CRUISE REPORT FOR THE HUDSON MISSION HUD 2007-045

Leg 1: Sept 28-Oct 1, Leg 2 : Oct 5-Oct 10, Leg 3 : Oct 10-Oct 18

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Objectives

The main objectives of the mission were:

- to obtain synoptic fall observations of the hydrography and the distributions of nutrients, phytoplankton, zooplankton and bacteria along three sections on the Scotian Shelf and one in Cabot Strait, i.e. to carry out the fall Atlantic Zone Monitoring Programme (AZMP).
- to retrieve and re-deploy moorings along a section (SS-B) across the slope waters of the central Scotian Shelf, in collaboration with members of the UK RAPID-WAVE (West Atlantic Variability Experiment) programme. RAPID-WAVE is funded by the UK Natural Environment Research Council (NERC) through the thematic programme “Rapid Climate Change (RAPID)”.

Additional objectives were:

- to carry out hydrographic, chemical and biological sampling at stations in the Gully and Roseway Basin
- to measure the underwater light field (1-2 times per day) and measure levels of CDOM (coloured dissolved organic material)
- to monitor temperature, salinity and *in vivo* phytoplankton fluorescence continuously in the near surface (using a flow-through system)
- to deploy APEX profiling floats in the slope waters (>2000 m) off Banquereau Bank, the Halifax Section, the SS-B section and the Western Scotian Shelf
- to investigate the vertical distribution of mesozooplankton at depths of up to 1000 m beyond the shelf-break

- to investigate the vertical distribution of macroplankton (e.g. krill) in the shelf basins, the Gully and Cabot Strait
- to sample using the MVP (Moving Vessel Profiler) on the BBL and HL sections
- to record acoustic backscattering along the ship's track
- to deploy SeaHorse, ADCP and Carioca moorings at HL2
- to deploy ADCP and/or drifters at stations HL2, HL2A, HL3A and at sites near HL4 and HL5, and stations M1 and M2 (east of the Halifax section) for the CANSARP programme
- to identify and enumerate birds while the ship was steaming during daylight hours
- to collect and preserve water samples for analysis of carbon dioxide levels
- to make VLOPC drops at stations of the main monitoring lines.

Summary of mission accomplishments and problems encountered

All of the stations of the main AZMP lines were sampled; 1 station in Roseway Basin and 4 in the Gully region were also sampled. An additional station was added to the Halifax line between HL5 and HL6. These two latter stations are at 100 m and 1000 m depth; the new station HL5A is at 500 m. CTDs and water sampling were carried out at all of the stations of the SS-B line. More stations had been included in the original plan, but had to be cut because of problems with the ship arising from leakage of the stern tubes. The first time this occurred was in the early hours of the morning of Sept 30, after little of the work had been done (see bridge log below). Severe leaking meant that the ship had to cease operations and return to BIO. The ship could only steam home at 2-10 knots and did not dock until the morning of Monday Oct 1. This terminated Leg 1. Repairs were carried out alongside and the ship was ready to sail again on Leg 2 on Friday Oct 5. The ship returned to the former working area (the slope waters of the central Scotian Shelf) and the remainder of the work that made up the collaboration with the British scientists was completed successfully (mooring retrievals and re-deployments, CTD and water sampling). The ship then proceeded to the western Scotian Shelf, where an APEX float was deployed beyond the Scotian Shelf and AZMP sampling was carried out along the Browns Bank line on the shelf, with MVP sampling between stations. The ship then returned to Halifax where the British scientists and the MVP operators disembarked. Further modifications were made to the stern tube packing at this time. These only delayed the departure of the ship by 4 hours, although subsequently the ship's maximum speed was restricted to ~10 knots. During the final Leg of the mission, AZMP sampling was carried out along the Halifax, Louisbourg and Cabot Strait lines, with additional sampling in the region of the Gully. CANSARP mooring deployments were made during Leg 2 of the mission, and the CANSARP drifters were deployed during Leg 3. The fact that most of the mission objectives were accomplished was due in part to the fact that the weather was never bad enough to interfere with operations, and in part to the efficiency and competence of the crew (and scientific staff). The latter meant that mooring deployments, which would normally be done during the day, could be done in the evening, which contributed to the efficient use of the ship.

Summary bridge log for the Hudson mission 2006-052

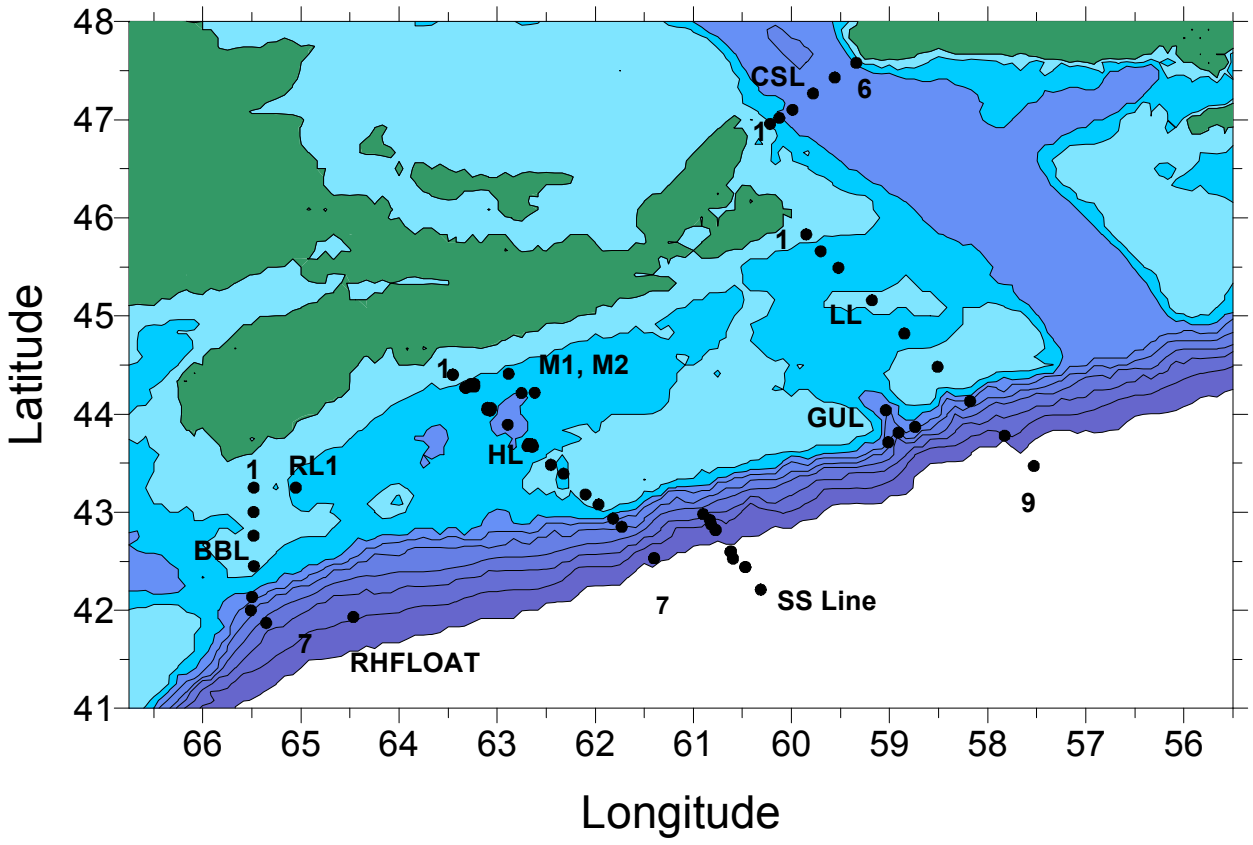
Sdate	stime	Event	Collector_station_name	start_lat	start_long	Sounding	Collectors_comments
28-Sep-07	1502	1	**BBasin**	44.69	-63.64	71	CTD 1 (Test)
28-Sep-07	1505	2	**BBasin**	44.70	-63.64	64	MVP TEST TOW 1
28-Sep-07	1611	3	**BBasin**	44.69	-63.64	59	BIONESS TEST TOW
28-Sep-07	1628	4	**BBasin**	44.70	-63.64	44	MVP TEST TOW 2
28-Sep-07	2157	5	**SEAHORSE MOORING**	44.29	-63.25	58	MOORING M1657 ONBOARD
28-Sep-07	2259	6	**SEAHORSE MOORING**	44.29	-63.25	163	MOORING M1662 DEPLOYED
28-Sep-07	2213	7	**SEAHORSE MOORING**	44.29	-63.25	163	MOORING M1663 DEPLOYED
29-Sep-07	0000	8	**HL2**	44.27	-63.32	165	CTD 2
29-Sep-07	0044	9	**HL2**	44.27	-63.32	154	RING NET 1 - 1
29-Sep-07	0100	10	**HL2**	44.27	-63.32	157	RING NET 1 - 2
29-Sep-07	0314	11	**HL1**	44.40	-63.45	90	MVP TOW 1
29-Sep-07	2020	12	**SS-B4**	42.44	-60.47	3500	MOORING RETRIEVAL
29-Sep-07	2048	13	**SS-B4**	42.44	-60.47	3500	MOORTING DEPLOYED
30-Sep-07	0100	14	**SS-B0**	42.98	-60.90	1914	CTD 3
30-Sep-07	0303	15	**SS-B1**	42.92	-60.83	2295	CTD 4
05-Oct-07	2046	16	**HL2A**	44.05	-63.08	189	MOORING CS2 DEPLOYED
06-Oct-07	0010	17	**HL3A**	43.68	-62.67	279	MOORING CS3 DEPLOYED
06-Oct-07	1405	18	**SS-B3**	42.60	-60.62	3400	MOORING RETRIEVED
06-Oct-07	1745	19	**SS-B5**	42.21	-60.31	4150	MOORING RETRIEVED
06-Oct-07	2011	25	**SS-B5**	42.21	-60.32	4005	CTD 5
07-Oct-07	0037	26	**SS-B5**	42.19	-60.28	4100	MOORING RELEASE TEST
07-Oct-07	0121	27	**SS-B5**	42.19	-60.31	4150	MOORING DEPLOYED
07-Oct-07	0249	28	**SS-B5**	42.21	-60.28	4150	APEX FLOAT 3278 DEPLOYED
07-Oct-07	0443	29	**SS-B4**	42.44	-60.47	3860	CTD 6
07-Oct-07	1026	30	**SSE-1/2**	42.36	-60.60	3400	MOORING RETRIEVED
07-Oct-07	1053	31	**SSE-1/2**	42.53	-60.59	3400	MOORING DEPLOYED
07-Oct-07	1436	32	**SSD-1/2**	42.88	-60.82	2600	MOORING RETRIEVED
07-Oct-07	1458	33	**SSD-1/2**	42.88	-60.82	2600	MOORING DEPLOYED
07-Oct-07	1657	34	**SS-B2**	42.82	-60.77	2930	MOORING RETRIEVED
07-Oct-07	1711	35	**SS-B2**	42.82	-60.77	2930	MOORING DEPLOYED
07-Oct-07	1934	36	**SS-B3**	42.60	-60.62	3188	CTD 7
07-Oct-07	2345	37	**SS-B3**	42.60	-60.62	3188	MOORING DEPLOYED
08-Oct-07	0320	38	**SS-B2**	42.82	-60.77	2780	CTD 8
08-Oct-07	2123	39	**RH_Float**	41.93	-64.46		APEX FLOAT 3275 DEPLOYED
09-Oct-07	0116	40	**BBL7**	41.87	-65.35	1871	RING NET 2 - 1
09-Oct-07	0253	41	**BBL7**	41.87	-65.35	1800	CTD 9
09-Oct-07	0447	42	**BBL7**	41.87	-65.35	1854	MULTI NET 1
09-Oct-07	0630	43	**BBL7**	41.86	-65.33	1851	MVP TOW 2
09-Oct-07	0827	44	**BBL6**	42.00	-65.51	1082	RING NET 3 - 1
09-Oct-07	0929	45	**BBL6**	41.99	-65.51	1156	CTD 10
09-Oct-07	1037	46	**BBL6**	41.98	-65.52	1149	MULTI NET 2
09-Oct-07	1210	47	**BBL6**	41.97	-65.52	1153	MVP TOW 3
09-Oct-07	1328	48	**BBL5**	42.14	-65.50	180	CTD 11

