CRUISE REPORT

HUDSON 99022

LABRADOR SEA

WOCE LINE AR7W

27 June - 13 July, 1999

A. CRUISE NARRATIVE

1. Highlights

a. WOCE Designation: WOCE Line AR7W
Atlantic Circulation Experiment

b. Expedition Designation: Hudson 99022

c. Chief Scientist: R. Allyn Clarke
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d. Ship: CCGS Hudson

e. Ports of Call: June 27 BIO, Dartmouth, NS, Canada
July 13 BIO, Dartmouth, NS, Canada

f. Cruise Dates: June 27 to July 13, 1999

2. Cruise Summary Information

a. Cruise Track

A cruise track is shown in Figure 1. Ship 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 additional cast types have been defined as: NET – Biological net tow; AGT – alongtrack temperature-salinity measurements; SAP – alongtrack shipboard ADCP measurements; GOF – GO Flow bottle cast; PMP – pump cast; MNT – Biological multinet cast; CLG – Challenger pump cast. As well, additional time codes have been defined as: BD – Begin Descent; EA – End Ascent. These codes are used during Lowered ADCP casts. Finally, in the Comment section of the SUM file there is frequent mention of operation notes indicated by “Op Note”. These notes will be included in the final cruise report.

Figure 1. Cruise track for 18HU99022/1. The date labels indicate the ships position at 0000Z.

Additional parameter codes have also been defined and appear in the parameter column of the WOCE SUM file. These codes are: 510 – extracted chlorophyll; 511 – phytoplankton count; 512 – High Pressure Liquid Chromatography (HPLC); 513 – Absorption Spectra; 515 - Thorium (^{234}Th); 516 - Protactinium (^{231}Pa) ; 517 - Iodine (^{129}I) ; 518 - Technetium (^{99} Tc). Sections that follow in the cruise report describe these measurements.

b. Total Number of Stations Occupied

The CTD and ROS station positions are shown in Figure 2. The WHP stations are all contained in the box defined by 50-62°N and 43-60°W. Table 1 lists the science operations for 99022.

Cast Type	Number of Operations	Detailed Division	Operation Numbers
Rosette & CTD	56	27 regular AR7W Sites plus Site 8.5	see Table 2
		7 Halifax Line Sites	see Table 3
		2 Seacat Calibrations	61 (also in Table 2), 147
		19 Biology Casts	32,35,56,70,71,84,87,90, 99,109,111,112,124,126, 134,137,145,152,154
		1 Basin test	1
Moorings	5	2 recoveries	58, 144
		2 deployments	59, 146
		1 release test	136
Biology	72	64 shallow net tows	4-6,8-10,12-14,16-18,20,21,22,24,28,31,34,36, 37,39,41,43,45,47,49,51,55, 60,67,72,74,78,79,85,89,95, 98,102, 103,105,106,110,119,121,123, 125,128,130,131,135,139,140, 148,150,151,153,155-160
		8 multinet tows	26,30,69,100,108,133, 142,143
Chemistry	25	8 Challenger Pump deployments at 4 locations	57,64,76,83,92,96,113, 118
		10 Go-Flo casts at 5 locations	33 (test), 53,54,63,66, 82,91,94,97,115
		7 surface pump casts at 4 locations	27 (test), 62,65,77,81, 114,117
		I, Tc sampling at CTD locations	38,42,46,50,52,56,70,73, 75,80,86,87,88,141,138, 137,93,99,132,134,104, 129,107,109,126,112,124, 120
		Th, Pa sampling at CTD locations	38,42,46,50,52,68,70,86, 87,129,134,107,109,112, 116,124,120

Table 1. Science operations conducted on 18HU99022/1.

Cast Type	Number of Operations	Detailed Division	Operation Numbers
Other	2	Ship Board ADCP	2
		Along track t, s, and fluorescence	3

Table 1. Science operations conducted on 18HU99022/1.

AR7W Site Number	99022 Deep Cast Operation Number
1	38
2	40
3	42
4	44
5	46
6	48
7	50
8	52
8.5	149
9	61
10	68
11	73
12	75
13	80
14	86
15	88
16	141
17	138
18	93
19	101
20	132
21	104
22	129
23	107
24	127
25	116
26	122
27	120
28	not occupied

Table 2. AR7W sites and rosette operation numbers for 18HU99022/1.

