CRUISE REPORT

CORIOLIS II 2017001

SCOTIAN SHELF

AZMP TRANSECTS +

April 18th – May 3rd

Table of Contents

CRUISE NARRATIVE

Highlights

Area Designation:	NAFO Regions: 5Ze, 4X, 4W, 4Vs, 4Vn, 3Pn, 3Ps Extent: 41^{o} 51'N - 47^{o} 35'N; 056^{o} 08'W - 066^{o} 08'W
Expedition Designation:	COR2017001 or 18OL17001 (ISDM format)
Chief Scientist:	Andrew Cogswell Ocean Ecosystem Science Division Marine Ecosystem Section Department of Fisheries and Oceans Bedford Institute of Oceanography PO Box 1006 Dartmouth, NS, Canada B2Y 4A2 Andrew.Cogswell@dfo-mpo.gc.ca
Ship:	Coriolis II (call sign - CGDN) oceanographic research vessel
Ports of Call:	Apr 18th, 2017 – Depart COVE, Dartmouth, NS Apr 23rd, 2017 – Arrive COVE, Dartmouth Apr 23rd, 2017 – Depart COVE, Dartmouth May 3rd, 2017 – Return COVE, Dartmouth, NS
Cruise Dates:	Apr 18th – May 3rd, 2017

Mission Summary

Overview

The spring 2017 AZMP survey was conducted aboard the oceanographic charter vessel Coriolis II. The week prior to sailing (April 10-13) was required to design and install the underway system in the forward lab, configure and install the DFO provided CTD package on the REFORMAR provided CTD rosette and frame, install the CTD winch, set up the laboratory equipment, network science computers and conduct a test CTD cast.

When testing the CTD in the afternoon of April 13th, the deck unit fuse blew because the wires in the slip ring were reversed. The wires to the sea cable were corrected in the junction box and upon replacing the fuse, the next alongside test cast worked well. Nonetheless, the lanyards on the Niskin bottles were too short and the bottles were not closing fully. That weekend, the REFORMAR CTD technician repaired the lanyards,

ordered spare fuses and the CTD and its operating system were ready for sailing. A day prior to sailing the underway system was turned on and was logging data alongside prior to departure. During the mission, the hull mounted Konsberg EM302 multibeam echo sounder (237 dB re 1 µ Pa @ 1 m and transmitting 1°x1° beams at 30 kHz) or the EM2040 multibeam echo sounder (218 dB re 1°µ Pa @ 1 m and transmitting 0.5 °x1° beams at frequencies between 200-400 kHz) were utilized with the exception of certain locations specified within the Gully MPA.

At ~0815 ADT on April 18th, (all times referred to in the Mission Summary are provided in Atlantic Daylight Time) the Coriolis II began the steam towards HL_00 in Bedford Basin to begin gear trials (Figure 1). Prior to beginning science operations, DFO science staff were provided with a tour of the ship and introduction to safety procedures. At ~1015, the first of three CTD test casts were conducted from the stern of the vessel. This was an opportunity for crew to become familiar with CTD launch and recovery techniques. When the CTD and net deployment tests were complete, the ship began the steam towards BBL_01 at ~1211.

Station occupations on the Browns Bank Line began at just before midnight on April 18th at BBL_01. After the completion of BBL_04 just before 1200 on the 19th, it was realized that the bottle numbers for the rosette had been offset by one with the firing mechanism position (i.e. bottle 12 was in position 1, bottle 1 was in position 2, etc…). This had not noticed during the first 4 casts because it appeared as though the extra surface bottle had just not fired. This meant that within the AZMP database template, metadata and data associated with the bottle fires had to be adjusted to reflect reality.

After BBL_04, occupation of the first Peter Smith station (PS_03) began at ~1400 on April 19th. First, odd number stations were occupied for CTD profiles when heading from Browns Bank to Georges Bank across the mouth of the North East Channel. At ~2000 on the 19th, the ship reversed direction heading back towards Browns Bank, completing the even numbers and PS_01. PS_01 was completed on April 20th at ~1000 before steaming to BBL_05, the first of 3 remaining stations of the Browns Bank Line. The occupation of BBL_07 (the last Browns Bank station) was completed at ~0200 on the 21st and the Coriolis II began the 17 hour steam to HL_07, arriving at 1900 on the 21st.

At the conclusion of the typical net and CTD operations at HL_07 on the 21st, 2 ARGO floats (S/N 429 and 430) were deployed. The occupation of the Halifax Line stations then proceeded in sequence from HL_06.7 to HL_04, finishing at ~0500 on the 23rd, before steaming back to the COVE in Halifax Harbour (arriving at ~1330 and departing ~1400) to acquire spare T/S sensors that were mistakenly absent from our science stores. The Coriolis II then sailed to HL_01, arriving at 1600 on the 23rd to begin the remainder of the Halifax Line stations, finishing at HL_3.3 at ~0320 on April 24th before setting course for the Gully MPA.

The Coriolis II arrived to begin the occupation of SG_28 in the Gully MPA at ~1700 on the 24th. All work in the Gully was completed in adherence to the requirements specified in the Gully MPA Activity Approval for the Atlantic Zone Monitoring Program 2015-2018 (Appendix 1A). After this occupation was complete at ~2100, the ship steamed to the head of the canyon in the Gully MPA where a sound velocity profile was conducted

in advance of multibeam operations that began at ~0000 on April 25. The extent of the multibeam survey was dictated by the constraints of the Fisheries Protection Program assessment issued just prior to sailing (17-HMAR-00075 – Appendix 1B). This assessment resulted in a number of survey requirements that were adhered to during the survey. Upon completion of the multibeam operations, a CTD cast was completed for a sound velocity profile at ~0400 on April 25th before completing the last 3 station occupations in the Gully MPA (GULD_03, GULD_04 and SG_23. The multibeam operations in the Gully MPA are described in detail in the Underway Sampling section of this report. These data, along with all multibeam acquired throughout the mission, were archived in the cruise folder of the Ocean Data Information Section (ODIS) server upon return to BIO and supplied to Alexandre Normandeau (Natural Resources Canada) to complete data QC. This QC will include both tidal and inertial motion unit correction before being provided to CHS and other interested parties. Gully operations were completed at ~1500 on the 25th before steaming ~5 hours to begin occupations at the offshore terminus of the Louisbourg Line at LL_09 on April 25th at ~2000.

Louisbourg Line stations were occupied in succession from LL_09 to LL_01. The remaining 2 ARGO floats (S/N 427 and 428) were deployed at the end of the occupation of LL_09. The last operation at LL_01 finished at ~1230 on April 27th. From there, the Coriolis II made the short traverse to the first station within the St. Anns Bank AOI, STAB_01. Beginning at ~1430, STAB_01 was occupied and was followed in succession with occupations of the remaining STAB stations, concluding with STAB_06 at 0500 on April 28th. The Coriolis II then travelled ~5.5 hours to the Newfoundland end of the Cabot Strait Line to begin the occupation of CSL_06 at ~1030 on the 28th. The Cabot Strait stations were completed in succession from CSL_06 to CSL_01, finishing at 0400 on April 29th before beginning the long 17 hour steam south to the first station (BP_01) of a transect that traverses the mouth of the Laurentian Channel.

Operations began at Brian Petrie station 1 (BP_01) at ~2130 on April 29th, proceeding southwest towards Banquereau. Operations at these stations were continuing as planned until the sea-state began to deteriorate early in the afternoon of April 30th. Operations ceased upon the completion of the occupation of BANQ_B3 on April 30th at ~1300. By the very early morning of May 1st, conditions had marginally improved and operations commenced at BANQ_B2 at ~0500. BANQ_B1 was completed shortly after this, with planned station occupations across the mouth of the Laurentian concluding at ~0700 on May 1st.

At the conclusion of planned station occupations (with the exception of HL_02 that would be occupied upon our return to Halifax), a decision was made that we would spend the remaining ~16 hours' time at our disposal to multibeam portions of 2 areas specified by Oceans and Coastal Management Division (OCMD) within and south of the Stone Fence Lophelia Conservation Area (LCA). The multibeam survey began on the eastern side of the LCA at ~0945 on May 1st. Over the next ~16 hours the bridge, with direction provided by the ship's multibeam technician, completed the planned multibeam survey route at ~7 kts, concluding at ~0200 on May 2nd. Refer to the Underway Sampling section of this report for more details of the Stone Fence multibeam survey.

Upon completion of the Stone Fence multibeam survey on May 2nd at ~0200, the ship set a course for Halifax, and arrived at HL_02 to begin the station occupation ~22.5 hours

later at 0030 on May 3rd. The occupation of HL_02 was completed at 0400 on May 3rd before returning to Halifax Harbour, arriving at the cove at 0730 on May 3rd to begin demobilization. By noon on the 3rd, all DFO gear, samples and data/metadata had been removed from the ship and taken back to BIO. The data has since been transferred to ODIS for archiving and scanning as necessary, and all parties interested in any aspect of these data have been provided with a copy.

Over the 16 day mission, the Coriolis II logged ~2209 nm and AZMP science staff conducted 176 operations at 69 stations (Figure 1). Table 1 breaks down the operations by sampling gear for each leg of the trip. The table also points to figures that display the deployment locations for each gear type. Each of these figures is accompanied by a table of coordinates detailing each deployment of that gear type. Table 2 contains the break down in time allocated to each gear type.

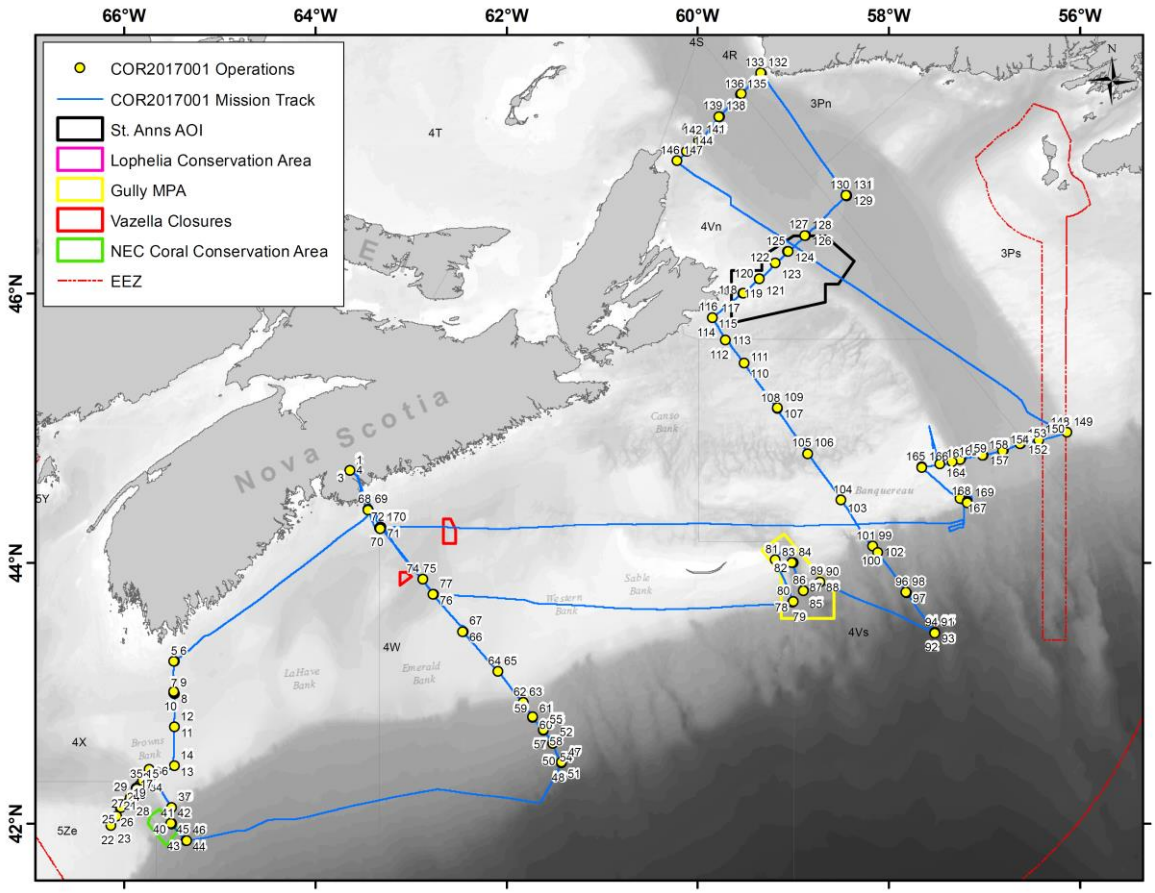


Figure 1. The locations for all 176 events during the COR2017001 AZMP spring survey. Some overlapping event labels may not visible.

Table 1. Summary of operations during the COR2017001 AZMP spring survey.

Operation	# of Operations	Figure
CTD	102	2
Vertical Ring Net Tows	66	
Multibeam Transects	N/A*	
Sound Velocity Profiles	3	
ARGO Float Deployments	4	

*Acquired throughout the mission. Refer to Underway Sampling section of this report.

Table 2. Break down of operational time by gear type during COR2017001.

Gear	~Operation Duration (hrs)
CTD	~61
Vertical Net Tows	~20
Multibeam Transects	N/A*
Sound Velocity Profiles	~1.5
Argo Float Deployments	~1

*Acquired throughout the mission.

Mission Participants

A complete ship's crew list for this mission can be found in Appendix 2.

Table 3. List of science staff aboard the COR2017001 spring AZMP mission.

	Name	Affiliation	Duty	Shift
1	Anstey, Carol	DFO – OESD	CTD Computer	Night
2	Benjamin, Robert	DFO – PCSD	Data Manager	Day
3	Cogswell, Andrew**	DFO – OESD	Chief Scientist/CTD Computer	Day
4	MacIsaac, Kevin	DFO – OESD	CTD/Nets/Biologist	Night
5	Perry, Timothy	DFO – OESD	Lab Technician	Night
6	Spry, Jeffrey	DFO – OESD	CTD/Nets/Lab Technician/Biologist	Day
7	Thamer, Peter	DFO – COOGER	Lab Technician	Day
8	Kachuk, Carolyn	DAL – Erin Bertrand	Student	Split
9	Arriojas, Hugo	DAL – Erin Bertrand	Student	Split
10	Hogan, Holly	EC – CWS	Bird and Mammal Observer	Day

**Chief Scientist
DFO: Department of Fisheries and Oceans Canada
MAR-OESD: Maritimes - Ocean Ecosystem Science Division
MAR-PCSD: Maritimes - Program Coordination and Support Division
EC-CWS: Environment Canada - Canadian Wildlife Service
DAL: Dalhousie University

Objectives

There were 14 defined objectives in the final version of the mission plan submitted to REFORMAR on March 28th, 2017 (below). Three more objectives were added for the production of this report. Table 4 describes whether each of these objectives was met along with any relevant supporting commentary.

Primary

1. Obtain spring observations of the hydrography and distribution of nutrients, phytoplankton and zooplankton at standard sampling stations along "**core**" Atlantic Zone Monitoring Program sections within the Maritimes Region (**Contact Mr. Andrew Cogswell** - http://www.bio.gc.ca/science/monitoring-monitorage/azmp-pmza-eng.php.).

Additional

2. Carry out hydrographic, chemical and biological sampling at stations in the Gully in support of Gully MPA monitoring initiatives by Oceans and Coastal Management Division (**Contact Dr. Dave Hebert** - http://www.mar.dfo-mpo.gc.ca/Gully-MPA).
3. Nutrients and hydrography across the Northeast Channel as part of NERACOOS Cooperative Agreement, (**Contact Dr. Dave Hebert** - http://www.neracoos.org/).
4. Deployment of ARGO floats in support of the International Argo Float Program (**Contact Dr. Blair Greenan** - http://www.meds-sdmm.dfo-mpo.gc.ca/isdm-gdsi/argo/index-eng.html).
5. Collect underway and CTD water samples at specified locations and depths to fulfil the regional component of an Aquatic Climate Change Adaptation Services Program (ACCASP) initiative investigating the delineation of ocean acidification and calcium carbonate saturation state of the Atlantic zone (**Contact Dr. Pierre Pepin** - http://www.dfo-mpo.gc.ca/science/oceanography-oceanographie/accasp/index-eng.html).
6. Water will be collected for the Bertrand lab from specified depths to evaluate whether and how organic and organometallic micronutrients influence primary productivity and phytoplankton community structure on the Scotian Shelf (**Contact Erin Bertrand** – Erin.Bertrand@dal.ca).
7. Collect surface water in conjunction with measurements of varying biological activity. Samples will be processed shore side and the organic content analyzed for their ability to act as cloud droplets to study the climate impact of organics in sea spray aerosol. (**Contact Rachel Chang** - http://fizz.phys.dal.ca/~rachel.chang/ for further information).
8. Bird and mammal observations as part of EC-CWS sea-bird observation program and in fulfilment of Gully MPA occupation requirements (**Contact Carina Gjerdrum –** carina.gjerdrum@canada.ca).
9. Carry out hydrographic, chemical and biological sampling at stations in the St. Anns Bank MPA as a continued monitoring effort in support of Oceans and Coastal Management Division (**Contact Dr. Dave Hebert** - http://www.dfo-

mpo.gc.ca/oceans/mpa-zpm/stanns-sainteanne-eng.html).

10. Collect water samples from strategic locations and depths to support a microbial community analysis via DNA, RNA and flow cytometry, as well as the isolation of novel diazotrophs (**Contact Dr. Julie Laroche** - http://www.dal.ca/faculty/science/biology/faculty-staff/our-faculty/julie-laroche.html .)
11. Conduct hydrographic, chemical and biological sampling across the mouth of the Laurentian Channel (BP and BANQ stations). This transect has been proposed to enhance our understanding of hydrographic phenomenon in these areas in support of current modelling efforts (**Contact Dr. Dave Brickman**).
12. Multibeam survey of the thalweg of the Gully for a study led by Dr. Alex Normandeau - NRCAN, Geological Survey of Canada (Atlantic).
13. Collection of CTD data from an internally recording RBRConcerto CTD. The CTD will be mounted on the rosette frame, configured with a "wet switch" to record only when immersed in water. The measurements are to be used for evaluation of the RBR "Deep CT" conductivity cell (compared with the on-board SBE CTD), as part of sensor evaluations for the Argo program (**Contact Dr. Clark Richards).**

Other (not included in form B)

14. Multibeam survey in an area specified by Oceans and Coastal Management Division, within and surrounding the Stone Fence Lophelia Conservation Area (**Contact Mr. Andrew Cogswell**).
15. Simrad EK60 echo sounder data capture throughout the mission (**Contact Dr. Catherine Johnson)**.
16. Collect live vertical net tow for Laura Helenius doing *C. finmarchicus* egg production study and opportunistic *C. hyperboreous* and *C. glacialis* genetics analysis (**Contact Dr. Catherine Johnson).**

Table 4. Status of objectives upon completion of the COR2017001 mission.

Objective	Status	Comments
1	Completed	
2	Completed	
3	Completed	
4	Completed	
5	Completed	
6	Completed	
7	Completed	
8	Completed	
9	Completed	
10	Completed	
11	Completed	
12	Completed	
13	Completed	
14	Partially Completed	All of the planned area surrounding the Lophelia Conservation Area and only a portion of a box to the south of it. Refer to the Underway Sampling section of this report.
15	Not Completed	Unfortunately, despite being on, the EK60 computer was not logging data throughout the mission
16	Completed	

SUMMARY OF ACTIVITIES

CTD Summary

Narrative

As summarized in Table 1, there were a total of 102 CTD casts during the mission (Figure 2 and Table 5). The configuration file used for the mission is provided in Appendix 3A. Two casts (Events 120 (STAB_02) and 175 (HL_02)) were aborted during the mission. Event 120 was aborted because the tubing was not removed from the primary and secondary plumbing prior to deployment. During Event 175, the deck unit alarm sounded and the pumps appeared to be turning on and off. A full profile at the station had been conducted at the station during the preceding event (174) and the second cast (Event 175) was attempted to acquire the remaining bottles from 50 m to the surface (but was aborted). The CTD was deployed again at HL_02 during Event 176, and while the profile data was incorrect, the bottles were fired to acquire water necessary for the Dalhousie group.

In general, the CTD performed well during the mission. It should be noted however that during the test casts at HL_00 and at BBL_01, BBL_02, BBL_03 and BBL_04 (Events 6, 10, 12 and 14) the bottles on the rosette were offset in relation to the firing mechanism (e.g., bottle 12 was in the 1 position and bottle 1 was in the 2 position, etc…). This meant that if 8 bottles were fired, bottle 12 and 1-7 were closed on the rosette. This led to some confusion on deck that was not relayed to the CTD control room. Lab staff were assuming that bottle 1 was fired near bottom, but in fact it was the next nominal depth up in the water column. It was assumed that the second surface bottle was just not firing. Once the problem was identified, the bottles were moved to their appropriate positions, and the preceding CTD files were reprocessed with the corrected ID labels. It does mean that bottom water was not collected at these 4 locations.

Another odd phenomenon was noted as well. Bottles were occasionally inadvertently fired during the first ¼ of the mission. It was not clear why this was happening until it was noted that it might be possible that the keyboard was accidentally knocked by an elbow. It was determined through trial and error, that the space bar on the keyboard could fire a bottle, not the first (bottom) bottle, but all subsequent bottle fires. The keyboard was then moved further up on the table to avoid accidental bottle fires throughout the remainder of the mission.

After the occupation of LL_09 (Event 92) it was noted during the light QC of data as it is entered into the AZMP database template that the ranges of the data being acquired from the SeaPoint UV fluorometer (S/N 3668) were broad and highly variable. All of the CDOM data were plotted to that point in the mission and a pervasive error was evident. After a period of what appears to be normal acquisition of CDOM data (at steady values <1 µg/L) the data values would occasionally jump to a value of ~20 µg/L or greater (Figure 3). Example plots and explanatory text describing the issue were sent to Dr. Emmanuel Devred for his advice, and the BIO CTD technician (Mr. Terry Cormier) will check with the distributor and manufacturer in an attempt to determine the cause of the

issue which also appears to have been a problem during HUD2016003 and HUD2016027.

Preliminary section plots and anomalies (where available) of temperature (°C), salinity (p.s.u.) and sigma-t (kg/m^3) can be viewed in Appendix 4.

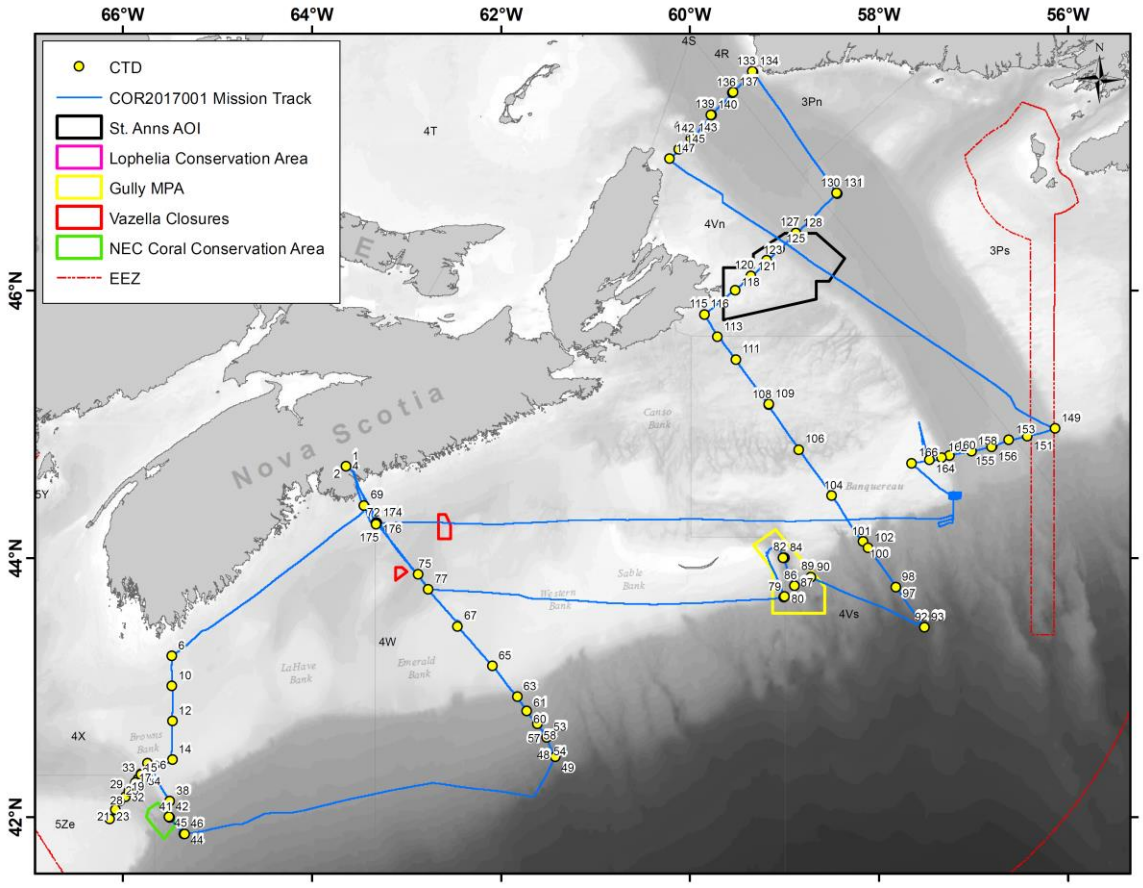


Figure 2. Locations for the 102 CTD casts during COR2017001 AZMP spring survey. Each cast is labelled with the consecutive mission event.

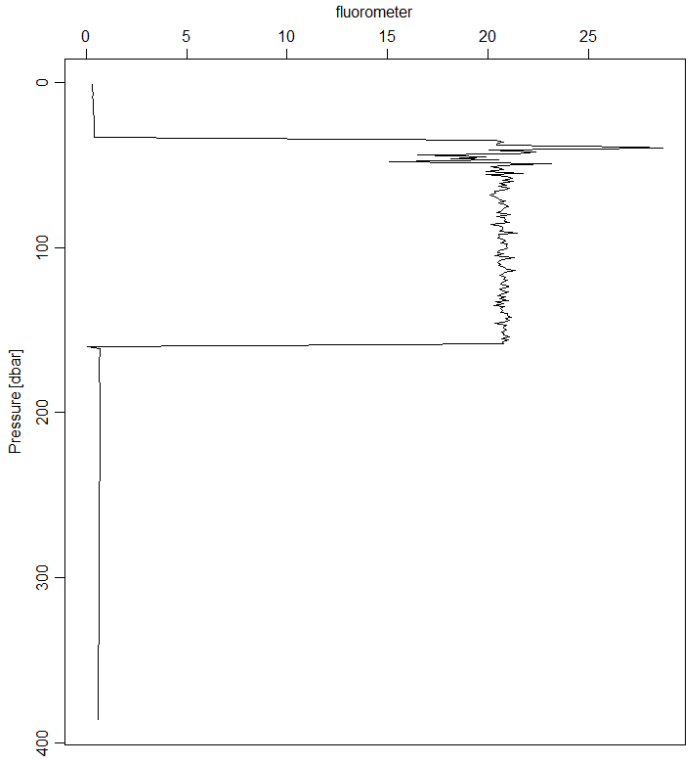


Figure 3. The CDOM (µg/L) profile at BANQ_B4, Event 160 of the spring 2017 COR2017001 mission.

