AMUNDSEN SCIENCE

ArcticNet
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2016 | Expedition Report

CCGS *Amundsen*

LEG 1A
GreenEdge / ArcticNet

LEG 1B
GreenEdge / ArcticNet

LEG 2A
ArcticNet / NETCARE

LEG 2B
ArcticNet / NETCARE /
Fondation W. Garfield Weston

LEG 3A
ArcticNet / ESRF

LEG 3B
ArcticNet / Fondation W. Garfield Weston

CCGS Des Groseilliers

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2016 Expedition Report

The 2016 Expedition Report is a collection of all cruise reports produced by the participating research teams of the 2016 CCGS *Amundsen* summer expedition and assembled by the Chief Scientists at the end of their leg. This report also includes information about cruises carried out in support of ArcticNet's mooring program and the maintenance of long-term ocean observatories in Hudson Bay (BaySys project) aboard the CGGS *Des Groseilliers.* The 2016 Expedition Report is divided into two parts:

Part I provides an overview of the expedition, along with the ship track, the stations visited and a synopsis of operations conducted. It also covers the mooring program in Hudson Bay.

Part II contains the reports submitted by participating science teams or researchers, with details on the specific objectives of their project, the field operations conducted and methodology used, and in some cases, preliminary results. When results are presented, they show the data as they were submitted at the end of the legs in 2016. The data presented in this report are illustrative only and have not been quality controlled, thus parties interested in the results should contact the project leader or the researchers who collected the data.

The sections in Part II describing each project are organized with atmospheric, surface ocean and sea ice components first (sections 1 to 7), followed by water column properties, which include the mooring program (sections 8 and 9), CTD-Rosette operations and physical properties (section 10), as well as a suite of chemical and biological parameters (sections 11 to 27). Contaminants cycling in seawater are treated in sections 28 and 29. Subsequent sections cover benthos sampling (sections 30 to 32), seabed mapping (section 33), sediments sampling (Sections 34 to 37) and ROV operations (section 38). Finally, section 39 and 40 present a summary of the School on board program and of the the educational project of GreenEdge.

The 2016 Expedition Report also includes four appendices: 1) the list of stations sampled, 2) the scientific log of activities conducted, 3) a copy of the CTD logbook and 4) the list of participants onboard during each leg.

The core oceanographic data generated by the CTD-Rosette operations, as well as meteorological information (AAVOS, Environment Canada) and data collected using the Moving Vessel Profiler (MVP), the ship-mounted current meter (SM-ADCP) and the thermosalinograph (TSG) are available in the Polar Data Catalogue (PDC) at www.polardata.ca.

Following ArcticNet's data policy, research teams must submit their metadata to the PDC and insure that their data are archived on the long-term, but it is not mandatory to use the PDC as a long-term archive as long as a link to the data is provided in the metadata (see www.arcticnet.ulaval.ca/Docs/data-policy for more details on data policy).

Part I – Overview and Synopsis of Operations

1 Overview of the 2016 *Amundsen* Expedition

1.1 Introduction

Understanding the transformation of the Arctic environment is one of the great challenges faced by Canadians and the national and international scientific communities. ArcticNet is a Network of Centres of Excellence of Canada that brings together scientists and managers in the natural, human health and social sciences with their partners from Inuit organizations, northern communities, federal and provincial agencies and the private sector to study the impacts of climate change and modernization in the coastal Canadian Arctic.

Since 2004, ArcticNet researchers have been conducting extensive multidisciplinary sampling programs in the Canadian Arctic using the Canadian research icebreaker *CCGS Amundsen*. The overarching goal of the ArcticNet marine-based research program is to study on a long-term basis how climate induced changes are impacting the marine ecosystem, contaminant transport, biogeochemical fluxes, and exchange processes across the ocean-sea ice-atmosphere interface in the Canadian Arctic Ocean. The knowledge generated from this multi-year program is being integrated into regional impact assessments to help decision makers and stakeholders develop effective adaptation strategies for the changing coastal Canadian Arctic.

The geographic scope of the ArcticNet marine-based research program includes the Beaufort Sea in the western Canadian Arctic, the Canadian Arctic Archipelago and Baffin Bay in the eastern Arctic, and extends into Hudson Bay, Ungava Bay and along the northern Labrador coast.

In the western Arctic, northern Baffin Bay and Hudson Bay, ArcticNet has established long-term oceanic observatories. Each observatory consists of a number of moorings equipped with instruments that gather continuous records of currents, temperature, conductivity, turbidity, dissolved oxygen and the vertical flux of carbon and contaminants. Some moorings are also equipped with autonomous hydrophones to record the acoustic background and the vocalizations of marine mammals.

On Friday, 3 June 2016, the CCGS *Amundsen* left its homeport of Quebec City for a 126-day expedition to the Canadian Arctic in support of several research programs, including: ArcticNet's annual marine-based research program (see Phase 3 projects- http://www.arcticnet.ulaval.ca/research/phase3projects.php) and its industry partners, the ArcticNet ESRF program, financing research to support the decision-making process related to oil and gas exploration and development on Canada's frontier lands and the Garfield Weston Foundation Innovative, aiming at investigating the oceanographic conditions near and surrounding the shipwreck Erebus in the Queen Maud Gulf; GreenEdge, a project that aimed to understand the dynamics of the phytoplankton spring bloom and determine its role in the Arctic

Ocean of tomorrow and NETCARE (Network on Climate and Aerosols: Addressing Key Uncertainties in Remote Canadian 3 Environments), a project configured around four research activities that address key uncertainties in the field, including carbonaceous aerosols, ice cloud formation and impacts, ocean-atmosphere interactions and implications of measurements on simulations of atmospheric processes and climate, and aimed to improve Canadian climate models as well as predictions of aerosols climate effects.

Mooring operations were also conducted as part of the BaySys project in Hudson Bay aboard the CCGS *Des Groseilliers*.

1.2 Regional Settings

1.2.1 *Labrador Sea and Fjords*

Between Labrador and Greenland lies the Labrador Sea, a key region that includes the Labrador Current system. This strong current carries cold water down from Baffin Bay to offshore Newfoundland and, therefore, strongly influences the oceanographic conditions on the Atlantic Canadian Shelf. The Labrador Sea acts as a corridor for southward drifting icebergs and ice islands, inducing risks for activities and operations conducted offshore Newfoundland. From this perspective, gathering scientific knowledge about the area is of particular importance as to inform federal departments and the private sector about the risks associated with the exploration and exploitation of oil and gas.

1.2.2 *Baffin Bay and Nares Strait*

Baffin Bay is located between Baffin Island and Greenland and connects the Arctic Ocean to the Northwest Atlantic. It is an important pathway for exchange of heat, salt and other properties between these two oceans. Baffin Bay's connection to the Arctic Ocean consists of three relatively narrow passages through the Canadian Arctic Archipelago (CAA). One of these passages, Nares Strait, is located between Ellesmere Island and Greenland and includes from south to north: Smith Sound, Kane Basin, Kennedy Channel, Hall Basin and Robeson Channel. Each winter, there is a prolonged period during which a land-fast ice arch spans the strait at the entrance to Robeson Channel and south of Kennedy Channel the southward flux of ice. However, in the past decade, variability in the formation of the ice arch has been observed with weaker conditions resulting in an increase in ice flux from the Arctic Ocean into Baffin Bay.

The formation of an ice arch in Nares Strait, the input of warm and salty Atlantic water from the West Greenland current moving northward along the coast of Greenland, and upwellings of warmer waters, all contribute to the creation of a large polynya, a year-round expanse of open waters, in Smith Sound and northern Baffin Bay. The North Water (NOW) Polynya is the largest (~80,000km^2) and most productive polynya in the Canadian Arctic and in addition to the tremendous marine bird resources in this area, it is of significance to many species of marine mammals. The NOW polynya has been the subject of intense ecosystem studies, including the Canadian-led study of the NOW Polynya in 1998.

Petermann Glacier is part of the Greenland ice sheet and is located east of Nares Strait near 81°N latitude. Two major ice calving events from this glacier have taken place in recent years: In August 2010, a giant ice island measuring 260 km^2 broke off from the floating portion of Petermann Glacier, reducing its area and volume by 25% and 10%, respectively, and in July 2012, a 130 km^2 ice island (about twice the area of Manhattan), calved from the northern tip of the glacier. These large ice islands have entered Nares Strait and flowed south into Baffin Bay.

1.2.3 *Canadian Arctic Archipelago*

The Canadian Arctic Archipelago (CAA) is a vast array of islands and channels that lies between Banks Island in the west and Baffin and Ellesmere Islands in the east. While transiting through the Northwest Passage, the science teams aboard the *Amundsen* extended their time series of atmosphere, ice and ocean data. This work is aimed at better understanding how the climate, ice conditions as well as ocean currents and biogeochemistry are changing under the effects of climate change and industrialization. With ice extent and volume shrinking in the Arctic, the Northwest Passage may be ice free and open to navigation during summer in the near future. Bathymetry data and sub-bottom information were collected while transiting through the Northwest Passage to map the seafloor and identify potential geohazards and obstacles to the safe navigation of this new seaway.

1.2.4 *Hudson Bay*

The *CCGS Des Groseiller* was used in Hudson Bay for the BaySys project, a partnership between ArcticNet, the University of Manitoba and Hydro Manitoba. The aim of the 2016 BaySys cruise was to recover, service and redeploy moorings. Hudson Bay is a virtually landlocked, immense inland sea that possesses unique characteristics among the world's oceans: a limited connection with the Arctic and Atlantic Oceans, a low salinity, a high volume of freshwater inputs from numerous rivers that drain central North America, and a winter season in which it is completely ice covered while summer is characterized by ice-free conditions.

1.2.5 *Beaufort Sea*

The Canadian Beaufort Sea/Mackenzie Shelf region of the Arctic Ocean has witnessed major changes in recent years, with decreasing sea ice cover and major shifts in sea-ice dynamics. The Beaufort Sea is characterized by a broad shelf onto which the Mackenzie River, the largest river in North America, carries large amounts of freshwater. The mixing of freshwater from the Mackenzie River and Arctic marine waters of the Beaufort Sea establishes an estuarine system over the shelf, with associated inputs of land-derived nutrients and freshwater biota. Along the Mackenzie Shelf stretches the Cape Bathurst polynya, an expanse of open water that exists year-round and is highly productive. This ecosystem is also exceptional since it provides habitat for some of the highest densities of birds and marine mammals in the Arctic.

Since 2002, extensive multidisciplinary research programs have been conducted in the Beaufort Sea area. Major oceanographic research activities were carried out as part of two major international overwintering research programs conducted on board the *CCGS Amundsen* in

2003-2004 (CASES program) and in 2007-2008 (CFL Study). Environmental and oceanographic research activities were also conducted in the offshore region of the Mackenzie Shelf, shelf slope and Beaufort Sea since 2009, in partnership with the Oil & Gas industry and within the framework of the Beaufort Regional Environmental Assessment (BREA, www.beaufortrea.ca) program. Overall since 2004, a marine observatory of a minimum of five oceanographic annual moorings (from 5 to 17 moorings) has been deployed and maintained annually in the area by ArcticNet researchers.

1.3 2016 *Amundsen* Expedition Plan

1.3.1 *General Schedule*

The *CCGS Amundsen* departed from its homeport in Quebec City on 3 June 2016 for a 126-day expedition to the Canadian Arctic, travelling a total of 17 812 nautical miles. The purpose of this expedition was to support the ArcticNet Marine Research Program, the GreenEdge-ArcticNet Program, the Network on Climate and Aerosols (NETCARE) Program, the Integrated Beaufort Observatory Project (iBO-ESRF) and a collaboration between ArcticNet, W. Garfield Weston Foundation and Parks Canada. The expedition was divided into three separate legs. Based on the scientific objectives, each leg was further subdivided into two segments.

1.3.2 *Leg 1a – GreenEdge / ArcticNet (3 June to 23 June 2016) Québec to Qikiqtarjuaq*

The *Amundsen* 2016 expedition started on 3 June 2016 for a three-week leg, Leg 1a, focused on the GreenEdge / ArcticNet program. The objective of this leg was to conduct multiple transect perpendicularly across the marginal ice zone (MIZ) off Baffin Island, from open water to sea ice and back again as many times as possible. Each transects were made out of one full station in open waters, one or more full stations in the MIZ and one or more ice stations. Between those full stations, succession of less detailed stations were completed. Leg 1a ended on June 23rd after the completion of 3 transects across the MIZ. The ship reached Qikiqtarjuaq that day, ready for a science rotation.

1.3.3 *Leg 1b – GreenEdge / ArcticNet (23 June to 14 July 2016) Qikiqtarjuaq to Iqaluit*

The core of Leg 1b was essentialy to continue what had been started in Leg 1a for the GreenEdge / ArcticNet program. Thus, after a quick science rotation in Qikiqtarjuaq on 23 June, the ship headed back to the MIZ off Baffin Island for three weeks of oceanographic sampling, following the same transect patterns as in Leg 1a. A larger emphasis was given to ice operations as many ice-cores were taken for analysis. The *Amundsen* science crew also deployed autonomous platforms (gliders and bio-Argo floats) and conducted detailed measurements of processes in the water-column. Leg 1 ended on 14 July with a full crew change in Iqaluit.

1.3.4 *Leg 2a – ArcticNet / NETCARE (14 July to 27 July 2016) Iqaluit to Qikiqtarjuaq*

The *Amundsen* spent approximately two weeks in Frobisher and Baffin Bay to fulfill specific objectives of the ArcticNet and NETCARE programs. Operations consisted of ROV dives, dedicated multibeam surveys, one deployment of the surface microlayer skimmer as well as coring activities. Opportunistic deployments of Agassiz trawl, IKMT and benthic beam trawl were also conducted when aggregations of fish were detected by the multibeam echo sounder. A lander deployed in 2015 by the teams of Ursula Witte (OceanLab, Abredeen, Scotland) and Philippe Archambault (UQAR/ISMER) near Qikiqtarjuaq was also recovered during Leg 2a. The Vessel sailed towards Qikiqtarjuaq for a science rotation on 27 July.

1.3.5 *Leg 2b – ArcticNet / NETCARE/ Fondation W. Garfield Weston (27 July to 25 August 2016) Qikiqtarjuaq to Kugluktuk*

The ArcticNet and NETCARE programs continued their journey as teams from W. Garfield Weston Foundation joined the science effort during Leg 2b. This four-week leg led the ship to the Canadian Arctic Archipelago, the Baffin Bay and the Nares Strait regions. Oceanographic sampling and coring operations were conducted in the Baffin Bay and the benthic lander was recovered off Qikiqtarjuaq. Other aims of Leg 2b included the deployment of three moorings, the recovery and redeployment of a mooring in Queen Maud Gulf as well as glacier and sea ice operations in Northern Baffin Bay and Nares Strait. The ship reached Kugluktuk on 25 August for a full crew rotation and the end of Leg 2.

1.3.6 *Leg 3a – ArcticNet / ESRF (25 August to 17 September 2016) Kugluktuk to Kugluktuk*

After the full crew change in Kugluktuk, the ship sailed the Beaufort Sea for a three-week leg led by chief scientist, Louis Fortier. The core of this leg was the operations surrounding the deployment of seven moorings and the recovery of five others. Coring operations were also conducted as well as MVP transects and two benthic landers recoveries. Numerous CTD-Rosette deployments (79) were performed generating a great collection of oceanographic data. The *Amundsen* sailed back to Kugluktuk on 17 September for a science rotation.

1.3.7 *Leg 3b – ArcticNet / Fondation W. Garfield Weston (17 September to 6 October 2016) Kugluktuk to Québec City*

As Leg 3 carried on, the ship sailed the water of the Canadian Arctic Archipelago, the Baffin Bay and the Labrador Sea for oceanographic sampling and coring operations. Dedicated multibeam seafloor surveys were conducted at Bylot Islands as well as opportunistic surveys while the Amundsen was transiting. IKMT and benthic beam trawl were also deployed when the echo sounder detected aggregations of fish. The Leg ended with the Amundsen making its way back to its homeport in Quebec City, accosting on 6 October.

1.4 2016 CCGS *Des Groseilliers* Expedition Plan

1.4.1 *BaySys – 26 September to 12 October – Churchill to Iqaluit*

The 2016 mooring field program took place in southern Hudson Bay from 26 September (Churchill) to 4 October (Kuujjuarapik). Opportunistic sampling continued from 5 October to 12 October in northern Hudson Bay, after which the ship returned to Iqaluit for crew change and all scientists disembarked. During the main eight-day cruise, members of all five multidisciplinary teams collected CTD profiles, water and sediment samples, and deployed oceanographic moorings along the full length of the southern coast of Hudson Bay. The focus of this field program was on the Nelson Estuary region and James Bay mouth, which are the major sources of riverine fresh water to the Hudson Bay system.

2 Leg 1a – 3 to 23 June 2016 – Baffin Bay

Chief Scientist: Marcel Babin[1] (marcel.babin@takuvik.ulaval.ca)
[1] *Takuvik, Université Laval, Québec, QC, Canada*

2.1 Introduction and Objectives

Starting on 3 June in Quebec City and ending on 23 June in Qikiqtarjuaq, Leg 1a was dedicated to the Green Edge program. The overarching goal of GreenEdge is to understand the processes that control the Arctic phytoplankton spring bloom (PSB) as it expands northward and to determine its fate in the ecosystem by investigating its related carbon fluxes. To do so, multiple oceanographic data were collected along transects traced across the marginal ice zone (MIZ) in Baffin Bay (Figure 2.1).

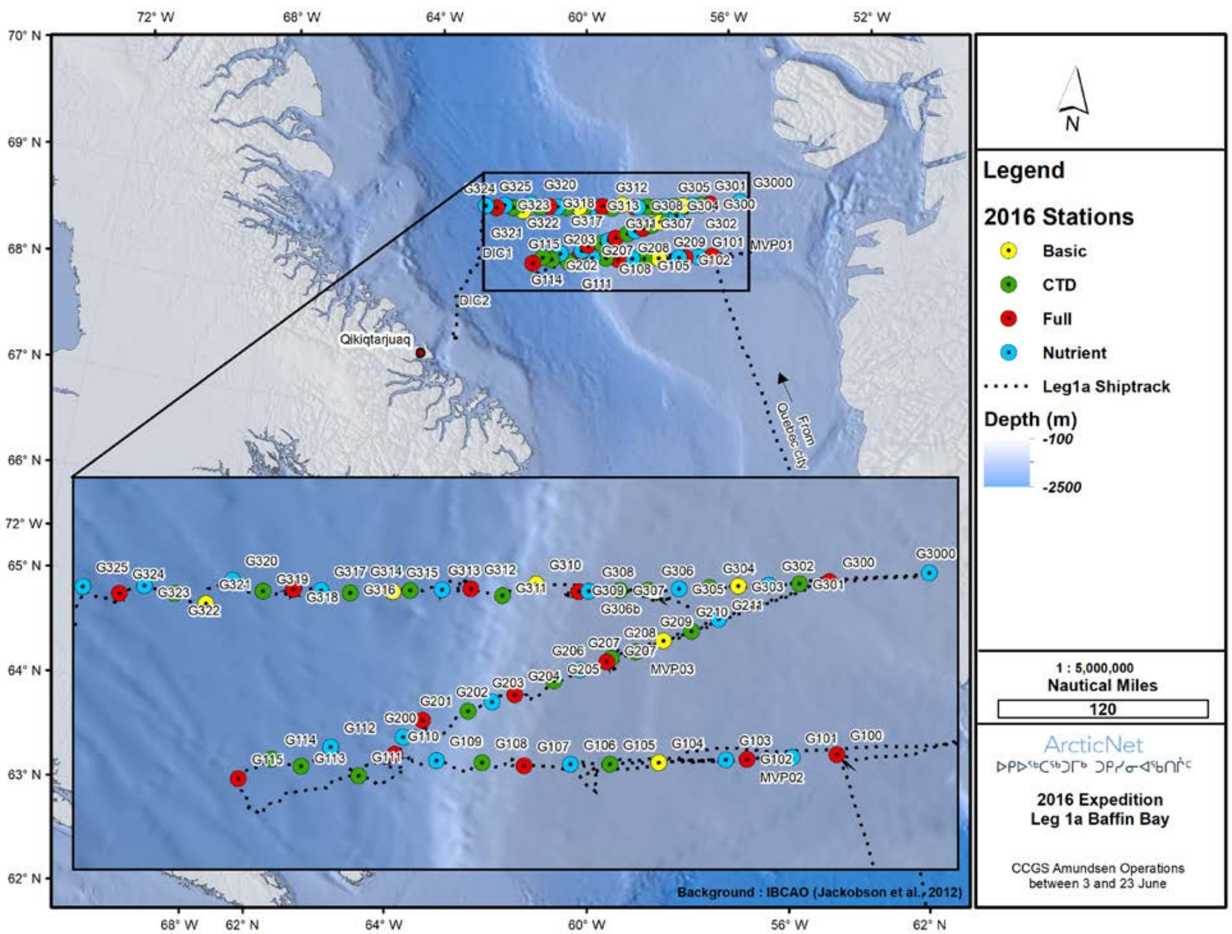

Figure 2.1. Ship track and the location of stations sampled in Baffin Bay during Leg 1a.

The project targets the following specific objectives:

- Understand the key physical, chemical and biological processes that govern the PSB in the Arctic Ocean.

- Identify key phytoplankton species involved and model their growth under various environmental conditions.
- Predict the fate of the PSB and related carbon transfer through the food chain (from plankton to humans) and toward the bottom sediments over the next few decades.
- Determine how the PSB responded to past climate variations.

2.2 Synopsis of Operations

This section provides a general synopsis and timeline of operations during Leg 1a. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during this leg are available in Part II of this report.

During this leg, the *Amundsen* traveled from Quebec City (3 June) to Qikiqtarjuaq (23 June) and 66 stations were visited with an overall tally of operations and activities as follows:

- 85 CTD-Rosette casts
- 13 box cores sampling of the sediments and 2 bottom grab deployments
- 6 ice sampling operations
- 8 Agassiz trawl deployments, 2 IKMT deployments and 3 beam trawl deployments
- 5 Hydrobios Deployments
- 2 glider deployments
- 6 double square net (DSN) deployments, and 8 five net vertical sampler (5NVS) deployments
- 1 Argo float deployment
- 1 iSVP deployment
- 1 mooring deployment
- 4 MVP profiles
- 13 IOP sensors deployments and 13 AOP sensors deployments
- 19 Zodiac deployments both for birds and SCAMP

A detailed scientific log for all sampling operations conducted during Leg 1a with the positions and depths of the visited stations is available in Appendices 1 and 2.

2.2.1 *Timeline of Operations*

Scientists embarked the *CCGS Amundsen* at Quebec City on 3 June for a departure the same day towards Baffin Bay. Three full days of transit along the St. Lawrence and the Labrador Sea were necessary to reach the first science station, station ISVP1, where a Polar iSVP was deployed. The two next days, as the ship progressed towards the marginal ice zone (MIZ) of Baffin Bay, the RemOceans Argo float was deployed along with a CTD-Rosette (Argo1) and a glider was recovered near the shore of Nuuk, GL (Glider).

The *Amundsen* reached the MIZ on the afternoon of 9 June and the first full open water station (G100) of the Green Edge transects was completed before nightfall. During the night, the MVP was deployed and kept profiling for over 6 hours (MVP01). The next day, 10 June, five stations were completed (G101, G102, MVP02, G104, G103). The first fast ice was met on 11 June. A full station (G107) was completed that day, right in the middle of the transect. Two CTD stations (G105, G108) and two nutrient stations (G106, G109) were also completed that day, including zodiac operations as well as glider and hydrobios deployments along with usual deck operations.

The deeper in-ice station of the first transect (G115) was reached on the early morning of 13 June. Ice operations took an important part of the schedule that day besides zodiac activities and deck operations.

Using the next four days to transect back east of the MIZ, the ship had the opportunity to complete 15 stations along the way: 3 full stations (G201, G204, G207), 1 basic station (G209), 4 nutrient stations (G200, G203, G206, G211), 5 CTD stations (G202, G205, G207, G208, G210) and 2 MVP stations (MVP03, MVP04). Those stations included zodiac trips, ice operations and hydrobios deployments. As the ship sailed back east, the ice got looser and looser until open water was reached on 17 June, marking the end of the second transect and the beginning of the third one with a full station (G300) and a nutrient station (G3000).

On 18 June, the ship was already heading back to the fast ice for the beginning of the last stretch of Leg 1a. Nine stations were completed that day (G303, G304, G305, G306, G306b, G307, G308, G309, G310), involving zodiac trips, coring operations and a great quantity of oceanographic sampling. The next three days, the crew and science teams stayed busy, keeping a nice pace of 5 stations-a-day until reaching G325 on 21 June, the last station of the transect. Ice operations, zodiac trips and hydrobios deployments were conducted on each of these days.

On 22 June, the ship sailed towards the science rotation destination, Qikiqtarjuaq. Along the way, two CTD-Rosette casts were conducted (DIC1, DIC2). Qikiqtarjuaq was reached that night as 15 scientists were getting ready to leave the ship the next day and 25 others were preparing their greetings for the incoming science teams.

2.3 Chief Scientist's Comments

The crew was very cooperative. Communication with the bridge was optimal. We achieved as much as we wanted, perhaps even more. The only logistical problem we experienced was related to the seawater pumping dedicated to the cooling of front-deck incubators. It stopped working few times while samples were being incubated, and when we were breaking ice. Those analyses were lost.

3 Leg 1b – 23 June to 14 July 2016 – Baffin Bay

Chief Scientist: Jean-Éric Tremblay[1] (Jean-Eric.Tremblay@bio.ulaval.ca)
[1] *Département de biologie, Université Laval, Québec, QC, Canada.*

3.1 Introduction and Objectives

Leg 1b started on 23 June at Qikiqtarjuaq and ended on 14 July in Iqaluit. This leg was the continuity of what had been started during Leg 1a and aims to collect as many data as possible along transects across the marginal ice zone (MIZ) in Baffin Bay (Figure 3.1).

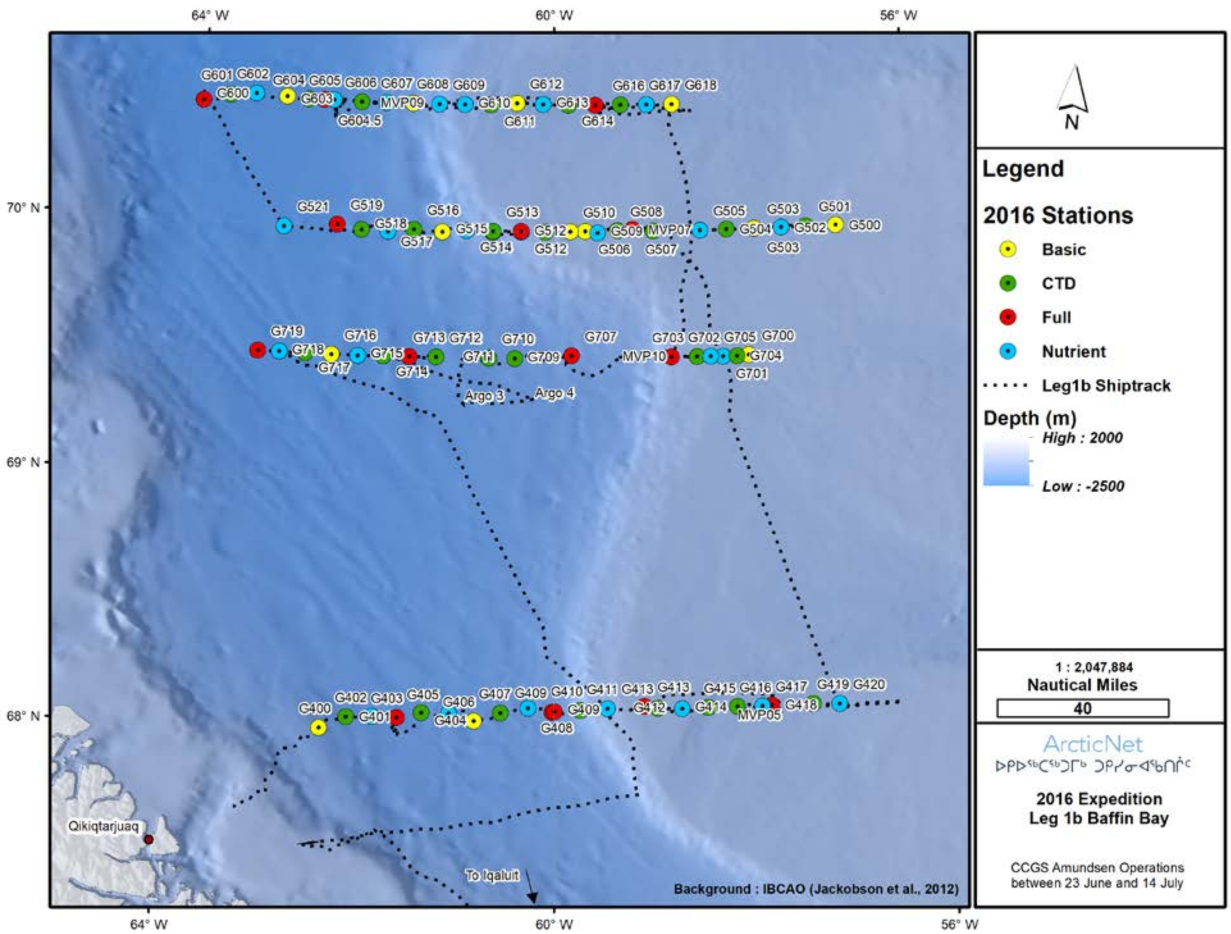

Figure 3.1. Ship track and the location of stations sampled in Baffin Bay during Leg 1b.

The project targets the following specific objectives:

- Understand the key physical, chemical and biological processes that govern the PSB in the Arctic Ocean.
- Identify key phytoplankton species involved and model their growth under various environmental conditions.
- Predict the fate of the PSB and related carbon transfer through the food chain (from plankton to humans) and toward the bottom sediments over the next few decades.
- Determine how the PSB responded to past climate variations.

3.2 Synopsis of Operations

This section provides a general synopsis and timeline of operations during Leg 1b. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during this leg are available in Part II of this report.

During this leg, the *Amundsen* traveled from Qikiqtarjuaq (23 June) to Iqaluit (14 July) and 95 stations were visited with an overall tally of operations and activities as follows:

- 119 CTD-Rosette casts
- 21 box cores sampling of the sediments
- 6 ice sampling operations
- 7 Agassiz trawl deployments, 4 IKMT deployments and 3 beam trawl deployments
- 5 Hydrobios Deployments
- 1 glider deployment
- 10 double square net (DSN) deployments, 14 five net vertical sampler (5NVS) deployments and 4 iSVP deployment
- 6 MVP profiles
- 16 IOP sensors deployments and 22 AOP sensors deployments
- 21 Zodiac deployments both for birds and SCAMP
- 4 floats deployments

A detailed scientific log for all sampling operations conducted during Leg 1b with the positions and depths of the visited stations is available in Appendices 1 and 2.

3.2.1 *Timeline of Operations*

After a science rotation in Qikiqtarjuaq on 23 June, participants of Leg 1b were ready to carry on the science effort begun in Leg 1a. The plan was to keep tracing transects across the marginal ice zone (MIZ) in Baffin Bay while collecting as many oceanographic data as possible. Actions were taken in that direction as early as June 24th. The first station of Leg 1b (G400), completed on 24 June, marked the beginning of a fourth transect for the GreenEdge teams.

That fourth transect is made out of 23 stations (G400 to G420) and took 5 days to complete. During those 5 days, people on board deployed valiant efforts to conduct operations in a safe and efficient manner. Amongst the many scientific activities onboard, ice operations were completed (G403, G409, G413), zodiac trips were conducted every day, 3 hydrobios were deployed (G403, G409, G413) and 38 CTD-rosette and 10 box core deployment were carried out. Eastern station of transect 4 was done by the night of 28 June. The ship then cruised towards the next transect while collecting precious data from the MVP (MVP05).

From 29 June to 2 July, the *Amundsen* was focused on completing the fifth transect of GreenEdge Expedition. Cruising east to west across the MIZ, the ship covered 26 scientific stations with that transect (G500 to G521). Along with the usual deck operations, the crew deployed two Polar iSVP (G512, G519), one hydrobios (G519) and collected ice data for analysis (G519). Zodiac trips were also taken each time a full station was getting done (G507, G512, G519).

On 3 July, after a whole night of transit, the ship reached station G600; beginning of the GreenEdge Program northest transect. Science activities started in the morning with a full station involving ice operations (G600). The same day, a CTD station (G601) and a nutrient station (G602) were completed. During the next 3 days, busy bees onboard managed to complete 16 stations; 2 full stations (G615, G604.5), 3 basic stations (G603, G608, G612), 5 nutrient stations (G605, G607, G609, G610, G613), 4 CTD stations (G604, G606, G611, G614) and 2 MVP lines (MVP08, MVP09). These stations involved the usual deck operations, but also zodiac trips (G605, G615, G604.5) and one iSVP deployement (G604.5). Three more stations were completed on that transect on 7 July, the ship then headed north to initiate the seventh and last transect of leg 1.

The seventh transect took 4 days and 22 stations to complete (G700 to G719). Amongst the usual deck operations, 4 bio-Argo floats (G708, G711, Argo3, Argo4) were deployed as well as an iSVP (Argo4) and a Glider (G713). No ice operations were conducted along that transect. After a long day of science operations on 10 July, the *Amundsen* began its journey towards Iqaluit where a full crew change was planned 14 July.

4 Leg 2a – 14 to 27 July 2016 – Frobisher and Baffin Bay

Chief Scientist: Christian Nozais[1] (Christian_nozais@uqar.ca)
[1] Institut des Sciences de la Mer, Université du Québec à Rimouski, Rimouski, QC, Canada

4.1 Introduction

Leg 2a of the 2016 *Amundsen* Expedition took place from 14 July to 27 July and was centered on the ArcticNet marine science and NETCARE programs, with scientific activities in inner and outer Frobisher Bay, and in the Labrador Sea, Davis Strait and southern Baffin Bay (Figure 4.1).

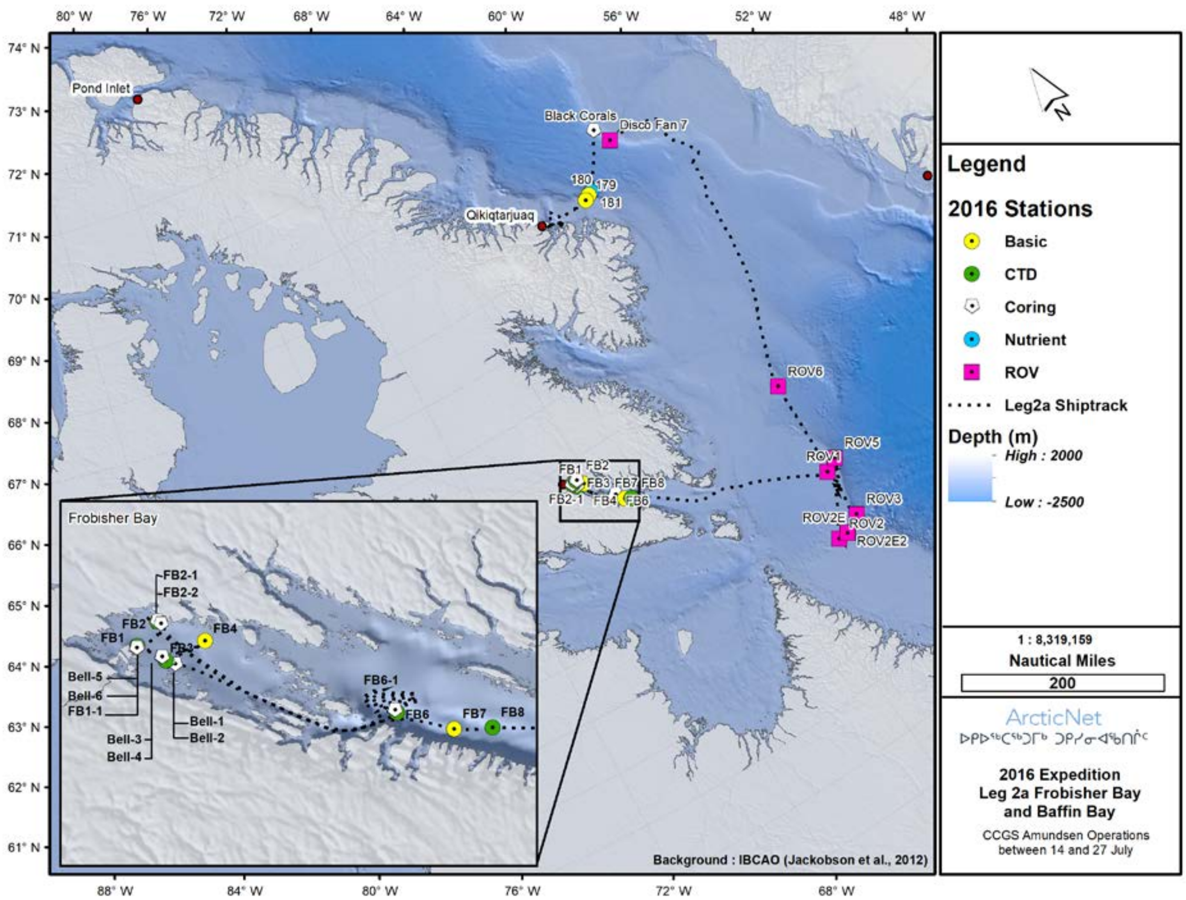

Figure 4.1. Ship track and the locations of stations sampled in inner and outer Frobisher Bay, and in the Labrador Sea, Davis Strait and southern Baffin Bay by the *CCGS Amundsen* during Leg 2a of the 2016 ArcticNet Expedition.

Specific objectives and priorities of Leg 2a were to:

- Conduct ROV dives at stations (numbering reflects order of priority):
- ROV1=NE Hatton Basin 1 (dives #1, 2)
- ROV2=NE Saglek Cold Seep (dives #3, 4)
- ROV5=NE Hatton Primnoa monster (dive #7)
- ROV6=SE Baffin Shelf (dive #8)
- ROV7=Disko Fan (dives #9, 10)
- ROV3=NE Saglek Primnoa coral-rich (Back-Up site)

- ROV4=SE Hatton Basin (Back-Up site)
- Sample the atmosphere and quantify gas fluxes at the seawater-atmosphere interface along the cruise track.
- Conduct basic operations at each ROV dive site (5 ROV sites and 5 basic stations)
- Undertake six piston coring – box coring in inner Frobisher Bay
- Deploy three box cores at three specific sites in inner Frobisher Bay
- Sample two basic stations in inner Frobisher Bay
- Sample three CTD stations in inner Frobisher Bay
- Deploy four box cores in outer Frobisher Bay
- Deploy four Agassiz trawl stations in outer Frobisher Bay
- Sample three CTD stations in outer Frobisher Bay
- Conduct Multibeam and sub-bottom seafloor survey in outer Frobisher Bay (12 hours).
- Conduct oceanographic sampling at designated stations in southern Baffin Bay
- Undertake opportunistic Zodiac launch for the deployment of the surface microlayer skimmer
- Undertake opportunistic IKMT or benthic beam trawl deployment if aggregation of fish is detected with the echosounder.

4.2 Synopsis of Operations

This section provides a general synopsis and timeline of operations during Leg 2a. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during this leg are available in Part II of this report. During this leg, the *Amundsen* traveled from Iqaluit (14 July) to Qikiqtarjuaq (27 July) and 28 stations were visited, with an overall tally of operations and activities as follows:

- 22 CTD-Rosette casts
- 6 ROV dives
- 5 optical profiles, including Secchi disk and PNF.
- 15 plankton net tows, including oblique and vertical net tows
- 4 Agassiz trawls to sample the benthic fauna
- 47 box cores
- 9 piston cores
- 1 skimmer deployment

A detailed scientific log for all sampling operations conducted during Leg 2a with the positions and depths of the visited stations is provided in Appendix 2.

4.2.1 *Timeline of Operations*

<u>Inner and outer Frobisher Bay</u>

Leg 2a started from Iqaluit on July 14th coinciding with a full crew change. The night of the 14 July was dedicated to a multibeam survey in outer Frobisher Bay. Following this multibeam survey, stations FB6 and FB6-1 were reached to conduct CTD casts and box coring operations. Thereafter, the *Amundsen* spent two days (15 and 16 July) conducting piston coring, box coring and CTD casts at selected stations in inner Frobisher Bay. Each piston coring site also included one deployment of the box corer. Piston coring operations were conducted during the daytime shift. During these two days, basic sampling operations (CTD-Rosette, nets and trawls, piston cores, and box cores) were also conducted at station FB4. Sampling operations planned at station FB5 were cancelled due to lack of time. After the sampling operations were completed in inner Frobisher Bay, the vessel then proceeded toward outer Frobisher Bay to conduct sampling operations involving CTD-Rosette, box cores, and Agassiz trawl deployments at stations FB7 and FB8. Once operations were completed in outer Frobisher Bay in the early morning of 17 July, the *Amundsen* started its transit toward site ROV1.

<u>Labrador Sea, Davis Strait, and Southern Baffin Bay</u>

The *Amundsen* arrived on station (site ROV1) in the late night of the 17 July. The first operation to be conducted at site ROV1 was the 10-hour multibeam survey. This survey was completed in the early morning of 18 July. The morning of 18 July was then dedicated to ROV operations at site ROV1. At this site, the dive was shortened due to issues with the video. Basic sampling operations (Optical profiles, CTD-Rosette, nets, and box cores) followed at this site. Upon completion, a multibeam sonar and sub-bottom profile survey was carried out at site ROV4, about 15 nautical miles to the south of site ROV1. Site ROV5 was the second site to be visited for ROV operations on the 19 July. Prior to the dive, basic sampling operations (Optical profiles, CTD-Rosette, nets, and box cores) were conducted at this site. The ROV dive took place thereafter but had to be shortened due to the loss of hydraulic pressure. The vessel then proceeded toward site ROV2. Since the ROV needed to be repaired, no dive was completed at the site. A multibeam sonar and sub-bottom profile survey was however completed at this site followed by basic sampling operations (Optical profiles, CTD-Rosette, nets, and box cores) on the 20 July. With favourable weather conditions, the zodiac was also launched for the deployment of the surface microlayer skimmer. Additional multibeam data were then collected en route to site ROV3. This site was reached in the early morning of 21 July and basic sampling operations (CTD-Rosette, nets, and box cores) were conducted at this site before the ROV dive. Diving operations followed but had to be refrained due to very strong currents. The *Amundsen* then sailed toward site ROV6 that was reached on the 22 July. At this site, the dive had to be cancelled after a transect of 260 metres due to issues with the ROV cage camera. It was followed by basic sampling operations (Optical profiles, CTD-Rosette, nets and Agassiz trawl, and box cores). The *Amundsen* then headed for the site ROV7 that was reached in the early morning of 24 July. Two sub-bottom profiles were collected prior to arrival at this site. Two ROV dive operations took place at this site (24 July and 25 July) and were followed by piston coring and basic sampling operations (Optical profiles, CTD-Rosette, nets, and box cores). The last activity at site ROV7 was the deployment of artificial substrates for taphonomy experiments. Upon completion, the vessel proceeded toward stations 181 (nutrient station), 180 (basic station), and 179 (nutrient station). After sampling operations at these stations, the *Amundsen* sailed toward the lander station. The lander deployed in 2015 near Qikiqtarjuaq by the teams of Ursula Witte (OceanLab, Abredeen, Scotland) and Philippe Archambault (UQAR/ISMER) was successfully recovered early morning on the 27 July. It was drifting at the surface since the 19 July. Leg 2a ended in Qikiqtarjuaq on 27 July with a science crew change.

4.3 Chief Scientist's Comments

The cruise was carried out according to the Expedition plan with almost all stations visited and operations involving the multibeam sonar, sub-bottom profiler, the CTD and water sampling rosette, nets, box corer, and Agassiz trawl successfully conducted between 14 July and 27 July. On the other hand, science participants expressed disappointment with the ROV performance. Indeed, frequent ROV breakdowns compromised some scientific objectives of the cruise. The CSSF ROV pilot Vincent Auger wrote a separate ROV operations and maintenance report highlighting the ROV problems that should be addressed before the 2017 field season.

The Chief Scientist and all the science participants would like to thank the Commanding Officer, officers and crew of the *CCGS Amundsen* for their hard work and dedication during all the scientific operations.

5 Leg 2b – 27 July to 25 August 2016 – Canadian Arctic Archipelago, Baffin Bay and Nares Strait

Chief Scientist: Tim Papakyriakou[1] (tim.papakyriakou@umanitoba.ca)
[1] *Centre for Earth Observation Science, Department of Environment and Geography, University of Manitoba, Winnipeg, MB, Canada*

5.1 Introduction

Leg 2b was carried out from 27 July to 25 August. The leg focused on the ArcticNet and NETCARE collaboration with the W. Garfield Weston Foundation with scientific operations conducted in Baffin Bay, Nares Strait and the Canadian Arctic Archipelago (Figure 5.1).

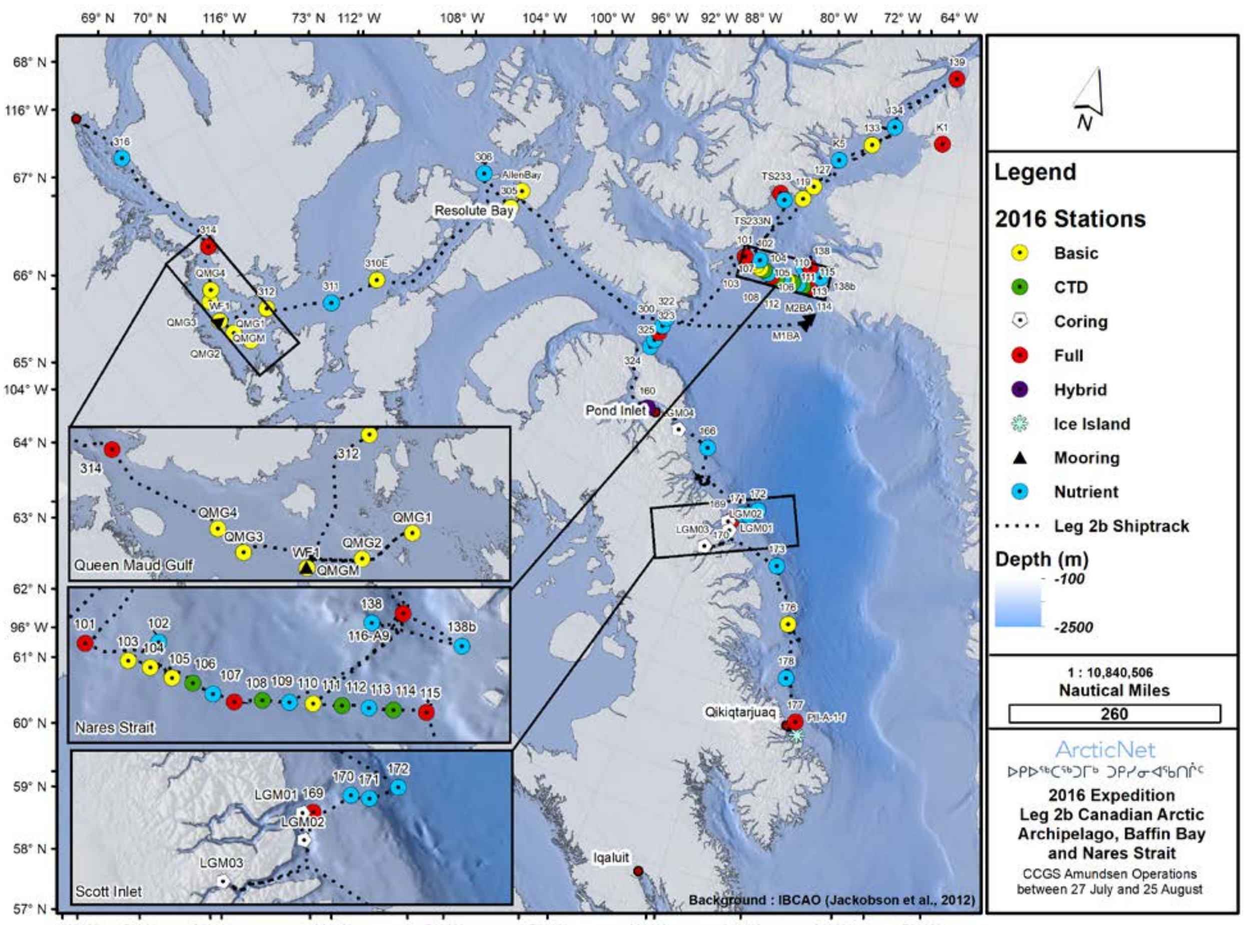

Figure 5.1 Ship track and the location of stations sampled in the Canadian Arctic Archipelago, Baffin Bay and Nares Strait during Leg 2b.

The specific objectives and priorities of Leg 2b were to:

- Recover a benthic lander off Qikiqtarjuaq;

- Conduct oceanographic sampling and coring operation off the Baffin Island Coast/Shelf and at designated stations in Nares Strait, Lancaster Sound, Northwest Passage and Queen Maud Gulf;
- Deploy triplicate box core at stations 177 (Qikiqtarjuaq), station 170 (Scott Inlet), station 323 (Lancaster Sound) and at Basic station 314 (Queen Maud Gulf);
- Conduct multibeam seafloor survey in Buchan Gulf;
- Deploy two moorings along with CTD-Rosette at station M1 and station M2 in Baffin Bay;
- Sample the Greenland-Ellesmere transect across Baffin Bay;
- Conduct MVP transect at Carey Islands in Baffin Bay;
- Deploy one CASQ core and triplicate box core at Full station 117;
- Conduct glacier operations at Trinity Glacier on Ellesmere Island ;
- Conduct sea ice operations in Northern Baffin Bay and Nares Strait including the deployment of on-ice met towers and ice beacons;
- Conduct a mooring recovery and redeployment in Queen Maud Gulf;
- Deploy the surface microlayer skimmer and fine scale pCO_2, temperature and salinity measurements;
- Conduct opportunistic melt pond sampling;
- Conduct opportunistic IKMT or benthic beam trawl deployment when aggregation of fish are detected with the echo sounder.
- Conduct a multibeam bathymetric survey at sites of previous ice island groundings near Coburg Island and in Kane Basin.
- Recover the GreenEdge gliders.

5.2 Synopsis of Operations

This section provides a general synopsis and timeline of operations during Leg 2b. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during this leg are available in Part II of this report.

During this leg, the *Amundsen* travelled from Qikiqtarjuaq (27 July) to Kugluktuk (25 August) and 69 stations were visited with an overall tally of operations and activities as follows:

- 87 CTD-Rosette casts
- 60 box cores sampling of the sediments, 6 CASQ cores and 4 gravity cores
- 28 Agassiz trawl deployments, 4 IKMT deployments and 14 beam trawl deployments
- 28 double square net (DSN) deployments, 28 five net vertical sampler (5NVS) deployments
- 4 Bioness deployments
- 4 mooring deployments and 2 mooring recoveries
- 5 MVP transects
- 21 optical profiles, including Secchi disk and PNF
- 6 Zodiac deployments
- 2 Helicopter rides

A detailed scientific log for all sampling operations conducted during Leg 2b with the positions and depths of the visited stations is available in Appendices 1 and 2.

5.2.1 *Timeline of Operations*

The ship left Qikiqtarjuaq after a science rotation on 27 July. The easy weather and ice conditions remained stable for much of the leg allowing science operations to proceed reasonably unimpeded. First science operations started the next day when a full station (177) and an ice island station (PII-A-1-f) were completed. Stations 178 to 166 were sampled between 29 July and 3 August along the east coast of Baffin Island. Days from 31 July to 2 August were mainly dedicated to coring operations near Scott Inlet as gravity core, box core and CASQ core were deployed from the deck (LGM-AMU-2016-03, LGM-AMU-2016-02, LGM-AMU-2016-01). The coring efforts continued on 3 August as the geology teams deployed a gravity core near the shore of Pond Inlet (LGM-AMU-2016-04).

During the next two days, a 5-station transect was conducted between Baffin Island and Devon Island (325, 324, 323, 300, 322). As the completion of the transect ended in the early morning of 5 August, the crew kept busy for the rest of the day by deploying 2 moorings along with CTD-rosette casts (M2=BA=16, M1=BA=16).

From 6 August to 10 August, ship operations were going at a fast pace as scientists and crew members performed a 15-station transect across Nares Strait. In order to allow sufficient time between basic and full stations, sampling alternated between basic stations (103, 104, 105, 110), CTD stations (106, 108, 111), nutrient stations (102, 107, 109, 113) and full stations (101, 108, 115) operations. Collection of valuable data was made possible because of the realization of this ambitious transect.

On 11 August, The *CCGS Amundsen* met heavy ice conditions as it sailed further north through the Nares Strait. However, the crew were still able to complete 10 stations (TS233, TS233N, 139, KANE_1, 134, 136, 133, KANE_5, 127, 119) and conduct 3 MVP transect profiles (133, 119) within ice openings over the period between 11 August and 15 August.

16 August was a transit day as the ship had to travel the whole way from Nares Strait to the Canadian Arctic Archipelago. The seascape was mainly ice free with small bergy bits and isolated floes along the way. During the first few days in the Canadian Arctic Archipelago, basic and nutrients stations were getting complete at a nice pace. On 20 August, the *Amundsen* entered Queen Maud Gulf, slowly making its way toward Kugluktuk while pursuing the oceanographic sampling effort. The next day, the last mooring station (WF1) allowed to recover 1 mooring and to deploy 2 more moorings. After 3 basic stations on the 22nd (QMG1, GMG3, GMG4), the ship replicated a transect for surface pCO_2 previously sampled by the *Martin Bergmann on* 23 August, then resumed sampling operations at station 314.

The next day, a nutrient station (316) marked the end of scientific operations for Leg 2b. The ship used the rest of the day to slowly cruise toward Kugluktuk while scientists on board prepared for the full crew change and their return in warmer weather.

5.3 Chief Scientist's Comments

This leg was ambitious both in terms of the number of stations and geographic domain covered. The ship and crew exceeded expectations sampling more stations than those identified in the cruise plan. For the most part the weather and ice were supportive of operations. There were occasions where sampling continued only because of the expertise and experience of the captain, officers and crew of the *Amundsen*. The Chief Scientist's tasks were greatly supported by an experienced and accommodating ship and science crew. I complement and extend thanks to all Coast Guard and Science personnel for a truly productive and enjoyable cruise.

6 Leg 3a – 25 August to 17 September 2016 – Beaufort Sea

Chief Scientist: Louis Fortier[1] (louis.fortier@bio.ulaval.ca)
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6.1 Introduction

Leg 3a of the 2016 Expedition took place from 25 August to 18 September and focused on achieving the objectives of ArcticNet's integrated Beaufort Observatory (iBO) program funded by the Environmental Studies Research Fund (ESRF). The ESFR program finances research to support the decision-making process related to oil and gas exploration and development on Canada's frontier lands. This year, the research efforts were concentrated in the Beaufort Sea (Figure 6.1).

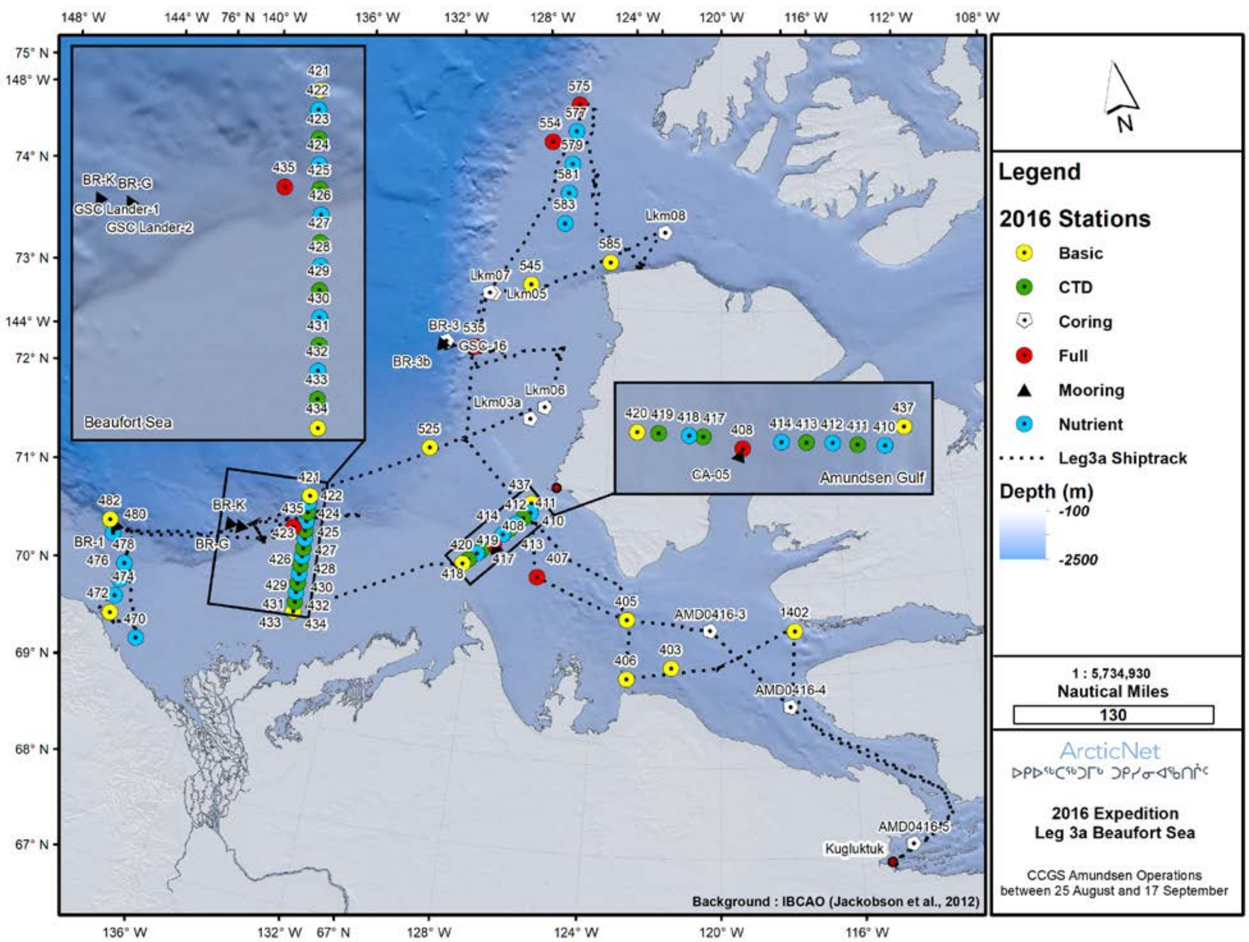

Figure 6.1. Ship track and the location of the stations sampled in Beaufort Sea during Leg 3a.

Specific objectives and priorities of Leg 3a were to:

- Conduct mooring operations at stations CA08, CA05, BR-K, BR-G, BR-3, BR-1;
- Conduct oceanographic sampling at designated stations in the Beaufort Sea and in M'Clure Strait;

- Deploy triplicate box core at Full station 435, at Basic station 465, at Nutrient Station 476 and at Mooring station BR-G;
- Deploy additional CTD-Rosette for large volume (10L) sampling for mercury analyses at Basic stations 421 and 434;
- Conduct coring operations in Amundsen Gulf, in Banks Island Shelf and in M'Clure Strait.
- Conduct sea-ice operations NW of Banks Island;
- Conduct opportunistic deployment of IKMT or benthic beam trawl if aggregation of fish are detected with the echo sounder;
- Conduct opportunistic surface water sampling at 3 Moorings stations with passive sampler;
- Deploy the vertical net from 100 m to the surface between Mooring stations BR-K and BR-G;
- Deploy the E-Z-Net to study the diurnal cycle in vertical distribution of fish larvae;
- Recover and redeploy the Benthic lander;
- Conduct opportunistic oceanographic sampling at the Thomson River plume on northern Banks Island for contaminants measurements.

6.2 Synopsis of Operations

This section provides a general synopsis and timeline of operations during Leg 3a. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during this leg are available in Part II of this report.

During this leg, the *Amundsen* traveled from Kugluktuk (25 August) to Kugluktuk (17 September) and 74 stations were visited with an overall tally of operations and activities as follows:

- 79 CTD-Rosette casts
- 29 box cores sampling of the sediments, 9 piston cores, 1 bottom grab deployment and 4 gravity cores
- 3 IKMT deployments and 11 beam trawl deployments
- 20 double square net (DSN) deployments, 15 five net vertical sampler (5NVS) deployments
- 1 E-Z-Net deployment and 3 hydrobios deployments
- 2 lander deployments
- 7 mooring deployments and 5 mooring recoveries
- 6 MVP profiles
- 11 optical profiles, including Secchi disk and PNF
- 31 radiosonde launches
- 3 Uptempo buoy deployments
- 3 Zodiac deployments

A detailed scientific log for all sampling operations conducted during Leg 3a with the positions and depths of the visited stations is available in Appendices 1 and 2.

6.2.1 *Timeline of Operations*

Leaving Kugluktuk on 25 August, the *Amundsen* headed west toward the Beaufort Sea for a full three-week journey of oceanographic sampling. The first station (AMD0416-4) was reached before noon on 26 August and the beginning of science operations was launched by a box core deployment (AMD0416-4). Another box core deployment followed at the next coring station reached the same day (AMD0416-3). A basic station and a full station were both completed in the next two days in the clear open water of the Amundsen Gulf (405, 407).

On 28 and 29 August, a total of 12 stations were completed in order to perform a transect across the Amundsen Gulf. Nutrient and CTD station types were alternated along that transect. Those two days were also used to deploy 2 moorings and recover another one (407, CA-05).

The ship reached the Beaufort Sea on the morning of 30 August prepared for a two-day South-to-North transect. A total of 18 stations were completed along that transect and allowed the recovery of two moorings (BR-G, BR-K), the deployment of the Uptempo buoy #11 (BR-G) as well as the collection of precious oceanographic data (stations 421 to 434). Two lander recovery operations also occurred during those days; one successful (GSC Lander-2) and one where the Lander could not be found (GSC Lander-1).

The next three days, 1 to 3 September, were dedicated to the oceanographic sampling of the Mackenzie Trough. During those days, the crew proceeded to a mooring recovery, a mooring deployment and an Uptempo buoy deployment (BR-1) as well as to many water sampling operations with the CTD-Rosette (482, 480, 478, 476, 474, 472, 470).

4 September was a busy day on board as 2 moorings were deployed (BR-G, BR-K), 2 landers were deployed (GSC Lander-1, GSC Lander-2) and sampling and coring operations were conducted at 4 different stations.

The ship used the next 5 days to sail to the northeast stations of Leg 3a, stopping multiple time along the way in order to conduct different science operations. Amongst those operations, one mooring was recovered (BR-3), Uptempo buoy #15 was deployed (BR-3) and 3 piston core deployments were conducted (Lakeman-03a, Lakeman-06) as well as gravity core and box core deployments (Lakeman-05).

The *CCGS Amundsen* reached the northeast station of Leg 3a in tight ice conditions on the afternoon of 10 September, ready to conduct a two-day North-to-South transect. 5 stations were completed in order to fulfill that transect, one full station (575) and four nutrient stations (577, 579, 581, 583). The ice conditions remained heavy along the transect, but ice got looser as the ship sailed south.

On 12 September, two stations were completed (585, Lakeman-08) before the ship started to slowly make its way back to Kugluktuk. En route, a total of 9 stations were completed allowing to conduct one mooring deployment (BR-3b) and 5 MVP profiles (BR-3b, 525, 403, 405, 406).

Science activities ended with coring operations in Coronation Gulf on the night of 16 September (AMD0416-5).

The ship reached Kugluktuk on 17 September full of excited scientists ready to go back to work with their new samples.

6.3 Chief Scientist's Comments

Science operations were interrupted for 15 hours on September 1st by the need to meet with a fuel barge at Hershel Island to get additional fuel. Service from the fuel provider were not particularly impressive. On top of this, on September 4th the Amundsen had to backtrack to assist that provider as the barge got separated from its tug in bad weather, losing an additional 34 hours of science operations.

For 14 years now, heavy ice (often multiyear ice) has prevented the scientific exploration of M'Clure Strait by the CCGS *Amundsen*. Again this year, several objectives could not be completed as ice conditions did not allow safe operations deep into the Strait. A narrow band of open water and loose ice along northern Banks Island could have enabled us to reach some of the planned stations, but the risk of this narrow channel closing on the Amundsen with some change in wind direction was deemed too high, especially as time constraints to reach Kugluktuk on schedule developed during the leg.

7 Leg 3b – 7 September to 6 October 2016 – Canadian Arctic Archipelago, Baffin Bay and Labrador Sea

Chief Scientist: Louis Fortier[1] (louis.fortier@bio.ulaval.ca)
[1] *Département de biologie, Université Laval, Québec, QC, Canada*

7.1 Introduction

Leg 3b started in Kugluktuk on 17 September and ended in Quebec City on 6 October (Figure 7.1). This segment of the Expedition focused on the ArcticNet program and W. Garfield Weston Foundation collaboration and marked the end of the 2016 CCGS *Amundsen* Expedition.

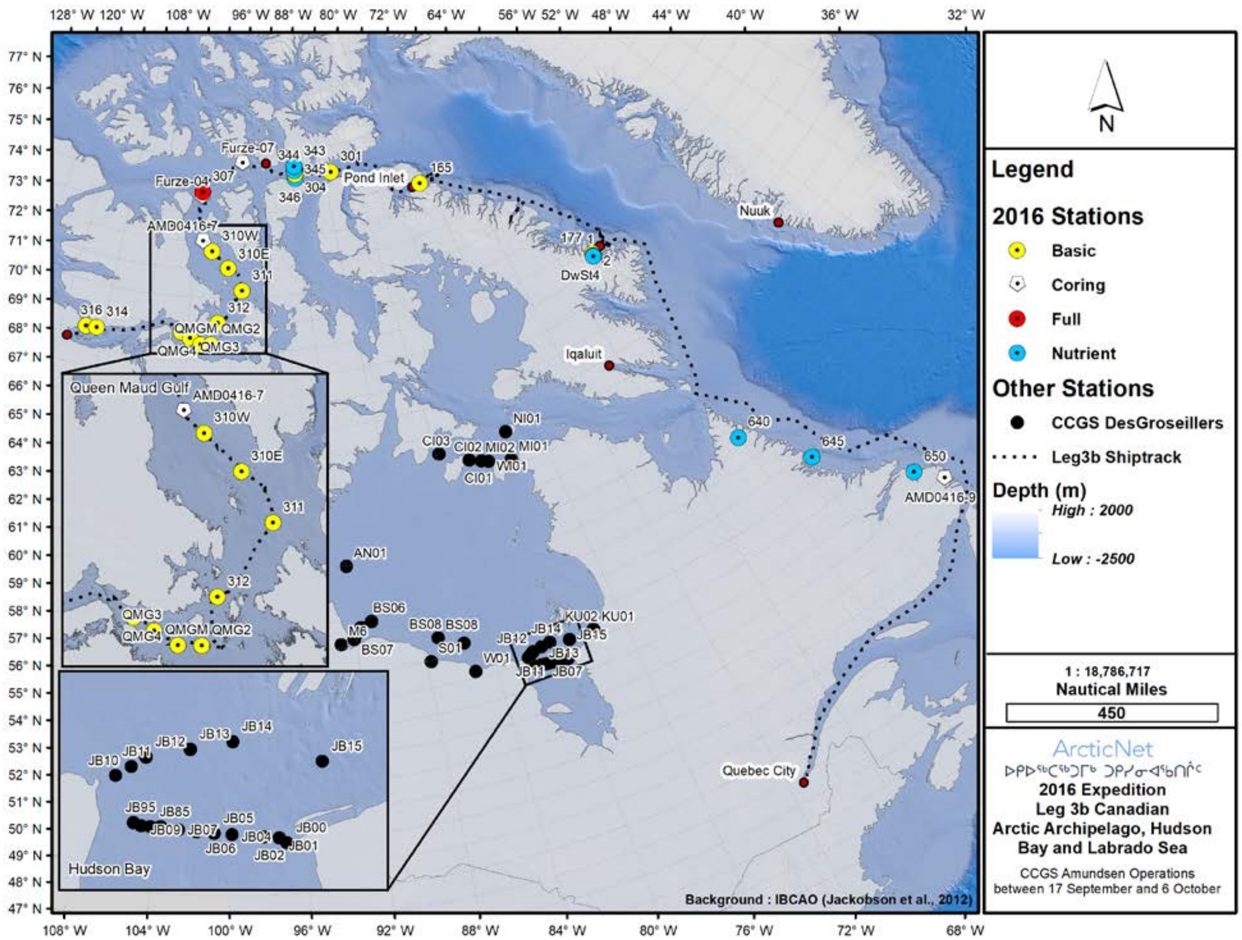

Figure 7.1. Ship track and the location of the stations sampled in the Canadian Arctic Archipelago and the Labrador Sea during Leg 3b. The stations in Hudson Bay were sampled from the *CCGS Des Groseillers*.

The specific objectives for Leg 3b were to:

- Conduct oceanographic sampling at designated stations in Queen Maud Gulf, McClintock Channel, Barrow Strait, Lancaster Sound, along the Baffin Island coast and in the Labrador Sea;

- Deploy triplicate box core at Basic stations QMG2 and 312 (Queen Maud Gulf);
- Conduct coring operations in McClintock Channel;
- Conduct multibeam seafloor survey at Bylot Island (up to 8 hours);
- Conduct ice island PII-A-1-f sampling near Qikiqtarjuaq;
- Recover a cargo at Qikiqtarjuaq;
- Conduct opportunistic IKMT or benthic beam trawl deployment if aggregations of fish are detected with the echo sounder;
- Conduct opportunistic atmospheric sampling at ice island PII-A-1-f.

7.2 Synopsis of Operations

This section provides a general synopsis and timeline of operations during Leg 3b. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during this leg are available in Part II of this report.

During this leg, the *Amundsen* traveled from Kugluktuk (17 September) to Quebec City (6 October) and 30 stations were visited with an overall tally of operations and activities as follows:

- 30 CTD-Rosette casts
- 22 box cores sampling of the sediments, 1 piston core and 2 gravity cores
- 1 IKMT deployment and 14 beam trawl deployments
- 15 double square net (DSN) deployments, 13 five net vertical sampler (5NVS) deployments
- 1 Bioness deployment and 1 hydrobios deployment
- 15 radiosonde launches
- 1 SX90 deployment
- 3 Zodiac deployments

A detailed scientific log for all sampling operations conducted during Leg 3b with the positions and depths of the visited stations is available in Appendices 1 and 2.

7.2.1 *Timeline of Operations*

Leg 3b started in Kugluktuk on 17 September as 20 scientists from Leg 3a remained on board and 20 others were replaced by new arrivals including 12 high-school students and their mentors for the Schools-on-Board program. The SoB contingent and 4 scientists left the ship in Pond Inlet on 25 September to be replaced by an international group of 16 researchers and dignitaries from universities, funding agencies and philanthropic organizations, who left the ship on 28 September after conducting a workshop on the funding of Arctic research and participating in the science operations between Pond Inlet and Qikiqtarjuaq. Two additional scientists boarded on 28 September for the Qik-Quebec segment. Scientific operations began on 18 September with the completion of two basic stations in Coronation Gulf (314, 316).

During the three next days, 19 September to 21 September, 8 basic stations were conducted in Queen Maud Gulf allowing multiple CTD-rosette, beam trawl, 5NVS, DSN and box core deployments. The cruise through Queen Maud Gulf was also an opportunity to deploy the Bioness (310E) and launch the radiosonde five different times (QMG4, QMG2, 312, 310E, 310W) in order to collect valuable atmospheric data. The last station in that region was a coring station (AMD0416-7) where a box core and a gravity core were deployed.

On 22 September, a full station and a coring station were completed (307, Furze-04). The ship then sailed through the Canadian Arctic Archipelago for 3 more days during which a short 5-station transect was completed (346, 304, 345, 344, 343) along with a coring station (Furze-07) and a basic station (301).

The *Amundsen* reached Bassin Bay in the morning of 26 September and started sampling the region by completing a basic station near Pond inlet. The 27th was a transit day and the next basic station in Baffin Bay (177) was only reached by the afternoon of the 28th, where the first small icebergs were seen. 29 September was a busy day as 4 nutrients stations were completed both from the ship deck (1, 2) and from the zodiac (Downstream 3, Downstream 4).

The *Amundsen* then started its stretch toward Québec City across the Labrador Sea. On its way, the ship stopped four different times for science purposes. First two times were on 1 October, when 2 nutrient stations were completed and the third and last times were on 2 October, when a nutrient and a coring stations marked the end of the 2016 *Amundsen* Expedition.

Between the 3rd and the 6th, the ship transited to Quebec City without any interruptions as the scientists started cleaning the laboratories and packing their belongings. The Amundsen docked in its homeport of Quebec City on 6 October.

7.3 Chief Scientist's Comments

The return leg at the end of the season is often the opportunity to conduct special activities such as the Schools-on-Board program, and to welcome representatives from different organizations who then becomes ambassadors for the science mission of the NGCC *Amundsen*. Such activities should be encouraged as they contribute to the reputation of the science program and help renew funding. They often result in major advances and spin-offs for ArcticNet and Amundsen Science. The outstanding contributions of the ship's personnel and scientists to the success of such activities is to be commended.

Part II – Project reports

1 Network on Climate and Aerosols: Addressing Key Uncertainties in Remote Canadian Environments – Legs 2a and 2b

Project leader: Jonathan Abbatt[1] (jabbatt@chem.utoronto.ca)

Cruise Participants - Leg 2a: Matthew Boyer[2], Rachel Chang[2], Roya Ghahreman[3], Victoria Irish[4] and Alexander Moravek[1]

Cruise Participants - Leg 2b: Matthew Boyer[2], Rachel Chang[2], Douglas Collins[1], Roya Ghahreman[3], Victoria Irish[4] and Alexander Moravek[1]

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1.1 Introduction

Atmospheric aerosols have important implications for climate due to their radiative properties in the atmosphere, including scattering and absorbing incoming solar radiation as well as influencing cloud properties. In the summertime Arctic atmosphere, local sources of aerosols are particularly important because long-range transport from lower latitudes is almost non-existent. Despite their importance, little is known about the specific sources of aerosol particles in the Arctic.

From 14 July to 25 August 2016, NETCARE participated in Leg 2 of the *CCGS Amundsen*'s annual cruise. This study was a follow-up from the study that took place in 2014, also on board the *CCGS Amundsen* following a similar route. The overall goal of this year's study was to use an array of atmospheric and oceanographic measurements to improve the current understanding of local aerosol sources, their chemical and physical properties and the role of biology on these properties across the Canadian Arctic.

The objectives of the study fell under two major categories:

1) To measure ambient atmospheric gases and the chemical and physical properties of aerosols. Specific objectives were to:

a) Observe secondary and primary aerosols in marine environments using aerosol sizing instruments and chemical composition measurements
b) Study the ability of arctic aerosols to activate as ice crystals and cloud droplets
c) Study sulphur compounds in the atmosphere, including dimethyl sulphide in the gas phase and methane sulphonic acid and sulphate in aerosol, rain and fog
d) Determine sources of ammonia in Arctic atmosphere

2) To investigate the potential impact of ocean biology on atmospheric particles by conducting controlled experiments on seawater collected during the cruise. Specific objectives included to:

a) Study the biology and chemistry of the sea surface microlayer and compare with bulk seawater
b) Investigate the impact of biological activity and ocean chemistry on sea spray aerosol production

1.2 Methodology

Operations were based on the icebreaker *CCGS Amundsen*. Observations of ambient Arctic air using a variety of techniques were conducted with measurement frequencies that depended on the goal of the measurement, and are listed in Table 1.1. Surface microlayer and bulk water were also collected using a rotating glass plate collector deployed from the zodiac at the stations listed in Table 1.2. Experiments will be conducted on these samples in the laboratory to discern differences in the properties of the microlayer versus the bulk water. Sea surface water samples were collected between stations and analyzed on board for ammonium. Finally, water was collected from the CTD-rosette at the stations listed in Table 1.3 to study the sea spray aerosol production efficiency of different water masses using a tank in which sea spray was generated in a controlled manner. Measurements of the number concentration, size distribution, cloud and ice nucleation properties, and chemical composition of sea spray particles conducted using both real-time analytical techniques and sample collection for offline analysis. Seawater collection was coordinated with biological sampling from the CTD-rosette, and water was further collected before and after experiments for surfactant analysis. All aerosol and water samples for offline analysis ashore were stored at -20° C.

Table 1.1. Ambient arctic air measurements, locations and frequency

Measurement	Instrument	Location(s)*	Sampling Period	Contact
Aerosol number concentration (d > 3 nm)	Ultrafine condensation particle counter	Foredeck laboratory	1 s	DC
Aerosol size distributions (d = 10 – 500 nm)	Scanning mobility particle sizer	Foredeck laboratory, Scatterometer laboratory	5 min	DC, RC
Aerosol size distributions (d = 0.5 – 20 μm)	Aerodynamic particle sizer	Foredeck laboratory, Scatterometer laboratory, above the bridge	1 min	DC, RC, VI
Black carbon concentration	Single particle soot photometer	Foredeck laboratory		DC
Carbon monoxide	CO Monitor (Thermo)	Foredeck laboratory	5 min	DC
Size-segregated aerosol chemical composition	Micro-orifice uniform deposit impactor; high flow cascade impactor; Teflon filter sampler	Foredeck laboratory	100 hours	DC
Ammonia	Quantum cascade laser spectrometer	Foredeck laboratory	1 s	AM
Cloud condensation nuclei concentrations	Cloud condensation nuclei counter	Scatterometer laboratory	1 hour	MB
Atmospheric dimethyl sulphide	GC-SCD	Above the bridge	2x/day	RG

Measurement	Instrument	Location(s)*	Sampling Period	Contact
Size-resolved aerosol MSA, SO4	Hi-Vol sampler	Above the bridge		RG
Fog composition	Strand fog water collector	Above the bridge		RG
Precipitation composition		Above the bridge		RG, AM
Atmospheric DNA	Hi-Vol sampler	Above the bridge	48-72 hrs	VI
Ice nucleating Particles	Single stage impactor	Above the bridge	2x/day	VI
CO_2	LiCor	Above the bridge	2 s	RG

*Foredeck laboratory: container located on the starboard side of the foredeck (aka – Bioness Ctrl Container); Scatterometer Lab: located on port side, amidships, Room 423

Table 1.2. Stations and locations of skimmer deployment

Date	Stn	Lon (W)	Lat (N)	Subsample[1]
2016-07-20	1	062°10.750	60°17.921	Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-28	2	063°22.067	67°23.466	Sal, O18, DIC, Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-01	3	070°30.236	71°17.200	Sal, O18, DIC, Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-06	4	071°11.418	76°20.341	Sal, O18, DIC, Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-08	5	071°47.267	76°43.777	Sal, O18, DIC, Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-09	6	075°42.963	76°18.789	Sal, O18, DIC, Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-11	7	076°29.841	77°47.213	Sal, O18, DIC, Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-13	8	062°40.774	81°20.041	Sal, O18, DIC, Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-15	9	074°33.757	78°18.659	Sal, DIC, Bio, DMS, DNA, INP, NH4, Ox, Hygr
2016-08-21	10	100°49.010	68°19.199	Sal, Bio, DMS, DNA, INP, NH4, Hygr
2016-08-23	11	105°30.022	68°58.699	Sal, Bio, DMS, DNA, INP, NH4, Ox, Hygr

[1]Sal=Salinity, DIC=Dissolved inorganic carbon, Bio=Biological variables (DOC/TOC, Bacteria, pico- & nano-phytoplankton, Chl a, nutrients, taxonomy, photosynthetic performance, surfactants, transparent exopolymers), DMS=aqueous dimethylsulphide & dimethylsulphide propionate, DNA=qPCR analysis, INP=ice nucleating particles, Ox=Laboratory oxidation experiments, Hygr=hygroscopicity measurements

Table 1.3. Stations and locations of sea spray tank experiments

Date	Stn	Lon (W)	Lat (N)	Measurements[1]
2016-07-22	ROV6	60.66	63.00	SMPS, APS, CCNC, SSI
2016-07-25	ROV7	91.25	67.99	SMPS, APS, CCNC, SSI
2016-08-01	169	70.52	71.27	SMPS, APS, CCNC, SSI, MOUDI
2016-08-04	323	80.45	74.16	SMPS, APS, CCNC, SSI, MOUDI, CPC, Surf
2016-08-08	117	71.81	76.74	SMPS, APS, CCNC, SSI, MOUDI, CPC, Surf
2016-08-09	108	74.56	76.27	SMPS, APS, CCNC, SSI, MOUDI, CPC, Surf
2016-08-10	101	77.38	76.38	SMPS, APS, CCNC, SSI, MOUDI, CPC
2016-08-13	139	62.79	81.35	SMPS, APS, CCNC, SSI, MOUDI, CPC, DMS, Surf
2016-08-14	Kane1	69.81	79.97	SMPS, APS, CCNC, SSI, MOUDI, CPC, DMS, Surf
2016-08-15	127	74.53	78.29	SMPS, APS, CCNC, SSI, MOUDI, CPC, Surf
2016-08-18	305	94.98	74.33	SMPS, APS, CCNC, SSI, MOUDI, CPC, DMS, Surf
2016-08-20	312	100.68	69.18	SMPS, APS, CCNC, SSI, MOUDI, CPC, Surf

[1]SMPS: Scanning Mobility Particle Sizer, APS: Aerodynamic Particle Sizer, CCNC: Cloud condensation nucleus counter, SSI: Single Stage Impactor (ice nucleation), MOUDI: Micro-orifice uniform deposit impactor (chemical composition), CPC: condensation particle counter, DMS: gas-phase dimethyl sulfide, Surf: surfactant analysis of seawater

1.3 Preliminary Results

1.3.1 *Ambient Size-Distribution Measurements*

Continuous measurements of aerosol number concentrations and size distributions revealed that high concentrations of particles were observed in a variety of locations along the cruise track, and that a significant fraction of the particles were of ultrafine size (diameter < 20 nm). Ongoing investigation of these data will be conducted in the context of characterizing the prevalence and identity of local primary and secondary aerosol production in the summertime Canadian Arctic, and will be used to support detailed studies of the chemical and physicochemical properties of the aerosol. Soot particle and carbon monoxide measurements will be used to identify the possible influence of biomass burning aerosol transported from the south, so influences from local sources can be of principal focus. Chemical composition measurements on size-resolved aerosol samples will be used to understand the quantitative relationship between the ambient aerosol and potential sources, such as sea spray aerosol (SSA), complemented by the direct measurement of SSA from sea spray tank experiments.

1.3.2 *Sinks and Sources of Ammonia (NH_3)*

Mixing ratios of atmospheric ammonia were generally low ranging between 0 to about 1.5 ppbv. Especially during rainy and foggy periods, values were close to zero, indicating scavenging of ammonia by water droplets. Values above 0.5 ppb were rare and were mostly observed during sunny weather conditions. Also, higher mixing ratios of ammonia in the vicinity of coastlines indicate the influence of ammonia emissions from bird colonies. The sources of ammonia from bird colonies is discussed in literature as a major source for ammonia in the Artic, but still has to be validated through further analysis for the data set of this cruise.

To investigate the air-sea exchange of ammonia, measured atmospheric ammonia levels must be compared to concentrations of ammonium in the surface sea water. As atmospheric measurements are potentially contaminated by stack emissions when on station, sea surface water samples were taken when the ship was in transit between stations. For this a closed PVC pipe was used and lowered down from the side of the ship while transiting. Altogether 14 samples were taken during Leg 2b and analyzed onboard using a fluorometer (TD-700). Ammonium concentrations of those samples were generally very low, often just above the detection limit (20 nM) of the instrument. The retrieved values were similar to the ones observed by analysis of the sea surface microlayer (Table 1.2) and the surface water samples collected with the rosette. The low concentrations of ammonium in the surface bulk water and the sea surface microlayer suggest an uptake of atmospheric ammonia by the ocean in the Canadian Artic in summertime. However, the data has to be still further analyzed and investigated in detail. To complete the picture of sources and sinks of ammonia, precipitation samples of fog and rainfall were taken during the leg and will be analyzed in the laboratory later.

1.3.3 *Other Measurements*

Tank experiments showed that size distributions and number production fluxes varied with water mass. Additional analysis will be required to understand the cause. Preliminary ambient atmospheric DMS measurements revealed that DMS was higher than average although quantification will require additional analysis in the work. Other measurements will be analyzed off-line in the laboratory.

1.4 Comments and Recommendations

We understand that the schedule of the ship was in flux due to the economic situation, which made it difficult to plan this year's expedition. While we greatly appreciate the amount of space that was made available to us, especially with less than one month before mobilization, we could have improved our planning of the campaign if we had known earlier.

We were very pleased with the amount and quality of the space that we were able to use throughout the ship. It allowed us to pursue numerous scientific objectives which would have been very challenging with less space. One challenge that we faced was that the Foredeck container (where the Bioness is controlled) suffered from over-heating due to the number of instruments present from all the users of the container. The high temperatures in the container caused some of our sampling equipment to fail and the signal of others to significantly drift. Increased ventilation and exchange of air with the outdoors would be of great benefit.

None of the participants felt that their immediate safety was an issue. A challenge that we mostly overcame was the lack of locations to which we could secure our equipment. This was especially an issue for our instrument rack in the Foredeck container but also in the Scatterometer lab. While these were handled during mobilization, the foredeck lab solution involved re-purposing the new securement space for gas cylinders, resulting in a cylinder being stored outdoors on deck in the end. Another concern was that announcements could not be heard clearly in any of the spaces in which we normally worked: the Foredeck container, the Met Ocean container, the Scatterometer lab. The latter location also did not have a telephone which made it hard for people to locate us.

Shipboard atmospheric sampling presents the basic analytical challenge of collecting genuine ambient samples, while avoiding artifacts from emissions of the sampling platform itself. The best conditions for atmospheric aerosol and trace gas measurements aboard the ship chiefly include wind directions that are within a 60-90° azimuth range centered about the ship's heading. Coordinating other scientific operations while maximizing a favorable ship orientation with respect to the wind direction would be advantageous for optimizing the value of ship time for atmospheric investigators. During Legs 2a and 2b of this expedition, stretches of continuous steaming were included in the cruise plan. Such stretches, including those to and from Petermann Glacier, and then southward toward Resolute Bay (enhanced by re-scheduling the Lancaster Sound transect earlier in the timeline), provided substantial 6-40 hour periods of clean sample time for atmospheric measurements, which were enhanced by the fortune of favorable wind directions and wind speeds. Further real-time prioritization of oceanographic station sequencing (as is coordinated by the Chief Scientist during the expedition) in response to wind conditions could further enhance periods of opportunistic ship/wind co-orientation and could provide improved returns on the investment of ship time for atmospheric investigators aboard the *CCGS Amundsen*. Access to the *CCGS Amundsen*, especially for expedition cruise tracks that span wide spatial extents of the Arctic as in Leg 2 of the 2016 expedition, is an opportunity of substantial value to the atmospheric chemistry community, as it allows for observations to be made over a large spatial extent of the under-studied Arctic boundary layer, and measurements are co-located with chemical and biological sampling of the surface ocean, which can affect the strength of local sources and sinks of atmospheric aerosols and trace gases.

2 Carbon Exchange Dynamics, Air-Surface Fluxes, Surface Climate and Greenhouse Gas Distribution – Legs 1, 2 and 3

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Project leaders - leg 2: Tim Papakyriakou[1] and Brent Else[2]
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2.1 Introduction

The biogeochemical cycling of carbon is continually changing within the Arctic Ocean as a consequence of climate change. The Arctic Ocean itself has undergone significant change in recent years, with large reductions in sea ice cover, increasing sea surface temperatures, and increased freshwater inputs. The objective of our research is to investigate such changes to the Arctic marine system and their influence on carbon dynamics, both within the water column and at the air-sea (or air-ice) interface.

Specific objectives of this research include:

1) Develop a process-level understanding of the exchange of CO_2, heat and momentum between the sea surface and atmosphere.
2) Forecast how the ocean's response to climate change and variability will affect the atmosphere-ocean cycling of CO_2.
3) Extrapolate the CO_2 fluxes by using remote sensing data with the collected field measurements.

Polar oceans are important regions for sea-air exchange of the greenhouse gases carbon-dioxide (CO_2) and methane (CH_4). Large quantities of CO_2 are exported to the deep ocean within sinking water formed during both sea-ice formation and surface cooling of poleward flowing water, but changes in seawater temperature, sea ice cover and upwelling intensity may reduce the oceanic sink of CO_2 in Arctic regions. Methane is released to the atmosphere from vast CH_4 deposits found in several shallow coastal shelf regions and terrestrial systems, and this may be accelerated by anthropogenic warming of terrestrial permafrost and marine sediments. At present, the spatiotemporal variability in the distributions and fluxes of these gases are poorly quantified. Moreover, the changes in the sea-air exchange rates of these gases in response to ocean warming and summer sea ice loss are uncertain. We aim to develop regional budgets for sea-air flux and marine inventories of these gases in the Canadian Arctic

Region. We hypothesize that warming and loss of summer sea ice will lead to net increase in the sea-to-air flux of these gases from Arctic regions.

2.2 Methodology

Multiple observation platforms have been utilized throughout the cruise to collect data pertaining to the atmosphere and the surface ocean, such as a meteorological tower on the ship's foredeck, an underway pCO_2 system in the engine room, and radiation sensors above the wheelhouse of the ship (Figure 2.1). Table 2.1 lists the variables that are monitored, the location where the sensor is installed and height, the purpose of each variable, along with the sampling and averaging frequency (if applicable).

Table 2.1. Summary of variable inventory and instrumentation. Rail and deck height above sea surface was measured on 23 August at 8 m and 7.15 m respectively.

Variable	Instrumentation	Location	Purpose	Ht above Main Deck (m)	Ht above sea srfc	Sample/Average Frequency (s)
Air temperature (Ta)	HMP155A	foredeck tower	meteorological parameter	8.16	15.31	1 / 60
Relative humidity (RH)	HMP155A	foredeck tower	meteorological parameter	8.16	15.31	1 / 60
Wind speed (ws-2D)	RM Young 05106-10	foredeck tower	meteorological parameter	9.65	16.8	1 / 60
Wind direction (wd-polar)	RM Young 05106-10	foredeck tower	meteorological parameter	9.65	16.8	1 / 60
Barometric pressure (Patm)	RM Young 61302V	foredeck tower	meteorological parameter	2.0	9.15	1 / 60
Incident solar radiation	Eppley Pyranometer	wheel-house platform	heat budget and microclilmate	On top of wheelhouse		2 / 60
Incident long-wave radiation	Eppley Pyrgeometer	wheel-house platform	heat budget and microclilmate	On top of wheelhouse		2 / 60
Photosynthetically active radiation (PAR)	Kipp & Zonen PARLite	wheel-house platform	heat budget and microclimate	On top of wheelhouse		2 / 60
Wind speed 3D (u, v, w)	Gill Wind Master Pro	foredeck tower	air-sea flux	7.5	14.65	0.1 (10 Hz)
Sonic temperature (Ts)	Gill Wind Master Pro	foredeck tower	air-sea flux	7.5	14.65	0.1 (10 Hz)

Variable	Instrumentation	Location	Purpose	Ht above Main Deck (m)	Ht above sea srfc	Sample/Average Frequency (s)
Atm. water vapour concentration (ρ_v)	LICOR LI7500A & LI7000	foredeck tower	air-sea flux	7.29	14.44	0.1 (10 Hz)
Atm. concentration of CO_2 (ρ_c)	LICOR LI7500A & LI7000	foredeck tower	air-sea flux	7.29	14.44	0.1 (10 Hz)
Rotational motion (acc_x, acc_y, acc_z, r_x, $_y$, r_{z})	Systron Donner MotionPak	foredeck tower	air-sea flux	6.8	13.95	0.1 (10 Hz)
Upper sea water temperature (Tsw)	General Oceanics 8050 pCO_2	under-way system, foreward engine room	air-sea flux and ancillary information	~-5 m		3 / 60
Sea water salinity (s)	General Oceanics 8050 pCO_2	under-way system, foreward engine room	air-sea flux and ancillary information	~-5 m		3 / 60
dissolved CO_2 in seawater	General Oceanics 8050 pCO_2	under-way system, foreward engine room	air-sea flux and ancillary information	~-5 m		3 / 60
pH	General Oceanics 8050 pCO_2	under-way system, foreward engine room	air-sea flux and ancillary information	~-5 m		3 / 60
dissolved O_2 in seawater	General Oceanics 8050 pCO_2	under-way system, foreward engine room	air-sea flux and ancillary information	~-5 m		3 / 60
Weather conditions	Campbell digital camera	wheel-house platform	meteorological parameter			15 min
Particle number concentration	WCPC3785	Foredeck tower	Particle flux			1/60

Additionally, water samples were collected from the rosette for the analysis of dissolved inorganic carbon (DIC), total alkalinity (TA), stable oxygen isotopes ($\delta^{18}O$), and salinity. These measurements will allow us to study the carbon chemistry of various water masses and identify freshwater inputs within Baffin Bay, Nares Strait and Northwest Passage. Samples from the rosette were only collected during the first half of Leg 1 (Leg 1a) along the G100 and G300 transects. These water samples were only collected at nutrient stations, in order to collect samples throughout the entire water column. At full and basic stations all of the rosette bottles were utilized to sample the surface waters and the deep chlorophyll maximum. Samples from the rosette were collected mainly during leg2b (~20 stations) with only three stations during Leg 2a. These water samples were collected at full, basic, and nutrient stations. The salinity samples were analyzed onboard in the salinometer room by using the AUTOSAL machine to compare it with the salinity log obtained from the CTD rosette. In addition to continuous underway sampling, discrete water samples for dissolved CH_4 and Nitrous-oxide (N_2O) were collected from multiple depths (typically surface, 10, 20, 40, 60, 80, 100, 120, 160, 200, 250, 300, 400, 500, 600, 800, 1000m, where applicable) from the following stations during leg 3: 405, 437, 408, 420, 434, 432, 430, 428, 426, 424, 472, 470, 474, 476, 478, 480, 482, 421, 535, 554, 314, 312, 343 and 344.

Figure 2.1. The radiation sensors and digital camera ocated above the wheelhouse of the Amundsen. Shown are the pyrgeometer (left), pyranometer (right) and PAR sensor (centre). The automated digital camera is mounted on the rail below and to the left of the prygeometer.

2.2.1 *Micrometeorology and Eddy Covariance Flux Tower*

The micrometeorological tower located on the front deck of the Amundsen provides continuous monitoring of meteorological variables and eddy covariance parameters (Figure 2.2). The tower consists of slower response sensors that record bulk meteorological conditions (air temperature, humidity, wind speed/direction, surface temperature) and fast response sensors that record the eddy covariance parameters (CO_2/H_2O concentration, 3D wind velocity, 3D ship motion, air temperature). All data was logged to Campbell Scientific data loggers; a model CR3000 logger was used for the eddy covariance data, a CR1000 logger for the slow response met data. Eddy covariance data were sampled at 10 Hz while slow response sensors were scanned every 2 s and saved as 2 minute averages. All loggers were synchronized to UTC time using the ship's GPS system as a reference. This year our one functioning LI7500A sensor became damaged during some rough sea conditions in eastern Baffin Bay early in Leg 1 and did not operate for the remainder of the experiment.

Atmospheric CO_2 and H_2O concentration was monitored using two sensors. Prior to it being damaged, the gas concentration was measured using a LICOR open path LI7500A. Additionally, a LI7000 was installed in the foredeck container drawing air through approximately 30 m of tube (Synflex Type "1300" ¼" OD) from an intake located just beneath the EC instrument arm, approximately 7.4 m from the ship's deck. An external pump (GAST DOA-V722) drew air through the gas analyzer. Internal cell pressure was less than atmospheric. As measured gas concentration is a function of cell pressure, calibration (zero and span) was undertaken daily at operating pressure using UHP nitrogen and traceable standard (477.18 ppm). An attempt was made to maintain constant cell pressure. Early in the leg pressure was maintained at approximately 72 kPa, but later changed to 60 kPa to match the cell pressure associated with the closed-path system. Gas concentrations were output from the gas analyzer using the sensors DAC output channels, and stored as 2 minute averages by the CR1000 data logger housed on the foredeck tower.

During Leg 2b, a closed-path eddy covariance system was installed and operated over the period between 14-23 August. The system was identical to that last deployed during the 2011 cruise. The closed-path system was situated at the base of starboard rail inside a weather proof enclosure, approximately 3 m from the tower base. Air was drawn through the gas analyzer from the inlet secured to the base of the EC arm by a high output pump housed in the foredeck container through ¼" Synflex Type "1300" tube. The air stream between the inlet and gas analyzer was heated (10 C) and dried. The drying system consisted of a nafian drier (Perma Pure PD-100T-48SS) and zero gas generator (Aadco model 747-30). Counter flow through the nafian drier was maintained between 13 and 14 lpm. The inlet air was drawn 13 m to the gas analyzer through a heated tube at a flow rate of 11 lpm. The inlet was secured to the support arm for the EC system, at 6.9 m up on the tower (just beneath the sonic anemometer). Internal cell pressure was maintained at 59 kPa using a T-fitting, and valve located in the closed system between the analyzer outlet and pump. Flow was measured using a flow meter installed in the system and situated just upstream of the analyzer measurement cell B. Reference gas (UHP N_2) was continuously run through cell A of the analyzer at a rate of 0.1 lpm.

The 2011 version of the system was fully automated (flow control, span, zero, climate control) controlled by data logger programming and making use of serial communication with the LI7000 gas analyzer. A power issue however damaged serial communications between the logger and LI7000 and therefore the system was modified to operate manually. The concentration of CO_2, H_2O, cell pressure and temperature were output using the analyzers DAC channels and sampled by the CR3000 on the main flux tower at 10 Hz. Span and zero were performed twice, once just prior to deployment at operating cell pressure and at the end of the deployment.

In addition, we added a particle counter (WCPC3785) on the foredeck tower to measure particle number concentrations for calculating the particle flux. The particle counter was maintained by, Ida Rosendaul, who is working in the Arctic Research Centre at Aarhus University in Denmark.

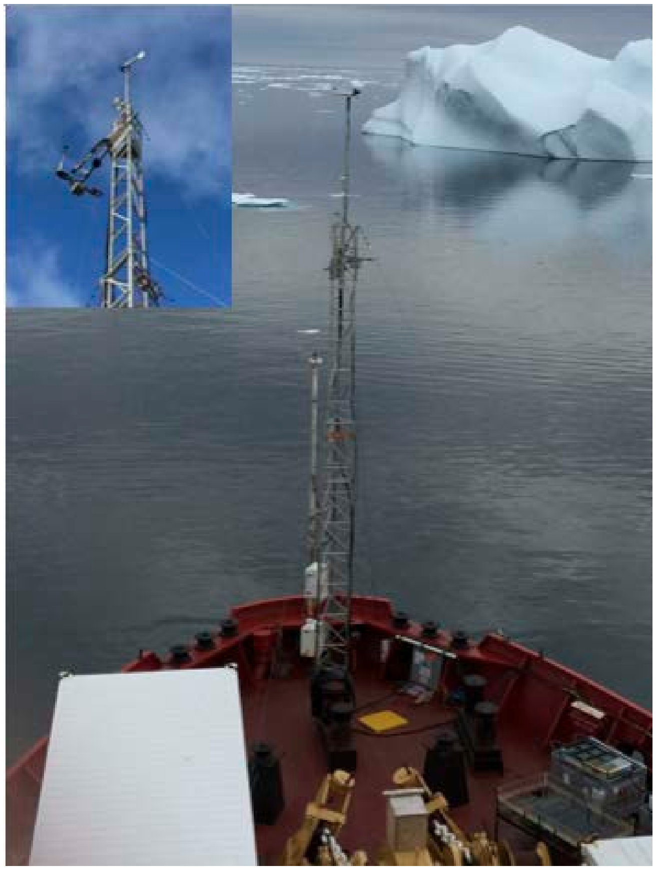

Figure 2.2. Meteorological tower located on the foredeck of the Amundsen with EC flux system (inset).

2.2.2 *Underway pCO$_2$ System*

A General Oceanics 8050 *p*CO$_2$ system has been installed on the ship to measure dissolved CO$_2$ within the upper 5 m of the sea surface in near real time (Figure 2.3). The system is located in the engine room of the *CCGS Amundsen*, and draws sample water from the ship's clean water intake. The water is passed into a sealed container through a shower head, maintaining a constant headspace. This set up allows the air in the headspace to come into equilibrium with the CO$_2$ concentration of the seawater, and the air is then cycled from the container into an LI-7000 gas analyzer in a closed loop. A temperature probe is located in the equilibrator to provide the equilibration temperature. The system also passes subsample of the water stream through an Idronaut Ocean Seven CTD, which measures temperature, conductivity, pressure, dissolved oxygen, pH and redox. All data is sent directly to a computer using software customized to the instrument. The LI-7000 gas analyzer is calibrated daily using ultra-high purity N$_2$ as a zero gas, and a gas with known CO$_2$ concentration as a span gas. Spanning of the H$_2$O sensor is not necessary because a condenser removes H$_2$O from the air stream before passing into the sample cell.

Figure 2.3. The underway system located in the engine room of the Amundsen.

2.3 Preliminary Results

We have CO_2 data at roughly 1 minute intervals from the surface water and lower atmosphere since the start of the expedition in early June, 2016. A very cursory examination of the raw data (unfiltered for outliers and contaminated or excessive sensor drift) reveals some notable trends in CO_2 over time and space (Figure 2.4). There was much higher atmospheric CO_2 partial pressure (pCO_2atm.) variability during the first half of the expedition (Jun 5 - ~Jul 25) as compared to the second half (Jul 25 - Sep 18). This may reflect the relatively high diversity of environments sampled during the early legs, from the Fl. St. Laurent, up through the Labrador Sea, then into Baffin Bay, and through the Arctic Archipelago finally arriving in Kugluktuk, NU on Aug. 25 (Figure 2.5). Surface water pCO_2aq was generally lower in the southern and eastern portions of the cruise (150 - 350ppm) than in the Beaufort Sea region (Aug 20 - Sep 18) (Figure 2.4). However, there were some notably high pCO_2 concentrations observed in the early portions of the cruise, but these were not consistently associated with any deviations in salinity or temperature (Figure 2.4). In contrast, periods of high surface ocean pCO_2aq. in the Beaufort Sea (Aug 20 - Sep 18) were associated with increases in surface salinity (Figure 2.4), which suggests that upwelling was responsible for supplying CO_2-rich water to the surface. Further analysis is required to determine whether these surface pCO_2aq. Concentrations were sufficient to make the ocean a net source of CO_2 to the atmosphere, but it appears likely. The lack of sea ice in the Beaufort combined with strong winds could have played a role in driving this upwelling. Loss of sea ice and changes in persistent atmospheric pressure gradients associated with climate change have the potential to increase the occurrence of such upwelling events, and may limit the ability of the Beaufort region to act as a sink for atmospheric CO_2

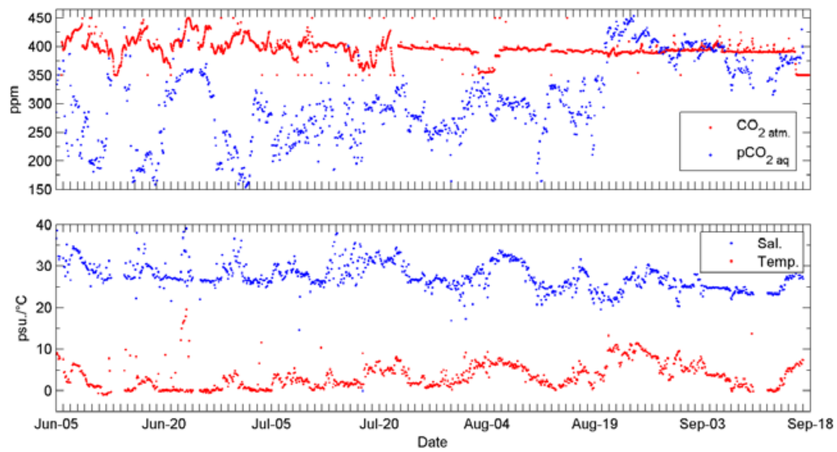

Figure 2.4. Scatter plot showing raw (uncorrected or filtered) continuous underway data including dissolved CO_2 at 5m (panel a, blue dots), atmospheric CO_2 (panel a, red dots), and surface water (5m) temperature (panel b, red dots) and salinity (panel b, blue dots).

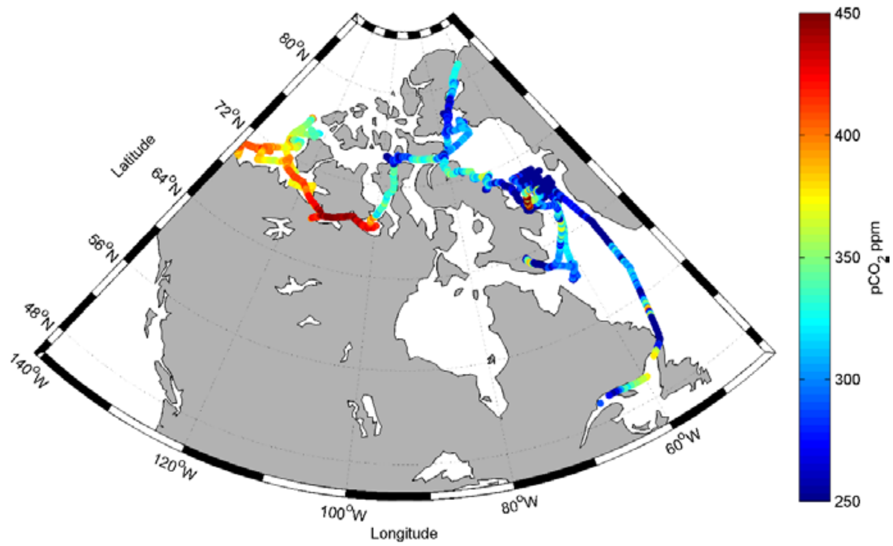

Figure 2.5. Map showing surface (5m) uncorrected dissolved CO_2 concentrations along cruise track between Jun 01 and Sep 18.

2.4 Comments and Recommendations

Next year, we will plan to compile our collected field data with the ship navigation and motion data (e.g. POS/MV data) directly to save time and increase efficiency. A kind reminder that when we are at station that the ship be pointed into the wind (when possible) so that the ship's smoke is not blown towards the met tower.

3 Glaciers, Iceberg and Ice Islands – Legs 2b and 3b

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3.1 Introduction

3.1.1 *Leg 2*

Tidewater glaciers drain glaciers, ice caps and ice sheets and terminate into the ocean where they discharge icebergs and ice islands (large tabular icebergs). The Canadian Ice Service (CIS) produces charts which identify the presence of icebergs, but currently has little knowledge about the sources and sinks of icebergs in Canadian waters. It is important to understand where these icebergs and ice islands originate from, where they drift, how they deteriorate and the time scale of these processes. Trinity and Wykeham Glaciers on SE Ellesmere Island have increased iceberg production from 22% of total iceberg discharge from the CAA (Canadian Arctic Archipelago) in 2000 to 62% in 2016. They are the only two glaciers in the Canadian Arctic to have shown consistent acceleration between 1999 and 2015, making them an area of significance for the study of ice discharge into Canadian Waters (Van Wychen et al., 2016). Observations and measurements made during this leg will address the following gaps in knowledge surrounding the production and movement of icebergs and ice islands in Canadian waters:

1) Which tidewater glaciers are the sources of icebergs and ice islands in Canadian waters and where do they drift?
2) Are there changes in the size, shape or timing of iceberg production in the recent past and is this linked to glacier dynamics?
3) Do sea ice conditions impact the production of icebergs at the termini of tidewater glaciers?
4) How is the velocity of Trinity Glacier changing over time?

3.1.2 *Leg 3*

Three large calving events, 31 km^2, 253 km^2 and 130 km^2 in surface area, occurred at northwest Greenland's Petermann Glacier in 2008, 2010, and 2012, respectively (Environment Canada, 2012; Falkner et al., 2011; Johannessen et al., 2012). This resulted in an influx of ice islands, large and tabular icebergs, within water bodies such as Nares Strait, Baffin Bay and the Labrador Sea where they pose as hazards to shipping and natural resource extraction industries (McGonigal et al, 2011; Peterson, 2011). Accessing ice islands for field data collection is strife with logistical difficulties, and this has led to a paucity of the in-situ data which is necessary for the calibration and validation of drift and deterioration models as well as remote-sensing techniques for identification and deterioration detection. The *CCGS Amundsen* has provided access to numerous ice islands since 2011 (Crawford et al., 2015; Forrest et al., 2012; Hamilton et al., 2012; Stern et al,. 2015; Wagner et al., 2015), and it would again be used to access a Petermann Ice Island (PII) fragment during Leg 3 of the 2016 ArcticNet science cruise.

The 2016 ice island field campaign had two objectives. The first was to maintain the two systems which were installed on an ice island, 'Petermann Ice Island (PII)-A-1-f" in 2015, which are collecting in-situ mass balance data. The first system, an ice penetrating radar, records ice thickness data and provides information on the magnitude of thinning which the ice island experienced over 2015-2016. A meteorological station was the second system and was instrumented to collect surface melt, ice and air temperature, and location data.

The second objective of the 2016 campaign was to collect on-ice data and ice samples. A mobile ice penetrating radar transect which was originally done in May 2016 was to be re-conducted. This would provide information on thickness change over a greater spatial area. Ablation stakes along the transect would be re-measured, and temperature loggers would be switched out. Finally, ice cores would be taken, with their orientation in respect to that of the ice island, for investigations into ice island detection with space-borne synthetic aperture radar (SAR).

The concurrent datasets of surface melt and ice thinning will provide the highest temporal resolution of ice island mass balance yet gathered. The ice thickness dataset will also be utilized specifically by cruise participant A. Crawford to model the surface and basal melt contributions to an ice island's overall thinning. The study of ice island mass balance is important for industrial operations in two ways. First, the assessment of thickness, and the magnitude of thinning expected at varying latitudes and environmental conditions, can be utilized in the planning of pipeline installations and thereby mitigate pipeline or well-head ruptures due to ice island scouring of the seabed. Ice island keel depths are also an important parameter to accurately input into drift models which provide offshore operators with predictions of their movement and thus allow for adequate planning of collision mitigation measures. Finally, the assessment of ice island mass balance during drift through decreasing latitudes can be utilized as a proxy for the deterioration of higher latitude ice features resulting from future climate change.

Secondary objectives were included for Leg 3 in the event that more time was available for ice island operations. These included CTDs, both far-field and down-current from the ice island, to better understand changes to the water column due to the ice island's presence. Finally, we also planned bathymetric and keel mapping with the ships EM302 multi-beam sonar and SX90 sonar. These were previously used for the same mapping purposes in October 2015 and July 2016, thus providing excellent data for detecting changes to the seafloor due to ice island scour and evolution of the ice island's keel.

3.2 Methodology

3.2.1 *Ice Island Measurements*

Ice island PII-2012-A_1-f, grounded near Qikiqtarjuaq, was visited on 27 July 2016 on behalf of Derek Mueller and Anna Crawford (Carleton University) to service weather stations, make measurements of surface melt and changes in ice depth. Nine ice depth measurements were made along a transect previously marked by Crawford using a ground penetrating radar (GPR) system 2 which will be compared with past measurements made at the same locations. Continuous measurements were unable to be made along the entire transect because of issues with the GPR receiver so spot measurements were made instead. Ablation stakes at each waypoint were measured to determine levels of surface melt since the previous survey in May 2016. Five additional ablation stakes located near the weather station in the view of camera were measured. A new 5m hole was drilled for the sonic ranger at the weather station.

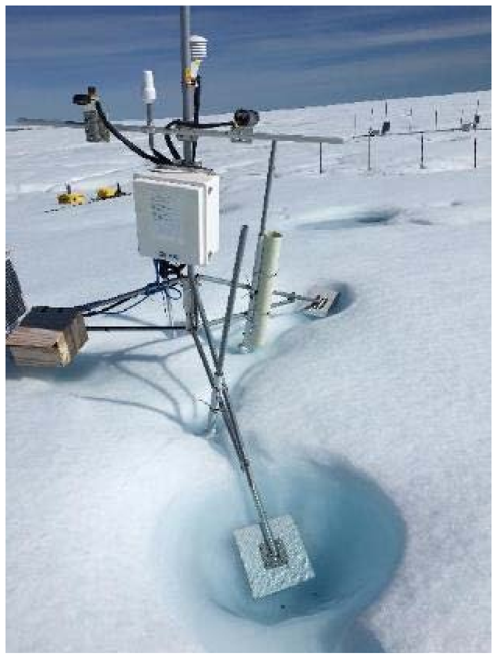

Figure 3.1. Weather station and ablation stakes on Ice Island PII-2012-A_1-f, July 27, 2016. Photo courtesy of Luke Copland.

3.2.2 *Iceberg Beacon Deployment*

Between 31 July and 14 August 2016 a total of 13 tracking beacons were deployed on icebergs and ice islands in Baffin Bay. Through a contract with Environment and Climate Change Canada (ECCC) six CALIB beacons were deployed onto icebergs and ice islands within Baffin Bay and Nares Strait (Table 3.1). Two beacons were deployed onto targets chosen by CIS and the remaining four targets were chosen based on size, location and whether they were likely to drift (Figure 3.2). Five of six beacons have since successfully transmitted data remotely. One of the beacons deployed (ID#: 300234011758690) is suspected to have had issues with the battery and has not transmitted any data since being deployed.

Table 3.1. CIS beacon deployment summary.

IMEI #	WMO ID	Asset Name	Deployment Date	Deployment Time (UTC)	Latitude N (start position)	Longitude W (start position)	Notes
300234011758690	4701652	ICALIB (4701652-8690)	02-Aug-16	11:30 AM	72.06178	-73.31847	Buchan Gulf Iceberg. Faulty Device - Not working

IMEI #	WMO ID	Asset Name	Deployment Date	Deployment Time (UTC)	Latitude N (start position)	Longitude W (start position)	Notes
300234061763030	4701653	ICALIB (4701653-3030)	02-Aug-16	12:20 PM	71.88914	-72.25875	Unk_S1 Ice Island
300234063515450	4701654	ICALIB (4701654-5450)	09-Aug-16	11:35 UTC	76.30836	-74.81636	S Nares Strait Ice Island
300234061761040	4701655	ICALIB (4701655-1040)	09-Aug-16	12:45 UTC	76.84956	-75.88631	East of Manson Icefield Ice Island
300234063513450	4701657	ICALIB (4701657-3450)	14-Aug-16	11:31 AM	79.74294	-64.96186	Humboldt Glacier Ice Island
300234061768060	4701656	ICALIB (4701656-8060)	14-Aug-16	11:49 AM	79.83578	-67.35725	Kane Basin Ice Island

Figure 3.2. Example of placement of CIS beacon. Deployed on iceberg near Buchan Gulf (72.06178N, -73.31847W), August 2, 2016. Photo courtesy of Luke Copland.

Seven additional beacons were deployed containing iridium GPS receivers (RockStar), batteries and solar panels (Figure 3.3). Three of these beacons were deployed onto icebergs/ice islands within Baffin Bay (Figure 3.4) and four were deployed within Trinity Fiord to track movement of icebergs produced by Trinity Glacier within and out of the fiord (Table 3.2). Positions of these seven beacons will be tracked hourly to monitor movement and identify drift patterns of icebergs around Baffin Bay. Initial results show that one beacon drifted >100 km within the first two weeks after deployment (Figure 3.5).

Figure 3.3. Example of placement of RockStar beacon on ice island. Deployed SE of Sam Ford Fiord, July 31, 2016. Photo courtesy of Abby Dalton.

Table 3.2. RockStar beacon deployment summary

Unit #	Deployment	Time (local)	Latitude N	Longitude W	Deployment Location
3655	31-Jul-16	18:37	70º45'46.76''	67º51'26.50''	SE of Sam Ford Fiord
3534	06-Aug-16	18:34	76º11'02.29''	69º55'31.80''	SW of Thule
3651	06-Aug-16	18:58	76º35'15.51''	71º35'00.91''	W of Thule
20781	10-Aug-16	17:54	77º57'01.57''	78º31'25.99''	Trinity Terminus
3635	10-Aug-16	17:59	77º56'07.96''	78º08'41.42''	Trinity Island
20785	10-Aug-16	10:22	77º56'30.47''	77º55'50.91''	Trinity Mid Fiord
20784	10-Aug-16	10:28	77º54'17.19''	77º29'8.83''	Trinity Outer Fiord

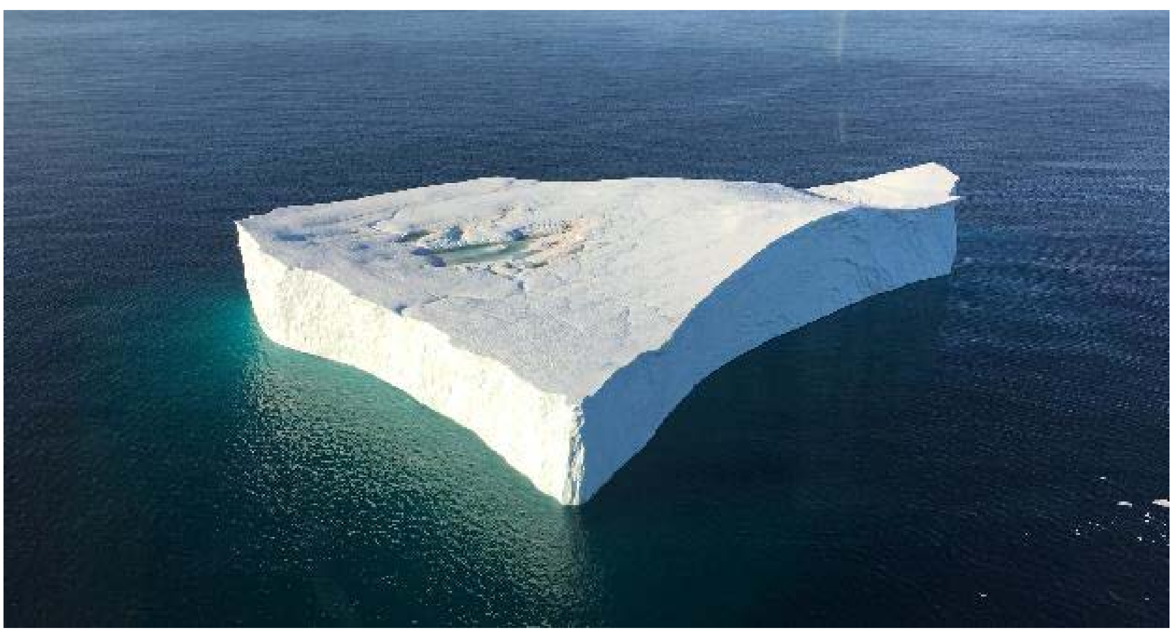

Figure 3.4. Example of an iceberg that was tracked with RockStar unit # 3651 to the west of Thule, Greenland, August 6, 2016. Photo courtesy of Luke Copland.

Figure 3.5. Drift track of the same iceberg between August 6 and 23, 2016.

3.2.3 *Differential GPS System Installation*

Two differential GPS systems (dGPS) were installed on Trinity Glacier on August 10, 2016 to monitor changes in glacier velocity (Figure 3.6). The first station is located down glacier (78º01'54.94''N, 78º50'56.40''W) and contains a battery and solar powered dGPS system (Trimble NetR9) and Iridium transceiver (Xeos XI-100). The second station is located up-glacier (78º01'51.75''N, 79º12'14.62''W) and contains a battery and solar powered dGPS (Trimble R7). The lower station transmits data remotely through Iridium and include south-looking solar-powered time lapse cameras (SpyPoint) facing ablation stakes marked with 5 cm increments to monitor surface melt rates. Timelapse cameras are programmed to take photos hourly.

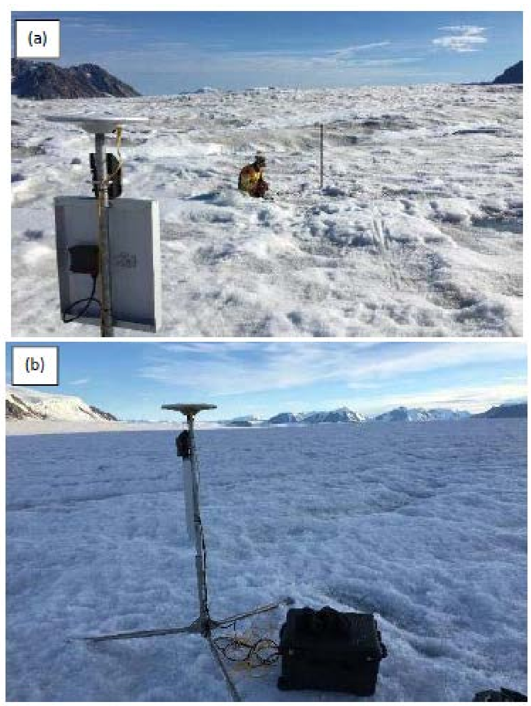

Figure 3.6. (a) Lower dGPS station and (b) Upper dGPS station on Trinity Glacier, August 10, 2016. Photos courtesy of Luke Copland.

3.2.4 *Time Lapse Camera Installation*

A DSLR camera (Canon EOS Rebel T6i with EF-S 24mm f/2.8 STM lens) was installed on a nunatak between Trinity and Wykeham Glaciers (77º55'50.64''N, 78º37'27.31''W) on August 10, 2016. The camera is housed within a Harbortronics unit mounted on a tripod. The camera is connected to a battery for power through the winter with a solar panel mounted on the tripod to recharge the battery during the summer months. The camera faces the terminus of Trinity Glacier and is set to take photos every hour to monitor iceberg calving events (Figure 3.7).

Figure 3.7. DSLR timelapse camera facing Trinity Glacier, August 10, 2016. Photo courtesy of Abby Dalton.

Three additional SpyPoint cameras were installed around Trinity Fiord on August 10, 2016 to monitor iceberg production and sea ice/iceberg movement within the fiord (Figure 3.8). Two cameras were installed between Trinity and Wykeham Glaciers (adjacent to the DSLR camera location), one facing the terminus of Wykeham Glacier and one facing outward towards the mouth of the fiord. A third camera was installed on an island directly in front of Trinity Glacier (77º57'21.23''N, 78º07'54.25''W) to monitor movement of sea ice and ice melange at the terminus.

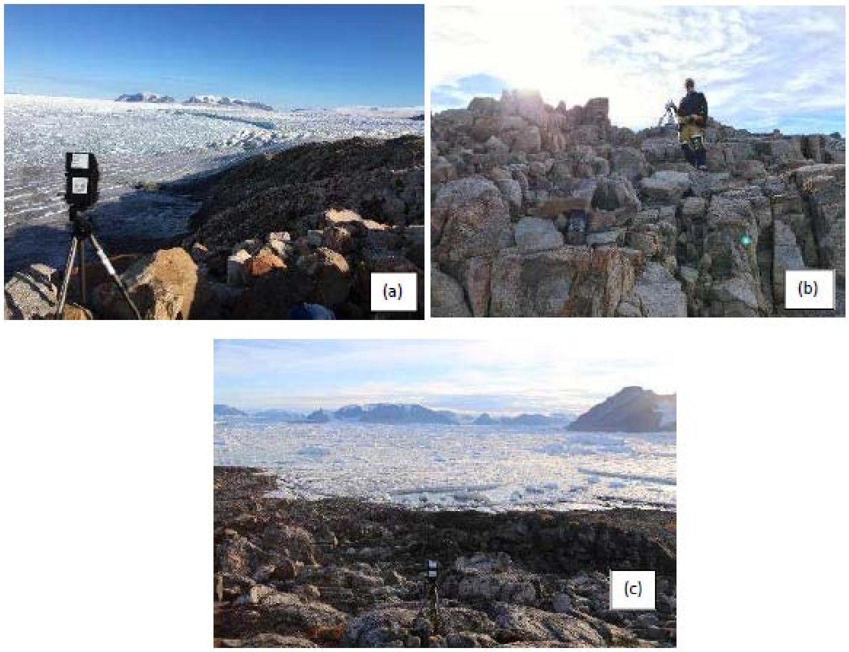

Figure 3.8. SpyPoint time lapse cameras (a) facing the terminus of Wykeham Glacier, (b) facing outward into Trinity Fiord and (c) on an island facing the terminus of Trinity Glacier, August 10, 2016. Photos courtesy of Luke Copland.

3.2.5 *Glacier Thickness Measurements*

Helicopter landings were made on the terminus of a number of glaciers along the coastline of eastern Ellesmere Island to measure their thicknesses with a 10 MHz ground penetrating radar system (Figure 3.9). This included two glaciers in Dobbin Bay and 5 glaciers around Manson Icefield. These thickness measurements were the first for most of these glaciers, with averages of ~150 m. These measurements help to constrain iceberg flux calculations from these glaciers.

Figure 3.9. Making ground-penetrating radar measurements of ice thickness on Mittie Glacier, Manson Icefield, August 16, 2016 (N76º 53.732’, W78º 58.774’). Ice thickness at this location was ~220 m. Photo courtesy of Luke Copland.

3.2.6 *Mass Balance*

Updates on the location and size of PII-A-1-f were monitored with synthetic aperture radar (SAR) imagery from the RADARSAT-2 (Canadian Space Agency), Sentinel-1 (European Space Agency) satellites and MODIS optical imagery (NASA). Positions were provided by collaborators at the Canadian Ice Service (Environment Canada) and the PolarView and Worldview web interfaces.

PII-A-1-f, a fragment of the 2012 Petermann Glacier calving event, was grounded at 67°23'N, 63°18'W– approximately 35 km southeast of Qikiqtarjuaq, NU (Figure 3.1). This is the same location as in 2015, however it had decreased in surface area from 14 km^2 to 11 km^2 and had rotated 180° around its grounding point on a shoal which has been mapped by the Amundsen's EM302 sonar and the SX90 fishing sonar.

Team personnel consisted of Anna Crawford (team leader), Ron Saper (PhD student and safety leader), Lauren Candlish (volunteer) and Hugo Jacques (crew member and bear monitor). The team and equipment were transferred to PII-A-1-f starting at 7:00 am EST on September 28, 2016. Ron Saper was not with the team on this date, but would join the team for the following day of work on September 29. A documentary film maker joined the team on the ice for the full day. Three trips were made by the helicopter to bring small groups of VIPs to the ice island for short sojourns. Approximately 2.2 km of the planned 3 km mIPR transect were completed during the 3 hours which the team had on the ice on September 28. Eight ablation stakes were measured en route, and 2 temperature loggers which were located on the two ablation stakes marking the far corners of the transect were switched out.

A large melt channel had cut to 10 m depth across the mIPR transect. For this reason, the team decided to complete all of the work on the far side of the channel on day 1 of field work, and would continue work on the installation side of the channel during their full day of field work on day 2. However, the second day of field work did not occur due to a helicopter maintenance issue. Crawford and Jacques did make it to the sIPR on day 1 to download the year worth of thickness data. However, there was a malfunction with the instrument after this. There had previously been some issues due to inconsistent satellite transmission of the data, but all transmissions ceased on Sept 28 and a solution was not possible with the cancellation of the second day of field work.

A number of ship-based operations were conducted on day 2. One far field CTD cast and 4 down current casts close to the ice island were taken. A number of circumnavigations of the ice island were conducted for mapping purposes. The EM302 successfully mapped the seafloor and, with the SX90, also mapped the keel of the ice island.

Data was also collected for a University of Manitoba research project on the microclimate of ice islands. This included surface water sampling as well as 50 m deep CTD casts from the zodiac and circumnavigating around the ice island for atmospheric data collection. Crawford and Saper joined one of the Zodiac trips and took GoPro video footage and oblique photos with a Nikon D7100 for possible 3D modeling of the ice island's sidewalls with structure-from-motion photogrammetry. A small ice sample was retrieved by Saper during the Zodiac trip and will be analyzed for c-axis ice crystal structure, leading to further future investigations which theorize that this structure is implicated in the signal returned to a SAR satellite by an ice island.

3.3 Preliminary Results

Initial results are included in the text above, such as the finding that one of our tracked icebergs drifted >100 km between Greenland and Ellesmere Island over the space of two weeks in August 2016. However, most results will only be known at a later time once the iceberg trackers have been followed for several months, and the dGPS instruments and time lapse cameras at Trinity Glacier are downloaded in the future.

3.3.1 *Mass Balance*

Data has been transmitted daily by both systems, with only the camera operating at a different time frequency (weekly photo). Table 3.3 shows an example of data transmitted from the met. station. We have seen over 6 m of total thickness change from sIPR data since October 2015. Approximately 2 m of this change is from surface ablation, as seen with the SR50 sonic ranger. The IPR system has recorded and transmitted daily radargrams since it was installed (Figure 3.11). Ice thickness has changed from approximately 110 m to 104 m.

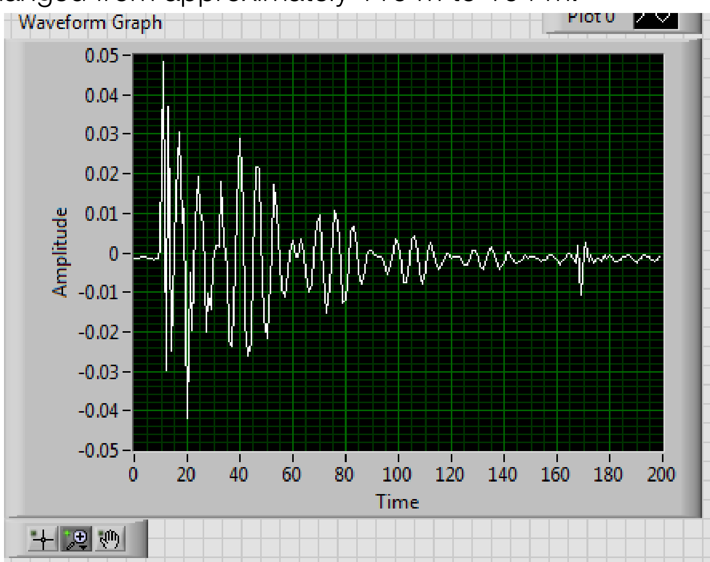

Figure 3.10. Sample radargram from the ice penetrating radar on October 22 2015. The airwave is first and the bed-wave is second at approximately 170 ns (Time).

Table 3.3 Raw data sampled from the meteorological station

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	(AC)
1	TOA5	2015_Ice	CR1000	72392	CR1000.:	CPU:Icel	64648	Hourly																					
2	TIMESTAMP	RECORD	BattV_M	PTemp_	T109_C_	DT	Q	Temp_C_A	Temp_C	Temp_C	Temp_C	Temp_C	Temp_C	Temp_C_	GPGGA	Time	Latitude	Hemisph	Longitud	Hemisph	GPS_Q	Num_Sa	HDOP	Altitude	Altitude_	Geoidal_	Geoidal_	DGPS_A	Diff
3	TS	RN			DegC	m	Good(2	DegC	DegC	DegC	DegC	DegC	DegC	DegC	unitless	hhmmss	ddmm.m	N_S	ddmm.m	W_E		uu	v.v	m	m	m	m	s	zzz
4			Min	Avg	Avg	Smp	Smp	Avg	Avg	Avg	Avg	Avg	Avg	Avg	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Smp	Sm
5	2015/10/20 17:00	181	12.45	-3.471	-3.931	0.429	537	-3.931	-4.054	-4.088	-4.033	-4.164	-4.44	-5.013		165858	6723.4	N	6318.7	W	2	11	0.7	10.1	M	10.6	M		'6D
6	2015/10/20 18:00	182	12.65	-3.527	-4.004	1.157	346	-4.023	-4.145	-4.173	-4.123	-4.248	-4.532	-5.035		175858	6723.4	N	6318.7	W	2	7	1.2	23.8	M	10.6	M		'69
7	2015/10/20 19:00	183	12.74	-3.68	-3.941	0.487	291	-4.425	-4.512	-4.547	-4.473	-4.608	-4.841	-5.107		185858	6723.4	N	6318.7	W	2	11	0.7	14.3	M	10.6	M		'6E
8	2015/10/20 20:00	184	12.69	-3.844	-3.785	0.819	172	-5.957	-6.131	-6.085	-5.825	-5.962	-6.102	-1.047		195858	6723.4	N	6318.7	W	2	12	0.7	13.2	M	10.6	M		'6F
9	2015/10/20 21:00	185	12.65	-4.298	-4.385	0.819	173	-6.343	-6.532	-6.364	-6.178	-6.169	-6.369	-2.449		205858	6723.4	N	6318.7	W	2	11	0.9	5.5	M	10.6	M		'58
10	2015/10/20 22:00	186	12.63	-4.71	-4.293	0.819	175	-6.362	-6.571	-6.418	-6.236	-6.209	-6.409	-4.8		215858	6723.4	N	6318.7	W	2	11	0.7	9.4	M	10.6	M		'53
11	2015/10/20 23:00	187	12.62	-4.9	-4.673	0.819	177	-6.537	-6.562	-6.425	-6.244	-6.22	-6.42	-6.194		225858	6723.4	N	6318.7	W	2	12	0.8	11	M	10.6	M		'6F
12	2015/10/21 00:00	188	12.62	-5.071	-4.028	0.819	178	-6.565	-6.557	-6.431	-6.268	-6.234	-6.425	-6.489		235858	6723.4	N	6318.7	W	2	11	0.7	9	M	10.6	M		'59
13	2015/10/21 01:00	189	12.6	-4.736	-3.993	0.819	176	-6.542	-6.553	-6.432	-6.279	-6.242	-6.429	-6.619		5858	6723.5	N	6318.8	W	2	11	0.9	6.8	M	10.6	M		'54
14	2015/10/21 02:00	190	12.6	-4.604	-4.282	0.819	174	-6.486	-6.545	-6.425	-6.28	-6.245	-6.427	-6.689		15858	6723.5	N	6318.8	W	2	12	0.7	9.7	M	10.6	M		'5D
15	2015/10/21 03:00	191	12.6	-4.831	-4.385	0.819	174	-6.522	-6.556	-6.438	-6.294	-6.261	-6.44	-6.75		25858	6723.5	N	6318.8	W	1	11	0.8	13	M	10.6	M		'62
16	2015/10/21 04:00	192	12.59	-4.824	-4.163	0.819	175	-6.532	-6.55	-6.437	-6.301	-6.266	-6.441	-6.779		35858	6723.5	N	6318.8	W	2	11	0.7	13.3	M	10.6	M		'69
17	2015/10/21 05:00	193	12.59	-4.816	-4.207	0.819	175	-6.593	-6.549	-6.437	-6.309	-6.276	-6.447	-6.807		45858	6723.5	N	6318.8	W	2	11	0.8	12.6	M	10.6	M		'6D
18	2015/10/21 06:00	194	12.59	-5.516	-4.766	0.819	176	-6.876	-6.548	-6.439	-6.303	-6.278	-6.45	-6.83		55858	6723.5	N	6318.8	W	2	9	0.9	16.1	M	10.6	M		'68
19	2015/10/21 07:00	195	12.59	-5.716	-4.597	0.821	174	-6.971	-6.548	-6.435	-6.32	-6.285	-6.45	-6.836		65858	6723.5	N	6318.8	W	2	10	0.8	8.1	M	10.6	M		'5E
20	2015/10/21 08:00	196	12.58	-5.568	-4.531	0.821	175	-7.029	-6.56	-6.432	-6.325	-6.292	-6.454	-6.847		75858	6723.5	N	6318.8	W	2	11	0.8	8.8	M	10.6	M		'5C
21	2015/10/21 09:00	197	12.58	-5.986	-5.003	0.821	176	-7.303	-6.588	-6.443	-6.329	-6.307	-6.471	-6.873		85858	6723.5	N	6318.8	W	1	11	0.8	16.8	M	10.6	M		'6A
22	2015/10/21 10:00	198	12.58	-7.284	-5.647	0.823	178	-7.77	-6.647	-6.48	-6.351	-6.333	-6.499	-6.911		95858	6723.5	N	6318.8	W	1	12	0.6	3.4	M	10.6	M		'57
23	2015/10/21 11:00	199	12.58	-7.84	-5.901	0.824	179	-8.14	-6.68	-6.476	-6.364	-6.34	-6.503	-6.916		105858	6723.5	N	6318.8	W	2	12	0.7	6.1	M	10.6	M		'59
24	2015/10/21 12:00	200	12.58	-8.97	-6.739	0.826	185	-8.46	-6.726	-6.476	-6.352	-6.338	-6.506	-6.93		115858	6723.5	N	6318.8	W	1	12	0.8	26.3	M	10.6	M		'62
25	2015/10/21 13:00	201	12.65	-8.72	-4.856	0.823	182	-8.6	-6.71	-6.429	-6.336	-6.311	-6.488	-6.922		125858	6723.5	N	6318.8	W	2	12	1	12.7	M	10.6	M		'68
26	2015/10/21 14:00	202	12.88	-6.917	-5.136	0.825	180	-8.37	-6.599	-6.31	-6.245	-6.254	-6.462	-6.92		135858	6723.5	N	6318.8	W	2	12	0.7	10.5	M	10.6	M		'65
27	2015/10/21 15:00	203	13.06	-5.315	-3.452	0.823	179	-7.881	-6.502	-6.222	-6.153	-6.208	-6.463	-6.955		145858	6723.5	N	6318.8	W	1	10	0.8	6.9	M	10.6	M		'56
28	2015/10/21 16:00	204	13.38	-3.733	-4.846	0.826	185	-7.715	-6.434	-6.135	-6.082	-6.176	-6.458	-6.967		155858	6723.5	N	6318.8	W	2	9	0.9	3.1	M	10.6	M		'52
29																													

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4 Waves-in-Ice Dissipation and Turbulence in the Marginal Ice Zone

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Cruise participants - Leg 1a: Dany Dumont[1] and Anda Claudia Vladoiu[2]
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4.1 Introduction

The marginal ice zone (MIZ) is a region of vigorous interaction between the atmosphere, sea ice and the ocean, including the coupled wave-ice processes. They act altogether to affect the upper ocean dynamics and its connection with the interior, the morphology of sea ice and atmosphere-ocean heat, momentum and moisture fluxes. The 2016 GreenEdge Amundsen expedition offers the opportunity to:

1) Observe the dissipation of wave energy in this particular zone by the deployment of wave buoys and high frequency current profiler;
2) Identify the mixing processes active at and near the MIZ.

While the first objective was conducted as an experimental platform to samples waves in ice covered regions (under favorable ocean conditions), the second was more general. Its mainly seeks to sketch the spatial variability of active turbulence, to identify the main physical processes responsible of the observed mixing and to specify the role played by the turbulence in the development of the bloom (i.e. mean diffusive nitrate fluxes).

4.2 Methodology

4.2.1 *SCAMP – Turbulence Sampling*

Figure 4.1. The SCAMP (left panel) and its deployment conducted from the Zodiac (right panel).

Between 10 June and 10 July 2016, more than 100 microstructure profiles were collected at 25 stations using a Self-Contained Autonomous Microstructure Profiler (SCAMP, *Precision Measurement Engineering Inc.*) designed to measure small-scale temperature fluctuations (Figure 4.1). This SCAMP was equipped with two fast response thermistors (FP07, time constant ~10 ms), a slower and more stable thermistor-conductivity sensor pair, and a pressure transducer all protected by a probe guard. The accuracy of the fast and precision thermistors were 0.05°C and 0.02°C, respectively. With a sampling rate of 100 Hz and a typical fall speed of 0.1 m s^{-1}, the instrument detects variations down to scales of the order of 1 mm, enabling a quasi-complete resolution of the small-scale behavior of diffusive temperature. The profiling was conducted from a ship's zodiac (in downward mode). Only two peoples were required for the deployment of the instrument and its recovery. Typically 3-5 profiles were recorded at each station with a maximum depth of ~100 m while ship drift at a distance of 1 km from main sampling sites. The first two meters of the profiles were discarded in order to eliminate the stabilization phase of the fall rate and any potential boat-induced movements.

Microstructure Data Processing

Microstructure measurements are susceptible to noise that reduces the range of dissipation rates observable in field studies, the lower end limit being estimated to be 10^{-11} to 10^{-9} m s^{-3}. The adverse effect of contamination can be limited by the use of a denoising filter as the fourth-order Butterworth bandstop filter or the high-order Lanczos filters which remove narrow-band, spurious components caused by vibrations.

Sampling Stations

The SCAMP operations were conducted in every full stations. Table 4.1 lists the geographical positions of these stations.

Table 4.1. Geographical positions of the sampling stations and their locations within the MIZ.

Station	Date UTC	Location	Lat (N)	Lon (W)
G107	2016-06-11	MIZ	59°16.425	68°31.187
G110	2016-06-12	Ice-covered sea	60°8.725	68°31.563
G115	2016-06-13	Ice-covered sea	61°21.798	68°26.353
G201	2016-06-14	Ice-covered, icebergs	59°57.057	68°37.995
G204	2016-06-15	Ice-covered-sea	59°16.038	68°42.655
G207	2016-06-16	MIZ, small icebergs	58°33.804	68°47.928
G309	2016-06-18	MIZ	58°44.212	69°00.002
G312	2016-06-19	MIZ	59°35.989	69°01.357
G318	2016-06-20	MIZ	60°57.783	69°00.183
G324	2016-06-21	Ice-covered sea	62°20.443	68°20.443
G402	2016-06-25	Ice-covered sea	68°04.422	61°36.509
G409	2016-06-26	Ice-covered sea	68°06.387	59°58.056
G413	2016-06-27	Drifting ice floes	68°07,309	58°58.185

G418	2016-06-28	Open water	68°06.873	57°45.239
G507	2016-06-30	Open water	70°01.023	59°04.784
G207	2016-07-01	Open water	70°00.080	60°21.385
G518	2016-07-02	MIZ	70°00.895	62°25.656
G600	2016-07-03	Ice-covered sea	70°30.119	64°00.068
G605	2017-07-04	Ice-covered sea	70°27.907	62°27.975
G615	2016-07-05	Open water	70°29.982	59°35.778
G604.5	2016-07-06	Near ice edge	70°29.939	62°37.580
G703	2016-07-07	Open water	69°29.998	58°43.317
G707	2016-07-08	Open water	69°30,595	59°48,458
G713	2016-07-09	Open water	69°30.187	61°35.259
G719	2016-07-10	MIZ	69°30.181	63°13.693

4.2.2 *Aquadopp and wave buoys: wave-in-ice dissipation*

<u>Aquadopp Deployment</u>

The Aquadopp is an acoustic Doppler current profiler that enables high precision measurements within a small range of depths, under the ice (every 7 mm in the 0-0.87 m depth layer). In the course of the GreenEdge field campaign, it was deployed on small ice floes within the marginal ice zone, while wave conditions were favorable. It was fixed head down within an ice floe of less than one meter thick and maintained at the surface with a square float (Figure 4.2, left panel). The Aquadopp was coupled with two wave buoys used to record the wave field (i.e. amplitude, period) either on the floe (Figure 4.2, left panel) or in the open water close to it. As the sea conditions encountered during the Leg 1 were mainly calm, with no significative wave amplitude or swell within the MIZ, only one Aquadopp deployment was realized (June 19, 2016; see Tab. 2 for details).

Figure 4.2. Deployment of the Aquadopp on an ice floe, within the MIZ (left panel), and the wave buoys alone (right panel).

<u>Wave Buoys Deployment</u>

At some stations, the wave buoys were deployed alone, either both on an ice floe (Figure 4.2, right panel) or one on the ice and the other within the open water. Over all, wave measurements were conducted in seven stations, in parallel to SCAMP deployments. Table below gives the details of the stations concerned.

Table 4.2 The geographical positions of the wave buoy sampling stations. The Aquadopp deployment was realized on June 19.

Station	Date UTC	Location	Lat (N)	Lon (W)
G107	2016-06-11	MIZ	59°16.425	68°31.187
G115	2016-06-13	Ice-covered sea	61°21.798	68°26.353
G201	2016-06-14	Ice-covered, icebergs	59°57.057	68°37.995
G204	2016-06-15	Ice-covered-sea	59°16.038	68°42.655
G309	2016-06-18	MIZ	58°44.212	69°00.002
G312	2016-06-19	MIZ	59°35.989	69°01.357
G604.5	2016-07-06	Near ice edge	70°29.939	62°37.580

5 Seabird Survey Report – Leg 3b

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Cruise participant - Leg 3b: Danielle Fife[1]
[1] *Canadian Wildlife Service, Environment Canada, Dartmouth, NS, Canada*

5.1 Introduction

The East Coast of Canada supports millions of breeding marine birds as well as migrants from the southern hemisphere and northeastern 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

5.2 Methodology

Seabird surveys were conducted from the port side of the bridge of the CCGS *Amundsen* from 29 September - 5 October 2016. 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. Details of the methods used can be found in the CWS standardized protocol for pelagic seabird surveys from moving platforms.

5.3 Preliminary Results

We surveyed 681.1 km of ocean from 29 September - 5 October 2016. A total of 728 birds were observed in transect (9674 birds in total, including 4 flocks of Snow Geese, each exceeding 500 individuals in the St. Lawrence estuary) from 9 families (Table 5.1). Bird densities averaged 3.3 birds/km^2 (ranging from 0 – 64.3 birds/km^2). The highest densities of birds (> 20 birds/km^2) were observed off the southeast coast of Baffin Island, and points off the central and southern coast of Labrador (Figure 5.1).

Alcids accounted for 70% of the sightings (Table 5.1), which were primarily Dovekie. The Dovekie are considered the most numerous bird in the North Atlantic, the majority of which breed in Greenland and winter in Atlantic Canada. Gulls made up a combined 30% of the birds observed, most of which were Black-legged Kittiwake.

Table 5.1 List of bird species observed during surveys from the CCG Amundsen, 29 Sep - 5 Oct, 2016

Family	Species	Latin	Number observed in transect	Total number observed
Gaviidae	Common Loon	*Gavia immer*	1	1
Procellariidae	Northern Fulmar	*Fulmarus glacialis*	64	170
	Sooty Shearwater	*Ardenna griseus*	2	2
Sulidae	Northern Gannet	*Morus bassanus*	11	33
Phalacrocoracidae	Double-crested Cormorant	*Phalacrocorax auritus*	0	2
Anatidae	Snow Goose	*Chen caerulescens*	0	8150
	Unidentified Ducks	All duck genera	0	2
Laridae	Black-legged Kittiwake	*Rissa tridactyla*	80	343
	Ring-billed Gull	*Larus delawarensis*	7	31
	Glaucous Gull	*Larus hyperboreus*	24	28
	Great Black-backed Gull	*Larus marinus*	4	21
	Herring Gull	*Larus argentatus*	7	19
	Unidentified Gulls	*Larus*	4	259
	Unidentified Jaegers	*Stercorarius* Jaegers	3	3
Scolopacidae	Unidentified Phalaropes	*Phalaropus*	7	7
Alcidae	Dovekie	*Alle alle*	236	277
	Thick-billed Murre	*Uria lomvia*	88	89
	Atlantic Puffin	*Fratercula arctica*	12	12
	Common Murre	*Uria aalge*	7	8
	Razorbill	*Alca torda*	3	4
	Black Guillemot	*Cepphus grylle*	1	1
	Murre or Razorbill	*Uria* or *Alca*	5	6
	Unidentified Murres	*Uria*	38	40
	Unidentified Auks	Alcidae	123	155
Passeriformes	Unidentified Passerines	Passeriformes	1	11
TOTAL			728	9674

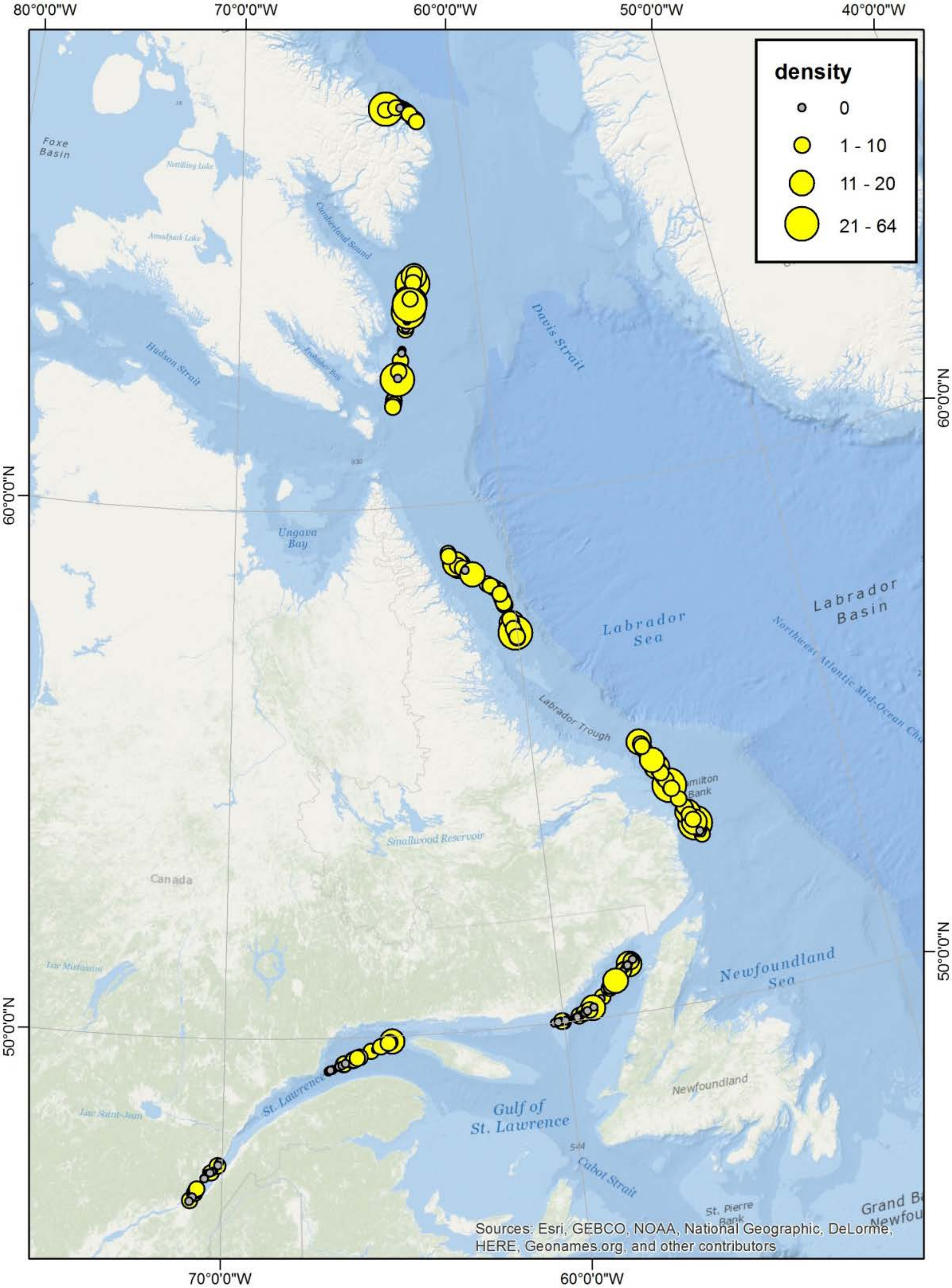

Figure 5.1 Density of bird species observed during surveys from the CCG Amundsen, 29/09/16 to 05/10/16

6 Marine Mammal and Bird Observation in Baffin Bay – Leg 1

Project leader: Anders Mosbech[1] (amo@bios.au.dk)
Cruise participant - Leg 1: Svend Erik Garbus[1]
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6.1 Introduction

Little is known about the distribution, abundance and diet of marine mammals and birds in the Canadian/Danish-Greenland Artic. The objective was to monitor marine mammals and birds in the Southern and Central Baffin Bay during the phytoplankton springbloom 2016. To describe the geographical (GPS position) relationship among species and observations across the MIZ. Relate the distribution and abundance of birds to the local abundance and biomass of juvenile Polar cod across the MIZ. Perform bird sampling with a shotgun from the zodiac to later compare the diet of sampled birds (Northern Fulmar, Thick-billed murre, Little auk, Black-legged Kitty wake and Glaucious gull) and polarcod to find any overlap. Test the hypothesis that seabirds prey on Polar cod.

6.2 Methodology

According to the Marine Mammal and Seabird Observer (MMSO) manual by Johansen et al. (2015) location (GPS-position), species, group size and behaviour was recorded for each observation by the MMSO during the different transects in the survey. Further the weather data and ice concentration was recorded. The active survey was conducted visually by a combination of binoculars and naked eye by one observer (Svend Erik Garbus, Aarhus University) from the bridge (15,2-16,6 meters above seawater) while the ship was transiting or transecting. Unsystematic observations were also performed outside the active surveys by the MMSO with help from the crew and other scientists.

6.2.1 *Active Survey Method*

All birds on the water within 300 m perpendicular to the trackline (90°) of the ship are recorded at beam with the ship and subdivided into designated distance bands (1-4) parallel to the trackline (Figure 5.1). Flying birds were also counted by the means of the snapshot technique (to reduce over estimation of birds). Within the transect strip at a certain distance ahead of the ship the birds were quickly counted at a certain moment of time (every 2 minutes).

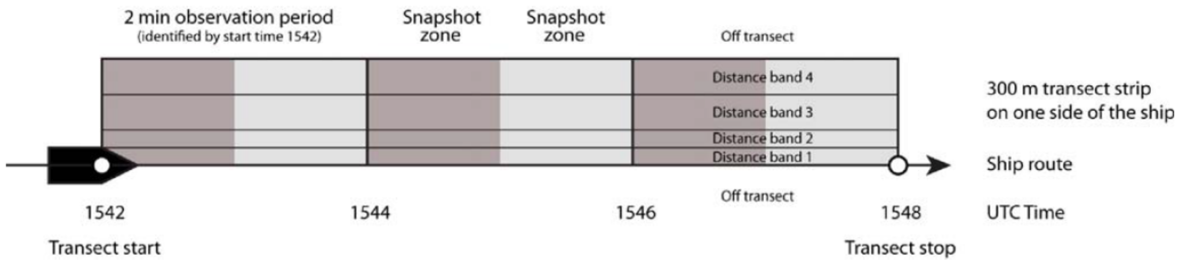

Figure 1. Schematic representation of the survey methodology. In the illustrated case observation periods are 2 minutes long and snapshot counts are made every minute (two snapshots per observation period).

Figure 6.1. Figure 1 from Johansen et al. (2015)

6.2.2 *Bird Sampling*

Bird sampling was conducted in Danish-Greenland waters by the MMSO/DVM (Svend Erik Garbus, Aarhus University). For the sampling a permit was issued by the Greenland authorities. Sampling was performed in good weather conditions from the zodiac with a 12 G 3" semiautomatic shotgun with a 2/4-3/4 choke. Birds were shot on the flight or on water using steel shots size 1-3 (4.0-3.5 mm) (larger birds) and steel shots size 5 (3.0 mm) (smaller birds) 32-36 grams pellet load. For further veterinary and chemical analyses blood was sampled from the dead birds. Blood was transferred to lithium-heparin tubes (green top) for plasma harvest and EDTA-tubes (purple top) for blood smears. Plasma was stored at -20° C and is planned to undergo biochemical analysis in Denmark. Blood smears were collared with hemo-collar for later microscopically blood differential counts.

Figure 6.2. Birds were shot on the flight or on the water with a 12 G 3" shotgun with 2/4-3/4 choke, steel shots (32-36 gram) size 1-3 (4.0-3.5 mm) for larger birds and size 5 (3.0 mm) for smaller birds. Empty shells were collected at every sampling. Photo: S.E. Garbus 2016.

Figure 6.3. Blood smear collared with the hemo-collar technique. Plasma from centrifuging. Photos: S.E. Garbus 2016.

6.3 Preliminary Results

Systematic observing has been conducted during ship transit time and at stations. A total of 20 different bird species and a total of 8 different mammal species have been identified. Northern Fulmar, Thick-billed murre and Little auk are the most common bird species observed. Ringed seal, Hooded seal and Harp seal are the most common seals. Long-finned pilot whale is the most common observed whale species observed. A total of 10 Polar bears have been observed. Thick-billed murre and the Little auk are most abundant in the area of the ice-edge but the murres are observed in great number within the ice in water ponds. Seals are most abundant on the ice. A total of 14 bird samplings from the zodiac were conducted with the result of 121 shot birds in Danish-Greenland waters as we had no permit for Canadian-Nunavat waters. All five different bird species within the Greenland permit was collected. All 121 birds were weighed, on 109 birds tracheal swabbing's were performed for later microbiological investigations. Blood smears were made and collared from 76 birds for a later blood cell differential count. Blood plasma was yielded from 76 birds for later biochemical blood parameters (BCCPs), hormones and pollutants. Full blood was also collected. On 61 birds a necropsy was initiated for extraction of liver-tissue, muscle-tissue and adipose tissue for chemical analyses by G. Massé and his team.

Table 6.1. Number of bird sampled during leg1

	Sampled
Fulmar	40
Thick-billed murre	36
Little auk	29
Glaucious gull	7
Black-legged kitty wake	9
Total	121

Birds will be sent back to Denmark for a fully examination and necropsy and for extraction and analyses of the intestinal content in relation to fish-ortholits and microbiological flora. Therefor no preliminary results are available at present regarding the GI-canal of the birds.

<u>Collaboration</u>

The different analyses should be seen in relation to the investigation of fish and zooplanction and foodweb connections between birds and Polar cod by Mathieu LeBlanc.

References

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7 PRO-ICE: Deployment of Biogeochemichal Argo Floats during Green Edge Cruise

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Cruise participants - Leg 1a: Marcel Babin[1], Claudie Marec[1], Eric Rehm[1] and Guislain Bécu[1]
Cruise participants - Leg 1b: Claudie Marec[1], José Lagunas[1], Eric Rehm[1] and Edouard Leymarie[2]
1 Takuvik, Université Laval, Québec, QC, Canada
2 Laboratoire d'Océanographie de Villefranche-sur-Mer, Villefranche sur mer, France

7.1 Introduction

The goal of this project is to deploy instrumented autonomous platforms that will profile between 0 and 1000m until their end of life (hopefully 3 years) in the Baffin Bay. They are dedicated to measure the biogeochemical parameters in the water column.

7.2 Methodology

<u>1 PRO-ICE</u>

Equipped with a restricted payload (CTD and Oxygen sensor) was deployed in the Labrador Sea.

> **takapm019B** (WMO number: 4901801)
> during leg1a, on 7th June 2016
> Lat: 58°33,655'N / Long: 52°50,267'W
> Bathymetry 3388m

This float was deployed as a prototype for navigation on cold waters.
It works perfectly till now. Its data are available on Villefranche server and will be soon available in Coriolis database.

<u>4 PRO-ICE</u>

During Leg 1a, we did a study of the possible zone for deployment, (thanks to Eric Rehm's simulations and Dany Dumont's advice about the dynamics of the zone). Four theoretical positions were chosen according to those discussions and bibliography about the currents in the area.

Those 4 positions were still sea-ice covered. A daily study of geo-referenced Radarsat ice maps (when available) lead to a decision of a late deployment to ensure to have an ice area.

The final position of 2 of the 4 deployments was adapted to fit with a CTD transect (700).

> **takapm009B** (WMO 6902667) deployed on 9th, July 2016
> lat: 69°30.062'N / Long 60°08.815'W
> bathymetry 1547m

This float is equipped with CTD, OCR wavelengths:380, 412, 490nM, PAR, fluo chla, fluo CDOM, Backscattering, Suna (nitrates), Optode (Oxygen)

takapm013B (WMO 4901802) deployed on 9th, July 2016
lat: 69°30.029'N / Long 61°00.658'W
bathymetry 1785m
This float is equipped with CTD, OCR wavelengths:380, 412, 490nM, PAR, fluo chla, fluo CDOM, Backscattering, Suna (nitrates), Optode (Oxygen)

takapm05B (WMO 4901803) deployed on 9th, July 2016
lat: 69°19.341'N / Long 60°58.997'W
bathymetry 1800m
This float is equipped with CTD, OCR wavelengths:380, 412, 490nM, PAR, fluo chla, fluo CDOM, Backscattering, Optode (Oxygen)

takapm014B (WMO 6902668) deployed on 9th, July 2016
lat: 69°20.209'N / Long 60°13.251'W
bathymetry 1627m
This float is equipped with CTD, OCR wavelengths:380, 412, 490nM, PAR, fluo chla, fluo CDOM, Backscattering, Optode (Oxygen) and Optical sea-ice detector developed by José Lagunas (Takuvik)

Tasks performed onboard before the deployments included:

- programming of the floats patterns and sensors resolution.
- Acquisition of O_2 sensor values during 30min (wet) for calibration purposes.

CTD casts were performed at each deployment; HPC and nutriments analysis were performed on the casts dedicated to floats takapm09B and takapm13B, both equipped with a nitrate sensor.

7.3 Preliminary Results

Data are available on the Villefranche server.

<u>Collaboration</u>

LOV (Edouard Leymarie, Christophe Penkerc'h) and DFO (Greg Smith, Pierre Pellerin, Fraser Davidon for support for floats simulation trajectories.

8 ArcticNet Mooring Program

Project leader: Louis Fortier[1] (louis.fortier@bio.ulaval.ca)
Cruise participants : Shawn Meredyk[1], Luc Michaud[1], Alexandre Forest[1]
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8.1 Introduction

Sampling year 2016 was part of a summer-fall campaign involving two legs and three support vessels, studying the air-sea interactions, underwater sound ecology, ocean circulation variability and basin-shelf sediment interactions of the southern Beaufort Sea, Amundsen Gulf, Hudson Bay, Queen Maud Gulf and northern Baffin Bay.

Mooring operations during Leg 2b (July 27 – August 24, 2016) included two continuing mooring programs (Weston and LTOO). The ArcticNet – Parks Canada – Weston Foundation moorings investigate the oceanographic conditions near and surrounding the shipwreck Erebus in the Queen Maud Gulf serviced by the CCGS Amundsen and Marty Bergmann. Where the new Baffin Bay LTOO moorings were deployed to study the bottom current rounding southern Greenland and it`s interactions with the Nares Strait and Lancaster Sound water masses.

Mooring operations during Leg 3a (August 25 – September 17, 2016) were part of the ArcticNet Long-Term Ocean Observatory (LTOO) project / and Integrated Beaufort Observatory (iBO; partly supported by the Environmental Study Research Fund (ESRF)). The LTOO moorings in the Cape Bathurst Polynya are a continuation of the LTOO dataset studying these productive waters. The iBO mooring sites are based on key locations identified by the Southern and Northeastern Beaufort Sea Marine Observatories project funded under the former Beaufort Regional Environmental Assessment (BREA) initiative from 2011 to 2014.

Mooring operations onboard the Laurier (September 20 – October 17, 2016) during the Amundsen Leg 3 concerned the re-deployment of iBO associated moorings maintained by the Institute of Ocean Sciences (IOS, Fisheries and Oceans Canada). The details of which can be found in the 2016 IOS cruise report (DFO, 2016).

Mooring operations onboard the DesGrossilliers (September 25 – October 12, 2016) were managed by the University of Manitoba`s research scientists (Sergei Kirilov, Igor Dimentrenko) with assistance from Quebec-Ocean`s marine technician Sylvain Blondeau. The objectives of this mission was to deploy four moorings near the mouth of the Nelson River. In-order to study the plume effects of outflow of the river (high current environment). A secondary objective was to try to recover AN01-13 (ArcticNet), which is part of the long-term BaySys program financed by HydroManitoba and the University of Manitoba`s Center for Earth and Ocean Studies (CEOS). The details of this mission can be found in the 2016 BaySys cruise report (BaySys, 2016).

The total ArcticNet managed mooring operations, during leg 2 and 3 onboard the Amundsen, included nine moorings deployed (2016) and seven moorings were redeployed in the southeastern Beaufort Sea, NE Baffin Bay, Amundsen Gulf and in the Queen Maud Gulf.

8.2 Methodology

8.2.1 *Areas of Focus*

Western Arctic

The Amundsen Gulf is an area where the air-sea interactions occurring in the ice-free sections of the southern Beaufort Sea and Amundsen Gulf were investigated. This productivity hotspot is of interest, to monitor the intermittent upwelling of cold-saline water on the eastern shelf, despite the fact that the origin of the upwelling is much closer to Cape Bathurst (e.g. CA06). In fact, ocean circulation is highly variable here, but the along-shelf flow of Pacific-derived water entering the Amundsen Gulf can be potentially monitored at depth. Mooring CA08-15 is the center of the 'Cape Bathurst polynya' as defined in Barber and Hanesiak (2004). This location is a very good candidate for the long-term monitoring of particle flux, as it has all the advantages of catching adequately both the seasonal signal and the inter-annual variability of marine productivity in the Amundsen Gulf, without having too much of the terrigenous inputs that characterize the moorings close to the Mackenzie Shelf.

Capturing the Beaufort gyre's anti-cyclonic (west) movement relative to a long-shore counter-current (east) plays an important role in understanding deep and shallow water movements relative to nutrient and particle fluxes.

Ice cover, examined by moored ice profilers and satellite imagery, plays a significant role in terms of affecting momentum transfer from wind to water, constrained (in the case of landfast ice) and enhanced (in the case of drift ice) by wind.

Hydrophone recordings on the shelf-slope area will monitor bioacoustics vocalizations throughout the year to better understand the potential impact that future operations in the Beaufort Sea could have on the marine mammals.

The Mackenzie Trough, a cross-shelf canyon in the Beaufort Sea shelf, has been observed to be a site of enhanced shelf-break exchange via upwelling (caused by wind- and ice-driven ocean surface stresses). The canyon provides a conduit for bringing deeper, nutrient rich water to the shelf. Shelf waters in the area are seasonally influenced by freshwater output from the Mackenzie River, both in terms of temperature-salinity properties and suspended sediments / turbidity.

Central Arctic

The ArcticNet – Parks Canada – Weston-Garfield Kitikmeot Marine Ecosystems Study moorings (WF1 and WF2), investigate the oceanographic conditions affecting the shipwreck Erebus in the Queen Maud Gulf while creating a baseline oceanographic water properties dataset.

8.2.2 *Individual Mooring Objectives – 2016*

i. Continued LTOO Moorings CA08-16 (400m) and CA05-16 (200m) were deployed, in an effort to collect data in the center and NW extent of the Amundsen Gulf. New LTOO moorings BA05-16 (535m) and BA06-16 (541m) were deployed in the NE Baffin Bay.
ii. Moorings BRK-16 (170 m), BRG-16 (700 m), BR3-16 (714m), BR3b-16 (690m), BR1-16 (699m) were re-deployed as part of the ongoing effort to assess ocean circulation (the southern extent of the Beaufort gyre current near the Mackenzie Shelf), biogeochemical fluxes and sea ice motion and thickness distribution in key areas of the Mackenzie shelf-slope system (Figure 8.1).

Figure 8.1 Mooring Locations 2014-2015-2016: iBO, LTOO and Weston Moorings (Green dot = 2015, white dot = 2016). Alternate iBO moorings DFO-1, DFO-2, and DFO-9 as well as other DFO moorings and MARES moorings are not provided in this report and can be found in the IOS cruise report 2016-13 (DFO, 2016).

8.2.3 *BREA & ArcticNet Mooring Designs*

Recoveries

CA05-15	Mouth of Amundsen Gulf
Target Instrument Depth (m)	Instrument
55	30" MSI syntactic spherical buoy
	Ice Profiling Sonar IPS4/5 #
	2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
	5/16" Amsteel 2 rope; 10m
	2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
67	ISUS#: , CLW: , ALW: , CT:
	ISUS frame (estimate)
	2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
	5/16" Amsteel 2 rope; 10 m
	2 x 1/2" galv shackle
78	Aural Hydrophone
	32 kHz 25% duty cycle
	2 x 1/2" galv shackle and pear link
	5/16" Amsteel 2 rope;10 m
	2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
90	Nortek 470kHz ADCP (UL)#
	Continetal frame
	Continetal frame panther buoys (6)
	RBR-XR420 CT
	2 x 1/2" galv shackle, D-Ring, 2 x 1/2" galv shackles
91.85	Nortek 470kHz ADCP (DL)#
	Continetal frame
	Continetal frame panther buoys (6)
	2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
	5/16" Amsteel 2 rope; 30m
	2 x 1/2" galv shackle and Pearl Link
123.6	Technicap PPS 3/3 24 S sediment trap #
	2 x 1/2" galv shackle
	5/16" Amsteel 2 rope; 20m
	2 x 1/2" galv shackle
145.9	MSI 30" Syntactic Foam Buoy
	2 x 1/2" galv shackle and pear link
	5/16" Amsteel 2 rope; 30m
	2 x 1/2" galv shackle
177.2	RCM / Seaguard #
	2 x 1/2" galv shackle , swivel and pear link
	5/16" Amsteel 2 rope; 5m
	2 x 1/2" galv shackle and pear link
183.1	17" Vitrovex Glass Floats (4x with Eddy Grip)
	2x 1/2" galv shackle
	5/16" Amsteel 2 rope; 5m
	2x 1/2" galv shackle
	1 x 5/8" galv shackle and pear link
192.15	865A Tandem#1: , #2
	Tandem assembly (2x chain SS)
	3 x 7/8" shackle, pear link
	5-8m 3/4" polysteel drop line w/ large Ring
	1.5 m chain
199.65	2 train wheels

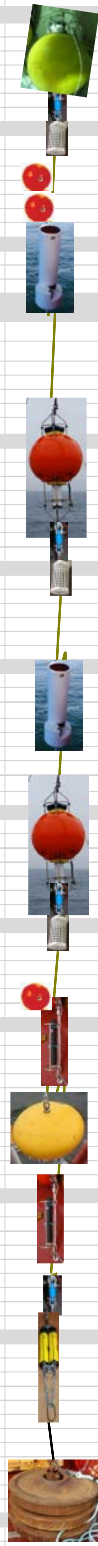
Figure 8.2 CA05-15 Design

CA08-15	Mouth of Amundsen Gulf	
Target Instrument Depth (m)		Instrument
65		ORE 30" Steel Buoy
		Argos Beacon#:
		Novatech RF/Flasher #
		2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
		5/16" Amsteel 2 rope; 10m
		2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
76.5		ISUS#: , CLW: , ALW: , CT:
		ISUS frame (estimate)
		2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
		5/16" Amsteel 2 rope; 10 m
		2 x 1/2" galv shackle
87.5		Aural Hydrophone #
		32 kHz 25% duty cycle
		2 x 1/2" galv shackle and pear link
		5/16" Amsteel 2 rope; 10 m
		2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
99.5		Nortek 470kHz ADCP (UL)#
		Continetal frame
		Continetal frame panther buoys (6)
		RBR-XR420 CT
		2 x 1/2" galv shackle, D-Ring, 2 x 1/2" galv shackles
101.4		Nortek 470kHz ADCP (DL)#
		Continetal frame
		Continetal frame panther buoys (6)
		2 x 1/2" galv shackle, swivel, 2 x 1/2" galv shackles
		5/16" Amsteel 2 rope; 40m
		2 x 1/2" galv shackle and Pearl Link
143.1		Technicap PPS 3/3 24 S sediment trap #48
		2 x 1/2" galv shackle
		5/16" Amsteel 2 rope; 40m
		2 x 1/2" galv shackle
185.4		ORE 30" Steel Buoy
		2 x 1/2" galv shackle
		5/16" Amsteel 2 rope; 100m
		2 x 1/2" galv shackle
		Swivel, 2 x 1\2"galv shackles
286.7		Nortek Aquadopp Current Meter AQD
		Aquafin instrument cage
		5/16" Amsteel 2 rope; 50m
		2 x 1/2" galv shackle
		1 x D-ring
		2 x 1\2"galv shackles
337.3		Nortek Aquadopp Current Meter AQD
		Aquafin instrument cage
		2 x 1/2" galv shackle, swivel and pear link
		5/16" Amsteel 2 rope; 50m
		2 x 1/2" galv shackle
388.2		17" Vitrovex Glass Floats (4x with Eddy Grip)
		1 x 1/2" galv shackle and pear ink
		1 x 5/8" galv shackle
392.1		865A Tandem#1: , #2
		Tandem assembly (2x chain SS)
		3 x 7/8" shackle and pear link
		5-8m 3/4" polysteel drop line w/ large Ring
		1.5 m chain
399.6		3 train wheels

Figure 8.3 CA08-16 Design

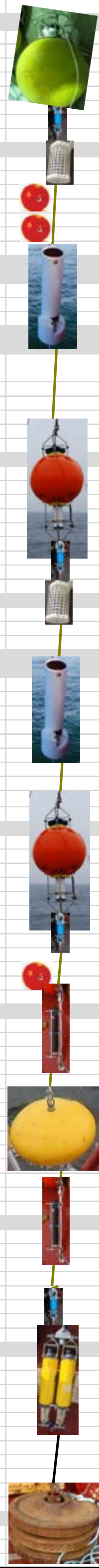
Site BR-K-15	Shelf edge between Ajurak and Pokak Area	
Target Instrument Depth (m)		Instrument
145.0		300 kHz WH ADCP #102
		Ext BC for ADCP #3835
		MSI Ellipsoid float
		MSI steel cage
		Benthos 27kHz UAT
146.0		SPMD (attached on cage)
		Swivel, galv shackles
146.8		300 m ellipsoid float
		5/16" Amsteel 2 rope; 5m
		galv shackle
		XR420CTm+Tu+Fl+DO #22043
152.3		LISST-100x particle analyzer #1445
		instrument frame
		SPMD
		galv shackles, swivel
153.7		1 MHz Nortek Aquadopp Current Profiler AQD #9711
		instrument cage with vane
		5/16" Amsteel 2 rope; 2 m
		Swivel, galv shackles
156.7		dual CART releases #31037 & #31091
		Tandem assembly
		D-ring 3/4-inch shackle
		10m 3/4" polysteel drop line
		~2 m chain + 7/8" shackle
169.70		1 train wheel

Figure 8.4 BR-K-15 Design



BR-G-15	Slope in Pokak	
Target Instrument Depth (m)		Instrument
60		Ice Profiling Sonar IPS5 #51108
		MSI cage
		30" MSI syntactic spherical buoy
		Benthos Pinger
		RBRXR420 CT logger #15273
		Swivel, galv shackles
61.0		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope, 63 m
		2 12B3 floats with prusek hitch
		Stainless shackle
124.9		Technicap PPS 3/3-24S sediment trap #45 motor #12_27
		Stainless shackle
127.9		RBRXR420 CTD-Tu-DO clamped to mooring line 1 m below trap #10419
		5/16" Amsteel 2 rope; 40 m
		Galv schackle
		5/16" Amsteel 2 rope; 15 m
		Stainless shackle
182.2		150 kHz QM ADCP DR #12841
		Ext batt case (4 BP) #2038
		Flotec M40 1500m extended frame
		NovaTech flasher
		RBRXR420 CT logger #15258
		Benthos Pinger
		Swivel, galv shackles
185		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope, 75 m
		Galv shackle
		5/16" Amsteel 2 rope, 50 m
		Stainless shackle
310.0		Technicap PPS 3/3-24S sediment trap #45 motor #12_21
		Stainless shackle
		5/16" Amsteel 2 rope; 150 m
		Galv shackles
464.4		75 kHz ADCP DR #12892
		External battery case (4 BP) #2028
		Flotec M40 1500m extended frame
		SPMD
		RBRXR420 CT logger #15266
		Galv shackles, swivel
		NovaTech flasher and Benthos Pinger
467		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope; 125 m
		galv shackle; prusek
		16" Flotec Hard Ball (3000m)
		shackles
589.7		Nortek Aquadopp Current Meter #9846
		Aquafin instrument cage
		5/16" Amsteel 2 rope; 100 m
		shackles
		1000 m ellipsoid float
		shackles
691.5		Nortek Aquadopp Current Meter #8434
		MSI instrument cage with welded vane
		RBR CT #15280
		galv shackles
		5/16" Amsteel 2 rope; 2m
		Swivel, galv shackles
694.7		dual CART releases #31904 & #33736
		Tandem assembly
		chain, D-ring 5/8-inch shackle
		5m 3/4" polysteel drop line
		~2 m chain, 7/8" shackle
702.7		3 train wheels

Figure 8.5 BR-G-16 Design



BR-03-15	Slope near Banks Island
Target Instrument Depth (m)	Instrument
60	Ice Profiling Sonar IPS5 #51104
	30" MSI syntactic spherical buoy
	MSI cage
	RBRXR420 CT logger clamped to mooring line #15270
	Stainless shackle, Swivel, galv shackles
61.0	SPMD (clamped to mooring line)
	2x12B3 floats with prusek hitch
	5/16" Amsteel 2 rope, 63 m
	Stainless shackle
124.9	Technicap PPS 3/3-24S sediment trap #39 motor #11_17
	Stainless shackle
127.9	RBRXR420 CTD clamped to mooring line 1 m below trap #17351
	5/16" Amsteel 2 rope; 40 m
	5/16" Amsteel 2 rope; 15 m
	Stainless shackle
182.0	150 kHz QM ADCP DR #12824
	Ext batt case (4 BP) #2031
	Flotec M40 1500m extended frame
	NovaTech Flasher
	RBRXR420 CT logger #15269
	Benthos Pinger
	Swivel, galv shackles
185	SPMD (clamped to mooring line)
	5/16" Amsteel 2 rope, 125 m
	Stainless shackle
309.7	Technicap PPS 3/3-24S sediment trap #47 motor #12_18
	Stainless shackle
	5/16" Amsteel 2 rope; 100 m
	Galv schackle
	5/16" Amsteel 2 rope; 45 m
	Stainless shackle
457	75 kHz ADCP DR #12942
	External battery case (4 BP) #33578
	Flotec M40 1500m extended frame
	NovaTech flasher
	Benthos Pinger
	RBRXR420 CT logger #15272
	Galv shackles, swivel
	5/16" Amsteel 2 rope; 125 m
	galv shackle; prusek
	16" Flotec Hard Ball (3000m)
	shackles
585	Nortek Aquadopp Current Meter AQD #6109
	Aquafin instrument cage
	5/16" Amsteel 2 rope; 100 m
	shackles
	1000 m ellipsoid float
	shackles
686	Nortek Aquadopp Current Meter AQD #8541
	Aquafin instrument cage
	shackles
	5/16" Amsteel 2 rope; 2m
	RBRXR420 CT logger #15278
	Swivel, galv shackles
689.6	dual 8242 releases #33697 & #33698
	Tandem assembly
	chain, D-ring 5/8-inch shackle
	5 m 3/4" polysteel drop line
	~2 m chain, 7/8" shackle
698	3 train wheels

Figure 8.6 BR-03-15 Design

BR-1-15	Slope in Mackenzie Trough
Target Instrument Depth (m)	Instrument
63	Ice Profiling Sonar IPS5 #51105
	MSI cage
	30" MSI syntactic spherical buoy
	Benthos 364\EL 27kHz 47752
	RBRXR420 CT logger #15262
	Swivel, galv shackles
	2 12B3 floats with prusek hitch
	5/16" Amsteel 2 rope, 63 m
	Stainless shackle
127.9	Technicap PPS 3/3-24S sediment trap #28 motor #07341
	Stainless shackle
130.85	RBRXR420 CT logger #? clamped to mooring line 1 m below trap
	5/16" Amsteel 2 rope; 52 m (1 x 40m, 1 x 12m)
	Stainless shackle
182	150 kHz QM ADCP DR #
	Ext batt case (4 BP) # 2032
	Flotec M40 1500m extended frame
	Benthos 364A/EL acoustic pinger 27 kHz #47747
	RBRXR420 CT logger #15279
	Novatech RF/Flasher: X06-065
	Swivel, galv shackles
	5/16" Amsteel 2 rope, 125 m
	Stainless shackle
309.7	Technicap PPS 3/3-24S sediment trap #29 motor #11_16
	Stainless shackle
	5/16" Amsteel 2 rope; 125 m
	5/16" Amsteel 2 rope; 25 m
	Stainless shackle
	Novatech RF/Flasher: X06-067
462	75 kHz ADCP DR #
	External battery case (4 BP) #2039
	Flotec M40 1500m extended frame
	Benthos 364A/EL acoustic pinger 27 kHz #47292
	RBRXR420 CT logger #15267
	Galv shackles, swivel
	5/16" Amsteel 2 rope; 125 m
	galv shackle; prusek
	16" Flotec Hard Ball (3000m)
	shackles
589	Nortek Aquadopp Current Meter #
	Aquafin instrument cage
	RBRXR420 CT logger #15268
	5/16" Amsteel 2 rope; 150 m
	shackles
	1000 m ellipsoid float
	shackles
	shackles
	RBRXR420 CTD Titanium logger #
741	Nortek Aquadopp Current Meter #
	Aquafin instrument cage
	shackles
	5/16" Amsteel 2 rope; 2m
	Swivel, galv shackles
744.4	dual CART releases # & #
	Tandem assembly
	chain, D-ring 5/8-inch shackle
	5m 3/4" polysteel drop line
	~2 m chain, 7/8" shackle
752.4	3 train wheels

Figure 8.7 BR-1-15 Design

WF1-15	Near Victoria Island	
Target Instrument Depth (m)		Instrument
66		
		Nortek 470kHz ADCP (UL)#6088
		Continental frame
		Continental frame panther buoys (6)
		ALEC ALW #73, CLW #8, CTW #145
		XEOS beacon# 300234062790570
		Swivel, 4x SS shackles
		5/16" Amsteel 2 rope; 10m
		1 x 1/2" SS shackle and Rope Loop
78		Technicap PPS 3/3 24 S sediment trap # motor # 12-23 ; Disc# 132
		5/16" Amsteel 2 rope; 10m
		1 x 1/2" SS shackle
		1 x 1/2" galv shackle
		SF-30-300m elliptical MSI buoy
		1 x 1/2" , 1 x 7/16" galv shackles, swivel
		2 x 1/2" SS shackle
		1 x 5/8" SS shackle
90		dual 865-A Benthos releases # 41442, 41456
		Tandem assembly
		D-ring 3/4-inch shackle
		3m 3/4" polysteel drop line
		~2 m chain + 7/8" shackle + Pear Link
97		1 train wheels

Figure 8.8 WF1-15 Design

WF2-15	**Wilmot Bay**	
Target Instrument Depth (m)		Instrument
19.5		MSI Benthic Tripod w\ 16 Kg lead ballast
		Sentinel V ADCP w\ ext. batt pack # ; #
		RBR ConcertoDuo CTD+Tu #

Figure 8.9 WF2-15 Design

Deployments

BA05-16	**Northeast Baffin Bay**	
Target Instrument Depth (m)		Instrument
418		Nortek 470kHz ADCP (DL)#6064
		Continetal frame
		Continetal frame panther buoys (6)
		Benthos Pinger
		SPMD (attached on cage)
		2 x 1/2" galv. shackle, swivel, 2 x 7/16" Galv. Shackles
		5/16" Amsteel 2 rope; 100m
		2x 1/2" SS shackle
		2 x Double Panther Floats
		5/16" Amsteel 2 rope; 2m
		1 x 5/8" SS shackle, 1 x 1/2" SS Shackle
521		Seaguard # 30
		- Single point with CTD , DO, Tu
		Link
		17" Vitrovex Glass Floats (4x with Eddy Grip) - Orange
		2x 3/8 " SS shackle , swivel
526		1 x 5/8" SS shackle and Rope Link
		865A Tandem#1: 41452 , #2 - 41438
		Tandem assembly (2x chain SS)
		1 x 7/8" galv shackle, pear link
		5m 3/4" polysteel drop line w/ large Ring
		1.5 m chain
535		2 train wheels

Figure 8.10 BA05-16 Design

BA06-16	Northeast Baffin Bay	
Target Instrument Depth (m)		Instrument
		
342		Nortek 190kHz ADCP (DL)#6116
		Contineteal frame
		Contineteal frame panther buoys (6)
		Benthos / RJE Pinger # 1002
		SPMD (attached on cage)
		2 x 1/2" galv. shackle, swivel, 2 x 7/16" Galv. Shackles
		5/16" Amsteel 2 rope; 190m
		2x 1/2" SS shackle
		2 x Double Panther Floats
		5/16" Amsteel 2 rope; 2m
		1 x 5/8" SS shackle, 1 x 1/2" SS Shackle
535		Seaguard # 292
		- Single point with CTD , DO, Tu
		Link
		17" Vitrovex Glass Floats (4x with Eddy Grip) - orange
		2x 3/8 " SS shackle , swivel
540		1 x 5/8" SS shackle and Rope Loop
		865A Tandem#1: - 41441 , #2 - 41449
		Tandem assembly (2x chain SS)
		1 x 7/8" galv shackle, pear link
		5m 3/4" polysteel drop line w/ large Ring
		1.5 m chain
549		2 train wheels

Figure 8.11BA06-16 Design

WF1-16	Near Victoria Island	
Target Instrument Depth (m)		Instrument
		
		RDI Sentinel V 300 kHz ADCP #24314
80		Sentinel V Ext. Batt Case #82706
		ASL Dual Frame
		RBR CTD-Tu #65774 (clamped to cage)
		XEOS beacon# 300234062790570
		Swivel, galv shackles
		5/16" Amsteel 2 rope; 10m
		2 x 1/2" galv shackle and Rope Link
		Technicap PPS 3/3 24 S sediment trap #56
94		disc# 136 , motor# 12-25
		2 x 1/2" galv shackle
		5/16" Amsteel 2 rope; 10m
		2 x 1/2" galv shackle and Pear Link
		SF-30-300m elliptical MSI buoy
		galv shackles, swivel
		2 x 1/2" galv shackle
106		dual CART releases #55660 & #33748
		Tandem assembly
		D-ring 3/4-inch shackle
		5m 3/4" polysteel drop line
		~2 m chain + 7/8" shackle + Pear Link
115		1 train wheels

Figure 8.12 WF1-16 Design

WF2-16	Wilmot Bay	
Target Instrument Depth (m)		Instrument
11.5		MSI Benthic Tripod w\ 16 Kg lead ballast
		Sentinel V ADCP w\ ext. batt pack #23590; #75169
		RBR ConcertoDuo CTD+Tu #65715

Figure 8.13 WF2-16 Design

CA08-16	Amundsen Gulf Polynya	
Target Instrument Depth (m)		Instrument
57		MSI 30" Spherical Buoy
		2 x 1/2" galv shackle
57.7		RBR CT-Tu-Fl-DO#17113
		Clamped on line
		2 x 1/2" galv shackle, swivel, 2 x 7/16" galv shackles
		5/16" Amsteel 2 rope; 20 m
		2 x 1/2" galv shackle
78.9		JASCO Hydrophone #M8E-51-732
		32 kHz 45% duty cycle
		2 x 1/2" galv shackle and pear link
		5/16" Amsteel 2 rope; 10 m
		1x 1/2" Galv.shackles
90.9		Nortek 470kHz ADCP (UL)#6070
		Continetal frame
		Continetal frame panther buoys (6)
		2 x 1/2" galv shackle, swivel, 2 x 7/16" galv shackles
92.7		Nortek 190kHz ADCP (DL)#6112
		Continetal frame
		Continetal frame panther buoys (6)
		1x 1/2" Galv.shackles
		5/16" Amsteel 2 rope; 40m
		2 x 3/8" SS Shackle, Safety Rope Link
134.5		Technicap PPS 3/3 24 S sediment trap #48 Titanium; motor #12_45
		Trap disc#
		2 x 3/8" SS Shackle
		5/16" Amsteel 2 rope; 40m
		2 x 1/2" galv shackle
176.8		MSI 30" Spherical Buoy
		2 x 1/2" galv shackle
		5/16" Amsteel 2 rope; 100m
		1x 1/2" Galv.shackles
		5/16" Amsteel 2 rope; 50m
		2 x 1/2" galv shackle
328.0		Nortek Aquadopp Current Meter AQD #9847
		Aquafin instrument cage
		ALEC ACTW #321
		1x 1/2" Galv.shackles
		5/16" Amsteel 2 rope; 50m
		2 x 1/2" galv shackle
378.9		17" Vitrovex Glass Floats (4x with Eddy Grip)
		1 x 5/8" SS shackle,SS Ring
384.0		Benthos Tandem #41444 & #41450
		Tandem assembly (2x chain SS)
		1 x 3/4", 1 x 5/8" Galv shackle and pear link
		5m 3/4" polysteel drop line w/ large Ring
		1.5 m chain
391.0		2 train wheels

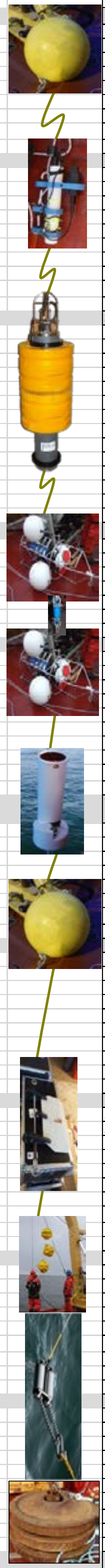


Figure 8.14 CA08-16 Design

CA05-16	Mouth of Amundsen Gulf	
Target Instrument Depth (m)		Instrument
60		30" MSI syntactic spherical buoy
		Ice Profiling Sonar IPS5 #51103
		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope; 10m
		2 x 1/2" galv shackle, swivel, 2 x 7/16" galv shackles
72.4		RBR CT-Tu-Fl-DO#17114
		2 x 1/2" galv shackle
		5/16" Amsteel 2 rope; 10 m
		2 x 1/2" galv shackle
83.4		MultiElectronique Aural M2 #33
		32 kHz 45% duty cycle
		1TB drive
		2 x 1/2" galv shackle and rope link
		5/16" Amsteel 2 rope;10 m
		1 x 1/2" galv shackle
95.4		300 kHz WH ADCP #3045
		MSI Ellipsoid float
		MSI SS cage
		2 x 1/2" galv shackle, swivel, 2 x 7/16" galv shackles
97.25		Nortek 470kHz ADCP (DL)#6063
		Continental frame
		Continental frame panther buoys (6)
		2 x 1/2" galv shackle
		5/16" Amsteel 2 rope; 30m
		2 x 1/2" galv shackle and Pearl Link
		Safety rope
129		Technicap PPS 3/3 24 S sediment trap #44 Titanium; motor #13_51
		2 x 1/2" galv shackle
		5/16" Amsteel 2 rope; 20m
		2 x 1/2" galv shackle
151.3		MSI 30" Syntactic Foam Buoy
		2 x 1/2" galv shackle and pear link
		5/16" Amsteel 2 rope; 25m
		1 x 5/8" , 1 X 1/2", SS shackle
177.6		RCM11 #285
		1 x 5/8" , 1 x 1/2" SS shackle and rope link
		5/16" Amsteel 2 rope; 10m
		2 x 1/2" galv shackle
188.5		SF-30-300m elliptical MSI buoy Green - Viny inside
		2x 1/2" galv shackle , pear link
		5/16" Amsteel 2 rope; 2m
		1x 1/2" SS shackle
		1 x 5/8" SS shackle
193		865A Tandem #41437 & #41453
		Tandem assembly (2x chain SS)
		1 x 7/8", 1 x 5/8" galv shackle, pear link
		5m 3/4" polysteel drop line w/ large Ring
		1.5 m chain
200		3 train wheels

Figure 8.15 CA05-16 Design

Site BRK-16	Shelf edge between Ajurak and Pokak Area	
Target Instrument Depth (m)		Instrument
		
145.3		300 kHz WH ADCP #7844
		MSI Ellipsoid float (buyancy to be checked)
		MSI steel cage
146.3		SPMD (attached on cage)
		Swivel, 2x 7/16" galv shackles, 2 x 1/2" galv. Shackle
147.1		300 m ellipsoid float
		5/16" Amsteel 2 rope; 5m
		2 x 1/2" galv shackle
		2 x 1/2" galv shackle
		RBR CT-Tu-Fl-DO#17112
152.6		LISST-100x particle analyzer #1445
		instrument frame
		Swivel, 2x 7/16" galv shackles, 2 x 1/2" galv. Shackle
154.0		1 MHz Nortek Aquadopp Current Profiler AQD #11147
		instrument cage with vane
		5/16" Amsteel 2 rope; 2 m
		Swivel, 2x 7/16" galv shackles, 2 x 1/2" galv. Shackle
157.0		dual CART releases #33744 & #33746
		Tandem assembly
		D-ring 3/4-inch galv. shackle
		10m 3/4" polysteel drop line
		~2 m chain + 7/8" shackle
170.00		1 train wheel

Figure 8.16 BRK-16 Design

BRG-16	Slope in Pokak	
Target Instrument Depth (m)		Instrument
62		Ice Profiling Sonar IPS5 #51106
		MSI cage
		30" MSI syntactic spherical buoy
		RBRXR420 CT logger #15271
		2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
63.2		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope, 60 m (45m +15m)
		1x 1/2" Galv shackles
		1 x Double Viny
		1x 1/2" galvshackles
		5/16" Amsteel 2 rope,2 m
		2x 1/2" SS shackles
127.4		Technicap PPS 3/3-24S sediment trap #45 Titanium; motor #11_16
		Safety rope
		2x 1/2" SS shackles
129.2		SBE37SM #12236 clamped to mooring line 1 m below
		5/16" Amsteel 2 rope; 50 m
		2x 1/2" Galv.shackles
179.5		150 kHz QM ADCP #12699
		Ext batt case (4 BP) #2030
		Flotec M40 1500m extended frame
		NovaTech flasher
		RBRXR420 CT logger #15264
		2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
182		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope, 125 m
		2x 1/2" SS shackles
307.2		Technicap PPS 3/3-24S sediment trap #24 Stainless; motor #12_27
		Safety rope
		2x 1/2" SS shackles
		5/16" Amsteel 2 rope; 150 m
		2x 1/2" Galv.shackles
461.6		75 kHz ADCP LR #12943
		External battery case (4 BP) #2033
		Flotec M40 1500m extended frame
		Benthos Pinger (New 2016)
		RBRXR420 CT logger #15275
		2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
		NovaTech flasher
464		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope; 125 m
		2x 1/2" Galv.shackles
		16" Flotec Hard Ball (3000m)
		2x 1/2" Galv.shackles
587.0		Nortek Aquadopp Current Meter #8419
		Aquafin instrument cage
		5/16" Amsteel 2 rope; 100 m
		2x ½" galv shackle;
		1000 m ellipsoid float
		2x ½" galv shackle;
688.8		Nortek Aquadopp Current Meter #8442
		Aquafin instrument cage
		2x 1/2" Galv.shackles
		5/16" Amsteel 2 rope; 2m
690.8		SBE37SM #10852 (clamped to mooring line)
		2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
692.0		dual CART releases #33738 & #33745
		Tandem assembly
		chain, D-ring 5/8-inch shackle
		5m 3/4" polysteel drop line
		~2 m chain, 7/8" shackle
700.0		3 train wheels

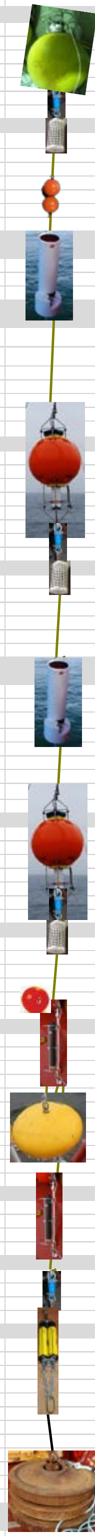
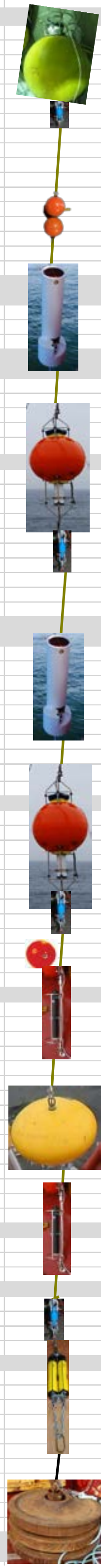


Figure 8.17 BRG-16 Design

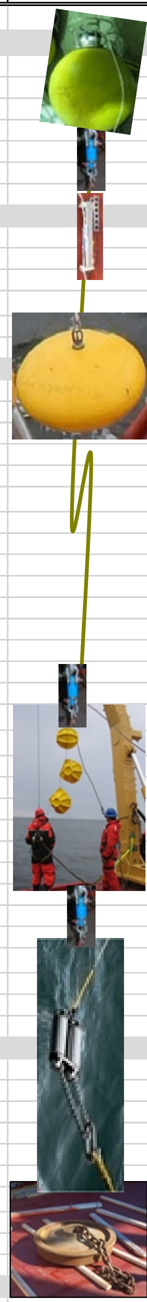


BR01-16	Slope in Mackenzie Trough
Target Instrument Depth (m)	Instrument
60	Ice Profiling Sonar IPS5 #51109
	MSI cage
	30" MSI syntactic spherical buoy
	RBRXR420 CT logger #15263
	2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
	5/16" Amsteel 2 rope, 65 m (1 x 50m, 1x 15m)
	2x 1/2" Galv.shackles
	1 x Double Viny
	2x 1/2" Galv.shackles
	5/16" Amsteel 2 rope, 2 m
	1 x 1/2", 1 x 7/16" Galv shackles with plastic inserts
130.2	Technicap PPS 3/3-24S sed trap #27 Stainless ;motor #12_22
	Safety rope
	1 x 1/2", 1 x 7/16" Galv shackles with pastic inserts
133.15	SBE37 CTD logger #12235 clamped to mooring line 1 m below trap
	5/16" Amsteel 2 rope; 50 m
	2x 1/2" Galv.shackles
182.3	150 kHz QM ADCP DR #12823
	Ext batt case (4 BP) #2028
	Flotec M40 1500m extended frame
	RBRXR420 CT logger #15274
	Novatech RF/Flasher:
	2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
	5/16" Amsteel 2 rope, 125 m
	1 x 1/2", 1 x 7/16" Galv shackles with plastic inserts
310	Technicap PPS 3/3-24S sediment trap #40 Titanium; motor #12_28
	Safety rope
	1 x 1/2", 1 x 7/16" Galv shackles with pastic inserts
	5/16" Amsteel 2 rope; 75 m
	2x 1/2" Galv.shackles
	5/16" Amsteel 2 rope; 75 m
	2x 1/2" Galv.shackles
	Novatech RF/Flasher:
462	75 kHz ADCP DR # 13079
	External battery case (4 BP) #83853
	Flotec M40 1500m extended frame
	Benthos Pinger (New 2016)
	RBRXR420 CT logger #17352
	2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
	5/16" Amsteel 2 rope; 125 m
	16" Flotec Hard Ball (3000m)
	2x 1/2" Galv.shackles
590	Nortek Aquadopp Current Meter # 8543
	Aquafin instrument cage
	5/16" Amsteel 2 rope; 75 m
	2x 1/2" Galv.shackles
	5/16" Amsteel 2 rope; 75 m
	2x ½" Gal shackles
	1000 m ellipsoid float
	2x ½" Gal shackles
742	Nortek Aquadopp Current Meter # 8448
	Aquafin instrument cage
	2x 1/2" Galv.shackles
	5/16" Amsteel 2 rope; 2m
743.8	SBE37SM #10850 (clamped to mooring line)
	2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
745.0	dual CART releases #33737 & #33749
	Tandem assembly
	chain, D-ring 5/8-inch shackle
	5m 3/4" polysteel drop line
	~2 m chain, 7/8" shackle
753.0	3 train wheels

Figure 8.18 BR01-16 Design

BR03-16		Slope near Banks Island
Target Instrument Depth (m)		Instrument
62		Ice Profiling Sonar IPS5 #51108
		30" MSI syntactic spherical buoy
		MSI cage
		RBR DUO CT logger #61550
		2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
62.6		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope, 60 m (20m + 40m)
		2x 1/2" Galv.shackles
		1 x double viny float
		2x 1/2" Galv.shackles
		5/16" Amsteel 2 rope, 2 m
		2 x 1/2" SS shackles
126.8		Technicap PPS 3/3-24S sediment trap #47 Titanium motor #09_345
		Safety rope
		2 x 1/2" SS shackles
129.7		SBE37 CTD clamped to mooring line 1 m below trap #10851
		5/16" Amsteel 2 rope; 50 m
		2x 1/2" Galv.shackles
178.9		150 kHz QM ADCP DR #8784
		Ext batt case (4 BP) #2035
		Flotec M40 1500m extended frame
		NovaTech Flasher
		RBR DUO CT logger #61551
		Benthos Pinger (New 2016)
		2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
181		SPMD (clamped to mooring line)
		5/16" Amsteel 2 rope, 125 m
		2 x 1/2" SS shackles
306.55		Technicap PPS 3/3-24S sediment trap #39 Titanium motor #12_23
		Safety rope
		2 x 1/2" SS shackles
		5/16" Amsteel 2 rope; 150 m
		2x 1/2" Galv.shackles
459		75 kHz ADCP DR #18785
		External battery case (4 BP) #2036
		Flotec M40 1500m extended frame
		NovaTech flasher
		RBRXR420 CT logger #15281
		2x 1/2" Galv.shackles, 2 x 7/16" Galv , Swivel
		5/16" Amsteel 2 rope; 115 m (70m + 45m)
		galv shackle; prusek
		16" Flotec Hard Ball (3000m)
		2x 1/2" Galv.shackles
576		Nortek Aquadopp Current Meter AQD #8447
		Aquafin instrument cage
		2x 1/2" Galv.shackles
		5/16" Amsteel 2 rope; 100 m
		2 x 1/2" galv. shackles
		1000 m ellipsoid float
		Swivel, 2x 7/16" galv shackles
678		Nortek Aquadopp Current Meter AQD #9473
		Aquafin instrument cage
		2x 1/2" Galv.shackles
		5/16" Amsteel 2 rope; 2m
680.1		SBE37SM #10849 (clamped to mooring line)
		Swivel, 2x 7/16" galv shackles
681.5		dual 8242 releases #33697 & #33698
		Tandem assembly
		chain, D-ring 5/8-inch shackle
		5 m 3/4" polysteel drop line
		~2 m chain, 7/8" shackle
690		3 train wheels

Figure 8.19 BR03-16 Design



BR3b-16		Slope near Banks Island
Target Instrument Depth (m)		Instrument
60		30" MSI syntactic spherical buoy
		Ice Profiling Sonar IPS5 #51104
		2 x 1/2" galv. shackle, swivel, 2 x 7/16" Galv. Shackles
		5/16" Amsteel 2 rope; 125m
62		SBE37SM #10196 (clamped to mooring line)
		2x 1/2" Galv shackle
		5/16" Amsteel 2 rope; 15m
		2x 1/2" Galv shackle
202		MSI Ellipical Buoy 33"
		2x 1/2" Galv shackle
		5/16" Amsteel 2 rope; 475m (125m + 100m x 3 + 50m)
		2 x 1/2" galv. shackle, swivel, 2 x 7/16" Galv. Shackles
		1 x 5/8" SS Shackle, 1 x 1/2" SS shackle, Swivel ,Rope Link
		17" Vitrovex Glass Floats (4x with Eddy Grip) - orange
		2x 3/8 " SS shackle , swivel
		1 x 5/8" SS shackle and Rope Loop
682		865A Tandem#1: - 41453 , #2 - 41451
		Tandem assembly (2x chain SS)
		1 x 7/8" galv shackle, pear link
		5m 3/4" polysteel drop line w/ large Ring
		1.5 m chain
690		2 train wheels

Figure 8.20 BR03b-16 Design

8.3 Preliminary Results

8.3.1 *2016 Deployment Summary*

Four moorings were deployed during Leg 3a\3b. Two LTOO moorings CA08-15 and CA05-15 during Leg 3a and two Weston Foundation – ArcticNet – Parks Canada moorings (WF1-15 and WF2-15) were deployed during Leg 3b. Benthic Tripod Mooring WF2-15 was deployed from the CCGS *Marty Bergman* by Parks Canada submarine archeological dive team, led by Marc-Andre Bernier. The benthic tripod ADCP and CTD-Tu sensor were pre-programmed by the ArcticNet Mooring Team (Shawn Meredyk) and the tripod was assembled and equipment attached to the frame by the dive team.