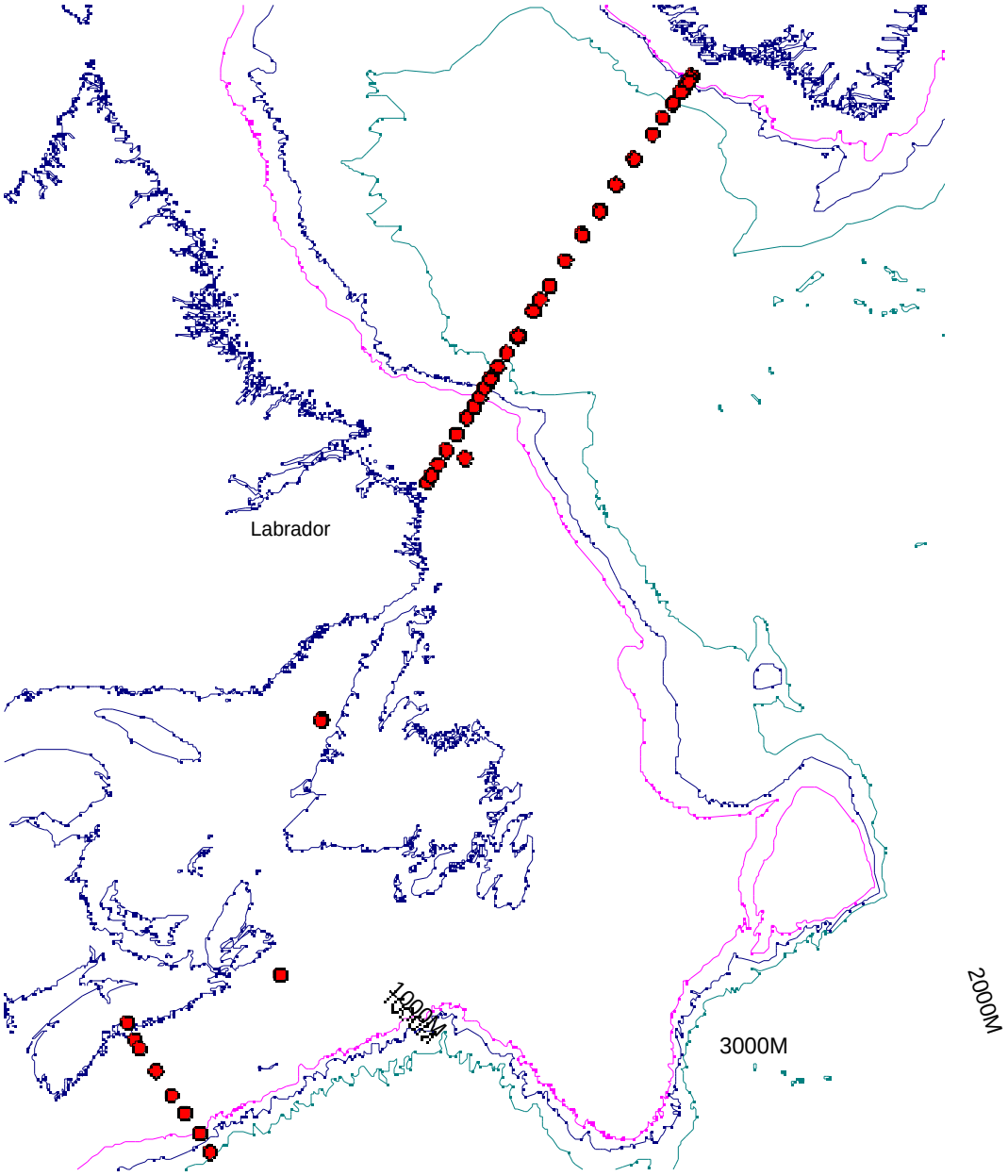

Figure 2. CTD, rosette and LADCP station positions on for Hudson 18HU99022/1.

Halifax Line Number	99022 Deep Cast Operation Number
1	7
2	11
3	15
4	19
5	23
6	25
7	29

Table 3. Halifax Line sites and rosette operation numbers for 18HU99022/1.

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 CFC's, carbon tetrachloride, methyl chloroform, total carbonate, alkalinity, oxygen, salinity, nutrients, oxygen isotopes, helium and tritium. On some casts, chemistry isotope sampling was also conducted for iodine, technetium, protactinium and thorium.

c. Floats and Drifters deployed

No floats or drifters were deployed.

d. Moorings deployed or recovered

A total of 5 mooring related operations, consisting of 2 deployments, 2 recoveries and 1 release test were conducted at various sites. The following summarizes the mooring operations.

Deployments:

1	M1326 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	M1325 multi-instrument mooring near OWS Bravo on AR7W. This mooring consisted of 4 microcats, 3 Seacat temperature/conductivity recorders, and 6 Aanderaa current meters

Recoveries:

1	M1276 standard mooring consisting of one current meter positioned 20m off bottom along AR7W on the Labrador Slope (12 month deployment) along the 1000m isobath. This mooring was deployed on 18HU98023.
	M1275 multi-instrument mooring near OWS Bravo on AR7W. This mooring consisted of 7 Seacat temperature/conductivity recorders, 6 Aanderaa current meters, and 3 SBE39 (two with temperature and one with temperature and pressure). This mooring was deployed on 18HU98023.

