/102 21:14:01

Hudson 032-2002 L3-25

Sample volume = 250 [liters] **Initial flow rate = 8000 [ml/min]**
Minimum flow rate = 4000 [ml/min] **Time limit = 63 [minutes]**
Pump data period = 1 [minutes] **Scheduled start 07/08/102 20:30:00**

DEPLOYMENT DATA

Event start: 07/08/102 20:30:00 32.8 Vb 5 °C
250.00 L delivered in 2640 seconds : Volume reached.
Event end: 07/08/102 21:14:01 30.1 Vb 14 °C

Normal shutdown.

PUMPING DATA

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat]
6.55	6.97	28.1
6.31	12.92	28.3
6.18	18.67	28.3
5.98	24.52	28.2
6.02	30.20	28.3
6.24	36.01	28.2
6.11	41.96	28.0
6.13	47.68	27.9
6.22	53.54	27.5
6.02	59.46	27.8
6.13	65.25	27.8
5.91	71.06	28.0
6.07	76.80	27.8
5.89	82.58	27.9
6.09	88.25	27.8
6.09	94.05	27.5
6.00	99.83	27.7
6.09	105.57	27.5
5.82	111.33	27.6
6.02	116.98	27.1
6.11	122.77	27.2
5.96	128.49	26.9

Sample interval = 1 [minutes]

[L/min]	[liters]	[Vbat
6.07	134.23	26.9
5.82	139.90	27.1
6.00	145.56	27.3
6.24	151.38	26.9
6.02	157.02	27.0
5.78	162.75	27.3
5.98	168.33	27.1
5.69	173.84	27.0
5.76	179.28	26.7
5.87	184.85	26.7
5.65	190.34	27.2
5.93	195.86	26.9
5.67	201.27	27.0
5.89	206.73	27.2
5.58	212.08	27.3
5.80	217.47	26.6
5.85	223.01	26.9
5.76	228.37	27.0
5.85	233.83	26.8
5.49	239.22	27.1
5.60	244.56	26.8

Checking for low battery during pumping event . . . done.
Lowest battery voltage measured while under load: 26.6
End of instrument data file.