Table 5. CTD casts during the COR2017001 AZMP spring survey. The coordinates provided are in decimal degrees and reflect the ship's position at the time of deployment as recorded using the ELOG meta-data logger. The SBE35 (high precision temperature sensor) was not included on the sensor package for this mission.

#	Event	Station	Date	Slat (DD)	Slon (DD)	Sounding (m)	pH	Water Collected	Aborted
1	1	HL_00	18/04/2017	44.6916	-63.6370	66	X		
2	2	HL_00	18/04/2017	44.6900	-63.6371	66	X		
3	4	HL_00	18/04/2017	44.6902	-63.6365	66	X		X
4	6	BBL_01	19/04/2017	43.2527	-65.4789	60	X	X	
5	10	BBL_02	19/04/2017	43.0192	-65.4810	117	X	X	
6	12	BBL_03	19/04/2017	42.7502	-65.4760	95	X	X	
7	14	BBL_04	19/04/2017	42.4500	-65.4759	98	X	X	
8	15	PS_03	19/04/2017	42.3010	-65.8388	209	X	X	
9	16	PS_03	19/04/2017	42.3006	-65.8374	209	X	X	
10	17	PS_05	19/04/2017	42.2262	-65.9015	233	X	X	
11	18	PS_05	19/04/2017	42.2252	-65.9020	233	X	X	
12	19	PS_07	19/04/2017	42.1592	-65.9735	219	X	X	X
13	20	PS_07	19/04/2017	42.1573	-65.9748	221	X	X	X
14	21	PS_09	19/04/2017	42.0573	-66.0732	92	X	X	
15	23	PS_10	20/04/2017	41.9862	-66.1376	89	X	X	
16	25	PS_08	20/04/2017	42.1241	-66.0369	203	X	X	
17	26	PS_08	20/04/2017	42.1241	-66.0348	202	X	X	X
18	28	PS_06	20/04/2017	42.2039	-65.9348	221	X	X	
19	29	PS_06	20/04/2017	42.2043	-65.9348	221	X	X	
20	31	PS_04	20/04/2017	42.2680	-65.8651	222	X	X	
21	32	PS_04	20/04/2017	42.2694	-65.8682	221	X	X	
22	33	PS_02	20/04/2017	42.3364	-65.8058	196	X	X	
23	34	PS_02	20/04/2017	42.3355	-65.8048	197	X	X	
24	36	PS_01	20/04/2017	42.4231	-65.7385	93	X	X	
25	38	BBL_05	20/04/2017	42.1266	-65.4994	216	X	X	
26	39	BBL_05	20/04/2017	42.1262	-65.5000	209	X	X	
27	41	BBL_06	20/04/2017	41.9991	-65.5053	1121	X	X	
28	42	BBL_06	20/04/2017	42.0003	-65.5069	1072	X	X	
29	44	BBL_07	20/04/2017	41.8661	-65.3499	1840		X	
30	45	BBL_07	21/04/2017	41.8694	-65.3491	1840		X	

31	46	BBL_07	21/04/2017	41.8679	-65.3475	1840		X		
32	48	HL_07	21/04/2017	42.4712	-61.4239	2752		X		
33	49	HL_07	22/04/2017	42.4744	-61.4275	2733		X		
34	53	HL_06.7	22/04/2017	42.6237	-61.5134	2267		X		
35	54	HL_06.7	22/04/2017	42.6236	-61.5153	2265		X		
36	57	HL_06.3	22/04/2017	42.7256	-61.6155	1731		X		
37	58	HL_06.3	22/04/2017	42.7260	-61.6165	1696		X		
38	60	HL_06	22/04/2017	42.8256	-61.7253	1118	X	X		
39	61	HL_06	22/04/2017	42.8250	-61.7256	1120	X	X		
40	63	HL_05.5	22/04/2017	42.9359	-61.8269	478	X	X		
41	65	HL_05	23/04/2017	43.1760	-62.0927	97	X	X		
42	67	HL_04	23/04/2017	43.4793	-62.4567	80	X	X		
43	69	HL_01	23/04/2017	44.3990	-63.4487	78	X	X		
44	72	HL_02	23/04/2017	44.2666	-63.3168	150	X	X	X	
45	73	HL_02	23/04/2017	44.2663	-63.3162	147	X	X		
46	75	HL_03	24/04/2017	43.8773	-62.8786	262	X	X		
47	77	HL_03.3	24/04/2017	43.7598	-62.7686	205	X	X		
48	79	SG_28	24/04/2017	43.7007	-59.0091	NA	X	X		
49	80	SG_28	24/04/2017	43.7049	-59.0019	948	X	X		
50	82	SVP_02	25/04/2017	44.0030	-59.0033	1010				
51	84	GULD_03	25/04/2017	44.0017	-59.0165	418	X	X		
52	86	GULD_04	25/04/2017	43.7878	-58.8974	2104		X		
53	87	GULD_04	25/04/2017	43.7870	-58.8997	2071		X		
54	89	SG_23	25/04/2017	43.8566	-58.7257	1273	X	X		
55	90	SG_23	25/04/2017	43.8558	-58.7247	1301	X	X		
56	92	LL_09	26/04/2017	43.4706	-57.5226	3770		X		
57	93	LL_09	26/04/2017	43.4704	-57.5218	3770		X		
58	97	LL_08	26/04/2017	43.7768	-57.8232	2876		X		
59	98	LL_08	26/04/2017	43.7782	-57.8275	2820		X		
60	100	LL_07	26/04/2017	44.1259	-58.1718	818	X	X		
61	101	LL_07	26/04/2017	44.1265	-58.1713	838	X	X	X	
62	102	LL_07.1	26/04/2017	44.0769	-58.1206	1047	X	X		
63	104	LL_06	26/04/2017	44.4725	-58.5041	60	X	X		
64	106	LL_05	27/04/2017	44.8176	-58.8492	234	X	X		
65	108	LL_04	27/04/2017	45.1532	-59.1703	87	X	X		
66	109	LL_04	27/04/2017	45.1561	-59.1718	92	X	X		
67	111	LL_03	27/04/2017	45.4887	-59.5173	142	X	X		

68	113	LL_02	27/04/2017	45.6543	-59.7094	126	X	X		
69	115	LL_01	27/04/2017	45.8218	-59.8504	92	X	X		
70	116	LL_01	27/04/2017	45.8217	-59.8502	91	X	X		
71	118	STAB_01	27/04/2017	46.0001	-59.5266	55	X	X		
72	120	STAB_02	27/04/2017	46.1043	-59.3580	59	X			X
73	121	STAB_02	27/04/2017	46.1047	-59.3586	60	X	X		
74	123	STAB_03	27/04/2017	46.2171	-59.1893	86	X	X		
75	125	STAB_04	27/04/2017	46.3005	-59.0585	158	X	X		
76	127	STAB_05	28/04/2017	46.4172	-58.8782	366	X	X		
77	128	STAB_05	28/04/2017	46.4169	-58.8779	367	X	X		
78	130	STAB_06	28/04/2017	46.7027	-58.4456	451	X	X		
79	131	STAB_06	28/04/2017	46.7072	-58.4480	445		X		
80	133	CSL_06	28/04/2017	47.5763	-59.3379	264	X	X		
81	134	CSL_06	28/04/2017	47.5775	-59.3386	261	X	X		
82	136	CSL_05	28/04/2017	47.4275	-59.5546	471	X	X		
83	137	CSL_05	28/04/2017	47.4291	-59.5489	469	X	X		
84	139	CSL_04	28/04/2017	47.2698	-59.7758	461	X	X		
85	140	CSL_04	28/04/2017	47.2691	-59.7774	461	X	X		
86	142	CSL_03	29/04/2017	47.0996	-59.9886	330	X	X		
87	143	CSL_03	29/04/2017	47.0998	-59.9881	329	X	X		
88	145	CSL_02	29/04/2017	47.0211	-60.1162	180	X	X		
89	147	CSL_01	29/04/2017	46.9542	-60.2166	76	X	X		
90	149	BP_01	30/04/2017	44.9748	-56.1400	229	X	X		
91	151	BP_04	30/04/2017	44.9183	-56.4383	383	X	X		
92	153	BP_05	30/04/2017	44.8886	-56.6280	402	X	X		
93	155	BANQ_B6	30/04/2017	44.8403	-56.8058	414	X	X		
94	156	BANQ_B6	30/04/2017	44.8387	-56.8115	411	X	X		
95	158	BANQ_B5	30/04/2017	44.8054	-57.0243	418	X	X		
96	160	BANQ_B4	30/04/2017	44.7722	-57.2544	390	X	X		
97	162	BANQ_B3	30/04/2017	44.7576	-57.3434	75	X	X		
98	164	BANQ_B2	01/05/2017	44.7413	-57.4719	51	X	X		
99	166	BANQ_B1	01/05/2017	44.7161	-57.6550	30	X	X		
100	174	HL_02	03/05/2017	44.2666	-63.3167	143	X	X		
101	175	HL_02	03/05/2017	44.2658	-63.3188	150	X			X
102	176	HL_02	03/05/2017	44.2586	-63.3210	154	X	X		

Oxygen

The oxygen data collected by the CTD sensors and Winkler titration method will be used to create new calibration coefficients before the final run of the CTD processing. It will be necessary to extract these corrected oxygen values when they are produced so they can be accurately reflected in our data archives.

The adjusted Soc values are calculated by a 2 step process. First, a "threshold field" is produced that subtracts the mean difference between the sensor and the average Winkler value for all samples, from the individual sample difference between the sensor and Winkler:

(SBE O2 – Winkler O2) - mean(SBE O2 – Winkler O2)

The next step calculates a new slope term by using the following equation:

NewSoc = mean(previousSoc*([Winkler O2]/[SBE O2]))

Before the Soc can be calculated however, some basic comparisons between the primary (#0133, calibrated Dec 23, 2016) and secondary (#0042, calibrated Jan 14, 2017) sensors were completed to remove outliers (Figure 4). The 1.5 * inter quartile range (IQR) was used to determine "outlier" data that could bias the results. During event 44 at BBL_07 (Sample IDs 440470 - 440478) the secondary sensor was acquiring data that was much lower than the primary sensor and the Winkler values where they were available. As well, during event 48 at HL_07 (440502 – 440504) the primary sensor temporarily acquired data lower than the secondary and not in line with the rest of the profile. These outlier data were removed prior to proceeding with the next step in Soc calculation.

Comparisons were also made between Winkler replicates (Figure 5). There were a total of 8 Winkler replicates removed from further Soc analysis (events 41, 60, 63, 65, 79, 93, 104 and 158 which correspond to sample ID numbers 440452, 440557, 440586, 440587, 440667, 440748, 440807, and 441096). The average difference between the Winkler replicates before outlier removal was -0.003. The "threshold field" was then calculated with the outlier sensor and Winkler data removed for the primary and secondary sensors and threshold outliers were removed (Figures 6 and 7).

Table 6 shows the previous and revised Soc values for both the primary and secondary oxygen sensors (#0133 and #0042). The Soc ratio was calculated for each sensor. The Soc ratios for the primary and secondary sensors were 1.0597 and 1.1567 (#0133 and #0042 respectively).

The original outlier free sensor values were then multiplied by their new corresponding Soc ratios to produce corrected primary and secondary sensor values. With the new Soc values being used to calculate corrected primary and secondary oxygen sensor values, the corrected mean difference between outlier free sensor values went from -0.61 ml/l before correction to -0.04 ml/l after correction (Figure 8).

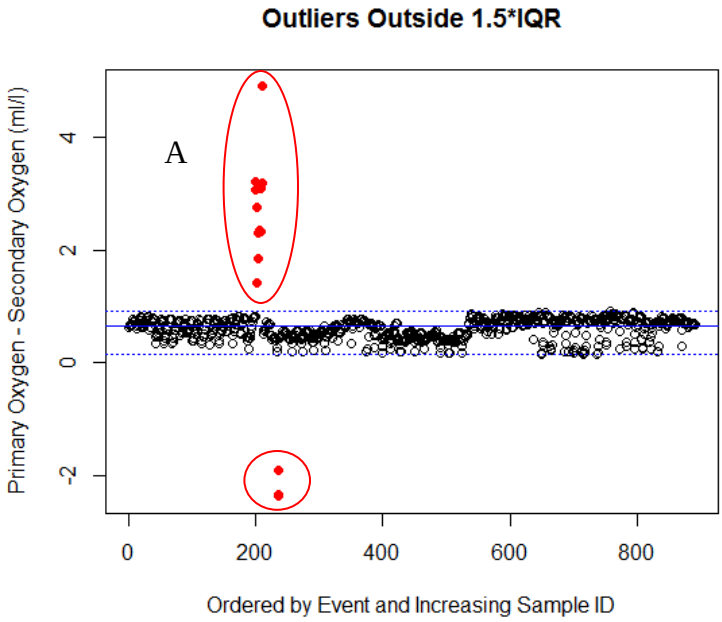


Figure 4. The difference between primary oxygen sensor #0133 and secondary oxygen sensor #0042. Outliers in red were removed prior to proceeding with Soc calculation: **A**) outliers from Event 44 (BBL_07 : 440470-440478), and **B**) Event 48 (HL_07: 440502 - 440504). The mean difference between sensors before outlier removal (solid blue line) is 0.65 ml/l. The lower and upper dotted blue lines are 0.14 and 0.90 ml/l respectively.

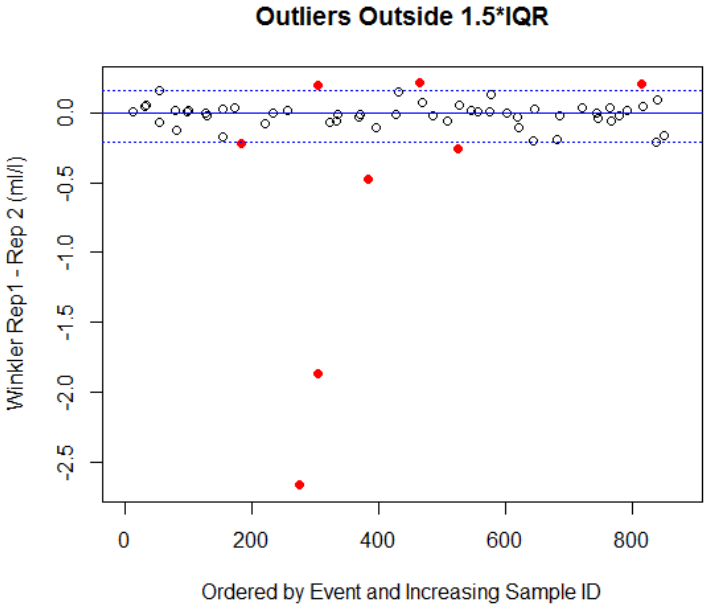


Figure 5. The mean difference (solid blue line) between 1st and 2nd Winkler replicates (-0.003 ml/l). The lower and upper dotted blue lines are -0.21 and 0.16 ml/l respectively. Note the 8 outliers in red that were removed prior to proceeding with Soc calculation (sample ID numbers 440452, 440557, 440586, 440587, 440667, 440748, 440807, and 441096).

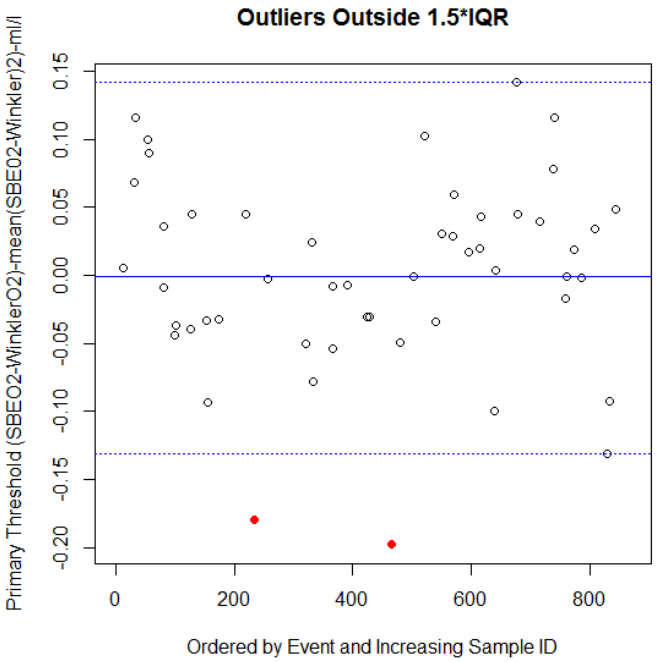


Figure 6. Outlier "threshold" values for the primary sensor were removed. **A)** - Event 97 at LL_08: 440752 and, **B)** Event 53 at HL_06.7: 440517. The solid blue line is the mean value of the primary sensor threshold (~0 ml/l) and the lower and upper dotted blue lines are -0.13 and 0.14 ml/l respectively. These outlier data points were removed and the remaining data were used to calculate the primary Soc values.

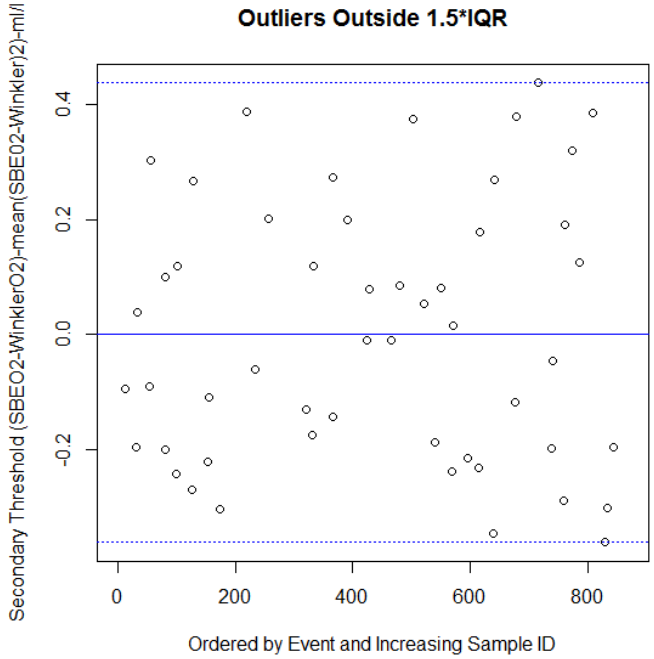


Figure 7. There were no outlier "threshold" field values for the secondary sensor, so all of the remaining data were used to calculate the secondary Soc value.

Table 6. Previous and new Soc values for the primary and secondary SBE Oxygen sensors.

	Old Soc	New Soc	Ratio (New:Old)
Primary Sensor #0133	4.0520e-1	4.294014e-1	1.059727
Secondary Sensor #0042	4.6100e-1	5.332471e-1	1.156718

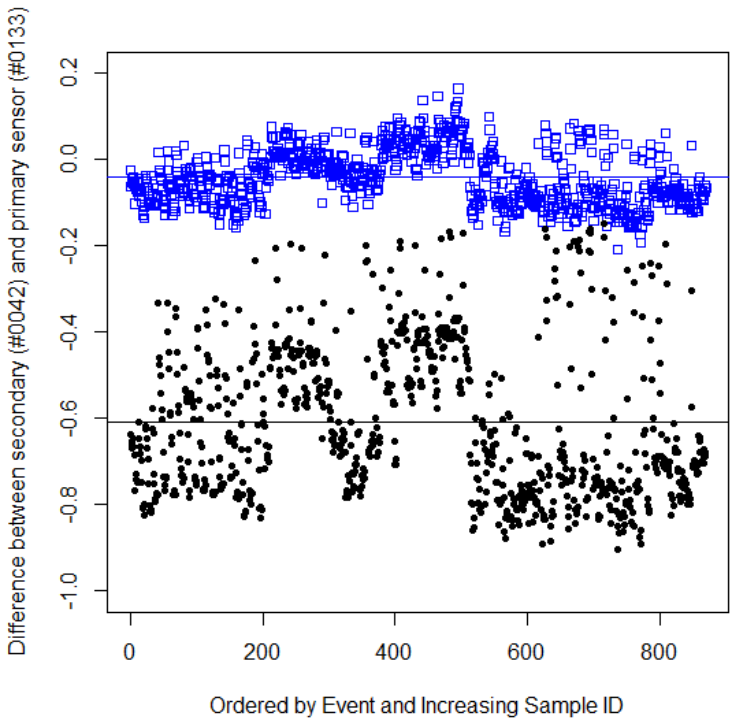


Figure 8. A) Black dots – uncorrected difference between outlier free secondary sensor values (#0042) and primary sensor (#0133) values (black line is the mean = -0.61 ml/l). Blue squares – Soc corrected difference between secondary sensor (#0042) values and primary sensor (#0133) values (blue line is the mean= -0.0410 ml/l).

Salinity

(With portions extracted from HUD2014017 Cruise Report)

Conductivity Calibration

The salinometer outputs the conductivity as a ratio with the standard; therefore, some conversions are done to get the conductivity of the bottle. The standard has a given K15 value:

K15 = conductivity of standard seawater at 15°C and 1 atm/conductivity of KCl solution (32.4356g/kg) at 15°C and 1 atm.

Where K15 = 0.99984 for this particular standard and the conductivity of KCl standard = 4.29140 S/m and can be found in the seawater Matlab package (gsw_C3515 function). Knowing K15 and the conductivity of the KCl solution, the conductivity of the standard seawater can be determined. Then, by multiplying by the conductivity ratio from the salinometer, the conductivity of the sample can be determined.

It should be noted that these samples were analyzed with a bath temperature of 24°C rather than the 15°C that the standard conductivity was defined. The salinometer program accounted for this temperature difference so that the output sample conductivity ratios with the standard are at 15°C.

Now we have the conductivity of the sample at 15°C and at the pressure of the bath in the salinometer; however, this needs to be converted to conductivity at the temperature and pressure of the CTD. This can be done using some functions from the same Matlab package.

First calculate the salinity of the bottle using the conductivity and pressure from the salinometer and a temperature of 15°C.

Salinity_bottle = gsw_SP_from_C(Conductivity_salinometer[mS/cm],T[C],P_bath)

Then re-calculate the conductivity from this salinity value using temperature and pressure from the CTD.

Conductivity_bottle = gsw_C_from_SP(Salinity_bottle,T_CTD,P_CTD) %[mS/cm]

This now gives conductivity values that can be compared to the CTD values. To correct the CTD conductivity a linear regression is done on this equation:

$$Bottle\_conductivity = b1 + b2*CTD\_conductivity$$

to find an intercept, b1, and slope, b2, that will make the CTD conductivity better match the bottle conductivity.

Comparing the difference between the primary (#3562 calibrated Dec 28, 2016) and secondary (#1076 calibrated January 6, 2017) sensors reveals 2 things (Figure 9). First,

there are extreme outliers associated with event 44 (BBL_07: 440467-440478) when the plumbing to both sensors became blocked during the cast (Figure 9A). The plumbing for both the primary and secondary systems was flushed with Triton prior to the next cast. Prior to the blockage, the difference between the sensors was 0.00294 P.S.U. (Figure 9 – blue line) but after the blockage, the difference was 0.02663 P.S.U. (Figure 9 – red line). For this reason, the remaining steps to calculate the coefficients will be done separately for all data collected prior to event 45 and everything after event 44.

When looking at the sensor differences prior to event 45, all points from event 44 are removed as well as a few other outliers slightly higher and lower than 1.5 * the IQR (Figure 10). The mean difference prior to the removal of event 44 is skewed positive (0.0578 P.S.U.) but the IQR is narrow, with a high of 6.5e-03 and a low of -5.0e-04. All data points highlighted in red for Figure 10 are removed before proceeding further. The next step after removing erroneous sensor data is to remove erroneous differences between the primary sensor and salinometer data (Figure 11). Figure 11 shows that 6 erroneous values were identified and removed. The same comparison was made between the secondary sensor and the salinometer and an additional 4 erroneous values were removed before calculated coefficients for both sensors prior to event 45 (Figure 12). The slope and intercept coefficients for both the primary and secondary sensors prior to event 45 are shown in Table 7. Figure 13 shows the difference between the 2 sensors both before and after correction.

When the comparison between sensors is made after event 44 (Figure 14), there are 74 outliers that are removed before proceeding. The mean value of the difference after event 44 is 2.6633e-02 P.S.U and the upper limit of the IQR is 3.16e-02 and the lower limit is 2.10e-02. After the outlier points are removed, the remaining primary values are compared to corresponding salinometer values and outliers are identified (Figure 15). The same comparison was made between the secondary sensor and the salinometer and an additional 4 erroneous values were removed before calculating coefficients for both sensors prior to after event 44 (Figure 16). The slope and intercept coefficients for both the primary and secondary sensors after event 44 are shown in Table 7. Figure 17 shows the difference between the 2 sensors both before and after correction.

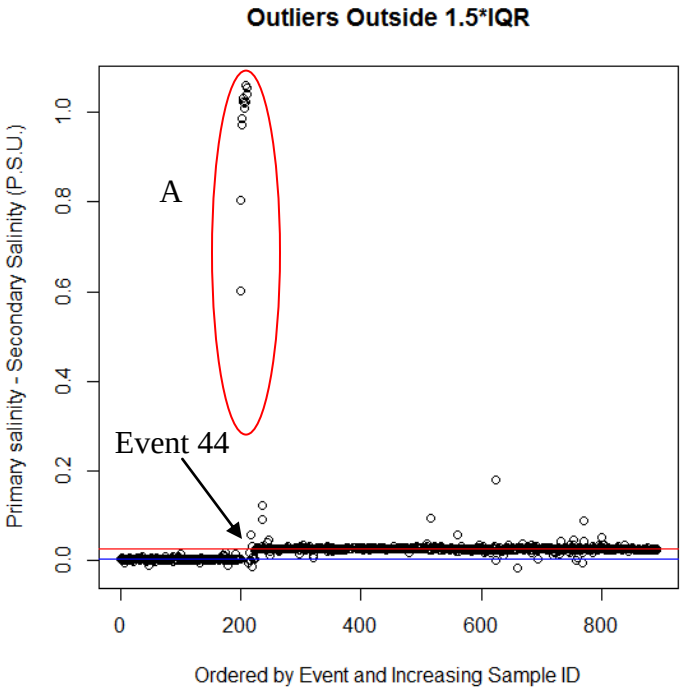


Figure 9. A) when the plumbing for both sensors was blocked during event 44 at BBL_07 (440467 to 440478). The mean sensor difference prior to event 44 was 0.00294 P.S.U (blue line) and the difference after event 44 was 0.02663 P.S.U. (red line).