8.3.2 *2016 Mooring Recovery Summary*

All seven moorings from the Beaufort Sea (BR1, BR3, BRK and BRG), the Amundsen Gulf (CA05 and CA08) and the Queen Maud Gulf (WF1) were successfully recovered using the CCGS *Amundsen* and CCGS *Marty Bergmann (WF2) (*Table 8.1*)*.

Table 8.1 Mooring Locations Summary Table of Moorings Recovered in 2016

Mooring_ID	LAT_DD	LONG_DD	Deploy	Recovery	Depth_m
CA05-15	71.2795	71.2795	2015	2016	200
CA08-15	71.0076	71.0076	2015	2016	391
BR1-15	70.4324	70.4324	2015	2016	757
BR3-15	73.4094	73.4094	2015	2016	690
BRK-15	70.8629	70.8629	2015	2016	170
BRG-15	71.002	71.002	2015	2016	700
WF1-15	68.2411	68.2411	2015	2016	97
WF2-15	68.0188	68.0188	2015	2016	20

8.3.3 *2016 Mooring Data Recovery Summary*

The seven moorings recovered aboard the CCGS Amundsen between August-September 2016 were 100% successfully recovered from their original deployment locations. Table 8.2 presents a summary of the raw data recovery success, which cumulates overall at 87% recovery. The results are from the ArcticNet QA/QC 2015-2016 DataYear Report, which contains detailed information and data plots from the recovered instruments

Table 8.2 2015-2016 Mooring Equipment Summary

Site	InstrumentID	TimeFirstGoodData	TimeLastGoodData	Nominal Depth (m)	Raw Data Recovery
BR1-15	ASL_IPS5_51106	30-Sep-2015 22:38:00	01-Sep-2016 15:53:00	56	100.00%
BR1-15	RBR_XR-420-CT_15262	30-Sep-2015 22:40:00	01-Sep-2016 15:50:00	57	100.00%
BR1-15	RBR_XR-420-CT_15268	30-Sep-2015 22:40:00	01-Sep-2016 15:50:00	124	100.00%
BR1-15	RDI_QM_12698	30-Sep-2015 22:45:00	01-Sep-2016 15:30:00	176	100.00%
BR1-15	RBR_XR-420-CT_15279	30-Sep-2015 22:40:00	01-Sep-2016 15:50:00	180	100.00%

BR1-15	Technicap_PPS_3-3_motor_11-16	01-Oct-2015 00:00:00	01-Sep-2016 15:58:00	306	99.70%
BR1-15	RDI_LR_12884	30-Sep-2015 22:30:00	01-Sep-2016 15:30:00	468	100.00%
BR1-15	RBR_XR-420-CT_15267	30-Sep-2015 22:40:00	01-Sep-2016 15:50:00	470	100.00%
BR1-15	Nortek_Aquadopp_2792	30-Sep-2015 23:00:00	01-Sep-2016 15:30:00	606	100.00%
BR1-15	Nortek_Aquadopp_2701	30-Sep-2015 23:00:00	25-Aug-2016 06:56:32	758	97.92%
BR1-15	RBR_Concerto-CTD_60270	30-Sep-2015 22:40:00	01-Sep-2016 15:50:00	762	100.00%
BR3-15	RBR_XR-420-CT_15270	31-Aug-2015 22:20:00	07-Sep-2016 23:00:00	40	100.00%
BR3-15	ASL_IPS5_51104	31-Aug-2015 22:30:00	07-Sep-2016 23:00:00	40	100.00%
BR3-15	Technicap_PPS_3-3_motor_11-17	01-Sep-2015 00:00:00	01-Sep-2016 00:00:00	100	98.12%
BR3-15	RBR_XR-420-CTD_17351	31-Aug-2015 22:30:00	07-Sep-2016 23:00:00	105	100.00%
BR3-15	RBR_XR-420-CT_15269	31-Aug-2015 22:20:00	07-Sep-2016 23:00:00	160	100.00%
BR3-15	RDI_QM_12824			160	0%
BR3-15	Technicap_PPS_3-3_motor_12-18	01-Sep-2015 00:00:00	01-Sep-2016 00:00:00	300	98.12%
BR3-15	RBR_XR-420-CT_15272	31-Aug-2015 22:20:00	07-Sep-2016 23:00:00	443	100.00%
BR3-15	RDI_LR_12942	31-Aug-2015 23:00:00	07-Sep-2016 22:00:00	443	100.00%
BR3-15	Nortek_Aquadopp_6109	31-Aug-2015 23:00:00	31-Jan-2016 01:00:00	588	41.02%
BR3-15	RBR_XR-420-CT_15278	31-Aug-2015 22:20:00	07-Sep-2016 23:00:00	696	100.00%
BR3-15	Nortek_Aquadopp_8541	31-Aug-2015 23:00:00	07-Sep-2016 22:00:00	696	100.00%
BRG-15	ASL_IPS5_51108	28-Aug-2015 19:00:00	01-Sep-2016 00:20:00	30	100.00%
BRG-15	RBR_XR-420-CT_15273	28-Aug-2015 19:00:00	01-Sep-2016 00:20:00	30	100.00%
BRG-15	Technicap_PPS_3-3_motor_12-27	01-Sep-2015 00:00:00	01-Sep-2016 00:00:00	101	98.92%
BRG-15	RBR_Concerto-CTD-Tu-DO_10419	28-Aug-2015 19:00:00	01-Sep-2016 00:00:00	102	100.00%
BRG-15	RDI_QM_12841	28-Aug-2015 19:15:00	31-Aug-2016 23:59:59	159	99.73%
BRG-15	RBR_XR-420-CT_15258	28-Aug-2015 19:10:00	01-Sep-2016 00:20:00	159	100.00%
BRG-15	Technicap_PPS_3-3_motor_12-21	01-Sep-2015 00:00:00	01-Sep-2016 00:00:00	290	98.92%
BRG-15	RDI_LR_12892	28-Aug-2015 19:00:00	31-Aug-2016 23:30:00	449	99.73%
BRG-15	RBR_XR-420-CT_15266	28-Aug-2015 19:00:00	01-Sep-2016 00:20:00	449	100.00%
BRG-15	Nortek_Aquadopp_9846	28-Aug-2015 19:00:00	01-Sep-2016 00:00:00	592	100.00%
BRG-15	Nortek_Aquadopp_8434	28-Aug-2015 19:00:00	01-Sep-2016 00:00:00	702	100.00%
BRG-15	RBR_XR-420-CT_15280	28-Aug-2015 18:50:00	01-Sep-2016 00:20:00	702	100.00%
BRK-15	RDI_WHS_102	27-Aug-2015 15:00:00	01-Sep-2016 02:00:00	145	100.00%
BRK-15	RBR_XR-420-CT+Tu-DO-FL_22043	27-Aug-2015 15:00:00	01-Sep-2016 02:00:00	152	100.00%
BRK-15	Sequoia_LISST100x_1445	27-Aug-2015 15:00:00	01-Sep-2016 02:00:00	152	100.00%
BRK-15	Nortek_AquaPro_9711	27-Aug-2015 15:00:00	01-Sep-2016 02:00:00	154	100.00%
CA05-15	ASL_IPS5_51075	24-Aug-2015 21:27:00	29-Aug-2016 15:01:00	55	99.73%
CA05-15	JFE-ALEC_Infinity-CLW-USB_7			67	0%
CA05-15	JFE-ALEC_Compact-LW_74	24-Aug-2015 22:00:00	29-Aug-2016 16:00:00	67	99.73%
CA05-15	JFE-ALEC_Infinity-CTW-USB_147	24-Aug-2015 22:00:30	18-May-2016 17:30:46	67	72.04%
CA05-15	Satlantic_ISUS-V3_135	24-Aug-2015 22:00:00	30-May-2016 11:00:00	67	75.27%
CA05-15	Multielectronique_AURAL_35			78	0%
CA05-15	Nortek_Continental_6085	24-Aug-2015 21:30:00	29-Aug-2016 15:00:00	87	99.73%
CA05-15	Nortek_Continental_5815	24-Aug-2015 21:30:00	29-Aug-2016 15:00:00	90	99.73%

CA05-15	Technicap_PPS_3-3_motor_12-22	01-Sep-2015 00:00:00	29-Aug-2016 16:06:00	124	97.58%
CA05-15	Aanderaa_RCM11_270	24-Aug-2015 00:00:00	18-Jul-2016 11:00:00	185	88.44%
CA08-15	Satlantic_ISUS-V3_134	23-Aug-2015 21:00:00	22-Jan-2016 12:07:00	76	40.97%
CA08-15	Multielectronique_AURAL_33	23-Aug-2015 21:00:00	28-Aug-2016 00:00:00	76	100.00%
CA08-15	JFE-ALEC_Compact-LW_66	23-Aug-2015 21:00:00	27-Aug-2016 23:00:09	76	99.73%
CA08-15	JFE-ALEC_Infinity-CTW-USB_320			76	0%
CA08-15	Nortek_Continental_6068	23-Aug-2015 20:50:00	28-Aug-2016 00:00:00	88	100.00%
CA08-15	Nortek_Continental_6071	23-Aug-2015 20:50:00	28-Aug-2016 00:00:00	100	100.00%
CA08-15	Technicap_PPS_3-3_motor_12-28	01-Sep-2015 00:00:00	28-Aug-2016 05:07:00	134	97.57%
CA08-15	Nortek_Aquadopp_9839	23-Aug-2015 21:00:00	23-Aug-2016 00:14:11	287	98.65%
CA08-15	Nortek_Aquadopp_2754	23-Aug-2015 21:00:00	20-Aug-2016 07:58:07	337	97.84%
WF1-15	JFE-ALEC_Compact-CTW_145			66	0%
WF1-15	JFE-ALEC_Infinity-CLW-USB_8			66	0%
WF1-15	JFE-ALEC_Compact-LW_73	21-Sep-2015 05:50:00	26-May-2016 22:50:17	66	74.25%
WF1-15	Nortek_Continental_6088	21-Sep-2015 01:13:31	20-Aug-2016 23:23:31	66	100.00%
WF1-15	Technicap_PPS_3-3_motor_12-23	01-Oct-2015 00:00:00	20-Aug-2016 23:23:31	78	97.01%
WF2-15	RBR_Concerto-CTD-Tu_65715	07-Sep-2015 15:45:00	31-Aug-2016 23:05:00	12	100.00%
WF2-15	RDI_SV100_23590	07-Sep-2015 15:45:00	31-Aug-2016 21:31:53	12	100.00%

8.3.4 *Lessons Learned Summary*

Table 8.3 Summary table of Lessons Learned throughout the mission

Problem	Solution	Operation
Tygon Tubing can cause pit corrosion on stainless steel eyelets on AQD finned frames.	Custom Plastic bushings could be made to replace the tygon tubing.	Deployment
Stainless Steel Shackle Corrosion	Buy Titanium Shackles or stop using stainless shackles altogether	Deployment
RDI end-cap / Bulkhead connectors are susceptible to pin corrosion and rubber delamination if mishandled in colder air temps.	Use enough silicone grease around pins. Use a heat gun for effective horizontal connector pulling.	Recovery
RDI battery case flooding through bulkhead connector	Diligence is needed when replacing O-rings. Have all RDI battery cases BH connectors inspected and use a heat gun for effective horizontal connector pulling.	Recovery
Technicap motor movement can be reverse sometimes	Verify the turning direction of the motor before deployment	Deployment
Nortek Bulkhead connectors can become loose and cause water ingress	Tighten BH connectors on Nortek Aquadopp units before deployment	Deployment

JFE-Alec devices are becoming unreliable for long deployments	Use more Microcat and RBR CT/D units in the future	Deployment

Acknowledgements

I would like to acknowledge the teamwork and co-operation between the Coast Guard crew of the CCGS Amundsen and the Mooring Team (Shawn Meredyk, Luc Michaud and Alexandre Forest (Golder)). Working together as a team and having the fortune of good weather, all the moorings were successfully deployed, recovered and re-deployed efficiently and safely as possible.

I would also like to acknowledge the teamwork and co-operation of Dr. Humfrey Melling (IOS) and the CCGS Sir-Wilfred Laurier for their hard work and attention to detail that successfully recovered and re-deployment of BR1-15.

9 BaySys Mooring Program – *CCGS Desgroseilliers* Expedition

Project leader: David Barber[1] (david.barber@umanitoba.ca)

Cruise participants: Jens Ehn[1], Claire Hornby[1], Sergei Kirillov[1], Igor Dmitrenko[1], Sylvain Blondeau[2], Lisa Matthes[1], Atreya Basu[1], Michelle Kamula[1], Zakhar Kazmiruk[1], Jake (Janghan) Lee[2], Masoud Goharrokhi[2] and Mary O'Brien

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9.1 Introduction

9.1.1 *Program Objectives*

BaySys is a four-year collaboration among industry partner Manitoba Hydro (Hydro Québec and Ouranos) and the Universities of Manitoba, Northern British Columbia, Québec à Rimouski, Alberta, Calgary, Laval and Trent to conduct research on Hudson Bay. The overarching goal of the project is to understand the role of freshwater in Hudson Bay marine and coastal systems, and in particular, to create a scientific basis to distinguish climate change effects from those of hydroelectric regulation of freshwater on physical, biological and biogeochemical conditions in Hudson Bay.

This project will address the main objective from a "systems" perspective, with sub-objectives to examine the climate, marine, and freshwater systems, and to study the cycling of carbon and contaminants. As such, five research teams have been organized to investigate five interconnected subsystems, with continuous consultation, integration and feedback from Manitoba Hydro and other project participants:

- (Team 1) Marine and Climate Systems
- (Team 2) Freshwater System (not involved in field work)
- (Team 3) Marine Ecosystem
- (Team 4) Carbon Cycling
- (Team 5) Contaminants

9.1.2 *Background and Regional Setting*

As the largest continental shelf sea in the world, Hudson Bay (low Arctic, Canada) receives an annual freshwater loading of about 760 km^3 from more than 42 rivers within a drainage basin of over 3×106 km^2 in area. An even larger seasonal freshwater flux, estimated at 1200 km^3 or more, is withdrawn from or added to the water column due to the formation or decay of sea ice in the Bay. The timing, duration, volume and location of freshwater loading to Hudson Bay thus have a major influence on the properties and processes of the marine waters and the dynamics of sea ice, which in turn strongly influence primary productivity, carbon and contaminant cycling in the Bay. Distinguishing between runoff and sea-ice melt is especially important in Hudson Bay because each contribute considerable annual fluxes of freshwater to Hudson Bay, and yet they may be affected differently by climate change and regulation. To address the overarching goal of providing a scientific basis to separate climate change and regulation impacts on the Hudson

Bay system, BaySys (2015-2019) will integrate field-based experimentation with coupled climatichydrological-oceanographic-biogeochemical modeling.

The 2016 mooring field program took place in southern Hudson Bay from September 26 (Churchill) to October 4 (Kujjaurapik) (Figure 9.1). Opportunistic sampling continued from October 5 to October 12 in northern Hudson Bay (Figure 9.1), after which the ship returned to Iqaluit for crew change and all scientists disembarked. During the main eight-day cruise, members of all five multi-disciplinary teams collected CTD profiles, water and sediment samples, and deployed oceanographic moorings along the full length of the southern coast of Hudson Bay. The focus of this field program was on the Nelson Estuary region and James Bay mouth, which are the major sources of riverine fresh water to the Hudson Bay system.

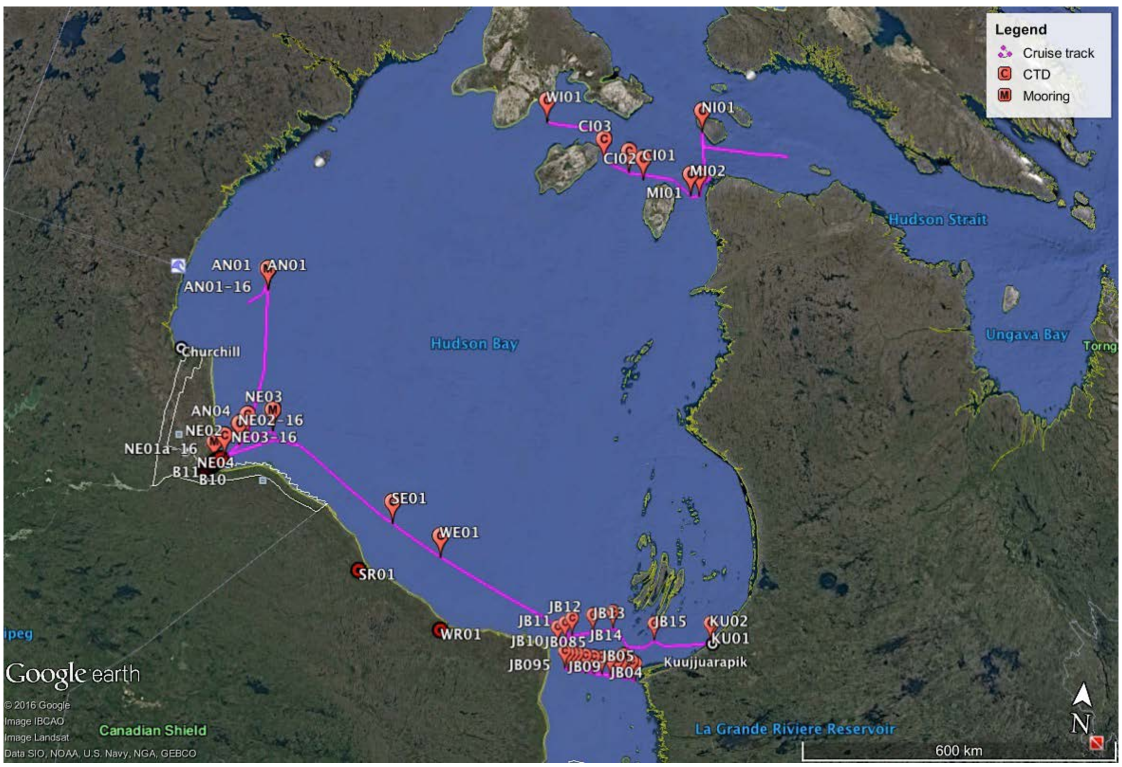


Figure 9.1 BaySys 2016 cruise track, mooring sites and CTD stations

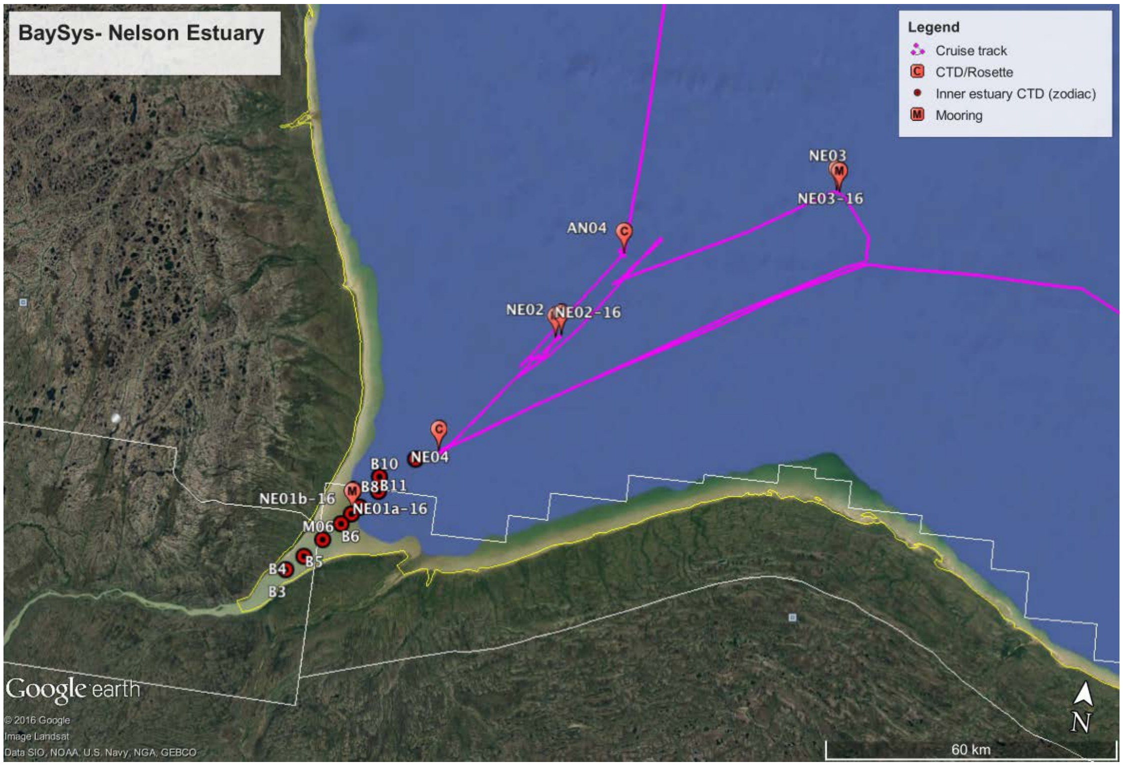


Figure 9.2 CTD water sampling (by zodiac) and mooring sites in the Nelson River Estaury

9.2 Methodology

9.2.1 *Mooring Operations*

<u>Mooring Instrumentation</u>

Five oceanographic moorings were deployed from September 26- October 1, 2016 (Table 9.1). All mooring components and their depths are show in Figure 9.3 to Figure 9.7. Three of the moorings located in deeper waters (i.e. AN01, NE03 and JB02) included custom-built buoyant mooring frames with upward looking Nortek Signature 500 Acoustic Doppler Current Meters (ADCPs). These are capable of measuring high-resolution near surface current profiles, ice draft and surface wave characterization. The TRDI Workhorse ADCPs, located further below mounted inline or in trawl-resistant bottom mounts, provide an additional current profile of the water column and surface tracking. Only the JB02 lacked a TRDI Workhorse ADCP; however instead it included a downward looking Nortek Aquadopp 600 kHz ADCP to provide observations of the currents below ~50 m depth (Figure 9.7). Trawl-resistant bottom mounts were deployed in the inner (NE01; Figure 9.5) and outer estuary (NE02;Figure 9.6) stations where higher water column dynamics are expected leading to high current speeds and ice ridging. Numerous RBR conductivity (C) and temperature (T) loggers, some with an additional Seapoint turbidity meter (Tu), were provided in-kind by Manitoba Hydro and attached to the mooring lines at select locations. In addition, 7 Wetlabs ECO triplet loggers were attached to near surface locations and on the trawl-resistant bottom mount on NE01 (inner estuary,Figure 9.5) to record chlorophyll-a fluorescence, CDOM fluorescence and turbidity.

A special addition to AN01, NE01 (however lost), NE02 and NE03, were the buoyant tubes moored at depths near the surface so that instrument imbedded within the tubes can record surface layer properties near the ice cover. Due to the length and smoothness of the tubes, they will resist being caught and carried off by drifting ice ridges. The drifting ice ridges, with sufficient draft to reach the tubes, will (hopefully) push down the tubes instead of catching them. However, in the event of tubes getting trapped and dragged by drifting, weak links were placed on the lines connecting the tubes to the moorings so that only the tube component of the moorings would be lost. Four sediment traps (see next section) were attached to AN01, NE02, NE03 and JB02 (Table 9.1), and are a contribution from Dr. Zou Zou Kuzyk of BaySys Team 4/5.

The mooring components are programmed for a one-year deployment with the planned recovery in the fall 2017. However, in the event that there is no suitable ship available for the fall 2017, they will be recovered in June/July 2017 during the CCGS Amundsen cruise in Hudson Bay.

Table 9.1 Summary of BaySys mooring locations, station IDs, sediment trap depths, and bottom depth at deployment

Date	Mooring location	ID	Latitude	Longitude	Bottom Depth (m)	Sediment trap depth (m)	Trap serial number
Sept 26	Churchill Estuary	AN01	59°58.156'N	91°57.144'W	109	85	718630
Sept 27	Nelson Estuary (outer)	NE02	57°30.007'N	91°48.095'W	46	35	718631
Sept 28	Nelson Estuary (shelf)	NE03	57°49.762'N	90°52.888'W	54	28	718632*
Sept 29	Nelson Estuary (inner)	NE01	57°07.923'N	92°24.704'W	29.7	No trap	
Oct 1	James Bay	JB02	54°40.973'N	80°11.226'W	101	75	718633*

* The rosette and motors for these two sediment traps were accidently swapped.

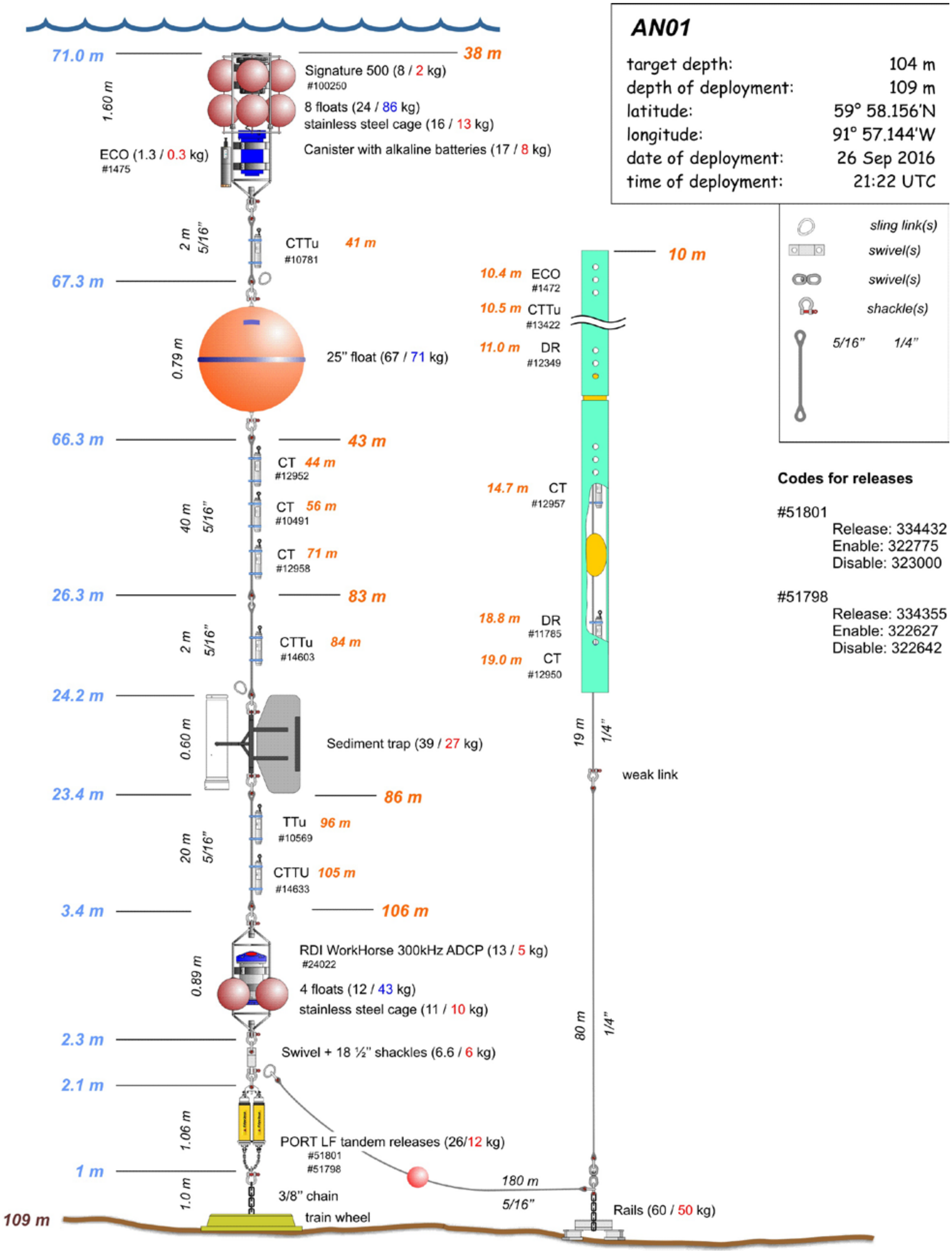


Figure 9.3 AN01 (Churchill shelf) mooring configuration, location and depth

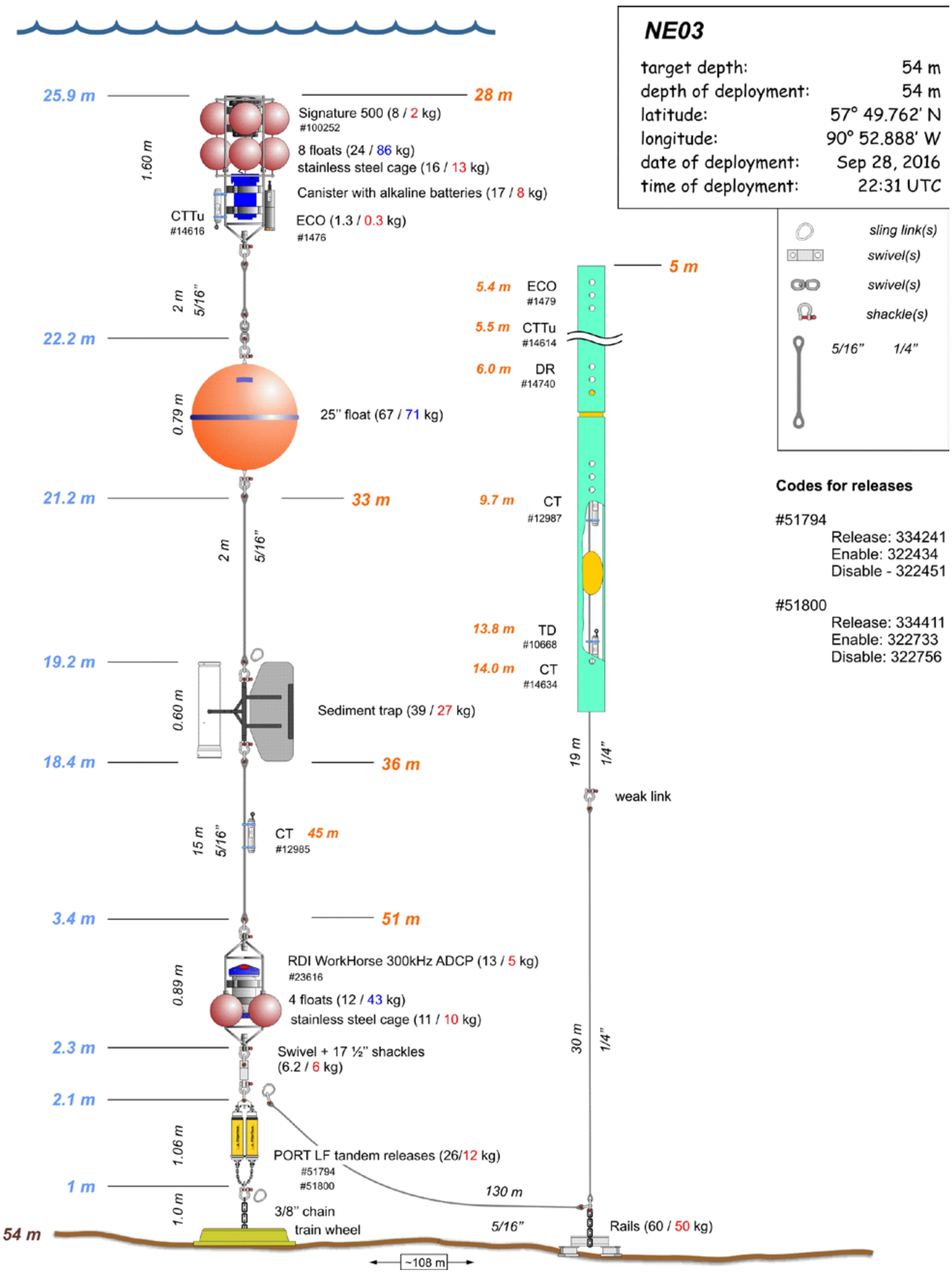


Figure 9.4 NE03 (Nelson River outer shelf) mooring configuration, location and depth

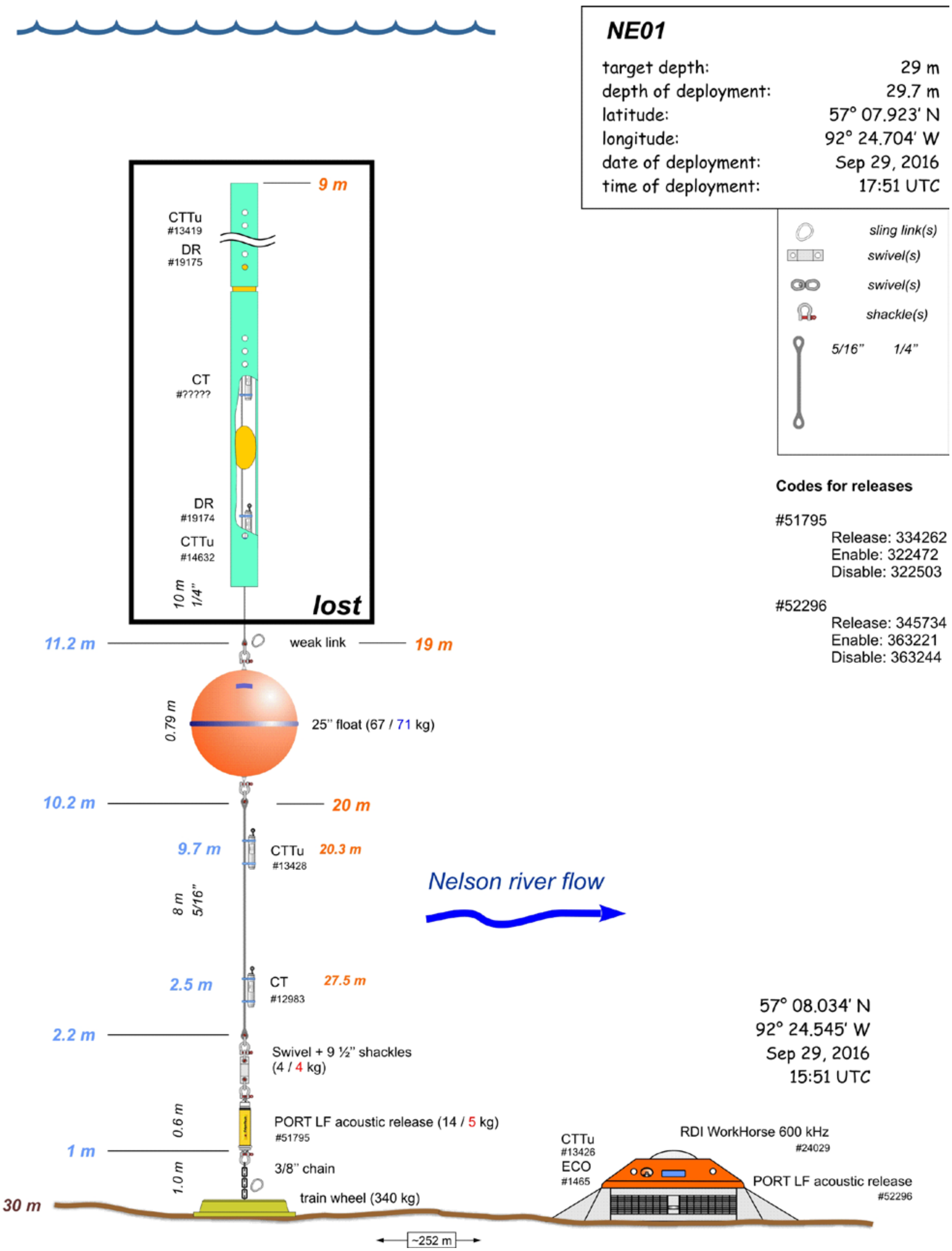


Figure 9.5 NE01 (Nelson Inner Estuary) mooring configuration, location and depth. Top tube was lost during helicopter transit.

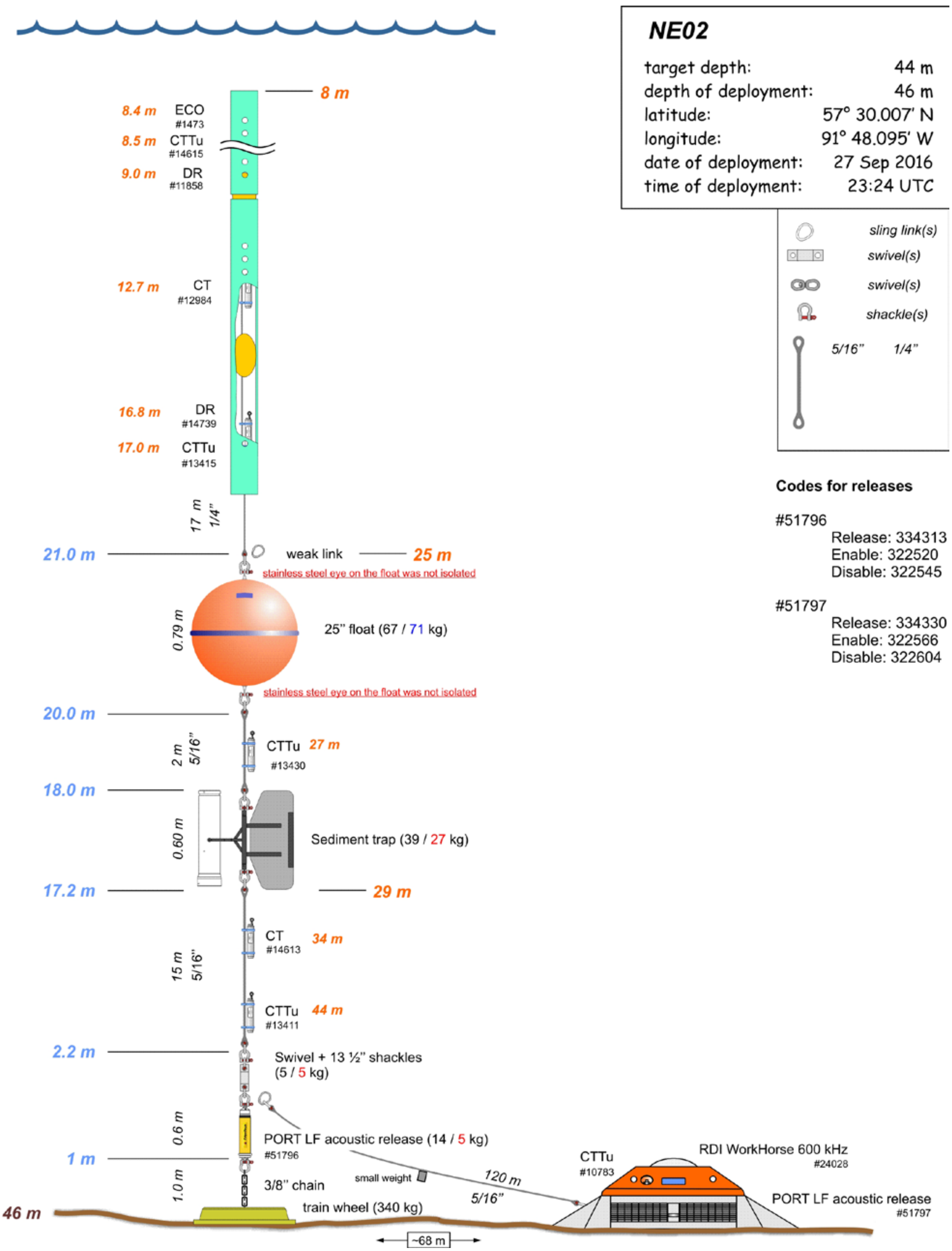


Figure 9.6 NE02 (Nelson Outer Estuary) mooring configuration, location and depth

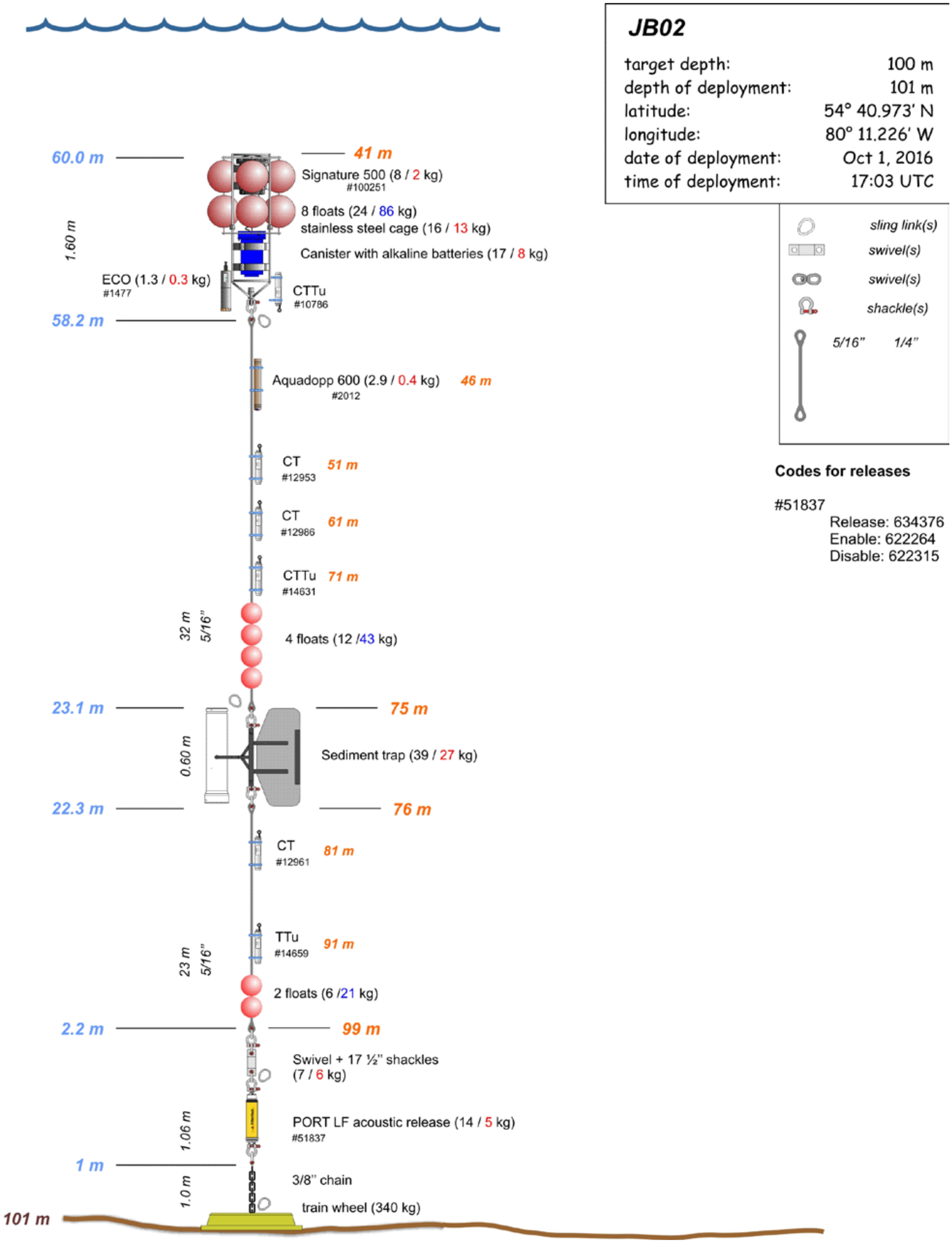


Figure 9.7 JB02 (James Bay) mooring configuration, location and depth

Mooring Deployment

All moorings (except NE01) were deployed from the foredeck by using the crane at the starboard side of the ship. The relatively short length of all moorings allowed deploying them "anchor last". The design of mooring AN04, NE02 and NE03 included a second component (surface buoyant tubes or TRBM) connected to a major line with a long rope near the bottom. Since each mooring carries two acoustic releases only, such a connection aims to increase the mooring survivability in a case of one of releases failure. The connecting line also facilitates the recovery by dragging in a case of both releases fail to respond at the moment of recovery.

Two elements of mooring NE01 were deployed separately in the inner estuarine area from helicopter. The deployment was supported by crew and scientist in the zodiac: the mooring elements were smoothly dropped into the water in the designated areas marked from zodiac with the small anchored surface floats.

Sediment Traps

The objective of the sediment trap program, as part of BaySys Team 4/5, is to determine the sinking fluxes of particulates (organic and lithogenic) through the water column. Four Gurney Instrument "Baker Type" sequential type sediment traps were deployed from the *CCGS Des Groseilliers* fixed to moorings AN01, NE02, NE03 and JB02 at depths ranging from 28 to 85 m below the water surface (Table 9.1).

Methods

Prior to embarking the ship, sediment trap solution, or density gradient solution, was prepared at the Churchill Norther Studies Centre (CNSC). To prepare the solution, 10L of sea water was collected from the port wharf and filtered through 0.7 um GF/F filter. The salinity of the filtered seawater was adjusted from 26.7 psu to 37 psu with 88.065g of ultra clean sea salt. Borax (44.4 g) was slowly added to 37% formaldehyde (0.45L) and placed on a magnetic stir plate overnight to dissolve. The solution was removed from the stir plate and, after settling for approx. 4 hours, was decanted and poured into 8.55 L of filtered sea water. The solution was stored in a 10L polypropylene aqua pak water container until sediment traps were ready to be assembled, which took place before deployed.

Once onboard the ship, all four sediment trap motor/timers were removed from their cases, checked over, including batteries and o-rings, and timer intervals were set simultaneously in central standard time (Table 9.2). All four sediment trap motors (Figure 9.8) were turned on at exactly 18:00 on 25-September-16 (interval 0) so that, simultaneously, they would began collecting particulates at 0:00 CST 4-October-16 (interval 1).

Table 9.2 Sediment trap sample intervals

Int.	Start Date	Start Time (CST)	End Date	End Time (CST)	Interval Days	Collection Area
delay	25-Sep-16	18:00	4-Oct-16	0:00	8.25	N/A
1	4-Oct-16	0:00	8-Nov-16	0:00	35	0.032 m^2
2	8-Nov-16	0:00	13-Dec-16	0:00	35	0.032 m^2
3	13-Dec-16	0:00	17-Jan-17	0:00	35	0.032 m^2
4	17-Jan-17	0:00	21-Feb-17	0:00	35	0.032 m^2
5	21-Feb-17	0:00	28-Mar-17	0:00	35	0.032 m^2
6	28-Mar-17	0:00	2-May-17	0:00	35	0.032 m^2
7	2-May-17	0:00	6-Jun-17	0:00	35	0.032 m^2
8	6-Jun-17	0:00	11-Jul-17	0:00	35	0.032 m^2
9	11-Jul-17	0:00	15-Aug-17	0:00	35	0.032 m^2
10	15-Aug-17	0:00	19-Sep-17	0:00	35	0.032 m^2

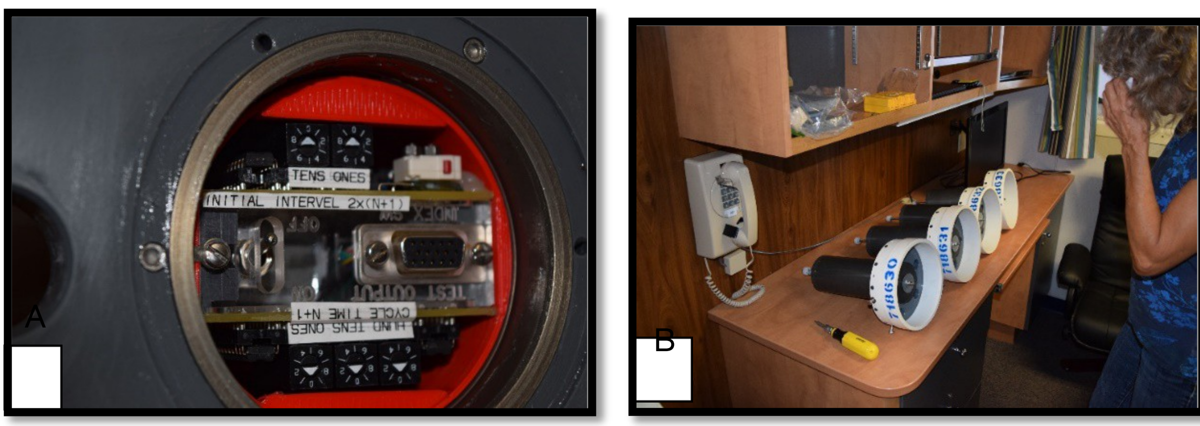


Figure 9.8 Sediment trap timers All timers were set simultaneously and turned on at the exact same time at 0:00 Hr on 4-October-2016.

Figure 9.9 Sediment trap equipment, methods and deployment

(Top left) Mary O'Brien fills sediment trap tubes with density gradient solution that are housed in a rosette assembly that also contains the motor/timer, and (top right) then places and secures the corresponding PVC tube that houses an asymmetrical funnel over the sediment trap tubes. (bottom left) Michelle Kamula and Mary O'Brien ensure the sediment trap tubes are lined up with the asymmetrical funnel and that the rosette, motor/timer smoothly rotates inside the PVC tube. (bottom right) Prior to deployment, a fin is secure fastened to the sediment trap and attached to the mooring line

Prior to deployment, each sediment trap was assembled by placing 10 sample tubes in the corresponding sediment trap rosette and filled to the surface with density gradient solution, leaving no head space (see preparation above and Figure 9.9). The rosette was set to position "0" or the start position, which held no tube. The corresponding PVC tube that houses an asymmetrical Teflon funnel was washed thoroughly using fresh water to remove any dust or particles and placed over top of the motor/timer and sample tube rosette assembly (Figure 9.9). Using a magnet, the rosette was turned slowly and each sample tube was checked to ensure it lined up with the funnel and that the rosette rotated smoothly inside the PVC tube housing (Figure 9.9). Fins containing a weight at the bottom were assembled and attached to the sediment trap directly before deployment (Figure 9.9). The sediment trap assembly was attached to the mooring by shackles and lowered into the water by crew and crane operator.

<u>Attempted Mooring Retrieval</u>

On September 26, the BaySys and Des Groseilliers crew attempted to retrieve lost ArcticNet mooring AN01. Several efforts were made to communicate with the mooring with the use of an acoustic release. Unfortunately, no signal was located. The ship then attempted to dredge for the mooring (Figure 9.10) and were unsuccessful. We will attempt to retrieve this mooring again using a multibeam survey with the CCGS *Amundsen* in June 2017.

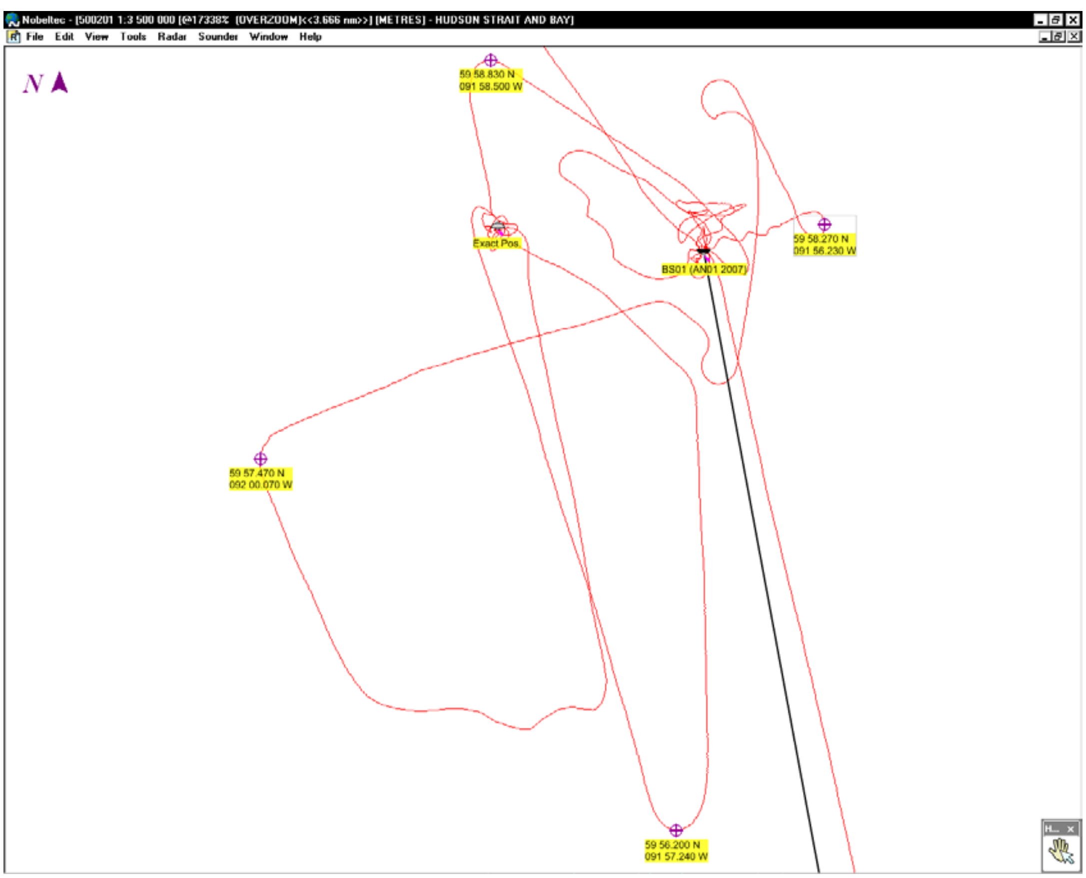


Figure 9.10 Map of dredging locations in attempt to locate lost AN01 mooring

9.2.2 *Water Sampling*

The second objective of our shipboard fieldwork was to characterize the physical and chemical properties in the water column, such as temperature, salinity, fluorescence, dissolved oxygen concentration, light penetration and turbidity. Water sampling was carried out using a CTD-Rosette (donated by Quebec Ocean), niskin bottles and bucket (in the river systems).

Table 9.3 Water sampling parameters collected by BaySys teams 1, 3, 4, 5

CTD	Conductivity temperature depth probe of two manufacturers (Seabird, Idronaut)
SPM	Suspended particular matter
CDOM	Colored dissolved organic matter
^{18}O	Oxygen Isotopes
a_p	Particle absorption
HPLC	High-performance liquid chromatography
POC	Particular organic carbon/ nitrogen
Lugol	Preserved phytoplankton samples
FlowCam	Dynamic imaging particle analyzer
NO_3, NO_2, Si, PO_4	Nitrite, nitrate, orthophosphate and orthosilicic acid
NH^4	Ammonium
Chl *a*	Chlorophyll *a*

<u>CTD-Rosette</u>

We used a SBE 25CTD with various other sensors (Table 9.4 and Table 9.5) mounted on a cylindrical frame known as a rosette. The rosette frame was originally equipped with 12 x 8 liter bottles but due to the maximum safe working load of the winch, it was limited to 10 bottles (Figure 9.11). The rosette supplied water samples, surface and at depth, for the teams on board.

Probes Calibration

1) Seabird CT Probes temperature, conductivity and oxygen have been calibrated at the Sea-Bird factory prior the ship departure from Quebec City.
2) Seabird Pressure sensor have been calibrated at Laval University prior the ship departure from Quebec City
3) Biospherical light sensor was new
4) Seatech fluorometer and transmissometer could not be calibrated but verified for min and max measurement and worked properly.

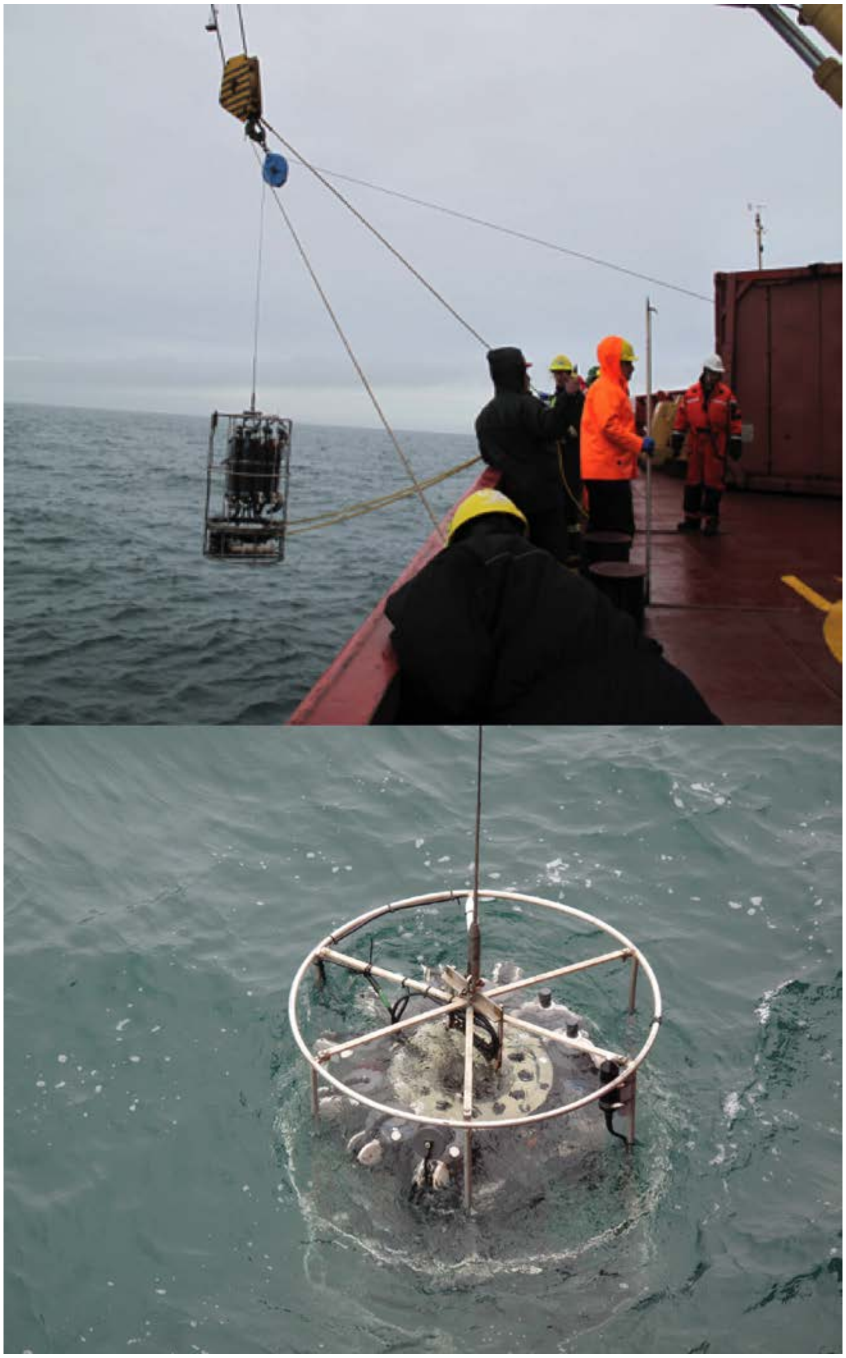


Figure 9.11 Rosette (10 bottle) operations on board *CCGS Des Groseilliers*

Table 9.4 Rosette Sensors

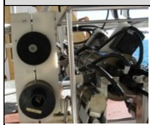
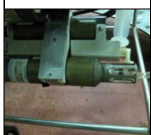
Photo	Instrument	Manufacturer	Type & Properties	Serial Number
	Data Logger	SeaBird	SBE-25 Sampling rate : 8 Hz	0039
	Temperature	SeaBird	SBE 3 Range: -5^{o}C to + 35^{o}C Accuracy: 0.001	031116
	Pressure	SeaBird	Accuracy: 0.015% of full range	290114
	Conductivity	SeaBird	SBE 4C Range: 0 to 7 S/m Accuracy: 0.0003	040819
	Oxygen	SeaBird	SBE-43 Range: 120% of saturation Accuracy: 2% of saturation	431007
	PAR	Biospherical	QSP2300	70422
	Fluorometer	Sea Tech	Minimum Detectable Level 0.02 µg/l Gain Sens, V/(µg/l) Range/(µg/l), 30x 1.0 5 10x 0.33 15 3x 0.1 50 1x 0.033 150	149
	Transmissometer	SeaTech	Path length: 25 cm Sensitivity: 1.25 mV	171

Table 9.5 Sensor Specifications

Parameter	Sensor Company Instrument Type	Range	Accuracy	Resolution
Attached to the Rosette				
Data Logger	SeaBird SBE-25 [1]	600 m		
Temperature	SeaBird SBE-03 [2]	-5°C à +35°C	0.001°C	0.0002°C
Conductivity	SeaBird SBE-4C [2]	0-7 S/m (0-70mmho/cm)	0.0003 S/m (0.003mmho/cm)	0.00004 S/m (0.0004 mmho/cm)
Pressure		up to 600m (1 000psia)	0.015% of full scale	0.01% of full scale
Dissolved oxygen	SeaBird SBE-43 [2]	120% of surface saturation[4]	2% of saturation	unknown

Light intensity (PAR)	Biospherical QSP-2300[3]	400-700 nm	
Fluorescence	SeaTech Chlorophyll-fluorometer	0-5 V	unknown
Transmissiometer	SeaTech	0-5 V	unknown

Notes: [1] Maximum depth of 600m; [2] Maximum depth of 6800m; [3] Maximum depth of 2000m

Salinity Samples

Salinity samples have been taken on most of the rosette cast for comparison with the conductivity sensor on the rosette.

Rosette Water Sampling

Water was sampled with the rosette according to each team's requests. To identify each water sample, we used the term "rosette cast" to describe one CTD-rosette operation. A different cast number is associated with each cast. The cast number is incremented every time the rosette is lowered in the water. The cast number is a seven-digit number: xxyyzzz, with xx: The last two digits of the current year; yy: A sequential (Québec-Océan) cruise number; zzz: The sequential cast number. For this cruise, the first cast number is: 1606001. To identify the nine rosette bottles on this cast we simply append the bottle number: 1606001nn, where "nn" is the bottle number (01 to 09).

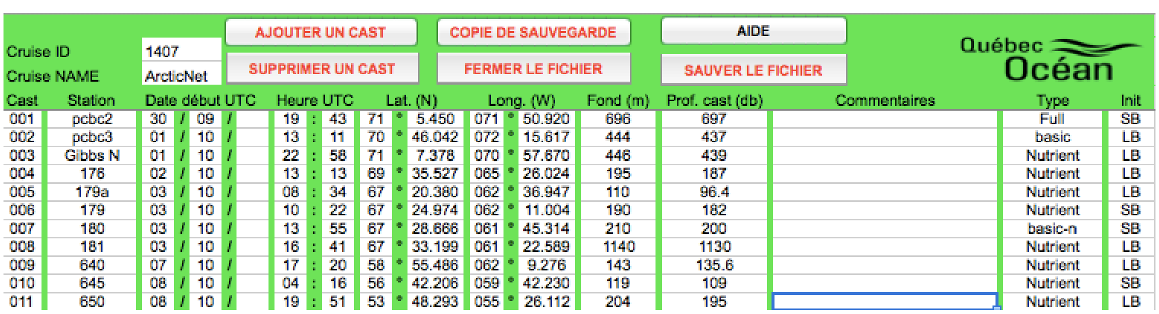
Two types of CTD-Rosette casts are defined as follows:

<u>CTD casts</u>: CTD profiles are only to collect data from water column

<u>Rosette casts:</u> Samples are obtained for Chlorophyll, Nutriment, Dissolved Oxygen, CDOM, Salinity, Flow Cam etc.

Sampling Stations

All the information concerning the Rosette casts is summarized in the CTD Logbook (one line per cast) and an example shown here in Figure 9.12. The information includes the cast number and station ID, date and time of sampling in UTC, latitude and longitude, bottom and cast depths, and comments concerning the casts.



Cast	Station	Date début UTC	Heure UTC	Lat. (N)	Long. (W)	Fond (m)	Prof. cast (db)	Commentaires	Type	Init
001	pcbc2	30 / 09 /	19 : 43	71 ° 5.450	071 ° 50.920	696	697		Full	SB
002	pcbc3	01 / 10 /	13 : 11	70 ° 46.042	072 ° 15.617	444	437		basic	LB
003	Gibbs N	01 / 10 /	22 : 58	71 ° 7.378	070 ° 57.670	446	439		Nutrient	LB
004	176	02 / 10 /	13 : 13	69 ° 35.527	065 ° 26.024	195	187		Nutrient	LB
005	179a	03 / 10 /	08 : 34	67 ° 20.380	062 ° 36.947	110	96.4		Nutrient	LB
006	179	03 / 10 /	10 : 22	67 ° 24.974	062 ° 11.004	190	182		Nutrient	SB
007	180	03 / 10 /	13 : 55	67 ° 28.666	061 ° 45.314	210	200		basic-n	SB
008	181	03 / 10 /	16 : 41	67 ° 33.199	061 ° 22.589	1140	1130		Nutrient	LB
009	640	07 / 10 /	17 : 20	58 ° 55.486	062 ° 9.276	143	135.6		Nutrient	LB
010	645	08 / 10 /	04 : 16	56 ° 42.206	059 ° 42.230	119	109		Nutrient	SB
011	650	08 / 10 /	19 : 51	53 ° 48.293	055 ° 26.112	204	195		Nutrient	LB

Figure 9.12 CTD Logbook example, one line per cast

An Excel® Rosette Sheet was created for every single cast. This file includes the same information as the CTD Logbook, plus a table of what was sampled and at what depth. Weather information at sampling time was also included in each Rosette Sheet, and is summarized in a Meteorological Logbook (one line per cast). For every cast, data from three seconds after a bottle is closed, to seven seconds later, is averaged and recorded in the ascii 'bottle files' (files with a btl extension). The information includes the bottle number, time and date, trip pressure, temperature, salinity, light transmission, fluorescence, dissolved oxygen. These files will be made available as soon as the data is processed and corrected, if necessary.

Problems Encountered with CTD-Rosette

We encountered a transistor failure in the power supply of the transmissometer and fluorometer sensors at the beginning of the cruise. In order to fix the problem technician Sylvain Blondeau had to short-cut the transistor circuit to bring power back to the sensors. However, when the pump was activated after some time in the salt water, the current drawn to the batteries was too much causing it to lose memory and configuration of the ctd, ultimately stopping the connectivity with the computer on deck. After a few casts, the pump finally burst. After this, the oxygen and conductivity had to be disconnected from the pump and positioned vertically so that water could pass thru them during the cast. The ctd was then configured so that it would not activate the pump during the cast.

Preliminary Results of Thermohaline Stratification in Hudson Bay (CTD profiles)

Temperature and salinity was recorded from the inner to the outer Nelson estuary as well as at James Bay mouth by the Idronaut CTD probe. Vertical CTD profiles show the distribution of riverine freshwater coming from Nelson river into Hudson Bay (Figure 9.13). Fresh and salty water start mixing in shallow water, whereby a strong outflow current of Nelson river might be the reason why salinity above 20 is measured in deeper water further away from the estuary. The warmer temperatures of the river water are following the same trend.

The high riverine freshwater input in James Bay is causing a strong thermohaline stratification at the entrance to Hudson Bay (Figure 9.14). A 20 m thick layer of less salty, warm water was found at the surface. According to the five CTD profiles in centre of James Bay mouth, the halocline was slightly lower (30 m) than the thermocline (20 m).

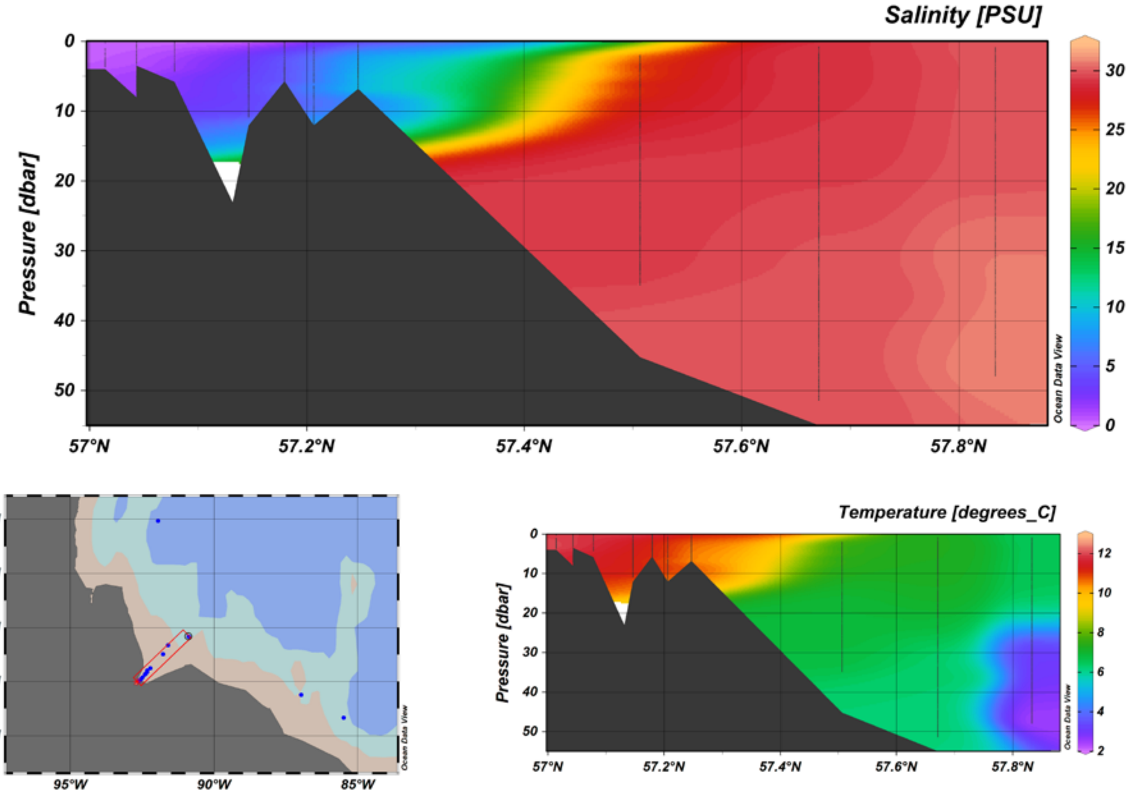


Figure 9.13 Temperature and salinity profile of Nelson Estuary CTD profiles (black lines) were taken in the inner and outer estuary

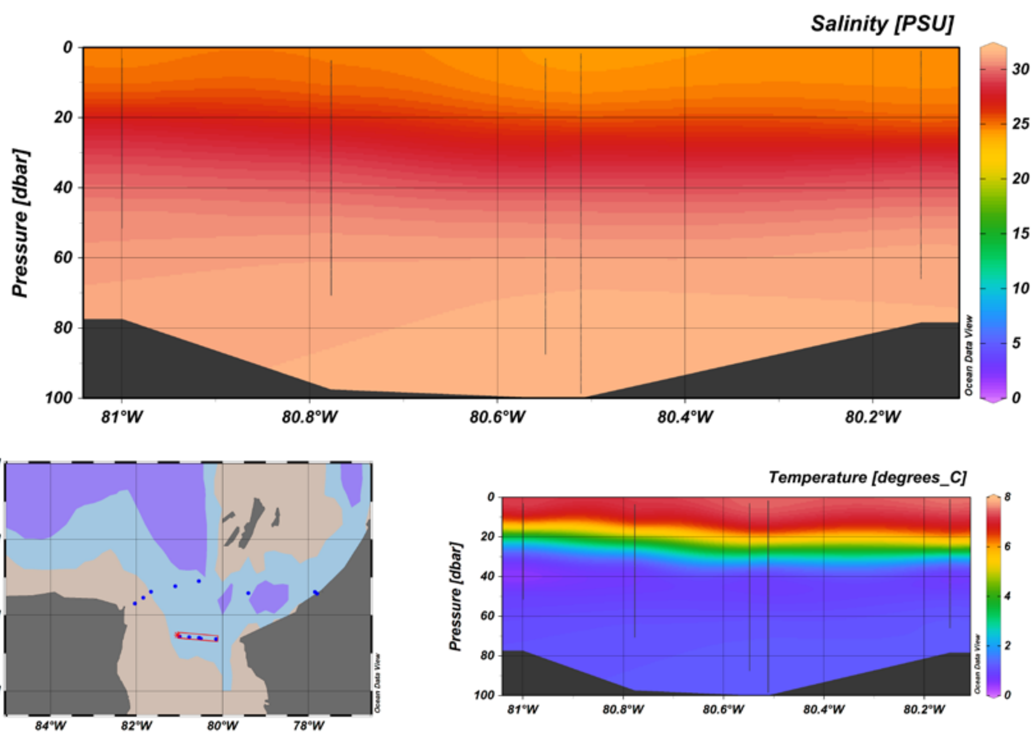


Figure 9.14 Temperature and salinity profile of James Bay mouth CTD profiles (black lines) were taken in the deep center of the opening to Hudson Bay

Freshwater Dynamics

In order to understand the freshwater dynamics of the Hudson Bay before the onset of winter, water samplings were carried out by members of Team 1 all along the south and southeast coastal belt of Hudson Bay. The emphasis was on assessing the distribution of runoff from the Nelson and Churchill River and also from the James Bay which normally accounts for 80% of the riverine input into the Hudson Bay. Few water samples were also collected in the northern Hudson Bay, near Coats and Mancel Island. Water samples collected, were intended for Total Suspended Solid (TSS) analysis along with CDOM and ^{18}O measurement. In field processing of the water samples was carried out for TSS retrieval, using vacuum filtration technique. Filters of pore size of 0.7 µm were used, and the filtered samples were stored in -4°C freezer. CDOM samples were prepared by syringe filtration using a 0.2 µm filter in 40ml amber coloured bottle. The filtered CDOM samples were stored in the +4°C refrigerator. Also ^{18}O and salinity samples were prepared. Salinity samples will serve as a calibration for the field measured salinity profile using the idranaut/ Rosette CTD. The filtered TSS and CDOM samples along with the ^{18}O and salinity has been brought back to CEOS for laboratory analysis.

Nutrients and Biological Sampling

The composition and distribution of the phytoplankton community in Hudson Bay fluctuates throughout the year depending on the thermohaline stratification, nutrient supply and the availability of solar radiation. The main goals for BaySys Team 3 were to assess the nutrient loading, phytoplankton biomass and size distribution of the micro- and nanofraction with respect to inshore/ offshore gradients in oceanographic parameters (main focus on underwater downwelling irradiance) and the influence of regulated or unregulated rivers. The aim of the participation in the fall cruise was to gain a baseline in biological productivity when there is sufficient light but a likely low nutrient concentration found in the upper water column.

Optical and Biological Characterization of pre-Freezing Conditions

The spectral light climate of the euphotic zone was investigated by in situ measurements of downwelling and upwelling irradiance as well as hyperspectral attenuation and transmission along the coast of southern Hudson Bay from Churchill, crossing James Bay, to Kuujjuarapik and at the entrance of the Bay between Coats Island, Mansel Island and Ivujivik. In Hudson Bay, a massive freshwater input by river runoff causes a strong stratification restricting upward nutrient flux into the surface layer and limiting phytoplankton production particularly in summer. The resulting low chlorophyll a concentration is expected to cause a high light transmission in the upper water column. However, coastal waters are strongly influenced by the sediment load from the numerous rivers which has a direct effect on the light attenuation coefficient. The aim of this investigation (under Team 1) was to describe the light conditions and inherent optical properties of the upper euphotic zone of Hudson Bay in fall before sea ice starts to form. To do so, a metal frame equipped with two UV-visible spectral radiometers (spherical RAMSES-ASC, TriOS GmbH, Germany) and one hyperspectral VIS photometer (VIPER G2, TriOS) was lowered from the front of the vessel in the direction of the sun.

Measurements were taken from the surface to a depth of 30 m every 0.5 m, roughly. Incident solar radiation was recorded with one UV-visible spectral radiometer (Cosine RAMSES-ACC, TriOS GmbH, Germany) at the same time. Inherent optical properties of the water column were investigated in terms of particle absorption, chlorophyll a concentration and the content of particulate organic carbon and nitrogen. Water for filtration was sampled by a rosette at three different depth levels: surface water between 1 m and 5 m, the depth of the chlorophyll maximum and 10 m above the bottom. For laboratory analysis of particle absorption (a_p) by spectrophotometry as well as the analysis of chlorophyll a concentration by high-performance liquid chromatography (HPLC) at the University of Manitoba, water samples of 1L were filtered through 25 mm Whatman GF/F filters and stored in a -80 °C freezer. Particular organic carbon and nitrogen (POC/N) samples (0.5L) were filtered through 21 mm Whatman GF/F filters and stored at -80 °C.

Figure 9.15 Measurements of incident solar radiation (left, radiometer attached to a stick pointing upward), total underwater irradiance and hyperspectral absorption and transmission within the water column (right, radiometers mounted to a metal frame and lowered with a weight a straight alignment)

Characterizing the Size Distribution of the Present Micro- and Nanophytoplankton

Water samples (100 mL) from the three depths were preserved with Lugol's solution in Amber bottles for later microscopic analysis. Furthermore, particles in the water from the same depth levels were directly analyzed by automated imaging technology (FlowCam, Fluid Imaging Technologies, INC., USA). The FlowCam as a dynamic imaging particle analyzer examines a fluid under a microscope which is pumped through a flow cell. An integrated camera takes images of particles within the fluid and characterizes them in terms of particle size and shape. For this project, water samples of 10mL were pre-filtered through a 100 µm mesh to analyze the particle size fraction between 10 – 100 µm.

Preliminary FlowCam results support the assumption of a low number of phytoplankton in the water column. Many particles of the investigated size fraction were identified as zooplankton (protozoa), detrital organic matter and inorganic sediment. Additionally, plankton appeared to differ in size and composition between Southern and Northern Hudson Bay. One reason might be the massive river runoff in the South flushing freshwater species into the Bay while in the northern part marine species are mainly found due to the strong inflow of seawater from the Atlantic Ocean. Differences in size might be linked with the low nutrient supply in the stratified southern Hudson Bay and the high nutrient concentration of the salty Atlantic water in the North. Particle composition also varied with depth. Small sediments as well as plankton with extensions (spikes, flagella) were mainly found in the upper water column. Penetrate phytoplankton of high abundance was often found in the bottom water. The following images represent a selection of imaged particles from different stations and depth levels.

Station M06 – Nelson Estuary

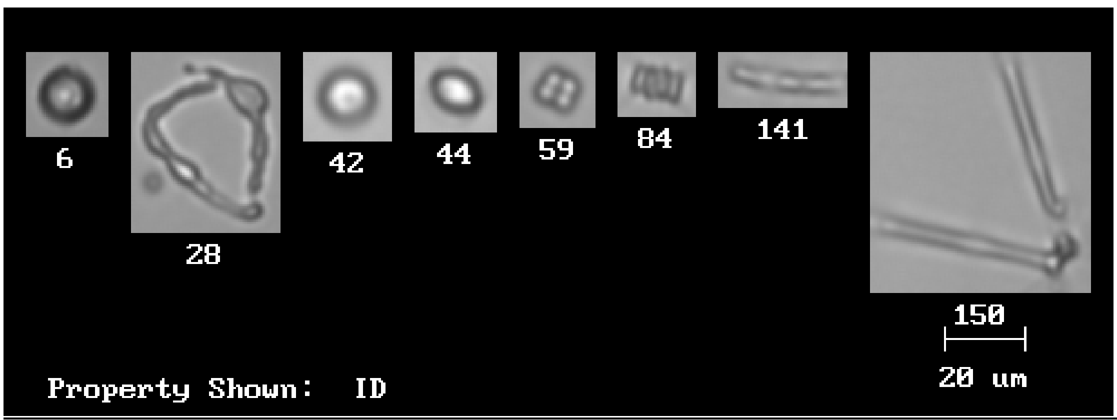


Figure 9.16 M06 - Surface water (1m)

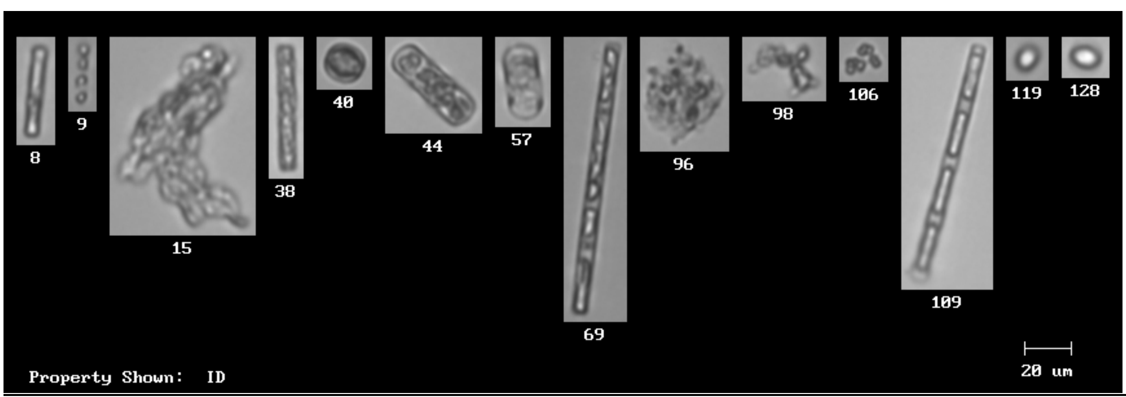


Figure 9.17 M06 - Bottom water (20m)

Station NE03 – Outer Nelson Estuary

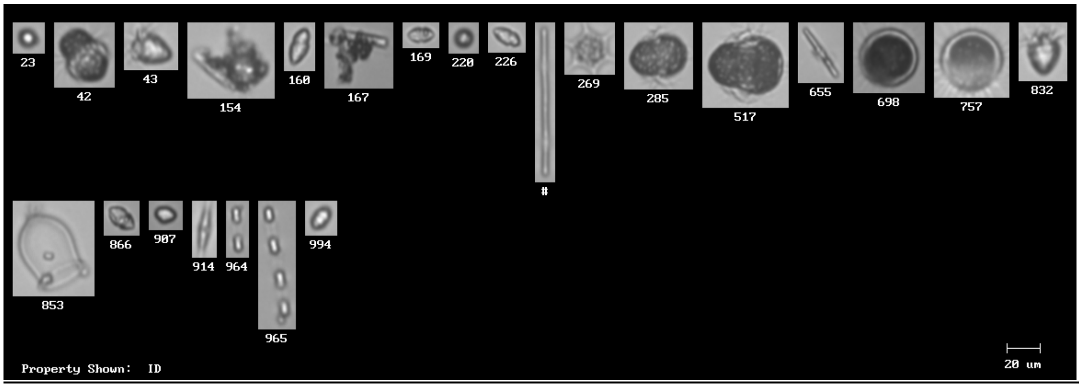


Figure 9.18 NE03 - Surface water (1m)

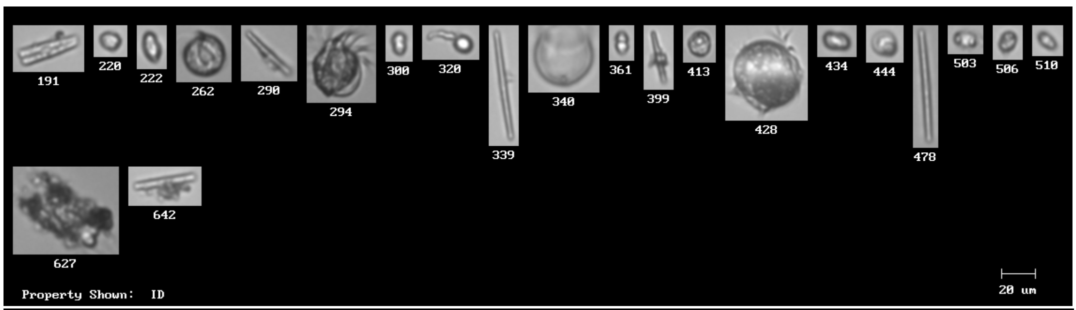


Figure 9.19 NE03 - Chlorophyll maximum depth (20m)

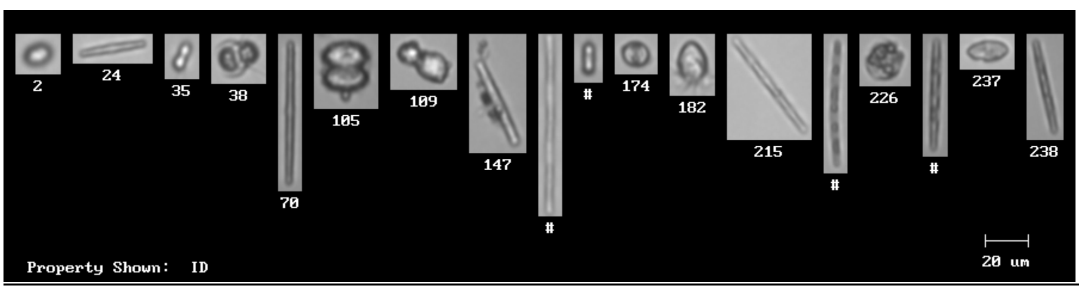


Figure 9.20 NE03 - Bottom water (50m)

Station JB05 – James Bay

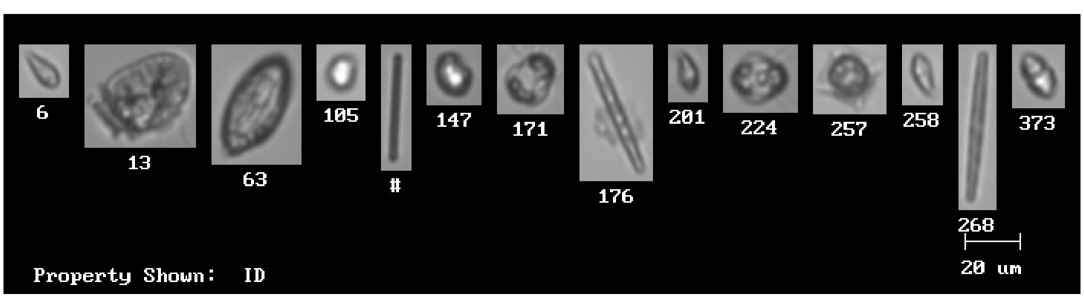


Figure 9.21 JB05 - Surface water (1m)

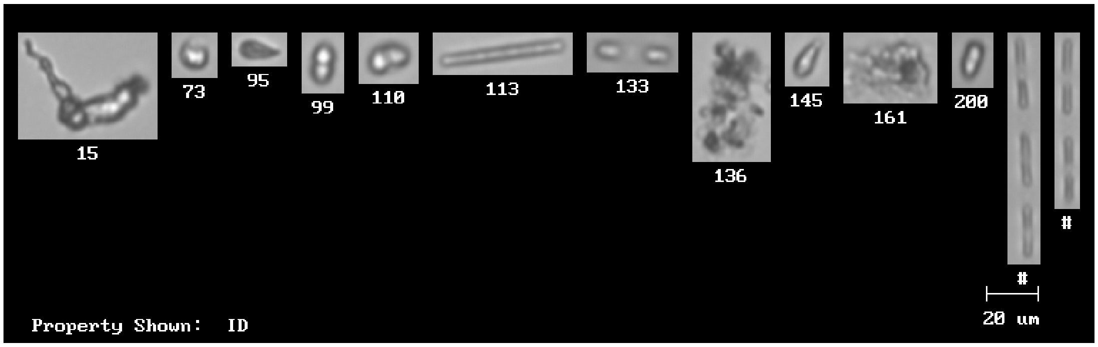


Figure 9.22 JB05 - Bottom water (20m)

Station C101 – Coats Island, Norther Hudson Bay

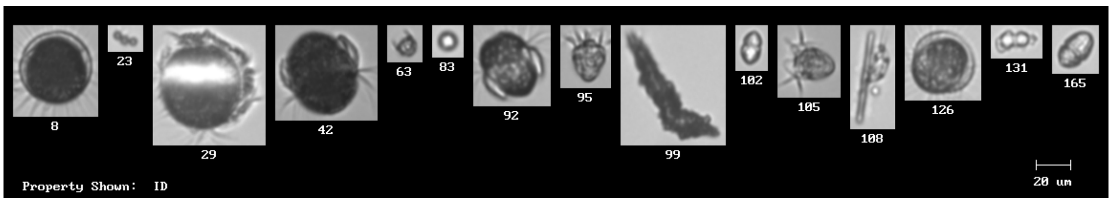


Figure 9.23 C101 - Surface water (1m)

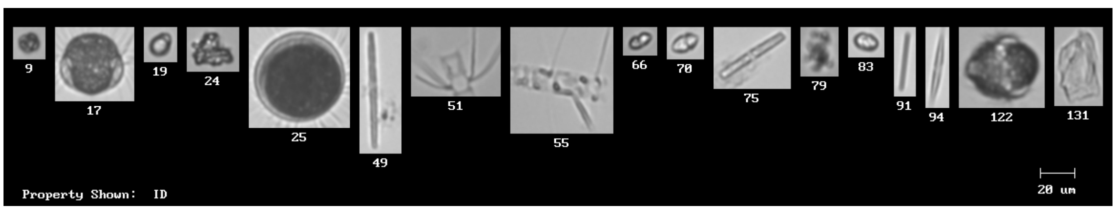


Figure 9.24 C101 - Chlorophyll maximum depth (40m)

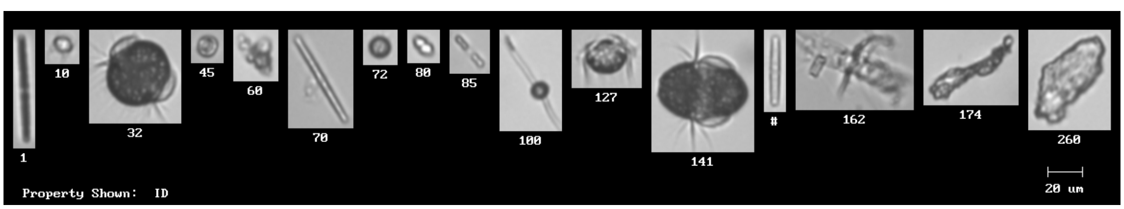


Figure 9.25 C101 - Bottom water (184m)

Distribution of Phytoplankton

Samples for inorganic nutrients (ammonium, nitrite, nitrate, orthophosphate and orthosilicic acid) were taken at the stations (Table 8.6) to establish detailed vertical profiles. Nitrite, nitrate, orthophosphate and orthosilicic acid samples were stored at -20 °C in a freezer and sent for analysis using a Bran+Luebbe AutoAnalyzer 3 based on standard colorimetric methods adapted for the analyzer (Grasshoff et al. 1999) at home laboratory. Ammonium samples were processed immediately after collection using the fluorometric method of Holmes et al. (1999). Water samples for chl a in the water column (maximum 100 m depth) were filtered through 25mm GF/F filters and the filters were incubated in 90% acetone in a fridge (4 °C) for 24 h. Chl a concentrations were measured using the fluorometric method of Parsons et al. 1984.

<u>Carbon Cycling</u>

The objective of Team 4 was to collect dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) in order to understand the carbon cycle in the costal Arctic ocean environment.

Methods

We collected almost 100 DIC and DOC samples along the coast of Hudson Bay, from the Churchill River to James Bay. A novel experimental incubation approach, involving Pyro Science technology, was used to measure dissolved oxygen (DO) (Figure 9.26). The objective of this experimental approach is to evaluate the rates of terrestrial OC remineralization in the Hudson Bay coastal waters during the June 2017 cruise.

Figure 9.26 Incubation setup, method and equipment

<u>Sediment Sampling</u>

One of Team 5's main sampling objectives was to collect significant quantity of suspended sediment in the Hudson Bay by applying two techniques.

Methods

One approach was to use an industrial centrifuge device (3’W * 4’L * 2’H; weighs 315 kg; 2 hp motor; 115/230 V; 22.6/11.3 amp AC power), which was fixed to the deck of the ship with straps (Figure 9.27). Fortunately, no electrical modifications needed to accommodate the centrifuge. The other form of sediment collection was the filtration system.

In order to run whole suspended sediment collection while the ship was moving, an inline water system (fire hydrant on the forward deck) was used to draw seawater from the ship's plumbing. During the entire period of the trip, suspended sediments were frequently collected and stored, approximately every 12 hours (Figure 9.27). Later, by matching the ship track to the time of sample collections (Figure 9.1), the physical and chemical properties of the suspended sediments will be linked back to the locations and the origin (source) of the materials in the suspended sediment can be determined by using fingerprinting technique.

Figure 9.27 Industrial centrifuge set up, suspended sediment samples, and collection tubes

Acknowledgements

The BaySys teams would like to thank the Captain and crew of the *Des Groseilliers* for their commitment to this field project and ensuring safe deployment of the moorings. We would like to acknowledge Manitoba Hydro and Churchill Northern Studies Centre (CNSC) for their extensive logistical and in-kind support to this field program. Lastly, we are grateful to the Natural Sciences and Engineering Research Council of Canada (NSERC) and ArcticNet Ancillary Ship Time Fund for providing financial support for this cruise and research.

Table 9.6 Water Parameter Collected

Investigated parameters at each station and depth level [m] of the BaySys *Des Groseilliers* field work between September 26 and October 8, 2016																	
Date	Stn	Bottom depth	CTD (Sea bird)	CTD (Idro-naut)	SPM	CDOM	O_{18}	Salinity	Vertical light profile	a_p	HPLC	POC/ N	Lugol	Flow cam	NO3, NO2, Si, PO4	NH4	Chl *a*
09/26/16	AN01	107	x	x	5, 30	5, 30, 100	5, 30, 100	5, 30, 100	0 - 30	5, 30, 100	5, 30, 100	5, 30, 100	-	-	5, 30, 100	5, 30, 100	5, 30, 100
09/27/16	AN04	60	x	x	1, 20, 50	1, 20, 50	1, 20, 50	1, 20, 50	0 - 30	1, 20, 50	1, 20, 50	1, 20, 50	1, 20, 50	1, 20, 50	1, 20, 50	1, 20, 50	1, 20, 50
	NE02	45	x	x	1, 20	1, 20, 35	1, 20, 35	1, 20, 35	0 - 30	1, 20, 35	1, 20, 35	1, 20, 35	1, 20, 35	1, 20, 35	1, 20, 35	1, 20, 35	1, 20, 35
09/28/16	NE03	55	x	-	1, 20, 50	1, 20, 50	1, 20, 50	1, 10, 20, 30, 40,	0 - 30	1, 20, 50	1, 20, 50	1, 20, 50	1, 20, 50	1, 20, 50	1, 10, 20, 30, 40, 50	1, 10, 20,	1, 10, 20, 30, 40, 50
09/29/16	NE04	11	-	x	-	-	-	-	0 - 30	-	-	-	-	-	-	-	-
	B3	3.5	-	x	1	1	1	1	-	1	1	1	1	1	1	1	1
	B5	5.8	-	x	1	1	1	1	-	1	1	1	1	1	1	1	1
	M6	23	-	x	1, 20	1, 20	1, 20	1, 20	-	1, 20	1, 20	1, 20	1, 20	1, 20	1, 10, 20	1, 10,	1, 10,
	B7	12	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
	B8	5.7	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
	B11	12	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
	B12	6.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
09/30/16	SE01	63	x	x	1, 15, 56	1, 15, 56	1, 15, 56	1, 15, 56	0 - 30	1, 15, 56	1, 15, 56	1, 15, 56	1, 15, 56	1, 15, 56	1, 15, 25, 35, 45, 56	1, 15, 25, 35,	1, 15, 25, 35, 45, 56
	SR01	-	-	-	1	1	1	1	-	-	-	1	-	-	1	1	1
	WE01	110	x	x	2, 40, 100	2, 40, 100	2, 40, 100	2, 40, 100	0 - 30	2, 40, 100	2, 40, 100	2, 40, 100	2, 40, 100	2, 40, 100	2, 15, 40, 70, 100	2, 15, 40, 70,	2, 15, 40,
	WR01	-	-	-	1	1	1	1	-	-	-	1	-	-	1	1	1
10/01/16	JB02	78	x	x	1, 25, 65	1, 25, 65	1, 25, 65	1, 25, 65	0 - 30	1, 25, 65	1, 25, 65	1, 25, 65	1, 25, 65	1, 25, 65	1, 15, 25, 35, 45, 65	1, 15, 25, 35,	1, 15, 25, 35, 45, 65
	JB01	50	x	-	1	1	1	1	-	-	-	1	-	-	1	-	-

	JB00	46	x	-	2, 10, 37	2, 10, 37	2, 10, 37	2, 10, 37	0 - 30	2, 10, 37	2, 10, 37	2, 10, 37	2, 10, 37	2, 10, 37	1, 10, 20, 30, 37	1, 10, 20, 30,	1, 10, 20,
10/02/16	JB03	111	x	x	1	1	1	-	-	-	-	1	-	-	1	-	-
	JB04	107	x	x	1	1	1	-	-	-	-	1	-	-	1	-	-
	JB05	97	x	x	7, 20, 50,	7, 20, 50, 87	7, 20, 50,	-	-	7, 20, 87	7, 20, 87	7, 20, 87	7, 20, 87	7, 20, 87	7, 20, 30, 50, 60, 87	7, 20, 30, 50,	7, 20, 30,
	JB06	77	x	x	1	1	1	-	-	-	-	1	-	-	1	-	-
	JB07	63	x	-	1	1	1	-	-	-	-	1	-	-	1	-	-
	JB08	45	x	-	1	1	1	-	-	-	-	1	-	-	1	-	-
	JB09	33	x	-	2, 10, 26	2, 10, 26	2, 10, 26	-	-	2, 10, 26	2, 10, 26	2, 10, 26	2, 10, 26	2, 10, 26	5, 10, 15, 20, 26	5, 10, 15, 20,	5, 10, 15,
	JB09.5	27	x	-	5, 21	5, 21	5, 21	-	-	-	-	5	-	-	5, 21	5, 21	-
	JB08.5	37	x	-	5, 27	5, 27	5, 27	-	-	-	-	5	-	-	5, 27	5, 27	-
10/03/16	JB10	24	x	x	5	5	5	-	-	-	-	5	-	-	5	-	-
	JB11	47	x	x	5, 37	5, 37	5, 37	-	-	5, 37	5, 37	5, 37	5, 37	5, 37	5, 37	5, 37	5, 37
	JB12	64	x	x	5, 50	5, 50	5, 50	-	-	-	-	5, 50	-	-	5, 50	5, 50	5, 50
	JB13	95	x	x	5, 86	5, 86	5, 86	-	-	5, 86	5, 86	5, 86	5, 86	5, 86	5,20,45, 86	5,20,4 5, 86	5,20, 4 5,86

	JB14	105	x	x	5, 45, 97	5, 45, 97	5, 45, 97	-	0 - 30	5, 45, 97	5, 45, 97	5, 45, 97	5, 45, 97	5, 45, 97	5, 45, 97	5, 45, 97	5, 45, 97
	JB15	170	x	x	5, 70, 160	5, 30, 50, 70,	5, 30, 50,	5, 30, 50, 70, 100,	0 - 30	5, 30, 160	5, 30, 160	5, 30, 70, 160	5, 30, 160	5, 30, 160	5, 40, 50, 70, 100,	5, 40, 50, 70,	5, 40, 50,
10/04/16	KU02	97	x	x	4, 45, 87	4, 45, 87	4, 45, 87	-	-	4, 45, 87	4, 45, 87	4, 45, 87	4, 45, 87	4, 45, 87	4, 10, 30, 45, 70, 87	4, 10, 30, 45,	4, 10, 30,
	KU01	43	x	x	-	-	-	-	-	-	-	5	-	-	5	5	
10/06/16	CI01	194	x	x	1, 40, 160,	1, 40, 160, 184	1, 40, 160,	1, 40, 160, 184	0 - 30	2, 40, 184	2, 40, 184	2, 40, 184	2, 40, 184	2, 40, 184	2, 15, 40, 60, 100,	2, 15, 40, 60,	2, 15, 40,
10/07/16	WI01	108	-	x	-	-	-	-	-	-	-	-	-	-	-	-	-
10/08/16	CI03	106	x	-	5, 40	5, 40	5, 40	5, 40	-	5, 40	5, 40	5, 40	5, 40	5, 40	5, 20, 30, 40	5, 20, 30, 40	5, 20, 30,
10/08/16	CI02	208	x	-	5, 20, 100,	5, 20, 100, 199	5, 20, 100,	5, 20, 100, 199	-	5, 20, 199	5, 20, 199	5, 20, 199	5, 20, 199	5, 20, 199	5, 20, 40, 60, 100,	5, 20, 40, 60,	5, 20, 40,
	MI02	125	x	x	2, 10,	2, 10,	2, 10,	2, 10,	0 - 30	2,	2, 10,	2, 10, 117	2, 10,	2, 10,	2, 10,	2, 10,	2, 10,
					60,	60, 117	60, 117	60, 117		10,	117		117	117	20, 40,	20, 40,	20,
					117					117					60, 100,	60, 100,	40,
															117	117	60
	MI01	68	x	x	5, 15,	5, 15, 60	5, 15, 60	5, 15, 60	0 - 30	5,	5, 15,	5, 15, 60	5, 15, 60	5, 15,	5, 15,	5, 15,	5, 15,
					60					15,	60			60	25, 35,	25, 35,	25,

										60					45, 60	45, 60	35,
																	45,
																	60
	N01	50	x	x	-	-	-	-	-	-	-	-	-	-	-	-	-

10 CTD/Rosette, LADCP and UVP operations – Legs 1, 2 and 3

Cruise participants - Leg 1: Claudie Marec[2], Pascal Guillot[1] and Marc Picheral[3]
Cruise participants - Leg 2: Juergen Zier[1] and Jeff Finniss[1]
Cruise participants - Leg 3: Stephane Aebischer[1] and David Simpson[1]
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10.1 Introduction

The objective of our shipboard fieldwork is to characterize the water column physical and chemical properties: temperature, salinity, fluorescence, CDOM, dissolved oxygen concentration, nitrate concentration, light penetration and turbidity. We use a SBE 911 CTD with various other sensors (see Table 10.1) mounted on a cylindrical frame known as a rosette. The rosette also supplies water samples for biologists, chemists and geologists.

For the GreenEdge cruise (Leg 1), another 300 kHz Lowered Acoustic Doppler Current Profiler (LADCP) was attached to the rosette frame. An UVP5 (Underwater Video Profiler) is also mounted to the rosette and connected with the Seabird CTD providing pictures of the particles in the water column.

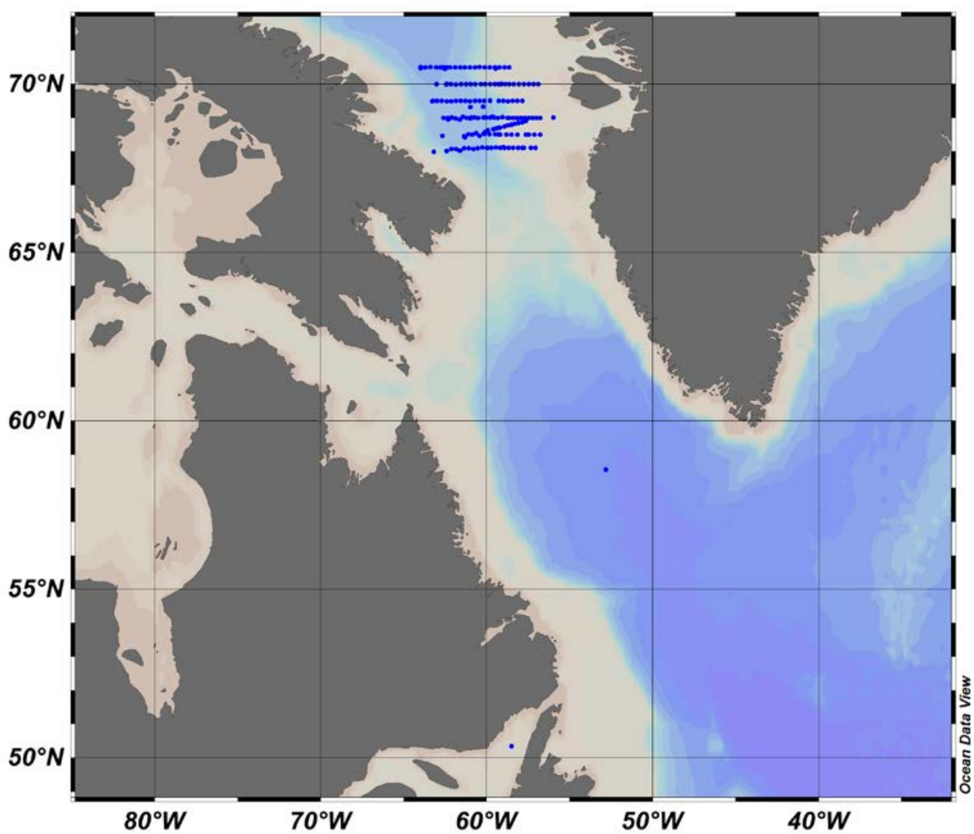

Figure 10.1. GreenEdge study region in Eastern Canadian Arctic, Leg1.

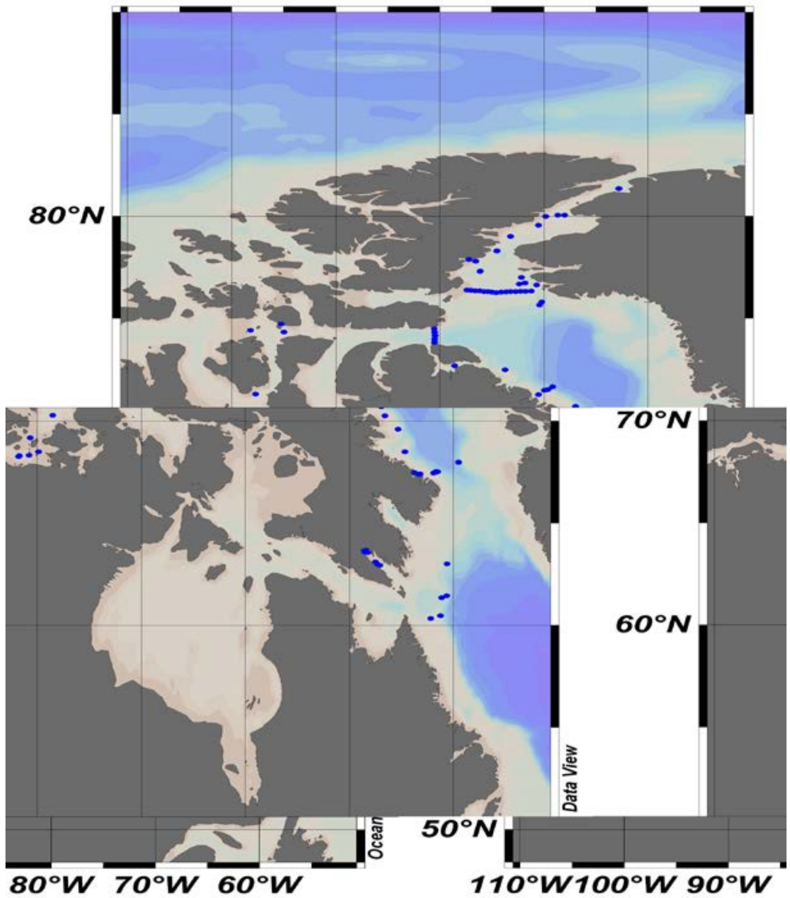

Figure 10.2. ArcticNet/Geotraces study region in Eastern Canadian Arctic, Leg 2.

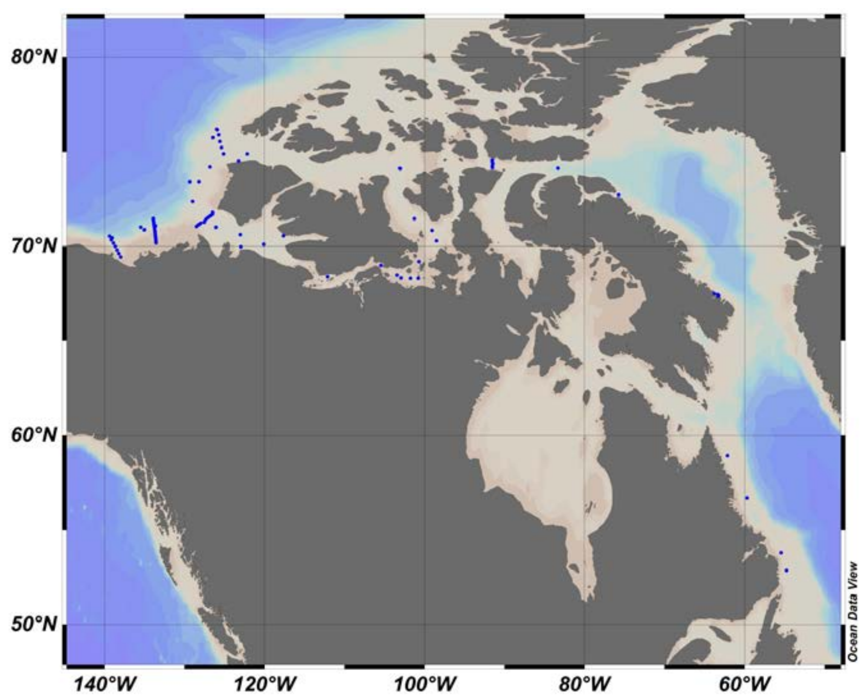

Figure 10.3. ArcticNet study region in Northern Canadian Arctic, Leg 3

10.2 Methodology – CTD-Rosette

For Leg 1, the rosette frame was equipped with twenty-two (22) twelve (12) liter bottles (Figure 10.4) (2 bottles must be removed to install the upward LADCP). For leg 2, the rosette frame was equipped with twenty-four (24) twelve (12) liter bottles. The sensors attached to the rosette are described in Table 10.1 and Table 10.2. At the beginning of the Leg 3a, a second fluorometer was installed on top of the CTD-Rosette to detect the maximum of chlorophyll while sampling up, on demand of Marjorie Blais.

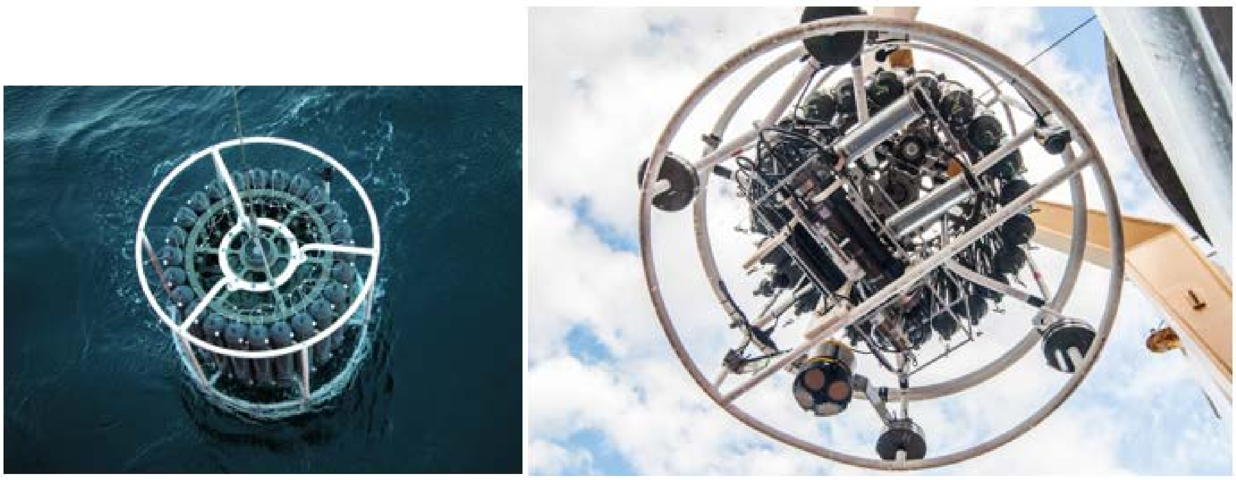

Figure 10.4. CTD-Rosette, right picture: Jessy Barrette

Table 10.1. Rosette sensors

Instrument	Parameter	Properties	Serial Number	Calibration date
Sea-Bird SBE 911plus	CTP	Sampling rate : 24 Hz	09P24760-0679	
2 SBE 3plus	Temperature	Range: -5°C to + 35°C Accuracy: 0.001	03P4204 03P4318	01-Dec-2015
Paroscientific Digiquartz®	Pressure	Accuracy: 0.015% of full range	0679	12-Jan-2016
2 SBE 4C	Conductivity	Range: 0 to 7 S/m Accuracy: 0.0003	042876 042696	01-Dec-2015
SBE 43	Dissolved Oxygen	Range: 120% of saturation Accuracy: 2% of saturation	430427	20-Dec-2015
MBARI-ISUS Satlantic	Nitrates	Range: 0.5 to 200 μM Accuracy: ± 2 μM	137	18-May-2016
QCP-2300 Biosherical	PAR	PAR Dynamic Range: 1.4×10^{-5} to 0.5 μE/(cm^2 sec)	7270	9-Dec-2015
QCR-2200 Biosherical	Surface PAR	PAR Spectral Response: Equal (better than ±10%) quantum response from 400 to 700nm	20147	9-Dec-2015
2 Seapoint	Fluorometer	Minimum Detectable Level 0.02 μg/l Gain Sens, V/(μg/l) Range/(μg/l), 10x 0.33 15	SCT-3120	1-Jan-2016 NA
WetLabs C-Star	Transmissometer	Path length: 25 cm Sensitivity: 1.25 mV	CST-671DR	16-Jan-2016
Teledyne PSA-916	Altimeter	Range: 50 m from bottom	1065	Feb 2014

Instrument	Parameter	Properties	Serial Number	Calibration date
WetLabs ECO	fluorometer (CDOM)	FL(RT)D Digital output resolution : 14 bit Analog output signal: 0-5V Range: 0.09-500ppb Ex/Em: 370/460nm	FLCDRTD-2344	8-Jun-2016
Underwater Vision Profiler (UVP5)	Hydroptic		203	04-Jun-2016

Table 10.2 Sensor specifications

Parameter	Sensor		Range	Accuracy	Resolution
	Compagny	Instrument Type			
Attached to the Rosette					
Data Logger	SeaBird	SBE-9plus [1]			
Temperature	SeaBird	SBE-03 [1]	-5°C à +35°C	0.001°C	0.0002°C
Conductivity	SeaBird	SBE-4C [1]	0-7 S/m (0-70mmho/cm)	0.0003 S/m (0.003mmho/cm)	0.00004 S/m (0.0004 mmho/cm)
Pressure	Paroscientific	410K-105	up to 10 500m (15 000psia)[2]	0.015% of full scale	0.001% of full scale
Dissolved oxygen	SeaBird	SBE-43 [3]	120% of surface saturation[4]	2% of saturation	unknown
Nitrates concentration	Satlantic	MBARI-ISUS 5T [6]	0.5 to 2000 µM	±2 µM	±0.5 µM
Light intensity (PAR)	Biospherical	QCP-2300			
sPAR	Biospherical	QCR-2200			
Fluorescence	Seapoint	Chlorophyll-fluorometer	0.02-150 µg/l	unknown	30
Transmissiometer	Wetlabs	C-Star	0-5 V	unknown	1.25 mV
Altimeter	Benthos	PSA-916 [7]	0 - 100 m	unknown	0.01 m
CDOM fluorescence	Wet Labs	FL(RT)D [7]	0.09-500ppb	unknown	14 bit

Notes: [1] Maximum depth of 6800m
[2] Depending on the configuration
[3] Maximum depth of 7,000m
[4] In all natural waters, fresh and marine
[5] Maximum depth of 1,200m
[6] Maximum depth of 1,000m
[7] Maximum depth of 6,000m

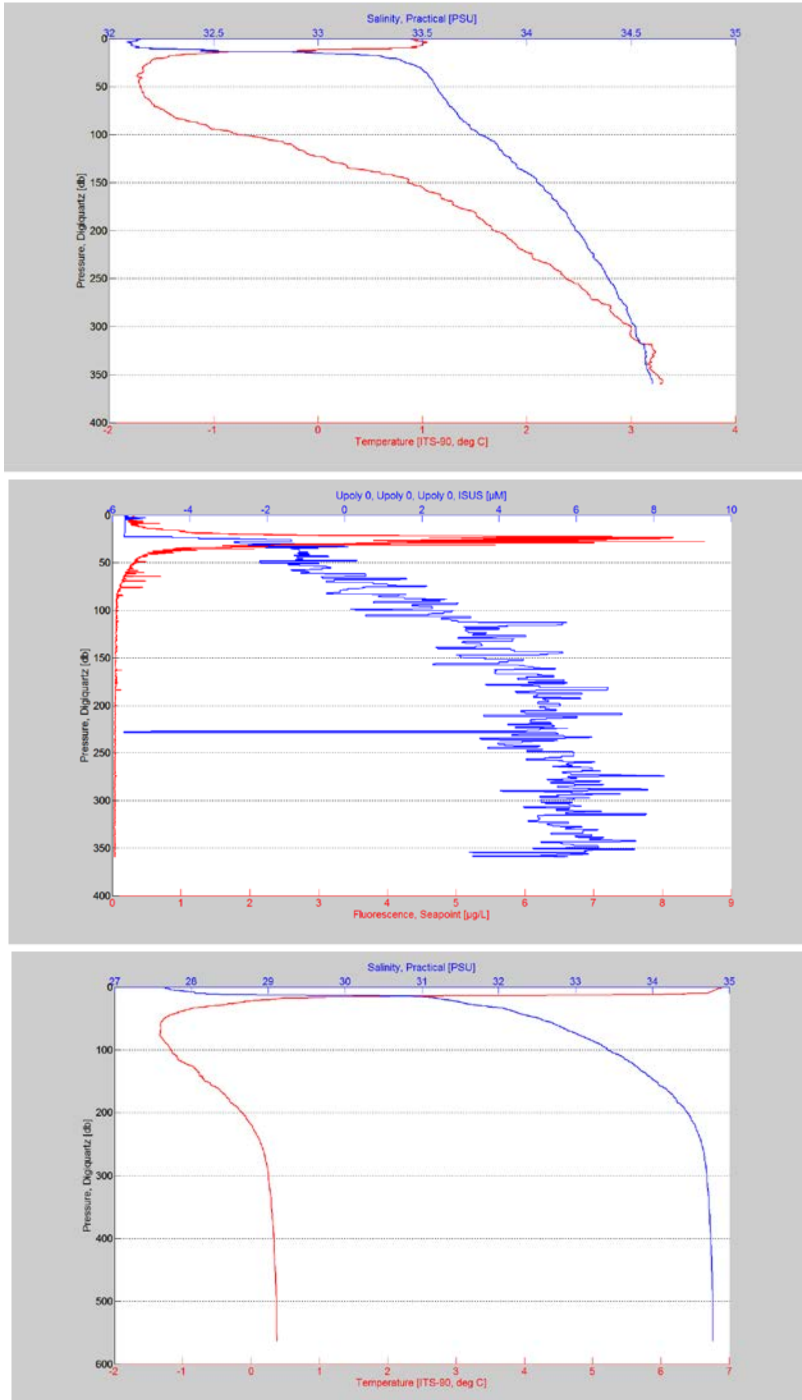

Figure 10.5. Example of data provided by the CTD-Rosette.

The solution TritonX was used to clean the conductivity cell at the end of the cruise (Aug 24, 2016).

10.2.1 *Probes Calibration – Salinity*

<u>Seabird CTD</u>

Water samples were taken on several casts with 200 ml bottles (Figure 10.6). They were analyzed with a GuildLine, Autosal model 8400B. Its range goes from 0.005 to 42 PSU with an accuracy better than 0.002 (Figure 10.7 to Figure 10.10). This part was mostly performed by the Geotraces team members for Leg 2.

Figure 10.6. Water samples bottles

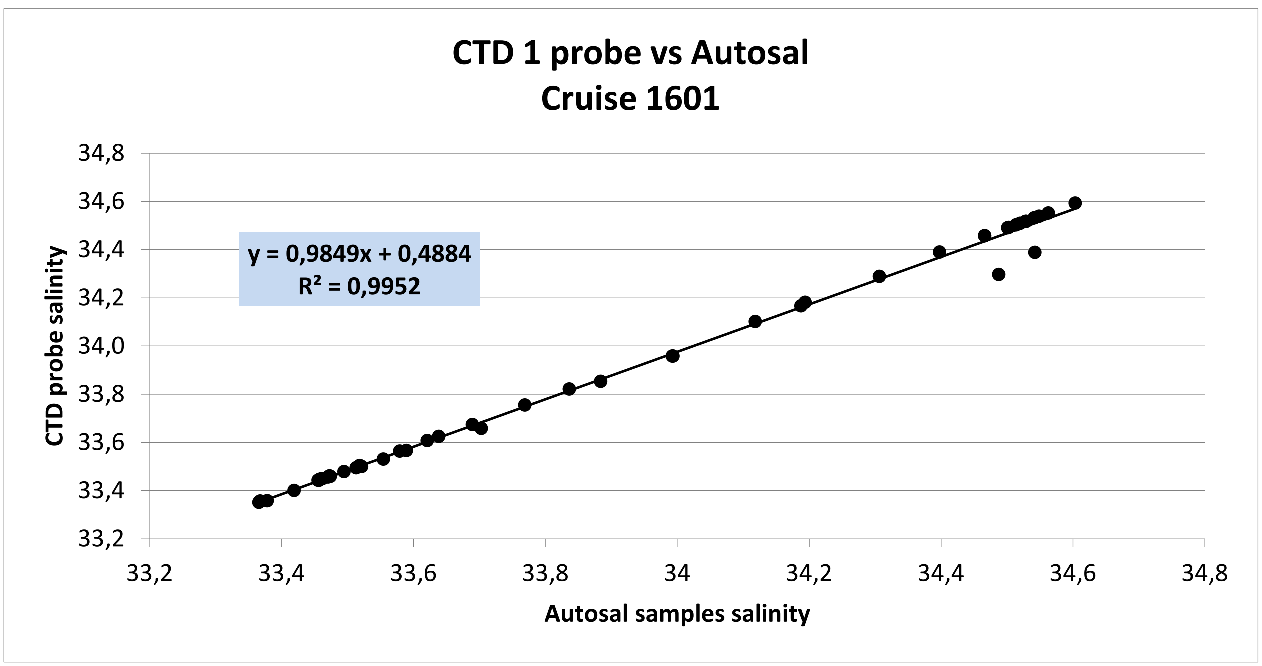

Figure 10.7. CTD salinity validation with in situ titrations (Leg 1).

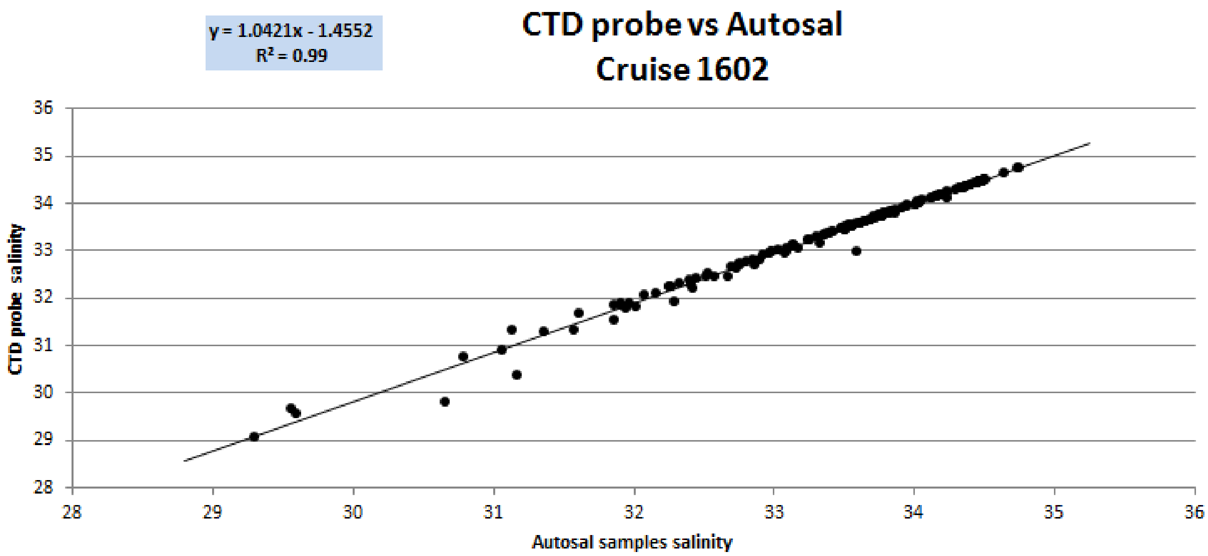

Figure 10.8. CTD salinity validation with in situ titrations.

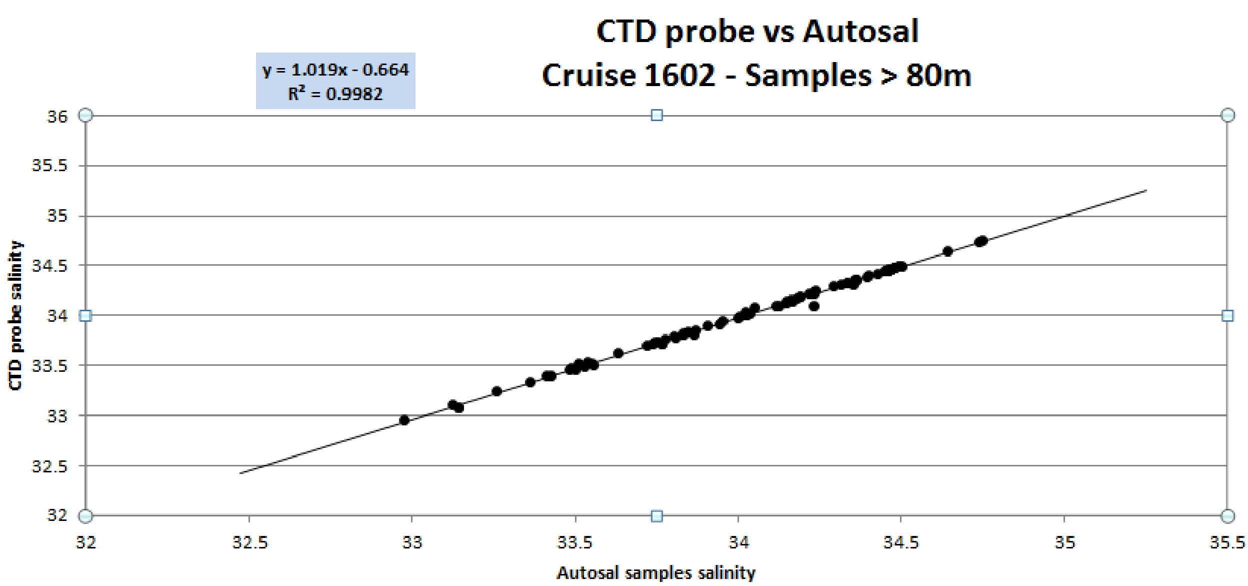

Figure 10.9. STD salinity validation with samples > 80m.

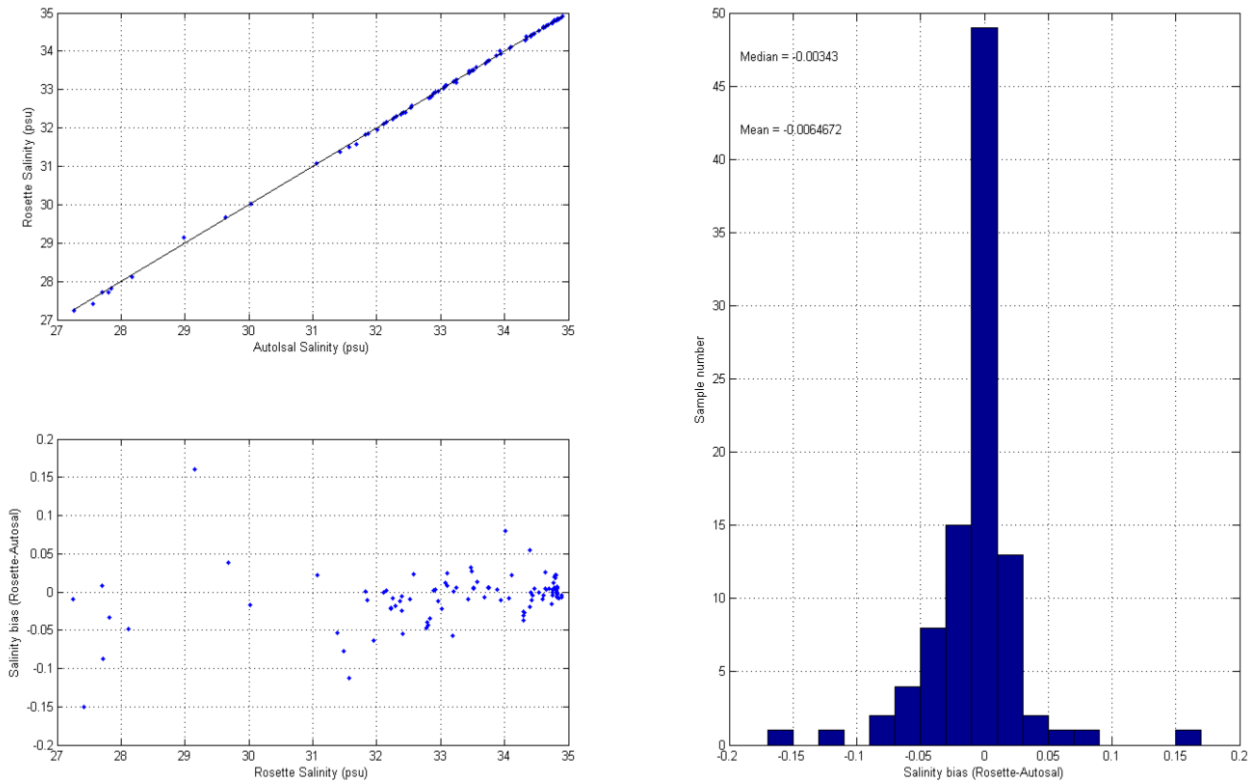

Figure 10.10. CTD salinity validation with in situ titrations.

<u>Seabird TSG</u>

Water samples were taken at different times during the transit from the surface thermosalinograph to measure salinity and fluorescence. The probe is located in the engine room. The samples were also analyzed with the GuildLine. The data collected from the TSG and the corresponding samples analyzed with the AutoSal were not assessed for agreement. The AutoSal data can be found in the excel file with the Rosette sample calculations. Fluorescence was analyzed with a fluorometer, which was tested once or twice during Leg 3a and 3b (Marjolaine Blais, Michèle Pelletier-Rousseau and Pierre Larouche). As far as the fluorescence is concerned, the samples were analysed with a fluorometer.

<u>Problem Encountered</u>

Leg 1

There were some problems with the autosal analyser disturbing the analyzing step:

- the pump stopped working correctly, one tube was blocked.
- a piece of the machine (allowing a good mixing of the water in the tank) broke.

Leg 2

A special attention has been made to keep the autosal room at an appropriate temperature (22°C). It is a crucial point to get accurate salinity values. A problem occurred at the end of the cruise leading to unreliable data. The electrodes were rinsed with isopropilic alcohol (70 %). Figure 10.8 shows the accuracy of the CTD probe, this graph shows a large difference between the CTD probe and the Autosal at depths < 80m. Figure 10.9 shows little difference between the CTD probe and the Autosal at depths >80m. This difference at shallower depths could be attributed to a greater mixing of the water column at these depths. It could also be the result of the location of the CTD probe on the rosette. The water that is being sampled in the bottles must be flushed before the bottles are closed. This is due to the water being pulled up with the rosette as it is raised. The CTD has a pump to flush it, meaning the CTD sensor may be flushed before the water inside the sampling bottles has had time to flush, creating a variance in the results. Further analysis of the sensor and the setup are required to fully understand these results.

Leg 3

A special attention has been made to keep the autosal room at an appropriate temperature (22°C). It is a crucial point to get accurate salinity values.

Figure 10.10 shows a comparison of the rosette salinity sensors and the corresponding samples analyzed with the AutoSal machine. The graphs show a higher degree of agreement for higher salinity values than lower salinity values. Typically, the lower salinity values were from Niskin bottles closed higher in the water column, where salinity and other parameters change more rapidly with depth than deeper in the water column where values are more stable (Figure 10.10). Therefore, it is possible that the AutoSal and Rosette salinity measurements are less in agreement in shallow depths because the salinity measurement from the Niskin Bottles is essentially an average of the salinity sampled from a column of water equal to the length of the bottles themselves, whereas the conductivity sensors sample at a very discreet point roughly half a meter below the bottom of the Niskin Bottles. However, we can not rule out that the Seabird Conductivity sensor is not skewed, so further investigation is necessary.

10.2.1 *Probes Calibration – Oxygen*

Oxygen sensor calibration was performed based on dissolved oxygen concentration measured in water samples using Winkler's method and a Mettler Toledo titration machine. This part was performed by the ArcticNet team members for leg 2 and 3 (Figure 10.11 to Figure 10.15). During Leg 3, the plots show significant discrepancies between the samples taken from the Niskin Bottles and the measurements made by the sensor on the Rosette (Figure 10.17 to Figure 10.20). It is likely that these errors are derived from; the bad quality of the reagent (Figure 10.16) and imprecision done during the manipulation. We should have redone our reagent and looked the values before the end of the cruise. In the future it might be a good idea to inform this to the next rosette operator, during the quick formation.

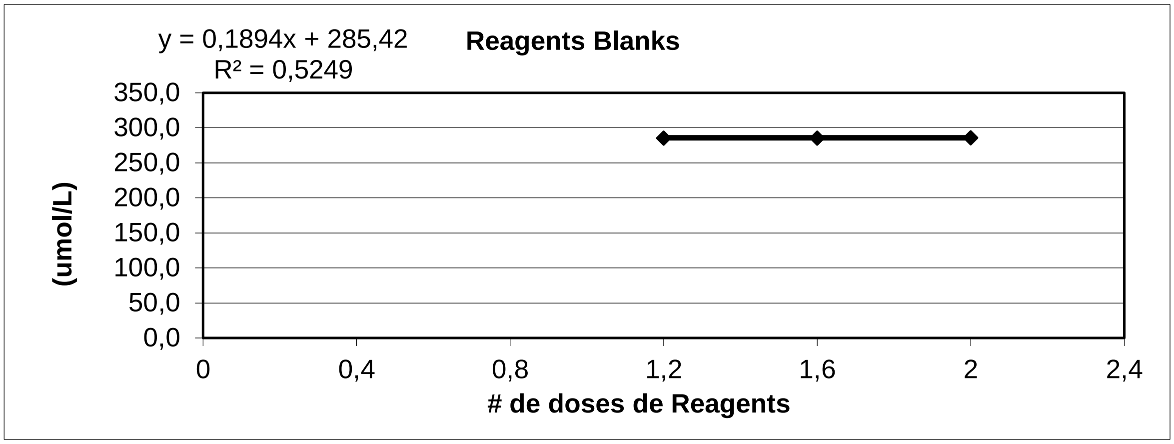

Figure 10.11. Reagent blanks

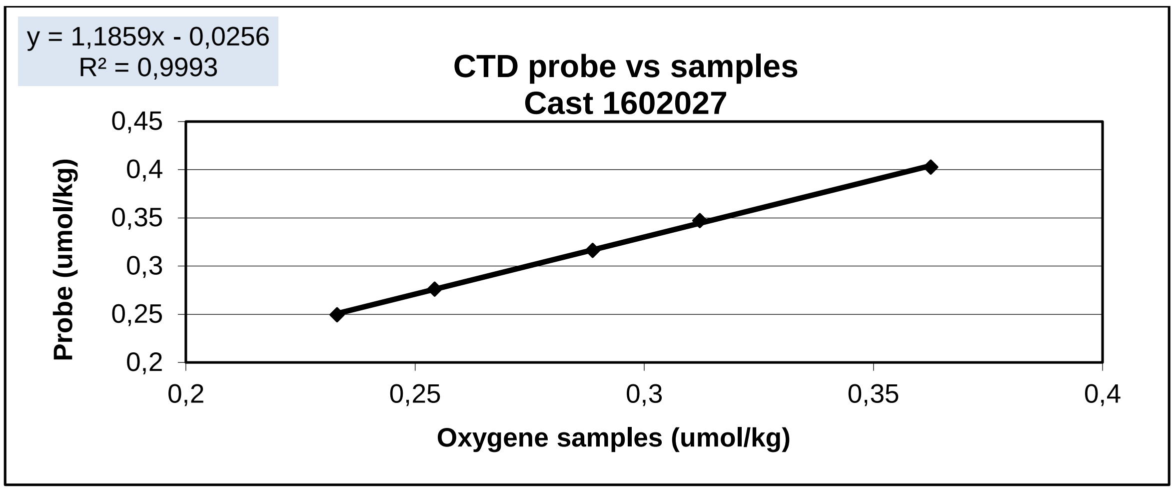

Figure 10.12. CTD probe vs samples cast 27

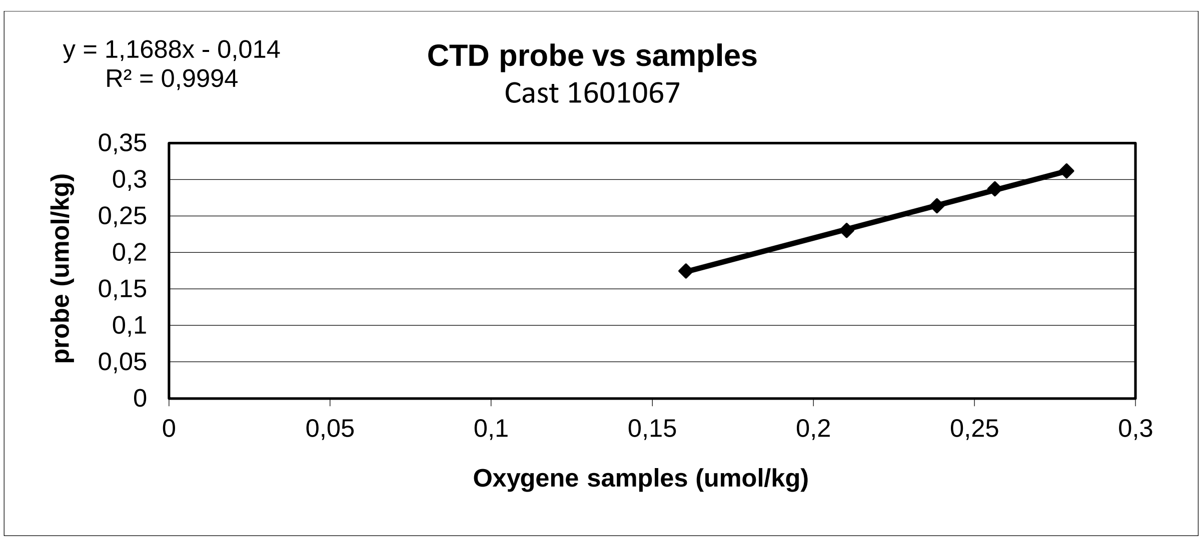

Figure 10.13. CTD oxygen validation with *in situ* titrations (cast 067)

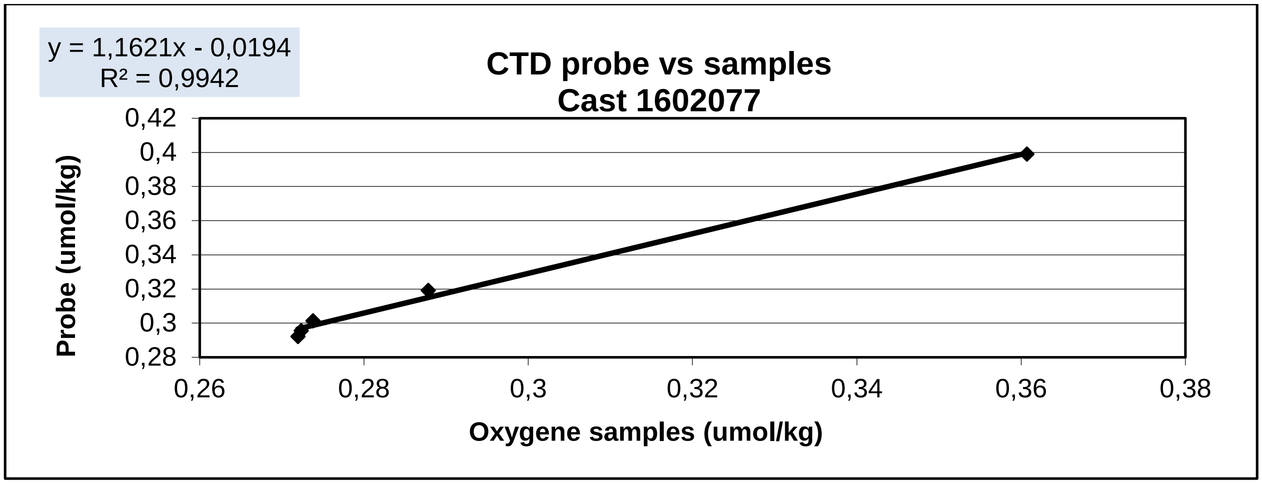

Figure 10.14. CTD Probe vs Samples Cast 77

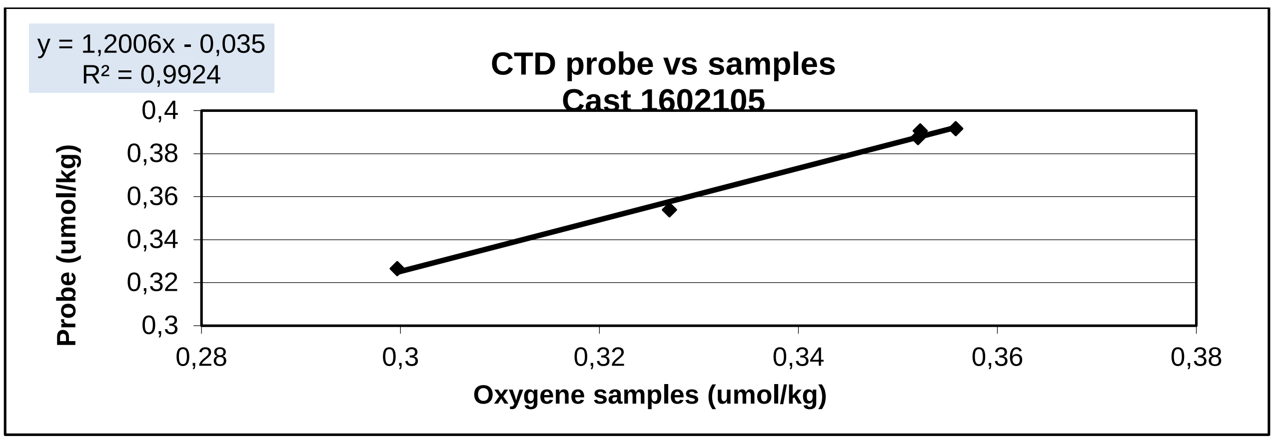

Figure 10.15. CTD Probe vs Samples Cast 105

Leg 3

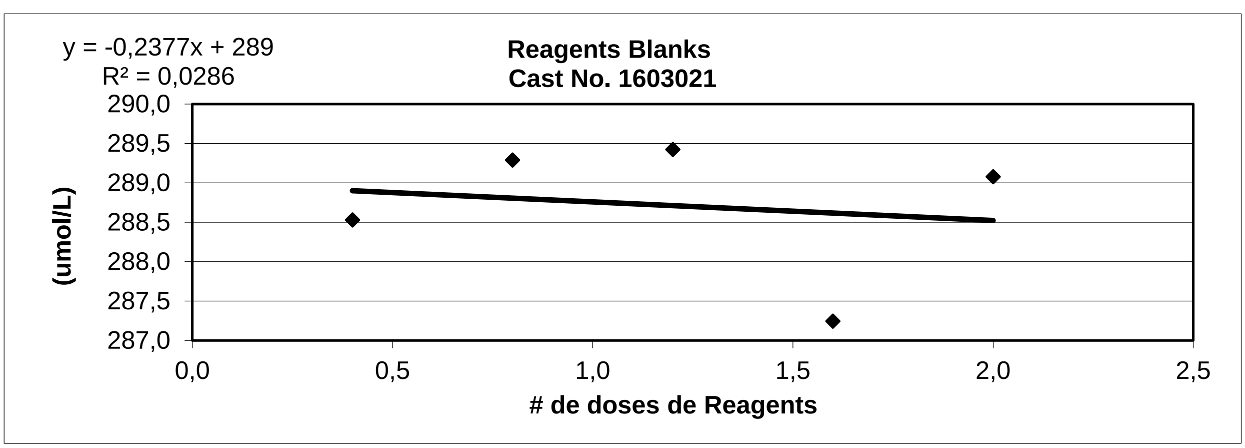

Figure 10.16. Reagent blanks (leg 3)

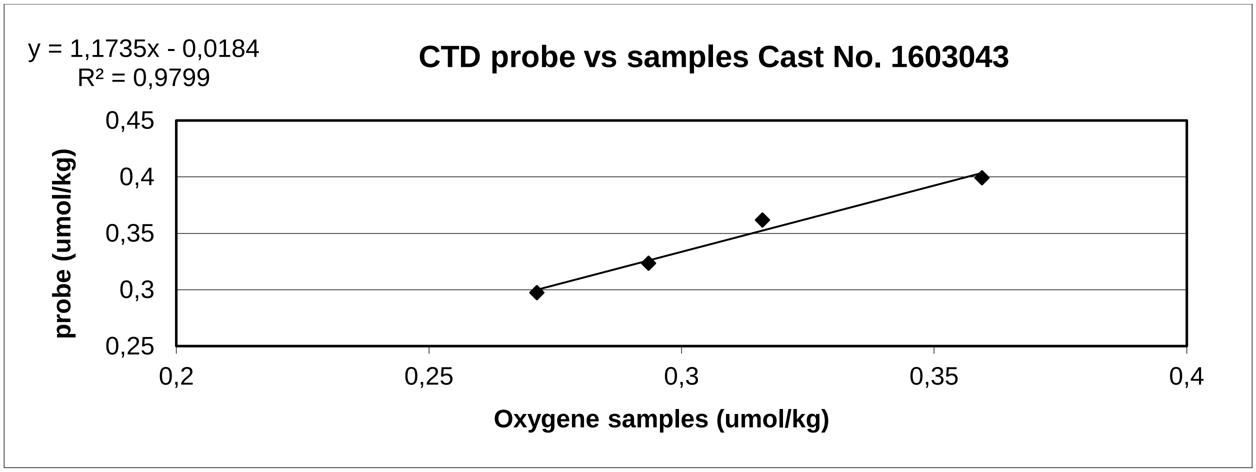

Figure 10.17. CTD Probe vs Samples (cast 27)

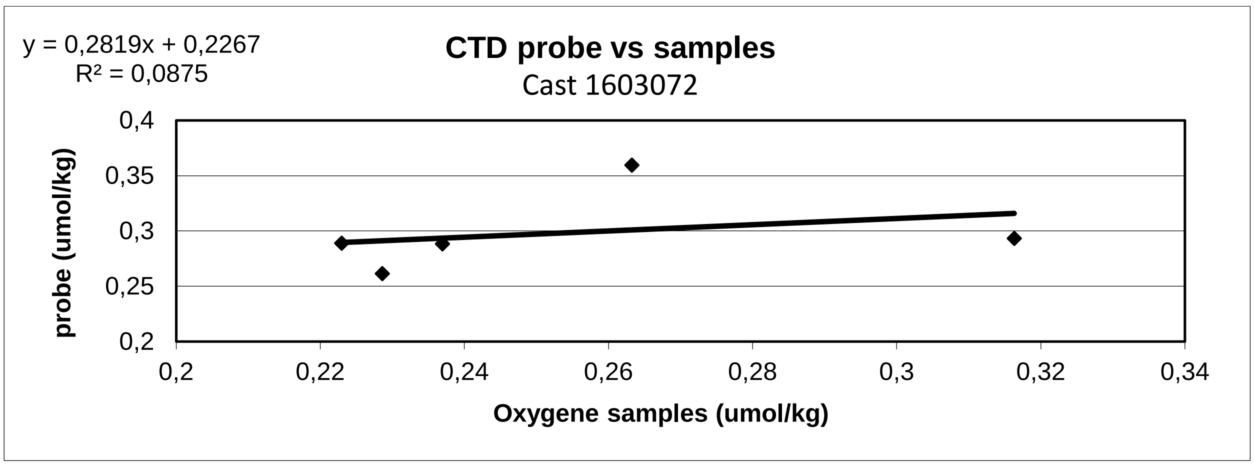

Figure 10.18. CTD Probe vs Samples (cast 77)

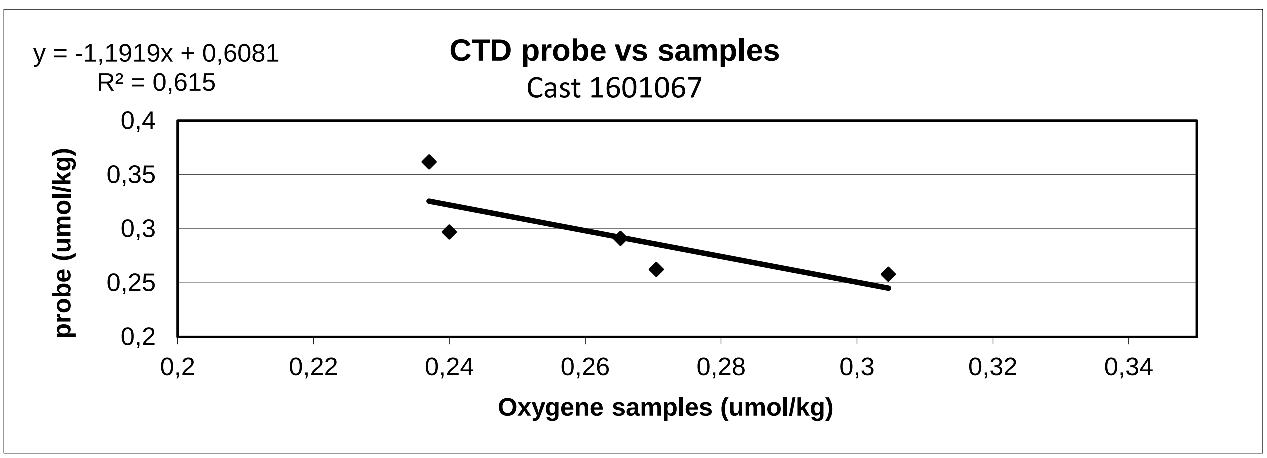

Figure 10.19. CTD Probe vs Samples (cast 105)

Problems Encountered

Reagent Blanks: During the process of titrating the blanks, during leg 2, the thiosulfate ran out after the first 4 titrations of samples. This caused the first 4 samples to be discarded, and a new thiosulfate calculation was performed. Those first 4 data points were not included in Figure 9.12, as they were no longer relevant once a new thiosulfate calculation was done.

10.2.1 *Water Sampling*

Water was sampled with the rosette according to each team's requests. To identify each water sample, we used the term "rosette cast" to describe one CTD-rosette operation. A different cast number is associated with each cast. The cast number is incremented every time the rosette is lowered in the water. The cast number is a seven-digit number:

xxyyzzz, with:
xx: the last two digits of the current year;
yy: a sequential (Québec-Océan) cruise number;
zzz: the sequential cast number.

For Leg 1, the first cast number is: 1601001. To identify the twenty-four rosette bottles on this cast we simply append the bottle number: 1601001nn, where "nn" is the bottle number (01 to 24).

For Leg 2, the first cast number is: 1602001. To identify the twenty-four rosette bottles on this cast we simply append the bottle number: 1602001nn, where "nn" is the bottle number (01 to 24).

For Leg 3, the first cast number is: 1603001. To identify the twenty-four rosette bottles we simply append the bottle number: 1603001nn, where "nn" is the bottle number (01 to 24).

All the information concerning the Rosette casts is summarized in the *CTD Logbook* (one row per cast). The information includes the cast and event number and station id, date and time of sampling in UTC, latitude and longitude, bottom and cast depths, and minimalist comments concerning the casts (Appendix 4).
An Excel® Rosette Sheet is also created for every single cast. It includes the same information as the CTD Logbook plus a table of what was actually sampled and at what depth. Weather information at the sampling time is included in each Rosette. For every cast, data from three seconds after a bottle is closed to seven seconds later is averaged and recorded in the ascii 'bottle files' (files with a btl extension). The information includes the bottle number, time and date, trip pressure, temperature, salinity, light transmission, fluorescence, dissolved oxygen, irradiance and CDOM measurements.

All those files are available in the directory "Data\Rosette" on the 'Shares' folder on the Amundsen server. There are six sub-directories in the rosette folder.

\Rosette\log\: Rosette sheets and CTD logbooks.
\Rosette\plots\: plots of every cast including salinity, temperature, oxygen, light transmission, nitrate, fluorescence and irradiance data.
\Rosette\odv\: Ocean Data Viewer file that include ctd cast files.
\Rosette\svp\: bin average files to help multibeam team to create a salinity velocity profile.
\Rosette\avg\: bin average files of every cast.
\Rosette\LADCP\: LADCP post-process data results.

Problems Encountered with the CTD-Rosette

One of the conductivity sensor has a problem during the first cruise: the shift with the other sensor was about 0.003 PSU. We tried to fix the problem by cleaning the sensor with triton and bleach without success. We continue to sample salinity (at deepest depths) in order to have enough field data for an efficient post-cruise calibration.

The nitrate Isus sensor sn 132 had a problem during the first cruise and was replaced by the instrument sn 137.

During leg 2, several elastics were tightened due to leaking problems. A second fluorometer was added to the top of the rosette in order to collect a better SCM during the up cast. The Isus nitrate sensor was replaced, as well as recalibrated using the Field Calibration procedure outlined in the user manual.

Directly after leaving Kugluktuk at the outset of Leg 3a, Thomas, the Amundsen Science technician, re-terminated the Rosette electro-mechanical cable. He did this to avoid problems with the well-used termination at a more inconvenient time. However, there were problems with the electrical system for the next five days. Short circuits persisted, and always the short was identified as being the in termination of the sea cable. Re-terminating the cable worked for a limited time, before a short circuit (usually on a deep cast) would cause a system failure and another lengthy period of down time while the cable was again re-terminated and the resin was allowed to cure around the splice. This occurred three times before the cause of the short circuits, water infiltration into the electro-mechanical sea cable, was ultimately identified. The cable was being cut with an electric grinder, which heated the cable and dispersed or evaporated any water from the cable that would have otherwise been seen. For the last re-termination, the steel cable was cut with a hand saw, and a bead of water was then seen protruding from a conductive wire within the cable. To avoid further short circuits and delays, 500m of cable was cut from the winch. The cable was re-terminated, and no problems persisted for the rest of the leg.

Several Niskin Bottle elastics were tightened and replaced (see the operator verbose)

During Leg 3a, a scientist studying nutrients believed there were some problems with the closing of Niskin Bottles. The passage below was circulated to all scientists sampling Rosette water:

Greetings CTD Water sampler. Following his analysis, Jonathan noticed inconsistencies with water sampled from **Bottle 12, Cast 61, Station 554, 405, 403**. His findings are more representative of surface water, rather than that of water sampled at 60m, where bottle 12 was meant to be closed. The records in the Rosette Shack confirm that this bottle was indeed fired to close at 60m, however, it is possible that the firing mechanism malfunctioned and remained open until the Rosette was at the surface, where it then closed. There is no way for us, the Rosette operators, to know with certainty whether this happened, but it is a possibility. We therefore recommend you review your findings from this sample.

10.3 Methodology – Lowered Acoustic Doppler Current Profiler (LADCP)

A 300 kHz LADCP (a RD-Instrument Workhorse®) was mounted on the rosette frame. The LADCP gets its power through the rosette cable and the data is uploaded on a portable computer connected to the instrument through a RS-232 interface after each cast. The LADCP is programmed in *individual ping* mode (one every second). The horizontal velocities are averaged over thirty-two, 8 m *bins* for a total (theoretical) range of 100 to 120 m. The settings are 57600 bauds, with no parity and one stop bit. Since the LADCP is lowered with the rosette, there will be several measurements for each depth interval. The processing is done in Matlab® according to Visbek (2002).

Figure 10.20. RDI LADCP mounted on the bottom of the SBE32 caroussel on the *Amundsen.*

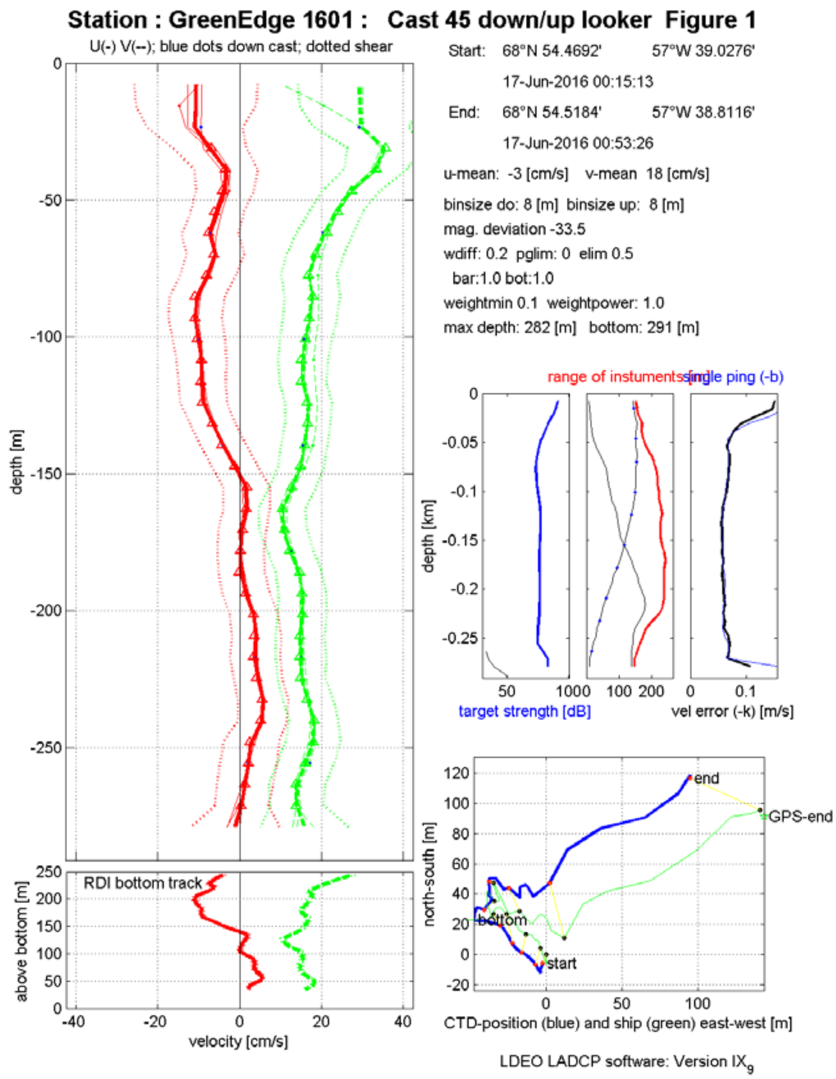

Figure 10.21. An example of profile velocities provided by the dual LADCP system during leg 1.

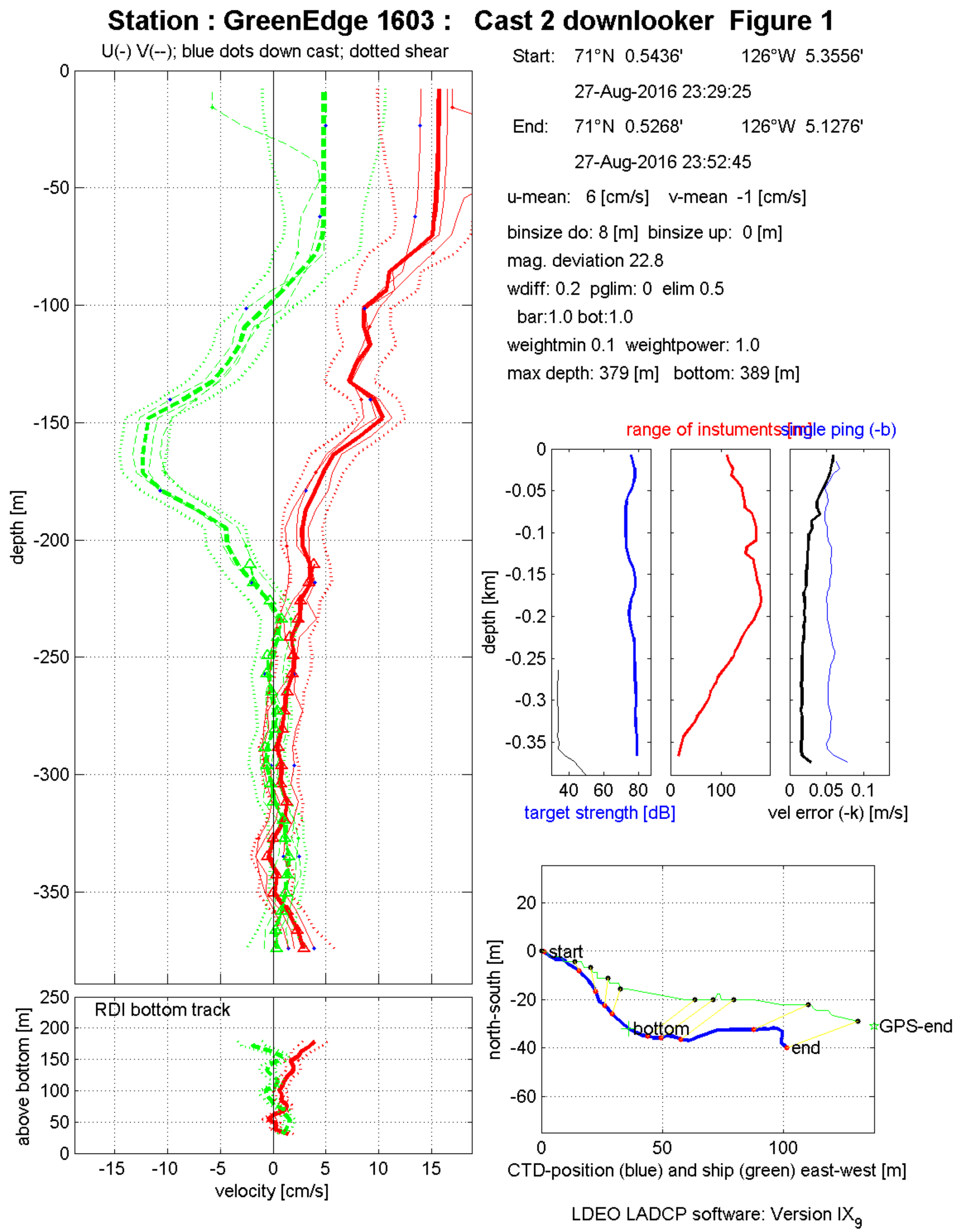

Figure 10.22. Example of current velocities for cast 002 as recorded by the LADCP.

Problems Encountered

During leg 1, no significant problem occurred with the Ladcps.

During leg 2, thanks to new power supply upgrade, the ADCP intensity was sufficient even for deep cast. Sometimes and probably due to the new power supply, it was difficult to communicate with the LADCP from the BBtalk software. An investigation should be done to fix the problem.

10.3.1 *Underwater Vision Profiler (UVP)*

The UVP5 is an instrument designed to take pictures of a slice of water illuminated by 2 rows of flashing LEDs while profiling or while being moored (Figure 10.23). An image processing performed either onboard while profiling, or in delayed mode after data recovery (at the user's convenience), estimates the particles size distribution and stores vignettes of the particles found in the images. The pixel size of the camera is approximately 150 microns, so that the particles detected by the UVP range from 150 microns up to a few centimeters.

The UVP main cylindrical case includes a camera, containing itself a hard drive (HD) and a flash drive (FD). There are 2 modes that can be used to record the images and process them. In clear waters, the "mixfd" mode is given preference; it processes the images while acquiring data, and stores only vignettes taken from the entire images. In more turbid waters, the "fullhd" mode is preferred; it stores the entire image on the camera hard drive (64Go USB drive).

During leg 1, 201 profils were done (ALL CTD casts except 2) for 1 300 000 images (80% sorted on board).

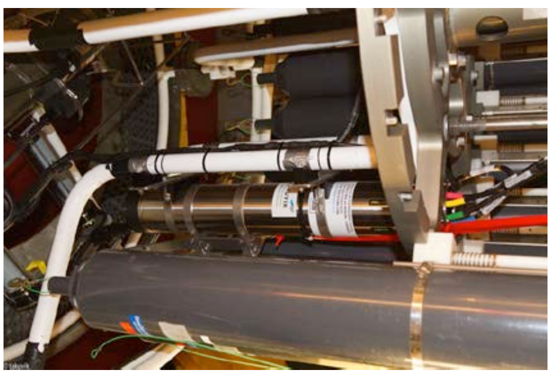

Figure 10.23. UVP mounted on the bottom of the SBE32 caroussel on the *Amundsen*

Problems Encountered

At the end of transect 500, the UVP stopped working. The problem was fixed quite rapidly (change of mother board), but casts 144 ad 145 were performed without UVP and cast 146 with the spare UVP.

Reference

Visbeck, 2002, J. Atmos. Ocean. Tech., 19, 794-807

11 High Resolution Survey of Oceanic Dimethylsulfide in Contrasted Marine Environments of the Canadian Arctic – Legs 1 and 2

Project leaders: Maurice Levasseur[1] (maurice.levasseur@bio.ulaval.ca) and Guillaume Massé[1]
Cruise participant - Leg 1a: Guillaume Leguen[2]
Cruise participants - Leg 1b: Martí Galí[1] and Guillaume Leguen[2]
Cruise participants - Leg 2: Martine Lizotte[1] and Robin Bénard[1]
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[2] *Intechmer, Tourlaville, France*

11.1 Introduction

Dimethylsulfide (DMS) is a gas produced by marine microbial food webs through the decomposition of dimethylsulfoniopropionate (DMSP), a compound synthesized by phytoplankton. DMS dissolved in seawater is emitted to the atmosphere, where it rapidly oxidizes to sulfate and other species and contributes to the formation and growth of aerosols. These aerosols can modify the brightness and lifetime of low-level marine clouds, as well as precipitation rates, by increasing the cloud droplet concentration, and can therefore have an impact on climate (Charlson et al. 1987). This is particularly true in non-polluted atmospheres, such as the summertime Arctic atmosphere, where background aerosol levels are low and DMS represents the dominant source of atmospheric sulfur (Leaitch et al. 2013). DMSP production differs strongly among different phytoplankton groups (Stefels et al. 2007). Thus, the species composition of the phytoplankton community strongly determines DMS concentrations and emission fluxes. Bacteria can also produce DMS from DMSP, so the composition and activity of the bacterial community is another important factor determining DMS production, together with grazing, which makes algal DMSP available to bacteria. In the 2016 Amundsen Expedition, we aimed at describing DMS and DMSP concentrations and dynamics across the ice edge, and their relationship to the composition and activity of planktonic communities. These data may help us understand the response of Arctic DMS emission in the context of dramatic environmental changes, such as the decline of summertime ice cover and the varying occurrence of under-ice and ice-edge blooms (Levasseur 2013).

Conspicuous alterations in the Arctic Ocean are underway and include reductions in snow cover as well as sea ice extent and thickness, the occurrence of which is linked to profound modifications in light availability in surface waters below the ice and at its margin. How these physical changes will impact the dynamics of bloom-forming micro-organisms and their production of the biogenic climate-active gas dimethylsulfide (DMS) are still unknown. Within both ArcticNet and Netcare research programs, questions such as: « What are the relative contributions of marginal ice blooms, under ice blooms and melt ponds to the production and sea-air exchanges of DMS? And “What is the relationship between phytoplankton blooms and DMS production/emission in Arctic waters?” are explored during this 2016 field season. The main objectives of Leg 2 included:

1) Deploying a high-frequency autonomous underway sampling instrument (MIMS – Membrane Inlet Mass Spectrometer) in order to obtain greater spatial and temporal resolution of surface concentrations of DMS across contrasted environments (open waters, ice, marginal ice zones, etc);
2) Sampling a selection of ArcticNet rosette stations (Basic and Full) located in Lancaster Sound, Baffin Bay, Kennedy Channel, Kane Basin, Peel Sound and Queen Maud Gulf to augment the existing time-series in this region of the Archipelago;
3) Opportunistic sampling of surface microlayer waters to increase the extent of measurements made in 2014 during the first Netcare campaign.

11.2 Methodology

11.2.1 *Leg 1*

Initially, we had planned to measure DMS in semi-continuous mode using a membrane inlet mass spectrometry (MIMS) system fed by the underway pump of the ship. However, the automatic system used to extract dissolved gases from the underway seawater flow did not work. After unsuccessful attempts to fix the system during Leg 1a, our team decided to switch to manual DMS analysis in discrete samples from the CTD-rosette.

During Leg 1b, seawater samples were taken at 5 depths in the water column at all FULL stations (16), and at 6 BASIC stations (2 depths, surface and subsurface chlorophyll maximum, SCM). DMS samples were analyzed immediately after collection. 20 mL of filtered seawater were purged for 15 minutes using ultrapure He (flow rate 50 mL/min) and pre-concentrated onto a glass liner filled with Tenax adsorbent placed in a cryogenic trap. The DMS trapped on Tenax was then thermally desorbed and analyzed by gas chromatography-mass spectrometry (GC-MS). The GC-MS was calibrated with injections of isotopically marked DMS; d3- and d6-DMS were used both as internal standards, injected along with natural samples, and to make calibration curves spanning the 0.5 - 45 nM range. Given the presence of *Phaeocystis sp.*, we compared different sample collection procedures to avoid overestimation of DMS concentrations. In selected Niskin bottles (N = 20), samples were collected in duplicate using either a 100 µm or a 5-µm mesh to screen out *Phaeocystis* cells or colonies, and the resulting DMS concentrations were compared.

Total DMSP (DMSPt) samples were collected in 20 mL glass vials directly from the Niskin bottle. To collect dissolved DMSP (DMSPd) samples, gravity filtration cups fitted with a 47 mm GF/F filter were loaded directly from the Niskin with 45-50 mL seawater, and allowed to drip into 20 mL vials. All DMSP samples were preserved using the microwaving method followed by acidification (Kinsey and Kieber 2016), and will be analyzed on land by gas chromatography and sulfur-specific flame photometric detection.

11.2.2 *Leg 2*

The MIMS was successfully deployed between 21 July and 18 August 2016. During this time we prioritized the ship's transits between stations to increase the chances of capturing fronts and physical features related to the presence of ice. After some initial troubleshooting with labview code components and communication issues with the ship's thermosalinograph (TSG) and GPS, the system was fully operational for the greater part of the cruise. One significant bottleneck of our system was the accessibility to liquid nitrogen (N_2). The multimodal injector used to cryogenically trap dimethylsulfide within the GC/MS requires a constant and large supply of liquid N_2. Unfortunately, the liquid N_2 plant on board was not able to furnish the daily requirements (35L) to our system and we could only deploy the MIMS every other day, at best, in order to allow the N_2 plant to replenish its reservoir. On 18 August, the N_2 plant stopped working altogether and a puncture was discovered in one of the compression lines. The copper line was rapidly fixed by Coast Guard and Amundsen Science personnel (we wish to thank Thomas Mainville, David Quirion and Simon Morisset for their invaluable help with this). However, re-filling the N_2 reservoir was very long thereafter and we were not able to redeploy the MIMS for the rest of the journey. During the year to come (2017), we will focus our attention on trying to find an alternative to this system of cryogenic trapping in order to reduce our dependence to liquid N_2.

During underway analysis of DMS on the MIMS our team sampled for various discrete variables; DMS using a Purge and Trap system (in order to validate and calibrate the MIMS method), total dimethylsulfoniopropionate ($DMSP_t$), dissolved dimethylsulfoniopropionate ($DMSP_d$), nutrients, chlorophyll *a* (chl *a*), phytoplankton taxonomy (preserved in both lugol and formaldehyde). A new collaboration was developed with Dr. Dimitri Kalenitchenko (Prof. Connie Lovejoy lab, Laval University) with whom we joined efforts during MIMS sampling. Dr. Kalenitchenko took samples for DNA during selected transits in order to test the method and provide a basis upon which we will build in order to pursue this collaborative work for years to come. The idea would be to include an automated sampling-scheme for DNA in association to the DMS-MIMS automated data. This collaborative work will be conducted at Laval University during the fall of 2016 and winter 2017.

As an addition to the underway sampling, 24 stations were sampled for water column vertical profiles of DMS, $DMSP_t$ and $DMSP_d$: NE Hatton Basin ROV1, NE Hatton Basin ROV5, SE Cold Seep Saglek ROV2, SE Baffin Shelf ROV6, Stn 180, Stn 177, Stn 169, Stn 160, Stn 323, Stn 115, Stn 111, Stn 116, Stn 108, Stn 105, Stn 101, Ts233 (Trinity Glacier), Stn 139 (Peterman Glacier), Stn 133, Stn 127, Stn 119, Stn 305, Stn 310e, Stn 312, And Stn QMGM. The vertical profiles of DMS, $DMSP_t$ and $DMSP_d$ included three light depths (100%, 50%, 1%), as well as the subsurface chlorophyll *a* maximum (SCM) and a deep cast of 100m for a total of five depths at every station. All the DMS samples were analyzed swiftly on-board using the GC/MS during periods of down time at the MIMS. $DMSP_t$ and $DMSP_d$ samples will be taken back to Laval University after demobilization for post-cruise analysis.

Eleven microlayer stations were sampled opportunistically along the cruise track (see Microlayer report for further information). Contrary to 2014, sampling of the microlayer was made possible through the use of an automated catamaran called the skimmer (as opposed to the use of a glass plate as was the case in 2014). Although a few issues arose with the skimmer, the sampling team composed of Vickie Irish and Matt Boyer were able to collect large volumes of microlayer nonetheless. We sub-sampled this microlayer water and associated bulk water for a suite of variables: DMS, DMSPt, DMSPd, nutrients, and TEP (transparent exopolymer particles). TEP samples were filtered and stained directly onboard and will be sent to Dr Oliver Wurl in Germany for analysis through a collaboration fostered within Netcare. After testing and comparing microlayer water collected through the two methods (skimmer and glass plate), we have come to the conclusion that the skimmer method may under-estimate concentrations of DMS likely through enhanced ventilation during sampling. We suggest to keep the glass plate method when it comes to sampling gases in the microlayer.

Finally, we also had the chance to analyze rainwater and fog water for the presence of DMS through a collaboration with Roghayeh Ghahremaninezhad (Prof. Ann-Lise Norman lab, University of Calgary).

11.3 Preliminary Results

11.3.1 *Leg 1*

DMS concentrations spanned between 0.4 and 53 nM, an unusually wide range (note that these concentrations can change slightly after validation). The maximal concentration was measured at 30 m depth (station G615), in a prominent SCM with the possible presence of *Phaeocystis*, an outstanding DMS(P) producer. Surface concentrations were also high, with values around 10 nM at some stations and a maximum of 14 nM at station G703. There was a stark contrast between ice-covered and open water stations, in terms of both magnitude and shape of the vertical DMS profiles, as illustrated in Figure 11.1.

These results suggest the existence of sharp gradients in the biological and physical processes that control DMS concentration across the marginal ice zone. A clearer picture will emerge when our results are analyzed in relation to phytoplankton and bacterioplankton dynamics, stratification and vertical turbulent diffusivity in the upper water column, ice cover and meteorological conditions.

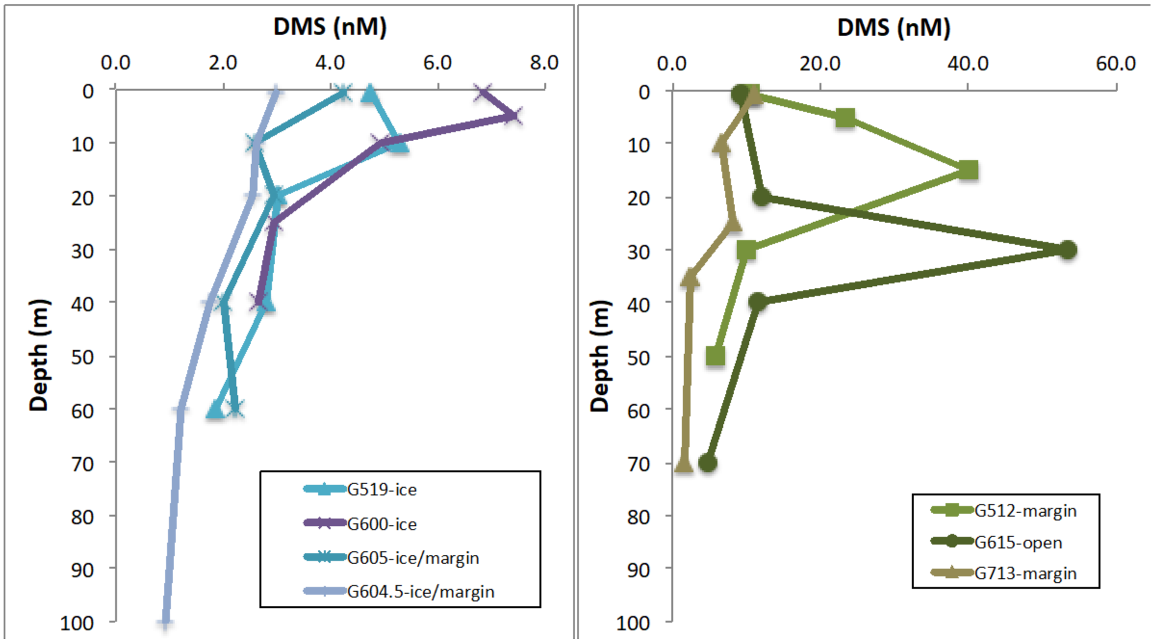

Figure 11.1. DMS concentrations at some ice- covered and open water stations. The distinction is sometimes ambiguous close to the ice edge, which may have been covered by ice until recently.

11.3.2 *Leg 2*

Because the MIMS provides real time data, we were able to detect an event during a transit between Station 172 and Buchan Gulf (Figure 11.1). We captured a transitional area between open waters and a large ice floe. The TSG data showed a decrease in salinity, which was mirrored by an increase in dimethylsulfide as the ship entered the ice floe (Figure 11.1). As the ship exited the ice floe, the salinity increased and dimethylsulfide levels returned to pre-ice floe values. This tool is very powerful and highly useful. Thanks to the images captured by the cameras we were able to pinpoint the moment when the ship entered the ice floe, have a good appreciation of the type of ice that had surrounded us during the transit within the floe (presence of melt ponds for example) and know precisely the moment when the ship exited the ice. We are grateful for this new tool and will be keen users of this service provided by ArcticNet. Overall, levels of oceanic DMS were found to be highly variable throughout the Archipelago, ranging from 3 nmol L^{-1} to 30 nmol L^{-1}.

<u>Collaborations</u>

Leg 1

In collaboration with Julie Dinasquet and Laetitia Dadaglio (PI Fabien Joux), we conducted two enrichment experiments to determine the response of bacterial communities to different methylated substrates. Surface seawater from two contrasting stations (one with open water and the other ice-covered) was filtered through 0.2 µm, inoculated with bacteria from the same station and spiked with one of the following compounds at 10 µM C concentration: methanol, trimethylamine oxide, DMSP, DMS or acrylate. Triplicate bottles for each treatment (plus one control) were incubated in the dark, and bacterial production and methanol consumption rates, as well as DMS, DMSP and acrylate concentrations, were monitored for a 9-day period. Samples for qPCR will be analysed on land.

Leg 2

In collaboration with the laboratory of David Kieber (SUNY, Syracuse), some DMSP samples will be further analyzed for dimethylsulfoxide (DMSO) and acrylate. DMSO is an oxidation product of DMS and DMSP, and acrylate is produced upon DMSP cleavage. The dynamics of these compounds in marine waters, especially acrylate, are poorly known to date.

11.4 Comments and Recommendations

Dynamic scheduling. The science-scheduling monitor near the officer's lounge is a wonderful addition to the science operations of the Amundsen. It has the potential of becoming a very powerful and useful tool. For the moment however it is not optimal at all. What is meant to be an easy and dynamic way of updating changes in the science operations has become source of frustration and disappointment. The fact that only the chief scientist can change the schedule is a nuisance. Our team strongly recommends that the coding for this chart be changed so that the Wheelhouse officers can change the times. To us it makes sense that the "brain" of the entire operations has access to this (the wheelhouse operates 24/7 and knows everything at all times), especially during the night when the chief scientist is sleeping and cannot get up every minute to check if the operations are on time. We have had a series (several weeks) of frustrating nights when the schedule was updated only to say "completed" but in reality everything was "EARLY" so that the little sleep we thought we were getting turned out to be very short indeed when we got awaken last minute. The schedule should be easier to change, times should be changed (not just the status: completed, on time or late… this doesn't help in any way when the schedule is ahead or when its late… early or late by how much? One hour, two hours?). So times need to be updated as well as the status. This is imperative if this system is to be operational and user friendly.

Pre-filters on the fume hoods. We noticed that many of the pre-filters on the fume hoods were extremely dirty (already at the beginning of Leg 2). We believe that changing these pre-filters more often could prolong the life of the actual filters, which probably cost more than the pre-filters. It would also give the fume hood users more confidence that the hoods are doing what they are supposed too: aspirating fumes efficiently.

Dangerous good containers. When we embarked at the beginning of Leg 2, there were no more 10L dangerous goods containers. This led to many problems for numerous teams. A reminder to empty these DG containers in the large volume containers near the rosette should be done by the chief scientist at the end of every leg so that the next people on board are not faced with emptying others team dangerous goods or trying to cope with other make-shift containers.

Storage allocation. Storage space allocation for empty and consumable boxes this year was not so easy. We found our boxes scattered all over the ship during the cruise despite the fact that they had been placed in a specific area of the Bow Thruster before the sea trials. Some lids and certain boxes were never found after possible displacement via other teams from previous Legs. We understand and appreciate the immense challenge the entire process may entail but perhaps fixed and identified spaces for each team would be beneficial.

Acknowledgement

Our heartfelt acknowledgements to Captain Alain Gariépy and chief scientists Christian Nozais and Tim Papakyriakou for giving us multiple opportunities to conduct all these operations.

We would also like to congratulate Simon Morisset for his role in developing the composite imagery related to the cameras installed on top of the bridge.

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12 Microlayer – Legs 1 and 2

Project leaders: Maurice Levasseur[1] (maurice.levasseur@bio.ulaval.ca) and Guillaume Massé[1]
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Cruise participants Leg 1b: Martí Galí[1] and Guillaume Leguen[2]
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12.1 Methodology

Surface microlayer (SML) and bulk water (BW) samples were taken on 11 different days during the Amundsen expedition to the Arctic in July and August 2016. Samples were collected using a skimmer (automatic and manual use). After sampling, SML and BW were each homogenized and were divided and treated according to protocols for different analyses (Table 12.1).

BW samples were subsampled in the same way for all variables mentioned in Table 12.1. Additional samples were taken from a niskin bottle at 0.5m deth for DIC/Alk, salinity and O18. The BW for DIC/Alk was stored in glass bottles using the gas-clean technique, then poisoned on the zodiac with HgCl2 and stored in a cooler until back at the ship where they were stored at 4°C. The O18 samples were taken directly after and stored in 10ml tubes. Salinity was taken in 100ml glass bottles from the same niskin and stored at 4°C.

Table 12.1 Synopsys of analyses

Analyses	Min sample vol	Max sample vol	Immediate sample handling	Storage temp
Temperature/ Salinity (Lisa Miller)	Bulk: 100ml	Bulk: 100ml	Homogenise, put in glass bottles.	Glass bottles Temp: room
Surfactants (Lisa Miller)	µlayer +bulk: 25ml of each	µlayer +bulk: 50ml (2 x 25ml) of each	Method 1: Freeze in HDPE bottles.	HDPE bottles Temp: -20C
DOC/TOC (Leg 2a: Joannie Leg 2b: Marjolaine & Aude)	One replicate µlayer: 55 ml Bulk: 55 ml	Two replicate µlayer: 75 ml Bulk: 75 ml	Subsample 8 ml in each tube, acidify with HCl and store at 4° C until analysis on a Shimadzu TOC analyzer at UQAR/ISMER	Borosilicate tubes; Temp: 4°C
Bacteria (Leg 2a: Joannie; Leg 2b: Marjolaine & Aude)	One replicate µlayer: 12 ml Bulk: 12 ml	Two replicate µlayer: 17 ml Bulk: 17 ml	Pour 4 ml in each cryovial, add glutaraldehyde, freeze quickly in liquid nitrogen and then store at -80° C until analysis by flow cytometry at UQAR/ISMER	Cryovials; Temp: -80°C
Pico- and nanophytoplankton abundance (Leg2a: Joannie; Leg 2b: Marjolaine & Aude)	One replicate µlayer: 13 ml Bulk: 13 ml	Two replicate µlayer: 18 ml Bulk: 18 ml	Pour 4 ml in each cryovial, add glutaraldehyde, freeze quickly in liquid nitrogen and then store at -80° C until the analysis by flow cytometry at UQAR/ISMER	Cryovials; Temp:-80°C

Chlorophyll *a* (Leg 2a: Joannie; Leg 2b: Marjolaine & Aude)	One replicate µlayer: 50 ml Bulk: 250 ml	Two replicate µlayer: 100 ml Bulk: 500 ml	Filtration on Whatman GF/F filter (nominal porosity of 0.7 µm), 18-36h acetone extraction in a fridge at 4° C and fluorometric determination (Turner Designs 10-AU) of the pigments onboard the ship	None; analysis done onboard
Nutrients (NO_3+NO_2, PO_4, $Si(OH)_4$) (if nobody of JET team is onboard) (Leg 2a: Joannie; Leg 2b: Marjolaine & Aude)	One replicate µlayer: 60 ml Bulk: 60 ml	Two replicate µlayer: 110 ml Bulk: 110 ml	Filtration and filtrate is kept frozen in 15 ml acid-washed polyethylene tubes for later analysis on a nutrient autoanalyzer onboard the ship	Polyethylene centrifuge tubes; Temp.: -20°C
Taxonomy (Leg 2a: Joannie; Leg 2b: Marjolaine & Aude)	One replicate µlayer: 65 ml Bulk: 215 ml	No replicate	Pour 50ml (µlayer) or 200ml (bulk) into a glass jar and add acidic lugol. Store at 4°C	4°C
Photosynthetic performance (Leg 2a: Joannie; Leg 2b: Marjolaine & Aude)	One replicate µlayer: 10 ml Bulk: 10 ml	Two replicate µlayer: 20 ml Bulk: 20 ml	Fill a borosilicate with water sample and measure natural fluorescence. Add DCMU and measure again.	None; analysis done onboard
DMS/DMSP (Martine/ Marjo/Maurice)	µlayer+ bulk: 150 ml of each	µlayer+ bulk: 1L of each	Purge and trapping on tenax. GC MS analysis onboard within 12 hours	Analysed onboard. DMSP stored at 4°C.
INP (Vickie)	µlayer+ bulk: 30ml (2x12ml plus rinse) of each	µlayer+ bulk: 60ml (4x12ml plus rinse) of each	Some water used directly in droplet freezing assays. Rest of water stored.	If not used directly in experiments, stored at -80C
DNA (Vickie)	µlayer: 250ml bulk: 250ml	µlayer: 500ml bulk: 500ml	Water directly into sterile falcon tubes.	-80°C
Hydroscopicity (Rachel/ Matt)	µlayer+ bulk: 100ml of each	µlayer+ bulk: 500ml	Stored in 100ml bottles.	-20°C
Oxidation (Doug)	µlayer+ bulk: 100ml of each	µlayer+ bulk: 1L	Put in glass bottles and stored in freezer.	-20°C
TEP (Oliver)	µlayer+ bulk: 100ml of each	µlayer+ bulk: 250ml	Filtered and alcian blue stained	-20°C
Ammonium (Alex)	µlayer+ bulk: 20ml of each	µlayer+ bulk: 40ml of each	Analysed onboard	
DAWT experiments (Jon/ Rachel/ Matt/ Vickie/ Doug)	µlayer: 100ml (~78ml for a microlayer thickness of 500um)	µlayer: 200ml? (~155ml for a microlayer thickness of 1000um)	If tank experiments did not take place straight away samples were frozen at -80C	-80°C

Table 12.2 Station numbers, dates and subsamples taken. (green indicates variable was taken and measured)

Station →	1	2	3	4	5	6	7	8	9	10	11
Date	16-07-20	16-07-28	16-08-01	16-08-06	16-08-08	16-08-09	16-08-11	16-08-13	16-08-15	16-08-21	16-08-23
Start location	Lat: 60°17.921 Long: 062°10.750	Lat: 67°23.466 Long: 063°22.067	Lat: 71°17.200 Long: 070°30.236	Lat: 76°20.341 Long: 071°11.418	Lat: 76°43.777 Long: 071°47.267	Lat: 76°18.789 Long: 075°42.963	Lat: 77°47.213 Long: 076°29.841	Lat: 81°20.041 Long: 062°40.774	Lat: 78°18.659 Long: 074°33.757	Lat: 68°19.199 Long: 100°49.010	Lat: 68°58.699 Long: 105°30.022
Variable											
Salinity		green	green	green	green	green	green	green	green	green	green
O18		green	green	green	green	green	green	green			
DIC		green	green	green	green	green	green	green	green		
Biological variables	green	green	green	green	green	green	green	green	green	green	green
DMS	green	green	green	green	green	green	green	green	green	green	green
DNA	green	green	green	green	green	green	green	green	green	green	green
INP	green	green	green	green	green	green	green	green	green	green	green
Ammonium	green	green	green	green	green	green	green	green	green	green	green
Oxidation	green	green	green	green	green	green	green	green	green		green
Hygro-scopicity	green	green	green	green	green	green	green	green	green	green	green
Tank experiments	green	green									

Station 1 – 20 July 2016

Figure 12.1 Conditions at station 1

Foggy with some sun trying to break through. Sea surface rippled but with a decent sized swell. Beaufort scale approx. 3-4.

Table 12.3 Timeline of operations – station 1

Time (UTC)	Notes
18:31	Latitude: 60° 17.921 Longitude: 062° 10.750 Skimmer sampling started at bottle 1.
18:47	Going in to see skimmer as she doesn't seem to be changing bottles. She had stopped on Bottle 5.
18:54	Carried on sampling using bottle 6.
19:00	Lost connection with the princess.
19:18	Emptied SML bottles in one large SML homogenising bottle. Same done for BW. Salinity 47.6 mS/cm.

* The princess' computer died between stn 1 and stn 2 so we re-purposed her to manually sample (see manual crank in picture below)

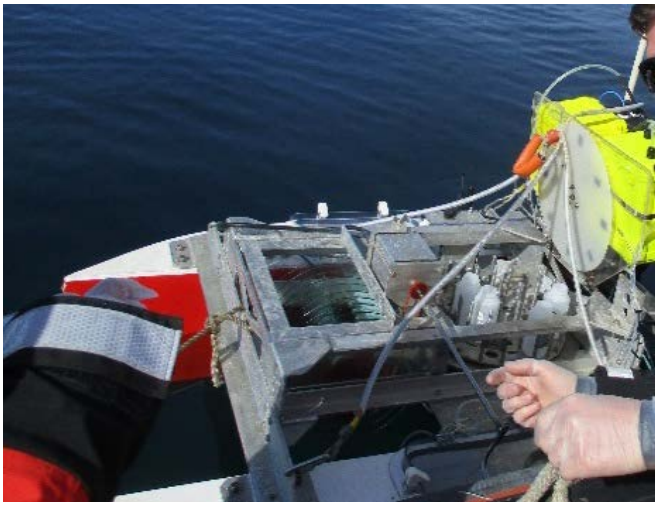

Figure 12.2 Manual sampling

Station 2 – 28 July 2016

Figure 12.3 Conditions at station 2

Sunny. Next to ice island (same one as from 2014). A few icebergs nearby. Can see land. Beaufort scale approx. 2.

Table 12.4 Timeline of operations – station 2

Start time (UTC)	Time taken to fill bottle	Bottle	rotations	Notes
15:37	3min	4	100	Latitude: 67° 23.466 Longitude: 063° 22.067
15:41	2min 15s	5	100	
15:45	3min 53s	6	228	Did not push down on skimmer therefore took longer.
15:52	2min 7s	7	102	
15:56	2min	8	76	Amundsen went past doing ice island mapping approx. 50m away.
16:00	1min 45s	1	75	
16:03	2min	2	100	
16:06	2min 10s	3	90	
16:10				Emptied SML bottles in one large SML homogenising bottle. Same done for BW.
16:21	1min 41s	5	78	
16:23	1min 49s	6	90	
16:26	1min 30s	7	80	
16:28	1min 35s	8	85	
16:31	2min 40s	1	93	
16:33	1min 25s	2	85	
16:35	1min 45s	3	83	
16:37	1min 50s	4	87	Finish sampling. Latitude: 67° 22.957 Longitude: 063° 23.289
17:15				Salinity 44.9 mS/cm Temp: 5.1°C
17:20				Cast 1 niskin. DIC/O18 and salinity samples. Latitude: 67° 22.77 Longitude: 063° 24.174
17:40				Finished all sampling. Latitude: 67° 22.779 Longitude: 062° 24.855

Station 3 – 1 August 2016

Figure 12.4 Conditions at station 3

Partly sunny. Light winds. Near Sam Ford Fjord. A few icebergs approx. 200m away. Can see land. Beaufort scale approx. 3.

Table 12.5 Timeline of operations – station 3

Start time (UTC)	Time taken to fill bottle	# rotations	Notes
12:56			Latitude: 71° 17.200 Longitude: 070° 30.236 Cast 1 niskin.
13:10			Finished DIC, O18 and salinity sampling. Salinity probe 38.2 mS/cm, Temp 6.6 °C
13:36	1min 20s	65	Latitude: 71° 17.635 Longitude: 070° 29.747 Started skimmer#1 deployment.
13:3	1min 14s	55	Bird ~5m nearby.
13:39	1min 9s	53	
13:43	1min 3s	53	
13:44	1min 2s	52	Noticed small bubbles around skimmer and near zodiac
13:46	1min 3s	56	
13:47	1min 12s	63	
13:49	1min 4s	58	Latitude: 71° 17.977 Longitude: 070° 29.567 Finished skimmer#1 deployment. Bird gone.
14:00			SML and BW in homogenising bottles.
14:07	1min 26s	86	Latitude: 71° 18.011 Longitude: 070° 29.530 Started skimmer#2 deployment.
14:10	1min 13s	70	
14:11	1min 7s	70	
14:13	1min 19s	81	
14:14	1min 18s	79	2 birds ~5m nearby again.
14:16	1min 17s	80	
14:18	1min 16s	73	Birds now only ~1m away.
14:20	1min 27s	85	Latitude: 71° 18.173 Longitude: 070° 29.467
14:30			SML and BW into homogenising bottles. Finished all sampling.

Station 4 – 6 August 2016

Figure 12.5 Conditions at station 4

Can see Greenland. Overcast, rippled sea surface but a bit of a swell. Beaufort scale ~2.

Table 12.6 Timeline of operations – station 4

Start time (UTC)	Time taken to fill bottle	# rotations	Notes
13:05			Latitude: 76° 20.341 Longitude: 071° 11.418 Cast 1 niskin.
13:39			Latitude: 71° 20.506 Longitude: 070° 12.082 Started skimmer#1 deployment.
13:39	53s	51	
13:40	1min 8s	60	
13:42	1min 11s	62	
13:43	1min 13s	65	
13:45	1min 30s	81	
13:47	1min 20s	71	
13:49	1min 11	63	
13:50	1min 5s	60	Latitude: 76° 20.576 Longitude: 071° 12.357 Finished skimmer#1 deployment. Microlayer conductivity: 49.8 mS/cm T: 7.4C Bulk conductivity: 50 mS/cm T:6.9C
14:06			Latitude: 76° 20.676 Longitude: 071° 12.568 Started skimmer#2 deployment.
14:06	1min 03s	71	
14:07	53s	58	
14:09	1min	70	
14:10	53s	62	
14:12	57s	66	
14:13	54s	62	`
14:14	56s	65	
14:15	56s	70	Latitude: 76° 20.759 Longitude: 071° 12.762 Finished skimmer#2 deployment.

Station 5 – 8 August 2016

Figure 12.6 Conditions at station 5

Sunny,slight swell,rippled surface. Beaufort scale~3/4

Table 12.7 Timeline of operations – station 5

Start time (UTC)	Time taken to fill bottle	rotations	Notes
10:30			Latitude: 76° 43.777 Longitude: 071° 47.267 Cast 1 niskin.
10:56			Latitude: 76° 43.573 Longitude: 071° 46.774 Started skimmer#1 deployment.
10:56	1min 7s	64	
10:58	1min 6s	65	
10:59	1min 17s	70	
11:00	1min 11s	65	
11:01	1min 19s	72	
11:03	1min 14s	65	
11:05	1min 18s	68	Kathy is seasick,did not use this bottle. Finished deployment #1 Latitude: 76° 43.418 Longitude: 071° 46.457 Finished skimmer#1 deployment. Microlayer conductivity: 50.1mS/cm T: 7.7C Bulk conductivity: 50.9 mS/cm T:7.0C Moved to another location.
11:21			Latitude: 76° 43.313 Longitude: 071° 46.011 Started skimmer#2 deployment.
11:21	1min 16s	71	
11:23	1min 11s	67	
11:24	1min 15s	68	
11:25	1min 24s	77	
11:27	1min 18s	72	
11:29	1min 21s	75	
11:30	1min 19s	72	Latitude: 76° 43.185 Longitude: 071° 45.843 Finished skimmer#2 deployment.

Station 6 – 9 August 2016

Figure 12.7 Conditions at station 6

Glorious and sunny, rippled waves. Icebergs more than 2miles away. Beaufort scale 2

Table 12.8 Timeline of operations – station 6

Start time (UTC)	Time taken to fill bottle	rotations	Notes
14:30			Latitude: 76° 18.789 Longitude: 075° 42.963 Cast 1 niskin.
14:47			Latitude: 76° 18.723 Longitude: 075° 42.378 Started skimmer#1 deployment.
14:47	1min 20s	88	
14:48	1min 18s	77	
14:50	1min 9s	76	
14:52	1min 3s	62	
14:54	1min 4s	62	
14:55	1min 7s	64	
14:56	1min 6s	65	
14:58	1min 12s	68	Latitude: 76° 18.658 Longitude: 075° 41.984 Finished skimmer#1 deployment. Microlayer conductivity: 48.7mS/cm T: 8C Bulk conductivity: 49.6 mS/cm T:6.5C
15:15			Latitude: 76° 18.587 Longitude: 075° 41.641 Started skimmer#2 deployment.
15:15	1min 19s	78	
15:16	1min 17s	74	
15:17	1min 18s	68	
15:18	1min 23s	82	
15:20	1min 23s	80	
15:22	1min 13s	72	
15:24	1min 10s	68	
15:25			Forgot to get lat long. Finished skimmer#2 deployment.

Station 7 – 11 August 2016

Figure 12.8 Conditions at station 7

A lot of ice and icebergs. Starting to spit rain. Overcast. Polar bears in vicinity.

Table 12.9 Timeline of operations – station 7

Start time (UTC)	Time taken to fill bottle	Rotations	Notes
16:45			Latitude: 77° 47.213 Longitude: 076° 29.841 Cast 1 niskin.
17:11			Latitude: 77° 47.114 Longitude: 076° 29.884 Started skimmer#1 deployment.
17:11	2min 20s	164	
17:14	1min 1s	73	
17:15	59s	73	
17:16	53s	68	
17:17	1min 21s	97	
17:20	1min 10s	86	
17:21	59s	73	Raining a little harder
17:29			Start skimmer#2 deployment Latitude: 77° 47.058 Longitude: 076° 30.008
17:29	1min 35s	117	
17:30	1min 19s	93	
17:33	58s	68	
17:34	57s	67	
17:35	1min 13s	97	
17:36	1min 1s	80	
17:37	1min	80	
17:40			Latitude: 77° 47.007 Longitude: 076° 30.120 Microlayer conductivity: 41.8mS/cm T: 5.4C Bulk conductivity: 43.8 mS/cm T:4.4C Finished skimmer#2 deployment.

Station 8 – 13 August 2016

Figure 12.9 Conditions at station 8

Overcast. Ice bits around. Beaufort scale ~1. No polar bears…yet.

Table 12.10 Timeline of operations – station 8

Start time (UTC)	Time taken to fill bottle	Rotations	Notes
10:05			Latitude: 81° 20.041 Longitude: 062° 40.774 Cast 1 niskin.
10:26			Latitude: 81° 20.107 Longitude: 062° 39.829 Started skimmer#1 deployment.
10:26	7min 47s	540	Latitude: 81° 20.162 Longitude: 062° 38.387 Finished skimmer#1 and started skimmer#2.
	9min 49s	640	Latitude: 81° 20.207 Longitude: 062° 38.917 Finished skimmer#1 and 2. Microlayer conductivity: 48.1mS/cm T: 2.2C Bulk conductivity: 48.4 mS/cm T:1.6C

Station 9 – 15 August 2016

Figure 12.10 Conditions at station 9

The stillness in the air reflects the condition in Matt's heart. Sunny, ice bits, 1/10th ice. BS 0. Clouds 1/9th cirrus. I'mmoved by the unmovement of things around us (Robin). In the emptiness of sound the chak chak of murder can be heard (Manu).

Table 12.11 Timeline of operations – station 9

Start time (UTC)	Time taken to fill bottle	Rotations	Notes
13:55			Latitude: 78° 18.659 Longitude: 074° 33.757 Started skimmer#1 deployment.
13:55	10min 18s	700	Latitude: 78° 18.627 Longitude: 074° 33.574 Finished skimmer#1 and started skimmer#2.
	40s	44	DMS sampling.
14:15	9min 41s	640	Latitude: 78° 18.581 Longitude: 074° 33.267 Finished skimmer#1 and 2. Microlayer conductivity: 45.1mS/cm T: 7.2C Bulk conductivity: 46.2 mS/cm T:5.3C
	5min 49s	40 dips	DMS and INP hand sampling with glass plate.

Station 10 – 21 August 2016

Figure 12.11Conditions at station 10

BS ~4, sunrise, clear skies, most wavy conditions yet.

Table 12.12 Timeline of operations – station 10

Start time (UTC)	Time taken to fill bottle	Rotations	Notes
09:55			Latitude: 68° 19.199 Longitude: 100° 49.010 Started skimmer#1 deployment.
10:05	10min 49s	~700 (based on av from other outings)	Skimmer handle had come off so clog was rotated manually, not as smoothly as with handle. Only 2L was collected. Latitude: 68° 19.303 Longitude: 100° 49.118 Finished skimmer#1 deployment.
			Salinity probe used once back on ship: Microlayer conductivity: 34.6 mS/cm T: 9.8C Bulk conductivity: 33.8 mS/cm T:10.8C

Station 11 – 23 August 2016

Figure 12.12 Conditions at station 11

Conditions: BS ~3, sunrise, mostly cloudy.