09-Oct-07	1356	49	**BBL5**	42.13	-65.49	218	LIGHT METER 1
09-Oct-07	1427	50	**BBL5**	42.12	-65.49	259	RING NET 4 - 1
09-Oct-07	1457	51	**BBL5**	42.12	-65.49	305	MVP TOW 4
09-Oct-07	1706	52	**BBL4**	42.45	-65.48	102	RING NET 5 - 1
09-Oct-07	1727	53	**BBL4**	42.44	-65.48	102	CTD 12
09-Oct-07	1750	54	**BBL4**	42.44	-65.48	102	LIGHT METER 2
09-Oct-07	1815	55	**BBL4**	42.43	-65.48	102	MVP TOW 5
09-Oct-07	2019	56	**BBL3**	42.76	-65.48	103	RING NET 6 - 1
09-Oct-07	2031	57	**BBL3**	42.76	-65.48	103	CTD 13
09-Oct-07	2112	58	**BBL3**	42.76	-65.48	102	MVP TOW 6
09-Oct-07	2237	59	**BBL2**	43.00	-65.48	120	CTD 14
09-Oct-07	2315	60	**BBL2**	43.00	-65.49	121	RING NET 7 - 1
09-Oct-07	2344	61	**BBL2**	43.00	-65.48	117	MVP TOW 7
10-Oct-07	0109	62	**BBL1**	43.25	-65.48	65	RING NET 8 - 1
10-Oct-07	0130	63	**BBL1**	43.25	-65.48	64	CTD 15
10-Oct-07	0330	64	**RL1**	43.25	-65.05	165	CTD 16
10-Oct-07	0409	65	**RL1**	43.25	-65.06	166	RING NET 9 - 1
10-Oct-07	0515	66	**RL1**	43.24	-65.07	163	BIONESS TOW 1
10-Oct-07	1405	67	**HL1**	44.40	-63.45	83	RING NET 10 - 1
10-Oct-07	1416	68	**HL1**	44.40	-63.45	88	CTD 17
10-Oct-07	1432	69	**HL1**	44.40	-63.45	82	LIGHT METER 3
10-Oct-07	1506	70	**HL1**	44.40	-63.45	84	LOPC 1
11-Oct-07	0205	71	**CS1**	44.30	-63.27	145	CTD 18
11-Oct-07	0230	72	**A-DRIFTER -HL2**	44.30	-63.27	145	DEPLOYED FLOAT (METOCEAN)
11-Oct-07	0257	73	**B-DRIFTER-HL2**	44.28	-63.23	148	CTD 19
11-Oct-07	0315	74	**B-DRIFTER-HL2**	44.28	-63.23	148	DEPLOYED FLOAT
11-Oct-07	0434	75	**HL2**	44.27	-63.32	156	LOPC 2
11-Oct-07	0449	76	**HL2**	44.27	-63.32	150	CTD 20
11-Oct-07	0531	77	**HL2**	44.27	-63.32	151	RING NET 11 - 1
11-Oct-07	0612	78	**C-DRIFTER-HL2**	44.28	-63.27	153	DEPLOYED FLOAT
11-Oct-07	0630	79	**D-DRIFTER-HL2**	44.31	-63.23	157	DEPLOYED FLOAT
11-Oct-07	0807	80	**HL2A**	44.06	-63.10	187	CTD 21
11-Oct-07	0832	81	**A-DRIFTER -HL2A**	44.06	-63.10	191	DEPLOYED FLOAT
11-Oct-07	0856	82	**HL2A**	44.04	-63.07	200	CTD 22
11-Oct-07	0923	83	**B-DRIFTER-HL2A**	44.04	-63.07	201	DEPLOYED FLOAT
11-Oct-07	0944	84	**C-DRIFTER-HL2A**	44.04	-63.10	192	DEPLOYED FLOAT
11-Oct-07	1007	85	**D-DRIFTER-HL2A**	44.06	-63.06	200	DEPLOYED FLOAT
11-Oct-07	1138	86	**HL3**	43.89	-62.89	271	BIONESS 2
11-Oct-07	1252	87	**HL3**	43.87	-62.85	261	CTD 23
11-Oct-07	1324	88	**HL3**	43.87	-62.86	262	LIGHT METER 4
11-Oct-07	1342	89	**HL3**	43.87	-62.86	264	LOPC 3
11-Oct-07	1405	90	**HL3**	43.87	-62.86	260	RING NET 12 - 1
11-Oct-07	1422	91	**HL3**	43.86	-62.87	265	RING NET 12 - 2
11-Oct-07	1604	92	**HL3A**	43.69	-62.68	154	CTD 24
11-Oct-07	1626	93	**A-DRIFTER-HL3A**	43.69	-62.68	154	DEPLOYED FLOAT
11-Oct-07	1651	94	**HL3A**	43.67	-62.65	126	CTD 25
11-Oct-07	1712	95	**B-DRIFTER-HL3A**	43.67	-62.64	130	DEPLOYED FLOAT
11-Oct-07	1732	96	**C-DRIFTER-HL3A**	43.67	-62.69	141	DEPLOYED FLOAT
11-Oct-07	1758	97	**D-DRIFTER-HL3A**	43.69	-62.64		DEPLOYED FLOAT
11-Oct-07	1950	98	**HL4**	43.48	-62.45	85	CTD 26
11-Oct-07	2011	99	**HL4**	43.47	-62.46	85	LOPC 4
11-Oct-07	2035	100	**HL4**	43.48	-62.46	85	RING NET 13 - 1
11-Oct-07	2143	101	**CS4**	43.39	-62.32	91	DEPLOYED FLOAT
12-Oct-07	0006	102	**HL5**	43.18	-62.10	103	RING NET 14 - 1