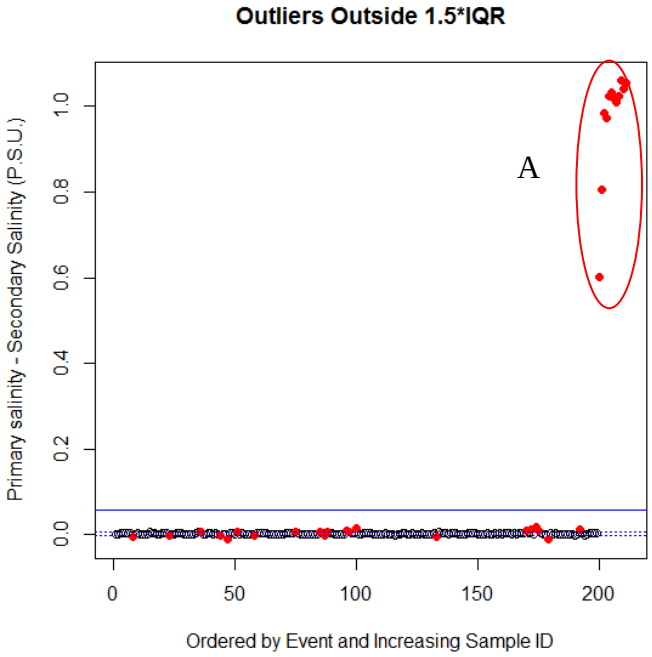


Figure 10. A) when the plumbing for both sensors was blocked during event 44 at BBL_07 (440467 to 440478). The mean difference (solid blue line skewed by the inclusion of event 44) is 5.784e-02 and the IQR upper limit is 6.5e-03 and the lower limit is -5.0e-04 (dotted blue lines).

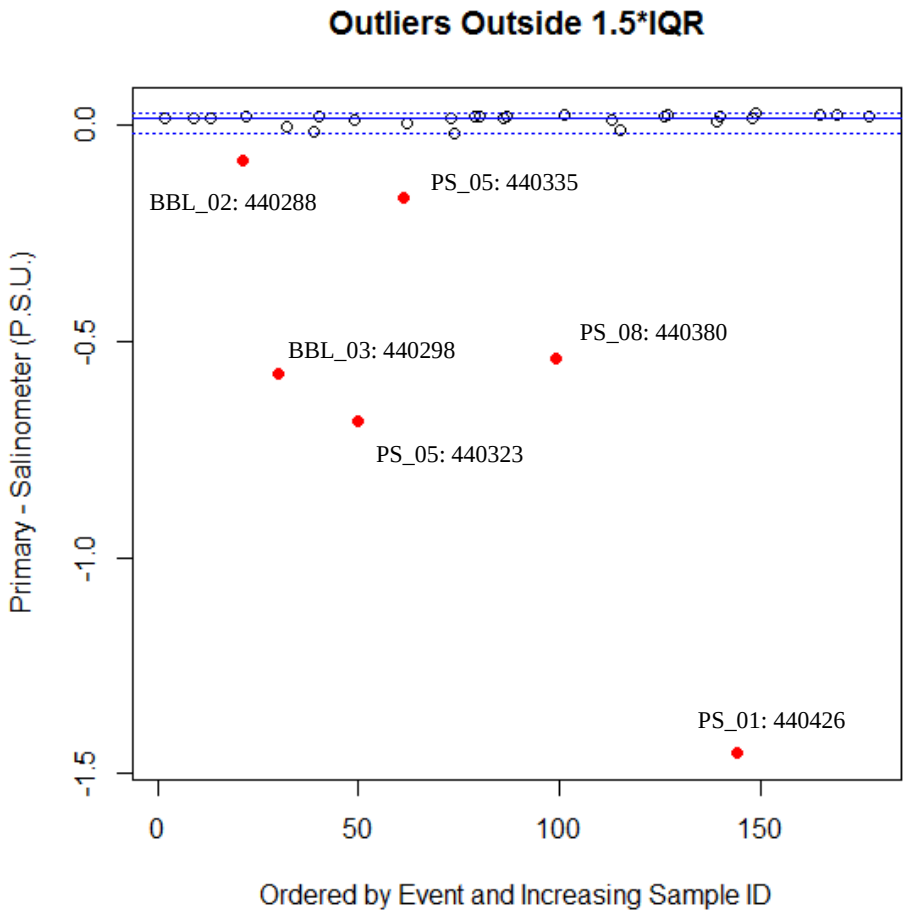


Figure 11. The difference between the primary sensor (#3562) and the salinometer after the removal of erroneous sensor data prior to event 45. Six erroneous values were removed prior to proceeding. The mean difference (solid blue line) between the primary and salinometer was 1.58e-02 and the IQR upper limit is 2.53e-02 and the lower limit is -2.11e-02 (dotted blue lines).

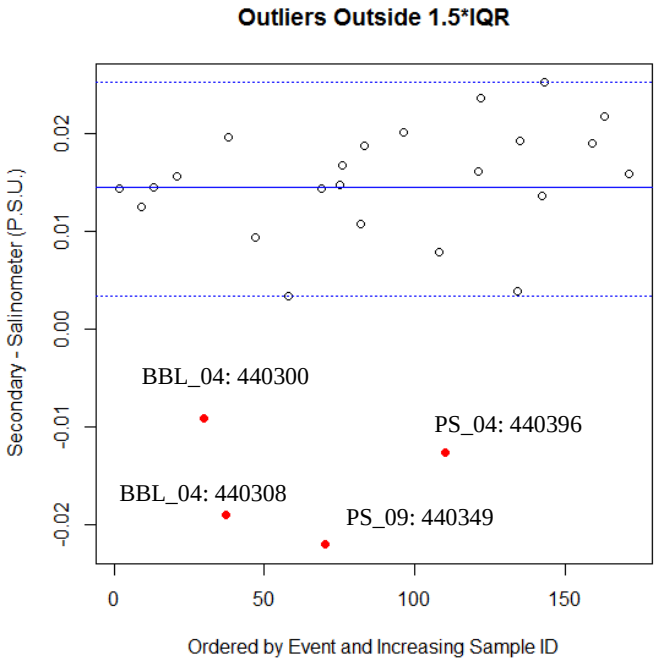


Figure 12. The difference between the secondary sensor (#1076) and the salinometer after the removal of erroneous sensor data prior to event 45. Four erroneous values were removed prior to proceeding. The mean difference (solid blue line) between the primary and salinometer was 1.45e-02 and the IQR upper limit is 2.52e-02 and the lower limit is -3.30e-03 (dotted blue lines).

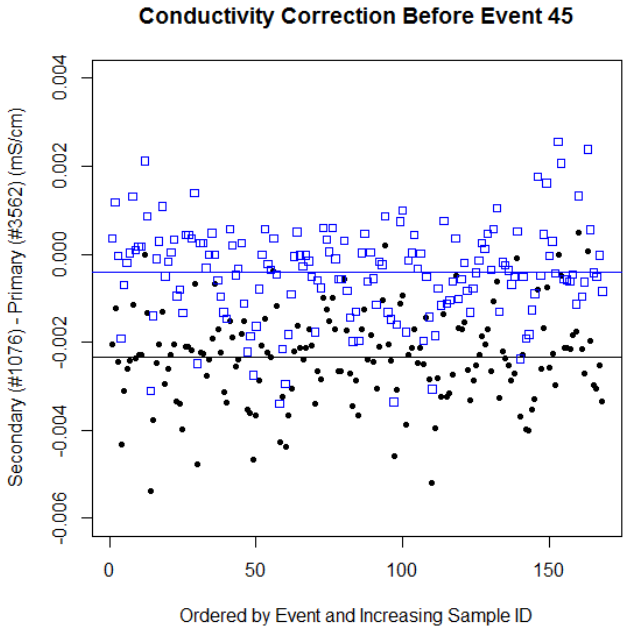


Figure 13. Before correction with new coefficients (black dots), the average difference between secondary (#1076) and primary (#3562) conductivity was ~2.3259e-03 mS/cm (solid black line). After correction, the average difference between sensors was 4.1477e-04.

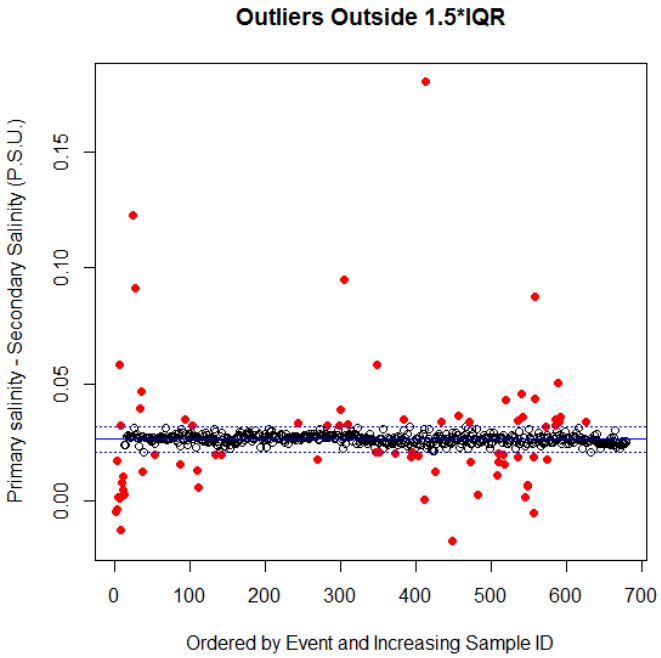


Figure 14. The mean difference between the primary and secondary sensors after event 44 is 2.66e-02 (solid blue line), the IQR upper limit is 3.16e-03 and the lower limit is -2.10e-02 (dotted blue lines).

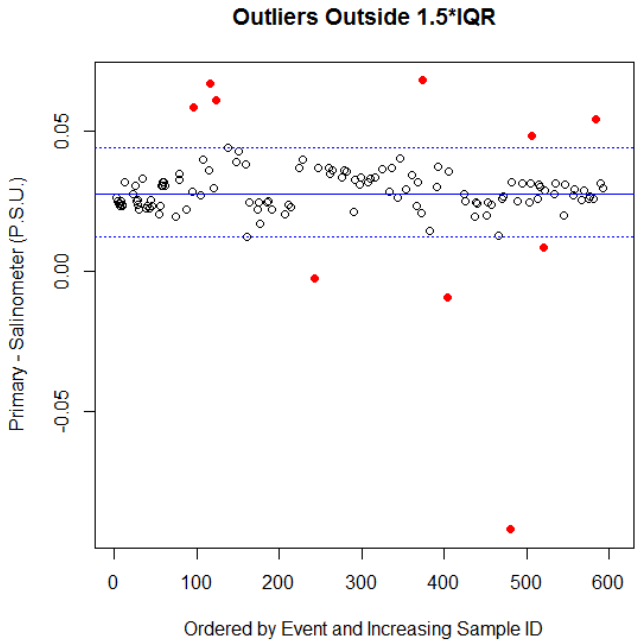


Figure 15. The difference between the primary sensor (#3562) and the salinometer after the removal of erroneous sensor data after event 44. 13 erroneous values were removed prior to proceeding (Sample IDs: 441015, 440927, 440748, 441071,440894, 440618, 440627, 440597, 441136, 441050). The mean difference (solid blue line) between the primary and salinometer was 2.73e-02 and the IQR upper limit is 4.38e-02 and the lower limit is -1.22e-02 (dotted blue lines).

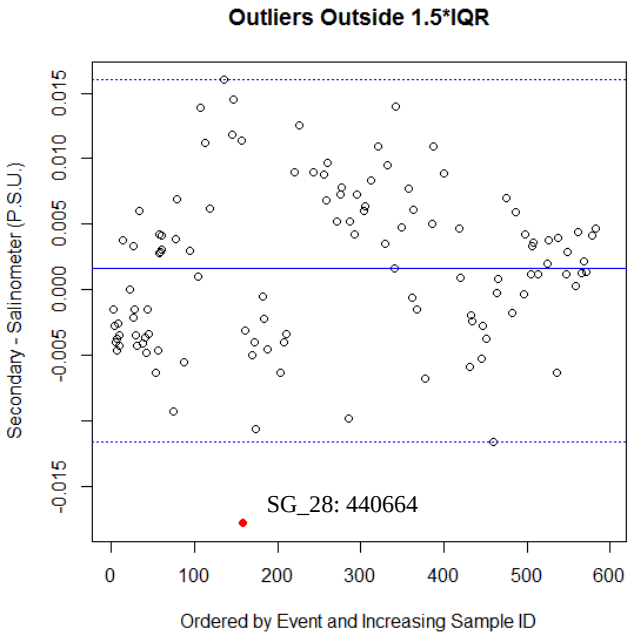


Figure 16. The difference between the secondary sensor (#1076) and the salinometer after the removal of erroneous sensor data after event 44. Four erroneous values were removed prior to proceeding. The mean difference (solid blue line) between the primary and salinometer was 1.6e-03 and the IQR upper limit is 1.60e-02 and the lower limit is –1.16e-02 (dotted blue lines).

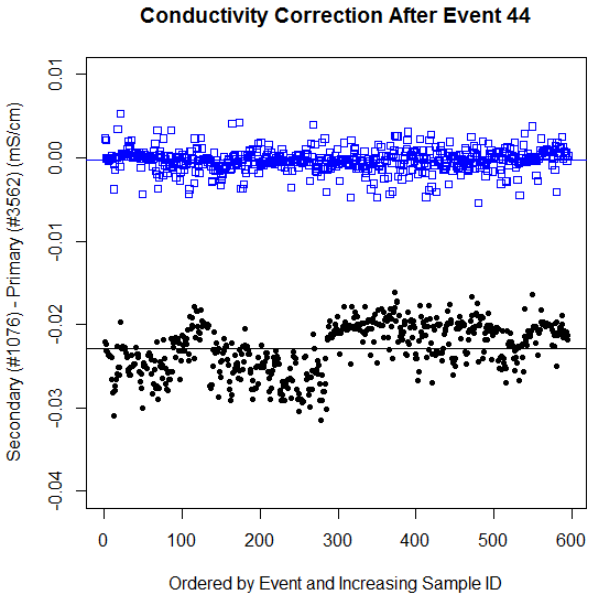


Figure 17. Before correction with new coefficients (black dots), the average difference between secondary (#1076) and primary (#3562) conductivity was -2.2833e-02 mS/cm (solid black line). After correction, the average difference between sensors was -2.9730e-04.

Table 7. The revised intercept (b1) and slope (b2) terms calculated for both the primary (#3562) and secondary (#1076) conductivity sensors from COR2017001 (before and after event 45.

Segment	Conductivity Sensor	b1	b2
Prior to event 45	Primary (#3562)	8.5651e-03	0.999265
	Secondary (#1076)	-1.5930e-02	0.999091
After event 44	Primary (#3562)	-5.6168e-03	0.999418
	Secondary (#1076)	-3.1973e-03	1.000051

Chlorophyll a

Throughout the mission, ChlA was measured in-situ via a SeaPoint fluorometer (SN: 6210 – calibrated Jan 1, 2015) attached to the CTD rosette (Appendix 3A). Duplicate samples were regularly taken for ChlA analysis with a Turner Fluormeter (1 out of 521 samples had no replicates for a total of 520 replicates). A comparison of the replicates showed that while the mean difference between replicates was 0 µg/L, there were a total of 83 out of 520 replicates that would be considered outliers (Figure 18). Outliers were selected via the 1.5 * interquartile range (1.5 IQR) method discussed in the previous oxygen and salinity sections of this report. These outliers were removed before making the comparison between the SeaPoint sensor values and the Turner sensor values.

Similar outlier identification methodology was employed to remove data that showed larger than expected differences between the SeaPoint sensor and the Turner Fluorometer data (Figure 19). First, both the SeaPoint data and the Turner data were standardized by dividing both data sets by the SeaPoint data value. This made each SeaPoint data value for a bottle fire equal to 1, and the corresponding mean replicate Turner fluorometer value a percentage of the SeaPoint value. A value of 1.15 means that the Turner Fluorometer value was 15% greater than its corresponding SeaPoint value and a value of 0.85 means that the Turner value was 15% less than the SeaPoint value. This was done, because calculating the straight difference between values was influenced greatly by their magnitude. The difference between 0.01 and 0.1 and the difference between 6.31 and 6.4 are both 0.09, but the relative difference is ~90% and ~1.4 % respectively. Figure 19 shows the outliers calculated in this way. Out of 438 comparisons between the CTD sensor and the mean of the Turner Fluorometer replicates, 10 outliers were identified and removed before proceeding. The blue line shows that on average, Turner Fluorometer values are ~2.36 % greater than their corresponding SeaPoint sensor values. Points are considered outliers if fluorometer values are 130% less than or 84% greater than corresponding SeaPoint sensor values. (Figure 19).

When the outliers are removed and a linear regression is applied to the log/log relationship between the CTD sensor and the mean replicates (Figure 20) the fit is strong and significant (R-squared: 0.8464, $p<2.2e-16$).

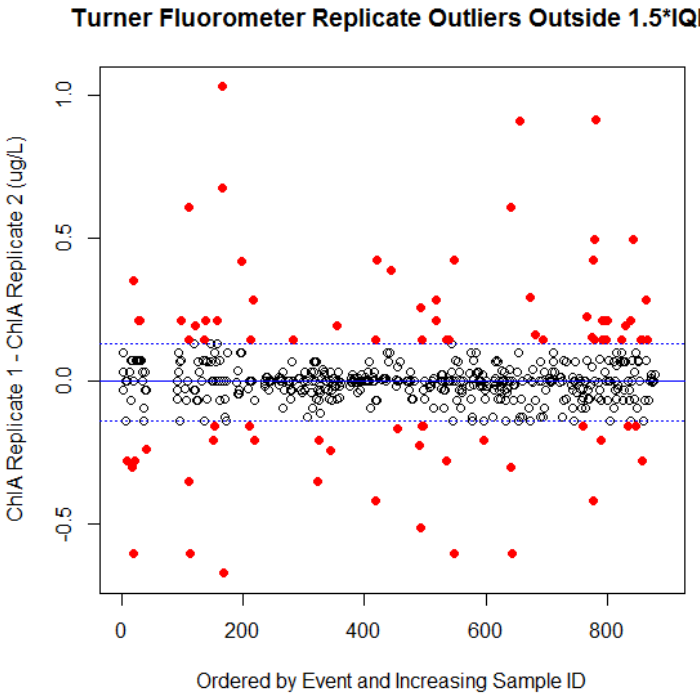


Figure 18. The outlier Turner replicates removed prior to determining the relationship between the Turner Fluorometer values and the SeaPoint sensor values collected during the COR2017001 mission. The mean difference is 0 µg/L, the upper limit of 1.5* IQR is 1.29 µg/L and the lower limit is -1.41 µg/L.

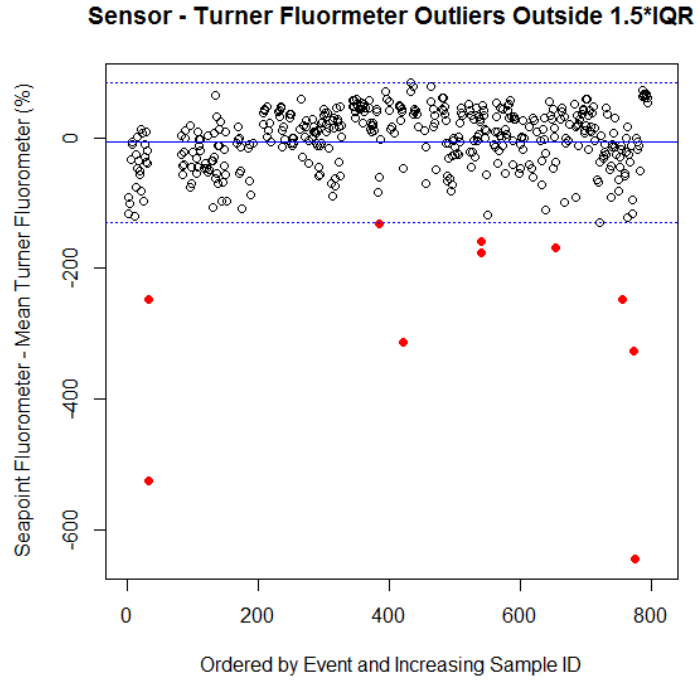


Figure 19. The outliers identified from calculating the % difference between Turner Fluorometer values and the SeaPoint sensor values collected during the COR2017001 mission.

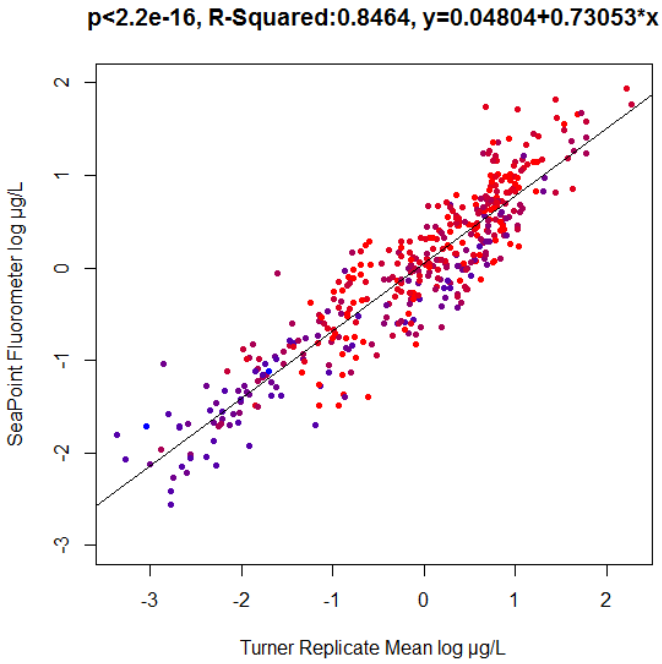


Figure 20. The log/log plot of SeaPoint Fluorometer values and the corresponding mean replicate Turner Fluorometer values colour coded by depth, where red and dark red are shallow (closer to the surface) and purple and blue are deep (closer to 100 m).

Water Samples for Chemical Analyses

Station specific rosette bottle firing depths and water collections for chemical analysis can be found by referring to the CTD deck sheet binder and/or water chemistry sampling document prepared upon the conclusion of the mission and provided to ODIS. Table 6 highlights CTD casts where water collections were made.

pH Sensor

The pH sensor (#1137, calibrated January 18, 2017) was deployed on the rosette only when the maximum depth was less than or equal to ~1250 m. The CTD casts for which it was deployed are noted in Table 5. The sensor was included during the mission to support an ACCASP initiative investigating the delineation of ocean acidification and calcium carbonate saturation state of the Atlantic zone.

Biological Program

Narrative

The "core" biological program conducted as part of cruise COR2017001, with some modifications, was a continuation of studies began in pre-AZMP years to describe the large-scale (spatial and temporal) variability in plankton biomass, productivity and biogenic carbon inventories on the Scotian Shelf.

The program currently consists of essentially 2 elements:

1. mesozooplankton community structure, population growth and biomass, and
2. dissolved organic carbon measurements

Table 5 provides a review of the stations where water samples were taken from rosette bottles for element 2 above. The mesoplankton sampling program is described below in more detail. This is followed by descriptions of "non-core" or ancillary biological sampling that includes text describing water sampling efforts in support of projects investigating: organic and organometallic micronutrients and their influence on primary productivity and phytoplankton community structure on the Scotian Shelf (Erin Bertrand – Dalhousie University), organic content of surface samples and their ability to form cloud droplets to study the climate impact of organics in sea spray aerosol (Rachel Chang – Dalhousie University), and water samples from strategic locations and depths to support a microbial community analysis via DNA, RNA and flow cytometry. The Biological Program section is concluded with a summary of pelagic seabird and marine mammal observations during COR2017001, provided by Carina Gjerdrum of the Canadian Wildlife Service.

The ultimate aim of "core" studies is twofold:

1. to provide a description of the inventories of biogenic carbon, their turnover rates and variability in space and time as part of Ocean Ecosystem Science Division's (OESD) continuing climate studies, and
2. to provide a description of plankton life-cycles and productivity on the Scotian Shelf and its influence or contribution to ecosystems in support of OESD's ecosystem-related research.

Mesozooplankton Sampling

Remarks/Comments

In order to estimate the mesozooplankton community abundance and biomass, a conical ring net of 202 µm mesh size with an aperture of 75 cm in diameter (filtering ratio 1:5) equipped with a KC Denmark flow-meter was towed vertically from the bottom to the surface at most stations (or from a maximum depth of 1000m – AZMP standard). In total, there were 66 vertical ring net tows during the mission (Table 8, Figure 21). Of these, 2 were 76 µm mesh tows (30 cm diameter and 1:5 filtering ratio) at HL_02 (events 71 and 172). The 76 µm net tows at HL_02 serve the same purpose of quantifying the community but targets a smaller fraction of the mesozooplankton community (i.e. smaller developmental stages, eggs and nauplii). Regardless of the mesh size, contents of the cod end were preserved in 4% buffered formaldehyde. 34 of the 202 µm mesh tows were conducted at stations along core AZMP sections (HL, BBL, CSL and LL) (Table 8). The remaining 30 casts were conducted at ancillary stations throughout the mission (Figure 21).

Five out of 66 casts were aborted for various reasons. Early in the mission at BBL_02, 3 consecutive casts were aborted (events 7 – 9) because the block positioned on the aft a-frame had a shallow groove so that in even moderately rough conditions, the wire would

jump the block. Given the height of the a-frame, fixing the problem each time resulted in significant delays so an alternative deployment method was developed. Unfortunately, no biological sample was acquired at BBL_02. All subsequent nets were deployed using a 22" deck mounted metering block that sent the wire through a snatch block on the port side Hiab crane. It was time consuming to deploy the nets in this fashion, but only 2 more aborted casts were experienced throughout the remainder of the mission (event 55 at HL_06.3 and event 170 at HL_02). Event 55 was aborted because the net had disconnected from the cross bow, and event 170 was aborted because the wire had jumped the deck mounted block in rough weather.

At the end of the mission a single "live tow" was conducted during event 173 at HL_02 for Laura Helenius who is working with Dr. Catherine Johnson on a *C. finmarchicus* egg production study. This sample was also opportunistically sampled for *C. hyperboreus* and *C. glacialis* for genetics analysis. These live samples were provided immediately to Laura upon our return to BIO on May 3rd.