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, CFC's
Glen Harrison	BIO harrisong@mar.dfo-mpo.gc.ca	Coordinator biological program nitrate and ammonium utilization by phytoplankton
Erica Head	BIO heade@mar.dfo-mpo.gc.ca	Macrozooplankton distribution, abundance and metabolism
Robert Houghton	LDEO houghton@ldeo.columbia.edu	Oxygen isotopes
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
Robert Pickart	WHOI pickart@rsp.whoi.edu	Lowered ADCP
Peter Rhines	UW rhines@killer.ocean.washington.edu	Moored instrument data
John Smith	BIO smithjn@mar.dfo-mpo.gc.ca	Chemistry isotopes

Table 4. List of Principal Investigators. See Section 7 for addresses.

4. Scientific Program and Methods

4.1 Physical - Chemical Program

a. Narrative

This expedition was conducting operations in support of three 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 and replacement of the two Labrador Sea moorings provide a measure of the winter cooling and water mass transformations over the winters of 1998/99 and 1999/2000.

The second initiative is 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. The purposes of the program are to determine the role of the biological pump to sequester carbon and to develop the regional algorithms that will allow primary productivity estimates to be made using data from Ocean Colour satellite sensors such as Sea Wifs. The physical oceanographic program is observing total carbonate, alkalinity and CFC's over the entire water column in support of these JGOFS objectives.

The third objective is to occupy the Halifax Section in support of DFO Atlantic Zone's monitoring strategy.

During this cruise, an ADCP was added to the CTD/rosette package to provide an estimate of the full depth velocity profile at each CTD station. This data will be useful for the detection and definition of various subsurface currents such as the deep western boundary undercurrents.

4.2 Biological Program

a. Narrative

The biological program conducted as part of cruise 99022, with some modifications, was a continuation of studies began in 1994 to describe the large scale (spatial and temporal) variability in plankton biomass and productivity in the Labrador Sea.

The program has consisted of essentially four elements:
(1) a phytoplankton biomass/primary productivity program - conducted most years by Jeff Anning (this year included Brian Irwin),
(2) a microbial program conducted by Bill Li or Paul Dickie,

(3) a mesozooplankton program conducted by Erica Head or Les Harris (this year including Tim Perry) and
(4) a dissolved organic carbon/community respiration program conducted by Paul Kepkay or Jay Bugden.

The ultimate aim of these studies is twofold:
(1) to provide a description of the inventories of biogenic carbon in 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.

New studies during this cruise included a more detailed investigation of microbial plankton (pico-phytoplankton, bacteria and viruses), measurements of phytoplankton utilization of nitrate and ammonium and more detailed studies of deep meso/macrozooplankton populations using the Multinet system.

In addition to the Labrador Sea study, phytoplankton, mesozooplankton and nutrient samples were collected at the seven stations along the Halifax line and three zooplankton tows were taken on the Cabot Strait line in support of OSD's obligations to the Atlantic Zone Monitoring Program.

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 (CO_2), nitrate and ammonium utilization rates from eight depths in the photic zone (i.e. the 1% light level ranged from 35-60 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. At a few stations, ^{14}C incubations were done for comparison. A total of 14 experiments were conducted (see Table 5); 10 stations were occupied along the AR7/W line and four in transit to and from the line. Four of the stations occupied were those where the chemistry ***in-situ*** pumps were deployed. Carbon-based primary productivity rates at these locations will be compared with vertical fluxes of particulate biogenic carbon derived from the thorium/carbon analyses to estimate fraction biogenic carbon export in the region.

Date	Site	Operation Number	LAT (N)	LON (W)	Photic Depth (m)	15N/13C	14C
29-Jun-99	LL3	32	45.48	-59.51	50	x	
30-Jun-99	NE-GSL#1	35	49.74	-59.39	50	x	
1-Jul-99	L3_1	38	53.68	-55.54	45	x	
2-Jul-99	L3_9	56	55.26	-53.97	35	x	
3-Jul-99	L3_10	70	55.42	-53.82	45	x	
4-Jul-99	L3_13	84	56.12	-53.05	40	x	
5-Jul-99	L3_18	90	58.20	-50.88	50	x	x
6-Jul-99	L3_19	99	58.63	-50.42	45	x	x
7-Jul-99	L3_25	111	60.29	-48.56	60	x	x
8-Jul-99	L3_24	126	60.17	-48.68	60	x	x
9-Jul-99	L3_17	137	57.82	-51.34	50	x	x
10-Jul-99	Mooring 1275	145	56.72	-52.48	40	x	x
11-Jul-99	Hamilton Bank	152	54.08	-54.51	55	x	
12-Jul-99	NE-GSL#2	154	49.71	-58.41	40	x	

Table 5. Sampling for stable isotopes.

c. Zooplankton Sampling — L. Harris

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

Vertical net tows were taken at 42 stations (11 on or near the Scotian Shelf, 2 in the Gulf and 29 from the Labrador Shelf/Labrador Sea) using a 3/4 meter 200 um mesh ring net. At all stations, tows were made from 100 meters to the surface. Additional stratified deep tows (2500 meters to the surface) were taken at 7 of the stations (1 off the Scotian Shelf and 6 in the Labrador Sea) using a multinet. Samples will be analysed for species composition, copepod stage structure and biomass. Vertical net tow and multinet tow locations are shown in Figure 3.

d. Measurements Of Copepod Metabolic Rates — L. Harris

Respiration rates (CO_2 production) of the copepod communities were determined at 7 stations in the Labrador Sea.

