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# 2010 | Expedition Report

## CCGS *Amundsen*

**LEG 1A**
ArcticNet
Hudson Bay

**LEG 1B**
ArcticNet
Coast of Baffin Island
and Canadian Arctic Archipelago

**LEG 2A**
ArcticNet/BP
Beaufort Sea

**LEG 2B**
ArcticNet/BP
Beaufort Sea

**LEG 3A**
ArcticNet/BP
Beaufort Sea

**LEG 3B**
ArcticNet
Canadian Arctic Archipelago
and Baffin Bay

**Leg 3C**
ArcticNet
Labrador fjords

# 2010 Expedition Report
# CCGS *Amundsen*

Edited by
Anissa Merzouk and Keith Lévesque

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**Part I – Overview and synopsis of operations**

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## 2010 Expedition Report

The 2010 Expedition Report is a collection of all the participating research teams' Cruise Reports assembled by the Chief Scientists at the end of the two Legs of the CCGS *Amundsen*'s Expedition. The 2010 Expedition Report is divided into two parts:

Part I gives an overview of the Expedition, shows the cruise track and the stations visited and provides a synopsis of operations conducted during each of the three legs, as well as for the BaySys cruise on the CCGS *Pierre Radisson*.

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 2010. The data presented in this report are illustrative only and have not been quality checked, thus parties interested in the results should contact the project leader or the researchers who collected the data.

The four Appendices provide information about the location, date, time and type of sampling performed at each station visited by the ship, as well as a list of science participants onboard during each Leg.

The core oceanographic data generated by the CTD-Rosette operations, as well as meteorological information (AAVOS) and data collected using the Moving Vessel Profiler (MVP), the hull mounted current meters (ADCPs) and the thermosalinograph (TSG) are available in the Polar Data Catalogue (PDC) at https://www.polardata.ca. Following ArcticNet's data policy, research teams must also submit their data on the PDC.

# Part I – Overview and synopsis of operations

## 1 Overview of the 2010 ArcticNet Expedition

### 1.1 Introduction

Following a very successful 168-d expedition in 2009 in support of the Malina, GEOTRACES and ArcticNet research programs, the CCGS *Amundsen* travelled to Hudson Bay, the Beaufort Sea, the Northwest Passage, Baffin Bay, and northern Labrador for the 2010 Expedition. ArcticNet researchers and their collaborators pursued their sampling efforts to help understand and predict the impacts of climate change on the Canadian Arctic marine environment.

Taking full advantage of its operational season this year, the Vessel left its homeport of Quebec City on 2 July and headed to Hudson Bay in support of the ArcticNet marine-based research program. The *Amundsen* then continued on through the Northwest Passage, carrying out sampling operations along the way. A first crew change took place on 12 August in Kugluktuk. From 12 August to 7 October, ArcticNet researchers and their Industry collaborators collected data in the Beaufort Sea focusing on the recently awarded offshore exploration licenses by the Government of Canada (see Section 1.2: ArcticNet-Industry Collaborations).

Once work in the Beaufort Sea was completed in early October, the vessel headed back to the Atlantic through the Northwest Passage in support of ArcticNet's marine-based research program in the Northwest Passage, northern Baffin Bay and northern Labrador. Having traveled over 22 000 nautical miles, the CCGS *Amundsen* concluded its 124-d annual voyage in Quebec City on 2 November 2010.

### 1.2 ArcticNet-Industry Collaborations

Although major inshore research activities were conducted in the 1970s and 1980s in large part due to the Oil & Gas interest in the Beaufort Sea region, much less is known about the offshore region of the Mackenzie Shelf, shelf slope and Beaufort Sea. Beginning in 2007, the Government of Canada through its Department of Indian and Northern Affairs Canada (INAC, now Aboriginal Affairs and Northern Development Canada, AANDC) awarded exploration licenses in the offshore Beaufort Sea, a region extensively studied by ArcticNet researchers and their affiliates since 2002.

An important part of ArcticNet's mandate is to provide Inuit and other northern communities and organizations, as well as federal departments and the private sector with the scientific knowledge needed to make decisions and formulate strategies to minimize the negative impacts and maximize the benefits of climate change and industrialization in the Canadian Arctic.

Building on successful research partnerships with several corporations operating in the Arctic, new research collaborations were developed with Imperial Oil and BP in the Beaufort Sea in 2009 and 2010, respectively. Through this new collaboration with BP in 2010, ArcticNet researchers and their private sector collaborators collected sea-ice, bathymetric, geophysical and biophysical data in the Beaufort Sea/Mackenzie Shelf/Amundsen Gulf region with a particular focus on the exploration licenses recently awarded by the Government of Canada. As an independent, academically-led network, ArcticNet ensures that all data collected through its collaborations is made available to all stakeholders including the public, private industry, government regulators, and northern communities.

The research components for the 2010 collaborative BP-ArcticNet program in Legs 2a, 2b and 3a were as follows:

1) Met/Ocean & Sea Ice Component**:** The overarching goal of this component was to provide data that describe the variability of met/ocean and sea ice variables within the exploration blocks relative to the larger area of the southern Beaufort Sea continental shelf. The objective was to provide data on the ocean-sea ice-atmosphere (OSA) interface over a range of time and space scales, focusing on spatial and temporal variability over diurnal, seasonal and interannual time scales.

2) Environment & Marine Resources Component**:** The general goal of this component was to quantify and map the summer-fall distribution and contamination of the main components of the pelagic and benthic food webs along on the Mackenzie Shelf with a special focus in the Exploration Licence areas EL449 and EL451.

3) Geology/ Bathymetry Component**:** The major goal of this component was to conduct an investigation of seabed stability conditions to meet engineering design and regulatory requirements for exploration drilling. Seabed mapping and bottom sediment characterization research is required to investigate seafloor stability conditions at the outer shelf/upper slope area of the central Beaufort Sea with special focus on specific areas in the exploration block. Foundation conditions, slope stability, seabed features and ice scouring are also key issues to be addressed.

## 1.3 2010 Expedition Plan

### *1.3.1 General schedule*

On 2 July 2010, the CCGS *Amundsen* left its homeport of Quebec City for a 4-month expedition to Hudson Bay and the Canadian High Arctic. Despite a one-day delay in departure and the loss of 5 days for the Search & Rescue of the *Clipper Adventurer* during

Leg 2b (see below), all priority activities for the 2010 Expedition were completed as planned.

### *1.3.2 Leg 1a – ArcticNet – 2 July to 2 August 2010 – Hudson Bay*

Leaving Quebec City on 02 July, the ship sailed towards Hudson Bay, entering Hudson Strait on 07 July. From 07 July to 02 August, the vessel conducted mooring and oceanographic sampling operations along sampling transects in Hudson Strait, Foxe Basin and Hudson Bay. Sampling included bottom mapping, measurements of the physico-chemical properties of the water column and meteorological variables and the sampling of seawater, sediment, benthic organisms, plankton and larval fish. The vessel sailed to Iqaluit for the science crew change on 02 August.

### *1.3.3 Leg 1b – ArcticNet – 2 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

Starting in Iqaluit on 02 August, the ship transited west towards Kugluktuk while carrying out mooring and oceanographic sampling operations in the Parry Channel and Northwest Passage. In addition to ArcticNet sampling operations, the Vessel welcomed aboard the 2010 Schools on Board program. The vessel dropped anchor off Kugluktuk on 12 August for a full crew change and the end of Leg 1.

### *1.3.4 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

Leg 2a started from Kugluktuk on 12 August. Between 12 and 26 August, the *Amundsen* carried out oceanographic sampling operations in the EL449 and EL451 exploration acreages (BP lease blocks). ArcticNet and BP researchers sampled the planktonic and benthic ecosystems at 18 stations distributed in the BP acreages, and deployed 12 bottom-anchored Marine Autonomous Recording Units. Oceanographic operations also included servicing and redeploying 4 subsurface moorings deployed in EL449 and EL451 in 2009 as well as recovering one ArcticNet mooring deployed in 2008. The ship sailed back to Sachs Harbour for the mid-Leg science crew change of 26 August.

### *1.3.5 Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea*

As part of the ArcticNet/BP work, Leg 2b was spent in the industry exploration acreages (EL446, EL449 & EL451) to conduct geotechnical work (piston and box coring) and a bathymetric and sub-bottom survey. Mooring operations were also carried out and included servicing and redeploying the 4 subsurface moorings deployed in EL 446 in 2009 and deploying one ArcticNet mooring recovered in the previous leg. The Vessel returned to Sachs Harbour for a full crew change on 22 & 23 September.

### *1.3.6 Leg 3a – ArcticNet/BP – 23 September to 7 October 2010 – Beaufort Sea*

From 23 September to 7 October, the ship carried out mooring and oceanographic sampling operations in Amundsen Gulf and on the Mackenzie Shelf. In the BP Pokak lease block, 11 out of the 12 bottom-anchored hydrophones were retrieved and a bathymetric and sub-bottom survey was conducted. The vessel also conducted ice related sampling operations (EM surveys and on-ice buoy deployments) northwest of Banks Island. The Vessel was back in Sachs Harbour for a science crew change on 7 October.

### *1.3.7 Leg 3b – ArcticNet – 7 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

Leaving Sachs Harbour on 7 October, the ship headed north and then east to conduct sampling operations in Prince of Whales Strait, Viscount-Melville Sound, Barrow Strait, Lancaster Sound and Baffin Bay. The Vessel made a stop in Iqaluit for a last science crew change on 22 October.

### *1.3.8 Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords*

Leaving Iqaluit on 22 October, the Vessel sampled the fjords of Northern Labrador as part of the ArcticNet Nunatsiavut Nuluak project. The ship returned to Quebec City on 2 November.

# 2 Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

**Chief Scientist:** Gary Stern[1,2] (Gary.Stern@dfo-mpo.gc.ca)
*[1] Fisheries and Oceans Canada (DFO), Freshwater Institute (FWI), 501 University Crescent, Winnipeg, MB, R3T 2N6, Canada.*
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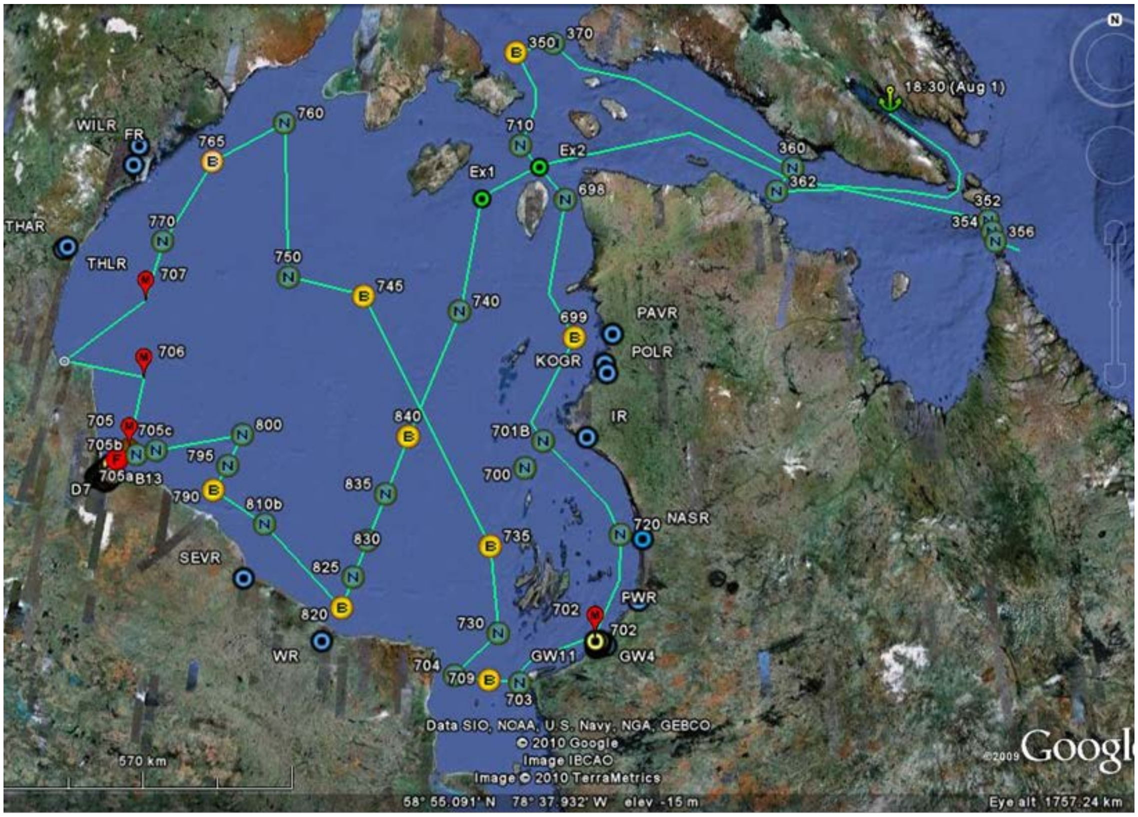
## 2.1 Introduction and objectives

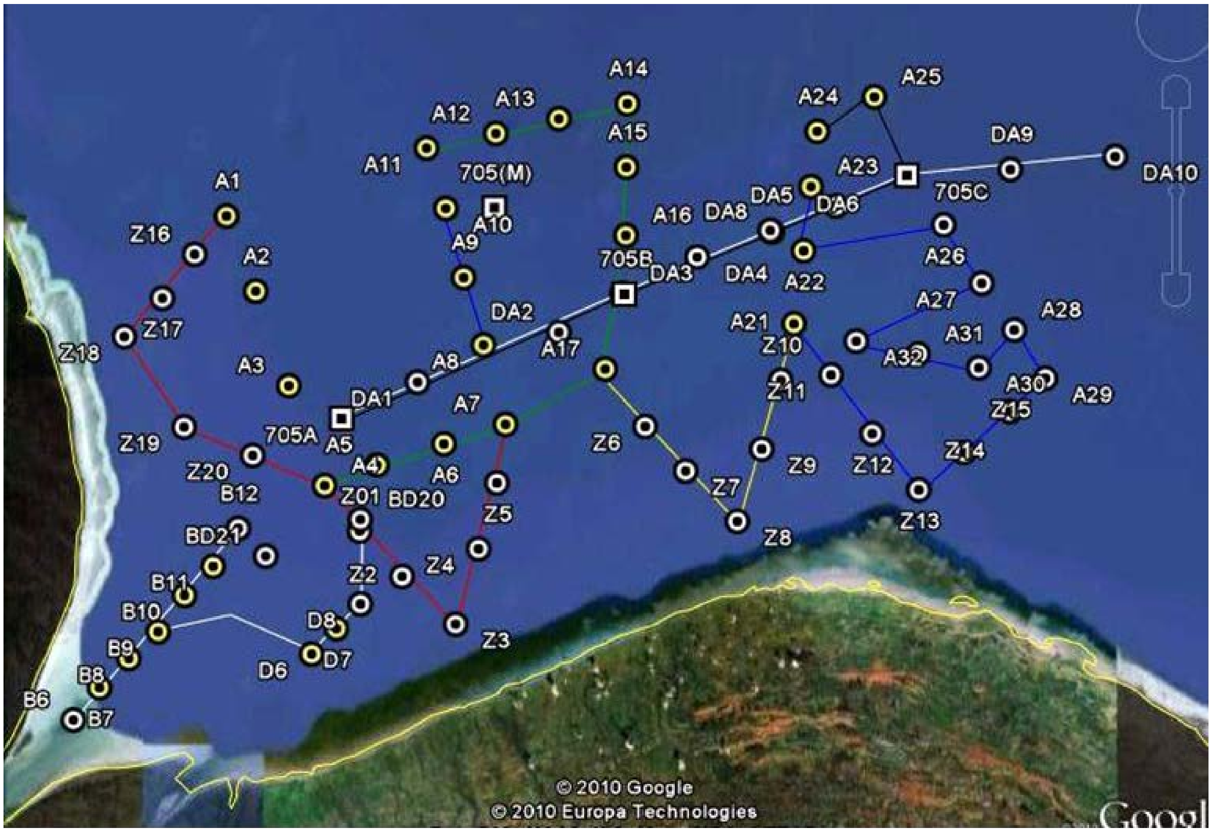
The objectives of Leg 1a were to conduct mooring and oceanographic sampling operations along sampling transects in Hudson Strait, Foxe Basin and Hudson Bay. Opportunistic sampling included bottom mapping, measurements of the physico-chemical properties of the water column and meteorological variables and the sampling of seawater, sediment, benthic organisms, plankton and larval fish.

## 2.2 Synopsis of operations

Leaving Quebec City on 02 July, the ship sailed towards Hudson Bay, entering Hudson Strait on 07 July. Scientific activities were conducted from 07 July to 02 August, before sailing to Iqaluit for a scientific crew change




Final cruise track and sampling stations for Leg 1a.




Nelson River estuary sampling

# 3 Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago

**Chief Scientist:** André Rochon[1] (andre_rochon@uqar.qc.ca)
*[1] Université du Québec à Rimouski (UQAR), Institut des sciences de la mer de Rimouski (ISMER), 310 allée des Ursulines, Rimouski, QC, G5L 3A1, Canada.*

## 3.1 Introduction and objectives

The objectives of Leg 1b were to conduct mooring and oceanographic sampling operations in the Parry Channel and Northwest Passage. In addition to ArcticNet sampling operations, the Vessel welcomed aboard the 2010 Schools on Board program.

## 3.2 Synopsis of operations


Final cruise track and sampling stations for Leg 1b.

August 02, 2010

The crew change in Iqaluit began around 9am. There were very little changes from the originally planned schedule. Lucette Barber (Schools on Board), Steven Kaslowski (ArcticNet photographer), Wayne Rivers (APTN network) and André Rochon (chief scientist) were on the first helicopter flight out of Iqaluit. Sea bottom mapping of the narrow and shallow areas near Iqaluit took place the night before on August 1st after the ship dropped the anchor, so most of the day was spent disembarking scientists, embarking new scientific personnel and fresh produce. The early afternoon was used for a presentation about life on board to the new students and scientists. This was followed by a familiarization tour on the security features of the ship. Departure was at 16:00 sharp at ~15knots. The Fisheries and Oceans engineers are planning a presentation about the new icebreaker Diefenbaker tomorrow afternoon and they plan to interview scientists about the laboratory facilities onboard.

August 03, 2003

I was awaken around 6 am this morning with the sun shining in my face, which meant that the ship was not facing the right direction… Indeed, the captain had stopped the ship to investigate a floating yellow buoy along the Hall Peninsula (Baffin Island). It turned out to be a single floating buoy without anything attached to it. The weather is nice, there are almost no clouds, and we are sailing at 13 knots. There were also two polar bear sightings, both of which were swimming several miles off the coasts. At 13:00 the engineer team of the new icebreaker project will be doing a presentation to the scientific staff and discuss with scientists about the working aspects in the laboratories. The weather has been foggy since the early afternoon, but it is a light fog and sunny above us, so visibility is relatively good.

August 4, 2010

We are still in fog, but somewhat thicker than yesterday (still sunny above us), and we are still sailing at ~14 knots. At 08:45 we entered in a patch of sea ice, all of it relatively broken up. There will be a helicopter safety training session at 13:00 today, and a fire drill at 15:00. The fire drill went smooth, except that some scientist were improperly dressed, which resulted in an additional exercise, this time with the proper clothes. We have settled on Isbjorn Strait and Patterson Inlet for the fjord visit tomorrow. Isbjorn Strait is the fjord immediately north of Gibbs Fjord. We should arrive at the entrance of Isbjorn Strait around 10 am tomorrow morning. We entered an area of about 7/10 of ice in early afternoon and came out of it around 23:00.

August 5, 2010

The fog cleared up around 6:30 and we could see the spectacular mountains and glaciers of Baffin Island. At around 8:15, a polar bear on an ice patch was at minimum 30-40 meters from the ship. Great photo opportunity. We should be at the entrance of Isbjorn Strait around 10:00. At 8:40 we entered another small patch of ice. The schools on board program is going very well. Several scientists are giving presentations everyday on various aspects of the scientific operations that are carried onboard (contaminants, nutrients, sea bottom mapping, etc.). The evenings are complemented with various activities and general interest talks. The fjord visit was in Paterson Inlet and Dexterity Fjord. We had to struggle with shallow seamounts to get out of Paterson Inlet and were on our way towards the MVP transect area.

August 6, 2010

We made excellent time during the night, so we arrived on the MVP transect at 12:00 and started collecting data around 12:15. The initiation for the Arctic Circle is happening today and most of the afternoon will be used for that purpose. After analyzing the bottom at station 301, we noticed that the bottom was all rocks. It was decided to move the station 10 miles to the west at the position 44º10.958 N and 83º56.559W. That way everyone is happy, including those doing the bottom sledge, boxcore and gravity core. Fog prevented us from sending the helicopter ashore to allow the mooring technicians to calibrate their instruments in prevision of the mooring in a couple of days. Instead, the helicopter left at 18:00 and we will be waiting for its return while doing some mapping. The technicians returned earlier than expected because they could not calibrate their instruments. We will give it another try tomorrow. We arrived on station on time at 23:30, and should leave sometimes around 10 or 10:30 tomorrow morning.

August 7, 2010

The weather is almost perfect for sampling today and Lancaster Sound is totally free of ice. The only thing missing is the sun, but otherwise the temperature is nice, and most importantly, there is no wind. We arrived on station on time last night and all operations are on time. The station was finished one hour early. The mooring will be installed later today even though the instruments could not be calibrated. The calibration based on other moorings installed this year will be applied to the data collected throughout the year when the mooring is retrieved next year. After looking at the schedule and considering the large amount of ice in the NW Passage on our way to Kugluktuk and the fact that we were a few hours behind schedule, we took the following decisions during a scientific meeting this afternoon:

The mooring station (BIO) will be only for mooring deployment, followed by a CTD rosette;

The mooring will be deployed, even though the equipment could not be calibrated:

All further Nutrient stations will be limited to 1 rosette only;

The basic station 305 will remained untouched

Because station 312 (Basic station) is located within the heaviest concentration of sea ice (based on August 5 sea ice chart) we will probably turn it into a nutrient station and only do a rosette;

If we manage to maintain a good speed in Peel Sound, which is doubtful, we may change station 310 (a Nutrient station) into a basic.

The visit to Beechey Island is now off the schedule. The deployment of the mooring went as planed and relatively fast. It was all over within 50 minutes, from start to finish. Impressive!

August 8, 2010

The weather is foggy and rainy, and quite cold. We are at station 305 and all operations went on schedule, we are even ahead of time. The bottom here is mostly rocks with a sandy clay matrix, with lots of benthos on it. The first boxcore came back empty, and a second attempt brought back about 20 cm of rocks and sediment. We left station 305 at 9:15 and are making relatively good speed, between 8.5 and 10 knots. We are now in heavy ice 8-9/10 but still going at 9-10 knots. Anne Fontaine hurt her shoulder while trying to prevent a fall. She saw the nurse and there is nothing too serious about it. A report has been filled.

August 9, 2010

The ice conditions that were apparently bad on satellite pictures and on ice maps have improved dramatically. We are now ahead of schedule since we did such good speed yesterday, 14 knots instead of 8. Consequently, we have transformed Station 310 from a nutrient to a Basic station. Sampling went according to plan with the exception of the cancelled rosette and boxcore. The latter was cancelled due to the absence of sediment at the bottom. We are now into Larsen Sound in approximately +9/10 of ice, some of which is multiyear and our speed is ~5 knots. We stopped next to a multiyear piece of ice for measuring ice temperature and water temperature below the ice (70 21.218N, 98 57.57W) following a request from Dave Barber. Originally we were supposed to collect an ice core and keep drilling to measure temperature and salinity below the ice. Because the drilling operation takes so long (drill by hand), we will only take one corer-length of ice and keep moving after that. We were once again making good speed after we left the sea ice station, so we will be able to turn station 312 into a basic as originally planned. 19:25 sunny and a sea of oil!!!

August 10, 2010

We arrived on station late because of fog and ice. The second rosette was cancelled due to a problem with the splice, which will have to be re-done, hopefully in time for tonight Nutrient station 314. The weather is nice and sunny, with a bit of fog. Joannie Ferland hit her head on the bow thrusters room while opening the door. A report has been filled Steeve Gagné managed to repair the rosette. He replaced the connectors on the rosette itself but there was still a communication problem, which turned out to be in the conductive wire itself. One of the small wires inside the main cable was broken, probably due to the way the rosette is handled during operations. Steeve will write a note about it in his report. In the mean time he had to cut 10 m of conductive wire, and the problem is now fixed. We left the last station at 20:30, Kugluktuk time.

August 11, 2010

We arrived in Kugluktuk at 11:30 and everyone is getting busy packing, cleaning, storing, writing. At 13:00 local time, the helicopter went to the airport to pick up some of the mooring material that was shipped earlier by Keith Levesque. A total of X trips were required to get everything aboard. The students from Schools on Board will make a slide and music presentation of their last 10 days aboard the ship tonight at 19:00.

# 4 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea

**Chief Scientist:** Martin Fortier[1] (Martin.Fortier@arcticnet.ulaval.ca)

[1] *ArcticNet, Pavillon Alexandre-Vachon local 4081, 1045 Avenue de la Médecine, Université Laval, Québec, QC, G1V 0A6, Canada.*

## 4.1 Introduction and objectives

The science program during Leg 2a of the 2010 CCGS *Amundsen* Expedition was a collaboration between ArcticNet and its industry partner BP. The region of study was centered around BP's exploration acreages, EL449 and EL451, which lie north of the Tuktoyaktuk peninsula in the southern Beaufort Sea, Northwest Territories. The main focus of Leg 2a was to complete the Environment and Marine Resources component of the ArcticNet-BP collaborative program. The specific objectives of Leg 2a were to:

- Sample at 18 biophysical stations distributed in EL 449 and EL 451.
- Service and redeploy some of the 8 subsurface moorings deployed in EL 446, EL449 & EL451 in 2009. The remaining moorings were serviced during Leg 2b.
- Deploy 12 bottom anchored Marine Autonomous Recording Units (MARU) in EL 449 and EL 451.
- Depending on ice conditions, deploy a moored Met/Ocean surface buoy for the duration of the leg.
- Upon encountering ice, conduct ice thickness and roughness surveys using the helicopter mounted EM Induction system and deploy ice drift satellite beacons on large ice floes in and around the Pokak lease block.

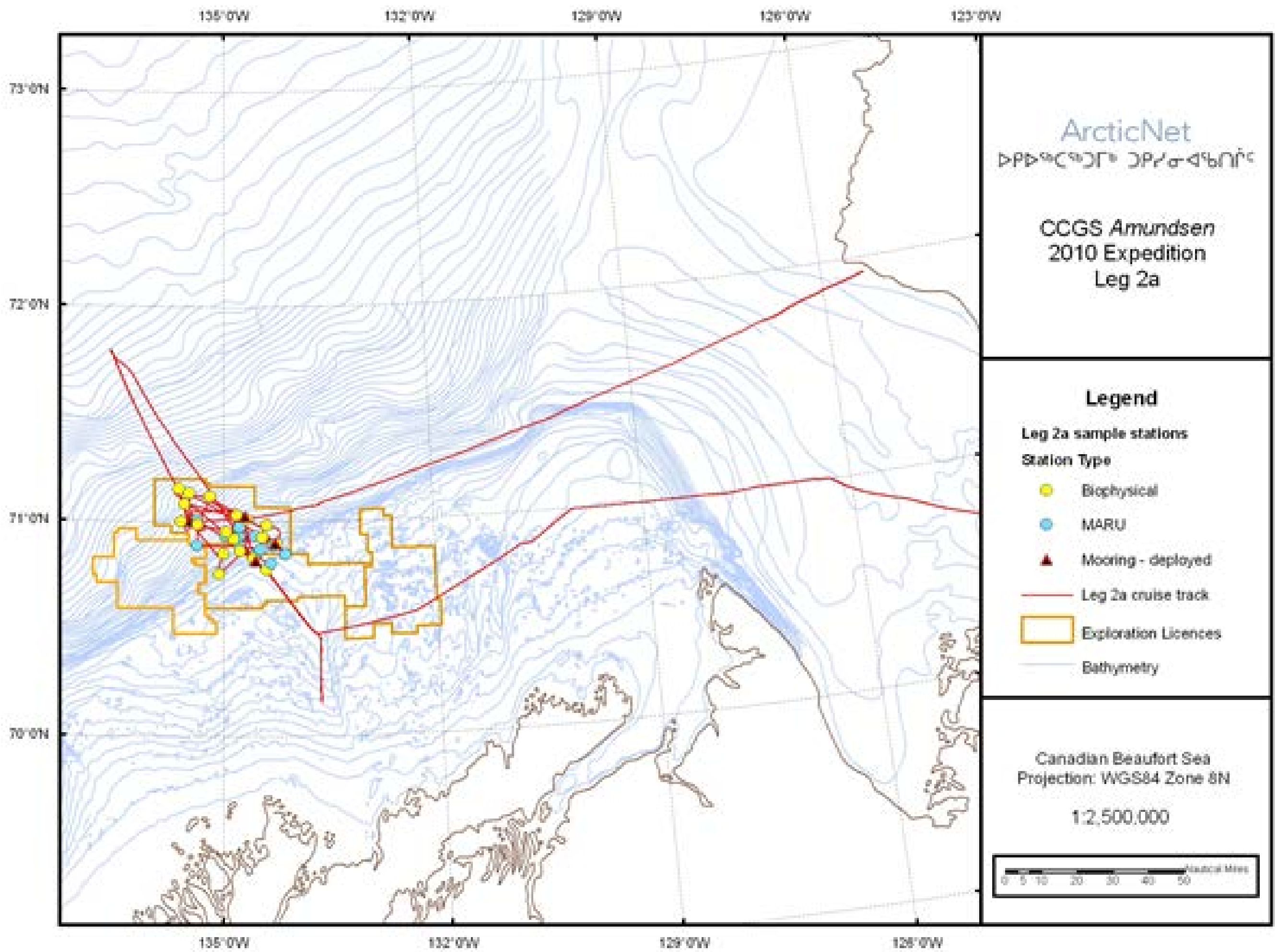
## 4.2 Synopsis of operations

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 Leg 2a are available in Part II of this report. A detailed scientific log of all sampling operations conducted during the expedition is also available in Appendix 2.

Leg 2a started in Kugluktuk, NT on 12 August coinciding with a full Coast Guard crew change. Science participants and Coast Guard crewmembers joined the ship using a chartered Boeing 737, which left Quebec City in the early morning of 12 August and landed later in the afternoon in Kugluktuk. The *Amundsen's* departure from Kugluktuk and transit towards the first sampling station in the southern Beaufort Sea was delayed until the morning of 13 August because of maintenance requirements on one of the ship's engines.

While transiting in Amundsen Gulf just north of Cape Bathurst, a pod of bowhead whales was spotted by the Inuvialuit Marine Wildlife Observers working from the ship's bridge. The observers counted approximately 20 individual whales (not corrected for re-sightings).

The ship reached the first biophysical sampling station (BP10-018) in the early morning of 15 August. During the remaining 10 days of Leg 2a, scientists and crew worked 24 hours a day to complete the ambitious cruise plan. All 12 MARUs were deployed, operations at 18 biophysical sampling stations were completed and a total of 5 moorings were retrieved and 4 were redeployed. Sampling at 18 biophysical stations involved 25 CTD-Rosette casts, 18 vertical plankton net tows, 18 horizontal plankton net tows, 25 box-cores and 18 Agassiz trawls. At selected stations, additional surface water sampling was conducted from the 7.33 m Zodiac launch. One radiosonde (meteorological balloon) was launched. Moreover, a multitude of oceanic and atmospheric parameters were measured continuously throughout the leg using the *Amundsen*'s extensive array of continuous samplers (SM-ADCP, EK-60 scientific echosounder, water surface $pCO_2$ and CTD on track system, foredeck and top bridge met towers, ceilometers, radiometer, all-sky camera). On the bridge, Marine Wildlife Observers spotted and identified marine mammals and seabirds for a 14 hours period each day. The EM302 multibeam sonar and the Knudsen sub-bottom profiler collected high-resolution bathymetry and sub-bottom data as field conditions permitted during the entire leg.




Leg 2a cruise track and sampling sites

# 5 Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea

**Chief Scientist:** Steve Blasco[1] (Steve.Blasco@NRCan-RNCan.gc.ca)

[1] *Natural Resources Canada (NRCan), Geological Survey of Canada (Atlantic), Bedford Institute of Oceanography, 1 Challenger Drive, Dartmouth, NS, B2Y 4A2, Canada.*

## 5.1 Introduction and objectives

The science program during Leg 2b of the 2010 CCGS *Amundsen* Expedition was a collaboration between ArcticNet and its industry partner BP. The region of study was centered around BP's exploration acreages, EL449, EL451 and EL453 which lie north of the Tuktoyaktuk peninsula in the southern Beaufort Sea, Northwest Territories (Figs). Water depths in the study region range from 40m on the Mackenzie Shelf to over 1000m along the Beaufort-Mackenzie slope. The joint program was focused on geotechnical and geochemical bottom sampling with piston and box cores, multibeam bathymetry and sub-bottom mapping, oceanographic mooring recovery and deployment, a remotely-operated vehicle (ROV) dive, and water column and atmospheric sampling.

The principal objectives for Leg 2b were to:

- Collect 44 piston cores, and 16 box cores for the BP-ArcticNet collaboration as well as complimentary piston and box cores for the Geological Survey of Canada (GSC)
- Recover and redeploy the oceanographic moorings not completed during Leg 2a
- Conduct remotely-operated (ROV) surveys on selected targets (time permitting)

## 5.2 Synopsis of operations

This section provides a general overview operations during Leg 2b. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during Leg 2 are available in Part 2 of this report. A detailed scientific log of all sampling operations conducted during the Leg is also available in Appendix 2.

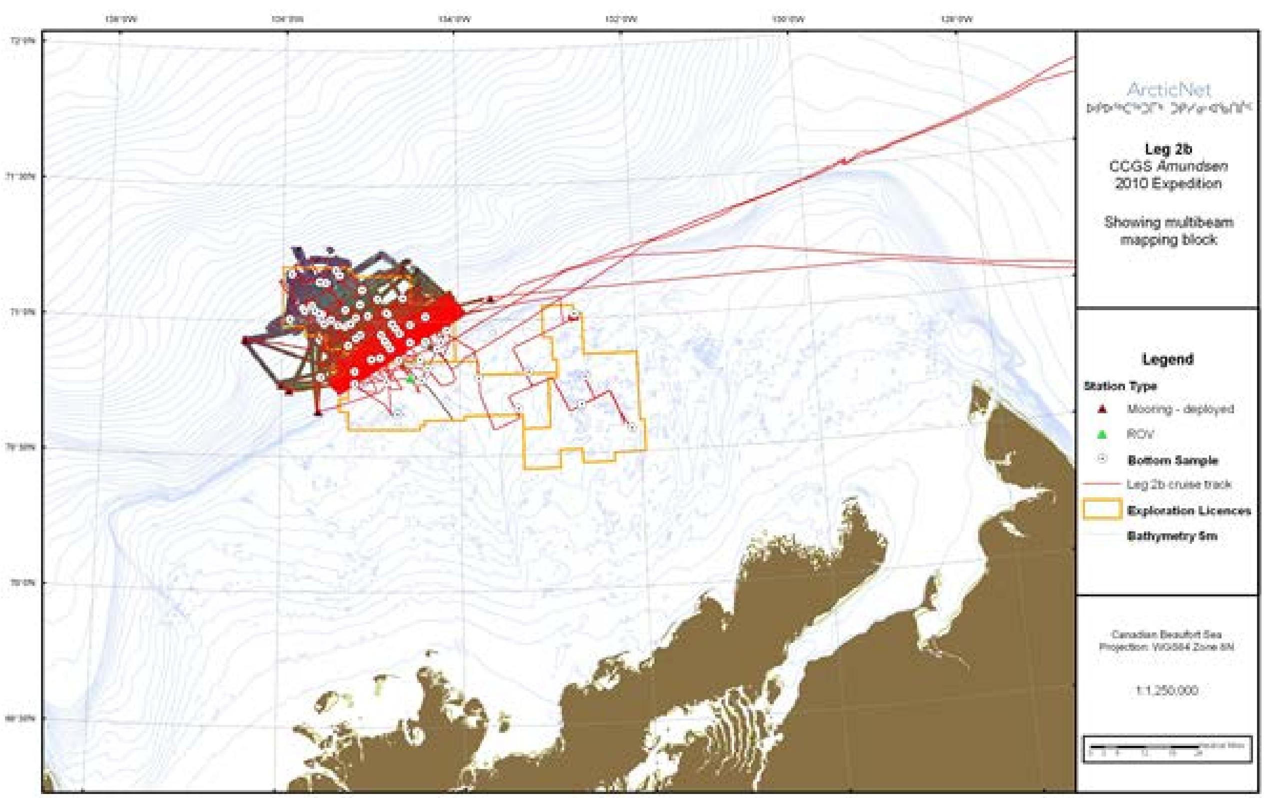
Leg 2b operations took place from 26 August to 23 September starting and ending with crew rotations in Sachs Harbour, NT. The 27-day Leg entailed 22 days of scientific operations and 5 days where the CCGS *Amundsen* was dispatched on an emergency Canadian Coast Guard Search and Rescue operation north of Kugluktuk, NT to rescue passengers from the grounded MV *Clipper Adventurer*.

Despite the unforeseen loss of 5 days of science, the program was an overwhelming success, with all sampling operations during Leg 2b completed as planned. Access to the MV *Clipper Adventurer* grounding site was only possible because of the mapping work

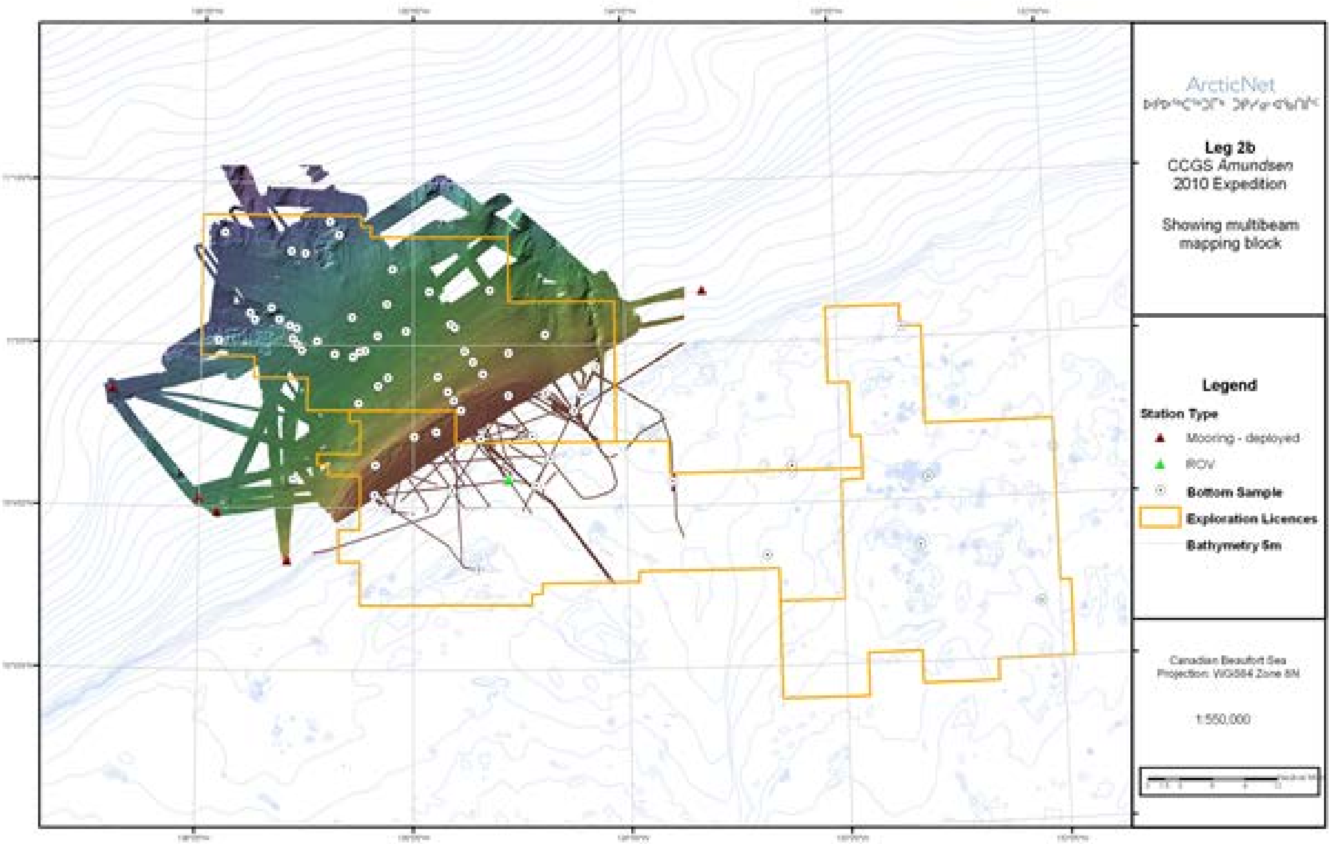
CCGS *Amundsen* had completed during previous expeditions allowing the ship to approach within a safe distance to the rescue site. Additionally, the use of a side-mounted multibeam system on the barge to map the shallow regions near the site, facilitated rescue operations and allowed the CCGS *Amundsen* to approach as near as possible for the rescue of the passengers.

A total of 49 piston (including 4 gravity) cores and 22 box cores were collected, together with approximately 8900 km of multibeam and sub-bottom data. Four oceanographic moorings, deployed in 2009, were recovered, serviced and redeployed and an ArcticNet mooring deployed in 2008 and recovered during Leg 2a was redeployed during Leg 2b. One remotely-operated vehicle (ROV) dive was completed on top of a seabed mud volcano and 10 CTD-Rosette casts were performed for water sampling.

In addition to the seabed mapping data collected in the offshore Beaufort study area, the Coast Guard rescue of the MV *Clipper Adventurer* allowed the CCGS *Amundsen's* bottom mapping team to collect additional multibeam and sub-bottom data while transiting back and forth to the grounding site in the Coronation Gulf and to collect site-specific data around the area of the grounded vessel. Both the *Amundsen*'s EM302 multibeam mapping system and the shallow-water EM3002 mounted on the Coast Guard barge were used in this effort (see Section 20).




Leg 2b survey region showing BP exploration licenses, cruise track, sampling sites, and multibeam block




Leg 2b survey region showing BP exploration licenses, sampling sites and multibeam mapping block.

# 6 Leg 3a – ArcticNet/BP – 23 September to 7 October 2010 – Beaufort Sea

**Chief Scientist:** Keith Levesque[1] (keith.levesque@arcticnet.ulaval.ca)

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## 6.1 Introduction and objectives

Leg 3a was a 2-week sampling program that included varied objectives and study areas. The major objectives for Leg 3a were to:

- Recover the 12 bottom anchored Marine Autonomous Recording Units (MARU) deployed on 15 August in the Pokak lease block.
- Recover 3 ArcticNet subsurface oceanographic moorings and deploy 5 new moorings in Amundsen Gulf.
- Expand the multibeam and sub-bottom coverage in the Pokak lease block priority areas.
- Conduct ice thickness and roughness surveys using the helicopter mounted EM Induction system, deploy Position-Only Sea Ice Motion Beacons on large ice floes and deploy Ice mass balance buoys.

## 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 Leg 3 are available in Part II of this report. A detailed scientific log of all sampling operations conducted during the leg is also available in Appendix 2.

Leg 3a started in Sachs Harbour on 23 September coinciding with a full Coast Guard crew change. Participants and crewmembers joined the ship using a chartered Boeing 737 going from Quebec City to Inuvik and then by chartered twin otter aircrafts from Inuvik to Sachs Harbour.

The crew change on 23 September went late into the evening. Not all luggage and science cargo made it on board that day because of diminishing daylight, which prevented the helicopter from completing the transfers. The *Amundsen* stayed at anchor for the night and the transfer of luggage and cargo was completed the next day around 10:00 AM.

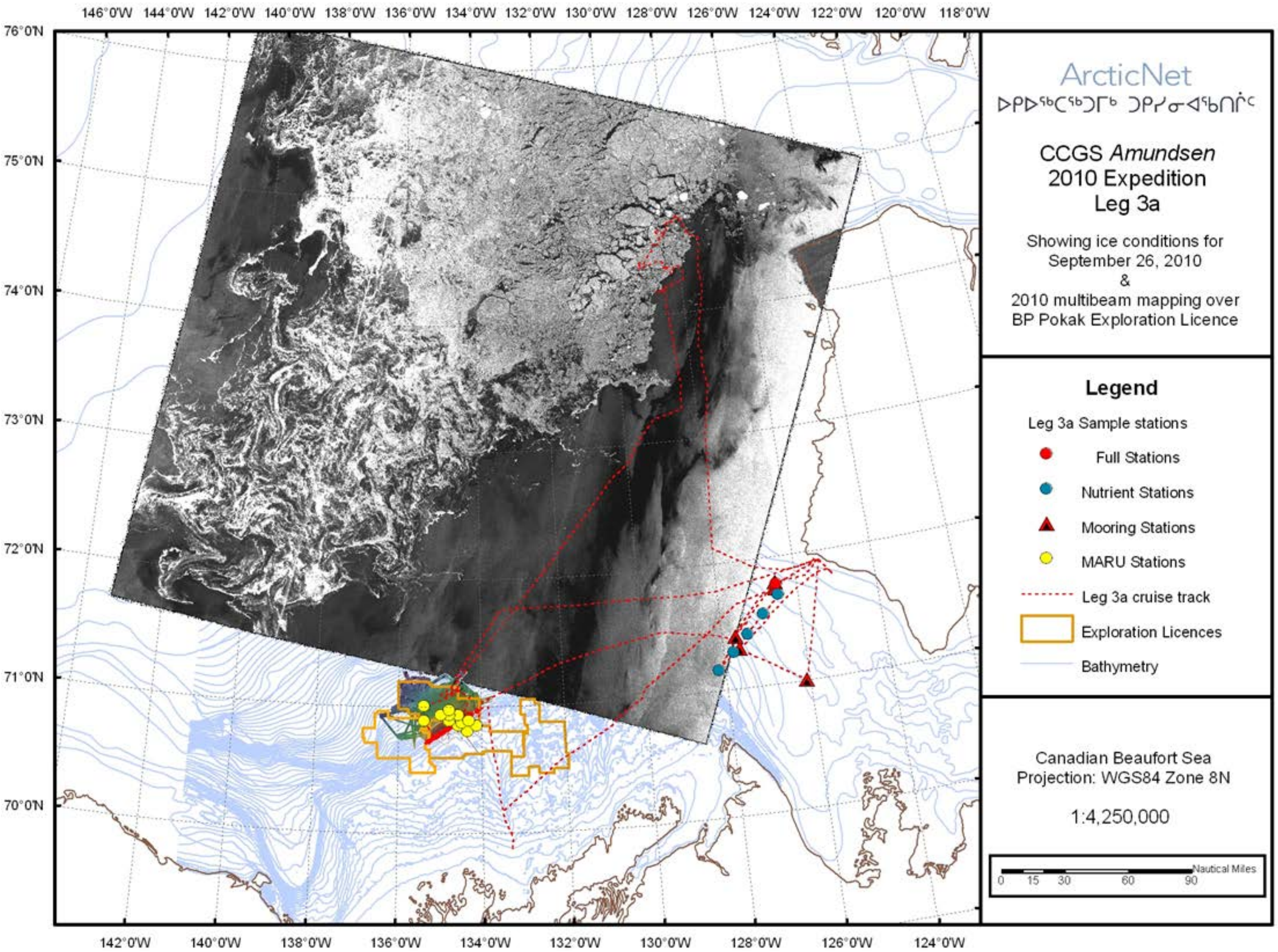
Leaving Sachs Harbour, the *Amundsen* transited towards the first of three ArcticNet subsurface oceanographic moorings to be recovered in Amundsen Gulf. The recovery of the three moorings was completed on 24 September. On 25 and 26 September, the bottom-anchored hydrophones (MARUs) deployed during Leg 2a in the BP-Pokak lease block were recovered. Unfortunately, one MARU did not surface even after sending the release signal on 4 separate occasions. In total, 11 out of 12 MARUs were successfully recovered.

From September 27 to 29, the vessel conducted ice related sampling operations in the southern Beaufort Sea. Operations included helicopter EMI surveys, ice beacon/buoy deployments, measurements of ice properties and icebreaking maneuvers. This 3-day foray into the ice field was planned as the first of two. Unfortunately, the second foray had to be cancelled for various reasons (see below).

Over the next 7 days, operations were complicated by spells of very bad weather, the need to Medevac a Coast Guard crewmember (Medevac from Tuktoyaktuk) and a Vessel fuel situation. Approximately 72 hours were lost due to bad weather alone. When weather permitted, scientists and crewmembers of the *Amundsen* worked 24 hours per day to complete the remaining scientific operations before the crew change of 07 October. Overall, 5 ArcticNet subsurface oceanographic moorings were deployed and sampling operations were conducted at 1 Full station and 5 Nutrient stations.

Operations during the leg also included 37 hours of dedicated multibeam and sub-bottom profiling surveys in the BP-Pokak lease block. These surveys allowed for completion of the coverage in priority area #2 and for the acquisition of additional coverage in the northeast corner of the block. In addition, a multitude of oceanic and atmospheric parameters were measured continuously using the *Amundsen*'s extensive array of continuous samplers (e.g., SM-ADCP, EK-60 scientific echosounder, water surface *p*CO2 and CTD on track system, foredeck and top bridge met towers, ceilometers, radiometer, all-sky camera). On the bridge, a Marine Wildlife Observer spotted and identified marine mammals and seabirds each day for a survey period of 12-h.

Sampling for Leg 3a ended on the evening of 06 October when the Vessel started its transit back to Sachs Harbour for a scientific crew change on the morning of 7 October.




Cruise track and sampling stations in Amundsen Gulf and Southern Beaufort Sea during Leg 3a of the 2010 ArcticNet expedition. Imagery for the ice conditions on 26 September is from Radarsat-2.

# 7 Leg 3b – ArcticNet – 7 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

**Chief Scientist:** Jean-Éric Tremblay[1] (jean-eric.tremblay@bio.ulaval.ca)
*[1] Université Laval, Département de Biologie, Pavillon Alexandre Vachon, Québec, QC, G1V 0A6, Canada.*

## 7.1 Introduction and objectives

Leg 3b was a 2-week sampling program that included varied objectives and study areas such as mooring retrieval, mapping and ice operations.

## 7.2 Synopsis of operations

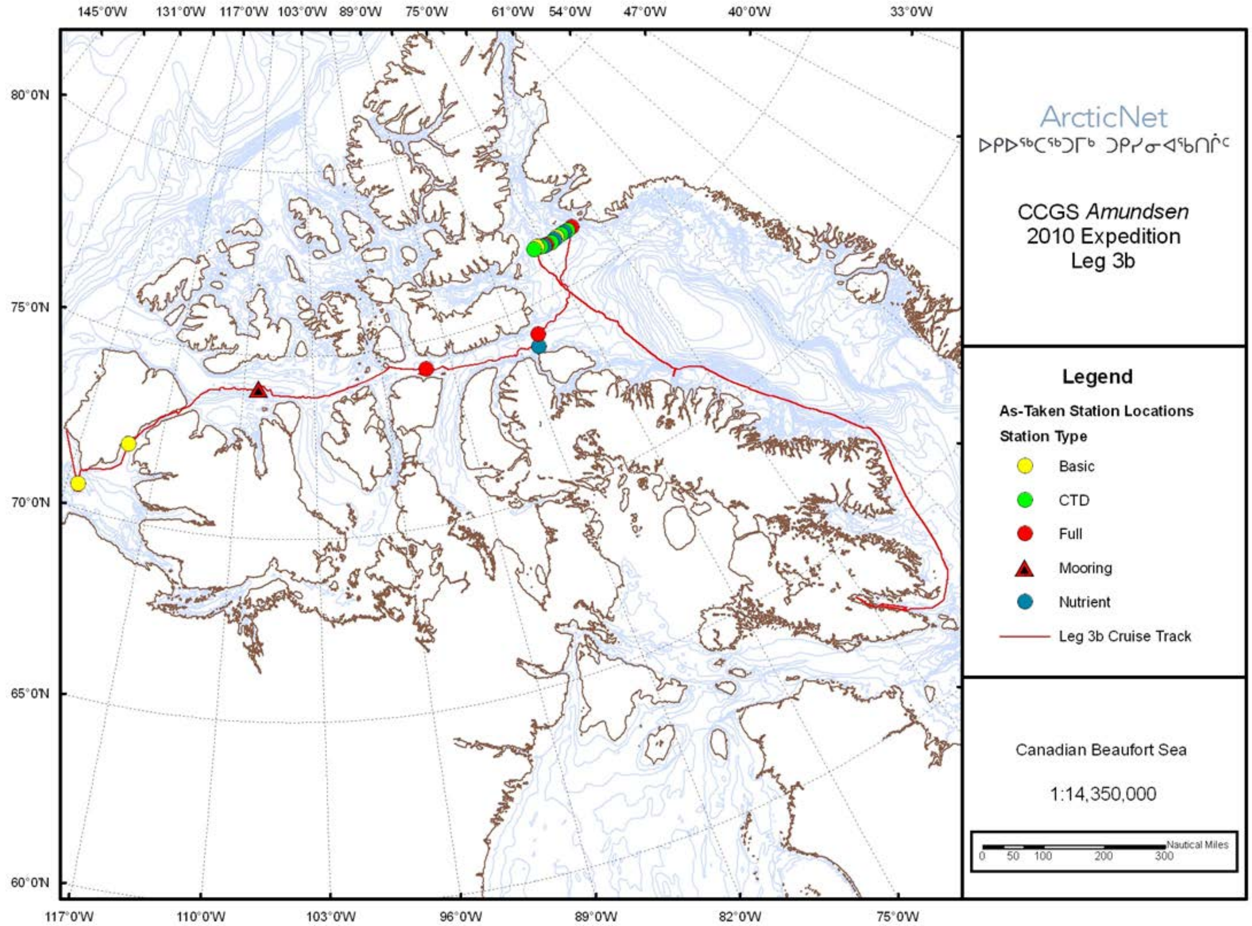
This section provides a general synopsis and timeline of operations during Leg 3b. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during Leg 3 are available in Part 2 of this report. A detailed scientific log of all sampling operations conducted during the leg is also available in Appendix 2.

Leg 3b started from Sachs Harbour on 07 October. Thirteen new science personnel boarded the *Amundsen* to join the 18 that were already on board. After some urgent work in the engine room, the ship lifted anchor and sailed toward station 405 while running the multibeam system. Station 405 was sampled successfully during the morning of the 8$^{th}$, after which the *Amundsen* sailed toward Prince of Wales Strait with some filming/photography of the ship off Nelson Head. Station 450 (100 m) was sampled during the night of 09 October and the ship resumed its northward transit. The next morning, the ship dropped anchor in 40 m of water (115˚ 58.099W, 73˚ 09.256N). The mooring team was sent ashore (site located on a small platform overlooking the ocean) to calibrate the 4 ADCPs to be deployed on mooring 308. The ship stayed in proximity due to poor visibility and uncertain weather conditions. Science passengers were transported on flight 1 (3 minutes) with half the equipment and the Polar Explorer contingent were transported on flight 2 with the rest of the calibration equipment.

Once out of Prince of Wales Strait, the ship travelled to an area in Viscount Melville Sound for a bathymetric survey. Unfortunately, the area was uniformly covered with new ice which made the survey impossible so we sailed east along the transit line until we met a large ice floe. The ship stayed against the ice floe for the rest of the night and resumed course at first light on the 10th. Ice operations began at 12h30 when the helicopter left with scientists to conduct ice-related sampling operations. They found a suitable ice floe (74˚ 13.350, 108˚ 04.387, taken from the helo's GPS) north east of the ship and deployed an ice mass balance buoy, an ice thickness buoy and a backup tracker buoy. The helicopter stayed with them for the duration of the operations. Since headwinds were strong and very cold, we parked the ship in an ice floe to get the mooring equipment out of the cargo hold and let the mooring technicians assemble the mooring. The helicopter came back at 17h00 as mooring assembly was nearing completion and we sailed for a lead located slightly north of the area targeted for mooring deployment (500-m line). Given the heavy ridging that typically occurs in this area we judged that a deeper deployment was reasonable. Mooring operations began in over 518 meters of water at 18h30 with the zodiac deployment and were successfully completed at 19h45. Since triangulation was impractical amidst the multiyear ice floes surrounding us, we passed over the mooring with the ship and the mapping team got a precise fix and visual echo of the instruments (74.09703˚N, 108.41523˚W, 536 m). The mooring responded to acoustic queries. We moved slightly off site and began operations for station 308 with a Rosette. Horizontal tows (Tucker and Agassiz) had to be cancelled as the hole got smaller and visibility was poor. The ship began transiting toward Resolute at 8h20 on the 11$^{th}$ and briefly paused against an ice floe to deploy an ice beacon (Matthew Asplin) at 74˚5.971N, 107˚17.953W.

As the ship passed Griffith Island the helicopter went to Resolute to disembark and pick-up DFO participants (engineers). We then moved to station 304, which was successfully sampled as a full. Transit toward the entrance of Lancaster Sound was relatively slow due to difficult ice conditions. Due to time constraints we only sampled two stations, located slightly to the east of their intended position due to ice conditions. The ship then sailed to the northeast to reach Baffin Bay. Transit during the night of the 15$^{th}$ was very slow due to reduced visibility and ice conditions. A problem was found with the propeller, which created unusual vibrations. The captain feared the heavy ice had damaged it, but a visual inspection revealed no apparent problem. Due to poor visibility (no helicopter) and a bad Radarsat image, it was impossible to perform ice island operations on the way up, so we opted to sample the stations starting at the eastern end of the transect between Greenland and Ellesmere Island. The sampling was completed without problems until reaching station 106 in the early morning of 17 October. Ice conditions got tougher and the visibility was extremely poor. After performing the CTD-Rosette cast at station 106, operations were stopped. We resumed transit for station 105 in the morning of the 17$^{th}$ and were successful in finding a hole sufficiently large for all operations.