Table 12.13 Timeline of operations – station 11

Start time (UTC)	Time taken to fill bottle	Rotations	Notes
10:40			Latitude: 68° 58.699 Longitude: 105° 30.022 Started skimmer#1 deployment.
10:50	7min 22s	500	Latitude: 68° 58.849 Longitude: 105° 30.247 Finished skimmer#1 deployment, started skimmer#2 deployment.
10:56	6min 51s	450	Latitude: 68° 59.037 Longitude: 105° 30.525 Finished skimmer#2 deployment. Microlayer conductivity: 42.7 mS/cm T: 7.2C Bulk conductivity: 43.3 mS/cm T:7C
	3 min 10s	28 dips	DMS sampling
	59 s	10 dips	INP sampling

13 Measurement of pH and Total Alkalinity (TA) in Seawater – Leg 3

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13.1 Introduction

Since the beginning of the industrial period in the late 18th century, humans have emitted large quantities of CO_2 into the atmosphere, mainly as a result of fossil-fuel burning, but also because of changes in land-practices (e.g., deforestation). Whereas atmospheric concentrations oscillated between 180 and 280 ppm over much of the past 400,000 years, current atmospheric concentrations have now reached 403 ppm, diverging wildly from the very reproducible, eleven last glacial-interglacial cycles. Hence, it is hard to argue that anthropogenic activities are unrelated to this increase in atmospheric CO_2 concentration and the associated rise in global temperatures.

The impact of climate change is disproportionately large in the high latitudes. Rapid warming in the northern polar region has resulted in significant glacial and sea-ice melt, affecting the fresh water budget and circulation of the Arctic Ocean and feeding back on Earth's radiation balance. Likewise, the uptake of anthropogenic CO_2 is accelerated in high latitude waters because the solubility of CO_2 in water increases with decreasing water temperature and salinity. Consequently, high latitude waters are more susceptible to ocean acidification.

A study of large-scale processes that modulate the spatial and temporal variability of the pH in surface waters, the pCO_2 gradient at the air-sea interface, and exchange of CO_2 with sub-thermocline waters and across oceanic basins. In addition to measurements of carbonate parameters (pH, TA), the stable carbon isotope composition, $\delta^{13}C(DIC)$, of dissolved inorganic carbon (DIC) will be determined to differentiate between inorganic (atmospheric CO_2 uptake, alkalinity exclusion, ikaite precipitation/ dissolution) and metabolic processes (photosynthesis, microbial degradation of allochtonous and autochtonous organic matter) in the ice and water column to CO_2 exchange. These results will be combined with historical data acquired since 2003 (i.e., CASES, IPY-CFL, IPY-Geotraces, Malina) to construct time-series of the saturation state of the waters with respect to aragonite in order to evaluate the impact of increasing atmospheric CO_2 concentrations, physical and biological processes on Arctic water acidification.

In order to elucidate the role physical mixing of various source waters, the stable oxygen isotope composition, $\delta^{18}O(H_2O)$, of water will be combined to other conservative (e.g., SP, T, TA) and non-conservative tracers (e.g., O_2, Ba, nutrients) to quantify the relative contribution of freshwater inputs (river, sea-ice melt, snow and glacier melt) and oceanic water masses (Pacific, Atlantic) to the vertical structure of the water column and the transfer of heat, salt and carbon between the North Pacific and North Atlantic through the Canadian Arctic Archipelago. Results of this water mass analysis will also serve as a template for the interpretation of the distribution of trace elements and their isotopes that are measured by other researchers involved in the Geotraces program.

13.2 Methodology

pH samples (Table 13.1) were collected from the rosette using a rubber tube and stored in LDPE 125 ml bottles. While sampling the Niskin bottle, with a low water flow, the air was carefully removed from the sampling tube which was held at the bottom of the bottle. The water was then allowed to overflow at about the same volume as the bottle before the tube was slowly removed from it, in order to leave enough water at the neck of the bottle to avoid having air inside while putting the cap on or having as little air as possible. The bottle was then closed air tight. The samples were, right after the sampling, equilibrated at 25°C, in a Digital One Rte 7 temperature controlled water bath, and analyzed immediately by colorimetry, using a UV-VIS spectrophotometer, model HP 8453 from Agilent Technology, using two pH indicators: phenol red and cresol purple. The sample was poured in a 50 mm quartz cell and used to measure the blank. Absorbance measurements were taken after adding the pH indicator to the sample. The method is described in Baldo, Morris and Byrne (1985) and in Clayton and Byrne (1993). TRIS buffers, prepared in our laboratory with the method described in Millero & al (1993), of salinities 35 and 25 were used to calibrate the spectrophotometer.

Alkalinity analyses were performed by titration, using an automatic titrator, model TTT865 titration manager, titralab, from Radiometer Analytical. The samples were collected from the Niskin bottles, using a rubber tube, and, stored in 250 ml glass bottles. They were poisoned, right after they were collected, with mercuric chloride as a preservative. Apiezon grease was put on the glass stoppers before closing the bottles and they were then clipped to keep them air tight. The samples were equilibrated at 25 C in a Digital One Rte 7, controlled temperature water bath, and then, titrated with a 0.03N hydrochloric acid solution. The titrant was standardized using Dickson water, which is a reference material for oceanic CO_2 measurements, and also a reference for alkalinity measurements. The reference material was purchased from Scripps Institution of Oceanography, in La Jolla, California, USA.

Samples for ^{18}O and ^{13}C were also collected. The ^{13}C samples were collected in 30ml amber glass bottles and poisoned with mercuric chloride for preservation. The ^{18}O samples were collected in 13 ml plastic test tubes with no special treatment. Those samples will be analyzed at Geotop, UQAM further in time.

Table 13.1. List of the station samples and the type of analysis performed on each depth (Leg 3a)

Station	Position		Depths sampled (m)
	Lat(N)	Lon(W)	
407	70°59.984	126°4.124	Bot, 300, 200, 100, 70, 50, 30, 20, 10, 5, Surface
437	71°48.007	126°29.726	Bot, 200, 100, 70, 50, 30, 20, 10, 5, Surface
412	71°33.682	126°55.637	Bot, 10, Surface
408	71°17.140	127°33.310	Bot, 100, 70, 50, 30, 20, 10, 5, Surface
418	71°9.617	128°10.048	Bot, 20, 10, Surface
420	71°2.774	128°31.024	Bot, 20, 10, Surface
434	70°10.561	133°32.887	Bot, 30, 20, 10, Surface
428	70°47.413	133°41.772	Bot, 50, 30, 20, 10, Surface
472	69°36.641	138°13.495	Bot, 100, 70, 50, 30, 20, 10, 5, Surface
476	69°58.990	138°39.076	Bot, 10, Surface
482	70°31.447	139°22.240	Bot, 200, 100, 70, 53, 30, 20, 10, Surface
435	71°4.871	133°37.530	Bot, 200, 100, 70, 50, 30, 20, 10, Surface
421	71°28.124	133°53.177	Bot, 900, 600, 300, 200, 100, 70, 50, 30, 20, 10, Surface
535	73°25.024	128°11.207	Bot, 200, 100, 70, 50, 30, 20, 10, 5, Surface
554	75°44.434	126°28.416	Bot, 200, 100, 70, 50, 30, 20, 10, Surface
575	76°9.602	125°54.497	Bot, 200, 100, 70, 50, 30, 20, 10, Surface
585	74°30.029	123°14.431	Bot, 200, 100, 70, 50, 30, 20, 10, Surface
405	70°36.538	123°1.528	Bot, 400, 300, 200, 100, 70, 50, 28, 20, 10, Surface
403	70°5.975	120°5.960	Bot, 200, 100, 70, 50, 35, 20, 10, 5

Table 13.2. List of the station samples and the type of analysis performed on each depth (Leg 3b).

Station	Cast	Lat. (N)	Long. (W)	Analyses	Depth
316	80	68°23.400'	112°07.200'	pH, TA, δ13C, $\delta^{18}O$	bottom, 100, 74, 50, 30, 20, 10, surface
314	81	68°58.218'	105°28.239'	pH, TA, δ13C, $\delta^{18}O$	bottom, 41, 30, 20, 10, surface
QMG-4	82	68°29.090'	103°25.745'	$\delta^{18}O$	bottom, 50, 30, 20, 10, surface
QMG-3	83	68°19.670'	102°56.530'	$\delta^{18}O$	bottom, 30, 20, 10, surface
QMG-M	84	68°18.166'	101°44.473'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 80, 60, 40, 20, 10, surface
QMG-2	85	68°18.820'	100°48.010'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 30, 20, 10, surface
312	86	69°10.200'	100°41.979'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 40, 20, 10, surface
311	87	70°16.854'	98°31.619'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 120, 80, 50, 30, 10, surface
310W	89	71°27.572'	101°16.283'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 120, 80, 50, 30, 10, surface
307	90	74°06.606'	103°06.952'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 300, 200, 120, 80, 50, 30, 10, surface
304	93	74°14.781'	91°31.078'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 200, 120, 80, 54, 30, 10, surface
301	97	74°07.307'	83°19.183'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 500, 300, 200, 100, 75, 50, 30, 10, surface
165	99	72°42.949'	75°45.438'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 500, 300, 200, 125, 80, 50, 30, 10, surface
177	100	67°28.568'	63°47.407'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 250, 150, 80, 50, 30, 10, surface
645	107	56°42.000'	59°42.000'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 100, 70, 50, 30, 20, 10, surface
650	108	53°48.000'	55°25.800'	pH, TA, $\delta^{13}C$, $\delta^{18}O$	bottom, 150, 100, 60, 40, 20, 10, surface

13.3 Preliminary Results

Here is an example of results from pH_T and TA analysis at the station 301 (74°07.307N; 83°19.183W) (Figure 13.1). The other variables of the carbonate system, such as DIC, pCO_2, or the saturation state with respect to minerals like calcite or aragonite will be estimated using the software CO_2SYS (Pierrot et al., 2006). Results concerning $\delta^{18}O$ and $\delta^{13}C$ are not available yet, and their analysis will be performed later at Geotop.

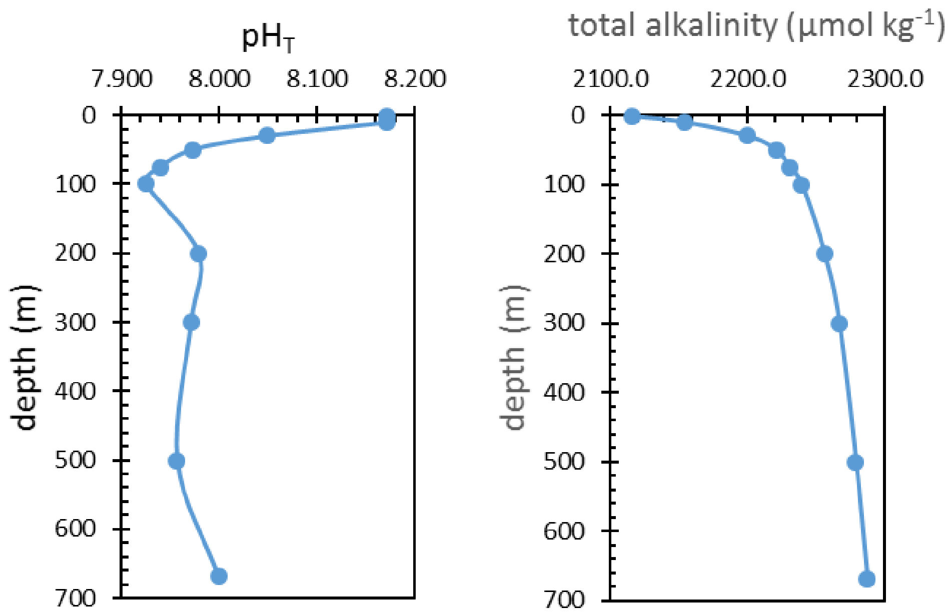

Figure 13.1. Depth profiles of pH_T and total alkalinity at the station 301.

More variables are needed to fully interpret these data, but we can already attempt to formulate some hypotheses. High pH values observed at the surface may be due to photosynthetic organisms that are taking out CO_2 from seawater and releasing O_2 through the photosynthetic reaction. Around 100 m, the pH is lower, probably due to respiration, that releases CO_2 in seawater, and we observe a small increase at the bottom of the water column. The total alkalinity depth profile indicates a homogeneous gradient, from relatively low alkalinities at the surface to high alkalinities at depth.

13.4 Comments and Recommendations

The transect schedule is made for people who just sample and store their samples for analysis that will be performed when they are back in their own lab. For those of us who have to sample, treat and analyse on board the ship, it is impossible to sample a whole transect. The tightness of the schedule denies a lot of the participants the chance to sample most of the stations of the transect besides the ones at both ends and maybe one in the middle. We understand that this type of scheduling has been used for a long time; however, as new participants are added in the group, sampling needs change, and, for those who have to process their samples on board, it is most likely impossible to sample when the transit and residence times are too short, unless they remain awake for insane amounts of time, which is against the regulation of the ship, increasing in the same time the risk of accidents. I believe that a discussion regarding this issue should take place during the next ArcticNet general meeting.

The possibility that the night sampling can be a half hour or an hour ahead of schedule makes us cut on sleep time that is especially precious during the times of intense sampling. We have to get up one and a half to two hours earlier, sometimes more, than our sampling time just in case something took less time or was cancelled while we are asleep. Since we cannot know in advance the schedule modifications that occur while we are sleeping, we think the night schedule should not be touched, as it was the case during Leg 3a last year.

14 Marine Productivity: Carbon and Nutrients Fluxes - Legs 1, 2 and 3

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14.1 Introduction

The Arctic climate displays high inter-annual variability and decadal oscillations that modulate growth conditions for marine primary producers. Much deeper perturbations recently became evident in conjunction with globally rising CO_2 levels and temperatures (IPCC 2007). Environmental changes already observed include a decline in the volume and extent of the sea-ice cover (Johannessen et al. 1999, Comiso et al. 2008), an advance in the melt period (Overpeck et al. 1997, Comiso 2006), and an increase in river discharge to the Arctic Ocean (Peterson et al. 2002, McClelland et al. 2006) due to increasing precipitation and terrestrial ice melt (Peterson et al. 2006). Consequently a longer ice-free season was observed in both Arctic (Laxon et al. 2003) and subarctic (Stabeno & Overland 2001) environments. These changes entail a longer growth season associated with a greater penetration of light into surface waters, which is expected to favoring phytoplankton production (Rysgaard et al. 1999), food web productivity and CO_2 drawdown by the ocean. However, phytoplankton productivity is likely to be limited by light but also by allochtonous nitrogen availability. The supply of allochtonous nitrogen is influenced by climate-driven processes, mainly the large-scale circulation, river discharge, upwelling and regional mixing processes. In the global change context, it appears crucial to improve the knowledge of the environmental processes (i.e. mainly light and nutrient availability) interacting to control phytoplankton productivity in the Canadian Arctic. Also, changes in fatty acid proportions and concentrations will reflect shifts in phytoplankton dynamics including species composition and size structure, and will reveal changes in marine energy pathways and ecosystem stability.

The main goals of our team for ArcticNet 2016 were to establish the horizontal and vertical distributions of phytoplankton nutrients, to measure the primary production located at the surface of the water column using O_2/Ar ratios and to assess the fatty acids concentrations in phytoplankton as well as zooplankton. The secondary objectives were to quantify biological nitrogen fluxes and primary production by doing incubations with ^{15}N tracer (nitrate assimilation and photosynthesis versus irradiance curves). Auxiliary objective was to calibrate the *ISUS* nitrate probe attached to the Rosette.

14.2 Methodology

14.2.1 *Nutrients*

Samples for inorganic nutrients (ammonium, nitrite, nitrate, orthophosphate and orthosilicic acid) were taken at all NUTRIENTS/BASIC/FULL stations (Table 14.1, Table 14.2, Table 14.3, Table 14.4) to establish detailed vertical profiles. Samples were stored at 4°C in the dark and analyzed for nitrate, nitrite, orthophosphate and orthosilicic acid within a few hours on a Bran+Luebbe AutoAnalyzer 3 using standard colorimetric methods adapted for the analyzer (Grasshoff et al. 1999).

14.2.2 *Ammonium*

Additional samples for ammonium determination were taken at all Full stations for leg 1, all Basic stations for Leg 3, and at stations where incubations were performed. Ammonium samples were processed immediately after collection using the fluorometric method of Holmes et al. (1999).

A quadrupole mass spectrometer (PrismaPlus, Pfeiffer Vacuum) was used to measure the dissolved gases (N_2, O_2, CO_2, Ar) coming for the underway seawater line located in the 610 laboratory. O_2 to Ar ratios will later be analyzed to measure primary production that occurred up to 10 days prior of the ship's passage in all the areas visited.

During Leg 1, samples for measuring phytoplankton pools of inorganic nutrients were taken at all FULL stations. To do so, 1L of seawater collected at the surface and SCM was filtered through a pre-combusted GF/F filters. Boiled MilliQ water was then added to the filters and nutrient concentration was determined with the Auto-Analyzer.

To determine NO_3^- uptake rates and primary production, water samples from the surface were incubated with different concentrations of nitrate (0.1 and 10 µM) along with ^{15}N and ^{13}C tracers. The bottles were then incubated for 24 h using on deck incubator. After 24 h, the water samples were filtered through a pre-combusted GF/F filters and the filters dried for 24 h at 60°C for further analyses. Nutrients at T_0 and T_{end} were measured with the Auto-Analyzer.

Additional water samples from surface were incubated during 6 h using temperature and light controlled incubators (two modules) to establish the relation between photosynthesis and irradiance. The first module was set at the same temperature as the surface water while the second module was set at T° + 5. Spikes of ^{13}C and ^{15}N were added to each bottle. Other nutrients (phosphate and silicate) were also added to the bottles to prevent a limitation from these nutrients during the incubation period. Incubations were then terminated by filtration through a pre-combusted GF/F filters and stored for further analyses. Isotopic ratios of nitrogen and carbon from all GF/F filters will be analyzed using mass spectrometry at the home laboratory.

During legs 2 and 3, in order to examine the potential effects of environmental conditions (e.g. acidity, alkalinity, free $C0_2$) on energy transfer through the food chain, we realized at Full and Basic stations, 3L filtrations in duplicate from surface and SCM water with pre-combusted GF/C, to analyse the lipids composition, which is the densest form of energy, in particulate organic matter (POM). Samples of 100 mg to 1000 mg of earlier and adult stage of copepods were also realized and stored on GF/F filters at -80°C to aims our objectives. Moreover, the pH at surface and SCM was measured by spectrophotometry using red phenol and cresol purple colorants. Additional 500 ml samples from both depths were used to determine the alkalinity of water. Most of the samples were analyzed on board before the end of the cruise (leftover samples will be analyzed soon at McGill University). Urea samples from surface and SCM were also collected and analyzed at incubation stations using spectrophotometry.

Water samples from the surface were incubated with ^{15}N and ^{13}C tracers to determine nitrate, ammonium and urea uptake rates and primary production. To do so, 600 mL samples were incubated for 24h using on deck incubator. After 24h, the water samples were filtered through a pre-combusted GF/F filters and the filters were dried for 24 h at 60 °C for further analyses. Filtrate samples from ammonium uptake were also kept to determine nitrification and regeneration rates. Finally, POC/PN, POP, BSi filtrations on GF/F filters were also done at surface and SCM. Isotopic ratios of nitrogen and carbon from all GF/F filters will further be analyzed using mass spectrometry.

Table 14.1. List of sampling stations and measurements during leg 1

Date	Station	Type	Nutrients	Ammonium	Natural abundance	Internal pool	Nitrate uptake	PI incubation
09-06-2016	G100	Full	x	x	x	x	x	x
10-06-2016	G101	Nut	x					
10-06-2016	G102	Full	x		x			
10-06-2016	G104	Basic	x	x		x	x	
10-06-2016	G103	Nut	x					
11-06-2016	G106	Nut	x					
11-06-2016	G107	Full	x	x	x	x	x	x
12-06-2016	G109	Nut	x					
12-06-2016	G110	Full	x	x				
13-06-2016	G112	Nut	x					
13-06-2016	G115	Full	x	x	x	x	x	x
14-06-2016	G200	Nut	x					
14-06-2016	G201	Full	x	x	x	x	x	x
15-06-2016	G203	Nut	x					

15-06-2016	G204	Full	x	x	x	x		x
16-06-2016	G206	Nut	x					
16-06-2016	G207	Full	x	x	x	x	x	x
16-06-2016	G209	Nut	x					
16-06-2016	G211	Nut	x					
17-06-2016	G3000	Nut	x					
17-06-2016	G300	Full	x	x	x	x	x	x
18-06-2016	G302	Nut	x					
18-06-2016	G303	Basic	x					
18-06-2016	G305	Nut	x					
18-06-2016	G308	Nut	x					
18-06-2016	G309	Basic	x					
19-06-2016	G310	Basic	x					
19-06-2016	G312	Full	x	x	x	x	x	x
19-06-2016	G313	Nut	x					
20-06-2016	G315	Basic	x					
20-06-2016	G317	Nut	x					
20-06-2016	G318	Full	x	x	x	x	x	
21-06-2016	G320	Nut	x					
21-06-2016	G321	Basic	x					
21-06-2016	G323	Nut	x					
21-06-2016	G324	Full	x	x	x	x	x	x
22-06-2016	G325	Nut	x					
22-06-2016	DIC1	Nut	x					
22-06-2016	DIC2	DIC	x					
24-06-2016	G400	Basic	x					
25-06-2016	G402	Nut	x					
25-06-2016	G403	Full	x	x	x	x	x	x

26-06-2016	G405	Nut	x					
26-06-2016	G406	Basic	x					
26-06-2016	G408	Nut	x					
26-06-2016	G409	Full	x	x	x	x	x	
27-06-2016	G411	Nut	x					
27-06-2016	G412	Basic	x					
27-06-2016	G414	Nut	x					
27-06-2016	G413/1	Full	x		x	x	x	x
27-06-2016	G413/2	Full	x	x				
28-06-2016	G418	Full	x	x	x	x	x	x
29-06-2016	G417	Nut	x					
29-06-2016	G420	Nut	x					
29-06-2016	G500	Basic	x					
30-06-2016	G502	Nut	x					
30-06-2016	G503	Basic	x					
30-06-2016	G505	Nut	x					
30-06-2016	G507	Full	x	x	x	x	x	x
30-06-2016	G506	Basic	x					
01-07-2016	G509	Nut	x					
01-07-2016	G510	Basic	x					
01-07-2016	G512/1	Nut	x					
01-07-2016	G512/2	Full	x	x	x	x	x	x
01-07-2016	G514	Nut	x					
02-07-2016	G515	Basic	x					
02-07-2016	G517	Nut	x					
02-07-2016	G519	Full	x	x	x	x	x	x
03-07-2016	G521	Nut	x					
03-07-2016	G600	Full	x	x	x	x	x	x

04-07-2016	G602	Nut	x					
04-07-2016	G603	Basic	x					
04-07-2016	G605/1	Nut	x					
04-07-2016	G605/2	Full	x	x	x	x	x	
05-07-2016	G615	Full	x	x	x	x	x	x
06-07-2016	G613	Nut	x					
06-07-2016	G612	Basic	x					
06-07-2016	G610	Nut	x					
06-07-2016	G604,5	Full	x	x		x	x	
06-07-2016	G607	Nut	x					
07-07-2016	G608	Basic	x					
07-07-2016	G609	Nut	x					
07-07-2016	G617	Nut	x					
07-07-2016	G618	Basic	x					
07-07-2016	G703	Full	x	x	x	x	x	x
08-07-2016	G700	Basic	x					
08-07-2016	G701	Nut	x					
08-07-2016	G705	Nut	x					
08-07-2016	G707	Full	x	x	x	x	x	x
09-07-2016	G708	Nut	x					
09-07-2016	G711	Nut	x					
09-07-2016	G713	Full	x	x	x	x	x	x
10-07-2016	G715	Nut	x					
10-07-2016	G716	Basic	x					
10-07-2016	G718	Nut	x					
10-07-2016	G719	Full	x	x	x	x	x	x

Table 14.2. List of sampling stations and measurements during Leg 2b

Station	NO_3, NO_2, Si, PO_4	NH_4	Urea (surface and SCM only)	CHN, POP, BSi, Fatty acids (phyto), Fatty acids (zoo)	pH, Alkalinity 15N-tracers uptake experiments
176	X	X	X	X	X
ROV6	X				
ROV7	X				
180	X				
181	X				
174	X				
173	X				
FB4	X				
ROV1	X				
ROV5	X				
169	X	X	X	X	X
170	X				
171	X				
172	X				
166	X	X	X	X	X
160	X				
325	X				
324	X				
323	X	X	X	X	X
300	X				
322	X				
115	X	X	X	X	X
113	X				
111	X				
ROV2	X				
179	X				
177	X	X	X	X	X
178	X				
138b	X				
116	X	X	X	X	X
110	X				
108	X	X		X	X
107	X				
105	X	X			
103	X				
101	X	X	X	X	X
TS233	X	X	X	X	X

Station	NO_3, NO_2, Si, PO_4	NH_4	Urea (surface and SCM only)	CHN, POP, BSi, Fatty acids (phyto), Fatty acids (zoo)	pH, Alkalinity 15N-tracers uptake experiments
TS233CASQ	X				
139	X	X	X	X	X
KANE1	X	X	X	X	X
134	X				
136	X				
133	X	X		X	X
KANE5	X				
127	X	X	X	X	X
119	X	X		X	X
AllenBay	X			X	X
305	X	X	X	X	X
306	X			X	X
310[E]	X	X	X	X	X
311	X			X	X
312	X			X	X
QMGM	X	X	X	X	X
QMG2	X				
QMG1	X	X			
QMG3	X				
QMG4	X			X	X
314	X	X	X	X	X
316	X	X			

Table 14.3. List of sampling stations and measurements during Leg 3a.

Stations	NO3, NO2, Si, PO4	NH4	Urea (surface and SCM only)	CHN, POP, BSi, Fatty acids, pH, Alkalinity	^{15}N-tracers uptake	NO_3 isotopes
407	X	X		X		
437	X	X				
410	X					
412	X					
414	X					
408	X	X	X	X	X	
418	X					
420	X	X				
434	X	X	X	X	X	

432	X					
430	X					
428	X					
426	X					
424	X					
472	X	X			X	
470	X					
474	X					
476	X					
478	X					
480	X					
482	X	X	X	X	X	
435	X	X	X	X	X	
421	X	X				
535	X	X				
554	X	X				
575	X	X				
577	X					
579	X					
581	X					
583	X					
585	X	X				
545	X					
525	X					
405	X					
406	X					
403	X					
402	X					

Table 14.4. List of sampling stations and measurements during Leg 3b

Stations	NO3, NO2, Si, PO4	NH4	Urea (surface and SCM only)	CHN, POP, BSi, Fatty acids, pH, Alkalinity	^{15}N-tracers uptake	NO_3 isotopes
316	X	X		X		
314	X	X	X	X	X	
QMG4	X	X				
QMG3	X	X				
QMGM	X	X		X		
QMG2	X	X				
312	X	X		X		
311	X	X		X		
310E	X	X	X	X	X	
310W	X	X		X		

307	X	X	X	X	X	
364	X					
304	X	X		X		
345	X					
344	X					
343	X					
301	X	X	X	X	X	
165	X	X	X	X	X	
Ice Island	X					
177	X	X	X	X	X	X
640	X	X	X	X	X	X
645	X			X		X
650	X	X	X	X	X	X

Collaboration

During Leg 1, collaboration with the MIO, Marseille (Nicole Garcia and Pierre Coupel) for ammonium measurements and nitrate assimilation incubations.

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15 Biogenic Elements, Primary Production and Nitrogen Cycle (^{13}C/^{15}N productions) – Leg 1

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Cruise participants - Leg 1a: Nicole Garcia[1]
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15.1 Introduction

The objectives of this project are to:

- Determine the distribution of biogenic elements C/N/P.
- Determine the new and regenerated primary production (NH_4, NO_3) (double labeling ^{13}C and ^{15}N) at different levels of the euphotic layer, associated with the contents of particulate and dissolved organic matter.
- Quantify ammonium regeneration and nitrification (^{15}N marking).

15.2 Methodology

- 13 Full stations were sampled during Leg 1a and 15 full stations during Leg 1b.
- 1 ice station was sampled during Leg 1a and 5 during Leg 1b.
- Rosette samples :
  - NH_4
  - MOT
  - 5L jerrican at each depth
- From the jerrican :
  - 18 production flasks
  - inoculation with tracers
  - incubation with simulated depth's light

* The depths were determined before each cast by studying the fluorescence and PAR/licor profiles of the preceding cast. In Leg 1b, the depths of samples were determined by the IOP/AOP measurements made a few hours before the rosette by Edouard Leymarie rather than by the PAR/Licor measures of the rosette. At the ice stations, light measurements were taken under the ice.

- Samples of 6x1L for the MOP and filtrations.
- Samples of 3x20ml for SN, filtration and fixation for conservation.

Table 15.1 and Table 14.2 shows the sampling operations during Leg 1a and Leg 1b

Table 15.1. Sampling Leg 1a

Parameters	Treatment	Analysis	st100 cast4	st102 cast7	st107 cast13	st 110 cast18	st115 cast25	st115 ice	st201 cast29	st204 cast34	st207 cast40	st300 cast49	st309 cast58	st312 cast66	st318 cast73	st324 cast81	Total
Ammonium (T_0 and T_{24}h)	Measure on board	Fluorimeter on board	12	12	12	12	12	2	22	12	12	20	12	12	12	12	176
Total organic matter	20 ml sample	Automatic analyzer AA3 Axflow	10	10	6	6	12	1	11	6	6	10	6	6	6	6	102
Nutrients (3 flasks NO_2/NO_3/PO_4-$SiOH_4$-Urea)	3 samples of 20ml	Automatic analyzer AA3 Axflow	30	36	18	18	36	4	22	18	18	26	18	18	18	18	298
Particulate organic matter (6 filters +1 blank-filter)	1L sample then filtration	Automatic analyzer AA3 Axflow	7	7	7	7	7	1	7	7	7	11	7	7	7	7	96
$^{13}C/^{15}NO_3$ Production	0.6L sample, incubation 24h, 6 levels of light then filtration	Mass spectrometer Sercon	6	6	6	6	6	1	10	6	6	6	6	6	6	6	83
$^{13}C/^{15}NO_4$ Production	0.6L sample, incubation 24h, 6 levels of light then filtration	Mass spectrometer Sercon	6	6	6	6	6	1	10	6	6	6	6	6	6	6	83
$^{13}C/^{15}$Urea Production	0.6L sample, incubation 24h, 6 levels of light then filtration	Mass spectrometer Sercon	6	6	6	6	6	1	0	6	6	6	6	6	6	6	73

$^{15}NO_4$ Regeneration	recovery of incubation filtrates 250 ml for 6 depths	Mass spectrometer Sercon	6	6	6	6	6	1	10	6	6	6	6	6	6	6	83
$^{15}NO_3$ Nitrification	recovery of incubation filtrates 250 ml for surface	Mass spectrometer Sercon	1	1	1	1	1	1	2	1	1	1	1	1	1	1	15

Table 15.2. Sampling Leg 1b

Station	403	403	403	409	409	413	413	418	507	512	519	519	600	600	605	615	604.5	703	707	713	719	
Cast	90	90	ice	98	Ice	408	Ice	111	124	135	144	Ice	148	Ice	156	160	168	176	184	193	202	Total
Ammonium (T_0 and T_{24}h)	12	14	2	12	2	10	3	12	12	14	9	2	10	2	11	12	12	6	12	12	12	181
Total organic matter	10	6	1	6	3	5	1	6	6	6	3	4	5	3	5	6	6	3	6	6	6	93
Nutrients (3 flasks NO_2/NO_3/PO_4-$SiOH_4$-Urea)	30	18	3	18	9	15	6	18	18	18	9	12	15	12	15	18	18	9	18	18	18	285
Particulate organic matter (6 filters +1 blank-filter)	7	7	2	7	3	6	1	7	7	7	3	4	6	3	6	7	7	4	7	7	7	108
^{13}C/$^{15}NO_3$ Production	6	8	1	6	1	5	1	6	6	7	6	0	5	0	6	6	6	3	6	6	6	91
^{13}C/$^{15}NO_4$ Production	6	8	1	6	1	5	1	6	6	7	6	0	5	0	6	6	6	3	6	6	6	91
^{13}C/^{15}Urea Production	6	8	1	6	1	5	1	6	6	6	6	0	5	0	5	6	6	3	6	6	6	89
$^{15}NO_4$ Regeneration	6	8	1	6	1	5	1	6	6	7	6	0	5	0	6	6	6	3	6	6	6	91
$^{15}NO_3$ Nitrification	1	1	1	1	1	1	1	1	1	1	1	0	1	0	2	1	1	1	1	1	1	19

15.3 Preliminary Results

Only ammonium measurements were made on board. The fluorimeter was calibrated daily with deep water free of ammonium (13 standards/day). Measurements of dissolved, total organic and particulate mineral matter will be made in the laboratory with an AA3 AXFLOW self-analyzer, using the wet oxidation method for organic matter. ^{13}C-^{15}N tracer incorporation measurements and characterization measurements of particulate matter will be performed with a SERCON mass spectrometer.

Some samples will be brought back at the end of the leg:

- Particulate organic matter (1 box of 20cm x 10cm of 96 2ml glass tubes containing dried filters of seawater: no chemicals or dangerous materials)
- Nitrogen production (3 boxes of 20cm x 10cm of 96 2ml glass tubes containing dried seawater filters: no chemicals or dangerous substances)
- Other samples (Nutrient Salts, Filtrates, Total Organic Matter will be landed at the end of Leg 1b at Iqaluit, brought back to Quebec, stored at 5°C and sent to France with the material in October)

15.4 Comments and Recommendations

Set up temperature and flow monitoring of the incubation tanks at the beginning of the mission to avoid uncertainties about the incubation conditions. Thanks to the machine and deck team who helped with the installation and improvements.

<u>Collaboration</u>

Collaboration with Jean-Éric TREMBLAY, Laval University, Pierre COUPEL, CDD MOI

16 Biogeochemistry of the Inorganic Carbon Cycle – Leg 3

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16.1 Introduction

The primary objective is to characterize the marine carbonate system at the stations sampled during this expedition. Dissolved inorganic carbon (DIC) and total alkalinity (TA) have been chosen, since for these two parameters certified reference materials are available, which are used internationally to warrant quality and comparability in time and space of the data. From these parameters, all relevant species of the carbonate system can be computed, anchored to the reference material. The data will be used to investigate carbonate system and pH conditions of water masses encountered at the sampled stations, especially investigating the Mackenzie Shelf region. Furthermore the data complement data from earlier expedtions into the region, e.g., CFL and ArcticNet, carried out by Dr. Alfonso Mucci's and Dr. Lisa Miller's groups, which will facilitate investigations of the spatiotemporal variability of the carbonate system and ocean acidification.

16.2 Methodology

Rosette sampling for DIC and TA was conducted in vertical profiles at all stations as shown in Table 16.1. DIC and TA samples were poisoned with 250µl saturated $HgCl_2$ solution and stored in the dark at 4°C to await analysis at Dalhousie University. DIC will be determined by coulometric titration and TA determined by potentiometric titration from the same sample simultaneously.

Table 16.1. Station locations and sample dates for dissolved inorganic carbon (DIC) and alkalinity (TA) samples.

Station	Latitude	Longitude	Date Sampled
407	70° 59' 94" N	126° 04' 65" W	28 August 2016
437	71° 47' 98" N	126° 29' 74" W	28 August 2016
412	71° 33' 83" N	126° 55' 57" W	29 August 2016
408	71° 17' 19" N	127° 33' 14" W	29 August 2016
418	71° 09' 63" N	128° 10' 09" W	30 August 2016
420	71° 02' 84" N	128° 31' 09" W	30 August 2016
434	70° 10' 60" N	133° 32' 89" W	30 August 2016
432	70° 23' 63" N	133° 36' 43" W	30 August 2016
428	70° 47' 42" N	133° 41' 74" W	30 August 2016
472	69° 36' 63" N	138° 13' 57" W	2 September 2016
470	69° 25' 79" N	137° 59' 54" W	2 September 2016
474	69° 47' 81" N	138° 26' 45" W	2 September 2016
476	69° 59' 09" N	138° 39' 11" W	2 September 2016
478	70° 10' 00" N	138° 54' 21" W	2 September 2016
482	70° 31' 51" N	139° 22' 38" W	3 September 2016
435	71° 04' 76" N	133° 37' 83" W	5 September 2016
421	71° 28' 13" N	133° 53' 95" W	5 September 2016
535	73° 25' 00" N	128° 11' 30" W	8 September 2016
554	75° 44' 46" N	126° 28' 59" W	10 September 2016
575	76° 09' 66" N	125° 54' 80" W	10 September 2016
585	74° 29' 99" N	123° 14' 67" W	12 September 2016
545	74° 10' 70" N	126° 49' 40" W	13 September 2016
405	70° 36' 56" N	123° 01' 83" W	15 September 2016
1402	70° 32' 89" N	117° 38' 05" W	16 September 2016
316	68° 23' 30" N	112° 07' 39" W	18 September 2016
314	68° 58' 20" N	105° 28' 27" W	19 September 2016
QMG4	68° 29' 20" N	103° 26' 35" W	19 September 2016
QMG3	68° 19' 67" N	102° 56' 42" W	19 September 2016
QMGM	68° 18' 44" N	101° 45' 00" W	19 September 2016
QMG2	68° 18' 82" N	100° 47' 95" W	19 September 2016
312	69° 10' 28" N	100° 41' 89" W	20 September 2016
310E	70° 49' 89" N	099° 04' 36" W	21 September 2016
307	74° 05' 89" N	103° 02' 39" W	22 September 2016
304	74° 14' 65" N	091° 30' 72" W	24 September 2016
301	74° 07' 28" N	083° 19' 08" W	25 September 2016
165	72° 42' 70" N	075° 45' 61" W	26 September 2016
177	67° 28' 57" N	063° 47' 46" W	28 September 2016

17 Silicon Cycle during the Spring Phytoplankton Bloom in Baffin Bay

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17.1 Introduction

Diatoms are an important component of phytoplankton in phytoplankton blooms of polar waters. In Baffin Bay, their importance has been stressed by fieldwork conducted during the NOW experiment (Michel *et al.*, 2002, Tremblay *et al.*, 2002). However, the complete silicon cycle has not been described hitherto and this was the goal of our present study. We aim at documenting the complete silicon cycle in the seasonal receding sea-ice zone by complementary tools enabling quantification of stocks (silicic acid, lithogenic, and biogenic silica), fluxes (biogenic silica production and silicic acid regeneration or dissolution), and estimation of diatom activities at the community level (silicic acid uptake kinetic parameters) and species-specific level (Figure 17.1).

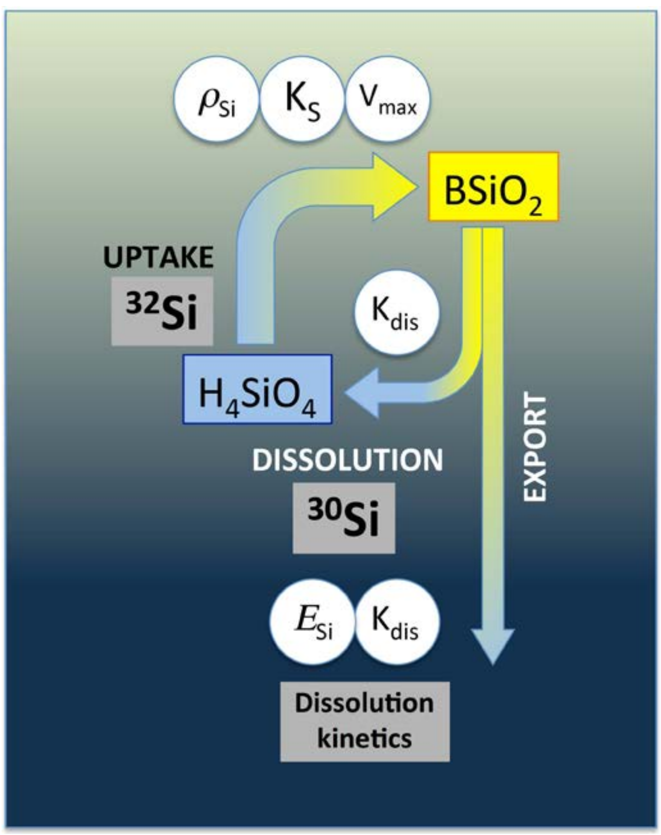

Figure 17.1. Scheme of the processes affecting the silicon cycle in the pelagic domain, together with specific methods used for quantifying silicon fluxes and stocks.

17.2 Methodology

17.2.1 *Silica Distribution*

Sampling for particulate and dissolved silica was done at 10 to 15 water depths during 'full stations', in the 10 last centimeters at the bottom of the ice when ice operations were possible, in sediment traps and in sediments. For water sampling, 100 mL to 1 L seawater (according to the seawater particulate load) were filtered onto 0.6 µm 47 mm polycarbonate membranes, then placed in eppendorf tubes and allowed to dry at 60°C overnight. Filtrates were stored at 4°C until analysis in Brest. Ice cores were sliced between 0 and 3 cm and between 3 to 10 cm. 5 to 10 cores were pooled and melted in 4 to 6 litres of 0.2µm-filtered seawater sampled on the previous nutrient station. Ice melted in 24 to 48 h, and 500 ml were filtered for bSiO2 and dissolved silica. Traps were recovered at the end of Leg 1b, particulate silica will be one of the core parameters (collaboration with C. Lalande). For sediment samples, sediment cores were sliced and split in between different core parameters, of which biogenic silica (collaboration N. Morata). At the laboratory, biogenic and lithogenic silica measurements will be made following the triple extraction procedure of Ragueneau *et al.* (2005) and dissolved silica will be measured using the protocol described in the same study.

17.2.2 *Biogenic Silica Production by the ^{32}Si Method*

Sampling for silica production was done at 5 to 7 photometric levels during every 'full stations", including the bottom of the ice. 170 mL of seawater were sampled in polycarbonate bottles then inoculated with 40 µL of an $H_4{}^{32}SiO_4$ solution (12 334 Bq mL^{-1}). After tracer addition samples were placed for 24 h in a deck board incubator cooled with circulating surface seawater and covered with neutral density screens to simulate the photometric depths of collection. At the end of incubation samples were filtered onto 0.6 µm 47 mm polycarbonate membranes, which were then rinsed with filtered seawater (0.2 µm), and stored in plastic scintillation vials for radioactivity counting back in the laboratory.

Different kinetic uptake experiments have been done during the two legs. For each, six to eight 170 mL samples, collected at the Subsurface chlorophyll maximum, received increasing H_4SiO_4 additions. These samples were spiked with ^{32}Si, like samples for silica production rate measurements, and incubated over 8 h to 24 h in deck incubators covered with appropriate light screens. After incubation, samples were filtered and stored as described for samples for silica production rate measurements. Growth limitations have been tested simultaneously by adding different nutrients ($Si(OH)_4$ and All nutrient) to some of the samples, or by incubating them at different light conditions (ice light profile vs water light profile).

17.2.3 *Biogenic Silica Production and Dissolution by the ^{30}Si Method*

Sampling for silica dissolution was done at 3 photometric levels during some 'full stations'. We followed the isotopic dilution technique of Fripiat *et al.*, (2009) adapted from Corvaisier *et al.* (2005), which enables to simultaneously measure the rates of silica production and biogenic silica dissolution in the same seawater sample. After spiking with a solution enriched in ^{30}Si, samples are incubated and the production rate is estimated from the change in isotopic composition of the particulate phase (increase in ^{30}Si), while the isotopic dilution (increase in ^{28}Si) in the ^{30}Si enriched seawater is used to derive the dissolution rate. For each depth, 5 L of seawater were sampled. One liter was subsampled and immediately filtered through 0.6 µm 47 mm polycarbonate membranes to obtain natural silicon isotopic ratios in the particulate and the dissolved phases (filtrate). The membranes were dried at 60°C overnight and the filtrate was directly preconcentrated (see below). The remaining seawater volume was subsampled in two 2L aliquots spiked with $H_4{}^{30}SiO_4$-enriched solution. One aliquot, devoted to production measurements, was spiked with a spike contribution representing less than 10% of natural concentrations to minimize the perturbation (Nelson and Goering, 1977a). In order to improve the method's dissolution detection limit, a second 2L aliquot was spiked by adding the same amount of $H_4{}^{30}SiO_4$ as natural silicic acid. Immediately after spike addition and gentle mixing, 1L of each aliquot was filtered through 0.6 µm 47 mm polycarbonate membranes to obtain initial (t_0) silicon isotopic ratios in the particulate and the dissolved phases (filtrate). The remaining 1L of each aliquot was poured into polycarbonate incubation bottles and placed respectively for 24 h (10% spiked samples) and 48 h (100% spiked samples) in a deck board incubator cooled with circulating surface seawater and covered with neutral density screens to simulate the photometric depths of collection. At the end of incubation, samples were filtered and treated as described above to characterize the final conditions of the incubation (t_{24} or t_{48}). Preconcentration of H_4SiO_4 in the filtrates (for both production and dissolution measurements) was made on board using a protocol adapted from the MAGIC method (Karl and Tien, 1992; Reynolds et al., 2006). The H_4SiO_4 of seawater was scavenged by the brucite precipitate ($Mg(OH)_2$) obtained by adding 1mL of 14M NaOH to the 1L of seawater sample in a separatory funnel and stirring strongly. The precipitate was recovered by decantation and centrifugation, then dissolved in 4.5 mL of 3N HCl, and stored in polyethylene vials for further treatment at the laboratory (mass spectrometer for determination of the different isotopic ratios).

17.2.4 *Diatom Species-Specific Silicic Acid Deposition Assessed by the PDMPO Method*

[2-(4-pyridyl)-5{[4-dimethylaminoethyl-aminocarbamoyl)-methoxy]phenyl}oxazole], or PDMPO (Lysosensor™ Yellow/Blue DND-160), selectively binds to polymerizing silica and emits an intense fluorescence under ultraviolet (UV) excitation wherever newly formed silica is deposited (Shimizu *et al.*, 2001). Following the protocol developed by Leblanc & Hutchins (2005), 170 mL of seawater were sampled (at the same depths as for ^{30}Si incorporations) in polycarbonate bottles then inoculated with 210 µL of a PDMPO solution (1 mM solution in DMSO diluted ten times just prior to spiking). After tracer addition spiked samples and not spiked blanks (controls) were placed for 24 h in a deck board incubator cooled with circulating surface seawater and covered with neutral density screens to simulate the photometric depths of collection. At the end of incubation spiked 100 mL of samples were filtered onto 0.6 µm 47 mm polycarbonate membranes, the placed in 15 mL TPX (polymethylpentene) tubes and silica extraction was performed by addition of 200 µL of 2.5N HF. After 1 hour extraction, 2.8 mL saturated H_3BO_3 were added and fluorescence was measured with a Turner Trilogy fluorometer after excitation by UV light (a complete calibration curve was also prepared and measured on board in the same conditions). The remaining 70 mL were centrifuged two times at 3000 rpm for ten minutes and the final pellet was resuspended in 10 mL absolute methanol, then placed into polyethylene vials stored at 4°C for further processing (microscopic slides preparation and examination) at the laboratory. The non-spiked control was treated the same way except that the remaining 70 mL were preserved by 0.4 mL of a Lugol solution for further counting and taxonomic identification at the laboratory.

17.2.5 *Particle Formation*

At four different full stations of Leg 1b, the aggregation ability of the phytoplankton community has been tested by incubating the water from the chlorophyll maximum in 3 to 12 roller tank. Roller tank were then incubated in the dark in a cold room, on a roller table at the speed of 2 rotation per minutes following the method by Shanks and Edmondson (1989) to promote aggregation. As soon as aggregates formed their orbital trajectory were recorded to measure their sinking rates (Ploug et al. 2010). Once the size spectrum stabilized, their number and size were assessed by taking a picture of the roller tank content after settling of aggregates to the bottom of the tank. Once the picture taken, the aggregates were carefully sampled with some water and filtration of aliquots were used to measure their silica and carbon content and their species composition.
Following the aggregation experiment on the diatom *Melosira*, 18 copepods *Calanus borealis* have been added to one of the tank to assess the impact of large copepods on particle size spectra. The change in the particle size spectrum and particle sinking rates have been monitored everyday using a video camera. Biovolume, biochemical composition, phytoplankton composition and the amount of fecal pellets produced will be measured back at the laboratory of LEMAR (Brest).

Full stations sampled during Leg 1a and 1b for 30Si and PDMPO analysis:
- Leg 1a: 100, 102, 110, 115, 204, 207, 300, 309 and 318
- Leg 1b: 403, 409, 418, 507,512,600, 615,700,707 and 713

17.3 Preliminary Results

For production and biomass, the work on board consisted mainly in filtrations for particulate silica samples and incubations using the tracers (^{32}Si, ^{30}Si, and PDMPO). Sample treatment will be performed at the laboratory and no preliminary result is available at present.

However, we had preliminary results on aggregation, showing that microzooplankton tend to decrease aggregation. Moreover, we only observed consistent aggregation when diatoms dominated the phytoplankton community, which happens mainly under the ice with the species Melosira. Phaeocystis bloom also led to some aggregation, but the particles formed were smaller more fragile and less dense than those formed from the melosira. Moreover, the presence of large copepods such as calanus borealis strongly decreased the size of the aggregates, but to understand the impact on fluxes, composition and sinking rates still need to be measured.

<u>Collaboration</u>

The different methods used will enable to quantify the complete silicon cycle, for silicon export the cycle is completed by sampled obtain from Catherine Lalande and Nathalie Morata. It will be particularly interesting to derive stoichiometric ratios from analyses performed for C and N production and stock quantification (collaboration with J.-E. Tremblay and P. Raimbault). This will give information on the coupling between the different biogeochemical cycles and should enable to examine, together with the Si kinetic experiments, the potential/actual limitation of diatom growth by nitrogen and/or silicon. Also of interest will be a collaboration with teams involved in biodiversity analyses (species succession and nutrient limitations).

18 Atmospheric Inputs, Quality of the Organic Matter and Photo-Oxydation – Leg 1b

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18.1 Introduction

This study will be integrated within the two following tasks of the GreenEdge project:

Workpackage 2: spring bloom dynamics

- Estimation of particulate organic matter quality (sugar analyses) during and after the bloom.
- Estimation of photodegradation state of phytoplankton during and after the bloom.

Workpackage 3: related carbon transfer through the food web and toward the bottom

- Estimation of the quality of the organic matter in the atmosphere, sea ice, and the water column.

Our study aims to assess for the first time the quality of organic matter in all kind of samples (atmospheric samples, ice samples, dissolved & particulate samples) in terms of "labile" organic compounds (sugars, dicarboxylic acids) including some persistent pollutants (phthalates) only for atmospheric samples before or during the diatom bloom. The contribution of these compounds to the total organic carbon will also evaluated. Previous investigations showed that primary saccharides were found to be dominant organic compound class in organic aerosols (0.91-112 ng m^{-3}) during the MALINA cruise but they have never been reported in ice samples or ices melted samples (Fu et al., 2013) in the broader arctic area. Other studies (MacKenzie river margin) showed a rather uniform distribution of carbohydrate in the surface waters in summer (Panagiotopoulos et al., 2014) but no data currently exist in the carbohydrate component of POM and DOM before or during diatoms bloom. Our study aims to provide further information on the organic matter composition (in trems of its specific components) and evaluate its contribution to the organic carbon pool.

- Estimation of photodegradation state of phytoplankton in the water column and their attached bacteria.
- Estimation of the contribution of sea ice diatoms to sinking and suspended particles.

The fate of marine organic matter (OM) involves a range of biotic and abiotic degradation processes which can be especially important for determining the nature and extent of removal of phytodetritus both prior to, and following, burial in the sedimentary environment (Wakeham and Lee, 1989; Wakeham and Canuel, 2006). Abiotic degradation processes have received less attention than their biologically-mediated (heterotrophic) counterparts and fall into two main categories: photooxidation and autoxidation (free radical degradation). It has been demonstrated that the efficiency of direct photochemical processes (e.g. chlorophyll photodegradation) decreases with temperature (SooHoo and Kiefer, 1983). The efficiency of Type II photosensitized processes in senescent phytoplanktonic cells seems to be limited mainly by two factors: (i) the diffusion rate of $^1O_2$ outside biological membranes and (ii) the photodegradation of the sensitizer (chlorophyll). Decrease in the diffusion rate of $^1O_2$ (Ehrenberg et al., 1998) and of the rate of photodegradation of chlorophyll (SooHoo and Kiefer, 1983) generally observed at low temperatures should thus favour photosensitizing effects in Arctic phytodetritus. This assumption is in agreement with our recent observations in vitro (Amiraux et al., 2016). The first objective is to investigate the photodegradation of phytodetritus at low-temperature and low irradiance. The second objective is to investigate the bacterial stress induced by (1) the transfer of $^1O_2$ from phytoplankton, (2) salinity stress induced by ice melting in order to evaluate the impact on algal material preservation.

18.2 Methodology

18.2.1 *Photoxidation*

- Filtration on GFF 24mm of ice melted and water column (7).
- Samples from box cores (firsts centimeters).

18.2.2 *Microbioloy*

- Use of propidium monoazyde (Viability) on 0,2 (free bacteria) and 0,8 micrometer nucleopore filters (attached bacteria).
- Filtration on 0,2 and 0,8 for bacterial stress.

18.2.3 *Sugar*

- Sampling of the sugar in ice cores (0-3, 3-6 and 6-10 cm) and the water column at 10 different depths.

18.2.4 *DOC*

- Sampling of the DOC in ice cores (0-3, 3-6 and 6-10 cm) and the water column at 10 different depths.

18.2.5 *Aerosol Sampling*

- Aerosol was sampled with a high volume vacuum sampler (TISH) at the 30 cubic feet meters during cycle of 48h.

Table 17.1, Table 17.2 and Table 17.3 shows the synopsis of samplings

Table 18.1 Samplings Synopsis (1/3)

						Photo-oxydation							
Cast	Date	Lattitude	Longitude	TOC	DOC	1	2	3	4	5	6	7	Box core
#G403/89	2016-06-25	68°1,870	61°36,062	X	X	80	40	30	20	10 DCM	5	0	X
#G409/97	2016-06-26	68°6,349	59°59,665	X	X	100	40	30	20 DCM	15	10	0	X
#G413/107	2016-06-27	68°7,350	58°57,970	X	X	60	40	30 DCM	20	15	10	0	
#G418/110	2016-06-28	68°6,856	57°46,182		X								X
#G507/123	2016-06-30	70°0,546	59°7,469		X	80	30	20	15	10 DCM	5	0	
#G512/134	2016-07-01	70°0,164	60°21,902		X	100	30	25	20	15 DCM	10	0	
#G519/143	2016-07-02	70°1,014	62°25,324	X	X	100	40	30	20	15	10	0	
#G600/147	2016-07-03	70°30,653	63°59,258	X	X	100	40	30	25	20	10	0	X
#G605/155	2016-07-04	70°29,574	62°25,345		X	100	40	30	25 DCM	loss	10	0	X
#G615/159	2016-07-05	70°29,926	59°31,504		X	100	50	40	35 DCM BLOOM	30	25	0	X
#G604,5/167	2016-07-06	70°30,095	62°37,526		X	100	60	40	30	20	10	0	
#G703/175	2016-07-07	69°29,984	58°43,458		X	100	50	35	30	20	10	0	
#G707/183	2016-07-08	69°30,738	59°48,318		X	100	40	35DCM	30	20	10	0	X
#G713/192	2016-07-09	69°30,037	61°34,918		X	100	30	25	20	15	10	0	X
#G719/201	2016-07-10	69°30,062	63°13,957		X	100	30	24	21	16	12	0	X

Table 18.2 Sampling Synopsis (2/3)

				Bacterial Viability					DNA/RNA bacterial Stress						
Cast	Date	Lattitude	Longitude	1	2	3	4	5	1	2	3	4	5	6	7
#G403/89	2016-06-25	68°1,870	61°36,062												
#G409/97	2016-06-26	68°6,349	59°59,665	0-3 ice	3-10 ice	10	20								
#G413/107	2016-06-27	68°7,350	58°57,970												
#G418/110	2016-06-28	68°6,856	57°46,182	100	40	30	20	0							
#G507/123	2016-06-30	70°0,546	59°7,469	80	15	10	5	0	80	30	20	15	10	5	0
#G512/134	2016-07-01	70°0,164	60°21,902	100	20	15	10	0	100	40	30	20	15	10	0
#G519/143	2016-07-02	70°1,014	62°25,324	100	30	20	15	0	100	40	30	20	15	10	0
#G600/147	2016-07-03	70°30,653	63°59,258	100	30	25 DCM	20	0	100	40	30	25	20	10	0
#G605/155	2016-07-04	70°29,574	62°25,345	100	30	25	20	0	100	40	30	25	20	10	0
#G615/159	2016-07-05	70°29,926	59°31,504	100	40	35	30	0	100	50	40	35	30	20	0

#G604,5/167	2016-07-06	70°30,095	62°37,526	O	O	O	O	O	X	X	X	X	X	X	X
#G703/175	2016-07-07	69°29,984	58°43,458	O	O	O	O	O							
#G707/183	2016-07-08	69°30,738	59°48,318	100	40	35	30	0	100	40	35 DCM	30	20	10	0
#G713/192	2016-07-09	69°30,037	61°34,918	100	25	20	15	0	100	30	25	20	15	10	0
#G719/201	2016-07-10	69°30,062	63°13,957	100	24	21	16	0							

Table 18.3 Sampling Synopsis (3/3)

				Aerosol Sampler			
Cast	Date	Lattitude	Longitude	Filter	Type	Day	Note
#G403/89	2016-06-25	68°1,870	61°36,062	1	Calibration	2016-06-25	
#G409/97	2016-06-26	68°6,349	59°59,665	2	Ech1	2016-06-25	
#G413/107	2016-06-27	68°7,350	58°57,970	3	Ech2	2016-06-27	Transit 24h to transect 2
#G418/110	2016-06-28	68°6,856	57°46,182	4	Blank 48h	2016-06-29	Freezing T°
#G507/123	2016-06-30	70°0,546	59°7,469	5	Ech3	2016-07-01	
#G512/134	2016-07-01	70°0,164	60°21,902	6	Ech 4	2016-07-03	
#G519/143	2016-07-02	70°1,014	62°25,324	7	Ech 5	06/07/2016 (10h35)	
#G600/147	2016-07-03	70°30,653	63°59,258	8	Ech6	2016-07-08	
#G605/155	2016-07-04	70°29,574	62°25,345	9	Blank 48h	2016-07-10	
#G615/159	2016-07-05	70°29,926	59°31,504				
#G604,5/167	2016-07-06	70°30,095	62°37,526				
#G703/175	2016-07-07	69°29,984	58°43,458				
#G707/183	2016-07-08	69°30,738	59°48,318				
#G713/192	2016-07-09	69°30,037	61°34,918				
#G719/201	2016-07-10	69°30,062	63°13,957				

18.3 Preliminary Results

Analyses for aerosol inputs will performed in the lab in Marseilles.

18.3.1 *Photo-oxydation*

Incubations of senescent phytoplanktonic cells at low and high irradiances and temperatures (thesis work of R. Amiraux) demonstrated unambiguously that:

- Low temperatures strongly favour the photosensitized degradation processes (probably due to the lowest diffusion rate of singlet oxygen at low temperatures).
- High irradiances, which favour the involvement of autoxidation processes, contribute to a strong decrease of the amounts of photooxidation products (Figure 17.1).

The combination of low temperature and low irradiance should strongly favour photosensitized degradation processes in phytoplankton and the preservation of the matter by degradation of the attached bacteria.

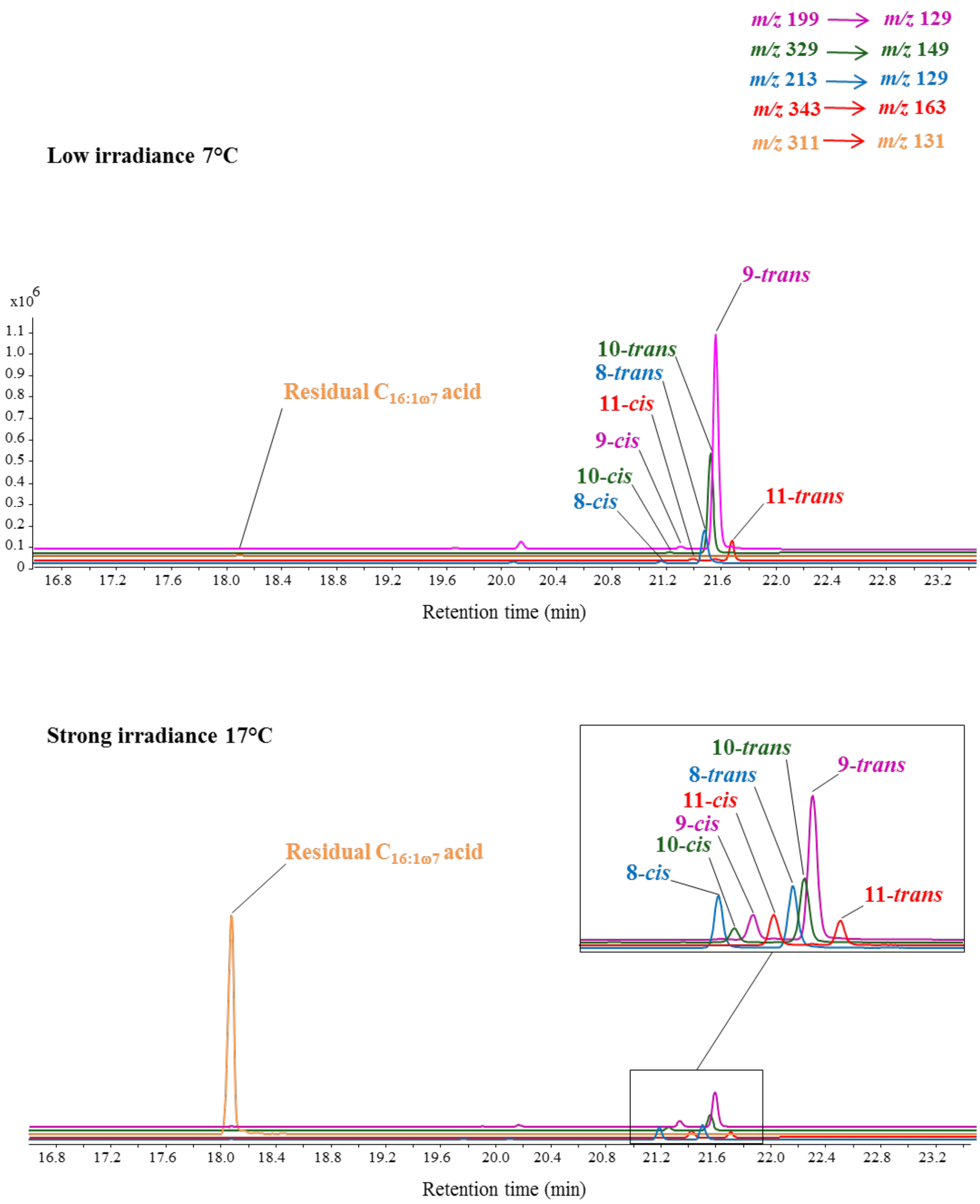

Figure 18.1. MRM chromatograms showing the production of palmitoleic oxidation products at low irradiance (34 J s^{-1}m^{-2}) and temperature (7°C) and at high irradiance (500 J s^{-1} m^{-2}) and temperature (17°C).

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19 Distribution and Biodiversity of Microorganisms in the Canadian Arctic – Legs 2a, 2b and 3a

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19.1 Introduction

Microbial communities, from all three domains of life, form the basis of marine food webs and have an important role in all biogeochemical cycles. Their distribution in the water column reflects water mass history as well as access to light and nutrients, and they are linked to the benthic community through processes such as sedimentation.

Our research is aimed firstly at surveying and mapping the biodiversity and structure of microbial communities in the Canadian Arctic. Microbes here are considered any single celled organism that routinely cannot be observed without a microscope and therefore includes: phytoplankton, heterotrophic protists (microbial eukaryote), Bacteria and Archaea. These groups are responsible for the net production in the Arctic and their interactions within the microbial food web determine the amount of fixed carbon (lipids, sugars, proteins etc.) that is available to higher trophic levels. Microbes also mediate biogeochemical cycling including Carbon, Nitrogen and Sulfur. This work is in the context of the ArcticNet project led by Dr. J-É Tremblay and is a contribution to ArcticNet ARC3Bio program.

This program was planned to repeat sampling along planned ArcticNet basic and full stations to complete the time series sampling conducted by C. Lovejoy during the ArcticNet program. In addition, surface and deep samples will contribute to an ongoing collaboration between C. Lovejoy and P. Galand and other researchers at CNRS Banyuls sur Mer, on identifying biogeochemical processes mediated by Euryarcheaota. This is part of the project EUREKA led by P. Galand that aims at revealing the diversity and function of marine Euryarchaeota, an important phyla of the domain Archaea. Euryarchaeota account for up to 10% of prokaryotes in the ocean and have not been cultivated. For this reason, we will be using genomic approaches to characterize this group from different water masses.

Finally, incubations were conducted to test the effect of freshwater on arctic microbial communities. The experiments aim at testing if dormant cells are able to start growing when environmental conditions change in the ocean. The project is conducted in the context of melting ice.

19.2 Methodology

19.2.1 *Sampling Overview*

Using the CTD-rosette system onboard the *CCGS Amundsen,* seawater was collected at each ROV station as well as the additional Basic stations FB4 and 187 to sample 4 depths per station for Leg 2a (Table 19.1), and at each basic and full station to sample a maximum of 6 depths per station for Leg 2b and 3a (Table 19.2 and Table 19.4).

Depths were chosen for sampling based on characteristics of the water column as profiled by the downcast of the CTD. The surface and bottom of the water column were always sampled, along with up to two other depths of interest such as the nitricline, or temperature features indicating water masses from the Atlantic or Pacific. We attempted always to sample the surface, the bottom and subsurface chlorophyll maximum (SCM), an important feature of northern oceans; however, at many stations the peak in fluorescence that indicates the DCM was broad and unstable.

Table 19.1. Number of depths sampled for each cast and station during Leg 2a.

Station	Rosette Cast	Number of Depths
FB4	3	2
ROV1	9	4
ROV5	11	4
ROV2	13	4
ROV3	14	3
ROV6	16	4
ROV7	18	4
180		4

Table 19.2. Samples collected during Leg 2b.

Date	Time (UTC)	Station	Lat (N)	Long (W)	number of depth sampled
29/July/2016	7h06	177	67°28.743	63°47.482	6
30/July/2016	8h33	176	69°35.515	65°21.311	6
01/August/2016	8h27	169	71°16.304	70°31.380	6
03/August/2016	20h47	160	72°41.062	78°34.238	6
04/August/2016	13h04	323	74°9.413	80°28.135	6
06/August/2016	9h16	115	76°19.864	71°11.738	6
07/August/2016	5h46	111	76°18.524	73°12.533	6
08/August/2016	8h04	116	76°44.336	71°48.457	6
09/August/2016	6h16	108	76°15.948	74°.33164	6
09/August/2016	13h05	105	76° 19.026	75° 45.473	6
10/August/2016	8h24	107	76° 22.991	77° 23.414	6
11/August/2016	9h29	TS233	77° 52.882	77° 11.662	6
13/August:2016	10H58	319	81°21.007	62°46.729	6
14/August/2016	9h20	Kane_1	79°58.891	69°47.173	6
14/August/2016	20H42	133	79°33.251	70°30.843	6
15/August/2016	13h56	127	78°18.040	74°31.959	6
16/August/2016	8h28	119	77°19.003	76°5.794	6
18/August/2016	9h24	305	74°19.741	94°59.013	6
19/August/2016	16h18	310E	71°17.668	97°42.093	6
20/August/2016	12h42	312	69°10.381	100°41.578	6

21/August/2016	4h22	QMG-M	68°18.234	101°44.700	6
22/August/2016	10h24	QMG-1	68°29.497	99°53.794	2
23/August/2016	1h25	QMG-4	68°29.046	103°25.692	4
23/August/2016	10h39	314	68°58.231	105°28.532	4

Table 19.3. Melt pond samples collected during Leg 2b.

Date	Time	Station	Lat (N)	Long (W)
11/August/2016	00H30	TRINITY_GL	78° 01'51.9''	79°12'14''
14/August/2016	17h10	DOBBIN_GL	79° 53.643'	74°21.521'
14/August/2016	17h50	EUGENIE_GL	79°48.761'	74°50.991'
16/August/2016	12h50	MITTIE_GL	76°53.732'	78°58;774'

Table 19.4. Samples collected during Leg 3a.

Date	Time (UTC)	Station	Lat (N)	Long (W)	number of depth sampled
02/September/2016	11H28	472	69°36.660	138°13.701	6
03/September/2016	05H15	482	70°4832	139°22.286	4
05/September/2016	15H00	435	71°4.6968	133°38.205	6
05/September/2016	18H06	421	71°28.0247	133°54.590	6
08/September/2016	8H54	445	73°24.706	128°11.767	6
09/September/2016	18H06	554	75°44.671	126°26.345	6
10/September/2016	18H26	575	76°10.902	125°59.581	6
12/September/2016	18H06	585	74°30.191	123°14.312	6
14/September/2016	06H02	525	72°23.084	128°59.329	6
14/September/2016	23H23	405	70°36.481	123°1.968	6
15/September/2016	15H23	403	70°6.016	120°6.074	6
15/September/2016	3H56	1402	70°32.916	117°38.057	4
28/August/2016	11h03	407	71°0.253'	126°3.982'	6
28/August/2016	19h51	437	71°48.036	126°29.956	6
29/August/2016	16h41	408	71°16.796	127°31.942	6
30/August/2016	03h32	420	71°2.978	128°30.874	3
30/August/2016	16H10	434	70°10.450	133°32.938	4

19.2.2 *DNA and RNA*

Samples for DNA and RNA were collected by filtering up to 6 liters of seawater onto a 3 µm polycarbonate filter and a 0.2 µm Sterivex cartridge (Millipore) using a peristaltic pump. This method gives us access to two distinct size fractions of the microbial community. Filters were stored in RNAlater buffer (Ambion) at -80ºC. Both DNA and RNA will be extracted upon returning to Université Laval; the first represents simple presence of the cell or gene, while the second indicates the community's capacity for protein production, sometimes conceptualized as the "active community" since it excludes cysts and dormant cells.

Because RNA in particular degrades at ambient temperature, filtering was stopped after a maximum of three hours, meaning that sometimes less than 6 liters was filtered. During Leg 2a, we did not see highly coloured filters that would indicate high photosynthetic biomass, but in discussions with the phytoplankton team onboard, we speculate that the sluggish filtration rate may have resulted from high numbers of *Phaeocystis*, a phytoplankton whose colonies are attached together by extracellular mucus.

19.2.3 *Epifluorescence Microscopy*

Slides were made for epifluorescence microscopy at each station and depth sampled. These slides will be used to estimate abundance of eukaryote cells. Seawater was fixed with 2.5 % glutaraldehyde and processed within 24 hours (Leg 2a) or 6 hours of sampling (Leg 2b and 3a). Fifty ml of fixed sample was filtered through a 0.8 µm black polycarbonate filter and stained with DAPI, a nucleic acid stain. This filter was mounted on slide using a drop of immersion oil and stored in darkness at -20ºC.

19.2.4 *Flow Cytometry (FCM)*

FCM is more accurate than microscopy to count cells in the "pico" size range (0.2–2 µm), and can include some functional information such as prokaryote versus eukaryote cells and the presence of photosynthetic pigments. FCM samples were taken from each station and depth, and fixed with 0.5% glutaraldehyde in duplicate for "dead" samples, or preserved in glycerol-TE buffer in triplicate for "live" samples. After a short incubation at ambient temperature in the fixative or buffer, samples were flash frozen in liquid nitrogen and stored at -80°C

19.2.5 *Fluorescent in situ Hybridization (FISH)*

FISH is a technique that uses fluorescent-labelled nucleic acid probes to identify a specific phylogenetic group of organisms under the microscope. Samples for FISH were collected in duplicate for eukaryotes and bacteria at each station and depth sampled. Seawater was fixed with 3.7 % formaldehyde and processed within 24 hours of sampling. For eukaryotic organisms, 90 ml of fixed sample was filtered onto a 0.8 µm polycarbonate filter. For bacteria, 35 ml was filtered onto a 0.2 µm polycarbonate filter. Filters were stored at -80 ºC.

19.2.6 *Conventional Light Microscopy*

At each station, for the surface water sample and DCM (where present), 225 ml of seawater was collected and fixed using FNU fixative (1 % paraformaldehyde, 0.1 % glutaraldehyde). At Laval University, these samples will be allowed to sediment in Utermöhl chambers and larger organisms, such as diatoms and dinoflagellates, will be identified to the highest possible taxonomic resolution on an inverted microscope.

19.2.7 *Chlorophyll a*

While the phytplankton team onboard the *Amundsen* collected water column samples for chlorophyll *a*, the depths they sampled were not always the same as ours. We therefore decided to collect our own chlorophyll samples from depths > 200 m at every station. 500 ml of seawater was filtered through a glass fibre filter and stored in darkness at -20 ºC. In addition, we pre-filtered the same quantity of water through a 3 µm polycarbonate filter before filtering onto a glass fibre filter, in order to sample only the < 3 µm size fraction of the photosynthetic community. Chlorophyll *a* will be extracted with ethanol and quantified at Université Laval.

Side project: To investigate the potential of future collaboration two side projects were developed on board.

19.2.8 *Glacier Melting Pond*

Luke Copland team sampled 5 different melting ponds on five different glaciers (Table 19.3). Glacier melting pond could be considered as an extreme environment where energy may be highly limited. We wondered if life is able to develop in these environment and which parameters constrains this life development. As a pre-project we would like to test 1. If we are able to extract and sequence DNA/RNA from these melting pond 2. If the microbial signature of these ponds is different between the five different samples that Luke's team provides us. Based on these results we will be able to propose for next years an ideal and realistic sampling plan that will deeply investigate this community ecology and the source of the microbial colonizer during melt pond formation in spring (Atmosphere, Ocean spray, under ice soil, ice …) and the destiny of the glacier microbial community when the glacier ice is transfer to the sea.

19.2.9 *DMS*

Martine Lizotte (Prof Maurice Levasseur's team) sampled and monitored the DMS present in seawater using a stainless steel acid rinse surface seawater income connected to a MIMS. Using a derivation of the Dr Lizotte water income we were able to continually collects seawater from the natural environment and to trap the community on a 0.2 µm mesh. Filters were then being process as those used on station (see section DNA and RNA).

This first test will tell us if we are able to characterise the surface pico eukaryote and bacterial community when the ship is in transit. In order to test the system, we have filtered seawater during 30 minutes (1.3 L of seawater collected) and during an hour (2.5 L of seawater collected) results from these filtrations will be compared to punctual measurement achieved by collecting 7L of seawater at the seawater income of Dr Lizotte system. Seawater punctual samples (5 in total) were then processed.

During our transit in the Kennedy channel we run the filtration system in parallel of the Dr Lizotte team (11 hours of sampling), we hope to be able to explains with our method a fraction of the DMS variability that Dr Lizotte monitored with the MIMS. We also tried to characterised the community and DMS variation while the *Amundsen* is moving from an open water area to a 1-year ice area. This specific experience was based on the DMS variations that Dr Lizotte observed on such margin when we left the Trinity station (see Martine Lizotte report). We noticed that during ice breaking the ship paint is released in seawater and collected in our filters, we will check how this affect our DNA/RNA analysis.

This new way to sampled DNA/RNA on the *Amundsen* could also provide a better coverage of the genetic surface pool present in the arctic by integrating the community over hours of transit instead of specific points. Depending of the preliminary results, we would recommend for future missions to coordinate nearly-continuous measurement (DMS, MVP, DNA sampling…) by setting up some redundant transect/transit every year.

19.3 Comments and Recommendations

With the samples we have collected for molecular and microscopic analyses, we hope to arrive at a more detailed understanding of the phylogeny, structure, and function of microbial communities in the Canadian Arctic.

We had good weather and all sampling operation went well. The lab space allocated allowed good working conditions.

Acknowledgement

We thank the chief scientist for a well-organised cruise and captain and crew for their professionalism and support.

20 Bacterial Dynamics in Response to the Arctic Spring Phytoplankton Bloom – Leg 1

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20.1 Introduction

The Arctic spring is a time of extreme environmental shifts resulting in massive phytoplankton blooms fueling the food web. Despite the importance of the bacterioplankton in remineralizing the primary production, studies of how the different phases of the bloom fuels the bacteria are rather scarce. Since bacterial abundance, community composition and activity are controlled mainly by substrate availability, grazing and virus induced mortality, enhanced primary production and food-web activities associated with the spring bloom would presumably affect bacterial processing of dissolved organic carbon (DOC) and thereby also the fate of carbon and nutrients in the region.

To investigate the parameters influencing the dynamics and functionality of bacterial communities during the spring bloom in the Baffin Bay, we sampled 7 transects during the GreenEdge cruise for bacterial production, respiration, abundance and community composition and performed biodegradation experiments with different sources of DOC.

This study is part of Greenedge WP2.

20.2 Methodology

20.2.1 *In situ Sampling*

Water was collected for different depths at each FULL stations with 12 L Niskin bottles mounted on a CTD rosette. Samples were taken for bacterial production, methanol assimilation, respiration, community composition (in collaboration with Dominique Marie and Margot Tragin from the Station Biologique de Roscoff), heterotrophic nanoflagelates and viruses abundance. For some stations samples were taken for imaging and for bacterial isolates.

20.2.2 *Bacterial Production*

Samples were taken for 8 to 10 depths at each full stations. Bacterial production was measured by [H^3]-Leucine incorporation (Kirchman et al. 1985) modified for microcentrifugation (Smith and Azam 1992). Triplicate 1.7 ml aliquots were incubated with [H^3]-Leucine (20 nM final conc.) in sterile 2.0 ml polypropylene tubes for 4 h at 1.5°C. Samples with 5% trichloroacetic acid added prior to isotope served as blanks. Leucine incorporation was converted to carbon production using a conservative conversion factor of 1.5 kg C mol leucine^{-1} (Simon and Azam 1989).

20.2.3 *Bacterial Respiration*

Samples were taken at 2-3 depths for each full stations (surface, DCM and below DCM). 3L of water was collected at each depth and filtered through 1 µm. 6-replicate BOD bottles. T_0 triplicate bottles were immediately fixed with $MnCl_2$ and NaOH+NaI and the 3 other bottles were incubated for 5 days in the dark at in situ temperature before fixation. Oxygen concentration was then measured with the Winkler method.

20.2.4 *HNF, Bacteria and Virus Abundance*

For HNF abundance, 4mL of water samples from 4 depths at each full stations were fixed with 1% (final conc.) glutaraldehyde (EM grade). For bacteria 1.5 mL was fixed with glutaraldehyde (1% final conc.). For bacteria infected by viruses and EM microscopy 50mL samples were fixed with glutaraldehyde (1% final conc.). All samples were stored at -80°C before further processing.

In order to fulfill efficiently all the mentioned tasks, two scientists were required.

20.2.5 *Biodegradation Experiments*

For five stations, enrichment experiments with different source of carbon were performed.

The capacity of bacterial community to utilize different source of carbon extracted from Arctic phytoplankton cultures was studied at an open water, marginal ice and at an ice station (exp 1). The capacity of the bacterial community to utilize different source of one-carbon and methylated compounds and the role and adaptability of bacteria to the DMSP cycle was studied at an open water station and at a marginal ice zone station (exp 2). For each stations, >20 L water was filtered through a rinsed 0.2 µm filter (Acropak 500 capsule filter, Pall) and collected in large containers. This 0.2 µm filtered water was then inoculated with indigenous bacteria (10-20% v/v, 0.65 µm gravity filtered; Durapore filters, Millipore) from the respective station. Aliquots were then distributed in 1-2-L bottles, and divided into treatments in triplicate.

Exp 1 was incubated for 12 d at in situ temperature in the dark and exp 2 was incubated for 9 d at in situ temperature in the dark. For both experiments samples were taken for bacterial production, abundance, fluorescence in situ hybridization in situ, DOC concentration at different time points during the incubations and for start and end community composition.

For exp 2 samples were taken for DMS, DMSP and acrylate concentration in collaboration with Dr. Marti Gali Tapias (Laval University).

20.3 Preliminary Results.

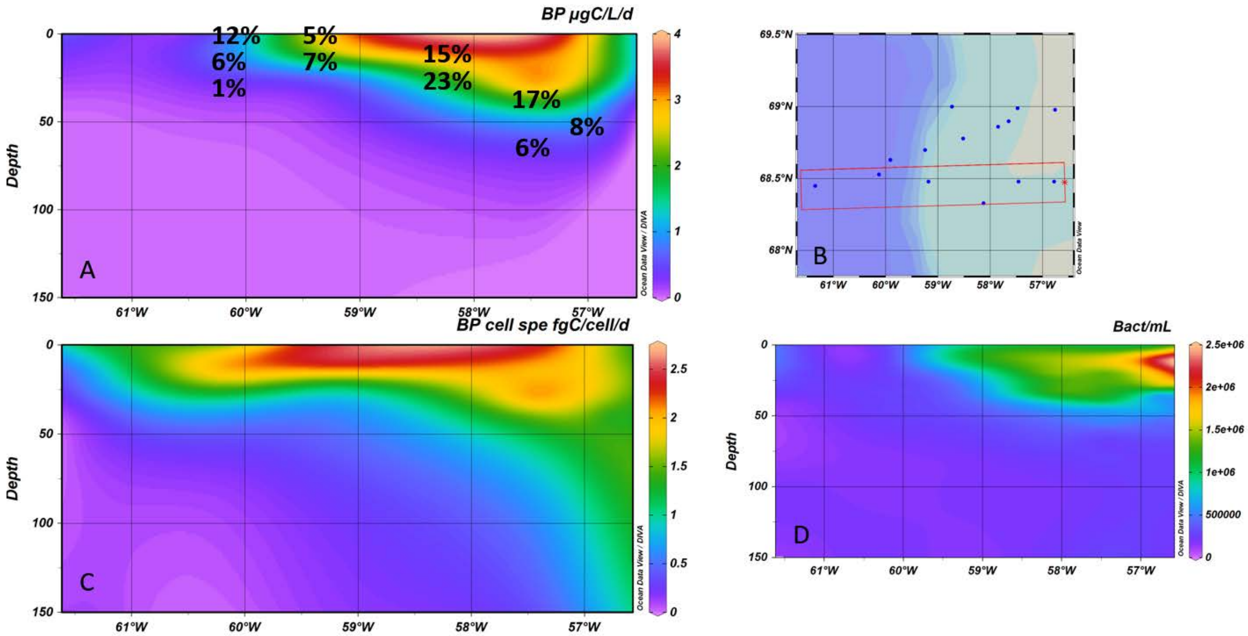

Figure 20.1. Bacterial production (A) during transect 1 (B) and cell specific bacterial production (C) (which is the production related to the abundance of bacteria (D)). Percentage represent the bacterial growth efficiency (BGE = (bacterial production/ (bacterial production+bacterial respiration))).

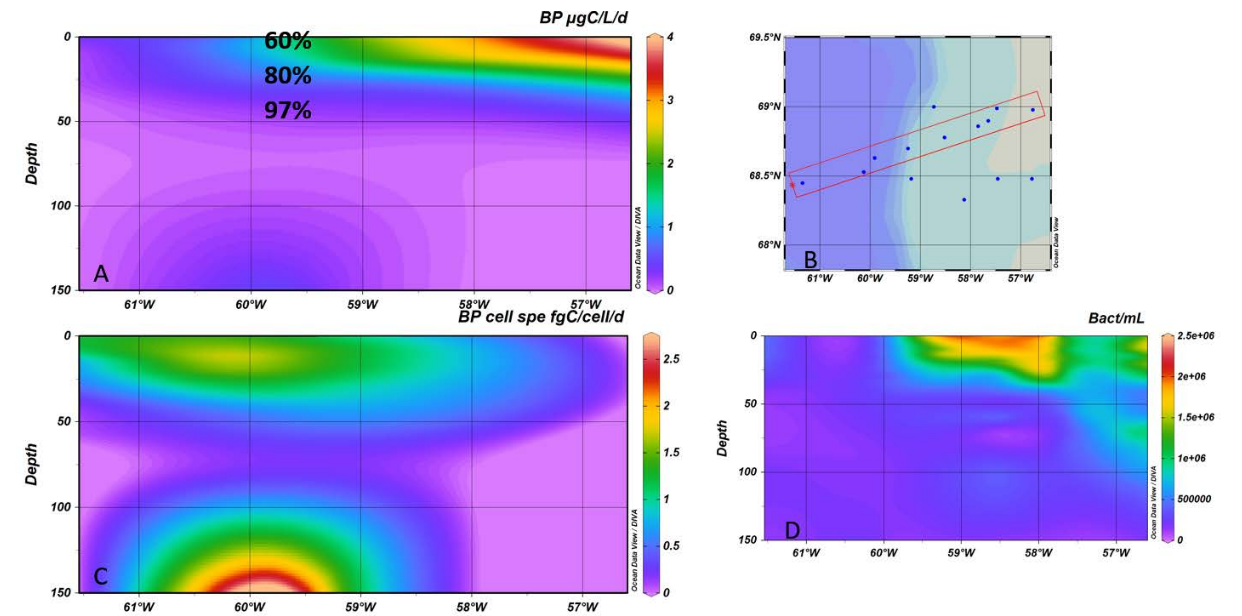

Figure 20.2. Bacterial production (A) during transect 2 (B) and cell specific bacterial production (C) (which is the production related to the abundance of bacteria (D)). Percentage represent the bacterial growth efficiency (BGE = (bacterial production/ (bacterial production+bacterial respiration)))

Collaboration

Collaborations were established with the Station Biologique de Roscoff for community composition sampling and with Marti Gali Tapias for the study of the bacteria involved in the DMSP cycle.

21 Diversity of Pico and Nano-Phytoplankton from Culturing and Molecular Approaches – Leg 1

Project leader: Daniel Vaulot[1] (vaulot@sb-roscoff.fr)
Cruise Participants - Leg 1: Dominique Marie[1] and Margot Tragin[1]
[1] *Station Biologique de Roscoff, Sorbonne Universités, Roscoff, France*

21.1 Introduction

Pico- and nano-phytoplankton form the background of the photosynthetic community. One key genus is the green alga *Micromonas* which cold-adapted ecotype seems to be present all year around and everywhere in the Arctic. Will there be a succession of different *Micromonas* populations during the bloom? Other small green algae (Chlorophyta) such as *Mantoniella* and *Pyramimonas*, heterokontophyta (Dictyiophyceae, Chrysophycae) and Haptophyta (*Chrysochromulina*) seem also to be important in arctic waters. Will their succession be in phase with the changes in the diatom community?

Flow cytometry will be performed onboard the *Amundsen* to enumerate pico- and nano-phytoplankton and total bacteria. Cultures will be initiated onboard through enrichments, dilutions or concentration by Tangential Flow Filtration (TFF). Back to laboratory, phytoplankton species will be isolated by flow cytometry sorting (small cells) or under an inverted microscope using pipettes (large cells). The cultures we will obtain will be deposited to the Roscoff Culture Collection (RCC) and will be identified by morphological identification via electron microscopy and analysis of DNA.

DNA and RNA will be collected to determine overall plankton diversity and in particular to identify heterotrophic groups using high throughput sequencing SSU rRNA gene surveys. The abundance of specific taxa (e.g. *Micromonas*) will also be estimated by quantitative PCR. For selected sites, whole community composition and activity will be investigated by way of metatranscriptomics. Plankton will be filtered and preserved with RNAlater and key genes identified using bioinformatics pipelines currently being developed by A. Monier in the Lovejoy lab.

21.2 Methodology

21.2.1 *Flow Cytometry*

Flow cytometry is performed onboard using an Accuri C6 equipped with a CSampler. Pico- and nano-phytoplanktonic cells as well as heterotrophic bacteria are enumerated. One sample from all depths per station are fixed with Glutaraldehyde (0.25% final concentration) supplemented by Pluronic F68 (0.01% final) for at least 15 minutes and then stored at -80°C. For delayed flow cytometry sorting, two additional samples from 6 to 9 depths per station are preserved by addition of DMSO (0.1%) supplemented by Pluronic F68 (0.01%) and placed at -80°C after at least 15 min incubation.

21.2.2 *Cultures*

Cultures of phytoplankton are performed following three methods:

- Enrichment: 1 mL of L1 or RS media are added into 50 mL flasks containing 25 mL of seawater sampled at the rosette.
- Dilution: dilutions of samples from the rosette in surface and DCM are performed into 96 deep well plates containing 500 µL of L1 medium to reach 1 or 10 cells per well.
- TFF: 2 liters of samples from surface and DCM are concentrated into about 25 mL by Tangential Flow Filtration (TFF). Concentrated samples are collected into 50 mL flasks and put at 4°C into a culture cabinet under a 12/12 light/dark cycle.

21.2.3 *DNA and RNA*

3 liters from the rosette of 6 samples per station are filtered through a series of filters (20 µm, 3 µm and 0.2 µm). Filters are put in cryovials containing RNA Latter and preserved at -80°C.

21.2.4 *QPCR*

2 liters from the rosette of 6 samples per station are filtered through 0.8 µm filters. Filters are rinced with 3 mL of rinsing buffer, then put in cryovials and preserved at -80°C.

21.2.5 *SEM*

200 µL from surface and DCM are filtered through 0.8 µm filters, then rinsed 3 times by milliQ water, put in 30 mm petri boxes and let for at least one hours at 35°C.

21.3 Preliminary Results

During the cruise:

- 820 for leg1A and 1060 for leg1B flow cytometry analyses were performed for enumeration of phytoplankton and bacteria (Figure 8.1) at 125 stations during the whole cruise.
- 126 for Leg 1a and 118 for Leg 1b DMSO-samples were preserved in duplicate for further flow cytometry sorting.
- 150 Glutaraldehyde preserved samples for Leg 1a and 188 for leg1B were collected as backup.
- 26 filters (0.8 µm) for Leg 1a and 29 for Leg 1b were collected for Electron Microscopy (SEM).
- 78 samples for Leg 1a and 82 for Leg 1b were collected onto 20 µm, 3 µm and 0.2 µm for RNA/DNA extraction and onto 0.8 µm for QPCR.
- 103 cultures during Leg 1a and 105 during Leg 1b were realised by addition of L1 or RS media or by TFF. Five 96 deep well plates during Leg 1a and 7 during Leg 1b with 1 or 10 cells per well were placed into the culture cabinet.

<u>Sampling Summary</u>

In -80°C freezer:

- 7 cryoboxes containing DMSO samples,
- 5 containing FCM samples,
- 5 blue tips boxes for RNA 0.2 µm sterivex,

- 2 cryoboxes containing RNA 20 µm filters,
- 2 cryoboxes containing RNA 3 µm filters,
- 2 cryoboxes containing QPCR 0.8 µm filters.

In the 4°C incubator:

- 208 cultures flasks and 12 deep-well plates (96 wells)
- 56 filters for SEM kept at room temperature

Culture flasks, deep-well plates and filters for SEM will be brought back to the laboratory by Dominique MARIE and Margot TRAGIN.

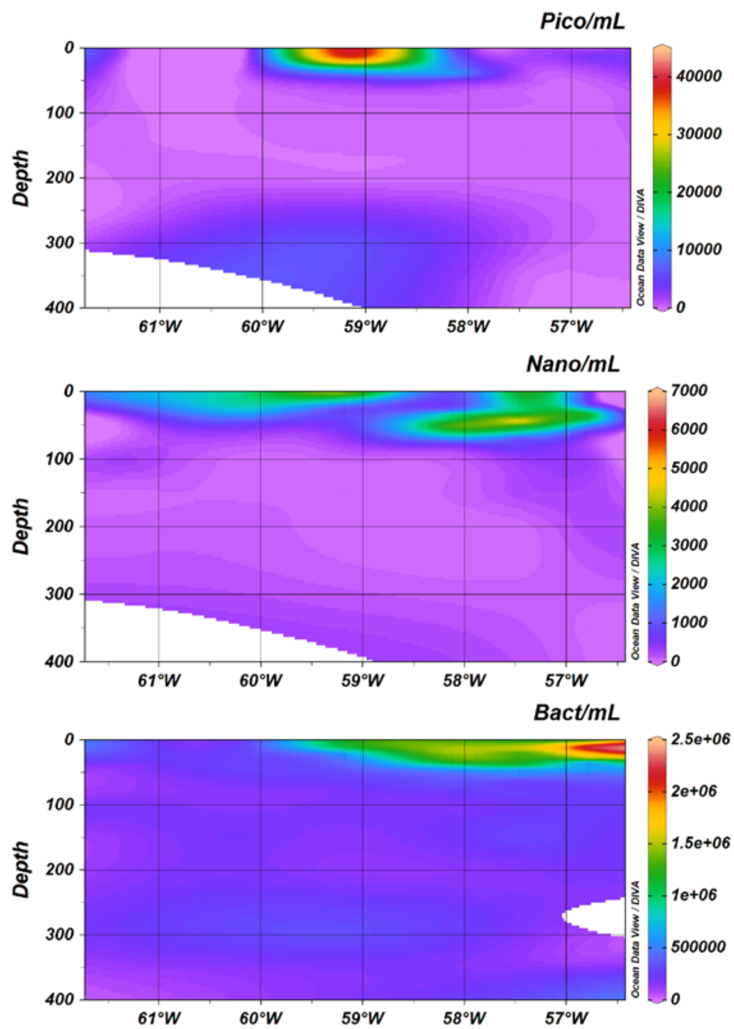

Figure 21.1. On board flow cytometry data (transect 100) drawn with ODV software (125 stations during the cruise and around 1880 samples). Two eukaryotic size fractions Pico and Nano-phytoplankton and the bacteria community were enumerated by flow cytometry (cells number per mL).

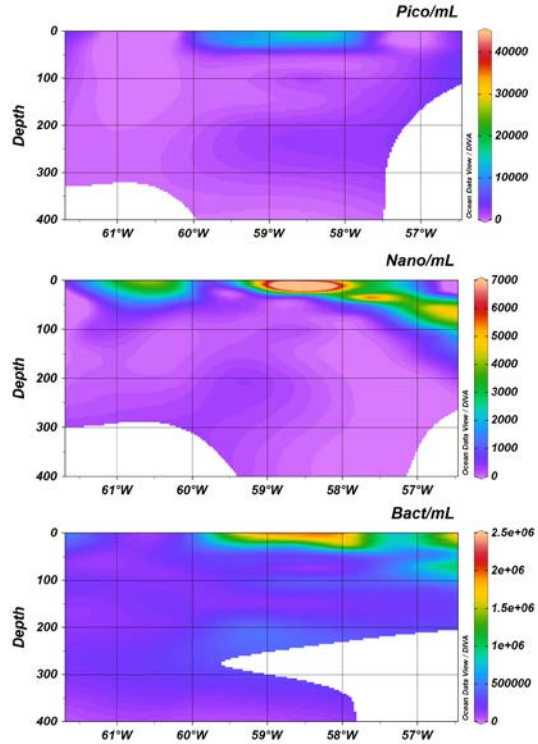

Figure 21.2. On board flow cytometry data (transect 200) drawn with ODV software (125 stations during the cruise and around 1880 samples). Two eukaryotic size fractions Pico and Nano-phytoplankton and the bacteria community were enumerated by flow cytometry (cells number per mL).

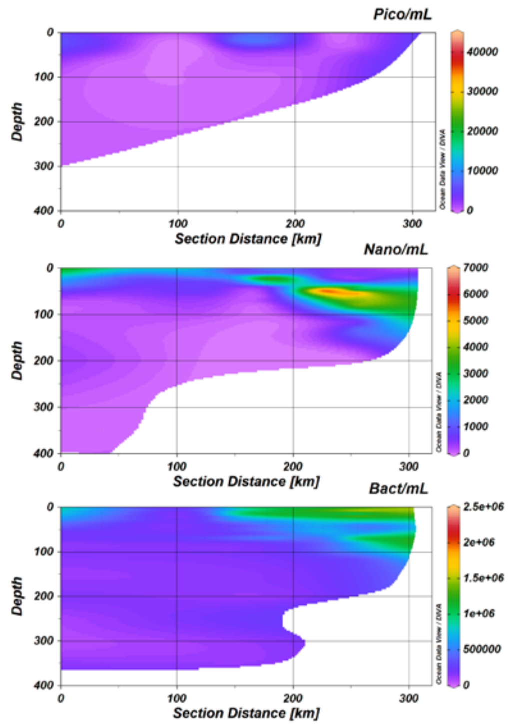

Figure 21.3. On board flow cytometry data (transect 300) drawn with ODV software (125 stations during the cruise and around 1880 samples). Two eukaryotic size fractions Pico and Nano-phytoplankton and the bacteria community were enumerated by flow cytometry (cells number per mL).

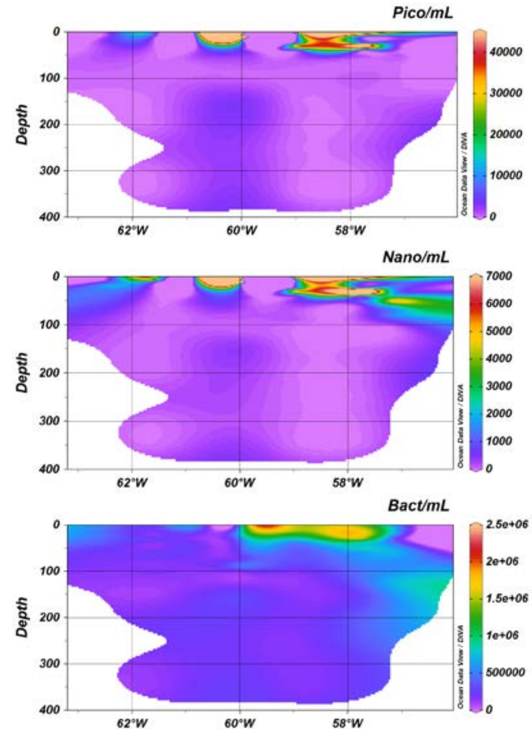

Figure 21.4. On board flow cytometry data (transect 400) drawn with ODV software (125 stations during the cruise and around 1880 samples). Two eukaryotic size fractions Pico and Nano-phytoplankton and the bacteria community were enumerated by flow cytometry (cells number per mL).

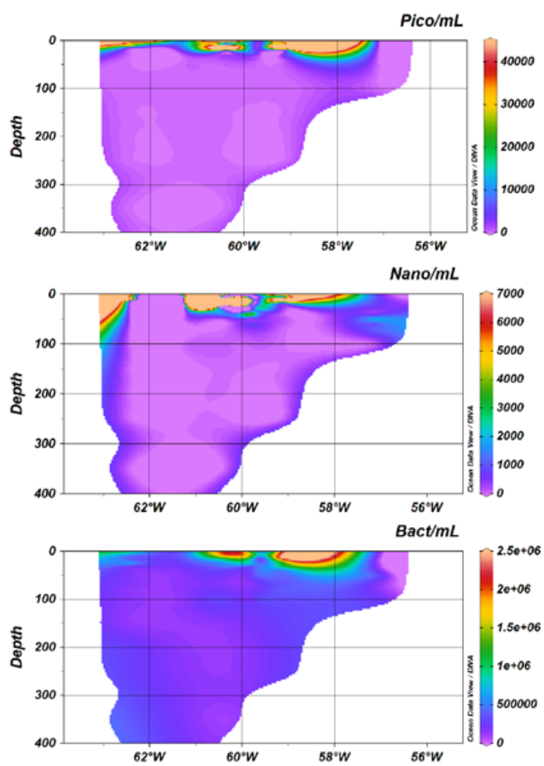

Figure 21.5. On board flow cytometry data (transect 500) drawn with ODV software (125 stations during the cruise and around 1880 samples). Two eukaryotic size fractions Pico and Nano-phytoplankton and the bacteria community were enumerated by flow cytometry (cells number per mL).

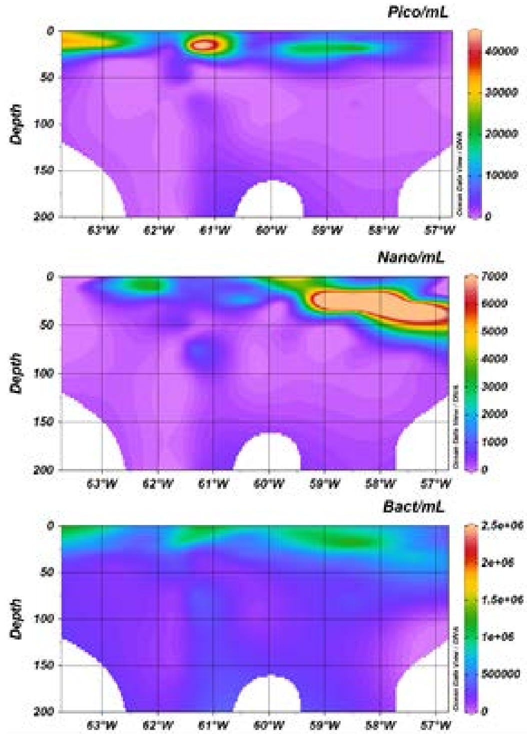

Figure 21.6. On board flow cytometry data (transect 600) drawn with ODV software (125 stations during the cruise and around 1880 samples). Two eukaryotic size fractions Pico and Nano-phytoplankton and the bacteria community were enumerated by flow cytometry (cells number per mL).

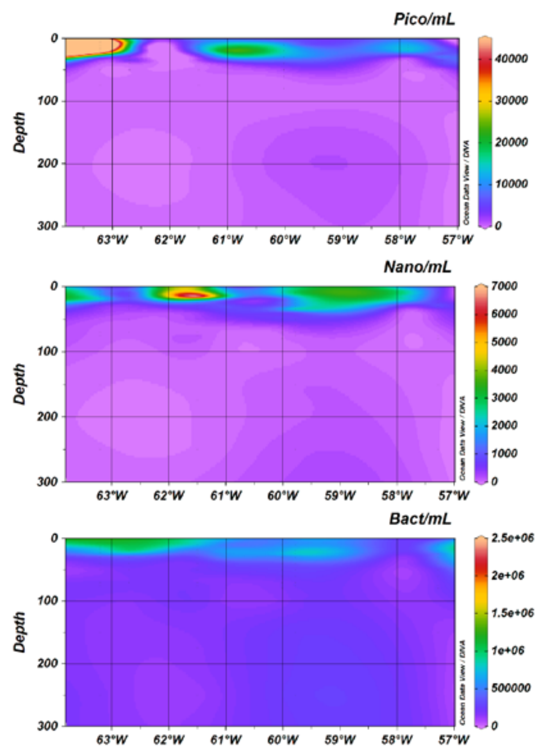

Figure 21.7. On board flow cytometry data (transect 700) drawn with ODV software (125 stations during the cruise and around 1880 samples). Two eukaryotic size fractions Pico and Nano-phytoplankton and the bacteria community were enumerated by flow cytometry (cells number per mL).

21.4 Comments and Recommendations

We did not encountered difficulties during the mobilization and during the cruise. We only had trouble with the culture cabinet that reached room temperature for some hours.

Collaboration

The different methods used will enable for teams involved in biodiversity analyses: D. Vaulot (Roscoff), C. Lovejoy (Québec), F. Joux (Banyuls).

Acknowledgement

We would like to thank the Canadian Coast Guard Ice Breaker *Amundsen* crew for their help in the all-day life onboard, as well as the chief and organization scientists F.Bruyant, K. Lévesque, M.Babin and J.E.Tremblay.

We are very satisfied by the facilities provided on board the *CCGS Amundsen.*

22 PAM Fluorometry and FLASH Photoinhibition Experiments – Leg 1

Project leader: Kevin Arrigo[1] (arrigo@stanford.edu)
Cruise participants - Leg 1: Hannah Joy-Warren[1] and Kate Lewis[1]
1 Department of Earth System Science, Stanford University, Stanford, California, United State

22.1 Introduction

We investigated taxon-specific adaptations to a simulated variable light environment through *FLuorescence After Light SHock* (*FLASH*) experiments. When a photosystem receives a photon, that photon undergoes one of three fates: photochemistry (carbon fixation), fluorescence (photon re-radiation), or dissipation as heat by the xanthophyll cycle. After high light exposure, fluorescence is quenched (called photoinhibition, a reduction in photosynthetic capacity), and photosystems can become photodamaged (qI) or use photoprotection (qE). The photoinhibition that occurs after high light exposure can affect productivity. The magnitude of this effect, and relative adaptation and acclimation, can differ by species. After a short exposure at surface irradiance, we measured the subsequent photodamage and photoinhibition (PAM Fluorometry), Photosynthesis vs. Irradiance (PE curves), particulate absorption (AP), particulate organic carbon (POC), pigments (HPLC and Chlorophyll), and species composition (taxonomy and IFCB). The results will shed light on the longer-term taxonomic group-specific effects of short-term surface irradiance exposure.

In the P vs. E method, seawater and ice algae samples are incubated under a range of irradiance levels to measure the photophysiology of natural phytoplankton. The resultant P vs. E curves provide estimates of maximum photosynthetic rates, the light intensity to which phytoplankton are adapted, light limited rates of photosynthesis and photoinhibition parameters. Photosynthetic parameters will be related to phytoplankton community structure, bloom phase and other relevant oceanographic metrics (including the light and nutrient environment) to draw conclusions of how phytoplankton communities adapt their photophysiological capabilities during the progression of the spring phytoplankton ice-edge bloom. This work is primarily part of Work Package 2 (Spring Bloom Dynamics) and addresses the overarching scientific objectives of GreenEdge including “What is the exact sequence of events that control the onset, maintenance and end of the phytoplankton spring bloom?” and “What are the key phytoplankton groups and species involved and what controls the succession?”

22.2 Methodology

22.2.1 *FLASH Photoinhibition Experiments.*

FLASH Experiments are ideally performed by one person, with a second person measuring the PE curves. A total of 20 FLASH experiments were performed at the DCM on the first cast at the following Main Stations: 102, 201, 204, 207, 309, 312, 318, 409, 413, 418, 507, 512, 519, 600, 605, 610, 707, 713, 719 and the following ice stations: 409, 413, 519, 600.

FLASH Experiments are made up of three parts: Surface Irradiance Exposure, PE curves, and filtrations.

Surface Irradiance Exposure. Phytoplankton and ice algae were incubated on deck for 20 minutes at *in situ* surface irradiance (also referred to here as the "light shock") with and without the D1 protein repair inhibitor, lincomycin. F_v/F_m (photochemical efficiency of Photosystem II) and non-photochemical quenching of fluorescence (NPQ) were measured on a PAM Fluorometer as an indicator of the resultant photodamage and subsequent repair. NPQ occurs after a light shock and can be broken into two components: photodamage (slow relaxing quenching), which is related to the rate of D1 protein repair in PSII, and photoprotection (fast relaxing quenching), which is related to xanthophyll cycling. F_v/F_m was measured over two-hours to track fast and slow relaxing quenching.

PE Curves. A total of 335 P vs. E curves were measured at 32 station locations and 17 FLASH experiments. Light-shocked and non-light shocked samples were incubated for 3-4 hours following the surface irradiance exposure. PE curves were then run on both samples. For each P vs. E curve, approximately 40ml of seawater sample was spiked with 150-300µl of radiolabelled bicarbonate ($H^{14}CO_3$, 2uCi uL^{-1}). 1.5ml of sample was added to scintillation vials which were incubated in a photosynthetron for 2 hours at 0°C under a gradient of 14 light levels, ranging from approximately 0 to 1000 µmol quanta m^2 s^{-1}. Three vials were killed immediately by being added to 50uL of buffered formalin and acidified to provide the baseline ^{14}C present. 20µl of sample was added to 50µl ethanolomine and 5.5 ml scintillation cocktail as a measure of how much ^{14}C was present in total after spiking the sample. After the incubation, 50uL of buffered formalin and 250 µL of 6 N hydrochloric acid was added and allowed to ventilate for 24 hours to drive off unincorporated inorganic carbon. After ventilation, 5.5 mL of scintillation cocktail (Ecolume) was added and vials were tightly capped, vortexed to mix, and ran on the liquid scintillation counter (LSC).

Filtrations. Light shocked and non-light shocked samples were incubated for 3-4 hours. To determine the longer-term effects of a short-term surface irradiance exposure, the following samples were collected: chlorophyll and HPLC pigments, POC, AP, and taxonomy or IFCB samples.

22.2.1 *PAM Fluorometry*

PAM Fluorometry measurements were performed on every Full Station during Legs 1a and 1b. The ideal number of people for these measurements is one.

Rapid Light Curves RLCs were measured on the DCM, one depth 10-15 m. shallower than the DCM and one depth 10-15 m. deeper than the DCM. Following a 30-minute dark adaption, RLCs were performed in duplicate on four light levels. The first three measure the electron transport rate (ETR) and the fourth measures non-photochemical quenching (NPQ). Gain, PM-Gain, Measuring Light Frequency, and Measuring Light Intensity were adjusted to achieve an F_0 between 300 and 700. RLCs were run with a Light Curve Width of 10 seconds. The Actinic Light

Amplitude and Light Curve Int. were adjusted for each duplicate set of RLCs as follows: 1, 4; 1, 5; 2, 4; 6, 5.

F_v/F_m measurements were performed on 10 depths at Full Stations following a 30-minute dark adaption with. As with the RLCs, Gain, PM-Gain, Measuring Light Frequency, and Measuring Light Intensity were adjusted to achieve an F_0 between 300 and 700. After a saturating pulse was delivered to the sample, F_v/F_m was recorded. F_v/F_m was measured five times per depth, each on a fresh aliquot of sample.

22.3 Preliminary Results

Preliminary results from the P vs. E curves indicate shade-adapted phytoplankton communities, indicated by steep initial light-limited slope (α) and photoinhibition at high irradiances (β) (Figure 22.1). Absolute magnitudes for photosynthetic parameters cannot be calculated until chlorophyll-a concentrations are provided from HPLC data.

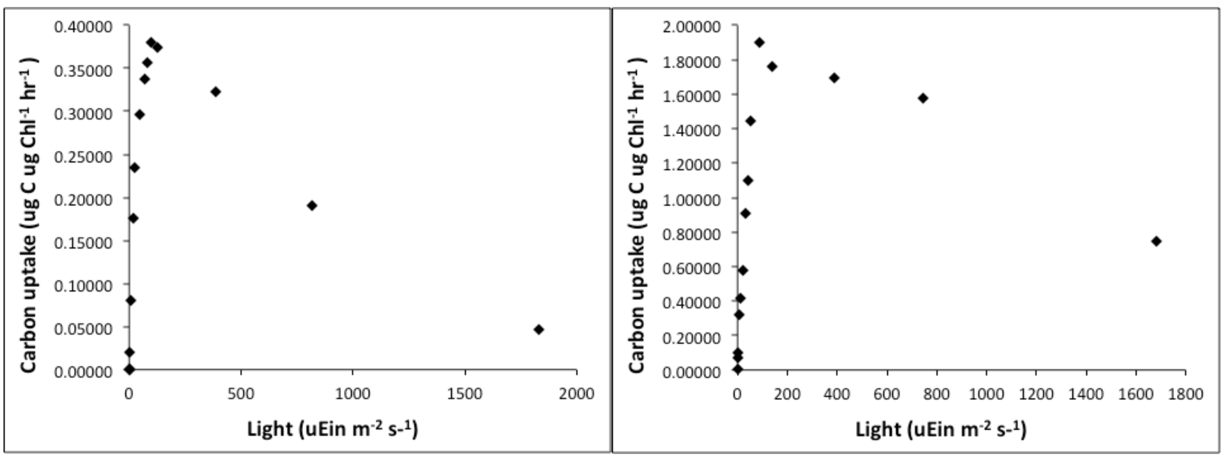

Figure 22.1. *Typical P vs. E curves from GreenEdge indicate shade acclimated phytoplankton communities.*

<u>Collaborations</u>

- PE curves were run by Kate Lewis (Arrigo Lab).
- AP samples were run by Antoine Sciandra (Leg 1a) and Annick Bricaud (Leg 1b; LOV).
- HPLC samples will be analyzed by Hervé Claustre.
- POC samples will be analyzed by Takuvik.
- IFCB samples were run by Pierre-Luc Grondin (Takuvik).

23 Particulate Absorption in Seawater, in Water Under the Ice and in the Ice – Leg 1

Project leader: Annick Bricaud[1] (bricaud@obs-vlfr.fr)
Cruise participant Leg 1a: Antoine Sciandra[1]
Cruise participant Leg 1b: Annick Bricaud[1]
[1] *Laboratoire d'Océanographie de Villefranche, Villefranche sur mer, France*

23.1 Introduction

The inherent optical properties of the suspended particulate matter (spectral absorption and scattering coefficients) modulate the radiative transfer of light within the water column. These properties are essential to infer the propagation of light with depth and its use by photosynthetic organisms, as well as to analyze the radiations received by ocean color satellites. The variability of absorption coefficients in the studied area needs to be determined (i) to derive appropriate parameterizations as functions of Chl or POC (*e.g.* for bio-optical models to be applied to the Arctic ocean), (ii) to derive the quantum yield of carbon fixation from P vs. E curves, and refine oceanic primary production models for the Arctic area.

The objectives of our measurements were to document the spectral absorption of light by suspended particulate material, and to discriminate the phytoplankton and detritus contributions at different depths of the water column. These measurements were performed simultaneously with phytoplankton pigments (HPLC) and particulate organic carbon (POC) measurements (see report 15 from H. Claustre).

23.2 Methodology

During Leg 1a, seawater was sampled in casts 3, 6, 8, 12, 17, 24, 28, 33, 37, 39, 43, 48, 57, 65, 72, 84, and water under the ice only once, at station G115. During Leg 1b, seawater was sampled in casts 89, 97, 107, 110, 123, 134, 143, 147, 155, 159, 167, 175, 183, 192, 201. Seawater was sampled with the CTD-rosette within 10 polycarbonate bottles (10 depths between 0 and 100 m, distributed around the fluorescence maximum) and filtered onto GF/F filters. During Leg 1b, 8 samples from ice cores were analyzed at stations G403 (1), 409 (1), 413 (1), G519 (2), G600 (3). 12 additional samples during Leg 1a, and 27 during Leg 1b, were analyzed for FLASH experiments.

Depending on the particulate charge, the filtered volume ranged between 0.150 and 2.7 liters. Absorption spectra of particulate matter (a_P) were measured between 200 and 860 nm with a Lambda19 Perkin Elmer spectrophotometer by placing each filter in an integrating sphere coated with baryum sulfate, a highly diffusive material (allowing the scattered photons to be seen by the detector and do not contribute to the attenuation signal). Filters were then put in methanol (100%) during 24h to remove pigments, and placed again in the spectrophotometer to measure the spectral absorption of non-algal particles (a_{NAP}). Spectral absorption of phytoplankton (a_{PHY}) is obtained by subtracting a_{NAP} from a_P (Figure 23.1). A correction was applied to account for the pathlength amplification by the filter and particles (using the formula derived by Stramski et al. 2015).

23.3 Preliminary Results

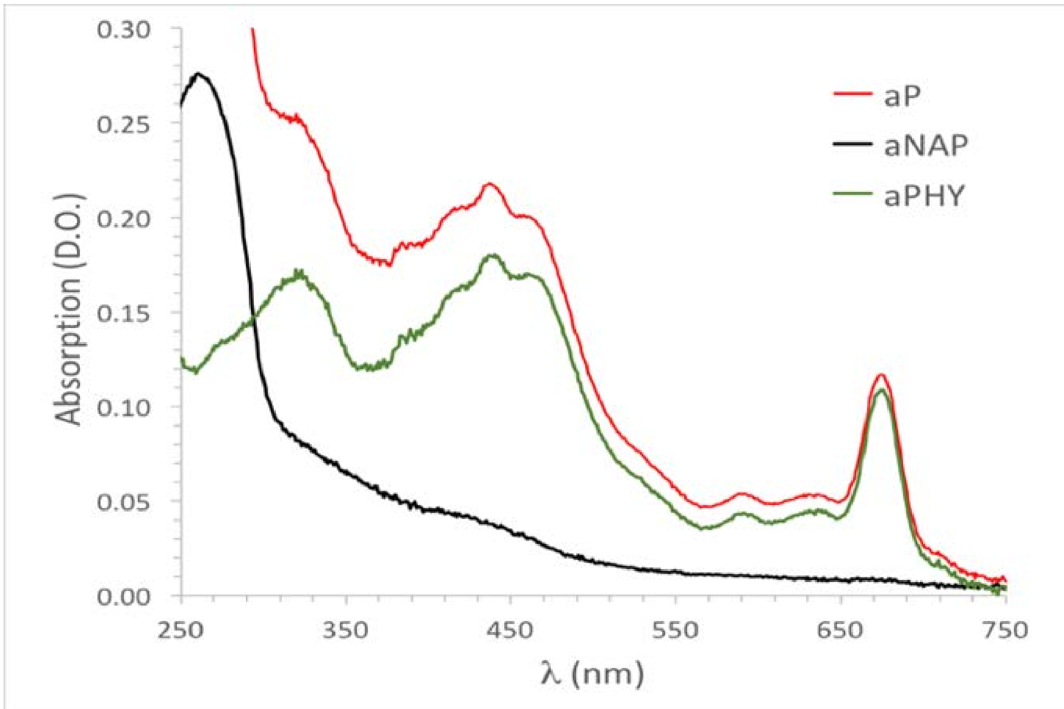

Figure 23.1. Example of spectrophotometric measu-rements of aP, aNAP and aPHY showing the relative contributions of phytoplankton and detritus to total absorption at different wavelengths.

Collaborations

- Bio-optical parameterizations/models for the Arctic (pigments, POC, ap, acdom : Takuvik, LOV)
- Photo-physiological parameters in the Arctic (P vs E curves, PAM, a_{phy}, pigments : Stanford Univ., Takuvik, LOV)

24 HPLC Pigments, Particulate Organic Carbon (POC) and Suspended Particulate Matter (SPM) – Leg 1

Project leader: Hervé Claustre[1] (claustre@obs-vlfr.fr)
Cruise Participant - Leg 1a: Hervé Claustre[1]
Cruise Participant - Leg 1b: Joséphine Ras[1]
[1]Laboratoire d'Océanographie de Villefranche, Villefranche-sur-mer, France

24.1 Introduction

The purpose of such measurements was to quantify the standing stocks of particulate material and of phytoplankton community biomass over the upper layer (<100m) and along the spatio-temporal gradient representative of the evolution of the ice-edge bloom (from pre-bloom conditions to bloom collapse).

More specifically:

- How evolve the phytoplankton community (e.g. diatoms vs nanoflagellates)
- How evolves their physiological state (diatom senescence, photoprotective status)
- What are the degradation products
- Calibration of the Seapoint fluorometer into its Chla equivalent and analysis of the variability of the relationship.
- Calibration of attenuation coefficient (derived from the CTD transmisiometer) into POC equivalent

24.2 Methodology

Just water sampling and subsequent filtration onto 25 mm GF/F (HPLC, stored at -80°C) and pre-ashed 25mm GF/F filters for POC/SPM
1 person can conduct both filtrations at the same time. The main issue is to define the appropriate volume of filtration. In general the following scheme was used (for POC, ap and pigments):

- Seapoint fluorometer >3 mg m-3: 500 ml
- Seapoint fluorometer: 1-3: 1 L
- Seapoint fluorometer < 1: Full bottle

During Leg 1b, additional sampling was also conducted for:

- Taxonomy; 250 ml stored in glass amber bottles, with 0.8ml Lugol added to each bottle. These were mixed by turning upside down 3 times, and then stored in the cold room.
- Chlorophyll a; 58 ml, then later during the leg, 500 ml, were collected and filtered on 25mm GF/F Whatman filters. Filters were stored in cryotubes and placed at -80°C until fluorescence measurement on board.

24.3 Preliminary Results

No preliminary results yet for HPLC, POC and Taxonomy.
Chlorophyll a measurements were performed on board by another person (Flavienne Bruyant). Overall 56 stations were sampled for pigments, taxonomy and chlorophyll a and 30 stations for POC. These amount to:

- 568 samples for pigment analysis by HPLC (FULL, BASIC and FLOAT stations);
- 305 samples for POC and SPM (FULL stations);
- 300 samples for chlorophyll a and for taxonomy during Leg 1b (FULL and BASIC stations).

<u>Collaboration</u>

- POC and SPM was sampled and will be processed by Takuvik
- HPLC and particulate absorption will be analyzed by LOV
- P vs I and PAM by Stanford
- Bacteria by SBR
- Possibility to conduct a study for the possible determination of C/Chla ratio in phytoplankton communities using POC, ap (aphy, anap), pigments and bacteria cytometric measurements (collaboration LOV, Takuvik, Roscoff)
- Merging data for pigments, aphy, PI curves (and possibly other parameters, nutrients?) to better constraint the photo-physiological parameters used in bio-optical models of primary production (collaboration Stanford, Takuvik, LOV)
- Comparison of pigment data with taxonomy observations and on board chlorophyll a measurements

25 Colored Organic Dissolved Matter (CDOM) and Imaging FlowCytobot (IFCB) – Leg 1

Project leaders: Marcel Babin[1] (marcel.babin@takuvik.ulaval.ca), Atsushi Matsuoka[1], Annick Bricaud[2]

Cruise Participants - Leg 1: Pierre-Luc Grondin[1] and Flavienne Bruyant[1]

[1] *Takuvik, Université Laval, Québec, QC, Canada*

[2] *Laboratoire d'Océanographie de Villefranche, Villefranche-sur-mer, France*

25.1 Introduction

25.1.1 *IFCB*

The main objective of the IFCB is to capture rapid changes in the phytoplankton communities' composition and to determine the species' growth optima. Using a high frequency submersible imaging flow cytometer (Imaging FlowCytobot), we can study the phytoplankton species succession in a phytoplankton spring bloom in the Arctic Ocean.

25.2 Methodology

25.2.1 *IFCB*

The IFCB was running only during Leg 1b, starting at transect #5 (stnS G5XX) until transect #7. Transect #4 was skipped since the IFCB was broken and it took one week to repair it. The IFCB was borrowed to Lee Karp-Boss (University of Maine, Orono, Maine). Typically, 50mL samples were collected from a Niskin bottle (or from a plastic container when many Niskins were pooled together) into Falcon tubes. They were kept in a cooler with ice until analysis to prevent algae from dying. Samples were analyzed using the IFCB, typically within 12h, with the following specifications: sample volume = 5mL, filter mesh size = 200µm, PMT value = 0,8, trigger value = 0,13. The software setup was the following: debubble with sample, prime sample tubing, sample volume 5mL, volume to skip = 0,5mL. Ice samples from ice cores (0-3cm and 3-10cm layers) were also collected at a few stations during Leg 1b. In order to prevent contamination between samples, Milli-Q water was run between samples with a lot of algae. The operations can be conducted while other measurements are made (e.g. CDOM, filtrations). 272 samples were analyzed from July 1st 2016 up to July 11th 2016, for a total of 233 007 images. Samples from Hannah Joy-Warren (Arrigo lab, UStanford) and Briva Moriceau (Brest?) were run as well, as an additional measurement for their experiment. IFCB samples' information and file names can be found within the electronic logbook (*Logsheet_IFCB_GreenEdge2016.xlsx*).

Figure 25.1. IFCB setup on board *CCGS Amundsen* during GE2016. (Photo: Pierre-Luc Grondin)

Processing and features extraction are done using scripts developed by Heidi Sosik at WHOI, MA, USA and Pierre-Luc Grondin, ULAVAL, QC. Taxonomy is done on Ecotaxa (*Picheral M, Colin S, Irisson J-O. Ecotaxa, a tool for the taxonomic classification of images. http://ecotaxa.obs-vlfr.fr*) using random forest algorithms. Reference set and validation of predictions are both done manually.

25.2.2 *CDOM*

The detailed methodology to determine light absorbance of CDOM using an UltraPath (World Precision Instruments, Inc.) is documented in Bricaud et al. [2010] and Matsuoka et al. [2012]. Briefly, a sample was collected from a CTD/Niskin bottle (or from a plastic container when pooling many Niskin bottles together) into pre-rinsed amber glass bottles. Those samples were filtered immediately after sampling, in dim light, using 0.2 µm GHP filters (Acrodisc Inc.) pre-rinsed with 200 ml of Milli-Q water. Filtered samples were then pumped into the sample cell of the Ultrapath instrument using a peristaltic pump. Absorbance spectra were measured from 200 to 735 nm with 1 nm increments with reference to a salt solution (the salinity of the reference was adjusted to that of the sample, ± 2 salinity unit), prepared with Milli-Q water and granular NaCl precombusted in an oven (at 450 ˚C for 4 hours). The sample tube was cleaned between measurements with diluted solutions of detergent, high reagent grade MeOH, 0.1N HCl, and with Milli-Q water. The cleanliness of the tube was checked by measuring the absorption spectrum of the reference water between each sample.

Temperature differences between reference and sample were minimized as far as possible, but could not be always avoided. As absorbance of pure water depends on temperature, this sometimes resulted in an underestimate of absorbance mostly beyond 700 nm for some samples. No temperature correction was applied to absorbance spectra in the data. To minimize the temperature and salinity effects on the absorbance among samples, the averages of the measured values of $OD_{CDOM}(\lambda)$ over a 5-nm interval around 685 nm ($OD_{null,CDOM}$) was assumed to be 0 and the $OD_{CDOM}(\lambda)$ spectrum was shifted accordingly [Pegau et al., 1997; Babin et al., 2003]:

$$a_{CDOM}(\lambda) = 2.303 \frac{[OD_{CDOM}(\lambda) - OD_{null,\,CDOM}]}{l} \qquad \text{(Eq. 1)}$$

where 2.303 is a factor for converting base e to base 10 logarithms, and l is the optical pathlength (m). For all measurements, a 2 m optical pathlength was used. The presence of microbubbles in the sample tube was minimized by using a peristaltic pump. When not totally removed, microbubbles induced a significant (and artificial) absorption detectable in the infrared, and the corresponding absorption spectra were discarded.

Spectra of $a_{CDOM}(\lambda)$ can be expressed as exponential functions as follows [e.g., Bricaud et al., 1981; Babin et al., 2003]:

$$a_{CDOM}(\lambda) = a_{CDOM}(\lambda_r) e^{(-S_{CDOM}(\lambda - \lambda_r))} \qquad \text{(Eq. 2)}$$

where λ_r is a reference wavelength (440 nm in this study), and S_{CDOM} denotes the spectral slope of CDOM. S_{CDOM} was calculated by fitting a non-linear regression to the data from 350 to 500 nm [Babin et al., 2003].

Figure 25.2. Experimental set up (Photo: Pierre-Luc Grondin)

Figure 25.3. Filtration rack (middle of the picture) (Photo: Pierre-Luc Grondin)

25.3 Preliminary results

25.3.1 *IFCB*

As of 11 June 2016, a lot of ice algae have been observed in the ice samples, particularly pennate diatoms (*Entomoneis* spp., *Navicula* spp., *Nitzschia* spp., *Fragilariopsis* spp., *Gyrosigma/Pleurosigma* spp., *Pseudo nitzschia* spp.). Flagellates (*Pyramimonas* spp.) and dinoflagellates (*Peridiniella* spp., *Gymnodinium/Gyrodinium* spp.) have also been observed, but in fewer proportions both in diversity and abundance. In water samples, except for the water-ice interface samples, there are not many cells that have been observed. However, no shift in communities has been observed up to now. Pierre-Luc Grondin is now conducting taxonomy analyses on the dataset to monitor any rapid changes in the communities' composition. The aim is to have, by the end of 2016, a final matrix of diversity and abundance comprising all IFCB samples ran during GreenEdge 2016.

25.3.2 *CDOM*

Data example:

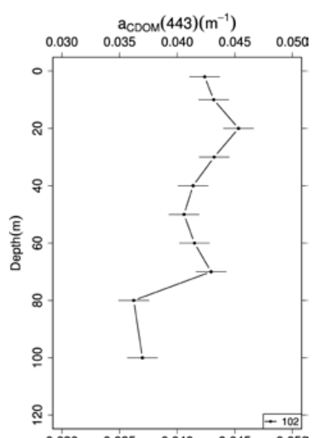

Figure 25.4. Absorption profile at 443nm, at station G102 (Graph: Atsushi Matsuoka)

Collaboration

There is collaboration between Takuvik (Université Laval, Québec) and the LOV (Villefranche-sur-mer, France) for sampling and data analysis of CDOM. Atsushi Matsuoka will be processing the data for the CDOM part.

Reference

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26 Phytoplankton Production and Biomass – Legs 2 and 3

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26.1 Introduction

Primary production plays a central role in the oceans as it supplies organic matter to the higher trophic levels, including zooplankton, fish larvae, marine mammals and birds. Marine polar ecosystems are particularly sensitive to any changes in primary production due to their low number of trophic links (Grebmeier et al. 2006; Moline et al. 2008; Post et al. 2009). The Arctic Ocean is changing as evidenced by the decrease in sea ice thickness and extent (Stroeve et al. 2007; Kwok et al. 2009), the early melt and late freeze-up of sea ice (Markus et al. 2009) and the enhancement of the hydrological cycle (Peterson et al. 2006; Serreze et al. 2006). These environmental changes have already altered the phytoplankton biomass distribution in the Arctic Ocean (Arrigo et al. 2008; Pabi et al. 2008). In this context, the general objectives of our research project are (1) to determine the spatial and temporal variability in production, biomass, abundance and taxonomic composition of the phytoplankton communities, and (2) to determine the role of environmental factors on the phytoplankton dynamics and its variability in Baffin Bay, Kane Basin, Canadian Arctic Archipelago, Amundsen Gulf and in Beaufort Sea.

The specific objectives of leg 3 were to determine:

1) the downwelling incident irradiance, every 10 minutes, with a Li-COR 2 pi sensor;
2) the transparency of the upper water column with a Secchi disk;
3) the underwater irradiance profile with a PNF-300 probe;
4) the concentrations of dissolved organic carbon (DOC), total organic carbon (TOC), total dissolved nitrogen (TDN) and total nitrogen (TN) with a Shimadzu TOC-V_{CPN} analyzer;
5) the chlorophyll *a* and pheopigment concentrations with a Turner Designs fluorometer (3 size-classes: >0.7 µm, >5 µm, >20 µm);
6) the abundance and taxonomic composition of phytoplankton using the inverted microscopy method;
7) the abundance of pico- and nanophytoplankton and heterotrophic bacteria by flow cytometry;
8) the phytoplankton production using the ^{14}C assimilation method (2 size-fractions: >0.7 µm, >5 µm).

As part of the NETCARE project, we had the additional objective to compare:

1) the concentrations of DOC, TOC, TDN and TN;
2) the concentration of chlorophyll *a* and pheopigment;

3) the abundance and taxonomic composition of phytoplankton;
4) the abundance of pico- and nanophytoplankton and heterotrophic bacteria in the surface micro-layer and in the underneath water.

Using tank experiment, we also had the objective to determine phytoplankton contribution to the aerosol formation. We first characterized the phytoplankton communities using the above-mentioned variables (5, 6, 7 and 8) and we measured the difference in DOC concentration and in the abundance of pico- and nanophytoplankton and heterotrophic bacteria at the beginning and at the end of the experiment. Micro-layer and tank experiment will be discussed in other report.

26.2 Methodology

At each water column station, we collected water samples with 12 L Niskin-type bottles attached to the CTD-rosette. During the daytime, we determined the depth of the euphotic zone with the Secchi disk and the PNF-300 probe. Size-fractionated (3 size-classes: >0.7 μm, >5 μm and >20 μm) chlorophyll *a* concentrations were measured onboard the ship at each sampling depth with a Turner Designs fluorometer (model 10-AU). Size-fractionated (2 size-classes: >0.7 μm and >5 μm) primary production was estimated at 7 optical depths in the water column (i.e. 100%, 50%, 30%, 15%, 5%, 1%, and 0.2% of the surface irradiance), following JGOFS protocol for simulated *in situ* incubation. The other samples collected during this expedition will be analyzed at ISMER. Detailed sampling activities are summarized in Table 26.1 and Table 26.2. Our chlorophyll *a* data will be used for the calibration of the CTD-Rosette chlorophyll *a* fluorescence sensor.

Table 26.1. Sampling operations during leg 2 of the ArcticNet 2016 expedition on board the CCCS *Amundsen*.

Station	Cast	Date	Position (min)		Chlorophyll a			POC/PON	DOC/DN	HPLC	Taxo	Cyto	Primary production	
		(yy-mm-dd)	Lat (°N)	Long (°N)	>0.7µm	>5µm	>20µm		TOC/TN			flux	>0,7µm	>5µm
177	28	29-Jul-16	67° 28,54	63°47,482	x	x	x	x	x	x	x	x	x	x
176	31	30-Jul-16	69° 35,15	65° 21.358	x	x	x	x	x	x	x	x	x	x
169	35	1-Aug-16	71° 16,304	70° 31,380	x	x	x	x	x	x	x	x	x	x
160	40	3-Aug-16	72° 41,062	78° 34,238	x	x	x	x	x		x	x		
323	43	04-août-16	74° 9,413	80° 28,135	x	x	x	x	x	x	x	x	x	x
115	50	06-août-16	76° 19,864	71° 11,558	x	x	x	x	x	x	x	x	x	x
111	55	07-août-16	76°18,524	73°12,533	x	x	x	x	x	x	x	x	x	x
116	60	08-août-16	76°44,336	71°48,457	x	x	x	x	x	x	x	x	x	x
108	64	09-août-16	76°15,948	74°33,164	x	x	x	x	x	x	x	x	x	x
105	67	09-août-16	76°19,026	75°45,373	x	x	x	x	x	x	x	x	x	x
101	73	10-août-16	76°22,970	77°23,414	x	x	x	x	x	x	x	x	x	x
Trinity (TS233)	75	11-août-16	77°52,883	77°11,663	x	x	x	x	x	x	x	x	x	x
139	78	13-août-16	81°21,007	62°46,729	x	x	x	x	x	x	x	x	x	x
Kane-1	80	14-août-16	79°58,891	69°47,173	x	x	x	x	x	x	x	x	x	x
133	83	14-août-16	79°33,252	70°30,844	x	x	x	x	x	x	x	x	x	x
127	86	15-août-16	78°18,041	74°31,960	x	x	x	x	x	x	x	x	x	x
119	89	16-août-16	77°18,908	76°6,221	x	x	x	x	x	x	x	x	x	x
305	92	17-août-16	74°19,741	94°59,014	x	x	x	x	x	x	x	x	x	x
310E	94	19-août-16	71°17,669	97°42,032	x	x	x	x	x	x	x	x	x	x
312	97	20-août-16	69°10,381	100°41,579	x	x	x	x	x	x	x	x	x	x
QMGM	101	21-août-16	68°18,234	101°44,700	x	x	x	x	x	x	x	x	x	x
QMG1	104	22-août-16	68°29,497	99°53,806	x	x	x	x	x		x	x		
QMG4	106	22-août-16	68°29,044	103°25,694	x	x	x	x	x		x	x		
314	108	23-août-16	68°58,286	105°28,550	x	x	x	x	x	x	x	x	x	x

Table 26.2. Sampling operations during leg 3 of the ArcticNet 2016 expedition on board the CCCS *Amundsen*.

Station	Cast	Date	Position (min)		Chlorophyll a			POC/PON	DOC/DN	HPLC	Taxo	Cyto	Primary production	
		(yy-mm-dd)	Lat (°N)	Long (°N)	>0.7µm	>5µm	>20µm		TOC/TN			flux	>0,7µm	>5µm
407	4	27-Aug-16	71°00.259	126°03.718	x	x	x	x	x	x	x	x	x	x
437	6	28-Aug-16	71°48.052	126°30.036	x	x	x	x	x	x	x	x	x	x
408	14	29-Aug-16	71°16.774	127°31.861	x	x	x	x	x	x	x	x	x	x
420	21	30-Aug-16	71°02.950	128°30.912	x	x	x	x	x	x	x	x	x	x
434	23	30-Aug-16	70°10.416	133°32.928	x	x	x	x	x	x	x	x		
472	39	02-Sep-16	69°36.686	138°16.646	x	x	x	x	x	x	x	x	x	x
482	47	03-Sep-16	70°31.447	139°22.240	x	x	x	x	x	x	x	x	x	x
435	52	05-Sep-16	71°04.687	133°38.003	x	x	x	x	x	x	x	x	x	x
421	53	05-Sep-16	71°28.016	133°54.467	x	x	x	x	x	x	x	x	x	x
535	58	08-Sep-16	73°24.678	128°11.635	x	x	x	x	x	x	x	x	x	x
554	60	09-Sep-16	75°44.594	126°26.424	x	x	x	x	x	x	x	x	x	x
575	62	10-Sep-16	76°10.913	125°59.248	x	x	x	x	x	x	x	x		
585	69	12-Sep-16	74°30.218	123°13.855	x	x	x	x	x	x	x	x	x	x
525	73	14-Sep-16	72°23.063	128°59.131	x	x	x				x	x		
405	74	14-Sep-16	70°36.510	123°03.021	x	x	x	x	x	x	x	x	x	x
403	77	15-sept-16	70°05.975	120°05.960	x	x	x	x	x	x	x	x		
1402	78	15-sept-16	70°33.134	117°38.256	x	x	x	x	x	x	x	x		
314	81	18-sept-16	68°58.220	105°28.182	x	x	x	x	x	x	x	x		
312	86	20-sept-16	69°10.265	100°41.857	x	x	x	x	x	x	x	x		
310W	89	21-sept-16	71°27.582	101°16.297	x	x	x	x	x	x	x	x		
307	90	22-sept-16	74°05.896	103°02.394	x	x	x	x	x	x	x	x		
304	93	24-sept-16	74°14.652	091°30.734	x	x	x	x	x	x	x	x		
301	97	24-sept-16	74°07.282	083°19.090	x	x	x	x	x	x	x	x		
165	98	26-sept-16	72°42.925	075°45.294	x	x	x	x	x	x	x	x		
177	100	28-sept-16	67°28.561	063°47.473	x	x	x	x	x	x	x	x		
640	106	01-oct-16	58°55.925	062°09.328	x	x	x							
650	108	02-oct-16	53°48.064	055°26.317	x	x	x							

26.3 Preliminary Results

During leg 2, chlorophyll *a* concentrations varied from about 21 to 328 mg m^{-2}. Comparatively to other regions sampled, Kane Basin had the highest averaged chlorophyll *a* concentration. Large cells (> 5µm) generally dominated the biomass throughout the study, with some exceptions in northern Davis Strait and in Baffin Bay (Figure 26.1).

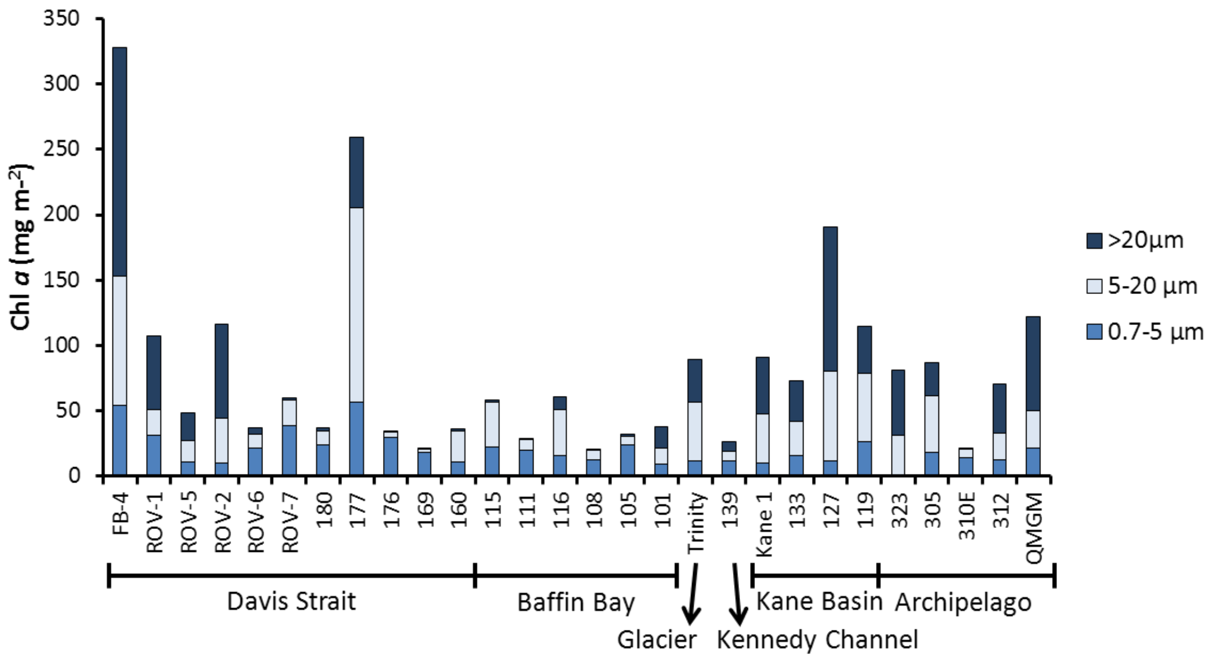

Figure 26.1. Chlorophyll *a* concentrations integrated over 100 m for different size fractions, 0.7-5 µm, 5-20 µm and > 20 µm, at stations sampled during leg 2.

During leg 3, Chlorophyll *a* concentrations varied from about 8 to 53 mg m^{-2}. Station 535 had the highest chlorophyll *a* concentration and it was the only station were large cells largely dominated the biomass. Everywhere else, small cells (< 5µm) generally dominated the biomass (from 48 to 90%; Figure 24.2).

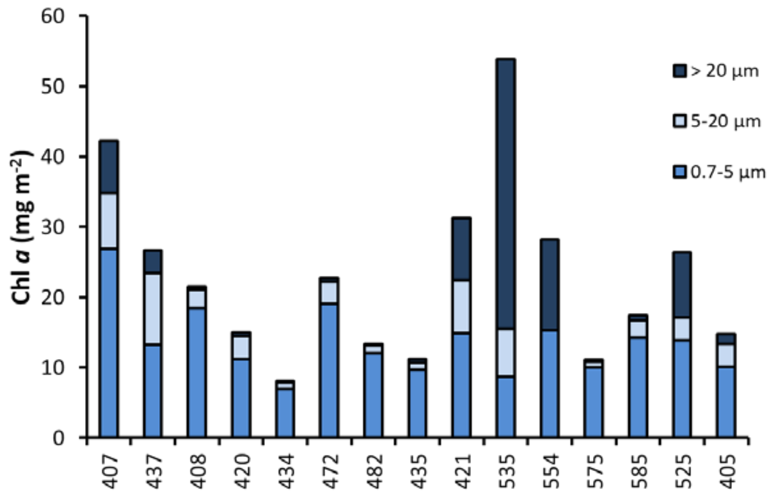

Figure 26.2. Chlorophyll *a* concentrations integrated over 100 m for different size fractions, 0.7-5 µm, 5-20 µm and > 20 µm, at stations sampled during Leg 3a.

26.4 Comments and Recommendations

It would be great to have a refrigerator in the AFT-lab instead of a Sanyo incubator. Storage is not always available in the cold room and the Sanyo incubator has the recurrent problem that it cannot keep a 4°C temperature for a whole cruise.

The blue barrels used for radioactive waste are too soft. When tightened, they tend to deform themselves and the lid can hardly be replaced. Moreover, it would be easier if all barrels could be accessed with no need to relocate them during the cruise (only 1 row of barrels instead of 2). The crew has some suggestions on how this could be achievable. Another option could be to place the first barrels needed during the cruise on top the rosette shack (only 1 row), while empty barrels needed afterwards could be placed somewhere else. As the first barrels get full, new empty barrels are brought on top of the rosette shack and form a second row, in front of the full barrels. It would avoid moving full barrels that are quite heavy. This recommendation arises from discussions with the crew.
As it is now, the new TV that shows the schedule is not a very useful tool. Being late on an operation doesn't give any clue about how late we are. Schedule updates are not frequent due to the complexity of uploading new schedule. To be useful, updated time for each operation must be provided each time an operation is delayed or cancelled. If this is too complicated, there could only be a text box saying for instance: "Starting from this operation, all other operations are delayed by xx hours''. Not only the chief scientist but also the bridge should be allowed to make these changes to the schedule (at night).

At the next ArcticNet planning meeting in Montreal, the need to do the full transect 101-115 could be re-assessed. Basic stations along this transect could possibly be changed to Nutrient or CTD stations in order to provide more time to cover Kane Basin and Kennedy Chanel, which are becoming easier to access with the ice retreat. Arctic spring bloom phenology is changing and covering a larger area would improve knowledge on these changes. Moreover, the schedule is very tight and does not allow much time for opportunistic sampling.

<u>Reference</u>

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27 Zooplankton and Fish Ecology – Legs 1, 2 and 3

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Cruise participants - Leg 2: Caroline Bouchard[1], Fanny Cusset[1] and François Fortier[1]
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27.1 Introduction

The overarching goal of Green Edge's work package 3 is to track the fate of the phytoplankton spring bloom (PSB) in the marine ecosystem. Some objectives among this work package are 1- the assessment of top-down regulation of the bloom by pelagic grazers and the subsequent impact for the food web, and 2- the monitoring of the bloom decline and sedimentation from the surface to the deep ocean. In line with these 2 main objectives our aims during this cruise were:

Objective 1: To monitor zooplankton and fish key parameters (abundance, diversity, biomass and distribution) using various nets and the echosounder EK60.

Objective 2: To measure under-ice export fluxes of biogenic matter using drifting sediment traps.

27.2 Methodology

27.2.1 . *Double Square Net (DSN) (1 × 500µm, 1 × 750µm, 1 × 50µm)*

Ichtyoplankton Net. Rectangular frame carrying two 6-m long, 1-m^2 mouth aperture, squareconical nets and an external 10-cm diameter, 50-µm mesh net (to collect microzooplanktonic prey of the fish larvae). The sampler was towed obliquely from the side of the ship at a speed of ca. 2-3 knots to a maximum depth of 90 m (depth estimated during deployment from cable length and angle; real depth obtained afterward from a Star Oddi® mini-CTD attached to the frame). The DSN was equipped with three KC® flowmeters. Fish larvae collected with the DSN were measured and preserved individually in 95% ethanol + 1% glycerol. Zooplankton samples from the 500-µm mesh and the 50-µm mesh nets were preserved in 4% formaldehyde solution for further taxonomic identification. During leg 2, zooplankton samples from the 750-µm mesh net were given to Alexis Burt (PI: Gary Stern) for contaminant analyses and/or preserved in 95% ethanol for genetic analyses. During leg 3, in most stations, a 20ml subsample from the 500-µm mesh sample was preserved in ethanol for genetic analysis and the zooplankton from the 750-µm mesh net was given to Jasmin Katharina Schuster and Jimmy Truong (PI: Gary Stern) for contaminant analysis.

27.2.2 . *5 Nets Vertical Sampler (5NVS) (2 × 200µm, 1 × 500µm, 1 × 50µm, LOKI)*

Zooplankton sampler. Four 1-m² metal frames attached together and rigged with three 6-m long, conical-square plankton nets, an external 10-cm diameter, 50-µm mesh net, and a LOKI (Lightframe Onsight Keyspecies Investigation system). Deployed vertically from 10 meters off the bottom to the surface, or less at deep station as the maximum depth recommended for the LOKI is 1000 m. The 5NVS was equipped with three KC Denmark ® flowmeters. After removal of fish larvae/juveniles (kept separately in 95% ethanol + 1% glycerol), zooplankton samples from the 500-µm mesh, the 50-µm mesh, the LOKI and half of the 200- µm mesh nets were preserved in 4% formaldehyde solution for abundance measurements, while samples from the other 200-µm mesh net were provided to Noé Sardet for the filming of living individuals during Leg 1a and preserved in 95% ethanol for genetic analyses during Leg 1b. During leg 2, the other half of the 200-µm mesh net was given to Owen Sherwood (PI: Evan Edinger) for studies on cold-water corals habitats (Leg 2a) or to Vincent Marmillot (PI: Jean-Éric Tremblay) for lipids analyses. During leg 3, the other 200-µm mesh net was split in half for Pierre Larouche/Vincent Marmillot and Jasmin Katharina Schuster/Jimmy Truong for nutrient and contaminant analysis respectively.

27.2.3 . *Bioness (9 × 750µm)*

Ichtyoplankton Multinet. Frame carrying nine 1-m² mouth aperture nets to collect zooplankton and fish larvae. The sampler was towed obliquely from the side of the ship at a speed of ca. 2-3 knots to a maximum depth of 90 m and nets were closed at each 10-m interval (depth recorded during deployment by the integrated CTD of the sampler). Fish larvae collected with the Bioness were measured and preserved individually in 95% ethanol + 1% glycerol while zooplankton samples were preserved in 4% formaldehyde solution for further taxonomic identification.

27.2.4 . *Modified Isaac-Kidd Midwater Trawl (IKMT)*

Pelagic juvenile and adult fish sampler. Rectangular net with a 9-m² mouth aperture and mesh size of 11 mm in the first section, 5 mm in the last section. The net was lowered to a depth where a fish aggregation has been detected with the echosounder and towed at that depth for 20 minutes at a speed of 2-3 knots (depth estimated during deployment from cable length and angle; real depth obtained afterward from a Star-Oddi® mini-CTD attached to the frame). The IKMT net was replaced by the RMT (Rectangular Mid-water Trawl) net after the initial net was torn apart by ice during leg 1. Fish collected with this sampler were measured and stored at -20°C. During leg 3, larvae were preserved in 95% ethanol + 1% glycerol.

27.2.5 . *Benthic Beam Trawl*

Demersal fish sampler. Rectangular net with a 3-m² mouth aperture, 32-mm mesh size in the first section, 16 mm in the last section, and a 10-mm mesh liner. The net was lowered to the bottom and towed for 15-20 minutes at a speed of 3 knots. Fish collected with this sampler were measured and stored at -20°C. During leg 3, larvae were preserved in 95% ethanol + 1% glycerol.

27.2.6 . *Hydrobios (9× 200μm)*

Multi-nets plankton sampler. Square device carrying 9 nets opening sequentially with a 0.5-m^2 mouth aperture and a mesh size of 200 μm. The sampler was deployed vertically from 20 meters off the bottom to the surface and the nets were opened at different depths that were set before the deployment. After removal of fish larvae/juveniles (kept separately in 95% ethanol + 1% glycerol), zooplankton samples from the nets were preserved in 4% formaldehyde solution for abundance measurements and taxonomic identification. *It was impossible to connect one of the nets; the multi-net sampling consisted of 8 instead of 9 nets

27.2.7 . *Acoustic Monitoring*

The Simrad® EK60 echosounder of the *Amundsen* allows our group to continuously monitor the spatial and vertical distribution of zooplankton and fish, the later mostly represented by Arctic cod (*Boreogadus saida*). The hull-mounted transducers are in operation 24h a day thus providing an extensive mapping of where the fishes are along the ship track.

27.2.8 . *Drifting Sediment Traps*

Two drifting lines consisting of a sequential sediment trap (Technicap PPS4/3) deployed at 25 m, 3 floats, and a mast carrying 2 Argos buoys and a radar reflector were deployed at station G115 (Sidney) and station G201 (Crosby) on June 13 and 14, respectively. Each trap had 12 cups programmed to rotate every 2 days. Crosby was successfully recovered on July 11. Laboratory analyses on the 12 samples collected will be conducted in the coming weeks. It was unfortunately impossible to locate Sidney who is still drifting (Figure 27.1).

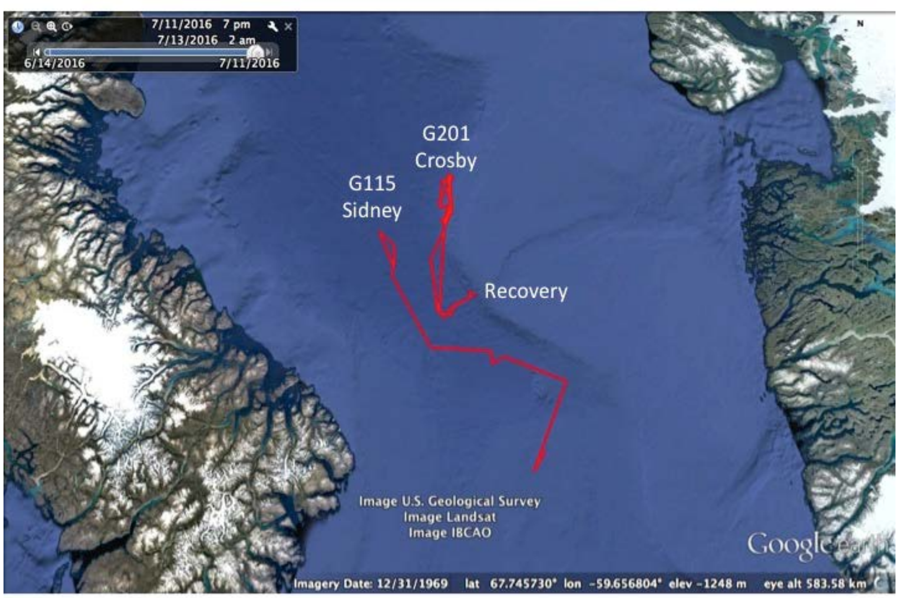

Figure 27.1. Drifting paths of Sydney and Crosby.

27.3 Preliminary Results

During leg 1, 59 net deployments were completed from which a total of 158 zooplankton samples were collected and 1525 fish were caught. 980 individuals were young-of-the-year (96% Arctic cod) and 545 were adults (25% Arctic cod).

Table 27.1. Summary of net operations during leg 1.

Station	Date	5NVS	DSN	Hydrobios	IKMT	Beam Trawl
G100	2016-06-09		X			X
G102	2016-06-10		X			
G107	2016-06-11	X		X		
G110	2016-06-12	X				
G115	2016-06-13	X				
G201	2016-06-14	X	X			
G204	2016-06-15	X		X		
G207	2016-06-14		X			
G300	2016-06-17		X			X
Opp. 1	2016-06-17					X
G309	2016-06-18		X		X	
G312	2016-06-19	X		X		
G318	2016-06-20	X		X		
G324	2016-06-21	X		X		
G403	2016-06-25	X		X		
G409	2016-06-26	X		X		
G413	2016-06-27	X		X		
G418	2016-06-28	X	X		X	
G503	2016-06-30					X
G507	2016-06-30	X	X			X
G512	2016-07-01	X	X			
G519	2016-07-02	X		X		
G600	2016-07-03	X		X		
G605	2016-07-04	X	X			
G615	2016-07-05	X	X		X	
G604.5	2016-07-06	X	X		X	
G703	2016-07-07	X	X		X	
G707	2016-07-08	X	X			
G713	2016-07-09		X			X
G719	2016-07-10	X	X			

During leg 2, zooplankton and fish were sampled at 37 stations during 90 net deployments (Table 27.2). A total of 308 zooplankton samples were collected and 1850 fish were caught. 1547 individuals were young-of-the-year (71% Arctic cod) and 303 were adults (38% Arctic cod).

Table 27.2. Summary of net operations during leg 2.

Station	Date	DSN	5NVS	Bioness	IKMT	Beam Trawl
FB4	2016-07-16	x	x			
ROV1	2016-07-18	x	x			
ROV5	2016-07-19	x				
ROV2	2016-07-20	x	x			
ROV3	2016-07-21	x	x			
ROV6	2016-07-22	x	x			
ROV7	2016-07-25		x			
180	2016-07-26		x			
177	2016-07-28	x	x			x
176	2016-07-30	x	x			
169	2016-08-01	x	x		x	
160	2016-08-03	x				
323	2016-08-04	x	x	x		x
115	2016-08-06	x	x	x	x	x
111	2016-08-07	x	x			
116	2016-08-08	x	x	x	x	x
108	2016-08-08	x		x	x	x
105	2016-08-09	x	x			
101	2016-08-10	x	x			x
TS233	2016-08-11		x			
139	2016-08-13	x	x			x
Kane1	2016-08-14	x	x			
127	2016-08-15	x	x			
119	2016-08-15	x	x			
133	2016-08-15	x	x			
Allen Bay	2016-08-17	x	x			
305	2016-08-18	x	x			
310E	2016-08-19	x	x			
311	2016-08-20	x	x			
312	2016-08-20	x	x			
QMGM	2016-08-21	x	x			x
QMG2	2016-08-21	x	x			x
QMG1	2016-08-22	x	x			x
QMG3	2016-08-22	x	x			x
QMG4	2016-08-23	x	x			x
314	2016-08-23	x	x			x
316	2016-08-24	x	x			x

Zooplankton and fish were sampled at 36 stations completing 98 net deployments (Table 27.3). A total of 299 zooplankton samples were collected (238 of which for taxonomic analysis) and 1119 fish were caught. 416 individuals were young-of-the-year (53% Arctic cod) and 703 were adults (49% Arctic cod).

Table 27.3. Summary of net operations during leg 3.

Stations	Date	Beam Trawl	Biones s	Hydrobio s	IKM T	Monster-LOKI	Tucke r
405	27-08-2016	X				X	X
407	28-08-2016			X	X	X	X
437	28-08-2016					X	X
408	29-08-2016	X	X			X	X
420	30-08-2016					X	X
434b	30-08-2016					X	X
421	31-08-2016					X	X
482	01-09-2016					X	X
472	02-09-2016	X				X	X
BR-G	04-09-2016					X	
435	05-09-2016	X		X	X	X	X
535	08-09-2016	X		X		X	X
554	09-09-2016					X	X
575	10-09-2016					X	X
579 en Route to 581	11-09-2016	X					
585	12-09-2016					X	X
545	13-09-2016	X					X
525	14-09-2016	X					X
405	15-09-2016						X
406	15-09-2016	X					X
403	15-09-2016	X			X		X
1402	16-09-2016	X					X
316	18-09-2016	X				X	X
314	18-09-2016	X				X	X
QMG4	19-09-2016	X				X	X
QMG3	19-09-2016	X				X	X
QMGM	19-09-2016	X				X	X
QMG2	19-09-2016	X				X	X
312	20-09-2016	X				X	X
311	20-09-2016	X				X	X
310E	20-09-2016	X	X				X
310W	21-09-2016	X				X	X
307	22-09-2016	X		X		X	X
304	24-09-2016	X				X	X
301	25-09-2016	X					X
165	26-09-2016	X				X	X
177	28-09-2016				X	X	X

Collaboration

Zooplankton and fish data will be assessed in conjunction with observations and stomach content of seabirds hunted by Svend Erik Garbus (PI: Anders Mosbech) to determine if the abundance and biomass of Arctic cod in the marginal ice zone influence the distribution and composition of the seabird assemblage (leg 1).

Acknowledgement

We would like to express our sincere gratitude to the commanding officer Alain Gariépy and each one of the officers and crew members of the *CCGS Amundsen* onboard during leg 2: the precious work of everyone was essential for making this mission a success. We would also like to thanks Christian Nozais and Tim Papakyriakou for their dedication as chief scientists.

28 Contaminants Sampling Program – Legs 2 and 3

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28.1 Introduction

This work is funded by the Northern Contaminants Program, ArcticNet and Environment and Climate Change Canada.

28.1.1 *Hydrocarbon, Mercury and Methyl Mercury Food Web Sampling*

Oil reserves under the sediments in Baffin Bay (including the North Water Polynya, Davis Strait, Lancaster Sound and Jones Sound) are the largest in Arctic Canada; with some potential reservoirs estimated to contain billions of barrels of oil. Global warming and reduced ice coverage has made these reserves more accessible and the exploration/exploitation of offshore oil in the region more feasible. With declining ice conditions oil exploration and shipping traffic through the North West Passage will only increase; both of these activities have the potential to increase petroleum hydrocarbon concentrations in Baffin Bay. However, hydrocarbons are also naturally present as a result of natural oil seeps, fossil fuel combustion, and terrestrial run-off. The purpose of this study is to continue to measure baseline concentrations of hydrocarbons in the Baffin Bay marine environment in advance of future oil exploration/exploitation and increased shipping.

28.1.2 *SPMD Deployments*

Our goal with the SPMDs is to monitor concentrations of persistent organic pollutants (POPs) in the mixed surface layer, the Pacific water mass and the deep Atlantic waters. The SPMDs were placed close to CTDs and/or ADCPs (Figure 28.1, Figure 28.4) located in each of these layers to allow us to relate our results to information gathered from them and confirm which water mass they were sampling. For more mooring information please see the mooring team's cruise report. These sites are also part of a global passive water monitoring network called AQUA-GAPS, which is a collaboration between Canada, USA and China. Additional samplers were deployed near Cambridge Bay and in northern Baffin Bay during leg 2.

Figure 28.1. SPMD cage installed on the mooring line on BREA mooring BR-3 (left) and BR-K (right).

28.1.3 *Mercury in Seawater*

Riverine inputs of mercury to the Arctic Ocean are recognized as a potentially important, although poorly quantified, sources of mercury to Arctic marine systems. One objective during Leg 3a was to collect depth profiles of aqueous mercury from nutrient transects extending out the Mackenize River and the Thomson River, located on the northern end of Banks Island in M'Clure Strait. Ongoing work in our laboratory is focused on measuring these rivers as mercury sources. Leg 3b stations targeted included BB3 and BB1, sampled during GEOTRACES in 2015, and the 353-354-355 transect in Hudson Strait.

In addition to water column measurements of mercury, we performed incubations to link rates of mercury methylation to bacterial activity and food web bioaccumulation. Previous measurements from ArcticNet 2007 identified water column methylation as the primary source of the monomethylmercury chemical form that bioaccumulates in Arctic food webs (Lehnherr et al, 2011). Methylation was attributed to bacterial processes analogous to those known to occur in anoxic sediments, despite limited empirical evidence. Our incubation experiments paired similar methylation and demethylation rate measurements as those completed during ArcticNet 2007 with additional measurements of phytoplankton uptake of labelled MMHg/Hg(II). Filtered controls were also measured in order to isolate the relative importance of cellular (i.e. bacterial) and potential non-cellular methylation mechanisms.

28.2 Methodology

28.2.1 *Hydrocarbon, Mercury and Methyl Mercury Food Web Sampling*

While on board the *CCGS Amundsen* we have collected invertebrates (benthic and pelagic) and surface sediment and sediment cores for this research.

Pelagic Invertebrates: Zooplankton were sampled from the whole water column using the 5-net vertical sampler (Monster Net with LOKI: 1 m^2 200 µm mesh; Figure 28.2), and from the surface 90 m using the oblique net tow (Tucker Net: 1 m^2 750 µm mesh) at 36 stations during Leg 2 (Table 28.1). Species of interest include: *Calanus hyperboreus*, *C. glacialis*, *Paraeuchaeta glacialis*, Chaetognaths (including *Parasagitta elegans*, *Pseudosagitta maxima*, and *Eukrohnia* sp.), *Themisto libellula*, *T. abyssorum*, *Hyperia galba, Cleone limacina*, *Limacina helicina,* Ctenophora and Hydromedusae.

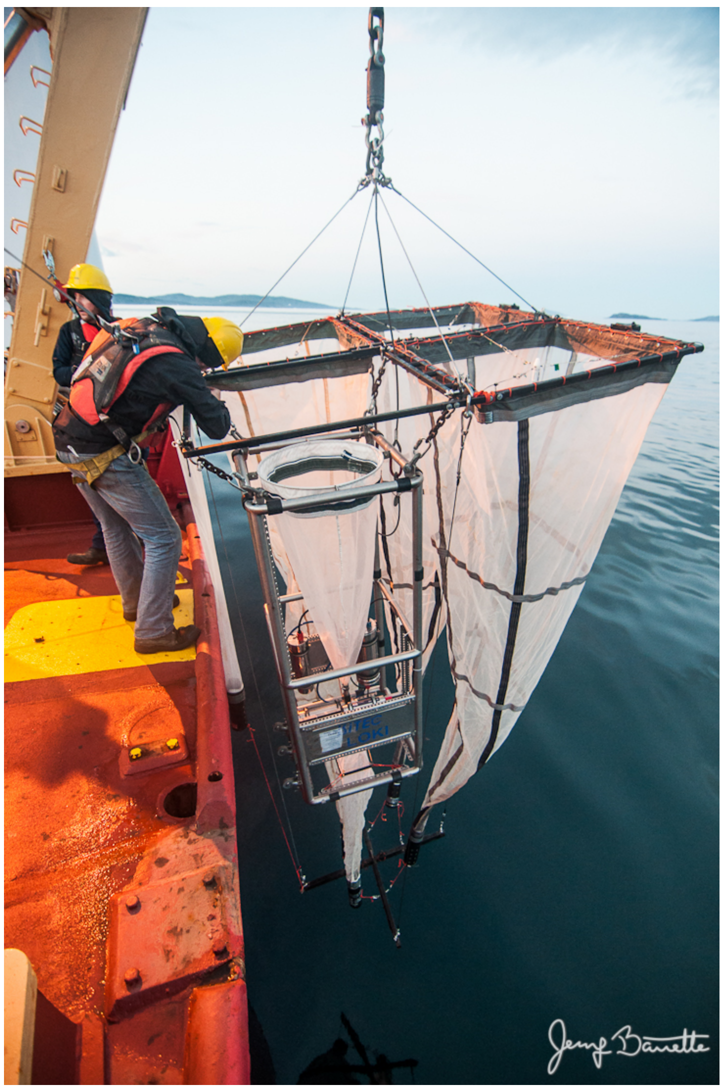

Figure 28.2. The 5-net vertical zooplankton sampler with LOKI (Monster net). (photo: Jessy Barrette 2013 ArcticNet Leg 1a)

Benthic Invertebrates: Benthic animals were collected using the Agassiz Trawl, as well as opportunistically from the Beam Trawl. Samples were identified as best as possible with help from members of the Archambault team (Figure 28.3). They were labelled and frozen at -20°C. Groups of interest include: Asteroidea (sea stars), Ophioroidea (brittle stars), decapods, and amphipods. Stations sampled are noted in Table 28.2.

Figure 28.3. Benthic invertebrates that were collected from the Beam Trawl 18 August, 2014 at station 407.

Push coring: Samples destined for hydrocarbon analysis were collected using 10 cm diameter plastic push cores from the boxcore (Table II) by members of the Hubert contaminant team. The sediment core was subsequently placed on a manual extruder and was either sectioned by 0.5 cm intervals for the first 10 cm, and then 1.0 cm for the balance of the core (approximately 30 cm total) or subsamples of Hubert cores were taken (2 cm intervals for the first 10 cm, and then 5 cm for the balance). Sediment was stored in Whirl-pac plastic bags or 20 ml plastic scintillation vials, and stored at -20°C. Surface sediments (0-5 cm) were collected as well.

Table 28.1. Zooplankton tows where species were collected for contaminants.

Leg	Station	Location	Date	Latitude (N)	Longitude (W)	Tow	Bottom Depth (m)	Sampler Depth (m)
2A	**FB-4**	**Frobisher Bay**	16-Jul-16	63 34.154	068 15.554	Oblique Tow (1m2, 750um mesh)	88	61
2A	**FB-4**	**Frobisher Bay**	16-Jul-16	63 33.497	068 14.875	Vertical Tow (1m2, 200um mesh)	106	96
2A	**ROV-1**	**Labrador Sea**	18-Jul-16	61 20.760	061 11.912	Vertical Tow (1m2, 200um mesh)	560	550
2A	**ROV-1**	**Labrador Sea**	18-Jul-16	62 20.704	061 10.484	Oblique Tow (1m2, 750um mesh)	563	119
2A	**ROV-5**	**Baffin Bay**	19-Jul-16	61 26.54	060 41.40	Oblique Tow (1m2, 750um mesh)	582	44
2A	**ROV-2**	**Labrador Sea**	20-Jul-16	60 19.45	062 11.96	Vertical Tow (1m2, 200um mesh)	281	271
2A	**ROV-2**	**Labrador Sea**	20-Jul-16	60 18.974	062 12.870	Oblique Tow (1m2, 750um mesh)	278	75
2A	**ROV-3**	**Labrador Sea**	21-Jul-16	60 28.095	061 17.370	Vertical Tow (1m2, 200um mesh)	435	427
2A	**ROV-3**	**Labrador Sea**	21-Jul-16	60 27.78	061 16.72	Oblique Tow (1m2, 750um mesh)	428	90
2A	**ROV-6**	**Labrador Sea**	22-Jul-16	62 59.957	060 38.803	Vertical Tow (1m2, 200um mesh)	458	448
2A	**ROV-6**	**Labrador Sea**	22-Jul-16	63 00.088	060 37.754	Oblique Tow (1m2, 750um mesh)	459	97
2A	**ROV-7**	**"Disko Fan" Baffin Bay**	24-Jul-16	67 58.51	059 30.21	Vertical Tow (1m2, 200um mesh)	872	862
2A	**180**	**Baffin Bay**	26-Jul-16	67 30.845	061 41.105	Vertical Tow (1m2, 200um mesh)	568	560
2B	**177**	**Qikiqtarjuaq**	28-Jul-16	67 28.350	063 47.200	Oblique Tow (1m2, 750um mesh)	375	93
2B	**177**	**Qikiqtarjuaq**	28-Jul-16	67 28.56	063 47.39	Vertical Tow (1m2, 200um mesh)	370	360
2B	**176**	**Baffin Bay**	30-Jul-16	69 35.203	065 21.241	Vertical Tow (1m2, 200um mesh)	380	370
2B	**176**	**Baffin Bay**	30-Jul-16	69 36.661	065 22.084	Oblique Tow (1m2, 750um mesh)	391	89.74
2B	**169**	**Scott Inlet**	01-Aug-16	71 16.804	070 32.308	Oblique Tow (1m2, 750um mesh)	771	90
2B	**169**	**Scott Inlet**	01-Aug-16	71 16.230	070 31.312	Vertical Tow (1m2, 200um mesh)	770	760
2B	**169**	**Scott Inlet**	01-Aug-16	71 16.62	070 33.52	IKMT trawl (9m2 aperture, 1cm mesh)	772	370
2B	**160**	**Pond Inlet**	03-Aug-16	72 41.853	078 34.391	Oblique Tow (1m2, 750um mesh)	730	99
2B	**323**	**Lancaster**	04-Aug-16	74 10.29	080 27.46	Oblique Tow (1m2, 750um mesh)	795	86
2B	**323**	**Lancaster**	04-Aug-16	74 09.508	080 28.286	Vertical Tow (1m2, 200um mesh)	791	781
2B	**115**	**Northwater**	06-Aug-16	76 20.039	070 09.880	Oblique Tow (1m2, 750um mesh)	675	89.22
2B	**115**	**Northwater**	06-Aug-16	76 20.092	071 12.542	Vertical Tow (1m2, 200um mesh)	674	664
2B	**111**	**Northwater**	07-Aug-16	76 18.751	073 10.719	Oblique Tow (1m2, 750um mesh)	593	100.37
2B	**111**	**Northwater**	07-Aug-16	76 18.511	073 12.951	Vertical Tow (1m2, 200um mesh)	591	581
2B	**117**	**Carey Islands**	08-Aug-16	76 44.39	071 48.70	Oblique Tow (1m2, 750um mesh)	690-700	111
2B	**117**	**Carey Islands**	08-Aug-16	76 44.593	071 49.457	Vertical Tow (1m2, 200um mesh)	725	711
2B	**108**	**Northwater**	08-Aug-16	76 16.009	074 32.777	Oblique Tow (1m2, 750um mesh)	446	93
2B	**105**	**Northwater**	09-Aug-16	76 19.021	078 43.899	Oblique Tow (1m2, 750um mesh)	320	113
2B	**105**	**Northwater**	09-Aug-16	76 19.079	075 45.457	Vertical Tow (1m2, 200um mesh)	328	318
2B	**101**	**Northwater**	10-Aug-16	76 23.916	077 24.231	Oblique Tow (1m2, 750um mesh)	348	87
2B	**101**	**Northwater**	10-Aug-16	76 23.517	077 24.531	Vertical Tow (1m2, 200um mesh)	348	338
2B	**TS233**	**Trinity Glacier**	11-Aug-16	77 52.880	077 11.534	Vertical Tow (1m2, 200um mesh)	525	515
2B	**139**	**Petermann Fjord**	13-Aug-16	81 21.859	062 41.864	Oblique Tow (1m2, 750um mesh)	535	95
2B	**139**	**Petermann Fjord**	13-Aug-16	81 22.054	062 40.164	Vertical Tow (1m2, 200um mesh)	475-461	451
2B	**KANE-1**	**Kane Basin**	14-Aug-16	79 58.277	069 48.966	Oblique Tow (1m2, 750um mesh)	242	121
2B	**KANE-1**	**Kane Basin**	14-Aug-16	79 58.471	069 49.609	Vertical Tow (1m2, 200um mesh)	246	236
2B	**133**	**Kane Basin**	15-Aug-16	79 33.06	070 30.78	Oblique Tow (1m2, 750um mesh)	182	92
2B	**133**	**Kane Basin**	15-Aug-16	79 32.75	070 28.42	Vertical Tow (1m2, 200um mesh)	166	156
2B	**127**	**Kane Basin**	15-Aug-16	78 17.12	074 33.72	Oblique Tow (1m2, 750um mesh)	620	97
2B	**127**	**Kane Basin**	15-Aug-16	78 17.528	074 29.774	Vertical Tow (1m2, 200um mesh)	530	520
2B	**119**	**Northwater**	16-Aug-16	77 19.656	076 18.131	Oblique Tow (1m2, 750um mesh)	478	91
2B	**119**	**Northwater**	16-Aug-16	77 19.050	076 13.374	Vertical Tow (1m2, 200um mesh)	489	479
2B	**Allen Bay**	**Resolute**	17-Aug-16	74 43.345	095 14.776	Oblique Tow (1m2, 750um mesh)	63-79	76.54
2B	**Allen Bay**	**Resolute**	17-Aug-16	74 43.72	095 15.58	Vertical Tow (1m2, 200um mesh)	65	55
2B	**305**	**Resolute**	18-Aug-16	74 19.655	094 56.290	Oblique Tow (1m2, 750um mesh)	172	111
2B	**305**	**Resolute**	18-Aug-16	74 19.848	094 55.636	Vertical Tow (1m2, 200um mesh)	178	168
2B	**310E**	**Peel Sound**	19-Aug-16	71 16.806	097 43.335	Oblique Tow (1m2, 750um mesh)	125	97.7
2B	**310E**	**Peel Sound**	19-Aug-16	71 17.046	097 42.164	Vertical Tow (1m2, 200um mesh)	119	109
2B	**311**	**Northwest Passage**	20-Aug-16	70 16.94	098 31.23	Oblique Tow (1m2, 750um mesh)	140	98.57
2B	**311**	**Northwest Passage**	20-Aug-16	70 16.09	098 32.09	Vertical Tow (1m2, 200um mesh)	155	145
2B	**312**	**Northwest Passage**	20-Aug-16	69 10.44	100 42.66	Oblique Tow (1m2, 750um mesh)	67	67.07
2B	**312**	**Northwest Passage**	20-Aug-16	69 10.30	100 42.23	Vertical Tow (1m2, 200um mesh)	68	58
2B	**QMG-M**	**Queen Maude Gulf**	20-Aug-16	68 17.92	101 45.38	Oblique Tow (1m2, 750um mesh)	118	93
2B	**QMG-M**	**Queen Maude Gulf**	20-21-Aug-16	68 18.14	101 44.49	Vertical Tow (1m2, 200um mesh)	113	103
2B	**QMG-2**	**Queen Maude Gulf**	20-21-Aug-16	68 18.53	100 49.150	Oblique Tow (1m2, 750um mesh)	60	64
2B	**QMG-2**	**Queen Maude Gulf**	21-Aug-16	68 18.797	100 47.927	Vertical Tow (1m2, 200um mesh)	56	46
2B	**QMG-1**	**Queen Maude Gulf**	22-Aug-16	68 29.409	99 52.774	Oblique Tow (1m2, 750um mesh)	47	58.95*
2B	**QMG-1**	**Queen Maude Gulf**	22-Aug-16	68 29.503	99 53.795	Vertical Tow (1m2, 200um mesh)	41	31
2B	**QMG-3**	**Queen Maude Gulf**	22-Aug-16	68 19.432	102 56.982	Oblique Tow (1m2, 750um mesh)	58	73*
2B	**QMG-3**	**Queen Maude Gulf**	22-Aug-16	68 19.653	102 56.479	Vertical Tow (1m2, 200um mesh)	48	38
2B	**QMG-4**	**Queen Maude Gulf**	23-Aug-16	68 28.65	103 25.31	Oblique Tow (1m2, 750um mesh)	76	77*
2B	**QMG-4**	**Queen Maude Gulf**	23-Aug-16	68 29.06	103 25.69	Vertical Tow (1m2, 200um mesh)	68	58
2B	**314**	**Dease Strait**	23-Aug-16	68 58.423	105 30.893	Oblique Tow (1m2, 750um mesh)	74-80	83*
2B	**314**	**Dease Strait**	23-Aug-16	68 58.27	105 28.44	Vertical Tow (1m2, 200um mesh)	81	71

*CTD sampler depth was not quite right for shallow stations

Table 28.2. List of benthic samples collected during Leg 2.

Leg	Station	Location	Date	Sampler	depth (m)	Lat	Long
2A	Bell5	Frobisher Bay	16-Jul-16	Box Core	104	63°38.564	-68°37.181
2A	FB4	Frobisher Bay	16-Jul-16	Box Core	118	63°33.530	-68°14.991
2A	FB4	Frobisher Bay	16-Jul-16	Agassiz	75-104	63 33.855	68.15.306
2A	ROV1	NE Hatton Basin	18-Jul-16	Box Core	562	61°20.485	-61°09.602
2A	ROV-6	Labrador Sea	22-Jul-16	Agassiz	450-457	62 55.839	60 40.090
2A	ROV7-wp14	Disko Fan	25-Jul-16	Box Core	909	67°58.206	-59°30.038
2A	ROV7-wp7	Disko Fan	25-Jul-16	Box Core	921	67°58.048	-59°30.100
2B	177	Qikiqtarjuaq	28-Jul-16	Box Core	370	67°28.59	-63°47.38
2B	177	Qikiqtarjuaq	29-Jul-16	Agassiz	371-383	67 28.825	63 45.703
2B	177	Qikiqtarjuaq	29-Jul-16	Beam Trawl	369-410	67 28.455	63 48.786
2B	176	Baffin Bay	30-Jul-16	Agassiz	413-396	69 36.128	65 20.163
2B	176	Baffin Bay	30-Jul-16	Box Core	376	69°35.823	-65°21.483
2B	LGM-AMU-2016-03	Baffin Bay	31-Jul-16	Box Core	610	70°34.741	-71°32.951
2B	169	Scott Inlet	01-Aug-16	Agassiz	774-699	71 17.84	70 33.49
2B	169	Scott Inlet	01-Aug-16	Box Core (trip)	768	71°16.208	-70°31.284
2B	LGM-AMU-2016-02	Scott Inlet	01-Aug-16	Box Core	694	71°04.237	-70°27.189
2B	160	Baffin Bay	03-Aug-16	Box Core	725	72°41.053	-78°34.186
2B	323	Lancaster Sound	04-Aug-16	Beam Trawl	793-796	74 10.456	80 10.452
2B	323	Lancaster Sound	04-Aug-16	Box Core (trip)	786	74°09.46	-80°27.64
2B	323	Lancaster Sound	05-Aug-16	Agassiz	789-790	74 09.892	80 16.956
2B	115	Northwater Transect	06-Aug-16	Agassiz	658-668	76 19.952	71 15.812
2B	115	Northwater Transect	06-Aug-16	Beam Trawl	669-522	76 21.436	71 08.585
2B	115	Northwater Transect	06-Aug-16	Box Core	669	76°20.386	-71°15.385
2B	111	Northwater Transect	07-Aug-16	Agassiz	594-605	76 19.030	73 09.930
2B	117=116	Carey Islands	08-Aug-16	Agassiz	707-582	76 43.49	71 51.75
2B	117=116	Carey Islands	08-Aug-16	Beam Trawl	674-597	76 42.71	71 48.49
2B	117=116	Carey Islands	08-Aug-16	Box Core	726	76°44.335	-71°48.964
2B	108	Northwater South Transect	09-Aug-16	Agassiz	447-444	76 15.602	74 34.767
2B	108	Northwater South Transect	09-Aug-16	Box Core	449	76°15.824	-74°36.185
2B	101	Northwater South Transect	10-Aug-16	Agassiz	371-377	76 21.880	77 23.633
2B	101	Northwater South Transect	10-Aug-16	Beam Trawl	391-349	76 23.114	77 23.286
2B	TS233	Trinity Glacier	11-Aug-16	Box Core	534	77°52.810	-77°10.532
2B	TS233 CASQ	Trinity Glacier	11-Aug-16	Agassiz	573-549	77 47.011	76 31.848
2B	TS233 CASQ	Trinity Glacier	11-Aug-16	Box Core	573	77°47.737	-76°32.015
2B	139	Petermann Fjord	13-Aug-16	Agassiz	572-556	81 20.667	62 44.693
2B	139	Petermann Fjord	13-Aug-16	Beam Trawl	519-522	81 20.057	62 40.348
2B	139	Nares Strait	13-Aug-16	Box Core	581	81°20.887	-62°49.919
2B	Kane_1	Kane Basin	14-Aug-16	Agassiz	243-245	79 58.883	69 49.785
2B	127	Kane Basin	15-Aug-16	Agassiz	534-559	78 17.376	74 29.569
2B	127	Kane Basin	15-Aug-16	Box Core	527	78°18.012	-74°28.613
2B	133	Kane Basin	15-Aug-16	Agassiz	167-164	79 32.83	70 26.53
2B	133	Kane Basin	15-Aug-16	Box Core	216	79°30.925	-70°49.695
2B	119	Northwater Transect	16-Aug-16	Agassiz	512-505	77 18.471	76 07.662
2B	Allen Bay	Resolute	18-Aug-16	Agassiz	85-82	74 43.41	95 15.28
2B	305	NW Passage - Resolute	18-Aug-16	Agassiz	172-173	74 20.231	94 57.057
2B	305	NW Passage - Resolute	18-Aug-16	Box Core	171	74°19.749	-94°59.023
2B	310E	NW Passage - Peel Sound	19-Aug-16	Agassiz	130-121	71 17.298	97 42.621
2B	311	NW passage	20-Aug-16	Agassiz	151-168	70 15.75	98 32.81
2B	312	NW passage	20-Aug-16	Box Core	67	69°10.187	-100°42.028
2B	QMGM	Queen Maude Golf	20-Aug-16	Agassiz	115-112	68 18.09	101 45.56
2B	QMGM	Queen Maude Golf	20-Aug-16	Box Core	118	68°18.14	-101°44.61
2B	QMGM	Queen Maude Golf	21-Aug-16	Beam Trawl	111	68 16.90	101 46.75
2B	QMG1	Queen Maude Golf	22-Aug-16	Box Core	43	68°29.53	-99°53.75

28.2.2 *SPMD Deployments*

This season, two new moorings were placed in Baffin Bay and cages were fixed to the ADCPs on each mooring (

Table 28.3). One regular SPMD, one silicon rubber strip and one Poly ethylene strip were arranged in each of the cages. Deployments went well.

Figure 28.4. Cage installed on Baffin Bay mooring BA-06-16.

Table 28.3. SPMDs deployed during Leg 2b of the ArcticNet 2016 cruise.

	BA-06-16 (549m)	BA-05-16 (535m)
50-60m surf mixed layer		
50-200m Pacific water		
>200 m Atlantic water	SPMD 344m	SPMD 420m

We have recovered six SPMD cages on three BREA (BR) moorings as outlined below (Table 28.4) were recovered successfully during 3A. Seven more were redeployed on the moorings outlined in Table 28.5. These will stay and sample the water passively until recovered in the 2017 season.

Table 28.4. SPMDs recovered during Leg3A of the ArcticNet 2016 cruise.

SPMD Depth (m)	BR-K-15 (300m)	BR-G-15 (700m)	BR-03-15 (700m)
50-60m surface mixed layer		SPMD 60m	SPMD 60m
50-200m Pacific water	SPMD 145m	SPMD 180m	SPMD 200m
>200 m Atlantic water		SPMD 460m	

Table 28.5. SPMDs deployed during leg3a of the ArcticNet 2016 cruise in the Beaufort Sea. * Mooring was deployed 60m lower than predicted.

SPMD Depth (m)	BR-K-16 (300m)	BR-G-16 (700m)	BR-03-16 (700m)	CA-05-16 (200m)
50-60m surface mixed layer		60m	*120m	60m
50-200m Pacific water	145m	180m	*240m	
>200 m Atlantic water		460m		

28.2.3 *Persistent Organic Pollutant (POP) Sampling*

See Table 28.6 for a summary of all samples collected during leg 3.

Table 28.6. Summary of air, water and zooplankton samples collected.

	Locations	Number	Depth	Comments
Air samples: pesticides, poly aromatic hydrocarbons, perfluorinated compounds and flame retardants	Continuously	16 + 2 blanks	n/a	Samples run for 48 hours
Water samples: pesticides, poly aromatic hydrocarbons, perfluorinated compounds and flame retardants	See Table 28.7	18 +2 blanks	Surface	160 L collected with submersible pump into collapsible containers extracted with XAD
Water particles: pesticides, poly aromatic hydrocarbons, perfluorinated	Continuously	5 +1 blanks	Surface	In-line water pump ~1000L each

	Locations	Number	Depth	Comments
compounds and flame retardants				
Water samples for perfluorinated compounds	4 locations	16 +2 blanks	Surface and 3 depth at each station	1-L from Rosette
Water samples for brominated anisoles	See Table 28.7	14	Surface	4-L from submersible pump extracted with SPE cartridges
Water samples for bacteria	20 locations	20	Surface	Filters to 50um then preserved with glutaraldehyde
Water for organophosphate flame retardants and plasticizers	8 locations across the archipelago	8	Surface	From submersible pump
Passive samplers on moorings for pesticides, poly aromatic hydrocarbons, perfluorinated compounds and flame retardants	BRG BR-3 BR-K CA-05	4	Depth	Collected previously deployed passive samplers at three stations and redeployed passives at four stations
Zooplankton for pesticides, poly aromatic hydrocarbons, perfluorinated compounds and flame retardants	12 Locations	12	n/a	Samples sieved to 180ums and stored

Air Sampling: The purpose of the air samples is to continue measuring the trends of pesticides in air in the Canadian Arctic that was started in 1992 by this group. Over the years, we have added more contaminants that are monitored, including current use pesticides, flame retardants, plasticizers, per-fluorinated compounds (PFCs, neutral and ionic) and poly aromatic hydrocarbons. We also will be screening the samples for microplastics.

We collected 48 hour long air samples continuously during Leg 3a-b. The air was drawn through a sampling train of a glass fiber filter to collect the particles followed by a sandwich of polyurethane foam and XAD-2 resin that collects the gas phase and very small particles. These samples will be returned to the ECCC lab, where they will be processed and analyzed.

Water Sampling: As with the air samples, these samples continue the work started in the early 1990s and the target list was expanded over time. This year we collected 6 types of water samples.

1) 200-L water samples were collected for pesticides, flame retardants, plasticizers, per-fluorinated compounds (neutral) and poly aromatic hydrocarbons. A solid phase absorbent (XAD-2) was used to concentrate the target compounds.
2) 1-L water samples for ionic PFCs, the water was collected and will be processed in the lab.
3) 4-L water samples for brominated anisoles - these are naturally produced compounds. A solid phase absorbent (ENV+) was used to concentrate the target compounds.
4) 1.5-mL water samples for bacteria counts that are used to interpret the brominated anisole samples.
5) 1000-L water particle samples for pesticides, flame retardants, plasticizers, per-fluorinated compounds (neutral) and poly aromatic hydrocarbons. Water was filtered by the in-line pump in the coring lab using a glass fiber cartridge filter.
6) 4-L water samples were collected for organophosphate flame retardants, the water was collected and will be processed in the lab.

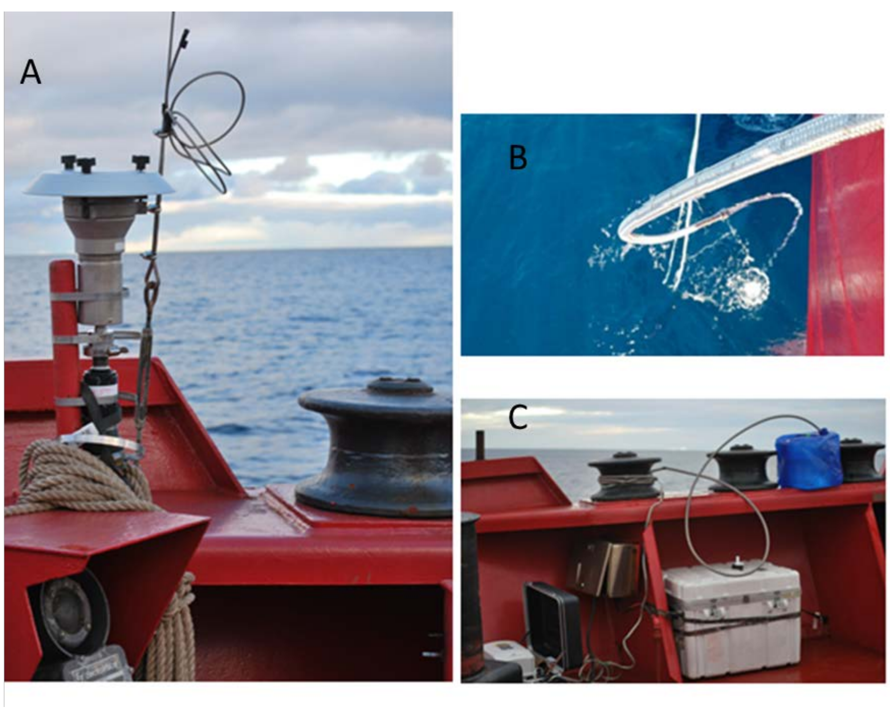

Figure 28.5. A) Air Sampler on the bow of the *Amundsen* collecting Arctic air in 48 hour intervals. B-C) Submersible pump collecting surface water at the bow into containers on the deck.

Table 28.7. High volume water samples collected during Leg 3a-b using a submersible pump or Rosette at deeper depths.

Station	Date (UTC)	Latitude (N)	Longitude (E)	Volume (L)	Depth
AMD0416-3	26/08/16	68.33585	-102.937	160	Surface
CA-08	27/08/16	71.00929	-126.091	160	Surface
437	28/08/16	71.27863	-127.538	160	Surface
CA-05	29/08/16	71.28068	-127.522	160	60m
BR-k	1/9/16	71.00221	-135.494	160	Surface
Hershel island	2/9/16	69.56541	-138.948	160	Surface
BRG	4/9/16	71.00285	-135.478	160	180m
BRK	4/9/16	70.87362	-135.005	140	145m
BR3	9/9/16	73.42224	-129.355	160	130m
554	9/9/16	75.74317	-126.441	160	Surface
575	10/9/16	76.1975	-126.034	160	Surface
583	11/9/16	75.53267	-125.562	160	Surface
510	12/9/16	74.8854	-122.169	160	Surface
QMG-4	19/09/16	68.48995	-103.42	160	Surface
AMD0416-7	21/09/16	71.86908	-102.723	160	Surface
304	24/09/16	74.24409	-91.5117	160	Surface
165	26/09/16	72.71783	-75.7556	160	Surface
177	28/09/16	67.47599	-63.7931	160	Surface

Zooplankton sampling: As with the water and air sampling, the purpose of collecting these samples was to quantify the occurrence and level of contaminants (Figure 27.6). Additionally, they will be screened for the occurrence and if found, the types of microplastics. The “left-over” water after the zooplankton were picked was collected, sieved to 180µm, and will also be screened for microplastics. All samples collected are outlined in Table 27.8.

Figure 28.6. Zooplankton identification after a Tucker net (750µm trawl). Sample contained mostly *Clione limacine*, *Themisto libellula* and *Limacina helicina.*

Table 28.8. Zooplankton tows where species were collected for contaminants during leg 3 of ArcticNet 2016.

Station	Location	Date (UTC)	Latitude (N)	Longitude (W)	Tow	Sampler Depth (m)
405	Beaufort	27/08/16	70 36.36 70	123 2.137	O-Tow (750um mesh)	73.3
405	Beaufort	27/08/16	70 36.801 70	123 2.08	V-Tow (200um mesh)	572
407	Beaufort	28/08/16	71 0.17 71	126 2.75	O-Tow (750um mesh)	72.8
407	Beaufort	28/08/16	71 0.31 71	126 4.17	V-Tow (200um mesh)	380
437	Beaufort	28/08/16	71 48.064 71	126 29.969	O-Tow (750um mesh)	90
437	Beaufort	28/08/16	71 48.009 71	126 29.764	V-Tow (200um mesh)	275
408	Beaufort	29/08/16	71 18.109 71	127 34.7	O-Tow (750um mesh)	90
420	Beaufort	30/08/16	71 3.25 71	128 30.55	O-Tow (750um mesh)	20
434b	Beaufort	30/08/16	70 10.61 70	133 32.9	O-Tow (750um mesh)	20

Station	Location	Date (UTC)	Latitude (N)	Longitude (W)	Tow	Sampler Depth (m)
421	Beaufort	31/08/16	71 28.077	133 53.769	O-Tow (750um mesh)	90
421	Beaufort	31/08/16	71 28.181 71	133 54.156	V-Tow (200um mesh)	950
482	Beaufort	01/09/16	70 31.434 70	139 24.125	O-Tow (750um mesh)	90
472	Beaufort	02/09/16	69 36.524 69	138 13.532	O-Tow (750um mesh)	90
BR-G	Beaufort	04/09/16	71 0.099 71	135 28.442	V-Tow (200um mesh)	100
435	Beaufort	05/09/16	71 4.465 71	133 38.613	O-Tow (750um mesh)	90
435	Beaufort	05/09/16	71 4.846 71	133 37.753	V-Tow (200um mesh)	296
535	Beaufort	08/09/16	73 25.02 73	128 11.16	O-Tow (750um mesh)	90
535	Beaufort	08/09/16	73 24.95 73	128 11.73	V-Tow (200um mesh)	279
554	Beaufort	09/09/16	75 44.423 75	126 28.334	O-Tow (750um mesh)	90
554	Beaufort	09/09/16	75 44.755 75	126 29.198	V-Tow (200um mesh)	360
575	Beaufort	10/09/16	76 10.832 76	125 57.546	O-Tow (750um mesh)	90
575	Beaufort	10/09/16	76 10.524 76	125 57.763	V-Tow (200um mesh)	307
585	Beaufort	12/09/16	74 30.84 74	123 11.09	O-Tow (750um mesh)	90
585	Beaufort	12/09/16	74 30.04 74	123 14.1	V-Tow (200um mesh)	367
525	Beaufort	14/09/16	72 22.969 72	129 0.476	O-Tow (750um mesh)	325
403	Beaufort	15/09/16	70 6.024 70	120 6.406	O-Tow (750um mesh)	90

Station	Location	Date (UTC)	Latitude (N)	Longitude (W)	Tow	Sampler Depth (m)
405	Beaufort	15/09/16	70 36.602 70	123 1.36	O-Tow (750um mesh)	100
406	Beaufort	15/09/16	69 58.337 69	122 57.68	O-Tow (750um mesh)	90
1402	Beaufort	16/09/16	70 32.68 70	117 39.59	O-Tow (750um mesh)	90
314	Queen Maud Gulf	18/09/16	68 58.175 68	105 28.171	O-Tow (750um mesh)	60
314	Queen Maud Gulf	18/09/16	68 58.23 68	105 28	V-Tow (200um mesh)	69
316	Queen Maud Gulf	18/09/16	68 23.276 68	112 6.587	O-Tow (750um mesh)	90
316	Queen Maud Gulf	18/09/16	68 23.389 68	112 7.26	V-Tow (200um mesh)	167
QMG3	Queen Maud Gulf	19/09/16	68 19.76 68	102 56.58	O-Tow (750um mesh)	40
QMG3	Queen Maud Gulf	19/09/16	68 19.71 68	102 56.43	V-Tow (200um mesh)	40
QMG4	Queen Maud Gulf	19/09/16	68 29.307 68	103 25.915	O-Tow (750um mesh)	50
QMG4	Queen Maud Gulf	19/09/16	68 29.255 68	103 25.432	V-Tow (200um mesh)	62
QMGM	Queen Maud Gulf	19/09/16	68 18.427 68	101 45.282	O-Tow (750um mesh)	90
QMGM	Queen Maud Gulf	19/09/16	68 18.277 68	101 45.081	V-Tow (200um mesh)	104
QMG2	Queen Maud Gulf	19/09/16	68 18.904 68	100 47.953	O-Tow (750um mesh)	35
QMG2	Queen Maud Gulf	20/09/16	68 18.771 68	100 48.036	V-Tow (200um mesh)	50
311	Northwest Passage	20/09/16	70 16.77 70	98 31.74	O-Tow (750um mesh)	90
311	Northwest Passage	20/09/16	70 17.002 70	98 31.425	V-Tow (200um mesh)	154

Station	Location	Date (UTC)	Latitude (N)	Longitude (W)	Tow	Sampler Depth (m)
312	Northwest Passage	20/09/16	69 10.073 69	100 42.51	O-Tow (750um mesh)	50
310E	Northwest Passage	20/09/16	70 49.917 70	99 3.717	O-Tow (750um mesh)	74.96
310W	Northwest Passage	21/09/16	71 27.485 71	101 16.093	O-Tow (750um mesh)	86.9
310W	Northwest Passage	21/09/16	71 27.566 71	101 16.269	V-Tow (200um mesh)	152
307	Lancaster Sound	22/09/16	74 5.28 74	103 1.98	O-Tow (750um mesh)	68.45
307	Lancaster Sound	22/09/16	74 5.9 74	103 2.56	V-Tow (200um mesh)	349
304	Lancaster Sound	24/09/16	74 15.232 74	91 31.194	O-Tow (750um mesh)	74
304	Lancaster Sound	24/09/16	74 14.795 74	91 31.142	V-Tow (200um mesh)	304
301	Lancaster Sound	25/09/16	74 7.14 74	83 17.97	O-Tow (750um mesh)	90
165	Baffin Bay	26/09/16	72 42.69 72	75 46.01	O-Tow (750um mesh)	61.7
165	Baffin Bay	26/09/16	72 43.02 72	75 45.24	V-Tow (200um mesh)	685
177	Baffin Bay	28/09/16	67 28.19 67	63 47.477	O-Tow (750um mesh)	87.12
177	Baffin Bay	28/09/16	67 28.553 67	63 47.68	V-Tow (200um mesh)	366

28.2.4 *Mercury in the Seawater*

Last year (2015) we discovered too late that the rosette bottles were too high in mercury (Hg) to sample sea water for this objective. As this section of our projects begin in Leg 3, this leg we tried to clean the rosette for mercury ahead of time (Table 28.9).

The acidic laboratory soap, citranox, was used (Figure 28.7). Bottles were filled half way, and 50mls of premeasured soap was added. Bottles were then filled to overflowing, closed, and allowed to soak for 20 – 30 hours. Bottles were emptied through the spigot, and then filled to overflowing three times with freshwater (rinses). The final rinse was emptied through the spigot.

During cleaning, the heater fans were turned off. Once the rosette was cleaned the first time (17 July), a sign was posted to be sure that no $HgCl_2$ would be used in the rosette shack.

Table 28.9. Rosette cleaning

Project	Leg	Operation	Solution	Date Started	Start Time (Local)	Date Finished	End Time (Local)	Rinses	Total Hours
ArcticNet 2016	2A	Rosette Cleaning 1	50 ml citranox in 12 L tap water	17-Jul-16	14:15	18-Jul-16	10:00	3x	20
ArcticNet 2016	2A	Rosette Cleaning 2	50 ml citranox in 12 L tap water	22-Jul-16	21:30	23-Jul-16	21:30	3x	24
ArcticNet 2016	2B	Rosette Cleaning 3	50 ml citranox in 12 L tap water	16-Aug-16	7:00	17-Aug-16	15:30	3x	32

Figure 28.7. Citranox Lab Detergent

Two riverine-marine transects were collected from the Mackenzie River, 434-432-430-421 and 482-478-470. The Thomson River transect was not sampled as M'Clure Strait was not accessible due to ice. During 3b, target stations BB3, BB1, 353-354-355 were cancelled due to time shortages and weather conditions.

During Leg 3a incubation water was collected from station 421, where water column mercury concentrations have been attributed to methylation (Wang et al, 2012). During Leg 3b incubation water was collected from station 307, which is near the 308, where water column methylation was measured in 2007 (Lehnherr et al, 2011).

Because other groups use $HgCl_2$ as a poison for their water samples at concentrations sufficient to contaminate seawater samples for mercury determination, colleagues on board during Leg 2 placed a sign on the door to the rosette shack asking that poisoning with $HgCl_2$ be performed on a table placed outside of the rosette shack.

Despite efforts to clean the rosette bottles during Leg 2 by our colleagues on board, we initially found high concentrations of total Hg in both the rosette shack environment (from blanks collected during rosette sampling) and in MilliQ water that was left to soak in rosette bottles.

While sampling the rosette, we attempted to avoid contamination by taking the following steps:

1) Waiting until all other teams had sampled and traffic in rosette shack was minimal and door was kept shut
2) Turning off heater to reduce air circulation
3) Rinsing Niskin bottle spigots with pH 2 water and wipe with clean wipes prior to sampling
4) Requesting that teams using $HgCl_2$ poison store sampling tubing in the rosette shack rather than in close proximity to concentrated $HgCl_2$

Full QA/QC analysis is required to determine whether these steps were sufficient to avoid contamination for sampling seawater mercury.

Table 28.10. Stations sampled for seawater mercury durong ArcticNet leg 3.

Station	Lat	Long	THg	MeHg	Zodiac surface	Incubation
434	70 10.658	133 33.262	x	x	x	
432	70 23.721	113 36.628	x	x		
430	70 25.926	133 39.025	x	x		
421	71 28.158	133 54.377	x	x		x
482	70 31.465	139 22.863	x	x		
478	70 09.991	138 54.433	x	x		
470	69 25.812	137 59.968	x	x		
554	75 44.6357	126 27.5194	x	x	x	
575	76 11.1823	126 0.9269	x	x		
579	75 32.0121	125 34.267	x	x		
583	74 52.867	125 7.883	x	x		
585	74 29.990	123 14.638	x	x		
311	70 16.854	98 31.619	x	x		
307	74 06.606	103 06.952	x	x	x	x
177	67 28.568	63 47.407	x	x		
PII-A-1-f	67 23.000	63 15.000			x	

28.2.5 *Water Sampling for Other Projects*

Surface water was sampled (2 x 4L) at Trinity Glacier station TS233 on 11 August 2016, and is stored at 4°C in the aft lab refrigerated container for the organic contaminants project that will start on Leg 3a.

We sampled the rosette (depths same as nutrients samples) at station 119 on 15 August 2016, in the northwater for hydrazine. This station was chosen because it fell inside the polygon of coordinates in which a Russian rocket may land this fall. We will test for existing hydrazine in the water column. We hope to be back next year to see whether there will be any difference before and after a known rocket fuselage will land in the area. Information on hydrazine can be found in Oh *et al*. 2013.

28.3 Comments and Recommendations

It would be beneficial for all users of the *Amundsen* to be made aware that $HgCl_2$ can contaminate all areas of our work. We should not share lab space with users who intend on spiking samples with $HgCl_2$. Scientists who use $HgCl_2$ should also be made aware of proper handling and disposal of their liquid and solid waste, as regular trash is not appropriate for gloves and tips that may be contaminated. Pouring spiked samples down the sink should also be discussed with science personnel, and all efforts should be made in the future to avoid this practice.