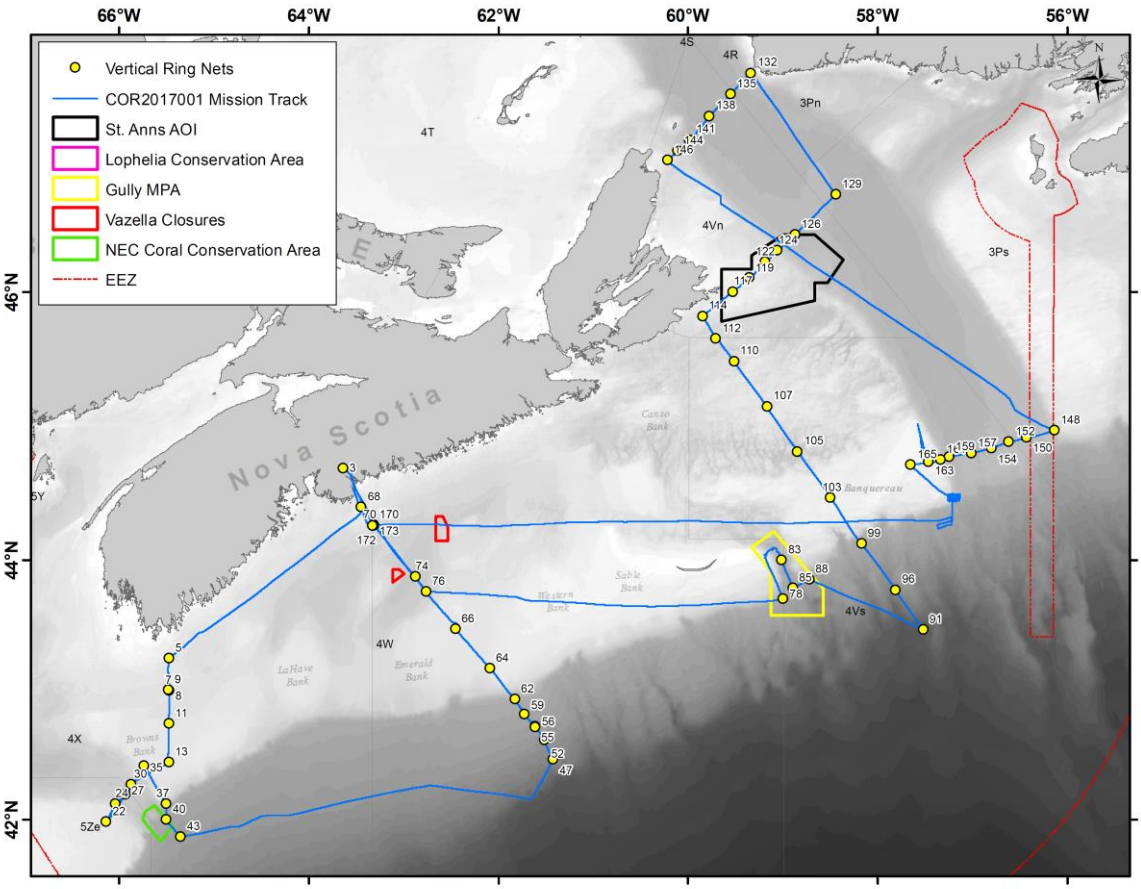


Figure 21. Locations for vertical ring net tows during COR2017001 AZMP spring survey. Each tow is labelled with the consecutive mission event.

Table 8. Zooplankton collection activities during the COR2017001 AZMP spring survey. The coordinates provided are in decimal degrees and reflect the ship's position at the time of deployment. Bold rows are tows that were aborted.

#	Event	Date	Station	Operation	Mesh Size (µm)	Slat (DD)	SLong (DD)	Objective	Comment
1	3	18/04/2017	HL_00	RingNet	200	44.6900	-63.6365		
2	5	19/04/2017	BBL_01	RingNet	200	43.2517	-65.4761	1	
3	**7**	**19/04/2017**	**BBL_02**	**RingNet**	**200**	**43.0025**	**-65.4738**	**1**	**Wire jumped block in A-Frame and had to be cut to be removed. Weight added to net for next cast.**
4	**8**	**19/04/2017**	**BBL_02**	**RingNet**	**200**	**43.0046**	**-65.4716**	**1**	**Could not obtain a good wire angle so ship repositioned for another try.**
5	**9**	**19/04/2017**	**BBL_02**	**RingNet**	**200**	**43.0093**	**-65.4766**	**1**	**The net jumped the block again and nets for BBL_02 were dropped to reconfigure the net deployment system on the way to the next station.**
6	11	19/04/2017	BBL_03	RingNet	200	42.7507	-65.4759	1	Deployed the net using the 22" metering block mounted to the deck and using the port side Hiab crane.
7	13	19/04/2017	BBL_04	RingNet	200	42.4506	-65.4756	1	
8	22	19/04/2017	PS_10	RingNet	200	41.9864	-66.1377	3	
9	24	20/04/2017	PS_08	RingNet	200	42.1237	-66.0358	3	
10	27	20/04/2017	PS_06	RingNet	200	42.1999	-65.9348	3	
11	30	20/04/2017	PS_04	RingNet	200	42.2744	-65.8722	3	
12	35	20/04/2017	PS_01	RingNet	200	42.4240	-65.7378	3	
13	37	20/04/2017	BBL_05	RingNet	200	42.1258	-65.4994	1	
14	40	20/04/2017	BBL_06	RingNet	200	42.0002	-65.5014	1	
15	43	20/04/2017	BBL_07	RingNet	200	41.8664	-65.3511	1	
16	47	21/04/2017	HL_07	RingNet	200	42.4734	-61.4242	1	
17	52	22/04/2017	HL_06.7	RingNet	200	42.6246	-61.5163		
18	**55**	**22/04/2017**	**HL_06.3**	**RingNet**	**200**	**42.7263**	**-61.6175**		**Net not attached to cross bow and hanging from the cod end upon return and was redone.**

19	56	22/04/2017	HL_06.3	RingNet	200	42.7233	-61.6147	
20	59	22/04/2017	HL_06	RingNet	200	42.8240	-61.7256	1
21	62	22/04/2017	HL_05.5	RingNet	200	42.9367	-61.8272	
22	64	23/04/2017	HL_05	RingNet	200	43.1767	-62.0929	1
23	66	23/04/2017	HL_04	RingNet	200	43.4753	-62.4553	1
24	68	23/04/2017	HL_01	RingNet	200	44.3993	-63.4497	1
25	70	23/04/2017	HL_02	RingNet	200	44.2662	-63.3181	1
26	71	23/04/2017	HL_02	RingNet	76	44.2648	-63.3167	1
27	74	24/04/2017	HL_03	RingNet	200	43.8775	-62.8770	1
28	76	24/04/2017	HL_03.3	RingNet	200	43.7593	-62.7659	
29	78	24/04/2017	SG_28	RingNet	200	43.7051	-59.0008	2
30	83	25/04/2017	GULD_03	RingNet	200	44.0019	-59.0173	2
31	85	25/04/2017	GULD_04	RingNet	200	43.7882	-58.9002	2
32	88	25/04/2017	SG_23	RingNet	200	43.8552	-58.7237	2
33	91	25/04/2017	LL_09	RingNet	200	43.4713	-57.5237	1
34	96	26/04/2017	LL_08	RingNet	200	43.7745	-57.8170	1
35	99	26/04/2017	LL_07	RingNet	200	44.1255	-58.1733	1
36	103	26/04/2017	LL_06	RingNet	200	44.4732	-58.5042	1
37	105	27/04/2017	LL_05	RingNet	200	44.8173	-58.8486	1
38	107	27/04/2017	LL_04	RingNet	200	45.1543	-59.1704	1
39	110	27/04/2017	LL_03	RingNet	200	45.4885	-59.5172	1
40	112	27/04/2017	LL_02	RingNet	200	45.6548	-59.7103	1
41	114	27/04/2017	LL_01	RingNet	200	45.8216	-59.8503	1
42	117	27/04/2017	STAB_01	RingNet	200	45.9995	-59.5284	9
43	119	27/04/2017	STAB_02	RingNet	200	46.1040	-59.3583	9
44	122	27/04/2017	STAB_03	RingNet	200	46.2164	-59.1897	9
45	124	27/04/2017	STAB_04	RingNet	200	46.3007	-59.0593	9
46	126	28/04/2017	STAB_05	RingNet	200	46.4166	-58.8763	9
47	129	28/04/2017	STAB_06	RingNet	200	46.7052	-58.4471	9
48	132	28/04/2017	CSL_06	RingNet	200	47.5759	-59.3382	1
49	135	28/04/2017	CSL_05	RingNet	200	47.4271	-59.5548	1
50	138	28/04/2017	CSL_04	RingNet	200	47.2703	-59.7769	1
51	141	29/04/2017	CSL_03	RingNet	200	47.1002	-59.9888	1
52	144	29/04/2017	CSL_02	RingNet	200	47.0218	-60.1156	1

53	146	29/04/2017	CSL_01	RingNet	200	46.9552	-60.2166	1	
54	148	30/04/2017	BP_01	RingNet	200	44.9751	-56.1413	11	
55	150	30/04/2017	BP_02	RingNet	200	44.9203	-56.4356	11	
56	152	30/04/2017	BP_05	RingNet	200	44.8891	-56.6217	11	
57	154	30/04/2017	BANQ_B6	RingNet	200	44.8413	-56.8060	11	
58	157	30/04/2017	BANQ_B5	RingNet	200	44.8038	-57.0201	11	
59	159	30/04/2017	BANQ_B4	RingNet	200	44.7762	-57.2503	11	
60	161	30/04/2017	BANQ_B3	RingNet	200	44.7568	-57.3406	11	
61	163	01/05/2017	BANQ_B2	RingNet	200	44.7395	-57.4700	11	
62	165	01/05/2017	BANQ_B1	RingNet	200	44.7170	-57.6557	11	
63	**170**	**03/05/2017**	**HL_02**	**RingNet**	**200**	**44.2634**	**-63.3210**	**1**	**Wire jumped the block and the tow was aborted and attempted again.**
64	171	03/05/2017	HL_02	RingNet	200	44.2629	-63.3225	1	
65	172	03/05/2017	HL_02	RingNet	76	44.2628	-63.3239	1	
66	173	03/05/2017	HL_02	RingNet	200	44.2614	-63.3260	16	

Microbial Protein and Organic Micronutrient Sampling

Principle Investigator: Dr. Erin Bertrand (Dalhousie University, Department of Biology)
Sampling by: Carolyn Kachuk, Hugo Arriojas (Dalhousie University)

Objective

To collect underway and rosette samples for protein and vitamin analyses in order to determine whether and how organic and organometallic micronutrients influence primary productivity and phytoplankton community structure on the Scotian Shelf. Sampling locations were coordinated with the LaRoche lab since our data types are synergistically informative.

Microbial Protein Sampling

Purpose

Proteins are key to microbial activity: the type and amount of proteins present determines, in large part, the contributions microbes make to the ecosystems they occupy. Proteins can also be used as indices for nutritional status: elevated expression of specific proteins can be diagnostic for different nutritional states, such as nitrogen starvation, iron starvation, or vitamin starvation. Protein sequences also contain taxonomic information and can be used to assess contributions of different organisms to specific functions.

Samples were collected for targeted, mass spectrometry- based proteomic analyses of microbial communities in order to characterize the role of organic micronutrients in structuring phytoplankton communities on the Scotian Shelf. Primary objectives include measuring phytoplankton nutritional status indicator proteins (nitrogen, vitamin B_{12}, vitamin B_1 starvation) and vitamin- production biomarker proteins. Development and application of peptides for primary producer community composition analyses is a secondary focus.

Sampling Methods

10L samples: A total of 70 size- fractionated microbial protein samples (10L of water each) were taken from the CTD rosette at depths ranging from the surface to 300 m depth (Table 9) along the Halifax Line, Browns Bank Line, Gully Line, St. Anns Bank Line, Cabot Strait Line, Banquereau and Brian Petrie Lines, and the Louisburg Line. In each case, water was pre-filtered (330 µm) while dispensing from the Niskin bottle into 10L carboys. Water was then filtered through 3 and 0.2 µm polycarbonate filters via peristaltic pumping. Filters were then frozen immediately at -80°C. Additional samples were added to stations when time and space allowed (such as BANQ_B1 and BANQ_B3). All planned samples were collected.

Vitamin Sampling

Purpose

To determine the particulate and dissolved concentrations of organic and organometallic micronutrients on the Scotian Shelf. Organic and organometallic micronutrients are required by many phytoplankton groups and only produced by a select few microbes, setting up a series of interactive dependencies between microbial groups. The importance of these dependencies are not well known, as they have not yet been studied on the Scotian Shelf. Measuring the concentrations of these micronutrients in the particulate and dissolved phases is one step towards understanding the role of microbial interactions in driving primary productivity and phytoplankton community structure.

Sampling Methods

A total of 70 particulate and 57 dissolved vitamin samples (1L each) were taken from the CTD rosette at depths ranging from the surface to 300 m depth along the Halifax, Browns Bank, Gully, and Louisburg lines (Table 9). Samples were protected from light and gently vacuum filtered through 0.2 µm nylon filters. Filters were frozen at -80°C and dissolved samples were frozen in amber HDPE bottles at -20°C. Sampling was planned for more stations but was not possible, as described above for protein sampling.

Nutrient Limitation Sampling

Purpose

To assess whether there may be B-vitamin and nitrogen limitation or B-vitamin and nitrogen co-limitation at Station HL_02

Sampling Methods

40 L of water was taken from rosette bottles at HL_02 at 5 m on the return trip (event 176). This water was added to 300 mL polycarbonate bottles, stored at 4°C and immediately transferred to Dalhousie University upon docking. There, triplicate bottles were supplemented with +/- nitrate, +/- vitamin B_{12}, +/- vitamin B1 and incubated at in-situ temperature under cool white LED lights simulating 5m depth. Biomass production and community composition was assessed over the course of 5 days; evidence for nitrogen and B-vitamin co-limitation was found.

Table 9. Protein and vitamin sampling, Bertrand Lab COR2017001.

Station	Depth (m)	Event	Sample ID	Protein Sample	Vitamin Sample	dVitamin Sample
BBL_01	1	6	440279	1	1	1
BBL_01	40	6	440272	1	1	1
BBL_05	1	39	440451	1	1	1
BBL_05	20	39	440448	1	1	1
BBL_05	40	39	440446	1	1	1

BBL_05	80	39	440444	1	1	1
BBL_07	1	45	440490	1	1	1
BBL_07	20	45	440485	1	1	1
BBL_07	40	45	440481	1	1	1
BBL_07	80	46	440491	1	1	1
HL_07	1	49	440516	1	1	1
HL_07	20	49	440511	1	1	1
HL_07	50	49	440506	1	1	1
HL_06	1	61	440575	1	1	1
HL_06	20	61	440571	1	1	1
HL_06	50	61	440566	1	1	1
HL_06	80	60	440561	1	1	1
HL_04	1	67	440608	1	1	1
HL_04	20	67	440603	1	1	1
HL_04	60	67	440599	1	1	1
HL_02	1	73	440640	1	1	1
HL_02	1	73	440638	1	1	1
HL_02	20	73	440637	1	1	1
HL_02	20	73	440635	1	1	1
HL_02	40	73	440634	1	1	1
HL_02	40	73	440632	1	1	1
HL_02	80	73	440631	1	1	1
HL_02	80	73	440629	1	1	1
GULD_04	1	87	440713	1	1	1
GULD_04	20	87	440708	1	1	1
GULD_04	40	87	440704	1	1	1
GULD_04	60	86	440701	1	1	1
GULD_04	100	86	440697	1	1	1
LL_09	1	93	440751	1	1	1
LL_09	20	93	440746	1	1	1
LL_09	80	92	440739	1	1	1
LL_09	250	92	440735	1	1	1
LL_07	1	101	440788	1	1	1
LL_07	20	101	440783	1	1	1
LL_07	80	100	440776	1	1	1
LL_07	250	100	440772	1	1	1
LL_07.1	10	102	440799	1	1	1
LL_07.1	20	102	440798	1	1	1
LL_07.1	80	102	440795	1	1	1
LL_07.1	250	102	440791	1	1	1
LL_04	1	109	440837	1	1	1

LL_04	20	109	440835	1	1	1
LL_04	40	109	440833	1	1	1
LL_04	80	109	440831	1	1	1
LL_01	1	116	440877	1	1	1
LL_01	20	116	440875	1	1	1
LL_01	40	116	440873	1	1	1
LL_01	60	116	440871	1	1	1
STAB_06	1	131	440950	1	1	-
STAB_06	20	131	440945	1	1	-
STAB_06	50	131	440941	1	1	-
STAB_06	80	130	440938	1	1	-
CSL_04	1	140	441002	1	1	-
CSL_04	20	140	440997	1	1	-
CSL_04	60	139	440991	1	1	-
CSL_04	300	139	440983	1	1	-
BANQ_B3	1	162	441121	1	1	-
BANQ_B3	20	162	441117	1	1	-
BANQ_B3	40	162	441114	1	1	-
BANQ_B1	1	166	441135	1	1	-
BANQ_B1	20	166	441131	1	1	-
HL_02 RET	1	176	441158	1	1	1
HL_02 RET	5	176	441156	-	-	-
HL_02 RET	5	176	441155	-	-	-
HL_02 RET	5	176	441154	-	-	-
HL_02 RET	5	176	441153	-	-	-
HL_02 RET	20	176	441152	1	1	1
HL_02 RET	40	176	441150	1	1	1
HL_02 RET	80	176	441148	1	1	1

RET = return trip

Microbial Community Analysis

Principle Investigator: Dr. Julie LaRoche (Dalhousie University)
Sampling by: Carolyn Kachuk and Hugo Arriojas (Dalhousie University)

Microbial Community Analysis

Purpose

Microbial communities and their associated processes are the foundation of marine life. Of particular interest to our group is the marine nitrogen cycle, comprising complex microbially-driven reactions whereby atmospheric nitrogen is fixed into a biologically-available form and cycled through the ecosystem. Though nitrogen is an essential element for life, the availability of fixed nitrogen can be a limiting factor for primary production and thus diazotrophs – organisms capable of biological nitrogen fixation – can be key to the productivity of an ecosystem.

Samples were collected for genomic and fluorescence-based analyses of the microbial communities on the Scotian shelf. Community composition will be assessed via 16S (bacterial) & 18S (eukaryotic) tag sequencing, and the naturally-fluorescent population will be characterized via flow cytometry. The latter method can also be used to quantify the bacterial community via nucleic acid stain SYBR green. Community function will be assessed via metagenomic sequencing, and qPCR assays for selected functional genes. Further samples were taken for manipulation in the lab, including targeted metagenomics and single cell isolation via fluorescence-associated cell sorting (FACS), and enrichment culturing of putative diazotrophs. In parallel with the Bertrand lab, we have conducted nutrient addition experiments (Fe +PO4, vitamins) that are designed to test whether dissolved inorganic nitrogen depletion will shift the community composition toward microbial species that can fix dinitrogen gas.

Sampling Methods

Genomics:

At 14 select stations along core AZMP lines, duplicate 4L water samples were collected from the CTD rosette each of 4 depths ranging from the surface to 300 m (Table 10). During collection, water was pre-filtered through a 330 μm mesh to remove zooplankton. Each water sample was then sequentially filtered through 3 and 0.2 μm polycarbonate filters by peristaltic pump until the water was depleted or the filters clogged. Filters were immediately frozen at -80 °C. Samples have been collected at selected stations to provide time-series continuity with previous years (2014 and 2016).

Flow Cytometry:
At each station and depth where genomic samples were collected, duplicate 2mL water samples (330μm filtered) were fixed with 2% paraformaldehyde (PFA) for 10 minutes at room temperature, then frozen at -80°C for later enumeration of bacteria and

characterization of the naturally fluorescent microbial community via the Accuri C6 flow cytometer.

At select stations (Table 10), 45 ml of 330 μm-filtered water were mixed with 5 ml of gly-TE buffer and frozen at -80 °C for later cell sorting on the BD Influx FACS instrument.

Enrichment Cultures:
At select stations (Table 10), large (4L) 330 μm-filtered water samples were collected. These samples were spiked with phosphate (200 nM) and iron (2 nM) and stored in conditions approximating natural light/dark cycles and ambient temperature until return to the lab.

Table 10. Microbial community samples – LaRoche lab – AZMP Spring 2017.

Station	Event	Depth (m)	ID#	DNA	Flow cytometry	Sorting Flow Cytometry	4L Culture
BBL_01	6	1	440278	2	-	-	-
		40	440271	2	-	-	-
BBL_05	39	1	440450	-	-	1	1
		1	440449	2	2	-	-
		20	440447	2	2	-	-
		40	440445	2	2	-	-
		80	440443	2	2	-	-
BBL_07	45	1	440489	2	2	-	-
		1	440488	-	-	1	1
		20	440484	2	2	-	-
	46	40	440492	2	2	-	-
	44	80	440473	2	2	-	-
HL_07	49	1	440515	2	2	-	-
		1	440514	-	-	1	1
		20	440510	2	2	-	-
		50	440507	2	2	-	-
	48	80	440503	2	2	-	-
HL_06	61	1	440574	2	2	-	-
		1	440572/573	-	-	1	1
		20	440570	2	2	-	-
		50	440565	2	2	-	-
	60	80	440562	2	2	-	-
HL_04	67	1	440607	2	2	-	-
		20	440602	2	2	-	-
		60	440598	2	2	-	-
HL_02		1	440639	2	2	-	-

		20	440636	2	2	-	-
		40	440633	2	2	-	-
		80	440630	2	2	-	-
GULD_04	87	1	440712	2	2	-	-
		20	440707	2	2	-	-
	86	60	440700	2	2	-	-
		250	440695	2	2	-	-
LL_09	93	1	440750	2	2	-	-
		20	440745	2	2	-	-
	92	80	440738	2	2	-	-
		250	440734	2	2	-	-
LL_07	101	1	440787	2	2	-	-
		20	440782	2	2	-	-
	100	80	440775	2	2	-	-
		250	440771	2	2	-	-
LL_04	109	1	440836	2	2	-	-
		20	440834	2	2	-	-
		40	440832	2	2	-	-
		80	440830	2	2	-	-
LL_01	116	1	440876	2	2	-	-
		20	440874	2	2	-	-
		40	440872	2	2	-	-
		60	440870	2	2	-	-
STAB_06	131	1	440949	2	2	-	-
		20	440946	2	2	-	-
	130	80	440937	2	2	-	-
		200	440933	2	2	-	-
CSL_04	140	1	441001	2	2	-	-
		20	440996	2	2	-	-
	139	60	440990	2	2	-	-
		300	440982	2	2	-	-
HL_02 RET	176	1	441157	2	2	1	-
		5	441156	-	-	-	16 x 2L
			441155				
			441154				
			441153				
		20	441151	2	2	-	-
		40	441149	2	2	-	-
		80	441147	2	2	-	-

Pelagic Seabird and Marine Mammal Observations

Seabird Survey Report
18 April – May, 2017
Canadian Wildlife Service, Environment and Climate Change Canada
Prepared by: Carina Gjerdrum carina.gjerdrum@ec.gc.ca
Observer(s): Holly Hogan

Background

The east coast of Canada supports millions of breeding marine birds as well as migrants from the southern hemisphere and north-eastern Atlantic. In 2005, the Canadian Wildlife Service (CWS) of Environment Canada initiated the Eastern Canada Seabirds at Sea (ECSAS) program with the goal of identifying and minimizing the impacts of human activities on birds in the marine environment. Since that time, a scientifically rigorous protocol for collecting data at sea and a sophisticated geodatabase have been developed, relationships with industry and DFO to support offshore seabird observers have been established, and over 100,000 km of ocean track have been surveyed by CWS-trained observers. These data are now being used to identify and address threats to birds in their marine environment. In addition, data are collected on marine mammals, sea turtles, sharks, and other marine organisms when they are encountered.

Methods

Seabird and marine mammal surveys were conducted from the starboard side of the bridge of the Coriolis II during the spring Scotian Shelf AZMP from 18 April to 2 May, 2017. Surveys were conducted while the ship was moving at speeds greater than 4 knots, looking forward and scanning a 90° arc to one side of the ship. All birds observed on the water within a 300m-wide transect were recorded, and we used the snapshot approach for flying birds (intermittent sampling based on the speed of the ship) to avoid overestimating abundance of birds flying in and out of transect. Distance sampling methods were incorporated to address the variation in bird detectability. Marine mammal observations were also recorded, although surveys were not specifically designed to detect marine mammals. Details of the methods used can be found in the CWS standardized protocol for pelagic seabird surveys from moving platforms[1].

Results

Seabird sightings

We surveyed 1489 km of ocean from 18 April to 2 May, 2017. A total of 3521 birds were observed in transect (5413 birds in total) from 10 families (Table 11). Bird densities averaged 7.6 birds/km^2 (ranging from 0 - 2276 birds/km^2). The highest densities of birds (> 50 birds/km^2) were observed on Banquereau (Figure 22a).

Dovekie accounted for 96% of the sightings (Table 11), including flocks of up to 1300 birds. The Dovekie were primarily observed on Sable Bank on the approach to the Gully MPA, the shelf break, and the southern edge of Banquereau (Figure 22b). Dovekie breed in the millions in Greenland, so it is likely that these birds were on their way to their Arctic breeding colonies. Other Alcids observed in lower numbers included Thick-billed Murre and a few Atlantic Puffin (Table 11).

Herring Gull made up 2% of the birds observed, many of which were seen well offshore (Figure 22c), far from their breeding colonies on the NS mainland. Northern Fulmar (2% of the birds observed) were more common on the eastern Scotian Shelf compared to the western shelf (Figure 22d), presumably heading for breeding colonies further north (NL and eastern Arctic). Northern Gannet comprised of 2% of the observations and were seen in low densities throughout the study area, also likely moving towards breeding colonies in NL and the Gulf of St. Lawrence. A complete list of all species observed can be found in Table 11.

Marine Mammal sightings

A total of 52 marine mammals were recorded during the surveys (Table 12), none of which occurred in the Gully MPA (Figure 23a). Long-finned Pilot Whales were the most common (54%; Table 12), observed primarily in the Northeast Channel (Figure 23a). Seals were also relatively common in this area (Figure 23a). A single unidentified turtle was sighted between Sable and Banquereau.

Gully MPA

Surveys were conducted within the Gully MPA in the afternoon of 24 April and the following morning on 25 April. A total of 29 birds were observed and but no marine mammals (Table 13). Bird sightings included Thick-billed Murre, Dovekie, and Northern Fulmar (Table 13; Figure 23b).

Table 11. List of bird species observed during surveys on the spring Scotian Shelf AZMP, from 18 April – 2 May, 2017.

Family	Species	Latin	Number observed in transect	Total number observed
Procellariidae	Northern Fulmar	*Fulmarus glacialis*	86	220
	Sooty Shearwater	*Ardenna griseus*	16	29
Hydrobatidae	Leach's Storm-Petrel	*Oceanodroma leucorhoa*	13	29
	Unidentified Storm-Petrels	Hydrobatidae	2	3
Phalacrocoracidae	Great Cormorant	*Phalacrocorax carbo*	1	1
Sulidae	Northern Gannet	*Morus bassanus*	54	112
Anatidae	Red-breasted Merganser	*Mergus serrator*	1	1
Charadriidae	Purple Sandpiper	*Calidris maritima*	0	1
Laridae	Pomarine Jaeger	*Stercorarius pomarinus*	2	5
	Unidentified Skuas	*Stercorarius* Skuas	0	1
	Black-legged Kittiwake	*Rissa tridactyla*	0	6
	Herring Gull	*Larus argentatus*	87	178
	Great Black-backed Gull	*Larus marinus*	9	22
	Iceland Gull	*Larus glaucoides*	1	6
	Glaucous Gull	*Larus hyperboreus*	1	1
	Unidentified Gulls	*Larus hyperboreus* or *glaucoides*	2	21
Alcidae	Dovekie	*Alle alle*	3381	5163
	Thick-billed Murre	*Uria lomvia*	102	140
	Common Murre	*Uria aalge*	0	8
	Unidentified Murres	*Uria*	23	72
	Atlantic Puffin	*Fratercula arctica*	3	3
	Unidentified Auks	Alcidae	10	23
Picidae	Northern Flicker	*Colaptes auratus*	1	1
Emberizidae	Song Sparrow	*Melospiza melodia*	0	1
	Unidentified songbirds	Passeriformes	1	2
TOTAL			**3521**	**5413**

Table 12. List of marine mammals observed during surveys on the spring Scotian Shelf AZMP, from 18 April – 2 May, 2017.