Mid-way through sampling of station 105 on Sunday 17 October, the helicopter was launched to perform an ice patrol over the remaining portion of the transect and, if possible (visibility was poor), deploy beacons on Petermann Ice Island PII-B (26 miles to the west). Two beacons were successfully deployed on the northern (#21340) and southern (#26340) portions of the fragment between 15h15 and 15h45. The circumference of PII-B was estimated at 20.8 nautical miles (total area of 90 km$^2$ assuming an semi-oval shape with maximum width of 4.5 nm and maximum length of 6.5 nm) and the freeboard was 14-15 m on average (but quite variable). Some of the largest fragments around it had up to 25 m of freeboard. It looked like a medium-sized piece had just broken off the southwestern tip and other small fragments were visible on the horizon.




Cruise track and sampling stations in Amundsen Gulf, Parry Channel and Baffin Bay during Leg 3b of the 2010 ArcticNet expedition.

On Monday 18 October, another beacon was deployed (#23350) near the center of fragment PII-B-a (formerly labeled PII-C). Conditions were initially sunny and then partly overcast. The fragment's shape was highly irregular and bore evidence of recent fragmentation at its southern end. The freeboard was more homogenous and seemed slightly higher than for PII-B. Its approximate dimension was 28 $km^2$. We had saved a fourth beacon to deploy on one of the two small fragments drifting south, but Radarsat support was unavailable and our transit was taking us to the general area late in the day – given the short window left for helicopter ops and the bad weather coming our way, we could not wait until the 19th and pushed forward toward Iqaluit. All three beacons are transmitting and the data is archived in Winnipeg. Arrangements are being made to provide access for CIS.

| Beacon ID | Fragment | Date | Latitude N | Longitude W |
|---|---|---|---|---|
| 21340 | PII-B | 17-Oct-10 | 76 17.933 | 77 58.261 |
| 26340 | PII-B | 17-Oct-10 | 76 15.057 | 77 54.774 |
| 23350 | PII-B-a (C) | 18-Oct-10 | 75 58.700 | 78 01.190 |

Upon completing beacon deployments, the *Amundsen* continued its transit in stormy weather toward Iqaluit for the science crew change. A bathymetric survey was conducted in Frobisher Bay during the night of the 22nd since the ship had to wait for daylight before entering the narrows to reach Iqaluit.

# 8 Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords

**Chief Scientist:** Michel Gosselin[1] (michel.gosselin@uqar.qc.ca)

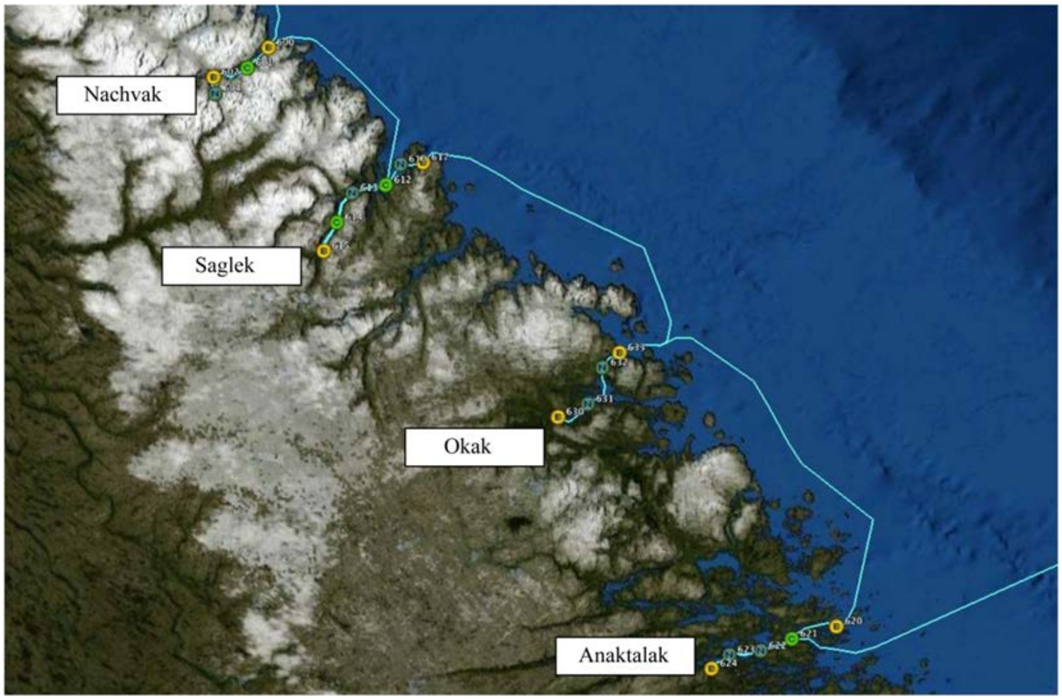
[1] *Université du Québec à Rimouski, Institut des sciences de la mer (ISMER), 310, allée des Ursulines, Rimouski, Quebec G5L 3A1*

## 8.1 Introduction and objectives

Leg 3c of the 2010 CCGS *Amundsen* ArcticNet Expedition took place from 22 to 31 October, starting in Iqaluit and ending in Quebec City. The overall goal of the expedition was to conduct oceanographic sampling in the fiords of Nunatsiavut, including Nachvak Fiord, Saglek Fiord, Okak Bay, and Anaktalak Fiord. Science operations onboard the CCGS *Amundsen* constitute a major field component of the ArcticNet Nunatsiavut Nuluak project, which is focused on studying the impacts of climate change and modernization on the Nunatsiavut marine environment and communities (NI's Ken Reimer of the Royal Military College and Tom Sheldon of the Nunastsiavut Government).

In partnership with the Nunatsiavut Government, the Royal Military College of Canada (Environmental Sciences Group), Parks Canada, the Department of National Defense, Environment Canada, the Department of Fisheries and Oceans, Vale Inco., and the Torngat Joint Secretariat, the ArcticNet Nunatsiavut Nuluak project is conducting a baseline inventory and comparative assessment of four northern Labrador fiord-based marine ecosystems. This project uses both a shore-based (operated from the Kangidluasuk base camp) and ship-based (from the CCGS *Amundsen*) approach. The overall objective of this project is to address Inuit concerns regarding the ecological integrity of the marine environment in northern Labrador by acquiring a better understanding of the effects of climate change, natural resource extraction and contaminants along the northern Labrador coast. An integrated regional approach has been implemented to ensure concerns from all stakeholders, including major industrial and governmental organizations, are adequately addressed. The four marine ecosystems that are currently being studied are Nachvak Fiord (a pristine ecosystem adjacent to the Torngat Mountains National Park Reserve), Saglek Bay (an area with a local source of PCB contamination due to historical operations at the site), Okak Bay (an area used frequently by Inuit for harvesting and travel), and Anaktalak Bay (the shipping route to the VALE Inco. Nickel mine, formerly Voisey's Bay nickel mine. These studies complement each other and provide excellent comparative data for other northern marine ecosystems currently being investigated by ArcticNet. The study integrates Inuit and Inuit knowledge throughout the entire process including the selection of indicators, areas of study, analysis and interpretation of data, and conducting field research. This project has developed strong partnerships with other northern organizations, such as the Torngat Wildlife, Plants and Fisheries Secretariat, Sikumiut Environmental Management Ltd., Nunatsiavut Health and Environment Review Committee (NHERC), Putjotik Fisheries

Ltd., and CJ Webb Inc. These valuable partners along with Nunatsiavut community members help us carry out our science program and determine the direction of our research.




The 4 Nunatsiavut Fiords and sampling stations visited during the 2010 CCGS *Amundsen* expedition.

The ArcticNet Nunatsiavut Nuluak program builds on previous work, and on well-established relationships between the proponents and their partners. In particular, the cruise aboard the CCGS *Amundsen* this year built upon a successful eight-week field season that was completed via long-liners run from the co-managed Kangidluasuk base camp during August and September, prior to boarding the ship. The sampling approach taken aboard the *Amundsen* was to complement the shore-based research whenever possible and pursue activities that would not be possible without the ship and its equipment. The sampling onboard the *Amundsen* consisted of CTD and MVP profiles, nutrient and phytoplankton samples using the rosette, zooplankton sampling using an oblique Tucker trawl and vertical Hydrobios and Monster tows for species composition, biomass, food-web dynamics, DNA barcoding and contaminants, multibeam seabed mapping and sub-bottom profiling, Agassiz trawl for biodiversity, contaminants, and food-web dynamics (see Table 1). Under the ArcticNet Nunatsiavut Nuluak umbrella, Ken Reimer, Trevor Bell, Sam Bentley and Reinhard Pienitz are spearheading the research into coastal food-web dynamics and contaminants, benthic biodiversity and habitat mapping, sediment flux and freshwater delivery, and paleoceanographyic work, respectively. Zooplankton (biomass and composition), phytoplankton, nutrients, and MVP and CTD profiles are being carried out jointly by the Nunatsiavut Nuluak team and Louis Fortier, Michel Gosselin, Jean-Éric Tremblay and Yves Gratton, respectively.

### 8.2 Synopsis of operations

This section provides a general synopsis and timeline of operations during Leg 3c. Detailed cruise reports provided by onboard participants and including specific objectives, methodology and preliminary results for projects conducted during Leg 3 are available in Part 2 of this report. A detailed scientific log of all sampling operations conducted during the leg is also available in Appendix 2.

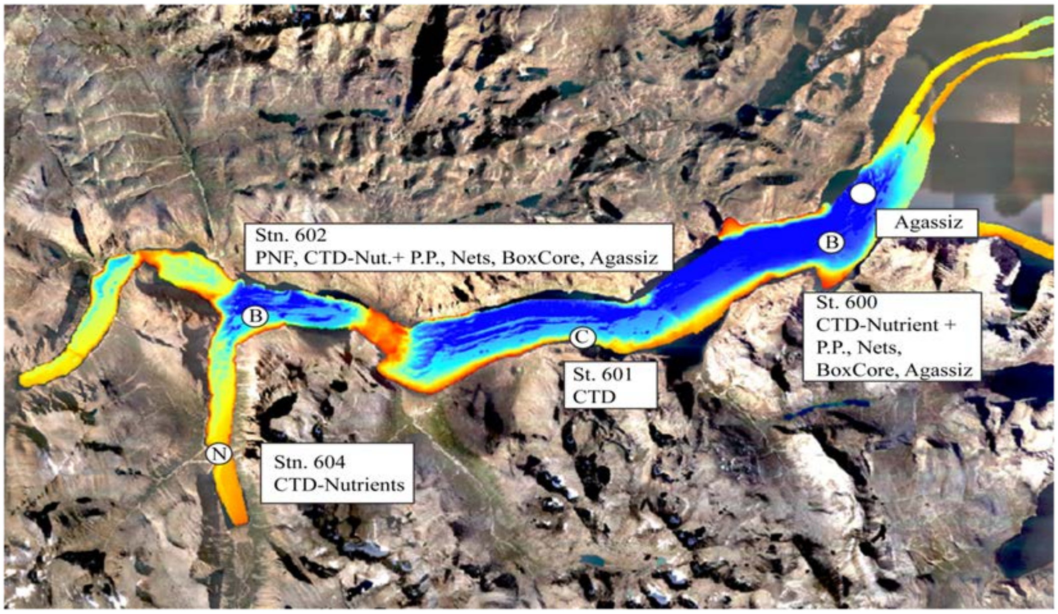
The science crew change took place on 22 October in Iqaluit from 10:00 AM to 14:00 PM at the onset of Leg 3c. Seven new science personnel boarded the CCGS *Amundsen* to join the 10 that were already on board. The ship left Iqaluit at 6:00 PM and arrived at the mouth of Nachvak Fiord 24 hours later. A bathymetric survey was conducted at the mouth of the fiord for a period of 3hrs. The Moving Vessel Profiler (MVP) was deployed and towed between stations 600 to 604 from 9:30 PM to 11:55 PM. On 24 October, water column and benthic sampling was conducted at 5 stations in the fiord starting at the Basic station 600 at 2:00 AM and ending at the Nutrient station 604 at 5:30 PM. In addition to work conducted at these stations, the Agassiz trawl was deployed at the mouth of the fiord and the barge was also deployed for a bathymetric survey of Tinutyarvik Cove.

The ship left Nachvak Fiord for Saglek Fiord at 8:00 PM on the 24th. On 25 October, water column and benthic sampling was conducted at 6 stations in Saglek Fiord, starting at Basic station 617 at 1:30 AM and finishing at Basic station 615 at 17:30 PM. The MVP was deployed between stations 615 and 617 from 6:15 PM to 10:00 PM. On the same day, the barge was deployed from 8:30 to 4:00 PM to survey with the multibeam system the Nachvak Brook delta in Torr Bay. Seabed mapping was also conducted with the *Amundsen* between stations 610 to 612 and in the Northern Arm of the Fiord.

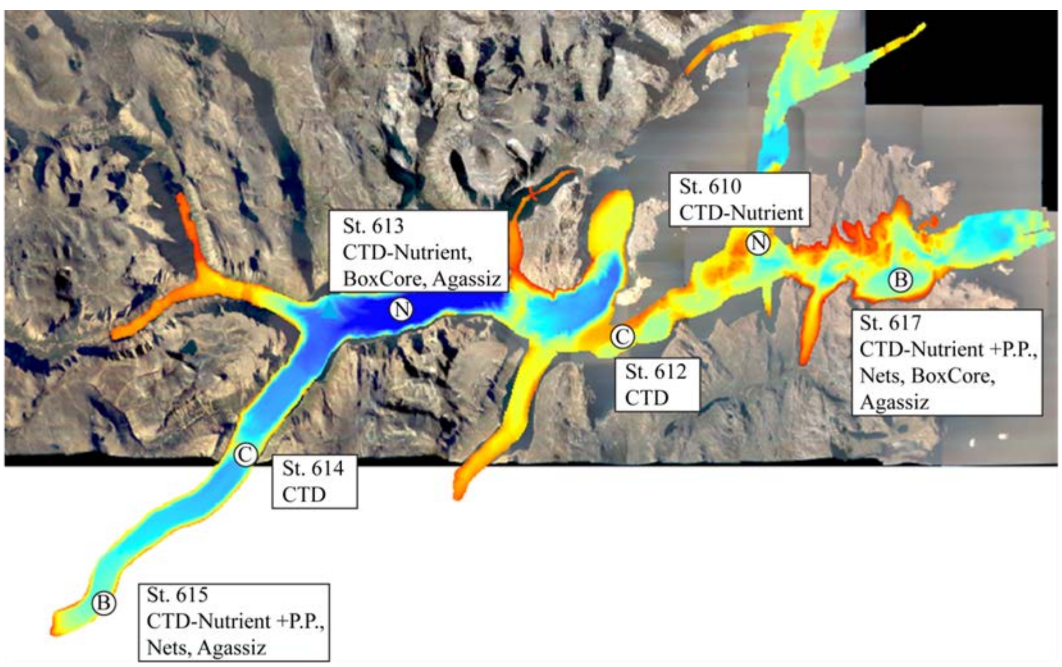
The ship transited from Saglek Fiord to Okak Bay from 10:00 PM on 25 October to 8:00 AM on 26 October. The barge was deployed from 8:30 AM to 4:00 PM for seabed mapping at Okak Island Cove. In Okak Bay, water column and benthic sampling was conducted at 4 stations, starting at Basic Station 633 at 8:45 AM and finishing at Basic station 630 at 20:30 PM. The MVP was then deployed between stations 630 and 633 from 20:45 PM to 23:30 PM.

The ship transited from Okak Bay to Anaktalak Fiord from 23:30 PM on 26 October to 8:00 AM on 27 October. The barge was deployed for seabed mapping of the inner basin from 8:30 AM to 2:45 PM. The MVP was deployed between the Niatak Island and station 624 from 9:45 AM to 1:00 PM. Water column and benthic sampling was conducted at 5 stations in the fiord, starting at Basic Station 624 at 1:00 PM and finishing at Basic station 620 at 1:30 AM on 28 October. On 27 October at 4:10 PM, 4 science participants disembarked the ship at Nain. The travel time of the helicopter was 31 minutes.

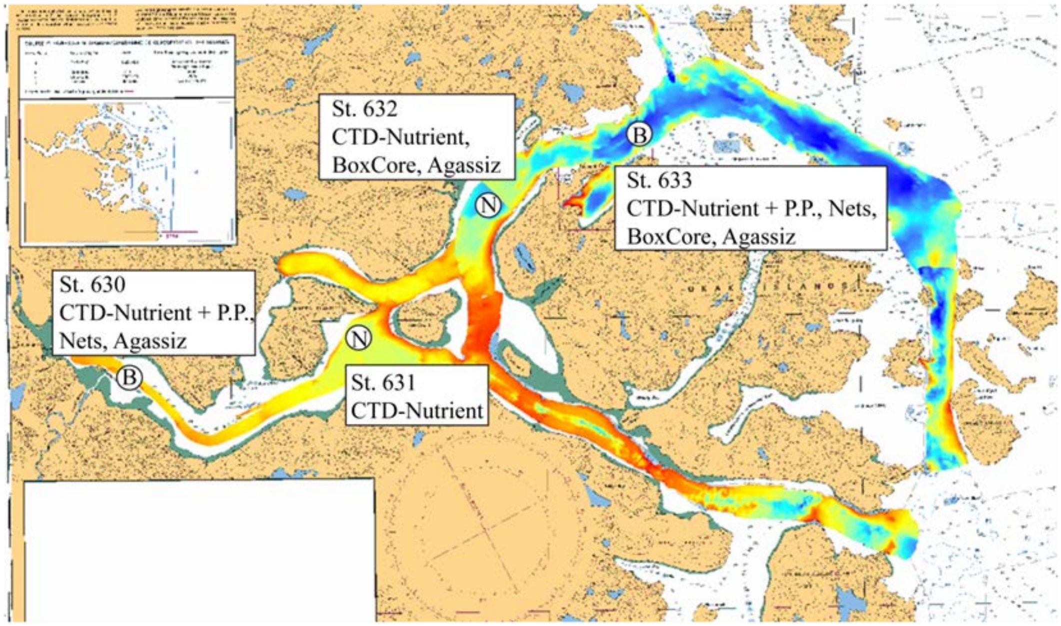
After the last sampling station in the Anaktalak Fiord on 28 October, the ship travelled to the southern Makkovik Margin for seabed mapping. The ship arrived on site at 12:30 PM. After discussion with Travis Hamilton, Pim Kuus and Commandant Stéphane Julien, the seabed mapping of the Makkovik margin was cancelled at 1:30 PM due to difficult weather and working conditions (eastern winds at 23 knots and waves of 2-3 m). The ship then headed to Québec City. The demobilization of ship's laboratories started in the afternoon and continued until arrival in Québec City on 31 October at 8:45 AM.



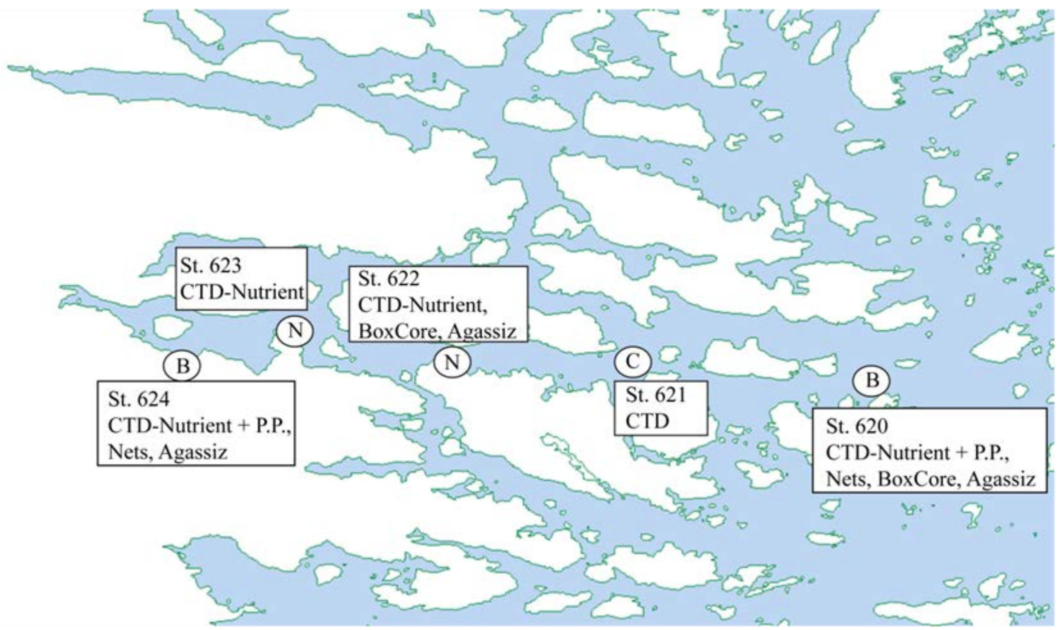

Bathymetry and sampling stations in Nachvak Fiord.



Bathymetry and sampling stations in Saglek Fiord.




Bathymetry and sampling stations in Okak Fiord.




Sampling stations in Anaktalak Fiord.

# Part II – Project reports

## 1 Mercury behavior and transformation in the Arctic water and lower atmosphere – Leg 1a, Leg 1b

ArcticNet Phase 2 – Project titled *Effects of Climate Change on Contaminant Cycling in the Coastal and Marine Ecosystems* (www.arcticnet.ulaval.ca/Phase 2/Stern_contaminants)

**Project leader**: Holger Hintelmann[1] (hhintelmann@trentu.ca)
**Cruise participant Leg 1a and Leg 1b**: Anabelle Baya[1]

[1] *Trent University, Department of Chemistry, 1600 West Bank Drive, Peterborough, ON, K9J 7B8, Canada.*

### 1.1 Introduction

Mercury (Hg) is a global pollutant from both natural and anthropogenic sources that is persistent in the atmosphere and can thus be transported and accumulated in areas far from the emission sources. Mercury contamination in the arctic regions, for long considered pristine with virtually no natural or anthropogenic sources, is a good example of the long-range transport of mercury.

Due to the accumulation of Hg in the arctic region over the past decades, mercury contamination in the arctic is currently an important environmental and health issue that raises great scientific interest. The aquatic wildlife and local communities are already exposed to high levels of mercury through the contamination of the food chain. During the past decade, steady progress has been made in the research of Hg cycling in the Polar Regions. The atmosphere has been identified as the major pathway for its introduction into the Arctic environment. However, due to limited analytical methods, the presence of organic mercury, mainly dimethylmercury (DMHg) and monomethyl mercury (MMHg) in the atmosphere and thus the direct contribution of the atmosphere has not been investigated. Considerable knowledge gaps still exist on the pathways and delivery processes of mercury to the aquatic food chain. Furthermore, limited studies have been conducted to investigate the methylation and demethylation rates of mercury in the aquatic ecosystems. A good understanding of the various MMHg sources to the aquatic ecosystem as well as the mechanisms controlling the methylation of Hg and the release and removal of MMHg is thus very important for the development of contamination control methods and mitigation processes to prevent toxicity.

Legs 1a and 1b of the 2010 Expedition was a continuity of the work that was started in 2010 in the Canadian high arctic. The main aim of the study was to gather information for a better understanding of the sources and fate of MMHg in the arctic aquatic ecosystem.

The objectives of the study were to:

- Measure organic mercury (monomethyl mercury, MMHg and dimethylmercury, DMHg) and inorganic mercury (Gaseous Elemental mercury, GEM) species concentrations in the lower atmosphere and in open water in the Arctic to investigate temporal and spatial trends in concentrations using a newly developed analytical method based on species specific mercury isotopic dilution and online ethylation.
- Investigate mercury methylation and demethylation rates in Arctic aquatic environments using species specific Hg isotopic dilution.
- Measure GEM flux over the ocean to better understand the pathway of Hg in the Arctic and quantify the exchange between the ocean and atmosphere.

## 1.2 Methodology

### *1.2.1 Air sampling*

Air was sampled for organic Hg determination during transit between the stations over open water. The air sample and permeation set up was located in a container on the foredeck while the sample line was on the side of the ship so that air above the water could be sampled.

### *1.2.2 Air sampling for organic mercury*

Air was pumped at a rate of 1 lpm and mixed with Hg species specific enriched isotopes ($CH_3{}^{200}HgCl$ and $(CH_3)_2{}^{198}Hg$) and passed through an online ethylation system before trapping on 4 Tenax traps placed in a row. The ethylation system consisted of a 45 µm cellulose filter impregnated with freshly prepared ethylating reagent (200 ml acetate buffer with 100 ml of sodiumtetraethylborate). The ethylated monomethyl mercury and dimethylmercury if present in the air sample was trapped on Tenax traps. Mercury enriched isotopes from a permeation source were added to the ethylation system to assess the ethylation efficiency of MMHg and the transformations that may occur during the sampling and online ethylation processes. The traps were collected after sampling and stored in the dark at 4ºC. The Hg species collected on the traps will be determined using thermal desorption to release the Hg species followed by analysis by GC-ICPMS at the Worsfold Water Quality Centre at Trent University.

Air was sampled for organic mercury while transiting in the Hudson Bay during Leg 1a and Lancaster Sound during Leg 1b for DMHg and MMHg using the online ethylation system.

### *1.2.3 GEM Flux and concentrations measurements*

A new technique based on the micrometeoroligal approach (Edwards et al. 2005) was developed and used to measure the mercury flux over ocean water.

The flux system (Figure 1.1) was deployed on Full stations during Leg 1a, and Basic and Full stations during Leg 1b, for a minimum sampling time of 2 hours. The air samples at 2 different heights were analyzed using the 2537A Tekran mercury vapor analyzer with a data point at one height every 5 minutes.

Furthermore, during transit air was continuously sampled for GEM concentrations in the lower atmosphere (Figure 1.1). The GEM values obtained from the Tekran 2537A will be valuable for spatial differences in GEM concentrations in Hudson Bay compared to the Canadian High Arctic.

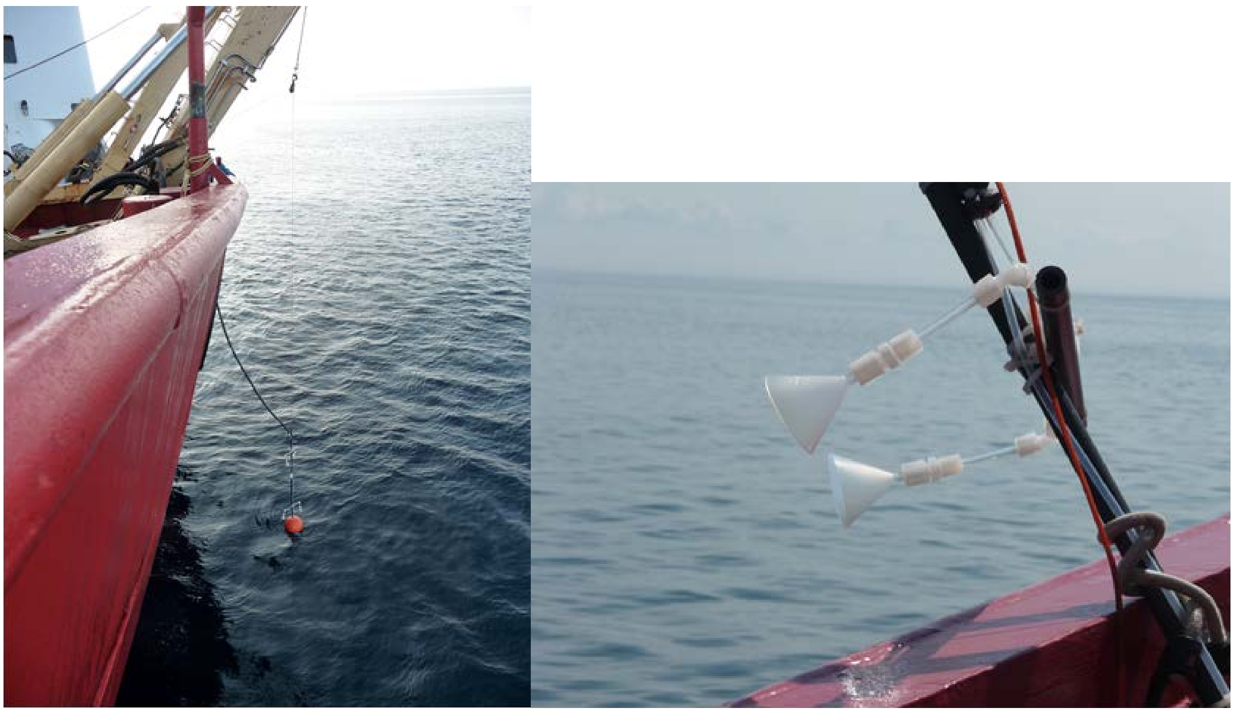


Figure 1.1. Left: GEM Flux measurement over water; Right: Sampling inlets for GEM concentrations measurement in the lower atmosphere

### 1.2.4 Water sampling

Water was sampled at 3 different depths (surface, bottom and chloromax or minimum oxygen) using acid-washed Teflon lined Niskin bottles (12 L) mounted on the CTD-Rosette.

The species of mercury that will be measured in sea water are:

- Monomethyl Mercury (MMHg)
- Dimethyl Mercury (DMHg)
- Total Dissolved Gaseous Mercury (DGM)

For dissolved gaseous mercury and dimethylmercury determination, water was sampled from the Niskin bottles to sparging bottles and purged with argon gas for 30 min at a rate of 200 ml min$^{-1}$. Dissolved gaseous mercury and dimethylmercury were trapped on gold traps and carbo traps respectively. A soda lime trap will be attached before the carbo trap to capture moisture. Water samples for MMHg determination were collected separately in 500 ml glass bottles and stored at -20 °C in the dark for analysis in the lab at the Worsfold quality centre, Trent University, by ethylation, purging and trapping.

Water samples were collected at Basic stations for mercury species concentrations measurements while incubations were also conducted during Leg 1a at Full stations for methylation and demethylation rates determination.

For incubations, the water samples collected in sparging glass vessels were spiked with isotope enriched Hg species as detailed in Table 1.1 and incubated for 12 hrs intervals (t=0, t=12, t=24) over 24 hours. After spiking, the DMHg concentrations were determined by purging and trapping on carbo traps while water samples were collected in glass bottles and frozen for MMHg concentrations determination in the lab. The incubations were done in triplicates for each sample interval.

Table 1.1. Spiking rate for enriched isotopes of Hg species for Hg methylation and demethylation rate investigation by incubation.

| Hg Species | Spiking rate (ng/L) |
|---|---|
| $^{200}Hg^{2+}$ | 40 |
| $CH_3{}^{199}Hg^{+}$ | 0.4 |
| $(CH_3)_2{}^{198}Hg$ | 0.25 |

## 1.3 Preliminary results

No preliminary results are available at this time as the water and air samples still need to be analyzed in the laboratory at Trent University.

The results will be able to confirm the presence and quantify the concentration of organic mercury in the atmosphere. The results from the incubations of water samples with Hg species including DMHg are expected to provide some data that will contribute for a better understanding of the transformations and rate of reactions of the Hg species in the water column.

# 2 Surface climate, air-surface fluxes and carbon exchange dynamics – Legs 1a, 1b, 2a, 2b, 3a, 3b

ArcticNet Phase 2 – Project titled *Carbon Exchange Dynamics in Coastal and Marine Ecosystems* www.arcticnet.ulaval.ca/Phase 2/Papakyriakou_carbon_dynamics.

**Project leaders**: Tim Papakyriakou[1] (papakyri@cc.umanitoba.ca) and BP (Legs 2a, 2b and 3a)
**Cruise participants Leg 1a**: Bruce Johnson[1] and Meredith Pind[1]
**Cruise participant Leg 1b**: Meredith Pind[1]
**Cruise participants Leg 2a**: Bruce Johnson[1] and Emmelia Stainton[1]
**Cruise participant Leg 2b**: Bruce Johnson[1]
**Cruise participant Legs 3a & 3b**: Kyle Swystun[1]

[1] *University of Manitoba, Centre for Earth Observation Science (CEOS), Wallace Building, 125 Dysart Rd, Winnipeg, MB, R3T 2N2, Canada.*

## 2.1 Introduction

Specific objectives relate to the development of tools (observation, model, and remote sensing) to assist with regional budgeting of (primarily) heat, $CO_2$ and momentum, and in the longer term, to develop the necessary process-level understanding of the exchange dynamics, to forecast how the ocean's response to climate change and variability will affect the atmosphere-ocean cycling of $CO_2$.

The surface meteorology and flux program of the *Amundsen* is designed to record basic meteorological and surface conditions, and to study exchanges of momentum, heat and mass across the atmosphere-sea ice-ocean interface in support of the objectives described above.

Novel to the air-sea studies is the ship-based application of the eddy covariance technique to the direct measurement of heat, $CO_2$ and momentum. Eddy covariance represents the lone local scale (100s m to km) direct measurement of the respective fluxes using micrometeorological approaches.

## 2.2 Methodology

### *2.2.1 Micrometeorology and eddy covariance flux tower*

Table 2.1 lists the variables that were monitored, the location where the sensor was installed, the purpose for each variable, along with the sampling and averaging frequency (if applicable).

Table 2.1. Inventory and application of ship-based variables monitored during the 2010 ArcticNet Expedition onboard the *Amundsen*.

| Variable | Instrumentation | Location of instrument | Purpose | Sample/ Avg Frequency (s) |
|---|---|---|---|---|
| air temperature (Ta) | HMP45C-212 | foredeck tower | meteorological | 1/60 |

| Variable | Instrumentation | Location of instrument | Purpose | Sample/ Avg Frequency (s) |
|---|---|---|---|---|
| relative humidity (RH) | HMP45C-212 | foredeck tower | meteorological | 1/60 |
| wind speed (ws-2D) | RM Young 05106-10 | foredeck tower | meteorological | 1/60 |
| wind direction (wd-polar) | RM Young 05106-10 | foredeck tower | meteorological | 1/60 |
| barometric pressure (Patm) | Vaisala PTB101B | foredeck tower | meteorological | 1/60 |
| sea surface temperature (Tsfc) | Apogee SI-111 | foredeck | meteorological | 1/60 |
| ship heading (H) | OceanServer OS5000 | foredeck tower | ancillary information | 1/-- |
| ship speed over ground (SOG), course over ground (COG)[3] | Garmin GPS16x-HVS | foredeck tower | ancillary information | 1/-- |
| ship location (lat., long.) | Garmin GPS16x-HVS | foredeck tower | ancillary information | 1/-- |
| incident solar radiation | Eppley Pyranometer | wheel-house platform | heat budget and microclimate | 2/60 (Leg 1) 3/60 (Leg 2&3) |
| incident long-wave radiation | Eppley Pyrgeometer | wheel-house platform | heat budget and microclimate | 2/60 (Leg 1) 3/60 (Leg 2&3) |
| photosynthetically active radiation (PAR) | Kipp & Zonen PARLite | wheel-house platform & foredeck tower | heat budget and microclimate | 2/60 & 1/60 (Leg 1) 3/60 (Leg 2&3) |
| wind speed 3D (u, v, w) | Gill Wind Master Pro | foredeck tower | air-sea flux | 0.1 (10 Hz) |
| ultra-violet A and B (UVA, UVB) | | wheel-house platform | heat budget and bioclimate | 0.1 (10 Hz) |
| sonic temperature (Ts) | Gill Wind Master Pro | foredeck tower | air-sea flux | 0.1 (10 Hz) |
| atm. water vapor concentration ($\rho_v$) | LICOR LI7500 & LI7000 | foredeck tower | air-sea flux | 0.1 (10 Hz) |
| atm. concentration of $CO_2$ ($\rho_c$) | LICOR LI7500 & LI7000 | foredeck tower | air-sea flux | 0.1 (10 Hz) |
| rotational motion (accx, accy, accz, r x, r_y, r_z) | Systron Donner MotionPak | foredeck tower | air-sea flux | 0.1 (10 Hz) |
| LI7500 sensor temperature | Fine wire thermocouples | foredeck tower | air-sea flux | 0.1 (10 Hz) |
| barometric pressure (mbar) | All Sensors BARO-A-4V-MINI-PRIME | foredeck tower | air-sea flux | 0.1 (10 Hz) |
| upper sea water temperature (Tsw) | General Oceanics 8050 $pCO_2$ | under-way system, forward engine room | air-sea flux and ancillary information | 3/60 (Leg 1) 3/120 (Leg 2&3) |
| sea water salinity (s) | General Oceanics 8050 $pCO_2$ | under-way system, forward engine room | air-sea flux and ancillary information | 3/60 (Leg 1) 3/120 (Leg 2&3) |
| dissolved $CO_2$ in seawater | General Oceanics 8050 $pCO_2$ | under-way system, forward engine room | air-sea flux and ancillary information | 3/60 (Leg 1) 3/120 (Leg 2&3) |
| pH | General Oceanics 8050 $pCO_2$ | under-way system, forward engine room | air-sea flux and ancillary information | 3/60 (Leg 1) 3/120 (Leg 2&3) |
| dissolved $O_2$ in seawater | General Oceanics 8050 $pCO_2$ | under-way system, forward engine room | air-sea flux and ancillary information | 3/60 (Leg 1) 3/120 (Leg 2&3) |

The micrometeorological tower located on the front deck of the *Amundsen* (Figure 2.1) provided continuous monitoring of meteorological variables and eddy covariance parameters. The tower consisted of slow response sensors that recorded bulk meteorological conditions (air temperature, humidity, wind speed/direction, surface temperature, barometric pressure) and fast response sensors that recorded the eddy covariance parameters ($CO_2$/$H_2O$ concentration, 3D wind velocity, 3D ship motion, air temperature). In addition, radiation sensors were installed on the roof of the wheelhouse to provide information on incoming long-wave, short-wave and photosynthetically active radiation (PAR) (Figure 2.2). All data was logged to Campbell Scientific dataloggers; a model CR3000 logger was used for the eddy covariance data, a CR1000 logger for the slow response met data, and a CR23X for the radiation data. All loggers were synchronized to UTC time using the ship's GPS system as a reference. Ship heading and location (latitude and longitude) were measured to compensate measured apparent wind information for ship direction and motion.

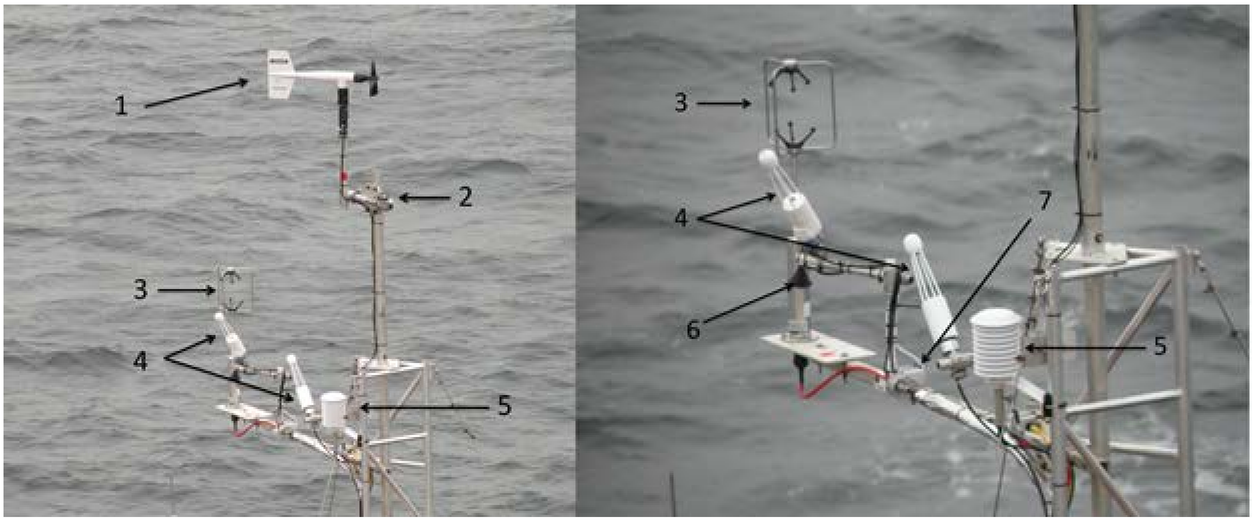



Figure 2.1. Flux and meteorological sensors on the foredeck tower. 1-RM Young 05106 2D anemometer, 2-Kipp & Zonen Par-Lite, 3-Gill Wind Master Pro 3D sonic anemometer, 4-Licor LI-7500 open path IRGA, 5-Vaisala HMP45C212 T/RH probe, 6-sample inlet for Licor LI-7000 closed path IRGA, 7-All Sensors BARO-4V-PRIME-MINI pressure transducer.

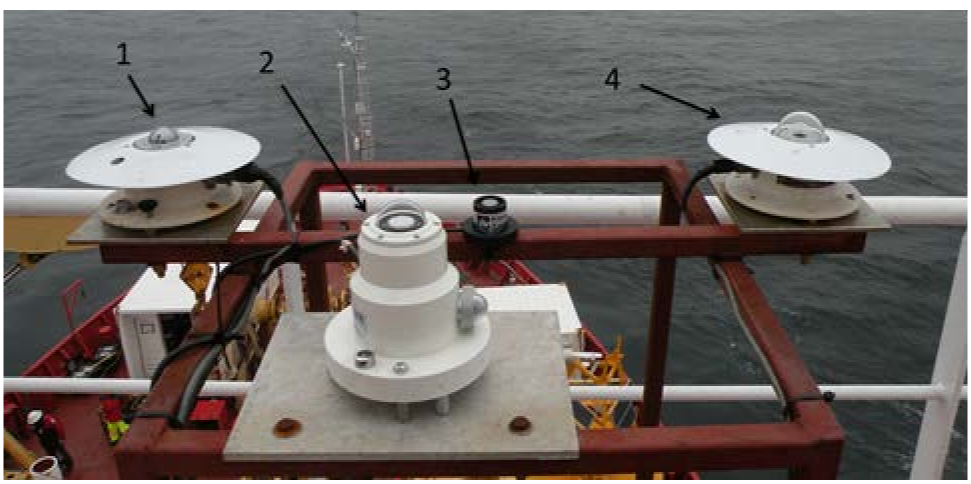



Figure 2.2. Radiation sensors on the roof of the wheelhouse. 1-Eppley PSP Pyrgeometer, 2-Kipp & Zonen UVS-AB-T Radiometer, 3-Kipp & Zonen PAR-Lite, 4-Eppley PIR Pyranometer.

New for 2010, a second sensor for measuring photosynthetically active radiation was installed on the tower to be used as a check against times when the sensor on the roof of the wheelhouse is shaded by the structures on the wheelhouse. A time series comparison of the two PAR sensors for the period 15 July to 19 July (Leg 1a) is shown the preliminary results section below (Figure 2.5). A different type of IR transducer (Apogee SI-111) was installed for measuring surface skin temperature. Results from Leg 1a seem to indicate that this sensor is more reliable than the sensors that were used in previous years.

The eddy covariance system on the tower made use of two separate gas analyzers and a single 3D sonic anemometer. The dual gas analyzers system allowed making use of both closed path and open path eddy covariance systems. The open path gas analyzer has the benefit of making measurements concurrently with the sonic anemometer, but the closed path gas analyzer is not as easily disturbed by adverse weather conditions.

In an effort to gather more precise data for making corrections to the calculated fluxes as measured by the open-path $CO_2$ system, three fine-wire thermocouples were attached to the sensor head for the 2010 Expedition. The thermocouples were installed to measure the temperatures of the base, spar and top bulb of the sensor head. A fast response barometric pressure sensor was placed on the tower at the same level as the $CO_2$ measurements were made, in an effort to more accurately measure the pressure fluctuations on the flux tower.

In order to make sure that the two systems were comparable, careful calibrations were performed on both instruments. The closed path system was based on a LI-7000 gas analyzer which employed two optical cells, one of which was used to monitor the drift of the instrument by constantly passing a stream of ultra-high purity $N_2$. In addition, the sample cell of the instrument was calibrated daily using the ultra-high purity $N_2$ to zero the $CO_2$ and $H_2O$ measurements, and a reference gas of known $CO_2$ to span the instrument. Occasionally, a span calibration of the $H_2O$ sensor was performed using a dew point generator (model LI-610). The open path gas analyzer (LI-7500) could not be calibrated as conveniently, and so it was calibrated approximately every two weeks. In general, it was found that this was effective for this instrument, which did not drift significantly over time.

In previous cruises, the LI7000 gas analyzer was housed in the foredeck container, which necessitated a long sample line (~22 m). Processing of the flux data has shown that signal noise appears to be drowning out any $CO_2$ signal that may be present. With this in mind, the gas analyzer with its system of valves and solenoids, was housed inside a watertight enclosure that was placed on the foredeck of the ship, close to the base of the flux tower (Figure 2.3). As a result, the sample line was reduced in length to about 8 m.

Figure 2.3. LI7000 gas analyzer enclosure at the base of the flux tower.

The ship motion correction necessary for the application of the eddy covariance technique requires accurate measurement of ship motion (3 plane measurement of angular acceleration and rate), heading and location. Rotational motion was monitored using a multi-axis inertial sensing system. Data related to heading and location was available from the ship's GPS and gyro. Using these data, yaw, pitch and roll, in addition to translational motion was calculated, and collectively this information was used to correct our 3D wind measurements.

Leg 1a – 1 July to 2 August 2010 – Hudson Bay
Leg 1b – 2 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago

The flux tower was operational as of 2200 UTC on 03 July 2010, the day following departure from Quebec City. Final installation of the new LI7000 enclosure at the base of the tower was completed as of 1530 UTC on 06 July 2010. The system operated continuously throughout Leg 1a, with short stoppages (usually less than 15 minutes) for calibration of the analyzers and tower maintenance. The closed-path system (LI7000) was turned off while at the port of Churchill on 20 July, but remained operational while at Churchill on 25 July.

The testing of the ship's motion effect on calculated $CO_2$ fluxes was conducted during Leg 1. A shroud was placed over the sensor head of the second analyzer to isolate it from external $CO_2$ fluxes.

Leg 2a – 12 August to 26 August 2010 – Beaufort Sea
Leg 2b – 26 August to 23 September 2010 – Beaufort Sea

The flux tower system was operational for the entire duration of Leg 2, with short, daily interruptions (generally < 30 minutes) for calibration and tower maintenance. Wherever possible, these interruptions were timed to correspond with poor flux conditions (i.e. when the ship was stopped at a station). The pump for the closed path system was turned off on numerous occasions when the ship was at station, and the wind was coming from behind the ship. During these interruptions, which could last for several hours, the flux system was measuring “dirty” air originating from the ship.

From past *Amundsen* expeditions, the accuracy of the Licor LI-7500 open path IRGA for ship-based eddy covariance studies has been called into question. Specifically, it is questioned whether the ship’s motion, or the presence of salt particles on the lens of the analyzer affects the calculated fluxes. With this in mind, a second LI-7500 was placed on the flux tower in close proximity to the first LI-7500 and the sonic anemometer during Leg 2. This second LI-7500 was allowed to remain “dirty” (i.e. the lenses of the analyzer were not cleaned during tower maintenance) for periods of time lasting up to three weeks. Post processing will determine whether an apparently clean analyzer, as indicated by its diagnostic value, but which has not been cleaned on a regular basis, gives different estimates of $CO_2$ fluxes.

An ultraviolet radiometer was added to the suite of radiation sensors located on the roof of the wheelhouse at the beginning of Leg 2a. This sensor provided separate measurements of global UV radiation (i.e. the sum of direct solar radiation plus radiation which has been scattered by particles in the air) in the UV-A and UV-B spectral ranges. The sensor was operational effective 0145 UTC on 15 August.

<u>Leg 3a – 23 September to 7 October 2010 – Beaufort Sea</u>
<u>Leg 3b – 7 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay</u>

The flux tower system was operational for the entire duration of Legs 3a and 3b, with short, daily interruptions (generally <30 minutes) for calibration and tower maintenance. Wherever possible, these interruptions were timed to correspond with poor flux conditions (i.e. when the ship was stopped on station). The pump for the closed path system was turned off on numerous occasions when the ship was at station, and the wind was coming from behind the ship. During these interruptions, which could last for several hours, the flux system was measuring “dirty” air originating from the ship.

### *2.2.2 On-track $pCO_2$ system*

A General Oceanics 8050 $pCO_2$ 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 2.4). The system was located in the engine room of the *Amundsen*, and draws sample water from the ship’s clean water intake. The water was passed into a sealed container through a shower head, maintaining a constant headspace. This set up allowed the air in the headspace to come into equilibrium with the $CO_2$ concentration of the seawater, and the air was then cycled from the container into an LI-7000 gas analyzer in a closed loop. A temperature probe was located in the equilibrator to provide the equilibration temperature. The system also passed subsample of the water stream through an Idronaut Ocean Seven CTD, which measured temperature, conductivity, pressure, dissolved oxygen, pH and redox. All data was sent directly to a computer using software customized for the instrument.

Figure 2.4. The on-track $pCO_2$ system located in the engine room of the CCGS *Amundsen*. The equilibration chamber is the clear cylinder (left, vertical with black top) and the gas analyzer is the green box behind the computer display.

The LI-7000 gas analyzer was 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 $H_2O$ sensor was not necessary because a condenser removed $H_2O$ from the air stream before passing into the sample cell.

The system was installed while still at port in Quebec City, but was only fully operational late on 5 July 2010. The system ran continuously throughout Leg 1a, with short stoppages (i.e. <30 minutes) for cleaning of the filter and CTD. The pump and water flow were turned off when the ship was at port in Churchill on 20 July and 25 July, although the system was still logging data.

The $pCO_2$ system was operational for the entire duration of Leg 2 and during Legs 3a and 3b, with short stoppages (generally <30 minutes) for cleaning of the filter and CTD assembly.

### 2.2.3 Idronaut CTD

New for Leg 2b, an Idronaut CTD was equipped with inputs for external sensors, one of which was designed to accept a thermistor that can be used to measure the temperature of the water as close to the ship's clean water intake as possible, and before the water is heated by passing through the pump and water lines inside the engine room. A thermistor had been set up during the original instrument installation at the beginning of Leg 1, but never recorded accurate temperatures. It was finally fixed during Leg 2b, became operational as of 01:30 UTC on 13 September, and recorded until the end of Leg 3b.

### 2.2.4 Continuous automated $CO_2$ sampler (CACS) (Leg 1a)

The CACS system measured dissolved gas in water using a peristaltic pump to draw water into the inner chamber of a gas permeable mini-module. A closed loop air stream was pumped through the outer chamber of the mini-module, and equilibrated with the dissolved gases in the water. The air loop then passed through an in-line Nafion tubing, an oxygen sensor, and a $CO_2$ analyzer (LI-820 Gas Hound). Data was logged on a Campbell Scientific CR10X datalogger at 15 second intervals.

During Leg 1a, the portable CACS $pCO_2$ system was used from the barge to do a more detailed survey of dissolved gases within the estuaries of the Great Whale River, Nelson River and Hayes River. Four estuary stations were sampled at the Great Whale River on 13 July, and seven stations were sampled at the Nelson / Hayes River estuary on 22 July (Table 2.2). Dissolved $CO_2$ values from the Great Whale River in comparison to the values measured at the ship's location are illustrated in Figure 2.6 of the results section below. Unfortunately, there were problems with the datalogger, and most of the data from the Nelson and Hayes rivers was lost.

Table 2.2. Locations of estuary sampling in the Great Whale River (GWR), Nelson River (NR) and Hayes River (HR) in Hudson Bay during Leg 1a.

| River | Station | Latitude N | Longitude W |
|---|---|---|---|
| GWR | GW1 | 55°16.092’ | 077°46.228’ |
| GWR | GW2 | 55°16.578’ | 077°49.182’ |
| GWR | GW3 | 55°17.393’ | 077°50.656’ |
| GWR | GW4 | 55°21.132’ | 077°53.466’ |
| NR | B6 | 57°06.681’ | 092°26.495’ |
| NR | B8 | 57°10.746’ | 092°23.873’ |
| NR | B10 | 57°14.821’ | 092°13.192’ |
| NR | B12 | 57°19.312’ | 092°06.892’ |
| NR | BD20 | 57°19.968’ | 091°52.197’ |
| HR | D6 | 57°11.252’ | 091°57.846’ |
| HR | D8 | 57°14.478’ | 091°52.130’ |

### *2.2.5 Data processing*

The high frequency variables associated with the eddy covariance system were scanned at 0.1 second intervals and stored as raw data and as 1 minute averages. The raw data were used to compute the fluxes (heat, mass and momentum) over time intervals that can range from 10 min to 60 min. Fluxes were computed during post processing.

The slow-sequence largely meteorological variables were scanned at 1 second intervals and saved as 1 minute averages. In regard to wind speed and direction, ship motion correction was applied in post-processing.

## 2.3 Preliminary results

### *2.3.1 Leg 1a – 1 July to 2 August 2010 – Hudson Bay*

A time series comparison of the two PAR sensors for the period 15 July to 19 July is shown (Figure 2.5).

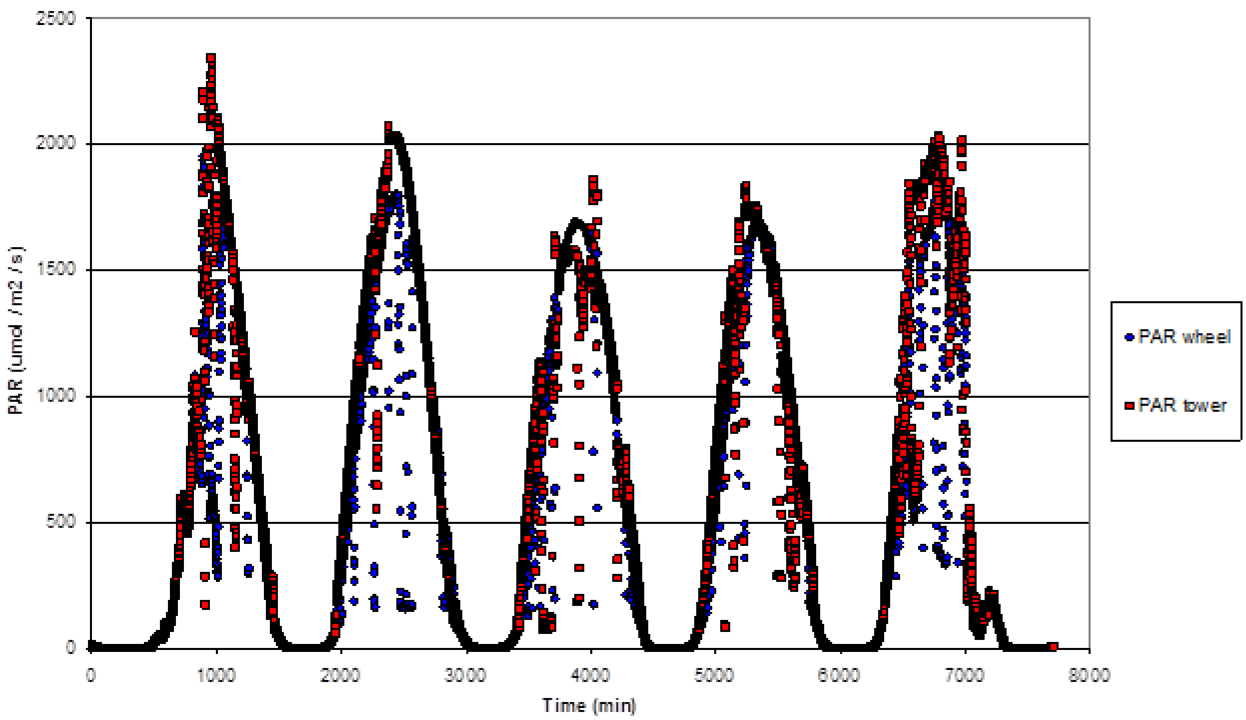



Figure 2.5. Time series comparison of the two PAR sensors during Leg 1a (15-19 July 2010).

Dissolved $CO_2$ values from the Great Whale River in comparison to the values measured at the ship's location are illustrated in Figure 2.6. Unfortunately, there were problems with the datalogger, and most of the data from the Nelson and Hayes rivers was lost.

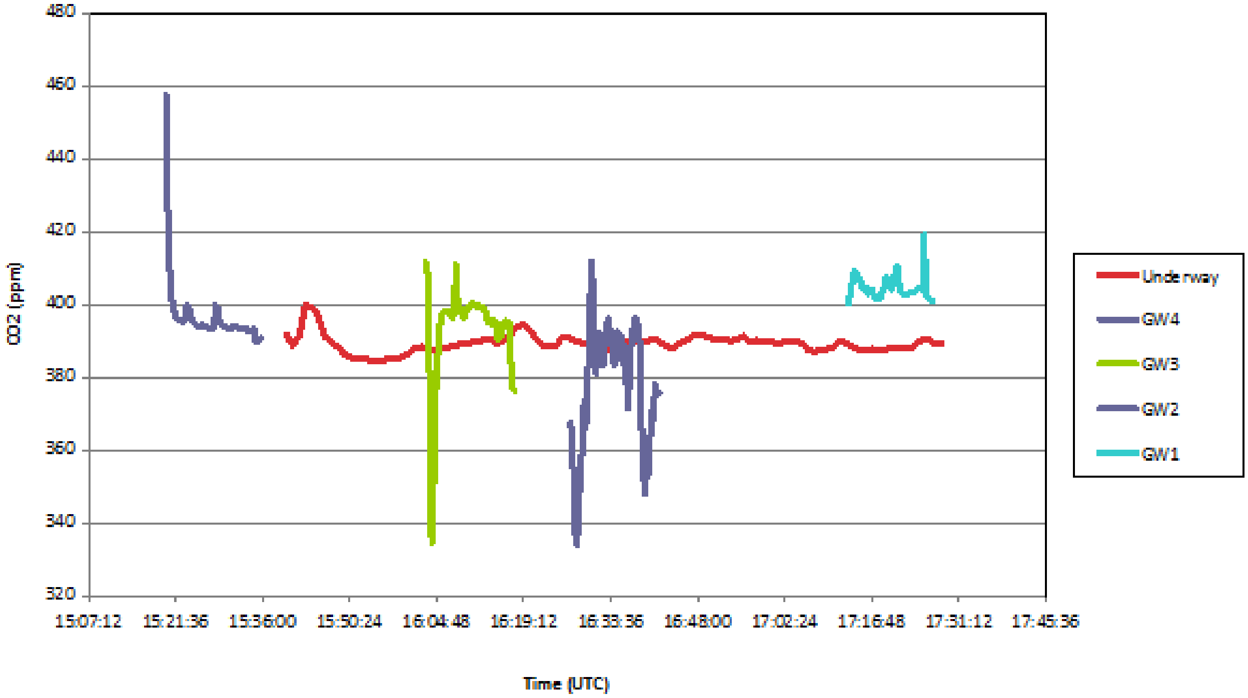



Figure 2.6. $pCO_2$ values from the on-track (underway) system and the CACS stations at the Great Whale River in Hudson Bay on 13 July 2010 during Leg 1a.