12-Oct-07	0022	103	**HL5**	43.18	-62.10	103	CTD 27
12-Oct-07	0140	104	**HL5**	43.18	-62.10	103	LOPC 5
12-Oct-07	0250	105	**CS5**	43.08	-61.97	104	DEPLOYED FLOAT
12-Oct-07	0356	106	**HL5A**	42.93	-61.82	540	CTD 28
12-Oct-07	0439	107	**HL5A**	42.93	-61.82	545	LOPC 6
12-Oct-07	0511	108	**HL5A**	42.93	-61.82	558	RING NET 15 - 1
12-Oct-07	0626	109	**HL6**	42.85	-61.73	1044	LOPC 7
12-Oct-07	0701	110	**HL6**	42.85	-61.73	1045	MULTINET 3
12-Oct-07	0835	111	**HL6**	42.85	-61.73	1041	CTD 29
12-Oct-07	0956	112	**HL6**	42.85	-61.75	986	RING NET 16 - 1
12-Oct-07	1337	113	**HL7**	42.53	-61.40	2076	MULTINET 4
12-Oct-07	1448	114	**HL7**	42.53	-61.40	2764	CTD 30
12-Oct-07	1650	115	**HL7**	42.54	-61.40	2750	LIGHT METER 5
12-Oct-07	1713	116	**HL7**	42.54	-61.41	2750	DEPLOYED FLOAT
12-Oct-07	2035	117	**HL7**	42.53	-61.40	2750	RING NET 17 - 1
12-Oct-07	2157	118	**HL7**	42.54	-61.41	2798	MULTINET 5
12-Oct-07	2328	119	**HL7**	42.56	-61.41	2798	LOPC 8
13-Oct-07	1428	120	**SG28**	43.71	-59.01	840	CTD 31
13-Oct-07	1519	121	**SG28**	43.72	-59.02	679	LIGHT METER 6
13-Oct-07	1552	122	**SG28**	43.71	-59.01	842	MULTINET 6
13-Oct-07	1856	123	**GULD3**	44.04	-59.04	816	BIONESS 3
13-Oct-07	2022	124	**GULD3**	44.10	-59.04	472	CTD 32
13-Oct-07	2115	125	**GULD3**	44.02	-59.04	500	RING NET 18 - 1
13-Oct-07	2330	126	**GULD4**	43.81	-58.91	2100	CTD 33
14-Oct-07	0123	127	**GULD4**	43.82	-58.91	2100	MULTINET 7
14-Oct-07	0324	128	**SG23**	43.87	-58.74	1000	CTD 34
14-Oct-07	0446	129	**SG23**	43.87	-58.74	971	MULTINET 8
14-Oct-07	0546	130	**SG23**	43.87	-58.74	870	CTD 35
14-Oct-07	1144	131	**LL9**	43.47	-57.53	3635	CTD 36
14-Oct-07	1436	132	**LL9**	43.48	-57.53	3635	LIGHT METER 7
14-Oct-07	1505	133	**LL9**	43.47	-57.54	3600	MULTINET 9
14-Oct-07	1624	134	**LL9**	43.47	-57.53	3650	APEX FLOAT 3277 DEPLOYED
14-Oct-07	1842	135	**LL8**	43.78	-57.83	2800	LIGHT METER 8
14-Oct-07	1904	136	**LL8**	43.78	-57.82	2800	CTD 37
14-Oct-07	2145	137	**LL8**	43.78	-57.83	2800	MULTINET 10
14-Oct-07	2324	138	**LL8**	43.77	-57.79	2800	LOPC 9
14-Oct-07	2354	139	**LL8**	43.77	-57.79	2800	RING NET 19 - 1
15-Oct-07	0349	140	**LL7**	44.13	-58.18	660	RING NET 20 - 1
15-Oct-07	0434	141	**LL7**	44.13	-58.18	692	CTD 38
15-Oct-07	0553	142	**LL7**	44.13	-58.18	682	MULTINET 11
15-Oct-07	0652	143	**LL7**	44.13	-58.18	690	LOPC 10
15-Oct-07	1005	144	**LL6**	44.48	-58.51	68	CTD 39
15-Oct-07	1025	145	**LL6**	44.47	-58.51	70	LOPC 11
15-Oct-07	1040	146	**LL6**	44.49	-58.51	72	RING NET 21 - 1
15-Oct-07	1413	147	**LL5**	44.82	-58.85	212	RING NET 22 - 1
15-Oct-07	1432	148	**LL5**	44.82	-58.85	234	CTD 40
15-Oct-07	1505	149	**LL5**	44.82	-58.84	258	LIGHT METER 9
15-Oct-07	1529	150	**LL5**	44.82	-58.82	251	LOPC 12
15-Oct-07	1837	151	**LL4**	45.16	-59.18	105	CTD 41
15-Oct-07	1900	152	**LL4**	45.16	-59.18	106	LOPC 13
15-Oct-07	1919	153	**LL4**	45.16	-59.18	106	RING NET 23 - 1
15-Oct-07	2214	154	**LL3**	45.49	-59.52	141	RING NET 24 - 1
15-Oct-07	2233	155	**LL3**	45.49	-59.52	143	CTD 42
15-Oct-07	2254	156	**LL3**	45.49	-59.52	142	LOPC 14

16-Oct-07	0046	157	**LL2**	45.66	-59.70	141	CTD 43
16-Oct-07	0110	158	**LL2**	45.66	-59.70	144	LOPC 15
16-Oct-07	0126	159	**LL2**	45.66	-59.70	145	RING NET 25 - 1
16-Oct-07	0309	160	**LL1**	45.83	-59.85	101	RING NET 26 - 1
16-Oct-07	0323	161	**LL1**	45.83	-59.85	102	CTD 44
16-Oct-07	0343	162	**LL1**	45.83	-59.85	99	LOPC 16
16-Oct-07	1231	163	**CSL1**	46.96	-60.22	80	CTD 45
16-Oct-07	1253	164	**CSL1**	46.96	-60.21	83	LOPC 17
16-Oct-07	1308	165	**CSL1**	46.94	-60.20	82	RING NET 27 - 1
16-Oct-07	1412	166	**CSL2**	47.02	-60.12	178	RING NET 28 - 1
16-Oct-07	1428	167	**CSL2**	47.01	-60.12	177	CTD 46
16-Oct-07	1458	168	**CSL2**	47.01	-60.12	172	LIGHT METER 10
16-Oct-07	1519	169	**CSL2**	47.00	-60.11	153	LOPC 18
16-Oct-07	1625	170	**CSL3**	47.10	-59.99	339	LOPC 19
16-Oct-07	1654	171	**CSL3**	47.10	-59.99	341	CTD 47
16-Oct-07	1735	172	**CSL3**	47.10	-59.98	340	MULTINET 12
16-Oct-07	1826	173	**CSL3**	47.10	-59.97	350	RING NET 29 - 1
16-Oct-07	2000	174	**CSL4**	47.27	-59.78	471	MULTINET 13
16-Oct-07	2056	175	**CSL4**	47.27	-59.78	470	LOPC 20
16-Oct-07	2128	176	**CSL4**	47.27	-59.77	470	CTD 48
16-Oct-07	2210	177	**CSL4**	47.26	-59.76	472	MULTINET 14
16-Oct-07	2305	178	**CSL4**	47.25	-59.75	471	RING NET 30 - 1
17-Oct-07	0117	179	**CSL5**	47.43	-59.56	480	LOPC 21
17-Oct-07	0151	180	**CSL5**	47.43	-59.55	490	CTD 49
17-Oct-07	0234	181	**CSL5**	47.43	-59.54	479	LOPC 22
17-Oct-07	0304	182	**CSL5**	47.43	-59.54	487	RING NET 31 - 1
17-Oct-07	0457	183	**CSL6**	47.58	-59.34	266	RING NET 32 - 1
17-Oct-07	0518	184	**CSL6**	47.58	-59.34	266	CTD 50
17-Oct-07	0546	185	**CSL6**	47.58	-59.34	261	LOPC 23
18-Oct-07	0525	186	**M2**	44.22	-62.62	177	DEPLOYED FLOAT #3326 METOCEAN
18-Oct-07	0609	187	**EMERALD NOSE**	44.21	-62.75	239	RING NET 33 - 1
18-Oct-07	0633	188	**EMERALD NOSE**	44.21	-62.75	239	RING NET 34 - 1
18-Oct-07	0701	189	**EMERALD NOSE**	44.21	-62.75	240	RING NET 35 - 1
18-Oct-07	0715	190	**EMERALD NOSE**	44.21	-62.75	240	RING NET 36 - 1
18-Oct-07	0853	191	**DRIFTER SITE**	44.41	-62.88	130	DEPLOYED FLOAT
18-Oct-07	1111	192	**CARIOCA MOORING**	44.30	-63.26	180	RETRIEVE BUOY ONLY/LEAVE STRING
18-Oct-07	1157	193	**HL2**	44.27	-63.32	351	RING NET 37 - 1, 37 - 2
18-Oct-07	1214	194	**HL2**	44.27	-63.33	196	RING NET 37 - 3
18-Oct-07	1238	195	**HL2**	44.27	-63.33	165	CTD 51

STATIONS SAMPLED ON THE HUDSON 2007-045 MISSION



*BBL = Browns Bank Line
RHFLOAT = Ross Hendry ARGO float deployment
RL1 = Roseway Basin
*HL = Halifax Line
M1, M2 = Smith/Tang drifters
SSL = Loder/Brit Slope water CTDs/Moorings
GUL = Gully
*LL = Louisbourg Line
*CSL = Cabot Strait Line