Appendix 4: GEOTOP Radiogenic Water Samples

Station	Average Press.	Sample ID	Analysis			Volume Pumped
OK-9	2697	253417	^{226}Ra	^{230}Th	^{232}Th	250
	2561	252419 253420	^{226}Ra	^{230}Th	^{232}Th	
	2293	253421 253422	^{226}Ra	^{230}Th	^{232}Th	
	1983	253424 253425	^{226}Ra	^{230}Th	^{232}Th	
	1613	253426 253427	^{226}Ra	^{230}Th	^{232}Th	
	1512	253428	^{226}Ra	^{230}Th	^{232}Th	
	1210	253429 253430	^{226}Ra	^{230}Th	^{232}Th	
	905	253431	^{226}Ra	^{230}Th	^{232}Th	
	643	253433 253434	^{226}Ra	^{230}Th	^{232}Th	
	363	253435 253436	^{226}Ra	^{230}Th	^{232}Th	
	150	253437 253438	^{226}Ra	^{230}Th	^{232}Th	
	30	253439 253440	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_01	145	253441	^{226}Ra			
	145	252441 253442	^{226}Ra	^{230}Th	^{232}Th	
	125	253443	^{226}Ra			
	100	253444 253445	^{226}Ra	^{230}Th	^{232}Th	
	79	253446	^{226}Ra			
	59	253447	^{226}Ra			
	50	253448	^{226}Ra			
	40	253449	^{226}Ra			
	30	253450	^{226}Ra			
	20	253451	^{226}Ra			
	10	253452	^{226}Ra			
	10	253453	^{226}Ra			
	2	253454	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_02	198	253455	^{226}Ra			
	180	253457	^{226}Ra			
	150	253458	^{226}Ra			
	101	253461	^{226}Ra			
	50	253466	^{226}Ra			
	10	253472	^{226}Ra			
	2	253477	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_03	142	253479	^{226}Ra			
	125	253480	^{226}Ra			
	100	253481	^{226}Ra			
	50	253484	^{226}Ra			
	10	253488	^{226}Ra			
	2	253490	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_04	160	253491	^{226}Ra			
	141	253493	^{226}Ra			
	120	253494	^{226}Ra			
	100	253495	^{226}Ra			
	50	253499	^{226}Ra			
	10	253503	^{226}Ra			
	4	253506	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_05	182	253507	^{226}Ra			
	100	253510	^{226}Ra			
	10	253518	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_06	235	253520	^{226}Ra			
	200	253521	^{226}Ra			
	150	253522	^{226}Ra			
	100	253524	^{226}Ra			
	50	253527	^{226}Ra			
	10	253532	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_07	355	253534	^{226}Ra			
	330	253535	^{226}Ra			
	10	253549	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_08	950	253551	^{226}Ra			
	861	253552	^{226}Ra			
	789	253553	^{226}Ra			
	700	253554	^{226}Ra			
	360	253557	^{226}Ra			
	100	253560	^{226}Ra			
	50	253563	^{226}Ra			
	10	253567	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_08.5	1691	253630	^{226}Ra	^{230}Th	^{232}Th	
	1612	253631	^{226}Ra	^{230}Th	^{232}Th	
	1464	253632	^{226}Ra	^{230}Th	^{232}Th	
	1311	253633	^{226}Ra	^{230}Th	^{232}Th	
	1160	253634	^{226}Ra	^{230}Th	^{232}Th	
	1054	253635	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_09	2065	253594	^{226}Ra			
	1971	253595	^{226}Ra			
	1900	253596	^{226}Ra			
	1210	253601	^{226}Ra			
	511	253605	^{226}Ra			
	20	253611	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_10	2700	253570	^{226}Ra	^{230}Th	^{232}Th	250
	2500	253573	^{226}Ra	^{230}Th	^{232}Th	
	2343	253575 253576	^{226}Ra	^{230}Th	^{232}Th	
	1925	253578 253579	^{226}Ra	^{230}Th	^{232}Th	
	1615	253580 253581	^{226}Ra	^{230}Th	^{232}Th	
	930	253584 253585	^{226}Ra	^{230}Th	^{232}Th	
	425	253587 253588	^{226}Ra	^{230}Th	^{232}Th	
	73	253590 253591 253592	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_11	2918	252636 253637	^{226}Ra	^{230}Th	^{232}Th	250
	2750	253638 253639	^{226}Ra	^{230}Th	^{232}Th	
	2427	253640 253641 253642	^{226}Ra	^{230}Th	^{232}Th	
	2070	253643 253644	^{226}Ra	^{230}Th	^{232}Th	
	1636	253645 253646 253647	^{226}Ra	^{230}Th	^{232}Th	
	1130	253648 253649	^{226}Ra	^{230}Th	^{232}Th	
	760	253650 253651	^{226}Ra	^{230}Th	^{232}Th	
	310	253653 253654	^{226}Ra	^{230}Th	^{232}Th	
	13	253658 253659	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_12	3129	253660 253661	^{226}Ra	^{230}Th	^{232}Th	
	2859	253663 253664	^{226}Ra	^{230}Th	^{232}Th	
	2617	253665 253666	^{226}Ra	^{230}Th	^{232}Th	
	2319	253667 253668	^{226}Ra	^{230}Th	^{232}Th	
	1895	253669 253670	^{226}Ra	^{230}Th	^{232}Th	
	1500	253671 253672	^{226}Ra	^{230}Th	^{232}Th	
	700	253675 253676	^{226}Ra	^{230}Th	^{232}Th	
	238	253678 253679	^{226}Ra	^{230}Th	^{232}Th	
	28	253681 253682 253683	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_14	3504	253701 253702	^{226}Ra	^{230}Th	^{232}Th	
	3329	253703 253704	^{226}Ra	^{230}Th	^{232}Th	
	3096	253705 253706	^{226}Ra	^{230}Th	^{232}Th	
	2551	253708 253709	^{226}Ra	^{230}Th	^{232}Th	
	2090	253710 253711	^{226}Ra	^{230}Th	^{232}Th	
	1411	253713 253714	^{226}Ra	^{230}Th	^{232}Th	
	970	253715 253716	^{226}Ra	^{230}Th	^{232}Th	
	596	253717 253718	^{226}Ra	^{230}Th	^{232}Th	
	301	253719 253720	^{226}Ra	^{230}Th	^{232}Th	
	106	253721 253722	^{226}Ra	^{230}Th	^{232}Th	
	16	253723 253724	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_15	3530	253742 253743	^{226}Ra	^{230}Th	^{232}Th	
	3023	253746 253747 253748	^{226}Ra	^{230}Th	^{232}Th	
	2131	253751 253752	^{226}Ra	^{230}Th	^{232}Th	
	775	253757 253758	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_16	3579	253781	^{226}Ra	^{230}Th	^{232}Th	250
	3579	253782	^{226}Ra	^{230}Th	^{232}Th	
	3579	253783	^{226}Ra	^{230}Th	^{232}Th	
	3020	253788	^{226}Ra	^{230}Th	^{232}Th	
	3020	253789	^{226}Ra	^{230}Th	^{232}Th	
	3020	253790	^{226}Ra	^{230}Th	^{232}Th	
	2851	253791	^{226}Ra	^{230}Th	^{232}Th	
	2851	253792	^{226}Ra	^{230}Th	^{232}Th	
	2851	253793	^{226}Ra	^{230}Th	^{232}Th	
	2690	253794	^{226}Ra	^{230}Th	^{232}Th	
	2690	253795	^{226}Ra	^{230}Th	^{232}Th	
	2010	253798	^{226}Ra	^{230}Th	^{232}Th	
	2010	253799	^{226}Ra	^{230}Th	^{232}Th	
	2010	253800	^{226}Ra	^{230}Th	^{232}Th	
	1530	253802	^{226}Ra	^{230}Th	^{232}Th	
	1530	253803	^{226}Ra	^{230}Th	^{232}Th	
	1530	253804	^{226}Ra	^{230}Th	^{232}Th	
	680	253769	^{226}Ra	^{230}Th	^{232}Th	
	680	253770	^{226}Ra	^{230}Th	^{232}Th	
	140	253774	^{226}Ra	^{230}Th	^{232}Th	
	140	253775	^{226}Ra	^{230}Th	^{232}Th	
	40	253777	^{226}Ra	^{230}Th	^{232}Th	
	40	253778	^{226}Ra	^{230}Th	^{232}Th	
	15	253779	^{226}Ra	^{230}Th	^{232}Th	
	15	253780	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_18	3559	253846 253847	^{226}Ra	^{230}Th	^{232}Th	250
	3202	253850	^{226}Ra	^{230}Th	^{232}Th	
	2624	253853 253854	^{226}Ra	^{230}Th	^{232}Th	
	2015	253855 253856 253857	^{226}Ra	^{230}Th	^{232}Th	
	774	253861 253862	^{226}Ra	^{230}Th	^{232}Th	
	20	253868 253869	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_19	3533	253870 253871	^{226}Ra	^{230}Th	^{232}Th	
	3111	253874 253875	^{226}Ra	^{230}Th	^{232}Th	
	2030	253879 253880 253881	^{226}Ra	^{230}Th	^{232}Th	
	1090	253884	^{226}Ra	^{230}Th	^{232}Th	
	300	253888 253889	^{226}Ra	^{230}Th	^{232}Th	
	24	253892 253893	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID		Analysis		Volume Pumped
L3_21	3409	253935 253936	^{226}Ra	^{230}Th	^{232}Th	250
	3015	253939 253940	^{226}Ra	^{230}Th	^{232}Th	
	2680	253941 253942	^{226}Ra	^{230}Th	^{232}Th	
	1947	253944 253945 253946	^{226}Ra	^{230}Th	^{232}Th	
	1175	253948 253949	^{226}Ra	^{230}Th	^{232}Th	
	301	253953 253954	^{226}Ra	^{230}Th	^{232}Th	
	14	253957 253958	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_22	3225	253959 253960	^{226}Ra	^{230}Th	^{232}Th	
	3069	253961 253962	^{226}Ra	^{230}Th	^{232}Th	
	2695	253964 253965	^{226}Ra	^{230}Th	^{232}Th	
	1955	253968 253969	^{226}Ra	^{230}Th	^{232}Th	
	1330	253971 253972	^{226}Ra	^{230}Th	^{232}Th	
	80	253979 253980	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_23	2984	253983	^{226}Ra	^{230}Th	^{232}Th	
		253984				
	2493	253987	^{226}Ra	^{230}Th	^{232}Th	
		253988				
		253989				
	1880	253991	^{226}Ra	^{230}Th	^{232}Th	
		253992				
	1015	253995	^{226}Ra	^{230}Th	^{232}Th	
		253996				