Egg production rates of ***Calanus finmarchicus***, the dominant copepod species, were measured at 6 stations in the Labrador Sea.

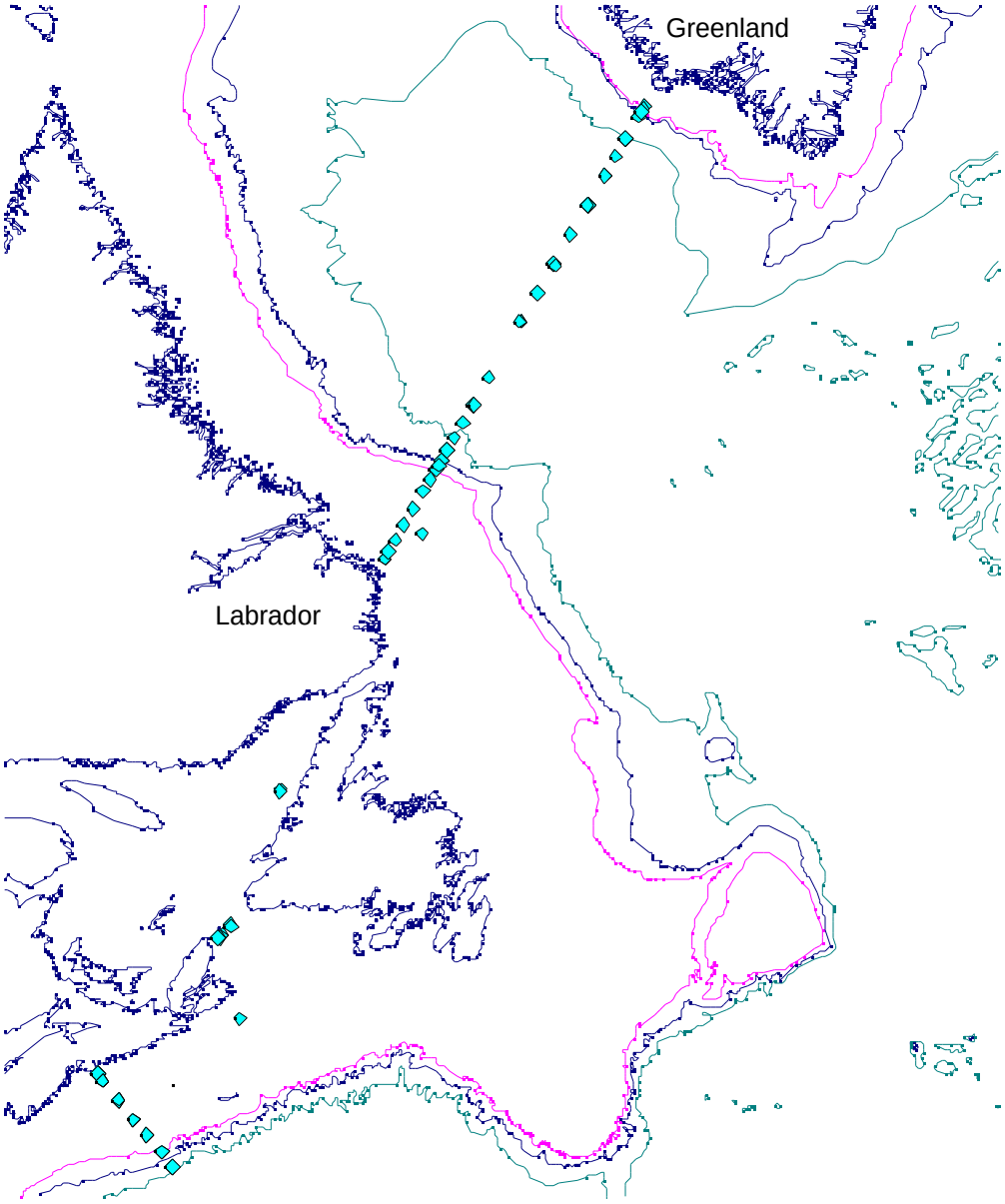

Figure 3. Net tow and multinet tow locations for 18HU99022/1.

e. Dissolved Organic Carbon (DOC) and Microbial Community Respiration — Jay Bugden / Paul Kepkay

Samples for DOC profiles, size fractionation of DOC (ultrafiltration) and microbial community respiration were collected at 27 sites on the AR7W line (see Table 6). Ultrafiltration and rates of respiration of seawater samples were carried out at the

time of collection (the ultrafiltration samples were frozen for later laboratory analysis), while samples for the DOC profiles were collected and frozen for later analysis.