Species	Latin	Total number observed
Long-finned Pilot Whale (Blackfish)	*Globicephala melas*	28
Humpback Whale	*Megaptera novaeangliae*	3
Fin Whale	*Balaenoptera physalus*	2
Unidentified Whales	Balaenopteridae	1
White-beaked Dolphin	*Lagenorhynchus albirostris*	3
Unidentified Dolphins	Delphinidae	4
Gray Seal	*Halichoerus grypus*	10
Unindentified Turtle	Chelonioidea	1
TOTAL		**52**

Table 13. List of species observed in the Gully Marine Protected Area during surveys on the spring Scotian Shelf AZMP, from 18 April – 2 May, 2017.

Species	Latin	Number observed in transect
Dovekie	*Alle alle*	20
Thick-billed Murre	*Uria lomvia*	8
Northern Fulmar	*Fulmarus glacialis*	1
Total sightings		**29**

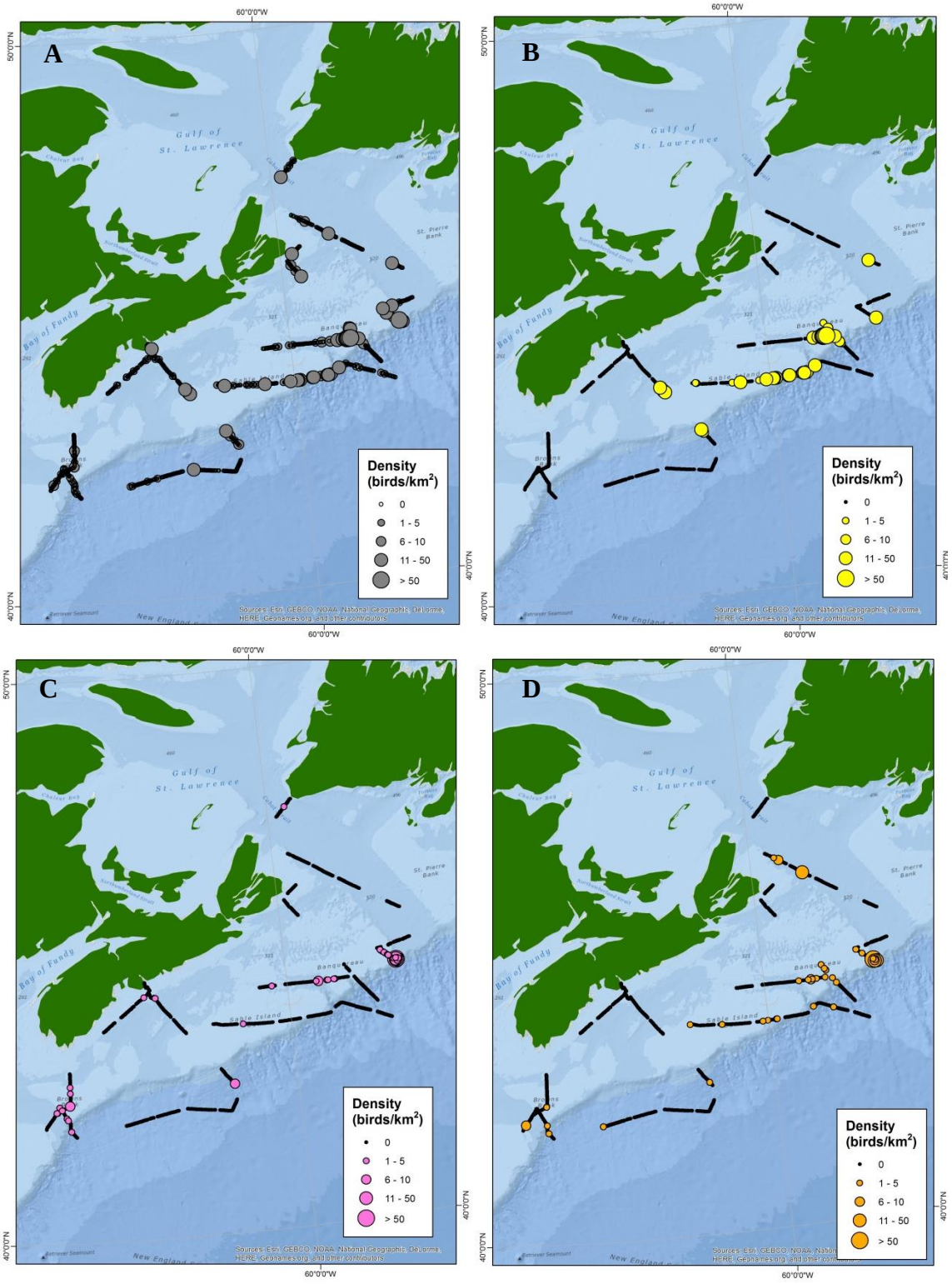


Figure 22. Density of A) all bird species combined, B) Dovekie, C) Herring Gull, and D) Northern Fulmar observed during the seabird survey on the spring Scotian Shelf AZMP, from 18 April – 2 May, 2017.

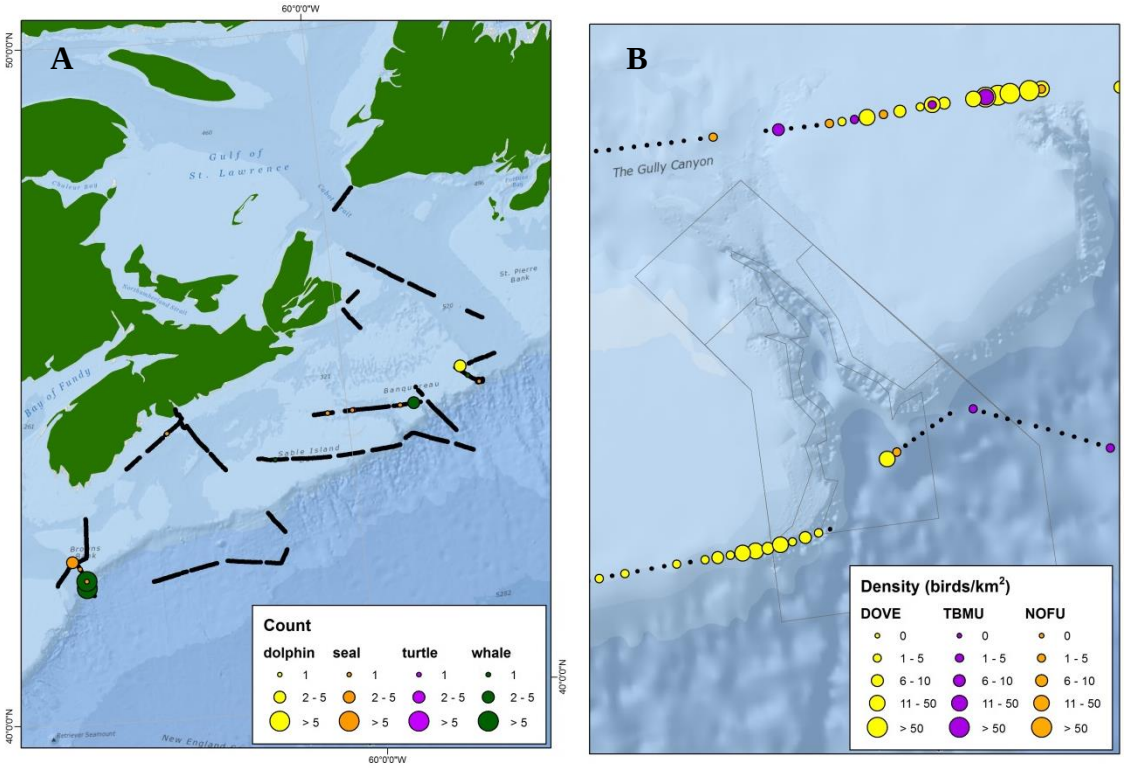


Figure 23. A) counts of marine mammals and B) density of Dovekie (DOVE), TBMU (Thick-billed Murre), and Northern Fulmar (NOFU) observed in the Gully Marine Protected Area on 24-25 April, 2017.

ARGO Float Deployments

Contributions by: Ingrid Peterson

Narrative

There were a total of 4 MetOcean ARGO floats deployed during the mission (Figure 24 and Table 14). As of May 30th, 2017 these floats continue to acquire data and their latest temperature profiles can be accessed on the following site by searching for their WMO numbers, 4902391-4902394 (Table 14).

http://www.argodatamgt.org/Access-to-data/Description-of-all-floats2

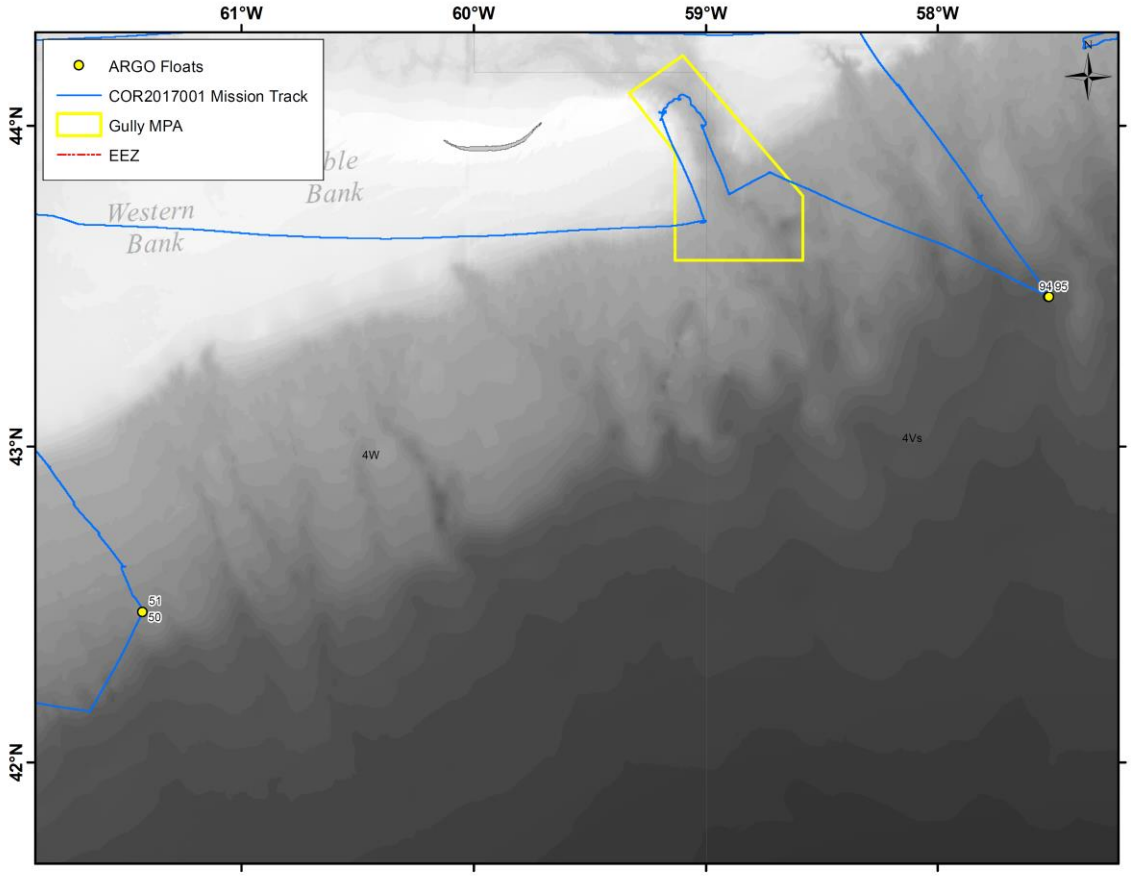


Figure 24. The locations for each Argo float deployment during COR2017001. Refer to Table 14 for more details.

Table 14. Details for Argo float deployments during COR2017001. The coordinates provided below are in decimal degrees and represent the ship's position at the time of deployment.

Date	Event	Station	Float Type	Float Deployed (UTC)	WMO #	S/N	Lat (DD)	Long (DD)
22/04/2017	50	HL_07	NOVA	04:39:19	4902393	429	42.4777	-61.4280
22/04/2017	51	HL_07	NOVA	04:43:42	4902394	430	42.4782	-61.4269
26/04/2017	94	LL_09	NOVA	04:46:19	4902391	427	43.4684	-57.5234
26/04/2017	95	LL_09	NOVA	04:51:44	4902392	428	43.4681	-57.5222

Underway Sampling

Contributions by: Robert Benjamin[1], Gilles Desmeules[2] and Julien Desrochers[3]
[1] Program Coordination and Support Division, DFO
[2] Université du Québec à Rimouski
[3] Le Centre Interdisciplinaire de Développement en Cartographie des Océans (CIDCO)

Navigation

Positional data and Date/time (GPGGA and GPZDA) from the ship's GPS was logged throughout the mission alone with sounding data from the ships EK60 scientific echo sounder. These data were logged at 1 Hz throughout the mission using NavNet, a data logging and distribution system designed by NRCAN. Prior to the ship's return to BIO, navigation data was converted into daily coordinate logs at 1 second intervals in both .csv and .shp formats.

Positional data from the ship's GPS was logged at 1 Hz throughout the mission using the Scientific Computer System (SCS) software developed by NOAA. The SCS software also logged the TSG data at 0.2 Hz or once every 5 seconds and the pC02 data at 1 Hz. Each serial feed to the SCS software was GMT time stamped as it was received. Both Navigation and Underway system logs were backed up daily to an external hard drive.

NOTE: The EK60 echo sounder is designed by Simrad. Details about the system can be found at www.simrad.com/ek60. The EK60 was setup with a three split beam transducer operating at 38 kHz, 120 kHz and 200 kHz. Sea floor bottom data was sent to the NavNet computer at 1 Hz in the standard SBBDT format. Other than the depth sounding data, the EK60 data was not logged throughout the mission.

Multibeam

Multibeam bathymetry data were collected throughout the mission by a dedicated multibeam technician aboard the vessel. A single multibeam survey was planned for the Gully MPA in the mission plan. The approval required to conduct this work in the Gully, and the restrictions imposed by permits, are discussed in the Mission Overview and details are provided in Appendix 1.

Upon arrival at the beginning of the planned start of the multibeam transect on April 25th at ~0530 AST, a sound velocity profile (SVP) was conducted (Figure 25 and Table 15). The Gully multibeam transect began at ~0545, with the vessel steaming ~6 kts and finished adjacent to GULD_03 (44.01 N, -59.00 W) at ~0900 on April 25th. The multibeam system was then turned off for the remainder of the time within the Gully MPA. Finally, a second SVP was conducted at the end of this transect prior to resuming monitoring activities at GULD_03 (Figure 25 and Table 15). The Gully MPA multibeam data collected was of 25 m resolution.

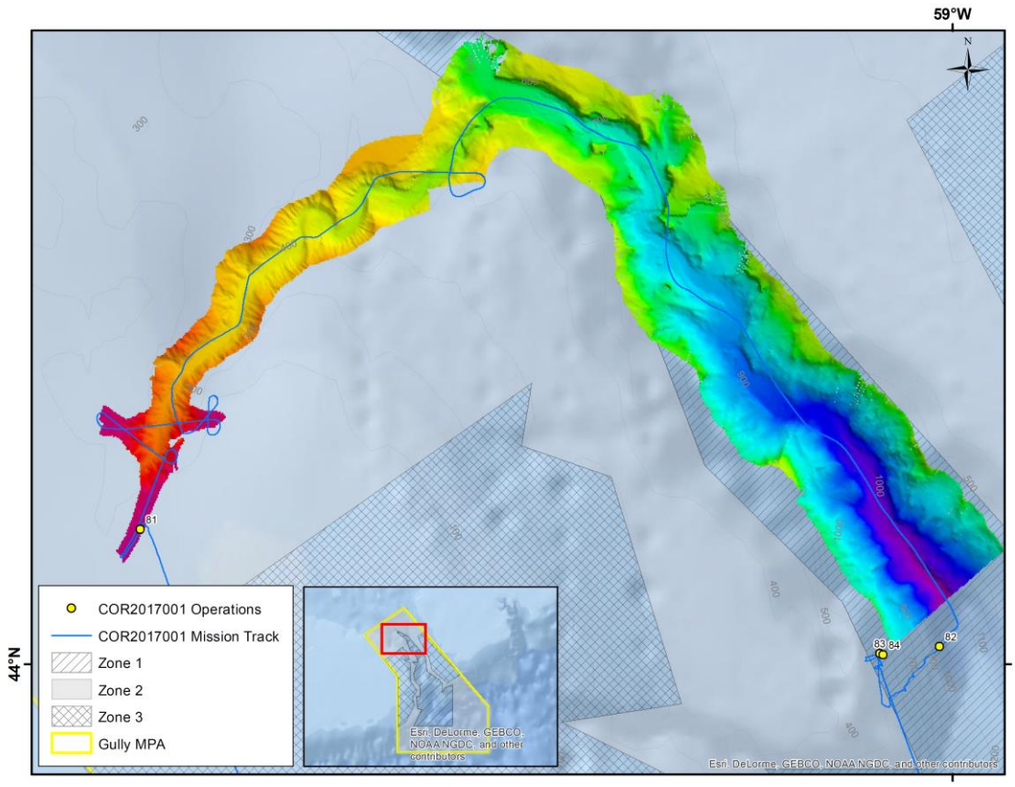


Figure 25. The multibeam survey of the Gully MPA. Note the sound velocity profiles conducted at the beginning (Event 81) and end (Event 82) of the survey. Events 83 and 84 are the CTD and net profile at GULD_03.

Table 15. The coordinates for the sound velocity profiles in the Gully MPA as part of the planned multibeam survey.

Date	Event	Station	Slat (DD)	Slong (DD)
25/04/2017	81	SVP_01	44.0229	-59.1919
25/04/2017	82	SVP_02	44.0030	-59.0033

The program also completed a second multibeam survey within a specified area encompassing the Stone Fence Lophelia Conservation Area (LCA). On April 24th, 9 days prior to the end of the mission, an e-mail was sent to Oceans and Coastal Management Division (OCMD) to determine their interest in, and the spatial extent of, a proposed multibeam survey near the LCA. Within an hour of sending the request to OCMD, we received a response identifying 2 possible survey extents (Figure 26). The first (a green rectangle) encompassed the LCA and ran adjacent to existing multibeam data to the south. The larger extent (purple rectangle) ran parallel to the existing multibeam data to the east and overlapped with the more northerly proposed survey extent around the LCA (Figure 26).

The multibeam work began at ~1544 on May 1st within the proposed bounds of the green rectangle around the LCA (Figure 26 and Table 16). The vessel travelled at ~6 kts to the south east and conducted 2 SVP at LCA_01 in the sourthern half of the LCA (Figure 26 and Table 16) before heading northeast towards the upper corner of the green rectangle and beginning a survey line across the LCA roughly in parallel with depth contours, from east to west. Once completed the vessel then commenced the the western half of the multibeam survey within the green rectangle in north to south lines that were roughly in parallel with the prevailing slope in this area (Figure 26). The green rectangle was completed at roughly 0300 on May 1st before the ship began the steam southeast towards the beginning of the line heading south on the eastern most margin of the larger extent. The vessel then continued on east/west survey lines (generally moving north) until the ship began the steam to HL_02 (0830 May 1st), arriving at the COVE by the morning of May 3rd. The multibeam data collected resulted in data that was of 10 and 25 m resolution for the green and purple rectangular extents, respectively.

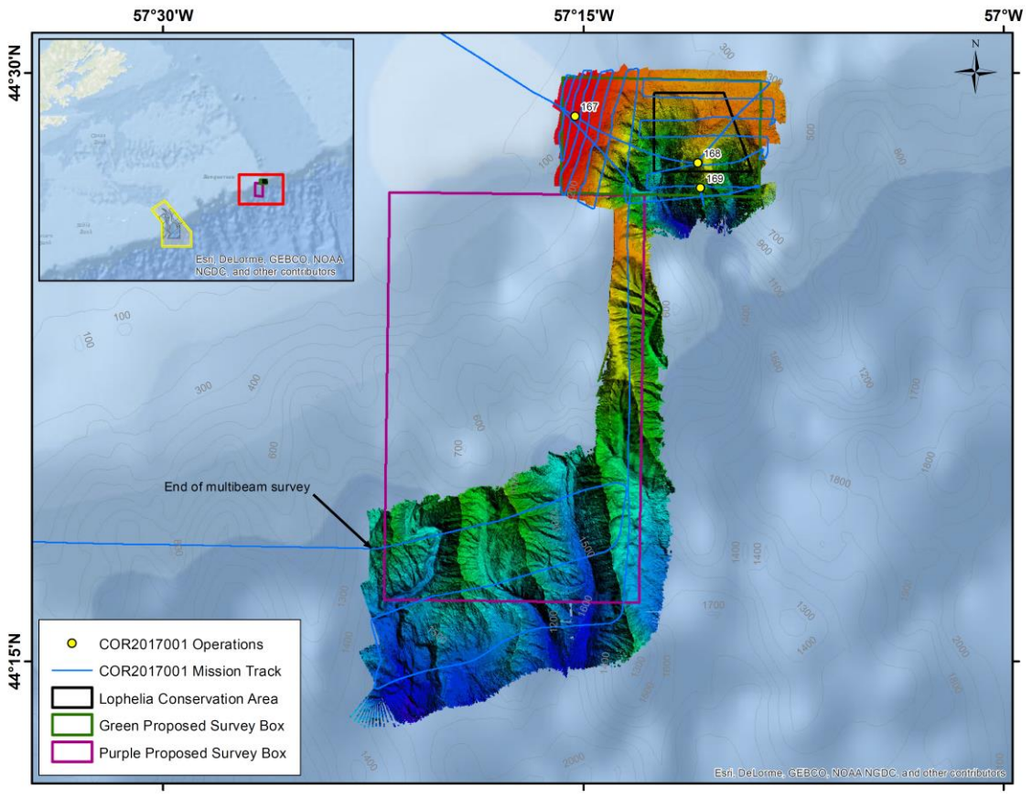


Figure 26. The multibeam survey of the Stone Fence Lophelia Conservation Area. The Green box proposed by OCMD encompassed the entire closure area. The purple box was only partially complete before the vessel was required to begin the steam to Halifax. The survey was started at event 167, 2 SVPs were conducted (events 168 and 169) and the survey was ended where noted in the figure.

Table 16.

Date	Event	Station	Slat (DD)	Slong (DD)
01/05/2017	167	SFMB	44.4816	-57.2549
01/05/2017	168	LCA_01	44.4618	-57.1821
01/05/2017	169	LCA_02	44.4512	-57.1804
02/05/2017	*	*	44.2985	-57.3776

*The end of the multibeam survey was not assigned an event or station number.

Equipment used for the MBES survey:

Applanix PosMV320:

The attitude and positioning data were acquired with the PosMV integrated system. The specs are as follows:

Acquisition mode : PPK - DPGS –WAAS
Horizontal precision : 0.02m – 0.5m – 2m
Vertical precision: 0.3m (DGPS)
Roll and pitch precision: 0.02°
Heading precision: 0.02°

Kongsberg EM2040:

The EM2040 is a multibeam which can operate at 3 different frequencies, 200, 300 and 400kHz. At 400kHz, the beam widths are 0.4° by 0.7° allowing for high resolution data. It has a swath coverage sector of up to 140° and a maximum ping rate of 50Hz. It has roll, pitch and yaw stablization available.

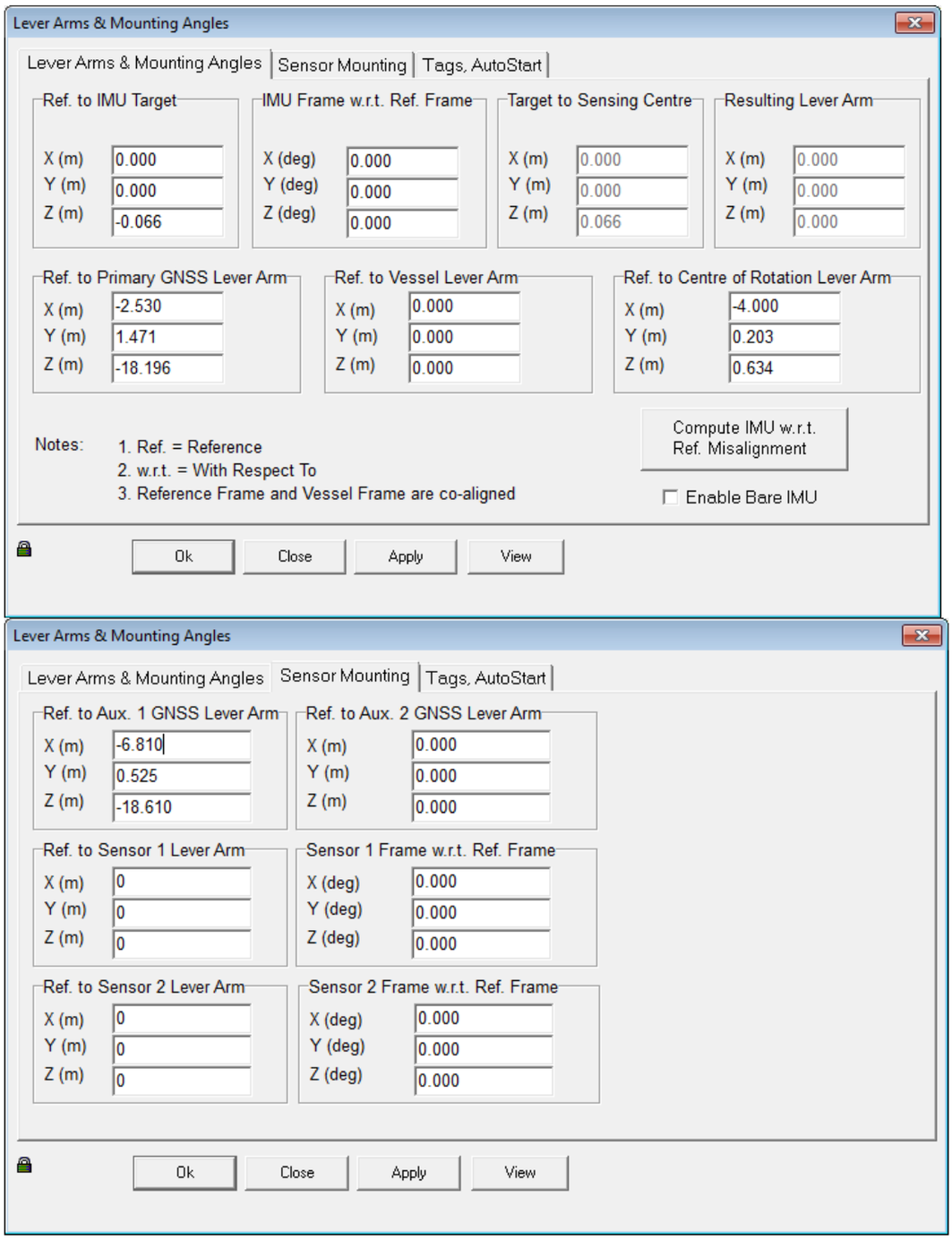
Kongsberg EM302:

The EM302 is a multibeam system operating at 30 kHz for deep water surveys. Beam widths of 0.5° by 1° allow for high resolution data. It has a swath coverage sector of up to 120°. The swath width is up to 5.5 times the water depth or 8km. Roll, pitch and yaw stablization are available.