<u>Acknowledgement</u>

We thank Caro Bouchard and Fanny Cusset for taking care of our live zooplankton sampling requirements, and also for splitting some beam trawl and IKMT samples with us. Thank you to Marie Pierrejean and Gonzalo Bravo, for their time on the deck and in the lab collecting, cleaning and identifying benthic invertebrates from both the Agassiz and the Beam trawls, and to Anirban Chakraborty and students form Casey Hubert's lab for organizing the sampling of the boxcore and being at every deployment. Thank you to Gabriel Joyal for helping us to find appropriate locations for boxcores, and for double checking on the station locations for us, especially in Scott Inlet.

A big thank you to the rosette operators Juergen Zier and Jeff Finniss for accommodating our last minute rosette sampling requests.

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Finally, thank you to Commandant Gariépy and crew of the *CCGS Amundsen* for facilitating an excellent scientific expedition. We are so lucky to get to work with such knowledgeable and passionate crew, who help us tirelessly to get our work done. We appreciate them so much. See you all next year on the Pont Avant!

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29 Microbial Hydrocarbon Biodegradation and Hydrocarbon Analysis in Marine Sediment - Legs 2a, 2b and 3a

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29.1 Introduction

29.1.1 *Sediment-Associated Hydrocarbon Sampling*

Oil reserves in the Canadian Arctic are currently being studied for future extraction by major oil companies; with reservoirs estimated to contain billions of barrels of oil. Receding ice coverage as a result of climate change is making these oil reserves easily accessible, and increasing the feasibility of exploration of offshore oil in the region. The consequence of declining ice conditions will be an inevitable increase in oil exploration as well as shipping traffic through the Canadian Arctic. A higher frequency of these activities will increase the risk for oil-spills in the Arctic, potentially releasing an unprecedented volume of petroleum hydrocarbons in the Arctic marine environment. However, hydrocarbons also naturally occur in Arctic marine sediments through natural oil seeps, fossil fuel combustion, and terrestrial run-off. The purpose of this study is to measure baseline concentrations of hydrocarbons in Baffin Bay and Cambridge Bay marine environment prior to future increase in marine traffic.

29.1.2 *Benthic Microbial Diversity and Hydrocarbon Biodegradation*

Marine sediment environments are high in microbial diversity and abundance with a cubic centimeter of seabed typically containing billions of microbial cells – about a thousand fold more than in overlying seawater. The theme of our research in the Canadian Arctic archipelago is to establish baseline data for the diversity and activity of microorganisms in Arctic sediments, and experimentally investigate how short and long term changes in environmental parameters (e.g. temperature; pulses of organic compounds such as hydrocarbons) may affect the community composition, metabolic rates and cycling of carbon and other nutrients. This work will determine the impact of permanently cold temperatures on the rates of biogeochemical processes such as sulfate reduction, which is responsible for up to half of organic carbon mineralization in coastal sediments.

The occurrence and locations of marine hydrocarbon seeps in Canada's Arctic are important to assess the ability of microbiota in Arctic seawater and sediments to biodegrade accidentally released petroleum hydrocarbons. A rapid natural response may depend on a region's microbiota being 'primed' for such biodegradation by the slow natural release of hydrocarbons from seabed seeps. Given that industrial activity and traffic in the Northwest Passage is expected to increase, the inherent biodegradation potential of marine microorganisms will be tested experimentally on samples obtained. Sediment associated microbial communities will also be compared to microbial communities in the water column to elucidate possible relationships of hydrocarbon degrading communities between the two environments. Samples collected will also be compared to Gulf of Mexico (GoM) sediment samples (a well-studied environment for bioremediation of spilled hydrocarbons) to measure any differences in the potential for biodegradation (microbial communities, rates of hydrocarbon oxidation). This data will be used to help develop a predictive measure of how different regions of the Arctic could respond to various pollution scenarios.

Another goal of our work is targeted diversity studies to explore the abundance and function of thermophilic endospores (thermo-spores) that remain dormant in permanently cold sediments, elaborating on biogeography analyses that have been conducted in the Eastern Arctic Ocean e.g. Svalbard. These spore-forming thermophiles belong to the so-called rare biosphere and are not detected in nucleic-acid-based diversity assays. Previous research has shown an unexpectedly high abundance of thermo-spores in sediments of the Eastern Arctic. Dormancy and unexpectedly high abundances make these thermo-spores ideal model organisms for studying passive dispersal. Additionally, the phylogenetic similarity between thermo-spores and microbes inhabiting oil reservoirs offers a clue about their possible origins. This study will test the hypothesis that thermo-spores are inhabitants of deeply buried hot oil reservoirs and are exposed to the cold seabed by deep-to-shallow passive dispersal through natural hydrocarbon seeps. Marine seep sediments from the Canadian Arctic will be used for setting up high-temperature incubations to revive and grow thermo-spores, followed by community characterization.

29.2 Methodology

While on board the *CCGS Amundsen* surface sediment and sediment cores were collected. During leg 2 and 3, sediment was collected using the box corer and water was collected using the CTD Rosette (Table 29.2).

29.2.1 *Push Coring*

Samples for hydrocarbon analysis were collected using 10cm diameter plastic push cores and surface sediment (0-5cm) from the box core (Table 29.1). The sediment core was subsequently placed on a manual extruder and sectioned at 0.5cm intervals for the first 10 cm, and then 1.0 cm for the remainder of the core (approximately 30cm total). Sediment was contained in Whirl-Pak plastic bags, and stored at -20°C.

Table 29.1. Sediment and water samples collected during leg 2 of ArcticNet 2016

Leg	Station	Location	Date	Operation	Depth (m)	Latitude	Longitude
2A	Bell1	Frobisher Bay	15-Jul-16	Box core	208	63°32.76	-68°28.51
2A	Bell2	Frobisher Bay	15-Jul-16	Box core	204	63°33.85	-68°30.11

Leg	Station	Location	Date	Operation	Depth (m)	Latitude	Longitude
2A	Bell3	Frobisher Bay	15-Jul-16	Box core	187	63°34.92	-68°31.26
2A	Bell4	Frobisher Bay	15-Jul-16	Box core	313	63°34.98	-68°31.33
2A	FB4	Frobisher Bay	16-Jul-16	CTD Rosette	114	63°33.527	-68°14.907
2A	FB4	Frobisher Bay	16-Jul-16	Box core	118	63°33.525	-68°14.967
2A	Bell5	Frobisher Bay	16-Jul-16	Box core	104	63°38.563	-68°37.158
2A	Bell6	Frobisher Bay	16-Jul-16	Box core	117	63°38.490	-68°36.920
2A	FB1-1	Frobisher Bay	16-Jul-16	Box core	135	63°38.436	-68°37.253
2A	FB2-2	Frobisher Bay	16-Jul-16	Box core (triplicate)	62	63°40.512	-68°25.822
2A	FB2-1	Frobisher Bay	16-Jul-16	Box core (triplicate)	80	63°39.805	-68°25.339
2A	FB7	Frobisher Bay	17-Jul-16	Box core	472	62°58.672	-67°16.931
2A	FB8	Frobisher Bay	17-Jul-16	Box core	610	62°55.390	-67°05.398
2A	ROV1	Hatton Basin	18-Jul-16	CTD Rosette	561	61°20.483	-61°09.544
2A	ROV1	Hatton Basin	18-Jul-16	Box core	562	61°20.504	-61°09.591
2A	ROV5	Hatton Basin	19-Jul-16	CTD Rosette	572	61°26.669	-60°40.730
2A	ROV5	Hatton Basin	19-Jul-16	Box core (duplicate)	615	61°29.35	-60°50.33
2A	ROV2	Saglek Bank	20-Jul-16	CTD Rosette	282	60°19.44	-62°11.66
2A	ROV2	Saglek Bank	20-Jul-16	Box core (duplicate)	275	60°18.865	-62°11.761
2A	ROV2E	Saglek Bank	20-Jul-16	Box core	286	60°18.91	-61°52.84
2A	ROV3	Saglek Bank	21-Jul-16	CTD Rosette	460	60°28.133	-61°16.751
2A	ROV3	Saglek Bank	21-Jul-16	Box core	452	60°27.968	-61°16.707
2A	ROV3-deep	Saglek Bank	21-Jul-16	Box core	622	60°28.093	-61°14.487
2A	ROV6	Baffin Shelf	22-Jul-16	CTD Rosette	460	63°00.072	-60°38.273
2A	ROV6	Baffin Shelf	22-Jul-16	Box core	457	63°00.231	-60°38.488
2A	ROV7	Disko Fan	25-Jul-16	CTD Rosette	931	67°58.683	-59°31.213
2A	ROV7-wp14	Disko Fan	25-Jul-16	Box core	909	67°58.181	-59°30.242
2A	ROV7-wp7	Disko Fan	25-Jul-16	Box core	921	67°58.056	-59°30.120
2A	Blackcoral	Disko Fan	25-Jul-16	Box core	1052	67°16.00	-59°48.00
2A	Basic180	Baffin Bay	26-Jul-16	CTD Rosette	642	67°31.152	-61°40.924
2A	Basic180	Baffin Bay	26-Jul-16	Box core	335	67°28.861	-61°39.760
2B	177	Baffin Bay	28-Jul-16	CTD Rosette	369	67°28.60	-63°47.36
2B	177	Baffin Bay	28-Jul-16	Box core (triplicate)	371	67°28.57	-63°47.41
2B	176	Baffin Bay	30-Jul-16	CTD Rosette	375	69°35.504	-65°21.269
2B	Basic176	Baffin Bay	30-Jul-16	Box core	376	69°35.823	-65°21.477

Leg	Station	Location	Date	Operation	Depth (m)	Latitude	Longitude
2B	LGM-AMU-2016-09	Baffin Bay	30-Jul-16	Box core	1189	69°28.552	-64°56.584
2B	LGM-AMU-2016-03	Baffin Bay	31-Jul-16	Box core	610	70°34.740	-71°32.956
2B	169	Baffin Bay	01-Aug-16	CTD Rosette	770	71°16.278	-70°31.349
2B	169	Baffin Bay	01-Aug-16	Box core (triplicate)	768	71°16.205	-70°31.267
2B	LGM-AMU-2016-02	Baffin Bay	01-Aug-16	Box core	694	71°04.221	-70°27.093
2B	160	Baffin Bay	03-Aug-16	Box core	725	72°41.054	-78°34.214
2B	323	NW passage	04-Aug-16	CTD Rosette	787	74°09.4	-80°28.000
2B	323	NW passage	04-Aug-16	Box core (triplicate)	788	74°09.39	-80°28.13
2B	115	Baffin Bay	06-Aug-16	CTD Rosette	675	76°19.880	-71°11.756
2B	115	Baffin Bay	06-Aug-16	Box core	669	76°20.385	-71°15.387
2B	111	Baffin Bay	07-Aug-16	CTD Rosette	592	76°18.501	-73°12.622
2B	111	Baffin Bay	07-Aug-16	Box core	596	76°18.392	-73°12.825
2B	116 CASQ	Baffin Bay	07-Aug-16	Box core	961	77°00.28	-72°08.28
2B	116	Baffin Bay	08-Aug-16	CTD Rosette	735	76°44.342	-71°48.508
2B	116	Baffin Bay	08-Aug-16	Box core (triplicate)	726	76°18.392	-73°12.825
2B	108	Baffin Bay	09-Aug-16	CTD Rosette	442	76°15.938	-74°33.014
2B	108	Baffin Bay	09-Aug-16	Box core	449	76°15.827	-74°36.084
2B	105	Baffin Bay	09-Aug-16	CTD Rosette	325	76°19.017	-75°45.50
2B	101	Baffin Bay	10-Aug-16	CTD Rosette	350	76°23.001	-77°23.441
2B	101	Baffin Bay	10-Aug-16	Box core	356	76°22.875	-77°23.239
2B	TS233	Baffin Bay	11-Aug-16	CTD Rosette	528	77°52.876	-77°11.653
2B	TS233	Baffin Bay	11-Aug-16	Box core	534	77°22.805	-77°10.490
2B	TS233 CASQ	Baffin Bay	11-Aug-16	Box core	573	77°47.728	-76°32.026
2B	139	Nares Strait	13-Aug-16	CTD Rosette	573	81°21.136	-62°47.104
2B	139	Nares Strait	13-Aug-16	Box core	581	81°20.876	-62°49.402
2B	KANE-1	Kane Basin	14-Aug-16	CTD Rosette	246	79°58.942	-69°47.049
2B	KANE-1	Kane Basin	14-Aug-16	Box core	247	79°59.064	-69°46.929
2B	133	Kane Basin	14-Aug-16	CTD Rosette	184	79°33.260	-70°30.792
2B	133	Kane Basin	14-Aug-16	Box core	216	79°30.934	-70°49.695
2B	127	Baffin Bay	15-Aug-16	CTD Rosette	603	78°18.051	-74°31.859
2B	127	Baffin Bay	15-Aug-16	Box core	527	78°18.004	-74°28.697

Leg	Station	Location	Date	Operation	Depth (m)	Latitude	Longitude
2B	119	Baffin Bay	16-Aug-16	CTD Rosette	514	77°19.055	-76°05.741
2B	119	Baffin Bay	16-Aug-16	Box core	514	77°19.165	-76°06.032
2B	Allen Bay	NW passage	17-Aug-16	CTD Rosette	70	74°43.636	-95°14.820
2B	305	NW passage	18-Aug-16	CTD Rosette	170	74°19.749	-94°59.034
2B	305	NW passage	18-Aug-16	Box core	171	74°19.746	-94°59.060
2B	310E	NW passage	19-Aug-16	CTD Rosette	132	71°17.622	-97°42.180
2B	311	NW passage	19-Aug-16	CTD Rosette	140	70°16.180	-98°31.000
2B	312	NW passage	20-Aug-16	CTD Rosette	67	69°10.400	-100°41.51
2B	312	NW passage	20-Aug-16	Box core	67	69°10.191	-100°41.968
2B	QMGM	NW passage	21-Aug-16	CTD Rosette	112	68°18.204	-101°44.599
2B	QMGM	NW passage	20-Aug-16	Box core	118	68°18.130	-101°44.61
2B	QMG1	NW passage	22-Aug-16	CTD Rosette	42	68°29.499	-99°53.784
2B	QMG1	NW passage	22-Aug-16	Box core	43	68°29.540	-99°53.790
2B	QMG3	NW passage	22-Aug-16	CTD Rosette	53	68°19.754	-102°56.660
2B	QMG3	NW passage	22-Aug-16	Box core	49	68°19.717	-102°56.458
2B	QMG4	NW passage	22-Aug-16	CTD Rosette	68	68°29.060	-103°25.70
2B	QMG4	NW passage	23-Aug-16	Box core	67	68°29.085	-103°25.712
2B	314	NW passage	23-Aug-16	CTD Rosette	78	68°58.290	-105°28.54
2B	314	NW passage	23-Aug-16	Box core (triplicate)	76	68°58.260	-105°28.57
2B	316	NW passage	24-Aug-16	CTD Rosette	174	68°22.960	-112°07.131
2B	316	NW passage	24-Aug-16	Box core	177	68°23.015	-112°06.969

29.2.2 *Surface Sediment Sampling*

Samples collected (Table 29.1) for microbial incubation experiments were scraped from the top 5cm of the box core using a sterile plastic spatula, contained in 500mL sterile mason jars and then stored at 4°C. Jars were filled completely with sediment in order to eliminate all headspace. Surface samples for DNA extraction (for microbial diversity analysis) were scraped from the top 5cm of the box core using a sterile painter's spatula into 2mL plastic vials (triplicate) and stored at -80°C.

29.2.3 *Sediment Push Coring*

Cores for incubation and diversity analyses were collected using the same extruding equipment the hydrocarbon study. These cores were sectioned at 2.0cm intervals for the first 10cm and then 5.0cm intervals for the remainder. At each interval, triplicate subsamples were collected for DNA extraction using the 2mL vials and methods described earlier. The bulk of the remaining section was kept in Whirl-Pak bags and stored at 4°C.

29.2.4 *Water Sampling*

Seawater samples (10L; surface and bottom) were requested for microbial community analysis to compare to sediment microbial communities (collected as previously described) from all Basic and Full stations. Water from an additional depth (50% to bottom) was collected in selected stations. Water was sampled from Niskin bottles fitted onto the Rosette sampler into clean Nalgene carboys. 3L of water from each depth was filtered through 0.4μm Pall membrane filters using a vacuum pump and filtration manifold. Filters were stored in Whirl-Pak bags at -80°C for future DNA extraction and sequencing of the 16s rRNA genes.

29.2.5 *Hydrocarbon Biodegradation Experiments*

Surface sediments from station FB2-2 (Leg2A; Frobisher Bay; triplicate box cores) were used to inoculate anaerobic hydrocarbon biodegradation incubations on July 23rd, 2016. Inoculated bottles used 10mL of sediment, 40mL of artificial seawater with 20mM sulphate, and 50μL of hydrocarbon (ship diesel, car diesel, crude oil and bunker fuel) and incubated at 4°C. One set of triplicate bottles from each hydrocarbon treatment were frozen at -20°C immediately after setup and subsampling. Additionally, unamended and sediment-free controls were set up. Incubations were subsampled for time'0' and subsamples were frozen at -20°C immediately. Bottles will be subsampled every two months; sulfate reduction, diesel removal, and microbial community composition will be monitored.

Table 29.2. Sediment and water samples collected during Leg 3a of ArcticNet 2016

Leg	Station	Location	Date	Operation	Cast	epth (r	Latitude	Longitude
3A	AMD0416-4	Amundsen Gulf	25-Aug-15	Box Core	1	409	69°39.23	-117°51.48
3A	AMD0416-3	Amundsen Gulf	26-Aug-16	Box Core	1	331	70°30.14	-120°20.16
3A	405	Amundsen Gulf	27-Aug-16	Box Core	1	627	70°36.49	-123°01.70
3A	407	Amundsen Gulf	27-Aug-16	Box Core	1	391	71°00.30	-126°04.33
3A	411	Amundsen Gulf	27-Aug-16	Box Core	1	432	71°37.42	-126°43.86
3A	437	Beaufort Sea	28-Aug-16	Bottom Grab	1	288	71°48.040	-126°29.715
3A	408	Beaufort Sea	29-Aug-16	Box Core	1	203	71°18.230	-127°34.492
3A	408	Beaufort Sea	29-Aug-16	CTD Rosette	1	199	71°16.83	-127°32.00
3A	420	Beaufort Sea	29-Aug-16	Box Core	1	43	71°03.57	-128°29.29
3A	420	Beaufort Sea	29-Aug-16	CTD Rosette	1	43	71°03.07	-128°30.69
3A	434	Beaufort Sea	30-Aug-16	Box Core	1	46	70°10.70	-133°32.57
3A	434	Beaufort Sea	30-Aug-16	CTD Rosette	1	46	70°10.47	-133°32.92
3A	BR-G	Beaufort Sea	04-Sep-16	Box Core	1	663	70°59.564	-135°27.791
3A	BR-G	Beaufort Sea	04-Sep-16	Box Core	2	668	70°59.584	-135°27.860
3A	BR-G	Beaufort Sea	04-Sep-16	Box Core	3	661	70°59.454	-135°27.718
3A	421	Beaufort Sea	31-Aug-16	Box Core	1	1134	71°23.937	-133°53.379
3A	421	Beaufort Sea	31-Aug-16	CTD Rosette	1	1143	71°28.14	-133°54.145
3A	482	Beaufort Sea	01-Sep-16	Box Core	1	826	70°31.48	-139°23.11
3A	482	Beaufort Sea	01-Sep-16	CTD Rosette	1	833	70°31.514	-139°22.315
3A	472	Beaufort Sea	02-Sep-16	Box Core	1	126	69°36.753	-138°13.680
3A	472	Beaufort Sea	02-Sep-16	CTD Rosette	1	127	69°36.660	-138°13.693
3A	435	Beaufort Sea	05-Sep-16	Box Core	1	279	71°04.477	-133°40.024
3A	435	Beaufort Sea	05-Sep-16	CTD Rosette	1	294	71°04.70	-133°38.32
3A	535	Beaufort Sea	08-Sep-16	Box Core	1	291	73°25.072	-128°11.279
3A	535	Beaufort Sea	08-Sep-16	Box Core	2	290	73°25.019	-128°11.465
3A	535	Beaufort Sea	08-Sep-16	Box Core	3	289	73°24.960	-128°11.424
3A	535	Beaufort Sea	08-Sep-16	CTD Rosette	1	290	73°24.756	-128°11.848
3A	554	Beaufort Sea	09-Sep-16	Box Core	1	373	75°44.49	-126°28.59
3A	554	Beaufort Sea	09-Sep-16	CTD Rosette	1	370	75°44.752	-126°26.77
3A	575	Beaufort Sea	10-Sep-16	Box Core	1	318	76°09.367	-125°52.540
3A	575	Beaufort Sea	10-Sep-16	CTD Rosette	1	319	76°10.9	-125°59.6
3A	585	Beaufort Sea	12-Sep-16	Box Core	1	382	74°30.78	-123°13.35
3A	585	Beaufort Sea	12-Sep-16	CTD Rosette	1	381	74°30.18	-123°14.43
3A	545	Beaufort Sea	13-Sep-16	Box Core	1	315	74°10.698	-126°49.380

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30 Geochemical Analyses of Corals – Leg 2a

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30.1 Methodology

30.1.1 *CTD-Rosette Sampling*

Water samples for the Hidden Biodiversity team were collected from the CTD-rosette by Sam Davin (UQÀM) to characterize the stable isotopic composition ($\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$, $\delta^{2}H$) and trace elements in the water column at selected waypoints. The resultant data will be used to answer long-standing questions about nutrient availability and transport in the Labrador Sea and southern Baffin Bay. In addition to their value as a robust, standalone chemical oceanographic dataset the isotopic values obtained from these water samples will be related to the biogeochemical signatures of the mineralized and proteinaceous components of deep-sea coral skeletons to develop a historical perspective of environmental change in the North Atlantic and Arctic Ocean. To further corraborate this data, 30 liters of water (alternating between surface water and bottom water at each site) was collected at each sampling station and filtered on site to yield several miligrams of sinking particulate organic matter (POM) from the water column. Sinking POM is of particular interest to the ArcticNet Hidden Biodiversity team because it is believed to constitute a considerable component of the diet of deep-sea corals. By identifying the isotopic signature of sinking POM we intend to shed light on the feeding habits and subsequent biological fractionation of $\delta^{13}C$, $\delta^{15}N$, and $\delta^{2}H$ isotopes in the two keystone coral species Primnoa resedaeformis and Keratoisis grayii.

30.1.2 *Geochemical Analyses of Corals*

Fragments of *Primnoa resedaeformis* and *Keratoisis grayii* colonies were collected during ROV operations at selected sites during Leg 2a by the ArcticNet Hidden Biodiversity team for biogeochemical assays targeting multi-decadal variability in physical seawater parameters, nutrient transport, and food availability. These species were chosen for their longevity and for their hybrid mineral/protein skeletons which facilitate the corals in functioning as dual archives of deep and surface ocean parameters.

The stable isotopic composition ($\delta^{13}C$, $\delta^{15}N$, $\delta^{2}H$) of these colonies will be analyzed to answer long-standing questions about nutrient availability and transport in the Labrador Sea and southern Baffin Bay. This data will be used in conjunction with stable isotope measurements made on seawater profiles and on sinking particulate organic matter collected during Leg 2a by Sam Davin (UQÀM) at corresponding ROV sites. Furthermore, the base of a large sub-fossil *Primnoa resedaeformis* colony collected during Leg 2a will be critical for developing the seminal methodology of measuring the hydrogen isotopic composition of deep-sea corals. The development of this methodology opens the door to for a novel marine proxy and ultimately a better understanding of both the biology of deep-sea corals and of high-latitude marine processes.

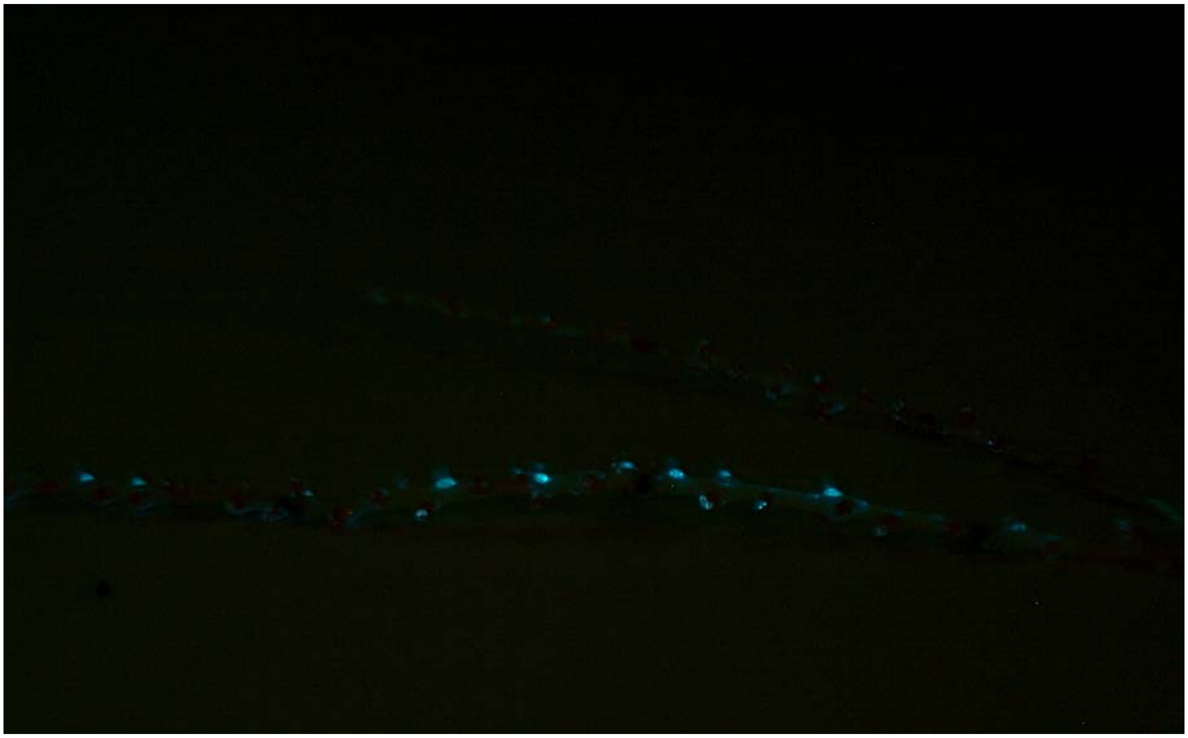

Figure 30.1. Bioluminescence

31 Response of the Benthos to Inputs on the Seafloor during the Spring Bloom – Leg 1a

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31.1 Introduction

In this Arctic, pelagic-benthic coupling is thought to be particularly tight in ice-covered areas (Carroll and Carroll 2003, Wassmann and Reigstad 2011). Over the annual cycle, the phytoplankton spring bloom represents by far the largest pulse of energy and carbon fuelling the Arctic pelagic and benthic food webs (Morata et al. 2008, Forest et al. 2011). The total and proportional annual primary production of ice algae and phytoplankton will likely change with shifts in the sea ice extent, thickness and duration, having repercussion for Arctic marine food webs and carbon transfers all the way to the seafloor. This will likely have critical consequences for the benthic populations in the Arctic Ocean. Hence, investigating the fate of organic matter supplied by the spring blooms is critical to gaining new knowledge on how changes in climatic and sea ice conditions affect Arctic marine biota and pelagic benthic coupling.
The main objective of this study was therefore to investigate how benthic communities' function change spatially as a function of environmental conditions and food inputs during the spring bloom, along the sea ice and depth gradient. This study was part of the workpackage 3 "related carbon transfer through the food web toward the bottom".

31.2 Methodology

Box corer sampling was conducted at 12 stations (Table 31.1). 5 to 8 push cores were collected (Figure 31.1). In order to characterize the inputs of fresh phytodetritus to the seafloor, at each station, 2 or 3 replicates sediment cores were collected and sliced every 0.5 cm until 2 cm, and every 1 cm until 10 cm for "initial conditions". Samples were frozen on board, and analyses of pigments, biogenic silica, total organic matter, carbon and nitrogen contents, will be carried out back at the LEMAR laboratory. Five to 10 trucked seringes were collected and the top 2 cm were preserved in formaline for future analyses of diatom frustules at the LEMAR laboratory. Surface sediment (0-2 cm) was also collected for bacterial community composition (collaboration with Julie Dinasquet, LOMIC, Banyuls s/mer).

Figure 31.1. Left: Boxcore sampling, Right: Sediment core incubation set

In order to characterize the activities from the overall community (including macro-, meio- and micro-fauna), 3 to 5 sediment cores were incubated with bottom water as in the Photo 2 for 48 to 72h in the dark in the cold room at 2°C, in order to measure respiration and nutrient fluxes (ammonia, nitrate, phosphate, silicate, dissolved inorganic carbon, dissolved organic carbon) of the overall community as indicator of metabolic activities (Table 31.1). Nutrient samples will be analysed back at the LEMAR laboratory.

Table 31.1. Samples collected. "Initial conditions" include the analyses of pigments, biogenic silica, diatom frustules, total organic matter, carbon and nitrogen contents. The nutrient fluxes studies are: ammonium, nitrate, phosphate, silicate, dissolved inorganic carbon, dissolved organic carbon.

Station	Latitude	Longitude	Depth of boxcore sampling	Number of cores collected for "inital conditions"	Samples fixed in formaline for diatom frustules	Samples collected for bacterial DNA	Number of cores incubated for nutrient fluxes
G115	68°22.777	061°16.436	1740	2	5	X	4
G201	68°35	59°55	1322	3	5	X	5
G300	69°00	56°47	198	3	5	X	5
G306b	68°59	58°96	309	2	5	X	4
G312	69°20	59°37	1452	2	5	X	4
G413	68° 7.6148	59° 0.1454	276	2	5	X	5
G418	68°6.8789	57°45.6977	385	2	6	X	5
G605	70°26,409	62°29.47	2017	3	5	X	5
G615	70°29.6588	59°28.42	602	3	5	X	5
G707	69°30.7684	59°48.7079	1700	3	5	X	5
G713	69°29.98	61°34.99	1895	3	5	X	3
G719	69°30.020	63°16.822	1950	3	5	X	3

31.3 Preliminary Results

Some stations showed a strong green color of the sediment in respect to others (Figure 31.2). This green color was mostly found at stations with a strong surface phytoplanktonic bloom, suggesting that green phytodetritus have already reached the seafloor. The quality of the material reaching the seafloor will be confirmed by the laboratory results.

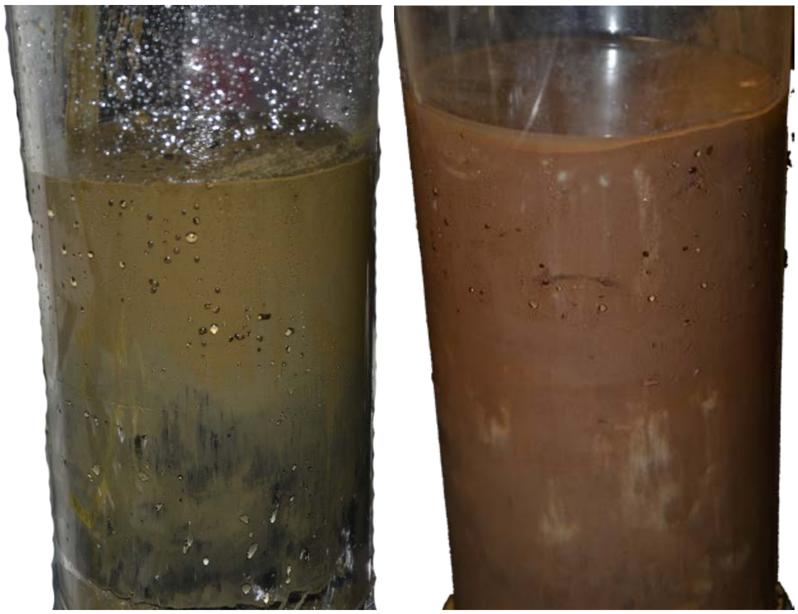

Figure 31.2. Left: Sediment showing a strong green, Right: Sediment without green

Benthic communities' functioning (including respiration rates) was expected to change along the depth gradient. However, preliminary results showed that at the deepest stations, respiration rates were higher than expected. This suggest that other parameters, like amount and source of food are likely important factors stucturing benthic communities functioning.

Collaboration

While we focused on the study of benthic communities' activities, the team of Philippe Archambault, at ISMER (Canada), studied the composition of benthic macro and meiofauna. We will collaborate in order to better assess the link between structure of functioning of the benthic communities.

In addition, in order to better the bacterial composition at the seafloor, we collected samples of surface sediment for Julie Dinasquet who will analyse bacterial community composition (LOMIC, Banyuls s/mer).

Finally, the initial concentrations of nutrients in the bottom water used for the sediment incubation were determined by Gabrièle Deslongchamps/Jean-Eric Tremblay (Takuvik, Québec-Océan).

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32 Benthic Diversity and Functioning across the Canadian Arctic

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32.1 Introduction

Ecosystem functions and services are linked to the diversity of active microbes, algae and consumers that compose the lower food web. Ongoing changes in the physical Arctic environment alter biodiversity in several ways, including shifts in species dominance and community structure, extinctions and invasions that affect major biogeochemical functions, such as nitrogen cycling, primary production, pelagic-benthic coupling and carbon storage. We have no certitude yet about how these changes will impact the food web. Arctic zooplankton is dominated by a handful of highly adapted, large copepod species that convert pulsed PP into lipid stores that are crucial for the survival of top predators (Darnis et al., 2012), but we do not know how this dominance will respond to change. By affecting both the quantity and the quality of sinking organic matter, shifts in PP, PFTs and zooplankton will presumably impact the diversity, community structure and function of the benthic fauna. The macrobenthos in marine sediments play important roles in ecosystem processes such as nutrient cycling, pollutant metabolism, dispersion and burial, and in secondary production (Snelgrove, 1998). Over the last few decades, the relationship between the distribution and diversity of soft-sediment species and the sediments in which they reside have been the subject of numerous studies (Gray 1974, Etter & Grassle 1992, Snelgrove & Butman 1994). Heterogeneous sediments, with more potential niches, seem to have a higher diversity than homogeneous sediments (Gray 1974). Indeed, the megafauna structure like sea anemonia, corals, sea pens can impact the diversity, community structure, distribution and function of the benthic fauna. Benthic consumers have been shown to depend more closely on ice algae than on phytoplankton (MacMahon et al., 2006, Sun et al., 2009, Roy et al., 2014). The quantity and the quality of sinking OM, food availability, sedimentation rate, sediment properties would be expected to vary with different levels of environmental variability. However, the scarce knowledge available for the Canadian Arctic makes it difficult to quantify and predict the cumulative impact of diverse factors of change on benthic biodiversity and function.

The main objectives are to

1) describe and compare the biodiversity (using a variety of different diversity indices) in different locations of the Canadian Arctic in relation to environmental variables

2) describe the relative importance of phytoplankton and ice algae as a food source to benthic organisms by looking at compound specific isotopes in faunal tissues, sediments and water column particulate organic matter (Leg 1)
3) describe the relative importance of megafauna structure on benthic ecosystems in term of biodiversity and functioning (Leg 2).

32.2 Methodology

The box core (Figure 32.1) was deployed to quantitatively sample diversity, abundance and biomass of endobenthic fauna and to obtain sediment cores for sediment analyses and incubations.

From the box cores (18 for Leg 1, 11 for Leg 2), sediments of usually a surface area of 0.125 m^2 and 10-15 cm in depth were collected and passed through a 0.5 mm mesh sieve and preserved in a 4 % formaldehyde solution for further identification in the laboratory (Table 31.1 and Table 31.3). Sub-cores of sediments were collected for sediment pigment content, organic matter, sediment grain size, porosity and nitrogen and phosphorus in sediment; for sediment pigments, the top 1 cm was collected, although for sediment grain size, the top 5 cm was collected. Sediment pigment and total nitrogen and phosphorus samples were frozen at -80°C, and porosity, organic matter and sediment grain size samples were frozen at -20°C. All samples will be transported off the ship for analyses in the lab at the Université du Québec in Rimouski, Université Laval in Québec city.

Figure 32.1. *Box core deployment and sediment cores sampling.*

At 13 stations for leg 1 and 29 stations for leg 2, the Agassiz trawl (Figure 32.2) was deployed to collect epibenthic fauna (Table 31.2 and Table 31.4). Catches were passed through a 2 mm mesh sieve. When possible, specimens were identified to the lowest taxonomic level, then counted and weighted. The unidentified specimens were preserved in a 4% seawater-formalin solution. At stations, some specimens were frozen at -20°C for compound specific isotope analysis.

Figure 32.2. Agassiz trawl deployment and identification of the specimens.

At the same station, water samples (maximum chlorophylle and bottom water) were taken from the CTD Rosette, filtered on GF/F filters and kept at -80°C for particulate organic matter compound specific isotope analysis. When possible, overlying water from the box core was sampled and filtered following the same method.

In order to achieve these operations efficiently and successfully, 2 people are required. While one person is collecting the water from the CTD Rosette, the other one is deploying the box core and the Agassiz trawl on the foredeck. Once all the samples are brought back to the laboratory, a minimum of 2 people are necessary for filtrations, sieving and identification of the organisms.

During Leg 2, for the experiment concerning the effect of megafauna structure on benthic ecosystem (Figure 31.3), incubations of 10 sediment cores were performed at station ROV 7in a dark and temperature controlled room (3°C). Five cores have been sampled in a coral patch of Kerastoisis sp and five cores have been sampled in sediment bare without corals. The oxygen concentrations and nutrient concentrations in the water column overlying the sediment (bottom water collected from rosette water samples obtained at the same station) in the incubation cores were measured periodically (about 4-8h intervals) over 48h to examine sediment community oxygen consumption and the benthic fluxes. At the end of the incubations, the sediment has been sliced: the top 5cm was sliced by centimeters and after by 5 centimeters. Each slice was sieved on a 0.5 mm mesh sieve to obtain macrofauna that were preserved in a 4% seawater-formalin solution and 5 mL of sediment was collected to analyse total nitrogen and phosphorus in each cores until 5centimeters.

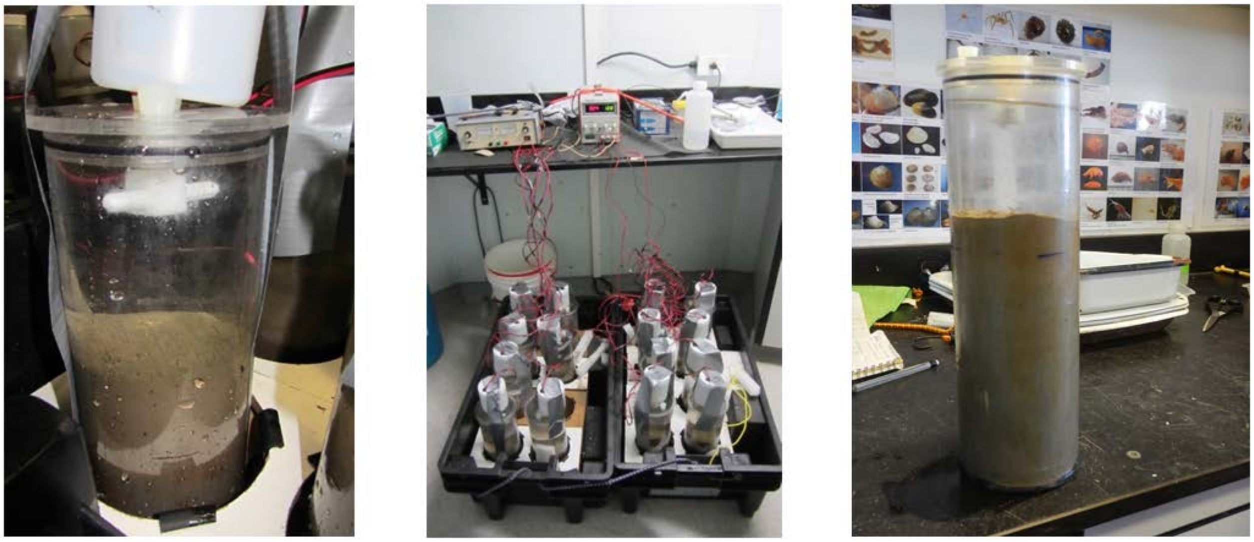

Figure 32.3. Experiment set-up in the temperature controlled room and slicing of sediment cores after finishing the experiment.

Table 32.1. Box coring stations during leg 1.

		START			END			
Station id	**Date**	**Lat. (N)**	**Long. (W)**	**Depth (m)**	Lat. (N)	Long. (W)	Depth (m)	**Duration (min)**
Full-G100	2016-06-09	Too rocky for deployment.						
Full-G102	2016-06-10	Too rocky for deployment.						
Nutrient-G103	2016-06-10	68°29.492	057°36.786	370	68°29.132	057°36.000	372	3
Full-G107	2016-06-11	68°30.077	059°16.093	403	68°29.989	059°15.570	396	6
Full-G110	2016-06-12	Problems with the winch.						
Full-G115	2016-06-13	Too much ice for deployment.						
Full-G201	2016-06-15	Too much ice for deployment.						
Full-G204	2016-06-15	68°42.249	059°09.867	445	68°42.437	059°08.099	429	6
Full-G207	2016-06-16	68°47.865	058°31.143	322	68°47.187	058°30.398	322	3

		START			END			
Station id	Date	Lat. (N)	Long. (W)	Depth (m)	Lat. (N)	Long. (W)	Depth (m)	Duration (min)
Full-G306b	2016-06-17	68º59.186	058º09.243	308	68º58.829	058º06.635	307	3
Full-G300	2016-06-17	68º59.969	056º47.328	199	69º00.256	056º48.434	208	3
Full-G309	2016-06-18	69º00.128	058º45.270	360	68º59.913	058º48.875	372	3
Full-G312	2016-06-19	Too much ice for deployment.						
Full-G318	2016-06-20	Too much ice for deployment.						
Full-G324	2016-06-21	Too deep for deployment.						
Full-G403	2016-06-25	Too much ice for deployment.						
Full-G409	2016-06-26	Too much ice for deployment.						
Full-G413	2016-06-27	Too much ice for deployment.						
Full-G418	2016-06-28	68º06.900	057º45.750	158	68º06.581	057º42.889	74	3
Full-G507	2016-06-30	70º00.653	059º06.984	359	70º00.923	059º09.457	237	3
Full-G512	2016-07-01	69º59.182	060º23.575	605	69º59.307	060º25.589	636	3
Full-G519	2016-07-02	Too much ice for deployment.						
Full-G600	2016-07-03	Too much ice for deployment.						

		START			END			
Station id	Date	Lat. (N)	Long. (W)	Depth (m)	Lat. (N)	Long. (W)	Depth (m)	Duration (min)
Full-G605	2016-07-04	Too much ice for deployment.						
Full-G615	2016-07-05	70º29.764	059º30.830	615	70º29.668	059º28.299	603	5
Full-G604.5	2016-07-06	Same station as G605.						
Full-G703	2016-07-07	69º30.069	058º44.177	520	69º30.234	058º42.362	499	5
Full-G707	2016-07-08	69º30.777	059º48.988	1427	69º29.140	059º51.547	1459	4
Full-G713	2016-07-09	Too deep for deployment.						
Full-G719	2016-07-10	Too deep for deployment.						

Table 32.2. Agassiz trawl stations during leg 1.

		START			END			
Station id	Date	Lat. (N)	Long. (W)	Depth (m)	Lat. (N)	Long. (W)	Depth (m)	Duration (min)
Full-G100	2016-06-09	Too rocky for deployment.						
Full-G102	2016-06-10	Too rocky for deployment.						
Nutrient-G103	2016-06-10	68º29.492	057º36.786	370	68º29.132	057º36.000	372	3
Full-G107	2016-06-11	68º30.077	059º16.093	403	68º29.989	059º15.570	396	6

		START			END			
Station id	**Date**	**Lat. (N)**	**Long. (W)**	**Depth (m)**	Lat. (N)	Long. (W)	Depth (m)	**Duration (min)**
Full-G110	2016-06-12	Problems with the winch.						
Full-G115	2016-06-13	Too much ice for deployment.						
Full-G201	2016-06-15	Too much ice for deployment.						
Full-G204	2016-06-15	68º42.249	059º09.867	445	68º42.437	059º08.099	429	6
Full-G207	2016-06-16	68º47.865	058º31.143	322	68º47.187	058º30.398	322	3
Full-G306b	2016-06-17	68º59.186	058º09.243	308	68º58.829	058º06.635	307	3
Full-G300	2016-06-17	68º59.969	056º47.328	199	69º00.256	056º48.434	208	3
Full-G309	2016-06-18	69º00.128	058º45.270	360	68º59.913	058º48.875	372	3
Full-G312	2016-06-19	Too much ice for deployment.						
Full-G318	2016-06-20	Too much ice for deployment.						
Full-G324	2016-06-21	Too deep for deployment.						
Full-G403	2016-06-25	Too much ice for deployment.						
Full-G409	2016-06-26	Too much ice for deployment.						
Full-G413	2016-06-27	Too much ice for deployment.						
Full-G418	2016-06-28	68º06.900	057º45.750	158	68º06.581	057º42.889	74	3

		START			END			
Station id	Date	Lat. (N)	Long. (W)	Depth (m)	Lat. (N)	Long. (W)	Depth (m)	Duration (min)
Full-G507	2016-06-30	70º00.653	059º06.984	359	70º00.923	059º09.457	237	3
Full-G512	2016-07-01	69º59.182	060º23.575	605	69º59.307	060º25.589	636	3
Full-G519	2016-07-02	Too much ice for deployment.						
Full-G600	2016-07-03	Too much ice for deployment.						
Full-G605	2016-07-04	Too much ice for deployment.						
Full-G615	2016-07-05	70º29.764	059º30.830	615	70º29.668	059º28.299	603	5
Full-G604.5	2016-07-06	Same station as G605.						
Full-G703	2016-07-07	69º30.069	058º44.177	520	69º30.234	058º42.362	499	5
Full-G707	2016-07-08	69º30.777	059º48.988	1427	69º29.140	059º51.547	1459	4
Full-G713	2016-07-09	Too deep for deployment.						
Full-G719	2016-07-10	Too deep for deployment.						

Table 32.3. Box coring stations during Leg 2b.

Station ID	Date	Latitude (N)	Longitude (W)	Depth (m)	Diversity	Grain size	Pigments	Organic content
Full-177	2016-07-28	67°28.57	63°47.41	373	x	x	x	x
Basic-176	2016-07-30	69°35.823	65°21.481	367	x	x	x	x
Full-169	2016-08-01	71°16.207	70°31.285	770				
Basic-160	2016-08-03	72°41.052	78°34.233	726	x	x	x	x
Full-323	2016-08-04	74°09.34	80°28.30	790	x	x	x	x
Full-115	2016-08-06	76°20.384	71°15.389	669	x	x	x	x
Basic-111	2016-08-07	76°18.446	73°12.830	596	x	x	x	x
Full-116	2016-08-08	76°44.33	71°49.08	722	x	x	x	x
Full-108	2016-08-09	76°15.832	74°36.099	449	x	x	x	x
Basic-105	no box core, too rocky							
Full-101	2016-08-10	76°22.884	77°23.157	357	x	x	x	x
Full-TS233	2016-08-11	67°28.430	63°41.526	680	x	x	x	x
Full-139	2016-08-13	67°28.441	63°41.555	679	x	x	x	x
Full-Kane 1	2016-08-14	67°28.986	61°39.996	360	x			
Basic-133	2016-08-14	79°30.916	70°49.744	217	x	x	x	x
Basic-127	2016-08-15	78°18.129	74°28.509	521	x	x	x	x
Basic-119	2016-08-16	77°19.296	76°05.916	516	x	x	x	x
Basic-Allen Bay	no box core, too rocky							
Basic-305	no box core, too rocky							

Station ID	Date	Latitude (N)	Longitude (W)	Depth (m)	Diversity	Grain size	Pigments	Organic content
Basic-310E	no box core, too rocky							
Basic-311	no box core, too rocky							
Full-QMGM	2016-08-20	68°18.16	101°44.22	113	x	x	x	x
Basic-QMG2	2016-08-21	68°18.810	100°47.94	56	x	x	x	x
Full-QMG1	2016-08-22	68°29.52	99°53.70	41	x	x	x	x
Basic-QMG3	2016-08-22	68°19.716	102°56.472	49	x	x	x	x
Full-QMG4	2016-08-22	68°29.084	103°25.708	67	x	x	x	x
Full-314	2016-08-23	68°58.23	105°28.46	80	x	x	x	x
Basic-316	2016-08-24	68°23.005	112°06.995	178	x	x	x	x

Table 32.4. Agassiz trawl stations during Leg 2b.

		Start			End				
Station ID	Date	Latitude (N)	Longitude (W)	Depth (m)	Latitude (N)	Longitude (W)	Depth (m)	Duration (min)	Comments
Full-177	2016-07-29	67°27.558	63°43.351	371	67°20.825	63°45.703	383	2.30	
Basic-176	2016-07-30	69°35.650	65°20.351	413	69°36.128	65°20.163	396	3	
Full-169	2016-08-01	71°16.93	70°30.83	774	71°17.84	70°33.49	699	3	
Basic-160	2016-08-03	76°18.53	73°13.27	590	76°18.34	73°12.89	592	3	

		Start			End				
Station ID	Date	Latitude (N)	Longitude (W)	Depth (m)	Latitude (N)	Longitude (W)	Depth (m)	Duration (min)	Comments
Full-323	2016-08-04	74°09.815	80°21.978	789	74°09.892	80°16.956	790	3	
Full-115	2016-08-06	76°20.217	71°12.097	658	76°19.952	71°15.812	668	3	
Basic-111	2016-08-07	76°18.376	73°13.130	594	76°19.030	73°09.930	605	3	
Full-116	2016-08-08	76°44.36	71°50.23	707	76°43.49	71°51.75	582	3	
Full-108	2016-08-09	76°15.65	74°37.52	447	76°15.602	74°34.767	444	3	
Basic-105	2015-10-13	Too rocky							
Full-101	2016-08-10	76°22.638	77°24.389	371	76°21.880	77°23.633	377	3	
Full-TS233Q	2016-08-11	77°47.789	76°31.957	573	77°47.011	76°31.848	549	1.45	
Full-139	2016-08-13	81°20.468	62°48.966	572	81°20.667	62°44.693	556	3	
Full-Kane 1	2016-08-14	64°10.38	60°24.02	350	64°10.97	60°24.09	352	3	
Basic-133	2016-08-14	79°32.83	70°26.53	167	79°33.12	70°26.82	164	3	
Basic-127	2016-08-15	78°18.34	74°30.036	534	78°17.376	74°29.569	559	3	
Basic-119	2016-08-16	77°19.111	76°06.693	512	77°18.471	76°07.662	505	3	
Basic-Allen Bay	2016-08-17	74°43.55	95°15.94	85	74°43.41	95°15.28	82	3	
Basic-305	2016-08-18	74°20.071	94°58.203	172	74°20.231	94°57.057	173	3	

		Start			End				
Station ID	Date	Latitude (N)	Longitude (W)	Depth (m)	Latitude (N)	Longitude (W)	Depth (m)	Duration (min)	Comments
Basic-310E	2016-08-19	71°17.411	97°41.890	130	71°17.298	97°42.621	121	3	
Basic-311	2016-08-19	70°15.90	98°32.24	151	70°15.75	98°32.81	168	3	
Basic-312	2016-08-20	69°10.23	100°42.44	67	69°10.21	100°42.98	65	3	
Full-QMGM	2016-08-20	68°18.16	101°45.06	115	68°18.09	101°45.56	112	3	
Basic-QMG2	2016-08-21	68°18.861	100°48.426	57	68°18.870	100°48.845	58	3	
Full-QMG1	2016-08-22	68°29.51	99°53.99	45	68°29.55	99°53.34	33	3	
Basic-QMG3	2016-08-22	68°19.901	102°55.361	50	68°19.978	102°55.874	55	3	
Full-QMG4	2016-08-22	68°28.83	103°23.93	70	68°28.61	103°23.40	74	3	
Basic-314	2016-08-23	68°58.07	105°29.82	81	68°57.89	105°30.15	74	3	

* During Leg 2, we did not deploy the box core at stations 105, Allen Bay, 305, 310E, and 311 because the bottom was too rocky. We did not deploy the Agassiz trawl at the stations 105 and TS233 (change by station TS233Q) because the bottom was too rocky and because of ice conditions.

32.3 Preliminary Results

At this point, we do not know exactly if spatial and temporal variability of benthic diversity is governed by sediment type, food availability or other environmental variables. Samples collected for compound specific isotope analysis also require further analysis. For detailed results, identification of organisms and sediment analyses will be carried on in home labs.

32.4 Comments and Recommendations

We did not deploy the box core at stations 105, Allen Bay, 305, 310E, and 311 because the bottom was too rocky. We did not deploy the Agassiz trawl at the stations 105 and TS233 (change by station TS233Q) because the bottom was too rocky and because of ice conditions.

Acknowledgement

We gratefully thanks the chief scientists Christian Nozais (2a) and Tim Papariyoupoulos (2b) and the Captain of the *Amundsen* Alain Gariépy. We also thank the day and night deck crew for their help with the gear deployment.

33 Seabed Mapping, MVP and Coring – Legs 1, 2 and 3

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33.1 *Introduction*

The *Amundsen* 2016 expedition Leg 1 cruise took place from 3 June to 14 July 2016. The *Marine Geoscience Lab.* (MGL – Université Laval, Québec was onboard and responsible for multibeam and sub-bottom data acquisition. The main objective of the mission was to acquire data on phytoplankton bloom in Baffin Bay as part of the GreenEdge research program. The *MGL* has been mainly involved in mapping the seabed morphology and in acquiring sub-bottom stratigraphy during transits.

The *Amundsen 2016 expedition* Leg 2 cruise took place from 14 July to 25 August 2016. The *Marine Geoscience Lab.* (MGL – Université Laval) was onboard and responsible for multibeam and sub-bottom data acquisition. The *MGL* has been mainly involved in mapping the seabed morphology and in acquiring sub-bottom stratigraphy during transits, as well as sampling 4 coring stations, assisting mooring deployment and recovery as well as deploying the *Moving Vessel Profiler* (MVP).

The *Amundsen 2016 expedition* Leg 3 cruise took place from 25 August to 5 October 2016. The *Marine Geoscience Lab.* (MGL – Université Laval) was onboard and responsible for multibeam and sub-bottom data acquisition. The *MGL* has been mainly involved in mapping the seabed morphology and in acquiring sub-bottom stratigraphy during transits, deploying the *Moving Vessel Profiler* (MVP), as well as assisting mooring deployment and recovery.

This cruise report presents the instruments, methods and preliminary results for all legs of 2016 Expedition.

33.2 Methodology

33.2.1 *Kongsberg EM302 Multibeam Sonar*

The *Amundsen* is equipped with an EM302 multibeam sonar operated with the Seafloor Information System (SIS). Attitude is given by an Applanix POS-MV receiving RTCM corrections from a CNAV 3050 GPS receiver. Position accuracies were approximatively < 0.8m in planimetry and < 1m in altimetry. Beam forming at the transducer head is done by using an AML probe. CTD-Rosette casts, when available, were used for sound speed corrections. During long periods without CTD casts, the WOA09 model was used. Anew Hydrographic Working Station (HWS) was installed by a Kongsberg before the Sea trials and the system worked perfectly during the whole cruise.

33.2.2 *Knudsen 3260 CHIRP Sub-bottom Profiler*

Since May 2016, a new Knudsen 3260 deck unit has been installed onboard the *Amundsen.* It was acquired to replace the old 320-BR system that shown signs of high degradation at the end of the 2015 field season. The new system now operates using a USB connector instead of a SCSII communication port. We also installed a new operating computer (HP EliteDesk). Sub-bottom profiles were acquired all along transits at a frequency of 3.5 kHz to image sub-bottom stratigraphy of the seafloor.

33.2.3 *Moving Vessel Profiler (MVP) 300*

The MVP measures temperature, salinity, transmissivity, dissolved O_2, fluorescence and sound velocity. Mainly, our team uses MVP data to correct for sound velocity during transit mapping, but these transects were also used to visualize water column properties for physical and biological purposes. The MVP transects were mainly used to support sampling stations selection. Table 33.1 details MVP operations during the 3 legs.

Table 33.1 MVP operations

Leg	Number of transect	MVP speed (min-max)
1	10	7kts – 11kts
2	4	6kts – 11kts
3	4	6kts – 11kts

33.3 Preliminary Results

All the data acquired during the cruise were pre-processed in real-time using the *CARIS HIPS&SIPS 9.0* software. This pre-processing phase is essential to rapidly detect any anomaly in the data collection. The final addition of the 2016 data will be done upon the return of the ship in Quebec City.

33.3.1 *Transit Mapping*

The mapping of the Arctic seabed is an important objective of the ArcticNet program. Transits routes were surveyed systematically in order to increase the multibeam dataset. These data will be shared with the Canadian Hydrographic Service (CHS) to update marine charts and might be useful for future work within the ArcticNet program (e.g. Figure 33.1). Some of the transits lines were deleted due to poor data quality in heavy ice conditions. Apart from lines ran in ice, the multibeam worked well and generated new data in previously poorly charted areas.

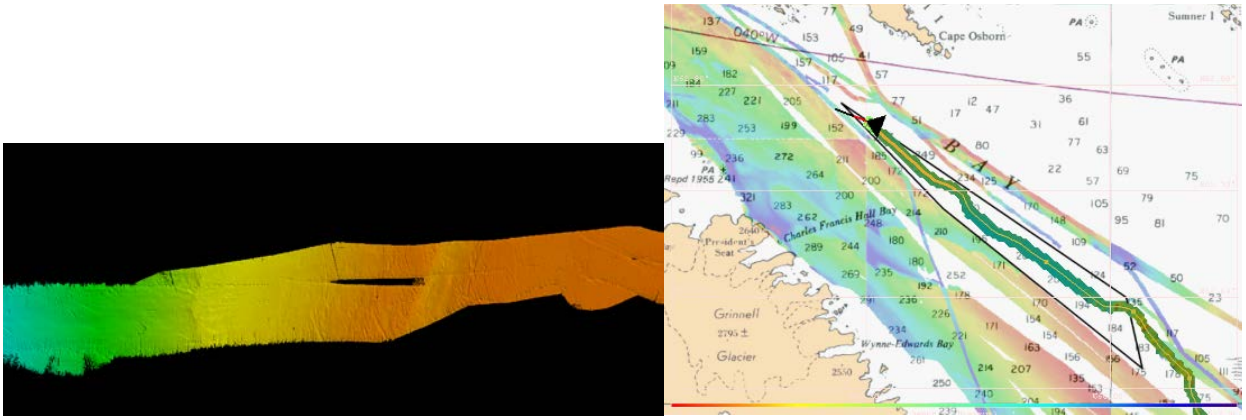

Figure 33.1. left) Data acquired during transit mapping (leg1); right) Opportunistic mapping in Frobisher Bay (leg1)

In 2016, our team has been developing a bathymetry database to easily access all the bathymetry data acquired since the beginning of the ArcticNet program. This ArcMap based database is a raster catalog of more than 3500 data grids (15’x30’ spatial extent) that can be rapidly added to navigation charts in order to improve the multibeam coverage of the Arctic (Figure 33.2). This year marked the trial version of this database and our experience so far has proven that, although some improvements need to be made, this type of database is very well suited for ArcticNet and CHS requirements.

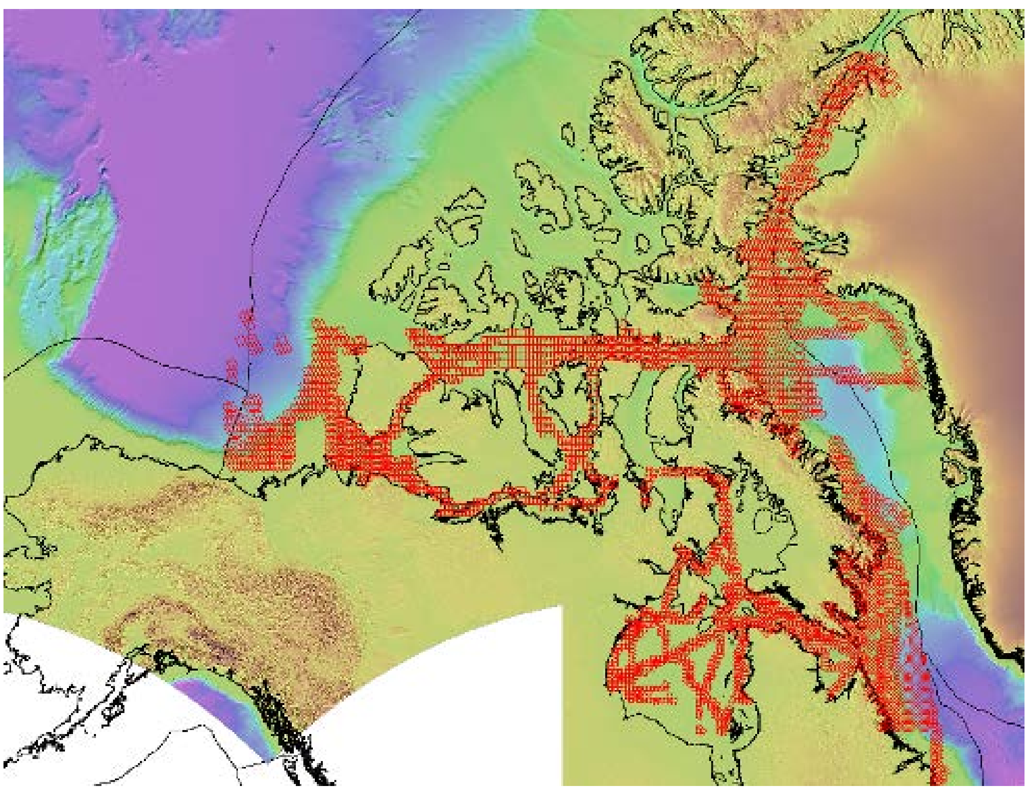

Figure 33.2. Image of the Amundsen Bathy-CHIRP Database for bathymetric and sub-bottom data collection.

33.3.2 *Dedicated mapping surveys*

Table 33.2 presents dedicated mapping surveys information undertaken during Leg 1a. Some examples of bathymetric surfaces are presented from Figure 33.3 to Figure 33.7.

Table 33.2. Dedicated mapping operations undertaken during Leg 1a.

Location	Start Date/Time	End Date/Time	Total time (hr)
South Falk-Fletcher Pass (Outter Frobisher Bay)	14/07/2016 23:30	15/07/2016 07:15	7,75
ROV stn 1	2016-07-17 23:00	2016-07-18 08:00	9
ROV stn 4	2016-07-18 21:00	2016-07-19 06:00	9
ROV stn 5	2016-07-19 08:00	2016-07-19 09:20	1,3
ROV stn 2	2016-07-20 02:40	2016-07-20 08:15	5,65
ROV stn 2	2016-07-20 17:00	2016-07-20 19:00	2
ROV stn 3	2016-07-21 00:00	2016-07-21 05:00	5
Sub-total			39,7

Figure 33.3 Surface image – ROV stn 1

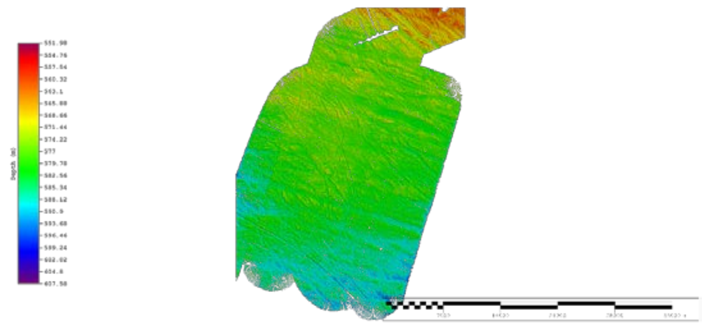

Figure 33.4 Surface image – ROV stn 4

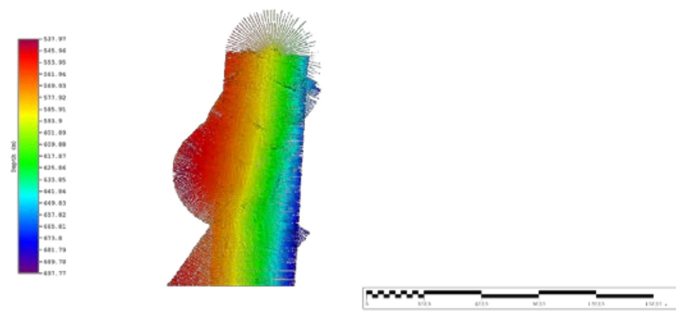

Figure 33.5 Surface image – ROV stn 5

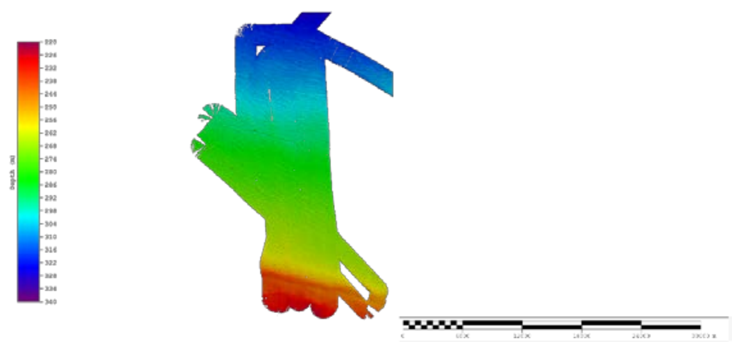

Figure 33.6 Surface image – ROV stn 2

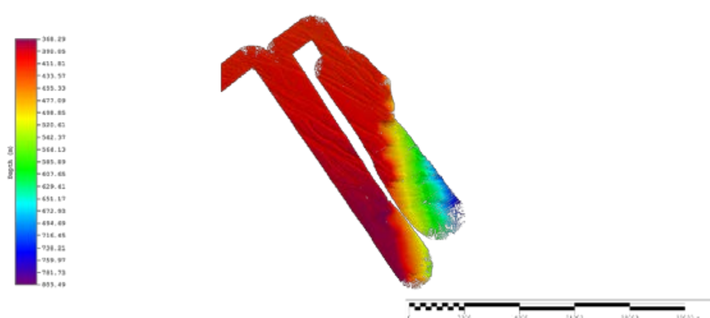

Figure 33.7 Surface image – ROV stn 3

Table 33.3 in present dedicated mapping surveys information undertaken during Leg 2a and Leg 2b. Some examples of bathymetric surfaces are presented from Figure 33.8 to Figure 32.10.

Table 33.3. Description of the dedicated mapping operations undertaken during Leg 2.

	Location	Start Date/Time	End Date/Time	Total time (hr)	Area (km²)	Description
Leg 2A	Falk-Fletcher Pass	2016-07-14 23:30	2016-07-15 07:15	7,75	122	Navigation Passage to Iqaluit. Memorial University/CHS (Endinger & al)
Leg 2A	ROV stn 1	2016-07-17 23:00	2016-07-18 08:00	9	266	Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2A	ROV stn 4	2016-07-18 21:00	2016-07-19 06:00	9	181	Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2A	ROV stn 5	2016-07-19 08:00	2016-07-19 09:20	1,3	14	Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2A	ROV stn 2	2016-07-20 02:40	2016-07-20 08:15	5,65	65	Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2A	ROV stn 2	2016-07-20 17:00	2016-07-20 19:00	2		Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2A	ROV stn 3	2016-07-21 00:00	2016-07-21 05:00	5	100	Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2A	ROV stn 6	2016-07-22 07:00	2016-07-22 12:30	5,5	55	Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2A	ROV stn 7	2016-07-24 05:30	2016-07-24 07:30	2,5	38	Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2A	ROV Black corals	2016-07-25 20:00	2016-07-25 22:30	2,5	34	Mapping ROV dive site / Memorial University (Endinger & al)
Leg 2B	Quikiktarjuuaq - Ice Island	2016-07-28 11:22	2016-07-28 12:50	1,5	39	Grounded ice island mapping. Circumnavigation for keel mapping with EM302 and SX90 sonars. / Carlton University (Mueller & Crawford)
Leg 2B	LGM-CASQ 09	2016-07-30 11:30	2016-07-30 15:30	4	237	Pre-coring survey / Université Laval - ISMER (Lajeunesse & St-Onge)
Leg 2B	Buchan Gulf	2016-08-02 07:30	2016-08-03 02:00	19	535	Buchan Gulf Trough mapping. / Unviersité Laval (Lajeunesse)
Leg 2B	Opportunistic Mapping near stn 117	2016-08-08 05:00	2016-08-08 06:00	1	92	ArcticNet station
Leg 2B	Opportunistic Mapping near stn 105	2016-08-09 06:00	2016-08-09 08:00	2	34	ArcticNet station
Leg 2B	Trinity Fjord	2016-08-10 20:00	2016-08-11 03:00	7	100	Trinity Fjord Mapping (Copland & Lajeunesse)
Leg 2B	Northern Baffin Bay - PII-B breaking point	2016-08-09 18:00	2016-08-09 20:30	2,5	12	Iceberg scouring site (Mueller & Crawford)
Leg 2B	Northern Baffin Bay	2016-08-16 11:30	2016-08-16 15:00	Transit	8	Iceberg scouring site (Mueller & Crawford)
Leg 2B	Opportunistic Mapping near stn 305	2016-08-17 22:00	2016-08-18 04:00	5	47	ArcticNet station
Leg 2B	Furze-1	2016-08-18 13:00	2016-08-18 14:30	1,5	9	Pre-coring survey / McEwan University (Furze)
Leg 2B	Opportunistic Mapping near stn 312	2016-08-20 05:30	2016-08-20 08:30	3	11	ArcticNet station
Leg 2B	Opportunistic Mapping in Queen Maud Gulf	2016-08-20 15:30	2016-08-23 20:00	25	150	Weston Foundation Stations in Queen Maud Gulf
	Total			**121,7**	**2149**	

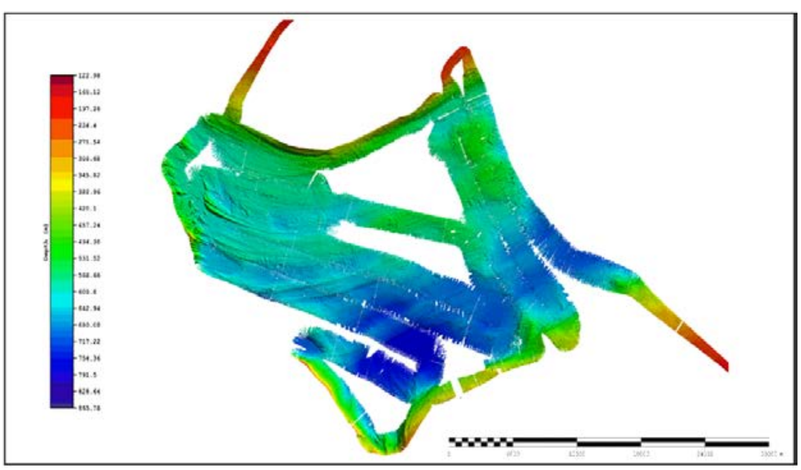

Figure 33.8. Bathymetric coverage of Buchan trough showing the high abundance of mega-scale glacial lineations (MSGL).

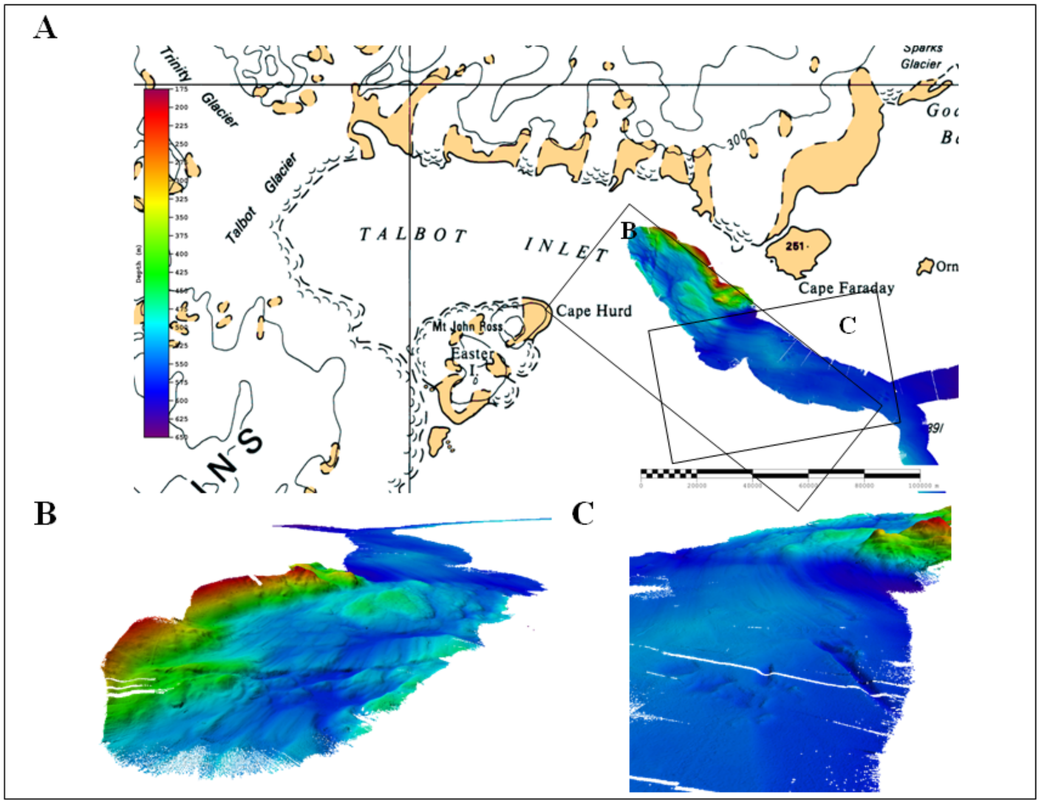

Figure 33.9. A) Bathymetric coverage inside Trinity Fjord; B) Horizontal 3D image of the glacial lineation on the seabed; C) Iceberg scours.

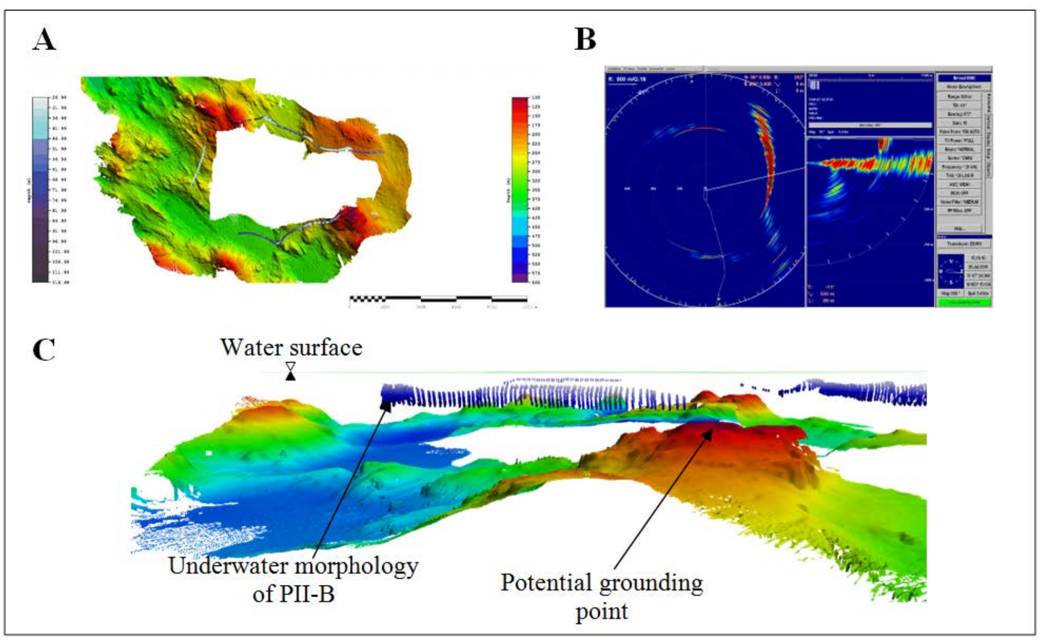

Figure 33.10. A) Seabed morphology (rainbow colorscale) around the ice island (blue colorscale represent keel depth); B) SX90 survey around the ice island. The right image shows the potential grounding site; C) Oblique 3D view of the ice island near the potential grounding area.

Table 33.4 in present dedicated mapping surveys information undertaken during Leg 3a and Leg 3b. Some examples of bathymetric surfaces are presented in Figure 33.11 to 14.

Table 33.4. Description of dedicated mapping surveys

Leg	Project	Date début	Date fin	Area (km^2)	Description
3A	Lakeman 2 & 3 area	2016-09-06; 11:03	2016-09-07; 01:58	57,55	Mappings mall mounds around the Lakeman 2 and 3 sites ; Very shallow area/ (King & Lakeman)
	BR-3 area	2016-09-08; 14:24	2016-09-08; 17:24	83,69	Opportunistic mapping of a mass movement scar
	Normandeau - Ballast fan, North Banks	2016-09-12; 05:35	2016-09-12; 13:35	74,43	Mapping of a s mall fan characterized by cyclic steps (Normandeau)
3B	Pond Inlet Trough	2016-09-25; 01:35	2016-09-25; 10:51	400,48	Mapping of glacial features l inked to ice streaming in the Trough (Lajeunesse &
	Clyde Inlet	2016-09-27; 10:40	2016-09-27; 18:10	147,40	Mapping of glacial features on the fjord's floor. Will be used for Pierre-Olivier Couette's Master study
	Broughton Trough	2016-09-29; 00:06	2016-09-29; 08:36	340,56	Opportunistic mapping of glacial features linked to ice streaming in the Trough
	Ice Island - Quikiktarjuuaq	2016-09-29;	2016-09-29;	33,2	Grounded ice island mapping. Circumnavigation for keel mapping with EM302 and SX90 s onars . 2x 1.5 h transit around the island/ Carlton University (Mueller & Crawford).

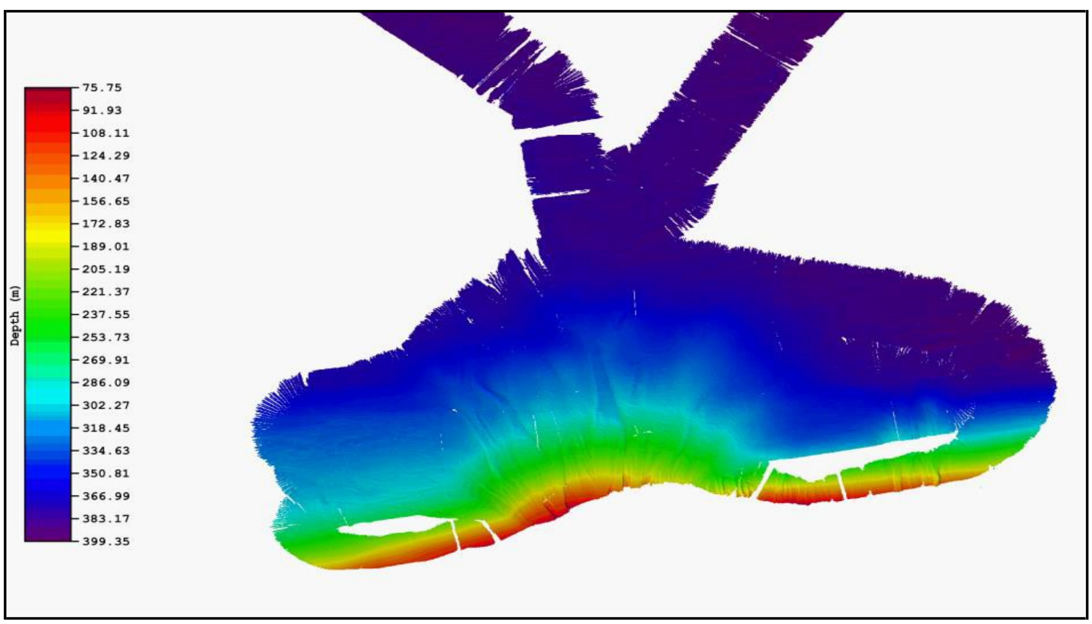

Figure 33.11. Bathymetric coverage of Ballast Fan showing many channels occupied by cyclic steps.

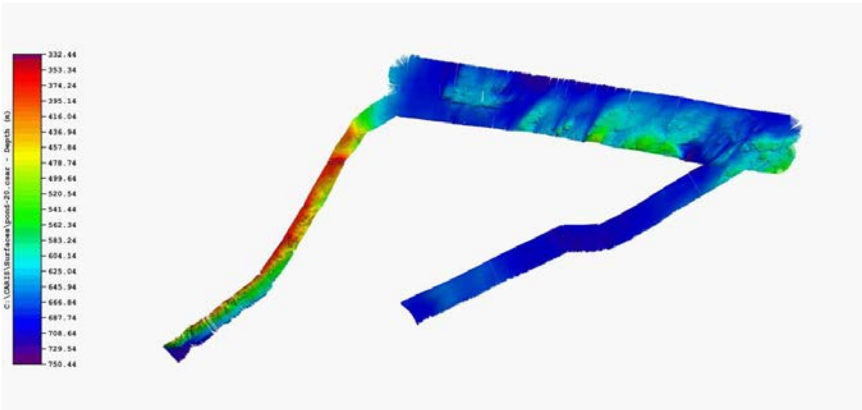

Figure 33.12. Bathymetric coverage of Pond Inlet trough survey showing glacial lineations.

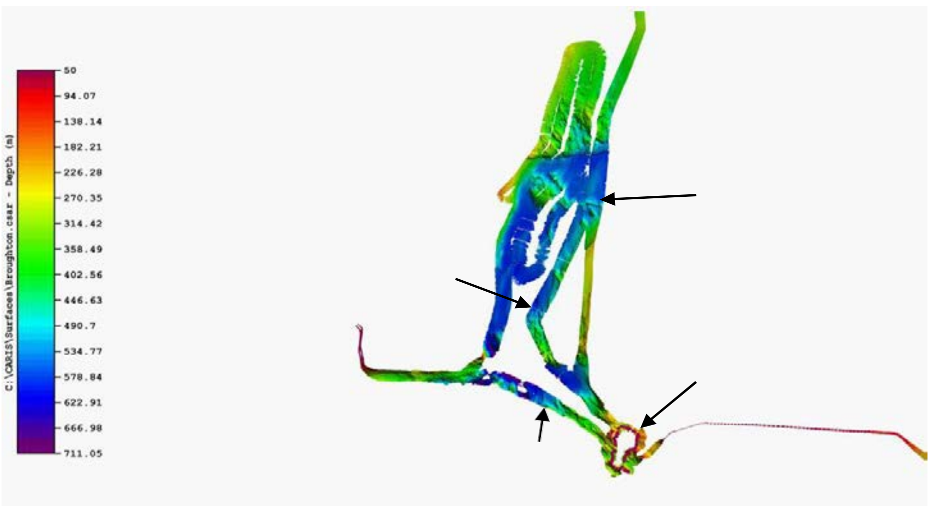

Figure 33.13. Bathymetric coverage of Broughton trough survey showing glacial lineation, moraines and the ice island.

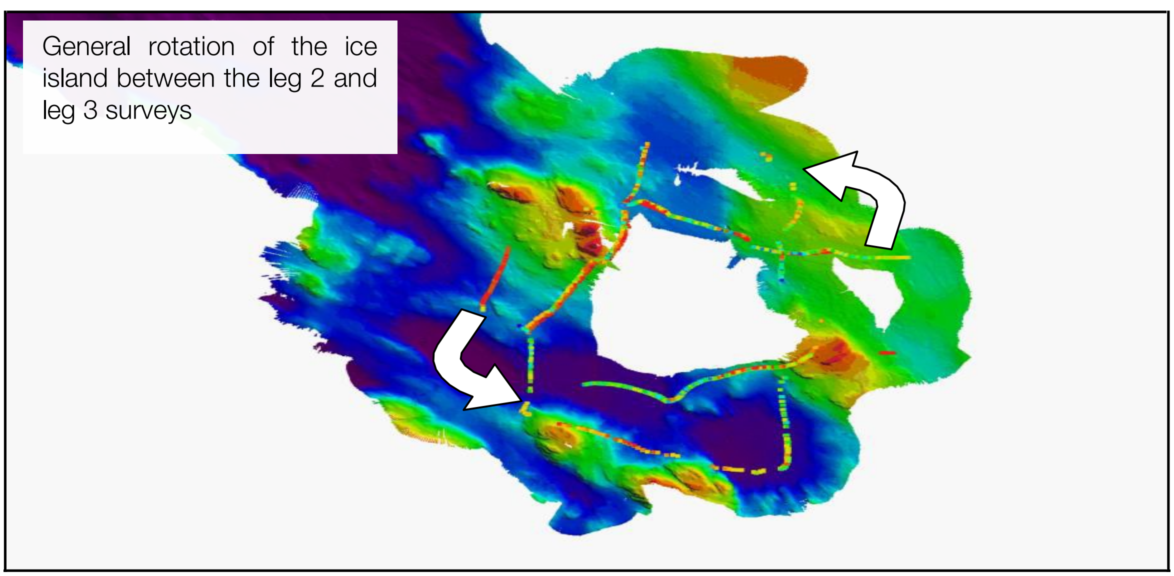

Figure 33.14. Difference in position of the ice island.

33.3.3 *MVP transects*

Table 33.5 describes the MVP transects performed during Leg1 (Figure 33.15).

Table 33.5. Description of the MVP transects performed during Leg1

Name of MVP transect	Name of Green Edge Transect	Location	Nb. of casts
01	100	Baffin Bay	36
02	100	Baffin Bay	16
03	200	Baffin Bay	72
04	300	Baffin Bay	70
05	400	Baffin Bay	59
06	500	Baffin Bay	89
07	500	Baffin Bay	15
08	600	Baffin Bay	153
09	600	Baffin Bay	44
10	700	Baffin Bay	20

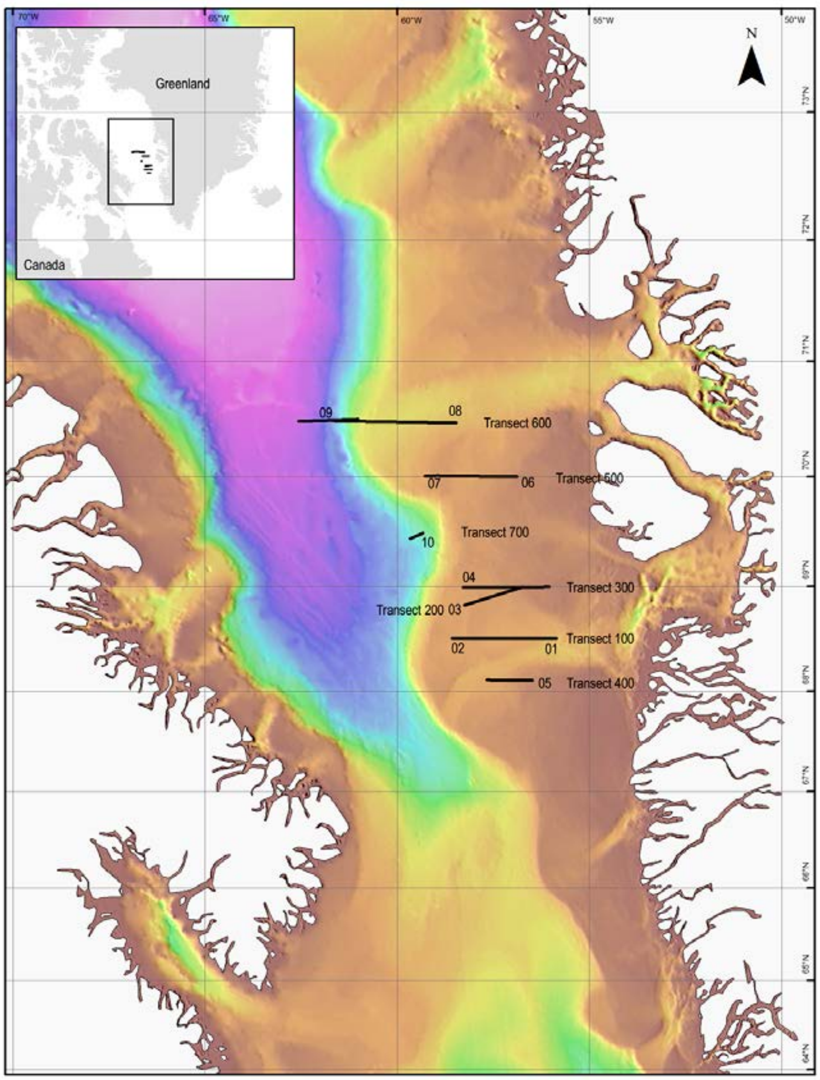

Figure 33.15. Location of the 10 MVP transects performed during Leg 1.

The following figures show the preliminary results of the 10 MVP transects (temperature, salinity, fluorescence and sound velocity) that were performed during Leg 1.

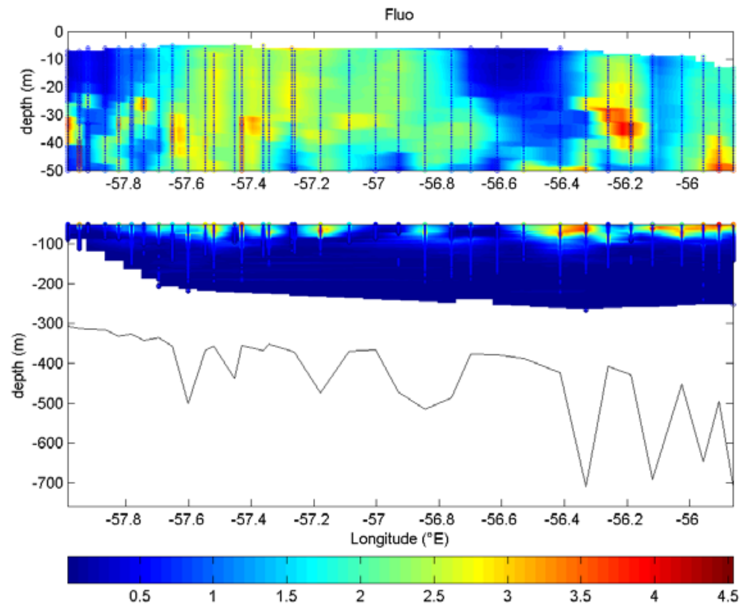

Figure 33.16. Fluorescence of MVP transect 01

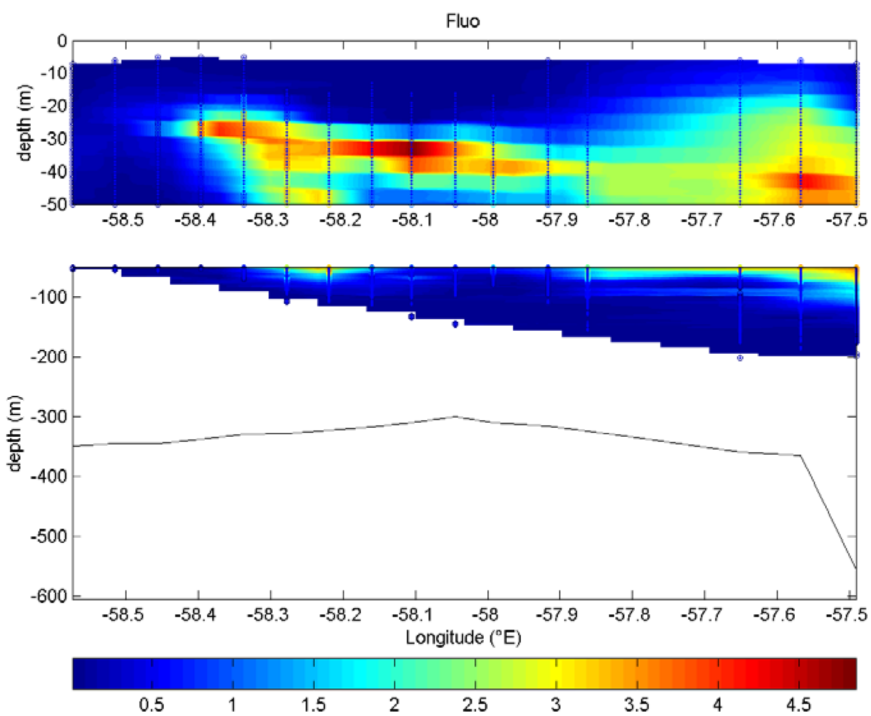

Figure 33.17. Fluorescence of MVP transect 02

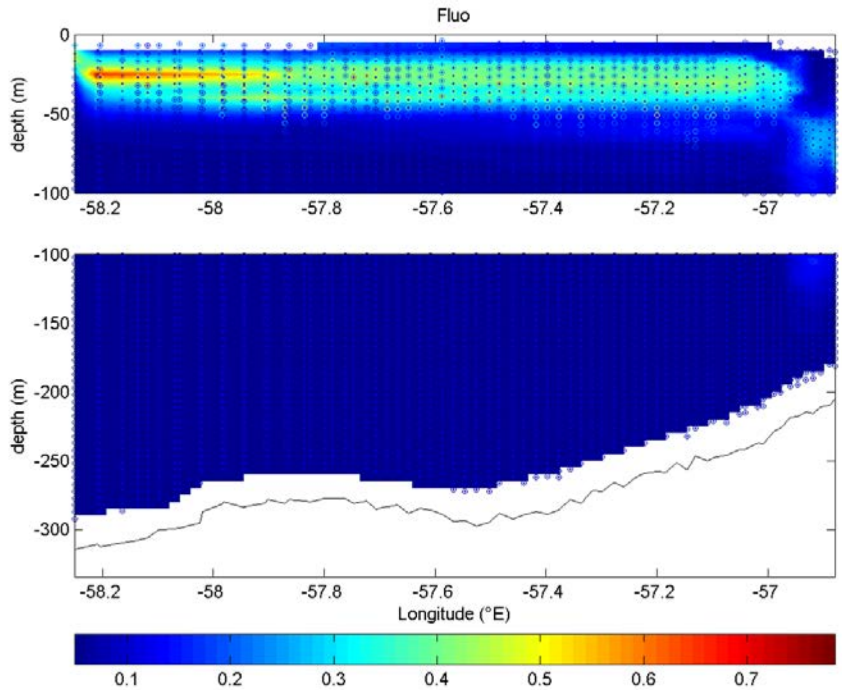

Figure 33.18. Fluorescence of MVP transect 03

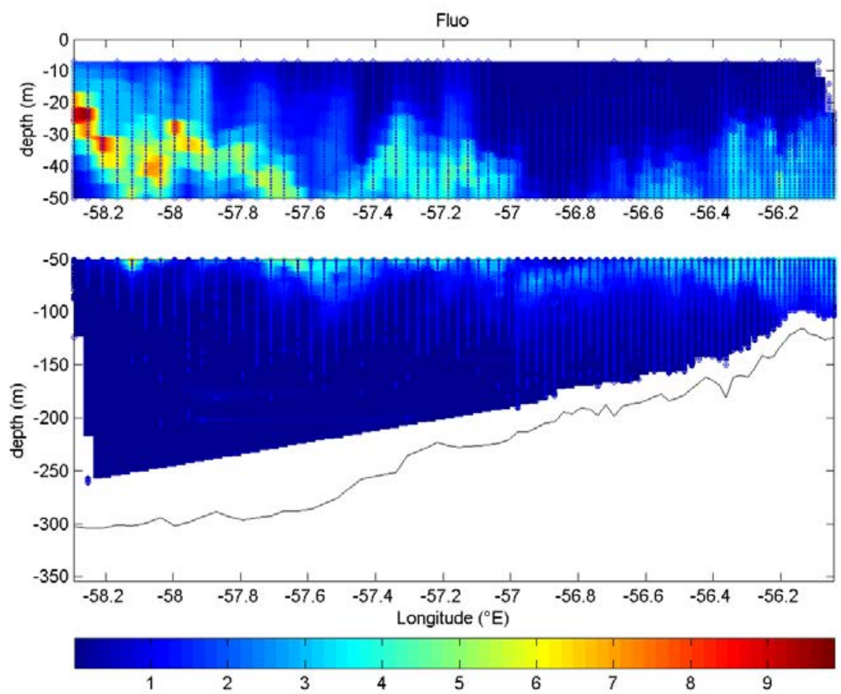

Figure 33.19. Fluorescence of MVP transect 04

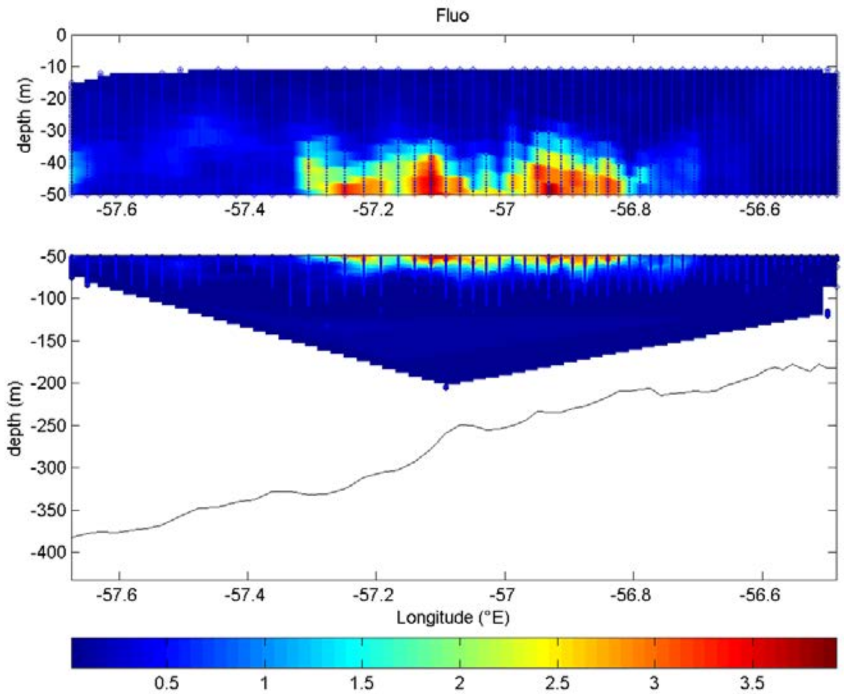

Figure 33.20. Fluorescence of MVP transect 05

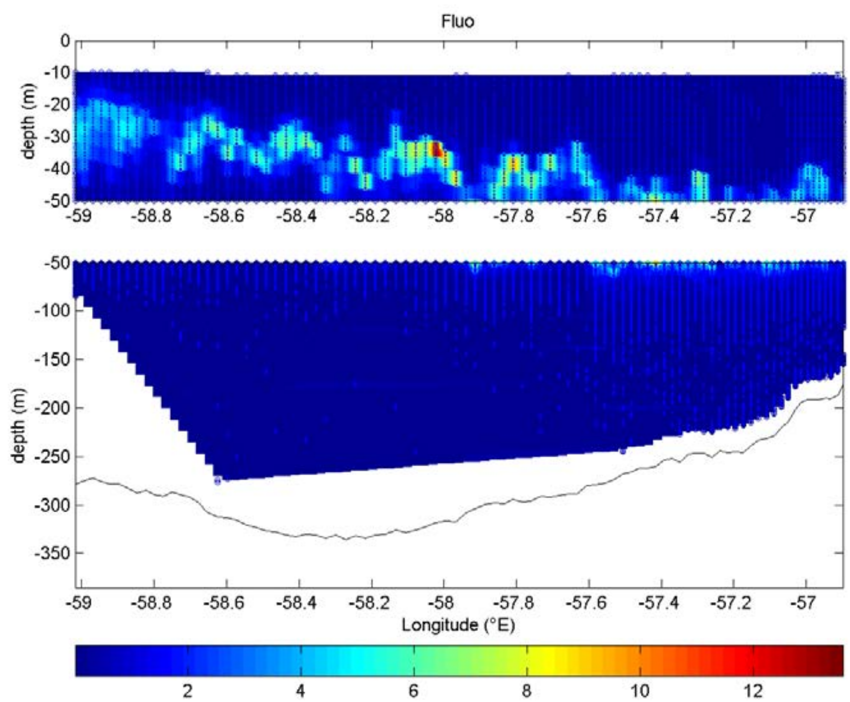

Figure 33.21. Fluorescence of MVP transect 06

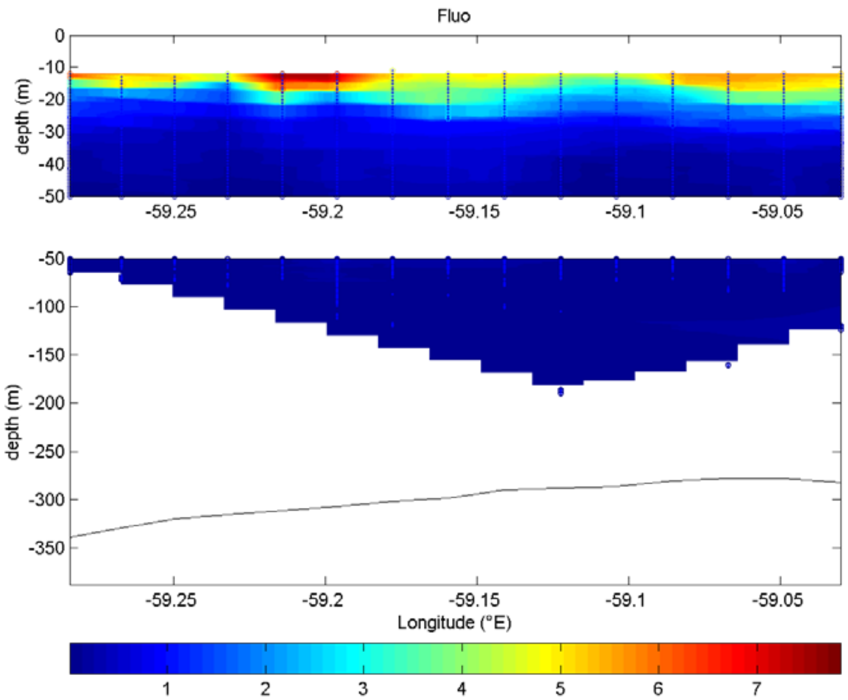

Figure 33.22. Fluorescence of MVP transect 07

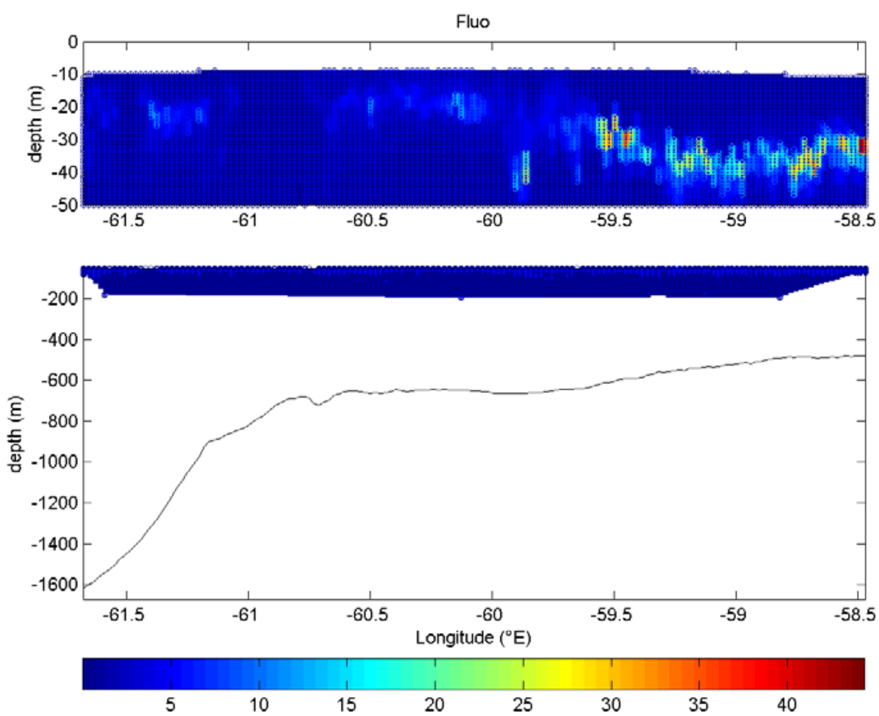

Figure 33.23. Fluorescence of MVP transect 08

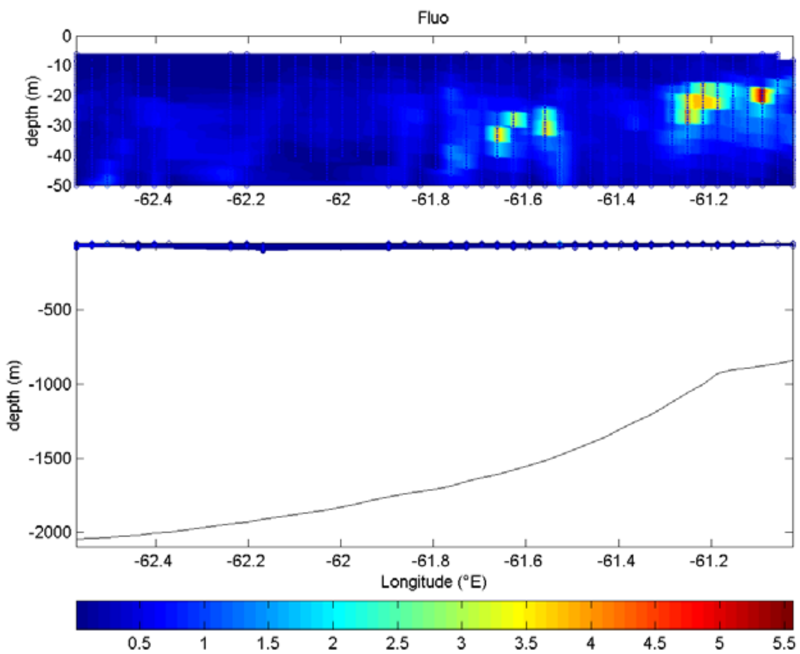

Figure 33.24. Fluorescence of MVP transect 09

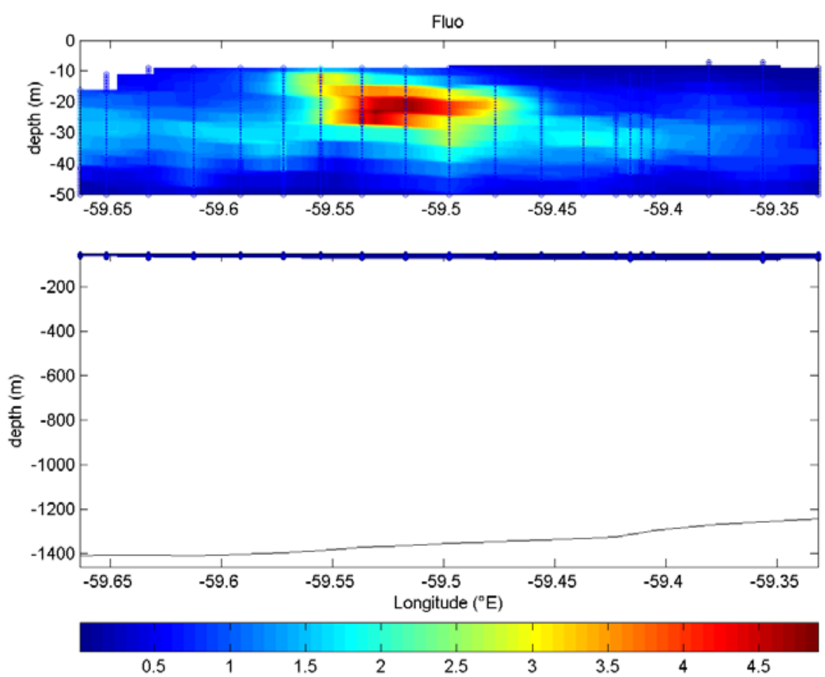

Figure 33.25. Fluorescence of MVP transect 10

During Leg 2 b, 4 MVP transect were performed. The first transect (Table 33.6) was performed as part of the ArcticNet program, whereas the three other transects were done with the objective to get data from North-to-South in Nares Strait, in order to compare the data with the Nares-X stations sampled in 2014.

Table 33.6 describes the MVP transects performed during Leg 2 and Figure 33.26 shows the preliminary fluorescence data for each transect.

Table 33.6. Description of the MVP transects performed during Leg2

MVP transect	Location	Speed (kts)	Nb. of casts
1602001	Carry Island - Greenland	6-7	40
1602002	Kane Basin	10	60
1602003	Northern Baffin Bay	10	23
1602004	Northern Baffin Bay – Coburg Island	10	84

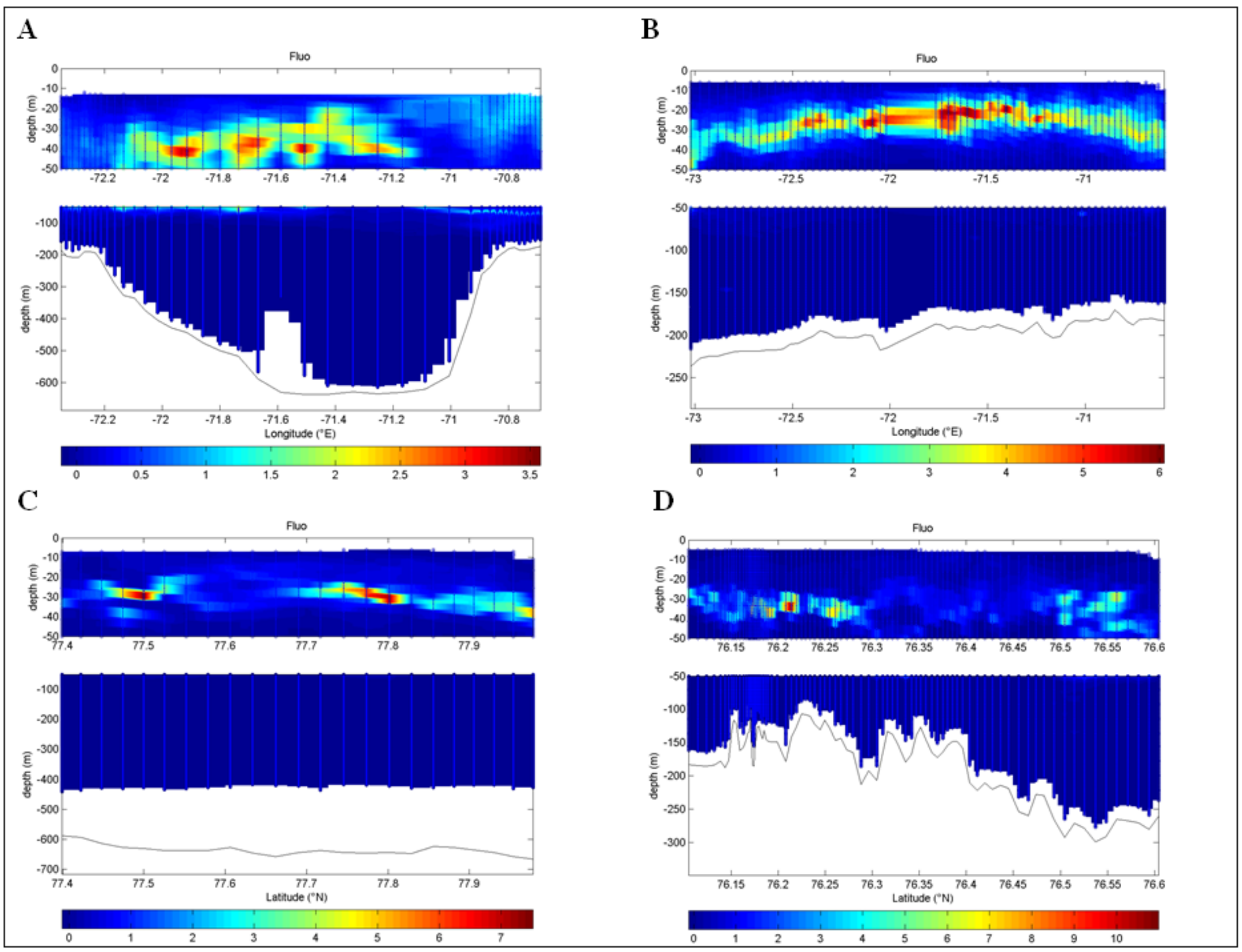

Figure 33.26. Fluorescence for the 4 MVP transects performed during Leg 2b; A) 1601001; B) 1601002; C) 1601003; D) 1601004

During Leg 3, 4 MVP transect were performed in the Amundsen Gulf, mainly to get information for positioning opportunistic stations. Table 33.76 and Figure 32.27 describes the MVP transects performed during leg 3 and Figure 32.28 to Figure 32.31 shows the preliminary fluorescence data for each transect.

Table 33.7. Description of the MVP transect performed during leg 3.

MVP transect	Location	Speed (kts)	Nb. of casts
1603002	Amundsen Gulf	10	15
1603003	Amundsen Gulf	10	58
1603004	Amundsen Gulf	10	47
1603005	Amundsen Gulf	10	28

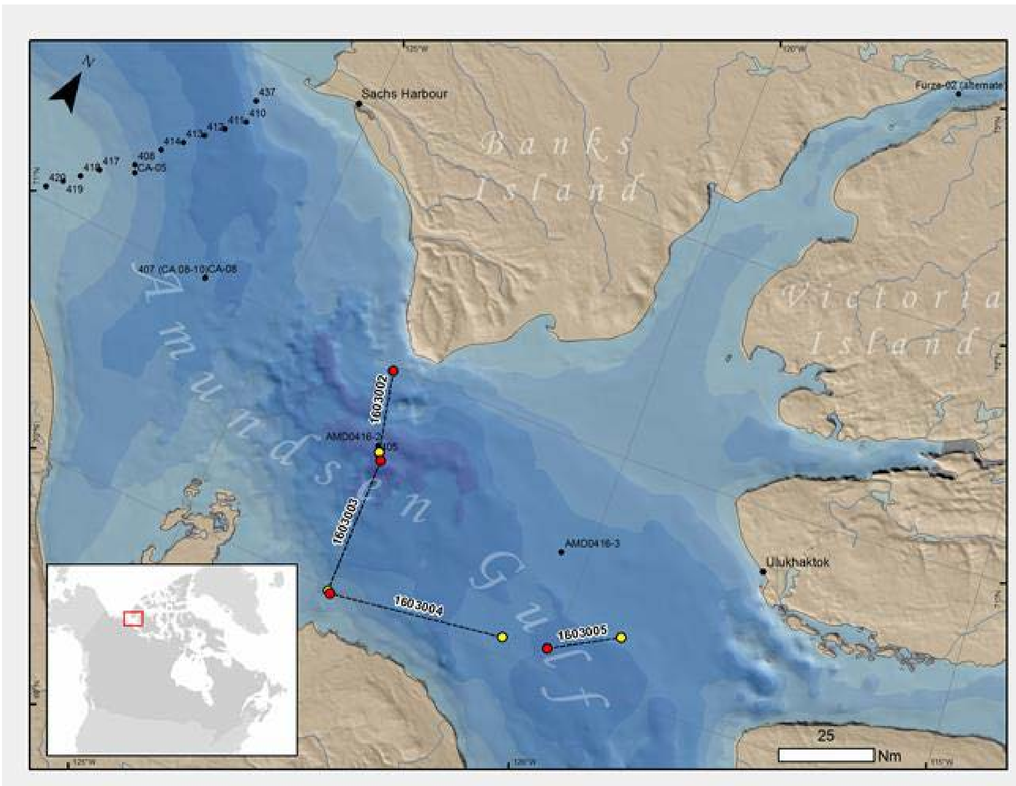

Figure 33.27. Location of the 4 MVP Transects performed during Leg 3a.

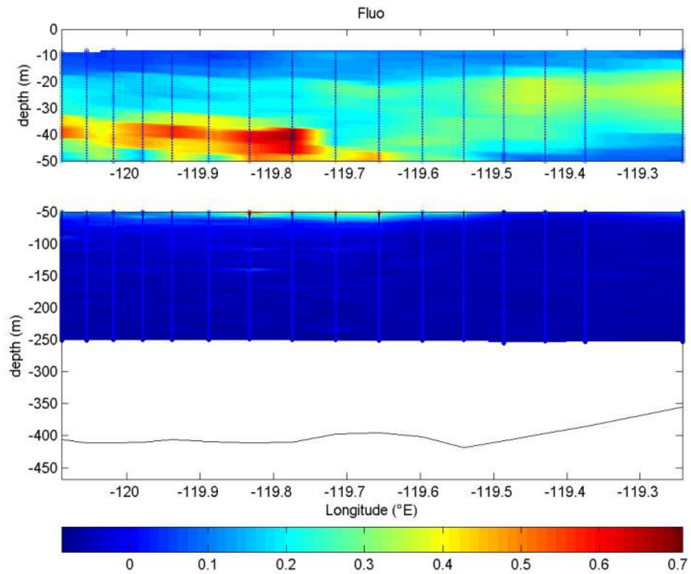

Figure 33.28. Fluorescence of MVP transect 1603002.

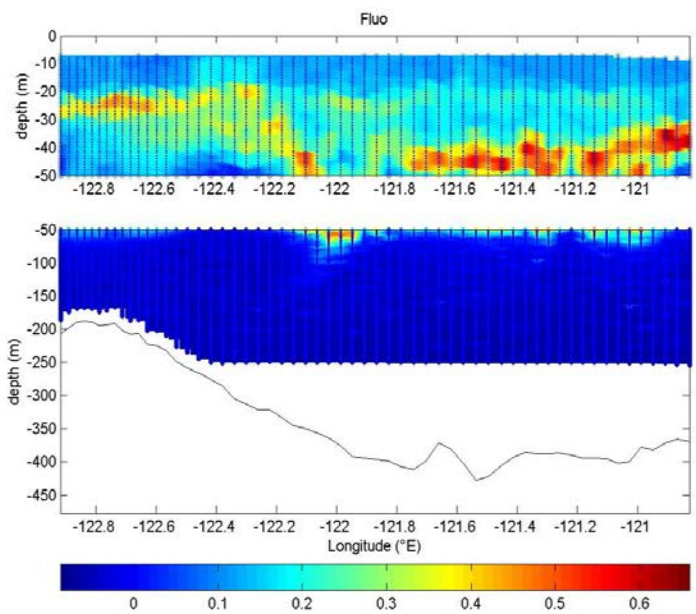

Figure 33.29. Fluorescence of MVP transect 1603003.

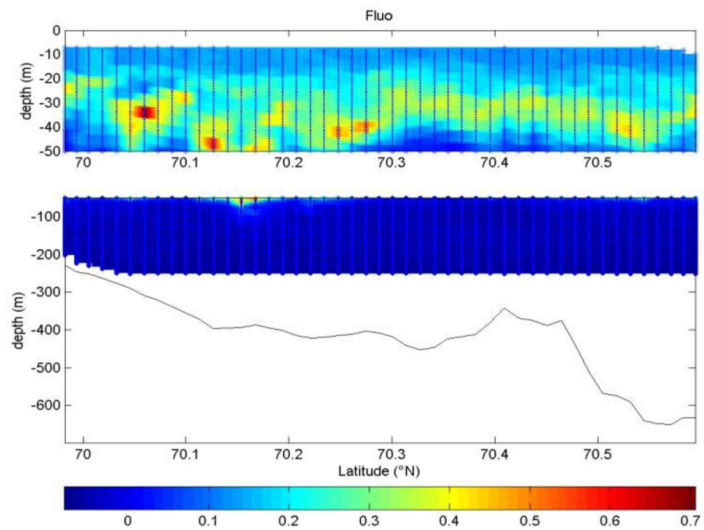

Figure 33.30. Fluorescence of MVP transect 1603004.

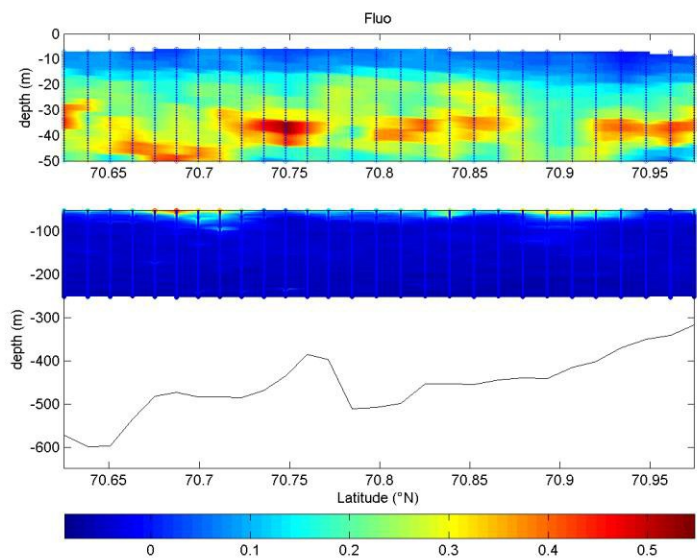

Figure 33.31. Fluorescence of MVP transect 1603005.

33.3.4 *Mooring Deployment and Recovery*

The role of the mapping team during mooring deployment and recovery was to 1) ensure the mooring was still in its position (identify the buoys and the exact position), 2) validate the depths of the deployment sites, 3) map the surface morphology of the sites and 4) determine the verticality of the moorings after deployment (Figure 33.32).

A multibeam survey over the mooring after deployment was systematically performed. The lines were processed in CARIS HIPS&SIPS right after to find the exact position of the mooring. The procedure started with the visualization of the water column data to find the buoys. The buoys scattering was added to bathymetry to find the final position of the deployment.

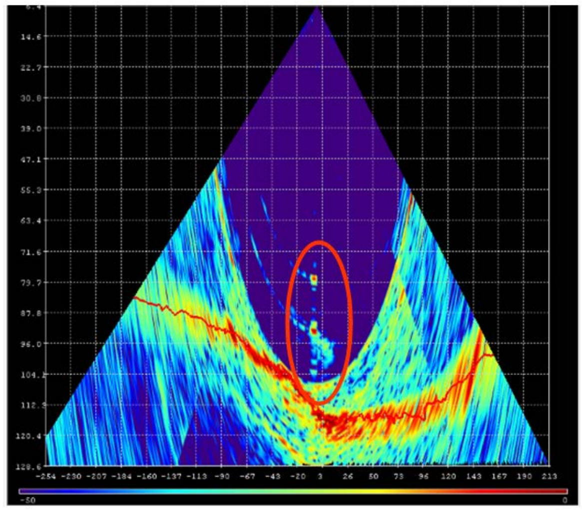

Figure 33.32. SIS water Column display of Mooring site WF1-16 after deployment. The red circle shows the buoys.

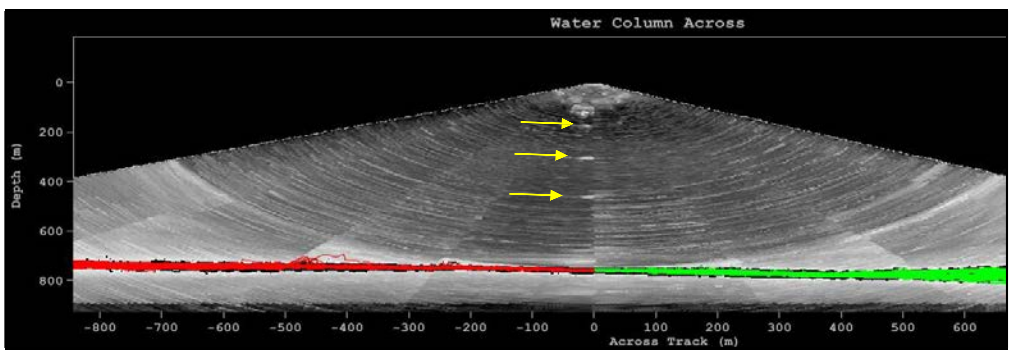

Figure 33.33. Caris Water column display used to assess the position and depth of BR-1-16 mooring. Yellow arrows show the buoys in the water column.

33.3.5 *Sediment Cores*

During Leg 2b, 5 gravity cores were taken at 4 coring sites. Table 33.8 presents the location and length of recovery, as well as the targeted type of sediment/feature.

Table 33.8. Description of the gravity cores taken during Leg 2b.

Location	Coordinates	Core length (Recovery/ Potential)	Target sediment or feature
Sam Ford Fjord	70° 34.74 N 071° 32.95 W	0 / 9m*	Holocene sediments – post-deglaciation sedimentary processes near a grounding zone wedge.
Sam Ford Fjord	70° 34.75 N 071 °32.95 W	0.35 / 1.95m	Holocene sediments – post-deglaciation sedimentary processes near a grounding zone wedge.

Location	Coordinates	Core length (Recovery/ Potential)	Target sediment or feature
Scott Trough	71° 13.74 N 070° 43.49 W	1.95 / 1.95m	Holocene sediments – post-deglaciation sedimentary processes off the Fjord (trough).
Erik Harbour	72° 34.81 N 076° 03.00 W	0.85 / 1.95m	Holocene sediments – post-deglaciation sedimentary processes at the mouth of the inlet.
Viscount Melville Sound	74° 34.95 N 098° 52.10 W	1.95 / 1.95m	Post-glacial sediment for paleo-oceanography (Furze et al.)
*First attempt of gravity coring was done with the piston core without the trigger weight arm and the piston in the corer.			

33.4 Comments and Recommendations

Given the performance of the MVP, this instrument could be deployed more often to acquire underway data for oceanographic studies, but as well as to get proper sound velocity correction for the multibeam sonar.

Box core deployment at stations should be discussed more with the mapping team to avoid potential damages to the box core or other benthic trawls.

It would be useful to have a T.V with the ship's cameras in the acquisition room. This T.V. could be used during transit through ice, during MVP operation, etc. Discussions with Maxime Carrier, the CCGS electronic technician, and there might be a possibility to install such a system in the acquisition room.

34 Integrated Marine Geoscience for Environmental Impact Assessment and Sustainable Development in Frobisher Bay, Nunavut – Leg 2a

Project leaders: Evan Edinger[1] (eedinger@mun.ca) and Linda Ham[2]
Cruise Participants - Leg 2a: Alec Aitken[3], Evan Edinger[1], Robert Deering[1], Erin Herder[1], Greg Middleton[4] and Angus Robertson[4]
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34.1 Introduction

Coastal regions of the Canadian Arctic face increasing pressures from climate change, resource exploitation, and infrastructure development. These pressures come together in a crucial region of the Eastern Arctic (IRIS region 2) in Frobisher Bay. Adjacent to the rapidly growing City of Iqaluit, the bay faces potential impacts from expanding commercial and subsistence fisheries, expanded terrestrial mining, increasing marine traffic, and infrastructure development for both the city and the proposed new port at Iqaluit.

As a large macrotidal embayment, Frobisher Bay presents interesting new opportunities and challenges, including the possibility of in-stream hydro-electric power generation, and localized rapid sediment transport and coastal erosion associated with sea-level rise and macrotidal settings. Infrastructure requirements for the City of Iqaluit, for the government of Nunavut, and for expanding facilities of the Port of Iqaluit place additional possible stressors on Frobisher Bay, from eutrophication, sedimentation, potential oil spills, and potential introduction of marine invasive species through ballast water. These interact with the seabed habitats of the bay both geologically and ecologically. Natural seabed geo-hazards in the bay may affect infrastructure development, which in turn have the potential to trigger submarine slope failure and sediment mass transport events (Hatcher & Forbes 2015).

Frobisher Bay is divided into inner and outer portions by the mid-bay islands. The inner bay is shallower, and more extremely macrotidal, and much more prone to geological hazards, with an extensive record of submarine slope failure. Furthermore, the inner bay has been the subject of ecological studies in the 1960's and 1970's and re-sampling these areas, and determining the spatial distribution of the habitats they represent will help determine the nature of long-term temporal change in these Arctic benthic communities.

34.1.1 *Marine Geohazards*

Inner Frobisher Bay is an area in which marine geohazards and future infrastructure projects intersect. From extensive multibeam echosounding surveys carried out in the area aboard CCGS *Amundsen* and MV Nuliajuk over the past three years a particular type of marine geohazard, submarine slope failures, have been found in abundance. With more than 250 of these submarine slope failure features being found in the inner bay they present a challenge to future seabed development in the region. The aim of the geohazards component of this project is to better understand why these events occur, where they occur, and how they are triggered, in support of future infrastructure development in the area. Piston cores are crucial for determining the age of these submarine slope failure events.

Building off of cores collected from a slope failure complex off of Hill Island over the past two years, six piston cores were planned for collection aboard CCGS *Amundsen* with the priority being to characterize and age four other submarine slope failures, and to collect an undisturbed stratigraphic record for the area. A number of these coring targets were other slope failures to be dated to better understand the slope failure chronology of the study area. These slope failures were chosen because of their difference in morphology from the Hill Island Complex that had been sampled over the past two years. Each of the piston coring sites in Frobisher Bay were accompanied by a box core in order to ensure that the near surface seabed sediments that may be blown aside by the piston core were also collected for analysis.

These box cores will also be analysed for benthic organisms (Refer to the section on box coring in inner Frobisher Bay). Initial analysis of video from our ROV dive at the Hill Island site in 2015 suggested that large benthic invertebrates on the path of the landslide were more abundant than off the landslide. Box core data may help to test this hypothesis.

34.1.2 *Marine Habitats, Marine Biodiversity and Temporal Change*

Box core and Agassiz trawl sampling in Frobisher Bay in 2016 support our efforts to map marine habitats throughout the bay, and to assess long-term temporal change in the bay. Fisheries Research Board of Canada scientists sampled benthic biota in the inner bay in the 1960's and 1970's (Wacasey et al. 1979, 1980, Cusson et al. 2007). Re-sampling of these historical sites, in the context of a wider habitat mapping program, will allow us to assess both spatial variation and temporal change in benthic species composition. We rely on the extensive multibeam sonar datasets in both the inner and outer bay, coupled with direct bottom sampling using box-cores and Agassiz trawls from CCGS *Amundsen*, and grab samples and drop-video samples from MV Nuliajuk, to ground-truth the multibeam. Initial sampling from Nuliajuk in 2015 identified submerged moraines and other features in the inner bay that appear to host distinct habitat types from the muddier bottoms found in basins. Sampling from Amundsen in 2016 aimed to re-sample the historical sites, sample the moraine near Lewis Bay, and to sample deeper water ridges and troughs in the outer bay that are beyond the depth range reachable from the Nuliajuk. These are coupled with CTD and rosette casts and zooplankton tows to characterize the water column and planktonic biodiversity (in conjunction with the nutrient and plankton teams). In addition to biological variables in the water column, we are also interested in calcium carbonate saturation state within the bay (cf. Azetsu-Scott et al. 2010), which is expected to change along the axis of the bay in response to the degree of freshwater influence and tidal mixing.

34.1.3 *Scientific Objectives of the Project relating to 2016 Field Work*

The general scientific objectives of the Frobisher Bay project are:

1) To create a benthic habitat map for all of Frobisher Bay using multibeam sonar and sub-bottom profiling, ground-truthed with direct benthic sampling and imaging by drop camera or ROV.
2) To assess long-term ecological change in inner Frobisher Bay benthic communities by re-sampling stations initially sampled by the Fisheries Research Board of Canada in the late 1960's and early1970's (Wacasey et al. 1979, 1980, Cusson et al. 2007).
3) To assess marine geohazards in inner Frobisher Bay, especially the nature, age, and recurrence interval of submarine landslides within the inner bay.
4) To apply the maps of hazards and sensitive habitats toward infrastructure development in the Frobisher Bay region.

The sampling objectives for the 2016 voyage aboard Amundsen were:

1) To map a deep hole in the NW portion of the outer bay that is too deep to be mapped using the less powerful sonar aboard MV Nuliajuk;
2) To re-sample two of the historical sites near Cairn Island, in the inner bay;
3) To sample the Lewis Bay moraine;
4) To sample troughs and ridges in the outer bay;
5) To collect box cores from landslide and witness core sites within inner Frobisher Bay.

34.2 Methodology

Methods employed during the Frobisher Bay portion of Leg 2a included seabed mapping with multibeam sonar and 3.5 kHz acoustic sub-bottom profiling, piston coring of targets chosen using past multibeam and sub-bottom profiles, box coring, and Agassiz trawling. Unlike the 2015 field season, no ROV or video transects were planned for Frobisher Bay in 2016. Figure 32.1, Figure 32.2 and Figure 32.3 show the locations of all box cores, Agassiz trawls, Piston cores, and multibeam data collected in inner and outer Frobisher Bay.

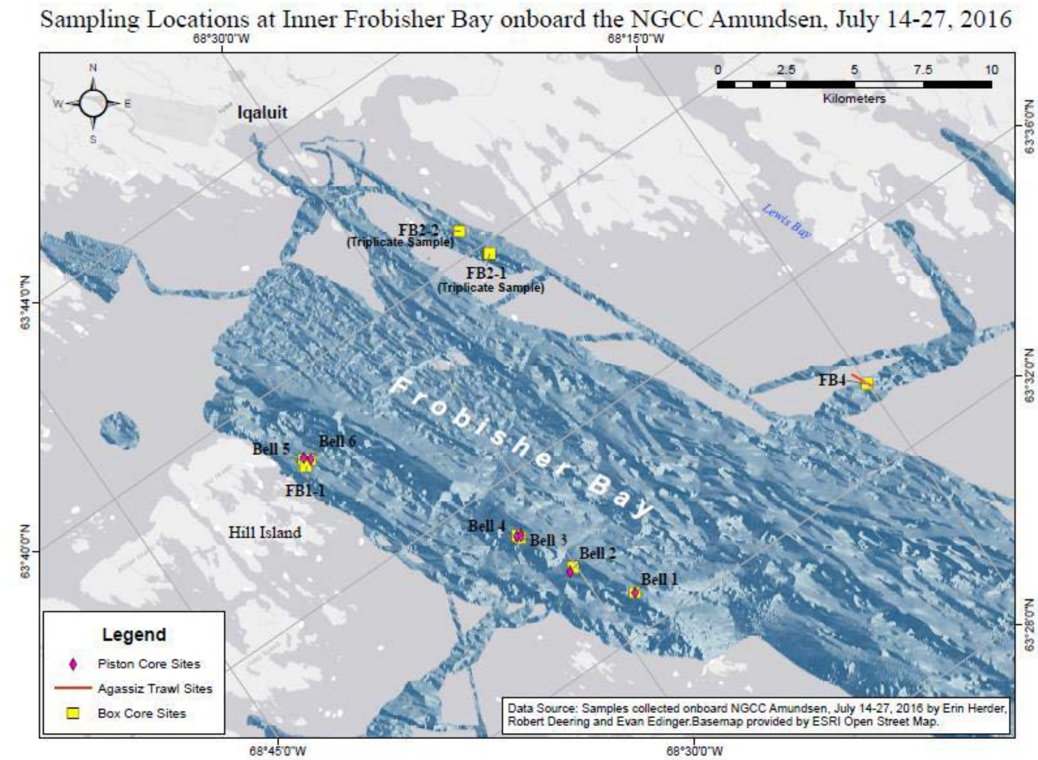

Figure 34.1 Sampling locations at inner Frobisher Bay onboard the NGCC Amundsen, July 14-27, 2016

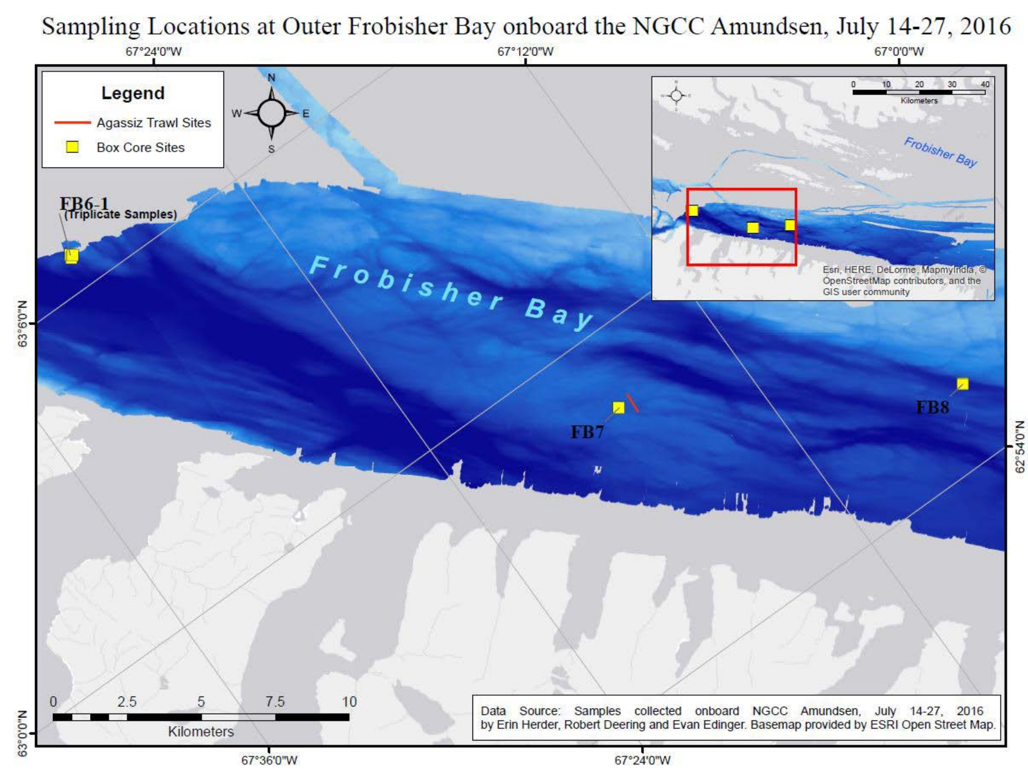

Figure 34.2 Sampling locations at Outer Frobisher Bay onboard the NGCC Amundsen, July 14-27, 2016

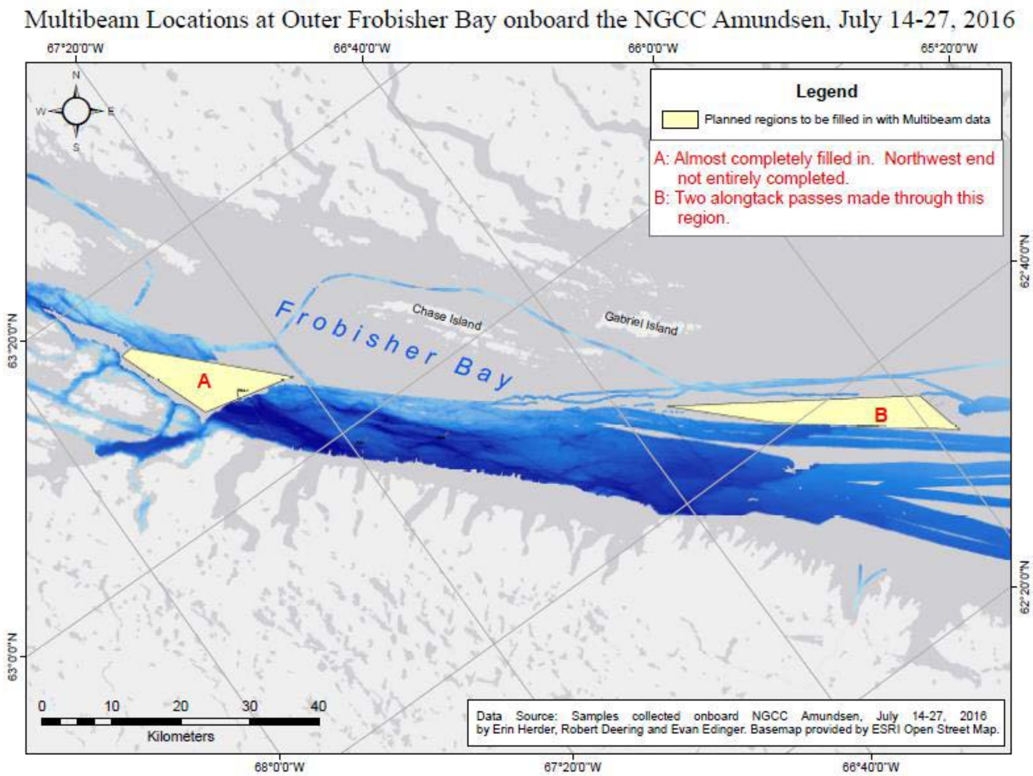

Figure 34.3 Multibeam locations at outer Frobisher Bay onboard the NGCC Amundsen, July 14-27, 2016

34.2.1 *Box Core*

Nineteen box cores were collected and processed in Frobisher Bay including 14 box cores in inner Frobisher Bay made up of 7 box cores associated with piston core sites, triplicate box cores at 2 historical Wacasey et al. (1979, 1980) sites, and a single box core on a moraine. In outer Frobisher Bay a total of 5 additional box cores at 3 sites were collected.

34.2.2 *Agassiz Trawls*

The Agassiz trawl aboard Amundsen was only deployed twice, once in the inner Bay at station FB4, and once in the outer bay at station FB7. Long processing times, a backlog of material to be processed, and a need to move offshore to begin the next portion of Leg 2a sampling, caused us to omit one box-core location, and two Agassiz trawl locations in the outer bay, and one basic station within the inner bay.

34.2.3 *Piston Cores*

Piston cores for this leg were collected by the AGC Large piston corer, off of the foredeck. This system is equipped with a 9 cm diameter plastic liner that is extracted from the piston corer and cut into 5 foot sections for storage and transportation. Prior to refrigeration, these sections are capped and sealed with wax to ensure that moisture is maintained within the sections Samples from box cores were collected by pushing the same plastic core liner as is used in piston coring into the sediments to extract an intact stratigraphic sequence. These push cores were then treated with the same methods as piston cores following extraction.

34.3 Preliminary Results

34.3.1 *Multibeam Sonar Acquisition*

Amundsen acquired multibeam sonar data during a dedicated survey in the NW portion of outer Frobisher Bay, in waters that were too deep to be reached (Bounding Coordinates: 63.125'N -67.615'W, 63.097'N -67.352'W, 63.247'N -67.683'W, 63.246'N -67.717'W). There was also an along-track survey in outer Frobisher Bay, to fill an elongated gap in the 300-500 m depth range. The gap in multibeam coverage along the SW margin of the outer bay remains unfilled.

34.3.2 *Box Coring and Agassiz Trawls*

Sediment samples were frozen at -20˚C for later processing. Fauna were picked from sieved sediment, fixed in 4% formalin, then transferred to 70% ethanol after 2 days (~48 hours). Carbonate bioclasts were frozen for later analysis, and bryozoans were packaged dry for transport back to Memorial. Box cores stations from the old FRBC sampling in the 1970s were sampled in triplicate. Box cores at outer bay stations, and at the Lewis Bay moraine, were sampled singly (Table 32.1).

Two Agassiz trawls were completed and processed in Frobisher Bay. For the first Agassiz trawl, a subsample (1/4 of the sample) was retained in 4% formalin for identification in the lab and the remaining sample was processed. Each individual collected was identified and weighted. Species that could not be identified were retained for identification in the lab. For the second Agassiz trawl, ¼ of the sample was retained in 4% formalin for identification in the lab and another ¼ of the sample was processed including weighing and identification of each individual (Table 32.2). Piston Coring

Six piston cores were collected using this method during leg 2A. Three piston cores (GSC 2016804-0007 (63° 34.974' N 68° 31.372' W), GSC 2016804-0009 (63° 38.589' N 67° 37.115' W), and GSC 2016804-0010 (63° 38.486' N 68° 36.910' W)) were collected to date submarine slope failures. Two piston cores (GSC 2016804-0001 (63° 32.754' N 68° 28.524' W) and GSC 2016804-0009 (63° 38.589' N 67° 37.115' W)) were collected as witness cores of undisturbed sediments. One piston core (GSC 2016804-0002 (63° 33.813' N 68° 30.347' W)) was collected to study the deglacial history of inner Frobisher Bay. A list of related piston cores and box cores can be found in Table 32.3. An additional box core (GSC 2016804-0013 (63° 38.436 N 68° 37.253 W)) was taken to accompany a piston core taken at that location in 2014. On board, all cores were sealed with wax and packed away for shipment to the Bedford Institute of Oceanography for further anaylsis. They will complement the piston cores collected from the Hill Island Complex over the past two years

Table 34.1 Box Core samples collected in Frobisher Bay, July 14-27, 2016

Site Name	Target (MUN)	Replicate #	Latitude	Longitude	Depth (m)	Grain Size Collected	Box Cores Planned	Box Cores Complete	Notes
FB6-1	outer bay, near new multibeam	1	63 06.67	67 31.10	459	N	3	3	Site on a steep slope and box core didn't collect full sample
		2	63 06.61	67 31.13	512	N			Site on a steep slope and box core didn't collect full sample
		3	63 06.64	67 31.02	452	N			Site on a steep slope and box core didn't collect full sample
Bell 1	piston core	1	63 32.76	68 28.51	208	N	1	1	Full box core
Bell 2	piston core	1	63 33.85	68 30.11	204	Y	1	1	Full box core
Bell 3	piston core	1	63 34.92	68 31.26	187	Y	1	1	Full box core
Bell 4	piston core	1	63 34.98	68 31.33	186	Y	1	1	Full box core
FB4-1	Lewis Bay moraine	1	63 33.525	68 14.967	118	Y	3	1	Cancelled remaining replicates due to bent box core at this site
Bell 5	piston core	1	63 38.563	68 37.158	104	Y	1	1	Full box core
Bell 6	piston core	1	63 38.490	68 36.920	117	Y	1	1	Full box core
FB1-1	2014 piston core	1	63 38.436	68 37.253	135	Y	1	1	Full box core
FB2-2	Wacasey	1	63 40.514	68 25.821	63	Y	3	3	Full box core
		2	63 40.517	68 25.828	62	Y			Full box core
		3	63 40.513	68 25.829	62	Y			Full box core
FB2-1	Wacasey	1	63 39.815	68 25.343	80	Y	3	3	Full box core
		2	63 39.81	68 25.32	80	Y			Full box core
		3	63 25.30	68 25.30	81	Y			Full box core
FB7	outer bay	1	62 58.672	67 16.931	572	Y	3	1	Full box core, cut reps due to scheduling
FB8	outer bay	1	62 55.390	67 05.389	610	Y	3	1	Full box core, cut reps due to scheduling

Table 34.2 Agassiz trawl samples collected in Frobisher Bay, July 14-27, 2016

Site Name	Target (MUN)	Rep. #	Latitude	Longitude	Depth (m)	Grain Size Collected	Box Cores Planned	Box Cores Completed	Notes
FB4-1	Lewis Bay moraine	1	63 33.855	68 15.306	75	N/A	1	1	Large tote full of sample
FB7-1	outer bay, ridge	1	62 58.792	62 58.398	436	N/A	1	1	1/2 tote full of sample

Table 34.3 Piston and box cores collected in Frobisher Bay during leg 2A, July 14-27, 2016

Piston Core GSC #	Push Core GSC #	Length of Piston Core Recovery (cm)	Length of Push Core Recovery (cm)
2016804-0001	2016804-0003	525.5	23
2016804-0002	2016804-0004	546	22
2016804-0007	2016804-0005	499	25
2016804-0008	2016804-0006	544	23
2016804-0009	2016804-0011	545	29
2016804-0010	2016804-0012	535	28

Conclusion

Sampling in Frobisher Bay during the 2016 Amundsen mission was limited to two days. During these two days, we completed: multibeam sonar mapping of a deep polygon in the outer bay that is below the reach of the Nunavut Government research vessel MV Nuliajuk, collection of 19 box cores, two Agassiz trawls, 6 CTD with associated water sampling, one set of plankton samples, and 6 piston cores.

34.4 Comments and Recommendations

Amundsen sampling in Frobisher Bay for 2017 will likely need to focus on the outer bay, and on deep portions of the outer bay that are inaccessible to sampling by the Nunavut government fisheries research vessel *MV Nuliajuk*. We will likely need to request a greater number of days in 2017 than we requested for 2016.

Reference

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35 Glacial Stratigraphy, Geomorphology, Geohazards and Paleoecology – Legs 2a, 3a and 3b

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Cruise Participant - Leg 2a: Angus Robertson[1]
Cruise Participants - Leg 3a: Edward (Ned) King[1], Alexandre Normandeau[1], Anna Pienkowski[2] and Thomas Lakeman[3]
Cruise Participant - Leg 3b: Anna Pienkowski[2]
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35.1 Introduction

Several years of experience and interpretation with the oceanographic moorings from the mooring team (e.g. Forest et. al. 2015) provide oceanographic context for interpretation of the seabed geological phenomena occurring at the Beaufort Shelf break and upper slope. Geological phenomena such as a narrow and relatively recent (post-glacial) erosion and non-deposition belt along the shelf break combined with elevated, albeit spatially variable, depocentres on the uppermost slope demonstrated the need for understanding the events which are responsible. Landers deployed in 2015 from the *Amundsen* needed recovery and two assemblies were prepared for a 2016-17 year-round seabed placement.

The first significant sonar survey in M'Clure Strait in 2015 was the basis for initial geologic mapping of the area (Figure 35.1).

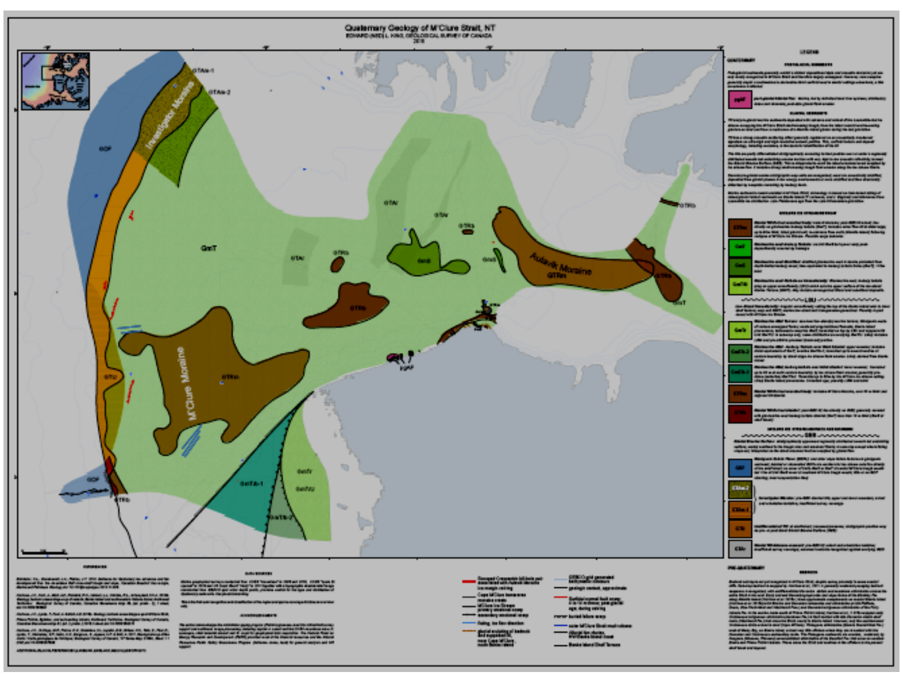

Figure 35.1 Preliminary surficial geology map of M'Clure Strait. (King, 2015, ArcticNet meeting)

Supplementary data from non-ArcticNet sources improved the mapping but significant knowledge and geographic gaps existed and no samples were extant so the plan to enter the Strait in 2016 was opportunistic.

A geohazard assessment towards safe engineering infrastructure and operations is an ongoing NRCan mandate in the Beaufort in order to advise industry and regulatory boards. The planned cruise promised to cover areas of massive submarine avalance/slide failures, canyons, newly discovered faults (King 2015) and to improve the database for a shallow geologic framework necessary to place these in a process and time context.

35.2 Methodology

35.2.1 *Sonar Surveys*

The U. Laval team was responsible for multibeam and sub-bottom profiler acquisition yet the NRCan, UQUAR, NGU, MacEwan U. teams were strongly dependant on access and interpretation of the data. This often involved specific requests for track alterations, specific multibeam area processing and display, and ready access to both new and extant data. NRCan also processed the sub-bottom data independently for onboard visualization and interpretation. The teams readily exchanged concepts and interpretations, which ultimately led to a productive and satisfying cruise.

35.2.2 *Piston Core Operations*

Deck operations functioned without incident during coring. Science staff were often numerous, partly because a large contingent were training. As usual, the various institutions with sampling interest collaborated and supplemented well.

35.2.3 *GPS on Foredeck*

Positioning and seabed referencing was attempted to help guide bridge/deck positioning and station holding for those stations with small targets. A GPS enabled field computer was placed on the foredeck running Global Mapper (GIS) with a continuous and logged GPS track for positional control. This allowed display of planned station positions, a target radius display (encircling the point), the track-logging GPS, and a manual marking and labelling of a waypoint immediately on seabed touchdown. Despite no A-frame positional correction from the ship's GPS antenna on the *Amundsen*, ship's positioning on the planned site was generally better than a 50m radius.

35.2.4 *Core Barrel Lifting*

In future coring operations it is recommended to sling the core barrels using the starboard crane from the storage area aft of the hatch to the piston assembly area (starboard foredeck aft of the A-frame) rather than manually lifting via the convoluted route, sometimes on a slippery deck. A simple spread-bar and hooks at the barrel ends would suffice.

For all sample sites a projection onto the nearby sub-bottom profiler and/or multibeam was generated. Most are not included in this summary.

35.2.5 *Lander Recovery and Deployment*

Hydrodynamic and sediment transport instrumentation were prescribed for a two lander year-long under ice deployment in the Beaufort Sea. A review of the tripods and their recovery and redeployment (including a new design Freefall lander) was conducted with all relevant participants, including the JSA. Attempts to communicate with the deep lander acoustic release were to no avail, as was several passes using the ArcticNet grappling equipment. The same routine at the shallow lander site received positive feedback from the seabed release but no clear response from the release command. Grappling was successful and the float package was retrieved, leading to the instrumented tripod with no evidence of damage.

The MAVS-4D was downloaded and it appeared to have run as programmed. The AquaDopp profiler was downloaded and it also appeared to have run as programmed but there was evidence of a slight water leak through the underwater connectors so this instrument could not be used again without repair. The SeaBird CTD was still running when interrogated but the downloading would be left to the DFO coastal group who would have the proper software.

On September 4th (local time) the landers were deployed. The deep lander site was occupied first, where a box core and CTD cast were conducted. With daylight diminishing, the ship traversed to the shallow (tripod) site where it was lowered to the seabed, tethered to an anchor hanging from the port crane with 300 m 1/2" polypropylene. A spooling device for paying line under controlled drift of the ship allowed approximately 220 m horizontal distance from the tripod lander. The line passed under the bow before final anchor release (Quick-Release) and the line remained free. Under triangulation around the anchor release to confirm its position, no get clear communication signals were established, possibly due to some extra floats we added to the Benthos tandem spheres causing acoustic blanking. Upon returning to the deep lander (freefall) site, the Iridium beacon was initiated and the frame lowered to the water surface, confirmed ships position and released with the Quick-Release to head to the seabed. Triangulation here established good range but did not lead to a better positioning than the ship's GPS antenna. Further details of operations and programming strategies are documented in an internal NRCan report (Robertson).

35.3 Preliminary Results

Figure 35.2 shows the survey tracks and geology-related stations. Table 35.1 provides a listing and some basic performance results.

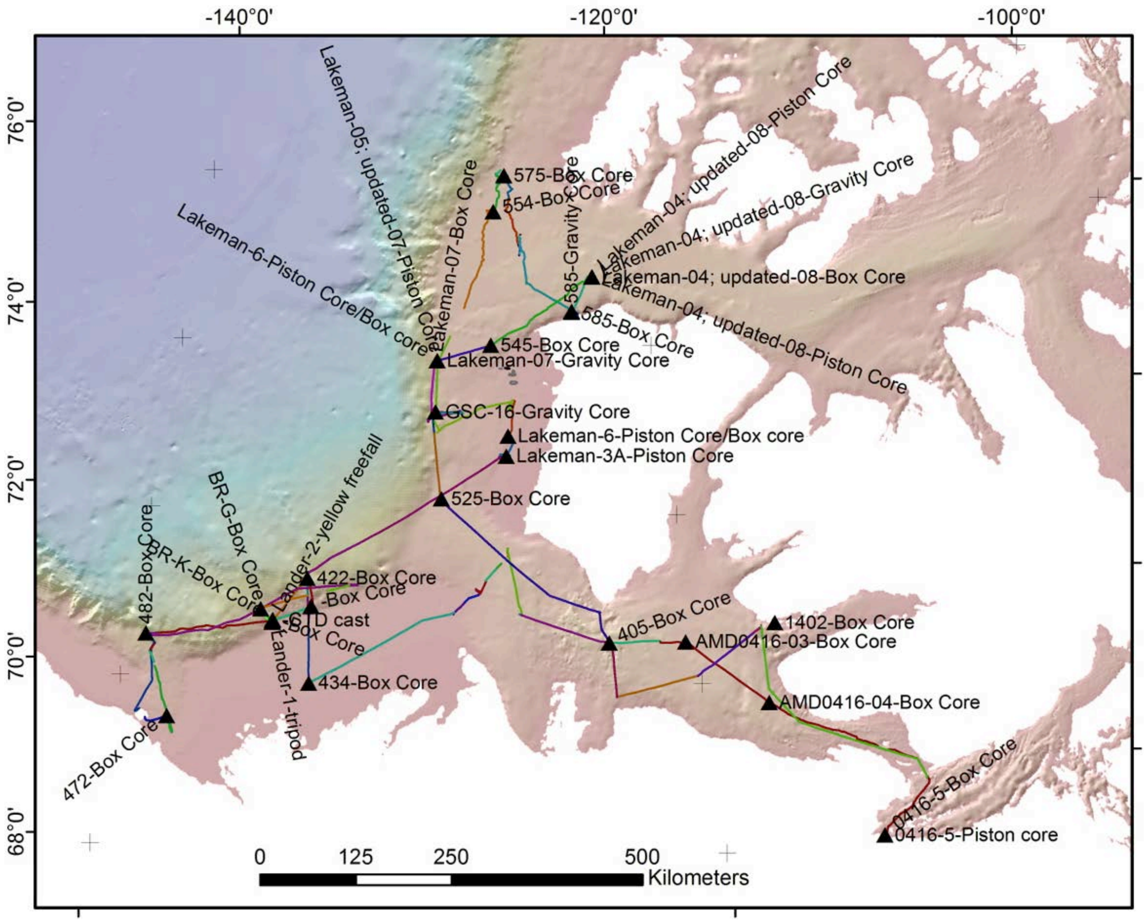

Figure 35.2. Overview of sonar survey tracks and geology-related sample stations.

Table 35.1 Core Station Summary

Vessel: CCGS Amundsen Chief Scientist: Louis Fortier NRCan PI: Ned King Date: August 24 to September 17, 2016												
				Position from portable GPS at A-Frame		Position from Ship's Science Log						
ArcticNet Station No.	GSCA Station No.	Sample Type	Day / Time (UTC)	Lat	Long	Lat	Long	Location	Water Depth (m)	App. Pen. (cm)	Core Length (cm)	Target/ Rationale
AMD0416-04	0001A	Box Core/ Push Core	239/1500	-	-	69,6532	-117,8598	Beaufort Sea - Central Amundsen Gulf	409	50	45,5	Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
AMD0416-03	0002A	Box Core/ Push Core	239/2130	-	-	70,5127	-120,3520	Beaufort Sea - Central Amundsen Gulf	331	50	46,0	Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)

405	0003A	Box Core/ Push Core	240/1024	-	-	70,6085	-123,0302	Beaufort Sea - Central Amundsen Gulf	627	45	42,0	Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
434	0004A	Box Core/ Push Core	243/1745	-	-	70,1783	-133,5424	Beaufort Sea - Beaufort Shelf	46	50	50,0	Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
422	0005A	Box Core/ Push Core	244/1045	-	-	71,3998	-133,8855	Beaufort Sea - Beaufort Slope	1134	50	45,0	Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
482	0006A	Box Core/ Push Core	245/1409	-	-	70,5257	-139,3850	Beaufort Sea - Beaufort Slope	826	50	49,0	Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
472	0007A	Box Core/ Push Core	247/0941	-	-	69,6119	-138,2299	Beaufort Sea - Beaufort Shelf	247	48	45,0	Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
BR-G	0008A	Box Core/ Push Core	248/2016	-	-	70,9920	-135,4613	Beaufort Sea - Beaufort Slope				Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
BR-K	0009A	Box Core/ Push Core	249/0227	-	-	70,8770	-134,9940	Beaufort Sea - Beaufort Slope	196			Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
Lander-2	0009A	Box Core/ Push Core	249/0229	70,876382	#########	-	-	Beaufort Sea - Beaufort Slope	196			Holocene chronology and provenance (J-C M-S, Uquar); general seabed and latest glacial sediment characterization (GSC)
Lander-1 tripod (shallow)	0010	Lander-tripod	250/0334	70,851833	#########	-	-	Beaufort Sea - Beaufort Shelf	124			one year duration current characterization and sediment affects at shelf break
	0010	Lander-tripod	250/0343	70,851955	#########			Beaufort Sea - Beaufort Shelf	124			
	0010		250/0402			70,8518	-134,9943	Beaufort Sea - Beaufort Shelf	124			

Lander-2 yellow cone frame	0011	Lander-freefall		70,851833	#########			Beaufort Sea - Beaufort Slope	198			one year duration current characterization and sediment affects across erosion belt immediately over the shelf break
	0011	CTD cast	250/0204	-	-	70,8736	-135,0032	Beaufort Sea - Beaufort Slope	180			
	0011	Lander-freefall	250/0441	70,873927	-135,0049	70,8742	-135,0035	Beaufort Sea - Beaufort Slope				
Lander-2	0012	Box Core/ Push Core	250/0907	71,075317	#########	-	-	Beaufort Sea - Beaufort Slope			43?	sediment character for lander "control"
Lakeman-3A	0013	Piston Core	250/1407	72,875428	#########	72,875	-126,362	Beaufort Sea/Banks Island Shelf	44	190	134,0	Stratified sediment package in prograding setting near terrace foresets: to establish lithology and age of one facies in the Banks Island sea-level low-stand Terrace
Lakeman-6	0014	Piston Core/ Box core		-	-	74,008	-129,127	Beaufort Sea/Banks Island Shelf	102	150	97,0	
Lakeman-6	0015	Piston Core/ Box core	250/2028	73,108290	#########	-	-	Beaufort Sea/Banks Island Shelf				
GSC-16	0016	Gravity Core	253/0318	73,408128	#########	-	-	Beaufort Sea/Banks Island Slope	636	215	186,0	mud overlying slide MTD
Lakeman-07	0017	Gravity Core	253/0714	74,008242	#########	-	-	Beaufort Sea/Banks Island Slope	419	215	165,0	stratified sediments over till blanket at base of seabed-expressed fault
Lakeman-07	0018	Box Core/ Push Core	253/0747	74,007785	#########	-	-	Beaufort Sea/Banks Island Slope	420	48	45,0	stratified sediments over till blanket at base of seabed-expressed fault
554	0019	Picton Core	254/0155	75,741487	#########	75,742	-126,475	Beaufort Sea/Outer M'Clure Strait	374	30	0,0	enter of 100m wide iceberg scour nearly reaching the underlying Glacial Erosion surface
554	0020	Box Core/ Push Core	253/0416	-	-	75,742	-126,477	Beaufort Sea/Outer M'Clure Strait	373	35	30,0	iceberg turbate; not in iceberg scour base (as per stn 0019); general seabed characterization
575	0021	Box Core/ Push Core	254/1128	76,155582	#########	76,156	-125,874	Beaufort Sea/Outer	318	30	26,0	iceberg turbate; general seabed characterization

								M'Clure Strait				
585	0022	Gravity Core	256/0718	74,499950	#########	-	-	Beaufort Sea/M'Clure Strait	377	10	0,0	at base of marine alluvial fan on north Banks Island; Beyond this (to the north) is iceberg scoured.
585	0023	Box Core/ Push Core	256/1612	74,513167	#########	-	-		382	48	44,0	seabed characterization
Lakeman-04; updated to 08	0024	Gravity Core	256/2020	74,885479	#########	-	-	Beaufort Sea/M'Clure Strait	504	160	148,0	Holocene chronology and provenance
Lakeman-04; updated to 08	0025	Piston Core	257/0104	74,884912	#########	-	-	Beaufort Sea/M'Clure Strait	504	~400	265,0	deglacial and Holocene chronology and paleoecology in only known undisturbed sediments in M'Clure Strait
Lakeman-04; updated to 08	0026	Piston Core	257/0450	74,885148	#########	-	-	Beaufort Sea/M'Clure Strait	504	~400	258,0	duplicate of stn. 0025 for added material
Lakeman-04; updated to 08	0027	Box Core/ Push Core	257/0100	-	-	74,885	-122,178	Beaufort Sea/M'Clure Strait	504	48	40,0	Two box cores at this location (stns. 24, 25, 26, 27, 28) for additional material. Only one is recorded for GSC. suspect incorrect log time
545	0028	Box Core/ Push Core	257/1225	-	-	74,178	-126,823	Beaufort Sea/Banks Island Shelf	315	45	44,0	seabed characterization
Lakeman-05; updated to 07	0029	Piston Core	257/1652	74,007702	#########	74,008	-129,127	Beaufort Sea/Banks Island Shelf	420	650	631,0	top of 2.5m deglacial muds over till blanket in unscoured area. Re-occupation of stn. 0017GC to reach to till. Postioned to within 75m of base of footwall on 4m high fault scarp
525	0030	Box Core/ Push Core	258/0828	-	-	72,392	-128,952	Beaufort Sea/NW Amundsen Gulf	347	45	40,0	general seabed and latest glacial sediment characterization
1402	0031	Box Core/ Push Core	260/0456	-	-	70,558	-117,154	Beaufort Sea/inner Amundsen Gulf	334	45	44,0	general seabed and latest glacial sediment characterization
0416-5	-	Piston core	260/1808	-	-	67,864	-115,072	off Coppermine River	52			Holocene of Coppermine river deposits

0416-5	-	Box Core/ Push Core	260/1855	-	-	67,865	-115,073	off Coppermine River	52			Holocene of Coppermine river deposits

Amundsen Gulf

A piston core and several box cores were recovered. Survey tracks generally covered areas with existing data of this nature but the area SE of Victoria Island and the outermost (NW) Amundsen Gulf are areas where the new data extend to unknown surficial geology. Nevertheless, most comprises thin surficial sediments dominated by iceberg turbate.

Central Beaufort Slope

Operations alternating between moorings/landers and the oceanographic transect resulted in a few traverses between the regions. Over several years this has produced nearly 80% seabed coverage. The Ipek Canyon and large submarine slide complex are revealed. Mass failures broadly spanning the post glacial and more recent past are recognized.

Mackenzie Trough

Two generally E-W traverses beyond the shelf break imaged glacial and post glacial strata. Though recognized from earlier surveys ,these help considerably in identifying relative age of numerous canyons, small canyon wall mass failures, and both buried and seabed-exposed (relatively recent) mass failures. One traverse from the outermost Mackenzie Trough to Herchel Island identified outer shelf canyons (within the Trough), partially filled with post-glacial stratified sediment, seabed erosion just below the trough flank (matching analogues on the eastern trough flank), and a possible sea-level low-stand buried erosional terrace. Immediately north of Herchel Island, constructional deposits occur at the seabed, overlying an otherwise flatling, planar seabed. At the same area infilled channels with thalwegs at greater than 60 m elevation (bsl) contain deposits which if sampled in the future, may help constrain the sea level history.

The basin south of Herchel was surveyed during the fueling operations and confirmed thick fluvial sediments in this relatively deep basin; the island comprises a hill-hole pair.

Central Banks Island Shelf

A widely-spaced survey grid was conducted across enigmatic mounds identified on 2011 survey data. These have a suspected glacial origin based on seismic character and stratigraphic position. Their geometry was better defined with the new data. The interpretation will bear on glacial reconstruction of the area.

Central Banks Island Slope

Three consecutive years of sonar coverage has been gained in the vicinity of the BR-3 mooring and Station 535, while maneuvering in the area, sometimes over wide areas, following routes of minimum sea-ice cover. This has given rise to increased seabed and shallow subottom geometries of several large slide complexes and glacial marginal deposits. At least two large slide scars are now recognized, one relatively old, with ~15 m of post-slide sediment cover incorporating at least two much smaller MTDs (mass transport deposits) and from very limited chronological understanding, likely glacial age or even older (Figure 35.3). Within this scar, a later MTD occurs, comprising at least 3 separate lobes, and with lesser sediment cover. A gravity core placed where this cover thins (ArcticNet Stn. GSC-16; NRCan stn. 20168050016) was taken to help assess age, probably reaching the MDT below. Sediment cover thickens to a few metres in the wide trough created by this bulging debrite and the older slide sidewall, so initial interpretation suggests this is not a very recent (Holocene) event. However, much smaller slide deposits originating from the large, older sidewall indicate minor retrogressive failure on its steep flank.

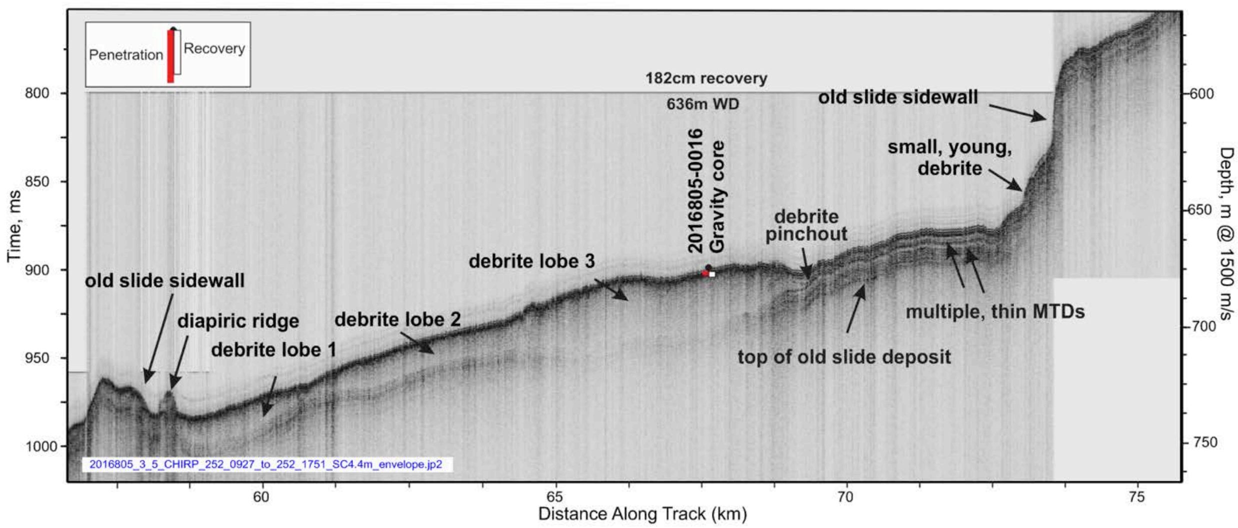

Figure 35.3. Debrite deposits (gravity mass wasting debris) situated within a large, older slide complex and partially covered with post-glacial stratified sediments.

A discrete and continuous ridge with no sediment cover parallels the western sidewall and is interpreted as extruded (diapiric) material forced from below the debrite lobes by the sudden loading and de-watering. Gravity core position is representative but not accurately positioned; actually collected along an adjacent profile.

Postglacial fault-scarp: Of significance to the NRCan geohazard assessment is newly recognized faults (King, 2015). Several isolated occurrence clearly comprise a system spanning the entire outermost M'Clure Strait shelf-break. A fault scarp can be followed in six different multibeam bathymetry datasets along the shelf break of the Beaufort Sea. In order to constrain the age of this fault-scarp, a piston, a gravity and a box core were collected at the foot of the scarp. This core will hopefully allow us to recognize sediment layers associated with the formation of the fault.

The available multibeam and sub-bottom profiles (Figure 35.4) suggest that the scarp is postglacial, which would make it a unique feature in the Arctic. The young age of the scarp is evidenced by iceberg scours that were formed prior to the uplift. Additionally, the fault-scarp is overlain by deglacial sediments that is faulted as well, suggesting that the scarp formed following the deposition of deglacial and postglacial sediments. A high-resolution analysis of the sediment cores should provide more insight on the precise age of this postglacial fault scarp.

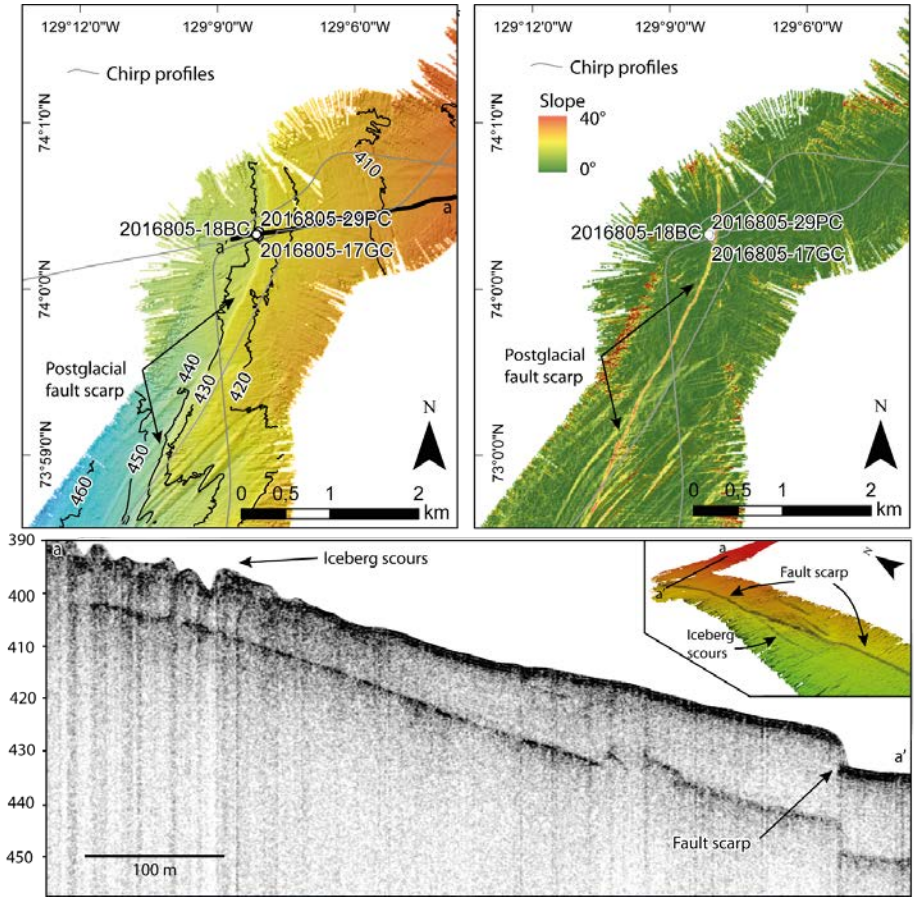

Figure 35.4. Fault scarps recognized in 2015 and further investigated in this cruise.

Upper left show bathymetry and the scarp in relation to 2016 sample stations. Upper right present a slope map while the lower panel shows the offset both at the seabed and on the glacial erosion surface.

Outer M’Clure Strait

The expedition into M’Clure Strait in 2015 provided the main basis for a preliminary surfical geology map (presented at ArcticNet 2015). This mapping identified the rare locations with suitable sediment for piston coring; iceberg scouring is ubiquitous and fully disturbs the upper 3 to 8 m with the exception of the upper 1-2 decimetres. The 2016 sonar traverses fill a major gap in the NW outer Strait area, allowing final map preparation. Except for the outermost shelf-break area, the thin surficial deglacial mud turbate (0-10m) covers the entire outer strait area.

The cores provide some groundtruth for the geophysics. Across the entire strait they always penetrate a thin (10-15cm) soft surficial brown mud. It likely represents a very limited sediment input since glaciers left the region. The only exception is the sandy alluvial fans along the north Banks Island coast (following section). The turbate is a greyer, very cohesive mud, and present in all the samples. The outer Strait piston core trial confirmed a very hard till below the turbate (below the regional glacier erosion horizon) despite no sample recovery.

Central M'Clure Strait: The deepest part of the basin escaped iceberg scour, leaving 4m of undisturbed stratified muds overlying a thin till lying on a regional smooth and broadly sculpted glacial erosion surface. As sea-ice covered (or nearly so) the original planned coresite, it was moved to an ice-free site identified from Polarstern 2012 Parasound sub-bottom profiler data. Three cores plus one box core here recovered the ubiquitous two post-glacial units (Figure 35.5). This and the overlying late glacial clay should reveal a paleoenvironmental record and some chance of age dating by more than one method. It is yet unclear if the core sampled the thin till between this and the regional erosion horizon. This basin revealed an intervening unit (above the grey glacimarine mud), much more pale in colour, clearly representing a latest glacial pulse of sediment input, likely during the height of calving or with a suspected glacial readvance. Its study should reveal the process history.

A short multibeam survey coincident with a Polarstern 2012 profiler track and across the core site identified enigmatic (Nissen, 2008) features not imaged on the 2012 multibeam as small N-S oriented ridges only 2m high and generally spaced at less than 500m (Figure 35.4). These are now identified as a field of small ribbed moraine (DeGeer or Rogen type), formed at or just up-ice from the floating margin as it calved. They are further evidence for the upper till interpretation representing the glacial retreat.

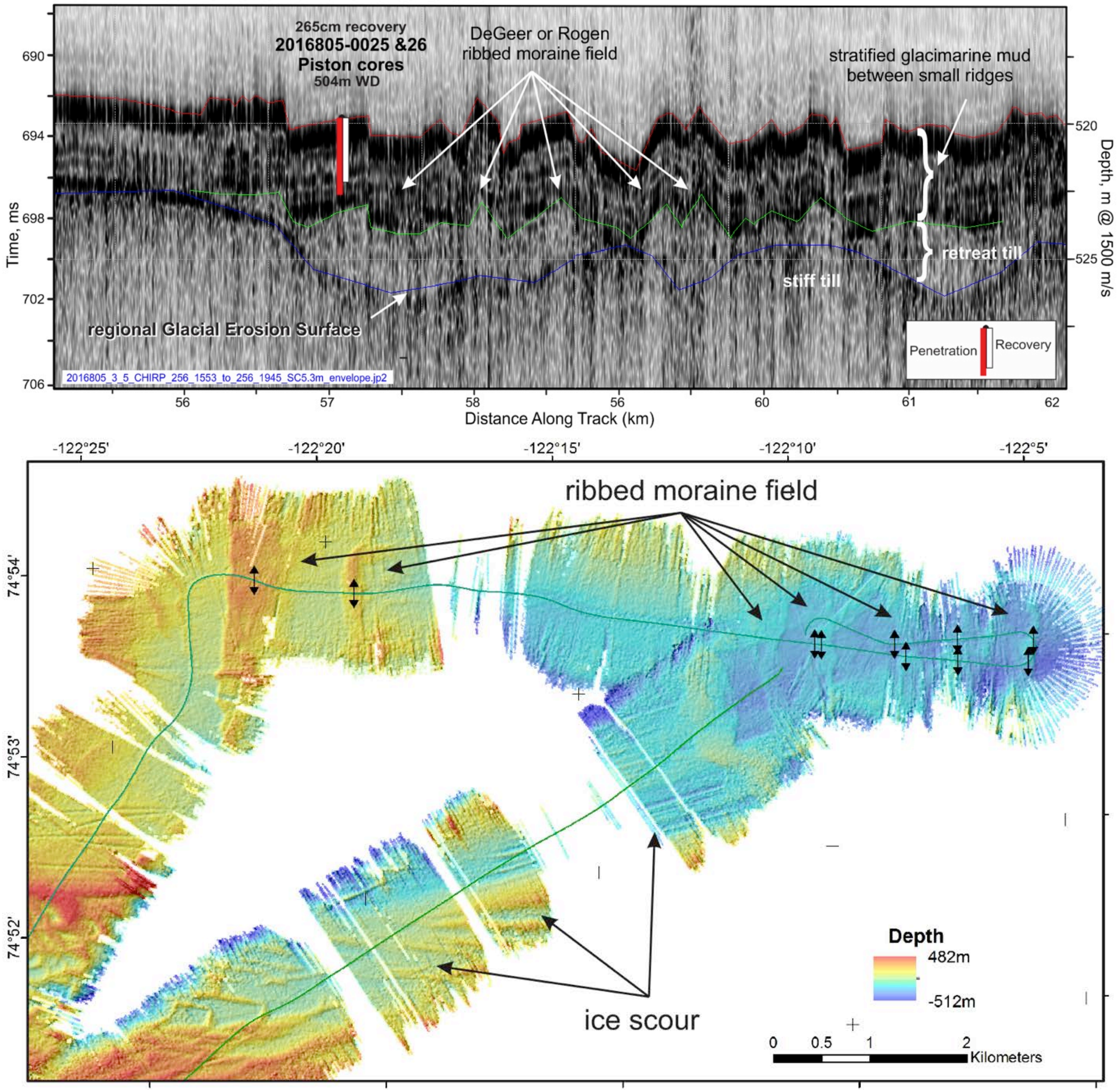

Figure 35.5. Setting of piston core Lakeman-08 (GSC stns. 20168050025 to 27) situated in the central basin of M'Clure Strait in the only known deglacial sediments not disturbed by iceberg scouring.

A post-glacial section ~4m thick on the 3.5kHz profile (extends full extent of the green tracks on the map) overlies an incoherent blanket interpreted as retreat till lying on a regional glacial erosion surface. The green horizon traces the top of this till/base of stratified glacimarine mud. The mound crests picked on this surface correspond to the double-headed arrows on the 2016 multibeam image, indicating their ridge geometry with a NS orientation. Several push cores from the boxcore were also recovered at this site. The samples will support geochronology, paleoecology and glacial reconstruction, process and history investigations.

Northwest Banks Island Coast: Marine alluvial fans were discovered in the 2015 survey along the north coast of Banks Island. One was targeted for further investigation as they represent the only obvious source of sediment entering the Strait in post-glacial time. A sonar survey of the submarine delta of the Ballast River reveals the presence of multiple channels (Figure 35.6), reflecting the braided channels on the deltaic plain. The thalwegs of these submarine channels are filled with crescentic bedforms, interpreted as upslope migrating bedforms formed under supercritical turbidity currents (e.g., Normandeau et al., 2016). Their wavelength clearly increases downslope, which is typical of cyclic steps, a type of bedform bounded up- and down-slope by hydraulic jumps.

The submarine delta downlaps an iceberg-scoured surface with very little Holocene sediments. An attempt to collect surficial sediment with a gravity core (22GC) on the distal part of the delta was unsuccessful but nonetheless allowed observing fine sand on the cutter. This fine sand on the cutter indicates that sand is the dominant lithology in this deltaic environment. A box core collected further offshore (23BC) revealed the presence of only 8 cm of Holocene muds in this area indicating either that 1) Holocene sediment deposition is controlled by turbidity current activity and delta progradation and does not extend offshore or that 2) the bedforms observed on the delta are relict features from deglacial times and that no Holocene sediments were deposited over them due to low sedimentation rates.

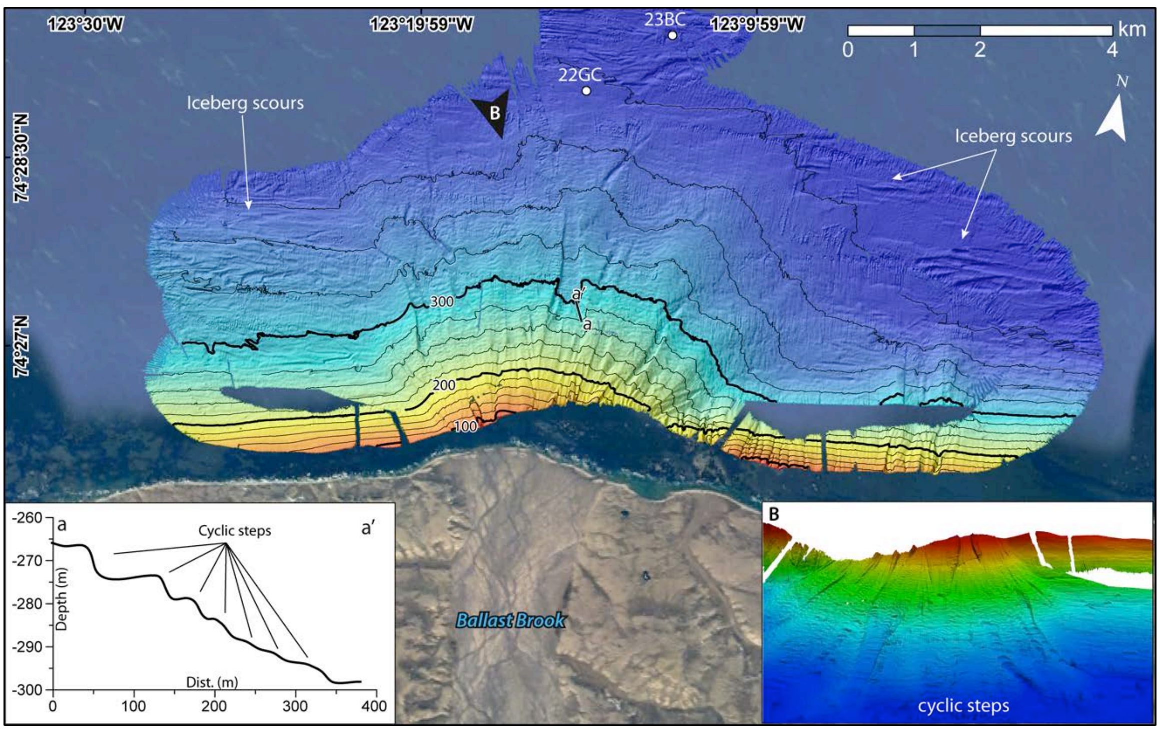

Figure 35.6. Submarine component of the Ballast Beach delta.

Summary of Geological Findings on *Amundsen* 2016 Leg3a

- Some of the relatively small submarine mass failures (10s of $10^6 m^3$) previously known on the continental slope off Mackenzie Trough now have corresponding sub-bottom data from which their approximate/relative age can be inferred.
- Excellent quality survey lines on the west flank of the Mackenzie Trough were collected, supplementing very few extant until now. Multiple current and sea-level related erosion events, subaerial channelization, and glacial retreat and ice scour event history are represented in the new survey data.

- Orientation of glacial features identified in 2015 on Banks Island Shelf have been delineated and help constrain glacial reconstruction.
- Marine alluvial fans along the north coast of Banks Island discovered in 2015 have been better studied, identifying elements of flood episodes and their processes (present-day activity remains uncertain). A core, despite lack of recovery, confirms its sandy nature. This helps constrain the origin of the ubiquitous surficial brown mud (only decimetres thick) recognized throughout M'Clure Strait.
- Traverses across the previously unsurveyed NW M'Clure Strait confirm a continuous thin blanket of iceberg scoured glacimarine mud, as inferred from regional considerations. Other traverses better outline glacier retreat-formed broad and thicker (10s of m) moraine geometries.
- Spectacular seabed faults identified in 2015 have been better imaged and cored at the base, helping confirm interpretations and towards better constraining the relative timing of faulting with associated till deposits, canyon heads, iceberg scour and slope-situated avalanches.
- A slide (gravity mass transport) complex near the BR-3 mooring site has been better defined in its geometry and stratigraphy and sampled to constrain age. Several failure events are recognized. The data form the basis for a case study and perhaps an archetype for an otherwise unknown Banks Island Slope sediment stability.
- Identification of ribbed moraines in the central M'Clure Strait confirm both interpretations of the glacial materials out of reach by coring and the inferred glacial retreat pattern.
- Numerous unfilled canyon heads apparently unrelated to the slide process have been identified along the Banks Island Shelf break. These are likely analogues to those imaged in 2014-15 at the Amundsen Gulf slope.
- Sediment cores critical to understanding the age and paleoenvironment of M'Clure Strait from the last glacial to present have been collected in the only known suitable basin.

Leg 3b

Leg 3b was centred on boxcore recovery at full/basic stations, from which pushcores were taken (Table 35.2). Due to the considerable downsizing of the geology team (A. Pieńkowski only, with help from Charles-Edouard Deschamps and Thomas Richerol, Université Laval à Rimouski), only one piston core was taken, in addition to a gravity core recovered from M'Clintock Channel. Unfortunately, the original targeted, piston core site immediately west to the Lowther-Young islands sill critical to answering early Holocene inflow of Atlantic origin water (and therefore Arctic-Atlantic ocean heat and water exchange) could not be reached due to multi-year ice. A deeper (>300 m) basin in easternmost Barrow Strait was therefore chosen as an alternative on the basis of sub-bottom profiling, with a 3.5 m long piston core recovered from the site.

Table 35.2. Sediment cores recovered during Leg 3b

GSC Core designation	Station designation	Latitude	Longitude	Water depth (m)
0033BC	316	68° 23.180' N	112° 05.254'W	180
0034BC	314	68° 58.37' N	105° 28.50'W	83
0035BC	53	68° 18.96' N	100° 48.23'W	53

0036BC	62	69° 10.025’ N	100° 41.611’W	62
0037BC	311	70° 16.882’ N	098° 32.326’W	177
0038BC	310E	70° 49.97’ N	099° 04.66’W	212
0039BC	310W	71° 27.569’ N	101° 16.344’W	163
0040BC	AMD0416-7	71° 52.143’ N	102° 43.367’W	246
0041GC	Furze-04	73° 38.940’ N	103° 43.367’W	337
0042BC	Furze-04	73° 38.933’ N	103° 23.319’W	337
0043BC	307	79° 06.134’ N	103° 00.853’W	349
0044PC & TWC	Furze-07	74° 42.486’ N	097° 11.674’W	320
0045BC	Furze-07	74° 42.411’ N	099° 11.739’W	321
0046BC	304	74° 14.770’ N	091° 31.318’W	314
0047BC	301	74° 07.27’ N	083° 19.61’W	677

*BC = boxcore, PC = piston core, TWC = trigger weight core, GC = gravity core

35.4 Comments and Recommendations

As with previous years, most expectations are met and some exceeded. Those opportunities lost were due to ice or weather conditions. Interactivity among the geo-related teams was free and creative and created several unexpected at-sea opportunities resulting in more valuable datasets. Rationalized requests for advice, changes and substitutions were consistently met by chief scientist and ship’s officers. Despite “typical” minor logistics issues as noted in this questionnaire the outcome was great satisfaction both from a geographic sonar coverage, coring success and added scientific understanding of those target geo-features accessible to the ship as well as features “happened” upon during the general operations and transits.

Acknowledgement

Most operations included invaluable input through close cooperation from the ArcticNet sonar acquisition team from Laval University; Étienne Brouard and Pierre-Olivier Couette and tireless assistance with the coring and box-coring operations from Jean Carlos Montero-Serrano and Pascal Rioux. We also wish to acknowledge the advice and deck help and material odds and ends from the mooring team, Luc Michaud, Shawn Meredyk, and Alex Forest. Of course, all the operations would not have come about without the logstistics and operations experience of First Officer, Alain Lacert, and his entire bridge, deck and support crew.

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36 Natural Climate and Oceanographic Variability in the Western Canadian Arctic Ocean since the Last Deglaciation

Project Leaders: Patrick Lajeunesse[1] (patrick.lajeunesse@ggr.ulaval.ca), Jean-Carlos Montero-Serrano[2], Guillaume St-Onge[2], André Rochon[2] and Guillaume Massé[3]

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36.1 Introduction

Benefitting from the presence of the of the Canadian Coast Guard (CCGS) *Amundsen* in the Makenzie Shelf/Slope, Amundsen Gulf, M'Clure Strait, Banks Island shelf, and Canadian Arctic Archipelago during the Leg 3a, the main objective of our team was the collect several sediment cores (box and piston) and seawater samples in these areas in order to:

1) Reconstruct changes in sediment provenance and transport related to climate variability;
2) Document Holocene changes in deep-water mass provenance;
3) Provide new insights on the potential linkages between Pacific water advection into Arctic and sea ice variability;
4) Establish a deglatial/Holocene high-resolution magnetostratigraphy for the western Canadian Arctic Ocean;
5) Document the evolution of primary and secondary productivity of the Canadian arctic ecosystem in relation with climate conditions.

This sampling is framed within the IRIS 1 targeted research from the ArcticNet funded project Mapping of Arctic Canada's Seafloor: Contributions to Global Change Science, Sustainable Resource Development, Safe Navigation of the Northwest Passage, Geohazards and Arctic Sovereignty (project leader: Patrick Lajeunesse).

36.2 Methodology

For Leg 3a, the ISMER-UQAR team was responsible, together with Amy Noël and Daniel Gittins from the Calgary University, for box coring operations. The piston corer was deployed together with the Geological Survey of Canada-Atlantic scientists (Edward King, Angus Robertson and Alexander Normandeau). For Leg 3b, the ISMER-UQAR team was responsible, together with Anna Pienkowski from the MacEwan University (Edmonton, Alberta), for box coring, gravity coring and also piston coring operations. The multibeam echosounder (Konsberg Simrad EM300) and sub-bottom profiler (Knudsen 320R) were used, in collaboration with the Marine Geoscience Lab. (MGL) from the Université Laval (Etienne Brouard and Pierre-Olivier Couette), to ensure that the seabed was suitable for deployment of the corers, as well as to identify the thickest apparent Holocene sequences. Note that the MGL was responsible for mapping the seabed morphology and in acquiring sub-bottom stratigraphy during this leg.

36.2.1 *Sediment Sampling*

Box corer

The box corer collects up to 0.125 m^3 of soft sediments at the seafloor and is suitable for any water depths (wire length is the limit). It is used for minimum disturbance of the sediment/water interface. When the sediment volume was sufficient (which was the case for most deployment), three push cores (PVC tubes of 10-cm diameter and 50-cm long) were taken from each box core using a vacuum pump to reduce compaction. Note that two push cores are for ISMER-UQAR team and one push cores is for Guillaume Massé (Takuvik, CNRS, Université Laval) (and two push cores for Anna, see Table 35.5). The sediment/water interface from each box-core location was subsampled into several ziploc bags for subsequent identification of dinoflagellate cysts and fish remains (notably, otoliths and bones), as well as grain size, mineralogical, geochemical and magnetic analyses.

During the expedition, the box corer was deployed 25 times for ISMER-UQAR and Université Laval teams (Table 36.1). In each box corer, 4 surface samples and 3 push cores were subsampled. Each push cores and surface sediments were stored into a cold room (4°C).

Gravity and piston corer

The gravity core has a maximum length of 2 m and penetrates the sediment under a 136-kg weight. A core catcher keeps the sediment in the corer when the latter is pulled upward. When the gravity core is used for the releasing of the piston corer, his name is trigger weight core. During the expedition, the gravity core was used for both purposes. The piston corer is used with a weight of 2000 kg. When the companion trigger weight core touches the seafloor, it causes the rise of the trip arm and induces the piston corer free fall. A core catcher keeps the sediment in the corer when the latter is pulled upward. This coring instrument allows the collection of long cores up to a maximum of 9-m length due to the suction exerted by the piston in the tube.

For Leg 3a, the piston corer was deployed 2 times during the expedition for ISMER-UQAR project, and thus a total of 2 piston cores and 3 trigger weight cores have been sampled. For Leg 3b, the piston corer was deployed 1 times during the expedition, and thus a total of 3 gravity cores have been sampled (one for UQAR-ISMER team, one for mac Ewan Universty team and the last one for Marine Geoscience Lab. (MGL) from the Université Laval. Each section cores were stored into a cold room (4°C). Note that box-cores collected in conjunction with a piston corer allow recovering the undisturbed sea-water interface, which is usually perturbed when the piston corer enters the sediments.

The sediment samples have been labelled using two numbering systems:

1. ISMER-UQAR system: AMD1603-01PC-AB AMD = Amundsen

16 = Year 2016
03 = Leg # 03
01 = Station # 1
PC = Corer type (piston corer)
AB = Core section if applicable

2. standardized NRCan system: 2016805-018BC

2016 = Year
805 = NRCan cruise number
01 = Station # 1
BC = Corer type (box corer)
AB = Core section if applicable

Noticed, that A represents the base of the sediment cores (Figure 36.1).

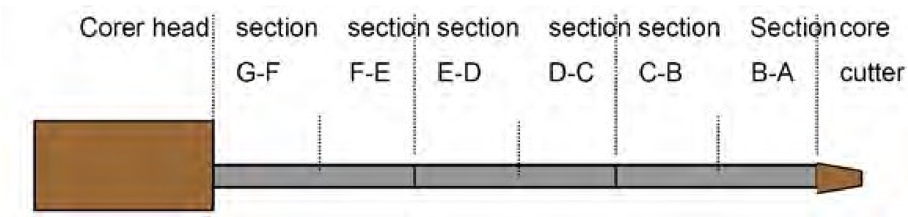

Figure 36.1. ISMER-UQAR labelling system for piston cores

36.2.2 *Seawater Sampling*

Seawater samples were recovered with a rosette equipped with 24 Niskin-type sample bottles of 12L. A CTD unit, which continuously measures the conductivity, temperature, density, dissolved oxygen, and the fluorescence is also attached to the rosette. The sampling depths were determined from temperature and salinity profiles in order to collect seawater samples from the Polar mixed layer, Pacific layer, Atlantic layer waters. Seawater samples were transferred into 20 L acid-cleaned LDPE- collapsible cubitainers. Location and water depths are reported in Table 36.1.

Seawater samples were labelled as follow:

Example: AMD1603-535-50
AMD = Amundsen
16 = Year 2016
03 = Leg # 03
535 = Station
# 535 50 = water depth (m)

All samples from ISMER-UQAR team will be redirected and stored and analyzed in details at Rimouski.

Table 36.1. Location, depth and characteristics (temperature, salinity, and water mass) of water sampling stations

Seawater station	Zone	Latitude N	Longitude W	Water depth (m)	Temperature (°C)	Salinity (psu)	Water mass
AMD1603-407	Amundsen Gulf	71°0.545'	126°5.370'	10	4.5	28.2	Polar Surface
(depth = 392 m)				100	-1,1	32.9	Pacific Water
Date: 27/08/2016				379	0.4	34.9	Atlantic Water
Hour (Québec -1): 18:50							
AMD1603-535	Banks Island shelf	73°24.707'	128°11.767'	12	0.1	27.75	Polar Surface
(depth = 289 m)				106	-1,3	33	Pacific Water
Date: 08/09/2016				275	-0,2	34.3	Atlantic Water
Hour (Québec -1): 03:48							
AMD0416-01	M'Clure Strait	74°53.096'	122°09.762'	10	-1,5	28.4	Polar Surface
(depth = 504 m)				100	-1,3	32.8	Pacific Water
Date: 12/09/2016				490	0.4	34.9	Atlantic Water
Hour (Québec -1): 17:22							
AMD1603-650	Labrador Sea	53°48,126'	55°26.327'	5			
(depth = 202 m)				50			
Date: 02/10/2016				200			
Hour (Québec -1): 13:00							
AMD0416-10	Labrador Sea	52°51,580'	54°45,875'	5			
(depth = 197 m)				50			
Date: 02/10/2016				187			
Hour (Québec -1): 18:00							

Table 36.2. Location, date hour, sampling depth of each box core, and length of the subsampled push cores (Leg 3a).

Name	ArcticNet station	Date - Hour	Zone	Latitude N	Longitude W	Depth (m)	Push cores length (cm) A	B	Comment(s)
AMD0416-04BC	AMD0416-4	26/08/2016 - 12:00 (Québec)	South Amundsen Gulf	69°39.23'	117°51.37'	415	44	44.5	0-15 cm Holocene interval
AMD0416-03BC	AMD0416-3	26/08/2016 - 19:00 (Québec)	South Amundsen Gulf	70°30.83'	120°20.92'	330	45	43	0-18 cm Holocene interval
AMD0416-02BC	AMD0416-2	27/08/2016 - 05:30 (Québec - 1)	Amundsen Gulf	70°36.51'	123°01.71'	628	43	43.5	0-22 cm Holocene / 22-43 cm postglacial intervals
AMD1603-407BC	407 full	27/08/2016 - 10:45 (Québec - 1)	Amundsen Gulf	70°00.55'	126°05.44'	390	49	47.5	0-12 cm Holocene interval / extention in BC-B
AMD1603-437BV	437 basic	28/08/2016 - 17:12(Québec - 1)	SW Banks Island	71°48.040'	126°29.715'	288	-	-	Van Veen grab sampling / Few sediment, rocks fragments. Non photo
AMD1603-411BC	411 CTD	28/08/2016 - 17:30 (Québec - 1)	SW Banks Island	71°37.42'	126°43.86'	435	45	45.5	0-12 cm Holocene interval
AMD1603-408BC	408 full	29/08/2016 - 07:00 (Québec - 1)	Amundsen Gulf	71°18.23'	127°34.49'	205	43	41.5	0-7.5 cm Holocene interval / extention in BC-A
AMD1603-420BC	420 basic	29/08/2016 - 11:40 (Québec - 1)	Mackenzie shelf (N Cape Bathurst)	71°03.58'	128°29.27'	43	-	-	Only surface sediment were colleted, rocks fragments. Non photo
AMD1603-434BC	434 basic	30/08/2016 - 11:30 (Québec - 1)	Mackenzie shelf (N Tuktoyaktuk Peninsula)	70°10.44'	133°32.65'	46	51	50.5	black horizons are observed throughout the box core
AMD1603-421BC	421 basic	31/08/2016 - 06:30 (Québec - 1)	Mackenzie Slope	71°23.99'	133°53.44'	1135	42.5	45	Sediments are composed of olive- grey silty clays / extention in BC-B
AMD1603-482BC	482 basic	01/09/2016 - 08:50 (Québec - 1)	N Mackenzie Trough	70°31.47'	139°23.09'	821	46	46	Sediments are composed of olive- grey silty clays
AMD1603-472BC	472 basic	02/09/2016 - 05:30 (Québec - 1)	S Mackenzie Trough	69°36.70'	138°13.64'	124	44.5	44.5	Sediments are composed of olive- grey silty clays
AMD1603-BRG-BC	BR-G Mooring	04/09/2016 - 15:15 (Québec - 1)	Mackenzie Slope	70°59.54'	135°27.76'	664	41.5	41	Sediments are composed of olive- grey silty clays

Table 36.3. Location, date, hour, depth, and length of trigger weight cores and gravity cores (Leg 3a).

Name	Date - Hour	Zone	Latitude N	Longitude W	Depth (m)	Length (m)	Section length (cm)			Comment(s)
							AB	BC	CD	
AMD0416-2 TWC	27/08/2016 - 11:30 (Québec - 1)	Amundsen Gulf	70°36.49'	123°01.62'	628	1.19	119	-	-	0-27 cm Holocene interval
2016805-019TWC	09/09/2016 - 19:20 (Québec - 1)	N M'Clure Strait	75°44.50'	126°28.50'	373	-	-	-	-	Not penetration
AMD0416-01GC (2016805-024PC)	12/09/2016 - 15:01 (Québec - 1)	M'Clure Strait	74°53.125'	122°10.020'	504	1.48	148	-	-	Three sedimentological units are observed.
AMD0416-05TWC	16/09/2016 - 16:40 (Québec - 1)	Coronation Gulf	67°51.870'	115°04.301'	60	-	-	-	-	

Table 36.4. Location, date, hour, depth, and length of piston cores (Leg 3a).