Station	Respiration	Ultrafiltration	DOC Profile
Site 1 (AR7W Line)	X	X	X
Site 2			X
Site 3			X
Site 4	X	X	X
Site 5			X
Site 6			X
Site 7			X
Site 8			X
Site 9	X	X	X
Site 10	X	X	X
Site 11			X
Site 12			X
Site 13	X	X	X
Site 14			X
Site 15			X
Site 16			X
Site 17	X	X	X
Site 18	X	X	X
Site 19	X	X	X
Site 20			X
Site 21			X
Site 22			X
Site 23			X
Site 24	X	X	X
Site 25	X	X	X
Site 26			X
Site 27			X

Table 6. Ultrafiltration, respiration and DOC sample collection.

f. Primary Production Measurements — Brian Irwin / Jeff Anning

Photosynthesis Irradiance (PI) measurements were done at fourteen (14) stations – one at Louisbourg Line 3, two in the Gulf of St Lawrence, one on Hamilton Bank and ten on AR7W (Table 7). Water samples were collected from three depths in the upper 40 meters of the water column. Depth selection depended on the depth of the chlorophyll maximum and the shape of the chlorophyll profile. High Pressure Liquid

Chromatography (HPLC) and Absorption Spectra samples were also collected at these depths.

At seven of the PI stations on AR7W water column primary production was measured with C^{14} at eight depths using deck incubators. These results will be compared with estimates of primary production measured with C^{13} at the same depths.

At all fourteen stations chlorophyll and CO_2 samples were collected at 10 metre interval from 100m to surface where depth permitted.

Station Label	Operation Number	ID	Depth	Latitude (N)	Longitude (W)	Date
LL3	32	213544	10	45 29.06	59 30.50	29-Jun-99
LL3	32	213542	20	45 29.06	59 30.50	29-Jun-99
LL3	32	213538	50	45 29.06	59 30.50	29-Jun-99
Gulf	35	213563	10	49 44.99	59 23.65	30-Jun-99
Gulf	35	213561	20	49 44.99	59 23.65	30-Jun-99
Gulf	35	213558	40	49 44.99	59 23.65	30-Jun-99
AR7W 01	38	213585	10	53 40.76	55 32.95	01-Jul-99
AR7W 01	38	213582	20	53 40.76	55 32.95	01-Jul-99
AR7W 01	38	213579	40	53 40.76	55 32.95	01-Jul-99
AR7W 09	56	213723	10	55 16.06	53 58.60	02-Jul-99
AR7W 09	56	213721	20	55 16.06	53 58.60	02-Jul-99
AR7W 09	56	213718	30	55 16.06	53 58.60	02-Jul-99
AR7W 10	70	213788	10	55 25.07	53 49.82	03-Jul-99
AR7W 10	70	213786	20	55 25.07	53 49.82	03-Jul-99
AR7W 10	70	213784	30	55 25.07	53 49.82	03-Jul-99
AR7W 13	84	213884	10	56 05.00	53 03.87	04-Jul-99
AR7W 13	84	213882	20	56 05.00	53 03.87	04-Jul-99
AR7W 13	84	213879	30	56 05.00	53 03.87	04-Jul-99
Flo Thru		191944	4	57 53.75	51 13.23	05-Jul-99
AR7W 18	90	213975	10	58 12.80	50 53.76	05-Jul-99
AR7W 18	90	213973	20	58 12.80	50 53.76	05-Jul-99
AR7W 18	90	213969	40	58 12.80	50 53.76	05-Jul-99
AR7W 19	99	214023	10	58 38.05	50 25.84	06-Jul-99
AR7W 19	99	214021	20	58 38.05	50 25.84	06-Jul-99
AR7W 19	99	214018	40	58 38.05	50 25.84	06-Jul-99
AR7W 25	111	214135	10	60 18.14	48 34.45	07-Jul-99
AR7W 25	111	214133	20	60 18.14	48 34.45	07-Jul-99
AR7W 25	111	214129	40	60 18.14	48 34.45	07-Jul-99
AR7W 24	126	214244	5	60 10.76	48 34.45	08-Jul-99
AR7W 24	126	214239	10	60 10.76	48 34.45	08-Jul-99
AR7W 24	126	214236	20	60 10.76	48 34.45	08-Jul-99