* Main AZMP lines

Routine AZMP sampling procedures

1. CTD profiles: CTD profiles were collected at all stations. As well as recording temperature, depth and salinity, the CTD was also equipped with an *in situ* fluorometer to examine the vertical distribution of phytoplankton, an oxygen sensor, and with Niskin bottles. Water samples were collected at all or selected depths at all AZMP stations and stations in Roseway Basin, the Gully and in the slope waters off the Central Scotian Shelf along the SS-B line. These were used to determine: dissolved oxygen, extracted chlorophyll, nutrients, bacterial biomass and algal taxonomy. Winkler oxygen titrations and salinity determinations were carried out for the water samples collected at all depths at stations of the SS-B line. POC, PON and HPLC pigment samples and samples for determination of absorption spectra were also taken at the surface. (Total number of profiles taken = 51)
2. VLOPC drops: VLOPC (Vertical Laser Optical Plankton Counter) profiles to the bottom or 300 m were taken to examine the vertical distribution of plankton "particles" on the HL, LL and CSL lines. (Total stations sampled = 23)
3. Vertical net tows: At the AZMP stations, a 200 μm mesh ring net was towed vertically to collect mesozooplankton. Tows were to the bottom, or 1000 m. Vertical ring net tows using a 76 μm mesh were taken on the Halifax Line. (Total number of vertical net tow stations = 37)
4. BIONESS tows: 1 in the Gully, 1 in Emerald Basin, 1 in Roseway Basin. (Total stations sampled =3)
5. MULTI-NET tows: 2 off the western Scotian Shelf, 2 off the central Scotian Shelf, 4 in the Gully region, 3 off the eastern Scotian Shelf and 3 in Cabot Strait. (Total stations sampled = 14)

Water sampling depths and ID numbers for CTD profiles

CTD	EVENT	STN	ID_TAG	DEPTH		CTD	EVENT	STN	ID_TAG	DEPTH
1	1	B.Basin	999999	24		30	114	HL7	322247	2854
2	8	HL2	322001	158		30	114	HL7	322248	2000
2	8	HL2	322002	103		30	114	HL7	322249	1499
2	8	HL2	322003	80		30	114	HL7	322250	1001
2	8	HL2	322004	59		30	114	HL7	322251	502
2	8	HL2	322005	51		30	114	HL7	322252	250
2	8	HL2	322006	39		30	114	HL7	322253	100
2	8	HL2	322007	29		30	114	HL7	322254	80
2	8	HL2	322008	19		30	114	HL7	322255	61
2	8	HL2	322009	10		30	114	HL7	322256	50
2	8	HL2	322010	2		30	114	HL7	322257	39
3	14	SS-B0	322011	1910		30	114	HL7	322258	30
3	14	SS-B0	322012	1400		30	114	HL7	322259	20
3	14	SS-B0	322013	801		30	114	HL7	322260	10
3	14	SS-B0	322014	300		30	114	HL7	322261	4
3	14	SS-B0	322015	250		31	120	SG28	322262	765
3	14	SS-B0	322016	101		31	120	SG28	322263	499

3	14	SS-B0	322017	80
3	14	SS-B0	322018	60
3	14	SS-B0	322019	49
3	14	SS-B0	322020	41
3	14	SS-B0	322021	30
3	14	SS-B0	322022	21
3	14	SS-B0	322023	12
3	14	SS-B0	322024	2
4	15	SS-B1	322025	2287
4	15	SS-B1	322026	2001
4	15	SS-B1	322027	1399
4	15	SS-B1	322028	800
4	15	SS-B1	322029	300
4	15	SS-B1	322030	249
4	15	SS-B1	322031	100
4	15	SS-B1	322032	80
4	15	SS-B1	322033	60
4	15	SS-B1	322034	49
4	15	SS-B1	322035	40
4	15	SS-B1	322036	30
4	15	SS-B1	322037	21
4	15	SS-B1	322038	10
4	15	SS-B1	322039	1
5	20	SS-B5	322040	4170
5	20	SS-B5	322041	3874
5	20	SS-B5	322042	3600
5	20	SS-B5	322043	3450
5	20	SS-B5	322044	3298
5	20	SS-B5	322045	3150
5	20	SS-B5	322046	2600
5	20	SS-B5	322047	2000
5	20	SS-B5	322048	1400
5	20	SS-B5	322049	800
5	20	SS-B5	322050	301
5	20	SS-B5	322051	252
5	20	SS-B5	322052	99
5	20	SS-B5	322053	51
5	20	SS-B5	322054	10
6	29	SS-B4	322055	3707
6	29	SS-B4	322056	3600
6	29	SS-B4	322057	3451
6	29	SS-B4	322058	3300
6	29	SS-B4	322059	3149
6	29	SS-B4	322060	2599
6	29	SS-B4	322061	2001
6	29	SS-B4	322062	1400
6	29	SS-B4	322063	800
6	29	SS-B4	322064	300
6	29	SS-B4	322065	250
31	120	SG28	322264	251
31	120	SG28	322265	99
31	120	SG28	322266	80
31	120	SG28	322267	59
31	120	SG28	322268	50
31	120	SG28	322269	41
31	120	SG28	322270	30
31	120	SG28	322271	20
31	120	SG28	322272	10
31	120	SG28	322273	3
32	124	GULD3	322274	483
32	124	GULD3	322275	250
32	124	GULD3	322276	150
32	124	GULD3	322277	101
32	124	GULD3	322278	81
32	124	GULD3	322279	60
32	124	GULD3	322280	51
32	124	GULD3	322281	41
32	124	GULD3	322282	31
32	124	GULD3	322283	21
32	124	GULD3	322284	11
32	124	GULD3	322285	4.5
33	126	GULD4	322286	2069
33	126	GULD4	322287	1501
33	126	GULD4	322288	1001
33	126	GULD4	322289	752
33	126	GULD4	322290	501
33	126	GULD4	322291	250
33	126	GULD4	322292	101
33	126	GULD4	322293	80
33	126	GULD4	322294	61
33	126	GULD4	322295	52
33	126	GULD4	322296	41
33	126	GULD4	322297	31
33	126	GULD4	322298	21
33	126	GULD4	322299	11
33	126	GULD4	322300	4
34	128	SG23	322301	942
34	128	SG23	322302	752
34	128	SG23	322303	500
34	128	SG23	322304	251
34	128	SG23	322305	150
34	128	SG23	322306	100
34	128	SG23	322307	79
34	128	SG23	322308	60
34	128	SG23	322309	50
35	130	SG23	322310	41
35	130	SG23	322311	31
35	130	SG23	322312	21

6	29	SS-B4	322066	99
6	29	SS-B4	322067	50
6	29	SS-B4	322068	10
7	36	SS-B3	322069	3307
7	36	SS-B3	322070	2950
7	36	SS-B3	322071	2701
7	36	SS-B3	322072	2450
7	36	SS-B3	322073	2200
7	36	SS-B3	322074	2000
7	36	SS-B3	322075	1400
7	36	SS-B3	322076	800
7	36	SS-B3	322077	301
7	36	SS-B3	322078	251
7	36	SS-B3	322079	100
7	36	SS-B3	322080	50
7	36	SS-B3	322081	10
8	38	SS-B2	322082	2774
8	38	SS-B2	322083	2701
8	38	SS-B2	322084	2450
8	38	SS-B2	322085	2200
8	38	SS-B2	322086	2000
8	38	SS-B2	322087	1400
8	38	SS-B2	322088	799
8	38	SS-B2	322089	301
8	38	SS-B2	322090	250
8	38	SS-B2	322091	101
8	38	SS-B2	322092	50
8	38	SS-B2	322093	11
9	41	BBL7	322094	1857
9	41	BBL7	322095	1499
9	41	BBL7	322096	1000
9	41	BBL7	322097	501
9	41	BBL7	322098	250
9	41	BBL7	322099	103
9	41	BBL7	322100	80
9	41	BBL7	322101	60
9	41	BBL7	322102	50
9	41	BBL7	322103	40
9	41	BBL7	322104	30
9	41	BBL7	322105	20
9	41	BBL7	322106	11
9	41	BBL7	322107	2.3
10	45	BBL6	322108	1115
10	45	BBL6	322109	750
10	45	BBL6	322110	502
10	45	BBL6	322111	250
10	45	BBL6	322112	100
10	45	BBL6	322113	79
10	45	BBL6	322114	59
35	130	SG23	322313	10
35	130	SG23	322314	4
36	131	LL9	322315	3772
36	131	LL9	322316	3000
36	131	LL9	322317	2000
36	131	LL9	322318	1500
36	131	LL9	322319	1000
36	131	LL9	322320	500
36	131	LL9	322321	251
36	131	LL9	322322	100
36	131	LL9	322323	80
36	131	LL9	322324	61
36	131	LL9	322325	51
36	131	LL9	322326	40
36	131	LL9	322327	31
36	131	LL9	322328	21
36	131	LL9	322329	11
36	131	LL9	322330	5
37	136	LL8	322331	2878
37	136	LL8	322332	1999
37	136	LL8	322333	1500
37	136	LL8	322334	1001
37	136	LL8	322335	502
37	136	LL8	322336	253
37	136	LL8	322337	102
37	136	LL8	322338	80
37	136	LL8	322339	61
37	136	LL8	322340	50
37	136	LL8	322341	40
37	136	LL8	322342	30
37	136	LL8	322343	20
37	136	LL8	322344	10
37	136	LL8	322345	3
38	141	LL7	322346	693
38	141	LL7	322347	499
38	141	LL7	322348	251
38	141	LL7	322349	100
38	141	LL7	322350	80
38	141	LL7	322351	59
38	141	LL7	322352	50
38	141	LL7	322353	40
38	141	LL7	322354	30
38	141	LL7	322355	20
38	141	LL7	322356	11
38	141	LL7	322357	5
39	144	LL6	322358	62
39	144	LL6	322359	51
39	144	LL6	322360	41
39	144	LL6	322361	30