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_24	2889	254007 254008	^{226}Ra	^{230}Th	^{232}Th	250
	2426	254011 254012	^{226}Ra	^{230}Th	^{232}Th	
	2150	254013 254014	^{226}Ra	^{230}Th	^{232}Th	
	1735	254015 254016	^{226}Ra	^{230}Th	^{232}Th	
	1360	254017 254018	^{226}Ra	^{230}Th	^{232}Th	
	650	254021 254022	^{226}Ra	^{230}Th	^{232}Th	
	30	254028 254029	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_25	2785	254098	^{226}Ra	^{230}Th	^{232}Th	250
	2785	254099	^{226}Ra	^{230}Th	^{232}Th	
	2701	254100	^{226}Ra	^{230}Th	^{232}Th	
	2701	254101	^{226}Ra	^{230}Th	^{232}Th	
	2600	254102	^{226}Ra	^{230}Th	^{232}Th	
	2600	254103	^{226}Ra	^{230}Th	^{232}Th	
	2481	254104	^{226}Ra	^{230}Th	^{232}Th	
	2481	254105	^{226}Ra	^{230}Th	^{232}Th	
	2340	254106	^{226}Ra	^{230}Th	^{232}Th	
	2340	254107	^{226}Ra	^{230}Th	^{232}Th	
	2170	254108	^{226}Ra	^{230}Th	^{232}Th	
	2170	254109	^{226}Ra	^{230}Th	^{232}Th	
	1990	254110	^{226}Ra	^{230}Th	^{232}Th	
	1990	254111	^{226}Ra	^{230}Th	^{232}Th	
	1811	254112	^{226}Ra	^{230}Th	^{232}Th	
	1811	254113	^{226}Ra	^{230}Th	^{232}Th	
	1630	254114	^{226}Ra	^{230}Th	^{232}Th	
	1630	254115	^{226}Ra	^{230}Th	^{232}Th	
	1430	254116	^{226}Ra	^{230}Th	^{232}Th	
	1430	254117	^{226}Ra	^{230}Th	^{232}Th	
	1250	254118	^{226}Ra	^{230}Th	^{232}Th	
	1250	254119	^{226}Ra	^{230}Th	^{232}Th	
	1030	254120	^{226}Ra	^{230}Th	^{232}Th	
	1030	254121	^{226}Ra	^{230}Th	^{232}Th	
	850	254078	^{226}Ra	^{230}Th	^{232}Th	
	850	254079	^{226}Ra	^{230}Th	^{232}Th	
	670	254080	^{226}Ra	^{230}Th	^{232}Th	
	670	254081	^{226}Ra	^{230}Th	^{232}Th	
	510	254082	^{226}Ra	^{230}Th	^{232}Th	
	510	254083	^{226}Ra	^{230}Th	^{232}Th	
	370	254084	^{226}Ra	^{230}Th	^{232}Th	
	370	254085	^{226}Ra	^{230}Th	^{232}Th	
	100	254090	^{226}Ra	^{230}Th	^{232}Th	
	100	254091	^{226}Ra	^{230}Th	^{232}Th	
	20	254094	^{226}Ra	^{230}Th	^{232}Th	
	20	254095	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_26	1245	254031	^{226}Ra			
	1200	254032	^{226}Ra			
	1130	254033	^{226}Ra			
	1070	254034	^{226}Ra			
	950	254035	^{226}Ra			
	820	254036	^{226}Ra			
	680	254037	^{226}Ra			
	520	254038	^{226}Ra			
	380	254039	^{226}Ra			
	250	254040	^{226}Ra			
	150	254041	^{226}Ra			
	80	254043	^{226}Ra			
	59	254044	^{226}Ra			
	50	254045	^{226}Ra			
	30	254047	^{226}Ra			
	20	254048	^{226}Ra			
	10	254049	^{226}Ra			
	2	254050	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L3_27	142	254068	^{226}Ra			
	100	254069	^{226}Ra			
	80	254070	^{226}Ra			
	59	254071	^{226}Ra			
	50	254072	^{226}Ra			
	40	254073	^{226}Ra			
	29	254074	^{226}Ra			
	20	254075	^{226}Ra			
	10	254076	^{226}Ra			
	2	254077	^{226}Ra			

Station	Average Press.	Sample ID		Analysis		Volume Pumped
L3_28	124	254051	^{226}Ra			
	100	254052	^{226}Ra			
	80	254053	^{226}Ra			
	60	254054	^{226}Ra			
	50	254055	^{226}Ra			
	39	254059	^{226}Ra			
	30	254060	^{226}Ra			
	20	254061	^{226}Ra			
	10	254062	^{226}Ra			
	10	254066	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
L5_27	189	254236	^{226}Ra			
	150	254238	^{226}Ra			
	100	254240	^{226}Ra			
	80	254242	^{226}Ra			
	60	254243	^{226}Ra			
	50	254244	^{226}Ra			
	40	254246	^{226}Ra			
	30	254247	^{226}Ra			
	19	254250	^{226}Ra			
	10	254251	^{226}Ra			
	3	254256	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
Bon_18	4135	255630 255631	^{226}Ra	^{230}Th	^{232}Th	
	3780	255632 255633	^{226}Ra	^{230}Th	^{232}Th	
	3250	255634 255635	^{226}Ra	^{230}Th	^{232}Th	
	2620	255636 255637	^{226}Ra	^{230}Th	^{232}Th	
	2194	255638 255639	^{226}Ra	^{230}Th	^{232}Th	
	1761	255640 255641	^{226}Ra	^{230}Th	^{232}Th	
	1320	255642 255643	^{226}Ra	^{230}Th	^{232}Th	
	518	255646 255647	^{226}Ra	^{230}Th	^{232}Th	
	64	255651 255652	^{226}Ra	^{230}Th	^{232}Th	

Station	Average Press.	Sample ID	Analysis			Volume Pumped
Bon_11	1502	255823	^{226}Ra			
	1371	255825	^{226}Ra			
	1141	255827	^{226}Ra			
	820	255829	^{226}Ra			
	500	255831	^{226}Ra			
	220	255833	^{226}Ra			
	49	255835	^{226}Ra			
	6	255837	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
Bon_10	940	255838	^{226}Ra			
	870	255839	^{226}Ra			
	780	255840	^{226}Ra			
	500	255842	^{226}Ra			
	221	255844	^{226}Ra			
	50	255848	^{226}Ra			
	9	255852	^{226}Ra			
	3	255854	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
Bon_08	320	255855	^{226}Ra			
	280	255856	^{226}Ra			
	100	255860	^{226}Ra			
	40	255864	^{226}Ra			
	10	255868	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
Bon_04	299	255930	^{226}Ra			
	250	255931	^{226}Ra			
	99	255934	^{226}Ra			
	49	255937	^{226}Ra			
	9	255942	^{226}Ra			

Station	Average Press.	Sample ID	Analysis			Volume Pumped
Bon_01	94	255968	^{226}Ra			
	68	255969	^{226}Ra			
	49	255970	^{226}Ra			
	39	255971	^{226}Ra			
	29	255972	^{226}Ra			
	18	255973	^{226}Ra			
	7	255974	^{226}Ra			
	2	255976	^{226}Ra			

Appendix 5: Lagrangian Float Deployment Logs

Serial No. 255

APEX Float Launch

Float was started. Date: July 5/2002 Time: 19:31 GMT
i.e. you sweep a magnet over the reset point and it beeps.