Station Label	Operation Number	ID	Depth	Latitude (N)	Longitude (W)	Date
AR7W 22	129	210502	0	59 45.06	49 10.01	08-Jul-99
AR7W 17	137	214359	10	57 49.81	51 21.18	09-Jul-99
AR7W 17	137	214355	30	57 49.81	51 21.18	09-Jul-99
AR7W 17	137	214353	40	57 49.81	51 21.18	09-Jul-99
Mooring	145	214428	10	56 43.47	52 28.83	10-Jul-99
Mooring	145	214426	20	56 43.47	52 28.83	10-Jul-99
Mooring	145	214424	30	56 43.47	52 28.83	10-Jul-99
Ham Bank	152	214449	10	54 04.98	54 30.91	11-Jul-99
Ham Bank	152	214447	20	54 04.98	54 30.91	11-Jul-99
Ham Bank	152	214445	25	54 04.98	54 30.91	11-Jul-99
Gulf	154	214463	5	49 24.75	58 24.49	12-Jul-99
Gulf	154	214461	10	49 24.75	58 24.49	12-Jul-99
Gulf	154	214459	20	49 24.75	58 24.49	12-Jul-99

Table 7. Sampling for primary production.

g. Distribution of Microbial Plankton — William Li

Samples were collected from the CTD rosette for cryogenic preservation and for onboard shipboard flow cytometric enumeration of microbial plankton (Table 8). Plankton were fixed using 1% paraformaldehyde and then cryogenically stored in liquid nitrogen. These samples will be analyzed on shore for abundance of picophytoplankton, heterotrophic bacteria, and viruses. Picophytoplankton are detected on the basis of autofluorescence from chlorophyll a and from phycoerythrin. Heterotrophic bacteria and viruses are detected after staining with the nucleic acid binding fluorochrome SYBR Green 1. Preliminary examination using shipboard flow cytometry has revealed high abundances of heterotrophic bacteria (up to 3 million cells per millilitre) in the upper mixed layer of the central Labrador Sea.

Event	Station	Cast	Samples	Cryo-storage	Picophytoplankton	Bacteria
7	Hfx-1	Shallow	9	X	X	
11	Hfx-2	Shallow	9	X	X	
15	Hfx-3	Shallow	13	X		
19	Hfx-4	Shallow	8	X	X	
23	Hfx-5	Shallow	9	X	X	
25	Hfx-6	Shallow	8	X	X	
29	Hfx-7	Deep	23	X	X	
32	Louisburg-3	Shallow	14	X	X	
35		Shallow	10	X	X	X
38	L3-01	Shallow	14	X	X	X
40	L3-02	Shallow	12	X		X
42	L3-03	Shallow	13	X		X
44	L3-04	Shallow	11	X		X
46	L3-05	Shallow	15	X		
48	L3-06	Shallow	14	X		
50	L3-07	Deep	18	X		
52	L3-08	Deep	23	X		
56	L3-09	Shallow	17	X	X	X
61	L3-09	Deep	18	X		
68	L3-10	Deep	24	X		X
70	L3-10	Shallow	16	X	X	X
73	L3-11	Deep	18	X		
75	L3-12	Deep	22	X		
80	L3-13	Deep	23	X		X
84	L3-13	Shallow	17	X	X	X
88	L3-15	Deep	24	X		
90	L3-18	Shallow	16	X	X	X
93	L3-18	Deep	24	X		X
99	L3-19	Shallow	16	X	X	X
101	L3-19	Deep	24	X		
104	L3-21	Deep	24	X		
107	L3-23	Deep	15	X		X
109	L3-23	Shallow	19	X		X
111	L3-25	Shallow	12	X	X	X
119	L3-28	Shallow	6	X		X
121	L3-27	Shallow	6	X		X
123	L3-26	Deep	17	X		X
126	L3-24	Shallow	11	X	X	X
127	L3-24	Deep	24	X		X
132	L3-20	Deep	19	X		X
133	L3-20	Shallow	15	X		X
137	L3-17	Shallow	13	X	X	X
138	L3-17	Deep	24	X		
140	L3-16	Deep	24	X		X
145	M-1275	Shallow	15	X	X	X
152	HamiltonBank	Shallow	14	X	X	X
154	GukfStLawr	Shallow	10	X	X	X

Table 8. Sampling for microbial plankton.

h. Metals and Radioisotopes Sampling Program

H. Edmonds, J. Dalziel, R. Nelson

Samples for dissolved and particulate metals, isotopes and particulate organic carbon were collected at several stations during this expedition. The data will be used to determine the flux of particulate metals and particulate organic carbon (POC) in the Labrador Sea. The samples were collected from three sources: Challenger pumps, 12 litre Go-Flo bottles and CTD rosette bottles. The following is a description of the samples processed from each of the sampling sources. Figure 4 indicates the location of chemical sampling.