10	45	BBL6	322115	49
10	45	BBL6	322116	40
10	45	BBL6	322117	31
10	45	BBL6	322118	21
10	45	BBL6	322119	10
10	45	BBL6	322120	1
11	49	BBL5	322121	180
11	49	BBL5	322122	150
11	49	BBL5	322123	100
11	49	BBL5	322124	80
11	49	BBL5	322125	59
11	49	BBL5	322126	50
11	49	BBL5	322127	40
11	49	BBL5	322128	30
11	49	BBL5	322129	20
11	49	BBL5	322130	10
11	49	BBL5	322131	3
12	53	BBL4	322132	96
12	53	BBL4	322133	80
12	53	BBL4	322134	60
12	53	BBL4	322135	50
12	53	BBL4	322136	40
12	53	BBL4	322137	30
12	53	BBL4	322138	20
12	53	BBL4	322139	10
12	53	BBL4	322140	3
13	57	BBL3	322141	96
13	57	BBL3	322142	80
13	57	BBL3	322143	60
13	57	BBL3	322144	49
13	57	BBL3	322145	40
13	57	BBL3	322146	30
13	57	BBL3	322147	20
13	57	BBL3	322148	11
13	57	BBL3	322149	5
14	59	BBL2	322150	115
14	59	BBL2	322151	81
14	59	BBL2	322152	60
14	59	BBL2	322153	51
14	59	BBL2	322154	41
14	59	BBL2	322155	30
14	59	BBL2	322156	21
14	59	BBL2	322157	10
14	59	BBL2	322158	3
15	63	BBL1	322159	58
15	63	BBL1	322160	50
15	63	BBL1	322161	41
15	63	BBL1	322162	31
15	63	BBL1	322163	21
39	144	LL6	322362	21
39	144	LL6	322363	11
39	144	LL6	322364	5
40	148	LL5	322365	224
40	148	LL5	322366	200
40	148	LL5	322367	150
40	148	LL5	322368	101
40	148	LL5	322369	81
40	148	LL5	322370	60
40	148	LL5	322371	52
40	148	LL5	322372	39
40	148	LL5	322373	30
40	148	LL5	322374	21
40	148	LL5	322375	11
40	148	LL5	322376	4
41	151	LL4	322377	98
41	151	LL4	322378	80
41	151	LL4	322379	60
41	151	LL4	322380	51
41	151	LL4	322381	40
41	151	LL4	322382	30
41	151	LL4	322383	20
41	151	LL4	322384	11
41	151	LL4	322385	5
42	155	LL3	322386	137
42	155	LL3	322387	101
42	155	LL3	322388	81
42	155	LL3	322389	60
42	155	LL3	322390	51
42	155	LL3	322391	40
42	155	LL3	322392	30
42	155	LL3	322393	21
42	155	LL3	322394	10
42	155	LL3	322395	4
43	157	LL2	322396	129
43	157	LL2	322397	100
43	157	LL2	322398	82
43	157	LL2	322399	61
43	157	LL2	322400	51
43	157	LL2	322401	41
43	157	LL2	322402	31
43	157	LL2	322403	20
43	157	LL2	322404	10
43	157	LL2	322405	5
44	161	LL1	322406	83
44	161	LL1	322407	61
44	161	LL1	322408	50
44	161	LL1	322409	40
44	161	LL1	322410	30

15	63	BBL1	322164	10	44	161	LL1	322411	21
15	63	BBL1	322165	4.3	44	161	LL1	322412	10
16	64	RL1	322166	158	44	161	LL1	322413	3
16	64	RL1	322167	100	45	163	CSL1	322414	74
16	64	RL1	322168	80	45	163	CSL1	322415	60
16	64	RL1	322169	60	45	163	CSL1	322416	50
16	64	RL1	322170	50	45	163	CSL1	322417	41
16	64	RL1	322171	40	45	163	CSL1	322418	30
16	64	RL1	322172	30	45	163	CSL1	322419	20
16	64	RL1	322173	21	45	163	CSL1	322420	10
16	64	RL1	322174	10	45	163	CSL1	322421	4
16	64	RL1	322175	4	46	167	CSL2	322422	167
17	68	HL1	322176	83	46	167	CSL2	322423	150
17	68	HL1	322177	61	46	167	CSL2	322424	99
17	68	HL1	322178	51	46	167	CSL2	322425	80
17	68	HL1	322179	41	46	167	CSL2	322426	59
17	68	HL1	322180	30	46	167	CSL2	322427	50
17	68	HL1	322181	20	46	167	CSL2	322428	40
17	68	HL1	322182	10	46	167	CSL2	322429	31
17	68	HL1	322183	4	46	167	CSL2	322430	20
18	71	CS1	NO BOTTLES	145	46	167	CSL2	322431	11
19	73	CS1	NO BOTTLES	145	46	167	CSL2	322432	3
20	76	HL2	322184	146	47	171	CSL3	322433	330
20	76	HL2	322185	100	47	171	CSL3	322434	200
20	76	HL2	322186	80	47	171	CSL3	322435	150
20	76	HL2	322187	61	47	171	CSL3	322436	100
20	76	HL2	322188	51	47	171	CSL3	322437	80
20	76	HL2	322189	40	47	171	CSL3	322438	60
20	76	HL2	322190	30	47	171	CSL3	322439	50
20	76	HL2	322191	20	47	171	CSL3	322440	40
20	76	HL2	322192	11	47	171	CSL3	322441	30
20	76	HL2	322193	4.5	47	171	CSL3	322442	20
21	80	HL2A	NO BOTTLES	187	47	171	CSL3	322443	10
22	82	HL2A	NO BOTTLES	196	47	171	CSL3	322444	4
23	87	HL3	322194	256	48	176	CSL4	322445	462
23	87	HL3	322195	201	48	176	CSL4	322446	300
23	87	HL3	322196	101	48	176	CSL4	322447	201
23	87	HL3	322197	81	48	176	CSL4	322448	150
23	87	HL3	322198	61	48	176	CSL4	322449	101
23	87	HL3	322199	51	48	176	CSL4	322450	81
23	87	HL3	322200	40	48	176	CSL4	322451	60
23	87	HL3	322201	30	48	176	CSL4	322452	49
23	87	HL3	322202	21	48	176	CSL4	322453	41
23	87	HL3	322203	10	48	176	CSL4	322454	30
23	87	HL3	322204	5	48	176	CSL4	322455	21

24	92	HL3A	NO BOTTLES	154	48	176	CSL4	322456	11
25	94	HL3A	NO BOTTLES	126	48	176	CSL4	322457	5
26	98	HL4	322205	80	49	180	CSL5	322458	470
26	98	HL4	322206	59	49	180	CSL5	322459	300
26	98	HL4	322207	50	49	180	CSL5	322460	202
26	98	HL4	322208	40	49	180	CSL5	322461	151
26	98	HL4	322209	30	49	180	CSL5	322462	101
26	98	HL4	322210	20	49	180	CSL5	322463	80
26	98	HL4	322211	11	49	180	CSL5	322464	60
26	98	HL4	322212	3	49	180	CSL5	322465	51
27	103	HL5	322213	96	49	180	CSL5	322466	40
27	103	HL5	322214	81	49	180	CSL5	322467	31
27	103	HL5	322215	61	49	180	CSL5	322468	21
27	103	HL5	322216	50	49	180	CSL5	322469	11
27	103	HL5	322217	41	49	180	CSL5	322470	3
27	103	HL5	322218	30	50	184	CSL6	322471	251
27	103	HL5	322219	21	50	184	CSL6	322472	200
27	103	HL5	322220	10	50	184	CSL6	322473	150
27	103	HL5	322221	5	50	184	CSL6	322474	100
28	106	HL5A	322222	532	50	184	CSL6	322475	80
28	106	HL5A	322223	251	50	184	CSL6	322476	60
28	106	HL5A	322224	150	50	184	CSL6	322477	50
28	106	HL5A	322225	100	50	184	CSL6	322478	40
28	106	HL5A	322226	80	50	184	CSL6	322479	31
28	106	HL5A	322227	60	50	184	CSL6	322480	21
28	106	HL5A	322228	51	50	184	CSL6	322481	9
28	106	HL5A	322229	40	50	184	CSL6	322482	4
28	106	HL5A	322230	30	51	195	HL2	322483	150
28	106	HL5A	322231	20	51	195	HL2	322484	101
28	106	HL5A	322232	10	51	195	HL2	322485	80
28	106	HL5A	322233	4	51	195	HL2	322486	61
29	111	HL6	322234	1026	51	195	HL2	322487	51
29	111	HL6	322235	750	51	195	HL2	322488	40
29	111	HL6	322236	500	51	195	HL2	322489	31
29	111	HL6	322237	250	51	195	HL2	322490	20
29	111	HL6	322238	101	51	195	HL2	322491	11
29	111	HL6	322239	80	51	195	HL2	322492	5
29	111	HL6	322240	60					
29	111	HL6	322241	51					
29	111	HL6	322242	40					
29	111	HL6	322243	31					
29	111	HL6	322244	20					
29	111	HL6	322245	10					
29	111	HL6	322246	4					

Moorings and Drifters - Richard Boyce

There were several moorings recovered and deployed during the course of the mission related to different programs. Also various types of surface and subsurface drifters were deployed.