Float deployed. Date: 5 July Time: 20:47 GMT
Float should be deployed within 6 hours of start time.

Deployed By: Murray Scotney

Vessel: Hudson Event No. 330

Latitude 56 57.18 N Longitude 52 11.11 W

Water Depth 3540 m Must be deeper than 2500 metres

Nearest CTD cast **Event No of cast.** **329**

Date: 5 July Time: 19:36 GMT

Latitude 56 57.32 N Longitude 52 11.88 W

Maximum Depth 3540 m

Any problems associated with the start up and deployment operation

Final Test Procedure completed July 05/02 O.K.

Serial No. 330

APEX Float Launch

Float was started. Date: July 03, 2002 Time: 04:12 GMT
i.e. you sweep a magnet over the reset point and it beeps.

Float deployed. Date: July 03, 2002 Time: 08:46 GMT
Float should be deployed within 6 hours of start time.

Deployed By: Derek Brittain

Vessel: Hudson Event No. 120

Latitude 55 25.2 N Longitude 53 59.0 W

Water Depth 2621 m Must be deeper than 2500 metres

Nearest CTD / XBT cast (circle one) Event No of cast.
118

Date: July 03, 2002 Time: 05:00 GMT

Latitude 55 25.2 N Longitude 53 59.0 W

Maximum Depth 2621 m

Any problems associated with the start up and deployment operation

Final test procedure performed July 3 / 02

Serial No. 334

APEX Float Launch

Float was started. Date: July 8/02 Time: 23:50 GMT
i.e. you sweep a magnet over the reset point and it beeps.

Float deployed. Date: July 9/02 Time: 00:52 GMT
Float should be deployed within 6 hours of start time.

Deployed By: Derek Brittain

Vessel: Hudson Event No. 260

Latitude 60 17.8 N Longitude 48 34.9 W

Water Depth 2786 m Must be deeper than 2500 metres

Nearest CTD Event No of cast. 259

Date: July 8 /02 Time: 23:35 GMT

Latitude 60 17.7 N Longitude 48 33.8 W

Maximum Depth 2786

Any problems associated with the start up and deployment operation

Final test procedure completed July 08/02

Serial No. 335

APEX Float Launch

Float was started. Date: July 7/02 Time: 00:20 GMT
i.e. you sweep a magnet over the reset point and it beeps.

Float deployed. Date: July 7/02 Time: 02:42 GMT
Float should be deployed within 6 hours of start time.

Deployed By: Derek Brittain

Vessel: Hudson Event No. 195

Latitude 58 38.4 N Longitude 50 25.0 W

Water Depth 3430 m Must be deeper than 2500 metres

Nearest CTD Event No of cast. 193

Date: July 7 /02 Time: 01:25 GMT

Latitude 58 38.4 N Longitude 50 25.0 W

Maximum Depth 3435

Any problems associated with the start up and deployment operation

Final test procedure completed July 07/02

Serial No. 506

APEX Float Launch

Float was started. Date: June 30, 2002 Time: 12:41 GMT
i.e. you sweep a magnet over the reset point and it beeps.

Float deployed. Date: June 30, 2002 Time: 15:55 GMT
Float should be deployed within 6 hours of start time.

Deployed By: Murray Scotney

Vessel: Hudson Event No. 90

Latitude 48 42.19 N Longitude 46 50.5 W

Water Depth 2650 m Must be deeper than 2500 metres

Nearest CTD / XBT cast (circle one) Event No of cast.
89

Date: June 30, 2002 Time: 14:53 GMT

Latitude 48 41.49 N Longitude 46 50.84 W

Maximum Depth 2636 m

Any problems associated with the start up and deployment operation

Final test performed June 30 / 02 OK

Appendix 6: Mooring Recovery and Deployment logs

Recovery

Mooring No: 1395
Ship: Hudson **Cruise No:** 2002-032 **Date:** June 24, 2002
Mooring Tech: Scotney, Boyce, Britten
Type of Nav: GPS
Sea State: 1 m swell light seas **Weather Conditions:** 20 kts SW
Cancel Notship: **Yes** ____ **No** ____

Recovery Log

Time (Z)	Instrument	Remarks
15:22	Release 335	Released, on way up
15:40		Sighted on surface
15:52		Hooked on
15:55	Release, tide gauge	All on board

Recovery

Mooring No: 1396
Ship: Hudson **Cruise No:** 2002-032 **Date:** July 3, 2002
Mooring Tech: Scotney, Boyce,
Type of Nav: GPS
Sea State: 1-2 metres **Weather Conditions:** SW 15
Cancel Notship: **Yes** ____ **No** ____

Recovery Log

Time (Z)	Instrument	Remarks
12:43	Release 742	Sent enable command, 0.5 cables from site – no response
12:44	Release 742	Sent enable command, 0.8 cables from site - responded
12:46	Release 742	Sent release command – mooring released
12:59		On surface by acoustic range of 390 m and increasing
13:01		Sighted
13:05		Hooked on
13:09	ACM 5574	On board
13:11	Release, 2bb	On board

Recovery

Mooring No: 1412
Ship: Hudson **Cruise No:** 2002-032 **Date:** June 24, 2002
Mooring Tech: Scotney, Boyce, Britten
Type of Nav: GPS
Sea State: 1 m swell light seas **Weather Conditions:** 25-30 kts SW, rain squalls
Cancel Notship: **Yes** ____ **No** ____

Recovery Log

Time (Z)	Instrument	Remarks
12:35	Release 790	Release command sent / released range 2228 m, vessel 5 cables from site
12:40		Float sighted on surface
12:55		BB package on surface
13:03		Hooked on
13:05		Buoy004 / μCat on board
13:10		ACM 4600 on board
13:14		2 bb on board
13:15		ACM 4998 on board
13:20		μCat / bb on board
13:23		ACM 5002 on board
13:30		μCat & ACM 5575 on board
13:34		2 bb on board
13:37		μCat & ACM 5578 on board
13:39		3 bb & release on board

Recovery

Mooring No: 1415
Ship: Hudson **Cruise No:** 2002-032 **Date:** June 24, 2002
Mooring Tech: Scotney, Boyce, Britten
Type of Nav: GPS
Sea State: 1 m swell / light sea **Weather Conditions:** 20 kts SW
Cancel Notship: **Yes** ____ **No** ____

Recovery Log

Time (Z)	Instrument	Remarks
14:56	Release 884	Released mooring
15:06		Package on surface
15:11		Hooked on package and on board