Name	Date - Hour	Zone	Latitude N	Longitude W	Depth (m)	Length (m)	Section length (cm)			Comment(s)
							AB	BC	CD	
AMD0416-2 PC	27/08/2016 - 11:30 (Québec - 1)	Amundsen Gulf	70°36.49'	123°01.62'	628	4.59	155	151	152	0-25 cm Holocene interval
2016805-019PC	09/09/2016 - 19:20 (Québec - 1)	N M'Clure Strait	75°44.50'	126°28.50'	373	-	-	-	-	No recovery; Sediment from the cutter was sampled into ziploc bag
AMD0416-05PC	16/09/2016 - 16:40 (Québec - 1)	Coronation Gulf	67°51.870'	115°04.301'	60	-	-	-	-	

Table 36.5. Location, depth and characteristics of coring operations (Leg 3b).

Date	Time	Station	Location	Lat (N)	Long (W)	Depth (m)	Sample	Name	Length (cm)	Comp. (cm)	Comments
18-sept-16	5am	316	Coronation Gulf	68° 23.35'	112° 05.51'	182	push- core	AMD1603-316BC-A	43	3	no pump needed
								AMD1603-316BC-B	45	2	no pump needed
18-sept-16	8pm	314	Coronation Gulf	68° 58.312'	105° 28.508'	89	push- core	AMD1603-314BC-A	38	0	pump needed

Date	Time	Station	Location	Lat (N)	Long (W)	Depth (m)	Sample	Name	Length (cm)	Comp. (cm)	Comments
19-sept-16	5am	QMG4	Queen Maud Gulf	68° 29.411'	103° 25.132'	82	push- core	AMD1603-314BC-B	36	1	B -> 3cm lost at the bottom because of dropstones
								AMD1603-QMG4BC-A	48	0,5	no pump needed
								AMD1603-QMG4BC-B	45	2,5	no pump needed
19-sept-16	9am	QMG3	Queen Maud Gulf	68° 18.85'	102° 56.69'	56	push- core	AMD1603-QMG3BC-A	40	2,5	nopumpneeded-no styrofoam
								AMD1603-QMG3BC-B	43	2	no pump needed - no styrofoam
19-sept-16	3pm	QMGM	Queen Maud Gulf	68° 18.619'	101° 45.928'	107	push- core	AMD1603-QMGMBC-A	43	2,5	nopumpneeded-no styrofoam
								AMD1603-QMGMBC-B	41	2,5	no pump needed - no styrofoam
19-sept-16	7pm	QMG2	Queen Maud Gulf (triplicat)	68° 18.988'	100° 48.194'	53	push- core	AMD1603-QMG2BC-A	38	1	box-core 02 - no pump needed - no styrofoam
								AMD1603-QMG2BC-B	38,5	2	box-core 02 - no pump needed - no styrofoam
20-sept-16	5am	312	Victoria Strait	69° 10.010'	100° 41.828'	66	push- core	AMD1603-312BC-A	35,5	2	pump needed - no styrofoam
								AMD1603-312BC-B	34	4	nopumpneeded-no styrofoam
20-sept-16	1:30pm	311	Victoria Strait	70° 16.858'	98° 32.046'	170	push- core	AMD1603-311BC-A	42	0,5	pump needed - no styrofoam
								AMD1603-311BC-B	43	0	pump needed - styrofoam
20-sept-16	9pm	310E	Larsen Soun	70° 49.946'	99° 04.597'	216	push- core	AMD1603-310EBC-A	36,5	4	nopumpneeded-no styrofoarm
								AMD1603-310EBC-B	42	0	pump needed - no styrofoam
21-sept-16	6am	310W	Mc Clintock Channel	71° 27.569'	101° 16.344'	163	push- core	AMD1603-310WBC-A	26	1,5	nopumpneeded-no styrofoam
								AMD1603-310WBC-B	NA	NA	lot of dropstone, box-core tilted, no push-core B
								AMD16-310W	25		No pump

Date	Time	Station	Location	Lat (N)	Long (W)	Depth (m)	Sample	Name	Length (cm)	Comp. (cm)	Comments
21-sept-16	11am	AMD04 16-7	Mc Clintock Channel	71° 52.152'	102° 43.482'	245	gravity- core	AMD0416-07GC	142	NA	liner broke at the core catcher, apparent penetration
	11:30 am	AMD04 16-7	Mc Clintock Channel				Push-core	AMD0416-07BC-A AMD0416-07BC-B AMD0416-07	40 39.5 39.5	0 -1	pump needed - no styrofoam (succion) pump needed - no styrofoam No pump
22-sept-16	3:30 pm	Furze-04	Mc Clintock Channel	73° 38.926'	103° 23.350'	338	Push-core	AMD1603-Furze04BC-A AMD1603-Furze04BC-B AMD16-FURZE04	34 31 31	-1 3	pump needed - no Styrofoam pump needed - no styrofoam No pump
	2 pm	307	Viscount Melville Sound	74° 06.134'	103° 00.853'	350	Push-core	AMD1603- 307BC-A AMD1603- 307BC-B AMD16-307	37.5 40 31	0 0 6	pump needed - no Styrofoam pump needed - no Styrofoam No pump
23-sept-16	11 am	Furze-07	Barrow Strait (white Wedding)	74° 42.411	97° 11.739'	318	Push-core	AMD1603-Furze07BC-A AMD1603-Furze07BC-B AMD16-FURZE07	44 44 39.5	0 1 8	pump needed - no Styrofoam pump needed - no Styrofoam No pump
24-sept-16	3:30 am	304	Barrow Strait	74° 14.774'	91° 31.318'	314	Push-core	AMD1603- 304BC-A AMD1603- 304BC-B AMD16-304	45.5 45 39	0 0 6	pump needed - no Styrofoam pump needed - no Styrofoam No pump
	11 pm	301	Landcaster Sound			378	Push-core	AMD1603- 301BC-A AMD1603- 301BC-B AMD16-301	38.5 37 25.5	0 0	pump needed - no Styrofoam pump needed - no Styrofoam Block by rocks
26-sept-16	2 pm	165	North of Bylot Island	72° 42.556'	75° 45.670'	645	Push-core	AMD1603- 165BC-A AMD1603- 165BC-B	41 43	0 -0.5	pump needed - no Styrofoam pump needed - no Styrofoam
27-sept-16	2 pm	Clyde Inlet	Clyde Inlet fjord				Gravity-core	AMD1603-ClydeGC			CANCELLED too much wind (57knt)
28-sept-16	6:15 pm	177	Qikiqtarjuak	67°28.514'	63°48.037'	385	Push-core	AMD1603- 177BC-A AMD1603-177BC-B			too dense and too sandy, not enough material into the box for a push core so only surface samples were taken

Date	Time	Station	Location	Lat (N)	Long (W)	Depth (m)	Sample	Name	Length (cm)	Comp. (cm)	Comments
01-oct-16	5 pm	AMD0416-08	Labrador Sea								CANCELLED snow storm, 2m high waves
	11:30 pm	AMD0416-09	Labrador Sea								CANCELLED, 2m high waves
02-oct-16	1 pm	650	Labrador Sea	53°42,476'	55°26,161'	202					Box core empty (sand)
	6 pm	AMD0416-10	Labrador Sea	52°51,580'	54°45,793'	202	Surface Sample				Box core almost empty (rocks)

36.3 Preliminary Results

On the Canadian Beaufort shelf, most of the surficial seabed sediments are predominantly composed of Holocene marine olive-grey silts and clays with relatively abundant benthic fauna. In contrast sediments from the Amundsen Gulf, M'Clure Strait, and Banks Island shelf areas are composed of a relatively thin layer (~10-20 5/7 cm) of brown, silty clay (likely the Holocene age) overlying a diamicton with abundant pebbles and cobbles (Figure 36.2). On the other hand, the piston corer collected in the Amundsen Gulf (AMD0416-02PC) is predominantly composed of Holocene marine olive-grey silty clay (upper 25 cm) overlaying massive gray clay (likely the postglacial age).

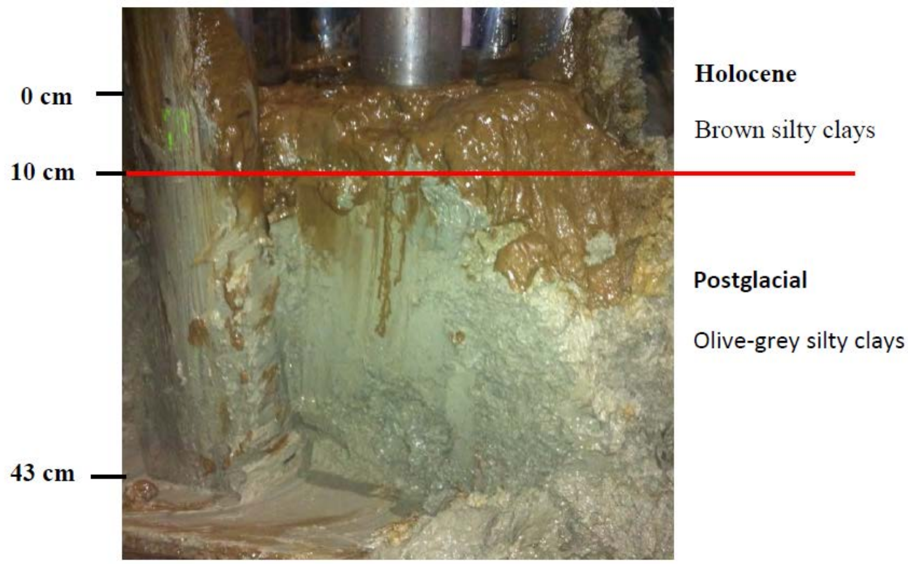

Figure 36.2 Simplified lithology of box core AMD1603-1402BC (Prince Albert Sound)

The time period covered by each core depends on the sediment accumulation rate at each location and that will be mainly determined following the paleomagnetic approach proposed by Barletta et al. (2008, 2010) and Lisé-Pronovost et al. (2009). This chronostratigraphic analysis will be performed in close collaboration with Guillaume St-Onge at ISMER-UQAR. The paleomagnetic age model will be improved by a combination of AMS-14C ages on mollusk shells and/or benthic foraminifers (when present) and 210Pb-137Cs measurements on the companion boxcores.

Preliminary results of locations of boxcores, CTD profils of seawater samples and pictures of the operations were included in the cruise report. Here is some example and for more informations contact the project leaders.

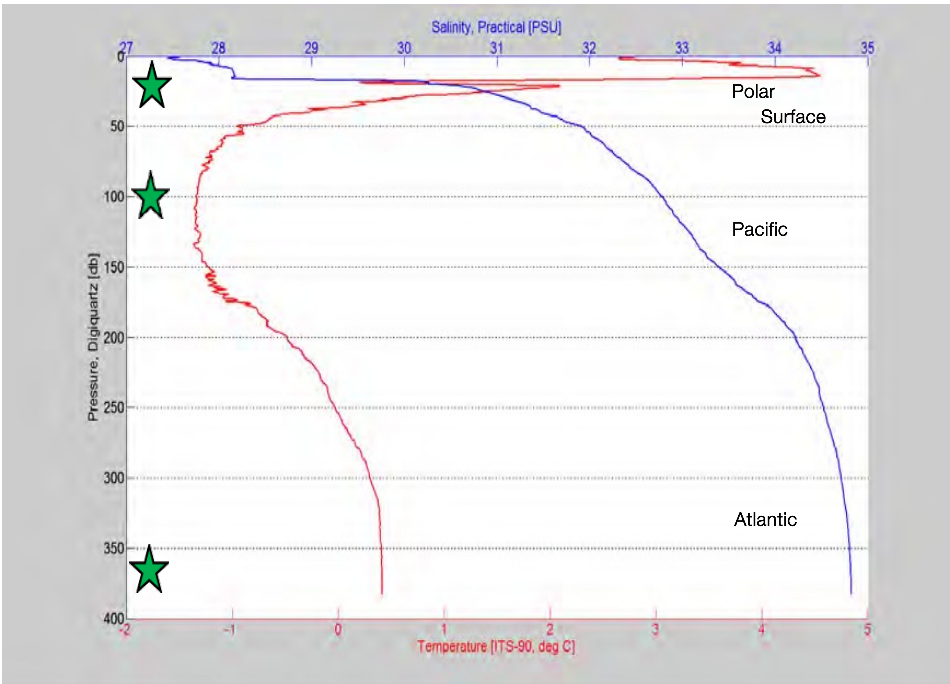

Figure 36.3. AMD1603-407 CTD profile.

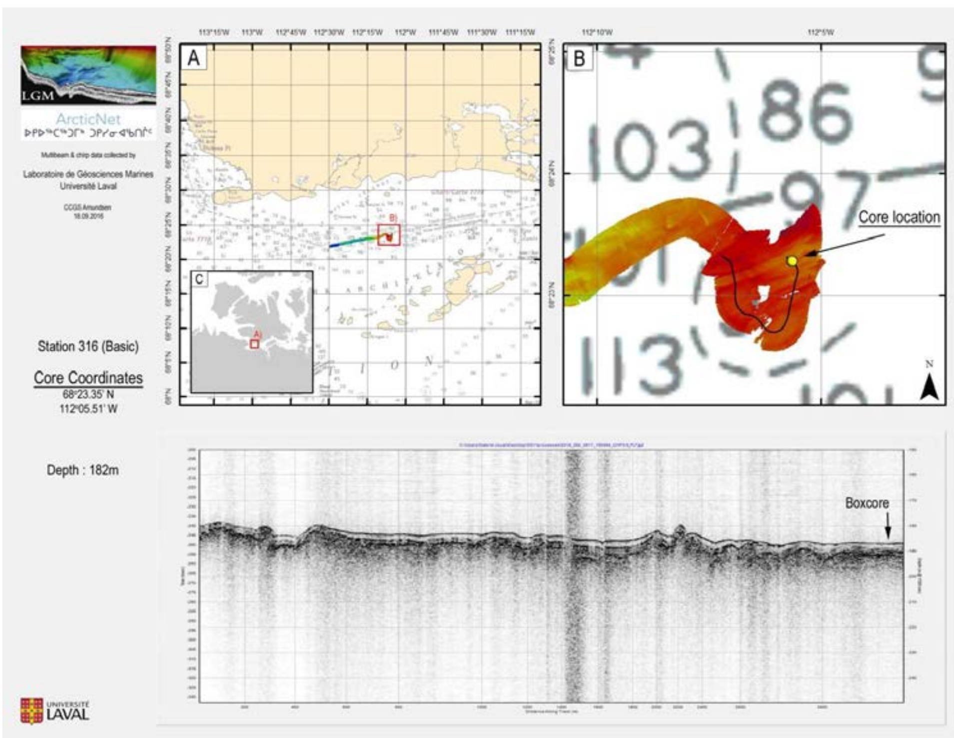

Figure 36.4. Samples locations on seismic profiles

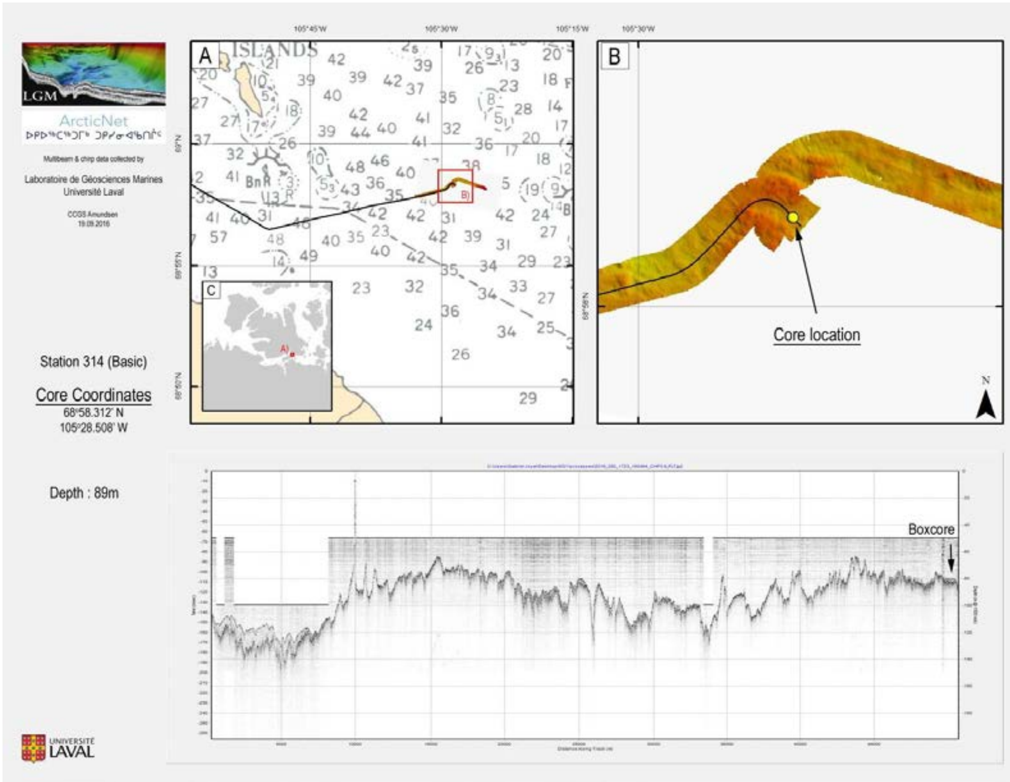

Figure 36.5. Samples locations on seismic profiles

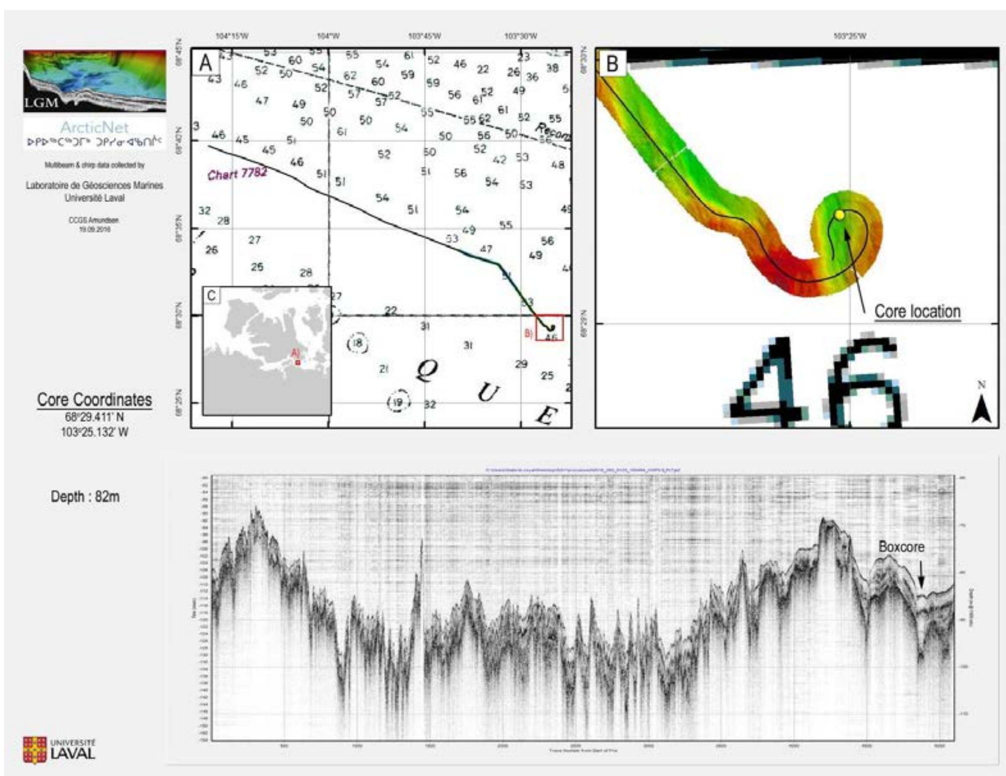

Figure 36.6. Samples locations on seismic profiles

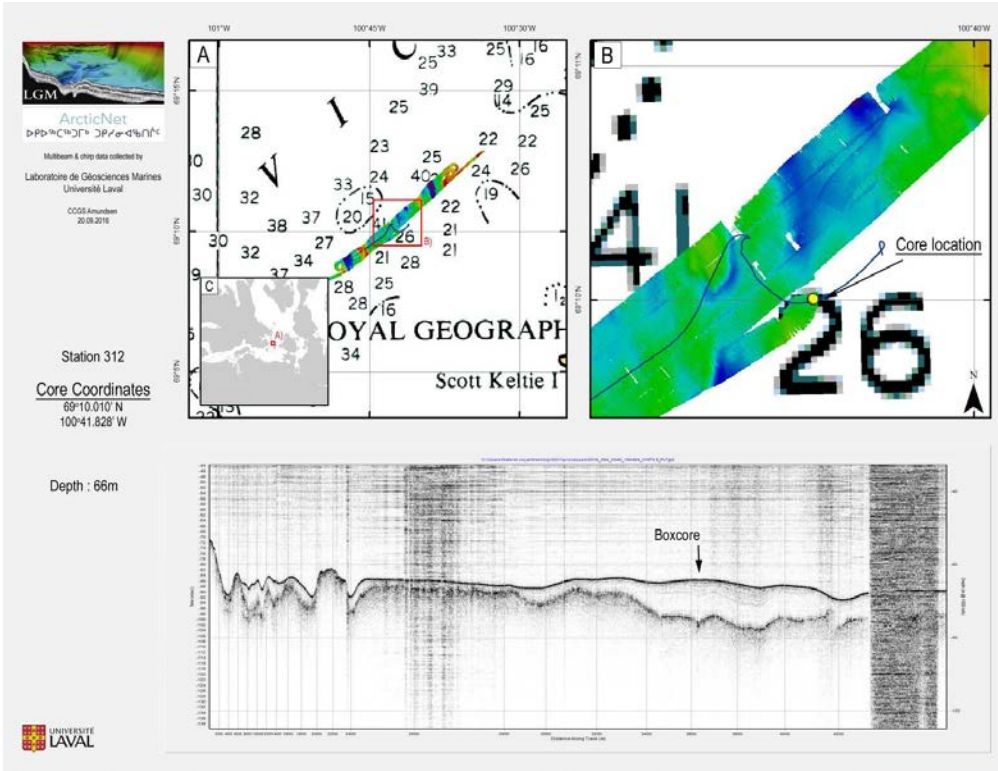

Figure 36.7. Samples locations on seismic profiles

Figure 36.8. Picture of box core AMD1603-316BC

Acknowledgement

We gratefully thank the chief scientists Louis Fortier, the Captain Alain Lacerte, the officers and crew of the *CCGS Amundsen* for their support, their help, and friendship throughout this leg of the 2016 ArcticNet cruise. We acknowledge the support of the mapping group (Etienne Brouard and Pierre-Olivier Couette), Marjolaine Blais (ISMER), the Geological Survey of Canada-Atlantic scientists (Edward King, Angus Robertson and Alexander Normandeau) involved in the piston corer deployment who greatly facilitated the site survey and operations on deck and, finally, Anna Pienkowski involved in the coring deployment who greatly facilitated the site survey and operations on deck.

Furthermore, the expedition was also a unique opportunity for Pascal Rioux (technician from ISMER-UQAR) and Stéphane Aebischer (research assistant from Université Laval and Arcticnet) to receive hands-on training in coring operations and CTD-Rosette, respectively.

37 CASQ and Box Sediment Sampling – Legs 2b and 3

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Cruise participants - Leg 2b: Caroline Guilmette[1], Eleanor Georgiadis[1,2], Philippine Campagne[1,2] and Stéphane Aebischer[3]
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37.1 Introduction

A sediment core collected during Leg 2b in the Qaanaaq area will be analyzed to provide quantitative and high-resolution climatic records covering the last ca. 10000 years. The data will enable a reconstruction of past sea ice, climate and environment changes that affected, enabled or constrained past Inuit cultures. This project is in collaboration between ICE-ARC scientists and the Greenedge consortium. Additionally, three sediment cores collected along the Nares Strait (Petermann, Kane and Trinity) will be subjected to a series of sedimentological, micropaleontological and geochemical analyzes to better understand and characterise the Holocene history of the Strait. Carbon dating of these cores will constrain the chronological frame of events -e.g. the retreat of the Greenland and Ellesmere ice-sheets and the establishment of the connection between the Pacific and Atlantic Oceans- affecting the area in relation to climate variation over the past 10,000 years. We will also sample 2 CASQ cores for Patrick Lajeunesse group at station LGM-02 and LGM 09.

37.2 Methodology

The selection of coring sites for Leg 2b was based on 3.5 KHz sub-bottom profiles collected during previous Arcticnet campaigns (AMD14-AMD15) and through mapping during the present cruise with the assistance of the shipboard Univ. Laval mapping group (Annie-Pier Trottier and Gabriel Joyal). A total of 4 sites were selected based on sediment thickness and characteristics observed on the profiles. It was the fourth time that sediment sampling using the CASQ corer was done onboard the *CCGS Amundsen* following the successful attempts in 2009 during the MALINA sampling campaign.

It was decided to use a 3 section corer (total length : 9m) at all selected coring sites (Table 37.1 and Table 37.2) during Leg 2b where sediment thickness was important enough. When deployed, each CASQ core for the Guillaume Massé group was accompanied by a boxcore and a CTD.

In each boxcore, 2 push cores (9 cm diameter) were collected, in addition to surface samples for diatoms and dinoflagellate cysts and foraminifera. For the CASQ cores, up to 5 series of large U-channels (10 cm wide) and 2 series of small U-channels (2 cm wide) were collected at up to 3 different levels along the entire length of the core. Shells, when present, were collected before

U-channel sampling and placed in Whirlpack bags for 14C dating. All U-channels were labelled, sealed and wrapped in the lab immediately after being extracted from the core, then stored in a cold container.

Table 37.1. CTD, Box and CASQ sampling stations

Station number	Latitude	Longitude	Location	Water depth (m)	Sampling device	Length
LGM-09	----------------- 69°28.584' N 69°28.548' N	------------------ 64°56.459' W 64°56.690' W	Home Bay	---- 1100 1189	---------- Boxcore CASQ	---------- 38 cm 552 cm
LGM-02	----------------- 71°04.221' N 71°04.251' N	------------------ 70°27.093' W 70°27.266' W	Scott Inlet	---- 694 694	----------- Boxcore CASQ	---------- 38 cm 270 cm
117Q	-------------- 77°00.28'N 77°00.29'N	--------------- 72°08.28'W 72°08.32'W	Qaanaak	957 961 964	CTD (n°056) Boxcore CASQ	---------- 40.5 cm 599 cm
TS-233	--------------- 77°47.782'N 77°47.751'N	----------------- 76°32.026'W 76°32.126'W	Trinity	---- 573 574	CTD (n°076) Boxcore CASQ	---------- 41 cm 793 cm
139	--------------- 81°20.876'N 81°20.87'N	----------------- 62°49.402'W 62°49.45'W	Petermann	---- 582 583	CTD (n°077) Boxcore CASQ	---------- 41.5 cm 593 cm
133	--------------- 79°30.934'N 79°30.908'N	----------------- 70°49.695'W 70°49.730'W	Kane	---- 215 217	CTD (n°083) Boxcore CASQ	---------- 40 cm 448 cm

In addition, most of the boxcores of the full and basic stations were sampled with 1 to 2 pushcores (Table 37.2) to observe and map the presence of charcoal and mature diagenetic hydrocarbons and to investigate possible transport agent.

Table 37.2. Box sampling stations

station	Name	latitude longitude	depth	BC #	length (cm)
177	AMD16- 177-1-BC2	67°28.57'N 063°47.39'W	368	1	21
	AMD16- 177-2-BC1	67°28.56'N 063°47.44'W	679	2	34
	AMD16- 177-2-BC2	67°28.57'N 063°47.41'W		2	19
176	AMD16- 176-BC1	69°35.823'N 068°21.477'W	377	1	24
	AMD16- 176-BC2	69°35.817'N 065°21.483'W		2	21.5
LGM-09	AMD16-LGM-09-BC1-1	69°28.584'N 064°56.459'W	110	1	38.5
	AMD16-LGM-09-BC1-2			1	38
	AMD16-LGM-09-BC1-3			1	39.5
LGM-03	AMD16-LGM-03-BC1-1	70°34.740'N 071°32.956'W	610	1	29.5

	AMD16-LGM-03-BC1-2			1	33
	AMD16-LGM-03-BC1-3			1	31.5
169	AMD16-169-BC1-1	71°16.205'N 070°31.267'W	768	1	32-33.5
	AMD16-169-BC1-2			1	33.5-35.5
LGM-02	AMD16-LGM-02-BC1-1	71°04.221'N 070°27.093'W	694	1	39
	AMD16-LGM-02-BC1-2			1	39.5
	AMD16-LGM-02-BC1-3			1	38
160	AMD16-160-BC1-1	72°41.054'N 078°34.214'W	726	1	43.5
	AMD16-160-BC1-2			1	43
323	AMD16-323-BC1-1	74°09.46'N 080°27.97'W	789	1	37
	AMD16-323-BC1-2			1	37
115	AMD16-115-BC1-1	76°20.385'N 071°15.387'W	669	1	36.5
	AMD16-115-BC1-2			1	36
111	AMD16-111-BC1-1	76°18.392'N 073°12.825'W	596	1	42
	AMD16-111-BC1-2			1	43
117Q	AMD16-117Q-BC1-1	77°00.28'N 072°08.28'W	961	1	40.5
	AMD16-117Q-BC1-2			1	39.5
116	AMD16-116-BC1-1	76°44.341'N 071°48.953'W	727	1	38.5
	AMD16-116-BC1-2			1	38.5
108	AMD16-108-BC2-1	76°15.827'N 074°36.084'W	449	2	27.5
	AMD16-108-BC2-2			2	22.5
101	AMD16-101-BC2-1	76°22.875'N 077°23.239'W	356	2	17.5
TS233	AMD16-TS233-BC1-1	77°52.805'N 077°10.490'W	535	1	51.3
	AMD16-TS233-BC1-2			1	48.8
TS233	AMD16-TS233 CASQ-	77°47.782'N 076°32.026'W	573	1	40.5
	AMD16-TS233 CASQ-			1	41
139	AMD16-139-BC2-1	81°20.876'N 062°49.402'W	582	2	40
	AMD16-139-BC2-2			2	41.5
133	AMD16-133-BC1-1	79°30.934'N 070°49.695'W	215	1	39.3
	AMD16-133-BC1-2			1	40
127	AMD16-127-BC2-1	78°18.004'N 074°28.697'W	527	2	20
312	AMD16-312-BC1-1	69°10.191'N 100°41.968'W	66	1	29.8
QMG	AMD16-QMG-BC2-1	68°18.13'N 101°44.61'W	117	2	42
	AMD16-QMG-BC2-2			2	42
QGM1	AMD16-QMG1-BC1-1	68°29.54'N 099°53.75'W	40	1	37,5
QGM4	AMD16-QMG4-BC2-1	68°29.085'N 103°25.712'W	69	2	28
314	AMD16-314-BC1-1	68°58.26'N 105°28.57'W	83	1	41
316	AMD16-316-BC1-1	68°23.015'N 112°06.969'W	117	1	40.5

37.3 Comments and Recommendations

Some maintenance was done before the mobilization:

- improvement of the fixation of the weights

- ease of the use of the pin in the fork
- fork was reworked and greased for an easier work
- adjustment of the diameter of the dowels on the yellow metallic plates used to assemble the barrels

Operations on deck:

- The CASQ core was deployed and recovered by an enlarged crew team this year. It was more efficient and secure.
- CREW: The making available of the sections on the foredeck: ½ hour maximum
- SCIENTISTS: Assembling of the sections: ~1 hr.
- CREW: Deployment and recovery of the Casq take less than 1 ½ hours
- SCIENTISTS: Sampling depends on the recovery size of the core and of the quantity of levels sampled. The most time consuming operation this year took 7 hours for 8 meters and 3 levels of sampling at Trinity station. Sampling operations do not permit other activities on the foredeck: 7 hours maximum
- CREW: Storage of the CASQ core sections by the crew: <1/2 hour

The availability of the paleolab for sample holding was really appreciated. We appreciated the professionalism and availability of the Chief scientist when handling a very diverse and heavy operation schedule. The CASQ group acknowledges the support of the mapping group (G. Joyal and A.-P. Trottier) and the scientists involved in the boxcore deployment who greatly facilitated the site survey and operations on deck. We also appreciate that the deck crew was always concerned and dedicated to ease the deck operations.

38 Hidden Biodiversity and Vulnerability of Hard-Bottom and Surrounding Environments in the Canadian Arctic – Leg 2a

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38.1 Introduction

The ROV-based research program on hard-bottom and vulnerable benthic environments aboard the CCGS Amundsen during its 2016 mission is sponsored jointly by an NSERC Ship-time grant (STAC), ArcticNet, the Amundsen program and by Fisheries and Oceans Canada. The major goals of the DFO-funded program to study coral and sponge habitats in the Canadian Arctic and the ArcticNet HiBio (Hidden biodiversity and vulnerability of hard-bottom and surrounding environments in the Canadian Arctic) project are to discover previously unknown coral and sponge biodiversity, other invertebrate and fish biodiversity, and previously under-sampled habitat types in the Canadian Arctic, especially the Eastern Arctic including the northern Labrador Sea and Baffin Bay. Particular emphasis is placed on steep and deep hard-bottom habitats that cannot be sampled effectively using traditional oceanographic sampling methods such as box-cores. The goals of the NSERC-STAC funded program were more focused on cold-water coral environments, especially their carbonate budgets, surficial geology, and carbonate taphonomy, their physical oceanography, especially near-bottom turbulence in gorgonian coral forests, and the paleoceanographic records that can be extracted from coral skeletons. An additional goal was to locate and sample a suspected cold seep on the NE Saglek Bank, northern Labrador.

The Super Mohawk (SuMo) ROV aboard CCGS *Amundsen* forms an integral part of the ArcticNet Hidden Biodiversity, NSERC STAC, and DFO funded programs. Associated research used instrumental data and water sampling from the CTD & rosette, invertebrate and ichthyoplankton sampling using the tucker and monster nets, and benthic sampling using the box corer and Agassiz trawl to sample the same environments through the water column, while seafloor mapping with multibeam sonar and sub-bottom profiler characterizes the seafloor underlying these benthic environments. Our integrated geological, biological, and oceanographic sampling addresses these understudied environments in a holistic fashion.

Most sites were chosen based on previously identified coral and/or sponge diversity and abundance hotspots from scientific trawl survey or commercial fisheries bycatch data. These included the various sites around Hatton Basin, NE Saglek Bank, & SE Baffin Shelf)). Exceptions were the site of a persistent surface oil slick and suspected hydrocarbon seep on Saglek Bank, and the bamboo coral forest at Disko Fan (Neves et al. 2014). Finally, one of the goals of the project is to identify and characterize corals and sponges in areas of the Arctic that have not previously been impacted by commercial fishing activities.

The General scientific objectives are to:

1) Assess coral and sponge biodiversity within the Hatton Basin / Hudson Strait coral and sponge hotspot and at the Disko Fan (SE Baffin Bay) narwhal-coral closure.
2) Assess fish diversity and abundance associated with coral and sponge habitats within the Hatton Basin / Hudson Strait coral and sponge hotspot and at the Disko Fan (SE Baffin Bay) narwhal-coral closure.
3) Measure impact of a single trawl pass on corals and sponges in two different types of coral and sponge habitats.
4) Contrast coral growth rates and carbonate production and degradation rates in three different types of coral habitats.
5) Compare surficial geology and sediment accumulation rates in three different types of coral habitats with those in adjacent non-coral environments.
6) Estimate carbonate accretion and degradation rates in high- and low-current coral habitat types.
7) Assess coral influence on benthic boundary layer current structure in a high-current regime.
8) Assess the hypothesized connection between hydrocarbon seeps, authigenic carbonates, and coral habitat.
9) Characterize the microbial and macrofaunal biota of a northern Labrador Sea cold seep and adjacent areas, and to collect thyasirid bivalves for assessment of their symbiotic microflora wherever these bivalves were encountered.
10) Determine how sedimented coral habitats contribute to regional infaunal sedimentary diversity and function.
11) Investigate the silica source for primary production based on stable Si-isotope measurements in siliceous sponges.
12) Measure stable isotope composition of particulate organic matter and coral protein layers for assessing paleoceanographic records in calcareous and proteinaceous deep-sea corals.
13) Measure aragonite and calcite saturation profiles in Frobisher Bay, the NW Labrador Sea and SE Baffin Bay.
14) Characterize water column microbial diversity in sites with abundant cold-water corals and sponges.

38.2 Methodology

A total of seven locations in the northern Labrador Sea and southeastern Baffin Bay were chosen to be surveyed using the SuMo ROV during the Amundsen 2016 expedition: NE Hatton Basin inner margin (ROV1), NE Hatton Basin outer margin (ROV5), NE Saglek Bank Cold Seep (ROV2), NE Saglek Bank coral hotspot (ROV3), SE Baffin sponge hotspot (ROV6), and Disko Fan bamboo coral forest (ROV7; Figure 35.1).

Two additional locations identified for multibeam surveys intended to guide future sampling included hypothesized authigenic carbonate mound fields near the Saglek Basin (ROV4, Jauer & Budkewitsch 2010), and a hypothesized hydrocarbon-seep authigenic carbonate mound near site ROV2 (again from Jauer & Budkewitsch 2010). Box core samples were collected at the hypothesized mound site near ROV2.

At each station, the intended sampling methodology consisted of: multibeam sonar and 3.5 kHz sub-bottom profile survey, one or two ROV dives, water column profile sampling with CTD and rosette, plankton sampling using standard vertical and horizontal tows (monster and Tucker nets), and box core and/or Agassiz trawl. The Agassiz trawl was cancelled in locations that appeared to contain too many boulders, and might therefore risk damaging the trawl. Box-cores were collected in triplicate, except in locations where the box corer appeared to be suffering damage from rocks, in which case box-coring at that location was stopped immediately.

The dive at the NE Saglek Cold Seep site (site 2) was cancelled due to a combination of issues with the ROV and scheduling. The ROV was inoperable on the third day of the ROV-focused part of Leg 2a, and postponing the dive there would have prevented dives at other locations without actually achieving sampling at the cold-seep site.

The SuMo ROV has a high definition (HD) camera (1Cam Alpha, Sub C Imaging, 24.1 megapixels) and two green lasers 6 cm apart for size indication. We used the FH video recording mode (second best resolution), since using the best resolution would reduce the camera storage capacity. A new sampling skid (Figure 38.2), essentially a sliding tray into which samples can be stowed opportunistically throughout the length of the dive, was installed at the beginning of Leg 2a. This sampling skid was invaluable.

An elevator built in 2015 to be used with this ROV was planned to be deployed at three of the seven sites: Hatton Basin (site 1), Saglek Bank cold seep (site 2), and Disko Fan (site 7). The elevator consisted of a platform holding seven polycarbonate boxes of mixed size at its base, and five floats at the top of the platform (Figure 38.2).

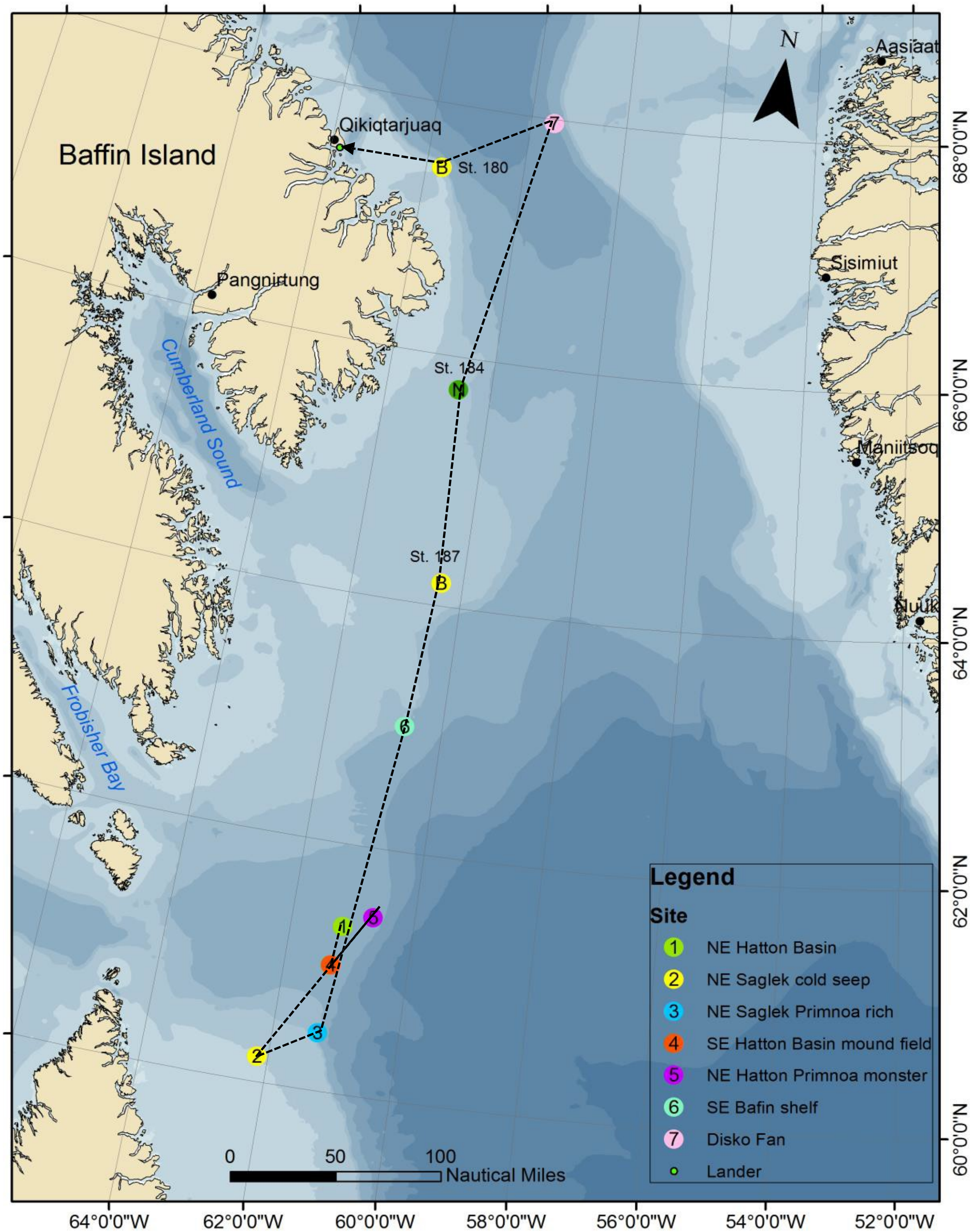


Figure 38.1 ROV dive locations visited during the 2016 CCGS Amundsen expedition. Order: 1, 4, 5, 2, 3, 6, 7

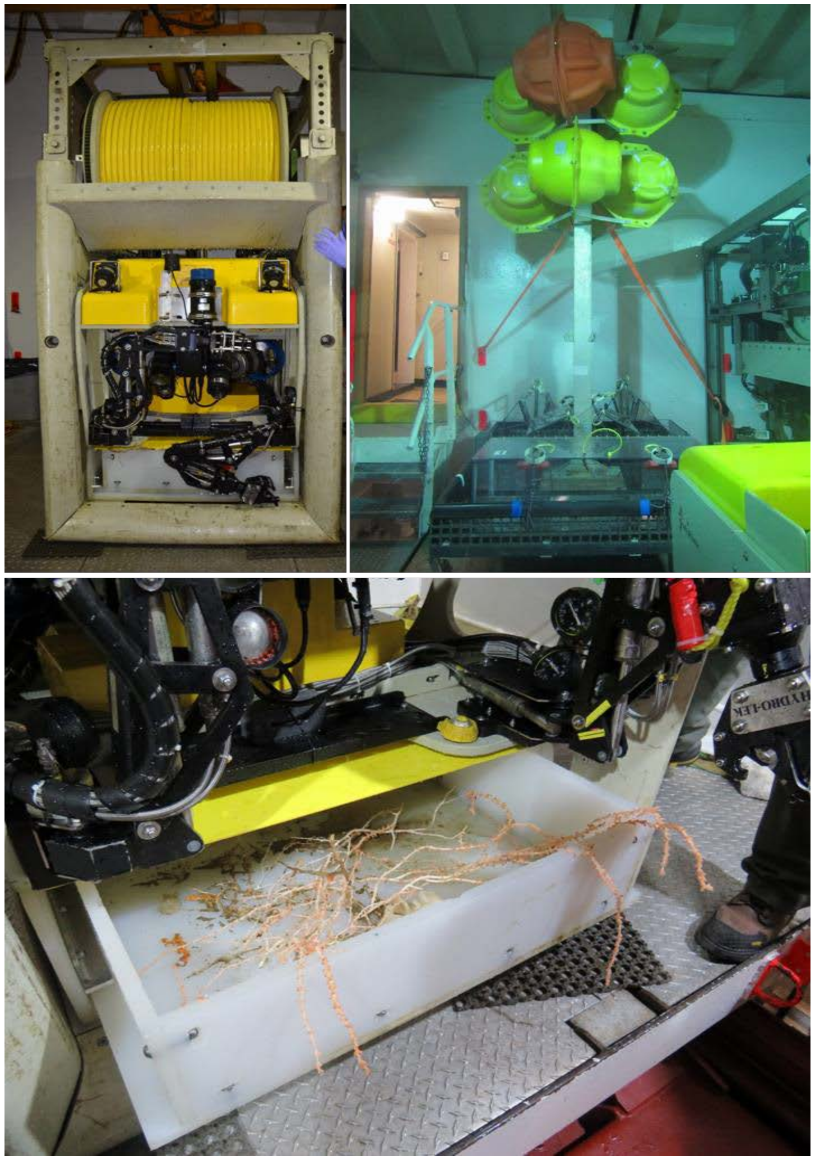


Figure 38.2 A) Super Mohawk (SuMo) ROV, B) elevator, and C) sampling skid with Keratoisis sp. samples.

38.3 Preliminary Results

Table 38.1 summarizes the sites where ROV surveys took place.

Table 38.1 Details on sites surveyed with the SuMO ROV during the 2016 CCGS Amundsen expedition.

Dive	Date	Site	Latitude (N)	Longitude (W)	Depth (m)	Bottom time
50	18-07-2016	1- NE Hatton Basin	61° 20.492'	61° 9.4292'	562-573	1:43
51	19-07-2016	5- NE Hatton Basin *Primnoa* monster set	61° 26.415'	60° 39.863'	626-633	0:52
52	21-07-2016	3- NE Saglek Bank	60° 28.035'	61° 16.687'	461-473	3:09

		Primnoa coral-rich area				
53	22-07-2016	6- SE Baffin shelf	62° 59.181'	60° 37.718'	492-500	0:24
54	24-07-2016	7- Disko Fan 1st dive	67° 58.127'	59° 30.24'	924-941	2:20
55	25-07-2016	7- Disko Fan 2nd dive	67° 58.124'	59° 30.278'	874-934	2:35

38.3.1 *Dive 50: NE Hatton Basin (Site ROV1, 61° 20.4921 N, -61° 9.4292 W),July 18th 2016*

At this site, the planned transect length was 2 km, but only ~1.1 km were surveyed (Figure 38.3) due to video loss associated to issues with the new ROV tether. The surveyed line depth ranged between 562-573.5 m. Bottom temperature (600 m) at this site ranged from <-1.5 to 4 °C between the two casts (Figure 38.4), but these data have not been validated yet, and this large discrepancy might still be corrected. Bottom salinity data can also be visualized in Figure 38.4.

Contrary to the indications of the pre-existing coral and sponge bycatch data, this site was sponge dominated, with very few of the heavily calcified corals that had been identified in trawl bycatch. Sponges were the most commonly observed organisms at this site, with glass sponge (possible Asconoma foliate) and large Geodia (42 x 42 cm) sponges being the most abundant taxa observed during the dive. Other sponge species observed include Polymastia sp., Phakellia sp., Mycale sp., blue encrusting sponge, and Geodia with a yellow encrusting sponge (possible Hexadella sp.).

Several species of corals were also observed, including soft corals (Nephtheids, and Anthomastus sp.), sea pens (Halipteris sp.), and one observation of Acanthogorgia armata. Sea anemones, a deep-sea crab, and squat lobsters were also seen near the bottom during the dive. Amphipods, adults with red bodies and juveniles with black bodies, were also very conspicuous at this site swimming in the water column and often swarming the ROV during transect (Figure 38.5). A few specimens of this amphipod were sampled with the sampling skid.

Fish such as redfish (Family Trachichthyidae), grenadier (Family Macrouridae) and skate (Rajidae) were also observed. No Primnoa resedaeformis large gorgonian corals were observed, contrary to the indications from the Northern Shrimp Survey bycatch data.

In terms of bottom type, the surveyed site was mainly sandy cobbly gravel, with occasional boulders. Many of the larger sponges, and all of the larger corals, were attached to the boulders. The multibeam survey and sub-bottom profile indicated an iceberg-scoured acoustically incoherent generally flat bottom, with undulating topography on the scale of 5 m (Figure 38.3

Box cores/Agassiz trawl

At this site, a single box-core (61°20.504 N, 61° 09.591 W, 562 m) was deployed, from which the whole box was retained. Among the fauna identified in the box-cores are: small yellow encrusting sponges, hispid sponges, stalked sponges, and a round sponge. No Agassiz trawl was deployed at this site because the bottom was considered too rocky for safety deployment of the trawl.

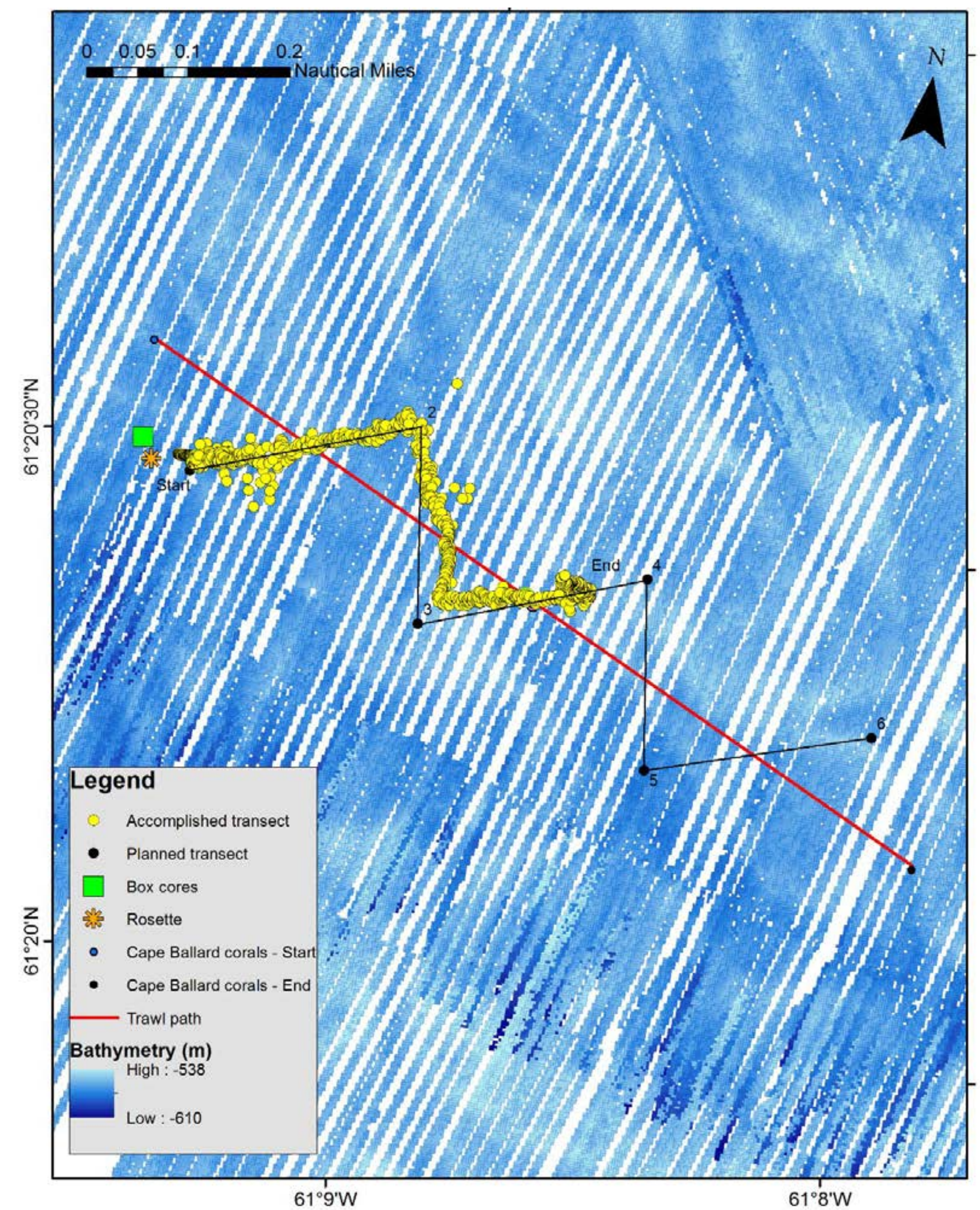


Figure 38.3 Map of site 1 (NE Hatton Basin) showing planned and accomplished ROV transect during the 2016 CCGS Amundsen

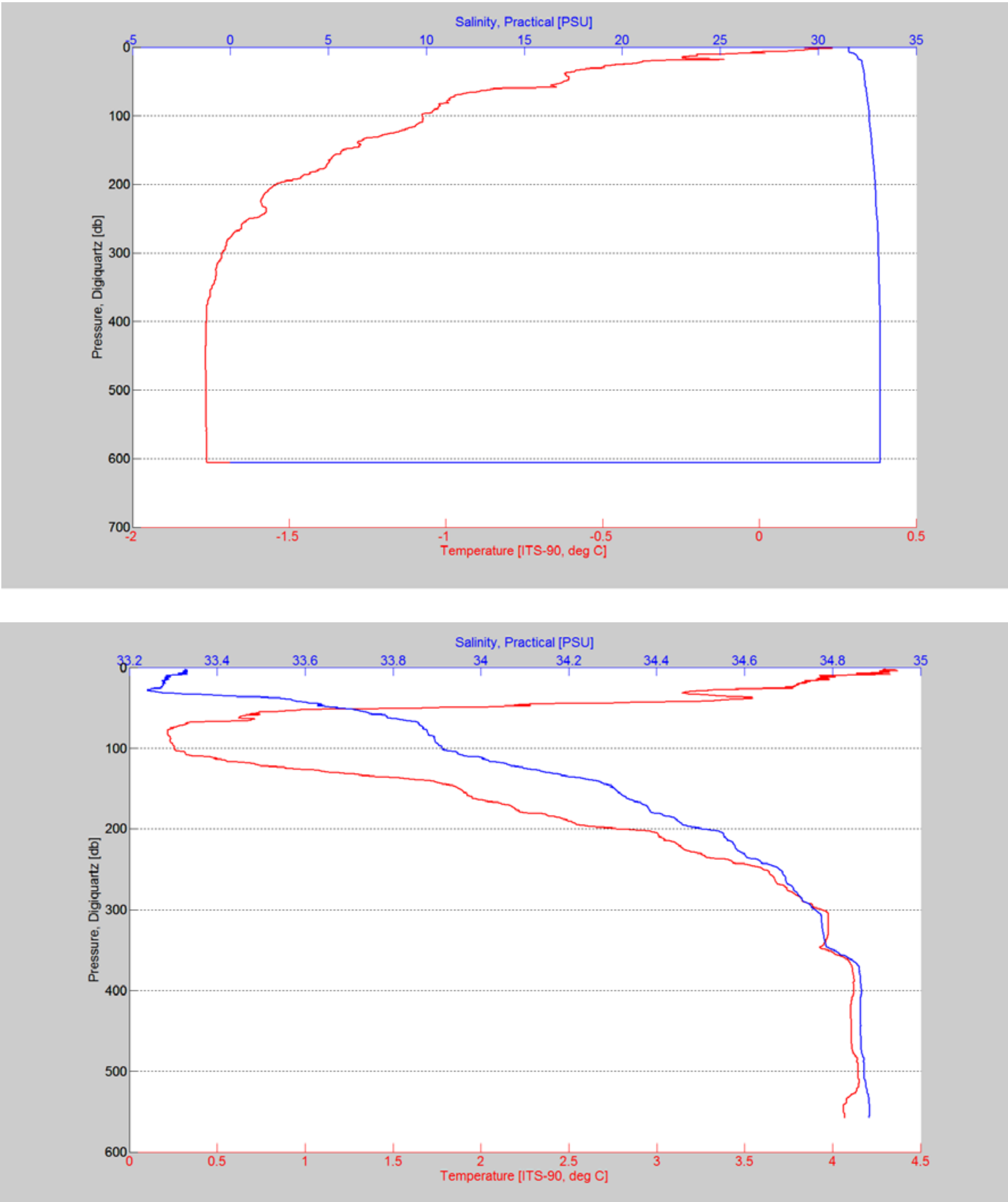


Figure 38.4 Temperature and salinity plot for rosette station 008 (A) and 009 (B) (ROV site 1)

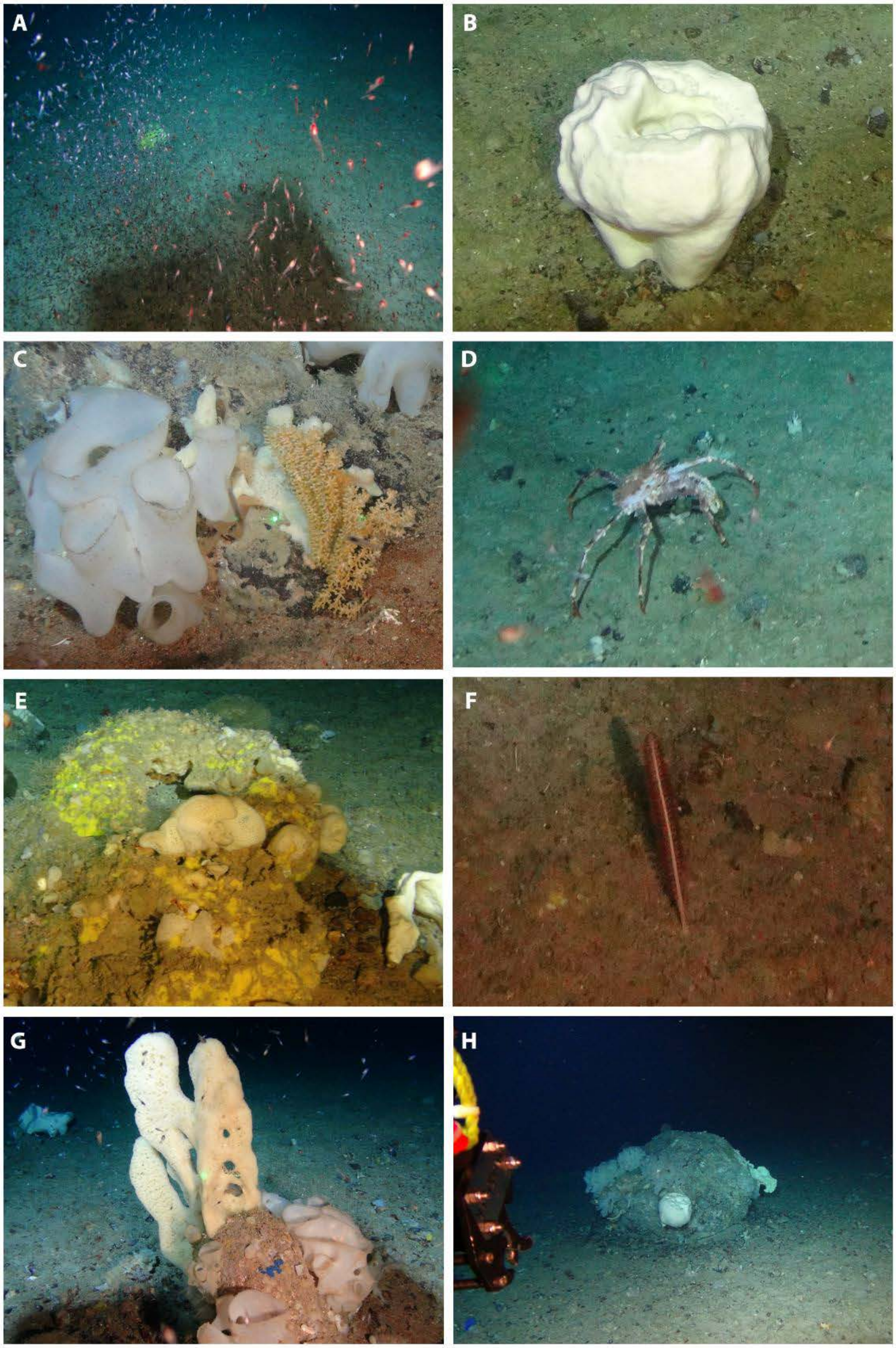


Figure 38.5 Photo-plate of megafauna observed during the ROV video transect at site 1 (NE Hatton Basin):

A) abundant amphipods in the water column, B) Geodia sp., C) Asconema sp. sponge, Acanthogorgia sp. yellow coral, D) Large unidentified crab, E) Geodia sp., Polymastia sp., yellow encrusting sponge, F) Sea pen (Halipteris sp.), G) Mycale sp., H) Boulder with Asconema sp., Geodia sp., and other sponges.

38.3.2 *Site ROV4, SE Hatton Basin carbonate mounds. No ROV dive or direct sampling: multibeam & sub-bottom survey only. July 18th, 2016.*

Following the ROV dive at station ROV1, the ROV pilots informed us that repairs to the ROV would require long delays, with a possible missed a diving day. Overnight, after completing basic station sampling at station ROV1, we carried out a multibeam sonar and sub-bottom profile survey of the reported mound field at station ROV 4, about 15 nautical miles to the south of station ROV1. A mound field, possibly composed of authigenic carbonates or other hydrocarbon seep materials had been reported in this location (Jauer & Budkewitsch 2010).

The multibeam and sub-bottom profile (Figure 38.6 and Figure 38.7) surveys showed extensively ice-scoured relatively flat bottom, acoustically incoherent, with undulating topography, generally similar to the bottom type at station ROV1. No evidence for an authigenic carbonate mound field was observed in multibeam. The sub-bottom profile indicated one small region where a possible, somewhat indistinct, unconformity may have separated undulating topography up to 10 m high from a relatively flat acoustically incoherent bottom below, consistent with the acoustic characteristics of hydrocarbon-seep related mounds elsewhere (Figure 38.7). Box core samples were not taken at this site.

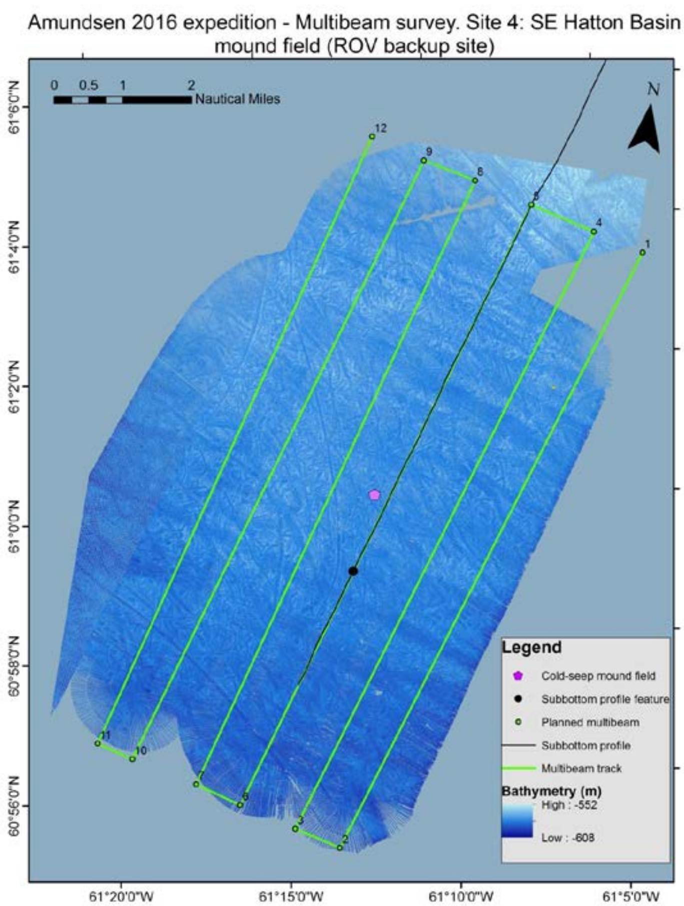


Figure 38.6 Map of site 4 (Cold seep mound) showing multibeam collected during the 2016 CCGS Amundsen expedition

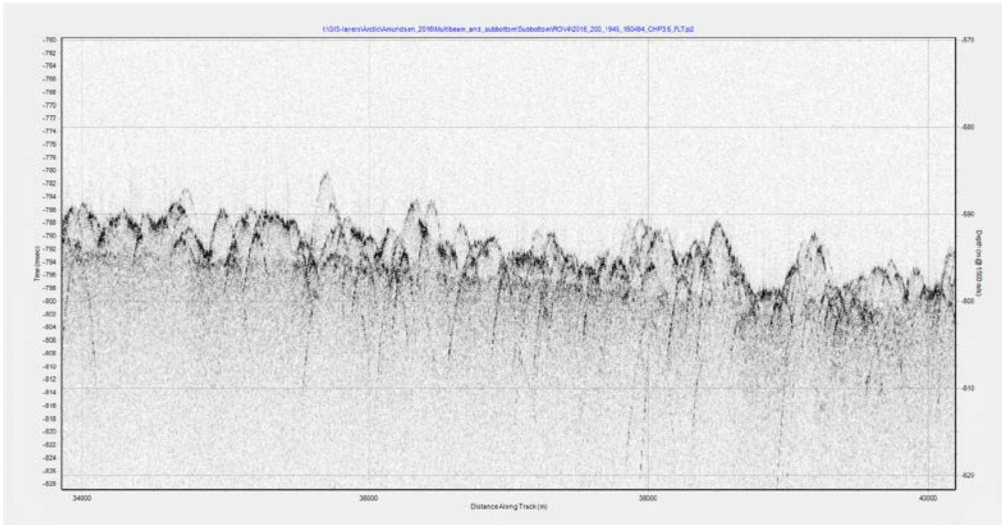


Figure 38.7 ub-bottom profile at point in site ROV 4 (black dot in Figure 38.6) showing potential unconformity between highly rugose surface features and harder reflector below.

This is the area that was interpreted as a potential authigenic carbonate mound field (Jauer & Budkewitsch 2010). The surface topography appears identical to the surface topography of the iceberg scoured till facies found at site ROV1, and throughout the area mapped in site ROV4. No evidence of authigenic carbonate mounds detected in multibeam or sub-bottom.

38.3.3 *Dive 51: NE Hatton Basin Mercers Monster (Site ROV5, 6°26.4154N, -60°39.8628W), July 19th 2016*

Site ROV5 is based upon extensive bycatch of the large gorgonian coral Primnoa resedaeformis in a commercial fisheries trawl in May 2007, a few weeks after three fishing industry groups announced a voluntary fisheries closure in the Hatton Basin region. Multibeam sonar of this region had been collected in 2006.

Because the commercial trawl path was 16 km in length, a 3.5 kHz sub-bottom profile line was recorded along the length of the trawl path, in order to determine the regions with hard bottoms, the preferred bottom types of Primnoa resedaeformis. The sub-bottom profile identified the portion of the trawl path closest to our originally planned ROV transect as a hard-bottom region.

At this site, the planned transect length was 3 km, but due to problems with the ROV in the previous dive, we modified the plan to survey a shorter transect line. Repairs to the ROV following the previous dive delayed the dive until the afternoon, and bottom time was limited to 1 hour, due to the loss of hydraulic pressure.

We prioritized sampling over a video transect, and therefore we stayed in the vicinities of the site where the ROV landed (Figure 38.8), as it was suitable for sampling. As a result, a total of 10 samples of corals and sponges (Table 38.2) were collected at this site, along 158 m of surveyed bottom. The surveyed depths ranged between 626-633 m. Because the ROV had to be recovered so early into the dive, we did not reach the trawl path, and we were unable to directly measure the impact of this commercial fisheries trawl on the Primnoa corals at this site.

Bottom temperature (~560 m) at this site was near 4 °C in both casts (Figure 38.9). Bottom salinity data can also be visualized in Figure 38.9.

Table 38.2 List of samples collected during dive 51 at NE Hatton Basin (site 5)

Sample id	Description	Depth (m)	Latitude (N)	Longitude (W)
A51-001	Dead *Primnoa* skeleton	632	61° 26.4145′	60° 39.8659′
A51-002	Dead *Primnoa* skeleton (2 small pieces)	633	61° 26.4173′	60° 39.8543′
A51-003	Round sponge	632	61° 26.4158′	60° 39.8752′
A51-004	Dead *Primnoa* skeleton	632	61° 26.4166′	60° 39.8777′
A51-005	Dead *Primnoa* skeleton	632	61° 26.4178′	60° 39.8747′
A51-006	Hexactinellid sponge	632	61° 26.418′	60° 39.8794′
A51-007	Fragment of *Geodia atlantica*	632	61° 26.4169′	60° 39.8797′
A51-008	*Mycale* sponge	632	61° 26.4145′	60° 39.8763′
A51-009	Dead *Primnoa* skeleton	632	61° 26.4146′	60° 39.8824′
A51-010	Live *Primnoa*	632	61° 26.4164′	60° 39.8785

Large gorgonian corals (Primnoa resedaeformis) and soft corals (Duva florida) where conspicuous at this site (Figure 38.10). Other corals include one sea pen (Pennatula sp.), several sea mushroom corals (probably Anthomastus sp.), and nephtheid soft corals. Colonies of D. florida were very abundant on gravel and on boulders where Primnoa was found. Some D. florida colonies reach 16 cm in height, while Primnoa colonies reach 60 cm.

Sponges were also a significant component of the benthic fauna at this site, including Geodia spp., glass sponges (Asconoma cf. foliate), and large unidentified lobed sponges. Most taxa were observed attached to hard substrates including boulders, cobble, and dead fragments of Primnoa. Both live and dead Primnoa were collected, as well as sponges including a glass sponge, Mycale sp., and an unidentified species (Table 38.2). Other observed megafauna include sea anemones, shrimp, sea stars, hydroids, and bryozoans.

One live and several dead Primnoa where collected (Table 38.2). The dead Primnoa samples are particularly valuable for paleoceanographic analysis, due to their skeletons made of both calcite and protein.

The bottom type was sandy gravel with cobbles and large boulders. The site surveyed was sloping gently toward the open Labrador Sea, rather than being the flat iceberg-scoured facies within the Hatton Basin. A longer dive in this region, as originally planned, would have allowed us to survey the three geomorphic facies represented here, including the deeper rill-and-gully zone, the gently sloping unscoured zone that we surveyed, and which was sampled by the trawler, and the flat iceberg-scoured zone at the top, and on the Hatton Basin side of the sill.

Box cores/Agassiz trawl

At this site, two box-cores (61°26.449 N, 60°39.867 W, 620 m, and 61°29.35 N, 60°50.33 W, 615 m) were deployed, from which only a small sample was retained. Among the fauna identified in the box-cores are sponges (four unidentified species), soft corals and one sea pen (possibly family Scleroptilidae, not previously reported for the region, Figure 38.16). No Agassiz trawl was deployed at this site.

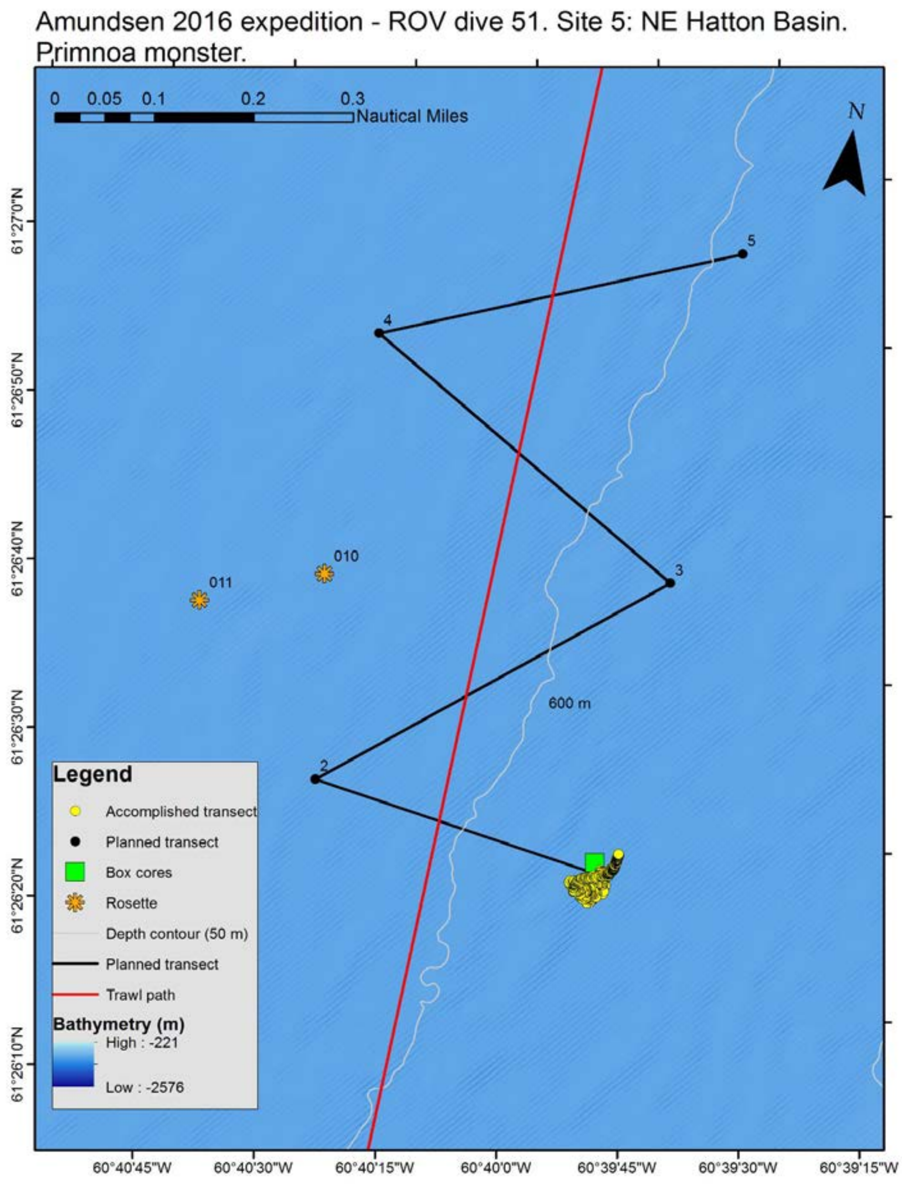
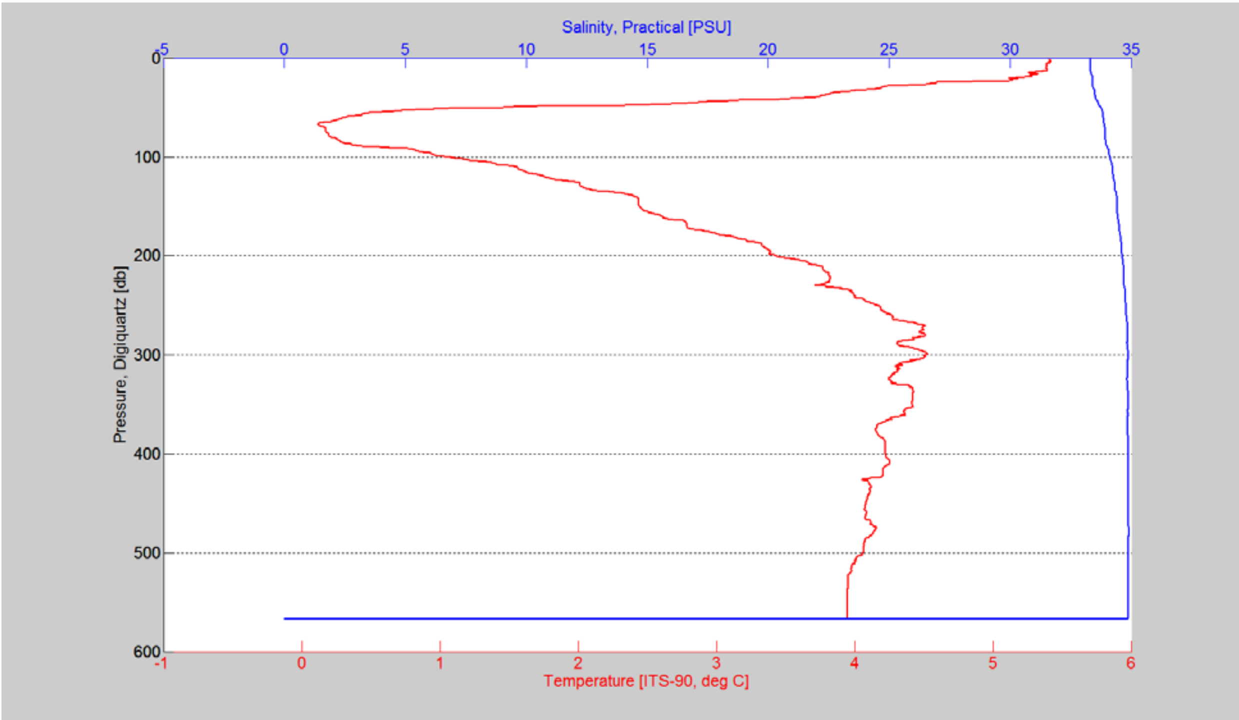


Figure 38.8 Map of site 5 (NE Hatton Basin, Primnoa monster) showing planned and accomplished ROV transect during the 2016 CCGS Amundsen expedition



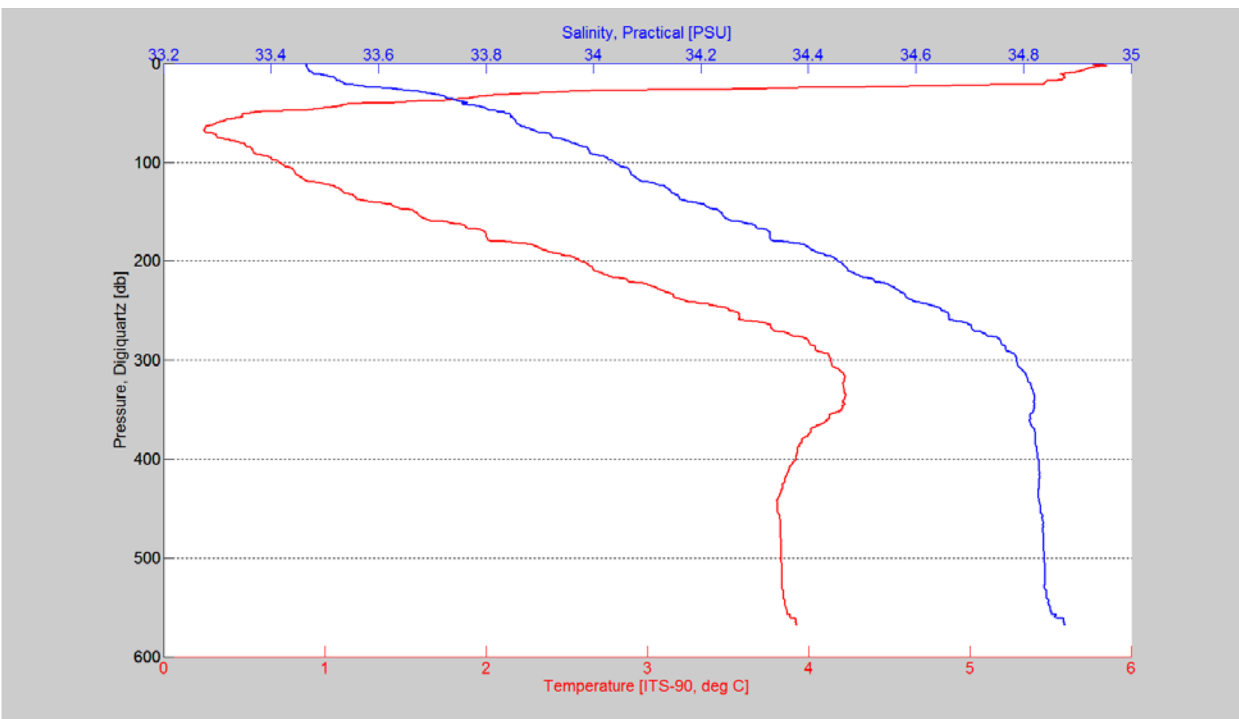


Figure 38.9 Temperature and salinity plot for rosette station 010 (A) and 011 (B) (ROV site 5)

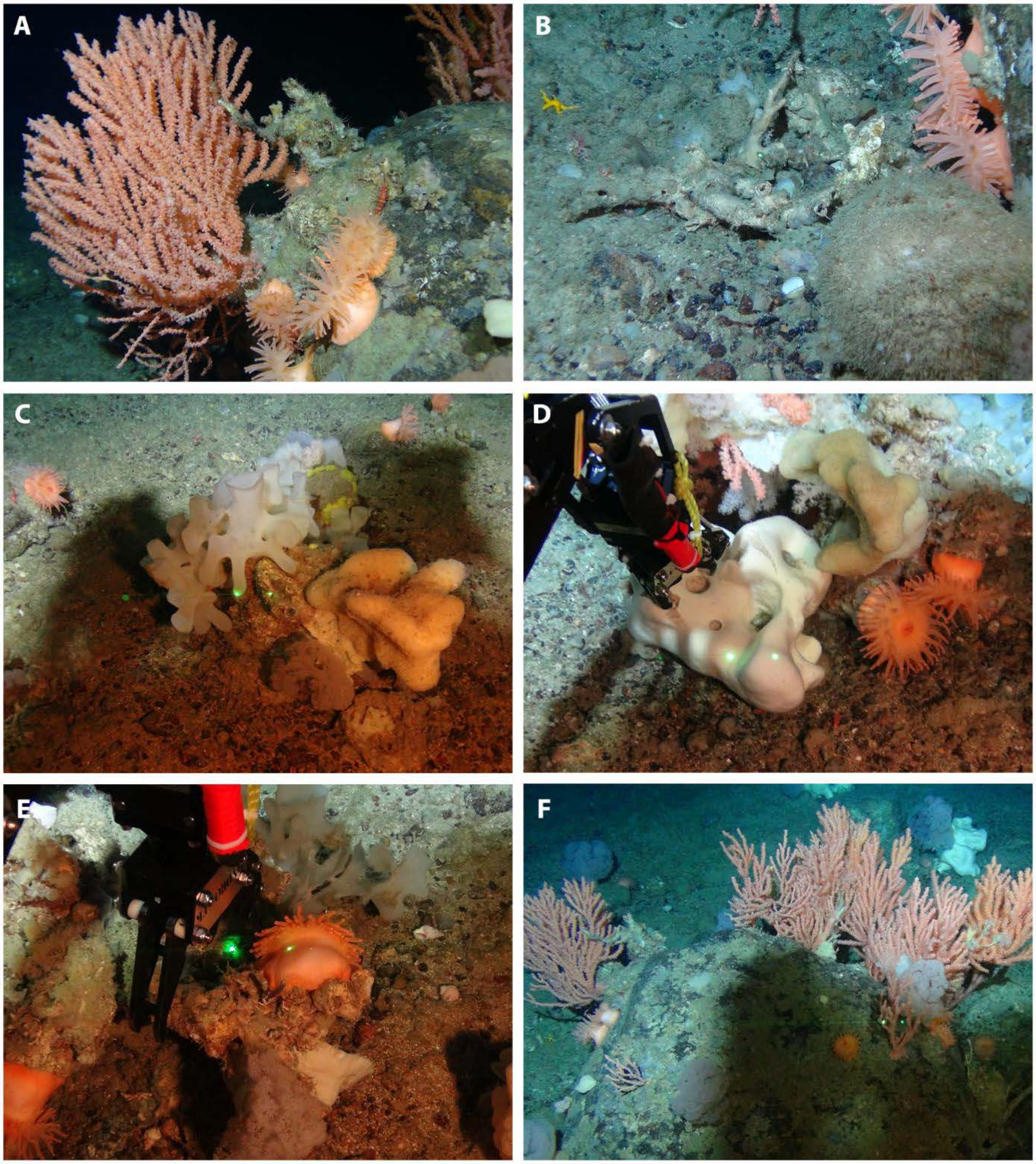


Figure 38.10 Photo-plate of megafauna observed during the ROV video transect at site 5 (NE Hatton Basin Primnoa monster):

A) Boulder with Primnoa, sea anemones, soft corals, shrimp, sponges, dead Primnoa bases, B) Dead Primnoa base, hispid Geodia sp., sea anemones, C) Asconema sp., soft corals, other sponges, sea anemones, D) Geodia sp., Mycale sp., sea anemones, Primnoa, and dead Primnoa skeleton, E) Boulder with Primnoa, soft coral, sea anemones, dead and Primnoa bases.

38.3.4 *Site ROV2. July 20, 2016. NE Saglek Bank suspected cold seep (60°19.302 N, - 62° 12.408)*

No ROV dive was completed at the site of the suspected cold seep, as the ROV required more than one full day's worth of repairs after the first two short dives.

At this site, we completed a multibeam sonar and sub-bottom profile survey (Figure 38.11) in an effort to locate the source of the oil slick observed at the surface in Radarsat imagery (Budkewitsch et al. 2014). Our hope was that if oil or methane gas were actively seeping from the seafloor, they would be visible in the multibeam sonar, and possibly also within the sub-bottom profile. We were also expecting to possibly find pockmarks on the surface if there was active gas venting. Neither the water column sonar nor the multibeam sonar and sub-bottom profiler revealed any direct evidence of the oil seeping from the bottom. Scientific crew on the deck during the collection of box-cores, however, did see oil sheen on the surface of the water.

Water sample collection at this site included two CTD and rosette casts, which included water samples that will be analyzed for dissolved methane (Punshon et al. 2014). Plankton collected at this site may also show petroleum residues on analysis. Triplicate box cores were collected at this site. The box cores yielded muddy coarse sand sediment, that also included bryozoans, and more significantly, abundant thyasirid bivalves, which are hypothesized to host methanotrophic bacteria that feed upon the hydrocarbons emanating from the bottom.

When it became apparent that an ROV dive at this site would not be possible on July 20th, we proposed skipping this site entirely, in order to complete more dives on the coral sites to the east and northeast of this site. Even had we located the source of the hydrocarbon seep during a dive (which was never guaranteed), we would not have had a day free to complete another dive during which to sample the seep using the elevator. Furthermore, the ROV performance was unreliable enough that a successful dive with the ROV elevator was doubtful.

En route to ROV site 3, we collected additional multibeam data, and two additional box cores, at a site identified from seismic data as possible cold seep mound (Jauer & Budkewitsch 2010; site ROV2b in the dive plan). Closer inspection in multibeam and sub-bottom profile, and box coring, revealed this possible mound to be a ridge composed of winnowed muddy sandy gravel, similar in composition to the winnowed ice-contact sediments seen at Station ROV2, and at station ROV1. We found no evidence of seabed structures produced by hydrocarbon seep-related authigenic carbonates in these locations.

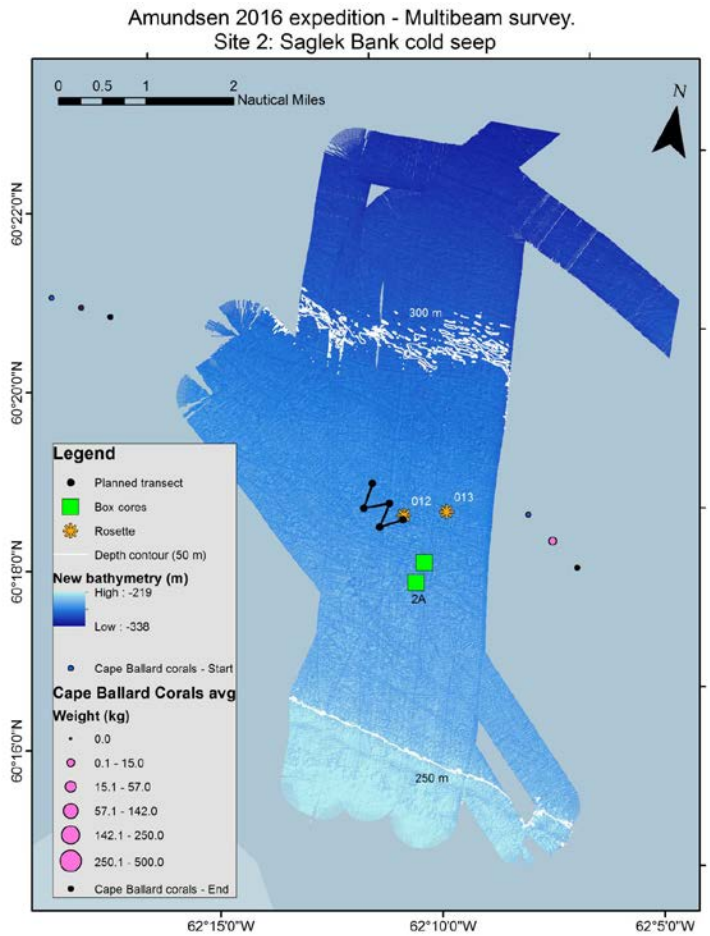


Figure 38.11 Map of site 2 (Saglek Bank cold seep) showing planned ROV transect, multibeam surveyed, box-cores and rosette samples obtained during the 2016 CCGS Amundsen expedition

38.3.5 *Dive 52: NE Saglek Primnoa Rich (Site ROV3, 60°28.0348N, -61°16.687W), July 21st 2016*

At this site, the planned transect length was 2.5 km, but only 1 km was surveyed (Figure 38.12 and Figure 38.13) due to very strong currents that refrained the dive to carry on. The surveyed depths ranged between 461-473 m. Bottom temperature (~420 m) at this site was ~4 °C (Figure 38.14). Bottom salinity data can also be visualized in Figure 38.14. Abundant amphipods and marine snow were noticed in the water column during this dive.

This site was dominated by large densely encrusted boulders populated with corals (*Primnoa resedaeformis*, *Paragorgia arborea*, *Duva florida*), hydrozoans, bryozoans, sea anemones, and sponges (*Geodia* spp., *Asconema* cf. *foliate*, *Phakellia* sp., Figure 38.15). *Primnoa resedaeformis* colonies (122 cm x 134 cm) were large and frequently observed on boulders, and smaller (i.e. juvenile) colonies on cobble. Colonies of *Paragorgia* sp. where infrequent with only 3 small colonies noted (< 53 cm in height).

Some *P. resedaeformis* colonies had parasitic hydroids growing on them. Several colonies were tipped over, possibly due to a combination of heavy weight and strong currents; although the possibility of physical contact with fishing gear in this heavily fished area should not be discarded. Dead fragments of *P. resedaeformis* were also observed at this site, but much less than during the previous dive at NE Hatton Basin (Site 5, dive 51).

Colonies of the soft coral *Duva florida* were large and abundant, reaching up to 30 cm in height and often growing on cobbles and pebbles. Other soft corals species were noted (nephtheids, *Anthomastus* sp.) throughout the dive particularly on cobble and pebbles. One sea pen colony (*Anthoptilum grandiflorum*) was also observed.

Many sponge species were also observed including *Geodia* spp., glass sponges (*Asconoma* cf. *foliata*), *Polymastia* spp., vase sponges (*Phakellia* sp.) and a large unidentified lobed sponge. Other invertebrates included echinoderms (mud stars), decapods (shrimp, squat lobster, crab), and sea anemones. Most taxa were observed attached to hard substrates including boulders, cobble and dead fragments of Primnoa. A live Primnoa colony was collected, along with two sponge species (Table 38.3). Dead Primnoa at this site were considerably less common than in the small portion of the site ROV5 dive that was completed.

Fish observed during this dive include grenadier (Family Macrouridae), Greenland cod (Gadus ogac), spotted wolfish (Anarhichas minor), redfish (Family Trachichthyidae), and a skate (Rajidae). Interestingly, the Atlantic cod individual was observed resting beneath a boulder, in a cavity very similar to those used by wolffish for denning (Figure 38.15).

Boulders were colonized by Primnoa, hydroids, bryozoans, sea anemones, and sponges (encrusting yellow sponge), with colonies to 1-1.5 m height common. In the region of the ROV transect through which the scientific survey trawl passed, many of the Primnoa corals were inclined about 15-25 degrees to the southeast, in the direction of the prevailing currents, but also in the direction that the trawl swept the bottom. No trawl door scars or other direct evidence of trawl damage was observed.

Three small colonies of Paragorgia arborea where observed with the largest reaching 53 cm in height - adult colonies of this species can reach up to 3 m. High bycatch values of this species were observed in Northern Shrimp Survey trawls in shallower water close to this site, but were not recorded in the trawl that this ROV dive crossed. We also observed two colonies of white Paragorgia sp., which is much rarer than the red form of this gorgonian, and has not been recorded in the northwest Atlantic north of the Stone Fence, in Nova Scotia.

Table 38.3 List of samples collected during dive 52 at NE Hatton Basin Primnoa coral-rich area (site 3)

Dive	Samples	Description	Depth (m)	Latitude (N)	Longitude (W)
52	R52-1	Live *Primnoa*	412	60° 28.1072′	61° 17.2367′
52	R52-2	*Polymastia* sponge	412	60° 28.1092′	61° 17.2354′
52	R52-3	Vase sponge	412	60° 28.1123′	61° 16.9721′

Box cores/Agassiz trawl

At this location, three box-cores (60°27.968 N, 61°16.702 W, 452 m, 60°27.769 N, 61°16.713 W, 427 m, and 60°28.121 N, 61°17.336 W, 401 m) were deployed at two nearby sites, from which only a small sample was retained. Among the fauna identified in the box-cores are: soft corals (e.g. *Anthomastus* sp., nephtheid corals), *Primnoa resedaeformis* (mainly dead skeleton), sponges (*Polymastia* sp., encrusting sponge, *Tentorium* sp., *Phycalia* sp.), polychaetes, hydroids, zoanthids, and bryozoans. A stoloniferous octocoral growing on pebbles and cobbles (Figure 38.16) might represent the first record of the species (and family) for this region. These samples of taxonomic interest were preserved both frozen at -20 °C and in ethanol 95% for molecular analysis. A detailed analysis of the specimens will confirm its status. No Agassiz trawl was deployed at this site.

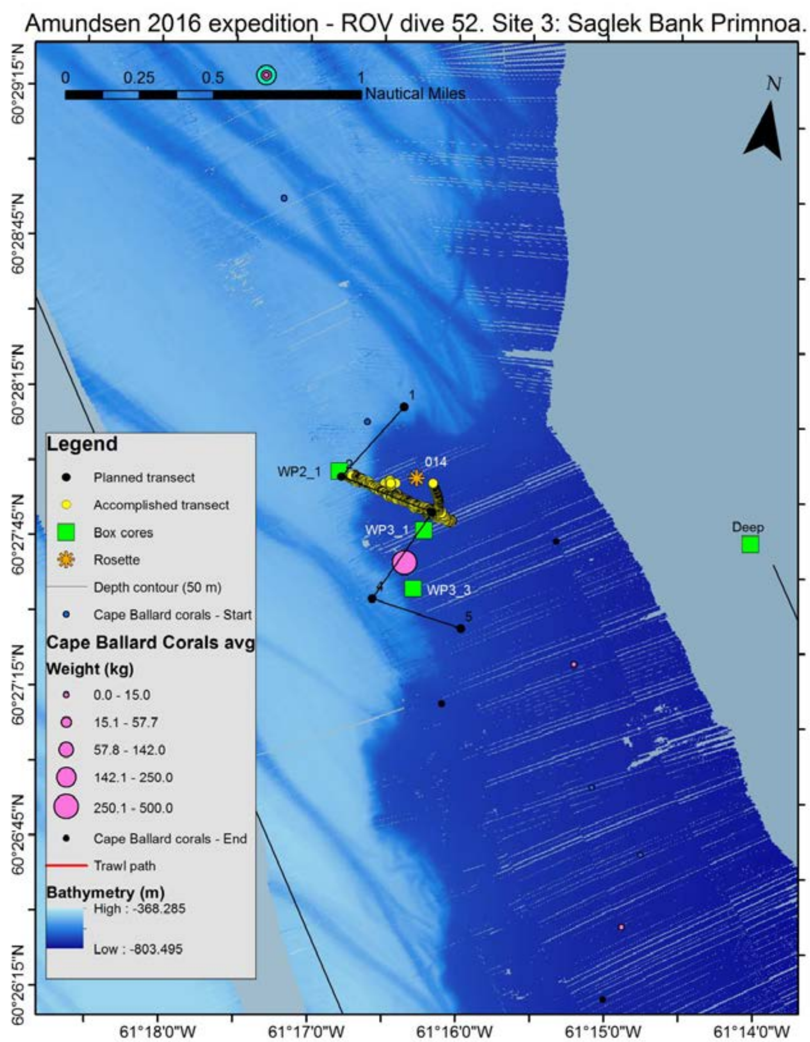


Figure 38.12 Map of site 3 (NE Hatton Basin, Primnoa monster) showing planned and accomplished ROV transect during the 2016 CCGS Amundsen expedition

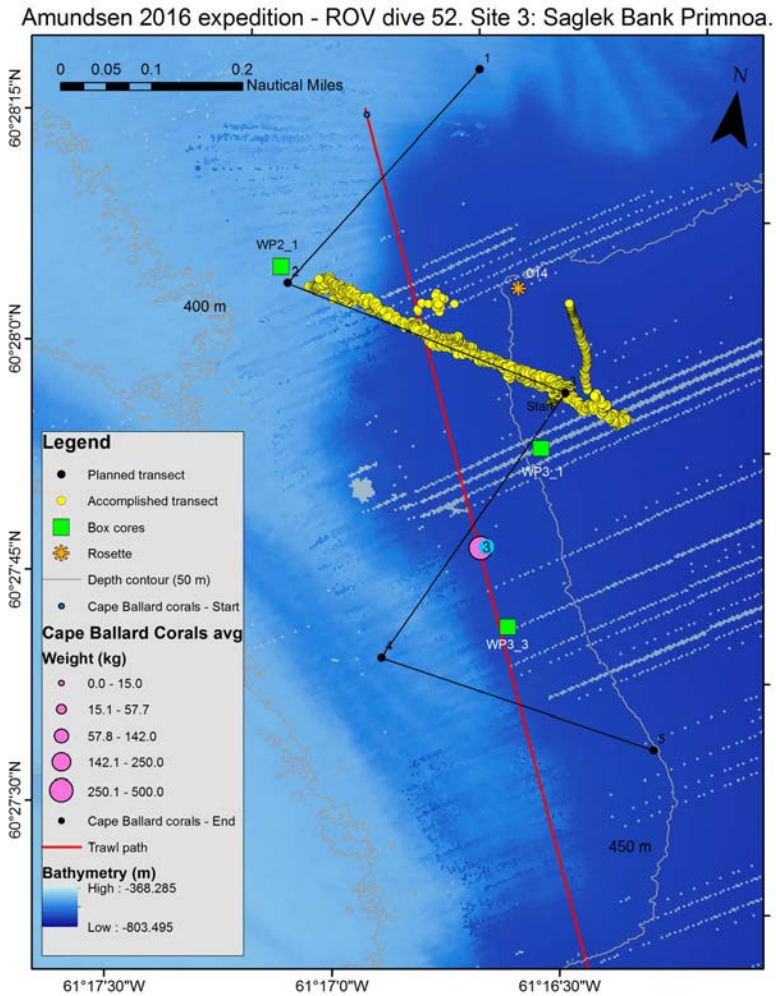


Figure 38.13 Close-up of map of site 3 (NE Hatton Basin, Primnoa monster) showing planned and accomplished ROV transect during the 2016 CCGS Amundsen expedition

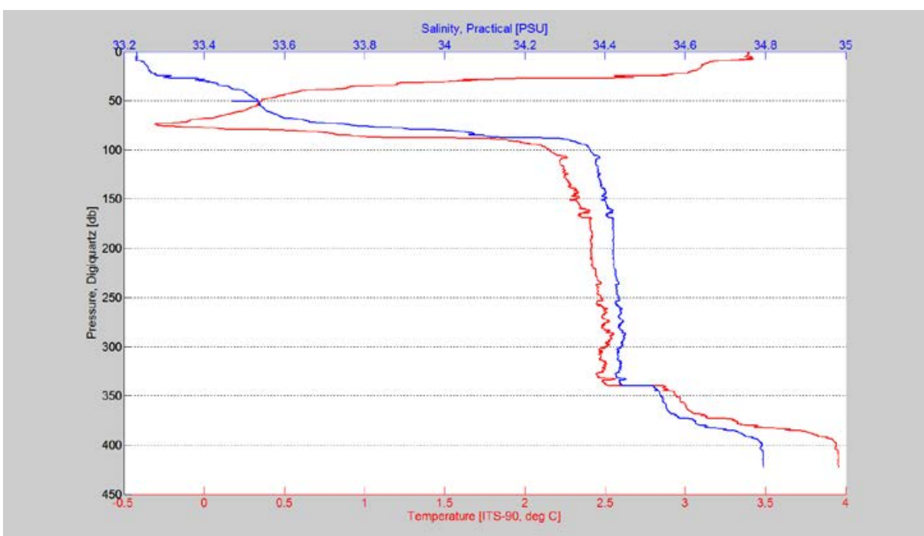


Figure 38.14 Temperature and salinity plot for rosette station 014 (ROV site 3)

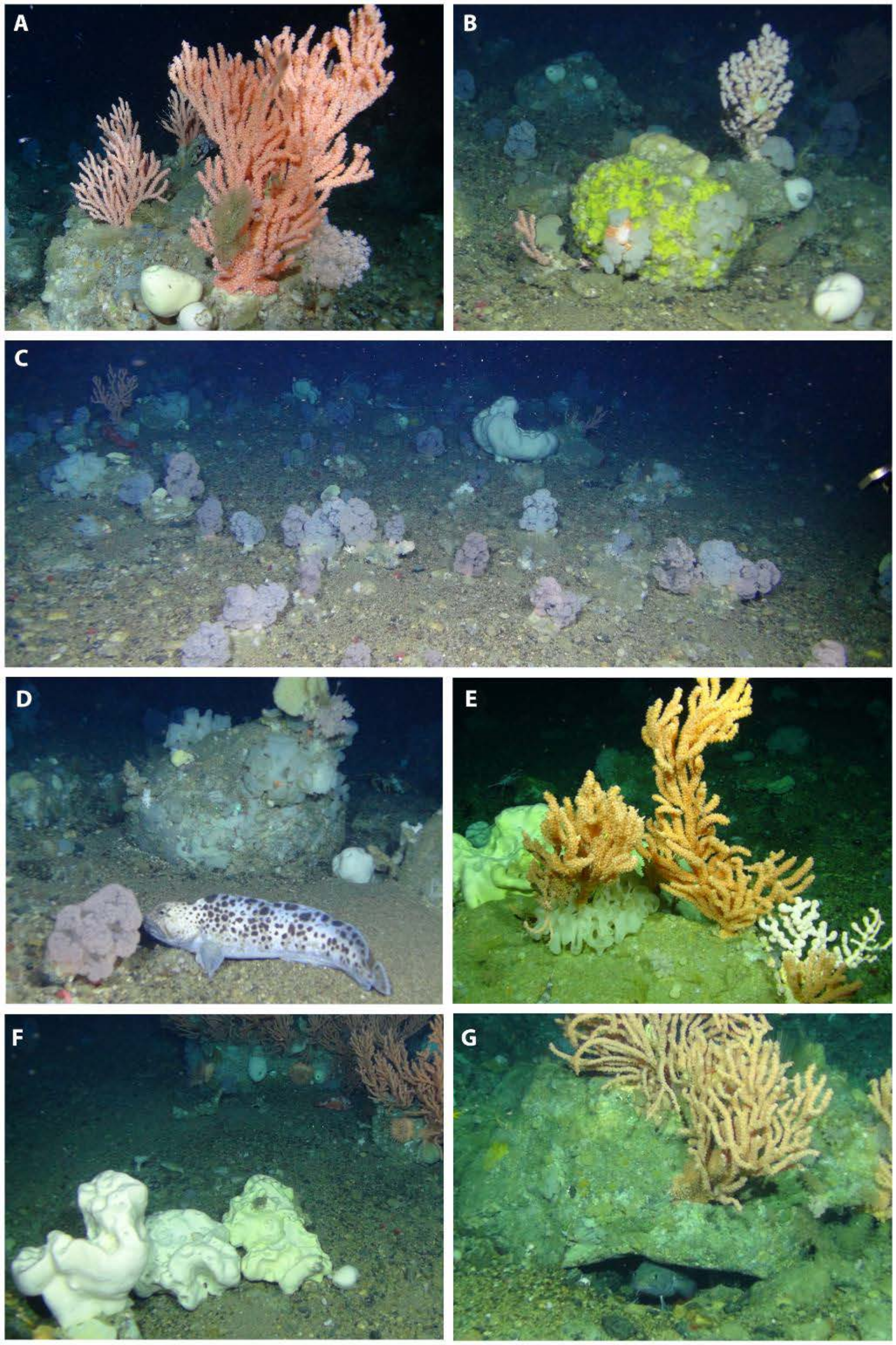


Figure 38.15 Photo-plate of megafauna observed during the ROV video transect at site 3 (Saglek Primnoa rich):

A) Boulder with Primnoa, soft corals, hydroids, Geodia sp., and other sponges, B) Sponge or boulder encrusted with yellow sponge, small Primnoa sp., Paragorgia sp., C) Soft corals (likely Duva florida), Primnoa sp., Geodia sp., D) Northern Spotted Wolfish, soft corals and sponges, E) Boulder with Primnoa sp., Geodia sp., Asconema sp., Paragorgia sp.; F) Irregular Geodia sp. with varying colour morphs, G) Gadus sp. (cod) under boulder with Primnoa attached

Figure 38.16 Main corals found in the box-cores deployed at ROV sites 3 (most) and 5 (J).

A) Anthomastus sp., B) soft coral (Nephtheidae), C) stoloniferous octocoral, D) miscellaneous of samples including branch of Primnoa resedaeformis and cobbles, E) nephtheid soft coral still alive, F) larger Anthomastus sp., G-I) probably hydrocorals (Stylasteriidae), J) sea pen (Scleroptilidae), K-L) Partially dead colony of Primnoa resedaeformis, M-N) bryozoans, O) sponge and soft coral, P) rocks in the box core.

38.3.6 *Dive 53: SE Baffin Shelf (Site ROV6, 62° 59.181 N, -60° 37.7177 W), July 22nd 2016*

At this site, the planned transect length was 2.8 km, but only ~260 m were surveyed (Figure 38.17) due to problems with the ROV cage camera. The surveyed line depth ranged between 492-500 m. Bottom temperature (~450 m) at this site was ~3.5 °C (Figure 38.18). Bottom salinity data can also be visualized in Figure 38.18.

Sponges were the most commonly observed taxa throughout this dive, with *Asconema foliata*, *Polymastia* spp., and *Geodia* spp. being the most abundant species observed. In general, sponges were noticeable smaller throughout the dive with the exception of a few isolated colonies of *Geodia* spp. (up to 50 cm in diameter) and of *A. foliate* (~45 cm in diameter) – the latter was observed with juvenile basket stars (*Gorgonocephalus* sp.), hydrozoans, crinoids, and amphipods living in the oscula of this colony (see Figure 38.15).

In terms of corals, only small soft corals where observed (Nephtheid spp., *Anthomastus* sp.) along with one sea pen (*Pennatula* sp.), with no large gorgonian corals documented. Other observed taxa included hydrozoans, basket stars (*Gorgonocephalus* sp.), ceriantharians, and bivalves.

Individual redfish (Family Trachichthyidae) where commonly seen throughout the dive, and a polar sculpin (*Cottunculus microps*). Evidence of recent fishing activities where observed including trawl door marks, fragments of *A. foliate* drifting across the sea floor, and numerous fishing boats noted in the vicinity on the ship's sonar.

Table 38.4 List of samples collected during dive 53 at NE Saglek Bank (site 3)

Samples	Description	Depth (m)	Latitude (N)	Longitude (W)
R53-1	Round sponge	500	62° 59.1962′	60° 37.7253′
R53-2	Glass sponge	500	62° 59.196′	60° 37.7249′

Box cores/Agassiz trawl

At this location, two box-cores (63°00.168 N, 60°38.565 W, 457 m, 63°00.23 N, 60°38.488 W, 457 m) were deployed, from which only small samples were retained (mainly rocky). Among the fauna identified in the box-cores are: sponges, hydroids, soft corals, tube worms, bryozoans, and tunicates. The Agassiz trawl was deployed once at this site. Sponges were very abundant in the trawl, especially the hexactinellid *Asconema foliata* (1.65 kg, Figure 37.20). Other organisms include *Geodia* sp., *Polymastia* sp., unidentified sponges, hydroids, soft corals, sea anemones, polychaetes, gastropods, bivalves, chitons, isopods, amphipods, brittle stars (e.g. *Ophiacantha bidentata*), basket stars (*Gorgonocephalus* sp. inside the sponges), bryozoans, and tunicates.

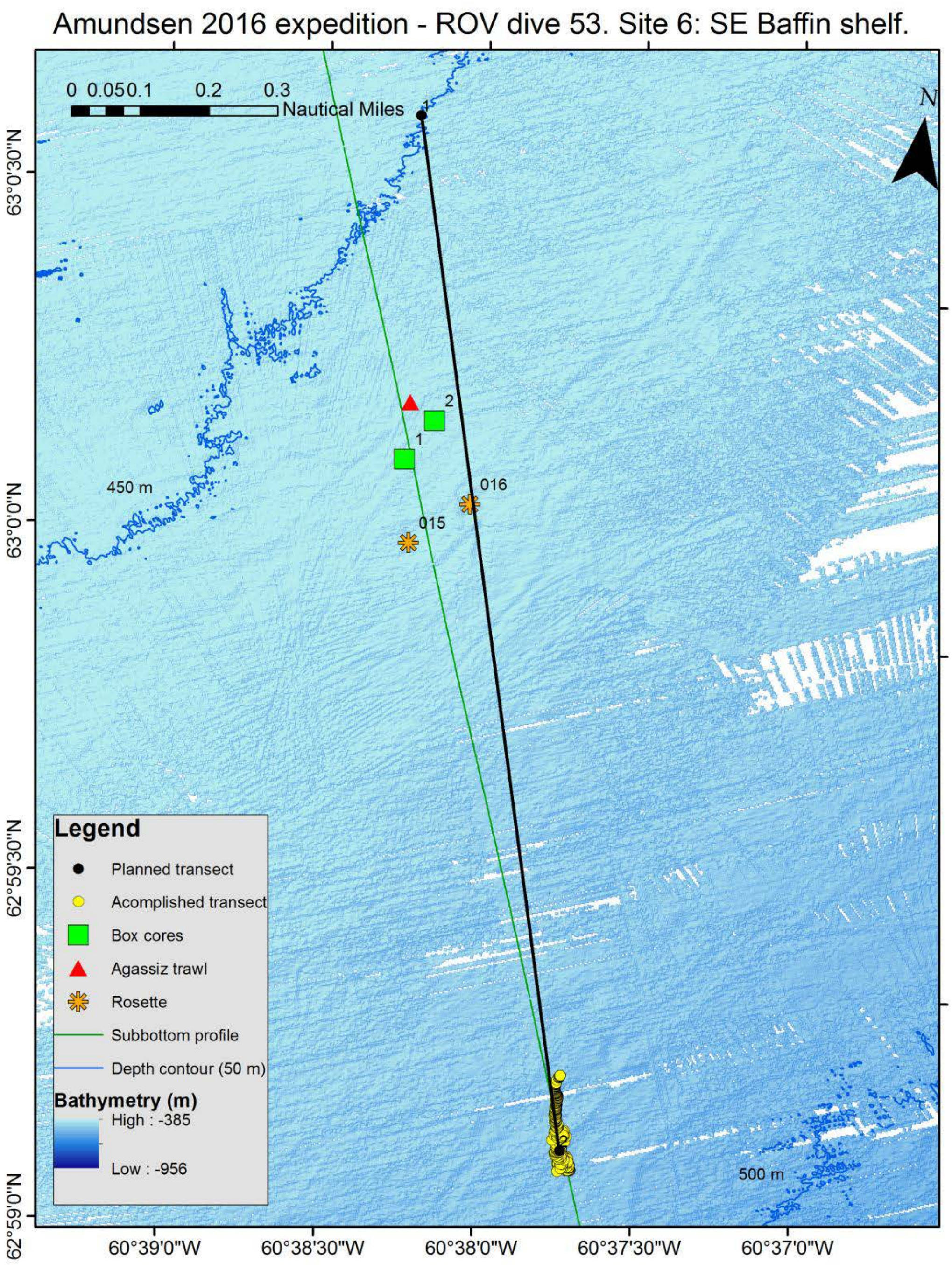


Figure 38.17 Map of site 6 (SE Baffin shelf) showing planned and accomplished ROV transect during the 2016 CCGS Amundsen expedition

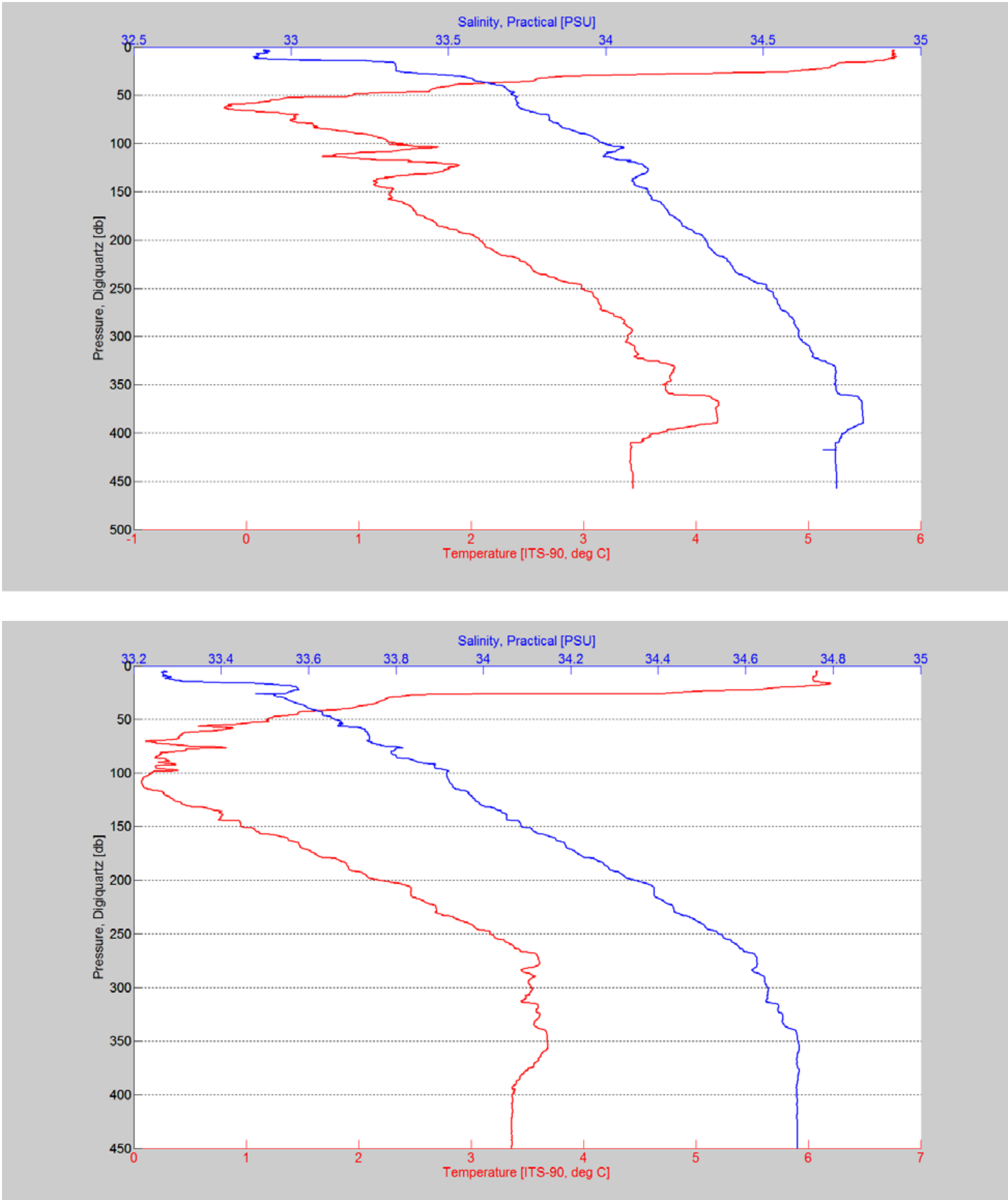


Figure 38.18 Temperature and salinity plot for rosette stations 015 (A) and 016 (B) (ROV site 6)

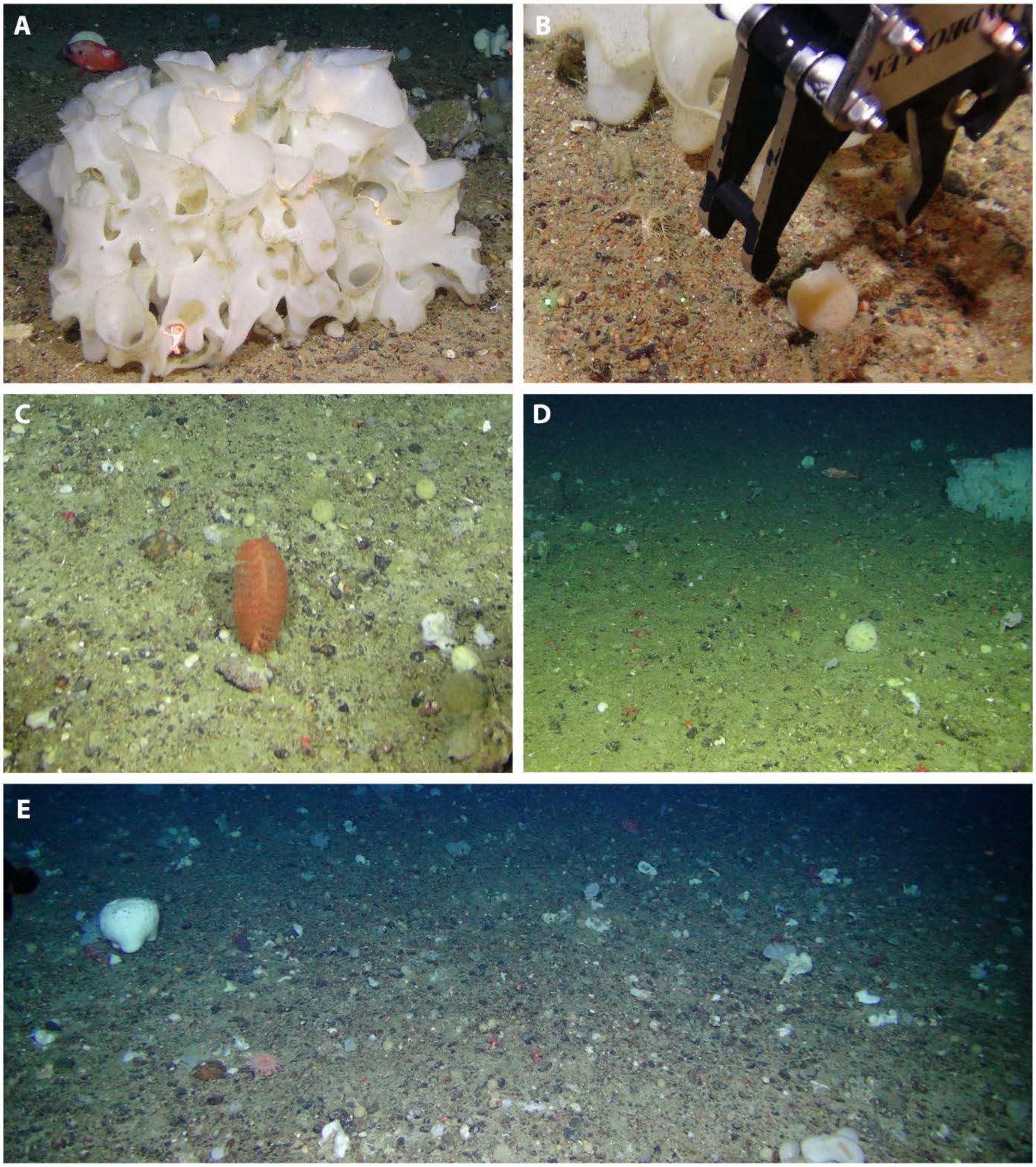


Figure 38.19 Photo-plate of megafauna observed during the ROV video transect at site 6 (SE Baffin shelf):

A) Asconema sp., redfish, bryozoans, echinoderms, B) Sampling Polymastia sp., C) Sea pen (possibly Pennatula grandis), D) Polymastia sp., Asconema sp., redfish, E) Geodia sp., other sponges, gravelly bottom

Figure 38.20 Main organisms collected by the Agassiz trawl deployed at site 6

38.3.7 *Dive 54: Disko Fan 1 (Site ROV7, 67° 58.1268 N, -59° 30.24 W), July 24th 2016*

Prior to arrival at this dive site, we collected two sub-bottom profiles at 4 kt. passing over the region to be surveyed using the ROV. These sub-bottom profiles (Figure 38.21) showed small ridges of unstratified sediment superimposed on the Disko Fan, with small valleys containing stratified sediment between them. Ridges were mostly in the 5-10 m height range, with one ridge approximately 15 m in height approximately 3 nautical miles from the intended dive site. A second line measured perpendicular to slope, following one ridge, found, not surprisingly, an even slope of unstratified sediments.

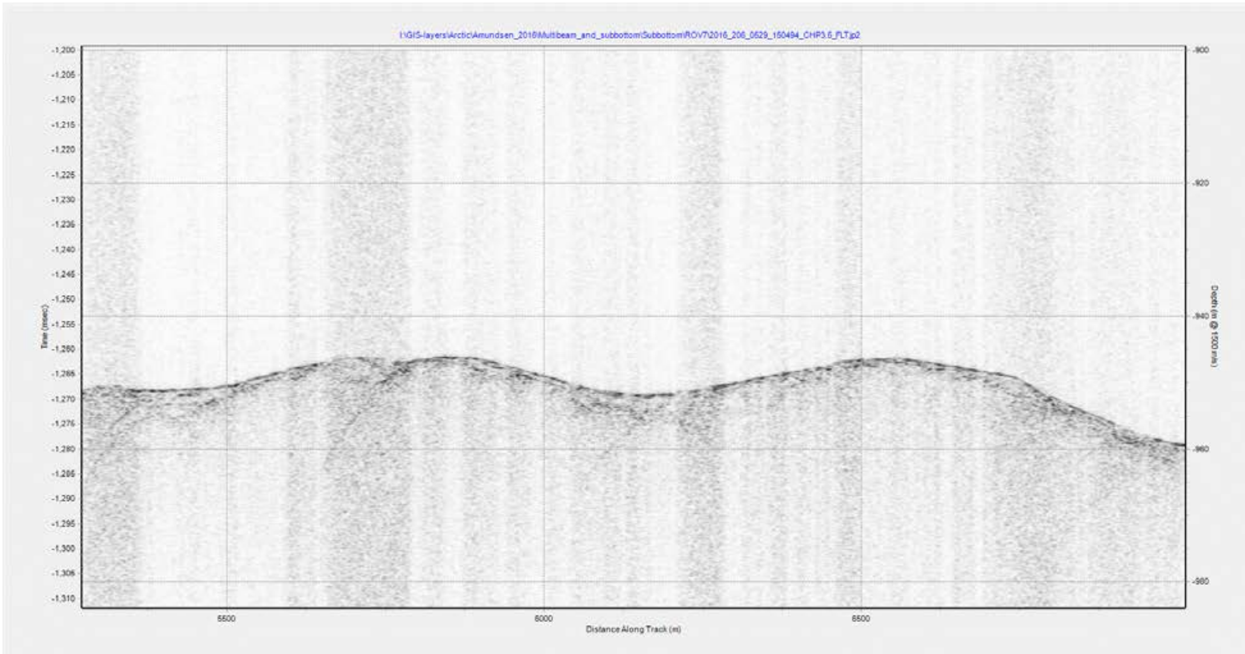


Figure 38.21 Close-up of subbottom profile at site ROV7, showing the profiles of the small ridges targeted by the piston cores. Two piston cores were collected from ridge A (2016804-014, 2016804-015), and one piston core (2016804-016) from ridge B.

Visual observations on the bottom indicated that corals were more common on small topographic rises, raising the hypothesis that the corals had created the topographic rises by baffling sediment. During both ROV dives, we selected sites for piston coring with abundant corals in large patches that could be targeted by the piston core, and that co-incided with two ridges identified on the sub-bottom profile and multibeam sonar.

At this site, the planned transect length was 1.7 km, but only ~271 m were surveyed (Figure 38.22) in search for appropriate locations for box-cores and piston cores. The surveyed line depth ranged between 924-941 m. Bottom temperature (~900 m) at this site was ~1 °C (Figure 38.23). Bottom salinity data can also be visualized in Figure 38.23

Instead of starting the dive at waypoint 1 where sampling could not take place (buffer zone), the ROV landed at waypoint 2, where dense colonies of Keratoisis sp. were readily observed (Figure 38.24). Colonies were seen forming dense patches in a muddy substrate, as observed in 2013 at a nearby location. Although live colonies were the most common form of this coral, fragments of dead colonies were also observed as we approached the trawl path from a DFO survey that occurred in 1999 in this area. There were no signs of recovery, as no colonies were observed in the area with dead colonies. A gillnet was also encountered near a coral patch, restating the exposure of these colonies to different types of fishing gear.

Crinoids and sponges were commonly observed living on Keratoisis sp. colonies. Other observed invertebrates include sea pens (probably Pennatula grandis and Anthoptilum grandiflorum), sponges (e.g. Asconema sp., and unidentified taxa) sea stars (e.g. Solaster sp.), and yellow parasitic zoanthids overgrowing colonies of Keratoisis sp. Skates, Greenland halibut

(Reinhardtius hippoglossoides), polar sculpin (Cottunculus microps), and rocklings (Gaidropsarus cf. argentatus) are among the fish observed during this dive.

A total of four samples were collected during this dive, including live and dead Keratoisis sp, skeletons from a trawl path in order to look to for Keratoisis sp. recruits, the parasitic zoanthid, and sponges (Table 38.5). Sampled colonies of Keratoisis sp. showed bioluminescence when brought back on board and inspected in the dark (Figure 38.25).

Table 38.5 List of samples collected during dive 54 at Disko Fan (site 7)

Samples	Description	Depth (m)	Latitude (N)	Longitude (W)
R54-1	Dead *Keratoisis* skeleton from trawl path	940.1	67°58.0897	-59°30.2500
R54-2	Yellow encrusting zoanthid	933	67°58.1763	-59°30.2403
R54-3	Live *Keratoisis* colony (branches)	923.7	67°58.1793	-59°30.1983
R54-4	*Keratoisis* skeleton	932.2	67°58.1940	-59°30.2596

Box cores/Agassiz trawl

At this location, four box-cores (ROV waypoint 14: 67°58.189 N, 59°30.287 W, 914 m, 67°58.181 N, 59°30.242 W, 909 m, and ROV waypoint 2: 67°58.093 N, 59°30.231 W, 919 m, and 67°58.056 N, 59°30.120 W, 921 m) were deployed. One of the box-cores collected a good amount of bamboo corals (*Keratoisis* sp., Figure 38.26) as seen during the ROV dive. The Agassiz trawl was not deployed at this site.

Piston cores

Piston cores at site ROV7 targeted thickets of the bamboo coral forests, to measure the depth of carbonate and siliciclastic sediment accumulation where the corals were growing, and to determine the length of time over which the coral forests have been growing. Two cores were collected from adjacent thickets on one ridge, while a third core was collected from a different coral thicket on a ridge approximately 500 m to the southeast (Table 38.6). Cores will be archived and processed at the Atlantic Geoscience Centre in Dartmouth, Nova Scotia.

Table 38.6 Piston cores deployed at ROV site 7

Core number	Latitude	Longitude	Depth (m)	Penetration depth (cm)
2016804014	67° 58.152 N	059 30.171 W	913	201
2016804015	67° 58.183 N	059 30.239 W	915	155
2016804016	67° 58.073 N	059 29.390 W	874	128

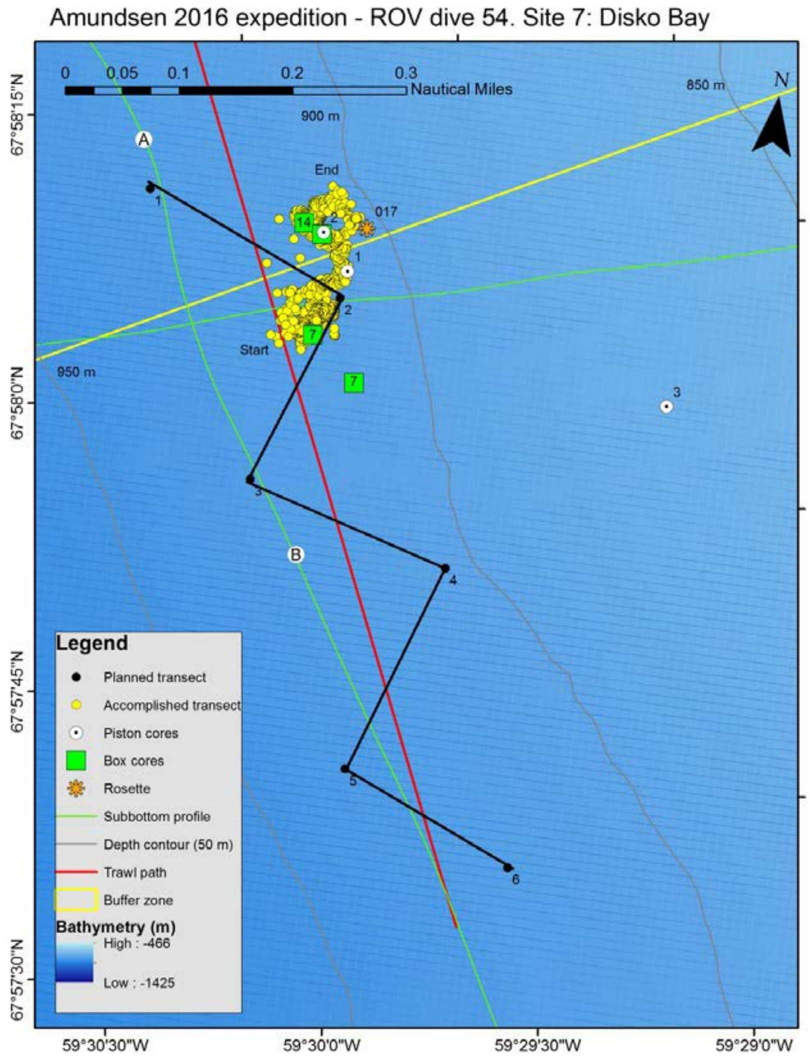


Figure 38.22 Map of site 7 (Disko Fan, Dive 54) showing planned and accomplished ROV transect during the 2016 CCGS Amundsen expedition. A and B indicate subbottom profile positions shown in figure 21

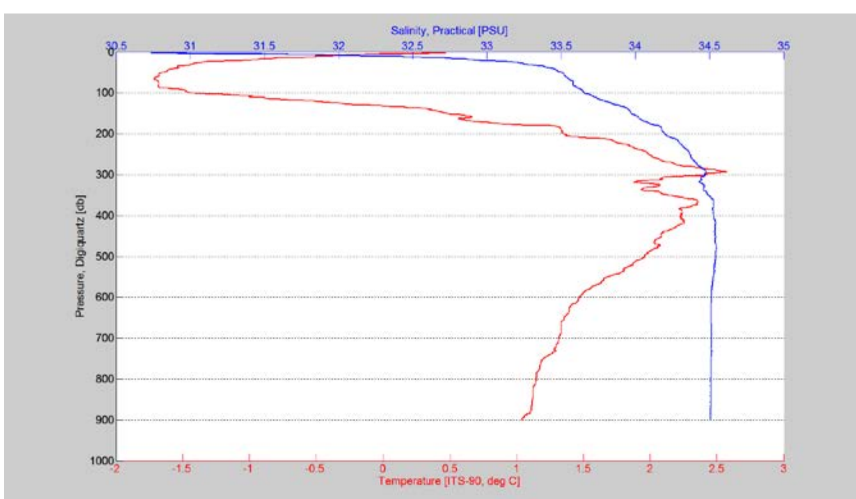


Figure 38.23 Temperature and salinity plot for rosette station 017 (ROV site 7, dive 54)

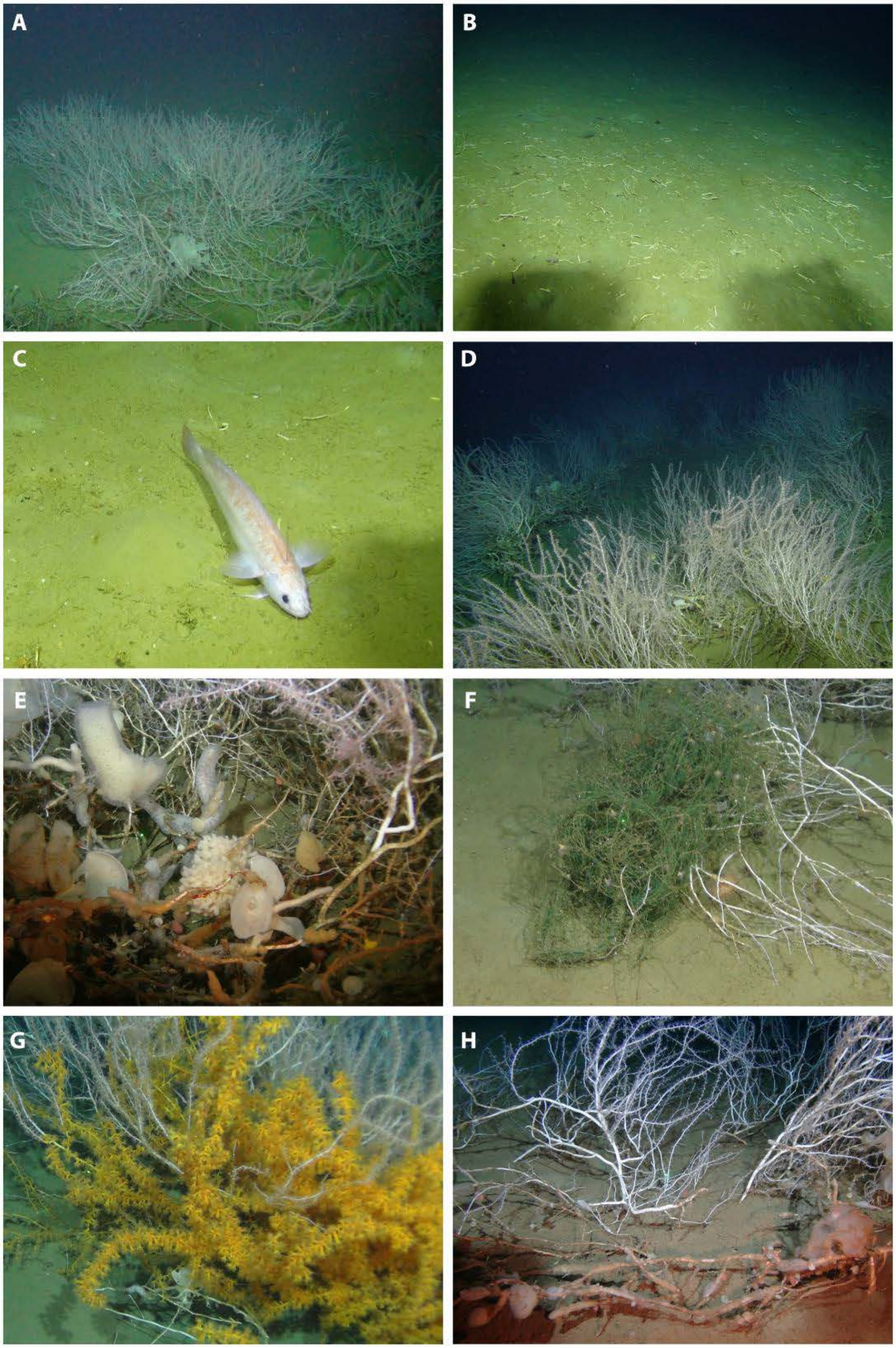


Figure 38.24 Photo-plate of megafauna observed during the ROV video transect at site 6 (SE Baffin shelf):

A) Keratoisis colonies, B) Broken corals near the trawl path, C) Fish, D) Keratoisis sp. bush, E) Sponges on dead coral skeleton, F) Fishing line caught in corals, G) Parasitic zooanthid growing on Keatoisis sp., H) Dead coral skeleton with attached sponges

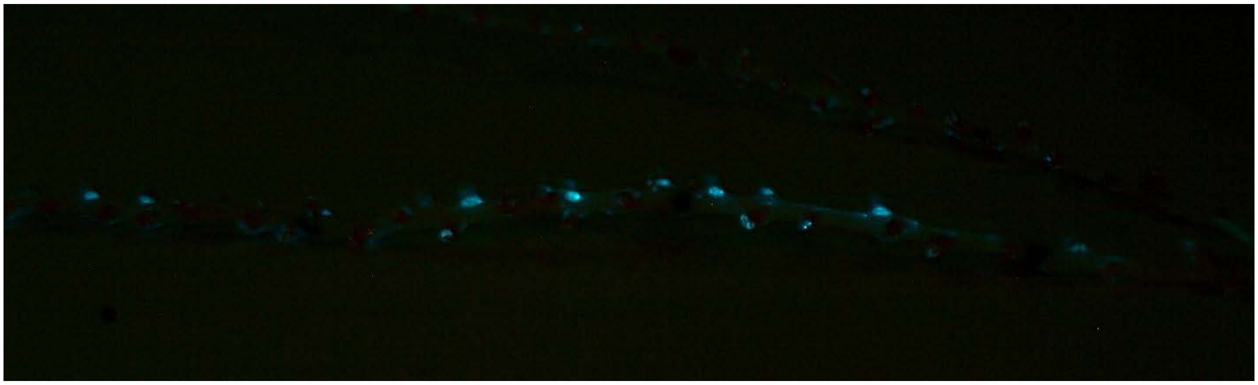


Figure 38.25 Fragment of Keratoisis sp. in the dark after collection, showing bioluminescence. Photo: Sam Davin

Figure 38.26 Box-core deployed at site 7 after ROV dive 54, showing fragments of Keratoisis sp.

38.3.8 *Dive 55: Disko Fan 2 (Site ROV7, 67° 58.1244 N, -59° 30.27828 W), July 25th 2016*

We decided to start this dive at waypoint 2 and follow a transect towards the northeast, by crossing ridges identified in the sub-bottom profile and multibeam (Figure 38.27). The transect direction was adjusted during the dive, as the ship needed to deviate from ice. At this site, ~2 km of bottom were video-surveyed, across depths ranging between 874-934 m. Bottom temperature (~930 m) at this site was also ~1 °C (Figure 38.28). Bottom salinity data can also be visualized in Figure 38.28.

As observed during dive 54, dense patches of Keratoisis sp. were identified during the transect, alternating with bare sediment areas where a few other invertebrates were observed. Keratoisis sp. forests were readily identifiable in the sonar. The overall megafaunal diversity seemed similar to the observed during dive 54 at a nearby location, with some differences. The sea pen Umbellula cf. encrinus, the bamboo coral Acanella arbuscula, and the solitary scleractinian Flabellum sp. were observed during this dive, but not during dive 54. Samples collected during this dive include both live and dead fragments of Keratoisis sp., as well as sponges (Table 38.7). Similar with fish observed in both dives, with the exception of northern wolfish (Anarhichas denticulatus) documented during this dive.

Table 38.7 List of samples collected during dive 55 at Disko Fan (site 7)

Sample	Description	Depth (m)	Latitude (N)	Longitude (W)
R55-1	Dead corals with sponge	876.6	67°58.04082	-59°29.04222
R55-2	Sponge	877.6	67°58.0494	-59°29.08452
R55-3	Dead fragments with sponge and scallops	876.6	67°58.04238	-59°29.04228
R55-4	Live coral fragments	876.5	67°58.04232	-59°29.03802
R55-5	live coral fragments, and sponge	876.5	67°58.04262	-59°29.04312
R55-6	live colony with scallops	876.4	67°58.0452	-59°29.03472
R55-7	Dead corals with sponge	876.7	67°58.03872	-59°29.03562
R55-8	Coral and sponge	876.6	67°58.03932	-59°29.0361
R55-9	*Asconema* sp.	876.6	67°58.0398	-59°29.03328

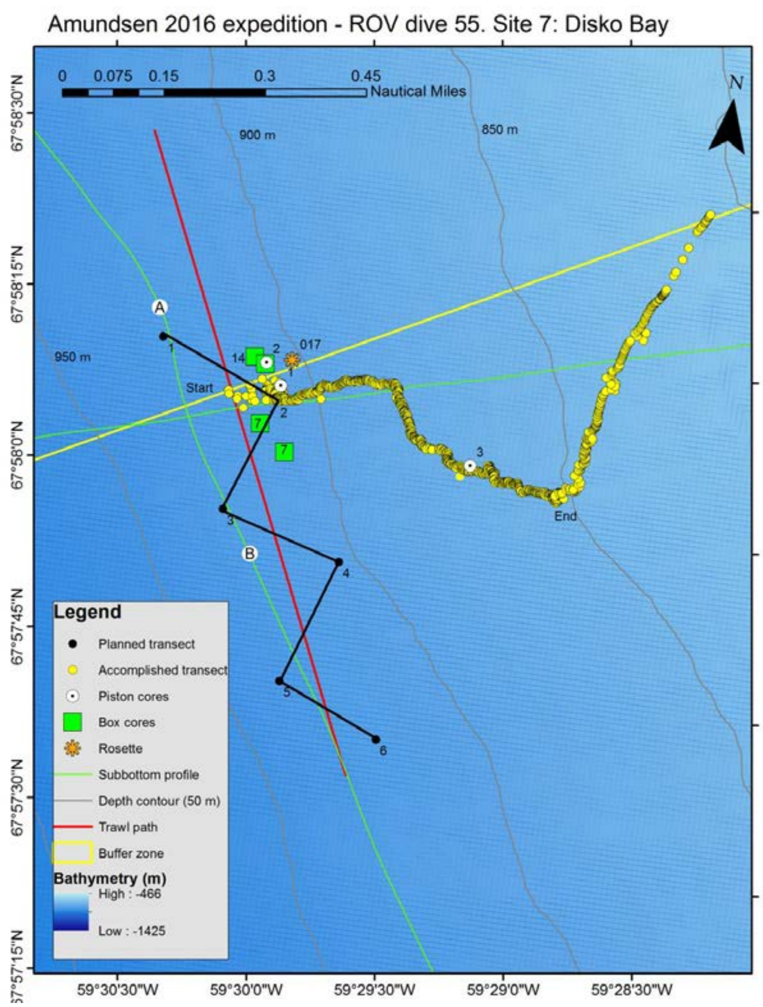


Figure 38.27 Map of site 7 (Disko Fan, Dive 55) showing planned and accomplished ROV transect during the 2016 CCGS Amundsen expedition. Numbers near box cores indicate box core identity. Arrow indicates ROV on mode ascent

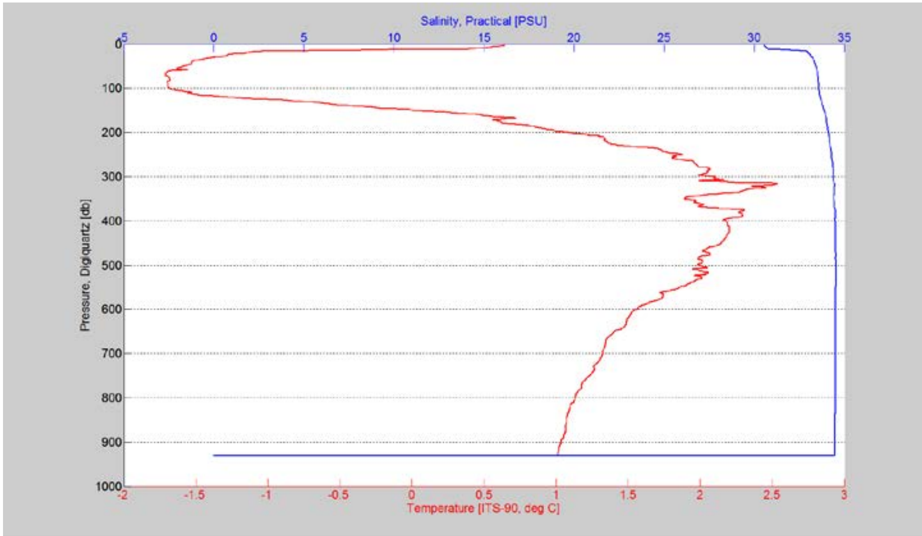


Figure 38.28 Temperature and salinity plot for rosette station 018 (ROV site 7, dive 55)

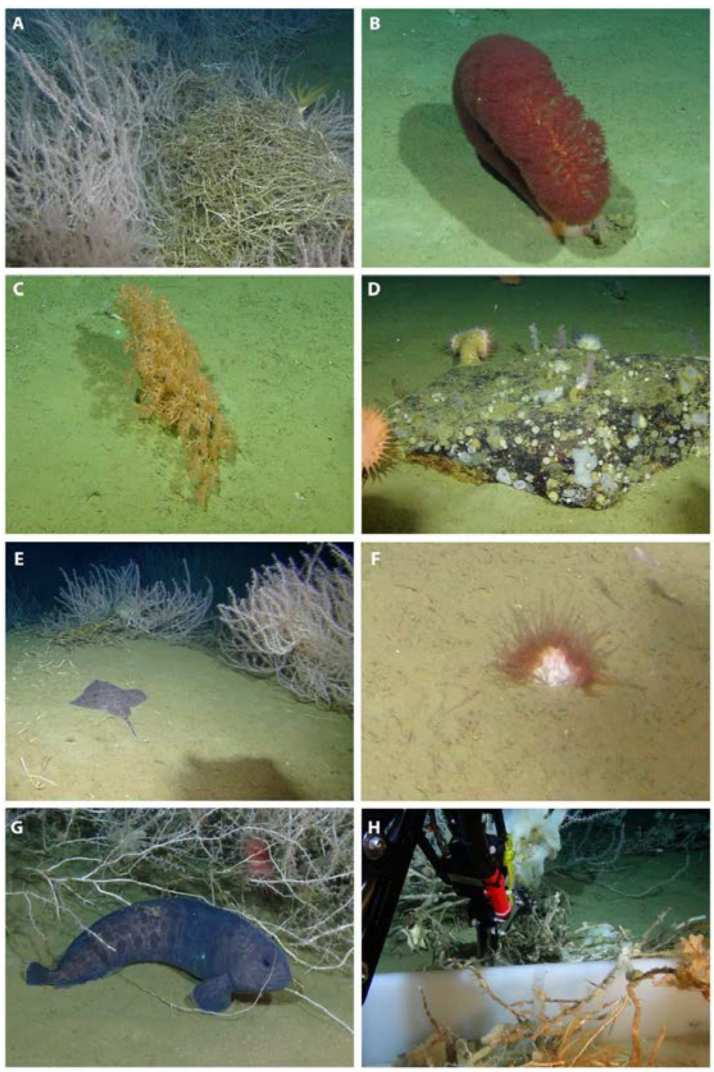


Figure 38.29 Photo-plate of megafauna observed during the ROV video transect at site 7 (Disko Fan, dive 55):

A) Keratoisis sp., B) Sea pen (Anthoptillum grandiflorum), C) Acanthogorgia sp., D) Boulder with Polymastia sp., Asconema sp., soft corals, tunicates, sea anemones, E) Skate, broken coral pieces, live coral, F) Flabellum sp., G) Northern wolfish, H) Sampling dead coral encrusted with sponges

38.3.9 *Other Operations*

At each ROV sites we collected a multibeam and sub-bottom profile data, in addition to water sampling, plankton sampling, and box coring, summing to most of a Basic Station. The water sampling was aimed at answering three major questions: what is the abundance, and stable isotopic composition, of organic and inorganic carbon and nitrogen in the water column, in both dissolved and particulate form, that could be available to feed corals and sponges and other benthos; what is the composition of the microbial biota in the water column, and what is the calcium carbonate saturation profile at each location (session 6).

The volume of water and number of depths sampled required for all the different water sampling goals necessitated two CTD/rosette casts at each location. Additional water sampling included sampling of dissolved methane, at the suspected cold seep sites. See report by microbial ecologist Dr. Mary Thaler for summary of the microbial diversity measurements.

38.3.10 *CTD-Rosette*

Water samples for the Hidden Biodiversity team were collected from the CTD-rosette by Sam Davin (UQÀM) to characterize the stable isotopic composition ($\delta^{13}C$, $\delta^{15}N$, $\delta^{18}O$, $\delta^{2}H$) and trace elements in the water column at selected waypoints. The resultant data will be used to answer long-standing questions about nutrient availability and transport in the Labrador Sea and southern Baffin Bay. In addition to their value as a robust, standalone chemical oceanographic dataset the isotopic values obtained from these water samples will be related to the biogeochemical signatures of the mineralized and proteinaceous components of deep-sea coral skeletons to develop a historical perspective of environmental change in the North Atlantic and Arctic Ocean.

To further corroborate these data, 30 liters of water (alternating between surface water and bottom water at each site) were collected at each sampling station and filtered on site to yield several milligrams of sinking particulate organic matter (POM) from the water column. Sinking POM is of particular interest to the ArcticNet Hidden Biodiversity team because it is believed to constitute a considerable component of the diet of deep-sea corals. By identifying the isotopic signature of sinking POM we intend to shed light on the feeding habits and subsequent biological fractionation of $\delta^{13}C$, $\delta^{15}N$, and $\delta^{2}H$ isotopes in the two keystone coral species Primnoa resedaeformis and Keratoisis sp.

Table 38.8 Information on CTD-rosette sampling at ROV sites during the 2016 Amundsen expedition

Depth	Station	Alk/DIC	pCO_2/CH_4	$d^{13}C\_CH_4$	$\delta^{18}O$	$\delta^{2}H$	$\delta^{13}C$	$\delta^{15}N$	Trace elements
surface	ROV-1	y	y		y	y	y	y	y
5	ROV-1	y	y		y	y	y	y	y
10	ROV-1	y	y		y	y	y	y	y
20	ROV-1	y	y		y	y	y	y	y
30	ROV-1	y	y		y	y	y	y	y
40	ROV-1	y	y		y	y	y	y	y
50	ROV-1	y	y		y	y	y	y	y
60	ROV-1	y	y		y	y	y	y	y
70	ROV-1	y	y		y	y	y	y	y
80	ROV-1	y	y		y	y	y	y	y
100	ROV-1	y	y		y	y	y	y	y
125	ROV-1	y	y		y	y	y	y	y
150	ROV-1	y	y		y	y	y	y	y
175	ROV-1	y	y		y	y	y	y	y
200	ROV-1	y	y	y	y	y	y	y	y
250	ROV-1	y	y		y	y	y	y	y
300	ROV-1	y	y		y	y	y	y	y
400	ROV-1	y	y	y	y	y	y	y	y
500	ROV-1	y	y		y	y	y	y	y
bottom	ROV-1	y	y	y	y	y	y	y	y
Total:	ROV-1	20	20	3	20	20	20	20	20
surface	ROV-2	y	y		y	y	y	y	y
5	ROV-2	y	y		y	y	y	y	y
10	ROV-2	y	y		y	y	y	y	y
20	ROV-2	y	y		y	y	y	y	y
30	ROV-2	y	y		y	y	y	y	y
40	ROV-2	y	y		y	y	y	y	y
50	ROV-2	y	y	y	y	y	y	y	y
60	ROV-2	y	y		y	y	y	y	y
70	ROV-2	y	y		y	y	y	y	y
80	ROV-2	y	y		y	y	y	y	y
100	ROV-2	y	y	y	y	y	y	y	y
125	ROV-2	y	y		y	y	y	y	y
150	ROV-2	y	y	y	y	y	y	y	y
175	ROV-2	y	y		y	y	y	y	y
200	ROV-2	y	y	y	y	y	y	y	y
250	ROV-2	y	y	y	y	y	y	y	y
bottom	ROV-2	y	y	y	y	y	y	y	y
Total:	ROV-2	17	17	6	17	17	17	17	17
surface	ROV-3	y	y		y	y	y	y	y

5	ROV-3	y	y			y	y	y	y	y
10	ROV-3	y	y			y	y	y	y	y
20	ROV-3	y	y			y	y	y	y	y
30	ROV-3	y	y			y	y	y	y	y
40	ROV-3	y	y			y	y	y	y	y
50	ROV-3	y	y			y	y	y	y	y
60	ROV-3	y	y			y	y	y	y	y
70	ROV-3	y	y			y	y	y	y	y
80	ROV-3	y	y			y	y	y	y	y
100	ROV-3	y	y	y		y	y	y	y	y
125	ROV-3	y	y			y	y	y	y	y
150	ROV-3	y	y			y	y	y	y	y
175	ROV-3	y	y			y	y	y	y	y
200	ROV-3	y	y	y		y	y	y	y	y
250	ROV-3	y	y			y	y	y	y	y
300	ROV-3	y	y		y	y	y	y	y	y
400	ROV-3	y	y		y	y	y	y	y	y
bottom	ROV-3	y	y			y	y	y	y	y
Total:	ROV-3	19	19	4		19	19	19	19	19
surface	ROV-5	y	y			y	y	y	y	y
5	ROV-5	y	y			y	y	y	y	y
10	ROV-5	y	y			y	y	y	y	y
20	ROV-5	y	y			y	y	y	y	y
30	ROV-5	y	y			y	y	y	y	y
40	ROV-5	y	y			y	y	y	y	y
50	ROV-5	y	y			y	y	y	y	y
60	ROV-5	y	y			y	y	y	y	y
70	ROV-5	y	y			y	y	y	y	y
80	ROV-5	y	y			y	y	y	y	y
100	ROV-5	y	y			y	y	y	y	y
125	ROV-5	y	y			y	y	y	y	y
150	ROV-5	y	y			y	y	y	y	y
175	ROV-5	y	y			y	y	y	y	y
200	ROV-5	y	y		y	y	y	y	y	y
250	ROV-5	y	y			y	y	y	y	y
300	ROV-5	y	y			y	y	y	y	y
400	ROV-5	y	y		y	y	y	y	y	y
500	ROV-5	y	y			y	y	y	y	y
bottom	ROV-5	y	y		y	y	y	y	y	y
Total:	ROV-5	20	20		3	20	20	20	20	20
surface	ROV-6	y	y			y	y	y	y	y
5	ROV-6	y	y			y	y	y	y	y

10	ROV-6	y	y		y	y	y	y	y
20	ROV-6	y	y		y	y	y	y	y
30	ROV-6	y	y		y	y	y	y	y
40	ROV-6	y	y		y	y	y	y	y
50	ROV-6	y	y	y	y	y	y	y	y
60	ROV-6	y	y		y	y	y	y	y
70	ROV-6	y	y		y	y	y	y	y
80	ROV-6	y	y		y	y	y	y	y
100	ROV-6	y	y	y	y	y	y	y	y
125	ROV-6	y	y		y	y	y	y	y
150	ROV-6	y	y	y	y	y	y	y	y
175	ROV-6	y	y		y	y	y	y	y
200	ROV-6	y	y	y	y	y	y	y	y
250	ROV-6	y	y	y	y	y	y	y	y
300	ROV-6	y	y	y	y	y	y	y	y
400	ROV-6	y	y	y	y	y	y	y	y
bottom	ROV-6	y	y	y	y	y	y	y	y
Total:	ROV-6	19	19	8	19	19	19	19	19
surface	ROV-7	y	y		y	y	y	y	y
5	ROV-7	y	y		y	y	y	y	y
10	ROV-7	y	y		y	y	y	y	y
20	ROV-7	y	y		y	y	y	y	y
30	ROV-7	y	y		y	y	y	y	y
40	ROV-7	y	y		y	y	y	y	y
50	ROV-7	y	y		y	y	y	y	y
60	ROV-7	y	y		y	y	y	y	y
70	ROV-7	y	y		y	y	y	y	y
80	ROV-7	y	y		y	y	y	y	y
100	ROV-7	y	y		y	y	y	y	y
125	ROV-7	y	y		y	y	y	y	y
150	ROV-7	y	y		y	y	y	y	y
175	ROV-7	y	y		y	y	y	y	y
200	ROV-7	y	y		y	y	y	y	y
250	ROV-7	y	y		y	y	y	y	y
300	ROV-7	y	y		y	y	y	y	y
400	ROV-7	y	y		y	y	y	y	y
500	ROV-7	y	y		y	y	y	y	y
600	ROV-7	y	y		y	y	y	y	y
700	ROV-7	y	y		y	y	y	y	y
800	ROV-7	y	y		y	y	y	y	y
bottom	ROV-7	y	y		y	y	y	y	y

Total:	ROV-7	23	23	0		23	23	23	23	23

38.3.11 *Geochemical Analyses of Corals: Sam Davin*

Fragments of Primnoa resedaeformis and Keratoisis sp. colonies were collected during ROV operations at selected sites during Leg 2a by the ArcticNet Hidden Biodiversity team for biogeochemical assays targeting multi-decadal variability in physical seawater parameters, nutrient transport, and food availability. These species were chosen for their longevity and for their hybrid mineral/protein skeletons which facilitate the corals in functioning as dual archives of deep and surface ocean parameters.

The stable isotopic composition ($\delta^{13}C$, $\delta^{15}N$, $\delta^{2}H$) of these colonies will be analyzed to answer long-standing questions about nutrient availability and transport in the Labrador Sea and southern Baffin Bay. This data will be used in conjunction with stable isotope measurements made on seawater profiles and on sinking particulate organic matter collected during Leg 2a by Sam Davin (UQÀM) at corresponding ROV sites.

Furthermore, the base of a large sub-fossil Primnoa resedaeformis colony collected during Leg 2a will be critical for developing the seminal methodology of measuring the hydrogen isotopic composition of deep-sea corals. The development of this methodology opens the door to for a novel marine proxy and ultimately a better understanding of both the biology of deep-sea corals and of high-latitude marine processes.

38.3.12 *Taxonomy of Arctic sponges: Curtin Dinn*

During leg 2a sponges were obtained through various methods (Box cores, Agassiz Trawl, ROV sampling) and were retained for taxonomy purposes. Sponges were photographed on board and in situ when possible (with ROV) for later use in taxonomic descriptions based on morphology. Sponges were fixed in ethanol 96% for DNA barcoding.

They were also fixed for histology and electron microscopy for analysis of ultrastructure for species of interest. Specimens collected will be referenced with ROV video to give a sense of abundance of species in surveyed areas. Collected specimens will be identified to lower taxonomic groupings with analysis of spicules and DNA barcodes.

Overall, a total of 111 sponge samples were obtained during leg 2a; 31 specimens were collected using the ROV sampling with associated video footage (some were not noted in ROV log as they were attached to other targeted samples). Some were known species, while many others were small encrusting species which are often ignored in trawl surveys alone. These specimens will give insight into the fauna of the Eastern Canadian Sub-arctic and Arctic regions and provide the potential for new sponge species descriptions.

38.3.13 *Collection and characterization of Thyasirid clams (Figure 38.30): Rachelle Dove*

A total of 19 box-cores from Frobisher Bay were inspected for thyasirids, with a total of 109 specimens found. At site 2 (Saglek Bank cold seep site), from 4 box-cores inspected, a total of 26 thyasyrids were found (Table 38.9).

Table 38.9 Thyasirid sampling summary for the 2016 CCGS Amunden expedition (Leg 2A)

	Site	
	Frobisher Bay	Cold Seep (ROV site 2)
Number of box cores	19	4
Sediment type	Very fine-moderately sandy	Sandy- rocky
Number of thyasirids	109	26

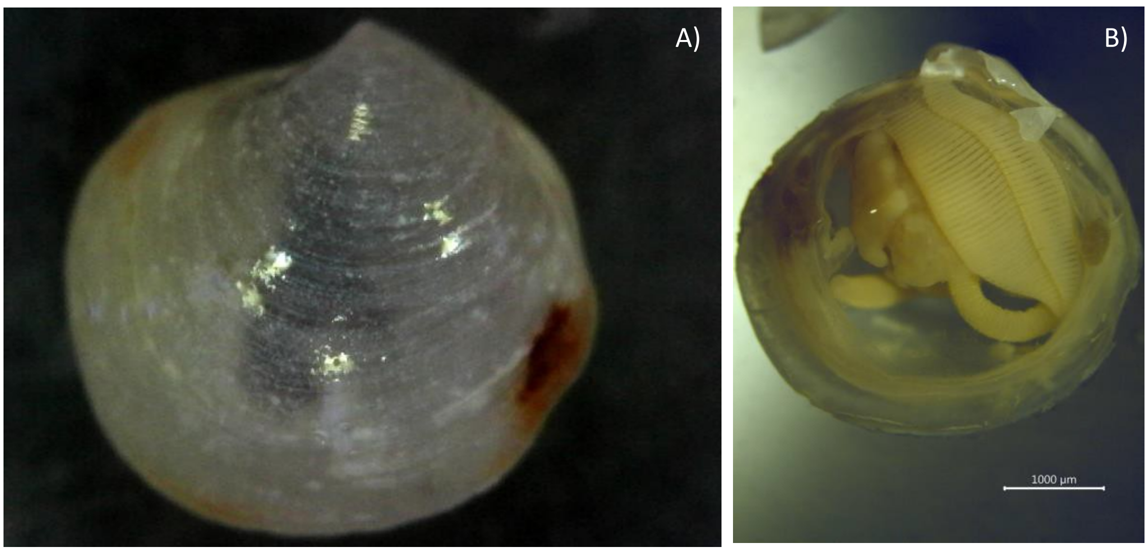


Figure 38.30 Thyasirid bivalves collected during the 2016 CCGS Amundsen expedition:

A) External shell of a thyasirid from NE Saglek Cold Seep site (ROV site 2), and B) The internal anatomy of a thyasirid bivalve. Photos: Rachelle Dove

38.3.14 *Plankton subsampling for stable isotopic analyses*

Subsamples from plankton tows were taken at some of the ROV dive sites, in order to characterize the bulk and compound-specific stable isotope composition of the zooplankton at each location. These data will be used in analyzing the geochemistry of the organic portions of coral skeletons (Table 38.10).

Table 38.10 Vertical plankton tow samples (200 µm mesh)

Mesh	ROV2 271-0m	ROV3 427-0m	ROV6 448-0m	ROV7 862-0m
> 500 µm	y	y	y	y
150-500 µm	y	y	y	y
50-150 µm	y	y	y	y

38.3.15 *Deployment of current meters*

One aspect of our NSERC-sponsored research was to have been deployment of two upward-facing 2 MHz ADCP current meters in high-current coral habitat and adjacent non-coral habitat (where corals had been removed by trawling). The purpose of the deployment was to measure the effect of corals on near-bottom turbulence in a high-current setting, to contrast with similar measurements in coral and trawled Keratoisis bamboo coral habitat in a low-current setting off the SW Grand Banks of Newfoundland (Zedel and Fowler 2009). This comparison requires precise placement of the current meters, hence deployment by ROV rather than by acoustic release.

The initial plan to had been to deploy these current meters using the ROV elevator, at site ROV1. When Site ROV1 did not locate dense patches of corals, we switched to the adjacent site ROV5, where we found dense patches of the large gorgonian coral Primnoa resedaeformis, and strong bottom currents. Unfortunately, the unreliable performance of the ROV prevented the deployment of the current meters at either coral site ROV3 or ROV5, either of which would have been appropriate. The ROV pilots advised us that they would likely be unable to complete deployment of the two current meters and two settlement arrays from the elevator during one dive, due to the persistent problems with the ROV. In the end, the current meters were not deployed.

We are trying to arrange for deployment of the two current meters in a moored configuration during leg 3b of the ArcticNet cruise. The two current meters would be deployed at the two high-current coral-rich sites ROV3 and ROV5, in a downward-looking configuration, and would characterize the current regime at the two sites. The measurements of the effects of corals on near-bottom turbulence will not be possible during this year's cruise.

38.3.16 *Coral recruitment and carbonate taphonomy experiments.*

Another aspect of our NSERC-sponsored research was to measure coral and other megafaunal recruitment to artificial substrates, and to measure the degradation of several types of carbonate bioclasts. We intended to compare settlement and taphonomy in different types of Arctic coral environments, specifically comparing the Primnoa coral forests of the Hudson Strait region with the bamboo coral forests of the Disko Fan site. These experiments were to have been deployed using the ROV elevator, adjacent to the current meters at one of the high-current Primnoa coral sites. Deployment and recovery using the clear polycarbonate sample boxes on the ROV elevator is desirable because the shells and corals on the taphonomy experiments should be protected from strong wave or water flow action while the experiments are being moved through the water during deployment or recovery.

Unfortunately, the unreliable performance of the ROV prevented this deployment at sites ROV3 or ROV5. In the end, we lowered one experiment to the bottom at site ROV7, without the benefit of the sample boxes on the ROV elevator, following the second dive at this location (Dive 55, Figure 31). Unprotected deployment by the winch cable with acoustic release was possible at this site because there were no waves or strong currents, and the moderate ice cover caused extraordinarily calm water, conditions that were not present at sites ROV3 or ROV5. The remaining experiments will be returned to MUN for deployment in appropriate cold-water carbonate environments near Newfoundland.

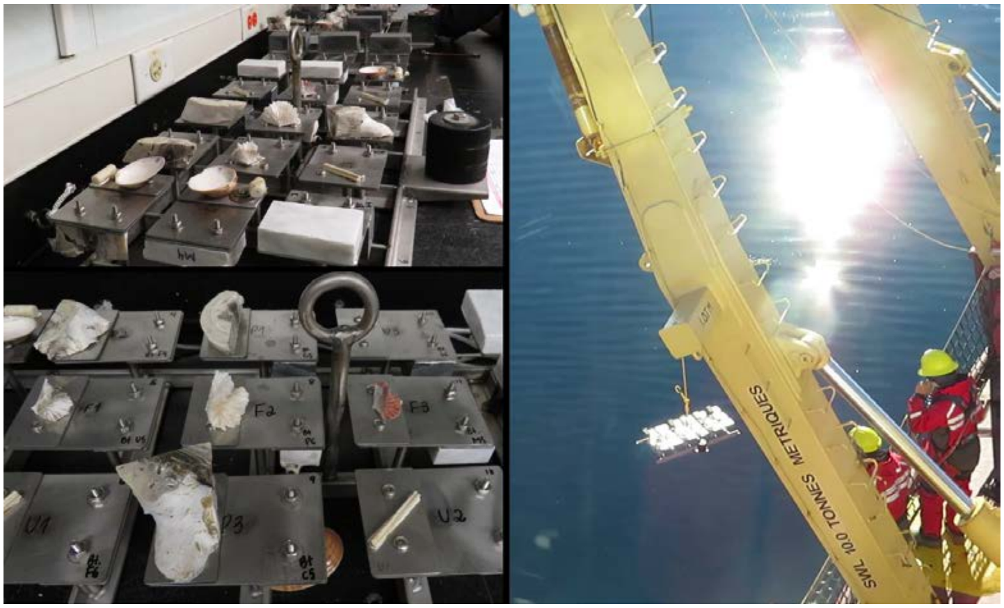


Figure 38.31 Experimental frame showing plates with corals and rocks and deployment

38.3.17 *Conclusions*

These preliminary results indicate that the dives were successful, based on objectives specified in our original dive plan:

<u>Invertebrates and fish diversity</u>

- Corals were abundant and diverse at most of the sites surveyed, especially at the site based on fisheries observer bycatch (ROV5) and the sites based on scientific survey trawl bycatch (ROV3, ROV7). The southern sites were visually dominated by the large calcareous gorgonian coral Primnoa resedaeformis, but hosted a high diversity and abundance of other corals including smaller gorgonian corals, soft corals, and occasional sea pens. Stylasterid corals were observed in the box cores from site ROV3, constituting a biogeographic range extension. Similarly, a white variety of Paragorgia sp. observed at this site represents another range extension, indicating the importance of NE Saglek bank for both abundance and diversity of corals.
- The diversity of sponges, corals, other invertebrates and fish was documented at all surveyed sites. These observations indicate high sponge concentrations and species richness in all sites, not only in the SE Baffin shelf site that was chosen for sponge bycatch. Evidence of fishing impacts at these site was documented in the form of trawl door scars and broken sponges, although this site appears to fit within a gap in fishing effort, when compared against maps of fishing effort compiled for the NW Labrador Sea.

- Observations show corals co-occur with sponges as well as other benthic animals (e.g. fish, octopus, basket stars, shrimp, hydroids, brittle stars, sea anemones, and bryozoans).

<u>Steep/deep versus gravelly bottom sites</u>

- An array of bottom types were observed in all five sites, from muddy bottoms to bedrock outcrops. The benthic fauna associated to the different bottom types was also distinct and dominated by different organisms, indicating the need to sample both types of habitats (e.g. soft and hard bottoms).

<u>Elevator system and new sampling skid</u>

- The elevator was not deployed, due to the inconsistent and unreliable performance of the ROV. Being unable to use the elevator, and not having a second dive at any of the sites except ROV7, meant that it was not possible to deploy the paired current meters or paired settlement and carbonate taphonomy experiments. By contrast, the new sampling skid worked very well, allowing multiple collections in good condition at almost all sites. Unfortunately, the hydraulic system of the new elevator lost hydraulic oil, and may contributed to the limited length of dives at almost all sites.

<u>Box Cores</u>

- Box cores planned in association with most of the dive sites were successfully collected, and represent an important additional data source. Even though many of the sites had gravel or cobble bottoms that limited box core penetration, the box cores yielded important samples that provided evidence of higher biodiversity importance of these sites than documented from the ROV alone. The combination of megafaunal surveys from the ROV video with direct sampling from the box cores is particularly powerful.

38.4 Comments and Recommendations

Dives were terminated early in nearly all of the dive sites (dive 50, 51, 52, 53, 54) due to electrical shortages causing visual black-out, hydraulic failure, mechanical failure, flooding of the umbilical cable, failure of the cage camera (required for recovering the ROV) or a combination of two or more factors. In the case of SuMo, infrequent use and associated maintenance, combined with overdue upgrades are the source of the failures previously stated. The ROV team aboard (Vincent Auger and Peter Lockhart, Canadian Scientific Submersible Facility) will submit a detailed ROV report and recommendations, as they did following the 2015 expedition. Considering the logistics and resources required to conduct ROV surveys, maximizing chances of success is paramount. Based on discussions between the ROV team and scientists aboard the 2016 expedition, and following many of the same issues during the 2015 expedition, the SuMo ROV will require considerably greater investment in maintenance if it is to be an efficient tool for scientific data collection.

Furthermore, it is recommended that commercial fishing footprint data from Vessel Monitoring Systems be available prior to the 2016 expedition, in order to assist with dive sites selection. Even in locations where the 2002-2014 fishing footprint has been used to help choose locations unimpacted by fishing, evidence of fishing damage was observed (e.g. SE Baffin). The addition of these data will help to focus the ROV dives in areas that have not been impacted by bottom-contact fishing gear.

Acknowledgements

We would like to thank the CCGS Amundsen captain Alain Gariépy, the ship crew, the scientific crew, the ROV operators Vincent Auger and Peter Lockhart (CCSF), and the chief scientist Dr. Christian Nozais for the great work making this expedition possible.

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39 Schools on Board – Leg 3b

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René Lapierre – Whitehorse, YK

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Mira Mason – Whitehore, YK
Maxime Therrien - Nanaimo, BC
Jaden Ford – Dawson Creek, BC
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Ege Nur Satir – Montreal, QC
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39.1 Introduction

As an outreach program of ArcticNet, a Network of Centres of Excellence of Canada that focuses on potential impacts of climate change on the North's environment and people, Schools on Board's Arctic Field Program takes small teams of high school students and teachers on board the *CCGS Amundsen* to experience and participate in ArcticNet's annual scientific expedition. Over the years, the field program has taken participants in the Beaufort Sea, through the famed Northwest Passage, along Baffin Island, and through the spectacular Labrador Fjords.

39.2 Methodology

While on board the *CCGS Amundsen* students were involved in a variety of sampling activities and participated in a variety of lectures and workshops delivered by scientists on board (Table 39.1).

Table 39.1. Summary of Schools on Board activities provided by scientists on board Leg 3b.

Name	Position/Affliation	Activity
Dr. Louis Fortier	Chief Scientist	Lectures: Mission of ArcticNet/Intro to Arctic System research Arctic Cod Participated in conference call

Name	Position/Affliation	Activity
Oliver Sulpis	PhD Candidate/McGill University/Dr. Alfonso Mucci	Lecture: Investigating Ocean pH levels Activity: (Lab)Analyzing water samples for pH
Sarah Schembri Cyril Aubry	MSc. Candidate Research Staff Université Laval	Activity: (Deck/Lab) Participants assisted with net deployments and sorting samples in the zooplankton lab.
Pierre Larouche	Research professional UQAR Dr. Michel Gosselin	Lecture: Phytoplankton Ecology/Ocean Optics and Remote Sensing Activity: (Lab) Chlorophyll a filtration
Lauren Candlish Nathalie Theriault	Research professionals CEOS – University of MB Dr. David Barber	Lecture: Atmosphere Sea Ice Interactions in the Canadian Arctic Activities: (Deck/Lab) Weather balloon launches off the helideck Ice core thermodynamics and sea ice vs. fresh water ice demonstration
Dr. Milovan Fustic	Post Doctoral Fellow University of Calgary Dr. Casey Huebert	Lecture: Plate tectonics evolution of life and stratigraphy Activities: Kugluktuk – dating of rocks and geological interpretation On board – (Deck/Lab) box core sampling, sediment core extrusion, water filtration
Kathleen Munson James Singer	Post Doctoral Fellow CEOS – U of Manitoba Dr. Fei Wang	Lecture: Mercury in the Arctic marine environment Activities: Water sampling from the rosette, PILMS lab, sampling from zodiac
David Capelle	Post Doctoral Fellow CEOS – U of Manitoba Dr. Tim Papakyriakou	Lecture: Greenhouse gases in the Arctic Included a hands-on activity demonstrating the effect of water temperature and dissolved gasses Activity: (Deck) participants viewed the underway water sampling system in the engine room and a tour of the weather tower on the foredeck
Dr. Anna Pienkowski	MacEwan University Professor Mark Furze	Lecture: Paleoclimatology/oceanography Activity: (Deck) Box core deployment and subsampling
David Simpson	ArcticNet – Rosette Operator (Intern) Keith Levesque	Activity – participants worked in the rosette shack with David during the deployment of the rosette. They were introduced to the mechanical aspects of the rosette and the type of data collected.
Vincent Marmillot	PhD Candidate Université Laval	Activity – (Lab) Filtration and culturing of phytoplankton

Name	Position/Affliation	Activity
	Jean-Eric Tremblay	
Étienne Brouard Pierre-Olivier Couette	PhD Candidate MSc Candidate Université Laval Patrick Lajeunesse	Activity – tour of acquisition room with explanation of the multibeam sonar and applications to navigation
Gabrièle Deslongchamps	MSc Candidate Université Laval	Activity – (Lab) Sampling from the rosette, processing samples in the nutrient lab. Gabriéle also engaged the students in a hands-on activity demonstrating stratification between different types of water masses (aka tank lab activity). Students then had to figure out the physical properties of a mystery solution.
Jimmy Truong	MSc Candidate EC and U of Toronto Liisa Jantunen	Activity – (Lab) zooplankton sorting
Thomas Richerol Charles Edouard Deschamps	Post Doctoral Fellow PhD Candidate UQAR Lajeunesse/Monero-Serrano	Activity – (Deck) Box core deployment and subsampling
Sira Chayer Chris Paetkau	Build Films Media	Media on board were working on a 4- minute expose on the Schools on Board field program in addition to documenting ArcticNet activities. Various aspects of the field program were documented via film and also through individual interviews of participants.

In addition to the science, students were fully immersed in all aspects of life on the ship and were integrated with the science team. The CCG crew also interacted with students by providing the necessary safety briefings but also through informal discussions regarding navigation and different types of jobs in the coast guard. A formal tour of the engine room and helicopter was also provided to the participants.

A very big 'merci beaucoup' to the scientists and crew of Leg 3b for making the 2016 Schools on Board field program a success!

40 "Science and Multimedia: In the Wake of an Icebreaker in the Arctic", the Educational Project of GreenEdge

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Cruise participant - Leg 1b: Pascaline Bourgain[2]
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40.1 Introduction

The education and outreach project of GreenEdge is dedicated to young students from 8 to 13 years old. The goals are multiple:

- to make children discover the scientific expedition occurring on board the *Amundsen* icebreaker in the frame of the GreenEdge project, its scientific challenges and its crew (both scientific and non-scientific).
- to educate about climate change issues and plankton role in the arctic marine ecosystem;
- to motivate children (especially young girls) to pursue scientific careers;
- to involve children in the creation of educational content;
- to offer direct interactions during the icebreaker expedition.

For this purpose, in late May 2016, Pascaline Bourgain went to meet 5 classes from the Ile-de-France region to present the expedition and conduct a workshop in which the students needed to identify which questions they wanted to ask. The selected questions were both dedicated to scientists and to the *Amundsen* crew. They were filmed by the young students themselves, under the supervision of Pascaline Bourgain.

As such, Pascaline boarding on the *Amundsen* aimed at making interviews to provide answers to 20 of the children questions.

40.2 Methodology

During Leg 1b, 20 short video interviews about science or everyday life were conducted on board. For this purpose, Pascaline Bourgain participated into several activities, like sea ice operations or zodiac operations. In addition of conducting educational interviews, she took the initiative to start working on video editing for half of the interviews.

All along Leg 1b, the contact with the classes was maintained through blog writing and pictures sending. The blog was translated into English in order to be published on the GreenEdge Expeditions website under the name "the school mediator logbook". On the 4th of July, direct live exchanges were proposed to the students through Iridium calls (a 15 minutes call for each of the 5 classes). This was the opportunity for the students to ask directly their questions to Pascaline Bourgain.

Finally, in the frame of the collaboration between Takuvik and Paramount (Noé Sardet and Sharif Mirshak), Pascaline Bourgain took pictures and videos of the activities occurring during leg1B such as scientific activities, logistics activities (helicopter) or landscapes.

Figure 40.1. Pascaline Bourgain (Picture from Brivaela Moriceau).

40.3 Preliminary Results

- All of the 20 interviews were realized. For half of them, Pascaline Bourgain took the initiative to start working on video editing.
- Direct exchanges with the classes occurred through blog writing and phone conversations.
- Pictures and videos were taken to document leg 1b.

Collaboration

The key success of this work was both the scientists and the crew participation. As such, Pascaline Bourgain wants to thank everybody onboard who accepted to be taken into pictures, filmed or interviewed for the accomplishment of the mission she was in charge. Anyone who appeared on the photo/movies signed a discharge for the use of their image.

In addition, special thanks to the 5 French teachers who worked with their students on the GreenEdge project and who maintained the link with the expedition, up to the summer holidays on the 5th of July.

Acknowledgment

The work accomplished could not have been achieved without the help and support of the expedition leader and the captain of the *Amundsen*. They highly facilitated the access and participation to the different scientific operations as well as the access to the ship and its crew (mechanics, officers, etc…). Thanks to the kind participation to both the crew and the scientists who accepted to be interviewed, the objectives of this outreach project are fully reached.