Halifax Station 2 : Mooring M1667, which included RCM8, RCM11 and Doppler Volume Sampler current meters, was recovered. The CO2 Carioca Buoy was also recovered. The mooring tackle was left with a 75" blow-up float attached to mooring line. The buoy will be serviced and re-attached to the mooring in the near future. The standard ADCP mooring M1662 was deployed.

SARNIF (CANSARP): Search and Rescue - New Initiative Fund (Canadian Search and Rescue Programme). Three moorings, HL2/CS1 (M1663), HL2A/CS2 (M1664) and HL3A/CS3 (M1665) were deployed. These included a WHADCP, LRADCP and a QMADCP. A total of 12 Seimac SLDMB surface drifters were deployed, 4 at each site. A total of 7 Metocean SLDMB surface drifters were also deployed, one at each site as well as one at CS4, CS5, M1 and M2. These transmit their position through the Argos satellite system.

Scotian Slope: Moorings M1623 and M1624 were recovered and the replacements, M1666 and M1667 were deployed. This is an on going program. In this area was mooring M1647 which included various types of current meters. There was good communication with the acoustic releases. Transponding to the releases indicated an ascent of 30 meters then an abrupt stop. Several passes around the mooring proved that the releases were still near the bottom. Nothing was observed to have surfaced. A second try several hours later gave the same results. The Hudson did not have a suitable crane for dragging operations. This will be done at a later time.

Apex Floats: A total of 4 Apex floats were deployed in water greater than 2000 meters. The sites were HL7, LL9, BB_HL and RAPID 5B.

Proudman Oceanographic Laboratory & National Marine Facilities: A contingent of oceanographers from Great Britain were on board to service their moorings related to the RAPID program. Two long moorings were recovered, the instruments serviced and calibrated and the moorings were redeployed. Also two "Bottom Landers" were recovered and deployed. This was all done successfully.

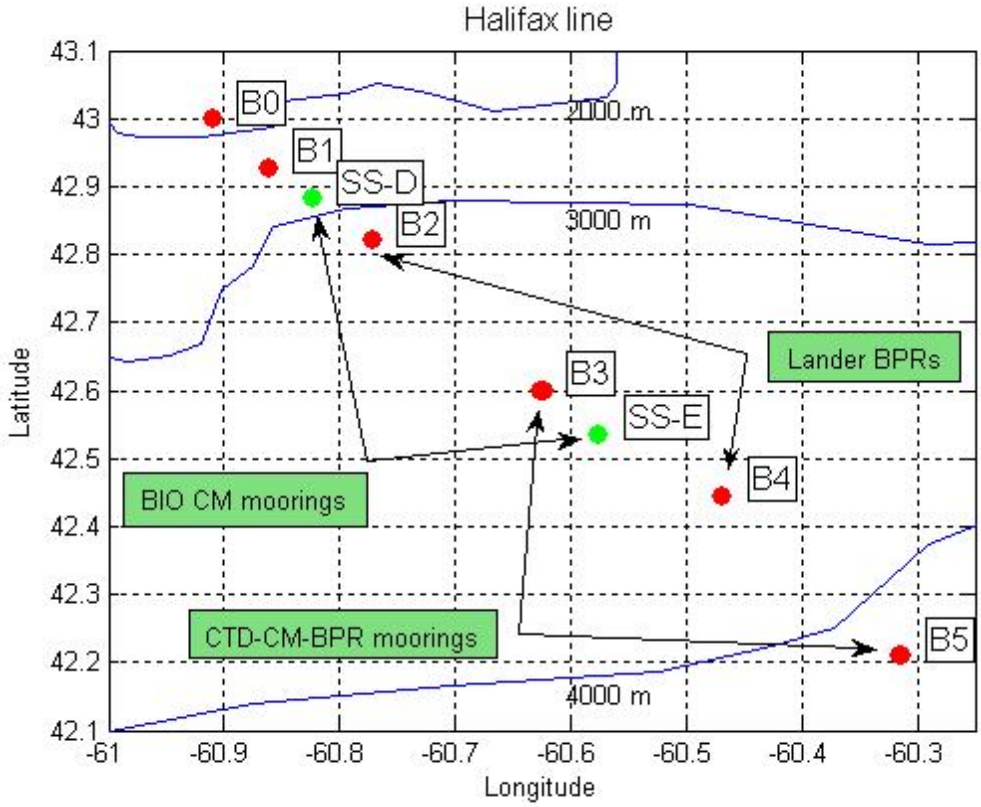
Mooring programme – RAPID-WAVE – Miguel Maqueda

The CCGS Hudson cruise Hud2007045 was the 2007 fall cruise of the Canadian "Atlantic Zone Monitoring Program" (AZMP, http://www.meds-sdmm.dfo-mpo.gc.ca/zmp/main_zmp_e.html). During the cruise, several Canadian and UK mooring stations on the Scotian Slope were visited and instruments were recovered and redeployed. CTD casts at the stations, as well as various biogeochemical measurements and sampling, were also carried out. The British crew for this cruise was made of technicians and scientists from the Proudman Oceanographic Laboratory (POL) and the National Oceanography Centre Southampton (NOCS): two Bottom Pressure Recorder (BPR) technicians (P. Foden and J. Pugh, POL), two mooring technicians from NOCS (J. Wynar and D. Comben, NOCS) and a PI (M. Maqueda, POL).

From an UK perspective, Hud2007045 was the fifth field campaign of the project RAPID-WAVE (West Atlantic Variability Experiment). RAPID-WAVE is funded by the UK Natural Environment Research Council (NERC) through the thematic programme "Rapid Climate Change (RAPID)". The project leaders are Chris Hughes (Proudman Oceanographic Laboratory), Richard Williams (University of Liverpool) and David Marshall (University of Reading). John Toole (Woods Hole Oceanographic Institution, WHOI) and John Loder (Bedford Institute of Oceanography) are international collaborators of the project. The British participation in this cruise was made possible thanks to Joint Project Agreement recently signed between the Bedford Institute of Oceanography (BIO) and NERC.

RAPID-WAVE aims at investigating how signals associated with changes in the Atlantic meridional overturning circulation propagate along the Atlantic deep western boundary current. As part of the project, two cruises took place in 2004. In the first one (27 April-6 May 2004, RV Oceanus, OC 401, WHOI), a line of 6 BPRs was deployed in an operation area approximately located at 36.5 N 67.5 W. In the second one (5-24 August 2004, RRS Charles Darwin, CD160), two additional lines of 6 BPRs and 5 CTD moorings each were deployed on the continental shelf break approximately south of St. John's and southeast of Halifax, respectively.

The RAPID-WAVE objectives during Hud2007045 were to recover and redeploy the two CTD-CM-BPR moorings deployed during the a cruise carried out in 2006 (2006 D308) and also to recover and redeploy two of the six BPRs of the Halifax line (see figure below). All objectives were achieved without significant problems, a success which is largely due to the support received by the RAPID-WAVE team from BIO technicians and scientists as well as the Hudson's officers and crew.



Locations of the BPRs and CTD mooring sites along the Halifax line as deployed during D308. Red dots indicate POL sites; green dots correspond to BIO current meter sites. BPRs are located at all POL sites. In addition, CTD-CM moorings where deployed at B3 and B5. During Hud200745, instruments at B2 (lander BPR), B3 (CTD-CM-BPR mooring), B4 (lander BPR) and B5 (CTD-BPR mooring) were recovered and redeployed. CTD stations were carried out at all POL stations. Bathymetric contour: 1000 m.

LATITUDE			LONGITUDE			Instrumentationdates of deployments and/or recovery, and any identifiers given to the site.
deg	min	N/S	deg	min	E/W	
42	49.2	N	60	46.5	W	Site B2: RL16-Bottom Pressure Recorder, recovered from 2704 m, 07/10/07, 16:45Z
42	26.5	N	60	28.2	W	Site B4: RL08-Bottom Pressure Recorder, recovered from 3655 m, 29/09/07, 20:22Z
42	49.1	N	60	46.4	W	Site B2: RL09-Bottom Pressure Recorder, deployed into 2700 m, 07/10/07, 17:45Z
42	26.4	N	60	27.9	W	Site B4: RL14-Bottom Pressure Recorder, deployed into 3563 m, 29/09/07, 21:33Z
42	36.0	N	60	37.5	W	Site B3: CTD mooring, recovered from 3255m, 6/10/07, 13:15Z Heights of instruments above seafloor: 0**, 250, 500*, 505***, 730, 980* (where ** denotes BPR, *** denotes current meter, * denotes CTD [Microcat with pressure sensor], and absence of * denotes CT logger)
42	12.6	N	60	18.8	W	Site B5: CTD mooring, recovered from 4100m, 6/10/07, 16:30Z Heights of instruments above seafloor: 0**, 250, 500*, 625, 775, 925* (where ** denotes BPR, * denotes CTD [Microcat with pressure sensor], and absence of * denotes CT logger)
42	35.8	N	60	37.8	W	Site B3: CTD mooring, deployed into 3190m, 8/10/07, 00:14Z Heights of instruments above seafloor: 0**, 250, 500*, 505***, 730, 980* (where ** denotes BPR, *** denotes current meter, * denotes CTD [Microcat with pressure sensor], and absence of * denotes CT logger)
42	12.4	N	60	18.7	W	Site B5: CTD mooring, deployed into 4120m, 7/10/07, 02:38Z Heights of instruments above seafloor: 0**, 250, 500*, 625, 775, 925* (where ** denotes BPR, * denotes CTD [Microcat with pressure sensor], and absence of * denotes CT logger)

Description of moorings recovered and re-deployed by scientists from the Proudman Oceanographic Laboratory and National Oceanographic Centre Southampton.