Recovery

Mooring No: 1419
Ship: Hudson **Cruise No:** 2002-032 **Date:** June 24, 2002
Mooring Tech: Scotney, Boyce, Britten
Type of Nav: GPS
Sea State: < 1 m swell **Weather Conditions:** 15-20 kts SSW
Cancel Notship: **Yes** ____ **No** ____

Recovery Log

Time (Z)	Instrument	Remarks
10:22	Release 810	Enable release / range 1190 m and closing. Moving vessel from 1.5 cables to 4 cable distant
10:29	Release 810	1275 m range – release command sent - successful!
10:32		Sighted on surface
10:45		BB on surface
10:52		Buoy along side – hooked on
10:55		Buoy on board
11:00		Seacat / μCat on board
11:03		ACM 697 on board
11:06		μCat & bb on board
11:10		ACM 695 on board
11:12		BB on board
11:17		ACM 7127 on board – single loose loop around CM – easily released
11:20		μCat & bb on board – tight snarl
11:25		ACM 6405 on board
11:26		3 bb & release on board

Placement

Mooring No: **1429**
Geographic Area: Scotian Slope **Intended Duration:** *1 year*
Ship: Hudson **Cruise No:** 2002-032 **Date:** June 25, 2002
Sea State: 2 metres NW **Weather Conditions:** 25-30 kts NW
Mooring Tech: Scotney, Boyce, Britten **Navigation Inst.** GPS
Notship #
Latitude 42 41.56 N **Longitude** 61 31.31 W **Time of Fix:** 12:42
Depth: Raw: 1070 fthm **Corrected:** 1965 m
Main Float: **Type:** syntatic **Markings:** 004
Beacon: **Type:** Argo **ID: S/N** ID 977/ 17053
Light: **Type:** none **Colour/Rate:**
Mooring Line: **Type:** 3/16" jacket **Colour:** yellow
Release: **Type:** 965 A **S/N:** 891 **Release Code:** A / / C Disable B ID: 22
Rx: 10.75 **Tx:** 12.0

Placement Log

Time (Z)	Instrument	Remarks
10:48	Argo Transmitter	Working
10:55	Float & μCat 2304	In water, had added 2 5 metre pieces of wire in parallel beneath the ballast weight – paying out 148 m length
11:00	ACM 2663	+ 234 m – in water
11:07	2 bb	+ 10 m wire in water
11:10	ACM 3306	+ 238 m wire (lost power to winch / restored)
11:18	μCat 2293	In water
11:19	1 bb & 42 m	In water
11:22	ACM 3584	511 m wire in water
11:25	ACM 4406	185 m wire in water
11:40	2 bb	184 m wire in water
	μCat 2292, ACM4603	9 m wire in water μCat clamped to wire
11:50	3 bb & release	In water
11:53		Anchor away at 42 41.65 N 61 31.44 W
12:33		Closest approach 42 41.6688 N 61 31.4867 W range 2051 m
12:42		Closest approach 42 41.6065 N 61 31.3495 W range 2025 m
12:53		Closest approach 42 41.4063 N 61 31.2069 W range 2043 m
		Best position 42 41.56 N 61 31.31 W

Placement

Mooring No: **1432_**
Geographic Area: Scotian Slope **Intended Duration:** *1 year__*
Ship: Hudson **Cruise No:** _2002-032 **Date:** _June 25, 2002
Sea State: _1-2 m swell, 0.5 m sea_ **Weather Conditions:** 15-20 kts WSW_
Mooring Tech: Scotney, Boyce, Britten **Navigation Inst.** __GPS__
Notship # _____
Latitude 42 50.66 N **Longitude** 61 37.41 W **Time of Fix:** 17:39
Depth: Raw: 608 fthm **Corrected:** 1120 m at anchor drop site
Main Float: **Type:** syntatic **Markings:** orange 011 on one side, 005 on other
Beacon: **Type:** Argo **ID: S/N** 19500 ID 22191
Light: **Type:** none **Colour/Rate:**
Mooring Line: **Type:** 3/16" jacket **Colour:** yellow
Release: **Type:** 965 A **S/N:** 807 **Release Code:** D

Placement Log

Time (Z)	Instrument	Remarks
15:59	Buoyancy & ACM 5359	In water, 47 m
16:04		98 m wire in water
16:06	μCat 2305	Clamped on wire / in water
16:08	ACM 1607	221 m wire
16:15	μCat 2305 & 1 bb	49 m, swivel moved to top of bb
16:18	ACM 6410	123 m in water
16:21	1 bb	123 m in water
16:25	ACM 7013	197 m in water
16:31	μCat 1918 & 2bb	84 m
16:35	ACM 9328	9 m outboard
16:37	3 bb & release	Outboard, towing to position
16:58		Anchor away, 608 fathoms = 1120 metres
		42 50.7916 N 61 37.5574 W
17:24		Closest approach 1172 m 42 50.6618 N 61 37.5463 W
17:39		Closest approach 1155 m 42 50.7927 N 61 37.4125 W
		Best position 42 50.66 N 61 37.41 W

Placement

Mooring No: **1433**
Geographic Area: Scotian Slope **Intended Duration:** *1 year*
Ship: Hudson **Cruise No:** 2002-032 **Date:** June 25, 2002
Sea State: 2-m waves **Weather Conditions:** 15-20 kts WSW
Mooring Tech: Scotney, Boyce, Britten **Navigation Inst.** GPS
Notship #
Latitude 42 50.8 N **Longitude** 61 37.58 W **Time of Fix:** 18:10
Depth: Raw: 605 fthm **Corrected:** 1114 m
Main Float: **Type:** Hibernia **Markings:** yellow
Beacon: **Type:** **ID: S/N**
Light: **Type:** none **Colour/Rate:**
Mooring Line: **Type:** **Colour:**
Release: **Type:** 966 A **S/N:** 337 **Release Code:** A / / C
Rx: 11.0 **Tx:** 10.0