Leg	Station ID	Station Type	Local Date	Local Time	UTC to local	Latitude (N)	Longitude (W)	Depth (m)
Leg 1a								
1a	ISVP1	ISVP	06-juin-2016	15:12	UTC-4	54°11.599'	054°33.641'	183
1a	Argo1	Argo	07-juin-2016	13:35	UTC-4	58°33.655'	052°50.267'	3388
1a	Glider	Glider	08-juin-2016	12:15	UTC-4	63°35.472'	053°29.024'	1606
1a	G100	Full	09-juin-2016	13:10	UTC-4	68°29.940'	056°47.387'	371
1a	MVP01	MVP	09-juin-2016	20:50	UTC-4	68°30.625'	055°51.306'	493
1a	G101	Nutrient	10-juin-2016	03:50	UTC-4	68°29.880'	057°07.991'	373
1a	G102	Full	10-juin-2016	05:46	UTC-4	68°29.909'	057°28.666'	364
1a	MVP02	MVP	10-juin-2016	13:12	UTC-4	68°29.950'	057°28.454'	364
1a	G104	Basic	10-juin-2016	20:02	UTC-4	68°29.960'	058°09.156'	323
1a	G103	Nutrient	10-juin-2016	23:35	UTC-4	68°29.965'	057°38.329'	368
1a	G105	CTD	11-juin-2016	04:00	UTC-4	68°29.929'	058°31.308'	352
1a	G106	Nutrient	11-juin-2016	08:31	UTC-4	68°30.067'	058°49.443'	321
1a	G107	Full	11-juin-2016	10:43	UTC-4	68°29.912'	059°10.762'	317
1a	G108	CTD	11-juin-2016	20:57	UTC-4	68°30.581'	059°29.825'	621
1a	G109	Nutrient	11-juin-2016	23:18	UTC-4	68°30.969'	059°50.712'	744
1a	G110	Full	12-juin-2016	05:40	UTC-4	68°32.032'	060°09.977'	729
1a	G111	CTD	12-juin-2016	20:36	UTC-4	68°28.248'	060°26.444'	1591
1a	G112	Nutrient	12-juin-2016	22:07	UTC-4	68°33.254'	060°39.212'	1649
1a	G113	CTD	13-juin-2016	01:17	UTC-4	68°29.815'	060°52.753'	1693
1a	G114	CTD	13-juin-2016	02:50	UTC-4	68°30.968'	061°06.279'	1720
1a	G115	Full	13-juin-2016	06:42	UTC-4	68°27.447'	061°21.223'	1733
1a	G200	Nutrient	14-juin-2016	06:25	UTC-4	68°35.030'	060°06.077'	1449
1a	G201	Full	14-juin-2016	13:15	UTC-4	68°37.995'	059°57.057'	1380
1a	G202	CTD	15-juin-2016	03:37	UTC-4	68°39.553'	059°36.200'	994
1a	G203	Nutrient	15-juin-2016	04:50	UTC-4	68°41.077'	059°24.990'	679
1a	G204	Full	15-juin-2016	07:00	UTC-4	68°42.274'	059°14.503'	524
1a	G205	CTD	15-juin-2016	20:14	UTC-4	68°44.641'	058°56.197'	354
1a	G206	Nutrient	15-juin-2016	21:36	UTC-4	68°46.414'	058°44.380'	332
1a	G207	CTD	15-juin-2016	23:30	UTC-4	68°48.278'	058°29.578'	321
1a	MVP03	MVP	16-juin-2016	00:42	UTC-4	68°49.511'	058°17.068'	324
1a	G207	Full	16-juin-2016	08:01	UTC-4	68°47.699'	058°31.706'	322

1a	G208	CTD	16-juin-2016	16:30	UTC-4	68°49.302'	058°18.045'	326
1a	G209	Basic	16-juin-2016	17:35	UTC-4	68°51.055'	058°04.960'	306
1a	G210	CTD	16-juin-2016	19:10	UTC-4	68°52.546'	057°51.787'	285
1a	G211	Nutrient	16-juin-2016	20:08	UTC-4	68°54.470'	057°39.014'	294
1a	MVP04	MVP	17-juin-2016	03:38	UTC-4	68°59.818'	058°18.473'	306
1a	G3000	Nutrient	17-juin-2016	09:02	UTC-4	69°00.463'	055°59.464'	126
1a	G300	Full	17-juin-2016	11:08	UTC-4	69°00.055'	056°46.454'	193
1a	G301	CTD	17-juin-2016	22:27	UTC-4	69°00.017'	057°00.572'	225
1a	G302	Nutrient	17-juin-2016	23:20	UTC-4	68°59.985'	057°14.915'	234
1a	G303	Basic	18-juin-2016	00:38	UTC-4	69°00.053'	057°29.156'	272
1a	G304	CTD	18-juin-2016	03:19	UTC-4	68°59.993'	057°42.659'	297
1a	G305	Nutrient	18-juin-2016	04:14	UTC-4	68°59.981'	057°56.978'	300
1a	G306	CTD	18-juin-2016	05:31	UTC-4	68°59.978'	058°11.261'	309
1a	G309	Full	18-juin-2016	07:01	UTC-4	69°00.045'	058°43.821'	342
1a	G306b	Coring	18-juin-2016	18:04	UTC-4	68°59.464'	058°08.981'	309
1a	G307	CTD	18-juin-2016	19:07	UTC-4	69°00.058'	058°24.805'	312
1a	G308	Nutrient	18-juin-2016	20:03	UTC-4	69°00.029'	058°39.144'	394
1a	G310	Basic	18-juin-2016	22:08	UTC-4	69°01.517'	059°03.917'	621
1a	G311	CTD	19-juin-2016	00:32	UTC-4	68°59.588'	059°19.716'	934
1a	G313	Nutrient	19-juin-2016	03:10	UTC-4	69°00.664'	059°47.966'	1501
1a	G312	Full	19-juin-2016	06:00	UTC-4	69°00.762'	059°34.368'	1395
1a	G314	CTD	19-juin-2016	21:29	UTC-4	69°00.575'	060°02.962'	1594
1a	G315	Basic	19-juin-2016	22:37	UTC-4	69°00.340'	060°10.866'	1624
1a	G316	CTD	20-juin-2016	01:59	UTC-4	69°00.086'	060°30.957'	1695
1a	G317	Nutrient	20-juin-2016	03:10	UTC-4	69°00.405'	060°44.577'	1733
1a	G318	Full	20-juin-2016	06:00	UTC-4	69°00.558'	060°57.648'	1737
1a	G319	CTD	20-juin-2016	20:51	UTC-4	69°00.100'	061°11.694'	1823
1a	G320	Nutrient	20-juin-2016	23:41	UTC-4	69°01.958'	061°26.362'	1851
1a	G321	Basic	21-juin-2016	02:53	UTC-4	68°57.729'	061°38.324'	2130
1a	G322	CTD	21-juin-2016	05:18	UTC-4	68°59.369'	061°53.062'	1863
1a	G323	Nutrient	21-juin-2016	07:50	UTC-4	69°00.514'	062°07.339'	1885
1a	G324	Full	21-juin-2016	11:00	UTC-4	68°59.025'	062°19.096'	1892
1a	G325	Nutrient	21-juin-2016	00:04	UTC-4	68°59.940'	062°36.158'	1889
1a	DIC1	DIC	22-juin-2016	07:35	UTC-4	68°27.982'	062°40.575'	1678

1a	DIC2	DIC	22-juin-2016	16:20	UTC-4	67°59.815'	063°11.816'	802
Leg 1b								
1b	G400	Basic	24-juin-2016	18:44	UTC-4	68°01.421'	062°23.842'	1264
1b	G401	CTD	25-juin-2016	00:53	UTC-4	68°04.265'	062°07.614'	1586
1b	G402	Nutrient	25-juin-2016	02:49	UTC-4	68°04.495'	061°51.622'	1663
1b	G403	Full	25-juin-2016	06:15	UTC-4	68°04.422'	061°36.509'	1509
1b	G404	CTD	25-juin-2016	19:12	UTC-4	68°05.677'	061°21.345'	1685
1b	G405	Nutrient	25-juin-2016	21:18	UTC-4	68°05.623'	061°04.609'	1665
1b	G406	Basic	26-juin-2016	00:08	UTC-4	68°03.963'	060°49.100'	1638
1b	G407	CTD	26-juin-2016	02:35	UTC-4	68°05.914'	060°32.711'	1605
1b	G408	Nutrient	26-juin-2016	04:48	UTC-4	68°07.080'	060°15.961'	1535
1b	G409	Full	26-juin-2016	08:10	UTC-4	68°06.183'	060°01.157'	1425
1b	G409	Full	26-juin-2016	16:54	UTC-4	68°06.275'	059°59.591'	1408
1b	G410	CTD	26-juin-2016	20:21	UTC-4	68°06.595'	059°43.707'	1058
1b	G411	Nutrient	26-juin-2016	22:29	UTC-4	68°06.954'	059°27.113'	511
1b	G412	Nutrient HPLC	27-juin-2016	01:27	UTC-4	68°06.734'	059°12.118'	307
1b	G413	CTD	27-juin-2016	03:21	UTC-4	68°06.925'	058°55.989'	272
1b	G414	Nutrient	27-juin-2016	04:47	UTC-4	68°06.696'	058°41.233'	277
1b	G415	CTD	27-juin-2016	06:33	UTC-4	68°06.834'	058°25.271'	403
1b	G413	Full	27-juin-2016	09:30	UTC-4	68°07.440'	059°04.440'	289
1b	MVP05	MVP	28-juin-2016	00:16	UTC-4	68°07.058'	057°41.198'	389
1b	G418	Full	28-juin-2016	06:52	UTC-4	68°06.869'	057°46.119'	383
1b	G416	CTD	28-juin-2016	18:56	UTC-4	68°06.858'	058°07.128'	403
1b	G417	Nutrient	28-juin-2016	20:00	UTC-4	68°06.806'	057°51.878'	383
1b	G419	CTD	28-juin-2016	21:52	UTC-4	68°06.821'	057°20.645'	334
1b	G420	Nutrient	28-juin-2016	22:55	UTC-4	68°06.578'	057°04.291'	261
1b	G5000	MVP	29-juin-2016	10:46	UTC-4	70°00.252'	059°02.411'	281
1b	G500	Basic	29-juin-2016	17:28	UTC-4	69°59.969'	056°51.005'	185
1b	G501	CTD	29-juin-2016	19:32	UTC-4	70°00.024'	057°11.119'	250
1b	G502	Nutrient	29-juin-2016	20:28	UTC-4	69°59.988'	057°27.466'	270
1b	G503	Basic	29-juin-2016	21:46	UTC-4	70°00.000'	057°45.691'	300
1b	G503	Basic	29-juin-2016	22:29	UTC-4	70°00.011'	057°45.803'	299
1b	G504	CTD	30-juin-2016	01:12	UTC-4	70°00.087'	058°04.204'	331
1b	G505	Nutrient	30-juin-2016	02:10	UTC-4	70°00.002'	058°21.891'	339

1b	MVP07	MVP	30-juin-2016	04:03	UTC-4	70°00.352'	058°57.590'	279
1b	G507	Full	30-juin-2016	06:00	UTC-4	70°00.509'	059°07.397'	291
1b	G506.5	CTD	30-juin-2016	16:04	UTC-4	70°00.079'	058°53.356'	288
1b	G506	Basic	30-juin-2016	17:13	UTC-4	70°00.165'	059°39.031'	315
1b	G508	CTD	30-juin-2016	20:29	UTC-4	70°00.237'	059°17.341'	343
1b	G509	Nutrient	30-juin-2016	21:52	UTC-4	69°59.794'	059°30.637'	391
1b	G510	Basic	30-juin-2016	23:41	UTC-4	70°00.049'	059°49.008'	461
1b	G511	CTD	01-juil-2016	02:07	UTC-4	69°59.966'	060°05.495'	451
1b	G512	Nutrient	01-juil-2016	03:23	UTC-4	70°00.002'	060°21.710'	546
1b	G513	CTD	01-juil-2016	05:20	UTC-4	69°59.791'	060°40.879'	941
1b	G512	Full	01-juil-2016	07:05	UTC-4	70°00.137'	060°21.924'	533
1b	G513	CTD	01-juil-2016	17:31	UTC-4	70°00.107'	060°40.749'	920
1b	G514	Nutrient	01-juil-2016	19:14	UTC-4	70°00.165'	060°58.339'	1257
1b	G515	Basic	01-juil-2016	21:34	UTC-4	69°59.812'	061°14.610'	1471
1b	G516	CTD	02-juil-2016	00:01	UTC-4	70°00.180'	061°33.690'	1694
1b	G517	Nutrient	02-juil-2016	02:08	UTC-4	69°59.552'	061°51.333'	1856
1b	G518	CTD	02-juil-2016	05:00	UTC-4	69°59.812'	062°09.019'	1964
1b	G519	Full	02-juil-2016	08:07	UTC-4	70°00.814'	062°25.371'	2158
1b	G521	Nutrient	02-juil-2016	23:10	UTC-4	69°59.830'	063°01.071'	2032
1b	G600	Full	03-juil-2016	08:00	UTC-4	70°28.525'	064°00.624'	2110
1b	G601	CTD	03-juil-2016	21:20	UTC-4	70°30.211'	063°42.156'	2120
1b	G602	Nutrient	03-juil-2016	23:00	UTC-4	70°30.810'	063°24.415'	2115
1b	G603	Basic	04-juil-2016	01:57	UTC-4	70°30.468'	063°03.204'	2112
1b	G604	CTD	04-juil-2016	04:09	UTC-4	70°30.053'	062°48.220'	2099
1b	G605	Nutrient	04-juil-2016	05:45	UTC-4	70°30.216'	062°31.071'	2042
1b	G606	CTD	04-juil-2016	19:30	UTC-4	70°30.003'	062°11.837'	1936
1b	MVP08	MVP	04-juil-2016	21:02	UTC-4	70°29.645'	061°41.518'	1643
1b	G615	Full	05-juil-2016	08:06	UTC-4	70°29.935'	059°31.460'	617
1b	G614	CTD	05-juil-2016	20:57	UTC-4	70°30.022'	059°49.858'	674
1b	G613	Nutrient	05-juil-2016	22:05	UTC-4	70°30.141'	060°07.337'	660
1b	G612	Basic	05-juil-2016	23:46	UTC-4	70°30.401'	060°25.328'	663
1b	G611	CTD	06-juil-2016	01:46	UTC-4	70°29.978'	060°43.146'	736
1b	G610	Nutrient	06-juil-2016	03:00	UTC-4	70°29.993'	061°00.930'	846
1b	MVP09	MVP	06-juil-2016	04:14	UTC-4	70°29.959'	061°59.999'	841

1b	G604.5	Full	06-juil-2016	08:14	UTC-4	70°30.126'	062°37.609'	2063
1b	G607	Nutrient	06-juil-2016	17:32	UTC-4	70°30.002'	061°54.772'	1778
1b	G608	Basic	06-juil-2016	19:23	UTC-4	70°29.993'	061°36.584'	1832
1b	G609	Nutrient	06-juil-2016	21:22	UTC-4	70°30.010'	061°18.606'	1170
1b	G616	CTD	07-juil-2016	02:00	UTC-4	70°30.002'	059°14.244'	568
1b	G617	Nutrient	07-juil-2016	03:11	UTC-4	70°29.990'	058°56.415'	530
1b	G618	Basic	07-juil-2016	04:30	UTC-4	70°29.957'	058°38.904'	497
1b	G703	Full	07-juil-2016	11:11	UTC-4	69°30.121'	058°43.022'	512
1b	G700	Basic	07-juil-2016	23:38	UTC-4	69°30.119'	057°52.332'	283
1b	G701	Nutrient	08-juil-2016	01:33	UTC-4	69°30.030'	058°09.252'	288
1b	G702	CTD	08-juil-2016	02:42	UTC-4	69°30.047'	058°26.139'	309
1b	G704	CTD	08-juil-2016	04:40	UTC-4	69°30.013'	058°00.091'	840
1b	G705	Nutrient	08-juil-2016	06:20	UTC-4	69°30.071'	058°17.327'	1200
1b	MVP10	MVP	08-juil-2016	07:45	UTC-4	69°30.124'	059°15.762'	1211
1b	G707	Full	08-juil-2016	10:12	UTC-4	69°30.710'	059°48.368'	1425
1b	G708	Argo	08-juil-2016	22:07	UTC-4	69°30.062'	060°08.815'	1547
1b	G709	CTD	09-juil-2016	00:16	UTC-4	69°30.005'	060°25.682'	1637
1b	G710	CTD	09-juil-2016	01:54	UTC-4	69°30.079'	060°42.546'	1710
1b	G711	Argo	09-juil-2016	03:37	UTC-4	69°30.029'	061°00.658'	2312
1b	Argo 3	Argo	09-juil-2016	06:00	UTC-4	69°19.341'	060°58.997'	1890
1b	Argo 4	Argo	09-juil-2016	08:24	UTC-4	69°20.209'	060°13.251'	1627
1b	G713	Full	09-juil-2016	11:57	UTC-4	69°30.093'	061°34.826'	1896
1b	G712	CTD	09-juil-2016	22:37	UTC-4	69°30.091'	061°17.224'	1825
1b	G714	CTD	10-juil-2016	00:26	UTC-4	69°30.027'	061°51.827'	1938
1b	G715	Nutrient	10-juil-2016	01:42	UTC-4	69°29.998'	062°08.378'	1952
1b	G716	Basic	10-juil-2016	03:28	UTC-4	69°30.014'	062°25.722'	1959
1b	G717	CTD	10-juil-2016	04:52	UTC-4	69°30.128'	062°42.695'	1969
1b	G718	Nutrient	10-juil-2016	06:20	UTC-4	69°30.180'	062°59.974'	1975
1b	G719	Full	10-juil-2016	08:25	UTC-4	69°30.053'	063°13.990'	1954
Leg 2a								
2a	FB6	CTD	15-juil-2016	08:26	UTC-4	63°06.190'	067°30.790'	612
2a	FB6-1	Coring	15-juil-2016	09:21	UTC-4	63°06.670'	067°31.100'	459
2a	Bell-1	Coring	15-juil-2016	14:12	UTC-4	63°32.743'	068°28.519'	210
2a	Bell-2	Coring	15-juil-2016	16:17	UTC-4	63°33.816'	068°30.361'	200

2a	Bell-1	Coring	15-juil-2016	20:56	UTC-4	63°32.750'	068°28.530'	208
2a	Bell-2	Coring	15-juil-2016	21:54	UTC-4	63°33.830'	068°30.130'	203
2a	Bell-3	Coring	15-juil-2016	22:30	UTC-4	63°34.920'	068°31.260'	187
2a	Bell-4	Coring	15-juil-2016	22:54	UTC-4	63°34.980'	068°31.330'	186
2a	FB3	CTD	15-juil-2016	23:34	UTC-4	63°34.170'	068°30.510'	161
2a	FB4	Basic	16-juil-2016	00:54	UTC-4	63°33.527'	068°14.907'	113
2a	Bell-4	Coring	16-juil-2016	05:45	UTC-4	63°34.960'	068°31.348'	190
2a	Bell-3	Coring	16-juil-2016	08:22	UTC-4	63°34.947'	068°31.115'	190
2a	Bell-5	Coring	16-juil-2016	10:08	UTC-4	63°38.578'	068°37.083'	103
2a	Bell-6	Coring	16-juil-2016	12:30	UTC-4	63°38.487'	068°36.911'	115
2a	FB1	CTD	16-juil-2016	13:24	UTC-4	63°38.801'	068°36.429'	86
2a	Bell-5	Coring	16-juil-2016	13:58	UTC-4	63°38.574'	068°37.153'	104
2a	Bell-6	Coring	16-juil-2016	14:21	UTC-4	63°38.495'	068°36.914'	118
2a	FB1-1	Coring	16-juil-2016	16:45	UTC-4	63°38.443'	068°37.246'	134
2a	FB2	CTD	16-juil-2016	18:07	UTC-4	63°40.487'	068°25.879'	63
2a	FB2-2	Coring	16-juil-2016	18:37	UTC-4	63°40.512'	068°25.822'	63
2a	FB2-1	Coring	16-juil-2016	19:35	UTC-4	63°39.817'	068°25.342'	81
2a	FB7	Basic	17-juil-2016	00:44	UTC-4	62°58.685'	067°17.062'	473
2a	FB8	CTD	17-juil-2016	04:16	UTC-4	62°55.412'	067°05.508'	608
2a	ROV1	ROV	18-juil-2016	08:44	UTC-4	61°20.480'	061°09.500'	559
2a	ROV5	ROV	19-juil-2016	09:40	UTC-4	61°26.690'	060°40.520'	576
2a	ROV2	ROV	20-juil-2016	08:15	UTC-4	60°19.300'	062°12.350'	279
2a	ROV2E	ROV	20-juil-2016	21:10	UTC-4	60°18.870'	061°52.750'	284
2a	ROV2E2	ROV	20-juil-2016	22:10	UTC-4	60°18.840'	061°53.630'	279
2a	ROV3	ROV	21-juil-2016	05:03	UTC-4	60°28.133'	061°16.751'	460
2a	ROV6	ROV	22-juil-2016	10:00	UTC-4	62°59.190'	060°37.700'	470
2a	Disco Fan 7	ROV	24-juil-2016	10:55	UTC-4	67°58.080'	059°30.190'	894
2a	Black Corals	Coring	25-juil-2016	20:37	UTC-4	68°16.030'	059°47.900'	1050
2a	181	Nutrient	26-juil-2016	08:12	UTC-4	67°30.200'	061°31.800'	936
2a	180	Basic	26-juil-2016	10:25	UTC-4	67°29.130'	061°40.280'	361
2a	179	Basic	26-juil-2016	20:08	UTC-4	67°26.940'	061°55.140'	190
Leg 2b								
2b	PII-A-1-f	Ice Island	28-juil-2016	10:57	UTC-4	67°24.126'	063°21.564'	286
2b	177	Full	28-juil-2016	19:25	UTC-4	67°28.540'	063°47.323'	340

2b	177 (2)	Full	28-juil-2016	23:24	UTC-4	67°28.520'	063°41.410'	680
2b	177 (3)	Full	29-juil-2016	00:00	UTC-4	67°28.613'	063°40.990'	683
2b	177	Full	29-juil-2016	01:17	UTC-4	67°25.558'	063°47.351'	371
2b	178	Nutrient	29-juil-2016	13:00	UTC-4	68°29.500'	064°40.075'	170
2b	176	Basic	30-juil-2016	02:34	UTC-4	69°35.439'	065°20.688'	401
2b	173	Nutrient	31-juil-2016	08:54	UTC-4	70°41.200'	066°57.070'	363
2b	LGM-AMU-2016-03	Coring	31-juil-2016	18:38	UTC-4	70°34.762'	071°32.981'	609
2b	169	Full	01-août-2016	01:01	UTC-4	71°16.165'	070°31.279'	769
2b	LGM-AMU-2016-01	Coring	01-août-2016	12:50	UTC-4	71°13.747'	070°43.365'	735
2b	LGM-AMU-2016-02	Coring	01-août-2016	14:59	UTC-4	71°04.200'	070°27.094'	697
2b	170	Nutrient	01-août-2016	20:31	UTC-4	71°28.858'	069°58.233'	693
2b	171	Nutrient	01-août-2016	22:10	UTC-4	71°30.850'	069°35.540'	688
2b	172	Nutrient	02-août-2016	00:26	UTC-4	71°39.675'	069°08.544'	1640
2b	166	Nutrient	03-août-2016	05:40	UTC-4	72°29.321'	073°43.281'	340
2b	LGM-AMU-2016-04	Coring	03-août-2016	10:36	UTC-4	72°34.820'	076°02.990'	119
2b	160	Hybrid	03-août-2016	15:31	UTC-4	72°41.268'	078°33.549'	731
2b	325	Nutrient	04-août-2016	04:07	UTC-4	73°49.019'	080°29.641'	677
2b	324	Nutrient	04-août-2016	06:20	UTC-4	73°59.037'	080°28.549'	774
2b	323	Full	04-août-2016	08:43	UTC-4	74°09.390'	080°28.380'	789
2b	300	Nutrient	05-août-2016	02:40	UTC-4	74°19.011'	080°29.761'	704
2b	322	Nutrient	05-août-2016	04:44	UTC-4	74°29.828'	080°32.377'	663
2b	M2=BA=16	Mooring	05-août-2016	20:18	UTC-4	75°39.290'	070°24.030'	531
2b	M1=BA=16	Mooring	05-août-2016	10:52	UTC-4	75°48.160'	070°11.950'	539
2b	115	Full	06-août-2016	03:01	UTC-4	76°19.907'	071°11.890'	677
2b	114	CTD	06-août-2016	17:52	UTC-4	76°19.565'	071°46.797'	620
2b	113	Nutrient	06-août-2016	20:00	UTC-4	76°19.280'	072°13.050'	556
2b	112	CTD	06-août-2016	21:40	UTC-4	76°19.000'	072°41.880'	563
2b	111	Basic	06-août-2016	22:54	UTC-4	76°18.480'	073°12.780'	591
2b	116-A9	Full	07-août-2016	08:56	UTC-4	77°00.190'	072°08.470'	959
2b	138	Nutrient	07-août-2016	14:52	UTC-4	76°40.959'	072°21.871'	169
2b	138b	Nutrient	07-août-2016	19:46	UTC-4	76°37.732'	070°41.279'	180
2b	116-A9	Full	07-août-2016	22:02	UTC-4	76°44.330'	071°49.100'	721
2b	110	Nutrient	08-août-2016	15:02	UTC-4	76°17.925'	073°38.046'	531
2b	109	CTD	08-août-2016	16:46	UTC-4	76°17.395'	074°06.738'	452

2b	108	Full	08-août-2016	17:57	UTC-4	76°15.777'	074°35.749'	447
2b	107	Nutrient	09-août-2016	03:48	UTC-4	76°16.865'	074°59.378'	438
2b	106	CTD	09-août-2016	05:37	UTC-4	76°18.734'	075°22.466'	377
2b	105	Basic	09-août-2016	09:02	UTC-4	76°19.030'	075°45.560'	326
2b	104	Basic	09-août-2016	14:52	UTC-4	76°20.627'	076°10.392'	190
2b	104	Basic	09-août-2016	15:05	UTC-4	76°20.626'	076°10.424'	190
2b	103	Basic	09-août-2016	16:10	UTC-4	76°21.178'	076°34.916'	148
2b	102	Nutrient	09-août-2016	17:47	UTC-4	76°27.359'	076°06.583'	135
2b	101	Full	09-août-2016	23:24	UTC-4	76°23.240'	077°23.860'	341
2b	Trinity (TS233)	Full	11-août-2016	03:06	UTC-4	77°52.838'	077°11.144'	525
2b	TS233N	Nutrient	11-août-2016	12:33	UTC-4	77°47.724'	076°31.982'	572
2b	139	Full	12-août-2016	23:33	UTC-4	81°21.410'	062°48.410'	587
2b	KANE_1	Full	14-août-2016	01:18	UTC-4	79°59.040'	062°48.042'	246
2b	134	Nutrient	14-août-2016	07:46	UTC-4	80°03.285'	068°39.884'	250
2b	136	Nutrient	14-août-2016	09:47	UTC-4	80°03.180'	067°58.850'	259
2b	133	Basic	14-août-2016	16:04	UTC-4	79°33.255'	070°30.533'	181
2b	KANE_5	Nutrient	15-août-2016	03:48	UTC-4	79°00.496'	073°12.615'	245
2b	127	Basic	15-août-2016	09:27	UTC-4	78°18.081'	074°31.069'	579
2b	119	Basic	15-août-2016	18:24	UTC-4	77°58.952'	074°58.128'	644
2b	Allen Bay	Basic	17-août-2016	18:48	UTC-4	74°43.636'	095°14.820'	70
2b	305	Basic	18-août-2016	01:03	UTC-4	74°19.750'	094°58.728'	171
2b	306	Nutrient	18-août-2016	10:34	UTC-4	74°24.860'	098°11.110'	137
2b	310E	Basic	19-août-2016	11:16	UTC-4	71°17.520'	097°42.000'	131
2b	311	Nutrient	19-août-2016	21:17	UTC-4	70°16.190'	098°31.300'	149
2b	312	Basic	20-août-2016	08:19	UTC-4	69°10.300'	100°41.900'	68
2b	QMGM	Basic	20-août-2016	17:56	UTC-4	68°14.484'	101°47.353'	108
2b	GMG2	Basic	21-août-2016	03:48	UTC-4	68°18.818'	100°48.041'	53
2b	WF1	Mooring	21-août-2016	10:52	UTC-4	68°14.794'	101°48.094'	113
2b	QMG1	Basic	22-août-2016	06:10	UTC-4	68°29.499'	099°53.784'	42
2b	GMG3	Basic	22-août-2016	16:37	UTC-4	68°19.754'	102°56.660'	53
2b	GMG4	Basic	22-août-2016	21:22	UTC-4	68°29.050'	103°25.710'	68
2b	314	Full	23-août-2016	06:15	UTC-4	68°58.287'	105°28.560'	79
2b	316	Nutrient	24-août-2016	01:19	UTC-4	68°22.960'	112°07.131'	176
Leg 3a								

3a	AMD0416-4	Coring	26-août-2016	10:58	UTC-5	69°39.230'	117°51.480'	406
3a	AMD0416-3	Coring	26-août-2016	18:06	UTC-5	70°30.140'	120°20.160'	330
3a	405	Basic	27-août-2016	00:36	UTC-5	70°36.670'	123°01.689'	625
3a	407	Full	27-août-2016	20:58	UTC-5	71°00.170'	126°02.750'	330
3a	437	Basic	28-août-2016	14:31	UTC-5	71°48.030'	126°29.913'	287
3a	410	Nutrient	28-août-2016	19:50	UTC-5	71°41.977'	126°29.486'	406
3a	411	CTD	28-août-2016	21:48	UTC-5	71°37.680'	126°42.870'	434
3a	412	Nutrient	28-août-2016	23:26	UTC-5	71°33.820'	126°55.580'	415
3a	413	CTD	29-août-2016	00:54	UTC-5	71°29.544'	127°08.206'	372
3a	414	Nutrient	29-août-2016	01:52	UTC-5	71°25.434'	127°20.072'	320
3a	408	Full	29-août-2016	03:54	UTC-5	71°18.109'	127°34.700'	202
3a	CA-05	Mooring	29-août-2016	10:06	UTC-5	71°16.720'	127°32.260'	199
3a	417	CTD	29-août-2016	18:13	UTC-5	71°13.271'	127°58.743'	83
3a	418	Nutrient	29-août-2016	18:40	UTC-5	71°11.085'	128°05.644'	70
3a	419	CTD	29-août-2016	19:48	UTC-5	71°06.310'	128°20.903'	57
3a	420	Basic	29-août-2016	20:26	UTC-5	71°02.950'	128°30.930'	40
3a	434	Basic	30-août-2016	08:45	UTC-5	70°10.660'	133°32.950'	46
3a	433	CTD	30-août-2016	12:42	UTC-5	70°17.206'	133°34.816'	55
3a	432	Nutrient	30-août-2016	13:31	UTC-5	70°23.637'	133°36.489'	63
3a	431	CTD	30-août-2016	14:27	UTC-5	70°29.492'	133°37.255'	68
3a	430	Nutrient	30-août-2016	15:15	UTC-5	70°35.734'	133°38.805'	71
3a	429	CTD	30-août-2016	16:16	UTC-5	70°41.863'	133°40.591'	69
3a	428	Nutrient	30-août-2016	17:16	UTC-5	70°47.433'	133°41.720'	75
3a	427	CTD	30-août-2016	18:14	UTC-5	70°52.770'	133°43.322'	81
3a	426	Nutrient	30-août-2016	19:09	UTC-5	70°59.082'	133°44.606'	100
3a	425	CTD	30-août-2016	20:13	UTC-5	71°04.730'	133°47.270'	305
3a	424	Nutrient	30-août-2016	21:14	UTC-5	71°10.370'	133°49.480'	576
3a	423	CTD	30-août-2016	22:52	UTC-5	71°16.250'	133°51.340'	795
3a	422	Nutrient	31-août-2016	00:12	UTC-5	71°22.738'	133°53.689'	1102
3a	421	Basic	31-août-2016	01:55	UTC-5	71°27.140'	133°54.145'	1143
3a	GSC Lander-1	Lander	31-août-2016	10:27	UTC-5	70°52.230'	135°01.110'	
3a	GSC Lander-2	Lander	31-août-2016	12:53	UTC-5	70°50.321'	135°08.462'	193
3a	BR-G	Mooring	31-août-2016	18:26	UTC-5	71°00.457'	135°31.072'	726
3a	BR-K	Mooring	31-août-2016	21:41	UTC-5	70°51.770'	135°01.830'	170

3a	482	Basic	01-sept-2016	05:44	UTC-5	70°31.502'	139°22.856'	827
3a	BR-1	Mooring	01-sept-2016	10:48	UTC-5	70°26.560'	139°00.900'	734
3a	472	Basic	02-sept-2016	03:18	UTC-5	69°36.524'	138°13.532'	125
3a	470	Nutrient	02-sept-2016	09:40	UTC-5	69°25.780'	137°59.470'	53
3a	474	Nutrient	02-sept-2016	12:15	UTC-5	69°47.803'	138°26.449'	173
3a	476	Nutrient	02-sept-2016	14:12	UTC-5	69°59.077'	138°39.080'	268
3a	478	Nutrient	02-sept-2016	16:14	UTC-5	70°10.002'	138°54.193'	377
3a	480	Nutrient	02-sept-2016	18:18	UTC-5	70°20.110'	139°08.784'	558
3a	BR-1	Mooring	02-sept-2016	20:29	UTC-5	70°25.840'	139°01.260'	761
3a	482	Basic	03-sept-2016	00:12	UTC-5	70°31.514'	139°22.315'	833
3a	BR-G	Mooring	04-sept-2016	12:20	UTC-5	71°00.073'	135°29.024'	701
3a	BR-K	Mooring	04-sept-2016	19:18	UTC-5	70°51.795'	135°01.539'	167
3a	GSC Lander-2	Lander	04-sept-2016	20:55	UTC-5	70°52.390'	135°00.560'	194
3a	GSC Lander-1	Lander	04-sept-2016	23:41	UTC-5	70°52.450'	135°00.210'	195
3a	435	Full	05-sept-2016	02:30	UTC-5	71°04.465'	133°38.613'	284
3a	421	Basic	05-sept-2016	12:43	UTC-5	71°28.054'	133°54.527'	1168
3a	Lakeman-03a	Coring	06-sept-2016	09:21	UTC-5	72°52.600'	126°21.600'	44
3a	Lakeman-06	Coring	06-sept-2016	13:44	UTC-5	73°06.416'	126°15.588'	102
3a	BR-3	Mooring	07-sept-2016	16:10	UTC-5	73°24.582'	129°18.999'	659
3a	535	Full	07-sept-2016	21:07	UTC-5	73°24.980'	128°11.620'	290
3a	BR-3	Mooring	08-sept-2016	19:40	UTC-5	73°24.536'	129°21.415'	694
3a	GSC-16	Coring	08-sept-2016	22:02	UTC-5	73°24.460'	129°11.700'	636
3a	Lakeman-05	Coring	09-sept-2016	02:05	UTC-5	74°00.449'	129°07.549'	414
3a	554	Full	09-sept-2016	15:34	UTC-5	75°44.861'	126°25.636'	370
3a	575	Full	10-sept-2016	13:24	UTC-5	76°10.900'	125°59.600'	319
3a	577	Nutrient	10-sept-2016	22:05	UTC-5	75°53.430'	125°43.230'	364
3a	579	Nutrient	11-sept-2016	02:09	UTC-5	75°32.034'	125°34.416'	391
3a	581	Nutrient	11-sept-2016	06:55	UTC-5	75°12.832'	125°23.259'	414
3a	583	Nutrient	11-sept-2016	20:14	UTC-5	74°52.840'	125°07.950'	467
3a	585	Basic	12-sept-2016	01:07	UTC-5	74°29.995'	123°14.639'	376
3a	Lakeman-08	Coring	12-sept-2016	14:51	UTC-5	74°53.129'	122°10.053'	506
3a	545	Basic	13-sept-2016	04:25	UTC-5	74°10.596'	126°49.020'	310
3a	Lakeman-07	Coring	13-sept-2016	11:43	UTC-5	74°00.457'	129°07.566'	420
3a	BR-3b	Mooring	13-sept-2016	16:10	UTC-5	73°23.920'	129°21.267'	690

3a	525	Basic	13-sept-2016	23:56	UTC-5	72°22.969'	129°00.476'	351
3a	405	Basic	14-sept-2016	18:05	UTC-5	70°36.479'	123°01.839'	630
3a	406	Basic	15-sept-2016	01:18	UTC-5	69°58.430'	122°57.291'	211
3a	403	Basic	15-sept-2016	10:19	UTC-5	70°06.030'	120°06.140'	411
3a	1402	Basic	15-sept-2016	20:21	UTC-5	70°32.680'	117°39.590'	342
3a	AMD0416-5	Coring	16-sept-2016	18:06	UTC-5	67°51.840'	115°04.317'	52
Leg 3b								
3b	316	Basic	18-sept-2016	02:26	UTC-5	68°23.276'	112°06.587'	176
3b	314	Basic	18-sept-2016	06:52	UTC-5	68°25.205'	111°49.905'	252
3b	QMG4	Basic	19-sept-2016	02:15	UTC-5	68°29.307'	103°25.915'	73
3b	QMG3	Basic	19-sept-2016	08:03	UTC-5	68°19.760'	102°56.580'	50
3b	QMGM	Basic	19-sept-2016	13:04	UTC-5	68°18.427'	101°45.782'	111
3b	QMG2	Basic	19-sept-2016	17:40	UTC-5	68°18.904'	100°47.953'	55
3b	312	Basic	20-sept-2016	03:01	UTC-5	69°10.073'	100°42.510'	64
3b	311	Basic	20-sept-2016	12:16	UTC-5	70°16.770'	098°31.740'	169
3b	310E	Basic	20-sept-2016	18:50	UTC-5	70°49.933'	099°04.119'	209
3b	310W	Basic	21-sept-2016	04:05	UTC-5	71°27.485'	101°16.093'	170
3b	AMD0416-7	Coring	21-sept-2016	11:05	UTC-5	71°52.130'	102°43.290'	246
3b	Furze-04	Coring	22-sept-2016	03:53	UTC-5	73°38.945'	103°23.808'	337
3b	307	Full	22-sept-2016	06:52	UTC-5	73°56.530'	103°03.130'	300
3b	Furze-07	Coring	23-sept-2016	11:37	UTC-5	74°42.456'	097°11.712'	320
3b	346	Nutrient	23-sept-2016	23:18	UTC-5	74°09.080'	091°31.120'	278
3b	304	Basic	24-sept-2016	01:02	UTC-5	74°15.232'	091°31.194'	316
3b	345	Nutrient	24-sept-2016	06:03	UTC-5	74°21.417'	091°29.040'	320
3b	344	Nutrient	24-sept-2016	07:34	UTC-5	74°26.915'	091°31.642'	161
3b	343	Nutrient	24-sept-2016	08:50	UTC-5	74°32.630'	091°32.980'	151
3b	301	Basic	24-sept-2016	18:54	UTC-5	74°06.082'	085°01.527'	503
3b	165	Basic	26-sept-2016	06:55	UTC-4	72°42.937'	075°45.258'	695
3b	177	Basic	28-sept-2016	15:58	UTC-4	67°28.190'	063°47.477'	453
3b	1	Nutrient	29-sept-2016	08:50	UTC-4	67°23.980'	063°14.980'	193
3b	2	Nutrient	29-sept-2016	09:49	UTC-4	67°23.300'	063°15.920'	157
3b	DOWNSTREAM 3	Nutrient	29-sept-2016	10:50	UTC-4	67°22.680'	063°17.200'	316
3b	DOWNSTREAM 4	Nutrient	29-sept-2016	12:00	UTC-4	67°22.325'	063°17.542'	340
3b	640	Nutrient	01-oct-2016	08:31	UTC-4	58°55.950'	062°09.300'	141

3b	645	Nutrient	01-oct-2016	20:05	UTC-4	56°41.970'	059°41.990'	119
3b	650	Nutrient	02-oct-2016	13:11	UTC-4	53°48.126'	055°26.327'	210
3b	AMD0416-9	Coring	02-oct-2016	18:10	UTC-4	52°51.562'	054°45.875'	204
Mooring Program - Hudson Bay (CCGS *Des Groseilliers*)								
DG	AN01	Acoustic	26-sept-2016	14:45	UTC-0	59 58.309	091 58.495	98
DG	AN04	Light	27-sept-2016	15:07	UTC-0	57 40.327	091 36.293	54
DG	BS04	Rosette	27-sept-2016	19:45	UTC-0	57 30.192	091 47.503	44
DG	BS06	Rosette	28-sept-2016	20:30	UTC-0	57 49.765	090 53.441	57
DG	BS07	Light	29-sept-2016	15:29	UTC-0	57 15.948	092 08.901	11
DG	M6	Mooring	29-sept-2016	15:51	UTC-0	57 08.034	092 24.545	29,7
DG	BS08	Light	30-sept-2016	13:50	UTC-0	56 45.501	086 58.336	
DG	S01	River	30-sept-2016		UTC-0	55 57.650	087 42.440	62
DG	BS08	Rosette	30-sept-2016	15:17	UTC-0	56 45.358	086 58.409	
DG	W01	River	30-sept-2016		UTC-0	55 12.890	085 14.460	63
DG	BS09	Rosette	30-sept-2016	19:46	UTC-0	56 20.026	085 29.975	110
DG	JB02	Rosette	01-oct-2016	14:27	UTC-0	54 41.166	080 08.935	78
DG	JB01	Rosette	01-oct-2016	18:14	UTC-0	54 40.682	079 57.490	50
DG	JB00	Rosette	01-oct-2016	19:16	UTC-0	54 38.450	079 51.690	46
DG	JB04	Rosette	02-oct-2016	11:11	UTC-0	54 42.173	80 32.920	107
DG	JB05	Rosette	02-oct-2016	12:20	UTC-0	54 42.609	80 46.623	97
DG	JB06	Rosette	02-oct-2016	13:29	UTC-0	54 43.314	80 59.983	77
DG	JB07	Rosette	02-oct-2016	14:26	UTC-0	54 44.080	81 13.754	63
DG	JB08	Rosette	02-oct-2016	16:59	UTC-0	54 45.391	81 27.331	45
DG	JB09	Rosette	02-oct-2016	17:55	UTC-0	54 45.640	81 41.833	33
DG	JB95	Rosette	02-oct-2016	18:45	UTC-0	54 46.990	81 47.812	27
DG	JB85	Rosette	02-oct-2016	19:48	UTC-0	54 45.245	81 34.985	37
DG	JB10	Rosette	03-oct-2016	10:20	UTC-0	55 09.341	82 02.430	24
DG	JB11	Rosette	03-oct-2016	11:18	UTC-0	55 13.880	81 50.712	47
DG	JB12	Rosette	03-oct-2016	12:22	UTC-0	55 18.778	81 39.786	64
DG	JB13	Rosette	03-oct-2016	14:16	UTC-0	55 22.999	81 05.937	95
DG	JB14	Rosette	03-oct-2016	16:23	UTC-0	55 27.005	80 33.230	105
DG	JB15	Rosette	03-oct-2016	21:46	UTC-0	55 17.486	79 24.114	170
DG	KU02	Rosette	04-oct-2016	10:20	UTC-0	55 18.553	77 51.268	97
DG	KU01	Rosette	04-oct-2016	11:18	UTC-0	55 17.247	77 48.325	43

DG	CI01	Rosette	06-oct-2016	19:00	UTC-0	62 27.777	80 20.109	194
DG	WI01	Light	06-oct-2016	20:24	UTC-0	62 27.512	80 20.282	191
DG	CI03	Idronaut	07-oct-2016	14:10	UTC-0	63 16.133	83 45.538	108
DG	CI02	Rosette	08-oct-2016	11:00	UTC-0	62 43.939	81 42.182	106
DG	MI02	Rosette	08-oct-2016	13:34	UTC-0	62 33.974	80 49.817	208
DG	MI01	Light	08-oct-2016	19:16	UTC-0	62 14.179	78 43.496	131
DG	NI01	CTD	09-oct-2016	18:17	UTC-0	63 15.603	78 21.240	50

Leg	Station ID	Station Type	Local Date	Local Time	UTC to local	Latitude (N)	Longitude (W)	Activity	Depth (m)	Heading (°)	Wind		Air (ºC)	Water (ºC)	Pr Baro	Hum (%)	Ice
											Dir	Speed					
Leg 1a																	
1a	Test	Test	05-juin-2016	14:32	UTC-4	50°20.430'	058°31.064'	CTD-Rosette ↓	202	194	330	2	9,0	7,8	1017,8	82	0/10
1a	Test	Test	05-juin-2016	14:53	UTC-4	50°20.400'	058°31.041'	CTD-Rosette ↑	202	190	330	2	10,1	7,5	1017,9	80	0/10
1a	ISVP1	ISVP	06-juin-2016	15:12	UTC-4	54°11.599'	054°33.641'	iSVP Deployment ↓	183	005	290	6	1,0	1,3	1019,0	99	0/10
1a	Argo1	Argo	07-juin-2016	13:35	UTC-4	58°33.655'	052°50.267'	Argo RemOceans ↓	3388	239	070	5	6,4	5,4	1021,8	91	0/10
1a	Argo1	Argo	07-juin-2016	14:08	UTC-4	58°33.534'	052°50.322'	CTD-Rosette ↓	3382	304	070	9	8,5	5,5	1021,9	82	0/10
1a	Argo1	Argo	07-juin-2016	15:05	UTC-4	58°33.423'	052°50.507'	CTD-Rosette ↑	3390	315	090	20	9,0	5,6	1021,8	79	0/10
1a	Glider	Glider	08-juin-2016	12:15	UTC-4	63°35.472'	053°29.024'	Glider Recovery ↑	1606	032	330	20	3,5	3,6	1021,3	96	0/10
1a	G100	Full	09-juin-2016	13:10	UTC-4	68°29.940'	056°47.387'	CTD-Rosette ↓	371	192	330	20	1,4	1,2	1017,9	99	Bergy
1a	G100	Full	09-juin-2016	13:46	UTC-4	68°29.837'	056°47.569'	CTD-Rosette ↑	370	188	328	25	1,6	1,5	1017,6	99	Bergy
1a	G100	Full	09-juin-2016	14:10	UTC-4	68°29.947'	056°47.078'	AOP ↓	372	280	345	20	0,3	1,5	1017,2	99	Bergy
1a	G100	Full	09-juin-2016	15:07	UTC-4	68°30.590'	056°46.951'	AOP ↑	470	184	330	25	2,8	1,4	1017,4	87	Bergy
1a	G100	Full	09-juin-2016	15:24	UTC-4	68°30.365'	057°47.037'	IOP ↓	377	127	345	25	1,7	1,4	1017,1	92	Bergy
1a	G100	Full	09-juin-2016	15:43	UTC-4	68°30.147'	056°47.376'	IOP ↑	375	132	340	25	1,0	1,5	1016,9	94	Bergy
1a	G100	Full	09-juin-2016	15:55	UTC-4	68°29.894'	056°46.686'	DSN ↓	372	160	332	20	1,0	1,5	1016,8	94	Bergy
1a	G100	Full	09-juin-2016	16:08	UTC-4	68°29.641'	056°46.070'	DSN ↑	372	135	320	17	2,4	1,5	1017,0	88	Bergy
1a	G100	Full	09-juin-2016	16:40	UTC-4	68°30.120'	046°47.540'	CTD-Rosette ↓	373	138	310	21	1,4	1,4	1016,4	92	Bergy
1a	G100	Full	09-juin-2016	17:14	UTC-4	68°29.997'	056°46.777'	CTD-Rosette ↑	372	172	335	25	5,2	1,5	1016,4	74	Bergy
1a	G100	Full	09-juin-2016	17:42	UTC-4	68°29.581'	056°46.433'	Beam Trawl ↓	370	183	320	17	2,4	1,5	1016,2	85	Bergy
1a	G100	Full	09-juin-2016	18:16	UTC-4	68°28.529'	056°43.242'	Beam Trawl ↑	350	093	320	22	1,3	1,5	1016,7	88	Bergy
1a	MVP01	MVP	09-juin-2016	20:50	UTC-4	68°30.625'	055°51.306'	MVP ↓	493	270	330	25	1,6	1,5	1013,7	90	Bergy
1a	MVP01	MVP	10-juin-2016	03:20	UTC-4	68°30.141'	057°08.014'	MVP ↑	375	289	335	25	-0,6	0,9	1014,7	99	Bergy
1a	G101	Nutrient	10-juin-2016	03:50	UTC-4	68°29.880'	057°07.991'	CTD-Rosette ↓	373	144	345	30	-0,1	0,9	1014,7	99	Bergy
1a	G101	Nutrient	10-juin-2016	04:43	UTC-4	68°29.528'	057°07.389'	CTD-Rosette ↑	371	164	330	19	1,5	0,9	1014,6	92	Bergy
1a	G102	Full	10-juin-2016	05:46	UTC-4	68°29.909'	057°28.666'	CTD-Rosette ↓	364	172	330	24	-0,8	0,7	1013,2	99	0/10
1a	G102	Full	10-juin-2016	06:30	UTC-4	68°29.461'	057°28.801'	CTD-Rosette ↑	370	185	330	19	2,0	0,7	1014,4	88	0/10
1a	G102	Full	10-juin-2016	06:47	UTC-4	68°29.953'	057°28.352'	DSN ↓	364	174	330	26	0,5	0,7	1014,1	93	0/10
1a	G102	Full	10-juin-2016	06:56	UTC-4	68°29.614'	057°28.991'	DSN ↑	364	090	340	20	0,1	0,7	1013,2	95	0/10
1a	G102	Full	10-juin-2016	08:05	UTC-4	68°30.055'	057°28.125'	CTD-Rosette ↓	363	120	330	22	-0,6	0,8	1012,7	95	0/10
1a	G102	Full	10-juin-2016	08:45	UTC-4	68°29.635'	057°28.248'	CTD-Rosette ↑	364	118	320	17	1,9	0,8	1012,4	85	Bergy
1a	G102	Full	10-juin-2016	09:00	UTC-4	68°29.578'	057°27.749'	AOP ↓	364	183	330	22	0,4	0,8	1012,3	91	Bergy
1a	G102	Full	10-juin-2016	09:35	UTC-4	68°29.728'	057°29.022'	AOP ↑	365	115	340	24	-0,6	0,8	1012,1	94	Bergy
1a	G102	Full	10-juin-2016	09:50	UTC-4	68°29.699'	057°29.364'	IOP ↓	366	171	330	19	0,3	0,8	1012,1	91	Bergy
1a	G102	Full	10-juin-2016	10:08	UTC-4	68°29.550'	057°29.733'	IOP ↑	367	156	330	20	0,5	0,8	1012,0	88	Bergy
1a	G102	Full	10-juin-2016					Zodiac ↓ (Birds)									
1a	G102	Full	10-juin-2016	11:30	UTC-4	68°30.132'	057°27.740'	Bottom Grab ↓	361	205	350	22	3,1	0,8	1011,6	78	Bergy
1a	G102	Full	10-juin-2016	11:30	UTC-4	68°30.122'	057°27.731'	Bottom Grab ↑	361	139	350	21	3,1	0,8	1011,6	75	Bergy
1a	G102	Full	10-juin-2016	11:44	UTC-4	68°30.148'	057°27.863'	Bottom Grab ↓	363	147	330	25	1,2	0,7	1011,3	84	Bergy
1a	G102	Full	10-juin-2016	12:05	UTC-4	68°30.120'	057°28.165'	Bottom Grab ↑	363	132	345	25	0,8	0,7	1011,2	86	Bergy
1a	G102	Full	10-juin-2016					Zodiac ↑ (Birds)									
1a	MVP02	MVP	10-juin-2016	13:12	UTC-4	68°29.950'	057°28.454'	MVP ↓	364	280	345	25	0,3	0,8	1010,3	87	Bergy

1a	MVP02	MVP	10-juin-2016	15:37	UTC-4	68°30.379'	058°43.867'	MVP ↑	365	267	325	20	-0,1	0,1	1010,6	91	Bergy
1a	G104	Basic	10-juin-2016	20:02	UTC-4	68°29.960'	058°09.156'	CTD-Rosette ↓	323	136	330	22	1,1	0,6	1008,7	86	Bergy
1a	G104	Basic	10-juin-2016	20:44	UTC-4	68°29.601'	058°08.790'	CTD-Rosette ↑	324	117	330	17	2,2	0,8	1008,7	83	Bergy
1a	G104	Basic	10-juin-2016	21:02	UTC-4	68°29.999'	058°09.113'	AOP ↓	323	184	340	21	0,2	0,8	1008,1	90	Bergy
1a	G104	Basic	10-juin-2016	21:40	UTC-4	68°30.176'	058°07.977'	AOP ↑	320	204	310	20	1,5	0,9	1007,9	86	Bergy
1a	G104	Basic	10-juin-2016	21:52	UTC-4	68°30.038'	058°09.614'	IOP ↓	325	133	330	20	0,3	1,0	1007,5	91	Bergy
1a	G104	Basic	10-juin-2016	22:15	UTC-4	68°29.690'	058°09.577'	IOP ↑	326	112	330	22	-0,4	1,0	1007,7	92	Bergy
1a	G103	Nutrient	10-juin-2016	23:35	UTC-4	68°29.965'	057°38.329'	CTD-Rosette ↓	368	135	330	23	-1,1	0,6	1006,8	95	Bergy
1a	G103	Nutrient	11-juin-2016	00:25	UTC-4	68°27.799'	057°37.448'	CTD-Rosette ↑	368	192	330	25	1,0	0,6	1006,5	89	Bergy
1a	G103	Nutrient	11-juin-2016	00:43	UTC-4	68°29.492'	057°36.786'	Agassiz Trawl ↓	370	131	330	25	-1,3	0,6	1006,2	97	Bergy
1a	G103	Nutrient	11-juin-2016	00:59	UTC-4	68°29.132'	057°36.000'	Agassiz Trawl ↑	372	076	325	25	-1,7	0,5	1006,3	99	Bergy
1a	G103	Nutrient	11-juin-2016	01:21	UTC-4	68°29.723'	057°38.052'	Agassiz Trawl ↓	368	132	335	25	-1,3	0,5	1006,4	98	Bergy
1a	G103	Nutrient	11-juin-2016	01:38	UTC-4	68°29.334'	057°37.203'	Agassiz Trawl ↑	370	072	315	25	-1,7	0,5	1006,4	98	Bergy
1a	G105	CTD	11-juin-2016	04:00	UTC-4	68°29.929'	058°31.308'	CTD-Rosette ↓	352	156	000	6	-1,9	0,7	1007,3	99	Bergy
1a	G105	CTD	11-juin-2016	04:25	UTC-4	68°29.843'	058°31.383'	CTD-Rosette ↑	351	165	320	15	-0,7	0,6	1007,3	98	Bergy
1a	G105	CTD	11-juin-2016	06:14	UTC-4	68°28.100'	058°37.400'	Glider Deployment ↓	346	119	320	15	-2,7	-0,4	1007,2	99	Bergy
1a	G106	Nutrient	11-juin-2016	08:31	UTC-4	68°30.067'	058°49.443'	CTD-Rosette ↓	321	198	325	15	-1,9	-0,9	1007,3	99	6/10
1a	G106	Nutrient	11-juin-2016	09:19	UTC-4	68°29.273'	058°49.775'	CTD-Rosette ↑	324	221	320	13	-1,2	-0,8	1007,5	99	6/10
1a	G107	Full	11-juin-2016	10:43	UTC-4	68°29.912'	059°10.762'	CTD-Rosette ↓	317	195	310	13	-0,5	-1,0	1008,1	97	9/10
1a	G107	Full	11-juin-2016	11:20	UTC-4	68°29.749'	059°10.655'	CTD-Rosette ↑	318	197	315	14	0,4	-0,9	1008,0	94	9/10
1a	G107	Full	11-juin-2016	12:35	UTC-4	68°31.187'	059°16.425'	Zodiac ↓ (SCAMP)	426	298	300	15	-1,0	-0,9	1007,7	98	9/10
1a	G107	Full	11-juin-2016	13:03	UTC-4	68°31.042'	059°16.238'	5NVS ↓	425	073	310	15	-1,2	-1,0	1007,8	98	9/10
1a	G107	Full	11-juin-2016	13:16	UTC-4	68°30.997'	059°16.221'	5NVS ↑	424	068	330	15	-1,3	-1,0	1007,8	99	9/10
1a	G107	Full	11-juin-2016	13:46	UTC-4	68°30.998'	059°15.924'	CTD-Rosette ↓	416	211	310	10	-0,3	-1,0	1008,1	98	9/10
1a	G107	Full	11-juin-2016	14:27	UTC-4	68°30.847'	059°15.916'	CTD-Rosette ↑	409	213	295	10	0,3	-1,0	1008,5	86	9/10
1a	G107	Full	11-juin-2016	14:33	UTC-4	68°30.831'	059°15.916'	Zodiac ↑ (SCAMP)	408	213	300	10	0,4	-1,0	1008,6	95	9/10
1a	G107	Full	11-juin-2016	15:30	UTC-4	68°30.380'	059°16.764'	AOP ↓	420	078	305	10	-1,3	-1,0	1008,9	99	9/10
1a	G107	Full	11-juin-2016	16:30	UTC-4	68°30.282'	059°16.803'	AOP ↑	422	063	300	10	-1,4	-1,0	1009,4	99	9/10
1a	G107	Full	11-juin-2016	17:05	UTC-4	68°30.257'	059°16.803'	Hydrobios ↓	418	071	290	10	-1,4	-0,9	1009,6	99	7/10
1a	G107	Full	11-juin-2016	17:17	UTC-4	68°30.210'	059°16.706'	Hydrobios ↑	414	079	310	10	-1,4	-0,9	1009,8	99	7/10
1a	G107	Full	11-juin-2016	17:44	UTC-4	68°30.190'	059°16.537'	CTD-Rosette ↓	412	186	310	8	-1,1	-0,9	1009,9	99	8/10
1a	G107	Full	11-juin-2016	18:09	UTC-4	68°30.137'	059°16.336'	CTD-Rosette ↑	408	187	320	4	-0,3	-1,0	1009,8	99	8/10
1a	G107	Full	11-juin-2016	18:25	UTC-4	68°30.161'	059°16.250'	IOP ↓	409	068	310	7	-0,8	-1,0	1009,8	99	8/10
1a	G107	Full	11-juin-2016	18:42	UTC-4	68°30.064'	059°16.092'	IOP ↑	402	075	290	8	-1,7	-1,0	1009,9	99	8/10
1a	G107	Full	11-juin-2016	18:53	UTC-4	68°30.077'	059°16.903'	Agassiz Trawl ↓	403	302	305	10	-1,7	-1,0	1010,0	99	8/10
1a	G107	Full	11-juin-2016	19:19	UTC-4	68°29.989'	059°15.570'	Agassiz Trawl ↑	396	017	310	9	-1,6	-1,0	1010,1	99	8/10
1a	G108	CTD	11-juin-2016	20:57	UTC-4	68°30.581'	059°29.825'	CTD-Rosette ↓	621	259	320	11	-0,9	-0,9	1010,8	99	8/10
1a	G108	CTD	11-juin-2016	21:20	UTC-4	68°30.536'	059°29.598'	CTD-Rosette ↑	619	017	310	6	-0,7	-1,0	1010,9	99	8/10
1a	G109	Nutrient	11-juin-2016	23:18	UTC-4	68°30.969'	059°50.712'	CTD-Rosette ↓	744	174	310	6	-0,3	-0,8	1011,5	99	8/10
1a	G109	Nutrient	12-juin-2016	00:29	UTC-4	68°30.802'	059°49.895'	CTD-Rosette ↑	704	187	310	1	-0,2	-0,9	1011,7	98	8/10
1a	G110	Full	12-juin-2016	05:40	UTC-4	68°32.032'	060°09.977'	CTD-Rosette ↓	729	141	280	2	-0,8	-1,0	1013,5	96	8/10
1a	G110	Full	12-juin-2016	06:20	UTC-4	68°31.950'	060°10.190'	CTD-Rosette ↑	1443	213	290	1	0,3	-1,0	1013,6	94	8/10
1a	G110	Full	12-juin-2016	06:47	UTC-4	68°32.248'	060°08.877'	AOP ↓	1459	275	280	3	-0,8	-1,0	1013,8	97	8/10

1a	G110	Full	12-juin-2016	07:05	UTC-4	68°32.231'	060°08.861'	5NVS ↓	1458	336	280	4	-0,8	-1,0	1013,8	97	8/10
1a	G110	Full	12-juin-2016	n.a.	UTC-4	68°32.240'	060°08.862'	5NVS ↑	1458	329	280	4	-0,8	-1,0	1013,8	97	8/10
1a	G110	Full	12-juin-2016	09:06	UTC-4	68°31.953'	060°08.483'	CTD-Rosette ↓	1454	096	290	5	0,0	-0,8	1014,2	97	8/10
1a	G110	Full	12-juin-2016	09:50	UTC-4	68°31.837'	060°08.208'	CTD-Rosette ↑	1451	129	250	4	1,5	-0,9	1014,4	94	8/10
1a	G110	Full	12-juin-2016	10:15	UTC-4	68°31.872'	060°08.742'	AOP ↑									
1a	G110	Full	12-juin-2016	10:55	UTC-4	68°31.563'	060°08.725'	CTD-Rosette ↓	1457	280	240	4	0,5	-1,0	1014,7	96	9+
1a	G110	Full	12-juin-2016	11:57	UTC-4	68°31.563'	060°08.272'	CTD-Rosette ↑	1454	253	250	3	1,0	-0,9	1014,8	93	9+
1a	G110	Full	12-juin-2016	12:10	UTC-4	68°31.339'	060°08.194'	Zodiac ↓ (Birds)	1453	259	290	4	0,8	-0,9	1014,6	94	9+
1a	G110	Full	12-juin-2016					Zodiac ↑ (Birds)									
1a	G110	Full	12-juin-2016					Zodiac ↓ (SCAMP)									
1a	G110	Full	12-juin-2016	16:00	UTC-4	68°31.560'	060°08.724'	Zodiac ↑ (SCAMP)									
1a	G111	CTD	12-juin-2016	20:36	UTC-4	68°28.248'	060°26.444'	CTD-Rosette ↓	1591	281	270	5	0,0	-0,8	1015,5	87	9+
1a	G111	CTD	12-juin-2016	20:55	UTC-4	68°28.235'	060°26.260'	CTD-Rosette ↑	1590	280	270	5	0,6	-0,8	1015,7	74	9+
1a	G112	Nutrient	12-juin-2016	22:07	UTC-4	68°33.254'	060°39.212'	CTD-Rosette ↓	1649	244	250	7	0,7	-0,9	1015,4	78	9+
1a	G112	Nutrient	12-juin-2016	23:48	UTC-4	68°33.003'	060°37.604'	CTD-Rosette ↑	1642	252	250	15	-0,3	-1,0	1015,0	77	9+
1a	G113	CTD	13-juin-2016	01:17	UTC-4	68°29.815'	060°52.753'	CTD-Rosette ↓	1693	182	230	9	-0,1	-1,0	1015,1	75	9/10
1a	G113	CTD	13-juin-2016	01:40	UTC-4	68°29.718'	060°52.493'	CTD-Rosette ↑	1691	185	230	11	-0,3	-1,0	1014,8	78	9/10
1a	G114	CTD	13-juin-2016	02:50	UTC-4	68°30.968'	061°06.279'	CTD-Rosette ↓	1720	240	250	9	0,3	-1,0	1014,7	89	9/10
1a	G114	CTD	13-juin-2016	03:07	UTC-4	68°30.897'	061°06.103'	CTD-Rosette ↑	1720	117	260	11	0,1	-1,0	1014,7	90	9/10
1a	G115	Full	13-juin-2016	06:42	UTC-4	68°27.447'	061°21.223'	Zodiac ↓ (SCAMP)	1733	006	270	9	0,6	-0,9	1015,8	91	9/10
1a	G115	Full	13-juin-2016	07:00	UTC-4	68°27.500'	061°21.223'	CTD-Rosette ↓	1731	207	290	3	2,5	-0,9	1015,8	84	9/10
1a	G115	Full	13-juin-2016	07:37	UTC-4	68°27.130'	061°21.095'	CTD-Rosette ↑	1732	170	290	10	1,5	-0,9	1015,9	90	9/10
1a	G115	Full	13-juin-2016	07:42	UTC-4	68°27.130'	061°21.095'	Zodiac ↑ (SCAMP)	1732	170	290	10	1,5	-0,9	1015,8	90	9/10
1a	G115	Full	13-juin-2016	08:33	UTC-4	68°26.898'	061°22.415'	5NVS ↓	1734	103	270	10	1,7	-0,9	1016,1	89	9/10
1a	G115	Full	13-juin-2016	09:34	UTC-4	68°26.587'	061°22.148'	5NVS ↑	1734	086	300	13	1,1	-0,9	1016,1	92	9/10
1a	G115	Full	13-juin-2016	10:15	UTC-4	68°26.353'	061°21.798'	CTD-Rosette ↓	1734	259	310	12	1,7	-0,9	1016,0	91	9/10
1a	G115	Full	13-juin-2016	10:55	UTC-4	68°26.125'	061°21.314'	CTD-Rosette ↑	1731	270	290	10	1,6	-0,9	1016,0	92	9/10
1a	G115	Full	13-juin-2016	11:12	UTC-4	68°26.096'	061°21.118'	IOP ↓	1732	052	270	8	1,5	-0,9	1015,9	92	9/10
1a	G115	Full	13-juin-2016	11:35	UTC-4	68°25.932'	061°20.591'	IOP ↑	1732	051	290	11	0,7	-0,9	1015,9	95	9/10
1a	G115	Full	13-juin-2016					Zodiac ↓ (Birds)									
1a	G115	Full	13-juin-2016					Zodiac ↑ (Birds)									
1a	G115	Full	13-juin-2016	13:20	UTC-4	68°25.231'	061°19.010'	CTD-Rosette ↓	1728	145	300	8	3,2	-0,9	1016,5	84	9/10
1a	G115	Full	13-juin-2016	14:35	UTC-4	68°24.729'	061°17.962'	CTD-Rosette ↑	1723	157	280	6	2,9	-0,9	1016,8	85	9/10
1a	G115	Full	13-juin-2016	n.a.	UTC-4	68°23.502'	061°16.818'	Ice Operation									
1a	G115	Full	13-juin-2016	19:31	UTC-4	68°23.168'	061°17.274'	Mooring Deployment ↓	1724	256	290	7	0,8	-1,0	1017,7	93	9/10
1a	G115	Full	13-juin-2016	20:17	UTC-4	68°22.777'	061°16.436'	Box Core ↓	1720	072	310	10	0,7	-0,9	1017,7	90	9/10
1a	G115	Full	13-juin-2016	21:06	UTC-4	68°22.595'	061°16.154'	Box Core (bottom)	1719	047	285	8	0,0	-0,8	1017,8	93	9/10
1a	G115	Full	13-juin-2016	21:58	UTC-4	68°22.356'	061°15.360'	Box Core ↑	1719	050	275	10	-0,7	-0,8	1017,9	96	9/10
1a	G115	Full	13-juin-2016	23:34	UTC-4	68°22.156'	061°14.026'	Box Core ↓	1710	039	300	9	-1,3	-0,8	1018,1	96	9/10
1a	G115	Full	14-juin-2016	00:20	UTC-4	68°21.953'	061°13.306'	Box Core (bottom)	1708	356	300	5	-2,0	-0,8	1018,5	96	9/10
1a	G115	Full	14-juin-2016	01:01	UTC-4	68°21.833'	061°12.790'	Box Core ↑	1708	009	280	6,5	-1,7	-0,7	1018,5	96	9/10
1a	G200	Nutrient	14-juin-2016	06:25	UTC-4	68°35.030'	060°06.077'	CTD-Rosette ↓	1449	214	270	7	-1,0	-1,0	1016,8	94	9/10
1a	G200	Nutrient	14-juin-2016	07:51	UTC-4	68°34.903'	060°07.013'	CTD-Rosette ↑	1455	199	300	2	1,0	-0,9	1020,0	87	9/10

1a	G201	Ice	14-juin-2016			68°36.180'	059°55.896'	Ice Operation	1380								9+
1a	G201	Full	14-juin-2016	13:15	UTC-4	68°37.995'	059°57.057'	Zodiac ↓ (SCAMP)	1380	197	320	8	0,3	-0,8	1022,5	95	9/10
1a	G201	Full	14-juin-2016	13:25	UTC-4	68°37.994'	059°56.883'	CTD-Rosette ↓	1378	165	310	3	1,5	-0,9	1022,6	90	9/10
1a	G201	Full	14-juin-2016	14:02	UTC-4	68°37.713'	059°56.567'	CTD-Rosette ↑	1373	210	320	2	2,3	-0,9	1022,9	85	9/10
1a	G201	Full	14-juin-2016	14:26	UTC-4	68°37.712'	059°56.781'	IOP ↓	1373	070	310	7	1,5	-0,9	1023,0	88	9/10
1a	G201	Full	14-juin-2016	14:53	UTC-4	68°37.530'	059°56.699'	IOP ↑	1371	099	300	8	0,5	-0,8	1023,2	92	9/10
1a	G201	Full	14-juin-2016	15:10	UTC-4	68°37.442'	059°56.537'	Zodiac ↑ (SCAMP)	1369	133	300	4	2,2	-0,8	1023,2	85	9/10
1a	G201	Full	14-juin-2016	15:25	UTC-4	68°36.825'	059°56.344'	DSN ↓	1401	185	280	7	2,1	-0,8	1023,3	86	9/10
1a	G201	Full	14-juin-2016	15:38	UTC-4	68°36.769'	059°56.104'	DSN ↑	1355	281	280	4	2,1	-0,8	1023,2	86	9/10
1a	G201	Full	14-juin-2016	16:20	UTC-4	68°36.633'	059°55.977'	CTD-Rosette ↓	1353	122	270	4	1,9	-0,8	1023,5	86	9/10
1a	G201	Full	14-juin-2016	17:00	UTC-4	68°36.485'	059°55.811'	CTD-Rosette ↑	1348	129	270	5	2,1	-0,7	1023,5	84	9/10
1a	G201	Full	14-juin-2016	17:45	UTC-4	68°35.491'	059°56.910'	Zodiac ↓ (Birds)	1357	300	270	8	0,8	-0,7	1023,4	90	9/10
1a	G201	Full	14-juin-2016	18:05	UTC-4	68°35.542'	059°56.962'	5NVS ↓	1355	004	270	9	0,5	-0,6	1023,5	90	9/10
1a	G201	Full	14-juin-2016	18:46	UTC-4	68°35.493'	059°56.597'	5NVS ↑	1349	012	260	9	0,5	-0,7	1023,5	89	9/10
1a	G201	Full	14-juin-2016					Zodiac ↑ (Birds)									
1a	G201	Full	14-juin-2016	19:35	UTC-4	68°35.433'	059°56.350'	CTD-Rosette ↓	1348	207	270	10	0,3	-0,8	1023,6	90	9/10
1a	G201	Full	14-juin-2016	20:35	UTC-4	68°35.364'	059°55.827'	CTD-Rosette ↑	1339	214	270	12	-0,2	-0,8	1023,6	92	9/10
1a	G201	Full	14-juin-2016	21:05	UTC-4	68°35.336'	059°55.498'	Mooring (Sediment)	1338	104	270	8	-0,3	-0,8	1023,8	91	9/10
1a	G201	Full	14-juin-2016	22:03	UTC-4	68°35.293'	059°55.515'	Box Core ↓	1333	002	270	9	-0,9	-0,8	1023,7	91	9/10
1a	G201	Full	14-juin-2016	22:40	UTC-4	68°35.175'	059°54.868'	Box Core (bottom)	1321	353	280	9	-1,4	-0,8	1023,7	91	9/10
1a	G201	Full	14-juin-2016	23:12	UTC-4	68°35.047'	059°54.256'	Box Core ↑	1309	016	270	5	-1,7	-0,8	1023,5	92	9/10
1a	G201	Full	14-juin-2016	23:30	UTC-4	68°35.040'	059°54.467'	Box Core ↓	1313	009	290	7	-2,0	-0,8	1023,6	94	9/10
1a	G201	Full	15-juin-2016	00:03	UTC-4	68°34.912'	059°54.050'	Box Core (bottom)	1304	018	300	10	-2,7	-0,9	1023,7	95	9/10
1a	G201	Full	15-juin-2016	00:36	UTC-4	68°34.745'	059°53.688'	Box Core ↑	1295	109	325	10	-2,2	-0,9	1023,9	98	9/10
1a	G202	CTD	15-juin-2016	03:37	UTC-4	68°39.553'	059°36.200'	CTD-Rosette ↓	994	116	260	10	-2,1	-0,8	1023,7	99	9+
1a	G202	CTD	15-juin-2016	03:58	UTC-4	68°39.498'	059°36.337'	CTD-Rosette ↑	993	120	280	1	-0,8	-0,9	1023,8	99	9+
1a	G203	Nutrient	15-juin-2016	04:50	UTC-4	68°41.077'	059°24.990'	CTD-Rosette ↓	679	195	290	4	-1,9	-0,9	1023,6	99	9/10
1a	G203	Nutrient	15-juin-2016	05:55	UTC-4	68°41.199'	059°26.221'	CTD-Rosette ↑	704	229	240	2	-1,7	-0,8	1023,5	99	9/10
1a	G204	Full	15-juin-2016	07:00	UTC-4	68°42.274'	059°14.503'	AOP ↓	524	084	240	4	-1,9	-0,9	1023,5	99	9/10
1a	G204	Full	15-juin-2016					AOP ↑									
1a	G204	Full	15-juin-2016	08:01	UTC-4	68°42.486'	059°15.360'	CTD-Rosette ↓	537	072	210	7	-1,2	-0,8	1023,1	99	9/10
1a	G204	Full	15-juin-2016	08:48	UTC-4	68°42.645'	059°15.622'	CTD-Rosette ↑	545	158	200	6	-1,4	-0,8	1023,1	99	9/10
1a	G204	Full	15-juin-2016					Zodiac ↓ (SCAMP)									
1a	G204	Full	15-juin-2016	09:53	UTC-4	68°42.655'	059°16.038'	Hydrobios ↓	555	275	165	10	-1,5	-0,8	1022,7	98	9/10
1a	G204	Full	15-juin-2016	10:19	UTC-4	68°42.686'	059°15.984'	Hydrobios ↑	554	287	175	8	-1,5	-0,8	1022,3	98	9/10
1a	G204	Full	15-juin-2016	10:37	UTC-4	68°42.705'	059°15.900'	CTD-Rosette ↓	550	104	200	7	-1,3	-0,7	1022,3	98	9/10
1a	G204	Full	15-juin-2016	11:20	UTC-4	68°42.721'	059°15.501'	CTD-Rosette ↑	544	116	200	7	0,1	-0,8	1021,7	96	9/10
1a	G204	Full	15-juin-2016					Zodiac ↑ (SCAMP)									
1a	G204	Full	15-juin-2016	12:14	UTC-4	68°42.764'	059°15.037'	IOP ↓	537	334	195	10	-0,6	-0,8	1021,1	97	9/10
1a	G204	Full	15-juin-2016	12:40	UTC-4	68°42.260'	059°14.765'	IOP ↑	534	035	195	10	0,0	-0,8	1021,2	94	9/10
1a	G204	Full	15-juin-2016	13:05	UTC-4	68°42.670'	059°14.472'	5NVS ↓	527	017	195	10	0,3	-0,8	1020,7	93	9/10
1a	G204	Full	15-juin-2016	13:35	UTC-4	68°42.714'	059°13.984'	5NVS ↑	520	089	200	15	1,1	-0,8	1020,6	92	9/10
1a	G204	Full	15-juin-2016	14:04	UTC-4	68°42.749'	059°13.460'	Zodiac ↓ (Birds)	513	069	205	15	1,1	-0,9	1020,2	92	9/10

1a	G204	Full	15-juin-2016	14:11	UTC-4	68°42.751'	059°13.340'	CTD-Rosette ↓	512	072	205	10	0,9	-0,9	1020,0	93	9/10
1a	G204	Full	15-juin-2016	14:38	UTC-4	68°41.743'	059°12.898'	CTD-Rosette ↑	508	069	215	10	1,0	-0,8	1020,0	93	9/10
1a	G204	Full	15-juin-2016	14:50	UTC-4	68°42.556'	059°12.474'	Zodiac ↑ (Birds)	496	097	225	10	1,1	-0,8	1019,9	93	9/10
1a	G204	Full	15-juin-2016	15:11	UTC-4	68°42.249'	059°09.867'	Agassiz Trawl ↓	445	113	225	15	1,2	-0,6	1019,7	93	8/10
1a	G204	Full	15-juin-2016	16:05	UTC-4	68°42.437'	059°08.099'	Agassiz Trawl ↑	429	355	240	12	0,4	-0,7	1019,1	95	8/10
1a	G204	Full	15-juin-2016	16:30	UTC-4	68°41.664'	058°07.758'	Ice Operation									
1a	G205	CTD	15-juin-2016	20:14	UTC-4	68°44.641'	058°56.197'	CTD-Rosette ↓	354	235	330	10	-0,7	-0,9	1018,3	99	8/10
1a	G205	CTD	15-juin-2016	20:33	UTC-4	68°44.484'	058°56.067'	CTD-Rosette ↑	354	216	340	15	-0,6	-0,8	1018,3	99	8/10
1a	G206	Nutrient	15-juin-2016	21:36	UTC-4	68°46.414'	058°44.380'	CTD-Rosette ↓	332	281	040	8	-0,8	-0,7	1018,0	99	8/10
1a	G206	Nutrient	15-juin-2016	22:27	UTC-4	68°46.005'	058°44.331'	CTD-Rosette ↑	332	304	045	8	-0,2	-0,6	1018,1	96	8/10
1a	G207	CTD	15-juin-2016	23:30	UTC-4	68°48.278'	058°29.578'	CTD-Rosette ↓	321	277	035	9	-0,4	-0,4	1017,8	93	7/10
1a	G207	CTD	15-juin-2016	23:48	UTC-4	68°48.180'	058°29.501'	CTD-Rosette ↑	320	302	045	9	-0,2	-0,2	1017,8	93	7/10
1a	MVP03	MVP	16-juin-2016	00:42	UTC-4	68°49.511'	058°17.068'	MVP ↓	324	070	015	10	-0,7	0,5	1017,4	97	1/10
1a	MVP03	MVP	16-juin-2016	07:19	UTC-4	68°49.884'	058°16.898'	MVP ↑	320	247	020	13	-0,3	1,4	1016,8	87	1/10
1a	G207	Full	16-juin-2016	08:01	UTC-4	68°47.699'	058°31.706'	CTD-Rosette ↓	322	217	340	17	-0,5	0,4	1016,9	94	6/10
1a	G207	Full	16-juin-2016	08:39	UTC-4	68°47.352'	058°32.475'	CTD-Rosette ↑	323	261	350	10	-0,9	0,3	1016,9	95	6/10
1a	G207	Full	16-juin-2016					AOP ↓									
1a	G207	Full	16-juin-2016	10:31	UTC-4	68°48.126'	058°30.954'	CTD-Rosette ↓	322	169	330	12	0,3	0,6	1016,4	94	6/10
1a	G207	Full	16-juin-2016	11:18	UTC-4	68°47.667'	058°31.972'	CTD-Rosette ↑	323	267	340	16	0,7	0,5	1016,3	92	6/10
1a	G207	Full	16-juin-2016					AOP ↑									
1a	G207	Full	16-juin-2016	12:30	UTC-4	68°47.928'	058°33.804'	Zodiac ↓ (SCAMP)	323	170	345	20	-0,6	0,4	1015,8	93	3/10
1a	G207	Full	16-juin-2016	12:55	UTC-4	68°47.799'	058°32.118'	DSN ↓	323	158	345	20	-0,7	0,4	1015,7	91	2/10
1a	G207	Full	16-juin-2016	13:07	UTC-4	68°47.570'	058°31.160'	DSN ↑	324	077	340	20	-1,2	0,4	1015,8	92	2/10
1a	G207	Full	16-juin-2016	13:25	UTC-4	68°47.487'	058°30.610'	IOP ↓	322	142	345	25	-0,3	0,5	1015,6	87	2/10
1a	G207	Full	16-juin-2016	13:53	UTC-4	68°47.456'	058°31.062'	IOP ↑	322	135	340	25	-0,6	0,4	1015,5	92	2/10
1a	G207	Full	16-juin-2016	14:03	UTC-4	68°47.301'	058°31.132'	Zodiac ↑ (SCAMP)	323	113	335	25	-1,4	0,5	1015,4	93	2/10
1a	G207	Full	16-juin-2016	14:27	UTC-4	68°47.907'	058°31.182'	CTD-Rosette ↓	323	184	330	25	-1,3	0,5	1015,1	94	Bergy
1a	G207	Full	16-juin-2016	14:49	UTC-4	68°47.858'	058°30.902'	CTD-Rosette ↑	323	183	330	20	0,3	0,1	1015,3	86	Bergy
1a	G207	Full	16-juin-2016	14:58	UTC-4	68°47.865'	058°31.143'	Agassiz Trawl ↓	322	159	345	20	0,3	0,1	1015,3	86	Bergy
1a	G207	Full	16-juin-2016	15:51	UTC-4	68°47.187'	058°30.398'	Agassiz Trawl ↑	322	137	330	25	-1,6	0,5	1014,6	96	Bergy
1a	G208	CTD	16-juin-2016	16:30	UTC-4	68°49.302'	058°18.045'	CTD-Rosette ↓	326	176	320	20	-2,1	0,9	1014,3	95	1/10
1a	G208	CTD	16-juin-2016	16:49	UTC-4	68°49.226'	058°17.924'	CTD-Rosette ↑	325	162	330	13	2,9	1,0	1014,3	77	1/10
1a	G209	Basic	16-juin-2016	17:35	UTC-4	68°51.055'	058°04.960'	CTD-Rosette ↓	306	170	330	22	-2,0	1,3	1013,4	94	1/10
1a	G209	Basic	16-juin-2016	18:23	UTC-4	68°50.948'	058°04.664'	CTD-Rosette ↑	305	164	330	14	2,4	1,3	1013,1	77	1/10
1a	G210	CTD	16-juin-2016	19:10	UTC-4	68°52.546'	057°51.787'	CTD-Rosette ↓	285	165	330	22	-1,8	1,5	1012,6	92	1/10
1a	G210	CTD	16-juin-2016	19:27	UTC-4	68°52.523'	057°51.636'	CTD-Rosette ↑	285	154	330	16	1,5	1,5	1012,7	80	1/10
1a	G211	Nutrient	16-juin-2016	20:08	UTC-4	68°54.470'	057°39.014'	CTD-Rosette ↓	294	170	350	20	0,2	1,4	1011,8	88	Bergy
1a	G211	Nutrient	16-juin-2016	20:56	UTC-4	68°54.508'	057°38.753'	CTD-Rosette ↑	294	178	340	21	2,3	1,3	1011,4	78	Bergy
1a	G211	Nutrient	16-juin-2016	22:26	UTC-4	68°59.468'	058°08.954'	Agassiz Cancelled	309	157	330	15	-2,5	1,3	1011,0	92	Bergy
1a	G211	Nutrient	16-juin-2016	22:52	UTC-4	68°59.186'	058°09.243'	Agassiz Trawl ↓	308	128	330	20	-2,5	1,3	1010,5	93	Bergy
1a	G211	Nutrient	16-juin-2016	23:26	UTC-4	68°58.829'	058°06.635'	Agassiz Trawl ↑	307	132	310	19	-2,4	1,2	1010,5	94	Bergy
1a	G211	Nutrient	17-juin-2016	00:17	UTC-4	68°58.955'	058°07.974'	CTD-Rosette ↓	308	151	310	15	-1,9	1,2	1009,9	92	Bergy
1a	G211	Nutrient	17-juin-2016	00:38	UTC-4	68°58.946'	058°07.518'	CTD-Rosette ↑	309	165	315	25	-0,3	1,1	1010,2	88	Bergy

1a	G211	Nutrient	17-juin-2016	00:56	UTC-4	68°58.716'	058°07.168'	Beam Trawl ↓	309	127	330	25	-1,7	1,1	1009,9	92	Bergy
1a	G211	Nutrient	17-juin-2016	01:34	UTC-4	68°58.267'	058°02.621'	Beam Trawl ↑	305	076	315	20	-2,8	1,1	1009,7	94	Bergy
1a	G211	Nutrient	17-juin-2016	02:14	UTC-4	68°58.969'	058°07.978'	Box Core ↓	309	115	315	20	-1,3	1,2	1009,5	92	Bergy
1a	G211	Nutrient	17-juin-2016	02:22	UTC-4	68°58.860'	058°08.013'	Box Core (bottom)	310	139	315	15	-1,1	1,1	1009,5	89	Bergy
1a	G211	Nutrient	17-juin-2016	02:31	UTC-4	68°58.854'	058°07.810'	Box Core ↑	308	152	310	20	-1,9	1,1	1009,4	93	Bergy
1a	MVP04	MVP	17-juin-2016	03:38	UTC-4	68°59.818'	058°18.473'	MVP ↓	306	018	290	15	-3,6	1,1	1009,0	98	Bergy
1a	MVP04	MVP	17-juin-2016	08:50	UTC-4	69°00.315'	055°59.918'	MVP ↑	130	000	300	13	-0,5	2,4	1007,8	96	Bergy
1a	G3000	Nutrient	17-juin-2016	09:02	UTC-4	69°00.463'	055°59.464'	CTD-Rosette ↓	126	163	290	12	-0,4	2,3	1007,7	97	Bergy
1a	G3000	Nutrient	17-juin-2016	09:34	UTC-4	69°00.412'	055°59.389'	CTD-Rosette ↑	126	154	280	10	0,3	2,4	1007,7	96	Bergy
1a	G300	Full	17-juin-2016	11:08	UTC-4	69°00.055'	056°46.454'	AOP ↓	193	136	270	12	-0,5	2,0	1008,0	85	Bergy
1a	G300	Full	17-juin-2016	12:01	UTC-4	68°59.824'	056°47.172'	AOP ↑	200	110	260	10	-0,1	1,9	1008,2	86	Bergy
1a	G300	Full	17-juin-2016	12:33	UTC-4	68°59.940'	056°47.318'	CTD-Rosette ↓	195	097	250	10	-1,2	1,8	1008,4	88	Bergy
1a	G300	Full	17-juin-2016	13:04	UTC-4	68°59.715'	056°47.358'	CTD-Rosette ↑	198	091	245	10	0,4	1,9	1008,6	81	Bergy
1a	G300	Full	17-juin-2016	13:14	UTC-4	68°59.727'	056°47.147'	Zodiac ↓ (SCAMP)	200	022	245	10	0,2	1,9	1008,6	83	Bergy
1a	G300	Full	17-juin-2016	13:27	UTC-4	68°59.999'	056°47.823'	DSN ↓	201	053	255	5	-1,1	1,9	1008,6	89	Bergy
1a	G300	Full	17-juin-2016	13:41	UTC-4	69°00.393'	056°47.688'	DSN ↑	196	320	250	5	-1,0	1,8	1008,6	89	Bergy
1a	G300	Full	17-juin-2016	14:01	UTC-4	69°00.019'	056°47.418'	IOP ↓	197	086	240	10	-0,7	1,8	1008,7	88	Bergy
1a	G300	Full	17-juin-2016	14:23	UTC-4	68°59.894'	056°47.358'	IOP ↑	197	053	195	10	0,2	1,9	1008,6	84	Bergy
1a	G300	Full	17-juin-2016	14:28	UTC-4	68°59.879'	056°47.310'	Zodiac ↑ (SCAMP)	196	065	195	5	0,2	1,9	1008,6	84	Bergy
1a	G300	Full	17-juin-2016	14:54	UTC-4	69°00.054'	056°46.777'	CTD-Rosette ↓	197	042	185	10	-0,2	2,0	1008,9	82	Bergy
1a	G300	Full	17-juin-2016	15:31	UTC-4	68°59.963'	056°46.620'	CTD-Rosette ↑	196	068	182	10	0,1	2,0	1009,0	78	Bergy
1a	G300	Full	17-juin-2016	15:42	UTC-4	68°59.989'	056°47.544'	Zodiac ↓ (Birds)	202	205	210	5	-0,8	2,0	1009,0	82	Bergy
1a	G300	Full	17-juin-2016	16:02	UTC-4	69°00.011'	056°47.296'	Beam Trawl ↓	197	019	210	5	-0,5	1,9	1009,3	86	Bergy
1a	G300	Full	17-juin-2016	16:50	UTC-4	69°01.284'	056°47.223'	Beam Trawl ↑	209	312	150	5	-1,4	1,9	1009,4	85	Bergy
1a	G300	Full	17-juin-2016	17:00	UTC-4	69°01.666'	056°48.401'	Zodiac ↑ (Birds)	204	091	180	3	-1,6	2,0	1009,6	85	Bergy
1a	G300	Full	17-juin-2016	17:30	UTC-4	69°00.002'	056°47.285'	CTD-Rosette ↓	198	081	190	5	-1,6	2,1	1007,5	87	Bergy
1a	G300	Full	17-juin-2016	17:50	UTC-4	68°59.963'	056°47.962'	CTD-Rosette ↑	199	068	180	1	-1,2	2,0	1010,0	91	Bergy
1a	G300	Full	17-juin-2016	18:12	UTC-4	68°59.969'	056°47.328'	Agassiz Trawl ↓	199	024	180	1	-1,2	2,0	1010,0	91	Bergy
1a	G300	Full	17-juin-2016	18:35	UTC-4	69°00.256'	056°48.434'	Agassiz Trawl ↑	208	218	130	6	-1,2	1,9	1009,9	91	Bergy
1a	G300	Full	17-juin-2016	19:00	UTC-4	69°00.048'	056°47.419'	Box Core ↓	197	000	150	6	-1,8	1,9	1007,5	85	Bergy
1a	G300	Full	17-juin-2016	19:05	UTC-4	69°00.036'	056°47.453'	Box Core (bottom)	200	341	160	5	-1,2	1,8	1010,0	82	Bergy
1a	G300	Full	17-juin-2016	19:12	UTC-4	69°00.017'	056°47.415'	Box Core ↑	199	346	150	4	-0,6	1,8	1009,9	82	Bergy
1a	G300	Full	17-juin-2016	19:30	UTC-4	69°00.048'	056°47.410'	Glider Deployment	198	030	140	5	-0,7	1,8	1009,8	84	Bergy
1a	G300	Full	17-juin-2016	19:50	UTC-4	69°00.148'	056°47.430'	Box Core ↓	199	000	140	5	-1,0	1,8	1009,8	86	Bergy
1a	G300	Full	17-juin-2016	19:55	UTC-4	69°00.157'	056°47.412'	Box Core (bottom)	198	314	140	5	-1,2	1,8	1010,0	86	Bergy
1a	G300	Full	17-juin-2016	20:00	UTC-4	69°00.173'	056°47.377'	Box Core ↑	198	307	160	5	-1,5	1,7	1010,0	87	Bergy
1a	G300	Full	17-juin-2016	20:18	UTC-4	69°00.035'	056°47.496'	Box Core ↓	199	003	160	6	-2,0	1,8	1009,9	90	Bergy
1a	G300	Full	17-juin-2016	20:22	UTC-4	69°00.037'	056°47.461'	Box Core (bottom)	200	351	170	7	-1,5	1,9	1009,9	89	Bergy
1a	G300	Full	17-juin-2016	20:29	UTC-4	69°00.021'	056°47.444'	Box Core ↑	199	324	175	10	-1,5	1,9	1009,9	89	Bergy
1a	G301	CTD	17-juin-2016	22:27	UTC-4	69°00.017'	057°00.572'	CTD-Rosette ↓	225	307	160	9	-2,3	1,8	1009,8	92	Bergy
1a	G301	CTD	17-juin-2016	22:42	UTC-4	69°00.092'	057°00.659'	CTD-Rosette ↑	226	272	140	8	-2,4	1,9	1009,8	92	Bergy
1a	G302	Nutrient	17-juin-2016	23:20	UTC-4	68°59.985'	057°14.915'	CTD-Rosette ↓	234	353	125	9	-2,3	1,6	1009,6	93	Bergy
1a	G302	Nutrient	17-juin-2016	23:59	UTC-4	69°00.132'	057°15.055'	CTD-Rosette ↑	233	003	145	10	-0,2	1,7	1009,3	85	Bergy

1a	G303	Basic	18-juin-2016	00:38	UTC-4	69°00.053'	057°29.156'	AOP ↓	272	308	152	10	-1,9	1,7	1009,1	92	Bergy
1a	G303	Basic	18-juin-2016	01:23	UTC-4	68°59.842'	057°28.450'	AOP ↑	272	024	148	10	-1,3	1,7	1009,0	93	Bergy
1a	G303	Basic	18-juin-2016	01:36	UTC-4	69°00.003'	057°29.149'	CTD-Rosette ↓	272	356	160	10	-1,3	1,8	1008,9	94	Bergy
1a	G303	Basic	18-juin-2016	02:09	UTC-4	69°00.007'	057°28.597'	CTD-Rosette ↑	272	029	150	12	-0,7	1,8	1008,8	91	Bergy
1a	G304	CTD	18-juin-2016	03:19	UTC-4	68°59.993'	057°42.659'	CTD-Rosette ↓	297	002	152	10	-2,0	1,4	1008,6	97	Bergy
1a	G304	CTD	18-juin-2016	03:35	UTC-4	68°59.990'	057°42.608'	CTD-Rosette ↑	298	011	125	11	-1,4	1,4	1008,5	96	Bergy
1a	G305	Nutrient	18-juin-2016	04:14	UTC-4	68°59.981'	057°56.978'	CTD-Rosette ↓	300	359	150	10	-2,1	1,6	1008,4	98	Bergy
1a	G305	Nutrient	18-juin-2016	04:55	UTC-4	69°00.051'	057°56.861'	CTD-Rosette ↑	302	073	160	2	-1,1	1,5	1008,4	98	Bergy
1a	G306	CTD	18-juin-2016	05:31	UTC-4	68°59.978'	058°11.261'	CTD-Rosette ↓	309	013	140	13	-2,1	1,5	1008,2	99	Bergy
1a	G306	CTD	18-juin-2016	05:50	UTC-4	69°00.021'	058°11.409'	CTD-Rosette ↑	308	051	150	2	-1,1	1,6	1008,0	97	Bergy
1a	G309	Full	18-juin-2016	07:01	UTC-4	69°00.045'	058°43.821'	AOP ↓	342	084	150	14	-2,1	0,9	1007,5	98	Bergy
1a	G309	Full	18-juin-2016	07:17	UTC-4	69°00.057'	058°44.460'	AOP (bottom)	353	064	150	2	-1,1	0,6	1007,4	95	7/10
1a	G309	Full	18-juin-2016	07:37	UTC-4	69°00.147'	058°45.432'	AOP ↑	363	060	160	6	-1,1	0,5	1007,4	94	7/10
1a	G309	Full	18-juin-2016					Zodiac ↓ (SCAMP)									
1a	G309	Full	18-juin-2016	08:43	UTC-4	69°00.002'	058°44.212'	CTD-Rosette ↓	347	339	140	10	-1,9	0,2	1007,0	99	7/10
1a	G309	Full	18-juin-2016	09:21	UTC-4	69°00.027'	058°45.581'	CTD-Rosette ↑	369	023	140	11	0,2	0,1	1006,9	93	7/10
1a	G309	Full	18-juin-2016	09:34	UTC-4	69°00.051'	058°44.440'	DSN ↓	349	256	125	10	-1,0	0,1	1006,6	96	7/10
1a	G309	Full	18-juin-2016	09:49	UTC-4	68°59.668'	058°45.517'	DSN ↑	332	148	145	15	-1,8	0,1	1006,5	99	7/10
1a	G309	Full	18-juin-2016	10:19	UTC-4	68°59.932'	058°44.225'	CTD-Rosette ↓	339	320	140	17	-1,1	0,1	1006,2	98	7/10
1a	G309	Full	18-juin-2016	11:02	UTC-4	68°59.937'	058°45.970'	CTD-Rosette ↑	305	339	130	17	0,7	0,1	1005,9	93	7/10
1a	G309	Full	18-juin-2016					Zodiac ↑ (SCAMP)									
1a	G309	Full	18-juin-2016	11:32	UTC-4	69°00.006'	058°43.451'	IOP ↓	337	327	140	15	-1,2	0,2	1005,4	98	7/10
1a	G309	Full	18-juin-2016	11:58	UTC-4	69°00.029'	058°44.161'	IOP ↑	348	326	125	18	-1,6	0,3	1005,3	98	1/10
1a	G309	Full	18-juin-2016	12:52	UTC-4	69°00.095'	058°44.604'	IKMT ↓	351	305	130	17	-0,8	0,2	1005,1	95	1/10
1a	G309	Full	18-juin-2016	13:02	UTC-4	69°00.048'	058°45.678'	IKMT ↑	366	244	120	18	-1,2	0,1	1004,9	96	1/10
1a	G309	Full	18-juin-2016	13:12	UTC-4	68°59.936'	058°46.630'	IKMT ↓	367	237	118	15	-1,1	-0,1	1004,8	96	Bergy
1a	G309	Full	18-juin-2016	13:47	UTC-4	68°59.015'	058°50.067'	IKMT ↑	394	275	134	20	-0,7	0,0	1004,7	95	Bergy
1a	G309	Full	18-juin-2016	14:14	UTC-4	68°59.167'	058°51.107'	Zodiac ↓ (Birds)	408	245	122	16	0,8	-0,2	1004,2	90	Bergy
1a	G309	Full	18-juin-2016	14:55	UTC-4	69°00.004'	058°43.872'	CTD-Rosette ↓	344	322	123	14	0,4	0,0	1003,7	91	Bergy
1a	G309	Full	18-juin-2016	15:22	UTC-4	68°59.994'	058°44.840'	CTD-Rosette ↑	346	341	125	17	2,5	0,1	1003,7	85	Bergy
1a	G309	Full	18-juin-2016	15:30	UTC-4	69°00.128'	058°45.270'	Agassiz Trawl ↓	360	303	135	17	2,9	0,1	1003,7	82	Bergy
1a	G309	Full	18-juin-2016	16:17	UTC-4	68°59.913'	058°48.875'	Agassiz Trawl ↑	372	226	130	14	0,5	0,0	1003,5	90	Bergy
1a	G309	Full	18-juin-2016	16:23	UTC-4	68°59.901'	058°49.286'	Zodiac ↑ (Birds)	378	226	130	14	0,5	0,0	1003,4	90	Bergy
1a	G306b	Coring	18-juin-2016	18:04	UTC-4	68°59.464'	058°08.981'	Box Core ↓	309	000	150	17	1,7	1,4	1002,8	84	Bergy
1a	G306b	Coring	18-juin-2016	18:11	UTC-4	68°59.501'	058°08.991'	Box Core (bottom)	309	330	150	13	1,9	1,5	1003,3	83	Bergy
1a	G306b	Coring	18-juin-2016	18:19	UTC-4	68°59.493'	058°08.984'	Box Core ↑	307	343	150	13	1,9	1,5	1003,3	83	Bergy
1a	G307	CTD	18-juin-2016	19:07	UTC-4	69°00.058'	058°24.805'	CTD-Rosette ↓	312	008	160	15	-1,3	1,5	1002,8	91	Bergy
1a	G307	CTD	18-juin-2016	19:25	UTC-4	69°00.241'	058°25.198'	CTD-Rosette ↑	311	320	150	9	3,6	1,5	1002,6	83	Bergy
1a	G308	Nutrient	18-juin-2016	20:03	UTC-4	69°00.029'	058°39.144'	CTD-Rosette ↓	394	330	180	14	-0,4	1,1	1002,8	99	Bergy
1a	G308	Nutrient	18-juin-2016	20:47	UTC-4	69°00.621'	058°39.584'	CTD-Rosette ↑	325	345	170	17	1,0	0,7	1002,7	98	Bergy
1a	G310	Basic	18-juin-2016	22:08	UTC-4	69°01.517'	059°03.917'	AOP ↓	621	324	160	14	-1,2	-0,5	1002,1	99	9/10
1a	G310	Basic	18-juin-2016	22:41	UTC-4	69°01.580'	059°03.417'	AOP ↑	621	311	150	12	-0,8	-0,6	1002,1	99	9/10
1a	G310	Basic	18-juin-2016	22:49	UTC-4	69°01.588'	059°03.355'	CTD-Rosette ↓	621	315	150	10	-1,1	-0,6	1002,2	99	9/10

1a	G310	Basic	18-juin-2016	23:24	UTC-4	69°01.659'	059°03.097'	CTD-Rosette ↑	614	268	130	10	-1,2	-0,6	1002,1	99	9/10
1a	G311	CTD	19-juin-2016	00:32	UTC-4	68°59.588'	059°19.716'	CTD-Rosette ↓	934	358	148	9	-1,1	-0,8	1001,8	99	9/10
1a	G311	CTD	19-juin-2016	01:09	UTC-4	68°59.668'	059°19.650'	CTD-Rosette ↑	931	034	155	8	-0,9	-0,8	1001,9	99	9/10
1a	G313	Nutrient	19-juin-2016	03:10	UTC-4	69°00.664'	059°47.966'	CTD-Rosette ↓	1501	049	150	6	-1,0	-0,9	1001,5	99	9/10
1a	G313	Nutrient	19-juin-2016	04:49	UTC-4	69°01.080'	059°46.829'	CTD-Rosette ↑	1500	057	220	1	-0,8	-0,9	1001,5	99	9+
1a	G312	Full	19-juin-2016	06:00	UTC-4	69°00.762'	059°34.368'	Ice Operation									
1a	G312	Full	19-juin-2016	09:15	UTC-4	69°00.729'	059°33.714'	CTD-Rosette ↓	1395	045	120	5	-0,4	-0,8	1002,4	97	9+
1a	G312	Full	19-juin-2016	09:52	UTC-4	69°00.785'	059°34.295'	CTD-Rosette ↑	1403	002	110	4	0,8	-0,8	1002,4	95	9+
1a	G312	Full	19-juin-2016	10:15	UTC-4	69°00.770'	059°34.519'	5NVS ↓	1403	206	070	2	0,2	-0,8	1002,2	96	9+
1a	G312	Full	19-juin-2016	10:56	UTC-4	69°00.802'	059°35.269'	5NVS ↑	1410	199	080	5	0,0	-0,8	1002,1	97	9+
1a	G312	Full	19-juin-2016	11:33	UTC-4	69°00.833'	059°36.049'	IOP ↓	1419	184	100	7	0,0	-0,7	1002,0	97	9/10
1a	G312	Full	19-juin-2016	12:00	UTC-4	69°00.875'	059°36.650'	IOP ↑	1424	198	118	3	0,2	-0,7	1002,1	97	9/10
1a	G312	Full	19-juin-2016	12:32	UTC-4	69°01.357'	059°35.989'	Zodiac ↓ (SCAMP)	1430	316	100	3	2,0	-0,8	1002,0	90	9/10
1a	G312	Full	19-juin-2016	12:41	UTC-4	69°01.381'	059°36.256'	CTD-Rosette ↓	1432	312	100	0,6	2,0	-0,8	1002,0	90	9/10
1a	G312	Full	19-juin-2016	13:22	UTC-4	69°01.455'	059°37.046'	CTD-Rosette ↑	1441	058	092	4	0,6	-0,7	1002,1	95	9/10
1a	G312	Full	19-juin-2016	14:06	UTC-4	69°01.638'	059°37.489'	Zodiac ↑ (SCAMP)	1446	322	070	3	0,7	-0,7	1002,3	96	9/10
1a	G312	Full	19-juin-2016	14:13	UTC-4	69°01.650'	059°37.423'	Zodiac ↓ (Birds)	1448	334	070	4	1,1	-0,7	1002,3	95	9/10
1a	G312	Full	19-juin-2016	14:24	UTC-4	69°01.609'	059°37.568'	Hydrobios ↓	1448	075	073	4	1,7	-0,7	1002,4	92	9/10
1a	G312	Full	19-juin-2016	15:39	UTC-4	69°01.782'	059°37.875'	Hydrobios ↑	1454	105	115	4	1,0	-0,7	1002,7	967	9/10
1a	G312	Full	19-juin-2016	15:52	UTC-4	69°01.908'	059°37.748'	Zodiac ↑ (Birds)	1882	011	088	4	1,0	-0,7	1002,7	97	9/10
1a	G312	Full	19-juin-2016	16:14	UTC-4	69°01.973'	059°37.741'	CTD-Rosette ↓	1458	004	070	5	0,9	-0,7	1002,7	97	9/10
1a	G312	Full	19-juin-2016	17:22	UTC-4	69°02.101'	059°37.307'	CTD-Rosette ↑	1454	356	080	11	1,7	-0,7	1002,7	94	9/10
1a	G312	Full	19-juin-2016	17:43	UTC-4	69°02.086'	059°37.058'	Box Core ↓	1451	165	050	4	0,4	-0,7	1002,7	97	9/10
1a	G312	Full	19-juin-2016	18:12	UTC-4	69°02.102'	059°36.985'	Box Core (bottom)	1455	177	060	6	0,0	-0,8	1002,8	99	9/10
1a	G312	Full	19-juin-2016	18:43	UTC-4	69°02.155'	059°36.915'	Box Core ↑	1454	170	070	4	-0,1	-0,7	1003,0	99	9/10
1a	G312	Full	19-juin-2016	18:57	UTC-4	69°02.183'	059°36.853'	Box Core ↓	1455	178	070	4	-0,1	-0,7	1003,0	99	9/10
1a	G312	Full	19-juin-2016	19:28	UTC-4	69°02.272'	059°36.721'	Box Core (bottom)	1456	214	090	6	0,2	-0,7	1003,2	99	9/10
1a	G312	Full	19-juin-2016	19:57	UTC-4	69°02.233'	059°36.631'	Box Core ↑	1454	257	130	6	0,2	-0,6	1003,3	99	9/10
1a	G314	CTD	19-juin-2016	21:29	UTC-4	69°00.575'	060°02.962'	CTD-Rosette ↓	1594	358	130	5	-1,6	-0,8	1003,4	99	9+
1a	G314	CTD	19-juin-2016	21:48	UTC-4	69°00.586'	060°02.982'	CTD-Rosette ↑	1594	291	140	4	-1,3	-0,9	1003,5	99	9+
1a	G315	Basic	19-juin-2016	22:37	UTC-4	69°00.340'	060°10.866'	AOP ↓	1624	279	140	13	-2,6	-0,8	1003,6	99	9+
1a	G315	Basic	19-juin-2016	23:28	UTC-4	69°00.388'	060°11.090'	AOP ↑	1627	011	135	4	-1,6	-0,9	1003,9	99	9+
1a	G315	Basic	20-juin-2016	03:44	UTC-4	69°00.372'	060°11.276'	CTD-Rosette ↓	1629	026	130	4	-1,4	-0,9	1003,9	99	9+
1a	G315	Basic	20-juin-2016	00:20	UTC-4	69°00.332'	060°11.762'	CTD-Rosette ↑	1631	026	120	3	-1,4	-0,7	1003,9	99	9+
1a	G316	CTD	20-juin-2016	01:59	UTC-4	69°00.086'	060°30.957'	CTD-Rosette ↓	1695	309	120	5	-0,5	-0,7	1004,3	99	9+
1a	G316	CTD	20-juin-2016	02:17	UTC-4	69°00.123'	060°30.977'	CTD-Rosette ↑	1695	313	115	6	-0,4	-0,8	1004,3	99	9+
1a	G317	Nutrient	20-juin-2016	03:10	UTC-4	69°00.405'	060°44.577'	CTD-Rosette ↓	1733	298	118	6	-1,2	-0,7	1004,3	99	9+
1a	G317	Nutrient	20-juin-2016	04:50	UTC-4	69°00.558'	060°44.369'	CTD-Rosette ↑	1730	208	080	5	-1,1	-0,8	1004,4	99	9+
1a	G318	Full	20-juin-2016	06:00	UTC-4	69°00.558'	060°57.648'	Ice Operation									
1a	G318	Full	20-juin-2016	09:09	UTC-4	69°00.436'	060°57.132'	CTD-Rosette ↓	1737	081	150	11	0,2	-0,9	1005,2	99	9+
1a	G318	Full	20-juin-2016	09:48	UTC-4	69°00.380'	060°57.149'	CTD-Rosette ↑	1772	007	140	5	1,2	-0,8	1005,4	99	9+
1a	G318	Full	20-juin-2016	10:00	UTC-4	69°00.558'	060°57.648'	Zodiac ↓ (SCAMP)	1737	081	150	11	0,2	-0,9	1005,2	99	9+
1a	G318	Full	20-juin-2016	10:25	UTC-4	69°00.183'	060°57.783'	Hydrobios ↓	1773	286	125	4	0,3	-0,8	1005,4	99	9+

1a	G318	Full	20-juin-2016	11:56	UTC-4	68°59.783'	060°58.325'	Hydrobios ↑	1774	339	182	4	3,3	-0,7	1005,3	89	9+
1a	G318	Full	20-juin-2016	12:07	UTC-4	68°59.732'	060°58.439'	Zodiac ↑ (SCAMP)	1775	269	150	3	2,4	-0,7	1005,2	92	8/10
1a	G318	Full	20-juin-2016	12:49	UTC-4	68°59.551'	060°58.682'	IOP ↓	1775	009	135	2	3,2	-0,7	1005,5	88	8/10
1a	G318	Full	20-juin-2016	13:15	UTC-4	68°59.463'	060°58.882'	IOP ↑	1775	037	090	3	1,1	-0,7	1005,5	97	8/10
1a	G318	Full	20-juin-2016	13:28	UTC-4	68°59.534'	060°59.053'	CTD-Rosette ↓	1776	293	068	3	0,8	-0,7	1005,5	97	8/10
1a	G318	Full	20-juin-2016	14:11	UTC-4	68°59.370'	060°59.412'	CTD-Rosette ↑	1777	027	152	3	3,1	-0,7	1005,4	88	8/10
1a	G318	Full	20-juin-2016	14:32	UTC-4	68°59.457'	060°59.351'	5NVS ↓	1777	351	207	5	2,8	-0,6	1005,7	86	8/10
1a	G318	Full	20-juin-2016	15:14	UTC-4	68°59.389'	060°59.339'	5NVS ↑	1777	276	165	2	0,6	-0,5	1006,0	97	8/10
1a	G318	Full	20-juin-2016	15:50	UTC-4	68°59.457'	060°59.120'	Box Core ↓	1777	020	225	4	2,0	-0,7	1006,0	92	8/10
1a	G318	Full	20-juin-2016	16:25	UTC-4	68°59.472'	060°58.951'	Box Core (bottom)	1777	104	220	2	2,3	-0,7	1006,2	91	8/10
1a	G318	Full	20-juin-2016	17:02	UTC-4	68°59.492'	060°58.607'	Box Core ↑	1776	173	260	3	1,3	-0,7	1006,1	93	8/10
1a	G318	Full	20-juin-2016	18:32	UTC-4	68°59.583'	060°57.471'	CTD-Rosette ↓	1770	168	300	1	1,2	-0,8	1006,1	94	8/10
1a	G318	Full	20-juin-2016	19:42	UTC-4	68°59.627'	060°56.712'	CTD-Rosette ↑	1767	312	260	2	-1,0	-0,7	1006,3	99	8/10
1a	G319	CTD	20-juin-2016	20:51	UTC-4	69°00.100'	061°11.694'	CTD-Rosette ↓	1823	215	220	11	-1,0	-0,7	1006,4	99	9/10
1a	G319	CTD	20-juin-2016	22:06	UTC-4	68°59.991'	061°11.210'	CTD-Rosette ↑	1822	240	180	11	-1,1	-0,6	1006,3	99	9/10
1a	G320	Nutrient	20-juin-2016	23:41	UTC-4	69°01.958'	061°26.362'	CTD-Rosette ↓	1851	198	260	3	-0,7	-0,8	1006,1	99	9/10
1a	G320	Nutrient	21-juin-2016	01:22	UTC-4	69°01.755'	061°26.418'	CTD-Rosette ↑	1851	266	335	2	-0,7	-0,7	1006,3	99	9/10
1a	G321	Basic	21-juin-2016	02:53	UTC-4	68°57.729'	061°38.324'	AOP ↓	2130	247	298	3	-0,6	-0,7	1006,2	99	8/10
1a	G321	Basic	21-juin-2016	03:30	UTC-4	68°57.718'	061°37.025'	AOP ↑	1838	288	310	2	-0,3	-0,8	1006,1	99	8/10
1a	G321	Basic	21-juin-2016	03:42	UTC-4	68°57.468'	061°38.015'	CTD-Rosette ↓	1840	002	315	2	-0,4	-0,8	1006,2	99	8/10
1a	G321	Basic	21-juin-2016	04:19	UTC-4	68°57.374'	061°37.717'	CTD-Rosette ↑	1838	276	000	0	-0,3	-0,8	1006,2	99	8/10
1a	G322	CTD	21-juin-2016	05:18	UTC-4	68°59.369'	061°53.062'	CTD-Rosette ↓	1863	206	340	1	-0,7	-0,7	1005,6	99	8/10
1a	G322	CTD	21-juin-2016	06:24	UTC-4	68°59.226'	061°52.761'	CTD-Rosette ↑	1862	280	000	3	-0,3	-0,7	1005,9	99	8/10
1a	G323	Nutrient	21-juin-2016	07:50	UTC-4	69°00.514'	062°07.339'	CTD-Rosette ↓	1885	207	060	4	1,3	-0,7	1006,5	93	8/10
1a	G323	Nutrient	21-juin-2016	09:36	UTC-4	69°00.520'	062°07.601'	CTD-Rosette ↑	1884	229	150	2	-0,2	-0,7	1006,8	98	8/10
1a	G324	Full	21-juin-2016	11:00	UTC-4	68°59.025'	062°19.096'	Ice Operation	1892	012	125	0,6	2,0	-0,7	1006,9	94	8/10
1a	G324	Full	21-juin-2016	13:42	UTC-4	68°59.779'	062°21.515'	CTD-Rosette ↓	2030	192	035	9	0,3	-0,7	1006,7	97	8/10
1a	G324	Full	21-juin-2016	14:18	UTC-4	68°59.602'	062°21.107'	CTD-Rosette ↑	1896	257	010	4	1,5	-0,6	1006,9	91	8/10
1a	G324	Full	21-juin-2016	14:31	UTC-4	68°59.540'	062°21.106'	Zodiac ↓ (SCAMP)	1897	311	018	4	1,2	-0,7	1006,9	94	8/10
1a	G324	Full	21-juin-2016	14:44	UTC-4	68°59.449'	062°21.057'	5NVS ↓	1898	192	030	5	0,4	-0,6	1006,9	97	8/10
1a	G324	Full	21-juin-2016	15:27	UTC-4	68°59.143'	062°20.601'	5NVS ↑	1896	179	070	3	0,0	-0,7	1007,1	97	8/10
1a	G324	Full	21-juin-2016	15:44	UTC-4	68°58.891'	062°20.888'	CTD-Rosette ↓	1899	025	100	2	0,7	-0,7	1007,4	96	8/10
1a	G324	Full	21-juin-2016	16:27	UTC-4	68°58.502'	062°20.443'	CTD-Rosette ↑	1898	042	030	3	0,3	-0,7	1007,4	97	8/10
1a	G324	Full	21-juin-2016	17:01	UTC-4	68°58.000'	062°20.199'	Zodiac ↑ (SCAMP)	1897	325	050	3	0,5	-0,8	1007,5	98	8/10
1a	G324	Full	21-juin-2016	17:13	UTC-4	68°58.105'	062°20.177'	IOP ↓	1896	338	050	2	0,8	-0,8	1007,5	96	8/10
1a	G324	Full	21-juin-2016	17:37	UTC-4	68°57.921'	062°20.144'	IOP ↑	1894	000	000	0	1,1	-0,8	1007,5	94	8/10
1a	G324	Full	21-juin-2016	17:50	UTC-4	68°57.866'	062°20.122'	Hydrobios ↓	1894	003	100	2	1,2	-0,8	1007,5	93	8/10
1a	G324	Full	21-juin-2016	19:32	UTC-4	68°57.393'	062°19.836'	Hydrobios ↑	1897	352	020	3	0,2	-0,8	1007,4	97	8/10
1a	G324	Full	21-juin-2016	19:50	UTC-4	68°57.354'	062°19.824'	CTD-Rosette ↓	1896	320	000	4	0,0	-0,8	1007,4	98	8/10
1a	G324	Full	21-juin-2016	21:01	UTC-4	68°57.241'	062°19.994'	CTD-Rosette ↑	1898	332	060	3	0,2	-0,8	1007,5	97	8/10
1a	G324	Full	21-juin-2016	21:21	UTC-4	68°57.378'	062°19.654'	Box Core ↓	1897	079	030	3	-0,9	-0,8	1007,5	99	8/10
1a	G324	Full	21-juin-2016	21:54	UTC-4	68°57.306'	062°19.649'	Box Core (bottom)	1897	051	330	3	-1,4	-0,7	1007,5	99	8/10
1a	G324	Full	21-juin-2016	22:33	UTC-4	68°57.232'	062°19.444'	Box Core ↑	1895	095	340	5	-1,6	-0,7	1007,1	99	8/10

1a	G325	Nutrient	21-juin-2016	00:04	UTC-4	68°59.940'	062°36.158'	CTD-Rosette ↓	1889	019	060	6	-2,1	-0,7	1006,5	99	0/10
1a	G325	Nutrient	22-juin-2016	01:45	UTC-4	68°59.894'	062°35.824'	CTD-Rosette ↑	1890	220	345	13	-1,9	-0,9	1006,0	99	0/10
1a	DIC1	DIC	22-juin-2016	07:35	UTC-4	68°27.982'	062°40.575'	CTD-Rosette ↓	1678	224	000	11	-0,8	-0,8	1001,7	99	9/10
1a	DIC1	DIC	22-juin-2016	09:18	UTC-4	68°27.702'	062°42.191'	CTD-Rosette ↑	1668	105	350	13	-0,4	-0,8	1000,3	97	9/10
1a	DIC2	DIC	22-juin-2016	16:20	UTC-4	67°59.815'	063°11.816'	CTD-Rosette ↓	802	118	330	8	0,2	-0,9	998,7	99	9/10
1a	DIC2	DIC	22-juin-2016	17:25	UTC-4	67°59.253'	063°11.520'	CTD-Rosette ↑	754	231	315	7	1,1	-0,8	998,9	99	9/10
Leg 1b																	
1b	G400	Basic	24-juin-2016	18:44	UTC-4	68°01.421'	062°23.842'	AOP ↓	1264	005	080	4	0,0	-0,6	998,3	99	9/10
1b	G400	Basic	24-juin-2016	19:22	UTC-4	68°00.917'	062°24.855'	AOP ↑	1234	345	110	1	1,2	-0,8	998,5	99	9/10
1b	G400	Basic	24-juin-2016	19:34	UTC-4	68°01.169'	062°25.119'	CTD-Rosette ↓	1241	040	110	1	1,2	-0,8	998,5	99	9/10
1b	G400	Basic	24-juin-2016	20:10	UTC-4	68°01.186'	062°25.118'	CTD-Rosette ↑	1243	046	100	3	0,5	-0,8	998,5	99	9/10
1b	G401	CTD	25-juin-2016	00:53	UTC-4	68°04.265'	062°07.614'	CTD-Rosette ↓	1586	306	150	5	-0,4	-0,9	998,1	99	9/10
1b	G401	CTD	25-juin-2016	01:52	UTC-4	68°04.541'	062°07.369'	CTD-Rosette ↑	1592	085	165	4	0,1	-0,9	998,2	99	9/10
1b	G402	Nutrient	25-juin-2016	02:49	UTC-4	68°04.495'	061°51.622'	CTD-Rosette ↓	1663	074	175	3	-0,3	-0,8	998,3	99	9/10
1b	G402	Nutrient	25-juin-2016	04:25	UTC-4	68°04.318'	061°50.894'	CTD-Rosette ↑	1470	071	180	3	-0,4	-0,7	998,4	99	9/10
1b	G403	Full	25-juin-2016	06:15	UTC-4	68°04.422'	061°36.509'	Ice Operation	1509	078	220	2	-0,1	-0,8	998,5	99	7/10
1b	G403	Full	25-juin-2016	09:00	UTC-4	68°04.422'	061°36.510'	Zodiac ↓ (SCAMP)	1685	078	220	1	-0,1	-0,8	998,5	99	7/10
1b	G403	Full	25-juin-2016	09:18	UTC-4	68°01.895'	061°36.064'	CTD-Rosette ↓	1678	077	220	8	0,6	-0,7	999,0	99	7/10
1b	G403	Full	25-juin-2016	09:56	UTC-4	68°01.712'	061°01.712'	CTD-Rosette ↑	1677	113	007	7	0,5	-0,6	999,1	98	7/10
1b	G403	Full	25-juin-2016	10:34	UTC-4	68°01.361'	061°37.526'	5NVS ↓	1675	320	210	6	-0,4	-0,6	999,3	99	7/10
1b	G403	Full	25-juin-2016	11:17	UTC-4	68°01.509'	061°37.973'	5NVS ↑	1674	353	210	7	-0,6	-0,5	999,4	99	7/10
1b	G403	Full	25-juin-2016	11:30	UTC-4	68°01.857'	061°39.372'	Zodiac ↑ (SCAMP)	1672	331	235	5	-0,3	-0,5	999,5	99	6/10
1b	G403	Full	25-juin-2016	12:16	UTC-4	68°01.857'	061°39.372'	IOP ↓	1672	331	235	5	-0,3	-0,5	999,5	99	6/10
1b	G403	Full	25-juin-2016	12:41	UTC-4	68°02.009'	061°39.205'	IOP ↑	1672	331	220	5	-0,3	-0,5	999,7	99	6/10
1b	G403	Full	25-juin-2016	12:51	UTC-4	68°01.951'	061°39.216'	CTD-Rosette ↓	1673	074	210	6	-0,2	-0,5	999,7	98	6/10
1b	G403	Full	25-juin-2016	13:32	UTC-4	68°02.063'	061°39.163'	CTD-Rosette ↑	1674	070	240	5	1,7	-0,7	999,9	91	6/10
1b	G403	Full	25-juin-2016	13:54	UTC-4	68°02.363'	061°38.103'	Hydrobios ↓	1678	067	225	5	0,7	-0,5	1000,0	96	6/10
1b	G403	Full	25-juin-2016	15:24	UTC-4	68°02.093'	061°36.898'	Hydrobios ↑	1678	093	225	4	1,5	-0,6	1000,6	91	6/10
1b	G403	Full	25-juin-2016	15:40	UTC-4	68°01.430'	061°36.046'	CTD-Rosette ↓	16778	014	210	3	0,2	-0,3	1001,1	97	6/10
1b	G403	Full	25-juin-2016	16:49	UTC-4	68°01.430'	061°36.046'	CTD-Rosette ↑	1677	017	210	3	0,2	-0,3	1001,1	97	6/10
1b	G403	Full	25-juin-2016	17:05	UTC-4	68°01.221'	061°35.865'	Box Core ↓	1675	140	178	4	0,8	-0,3	1001,3	94	6/10
1b	G403	Full	25-juin-2016	17:36	UTC-4	68°00.913'	061°35.715'	Box Core (bottom)	1675	320	160	4	-0,5	-0,5	1001,5	99	6/10
1b	G403	Full	25-juin-2016	18:12	UTC-4	68°00.521'	061°35.630'	Box Core ↑	1673	285	140	4	-0,4	-0,3	1001,6	98	6/10
1b	G404	CTD	25-juin-2016	19:12	UTC-4	68°05.677'	061°21.345'	CTD-Rosette ↓	1685	113	180	2	-0,6	-0,4	1001,8	99	6/10
1b	G404	CTD	25-juin-2016	20:13	UTC-4	68°05.386'	061°20.609'	CTD-Rosette ↑	1684	079	180	4	-0,3	-0,5	1002,2	99	6/10
1b	G405	Nutrient	25-juin-2016	21:18	UTC-4	68°05.623'	061°04.609'	CTD-Rosette ↓	1665	295	150	3	-1,3	-0,6	1002,5	99	6/10
1b	G405	Nutrient	25-juin-2016	22:00	UTC-4	68°05.885'	061°04.696'	CTD-Rosette ↑	1665	346	200	3	-0,3	-0,7	1002,8	99	6/10
1b	G406	Basic	26-juin-2016	00:08	UTC-4	68°03.963'	060°49.100'	AOP ↓	1638	220	085	3	-1,3	-0,6	1003,2	99	6/10
1b	G406	Basic	26-juin-2016	00:42	UTC-4	68°04.363'	060°49.225'	AOP ↑	1641	208	085	3	-1,4	-0,6	1003,4	99	6/10
1b	G406	Basic	26-juin-2016	00:58	UTC-4	68°04.780'	060°48.965'	CTD-Rosette ↓	1640	306	075	3	-1,0	-0,6	1003,5	99	6/10
1b	G406	Basic	26-juin-2016	01:36	UTC-4	68°04.763'	060°49.411'	CTD-Rosette ↑	1641	222	077	3	-0,8	-0,7	1003,6	99	6/10
1b	G407	CTD	26-juin-2016	02:35	UTC-4	68°05.914'	060°32.711'	CTD-Rosette ↓	1605	250	035	3	-0,8	-0,7	1003,9	99	6/10
1b	G407	CTD	26-juin-2016	03:34	UTC-4	68°05.688'	060°33.751'	CTD-Rosette ↑	1607	250	065	6	0,1	-0,6	1004,3	99	6/10

1b	G408	Nutrient	26-juin-2016	04:48	UTC-4	68°07.080'	060°15.961'	CTD-Rosette ↓	1535	345	100	8	-0,9	-0,7	1004,6	99	6/10
1b	G408	Nutrient	26-juin-2016	06:20	UTC-4	68°06.873'	060°17.267'	CTD-Rosette ↑	1543	018	120	3	-0,1	-0,6	1005,0	99	6/10
1b	G409	Full	26-juin-2016	08:10	UTC-4	68°06.183'	060°01.157'	Ice Operation	1425	059	100	7	-0,2	-0,7	1005,6	99	6/10
1b	G409	Full	26-juin-2016	09:40	UTC-4	68°05.814'	060°00.530'	Ice Operation	1428	055	085	8	0,1	-0,7	1006,0	99	6/10
1b	G409	Full	26-juin-2016	10:20	UTC-4	68°06.393'	059°59.698'	CTD-Rosette ↓	1409	351	110	11	0,1	-0,7	1006,2	99	6/10
1b	G409	Full	26-juin-2016	10:58	UTC-4	68°06.109'	059°59.511'	CTD-Rosette ↑	1411	312	110	9	0,9	-0,7	10056,2	99	6/10
1b	G409	Full	26-juin-2016	12:04	UTC-4	68°06.680'	059°57.576'	Zodiac ↓ (SCAMP)	1394	218	110	8	-0,1	-0,6	1006,4	99	6/10
1b	G409	Full	26-juin-2016	12:20	UTC-4	68°06.630'	059°57.545'	5NVS ↓	1395	268	090	9	-0,1	-0,6	1006,5	99	6/10
1b	G409	Full	26-juin-2016	13:04	UTC-4	68°06.573'	059°57.861'	5NVS ↑	1398	199	085	6	0,1	-0,6	1006,5	99	6/10
1b	G409	Full	26-juin-2016	13:20	UTC-4	68°06.552'	059°57.925'	IOP ↓	1398	169	105	9	0,2	-0,6	1006,8	99	6/10
1b	G409	Full	26-juin-2016	13:45	UTC-4	68°06.478'	059°58.111'	IOP ↑	1396	233	100	9	0,1	-0,6	1007,0	99	6/10
1b	G409	Full	26-juin-2016	14:02	UTC-4	68°06.387'	059°58.056'	Zodiac ↑ (SCAMP)	1397	297	085	9	1,1	-0,6	1007,2	99	6/10
1b	G409	Full	26-juin-2016	14:13	UTC-4	68°06.351'	059°58.218'	CTD-Rosette ↓	1396	306	080	8	1,7	-0,7	1007,3	99	6/10
1b	G409	Full	26-juin-2016	14:54	UTC-4	68°06.080'	059°58.524'	CTD-Rosette ↑	1411	350	090	10	2,5	-0,7	1007,3	93	6/10
1b	G409	Full	26-juin-2016	15:17	UTC-4	68°06.058'	059°58.615'	Hydrobios ↓	1412	183	090	10	1,4	-0,7	1007,5	96	8/10
1b	G409	Full	26-juin-2016	16:36	UTC-4	68°06.303'	059°59.313'	Hydrobios ↑	1408	228	130	9	-0,2	-0,6	1008,2	99	8/10
1b	G409	Full	26-juin-2016	16:54	UTC-4	68°06.275'	059°59.591'	CTD-Rosette ↓	1408	060	140	5	0,3	-0,7	1008,3	99	8/10
1b	G409	Full	26-juin-2016	17:55	UTC-4	68°06.378'	059°59.558'	CTD-Rosette ↑	1409	055	140	7	0,0	-0,7	1009,0	99	8/10
1b	G409	Full	26-juin-2016	18:12	UTC-4	68°06.378'	059°59.357'	Box Core ↓	1408	293	140	6	0,0	-0,7	1009,0	99	8/10
1b	G409	Full	26-juin-2016	18:36	UTC-4	68°06.403'	059°59.193'	Box Core (bottom)	1407	278	130	10	-1,1	-0,7	1009,1	99	8/10
1b	G409	Full	26-juin-2016	19:05	UTC-4	68°06.428'	059°58.941'	Box Core ↑	1404	355	140	8	-0,9	-0,6	1009,5	99	8/10
1b	G410	CTD	26-juin-2016	20:21	UTC-4	68°06.595'	059°43.707'	CTD-Rosette ↓	1058	024	110	9	-0,8	-0,8	1010,0	99	8/10
1b	G410	CTD	26-juin-2016	21:03	UTC-4	68°06.662'	059°43.303'	CTD-Rosette ↑	1038	007	120	6	-0,9	-0,8	1010,4	99	8/10
1b	G411	Nutrient	26-juin-2016	22:29	UTC-4	68°06.954'	059°27.113'	CTD-Rosette ↓	511	121	120	5	-1,1	-0,8	1010,8	99	8/10
1b	G411	Nutrient	26-juin-2016	23:19	UTC-4	68°07.050'	059°26.666'	CTD-Rosette ↑	499	120	140	4	-1,1	-0,7	1010,9	99	8/10
1b	G412	Nutrient HPL	27-juin-2016	01:27	UTC-4	68°06.734'	059°12.118'	CTD-Rosette ↓	307	287	175	2	-2,2	-0,8	1011,5	99	9/10
1b	G412	Nutrient HPL	27-juin-2016	02:07	UTC-4	68°06.743'	059°12.039'	CTD-Rosette ↑	305	314	295	1	-2,2	-0,8	1011,8	99	9/10
1b	G413	CTD	27-juin-2016	03:21	UTC-4	68°06.925'	058°55.989'	CTD-Rosette ↓ (unrecorded)	272	179	015	0	-1,5	-0,8	1012,3	99	8/10
1b	G413	CTD	27-juin-2016	03:28	UTC-4	68°06.899'	058°56.064'	CTD-Rosette ↑	272	145	060	0	-1,5	-0,8	1012,2	99	8/10
1b	G413	CTD	27-juin-2016	03:32	UTC-4	68°06.866'	058°56.128'	CTD-Rosette ↓	272	144	090	1	-1,4	-0,7	1012,2	99	8/10
1b	G413	CTD	27-juin-2016	03:49	UTC-4	68°06.869'	058°56.531'	CTD-Rosette ↑	272	242	005	1	-0,9	-0,7	1012,3	99	8/10
1b	G414	Nutrient	27-juin-2016	04:47	UTC-4	68°06.696'	058°41.233'	CTD-Rosette ↓	277	348	090	2	-0,9	-0,8	1012,2	99	8/10
1b	G414	Nutrient	27-juin-2016	05:29	UTC-4	68°06.516'	058°41.432'	CTD-Rosette ↑	272	021	120	1	0,0	-0,5	1012,4	99	8/10
1b	G415	CTD	27-juin-2016	06:33	UTC-4	68°06.834'	058°25.271'	CTD-Rosette ↓	403	317	080	4	-1,0	-0,5	1012,4	99	8/10
1b	G415	CTD	27-juin-2016	06:55	UTC-4	68°06.564'	058°25.267'	CTD-Rosette ↑	403	353	120	1	0,2	-0,4	1012,6	99	8/10
1b	G413	Full	27-juin-2016	09:30	UTC-4	68°07.440'	059°04.440'	Ice Operation	289	327	030	2	0,3	-0,7	1013,0	99	8/10
1b	G413	Full	27-juin-2016	12:06	UTC-4	68°08.185'	058°55.875'	CTD-Rosette ↓	285	234	000	10	0,1	-0,6	1013,1	99	7/10
1b	G413	Full	27-juin-2016	12:42	UTC-4	68°08.532'	058°55.571'	CTD-Rosette ↑	286	278	075	1	1,7	-0,5	1013,2	96	7/10
1b	G413	Full	27-juin-2016	13:31	UTC-4	68°07.309'	058°58.185'	Zodiac ↓ (SCAMP)	274	278	358	2	1,1	-0,6	1013,2	98	7/10
1b	G413	Full	27-juin-2016	13:40	UTC-4	68°07.343'	058°58.078'	CTD-Rosette ↓	273	276	355	2	0,9	-0,6	1013,1	98	7/10
1b	G413	Full	27-juin-2016	14:14	UTC-4	68°07.348'	058°57.616'	CTD-Rosette ↑	274	294	020	4	1,0	-0,5	1012,9	98	7/10
1b	G413	Full	27-juin-2016	14:28	UTC-4	68°07.332'	058°57.366'	IOP ↓	273	062	340	5	0,9	-0,5	1012,8	98	7/10
1b	G413	Full	27-juin-2016	14:54	UTC-4	68°07.311'	058°57.007'	IOP ↑	272	083	345	5	0,2	-0,6	1012,8	99	7/10

1b	G413	Full	27-juin-2016	15:01	UTC-4	68°07.310'	058°56.881'	Zodiac ↑ (SCAMP)	271	079	350	5	0,1	-0,6	1012,8	99	7/10
1b	G413	Full	27-juin-2016	15:40	UTC-4	68°07.802'	058°58.046'	5NVS ↓	286	074	350	7	-0,5	-0,6	1012,8	99	7/10
1b	G413	Full	27-juin-2016	15:57	UTC-4	68°07.692'	058°57.997'	5NVS ↑	280	068	350	6	-0,5	-0,6	1012,7	99	7/10
1b	G413	Full	27-juin-2016	16:19	UTC-4	68°07.566'	058°58.610'	CTD-Rosette ↓	273	298	010	6	-0,1	-0,5	1012,7	99	7/10
1b	G413	Full	27-juin-2016	16:56	UTC-4	68°07.335'	058°58.966'	CTD-Rosette ↑	273	269	020	6	0,3	-0,6	1012,6	99	7/10
1b	G413	Full	27-juin-2016	17:11	UTC-4	68°07.418'	058°58.847'	Hydrobios ↓	274	274	340	7	-0,2	-0,5	1012,6	99	7/10
1b	G413	Full	27-juin-2016	17:28	UTC-4	68°07.314'	058°59.008'	Hydrobios ↑	274	063	330	6	-0,5	-0,5	1012,7	99	7/10
1b	G413	Full	27-juin-2016	17:55	UTC-4	68°08.233'	058°59.615'	CTD-Rosette ↓	284	247	000	8	-0,3	-0,5	1012,6	99	7/10
1b	G413	Full	27-juin-2016	18:20	UTC-4	68°07.979'	058°59.627'	CTD-Rosette ↑	284	219	350	2	0,1	-0,6	1012,6	99	7/10
1b	G413	Full	27-juin-2016	18:32	UTC-4	68°07.848'	058°59.830'	Box Core ↓	284	050	010	1	0,0	-0,6	1012,5	99	7/10
1b	G413	Full	27-juin-2016	18:38	UTC-4	68°07.801'	058°59.911'	Box Core (bottom)	285	066	340	5	-0,5	-0,6	1012,6	99	7/10
1b	G413	Full	27-juin-2016	18:45	UTC-4	68°07.775'	058°59.969'	Box Core ↑	283	080	320	6	-0,9	-0,6	1012,5	99	7/10
1b	G413	Full	27-juin-2016	18:57	UTC-4	68°07.701'	059°00.075'	Box Core ↓	283	072	320	6	-0,9	-0,6	1012,4	99	7/10
1b	G413	Full	27-juin-2016	19:04	UTC-4	68°07.668'	059°00.075'	Box Core (bottom)	280	074	320	7	-0,9	-0,6	1012,2	99	7/10
1b	G413	Full	27-juin-2016	19:10	UTC-4	68°07.668'	059°00.117'	Box Core ↑	278	072	320	7	-0,9	-0,6	1012,2	99	7/10
1b	G413	Full	27-juin-2016	19:23	UTC-4	68°07.698'	058°59.908'	Box Core ↓	283	076	320	8	-0,7	-0,6	1012,3	99	7/10
1b	G413	Full	27-juin-2016	19:29	UTC-4	68°07.679'	058°59.893'	Box Core (bottom)	282	092	320	8	-0,7	-0,6	1012,3	99	7/10
1b	G413	Full	27-juin-2016	19:36	UTC-4	68°07.680'	058°59.932'	Box Core ↑	282	092	320	8	-0,7	-0,6	1012,3	99	7/10
1b	G413	Full	27-juin-2016	19:40	UTC-4	68°07.645'	058°59.905'	Box Core ↓	283	063	320	8	-0,6	-0,7	1012,2	99	7/10
1b	G413	Full	27-juin-2016	19:46	UTC-4	68°07.638'	058°59.919'	Box Core (bottom)	282	076	320	8	-0,6	-0,7	1012,2	99	7/10
1b	G413	Full	27-juin-2016	19:51	UTC-4	68°07.629'	058°59.907'	Box Core ↑	282	068	320	7	-0,5	-0,7	1012,3	99	7/10
1b	G413	Full	27-juin-2016	20:07	UTC-4	68°07.595'	058°59.991'	Box Core ↓	281	068	305	10	-0,4	-0,7	1012,2	99	7/10
1b	G413	Full	27-juin-2016	20:12	UTC-4	68°07.582'	058°59.996'	Box Core (bottom)	280	071	310	10	-0,5	-0,7	1012,0	99	7/10
1b	G413	Full	27-juin-2016	20:20	UTC-4	68°07.581'	058°59.982'	Box Core ↑	280	060	310	10	-0,4	-0,5	1011,9	99	7/10
1b	MVP05	MVP	28-juin-2016	00:16	UTC-4	68°07.058'	057°41.198'	MVP ↓	389	089	330	16	-0,2	0,8	1009,0	99	1/10
1b	MVP05	MVP	28-juin-2016	04:15	UTC-4	68°06.340'	056°26.133'	MVP ↑	188	089	320	13	0,8	2,9	1006,8	99	1/10
1b	G418	Full	28-juin-2016	06:52	UTC-4	68°06.869'	057°46.119'	CTD-Rosette ↓	383	145	320	13	0,3	2,3	1006,5	99	1/10
1b	G418	Full	28-juin-2016	07:32	UTC-4	68°06.827'	057°46.292'	CTD-Rosette ↑	381	153	300	4	1,0	2,0	1006,8	99	1/10
1b	G418	Full	28-juin-2016	07:45	UTC-4			Zodiac ↓ (SCAMP)									
1b	G418	Full	28-juin-2016	08:12	UTC-4	68°06.790'	057°45.719'	DSN ↓	381	141	320	8	2,1	1,8	1006,8	94	1/10
1b	G418	Full	28-juin-2016	08:33	UTC-4	68°06.900'	057°44.038'	DSN ↑	386	014	320	14	0,2	1,9	1006,7	99	1/10
1b	G418	Full	28-juin-2016	09:04	UTC-4	68°06.873'	057°45.239'	IOP ↓	385	130	320	11	0,6	2,1	1006,5	99	1/10
1b	G418	Full	28-juin-2016	09:30	UTC-4	68°06.823'	057°45.156'	IOP ↑	386	124	320	11	0,2	1,8	1006,7	99	1/10
1b	G418	Full	28-juin-2016	09:35	UTC-4	68°06.811'	057°45.172'	AOP ↓	385	143	320	11	0,2	1,8	1006,7	99	1/10
1b	G418	Full	28-juin-2016	10:16	UTC-4	68°07.019'	057°44.650'	AOP ↑	388	145	320	11	2,0	1,8	1006,3	97	1/10
1b	G418	Full	28-juin-2016	10:30	UTC-4			Zodiac ↑ (SCAMP)									
1b	G418	Full	28-juin-2016	10:56	UTC-4	68°06.901'	057°45.789'	5NVS ↓	383	140	320	12	0,4	1,7	1006,2	99	1/10
1b	G418	Full	28-juin-2016	11:19	UTC-4	68°06.815'	057°45.624'	5NVS ↑	384	137	315	11	0,4	1,6	1006,1	99	1/10
1b	G418	Full	28-juin-2016	12:04	UTC-4	68°06.861'	057°45.853'	CTD-Rosette ↓	384	112	330	13	3,3	1,8	1005,7	98	0/10
1b	G418	Full	28-juin-2016	12:44	UTC-4	68°06.921'	057°45.830'	CTD-Rosette ↑	383	191	320	9	2,2	1,6	1005,7	96	0/10
1b	G418	Full	28-juin-2016	12:54	UTC-4	68°06.915'	057°45.828'	Zodiac ↓ (Birds)	383	164	328	8	1,9	1,5	1005,8	97	0/10
1b	G418	Full	28-juin-2016	13:20	UTC-4	68°06.768'	057°45.742'	IKMT ↓	383	150	335	7	0,8	1,5	1006,1	99	1/10
1b	G418	Full	28-juin-2016	14:27	UTC-4	68°05.616'	057°39.859'	IKMT ↑	373	318	315	8	1,1	1,9	1006,0	99	0/10

1b	G418	Full	28-juin-2016	14:58	UTC-4	68°06.870'	057°45.720'	Zodiac ↑ (Birds)	384	038	295	14	0,7	2,0	1005,6	99	1/10
1b	G418	Full	28-juin-2016	15:16	UTC-4	68°06.900'	057°45.696'	CTD-Rosette ↓	383	191	314	14	0,4	1,5	1005,2	99	1/10
1b	G418	Full	28-juin-2016	15:39	UTC-4	68°06.926'	057°45.759'	CTD-Rosette ↑	385	161	318	12	2,7	1,5	1005,2	99	1/10
1b	G418	Full	28-juin-2016	15:47	UTC-4	68°06.852'	057°45.750'	Agassiz Trawl ↓	384	158	318	16	2,7	1,5	1005,2	99	1/10
1b	G418	Full	28-juin-2016	16:28	UTC-4	68°06.581'	057°42.889'	Agassiz Trawl ↑	386	074	320	13	1,0	1,9	1004,9	99	1/10
1b	G418	Full	28-juin-2016	16:53	UTC-4	68°06.908'	057°46.082'	Box Core ↓	383	139	340	10	1,2	2,0	1005,4	98	1/10
1b	G418	Full	28-juin-2016	17:02	UTC-4	68°06.887'	057°46.183'	Box Core (bottom)	383	231	335	12	1,7	1,8	1005,3	96	1/10
1b	G418	Full	28-juin-2016	17:12	UTC-4	68°06.843'	057°46.281'	Box Core ↑	382	228	335	13	1,9	1,7	1005,4	97	1/10
1b	G418	Full	28-juin-2016	17:30	UTC-4	68°06.961'	057°46.271'	Box Core ↓	382	228	330	4	1,8	1,8	1005,1	97	1/10
1b	G418	Full	28-juin-2016	17:38	UTC-4	68°06.956'	057°46.279'	Box Core (bottom)	382	222	010	1	1,7	1,9	1005,4	97	1/10
1b	G418	Full	28-juin-2016	17:47	UTC-4	68°06.941'	057°46.327'	Box Core ↑	283	220	350	1	1,8	1,9	1005,2	96	1/10
1b	G416	CTD	28-juin-2016	18:56	UTC-4	68°06.858'	058°07.128'	CTD-Rosette ↓	403	132	320	14	0,0	-0,1	1004,9	99	7/10
1b	G416	CTD	28-juin-2016	19:17	UTC-4	68°06.884'	058°07.128'	CTD-Rosette ↑	403	132	310	11	-0,2	-0,1	1005,2	99	7/10
1b	G417	Nutrient	28-juin-2016	20:00	UTC-4	68°06.806'	057°51.878'	CTD-Rosette ↓	383	184	350	11	0,7	0,2	1005,2	99	7/10
1b	G417	Nutrient	28-juin-2016	20:43	UTC-4	68°06.635'	057°51.455'	CTD-Rosette ↑	384	169	340	8	1,1	0,8	1005,0	99	7/10
1b	G419	CTD	28-juin-2016	21:52	UTC-4	68°06.821'	057°20.645'	CTD-Rosette ↓	334	177	320	19	1,5	2,0	1003,7	99	1/10
1b	G419	CTD	28-juin-2016	22:09	UTC-4	68°06.728'	057°20.556'	CTD-Rosette ↑	333	165	330	16	5,1	2,1	1003,6	88	1/10
1b	G420	Nutrient	28-juin-2016	22:55	UTC-4	68°06.578'	057°04.291'	CTD-Rosette ↓	261	155	330	14	1,0	2,6	1002,8	99	Bergy
1b	G420	Nutrient	28-juin-2016	23:32	UTC-4	68°06.246'	057°04.244'	CTD-Rosette ↑	255	175	320	20	2,3	2,8	1002,7	99	Bergy
1b	G5000	MVP	29-juin-2016	10:46	UTC-4	70°00.252'	059°02.411'	MVP ↓	281	085	300	18	-0,6	1,5	1003,9	99	Bergy
1b	G5000	MVP	29-juin-2016	17:18	UTC-4	70°00.099'	056°51.375'	MVP ↑	185	101	180	11	2,3	3,6	1007,9	99	Bergy
1b	G500	Basic	29-juin-2016	17:28	UTC-4	69°59.969'	056°51.005'	AOP ↓	185	172	200	6	2,4	3,8	1008,2	99	0/10
1b	G500	Basic	29-juin-2016	18:05	UTC-4	70°00.547'	056°51.428'	AOP ↑	184	143	190	11	2,1	3,8	1008,7	99	0/10
1b	G500	Basic	29-juin-2016	18:24	UTC-4	70°00.040'	056°53.869'	CTD-Rosette ↓	187	120	180	14	1,8	3,8	1009,2	99	0/10
1b	G500	Basic	29-juin-2016	18:52	UTC-4	70°00.232'	057°04.059'	CTD-Rosette ↑	194	071	160	7	2,7	3,9	1009,9	99	0/10
1b	G501	CTD	29-juin-2016	19:32	UTC-4	70°00.024'	057°11.119'	CTD-Rosette ↓	250	352	170	15	1,7	3,7	1009,8	99	1/10
1b	G501	CTD	29-juin-2016	19:46	UTC-4	70°00.027'	057°11.166'	CTD-Rosette ↑	250	285	160	15	2,8	3,6	1010,4	99	1/10
1b	G502	Nutrient	29-juin-2016	20:28	UTC-4	69°59.988'	057°27.466'	CTD-Rosette ↓	270	233	140	12	1,5	3,4	1010,9	99	Bergy
1b	G502	Nutrient	29-juin-2016	21:06	UTC-4	70°00.063'	057°27.371'	CTD-Rosette ↑	268	218	140	13	3,3	3,4	1011,4	92	Bergy
1b	G503	Basic	29-juin-2016	21:46	UTC-4	70°00.000'	057°45.691'	AOP ↓	300	350	160	13	1,1	3,3	1011,7	99	Bergy
1b	G503	Basic	29-juin-2016	22:19	UTC-4	69°59.735'	057°45.382'	AOP ↑	303	320	150	11	0,8	3,3	1012,1	99	Bergy
1b	G503	Basic	29-juin-2016	22:29	UTC-4	70°00.011'	057°45.803'	CTD-Rosette ↓	299	113	170	13	0,8	3,3	1012,4	99	Bergy
1b	G503	Basic	29-juin-2016	23:03	UTC-4	70°00.075'	057°46.189'	CTD-Rosette ↑	304	345	160	10	4,0	3,2	1012,5	86	Berg
1b	G503	Basic	29-juin-2016	23:28	UTC-4	70°00.135'	057°43.769'	Beam Trawl ↓	301	313	160	13	1,4	3,2	1012,4	98	Bergy
1b	G503	Basic	30-juin-2016	00:21	UTC-4	69°59.769'	057°50.417'	Beam Trawl ↑	305	354	155	16	1,4	3,1	1013,1	95	Bergy
1b	G504	CTD	30-juin-2016	01:12	UTC-4	70°00.087'	058°04.204'	CTD-Rosette ↓	331	043	152	18	1,5	3,0	1013,5	94	Bergy
1b	G504	CTD	30-juin-2016	01:28	UTC-4	70°00.100'	058°04.462'	CTD-Rosette ↑	334	352	163	13	2,1	3,0	1013,6	91	Bergy
1b	G505	Nutrient	30-juin-2016	02:10	UTC-4	70°00.002'	058°21.891'	CTD-Rosette ↓	339	329	167	18	1,3	2,8	1014,1	96	Bergy
1b	G505	Nutrient	30-juin-2016	02:50	UTC-4	69°59.998'	058°21.736'	CTD-Rosette ↑	339	338	148	14	2,5	2,7	1014,6	93	Bergy
1b	MVP07	MVP	30-juin-2016	04:03	UTC-4	70°00.352'	058°57.590'	MVP ↓	279	270	150	14	0,1	1,8	1014,7	99	Bergy
1b	MVP07	MVP	30-juin-2016	05:05	UTC-4	70°00.749'	058°18.740'	MVP ↑	354	270	180	5	-1,6	0,4	1015,,47	99	Bergy
1b	G507	Full	30-juin-2016	06:00	UTC-4	70°00.509'	059°07.397'	CTD-Rosette ↓	291	328	160	11	-0,7	0,5	1015,8	99	Bergy
1b	G507	Full	30-juin-2016	06:37	UTC-4	70°00.733'	059°07.914'	CTD-Rosette ↑	296	296	160	14	-0,9	0,2	1016,1	99	Bergy

1b	G507	Full	30-juin-2016	06:59	UTC-4	70°00.892'	059°07.964'	IOP ↓	296	327	170	14	-1,0	0,4	1016,2	99	Bergy
1b	G507	Full	30-juin-2016	07:25	UTC-4	70°01.023'	059°08.254'	IOP ↑	296	355	170	8	-1,1	0,3	1016,7	99	Bergy
1b	G507	Full	30-juin-2016	08:00	UTC-4			Zodiac ↓ (SCAMP)									
1b	G507	Full	30-juin-2016	08:18	UTC-4	70°01.023'	059°04.784'	DSN ↓	288	304	160	12	-0,7	0,2	1016,7	99	Bergy
1b	G507	Full	30-juin-2016	08:34	UTC-4	70°01.262'	059°06.440'	DSN ↑	291	274	160	11	-0,8	0,2	1016,8	99	Bergy
1b	G507	Full	30-juin-2016	08:59	UTC-4	70°00.444'	059°07.047'	AOP ↓	293	343	170	13	-0,9	0,1	1017,1	99	Bergy
1b	G507	Full	30-juin-2016	09:31	UTC-4	70°00.245'	059°06.353'	AOP ↑	293	327	170	12	-0,8	-0,1	1017,2	99	Bergy
1b	G507	Full	30-juin-2016	09:45	UTC-4			Zodiac ↑ (SCAMP)									
1b	G507	Full	30-juin-2016	10:00	UTC-4	69°59.059'	059°02.401'	Beam Trawl ↓	284	324	170	13	-0,4	-0,2	1017,2	99	Bergy
1b	G507	Full	30-juin-2016	10:51	UTC-4	69°58.438'	059°08.294'	Beam Trawl ↑	299	221	160	16	-0,4	0,0	1017,6	99	Bergy
1b	G507	Full	30-juin-2016	12:03	UTC-4	70°00.459'	059°07.360'	CTD-Rosette ↓	294	015	165	14	0,4	0,5	1017,8	96	Bergy
1b	G507	Full	30-juin-2016	12:41	UTC-4	70°00.531'	059°07.736'	CTD-Rosette ↑	292	036	164	15	3,1	0,5	1018,0	85	Bergy
1b	G507	Full	30-juin-2016	13:02	UTC-4	70°00.458'	059°07.328'	5NVS ↓	294	331	168	12	-0,1	0,4	1010,1	97	Bergy
1b	G507	Full	30-juin-2016	13:20	UTC-4	70°00.500'	059°07.666'	5NVS ↑	295	050	164	13	-0,6	0,4	1018,0	99	Bergy
1b	G507	Full	30-juin-2016	13:46	UTC-4	70°00.474'	059°07.443'	CTD-Rosette ↓	296	354	170	13	0,1	0,4	1017,9	98	Bergy
1b	G507	Full	30-juin-2016	14:07	UTC-4	70°00.471'	059°07.937'	CTD-Rosette ↑	296	306	178	12	0,5	0,3	1018,2	97	Bergy
1b	G507	Full	30-juin-2016	14:22	UTC-4	70°00.653'	059°06.984'	Agassiz Trawl ↓	294	359	177	12	0,5	0,3	1018,1	97	Bergy
1b	G507	Full	30-juin-2016	14:53	UTC-4	70°00.923'	059°09.457'	Agassiz Trawl ↑	307	237	167	18	-0,6	0,4	1018,2	99	Bergy
1b	G506.5	CTD	30-juin-2016	16:04	UTC-4	70°00.079'	058°53.356'	CTD-Rosette ↓	288	352	190	12	-0,3	0,8	1018,5	99	Bergy
1b	G506.5	CTD	30-juin-2016	16:20	UTC-4	70°00.238'	058°53.241'	CTD-Rosette ↑	288	335	190	12	-0,8	1,2	1018,5	99	Bergy
1b	G506	Basic	30-juin-2016	17:13	UTC-4	70°00.165'	059°39.031'	AOP ↓	315	015	193	10	0,1	1,2	1018,7	99	Bergy
1b	G506	Basic	30-juin-2016	17:54	UTC-4	70°00.186'	058°40.249'	AOP ↑	312	036	180	8	0,8	1,4	1018,8	99	Bergy
1b	G506	Basic	30-juin-2016	18:05	UTC-4	70°00.198'	058°39.378'	CTD-Rosette ↓	314	331	190	1	0,6	1,5	1018,8	99	Bergy
1b	G506	Basic	30-juin-2016	18:41	UTC-4	70°00.573'	058°39.530'	CTD-Rosette ↑	316	005	180	11	0,3	1,5	1019,0	99	Bergy
1b	G508	CTD	30-juin-2016	20:29	UTC-4	70°00.237'	059°17.341'	CTD-Rosette ↓	343	354	180	8	-2,4	-0,1	1019,0	99	Bergy
1b	G508	CTD	30-juin-2016	20:47	UTC-4	70°00.368'	059°16.931'	CTD-Rosette ↑	344	030	180	9	-2,5	-0,3	1018,9	99	Bergy
1b	G509	Nutrient	30-juin-2016	21:52	UTC-4	69°59.794'	059°30.637'	CTD-Rosette ↓	391	020	170	12	-2,5	-0,5	1018,7	99	2/10
1b	G509	Nutrient	30-juin-2016	22:37	UTC-4	69°59.711'	059°29.683'	CTD-Rosette ↑	386	063	180	12	-2,0	-0,5	1018,8	99	2/10
1b	G510	Basic	30-juin-2016	23:41	UTC-4	70°00.049'	059°49.008'	AOP ↓	461	358	180	7	-2,7	-0,6	1018,2	99	2/10
1b	G510	Basic	01-juil-2016	00:18	UTC-4	69°59.668'	059°48.678'	AOP ↑	464	300	167	10	-2,7	-0,5	1018,2	99	Bergy
1b	G510	Basic	01-juil-2016	00:30	UTC-4	70°00.005'	059°48.499'	CTD-Rosette ↓	459	003	170	7	-2,3	-0,5	1018,1	99	Bergy
1b	G510	Basic	01-juil-2016	01:03	UTC-4	69°59.800'	059°48.205'	CTD-Rosette ↑	459	024	167	10	-1,9	-0,5	1017,9	99	Bergy
1b	G511	CTD	01-juil-2016	02:07	UTC-4	69°59.966'	060°05.495'	CTD-Rosette ↓	451	014	167	10	-3,1	-0,2	1017,6	99	Bergy
1b	G511	CTD	01-juil-2016	02:29	UTC-4	70°00.003'	060°05.424'	CTD-Rosette ↑	480	359	155	10	-1,4	-0,1	1017,6	99	Bergy
1b	G512	Nutrient	01-juil-2016	03:23	UTC-4	70°00.002'	060°21.710'	CTD-Rosette ↓	546	352	150	10	-2,5	-0,4	1017,4	99	Bergy
1b	G512	Nutrient	01-juil-2016	04:15	UTC-4	70°00.140'	060°21.566'	CTD-Rosette ↑	528	062	220	1	-2,3	-0,4	1017,3	99	Bergy
1b	G513	CTD	01-juil-2016	05:20	UTC-4	69°59.791'	060°40.879'	CTD-Rosette ↓	941	342	150	13	-3,0	-0,3	1016,97	99	5/10
1b	G513	CTD	01-juil-2016	05:59	UTC-4	70°00.135'	060°40.902'	CTD-Rosette ↑	921	060	160	2	-2,1	-0,4	1016,7	99	5/10
1b	G512	Full	01-juil-2016	07:05	UTC-4	70°00.137'	060°21.924'	CTD-Rosette ↓	533	031	160	16	-2,5	-0,4	1016,4	99	4/10
1b	G512	Full	01-juil-2016	07:45	UTC-4	70°00.372'	060°21.507'	CTD-Rosette ↑	516	038	000	0	-1,7	-0,4	1016,6	99	4/10
1b	G512	Full	01-juil-2016	n.a.	UTC-4			Zodiac ↓ (SCAMP)									
1b	G512	Full	01-juil-2016	08:24	UTC-4	70°00.076'	060°21.564'	IOP ↓	537	255	140	12	-2,5	-0,3	1016,3	99	4/10
1b	G512	Full	01-juil-2016	08:50	UTC-4	70°00.080'	060°21.385'	IOP ↑	528	283	150	10	-2,4	-0,3	1016,3	99	4/10

1b	G512	Full	01-juil-2016	09:12	UTC-4	70°00.108'	060°22.488'	iSVP Deployment ↓									
1b	G512	Full	01-juil-2016	09:16	UTC-4	70°00.028'	060°20.972'	DSN ↓	529	318	160	11	-2,3	-0,3	1017,0	99	4/10
1b	G512	Full	01-juil-2016	09:32	UTC-4	69°59.947'	060°20.737'	DSN ↑	529	000	150	10	-2,1	-0,3	1016,2	99	4/10
1b	G512	Full	01-juil-2016	09:49	UTC-4	69°59.500'	060°18.859'	AOP ↓	523	136	160	11	-1,2	-0,3	1016,2	99	4/10
1b	G512	Full	01-juil-2016	10:24	UTC-4	69°59.634'	060°19.635'	AOP ↑	426	065	150	7	-1,8	-0,3	1016,2	99	4/10
1b	G512	Full	01-juil-2016					Zodiac ↑ (SCAMP)									
1b	G512	Full	01-juil-2016	12:16	UTC-4	69°59.997'	060°21.854'	CTD-Rosette ↓	541	020	162	12	-0,9	-0,1	1016,0	99	4/10
1b	G512	Full	01-juil-2016	12:57	UTC-4	69°59.925'	060°22.488'	CTD-Rosette ↑	555	009	161	14	-0,5	-0,1	1015,8	99	4/10
1b	G512	Full	01-juil-2016	13:07	UTC-4	69°59.933'	060°22.642'	Zodiac ↓ (Birds)	556	023	160	15	0,8	0,0	1015,7	99	4/10
1b	G512	Full	01-juil-2016	13:24	UTC-4	69°59.996'	060°22.001'	5NVS ↓	540	318	162	13	-0,9	0,0	1015,5	99	4/10
1b	G512	Full	01-juil-2016	13:57	UTC-4	69°59.886'	060°22.292'	5NVS ↑	550	323	167	13	-1,8	0,0	1015,5	99	4/10
1b	G512	Full	01-juil-2016	14:26	UTC-4	70°00.010'	060°22.017'	CTD-Rosette ↓	542	348	163	10	-1,1	0,0	1015,5	99	4/10
1b	G512	Full	01-juil-2016	15:02	UTC-4	70°00.063'	060°22.748'	CTD-Rosette ↑	551	000	155	12	-1,5	0,0	1015,6	99	4/10
1b	G512	Full	01-juil-2016	15:07	UTC-4	70°00.129'	060°22.820'	Zodiac ↑ (Birds)	543	018	155	12	-1,5	0,0	1015,6	99	4/10
1b	G512	Full	01-juil-2016	15:27	UTC-4	69°59.182'	060°23.575'	Agassiz Trawl ↓	605	270	150	13	-0,6	0,0	1015,6	98	4/10
1b	G512	Full	01-juil-2016	16:28	UTC-4	69°59.307'	060°25.589'	Agassiz Trawl ↑	636	356	160	13	-1,7	0,0	1015,1	99	4/10
1b	G513	CTD	01-juil-2016	17:31	UTC-4	70°00.107'	060°40.749'	CTD-Rosette ↓	920	008	150	12	-1,9	0,0	1015,0	99	4/10
1b	G513	CTD	01-juil-2016	18:09	UTC-4	70°00.597'	060°40.670'	CTD-Rosette ↑	883	064	210	2	-0,7	-0,1	1015,0	99	4/10
1b	G514	Nutrient	01-juil-2016	19:14	UTC-4	70°00.165'	060°58.339'	CTD-Rosette ↓	1257	082	160	10	-2,0	-0,3	1014,8	99	4/10
1b	G514	Nutrient	01-juil-2016	20:33	UTC-4	70°00.789'	060°58.547'	CTD-Rosette ↑	1232	090	170	4	-1,3	-0,3	1015,0	99	4/10
1b	G515	Basic	01-juil-2016	21:34	UTC-4	69°59.812'	061°14.610'	AOP ↓	1471	343	160	9	-2,3	-0,7	1014,9	99	5/10
1b	G515	Basic	01-juil-2016	22:12	UTC-4	69°59.834'	061°14.265'	AOP ↑	1465	301	130	8	-2,1	-0,7	1014,9	99	5/10
1b	G515	Basic	01-juil-2016	22:20	UTC-4	69°59.842'	061°14.295'	CTD-Rosette ↓	1466	059	150	4	-2,1	-0,6	1014,9	99	5/10
1b	G515	Basic	01-juil-2016	22:56	UTC-4	69°59.934'	061°14.342'	CTD-Rosette ↑	1465	061	160	5	-2,0	-0,6	1014,8	99	5/10
1b	G516	CTD	02-juil-2016	00:01	UTC-4	70°00.180'	061°33.690'	CTD-Rosette ↓	1694	067	160	5	-2,6	-0,8	1014,8	99	5/10
1b	G516	CTD	02-juil-2016	01:05	UTC-4	70°00.210'	061°33.146'	CTD-Rosette ↑	1688	019	179	5	-1,9	-0,7	1014,6	99	5/10
1b	G517	Nutrient	02-juil-2016	02:08	UTC-4	69°59.552'	061°51.333'	CTD-Rosette ↓	1856	334	164	5	-2,8	-0,8	1014,5	99	5/10
1b	G517	Nutrient	02-juil-2016	03:46	UTC-4	69°59.330'	061°50.053'	CTD-Rosette ↑	1850	337	315	0	-2,0	-0,8	1015,0	99	5/10
1b	G518	CTD	02-juil-2016	05:00	UTC-4	69°59.812'	062°09.019'	CTD-Rosette ↓	1964	239	310	4	-2,9	-0,8	1015,1	99	5/10
1b	G518	CTD	02-juil-2016	06:08	UTC-4	69°59.814'	062°09.838'	CTD-Rosette ↑	1968	197	000	0	-2,8	-0,7	1015,3	99	5/10
1b	G519	Full	02-juil-2016	08:07	UTC-4	70°00.814'	062°25.371'	Ice Operation	2158	270	120	8	-2,4	-0,8	1015,8	99	7/10
1b	G519	Full	02-juil-2016	09:47	UTC-4	70°00.546'	062°25.752'	iSVP Deployment ↓									
1b	G519	Full	02-juil-2016	10:54	UTC-4	70°00.267'	062°25.374'	CTD-Rosette ↓	2004	214	345	2	-1,3	-0,8	1016,8	99	7/10
1b	G519	Full	02-juil-2016	11:34	UTC-4	70°01.024'	062°25.220'	CTD-Rosette ↑	2004	260	000	11	-0,6	-0,7	1017,0	97	7/10
1b	G519	Full	02-juil-2016	12:28	UTC-4	70°00.895'	062°25.656'	Zodiac ↓ (SCAMP)	2004	283	003	2	-0,5	-0,7	1017,1	97	7/10
1b	G519	Full	02-juil-2016	12:48	UTC-4	70°00.767'	062°25.833'	IOP ↓	2003	012	028	4	-1,6	-0,7	1017,2	98	7/10
1b	G519	Full	02-juil-2016	13:12	UTC-4	70°00.724'	062°25.761'	IOP ↑	2005	024	033	5	-1,7	-0,7	1017,3	98	7/10
1b	G519	Full	02-juil-2016	13:22	UTC-4	70°00.517'	062°25.753'	CTD-Rosette ↓	2005	301	030	3	-1,6	-0,7	1017,4	99	7/10
1b	G519	Full	02-juil-2016	14:07	UTC-4	70°00.420'	062°25.937'	CTD-Rosette ↑	2005	243	344	2	0,0	0,7	1017,6	96	7/10
1b	G519	Full	02-juil-2016	14:15	UTC-4			Zodiac ↑ (SCAMP)									
1b	G519	Full	02-juil-2016	14:29	UTC-4	70°00.008'	062°26.219'	5NVS ↓	2005	208	020	5	-0,1	-0,7	1017,7	96	7/10
1b	G519	Full	02-juil-2016	15:13	UTC-4	69°59.724'	062°26.382'	5NVS ↑	2005	293	005	4	-1,1	-0,7	1018,1	98	7/10
1b	G519	Full	02-juil-2016	15:52	UTC-4	69°59.158'	062°26.901'	CTD-Rosette ↓	2006	294	030	3	-1,2	-0,7	1018,2	99	7/10

1b	G519	Full	02-juil-2016	17:20	UTC-4	69°58.886'	062°27.458'	CTD-Rosette ↑	2006	262	030	4	-1,0	-0,7	1018,7	98	7/10
1b	G519	Full	02-juil-2016	17:38	UTC-4	69°59.019'	062°26.948'	Hydrobios ↓	2005	128	000	2	-0,8	-0,7	1018,8	97	7/10
1b	G519	Full	02-juil-2016	19:29	UTC-4	69°59.071'	062°27.851'	Hydrobios ↑	2007	073	350	6	-1,8	-0,7	1018,4	99	7/10
1b	G519	Full	02-juil-2016	19:40	UTC-4	69°59.078'	062°27.997'	IOP ↓	2007	086	350	6	-2,0	-0,7	1019,5	99	7/10
1b	G519	Full	02-juil-2016	20:04	UTC-4	69°59.116'	062°28.305'	IOP ↑	2004	107	000	5	-2,0	-0,7	1019,5	99	7/10
1b	G519	Full	02-juil-2016	20:12	UTC-4	69°59.133'	068°28.515'	Box Core ↓	2008	129	000	7	-2,0	-0,7	1019,6	99	7/10
1b	G519	Full	02-juil-2016	20:47	UTC-4	69°59.169'	062°28.850'	Box Core (bottom)	2008	125	000	5	-2,1	-0,6	1019,8	99	7/10
1b	G519	Full	02-juil-2016	21:28	UTC-4	69°59.189'	062°29.220'	Box Core ↑	2009	n.a.	020	6	-2,5	-0,6	1020,1	99	7/10
1b	G521	Nutrient	02-juil-2016	23:10	UTC-4	69°59.830'	063°01.071'	CTD-Rosette ↓	2032	249	350	6	-2,7	-0,6	1020,6	99	7/10
1b	G521	Nutrient	03-juil-2016	00:55	UTC-4	69°59.267'	063°00.991'	CTD-Rosette ↑	2031	294	014	4	-2,5	-0,5	1021,0	99	8/10
1b	G600	Full	03-juil-2016	08:00	UTC-4	70°28.525'	064°00.624'	Ice Operation	2110	5	005	8	0,0	-0,7	1023,5	99	8/10
1b	G600	Full	03-juil-2016	10:22	UTC-4	70°30.678'	063°59.242'	CTD-Rosette ↓	2114	313	050	9	0,0	-0,4	1024,0	99	8/10
1b	G600	Full	03-juil-2016	11:01	UTC-4	70°30.453'	063°59.621'	CTD-Rosette ↑	2113	273	010	8	0,9	-0,5	1023,9	99	8/10
1b	G600	Full	03-juil-2016	11:11	UTC-4	70°30.150'	063°59.717'	5NVS ↓	2113	092	005	9	-0,4	-0,5	1024,0	99	8/10
1b	G600	Full	03-juil-2016	11:47	UTC-4			5NVS ↑	2113								
1b	G600	Full	03-juil-2016	12:27	UTC-4	70°30.119'	064°00.068'	Zodiac ↓ (SCAMP)	2113	236	001	8	-0,5	-0,4	1024,0	99	8/10
1b	G600	Full	03-juil-2016	12:59	UTC-4	70°29.963'	063°59.985'	CTD-Rosette ↓	2112	265	357	5	0,6	-0,5	1024,2	98	8/10
1b	G600	Full	03-juil-2016	13:41	UTC-4	76°29.665'	063°59.983'	CTD-Rosette ↑	2113	227	001	10	0,7	-0,6	1024,3	97	8/10
1b	G600	Full	03-juil-2016	13:57	UTC-4	70°29.604'	063°59.945'	IOP ↓	2112	107	358	8	0,1	-0,6	1024,4	98	8/10
1b	G600	Full	03-juil-2016	14:22	UTC-4	70°29.437'	064°00.016'	IOP ↑	2112	114	000	9	-1,1	-0,6	1024,4	99	8/10
1b	G600	Full	03-juil-2016	14:31	UTC-4	70°29.467'	063°59.513'	Zodiac ↑ (SCAMP)	2111	015	005	8	-1,2	0,5	1024,4	99	8/10
1b	G600	Full	03-juil-2016	14:51	UTC-4	70°29.271'	063°59.431'	Hydrobios ↓	2111	091	345	7	-0,7	-0,5	1024,6	99	8/10
1b	G600	Full	03-juil-2016	16:45	UTC-4	70°28.702'	063°59.008'	Hydrobios ↑	2111	111	330	6	-0,7	-0,5	1024,8	99	8/10
1b	G600	Full	03-juil-2016	17:01	UTC-4	70°28.661'	063°58.747'	CTD-Rosette ↓	2110	264	005	8	-0,6	-0,5	1024,8	99	8/10
1b	G600	Full	03-juil-2016	17:06	UTC-4	70°28.637'	063°58.727'	CTD-Rosette ↑	2111	286	001	7	-0,6	-0,5	1024,8	99	8/10
1b	G600	Full	03-juil-2016	17:10	UTC-4	70°28.620'	063°58.719'	CTD-Rosette ↓	2111	283	000	5	-0,2	-0,6	1024,8	99	8/10
1b	G600	Full	03-juil-2016	18:35	UTC-4	70°28.153'	063°58.925'	CTD-Rosette ↑	2111	264	160	1	-0,3	-0,5	1024,9	99	8/10
1b	G600	Full	03-juil-2016	18:51	UTC-4	70°28.251'	063°58.993'	Box Core ↓	2111	117	190	3	-0,5	-0,5	1024,9	99	8/10
1b	G600	Full	03-juil-2016	19:24	UTC-4	70°28.131'	063°59.098'	Box Core (bottom)	2111	085	300	6	-1,7	-0,4	1024,9	99	8/10
1b	G600	Full	03-juil-2016	20:05	UTC-4	70°27.994'	063°59.305'	Box Core ↑	2111	114	000	7	-2,1	-0,4	1024,9	99	8/10
1b	G601	CTD	03-juil-2016	21:20	UTC-4	70°30.211'	063°42.156'	CTD-Rosette ↓	2120	280	010	3	-2,0	-0,5	1025,0	99	8/10
1b	G601	CTD	03-juil-2016	21:59	UTC-4	70°30.129'	063°42.310'	CTD-Rosette ↑	2117	239	340	7	-1,2	-0,5	1025,0	99	8/10
1b	G602	Nutrient	03-juil-2016	23:00	UTC-4	70°30.810'	063°24.415'	CTD-Rosette ↓	2115	263	350	6	-1,9	-0,5	1024,5	99	8/10
1b	G602	Nutrient	04-juil-2016	00:11	UTC-4	70°30.520'	063°24.762'	CTD-Rosette ↑	2115	224	347	3	-1,6	-0,4	1024,4	99	8/10
1b	G603	Basic	04-juil-2016	01:57	UTC-4	70°30.468'	063°03.204'	AOP ↓	2112	340	290	8	-3,0	-0,6	1024,1	99	8/10
1b	G603	Basic	04-juil-2016	02:31	UTC-4	70°30.181'	063°02.469'	AOP ↑	2110	330	288	9	-3,2	-0,5	1024,0	99	8/10
1b	G603	Basic	04-juil-2016	02:43	UTC-4	70°30.104'	063°02.588'	CTD-Rosette ↓	2110	264	303	9	-3,1	-0,5	1023,9	99	8/10
1b	G603	Basic	04-juil-2016	03:21	UTC-4	70°30.014'	063°01.764'	CTD-Rosette ↑	2110	155	298	7	-1,9	-0,5	1023,9	99	8/10
1b	G604	CTD	04-juil-2016	04:09	UTC-4	70°30.053'	062°48.220'	CTD-Rosette ↓	2099	194	170	7	-2,5	-0,6	1023,8	99	8/10
1b	G604	CTD	04-juil-2016	04:50	UTC-4	70°29.781'	062°47.600'	CTD-Rosette ↑	2098	200	130	3	-1,7	-0,4	1023,6	99	8/10
1b	G605	Nutrient	04-juil-2016	05:45	UTC-4	70°30.216'	062°31.071'	CTD-Rosette ↓	2042	205	260	14	-3,7	-0,7	1023,4	99	8/10
1b	G605	Nutrient	04-juil-2016	07:00	UTC-4	70°29.514'	062°31.240'	CTD-Rosette ↑	2038	230	170	4	-3,1	-0,6	1023,4	98	8/10
1b	G605	Full	04-juil-2016	08:13	UTC-4	70°29.594'	062°25.352'	CTD-Rosette ↓	2017	184	335	10	-2,9	-0,6	1023,3	98	8/10

1b	G605	Full	04-juil-2016	08:52	UTC-4	70°29.344'	062°25.583'	CTD-Rosette ↑	2019	228	320	7	-2,1	-0,6	1023,4	99	8/10
1b	G605	Full	04-juil-2016	09:16	UTC-4	70°28.092'	062°29.632'	DSN ↓	2028	098	340	7	-2,1	-0,7	1023,3	99	8/10
1b	G605	Full	04-juil-2016	09:31	UTC-4	70°28.088'	062°28.553'	DSN ↑	2025	091	330	8	-2,0	-0,6	1023,3	99	8/10
1b	G605	Full	04-juil-2016					Zodiac ↓ (SCAMP)									
1b	G605	Full	04-juil-2016	09:51	UTC-4	70°27.907'	062°27.975'	AOP ↓	2022	116	310	11	-1,6	-0,6	1023,3	99	8/10
1b	G605	Full	04-juil-2016	10:24	UTC-4	70°27.943'	062°28.903'	AOP ↑	2027	085	330	11	-1,4	-0,6	1023,0	99	8/10
1b	G605	Full	04-juil-2016	10:34	UTC-4	70°27.950'	062°29.587'	IOP ↓	2029	062	300	11	-1,3	-0,6	1022,9	99	8/10
1b	G605	Full	04-juil-2016	10:58	UTC-4	70°27.854'	062°29.471'	IOP ↑	2028	068	310	11	-1,0	-0,5	1022,8	99	8/10
1b	G605	Full	04-juil-2016					Zodiac ↑ (SCAMP)									
1b	G605	Full	04-juil-2016	12:06	UTC-4	70°27.838'	062°30.194'	CTD-Rosette ↓	2031	253	344	7	-0,6	-0,5	1022,6	99	6/10
1b	G605	Full	04-juil-2016	12:46	UTC-4	70°27.474'	062°30.718'	CTD-Rosette ↑	2030	225	325	10	-0,9	-0,6	1022,5	99	6/10
1b	G605	Full	04-juil-2016	13:04	UTC-4	70°27.371'	062°31.141'	5NVS ↓	2030	086	324	14	-1,2	-0,6	1022,5	99	6/10
1b	G605	Full	04-juil-2016	13:47	UTC-4	70°27.005'	062°30.653'	5NVS ↑	2026	067	314	12	-1,5	-0,6	1022,5	99	6/10
1b	G605	Full	04-juil-2016	14:05	UTC-4	70°27.025'	062°30.583'	CTD-Rosette ↓	2025	221	314	12	-1,2	-0,6	1022,7	99	6/10
1b	G605	Full	04-juil-2016	15:32	UTC-4	70°26.287'	062°29.055'	CTD-Rosette ↑	2016	227	315	8	-0,6	-0,6	1022,7	99	6/10
1b	G605	Full	04-juil-2016	15:50	UTC-4	70°26.396'	062°29.379'	Box Core ↓	2018	081	305	10	-1,5	-0,6	1022,6	99	8/10
1b	G605	Full	04-juil-2016	16:20	UTC-4	70°26.192'	062°29.089'	Box Core (bottom)	2015	129	280	9	-1,4	-0,5	1022,6	99	8/10
1b	G605	Full	04-juil-2016	17:01	UTC-4	70°25.888'	062°28.278'	Box Core ↑	2012	065	297	14	-0,9	-0,5	1022,3	99	8/10
1b	G605	Full	04-juil-2016	17:30	UTC-4	70°26.530'	062°27.639'	Box Core ↓	2012	058	220	10	-0,7	-0,5	1022,3	99	8/10
1b	G605	Full	04-juil-2016	18:00	UTC-4	70°26.454'	062°27.122'	Box Core (bottom)	2007	141	220	10	-0,7	-0,5	1022,3	99	8/10
1b	G605	Full	04-juil-2016	18:41	UTC-4	70°26.286'	062°26.496'	Box Core ↑	2005	057	270	12	-0,7	-0,5	1022,1	99	8/10
1b	G606	CTD	04-juil-2016	19:30	UTC-4	70°30.003'	062°11.837'	CTD-Rosette ↓	1936	169	240	27	-0,5	-0,4	1021,9	97	1/10
1b	G606	CTD	04-juil-2016	20:07	UTC-4	70°30.022'	062°11.590'	CTD-Rosette ↑	1929	138	310	12	-0,1	-0,2	1021,8	95	1/10
1b	MVP08	MVP	04-juil-2016	21:02	UTC-4	70°29.645'	061°41.518'	MVP ↓	1643	051	295	13	0,5	0,7	1021,4	94	Bergy
1b	MVP08	MVP	04-juil-2016	05:35	UTC-4	70°28.327'	058°25.735'	MVP ↑	486	085	280	23	1,7	3,4	1017,1	97	Bergy
1b	G615	Full	05-juil-2016	08:06	UTC-4	70°29.935'	059°31.460'	CTD-Rosette ↓	617	201	355	14	3,4	2,6	1017,4	91	Bergy
1b	G615	Full	05-juil-2016	08:42	UTC-4	70°29.774'	059°32.104'	CTD-Rosette ↑	616	193	350	17	1,8	2,7	1017,3	97	Bergy
1b	G615	Full	05-juil-2016					Zodiac ↓ (SCAMP)									
1b	G615	Full	05-juil-2016	09:15	UTC-4	70°29.982'	059°35.778'	DSN ↓	634	120	350	13	0,9	2,4	1017,1	99	Bergy
1b	G615	Full	05-juil-2016	09:33	UTC-4	70°29.832'	059°34.184'	DSN ↑	623	128	000	11	0,9	2,7	1017,3	99	Bergy
1b	G615	Full	05-juil-2016	09:48	UTC-4	70°30.069'	059°30.591'	IOP ↓	617	161	000	14	0,8	2,7	1017,1	99	Bergy
1b	G615	Full	05-juil-2016	10:12	UTC-4	70°29.888'	059°31.266'	IOP ↑	615	115	350	12	0,9	3,0	1017,0	99	Bergy
1b	G615	Full	05-juil-2016	10:32	UTC-4	70°30.233'	059°32.155'	AOP ↓	623	187	000	12	0,8	3,2	1016,9	99	Bergy
1b	G615	Full	05-juil-2016	11:01	UTC-4	70°30.566'	059°32.995'	AOP ↑	637	192	350	15	0,8	3,0	1016,9	99	Bergy
1b	G615	Full	05-juil-2016					Zodiac ↑ (SCAMP)									
1b	G615	Full	05-juil-2016	12:04	UTC-4	70°30.119'	059°30.251'	CTD-Rosette ↓	619	207	358	13	0,8	3,1	1016,5	99	Bergy
1b	G615	Full	05-juil-2016	12:45	UTC-4	70°30.045'	059°29.949'	CTD-Rosette ↑	616	184	337	14	3,1	3,2	1016,5	90	Bergy
1b	G615	Full	05-juil-2016	13:08	UTC-4	70°29.755'	059°30.806'	Zodiac ↓ (Birds)	613	083	330	18	2,3	3,2	1016,4	95	Bergy
1b	G615	Full	05-juil-2016	13:24	UTC-4	70°29.908'	059°31.044'	5NVS ↓	615	151	352	14	0,9	3,2	1016,1	99	Bergy
1b	G615	Full	05-juil-2016	14:02	UTC-4	70°29.888'	059°30.939'	5NVS ↑	615	160	350	15	0,9	3,2	1016,3	99	Bergy
1b	G615	Full	05-juil-2016	14:26	UTC-4	70°29.529'	059°31.274'	Zodiac ↑ (Birds)	610	081	330	13	1,3	3,1	1016,2	99	Bergy
1b	G615	Full	05-juil-2016	14:52	UTC-4	70°29.840'	059°28.840'	IKMT ↓	615	174	347	12	1,0	3,2	1016,2	99	Bergy
1b	G615	Full	05-juil-2016	16:10	UTC-4	70°29.285'	059°21.477'	IKMT ↑	581	049	290	17	1,0	3,5	1015,9	99	Bergy

1b	G615	Full	05-juil-2016	16:46	UTC-4	70°28.150'	059°28.851'	CTD-Rosette ↓	577	158	140	16	1,1	3,5	1015,6	99	Bergy
1b	G615	Full	05-juil-2016	17:26	UTC-4	70°27.958'	059°28.449'	CTD-Rosette ↑	576	182	340	18	3,2	3,0	1015,7	95	Bergy
1b	G615	Full	05-juil-2016	17:53	UTC-4	70°29.764'	059°30.830'	Agassiz Trawl ↓	615	120	180	26	0,6	3,2	1015,1	99	Bergy
1b	G615	Full	05-juil-2016	18:42	UTC-4	70°29.668'	059°28.299'	Agassiz Trawl ↑	603	049	270	16	0,5	3,2	1015,2	99	Bergy
1b	G615	Full	05-juil-2016	18:59	UTC-4	70°29.964'	059°30.855'	Box Core ↓	617	162	170	20	0,6	3,4	1014,9	99	Bergy
1b	G615	Full	05-juil-2016	19:08	UTC-4	70°29.969'	059°30.927'	Box Core (bottom)	617	195	280	8	0,5	3,4	1015,3	99	Bergy
1b	G615	Full	05-juil-2016	19:21	UTC-4	70°29.927'	059°30.961'	Box Core ↑	617	187	140	8	1,5	3,3	1015,2	99	Bergy
1b	G615	Full	05-juil-2016	19:33	UTC-4	70°29.990'	059°31.118'	Box Core ↓	618	201	160	10	2,6	3,2	1015,2	98	Bergy
1b	G615	Full	05-juil-2016	19:42	UTC-4	70°29.984'	059°31.189'	Box Core (bottom)	619	187	150	10	1,3	3,1	1015,2	99	Bergy
1b	G615	Full	05-juil-2016	19:54	UTC-4	70°29.954'	059°31.325'	Box Core ↑	619	218	335	16	1,8	3,3	1015,2	99	Bergy
1b	G614	CTD	05-juil-2016	20:57	UTC-4	70°30.022'	059°49.858'	CTD-Rosette ↓	674	173	340	11	0,7	2,7	1015,0	99	Bergy
1b	G614	CTD	05-juil-2016	21:25	UTC-4	70°30.075'	059°50.226'	CTD-Rosette ↑	673	205	330	10	1,9	2,1	1015,1	99	Bergy
1b	G613	Nutrient	05-juil-2016	22:05	UTC-4	70°30.141'	060°07.337'	CTD-Rosette ↓	660	195	325	12	2,0	2,1	1015,0	99	Bergy
1b	G613	Nutrient	05-juil-2016	23:01	UTC-4	70°30.349'	060°07.359'	CTD-Rosette ↑	661	211	320	17	2,3	2,0	1014,7	96	Bergy
1b	G612	Basic	05-juil-2016	23:46	UTC-4	70°30.401'	060°25.328'	AOP ↓	663	128	330	15	2,3	2,0	1014,5	93	Bergy
1b	G612	Basic	06-juil-2016	00:22	UTC-4	70°30.773'	060°25.995'	AOP ↑	663	106	333	18	2,4	1,8	1014,1	93	Bergy
1b	G612	Basic	06-juil-2016	00:32	UTC-4	70°30.755'	060°26.050'	CTD-Rosette ↓	664	171	335	14	2,4	2,0	1014,2	93	Bergy
1b	G612	Basic	06-juil-2016	01:04	UTC-4	70°30.731'	060°25.504'	CTD-Rosette ↑	662	207	330	17	2,8	2,0	1014,1	91	Bergy
1b	G611	CTD	06-juil-2016	01:46	UTC-4	70°29.978'	060°43.146'	CTD-Rosette ↓	736	167	332	13	2,1	1,9	1013,8	95	Bergy
1b	G611	CTD	06-juil-2016	02:17	UTC-4	70°29.996'	060°42.914'	CTD-Rosette ↑	730	182	333	17	4,0	1,6	1014,4	88	Bergy
1b	G610	Nutrient	06-juil-2016	03:00	UTC-4	70°29.993'	061°00.930'	CTD-Rosette ↓	846	187	329	18	2,3	1,7	1014,6	94	Bergy
1b	G610	Nutrient	06-juil-2016	04:04	UTC-4	70°30.006'	061°00.176'	CTD-Rosette ↑	841	189	130	7	6,1	1,1	1014,7	80	Bergy
1b	MVP09	MVP	06-juil-2016	04:14	UTC-4	70°29.959'	061°59.999'	MVP ↓	841	285	130	7	6,1	1,1	1014,7	80	Bergy
1b	MVP09	MVP	06-juil-2016	07:36	UTC-4	70°29.814'	062°38.232'	MVP ↑	2070	278	150	24	1,3	0,6	1015,2	96	Bergy
1b	G604.5	Full	06-juil-2016	08:14	UTC-4	70°30.126'	062°37.609'	CTD-Rosette ↓	2063	183	330	17	1,4	0,3	1015,7	94	2/10
1b	G604.5	Full	06-juil-2016	08:53	UTC-4	70°29.905'	062°36.913'	CTD-Rosette ↑	2060	176	330	12	2,5	0,1	1015,9	90	2/10
1b	G604.5	Full	06-juil-2016					Zodiac ↓ (SCAMP)									
1b	G604.5	Full	06-juil-2016	09:09	UTC-4	70°29.772'	062°36.228'	iSVP Deployment ↓									
1b	G604.5	Full	06-juil-2016	09:12	UTC-4	70°29.703'	062°36.643'	DSN ↓	2059	118	340	14	1,6	0,3	1015,9	95	2/10
1b	G604.5	Full	06-juil-2016	09:27	UTC-4	70°29.652'	062°34.973'	DSN ↑	2052	059	340	16	1,4	0,2	1015,9	96	2/10
1b	G604.5	Full	06-juil-2016	09:46	UTC-4	70°29.939'	062°37.580'	IOP ↓	2061	150	330	15	1,4	0,5	1015,6	96	2/10
1b	G604.5	Full	06-juil-2016	10:10	UTC-4	70°29.713'	062°37.223'	IOP ↑	2057	135	340	15	1,0	0,4	1015,9	97	2/10
1b	G604.5	Full	06-juil-2016	10:18	UTC-4	70°29.867'	062°37.613'	AOP ↓	2062	177	350	14	1,0	0,4	1015,9	93	2/10
1b	G604.5	Full	06-juil-2016	10:50	UTC-4	70°30.084'	062°37.900'	AOP ↑	2062	158	000	14	2,6	0,1	1015,7	91	2/10
1b	G604.5	Full	06-juil-2016					Zodiac ↑ (SCAMP)									
1b	G604.5	Full	06-juil-2016	12:05	UTC-4	70°29.994'	062°37.880'	CTD-Rosette ↓	2063	198	334	15	3,3	0,3	1015,7	86	2/10
1b	G604.5	Full	06-juil-2016	12:43	UTC-4	70°30.002'	062°37.741'	CTD-Rosette ↑	2061	184	330	15	3,9	0,1	1015,5	86	2/10
1b	G604.5	Full	06-juil-2016	13:02	UTC-4	70°29.903'	062°38.133'	Zodiac ↓ (Birds)	2066	289	347	14	1,6	0,2	1015,4	95	2/10
1b	G604.5	Full	06-juil-2016	13:17	UTC-4	70°29.932'	062°37.968'	5NVS ↓	2062	097	340	13	1,3	0,4	1015,5	96	2/10
1b	G604.5	Full	06-juil-2016	14:00	UTC-4	70°29.885'	062°38.471'	5NVS ↑	2067	155	332	12	1,0	0,2	1015,5	96	2/10
1b	G604.5	Full	06-juil-2016	14:35	UTC-4	70°29.829'	062°37.938'	IKMT ↓	2062	165	344	11	1,5	0,7	1015,5	93	2/10
1b	G604.5	Full	06-juil-2016	16:00	UTC-4	70°30.301'	062°28.517'	IKMT ↑	2033	348	210	15	1,5	0,8	1015,4	96	2/10
1b	G604.5	Full	06-juil-2016	16:10	UTC-4	70°30.465'	062°28.567'	Zodiac ↑ (Birds)	2034	028	210	15	1,5	0,8	1015,4	96	2/10

1b	G607	Nutrient	06-juil-2016	17:32	UTC-4	70°30.002'	061°54.772'	CTD-Rosette ↓	1778	189	060	10	5,2	1,4	1015,0	83	2/10
1b	G607	Nutrient	06-juil-2016	18:45	UTC-4	70°29.792'	061°54.350'	CTD-Rosette ↑	1774	248	090	4	2,9	1,5	1015,0	91	2/10
1b	G608	Basic	06-juil-2016	19:23	UTC-4	70°29.993'	061°36.584'	AOP ↓	1832	355	260	12	2,2	1,8	1014,4	96	2/10
1b	G608	Basic	06-juil-2016	19:51	UTC-4	70°29.623'	061°36.704'	AOP ↑	1567	n.a.	000	14	2,4	2,1	1014,7	96	2/10
1b	G608	Basic	06-juil-2016	20:01	UTC-4	70°30.120'	061°36.359'	CTD-Rosette ↓	1559	227	000	12	2,6	2,0	1014,6	95	2/10
1b	G608	Basic	06-juil-2016	20:35	UTC-4	70°30.125'	061°36.183'	CTD-Rosette ↑	1555	201	350	10	3,0	2,2	1014,8	93	2/10
1b	G609	Nutrient	06-juil-2016	21:22	UTC-4	70°30.010'	061°18.606'	CTD-Rosette ↓	1170	194	000	12	2,6	2,2	1014,7	95	Bergy
1b	G609	Nutrient	06-juil-2016	22:34	UTC-4	70°29.996'	061°18.263'	CTD-Rosette ↑	1164	212	010	15	3,2	2,1	1014,7	92	Bergy
1b	G616	CTD	07-juil-2016	02:00	UTC-4	70°30.002'	059°14.244'	CTD-Rosette ↓	568	195	007	15	5,3	3,5	1013,6	82	Bergy
1b	G616	CTD	07-juil-2016	02:25	UTC-4	70°29.997'	059°13.803'	CTD-Rosette ↑	567	207	003	18	5,5	3,6	1013,6	85	Bergy
1b	G617	Nutrient	07-juil-2016	03:11	UTC-4	70°29.990'	058°56.415'	CTD-Rosette ↓	530	254	005	19	4,9	3,5	1013,4	84	Bergy
1b	G617	Nutrient	07-juil-2016	04:00	UTC-4	70°29.965'	058°55.115'	CTD-Rosette ↑	525	174	000	14	6,5	3,3	1013,6	80	Bergy
1b	G618	Basic	07-juil-2016	04:30	UTC-4	70°29.957'	058°38.904'	AOP ↓	497	348	010	18	4,7	3,4	1013,4	88	Bergy
1b	G618	Basic	07-juil-2016	05:12	UTC-4	70°29.680'	058°39.960'	AOP ↑	498	158	340	16	4,3	3,5	1013,7	91	Bergy
1b	G618	Basic	07-juil-2016	05:30	UTC-4	70°30.077'	058°38.804'	CTD-Rosette ↓	498	189	240	15	4,4	3,5	1013,7	91	Bergy
1b	G618	Basic	07-juil-2016	06:10	UTC-4	70°29.815'	058°38.568'	CTD-Rosette ↑	495	193	030	10	6,1	3,5	1013,9	84	Bergy
1b	G703	Full	07-juil-2016	11:11	UTC-4	69°30.121'	058°43.022'	AOP ↓	512	142	160	6	3,1	3,2	1015,0	95	Bergy
1b	G703	Full	07-juil-2016	11:44	UTC-4	69°30.386'	058°43.469'	AOP ↑	510	138	160	8	3,1	2,1	1015,3	95	Bergy
1b	G703	Full	07-juil-2016	12:36	UTC-4	69°29.998'	058°43.317'	Zodiac ↓ (SCAMP)	521	003	152	9	3,3	2,0	1015,3	93	Bergy
1b	G703	Full	07-juil-2016	12:41	UTC-4	69°30.001'	058°43.433'	CTD-Rosette ↓	525	340	155	7	4,2	2,0	1015,4	88	Bergy
1b	G703	Full	07-juil-2016	13:21	UTC-4	69°29.998'	058°43.894'	CTD-Rosette ↑	522	025	155	11	4,3	2,0	1015,6	87	Bergy
1b	G703	Full	07-juil-2016	13:31	UTC-4	69°30.151'	058°42.958'	DSN ↓	510	340	167	9	3,9	1,9	1015,6	90	Bergy
1b	G703	Full	07-juil-2016	13:51	UTC-4	69°30.412'	058°44.729'	DSN ↑	518	235	164	8	3,2	2,3	1015,7	94	Bergy
1b	G703	Full	07-juil-2016	14:19	UTC-4	69°29.999'	058°43.177'	CTD-Rosette ↓	518	356	166	7	4,1	2,1	1015,8	90	Bergy
1b	G703	Full	07-juil-2016	14:55	UTC-4	69°30.029'	058°43.039'	CTD-Rosette ↑	515	035	179	5	4,9	1,2	1016,2	85	Bergy
1b	G703	Full	07-juil-2016	14:59	UTC-4	69°30.029'	058°43.114'	Zodiac ↑ (SCAMP)	515	032	167	11	4,9	1,1	1016,2	85	Bergy
1b	G703	Full	07-juil-2016	15:20	UTC-4	69°29.999'	058°43.239'	Zodiac ↓ (Birds)	518	346	179	7	4,2	1,7	1016,4	90	Bergy
1b	G703	Full	07-juil-2016	15:33	UTC-4	69°29.999'	058°43.182'	5NVS ↓	518	014	177	8	4,2	1,8	1016,5	89	Bergy
1b	G703	Full	07-juil-2016	16:05	UTC-4	69°29.975'	058°43.165'	5NVS ↑	522	304	140	7	3,2	1,9	1016,5	95	Bergy
1b	G703	Full	07-juil-2016	16:20	UTC-4	69°29.975'	058°43.165'	Zodiac ↑ (Birds)	522	314	140	7	3,2	1,9	1016,5	95	Bergy
1b	G703	Full	07-juil-2016	16:34	UTC-4	69°30.024'	058°43.145'	IOP ↓	518	351	130	6	3,1	2,0	1016,4	95	Bergy
1b	G703	Full	07-juil-2016	16:59	UTC-4	69°29.998'	058°42.985'	IOP ↑	515	008	148	7	5,1	1,9	1016,4	86	Bergy
1b	G703	Full	07-juil-2016	17:17	UTC-4	69°30.169'	058°43.066'	IKMT ↓	513	342	150	5	5,3	1,8	1016,4	84	Bergy
1b	G703	Full	07-juil-2016	18:47	UTC-4	69°29.398'	058°40.740'	IKMT ↑	443	288	250	3	4,2	3,0	1016,3	91	Bergy
1b	G703	Full	07-juil-2016	19:20	UTC-4	69°29.964'	058°43.324'	CTD-Rosette ↓	524	006	340	1	3,4	2,8	1016,4	95	Bergy
1b	G703	Full	07-juil-2016	19:58	UTC-4	69°29.802'	058°43.232'	CTD-Rosette ↑	527	273	160	6	4,0	2,5	1016,3	92	Bergy
1b	G703	Full	07-juil-2016	20:14	UTC-4	69°29.954'	058°43.950'	Agassiz Trawl ↓	522	076	160	9	3,0	2,4	1016,1	96	Bergy
1b	G703	Full	07-juil-2016	20:47	UTC-4	69°30.401'	058°43.047'	Agassiz Trawl ↑	505	281	160	5	4,2	2,4	1016,1	90	Bergy
1b	G703	Full	07-juil-2016	20:56	UTC-4	69°30.069'	058°44.177'	Agassiz Trawl ↓	520	182	170	7	4,2	2,5	1016,2	90	Bergy
1b	G703	Full	07-juil-2016	21:38	UTC-4	69°30.234'	058°42.362'	Agassiz Trawl ↑	499	352	210	7	3,9	2,5	1016,3	91	Bergy
1b	G700	Basic	07-juil-2016	23:38	UTC-4	69°30.119'	057°52.332'	AOP ↓	283	000	200	6	3,1	4,4	1016,0	97	Bergy
1b	G700	Basic	08-juil-2016	00:14	UTC-4	69°29.838'	057°53.257'	AOP ↑	287	024	185	5	3,8	4,5	1016,0	93	Bergy
1b	G700	Basic	08-juil-2016	00:27	UTC-4	69°30.058'	057°52.115'	CTD-Rosette ↓	284	028	205	7	3,7	4,5	1016,0	93	Bergy

1b	G700	Basic	08-juil-2016	00:56	UTC-4	69°29.999'	057°52.867'	CTD-Rosette ↑	283	025	208	6	4,0	4,3	1016,0	90	Bergy
1b	G701	Nutrient	08-juil-2016	01:33	UTC-4	69°30.030'	058°09.252'	CTD-Rosette ↓	288	047	200	5	2,6	4,5	1015,9	97	Bergy
1b	G701	Nutrient	08-juil-2016	02:08	UTC-4	69°30.019'	058°10.567'	CTD-Rosette ↑	283	342	202	8	3,1	4,0	1015,9	94	Bergy
1b	G702	CTD	08-juil-2016	02:42	UTC-4	69°30.047'	058°26.139'	CTD-Rosette ↓	309	109	212	8	1,2	3,6	1015,7	99	Bergy
1b	G702	CTD	08-juil-2016	02:59	UTC-4	69°30.175'	058°26.286'	CTD-Rosette ↑	309	113	211	4	1,1	3,5	1015,8	99	Bergy
1b	G704	CTD	08-juil-2016	04:40	UTC-4	69°30.013'	058°00.091'	CTD-Rosette ↓	840	110	100	10	-0,7	2,7	1015,7	99	Bergy
1b	G704	CTD	08-juil-2016	05:22	UTC-4	69°30.143'	058°59.144'	CTD-Rosette ↑	800	112	270	5	0,2	1,8	1015,8	99	Bergy
1b	G705	Nutrient	08-juil-2016	06:20	UTC-4	69°30.071'	058°17.327'	CTD-Rosette ↓	1200	095	080	5	-0,9	1,9	1015,5	99	Bergy
1b	G705	Nutrient	08-juil-2016	06:35	UTC-4	69°30.282'	059°15.667'	CTD-Rosette ↑	1209	117	320	5	-0,4	1,1	1015,6	99	Bergy
1b	MVP10	MVP	08-juil-2016	07:45	UTC-4	69°30.124'	059°15.762'	MVP ↓	1211	258	320	5	-0,5	1,3	1015,6	99	Bergy
1b	MVP10	MVP	08-juil-2016	09:15	UTC-4	69°26.428'	059°41.169'	MVP ↑	1420	255	110	15	-0,6	1,9	1015,7	99	Bergy
1b	G707	Full	08-juil-2016	10:12	UTC-4	69°30.710'	059°48.368'	CTD-Rosette ↓	1425	060	240	10	-0,2	2,1	1015,7	99	Bergy
1b	G707	Full	08-juil-2016	10:48	UTC-4	69°30.891'	059°47.644'	CTD-Rosette ↑	1417	350	215	6	0,3	1,6	1015,5	99	Bergy
1b	G707	Full	08-juil-2016	10:59	UTC-4	69°31.108'	059°47.578'	AOP ↓	1414	023	200	10	0,1	1,7	1015,4	99	Bergy
1b	G707	Full	08-juil-2016	11:31	UTC-4	69°30.876'	059°47.294'	AOP ↑	1416	040	210	7	0,7	1,8	1015,3	99	Bergy
1b	G707	Full	08-juil-2016	12:09	UTC-4	69°30.595'	059°48.458'	Zodiac ↓ (SCAMP)	1425	032	185	12	0,4	2,1	1015,3	99	Bergy
1b	G707	Full	08-juil-2016	12:24	UTC-4	69°30.745'	059°48.254'	DSN ↓	1419	236	205	9	0,9	2,1	1015,3	99	Bergy
1b	G707	Full	08-juil-2016	12:41	UTC-4	69°30.485'	059°47.251'	DSN ↑	1417	078	204	12	0,4	2,2	1015,3	99	Bergy
1b	G707	Full	08-juil-2016	13:03	UTC-4	69°30.674'	059°48.132'	IOP ↓	1420	013	212	8	0,5	2,1	1015,3	99	Bergy
1b	G707	Full	08-juil-2016	13:27	UTC-4	69°30.673'	059°47.445'	IOP ↑	1418	340	205	8	0,7	1,9	1015,3	99	Bergy
1b	G707	Full	08-juil-2016	13:38	UTC-4	69°30.675'	059°48.507'	CTD-Rosette ↓	1424	341	207	8	0,9	2,1	1015,3	99	Bergy
1b	G707	Full	08-juil-2016	14:16	UTC-4	69°30.603'	059°48.379'	CTD-Rosette ↑	1423	070	210	9	2,0	2,0	1015,4	97	Bergy
1b	G707	Full	08-juil-2016	14:20	UTC-4	69°30.592'	059°48.365'	Zodiac ↑ (SCAMP)	1423	041	212	7	2,1	2,0	1015,4	96	Bergy
1b	G707	Full	08-juil-2016	14:27	UTC-4	69°30.677'	059°48.431'	Zodiac ↓ (Birds)	1422	304	208	7	2,1	2,0	1015,4	96	Bergy
1b	G707	Full	08-juil-2016	14:46	UTC-4	69°30.672'	059°48.291'	5NVS ↓	1423	340	207	8	0,9	2,1	1015,2	99	Bergy
1b	G707	Full	08-juil-2016	15:28	UTC-4	69°30.677'	059°48.468'	5NVS ↑	1423	331	194	11	0,8	2,1	1015,0	99	Bergy
1b	G707	Full	08-juil-2016	15:50	UTC-4	69°30.675'	059°48.404'	CTD-Rosette ↓	1421	030	195	11	1,6	1,9	1015,1	98	Bergy
1b	G707	Full	08-juil-2016	17:01	UTC-4	69°30.701'	059°48.695'	CTD-Rosette ↑	1425	052	190	8	1,6	1,6	1015,1	98	Bergy
1b	G707	Full	08-juil-2016	17:04	UTC-4	69°30.704'	059°48.765'	Zodiac ↑ (Birds)	1424	080	180	8	1,6	1,6	1015,1	97	Bergy
1b	G707	Full	08-juil-2016	17:18	UTC-4	69°30.777'	059°48.988'	Agassiz Trawl ↓	1427	261	181	8	1,5	1,6	1015,1	98	Bergy
1b	G707	Full	08-juil-2016	18:50	UTC-4	69°29.140'	059°51.547'	Agassiz Trawl ↑	1459	340	270	6	1,0	2,4	1014,6	99	Bergy
1b	G707	Full	08-juil-2016	19:08	UTC-4	69°30.630'	059°48.411'	Box Core ↓	1424	352	220	10	1,2	2,4	1014,6	99	Bergy
1b	G707	Full	08-juil-2016	19:28	UTC-4	69°30.660'	059°48.714'	Box Core (bottom)	1426	009	180	9	1,5	2,0	1014,8	96	Bergy
1b	G707	Full	08-juil-2016	19:56	UTC-4	69°30.835'	059°48.758'	Box Core ↑	1427	348	190	11	1,2	1,9	1014,6	98	Bergy
1b	G707	Full	08-juil-2016	20:07	UTC-4	69°30.781'	059°48.674'	Box Core ↓	1426	338	200	11	1,4	2,0	1014,6	98	Bergy
1b	G707	Full	08-juil-2016	20:26	UTC-4	69°30.810'	059°48.625'	Box Core (bottom)	1426	333	180	12	1,2	1,9	1014,6	99	Bergy
1b	G707	Full	08-juil-2016	20:56	UTC-4	69°30.955'	059°48.298'	Box Core ↑	1423	321	170	12	1,3	1,9	1014,5	99	Bergy
1b	G708	Argo	08-juil-2016	22:07	UTC-4	69°30.062'	060°08.815'	Float 1 ↓	1547	290	170	12	0,9	2,1	1014,4	99	Bergy
1b	G708	Argo	08-juil-2016	22:15	UTC-4	69°30.110'	060°08.934'	CTD-Rosette ↓	1544	011	170	11	1,2	1,8	1014,4	99	Bergy
1b	G708	Argo	08-juil-2016	23:26	UTC-4	69°30.847'	060°08.918'	CTD-Rosette ↑	1534	031	170	13	2,3	1,6	1014,3	98	Bergy
1b	G709	CTD	09-juil-2016	00:16	UTC-4	69°30.005'	060°25.682'	CTD-Rosette ↓	1637	165	170	11	0,9	1,9	1014,0	99	Bergy
1b	G709	CTD	09-juil-2016	00:58	UTC-4	69°30.036'	060°25.507'	CTD-Rosette ↑	1635	049	167	13	1,2	1,0	1015,3	99	Bergy
1b	G710	CTD	09-juil-2016	01:54	UTC-4	69°30.079'	060°42.546'	CTD-Rosette ↓	1710	244	174	11	0,8	1,7	1014,8	99	Bergy

1b	G710	CTD	09-juil-2016	02:35	UTC-4	69°30.020'	060°42.088'	CTD-Rosette ↑	1705	063	179	12	1,3	1,3	1015,0	99	Bergy
1b	G711	Argo	09-juil-2016	03:37	UTC-4	69°30.029'	061°00.658'	Float 2 ↓	2312	060	167	9	0,9	1,7	1015,0	99	Bergy
1b	G711	Argo	09-juil-2016	03:45	UTC-4	69°29.967'	061°00.711'	CTD-Rosette ↓	1787	332	177	10	1,0	1,6	1015,2	99	Bergy
1b	G711	Argo	09-juil-2016	04:57	UTC-4	69°29.838'	061°00.035'	CTD-Rosette ↑	1784	080	260	3	1,0	1,5	1015,3	99	Bergy
1b	Argo 3	Argo	09-juil-2016	06:00	UTC-4	69°19.341'	060°58.997'	Float 3 ↓	1890	270	290	20	0,2	1,6	1015,2	99	Bergy
1b	Argo 3	Argo	09-juil-2016	06:09	UTC-4	69°19.365'	060°59.302'	CTD-Rosette ↓	1798	323	290	20	0,2	1,6	1015,2	99	Bergy
1b	Argo 3	Argo	09-juil-2016	06:40	UTC-4	69°19.437'	060°59.169'	CTD-Rosette ↑	1799	319	150	14	0,4	1,4	1015,4	99	Bergy
1b	Argo 4	Argo	09-juil-2016	08:24	UTC-4	69°20.209'	060°13.251'	Float 4 ↓	1627	300	140	19	1,0	1,7	1016,8	96	Bergy
1b	Argo 4	Argo	09-juil-2016	08:33	UTC-4	69°20.161'	060°13.137'	CTD-Rosette ↓	1625	348	140	17	1,3	1,7	1016,9	94	Bergy
1b	Argo 4	Argo	09-juil-2016	09:06	UTC-4	69°20.331'	060°13.566'	CTD-Rosette ↑	1627	028	150	14	2,1	1,7	1017,2	91	Bergy
1b	Argo 4	Argo	09-juil-2016	08:39	UTC-4	69°21.000'	060°13.500'	iSVP Deployment ↓	1625	024	140	17	3,0	1,6	1017,2	88	Bergy
1b	G713	Full	09-juil-2016	11:57	UTC-4	69°30.093'	061°34.826'	AOP ↓	1896	342	152	13	0,8	1,8	1015,1	94	Bergy
1b	G713	Full	09-juil-2016	12:30	UTC-4	69°30.004'	061°35.292'	AOP ↑	1897	023	153	16	1,6	1,7	1015,0	91	Bergy
1b	G713	Full	09-juil-2016	12:50	UTC-4	69°30.068'	061°34.901'	CTD-Rosette ↓	1899	001	150	18	1,1	1,8	1015,0	93	Bergy
1b	G713	Full	09-juil-2016	13:24	UTC-4	69°29.996'	061°35.055'	CTD-Rosette ↑	1897	347	166	17	3,6	1,6	1015,4	84	Bergy
1b	G713	Full	09-juil-2016	13:42	UTC-4	69°30.187'	061°35.259'	Glider Deployment ↓	1899	271	158	17	0,9	1,6	1015,4	94	Bergy
1b	G713	Full	09-juil-2016	13:49	UTC-4	69°30.260'	061°35.651'	DSN ↓	1900	242	164	15	0,8	1,8	1015,4	95	Bergy
1b	G713	Full	09-juil-2016	14:06	UTC-4	69°29.936'	061°37.369'	DSN ↑	1907	218	155	16	0,8	1,8	1015,5	95	Bergy
1b	G713	Full	09-juil-2016	14:20	UTC-4	69°29.018'	061°42.396'	Glider Surface	1900	240	158	17	0,9	1,6	1015,4	94	Bergy
1b	G713	Full	09-juil-2016	14:40	UTC-4	69°28.876'	061°34.119'	Zodiac ↑ (Glider)	1896	257	147	18	0,6	1,8	1015,6	96	Bergy
1b	G713	Full	09-juil-2016	14:47	UTC-4	69°29.004'	061°34.709'	Zodiac ↓ (SCAMP)	1898	349	152	21	0,6	1,8	1015,6	96	Bergy
1b	G713	Full	09-juil-2016	14:56	UTC-4	69°29.265'	061°34.831'	Beam Trawl ↓	1898	333	165	19	0,8	1,8	1015,7	95	Bergy
1b	G713	Full	09-juil-2016	15:57	UTC-4	69°28.986'	061°42.289'	Beam Trawl ↑	1921	260	050	11	0,7	2,0	1016,2	96	Bergy
1b	G713	Full	09-juil-2016	16:00	UTC-4	69°29.018'	061°42.396'	Zodiac ↑ (SCAMP)	1922	293	060	17	0,7	1,9	1015,2	96	Bergy
1b	G713	Full	09-juil-2016	16:31	UTC-4	69°30.026'	061°34.643'	CTD-Rosette ↓	1896	329	170	14	0,5	2,0	1016,5	97	Bergy
1b	G713	Full	09-juil-2016	17:14	UTC-4	69°30.003'	061°34.870'	CTD-Rosette ↑	1896	016	151	23	2,2	2,1	1016,8	89	Bergy
1b	G713	Full	09-juil-2016	17:23	UTC-4	69°29.995'	061°34.909'	IOP ↓	1897	317	163	24	1,3	1,8	1016,8	91	Bergy
1b	G713	Full	09-juil-2016	17:49	UTC-4	69°30.125'	061°34.545'	IOP ↑	1895	326	140	17	-0,4	2,0	1016,9	99	Bergy
1b	G713	Full	09-juil-2016	18:10	UTC-4	69°30.037'	061°34.698'	CTD-Rosette ↓	1895	327	190	11	0,3	2,0	1017,0	99	Bergy
1b	G713	Full	09-juil-2016	19:25	UTC-4	69°30.088'	061°34.717'	CTD-Rosette ↑	1892	355	190	13	3,2	2,1	1017,5	88	Bergy
1b	G713	Full	09-juil-2016	19:38	UTC-4	69°30.017'	061°34.813'	Box Core ↓	1894	327	180	12	1,7	2,0	1017,5	93	Bergy
1b	G713	Full	09-juil-2016	20:02	UTC-4	69°29.984'	061°34.923'	Box Core (bottom)	1896	303	160	17	0,1	2,0	1017,7	99	Bergy
1b	G713	Full	09-juil-2016	20:41	UTC-4	69°30.017'	061°35.088'	Box Core ↑	1896	306	160	18	1,2	2,0	1017,7	93	Bergy
1b	G713	Full	09-juil-2016	20:52	UTC-4	69°30.035'	061°35.067'	Box Core ↓	1897	306	160	15	1,2	2,0	1017,8	93	Bergy
1b	G713	Full	09-juil-2016	21:16	UTC-4	69°30.059'	061°34.667'	Box Core (bottom)	1897	304	150	20	1,3	1,8	1017,9	93	Bergy
1b	G713	Full	09-juil-2016	21:55	UTC-4	69°30.188'	061°34.868'	Box Core ↑	1896	311	150	18	1,2	1,8	1018,0	94	Bergy
1b	G712	CTD	09-juil-2016	22:37	UTC-4	69°30.091'	061°17.224'	CTD-Rosette ↓	1825	320	150	17	1,1	1,8	1017,7	94	Bergy
1b	G712	CTD	09-juil-2016	23:16	UTC-4	69°30.328'	061°18.006'	CTD-Rosette ↑	1826	001	140	17	1,9	1,7	1018,6	90	Bergy
1b	G714	CTD	10-juil-2016	00:26	UTC-4	69°30.027'	061°51.827'	CTD-Rosette ↓	1938	346	135	20	1,2	1,8	1018,2	94	Bergy
1b	G714	CTD	10-juil-2016	01:05	UTC-4	69°30.000'	061°52.723'	CTD-Rosette ↑	1937	357	118	18	3,0	1,5	1018,2	88	Bergy
1b	G715	Nutrient	10-juil-2016	01:42	UTC-4	69°29.998'	062°08.378'	CTD-Rosette ↓	1952	326	122	17	0,8	0,9	1018,2	96	Bergy
1b	G715	Nutrient	10-juil-2016	02:49	UTC-4	69°30.002'	062°09.852'	CTD-Rosette ↑	1953	300	125	19	2,4	0,4	1018,3	90	Bergy
1b	G716	Basic	10-juil-2016	03:28	UTC-4	69°30.014'	062°25.722'	CTD-Rosette ↓	1959	295	118	18	1,1	0,3	1018,3	98	Bergy

1b	G716	Basic	10-juil-2016	04:10	UTC-4	69°30.018'	062°25.728'	CTD-Rosette ↑	1958	308	140	18	1,1	0,0	1018,4	96	Bergy
1b	G717	CTD	10-juil-2016	04:52	UTC-4	69°30.128'	062°42.695'	CTD-Rosette ↓	1969	303	060	17	-0,2	0,0	1018,2	99	4/10
1b	G717	CTD	10-juil-2016	05:34	UTC-4	69°30.299'	062°42.705'	CTD-Rosette ↑	1970	315	140	18	0,9	0,0	1018,3	96	4/10
1b	G718	Nutrient	10-juil-2016	06:20	UTC-4	69°30.180'	062°59.974'	CTD-Rosette ↓	1975	013	100	21	0,0	0,2	1018,6	99	4/10
1b	G718	Nutrient	10-juil-2016	07:41	UTC-4	69°30.308'	062°59.823'	CTD-Rosette ↑	1977	033	220	3	1,5	0,5	1018,2	93	4/10
1b	G719	Full	10-juil-2016	08:25	UTC-4	69°30.053'	063°13.990'	CTD-Rosette ↓	1954	007	135	17	0,4	-0,1	1018,4	96	6/10
1b	G719	Full	10-juil-2016	09:03	UTC-4	69°30.181'	063°13.693'	CTD-Rosette ↑	1955	008	130	11	1,6	-0,4	1018,5	89	6/10
1b	G719	Full	10-juil-2016					Zodiac ↓ (SCAMP)									
1b	G719	Full	10-juil-2016	09:36	UTC-4	69°30.131'	063°12.907'	5NVS ↓	1955	269	135	11	0,8	-0,5	1018,8	94	6/10
1b	G719	Full	10-juil-2016	10:17	UTC-4	69°30.309'	063°13.102'	5NVS ↑	1954	297	150	15	0,2	-0,5	1018,8	98	6/10
1b	G719	Full	10-juil-2016	10:31	UTC-4	69°30.225'	063°12.553'	IOP ↓	1954	274	140	11	0,0	-0,4	1019,1	99	6/10
1b	G719	Full	10-juil-2016	10:56	UTC-4	69°30.357'	063°12.365'	IOP ↑	1955	341	130	12	-0,1	-0,5	1019,1	99	6/10
1b	G719	Full	10-juil-2016	11:20	UTC-4	69°29.728'	063°12.145'	AOP ↓	1954	350	160	13	-0,1	-0,6	1019,1	99	6/10
1b	G719	Full	10-juil-2016	11:51	UTC-4	69°29.586'	063°11.570'	AOP ↑	1953	309	140	12	-0,3	-0,4	1019,2	99	6/10
1b	G719	Full	10-juil-2016					Zodiac ↑ (SCAMP)									
1b	G719	Full	10-juil-2016	12:41	UTC-4	69°29.980'	063°16.717'	CTD-Rosette ↓	1954	317	122	12	-0,3	-0,5	1019,2	99	6/10
1b	G719	Full	10-juil-2016	13:19	UTC-4	69°30.048'	063°16.784'	CTD-Rosette ↑	1952	066	123	12	-0,2	-0,6	1019,2	99	6/10
1b	G719	Full	10-juil-2016	13:52	UTC-4	69°29.760'	063°29.771'	DSN ↓	1951	016	120	14	-0,3	-0,6	1019,4	99	6/10
1b	G719	Full	10-juil-2016	14:08	UTC-4	69°29.998'	063°15.887'	DSN ↑	1951	248	120	12	0,2	-0,6	1019,5	99	6/10
1b	G719	Full	10-juil-2016	14:27	UTC-4	69°29.972'	063°16.970'	CTD-Rosette ↓	1950	342	119	10	0,0	-0,6	1019,5	99	6/10
1b	G719	Full	10-juil-2016	15:42	UTC-4	69°30.021'	063°17.058'	CTD-Rosette ↑	1951	280	120	12	0,7	-0,7	1019,5	99	6/10
1b	G719	Full	10-juil-2016	15:56	UTC-4	69°30.017'	063°16.762'	Box Core ↓	1951	283	100	10	0,1	-0,6	1019,5	99	6/10
1b	G719	Full	10-juil-2016	16:19	UTC-4	69°30.040'	063°16.723'	Box Core (bottom)	1951	295	120	12	0,2	-0,6	1019,5	99	6/10
1b	G719	Full	10-juil-2016	16:58	UTC-4	69°30.131'	063°16.762'	Box Core ↑	1951	254	120	13	-0,1	-0,6	1019,7	99	6/10
1b	G719	Full	10-juil-2016	17:12	UTC-4	69°30.020'	063°16.822'	Box Core ↓	1950	177	120	11	-0,2	-0,6	1019,7	99	6/10
1b	G719	Full	10-juil-2016	17:36	UTC-4	69°30.109'	063°16.900'	Box Core (bottom)	1950	261	090	10	-0,2	-0,6	1017,3	99	6/10
1b	G719	Full	10-juil-2016	18:17	UTC-4	69°30.178'	063°16.828'	Box Core ↑	1952	320	140	12	-0,4	-0,7	1019,7	99	6/10
1b	G719	Full	10-juil-2016	23:56	UTC-4	69°16.960'	061°24.084'	Zodiac ↑ (Glider)	1852	282	100	8	-0,3	0,4	1019,9	99	7/10
Leg 2a																	
2a	FB6	CTD	15-juil-2016	08:26	UTC-4	63°06.190'	067°30.790'	CTD-Rosette ↓	612	127	120	20/25	2.2	0.3	993,0	97	Bergy
2a	FB6	CTD	15-juil-2016	08:54	UTC-4	63°06.230'	067°30.640'	CTD-Rosette ↑	529	121	110	20/25	3.2	0.2	992,5	93	Bergy
2a	FB6-1	Coring	15-juil-2016	09:21	UTC-4	63°06.670'	067°31.100'	Box Core ↓	459	131	130	10/15	2.4	0.6	992,9	95	Bergy
2a	FB6-1	Coring	15-juil-2016	09:37	UTC-4	63°06.670'	067°31.100'	Box Core (bottom)	459	136	120	10/15	2.2	0.7	993,0	96	Bergy
2a	FB6-1	Coring	15-juil-2016	09:42	UTC-4	63°06.640'	067°31.120'	Box Core ↑	496	136	125	15	2.4	0.7	992,8	96	Bergy
2a	FB6-1	Coring	15-juil-2016	09:49	UTC-4	63°06.620'	067°31.140'	Box Core ↓	510	134	120	15	2.4	0.7	992,8	96	Bergy
2a	FB6-1	Coring	15-juil-2016	10:00	UTC-4	63°06.610'	067°31.130'	Box Core (bottom)	512	132	130	15	2.7	0.7	992,5	95	Bergy
2a	FB6-1	Coring	15-juil-2016	10:11	UTC-4	63°06.630'	067°31.070'	Box Core ↑	485	129	140	15/20	2.7	0.8	992,4	96	Bergy
2a	FB6-1	Coring	15-juil-2016	10:20	UTC-4	63°06.660'	067°30.980'	Box Core ↓	443	144	140	15/20	2.6	0.8	992,3	96	Bergy
2a	FB6-1	Coring	15-juil-2016	10:30	UTC-4	63°06.640'	067°31.020'	Box Core (bottom)	452	172	120	20	2.8	0.8	992,2	96	Bergy
2a	FB6-1	Coring	15-juil-2016	10:40	UTC-4	63°06.590'	067°31.140'	Box Core ↑	519	145	130	20/25	3.3	0.8	992,1	92	Bergy
2a	Bell-1	Coring	15-juil-2016	14:12	UTC-4	63°32.743'	068°28.519'	Piston Core ↓	210	249	150	5	3.0	0.7	992,0	97	Bergy
2a	Bell-1	Coring	15-juil-2016	14:17	UTC-4	63°32.754'	068°28.524'	Piston Core (bottom)	210	256	135	6	2.9	0.4	992,0	98	Bergy
2a	Bell-1	Coring	15-juil-2016	14:23	UTC-4	63°32.771'	068°28.547'	Piston Core ↑	211	267	140	6	3.3	0.4	991,6	97	Bergy