System setup on the vessel

POSMV:

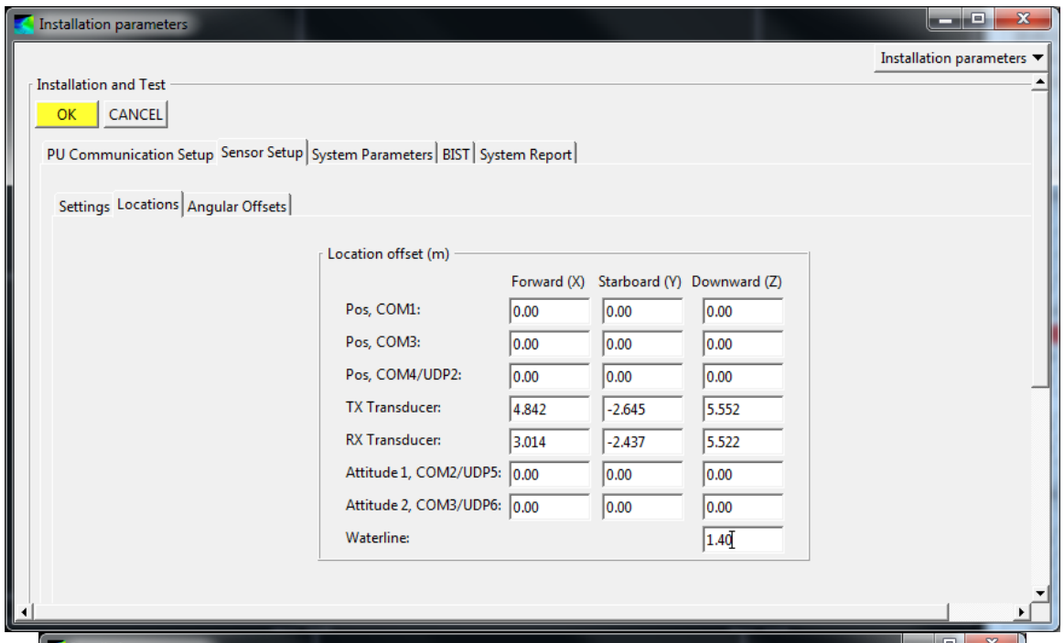
The lever arms and boresight angles between the IMU, the PRP (positioning reference point) and the GNSS antennas were setup in PosVIEW :

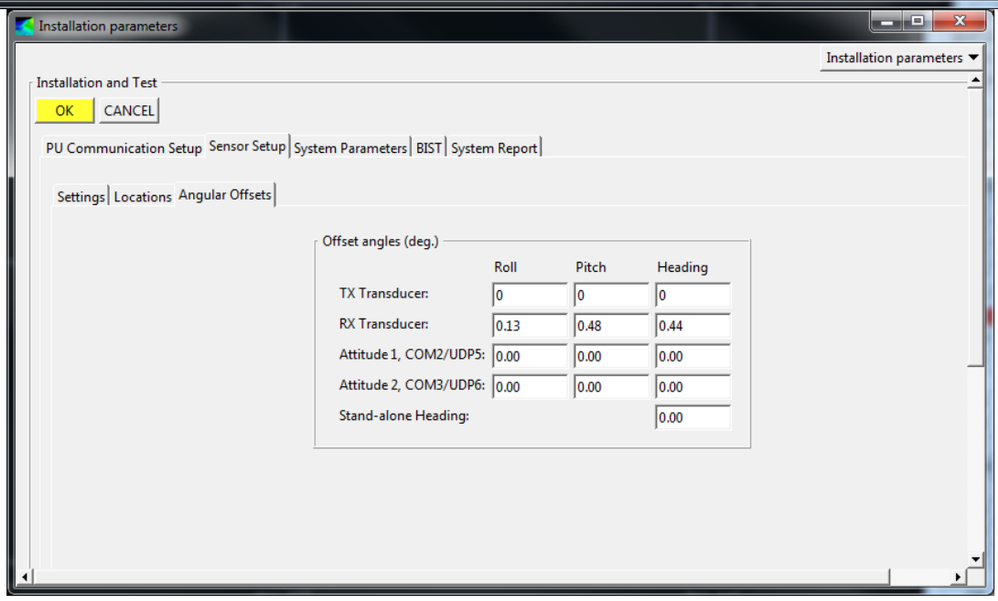


For the Coriolis II setup, the reference frame is the IMU frame and the PRP is located at the IMU center.

EM2040:

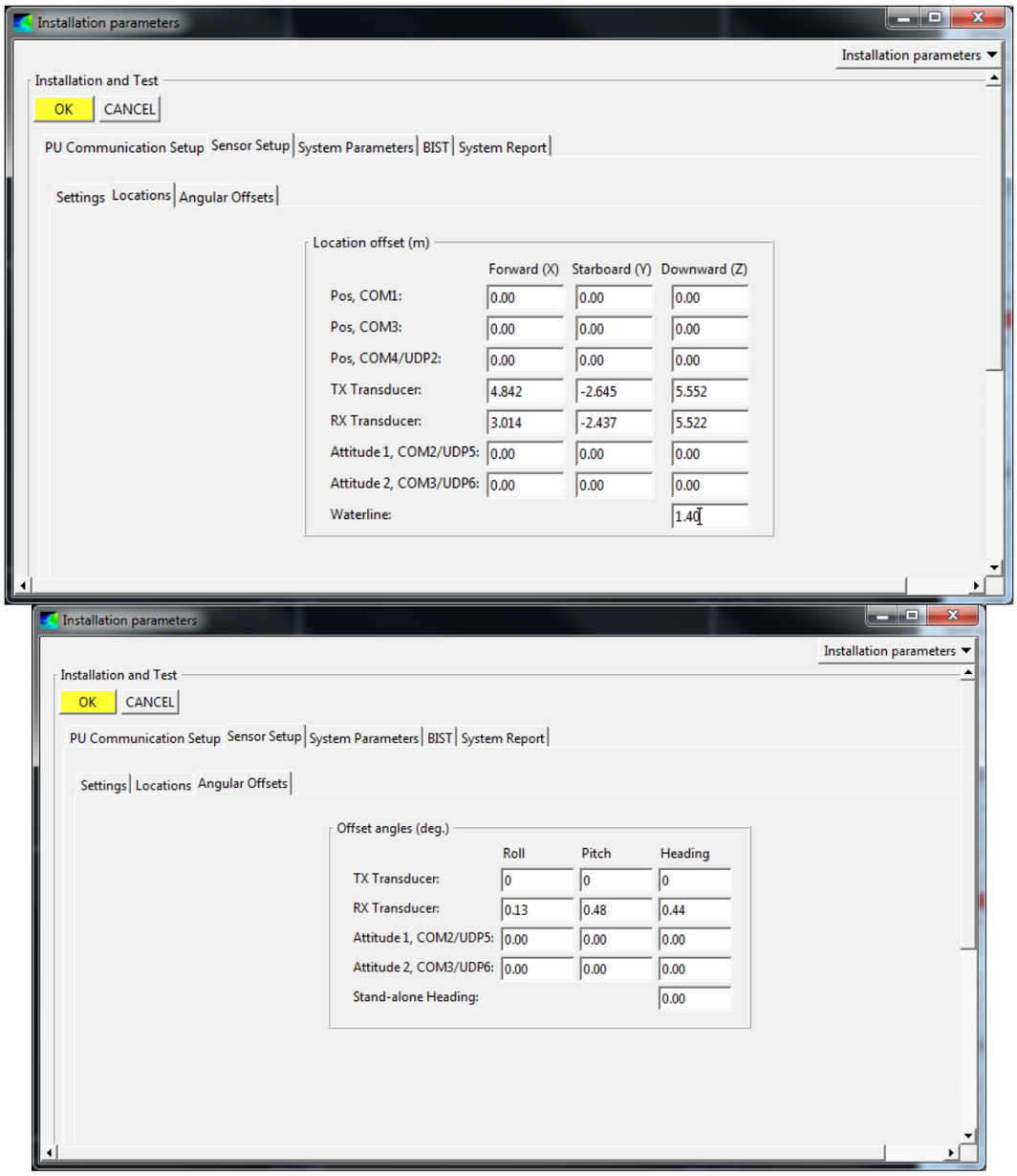
The different lever arms and angular offsets between the MBES RX AND TX antennas with the PRP are input in the acquisition software SIS from Kongsberg:


Installation parameters
Installation parameters
Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
System Report
Settings
Locations
Angular Offsets
Location offset (m)
Forward (X)
Starboard (Y)
Downward (Z)
Pos, COM1:
0.00
0.00
0.00
Pos, COM3:
0.00
0.00
0.00
Pos, COM4/UDP2:
0.00
0.00
0.00
TX Transducer:
4.842
-2.645
5.552
RX Transducer:
3.014
-2.437
5.522
Attitude 1, COM2/UDP5:
0.00
0.00
0.00
Attitude 2, COM3/UDP6:
0.00
0.00
0.00
Waterline:
1.40


Installation parameters
Installation parameters
Installation and Test
OK
CANCEL
PU Communication Setup
Sensor Setup
System Parameters
BIST
System Report
Settings
Locations
Angular Offsets
Offset angles (deg.)
Roll
Pitch
Heading
TX Transducer:
0
0
0
RX Transducer:
0.13
0.48
0.44
Attitude 1, COM2/UDP5:
0.00
0.00
0.00
Attitude 2, COM3/UDP6:
0.00
0.00
0.00
Stand-alone Heading:
0.00

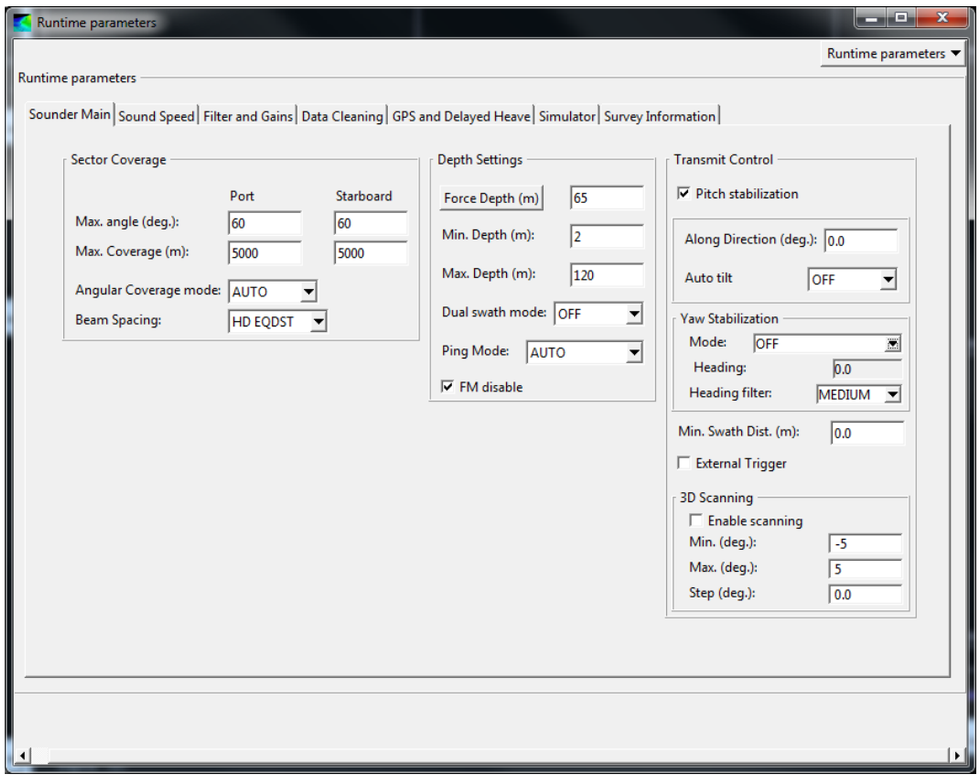
EM302:

The different lever arms and angular offsets between the MBES RX AND TX antennas with the PRP are input in the acquisition software SIS from Kongsberg:



The sonar settings for both surveys:

The swath coverage is set to 120°, the beam spacing is set to equidistant and the ‘’Ping’’ mode is set to AUTO so it can adjust automatically with the depth. The depth settings were adjusted according to the observed depth during the survey. Roll and Pitch stabilization was also applied.



Data processing methodology:

For the multibeam surveys, the mandate was not to process the data at sea, but provisional processing was performed to validate the quality of the data. Data was processed using the CARIS software. The processing methodology was the same for both surveys:

1. Importation of MBES data (all files including navigation and bathymetry)
2. Importation of the SVP data (SV profile in .svp format)
3. Application of the SVC correction (data correction for speed of sound)
4. Application of a zero tide (reduction to the water level)
5. Application of ‘’Merge’’ (geo-referencing of the soundings after different processing steps)
6. Cleaning of outliers

During this provisional processing, the data was reduced to the water level (ie: by neglecting the effects of the tide). Given the low precision of the vertical GNSS measurements, it would be preferable to use tide models to reduce the data to a known vertical reference. During the SVC correction and Merge, the delayed heave was applied to ensure that the ‘’heave’’ motion was taken into account when the SVP was applied.

Underway Seawater System

The underway system was placed in the wet lab and was connected to the pumped seawater plumbing. The configuration file for the Thermosalinograph (TSG) on COR2017001 can be found in Appendix 3B. The SeaBird SeaSave software logged both temperature of the water from a thermistor mounted in the moon pool of the ship and in the water bath of the TSG in the wet lab. As noted in the configuration file in Appendix 3B, the water bath of the TSG was also equipped with a conductivity sensor, an ultraviolet fluorometer, fluorometer, pH sensor and optode. The sampling rate for these sensors was 0.2 Hz. The underway system water bath also housed a ProOceanus CO_2-Pro Atmosphere system to measure the partial pressure of CO_2.

Each day from April 18 to May 1st, a single PCO2 and TIC sample, along with 2 ChlA samples were acquired every day and provided with a unique sample ID. The scanned paper log for these samples will eventually be located here: R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\SCANNED_LOGS and the digital e-logs can be found here:

R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\ELOG\Flow-Through Log. In total there were 12 PCO_2, 12 TIC and 24 Chla samples taken over this period.

TSG and navigation underway data was managed the NOAA Scientific Computing Systems (SCS) software. These data are submitted to ODIS upon conclusion of the mission but Dr. Dave Hebert (Dave.Hebert@dfo-mpo.gc.ca) is the point of contact for these data.

Data Management

Prepared by: Robert Benjamin
Division: Program Coordination and Support Division, DFO

Please refer to Appendix 5 for a table detailing the data collected during COR2017001, its current status and location if available.

Data Collection

In addition to standard AZMP manual data collection methods (i.e., Bridge log, various equipment specific deck sheets) ELOG, an electronic logbook system for collecting event metadata including position and sounding was again used during COR2017001. This electronic logbook was accessible via computers connected to the Coriolis II's network on-board the vessel with one available for the bridge crew. Metadata related to each piece of equipment was collected in the electronic log including position/time deployed, on bottom and recovered. Additional logbooks were employed to act as an itinerary, a daily operational log and a logbook to monitor the flow through. All digital logbooks were backed up daily and at the end of the mission were sent to ODIS for storage.

Nav-Net, an on board ship's data collection system was used to collect GPS and EK60 bottom sounding data available during the entire mission. These data will be located in the NavNet archive here: \\ent.dfo-mpo.ca\ATLShares\Science\BIODataSvc\SRC\Navnet\2017\COR2017001_Navnet.7z

Data Input Template

Reports were generated from shipboard input data in the AZMP Template Database to compare with corresponding CTD sensor data and conduct preliminary analyses included in this report.

GIS

Daily navigation and operations were maintained in a graphical information system (QGIS). Final line and point shapefile were generated from these data for the cruise report.

Hardware

One laptop was used to run the NavNet software. GPS data and EK60 Sounding data was sent to this computer via serial RS232 and logged. Note we could not transfer these data to our other computers via Ethernet due to some problem with the ships network that we could not resolve in the allotted time. Data was transferred via Serial RS232 where needed. (TSG , SCS, E-log logging computer.)

APPENDICES

Appendix 1A. Gully MPA Activity Approval for the AZMP 2015-2018

Gully Approval
Signed Letter from RI

Appendix 1B. DFO Fisheries Protection Program Multibeam Proposal Approval and Survey Requirements.

AZMP_echo_sounder
_Survey_LOA.pdf

Appendix 2.Coriolis II crew during COR2017001.

Surname	Name	Position
Spears	Albert	Master
Méthé	Louis-Nicolas	Ch Mate
Burke	Darren	1st mate
Desmeules	Gilles	Ch Engineer
St-Cyr	Jean-Michel	2nd Engineer
Paridis	Vincent	3rd Engineer
Pelletier	Gilles	OS
Dufour	Mikel	OS
Mestekawy	Saad	AB
Daoust	Gabriel	AB
Chouinard	Tommy	CH Cook
Brodeur	Carole	2nd Cook
Desrochers	Julien	CIDCO Tech
Desmeules	Gilles	ISMER Tech

Appendix 3A. CTD Configuration File – COR2017001.xmlcon

Date: 05/18/2017

Instrument configuration file:
C:\Users\CogswellA\Documents\AZMP\Missions\2017\2017 Spring\atsea\COR2017001\CTD\CTD_Processing\2017001COR\COR2017001.xmlcon

Configuration report for SBE 911plus/917plus CTD

Frequency channels suppressed : 0
Voltage words suppressed : 0
Computer interface : RS-232C
Deck unit : SBE11plus Firmware Version >= 5.0
Scans to average : 1
NMEA position data added : Yes
NMEA depth data added : No
NMEA time added : No
NMEA device connected to : deck unit
Surface PAR voltage added : No
Scan time added : No

1) Frequency 0, Temperature

Serial number : 5083
Calibrated on : 28-Dec-16
A : 3.68121190e-003
B : 5.97281324e-004
C : 1.50725995e-005
D : 2.03715852e-006
F0 : 2984.742
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 3562
Calibrated on : 28-Dec-2016
G : -9.85265633e+000
H : 1.20331887e+000
I : -1.38434966e-003
J : 1.61818481e-004
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Frequency 2, Pressure, Digiquartz with TC

Serial number : 1214
Calibrated on : 30-Nov-16
C1 : -4.470905e+004
C2 : 3.840789e-001
C3 : 1.367850e-002
D1 : 3.661600e-002
D2 : 0.000000e+000
T1 : 3.015271e+001
T2 : -1.367200e-004
T3 : 3.926620e-006
T4 : 3.761680e-009
T5 : 0.000000e+000
Slope : 0.99999865

Offset : -1.26180
AD590M : 1.280000e-002
AD590B : -9.348400e+000

4) Frequency 3, Temperature, 2

Serial number : 1376
Calibrated on : 29-Dec-16
A : 3.68121199e-003
B : 6.00662910e-004
C : 1.51551906e-005
D : 2.13378130e-006
F0 : 6469.737
Slope : 1.00000000
Offset : 0.0000

5) Frequency 4, Conductivity, 2

Serial number : 1076
Calibrated on : 06-Jan-2017
G : -4.19695534e+000
H : 5.67131571e-001
I : -6.00628322e-005
J : 3.39467227e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

6) A/D voltage 0, Altimeter

Serial number : 49058
Calibrated on : 16-Dec-2009
Scale factor : 15.000
Offset : 0.000

7) A/D voltage 1, PAR/Irradiance, Biospherical/Licor

Serial number : 1043
Calibrated on : 1-Dec-2015
M : 0.80736900
B : 1.03324700
Calibration constant : 7358893222.45934200
Multiplier : 1.00000000
Offset : 0.00000000

8) A/D voltage 2, Oxygen, SBE 43

Serial number : 0133
Calibrated on : 23-Dec-2016
Equation : Sea-Bird
Soc : 4.05200e-001
Offset : -6.68300e-001
A : -5.57050e-003
B : 2.52730e-004
C : -3.85340e-006
E : 3.60000e-002
Tau20 : 1.03000e+000
D1 : 1.92634e-004
D2 : -4.64803e-002
H1 : -3.30000e-002
H2 : 5.00000e+003
H3 : 1.45000e+003

9) A/D voltage 3, Oxygen, SBE 43, 2

Serial number : 0042
Calibrated on : 14-Jan-2017
Equation : Sea-Bird
Soc : 4.61000e-001
Offset : -5.02600e-001
A : -4.36300e-003
B : 1.65450e-004
C : -2.38340e-006
E : 3.60000e-002
Tau20 : 1.38000e+000
D1 : 1.92634e-004
D2 : -4.64803e-002
H1 : -3.30000e-002
H2 : 5.00000e+003
H3 : 1.45000e+003

10) A/D voltage 4, Fluorometer, Seapoint Ultraviolet

Serial number : 3668
Calibrated on : 1-Jan-2015
Range : 50.000000
Offset : 0.000000

11) A/D voltage 5, Fluorometer, Seapoint

Serial number : 6210
Calibrated on : 1-Jan-2015
Gain setting : 3 x, 0-50 µg/l
Offset : 0.000

12) A/D voltage 6, pH

Serial number : 1137
Calibrated on : 18-Jan-2017
pH slope : 4.5923
pH offset : 2.5397

13) A/D voltage 7, OBS, WET Labs, ECO-BB

Serial number : 1490
Calibrated on : 9-Aug-2016
ScaleFactor : 0.002983
Dark output : 0.048000

Scan length : 37

Appendix 3B. TSG Configuration File

Date: 06/01/2017

Instrument configuration file:
R:\Science\BIODataSvc\IN\COR2017001\TSG\COR2017001\20170416_135203.XMLCON

Configuration report for SBE 21 Seacat Thermosalinograph

Remote temperature : SBE 38
External voltage channels : 4
Sample interval : 5 seconds
NMEA position data added : Yes
NMEA depth data added : No
NMEA time added : Yes
NMEA device connected to : PC
Scan time added : No

1) Frequency 0, Temperature

Serial number : 3396
Calibrated on : 03-Nov-16
G : 4.22439338e-003
H : 6.10669821e-004
I : 1.73702842e-005
J : 9.92614369e-007
F0 : 1000.000
Slope : 1.00000000
Offset : 0.0000

2) Frequency 1, Conductivity

Serial number : 3396
Calibrated on : 03-Nov-16
G : -3.95386223e+000
H : 4.66205688e-001
I : -1.03388228e-004
J : 2.90179481e-005
CTcor : 3.2500e-006
CPcor : -9.57000000e-008
Slope : 1.00000000
Offset : 0.00000

3) Serial RS-232, Temperature, SBE 38

Serial number : 0766

Calibrated on : Jul 2015

4) A/D voltage 0, Fluorometer, WET Labs WETstar

Serial number : WSCHL-1468
Calibrated on : aug 14 2014
Blank output : 0.054
Scale factor : 15.500

5) A/D voltage 1, pH

Serial number : 1129
Calibrated on : 14-Nov-16
pH slope : 4.6330
pH offset : 2.5287

6) A/D voltage 2, User Polynomial

Serial number : 591
Calibrated on : jan 22 2016
Sensor name : optode 4831F CalPhase
A0 : 10.00000000
A1 : 12.00000000
A2 : 0.00000000
A3 : 0.00000000

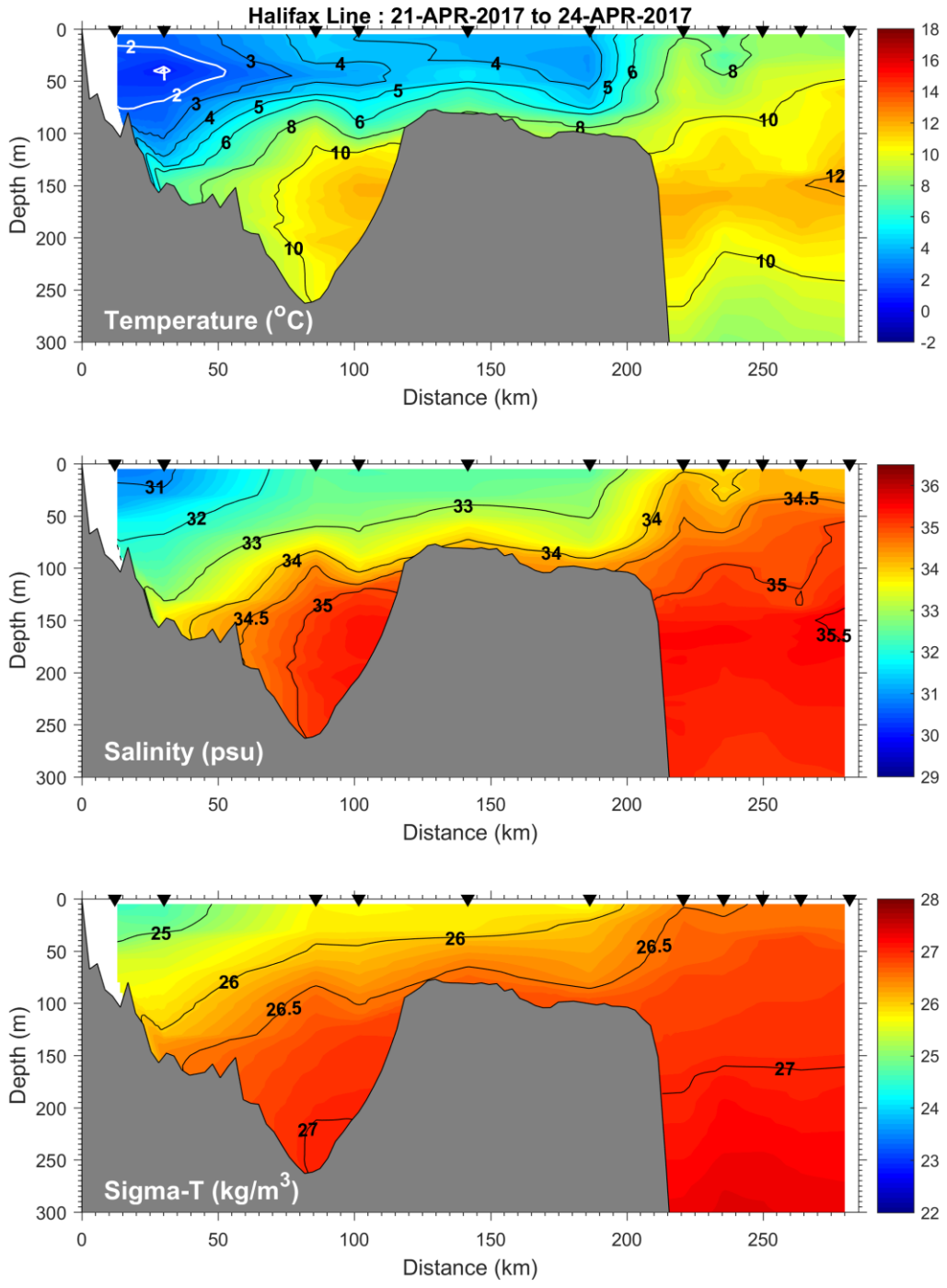
7) A/D voltage 3, Fluorometer, Seapoint Ultraviolet

Serial number : 6211
Calibrated on :
Range : 50.000000
Offset : 0.000000
scan length : 48