Placement Log

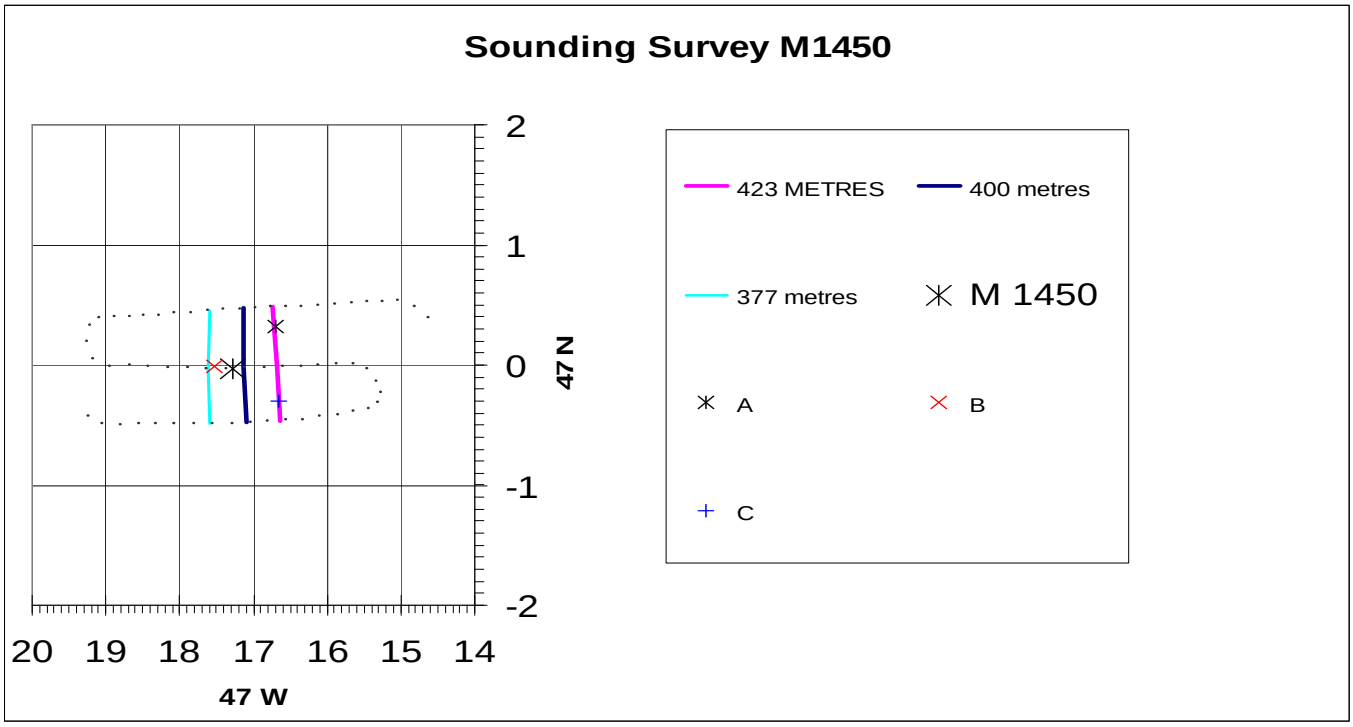
Time (Z)	Instrument	Remarks
18:10	Float, tide gauge 1017, release and anchor	released

Placement

Mooring No: **1450**
Geographic Area: Flemish Pass **Intended Duration:** 8 months
Ship: Hudson **Cruise No:** 2002-032 **Date:** June 29, 2002
Sea State: 2 m swell, **Weather Conditions:** 20 kts SSW
Mooring Tech: Scotney, Boyce, Britten **Navigation Inst.** GPS
Notship # 1345
Latitude 46 59.974 N **Longitude** 47 17.287 W **Time of Fix:** 13:31
Depth: Raw: 203 fthm **Corrected:** **398 m**
Main Float: **Type:** Braincon 2 disc **Markings:** '7
Beacon: **Type:** Argo **ID: S/N** ID 8544 S/N 12402
Light: **Type:** none **Colour/Rate:**
Mooring Line: **Type:** jacket **Colour:** yellow
Release: **Type:** 965 A **S/N:** 892 **Release Code:** A / / C
Rx: 11.0 **Tx:** 10.0

Placement Log

Time (Z)	Instrument	Remarks
09:40		Guard Buoy 'A' rigged / anchor over the side
09:41		Guard Buoy in water
09:55		47 00.3252 N 47 16.6918 W anchor away 227 ftms, 423 m
10:14		Guard Buoy 'C' in water
10:25		Anchor away 46 59.7024 N 47 16.6581 W 227 ftms, 423 m
11:45		Argo transmitter not working due to pressure switch – disabled pressure switch to continuously on
11:54		Float and ACM 4241 in water
11:56	ACM 4602	160 m in water
12:01	2bb	Test shackle attached, 36 m wire in water
12:03	ACM 4342	74 m wire in water
12:06	ACM 786	9 m wire in water
12:10	3 bb & release	Out board, test shackle attached to bb
12:27:48	Anchor away	46 59.9739 N 47 17.1850 W 213 ftms
12:55		Guard Buoy 'B' in the water
13:07	Anchor away	46 59.9931 N 47 17.5277 W 203 ftms
13:31	Closest approach	Range 401 m at 46 59.9924 N 47 17.2873 W