2a	Bell-2	Coring	15-juil-2016	16:17	UTC-4	63°33.816'	068°30.361'	Piston Core ↓	200	059	145	6	2.5	0.6	991,6	99	Bergy
2a	Bell-2	Coring	15-juil-2016	16:23	UTC-4	63°33.813'	068°30.347'	Piston Core (bottom)	204	053	145	6	2.4	0.8	991,6	99	Bergy
2a	Bell-2	Coring	15-juil-2016	16:27	UTC-4	63°33.811'	068°30.342'	Piston Core ↑	200	060	155	6	2.4	0.8	991,6	99	Bergy
2a	Bell-1	Coring	15-juil-2016	20:56	UTC-4	63°32.750'	068°28.530'	Box Core ↓	208	300	Calm		2.9	1.8	991,1	99	Bergy
2a	Bell-1	Coring	15-juil-2016	21:07	UTC-4	63°32.760'	068°28.510'	Box Core (bottom)	208	305	Calm		2.8	1.3	991,1	99	Bergy
2a	Bell-1	Coring	15-juil-2016	21:12	UTC-4	63°32.760'	068°28.460'	Box Core ↑	209	316	Calm		2.7	1.3	991,1	99	Bergy
2a	Bell-2	Coring	15-juil-2016	21:54	UTC-4	63°33.830'	068°30.130'	Box Core ↓	203	295	Calm		2.7	1.8	990,9	99	Bergy
2a	Bell-2	Coring	15-juil-2016	21:59	UTC-4	63°33.850'	068°30.110'	Box Core (bottom)	204	298	Calm		2.7	1.8	990,9	99	Bergy
2a	Bell-2	Coring	15-juil-2016	22:02	UTC-4	63°33.860'	068°30.070'	Box Core ↑	206	304	Calm		2.7	1.8	990,9	99	Bergy
2a	Bell-3	Coring	15-juil-2016	22:30	UTC-4	63°34.920'	068°31.260'	Box Core ↓	187	314	Calm		2.9	1.7	990,7	99	Bergy
2a	Bell-3	Coring	15-juil-2016	22:35	UTC-4	63°34.920'	068°31.260'	Box Core (bottom)	187	310	140	5	2.9	1.7	990,7	99	Bergy
2a	Bell-3	Coring	15-juil-2016	22:39	UTC-4	63°34.920'	068°31.260'	Box Core ↑	187	310	140	5	2.9	1.7	990,7	99	Bergy
2a	Bell-4	Coring	15-juil-2016	22:54	UTC-4	63°34.980'	068°31.330'	Box Core ↓	186	313	Calm		3.1	1.2	990,5	99	Bergy
2a	Bell-4	Coring	15-juil-2016	22:59	UTC-4	63°34.980'	068°31.330'	Box Core (bottom)	186	313	Calm		3.1	1.2	990,5	99	Bergy
2a	Bell-4	Coring	15-juil-2016	23:02	UTC-4	63°34.980'	068°31.310'	Box Core ↑	186	314	Calm		3.1	1.2	990,5	99	Bergy
2a	FB3	CTD	15-juil-2016	23:34	UTC-4	63°34.170'	068°30.510'	CTD-Rosette ↓	161	328	340	5	3.0	1.5	990,2	99	Bergy
2a	FB3	CTD	15-juil-2016	23:42	UTC-4	63°34.120'	068°30.470'	CTD-Rosette (bottom)	150	308	340	5	3.0	1.5	990,2	99	Bergy
2a	FB3	CTD	15-juil-2016	23:45	UTC-4	63°34.110'	068°30.480'	CTD-Rosette ↑	145	303	340	5	3.0	1.5	990,2	99	Bergy
2a	FB4	Basic	16-juil-2016	00:54	UTC-4	63°33.527'	068°14.907'	CTD-Rosette ↓	113	114	320	6	3.1	0.9	989,3	99	1/10
2a	FB4	Basic	16-juil-2016	01:26	UTC-4	63°33.583'	068°14.922'	CTD-Rosette ↑	125	149	Calm		3.4	0.8	988,9	99	1/10
2a	FB4	Basic	16-juil-2016	01:40	UTC-4	63°33.727'	068°14.684'	DSN ↓	088	010	Calm		3.2	0.8	988,7	99	1/10
2a	FB4	Basic	16-juil-2016	01:57	UTC-4	63°34.154'	068°15.554'	DSN ↑	059	258	Calm		3.1	0.8	988,5	99	1/10
2a	FB4	Basic	16-juil-2016	02:56	UTC-4	63°33.503'	068°14.841'	5NVS ↓	107	356	290	6	2.4	0.6	988,2	99	1/10
2a	FB4	Basic	16-juil-2016	03:06	UTC-4	63°33.497'	068°14.875'	5NVS ↑	110	019	290	4	2.4	0.6	988,1	99	1/10
2a	FB4	Basic	16-juil-2016	03:31	UTC-4	63°33.522'	068°14.942'	Box Core ↓	117	203	290	5	2.6	0.7	987,8	99	1/10
2a	FB4	Basic	16-juil-2016	03:34	UTC-4	63°33.525'	068°14.967'	Box Core (bottom)	118	217	290	4	2.6	0.7	987,7	99	1/10
2a	FB4	Basic	16-juil-2016	03:37	UTC-4	63°33.530'	068°14.991'	Box Core ↑	118	218	290	5	2.6	0.7	987,7	99	1/10
2a	FB4	Basic	16-juil-2016	04:14	UTC-4	63°33.430'	068°14.846'	Agassiz Trawl ↓	104	356	325	4	2.7	0.6	987,3	99	1/10
2a	FB4	Basic	16-juil-2016	04:29	UTC-4	63°33.855'	068°15.306'	Agassiz Trawl ↑	75	304	320	2	3.0	0.6	987,3	99	1/10
2a	Bell-4	Coring	16-juil-2016	05:45	UTC-4	63°34.960'	068°31.348'	Piston Core ↓	190	004	340	4	3.2	1.2	987,2	99	0/10
2a	Bell-4	Coring	16-juil-2016	05:49	UTC-4	63°34.974'	068°31.372'	Piston Core (bottom)	190	028	310	3	3.2	1.1	987,2	99	0/10
2a	Bell-4	Coring	16-juil-2016	05:55	UTC-4	63°34.364'	068°31.363'	Piston Core ↑	190	030	310	3	3.1	1.1	987,2	99	0/10
2a	Bell-3	Coring	16-juil-2016	08:22	UTC-4	63°34.947'	068°31.115'	Piston Core ↓	190	288	Calm		3.1	1.3	987,2	99	1/10
2a	Bell-3	Coring	16-juil-2016	08:27	UTC-4	63°34.945'	068°31.198'	Piston Core (bottom)	190	265	Calm		3.1	1.3	987,2	99	1/10
2a	Bell-3	Coring	16-juil-2016	08:32	UTC-4	63°34.941'	068°31.193'	Piston Core ↑	190	268	Calm		3.1	1.3	987,2	99	1/10
2a	Bell-5	Coring	16-juil-2016	10:08	UTC-4	63°38.578'	068°37.083'	Piston Core ↓	103	236	120	5	3.0	1.8	987,4	98	1/10
2a	Bell-5	Coring	16-juil-2016	10:09	UTC-4	63°38.589'	068°37.115'	Piston Core (bottom)	101	218	120	5	2.9	1.5	987,4	98	1/10
2a	Bell-5	Coring	16-juil-2016	10:12	UTC-4	63°38.595'	068°37.124'	Piston Core ↑	101	212	120	5	2.9	1.5	987,4	98	1/10
2a	Bell-6	Coring	16-juil-2016	12:30	UTC-4	63°38.487'	068°36.911'	Piston Core ↓	115	099	140	11	2.7	0.8	987,6	99	1/10
2a	Bell-6	Coring	16-juil-2016	12:33	UTC-4	63°38.486'	068°36.910'	Piston Core (bottom)	115	092	140	11	2.6	0.8	987,5	99	1/10
2a	Bell-6	Coring	16-juil-2016	12:36	UTC-4	63°38.487'	068°36.903'	Piston Core ↑	115	088	130	12	2.6	0.8	987,5	99	1/10
2a	FB1	CTD	16-juil-2016	13:24	UTC-4	63°38.801'	068°36.429'	CTD-Rosette ↓	86	119	120	14	2.4	0.9	987,5	99	1/10
2a	FB1	CTD	16-juil-2016	13:36	UTC-4	63°38.795'	068°36.576'	CTD-Rosette ↑	65	063	120	18	2.2	0.7	987,6	99	1/10

2a	Bell-5	Coring	16-juil-2016	13:58	UTC-4	63°38.574'	068°37.153'	Box Core ↓	104	135	130	19	2.3	0.9	987,5	99	1/10
2a	Bell-5	Coring	16-juil-2016	14:01	UTC-4	63°38.563'	068°37.158'	Box Core (bottom)	104	129	130	18	2.2	1.3	987,5	99	1/10
2a	Bell-5	Coring	16-juil-2016	14:04	UTC-4	63°38.564'	068°37.181'	Box Core ↑	105	130	130	19	2.2	1.3	987,5	99	1/10
2a	Bell-6	Coring	16-juil-2016	14:21	UTC-4	63°38.495'	068°36.914'	Box Core ↓	118	098	130	15	2.1	1.3	987,7	99	1/10
2a	Bell-6	Coring	16-juil-2016	14:24	UTC-4	63°38.490'	068°36.920'	Box Core (bottom)	117	119	120	14	2.1	1.3	987,7	99	1/10
2a	Bell-6	Coring	16-juil-2016	14:27	UTC-4	63°38.485'	068°36.936'	Box Core ↑	118	132	120	14	2.1	1.3	987,7	99	1/10
2a	FB1-1	Coring	16-juil-2016	16:45	UTC-4	63°38.443'	068°37.246'	Box Core ↓	134	136	132	25	2.7	1.6	988,1	93	0/10
2a	FB1-1	Coring	16-juil-2016	16:50	UTC-4	63°38.436'	068°37.253'	Box Core (bottom)	135	124	130	23	2.7	1.6	988,1	93	0/10
2a	FB1-1	Coring	16-juil-2016	16:54	UTC-4	63°38.431'	068°37.228'	Box Core ↑	134	125	125	20	2.0	1.2	988,1	95	0/10
2a	FB2	CTD	16-juil-2016	18:07	UTC-4	63°40.487'	068°25.879'	CTD-Rosette ↓	63	140	140	17	2.1	1.3	988,9	98	1/10
2a	FB2	CTD	16-juil-2016	18:25	UTC-4	63°40.506'	068°25.834'	CTD-Rosette ↑	63	152	142	15	2.2	1.3	989,1	99	1/10
2a	FB2-2	Coring	16-juil-2016	18:37	UTC-4	63°40.512'	068°25.822'	Box Core ↓	63	157	147	17	2.2	1.2	989,2	99	1/10
2a	FB2-2	Coring	16-juil-2016	18:39	UTC-4	63°40.514'	068°25.821'	Box Core ↑	63	158	147	17	2.2	1.2	989,2	99	1/10
2a	FB2-2	Coring	16-juil-2016	18:55	UTC-4	63°40.517'	068°25.827'	Box Core ↓	62	161	141	19	1.6	1.3	989,5	99	1/10
2a	FB2-2	Coring	16-juil-2016	18:59	UTC-4	63°40.517'	068°25.828'	Box Core ↑	62	156	145	18	1.6	1.3	989,4	99	1/10
2a	FB2-2	Coring	16-juil-2016	19:11	UTC-4	63°40.515'	068°25.831'	Box Core ↓	62	157	140	20	1.6	1.3	989,5	99	1/10
2a	FB2-2	Coring	16-juil-2016	19:14	UTC-4	63°40.513'	068°25.829'	Box Core ↑	62	156	140	19	1.6	1.3	989,5	99	1/10
2a	FB2-1	Coring	16-juil-2016	19:35	UTC-4	63°39.817'	068°25.342'	Box Core ↓	81	142	141	17	1.5	1.2	989,6	99	0/10
2a	FB2-1	Coring	16-juil-2016	19:39	UTC-4	63°39.818'	068°25.343'	Box Core ↑	80	139	138	17	1.5	1.2	989,6	99	0/10
2a	FB2-1	Coring	16-juil-2016	19:50	UTC-4	63°39.805'	068°25.339'	Box Core ↓	79	132	143	20	1.7	1.1	989,9	99	0/10
2a	FB2-1	Coring	16-juil-2016	19:53	UTC-4	63°39.810'	068°25.320'	Box Core ↑	80	130	130	15/20	1.7	1.1	989,9	99	0/10
2a	FB2-1	Coring	16-juil-2016	20:02	UTC-4	63°39.800'	068°25.320'	Box Core ↓	80	131	130	15/20	1.8	1.0	990,0	99	0/10
2a	FB2-1	Coring	16-juil-2016	20:06	UTC-4	63°39.811'	068°25.300'	Box Core ↑	81	126	130	15/20	1.8	1.0	990,0	99	0/10
2a	FB7	Basic	17-juil-2016	00:44	UTC-4	62°58.685'	067°17.062'	CTD-Rosette ↓	473	136	120	13	0.4	1.1	993,3	99	0/10
2a	FB7	Basic	17-juil-2016	01:42	UTC-4	62°58.793'	067°17.182'	CTD-Rosette ↑	448	131	090	11	0.5	1.2	994,1	99	Bergy
2a	FB7	Basic	17-juil-2016	01:56	UTC-4	62°58.667'	067°17.009'	Box Core ↓	474	118	120	9	0.5	1.2	994,1	99	Bergy
2a	FB7	Basic	17-juil-2016	02:08	UTC-4	62°58.672'	067°16.931'	Box Core (bottom)	472	104	110	10	0.6	1.2	994,2	99	Bergy
2a	FB7	Basic	17-juil-2016	02:17	UTC-4	62°58.694'	067°16.970'	Box Core ↑	474	094	120	10	0.6	1.2	994,3	99	Bergy
2a	FB7	Basic	17-juil-2016	03:09	UTC-4	62°58.756'	067°15.760'	Agassiz Trawl ↓	443	298	120	10	1.1	1.1	995,0	99	Bergy
2a	FB7	Basic	17-juil-2016	03:20	UTC-4	62°58.792'	067°16.367'	Agassiz Trawl (bottom)	443	226	120	10	1.3	1.2	995,2	98	Bergy
2a	FB7	Basic	17-juil-2016	03:36	UTC-4	62°58.398'	067°16.406'	Agassiz Trawl ↑	477	152	090	10	1.1	1.2	995,2	98	Bergy
2a	FB8	CTD	17-juil-2016	04:16	UTC-4	62°55.412'	067°05.508'	CTD-Rosette ↓	608	134	100	5	2.0	1.1	995,7	94	Bergy
2a	FB8	CTD	17-juil-2016	05:25	UTC-4	62°55.515'	067°05.418'	CTD-Rosette ↑	608	163	110	6	2.2	1.1	996,9	93	Bergy
2a	FB8	CTD	17-juil-2016	05:33	UTC-4	62°55.398'	067°05.408'	Box Core ↓	611	180	230	10	2.8	0.8	997,3	91	Bergy
2a	FB8	CTD	17-juil-2016	05:41	UTC-4	62°55.390'	067°05.389'	Box Core (bottom)	610	235	220	9	6.0	0.8	997,2	79	Bergy
2a	FB8	CTD	17-juil-2016	05:52	UTC-4	62°55.435'	061°05.340'	Box Core ↑	610	306	205	8	7.6	0.7	997,2	71	Bergy
2a	ROV1	ROV	18-juil-2016	08:44	UTC-4	61°20.480'	061°09.500'	ROV Dive 1 ↓	559	168	150	15/20	8.7	5.0	1004,7	83	0/10
2a	ROV1	ROV	18-juil-2016	11:44	UTC-4	61°20.430'	061°08.690'	ROV Dive 1 ↑	559	143	160	20	7.0	4.6	1003,8	85	0/10
2a	ROV1	ROV	18-juil-2016	13:00	UTC-4	61°20.566'	061°09.977'	PNF ↓	559	170	170	17	6.8	4.8	1003,3	85	0/10
2a	ROV1	ROV	18-juil-2016	13:04	UTC-4	61°20.571'	061°10.061'	PNF ↑	559	172	170	17	6.8	4.8	1003,3	85	0/10
2a	ROV1	ROV	18-juil-2016	13:05	UTC-4	61°20.576'	061°10.098'	Secchi Disk ↓	559	173	170	18	6.8	4.8	1003,3	85	0/10
2a	ROV1	ROV	18-juil-2016	13:07	UTC-4	61°20.577'	061°10.137'	Secchi Disk ↑	559	175	170	18	6.8	4.8	1003,3	85	0/10
2a	ROV1	ROV	18-juil-2016	13:22	UTC-4	61°20.515'	061°09.628'	CTD-Rosette ↓	559	158	170	17	6.8	4.8	1003,1	85	0/10

2a	ROV1	ROV	18-juil-2016	14:26	UTC-4	61°20.475'	061°09.803'	CTD-Rosette ↑	561	152	170	16	7.1	4.9	1003,1	83	0/10
2a	ROV1	ROV	18-juil-2016	14:46	UTC-4	61°20.503'	061°09.560'	5NVS ↓ Cancelled	561	160	170	18	7.1	5.0	1003,0	82	0/10
2a	ROV1	ROV	18-juil-2016	15:41	UTC-4	61°20.713'	061°10.833'	5NVS ↓	565	178	180	18	7.1	5.0	1003,1	82	0/10
2a	ROV1	ROV	18-juil-2016	16:24	UTC-4	61°20.760'	061°11.912'	5NVS ↑	561	179	168	18	6.8	4.9	1003,0	84	0/10
2a	ROV1	ROV	18-juil-2016	16:50	UTC-4	61°20.483'	061°09.544'	CTD-Rosette ↓	559	142	175	20	6.9	4.9	1002,8	84	0/10
2a	ROV1	ROV	18-juil-2016	17:37	UTC-4	61°20.508'	061°10.618'	CTD-Rosette ↑	563	136	165	19	7.5	4.7	1002,8	83	0/10
2a	ROV1	ROV	18-juil-2016	17:53	UTC-4	61°20.368'	061°09.545'	DSN ↓	563	325	175	18	7.8	4.4	1002,5	82	0/10
2a	ROV1	ROV	18-juil-2016	18:06	UTC-4	61°20.704'	061°10.484'	DSN ↑	561	264	174	16	8.5	4.3	1002,7	82	0/10
2a	ROV1	ROV	18-juil-2016	18:26	UTC-4	61°20.492'	061°09.538'	Box Core ↓ (problem with 500 HP)	563	111	170	15	7.3	4.2	1003,0	84	0/10
2a	ROV1	ROV	18-juil-2016	18:47	UTC-4	61°20.504'	061°09.591'	Box Core (bottom)	562	134	185	11	8.1	4.2	1003,1	80	0/10
2a	ROV1	ROV	18-juil-2016	19:02	UTC-4	61°20.485'	061°09.602'	Box Core ↑	561	126	175	10	7.8	4.2	1003,3	81	0/10
2a	ROV5	ROV	19-juil-2016	09:40	UTC-4	61°26.690'	060°40.520'	PNF + Secchi Disk ↕	576	288	Calm		7.2	6.0	1005,2	94	0/10
2a	ROV5	ROV	19-juil-2016	09:54	UTC-4	61°26.680'	060°40.570'	CTD-Rosette ↓	576	179	200	8	7.8	6.0	1005,3	91	0/10
2a	ROV5	ROV	19-juil-2016	10:10	UTC-4	61°26.660'	060°40.380'	CTD-Rosette (bottom)	583	173	Calm		8.0	6.0	1005,5	91	0/10
2a	ROV5	ROV	19-juil-2016	11:12	UTC-4	61°26.310'	060°39.560'	CTD-Rosette ↑	630	250	Calm		8.9	6.1	1005,8	85	0/10
2a	ROV5	ROV	19-juil-2016	11:30	UTC-4	61°26.760'	060°40.830'	DSN ↓	567	294	Calm		8.4	6.2	1005,7	88	0/10
2a	ROV5	ROV	19-juil-2016					DSN (bottom)									0/10
2a	ROV5	ROV	19-juil-2016					DSN ↑	Cancelled								0/10
2a	ROV5	ROV	19-juil-2016	11:42	UTC-4	61°26.540'	060°41.400'	DSN ↓ (essai #2)	556	177	Calm		8.4	6.2	1005,7	88	0/10
2a	ROV5	ROV	19-juil-2016					DSN ↑ (essai #2)	Cancelled (problem with 500 HP)								0/10
2a	ROV5	ROV	19-juil-2016	12:41	UTC-4	61°26.669'	060°40.730'	CTD-Rosette ↓	572	304	VAR	5	7.7	6.3	1005,9	94	0/10
2a	ROV5	ROV	19-juil-2016	13:29	UTC-4	61°26.352'	060°40.802'	CTD-Rosette ↑	573	011	120	10	7.7	6.3	1005,9	94	0/10
2a	ROV5	ROV	19-juil-2016	14:47	UTC-4	61°26.439'	060°39.822'	ROV Dive 2 ↓	618	120	150	12	7.2	6.2	1006,3	95	0/10
2a	ROV5	ROV	19-juil-2016	17:08	UTC-4	61°26.320'	060°39.641'	ROV Dive 2 ↑	618	120	150	8	7.3	6.1	1007,1	95	0/10
2a	ROV5	ROV	19-juil-2016	18:05	UTC-4	61°26.426'	060°39.866'	Box Core ↓	616	054	144	6	7.2	6.3	1007,2	96	0/10
2a	ROV5	ROV	19-juil-2016	19:19	UTC-4	61°26.448'	060°39.867'	Box Core (bottom)	620	104	154	8	7.3	6.3	1007,4	97	0/10
2a	ROV5	ROV	19-juil-2016	19:32	UTC-4	61°26.449'	060°39.865'	Box Core ↑	620	120	152	10	7.2	6.3	1007,6	97	0/10
2a	ROV5	ROV	19-juil-2016	19:45	UTC-4	61°26.450'	060°39.852'	Box Core ↓	618	138	158	9	7.2	6.3	1007,7	97	0/10
2a	ROV5	ROV	19-juil-2016	19:55	UTC-4	61°26.350'	060°39.330'	Box Core (bottom)	615	127	150	10	7.2	6.3	1007,8	97	0/10
2a	ROV5	ROV	19-juil-2016	20:03	UTC-4	61°26.440'	060°39.850'	Box Core ↑	615	096	150	10	7.2	6.3	1007,8	97	0/10
2a	ROV5	ROV	19-juil-2016	Cancelled				Box Core ↓	Cancelled								0/10
2a	ROV5	ROV	19-juil-2016					Box Core (bottom)									0/10
2a	ROV5	ROV	19-juil-2016					Box Core ↑									0/10
2a	ROV2	ROV	20-juil-2016	08:15	UTC-4	60°19.300'	062°12.350'	PNF + Secchi Disk ↕	279	185	130	10	3.0	3.3	1009,6	99	Bergy
2a	ROV2	ROV	20-juil-2016	08:43	UTC-4	60°19.330'	062°12.390'	CTD-Rosette ↓	281	148	130	10	3.2	3.5	1009,7	99	Bergy
2a	ROV2	ROV	20-juil-2016	08:54	UTC-4	60°19.390'	062°12.430'	CTD-Rosette (bottom)	281	160	120	10	3.3	3.6	1009,7	99	Bergy
2a	ROV2	ROV	20-juil-2016	09:31	UTC-4	60°19.720'	062°12.530'	CTD-Rosette ↑	284	184	130	10	3.4	3.5	1009,8	99	Bergy
2a	ROV2	ROV	20-juil-2016	09:54	UTC-4	60°19.320'	062°12.310'	5NVS ↓	281	193	130	10/12	3.3	3.5	1009,7	99	Bergy
2a	ROV2	ROV	20-juil-2016	10:02	UTC-4	60°19.360'	062°12.160'	5NVS (bottom)	280	226	130	12	3.3	3.5	1009,7	99	Bergy
2a	ROV2	ROV	20-juil-2016	10:11	UTC-4	60°19.450'	062°11.960'	5NVS ↑	281	220	130	12	3.3	3.5	1009,7	99	Bergy
2a	ROV2	ROV	20-juil-2016	11:23	UTC-4	60°19.440'	062°11.660'	CTD-Rosette ↓	282	165	130	12	3.6	2.7	1010,0	99	Bergy
2a	ROV2	ROV	20-juil-2016	11:37	UTC-4	60°19.520'	062°10.900'	CTD-Rosette (bottom)	282	153	130	12	3.5	2.6	1010,1	99	Bergy
2a	ROV2	ROV	20-juil-2016	11:57	UTC-4	60°19.518'	062°09.735'	CTD-Rosette ↑	283	123	140	14	3.8	2.6	1009,9	99	Bergy

2a	ROV2	ROV	20-juil-2016	12:39	UTC-4	60°19.606'	062°12.158'	DSN ↓	282	269	160	6	4.2	3.7	1010,2	99	Bergy
2a	ROV2	ROV	20-juil-2016	12:55	UTC-4	60°18.974'	062°12.870'	DSN ↑	273	196	160	6	3.9	3.8	1010,1	99	Bergy
2a	ROV2	ROV	20-juil-2016	13:56	UTC-4	60°18.341'	062°12.185'	Zodiac ↓ (SKIMMER)	268	240	120	5	3.8	4.2	1010,5	99	Bergy
2a	ROV2	ROV	20-juil-2016					Zodiac ↑ (SKIMMER)									Bergy
2a	ROV2	ROV	20-juil-2016	14:24	UTC-4	60°19.244'	062°12.261'	Box Core ↓ Cancelled	278	004	120	6	4.6	4.2	1010,4	99	Bergy
2a	ROV2	ROV	20-juil-2016	14:34	UTC-4	60°19.232'	062°12.113'	Box Core (bottom) Cancelled	277	301	120	9	5.1	4.2	1010,4	100	Bergy
2a	ROV2	ROV	20-juil-2016	14:42	UTC-4	60°19.168'	062°12.006'	Box Core ↓	276	310	130	7	4.7	3.9	1010,5	100	Bergy
2a	ROV2	ROV	20-juil-2016	14:49	UTC-4	60°19.098'	062°11.921'	Box Core (bottom)	277	301	120	8	4.7	3.9	1010,5	100	Bergy
2a	ROV2	ROV	20-juil-2016	14:55	UTC-4	60°19.032'	062°11.880'	Box Core ↑	276	279	130	9	4.3	4.0	1010,4	99	Bergy
2a	ROV2	ROV	20-juil-2016	15:03	UTC-4	60°18.954'	062°11.833'	Box Core ↓	274	319	130	7	3.9	4.2	1010,4	99	Bergy
2a	ROV2	ROV	20-juil-2016	15:11	UTC-4	60°18.865'	062°11.761'	Box Core (bottom)	275	315	130	8	4.9	4.2	1010,4	100	Bergy
2a	ROV2	ROV	20-juil-2016	15:16	UTC-4	60°18.815'	062°11.772'	Box Core ↑	273	323	130	8	4.9	4.2	1010,4	100	Bergy
2a	ROV2	ROV	20-juil-2016	15:29	UTC-4	60°18.715'	062°11.844'	Box Core ↓	272	346	130	10	5.9	4.0	1010,4	99	Bergy
2a	ROV2	ROV	20-juil-2016	15:36	UTC-4	60°18.625'	062°11.870'	Box Core (bottom)	272	261	130	12	5.9	4.0	1010,4	99	Bergy
2a	ROV2	ROV	20-juil-2016	15:43	UTC-4	60°18.610'	062°11.802'	Box Core ↑	272	281	130	12	5.0	4.0	1010,3	99	Bergy
2a	ROV2E	ROV	20-juil-2016	21:10	UTC-4	60°18.870'	061°52.750'	Box Core ↓	284	198	Calm		5.5	4.1	1010,7	99	Bergy
2a	ROV2E	ROV	20-juil-2016	21:17	UTC-4	60°18.910'	061°52.840'	Box Core (bottom)	286	205	Calm		5.5	4.1	1010,7	99	Bergy
2a	ROV2E	ROV	20-juil-2016	21:23	UTC-4	60°18.950'	061°52.930'	Box Core ↑	288	198	Calm		5.6	4.0	1010,6	100	Bergy
2a	ROV2E	ROV	20-juil-2016	21:33	UTC-4	60°18.770'	061°52.790'	Box Core ↓	280	127	Calm		5.5	4.0	1010,5	99	Bergy
2a	ROV2E	ROV	20-juil-2016	21:40	UTC-4	60°18.810'	061°52.800'	Box Core (bottom)	279	186	Calm		5.1	4.3	1010,5	99	Bergy
2a	ROV2E	ROV	20-juil-2016	21:45	UTC-4	60°18.820'	061°52.830'	Box Core ↑	282	188	Calm		5.1	4.3	1010,5	99	Bergy
2a	ROV2E2	ROV	20-juil-2016	22:10	UTC-4	60°18.840'	061°53.630'	Box Core ↓	279	181	Calm		5.1	4.2	1010,3	99	Bergy
2a	ROV2E2	ROV	20-juil-2016	22:16	UTC-4	60°18.860'	061°53.620'	Box Core (bottom)	278	187	Calm		5.1	4.2	1010,3	99	Bergy
2a	ROV2E2	ROV	20-juil-2016	22:21	UTC-4	60°18.870'	061°53.600'	Box Core ↑ Cancelled	280	187	Calm		5.1	4.2	1010,3	99	Bergy
2a	ROV2E2	ROV	20-juil-2016					Box Core ↓									Bergy
2a	ROV2E2	ROV	20-juil-2016					Box Core (bottom)									Bergy
2a	ROV2E2	ROV	20-juil-2016					Box Core ↑									Bergy
2a	ROV3	ROV	21-juil-2016	05:03	UTC-4	60°28.133'	061°16.751'	CTD-Rosette ↓	460	139	113	6	4.6	4.1	1009,1	99	NIL
2a	ROV3	ROV	21-juil-2016	06:10	UTC-4	60°28.642'	061°18.220'	CTD-Rosette ↑	404	044	105	8	5.0	3.9	1008,7	100	0/10
2a	ROV3	ROV	21-juil-2016	06:28	UTC-4	60°28.030'	061°16.661'	5NVS ↓	461	117	130	10	4.7	3.9	1008,6	99	0/10
2a	ROV3	ROV	21-juil-2016	06:51	UTC-4	60°28.095'	061°17.370'	5NVS ↑	401	207	115	8	4.7	4.5	1008,7	99	0/10
2a	ROV3	ROV	21-juil-2016	08:12	UTC-4	60°28.040'	061°16.700'	DSN ↓	459	227	090	5	4.4	4.8	1008,4	99	0/10
2a	ROV3	ROV	21-juil-2016	08:25	UTC-4	60°27.780'	061°16.720'	DSN ↑	426	081	120	8	4.4	4.8	1008,4	99	0/10
2a	ROV3	ROV	21-juil-2016	09:02	UTC-4	60°28.010'	061°16.690'	ROV Dive 3 ↓	456	152	110	10/12	4.5	4.4	1008,2	100	0/10
2a	ROV3	ROV	21-juil-2016	13:11	UTC-4	60°28.131'	061°16.694'	ROV Dive 3 ↑	456	237	120	11	4.6	4.8	1007,7	100	0/10
2a	ROV3	ROV	21-juil-2016	14:17	UTC-4	60°28.037'	061°16.706'	Box Core ↓	455	198	120	10	4.6	4.7	1007,7	99	0/10
2a	ROV3	ROV	21-juil-2016	14:32	UTC-4	60°27.968'	061°16.707'	Box Core (bottom)	452	160	140	11	4.5	4.7	1007,7	99	0/10
2a	ROV3	ROV	21-juil-2016	14:43	UTC-4	60°27.917'	061°16.552'	Box Core ↑	460	138	130	11	4.3	4.8	1007,8	99	0/10
2a	ROV3	ROV	21-juil-2016	14:55	UTC-4	60°27.898'	061°16.457'	Box Core ↓ Cancelled	464	201	130	8	4.1	4.8	1007,7	99	0/10
2a	ROV3	ROV	21-juil-2016	15:07	UTC-4	60°27.848'	061°16.482'	Box Core (bottom) Cancelled	462	129	130	10	4.0	4.6	1007,7	99	0/10
2a	ROV3	ROV	21-juil-2016	15:22	UTC-4	60°27.880'	061°16.401'	Box Core ↓	473	156	130	9	3.9	4.2	1007,8	99	0/10
2a	ROV3	ROV	21-juil-2016	15:42	UTC-4	60°27.769'	061°16.713'	Box Core (bottom)	427	196	120	11	3.9	4.1	1007,7	99	0/10
2a	ROV3	ROV	21-juil-2016	15:52	UTC-4	60°27.759'	061°16.819'	Box Core ↑	407	205	130	10	4.1	4.1	1007,8	99	0/10

2a	ROV3	ROV	21-juil-2016	16:15	UTC-4	60°28.118'	061°17.330'	Box Core ↓	401	132	132	11	5.0	3.7	1007,8	100	0/10
2a	ROV3	ROV	21-juil-2016	16:24	UTC-4	60°28.121'	061°17.336'	Box Core (bottom)	401	133	123	12	4.4	3.7	1007,8	99	0/10
2a	ROV3	ROV	21-juil-2016	16:33	UTC-4	60°28.124'	061°17.324'	Box Core ↑	401	137	125	12	4.1	3.4	1007,7	99	0/10
2a	ROV3	ROV	21-juil-2016	17:01	UTC-4	60°28.109'	061°14.468'	Box Core ↓	622	143	125	14	4.4	3.9	1007,5	99	0/10
2a	ROV3	ROV	21-juil-2016	17:15	UTC-4	60°28.093'	061°14.487'	Box Core (bottom)	622	129	130	14	4.3	4.4	1007,6	99	0/10
2a	ROV3	ROV	21-juil-2016		UTC-4	60°28.090'	061°14.551'	Box Core ↑	617	131	121	14	4.3	4.5	1007,6	99	0/10
2a	ROV6	ROV	22-juil-2016	10:00	UTC-4	62°59.190'	060°37.700'	ROV Dive 4 ↓	470	073	130	15/20	7.1	6.7	1010,0	99	0/10
2a	ROV6	ROV	22-juil-2016	11:20	UTC-4	62°59.330'	060°37.760'	ROV Dive 4 ↑	470	066	120	15	7.1	6.8	1010,3	99	0/10
2a	ROV6	ROV	22-juil-2016	12:44	UTC-4	63°00.046'	060°38.485'	PNF ↓	458	117	120	17	6.8	6.5	1010,6	99	0/10
2a	ROV6	ROV	22-juil-2016	12:48	UTC-4	63°00.049'	060°38.505'	PNF ↑	458	109	120	17	6.8	6.5	1010,6	99	0/10
2a	ROV6	ROV	22-juil-2016	12:50	UTC-4	63°00.039'	060°38.487'	Secchi Disk ↓	458	120	120	15	6.7	6.4	1010,7	100	0/10
2a	ROV6	ROV	22-juil-2016	12:51	UTC-4	63°00.036'	060°38.489'	Secchi Disk ↑	458	122	120	15	6.7	6.4	1010,7	100	0/10
2a	ROV6	ROV	22-juil-2016	13:01	UTC-4	63°00.028'	060°38.417'	CTD-Rosette ↓	458	118	120	16	6.8	6.4	1010,8	100	0/10
2a	ROV6	ROV	22-juil-2016	14:00	UTC-4	62°59.975'	060°38.774'	CTD-Rosette ↑	456	139	130	14	6.8	6.6	1011,1	100	0/10
2a	ROV6	ROV	22-juil-2016	14:17	UTC-4	63°00.106'	060°38.425'	5NVS ↓	458	141	120	14	6.8	6.6	1011,1	100	0/10
2a	ROV6	ROV	22-juil-2016	14:41	UTC-4	62°59.957'	060°38.803'	5NVS ↑	456	149	110	15	6.5	6.7	1011,1	99	0/10
2a	ROV6	ROV	22-juil-2016	15:23	UTC-4	63°00.072'	060°38.273'	CTD-Rosette ↓	460	127	120	19	6.4	6.8	1011,0	100	0/10
2a	ROV6	ROV	22-juil-2016	16:10	UTC-4	63°00.069'	060°39.275'	CTD-Rosette ↑	449	161	115	17	6.5	6.8	1011,1	100	0/10
2a	ROV6	ROV	22-juil-2016	16:33	UTC-4	62°59.815'	060°38.103'	DSN ↓	460	090	122	18	6.8	6.7	1011,1	98	0/10
2a	ROV6	ROV	22-juil-2016	16:46	UTC-4	63°00.088'	060°37.754'	DSN ↑	468	346	120	18	6.9	6.8	1011,0	97	0/10
2a	ROV6	ROV	22-juil-2016	17:02	UTC-4	63°00.206'	060°38.368'	Box Core ↓	458	142	130	17	7.2	6.8	1011,0	96	0/10
2a	ROV6	ROV	22-juil-2016	17:13	UTC-4	63°00.206'	060°38.407'	Box Core (bottom)	458	159	130	18	7.3	6.8	1011,1	95	0/10
2a	ROV6	ROV	22-juil-2016	17:25	UTC-4	63°00.168'	060°38.565'	Box Core ↑ Cancelled	457	150	130	15	7.3	6.8	1011,1	95	0/10
2a	ROV6	ROV	22-juil-2016	17:26	UTC-4	63°00.168'	060°38.565'	Box Core ↓	457	150	130	15	7.3	6.8	1011,1	95	0/10
2a	ROV6	ROV	22-juil-2016	17:36	UTC-4	63°00.169'	060°38.709'	Box Core (bottom)	456	168	130	16	7.2	6.8	1011,1	96	0/10
2a	ROV6	ROV	22-juil-2016	17:44	UTC-4	63°00.171'	060°38.808'	Box Core ↑	454	139	128	16	7.2	6.8	1011,1	96	0/10
2a	ROV6	ROV	22-juil-2016	18:01	UTC-4	63°00.102'	060°38.383'	Box Core ↓	460	140	133	18	7.3	6.8	1011,1	96	0/10
2a	ROV6	ROV	22-juil-2016	18:08	UTC-4	63°00.126'	060°38.457'	Box Core (bottom)	459	147	137	17	7.3	6.8	1011,1	95	0/10
2a	ROV6	ROV	22-juil-2016	18:15	UTC-4	63°00.135'	060°38.510'	Box Core ↑	460	139	138	19	7.4	6.8	1011,0	95	0/10
2a	ROV6	ROV	22-juil-2016	18:30	UTC-4	63°00.200'	060°38.491'	Box Core ↓	458	318	127	18	7.7	6.7	1010,9	93	0/10
2a	ROV6	ROV	22-juil-2016	18:37	UTC-4	63°00.231'	060°38.488'	Box Core (bottom)	457	266	131	19	7.7	6.7	1010,9	93	0/10
2a	ROV6	ROV	22-juil-2016	18:43	UTC-4	63°00.347'	060°38.564'	Box Core ↑	456	266	132	20	7.4	6.7	1010,8	93	0/10
2a	ROV6	ROV	22-juil-2016	19:05	UTC-4	63°00.251'	060°38.573'	Agassiz Trawl ↓	457	186	137	19	8.2	6.7	1010,9	91	0/10
2a	ROV6	ROV	22-juil-2016	19:35	UTC-4	62°59.839'	060°40.090'	Agassiz Trawl ↑	450	200	137	21	7.4	7.0	1011,0	94	0/10
2a	Disco Fan 7	ROV	24-juil-2016	10:55	UTC-4	67°58.080'	059°30.190'	ROV Dive 5 ↓	894	162	150	15/20	1.7	0.8	1017,5	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	13:50	UTC-4	67°58.163'	059°30.251'	ROV Dive 5 ↑	907	169	130	17	1.6	1.2	1015,9	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	15:10	UTC-4	67°58.130'	059°30.091'	Piston Core ↓	910	179	130	16	1.3	1.4	1015,9	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	15:24	UTC-4	67°58.152'	059°30.171'	Piston Core (bottom)	913	191	130	17	1.2	1.3	1016,0	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	15:40	UTC-4	67°58.159'	059°29.822'	Piston Core ↑	890	171	130	20	1.2	1.3	1016,1	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	18:00	UTC-4	67°58.182'	059°30.259'	Piston Core ↓	917	254	140	18	1.4	1.3	1016,0	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	18:15	UTC-4	67°58.183'	059°30.239'	Piston Core (bottom)	915	254	134	18	1.0	1.4	1016,0	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	18:30	UTC-4	67°58.184'	059°30.238'	Piston Core ↑	914	245	148	17	1.0	1.4	1016,0	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	19:56	UTC-4	67°58.150'	059°30.290'	PNF + Secchi Disk ↕	917	254	140	15/20	0.6	1.4	1016,0	99	Thick 1st year

2a	Disco Fan 7	ROV	24-juil-2016	20:25	UTC-4	67°58.200'	059°30.140'	CTD-Rosette ↓	902	006	140	15/20	1.0	1.4	1016,1	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	20:45	UTC-4	67°58.180'	059°30.100'	CTD-Rosette (bottom)	903	009	140	15/20	1.2	1.3	1016,4	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	21:38	UTC-4	67°58.120'	059°30.450'	CTD-Rosette ↑	924	352	130	10	2.3	1.3	1016,8	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	22:05	UTC-4	67°58.360'	059°29.650'	5NVS ↓	872	238	140	10	0.9	1.3	1016,3	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	22:28	UTC-4	67°58.440'	059°29.800'	5NVS (bottom)	873	249	140	10	0.6	1.3	1016,0	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	23:03	UTC-4	67°58.510'	059°30.210'	5NVS ↑	890	283	150	10	0.5	1.4	1015,5	99	Thick 1st year
2a	Disco Fan 7	ROV	24-juil-2016	23:56	UTC-4	67°58.683'	059°31.213'	CTD-Rosette ↓	931	330	140	5	0.3	1.3	1015,9	99	Thick 1st year
2a	Disco Fan 7	ROV	25-juil-2016	00:57	UTC-4	67°59.225'	059°32.279'	CTD-Rosette ↑	941	328	120	3	0.5	1.4	1016,1	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	01:32	UTC-4	67°58.187'	059°32.275'	Box Core ↓	910	129	Calm		0.2	1.3	1015,7	99	Thick 1st year
2a	Disco Fan 7	ROV	25-juil-2016	01:46	UTC-4	67°58.189'	059°30.287'	Box Core (bottom)	914	158	Calm		0.3	1.3	1015,7	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	01:57	UTC-4	67°58.183'	059°30.286'	Box Core ↑	914	156	Calm		0.5	1.3	1015,8	99	Thick 1st year
2a	Disco Fan 7	ROV	25-juil-2016	02:08	UTC-4	67°58.175'	059°30.244'	Box Core ↓	911	143	Calm		0.7	1.3	1015,8	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	02:19	UTC-4	67°58.181'	059°30.242'	Box Core (bottom)	909	134	Calm		0.6	1.3	1016,0	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	02:30	UTC-4	67°58.206'	059°30.038'	Box Core ↑	895	109	Calm		0.6	1.3	1016,0	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	03:27	UTC-4	67°58.072'	059°30.313'	Box Core ↓	922	154	280	4	-0.3	1.0	1016,1	99	Thick 1st year
2a	Disco Fan 7	ROV	25-juil-2016	03:38	UTC-4	67°58.093'	059°30.231'	Box Core (bottom)	919	184	270	3	0.1	1.0	1016,4	99	Thick 1st year
2a	Disco Fan 7	ROV	25-juil-2016	03:50	UTC-4	67°58.035'	059°30.056'	Box Core ↑	909	161	280	6	0.1	1.2	1016,7	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	04:25	UTC-4	67°58.076'	059°30.186'	Box Core ↓	915	166	287	7	-0.2	1.1	1016,7	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	04:37	UTC-4	67°58.056'	059°30.120'	Box Core (bottom)	921	270	265	6	-0.1	1.1	1017,2	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	04:48	UTC-4	67°58.048'	059°30.100'	Box Core ↑	915	272	310	7	0.0	1.1	1017,4	99	1/10
2a	Disco Fan 7	ROV	25-juil-2016	10:16	UTC-4	67°58.130'	059°30.200'	ROV Dive 6 ↓	912	320	270	5	0.8	1.4	1020,5	99	2/10
2a	Disco Fan 7	ROV	25-juil-2016	14:37	UTC-4	67°58.527'	059°28.513'	ROV Dive 6 ↑	912	173	270	5	3.1	1.3	1021,9	92	2/10
2a	Disco Fan 7	ROV	25-juil-2016	15:22	UTC-4	67°58.060'	059°29.365'	Piston Core ↓	872	209	280	4	3.5	1.8	1022,1	90	2/10
2a	Disco Fan 7	ROV	25-juil-2016	15:51	UTC-4	67°58.073'	059°29.390'	Piston Core (bottom)	874	268	Calm		4.0	1.9	1022,3	87	2/10
2a	Disco Fan 7	ROV	25-juil-2016	16:12	UTC-4	67°58.073'	059°28.929'	Piston Core ↑	850	275	Calm		5.0	1.6	1022,5	82	2/10
2a	Disco Fan 7	ROV	25-juil-2016	16:38	UTC-4	67°58.133'	059°30.136'	Carbonate, Ex-Frames ↓	912	268	Calm		4.1	1.7	1022,7	89	3/10
2a	Disco Fan 7	ROV	25-juil-2016	17:05	UTC-4	67°58.131'	059°30.159'	Carbonate, Ex-Frames (bottom)	912	278	Calm		3.9	1.9	1022,8	89	3/10
2a	Disco Fan 7	ROV	25-juil-2016	17:19	UTC-4	67°58.118'	059°30.155'	Carbonate, Ex-Frames ↑	912	298	Calm		4.0	2.2	1022,7	88	3/10
2a	Black Corals	Coring	25-juil-2016	20:37	UTC-4	68°16.030'	059°47.900'	Box Core ↓	1050	197	170	5	5.5	2.9	1023,1	92	Bergy
2a	Black Corals	Coring	25-juil-2016	20:55	UTC-4	68°16.020'	059°47.980'	Box Core (bottom)	1054	210	170	5	5.5	2.9	1023,1	92	Bergy
2a	Black Corals	Coring	25-juil-2016	21:10	UTC-4			Box Core ↑	Cancelled								Bergy
2a	Black Corals	Coring	25-juil-2016	21:11	UTC-4	68°16.010'	059°47.980'	Box Core ↓	1051	216	180	5	5.7	2.9	1023,1	92	Bergy
2a	Black Corals	Coring	25-juil-2016	21:26	UTC-4	68°16.000'	059°47.990'	Box Core (bottom)	1052	233	180	5	5.6	2.9	1023,2	92	Bergy
2a	Black Corals	Coring	25-juil-2016	21:38	UTC-4	68°16.000'	059°47.960'	Box Core ↑ Cancelled	1051	233	180	5	5.6	2.9	1023,2	92	Bergy
2a	Black Corals	Coring	25-juil-2016	21:42	UTC-4	68°16.000'	059°47.960'	Box Core ↓	1051	239	180	5	5.6	2.9	1023,2	92	Bergy
2a	Black Corals	Coring	25-juil-2016	21:57	UTC-4	68°16.000'	059°48.000'	Box Core (bottom)	1052	255	180	5	5.3	2.8	1023,3	92	Bergy
2a	Black Corals	Coring	25-juil-2016	22:10	UTC-4	68°16.000'	059°47.970'	Box Core ↑	1059	270	180	5	5.3	2.8	1023,3	92	Bergy
2a	Black Corals	Coring	25-juil-2016	22:20	UTC-4	68°16.120'	059°47.940'	Agassiz Trawl ↓	1065	290	180	5	5.3	2.8	1023,3	92	Bergy
2a	Black Corals	Coring	25-juil-2016	22:50	UTC-4	68°16.160'	059°49.600'	Agassiz Trawl (bottom)	1148	250	180	5	5.3	2.8	1023,3	92	Bergy
2a	Black Corals	Coring	25-juil-2016	23:24	UTC-4	68°15.590'	059°49.380'	Agassiz Trawl ↑	1120	094	180	5	3.4	3.5	1023,5	94	Bergy
2a	181	Nutrient	26-juil-2016	08:12	UTC-4	67°30.200'	061°31.800'	CTD-Rosette ↓	936	139	130	12	2.3	-0.2	1022,9	91	4/10
2a	181	Nutrient	26-juil-2016	08:33	UTC-4	67°30.040'	061°31.490'	CTD-Rosette (bottom)	931	130	130	12	2.1	-0.2	1022,9	91	4/10
2a	181	Nutrient	26-juil-2016	09:30	UTC-4	67°29.730'	061°31.460'	CTD-Rosette ↑	884	269	130	12	3.7	-0.1	1023,0	85	4/10

2a	180	Basic	26-juil-2016	10:25	UTC-4	67°29.130'	061°40.280'	PNF + Secchi Disk ↕	361	230	110	15	2.2	0.0	1022,7	90	4/10
2a	180	Basic	26-juil-2016	10:46	UTC-4	67°29.130'	061°40.510'	CTD-Rosette ↓	350	088	140	15	2.2	-0.1	1022,8	90	4/10
2a	180	Basic	26-juil-2016	10:59	UTC-4	67°29.140'	061°40.580'	CTD-Rosette (bottom)	348	084	140	15	2.2	-0.1	1022,8	90	4/10
2a	180	Basic	26-juil-2016	11:31	UTC-4	67°29.260'	061°40.510'	CTD-Rosette ↑	369	094	130	15	2.2	0.0	1022,5	91	4/10
2a	180	Basic	26-juil-2016	12:54	UTC-4	67°30.686'	061°41.030'	5NVS ↓	568	136	145	13	5.0	0.3	1022,4	82	4/10
2a	180	Basic	26-juil-2016	13:28	UTC-4	67°30.845'	061°41.105'	5NVS ↑	593	181	140	13	3.0	0.5	1022,2	90	4/10
2a	180	Basic	26-juil-2016	13:44	UTC-4	67°31.152'	061°40.924'	CTD-Rosette ↓	642	162	140	12	3.0	0.4	1022,3	91	4/10
2a	180	Basic	26-juil-2016	14:37	UTC-4	67°31.666'	061°40.855'	CTD-Rosette ↑	744	147	140	12	3.2	0.4	1022,3	93	4/10
2a	180	Basic	26-juil-2016	18:12	UTC-4	67°28.877'	061°39.928'	Box Core ↓	340	112	130	11	3.0	0.5	1022,3	99	3/10
2a	180	Basic	26-juil-2016	18:20	UTC-4	67°28.790'	061°39.854'	Box Core (bottom)		350	125	10	3.1	0.3	1022,3	99	3/10
2a	180	Basic	26-juil-2016	18:27	UTC-4			Box Core ↑	Cancelled	355			3.2	0.2	1022,4	99	3/10
2a	180	Basic	26-juil-2016	18:30	UTC-4	67°28.870'	061°39.845'	Box Core ↓	327	000	120	12	3.2	0.2	1022,4	99	3/10
2a	180	Basic	26-juil-2016	18:36	UTC-4	67°28.861'	061°39.760'	Box Core (bottom)	335	338	120	11	3.2	0.2	1022,4	99	3/10
2a	180	Basic	26-juil-2016	18:41	UTC-4	67°28.858'	061°39.750'	Box Core ↑	349	339	130	10	3.6	0.4	1022,5	98	3/10
2a	179	Basic	26-juil-2016	20:08	UTC-4	67°26.940'	061°55.140'	CTD-Rosette ↓	190	351	120	10	3.0	0.4	1022,3	99	2/10
2a	179	Basic	26-juil-2016	20:17	UTC-4	67°26.850'	061°55.270'	CTD-Rosette (bottom)	187	349	120	10	3.0	0.4	1022,3	99	2/10
2a	179	Basic	26-juil-2016	20:40	UTC-4	67°26.640'	061°55.620'	CTD-Rosette ↑	187	348	120	10	3.0	0.4	1022,3	99	2/10
Leg 2b																	
2b	PII-A-1-f	Ice Island	28-juil-2016	10:57	UTC-4	67°24.126'	063°21.564'	SKIMMER	286	080	075	11	4.9	2.0	1026,0	88	1/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	12:45	UTC-4	67°24.240'	063°16.391'	Mapping	206	016	100	12	3.9	2.5	1025,9	93	1/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	13:10	UTC-4	67°24.424'	063°16.014'	CTD-Rosette ↓	192	101	090	10	3.6	2.9	1025,8	96	1/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	13:25	UTC-4	67°24.436'	063°16.212'	CTD-Rosette ↑	193	110	090	10	3.9	2.4	1025,8	96	1/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	13:52	UTC-4	67°23.679'	063°12.868'	CTD-Rosette ↓	225	100	090	12	5.2	2.4	1025,7	94	1/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	14:09	UTC-4	67°23.693'	063°13.079'	CTD-Rosette ↑	227	100	090	12	5.0	2.3	1025,7	94	1/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	15:27	UTC-4	67°23.341'	063°22.257'	CTD-Rosette ↓	351	091	090	15	4.4	2.2	1025,6	96	1/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	15:45	UTC-4	67°23.359'	063°22.338'	CTD-Rosette ↑	348	104	080	13	4.6	1.5	1025,6	96	1/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	16:26	UTC-4	67°22.515'	063°17.689'	CTD-Rosette ↓	325	082	090	13	4.9	3.2	1025,6	96	2/10 + Ice Island
2b	PII-A-1-f	Ice Island	28-juil-2016	16:48	UTC-4	67°22.518'	063°17.694'	CTD-Rosette ↑	324	085	085	12	4.5	2.4	1025,7	98	2/10 + Ice Island
2b	177	Full	28-juil-2016	19:25	UTC-4	67°28.540'	063°47.323'	PNF + Secchi Disk ↕	340	327	Calm		7.0	3.8	1026,0	95	0/10
2b	177	Full	28-juil-2016	19:35	UTC-4	67°28.554'	063°47.337'	DSN ↓	380	252	Calm		8.3	2.5	1026,0	90	0/10
2b	177	Full	28-juil-2016	19:53	UTC-4	67°28.350'	063°47.200'	DSN ↑	400	256	Calm		8.4	4.1	1025,9	88	0/10
2b	177	Full	28-juil-2016	20:14	UTC-4	67°28.550'	063°47.430'	5NVS ↓	374	014	Calm		7.3	4.6	1025,9	91	Bergy
2b	177	Full	28-juil-2016	20:23	UTC-4	67°28.560'	063°47.390'	5NVS (bottom)	368	358	Calm		7.3	4.6	1025,9	91	Bergy
2b	177	Full	28-juil-2016	20:39	UTC-4	67°28.650'	063°47.310'	5NVS ↑	367	330	Calm		7.5	2.0	1025,8	89	Bergy
2b	177	Full	28-juil-2016	20:51	UTC-4	67°28.600'	063°47.420'	CTD-Rosette ↓	370	198	Calm		8.0	2.0	1025,8	85	Bergy
2b	177	Full	28-juil-2016	21:03	UTC-4	67°28.600'	063°47.360'	CTD-Rosette (bottom)	369	199	Calm		7.0	2.8	1025,8	92	Bergy
2b	177	Full	28-juil-2016	21:41	UTC-4	67°28.620'	063°47.120'	CTD-Rosette ↑	366	163	Calm		6.0	1.4	1025,7	93	Bergy
2b	177	Full	28-juil-2016	21:58	UTC-4	67°28.570'	063°47.390'	Box Core ↓	369	268	Calm		6.3	1.6	1025,7	93	Bergy
2b	177	Full	28-juil-2016	22:04	UTC-4	67°28.580'	063°47.410'	Box Core (bottom)	370	240	Calm		7.0	2.2	1025,7	91	Bergy
2b	177	Full	28-juil-2016	22:10	UTC-4	67°28.590'	063°47.380'	Box Core ↑	368	220	Calm		7.0	2.2	1025,7	91	Bergy
2b	177	Full	28-juil-2016	22:16	UTC-4	67°28.560'	063°47.440'	Box Core ↓	374	243	Calm		7.0	2.0	1025,7	89	Bergy
2b	177	Full	28-juil-2016	22:22	UTC-4	67°28.570'	063°47.410'	Box Core (bottom)	371	248	Calm		7.0	2.0	1025,7	89	Bergy
2b	177	Full	28-juil-2016	22:27	UTC-4	67°28.570'	063°47.390'	Box Core ↑	368	253	Calm		7.3	2.3	1025,7	86	Bergy

2b	177	Full	28-juil-2016	22:35	UTC-4	67°28.570'	063°47.420'	Box Core ↓	373	247	Calm		7.3	2.3	1025,7	86	Bergy
2b	177	Full	28-juil-2016	22:40	UTC-4	67°28.570'	063°47.410'	Box Core (bottom)	371	251	Calm		7.6	2.5	1025,6	88	Bergy
2b	177	Full	28-juil-2016	22:46	UTC-4	67°28.580'	063°47.380'	Box Core ↑	368	251	Calm		7.6	2.5	1025,6	88	Bergy
2b	177 (2)	Full	28-juil-2016	23:24	UTC-4	67°28.520'	063°41.410'	Box Core ↓	680	246	Calm		6.4	4.4	1025,4	92	Bergy
2b	177 (2)	Full	28-juil-2016	23:34	UTC-4	67°28.520'	063°41.360'	Box Core (bottom)	681	244	Calm		6.4	4.4	1025,4	92	Bergy
2b	177 (2)	Full	28-juil-2016	23:43	UTC-4	67°28.510'	063°41.360'	Box Core ↑	680	260	Calm		6.3	2.4	1025,3	91	Bergy
2b	177 (3)	Full	29-juil-2016	00:00	UTC-4	67°28.613'	063°40.990'	Box Core ↓	683	084	Calm		6.4	2.3	1025,2	91	Bergy
2b	177 (3)	Full	29-juil-2016	00:11	UTC-4	67°28.617'	063°40.895'	Box Core (bottom)	659	022	Calm		6.4	1.9	1025,1	92	Bergy
2b	177 (3)	Full	29-juil-2016	00:19	UTC-4	67°28.618'	063°40.816'	Box Core ↑	629	037	Calm		6.3	1.4	1025,2	93	Bergy
2b	177	Full	29-juil-2016	01:17	UTC-4	67°25.558'	063°47.351'	Agassiz Trawl ↓	371	092	Calm		6.9	3.9	1024,9	89	Bergy
2b	177	Full	29-juil-2016	01:43	UTC-4	67°28.825'	063°45.703'	Agassiz Trawl ↑	383	029	Calm		5.9	2.1	1024,9	95	Bergy
2b	177	Full	29-juil-2016	02:05	UTC-4	67°28.574'	063°47.385'	Beam Trawl ↓	369	090	Calm		5.7	3.8	1024,9	95	Bergy
2b	177	Full	29-juil-2016	02:45	UTC-4	67°28.455'	063°48.786'	Beam Trawl ↑	410	146	Calm		5.0	3.9	1024,8	97	Bergy
2b	177	Full	29-juil-2016	03:03	UTC-4	67°28.539'	063°47.489'	CTD-Rosette ↓	374	075	090	4	5.5	3.8	1024,8	96	Bergy
2b	177	Full	29-juil-2016	03:45	UTC-4	67°28.622'	063°47.355'	CTD-Rosette ↑	367	077	090	2	5.4	1.8	1024,8	98	Bergy
2b	178	Nutrient	29-juil-2016	13:00	UTC-4	68°29.500'	064°40.075'	CTD-Rosette ↓	170	346	090	8	3.6	0.2	1024,6	98	3/10
2b	178	Nutrient	29-juil-2016	13:40	UTC-4	68°29.124'	064°39.637'	CTD-Rosette ↑	166	324	100	7	2.9	-0.2	1024,5	99	3/10
2b	178	Nutrient	29-juil-2016	17:08	UTC-4	68°44.171'	064°49.501'	PNF ↓	126	343	080	7	2.2	0.3	1024,2	99	3/10
2b	178	Nutrient	29-juil-2016	17:16	UTC-4	68°44.209'	064°49.498'	PNF ↑	127	358	080	5	2.2	0.3	1024,2	99	3/10
2b	178	Nutrient	29-juil-2016	17:17	UTC-4	68°44.235'	064°49.504'	Secchi Disk ↓	126	354	090	7	2.7	0.4	1024,3	99	3/10
2b	178	Nutrient	29-juil-2016	17:18	UTC-4	68°44.251'	064°49.506'	Secchi Disk ↑	127		090	7	2.7	0.4	1024,3	99	3/10
2b	176	Basic	30-juil-2016	02:34	UTC-4	69°35.439'	065°20.688'	CTD-Rosette ↓	401	018	100	5	2.7	2.0	1023,1	99	2/10
2b	176	Basic	30-juil-2016	03:30	UTC-4	69°35.390'	065°20.911'	CTD-Rosette ↑	387	027	120	6	1.6	0.6	1023,1	99	2/10
2b	176	Basic	30-juil-2016	03:45	UTC-4	69°35.336'	065°20.797'	5NVS ↓	391	112	100	7	1.8	0.5	1023,0	99	2/10
2b	176	Basic	30-juil-2016	04:15	UTC-4	69°35.203'	065°21.241'	5NVS ↑	366	121	120	9	1.7	0.7	1023,1	99	2/10
2b	176	Basic	30-juil-2016	04:30	UTC-4	69°35.504'	065°21.269'	CTD-Rosette ↓	375	061			2.0	1.4	1023,1	99	2/10
2b	176	Basic	30-juil-2016	05:21	UTC-4	69°35.469'	065°21.574'	CTD-Rosette ↑	359	091	140	8	1.7	1.1	1022,9	99	2/10
2b	176	Basic	30-juil-2016	05:36	UTC-4	69°35.827'	065°21.471'	Box Core ↓	379	094	125	6	1.7	1.2	1022,4	99	3/10
2b	176	Basic	30-juil-2016	05:45	UTC-4	69°35.823'	065°21.477'	Box Core (bottom)	376	089	125	6	1.6	1.4	1022,9	99	3/10
2b	176	Basic	30-juil-2016	05:51	UTC-4	69°35.823'	065°21.483'	Box Core ↑	377	093	125	7	1.7	0.9	1022,8	99	3/10
2b	176	Basic	30-juil-2016	06:01	UTC-4	69°35.819'	065°21.481'	Box Core ↓	367	090	125	7	1.7	0.9	1022,8	99	3/10
2b	176	Basic	30-juil-2016	06:06	UTC-4	69°35.817'	065°21.483'	Box Core (bottom)	377	089	128	6	1.6	0.7	1022,7	99	3/10
2b	176	Basic	30-juil-2016	06:15	UTC-4	69°35.818'	065°21.497'	Box Core ↑	377	091	130	7	1.6	0.6	1022,7	99	3/10
2b	176	Basic	30-juil-2016	06:25	UTC-4	69°35.650'	065°20.351'	Agassiz Trawl ↓	413	096	130	7	1.7	0.6	1022,8	99	3/10
2b	176	Basic	30-juil-2016	06:57	UTC-4	69°36.128'	065°20.863'	Agassiz Trawl ↑	396	250	130	6	2.5	1.6	1022,8	99	3/10
2b	176	Basic	30-juil-2016	07:14	UTC-4	69°36.267'	065°21.023'	DSN ↓	390	350	120	5	2.1	1.3	1022,6	97	3/10
2b	176	Basic	30-juil-2016	07:25	UTC-4	69°36.661'	065°22.084'	DSN ↑	327	275	125	6	2.3	1.8	1023,0	97	3/10
2b	176	Basic	30-juil-2016	15:32	UTC-4	69°28.483'	064°56.608'	Box Core ↓	1187	008	130	4	3.6	2.7	1021,8	93	3/10
2b	176	Basic	30-juil-2016	15:50	UTC-4	69°28.552'	064°56.584'	Box Core (bottom)	1189	314	170	5	5.0	2.2	1021,8	86	3/10
2b	176	Basic	30-juil-2016	16:11	UTC-4	69°28.584'	064°56.459'	Box Core ↑	1191	303	150	8	4.9	1.1	1021,7	86	3/10
2b	176	Basic	30-juil-2016	18:07	UTC-4	69°28.548'	064°56.701'	CASQ Core ↓	1189	110	140	14	2.6	0.9	1021,4	98	3/10
2b	176	Basic	30-juil-2016	18:21	UTC-4	69°28.548'	064°56.690'	CASQ Core (bottom)	1189	104	135	12	2.7	0.7	1021,2	98	3/10
2b	176	Basic	30-juil-2016	18:38	UTC-4	69°28.562'	064°56.754'	CASQ Core ↑	1188	204	135	11	2.6	0.7	1021,2	99	3/10

2b	176	Basic	31-juil-2016	05:15	UTC-4	70°14.529'	066°36.634'	CTD-Rosette ↓	134	160	120	9	1.1	0.7	1018,3	92	5/10
2b	176	Basic	31-juil-2016	05:42	UTC-4	70°14.530'	066°36.645'	CTD-Rosette ↑	132	167	120	10	1.3	0.3	1018,3	91	5/10
2b	173	Nutrient	31-juil-2016	08:54	UTC-4	70°41.200'	066°57.070'	CTD-Rosette ↓	363	111	130	10	2.1	2.8	1017,6	92	2/10
2b	173	Nutrient	31-juil-2016	09:06	UTC-4	70°41.270'	066°57.010'	CTD-Rosette (bottom)	376	109	130	10	2.1	2.8	1017,6	92	2/10
2b	173	Nutrient	31-juil-2016	09:46	UTC-4	70°41.520'	066°56.810'	CTD-Rosette ↑	397	100	130	10	2.1	2.6	1017,6	93	2/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	18:38	UTC-4	70°34.762'	071°32.981'	Gravity Core ↓	609	170	195	6	14.4	8.4	1015,5	54	0/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	18:46	UTC-4	70°34.740'	071°32.957'	Gravity Core (bottom)	609	160	210	6	14.5	6.6	1015,5	55	0/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	18:59	UTC-4	70°34.742'	071°32.960'	Gravity Core ↑	610	170	210	6	14.5	5.4	1015,5	55	0/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	19:15	UTC-4	70°34.740'	071°32.960'	Box Core ↓	610	162	016	3	13.9	4.4	1015,5	58	0/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	19:28	UTC-4	70°34.740'	071°32.956'	Box Core (bottom)	610	164	270	3	13.4	4.4	1015,6	58	0/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	19:36	UTC-4	70°34.741'	071°32.951'	Box Core ↑	610	168			13.7	4.0	1015,5	57	0/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	19:49	UTC-4	70°34.741'	071°32.956'	Gravity Core ↓	610	170	Calm		14.3	3.5	1015,4	57	0/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	19:57	UTC-4	70°34.750'	071°32.950'	Gravity Core (bottom)	610	170	Calm		14.2	3.7	1015,4	57	0/10
2b	LGM-AMU-2016-03	Coring	31-juil-2016	20:05	UTC-4	70°34.740'	071°32.970'	Gravity Core ↑	610	190	Calm		13.3	3.8	1015,4	60	0/10
2b	169	Full	01-août-2016	01:01	UTC-4	71°16.165'	070°31.279'	CTD-Rosette ↓	769	346	140	7	4.9	5.3	1014,3	92	Bergy
2b	169	Full	01-août-2016	02:08	UTC-4	71°16.278'	070°31.074'	CTD-Rosette ↑	772	011	190	4	5.6	2.1	1014,3	89	Bergy
2b	169	Full	01-août-2016	02:20	UTC-4	71°16.480'	070°30.887'	DSN ↓	774	001	196	5	6.3	2.0	1014,3	84	Bergy
2b	169	Full	01-août-2016	02:37	UTC-4	71°16.804'	070°32.308'	DSN ↑	775	243	190	7	7.1	4.3	1014,3	81	Bergy
2b	169	Full	01-août-2016	02:58	UTC-4	71°16.193'	070°31.485'	5NVS ↓	770	021	190	8	5.5	5.2	1014,3	90	Bergy
2b	169	Full	01-août-2016	03:48	UTC-4	71°16.230'	070°31.312'	5NVS ↑	769	025	210	10	10.6	3.2	1014,4	67	Bergy
2b	169	Full	01-août-2016	04:04	UTC-4	71°16.259'	070°31.317'	PNF + Secchi Disk ↓	769	059	220	7	10.6	3.0	1014,4	69	Bergy
2b	169	Full	01-août-2016	04:11	UTC-4	71°16.277'	070°31.348'	PNF + Secchi Disk ↑	769	060	220	8	10.6	3.0	1014,4	69	Bergy
2b	169	Full	01-août-2016	04:23	UTC-4	71°16.278'	070°31.349'	CTD-Rosette ↓	770	054	210	7	10.5	2.9	1014,3	70	Bergy
2b	169	Full	01-août-2016	05:25	UTC-4	71°16.328'	070°31.140'	CTD-Rosette ↑	769	109	220	12	11.7	1.7	1014,1	62	Bergy
2b	169	Full	01-août-2016	05:58	UTC-4	71°16.205'	070°31.269'	Box Core ↓	768	194	225	13	11.0	2.8	1014,3	67	Bergy
2b	169	Full	01-août-2016	06:11	UTC-4	71°16.205'	070°31.267'	Box Core (bottom)	768	198	225	13	11.0	2.8	1014,2	64	Bergy
2b	169	Full	01-août-2016	06:25	UTC-4	71°16.208'	070°31.284'	Box Core ↑	767	183	210	11	11.5	2.2	1014,3	64	Bergy
2b	169	Full	01-août-2016	06:34	UTC-4	71°16.207'	070°31.285'	Box Core ↓	770	186	205	9	10.7	2.1	1014,3	69	Bergy
2b	169	Full	01-août-2016	06:46	UTC-4	71°16.207'	070°31.283'	Box Core (bottom)	768	183	205	11	10.5	2.2	1014,2	68	Bergy
2b	169	Full	01-août-2016	06:53	UTC-4	71°16.206'	070°31.279'	Box Core ↑	769	196	210	11	10.7	2.5	1014,2	68	Bergy
2b	169	Full	01-août-2016	07:04	UTC-4	71°16.206'	070°31.281'	Box Core ↓	769	188	210	10	10.4	2.7	1014,3	70	Bergy
2b	169	Full	01-août-2016	07:16	UTC-4	71°16.207'	070°31.281'	Box Core (bottom)	770	186	195	10	10.4	2.7	1014,0	70	Bergy
2b	169	Full	01-août-2016	07:28	UTC-4	71°16.240'	070°31.220'	Box Core ↑	770	113	190	10	10.1	2.7	1014,2	72	Bergy
2b	169	Full	01-août-2016	08:48	UTC-4	71°16.930'	070°30.830'	Agassiz Trawl ↓	774	335	200	10	11.6	3.4	1014,1	63	Bergy
2b	169	Full	01-août-2016	09:10	UTC-4	71°17.360'	070°30.060'	Agassiz Trawl (bottom)	770	305	210	15	10.7	5.2	1013,7	68	Bergy
2b	169	Full	01-août-2016	09:33	UTC-4	71°17.840'	070°33.490'	Agassiz Trawl ↑	699	305	210	15/20	11.3	5.5	1013,6	64	Bergy
2b	169	Full	01-août-2016	10:09	UTC-4	71°17.140'	070°31.580'	IKMT ↓	773	286	200	10/15	10.2	5.8	1013,5	69	Bergy
2b	169	Full	01-août-2016	10:35	UTC-4	71°16.620'	070°33.520'	IKMT (bottom)	771	154	190	10	11.5	5.8	1013,4	65	Bergy
2b	169	Full	01-août-2016	11:14	UTC-4	71°17.220'	070°31.450'	IKMT ↑	774	248	200	20	11.6	6.0	1013,2	66	Bergy
2b	LGM-AMU-2016-01	Coring	01-août-2016	12:50	UTC-4	71°13.747'	070°43.365'	Gravity Core ↓	735	233	200	14	10.9	5.6	1012,6	69	Bergy
2b	LGM-AMU-2016-01	Coring	01-août-2016	13:04	UTC-4	71°13.748'	070°43.499'	Gravity Core (bottom)	735	243	200	14	11.2	4.1	1012,6	67	Bergy
2b	LGM-AMU-2016-01	Coring	01-août-2016	13:18	UTC-4	71°13.753'	070°43.525'	Gravity Core ↑	733	242	190	14	11.5	3.8	1012,6	67	Bergy
2b	LGM-AMU-2016-02	Coring	01-août-2016	14:59	UTC-4	71°04.200'	070°27.094'	Box Core ↓	697	072	190	17	14,7	4,7	1013,2	54	Bergy

2b	LGM-AMU-2016-02	Coring	01-août-2016	15:12	UTC-4	71°04.221'	070°27.093'	Box Core (bottom)	694	314	200	15	14.8	3.3	1013,0	54	Bergy
2b	LGM-AMU-2016-02	Coring	01-août-2016	15:22	UTC-4	71°04.237'	070°27.189'	Box Core ↑	696	329	200	14	14.5	5.2	1013,0	55	Bergy
2b	LGM-AMU-2016-02	Coring	01-août-2016	16:12	UTC-4	71°04.249'	070°27.265'	CASQ Core ↓	693	326	181	11	14.6	6.5	1013,2	54	Bergy
2b	LGM-AMU-2016-02	Coring	01-août-2016	16:20	UTC-4	71°04.251'	070°27.266'	CASQ Core (bottom)	694	326	165	13	14.0	6.6	1013,3	58	Bergy
2b	LGM-AMU-2016-02	Coring	01-août-2016	16:52	UTC-4	71°04.248'	070°27.270'	CASQ Core ↑	692	316	189	14	13,6	6.6	1013,2	60	Bergy
2b	170	Nutrient	01-août-2016	20:31	UTC-4	71°28.858'	069°58.233'	CTD-Rosette ↓	693	200	200	11	9.3	4.0	1012,9	79	3/10
2b	170	Nutrient	01-août-2016	20:38	UTC-4	71°29.080'	069°57.710'	CTD-Rosette ↑	700	194	210	10	9.3	2.1	1012,9	79	3/10
2b	171	Nutrient	01-août-2016	22:10	UTC-4	71°30.850'	069°35.540'	CTD-Rosette ↓	688	041	200	10/15	7.6	3.1	1012,7	86	1/10
2b	171	Nutrient	01-août-2016	22:28	UTC-4	71°30.880'	069°35.310'	CTD-Rosette (bottom)	692	156	190	10	7.9	2.7	1012,7	85	1/10
2b	171	Nutrient	01-août-2016	23:06	UTC-4	71°30.970'	069°35.140'	CTD-Rosette ↑	699	173	210	15	8.2	3.1	1012,7	84	1/10
2b	172	Nutrient	02-août-2016	00:26	UTC-4	71°39.675'	069°08.544'	CTD-Rosette ↓	1640	180	200	13	7.4	5.1	1012,8	87	1/10
2b	172	Nutrient	02-août-2016	02:00	UTC-4	71°40.043'	069°08.393'	CTD-Rosette ↑	1647	192	190	14	6.6	5.1	1012,5	90	1/10
2b	166	Nutrient	03-août-2016	05:40	UTC-4	72°29.321'	073°43.281'	CTD-Rosette ↓	340	009	Calm		6.1	5.4	1017,9	87	Bergy
2b	166	Nutrient	03-août-2016	06:37	UTC-4	72°29.079'	073°43.581'	CTD-Rosette ↑	331	015	Calm		8.8	5.8	1018,0	76	Bergy
2b	LGM-AMU-2016-04	Coring	03-août-2016	10:36	UTC-4	72°34.820'	076°02.990'	Gravity Core ↓	119	184	Calm		6.9	4.2	1017,2	90	Bergy
2b	LGM-AMU-2016-04	Coring	03-août-2016	10:38	UTC-4	72°34.810'	076°03.000'	Gravity Core (bottom)	119	185	Calm		6.9	4.2	1017,2	90	Bergy
2b	LGM-AMU-2016-04	Coring	03-août-2016	10:41	UTC-4	72°34.810'	076°02.990'	Gravity Core ↑	119	178	Calm		6.9	4.2	1017,2	90	Bergy
2b	160	Hybrid	03-août-2016	15:31	UTC-4	72°41.268'	078°33.549'	DSN ↓	731	349	Calm		9.5	7.6	1016,3	83	Bergy
2b	160	Hybrid	03-août-2016	15:45	UTC-4	72°41.853'	078°34.391'	DSN ↑	696	294	Calm		10.3	7.5	1016,3	80	Bergy
2b	160	Hybrid	03-août-2016	16:44	UTC-4	72°41.056'	078°34.244'	CTD-Rosette ↓	726	210	Calm		12.3	8.1	1016,2	72	Bergy
2b	160	Hybrid	03-août-2016	17:51	UTC-4	72°41.240'	078°33.860'	CTD-Rosette ↑	726	211	320	6	11.1	6.6	1016,1	81	Bergy
2b	160	Hybrid	03-août-2016	19:15	UTC-4	72°41.052'	078°34.233'	Box Core ↓	725	213	134	3	9.7	6.6	1015,6	89	Bergy
2b	160	Hybrid	03-août-2016	19:25	UTC-4	72°41.054'	078°34.214'	Box Core (bottom)	725	216	156	4	8.6	6.4	1015,6	93	Bergy
2b	160	Hybrid	03-août-2016	19:37	UTC-4	72°41.053'	078°34.186'	Box Core ↑	725	225	154	3	8.4	6.3	1018,7	93	Bergy
2b	325	Nutrient	04-août-2016	04:07	UTC-4	73°49.019'	080°29.641'	CTD-Rosette ↓	677	270	115	5	6.9	4.8	1010,1	86	Bergy
2b	325	Nutrient	04-août-2016	05:05	UTC-4	73°48.994'	080°27.787'	CTD-Rosette ↑	688	260	106	8	6.9	5.0	1009,2	85	Bergy
2b	324	Nutrient	04-août-2016	06:20	UTC-4	73°59.037'	080°28.549'	CTD-Rosette ↓	774	026	145	6	6.2	5.9	1009,1	95	Bergy
2b	324	Nutrient	04-août-2016	07:27	UTC-4	73°59.008'	080°28.319'	CTD-Rosette ↑	780	332	170	6	8.0	6.0	1008,4	89	Bergy
2b	323	Full	04-août-2016	08:43	UTC-4	74°09.390'	080°28.380'	PNF + Secchi Disk ↕	789	282	210	15	6.6	6.0	1008,0	96	Bergy
2b	323	Full	04-août-2016	09:01	UTC-4	74°09.400'	080°28.220'	CTD-Rosette ↓	786	187	210	10/15	7.6	6.0	1007,9	94	Bergy
2b	323	Full	04-août-2016	09:20	UTC-4	74°09.400'	080°28.000'	CTD-Rosette (bottom)	787	200	240	15	7.6	5.6	1007,5	99	Bergy
2b	323	Full	04-août-2016	09:59	UTC-4	74°09.330'	080°26.860'	CTD-Rosette ↑	801	218	250	15/20	5.9	5.9	1007,5	99	Bergy
2b	323	Full	04-août-2016	10:20	UTC-4	74°09.570'	080°27.650'	DSN ↓	788	051	250	20	4.7	6.0	1007,4	99	Bergy
2b	323	Full	04-août-2016	10:29	UTC-4	74°09.960'	080°27.540'	DSN (bottom)	789	335	270	20	4.7	6.0	1007,4	99	Bergy
2b	323	Full	04-août-2016	10:37	UTC-4	74°10.290'	080°27.460'	DSN ↑	785	339	270	20	3.7	6.1	1007,6	99	Bergy
2b	323	Full	04-août-2016	11:10	UTC-4	74°09.420'	080°27.660'	CTD-Rosette ↓	789	265	250	20	3.7	6.1	1007,5	98	Bergy
2b	323	Full	04-août-2016	11:30	UTC-4	74°09.390'	080°27.020'	CTD-Rosette (bottom)	801	259	260	20	3.6	6.1	1007,5	97	Bergy
2b	323	Full	04-août-2016	12:21	UTC-4	74°09.173'	080°25.439'	CTD-Rosette ↑	792	276	260	19	3.6	6.0	1007,5	97	Bergy
2b	323	Full	04-août-2016	13:20	UTC-4	74°09.261'	080°25.544'	Beam Trawl ↓	793	023	260	18	3.9	5.7	1007,7	98	Bergy
2b	323	Full	04-août-2016	14:46	UTC-4	74°10.041'	080°10.452'	Beam Trawl ↑	796	021	260	17	3.8	6.0	1008,3	96	Bergy
2b	323	Full	04-août-2016	16:45	UTC-4	74°09.456'	080°28.517'	5NVS ↓	790	262	240	22	4.3	5.8	1008,6	91	Bergy
2b	323	Full	04-août-2016	17:40	UTC-4	74°09.508'	080°28.286'	5NVS ↑	789	269	240	21	4.5	5.8	1009,4	90	Bergy
2b	323	Full	04-août-2016	19:29	UTC-4	74°09.173'	080°26.343'	Bioness ↓	800	230	230	27	5.1	5.9	1009,8	85	Bergy

2b	323	Full	04-août-2016	19:50	UTC-4	74°08.571'	080°27.587'	Bioness ↑	796	270	245	25/30	4.0	5.8	1009,9	88	Bergy
2b	323	Full	04-août-2016	20:50	UTC-4	74°09.400'	080°28.220'	Box Core ↓	789	270	260	25	4.2	5.8	1010,3	88	Bergy
2b	323	Full	04-août-2016	20:59	UTC-4	74°09.460'	080°27.970'	Box Core (bottom)	786	253	260	25/30	4.2	5.9	1010,4	88	Bergy
2b	323	Full	04-août-2016	21:08	UTC-4	74°09.460'	080°27.640'	Box Core ↑	792	268	260	30	4.1	5.9	1010,3	88	Bergy
2b	323	Full	04-août-2016	21:21	UTC-4	74°09.370'	080°28.350'	Box Core ↓	792	265	250	25	4.1	5.9	1010,4	88	Bergy
2b	323	Full	04-août-2016	21:31	UTC-4	74°09.390'	080°28.130'	Box Core (bottom)	788	277	250	25/30	4.0	5.9	1010,5	89	Bergy
2b	323	Full	04-août-2016	21:40	UTC-4	74°09.440'	080°28.030'	Box Core ↑	788	273	250	25/30	4.0	5.9	1010,5	89	Bergy
2b	323	Full	04-août-2016	21:51	UTC-4	74°09.340'	080°28.300'	Box Core ↓	790	267	250	25/30	3.8	5.8	1010,4	89	Bergy
2b	323	Full	04-août-2016	22:06	UTC-4	74°09.410'	080°28.290'	Box Core (bottom)	789	278	250	20/25	3.6	5.8	1010,7	90	Bergy
2b	323	Full	04-août-2016	22:15	UTC-4	74°09.450'	080°28.390'	Box Core ↑	791	276	240	20/25	3.7	5.8	1010,8	90	Bergy
2b	323	Full	05-août-2016	00:26	UTC-4	74°09.815'	080°21.978'	Agassiz Trawl ↓	789	052	260	21	3.7	5.6	1011,1	89	Bergy
2b	323	Full	05-août-2016	01:08	UTC-4	74°09.892'	080°16.956'	Agassiz Trawl ↑	790	052	260	14	3.6	5.7	1011,2	88	Bergy
2b	300	Nutrient	05-août-2016	02:40	UTC-4	74°19.011'	080°29.761'	CTD-Rosette ↓	704	201	270	12	5.0	6.6	1011,9	93	Bergy
2b	300	Nutrient	05-août-2016	03:37	UTC-4	74°18.711'	080°30.820'	CTD-Rosette ↑	704	262	270	11	4.1	6.5	1012,0	85	Bergy
2b	322	Nutrient	05-août-2016	04:44	UTC-4	74°29.828'	080°32.377'	CTD-Rosette ↓	663	280	220	4	3.1	5.0	1012,1	96	Bergy
2b	322	Nutrient	05-août-2016	05:46	UTC-4	74°29.572'	080°35.721'	CTD-Rosette ↑	662	285	240	14	3.0	5.2	1012,1	97	Bergy
2b	M2=BA=16	Mooring	05-août-2016	20:18	UTC-4	75°39.290'	070°24.030'	Mooring Deployment ↓	531	100	310	10	4.9	6.9	1015,5	82	Bergy
2b	M2=BA=16	Mooring	05-août-2016	21:08	UTC-4	75°39.120'	070°25.290'	CTD-Rosette ↓	534	310	280	5/10	5.2	6.9	1015,4	73	Bergy
2b	M2=BA=16	Mooring	05-août-2016	21:23	UTC-4	75°39.160'	070°25.180'	CTD-Rosette (bottom)	534	256	310	5	5.3	6.9	1015,6	74	Bergy
2b	M2=BA=16	Mooring	05-août-2016	21:31	UTC-4	75°39.200'	070°25.240'	CTD-Rosette ↑	534	312	Calm		5.3	6.9	1015,5	74	Bergy
2b	M1=BA=16	Mooring	05-août-2016	10:52	UTC-4	75°48.160'	070°11.950'	Mooring Deployment ↓	539	089	Calm		5.0	6.9	1015,7	76	Bergy
2b	M1=BA=16	Mooring	05-août-2016	23:40	UTC-4	75°47.930'	070°12.800'	CTD-Rosette ↓	538	239	Calm		5.9	7.0	1016,0	75	Bergy
2b	M1=BA=16	Mooring	05-août-2016	23:53	UTC-4	75°47.955'	070°12.828'	CTD-Rosette (bottom)	536	261	Calm		5.4	7.0	1016,0	76	Bergy
2b	M1=BA=16	Mooring	06-août-2016	00:02	UTC-4	75°47.982'	070°12.897'	CTD-Rosette ↑	536	260	Calm		5.2	7.0	1015,8	77	Bergy
2b	115	Full	06-août-2016	03:01	UTC-4	76°19.907'	071°11.890'	CTD-Rosette ↓	677	256	240	4	4.6	6.0	1016,4	74	Bergy
2b	115	Full	06-août-2016	04:04	UTC-4	76°19.760'	071°11.404'	CTD-Rosette ↑	642	243	153	11	4.3	5.6	1016,4	74	Bergy
2b	115	Full	06-août-2016	04:16	UTC-4	76°19.968'	071°12.134'	DSN ↓	675	120	185	11	4.4	5.6	1016,9	74	Bergy
2b	115	Full	06-août-2016	04:30	UTC-4	76°20.039'	071°09.880'	DSN ↑	645	000	195	12	4.8	5.8	1017,1	74	Bergy
2b	115	Full	06-août-2016	04:44	UTC-4	76°19.986'	071°12.225'	PNF + Secchi Disk ↓	675	15	135	11	4.5	5.8	1017,2	74	Bergy
2b	115	Full	06-août-2016	04:52	UTC-4	76°19.956'	071°12.163'	PNF + Secchi Disk ↑	675	121	140	11	4.6	5.8	1017,3	75	Bergy
2b	115	Full	06-août-2016	05:12	UTC-4	76°19.880'	071°11.756'	CTD-Rosette ↓	675	281	200	11	4.6	5.7	1017,0	75	Bergy
2b	115	Full	06-août-2016	06:05	UTC-4	76°19.632'	071°11.140'	CTD-Rosette ↑	643	253	100	11	4.6	5.7	1017,4	75	Bergy
2b	115	Full	06-août-2016	06:23	UTC-4	76°19.928'	071°12.537'	Beam Trawl ↓	669	088	130	0/5	4.7	5.9	1017,1	74	Bergy
2b	115	Full	06-août-2016	07:30	UTC-4	76°21.716'	071°07.298'	Beam Trawl (bottom)	484	255	200	3	4.4	6.1	1018,1	74	Bergy
2b	115	Full	06-août-2016	07:38	UTC-4	76°21.436'	071°08.585'	Beam Trawl ↑	522	201	180	4	4.4	6.0	1018,2	74	Bergy
2b	115	Full	06-août-2016	08:45	UTC-4	76°19.896'	071°12.375'	Zodiac ↓		300	180	2/3	4.8	6.2	1018,7	72	Bergy
2b	115	Full	06-août-2016	08:58	UTC-4	76°19.908'	071°12.420'	5NVS ↓	672	261	180	0/5	4.8	6.2	1018,7	72	Bergy
2b	115	Full	06-août-2016	09:18	UTC-4	76°19.975'	071°12.437'	5NVS (bottom)	674	289	230	3	4.5	6.1	1018,7	74	Bergy
2b	115	Full	06-août-2016	09:40	UTC-4	76°20.092'	071°12.542'	5NVS ↑	665	273	Calm		4.3	6.3	1018,8	74	Bergy
2b	115	Full	06-août-2016	10:06	UTC-4	76°20.219'	071°12.307'	Bioness ↓ (Malfunction)	656	036	Calm		5.7	6.1	1018,9	68	Bergy
2b	115	Full	06-août-2016	10:24	UTC-4	76°20.155'	071°11.397'	Bioness ↑	658	235	180	4	4.6	6.2	1019,0	72	Bergy
2b	115	Full	06-août-2016	10:48	UTC-4	76°20.796'	071°13.182'	Zodiac ↑	656	300	Calm		4.5	6.2	1019,1	74	Bergy
2b	115	Full	06-août-2016	10:59	UTC-4	76°20.972'	071°13.672'	Bioness ↓	655	336	000	0/5	4.5	6.2	1019,1	73	Bergy

2b	115	Full	06-août-2016	11:22	UTC-4	76°21.280'	071°12.370'	Bioness ↑	644	265	Calm		4.7	6.3	1019,1	73	Bergy
2b	115	Full	06-août-2016	12:17	UTC-4	76°20.217'	071°12.097'	Agassiz Trawl ↓	658	342	Calm		4.7	6.3	1019,1	73	Bergy
2b	115	Full	06-août-2016	13:05	UTC-4	76°19.952'	071°15.812'	Agassiz Trawl ↑	668	156	Calm		4.9	6.2	1019,2	73	Bergy
2b	115	Full	06-août-2016	13:47	UTC-4	76°20.981'	071°09.468'	IKMT ↓	625	038	Calm		5.3	6.3	1019,4	70	Bergy
2b	115	Full	06-août-2016	14:47	UTC-4	76°23.605'	071°08.882'	IKMT ↑	379	272	Calm		4.9	6.7	1019,6	73	Bergy
2b	115	Full	06-août-2016	15:28	UTC-4	76°20.384'	071°15.389'	Box Core ↓	669	296	260	3	4.8	6.3	1019,7	73	Bergy
2b	115	Full	06-août-2016	15:43	UTC-4	76°20.385'	071°15.387'	Box Core (bottom)	669	291	250	4	4.6	6.5	1019,9	75	Bergy
2b	115	Full	06-août-2016	15:57	UTC-4	76°20.386'	071°15.385'	Box Core ↑	669	287	227	3	4.5	6.4	1020,0	75	Bergy
2b	115	Full	06-août-2016	16:12	UTC-4	76°20.391'	071°15.405'	Box Core ↓	670	280	230	4	4.5	6.7	1020,0	77	Bergy
2b	115	Full	06-août-2016	16:25	UTC-4	76°20.383'	071°15.431'	Box Core (bottom)	669	287	225	4	4.6	6.2	1020,0	76	Bergy
2b	115	Full	06-août-2016	16:38	UTC-4	76°20.379'	071°15.446'	Box Core ↑	669	286	225	4	4.9	6.2	1020,0	74	Bergy
2b	114	CTD	06-août-2016	17:52	UTC-4	76°19.565'	071°46.797'	Helicopter	620	240	240	5	4.7	6.2	1020,5	75	Bergy
2b	114	CTD	06-août-2016	18:40	UTC-4	76°19.516'	071°46.913'	CTD-Rosette ↓	617	300	260	6	4.8	6.0	1020,7	76	Bergy
2b	114	CTD	06-août-2016	19:06	UTC-4	76°19.452'	071°46.814'	CTD-Rosette ↑	612	298	000	0/5	4.9	6.3	1020,8	76	Bergy
2b	113	Nutrient	06-août-2016	20:00	UTC-4	76°19.280'	072°13.050'	CTD-Rosette ↓	556	185	280	5	5.0	6.4	1020,9	77	Bergy
2b	113	Nutrient	06-août-2016	20:15	UTC-4	76°19.260'	072°13.110'	CTD-Rosette (bottom)	553	185	Calm		5.7	6.3	1020,9	73	Bergy
2b	113	Nutrient	06-août-2016	20:50	UTC-4	76°19.260'	072°13.050'	CTD-Rosette ↑	554	185	280	5	5.9	6.4	1021,0	75	Bergy
2b	112	CTD	06-août-2016	21:40	UTC-4	76°19.000'	072°41.880'	CTD-Rosette ↓	563	171	280	5/10	4.4	6.7	1021,2	82	Bergy
2b	112	CTD	06-août-2016	21:55	UTC-4	76°19.020'	072°41.780'	CTD-Rosette (bottom)	560	185	Calm		5.0	6.7	1021,2	79	Bergy
2b	112	CTD	06-août-2016	22:03	UTC-4	76°19.040'	072°41.650'	CTD-Rosette ↑	555	184	280	5/10	5.0	6.7	1021,2	79	Bergy
2b	111	Basic	06-août-2016	22:54	UTC-4	76°18.480'	073°12.780'	CTD-Rosette ↓	591	169	310	5	4.0	5.7	1021,1	79	Bergy
2b	111	Basic	06-août-2016	23:08	UTC-4	76°18.510'	073°12.880'	CTD-Rosette (bottom)	594	148	Calm		4.7	5.6	1021,2	75	Bergy
2b	111	Basic	06-août-2016	23:45	UTC-4	76°18.620'	073°12.950'	CTD-Rosette ↑	607	163	Calm		5.1	5.4	1021,1	72	Bergy
2b	111	Basic	06-août-2016	23:51	UTC-4	76°18.533'	073°12.978'	DSN ↓	592	163	Calm		5.1	5.4	1021,0	72	Bergy
2b	111	Basic	07-août-2016	00:08	UTC-4	76°18.751'	073°10.719'	DSN ↑	609	015	310	6	4.4	5.4	1021,1	77	Bergy
2b	111	Basic	07-août-2016	00:44	UTC-4	76°18.470'	073°12.875'	5NVS ↓	595	195	290	4	4.1	5.3	1021,1	80	Bergy
2b	111	Basic	07-août-2016	01:22	UTC-4	76°18.511'	073°12.951'	5NVS ↑	590	226	290	7	3.9	5.2	1021,0	84	Bergy
2b	111	Full	07-août-2016	01:42	UTC-4	76°18.501'	073°12.622'	CTD-Rosette ↓	592	082	300	7	3.7	5.2	1021,1	84	Bergy
2b	111	Full	07-août-2016	02:29	UTC-4	76°18.653'	073°11.724'	CTD-Rosette ↑	595	072	300	6	3.6	5.2	1021,2	84	Bergy
2b	111	Full	07-août-2016	02:49	UTC-4	76°18.376'	073°13.130'	Agassiz Trawl ↓	594	053	300	6	3.7	5.4	1021,2	85	Bergy
2b	111	Full	07-août-2016	03:20	UTC-4	76°19.030'	073°09.930'	Agassiz Trawl ↑	605	339	290	6	3.8	5.3	1021,4	85	Bergy
2b	111	Full	07-août-2016	03:40	UTC-4	76°18.446'	073°12.830'	Box Core ↓	596	078	290	6	3.7	5.3	1021,3	87	Bergy
2b	111	Full	07-août-2016	03:48	UTC-4	76°18.392'	073°12.825'	Box Core (bottom)	596	077	290	7	4.0	5.4	1021,4	86	Bergy
2b	111	Full	07-août-2016	03:56	UTC-4	76°18.389'	073°12.795'	Box Core ↑	598	148	295	5	3.8	5.2	1021,5	87	Bergy
2b	111	Full	07-août-2016	04:05	UTC-4	76°18.410'	073°12.701'	Box Core ↓	597	104	300	6	4.6	5.2	1021,5	83	Bergy
2b	111	Full	07-août-2016	04:12	UTC-4	76°18.365'	073°12.645'	Box Core (bottom)	596	028	295	6	4.0	5.2	1021,5	86	Bergy
2b	111	Full	07-août-2016	04:20	UTC-4	76°18.389'	073°12.372'	Box Core ↑	597	304	290	6	4.0	5.1	1021,6	87	Bergy
2b	116-A9	Full	07-août-2016	08:56	UTC-4	77°00.190'	072°08.470'	CTD-Rosette ↓	959	029	340	10	5.0	5.1	1021,8	77	Bergy
2b	116-A9	Full	07-août-2016	09:19	UTC-4	77°00.230'	072°08.270'	CTD-Rosette (bottom)	962	042	340	10	4.3	5.2	1021,7	74	Bergy
2b	116-A9	Full	07-août-2016	09:34	UTC-4	77°00.260'	072°08.240'	CTD-Rosette ↑	962	032	340	10	4.0	5.1	1021,6	77	Bergy
2b	116-A9	Full	07-août-2016	09:50	UTC-4	77°00.300'	072°08.250'	Box Core ↓	965	069	330	10	4.0	5.1	1021,6	80	Bergy
2b	116-A9	Full	07-août-2016	10:04	UTC-4	77°00.280'	072°08.280'	Box Core (bottom)	961	071	340	10/15	3.7	5.0	1021,6	81	Bergy
2b	116-A9	Full	07-août-2016	10:20	UTC-4	77°00.230'	072°08.200'	Box Core ↑	964	080	340	10/15	3.8	5.0	1021,6	82	Bergy

2b	116-A9	Full	07-août-2016	11:33	UTC-4	77°00.310'	072°08.390'	CASQ Core ↓	962	099	340	5/10	3.8	5.1	1021,5	85	Bergy
2b	116-A9	Full	07-août-2016	11:45	UTC-4	77°00.290'	072°08.320'	CASQ Core (bottom)	963	089	340	5/10	3.8	5.2	1021,5	85	Bergy
2b	116-A9	Full	07-août-2016	11:57	UTC-4	77°00.300'	072°08.152'	CASQ Core ↑	967	087	330	7	3.9	5.2	1021,5	85	Bergy
2b	138	Nutrient	07-août-2016	14:52	UTC-4	76°40.959'	072°21.871'	CTD-Rosette ↓	169	317	320	14	4.4	5.6	1021,2	88	Bergy
2b	138	Nutrient	07-août-2016	15:16	UTC-4	76°40.864'	072°22.090'	CTD-Rosette ↑	169	359	310	14	4.5	5.4	1021,3	87	Bergy
2b	138	Nutrient	07-août-2016	15:35	UTC-4	76°41.020'	072°21.838'	MVP ↓	171	350	330	14	4.7	5.6	1021,5	87	Bergy
2b	138	Nutrient	07-août-2016	19:26	UTC-4	76°37.731'	070°39.286'	MVP ↑	178	0-360	320	13	5.5	5.7	1021,7	84	Bergy
2b	138b	Nutrient	07-août-2016	19:46	UTC-4	76°37.732'	070°41.279'	CTD-Rosette ↓	180	323	315	13	5.7	5.8	1020,6	84	Bergy
2b	138b	Nutrient	07-août-2016	20:18	UTC-4	76°37.650'	070°41.190'	CTD-Rosette ↑	179	319	330	10/15	5.9	5.8	1020,7	80	Bergy
2b	116-A9	Full	07-août-2016	22:02	UTC-4	76°44.330'	071°49.100'	CTD-Rosette ↓	721	052	350	15	5.1	5.5	1021,0	83	Bergy
2b	116-A9	Full	07-août-2016	22:17	UTC-4	76°44.340'	071°49.070'	CTD-Rosette (bottom)	723	357	350	15	5.4	5.4	1020,9	78	Bergy
2b	116-A9	Full	07-août-2016	22:58	UTC-4	76°44.320'	071°49.990'	CTD-Rosette ↑	706	332	340	10/15	5.0	5.2	1021,0	86	Bergy
2b	116-A9	Full	07-août-2016	23:11	UTC-4	76°44.240'	071°50.830'	DSN ↓	690	129	330	10	5.2	5.2	1021,0	83	Bergy
2b	116-A9	Full	07-août-2016	23:20	UTC-4	76°44.240'	071°49.590'	DSN (bottom)	705	069	330	10/15	5.2	5.3	1021,0	82	Bergy
2b	116-A9	Full	07-août-2016	23:28	UTC-4	76°44.390'	071°48.700'	DSN ↑	733	051	330	10	5.2	5.3	1021,0	82	Bergy
2b	116-A9	Full	08-août-2016	00:10	UTC-4	76°44.377'	071°49.295'	5NVS ↓	721	330	310	8	5.0	5.1	1021,0	84	Bergy
2b	116-A9	Full	08-août-2016	00:57	UTC-4	76°44.593'	071°49.457'	5NVS ↑	734	340	340	11	5.8	5.3	1020,9	74	Bergy
2b	116-A9	Full	08-août-2016	01:33	UTC-4	76°44.882'	071°49.000'	IKMT ↓	761	076	020	11	5.3	5.3	1020,9	82	Bergy
2b	116-A9	Full	08-août-2016	02:29	UTC-4	76°46.861'	071°45.956'	IKMT ↑	832	205	020	12	5.5	5.4	1020,8	79	Bergy
2b	116-A9	Full	08-août-2016	03:00	UTC-4	76°45.804'	071°46.954'	Bioness ↓	807	190	045	11	5.5	5.4	1020,9	77	Bergy
2b	116-A9	Full	08-août-2016	03:17	UTC-4	76°45.675'	071°49.419'	Bioness ↑	790	325	045	10	5.9	5.4	1020,9	78	Bergy
2b	116-A9	Full	08-août-2016	03:45	UTC-4	76°44.394'	071°48.948'	PNF ↓	730	046	020	10	5.3	5.2	1021,1	81	Bergy
2b	116-A9	Full	08-août-2016	03:53	UTC-4	76°44.368'	071°48.696'	PNF ↑	736	047	050	8	5.5	5.2	1021,2	79	Bergy
2b	116-A9	Full	08-août-2016	04:01	UTC-4	76°44.342'	071°48.508'	CTD-Rosette ↓	735	347	040	7	5.1	5.9	1021,3	71	Bergy
2b	116-A9	Full	08-août-2016	04:57	UTC-4	76°44.368'	071°48.370'	CTD-Rosette ↑	739	307	080	4	5.8	5.1	1021,7	74	Bergy
2b	116-A9	Full	08-août-2016	05:00	UTC-4	76°44.368'	071°48.370'	Mapping									
2b	116-A9	Full	08-août-2016	06:15	UTC-4			Zodiac ↓ (SKIMMER)									
2b	116-A9	Full	08-août-2016	06:34	UTC-4	76°44.339'	071°48.973'	Box Core ↓	727	339	335	4	5.4	5.2	1021,9	81	Bergy
2b	116-A9	Full	08-août-2016	06:46	UTC-4	76°44.341'	071°48.953'	Box Core (bottom)	726	335	325	5	5.3	5.2	1021,9	79	Bergy
2b	116-A9	Full	08-août-2016	06:58	UTC-4	76°44.335'	071°48.964'	Box Core ↑	726	337	325	4	5.0	5.2	1022,0	82	Bergy
2b	116-A9	Full	08-août-2016	07:05	UTC-4	76°44.337'	071°48.978'	Box Core ↓	725	339	320	7	4.9	5.2	1022,1	83	Bergy
2b	116-A9	Full	08-août-2016	07:17	UTC-4	76°44.338'	071°48.973'	Box Core (bottom)	723	338	320	5	4.9	5.2	1022,1	84	Bergy
2b	116-A9	Full	08-août-2016	07:30	UTC-4	76°44.339'	071°48.961'	Box Core ↑	726	336	317	6	5.0	5.2	1022,1	80	Bergy
2b	116-A9	Full	08-août-2016	08:43	UTC-4	76°44.330'	071°49.080'	Box Core ↓	722	016	Calm		4.9	5.2	1022,3	86	Bergy
2b	116-A9	Full	08-août-2016	08:54	UTC-4	76°44.350'	071°49.120'	Box Core (bottom)	723	022	Calm		4.9	5.3	1022,2	86	Bergy
2b	116-A9	Full	08-août-2016	09:05	UTC-4	76°44.350'	071°49.120'	Box Core ↑	723	001	320	10	4.9	5.3	1022,2	86	Bergy
2b	116-A9	Full	08-août-2016	09:20	UTC-4	76°44.360'	071°50.230'	Agassiz Trawl ↓	707	228	Calm		5.2	5.4	1022,2	85	Bergy
2b	116-A9	Full	08-août-2016	09:39	UTC-4	76°43.980'	071°51.520'	Agassiz Trawl (bottom)	659	203	Calm		6.0	5.4	1022,2	83	Bergy
2b	116-A9	Full	08-août-2016	10:00	UTC-4	76°43.490'	071°51.750'	Agassiz Trawl ↑	582	153	Calm		5.8	5.4	1022,2	83	Bergy
2b	116-A9	Full	08-août-2016	10:24	UTC-4	76°43.600'	071°49.320'	Beam Trawl ↓	674	005	Calm		5.8	5.5	1022,2	82	Bergy
2b	116-A9	Full	08-août-2016	10:50	UTC-4	76°43.320'	071°52.940'	Beam Trawl (bottom)	550	179	Calm		5.6	5.5	1022,1	86	Bergy
2b	116-A9	Full	08-août-2016	11:28	UTC-4	76°42.710'	071°48.490'	Beam Trawl ↑	597	018	050	10	5.2	5.6	1022,0	87	Bergy
2b	110	Nutrient	08-août-2016	15:02	UTC-4	76°17.925'	073°38.046'	CTD-Rosette ↓	531	327	340	11	3.7	5.5	1021,8	89	Bergy

2b	110	Nutrient	08-août-2016	16:02	UTC-4	76°17.795'	073°38.319'	CTD-Rosette ↑	527	318	340	11	3.6	5.4	1021,7	91	Bergy
2b	110	Nutrient	08-août-2016	13:05	UTC-4	76°29.996'	072°31.571'	Bioness ↓ (Test)	577	146	310	11	4.6	5.4	1021,7	93	Bergy
2b	110	Nutrient	08-août-2016	13:14	UTC-4	76°29.796'	072°31.062'	Bioness ↑ (Test)	577	147	270	7	6.1	5.4	1021,7	82	Bergy
2b	109	CTD	08-août-2016	16:46	UTC-4	76°17.395'	074°06.738'	CTD-Rosette ↓	452	355	345	11	2.9	5.2	1021,5	90	Bergy
2b	109	CTD	08-août-2016	17:09	UTC-4	76°17.370'	074°06.731'	CTD-Rosette ↑	454	357	350	11	2.8	5.0	1021,6	89	Bergy
2b	108	Full	08-août-2016	17:57	UTC-4	76°15.777'	074°35.749'	CTD-Rosette ↓	447	345	350	12	2.6	2.0	1021,3	87	1/10
2b	108	Full	08-août-2016	18:48	UTC-4	76°15.773'	074°35.877'	CTD-Rosette ↑	450	346	335	11	2.7	4.1	1021,4	85	1/10
2b	108	Full	08-août-2016	18:54	UTC-4	76°15.720'	074°35.634'	DSN ↓	447	062	335	12	2.7	4.1	1021,4	85	1/10
2b	108	Full	08-août-2016	19:15	UTC-4	76°16.009'	074°32.777'	DSN ↑	437	032	336	11	2.5	4.2	1021,3	86	1/10
2b	108	Full	08-août-2016	19:38	UTC-4	76°15.829'	074°35.740'	5NVS ↓	444	338	335	11	2.6	4.6	1021,1	87	1/10
2b	108	Full	08-août-2016					5NVS Cancelled									1/10
2b	108	Full	08-août-2016	19:58	UTC-4	76°15.420'	074°36.890'	IKMT ↓	446	160	000	10	2.5	4.1	1021,2	86	1/10
2b	108	Full	08-août-2016	20:17	UTC-4	76°15.240'	074°33.750'	IKMT (bottom)	443	057	000	10	2.5	4.1	1021,2	86	1/10
2b	108	Full	08-août-2016	20:55	UTC-4	76°16.220'	074°34.260'	IKMT ↑	442	200	340	10	2.8	4.7	1020,9	85	1/10
2b	108	Full	08-août-2016	21:20	UTC-4	76°15.540'	074°35.880'	Beam Trawl ↓	447	222	350	10/15	2.9	4.6	1021,0	84	1/10
2b	108	Full	08-août-2016	21:40	UTC-4	76°15.170'	074°32.530'	Beam Trawl (bottom)	441	070	350	10/15	3.1	4.6	1020,8	81	1/10
2b	108	Full	08-août-2016	22:15	UTC-4	76°16.150'	074°32.750'	Beam Trawl ↑	442	250	290	10/15	2.6	4.9	1020,5	85	1/10
2b	108	Full	08-août-2016	22:47	UTC-4	76°15.710'	074°31.310'	Bioness ↓	439	280	300	10	2.4	4.7	1020,4	86	1/10
2b	108	Full	08-août-2016	23:03	UTC-4	76°15.390'	074°33.370'	Bioness ↑	442	306	310	10	2.7	4.9	1020,1	87	1/10
2b	108	Full	08-août-2016	23:51	UTC-4	76°15.650'	074°37.520'	Agassiz Trawl ↓	447	207	300	10	2.8	4.9	1017,2	85	1/10
2b	108	Full	09-août-2016	00:25	UTC-4	76°15.602'	074°34.767'	Agassiz Trawl ↑	444	040	310	11	3.0	4.9	1019,4	82	1/10
2b	108	Full	09-août-2016	00:44	UTC-4	76°15.882'	074°36.148'	Box Core ↓	449	066	310	11	2.9	4.7	1019,3	83	1/10
2b	108	Full	09-août-2016	00:50	UTC-4	76°15.874'	074°36.248'	Box Core (bottom)	450	080	330	12	2.7	4.6	1019,2	83	1/10
2b	108	Full	09-août-2016	00:56	UTC-4	76°15.846'	074°36.205'	Box Core ↑	450	084	320	12	2.7	4.6	1019,2	83	1/10
2b	108	Full	09-août-2016	01:04	UTC-4	76°15.832'	074°36.099'	Box Core ↓	449	083	310	11	2.7	4.7	1019,1	83	Bergy
2b	108	Full	09-août-2016	01:10	UTC-4	76°15.827'	074°36.084'	Box Core (bottom)	449	081	310	11	2.8	4.4	1019,0	83	Bergy
2b	108	Full	09-août-2016	01:16	UTC-4	76°15.824'	074°36.185'	Box Core ↑	451	082	310	11	2.8	4.4	1019,0	83	Bergy
2b	108	Full	09-août-2016	01:58	UTC-4	76°15.928'	074°32.745'	PNF ↓	442	091	315	11	2.7	4.5	1018,8	85	Bergy
2b	108	Full	09-août-2016	02:05	UTC-4	76°15.931'	074°32.900'	PNF ↑	441	087	315	12	2.6	4.5	1018,7	85	Bergy
2b	108	Full	09-août-2016	02:11	UTC-4	76°15.938'	074°33.014'	CTD-Rosette ↓	442	086	315	12	2.6	4.7	1018,6	85	Bergy
2b	108	Full	09-août-2016	02:57	UTC-4	76°15.975'	074°33.399'	CTD-Rosette ↑	443	071	310	11	3.2	4.9	1018,3	83	Bergy
2b	107	Nutrient	09-août-2016	03:48	UTC-4	76°16.865'	074°59.378'	CTD-Rosette ↓	438	078	310	11	2.3	3.7	1018,0	87	2/10
2b	107	Nutrient	09-août-2016	04:36	UTC-4	76°16.802'	074°59.381'	CTD-Rosette ↑	438	034	320	11	3.3	3.1	1017,6	81	2/10
2b	106	CTD	09-août-2016	05:37	UTC-4	76°18.734'	075°22.466'	CTD-Rosette ↓	377	333	340	11	3.0	1.8	1017,5	82	2/10
2b	106	CTD	09-août-2016	06:06	UTC-4	76°18.739'	075°22.440'	CTD-Rosette ↑	377	305	335	11	4.4	2.4	1017,5	70	2/10
2b	105	Basic	09-août-2016	09:02	UTC-4	76°19.030'	075°45.560'	CTD-Rosette ↓	326	268	290	10	5.0	3.9	1016,2	79	1/10
2b	105	Basic	09-août-2016	09:12	UTC-4	76°19.017'	075°45.500'	CTD-Rosette (bottom)	325	270	290	11	5.2	4.4	1016,0	64	1/10
2b	105	Basic	09-août-2016	09:52	UTC-4	76°18.970'	075°45.040'	CTD-Rosette ↑	324	249	280	10	5.9	4.2	1015,8	59	1/10
2b	105	Basic	09-août-2016	10:10	UTC-4	76°18.969'	075°45.577'	Zodiac ↓ (SKIMMER)	324	000	270	11	5.4	4.0	1015,8	60	1/10
2b	105	Basic	09-août-2016	10:27	UTC-4	76°19.021'	075°46.067'	DSN ↓	328	174	280	11	4.7	4.0	1015,7	73	1/10
2b	105	Basic	09-août-2016	10:47	UTC-4	76°19.021'	075°43.899'	DSN ↑	319	355	310	10	5.2	4.0	1015,6	69	1/10
2b	105	Basic	09-août-2016	11:07	UTC-4	76°19.077'	075°45.482'	5NVS ↓	328	290	310	10	4.9	4.0	1015,3	74	1/10
2b	105	Basic	09-août-2016	11:15	UTC-4	76°19.079'	075°45.457'	5NVS (bottom)	328	290	300	9	4.9	4.0	1015,3	75	1/10

2b	105	Basic	09-août-2016	11:35	UTC-4	76°19.080'	075°45.433'	5NVS ↑	327	295	300	10	4.8	4.4	1015,1	78	1/10
2b	105	Basic	09-août-2016	11:57	UTC-4	76°18.717'	075°43.073'	Zodiac ↑	313	095	310	11	4.5	4.1	1014,9	80	1/10
2b	105	Basic	09-août-2016	12:37	UTC-4	76°19.051'	075°45.618'	CTD-Rosette ↓	327	310	320	11	4.4	4.1	1014,7	82	1/10
2b	105	Basic	09-août-2016	13:24	UTC-4	76°19.135'	075°46.053'	CTD-Rosette ↑	329	305	300	11	4.2	4.2	1014,3	85	1/10
2b	105	Basic	09-août-2016	13:36	UTC-4	76°19.078'	075°45.606'	Box Core ↓	328	308	300	11	4.2	4.2	1014,2	86	Bergy
2b	105	Basic	09-août-2016	13:43	UTC-4	76°19.067'	075°45.483'	Box Core (bottom)	329	296	290	11	4.2	4.2	1014,1	86	Bergy
2b	105	Basic	09-août-2016	13:49	UTC-4	76°19.068'	075°45.478'	Box Core ↑	329	252	300	11	4.3	4.1	1014,0	86	Bergy
2b	104	Basic	09-août-2016	14:52	UTC-4	76°20.627'	076°10.392'	CTD-Rosette ↓	190	316	250	11	4.3	4.6	1013,6	85	Bergy
2b	104	Basic	09-août-2016	15:05	UTC-4	76°20.626'	076°10.424'	CTD-Rosette ↑	190	266	260	11	3.6	4.6	1013,5	88	Bergy
2b	103	Basic	09-août-2016	16:10	UTC-4	76°21.178'	076°34.916'	CTD-Rosette ↓	148	354	240	6	3.6	3.4	1013,2	90	Bergy
2b	103	Basic	09-août-2016	16:41	UTC-4	76°21.174'	076°34.889'	CTD-Rosette ↑	148	343	220	6	3.8	3.4	1012,9	88	Bergy
2b	103	Basic	09-août-2016					Multibeam Mapping									Bergy
2b	103	Basic	09-août-2016	16:45	UTC-4	76°21.102'	076°34.829'	Zodiac ↕ (Test)	149	317	200	11	4.1	3.4	1012,8	86	Bergy
2b	102	Nutrient	09-août-2016	17:47	UTC-4	76°27.359'	076°06.583'	Feature Mapping	135	046	180	13	4.0	2.9	1012,8	87	1/10
2b	102	Nutrient	09-août-2016	21:45	UTC-4	76°22.260'	077°00.420'	CTD-Rosette ↓	262	226	190	5	4.3	1.7	1011,7	91	3/10
2b	102	Nutrient	09-août-2016	21:55	UTC-4	76°22.220'	077°00.530'	CTD-Rosette (bottom)	263	238	180	5	4.5	1.6	1011,7	93	3/10
2b	102	Nutrient	09-août-2016	21:59	UTC-4	76°22.200'	077°00.640'	CTD-Rosette ↑	263	246	180	5	4.5	1.6	1011,7	93	3/10
2b	101	Full	09-août-2016	23:24	UTC-4	76°23.240'	077°23.860'	CTD-Rosette ↓	341	349	230	10	4.3	2.3	1011,5	82	3/10
2b	101	Full	09-août-2016	23:35	UTC-4	76°23.280'	077°23.840'	CTD-Rosette (bottom)	339	004	240	10	4.2	2.0	1011,4	82	3/10
2b	101	Full	10-août-2016	00:09	UTC-4	76°23.420'	077°24.018'	CTD-Rosette ↑	336	291	240	8	4.5	1.6	1011,3	79	3/10
2b	101	Full	10-août-2016	00:45	UTC-4	76°23.370'	077°23.092'	DSN ↓	342	353	230	10	4.5	1.6	1011,2	80	3/10
2b	101	Full	10-août-2016	00:53	UTC-4	76°23.916'	077°24.231'	DSN ↑	348	295	230	7	4.5	1.8	1011,2	81	3/10
2b	101	Full	10-août-2016	01:22	UTC-4	76°23.441'	077°24.681'	5NVS ↓	350	079	260	7	4.5	2.2	1011,1	81	3/10
2b	101	Full	10-août-2016	01:45	UTC-4	76°23.517'	077°24.531'	5NVS ↑	342	335	260	8	4.4	1.9	1011,2	81	3/10
2b	101	Full	10-août-2016	02:09	UTC-4	76°23.532'	077°26.744'	Beam Trawl ↓	391	186	250	11	3.9	2.1	1011,3	84	3/10
2b	101	Full	10-août-2016	03:08	UTC-4	76°23.114'	077°23.286'	Beam Trawl ↑	349	316	250	11	5.1	2.0	1011,3	78	3/10
2b	101	Full	10-août-2016	03:54	UTC-4	76°23.716'	077°21.063'	PNF ↓	331	077	300	8	5.2	2.0	1011,5	74	3/10
2b	101	Full	10-août-2016	04:06	UTC-4	76°23.694'	077°21.843'	PNF ↑	332	079	300	8	5.2	2.0	1011,5	74	3/10
2b	101	Full	10-août-2016	04:21	UTC-4	76°23.001'	077°23.441'	CTD-Rosette ↓	350	248	305	6	5.1	2.2	1011,5	77	3/10
2b	101	Full	10-août-2016	04:53	UTC-4	76°22.890'	077°23.076'	CTD-Rosette ↑	355	311	285	11	6.4	2.0	1011,5	67	3/10
2b	101	Full	10-août-2016	05:12	UTC-4	76°22.884'	077°23.157'	Box Core ↓	357	312	280	11	6.7	2.0	1011,6	67	3/10
2b	101	Full	10-août-2016	05:16	UTC-4	76°22.884'	077°23.161'	Box Core (bottom)	356	310	285	11	6.7	2.0	1011,6	67	3/10
2b	101	Full	10-août-2016	05:23	UTC-4	76°22.884'	077°23.203'	Box Core ↑	356	295	285	11	6.5	2.0	1011,5	69	3/10
2b	101	Full	10-août-2016	05:30	UTC-4	76°22.872'	077°23.238'	Box Core ↓	355	322	285	10	6.8	2.0	1011,5	67	3/10
2b	101	Full	10-août-2016	05:35	UTC-4	76°22.875'	077°23.239'	Box Core (bottom)	356	323	290	11	6.8	2.0	1011,5	67	3/10
2b	101	Full	10-août-2016	05:40	UTC-4	76°22.961'	077°23.663'	Box Core ↑	357	325	290	11	6.8	2.0	1011,5	67	3/10
2b	101	Full	10-août-2016	06:10	UTC-4	76°22.638'	077°24.389'	Agassiz Trawl ↓	371	270	290	11	6.8	2.0	1011,4	67	3/10
2b	101	Full	10-août-2016	06:35	UTC-4	76°21.880'	077°23.633'	Agassiz Trawl ↑	377	080	286	10	6.7	2.0	1011,5	68	3/10
2b	101	Full	10-août-2016					Feature Mapping									
2b	Trinity (TS233)	Full	11-août-2016	03:06	UTC-4	77°52.838'	077°11.144'	CTD-Rosette ↓	525	266	270	11	1.4	2.0	1009,6	91	9/10
2b	Trinity (TS233)	Full	11-août-2016	03:59	UTC-4	77°52.885'	077°11.472'	CTD-Rosette ↑	524	019	330	12	1.6	1.7	1009,4	89	9/10
2b	Trinity (TS233)	Full	11-août-2016	04:07	UTC-4	77°52.870'	077°11.500'	5NVS ↓	525	058	Calm		1.7	1.6	1009,4	87	8/10
2b	Trinity (TS233)	Full	11-août-2016	04:42	UTC-4	77°52.880'	077°11.534'	5NVS ↑	525	140	Calm		1.4	1.8	1009,3	87	8/10

2b	Trinity (TS233)	Full	11-août-2016	05:03	UTC-4	77°52.865'	077°11.677'	PNF + Secchi Disk ↓	528	111	Calm		0.7	1.8	1009,3	95	8/10
2b	Trinity (TS233)	Full	11-août-2016	05:08	UTC-4	77°52.700'	077°11.674'	PNF + Secchi Disk ↑	528	106	Calm		0.7	1.8	1009,3	95	8/10
2b	Trinity (TS233)	Full	11-août-2016	05:22	UTC-4	77°52.876'	077°11.653'	CTD-Rosette ↓	528	111	Calm		0.3	1.8	1009,3	97	8/10
2b	Trinity (TS233)	Full	11-août-2016	06:17	UTC-4	77°52.856'	077°11.539'	CTD-Rosette ↑	531	115	Calm		0.3	1.8	1009,3	99	8/10
2b	Trinity (TS233)	Full	11-août-2016	06:29	UTC-4	77°52.797'	077°10.523'	Box Core ↓	534	103	135	4	0.4	1.8	1009,3	99	8/10
2b	Trinity (TS233)	Full	11-août-2016	06:39	UTC-4	77°52.805'	077°10.490'	Box Core (bottom)	534	112	070	3	0.6	1.7	1009,2	99	8/10
2b	Trinity (TS233)	Full	11-août-2016	06:51	UTC-4	77°52.810'	077°10.532'	Box Core ↑	534	126	105	4	0.6	1.6	1009,1	99	8/10
2b	Trinity (TS233)	Full	11-août-2016	06:58	UTC-4	77°52.807'	077°10.560'	Box Core ↓	534	124	120	4	0.6	1.6	1009,1	99	8/10
2b	Trinity (TS233)	Full	11-août-2016	07:07	UTC-4	77°52.807'	077°10.560'	Box Core (bottom)	534	133	140	3	0.7	1.7	1009,1	99	8/10
2b	Trinity (TS233)	Full	11-août-2016	07:20	UTC-4	77°52.805'	077°10.541'	Box Core ↑	534	110	130	3	0.6	1.7	1009,1	99	8/10
2b	TS233N	Nutrient	11-août-2016	12:33	UTC-4	77°47.724'	076°31.982'	CTD-Rosette ↓	572	035	Calm		2.0	2.0	1008,1	96	3/10
2b	TS233N	Nutrient	11-août-2016	13:36	UTC-4	77°47.727'	076°32.015'	CTD-Rosette ↑	572	207	Calm		2.1	1.5	1007,8	94	3/10
2b	TS233N	Nutrient	11-août-2016	13:55	UTC-4	77°47.789'	076°31.957'	Agassiz Trawl ↓	573	217	Calm		2.2	1.5	1007,9	95	3/10
2b	TS233N	Nutrient	11-août-2016	14:26	UTC-4	77°47.011'	076°31.848'	Agassiz Trawl ↑	549	130	Calm		1.8	2.6	1007,7	96	3/10
2b	TS233N	Nutrient	11-août-2016	14:45	UTC-4	77°46.936'	076°31.488'	Zodiac ↑	541	160	Calm		2.4	2.4	1007,7	95	3/10
2b	TS233N	Nutrient	11-août-2016	15:15	UTC-4	77°47.704'	076°32.019'	Box Core ↓	573	352	Calm		1.7	2.8	1007,4	96	3/10
2b	TS233N	Nutrient	11-août-2016	15:23	UTC-4	77°47.728'	076°32.026'	Box Core (bottom)	573	350	Calm		1.9	2.5	1007,4	96	3/10
2b	TS233N	Nutrient	11-août-2016	15:35	UTC-4	77°47.737'	076°32.015'	Box Core ↑	576	344	Calm		1.8	2.2	1007,5	96	3/10
2b	TS233N	Nutrient	11-août-2016	16:23	UTC-4	77°47.743'	076°32.106'	CASQ Core ↓	574	060	Calm		2.1	1.9	1007,4	94	3/10
2b	TS233N	Nutrient	11-août-2016	16:37	UTC-4	77°47.751'	076°32.126'	CASQ Core (bottom)	574	112	030	0/5	2.0	1.9	1007,4	94	3/10
2b	TS233N	Nutrient	11-août-2016	16:59	UTC-4	77°47.751'	076°32.997'	CASQ Core ↑	574	136	030	0/5	1.9	2.0	1007,2	95	3/10
2b	139	Full	12-août-2016	23:33	UTC-4	81°21.410'	062°48.410'	CTD-Rosette ↓	587	230	220	10/15	0.2	-0.3	1007,0	93	2/10
2b	139	Full	12-août-2016	23:51	UTC-4	81°21.470'	062°48.040'	CTD-Rosette (bottom)	601	237	230	15	0.2	-0.3	1006,9	93	2/10
2b	139	Full	13-août-2016	00:33	UTC-4	81°21.636'	062°46.223'	CTD-Rosette ↑	539	233	220	15	0.4	-0.3	1007,0	95	2/10
2b	139	Full	13-août-2016	00:45	UTC-4	81°21.543'	062°41.617'	DSN ↓	535	053	220	14	0.5	-0.3	1007,4	95	2/10
2b	139	Full	13-août-2016	00:58	UTC-4	81°21.859'	062°41.864'	DSN ↑	469	041	250	11	0.5	-0.3	1007,1	95	2/10
2b	139	Full	13-août-2016	01:17	UTC-4	81°22.072'	062°40.840'	5NVS ↓	475	226	250	11	-0.1	-0.3	1007,2	97	2/10
2b	139	Full	13-août-2016	01:46	UTC-4	81°22.054'	062°40.164'	5NVS ↑	449	248	240	11	-0.3	-0.3	1007,5	98	2/10
2b	139	Full	13-août-2016	02:21	UTC-4	81°20.972'	062°48.786'	Box Core ↓	581	261	230	12	-0.2	-0.2	1007,6	98	3/10
2b	139	Full	13-août-2016	02:29	UTC-4	81°20.977'	062°48.895'	Box Core (bottom)	581	254	220	12	-0.2	-0.2	1007,8	98	3/10
2b	139	Full	13-août-2016	02:36	UTC-4	81°20.963'	062°49.249'	Box Core ↑	582	250	230	13	-0.2	-0.2	1007,8	98	3/10
2b	139	Full	13-août-2016	02:49	UTC-4	81°20.894'	062°49.489'	Box Core ↓	581	239	230	10	-0.2	-0.2	1007,9	97	3/10
2b	139	Full	13-août-2016	02:56	UTC-4	81°20.876'	062°49.402'	Box Core (bottom)	581	259	230	10	-0.2	-0.2	1007,9	97	3/10
2b	139	Full	13-août-2016	03:04	UTC-4	81°20.887'	062°49.919'	Box Core ↑	582	259	220	9	-0.4	-0.2	1007,9	97	3/10
2b	139	Full	13-août-2016	03:18	UTC-4	81°20.468'	062°48.966'	Agassiz Trawl ↓	572	061	250	5	-0.4	-0.2	1008,1	97	3/10
2b	139	Full	13-août-2016	03:43	UTC-4	81°20.667'	062°44.693'	Agassiz Trawl ↑	556	041	250	5	-0.4	-0.2	1008,1	97	3/10
2b	139	Full	13-août-2016	04:12	UTC-4	81°20.470'	062°41.656'	Beam Trawl ↓	519	050	255	8	-0.5	-0.2	1008,3	98	3/10
2b	139	Full	13-août-2016	04:37	UTC-4	81°19.976'	062°41.800'	Beam Trawl (bottom)	521	076	Calm		-0.4	-0.2	1008,4	98	3/10
2b	139	Full	13-août-2016	05:22	UTC-4	81°20.057'	062°40.348'	Beam Trawl ↑	522	033	260	5	-0.7	-0.2	1008,5	97	3/10
2b	139	Full	13-août-2016	05:26	UTC-4	81°20.539'	062°45.649'	PNF + Secchi Disk ↓	564	290	250	7	-0.7	-0.2	1008,6	95	3/10
2b	139	Full	13-août-2016	05:34	UTC-4	81°20.619'	062°45.250'	PNF + Secchi Disk ↑	561	093	230	5	0.5	-0.2	1008,6	91	3/10
2b	139	Full	13-août-2016	06:54	UTC-4	81°20.997'	062°46.723'	CTD-Rosette ↓	573	203	240	8	-0.5	-0.2	1008,6	94	3/10
2b	139	Full	13-août-2016	07:42	UTC-4	81°21.136'	062°47.104'	CTD-Rosette ↑	584	292	212	8	-0.3	-0.3	1008,6	97	3/10

2b	139	Full	13-août-2016	07:45	UTC-4			Zodiac ↑									3/10
2b	139	Full	13-août-2016	09:27	UTC-4	81°20.870'	062°49.490'	CASQ Core ↓	583	235	220	8	-0.2	-0.1	1008,6	99	3/10
2b	139	Full	13-août-2016	09:35	UTC-4	81°20.870'	062°49.450'	CASQ Core (bottom)	583	231	210	8	-0.3	-0.2	1008,5	99	3/10
2b	139	Full	13-août-2016	09:43	UTC-4	81°20.930'	062°49.040'	CASQ Core ↑	583	273	190	8	-0.5	-0.2	1008,5	99	3/10
2b	KANE_1	Full	14-août-2016	01:18	UTC-4	79°59.040'	062°48.042'	CTD-Rosette ↓	246	012	Calm		-0.9	0.3	1009,0	99	4/10
2b	KANE_1	Full	14-août-2016	01:59	UTC-4	79°58.723'	062°48.983'	CTD-Rosette ↑	245	105	Calm		-1.6	0.4	1009,2	99	4/10
2b	KANE_1	Full	14-août-2016	02:17	UTC-4	79°58.570'	062°50.982'	DSN ↓	244	165	Calm		-1.4	0.3	1009,3	99	4/10
2b	KANE_1	Full	14-août-2016	02:33	UTC-4	79°58.277'	069°48.966'	DSN ↑	247	080	Calm		-1.3	0.3	1009,3	99	4/10
2b	KANE_1	Full	14-août-2016	02:55	UTC-4	79°58.654'	069°49.242'	5NVS ↓	246	049	350	8	-0.8	0.2	1009,2	99	4/10
2b	KANE_1	Full	14-août-2016	03:12	UTC-4	79°58.471'	069°49.609'	5NVS ↑	245	016	350	11	-0.9	0.3	1009,3	99	4/10
2b	KANE_1	Full	14-août-2016	03:37	UTC-4	79°59.181'	069°48.066'	Agassiz Trawl ↓	243	241	350	8	-0.7	0.2	1009,1	99	4/10
2b	KANE_1	Full	14-août-2016	03:51	UTC-4	79°58.883'	069°49.785'	Agassiz Trawl ↑	245	221	350	8	-0.2	0.4	1009,3	99	4/10
2b	KANE_1	Full	14-août-2016	04:14	UTC-4	79°59.051'	069°46.913'	Box Core ↓	246	017	355	10	-0.6	0.4	1009,2	99	3/10
2b	KANE_1	Full	14-août-2016	04:20	UTC-4	79°59.043'	069°46.958'	Box Core (bottom)	247	013	355	10	-0.6	0.4	1009,2	99	3/10
2b	KANE_1	Full	14-août-2016	04:24	UTC-4	79°58.996'	069°47.132'	Box Core ↑	246	011	350	10	-0.6	0.4	1009,2	99	3/10
2b	KANE_1	Full	14-août-2016	04:32	UTC-4	79°59.980'	069°46.974'	Box Core ↓	247	032	355	9	-0.5	0.5	1009,2	99	3/10
2b	KANE_1	Full	14-août-2016	04:39	UTC-4	79°59.064'	069°46.929'	Box Core (bottom)	247	025	355	9	-0.5	0.5	1009,2	99	3/10
2b	KANE_1	Full	14-août-2016	04:42	UTC-4	79°59.055'	069°46.900'	Box Core ↑	247	020	355	9	-0.5	0.5	1009,3	99	3/10
2b	KANE_1	Full	14-août-2016	05:00	UTC-4	79°59.046'	069°46.678'	PNF + Secchi Disk ↓	248	011	350	9	-0.5	0.7	1009,0	99	3/10
2b	KANE_1	Full	14-août-2016	05:10	UTC-4	79°58.926'	069°46.964'	PNF + Secchi Disk ↑	247	033	350	9	-0.5	0.7	1009,3	99	3/10
2b	KANE_1	Full	14-août-2016	05:15	UTC-4	79°58.942'	069°47.049'	CTD-Rosette ↓	246	000	350	10	-0.5	0.7	1009,3	99	3/10
2b	KANE_1	Full	14-août-2016	05:59	UTC-4	79°58.408'	069°48.416'	CTD-Rosette ↑	247	005	000	9	-0.5	0.8	1009,1	99	3/10
2b	134	Nutrient	14-août-2016	07:46	UTC-4	80°03.285'	068°39.884'	CTD-Rosette ↓	250	054	065	7	-0.1	0.1	1008,8	96	4/10
2b	134	Nutrient	14-août-2016	08:00	UTC-4	80°03.330'	068°40.180'	CTD-Rosette (bottom)	257	065	050	5/10	-0.1	0.1	1008,8	96	4/10
2b	134	Nutrient	14-août-2016	08:29	UTC-4	80°03.290'	068°41.330'	CTD-Rosette ↑	259	083	050	5	0.0	0.4	1008,8	95	4/10
2b	136	Nutrient	14-août-2016	09:47	UTC-4	80°03.180'	067°58.850'	CTD-Rosette ↓	259	070	100	5/10	0.8	0.7	1008,3	89	2/10
2b	136	Nutrient	14-août-2016	09:59	UTC-4	80°03.280'	067°58.760'	CTD-Rosette (bottom)	256	010	100	5	0.9	0.7	1008,3	89	2/10
2b	136	Nutrient	14-août-2016	10:35	UTC-4	80°03.650'	067°58.630'	CTD-Rosette ↑	260	353	080	5	1.8	0.9	1008,1	85	2/10
2b	133	Basic	14-août-2016	16:04	UTC-4	79°33.255'	070°30.533'	PNF + Secchi Disk ↓	181	236	220	7	0.5	1.6	1007,2	93	2/10
2b	133	Basic	14-août-2016	16:12	UTC-4	79°33.251'	070°30.578'	PNF + Secchi Disk ↑	181	322	220	7	0.5	1.6	1007,2	93	2/10
2b	133	Basic	14-août-2016	16:34	UTC-4	79°33.260'	070°30.792'	CTD-Rosette ↓	184	337	230	6	0.5	1.7	1007,2	93	2/10
2b	133	Basic	14-août-2016	17:14	UTC-4	79°33.283'	070°30.939'	CTD-Rosette ↑	186	080	200	6	2.6	1.7	1007,0	86	2/10
2b	133	Basic	14-août-2016	18:02	UTC-4	79°30.941'	070°49.668'	Box Core ↓	215	117	210	5	1.2	1.0	1007,0	95	2/10
2b	133	Basic	14-août-2016	18:05	UTC-4	79°30.934'	070°49.695'	Box Core (bottom)	216	107	210	5	1.2	1.0	1007,0	95	2/10
2b	133	Basic	14-août-2016	18:09	UTC-4	79°30.925'	070°49.695'	Box Core ↑	216	108	208	5	1.2	1.0	1007,0	95	2/10
2b	133	Basic	14-août-2016	19:32	UTC-4	79°30.916'	070°49.744'	Box Core ↓	217	133	180	7	1.3	0.7	1006,5	96	2/10
2b	133	Basic	14-août-2016	19:35	UTC-4	79°30.920'	070°49.748'	Box Core (bottom)	217	133	180	7	1.3	0.7	1006,5	96	2/10
2b	133	Basic	14-août-2016	19:40	UTC-4	79°30.936'	070°49.798'	Box Core ↑	216	135	180	7	1.4	0.8	1006,5	96	2/10
2b	133	Basic	14-août-2016	18:46	UTC-4	79°30.914'	070°49.691'	CASQ Core ↓	217	103	203	6	2.1	0.8	1006,8	92	2/10
2b	133	Basic	14-août-2016	18:53	UTC-4	79°30.908'	070°49.730'	CASQ Core (bottom)	217	135	200	6	1.3	0.7	1006,8	96	2/10
2b	133	Basic	14-août-2016	19:13	UTC-4	79°30.917'	070°49.760'	CASQ Core ↑	217	135	185	6	1.2	0.7	1006,8	97	2/10
2b	133	Basic	14-août-2016	20:22	UTC-4	79°33.100'	070°30.240'	CTD-Rosette ↓	178	175	180	7	1.9	1.7	1006,3	95	1/10
2b	133	Basic	14-août-2016	20:31	UTC-4	79°33.080'	070°30.130'	CTD-Rosette (bottom)	177	180	180	7	1.3	1.7	1006,2	96	1/10

2b	133	Basic	14-août-2016	20:58	UTC-4	79°33.070'	070°29.970'	CTD-Rosette ↑	176	184	180	9	1.3	1.7	1006,1	96	1/10
2b	133	Basic	14-août-2016	21:15	UTC-4	79°33.190'	070°28.410'	DSN ↓	169	291	180	10	1.3	1.7	1006,1	96	1/10
2b	133	Basic	14-août-2016	21:23	UTC-4	79°33.200'	070°29.820'	DSN (bottom)	183	246	180	10	1.3	1.7	1006,1	96	1/10
2b	133	Basic	14-août-2016	21:30	UTC-4	79°33.060'	070°30.780'	DSN ↑	181	187	180	10	1.5	1.8	1006,0	95	1/10
2b	133	Basic	14-août-2016	21:46	UTC-4	79°32.750'	070°28.480'	5NVS ↓	166	171	190	10	1.7	1.9	1005,7	95	1/10
2b	133	Basic	14-août-2016	21:51	UTC-4	79°32.750'	070°28.440'	5NVS (bottom)	165	172	190	10	1.8	1.8	1005,7	95	1/10
2b	133	Basic	14-août-2016	21:57	UTC-4	79°32.750'	070°28.420'	5NVS ↑	165	204	190	10	1.8	1.8	1005,7	95	1/10
2b	133	Basic	14-août-2016	22:15	UTC-4	79°32.830'	070°26.530'	Agassiz Trawl ↓	167	045	180	10	1.8	1.7	1005,7	95	1/10
2b	133	Basic	14-août-2016	22:20	UTC-4	79°32.961'	070°22.230'	Agassiz Trawl (bottom)	164	350	180	10	1.8	1.7	1005,7	95	1/10
2b	133	Basic	14-août-2016	22:26	UTC-4	79°33.120'	070°26.820'	Agassiz Trawl ↑	164	294	180	10	1.8	1.7	1005,7	95	1/10
2b	133	Basic	14-août-2016	23:02	UTC-4	79°28.810'	070°34.850'	MVP ↓	192	210	220	10	1.8	1.6	1005,5	92	0/10
2b	133	Basic	15-août-2016	00:59	UTC-4	79°17.100'	071°50.300'	MVP ↑	198	215	210	9	3.1	2.1	1005,4	81	1/10
2b	133	Basic	15-août-2016	01:21	UTC-4	79°15.340'	071°59.824'	MVP ↓	219	228	210	11	3.0	1.9	1005,2	82	1/10
2b	133	Basic	15-août-2016	03:13	UTC-4	79°04.214'	073°04.688'	MVP ↑	242	228	228	8	3.8	2.3	1005,5	92	1/10
2b	KANE_5	Nutrient	15-août-2016	03:48	UTC-4	79°00.496'	073°12.615'	CTD-Rosette ↓	245	271	240	8	2.1	1.8	1005,7	85	1/10
2b	KANE_5	Nutrient	15-août-2016	04:27	UTC-4	79°00.416'	073°12.524'	CTD-Rosette ↑	244	212	230	12	2.3	1.7	1005,8	82	2/10
2b	127	Basic	15-août-2016	09:27	UTC-4	78°18.081'	074°31.069'	PNF + Secchi Disk ↓	579	219	Calm		3.7	1.6	1006,0	76	2/10
2b	127	Basic	15-août-2016	09:34	UTC-4	78°18.081'	074°31.069'	PNF + Secchi Disk ↑	579	219	Calm		4.0	1.6	1006,0	72	2/10
2b	127	Basic	15-août-2016	09:15	UTC-4	78°18.081'	074°31.069'	Zodiac ↓	579	219	Calm		3.7	1.6	1006,0	76	2/10
2b	127	Basic	15-août-2016	09:52	UTC-4	78°18.051'	074°31.859'	CTD-Rosette ↓	603	081	Calm		4.5	1.7	1005,9	72	2/10
2b	127	Basic	15-août-2016	10:50	UTC-4	78°17.570'	074°32.094'	CTD-Rosette ↑	598	195	235	4	3.0	1.8	1006,0	84	2/10
2b	127	Basic	15-août-2016	11:22	UTC-4	78°17.650'	074°32.730'	DSN ↓	609	299	Calm		3.4	1.7	1005,5	83	2/10
2b	127	Basic	15-août-2016	11:31	UTC-4	78°17.460'	074°34.280'	DSN (bottom)	616	207	Calm		3.4	1.7	1005,5	83	2/10
2b	127	Basic	15-août-2016	11:40	UTC-4	78°17.120'	074°33.720'	DSN ↑	624	094	Calm		3.4	1.7	1005,5	83	2/10
2b	127	Basic	15-août-2016	12:27	UTC-4	78°17.962'	074°28.649'	5NVS ↓	530	017	210	5	4.1	1.8	1005,1	78	2/10
2b	127	Basic	15-août-2016	13:02	UTC-4	78°17.528'	074°29.774'	5NVS ↑	554	030	Calm		4.6	1.3	1005,2	75	2/10
2b	127	Basic	15-août-2016	13:25	UTC-4	78°17.976'	074°29.235'	CTD-Rosette ↓	530	212	220	4	4.9	1.6	1005,1	72	2/10
2b	127	Basic	15-août-2016	14:29	UTC-4	78°16.957'	074°31.089'	CTD-Rosette ↑	561	210	240	4	4.7	1.7	1005,1	69	2/10
2b	127	Basic	15-août-2016	15:03	UTC-4	78°18.049'	074°28.294'	Box Core ↓	527	226	Calm		3.0	1.9	1005,2	84	2/10
2b	127	Basic	15-août-2016	15:15	UTC-4	78°17.907'	074°28.649'	Box Core (bottom)	534	276	Calm		2.9	1.9	1005,1	85	2/10
2b	127	Basic	15-août-2016	15:23	UTC-4	78°17.833'	074°28.774'	Box Core ↑	539	347	Calm		2.9	1.9	1005,1	85	2/10
2b	127	Basic	15-août-2016	15:41	UTC-4	78°18.129'	074°28.509'	Box Core ↓	521	009	Calm		4.5	2.0	1005,1	79	2/10
2b	127	Basic	15-août-2016	15:50	UTC-4	78°18.004'	074°28.697'	Box Core (bottom)	527	015	Calm		3.5	2.2	1005,1	84	2/10
2b	127	Basic	15-août-2016	15:57	UTC-4	78°18.012'	074°28.613'	Box Core ↑	526	012	Calm		4.4	2.1	1005,1	78	2/10
2b	127	Basic	15-août-2016	16:12	UTC-4	78°18.340'	074°30.036'	Agassiz Trawl ↓	534	150	Calm		4.2	1.8	1005,2	81	2/10
2b	127	Basic	15-août-2016	16:26	UTC-4	78°17.801'	074°29.740'	Agassiz Trawl (bottom)	540	140	Calm		2.9	2.0	1005,1	85	2/10
2b	127	Basic	15-août-2016	16:41	UTC-4	78°17.376'	074°29.569'	Agassiz Trawl ↑	559	140	Calm		2.6	1.8	1005,0	85	2/10
2b	119	Basic	15-août-2016	18:24	UTC-4	77°58.952'	074°58.128'	MVP ↓	644	170	090	9	2.1	1.8	1004,8	89	1/10
2b	119	Basic	15-août-2016	22:30	UTC-4	77°22.390'	075°44.450'	MVP ↑	569	225	180	5	2.3	3.2	1005,0	92	1/10
2b	119	Basic	15-août-2016	23:30	UTC-4	77°18.360'	076°08.830'	CTD-Rosette ↓	503	198	180	5	2.6	2.0	1004,7	84	2/10
2b	119	Basic	15-août-2016	23:43	UTC-4	77°18.150'	076°09.030'	CTD-Rosette (bottom)	503	192	170	5	2.6	2.6	1004,7	85	2/10
2b	119	Basic	16-août-2016	00:20	UTC-4	77°17.611'	076°09.225'	CTD-Rosette ↑	499	269	160	5	2.2	3.2	1004,6	87	2/10
2b	119	Basic	16-août-2016	00:56	UTC-4	77°20.147'	076°15.869'	DSN ↓	478	223	160	6	2.7	1.7	1004,6	84	2/10

2b	119	Basic	16-août-2016	01:11	UTC-4	77°19.656'	076°18.131'	DSN ↑	469	230	170	7	2.5	1.4	1004,6	85	2/10
2b	119	Basic	16-août-2016	01:31	UTC-4	77°19.283'	076°12.941'	5NVS ↓	492	102	160	6	2.4	1.6	1004,4	87	2/10
2b	119	Basic	16-août-2016	02:06	UTC-4	77°19.050'	076°13.374'	5NVS ↑	488	341	130	6	2.3	1.3	1004,6	89	2/10
2b	119	Basic	16-août-2016	02:29	UTC-4	77°19.296'	076°05.916'	Box Core ↓	516	034	120	5	2.2	1.3	1004,3	91	2/10
2b	119	Basic	16-août-2016	02:39	UTC-4	77°19.176'	076°05.940'	Box Core (bottom)	514	028	110	6	2.3	1.5	1004,4	91	2/10
2b	119	Basic	16-août-2016	02:45	UTC-4	77°19.194'	076°05.859'	Box Core ↑	515	010	130	5	2.4	1.5	1004,4	90	2/10
2b	119	Basic	16-août-2016	02:53	UTC-4	77°19.220'	076°06.017'	Box Core ↓	515	019	140	7	2.5	1.5	1004,4	89	2/10
2b	119	Basic	16-août-2016	02:59	UTC-4	77°19.165'	076°06.032'	Box Core (bottom)	514	012	140	6	2.5	1.5	1004,4	89	2/10
2b	119	Basic	16-août-2016	03:06	UTC-4	77°19.182'	076°06.030'	Box Core ↑	514	001	130	6	2.8	1.5	1004,3	87	2/10
2b	119	Basic	16-août-2016	03:20	UTC-4	77°19.111'	076°06.693'	Agassiz Trawl ↓	512	203	120	5	3.0	1.5	1004,3	88	2/10
2b	119	Basic	16-août-2016	03:43	UTC-4	77°18.471'	076°07.662'	Agassiz Trawl ↑	505	210	120	5	2.4	1.3	1004,3	92	2/10
2b	119	Basic	16-août-2016	04:01	UTC-4	77°18.978'	076°06.998'	PNF ↓	512	112	125	6	2.1	1.3	1004,3	92	2/10
2b	119	Basic	16-août-2016	04:06	UTC-4	77°18.875'	076°07.123'	PNF ↑	513	150	125	6	2.1	1.3	1004,3	92	2/10
2b	119	Basic	16-août-2016	04:24	UTC-4	77°19.055'	076°05.741'	CTD-Rosette ↓	514	014	125	8	2.4	1.4	1004,1	91	2/10
2b	119	Basic	16-août-2016	05:13	UTC-4	77°18.678'	076°06.201'	CTD-Rosette ↑	517	000	140	10	3.0	2.1	1004,3	87	2/10
2b	119	Basic	16-août-2016	09:50	UTC-4	76°36.490'	077°25.230'	MVP ↓	261	215	Calm		3.2	2.3	1003,3	91	1/10
2b	119	Basic	16-août-2016	14:21	UTC-4	76°04.274'	077°51.457'	MVP ↑	185	184	Calm		3.8	3.1	1001,9	94	Bergy
2b	Allen Bay	Basic	17-août-2016	18:48	UTC-4	74°43.636'	095°14.820'	CTD-Rosette ↓	70	000	340	12	2.7	3.9	1008,8	77	Bergy
2b	Allen Bay	Basic	17-août-2016	19:11	UTC-4	74°43.638'	095°14.766'	CTD-Rosette ↑	69	337	340	12	2.9	3.9	1009,1	75	Bergy
2b	Allen Bay	Basic	17-août-2016	19:23	UTC-4	74°43.688'	095°15.850'	DSN ↓	63	160	340	8	2.9	3.9	1009,1	74	Bergy
2b	Allen Bay	Basic	17-août-2016	19:36	UTC-4	74°43.345'	095°14.776'	DSN ↑	76	102	340	12	3.2	3.9	1009,4	74	Bergy
2b	Allen Bay	Basic	17-août-2016	19:52	UTC-4	74°43.661'	095°15.516'	5NVS ↓	68	326	340	15	2.4	3.9	1009,4	77	Bergy
2b	Allen Bay	Basic	17-août-2016	19:57	UTC-4	74°43.720'	095°15.580'	5NVS ↑	69	337	330	12	2.4	3.9	1009,4	79	Bergy
2b	Allen Bay	Basic	17-août-2016	20:14	UTC-4	74°43.780'	095°15.710'	Box Core ↓ Cancelled	68	338	350	15	2.5	3.9	1009,6	77	Bergy
2b	Allen Bay	Basic	17-août-2016	20:15	UTC-4	74°43.780'	095°15.690'	Box Core (bottom) Cancelled	70	341	340	15	2.5	3.9	1009,6	77	0/10
2b	Allen Bay	Basic	17-août-2016	20:17	UTC-4	74°43.780'	095°15.670'	Box Core ↑ Cancelled	70	346	340	15	2.5	3.9	1009,6	77	0/10
2b	Allen Bay	Basic	17-août-2016	20:17	UTC-4	74°43.780'	095°15.670'	Box Core ↓	70	346	340	15	2.5	3.9	1009,6	77	0/10
2b	Allen Bay	Basic	17-août-2016	20:20	UTC-4	74°43.780'	095°15.650'	Box Core (bottom)	71	349	340	15	2.5	3.9	1009,6	77	0/10
2b	Allen Bay	Basic	17-août-2016	20:22	UTC-4	74°43.770'	095°15.630'	Box Core ↑	71	352	340	15	2.5	3.9	1009,6	77	0/10
2b	Allen Bay	Basic	17-août-2016	20:35	UTC-4	74°43.550'	095°15.940'	Agassiz Trawl ↓	85	140	340	15	2.2	3.9	1009,6	82	0/10
2b	Allen Bay	Basic	17-août-2016	20:37	UTC-4	74°43.490'	095°15.730'	Agassiz Trawl (bottom)	85	116	340	15	2.2	3.9	1009,6	82	0/10
2b	Allen Bay	Basic	17-août-2016	20:42	UTC-4	74°43.410'	095°15.280'	Agassiz Trawl ↑	82	094	340	15	2.3	3.9	1009,6	77	0/10
2b	305	Basic	18-août-2016	01:03	UTC-4	74°19.750'	094°58.728'	CTD-Rosette ↓	171	342	340	11	1.0	1.4	1010,3	83	1/10
2b	305	Basic	18-août-2016	01:39	UTC-4	74°19.778'	094°58.126'	CTD-Rosette ↑	172	273	340	10	0.7	1.6	1010,6	85	1/10
2b	305	Basic	18-août-2016	01:47	UTC-4	74°19.588'	094°58.226'	DSN ↓	172	143	340	12	0.5	1.5	1010,7	87	1/10
2b	305	Basic	18-août-2016	02:02	UTC-4	74°19.655'	094°56.290'	DSN ↑	175	016	330	16	0.4	1.1	1010,7	86	1/10
2b	305	Basic	18-août-2016	02:15	UTC-4	74°19.834'	094°55.818'	5NVS ↓	178	336	330	14	0.6	0.9	1010,8	84	1/10
2b	305	Basic	18-août-2016	02:27	UTC-4	74°19.848'	094°55.636'	5NVS ↑	178	320	310	16	0.6	0.9	1010,8	83	1/10
2b	305	Basic	18-août-2016	02:48	UTC-4	74°19.743'	094°59.121'	Box Core ↓	171	342	330	15	0.2	1.1	1010,8	90	1/10
2b	305	Basic	18-août-2016	02:50	UTC-4	74°19.746'	094°59.060'	Box Core (bottom)	171	348	340	16	0.2	1.1	1010,8	91	1/10
2b	305	Basic	18-août-2016	02:53	UTC-4	74°19.749'	094°59.023'	Box Core ↑	171	339	330	16	0.1	1.4	1011,1	90	1/10
2b	305	Basic	18-août-2016	03:06	UTC-4	74°20.071'	094°58.203'	Agassiz Trawl ↓	172	043	330	14	0.2	1.5	1011,2	87	1/10
2b	305	Basic	18-août-2016	03:18	UTC-4	74°20.231'	094°57.057'	Agassiz Trawl ↑	173	045	340	15	0.3	1.5	1011,2	78	1/10

2b	305	Basic	18-août-2016	03:30	UTC-4			Mapping									1/10
2b	305	Basic	18-août-2016	05:13	UTC-4	74°19.749'	094°59.034'	CTD-Rosette ↓	170	130	290	13	0.6	1.4	1011,9	81	1/10
2b	305	Nutrient	18-août-2016	06:00	UTC-4	74°19.735'	094°58.964'	CTD-Rosette ↑	171	287	310	15	0.0	1.4	1012,1	82	1/10
2b	306	Nutrient	18-août-2016	10:34	UTC-4	74°24.860'	098°11.110'	CTD-Rosette ↓	137	263	260	10	-0.4	0.2	1014,2	86	1/10
2b	306	Nutrient	18-août-2016	10:42	UTC-4	74°24.840'	098°11.010'	CTD-Rosette (bottom)	137	271	260	10	-0.4	0.1	1014,2	87	1/10
2b	306	Nutrient	18-août-2016	11:03	UTC-4	74°24.770'	098°10.520'	CTD-Rosette ↑	135	263	250	10	-0.4	0.2	1014,1	88	1/10
2b	306	Nutrient	18-août-2016	14:08	UTC-4	74°34.958'	098°52.189'	Core ↓	215	308	270	14	0.7	-0.3	1014,2	92	
2b	306	Nutrient	18-août-2016	14:12	UTC-4	74°34.950'	098°52.107'	Core (bottom)	214	308	270	11	0.2	-0.3	1014,3	94	
2b	306	Nutrient	18-août-2016	14:16	UTC-4	74°34.913'	098°51.925'	Core ↑	214	308	270	13	0.2	-0.3	1014,3	94	
2b	306	Nutrient	18-août-2016					Ice Floes (Martine)									
2b	310E	Basic	19-août-2016	11:16	UTC-4	71°17.520'	097°42.000'	PNF ↓	131	229	190	25	2.2	3.5	1015,6	91	0/10
2b	310E	Basic	19-août-2016	11:22	UTC-4	71°17.560'	097°42.070'	PNF ↑	131	258	190	25	2.2	3.5	1015,6	91	0/10
2b	310E	Basic	19-août-2016	11:29	UTC-4	71°17.590'	097°42.150'	Secchi Disk ↓	131	216	200	25	2.1	3.5	1016,6	91	0/10
2b	310E	Basic	19-août-2016	11:31	UTC-4	71°17.600'	097°42.150'	Secchi Disk ↑	131	212	200	25	2.1	3.5	1016,6	91	0/10
2b	310E	Basic	19-août-2016	12:13	UTC-4	71°17.622'	097°42.180'	CTD-Rosette ↓	131	224	190	28	2.3	3.4	1014,8	89	0/10
2b	310E	Basic	19-août-2016	12:47	UTC-4	71°17.894'	097°41.693'	CTD-Rosette ↑	132	242	190	26	2.3	3.3	1014,8	89	0/10
2b	310E	Basic	19-août-2016	12:57	UTC-4	71°17.358'	097°42.178'	DSN ↓	125	213	190	25	2.4	3.3	1014,7	89	0/10
2b	310E	Basic	19-août-2016	13:15	UTC-4	71°16.806'	097°43.335'	DSN ↑	103	168	190	23	2.3	3.2	1014,5	90	0/10
2b	310E	Basic	19-août-2016	13:36	UTC-4	71°17.017'	097°42.345'	5NVS ↓	119	188	190	22	2.2	2.9	1014,8	91	0/10
2b	310E	Basic	19-août-2016	13:45	UTC-4	71°17.046'	097°42.164'	5NVS ↑	122	200	190	24	2.2	2.6	1014,8	91	0/10
2b	310E	Basic	19-août-2016	14:27	UTC-4	71°17.566'	097°42.194'	CTD-Rosette ↓	130	223	190	29	2.3	3.2	1014,0	89	0/10
2b	310E	Basic	19-août-2016	15:02	UTC-4	71°17.722'	097°41.535'	CTD-Rosette ↑	136	231	190	27	2.4	3.0	1014,2	87	0/10
2b	310E	Basic	19-août-2016					Box Core ↓	Cancelled								0/10
2b	310E	Basic	19-août-2016					Box Core (bottom)									0/10
2b	310E	Basic	19-août-2016					Box Core ↑									0/10
2b	310E	Basic	19-août-2016	15:13	UTC-4	71°17.411'	097°41.890'	Agassiz Trawl ↓	130	231	190	25	2.4	3.0	1013,8	88	0/10
2b	310E	Basic	19-août-2016	15:25	UTC-4	71°17.298'	097°42.621'	Agassiz Trawl ↑	121	203	190	25	2.3	2.9	1013,9	88	0/10
2b	311	Nutrient	19-août-2016	21:17	UTC-4	70°16.190'	098°31.300'	CTD-Rosette ↓	149	190	190	20	3.4	3.0	1013,6	89	Bergy
2b	311	Nutrient	19-août-2016	21:25	UTC-4	70°16.200'	098°31.000'	CTD-Rosette (bottom)	140	197	190	20	3.5	2.8	1013,7	88	Bergy
2b	311	Nutrient	19-août-2016	21:50	UTC-4	70°16.180'	098°30.440'	CTD-Rosette ↑	137	199	180	20	3.4	2.6	1013,5	88	Bergy
2b	311	Nutrient	19-août-2016	22:02	UTC-4	70°16.430'	098°30.530'	DSN ↓	141	337	180	20	3.7	2.6	1013,5	87	Bergy
2b	311	Nutrient	19-août-2016	22:08	UTC-4	70°16.610'	098°30.720'	DSN (bottom)	143	315	180	20	3.7	2.6	1013,5	87	Bergy
2b	311	Nutrient	19-août-2016	22:18	UTC-4	70°16.940'	098°31.230'	DSN ↑	163	309	180	20	3.7	2.6	1013,5	87	Bergy
2b	311	Nutrient	19-août-2016	22:54	UTC-4	70°16.060'	098°32.030'	5NVS ↓	155	211	190	25	3.7	3.0	1012,8	85	Bergy
2b	311	Nutrient	19-août-2016	22:58	UTC-4	70°16.070'	098°32.040'	5NVS (bottom)	154	223	180	20	3.6	3.0	1012,8	85	Bergy
2b	311	Nutrient	19-août-2016	23:05	UTC-4	70°16.090'	098°32.090'	5NVS ↑	155	225	180	20	3.6	3.0	1012,8	85	Bergy
2b	311	Nutrient	19-août-2016	23:15	UTC-4	70°15.900'	098°32.240'	Agassiz Trawl ↓	151	215	180	25	3.7	2.8	1012,8	86	Bergy
2b	311	Nutrient	19-août-2016	23:18	UTC-4	70°15.840'	098°32.470'	Agassiz Trawl (bottom)	151	217	180	20	3.7	2.8	1012,8	86	Bergy
2b	311	Nutrient	19-août-2016	23:25	UTC-4	70°15.750'	098°32.810'	Agassiz Trawl ↑	168	212	180	20	3.7	2.8	1011,8	86	Bergy
2b	312	Basic	20-août-2016	08:19	UTC-4	69°10.300'	100°41.900'	PNF ↓	68	200	170	20	5.7	4.7	1009,7	84	0/10
2b	312	Basic	20-août-2016	08:25	UTC-4	69°10.360'	100°41.870'	PNF ↑	68	216	170	20	5.7	4.7	1009,7	84	0/10
2b	312	Basic	20-août-2016	08:26	UTC-4	69°10.360'	100°41.890'	Secchi Disk ↓	68	205	170	20	5.7	4.7	1009,7	84	0/10
2b	312	Basic	20-août-2016	08:28	UTC-4	69°10.380'	100°41.880'	Secchi Disk ↑	68	217	170	20	5.7	4.7	1009,7	84	0/10

2b	312	Basic	20-août-2016	08:38	UTC-4	69°10.320'	100°41.710'	CTD-Rosette ↓	66	177	160	20	5.8	4.8	1009,9	84	0/10
2b	312	Basic	20-août-2016	08:45	UTC-4	69°10.400'	100°41.510'	CTD-Rosette (bottom)	67	178	170	20	5.9	4.8	1009,9	84	0/10
2b	312	Basic	20-août-2016	09:05	UTC-4	69°10.590'	100°41.100'	CTD-Rosette ↑	66	173	170	20	5.8	4.7	1009,9	85	0/10
2b	312	Basic	20-août-2016	09:16	UTC-4	69°10.550'	100°41.790'	DSN ↓	67	233	190	25	5.8	4.7	1009,9	85	0/10
2b	312	Basic	20-août-2016	09:22	UTC-4	69°10.500'	100°42.300'	DSN (bottom)	68	230	190	20	5.9	4.8	1009,7	85	0/10
2b	312	Basic	20-août-2016	09:25	UTC-4	69°10.440'	100°42.660'	DSN ↑	63	215	190	20	5.9	4.8	1009,7	85	0/10
2b	312	Basic	20-août-2016	09:44	UTC-4	69°10.300'	100°42.190'	5NVS ↓	68	195	170	20	6.0	5.0	1009,6	85	0/10
2b	312	Basic	20-août-2016	09:46	UTC-4	69°10.300'	100°42.210'	5NVS (bottom)	68	191	170	20	6.0	5.0	1009,6	85	0/10
2b	312	Basic	20-août-2016	09:49	UTC-4	69°10.300'	100°42.230'	5NVS ↑	68	196	170	20	6.0	5.0	1009,6	85	0/10
2b	312	Basic	20-août-2016	10:25	UTC-4	69°10.260'	100°41.930'	CTD-Rosette ↓	67	163	180	15/20	6.0	5.0	1009,8	85	0/10
2b	312	Basic	20-août-2016	10:36	UTC-4	69°10.290'	100°41.900'	CTD-Rosette (bottom)	68	170	180	15/20	6.1	5.0	1009,9	85	0/10
2b	312	Basic	20-août-2016	10:52	UTC-4	69°10.330'	100°41.890'	CTD-Rosette ↑	68	165	170	15/20	6.2	4.8	1009,9	86	0/10
2b	312	Basic	20-août-2016	11:05	UTC-4	69°10.230'	100°42.440'	Agassiz Trawl ↓	67	240	180	20	6.1	4.8	1009,9	85	0/10
2b	312	Basic	20-août-2016	11:07	UTC-4	69°10.220'	100°42.580'	Agassiz Trawl (bottom)	64	237	180	20	6.1	4.8	1009,9	85	0/10
2b	312	Basic	20-août-2016	11:12	UTC-4	69°10.210'	100°42.980'	Agassiz Trawl ↑	65	241	180	20	6.1	4.8	1009,9	85	0/10
2b	312	Basic	20-août-2016	12:15	UTC-4	69°10.191'	100°41.901'	Box Core ↓	66	173	180	17	6.9	4.7	1009,9	81	0/10
2b	312	Basic	20-août-2016	12:17	UTC-4	69°10.191'	100°41.968'	Box Core (bottom)	67	176	180	17	6.9	4.7	1009,9	81	0/10
2b	312	Basic	20-août-2016	12:19	UTC-4	69°10.187'	100°42.028'	Box Core ↑	68	165	180	17	6.9	4.7	1009,9	81	0/10
2b	312	Basic	20-août-2016	12:31	UTC-4	69°10.174'	100°42.062'	Box Core ↓	67	169	180	15	6.5	4.9	1010,0	83	0/10
2b	312	Basic	20-août-2016	12:33	UTC-4	69°10.165'	100°42.131'	Box Core (bottom)	67	169	190	15	6.5	4.8	1010,1	83	0/10
2b	312	Basic	20-août-2016	12:35	UTC-4	69°10.161'	100°42.201'	Box Core ↑	67	161	190	15	6.5	4.8	1010,1	83	0/10
2b	QMGM	Basic	20-août-2016	17:56	UTC-4	68°14.484'	101°47.353'	PNF ↓	108	260	130	10	11.0	9.4	1009,2	81	0/10
2b	QMGM	Basic	20-août-2016	18:04	UTC-4	68°14.552'	101°47.240'	PNF ↑	112	285	135	11	11.3	10.0	1009,2	79	0/10
2b	QMGM	Basic	20-août-2016	18:35	UTC-4	68°14.706'	101°46.896'	CTD-Rosette ↓	111	138	120	10	11.5	9.9	1009,2	79	0/10
2b	QMGM	Basic	20-août-2016	18:20	UTC-4			Helicopter									0/10
2b	QMGM	Basic	20-août-2016	18:45	UTC-4	68°14.747'	101°46.769'	CTD-Rosette ↑		200			11.2	9.3	1009,0		
2b	QMGM	Basic	20-août-2016	18:50	UTC-4	68°14.327'	101°48.752'	Mooring Recovery ↑	90	0-360	111	15	11.3	10.0	1008,9	82	0/10
2b	QMGM	Basic	20-août-2016	19:46	UTC-4	68°14.350'	101°48.152'	Mooring on Deck	92	089	120	11	11.9	9.7	1008,9	81	0/10
2b	QMGM	Basic	20-août-2016	20:29	UTC-4	68°18.070'	101°44.660'	CTD-Rosette ↓	112	100	130	15	11.3	9.9	1008,8	83	0/10
2b	QMGM	Basic	20-août-2016	20:36	UTC-4	68°18.040'	101°44.590'	CTD-Rosette (bottom)	112	095	130	15	11.0	9.5	1008,7	84	0/10
2b	QMGM	Basic	20-août-2016	20:56	UTC-4	68°18.000'	101°44.350'	CTD-Rosette ↑	114	090	130	15	10.9	9.1	1008,6	83	0/10
2b	QMGM	Basic	20-août-2016	21:05	UTC-4	68°18.180'	101°44.390'	DSN ↓	112	327	130	15	11.0	9.1	1008,6	83	0/10
2b	QMGM	Basic	20-août-2016	21:14	UTC-4	68°18.180'	101°45.190'	DSN (bottom)	116	217	130	15	11.0	9.1	1008,6	83	0/10
2b	QMGM	Basic	20-août-2016	21:21	UTC-4	68°17.920'	101°45.380'	DSN ↑	115	169	130	15	11.0	9.1	1008,6	83	0/10
2b	QMGM	Basic	20-août-2016	21:36	UTC-4	68°18.150'	101°44.480'	5NVS ↓	118	131	130	15	11.0	9.4	1008,5	83	0/10
2b	QMGM	Basic	20-août-2016	21:39	UTC-4	68°18.140'	101°44.490'	5NVS (bottom)	118	117	130	15	11.0	9.4	1008,5	83	0/10
2b	QMGM	Basic	20-août-2016	21:45	UTC-4	68°18.140'	101°44.490'	5NVS ↑	118	092	130	15	11.0	9.4	1008,5	83	0/10
2b	QMGM	Basic	20-août-2016	22:00	UTC-4	68°18.290'	101°45.500'	Beam Trawl ↓	112	246	130	15	11.2	9.2	1008,5	79	0/10
2b	QMGM	Basic	20-août-2016	22:06	UTC-4	68°18.090'	101°45.980'	Bean Trawl (bottom)	113	185	130	15	11.2	9.2	1008,5	79	0/10
2b	QMGM	Basic	20-août-2016	22:33	UTC-4	68°16.900'	101°46.750'	Beam Trawl ↑	117	188	140	15	11.1	9.4	1008,4	80	0/10
2b	QMGM	Basic	20-août-2016	22:57	UTC-4	68°18.160'	101°44.620'	Box Core ↓	113	134	140	17	11.4	9.5	1008,3	79	0/10
2b	QMGM	Basic	20-août-2016	22:59	UTC-4	68°18.150'	101°44.630'	Box Core (bottom)	117	121	140	17	11.4	9.5	1008,3	79	0/10
2b	QMGM	Basic	20-août-2016	23:01	UTC-4	68°18.140'	101°44.640'	Box Core ↑	114	126	140	17	11.4	9.5	1008,3	79	0/10

2b	QMGM	Basic	20-août-2016	23:07	UTC-4	68°18.130'	101°44.620'	Box Core ↓	118	112	140	17	11.3	9.5	1008,3	78	0/10
2b	QMGM	Basic	20-août-2016	23:09	UTC-4	68°18.130'	101°44.610'	Box Core (bottom)	118	101	150	17	11.3	9.5	1008,3	78	0/10
2b	QMGM	Basic	20-août-2016	23:11	UTC-4	68°18.140'	101°44.610'	Box Core ↑	113	095	150	17	11.3	9.5	1008,3	78	0/10
2b	QMGM	Basic	20-août-2016	23:27	UTC-4	68°18.160'	101°45.060'	Agassiz Trawl ↓	115	241	150	16	11.5	9.2	1008,2	77	0/10
2b	QMGM	Basic	20-août-2016	23:30	UTC-4	68°18.130'	101°45.240'	Agassiz Trawl (bottom)	112	240	150	17	11.5	9.2	1008,2	77	0/10
2b	QMGM	Basic	20-août-2016	23:35	UTC-4	68°18.090'	101°45.560'	Agassiz Trawl ↑	112	232	150	17	11.5	9.2	1008,2	77	0/10
2b	QMGM	Basic	21-août-2016	00:17	UTC-4	68°18.204'	101°44.599'	CTD-Rosette ↓	113	133	150	17	11.3	9.2	1008,2	76	0/10
2b	QMGM	Basic	21-août-2016	00:54	UTC-4	68°18.274'	101°44.742'	CTD-Rosette ↑	112	115	150	17	11.1	9.2	1008,1	76	0/10
2b	GMG2	Basic	21-août-2016	03:48	UTC-4	68°18.818'	100°48.041'	CTD-Rosette ↓	53	127	160	14	8.9	9.0	1008,2	77	0/10
2b	GMG2	Basic	21-août-2016	04:05	UTC-4	68°18.824'	100°47.909'	CTD-Rosette ↑	56	148	160	14	8.9	8.3	1008,2	76	0/10
2b	GMG2	Basic	21-août-2016	04:14	UTC-4	68°18.758'	100°48.151'	DSN ↓	60	285	160	14	8.9	8.3	1008,2	76	0/10
2b	GMG2	Basic	21-août-2016	04:29	UTC-4	68°18.530'	100°49.150'	DSN ↑	57	140	160	16	8.8	8.5	1008,0	74	0/10
2b	GMG2	Basic	21-août-2016	04:43	UTC-4	68°18.787'	100°47.963'	5NVS ↓	58	114	165	14	9.0	8.9	1008,0	77	0/10
2b	GMG2	Basic	21-août-2016	04:50	UTC-4	68°18.797'	100°47.927'	5NVS ↑	55	127	160	13	8.8	8.5	1007,9	78	0/10
2b	GMG2	Basic	21-août-2016	05:25	UTC-4	68°18.795'	100°47.878'	Zodiac ↓	55	220	145	12	8.6	8.1	1007,9	77	0/10
2b	GMG2	Basic	21-août-2016	05:37	UTC-4	68°18.833'	100°48.258'	Beam Trawl ↓	58	250	160	12	8.4	8.3	1007,7	77	0/10
2b	GMG2	Basic	21-août-2016	05:42	UTC-4	68°18.723'	100°48.209'	Beam Trawl (bottom)	67	067	155	13	8.3	8.6	1007,6	80	0/10
2b	GMG2	Basic	21-août-2016	06:10	UTC-4	68°18.929'	100°51.222'	Beam Trawl ↑	107	200	160	15	8.3	8.5	1007,6	80	0/10
2b	GMG2	Basic	21-août-2016	06:30	UTC-4	68°16.838'	100°49.854'	Zodiac ↑		240	160	18	8.5	8.3	1007.5	78	0/10
2b	GMG2	Basic	21-août-2016	06:57	UTC-4	68°18.810'	100°47.911'	Box Core ↓	56	077	175	16	8.8	8.5	1007.3	77	0/10
2b	GMG2	Basic	21-août-2016	06:59	UTC-4	68°18.826'	100°47.943'	Box Core (bottom)	56	073	170	15	9.0	8.6	1007.4	76	0/10
2b	GMG2	Basic	21-août-2016	07:03	UTC-4	68°18.840'	100°48.005'	Box Core ↑	55	058	173	17	9.0	8.6	1007.4	76	0/10
2b	GMG2	Basic	21-août-2016	07:15	UTC-4	68°18.861'	100°48.426'	Agassiz Trawl ↓	57	265	170	14	9.1	7.8	1007.3	76	0/10
2b	GMG2	Basic	21-août-2016	07:25	UTC-4	68°18.870'	100°48.845'	Agassiz Trawl ↑	58	265	170	14	8.7	7.7	1007.2	77	0/10
2b	WF1	Mooring	21-août-2016	10:52	UTC-4	68°14.794'	101°48.094'	Mooring Deployment ↓	113	122	175	15	9.6	9.8	1006.1	84	0/10
2b	WF1	Mooring	21-août-2016	11:12	UTC-4	68°14.797'	101°48.262'	Mooring (bottom)	114	102	175	11	9.7	9.4	1006.1	84	0/10
2b	WF1	Mooring	21-août-2016	15:11	UTC-4	68°14.948'	101°48.468'	CTD-Rosette ↓	97	145	160	13	11.8	10.2	1005.7	79	0/10
2b	WF1	Mooring	21-août-2016	15:21	UTC-4	68°14.990'	101°48.443'	CTD-Rosette ↑	98	150	160	14	11.8	10.2	1005.7	79	0/10
2b	WF1	Mooring	21-août-2016	12:12	UTC-4	68°14.987'	101°48.889'	Mooring Recovery ↑	113		160	13	10.3	10.0	1006.0	83	0/10
2b	WF1	Mooring	21-août-2016	12:55	UTC-4	68°15.059'	101°49.629'	Mooring on Deck	101	150	170	13	10.3	9.5	1005.9	83	0/10
2b	WF1	Mooring	21-août-2016	13:37	UTC-4	68°14.833'	101°48.229'	Mooring Deployment ↓	108	148	160	12	10.6	10.1	1005.8	83	0/10
2b	WF1	Mooring	21-août-2016	14:22	UTC-4	68°14.868'	101°48.550'	Camera Calibration	98	353	150	15	11.2	10.1	1005.7	82	0/10
2b	WF1	Mooring	21-août-2016	14:44	UTC-4	68°15.083'	101°48.923'	Camera Calibration	91	358	160	13	14.2	9.9	1005.7	70	0/10
2b	WF1	Mooring	21-août-2016	14:51	UTC-4	68°15.180'	101°49.136'	Zodiac ↑	92	256	160	13	14.2	9.9	1005.7	70	0/10
2b	QMG1	Basic	22-août-2016	06:10	UTC-4	68°29.499'	099°53.784'	CTD-Rosette ↓	42	013	000	23	4.0	6.3	1010,0	98	0/10
2b	QMG1	Basic	22-août-2016	06:37	UTC-4	68°29.514'	099°53.800'	CTD-Rosette ↑	42	019	010	20	4.0	6.2	1010,3	96	0/10
2b	QMG1	Basic	22-août-2016	06:44	UTC-4	68°29.468'	099°53.406'	DSN ↓	37	068	015	26	4.1	6.1	1010,4	95	0/10
2b	QMG1	Basic	22-août-2016	06:53	UTC-4	68°29.409'	099°52.774'	DSN ↑	44	170	010	26	4.0	6.1	1010,5	95	0/10
2b	QMG1	Basic	22-août-2016	07:05	UTC-4	68°29.475'	099°53.679'	5NVS ↓	41	015	025	25	4.3	6.1	1010,6	95	0/10
2b	QMG1	Basic	22-août-2016	07:14	UTC-4	68°29.503'	099°53.795'	5NVS ↑	45	313	020	25	4.3	6.1	1010,6	95	0/10
2b	QMG1	Basic	22-août-2016	07:32	UTC-4	68°29.505'	099°53.926'	Beam Trawl ↓	40	068	015	26	3.8	5.9	1011,0	95	0/10
2b	QMG1	Basic	22-août-2016	07:57	UTC-4	68°29.590'	099°50.790'	Beam Trawl ↑	28	051	010	30	3.7	5.9	1011,1	95	0/10
2b	QMG1	Basic	22-août-2016	09:08	UTC-4	68°29.510'	099°53.990'	Agassiz Trawl ↓	45	048	010	30	3.2	5.9	1011,7	94	0/10

2b	QMG1	Basic	22-août-2016	09:18	UTC-4	68°29.550'	099°53.340'	Agassiz Trawl ↑	33	039	010	30	2.9	5.9	1012,1	95	0/10
2b	QMG1	Basic	22-août-2016	09:48	UTC-4	68°29.540'	099°53.750'	Box Core ↓	40	023	000	30	2.6	5.8	1012,3	96	0/10
2b	QMG1	Basic	22-août-2016	09:50	UTC-4	68°29.540'	099°53.750'	Box Core (bottom)	43	017	000	30	2.6	5.8	1012,3	96	0/10
2b	QMG1	Basic	22-août-2016	09:51	UTC-4	68°29.530'	099°53.750'	Box Core ↑	44	020	000	30	2.6	5.8	1012,3	96	0/10
2b	QMG1	Basic	22-août-2016	10:00	UTC-4	68°29.520'	099°53.700'	Box Core ↓	41	019	010	30	2.2	5.8	1012,5	98	0/10
2b	QMG1	Basic	22-août-2016	10:02	UTC-4	68°29.520'	099°53.700'	Box Core (bottom)	41	013	010	30	2.2	5.8	1012,5	98	0/10
2b	QMG1	Basic	22-août-2016	10:03	UTC-4	68°29.520'	099°53.700'	Box Core ↑	41	017	010	30	2.2	5.8	1012,5	98	0/10
2b	GMG3	Basic	22-août-2016	16:37	UTC-4	68°19.754'	102°56.660'	CTD-Rosette ↓	53	060	000	15	3.5	8.0	1017,0	88	0/10
2b	GMG3	Basic	22-août-2016	17:00	UTC-4	68°19.780'	102°56.696'	CTD-Rosette ↑	54	090	000	10	2.5	8.0	1017,0	88	0/10
2b	GMG3	Basic	22-août-2016	17:52	UTC-4	68°19.808'	102°56.895'	DSN ↓	58	240	010	14	2.8	7.9	1017,0	89	0/10
2b	GMG3	Basic	22-août-2016	18:04	UTC-4	68°19.422'	102°56.982'	DSN ↑	52	140	010	14	3.3	8.0	1017,3	86	0/10
2b	GMG3	Basic	22-août-2016	18:15	UTC-4	68°19.632'	102°56.434'	5NVS ↓	48	010	000	15	3.3	8.2	1017,2	88	0/10
2b	GMG3	Basic	22-août-2016	18:20	UTC-4	68°19.653'	102°56.479'	5NVS ↑	47	115	010	15	2.7	8.2	1017,0	88	0/10
2b	GMG3	Basic	22-août-2016	18:37	UTC-4	68°20.124'	102°56.673'	Beam Trawl ↓	54	258	010	14	2.8	8.2	1017,9	87	0/10
2b	GMG3	Basic	22-août-2016	18:43	UTC-4	68°20.012'	102°56.885'	Beam Trawl (bottom)	59	200	000	9	3.4	8.2	1017,3	85	0/10
2b	GMG3	Basic	22-août-2016	19:10	UTC-4	68°19.158'	102°55.947'	Beam Trawl ↑	54	086	018	10	4.0	8.2	1017,5	81	0/10
2b	GMG3	Basic	22-août-2016	19:17	UTC-4	68°19.901'	102°55.361'	Agassiz Trawl ↓	50	320	010	14	3.1	8.4	1017,5	85	0/10
2b	GMG3	Basic	22-août-2016	19:25	UTC-4	68°19.978'	102°55.874'	Agassiz Trawl ↑	55	260	015	14	3.1	8.3	1017,9	84	0/10
2b	GMG3	Basic	22-août-2016	19:40	UTC-4	68°19.716'	102°56.472'	Box Core ↓	49	148	020	11	3.8	8.2	1017,5	84	0/10
2b	GMG3	Basic	22-août-2016	19:42	UTC-4	68°19.717'	102°56.458'	Box Core (bottom)	49	156	020	11	3.8	8.2	1017,5	84	0/10
2b	GMG3	Basic	22-août-2016	19:44	UTC-4	68°19.716'	102°56.431'	Box Core ↑	50	132	015	12	3.5	8.3	1017,6	83	0/10
2b	GMG4	Basic	22-août-2016	21:22	UTC-4	68°29.050'	103°25.710'	CTD-Rosette ↓	68	342	030	10	3.5	8.4	1017,6	82	0/10
2b	GMG4	Basic	22-août-2016	21:28	UTC-4	68°29.060'	103°25.700'	CTD-Rosette (bottom)	68	344	030	10	3.5	8.4	1017,6	82	0/10
2b	GMG4	Basic	22-août-2016	21:45	UTC-4	68°29.050'	103°25.740'	CTD-Rosette ↑	69	347	030	10	3.3	8.5	1017,8	82	0/10
2b	GMG4	Basic	22-août-2016	21:55	UTC-4	68°28.920'	103°26.070'	DSN ↓	74	172	030	10	3.3	8.5	1017,8	82	0/10
2b	GMG4	Basic	22-août-2016	22:04	UTC-4	68°28.650'	103°25.310'	DSN ↑	65	100	040	10	3.4	8.6	1017,9	81	0/10
2b	GMG4	Basic	22-août-2016	22:18	UTC-4	68°29.060'	103°25.720'	5NVS ↓	68	000	020	10	3.2	8.6	1017,7	84	0/10
2b	GMG4	Basic	22-août-2016	22:24	UTC-4	68°29.060'	103°25.690'	5NVS ↑	68	008	020	10	3.2	8.6	1017,7	84	0/10
2b	GMG4	Basic	22-août-2016	22:39	UTC-4	68°28.810'	103°25.760'	Beam Trawl ↓	66	129	020	10	3.4	8.7	1017,7	83	0/10
2b	GMG4	Basic	22-août-2016	22:44	UTC-4	68°28.710'	103°25.360'	Beam Trawl (bottom)	68	105	020	10	3.4	8.7	1017,7	83	0/10
2b	GMG4	Basic	22-août-2016	23:08	UTC-4	68°28.650'	103°22.250'	Beam Trawl ↑	65	026	020	10	3.1	8.6	1017,7	86	0/10
2b	GMG4	Basic	22-août-2016	23:23	UTC-4	68°28.830'	103°23.930'	Agassiz Trawl ↓	70	162	020	10	3.4	8.4	1017,7	86	0/10
2b	GMG4	Basic	22-août-2016	23:33	UTC-4	68°28.610'	103°23.400'	Agassiz Trawl ↑	74	095	020	10	3.3	8.5	1017,8	84	0/10
2b	GMG4	Basic	22-août-2016	23:50	UTC-4	68°29.020'	103°25.630'	Box Core ↓	69	348	330	5/10	3.3	8.6	1017,8	84	0/10
2b	GMG4	Basic	22-août-2016	23:52	UTC-4	68°29.020'	103°25.620'	Box Core (bottom)	70	348	330	5/10	3.3	8.6	1017,8	84	0/10
2b	GMG4	Basic	22-août-2016	23:53	UTC-4	68°29.020'	103°25.620'	Box Core ↑	69	348	330	5	3.3	8.6	1017,8	84	0/10
2b	GMG4	Basic	23-août-2016	00:01	UTC-4	68°29.089'	103°25.708'	Box Core ↓	67	328	320	3	3.2	8.5	1017,7	84	0/10
2b	GMG4	Basic	23-août-2016	00:02	UTC-4	68°29.085'	103°25.712'	Box Core (bottom)	67	325	320	3	3.2	8.6	1017,7	84	0/10
2b	GMG4	Basic	23-août-2016	00:04	UTC-4	68°29.082'	103°25.708'	Box Core ↑	67	327	320	3	3.2	8.6	1017,7	84	0/10
2b	314	Full	23-août-2016	06:15	UTC-4	68°58.287'	105°28.560'	Zodiac ↓	79	140	140	11	4.2	8.2	1016,4	83	0/10
2b	314	Full	23-août-2016	06:35	UTC-4	68°58.219'	105°28.551'	CTD-Rosette ↓	75	107	140	12	4.1	8.2	1016,3	83	0/10
2b	314	Full	23-août-2016	07:01	UTC-4	68°58.247'	105°28.432'	CTD-Rosette ↑	81	180	135	12	4.0	8.3	1015,9	83	0/10
2b	314	Full	23-août-2016	07:07	UTC-4	68°58.263'	105°28.776'	DSN ↓	74	240	155	8	4.0	8.3	1015,9	83	0/10

2b	314	Full	23-août-2016	07:23	UTC-4	68°58.423'	105°30.893'	DSN ↑	81	244	110	7	3.9	8.6	1015,8	84	0/10
2b	314	Full	23-août-2016	08:27	UTC-4	68°58.184'	105°28.114'	PNF + Secchi Disk ↓	74	0-360	150	15	3.9	8.4	1015,0	85	0/10
2b	314	Full	23-août-2016	08:39	UTC-4	68°58.210'	105°28.330'	PNF + Secchi Disk ↑	81	161	150	15/20	4.0	8.4	1015,3	85	0/10
2b	314	Full	23-août-2016	08:51	UTC-4	68°58.220'	105°28.300'	5NVS ↓	82	170	140	15	4.0	8.4	1015,3	86	0/10
2b	314	Full	23-août-2016	08:58	UTC-4	68°58.270'	105°28.440'	5NVS ↑	80	169	160	15	4.0	8.4	1015,3	86	0/10
2b	314	Full	23-août-2016	09:16	UTC-4	68°58.250'	105°28.530'	CTD-Rosette ↓	77	158	160	15	4.2	8.4	1015,1	85	0/10
2b	314	Full	23-août-2016	09:22	UTC-4	68°58.290'	105°28.540'	CTD-Rosette (bottom)	78	150	150	15	4.2	8.4	1015,0	85	0/10
2b	314	Full	23-août-2016	09:45	UTC-4	68°58.500'	105°28.520'	CTD-Rosette ↑	77	145	150	15	4.4	8.4	1014,8	85	0/10
2b	314	Full	23-août-2016	10:02	UTC-4	68°58.660'	105°29.480'	Beam Trawl ↓	80	204	160	18	4.3	8.4	1014,7	86	0/10
2b	314	Full	23-août-2016	10:09	UTC-4	68°58.520'	105°30.010'	Beam Trawl (bottom)	81	200	160	18	4.3	8.4	1014,7	86	0/10
2b	314	Full	23-août-2016	10:35	UTC-4	68°57.610'	105°31.890'	Beam Trawl ↑	78	193	150	20	4.5	8.2	1014,3	87	0/10
2b	314	Full	23-août-2016	10:58	UTC-4	68°58.070'	105°29.820'	Agassiz Trawl ↓	81	186	150	20	5.1	8.2	1014,3	85	0/10
2b	314	Full	23-août-2016	11:06	UTC-4	68°57.890'	105°30.150'	Agassiz Trawl ↑	74	179	150	20	4.6	8.3	1014,0	85	0/10
2b	314	Full	23-août-2016	11:26	UTC-4	68°58.260'	105°28.570'	Box Core ↓	77	171	150	15/20	5.2	8.3	1014,1	86	0/10
2b	314	Full	23-août-2016	11:29	UTC-4	68°58.260'	105°28.570'	Box Core (bottom)	76	171	150	15/20	5.2	8.3	1014,1	86	0/10
2b	314	Full	23-août-2016	11:31	UTC-4	68°58.270'	105°28.580'	Box Core ↑	76	170	150	15/20	5.2	8.3	1014,1	86	0/10
2b	314	Full	23-août-2016	11:38	UTC-4	68°58.230'	105°28.510'	Box Core ↓	78	164	160	15	4.8	8.4	1014,2	87	0/10
2b	314	Full	23-août-2016	11:40	UTC-4	68°58.240'	105°28.510'	Box Core (bottom)	78	168	160	15	4.8	8.4	1014,2	87	0/10
2b	314	Full	23-août-2016	11:42	UTC-4	68°58.240'	105°28.500'	Box Core ↑	78	167	160	15	4.8	8.4	1014,2	87	0/10
2b	314	Full	23-août-2016	11:49	UTC-4	68°58.230'	105°28.460'	Box Core ↓	80	175	160	15	4.8	8.4	1014,2	88	0/10
2b	314	Full	23-août-2016	11:51	UTC-4	68°58.240'	105°28.470'	Box Core (bottom)	79	175	160	15	4.8	8.4	1014,2	88	0/10
2b	314	Full	23-août-2016	11:53	UTC-4	68°58.240'	105°28.480'	Box Core ↑	79	172	160	15	4.8	8.4	1014,2	88	0/10
2b	314	Full	23-août-2016	13:13	UTC-4	69°01.014'	105°43.365'	Transect Martin Bergman UN10	82	241	150	16	5.3	8.3	1013,4	92	0/10
2b	314	Full	23-août-2016	13:34	UTC-4	69°00.025'	105°48.872'	Transect Martin Bergman UN20	53	236	125	14	4.9	8.3	1013,0	95	0/10
2b	314	Full	23-août-2016	13:55	UTC-4	68°58.981'	105°54.077'	Transect Martin Bergman UN30	78	236	120	16	5.2	8.1	1012,6	96	0/10
2b	316	Nutrient	24-août-2016	01:19	UTC-4	68°22.960'	112°07.131'	CTD-Rosette ↓	176	318	300	19	7.4	8.5	1017,7	88	0/10
2b	316	Nutrient	24-août-2016	01:57	UTC-4	68°22.761'	112°07.004'	CTD-Rosette ↑	174	326	310	17	7.4	8.3	1018,6	87	0/10
2b	316	Nutrient	24-août-2016	02:05	UTC-4	68°23.130'	112°07.131'	DSN ↓	178	352	310	20	7.4	8.3	1018,7	87	0/10
2b	316	Nutrient	24-août-2016	02:22	UTC-4	68°23.796'	112°06.604'	DSN ↑	178	338	310	19	7.4	8.3	1018,8	88	0/10
2b	316	Nutrient	24-août-2016	02:42	UTC-4	68°23.061'	112°07.090'	5NVS ↓	173	310	310	18	7.9	8.5	1019,2	88	0/10
2b	316	Nutrient	24-août-2016	02:54	UTC-4	68°23.030'	112°07.035'	5NVS ↑	176	326	310	18	7.8	8.5	1019,2	88	0/10
2b	316	Nutrient	24-août-2016	03:10	UTC-4	68°23.503'	112°07.877'	Beam Trawl ↓	181	320	320	17	7.7	8.4	1019,2	88	0/10
2b	316	Nutrient	24-août-2016	03:50	UTC-4	68°23.876'	112°10.459'	Beam Trawl ↑	187	168	320	18	7.8	8.8	1019,7	88	0/10
2b	316	Nutrient	24-août-2016	04:00	UTC-4	68°23.183'	112°06.712'	Agassiz Trawl ↓	147	040	305	15	8.6	7.5	1019,9	87	0/10
2b	316	Nutrient	24-août-2016	04:23	UTC-4			Agassiz Trawl ↑	Cancelled								0/10
2b	316	Nutrient	24-août-2016	04:36	UTC-4	68°22.971'	112°06.885'	Agassiz Trawl ↓	177	040	330	14	7.5	8.5	1019,9	84	0/10
2b	316	Nutrient	24-août-2016	04:47	UTC-4	68°23.053'	112°06.199'	Agassiz Trawl ↑	177	040	310	15	7.4	8.5	1020,0	84	0/10
2b	316	Nutrient	24-août-2016	05:03	UTC-4	68°23.005'	112°06.995'	Box Core ↓	178	320	300	21	7.2	8.5	1019,9	86	0/10
2b	316	Nutrient	24-août-2016	05:06	UTC-4	68°23.015'	112°06.969'	Box Core (bottom)	177	325	310	21	7.2	8.5	1019,9	86	0/10
2b	316	Nutrient	24-août-2016	05:09	UTC-4	68°23.020'	112°06.961'	Box Core ↑	176	315	310	21	7.2	8.5	1019,9	86	0/10
Leg 3a																	
3a	AMD0416-4	Coring	26-août-2016	10:58	UTC-5	69°39.230'	117°51.480'	Box Core ↓	406	112	010	6	5,3	8.2	1016,4	84	0/10
3a	AMD0416-4	Coring	26-août-2016	11:10	UTC-5	69°39.190'	117°51.590'	Box Core (bottom)	409	204	020	8	5,2	8.3	1016,4	83	0/10

3a	AMD0416-4	Coring	26-août-2016	11:20	UTC-5	69°39.150'	117°51.730'	Box Core ↑	406	162	020	9	5.0	8.3	1016,4	84	0/10
3a	AMD0416-3	Coring	26-août-2016	18:06	UTC-5	70°30.140'	120°20.160'	Box Core ↓	330	163	350	11	4.1	7.4	1020.4	84	0/10
3a	AMD0416-3	Coring	26-août-2016	18:14	UTC-5	70°30.760'	120°21.120'	Box Core (bottom)	331	159	350	12	4.3	7.4	1020.4	82	0/10
3a	AMD0416-3	Coring	26-août-2016	18:22	UTC-5	70°30.730'	120°21.230'	Box Core ↑	330	166	350	13	3.4	7.4	1020.4	85	0/10
3a	405	Basic	27-août-2016	00:36	UTC-5	70°36.670'	123°01.689'	CTD-Rosette ↓	625	170	355	5	5.1	7.5	1022.8	82	0/10
3a	405	Basic	27-août-2016	01:09	UTC-5	70°36.484'	123°01.889'	CTD-Rosette ↑	627	195	353	6	6.1	7.6	1023,0	79	0/10
3a	405	Basic	27-août-2016	01:56	UTC-5	70°36.360'	123°02.137'	DSN ↓	578	114	330	4	5.5	7.5	1022,9	75	0/10
3a	405	Basic	27-août-2016	02:14	UTC-5	70°36.112'	123°00.609'	DSN ↑	633	093	045	7	5,2	7.5	1023,1	79	0/10
3a	405	Basic	27-août-2016	03:02	UTC-5	70°36.801'	123°02.080'	5NVS ↓	623	223	070	8	4.5	7.5	1023,3	84	0/10
3a	405	Basic	27-août-2016	03:37	UTC-5	70°36.874'	123°02.663'	5NVS ↑	613	221	075	7	4.4	7.5	1023,4	81	0/10
3a	405	Basic	27-août-2016	05:13	UTC-5	70°36.490'	123°01.700'	Box Core ↓	630	200	020	6	4.4	7.5	1023,6	82	0/10
3a	405	Basic	27-août-2016	05:24	UTC-5	70°36.510'	123°01.810'	Box Core (bottom)	627	208	020	6	4.4	7.5	1023,6	82	0/10
3a	405	Basic	27-août-2016	05:37	UTC-5	70°36.540'	123°01.930'	Box Core ↑	620	207	050	6	4.9	7.5	1023,9	81	0/10
3a	405	Basic	27-août-2016	06:17	UTC-5	70°36.580'	123°01.360'	Beam Trawl ↓	631	230	040	9	4.2	7.5	1024,1	84	0/10
3a	405	Basic	27-août-2016	07:38	UTC-5	70°34.726'	123°00.231'	Beam Trawl ↑	650	110	030	9	3.3	7.5	1024,9	88	0/10
3a	405	Basic	27-août-2016	10:32	UTC-5			Piston Core ↓									0/10
3a	405	Basic	27-août-2016	10:45	UTC-5	70°36.490'	123°01.622'	Piston Core (bottom)	630								0/10
3a	405	Basic	27-août-2016	10:50	UTC-5			Piston Core ↑									0/10
3a	405	Basic	27-août-2016	12:20	UTC-5	70°36.102'	122°59.362'	MVP ↓	635	356	025	10	4.7	7.5	1025,7	86	0/10
3a	405	Basic	27-août-2016	12:36	UTC-5	70°36.874'	123°04.180'	MVP ↑	577	348	028	10	4.6	7.5	1025,5	86	0/10
3a	405	Basic	27-août-2016	18:02	UTC-5	71°00.554'	126°05.457'	PNF Water Pump	392	282	350	7	4.0	3.8	1028,6	89	0/10
3a	405	Basic	27-août-2016	18:22	UTC-5	71°00.544'	126°05.418'	CTD-Rosette ↓	393	162	340	2	5.3	3.8	1028,9	83	0/10
3a	405	Basic	27-août-2016	18:55	UTC-5	71°00.524'	126°05.092'	CTD-Rosette ↑	395	189	330	5	5.6	3.6	1029,1	83	0/10
3a	407	Full	27-août-2016	20:58	UTC-5	71°00.170'	126°02.750'	DSN ↓	330	075	330	8	3.5	3.5	1029,3	94	0/10
3a	407	Full	27-août-2016	21:20	UTC-5	71°00.350'	126°01.970'	DSN ↑	394	160	330	8	4.0	3.5	1029,4	93	0/10
3a	407	Full	27-août-2016	21:52	UTC-5	71°00.310'	126°04.170'	5NVS ↓	392	133	330	8	3.6	3.5	1029,5	95	0/10
3a	407	Full	27-août-2016	22:16	UTC-5	71°00.330'	126°03.950'	5NVS ↑	390	157	320	8	3.5	3.9	1029,6	95	0/10
3a	407	Full	27-août-2016	22:51	UTC-5	71°00.300'	126°04.330'	Box Core ↓	393	244	330	6	4.2	3.8	1029,8	94	0/10
3a	407	Full	27-août-2016	22:59	UTC-5	71°00.290'	126°04.300'	Box Core (bottom)	391	256	340	5	4.2	4.0	1029,9	95	0/10
3a	407	Full	27-août-2016	23:06	UTC-5	71°00.260'	126°04.260'	Box Core ↑	392	258	340	5	4.2	4.0	1029,9	95	0/10
3a	407	Full	28-août-2016	00:04	UTC-5	71°00.290'	126°02.749'	Hydrobios ↓	395	141	328	7	3.7	4.40	1029,9	96	0/10
3a	407	Full	28-août-2016	00:30	UTC-5	71°00.394'	126°02.581'	Hydrobios ↑	395	100	329	9	3.7	4.76	1030,0	97	0/10
3a	407	Full	28-août-2016	01:24	UTC-5	70°59.935'	126°04.638'	CTD-Rosette ↓	394	185	318	8	4.5	3.98	1030,3	96	0/10
3a	407	Full	28-août-2016	02:24	UTC-5	71°00.011'	126°02.794'	CTD-Rosette ↑	393	159	300	7	4.7	3.92	1030,3	94	0/10
3a	407	Full	28-août-2016	04:43	UTC-5	71°01.124'	126°07.838'	IKMT ↓	387	120	300	9	3.3	4.62	1030,6	99	0/10
3a	407	Full	28-août-2016	05:29	UTC-5	71°02.242'	126°05.414'	IKMT ↑	392	200	310	10	3.8	4.73	1030,6	99	0/10
3a	407	Full	28-août-2016	05:57	UTC-5	71°00.248'	126°04.118'	CTD-Rosette ↓	391	161	310	7	4.0	4.5	1030,7	99	0/10
3a	407	Full	28-août-2016	06:45	UTC-5	71°00.346'	126°03.113'	CTD-Rosette ↑	392	114	300	6	4.3	3.08	1038,8	97	0/10
3a	407	Full	28-août-2016	09:32	UTC-5	71°00.442'	126°04.502'	Mooring Deployment	394	062	290	10	3.9	3.9	1030,7	96	0/10
3a	407	Full	28-août-2016	10:13	UTC-5	71°00.570'	126°04.510'	CTD-Rosette ↓	390	035	310	10	4.3	3.5	1031,0	96	0/10
3a	407	Full	28-août-2016	10:34	UTC-5	71°00.590'	126°04.270'	CTD-Rosette ↑	394	089	300	10	4.1	3.8	1030,8	96	0/10
3a	437	Basic	28-août-2016	14:31	UTC-5	71°48.030'	126°29.913'	PNF ↓	287	297	167	3	6.2	5.70	1031,1	82	0/10
3a	437	Basic	28-août-2016	14:37	UTC-5	71°48.043'	126°29.931'	PNF ↑	289	287	168	2	6.2	5.70	1031,1	82	0/10

3a	437	Basic	28-août-2016		UTC-5			Secchi Disk ↓										
3a	437	Basic	28-août-2016	14:39	UTC-5	71°48.052'	126°29.933'	Secchi Disk ↑	292	293	180	2	6.9	4.9	1031,1	82	0/10
3a	437	Basic	28-août-2016	14:47	UTC-5	71°48.044'	126°29.907'	CTD-Rosette ↓	288	016	290	2	6.9	4.9	1031,1	79	0/10
3a	437	Basic	28-août-2016	15:31	UTC-5	71°48.120'	126°30.198'	CTD-Rosette ↑	290	092	285	4	5.6	4.4	1031,1	85	0/10
3a	437	Basic	28-août-2016	15:45	UTC-5	71°48.064'	126°29.969'	DSN ↓	289	351	270	6	6.2	4.5	1031,1	84	0/10
3a	437	Basic	28-août-2016	16:00	UTC-5	71°48.363'	126°30.943'	DSN ↑	290	266	280	4	5.8	5.0	1031,0	88	0/10
3a	437	Basic	28-août-2016	16:25	UTC-5	71°48.009'	126°29.764'	5NVS ↓	287	042	270	0	7.3	5.2	1031,1	83	0/10
3a	437	Basic	28-août-2016	16:44	UTC-5	71°48.094'	126°29.832'	5NVS ↑	285	017	275	1	5.3	4.7	1031,2	92	0/10
3a	437	Basic	28-août-2016	17:17	UTC-5	71°48.040'	126°29.715'	Bottom Grab ↓	288	189	310	5	5.7	5.0	1031,4	93	0/10
3a	437	Basic	28-août-2016	17:40	UTC-5	71°48.173'	126°29.866'	Bottom Grab ↑	283	210	330	0	7.5	4.7	1031,4	85	0/10
3a	437	Basic	28-août-2016	17:57	UTC-5	71°47.981'	126°29.743'	CTD-Rosette ↓	290	121	330	1	7.6	4.7	1031,4	84	0/10
3a	437	Basic	28-août-2016	18:45	UTC-5	71°48.106'	126°29.828'	CTD-Rosette ↑	283	058	330	5	5.3	5.1	1031,5	94	0/10
3a	410	Nutrient	28-août-2016	19:50	UTC-5	71°41.977'	126°29.486'	CTD-Rosette ↓	406	088	000	3	5.8	6.7	1031,5	92	0/10
3a	410	Nutrient	28-août-2016	20:59	UTC-5	71°41.990'	126°30.870'	CTD-Rosette ↑	416	111	340	5	4.9	7.1	1031,5	96	0/10
3a	411	CTD	28-août-2016	21:48	UTC-5	71°37.680'	126°42.870'	CTD-Rosette ↓	434	105	010	5	5.2	6.9	1031,7	94	0/10
3a	411	CTD	28-août-2016	22:17	UTC-5	71°37.460'	126°43.440'	CTD-Rosette ↑	432	269	020	5	5.1	6.7	1031,7	95	0/10
3a	411	CTD	28-août-2016	22:27	UTC-5	71°37.420'	126°43.860'	Box Core ↓	432	227	010	7	5.6	6.5	1031,6	91	0/10
3a	411	CTD	28-août-2016	22:36	UTC-5	71°37.420'	126°43.880'	Box Core (bottom)	432	244	010	7	5.6	6.5	1031,6	91	0/10
3a	411	CTD	28-août-2016	22:45	UTC-5	71°37.370'	126°43.910'	Box Core ↑	433	268	020	4	5.8	6.3	1031,6	91	0/10
3a	412	Nutrient	28-août-2016	23:26	UTC-5	71°33.820'	126°55.580'	CTD-Rosette ↓	415	239	020	6	5.1	6.7	1031,6	93	0/10
3a	412	Nutrient	29-août-2016	00:16	UTC-5	71°33.372'	126°56.282'	CTD-Rosette ↑	414	245	022	5	6.6	6.7	1031,6	86	0/10
3a	413	CTD	29-août-2016	00:54	UTC-5	71°29.544'	127°08.206'	CTD-Rosette ↓	372	305	045	4	5.1	7.0	1031,7	93	0/10
3a	413	CTD	29-août-2016	01:14	UTC-5	71°29.389'	127°08.331'	CTD-Rosette ↑	369	251	030	5	5.5	6.5	1031,7	93	0/10
3a	414	Nutrient	29-août-2016	01:52	UTC-5	71°25.434'	127°20.072'	CTD-Rosette ↓	320	160	015	7	2.6	4.2	1031,7	96	0/10
3a	414	Nutrient	29-août-2016	02:35	UTC-5	71°25.082'	127°19.228'	CTD-Rosette ↑	316	199	357	7	3.4	2.4	1031,5	96	0/10
3a	408	Full	29-août-2016	03:54	UTC-5	71°18.109'	127°34.700'	DSN ↓	202	035	000	12	2.1	3.0	1031,8	98	0/10
3a	408	Full	29-août-2016	04:10	UTC-5	71°18.433'	127°34.728'	DSN ↑	204	222	000	13	2.1	3.1	1031,7	98	0/10
3a	408	Full	29-août-2016	05:05	UTC-5	71°18.382'	127°35.665'	Bioness ↓	204	258	045	8	2.9	3.2	1032,4	96	0/10
3a	408	Full	29-août-2016	06:02	UTC-5	71°18.690'	127°41.142'	Bioness ↑	183	302	015	13	2.2	3.0	1032,3	98	0/10
3a	408	Full	29-août-2016	06:30	UTC-5	71°18.230'	127°34.492'	Box Core ↓	204	172	030	10	2.0	3.0	1032,1	98	0/10
3a	408	Full	29-août-2016	06:36	UTC-5	71°18.227'	127°34.518'	Box Core (bottom)	203	195	030	10	2.0	3.0	1032,1	98	0/10
3a	408	Full	29-août-2016	06:43	UTC-5	71°18.224'	127°34.529'	Box Core ↑	204	211	015	8	1.9	2.8	1032,1	98	0/10
3a	408	Full	29-août-2016	08:20	UTC-5	71°18.770'	127°34.870'	5NVS ↓	206	210	010	10	3.5	1.9	1032,1	96	0/10
3a	408	Full	29-août-2016	08:35	UTC-5	71°18.730'	127°34.800'	5NVS ↑	206	184	350	12	3.4	1.9	1032,2	96	0/10
3a	408	Full	29-août-2016	09:07	UTC-5	71°17.200'	127°33.130'	CTD-Rosette ↓	200	166	350	12	1.7	2.2	1032,7	98	0/10
3a	408	Full	29-août-2016	09:50	UTC-5	71°16.910'	127°33.270'	CTD-Rosette ↑	196	239	340	12	2.2	2.6	1032,9	99	0/10
3a	CA-05	Mooring	29-août-2016	10:06	UTC-5	71°16.720'	127°32.260'	Mooring Recovery ↑	199	080	350	10	1.5	2.6	1033,1	99	0/10
3a	CA-05	Mooring	29-août-2016	10:44	UTC-5	71°16.580'	127°32.140'	Mooring on Deck	195	256	000	15	1.7	2.5	1033,1	99	0/10
3a	CA-05	Mooring	29-août-2016	10:45	UTC-5	71°16.580'	127°32.140'	Radiosonde Launch	195	256	000	15	1.7	2.5	1033,1	99	0/10
3a	CA-05	Mooring	29-août-2016	11:12	UTC-5	71°16.740'	127°32.290'	PNF Water Pump ↓	199	180	000	11	1.5	2.6	1030,7	99	0/10
3a	CA-05	Mooring	29-août-2016	11:20	UTC-5	71°16.720'	127°32.330'	PNF Water Pump ↑	197	219	000	13	1.8	2.6	1030,7	99	0/10
3a	CA-05	Mooring	29-août-2016	11:35	UTC-5	71°16.830'	127°32.000'	CTD-Rosette ↓	199	214	000	10	2.3	2.6	1030,6	98	0/10
3a	CA-05	Mooring	29-août-2016	12:13	UTC-5	71°16.606'	127°31.641'	CTD-Rosette ↑	199	203	345	13	3.1	2.5	1033,2	95	0/10