### *2.3.2 Leg 2a – 12 August to 26 August 2010 – Beaufort Sea*
### *Leg 2b – 26 August to 23 September 2010 – Beaufort Sea*

A comparison of the $CO_2$ concentrations from the closed-path system on the meteorological tower and the $pCO_2$ system in the engine room recorded on 19 August is shown in Figure 2.7.

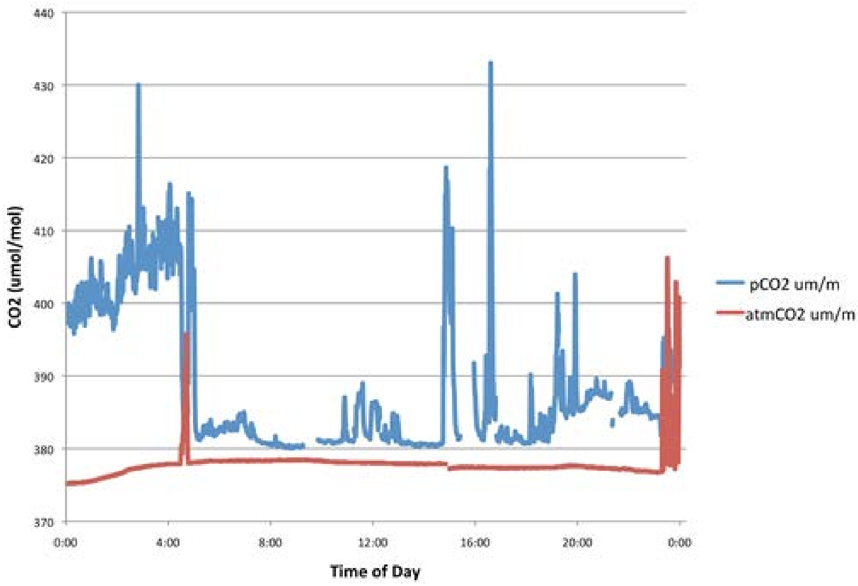



Figure 2.7. $CO_2$ concentrations from the closed-path system on the foredeck meteorological tower and the on-track system in the engine room for 19 August 2010 during Leg 2a.

A comparison of the $CO_2$ concentrations from the closed-path system on the meteorological tower and the $pCO_2$ system in the engine room for 15 September is shown in Figure 2.8. This comparison gives a general view of the flux gradient between the ocean and the atmosphere.

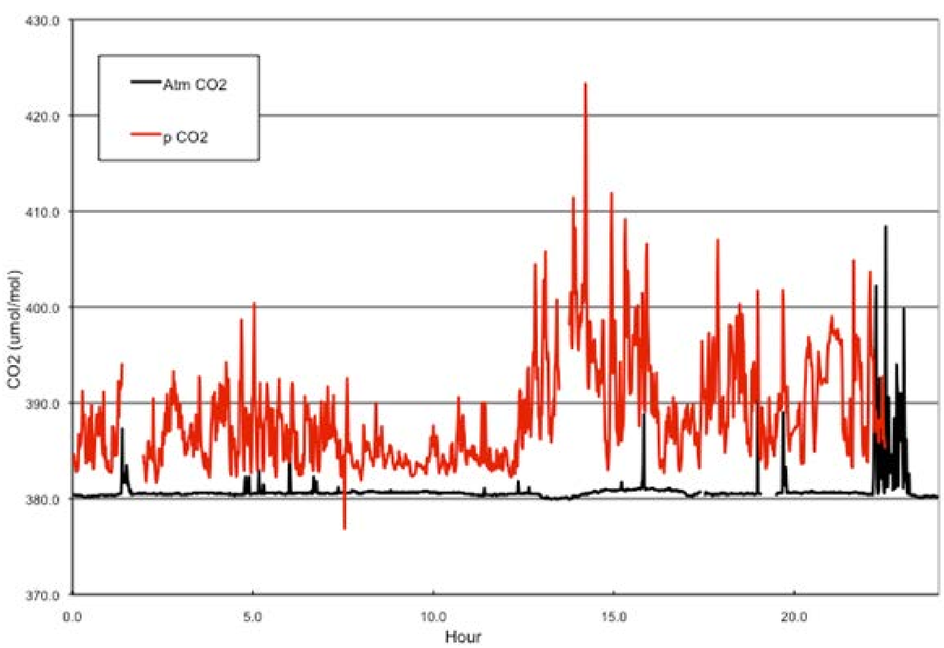



Figure 2.8. Comparison of $CO_2$ concentrations from the closed-path system on the foredeck meteorological tower and the on-track system in the engine room for 15 September 2010 during Leg 2b.

A comparison of the water temperatures measured by the on-track $pCO_2$ system (equilibrator T; inlet T), with the surface skin temperature measured from the foredeck meteorological tower for 15 September is shown in Figure 2.9. From this data, the amount of heating the water has undergone before entering the equilibrator can be observed, as can the good coherence between the measured surface temperature and the water temperature at the inlet.

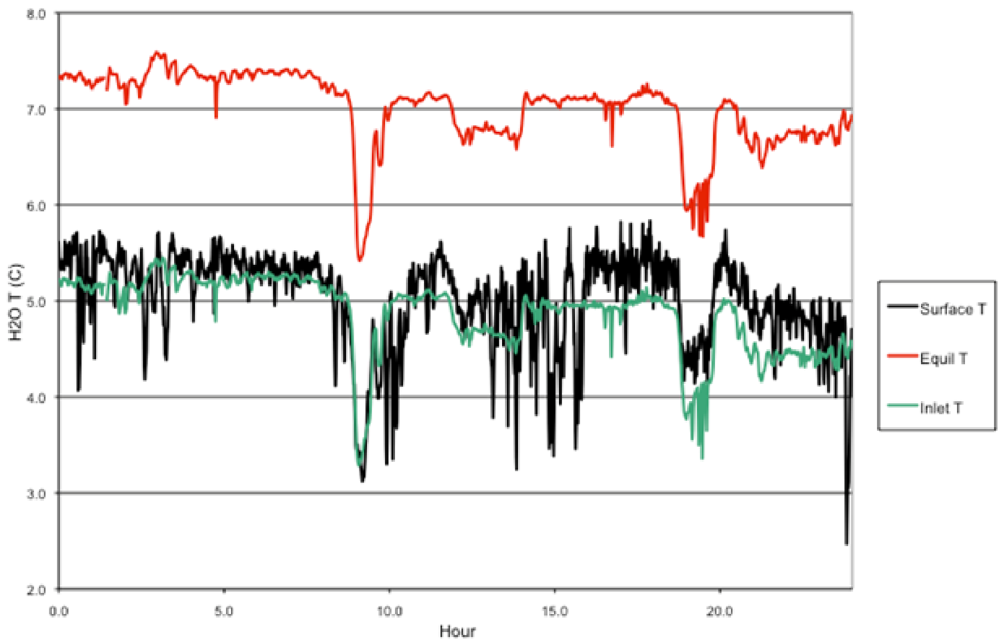



Figure 2.9. Comparison of surface skin temperature from the foredeck meteorological tower, and water temperatures (equilibrator and inlet) from the on-track $pCO_2$ system for 15 September 2010 during Leg 2b.

## 2.4 Comments and recommendations

During Leg 2, a considerable amount of potentially good quality data was lost due to the orientation of the ship with respect to the prevailing winds while located at sampling stations. Flux data is routinely filtered out if the ship lies within the flux footprint of the eddy covariance system. All flux data needs to be corrected for the ship's motion in post-processing, so data collected while the ship is stationary is potentially of higher quality. Whenever possible, the ship should be oriented to face into the prevailing winds while at a station to avoid this loss of data.

# 3 Ocean – sea ice – atmosphere processes – Legs 2a, 2b, 3a and 3b

ArcticNet Phase 2 – Project titled *The role of sea-ice in ArcticNet IRISes*.
http://www.arcticnet.ulaval.ca/pdf/phase2/barber_seaice.pdf

**Project leaders:** David Barber[1] (dbarber@cc.umanitoba.ca), BP (Legs 2a, 2b and 3a) and IORVL (Leg 3a)

**Cruise participants Leg 2a**: Ryan Galley[1], Emmelia Stainton[1], Kerri-Ann Warner[1] and David Babb[1]
**Cruise participants Leg 2b**: David Babb[1]
**Cruise participants Leg 3a**: Ryan Galley[1], Kerri-Ann Warner[1], David Babb[1], Matthew Asplin[1] and Alexander Komarov[1]
**Cruise participants Leg 3a**: Matthew Asplin[1]
*[1] University of Manitoba, Centre for Earth Observation Science (CEOS), 460 Wallace Building, Winnipeg, MB, R3T 2N2, Canada.*

## 3.1 Introduction

The research interest of the Sea Ice and Atmosphere group revolves around improving the understanding of ocean-sea ice-atmosphere dynamic and thermodynamic coupling. A large ensemble of ship-based sensors, and physical sampling equipment that collect sensor-based atmospheric, oceanic and sea ice data are utilized. Data collection is driven by many interlinked objectives, including:

- Develop a dataset of ice thickness, ice concentration and ice roughness for use in future engineering purposes.
- Develop and improve of satellite-based remote sensing of sea ice using a ship-based EM sampling program, and physical sampling of sea ice geophysical and electrical properties.
- Improve the understanding of atmospheric coupling of sea ice dynamics and thermodynamics by monitoring atmospheric conditions, sea ice motion, sea ice roughness, and growth and ablation of sea ice.
- Improve the dynamic modeling of dynamic and thermodynamic ocean-sea ice-atmosphere processes.
- Continue time-series monitoring of near surface water currents, and upper ocean light, temperature and salinity near the industry exploration lease blocks (Legs 2a, 2b and 3a).
- Evaluate the sea ice climatology of the Southern Beaufort Sea, the Pokak Block lease area, and the Canadian Arctic Archipelago (Leg 3b).

Active ArcticNet sampling programs, such as ice geophysics and dynamics, ice distribution and thickness, are of particular interest to BP and IORVL for the planning and development of potential future offshore drilling platforms. The group's 2010 ArcticNet monitoring and sampling program was expanded to accommodate monitoring within BP and IORVL exploration blocks in the southern Beaufort Sea during Legs 2a, 2b and 3a. The emphasis of the expanded program was on site specific time-series monitoring of near surface water currents, and upper ocean light, temperature and salinity.

## 3.2 Methodology – Sea ice

### *3.2.1 Helicopter-based EMI surveys*

Figure 3.1. Helicopter with IcePic taking off from CCGS *Amundsen* on 18 Aug 2010 during Leg 2a.

The helicopter-based EM induction system (IcePic) was used during Leg 2a only, to derive sea ice thickness and surface roughness for mobile first-year and multi-year ice.

In Leg 2a, the system worked as it should have for two flights on 18 August 2010 in the southern Beaufort Sea centered about 72°N, 137°W.

In Leg 3a, the system worked as it should have for two flights on 27 September, three flights on 28 September and one flight on 29 September 2010 in the southern Beaufort Sea centered about 74.5°N, 129°W.

These flights were made under 'new' pilot guidelines for the BO-105 Nose Stinger Ice Probe Operations, which did not seem to affect the data quality at first glance.

The raw data from these flights has been post-processed only to the point of a 'first-look' on-board. Preliminary data indicates that water at the surface sometimes creates specular reflection in the laser data making it impossible to determine the sea ice thickness at these points.

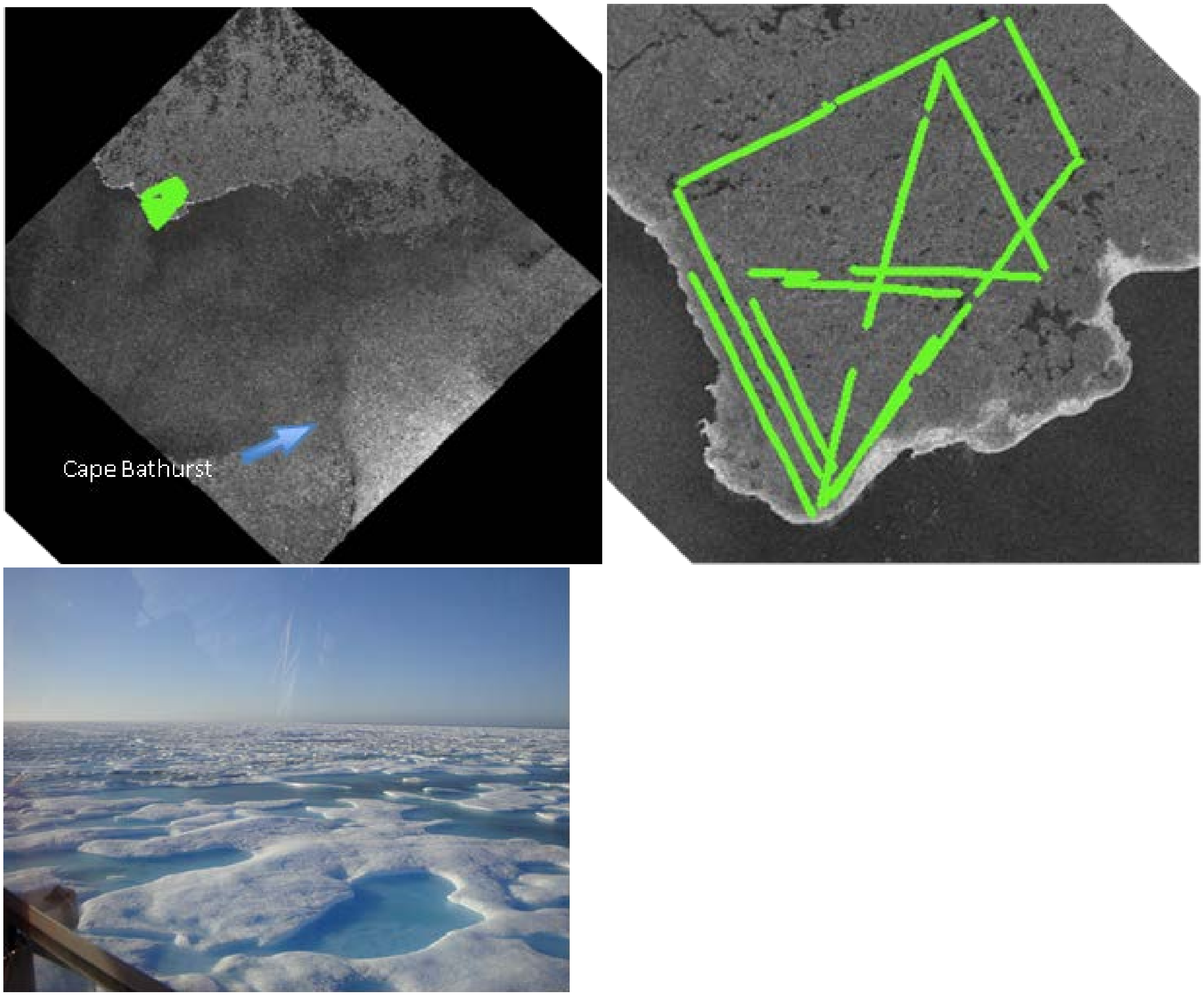



Figure 3.2. [Top left] Radarsat-2 geotiff showing the position of the sea ice and the flight lines made on 18 Aug 2010 during Leg 2a, noting the position of Cape Bathurst in the bottom right corner (R2 Scene shows only uncalibrated DN's). [Top right] A blow-up of the top left image – approximate distance from side to side is 45 nm. [Bottom] Photo of the area taken from the helicopter during flight. Note the amount of water at the ice surface (D. Babb).

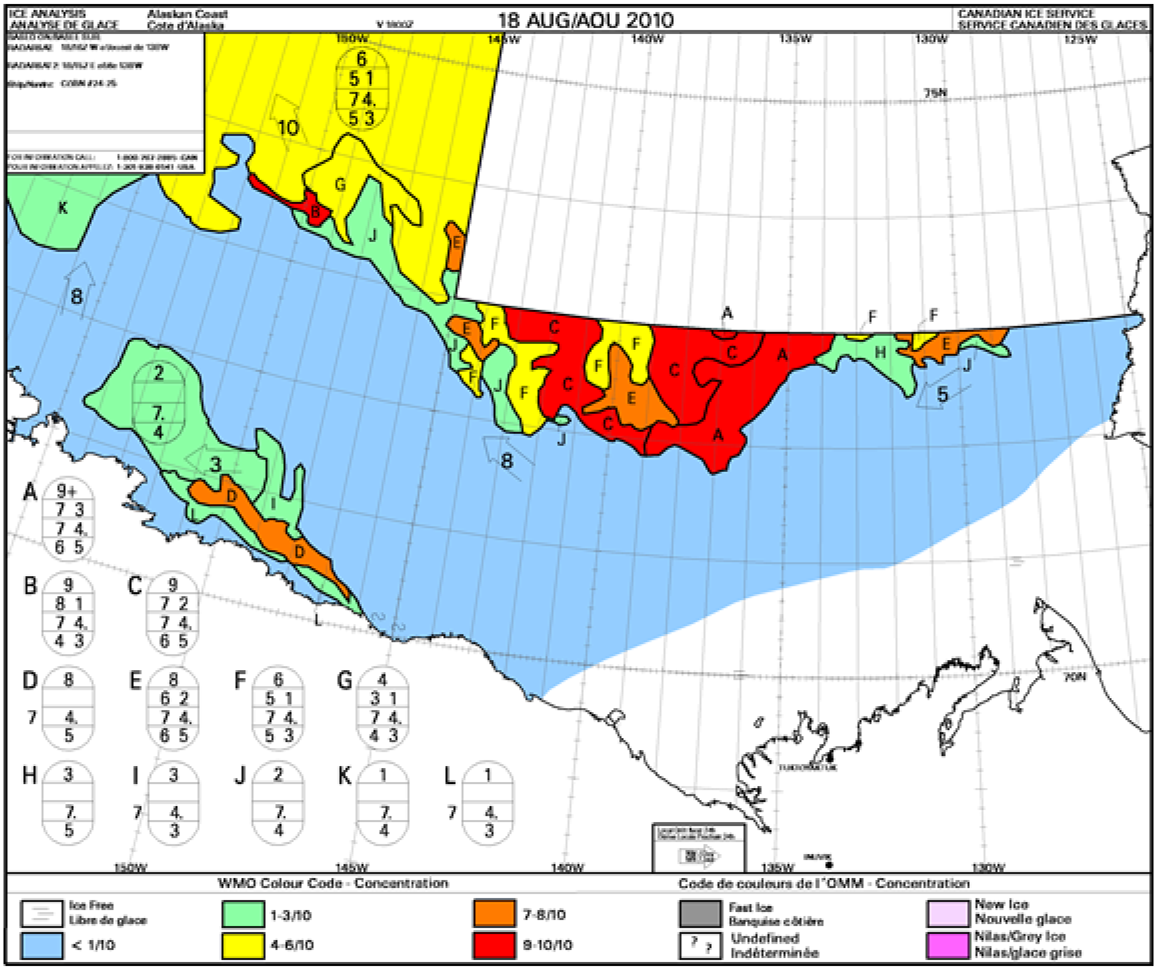



Figure 3.3. Canadian Ice Service digital analysis for the ‘Alaska’ region on 18 August 2010. The area in which the helicopter flew with the IcePic is approximately denoted by the black square.

During leg 2a, the Canadian Ice Service digital chart for the area flown for the date and location of the flights shows that the ice over-flown was 9+/10ths in concentration, made up of 7/10ths old ice (vast floes) and 3/10ths thick first-year sea ice (big floes) (Figure 3.3).

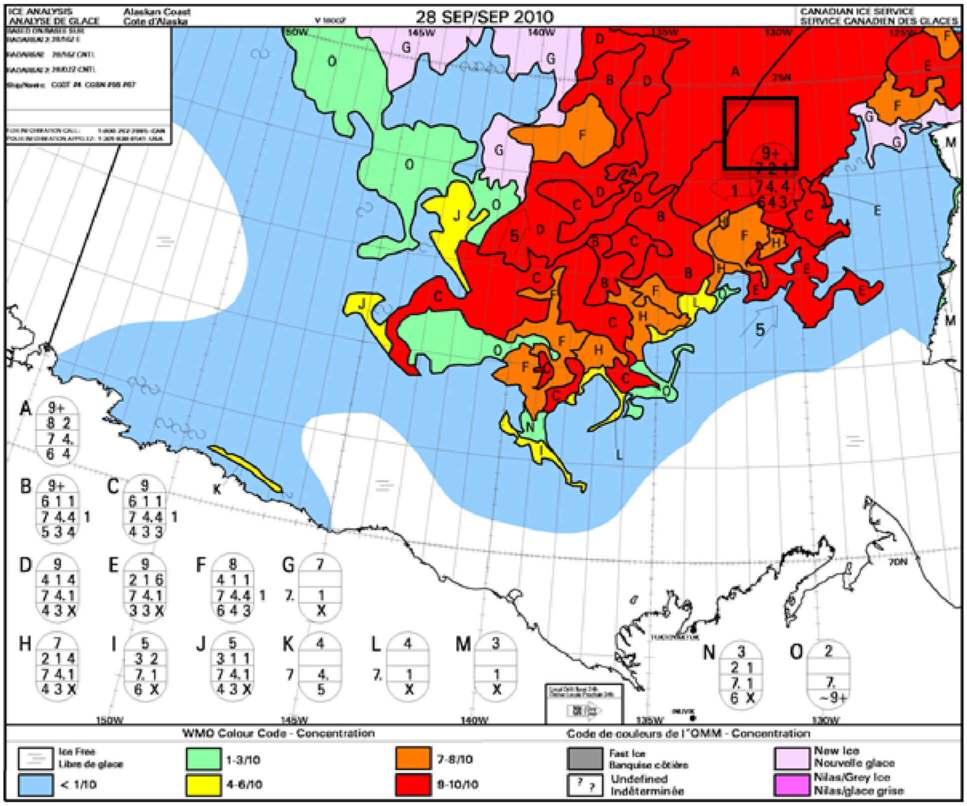



Figure 3.4. Canadian Ice Service digital analysis for the 'Alaska' region on 28 September 2010. The general area CCGS *Amundsen* operated in on 27, 28, 29 September is denoted by the black square.

During Leg 3a, the Canadian Ice Service digital chart for the median date and area where flights were conducted shows that the sea ice was 9+/10ths in concentration and made up of 7/10ths old ice (vast floes) and 2/10ths grey sea ice (Figure 3.4).

### *3.2.2 Position-only sea ice motion beacons*

Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea

Three Oceanetics position-only beacons were installed during HEMI operations on 18 August 2010. Positions in WGS84 are given in Table 3.1. The functionality of these beacons has not yet been ascertained.

Table 3.1. Coordinates of the three ice motion beacons deployed during Leg 2a in the Beaufort Sea.

| Beacon ID | Latitude N | Longitude W |
|---|---|---|
| 289110 | 71°52.499 | 137°05.054 |
| 285100 | 72°07.458 | 137°24.673 |
| 284100 | 71°57.506 | 136°42.249 |

Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea

Fourteen Oceanetics position-only beacons (POB) were installed during operations on 27-29 September 2010. Each has been confirmed to have successfully transmitted to

Winnipeg.

Table 3.2. Summary of POB deployments carried out during Leg 3a giving Oceanetics Iridium serial number, date and location for each (datum is NAD83).

| Serial Number | Date Deployed | Latitude N | Longitude W |
|---|---|---|---|
| 25480 | 20100928 | 74° 37.750’ | 129° 12.202’ |
| 96630 | 20100928 | 74° 45.621’ | 129° 17.889’ |
| 23490 | 20100928 | 74° 42.637’ | 128° 49.458’ |
| 27340 | 20100928 | 74° 27.328’ | 128° 21.573’ |
| 22370 | 20100928 | 74° 21.025’ | 129° 09.127’ |
| 24350 | 20100928 | 74° 29.664’ | 128° 44.408’ |
| 21490 | 20100929 | 74° 44.230’ | 127° 54.229’ |
| 21350 | 20100929 | 74° 50.572’ | 127° 38.244’ |
| 27480 | 20100929 | 75° 01.491’ | 127° 02.534’ |
| 20350 | 20100929 | 74° 50.105’ | 128° 14.388’ |
| 23340 | 20100929 | 74° 43.068’ | 128° 03.939’ |
| 29340 | 20100929 | 74° 43.981’ | 127° 46.057’ |
| 27350 | 20100929 | 74° 33.195’ | 128° 08.074’ |
| 28330 | 20100929 | 74° 35.697’ | 129° 16.226’ |

Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

Four ice motion beacons were deployed during Leg 3b, and are summarized below (Table 3.3). One beacon was deployed on a large multi-year ice floe in Viscount Melville Sound on 11 October 2010. The other three were deployed by helicopter on the Petermann Ice Island fragments in northern Baffin Bay.

Table 3.3. Summary of ice beacon deployments carried out during Leg 3b giving Oceanetics Iridium serial number, date and location for each (datum is NAD83).

| Beacon ID | Date | Latitude N | Longitude W |
|---|---|---|---|
| 20490 (MYI) | 11 Oct 2010 | 74° 06.048 | 107° 18.948 |
| 21340 | 17 Oct 2010 | 76° 17.816 | 077° 59.402 |
| 26340 | 17 Oct 2010 | 76° 15.105 | 077° 54.972 |
| 23350 | 18 Oct 2010 | ? | ? |

### *3.2.3 Ice thickness camera (Leg 3b)*

Ship-based monitoring using cameras and manual observations of sea ice concentration was carried out in close proximity to the ship. A downward-looking camera monitored ice thickness where ice breaking was necessary: when breaking through ice, some of the broken ice floes will turn on their side. Where imagery is clear and floe thickness can be estimated, estimates of ice thickness will be manually post-process from this photography.

### *3.2.4 Ice mass balance system installation*

On 27 September 2010, a CEOS ice mass balance system (IMB04) was installed on a multi-year sea ice floe at 74°14.990'N, 128°49.025'W (NAD83). The ice floe was 237cm thick at the point where the temperature string was installed. There was 7cm of snow on the floe. The instrument mast, temperature string and underwater sounder were installed successfully and a successful transmission has been confirmed in Winnipeg since the system's installation.

Figure 3.5. Ice mass balance system (CEOS IMB04) installed in the Beaufort Sea on 27 September 2010 during Leg 3a.

### *3.2.5 Ship-based EM measurements*

EM measurements using a C-Band scatterometer were conducted in order to observe the interaction of electromagnetic radiation with various ice conditions. The collected data will be used in electromagnetic modeling studies and for calibration of satellite remote sensing data. The results of this study will allow for us to improve our knowledge of the temporal evolution of sea ice physical, thermodynamic, and electrical properties during the late summer, and early ice formation season (late August, September, October).

During Leg 2a, on 18 August 2010, one site (71.47°N, 136.43°W) was scanned using the C-Band scatterometer on 18 August 2010. Coincident measurements of sea ice temperature and salinity at 5cm intervals were made.

During Leg 3a, on various occasions between 27 September 2010 and 29 September 2010. A calibration scan for the C-Band Scatterometer was conducted on 27 September 2010 at 74°21.4751'N, 128°27.9062'W. A total of six sites were scanned using the C-Band Scatterometer. Coincident measurements of sea ice temperature and salinity at 5cm intervals were made. Three ice cores were collected at each station for post processing in the lab to analyze density and microstructure. The final three cores taken from each sampling station will be shipped back to the University of Manitoba where they will be cut, shaved and processed in the cold lab. These samples will be used to analyze the vertical microstructure and the density of the ice at the various sites.

## 3.3 Methodology – Air-sea heat and momentum exchange (Leg 2)

A surface buoy suspending a 45 m string of sensors was deployed at 250 m (70°56.948'N, 134° 44.593'W), at 24:00 GMT on 24 August during Leg 2a. Eleven PAR (light intensity) sensors (JFE ALEC©, model MDS MkV-L) and temperature/conductivity sensors (JFE ALEC©, model ACT-HR Compact CT) were attached at 3, 6, 9, 12, 15, 20, 25, 30, 35, 40, and 45m. Two current profilers (Nortek Aquadopp) were positioned at 3 and 45m. The surface buoy was recovered at 00:30 GMT on 20 September during Leg 2b. All data from the PAR and CT sensors was downloaded and processed, and from a preliminary review the data appears to be good quality.

Figure 3.6. [Left] JFE ALEC© compact CT sensor. [Middle] Aquadopp current profiler. [Right] JFE ALEC© PAR sensor (Photo: E. Stainton).

## 3.4 Methodology – Atmosphere and meteorology

### *3.4.1 All-sky camera*

The all-sky camera (Nikon D-90) system was used to take pictures of the sky in order to determine the percentage and type of cloud cover throughout the cruise. The system consisted of a Nikon D-90 camera outfitted with fish-eye lenses, mounted in a weatherproof enclosure.

The camera was programmed to take pictures using an external intervalometer set at 15-minute intervals. The system was mounted in a small 'crow's nest' immediately above the ship's wheelhouse (Figure 3.7). The all-sky camera was fully functional upon arrival onboard, and should only require regular maintenance and data backup on future legs. Imagery collection commenced on 04 July 04, and will be post-processed into a tabular format describing cloud fractional coverage, cloud type, UTC date and time, and coordinates.

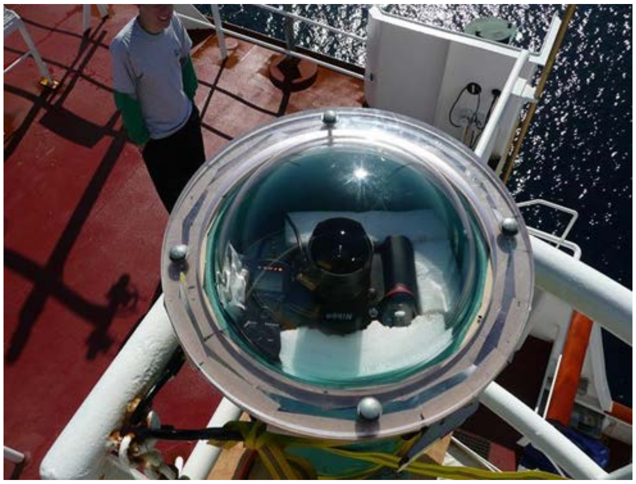


Figure 3.7. All sky camera (Nikon D-90) with fisheye lenses attached in a weatherproof enclosure.

The all-sky camera was fully functional during Legs 2a, 2b, 3a and 3b, and required only regular maintenance and data backup. Imagery will be post-processed into a tabular format describing cloud fractional coverage, cloud type, UTC date and time, and coordinates.

### *3.4.2 Ceilometer*

The Vaisala CT25K ceilometer was used to measure the height of up to three separate cloud layers above the ship (Figure 3.8). The instrument measures backscatter from an active laser pulse to identify cloud heights. The instrument sampled at a frequency of approximately once every 30 seconds. The ceilometer was fully functional throughout all of Legs 2a, 2b, 3a and 3b. Routine maintenance and data backup was performed at regular intervals. All data files are raw text format, and will require post-processing.

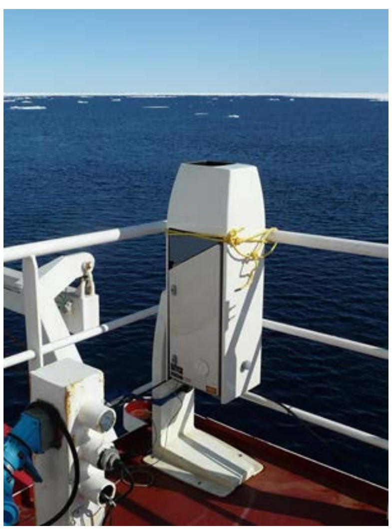


Figure 3.8. The ceilometer (Vaisala CT25K) mounted at 90°.

### 3.4.3 Temperature and water vapour profiling radiometer

A radiometrics temperature and water vapour 3000A profiling radiometer (TP/WVP3000A) was used to measure the temperature, relative humidity, and pressure within the atmosphere using passive microwave radiometry at 22 – 29GHz, and 51 – 59GHz. The TP/WVP3000A was installed on a mount attached to the white container laboratory located directly behind the ship's wheelhouse (Figure 3.9). The instrument was suspended away from the roof of the shed to ensure that the field-of-view (approximately 15° above the horizon to the left and right to the zenith) was clear of any obfuscation.

Figure 3.9. The temperature and water vapour profiling radiometer (TP/WVP 3000A) mounted on the roof of the MetOcean Container.

The instrument generated vertical profiles of upper-level air variables including temperature, water vapour density, relative humidity, and liquid water from the surface to an altitude of 10km. The resolution of the measurements varied with height. The resolution of the instrument was 50m from the surface to an altitude of 500m, then increased to 100m from 500m to 2km altitude, and was 250m for measurements from 2km to 10km. In addition, the instrument also measured concurrent basic surface meteorology variables, including pressure, relative humidity, and ambient temperature. A skyward-looking infrared sensor measured the temperature of the sky. A rain-sensor detected the presence of any precipitation. The instrument also calculated integrated column water vapour, and liquid water content. The sampling frequency for all data was approximately one complete profile per minute.

The temperature and water vapour profiling radiometer (TP/WVP 3000A) was not operational during Legs 2a and 2b, having not been operational during Leg 1. Upon many attempts to get the unit functioning, it was determined that the issue was with the software and thus measures were arranged to have a new software package for the next leg. Upon the arrival of the Leg 3a participants, it was determined there was an ongoing problem from previous issues regarding an error message "server not ready." It was determined that the problem was related to a corrupt windows service (cryptography), which the profiler software depends upon, to run the profiler server software as daily scheduled task in windows task scheduler. The problem was corrected, and no further problems were noted with the software or hardware. The profiling radiometer was fully functional throughout leg 3B without any notable issues or errors. It should be noted that the radome window was very dirty at the end of the leg, and will need to be considered when working with the data.

A liquid nitrogen calibration was performed on 27 September 2010 in Leg 3a, and should be repeated at least once more during Leg 3b. All data files are raw text format, and will require post-processing. The end data product will have UTC date and time, and coordinates attached to surface and upper-level data values, and integrated liquid and water vapour.

#### *3.4.4 Radiosondes*

Balloon launches allowed physical sampling of the troposphere and were also used to profile low-pressure systems, cyclones, and periods of significant warm or cold-air advection aloft. Before launch, the radiosonde’s temperature, pressure and humidity sensors are calibrated using the Vaisala ground station calibration unit. Surface meteorological observations are also noted and recorded for each launch. Starting meteorological conditions are input into the sounding including: sea level pressure, air temperature, relative humidity, and wind speed and direction.

Data was transmitted at a rate of one message per second via VHF radio (~400.00MHz). Each data message reported a value for pressure, temperature and humidity data (raw PTU data). GPS strings were also transmitted, and were used to calculate upper-level wind speed and direction. All radiosonde data files were exported as a raw time series, and will require quality assurance, and post-processing. Furthermore, an ongoing problem with the paired humidity sensors will need to be checked and rectified if necessary.

Figure 3.10. A weather balloon with attached radiosonde and the launch from the helicopter deck (Photos: M. Gervais).

In Leg 2, there was one meteorological balloon launched during Leg 2a but none during Leg 2b. Balloon launches were coordinated to correspond with the over-flights of the earth-orbiting satellites CLOUDSAT and CALIPSO for an Arctic validation study currently being undertaken by this group.

During Leg 3a, a total of 13 balloons were launched, which were carried out at least once per day to provide continuous physical sampling of the troposphere. If a significant closed low-pressure system is affecting the region, the sampling interval is increased to 6-hourly. All radiosonde launches are summarized in Table 3.4.

Table 3.4. Summary of weather balloons launched during Leg 3a.

| Date (GMT) | Time (GMT) | Tair (°C) | RH (%) | P (mbar) | Wind speed (kts) | Wind dir. (°true) |
|---|---|---|---|---|---|---|
| 20100925 | 0600 | -0.2 | 89 | 1008.1 | 14 | 020 |
| 20100925 | 1800 | 1.0 | 71 | 1000.77 | 23 | 190 |
| 20100926 | 0600 | 0.0 | 66 | 1003.13 | 5 | 320 |
| 20100926 | 1800 | 0.8 | 78 | 1005.22 | 9 | 265 |
| 20100927 | 0600 | -1.6 | 79 | 1006.10 | 11 | 040 |
| 20100927 | 1800 | -5.2 | 99 | 1003.18 | 8 | 207 |
| 20100928 | 0600 | -3.6 | 96 | 1000.73 | 7 | 165 |
| 20100929 | 1800 | -2.7 | 89 | 1000.16 | 5 | 154 |
| 20100930 | 1800 | -0.8 | 68 | 1008.99 | 20 | 287 |
| 20101001 | 1800 | 0.7 | 87 | 1013.75 | 7 | 265 |
| 20101002 | 1800 | 0.0 | 98 | 1000.60 | 28 | 066 |
| 20101004 | 1800 | -3.9 | 74 | 1016.41 | 33 | 087 |
| 20101005 | 1800 | -6.3 | 74 | 1006.40 | 27 | 080 |

During Leg 3b, there were 6 balloon launches (Table 3.5). Balloon launches were carried out at least once per day during Leg 3a to provide continuous physical sampling of the troposphere, but were scaled back this leg as the primary study area was the Southern

Beaufort Sea. Sampling opportunities along the Baffin Bay transect were limited by an uncertainty over whether balloons could be launched in Danish waters. Data in this region was not critical to the sampling program, so launches were suspended.

Table 3.5. Summary of weather balloons launched during Leg 3b.

| Date (GMT) | Time (GMT) | Tair (°C) | RH (%) | P (mbar) | Wind speed (kts) | Wind dir. (°true) |
|---|---|---|---|---|---|---|
| 20101009 | 0600 | -1.4 | 99 | 1009.99 | 1 | 005 |
| 20101010 | 0600 | -2.0 | 99 | 1018.00 | 19 | 015 |
| 20101011 | 1830 | -3.4 | 99 | 1008.54 | 20 | 040 |
| 20101012 | 0000 | -4.2 | 98 | 1006.30 | 17 | 095 |
| 20101013 | 1800 | -4.1 | 99 | 1003.38 | 26 | 083 |
| 20101017 | 0000 | -2.2 | 99 | 1012.42 | 9 | 055 |

## 3.5 Preliminary results

### *3.5.1 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

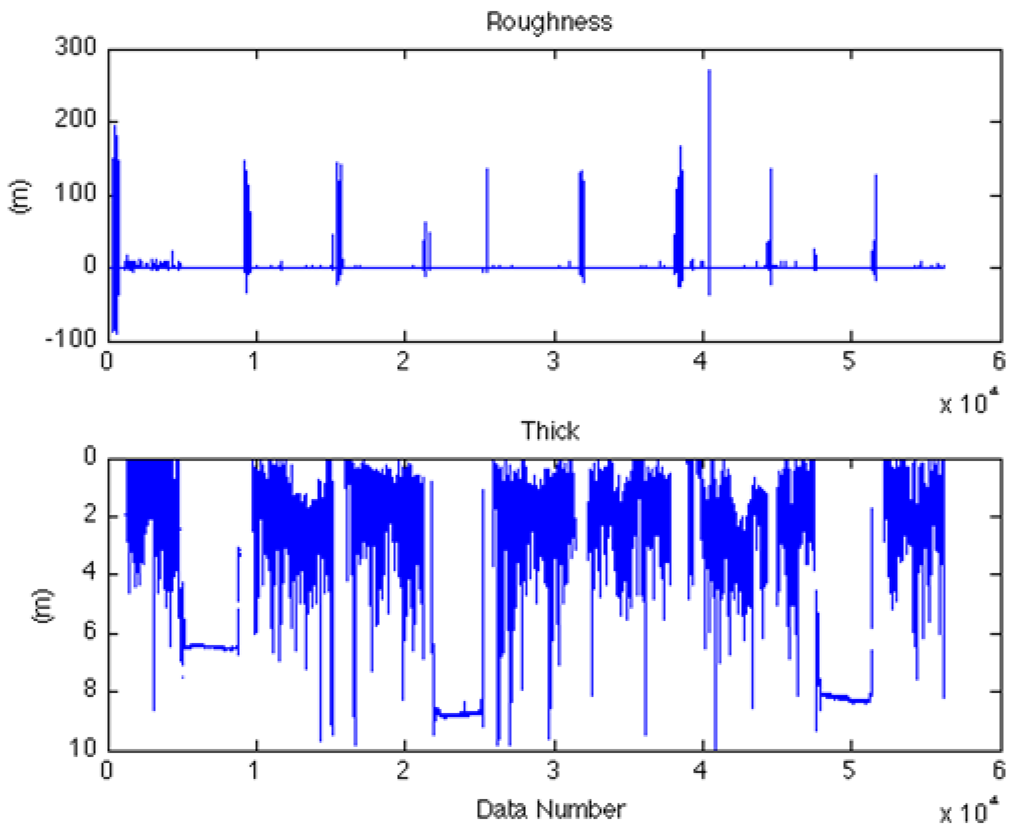



Figure 3.11. A sample of raw (not quality checked, completely unfiltered) HEMI data for surface roughness (top) and ice thickness (bottom).

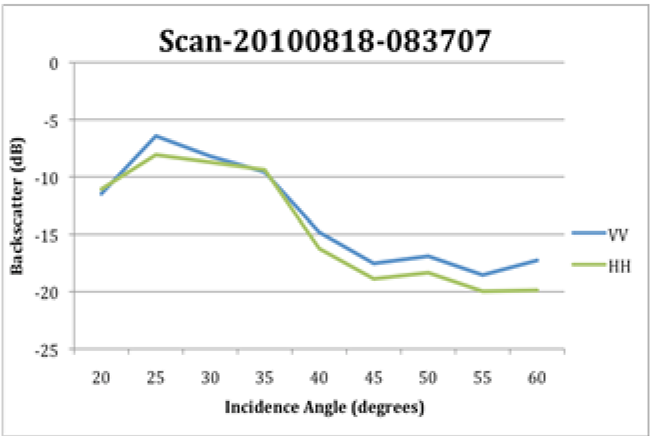



Figure 3.12. Ship-based EM measurements of VV and HH polarized scans of a late-summer multi-year floe recorded in the Beaufort Sea during Leg 2a. The scan parameters were: Azimuth: 0° to 60°, Elevation: 20° to 60°, and Step/Interval: 5°.

### *3.5.2 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

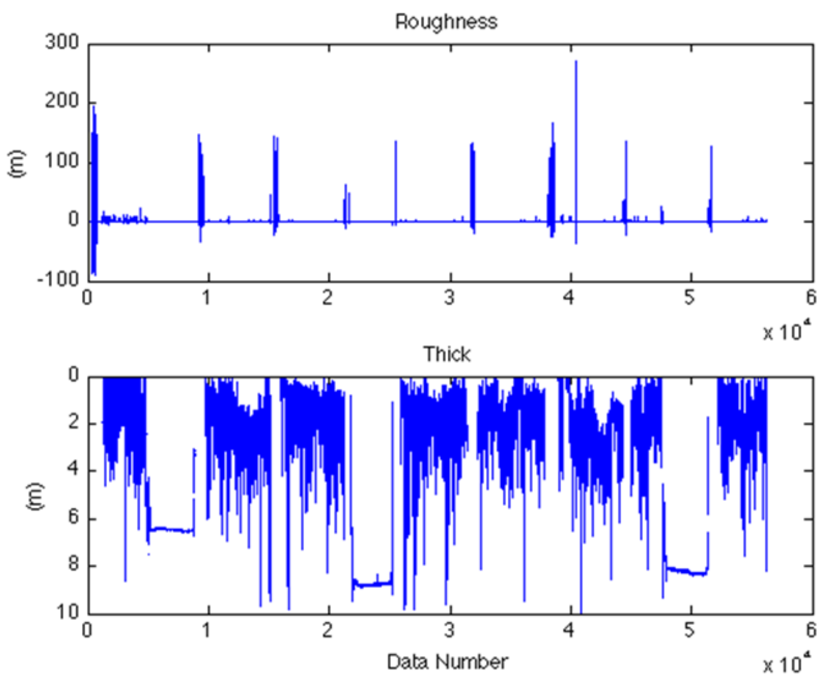



Figure 3.13. A sample of raw (Not quality checked, completely unfiltered) HEMI data for surface roughness (top) and ice thickness (bottom) conducted in the Beaufort Sea during Leg 3a.

Figure 3.14 displays the results of a sampling station on 29 September 2010. The first graph (left) displays the temperature profile ranging from -2.3°C at the surface down to -0.96°C at the 55cm measurement. The second graph (center) displays the salinity profile for the same floe. The top 60cm of this floe had virtually no saline content due to the fact that this sampling station was on a piece of multi-year ice (MYI). The third graph (right) displays the backscattering signature from the C-Band scatterometer on the same sampling site.

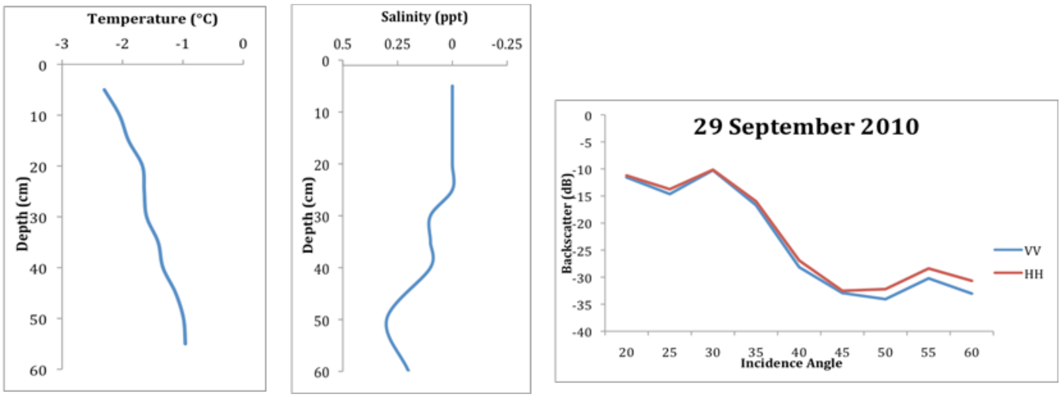



Figure 3.14. Temperature (left), salinity (center) profiles from the top 60cm of a MY ice floe sampled in the Beaufort Sea on 29 September during Leg 3a, along results from the C-band scatterometer from the same floe (right).

## 3.6 Comments and recommendations

Data collection proceeded as planned for the ocean and atmosphere portion of the work, and ended with Leg 3b on 22 October.

The sea ice in 2010 reached its 3rd lowest recorded extent since satellite based monitoring began in the 1970s. Figure 3.15 below displays Arctic Sea Ice Extent as of 20 September 2010 with the orange line representing the median sea ice extent for the 1979 – 2000 period.

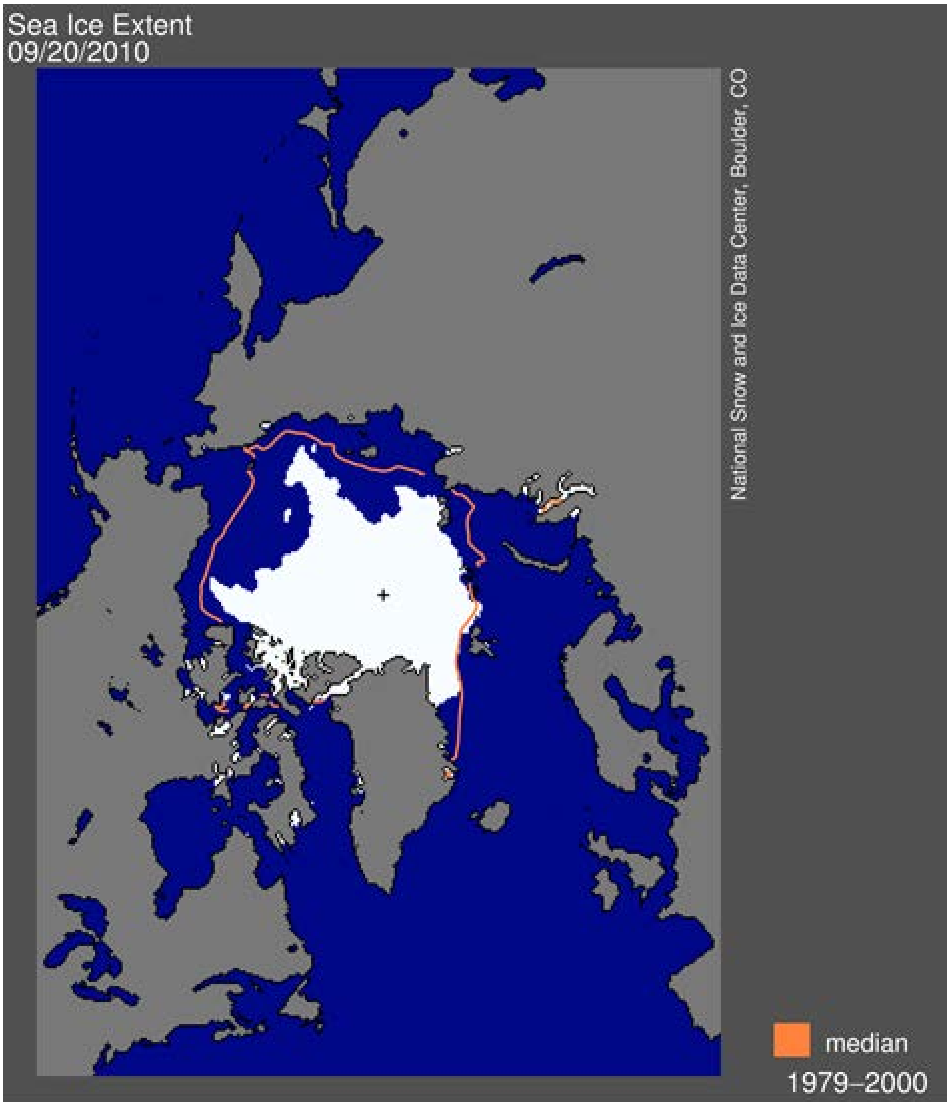



Figure 3.15. Sea ice extent on 20 September 2010 during Leg 2b (NSIDC website).

The 2010 sea ice extent was greater than only the record low year of 2007 and the subsequent year of 2008. This can be explained through the Dipole phenomena which occurred in 2010 creating a strong high pressure system over the Beaufort Sea, bringing with it warmer than normal air temperatures. On the Leg 3a, a visit to the ice pack to carry out a sampling regime will help to better understand the impacts of this near record year (see page 63,  Integrity of Beaufort Sea ice in the fall season – Leg 3a).

# 4 Integrity of Beaufort Sea ice in the fall season – Leg 3a

**Project leaders:** Exxon Mobil and BP

**Cruise participant Leg 3a**: Exxon Mobil

## 4.1 Introduction

This study is intended to evaluate the integrity of the sea ice, particularly old and multi-year, present in the Beaufort Sea during the fall season. The direct measure of ice integrity is obtained by localized breaking of ice floes by the Canadian Coast Guard icebreaker *Amundsen*. The direct measurements of integrity or strength will be used to verify and calibrate more indirect measurements of ice floe integrity or strength.

## 4.2 Methodology

The icebreaker *Amundsen* tested the integrity of select ice floes. Ice floes targeted were floes in which ice cores had been collected and/or helicopter based electromagnetic thickness measurements (HEMI) had been made. The integrity of the floes tested was evaluated using ship-based observations and through conversations with Captain, ice observer and ArcticNet scientists.

## 4.3 Preliminary results

Icebreaking tests were conducted on 27-19 September 2010 during three days of ArcticNet work in ice offshore Banks Island (Figure 4.1). A log of observations collected during the icebreaking was kept. In addition to these observations, approximately 3000 photos and 100 videos of the icebreaking activities were collected. Finally, the movement of the icebreaker was captured with the onboard AVOS system and through a personal GPS recorder. All of the collected data will later be synchronized and synthesized to study the integrity of the sea ice as indicated by the *Amundsen*'s ability to break ice features.

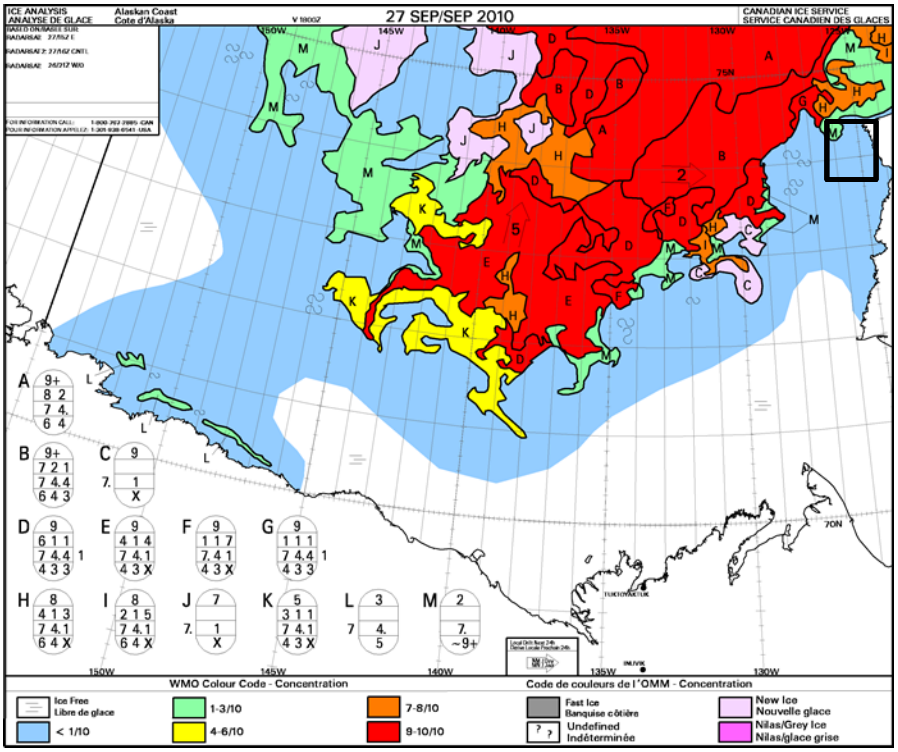



Figure 4.1. CIS daily ice chart showing ice conditions in the area where icebreaking tests were conducted on 27-29 September 2010 during Leg 3a.

## 4.4 Comments and recommendations

Better coordination of ice studies would be beneficial in future expeditions. In the most ideal scenario, ice cores and HEMI data would be collected on every floe tested by the icebreaker. In particular, better alignment between the ships pathway and the HEMI data is desired.

# 5 Mooring program – Legs 1a, 1b, 2a, 2b & 3a

ArcticNet Phase 2 – Project titled *Long-Term Observatories in Canadian Arctic Waters*.
http://www.arcticnet.ulaval.ca/pdf/phase2/gratton_marine_observatories.pdf

**Project leaders**: Yves Gratton[1] (yves_gratton@ete.inrs.ca), IMG-Golder Corporation and BP (Legs 2a, 2b and 3a)

**Operations participants Legs 1a & 1b**: Sylvain Gagnon[2], Steeve Gagné[2] and Vincent Dupuis[2]
**Operations participants Legs 2a & 2b**: Luc Michaud[2], Pascal Massot[2], Jean Ouellette[2], Greg Curtiss[4], Jessica Cote[4] and Phil Osborne[4]
**Operations participants Legs 3a**: Pascal Massot[2], Jean Ouellette[2], Steeve Gagné[2] and Vincent Dupuis[2]
**2010 ArcticNet Mooring Report author**: Shawn Meredyk[3]
*[1] Institut national de la recherche scientifique (INRS) – Eau, terre et environnement (ETE), 490, de la Couronne, Québec, QC, G1K 9A9, Canada.*
*[2] Université Laval, Québec-Océan, Pavillon Alexandre-Vachon local 2078, 1045 avenue de la Médecine, Québec, QC, G1V 0A6, Canada.*
*[3] ArcticNet, Pavillon Alexandre-Vachon local 4081, 1045 avenue de la Médecine, Université Laval, Québec, QC, Canada, G1V 0A6, Canada.*
*[4] IMG-Golder Corporation (Golder Associates Inc.), suite 200, 18300 NE Union Hill Road, Redmond, WA 98052, USA.*

## 5.1 Introduction

ArcticNet's 2010 mooring operations were carried out from onboard the CCGS *Amundsen* between 02 July and 07 October during Legs 1a,1b, 2a, 2b and 3a. The Mooring operations constituted a collaboration between several parties. In 2010, the petroleum companies Imperial Oil Limited (IOL / ESSO) and British Petroleum (BP) contracted IMG-Golder to design and help (ArcticNet Mooring personal were part of the mooring operations) re-deploy two mooring arrays (nine moorings) in their three respective Exploration Lease Blocks: EL 446 (IOL), EL 449 (BP) and EL 451 (BP).

The primary ArcticNet objectives of the CCGS *Amundsen* mooring operations in 2010 were to:

- Recover the four 2009 ArcticNet moorings (CA05-, CA05-MMP, CA16-, CA16-MMP) that were deployed in the Beaufort Sea.
- Re-deploy these four moorings with the addition of two more moorings (CA04- and CA08-).
- Recover (and re-deploy) the four 2009 Hudson Bay moorings (AN01-, AN02-, AN03-, AN04- / MH01-) with the addition of two more shallow water moorings at site AN04- (A, B)
- Deploy moorings in Lancaster Sound and in Viscount Melville Sound.

### 5.1.1 Overview of 2010 mooring operations

In 2010, ArcticNet mooring operations took place in the Beaufort Sea, in Hudson Bay as well as in the Canadian Arctic Archipelago in Lancaster Sound and Viscount Melville Sound (Figure 5.1). A summary of all ArcticNet mooring operations performed in 2010, including the recovery results for the 2010 deployments, are presented in Table 5.1.