Multi-frequency Acoustics HUDSON 2007-045 – Norman Cochrane

Objective:
To survey the Scotian Shelf and adjacent waters for primarily macrozooplankton with collection of sufficient acoustic data to also discern the water column distribution of fish as an aid to analysis.

Equipment:
Two survey DataSonics DFT-210 scientific echosounders were operated at 12 & 200 kHz. Echosounder outputs were digitized to 12 bits resolution by a custom digitizer and logged to PC hard drive. A FURUNO 200-B transducer deployed though a stand pipe in HUDSON's GP lab was used at 200 kHz while an EDO 323B mounted on HUDSON's main ram was used at 12 kHz.

Procedure:
The echosounders were pinged simultaneously pinged at a 1 ping/2s rate for the cruise duration. Data were decimated by a factor of 5 for logging yielding an effective ping rate of 1 ping/10s. The full ping rate was used to derive bathymetric depths to control deployment of the Moving Vessel Profiler (MVP). Acoustic pulse lengths were 2 ms at 12 kHz and 5 ms at 200 kHz. The demodulated echosounder outputs were digitized at a 5 kHz/channel sampling rate to a maximum range of 409 ms 2-way travel time (about 300 m depth). Each logged acoustic ping was time-stamped and GPS navigation data was appended.

Results:
A quantity of good data was recorded; however, the 12 kHz channel failed at ping 6342 of File # 6 and remained inoperative for the remainder of the voyage. The 200 kHz recording continued. A number of fairly extended recording gaps occurred when the sounders were switched off to avoid interference with other experiments.

Significant acoustic scattering was observed from the deeper (> 200 m) reaches of Emerald Basin at both 12 and 200 kHz. The bulk of this scattering appeared not to migrate in the normal diurnal cycle. This could signify an unusually large population of siphonophores.

FILE #	TIME (ADT)	LOCATION
1	14:42 Sep. 27 – 14:47 Sep. 27	44 40.90 N 63 36.82 W
		Noise sample alongside at BIO
2	14:55 Sep. 27 – 14:55 Sep. 28	At: 44 41.01 N 63 37.49 W
		Alongside – Bedford Basin
3	14:55 Sep. 28 – 14:55 Sep. 29	To: 42 31.67 N 60 43.22 W
		Bedford Basin – south on Halifax Line to HL6 then to SE east of HL7
4	14:55 Sep. 29 – 14:32 Oct. 01	To: 44 40.90 N 63 36.82 W
		East of HL7 – time break – near WB1 to BIO
5	15:11 Oct. 04 – 15:14 Oct. 05	To: 44 17.03 N 63 25.20 W

		BIO – HL1 – just to SW of HL1
6	15:14 Oct. 05 – 18:44 Oct. 06	To: 42 12.82 N 60 18.47 W
		SW of HL1 – HL2A – HL3A – to SE to NE of HL8 (12 kHz fails)
7	18:44 Oct. 06 – 21:26 Oct. 08	To: 41 52.78 N 65 12.40 W
		NE of HL8 – time break - East of HL7 - west to just E of BBL7
8	21:26 Oct. 08 – 10:17 Oct. 09	To: 42 08.11 N 65 30.02 W
		Just E of BBL7 – BBL7 then north on Browns Bank Line to BBL5
9	10:18 Oct. 09 – 10:21 Oct. 09	To: 42 08.09 N 65 29.99 W
		At BBL5
10	10:21 Oct. 09 – 10:40 Oct. 09	To: 42 08.11 N 65 29.70 W
		At BBL5
11	10:41 Oct. 09 – 14:10 Oct. 09	To: 42 26.92 N 65 28.71 W
		BBL5 north to BBL4
12	14:11 Oct. 09 – 13:43 Oct. 10	To: 44 38.48 63 33.22 W
		BBL4 – BBL1 – RL1 – HL1 – mouth Halifax Harbour
13	03:02 Oct. 11 – 03:02 Oct. 12	To: 42 53.19 N 61 46.83 W
		HL2 - south on Halifax Line to HL6
14	03:02 Oct. 12 – 03:02 Oct. 13	To: 43 05.48 N 60 32.40 W
		HL6 – HL7 – NE toward Gully
15	03:02 Oct. 13 – 18:41 Oct. 14	To: 43 46.74 N 57 49.72 W
		NE of HL7 – Gully MPA – time break – approaching LL9 – LL8
16	18:41 Oct. 14 – 18:41 Oct. 15	To: 42 26.47 N 59 28.17 W
		LL8 - north on Lousibourg Line to just south of LL3
17	18:42 Oct. 15 – 18:42 Oct. 16	To: 47 15.83 N 59 46.22 W
		To LL3 – LL1 – CSL1 – northeast on Cabot Strait L to CSL4
18	18:42 Oct. 16 – 18:42 Oct. 17	To: 45 03.89 N 60 56.71 W
		CSL4 – CSL6 then SW through LL1 and to SW to off Canso
19	18:42 Oct. 17 – 16:17 Oct. 18	To: 44 40.90 N 63 36.82 W
		Off Canso – Little E. Basin – north tip Emerald Basin – HL2 - BIO

File names: HA0745xx.dat
Data format: Header + 2 ch x 2045 pts/ch @ 5 kHz/ch (standard)

Moving Vessel Profiler (MVP) Tows – M. Mitchell

MVP surveys of the Halifax and Browns Bank AZMP lines were carried out to obtain high resolution profiles of CTD as well as of fluorescence and zooplankton counts. The Halifax line was surveyed in one continuous tow (64 profiles), but the Browns Bank line was surveyed in separate segments between each station along the line (50 profiles).
The MVP towed fish was deployed from the ship's quarterdeck and towed at speeds ranging from 10 to 12 kts because of problems with one of the ship's shafts. The towed fish was mounted with a fluorometer (Wetlabs s/n WS1S-120SS job 9602010), a CTD (Applied Microsystems Ltd, Micro CTD s/n 7173), and a Laser Optical Plankton Counter (BIO Black unit). The system was set to profile to a depth of 10 m from the bottom but was occasionally operated in different modes because of noise in the depth data from the sounders.
No winch problems were encountered during the surveys: the winch system performed very well throughout the cruise.

MVP survey summary

Tow #	Event #	Location	Start				End		Comment
			Date	Start	Latitude	Longitude	Latitude	Longitude	
1	11	HL1 to HL6	29-Sep	00:25	44°23.86	63°26.72	42°52.97	61°46.91	64 profiles
2	43	BBL7 to BBL6	9-Oct	03:51	41°53.34	65°22.41	41°59.77	65°30.32	6 profiles
3	47	BBL6 to BBL5	9-Oct	09:14	41°58.81	65°30.84	42°05.79	65°30.16	5 profiles
4	51	BBL5 to BBL4	9-Oct	12:05	42°07.85	65°30.01	42°26.14	65°28.85	12 profiles
5	55	BBL4 to BBL3	9-Oct	15:20	42°26.41	65°28.94	42°45.16	65°28.72	11 profiles
6	58	BBL3 to BBL2	9-Oct	18:15	42°45.73	65°28.81	42°58.10	65°28.80	8 profiles
7	61	BBL2 to BBL1	9-Oct	20:50	43°00.68	65°28.81	43°12.53	65°28.81	8 profiles

Carbon dioxide sampling - Elizabeth Shadwick

The autumn 2007 AZMP cruise was the third of five planned cruises as part of the field work component of my doctoral thesis research. The primary aim of this research is to establish a carbon budget for the Scotian shelf region. Data collected on DFO cruises will enable us to address the four major, interacting processes governing the fluxes of carbon between the atmosphere and the shelf waters: biological activity; the contribution of fresh water from the outflow of the St. Lawrence river; air-sea flux; and the lateral or vertical transport at the shelf break.

Approximately 300 water samples were collected this autumn (see table for station specifics), at all water depths for each station. These samples will be analyzed for dissolved inorganic carbon (DIC) and total alkalinity (TA). The determination of these two parameters will allow us to calculate the remaining carbon system parameters – pH, carbonate alkalinity (CA), and partial pressure of carbon dioxide (pCO_2).

Line	**Stations Sampled**
Browns Bank	BBL1, BBL3, BBL4, BBL5, BBL7
Halifax	HL1, HL2, HL3, HL4, HL5, HL6, HL7
Louisburg	LL1, LL2, LL4, LL6, LL8
Cabot Strait	CSL1, CSL3, CSL4, CSL6

An underway CO_2 system was also run throughout the cruise making high frequency measurements of both atmospheric and oceanic carbon dioxide concentrations. An open path atmospheric sensor was mounted above the bridge and measured the CO_2 content and temperature of the air, while the corresponding wind speed and direction measurements were taken from the ship's internal meteorological monitoring system. An additional underway system was installed in the geochemistry lab; surface water CO_2 and temperature was measured continuously using the seawater intake located roughly 3 meters below the surface. Using the concentration difference between atmosphere and the ocean, along with air and sea surface temperature and wind speed, the flux of CO_2 from air to sea (or vice versa) may be computed.