3a	CA-05	Mooring	29-août-2016	13:08	UTC-5	71°16.960'	127°33.305'	Beam Trawl ↓	199	152	003	12	1.6	2.5	1033,4	99	0/10
3a	CA-05	Mooring	29-août-2016	13:45	UTC-5	71°16.292'	127°30.367'	Beam Trawl ↑	200	082	355	9	1.7	2.6	1033,4	98	0/10
3a	CA-05	Mooring	29-août-2016	14:13	UTC-5	71°17.154'	127°32.129'	CTD-Rosette ↓ + POPS	203	203	345	12	1.9	2.6	1033,6	98	0/10
3a	CA-05	Mooring	29-août-2016	14:31	UTC-5	71°17.006'	127°31.718'	CTD-Rosette ↑ + POPS	202	185	345	13	2.6	2.3	1033,7	97	0/10
3a	CA-05	Mooring	29-août-2016	16:43	UTC-5	71°16.677'	127°31.870'	Mooring Deployment	198	225	000	13	1.8	2.1	1034,2	96	0/10
3a	CA-05	Mooring	29-août-2016	17:05	UTC-5	71°16.533'	127°31.741'	CTD-Rosette ↓	198	187	347	13	1.8	1.8	1034,2	96	0/10
3a	CA-05	Mooring	29-août-2016	17:17	UTC-5	71°16.376'	127°31.528'	CTD-Rosette ↑	197	186	350	14	2.7	2.0	1034,2	94	0/10
3a	417	CTD	29-août-2016	18:13	UTC-5	71°13.271'	127°58.743'	CTD-Rosette ↓	83	203	000	21	2.3	4.2	1034,4	91	0/10
3a	417	CTD	29-août-2016	18:21	UTC-5	71°13.231'	127°58.645'	CTD-Rosette ↑	83	222	005	18	4.0	4.9	1034,5	83	0/10
3a	418	Nutrient	29-août-2016	18:40	UTC-5	71°11.085'	128°05.644'	Radiosonde Launch	70	223	015	19	3.2	5.2	1034,8	88	0/10
3a	418	Nutrient	29-août-2016	18:56	UTC-5	71°09.637'	128°10.089'	CTD-Rosette ↓	65	208	005	20	3.2	5.4	1034,9	88	0/10
3a	418	Nutrient	29-août-2016	19:15	UTC-5	71°09.587'	128°09.999'	CTD-Rosette ↑	66	190	000	22	6.3	5.8	1034,9	74	0/10
3a	419	CTD	29-août-2016	19:48	UTC-5	71°06.310'	128°20.903'	CTD-Rosette ↓	57	223	005	23	2.9	6.2	1035,0	88	0/10
3a	419	CTD	29-août-2016	19:58	UTC-5	71°06.280'	128°20.930'	CTD-Rosette ↑	57	195	010	16	2.6	6.2	1035,0	87	0/10
3a	420	Basic	29-août-2016	20:26	UTC-5	71°02.950'	128°30.930'	PNF ↓	40	216	040	15	2.7	6.2	1035,3	89	0/10
3a	420	Basic	29-août-2016	20:35	UTC-5	71°02.860'	128°31.040'	PNF ↑	43	178	020	15	2.9	6.2	1035,2	87	0/10
3a	420	Basic	29-août-2016	20:41	UTC-5	71°02.840'	128°31.070'	CTD-Rosette ↓	43	219	010	19	2.0	6.1	1035,1	90	0/10
3a	420	Basic	29-août-2016	20:56	UTC-5	71°02.620'	128°30.990'	CTD-Rosette ↑	45	200	010	20	1.0	6.2	1035,0	92	0/10
3a	420	Basic	29-août-2016	21:18	UTC-5	71°03.250'	128°30.550'	DSN ↓	42	200	010	15	1.8	6.3	1035,5	91	0/10
3a	420	Basic	29-août-2016	21:26	UTC-5	71°03.000'	128°30.760'	DSN ↑	41	180	010	15	1.0	6.3	1035,2	95	0/10
3a	420	Basic	29-août-2016	22:03	UTC-5	71°03.120'	128°30.560'	5NVS ↓	43	194	010	20	0.6	6.3	1035,1	95	0/10
3a	420	Basic	29-août-2016	22:07	UTC-5	71°03.100'	128°30.620'	5NVS ↑	44	180	010	21	0.6	6.3	1035,1	95	0/10
3a	420	Basic	29-août-2016	22:27	UTC-5	71°03.070'	128°30.690'	CTD-Rosette ↓	43	160	000	20	2.8	6.1	1035,6	88	0/10
3a	420	Basic	29-août-2016	22:43	UTC-5	71°02.850'	128°31.080'	CTD-Rosette ↑	43	215	010	18	1.0	6.2	1035,6	93	0/10
3a	420	Basic	29-août-2016	23:12	UTC-5	71°03.570'	128°29.290'	Box Core ↓	43	191	010	11	0.8	6.3	1035,7	94	0/10
3a	420	Basic	29-août-2016	23:14	UTC-5	71°03.571'	128°29.271'	Box Core (bottom)	43	195	010	11	0.8	6.3	1035,7	94	0/10
3a	420	Basic	29-août-2016	23:16	UTC-5	71°03.580'	128°29.330'	Box Core ↑	43	194	010	17	1.7	6.2	1035,7	90	0/10
3a	420	Basic	30-août-2016	06:52	UTC-5	70°21.350'	132°41.320'	Radiosonde Launch	40	238	030	11	1.7	8.6	1037,8	92	0/10
3a	434	Basic	30-août-2016	08:45	UTC-5	70°10.660'	133°32.950'	Zodiac ↓	46	132	060	10	3.0	8.9	1037,7	88	0/10
3a	434	Basic	30-août-2016	08:54	UTC-5	70°10.650'	133°32.970'	Zodiac ↑	46	160	040	11	2.2	8.9	1037,6	90	0/10
3a	434	Basic	30-août-2016	09:14	UTC-5	70°10.600'	133°32.900'	CTD-Rosette ↓	46	229	020	11	2.1	9.0	1037,6	92	0/10
3a	434	Basic	30-août-2016	09:35	UTC-5	70°10.480'	133°32.970'	CTD-Rosette ↑	46	270	040	8	4.4	9.0	1037,5	82	0/10
3a	434	Basic	30-août-2016	09:54	UTC-5	70°10.610'	133°32.900'	DSN ↓	46	220	040	13	2.5	9.0	1037,4	91	0/10
3a	434	Basic	30-août-2016	10:05	UTC-5	70°10.180'	133°33.140'	DSN ↑	45	190	050	11	2.4	9.0	1037,6	91	0/10
3a	434	Basic	30-août-2016	10:33	UTC-5	70°10.710'	133°33.020'	5NVS ↓	46	227	050	8	2.6	9.0	1037,5	92	0/10
3a	434	Basic	30-août-2016	10:38	UTC-5	70°10.690'	133°32.960'	5NVS ↑	46	190	050	8	2.6	9.0	1037,5	92	0/10
3a	434	Basic	30-août-2016	10:54	UTC-5	70°10.570'	133°32.950'	PNF + Secchi Disk ↓	45	259	060	8	3.0	9.0	1037,5	90	0/10
3a	434	Basic	30-août-2016	11:00	UTC-5	70°10.530'	133°32.900'	PNF + Secchi Disk ↑	46	250	070	9	2.7	9.0	1037,4	90	0/10
3a	434	Basic	30-août-2016	11:07	UTC-5	70°10.470'	133°32.920'	CTD-Rosette ↓	46	278	070	9	2.7	8.9	1037,4	90	0/10
3a	434	Basic	30-août-2016	11:25	UTC-5	70°10.300'	133°32.900'	CTD-Rosette ↑	45	252	040	5	3.3	8.9	1037,5	87	0/10
3a	434	Basic	30-août-2016	11:43	UTC-5	70°10.700'	133°32.570'	Box Core ↓	46	237	050	8	2.9	9.0	1037,4	90	0/10
3a	434	Basic	30-août-2016	11:45	UTC-5	70°10.697'	133°32.564'	Box Core (bottom)	46	244	050	8	2.9	9.0	1037,4	90	0/10
3a	434	Basic	30-août-2016	11:48	UTC-5	70°10.680'	133°32.599'	Box Core ↑	46	271	050	8	2.9	8.8	1037,6	89	0/10

3a	433	CTD	30-août-2016	12:42	UTC-5	70°17.206'	133°34.816'	CTD-Rosette ↓	55	280	060	9	2.5	9.1	1037,3	93	0/10
3a	433	CTD	30-août-2016	12:54	UTC-5	70°17.155'	133°34.877'	CTD-Rosette ↑	55	274	070	9	3.1	9.0	1037,4	89	0/10
3a	432	Nutrient	30-août-2016	13:31	UTC-5	70°23.637'	133°36.489'	CTD-Rosette ↓	63	273	095	6	2.4	9.0	1036,9	91	0/10
3a	432	Nutrient	30-août-2016	13:50	UTC-5	70°23.657'	133°36.656'	CTD-Rosette ↑	63	273	100	6	2.6	8.7	1037,1	90	0/10
3a	431	CTD	30-août-2016	14:27	UTC-5	70°29.492'	133°37.255'	CTD-Rosette ↓	68	310	120	5	2.6	8.8	1036,9	90	0/10
3a	431	CTD	30-août-2016	14:35	UTC-5	70°29.514'	133°37.280'	CTD-Rosette ↑	68	315	095	4	3.1	8.6	1037,0	90	0/10
3a	430	Nutrient	30-août-2016	15:15	UTC-5	70°35.734'	133°38.805'	CTD-Rosette ↓	71	008	160	4	2.5	8.6	1036,8	91	0/10
3a	430	Nutrient	30-août-2016	15:36	UTC-5	70°35.836'	133°38.950'	CTD-Rosette ↑	71	352	145	4	3.4	7.9	1036,7	87	0/10
3a	429	CTD	30-août-2016	16:16	UTC-5	70°41.863'	133°40.591'	CTD-Rosette ↓	69	085	210	2	2.7	8.3	1036,8	90	0/10
3a	429	CTD	30-août-2016	16:26	UTC-5	70°41.877'	133°40.461'	CTD-Rosette ↑	69	062	210	2	2.7	8.3	1036,8	90	0/10
3a	428	Nutrient	30-août-2016	17:16	UTC-5	70°47.433'	133°41.720'	CTD-Rosette ↓	75	041	210	1	3.2	8.2	1036,5	89	0/10
3a	428	Nutrient	30-août-2016	17:36	UTC-5	70°47.415'	133°41.792'	CTD-Rosette ↑	75	018	060	1	3.2	7.8	1036,4	88	0/10
3a	427	CTD	30-août-2016	18:14	UTC-5	70°52.770'	133°43.322'	CTD-Rosette ↓	81	080	030	3	1.8	7.2	1036,2	94	0/10
3a	427	CTD	30-août-2016	18:24	UTC-5	70°52.751'	133°43.213'	CTD-Rosette ↑	81	071	030	3	1.4	6.4	1036,2	95	0/10
3a	426	Nutrient	30-août-2016	19:09	UTC-5	70°59.082'	133°44.606'	CTD-Rosette ↓	100	262	110	4	0.6	5.8	1035,7	97	0/10
3a	426	Nutrient	30-août-2016	19:33	UTC-5	70°59.034'	133°44.772'	CTD-Rosette ↑	100	249	150	3	0.5	5.6	1035,5	98	0/10
3a	426	Nutrient	30-août-2016	18:38	UTC-5	70°54.710'	133°43.230'	Radiosonde Launch	82	358	070	2	1.4	5.9	1035,8	96	0/10
3a	425	CTD	30-août-2016	20:13	UTC-5	71°04.730'	133°47.270'	CTD-Rosette ↓	305	331	060	3	0.2	5.3	1035,4	99	0/10
3a	425	CTD	30-août-2016	20:31	UTC-5	71°04.750'	133°47.100'	CTD-Rosette ↑	306	214	110	4	0.4	4.3	1035,2	99	0/10
3a	424	Nutrient	30-août-2016	21:14	UTC-5	71°10.370'	133°49.480'	CTD-Rosette ↓	576	332	Light air		-0.4	4.3	1034,9	99	0/10
3a	424	Nutrient	30-août-2016	22:10	UTC-5	71°10.280'	133°48.350'	CTD-Rosette ↑	578	277	Light air		-0.6	4.3	1034,7	99	0/10
3a	423	CTD	30-août-2016	22:52	UTC-5	71°16.250'	133°51.340'	CTD-Rosette ↓	795	347	Light air		-0.6	4.1	1034,4	99	0/10
3a	423	CTD	30-août-2016	23:26	UTC-5	71°16.270'	133°50.940'	CTD-Rosette ↑	803	039	Light air		0.5	4.3	1034,3	98	0/10
3a	422	Nutrient	31-août-2016	00:12	UTC-5	71°22.738'	133°53.689'	CTD-Rosette ↓	1102	004	150	7	-0.5	4.1	1034,1	99	0/10
3a	422	Nutrient	31-août-2016	00:30	UTC-5	71°22.758'	133°53.537'	CTD-Rosette ↑	1102	028	148	6	0.1	4.1	1034,0	99	0/10
3a	421	Basic	31-août-2016	01:55	UTC-5	71°27.140'	133°54.145'	CTD-Rosette ↓	1143	329	150	9	-0.4	3.9	1033,4	99	0/10
3a	421	Basic	31-août-2016	02:06	UTC-5	71°28.173'	133°53.981'	CTD-Rosette ↑	1141	345	140	11	-0.1	3.9	1033,4	99	0/10
3a	421	Basic	31-août-2016	02:44	UTC-5	71°28.077'	133°53.769'	DSN ↓	1126	305	165	9	-0.6	3.9	1032,9	99	0/10
3a	421	Basic	31-août-2016	02:59	UTC-5	71°28.195'	133°55.095'	DSN ↑	1178	237	155	8	-0.2	3.9	1032,8	99	0/10
3a	421	Basic	31-août-2016	03:26	UTC-5	71°28.181'	133°54.156'	5NVS ↓	1144	286	135	11	0.1	3.9	1032,8	99	0/10
3a	421	Basic	31-août-2016	04:23	UTC-5	71°28.696'	133°52.996'	5NVS ↑	1140	336	150	10	0.7	3.8	1032,6	99	0/10
3a	421	Basic	31-août-2016	05:27	UTC-5	71°23.937'	133°53.379'	Box Core ↓	1130	032	140	10	1.3	3.8	1032,4	99	0/10
3a	421	Basic	31-août-2016	05:45	UTC-5	71°23.987'	133°53.127'	Box Core (bottom)	1134	327	120	10	2.8	3.8	1032,4	99	0/10
3a	421	Basic	31-août-2016	06:11	UTC-5	71°24.155'	133°52.746'	Box Core ↑	1132	300	140	10	2.4	3.9	1032,3	97	0/10
3a	421	Basic	31-août-2016	06:30	UTC-5	71°24.418'	133°52.230'	Radiosonde Launch	1130	322	130	10	2.1	3.8	1032,8	97	0/10
3a	GSC Lander-1	Lander	31-août-2016	10:27	UTC-5	70°52.230'	135°01.110'	Lander not found		0-360	Underway to next station						0/10
3a	GSC Lander-2	Lander	31-août-2016	10:56	UTC-5	Start interrogating Lander-2											0/10
3a	GSC Lander-2	Lander	31-août-2016	12:53	UTC-5	70°50.321'	135°08.462'	Lander-2 Recovery ↑	193	180	125	18	3.8	4.8	1028,2	88	0/10
3a	GSC Lander-2	Lander	31-août-2016	13:10	UTC-5	70°50.476'	135°08.056'	Lander-2 on Deck	201	110	130	16	4	4.8	1028,1	89	0/10
3a	BR-G	Mooring	31-août-2016	18:26	UTC-5	71°00.457'	135°31.072'	Uptempo Buoy ⑪ ↓	726	313	110	16	6.8	4.2	1029,0	75	0/10
3a	BR-G	Mooring	31-août-2016	18:37	UTC-5	71°00.507'	135°30.811'	Radiosonde Launch	718	200	110	16	6.7	4.1	1029,0	75	0/10
3a	BR-G	Mooring	31-août-2016	18:49	UTC-5	71°00.631'	135°30.549'	Mini CTD ↓	717	245	115	14	4.9	4.2	1028,8	83	0/10
3a	BR-G	Mooring	31-août-2016	18:49	UTC-5	71°00.649'	135°30.505'	Mini CTD ↑	720	273	115	12	4.8	4.2	1028,8	83	0/10

3a	BR-G	Mooring	31-août-2016	19:54	UTC-5	71°00.220'	135°29.910'	Mooring Recovery ↑	703	148	075	10	3.7	4.6	1028,9	88	0/10
3a	BR-G	Mooring	31-août-2016	20:38	UTC-5	71°00.230'	135°29.730'	Mooring on Deck	705	147	070	11	4.0	4.1	1029,2	91	0/10
3a	BR-K	Mooring	31-août-2016	21:41	UTC-5	70°51.770'	135°01.830'	Mooring Recovery ↑	170	140	100	12	5.7	4.8	1028,8	83	0/10
3a	BR-K	Mooring	31-août-2016	22:04	UTC-5	70°51.930'	135°01.620'	Mooring on Deck	180	003	100	12	5.7	4.8	1028,8	83	0/10
3a	BR-K	Mooring	31-août-2016	22:22	UTC-5	70°52.010'	135°01.710'	CTD-Rosette ↓	186	281	090	15	6.3	4.9	1028,9	81	0/10
3a	BR-K	Mooring	31-août-2016	22:35	UTC-5	70°51.990'	135°01.710'	CTD-Rosette ↑	186	291	090	15	7.7	5.0	1029,0	75	0/10
3a	482	Basic	01-sept-2016	05:44	UTC-5	70°31.502'	139°22.856'	CTD-Rosette ↓	827	314	090	13	5.6	5.7	1029,2	89	0/10
3a	482	Basic	01-sept-2016	06:36	UTC-5	70°31.336'	139°23.279'	CTD-Rosette ↑	817	309	090	10	9.3	4.4	1029,0	74	0/10
3a	482	Basic	01-sept-2016	06:52	UTC-5	70°31.434'	139°24.125'	DSN ↓	816	304	100	13	6.4	4.5	1029,0	85	0/10
3a	482	Basic	01-sept-2016	07:06	UTC-5	70°31.593'	139°25.976'	DSN ↑	822	300	120	13	7.7	5.2	1028,9	78	0/10
3a	482	Basic	01-sept-2016	06:56	UTC-5	70°31.571'	139°24.740'	Radiosonde Launch	821	265	100	12	6.4	4.5	1028,9	78	0/10
3a	482	Basic	01-sept-2016	07:30	UTC-5	70°31.454'	139°23.196'	5NVS ↓	821	276	115	12	6.1	5.7	1028,9	84	0/10
3a	482	Basic	01-sept-2016	08:20	UTC-5	70°31.820'	139°23.490'	5NVS ↑	829	271	100	10	5.3	5.5	1028,8	89	0/10
3a	482	Basic	01-sept-2016	08:58	UTC-5	70°31.480'	139°23.110'	Box Core ↓	823	288	100	13	5.3	5.6	1028,6	88	0/10
3a	482	Basic	01-sept-2016	09:09	UTC-5	70°31.540'	139°23.100'	Box Core (bottom)	826	262	100	12	5.2	5.4	1028,5	86	0/10
3a	482	Basic	01-sept-2016	09:28	UTC-5	70°31.630'	139°23.200'	Box Core ↑	828	272	100	13	5.1	5.3	1028,6	86	0/10
3a	BR-1	Mooring	01-sept-2016	10:48	UTC-5	70°26.560'	139°00.900'	Uptempo Buoy ↓	734	0-360	110	11	5.1	5.1	1028,1	88	0/10
3a	BR-1	Mooring	01-sept-2016	10:58	UTC-5	70°25.870'	139°01.630'	Mooring Recovery ↑	752	043	100	11	5.1	4.9	1028,1	89	0/10
3a	BR-1	Mooring	01-sept-2016	12:05	UTC-5	70°26.028'	139°02.707'	Mooring on Deck	1131	043	110	11	5.3	4.8	1028,2	89	0/10
3a	BR-1	Mooring	01-sept-2016	19:00	UTC-5	69°33.937'	138°56.860'	Radiosonde Launch	11	003	110	10	7.7	4.2	1025,9	83	0/10
3a	472	Basic	02-sept-2016	03:18	UTC-5	69°36.524'	138°13.532'	DSN ↓	125	209	090	6	6.3	6.8	1025,6	93	0/10
3a	472	Basic	02-sept-2016	03:35	UTC-5	69°35.915'	138°13.693'	DSN ↑	123	141	090	8	6.2	6.8	1025,6	93	0/10
3a	472	Basic	02-sept-2016	03:58	UTC-5	69°36.626'	138°13.065'	5NVS ↓	125	269	090	6	6.4	6.9	1025,6	93	0/10
3a	472	Basic	02-sept-2016	04:09	UTC-5	69°36.638'	138°13.165'	5NVS ↑	125	246	090	6	6.5	6.8	1025,7	93	0/10
3a	472	Basic	02-sept-2016	04:37	UTC-5	69°36.753'	138°13.680'	Box Core ↓	126	114	080	6	6.6	6.4	1025,6	92	0/10
3a	472	Basic	02-sept-2016	04:41	UTC-5	69°36.722'	138°13.743'	Box Core (bottom)	126	168	080	6	6.6	6.4	1025,6	92	0/10
3a	472	Basic	02-sept-2016	04:45	UTC-5	69°36.714'	138°13.796'	Box Core ↑	126	177	080	6	6.3	6.6	1025,5	94	0/10
3a	472	Basic	02-sept-2016	05:11	UTC-5	69°36.613'	138°15.107'	Beam Trawl ↓	128	229	070	6	7.3	6.5	1025,6	89	0/10
3a	472	Basic	02-sept-2016	05:37	UTC-5	69°36.226'	138°17.363'	Beam Trawl ↑	128	234	045	5	8.2	6.9	1025,5	83	0/10
3a	472	Basic	02-sept-2016	06:23	UTC-5	69°36.660'	138°13.693'	CTD-Rosette ↓	127	294	030	5	6.1	7.0	1025,3	94	0/10
3a	472	Basic	02-sept-2016	07:05	UTC-5	69°36.727'	138°13.449'	CTD-Rosette ↑	126	280	005	5	6.4	5.5	1025,6	94	0/10
3a	472	Basic	02-sept-2016	06:46	UTC-5	69°36.712'	138°13.586'	Radiosonde Launch	125	275	015	5	6.5	5.7	1025,6	93	0/10
3a	472	Basic	02-sept-2016	07:55	UTC-5	69°36.640'	138°13.570'	CTD-Rosette ↓	125	076	290	7	6.0	5.5	1025,9	94	0/10
3a	472	Basic	02-sept-2016	08:31	UTC-5	69°36.600'	138°13.260'	CTD-Rosette ↑	125	183	300	13	4.1	5.8	1026,2	99	0/10
3a	470	Nutrient	02-sept-2016	09:40	UTC-5	69°25.780'	137°59.470'	CTD-Rosette ↓	53	092	300	7	4.3	6.2	1026,7	98	0/10
3a	470	Nutrient	02-sept-2016	10:04	UTC-5	69°25.710'	137°58.680'	CTD-Rosette ↑	53	119	290	8	4.6	5.4	1026,9	98	0/10
3a	474	Nutrient	02-sept-2016	12:15	UTC-5	69°47.803'	138°26.449'	CTD-Rosette ↓	173	159	315	11	4.7	7.4	1027,2	97	0/10
3a	474	Nutrient	02-sept-2016	12:56	UTC-5	69°47.455'	138°26.868'	CTD-Rosette ↑	171	200	320	15	5.7	6.5	1027,7	84	0/10
3a	476	Nutrient	02-sept-2016	14:12	UTC-5	69°59.077'	138°39.080'	CTD-Rosette ↓	268	117	315	19	3.2	6.6	1027,7	92	0/10
3a	476	Nutrient	02-sept-2016	15:01	UTC-5	69°58.794'	138°38.458'	CTD-Rosette ↑	264	167	315	19	4.1	6.4	1027,8	89	0/10
3a	478	Nutrient	02-sept-2016	16:14	UTC-5	70°10.002'	138°54.193'	CTD-Rosette ↓	377	111	275	15/20	3.0	6.9	1027,5	90	0/10
3a	478	Nutrient	02-sept-2016	17:06	UTC-5	70°10.360'	138°52.984'	CTD-Rosette ↑	377	137	285	22	5.9	6.2	1027,3	81	0/10
3a	480	Nutrient	02-sept-2016	18:18	UTC-5	70°20.110'	139°08.784'	CTD-Rosette ↓	558	109	300	23	3.0	5.0	1026,4	93	0/10

3a	480	Nutrient	02-sept-2016	19:17	UTC-5	70°20.141'	139°08.801'	CTD-Rosette ↑	871	071	285	23	6.2	4.8	1026,6	81	0/10
3a	480	Nutrient	02-sept-2016	19:05	UTC-5	70°20.141'	139°08.831'	Radiosonde Launch	560	114	270	22	5.7	4.8	1026,7	82	0/10
3a	BR-1	Mooring	02-sept-2016	20:29	UTC-5	70°25.840'	139°01.260'	Start Mooring Deployment	761	193	280	20	3.2	5.5	1025,8	89	0/10
3a	BR-1	Mooring	02-sept-2016	21:46	UTC-5	70°25.900'	139°01.470'	Mooring Deployment ↓	758	029	250	22	2.5	6.4	1025,0	93	0/10
3a	BR-1	Mooring	02-sept-2016	22:39	UTC-5	70°26.040'	139°02.420'	CTD-Rosette ↓	750	085	260	24	2.9	6.9	1024,1	91	0/10
3a	BR-1	Mooring	02-sept-2016	23:11	UTC-5	70°26.040'	139°02.430'	CTD-Rosette ↑	753	069	270	20	4.7	6.1	1023,8	85	0/10
3a	482	Basic	03-sept-2016	00:12	UTC-5	70°31.514'	139°22.315'	CTD-Rosette ↓	833	067	275	32	2.8	6.5	1022,8	94	0/10
3a	482	Basic	03-sept-2016	01:09	UTC-5	70°31.410'	139°21.901'	CTD-Rosette ↑	830	048	270	32	5.4	5.4	1022,2	84	0/10
3a	482	Basic	04-sept-2016	06:45	UTC-5	71°00.106'	135°29.580'	Radiosonde Launch	698	205	330	10	0.6	3.3	1013,6	99	0/10
3a	BR-G	Mooring	04-sept-2016	12:20	UTC-5	71°00.073'	135°29.024'	Start Mooring Deployment	701	081	270	7	1.4	3.3	1011,2	96	0/10
3a	BR-G	Mooring	04-sept-2016	12:59	UTC-5	71°00.136'	135°29.612'	Mooring Deployment ↓	698	142	270	11	1.6	3.3	1011,0	94	0/10
3a	BR-G	Mooring	04-sept-2016	13:43	UTC-5	71°00.201'	135°28.826'	CTD-Rosette ↓	701	065	270	11	0.7	3.3	1010,7	98	0/10
3a	BR-G	Mooring	04-sept-2016	14:17	UTC-5	71°00.145'	135°28.096'	CTD-Rosette ↑	690	110	272	12	1.4	3.3	1010,4	95	0/10
3a	BR-G	Mooring	04-sept-2016	14:32	UTC-5	71°00.099'	135°28.442'	5NVS ↓	695	083	275	9	1.1	3.3	1010,2	95	0/10
3a	BR-G	Mooring	04-sept-2016	14:42	UTC-5	71°00.030'	135°28.295'	5NVS ↑	689	095	275	10	0.2	3.3	1010,2	97	0/10
3a	BR-G	Mooring	04-sept-2016	15:06	UTC-5	70°59.564'	135°27.791'	Box Core ↓	666	087	275	9.4	0.8	3.3	1010,0	98	0/10
3a	BR-G	Mooring	04-sept-2016	15:16	UTC-5	70°59.519'	135°27.680'	Box Core (bottom)	663	112	269	12	0.3	3.3	1010,9	98	0/10
3a	BR-G	Mooring	04-sept-2016	15:30	UTC-5	70°59.538'	135°27.740'	Box Core ↑	666	092	280	8	2.6	3.3	1009,9	92	0/10
3a	BR-G	Mooring	04-sept-2016	15:44	UTC-5	70°59.584'	135°27.860'	Box Core ↓	667	089	285	10	1.0	3.3	1009,8	96	0/10
3a	BR-G	Mooring	04-sept-2016	15:55	UTC-5	70°59.540'	135°27.778'	Box Core (bottom)	668	104	280	10	1.0	3.3	1009,7	96	0/10
3a	BR-G	Mooring	04-sept-2016	16:10	UTC-5	70°59.481'	135°27.718'	Box Core ↑	661	098	285	10	1.8	3.3	1009,5	95	0/10
3a	BR-G	Mooring	04-sept-2016	16:20	UTC-5	70°59.454'	135°27.718'	Box Core ↓	664	109	285	11	2.0	3.3	1009,5	93	0/10
3a	BR-G	Mooring	04-sept-2016	16:31	UTC-5	70°59.449'	135°27.715'	Box Core (bottom)	661	108	285	13	2.1	3.3	1009,4	93	0/10
3a	BR-G	Mooring	04-sept-2016	16:46	UTC-5	70°59.430'	135°27.701'	Box Core ↑	663	117	290	13	2.3	3.3	1009,4	92	0/10
3a	BR-K	Mooring	04-sept-2016	19:18	UTC-5	70°51.795'	135°01.539'	Mooring Deployment ↓	167	138	290	13	1.3	3.7	1008,5	93	0/10
3a	BR-K	Mooring	04-sept-2016	18:50	UTC-5	70°51.763'	135°01.666'	Radiosonde Launch	170	277	300	14	1.3	3.7	1008,5	93	0/10
3a	BR-K	Mooring	04-sept-2016	20:06	UTC-5	70°51.890'	135°02.200'	CTD-Rosette ↓ + POPS	184	143	310	15	1.1	3.7	1008,2	96	0/10
3a	BR-K	Mooring	04-sept-2016	20:24	UTC-5	70°51.980'	135°01.590'	CTD-Rosette ↑ + POPS	181	131	290	10	4.7	3.7	1008,2	77	0/10
3a	GSC Lander-2	Lander	04-sept-2016	20:55	UTC-5	70°52.390'	135°00.560'	CTD-Rosette ↓	194	122	300	10	2.6	3.7	1008,0	85	0/10
3a	GSC Lander-2	Lander	04-sept-2016	21:08	UTC-5	70°52.450'	135°00.040'	CTD-Rosette ↑	188	143	300	12	1.5	3.7	1008,1	90	0/10
3a	GSC Lander-2	Lander	04-sept-2016	21:20	UTC-5	70°52.540'	135°00.070'	Box Core ↓	197	135	310	12	2.6	3.6	1007,9	86	0/10
3a	GSC Lander-2	Lander	04-sept-2016	21:27	UTC-5	70°52.620'	134°59.640'	Box Core (bottom)	196	154	310	10	2.6	3.6	1007,8	84	0/10
3a	GSC Lander-2	Lander	04-sept-2016	21:33	UTC-5	70°52.620'	134°59.480'	Box Core ↑	192	181	310	10	2.6	3.6	1007,8	84	0/10
3a	GSC Lander-2	Lander	04-sept-2016	22:34	UTC-5	70°51.111'	135°00.020'	Lander-2 Deployment ↓	124								0/10
3a	GSC Lander-2	Lander	04-sept-2016	23:02	UTC-5	70°51.111'	134°59.660'	Tripod's anchor released									0/10
3a	GSC Lander-1	Lander	04-sept-2016	23:41	UTC-5	70°52.450'	135°00.210'	Lander-1 Deployment ↓	195	256	300	12	0.6	3.7	1006,7	93	0/10
3a	435	Full	05-sept-2016	02:30	UTC-5	71°04.465'	133°38.613'	DSN ↓	284	068	295	18	0.8	3.3	1005,4	91	0/10
3a	435	Full	05-sept-2016	02:43	UTC-5	71°04.797'	133°37.793'	DSN ↑	305	340	285	16	0.4	3.4	1005,4	94	0/10
3a	435	Full	05-sept-2016	03:07	UTC-5	71°04.846'	133°37.753'	5NVS ↓	306	089	285	17	0.8	3.4	1005,3	94	0/10
3a	435	Full	05-sept-2016	03:27	UTC-5	71°04.845'	133°37.100'	5NVS ↑	312	072	300	17	0.7	3.4	1005,1	91	0/10
3a	435	Full	05-sept-2016	04:00	UTC-5	71°04.477'	133°40.024'	Box Core ↓	275	115	290	17	1.0	3.4	1004,9	91	0/10
3a	435	Full	05-sept-2016	04:07	UTC-5	71°04.519'	133°39.854'	Box Core (bottom)	279	110	290	17	1.0	3.4	1004,9	91	0/10
3a	435	Full	05-sept-2016	04:12	UTC-5	71°04.545'	133°39.691'	Box Core ↑	279	113	285	17	2.6	3.3	1005,0	85	0/10

3a	435	Full	05-sept-2016	04:40	UTC-5	71°04.752'	133°37.802'	CTD-Rosette ↓	302	131	285	18	1.7	3.3	1004,7	91	0/10
3a	435	Full	05-sept-2016	05:25	UTC-5	71°05.169'	133°37.109'	CTD-Rosette ↑	327	092	285	18	2.7	3.4	1004,7	87	0/10
3a	435	Full	05-sept-2016	06:02	UTC-5	71°04.855'	133°37.725'	Hydrobios ↓	307	090	290	15	1.5	3.3	1004,4	90	0/10
3a	435	Full	05-sept-2016	06:20	UTC-5	71°04.884'	133°37.432'	Hydrobios ↑	312	075	285	13	1.3	3.2	1004,3	90	0/10
3a	435	Full	05-sept-2016	07:08	UTC-5	71°04.759'	133°36.710'	IKMT ↓	307	072	285	15	1.6	3.4	1004,0	93	0/10
3a	435	Full	05-sept-2016	07:48	UTC-5	71°05.763'	133°32.427'	IKMT ↑	367	014	280	14	0.9	3.4	1004,0	96	0/10
3a	435	Full	05-sept-2016	06:55	UTC-5	71°04.752'	133°37.342'	Radiosonde Launch	313	257	280	14	2.7	3.3	1004,2	87	0/10
3a	435	Full	05-sept-2016	08:38	UTC-5	71°04.860'	133°38.910'	Beam Trawl ↓	299	081	280	15	1.3	3.2	1004,0	95	0/10
3a	435	Full	05-sept-2016	09:22	UTC-5	71°05.360'	133°34.970'	Beam Trawl ↑	351	025	270	15	1.2	3.2	1004,0	96	0/10
3a	435	Full	05-sept-2016	09:33	UTC-5	71°05.380'	133°34.370'	PNF + Secchi Disk ↓	346	113	280	10	2.4	3.2	1004,1	93	0/10
3a	435	Full	05-sept-2016	09:39	UTC-5	71°05.400'	133°34.240'	PNF + Secchi Disk ↑	345	139	290	12	2.1	3.1	1004,0	93	0/10
3a	435	Full	05-sept-2016	09:57	UTC-5	71°04.700'	133°38.320'	CTD-Rosette ↓	294	109	290	14	2.1	3.1	1003,8	93	0/10
3a	435	Full	05-sept-2016	10:33	UTC-5	71°04.830'	133°37.080'	CTD-Rosette ↑	312	149	290	10	5.2	3.1	1004,1	82	0/10
3a	421	Basic	05-sept-2016	12:43	UTC-5	71°28.054'	133°54.527'	PNF + Secchi Disk ↓	1168	122	010	12	0.4	3.4	1004,3	96	0/10
3a	421	Basic	05-sept-2016	12:51	UTC-5	71°28.023'	133°54.510'	PNF + Secchi Disk ↑	1163	140	010	15	0.3	3.5	1004,4	96	0/10
3a	421	Basic	05-sept-2016	13:02	UTC-5	71°28.016'	133°54.562'	CTD-Rosette ↓	1165	158	015	16	0.5	3.5	1004,5	95	0/10
3a	421	Basic	05-sept-2016	14:12	UTC-5	71°28.050'	133°53.837'	CTD-Rosette ↑	1132	210	000	12	2.4	3.5	1005,2	78	0/10
3a	421	Basic	05-sept-2016	14:49	UTC-5	71°28.136'	133°55.071'	CTD-Rosette ↓	1182	173	010	12	-0.3	3.4	1005,6	84	0/10
3a	421	Basic	05-sept-2016	15:01	UTC-5	71°28.113'	133°54.872'	CTD-Rosette ↑	1176	213	350	13	0.9	3.4	1005,8	79	0/10
3a	421	Basic	05-sept-2016	15:34	UTC-5	71°28.121'	133°53.934'	CTD-Rosette ↓	1136	194	345	11	1.5	3.4	1006,0	75	0/10
3a	421	Basic	05-sept-2016	17:03	UTC-5	71°28.092'	133°52.666'	CTD-Rosette ↑	1106	127	015	14	0.2	3.4	1006,8	77	0/10
3a	421	Basic	05-sept-2016	18:48	UTC-5	71°40.820'	132°57.952'	Radiosonde Launch	1215	059	345	15	-1.1	3.4	1007,4	87	0/10
3a	421	Basic	06-sept-2016	07:03	UTC-5	72°51.531'	126°22.066'	Radiosonde Launch	38	270	330	18	-1.3	2.6	1009,0	80	0/10
3a	Lakeman-03a	Coring	06-sept-2016	09:21	UTC-5	72°52.600'	126°21.600'	Piston Core ↓	44	170							0/10
3a	Lakeman-03a	Coring	06-sept-2016	09:23	UTC-5	72°52.500'	126°21.700'	Piston Core (bottom)	44	170							0/10
3a	Lakeman-03a	Coring	06-sept-2016	09:30	UTC-5	72°52.500'	126°21.600'	Piston Core ↑	44	170	320	20	-1.2	2.2	1008,9	87	0/10
3a	Lakeman-06	Coring	06-sept-2016	13:44	UTC-5	73°06.416'	126°15.588'	Piston Core ↓	102	127	315	13	-0.2	1.7	1009,8	82	0/10
3a	Lakeman-06	Coring	06-sept-2016	13:47	UTC-5	73°06.510'	126°15.663'	Piston Core (bottom)	102	185							0/10
3a	Lakeman-06	Coring	06-sept-2016	14:05	UTC-5	73°06.260'	126°15.185'	Piston Core ↑	100	127	315	10	1.8	1.8	1009,9	73	0/10
3a	Lakeman-06	Coring	06-sept-2016	15:25	UTC-5	73°06.498'	126°15.704'	Piston Core ↓	102								0/10
3a	Lakeman-06	Coring	06-sept-2016	15:29	UTC-5	73°06.499'	126°15.708'	Piston Core (bottom)	102								0/10
3a	Lakeman-06	Coring	06-sept-2016	15:43	UTC-5	73°06.500'	126°15.500'	Piston Core ↑	103								0/10
3a	BR-3	Mooring	07-sept-2016	16:10	UTC-5	73°24.582'	129°18.999'	Uptempo Buoy ⑮↓	659	063	280	10	-0.4	0.2	997,1	99	0/10
3a	BR-3	Mooring	07-sept-2016	17:11	UTC-5	73°24.313'	129°20.485'	CTD-Rosette ↓	672	123	275	14	-0.6	0.2	997,1	99	0/10
3a	BR-3	Mooring	07-sept-2016	17:40	UTC-5	73°24.265'	129°20.611'	CTD-Rosette ↑	676	144	285	15	0.5	0.2	997,2	96	0/10
3a	BR-3	Mooring	07-sept-2016	18:00	UTC-5	73°24.459'	129°21.171'	Mooring Recovery ↑	687	050	280	14	-0.9	0.1	997,6	98	0/10
3a	BR-3	Mooring	07-sept-2016	18:52	UTC-5	73°24.529'	129°22.998'	Radiosonde Launch	736	260	315	14	-1.0	0.1	998,0	97	0/10
3a	BR-3	Mooring	07-sept-2016	19:03	UTC-5	73°24.477'	129°23.590'	Mooring on Deck		303	310	14	-0.9	0.1	998,7	98	0/10
3a	535	Full	07-sept-2016	21:07	UTC-5	73°24.980'	128°11.620'	PNF + Secchi Disk ↓	290	102	310	15	-1.2	0.2	998,8	98	0/10
3a	535	Full	07-sept-2016	21:13	UTC-5	73°25.010'	128°11.580'	PNF + Secchi Disk ↑	290	097	310	15	-1.1	0.2	998,8	97	0/10
3a	535	Full	07-sept-2016	21:17	UTC-5	73°25.020'	128°11.160'	DSN ↓	287	069	310	15	-1.1	0.2	998,8	97	0/10
3a	535	Full	07-sept-2016	21:34	UTC-5	73°25.440'	128°09.660'	DSN ↑	287	034	310	15	-1.1	0.2	999,0	97	0/10
3a	535	Full	07-sept-2016	22:09	UTC-5	73°24.950'	128°11.730'	5NVS ↓	290	094	330	15	-1.2	0.2	999,6	97	0/10

3a	535	Full	07-sept-2016	22:24	UTC-5	73°25.000'	128°11.840'	5NVS ↑	292	113	320	15	-1.2	0.2	999,7	98	0/10
3a	535	Full	07-sept-2016	22:42	UTC-5	73°25.010'	128°11.310'	CTD-Rosette ↓	290	110	340	15	-1.2	0.3	1000,0	98	0/10
3a	535	Full	07-sept-2016	23:26	UTC-5	73°25.050'	128°11.200'	CTD-Rosette ↑	286	114	340	17	-1.3	0.3	1000,3	97	0/10
3a	535	Full	08-sept-2016	00:41	UTC-5	73°25.100'	128°10.826'	Hydrobios ↓	290	188	005	18	-0.6	0.4	1001,9	91	0/10
3a	535	Full	08-sept-2016	01:00	UTC-5	73°25.054'	128°11.001'	Hydrobios ↑	288	181	358	22	-1.6	0.4	1002,2	91	0/10
3a	535	Full	08-sept-2016	02:17	UTC-5	73°25.146'	128°11.743'	Beam Trawl ↓	293	153	000	23	-2.2	0.7	1003,9	94	0/10
3a	535	Full	08-sept-2016	02:57	UTC-5	73°24.097'	128°09.336'	Beam Trawl ↑	278	188	358	23	-2.9	0.6	1004,9	92	0/10
3a	535	Full	08-sept-2016	03:50	UTC-5	73°24.756'	128°11.848'	CTD-Rosette ↓	290	210	000	25	-3.4	0.5	1006,2	93	0/10
3a	535	Full	08-sept-2016	04:24	UTC-5	73°24.627'	128°11.400'	CTD-Rosette ↑	289	160	345	25	-2.5	0.6	1007,0	90	0/10
3a	535	Full	08-sept-2016	13:00	UTC-5	73°25.072'	128°11.279'	Box Core ↓	288	103	285	12	-0.8	0.8	1011,7	91	0/10
3a	535	Full	08-sept-2016	13:06	UTC-5	73°25.074'	128°11.245'	Box Core (bottom)	291	078	296	14	-0.8	0.8	1011,7	91	0/10
3a	535	Full	08-sept-2016	13:15	UTC-5	73°25.098'	128°11.113'	Box Core ↑	294	115	285	10	-0.8	0.7	1011,7	91	0/10
3a	535	Full	08-sept-2016	13:28	UTC-5	73°25.019'	128°11.465'	Box Core ↓	291	102	290	12	0.8	0.7	1011,8	84	0/10
3a	535	Full	08-sept-2016	13:35	UTC-5	73°25.042'	128°11.425'	Box Core (bottom)	290	104	290	10	-0.9	0.7	1011,7	91	0/10
3a	535	Full	08-sept-2016	13:43	UTC-5	73°25.026'	128°11.273'	Box Core ↑	289	134	285	13	-0.1	0.7	1011,8	87	0/10
3a	535	Full	08-sept-2016	13:53	UTC-5	73°24.960'	128°11.424'	Box Core ↓	287	132	285	15	0.4	0.7	1011,8	86	0/10
3a	535	Full	08-sept-2016	13:59	UTC-5	73°24.972'	128°11.309'	Box Core (bottom)	289	104	285	10	-0.3	0.7	1011,8	86	0/10
3a	535	Full	08-sept-2016	14:07	UTC-5	73°24.975'	128°11.302'	Box Core ↑	289	121	285	14	-0.3	0.7	1011,9	89	0/10
3a	BR-3	Mooring	08-sept-2016	17:50	UTC-5			Start Mooring Deployment									1/10
3a	BR-3	Mooring	08-sept-2016	19:40	UTC-5	73°24.536'	129°21.415'	Mooring Deployment ↓	694	035	270	14	-1.1	0.0	1012,6	94	1/10
3a	BR-3	Mooring	08-sept-2016	18:48	UTC-5	73°24.541'	129°21.886'	Radiosonde Launch	744	250	255	10	-0.9	0.1	1012,9	92	1/10
3a	BR-3	Mooring	08-sept-2016	20:59	UTC-5	73°25.100'	129°21.360'	CTD-Rosette ↓ + POPS	719	083	260	16	-1.2	0.1	1012,2	95	1/10
3a	BR-3	Mooring	08-sept-2016	21:33	UTC-5	73°25.350'	129°21.310'	CTD-Rosette ↑ + POPS	711	092	260	14	1.4	0.0	1011,9	87	1/10
3a	GSC-16	Coring	08-sept-2016	22:02	UTC-5	73°24.460'	129°11.700'	Gravity Core ↓	636	111	260	13	1.2	0.2	1011,9	87	1/10
3a	GSC-16	Coring	08-sept-2016	22:16	UTC-5	73°24.480'	129°11.620'	Gravity Core (bottom)	636	113	260	13	2.0	0.3	1011,8	83	1/10
3a	GSC-16	Coring	08-sept-2016	22:28	UTC-5	73°24.490'	129°11.480'	Gravity Core ↑	635	088	250	11	0.0	0.4	1011,8	91	1/10
3a	Lakeman-05	Coring	09-sept-2016	02:05	UTC-5	74°00.449'	129°07.549'	Gravity Core ↓	414	097	240	24	0.5	-0.3	1008,7	90	0/10
3a	Lakeman-05	Coring	09-sept-2016	02:14	UTC-5	74°00.483'	129°07.584'	Gravity Core (bottom)	420	041	240	14	0.7	-0.3	1008,6	87	0/10
3a	Lakeman-05	Coring	09-sept-2016	02:22	UTC-5	74°00.483'	129°07.182'	Gravity Core ↑	412	085	235	24	0.8	-0.3	1008,4	87	0/10
3a	Lakeman-05	Coring	09-sept-2016	02:40	UTC-5	74°00.453'	129°07.589'	Box Core ↓	419	083	237	25	0.2	-0.4	1008,2	88	0/10
3a	Lakeman-05	Coring	09-sept-2016	02:47	UTC-5	74°00.464'	129°07.618'	Box Core (bottom)	420	083	230	24	0.2	-0.4	1008,2	88	0/10
3a	Lakeman-05	Coring	09-sept-2016	02:55	UTC-5	74°00.480'	129°07.161'	Box Core ↑	410	090	240	21	108	-0.4	1008,2	82	0/10
3a	554	Full	09-sept-2016	15:34	UTC-5	75°44.861'	126°25.636'	PNF + Secchi Disk ↓	370	226	005	16	-3.4	-0.9	996,5	96	6/10
3a	554	Full	09-sept-2016	15:45	UTC-5	75°44.782'	126°25.924'	PNF + Secchi Disk ↑	369	179	015	13	-2.2	-0.9	996,6	93	6/10
3a	554	Full	09-sept-2016	15:43	UTC-5	75°44.794'	126°25.853'	Zodiac ↓	370	284	015	14	-2.2	-0.9	996,6	93	6/10
3a	554	Full	09-sept-2016	16:41	UTC-5	75°44.382'	126°26.874'	Zodiac ↑	371	239	005	15	-1.6	-0.9	996,8	87	6/10
3a	554	Full	09-sept-2016	15:55	UTC-5	75°44.752'	126°26.177'	CTD-Rosette ↓	370	208	000	17	-2.7	-0.9	996,7	93	6/10
3a	554	Full	09-sept-2016	16:36	UTC-5	75°44.442'	126°26.744'	CTD-Rosette ↑	371	221	000	17	-2.5	-0.9	996,8	91	6/10
3a	554	Full	09-sept-2016	17:06	UTC-5	75°44.423'	126°28.334'	DSN ↓	373	239	003	17	-3.5	-0.9	996,8	94	6/10
3a	554	Full	09-sept-2016	17:23	UTC-5	75°44.085'	126°27.574'	DSN ↑	373	113	005	19	-4.4	-0.9	996,9	93	6/10
3a	554	Full	09-sept-2016	17:52	UTC-5	75°44.755'	126°29.198'	5NVS ↓	370	137	005	19	-4.4	-0.9	997,1	95	6/10
3a	554	Full	09-sept-2016	18:13	UTC-5	75°44.633'	126°29.746'	5NVS ↑	372	165	355	18	-5.3	-0.9	997,3	94	6/10
3a	554	Full	09-sept-2016	19:00	UTC-5	75°44.453'	126°28.633'	CTD-Rosette ↓	370	185	330	20	-4.6	-0.9	997,7	92	6/10

3a	554	Full	09-sept-2016	19:45	UTC-5	75°44.329'	126°28.091'	CTD-Rosette ↑	372	177	345	17	-3.2	-0.9	998,7	81	6/10
3a	554	Full	09-sept-2016	18:50	UTC-5	75°44.362'	126°28.540'	Radiosonde Launch	140	185	330	18	-5.6	-0.9	997,6	95	6/10
3a	554	Full	09-sept-2016	20:45	UTC-5			Piston Core ↓									6/10
3a	554	Full	09-sept-2016	20:55	UTC-5	75°44.500'	126°28.500'	Piston Core (bottom)									6/10
3a	554	Full	09-sept-2016	21:04	UTC-5			Piston Core ↑									6/10
3a	554	Full	09-sept-2016	22:16	UTC-5	75°44.490'	126°28.590'	Box Core ↓	373	139	340	15	-5.3	-0.9	998,3	83	6/10
3a	554	Full	09-sept-2016	22:23	UTC-5	75°44.490'	126°28.600'	Box Core (bottom)	373	150	320	11	-5.5	-0.9	998,5	84	6/10
3a	554	Full	09-sept-2016	22:31	UTC-5	75°44.440'	126°28.480'	Box Core ↑	373	109	320	9	-5.1	-0.9	998,6	83	6/10
3a	554	Full	10-sept-2016	06:45	UTC-5	76°13.000'	126°03.602'	Radiosonde Launch	334	305	270	14	-4.3	-0.8	1000,7	77	8/10
3a	575	Full	10-sept-2016	13:24	UTC-5	76°10.900'	125°59.600'	CTD-Rosette ↓	319	155	260	19	-3.5	-0.9	1001,1	92	7/10
3a	575	Full	10-sept-2016	13:58	UTC-5	76°10.990'	125°58.150'	CTD-Rosette ↑	310	111	255	22	-2.8	-0.9	1002,3	88	7/10
3a	575	Full	10-sept-2016	14:18	UTC-5	76°10.832'	125°57.546'	DSN ↓	313	268	240	20	-3.3	-0.9	1000,4	92	8/10
3a	575	Full	10-sept-2016	14:34	UTC-5	76°10.642'	125°57.804'	DSN ↑	318	091	240	18	-3.3	-0.9	1000,4	92	8/10
3a	575	Full	10-sept-2016	14:57	UTC-5	76°10.524'	125°57.763'	5NVS ↓	318	033	250	21	-0.8	-0.9	1000,6	85	8/10
3a	575	Full	10-sept-2016	15:17	UTC-5	76°10.374'	125°56.600'	5NVS ↑	312	018	255	23	-3.3	-0.9	1000,4	90	8/10
3a	575	Full	10-sept-2016	17:02	UTC-5	76°09.659'	125°54.807'	CTD-Rosette ↓	316	211	255	18	-2.6	-0.9	1001,1	83	8/10
3a	575	Full	10-sept-2016	17:44	UTC-5	76°09.417'	125°53.671'	CTD-Rosette ↑	316	220	260	24	-3.4	-0.9	1001,3	91	8/10
3a	575	Full	10-sept-2016	18:23	UTC-5	76°09.367'	125°52.540'	Box Core ↓	320	317	240	20	-2.5	-0.9	1001,8	85	8/10
3a	575	Full	10-sept-2016	18:27	UTC-5	76°09.333'	125°52.441'	Box Core (bottom)	318	272	240	20	-2.5	-0.9	1001,8	85	8/10
3a	575	Full	10-sept-2016	18:35	UTC-5	76°09.301'	125°51.957'	Box Core ↑	318	012	240	18	-3.5	-0.9	1001,9	89	8/10
3a	575	Full	10-sept-2016	18:50	UTC-5	76°09.335'	125°50.557'	Radiosonde Launch	315	017	250	25	-2.6	-0.9	1001,7	87	8/10
3a	577	Nutrient	10-sept-2016	22:05	UTC-5	75°53.430'	125°43.230'	CTD-Rosette ↓	364	084	250	17	-2.3	-0.9	1003,5	83	8/10
3a	577	Nutrient	10-sept-2016	22:50	UTC-5	75°53.410'	125°42.080'	CTD-Rosette ↑	362	098	250	15	-1.6	-1.0	1003,7	81	8/10
3a	579	Nutrient	11-sept-2016	02:09	UTC-5	75°32.034'	125°34.416'	CTD-Rosette ↓	391	147	260	17	-3.0	-1.0	1005,6	77	6/10
3a	579	Nutrient	11-sept-2016	02:53	UTC-5	75°31.846'	125°33.201'	CTD-Rosette ↑	390	148	265	17	-3.1	-1.0	1006,0	79	6/10
3a	579	Nutrient	11-sept-2016	05:10	UTC-5	75°18.634'	125°18.315'	Beam Trawl ↓	406	318	245	18	-2.9	-1.0	1007,4	85	7/10
3a	579	Nutrient	11-sept-2016	05:58	UTC-5	75°19.687'	125°22.287'	Beam Trawl ↑	245	305	250	18	-3.0	-1.0	1007,6	81	7/10
3a	581	Nutrient	11-sept-2016	06:55	UTC-5	75°12.832'	125°23.259'	Radiosonde Launch	414	125	240	15	-2.8	-1.0	1007,6	77	5/10
3a	581	Nutrient	11-sept-2016	07:05	UTC-5	75°12.877'	125°23.541'	CTD-Rosette ↓	414	065	240	15	-2.8	-1.0	1007,6	77	5/10
3a	581	Nutrient	11-sept-2016	07:54	UTC-5	75°13.215'	125°24.030'	CTD-Rosette ↑	414	078	240	10	-2.0	-1.0	1007,9	69	5/10
3a	581	Nutrient	11-sept-2016	07:10	UTC-5	75°03.813'	125°10.043'	Radiosonde Launch	448	170	255	18	-2.3	-1.0	1005,4	87	4/10
3a	583	Nutrient	11-sept-2016	20:14	UTC-5	74°52.840'	125°07.950'	CTD-Rosette ↓	467	086	240	18	-2.0	-0.9	1005,8	86	3/10
3a	583	Nutrient	11-sept-2016	21:01	UTC-5	74°53.110'	125°06.570'	CTD-Rosette ↑	470	074	230	15	-2.7	-0.9	1005,7	88	3/10
3a	585	Basic	12-sept-2016	01:07	UTC-5	74°29.995'	123°14.639'	CTD-Rosette ↓	376	060	225	15	-2.9	-0.9	1004,7	92	1/10
3a	585	Basic	12-sept-2016	01:51	UTC-5	74°30.190'	123°13.583'	CTD-Rosette ↑	381	068	220	13	-1.7	-0.9	1004,4	88	1/10
3a	585	Basic	12-sept-2016	02:11	UTC-5	74°29.992'	123°14.202'	Gravity Core ↓	377	076	215	14	-2.3	-0.9	1004,1	91	1/10
3a	585	Basic	12-sept-2016	02:17	UTC-5	74°29.995'	123°14.241'	Gravity Core (bottom)	377	085	220	12	-2.3	-0.9	1004,1	91	1/10
3a	585	Basic	12-sept-2016	02:25	UTC-5	74°30.021'	123°14.262'	Gravity Core ↑	377	072	212	13	-2.3	-0.9	1004,1	90	1/10
3a	585	Basic	12-sept-2016	07:00	UTC-5	74°27.327'	123°17.448'	Radiosonde Launch	190	094	355	2	-3.6	-0.8	1002,4	89	2/10
3a	585	Basic	12-sept-2016	08:12	UTC-5	74°30.840'	123°11.090'	DSN ↓	383	317	Light air		-3.4	-0.9	1002,1	89	2/10
3a	585	Basic	12-sept-2016	08:32	UTC-5	74°30.980'	123°12.770'	DSN ↑	384	251	Light air		-3.4	-0.9	1002,1	89	2/10
3a	585	Basic	12-sept-2016	09:02	UTC-5	74°30.040'	123°14.100'	5NVS ↓	377	130	270	7	-3.4	-0.9	1002,0	91	2/10
3a	585	Basic	12-sept-2016	09:31	UTC-5	74°30.060'	123°13.070'	5NVS ↑	381	333	260	7	-3.6	-0.8	1001,9	90	2/10

3a	585	Basic	12-sept-2016	09:47	UTC-5	74°30.090'	123°14.250'	PNF + Secchi Disk ↓	377	113	280	8	-3.5	-0.8	1001,8	89	2/10
3a	585	Basic	12-sept-2016	09:53	UTC-5	74°30.120'	123°14.060'	PNF + Secchi Disk ↑	382	136	290	6	-3.2	-0.9	1001,8	84	2/10
3a	585	Basic	12-sept-2016	10:00	UTC-5	74°30.180'	123°14.430'	CTD-Rosette ↓	381	119	290	6	-2.6	-0.8	1001,8	79	2/10
3a	585	Basic	12-sept-2016	10:42	UTC-5	74°30.220'	123°12.840'	CTD-Rosette ↑	385	120	310	10	-3.5	-0.8	1001,8	86	2/10
3a	585	Basic	12-sept-2016	11:05	UTC-5	74°30.780'	123°13.350'	Box Core ↓	382	117	000	14	-3.3	-0.9	1001,6	84	2/10
3a	585	Basic	12-sept-2016	11:12	UTC-5	74°30.790'	123°13.330'	Box Core (bottom)	382	145	340	11	-3.5	-0.9	1001,8	83	2/10
3a	585	Basic	12-sept-2016	11:22	UTC-5	74°30.820'	123°13.200'	Box Core ↑	381	130	340	11	-3.5	-0.9	1001,9	79	2/10
3a	Lakeman-08	Coring	12-sept-2016	14:51	UTC-5	74°53.129'	122°10.053'	Gravity Core ↓	506	150	030	11	-4.6	-0.9	1003,0	90	1/10
3a	Lakeman-08	Coring	12-sept-2016	15:01	UTC-5	74°53.125'	122°01.020'	Gravity Core (bottom)	504	287	045	11	-3.9	-0.9	1003,1	87	1/10
3a	Lakeman-08	Coring	12-sept-2016	15:11	UTC-5			Gravity Core ↑		180							1/10
3a	Lakeman-08	Coring	12-sept-2016	15:53	UTC-5	74°53.110'	122°09.987'	Piston Core ↓	504	180	355	17	-4.0	-0.9	1003,3	90	1/10
3a	Lakeman-08	Coring	12-sept-2016	16:04	UTC-5	74°53.103'	122°09.829'	Piston Core (bottom)	504	245	010	19	-1.6	-0.8	1003,4	76	1/10
3a	Lakeman-08	Coring	12-sept-2016	16:30	UTC-5	74°52.850'	122°09.472'	Piston Core ↑	502	222	000	17	-1.9	-0.9	1003,6	74	1/10
3a	Lakeman-08	Coring	12-sept-2016	16:51	UTC-5	74°53.109'	122°09.823'	CTD-Rosette ↓	504	183	000	12	-3.5	-0.9	1003,6	77	1/10
3a	Lakeman-08	Coring	12-sept-2016	17:22	UTC-5	74°53.100'	122°09.800'	CTD-Rosette ↑									1/10
3a	Lakeman-08	Coring	12-sept-2016	18:35	UTC-5	74°53.105'	122°10.163'	Piston Core ↓	504	192	000	16	-1.5	-0.8	1004,2	76	1/10
3a	Lakeman-08	Coring	12-sept-2016	18:49	UTC-5	74°53.115'	122°10.029'	Piston Core (bottom)	504	180	000	17	-1.6	-0.8	1004,2	76	1/10
3a	Lakeman-08	Coring	12-sept-2016	19:10	UTC-5	74°53.119'	122°10.247'	Piston Core ↑	504	137	345	17	-1.5	-0.8	1004,3	82	1/10
3a	Lakeman-08	Coring	12-sept-2016	19:53	UTC-5	74°53.083'	122°10.558'	Box Core ↓	504	165	355	16	-3.1	-0.8	1004,3	89	1/10
3a	Lakeman-08	Coring	12-sept-2016	20:00	UTC-5	74°53.080'	122°10.660'	Box Core (bottom)	504	156	350	18	-3.9	-0.8	1004,4	89	1/10
3a	Lakeman-08	Coring	12-sept-2016	18:54	UTC-5	74°53.126'	122°10.064'	Radiosonde Launch	504	150	355	17	-4.7	-0.8	1004,2	77	1/10
3a	Lakeman-08	Coring	12-sept-2016	20:11	UTC-5	74°53.010'	122°11.030'	Box Core ↑	505	138	000	18	-4.3	-0.8	1004,4	89	1/10
3a	Lakeman-08	Coring	12-sept-2016	20:25	UTC-5	74°53.140'	122°10.090'	Box Core ↓	504	183	000	19	-4.9	-0.8	1004,6	89	1/10
3a	Lakeman-08	Coring	12-sept-2016	20:35	UTC-5	74°53.130'	122°10.210'	Box Core (bottom)	505	169	000	19	-4.9	-0.8	1004,6	89	1/10
3a	Lakeman-08	Coring	12-sept-2016	20:46	UTC-5	74°53.120'	122°10.390'	Box Core ↑	504	169	010	19	-4.9	-0.8	1004,6	88	1/10
3a	545	Basic	13-sept-2016	04:25	UTC-5	74°10.596'	126°49.020'	DSN ↓	310	174	005	15	-4.2	-0.4	1008,7	85	1/10
3a	545	Basic	13-sept-2016	04:44	UTC-5	74°10.155'	126°47.325'	DSN ↑	303	077	015	12	-4.1	-0.4	1008,8	80	1/10
3a	545	Basic	13-sept-2016	05:05	UTC-5	74°10.699'	126°49.461'	CTD-Rosette ↓	315	222	000	12	-3.9	-0.4	1008,7	77	1/10
3a	545	Basic	13-sept-2016	05:44	UTC-5	74°10.731'	126°48.283'	CTD-Rosette ↑	305	189	305	14	-2.4	-0.4	1009,0	66	1/10
3a	545	Basic	13-sept-2016	06:00	UTC-5	74°10.370'	126°48.502'	Beam Trawl ↓	304	212	340	15	-3.0	-0.4	1009,1	67	1/10
3a	545	Basic	13-sept-2016	06:47	UTC-5	74°09.861'	126°43.813'	Beam Trawl ↑	279	076	345	10	-4.4	-0.4	1009,2	64	1/10
3a	545	Basic	13-sept-2016	06:50	UTC-5	74°09.606'	126°43.950'	Radiosonde Launch	274	270	330	10	-4.6	-0.4	1009,3	63	1/10
3a	545	Basic	13-sept-2016	07:18	UTC-5	74°10.698'	126°49.380'	Box Core ↓	324	174	015	13	-4.3	-0.4	1009,1	62	1/10
3a	545	Basic	13-sept-2016	07:25	UTC-5	74°10.709'	126°49.405'	Box Core (bottom)	315	128	345	9	-4.4	-0.4	1009,2	63	1/10
3a	545	Basic	13-sept-2016	07:33	UTC-5	74°10.693'	126°49.586'	Box Core ↑	315	173	350	11	-3.7	-0.4	1009,2	60	1/10
3a	Lakeman-07	Coring	13-sept-2016	11:43	UTC-5	74°00.457'	129°07.566'	Piston Core ↓	420	200	000	13	-3.9	-0.5	1009,8	71	0/10
3a	Lakeman-07	Coring	13-sept-2016	11:52	UTC-5	74°00.465'	129°07.622'	Piston Core (bottom)	420	178	340	11	-3.2	-0.5	1009,8	69	0/10
3a	Lakeman-07	Coring	13-sept-2016	12:15	UTC-5	74°00.405'	129°07.214'	Piston Core ↑	413	188	350	9	-2.6	-0.5	1009,9	67	0/10
3a	BR-3b	Mooring	13-sept-2016	16:10	UTC-5	73°23.920'	129°21.267'	Start Mooring Deployment	690	154	285	16	-1.7	1.5	1010,3	70	0/10
3a	BR-3b	Mooring	13-sept-2016	16:39	UTC-5	73°24.086'	129°21.215'	Mooring Deployment ↓	690	165	285	17	-1.9	1.5	1010,2	79	0/10
3a	BR-3b	Mooring	13-sept-2016	17:21	UTC-5	73°23.783'	129°20.551'	CTD-Rosette ↓	667	101	303	16	-2.2	1.7	1010,3	77	0/10
3a	BR-3b	Mooring	13-sept-2016	18:03	UTC-5	73°23.725'	129°19.754'	CTD-Rosette ↑	662	136	300	16	-2.1	1.8	1010,3	75	0/10
3a	BR-3b	Mooring	13-sept-2016	18:52	UTC-5	73°13.790'	129°16.616'	Radiosonde Launch	755	174	290	18	-2.8	1.4	1010,4	84	0/10

3a	BR-3b	Mooring	13-sept-2016	19:10	UTC-5	73°11.365'	129°15.880'	MVP ↓	761	158	300	16	-2.5	1.8	1010,4	82	0/10
3a	BR-3b	Mooring	13-sept-2016	19:38	UTC-5	73°08.017'	129°14.689'	MVP ↑	669	190	315	18	-2.2	1.7	1010,5	87	0/10
3a	525	Basic	13-sept-2016	23:56	UTC-5	72°22.969'	129°00.476'	DSN ↓	351	091	290	17	-2.2	0.6	1011,2	75	0/10
3a	525	Basic	14-sept-2016	00:34	UTC-5	72°23.741'	128°56.968'	DSN ↑	346	350	290	13	-2.5	0.6	1011,3	76	0/10
3a	525	Basic	14-sept-2016	00:58	UTC-5	72°23.097'	128°59.385'	CTD-Rosette ↓	349	106	285	12	-2.2	0.7	1011,3	75	0/10
3a	525	Basic	14-sept-2016	01:46	UTC-5	72°22.922'	129°58.152'	CTD-Rosette ↑	350	126	285	17	0.4	0.6	1011,4	73	0/10
3a	525	Basic	14-sept-2016	02:12	UTC-5	72°22.429'	128°01.278'	Beam Trawl ↓	352	127	285	16	-1.4	0.7	1011,2	82	0/10
3a	525	Basic	14-sept-2016	02:56	UTC-5	72°23.194'	128°57.780'	Beam Trawl ↑	347	343	285	16	-3.2	0.6	1011,4	94	0/10
3a	525	Basic	14-sept-2016	03:22	UTC-5	72°23.613'	128°57.279'	Box Core ↓	347	102	275	18	-2.9	0.6	1011,3	91	0/10
3a	525	Basic	14-sept-2016	03:28	UTC-5	72°23.545'	128°57.139'	Box Core (bottom)	347	044	285	19	-2.9	0.6	1011,3	91	0/10
3a	525	Basic	14-sept-2016	03:35	UTC-5	72°23.438'	128°56.905'	Box Core ↑	347	114	270	17	-2.4	0.7	1011,3	85	0/10
3a	525	Basic	14-sept-2016	06:50	UTC-5	71°57.178'	127°29.243'	Radiosonde Launch	403	132	300	14	-1.6	3.4	1011,8	73	0/10
3a	525	Basic	14-sept-2016	15:25	UTC-5	70°57.437'	123°16.830'	MVP ↓	332	160	270	13	-0.3	4.3	1011,4	74	0/10
3a	525	Basic	14-sept-2016	17:50	UTC-5	70°36.131'	123°01.720'	MVP ↑	616	174	300	12	0.5	4.3	1012,1	63	0/10
3a	405	Basic	14-sept-2016	18:05	UTC-5	70°36.479'	123°01.839'	PNF + Secchi Disk ↓	630	120	280	11	0.4	4.4	1012,0	61	0/10
3a	405	Basic	14-sept-2016	18:10	UTC-5	70°36.500'	123°01.805'	PNF + Secchi Disk ↑	630	090	280	11	0.4	4.4	1012,0	61	0/10
3a	405	Basic	14-sept-2016	18:20	UTC-5	70°36.455'	123°02.002'	CTD-Rosette ↓	620	118	300	12	0.8	4.4	1012,1	59	0/10
3a	405	Basic	14-sept-2016	19:02	UTC-5	70°36.632'	123°01.966'	CTD-Rosette ↑	627	107	300	10	2.4	4.4	1012,1	59	0/10
3a	405	Basic	14-sept-2016	18:52	UTC-5	70°36.614'	123°02.016'	Radiosonde Launch	627	098	280	10	2.6	4.4	1012,1	58	0/10
3a	405	Basic	14-sept-2016	19:15	UTC-5	70°36.602'	123°01.360'	DSN ↓	630	100	280	13	1.0	4.4	1012,1	60	0/10
3a	405	Basic	14-sept-2016	19:36	UTC-5	70°36.895'	122°58.786'	DSN ↑	619	070	290	15	-0.1	4.4	1011,9	68	0/10
3a	405	Basic	14-sept-2016	19:58	UTC-5	70°36.554'	123°01.866'	CTD-Rosette ↓	627	138	310	12	0.4	4.5	1011,7	67	0/10
3a	405	Basic	14-sept-2016	20:52	UTC-5	70°36.360'	123°00.810'	CTD-Rosette ↑	630	087	250	8	-0.6	4.5	1011,9	85	0/10
3a	405	Basic	14-sept-2016	21:10	UTC-5	70°36.180'	122°59.900'	MVP ↓	622	150	280	10	-0.3	4.5	1011,8	75	0/10
3a	405	Basic	15-sept-2016	01:01	UTC-5	69°57.928'	122°57.064'	MVP ↑	202	187	250	7	0.2	4.4	1012,0	57	0/10
3a	406	Basic	15-sept-2016	01:18	UTC-5	69°58.430'	122°57.291'	CTD-Rosette ↓	211	100	255	7	0.1	4.4	1012,0	56	0/10
3a	406	Basic	15-sept-2016	01:52	UTC-5	69°58.350'	122°56.569'	CTD-Rosette ↑	209	150	275	7	0.7	4.5	1012,0	55	0/10
3a	406	Basic	15-sept-2016	02:07	UTC-5	69°58.337'	122°57.680'	DSN ↓	214	089	295	5	0.7	4.5	1011,9	55	0/10
3a	406	Basic	15-sept-2016	02:25	UTC-5	69°58.882'	122°56.293'	DSN ↑	218	338	270	6	0.1	4.4	1011,8	55	0/10
3a	406	Basic	15-sept-2016	02:51	UTC-5	69°58.248'	122°57.201'	Beam Trawl ↓	209	004	225	4	0.2	4.3	1011,6	58	0/10
3a	406	Basic	15-sept-2016	03:23	UTC-5	69°58.540'	122°56.496'	Beam Trawl ↑	214	015	270	3	0.4	4.1	1011,6	57	0/10
3a	406	Basic	15-sept-2016	04:14	UTC-5	69°58.308'	122°57.401'	MVP ↓	210	082	290	8	0.1	3.9	1011,2	65	0/10
3a	406	Basic	15-sept-2016	09:10	UTC-5	70°04.800'	120°37.500'	MVP ↑	376	080	270	8	-1.0	4.9	1010,5	88	0/10
3a	406	Basic	15-sept-2016	07:00	UTC-5	70°01.881'	121°36.420'	Radiosonde Launch	395	080	250	8	-1.0	4.5	1010,9	82	0/10
3a	403	Basic	15-sept-2016	10:19	UTC-5	70°06.030'	120°06.140'	CTD-Rosette ↓	411	111	270	8	-1.0	4.9	1010,5	88	0/10
3a	403	Basic	15-sept-2016	11:20	UTC-5	70°06.010'	120°05.350'	CTD-Rosette ↑	413	086	250	9	0.7	4.9	1010,4	81	0/10
3a	403	Basic	15-sept-2016	11:58	UTC-5	70°06.024'	120°06.406'	DSN ↓	411	064	220	4	-0.8	4.9	1010,5	90	0/10
3a	403	Basic	15-sept-2016	12:10	UTC-5	70°06.265'	120°06.996'	DSN ↑	413	247	275	6	-0.8	4.9	1010,5	88	0/10
3a	403	Basic	15-sept-2016	12:33	UTC-5	70°05.979'	120°05.786'	IKMT + Net Mind ↓	412	070	215	2	-1.0	4.9	1010,5	96	0/10
3a	403	Basic	15-sept-2016	13:28	UTC-5	70°06.474'	120°04.648'	IKMT + Net Mind ↑	414	301	260	9	0.8	5.0	1010,3	71	0/10
3a	403	Basic	15-sept-2016	13:45	UTC-5	70°05.954'	120°06.422'	Beam Trawl ↓	410	059	270	4	0.3	5.0	1010,1	75	0/10
3a	403	Basic	15-sept-2016	14:32	UTC-5	70°06.320'	120°05.525'	Beam Trawl ↑	412	326	295	12	0.7	5.0	1010,3	74	0/10
3a	403	Basic	15-sept-2016	14:50	UTC-5	70°05.886'	120°06.710'	MVP ↓	410	056	310	6	0.0	5.0	1010,3	80	0/10

3a	403	Basic	15-sept-2016	17:04	UTC-5	70°15.901'	119°12.182'	MVP ↑	356	061	280	10	0.8	5.6	1010,1	61	0/10
3a	403	Basic	15-sept-2016	18:46	UTC-5	70°25.956'	118°16.589'	Radiosonde Launch	381	060	260	11	1.3	5.2	1009,9	65	0/10
3a	403	Basic	15-sept-2016	19:14	UTC-5	70°27.373'	118°08.255'	Zodiac ↓	397	021	280	10	1.3	5.4	1009,8	64	0/10
3a	1402	Basic	15-sept-2016	20:21	UTC-5	70°32.680'	117°39.590'	DSN ↓	342	032	270	12	1.6	5.7	1009,6	68	0/10
3a	1402	Basic	15-sept-2016	20:38	UTC-5	70°33.400'	117°39.130'	DSN ↑	336	346	270	11	1.4	5.7	1009,5	67	0/10
3a	1402	Basic	15-sept-2016	20:58	UTC-5	70°33.010'	117°38.200'	CTD-Rosette ↓	342	069	240	12	1.7	5.9	1009,5	82	0/10
3a	1402	Basic	15-sept-2016	21:26	UTC-5	70°33.230'	117°38.350'	CTD-Rosette ↑	345	114	240	12	1.7	5.9	1009,5	82	0/10
3a	1402	Basic	15-sept-2016	22:53	UTC-5	70°32.900'	117°38.050'	CTD-Rosette ↓	340	066	240	11	1.0	5.8	1009,4	89	0/10
3a	1402	Basic	15-sept-2016	23:34	UTC-5	70°33.080'	117°38.240'	CTD-Rosette ↑	344	148	250	17	1.6	5.9	1009,5	81	0/10
3a	1402	Basic	15-sept-2016	23:51	UTC-5	70°33.471'	117°39.228'	Box Core ↓	335	097	270	15	1.9	5.9	1009,3	68	0/10
3a	1402	Basic	15-sept-2016	23:56	UTC-5	70°33.486'	117°39.233'	Box Core (bottom)	334	116	270	1	1.9	5.9	1009,3	68	0/10
3a	1402	Basic	16-sept-2016	00:03	UTC-5	70°33.502'	117°39.173'	Box Core ↑	335	115	285	14	3.1	5.9	1009,6	65	0/10
3a	1402	Basic	16-sept-2016	00:25	UTC-5	70°32.763'	117°39.006'	Beam Trawl ↓	349	100	270	11	2.2	5.8	1009,2	66	0/10
3a	1402	Basic	16-sept-2016	01:20	UTC-5	70°32.938'	117°39.163'	Beam Trawl ↑	350	120	270	9	2.2	5.8	1009,7	62	0/10
3a	1402	Basic	16-sept-2016	06:50	UTC-5	69°25.662'	117°06.342'	Radiosonde Launch	194	147	150	15	1.3	5.5	1008,8	64	0/10
3a	AMD0416-5	Coring	16-sept-2016	18:06	UTC-5	67°51.840'	115°04.317'	Piston Core ↓	52	296	166	9	6.9	6.4	999,8	73	0/10
3a	AMD0416-5	Coring	16-sept-2016	18:08	UTC-5	67°51.840'	115°04.317'	Piston Core (bottom)	52	304	170	10	7.2	6.5	999,7	72	0/10
3a	AMD0416-5	Coring	16-sept-2016	18:22	UTC-5	67°51.803'	115°04.361'	Piston Core ↑	52	90	174	11	7.1	6.5	999,7	74	0/10
3a	AMD0416-5	Coring	16-sept-2016	18:52	UTC-5	67°51.905'	115°04.310'	Box Core ↓	52	301	165	14	7.1	6.2	1001,5	73	0/10
3a	AMD0416-5	Coring	16-sept-2016	18:55	UTC-5	67°51.923'	115°04.328'	Box Core (bottom)	52	298	165	14	7.1	6.2	1001,5	73	0/10
3a	AMD0416-5	Coring	16-sept-2016	18:57	UTC-5	67°51.937'	115°04.361'	Box Core ↑	52	287	165	14	7.1	6.2	1001,5	73	0/10
Leg 3b																	
3b	316	Basic	18-sept-2016	02:26	UTC-5	68°23.276'	112°06.587'	DSN ↓	176	099	315	12	2.9	5.7	996,2	98	0/10
3b	316	Basic	18-sept-2016	02:44	UTC-5	68°23.632'	112°05.471'	DSN ↑	171	302	300	17	3.0	5.6	996,5	97	0/10
3b	316	Basic	18-sept-2016	03:05	UTC-5	68°23.300'	112°07.390'	CTD-Rosette ↓	173	149	300	15	3.3	5.5	996,5	98	0/10
3b	316	Basic	18-sept-2016	03:45	UTC-5	68°23.081'	112°06.557'	CTD-Rosette ↑	177	195	320	18	5.0	5.4	997,1	89	0/10
3b	316	Basic	18-sept-2016	04:05	UTC-5	68°23.389'	112°07.260'	5NVS ↓	177	148	315	20	3.1	5.4	997,1	96	0/10
3b	316	Basic	18-sept-2016	04:38	UTC-5	68°23.335'	112°07.234'	5NVS ↑	174	108	315	14	3.1	5.0	997,6	97	0/10
3b	316	Basic	18-sept-2016	04:54	UTC-5	68°23.180'	112°05.259'	Box Core ↓	182	063	315	15	3.1	5.3	997,9	98	0/10
3b	316	Basic	18-sept-2016	04:58	UTC-5	68°23.125'	112°05.254'	Box Core (bottom)	180	115	300	12	3.1	5.3	997,1	97	0/10
3b	316	Basic	18-sept-2016	05:02	UTC-5	68°23.100'	112°05.255'	Box Core ↑	180	093	300	12	3.1	5.3	998,1	97	0/10
3b	316	Basic	18-sept-2016	05:30	UTC-5	68°23.206'	112°07.141'	Beam Trawl ↓	175	113	300	15	4.0	5.4	998,4	95	0/10
3b	316	Basic	18-sept-2016	06:05	UTC-5	68°23.666'	112°05.012'	Beam Trawl ↑	175	013	290	15	3.7	5.4	998,8	95	0/10
3b	314	Basic	18-sept-2016	06:52	UTC-5	68°25.205'	111°49.905'	Radiosonde Launch	252	065	285	13	3.4	5.3	999,3	96	0/10
3b	314	Basic	18-sept-2016	18:45	UTC-5	68°58.175'	105°28.171'	DSN ↓	075	163	315	19	2.7	3.9	1003,3	89	0/10
3b	314	Basic	18-sept-2016	19:10	UTC-5	68°58.186'	105°25.977'	DSN ↑	072	050	320	16	3.0	3.8	1003,5	88	0/10
3b	314	Basic	18-sept-2016	18:53	UTC-5	68°57.979'	105°27.464'	Radiosonde Launch	82	075	315	16	4.6	3.9	1003,5	81	0/10
3b	314	Basic	18-sept-2016	19:35	UTC-5	68°58.195'	105°28.275'	CTD-Rosette ↓	81	164	315	17	2.8	3.8	1003,7	88	0/10
3b	314	Basic	18-sept-2016	20:04	UTC-5	68°58.230'	105°28.070'	CTD-Rosette ↑	79	155	310	13	4.6	3.6	1004,4	80	0/10
3b	314	Basic	18-sept-2016	20:17	UTC-5	68°58.230'	105°28.000'	5NVS ↓	78	140	330	13	5.0	3.7	1004,5	78	0/10
3b	314	Basic	18-sept-2016	20:22	UTC-5	68°58.230'	105°27.990'	5NVS ↑	78	140	330	15	3.4	3.7	1004,5	84	0/10
3b	314	Basic	18-sept-2016	20:49	UTC-5	68°58.380'	105°28.510'	Box Core ↓	89	125	310	11	2.5	3.7	1004,9	86	0/10
3b	314	Basic	18-sept-2016	20:52	UTC-5	68°58.370'	105°28.500'	Box Core (bottom)	76	123	310	11	2.5	3.7	1004,9	87	0/10

3b	314	Basic	18-sept-2016	20:55	UTC-5	68°58.360'	105°28.490'	Box Core ↑	77	115	310	11	2.5	3.7	1005.0	87	0/10
3b	314	Basic	18-sept-2016	21:14	UTC-5	68°58.330'	105°28.460'	Beam Trawl ↓	78	119	300	14	1.8	3.7	1005,1	91	0/10
3b	314	Basic	18-sept-2016	21:33	UTC-5	68°58.460'	105°26.210'	Beam Trawl ↑	70	045	300	14	1.7	3.7	1005,4	90	0/10
3b	QMG4	Basic	19-sept-2016	02:15	UTC-5	68°29.307'	103°25.915'	DSN ↓	73	165	315	7	0.5	4.2	1006,4	99	0/10
3b	QMG4	Basic	19-sept-2016	02:36	UTC-5	68°29.356'	103°25.227'	DSN ↑	83	195	325	12	0.5	4.1	1006,4	99	0/10
3b	QMG4	Basic	19-sept-2016	02:51	UTC-5	68°29.196'	103°26.340'	CTD-Rosette ↓	77	156	315	12	1.0	4.1	1006,5	98	0/10
3b	QMG4	Basic	19-sept-2016	03:20	UTC-5	68°29.173'	103°25.581'	CTD-Rosette ↑	69	172	315	10	3.0	4.1	1006,9	87	0/10
3b	QMG4	Basic	19-sept-2016	03:38	UTC-5	68°29.255'	103°25.432'	5NVS ↓	72	135	335	10	0.6	4.1	1007,0	96	0/10
3b	QMG4	Basic	19-sept-2016	03:44	UTC-5	68°29.266'	103°25.417'	5NVS ↑	75	132	315	11	0.6	4.1	1007,0	96	0/10
3b	QMG4	Basic	19-sept-2016	05:03	UTC-5	68°29.402'	103°25.164'	Box Core ↓	85	099	325	9	0.5	4.1	1007,1	95	0/10
3b	QMG4	Basic	19-sept-2016	05:07	UTC-5	68°29.395'	103°25.165'	Box Core (bottom)	85	120	315	8	0.5	4.1	1007,5	97	0/10
3b	QMG4	Basic	19-sept-2016	05:10	UTC-5	68°29.390'	103°25.158'	Box Core ↑	85	135	315	8	0.5	4.1	1007,5	97	0/10
3b	QMG4	Basic	19-sept-2016	05:34	UTC-5	68°29.041'	103°25.605'	Beam Trawl ↓	69	151	325	9	0.8	4.2	1007,7	97	0/10
3b	QMG4	Basic	19-sept-2016	06:03	UTC-5	68°28.929'	103°23.200'	Beam Trawl ↑	85	058	330	10	0.2	4.2	1007,9	98	0/10
3b	QMG4	Basic	19-sept-2016	06:55	UTC-5	68°24.817'	103°11.461'	Radiosonde Launch	78	140	330	10	0.1	4.5	1008,3	98	0/10
3b	QMG3	Basic	19-sept-2016	08:03	UTC-5	68°19.760'	102°56.580'	DSN ↓	50	149	350	9	0.4	4.0	1008,7	96	0/10
3b	QMG3	Basic	19-sept-2016	08:20	UTC-5	68°19.600'	102°54.910'	DSN ↑	54	118	330	9	-0.3	4.5	1008,8	98	0/10
3b	QMG3	Basic	19-sept-2016	08:40	UTC-5	68°19.670'	102°56.430'	CTD-Rosette ↓	50	171	340	5	0.1	4.6	1008,8	98	0/10
3b	QMG3	Basic	19-sept-2016	09:01	UTC-5	68°19.680'	102°56.030'	CTD-Rosette ↑	52	147	340	8	-0.1	4.7	1009,0	97	0/10
3b	QMG3	Basic	19-sept-2016	09:21	UTC-5	68°19.710'	102°56.430'	5NVS ↓	50	144	340	7	0.0	4.8	1009,1	97	0/10
3b	QMG3	Basic	19-sept-2016	09:27	UTC-5	68°19.730'	102°56.340'	5NVS ↑	51	150	340	7	0.0	4.8	1009,1	97	0/10
3b	QMG3	Basic	19-sept-2016	09:47	UTC-5	68°19.860'	102°56.710'	Box Core ↓	55	206	330	7	0.4	4.8	1009,2	95	0/10
3b	QMG3	Basic	19-sept-2016	09:51	UTC-5	68°19.850'	102°56.690'	Box Core (bottom)	56	242	330	4	0.7	4.7	1009,2	94	0/10
3b	QMG3	Basic	19-sept-2016	09:55	UTC-5	68°19.840'	102°56.680'	Box Core ↑	56	261	330	4	0.7	4.7	1009,2	94	0/10
3b	QMG3	Basic	19-sept-2016	10:15	UTC-5	68°19.970'	102°57.100'	Beam Trawl ↓	55	143	340	9	0.1	4.8	1009,2	95	0/10
3b	QMG3	Basic	19-sept-2016	10:36	UTC-5	68°19.940'	102°55.400'	Beam Trawl ↑	55	058	320	8	-0.2	4.8	1009,2	95	0/10
3b	QMGM	Basic	19-sept-2016	13:04	UTC-5	68°18.427'	101°45.782'	DSN ↓	111	209	358	6	0.0	3.3	1009,1	98	0/10
3b	QMGM	Basic	19-sept-2016	13:21	UTC-5	68°18.481'	101°44.647'	DSN ↑	104	329	010	6	0.0	3.7	1009,2	97	0/10
3b	QMGM	Basic	19-sept-2016	13:40	UTC-5	68°18.431'	101°45.007'	CTD-Rosette ↓	112	171	345	6	1.5	3.4	1009,5	95	0/10
3b	QMGM	Basic	19-sept-2016	14:05	UTC-5	68°18.343'	101°45.050'	CTD-Rosette ↑	113	201	340	6	1.4	3.3	1009,6	94	0/10
3b	QMGM	Basic	19-sept-2016	14:23	UTC-5	68°18.277'	101°45.081'	5NVS ↓	114	139	310	6	1.1	3.3	1009,7	92	0/10
3b	QMGM	Basic	19-sept-2016	14:34	UTC-5	68°18.274'	101°45.194'	5NVS ↑	118	159	318	7	0.6	3.4	1009,8	94	0/10
3b	QMGM	Basic	19-sept-2016	14:55	UTC-5	68°18.625'	101°45.928'	Box Core ↓	111	187	320	6	0.3	3.5	1009,7	96	0/10
3b	QMGM	Basic	19-sept-2016	14:59	UTC-5	68°18.619'	101°45.928'	Box Core (bottom)	108	203	330	6	1.2	3.3	1009,9	95	0/10
3b	QMGM	Basic	19-sept-2016	15:04	UTC-5	68°18.611'	101°45.907'	Box Core ↑	107	210	318	6	1.2	3.3	1009,9	95	0/10
3b	QMGM	Basic	19-sept-2016	15:24	UTC-5	68°18.152'	101°45.717'	Beam Trawl ↓	116	144	333	5	1.8	3.3	1010,0	92	0/10
3b	QMGM	Basic	19-sept-2016	15:51	UTC-5	68°18.418'	101°45.454'	Beam Trawl ↑	112	195	300	7	0.1	3.6	1010,0	97	0/10
3b	QMG2	Basic	19-sept-2016	17:40	UTC-5	68°18.904'	100°47.953'	DSN ↓	55	104	300	8	0.0	3.9	1010,4	99	0/10
3b	QMG2	Basic	19-sept-2016	17:52	UTC-5	68°19.103'	100°47.191'	DSN ↑	47	032	300	10	-0.1	4.0	1010,5	99	0/10
3b	QMG2	Basic	19-sept-2016	18:23	UTC-5	68°18.814'	100°47.956'	CTD-Rosette ↓	54	170	300	12	0.5	4.0	1010,5	98	0/10
3b	QMG2	Basic	19-sept-2016	18:45	UTC-5	68°18.812'	100°48.187'	CTD-Rosette ↑	59	109	285	8	0.7	3.8	1010,6	97	0/10
3b	QMG2	Basic	19-sept-2016	19:03	UTC-5	68°18.771'	100°48.036'	5NVS ↓	60	094	300	8	0.0	3.9	1010,5	98	0/10
3b	QMG2	Basic	19-sept-2016	19:08	UTC-5	68°18.764'	100°48.093'	5NVS ↑	60	099	315	7	0.0	3.9	1010,5	98	0/10

3b	QMG2	Basic	19-sept-2016	18:55	UTC-5	68°18.783'	100°47.998'	Radiosonde Launch	58	094	300	7	0.2	3.9	1010,5	97	0/10
3b	QMG2	Basic	19-sept-2016	19:29	UTC-5	68°18.989'	100°48.183'	Box Core ↓	52	085	300	10	0.4	4.0	1010,5	97	0/10
3b	QMG2	Basic	19-sept-2016	19:31	UTC-5	68°18.988'	100°48.187'	Box Core (bottom)	52	078	300	10	0.4	4.0	1010,5	97	0/10
3b	QMG2	Basic	19-sept-2016	19:33	UTC-5	68°18.986'	100°48.194'	Box Core ↑	52	072	300	11	0.7	4.0	1010,6	94	0/10
3b	QMG2	Basic	19-sept-2016	19:45	UTC-5	68°18.977'	100°48.200'	Box Core ↓	52	074	300	14	0.8	4.0	1010,6	94	0/10
3b	QMG2	Basic	19-sept-2016	19:48	UTC-5	68°18.975'	100°48.196'	Box Core (bottom)	52	066	300	14	0.8	4.0	1010,6	94	0/10
3b	QMG2	Basic	19-sept-2016	19:50	UTC-5	68°18.975'	100°48.188'	Box Core ↑	52	070	300	14	0.8	4.0	1010,6	94	0/10
3b	QMG2	Basic	19-sept-2016	20:04	UTC-5	68°18.970'	100°48.222'	Box Core ↓	52	080	280	9	0.6	4.1	1010,7	96	0/10
3b	QMG2	Basic	19-sept-2016	20:06	UTC-5	68°18.960'	100°48.230'	Box Core (bottom)	53	073	280	9	0.6	4.1	1010,7	96	0/10
3b	QMG2	Basic	19-sept-2016	20:08	UTC-5	68°18.960'	100°48.230'	Box Core ↑	52	076	280	10	0.6	4.1	1010,8	96	0/10
3b	QMG2	Basic	19-sept-2016	20:37	UTC-5	68°17.810'	100°50.430'	Beam Trawl ↓	108	078	290	12	1.2	4.0	1010,7	96	0/10
3b	QMG2	Basic	19-sept-2016	20:57	UTC-5	68°18.450'	100°49.310'	Beam Trawl ↑	81	012	290	12	1.3	3.8	1010,9	94	0/10
3b	312	Basic	20-sept-2016	03:01	UTC-5	69°10.073'	100°42.510'	DSN ↓	64	114	345	21	-0.4	1.8	1012,5	85	0/10
3b	312	Basic	20-sept-2016	03:18	UTC-5	69°10.239'	100°41.106'	DSN ↑	68	353	340	18	-0.3	1.7	1012,9	85	0/10
3b	312	Basic	20-sept-2016	03:36	UTC-5	69°10.273'	100°41.886'	CTD-Rosette ↓	73	172	335	19	0.0	1.7	1012,9	85	0/10
3b	312	Basic	20-sept-2016	03:58	UTC-5	69°10.199'	100°41.517'	CTD-Rosette ↑	64	182	330	15	3.9	1.7	1013,2	69	0/10
3b	312	Basic	20-sept-2016	04:24	UTC-5	69°10.199'	100°41.932'	5NVS ↓	66	141	340	15	0.2	1.7	1013,3	80	0/10
3b	312	Basic	20-sept-2016	04:30	UTC-5	69°10.198'	100°41.981'	5NVS ↑	66	160	330	18	-0.2	1.7	1013,4	80	0/10
3b	312	Basic	20-sept-2016	04:55	UTC-5	69°10.019'	100°41.637'	Box Core ↓	62	128	320	16	1.5	1.7	1013,6	78	0/10
3b	312	Basic	20-sept-2016	04:57	UTC-5	69°10.025'	100°41.611'	Box Core (bottom)	62	120	320	17	1.5	1.7	1013,6	78	0/10
3b	312	Basic	20-sept-2016	05:00	UTC-5	69°10.027'	100°41.603'	Box Core ↑	62	119	320	17	1.5	1.7	1013,6	78	0/10
3b	312	Basic	20-sept-2016	05:19	UTC-5	69°10.200'	100°41.560'	Beam Trawl ↓	64	146	330	13	1.2	1.8	1013,7	78	0/10
3b	312	Basic	20-sept-2016	05:42	UTC-5	69°10.584'	100°39.532'	Beam Trawl ↑	60	040	310	16	0.2	1.9	1014,0	83	0/10
3b	312	Basic	20-sept-2016	06:55	UTC-5	69°20.128'	100°14.723'	Radiosonde Launch	39	026	310	14	0.0	1.7	1013,9	88	0/10
3b	311	Basic	20-sept-2016	12:16	UTC-5	70°16.770'	098°31.740'	DSN ↓	169	104	285	10	-0.1	1.0	1013,5	92	0/10
3b	311	Basic	20-sept-2016	12:29	UTC-5	70°17.099'	098°31.176'	DSN ↑	163	298	280	10	0.1	1.0	1013,4	91	0/10
3b	311	Basic	20-sept-2016	12:44	UTC-5	70°17.095'	098°31.228'	CTD-Rosette ↓	163	089	275	12	1.0	1.0	1013,5	88	0/10
3b	311	Basic	20-sept-2016	13:21	UTC-5	70°17.016'	098°31.023'	CTD-Rosette ↑	161	126	270	15	3.7	1.1	1013,8	78	0/10
3b	311	Basic	20-sept-2016	13:40	UTC-5	70°17.002'	098°31.425'	5NVS ↓	164	108	270	12	1.9	1.1	1013,9	84	0/10
3b	311	Basic	20-sept-2016	13:51	UTC-5	70°16.956'	098°31.357'	5NVS ↑	164	091	280	12	2.5	1.1	1014,0	81	0/10
3b	311	Basic	20-sept-2016	14:12	UTC-5	70°16.903'	098°32.339'	Box Core ↓	178	106	275	15	0.8	1.1	1013,8	88	0/10
3b	311	Basic	20-sept-2016	14:15	UTC-5	70°16.882'	098°32.326'	Box Core (bottom)	177	107	270	15	0.8	1.1	1013,8	88	0/10
3b	311	Basic	20-sept-2016	14:23	UTC-5	70°16.850'	098°32.294'	Box Core ↑	176	099	280	11	2.0	1.1	1013,9	83	0/10
3b	311	Basic	20-sept-2016	14:44	UTC-5	70°16.751'	098°32.183'	Beam Trawl ↓	174	103	285	12	1.3	1.1	1014,0	86	0/10
3b	311	Basic	20-sept-2016	15:13	UTC-5	70°17.449'	098°30.790'	Beam Trawl ↑	159	332	280	17	0.5	1.1	1014,2	89	0/10
3b	310E	Basic	20-sept-2016	18:50	UTC-5	70°49.933'	099°04.119'	Radiosonde Launch	209	101	250	11	0.6	0.5	1014,2	89	0/10
3b	310E	Basic	20-sept-2016	18:17	UTC-5	70°49.917'	099°03.717'	DSN ↓	210	040	240	13	0.4	0.6	1014,4	90	0/10
3b	310E	Basic	20-sept-2016	18:35	UTC-5	70°50.597'	099°03.126'	DSN ↑	211	349	240	10	0.2	0.5	1014,4	91	0/10
3b	310E	Basic	20-sept-2016	19:01	UTC-5	70°49.892'	099°04.321'	CTD-Rosette ↓	211	092	240	12	0.6	0.5	1014,2	89	0/10
3b	310E	Basic	20-sept-2016	19:44	UTC-5	70°49.988'	099°04.353'	CTD-Rosette ↑	211	070	255	11	4.0	0.5	1014,4	79	0/10
3b	310E	Basic	20-sept-2016	20:12	UTC-5	70°50.130'	099°03.710'	Bioness ↓	211	091	260	9	2.4	0.5	1014,4	83	0/10
3b	310E	Basic	20-sept-2016	21:18	UTC-5	70°47.740'	098°59.430'	Bioness ↑	218	214	270	16	0.9	0.4	1014,4	87	0/10
3b	310E	Basic	20-sept-2016	21:56	UTC-5	70°49.970'	099°04.660'	Box Core ↓	211	090	270	15	0.6	0.4	1014,2	87	0/10

3b	310E	Basic	20-sept-2016	22:02	UTC-5	70°49.970'	099°04.660'	Box Core (bottom)	212	084	270	13	1.0	0.4	1014,5	85	0/10
3b	310E	Basic	20-sept-2016	22:06	UTC-5	70°49.990'	099°04.620'	Box Core ↑	211	109	270	13	1.0	0.4	1014,5	85	0/10
3b	310E	Basic	20-sept-2016	22:32	UTC-5	70°49.560'	099°06.650'	Beam Trawl ↓	214	075	260	12	0.8	0.5	1014,3	87	0/10
3b	310E	Basic	20-sept-2016	23:04	UTC-5	70°50.480'	099°04.360'	Beam Trawl ↑	215	350	260	14	0.3	0.5	1014,4	89	0/10
3b	310W	Basic	21-sept-2016	04:05	UTC-5	71°27.485'	101°16.093'	DSN ↓	170	051	210	15	0.4	0.2	1013,0	90	0/10
3b	310W	Basic	21-sept-2016	04:22	UTC-5	71°28.049'	101°16.866'	DSN ↑	160	010	210	15	-0.2	0.2	1012,9	92	0/10
3b	310W	Basic	21-sept-2016	04:48	UTC-5	71°27.583'	101°16.215'	CTD-Rosette ↓	165	025	195	11	0.1	0.2	1012,6	92	0/10
3b	310W	Basic	21-sept-2016	05:25	UTC-5	71°27.647'	101°16.585'	CTD-Rosette ↑	165	070	210	16	4.1	0.2	1012,5	77	0/10
3b	310W	Basic	21-sept-2016	05:46	UTC-5	71°27.566'	101°16.269'	5NVS ↓	165	021	210	16	0.1	0.2	1012,3	92	0/10
3b	310W	Basic	21-sept-2016	05:58	UTC-5	71°27.564'	101°16.249'	5NVS ↑	166	024	210	13	-0.1	0.2	1012,3	93	0/10
3b	310W	Basic	21-sept-2016	06:17	UTC-5	71°27.571'	101°16.326'	Box Core ↓	162	028	195	17	1.6	0.2	1012,2	87	0/10
3b	310W	Basic	21-sept-2016	06:21	UTC-5	71°27.569'	101°16.344'	Box Core (bottom)	163	026	195	15	1.8	0.2	1012,1	86	0/10
3b	310W	Basic	21-sept-2016	06:26	UTC-5	71°27.568'	101°16.322'	Box Core ↑	163	019	195	15	1.8	0.2	1012,1	86	0/10
3b	310W	Basic	21-sept-2016	06:43	UTC-5	71°27.622'	101°16.113'	Beam Trawl ↓	170	022	195	18	0.7	0.3	1011,8	90	0/10
3b	310W	Basic	21-sept-2016	07:12	UTC-5	71°28.357'	101°18.391'	Beam Trawl ↑	164	281	195	13	-0.3	0.2	1011,4	93	0/10
3b	310W	Basic	21-sept-2016	06:51	UTC-5	71°27.903'	101°16.341'	Radiosonde Launch	163	310	195	16	0.1	0.3	1011,6	92	0/10
3b	AMD0416-7	Coring	21-sept-2016	11:05	UTC-5	71°52.130'	102°43.290'	Gravity Core ↓	246	020	170	20	0.0	-0.1	1006,9	87	0/10
3b	AMD0416-7	Coring	21-sept-2016	11:11	UTC-5	71°52.133'	102°43.303'	Gravity Core (bottom)	246	033	180	15	2.4	0.0	1006,9	80	0/10
3b	AMD0416-7	Coring	21-sept-2016	11:16	UTC-5	71°52.140'	102°43.350'	Gravity Core ↑	246	021	180	15	2.4	0.0	1006,9	80	0/10
3b	AMD0416-7	Coring	21-sept-2016	11:25	UTC-5	71°52.140'	102°43.340'	Box Core ↓	246	035	170	14	3.7	0.0	1006,8	76	0/10
3b	AMD0416-7	Coring	21-sept-2016	11:30	UTC-5	71°52.143'	102°43.367'	Box Core (bottom)	246	004	180	16	2.5	0.0	1006,7	81	0/10
3b	AMD0416-7	Coring	21-sept-2016	11:37	UTC-5	71°52.150'	102°43.288'	Box Core ↑	245	007	180	16	2.5	0.0	1006,7	81	0/10
3b	AMD0416-7	Coring	21-sept-2016	18:50	UTC-5	72°58.032'	103°37.485'	Radiosonde Launch	355	070	205	8	-0.1	-0.7	1003,0	99	8/10
3b	Furze-04	Coring	22-sept-2016	03:53	UTC-5	73°38.945'	103°23.808'	Gravity Core ↓	337	033	210	7	-0.2	-0.9	1005,8	97	8/10
3b	Furze-04	Coring	22-sept-2016	03:59	UTC-5	73°38.940'	103°23.699'	Gravity Core (bottom)	337	359	210	7	-0.1	-0.9	1006,0	96	8/10
3b	Furze-04	Coring	22-sept-2016	04:08	UTC-5	73°38.937'	103°23.576'	Gravity Core ↑	337	353	210	7	-0.1	-0.9	1006,0	96	8/10
3b	Furze-04	Coring	22-sept-2016	04:18	UTC-5	73°38.941'	103°23.398'	Box Core ↓	337	025	190	7	-0.6	-0.8	1006,1	97	8/10
3b	Furze-04	Coring	22-sept-2016	04:25	UTC-5	73°38.933'	103°23.319'	Box Core (bottom)	337	025	200	8	-0.4	-0.8	1006,1	97	8/10
3b	Furze-04	Coring	22-sept-2016	04:31	UTC-5	73°38.936'	103°23.203'	Box Core ↑	337	007	200	6	0.0	-0.8	1006,2	96	8/10
3b	307	Full	22-sept-2016	06:52	UTC-5	73°56.530'	103°03.130'	Radiosonde Launch	300	009	190	9	0.8	-0.8	1006,6	94	8/10
3b	307	Full	22-sept-2016	08:16	UTC-5	74°05.280'	103°01.980'	DSN ↓	365	074	220	6	0.5	-0.8	1006,8	96	6/10
3b	307	Full	22-sept-2016	08:32	UTC-5	74°05.540'	102°59.590'	DSN ↑	352	357	220	6	0.5	-0.8	1006,9	96	6/10
3b	307	Full	22-sept-2016	08:59	UTC-5	74°05.900'	103°02.560'	5NVS ↓	360	348	200	8	-0.1	-0.8	1006,9	98	6/10
3b	307	Full	22-sept-2016	09:20	UTC-5	74°05.900'	103°02.430'	5NVS ↑	359	324	190	6	-0.4	-0.8	1007,1	99	6/10
3b	307	Full	22-sept-2016	09:42	UTC-5	74°05.890'	103°02.390'	CTD-Rosette ↓	357	029	180	6	-0.4	-0.8	1007,1	99	6/10
3b	307	Full	22-sept-2016	10:30	UTC-5	74°05.950'	103°02.510'	CTD-Rosette ↑	358	064	190	6	0.5	-0.8	1007,5	98	6/10
3b	307	Full	22-sept-2016	10:51	UTC-5	74°05.870'	103°02.700'	Hydrobios ↓	358	317	190	6	-0.2	-0.8	1007,6	97	6/10
3b	307	Full	22-sept-2016	11:15	UTC-5	74°05.920'	103°02.410'	Hydrobios ↑	358	344	200	6	-0.3	-0.8	1007,6	99	6/10
3b	307	Full	22-sept-2016	12:04	UTC-5	74°06.805'	103°06.665'	CTD-Rosette ↓	354	015	195	7	0.3	-0.8	1007,6	98	6/10
3b	307	Full	22-sept-2016	12:38	UTC-5	74°06.881'	103°06.555'	CTD-Rosette ↑	352	309	175	8	0.0	-0.8	1007,5	96	6/10
3b	307	Full	22-sept-2016	12:45	UTC-5	74°07.035'	103°06.536'	Zodiac ↓ (samples)	354	048	170	7	0.0	-0.8	1007,6	95	7/10
3b	307	Full	22-sept-2016	12:58	UTC-5	74°06.747'	103°04.867'	Zodiac ↑ (samples)	352	139	175	9	0.2	-0.8	1007,7	96	7/10
3b	307	Full	22-sept-2016	13:12	UTC-5	74°05.722'	103°02.335'	Zodiac ↓ (report)	357	154	165	10	-0.8	-0.8	1007,3	97	7/10

3b	307	Full	22-sept-2016	14:18	UTC-5	74°06.226'	103°01.415'	Zodiac ↑ (report)	350	329	165	10	-0.6	-0.8	1007,6	95	7/10
3b	307	Full	22-sept-2016	13:24	UTC-5	74°05.259'	103°01.635'	Beam Trawl ↓	362	051	175	10	-0.9	-0.8	1007,3	97	7/10
3b	307	Full	22-sept-2016	14:06	UTC-5	74°05.872'	103°01.066'	Beam Trawl ↑	350	306	165	11	-0.5	-0.8	1007,6	97	7/10
3b	307	Full	22-sept-2016	14:35	UTC-5	74°06.120'	103°00.888'	Box Core ↓	393	017	160	12	-0.9	-0.8	1007,8	96	6/10
3b	307	Full	22-sept-2016	14:41	UTC-5	74°06.134'	103°00.853'	Box Core (bottom)	349	349	150	12	-0.5	-0.8	1007,7	96	6/10
3b	307	Full	22-sept-2016	14:49	UTC-5	74°06.149'	103°00.810'	Box Core ↑	349	342	150	12	1.0	-0.8	1007,6	90	6/10
3b	307	Full	22-sept-2016	18:47	UTC-5	74°16.905'	101°19.424'	Radiosonde Launch	202	142	160	8	-0.9	-0.9	1007,8	99	6/10
3b	307	Full	23-sept-2016	07:13	UTC-5	74°39.730'	098°57.000'	Radiosonde Launch	170	008	155	18	0.2	-1.1	1008,8	99	6/10
3b	Furze-07	Coring	23-sept-2016	11:37	UTC-5	74°42.456'	097°11.712'	Piston Core ↓	320	293	120	28	0.9	-0.7	1007,4	91	2/10
3b	Furze-07	Coring	23-sept-2016	11:44	UTC-5	74°42.486'	097°11.674'	Piston Core (bottom)	320	351	130	27	1.0	-0.7	1007,1	90	2/10
3b	Furze-07	Coring	23-sept-2016	11:56	UTC-5	74°42.665'	097°11.886'	Piston Core ↑	310	151	120	29	1.4	-0.7	1007,1	89	2/10
3b	Furze-07	Coring	23-sept-2016	13:02	UTC-5	74°42.408'	097°11.726'	Box Core ↓	318	338	120	16	3.4	-0.6	1007,0	80	1/10
3b	Furze-07	Coring	23-sept-2016	13:09	UTC-5	74°42.411'	097°11.739'	Box Core (bottom)	321	311	120	16	3.4	-0.6	1007,0	80	1/10
3b	Furze-07	Coring	23-sept-2016	13:16	UTC-5	74°42.431'	097°11.644'	Box Core ↑	322	327	120	18	3.5	-0.6	1007,0	81	1/10
3b	346	Nutrient	23-sept-2016	23:18	UTC-5	74°09.080'	091°31.120'	CTD-Rosette ↓	278	282	160	23	1.7	-0.8	1010,3	81	1/10
3b	346	Nutrient	24-sept-2016	00:02	UTC-5	74°09.099'	091°28.552'	CTD-Rosette ↑	279	215	090	18	1.8	-0.7	1011,4	82	1/10
3b	304	Basic	24-sept-2016	01:02	UTC-5	74°15.232'	091°31.194'	DSN ↓	316	285	140	30	0.0	-0.3	1010,2	87	1/10
3b	304	Basic	24-sept-2016	01:21	UTC-5	74°15.042'	091°33.589'	DSN ↑	310	300	105	24	0.4	-0.3	1010,4	86	1/10
3b	304	Basic	24-sept-2016	01:40	UTC-5	74°14.658'	091°30.753'	CTD-Rosette ↓	315	297	100	23	0.7	-0.3	1010,7	86	0/10
3b	304	Basic	24-sept-2016	02:29	UTC-5	74°14.698'	091°31.116'	CTD-Rosette ↑	313	001	137	25	2.3	-0.4	1010,3	79	0/10
3b	304	Basic	24-sept-2016	02:49	UTC-5	74°14.795'	091°31.142'	5NVS ↓	315	341	120	28	1.7	-0.3	1010,1	83	0/10
3b	304	Basic	24-sept-2016	03:08	UTC-5	74°14.798'	091°31.059'	5NVS ↑	314	346	125	26	2.6	-0.4	1010,2	85	0/10
3b	304	Basic	24-sept-2016	03:32	UTC-5	74°14.769'	091°31.358'	Box Core ↓	314	337	125	30	2.8	-0.4	1009,7	80	0/10
3b	304	Basic	24-sept-2016	03:38	UTC-5	74°14.770'	091°31.318'	Box Core (bottom)	314	004	135	30	2.8	-0.4	1009,8	80	0/10
3b	304	Basic	24-sept-2016	03:44	UTC-5	74°14.774'	091°31.421'	Box Core ↑	316	322	130	31	3.5	-0.4	1009,6	78	0/10
3b	304	Basic	24-sept-2016	04:08	UTC-5	74°14.982'	091°31.403'	Beam Trawl ↓	314	295	140	26	5.0	-0.4	1009,6	73	0/10
3b	304	Basic	24-sept-2016	04:47	UTC-5	74°13.970'	091°33.512'	Beam Trawl ↑	304	174	140	26	1.3	-0.4	1010,1	85	0/10
3b	345	Nutrient	24-sept-2016	06:03	UTC-5	74°21.417'	091°29.040'	CTD-Rosette ↓	320	310	125	21	0.7	-0.6	1009,4	88	4/10
3b	345	Nutrient	24-sept-2016	06:47	UTC-5	74°21.560'	091°27.909'	CTD-Rosette ↑	314	296	120	21	1.8	-0.7	1009,8	83	4/10
3b	344	Nutrient	24-sept-2016	07:34	UTC-5	74°26.915'	091°31.642'	CTD-Rosette ↓	161	345	120	26	0.8	-0.8	1009,5	86	4/10
3b	344	Nutrient	24-sept-2016	08:04	UTC-5	74°26.960'	091°30.980'	CTD-Rosette ↑	161	350	120	18	3.4	-0.7	1009,4	77	4/10
3b	344	Nutrient	24-sept-2016	06:55	UTC-5	74°21.860'	091°27.243'	Radiosonde Launch	300	056	120	21	2.1	-0.7	1009,8	83	4/10
3b	343	Nutrient	24-sept-2016	08:50	UTC-5	74°32.630'	091°32.980'	CTD-Rosette ↓	151	318	120	25	1.0	-0.7	1009,5	86	4/10
3b	343	Nutrient	24-sept-2016	09:19	UTC-5	74°32.780'	091°33.820'	CTD-Rosette ↑	150	315	120	20	3.1	-0.6	1009,6	79	4/10
3b	301	Basic	24-sept-2016	18:54	UTC-5	74°06.082'	085°01.527'	Radiosonde Launch	503	085	185	15	2.9	-0.4	1013,8	79	1/10
3b	301	Basic	24-sept-2016	21:37	UTC-5	74°07.140'	083°17.970'	DSN ↓	675	013	170	7	0.6	-0.4	1015,0	84	1/10
3b	301	Basic	24-sept-2016	21:54	UTC-5	74°07.660'	083°19.470'	DSN ↑	675	214	170	7	0.6	-0.4	1015,0	84	1/10
3b	301	Basic	24-sept-2016	22:12	UTC-5	74°07.280'	083°19.090'	CTD-Rosette ↓	678	342	140	6	0.3	-0.4	1015,0	88	1/10
3b	301	Basic	24-sept-2016	23:14	UTC-5	74°07.270'	083°19.440'	CTD-Rosette ↑	678	003	170	6	1.6	-0.4	1015,0	83	1/10
3b	301	Basic	24-sept-2016	23:29	UTC-5	74°07.290'	083°19.560'	Box Core ↓	678	355	090	5	1.2	-0.3	1014,9	86	1/10
3b	301	Basic	24-sept-2016	23:38	UTC-5	74°07.270'	083°19.610'	Box Core (bottom)	677	337	090	5	1.2	-0.3	1014,9	86	1/10
3b	301	Basic	24-sept-2016	23:53	UTC-5	74°07.258'	083°19.554'	Box Core ↑	676	344	190	11	1.6	-0.3	1015,0	84	1/10
3b	301	Basic	25-sept-2016	00:24	UTC-5	74°05.622'	083°13.448'	Beam Trawl ↓	670	118	235	16	1.9	-0.4	1014,8	86	1/10

3b	301	Basic	25-sept-2016	01:48	UTC-5	74°06.784'	083°13.900'	Beam Trawl ↑	676	013	210	6	2.0	-0.3	1014,8	85	1/10
3b	165	Basic	26-sept-2016	06:55	UTC-4	72°42.937'	075°45.258'	CTD-Rosette ↓	695	081	250	24	2.4	1.4	1009,2	86	0/10
3b	165	Basic	26-sept-2016	07:21	UTC-4	72°42.808'	075°45.271'	CTD-Rosette ↑	697	069	255	17	4.6	1.5	1009,6	77	0/10
3b	165	Basic	26-sept-2016	08:27	UTC-4	72°42.690'	075°46.010'	DSN ↓	700	081	260	23	3.4	1.4	1009,2	84	0/10
3b	165	Basic	26-sept-2016	09:00	UTC-4	72°42.940'	075°41.700'	DSN ↑	685	116	260	21	2.4	1.4	1008,8	88	0/10
3b	165	Basic	26-sept-2016	09:47	UTC-4	72°43.020'	075°45.240'	5NVS ↓	695	062	270	27	2.4	1.4	1008,3	88	0/10
3b	165	Basic	26-sept-2016	10:26	UTC-4	72°42.820'	075°44.950'	5NVS ↑	698	099	260	20	6.0	1.5	1008,8	75	0/10
3b	165	Basic	26-sept-2016	10:59	UTC-4	72°42.700'	075°45.610'	CTD-Rosette ↓	699	085	270	17	4.8	1.5	1008,8	79	0/10
3b	165	Basic	26-sept-2016	11:58	UTC-4	72°42.221'	075°45.039'	CTD-Rosette ↑	698	071	255	19	5.0	1.5	1008,1	77	0/10
3b	165	Basic	26-sept-2016	12:45	UTC-4	72°42.774'	075°45.248'	Beam Trawl ↓	698	074	270	20	2.7	1.5	1008,9	87	0/10
3b	165	Basic	26-sept-2016	14:01	UTC-4	72°44.753'	075°41.826'	Beam Trawl ↑	615	103	260	15	2.6	1.8	1008,9	96	0/10
3b	165	Basic	26-sept-2016	14:26	UTC-4	72°42.927'	075°45.816'	Box Core ↓	695	118	270	27	2.8	1.7	1008,0	91	0/10
3b	165	Basic	26-sept-2016	14:47	UTC-4	72°42.549'	075°45.646'	Box Core (bottom)	697	088	275	25	4.5	1.4	1008,5	84	0/10
3b	165	Basic	26-sept-2016	15:03	UTC-4	72°42.322'	075°45.699'	Box Core ↑	698	145	270	25	5.7	1.3	1008,2	79	0/10
3b	165	Basic	26-sept-2016	20:06	UTC-4	72°02.610'	073°08.110'	Radiosonde Launch	157	126	200	19	4.8	2.7	1008,1	84	Bergy
3b	177	Basic	28-sept-2016	15:58	UTC-4	67°28.190'	063°47.477'	DSN ↓	453	129	75	6	4.4	3.1	1012,7	65	1/10
3b	177	Basic	28-sept-2016	16:17	UTC-4	67°28.285'	063°46.388'	DSN ↑	415	307	75	6	3.3	3.1	1012,8	71	1/10
3b	177	Basic	28-sept-2016	16:35	UTC-4	67°28.575'	063°47.461'	CTD-Rosette ↓	370	084	120	1	3.5	3.0	1013,0	70	1/10
3b	177	Basic	28-sept-2016	17:24	UTC-4	67°28.454'	063°47.838'	CTD-Rosette ↑	393	022	245	4	4.3	3.0	1013,3	68	1/10
3b	177	Basic	28-sept-2016	17:47	UTC-4	67°28.553'	063°47.680'	5NVS ↓	376	324	170	7	3.2	3.1	1013,3	75	Bergy
3b	177	Basic	28-sept-2016	18:10	UTC-4	67°28.527'	063°48.066'	5NVS ↑	383	108	170	5	3.2	3.0	1013,6	77	Bergy
3b	177	Basic	28-sept-2016	18:31	UTC-4	67°28.514'	063°48.010'	Box Core ↓	385	84	180	5	3.0	3.1	1013,7	78	Bergy
3b	177	Basic	28-sept-2016	18:37	UTC-4	67°28.525'	063°48.022'	Box Core (bottom)	382	103	175	5	3.0	3.1	1013,7	78	Bergy
3b	177	Basic	28-sept-2016	18:47	UTC-4	67°28.484'	063°48.030'	Box Core ↑	386	095	175	5	3.0	3.1	1013,8	78	Bergy
3b	177	Basic	28-sept-2016	19:08	UTC-4	67°28.245'	063°48.754'	IKMT ↓	458	137	180	3	2.8	3.2	1013,9	77	Bergy
3b	177	Basic	28-sept-2016	19:47	UTC-4	67°28.665'	063°45.650'	IKMT ↑	383	274	180	2	2.6	3.1	1014,0	78	Bergy
3b	177	Basic	28-sept-2016	20:00	UTC-4			Radiosonde Launch	383		180	2	2.6	3.1	1013,9	78	Bergy
3b	177	Basic	29-sept-2016	05:30	UTC-4	67°26.280'	063°21.428'	CTD-Rosette ↓	270	048	140	5	2.1	3.1	1011,4	85	Bergy
3b	177	Basic	29-sept-2016	06:13	UTC-4	67°26.324'	063°22.465'	CTD-Rosette ↑	400	031	165	10	2.7	3.1	1011,2	77	Bergy
3b	177	Basic	29-sept-2016	06:23	UTC-4	67°26.344'	063°22.839'	SX 90 ↓	418	045	160	10	2.7	3.1	1011,1	76	Bergy
3b	177	Basic	29-sept-2016	08:00	UTC-4	67°24.060'	063°20.240'	SX 90 ↑	170	330	140	7	2.2	2.8	1009,8	83	Bergy
3b	1	Nutrient	29-sept-2016	08:50	UTC-4	67°23.980'	063°14.980'	CTD-Rosette ↓	193	096	150	5	2.5	2.9	1009,6	76	Bergy
3b	1	Nutrient	29-sept-2016	09:25	UTC-4	67°24.170'	063°15.040'	CTD-Rosette ↑	194	128	Light air		2.8	2.9	1009,4	75	Bergy
3b	2	Nutrient	29-sept-2016	09:49	UTC-4	67°23.300'	063°15.920'	CTD-Rosette ↓	157	073	190	10	2.1	2.9	1009,1	77	Bergy
3b	2	Nutrient	29-sept-2016	10:17	UTC-4	67°23.660'	063°15.620'	CTD-Rosette ↑	227	082	200	8	3.2	2.9	1008,8	75	Bergy
3b	DOWNSTREAM 3	Nutrient	29-sept-2016	10:50	UTC-4	67°22.680'	063°17.200'	CTD-Rosette ↓	316	076	180	9	2.2	2.9	1008,3	76	Bergy
3b	DOWNSTREAM 3	Nutrient	29-sept-2016	11:20	UTC-4	67°22.940'	063°17.190'	CTD-Rosette ↑	270	055	190	10	3.0	2.9	1008,1	75	Bergy
3b	DOWNSTREAM 4	Nutrient	29-sept-2016	12:00	UTC-4	67°22.325'	063°17.542'	CTD-Rosette ↓	340	076	195	11	2.9	2.5	1007,5	71	Bergy
3b	DOWNSTREAM 4	Nutrient	29-sept-2016	12:33	UTC-4	67°22.334'	063°17.451'	CTD-Rosette ↑	342	074	200	8	2.8	2.6	1007,2	77	Bergy
3b	DOWNSTREAM 4	Nutrient	29-sept-2016	12:39	UTC-4	67°22.333'	063°17.350'	Zodiac ↓	341	057	205	9	2.8	2.6	1007,0	76	Bergy
3b	DOWNSTREAM 4	Nutrient	29-sept-2016	14:22	UTC-4	67°22.678'	063°16.783'	Zodiac ↑	317	203	320	2	2.3	2.7	1006,4	83	Bergy
3b	640	Nutrient	01-oct-2016	08:31	UTC-4	58°55.950'	062°09.300'	CTD-Rosette ↓	141	130	320	12	3.5	2.4	1014,1	79	0/10
3b	640	Nutrient	01-oct-2016	09:07	UTC-4	58°55.900'	062°09.250'	CTD-Rosette ↑	143	145	320	11	6.8	2.3	1014,2	69	0/10

3b	645	Nutrient	01-oct-2016	20:05	UTC-4	56°41.970'	059°41.990'	CTD-Rosette ↓	119	139	310	10	2.8	3.0	1019,4	81	0/10
3b	645	Nutrient	01-oct-2016	20:32	UTC-4	56°41.860'	059°41.750'	CTD-Rosette ↑	118	132	310	10	3.9	2.9	1019,4	76	0/10
3b	650	Nutrient	02-oct-2016	13:11	UTC-4	53°48.126'	055°26.327'	CTD-Rosette ↓	210	110	285	8	3.9	3.7	1012,2	76	0/10
3b	650	Nutrient	02-oct-2016	13:55	UTC-4	53°47.538'	055°26.137'	CTD-Rosette ↑	202	125	314	9	4.4	3.7	1011,7	74	0/10
3b	650	Nutrient	02-oct-2016	13:57	UTC-4	53°47.493'	055°26.136'	Box Core ↓	202	120	316	6	4.4	3.7	1011,7	74	0/10
3b	650	Nutrient	02-oct-2016	14:00	UTC-4	53°47.476'	055°26.161'	Box Core (bottom)	203	166	315	9	3.6	3.7	1011,6	76	0/10
3b	650	Nutrient	02-oct-2016	14:05	UTC-4	53°47.387'	055°26.071'	Box Core ↑	204	124	345	8	3.6	3.7	1011,6	76	0/10
3b	AMD0416-9	Coring	02-oct-2016	18:10	UTC-4	52°51.562'	054°45.875'	CTD-Rosette ↓	204	300	130	9	4.1	4.7	1007,8	84	0/10
3b	AMD0416-9	Coring	02-oct-2016	18:28	UTC-4	52°51.356'	054°45.954'	CTD-Rosette ↑	197	270	130	8	3.7	4.7	1007,4	88	0/10
3b	AMD0416-9	Coring	02-oct-2016	18:40	UTC-4	52°51.589'	054°45.824'	Box Core ↓	202	053	120	8	4.0	4.7	1007,2	88	0/10
3b	AMD0416-9	Coring	02-oct-2016	18:44	UTC-4	52°51.580'	054°45.793'	Box Core (bottom)	201	019	125	9	4.0	4.7	1007,2	88	0/10
3b	AMD0416-9	Coring	02-oct-2016	18:49	UTC-4	52°51.612'	054°45.758'	Box Core ↑	204	018	125	9	4.0	4.7	1007,2	88	0/10
Mooring Program - Hudson Bay (CCGS *Des Groseilliers)*																	
BS	AN01		26-sept-2016	14:45	UTC-0			Acoustic ↓	98		160	11	5,4				
BS	AN01		26-sept-2016	14:57	UTC-0			Acoustic ↓	96		160	11	5,5				
BS	AN01		26-sept-2016	15:06	UTC-0			Acoustic ↓	96		160	11	5,5				
BS	AN01		26-sept-2016	18:15	UTC-0			Light profiler	105		180	5	5,4				
BS	AN01		26-sept-2016	18:20	UTC-0			Light profiler	100		180	5	5,4				
BS	AN01		26-sept-2016	21:22	UTC-0			Mooring	112		270	3	5,2				
BS	AN01		26-sept-2016	23:43	UTC-0			Rosette	107		350	14	5,3				
BS	AN01		26-sept-2016	23:50	UTC-0			Rosette	107		350	14	5,3				
BS	AN01		26-sept-2016	00:25	UTC-0			Rosette (not completed)	100		0	13	5,2				
BS	AN01		26-sept-2016	00:37	UTC-0			Idronaut	100		0	15	5,4				
BS	AN01		26-sept-2016	00:51	UTC-0			Niskin sampling	100		0	15	5,3				
BS	AN04		27-sept-2016	15:07	UTC-0			Light profiler	54		40	14	6,5				
BS	AN04		27-sept-2016	15:27	UTC-0			Light profiler	53		45	14	6,5				
BS	AN04		27-sept-2016	16:30	UTC-0			Rosette	60		350	15	6,7				
BS	BS03		27-sept-2016		UTC-0						40	15	7,2				
BS	BS04		27-sept-2016	19:45	UTC-0			Rosette	44		50	15	6,8				
BS	BS04		27-sept-2016	20:08	UTC-0			Rosette	45		45	12	6,7				
BS	BS04		27-sept-2016	20:36	UTC-0			Light profiler	45		75	13	6,7				
BS	BS04		27-sept-2016	20:48	UTC-0			Light profiler	45		80	13	6,7				
BS	BS04		27-sept-2016	23:24	UTC-0			Mooring (wheel)	46		90	8	7,4				
BS	BS04		27-sept-2016	23:23	UTC-0			Mooring (ADCP)	46								
BS	BS04		27-sept-2016	23:43	UTC-0			Niskin sampling	47		90	10	7,3				
BS	BS04		27-sept-2016	23:49	UTC-0			Niskin sampling	47		90	10	7,3				
BS	BS06		28-sept-2016	20:30	UTC-0			Rosette	57		230	20	8,6				
BS	BS06		28-sept-2016	20:51	UTC-0			Rosette	55		230	20	8,6				
BS	BS06		28-sept-2016	22:31	UTC-0			Mooring (tube)	54		250	15	9,4				
BS	BS06		28-sept-2016		UTC-0			Mooring (train wheel)	54		250	15	9,4				
BS	BS06		28-sept-2016	22:55	UTC-0			Light profiler	56		270	13	9,2				
BS	BS06		28-sept-2016	23:10	UTC-0			Rosette	59		270	12	9,2				
BS	BS07		29-sept-2016	15:29	UTC-0			Light profiler	11		215	12	8,2				

BS	M6		29-sept-2016	15:51	UTC-0			Mooring (ADCP)	29,7		225	15					
BS	M6		29-sept-2016	17:51	UTC-0			Mooring (train wheel)	29		225	20					
BS	BS08		30-sept-2016	13:50	UTC-0			Light profiler	62		230	12	8,3				
BS	S01		30-sept-2016		UTC-0			River sample									
BS	BS08		30-sept-2016	15:17	UTC-0			Rosette	63		250	10	8,5				
BS	W01		30-sept-2016		UTC-0			River sample									
BS	BS09		30-sept-2016	19:46	UTC-0			Rosette	110		240	15	8,4				
BS	BS09		30-sept-2016	20:12	UTC-0			Light profiler	109		250	14	9,8				
BS	BS09		30-sept-2016	20:18	UTC-0			Light profiler	108		250	14	9,8				
BS	JB02		01-oct-2016	14:27	UTC-0			Rosette	78		180	10	8,6				
BS	JB02		01-oct-2016	14:56	UTC-0			Light profiler	73		170	5	8,1				
BS	JB02		01-oct-2016	17:03	UTC-0			Mooring	101		220	10	9				
BS	JB01		01-oct-2016	18:14	UTC-0			Rosette	50		180	10	8,6				
BS	JB01		01-oct-2016	18:39	UTC-0			Rosette	51		180	10	8,5				
BS	JB00		01-oct-2016	19:16	UTC-0			Rosette	46		190	15	8,9				
BS	JB00		01-oct-2016	19:39	UTC-0			Light profiler	46		190	15	8,8				
BS	JB03		01-oct-2016		UTC-0			Rosette									
BS	JB03		02-oct-2016	10:21	UTC-0			Rosette	111		45	20	6				
BS	JB04		02-oct-2016	11:11	UTC-0			Rosette	107		30	24	6				
BS	JB05		02-oct-2016	12:20	UTC-0			Rosette	97		35	25	6,1				
BS	JB06		02-oct-2016	13:29	UTC-0			Rosette	77		15	22	6,1				
BS	JB07		02-oct-2016	14:26	UTC-0			Rosette	63		20	22	5,9				
BS	JB08		02-oct-2016	16:59	UTC-0			Rosette	45		0	25	4,9				
BS	JB09		02-oct-2016	17:55	UTC-0			Rosette	33		35	23	5,8				
BS	JB95		02-oct-2016	18:45	UTC-0			Rosette	27		35	22	6,8				
BS	JB85		02-oct-2016	19:48	UTC-0			Rosette	37		30	20	5,2				
BS	JB10		03-oct-2016	10:20	UTC-0			Rosette	24		160	13	5				
BS	JB11		03-oct-2016	11:18	UTC-0			Rosette	47		170	18	5,5				
BS	JB12		03-oct-2016	12:22	UTC-0			Rosette	64		170	20	5				
BS	JB13		03-oct-2016	14:16	UTC-0			Rosette	95		175	18	5,7				
BS	JB14		03-oct-2016	16:23	UTC-0			Rosette	105		170	25	6,4				
BS	JB14		03-oct-2016	16:42	UTC-0			Light profiler	102		180	23	6,5				
BS	JB15		03-oct-2016	21:46	UTC-0			Rosette	170		200	27	8,4				
BS	JB15		03-oct-2016	22:13	UTC-0			Light profiler	166		200	27	8,4				
BS	KU02		04-oct-2016	10:20	UTC-0			Rosette	97		210	19	10,7				
BS	KU01		04-oct-2016	11:18	UTC-0			Rosette	43		225		1,2				
BS	CI01		06-oct-2016	19:00	UTC-0			Rosette	194		25	15	-0,6				
BS	CI01		06-oct-2016	20:17	UTC-0			Light Profiler	191		10	18	-0,6				
BS	WI01		06-oct-2016	20:24	UTC-0			Light profiler	191		10	18	-0,6				
BS	CI03		07-oct-2016	14:10	UTC-0			Idronaut (CTD)	108		320	6	-1,6				
BS	CI02		08-oct-2016	11:00	UTC-0			Rosette	106		20	16	-0,5				
BS	MI02		08-oct-2016	13:34	UTC-0			Rosette	208		25	20	-0,8				
BS	MI02		08-oct-2016	18:51	UTC-0			Rosette	125		15	20	-0,5				

BS	MI01		08-oct-2016	19:16	UTC-0			Light Profiler	131		20	18	-0,5				
BS	MI01		08-oct-2016	20:10	UTC-0			Rosette	68		20	18	-0,2				
BS	MI01		08-oct-2016	20:31	UTC-0			Light Profiler	70		20	18	-0,5				
BS	NI01		09-oct-2016	18:17	UTC-0			Rosette CTD only	50		310	15	0				

Leg	Cast	Station	Start Date UTC	Time UTC	Latitude N	Longitude W	Bottom depth (m)	Cast depth (dbar)	Comments	Rosette Type	Init
Leg 1a											
1a	001	Test GSL	2016-06-05	18:33	50°20,443	058°31,058	200	190	test sur winch	Test	PG
1a	002	Test	2016-06-07	18:13	58°33,580	052°50,304	3700	990	pb CDOM	Test	MP
1a	003	G100	2016-06-09	17:13	68°29,920	056°47,400	371	360	no pb	Full	CM
1a	004	G100	2016-06-09	20:40	68°30,104	056°47,566	371	360	no pb	Full	MP
1a	005	G101	2016-06-10	07:59	68°29,792	057°7,944	369	361		Nutrients	PG
1a	006	G102	2016-06-10	09:53	68°29,830	057°28,748	364	354		Full-Physio	PG
1a	007	G102	2016-06-10	12:10	68°30,005	057°28,150	361	355	No pb /9m du fond	Full-diversit	CM
1a	008	G104	2016-06-11	00:10	68°29,869	058°9,160	323	311	fichier config sans dble capteur	Basic-Phyto	CM
1a	009	G103	2016-06-11	03:41	68°29,928	057°38,352	368	355		Nutrients	CMMP
1a	010	G105	2016-06-11	08:06	68°29,920	058°31,315	349	340		Benthos	PG
1a	011	G106	2016-06-11	12:37	68°29,980	058°49,448	321	312	no pb	Nutrients	CM
1a	012	G107	2016-06-11	14:48	68°29,906	059°10,738	317	307	no pb	Physio	CM
1a	013	G107	2016-06-11	17:51	68°30,943	059°15,910	411	405		Full-Physio	MP
1a	014	G107	2016-06-11	21:48	68°30,180	059°16,486	407	399		Full-Benthos	PG
1a	015	G108	2016-06-12	01:06	68°30,550	059°29,820	621	347	pas de bouteilles	CTD	CM
1a	016	G109	2016-06-12	03:23	68°30,966	059°50,654	1300	734		Nutrients	MP
1a	017	G110	2016-06-12	09:44	68°32,022	060°10,022	1460	351		Full-Phyto	PG
1a	018	G110	2016-06-12	13:12	68°31,939	060°8,470	1450	346	sans ISUS	Full-Phyto	CM
1a	019	G110	2016-06-12	15:02	68°31,553	060°8,664	1457	1438	sans ISUS ni PAR	Benthos	CM
1a	020	G111	2016-06-13	00:42	68°28,244	060°26,378	1591	347	pas de bouteilles	CTD	CM
1a	021	G112	2016-06-13	02:13	68°33,240	060°39,109	1649	1631	sans ISUS ni PAR	Nutients	CM
1a	022	G113	2016-06-13	05:25	68°29,790	060°52,650	1691	348		CTD	MP
1a	023	G114	2016-06-13	06:54	68°30,948	061°6,258	1721	347		CTD	MP
1a	024	G115	2016-06-13	11:02	68°27,362	061°21,350	1700	351		Full-Phyto	PG
1a	025	G115	2016-06-13	14:20	68°26,320	061°21,751	1734	347		Full-phyto	CM
1a	026	G115	2016-06-13	17:24	68°25,219	061°18,950	1730	1711		Benthos	MP
1a	027	G200	2016-06-14	10:29	68°35,020	060°6,193	1446	1437		Nutrients	PG
1a	028	G201	2016-06-14	17:29	68°37,980	059°56,815	1378	349		Phyto	MP
1a	029	G201	2016-06-14	20:25	68°36,589	059°55,939	1354	351	Btl 6 is leaking	Full-Phyto	PG
1a	030	G201	2016-06-14	23:39	68°35,431	059°56,304	1345	1327	fuite bouteille24	Benthos	CM
1a	031	G202	2016-06-15	07:41	68°39,547	059°36,246	994	349		CTD	MP
1a	032	G203	2016-06-15	08:55	68°41,080	059°25,189	680	675	Pb LADCP	Nutrient	PG
1a	033	G204	2016-06-15	12:06	68°42,509	059°15,428	537	348		Full-Phyto	CM
1a	034	G204	2016-06-15	14:43	68°42,713	059°15,884	549	348		Full-production	CM
1a	035	G204	2016-06-15	18:15	68°42,749	059°13,301	512	500		Benthos	MP
1a	036	G205	2016-06-16	00:20	68°44,594	058°56,154	354	342	sans prelevement	CTD	CM
1a	037	G206	2016-06-16	01:42	68°46,382	058°44,356	332	323		nutriments	CM
1a	038	G207	2016-06-16	03:35	68°48,251	058°29,522	321	312		CTD	CM
1a	039	G207	2016-06-16	12:06	68°47,647	058°31,732	322	315		Full Phyto	CM
1a	040	G207	2016-06-16	14:37	68°48,110	058°31,031	322	312		Full-Production	CM
1a	041	G207	2016-06-16	18:32	68°47,906	058°31,140	322	310		Benthos	MP
1a	042	G208	2016-06-16	20:35	68°49,265	058°17,995	323	315		CTD	PG
1a	043	G209	2016-06-16	21:39	68°51,014	058°4,926	305	295		Nutrients	PG
1a	044	G210	2016-06-16	23:14	68°52,541	057°51,728	282	272		CTD	PG
1a	045	G211	2016-06-17	00:14	68°54,476	057°39,028	292	282		Nutrients	CM
1a	046	G	2016-06-17	04:22	68°58,985	058°7,931	306	299		Benthos	CM
1a	047	G3000	2016-06-17	13:07	69°0,448	055°59,458	127	116		Nutrients	CM
1a	048	G300	2016-06-17	16:38	68°59,911	056°47,364	196	186		Full	MP
1a	049	G300	2016-06-17	18:58	69°0,034	056°46,793	196	186		phyto	MP
1a	050	G300	2016-06-17	21:36	68°59,987	056°47,366	198	189		Benthos	PG
1a	051	G301	2016-06-18	02:32	69°0,030	057°0,616	224	215		CTD	CM
1a	052	G302	2016-06-18	03:26	69°0,004	057°14,941	232	221		Nutients	CM
1a	053	G303	2016-06-18	05:40	68°59,996	057°29,116	271	261		Full	MP
1a	054	G304	2016-06-18	07:24	68°59,987	057°42,636	296	286		ctd	MP
1a	055	G305	2016-06-18	08:18	68°59,980	057°56,956	299	291		Nutrients	PG
1a	056	G306	2016-06-18	09:36	68°59,980	058°11,315	307	297		CTD	PG
1a	057	G309	2016-06-18	12:49	68°59,987	058°44,366	345	335		Full-phyto	PG
1a	058	G309	2016-06-18	14:24	68°59,915	058°44,350	343	334		Full-production	PG
1a	059	G309	2016-06-18	19:00	68°59,993	058°43,955	345	335		Benthos	MP
1a	060	G307	2016-06-18	23:11	69°0,107	058°24,953	311	302		CTD	PG
1a	061	G308	2016-06-19	00:08	69°0,084	058°39,178	325	315		Nutrients	CM
1a	062	G310	2016-06-19	02:54	69°1,586	059°3,301	621	347		Basic Phyto	CM
1a	063	G311	2016-06-19	04:36	68°59,591	059°19,722	928	918		CTD	MP
1a	064	G313	2016-06-19	07:14	69°0,678	059°47,948	1496	1486		Nutrients	PG
1a	065	G312	2016-06-19	13:21	69°0,740	059°33,814	1434	347		Full_Phyto	CM
1a	066	G312	2016-06-19	16:45	69°1,381	059°36,335	1434	351		Full-production	MP

1a	067	G312	2016-06-19	20:18	69°1,988	059°37,691	1451	1442		Benthos	PG
1a	068	G314	2016-06-20	01:34	69°0,577	060°2,987	1594	347		CTD	CM
1a	069	G315	2016-06-20	03:49	69°0,348	060°11,365	1627	347		Nutrients	MP
1a	070	G316	2016-06-20	06:02	69°0,083	060°30,943	1694	349		CTD	MP
1a	071	G317	2016-06-20	07:17	69°0,418	060°44,558	1726	1716	No Isus no PAR	Nutrients	MP
1a	072	G318	2016-06-20	13:15	69°0,438	060°57,152	1730	347		Full-Phyto	CM
1a	073	G318	2016-06-20	17:33	68°59,507	060°59,071	1775	256		Full-Production	MP
1a	074	G318	2016-06-20	22:37	68°59,597	060°57,354	1765	1756	Ni Isus no PAR	Benthos	PG
1a	075	G319	2016-06-21	00:57	69°0,101	061°11,665	1819	1800		CTD	CM
1a	076	G320	2016-06-21	03:46	69°1,980	061°26,285	1847	1837		Nutrients	CM
1a	077	G321	2016-06-21	07:48	68°57,461	061°37,948	1839	348		Basic	MP
1a	078	G322	2016-06-21	09:19	68°59,347	061°52,993	1856	1847	No PAR, no ISUS	CTD	PG
1a	079	G323	2016-06-21	11:56	69°0,514	062°7,333	1880	1870	No PAR, no ISUS	Nutrients	CM
1a	080	G324	2016-06-21	17:46	68°59,772	062°21,488	1899	356		Full-phyto	MP
1a	081	G324	2016-06-21	19:49	68°58,843	062°20,875	1890	348	Pb Isus during the upcast	Full-production	PG
1a	082	G324	2016-06-21	23:53	68°57,334	062°19,834	1897	1882	No PAR, no ISUS	Benthos	CM
1a	083	G325	2016-06-22	04:08	68°59,959	062°36,185	1885	1876	No PAR, no ISUS	Nutrients	MP
1a	084	DIC-1	2016-06-22	11:40	68°27,959	062°40,634	1669	1660	No PAR, no ISUS	DIC	CM
1a	085	DIC-2	2016-06-22	20:24	67°59,700	063°11,718	776	768	No PAR	DIC	PG
Leg 1b											
1b	086	G400	2016-06-24	23:38	68°1,174	062°25,132	1244	351		BASIC	PG
1b	087	G401	2016-06-25	04:58	68°4,289	062°7,588	1588	1579		CTD	MP
1b	088	G402	2016-06-25	06:53	68°4,498	061°51,600	1657	1647		Nutrients	PG
1b	089	G403	2016-06-25	13:24	68°1,871	061°36,062	1678	347		Full-Phyto	CM
1b	090	G403	2016-06-25	16:56	68°1,962	061°39,205	1672	357		Full-production	MP
1b	091	G403	2016-06-25	19:45	68°1,951	061°36,532	1673	1664	No PAR no ISUS	Benthos	PG
1b	092	G404	2016-06-25	23:16	68°5,626	061°21,270	1682	1673	No PAR no ISUS	CTD	CM
1b	093	G405	2016-06-26	01:23	68°5,618	061°4,588	1660	1650	No PAR no ISUS	Nutrients	CM
1b	094	G406	2016-06-26	05:03	68°4,769	060°48,961	1978	357		Full-Phyto	MP
1b	095	G407	2016-06-26	06:39	68°5,896	060°32,786	1601	1592	No PAR no ISUS	CTD	MP
1b	096	G408	2016-06-26	08:52	68°7,058	060°16,090	1534	1525	No PAR no ISUS	Nutrients	PG
1b	097	G409	2016-06-26	14:25	68°6,349	059°59,665	1408	348		Full Phyto	CM
1b	098	G409	2016-06-26	18:18	68°6,318	059°58,228	1395	356		Phyto prod	MP
1b	099	G409	2016-06-26	20:59	68°6,307	059°59,635	1404	1396	No PAR, no ISUS	Benthos	PG
1b	100	G410	2016-06-27	00:26	68°6,589	059°43,708	1052	1043	No PAR, no ISUS	CTD	CM
1b	101	G411	2016-06-27	02:35	68°6,967	059°27,088	507	498		Nut	CM
1b	102	G412	2016-06-27	05:39	68°6,734	059°12,089	303	294		NUT HPLC	MP
1b	103	G413	2016-06-27	07:37	68°6,905	058°56,237	271	261	pb ISUS	CTD	MP
1b	104	G414	2016-06-27	08:52	68°6,692	058°41,262	273	264	ISUS did not work	Nutrients	PG
1b	105	G415	2016-06-27	10:38	68°6,732	058°25,272	402	393	ISUS with 25µM shift	CTD	PG
1b	106	G413		:	°	°	284		ISUS NOK Archiving OFF	Full	MP
1b	107	G413	2016-06-27	17:46	68°7,350	058°57,970	272	262	ISUS change	Full	MP
1b	108	G413	2016-06-27	20:24	68°7,518	058°58,686	272	264	btl 20 did not close	Full-production	PG
1b	109	G413	2016-06-27	21:56	68°8,138	058°59,603	283	275	btl 20 did not close	Benthos	PG
1b	110	G418	2016-06-28	10:57	68°6,856	057°46,182	380	371		Full-Phyto	PG
1b	111	G418	2016-06-28	16:09	68°6,841	057°45,898	383	356		Full Production	MP
1b	112	G418	2016-06-28	19:19	68°6,910	057°45,674	382	373		Benthos	MP
1b	113	G416	2016-06-28	23:01	68°6,876	058°7,039	400	391		CTD	PG
1b	114	G417	2016-06-29	00:05	68°6,811	057°51,833	384	374	btl 20 ok (closed for test)	Nurients	CM
1b	115	G419	2016-06-29	01:57	68°6,796	057°20,618	330	320		CTD	CM
1b	116	G420	2016-06-29	03:01	68°6,540	057°4,306	260	250		Nutrients	CM
1b	117	G500	2016-06-29	22:27	70°0,078	056°53,873	186	176		BASIC-Phyto	PG
1b	118	G501	2016-06-29	23:36	70°0,011	057°11,142	249	240		CTD	PG
1b	119	G502	2016-06-30	00:33	70°0,012	057°27,473	267	256		Nutrients	CM
1b	120	G503	2016-06-30	02:34	70°0,002	057°45,858	296	289		BASIC-Phyto-benthos	CM
1b	121	G504	2016-06-30	05:16	70°0,110	058°4,297	330	320		CTD	MP
1b	122	G505	2016-06-30	06:14	69°59,990	058°21,772	339	329		Nutrients	MP
1b	123	G507	2016-06-30	10:06	70°0,546	059°7,469	293	284		Full-Phyto	PG
1b	124	G507	2016-06-30	16:07	70°0,463	059°7,438	293	283		N assimilation	MP
1b	125	G507	2016-06-30	17:51	70°0,452	059°7,507	293	282		Benthos	MP
1b	126	G506.5	2016-06-30	20:07	70°0,138	058°53,347	286	276		CTD	PG
1b	127	G506	2016-06-30	22:09	70°0,259	058°39,376	313	303		BASIC	PG
1b	128	G508	2016-07-01	00:34	70°0,257	059°17,238	339	330		CTD	CM
1b	129	G509	2016-07-01	01:58	69°59,788	059°30,595	391	384		Nutrients	CM
1b	130	G510	2016-07-01	04:34	69°59,988	059°48,485	459	347		Full-phyto	MP
1b	131	G511	2016-07-01	06:11	69°59,989	060°5,491	480	476	Touche le fond	CTD	MP
1b	132	G512	2016-07-01	07:27	69°59,988	060°21,697	544	535		Nutrient	MP
1b	133	G513	2016-07-01	09:24	69°59,842	060°40,856	931	921		CTD	PG
1b	134	G512	2016-07-01	11:09	70°0,164	060°21,902	532	351		Full-Phyto	PG
1b	135	G512	2016-07-01	16:21	69°59,978	060°21,906	541	357	Seapoint câble 0-50µg/l	N assimilation	MP
1b	136	G512	2016-07-01	18:30	69°59,992	060°22,103	547	533		Benthos	MP

1b	137	G513	2016-07-01	21:36	70°0,186	060°40,848	906	897		CTD	PG
1b	138	G514	2016-07-01	23:17	70°0,214	060°58,439	1247	1240		Nutrients	PG
1b	139	G515	2016-07-02	02:27	69°59,844	061°14,335	1470	347		Basic Phyto	CM
1b	140	G516	2016-07-02	04:06	70°0,158	061°33,679	1686	1676		CTD	MP
1b	141	G517	2016-07-02	06:12	69°59,536	061°51,290	1849	1839		Nutrients	MP
1b	142	G518	2016-07-02	09:01	69°59,789	062°9,128	1961	1951	No PAR, no ISUS	CTD	PG
1b	143	G519	2016-07-02	15:01	70°1,014	062°25,324	2000	347		Full Phyto	CM
1b	144	G519	2016-07-02	17:29	70°0,368	062°25,758	2004	347	UVP5 NOK	Assimilation	MP
1b	145	G519	2016-07-02	19:57	69°59,124	062°26,891	2002	1993	no Isus, no PAR, no UVP	Benthos	PG
1b	146	G521	2016-07-03	03:15	69°59,802	063°1,075	2029	2020	UVP5sn200 installe	Nut	MP
1b	147	G600	2016-07-03	14:27	70°30,653	063°59,258	2113	347		Full phyto	CM
1b	148	G600	2016-07-03	17:05	70°29,928	063°59,960	2110	356		Full production	MP
1b	149	G600	2016-07-03	21:15	70°28,591	063°58,688	2106	2098	no PAR, no ISUS	Benthos	PG
1b	150	G601	2016-07-04	01:25	70°30,200	063°42,157	2120	990		CTD	CM
1b	151	G602	2016-07-04	03:06	70°30,791	063°24,434	2115	993			MP
1b	152	G603	2016-07-04	06:47	70°30,089	063°2,538	2216	346		Phyto	MP
1b	153	G604	2016-07-04	08:13	70°30,028	062°48,131	2099	1001	dual conduc shift ~0.003	CTD	PG
1b	154	G605	2016-07-04	09:49	70°30,158	062°31,042	2040	1001	dual conduc shift ~0.003	Nutrients	PG
1b	155	G605	2016-07-04	12:18	70°29,574	062°25,345	2017	348	C star bruite	full phyto	CM
1b	156	G605	2016-07-04	16:10	70°27,806	062°30,236	2031	356	dual conduc shift ~0.003		MP
1b	157	G605	2016-07-04	18:09	70°26,995	062°30,467	2017	2007		Benthos	MP
1b	158	G606	2016-07-04	23:33	70°30,019	062°11,786	1930	1001		CTD	PG
1b	159	G615	2016-07-05	12:11	70°29,926	059°31,504	617	347	Seapoint cable0-50µg/l	Full phyto	CM
1b	160	G615	2016-07-05	16:09	70°30,108	059°30,211	617	357		Full prod	MP
1b	161	G615	2016-07-05	20:51	70°28,096	059°28,829	575	566		Benthos	CS
1b	162	G614	2016-07-06	01:01	70°30,035	059°49,897	669	659		CTD	CM
1b	163	G613	2016-07-06	02:10	70°30,137	060°7,364	657	647		Nutients	CM
1b	164	G612	2016-07-06	04:36	70°30,769	060°26,010	664	346		Basic	MP
1b	165	G611	2016-07-06	05:51	70°30,010	060°43,126	733	724	seapoint cable 0-15	CTD	MP
1b	166	G610	2016-07-06	07:03	70°30,022	061°0,834	840	831		Nutrients	MP
1b	167	G604.5	2016-07-06	12:19	70°30,095	062°37,526	840	348		Full phyto	CM
1b	168	G604.5	2016-07-06	16:09	70°30,022	062°37,847	2060	356		Prod	MP
1b	169	G607	2016-07-06	21:36	70°29,999	061°54,731	1777	1001		Nutrients	PG
1b	170	G608	2016-07-07	00:06	70°30,126	061°36,341	1559	348		Full Phyto	CM
1b	171	G609	2016-07-07	01:28	70°30,028	061°18,551	1166	992		Nutrients	CM
1b	172	G616	2016-07-07	06:04	70°30,013	059°14,180	568	559		CTD	MP
1b	173	G617	2016-07-07	07:15	70°29,953	058°56,352	528	518		Nutrients	MP
1b	174	G618	2016-07-07	09:35	70°29,998	058°38,671	498	351	Fluo (0-15µg/l) out of range	Basic	PG
1b	175	G703	2016-07-07	16:45	69°29,984	058°43,458	523	513		Full Phyto	MP
1b	176	G703	2016-07-07	18:23	69°29,986	058°43,147	525	356		Full Prod	MP
1b	177	G703	2016-07-07	23:27	69°29,953	058°43,319	523	515		Benthos	PG
1b	178	G700	2016-07-08	04:31	69°30,037	057°52,216	285	275		Nutrients	MP
1b	179	G701	2016-07-08	05:37	69°30,054	058°9,385	284	276		Nutrients	MP
1b	180	G702	2016-07-08	06:46	69°30,103	058°26,184	308	299		CTD	MP
1b	181	G704	2016-07-08	08:43	69°30,022	059°0,032	1017	1009		CTD	PG
1b	182	G705	2016-07-08	10:24	69°30,096	059°17,228	1215	1001		Nutrients	PG
1b	183	G707	2016-07-08	14:18	69°30,738	059°48,318	1423	350		Full phyto	CS
1b	184	G707	2016-07-08	17:42	69°30,650	059°48,436	1416	356		Full Prod	MP
1b	185	G707	2016-07-08	19:54	69°30,655	059°48,440	1419	1409	no PAR, no ISUS, Fluo (0-15µg/L out of range	Benthos	PG
1b	186	G708	2016-07-09	02:20	69°30,146	060°8,977	1542	1000	PAR & ISUS & Seapoint cable 0-50µg/L	Nutriments	CS
1b	187	G709	2016-07-09	04:20	69°30,040	060°25,636	1638	988	stop a 500m remontee	CTD	MP
1b	188	G710	2016-07-09	05:59	69°30,101	060°42,347	1697	989	stop a 300m descente	CTD	MP
1b	189	G711	2016-07-09	07:49	69°29,966	061°0,703	1785	1001	Fluo cable 0-15µg/L	Nutrients	PG
1b	190	Float03	2016-07-09	10:12	69°19,378	060°59,033	1800	501		CTD-HPLC	PG
1b	191	Float04	2016-07-09	12:39	69°20,166	060°13,178	1625	500		CTD-HPLC	CS
1b	192	G713	2016-07-09	16:54	69°30,037	061°34,918	1900	356		Full Phyto	MP
1b	193	G713	2016-07-09	20:36	69°30,038	061°34,622	1895	347		Full Prod	PG
1b	194	G713	2016-07-09	22:13	69°30,042	061°34,655	1892	1884	no PAR, no Isus, Seapoint 0-15µg/L out of range	Benthos	PG
1b	195	G712	2016-07-10	02:42	69°30,102	061°17,242	1825	991	PAR, ISUS, Fluo 0-50	CTD	CM
1b	196	G714	2016-07-10	04:30	69°29,994	061°51,898	1930	989		CTD	MP
1b	197	G715	2016-07-10	05:47	69°29,990	062°8,404	1940	989		Nutriments	MP
1b	198	G716	2016-07-10	07:32	69°30,002	062°25,600	1959	593		Basic	MP
1b	199	G717	2016-07-10	08:56	69°30,157	062°42,758	1970	1000		CTD	PG
1b	200	G718	2016-07-10	10:24	69°30,200	063°0,030	1974	1002		Nutrients	PG
1b	201	G719	2016-07-10	12:30	69°30,062	063°13,957	1954	347		Full Phyto	CM
1b	202	G719	2016-07-10	16:45	69°29,983	063°16,730	1950	356		Production	MP
1b	203	G719	2016-07-10	18:31	69°29,998	063°17,012	1948	1939	retire PAR et ISUS	Benthos	MP
Leg 2a											

2a	001	FB6	2016-07-15	12:30	63°6,184	067°30,784	595	586	Bio/Chem	CTD	JZ
2a	002	FB3	2016-07-16	03:37	63°34,141	068°30,475	150	142	SPAR faulty, no second CT	CTD	JZ
2a	003	FB4	2016-07-16	04:58	63°33,541	068°14,924	115	106	SPAR faulty Bio/Chem	Basic	JZ
2a	004	FB1	2016-07-16	17:28	63°38,798	068°36,503	61	47		CTD	JF
2a	005	FB2-2	2016-07-16	22:09	63°40,498	068°25,877	60	50		CTD	JF
2a	006	FB7	2016-07-17	04:49	62°58,721	067°17,098	455	445	Bio/Chemical	Basic	JZ
2a	007	FB8	2016-07-17	08:19	62°55,421	067°5,468	605	600		CTD	JF
2a	008	ROV1	2016-07-17	17:27	61°20,521	061°9,665	556	546		Basic	JF
2a	009	ROV1	2016-07-18	20:54	61°20,484	061°9,568	562	552	Bio	Basic	JZ
2a	010	ROV5	2016-07-19	13:58	61°26,694	060°40,514	583	561		Basic	JF
2a	011	ROV5	2016-07-19	16:47	61°26,650	060°40,764	572	562	Bio	Basic	JZ
2a	012	ROV2	2016-07-20	12:46	60°19,354	062°12,397	279	268		Basic	JF
2a	013	ROV2	2016-07-20	15:26	60°19,477	062°11,455	279	271	Bio	Basic	JZ
2a	014	ROV3	2016-07-21	09:08	60°28,138	061°16,807	436	419		Basic	JZ
2a	015	ROV6	2016-07-22	17:05	63°0,049	060°38,513	456	453		Basic	JF
2a	016	ROV6	2016-07-22	19:27	63°0,118	060°38,336	454	445	Bio	Basic	JZ
2a	017	Disco Fan 7	2016-07-25	00:28	67°58,192	059°30,140	902	891	Ox samples	Basic	JF
2a	018	Disco Fan 7	2016-07-25	04:00	67°58,722	059°31,302	932	920	Bio	Basic	JZ
2a	019	181	2016-07-26	12:15	67°30,196	061°31,783	928	921		Nuts	JZ
2a	020	180	2016-07-26	14:51	67°29,131	061°40,574	342	336		Basic	JF
2a	021	180	2016-07-26	17:49	67°31,212	061°40,949	658	637	Bio	Basic	JF
2a	022	179	2016-07-27	00:12	67°26,876	061°55,186	186	176		Nuts	JZ
Leg 2b											
2b	023	PII-A-1-f	2016-07-28	17:15	67°24,426	063°16,117	192	183		CTD	JF
2b	024	PII-A-1-f	2016-07-28	17:58	67°23,687	063°12,978	226	216		CTD	JF
2b	025	PII-A-1-f	2016-07-28	19:31	67°23,351	063°22,307	347	337		CTD	JF
2b	026	PII-A-1-f	2016-07-28	20:30	67°22,516	063°17,712	326	317		CTD	JF
2b	027	177	2016-07-29	00:54	67°28,614	063°47,383	365	356	Ox samples	Full	JZ
2b	028	177	2016-07-29	07:06	67°28,543	063°47,482	371	362	Bio	Full	JZ
2b	029	178	2016-07-29	17:04	68°29,447	064°40,057	167	157		Nuts	JF
2b	030	176	2016-07-30	06:39	69°35,434	065°20,698	400	390		Basic	JZ
2b	031	176	2016-07-30	08:33	69°35,515	065°21,311	368	359	Bio	basic	JZ
2b	032	174	2016-07-31	09:18	70°14,534	066°36,648	132	122		nuts	JZ
2b	033	173	2016-07-31	12:57	70°41,224	066°57,068	370	358		nuts	JF
2b	034	169	2016-08-01	05:05	71°16,164	070°31,272	766	756		Full	JZ
2b	035	169	2016-08-01	08:27	71°16,304	070°31,380	767	758	Bio	Full	JF
2b	036	170	2016-08-01	23:35	71°28,877	069°58,180	692	682		Nuts	JF
2b	037	171	2016-08-02	02:14	71°30,863	069°35,516	690	681		Nuts	JZ
2b	038	172	2016-08-02	04:31	71°39,710	069°8,537	1634	1615		Nuts	JZ
2b	039	166	2016-08-03	09:45	72°29,321	073°43,308	336	326		Nuts	JF
2b	040	160	2016-08-03	20:49	72°41,062	078°34,238	721	712	Bio	Hybrid	JF
2b	041	325	2016-08-04	08:11	73°49,016	080°29,486	680	670		Nuts	JZ
2b	042	324	2016-08-04	10:25	73°59,015	080°28,537	768	759		Nuts	JF
2b	043	323	2016-08-04	13:04	74°9,413	080°28,135	782	772	Bio	Full	JF
2b	044	323	2016-08-04	15:14	74°9,424	080°27,378	796	788		Full	JF
2b	045	300	2016-08-05	06:43	74°18,979	080°29,802	701	690		Nuts	JZ
2b	046	322	2016-08-05	08:49	74°29,807	080°32,502	663	653		Nuts	JF
2b	047	M2=BA=16	2016-08-06	01:12	75°39,130	070°25,151	533	523		CTD	JF
2b	048	M1=BA=16	2016-08-06	03:44	75°47,939	070°12,749	536	526		CTD	JF
2b	049	115	2016-08-06	07:06	76°19,908	071°11,857	673	664		Full	JZ
2b	050	115	2016-08-06	09:16	76°19,864	071°11,738	669	660	Bio	Full	JZ
2b	051	114	2016-08-06	22:45	76°19,508	071°46,860	612	603		CTD	JF
2b	052	113	2016-08-07	00:04	76°19,286	072°13,072	551	542		Nuts	JF
2b	053	112	2016-08-07	01:44	76°19,009	072°41,873	557	548		CTD	JZ
2b	054	111	2016-08-07	02:57	76°18,490	073°12,814	587	577		Basic	JZ
2b	055	111	2016-08-07	05:46	76°18,524	073°12,533	599	589	Bio	Basic	JZ
2b	056	CASQ	2016-08-07	13:00	77°0,190	072°8,525	957	947		CTD	JF
2b	057	138	2016-08-07	18:56	76°40,931	072°21,977	165	147	Not able to fire bottles	Nuts	JF
2b	058	138b	2016-08-07	23:51	76°37,724	070°41,263	179	170	Bottles fired instead of 138	CTD	JZ
2b	059	116	2016-08-08	02:03	76°44,322	071°49,147	718	709	Bottle 22 did not fire initially called 11	Full	JZ
2b	060	116	2016-08-08	08:04	76°44,336	071°48,457	733	723	Bottle 22 did not fire, Bio; initially calle	Full	JF
2b	061	110	2016-08-08	19:06	76°17,915	073°37,976	528	518	Bottle 22 did not fire	Nuts	JF
2b	062	109	2016-08-08	20:50	76°17,384	074°6,746	452	442		CTD	JF
2b	063	108	2016-08-08	22:02	76°15,760	074°35,892	448	438	Bottle 22 did not fire	Full	JZ
2b	064	108	2016-08-09	06:16	76°15,948	074°33,164	439	429	Bio	Full	JZ
2b	065	107	2016-08-09	07:52	76°16,854	074°59,563	436	427		Nuts	JZ
2b	066	106	2016-08-09	09:41	76°18,728	075°22,436	375	366		CTD	JZ
2b	067	105	2016-08-09	13:05	76°19,026	075°45,473	324	314	Bio	Basic	JF
2b	068	105	2016-08-09	16:42	76°19,051	075°45,625	327	318		Basic	JF
2b	069	104	2016-08-09	18:57	76°20,622	076°10,366	192	182		CTD	JF
2b	070	103	2016-08-09	20:14	76°21,169	076°34,922	146	136		NUts	JF

2b	071	102	2016-08-10	01:48	76°22,253	077°0,408	260	251		CTD	JZ
2b	072	101	2016-08-10	03:26	76°23,243	077°23,861	337	327	Chemical	Full	JZ
2b	073	101	2016-08-10	08:24	76°22,991	077°23,414	348	338	Bio	Full	JZ
2b	074	TS233	2016-08-11	07:10	77°52,843	077°11,188	524	514		Full	JZ
2b	075	TS233	2016-08-11	09:29	77°52,883	077°11,663	525	515		Full	JF
2b	076	Ts233	2016-08-11	16:38	77°47,730	076°31,922	570	560		Nuts	JF
2b	077	139	2016-08-13	03:36	81°21,436	062°48,206	599	588	Chem, Ox samples	Full	JZ
2b	078	139	2016-08-13	10:58	81°21,007	062°46,729	571	562	Bio	Full	JF
2b	079	Kane_1	2016-08-14	05:22	79°59,015	069°48,242	245	235		Full	JZ
2b	080	Kane_1	2016-08-14	09:20	79°58,891	069°47,173	245	236	Bio	Full	JZ
2b	081	134	2016-08-14	11:51	80°3,311	068°40,014	252	239		Nuts	JF
2b	082	136	2016-08-14	13:51	80°3,214	067°58,850	256	251		Nuts	JF
2b	083	133	2016-08-14	20:42	79°33,252	070°30,844	182	174	Bio	Basic	JF
2b	084	133	2016-08-15	00:26	79°33,098	070°30,172	176	165	Chem	Basic	JZ
2b	085	Kane_5	2016-08-15	07:52	79°0,496	073°12,533	243	234		Nuts	JZ
2b	086	127	2016-08-15	13:56	78°18,041	074°31,960	600	591	Bio	Basic	JF
2b	087	127	2016-08-15	17:32	78°17,909	074°29,318	542	530		Basic	JF
2b	088	119	2016-08-16	03:33	77°18,308	076°8,873	501	495	Chem	Basic	SA
2b	089	119	2016-08-16	08:28	77°19,003	076°5,795	512	503	Bio	Basic	JZ
2b	090	Allen Bay	2016-08-17	22:54	74°43,630	095°14,797	67	58		Nuts	SA
2b	091	305	2016-08-18	05:07	74°19,745	094°58,626	169	159	Chem	Basic	JZ
2b	092	305	2016-08-18	09:24	74°19,741	094°59,014	169	160	Bio	Basic	JF
2b	093	306	2016-08-18	14:37	74°24,848	098°11,050	136	126		Nuts	JZ
2b	094	310E	2016-08-19	16:18	71°17,669	097°42,094	130	120	Bio	Basic	JZ
2b	095	310E	2016-08-19	18:32	71°17,623	097°42,166	128	120		Basic	JF
2b	096	311	2016-08-20	01:20	70°16,205	098°31,144	139	130		Nuts	SA
2b	097	312	2016-08-20	12:42	69°10,381	100°41,579	65	56	Bio	Basic	JF
2b	098	312	2016-08-20	14:33	69°10,298	100°41,909	66	57	Chem	Basic	JZ
2b	099	QMQM	2016-08-20	22:38	68°14,768	101°46,873	105	95		Mooring	SA
2b	100	QMGM	2016-08-21	00:33	68°18,050	101°44,650	109	99		Nuts	JF
2b	101	QMGM	2016-08-21	04:22	68°18,234	101°44,700	110	101		Basic	JF
2b	102	QMG2	2016-08-21	07:52	68°18,820	100°48,011	50	41		BASIC	JF
2b	103	QMGM	2016-08-21	19:15	68°14,982	101°48,496	93	83	Deployed	Mooring	SA
2b	104	QMG1	2016-08-22	10:24	68°29,497	099°53,794	37	29	Bio/Chem	Basic	JZ
2b	105	QMG3	2016-08-22	20:43	68°19,768	102°56,705	52	43		Nuts	JF
2b	106	QMG4	2016-08-23	01:25	68°29,046	103°25,692	65	55		Basic	SA
2b	107	314	2016-08-23	10:39	68°58,231	105°28,532	74	64		Full	JF
2b	108	316	2016-08-23	13:19	68°58,286	105°28,550	77	66		NUTS	JF
2b	109	316	2016-08-24	05:24	68°22,897	112°7,042	174	165		Nuts	JZ
Leg 3a											
3a	001	405	2016-08-27	05:41	70°36,638	123°1,735	626	558	Chem (failure)	Full	SA
3a	002	CA-08	2016-08-27	23:28	71°0,545	126°5,370	390	379	Mooring recovered	Mooring (recovered)/geo	DS
3a	003	407	2016-08-28	06:30	70°59,977	126°4,475	391	381	Chem	Full	DS
3a	004	407	2016-08-28	11:03	71°0,253	126°3,983	387	378	Mooring deployed (before triangulatio	Full	SA
3a	005	407	2016-08-28	15:17	71°0,576	126°4,478	386	376	Mooring deployed (after triangulation)	Full	SA
3a	006	437	2016-08-28	19:51	71°48,036	126°29,956	289	279	Biology	Basic	DS
3a	007	437	2016-08-28	23:03	71°47,994	126°29,735	288	279	Chem	Basic	DS
3a	008	410	2016-08-29	01:15	71°42,042	126°29,657	405	394		Nuts	DS
3a	009	411	2016-08-29	02:53	71°37,648	126°42,941	430	423		CTD	SA
3a	010	412	2016-08-29	04:30	71°33,794	126°55,600	411	403		Nuts	SA
3a	011	413	2016-08-29	05:58	71°29,515	127°8,238	368	360		CTD	SA
3a	012	414	2016-08-29	06:56	71°25,414	127°20,044	313	305		Nuts	SA
3a	013	408	2016-08-29	14:13	71°17,171	127°33,210	197	188	Chem/Mooring RECOVERY	Full	DS
3a	014	CA-05	2016-08-29	16:41	71°16,796	127°31,942	199	187	Bio	Full	DS
3a	015	CA-05	2016-08-29	19:17	71°17,132	127°32,060	200	190	POPS	Mooring	DS
3a	016	CA-05	2016-08-29	22:07	71°16,522	127°31,708	195	185	DEPLOYMENT	Mooring	DS
3a	017	417	2016-08-29	23:15	71°13,260	127°58,730	82	73		CTD	DS
3a	018	418	2016-08-30	00:01	71°9,623	128°10,051	64	54		Nuts	SA
3a	019	419	2016-08-30	00:52	71°6,289	128°20,900	54	46		CTD	SA
3a	020	420	2016-08-30	01:44	71°2,803	128°31,036	42	33	Chem	Basic	SA
3a	021	420	2016-08-30	03:32	71°2,978	128°30,875	39	28	Bio	Basic	SA
3a	022	434	2016-08-30	14:20	70°10,578	133°32,898	45	35	Chem	Basic	DS
3a	023	434	2016-08-30	16:10	70°10,451	133°32,939	44	35	BIO	Basic	DS
3a	024	433	2016-08-30	17:44	70°17,194	133°34,780	54	44	CTD	CTD	DS
3a	025	432	2016-08-30	18:33	70°23,638	133°36,475	61	51		NUTS	DS
3a	026	431	2016-08-30	19:30	70°29,490	133°37,234	66	56		CTD	DS
3a	027	430	2016-08-30	20:19	70°35,735	133°38,845	68	59		NUTS	DS
3a	028	429	2016-08-30	21:21	70°41,875	133°40,487	67	57		CTD	SA
3a	029	428	2016-08-30	22:20	70°47,418	133°41,761	72	62		Nuts	SA
3a	030	427	2016-08-30	23:19	70°52,757	133°43,292	78	69		CTD	SA
3a	031	426	2016-08-31	00:13	70°59,068	133°44,662	98	89		Nuts	SA

3a	032	425	2016-08-31	01:18	71°4,732	133°47,260	302	293		CTD	SA
3a	033	424	2016-08-31	02:18	71°10,387	133°49,392	577	568		Nuts	SA
3a	034	423	2016-08-31	03:58	71°16,254	133°51,272	795	787		CTD	SA
3a	035	422	2016-08-31	05:15	71°22,727	133°53,664	1102	328	court circuit	Nuts	SA
3a	036	421	2016-08-31	07:00	71°28,138	133°54,074	1141	40	court circuit	Basic	SA
3a	037	152	2016-09-01	03:27	70°52,007	135°1,734	183	175	Mooring recovery (BRK-1)	Mooring	SA
3a	038	482	2016-09-01	10:48	70°31,482	139°22,914	818	810	Chem short circuit	Basic	DS
3a	039	472	2016-09-02	11:28	69°36,660	138°13,702	124	114	Biology	Basic	DS
3a	040	472	2016-09-02	12:59	69°36,631	138°13,540	123	113	Chemistry	Basic	DS
3a	041	470	2016-09-02	14:49	69°25,732	137°59,333	51	42	Nutrients	Basic	DS
3a	042	474	2016-09-02	17:19	69°47,794	138°26,485	171	161	Nutrients	NUTS	DS
3a	043	476	2016-09-02	19:15	69°59,065	138°39,103	264	255	Nuts	Nuts	DS
3a	044	478	2016-09-02	21:19	70°10,039	138°54,146	377	267		Nuts	SA
3a	045	480	2016-09-02	23:22	70°20,100	139°8,833	556	547		Nuts	SA
3a	046	BR-1	2016-09-03	03:43	70°26,033	139°2,423	743	733	Mooring deployed (BR-1)	Mooring	SA
3a	047	482	2016-09-03	05:15	70°31,483	139°22,286	822	811	Basic (Bio/chem)	Basic	SA
3a	048	BR-G	2016-09-04	18:46	71°0,186	135°28,772	689	680	Mooring and POPS	Mooring	DS
3a	049	BR-K	2016-09-05	01:11	70°51,901	135°2,070	181	172	Mooring deployed + POPS	Mooring	SA
3a	050	GSC-2	2016-09-05	01:59	70°52,408	135°0,388	189	180	Lander	Lander	SA
3a	051	435	2016-09-05	09:43	71°4,793	133°37,727	306	297	Chem	Full	SA
3a	052	435	2016-09-05	15:00	71°4,697	133°38,206	293	283	Bio	Full	DS
3a	053	421	2016-09-05	18:06	71°28,025	133°54,590	1159	1149	Bio	Basic	DS
3a	054	421	2016-09-05	19:52	71°28,141	133°55,032	1165	68	HG	Basic	DS
3a	055	421	2016-09-05	20:38	71°28,129	133°53,851	1122	1114	Chem	Basic	DS
3a	056	BR-3	2016-09-07	22:15	73°24,310	129°20,546	670	662	Mooring (Recovery)	Mooring	DS
3a	057	535	2016-09-08	03:46	73°25,008	128°11,233	287	279	Chem	Full	SA
3a	058	535	2016-09-08	08:54	73°24,707	128°11,767	289	277	Bio	Full	SA
3a	059	BR-3	2016-09-09	02:02	73°25,122	129°21,300	715	709	Mooring (Deployed) + POPS	Mooring	SA
3a	060	554	2016-09-09	21:00	75°44,671	126°26,346	367	360	Bio	Full	DS
3a	061	554	2016-09-10	00:04	75°44,456	126°28,534	370	363	Chem	Full	DS
3a	062	575	2016-09-10	18:26	76°10,902	125°59,581	313	303	Bio	Full	DS
3a	063	575	2016-09-10	22:06	76°9,646	125°54,704	310	304	Chem	Full	SA
3a	064	577	2016-09-11	03:09	75°53,425	125°43,192	363	354		Nuts	SA
3a	065	579	2016-09-11	07:13	75°32,021	125°34,267	387	377		Nuts	SA
3a	066	581	2016-09-11	12:09	75°12,895	125°23,580	409	403		Nuts	DS
3a	067	583	2016-09-12	01:18	74°52,867	125°7,883	465	455		Nuts	SA
3a	068	585	2016-09-12	06:10	74°29,990	123°14,638	373	364	Chem	Basic	SA
3a	069	585	2016-09-12	15:05	74°30,191	123°14,312	379	370	Bio	Basic	DS
3a	070	LAKEMAN-08	2016-09-12	21:55	74°53,117	122°9,778	502	492	PISTON CORE	PISTON	DS
3a	071	545	2016-09-13	10:09	74°10,700	126°49,309	311	303	Chem	Basic	SA
3a	072	BR-3	2016-09-13	22:27	73°23,719	129°20,274	662	653	Mooring Deployed, O2 samples taken	Mooring+POPS	DS
3a	073	525	2016-09-14	06:02	72°23,084	128°59,329	345	337	Chem	Basic	SA
3a	074	405	2016-09-14	23:23	70°36,481	123°1,968	614	608	Bio	Basic	DS
3a	075	405	2016-09-15	01:01	70°36,554	123°1,746	626	616	CHEM	Basic	SA
3a	076	406	2016-09-15	06:22	69°58,430	122°57,274	207	200	Chem/bio	Basic	SA
3a	077	403	2016-09-15	15:23	70°6,016	120°6,074	410	400	ALL PURPOSE	Basic	DS
3a	078	1402	2016-09-16	02:02	70°33,054	117°38,155	340	333	Bio	Basic	SA
3a	079	1402	2016-09-16	03:56	70°32,916	117°38,057	338	329	Chem	Basic	SA
Leg 3b											
3b	080	316	2016-09-18	08:09	68°23,292	112°7,346	170	161	ALL	Basic	DS
3b	081	314	2016-09-19	00:38	68°58,220	105°28,243	80	71	ALL	Basic	DS
3b	082	QMG4	2016-09-19	07:55	68°29,196	103°26,269	69	62	ALL	Basic	DS
3b	083	QMG3	2016-09-19	13:46	68°19,670	102°56,346	51	40	ALL	Basic	SA
3b	084	QMGM	2016-09-19	18:43	68°18,418	101°45,023	111	101	All	Basic	SA
3b	085	QMG2	2016-09-19	23:27	68°18,834	100°48,014	52	42	ALL	Basic	DS
3b	086	312	2016-09-20	08:39	69°10,265	100°41,857	64	55	ALL	Basic	DS
3b	087	311	2016-09-20	17:48	70°17,075	098°31,261	158	149	All	Basic	SA
3b	088	310E	2016-09-21	00:05	70°49,908	099°4,368	208	199	ALL	Basic	DS
3b	089	310W	2016-09-21	09:51	71°27,582	101°16,297	163	152	All	Basic	DS
3b	090	307	2016-09-22	14:45	74°5,898	103°2,394	356	346	Full (chem)	Full	SA
3b	091	307	2016-09-22	17:07	74°6,818	103°6,671	350	342	Full (Bio)	Full	SA
3b	092	346	2016-09-24	04:21	74°9,103	091°30,914	278	270		NUTS	DS
3b	093	304	2016-09-24	06:43	74°14,652	091°30,734	311	302	ALL	Basic	DS
3b	094	345	2016-09-24	11:06	74°21,420	091°28,997	319	309		Nuts	SA
3b	095	344	2016-09-24	12:38	74°26,924	091°31,544	159	149		Nuts	SA
3b	096	343	2016-09-24	13:53	74°32,641	091°33,079	149	140		Nuts	SA
3b	097	301	2016-09-25	03:16	74°7,282	083°19,090	678	669	ALL	Basic	DS
3b	098	165	2016-09-26	10:59	72°42,925	075°45,294	696	150	Bio	Basic	SA
3b	099	165	2016-09-26	15:02	72°42,673	075°45,488	694	686	Chem	Basic	SA
3b	100	177	2016-09-28	20:39	67°28,561	063°47,473	376	365	All	Basic	DS
3b	101	FARFIELD 0	2016-09-29	09:34	67°26,291	063°21,457	285	269	Ice island	NUTS	DS

3b	102	FARFIELD 1	2016-09-29	12:55	67°23,995	063°14,974	193	184	Ice island	NUTS	SA
3b	103	FARFIELD 2	2016-09-29	13:53	67°23,333	063°15,896	177	164	Ice island	NUTS	SA
3b	104	FARFIELD 3	2016-09-29	14:53	67°22,704	063°17,206	297	290	Ice island	NUTS	SA
3b	105	FARFIELD 4	2016-09-29	16:03	67°22,334	063°17,542	338	328	Ice island	NUTS	DS
3b	106	640	2016-10-01	12:34	58°55,925	062°9,328	139	132	ALL	NUTS	SA
3b	107	645	2016-10-02	00:07	56°41,956	059°41,982	118	104	All	Nuts	SA
3b	108	650	2016-10-02	17:15	53°48,064	055°26,317	203	195	All	NUTS	DS
3b	109	AMD0416-11	2016-10-02	22:15	52°51,497	054°45,932	195	188		Geo	SA

Leg	Name	Positions	Affiliation	Network Investigator/ Supervisor	Embark place	Embark date	Disembark place	Disembark date
Leg 2b, 3a, 3b	Aebischer, Stephane	Professional	ArcticNet	Lévesque, Keith	Qikiqtarjuaq	27-Jul-16	Québec city	6-Oct-16
Leg 2a, 2b	Ahmed, Mohamed	PhD Student	University of Calgary	Else, Brent	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 1b	Amiraux, Rémi	PhD Student	MIO	Rontani, Jean-François	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Asselin, Charles	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 3a, 3b	Aubry, Cyril	Research Staff	Université Laval	Fortier, Louis	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 2a	Auger, Vincent	Professional	Canadian Scientific Submersible Facility	Auger, Vincent	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 1a	Babin, Marcel	Researcher/Professor	Takuvik	Babin, Marcel	Québec city	3-Jun-16	Qikiqtarjuaq	23-juin-16
Leg 1a	Barbedo de Freitas, Lucas	PhD Student	UQAR	Bélanger, Simon	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
BaySys	Basu, Atreya	PhD Student	CEOS	Baber, David	Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 3b	Bauce, Eric	Dignitary	Université Laval		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 1a	Bécu, Guislain	Research Staff	Takuvik	Babin, Marcel	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 2a, 2b	Bénard, Robin	PhD Student	Université Laval	Levasseur, Maurice	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3a	Benkort, Deborah	PhD Student	Université Laval	Fortier, Louis	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 2b, 3a	Blais, Marjolaine	Research Staff	ISMER - UQAR	Gosselin, Michel	Qikiqtarjuaq	27-Jul-16	Kugluktuk	17-Sep-16
BaySys	Blondeau Sylvain	Technician	ArcticNet	Lévesque, Keith	Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 2b	Boivin-Rioux, Aude	MSc Student	ISMER - UQAR	Gosselin, Michel	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 2a, 2b	Bouchard, Caroline	Postdoctoral Fellow	Université Laval	Fortier, Louis	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 1b	Bourgain, Pascaline	Media/Artist	Parafilms	Sansoulet, Julie	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Bourget, Edwin	Dignitary	Université Laval		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 3b	Bourget, Yves	Dignitary	Université Laval		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 3b	Boutin, Anne	Dignitary	CNRS		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 2a, 2b	Boyer, Matt	MSc Student	Dalhousie University	Chang, Rachel	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 2b	Bravo, Gonzalo	MSc Student	ISMER - UQAR	Archambault, Philippe	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 1b	Bricaud, Annick	Researcher/Professor	LOV	Bricaud, Annick	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Brière, Denis	Dignitary	Université Laval		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 3b	Brindamour, Charles	Dignitary	Intact Assurances		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 1b	Brouard, Étienne	PhD Student	Université Laval	Lajeunesse, Patrick	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 3a, 3b	Brouard, Étienne	PhD Student	Université Laval	Lajeunesse, Patrick	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 1b	Brunet, Camille	PhD Student	MIO	Quéguiner, Bernard	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 1a, 1b	Bruyant, Flavienne	Research Staff	Takuvik	Babin, Marcel	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 1a, 1b, 2a	Burgers, Tonya	PhD Student	University of Calgary	Brent, Else / Papakiryakou, Tim	Québec city	3-Jun-16	Qikiqtarjuaq	27-Jul-16
Leg 2a, 2b	Burt, Alexis	Research Staff	CEOS	Stern, Gary	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3b	Byers, Michael	Dignitary	UBC	Fortier, Louis	Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 2b	Campagne, Philippine	PhD Student	ISMER - UQAR	Lajeunesse / St-Onge	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 3a, 3b	Candlish, Lauren	Research Staff	Univeristy of Manitoba	Barber, David	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 3b	Cannon, Lawrence	Dignitary	Government of Canada		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 3a, 3b	Capelle, David	Postdoctoral Fellow	University of Manitoba	Papakyriakou, Tim	Kugluktuk	25-Aug-16	Pond Inlet	25-Sep-16
Leg 2a, 2b	Chakraborty, Anirban	Postdoctoral Fellow	University of Calgary	Casey, Hubert	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 1a, 1b	Chalut, Katrine	Research Staff	ISMER - UQAR	Archambault, Philippe	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 2a, 2b	Chang, Rachel	Researcher/Professor	Dalhousie University	Chang, Rachel	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3b	Chapuis, Nicolas	Dignitary	Ambassade de France		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 2a	Charette, Joannie	MSc Student	ISMER - UQAR	Gosselin, Michel	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3a, 3b	Chayer, Sira	Media/Artist	ArcticNet / Buildfilms	Blasco, Katie	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 1a	Claustre, Hervé	Researcher/Professor	LOV	Clautre / Bricaud	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 2b	Collins, Doug	Postdoctoral Fellow	University of Toronto	Abbatt, John	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 2b	Copland, Luke	Researcher/Professor	University of Ottawa	Copland, Luke	Qikiqtarjuaq	27-Jul-16	Resolute	18-Aug-16
Leg 3a, 3b	Couette, Pierre-Olivier	MSc Student	Université Laval	Lajeunesse, Patrick	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 1b	Coupel, Pierre	Postdoctoral Fellow	MIO	Babin, Marcel	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Crawford, Anna	PhD Student	Carleton University	Derek, Mueller	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 1a, 1b	Cusa, Marine	Research Staff	LEMAR	Morata, Nathalie	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 2a, 2b	Cusset, Fanny	Professional	Université Laval	Fortier, Louis	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 1a, 1b	Dadaglio, Laeticia	PhD Student	Banyuls	Joux, Fabien	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Dalglish, Geordie	Dignitary	The W. Garfield Weston Foundation		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 3b	Dallaire, Michel	Dignitary	Cominar		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 2b	Dalton, Abigail	MSc Student	University of Ottawa	Copland, Luke	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 2a	Davin, Sam	PhD Student	UQAM	Hillaire-Marcel / Edinger	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 2a	de Moura Neves, Barbara	Postdoctoral Fellow	Memorial University	Edinger / Archambault / DFO	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16

Leg 2a	Deering, Robert	PhD Student	Memorial University	Bell, Trevor	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3b	Deschamps, Charles Edouard	MSc Student	ISMER - UQAR	Montero-Serrano, Jean-Carlos	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 1a, 1b	Deslongchamps, Gabrièle	Research Staff	Université Laval	Tremblay, Jean-Éric	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Deslongchamps, Gabrièle	Research Staff	Université laval	Tremblay, Jean-Éric	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 3b	Dietrich, Elijah	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 1a, 1b	Dinasquet, Julie	Postdoctoral Fellow	Banyuls	Joux, Fabien	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 2a	Dinn, Curtis	MSc Student	University of Alberta	Leys	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
BaySys	Dmitrenko, Igor	Researcher/Professor	CEOS	Baber, David	Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 3b	Dousset, Vincent	Dignitary	Université de Bordeaux		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 2a	Dove, Rachelle	MSc Student	Memorial University	Dufour, Suzanne	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 1a	Dumont, Dany	Researcher/Professor	ISMER - UQAR	Dumont, Dany	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 2a	Edinger, Evan	Researcher/Professor	Memorial University	Edinger, Evan	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 2a	Ellefson, Emily	BSc Student	University of Calgary	Casey, Hubert	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3b	Fife, Danielle	Professional	Canadian Wildlife Service	Gjerdrum, Carina	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 1a, 1b	Filteau, Gabrielle	MSc Student	Université Laval	Tremblay, Jean-Éric	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 2a, 2b	Finniss, Jeff	Professional	ArcticNet	Lévesque, Keith	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3b	Ford, Jaden	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 3a	Forest, Alexandre	Professional	Golder	Lévesque, Keith	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 3b	Forslund, Jenna	Teacher	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 2a, 2b	Fortier, François	BSc Student	Université Laval	Fortier, Louis	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3a, 3b	Fortier, Louis	Researcher/Professor	ArcticNet / Université Laval	Fortier, Louis	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 3b	Fuchs, Alain	Dignitary	CNRS		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 2a	Fustic, Milovan	Postdoctoral Fellow	University of Calgary	Casey, Hubert	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3b	Fustic, Milovan	Postdoctoral Fellow	University of Calgary	Casey, Hubert	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 2b, 3a	Gagnon, Jonathan	Research Staff	Université laval	Tremblay, Jean-Éric	Qikiqtarjuaq	27-Jul-16	Kugluktuk	17-Sep-16
Leg 1b	Gali Tapias, Marti	Postdoctoral Fellow	Takuvik	Levasseur/Massé	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 1a, 1b	Garbus, Svend Erik	Professional	Aarhus University	Mosbech, Anders	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 1a	Garcia, Nicole	Professional	MIO	Tremblay / Raimbault	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 2b	Georgiadis, Eleanor	MSc Student	Takuvik	Massé, Guillaume	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 2a, 2b	Ghahremaninezhadgharelar, Roghayeh	PhD Student	University of Calgary	Norman, AnnLise	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3b	Girard, Mario	Dignitary	Port de Québec		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 3a	Gittins, Daniel	Research Staff	University of Calgary	Casey, Hubert	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
BaySys	Goharrokhi, Masoud	Research Staff	University of Manitoba	Barber, David	Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 1a	Goyens, Clemence	Postdoctoral Fellow	UQAR	Bélanger, Simon	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 1a, 1b	Grondin, Pierre-Luc	MSc Student	Takuvik	Babin, Marcel	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3a	Guignard, Constance	Research Staff	McGill University	Mucci, Alfonso	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 1a, 1b	Guillot, Pascal	Professional	ArcticNet	Lévesque, Keith	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 2b	Guilmette, Caroline	Research Staff	Takuvik	Massé, Guillaume	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 2a	Herder, Erin	MSc Student	Memorial University	Aitken / Edinger	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 1a	Hillion, Sandrine	Research Staff	Brest LEMAR	Leynaert	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 2a, 2b	Irish, Victoria	PhD Student	UBC	Papakyriakou, Tim	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 1a	Joyal, Gabriel	Professional	Université Laval	Lajeunesse, Patrick	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 2a, 2b	Joyal, Gabriel	Professional	Université Laval	Lajeunesse, Patrick	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 1a, 1b	Joy-Warren, Hannah	PhD Student	Standford	Arigo, Kevin	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 2b, 3a	Kalenitchenko, Dimitri	Postdoctoral Fellow	Université Laval	Lovejoy, Connie	Qikiqtarjuaq	27-Jul-16	Kugluktuk	17-Sep-16
BaySys	Kamula, Michelle	Research Staff	CEOS	Kuyzk, Zou Zou	Churchill	26-sept-16	Iqaluit	12-oct-16
BaySys	Kazmiruk, Zakhar	MSc Student	CEOS	Kuyzk, Zou Zou	Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 3a	King, Edward (Ned)	Researcher/Professor	Natural Resource Canada	King, Ned	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
BaySys	Kirillov, Sergei	Professional	CEOS	Baber, David	Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 3b	Koscielny, Emma-Jean	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 1b	Lagunas Morales, Jose	Research Staff	Takuvik	Babin, Marcel	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 3a	Lakeman, Thomas	Researcher/Professor	Dalhousie University	King, Ned	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 1a, 1b	Lalande, Catherine	Research Staff	Takuvik	Fortier, Louis	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Lapierre, René	Teacher	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 3a, 3b	Larouche, Pierre	Researcher/Professor	DFO	Tremblay, Jean-Éric / Gosselin, Mic	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 1a, 1b	LeBlanc, Mathieu	PhD Student	Takuvik	Fortier, Louis	Québec city	3-Jun-16	Iqaluit	14-Jul-16
BaySys	Lee, Jake (Janghan)	PhD Student	Université Laval	Tremblay, Jean-Éric	Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 1a, 1b	LeGuen, Guillaume	Technician	Université Laval	Levasseur / Massé	Québec city	3-Jun-16	Iqaluit	14-Jul-16

Leg 1a	Lévesque, Keith	Professional	ArcticNet	Lévesque, Keith	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 1a, 1b	Lewis, Kate Marie	PhD Student	Standford	Arigo, Kevin	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 1b	Leymarie, Edouard	Professional	LOV	Babin, Marcel	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 2b	Li, Yijie	PhD Student	ISMER - UQAR	Xie, Huixang	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 3a	Lim, Rangyn	Contractor	Kavik-Stantec	Michelle Bailey / Michael Fabijan	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 1a, 1b	Linkowski, Thomas	Professional	ArcticNet	Lévesque, Keith	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3a	Linkowski, Thomas	Professional	ArcticNet	Lévesque, Keith	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 2a, 2b	Lizotte, Martine	Research Staff	Université Laval	Levasseur, Maurice	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 2a	Lockhart, Peter	Professional	Canadian Scientific Submersible Facility	Auger, Vincent	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 2a, 2b	Loria, Ainsleigh	BSc Student	CEOS	Stern, Gary	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3a	Lucas, Trevor	Contractor	Kavik-Stantec	Michelle Bailey / Michael Fabijan	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 1a, 1b	Marec, Claudie	Professional	Takuvik	Babin, Marcel	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 1a, 1b	Marie, Dominique	Professional	Station Biologique de Roscoff	Vaulot, Daniel	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 2b	Marmillot, Vincent	PhD Student	Université laval	Tremblay, Jean-Éric	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 3b	Marmillot, Vincent	PhD Student	Université laval	Tremblay, Jean-Éric	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 3b	Mason, Mira	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
BaySys	Matthes, Lisa	PhD Student	University of Manitoba - C	Baber, David	Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 2b, 3a	Meredyk, Shawn	Professional	ArcticNet	Lévesque, Keith	Qikiqtarjuaq	27-Jul-16	Kugluktuk	17-Sep-16
Leg 3a	Michaud, Luc	Professional	ArcticNet	Lévesque, Keith	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 2a	Middleton, Greg	Professional	Geological Survey of Canada	Campbell, Calvin	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 1a	Mishak, Sharif	Media/Artist	Parafilms	Sansoulet, Julie	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 3a, 3b	Mol, Jacoba	MSc Student	Dalhousie University	Thomas / Papakyriakou	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 3a	Montero-Serrano, Jean-Carlos	Researcher/Professor	ISMER - UQAR	Montero-Serrano, Jean-Carlos	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 3b	Moore, Savanna	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 1a, 1b	Morata, Nathalie	Postdoctoral Fellow	LEMAR	Morata, Nathalie	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 2a, 2b	Moravek, Alex	Postdoctoral Fellow	University of Toronto	Murphy, Jennifer	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 1b	Moriceaux, Brivaela	Researcher/Professor	Brest LEMAR	Leynaert / Moriceau	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 2a, 2b	Morisset, Simon	Professional	ArcticNet	Lévesque, Keith	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3b	Morisset, Simon	Professional	ArcticNet	Lévesque, Keith	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 3a, 3b	Munson, Kathleen	Postdoctoral Fellow	University of Manitoba	Fei, Wang	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 1a, 1b	Nadaï, Gabrielle	BSc Student	Takuvik	Fortier, Louis	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3a	Neilson, Craig	BSc Student	MacEwan University	Furze, Mark	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 3a	Noël, Amy	PhD Student	University of Calgary	Casey, Hubert	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 3a	Normandeau, Alexandre	Researcher/Professor	Natural Resource Canada	King, Ned	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 2a	Nozais, Christian	Researcher/Professor	ISMER - UQAR	Nozais, Chrisian	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
BaySys	O'brien, Mary	Professional	DFO		Churchill	26-sept-16	Iqaluit	12-oct-16
Leg 3b	Paetkau, Christopher	Media/Artist	ArcticNet / Buildfilms	Blasco, Katie	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 2b	Papakyriakou, Tim	Researcher/Professor	CEOS	Papakyriakou, Tim	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 1a, 1b	Pelletier, Noémie	BSc Student	ISMER - UQAR	Nozais, Christian	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3a	Pelletier-Rousseau, Michèle	Research Staff	ISMER - UQAR	Gosselin, Michel	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 1a, 1b	Picheral, Marc	Professional	LOV	Stenman, Lars	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3a, 3b	Pieńkowski, Anna	Researcher/Professor	MacEwan University	Furze, Mark	Kugluktuk	25-Aug-16	Pond Inlet	25-Sep-16
Leg 2a, 2b	Pierrejean, Marie	PhD Student	ISMER - UQAR	Archambault, Philippe	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 2a	Polanski, John R.	Technician	University of Aberdeen	Archambault, Philippe	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3b	Poulin, Marie-France	Dignitary	Groupe CAMADA		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 1a	Quéguiner, Bernard	Researcher/Professor	MIO	Quéguiner, Bernard	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 1b	Ras, Joséphine	Professional	LOV	Bricaud, Annick	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 1a, 1b	Rehm, Eric	Research Staff	Takuvik	Babin, Marcel	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Richerol, Thomas	Postdoctoral Fellow	ISMER - UQAR	Montero-Serrano, Jean-Carlos	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 3a	Rioux, Pascal	Professional	ISMER - UQAR	Montero-Serrano, Jean-Carlos	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 2a	Robertson, Angus	Professional	Geological Survey of Canada	Campbell, Calvin	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3a	Robertson, Angus	Professional	Natural Resource Canada	King, Ned	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 2b	Rosendahl, Ida	PhD Student	CEOS	Papakyriakou, Tim	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 3b	Saper, Ron	PhD Student	Carleton University	Derek, Mueller	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 1a	Sardet, Noé	Media/Artist	Parafilms	Sansoulet, Julie	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 3b	Satir, Ege Nur	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 3b	Saunders, William	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16

Leg 3a, 3b	Schembri, Sarah	PhD Student	Université Laval	Fortier, Louis	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 3a	Schuster, Jasmin	Postdoctoral Fellow	EC and UofToronto	Jantunen, Liisa	Kugluktuk	25-Aug-16	Kugluktuk	17-Sep-16
Leg 1a	Sciandra, Antoine	Researcher/Professor	LOV	Clautre / Bricaud	Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 1b	Sevigny, Caroline	Postdoctoral Fellow	ISMER - UQAR	Dumont, Dany	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 2a	Sherwood, Owen	Researcher/Professor	INSTAAR	NSERC collaborator	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3a, 3b	Simpson, David	Professional	ArcticNet	Lévesque, Keith	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 3a, 3b	Singer, James	MSc Student	University of Manitoba	Fei, Wang	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 2b	Stacey, Deidra	Research Staff	University of Calgary	Casey, Hubert	Qikiqtarjuaq	27-Jul-16	Kugluktuk	25-Aug-16
Leg 3b	Sulpis, Olivier	MSc Student	McGill University	Mucci, Alfonso	Kugluktuk	17-Sep-16	Québec city	6-Oct-16
Leg 2a	Thaler, Mary	Postdoctoral Fellow	Université Laval	Lovejoy, Connie	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3a, 3b	Theriault, Nathalie	Research Staff	University of Manitoba	Barber, David	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 3b	Therrien, Maxime	High School Student	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 1a, 1b	Tragin, Margot	PhD Student	Station Biologique de Roscoff	Vaulot, Daniel	Québec city	3-Jun-16	Iqaluit	14-Jul-16
Leg 1b	Tremblay, Jean-Éric	Researcher/Professor	ArcticNet	Tremblay, Jean-Éric	Qikiqtarjuaq	23-Jun-16	Iqaluit	14-Jul-16
Leg 3b	Tremblay, Nathalie	Dignitary	Desjardins		Pond Inlet	25-Sep-16	Qikiqtarjuaq	28-Sep-16
Leg 2a, 2b	Trottier, Annie-Pier	MSc Student	Université Laval	Lajeunesse, Patrick	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16
Leg 3a, 3b	Truong, Jimmy	MSc Student	EC and UofToronto	Jantunen, Liisa	Kugluktuk	25-Aug-16	Québec city	6-Oct-16
Leg 1a	Vladoiu, Anda	PhD Student	LOCEAN		Québec city	3-Jun-16	Qikiqtarjuaq	23-Jun-16
Leg 2a	Wareham, Vonda	Professional	DFO	Gilkinson, Kent	Iqaluit	14-Jul-16	Qikiqtarjuaq	27-Jul-16
Leg 3b	Watts, Michelle	Professional	ArcticNet	SoB	Kugluktuk	17-Sep-16	Pond Inlet	25-Sep-16
Leg 2a, 2b	Zier, Juergen	Professional	ArcticNet	Lévesque, Keith	Iqaluit	14-Jul-16	Kugluktuk	25-Aug-16