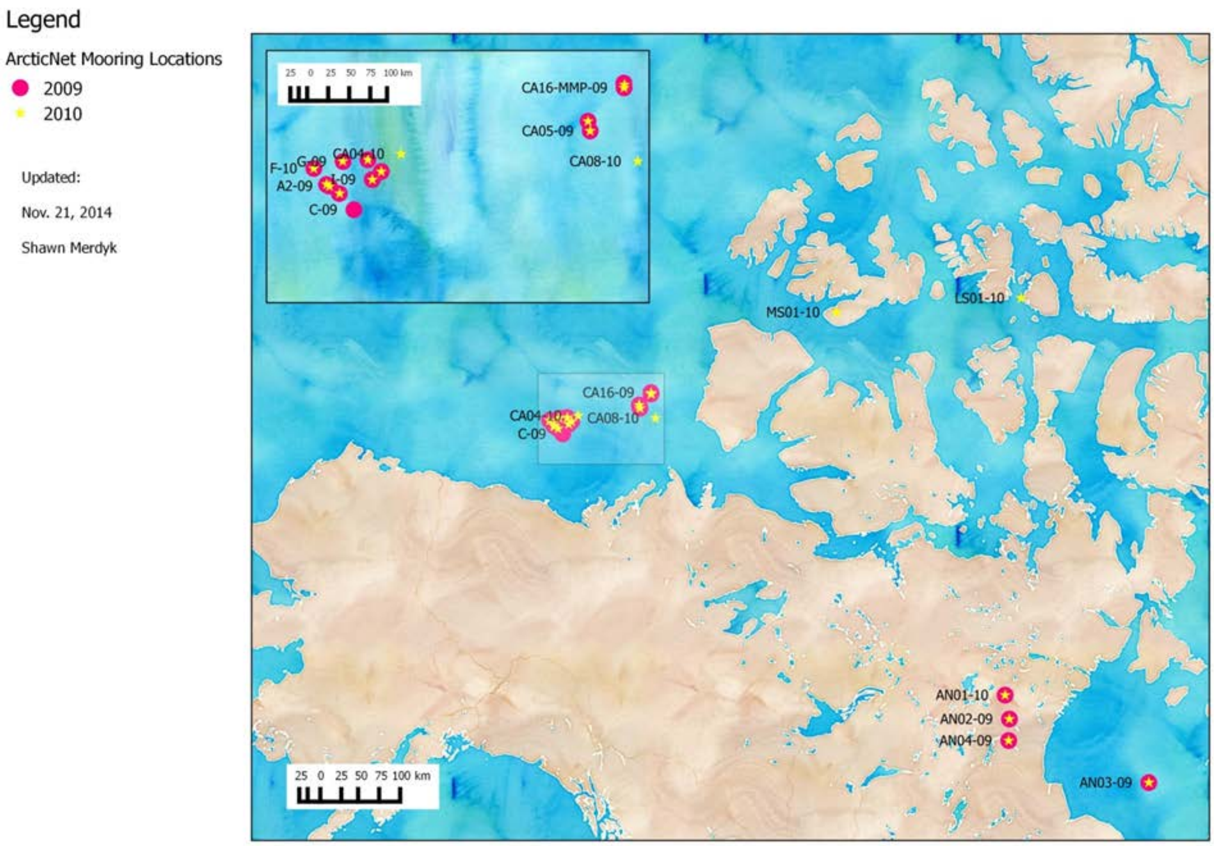



Figure 5.1. Overview of ArcticNet mooring operations conducted in 2010 in Hudson Bay, Beaufort Sea (top left inset map for the Beaufort Sea moorings locations), Lancaster Sound and Viscount Melville Sound.

Table 5.1. Summary of mooring operations conducted onboard the *Amundsen* in 2010 in Hudson Bay, the Beaufort Sea, Lancaster Sound and Viscount Melville Sound, including recovery of 2009 moorings (-09), deployment of 2010 moorings and recovery results in 2011 (-10).

| Mooring ID | Program | Area | Rationale | Deploy | Recover | Latitude N | Longitude W | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| A1-09 | ArcticNet-Industry collaboration | Shelf slope Ajurak lease block | ArcticNet-Industry Mooring | 2009 | 2010 | 70°45.684 | 136°00.384 | 688 |
| A2-09 | ArcticNet-Industry collaboration | Shelf slope Ajurak lease block | ArcticNet-Industry Mooring | 2009 | 2010 | 70°44.784 | 135°55.212 | 615 |
| AN01-09 | ArcticNet | Hudson Bay West, north of Nelson River | See AN01-10 for explanation | 2009 | 2010 | 59°58.164 | 091°57.054 | 104 |
| AN02-09 | ArcticNet | Hudson Bay West, | See AN01-10 for explanation | 2009 | LOST | 58°46.686 | 091°32.094 | 76 |

| Mooring ID | Program | Area | Rationale | Deploy | Recover | Latitude N | Longitude W | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| | | north of Nelson River, closer than AN01 | | | | | | |
| AN03-09 | ArcticNet | Hudson Bay East, near Great Whale River | See AN01-10 for explanation | 2009 | LOST | 55°24.534 | 077°55.860 | 136 |
| AN04-09 | ArcticNet-Manitoba Hydro | Hudson Bay West, Nelson River outer estuary | Manitoba Hydro partnership | 2009 | 2010 | 57°40.212 | 091°36.192 | 54 |
| B-09 | ArcticNet-Industry collaboration | Shelf break Ajurak lease block | ArcticNet-Industry Mooring | 2009 | 2010 | 70°39.990 | 135°35.862 | 154 |
| C-09 | ArcticNet-Industry collaboration | | ArcticNet-Industry Mooring | 2009 | 2009 | 70°29.724 | 135°08.028 | 61 |
| CA05-09 | ArcticNet | Amundsen Gulf mouth near Mackenzie Shelf | Productivity hotspot on the eastern slope of the shelf as estimated from benthic sampling. Monitor the intermittent upwelling of cold-saline water on the eastern shelf, despite the fact that the origin of the upwelling is closer to Cape Bathurst (CA06). Ocean circulation is highly variable, but the along-shelf flow of Pacific-derived water entering the Amundsen Gulf could be monitored at depth. A MMP is equipped on the mooring for this reason. | 2009 | 2010 (partly lost) | 71°19.050 | 127°35.514 | 204 |
| CA05-MMP-09 | ArcticNet | Amundsen Gulf mouth near Mackenzie Shelf | MMP dedicated line in association with CA05. Moving profiler to track fluorescence and ocean properties at the eastern shelf. Pacific-derived waters (Beaufort Undercurrent) entering the Amundsen Gulf can be monitored here. Circulation is highly variable on a monthly to seasonal scale. | 2009 | 2010 | 71°25.026 | 127°39.684 | 235 |
| CA16-09 | ArcticNet | Amundsen Gulf West (central) | Center of the Cape Bathurst polynya as defined in Barber and Hanesiak (2004). Long-term monitoring site of particle fluxes: seasonal signal and inter-annual variability of marine productivity in the Amundsen Gulf | 2009 | 2010 | 71°48.090 | 126°31.020 | 314 |
| CA16-MMP-09 | ArcticNet | Amundsen Gulf mouth near Sachs Harbour | Apparent productivity coldspot in contrast to CA05. Monitor the intrusion of water masses coming from the Canada Basin into the Amundsen Gulf, both at the surface and at depth. The circulation is dictated by the behavior of the Beaufort Gyre. Eddies were detected at this location during CFL 2008. | 2009 | 2010 | 71°45.270 | 126°30.564 | 353 |

| Mooring ID | Program | Area | Rationale | Deploy | Recover | Latitude N | Longitude W | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| F-09 | ArcticNet-Industry collaboration | Deep water Ajurak lease block | ArcticNet-Industry Mooring | 2009 | 2010 | 70°55.818 | 136°24.642 | 1010 |
| G-09 | ArcticNet-Industry collaboration | Deep water Pokak lease block | ArcticNet-Industry Mooring | 2009 | 2010 | 71°0.126 | 135°28.770 | 702 |
| H-09 | ArcticNet-Industry collaboration | Shelf slope Pokak lease block | ArcticNet-Industry Mooring | 2009 | 2010 | 71°1.248 | 134°41.226 | 367 |
| I-09 | ArcticNet-Industry collaboration | Shelf BP lease block | ArcticNet-Industry Mooring | 2009 | 2010 | 70°48.870 | 134°32.724 | 75 |
| J-09 | ArcticNet-Industry collaboration | Shelf BP lease block | ArcticNet-Industry Mooring | 2009 | 2010 | 70°53.880 | 134°15.612 | 83 |
| A1-10 | ArcticNet-Industry collaboration | Shelf slope Ajurak lease block | ArcticNet-Industry Mooring | 2010 | 2011 | 70°45.918 | 136°00.300 | 684 |
| A2-10 | ArcticNet-Industry collaboration | Shelf slope Ajurak lease block | ArcticNet-Industry Mooring | 2010 | 2011 | 70°44.634 | 135°54.876 | 608 |
| AN01-10 | ArcticNet | Hudson Bay West, north of Nelson River | Same as AN01-09 | 2010 | 2011 | 59°58.170 | 091°56.988 | 105 |
| AN02-10 | ArcticNet | Hudson Bay West, north of Nelson River but closer to Nelson River than AN04 | Same as AN02-09 | 2010 | LOST | 58°46.686 | 091°32.094 | 75 |
| AN03-10 | ArcticNet | Hudson Bay East, near Great Whale River | Same as AN03-09 | 2010 | 2011 | 55°24.822 | 077°55.122 | 139 |
| AN04-10 | ArcticNet-Manitoba Hydro | Hudson Bay West, Nelson River outer estuary | Manitoba Hydro partnership | 2010 | LOST | 57°40.206 | 091°36.180 | 60 |
| B-10 | ArcticNet-Industry collaboration | Shelf break Ajurak lease block | ArcticNet-Industry Mooring | 2010 | 2011 | 70°40.098 | 135°35.160 | 149 |
| CA04-10 | ArcticNet | Kugmallit Valley (upper Mackenzie Shelf slope) | Historical cross-shelf transect during CASES to study Shelf-Basin interactions (with CA07 and CA12). | 2010 | LOST | 71°4.884 | 133°37.734 | 305 |
| CA05-10 | ArcticNet | Amundsen Gulf mouth near Mackenzie Shelf | Productivity hotspot on the eastern slope of the shelf as estimated from benthic sampling. Monitor the intermittent upwelling of cold-saline water on the eastern shelf, despite the fact that the origin of the upwelling is closer to Cape Bathurst (CA06). Ocean circulation is highly variable, but the along-shelf flow of Pacific-derived water entering the Amundsen Gulf could be monitored at depth. MMP is equipped on the mooring for this reason. | 2010 | LOST | 71°19.062 | 127°35.628 | 205 |
| CA05-MMP-10 | ArcticNet | Amundsen Gulf mouth near Mackenzie Shelf | MMP dedicated line in association with CA05. Moving profiler to track fluorescence | 2010 | LOST | 71°25.002 | 127°39.666 | 235 |

| Mooring ID | Program | Area | Rationale | Deploy | Recover | Latitude N | Longitude W | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| | | | and ocean properties at the eastern shelf. Pacific-derived waters (Beaufort Undercurrent) entering the Amundsen Gulf can be monitored here. Circulation is highly variable on a monthly to seasonal scale. | | | | | |
| CA08-10 | ArcticNet | Amundsen Gulf West (central) | Center of the Cape Bathurst polynya as defined in Barber and Hanesiak (2004). Long-term monitoring site of particle fluxes: seasonal signal and inter-annual variability of marine productivity in the Amundsen Gulf | 2010 | LOST | 71°0.276 | 126°4.278 | 395 |
| CA16-10 | ArcticNet | Amundsen Gulf mouth near Sachs Harbour | Apparent productivity coldspot in contrast to CA05. Monitor the intrusion of water masses coming from the Canada Basin into the Amundsen Gulf, at the surface and at depth. Circulation dictated by the behavior of the Beaufort Gyre. Eddies were detected at this location during CFL 2008. | 2010 | LOST | 71°47.178 | 126°29.760 | 315 |
| CA16-MMP-10 | ArcticNet | Amundsen Gulf mouth near Sachs Harbour | MMP-dedicated line in association with CA16. Moving profiler to track fluorescence and ocean properties at the Gulf mouth. Waters from the Canada Basin entering the Amundsen Gulf can be monitored here. Circulation depends on the strength of the Beaufort Gyre. | 2010 | LOST | 71°45.270 | 126°30.540 | 353 |
| F-10 | ArcticNet-Industry collaboration | Deep water Ajurak lease block | ArcticNet-Industry Mooring | 2010 | 2011 | 70°55.848 | 136°24.858 | 1003 |
| G-10 | ArcticNet-Industry collaboration | Deep water Pokak lease block | ArcticNet-Industry Mooring | 2010 | 2011 | 71°0.378 | 135°29.322 | 706 |
| H-10 | ArcticNet-Industry collaboration | Shelf slope Pokak lease block | ArcticNet-Industry Mooring | 2010 | 2011 | 71°01.260 | 134°41.118 | 363 |
| I-10 | ArcticNet-Industry collaboration | Shelf BP lease block | ArcticNet-Industry Mooring | 2010 | 2011 | 70°48.786 | 134°32.610 | 73 |
| J-10 | ArcticNet-Industry collaboration | Shelf BP lease block | ArcticNet-Industry Mooring | 2010 | 2011 | 70°53.862 | 134°15.654 | 82 |
| LS01-10 | ArcticNet | Lancaster Sound near Barrow Strait | Location based on previous partnership with S. Prinsenberg (DFO) | 2010 | 2011 | 74°28.176 | 090°23.298 | 275 |
| MS01-10 | ArcticNet | Viscount Melville Sound (deepest point) | Marine productivity hotspot based on P. Richard's work on beluga whale migration. New exploratory mooring for 2010 (initially planned for 2009). Complementary mooring to | 2010 | 2011 (partly lost) | 74°05.760 | 108°24.792 | 500 |

| Mooring ID | Program | Area | Rationale | Deploy | Recover | Latitude N | Longitude W | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| | | | LS01 to study west-east gradient in productivity and ocean circulation in the Canadian Archipelago. | | | | | |

## 5.2 Methodology – Mooring design and instrumentation

### *5.2.1 Taut-line moorings*

ArcticNet moorings were generally designed to be of taut-line configuration (Figure 5.2). The first instrument deployed close to the surface was a conductivity-temperature probe. Different models from RBR, Sea-Bird, Alec or Nortek companies were used. Sediment traps were always attached 5 to 10 meters below a current meter. Acoustic Doppler Current Profilers (ADCPs) were deployed at 100 meters so they could provide current data from 100 meters and upwards and simpler Current Meters (CMs) were used at 200 m and 400 meters.

The McLane Moored Profiler (MMP) is a moving profiler that slides up and down along the mooring line recording temperature, salinity, pressure and fluorescence data (Figure 5.2). MMP moorings were paired with traditional moorings that contained a full suite of oceanographic equipment (sediment traps, current meters, CTDs) so that the CTD data on the MMP moorings could be verified with the adjoining mooring and increase the resolution of the water column data. Again in 2010, two MMP moorings were deployed in the Beaufort Sea next to moorings CA05 and CA16 and were named accordingly CA05-MMP and CA16-MMP.

The moorings generally consisted of the following oceanographic equipment.

- Top float with ice profiler (IPS).
- JFE-ALEC CT or SBE37 Conductivity, Temperature and Depth (CTD) probe to record water characteristics.
- Hydrophone (AURAL) – bioacoustics.
- RCM 11/ RBR with Aquadopp or AquaPro Conductivity, Temperature and Depth (CTD) probe with single-point current meter.
- ISUS V3 Nitrate sensor.
- Technicap sediment traps (24cups – bi-weekly sampling rate) to trap descending sediment for particle flux analysis and accumulation rates.
- RDI or Nortek Continental current profilers.
- 30” ORE float and/or 17” BENTHOS floats in-line floatation to balance the weight/ float balance throughout the mooring line.
- Technicap sediment traps (24 cups – bi-weekly sampling rate) to trap descending sediment for particle flux analysis and accumulation rates (deeper water moorings).
- RCM 11 / Aquadopp or AquaPro with RBR Conductivity, Temperature and Depth (CTD) probe with single-point current meter.

- 17” BENTHOS floats in-line floatation to balance the weight/ float balance throughout the mooring line.
- Tandem mooring releases (Oceano 861AR and BENTHOS 865A).
- An anchor (one to four train wheels).

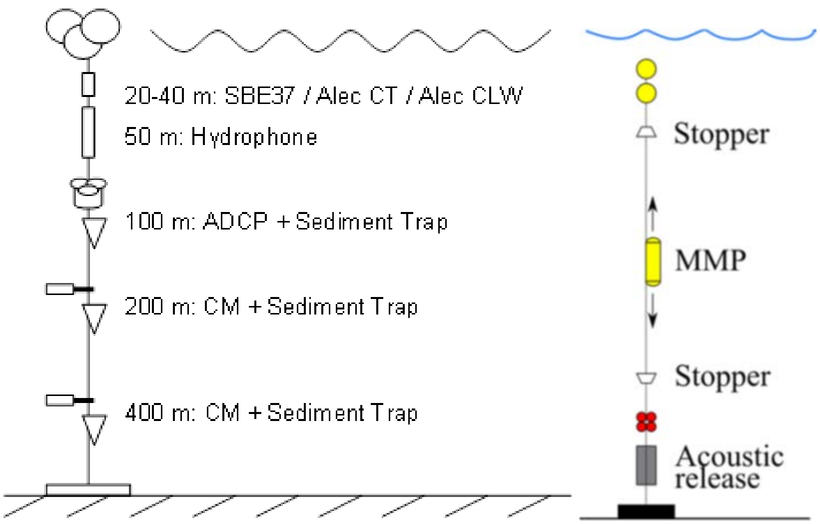



Figure 5.2. Illustration of general ArcticNet mooring designs. Left: Taut-line configuration and Right: MMP mooring setup.

### *5.2.2 Benthic frame mooring*

The only mooring not of a taut-line configuration was industry mooring C-09 deployed in 2009 in IOL’s Ajurak exploration lease (Figure 5.3). This mooring was recovered in 2010 but not re-deployed. Mooring C-09 was a bottom frame mooring meant for deployments in shallow shelf waters. At the shallowest site (C) at the south-eastern corner of IOL’s Ajurak lease area, an Acoustic Doppler Current Profiler (ADCP) was deployed to measure current profiles as well as directional wave data. In order to measure wave height, period and direction accurately, the ADCP must be stable and a benthic frame was used instead of a taut-line mooring.

There is no documentation in the ArcticNet archives identifying the exact programmed settings of the ArcticNet and Golder/IOL-BP lease block moorings deployed in 2010.

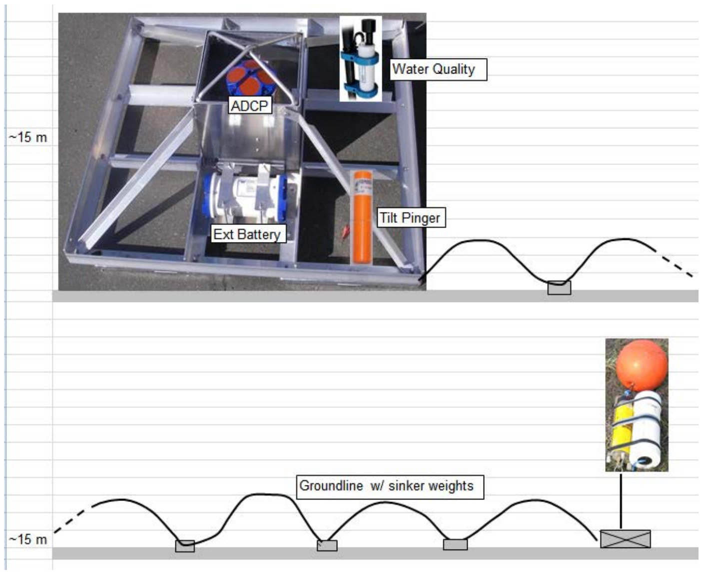



Figure 5.3. Benthic frame design of mooring C-09 deployed in the IOL Ajurak lease block in the Beaufort Sea in 2009 and recovered in 2010 (not redeployed in 2010).

Current profile data were recorded in XYZ coordinates, while wave data were recorded in beam coordinates. Even after the compass calibration, errors may occur in the ADCP heading due to fluctuations in the earth's magnetic field caused by the reduced horizontal component this close to the magnetic pole. ADCP heading data are recorded, and since the frame does not move, an average heading can be determined and applied during data processing.

Along with the current/wave measurements, water parameters were obtained using an RBRXR420 CTD (plus Dissolved Oxygen), and an Alec CLW (Fluorescence plus Chlorophyll).

An acoustic tilt-pinger was used to monitor the verticality of the frame and thus ensure that the bottom frame was deployed upright. The primary recovery mechanism is a released activated pop-up buoy, while the groundline can be dragged up if necessary. The groundline was 1" buoyant polysteel rope with small weights every 10-20 m.

## 5.3 Methodology – Mooring equipment calibration

Compass accuracy is essential for current meters deployed near or above the Arctic Circle, due to the reduced magnitude of the horizontal component of the earth's magnetic field. Therefore, it was important to calibrate internal compasses near the approximate latitude where they were deployed and care was taken to eliminate all ferrous material in the mooring cages and in the calibration environment. Golder performed the compass calibrations for the Beaufort Sea moorings, including some of the ArcticNet mooring ADCPs. Compass calibration coefficients in the Beaufort Sea were not kept for 2010, which reduces the accuracy of post-processed ADCP data.

The ADCP compasses should be re-calibrated whenever the batteries are replaced. The calibrations need to be done away (minimum 20 m) from any magnetic influences and therefore, cannot be done on the ship. In advance, the plan was to physically separate the ADCP compasses (in the transducer heads), from their battery packs, by using external battery canisters. By mounting the ADCP and external battery 20-30 cm apart in their respective cages, the effect of the batteries on the compasses was reduced (potentially removed, though RDI recommends 1m distance (conservative)). Also the fact that the batteries are in-line below the compass and not off to one side reduces their effect on the compass. With this configuration it should be possible to replace the batteries without having to re-calibrate the compasses. However, Meredyk (2014) points out the great benefit from a data quality stand-point in pre-calibrations (compass calibration coefficients) and in calibrating the instruments in their deployment cage-floats. This hasn't been done as of 2014 due to logistical constraints.

All mooring instruments deployed in 2010 were calibrated by their respective manufacturers prior to the expedition, except the current meters' compasses (RDI, Nortek and Anderaa) which were calibrated on land near their respective deployment areas (Figure 5.4).


Figure 5.4. ArcticNet and BREA mooring equipment compass calibration sites for 2010 operations in Hudson Bay (3x), Lancaster Sound and the Beaufort Sea (Inuvik, NT and Sachs Harbour, NT)

The ArcticNet mooring equipment was calibrated in three Hudson Bay locations:

- 12 July 2010 – Belanger Island: 56°09.295’ N, 76°38.494’ W, Magnetic declination 17º
- 18 July 2010 – Marble Island: 62°39.269’ N, 90°58.263’ W, Magnetic declination 10º
- 20 July 2010 – Churchill River, MB: 58°40.595’ N, 94°10.107’ W, Magnetic declination 2º

Two Beaufort Sea locations:

- Inuvik, NWT Airport: 68°18.475’ N, 133°29.201’ W, Magnetic declination ~23 º (TBC from NRCan website)
- Sachs Harbour: 71º55.572’ N, 125º05.105’ W, Magnetic declination ~28º (TBC from NRCan website)

One Lancaster Sound location:

- 06 August 2010 – Devon Island : 74°34.3367’ N, 80°43.7241’ W, Magnetic declination 2º

In Viscount Melville Sound, instrument calibration was unsuccessful due to weather and ferrous soil (erratic readings).

### 5.3.1 Compass calibration procedure (ArcticNet)

The calibration site was selected in a location that was flat and without trees, without rock out-crops and with a view of the *Amundsen* in-case the helicopter needed to return to the boat and for the bridge to keep watch over the field crew (Figure 5.5).

Figure 5.5. Two sites of compass calibration conducted in Hudson Bay during Leg 1. Left: near Punngaviapik, QC (SE Hudson Bay), 12 July 2010 18:38 UTC, 56°09.2946' N, 76°38.4941' W, mag. decl. 17°. Right: Marble Island (NW Hudson Bay), 18 July 2010, 62°39.2688' N, 90°58.2629' W, mag. decl. 10°.

Using a handheld GPS (Garmin Map 72H) true north was found and the latitude and longitude were recorded. A landmark was placed >30 m along the same longitude. The calibration table 0° markings (along with device 0 degree marking) were aligned to True North and using the analog compass, the magnetic declination (actual) was recorded and compared to the theoretical value (helicopter flight tables and/or NRCan website) (Figure 5.6).


Figure 5.6. Analog compass used for magnetic declination verification during the compass calibrations in the field.

The ADCP calibrations were conducted with a custom tilt and rotate jig using a tripod with a spinning top fixture, where the ADCP was installed and aligned to true north, before calibration began (Figure 5.7).

Figure 5.7. Aquadopp instrument head with indicating mark for instrument's zero heading, Lancaster Sound, Devon Island.

The calibration procedures followed standard manufacturer protocols for each instrument and is briefly described below. At the calibration site, the ADCP was set on the tripod. The heads (beams) on the RDI ADCP are numbered 1=East, 2=West, 3=North, 4=South. Each ADCP was aligned on the tripod so the notch at beam-3 (north) points at the landmark located by GPS to be true-north from the tripod (Figure 5.8). The communication cable hangs down from the bottom connector on the side opposite that.

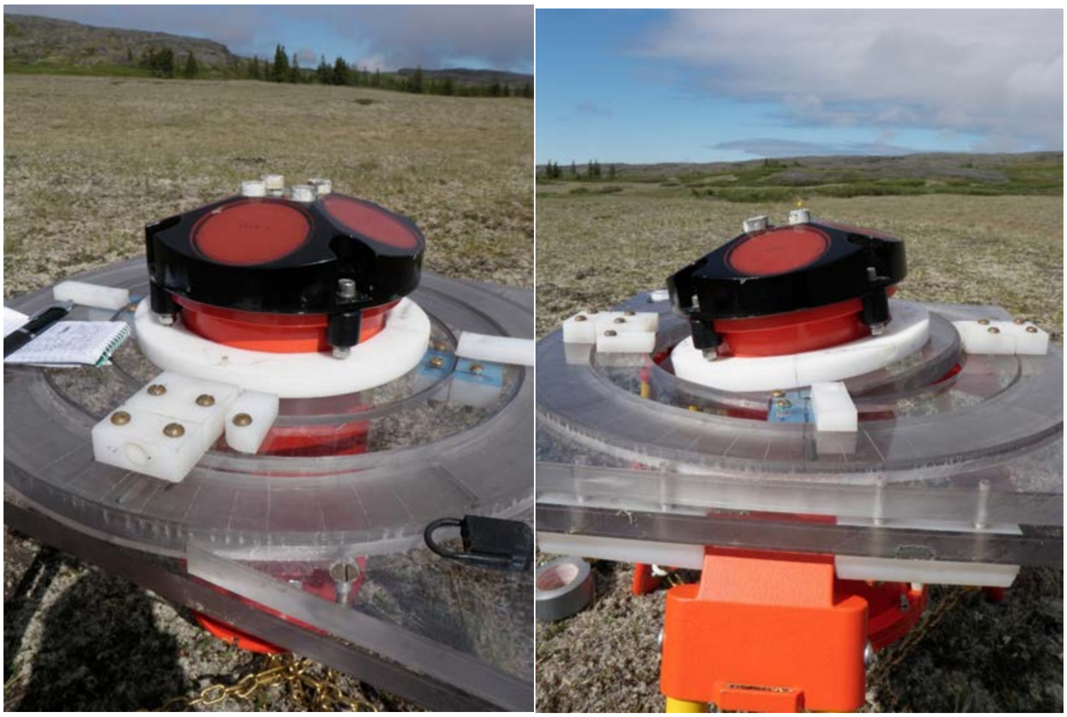


Figure 5.8. WHS ADCP in older model ArcticNet calibration table.

The RDI utility program “BBtalk” is run on the laptop-PC connected to a diesel generator:

1. ‘Enter’ was pressed to wake up the instrument.
2. Command ‘AX’ was entered to check the internal compass table with the instrument vertical, then the instrument was tilted 10º to 20º from the vertical axis.
3. Command ‘AF’ was entered, then the unit was rotated around the vertical axis while tilted (<5° / sec.).
4. ‘F3’ was pressed on the PC to record entries to a file named ‘WHS_####-cal_yyyy.txt’ where #### was the unit’s serial number and yyyy was the year.
5. The rotation was repeated with different tilt angle as prompted by the program (<5° / sec.).
6. The turntable was rotated back to 0º (notch points to true north) and ‘PC2’ entered to display the data stream to screen. When the displayed heading value was stable (after about 5-10 seconds), the heading was recorded with respect to its True North Heading, ‘Enter’ was pressed and the unit rotated 10º to the next mark on the turntable. ‘PC2’ was entered, and when heading was stable, ‘Enter’ was pressed again. This sequence

was repeated at successive marks around the turntable until the last measurement at 360º which is back at 0º (=360º).
7. ‘F3’ was pressed to stop logging to the file and the heading data was filled into a plotting program (EXCEL) and the slope (6 orders) coefficients were calculated. These coefficients will be used in post processing to further improve on the accuracy of the measured current directions.

No detailed procedure was available concerning the ArcticNet Beaufort Sea compass calibrations from Sachs Harbour, NT or Kugluktuk, NT, although it likely followed the ArcticNet compass procedure used in Hudson Bay and detailed above.

No calibration procedure or results exist for the mooring equipment deployed in Leg 2, calibrated in Kugluktuk, NT or Sachs Harbour, NT.

Compass calibration results (ArcticNet)

Readings were taken at 60° heading intervals. Seaguard #292 and WHS#8682 experienced erratic readings during calibration, which prevented an accurate compass calibration for either instrument. Therefore, these equipments will need to be post-calibrated after recovery (potentially 2011) (Table 5.2).

Ideally, the RDI ADCP units need to have a compass calibration performed (hard and soft iron) before deployment, this way the calibration coefficients can be stored in the unit’s memory matrices and the adjusted (real) heading can be calculated. Unfortunately, this could not be completed for the WHS #8682 device and this unit’s data would have been potentially recorded using the 2007 NABOS calibration coefficients recorded in Kirkeness, Norway in 2007. It is unknown if subsequent compass calibrations were performed at Université Laval during maintenance periods in 2008 and 2009. Caution and critical analysis of this instrument’s data would be needed before accepting / using its data (Meredyk 2014).

All of the instruments needed for the Beaufort Sea mooring sites were calibrated relatively close to the respective deployment sites (Figure 5.4) and were reported as having been properly calibrated, though not always completely calibrated due to erratic readings (ferrous terrain) (Boivert et al. 2010).

Table 5.2. ArcticNet mooring equipment compass calibrations conducted during Leg 1 in Hudson Bay (HB) and Lancaster Sound (LS).

| Instrument | SN | Region | Pre-Calibration site | Pre-calibration date | pre-calibration status |
|---|---|---|---|---|---|
| RCM11 | 266 | HB | Near Punngaviapik, QC | Jul-10 | Good |
| WHS | 3045 | HB | Near Punngaviapik, QC | Jul-10 | Good |
| RCM-Seaguard | 292 | HB | Marble Island | Jul-10 | Needs Post-calib |
| WHS | 8682 | HB | Marble Island | Jul-10 | Needs Post-calib |
| RCM-Seaguard | 30 | HB | Churchill River | Jul-10 | unknown |
| WHS | 5560 | HB | Churchill River | Jul-10 | Good |
| AQD | 3914 | LS | Devon Island | Aug-10 | Needs Post-calib |
| AQD | 3921 | LS | Devon Island | Aug-10 | Needs Post-calib |

### 5.3.2 Compass calibration procedure (Golder)

The Golder compass calibration procedure was used for Legs 2a and 2b and is briefly described here.

All of the current meter compasses (Aquadopp, Continental (CNL) , WorkHorse – Sentinel (WHS) ) needed for the Golder/IOL-BP moorings (along with several ADCPs for ArcticNet moorings as well) were all calibrated by Golder in Inuvik, NWT (July 2010) (Figure 5.9) and then transferred to Sachs Harbour, by the Golder technical staff (contracted-out by Imperial Oil Limited (IOL / ESSO)).

The calibration procedure follows a very similar process to the ArcticNet ADCP compass calibration procedure described below. The difference between ArcticNet and Golder methods (both are effective) resided in the finding of the true north. Golder technical staff used a Furuno SC-30 satellite compass to determine true north heading (based on two internal antennas) whereas ArcticNet mooring professionals used a handheld GPS and the landmark method.

Communication was established with the instrument using the manufacturer's calibration software after a serial communications line was connected to the instrument. Power was provided to the instrument by the instrument's internal battery pack or an external AC power supply.

Figure 5.9. Mooring instrument compass calibration performed in Inuvik, NWT using a jig with a RDI WHS (left) and a RDI DVS750 (right) (Golder Cruise Report Leg 2, 2010).

For Leg 2a, the current meters were oriented in the configuration in which they would be deployed. On-screen directions were followed to rotate the instrument through 360° with varying degrees of pitch and roll, until calibration was achieved.

For Leg 2b, the current meter was oriented in a downward-looking mode (i.e., the orientation in which it will be deployed) and rotated through 360° in +/- 90° increments, with

+/- 45° increments of pitch and roll, until a minimum of 20 samples were obtained and a "pass" result was achieved for all calibration criteria. It normally takes more iteration to obtain a "pass" when a compass calibration is done by hand, compared to using the turntable, but the outcome is the same. An acceptable Arctic calibration (≤ 5° error) was produced for the Leg 2b instrument in question.

The following spare instruments (leased from ASL Environmental) were calibrated for Leg 2a (Inuvik, NWT):

- TRDI 75 kHz LR ADCP
- TRDI 150 kHz QM ADCP
- TRDI 300 kHz Work Horse ADCP
- TRDI DVS 750 current meter
- TRDI DVS 6000 current meter

In addition, the following ArcticNet instruments were calibrated for Leg 2a (Inuvik, NWT):

- Nortek Aquadopp profilers (owned by University of Manitoba)
- 4 Nortek Continental 470 kHz current meter
- 1 Nortek Continental 190 kHz current meter
- 7 Nortek Aquadopp profilers
- 1 Aanderaa RCM 11

Compass calibration results (Golder)

There was no record kept regarding the outcome of the calibration results for the Golder calibrated instruments (pre/post compass error, or raw data) for 2010. However, it was noted in the Golder 2010 Field Report that all the instruments were calibrated until they 'passed' the acceptable heading error.

DVS current meters

It is recommended that the compasses on the uncalibrated DVS current meters deployed at F-10 be checked in Inuvik in 2011 using a calibration stand and GPS compass. Although these instruments cannot be post-cruise calibrated, it might be possible to get a sense of the error range for each compass (compass calibration coefficients through compass verification).

### *5.3.3 CTD sensor calibration*

Beaufort Sea

Calibrations of the CTD sensors used in the Beaufort Sea (RCM 11; Seabird37; RBR XR420) in 2010, were done at their respective factories in 2009 and also by ASL onboard the *Amundsen* in 2009.

JFE-Alec sensors (CTW, CLW, EM) gave only raw data and needed to be converted using calibration coefficients (not internally stored). Calibration details (calibration range, calibration date, etc.) for 2009 as well as ASL calibration certificates, usually provided by the instruments' manufacturers, are unavailable. Although there is no reason to believe the deployed instruments have malfunctioned, without the verification certificates, all the JFE-ALEC data for 2009-2010 and 2010-2011 should be handled with care.

Hudson Bay

The CTD sensors on the Aanderaa RCM (Recording Current Meter) units used in Hudson Bay moorings were calibrated by the company in 2007 or by P. Massot (Université Laval) in 2009. The CTD sensor compass calibration procedure was documented by the 2010 Hudson Bay mooring team (S. Gagné and L. Michaud) and is outlined below:

- The RCM11 unit was opened to verify the internal zero heading indicator, to connect the battery pack and to turn the unit onto continuous sampling (1 sensor per second) for all 8 channels (sensors connected)

- Deck Unit Aanderaa A-3127 was connected to the port on top of the RCM11 and to the laptop-PC, and the Hyperterm terminal program was used to look at (and during actual compass calibrations, to capture to file) the ascii output from it.

- The water-current simulation Test Unit (Aanderaa A-3731) was placed over the Doppler current sensors (type DCS-3900) with transducer surfaces moistened for best acoustic contact (Figure 5.10). The RCM11 was rotated 90 degrees to verify that the acoustic sensors functioned properly and changed the simulated "direction" by about that amount (channel 3 is the compass sensor's heading data channel). The instrument was inclined to check the built-in tilt sensor functionality.

- By rotating the calibration table in 10° increments and recording the values on channel 3 (takes at least two readings before compass stabilizes), then converting the raw values (channel 3 value * 0.352) into actual headings and plotting the $6^{th}$ order slope of the fitted line, compass calibration coefficients and the compass error can be calculated / recorded for post-processing of the unit's data.


Figure 5.10. Left: Reading stabilizer for Aanderaa instruments. Right; RCM-Seaguard #30 with water current simulator affixed. Photos from ADCP compass calibration site in Churchill River (causeway), Hudson Bay, on 20 July 2010: 74° 34.3367' N, 80° 43.7241' W – Mag. Decl. 2°.

## 5.4 Methodology – Mooring operations

### *5.4.1 Hudson Bay (Leg 1a)*

In Hudson Bay during Leg 1a, the ArcticNet mooring team successfully retrieved two (AN01, AN04) of four moorings (four sites) deployed in 2009 (AN01, AN02, AN03, AN04; Figure 5.11). Moorings AN02-09 and AN03-09 were not recovered due to acoustic release problems. The releases on AN02-09 did respond after surface interrogation, and the release command was sent but no mooring instrument surfaced. The releases on AN03-09 did not respond to surface interrogation from several locations at various distances out to 10 nm from the recorded mooring position.

Four ArcticNet moorings (AN01, AN03 and AN04-10(a,b)) were successfully deployed during Leg 1a (Figure 5.11). Mooring AN02 was not re-deployed because it failed to be recovered two years in a row. It was speculated that the top float may be too shallow and the situation must be assessed carefully by a closer investigation into why the mooring recoveries haven't been successful.

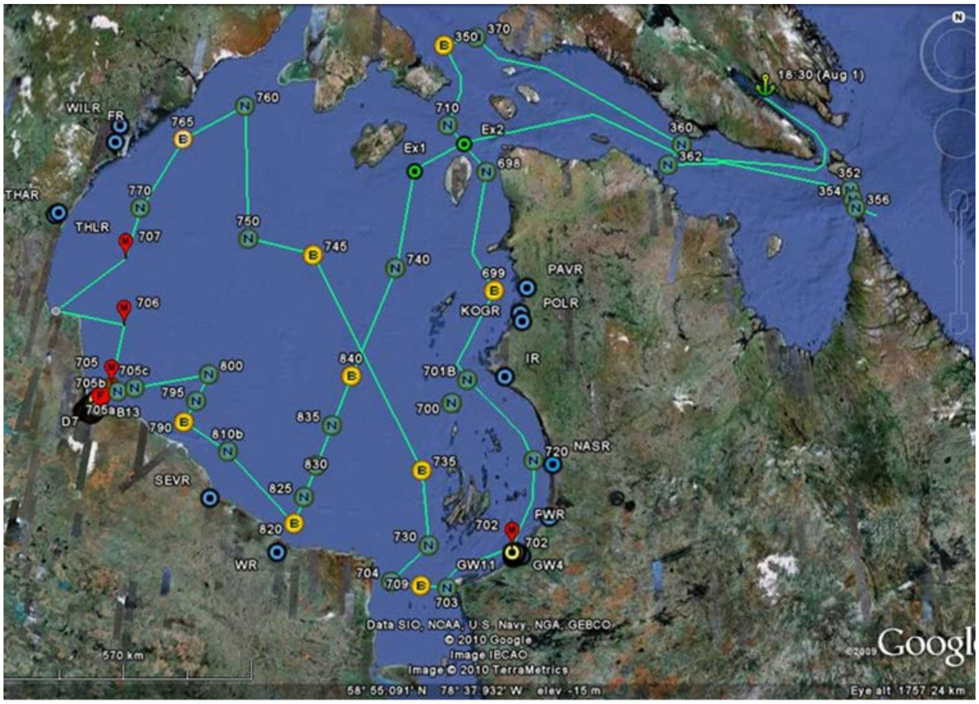



Figure 5.11. Cruise track of the Amundsen in Hudson Bay during Leg 1a with the locations of mooring sites: Station 707 = AN01, 706 = AN02, 702 = AN03, 705 = AN04.

Manitoba Hydro funded four days of ship time on Leg 1a to be devoted to an investigation of the dimensions and gradients of the plume of the Hayes and Nelson Rivers in Hudson Bay.

On 24 July 2010, the ArcticNet mooring team successfully recovered the Manitoba Hydro moorings (AN04-09) at Station 705 (Figure 5.12). These moorings were deployed in August 2009 with only an RDCP set at 5 m above bottom, roughly 50 m depth in the water column. Data recovered from AN04-09 encompassed 05 August 2009 to 07 June 2010. AN04-10 was redeployed as a pair of moorings (AN04a-10 and AN04b-10), on separate anchors, within 100 m of each other. Mooring AN04a-10 was identical to AN04-09 with an RDCP 5 m above bottom and AN04b-10 was deployed with CTs at 10 and 20 m above bottom and a CTD at 30 m above bottom, in 60 m of water.

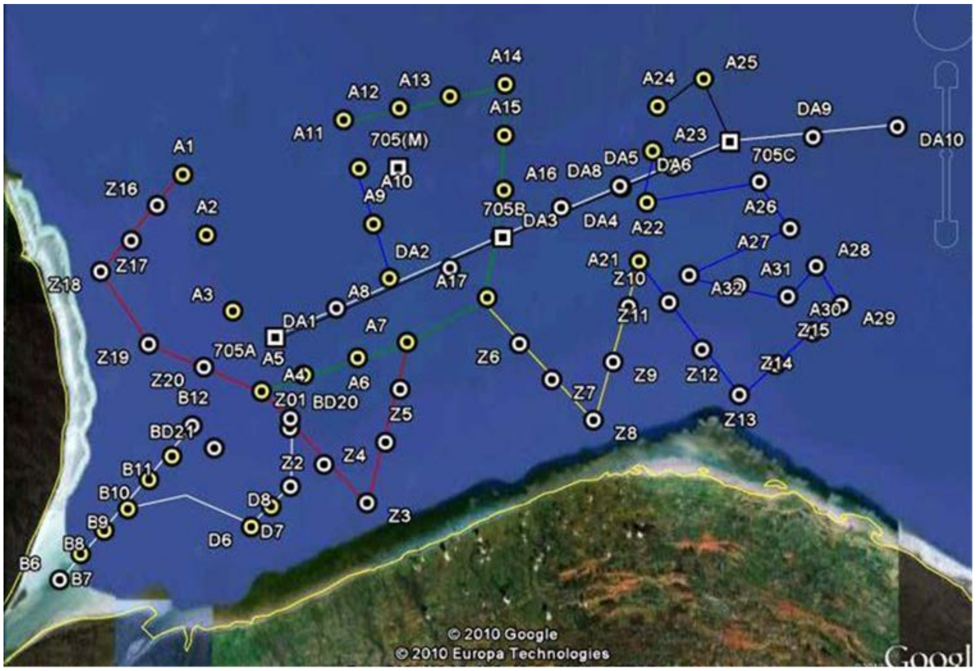



Figure 5.12. Sampling grid around Station 705 at Nelson River, MB, in Hudson Bay during Leg 1a. Mooring AN04 is labeled as 705(M).

### *5.4.2 Lancaster Sound (Leg 1b)*

On 06 August 2010 at 18:00 UTC, the *Amundsen*'s helicopter and mooring technicians went ashore to calibrate mooring LS01-10 ADCP compasses; however, the ferrous soils (contributing factor: erratic / weak horizontal component of the earth's magnetic field) prevented the instruments from being accurately calibrated. Even though the instruments could not be calibrated the decision was to deploy these instruments and post-calibrate after recovery. On 07 August, mooring LS01-10 was deployed (50 min total time, prep and deploy) in good weather (no wind, no sun) (Figure 5.13).

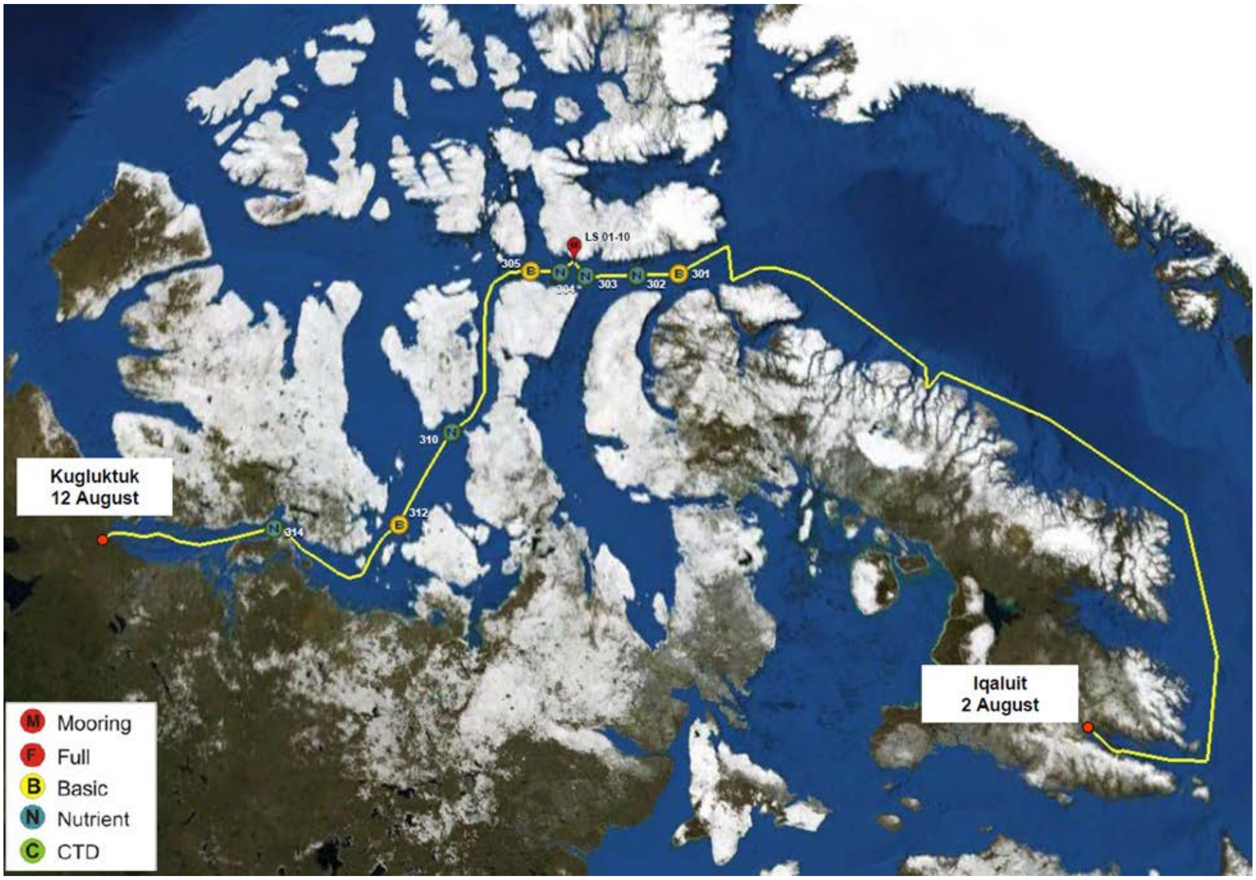



Figure 5.13. *Amundsen* ship track through the Canadian Arctic Archipelago during Leg 1b. The mooring in Lancaster Sound is labeled LS01-10.

### *5.4.3 Beaufort Sea – ASL-Golder / IOL-BP (Legs 2a & 2b)*

Health and safety

All personnel involved in recovery, servicing, and re-deployment of the moorings participated in development of a Job Safety Analysis (JSA) and development of Specific Work Instructions (SWI), which identified the sequence of basic job steps, personnel responsible for the job steps, potential hazards, and safety controls to eliminate hazards including PPE. Preparatory meetings were held in advance of mooring operations on Leg 2a and 2b to review the JSA and discuss any details pertinent to the operation. A toolbox/tailgate meeting led by the CCG was held on the foredeck prior to each deployment/recovery operation. A toolbox/tailgate meeting led by the Coast Guard (normally, by the Chief Officer), was held on the foredeck prior to each deployment/recovery operation. The SWI for Leg 2b also incorporated additional precautions for handling flooded instruments to avoid spills or leakage of potentially hazardous battery/seawater mixtures.

Instrument servicing and data recovery (Preliminary QA/QC)

Servicing and inspection of the instruments, data recovery and deployment setup involved the following steps:

- Cleaning instrument (rinse with fresh water and air dry) and inspecting for damage (check cable, transducers, and canister or housing for corrosion and leakage).
- Initiating communications with the instruments
- Checking the instrument clock to see if it had drifted during the deployment
- Checking recorder and file status
- Downloading the data from the instrument
- Copying the data to a backup portable drive
- Preliminary review of the data to check for any obvious errors (clock drift) , duration of data record (time series completeness), and general quality of the record (recorder and file status, time series plots)
- Opening the housing and inspecting the interior for corrosion and other damage
- Changing the batteries (if required) and replacing desiccant (if applicable)
- Cleaning the o-ring surfaces and re-greasing and replacing all o-rings
- Re-programming the instrument for re-deployment

Overview of operations

Legs 2a (12-26 August 2010) and 2b (26 August to 22 Sept ember 2010) were multi-faceted programs involving biology, ocean chemistry, marine mammal observations, meteorological, and other oceanographic investigations.

The primary ArcticNet mooring team objectives for Leg 2 was to help the Golder technical staff recover five and re-deploy four (C-09 was not to be re-deployed) oceanographic moorings in the Imperial Oil Limited (IOL) Ajurak lease area (EL 446; sites A1, A2, B, C, F), and four in the British Petroleum (BP) lease area (EL 449; sites G, H, I, J). All recovery and deployment operations were successful with a total of nine industry (ASL/IOL-BP) moorings recovered and eight moorings re-deployed using the same mooring design (Figure 5.14).

The sub-surface moored instrumentation were primarily intended to measure ice draft, water velocity profiles, and waves, but also water parameters such as temperature, salinity, dissolved oxygen, chlorophyll and turbidity. All moorings were taut-line except site C-09 which was a bottom frame (Figure 5.3).

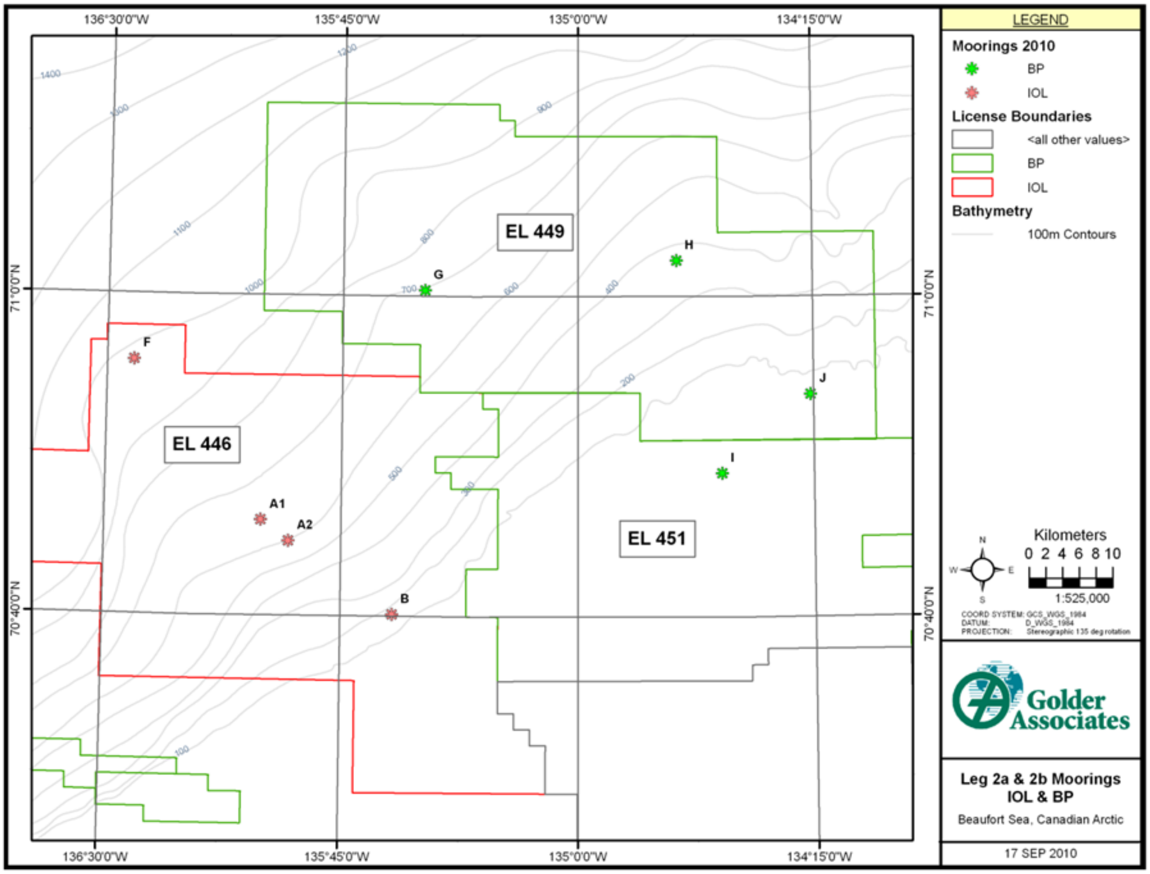



Figure 5.14. Locations of IOL-BP mooring sites with respect to Oil Company Exploration Licenses (EL) in the Beaufort Sea. Operations were carried out by Golder and ArcticNet during Legs 2a & 2b.

## Recovery operations

The IPS deployment depth was based on records obtained from the EM302 multi-beam system on-board the CCGS *Amundsen*. Summaries of the data records and clock drifts from each instrument on moorings recovered in Legs 2a & 2b are provided in Table 5.3. On recovery, instrument clocks were compared to a GPS receiver clock in order to determine if the instrument clock drifted ahead (fast) or behind (slow) GPS time.

Table 5.3. Summary of data record and clock drift for each moored instrument deployed on ASL/IOL-BP moorings in the Beaufort Sea in 2009 and recovered on Legs 2a and 2b in 2010.

| Mooring | Instrument | Start Time | End Time | Clock Drift |
|---|---|---|---|---|
| **Leg 2a** | | | | |
| G-09 | IPS5 #51102 | 22 July 2009 20:43 | 19 August 2010 13:50 | 00:09:55 slow |
| G-09 | 150 kHz QM ADCP #12825 | 23 July 2009 02:00 | 19 August 2010 03:46 | 00:04:32 slow |
| G-09 | 75 kHz LR ADCP #12884 | 23 July 2009 17:00 | 15 August 2010 08:46 | 00:03:35 slow |
| G-09 | DVS 750 #12756 | 22 July 2009 20:00 | 19 August 2010 13:30 | 01:06:15 slow |
| G-09 | RBR XR420 CT #15265 | 23 July 2009 17:00 | 19 August 2010 19:20 | 00:00:26 fast |
| G-09 | RBR XR420 CT #15268 | 23 July 2009 17:00 | 19 August 2010 19:40 | 00:00:56 fast |
| G-09 | RBR XR420 CT #15273 | 23 July 2009 17:00 | 19 August 2010 19:00 | 00:00:50 fast |

| Mooring | Instrument | Start Time | End Time | Clock Drift |
|---|---|---|---|---|
| G-09 | RBR XR420 CT #15277 | 23 July 2009 16:00 | 19 August 2010 21:10 | 00:00:17 fast |
| H-09 | IPS5 #51107 | 22 July 2009 14:50 | 16 August 2010 01:03 | 00:13:28 slow |
| H-09 | 150 kHz QM ADCP #12698 | 22 July 2009 18:00 | 22 August 2010 17:30 | 00:05:08 slow |
| H-09 | 75 kHz LR ADCP #12942 | 22 July 2009 20:00 | 22 August 2010 18:15 | 00:04:31 slow |
| H-09 | RBR XR420 CT #15271 | 22 July 2009 17:00 | 22 August 2010 18:30 | 00:00:18 fast |
| H-09 | RBR XR420 CT #15270 | 22 July 2009 17:00 | 22 August 2010 18:30 | 00:00:19 fast |
| H-09 | RBR XR420 CT #15281 | 22 July 2009 16:00 | 22 August 2010 18:40 | 00:00:34 fast |
| I-09 | IPS5 #51104 | 22 July 2009 18:54 | 24 August 2010 00:24 | 00:12:37 slow |
| I-09 | 300 kHz WHS ADCP #12813 | 22 July 2009 17:00 | 24 August 2010 01:45 | 00:01:26 slow |
| I-09 | Alec CLW #006 | 21 July 2009 21:00 | 23 May 2010 02:50 | 03:18:38 fast |
| I-09 | RBR XR420 CT #17114 | 21 July 2009 16:00 | 24 August 2010 15:00 | 00:00:28 fast |
| J-09 | IPS5 #51105 | 21 July 2009 03:34 | 15 August 2010 17:52 | 00:13:28 slow |
| J-09 | 150 kHz QM ADCP #12841 | 21 July 2009 17:00 | 15 August 2010 21:22 | 00:05:08 slow |
| J-09 | Alec CLW #007 | 21 July 2009 23:00 | 15 August 2010 22:00 | NA |
| J-09 | RBR XR420 CT #17113 | 21 July 2009 20:00 | 03 January 2010 12:00 | NA |
| **Leg 2b** | | | | |
| A1-09 | IPS5 #51106 | 02 October 2009 00:00 | 9 September 2010 23:00 | 00:45:00 slow |
| A1-09 | 150 kHz QM ADCP #12823 | 01 October 2009 23:00 | 9 September 2010 23:30 | 00:00:46 slow |
| A1-09 | 75 kHz LR ADCP #12943 | 01 October 2009 23:00 | 9 September 2010 23:30 | 00:01:37 fast |
| A1-09 | DVS 750 #12800 | 02 October 2009 01:00 | 10 September 2010 01:26 | 00:01:04 fast |
| A1-09 | RBR XR420 CT #15269 | 19 July 2009 17:00:00 | 31 August 2010 17:20 | 00:00:05 fast |
| A1-09 | RBR XR420 CT #15279 | 19 July 2009 17:00:00 | 31 August 2010 00:20 | 00:00:37 fast |
| A1-09 | RBR XR420 CT #15263 | 19 July 2009 17:00:00 | 31 August 2010 02:07 | 00:00:43 fast |
| A1-09 | RBR XR420 CT #15274 | 02 October 2009 01:20 | 10 September 2010 14:10 | 00:00:03 slow |
| A2-09 | IPS5 #51109 | 24 July 2009 17:00 | 11 September 2010 19:00 | 00:11:56 slow |
| A2-09 | 150 kHz QM ADCP #12699 | 25 July 2009 16:00 | 13 August 2010 22:52 | 00:00:02 slow |
| A2-09 | 75 kHz LR ADCP #12962 | 25 July 2009 16:00 | 05 June 2010 19:00 | 00:00:39 fast |
| A2-09 | DVS 750 #10717 | 25 July 2009 16:00 | 25 August 2010 22:45 | 01:19:12 slow |
| A2-09 | RBR XR420 CT #15266 | 25 July 2009 16:00 | 31 August 2010 03:51 | 00:01:10 fast |
| A2-09 | RBR XR420 CT #15258 | 23 July 2009 17:00 | 31 August 2010 12:55 | 00:00:48 fast |
| A2-09 | RBR XR420 CT #15262 | 23 July 2009 17:00 | 31 August 2010 21:39 | 00:00:20 fast |
| A2-09 | RBR XR420 CT #15278 | 23 July 2009 16:00 | 30 August 2010 21:07 | 00:00:09 fast |
| B-09 | IPS5 #51103 | 16 September 2009 22:10 | 3 September 2010 01:14 | 00:08:25fast |
| B-09 | 150 kHz QM ADCP #12585 | 16 September 2009 22:10 | 19 August 2010 12:18 | 00:02:20 slow |
| B-09 | RBR XR420 CT #15262 | 19 July 2009 04:00 | 19 July 2010 03:00 | 00:00:45 slow |
| B-09 | RBR XR420 CT #15278 | 19 July 2009 04:00 | 20 July 2010 12:00 | 00:00:09 fast |
| F-09 | IPS5 #51108 | 24 July 2009 17:00 | 5 September 2010 18:00 | 00:09:42 slow |
| F-09 | 150 kHz QM ADCP #12824 | 24 July 2009 22:10 | 30 August 2010 23:34 | 00:05:53 slow |
| F-09 | 75 kHz LR ADCP #12892 | 23 July 2009 17:00 | 3 September 2010 01:14 | NA |
| F-09 | DVS 750 #12800 | 24 July 2009 | Data not Recovered | NA |
| F-09 | DVS 750 #12800 | 24 July 2009 | Data not Recovered | NA |
| F-09 | DVS 6000 #12708 | 24 July 2009 20:00 | 24 February 2010 22:40 | 01:10:12 slow |
| F-09 | DVS 6000 #12638 | 24 July 2009 20:05 | 18 June 2010 03:45 | 01:03:03 slow |
| F-09 | DVS 6000 #12641 | 24 July 2009 20:00 | 16 April 2010 16:45 | 01:02:40 slow |
| F-09 | RBR XR420 CT #15280 | 19 July 2009 17:00 | 31 August 2010 05:13 | 00:00:05 fast |
| F-09 | RBR XR420 CT #15264 | 19 July 2009 17:00 | 31 August 2010 03:31 | 00:00:25 fast |
| F-09 | RBR XR420 CT #15272 | 19 July 2009 16:00 | 30 August 2010 23:20 | NA |

Recovery problems

During Leg 2a, all of the CART releases showed signs of corrosion that exceeded expectations. One spare CART acoustic release was used on Leg 2a to replace a CART on

Mooring G which was flooded when it was retrieved. Due to the large amount of potential dangerous liquid in the flooded instrument, a full inspection as to the cause of the failure was not completed aboard the *Amundsen*. In addition, the tension bails (vertical rods) from one of the spare set of CART releases were used.