Challenger Pump Sampling:
The pumps were used at four stations (9, 13, 18 and 25) on the AR7W line to sample for dissolved/particulate metals, Thorium (^{234}Th) and POC. At each station, the pumps were deployed twice, to four depths (25, 50, 100, 250 m). One cast was deployed to sample for particulate and dissolved ^{234}Th and POC. The pumps were deployed again to the same depths to collect a particulate sample for metals, ^{230}Th and Protactinium (^{231}Pa). At all stations, the pumps were programmed to sample for 2 to 2.5 hours. While the Challenger pumps were deployed, a surface pumping system was deployed to 1-2 m to collect a corresponding sample from the surface. At station 18, sea and weather conditions prohibited the deployment of the surface pump.

Go-Flo Sampling:
At each of the four pumping stations, water samples were collected at matching depths i.e. surface, 25, 50, 100, 250 m for total mercury, dissolved - metals, ^{230}Th, and ^{231}Pa and particulate - metals, ^{230}Th, ^{231}Pa. The 12 litre Go-Flos were deployed on stainless steel hydrowire from the foredeck and subsampled in a clean area of the forward lab. All materials used to handle the water samples have been acid cleaned and all filter manipulations required on board were conducted in a positive air laminar flow “clean bench”. Salinity and nutrient samples were collected from each Go-Flo as a check of the sampling depth. At stations 9 and 18, in addition to the sampling at the Challenger pump depths, the water column was also sampled at depths >250 m coincident with depths chosen for CTD samples. A total of 24 samples were collected for total Hg, 36 for dissolved/particulate metals and 32 samples each for ^{230}Th and ^{231}Pa.

CTD Sampling:
Water samples were collected from the CTD at 25 stations on the AR7W line. A total of 118 samples were collected for Iodine (^{129}I) from 25 stations and 8 samples for Technetium (^{99}Tc) at 4 stations. These samples were collected to measure the extent of the “Sellafield” reprocessing signal flowing in and out of the Labrador Sea. Samples for ^{230}Th and ^{231}Pa were also collected at 12 stations with a total of 80 samples collected for each of these isotopes.