A moored CO_2 sensing CARIOCA buoy was deployed in April 2007 at Station 2 on the Halifax Line. This state-of-the-art instrument makes hourly high resolution measurements of surface ocean CO_2, fluorescence, and other physical parameters. The buoy will remain deployed for several seasons providing data for the full seasonal cycle of surface ocean CO_2 in this region. This data is complimented by bottle samples collected on annual AZMP cruises. The CARIOCA buoy was recovered on the final day of the cruise; we expect to replace the batteries in the coming weeks and redeploy the instrument in mid-November at the same location.

CTD and Light Sampling – Edward Horne

The Seabird 911 CTD used on this voyage was mounted in our standard 24 bottle rosette and was equipped with a PAR sensor and a CDOM fluorometer for profiles less than 300m. The CTD was equipped with dual T,C and Oxygen sensors. This was fortunate for on stations 59, 63, 64, 68, 71, 73, 76, 80, 82, 87, 92, 94, and 98 the primary sensors were all reading incorrectly. We tried changing the pump and connectors without success. Finally Adam took it all apart and put it back together and it worked. Our best guess is that maybe there was a blockage in the air vent. In any case the secondary values for T,C, S and oxygen should be used for the above mentioned stations. A total of 51 casts were taken and their positions are shown in the cruise log. A new version of Merle Pittman's time correction program for the CTD logging computer was tried. It now works manually and works automatically until a CTD profile is occurring during the time when it tries to update. Merle pittman is working on correcting this problem. The last station, 195 was logged with Seasave version 7.14C. This is Seabird's latest version and has many advanced plotting features. Since we will probably be moving to this software next year one station was needed to see if our processing software worked properly with this version. All other stations we logged with Seasave version 5.37D which we have used for years.

Light profiles were collected at 10 stations whose positions are shown in the cruise log (see above) with a Satlantic mini Hyperspectral profiler. Profiles were taken as close to noon as possible. A CTD profile was taken at all stations and samples were collected form CDOM, chlorophyll, at all depths, and HPLC and absorption at the surface.

PELAGIC BIRD SURVEY — CARINA GJERDRUM, ENVIRONMENT CANADA

BACKGROUND

Data on the offshore distribution and abundance of marine birds are required in order to identify and minimize the impacts of human activities at sea on birds. These data will provide critical, and currently unavailable, information for environmental assessments for offshore developments, and will help identify areas where birds are at high risk for oil pollution, and other human activities. Our primary objective for the pelagic monitoring program is to map the relative abundance and distribution of pelagic birds in Atlantic Canada. We rely on ships-of-opportunity to carry seabird observers to offshore areas throughout the region, and prioritise areas that can be surveyed across multiple seasons and years.

Protocol

The main objective of our protocol is to ensure that observers conducting surveys at sea from a moving platform are recording data in a consistent, unbiased fashion that permit

subsequent conversion into seabird densities. This protocol is consistent with methods used elsewhere in the world, making these data comparable to other geographic areas.

Surveys are conducted while looking forward from the bridge, scanning ahead to a 90^{o} angle from either the port or starboard side, limiting observations to a transect band 300m wide from the side of the platform. A survey consists of a series of ten-minute observation periods, which are exclusively dedicated to detecting birds at sea. We conduct as many consecutive ten-minute observation periods as possible, regardless if birds are present or not, and try to ensure consistent coverage throughout the day. Observations can only be conducted when the platform is travelling at a minimum speed of 4 knots (7.4 km/h) and a maximum of 19 knots (35.2 km/h). We do not conduct observations when visibility is poor (i.e., when the entire width of the 300m transect is not visible due to rain or fog).

We scan the transect continuously by eye, to count and identify birds present in air or on water. Binoculars are used to confirm the species identification, and other details, such as age, moult, carrying fish, etc. We continuously record all birds observed on the sea surface throughout the ten-minute period, and estimate their distance from the platform. Flying birds are not recorded continuously throughout the 10-minute period, as this would overestimate bird density. Instead, we record flying birds using instantaneous counts, or "snapshots", at regular intervals throughout the observation period. The number of snapshots conducted depends on the speed of the platform.

GENERAL RESULTS FROM 2007 FALL SCOTIAN SHELF SURVEY

A total of 1295 km of ocean track were surveyed from 28 September – 19 October. I encountered 1815 birds from 7 families within the survey transect (Table 1, Fig. 1). The most abundant species observed during the trip was the Greater Shearwater, accounting for 74% of the observations (Table 1). Most of these shearwaters were seen at the edge of the shelf, especially in the vicinity of the Gully MPA and in the Cabot Strait (Fig. 1). These birds have spent the summer in Atlantic Canada, their non-breeding season, and are now migrating to breeding grounds in the southern hemisphere. The Northern Fulmar, which breeds in the eastern Arctic and Greenland, was the second most abundant species recorded, accounting for 7% of the birds observed. Juvenile Northern Gannets were relatively common on the shelf, migrating in advance of the adults to southern wintering areas. The adults were observed in the Cabot Strait and near Halifax harbour. I observed three species of Alcidae; Atlantic Puffins were seen in the nearshore, beyond St. Margaret's Bay, and along the Louisburg Line. The majority of the Dovekie occurred in the Cabot Strait. Leach's Storm-petrels were most common in the slope waters, whereas the Gulls and Jaegers were seen throughout the survey. These results are very similar to those collected during this same fall survey in 2006.

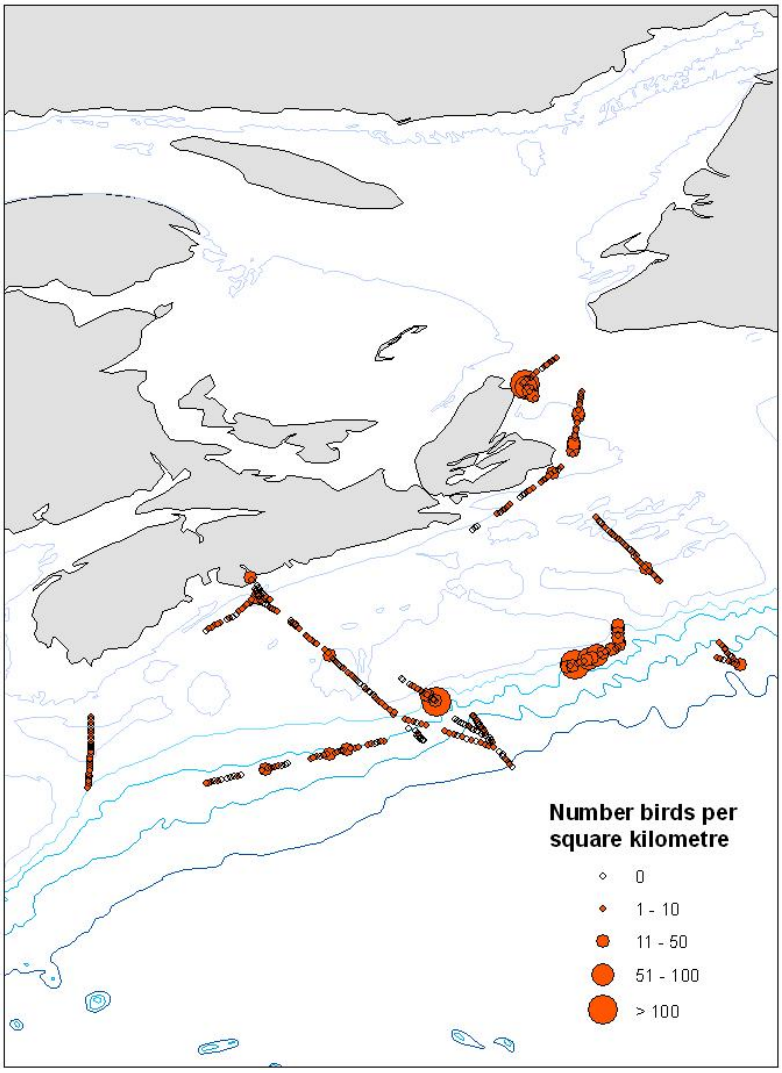


Figure 1. Bird densities (number of birds/km^2) observed during fall 2007 surveys.

A number of other birds were observed, but not within the survey transect. These include 2 Manx Shearwaters, 6 Loons, 2 Dowitchers, a Greater Yellowlegs and a *Calidris* sandpiper. I also observed an unusually large number of migrating terrestrial birds temporarily associated with the vessel, including 2 Osprey, a Peregrine Falcon, Mourning Dove, Grey Catbird, Ruby-crowned Kinglet, Bohemian Waxwing, Yellow Warbler, Myrtle Warbler, Blackpoll Warbler, Yellow-breasted Chat, Chipping Sparrow, White-throated Sparrow, White-crowned Sparrow, Dark-eyed Junco, Lapland Longspur, and American Goldfinch. Birds tend to move in large numbers during favourable conditions, but may also be blown off-course when conditions are poor. The winds were not unusually strong and fog was not common during this cruise, so the number and diversity of terrestrial birds observed likely represents a 'pulse' of migration over an area normally traversed.

It is worth noting that on 7 October; approximately 30 immature Blackpoll Warblers were found dead on the helicopter deck of the Hudson. It was reported that a flock of "hundreds" appeared the night before, likely attracted to lights on the stern of the vessel. Four were collected to determine the cause of death. Blackpoll Warblers are known to make long migration flights over the ocean to wintering areas in the Caribbean and Mexico.