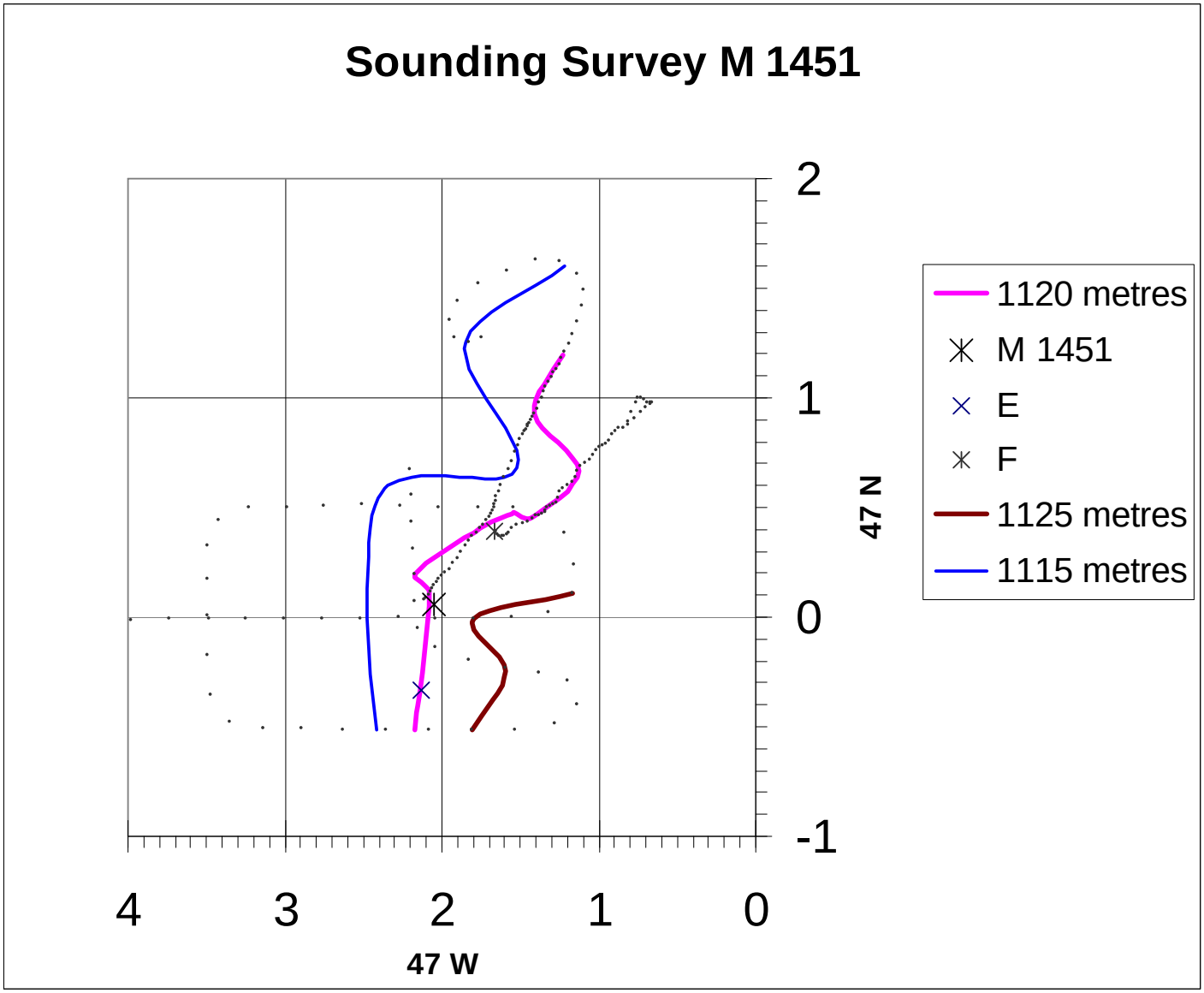

Sounding Survey M1450
2
1
0
-1
-2
47 N
20 19 18 17 16 15 14
47 W
423 METRES
400 metres
377 metres
M 1450
A
B
C

Placement

Mooring No: **1451_**
Geographic Area: Flemish Pass **Intended Duration:** 8 months
Ship: Hudson **Cruise No:** _2002-032 **Date:** _June 29, 2002
Sea State: _1-2 m swell, 0.5 m sea_ **Weather Conditions:** 20 kts SSW - fog
Mooring Tech: Scotney, Boyce, Brittain **Navigation Inst.** __GPS__
Notship # _1345_____
Latitude 47 00.056 N **Longitude** 47 2.054 W **Time of Fix:** 17:56
Depth: Raw: 608 fthm **Corrected:** 1123 m
Main Float: **Type:** Braincon 4 disc **Markings:** 9 on tail
Beacon: **Type:** Argo **ID: S/N** S/N 17052 ID 4765
Light: **Type:** none **Colour/Rate:**
Mooring Line: **Type:** 3/16 jacket **Colour:** yellow
Release: **Type:** 965 A **S/N:** 806 **Release Code:** B / / A
Rx: 11.5

Placement Log

Time (Z)	Instrument	Remarks
16:26	Float & ACM 4349	In water – slip line to front of float caught in fitting / line was cut leaving 6 metres or so on float
16:35	ACM 5573	159 m in water
16:40	3 bb	36 m in water
16:45	μCat 1916 & ACM 4154	297 m wire (power off on winch briefly) in water
16:53	ACM 3300	146 m, in water
16:58	2 bb	145 m in water
17:04	μCat 1917	ACM 3196, 9 m in water
17:07	3 bb & release	Outboard
17:11	Anchor away	47 00.0785 N 47 02.1069 W 608 fthms
17:39:18	Closest approach	1145 m range 47 00.0579 N 47 2.0009 W
17:56:03	Closest approach	1143 m range 47 00.0333 N 47 2.1006 W
18:35		Guard Buoy 'F' in water
19:07		Anchor away 47 00.3911 N 47 1.6647 W 608 ftms 1119 m
19:32		Buoy 'E' in water
20:23	Anchor away	46 59.6676 N 47 02.1311 W
		CTD station at 47 39.97 N 46 29.72 W has average sound velocity of 1473.4 m/s
		Sounding of 608 fathoms = 0.7600 secs = 1115 + 8 m = 1123 m


Sounding Survey M 1451
2
1
0
-1
47 N
4
3
2
1
0
47 W
1120 metres
M 1451
E
F
1125 metres
1115 metres