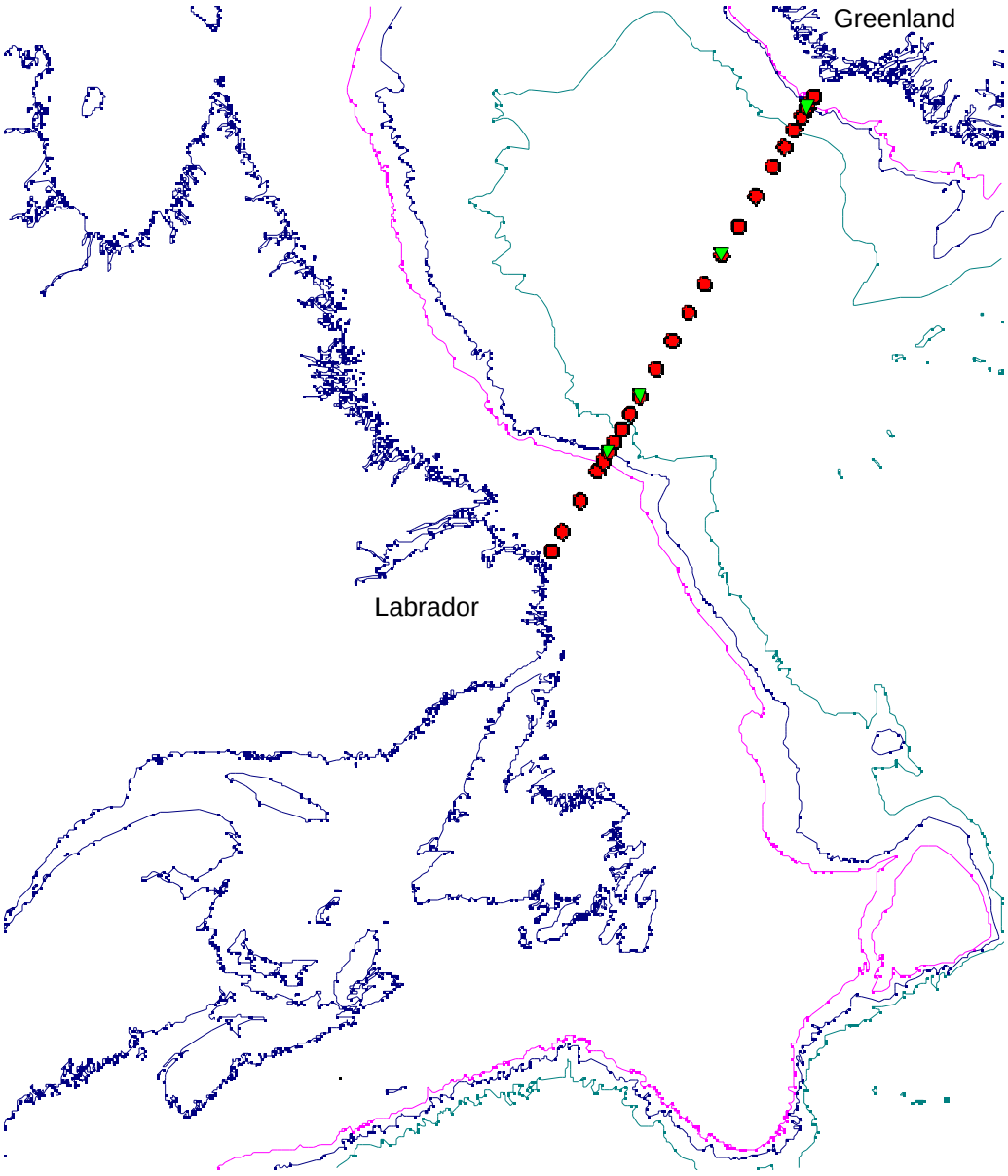

Figure 4. Chemical sampling for 18HU99022/1. Red circles indicate I, Tc, Th, or Pa sampling from the rosette, while green triangles indicate Go-Flo, Challenger pump or surface pump sampling.

5. Major Problems and Goals Not Achieved

none

6. Other Incidents of Note

This was the first deep ocean cruise to use the recently acquired HP NT NetServers (Model LH3 PII 400). These servers have replaced the MicroVAX systems first used in 1986. The HP servers provide Science staff with 12 gigabytes of disk space, are mirrored internally and operate in parallel. Science backups on the servers were easy and rapid using the HP DAT tapes.

This was also the first cruise to use the OSD Ocean Data and Information system (ODIN). ODIN is a shipboard database application for tracking and collecting the metadata and water sample data associated with an oceanographic cruise. ODIN was beta tested last year, during 18HU98023/1 in the Labrador Sea. The system was implemented on 99022 as an operational system. Our standard paper based system was maintained in parallel to ODIN.

7. List of Cruise Participants

Name	Responsibility	Affiliation
Jeff Anning	Underway Sampling, photosynthesis	BIO
Jay Bugden	DOC Levels, respiration rates	BIO
Allyn Clarke	Senior Scientist	BIO
Pierre Clement	Nutrients	BIO
John Dalziel	Tracers	BIO
Jennifer Dixon	CO_2, CFC's, Alkalinity	BDR
Henrietta Edmonds	Tracers	URI
Bob Gershey	Scientist, CO_2, CFC's, Alkalinity	BDR
Jean Hanley	Helium, Tritium	LDEO
Les Harris	Zooplankton, Net Tows	BIO
Glen Harrison	Assistant Scientist	BIO
Albert Hartling	Winch Room, moorings	BIO
Brian Irwin	Primary Production	BIO
Anthony Isenor	Data Manager	BIO
Jeffrey Jackson	Computer Room	BIO
John Lazier	Oxygens	BIO
Bill Li	Bacterial abundance and activity	BIO
Richard Nelson	Tracers	BIO
Tim Perry	Zooplankton, Net Tows	BIO
Bob Ryan	CTD Technician, Moorings	BIO
Murray Scotney	Moorings, instrumentation	BIO
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
LDEO	Lamont-Doherty Geological Observatory Columbia University Palisades, NY 10964 USA
URI	University of Rhode Island Graduate School of Oceanography South Ferry Road Narragansett, RI 02882 USA
UW	University of Washington Seattle, WA 98195 USA
WHOI	Woods Hole Oceanographic Institution Woods Hole, MA 02543 USA

B. UNDERWAY MEASUREMENTS

1. Navigation and Bathymetry — Anthony W. Isenor

The navigation system onboard CCGS Hudson consists of a differential GPS receiver and AGCNAV. The receiver also broadcasts navigation NMEA strings throughout the ship's network at about 1 Hz. The navigation data are then logged at one minute intervals on a PC. This PC was running the AGCNAV software package, 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 consisted of a Raytheon Line Scan Recorder, Model LSR 1811-2 (serial number A117) connected to a hull mounted 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 607). Logging, using Transect software on a 486 PC, was started on June 27 at 1535 Z in Halifax Harbour. Two different configurations were used for logging. On the Halifax Line, 30 second averages were logged. From the Louisbourg Site (on July 29, 1999 at 1522 Z), 5 minute averages were logged. The configuration of the equipment results in a bin length of 4 metros and a total of 128 bins. The averaged data are stored to disk and backed up every few days. ADCP logging was stopped on July 13 at 2247 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 was measured and logged every 30 sec. Temperature and conductivity were measured with Seabird sensors and the fluorescence by a Wetlabs follow-through fluorometer. Incident Photosynthetically Active Radiation was measured with a Li-Cor Spherical Quantum Sensor and this data was merged with the sea water parameters. Exact time and positions were provided by a Northstar GPS 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. The computer also logged the time and position of these samples.

4. XBT and XCTD

No probes were used.

5. Meteorological observations

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

6. Atmospheric Chemistry

There was no atmospheric chemistry program.