The battery canisters on two of the four QM ADCPs recovered on Leg 2a had corrosion on the connectors of the end caps. In both cases the y-cable used to connect the battery canister to the instrument had at least one pin that was severely corroded. One of the battery canisters was removed from service and replaced with the spare battery canister leased from ASL. The second battery canister was cleaned, Dow Corning 111 was added into the connector, and the other end of the Y cable was used.

The IPS5 from Mooring H had a failed pressure port leaking silicone inside the instrument and at least a small amount of salt water leaked through the pressure port. Inside the instrument there was thin grease along the lower portion of the electronics chassis and on the inside of the canister where the chassis sits. The chassis had more grease on the black plate at the bottom and there was also light corrosion on the ribbon cable just above the black plate, and on the lower part of the electronics. Just beneath the pressure port there is a flat surface and there were salt crystals on the surface. The instrument stopped recording data on 16 August, but the pressure data looks incorrect beginning on 01 August. The damage seems to be minor, but it could not be redeployed. It was replaced with the spare IPS5 leased from ASL.

During Leg 2b, all of the CART releases showed signs of corrosion that exceeded expectations. The corrosion on the Mooring B releases required the use of two spare CART releases. The corrosion occurred on the tensions bails (vertical rods) and on the bolts and the clevis at the base of the release that holds the release closed (Figure 5.15).

Figure 5.15. Corrosion of the CART tandem frame components (left) and tension rod thread (right) from Mooring B-09 recovered in the Beaufort Sea during Leg 2b.

On Leg 2b, the QM ADCP on Mooring F and the LR ADCP on Mooring A2 also both had corrosion on the connector of the end cap and were removed from service. The QM ADCP and LR ADCP were replaced with the spares calibrated in Inuvik before the start of Leg 2a.

Two DVS 750 current meters (#12685, 12684) on Mooring F were recovered in a flooded condition and corrosion was visible around the heads (Figure 5.16). It was not possible to recover any data from memory on either instrument. One DVS 750 was replaced with the spare DVS750 provided by Teledyne RDI and the other with one of the serviced DVS 6000s from a lower (deeper) part of the mooring. The spare DVS 6000 that was calibrated in Inuvik before the start of Leg 2a, and was substituted for the DVS 6000 used to replace one of the flooded DVS 750s.

Figure 5.16. Photos of corrosion on DVS 750 transducer heads for Mooring F-09.

The three DVS 6000 current meters (#12708, 12638, 12641) on Mooring F and one DVS 750 current meter on Mooring A1 did not perform as well as predicted by the manufacturer in terms of battery consumption (sampling regime too intense for battery: 2010 sampling regime was changed to using an ensemble interval of 30 min, which decreases the battery consumption by 62%). The batteries in these instruments were replaced with new alkaline battery packs. The four current meters were serviced and reinstalled on the respective moorings. These instruments will not have calibrated compasses for the 2010-2011 dataset. They will provide current speed, but may not provide reliable data for current direction in the second year of deployment. The compasses on the un-calibrated DVS current meters should be checked in Inuvik (or a site near the approximate latitude of their deployment) in 2011 using a calibration turntable and GPS compass. Although these instruments cannot be post-cruise calibrated (according to Teledyne RDI), it might be possible to quantify the heading error for each compass.

Re-deployment operations: The eight moorings re-deployed by ArcticNet /Golder in IOL/BP exploration leases (Figure 5.14) were all deployed top first, with the anchors free-falling at the end of the operation (anchor last). Sea ice was not present during any of the redeployments and CTD casts were performed after every deployment. A summary of the re-deployed mooring locations, designs, dates of recovery and redeployment, water depths for Legs 2a and 2b are found in Table 5.1.

### *5.4.4 Beaufort Sea – MetOcean Buoy mooring (Leg 2b)*

The surface MetOcean buoy mooring deployed by University of Manitoba was successfully recovered on Leg 2b on 20 September 2010 with the combined efforts of Golder and ArcticNet mooring teams. The A-frame and capstan were used to recover the surface mooring accompanied by its attached instruments (CTs). Golder downloaded the Aquadopp current meters and recorded the relative clock drifts. The preliminary recorder's data can be seen in the Golder Leg 2 Mooring Field Report for 2009-2010.

### *5.4.5 Beaufort Sea – ArcticNet moorings (Legs 2b & 3a)*

During Leg 2b, mooring CA04-10 was deployed on 21 September on the return voyage to Sachs Harbour. This was a historical mooring location, which was not deployed in year 2009.

Expedition year 2010, was a good year for ArcticNet mooring recoveries in the Beaufort Sea, recovering all of the 2009 moorings during Leg 3a. However, CA05-09 was only partially recovered possibly due to a faulty batch of stainless steel shackles connecting the sediment traps to the mooring line. All moorings were imaged in the water column using the multibeam system (See 246 on seabed mapping).

During Leg 3a, the recovery of four and redeployment of five moorings (CA05-, CA05-MMP, CA08-, CA16-, CA16-MMP) were successfully performed in the southern Beaufort Sea and the Amundsen Gulf (Figure 5.17).

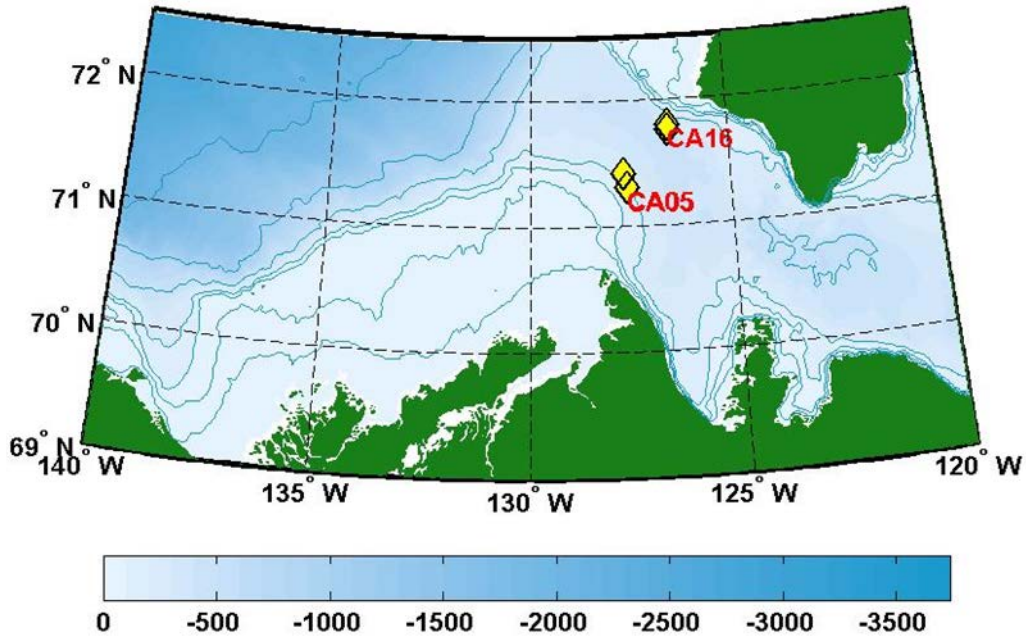



Figure 5.17. ArcticNet moorings recovered and redeployed in the Beaufort Sea/Amundsen Gulf region in 2010 (CA05, CA05-MMP, CA16, CA16-MMP) (Map: INRS QA-QC Report 2009-2010).

### *5.4.6 Viscount Melville Sound – ArcticNet mooring (Leg 3b)*

Before mooring MS01-10 was deployed, four ADCPs compasses were calibrated on the land on the shores of Victoria Island / Prince of Wales Strait area (no raw data exists pertaining to the outcome (good / bad) of the calibrations).

Mooring MS01-10 was deployed on 10 October 2010 in Viscount Melville Sound (2 nm east of initial location) using the Zodiac pulling method in an anchor-last procedure. The multibeam water column image provided an accurate location of the mooring at depth, because vessel maneuvering was not possible due to multiple ice floes / heavy ice pack. The acoustic releases responded to range queries and the vessel continued with proceeding operations.

The Aural M2 hydrophone and Technicap PPS 3/3 sediment trap were not deployed on this mooring due to missing parts (hydrophone) and defective motor assembly (sediment trap).

## 5.5 Methodology – Mooring operations procedures

### *5.5.1 Mooring recovery (Golder mooring team, 2010, CCGS Amundsen)*

There were no detailed documented procedures concerning the recovery operations of either the 2009 ArcticNet or ASL/IOL-BP moorings that were conducted in the Beaufort Sea during Legs 2a and 2b.

- All ArcticNet, Coast Guard, BP and IMG-Golder personnel attended a pre-operations Job Safety Assessment (JSA) and planning meeting involving the morning-of or night before the mooring operations.
- Cables and acoustic equipment were prepared and tested before the operation.
- A pre-operations 'toolbox' meeting took place on the deck to identify role and review responsibilities during mooring operations.
- The ship was stopped about 1-2 cables from the deployment location.
- A CTD cast was done usually before recovery (or after deployment) of the mooring.
- Transducer ranges were taken on the acoustic releases from several positions around the mooring site to verify approximate location and distance from the ship.
- When greater accuracy was needed (due to poor visibility or nearby ice) then triangulation was done by taking three range fixes from points surrounding the target location: ranges and locations were logged and a program was run to determine the most likely location of the mooring.
- The ship was then re-positioned sufficiently down-drift from this location and another range is taken before sending the release code.
- If the area over the target was clear then the Release code was transmitted, its confirmation reported, and the release time logged.
- When the mooring surfaced, the time and its location (distance & direction from ship position) were logged.
- The boat was launched and hooked onto the top float when all floatation components had reached the surface.
- The boat then pulled this alongside the ship and hooked it onto the A-frame winch hook.
- As the A-frame hook lifted sections of mooring on deck, the time was logged when each instrument came out of the water.
- The mooring lines were completely disassembled.
- Data from the instruments was downloaded and preliminary quality assurance and quality control (QA/QC) was performed on the data.
- Servicing / maintenance of the instruments was carried out, including any required trouble-shooting or field repairs.
- The instruments were re-programmed for the next year of operations (if applicable).

### *5.5.2 Mooring deployment*

There were no detailed documented procedures concerning the recovery operations of either the 2009 ArcticNet or ASL/IOL-BP moorings that were conducted in the Beaufort Sea during Legs 2a and 2b.

This deployment procedure outlined below is based on the Golder Field Report 2010 and the current (2014) ArcticNet / CCGS *Amundsen* procedures.

- The instruments were programmed and mounted into their respective frames / floats.
- The mooring releases were verified for proper functioning.
- The mooring was assembled top-down on the foredeck according to the planned design.
- The mooring equipment attachments were confirmed and double checked.
- A Toolbox Meeting with Mooring and Ship's mooring crews was held on the foredeck to identify roles and review safety considerations.
- The Zodiac was launched (if needed).
- Date and time were recorded at the start of mooring operations by a fourth mooring team member, stationed on the bridge.
- A throw-line was attached to the top metal loop of the top float and the SeaCatch® secured (connected to the bottom of the frame, using the 500-hp winch line), paying attention to the release arm of the SeaCatch® so that it is free to lift up and outward without restriction.
- The throw-line was thrown to the Zodiac, which then attached it to the bow horn / tack.
- The mooring line was then tacked / secured and the Zodiac was then instructed to maintain a taut-line (**not** tight), unless otherwise instructed by the lead mooring professional / chief officer
- The top float was raised off the deck and the A-frame extended, undoing the mooring line tack before the instrument reaches the deck edge.
- The instrument was lowered and the safety pin of the SeaCatch® released at deck level, then subsequently releasing the SeaCatch® and top float at the water surface. Depending on wave conditions, timing of SeaCatch® release may need to be timed with a lull in wave period.
- The SeaCatch® was then brought back to the deck level (A-frame brought back in at the same time) and attached to the next solid structure (i.e. cage), pearl link / D-ring (added to the top-side of next device to be lifted).
- The mooring line was payed-out until there was 10-30 m remaining (30 m is advisable for rough seas), then the mooring line put on-tack.
- The next instrument was then raised by the 500-hp winch wire as the mooring line in-tack was released.
- The same procedure of lowering the device to the water then putting the mooring line on tack, then attaching the SeaCatch® to the top-side of the next device was followed until each device was in the water. Meanwhile, the Zodiac continued to maintain a taught-line so as to not allow for the deployed / in-water equipment to get entangled.
- The final release of the anchor was preceded by the Zodiac releasing its tack of the top float (trying to retain its tack line, or at least a good portion of it) and the chief officer confirmed the tagline release from the Zodiac and confirmation that the vessel was at the desired depth and position.
- The SeaCatch® on the Anchor chain shackle (located in the middle of the 2 m anchor chain, just above the protective chain cylinder) was then released to let the mooring free-fall into position.
- The Zodiac® and 4$^{th}$ team member on the bridge then marked the time and mooring / target location of the last seen vertical position of the top float on-descent.

- The Zodiac® returned to the vessel and the A-frame and 500hp winch were stopped and secured.
- The vessel then proceeded to 3 triangulation points at ~100 m around the target location and verified acoustic release communications through ranging / ‘pinging’ which allow for the anchor position to be calculated. These data were then input into a MatLab® triangulation script to determine the triangulated position of the mooring and kept within the field deployment sheets (Figure 5.20).
- A multibeam survey is performed to confirm the orientation and position and orientation of the mooring. Depending on the vessel’s proximity to the mooring line, equipment and top-float depths might be visible, if the vessel travels directly over-top the mooring (example image Fig. 27).
- A post-deployment CTD cast / profile can be done, though the pre-deployment cast is sufficient if the CTD-Rosette was programmed to take several water samples at the same time as profiling the water column. The CTD profile plots for each mooring were kept within the field deployment workbook (EXCEL) and also archived at ArcticNet (Figure 5.19).
- The fore deck was cleaned of debris and remaining mooring equipment / cages were secured on the foredeck.


Figure 5.18. Multibeam water column imagery identifying orientation and instrument depths for deployed moorings (Screenshot courtesy of ArcticNet multibeam processing team).

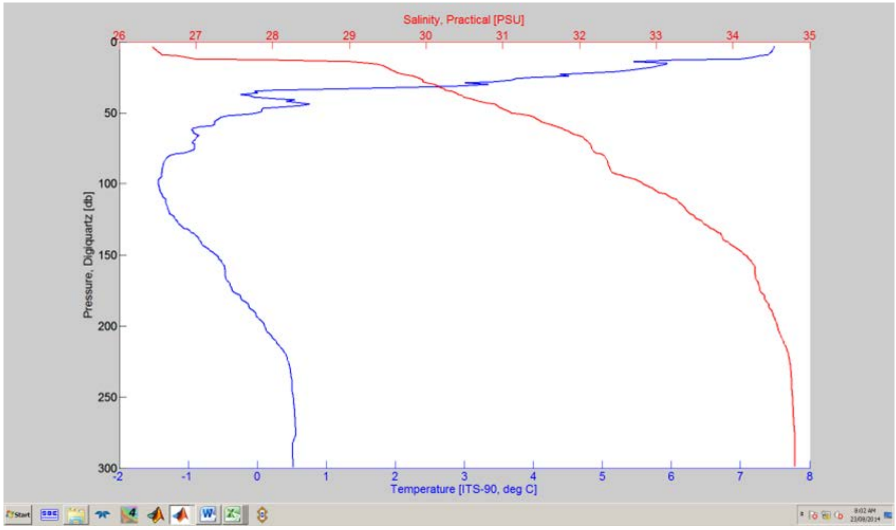



Figure 5.19. Example of a CTD-Rosette temperature and salinity profile (BS2-14).

### 5.5.3 *Triangulation of mooring position procedure*

The triangulation of the mooring positions was not well documented, but would most likely consist of the vessel proceeding to 3 triangulation points ~100 m around the target location (position were anchor was released) and verification of acoustic release communications through ranging / ‘pinging’, allowing for the anchor position to be calculated (Figure 5.20).

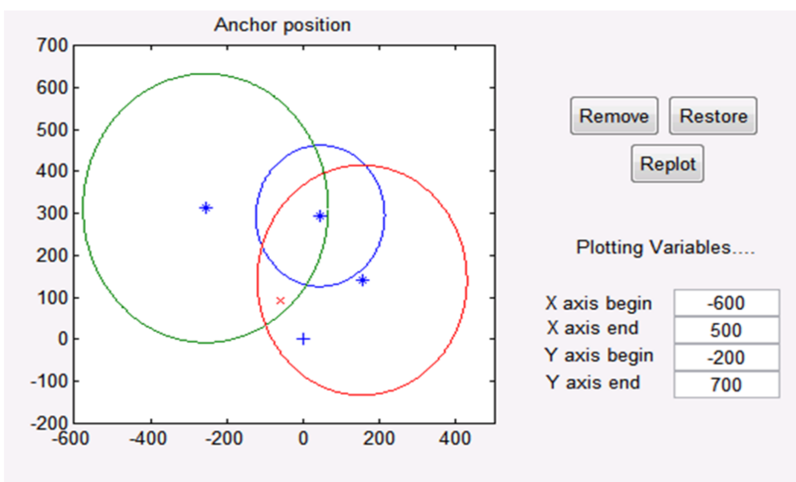



Figure 5.20. Triangulation plot from BS1-14 using Art's Acoustic Survey Matlab Script.

## 5.6 Comments and recommendations

### *5.6.1 Hudson Bay Leg 1a*

Steel-toed boots should not be worn by the operator that spins the calibration table as this could potentially (small chance) throw off the calibration of the compass on the more sensitive devices (RDI ADCPs and Nortek ADCPs).

### *5.6.2 Beaufort Sea Leg 2 (Golder's comments)*

<u>CART releases</u>

Corrosion was a major issue on the oceanographic moorings particularly on the CART releases. On at least 4 of 7 moorings, the corrosion required all or portions of the CART to be replaced by parts from the 4 spare CART releases. The corrosion occurred on the tension bails (vertical rods) and on the bolts and the clevis at the base of the release which holds the release closed (Fig. 22). The manufacturer, ORE Offshore, should be contacted to discuss the issue and determine the best approach to solving the corrosion problem.

<u>Delegation of mooring operations responsibilities</u>

The creation of a Job Safety Assessment, required by BP, identified a sequence of steps for mooring recovery, deployment and data retrieval. The JSA helped clarify the steps involved in the mooring recovery and deployment operations. The JSA not only identifies roles and responsibilities, but also acceptable PPE and a Hazards Analysis (which is needed by the CCG – French document). The JSA along with the Hazard Analysis creates a safety-first mentality that reduces confusion and increases safety for all mooring operations on-board.

<u>FRC / Zodiac mooring assistance during mooring operations</u>

The use of a Fast Rescue Craft / Zodiac can decrease the chance of the mooring line becoming entangled once the mooring anchor is released (deployment free-fall). Mooring line entanglements were encountered during the CASES program and periodically noticed by IOS (DFO) from time to time. In an effort to continue to deploy anchor-first, but to reduce the chance of entanglement (which prevents the mooring from releasing from the anchor), the Zodiac was used to pull the mooring line taut. The risk in pulling the line mooring line with the Zodiac is such that the Zodiac and chief officer and mooring leader need to have effective communications to prevent the mooring line from being too taut, especially in non-ideal weather conditions. The swell / waves will cause periodically high tension on the mooring line connected to the Zodiac and possess a safety risk to the mooring personal on the deck. Attention to procedure and effective communications with all personnel involved will make for a safe and smooth operation. It should be noted that ice pack may traverse the taut mooring line, still connected to the Zodiac. This is particularly hazardous for the Zodiac, mooring equipment and support vessel and mooring personal on-deck. Unfortunately, there is nothing that can be done about this situation and experience and effective communications with the Zodiac will either raise or lower the mooring line, under the ice pack keel.

Instrumentation corrosion

Corrosion was a major problem on the 2009 moorings, especially for the CART releases, DVS 750 and impulse bulkhead connectors on the RDI ADCP housings (main unit and battery canisters).

Corrosion on the DVS transducer heads is the suspected culprit in the unit flooding instances. This problem needs to be addressed / repaired by RDI. As for next year's deployments, possibly looking into a different company's technology (Nortek AquaPro) could be a viable solution in the interim.

Alkaline batteries and an intense sampling regime prevented the DVS units from recording the full 12 month deployment period; therefore, still using an alkaline battery pack, the sampling regime was reduced to a 30 min interval, which increased battery life by 62%.

# 6 Water column structure and ocean circulation (CTD-Rosette, MVP and ADCP operations) – Legs 1a, 1b, 2a, 2b, 3a, 3b and 3c

ArcticNet Phase 2 – Project titled *Long-Term Observatories in Canadian Arctic Waters*.
http://www.arcticnet.ulaval.ca/pdf/phase2/gratton_marine_observatories.pdf .

**Project leader**: Yves Gratton[1] (yves_gratton@ete.inrs.ca) and BP (Legs 2a, 2b and 3a)

**Cruise participants Legs 1a & 1b**: Dominique Boisvert[1] and Camil Hamel[1]
**Cruise participants Leg 2a**: Yves Gratton[1], Alexandre Forest[1] and Jessy Barrette[1]
**Cruise participants Leg 2b**: Alexandre Forest[1] and Jessy Barrette[1]
**Cruise participants Legs 3a & 3b**: Dominique Boisvert[1] and Melissa Gervais[1]
**Cruise participant Leg 3c**: Melissa Gervais[1]
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## 6.1 Introduction

### *6.1.1 Leg 1a – ArcticNet – 02 July to 02 August 2010 – Hudson Bay*

*Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

The objective of this team for Leg 1 was to describe the water masses and general circulation in Hudson Bay and Hudson Strait as well as through the Northwest Passage and in the Amundsen Gulf. Physical parameters were recorded using a Sea-Bird CTD-Rosette frame equipped with 24 bottles of 12 L, a ship mounted RDInstruments Ocean Surveyor ADCP (150 kHz), and a Brooke Ocean Moving Vessel Profiler (MVP).

### *6.1.2 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

*Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea*

In Leg 2, the CTD-Rosette and MVP group examined and monitored the spatial and temporal variability of the physical processes responsible for mixing, water mass exchange and general ocean circulation. Selected key research questions include:

- What is the role of the Mackenzie River freshwater on oceanic circulation and upper stratification?
- How do Pacific and Atlantic water masses move along-shelf and across-shelf and what are the forcing mechanisms driving these exchanges?
- What are the roles of brine convection, eddies, upwelling and micro-scale turbulence in shaping the vertical and horizontal structure of the water column?

Answering these questions is necessary in order to develop more accurate predictive models for nutrient supply, sediment transport, biogeochemical cycling and overall biological productivity of the Beaufort Sea. Both mooring data (time series at fixed depths and locations) and ship-based data (vertical “snap-shots” over the area) are used.

The objective of the field work campaign for Leg 2 was primarily to characterize the water column physical and chemical properties using electrical and optical *in situ* probes: temperature, salinity, fluorescence, CDOM, dissolved oxygen concentration, nitrate concentration, light penetration and turbidity.

### *6.1.3 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

### *Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

### *Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords*

During Leg 3, the team examined the physical processes responsible for water mass exchange and circulation between the Canada Basin and the continental shelf as well as through the Northwest Passage and in the Labrador Fjords.

The objective of the shipboard field work was to characterize the water column physical and chemical properties: temperature, salinity, fluorescence, CDOM, dissolved oxygen concentration, nitrate concentration, light penetration and turbidity.

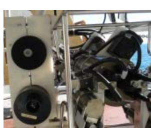
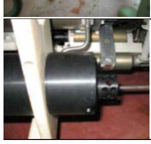
## 6.2 Methodology – CTD-Rosette

### *6.2.1 Instrumentation*

Figure 6.1. CTD-Rosette system used on the *Amundsen* to characterize water column properties and collect seawater samples. Photo on the right shows the different sensors located below the bottles

The Rosette frame was equipped with twenty-four 12 liter Niskin bottles that were remotely closed at predetermined depths. A SBE 911 CTD and various other sensors were used mounted on the Rosette frame (Figure 6.1). In Leg 2, a Lowered Acoustic Doppler Current Profiler (LADCP) was attached to the frame to provide vertical profiles of horizontal current velocities on station. The Rosette also provided water samples for biologists and chemists.

Table 6.1. Sensors equipped on the Rosette.

| Photo | Item | Manufacturer | Type & Properties | Serial Number |
|---|---|---|---|---|
|  | CTD | SeaBird | SBE-911<br>Sampling rate : 24 Hz | 0679 |
| | Temperature | SeaBird | SBE 3plus<br>Range: -5ºC to + 35ºC<br>Accuracy: 0.001 | 4204 |
| | Pressure | SeaBird | Accuracy:<br>0.015% of full range | 90584 |
|  | Conductivity | SeaBird | SBE 4C<br>Range: 0 to 7 S/m<br>Accuracy: 0.0003 | 2696 |
| | Oxygen | SeaBird | SBE-43<br>Range: 120% of saturation<br>Accuracy: 2% of saturation | 0427 |
|  | Nitrates [a] | Satlantic | MBARI ISUS<br>Range: 0.5 to 200 µM<br>Accuracy: ± 2 µM | 134 |
|  | PAR [a] | Biospherical | PAR Dynamic Range: $1.4 \times 10^{-5}$ µE/(cm$^2$ sec) to 0.5 µE/(cm$^2$ sec) | 4664 |
| | SPAR | Biospherical | PAR Spectral Response: Equal (better than ±10%) quantum response from 400 to 700 nm | 20123 |

| Photo | Item | Manufacturer | Type & Properties | Serial Number |
|---|---|---|---|---|
|  | Fluorometer | Sea Point | Min. detectable level 0.02 µg/l<br>Gain sens / V(µ/l) / Range (µ/l)<br>30X / 1.0 / 5<br>10X / 0.33 / 15<br>3X / 0.1 / 50<br>1X / 0.033 / 150 | 2465 |
|  | Transmissometer | WetLab | Path length: 25 cm<br>Sensitivity 1.25 mV | CST-558DR |
|  | Altimeter | Benthos | Range: 50 m from bottom | 1044 |
| | ECO fluorometer (CDOM) | Wet Labs | FL(RT)D<br>Digital output resolution : 14 bit<br>Analog output signal: 0-5V<br>Range: 0.09-500 ppb<br>Ex/Em: 370/460 nm | |

[a] The Rosette was restricted to the first 1000 m because of the PAR and Nitrates sensors.

Table 6.2. Rosette's sensors specifications.

| Parameter | Sensor | | Range | Accuracy | Resolution |
|---|---|---|---|---|---|
| | Manufacturer | Instrument Type | | | |
| CTD | 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 | QCP2300 | $1.4\times10^{-5}$ to 0.5 µE/(cm$^2$·sec) | | |
| sPAR | Biospherical | QCP2200 | $1.4\times10^{-5}$ to 0.5 µE/(cm$^2$·sec) | | |
| 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 7000m
[4] In all natural waters, fresh and marine
[5] Maximum depth of 1200m
[6] Maximum depth of 1000m
[7] Maximum depth of 6000m

### *6.2.2 Lowered Acoustic Doppler Current Profiler (LADCP) (Leg 2)*

Figure 6.2. LADCP equipped on the Rosette frame during Leg 2 to measure currents in the water column.

A 300 kHz LADCP (a RD-Instrument Workhorse®) was mounted on the Rosette frame during Legs 2 and 3. The LADCP gets its power through the Rosette cable and the data was uploaded on a portable computer connected to the instrument through a RS-232 interface after each cast. The LADCP was programmed in *individual ping* mode (one every second). The horizontal velocities were averaged over thirty-two, 4 m *bins* for a total (theoretical) range of 100 to 120 m. The settings were 57600 bauds, with no parity and one stop bit. Since the ADCP was lowered with the Rosette, there were several measurements for each depth interval. Processing was done in Matlab® according to Visbek (2002; J. Atmos. Ocean. Tech., 19, 794-807)

### *6.2.3 Sensor calibration*

**Salinity**: Samples were usually taken on 2-3 casts during each Leg using small glass 200-mL bottles. They were analyzed onboard with an autosal GuildLine model 8400B (range from 0.005 to 42 and accuracy < 0.002).

Figure 6.3. Bottles used to collect samples (left) for salinity calibration and the Guildline instrument (right) used to analyze salinity samples onboard the *Amundsen*.

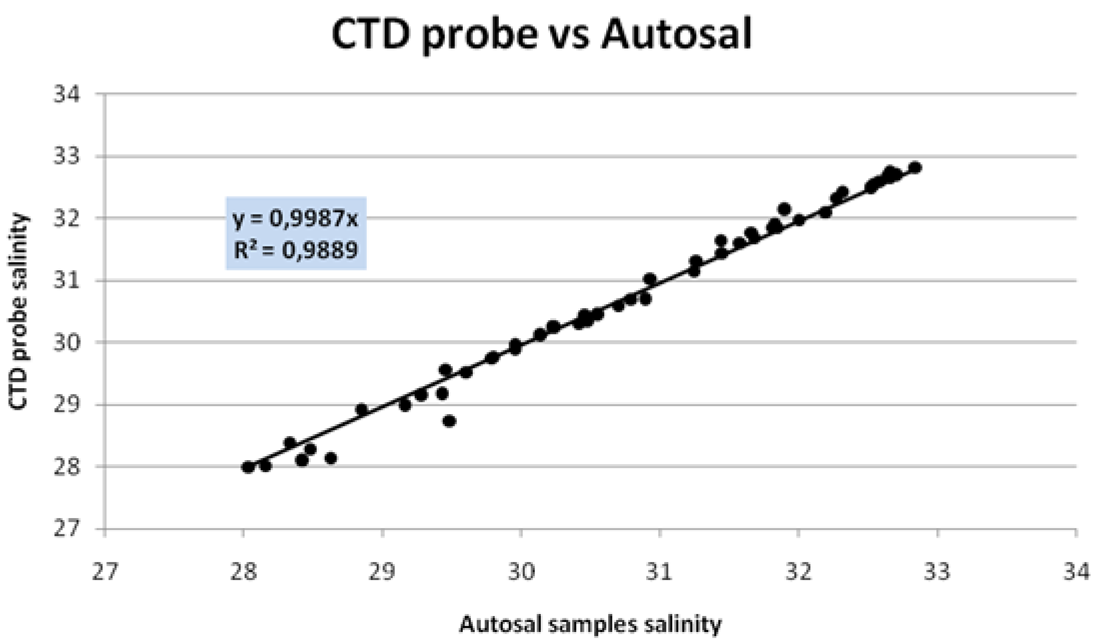



Figure 6.4. Comparison between salinity measurements obtained from the Ctd sensor on the Rosette and from calibration samples analyzed onboard. Example is from Leg1.

**Oxygen**: Oxygen calibrations were performed onboard during or after each leg using Winkler's method and a Mettler Toledo Titrator. Reagent blanks were tested at least once per leg. Water samples for oxygen titration were obtained in triplicates from a few casts per leg from five depths that offered a wide range of values.


Figure 6.5. Bottles used to collect samples (left) for oxygen calibration and the Mettler Toledo titrator (right) used to analyze the samples onboard the *Amundsen*.

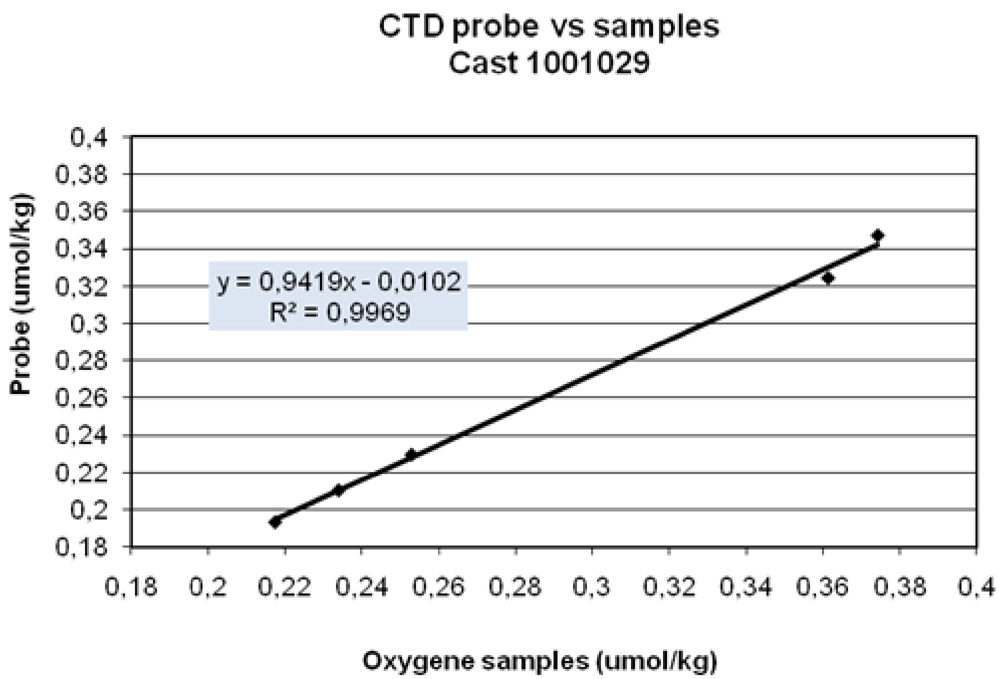



Figure 6.6. Comparison between oxygen measurements obtained from the CTD sensor on the Rosette and from calibration samples analyzed onboard by Winkler titration. Example is from Leg1.

### *6.2.4 Sampling*

<u>Leg 1a – ArcticNet – 02 July to 02 August 2010 – Hudson Bay</u>

<u>Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago</u>

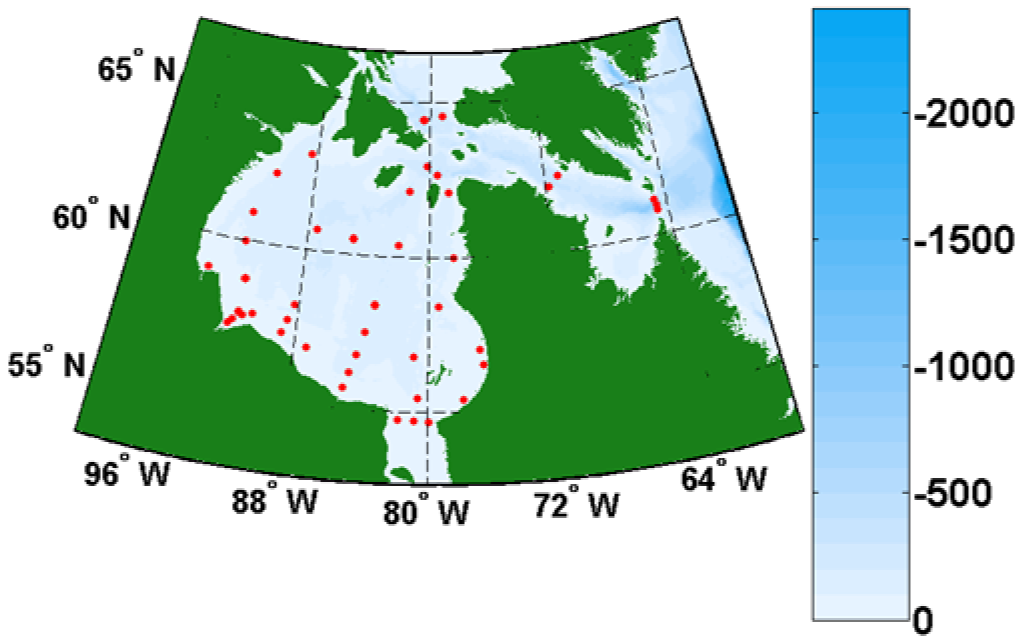



Figure 6.7. Locations of CTD-Rosette casts conducted in Hudson Bay, Hudson Strait and Foxe Basin during Leg 1a.

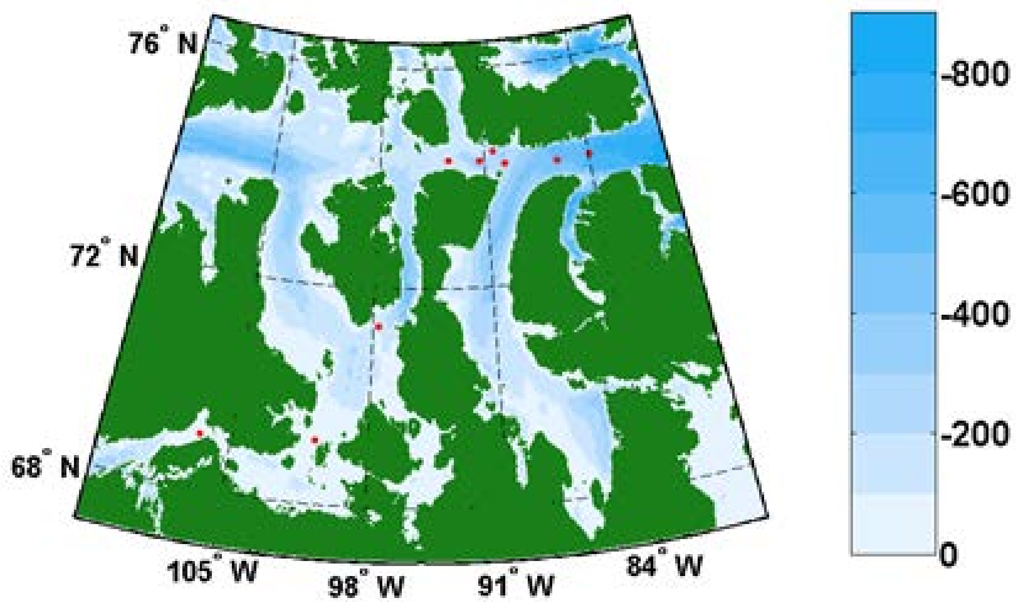



Figure 6.8. Locations of CTD-Rosette casts conducted in the Canadian Arctic Archipelago (Northwest Passage) during Leg 1b.

Water was sampled from the Rosette according to each team's requests, usually following this collection system:

*__Nutrients__* (J.-É. Tremblay): chlorophyll maximum, surface, 10 m, 20 m, 30 m, 40 m, 50 m, 60 m, 80 m, 100 m, 120 m, 140 m, 160 m, 180 m, 200 m, 250 m, 300 m and every 100 m down to the bottom.
*__Mercury__* (H. Hintelmann): Surface, bottom, mid-water column (unusual biological activity).
*__DOC/DON__* (C. Michel): Salinity of 33.1, surface, 10 m, 20 m, 30 m, 40 m, 50 m, 60 m, 80 m, 100 m, 120 m, 140 m, 160 m, 180 m, 200 m, 250 m, 300 m and every 100 m down to the bottom.
*__CDOM__* (G. McCullough): 100 m, 70 m, 50 m, 40 m, 30 m, 20 m, 10 m.
*__Primary production__* (M. Gosselin): 50%, 30%, 15%, 5%, 1%, 0.2% of light, chlorophyll maximum, 75 m and 100 m while in open water, or nutrients profile below 100 m deep.
*__DNA__* (C. Lovejoy): surface, chlorophyll maximum, nitracline, bottom.

Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea

Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea

Figure 6.9 and Figure 6.10 show the location of the CTD-Rosette and MVP casts completed during Leg 2.

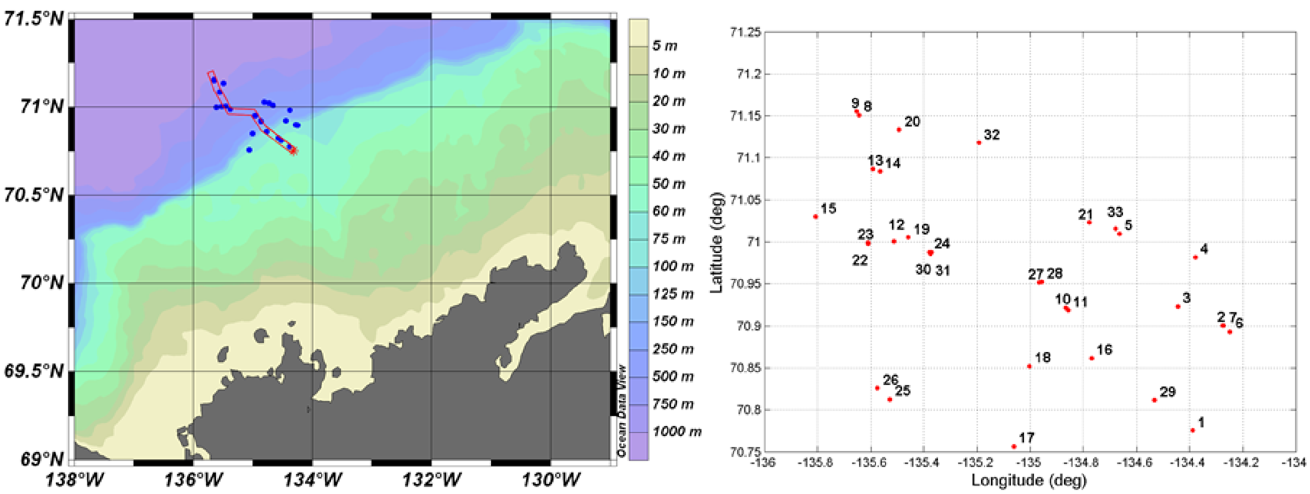



Figure 6.9. Left: Location of CTD-Rosette casts conducted during Leg 2a, with BP section indicated in red. Right: CTD-Rosette casts (red dots) identified by cast number. Note that casts 8 and 9 in the upper left corner are the northernmost ones and they correspond to Station BP10-009.

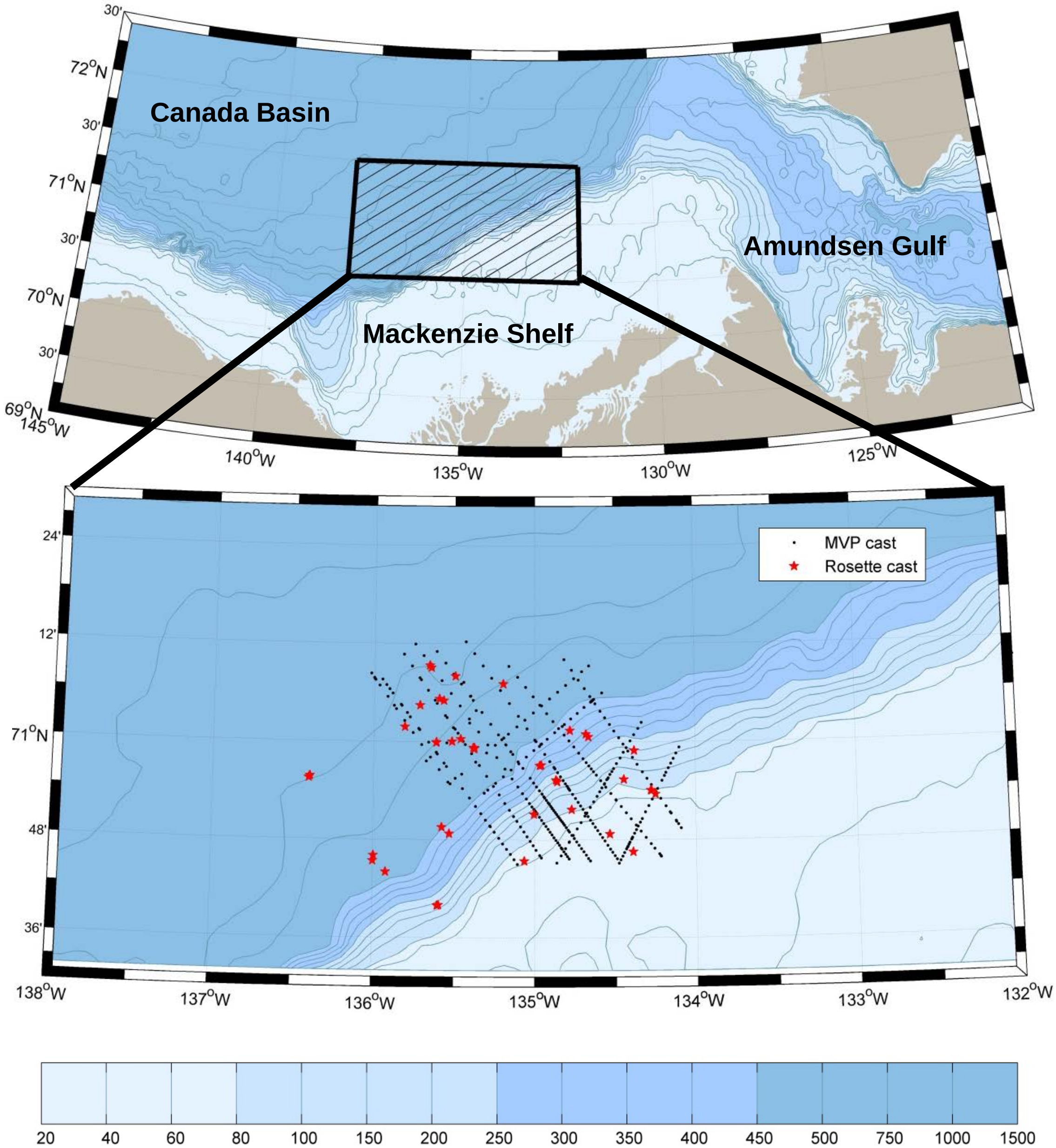



Figure 6.10. Location of the CTD-Rosette casts (red stars) and MVP casts (black dots) performed in the BP and IOL lease blocks in the southern Beaufort Sea during Legs 2a and 2b.

Water was sampled with the Rosette according to each team's requests. Most of the requests occurred during Leg 2a, whereas little water sampling was performed during Leg 2b (see CTD logbook in Appendix 3 for details).

Three types of CTD-Rosette casts were defined:

*CTD casts (Leg 2a and 2b):* CTD profile only, no bottle was closed. This type of cast was usually performed prior to each mooring recovery and after each mooring deployment. A simple CTD cast was also performed for the USBL calibration on 02 September 2010.

*Biophysical casts (Leg 2a and 2b):* During Leg 2a, samples were obtained for nutrients, contaminants, salinity, dissolved oxygen (DO) and the $\delta^{18}O$ to $\delta^{16}O$ ratio. In some instances, Total Alkalinity (TA), pH and Dissolved Inorganic Carbon (DIC) samples were also extracted from the same bottles. During Leg 2b, only one biophysical cast (1002040) for DO, TA, DIC, salinity and pH was performed (i.e. no nutrient and no contaminant).

*BP-1 to BP-5 casts (Leg 2a only):* Twelve dedicated bottles (new ultra-clean bottles) were closed at approximately 125 m (six bottles) and 240 m (six bottles) to sample the Pacific and Atlantic water mass cores.

Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea

Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords

During Leg 3, the CTD-rosette was deployed sixty-five (65) times and all data was recovered. Figure 6.11show the location of the Rosette casts.

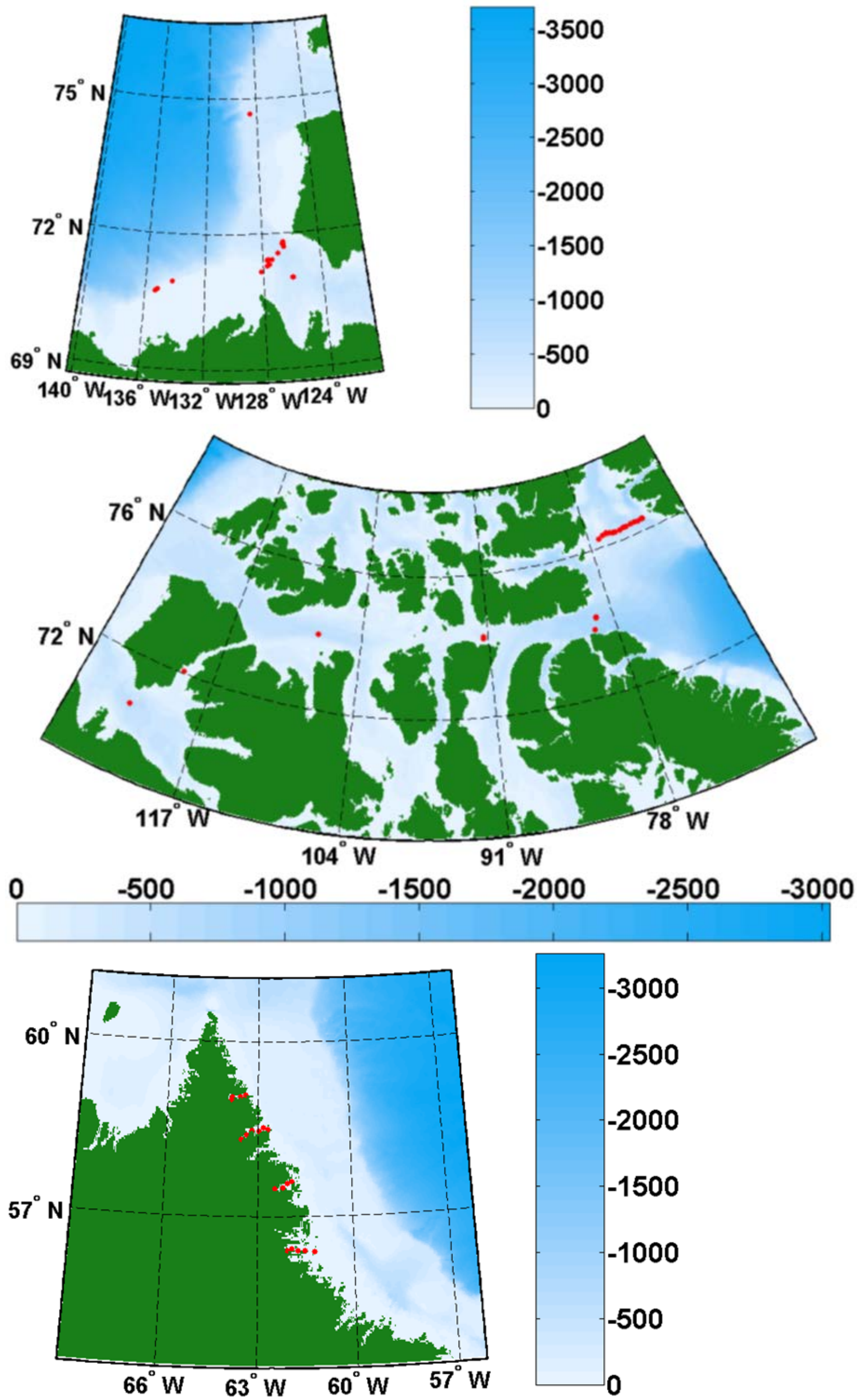



Figure 6.11. Locations of CTD-Ropsette casts conducted during Leg 3a (top), Leg 3b (center) and Leg 3c (bottom).

Three types of CTD-Rosette casts were defined:

CTD only*:* CTD profile only, no bottle was closed.

Nutrients and PP casts: High resolution sampling of the water column was done for nutrients and primary production. In some instances, Arsenic and $\delta^{18}O$ samples were also extracted from the same bottles.

Microbial diversity: Samples are obtained for microbial diversity at four to five depths of interest in the water column (ex: Nitracline, Oxygen minimum).

### *6.2.5 Data availability*

All the information regarding the Rosette casts is summarized in the CTD Logbook (Appendix 3) which includes cast number and station ID, date and time of sampling in UTC, latitude and longitude, bottom and cast depths, and comments concerning each cast. For every cast, data from three seconds before a bottle was closed to seven seconds after was averaged and recorded in the ascii '*bottle files*'. The information included the bottle number, time and date, trip pressure, temperature, salinity, light transmission, fluorescence, dissolved oxygen, irradiance and pH measurements.

During Leg 1, a total of 80 casts were performed between 02 July 2010 and 12 August 2010.

During Leg 2, the CTD-Rosette was deployed 43 times and the data from 42 casts was recovered. Cast 24 was aborted due to communication problems; therefore, the data is not available.

## 6.3 Methodology – Ship-mounted ADCP (SM-ADCP)

Velocity data have been recorded continuously using a ship mounted RD-Instruments Ocean Surveyor 150 kHz ADCP (SM-ADCP). The GPS signal was available through the ship's navigation system or through the EK-60. The SM-ADCP provided dependable horizontal currents every 8 m only down to 125 or 150 m, the protective ice window absorbing part of the energy. The signal could reach 200-300 m when the ship was on station.

## 6.4 Methodology – Moving Vessel Profiler (MVP)

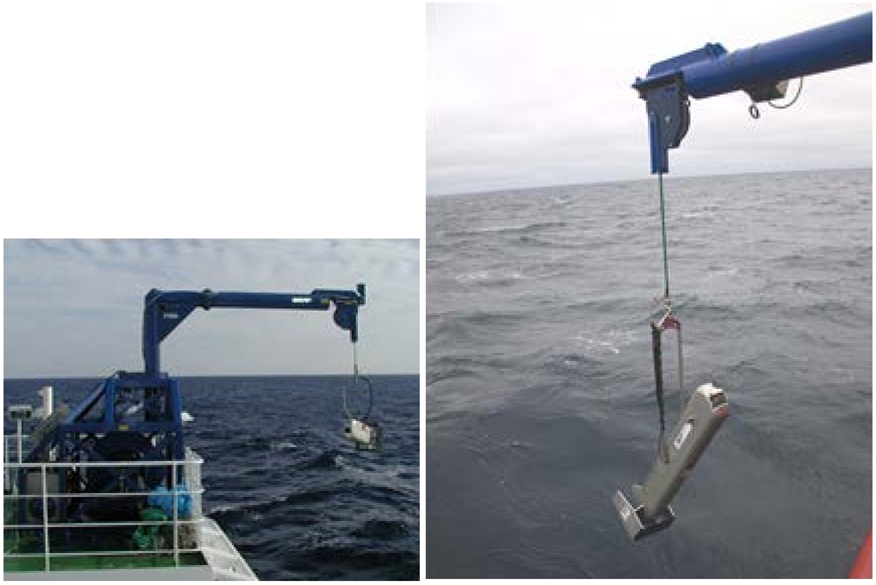


Figure 6.12. Moving Vessel Profiler used on the *Amundsen*. To conduct continuous vertical profiles of water column properties.

The Moving Vessel Profiler (MVP; model MVP300-1700) is a towed CTD fish-like profiler (also equipped with fluorescence, transmissivity and dissolved oxygen sensors) built by Brook Ocean Technology (BOT). It is usually used in automatic mode. The “fish” (Figure 6.12) freefalls at ~5 m $s^{-1}$ and is automatically winched back to 12 m below the surface (Figure 6.13) after each cast.

The MVP was equipped with 1700 m of cable and could profile down to 300 m at 12 knots. The slower the cruising speed, the deeper the MVP can reach and the better the horizontal resolution. At 4 knots, the MVP can profile down to 400 m with a 800 m horizontal resolution.