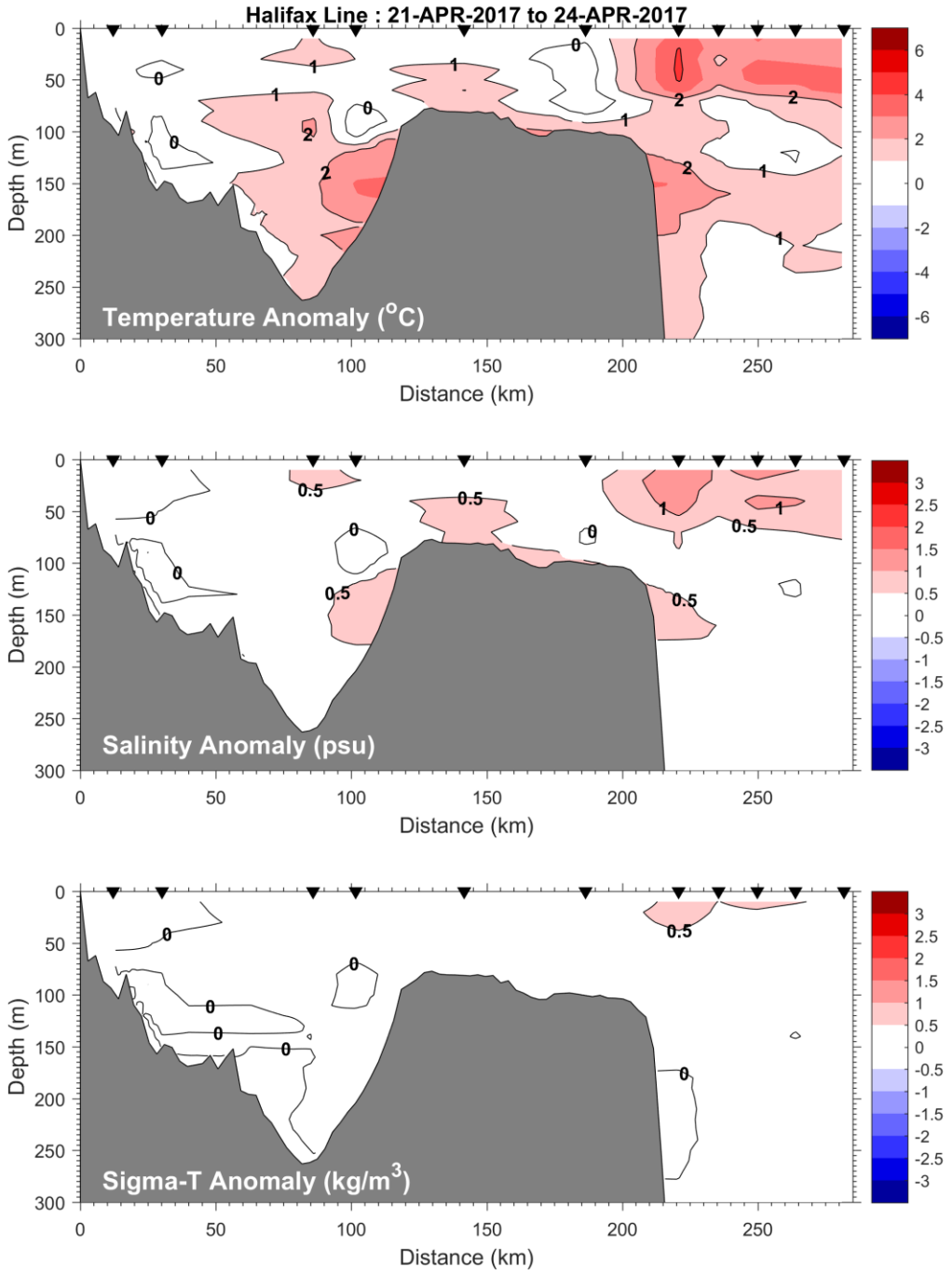
Appendix 4. Preliminary Section Plots and Anomalies (T/S/Sigma-T)

Halifax Line

Section

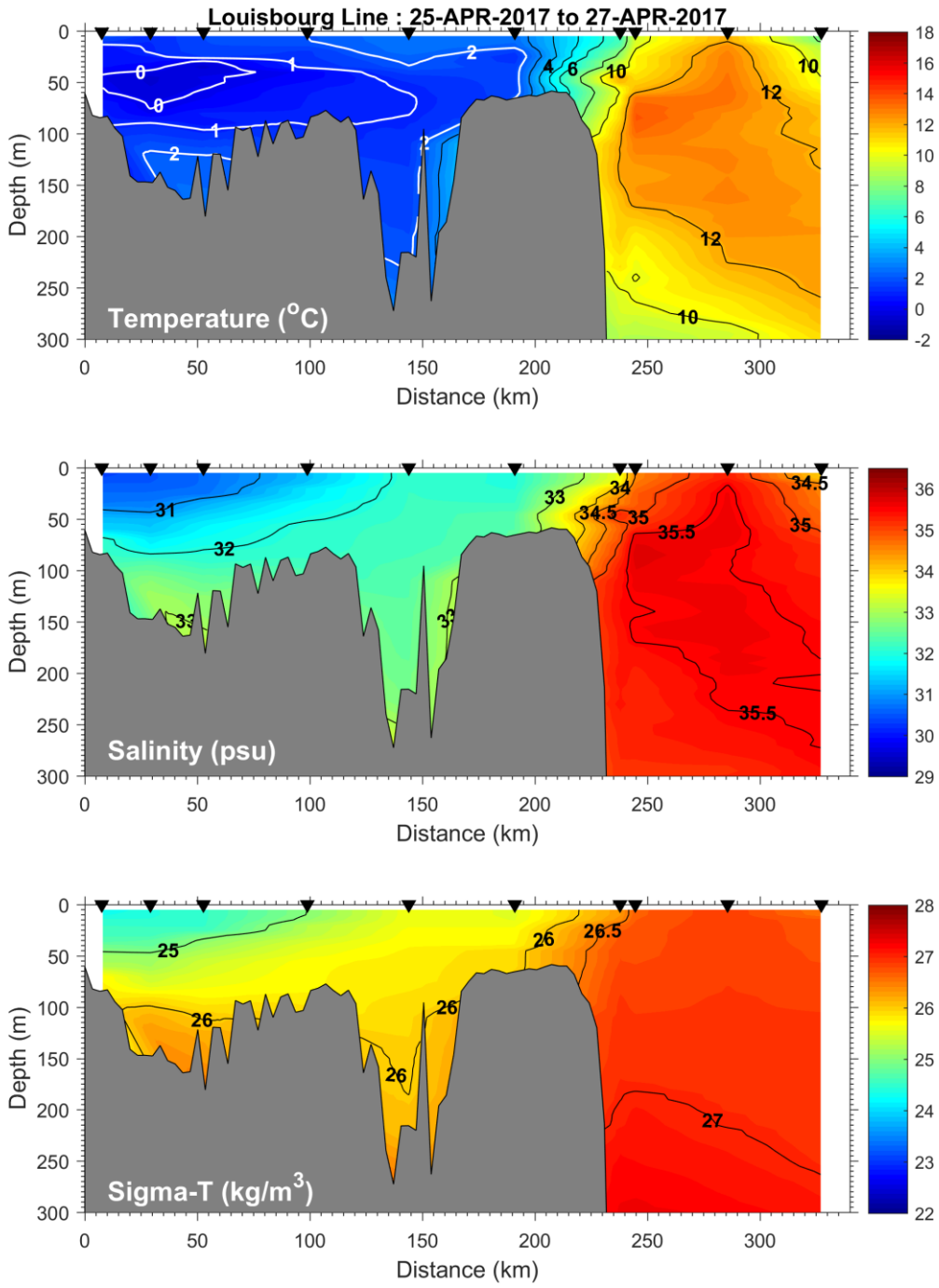


Anomaly

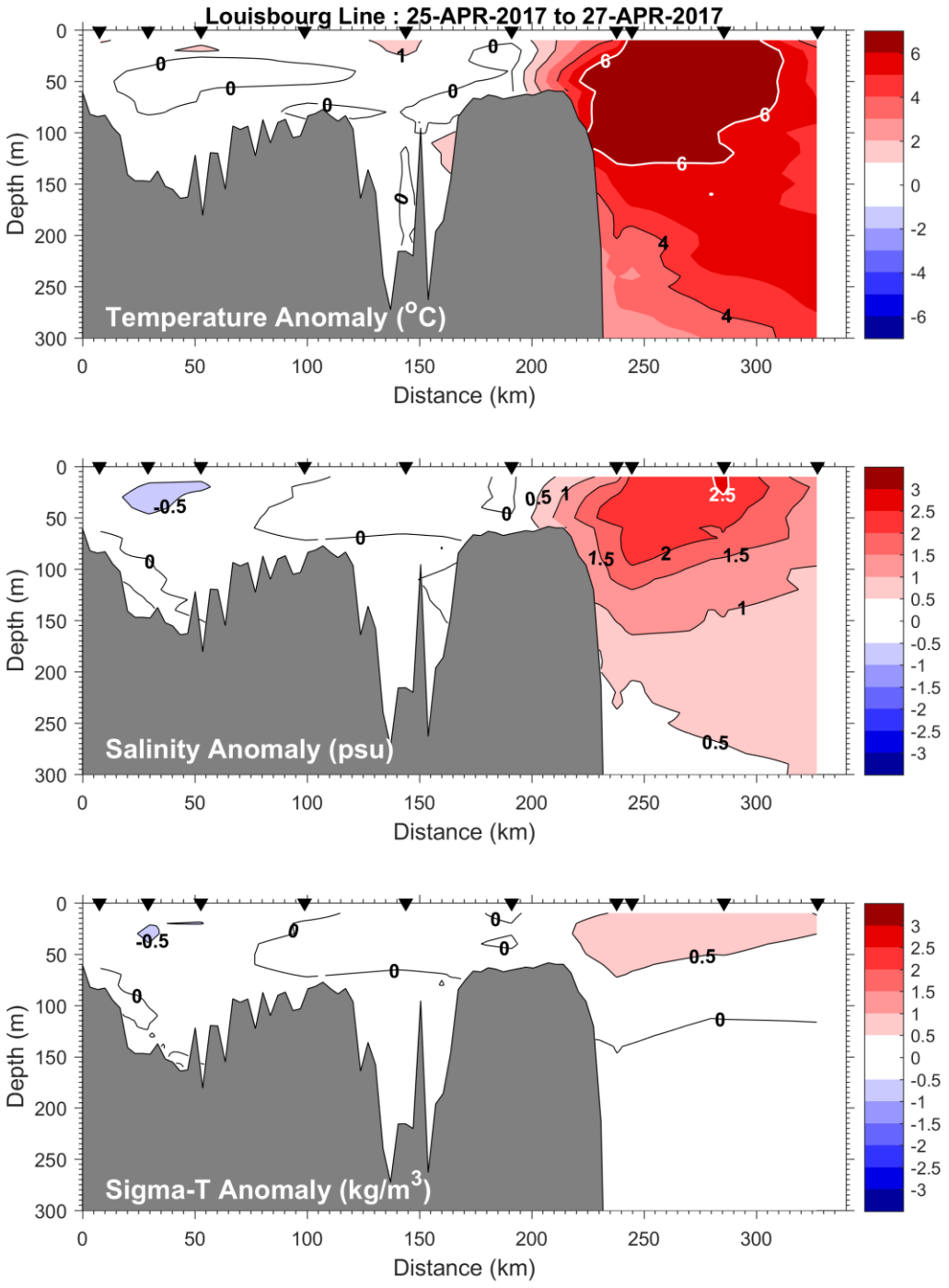

Halifax Line : 21-APR-2017 to 24-APR-2017
Temperature Anomaly (°C)
Salinity Anomaly (psu)
Sigma-T Anomaly (kg/m3)
Depth (m)
Distance (km)

Louisbourg Line

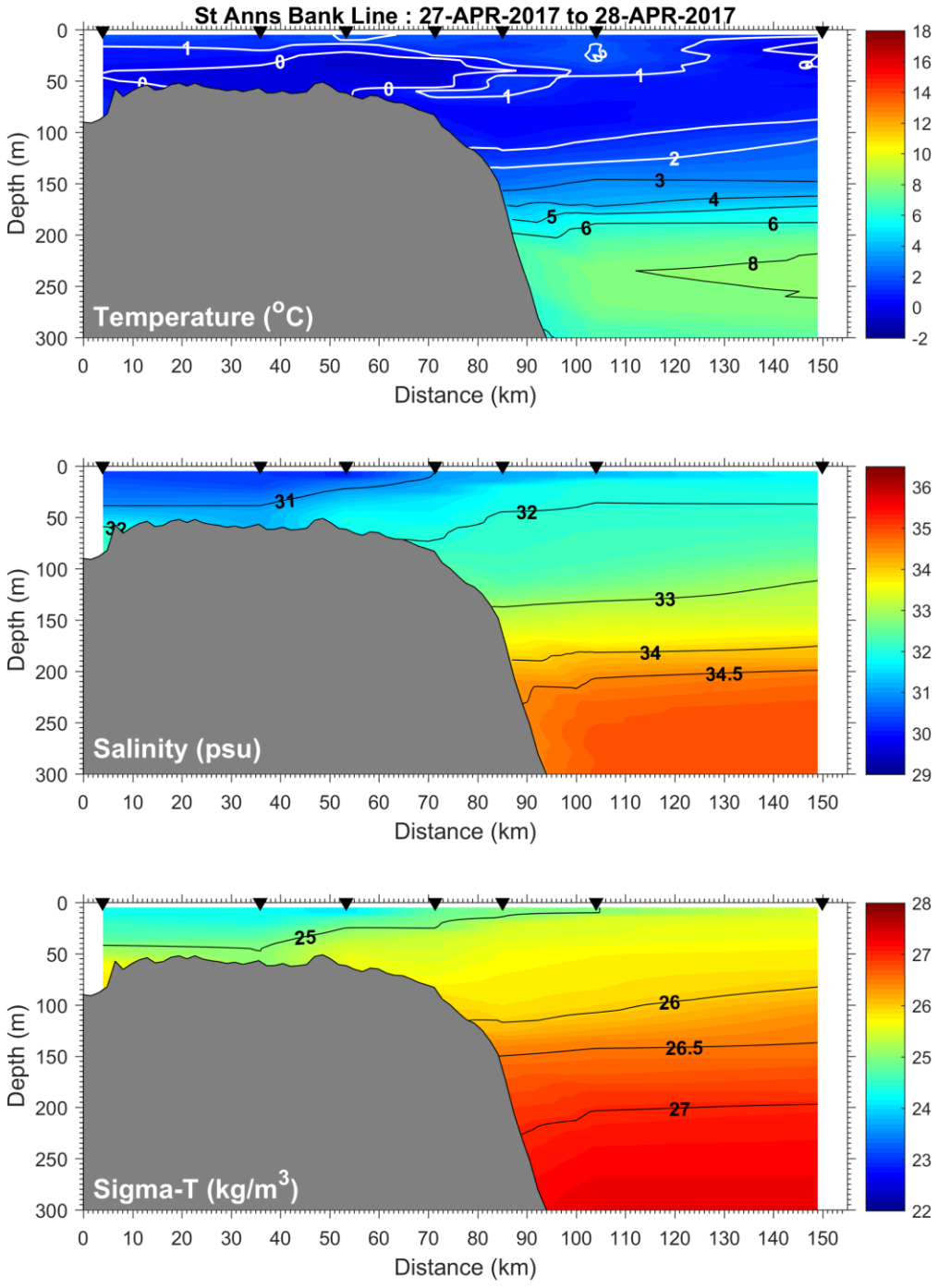
Section



Anomaly

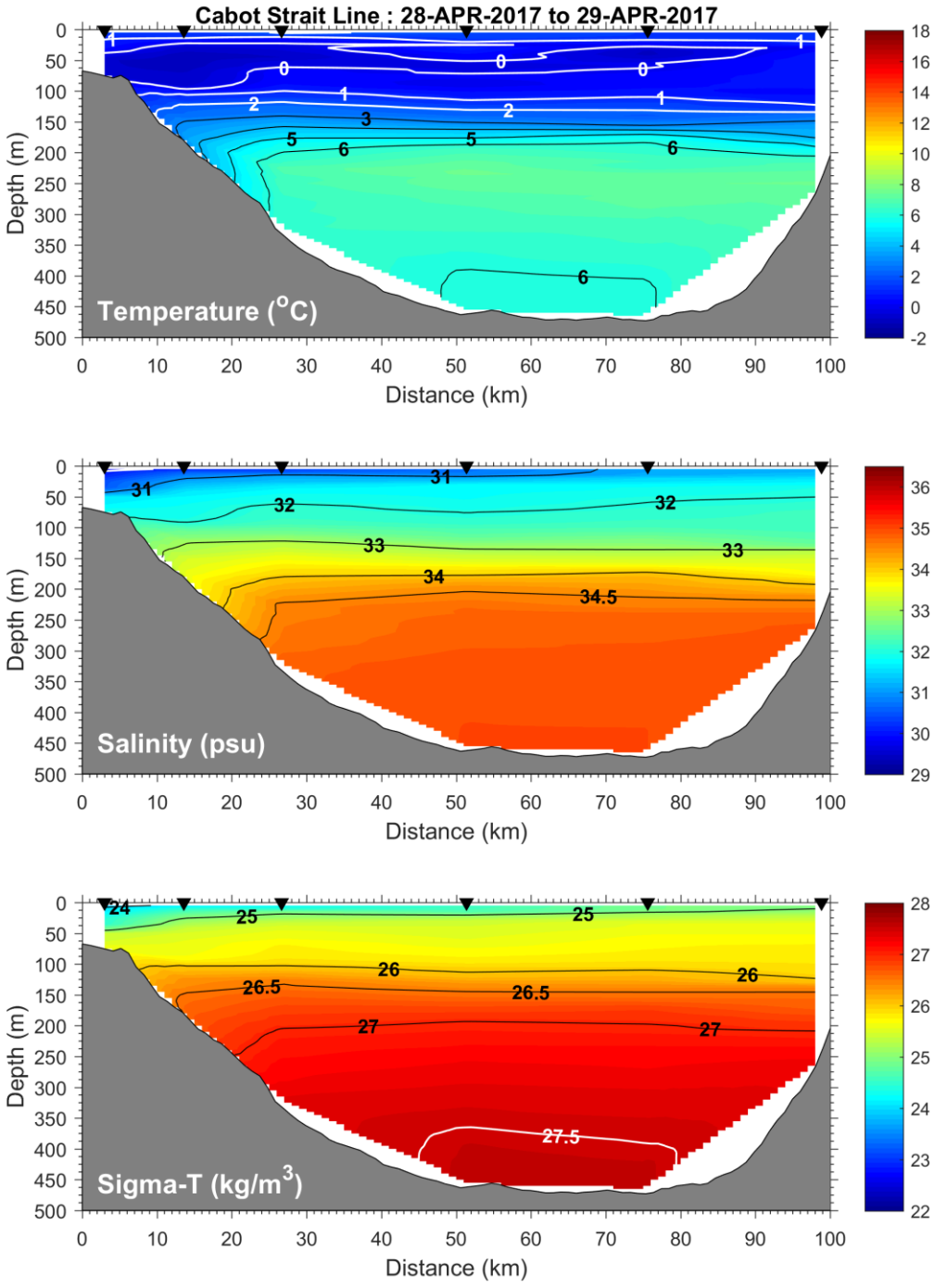

Louisbourg Line : 25-APR-2017 to 27-APR-2017
Temperature Anomaly (°C)
Salinity Anomaly (psu)
Sigma-T Anomaly (kg/m3)
Depth (m)
Distance (km)

St. Anns Bank Line
Section

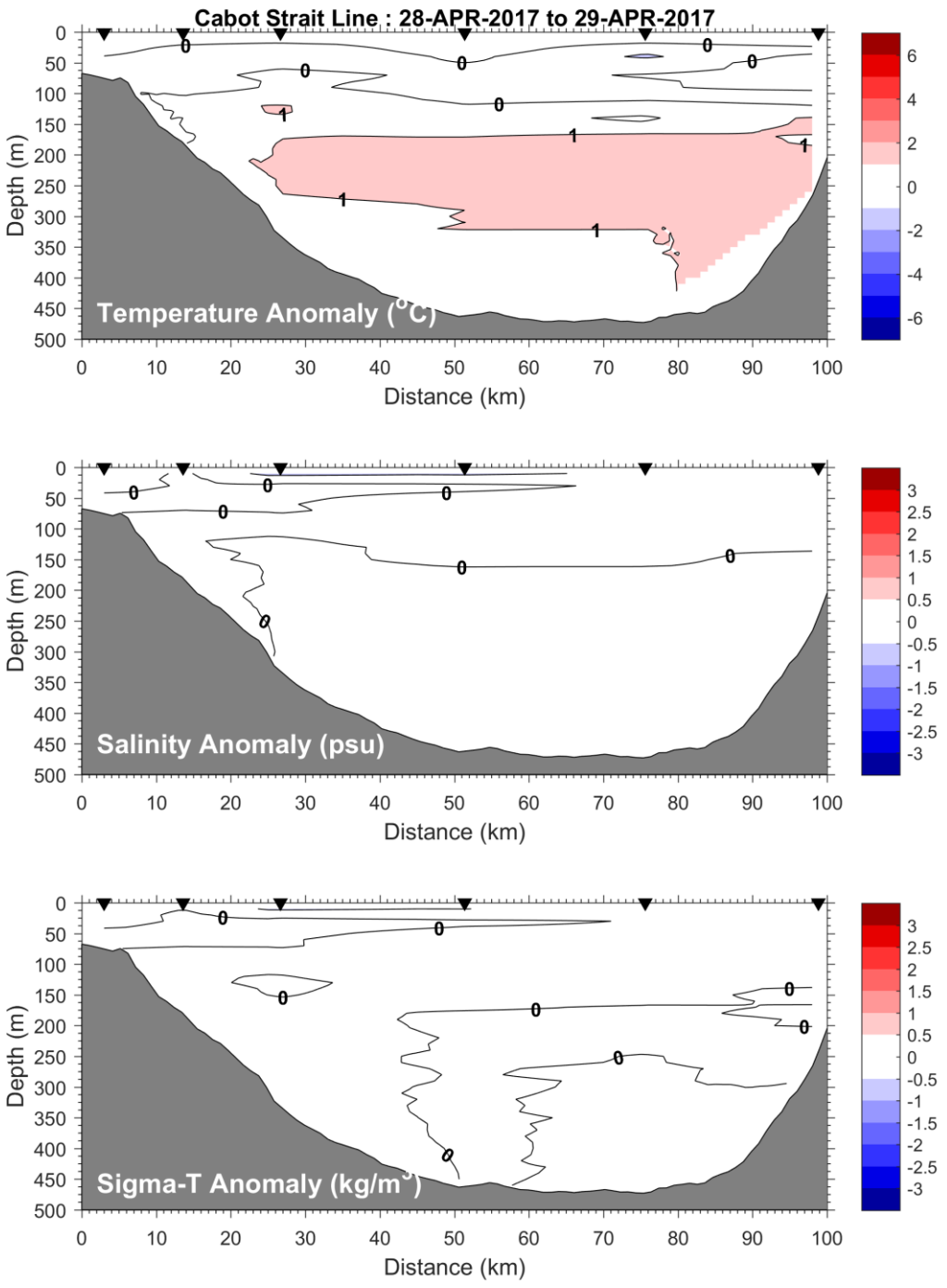


Cabot Strait Line

Section

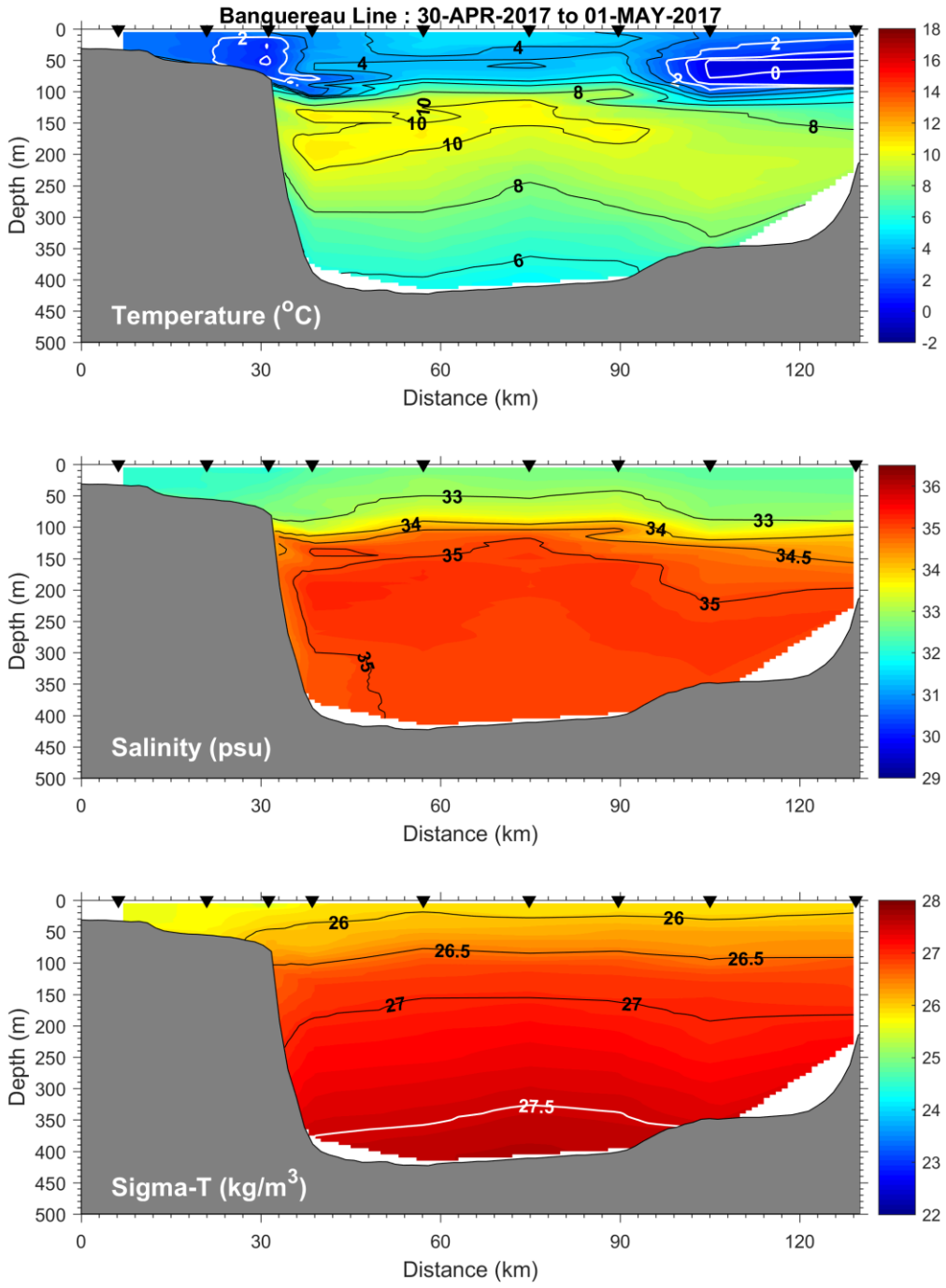


Anomaly

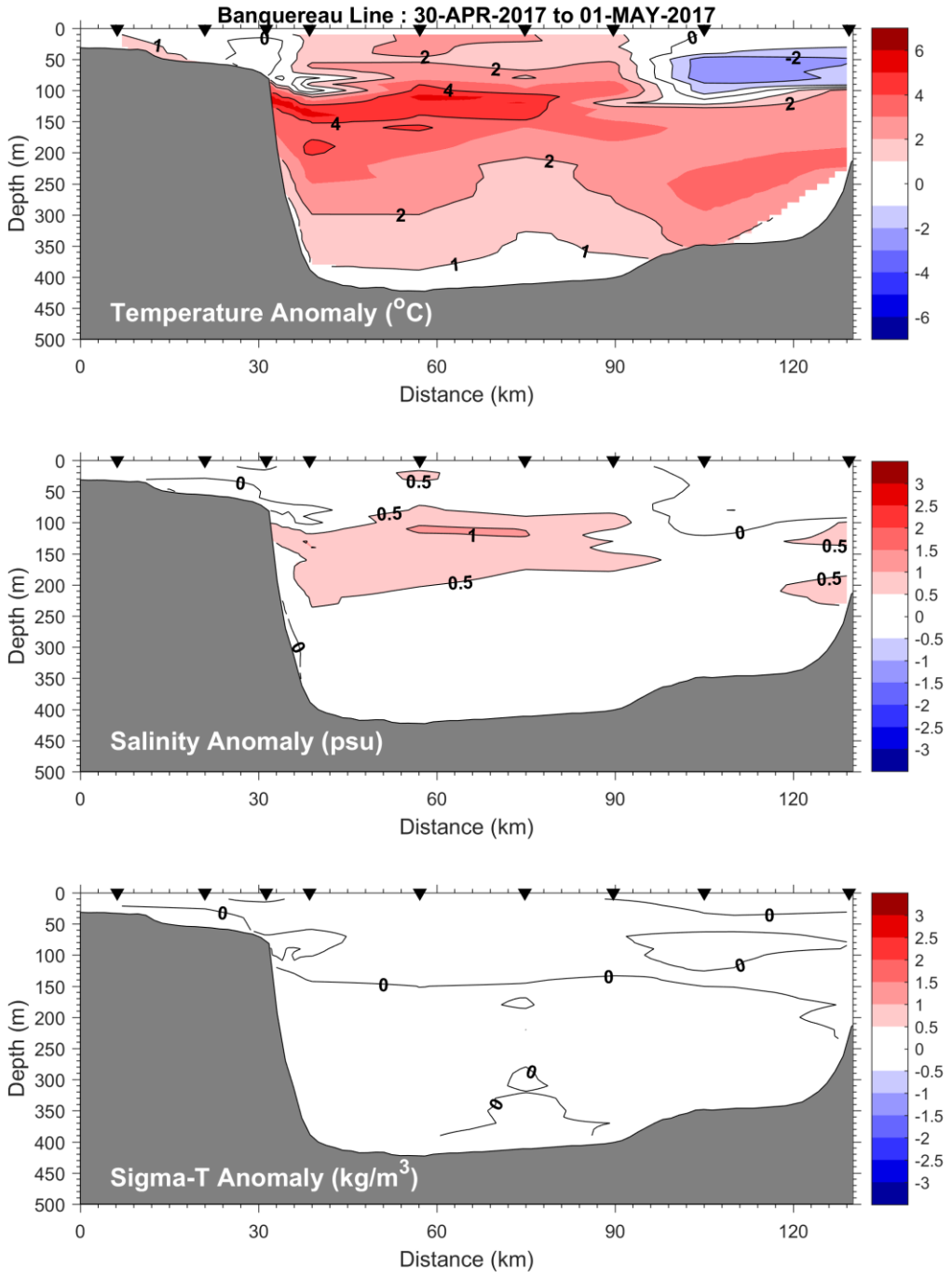

Cabot Strait Line : 28-APR-2017 to 29-APR-2017
Temperature Anomaly (°C)
Salinity Anomaly (psu)
Sigma-T Anomaly (kg/m³)
Depth (m)
Distance (km)