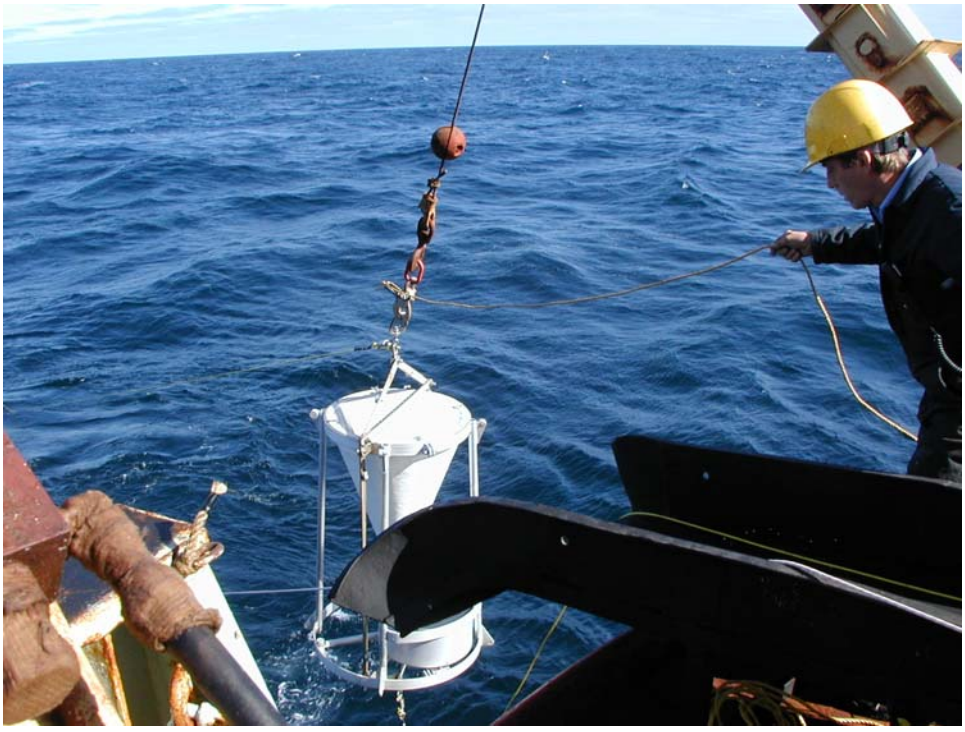
Placement

Mooring No: **1452**
Geographic Area: Labrador Sea **Intended Duration:** *1 year*
Ship: Hudson **Cruise No:** 2002-032 **Date:** July 4, 2002
Sea State: 2-4 metres **Weather Conditions:** 15 W
Mooring Tech: Scotney, Boyce **Navigation Inst.** GPS
Notship #
Latitude 56 40.60 N **Longitude** 52 24.90 W **Time of Fix:** 22:48
Depth: Raw: 1884 fthm **Corrected:** 3518 m
Main Float: **Type:** syntatic **Markings:** 001 orange
Beacon: **Type:** Argo **ID: S/N** ID 974 / 13832
Light: **Type:** none **Colour/Rate:**
Mooring Line: **Type:** 3/16 jacket **Colour:** yellow
Release:Type: 965 A **S/N:** 888 **freq:** **Rx** 11.5 **Tx** 10.0 **Code:** Enable B release C ID:19
965A **S/N:** 885 **Freq:** **Rx** 9.25 **Tx** 10.0 **Code:** Enable A release C ID:16
965A **S/N:** 808 **Freq:** **Rx** 10.0 **Tx** 11.75 **Code:** Enable B release C ID:09

Placement Log

Tim: (Z)	Instrument	Remarks
18:33	Float & SeaCat 1678	In water
18:36	ACM 5567	In water on slip line, 73 m wire
18:55	Trap # 1	Attached to wire top & bottom, in water, 73 m wire
18:58	SeaCat 1624	247 m, in water
19:05	SeaCat 2398	248 m, in water
19:10	ACM 5569	110 m, in water
19:13	2 SUBs	20 m, in water
19:17	2 SUBs	114 m, in water – bar at end of mooring chute bent in process
19:25	SeaCat 1626	50 m, in water, also on slip line, in water
19:35	Trap # 2	50 m, in water
		Shackled to 144 m, in water
19:40	ACM 5577	120 m , in water
19:44	Release 88 & 2 bb	124 m in water
19:47	SeaCat 2365	247 m, in water
19:52	ACM 6402	119 m in water
19:55	3bb	124 m in water
19:59	SeaCat 2393	486 m, in water
20:08	SeaCat 1896	9 m, in water
20:08	ACM 6409	433 m, in water
20:15	3 bb	256m, in water
20:21	Release 885	125 m, in water
20:24	3 bb	134 m, in water
20:26	ACM 7134	20 m, in water
20:31	3 bb, release 888	Outboard on chain

Preparing to launch Sediment trap # 1



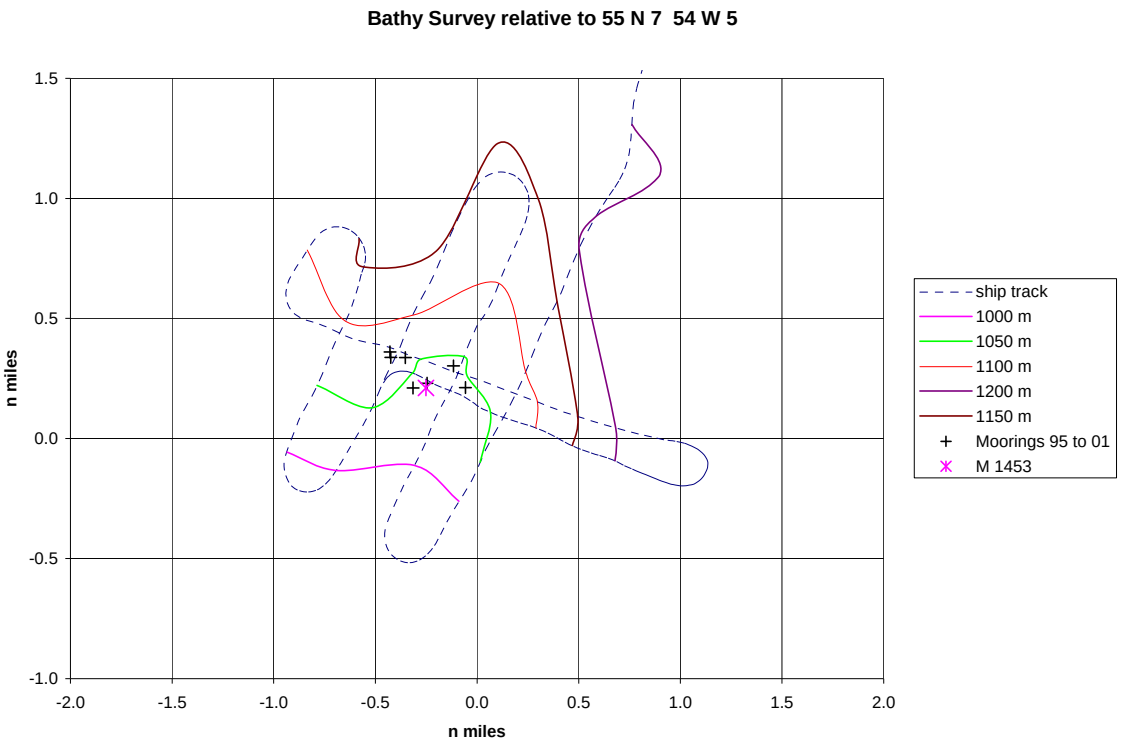
Trap # 2 going into the water

Placement

Mooring No: **1453**
Geographic Area: Labrador Sea **Intended Duration:** *1 year*
Ship: Hudson **Cruise No:** 2002-032 **Date:** July 3, 2002
Sea State: 1-2 m sea **Weather Conditions:** SW 15
Mooring Tech: Scotney, Boyce **Navigation Inst.** GPS
Notship #
Latitude 55 07.21 N **Longitude** 54 05.44 W **Time of Fix:** 16:14
Depth: Raw: 640 fthm **Corrected:** 1032 metres
Main Float: **Type:** Hibernia **Markings:** Yellow
Beacon: **Type:** none **ID: S/N**
Light: **Type:** none **Colour/Rate:**
Mooring Line: **Type:** 3/16 jacket **Colour:** yellow
Release: **Type:** 965 A **S/N:** 890 **Release Code:** 10.5 khz / release code C

Placement Log

Time (Z)	Instrument	Remarks
14:01	Float & ACM 4208	In water
14:03	Release & anchor	Anchor away 55 07.237 N 54 05.597 W depth 564 ftms 1035 m
15:46:44	Closest approach	North to south, range 1080 m 55 07.2087 N 54 05.6031 W
16:14:56	Closest approach	West to east, range 1077 m 55 07.2556 N 54 05.436 W
		Best position
		55 07.21 N 54 05.44


Bathy Survey relative to 55 N 7 54 W 5
n miles
n miles
1.5
1.0
0.5
0.0
-0.5
-1.0
-2.0
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
ship track
1000 m
1050 m
1100 m
1200 m
1150 m
Moorings 95 to 01
M 1453