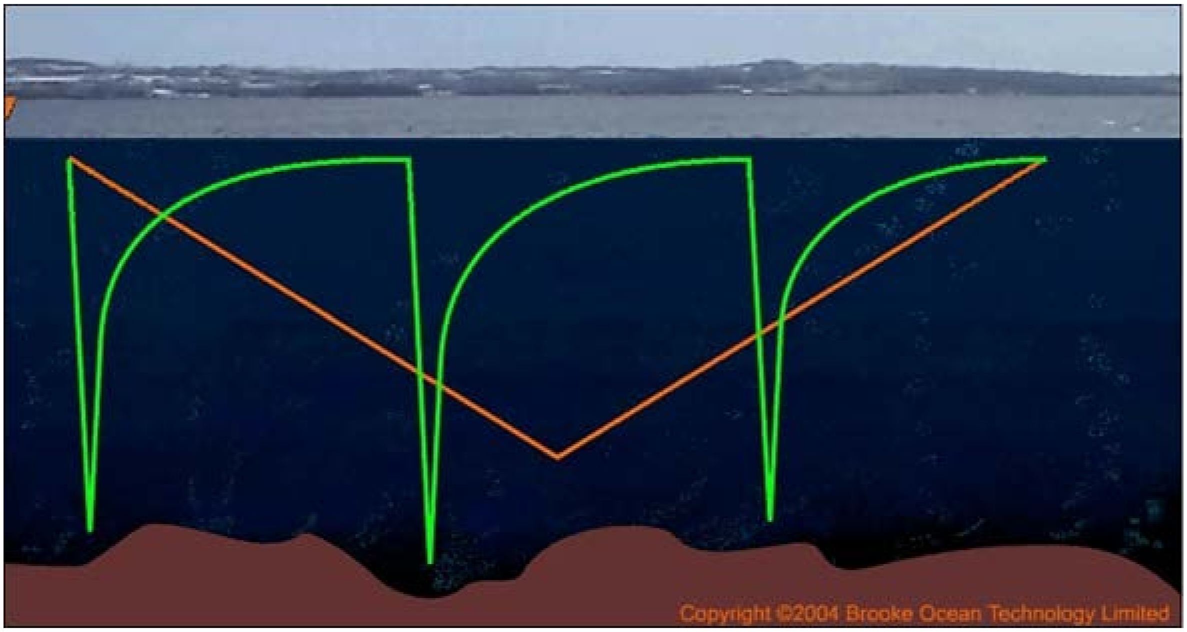



Figure 6.13. MVP fish profiling trajectory below the water (green line) while it is towed by the *Amundsen*.

During Leg 1, MVP transects were made in Hudson Bay, Hudson Strait and Lancaster Sound. The MVP was likely hit by ice during the Lancaster Sound transect and its support frame was bent. The probes and cables were not damaged.

This instrument was not used during Leg 2a but was intensively used during Leg 2b to cover the sub-bottom mapping lines (see next section). During Leg 2a, the first 10 and last 10 meters of the water column were lost, while during Leg 2b, the first 12 m and last 20 meters were lost. During Leg 2, a total of 14 MVP transects were performed for a grand total of more than 300 profiles.

During Leg 3, the MVP was used only in the Labrador fiords during Leg 3c.

Problems encountered with the MVP (Leg 2b)

A major problem encountered with the MVP was the leakage of oil from the hydraulic pump during deployment. For an 8-hour deployment with semi-continuous profiling, the pump lost about 1.5 liter of oil. This could have been a major issue if the pump had lost more oil (or was not checked for several deployments). Fortunately, the pump was refilled after each deployment and the level of oil checked regularly.

Another problem was the frequent loss of communication between the MVP control unit and the M300 bottom sensor. If the bottom depth reading was lost momentarily during a downcast, the profile stopped and the MVP was automatically recovered at its dock position. The problem was bypassed by increasing the time-out delay between the MVP and the M300, but this is not recommended for further deployments as it is risky. Instead, the connection should be repaired and checked for signal stability.

A third problem was the malfunctioning of the fluorometer, which did not work at all during Leg 2b and should be changed.

The final problem was the sporadic malfunctioning of the auto-recovery when the MVP reached its bottom depth time-out. This can cause the MVP to hit the bottom if the controller is not aware that sometimes the MVP does not stop at its boundary depth and continues to fall. This happened three times in total during Leg 2, but thanks to the vigilance of the MVP operators, the profiler was stopped and recovered manually before any incident happened.

## 6.5 Preliminary results

### *6.5.1 Leg 1a – ArcticNet – 02 July to 02 August 2010 – Hudson Bay*

### *Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

Sections of salinity profiles obtained with the MVP in Hudson Bay, Hudson Strait and Lancaster Sound during Leg 1 are presented in Figure 6.14.

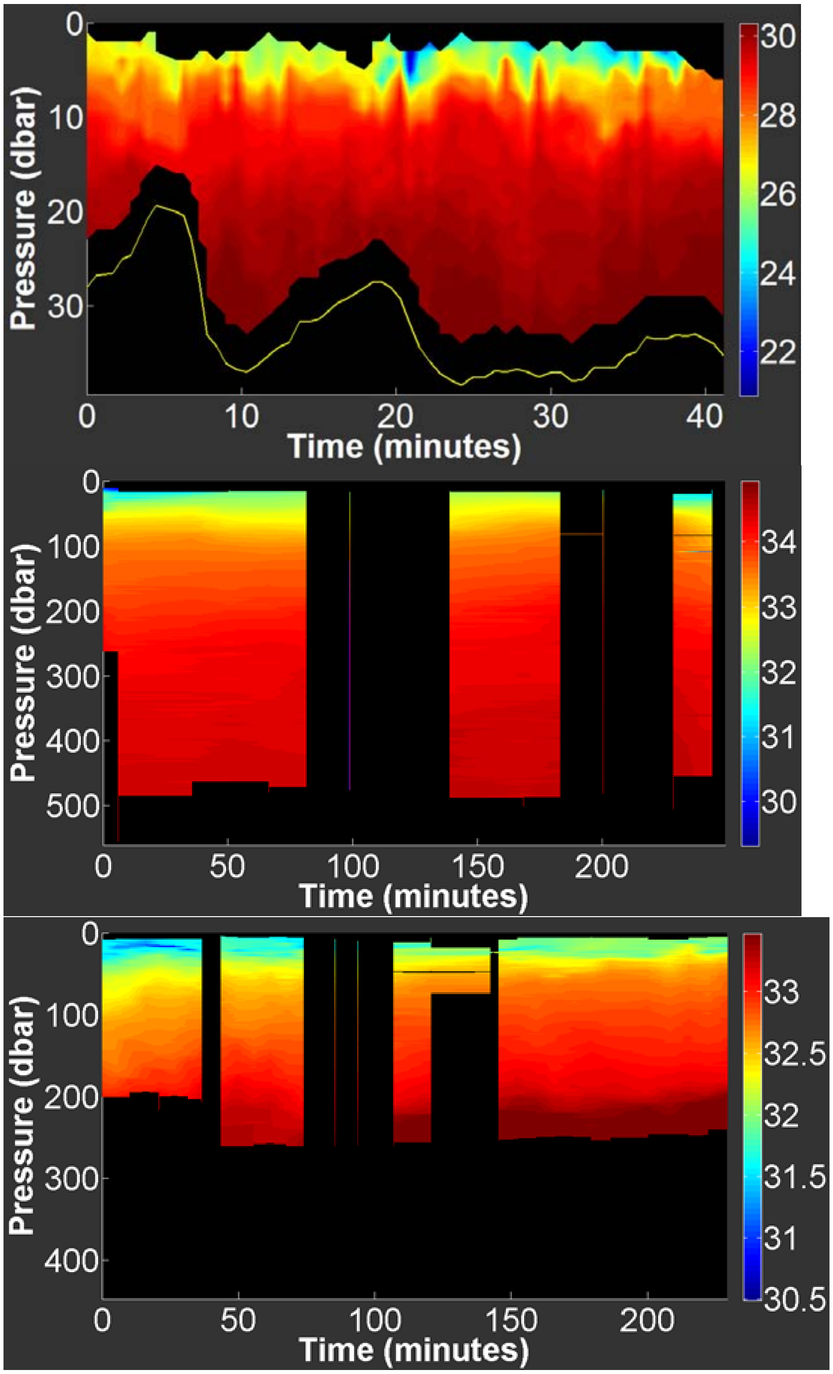



Figure 6.14. Salinity profiles from MVP Transect 2 in Hudson Bay (upper panel) and MVP Transect 3 in Hudson Strait (middle) during Leg 1a, and for MVP Transect 4 conducted in Lancaster Sound (bottom) during Leg 1b.

### *6.5.2 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

### *Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea*

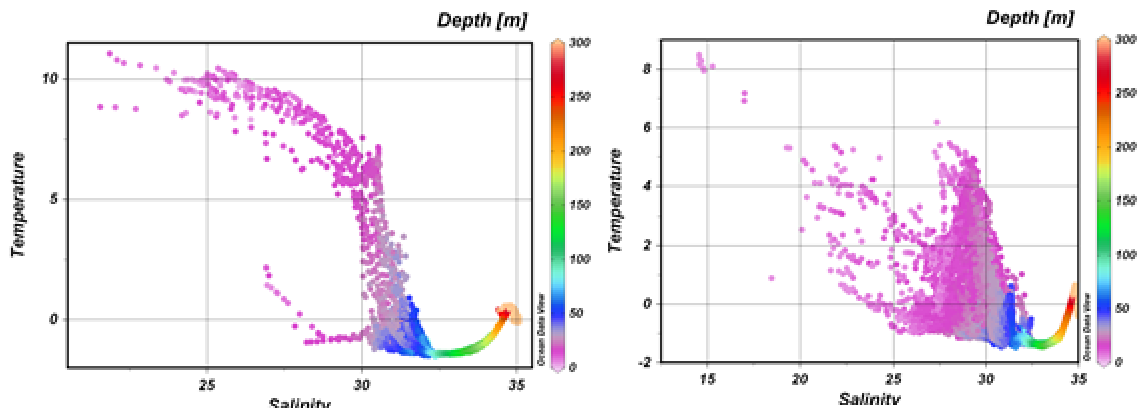



Figure 6.15. T-S diagrams constructed with data from Leg 2a in August-September 2010 (left) and Malina in August 2009 (right). Note the much warmer surface water in 2010. In 2009, the warmer waters (upper left corner) were found only very close the mouth of the Mackenzie.

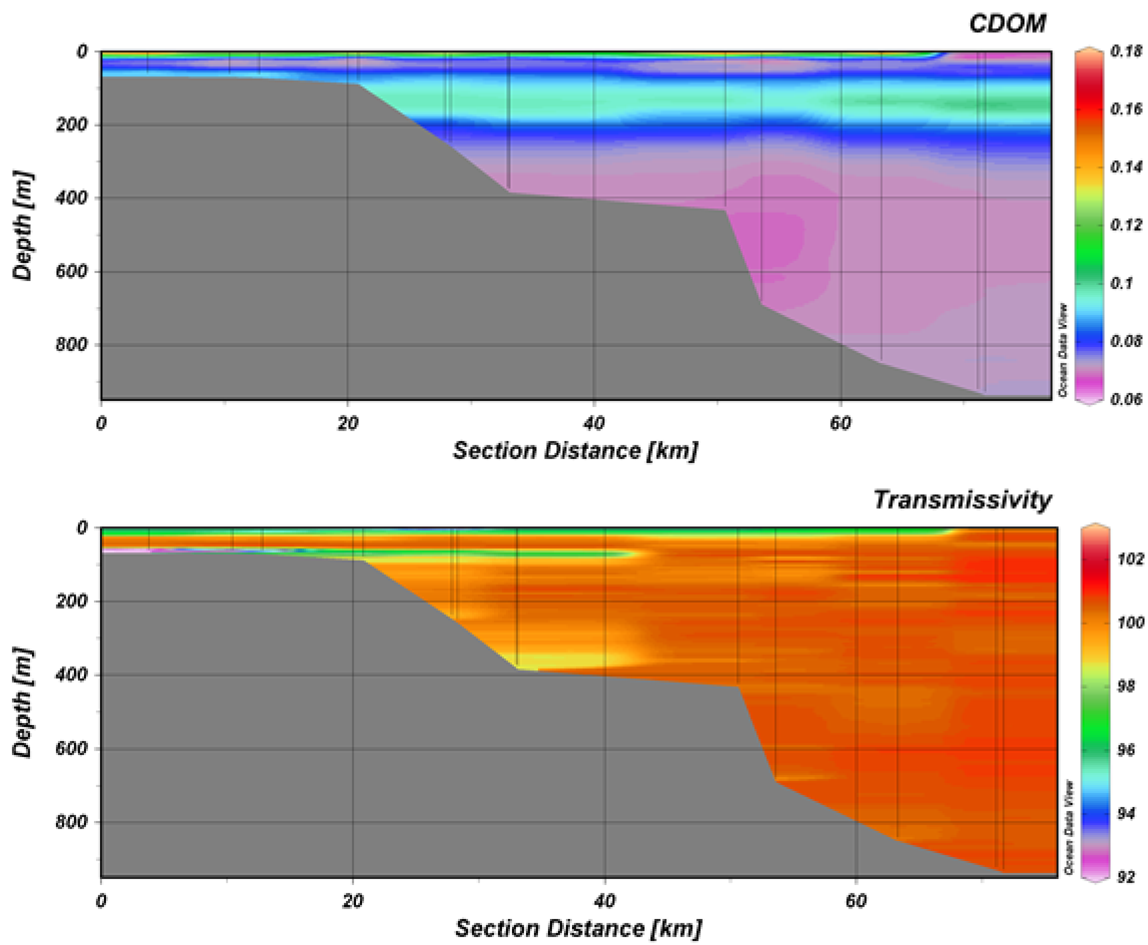



Figure 6.16. Dissolved Organic Matter (CDOM; above) and transmissivity (below) along the BP section. The BP section made up of Stations, from northwest to southwest, 9, 7, 16, 3, 4, 11, 13 and 18, sampled during Leg 2a (see map in Figure 6.9).

Two features are worth mentioning on this section (Figure 6.16): on the upper panel, the Pacific water layer is well defined by higher CDOM concentrations, as well as the thin surface layer. On the lower panel, the low transmissivity feature of ~ 400 was probably related to resuspended material drifting away from the shelf and slowly sinking. This feature was also observed in 2009.

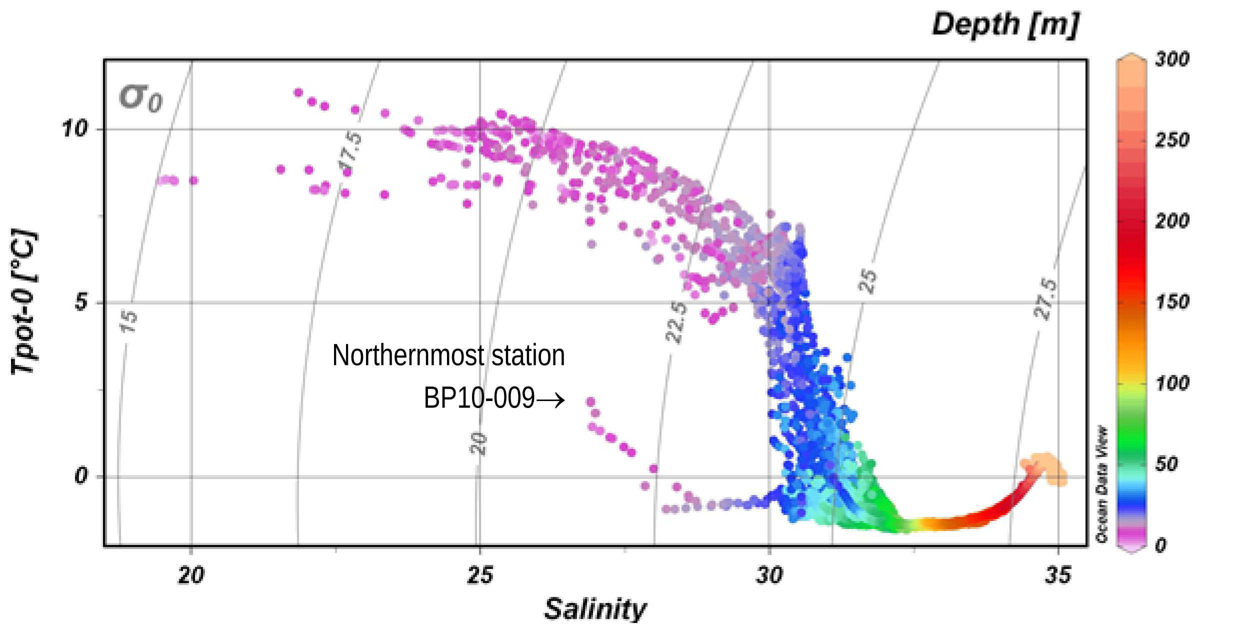



Figure 6.17. Potential temperature against salinity recorded with the CTD-Rosette profiler for all stations (all depths) located in the BP/IOL blocks and sampled during Leg 2. The color of each dot provides the 1-m bin average depth of each T/S signature. The isopycnals (sigma-theta, kg $m^{-3}$) are given in the background (grey curves).

Note the very warm (up to ~10°C) and relatively fresh (<28 salinity) surface layer detected in August-September 2010 in the study region (Figure 6.17).

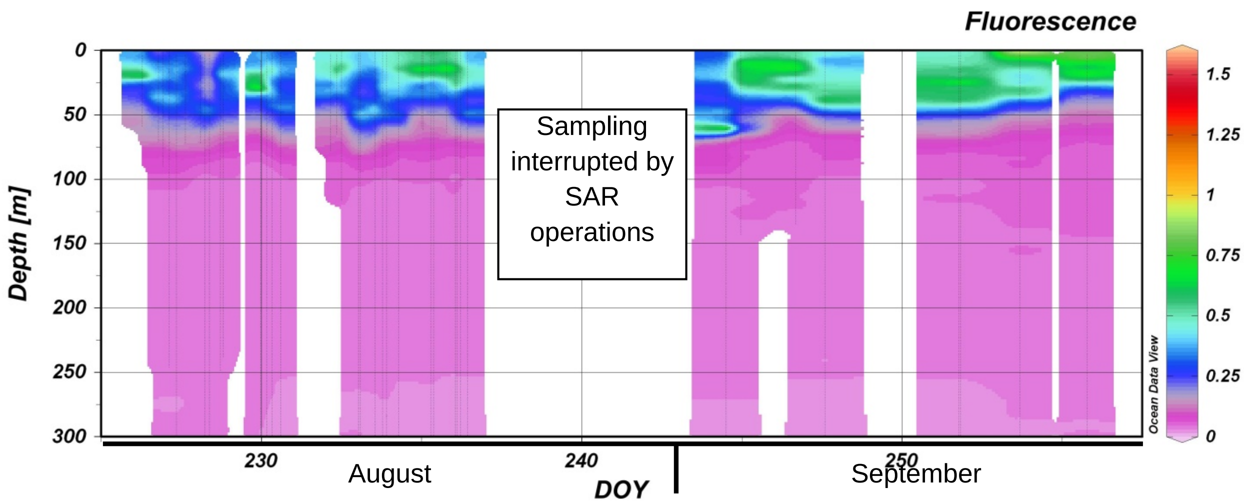



Figure 6.18. Time-series of relative and uncorrected chlorophyll fluorescence concentration (µg Chl *a* $L^{-1}$) recorded in the study area throughout the entire Leg 2 with the fluorometer probe attached to the CTD-

Rosette profiler. The x-axis is given in day-of-year (DOY) with number 1 being January 1st, 2010. Note the weak fluorescence (<1 µg Chl a L-1) detected in the surface layer. Sampling was interrupted in late August due to Search and Rescue (SAR) operations.

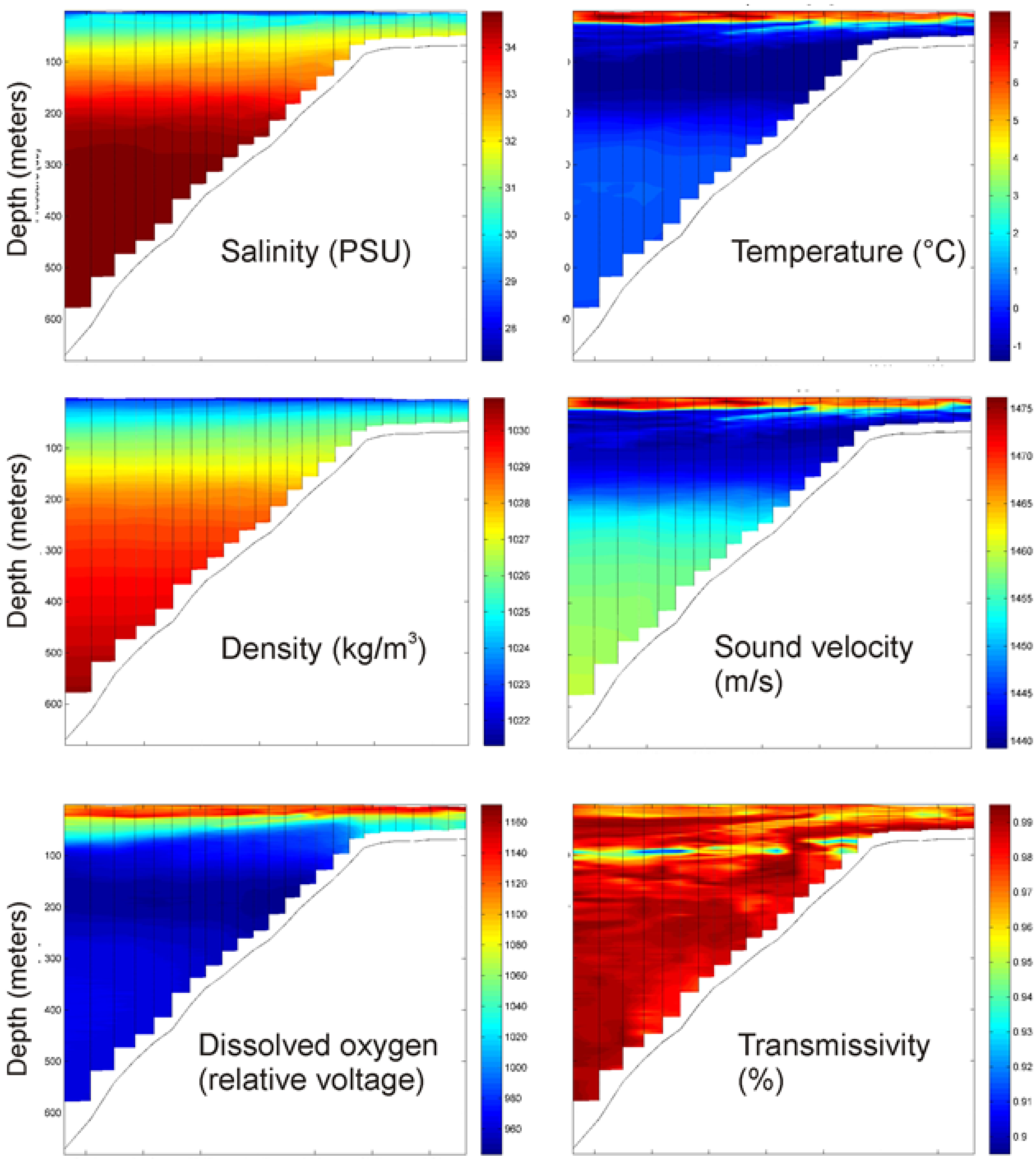



Figure 6.19. Physical-chemical properties of the water column acquired during the cross-shelf MVP transect (line 7) carried out on 03 September during Leg 2b. Thirteen other cross-shelf or along-shelf transects were performed during Leg 2b (Figure 6.10).

Note the strong vertical stratification in the area in Figure 6.19 exemplified by the density profiles and the marked intermediate nepheloid layer (turbid mid-water particle plume) apparent on the transmissivity transect. Unfortunately, the fluorescence probe encased in the MVP fish profiler did not work during Leg 2b.

## 6.6 Comments and recommendations

Rosette: The Rosette frame is unbalanced and too light. Weights should be added to compensate for the LADCP and also to make the Rosette generally heavier. It is estimated to require a supplementary 200 lbs.

Sensors: All sensors worked fine throughout Legs 1 and 2. Some anomalously low values in dissolved oxygen were recorded at depth at the beginning of Leg 2a (e.g. casts 5, 8, 9). This should be further explored as no cause was found. The problem was not apparent after 21 August.

Pump: No problems with the pump. During Leg 2, there were problems with the pump between the bottom and ~500 m on the upcast for casts 7, 8, 13 and 4. The problem was solved by changing a cable.

CTD: The CTD worked fine throughout Legs 1 and 2.

CTD and MVP acquisition computers: These two instruments should have distinct acquisition computers with a bare minimum of software (i.e. no Office® or Matlab®). The Brooke Ocean Technology technician recommended that both instruments should not be controlled by the same computer. If something happens to the computer, both instruments would be lost at the same time.

CTD data processing computer: A new processing computer with SeaSave, SBEDataProcessing, WinADCP, Microsoft Office® (Word, Excel and Power Point) and Matlab® installed is needed. All CTD, MVP, and LADCP data processing has to be done on the same computer so that the operators on shift have access to the same programs and to a single data set. This enables a smooth transition between different Legs and it is easier to back-up the processed data. This computer would need to have access to the “shares” folder to enable transfer of the processed CTD data.

Deck Unit: During Leg 1, the Deck Unit had some major problems during cast 1001073. It stopped communicating with the water sampler, and the deck unit had to be reset and a different data file created for the upcast. After that, there were some problems closing bottles (the signal had to be sent more than once for some bottles). The problems got worse on the attempted second cast at Station 312, the Rosette simply would not start. The tech team from U. Laval (led by S. Gagné) had to change a section of the cable. No problems were encountered during Leg 2.

Deck material (winch, A-frame, etc.): Everything worked fine in Leg 1, but during Leg 2, communication with the Rosette was lost at 400 m on cast 24. The splice on the Rosette cable had to be redone. The winch often shook vigorously on the first 20 m of the downcast and this could cause abnormal tension in the electro-mechanic wire and is not good for the connection. This should be checked as soon as possible or at the latest when the vessel returns to Quebec City.

LADCP: On some casts during Legs 2 and 3, two data files were created by the instrument instead of the usual one. The cause of this problem was not determined.

The LADCP was pitching and rolling significantly because the Rosette was not balanced. This had an effect on the data quality and in turn, will affect the data processing, but to what point, it is not known.

The acquisition of expendable, affordable “extension” cables for the LADCP is recommended. These cables could be used as expendable interface cables between the much more expensive T-cable and the RS-232 cable.

In shallow water, Visbek (2002) approach performs poorly. This happens whenever the instrument “sees” the bottom from the surface. It is recommended that the Rosette operators leave the LADCP under the surface a little longer than the three minutes suggested by SeaBird before starting the downcast to make sure that there are at least three “Short-term averages” (STA: one minute averages) to work with.

SM-ADCP: During Leg 1, the NAV signal (GPS) was erratic and therefore the data set is incomplete.

The SM-ADCP should have its own monitor and keyboard, instead of being accessible solely through the ship’s network. The acquisition process could not be verified for long periods of time because of network problems and as a result, data was lost during Legs 1 and 2. The ship’s navigation was lost regularly and the instrument stopped often for unknown reasons. During Leg 1001, the instrument logged ~600 mg instead of the usual ~4 gb. The Rosette operators should check the acquisition twice a day until the situation returns to the normal. Moreover, a 75 kHz, or better, a bi-frequency transducer should be acquired at the next opportunity. The vertical resolution would be halved but the depth penetration would be doubled.

# 7 Remote sensing and marine optics in Hudson Bay – Leg 1a

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## 7.1 Introduction

The general research objective of this study was to measure the *in situ* optical properties of the particulate and dissolved matter in order to better interpret the satellite images of ocean colour. Using data from satellites to measure sea surface temperatures as an indicator of physical processes (currents, upwellings, etc.) and ocean color data to measure chlorophyll concentration and evaluate phytoplankton productivity, the ArcticNet data will be utilized for interpretation and comparison measures. The optical properties of marine and coastal ecosystems in the Hudson Bay are complex due to the presence of large freshwater inflows. Accordingly, there remains an ongoing need to collect the relevant in situ data to validate the remote sensing data.

Enabling such data comparisons will contribute to the overall assessment of quantifying the response of the marine ecosystem to climate-induced variability and change in sea temperature. It will further contribute to the understanding of the environmental variables that govern the abundance and the species composition of the summer phytoplankton communities in Hudson Bay with a special attention to the hot spots.

## 7.2 Methodology

Different optical measurements were made during Leg 1a. The primary instrument was an optical profiling system (Figure 7.1) made of a variety of instruments enabling the measurement of various biological and optical water properties. These instruments were:

- A Wetlabs ACS measuring hyperspectral attenuation and absorption of light
- A Wetlabs AC9 equiped with a 0.2 µm filter to measure absorption by dissolved matter at 9 wavelengths
- A Wetlabs ECO-BB9 to measure light backscattering by particles at 9 wavelengths
- A Sequoia LISST-100X to measure the size spectra of particles up to 250 µm
- A pair of Satlantic hyperspectral light sensors to measure upwelling radiance and surface irradiance
- A Seabird SBE49 CTD to measure the vertical structure of the water column

- A pair of Wetlabs fluorometers to measure both phytoplankton and CDOM concentrations.

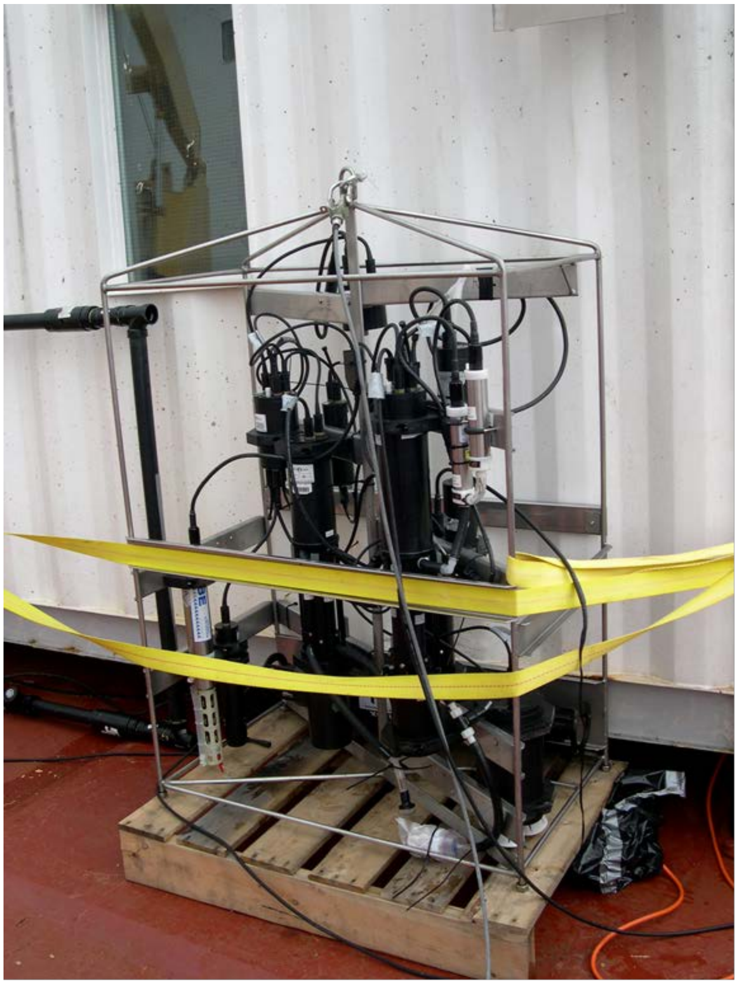

Figure 7.1. Optical profiler used during Leg 1a in Hudson Bay.

To complement the optical measurements, photos of the water surface and the sky were also taken.

Water samples were taken at different depths in order to complete the bio-optical informations gathered by the optical profiler. A surface water sample was collected using a bucket and two to three depths were sampled using the CTD-Rosette system. In general, samples were taken at 10 meters and at the chloromax depths at Nutrient stations while the sampled depths were 30%, 15% and chloromax at Basic stations.

Sea water samples were taken to measure total suspended matter using two different filters (GF/F and polycarbonate) in an effort to intercompare their respective performance. GF/F filters will also allow the determination of both the sample organic and inorganic fractions by burning the filter at 550°C. All samples were frozen at -80°C and will be processed upon the return of the ship. Filtrations were also made for HPLC and pigments absorption using GF/F filters. These samples were flash frozen in liquid nitrogen in the filtration laboratory and transferred to a dry shipper for conservation. Finally, samples were also collected for colored dissolved organic matter (CDOM) and chlorophyll content. The CDOM samples were stored in the -15°C freezer while chlorophyll was measured onboard using a fluorometer. In addition to planned stations, samples coming from four rivers located along the Hudson Bay coast were also processed in cooperation with the U. of Manitoba team. This should allow to better define the optical properties of inflowing fresh waters from different hydrographic basins.

Overall, all Nutrients and Basic stations were sampled except Stations 704 and 825, leading to an impressive spatial coverage of the optical properties of Hudson Bay that will complement the dataset acquired during the 2005 ArcticNet Expedition by improving both the spatial and temporal coverage.

## 7.3 Preliminary results

No preliminary results are available yet.

## 7.4 Comments and recommendations

The *Amundsen* equipment and facilities improved a lot over the years. The only recommendation made here is about the floor of the 610 laboratory, that is very slippery when it is wet, which happens very often due to the nature of the work being done there. This is really dangerous for the people working in that laboratory.

# 8 Freshwater-marine interactions in Hudson Bay – Leg1a

ArcticNet Phase 2 – Project titled *Freshwater-Marine Coupling in the Hudson Bay IRIS*.
http://www.arcticnet.ulaval.ca/pdf/phase2/barber_freshwater-marine_coupling.pdf

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## 8.1 Introduction

The general goal of the Freshwater – Marine Interactions Project is to document and study transfers of freshwater, suspended sediments, nutrients and organic matter into Hudson Bay from its watershed, to trace their circulation through Hudson Bay and, in particular, to investigate their effect on the light regime in Hudson Bay, with emphasis on studies in and near the estuaries of the Churchill and Hayes – Nelson Rivers in the southwest, and the Rivière de la Grande Baleine in the southeast.

The particular goals for Leg 1a were twofold:

- a collaborative systematic study on the relationship of water masses to organic matter composition (DOC) and the carbonate system using tracers, including salinity, colour and fluorescence spectra of organic matter (CDOM & FDOM), oxygen-18 isotope concentration ($\delta^{18}O$) and total alkalinity (TA), in order to determine the key drivers of carbon fluxes in Hudson Bay.

- a survey of the dimensions and gradients [salinity, suspended matter (TSM), chlorophyll-a (chla), DOC, CDOM, major nutrients, $\delta^{18}O$] of the plume of the Hayes and Nelson Rivers in Hudson Bay.

Previous work (Granskog et al. 2007, Else et al. 2008) indicated the significant influence of runoff as a source of labile organic carbon, resulting in remineralization and outgassing of $CO_2$ (Else et al. 2008ab), also evidenced by the loss of CDOM before waters exit Hudson Bay (Granskog et al. 2009). This suggests that ocean colour could be used to estimate $CO_2$ fluxes (Else et al. 2008), although this method would need to be refined, as currently there is very scarce data and large regional contrasts in bio-optical properties of surface waters in the bay (Granskog et al. 2007). Mundy et al. (2010) found that sea ice formation could possibly result in subsurface injections of carbon, through brine convection, and in surface dilution of DOC, possibly resulting in a sink of atmospheric $CO_2$ in areas where sea ice melt dominates. However, direct observations are lacking, and this data set could shed new light on the origin of deep waters in the bay.

This collaborative project takes a holistic approach, with collaborative sampling of tracers (salinity, $\delta^{18}O$, TA), organic matter (CDOM, DOC) and the carbonate system, to investigate which processes drive carbon cycling in Hudson Bay. The resulting data set will serve as validation data for remotely sensed ocean color in order to improve the reliability in estimating $CO_2$ fluxes from ocean color (or IR) data. TA could be used as an additional tracer for water masses, in addition to salinity, $\delta^{18}O$ and CDOM (Granskog et al. 2009), to investigate the origin of deep waters in the bay. Experiments on photochemical mineralization of CDOM would allow quantifying the remineralization of CDOM in different regimes in the Bay, and with the aid of irradiance measurements also the vertical distribution of photomineralization can be assessed. This would also improve the current understanding of the factors controlling the light penetration, and thereby primary production.

### *8.1.1 Hyperspectral reflectance data*

Optical properties of bodies of water depend heavily on the inherent properties of water as well as the optical properties of dissolved and suspended materials. This relationship is the basis for ocean colour remote sensing, which seeks to connect synoptic satellite images to processes occurring in the upper layers of the water surface. These processes are the connection between incoming solar radiation and marine primary production and serve an important role in the health of the bay.

This study aims to understand the influence of physical processes on biological systems through the connection between ice features—such as polynyas—and observed water colour. The areal focus of this study is a little-known latent heat polynya that occurs in the northwest corner of Hudson Bay (Saucier et al. 2004). Other coastal regions, including the sensible heat polynyas of the Nelson and Great Whale Rivers, may also be studied.

*In situ* validation is required for this study due to the optically complex nature of coastal and inland seas, of which Hudson Bay is a classic example. Existing ocean colour algorithms that relate optical response to constituent material are only appropriate in the case 1 waters that persist in the global ocean and are subject to extreme errors in shallow, high sediment, near ice, or freshwater-fed marine regions (IOCCG 2000). Optical data collected from above or below the surface for a given area can be used to compute the Apparent Optical Properties (AOPs) of the area, which can then be extrapolated to remotely sensed values collected from air- or spaceborne platforms. The goal of the field component was to calculate and relate the water leaving radiance for specific wavelengths of light and relate those to measured inherent properties of water thus serving as valuable validation data for further synoptic studies.

## 8.2 Methodology

### *8.2.1 Water masses, DOC and nutrients*

In Hudson Bay, 4 L of water was collected from the ship's CTD-Rosette at 10-m depth intervals (excluding 50 m) to 100 m depth or to the bottom, and in deeper water at 20 m intervals from 100 m to near-bottom. In Hudson Strait, 4-L samples were collected only at the surface, chlorophyll maximum and near-bottom. At every station, surface samples were collected by dipping 2 or 4 sample bottles directly into the sea, just below surface, either 1) by rope from the forward deck as the ship arrived on station, taking care to sample before water was disturbed by operation of the ship's bow thrusters, or 2) from the ship's boat (Zodiac) if it were launched at the station.

Samples were collected as described above for every named station in Hudson Bay (list below). In addition, water was sampled from above the limit of salt intrusion in 13 tributary rivers.

1. Full profiles (Hudson Bay): Stations 710, 698, 699, 701B, 720, CL, 702, 703, 709, 704, 730, 735, 745, 750, 760, 765, 770, 707, 706, 705(A,B,C,M), 790, 795, 800, 810, 820, 825, 830, 835, 840, and 740.
2. Surface, Chla max and near-bottom (Hudson Strait and Foxe Basin): Stations 356, 352, 360, 362, 370, and 350.
3. Rivers
   - Quebec shore: Pavungnituk, Kogaluk, Polemund, Innukshuak, Nastapoka, Nagaluk, Petite Baleine and Grand Baleine Rivers.
   - Nunavut/Manitoba shore: Rosemund, Tha' Anne, Thewiaza, Churchill Rivers
   - Ontario shore: Severn and Winisk Rivers.

Unfortunately, due to mechanical problems with the helicopter, followed by adverse flying weather, no freshwater sampling was carried out from either the Hayes or Nelson Rivers. The team had sampled both rivers frequently in previous years (2005, 2006, 2007 and 2009) for most of the parameters studied on this expedition.

All water samples were collected in 2-L large mouth polycarbonate bottles which had been acid-soaked and Milli-Q rinsed prior to the expedition, and which were Milli-Q rinsed between each sample collection. In every case, surface and Rosette samples were collected after rinsing bottles 3 times with sample water. Subsamples were filtered and stored for future analysis usually within 6 h of collection (or in a few cases, the day after collection, in which case they had been stored refrigerated in the interim).

Salinity was determined using the on-board salinometer for all offshore samples. Whole water from nearshore and inner estuarine samples was retained for later analysis at DFO-IOS (R. Macdonald). This latter group comprised samples collected in <20 m of water within the Hayes – Nelson Rivers estuary region, where turbidity might possibly have altered the calibration of the on-board salinometer.

Dissolved nutrients ($NO_3$, $NO_2$, P for all Hudson Bay stations; Si for rivers and the Nelson estuary region only) were subsampled only where identical samples were not collected by the nutrient team (J. Gagnon from J.-É. Tremblay's lab, U. Laval). Subsamples for dissolved nitrogen ($NO_3$, $NO_2$) and phosphorous were collected by filtration through GF/F filters (pre-combusted 5 h at 550°C; rinsed with 50 ml of sample water) and for dissolved silica through polycarbonate filters (1.2 µm). Subsamples were analyzed on board using Bran & Luebbe autoanalyzers.

Subsamples for DOC were collected by filtration through GF/F filters (pre-combusted 5 h at 550°C; rinsed with 50 ml of sample water) into autoanalyzer vials (pre-combusted, prepared with an aliquot of hydrochloric acid) and stored refrigerated (dark, at 4°C) for subsequent analysis at U. Quebec à Rimouski (M. Allard).

Subsamples for CDOM & FDOM were collected by filtration through GF/F filters (pre-combusted 5 h at 450°C; rinsed with 50 ml of sample water) into 60 ml sample bottles (acid soaked, Milli-Q rinsed, pre-combusted 5 h at 550°C) and stored refrigerated (dark, at 4°C) for subsequent analysis at Trent U. (C. Gueguen).

Subsamples for subsequent particulate nutrient (POC-PON, PP) and Chla determination were collected on 25 mm GF/F filters (pre-combusted 5 h at 550°C) over a gentle vacuum. Subsamples for subsequent TSM determination were collected on pre-weighed, 47 mm GF/F filters (pre-combusted 5 h at 550°C) over a gentle vacuum. All filters were stored frozen.

Unfiltered subsamples for subsequent $\delta^{18}O$ analysis were stored in 20 ml scintillation vials.

### *8.2.2 Hayes – Nelson Rivers Plume Study*

Manitoba Hydro funded four days of ship time on Leg 1a to be devoted to an investigation of the dimensions and gradients of the plume of the Hayes and Nelson Rivers in Hudson Bay. This study was carried out between 21 and 27 July 2010. The *Amundsen* arrived in the Hayes-Nelson region from Churchill on the evening of 21 July 2010. Due to the failure of a helicopter part, it was necessary to leave the region in the late afternoon of 24 July to return to Churchill to pick up the helicopter part. The ship arrived back in the Hayes-Nelson region on the morning of 26 July and left the region finally in the afternoon of 27 July.

In this time, surface water was sampled and CTD casts were made at over 70 stations in a region extending roughly 55 km from the Hudson Bay shore northward, and extending from the rivers' mouths ENE roughly 110 km, to just NE of Cape Tatnam (Figure 8.1). The calm seas and good weather allowed to complete an initial survey (surface samples and CTD casts) of the entire region in only 44 hours, from 22:00 on 21 July to 18:00 on 23 July. Water was also sampled at 10 m depth intervals at Stations 705A, 705B, 705C and 705M. Additional sampling (replication and more detailed cross-plume transects, helicopter sampling upstream in the Hayes and Nelson Rivers) was attempted on 27 July, but weather and the helicopter failure allowed for only some additional replicate sampling using the *Amundsen*.

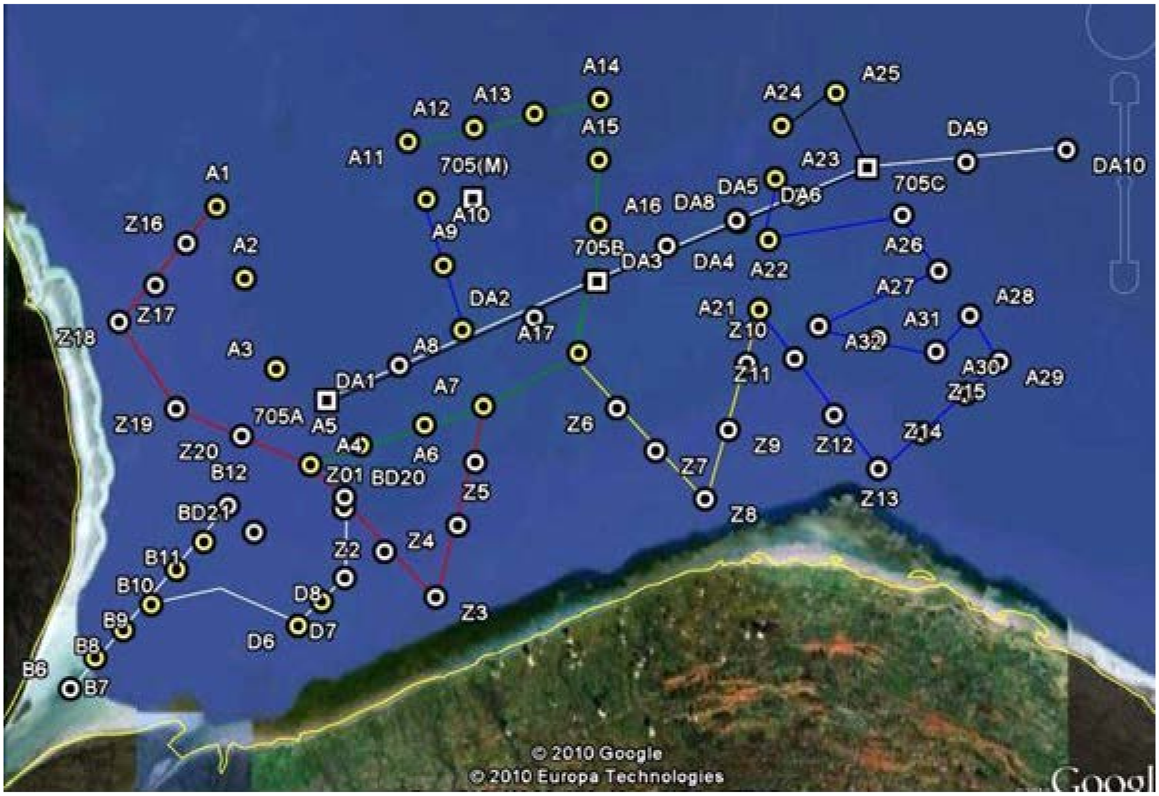


Figure 8.1. Stations sampled in the Hayes-Nelson Rivers region in Hudson Bay during Leg 1a. Lines indicate tracks of either the *Amundsen* or its barge or Zodiac boats.

At all stations, water was collected and vertical profiles of conductivity, temperature and turbidity were recorded using recently calibrated Idronaut CTDs. CTDs used in the survey were intercalibrated on site. Except at the four named ArcticNet stations (where full Rosette and ArcticNet CTD profiles were sampled) CTD casts were recorded to the bottom or to 30 m depth, whichever was less. Water was pre-processed (filtered and sub-samples stabilized) on board for later analysis for salinity, TSM, chla, CDOM & FDOM, $\delta^{18}O$, and dissolved and particulate organic carbon (DOC, POC), nitrogen ($NO_3$, $NO_2$, PON), and phosphorous (DP, PP) and dissolved silica (Si) [split by filtration on GF/F (C, N, P at 0.7 μm) or polycarbonate filters (Si at 1.2 μm)].

On 24 July, the Manitoba Hydro mooring at station 705M was successfully recovered. The mooring was deployed in August 2009 with only an RDCP set at 5 m above bottom, roughly 50 m depth in the water column. Data recovered extends from 05 August 2009 to 07 June 2010. A pair of moorings was redeployed (on separate anchors, within 100 m of each other) with instruments in the earlier 2007-2009 configuration: one with RDCP at 5 m above bottom and another with CTs at 10 m and 20 m above bottom and a CTD at 30 m above bottom, in 60 m of water.

In addition to this sampling program dedicated to characterizing gradients in the plume, the multi-beam sonar on board the *Amundsen* and its barge were used to extend detailed bottom mapping begun in 2007 to within the region mapped by Manitoba Hydro a few years ago. Finally, numerous biological and paleolimnological samples and measurements were completed by other ArcticNet researchers at one or more of Stations 705A, 705B, 705C and 705M (including carbon flux observations, net tows for phyto- and zooplankton, primary production measurements, vertical profiles of dissolved oxygen, nitrates/nitrites, chlorophyll-a and coloured dissolved organic matter fluorescence, optical beam attenuation, observations of reflectance, attenuation, absorption and backscattering spectra above the surface and within the water column, box cores for benthic invertebrates and contaminants measurements, gravity and piston cores for paleo studies of watershed-marine interaction)

### *8.2.3 Hyperspectral reflectance data*

Two separate and complimentary methods were used on Leg 1a: above- and in water. The above water method used a Satlantic HyperSAS ocean colour radiometer to measure three main variables and ancillary data from a point on the bow of the *Amundsen*. The in-water method collected similar data using the Satlantic HyperOCR Profiler II deployed from a Zodiac well away from the upper-layer mixing caused by ship wash and shadowing. These methods both can compute water leaving radiance as well as attenuation, reflection, and remote sensing reflectance. This is possible for 255 bands centred in the visible spectrum from 350-800 nm (violet-near infrared).

<u>HyperSAS – Above water radiometer</u>

The HyperSAS above water radiometer was composed of two aimed radiance sensors on a swivelling platform and an incoming solar irradiance sensor mounted on a pole away from shade. The downward-looking sensor measured $L_T$—upwelling radiance from the water surface—and $L_i$, the downwelling diffuse sky radiance.

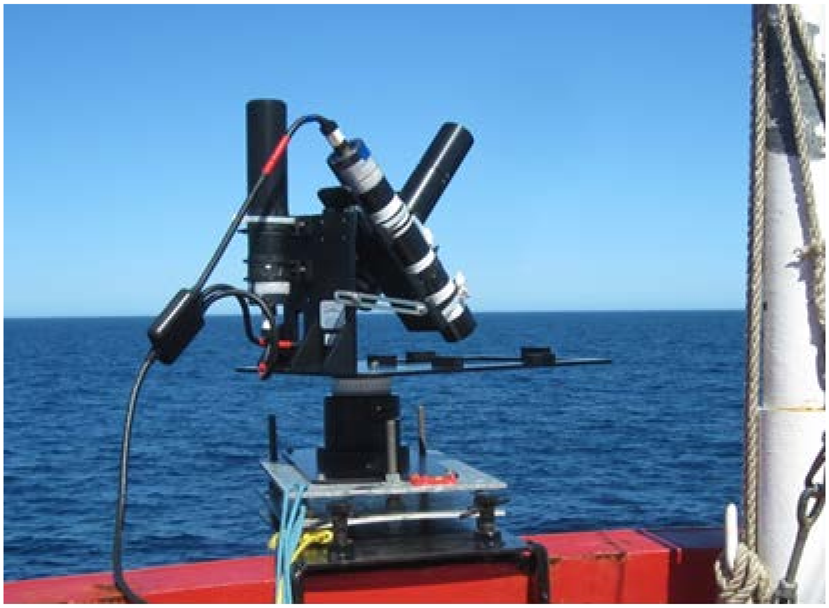

Figure 8.2. HyperSAS radiometer measuring above-water irradiance deployed on bow of the *Amundsen*.

The LT and Li sensors were mounted at equal angles away from nadir and zenith respectively (40° was used in this study) to properly compensate and remove sky glint from the $L_T$ signal. The separate surface irradiance sensor measured total irradiance reaching the Earth's surface and therefore the total radiation that reaches the air-water interface.

Figure 8.3. HyperSAS sky irradiance sensor used during Leg 1a.

This system was deployed in calm seas on the front lip of the bow, aimed 90 to 130 degrees away from the solar azimuth (130 was optimal) and carefully monitored to not be influenced by ship shadowing or bow thruster wash. Sup-optimal values were used when ship orientation or operations required movement. Ancillary data collected included pitch, roll, compass heading (magnetic) and GPS points at all collection sites. The sensor was mounted at and around Rosette, Basic, Mooring and Full stations, as well as periods of transit with calm seas and sunny skies. The versatility of the HyperSAS led to a great deal of data being collected during normal ship operations.

Figure 8.4. HyperSAS radiometer mounted 7.6 m above water surface to measure irradiance during Leg 1a.

HyperOCR Profiler II

The HyperOCR Profiler II is an in-water hyperspectral system that uses two immersed sensors and ancillary sensors to create a depth profile of upwelling radiance and downwelling irradiance to discern optical properties of a parcel of seawater. The system is unaffected by sky and sun glint but is more difficult to deploy, as it requires the use of a small boat away from the *Amundsen* and thus was only used at Basic, Mooring or Full stations.

The HyperOCR Profiler II acted as a CTD profiler, recording temperature, conductivity and pressure in addition to the two hyperspectral radiometers mounted on the unit. It transmitted real-time data to the base station operated on the boat where it was logged on a notebook computer. Data was collected on the descending cast, as the profiler was calibrated to freefall at a specific rate (0.3 m/s) and at a minimal tilt (<10°). Additionally, there was a sky irradiance sensor mounted on the boat similar to the HyperSAS setup.

The Profiler II was, like many optical systems, dependent on weather. A uniform sky condition (all clear or all cloudy) was preferable, with clear sky being optimal. Wave height can limit work performed on the Zodiac and foul weather made any operations unpractical. This deployment was also limited to daytime stations.

Figure 8.5. Deployment of the HyperOCR Profiler II from the Zodiac.

### *8.2.4 Meteorological observations*

During Leg 1a, manual weather and sea state observations were recorded every 3 hours, including temperature, relative humidity, atmospheric pressure, wind speed and direction, visibility, cloud fractional coverage, wave period and wave height (M. Asplin's team, U. of Manitoba). Digital ceilometer (cloud height) and all sky camera records (15 min. intervals) were successfully recorded throughout the expedition. The profiling radiometer on board failed and no useful data was recorded.

Two weather balloons were successfully launched during Leg 1a (Figure 8.6). One was launched at 03:30 EST on 14 July and reached a maximum altitude of 18 km. The second was launched on 20 July outside of Churchill into a thunderstorm system at 18:00 reaching a maximum altitude of 27 km.


Figure 8.6. Weather balloon launches during Leg 1a in Hudson Bay.

## 8.3 Preliminary results

Two longitudinal and two transverse sections of salinity profiles along the Hayes – Nelson Rivers plume are shown in the figures below. Vertical dimensions are pressure (dBar) and only approximately corrected for atmospheric pressure. None of the data have been thoroughly subjected to quality control and inter-calibration between instruments, and should be viewed as only an approximation of the salinity distributions encountered. All charts were prepared using Ocean Data View (Schlitzer, R., Ocean Data View, http://odv.awi.de, 2010).

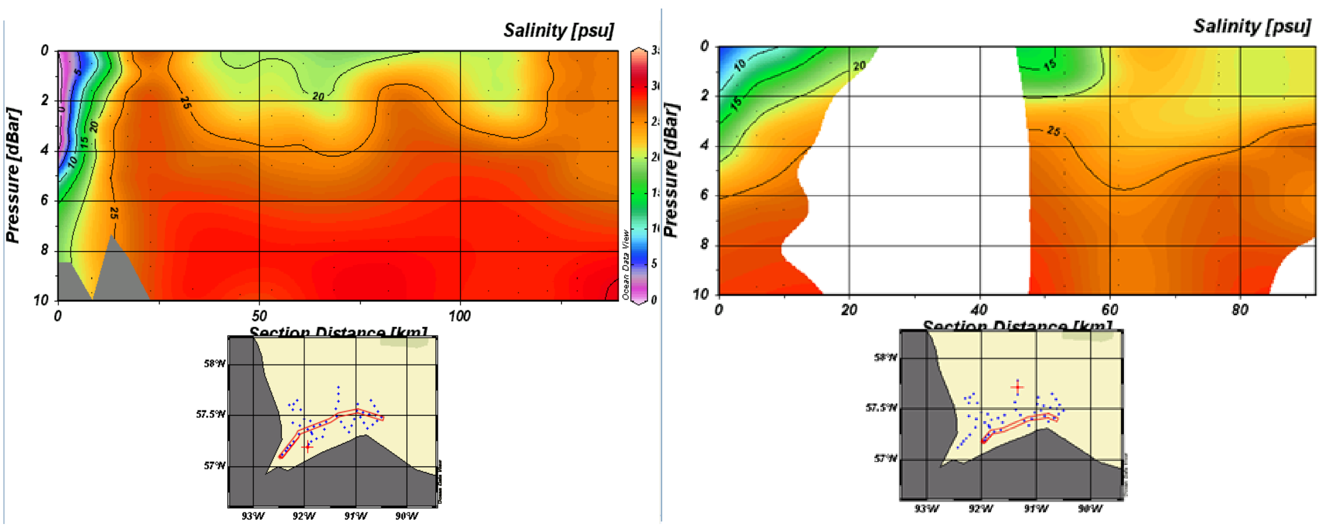


Figure 8.7. Longitudinal sections of salinity collected in the Hayes-Nelson Rivers plume following the 20 m isobath (left panel) and the 10 m isobath (right panel) in Hudson Bay during Leg 1a.

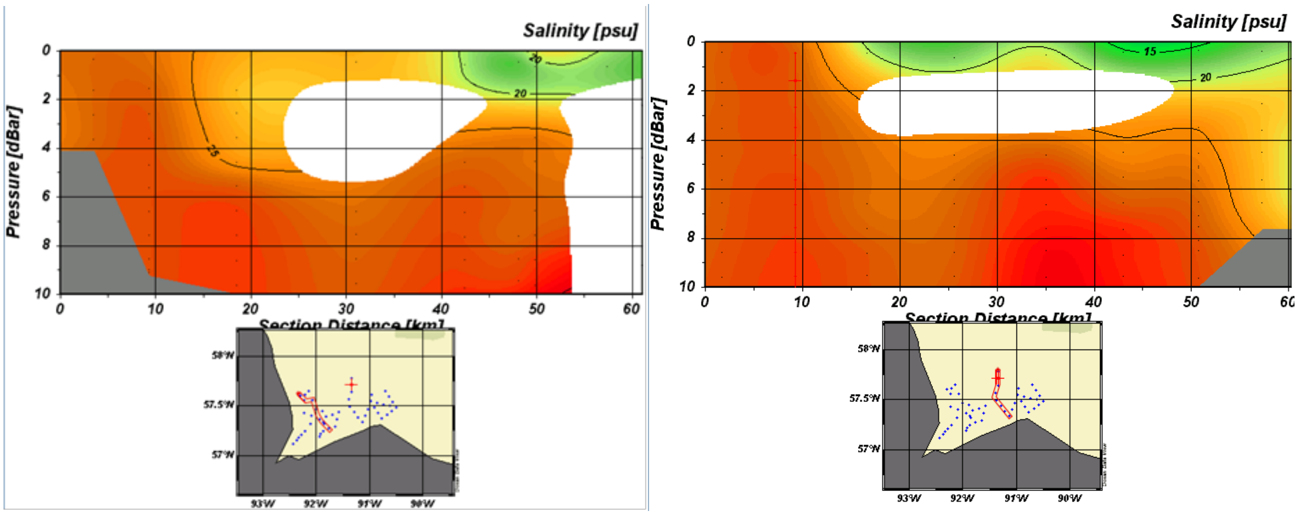


Figure 8.8. Transverse sections of salinity collected in the Hayes-Nelson Rivers plume 40 km from the mouth (left panel) and 80 km from the mouth (right panel) in Hudson Bay during Leg 1a.