Brian Petrie/Banquereau Line

Section

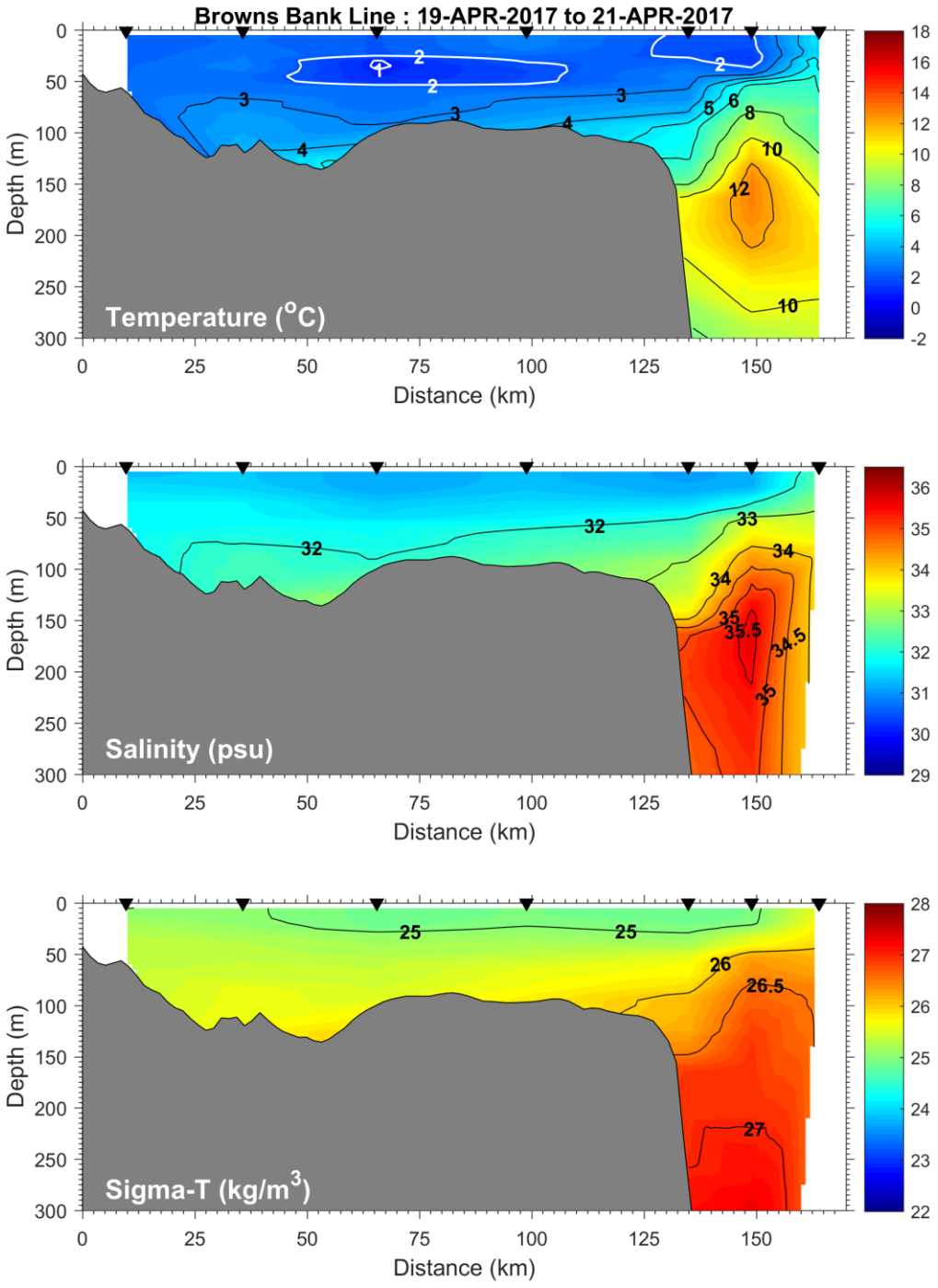


Anomaly

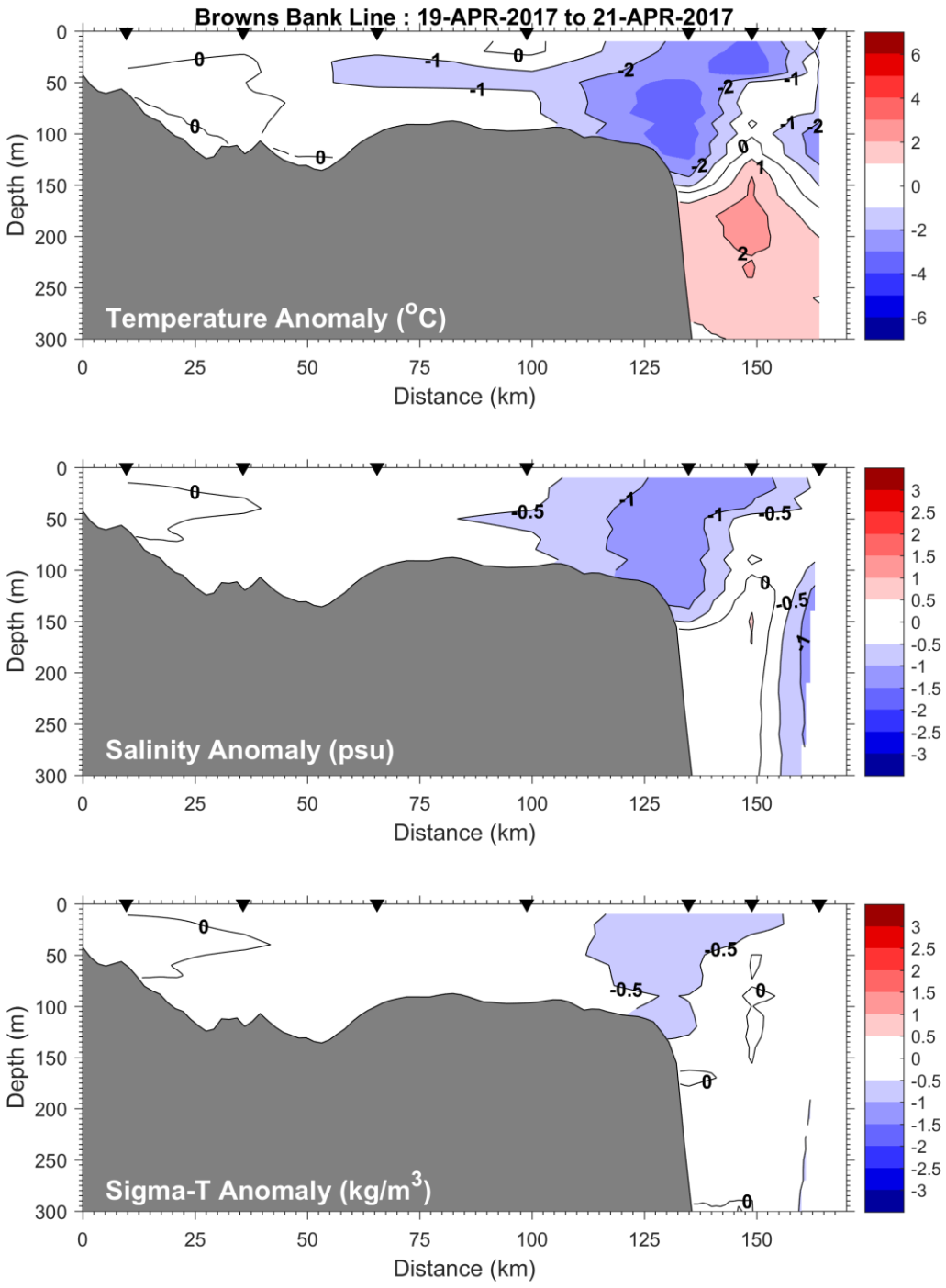

Banguereau Line : 30-APR-2017 to 01-MAY-2017
Depth (m)
Distance (km)
Temperature Anomaly (°C)
Salinity Anomaly (psu)
Sigma-T Anomaly (kg/m3)

Browns Bank Line

Section

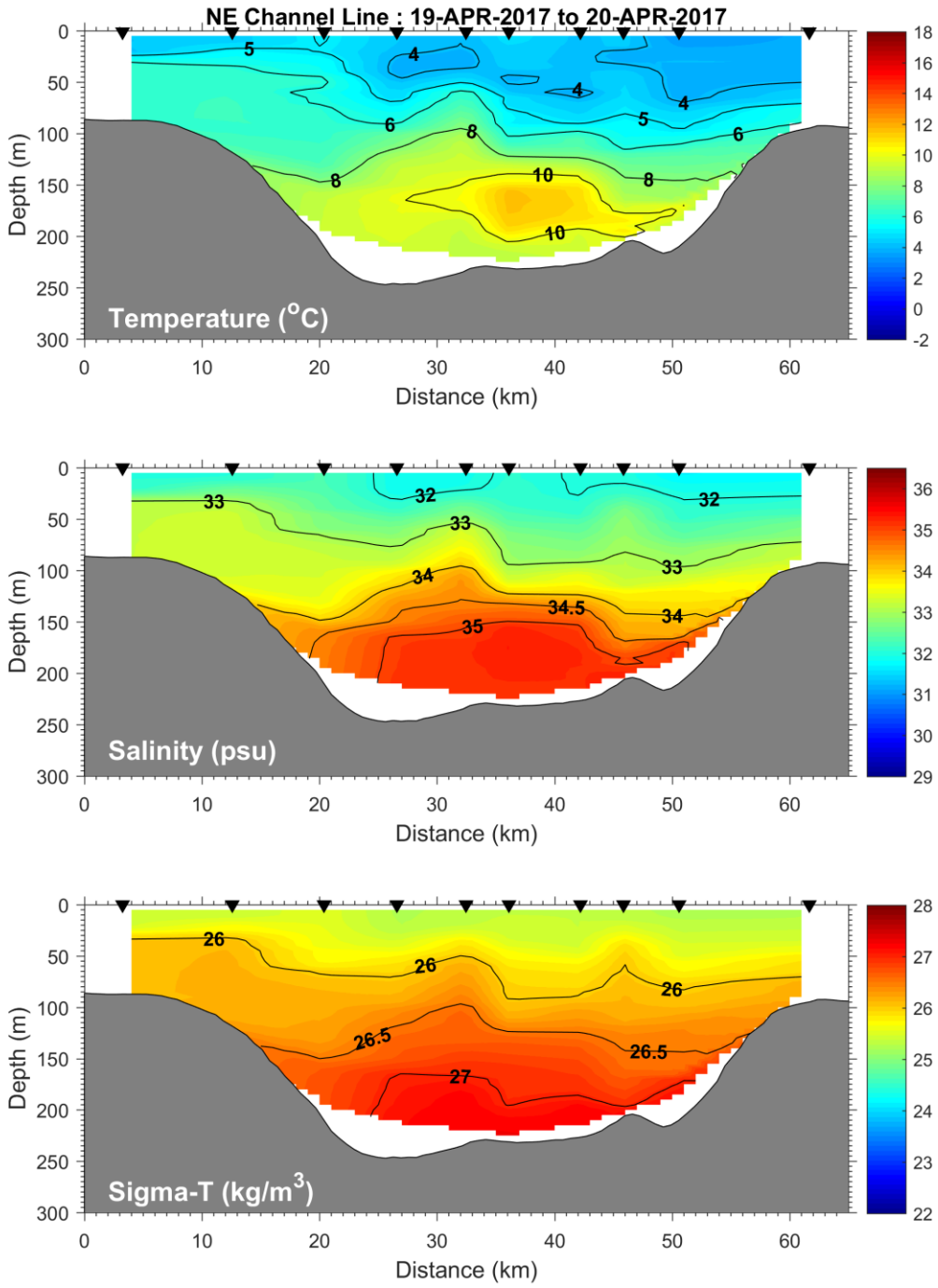


Anomaly

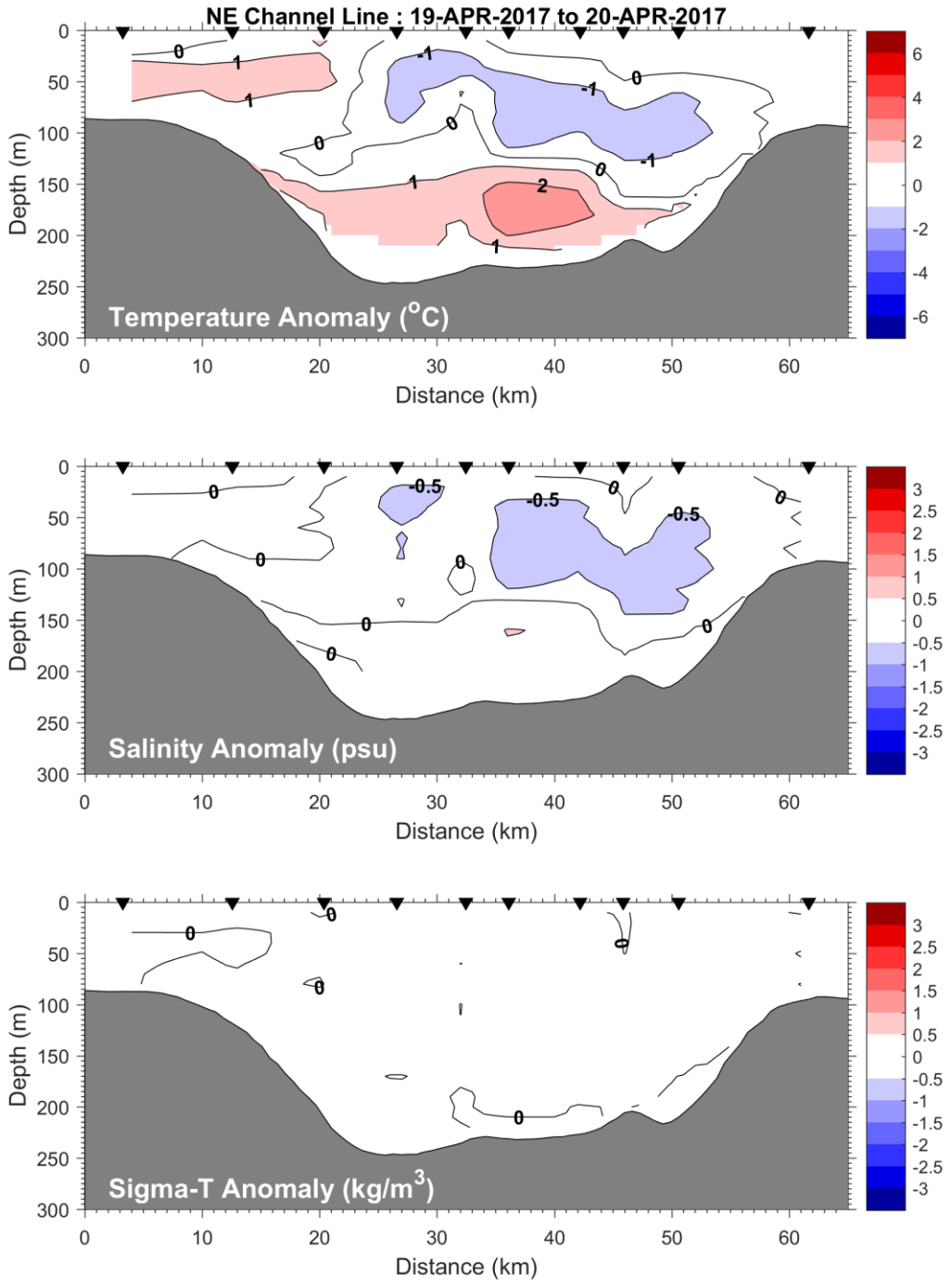

Browns Bank Line : 19-APR-2017 to 21-APR-2017
Temperature Anomaly (°C)
Salinity Anomaly (psu)
Sigma-T Anomaly (kg/m3)
Depth (m)
Distance (km)

Peter Smith Line

Section



Anomaly


NE Channel Line : 19-APR-2017 to 20-APR-2017
Depth (m)
Distance (km)
Temperature Anomaly (°C)
Salinity Anomaly (psu)
Sigma-T Anomaly (kg/m3)

Appendix 5. Data and Meta-data Collections During COR2017001

Data Source	Responsible Party	Data Description	File Extension(s)	Data Volume	Data Location	Notes
CTD – Raw Data	Robert Benjamin	Raw primary and secondary temperature, salinity and oxygen data as well as in-water and surface PAR, fluorescence, pH, back scatter, and CDOM from CTD casts	.BL, .HDR, .HEX, .XMLCON	418 files/396 MB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\CTD\CTD_Acquisition\2017001COR\ctddata	
CTD – Configuration Files	Robert Benjamin	Configuration files for SBE 911plus used during the mission	.XMLCON. .TXT, .XML	2 files//15 KB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\CTD\CTD_Acquisition\2017001COR\ctd_con	
CTD – Documents	Robert Benjamin	CTD install documentation for COR2017001 and guide to shipboard	.DOCX, .DOC, .pdf	2 files/311 KB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\CTD\CTD_Acquisition\2017001COR	

		CTD acquisition and processing procedures.				
CTD –Calibration Sheets	Robert Benjamin	Calibration sheets for the various sensors and spares for the CTD	.PDF	23 files/1 folder/1.2 MB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\CTD\CTD_Acquisition\2017001COR\Sensor_Calibration_Sheets	
CTD – Processed Data	Robert Benjamin	Processed CTD sensor and bottle data	.Q35, .QAT, .ODF, .IMS, .IGS, .CNV, .TXT, .ROS, .BL, .BTL, .HDR, .HEX, .XMLCON, .HBK, .CTD, .DOC, .PSA, .SBEBAT, .DOCX	# files/## folders/# GB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\CTD\CTD_Processing\2017001COR	
Scientific Computing Software acquisition files for underway system	Robert Benjamin	.RAW files for meterological data, coordinates, Sounder and TSG collected over the	.RAW, .CSV	## files/### MB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\SCS	

		duration of the mission				
TSG data collection, sensor calibration documents as well as pdf scan of log book	Robert Benjamin	SBE .hex format data collection from the TSG	.HDR, .HEX, .XMLCON, .XML,.PDF,. MRK, .TXT, .EXE	354 files/46 folders/ 499 MB	R:\Science\BIODataSvc\SRC\ 2010s\2017\COR2017001\TS G	
PCO2	Robert Benjamin/Stev e Punshon	Daily files containing time, PCO2 measurement s and some other associated data including temperature	.log	18 files/1 folder/102 MB	R:\Science\BIODataSvc\SRC\ 2010s\2017\COR2017001\pC O2	
Multibeam	Robert Benjamin	Multibeam data collected throughout the mission	.CSV, .GPX, .TXT, .ASC, .TIF, .TIFW, .DBF, .PRJ, .QPJ, .SHP, .SHX	26 files/5 folders/319 MB	R:\Science\BIODataSvc\SRC\ 2010s\2017\COR2017001\M B	This is the partially QC'd survey data from the Gully and Stone Fence. The remaining multibeam data collected throughout the mission was provided to Alex Normendeau

						for further processing. The data set is quite larger and will likely not be placed on this server but rather held by CHS in their servers.
ELOG Logbook	Robert Benjamin	Associated daily log books, ELOG configuration file. Contains the meta-data for the mission	.CFG, .LOG, .BAK	36 files/4 folders/426 KB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\ELOG	Includes all mission operational details.
At sea database	Robert Benjamin	All mission meta-data, .QAT file data and shipboard laboratory analysis	.ACCDB, .LOG, .CSV, .BAK	8 files/2 folders/ 84.1 MB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\DB	The chlorophyll, oxygen, salinity and mission event summaries are also included in this folder.
Scanned Logs	Andrew Cogswell/Robert Benjamin	Scanned paper logs for BioNess, Chlorophyll,	.PDF		R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\SCANNED_LOGS	

		CTD deployments, filter log lab book, instrumentation, ring net tows and the underway sampling log				
Cruise Track	Robert Benjamin	The mission track in both .csv and shape file format	.CSV, .BAK, .CPG, .DBF, .PRJ, .SBN, .SBX, .SHP, .GPX	132 files/1 folder/388 MB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\Cruise_Track	
Bridge Log	Andrew Cogswell	Bridge log detailing station occupation information	.PDF		R:\Science\BIODataSvc\ARC\BridgeLogs\2010s\2017	
ARGO Data	Ingrid Peterson	Georeferenced salinity and temperature profiles and track data provided to GDAC's			http://www.argodatamgt.org/Access-to-data/Description-of-all-floats2	This data is gathered in the months and years following the mission and are available via the International ARGO Project Home Page - http://www.argo.net/

Shipboard Laboratory Analysis	Jeff Spry	Chlorophyll, Winkler oxygen, salinities,	.XLS, .XLSX, .DAT, .CSV	20 files/3 folders/2.42 MB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\JeffSpry	These data have already been ported into AZMP operational database currently in possession of Robert Benjamin.
Rosette/Vertical Net Tows/Shore-side Laboratory Analysis	Jeff Spry	CHN, HPLC, Nutrients, TIC&TA/PCO2, and Zooplankton analysis.			R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\Biochem	Added to this folder as these data become available
GIS files – Derived from GPS and Operational Data and Meta-data	Robert Benjamin	GIS data products including full cruise track – Full_Track.txt	.TIF, .DBF, .PRJ, .SBN, .SBX, .SHP, .XML, .CSV, .QGS, .PNG, .PNGW	19 files/4 folders/118 MB	R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\GIS	
CTD Rosette - Ocean Acidification Data	Kumiko Azetsu-Scott and Steve Punshon	Project examining PCO_2, total alkalinity, total dissolved carbon and pH			R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\Biochem	Refined data will be received for archiving at a later date and archived in proposed folder
Flow Thru - Ocean	Kumiko	Samples			R:\Science\BIODataSvc\SRC\	Lab data will

Acidification Data	Azetsu-Scott and Steve Punshon	collected from the underway for TIC and PCO_2			2010s\2017\COR2017001\Biochem	be received for archiving at a later date and archived in proposed folder
Flow Thru – Chla	Jeff Spry/Robert Benjamin	The underway Chla samples			R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\FlowThru	It has been proposed that these data will be managed independently of the rosette data in a FlowThrough database once it has been created.
CWS Bird and Mammal Data	Carina Gjerdrum (CWS)	Georeferenced ID's and quantities of mammals and birds during transit.				Summary data provided to AZMP PI for inclusion in cruise reports and for permit reporting in MPA.
Net tows	Jeff Spry/Sprytech	Zooplankton samples analyzed for taxonomic ID and enumeration for core and	.xlsx		R:\Science\BIODataSvc\SRC\2010s\2017\COR2017001\Biochem\Plankton	These data will be produced and placed in this folder when they are completed and should be

		ancillary AZMP program				added to the AZMP database template before adding to BioChem.
Data collected to evaluate whether and how organic and organometallic micronutrients influence primary productivity and phytoplankton community structure on the Scotian Shelf	Erin Bertrand (Dalhousie University)				These data should be stored in the appropriate section in the cruise folder. I'm not sure how these data should be dealt with (e.g., database) over the longer term.	As per the data agreement, these data should be supplied to us within ~6 months after each cruise to perform protein and vitamin concentration quality controls. She should be contacted within 6 months
The organic content of water samples analysed for their ability to act as cloud droplets to study the climate impact of organics in sea spray aerosol	Rachel Chang (Dalhousie University)					Within 6 months after sample collection Rachel should be contacted to supply these data

Characterization of microbial community with special interest in N Cycle (DNA and RNA, flow cytometery)	Julie LaRoche					The author has agreed to supply these data upon publication of these data but should also be contacted within 6 months