### 8.3.1 *Hyperspectral reflectance data*

This data requires a great deal of processing, so this section will only display preliminary data. The following map shows the stations that have some optical data collected. The rest were not sampled due to station time (night or insufficient light) or poor weather. Fortunately, during this study many of the stations in the northwest were sampled, as were multiple river estuaries. Further processing is required to determine data quality and actual coverage.

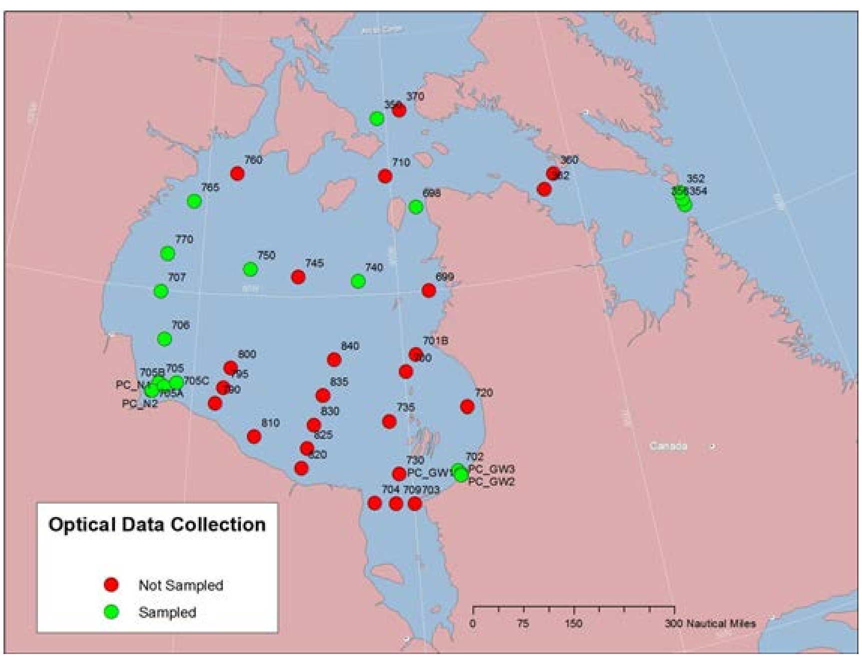


Figure 8.9. Map showing sites where optical data were collected in Hudson Bay during Leg 1a.

## 8.4 Comments and recommendations

A continuous record of spectral attenuation and absorption was attempted using surface waters piped to a spigot in the forward filtration laboratory (room# 610). Although the piping of the system was stainless steel, some rust apparently formed in the system and was carried at low but significant concentrations in the flow. It appears the stainless steel line suffers from the same problem as the Teflon line installed in 2007. During the first week of continuous flow-through measurements, rust formed a thin patina on the optical tubes and lenses of the ACS instrument which ultimately rendered all of the attenuation and absorption measurements unusable. Unless this problem can be rectified, the stainless steel in-ship sea water delivery system should not be used for measurements which may be deleteriously affected by, or with instruments which may be damaged by continuous exposure to low levels of suspended iron oxide and associated contaminants.

### *8.4.1 Hyperspectral reflectance data*

Relative to much of the work conducted within the ArcticNet program, optical sampling is less dependent on ship and crew resources as it is on weather and timing. More daylight stations would help to increase spatial coverage, but it is understandably difficult to control. Deployment of the Profiler II was particularly dependent on use of the Zodiac and as such was more difficult particularly if it had mechanical difficulties and was constrained by station time.

The HyperSAS set-up was time consuming as the system must be deployed and dismantled during every sampling session. The bow was a very good location, but was subject to waves and therefore could not serve as a ‘round the clock' location for the HyperSAS. Storage space on the foredeck may make it easier to deploy and retrieve in the future and be safer for sensitive equipment.

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# 9 Inorganic carbon system analysis – Legs 1a

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## 9.1 Methodology

Aqueous (sea and river water) samples were collected for both total inorganic carbon (TIC) and total alkalinity ($A_T$) analysis throughout Hudson Bay. These samples will be analyzed at the Institute of Ocean Sciences (DFO) and at Dalhousie University, and the results will allow calculating both pH and $p$CO$_2$ for comparison with independent measurements of $p$CO$_2$ and air-sea $CO_2$ flux by T. Papakyriakou's group (U. Manitoba), as well as long-term acidification and freshwater transport studies of the Arctic.

Up until 20 July, full profiles were collected, with single samples collected at each depth, at all Rosette stations. Surface samples for alkalinity (not using gas-clean methods) were also collected from some Zodiac and barge deployments, as well as from some helicopter deployments up some rivers.

After 20 July, the focus was primarily on surface waters, collecting water from each Primary Production or Nutrient Rosette only the surface, 10 m, and 60 m, with the surface sampled in duplicate. In addition, surface and 10 m samples were collected from the barge transect to the Nelson River (Stations B12, B8, and B6) using F. Wang's group (U. Manitoba) trace-metal clean Niskin. Finally, additional surface samples were collected by Zodiac at Stations 706, 705, 790, 830, and 840, again using the F. Wang's Niskin. Salinity samples were collected from all stations and depths that were not already being sampled by the G. McCullough's team (U. Manitoba).

Intercalibration samples were collected at the last station, #740. Duplicate samples, one bottle to go to IOS and one to go to Dalhousie for analysis, were collected from each depth, for a full profile.

Single samples from which both TIC and $A_T$ can be analyzed were collected into glass bottles, most of which met the standards of Dickson et al. (2007). However, some bottles used just before20 July, as well as in the intercalibration cast, had plastic screw caps and could not take a reproducible head-space. All samples were poisoned with 100 µL saturated $HgCl_2$ solution and stored in the dark in the refrigerated container on board for transport back to Quebec City. The samples will be analyzed by coulometric titration for TIC and potentiometric titration for $A_T$, both according to Dickson et al. (2007).

Samples were also collected for S. Johannessen (DFO-IOS), who will be conducting photochemical experiments back at IOS. These were 1-L samples, filtered through 0.2 μm polycarbonate and collected in duplicate along the Nelson River transect and at Stations 705b, 705c, 705, 800, 795, 790, 820, and 740. They were also refrigerated in the dark for transport back to Quebec City.

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# 10 Carbon and nutrients fluxes and marine productivity – Legs 1a, 1b, 2a, 2b, 3a, 3b and 3c

ArcticNet Phase 2 – Project titled *Marine Biological Hotspots: Ecosystem Services and Susceptibility to Climate Change*.
http://www.arcticnet.ulaval.ca/pdf/phase2/tremblayJE_marine_ecosystem_services.pdf

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## 10.1 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. Models predict further reductions in ice cover (ACIA 2004). These changes entail a greater penetration of light into surface waters, which is expected to bolster phytoplankton production (Rysgaard et al. 1999), food web productivity and $CO_2$ drawdown by the ocean. At present, phytoplankton production varies by two orders of magnitude across the Canadian Arctic, but the forcing mechanisms are poorly understood and quantified.

### *10.1.1 Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay*

The Hudson Bay system (i.e. Hudson Bay, Hudson Strait and Foxe Basin) is a large inland sea (1.23 x $10^6$ $km^2$; Granskog et al. 2007) located in the subarctic Canada. This system is covered by sea ice from mid-October to early August (Gagnon & Gough 2005) and receives an important freshwater discharge (*ca*. 592 $km^3$ $y^{-1}$) from the large drainage basin which surrounds it (*ca*. 3.1 x $10^6$ $km^2$) (Déry et al. 2005). Its subarctic location and the presence of a seasonal ice cover make the Hudson Bay system particularly vulnerable to climate-related changes. Several studies have already reported a reduction in the sea-ice extent (Gough et al. 2004, Gagnon & Gough 2006), an increase in surface water temperature (Gagnon & Gough 2005), an earlier ice break-up and a delayed freeze-up (Gough et al. 2004, Gagnon & Gough 2005, Markus et al. 2009) in the Hudson Bay area. According to Joly et al. (2010), the ice-free season in Hudson Bay will be reduced to 7 to 9 weeks during the period from 2041 to 2070. These changes entail a longer growth season associated with a greater penetration of light into surface waters, which is expected to favor 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. These forcing mechanisms on phytoplankton productivity were poorly studied and quantified in the Hudson Bay system until now. 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 this subpolar inland sea.

The main goals for Leg 1a were to:

- Establish the horizontal and vertical distributions of phytoplankton nutrients and the influence of different processes (e.g. mixing, upwelling and biological processes) on these distributions.
- Experimentally assess causal relationships between phytoplankton productivity and the availability of light.
- Determine the uptake of different sources of inorganic nitrogen by phytoplankton.
- Experimentally assess the relationships between nitrogen concentration, temperature, photosynthesis and the kinetics of nitrogen uptake.

Ancillary objectives were to calibrate the *SeaPoint* fluorometer and *ISUS* nitrate probe attached to the Rosette.

#### *10.1.2 Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

#### *Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

The environmental changes occurring in the Arctic entail a longer growth season associated with a greater penetration of light into surface waters, which is expected to favor 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. These forcing mechanisms on phytoplankton productivity were poorly studied and quantified in the Canadian Arctic system until now. 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.

The main goals for this team for Leg 1b and Leg 2a were to:

- Establish the horizontal and vertical distributions of phytoplankton nutrients and the influence of different processes (e.g. mixing, upwelling and biological processes) on these distributions.
- Experimentally establish nutrient uptake by different phytoplankton communities (i.e. Baffin Bay and Beaufort Sea) with different light availability
- Measure the spatial and temporal variability of the natural abundance of carbon and nitrogen stable isotopes to assess the nitrogen status of phytoplankton communities.

An ancillary objective were to calibrate the *SeaPoint* fluorometer and *ISUS* nitrate probe attached to the Rosette.

### *10.1.3 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

### *Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

### *Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords*

In the Canadian Archipelago, the productivity of phytoplankton is likely to be limited by light or the supply of allochtonous dissolved nitrogen, depending on ice conditions. The supply of allochtonous dissolved nitrogen is influenced by climate-driven processes, mainly the large-scale circulation, river discharge, upwelling and regional mixing processes. Over most of the western Arctic, and especially the Beaufort Sea, the concentrations of dissolved inorganic nitrogen (i.e. nitrate, nitrite and ammonium) at surface remain low throughout the year and the phytoplankton possibly depend on local recycling and the dissolved organic nitrogen (DON; e.g. urea, amino acids and primary amines) supplied by rivers. A large portion of the phytoplankton biomass is typically located within subsurface chlorophyll maxima (SCM). SCM productivity is possibly in balance with the episodic supply of nitrate across the halocline and/or the supply of ammonium and nitrate by local recycling and nitrification, respectively. Despite the importance of SCM for the food web and $CO_2$ fluxes, little is known about their structure, turnover and susceptibility to environmental variability and change.

The main goal of this project during Leg 3 was to determine the horizontal and vertical distributions of nutrients and to establish the influence of different processes (e.g. mixing, upwelling and biological processes) on nutrient concentrations. Ancillary objectives were to calibrate the *SeaPoint* fluorometer and *ISUS* nitrate probe attached to the Rosette.

## 10.2 Methodology

Samples for inorganic nutrients (ammonium, nitrite, nitrate, orthophosphate and orthosilicic acid) were taken at all Rosette stations (See page 99) 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). Additional samples for ammonium determination were taken at stations where incubations were performed and processed immediately after collection using the fluorometric method of Holmes et al. (1999).

Samples for the natural abundance of $^{15}$N and $^{13}$C in particulate organic matter were taken at surface (*ca*. 5 m) and at the depth of the chlorophyll maximum at stations where incubations were performed. Twelve to twenty-two liters per sampled depths were filtered onto 47 mm pre-combusted GF/F filters with a peristaltic pump. The filters were then dried at 60°C during 48 h. Isotopic composition will be determined in laboratory using an elemental analyzer coupled with an isotopic ratio mass spectrometer. These data will be used for nitrogen uptake calculations and to assess the nitrogen status of phytoplankton communities.

At each station, water samples from 5-8 depths in the water column were filtered onto Whatman GF/F filters for chlorophyll *a* (chl *a*) determination. Concentrations of chl *a* were determined on board the ship on a 10-AU Turner Designs fluorometer, after 24 h extraction in 90% acetone at 4°C in the dark (acidification method; Parsons et al. 1984). The fluorometer was calibrated using chl *a* extract from *Anacystis nidulans* (Sigma). These data will be used to calibrate the *SeaPoint* fluorometer coupled to the CTD-Rosette system.

### *10.2.1 Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay*

The relationship between light intensity and the uptake of C and N by phytoplankton (light-gradient incubation in Table 10.1 from surface (*ca*. 5 m) and chlorophyll maximum depths was assessed using dual labelling with stable isotopes of C and N in four light-gradient modules (10 light intensities per module). Temperature was maintained at *in situ* levels with a chilling circulator. Two sodium lights were used to illuminate the four modules. Samples from all modules were spiked with $^{13}$C-bicarbonate; two modules were amended with $^{15}$N-nitrate and two with $^{15}$N-ammonium. After incubation of 4 to 6 h, samples were filtered onto 24 mm pre-combusted GF/F filters. All filters were dried at 60°C and stored for post-cruise determination of isotopic enrichment and particulate organic carbon and nitrogen using an elemental analyzer coupled with an isotopic ratio mass spectrometer.

Table 10.1. List of sampling stations visited and measurements carried out for carbon and nutrient concentrations and fluxes during Leg 1a in Hudson Bay.

| Station | Cast | Date | UTC | Nuts | Natural abundance | Light gradient | $N_2$ fixation | Kinetics | Chlorophyll *a* |
|---|---|---|---|---|---|---|---|---|---|
| 356 | 003 | 07/07/2010 | 08:44 | X | X | X | | | X |
| 354 | 004 | 07/07/2010 | 11:08 | X | | | | | |
| 352 | 005 | 07/07/2010 | 13:35 | X | X | X | | | X |
| 362 | 006 | 08/07/2010 | 07:56 | X | X | X | | | X |
| 360 | 007 | 08/07/2010 | 11:11 | X | X | X | | | X |
| 370 | 008 | 09/07/2010 | 07:06 | X | | | | | |
| 350 | 010 | 09/07/2010 | 15:44 | X | X | X | X | | X |
| 710 | 011 | 10/07/2010 | 04:20 | X | | | | | |
| 698 | 012 | 10/07/2010 | 16:26 | X | | | | | |
| 699 | 013 | 11/07/2010 | 03:59 | X | X | X | X | | X |
| 701b | 015 | 11/07/2010 | 16:45 | X | | | | | |
| 720 | 016 | 12/07/2010 | 09:26 | X | | | | | |
| 702 | 019 | 13/07/2010 | 16:36 | X | X | X | X | | X |
| 703 | 021 | 15/07/2010 | 02:01 | X | | | | | |
| 709 | 023 | 15/07/2010 | 08:10 | X | X | X | X | | X |
| 704 | 024 | 15/07/2010 | 12:31 | X | | | | | |
| 730 | 025 | 15/07/2010 | 18:09 | X | X | X | X | | X |
| 735 | 027 | 16/07/2010 | 04:40 | X | | | | | |
| 745 | 030 | 17/07/2010 | 07:38 | X | X | X | X | X | X |
| 750 | 031 | 17/07/2010 | 15:50 | X | | | | | |
| 760 | 032 | 18/07/2010 | 04:01 | X | | | | | |
| 765 | 034 | 18/07/2010 | 13:50 | X | X | X | X | | X |
| 770 | 035 | 19/07/2010 | 00:10 | X | | | | | |
| 707 | 037 | 19/07/2010 | 09:52 | X | X | X | X | | X |
| 706 | 040 | 21/07/2010 | 13:14 | X | X | X | X | | X |
| 705a | 048 | 23/07/2010 | 11:17 | X | X | | X | | X |
| 705b | 049 | 23/07/2010 | 17:17 | X | X | | X | | X |
| 705c | 050 | 23/07/2010 | 21:03 | X | X | | X | | X |
| 705 | 051 | 24/07/2010 | 10:58 | X | X | X | X | | X |
| 800 | 054 | 28/07/2010 | 01:30 | X | | | | | |
| 795 | 055 | 28/07/2010 | 05:08 | X | | | | | |
| 790 | 056 | 28/07/2010 | 09:50 | X | X | X | X | | X |
| 810 | 058 | 29/07/2010 | 18:07 | X | | | | | |
| 820 | 060 | 29/07/2010 | 04:28 | X | X | X | X | | X |
| 825 | 061 | 29/07/2010 | 08:50 | X | | | | | |
| 830 | 062 | 29/07/2010 | 14:00 | X | | | | | |
| 835 | 063 | 29/07/2010 | 18:19 | X | | | | | |
| 840 | 064 | 29/07/2010 | 00:04 | X | X | X | X | X | X |
| 740 | 066 | 30/07/2010 | 14:56 | X | X | X | | | X |

Duplicate samples for labelled nitrogen ($N_2$) fixation were collected at surface (*ca*. 5 m) and incubated 24 h in two 600 ml bottles inoculated with 1 ml of $^{15}N_2$ through twin-valve bottle caps. Bottles were placed in an incubator illuminated by sun-simulating fluorescent tubes maintained at *in situ* temperature with a chilling circulator. Samples were then filtered onto 25 mm pre-combusted GF/F filters and dry 48 h at 60°C. $N_2$ uptake will be determined post-cruise using an elemental analyzer coupled with an isotopic ratio mass spectrometer.

The effect of temperature on carbon, nitrate and ammonium uptake was determined in two incubators maintained at 5 and 10°C, respectively, with high-capacity chilling circulators. Illumination was provided by sun-simulating fluorescent tubes. For each incubator, bottles were spiked at 6 different concentrations with the target $^{15}N$-labelled nitrogen source and a constant concentration of $^{13}C$-bicarbonate. Samples were incubated during 6 h and then filtered onto 25 mm pre-combusted GF/F filters and dried 48 h at 60°C. Post-cruise determination of isotopic enrichment and particulate organic carbon and nitrogen will be assessed using an elemental analyzer coupled with an isotopic ratio mass spectrometer.

### *10.2.2 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

Table 10.2. List of sampling stations and measurements for carbon and nutrient fluxes during Legs 1b and 2a.

| Leg | Station | Cast | Date | Nuts | Natural abundance | Chlorophyll *a* | Incubation |
|---|---|---|---|---|---|---|---|
| 1b | 301 | 70 | | X | X | X | X |
| 1b | 302 | 71 | | X | X | X | X |
| 1b | 303 | 73 | | X | | | X |
| 1b | 304 | 75 | | X | | | |
| 1b | 305 | 77 | | X | X | X | |
| 1b | 310 | 78 | | X | | | |
| 1b | 312 | 79 | | X | | | |
| 1b | 314 | 81 | | X | | | |
| 2a | BP10-18 | 1 | | X | | X | |
| 2a | BP10-14 | 3 | | X | | X | |
| 2a | BP10-15 | 4 | | X | | | |
| 2a | BP10-10 | 5 | | X | | | |
| 2a | BP10-12 | 6 | | X | | X | |
| 2a | BP10-09 | 9 | | X | | X | X |
| 2a | BP10-04 | 11 | | X | | | |
| 2a | BP10-07 | 14 | | X | | | |
| 2a | BP10-05 | 15 | | X | X | | |
| 2a | BP10-11 | 16 | | X | | | |
| 2a | BP10-01 | 17 | | X | | X | |
| 2a | BP10-02 | 18 | | X | | | X |
| 2a | BP10-08 | 20 | | X | | | |
| 2a | BP10-06 | 22 | | X | X | X | |
| 2a | BP10-13 | 26 | | X | | X | |
| 2a | BP10-03 | 28 | | X | | | |
| 2a | BP10-16 | 31 | | X | | | |
| 2a | BP10-17 | 32 | | X | | | |

The Si:N consumption ratio is higher in the Beaufort Sea, because of the higher Si:N dissolved ratio in this region (≈2) compared to Baffin Bay (≈1). This difference could be explained by a different taxonomic composition between the regional phytoplankton communities (mostly diatoms) or by a more important light limitation for nitrogen uptake at deep chlorophyll maximum in the Beaufort Sea. The relationship between light intensity and the nutrient uptake by phytoplankton from chlorophyll maximum depths was assessed using kinetic incubations in two light intensities (surface and chlorophyll maximum average light intensities). Temperature was maintained at 2ºC with a chilling circulator. Water for incubations was enriched in nutrients with deep filtered water or enriched-nutrient solutions. Incubation durations were between 24-48 hours with a sampling interval of 6 hours. Samples were analyzed using the Bran+Luebbe AutoAnalyzer 3 using standard colorimetric methods adapted for the analyzer (Grasshoff et al. 1999). There were some experimental issues for the incubations, so the calculation of nutrient uptake for the two light intensities will not be done. Incubations were coupled with filtrations for particulate organic carbon and nitrogen, total particulate phosphorus (24mm pre-combusted GFF filters, then dried at 60°C for post-cruise analysis using an elemental analyzer coupled with an isotopic ratio mass spectrometer), biogenic silica (0.8 µm polycarbonate filters, then frozen at -20°C for post-cruise analysis) and chlorophyll a.

### *10.2.3 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

### *Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

### *Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords*

Samples for inorganic nutrients (ammonium, nitrite, nitrate, orthophosphate and orthosilicic acid) were taken at all Rosette stations (Table 10.2 and Table 10.3) to establish detailed vertical profiles.

Table 10.3. List of sampling stations and measurements for carbon and nutrients during Legs 3a and 3b.

| Station ID | Cast # | Date | Time UTC | Nutrients |
|---|---|---|---|---|
| 437 | 006 | 10/01/2010 | 02:43 | X |
| 410 | 008 | 10/01/2010 | 07:36 | X |
| 412 | 009 | 10/01/2010 | 09:21 | X |
| 414 | 010 | 10/01/2010 | 10:53 | X |
| 416 | 011 | 10/01/2010 | 12:19 | X |
| 418 | 012 | 10/01/2010 | 13:36 | X |
| 408 | 017 | 10/07/2010 | 22:32 | X |
| 407 | 018 | 10/07/2010 | 04:09 | X |
| 405 | 022 | 10/08/2010 | 20:15 | X |
| 450 | 023 | 10/09/2010 | 06:53 | X |
| 308 | 025 | 10/11/2010 | 04:22 | X |
| 304 | 026 | 10/12/2010 | 20:22 | X |
| 324 | 028 | 10/14/2010 | 16:33 | X |
| 323 | 029 | 10/14/2010 | 20:01 | X |
| 115 | 031 | 10/15/2010 | 23:29 | X |
| 113 | 034 | 10/16/2010 | 08:00 | X |
| 111 | 037 | 10/16/2010 | 13:43 | X |
| 110 | 038 | 10/16/2010 | 17:17 | X |
| 109 | 039 | 10/16/2010 | 19:34 | X |
| 107 | 042 | 10/17/2010 | 04:26 | X |
| 105 | 044 | 10/17/2010 | 14:39 | X |

Table 10.4. List of sampling stations and measurements for carbon and nutrients during Leg 3c.

| Station | | Region | Start | | Stop | | Depth (m) |
|---|---|---|---|---|---|---|---|
| ID | Type | | Latitude N | Longitude W | Latitude N | Longitude W | |
| 600 | Basic | Nachvak Fiord | 59° 05' 28" | 63° 26' 13" | 59° 05' 23" | 63° 26' 13" | 207 |
| 602 | Basic | Nachvak Fiord | 59° 03' 24" | 63° 51' 99" | 59° 03' 21" | 63° 51' 96" | 165 |
| 604 | Nutrients | Nachvak Fiord | 58° 59' 88" | 63° 53' 58" | 58° 59' 88" | 63° 53' 59" | 55 |
| 610 | Nutrients | Saglek Fiord | 58° 30' 09" | 62° 41' 38" | 58° 29' 94" | 62° 41' 25" | 130 |
| 613 | Nutrients | Saglek Fiord | 58° 29' 03" | 63° 13' 11" | 58° 29' 04" | 63° 13' 08" | 255 |
| 615 | Basic | Saglek Fiord | 58° 19' 16" | 63° 32' 44" | 58° 19' 17" | 63° 32' 43" | 132 |
| 617 | Basic | Saglek Fiord | 58° 30' 09" | 62° 41' 38" | 58° 29' 94" | 62° 41' 25" | 132 |
| 630 | Basic | Okak Bay | 57° 28' 33" | 62° 26' 78" | 57° 28' 32" | 62° 26' 79" | 50 |
| 631 | Nutrient | Okak Bay | 57° 29' 66" | 62° 11' 40" | 57° 29' 61" | 62° 11' 44" | 87 |
| 632 | Nutrient | Okak Bay | 57° 34' 10" | 62° 03' 10" | 57° 34' 10" | 62° 03' 09" | 83 |
| 633 | Basic | Okak Bay | 57° 36' 30" | 61° 54' 26" | 57° 36' 23" | 63° 54' 24" | 178 |
| 620 | Basic | Anaktalak Bay | 56° 24' 03" | 61° 12' 71" | 56° 24' 05" | 61° 12' 68" | 70 |
| 622 | Nutrient | Anaktalak Bay | 56° 25' 03" | 61° 44' 05" | 56° 25' 08" | 61° 44' 05" | 83 |
| 623 | Nutrient | Anaktalak Bay | 56° 26' 80" | 61° 56' 47" | 56° 26' 79" | 61° 56' 49" | 95 |
| 624 | Basic | Anaktalak Bay | 56° 25' 22" | 62° 04' 25" | 56° 25' 22" | 62° 04' 26" | 62 |

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# 11 Molecular microbial diversity in the Canadian Arctic – Legs 1a, 3a and 3b

ArcticNet Phase 2 – Project titled Marine Biological Hotspots: Ecosystem Services and Susceptibility to Climate Change.
http://www.arcticnet.ulaval.ca/pdf/phase2/tremblayJE_marine_ecosystem_services.pdf

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## 11.1 Introduction

Microbes are a heterogeneous group that includes bacteria, archaea and small single celled protists, and are key to understanding the dynamics of marine ecosystems. They are numerically the most abundant organisms in Arctic seas and despite their small size they account for the bulk of biomass. Marine microbes form the basis of marine food webs and play an important role in the global carbon and nitrogen cycles as well as in many other nutrient cycles. While these communities are highly diverse, the majority of organisms cannot be cultured, and are virtually impossible to distinguish morphologically. Molecular tools must therefore be used to describe their genetic and functional diversity. Clone libraries, denaturing gradient gel electrophoresis, qPCR and fluorescent *in situ* hybridization are all examples of such tools. The study of different genes, their function, diversity, and expression leads to a better understanding of the detailed role of microbes in our ecosystems. Recent advances, applying molecular based techniques to probe DNA collected from the sea have revealed surprising diversity of both prokaryotic and eukaryotic microbes in all systems investigated.

Previous data from the North Water (NOW), Canada Basin, Beaufort Sea and Norwegian Arctic waters has revealed distinct and diverse microbial communities at different depths and among marine systems that harbour a pool of microbial genes implicated in nutrient cycles and food webs.

The goal for the 2010 Expedition in Hudson Bay and through the Canadian Arctic was to collect samples for DNA- and RNA-based analyses and conventional and epifluorescent microscopy.

### *11.1.1 Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay*

The first objective was to collect microbial DNA and ancillary data from the Hudson Bay, which is a freshwater and coastal system influenced sub-arctic marine environment, and to compare this to contrasting Arctic systems. The second objective was to obtain RNA samples from the same sites to investigate expression of key genes under different oceanographic conditions. The cruise path of the CCGS *Amundsen* on Leg 1a was ideal for these objectives.

## 11.2 Methodology

The sampling strategy was to obtain microbial and other biological data from different water masses in the water column, such as the upper mixed layer, the Chlorophyll maximum, the nitracline and the deep layer. In addition, the sampling choices were based on readouts from the CTD's oxygen, temperature, salinity and fluorescence probes. Biologically significant features were identified during the downcast of the CTD-Rosette. All variables were sampled using standard techniques:

DNA: Deoxyribonucleic acids, for biodiversity analysis using serial filtration, eukaryotes on 3 µm polycarbonate filters and prokaryotes on 0.2 µm Sterivex filters.
RNA: Ribonucleic acids, for enzymes expression using RNase cleaned serial filtration, similar as for DNA.
Chl *a*: Chlorophyll a, for concentration estimation.
HPLC: High Pressure Liquid Chromatography, for pigment analysis.
DAPI: 4'6-diamino-2-phenylindole, for pico and nano plankton concentration estimation using epifluorescence microscopy.
FISH: Fluorescence in situ Hybridization, applied to eukaryotes and prokaryotes respectively, for concentration estimation of specific microbial groups.
Virus: Virus-like particles (as well as bacteria plus archaea), for concentration estimation using SYBR Gold and microscopy.
FNU: Fluorescence Normarski Utermohl, for protist identification.

### *11.2.1 DNA and RNA*

Samples for DNA and RNA were collected by filtering seawater onto a 3 µm polycarbonate filter and a 0.2 µm Sterivex cartridge (Fisher Scientific) using a peristaltic pump. This method allowed separating the large and small size fractions of the microbial community.For RNA, 4 L were filtered at 4ºC to prevent degradation of the fragile RNA molecule. Filters were stored in RLT buffer (Qiagen) with ß-mercaptoethanol, flash-frozen in liquid nitrogen, and then stored at -80 ºC. For DNA, 6 L of water were filtered at room temperature. Filters were stored in lysis buffer (50 mM tris, 40 mM EDTA and 0.75 M sucrose) at -80 ºC.

DNA for Guelph (Leg 3): Only at the surface, samples for DNA were collected for researcher L. N'Guessan at the University of Guelph using the sample method as above.

### *11.2.2 Chlorophyll a and HPLC*

While other teams onboard the *Amundsen* collected water column samples for chlorophyll *a*, the depths they sampled were not always the same as for microbial diversity. It was therefore decided to collect chlorophyll samples from each depth at every station. 500 ml of seawater was filtered through a glass fibre filter and stored in darkness at -80ºC. In addition, the same quantity of water was pre-filtered 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.

Samples for HPLC analyses where collected at the surface and chlorophyll maximum. 2 l of seawater was filtered through a glass fibre filter, flash-frozen in liquid nitrogen, and then stored at -80 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.

### *11.2.3 Epifluorescent Microscopy*

Slides were made for epifluorescent microscopy at each station and depth sampled. These slides will be used to estimate bacterial and eukaryote abundance. Seawater was fixed with 2.5 % glutaraldehyde and processed 1-24 hours after sampling. For eukaryotic organisms, 50 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 -20 ºC. An identical procedure was followed for bacteria, except that 15 ml were filtered onto a 0.2 µm black polycarbonate filter.

### *11.2.4 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 6-24 hours after sampling. For eukaryotic organisms, 90 ml of fixed sample was filtered onto a 0.8 µm polycarbonate filter. For bacteria, 10 ml was filtered onto a 0.2 µm polycarbonate filter. Filters were air-dried and stored at -20 ºC.

### *11.2.5 Conventional Light Microscopy*

At each station and at surface and chlorophyll maximum, 225 ml of seawater was collected and fixed using FNU fixative (1 % paraformaldehyde, 0.1 % glutaraldehyde). At Université

Laval, 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.

### *11.2.6 Plankton net*

A phytoplankton net (35 µm pore size) was deployed at each station. The net was deployed vertically to 50 m depth. Sub-samples from the phytoplankton net were fixed with FNU (45ml) and with Lugol iodine (50ml) for use in light microscopy. The rest of the sample was filtered through a cellulose acetate filter and stored in ethanol at 4 ºC in the dark.

### *11.2.7 Grazing experiment (Leg 3)*

Grazing experiments using fluorescently-labelled bacteria (FLBs) were carried out at selected stations and depths following the protocols obtained from Vaqué and Unrein (Institut Ciencies del Mar, Barcelona) with slight alterations. Such grazing experiments give a semi-quantitative estimate of the consumption of bacteria by naturally occurring eukaryotic assemblages. An appropriate concentration of FLBs was added to replicate seawater samples, and the subsampled at 0 minutes, 45 minutes and 120 minutes. Subsamples were taken as described in "Epifluorescent Microscopy" (no subsamples were taken for FISH).

Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

In total, 17 stations were sampled during Leg 1a (Table 11.1), including 15 stations where four depths were sampled for all variables and two additional stations were sampled for most variables.

Table 11.1. Summary of stations sampled for molecular microbial diversity in Hudson Bay during Leg 1a.

| **Date in 2010** | **Station** | | | | **Number of samples for each analysis (1 per depth)** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Station type** | **Station number** | **Cast number** | **Depth (m)** | **DNA (< 3 µm & > 3 µm)** | **RNA (< 3 µm & > 3 µm)** | **Chl *a* (< 3 µm & total)** | **HPLC (< 3 µm & total )** | **DAPI (Prokaryotes & Eukaryotes)** | **FISH (Prokaryotes & Eukaryotes)** | **Virus** | **FNU** |
| 07.07 | Nutrient | 354 | 004 | 572 | 4&4 | 0 | 4&4 | 0 | 4&4 | 4&4 | 0 | 2 |
| 09.07 | Basic | 350 | 009 | 388 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 0 | 2 |
| 10.07 | Nutrient | 710 | 011 | 278 | 4&4 | 0 | 4&4 | 0 | 4&4 | 4&4 | 0 | 2 |
| 11.07 | Basic | 699 | 014 | 83 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |

| Date in 2010 | Station | | | | Number of samples for each analysis (1 per depth) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Station type | Station number | Cast number | Depth (m) | DNA (< 3 µm & > 3 µm) | RNA (< 3 µm & > 3 µm) | Chl *a* (< 3 µm & total) | HPLC (< 3 µm & total ) | DAPI (Prokaryotes & Eukaryotes) | FISH (Prokaryotes & Eukaryotes) | Virus | FNU |
| 12.07 | Lovejoy | Umq | 017 | 110 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 13.07 | Mooring | 702 | 020 | 135 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 15.07 | Basic | 709 | 023 | 88 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 15.07 | Basic | 735 | 026 | 178 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 4&4 | Basic | 745 | 029 | 184 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 18.07 | Mooring | 765 | 033 | 104 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 19.07 | Mooring | 707 | 038 | 101 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 21.07 | Mooring | 706 | 041 | 78 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 23.07 | Full | 705a | 048 | 34 | 3&3 | 3&3 | 3&3 | 2&2 | 3&3 | 3&3 | 4 | 2 |
| 24.07 | Mooring | 705 | 052 | 64 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 28.07 | Basic | 790 | 057 | 36 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 28.07 | Basic | 820 | 059 | 53 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| 29.07 | Basic | 840 | 065 | 175 | 4&4 | 4&4 | 4&4 | 2&2 | 4&4 | 4&4 | 4 | 2 |
| **Total number of samples** | | | | | **134** | **118** | **134** | **60** | **134** | **134** | **56** | **34** |

## Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea

## Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

Table 11.2. Summary of stations sampled for molecular microbial diversity during Legs 3a and 3b.

| Date | Station | Cast # | Bottle # | Depth (m) | Feature | Grazing Experiment |
|---|---|---|---|---|---|---|
| **Leg 3a** | | | | | | |
| 27/09/2010 | Ice Core | | | | | |
| 28/09/2010 | NWBI-1 | 5 | 2 | 369 | bottom | * |
| | | | 11 | 100 | nitricline | * |
| | | | 13 | 60/55 | chl max | * |
| 29/09/2010 | Ice Core | | | | | |
| 29/09/2010 | Ice Core | | | | | |
| 01/10/2010 | 437 | 7 | 1,2 | 349 | bottom | * |
| | | | 3,4 | 230 | ox. Min | * |
| | | | 5,6 | 80 | Temp min | * |
| | | | 7,8 | 60 | nitricline | * |
| | | | 9,10 | 37 | chl max | Yes |
| | | | 11,12 | 0 | surface | * |
| 06/10/2010 | 408 | 17 | 1,2 | 195 | bottom | * |
| | | | 12,13 | 46 | chl max | Yes |
| | | | 23,24 | 2.5 | surface | * |
| 07/10/2010 | 407 | 19 | 1,2 | 385 | bottom | |
| | | | 3,4 | 200 | ox. Min. | * |
| | | | 5,6 | 80 | nitricline | * |

| Date | Station | Cast # | Bottle # | Depth (m) | Feature | Grazing Experiment |
|---|---|---|---|---|---|---|
| | | | 7,8 | 56 | chl max | * |
| | | | 9,10 | 38 | halocline | * |
| | | | 11,12,13 | 0.5 | surface | Yes |
| 08/10/2010 | 405 | 20 | 1,2 | 604 | bottom | * |
| | | | 3,4 | 170 | | * |
| | | | 5,6 | 55 | | * |
| | | | 7,8,9 | 40 | | Yes |
| | | | 10,11,12 | 2 | surface | * |
| **Leg 3b** | | | | | | |
| 09/10/2010 | 450 | 23 | 1,2 | 90 | bottom | * |
| | | | 14,15 | 18 | chl. Max | * |
| | | | 23,24 | 1 | surface | * |
| 11/10/2010 | 308 | 24 | 1,2 | 538 | bottom | * |
| | | | 3,4 | 450 | ox feature | * |
| | | | 5,6 | 300 | ox feature | * |
| | | | 7,8 | 60 | nitricline | * |
| | | | 9,10 | 22 | halocline/temp max | * |
| | | | 11,12,13 | 1 | surface | Yes |
| 12/10/2010 | 304 | 27 | 1,2 | 297 | bottom | * |
| | | | 5,6 | 240 | Atlantic water | * |
| | | | 7,8 | 130 | Oxygen min. | * |
| | | | 11,12 | 18 | halocline | * |
| | | | 13,14,15 | 1 | surface | Yes |
| 14/10/10 | 323 | 30 | 1,2 | 789 | bottom | * |
| | | | 3,4 | 420 | Atlantic water | * |
| | | | 5,6 | 100 | temp min | * |
| | | | 7,8 | 20 | temp max | * |
| | | | 9,10,11 | | surface | Yes |
| 16/10/10 | 115 | 32 | 1,2 | 647 | bottom | * |
| | | | 3,4 | 420 | | * |
| | | | 5,6 | 340 | | * |
| | | | 7,8 | 250 | warm layer | * |
| | | | 9,10 | 75 | temp feature | * |
| | | | 11,12 | 50 | cold layer | * |
| | | | 13,14 | 25 | halocline | * |
| | | | 15,16 | 1 | surface | Yes |
| 16/10/10 | 111 | 36 | 1,2 | 594 | bottom | * |
| | | | 3,4 | 220 | warm water | * |
| | | | 5,6 | 60 | temp min | * |
| | | | 7,8 | 30 | temp max | * |
| | | | 9,10,11 | 2 | surface | * |
| 17/10/10 | 108 | 41 | 1,2 | 457 | bottom | * |
| | | | 3,4 | 210 | Atlantic water | * |
| | | | 5,6 | 160 | | * |
| | | | 7,8 | 60 | chl max | Yes |
| | | | 9,10,11 | 1 | surface | * |
| 17/10/10 | 105 | 45 | 1,2 | 314 | bottom | * |
| | | | 3,4 | 150 | 2nd thermocline | * |
| | | | 5,6 | 100 | temp | * |
| | | | 7,8 | 50 | thermocline | * |
| | | | 9,10,11 | 1 | surface | * |

### 11.3 Preliminary results

It is currently not feasible to conduct further analysis on board for most of the samples, and results of the microbial surveys will be known only after extensive laboratory work at U. Laval. The epifluorescence microscope on board the *Amundsen* was used for non-exhaustive counting of prokaryotes, viruses and small flagellates. The access to these data gave immediate insight on different regions sampled, and they are still in process.

The samples that were collected for molecular and microscopic analyses, will provide a more detailed understanding of the phylogeny, structure, and function of microbial communities in the Canadian Arctic.

### 11.4 Comments and recommendations (Leg 1)

One fume hood onboard should be designated to manipulate concentrated acids (i.e., dilutions to obtain a working stock) and set up with a specific filter for this type of chemicals.

Problems were also encountered relative to the use of the fume hood in room 553: (1) its efficiency was not optimal (weak aspiration of chemical vapors) leading to dispersion in the room and inhalation by users; (2) its users, the Hintelmann and Lovejoy groups, were using non-compatible chemicals at the same time.

# 12 Phytoplankton biomass and primary production – Legs 1a, 1b, 3a, 3b and 3c

ArcticNet Phase 2 – Project titled *Marine Biological Hotspots: Ecosystem Services and Susceptibility to Climate Change*.
http://www.arcticnet.ulaval.ca/pdf/phase2/tremblayJE_marine_ecosystem_services.pdf

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**Cruise participants Legs 1a and 1b**: Joannie Ferland[1] and Mathieu Ardyna[1]
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## 12.1 Introduction

Primary production plays a central role in the Arctic Ocean as it supplies organic matter to the higher trophic levels, including the arctic cod key specie as well as marine mammals. Marine ecosystems in Polar Regions are particularly sensitive to any change in primary production due to their low number of trophic links (Grebmeier et al. 2006, Moline et al. 2008, Post et al. 2009). Primary production is extremely sensitive to climate variability and change (Arrigo et al. 2008, Pabi et al. 2008). Phytoplankton is also a key factor in ocean biogeochemistry as it acts as the power source for the biological pump of the atmosphere/ocean carbon cycle. Therefore, any modification of the phytoplankton production and community will play a critical role in the response of the climate change.

The Arctic ecosystem is already undergoing climate changes as the shrinking of its sea ice cover, the loss of ice thickness (Stroeve et al. 2007, Kwok et al. 2009) and early melt/late freeze-up of the ice (Markus et al. 2009), and increase of the hydrological cycle (Peterson et al. 2006, Serreze et al. 2006).

The general objectives of this team for Legs 1a and 1b was to:

- Determine the spatial and temporal variability of phytoplankton production, biomass, abundance and communities in the Hudson Bay system, the Canadian Arctic archipelago, the Beaufort Sea and in Baffin Bay.
- Determine the role of environmental factors on phytoplankton dynamics and its variability.

## 12.2 Methodology

The following optical and phytoplankton measurements were conducted:

- Continuous downwelling incident irradiance, every 10 minutes, with a Li-I-COR sensor 2 pi.
- Transparency of the water with a Secchi disk.
- Profiles of light in the water column with a profiler of natural fluorescence (PNF 300).
- In Legs 1 and 2, concentration of dissolved (DOC) and total (TOC) organic carbon with a Shimadzu TOC-5000 analyzer.
- In Legs 1 and 2, concentrations Dissolved Organic Carbon (COD) / Nitrogen (NOD) with a Shimadzu-2100 analyzer.
- In Leg 3, 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
- Chlorophyll *a* and phaeopigment concentrations with a Turner Designs fluorometer (model 10-AU) for 3 size classes : >0.7 µm, >5 µm, >20 µm.
- Concentration of particulate organic carbon (POC) /nitrogen (PON) with a CHN analyzer.
- Phytoplankton pigment signature using the high performance liquid chromatography method (HPLC).
- Abundance and taxonomic composition of phytoplankton with the inverted microscopy method.
- Abundance of pico- and nano-phytoplankton and heterotrophic bacteria using a flux cytometer.
- Phytoplankton production using the $^{14}C$ assimilation method for 2 size-fractions: >0.7 µm and >5 µm.

At each station, water samples for these measurements were collected with Niskin bottles attached on the CTD-Rosette. Incident PAR (photosynthetically available radiation) was continuously recorded with Li-Cor 2pi sensor. Light profiles in the water column were carried out with a PNF-300 and the transparency of the water was measured with a Secchi disk at every station to determine the photic depths, except for some stations at which the ship arrived during the night.

Size fractioned (<0.2 µm, >0.7 µm,>5 µm) primary production experiments were conducted to estimate daily primary production at 7 optical depths (depths corresponding to 100%, 50%, 30%, 15%, 5%, 1%, and 0.2% of the surface irradiance) following JGOFS protocol for simulated *in situ* incubation.

Samples will be processed and results of Chl *a* biomass and primary production will be analyzed at the laboratory in Rimouski.

- Chlorophyll *a* results were shared with P. Larouche (DFO-IML; Leg 1a) and with J.-É. Tremblay's team (U. Laval; Legs 1 and 3) for calibration of their chlorophyll *a* fluorescence sensors.

- In addition, zooplankton was sampled for J. Gagné (DFO-IML) during Leg 1a in collaboration with L. Fortier's team (U. Laval). This collaboration also allowed additional dinoflagellate sampling for A. Rochon's team (UQAR) during Leg 1a.

### *12.2.1 Leg 1a – ArcticNet – 02 July to 02 August 2010 – Hudson Bay*

### *Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

During Leg 1, 32 stations located in the Hudson Bay System, along the coast of Baffin Island and in the Northwest Passage were visited. Twenty (20) incubations were conducted to determine primary production rates (Table 12.1). Moreover, nitrogen status of phytoplankton was determined on 12 occasions at the depth of 50% surface irradiance, and at the depth of the Chl *a* maximum.

The team also participated in the VIP community visit at Churchill as the phytoplankton and nutrients station. As part of the *School on board program*, the team fully participated by giving a short lecture and holding four laboratory activities (twice) for chlorophyll *a* concentration measurements: Secchi disk/CTD/Rosette operation, filtration/extraction, fluorescence, and calculations.

Table 12.1. Sampling operations conducted for phytoplankton biomass and primary production during Legs 1a and 1b.

| Station ID | Station type | Latitude N | Longitude W | Date | PP | N Status | Chl *a* | CHN | DOC | Taxonomy | Cytometry | HPLC | Secchi disk | PNF300 | Zoo |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 356 | Nutrient | 60°48.341 | 64°43.495 | 07/07/2010 | | | X | X | X | X | X | | | | |
| 354 | Nutrient | 60°58.234 | 64°46.312 | 07/07/2010 | | | | | X | | X | | | | |
| 352 | Nutrient | 61°09.194 | 64°48.358 | 07/07/2010 | X | | X | X | X | X | X | | | | |
| 362 | Nutrient | 62°05.158 | 71°43.019 | 08/07/2010 | | | X | X | X | X | X | | | | |
| 360 | Nutrient | 62°25.503 | 71°04.599 | 08/07/2010 | X | | X | X | X | X | X | | | | |
| 350 | Basic | 64°26.457 | 80°27.768 | 09/07/2010 | | | X | X | X | X | X | | X | X | X |
| 710 | Nutrient | 62°57.880 | 80°12.903 | 10/07/2010 | | | X | X | X | X | X | | | | |
| 698 | Nutrient | 62°07.351 | 78°41.817 | 10/07/2010 | | | X | X | X | X | X | | | | |
| 699 | Basic | 59°59.899 | 78°26.244 | 11/07/2010 | X | X | X | X | X | X | X | | X | X | X |
| 702 | Mooring | 55°24.535 | 77°55.859 | 12/07/2010 | X | X | X | X | X | X | X | | X | X | X |
| 709 | Basic | 54°42.709 | 80°46.790 | 15/07/2010 | X | | X | X | X | X | X | | | | X |
| 730 | Nutrient | 55°26.877 | 80°33.311 | 15/07/2010 | | | X | X | X | X | X | | X | X | |
| 735 | Basic | 56°47.606 | 80°49.876 | 16/07/2010 | X | | X | X | X | X | X | | X | X | X |
| 740 | Nutrient | 60°22.114 | 81°59.157 | 29/07/2010 | X | | X | X | X | X | X | | | | X |
| 745 | Basic | 60°30.345 | 85°00.917 | 17/07/2010 | X | X | X | X | X | X | X | | X | X | X |
| 750 | Nutrient | 60°40.754 | 87°28.480 | 17/07/2010 | | | X | X | X | X | X | | | | X |
| 765 | Basic | 62°18.267 | 90°40.248 | 18/07/2010 | X | | X | X | X | X | X | | X | X | X |
| 770 | Nutrient | 60°56.099 | 91°47.727 | 18/07/2010 | | | | | | | | | | | X |
| 707 | Mooring | 59°58.165 | 91°57.051 | 19/07/2010 | X | X | X | X | X | X | X | | X | X | X |
| 706 | Mooring | 58°46.688 | 91°32.096 | 21/07/2010 | X | | X | X | X | X | X | | X | X | X |
| 705a | Full | 57°26.501 | 91°54.550 | 23/07/2010 | X | | X | X | X | X | X | | X | X | X |
| 705 | Mooring | 57°40.210 | 91°36.194 | 24/07/2010 | X | | X | X | X | X | X | | X | X | X |
| 790 | Basic | 57°14.884 | 88°52.964 | 28/07/2010 | X | | X | X | X | X | X | | X | X | X |
| 820 | Basic | 55°41.295 | 84°52.508 | 29/07/2010 | X | | X | X | X | X | X | | | X | X |
| 840 | Basic | 58°24.660 | 83°19.020 | 29/07/2010 | X | | X | X | X | X | X | | X | X | X |
| 850 | Nutrient | 62°8.072 | 81°23.989 | 30/07/2010 | | | X | X | X | X | X | | | | X |
| 301 | Basic | 74°11.162 | 83°57.012 | 07/08/2010 | X | | X | X | X | X | X | X | X | X | |
| 302 | Nutrient | 74°9.684 | 86°10.517 | 07/08/2010 | | | X | | | | | | | | |
| 303 | Nutrient | 74°13.339 | 89°36.649 | 07/08/2010 | X | | X | X | X | X | X | X | X | X | |
| 305 | Basic | 74°19.716 | 93°24.654 | 08/08/2010 | X | | X | X | X | X | X | X | X | X | |
| 310 | Basic | 71°17.608 | 97°41.432 | 09/08/2010 | X | | X | X | X | X | X | X | X | X | |
| 314 | Nutrient | 69°0.181 | 106°35.968 | 11/08/2010 | | | X | X | X | X | X | X | X | X | |

### *1.1.1 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

### *Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

### *Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords*

Table 12.2. Sampling operations conducted for phytoplankton biomass and primary production during Legs 3a, 3b and 3c.

| Station # | Cast | Date | Position (min) | | Chlorophyll *a* | | | POC/PON | DOC | TOC | HPLC | Cells | Cells | Pico. | Bact. | Primary production | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (jj-month-yy) | Latitude (N) | Longitude (W) | >0.7um | >5um | >20um | >0.7um | | | >0.7 µm | Lugol | Formol | flow cyto | flow cyto | >0.7 µm | >5 µm |
| NBWI-1 | 5 | 28-sept-10 | 74°40.267 | 128°32.636 | X | X | X | X | X | X | X | X | X | X | X | | |
| 437 | 6 | 30-sept-10 | 71°46.781 | 126°32.533 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 418 | 12 | 01-oct-10 | 71°9.836 | 128°10.170 | X | X | X | X | X | X | X | X | X | X | X | | |
| 408 | 17 | 06-oct-10 | 71°18.707 | 127°34.813 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 407 | 18 | 07-oct-10 | 71°1.045 | 126°2.246 | X | X | X | X | X | X | X | X | X | X | X | | |
| 405 | 21 | 08-oct-10 | 70°38.777 | 123°1.945 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 450 | 23 | 09-oct-10 | 72°3.100 | 119°46.590 | X | X | X | X | X | X | X | X | X | X | X | | |
| 308 | 25 | 11-oct-10 | 74°6.889 | 108°25.979 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 304 | 26 | 12-oct-10 | 74°15.121 | 91°31.057 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 324 | 28 | 14-oct-10 | 73°52.645 | 80°10.304 | X | X | X | X | X | X | X | X | X | X | X | | |
| 323 | 29 | 14-oct-10 | 74°11.218 | 79°46.559 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 115 | 31 | 15-oct-10 | 76°20.048 | 71°11.112 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 111 | 37 | 16-oct-10 | 76°17.574 | 73°16.561 | X | X | X | X | X | X | X | X | X | X | X | | |
| 108 | 40 | 16-oct-10 | 76°16.205 | 74°43.556 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 105 | 44 | 17-oct-10 | 76°20.26 | 75°48.948 | X | X | X | X | X | X | X | X | X | X | X | X | X |

| Station # | Cast | Date | Position (min) | | Chlorophyll *a* | | | POC/PON | DOC | TOC | HPLC | Cells | Cells | Pico. | Bact. | Primary production | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (jj-month-yy) | Latitude (N) | Longitude (W) | >0.7um | >5um | >20um | >0.7um | | | >0.7 µm | Lugol | Formol | flow cyto | flow cyto | >0.7 µm | >5 µm |
| 600 | 47 | 24-oct-10 | 59°5.293 | 63°26.131 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 602 | 49 | 24-oct-10 | 59°3.239 | 63°51.959 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 617 | 51 | 25-oct-10 | 58°19.166 | 62°41.365 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 615 | 56 | 25-oct-10 | 58°19.166 | 63°32.412 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 633 | 57 | 26-oct-10 | 57°36.292 | 61°54.251 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 630 | 60 | 26-oct-10 | 57°28.333 | 62°26.783 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 624 | 61 | 27-oct-10 | 56°25.217 | 62°4.254 | X | X | X | X | X | X | X | X | X | X | X | X | X |
| 620 | 65 | 28-oct-10 | 56°24.029 | 61°12.712 | X | X | X | X | X | X | X | X | X | X | X | X | X |

## 12.3 Preliminary results

### *12.3.1 Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay*

### *Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

Preliminary results from Chl *a* measurements show that there was large spatial variability in phytoplankton biomass. The freshwater influenced southern Hudson Bay generally presented twice lower Chl *a* biomass than Hudson Strait, Foxe Basin and Lancaster Sound. The heterogeneity of the sea ice cover could constitute part of the explanation for this spatial variability in Chl *a* biomass.

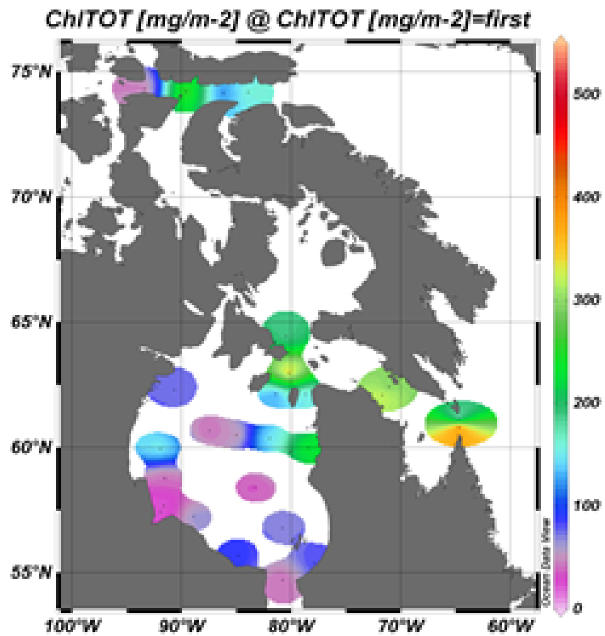


Figure 12.1. Surface cholorophyll a in Hudson Bay, Hudson Strait and Lancaster Sound measured during Legs 1a and 1b.

### *1.1.2 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

### *Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

### *Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords*

Chlorophyll *a* concentrations were measured in different regions of the Canadian Arctic Ocean. Values were integrated over 100 m or down to the bottom depth when it was < 100 m. Concentrations ranged from 20 to 130 mg $m^{-2}$ (Figure 1). The phytoplankton biomass was dominated by large cells ( > 5 µm) in all regions sampled.

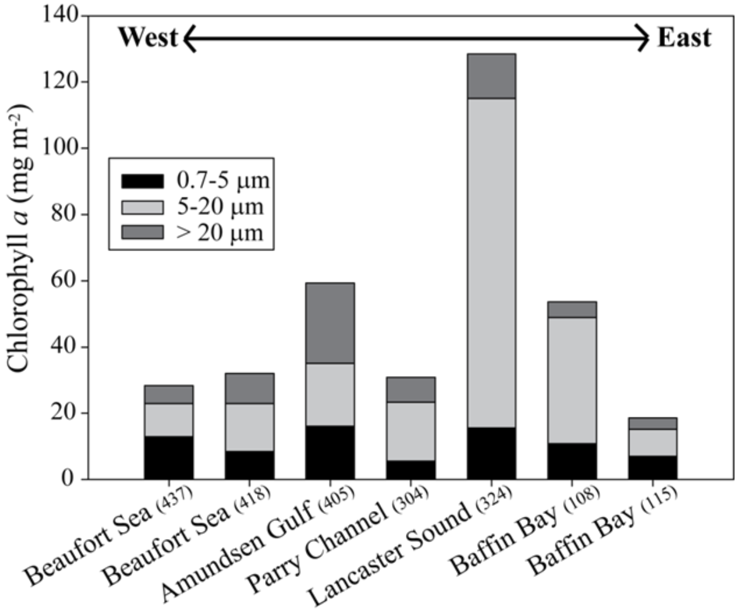


Figure 12.2. Chlorophyll *a* concentrations in the Canadian Arctic Ocean. Concentrations were integrated over the upper 100 m, except at Station 418 where they were integrated over 55 m.

Chlorophyll *a* concentrations were measured at the mouth and at the head of each fiord. Values were integrated over 100 m or down to the bottom depth when it was < 100 m. Concentrations ranged from 20 to 60 mg $m^{-2}$ (Figure 14). The phytoplankton biomass was dominated by small cells (0.7-5 µm) in Nachvak Fiord and Anaktalak Bay and by large cells (>20 µm) at the head of the Saglek Fiord and Okak Bay.

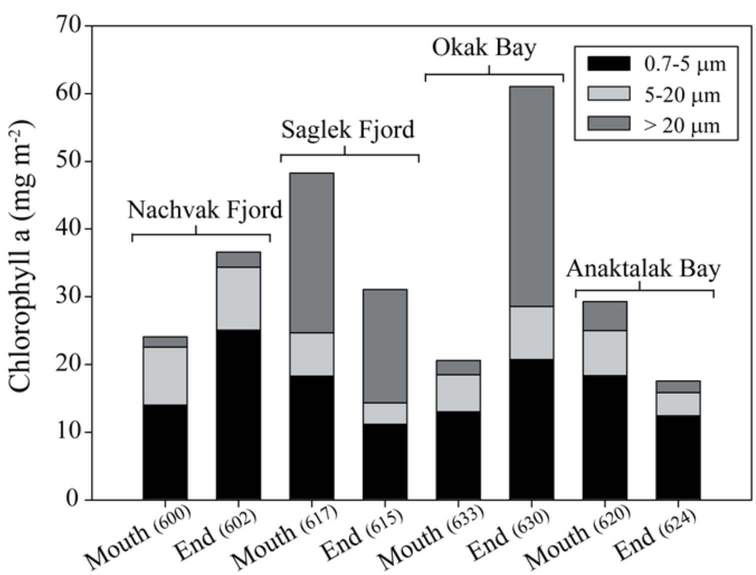


Figure 12.3. Chlorophyll *a* concentrations in the four fiords of Nunatsiavut visited during Leg 3c. Concentrations were integrated over the upper 100 m, except at Station 630, 620 and 624 where they were integrated over 38 m, 69 m and 53 m, respectively.

## 12.4 Comments and recommendations

Particular thanks are given to the crew members who helped build a frame to support and secure the incubator on the foredeck during Leg 1. They also managed, with the help of the Quebec-Ocean team, to transfer the continuous sea surface water flow system from the rusted and warm waters flowing from the firefighter system pump towards a more direct and cleaner surface intake.

Under ice-covered conditions, the foredeck incubator should be connected to the continuous sea surface water flow system which provides clean water to the atmosphere and mercury teams. It should be noted that the seawater from the firefighter system pump is rusted and too warm to be used during incubations.

The Health and Security committee of the CCGS *Amundsen* requested to increase the height of the incubator freeboard in order to reduce freezing of the foredeck.

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# 13 Zooplankton and ichtyoplankton – Legs 1a, 1b, 3a, 3b and 3c

ArcticNet Phase 2 – Project titled *Marine Biological Hotspots: Ecosystem Services and Susceptibility to Climate Change*.
http://www.arcticnet.ulaval.ca/pdf/phase2/tremblayJE_marine_ecosystem_services.pdf
ArcticNet Phase 2 – Project titled *Freshwater-Marine Coupling in the Hudson Bay IRIS*.
http://www.arcticnet.ulaval.ca/pdf/phase2/barber_freshwater-marine_coupling.pdf

**Project leaders:** Louis Fortier[1] (louis.fortier@bio.ulaval.ca) and BP (Leg 2a)

**Cruise participants Legs 1a and 1b:** Cyril Aubry[1], Marianne Falardeau-Côté[1] and Marie-Claude Perreault[1]
**Cruise participants Legs 2a:** Dominique Robert[1], Caroline Bouchard[1], Makoto Sampei[1] and Keita Suzuki[1]
**Cruise participants Legs 3a and 3b:** Maxime Geoffroy[1] and Hélen Cloutier[1]
**Cruise participants Leg 3c:** Maxime Geoffroy[1], Hélen Cloutier[1], Tanya Brown[2] and Esteban Estrada[3]
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## 13.1 Introduction

The primary objectives of the zooplankton program were to:

- Sample the overall zooplankton assemblage over the entire water column.
- Sample the ichthyoplankton community (focusing on the dominant species Arctic cod) in the surface (0-90 m) layer.

The resulting sample sets will allow assessing zooplankton abundance by species and developmental stages for each region and station visited and to increase the size of arctic cod larval dataset (length-at-age) based on otoliths analysis.

Secondary field objectives for Leg 1 were to use zooplankton samples to:

- Study qualitatively and quantitatively the egg production and nauplii development for *Oithona similis*, *Pseudocalanus* spp., *Microcalanus* spp. and *Oncea borealis* species.
- Sort and weight main micro-zooplankton taxa from selected samples in order to estimate stage-specific biomass (G. Darnis and L. Fortier).

## 13.2 Methodology

### *13.2.1 Zooplankton assemblages*

The zooplankton assemblage integrated over the entire water column was collected at by deploying the 5-Net Vertical Sampler (5NVS or Monster Net – Figure 13.1) from 10 m above the bottom to the surface at a retrieval rate of 30-40 m $min^{-1}$. The 5NVS carried four 1-$m^2$ aperture nets (three with 200-µm mesh and one with 500 µm mesh), and one (two in Leg 1) 50-µm mesh cylindrical nets of 0.1 m diameter, for the collection of the entire mesozooplankton size spectrum. Flow meters were installed on each square net to calculate abundances. The 50 µm mesh sample (copepod eggs and nauplii) and the 500 µm mesh sample (macrozooplankton, including jellies) were preserved in formalin. The three 200 µm mesh samples were processed as follows:

In Leg 1: One of the three 200 µm mesh sample was split in 2 subsamples: one was preserved in formalin and the other half kept frozen for biomass measurement. Another 200 µm mesh sample and the other 50 µm mesh sample were used as live tows for incubations of gravid females, as well as for individual dry weight measurements. The third 200 µm mesh sample was provided to the contaminant team (G. Stern' s group, DFO-FWI) for the assessment of contaminant levels (for Leg 1a only; on Leg 1b, it was preserved in formalin).

In Leg 2a: Two of the three 200-µm mesh samples were preserved in formalin and the third one was provided to the ArcticNet contaminant team (G. Stern' s group, DFO-FWI) for the assessment of contaminant levels. A fraction of one of the two 200-µm mesh samples was also taken and preserved frozen (-20$^{o}$C) for biomass estimation.

In Leg 3: One of the three 200 µm mesh sample was preserved in formalin, another one was used to calculate the dry weight of the zooplankton assemblage and the last one was used to select crustaceans for bar coding. The latter samples were given to F. Dufresne (UQAR).

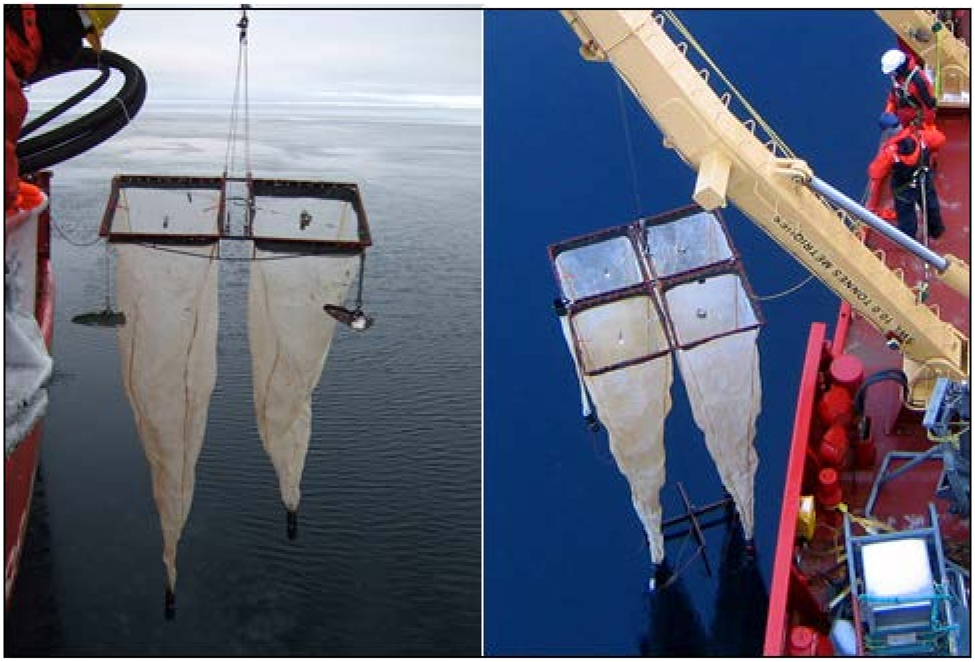

Figure 13.1. Zooplankton and fish sampling gear used during Leg 1. Left: 2 x 1-$m^2$ Tucker net and Right: 4 x 1-$m^2$ Monster net. (Photos were taken during previous ArcticNet expeditions).

### *13.2.2 Ichtyoplankton and mesozooplankton community*

The ichthyoplankton and mesozooplankton assemblages in the 0-90 m surface layer were sampled with the Double Square Net sampler (DSN or Tucker Net – Figure 13.1), a rectangular metal frame carrying side by side two 6-m long, 1-$m^2$ mouth aperture, square-conical nets, and towed at 20 m $min^{-1}$ and 2-3 knots. One was 750-µm mesh while the second one was 500-µm mesh. A 50-µm mesh cylindrical net of 0.1 m diameter was also attached to the frame. The zooplankton (minus fish larvae) from the 750-µm mesh net was provided fresh to the contaminant team (G. Stern' s group, DFO-FWI) on Legs 1 and 2a, and to F. Dufresne (UQAR) in Leg 3 to provide crustaceans for bar coding. The zooplankton (minus fish larvae) from the other 500-µm mesh and 50-µm mesh nets was preserved in formalin for further analysis of the zooplankton assemblage in the layer occupied by fish larvae.

All fish were sorted at sea and preserved in 95% ethanol. For each station, a subset of up to 25 larvae of Arctic cod per net was photographed over millimetric paper and measured (length and body height at the anus).

In addition, the biomass of adult fish along the track of the ship was monitored continuously with the EK60 echosounder. The EK60 signal will be processed in the laboratory to assess fish biomass following the methodology of Benoit et al. (2008).

### 13.2.3 Moored sediment traps

Finally, sediment traps were recovered and deployed for measurement of the vertical carbon fluxes as part of the mooring program. The traps provide information on the annual flux of carbon (including zooplankton fecal fluxes), as well as annual collections of entrapped zooplankton (swimmers).

Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago

To study qualitatively and quantitatively the egg production and nauplii development for *Oithona similis*, *Pseudocalanus* spp., *Microcalanus* spp. and *Oncea Borealis* species, gravid females were selected from live tows, and placed individually in small petri dish filled with filtered sea water. They were then kept in an incubator at a selected temperature. Water was changed every day and food was provided from 20 µm filtered seawater. Changes in the development of the eggs were monitored every day. Unfortunately, it was impossible to keep any individual alive more than few days, and therefore the development of the eggs and nauplii could not be assessed.

During Leg 1, sampling was performed at as many stations as possible, but winds and waves limited opportunities of the Tucker net deployments in one area.

Overall zooplankton assemblages were sampled at 18 stations during Leg 1 while ichtyoplankton and mesozooplankton community was collected at 17 stations (Table 13.1).

Table 13.1. . Summary of sampling activities and field experiments of the zooplankton group in Hudson Bay during Leg 1.

| Date | Station ID | Latitude N | Longitude W | Depth (m) | Tucker Net | Monster Net | Incubation | Copepods Dry Weight |
|---|---|---|---|---|---|---|---|---|
| 2010-07-09 | 350 | 64º 26.26 | 080º 27.62 | 380 | X | X | X | |
| 2010-07-11 | 699 | 59º 59.84 | 078º 26.28 | 83 | X | X | X | |
| 2010-07-13 | 702 | 55º 25.22 | 077º 54.75 | 133 | X | X | X | X |
| 2010-07-15 | 709 | 54º 43.17 | 080º 45.94 | 89 | X | X | X | X |
| 2010-07-16 | 735 | 56º 47.56 | 080º 50.14 | 184 | X | X | X | X |
| 2010-07-17 | 745 | 60º 30.40 | 085º 00.84 | 186 | X | X | X | X |
| 2010-07-18 | 765 | 62º 18.44 | 090º 39.63 | 103 | X | X | X | X |
| 2010-07-19 | 707 | 59º 58.14 | 091º 57.00 | 106 | X | X | X | X |
| 2010-07-21 | 706 | 58º 46.95 | 091º 32.35 | 78 | X | X | X | |
| 2010-07-22 | 705a | 57º 25.5 | 091º 53.5 | 35 | X | X | X | |
| 2010-07-24 | 705 | 57º 39.91 | 091º 36.31 | 57 | X | X | X | X |
| 2010-07-28 | 790 | 57º 14.859 | 088º 52.849 | 40 | X | X | X | X |
| 2010-07-29 | 820 | 55º 41.55 | 084º 53.58 | 53 | | X | X | |

| Date | Station ID | Latitude N | Longitude W | Depth (m) | Tucker Net | Monster Net | Incubation | Copepods Dry Weight |
|---|---|---|---|---|---|---|---|---|
| 2010-07-30 | 840 | 58º 24.73 | 083º 18.08 | 177 | X | X | X | |
| 2010-08-07 | 301 | 74º 11.254 | 083º 52.757 | 669 | X | X | X | |
| 2010-08-08 | 305 | 74º 19.686 | 093º 25.544 | 168 | X | X | | X |
| 2010-08-09 | 310 | 71º 17.622 | 097º 39.949 | 141 | X | X | | |
| 2010-08-10 | 312 | 69º 09.534 | 100º 42.093 | 49 | X | X | | |
| 2010-07-13 (river) | GW1a | 55º 16.092 | 077º 46.228 | 4.8 | X | | | |
| 2010-07-13 (river) | GW1b | 55º 15.955 | 077º 46.228 | 5 | X | | | |
| 2010-07-22 (river) | B8 | 57º 08.638 | 092º 23.297 | 19.3 | XX | | | |
| 2010-07-22 (river) | D7 | 57º 13.004 | 091º 54.14 | 13.5 | X | | | |
| **TOTAL** | | | | | **17 (5)** | **18** | **15** | **9** |

Also, 4 river stations sample were collected in Hudson Bay (Leg 1a) with ring nets aboard the barge. Two of these stations were sampled with a 50 cm diameter ring equipped with a 64-µm mesh sized net, while the two others were sampled with a 1-m diameter ring equipped with a 500 µm mesh sized net.

As part of the mooring program in Hudson Bay and Lancaster Sound, one sediment trap has been recovered and four have been deployed for measurement of the vertical carbon fluxes. The traps provide information on the annual flux of carbon (including zooplankton fecal fluxes), as well as annual collections of entrapped zooplankton (swimmers).

Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea

All 18 stations of the BP Pokak sampling grid were visited and sampled for zooplankton assemblages.

Table 13.2. Summary table of the sample sets remaining with the zooplankton group.

| Objective | Set # | Type | Description | No. of samples / stations | Status |
|---|---|---|---|---|---|
| Zooplankton | 1 | vertical | 200 µm mesh | 17 samples | Onboard until Nov |
| | 2 | vertical | 200 µm mesh | 17 samples | Debark 26 Aug with MS |
| | 3 | vertical | 500 µm mesh | 17 samples | Debark 26 Aug with MS |
| | 4 | vertical | 50 µm mesh | 15 samples | Onboard until Nov |
| Ichtyoplankton and mesozooplankton | 5 | oblique | 500 µm mesh | 18 samples | Onboard until Nov |
| | 6 | oblique | 50 µm mesh | 18 samples | Onboard until Nov |
| | 7 | oblique | Larvae 750 µm | 18 stations | Onboard until Nov |
| | 8 | oblique | Larvae 750/500 | 18 stations | Onboard until Nov |
| Carbon flux | 9 | sediment traps | Mooring G-09 | 48 samples | Debark 26 Aug with MS |

Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea

Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords

A total of 11 stations (Table 13.3) were sampled during Leg 3a and 3b and 8 stations during Leg 3c (Table 13.4). Two sediment traps have been recovered and three have been deployed for measurement of the vertical carbon fluxes as part of the mooring program. The traps provide information on the annual flux of carbon (including zooplankton fecal fluxes) in the Beaufort Sea, as well as annual collections of entrapped zooplankton (swimmers).

Table 13.3. Summary of sampling activities and field experiments of the zooplankton group during Leg3 a and b.

| Date | Station | Latitude N | Longitude W | Depth (m) | Tucker Net | Monster Net |
|---|---|---|---|---|---|---|
| 2010-10-01 | 437 | 71º 47.100 | 126º 34.400 | 348 | X | X |
| 2010-10-07 | 407 | 71º 00.440 | 125º 59.720 | 394 | X | X |
| 2010-10-08 | 405 | 70º 38.923 | 123º 00.664 | 608 | X | X |
| 2010-10-09 | 450 | 72º 03.110 | 119º 46.700 | 102 | X | X |
| 2010-10-11 | 308 | 74º 06.463 | 108º 25.371 | 552 | | X |
| 2010-10-12 | 304 | 74º 12.820 | 091º 29.510 | 305 | X | X |
| 2010-10-14 | 323 | 74º 11.970 | 079º 43.330 | 778 | X | X |
| 2010-10-16 | 115 | 76º 20.420 | 071º 09.690 | 202 | X | X |
| 2010-10-16 | 111 | 76º 17.660 | 073º 16.920 | 565 | X | X |
| 2010-10-17 | 108 | 76º 15.880 | 074º 45.300 | 464 | X | X |
| 2010-10-17 | 105 | 76º 19.150 | 075º 50.720 | 322 | X | X |
| **TOTAL** | | | | | **10** | **11** |

Table 13.4. Zooplankton sampling stations using the Tucker trawl, vertical Monster and Hydrobios nets during Leg 3c.

| Station | | Region | Net | Start | | Stop | | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| ID | Type | | | Latitude N | Longitude W | Latitude N | Longitude W | |
| 600 | Basic | Nachvak Fiord | Tucker, Monster, Hydrobios | 59° 05' 75" | 63° 26' 34" | 59° 05' 35" | 63° 26' 33" | -192 |
| 602 | Basic | Nachvak Fiord | Tucker, Monster, Hydrobios | 59° 03' 19" | 63° 49' 55" | 59° 03' 38" | 63° 50' 83" | -161 |
| 615 | Basic | Saglek Fiord | Tucker, Monster, Hydrobios | 58° 19' 54" | 63° 31' 92" | 58° 19' 14" | 63° 32' 69" | -131 |
| 617 | Basic | Saglek Fiord | Tucker, Monster, Hydrobios | 58° 30' 06" | 62° 41' 35" | 58° 30' 25" | 62° 41' 11" | -131 |
| 630 | Basic | Okak Bay | Tucker, Monster, Hydrobios | 57° 27' 73" | 62° 25' 10" | 57° 27' 73" | 62° 27' 85" | -45 |
| 633 | Basic | Okak Bay | Tucker, Monster, Hydrobios | 57° 36' 25" | 61° 52' 82" | 57° 36' 55" | 61° 54' 24" | -149 |
| 620 | Basic | Anaktalak Bay | Tucker, Monster, Hydrobios | 56° 23' 96" | 61° 12' 49" | 56° 24' 04" | 61° 12' 43" | -70 |
| 624 | Basic | Anaktalak Bay | Tucker, Monster, Hydrobios | 56° 25' 65" | 62° 03' 42" | 56° 25' 62" | 62° 03' 56" | -62 |

## 13.3 Preliminary results

### *13.3.1 Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay*

### *Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

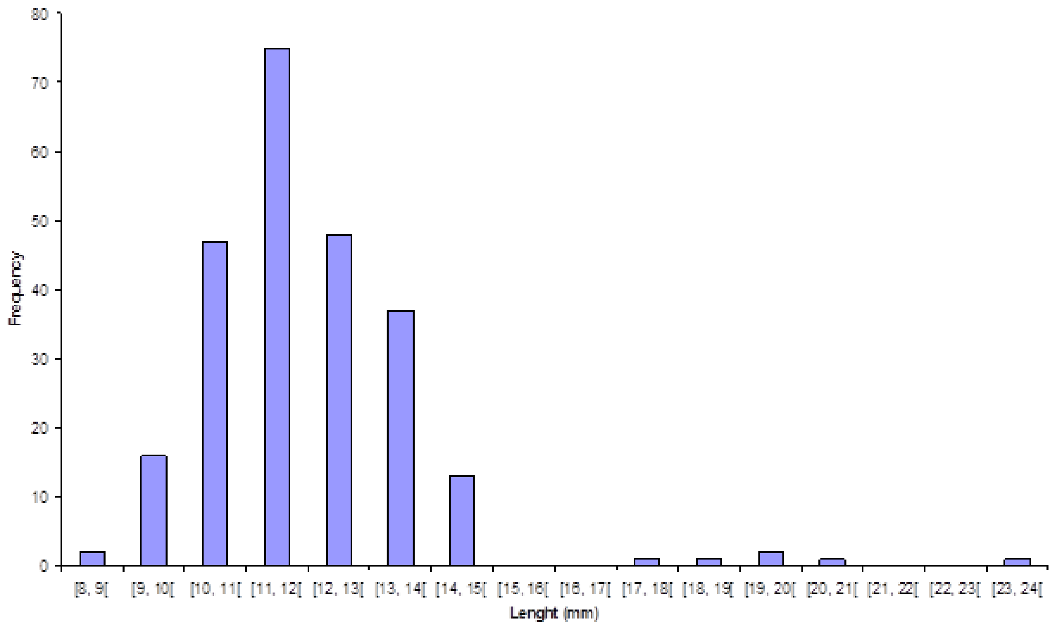


Figure 13.2. Size-frequency distribution of the Arctic cod (*Boreogadus saida*) larvae measured during Leg 1.

### *13.3.2 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

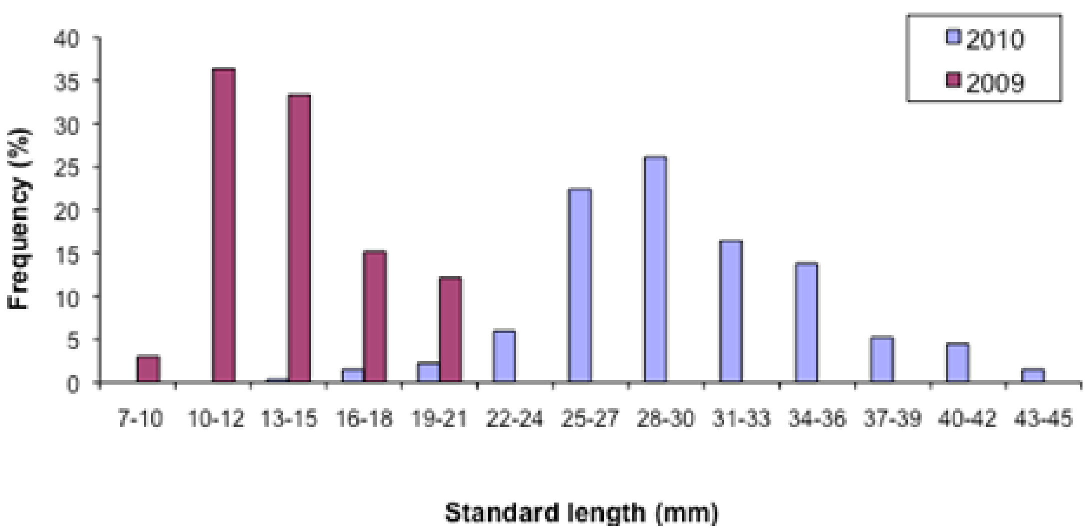


Figure 13.3. Size-frequency distribution of young-of-the-year Arctic cod (*Boreogadus saida*) measured during leg 2a 2010, compared to that of individuals captured during the same period in 2009.

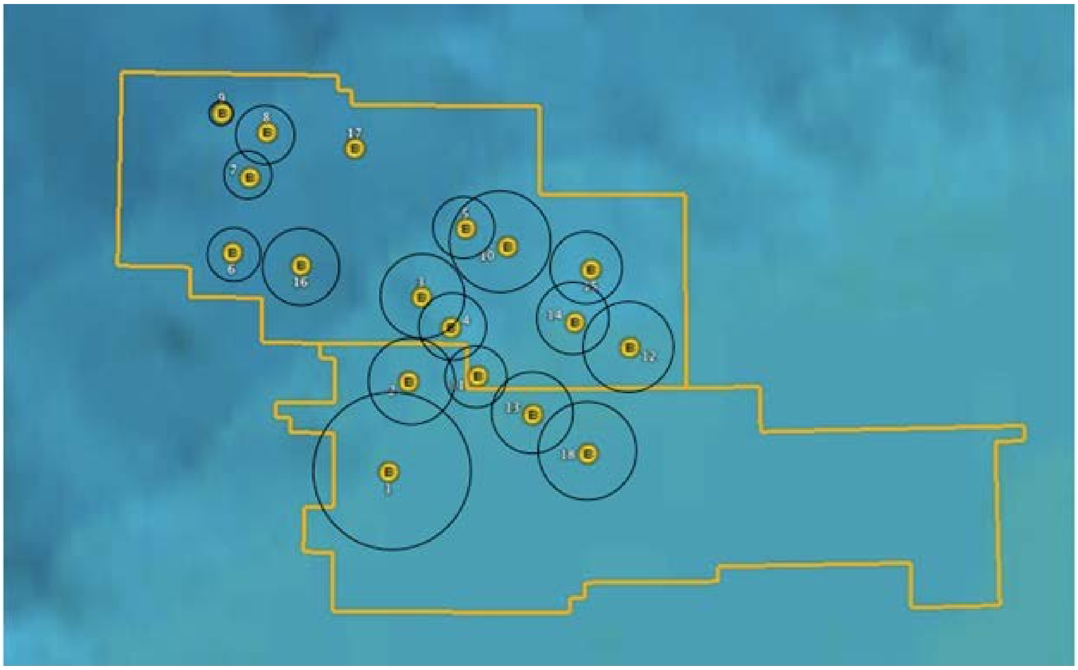

Figure 13.4. Distribution of Arctic cod juveniles (*Boreogadus saida*) in the BP Pokak sampling grid. Surface of bubbles is proportional to abundance (number 100 $m^{-3}$). Maximum abundance (St. BP10-001): 5.3 juveniles 100 $m^{-3}$; minimum abundance (St. BP10-009): 0.1 juvenile 100 $m^{-3}$.

### 13.3.3 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea

### Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

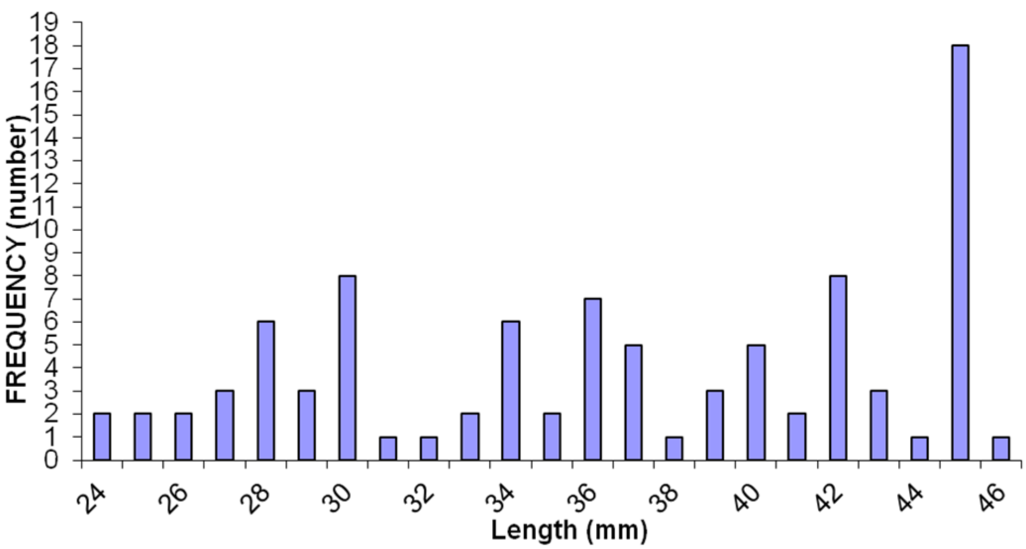


Figure 13.5. Size-frequency distribution of the Arctic cod (*Boreogadus saida*) larvae measured during Legs 3a and 3b.

### 13.4 Comments and recommendations

All operations were conducted with success. However, we experienced a problem with the 500 HP winch reset that may have altered sampling depth. This issue should be looked at. As usual, special care should be taken under ice conditions to prevent any damage to nets and sample, and a backwash should be asked of the bridge for vertical tows.

**Reference**

Benoit et al. (2008), Journal of Geophysical Research - Oceans. doi:10.1029/2007JC004276)

# 14 Marine Wildlife Observer program – Legs 2a and 2b

**Project leaders:** BP

**Cruise participants Legs 2a and 2b**: Golder Associates Limited[1], IMG-Golder Corporation[2], Inuvik community resident[3] and Ulukhaktok community resident[4]
*[1] Golder Associates Ltd., Yellowknife (NWT)*
*[2] IMG-Golder Corporation, Inuvik (NWT)*
*[3] Community resident, Inuvik (NWT)*
*[4] Community resident, Ulukhaktok (NWT)*

## 14.1 Introduction

The Marine Wildlife Observer (MWO) Program conducted for BP Exploration Operating Company Limited (BP) by IMG-Golder Corporation (IMG-Golder) was designed to gather baseline data on the occurrence of marine wildlife in an offshore area of the Beaufort Sea. The area of interest consisted of Exploration Licences (ELs) 451, 453, 446 and 449.

During Leg 2, the objective of the program was to collect data that could be analysed to describe distribution and relative abundance of marine wildlife in the ELs. To achieve this objective, MWOs recorded wildlife sightings in the area of interest while scientific operations were carried out from the CCGS *Amundsen*. The collected data will contribute to baseline knowledge of the use of the area by marine wildlife and may be included in future Environmental and Social Impact Assessments submitted for oil and gas activities in the Southern Beaufort Sea.

During Leg 3a, The objective of the Marine Wildlife Observation program was to gain a better understanding of wildlife diversity and abundance in the region spanning the open water central to eastern Beaufort Shelf, and the northern Beaufort sea ice pack.

## 14.2 Methodology

### *14.2.1 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

### *Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea*

Marine wildlife observations occurred every day of Legs 2a and 2b once the CCGS Amundsen entered the area of interest (Leg 2a from 14 August through 25 August and Leg 2b from 26 August through 20 September). Four MWOs performed scheduled watches (or shifts) for a total of 14 hours each day between 06:00 and 20:00 hours (MDT). Two teams of two MWOs switched on and off one and two-hour shifts throughout the day to allow time for breaks and data downloading (Table 14.1).

Table 14.1. Marine Wildlife Observers schedule for Leg 2a.

| 24 Hour Clock (MDT) | 12 Hour Clock (MDT) | Marine Wildlife Observer | | | | | |
|---|---|---|---|---|---|---|---|
| | | Team 1 | | | Team 2 | | |
| | | Roger | James | Notes | Robin/ Katelyn | Michele | Notes |
| 00:00-06:00 | 00:00-06:00 | | | | | | |
| 06:00-06:30 | 06:00-06:30 | WATCH 1 | WATCH 1 | **Toolbox | | | |
| 06:30-07:00 | 06:30-07:00 | WATCH 1 | WATCH 1 | | | | |
| 07:00-07:30 | 07:00-07:30 | WATCH 1 | WATCH 1 | | | | |
| 07:30-08:00 | 07:30-08:00 | WATCH 1 | BIRD 1 | | 7:30 BREAKFAST | | |
| 08:00-08:30 | 08:00-08:30 | 8:00 BREAKFAST | | | WATCH 1 | WATCH 1 | Toolbox |
| 08:30-09:00 | 08:30-09:00 | DATA | DATA | | WATCH 1 | WATCH 1 | |
| 09:00-09:30 | 09:00-09:30 | DATA | DATA | | WATCH 1 | WATCH 1 | |
| 09:30-10:00 | 09:30-10:00 | | | | WATCH 1 | WATCH 1 | |
| 10:00-10:30 | 10:00-10:30 | WATCH 2 | WATCH 2 | | DATA | DATA | |
| 10:30-11:00 | 10:30-11:00 | WATCH 2 | WATCH 2 | | DATA | DATA | |
| 11:00-11:30 | 11:00-11:30 | WATCH 2 | WATCH 2 | | | | |
| 11:30-12:00 | 11:30-12:00 | WATCH 2 | WATCH 2 | | 11:30 LUNCH | | |
| 12:00-12:30 | 12:00-12:30 | 12:00 LUNCH | | | BIRD 2 | WATCH 2 | |
| 12:30-13:00 | 12:30-1:00 | DATA | DATA | | WATCH 2 | WATCH 2 | |
| 13:00-13:30 | 1:00-1:30 | DATA | DATA | | WATCH 2 | WATCH 2 | |
| 13:30-14:00 | 1:30-2:00 | | | | WATCH 2 | WATCH 2 | |
| 14:00-14:30 | 2:00-2:30 | WATCH 3 | WATCH 3 | | DATA | DATA | |
| 14:30-15:00 | 2:30-3:00 | WATCH 3 | WATCH 3 | | | | |
| 15:00-15:30 | 3:00-3:30 | WATCH 3 | WATCH 3 | | | | |
| 15:30-16:00 | 3:30-4:00 | WATCH 3 | WATCH 3 | | | | |
| 16:00-16:30 | 4:00-4:30 | DATA | DATA | | WATCH 3 | WATCH 3 | |
| 16:30-17:00 | 4:30-5:00 | | | | WATCH 3 | WATCH 3 | |
| 17:00-17:30 | 5:00-5:30 | WATCH 4 | WATCH 4 | | DATA | DATA | |
| 17:30-18:00 | 5:30-6:00 | WATCH 4 | WATCH 4 | | 5:30 DINNER | | |
| 18:00-18:30 | 6:00-6:30 | 6:00 DINNER | | | WATCH 4 | WATCH 4 | |
| 18:30-19:00 | 6:30-7:00 | | | | WATCH 4 | WATCH 4 | |
| 19:00-19:30 | 7:00-7:30 | | | | WATCH 4 | WATCH 4 | |
| 19:30-20:00 | 7:30-8:00 | | | | BIRD 3 | WATCH 4 | |
| 20:00-20:30 | 8:00-8:30 | | | | DATA | DATA | |
| 20:30-21:00 | 8:30-9:00 | | | | Daily Reporting | | |
| 21:00-21:30 | 9:00-9:30 | | | | | | |
| 22:00-00:00 | 10:00-00:00 | | | | | | |

During Leg 2b, the first MWO watches in the day were shifted to start at 08:00 and 10:00 hours, respectively for teams 1 and 2 (two hours later than during Leg 2a), to optimize the use of daylight hours. Daily watch periods ended accordingly at 20:00 and 22:00 hours, respectively for the two teams (Table 14.2).

Table 14.2. Marine Wildlife Observers schedule for Leg 2b.

| 24 Hour Clock (MDT) | 12 Hour Clock (MDT) | Marine Wildlife Observer | | | | | |
|---|---|---|---|---|---|---|---|
| | | Team 1 | | | Team 2 | | |
| | | Katelyn | Michele | Notes | Roger | James | Notes |
| 00:00-06:00 | 00:00-06:00 | | | | | | |
| 06:00-06:30 | 06:00-06:30 | | | | | | |
| 06:30-07:00 | 06:30-07:00 | | | | | | |
| 07:00-07:30 | 07:00-07:30 | | | | | | |
| 07:30-08:00 | 07:30-08:00 | | | | 7:30 BREAKFAST | | |
| 08:00-08:30 | 08:00-08:30 | | | | BIRD 1 | WATCH 1 | Toolbox |
| 08:30-09:00 | 08:30-09:00 | | | | WATCH 1 | WATCH 1 | |
| 09:00-09:30 | 09:00-09:30 | | | | WATCH 1 | WATCH 1 | |
| 09:30-10:00 | 09:30-10:00 | | | | WATCH 1 | WATCH 1 | |
| 10:00-10:30 | 10:00-10:30 | WATCH 1 | WATCH 1 | **Toolbox | DATA | DATA | |
| 10:30-11:00 | 10:30-11:00 | WATCH 1 | WATCH 1 | | DATA | DATA | |
| 11:00-11:30 | 11:00-11:30 | WATCH 1 | WATCH 1 | | | | |
| 11:30-12:00 | 11:30-12:00 | WATCH 1 | WATCH 1 | | 11:30 LUNCH | | |
| 12:00-12:30 | 12:00-12:30 | 12:00 LUNCH | | | WATCH 2 | WATCH 2 | |
| 12:30-13:00 | 12:30-1:00 | DATA | DATA | | WATCH 2 | WATCH 2 | |
| 13:00-13:30 | 1:00-1:30 | DATA | DATA | | WATCH 2 | WATCH 2 | |
| 13:30-14:00 | 1:30-2:00 | | | | BIRD 2 | WATCH 2 | |
| 14:00-14:30 | 2:00-2:30 | WATCH 2 | WATCH 2 | | DATA | DATA | |
| 14:30-15:00 | 2:30-3:00 | WATCH 2 | WATCH 2 | | | | |
| 15:00-15:30 | 3:00-3:30 | WATCH 2 | WATCH 2 | | | | |
| 15:30-16:00 | 3:30-4:00 | WATCH 2 | WATCH 2 | | | | |
| 16:00-16:30 | 4:00-4:30 | DATA | DATA | | WATCH 3 | WATCH 3 | |
| 16:30-17:00 | 4:30-5:00 | | | | WATCH 3 | WATCH 3 | |
| 17:00-17:30 | 5:00-5:30 | WATCH 3 | WATCH 3 | | DATA | DATA | |
| 17:30-18:00 | 5:30-6:00 | WATCH 3 | WATCH 3 | | 5:30 DINNER | | |
| 18:00-18:30 | 6:00-6:30 | 6:00 DINNER | | | WATCH 4 | WATCH 4 | |
| 18:30-19:00 | 6:30-7:00 | | | | WATCH 4 | WATCH 4 | |
| 19:00-19:30 | 7:00-7:30 | | | | WATCH 4 | WATCH 4 | |
| 19:30-20:00 | 7:30-8:00 | | | | WATCH 4 | WATCH 4 | |
| 20:00-20:30 | 8:00-8:30 | WATCH 4 | WATCH 4 | | | | |
| 20:30-21:00 | 8:30-9:00 | WATCH 4 | WATCH 4 | | | | |
| 21:00-21:30 | 9:00-9:30 | WATCH 4 | WATCH 4 | | | | |
| 22:00-00:00 | 10:00-00:00 | WATCH 1 | BIRD 3 | | | | |
| 22:00-22:30 | 10:00-10:30 | DATA | Reporting | | | | |

## *14.2.2 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

One Wildlife Observer conducting 12-hour shifts during daylight hours executed observations from the bridge of the *Amundsen*. The shift times varied depending on sunrise and sunset hours in the vessel's survey area.

Marine wildlife observations were made all day from the bridge, regardless whether the vessel was stationary or in-transit. Watches were discontinued when visibility was poor due to weather conditions or on rare occasions when all four MWOs needed to attend Health and Safety or other crew meetings. During each watch, one of the two MWOs was positioned on the port side of the bridge and the other on the starboard side. Each MWO was responsible for surveying the area on their side of the vessel unless otherwise specified by protocol (explained below).

Two types of observations were carried out each day: marine mammal and seabird observations. Marine mammal observations were completed eight times per day during the blue WATCH blocks depicted in Table 14.1. Seabird observations were completed three times per day during the red BIRD blocks shown in Table 14.1.

### *14.2.3 Marine mammal observations*

When the vessel was moving, marine mammal observations consisted of scanning the water from the bow (0°) to the stern (180°), focusing on the water ahead and to the side of the moving vessel (to 90° or 270° depending on the location of the MWO. When the vessel was stationary, MWOs distributed their focus evenly around the entire port or starboard side of the vessel (to 180°). To ease the strain on the observers' eyes, two types of scanning techniques were used to detect marine mammals: U and S scans (Figure 14.1). While the MWOs scanned the water parallel to the horizon when using the S scan method (in s-shaped lines), the U scans consisted of scanned lines perpendicular to the horizon (shaped like the letter u). The sequence of the two scan patterns was decided by the individual MWO. Scans were performed using a combination of the naked eye and reticle binoculars. Big eye binoculars were used to identify distant marine wildlife sightings made during these scans.

During the scheduled seabird watches, one MWO continued to perform marine mammal observations but shifted focus of their scans to cover the port and starboard sides of the vessel (from 270° to 90°). During these marine mammal watches, the MWO was located in the centre of the bridge.

Opportunistic seabird sightings (i.e., seabird sightings outside a scheduled seabird watch) were also recorded during the scheduled marine mammal observations.

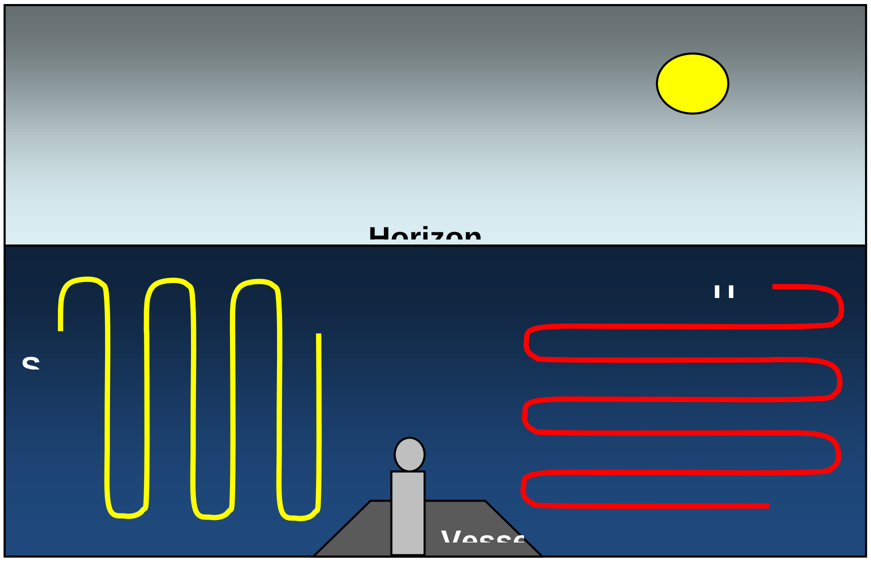


Figure 14.1. S and U scanning techniques used by marine Wildlife Observers during marine mammal observations.

### *14.2.4 Seabird observations*

Seabird watches were completed three times a day: in the morning, at noon and in the evening (Table 14.1). Each watch consisted of two 10-minute intervals and was completed by one of the two MWOs on watch. When the vessel was moving, surveys consisted of a continuous scan of the water in a 300 m wide transect at a 90° angle from the bow (0°) along the side of the vessel (Figure 14.2). When the vessel was stationary, observations were made by scanning the 300 m wide transect from the bow (0°) to the stern of the vessel (180°; thereby doubling the transect area).

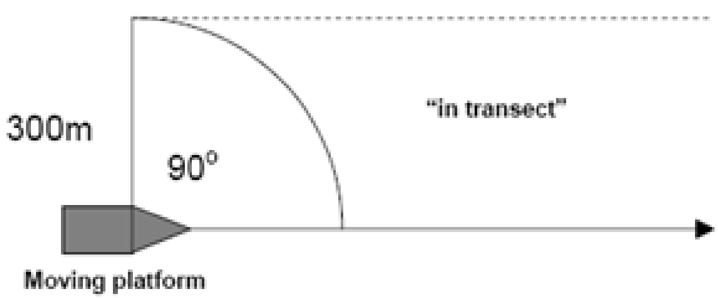


Figure 14.2. Seabird observations conducted by Marine Wildlife Observers on a moving vessel using a 90° scan, covering a 300 m transect from a moving vessel.

In order not to overestimate the bird density, flying birds were not recorded continuously throughout the 10-minute period. When many flocks were present, MWOs used 'snapshot' counts in certain intervals to record flying birds during the watch period. The number of snapshots performed during each 10-minute period was dependent on the speed of the vessel (the slower the vessel, the more snapshots). Snapshot counts were not used for occasional flocks. Sightings of flying birds were recorded indicating whether the snapshot method was used or not.

### *14.2.5 Data recording and storage*

All marine mammal and seabird sightings as well as environmental conditions and vessel information (speed, direction etc.) were recorded using handheld computers (iPAQs). Environmental condition, marine mammal and seabird observation forms (that were created prior to the field program) were uploaded to the screen of the handheld computer and completed by the MWOs during their watch periods. Bluetooth GPS units were used to record the locations of sightings. Additionally, Garmin GPS units were used as a backup. Photographs of sightings were taken when possible using a Nikon D300.

All completed data forms were downloaded to a laptop at the end of every watch period (depicted as green DATA blocks in Table 14.1) by each MWO. At the end of each day, all compiled data underwent quality assurance and quality control (QA/QC), back-up copies were produced and daily reports were compiled.

One iPAQ related technical issue was noted, analysed and resolved. It was not possible to download information from the iPAQ computers to the laptop if the time recorded on the data forms of the two iPAQs was identical. The solution chosen to overcome this problem was to manually change the time to the next minute (if two forms had the identical time). This allowed the forms to download properly on the laptop.

## 14.3 Preliminary results

### *14.3.1 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*
### *Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea*

Marine mammal sighting summary

In Leg 2a, two different species of marine mammals were observed during scheduled marine mammal watches: bowhead whale (*Balaena mysticetus)* and ringed seal (*Pusa hispida)*.

In Leg 2b, four different species of marine mammals were observed during scheduled marine mammal watches: bowhead whale (*Baleana mysticetus*) beluga whale (*Delphinapterus leucas*), ringed seal (*Pusa hispida*) and bearded seal (*Erignathus barbatus*).

Unidentified whales and seals were also recorded when MWOs were unable to identify the animals due to one or a combination of the following factors:

- poor visibility due to environmental conditions;
- the mammal was too far away; and/or
- the mammal dove under water.

During Leg 2a, there were approximately 53 sightings of a total of 102 individual marine mammals (not corrected yet for re-sightings) during scheduled marine mammal watches, most of them ringed seals. Four polar bears (*Ursus maritimus*) were observed outside of the scheduled MWO watch periods: one adult bear was observed swimming in the water when the vessel was in transit from Kugluktuk to the area of interest (on 14 August) and one female with two cubs was observed in the ice pack north of the area of interest when the vessel went to the ice to avoid heavy seas (on 18 August).

During Leg 2b, there were approximately 47 sightings of a total of 139 individual marine mammals (not corrected yet for re-sightings) during scheduled marine mammal watches on Leg 2b, most of them ringed seals.

<u>Seabird sighting summary</u>

In Leg 2a, a total of 15 seabird species were observed either during scheduled seabird watches or opportunistically during scheduled marine mammal watches. Species observed were: arctic tern (*Sterna paradisaea*), black-legged kittiwake (*Rissa tridactyla*), brant (*Branta bernicla*), common eider (*Somateria mollissima*), common loon (*Gavia immer*), glaucous gull (*Larus hyperboreaus*), herring gull (*Larus argentatus*), king eider (*Somateria spectabilis*), long-tailed duck (*Clangula hyemalis*), long-tailed jaeger (*Stercorarius longicaudus*), pacific loon (*Gavia pacifica*), pomarine jaeger (*Stercorarius pomarinus*), red-throated loon (*Gavia stellata*), and thick-billed murre (*Uria lomvia*). Additional sightings of unknown loons, murres, sandpipers and completely unidentified birds were also recorded during Leg 2a.

In Leg 2b, a total of 24 seabird and three land bird species were identified, either during scheduled seabird watches or opportunistically during scheduled marine mammal observations. Recorded seabird species were american golden plover (*Pluvialis dominica*), thick billed-murre (*Uria lomvia*), arctic loon (*Garvia arctica*), arctic tern (*Sterna paradisaea*), black-legged kittiwake (*Rissa tridactyla*), brant (*Branta bernicla*), common eider (*Somateria mollissima*), common loon (*Gavia immer*), common murre (*Uria aalge*), dovekie (*Alle alle*), glaucous gull (*Larus hyperboreus*), herring gull (*Larus argentatus*), king eider (Somateria spectabilis), , long-tailed duck (*Clangula hyemalis*), long-tailed jaeger (*Stercorarius longicaudus*), northern fulmar (*Fulmarus glacialis*), pacific loon (*Gavia pacifica*), pomarine jaeger (*Sterocarius pomarinus*), Sabine's gull (*Xema sabini*), semi-palmated sandpiper (*Calidris pusilla*), short-tailed shearwater (*Puffinus tenuirostris*), snow goose (*Chen caerulescens*), Thayer's gull (*Larus thayeri*), and yellow-billed loon (*Gavia adamsii*). Recorded land bird species were: lapland longspur (*Calcarius lapponicus*), snow bunting (*Plectrophenax nivalis*), and peregrine falcon (*Falco peregrinus*). Additional sightings of unknown ducks, eiders and gulls were recorded as well as a number of completely unidentified birds.

Some birds could not be identified due to one, or a combination of the following factors:

- poor sightability due to environmental conditions;
- the bird was too far away; and/or
- the bird was flying too fast.

There were approximately 221 sightings of a total of 745 individual birds (not corrected yet for re-sightings) during Leg 2a, most commonly black-legged kittiwakes and glaucous gulls.

There were approximately 672 sightings of a total of 3 245 individual birds (not corrected yet for re-sightings) during Leg 2b, most commonly black legged-kittiwakes and glaucous gulls.

### *14.3.2 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

Observations were carried out over a period of 13 days in the Beaufort Sea. Three of these days were spent in the ice pack near multi-year ice floes. The total numbers of species observed over the survey period are summarized in Table 14.3 A total of 13 mammals and 255 birds were observed. Marine mammal sightings were limited to days when the *Amundsen* was in the northern ice pack except for a single Ringed Seal sighting on the first day of operations. The Glaucous Gull was the most frequently observed bird species.

Table 14.3. Summary of wildlife observed in the Beaufort Sea during Leg 3a.

| Species | Number of Sightings | Number of Individuals |
|---|---|---|
| ***Mammals:*** | | |
| Polar Bear | 6 | 8 |
| Ringed Seal | 5 | 5 |
| ***Birds:*** | | |
| Arctic Tern | 7 | 29 |
| Black Brant | 1 | 10 |
| Glaucous Gull | 51 | 99 |
| Long-tailed Jaeger | 1 | 6 |
| Northern Fulmar | 1 | 1 |
| Pacific Loon | 5 | 6 |
| Parasitic Jaeger | 11 | 82 |
| Snowy Owl | 11 | 3 |
| UnID Gull | 2 | 17 |
| UnID Jaeger | 1 | 1 |
| UnID Tern | 1 | 1 |

Environmental conditions were generally favourable for the first part of the survey period, with visibility and weather conditions deteriorating at the end of the Leg. Mid-day environmental updates are summarized in Table 14.4

Table 14.4. Selected environmental variables recorded during mid-day observations during Leg 3a.

| Observation Log Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **Start Date UTC** | 09/24/10 | 09/25/10 | 09/26/10 | 09/27/10 | 09/28/10 | 09/29/10 | 09/30/10 |
| **Start Time UTC** | 6:35pm | 2:11pm | 1:55pm | 2:29pm | 2:22pm | 1:59pm | 1:59pm |
| **Update Time** | 6:52pm | 5:27pm | 5:25pm | 8:15pm | 7:52pm | 7:57pm | 7:52pm |
| **Water depth (m)** | 430 | 72 | 648 | 374 | 400 | 590 | 24 |
| **Wave Height (m)** | 0.5-1.0 | 1.0-2.0 | 0.5-1.0 | <0.1 | <0.1 | <0.1 | 1.0-2.0 |
| **Sea State** | 2 – smooth wavelets (0.1 – 0.5m) | 4 - Moderate waves, some spray | 3 - Slight - small white caps | 0.5 - Ripples (<0.1m) | 0 - Glassy (0m) | 0.5 - Ripples (<0.1m) | 4 - Moderate waves, some spray |
| **Obstructions to Visibility** | Patchy/Variable Fog | Patchy/Variable Fog | Patchy/Variable Fog | Patchy/Variable Fog | Patchy/Variable Fog | Patchy/Variable Fog | Patchy/Variable Fog |
| **Cloud Cover** | 95% | 80% | 75% | 70% | 30% | 50% | 60% |
| **Wind Direction** | NE | SE | SE | Variable | SE | SE | W |
| **Wind Force (Beaufort)** | 3 - Gentle Breeze (7-10knots) | 5 - Fresh breeze (17-21knots) | 3 - Gentle Breeze (7-10knots) | 1 - Light air (1-3kts) | 3 - Gentle Breeze (7-10knots) | 1 - Light air (1-3kts) | 6 - Strong breeze (22-27kts) |
| **Visibility (m)** | 500 | 500 | 100 | 500 | 1500 | 1500 | 1500 |
| **Sunglare** | No glare | Weak glare | Strong glare | No glare | Strong glare | No glare | Weak glare |
| **Sun glare angle FROM** | 0 | 9 | 2 | 0 | 2 | 0 | 9 |
| **Sun glare angle TO** | 0 | 3 | 2 | 0 | 2 | 0 | 9 |
| **Sightability** | Medium | Medium | Medium | Medium | High | Medium | Medium |
| **Ice Visible** | No | No | No | Yes | Yes | Yes | No |
| **Ice Cover Within ~1000m** | 0 | 0 | 0 | >75% | >75% | >75% | 0 |
| **Comments** | | | N71.00 W135.22 | N74.36 W128.47 | N74.26 W129.06 | N74.42 W128.12 | N71.55 W125.20 |

| Observation Log Day | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|
| **Start Date UTC** | 10/01/10 | 10/02/10 | 10/03/10 | 10/04/10 | 10/05/10 | 10/06/10 |
| **Start Time UTC** | 2:00pm | 2:03pm | 2:03pm | 1:56pm | 1:57pm | 1:57pm |
| **Update Time** | 7:52pm | 1:34am | 7:55pm | 7:55pm | 8:13pm | 7:58pm |
| **Water depth (m)** | 238 | 8.4 | 80 | 217 | 16.8 | 297 |
| **Wave Height (m)** | <0.1 | 0.5-1.0 | 0.5-1.0 | 1.0-2.0 | 0.5-1.0 | 0.5-1.0 |
| **Sea State** | 1 - Small wavelets (0-0.1m) | 4 - Moderate waves, some spray | 4 - Moderate waves, some spray | 5 - Rough, larger waves (2.4-4m) | 4 - Moderate waves, some spray | 3 - Slight - small white caps |
| **Obstructions to Visibility** | Patchy/Variable Fog | Thick fog | Patchy/Variable Fog | | Patchy/Variable Fog | Patchy/Variable Fog |
| **Cloud Cover** | 50% | 100% | 90% | 70% | 95% | 75% |
| **Wind Direction** | W | SW | NE | E | E | NE |
| **Wind Force (Beaufort)** | 3 - Gentle Breeze (7-10knots) | 6 - Strong breeze (22-27kts) | 5 - Fresh breeze (17-21knots) | 6 - Strong breeze (22-27kts) | 6 - Strong breeze (22-27kts) | 5 - Fresh breeze (17-21knots) |
| **Visibility (m)** | 2000 | 100 | 2000 | 750 | 1500 | 2000 |
| **Sunglare** | Strong glare | No glare | No glare | Weak glare | Weak glare | Weak glare |
| **Sun glare angle** | 4 | 0 | 0 | 2 | 2 | 10 |

| Observation Log Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| **FROM** | | | | | | | |
| **Sun glare angle TO** | 4 | 0 | 0 | 2 | 2 | 10 | |
| **Sightability** | Medium | Poor | Medium | Poor | Poor | Medium | |
| **Ice Visible** | No | No | No | No | No | No | |
| **Ice Cover Within ~1000m** | 0 | 1 | 0 | 0 | 0 | 0 | |
| **Comments** | N71.25 W127.42 | N69.51 W133.20 | N70.54 W134.24 | N71.47 W129.30 | N71.55 W125.21 | N71.22 W127.21 | |

# 15 Bioacoustics research program – Legs 2a and 3a

ArcticNet Phase 2 – Project titled *Impacts of Global Warming on Arctic Marine Mammals*. http://www.arcticnet.ulaval.ca/pdf/phase2/ferguson_marine_mammals.pdf.

**Project leaders:** ArcticNet and BP

**Cruise participants Leg 2a & 3a:** BP

## 15.1 Introduction

Since 2002, ArcticNet has deployed passive hydrophones on sub-surface oceanographic moorings in the Amundsen Gulf and Mackenzie Shelf region. The number of ArcticNet hydrophones and the individual nature of the hydrophones limit the data to point detections over an annual cycle.

In 2008, Imperial Oil Resources Ventures Limited (IORVL) initiated a seasonal Bioacoustics Research Program in the Canadian Beaufort Sea that involved the deployment of an array of Marine Autonomous Recording Units (MARUs) to record the sounds of marine mammals, with a particular focus on bowhead whales (*Balaena mysticetus*). The array was located in Exploration Licence (EL) 446 and in a control area east of EL 446. The work was continued in 2009 with the deployment of an array in EL 446.

In 2010, BP Exploration Operating Company Limited (BP) committed to a third year of data collection in the Canadian Beaufort, specifically in EL 449 and 451, located adjacent to, and east of EL 446. During 2010, the data collection was expanded to include both bowhead and beluga whales (*Delphinapterus leucas*). The specific program objectives for 2010 included the collection of:

- Continuous audio data at a sampling rate of 2 kHz with the intent of determining the temporal and spatial occurrence and relative levels of acoustic activity of vocalizing bowhead whales in the area of interest.
- A subsample of audio data at a sampling rate of 16 kHz with the intent of determining the temporal and spatial occurrence of vocalizing beluga whales in the area of interest.
- Continuous audio data at a sampling rate of 2 kHz to quantify the spatio-temporal dynamics of the ambient noise environment throughout the area of interest.

The data collected will allow compiling three (3) years of information on bowhead whale presence and movement in EL 446, 449 and 451. It will also establish an initial understanding of beluga presence in EL 449, specifically in the deep offshore waters using a passive acoustic system. This information can be used to complement annual acoustic data collected by ArcticNet, and add to the growing body of knowledge around bowhead and beluga habitat use in this area. This information is useful from a habitat use perspective and to understand the potential implications of industry activities in this area of the

Canadian Beaufort. This information may also be used to design mitigative measures and monitoring programs by industry and Canadian regulators in the future.

### 15.2 Methodology

An *autonomous recording unit (ARU)* is a digital audio recorder that can be programmed to record on a desired daily schedule and deployed for periods of weeks or months in a remote environment. The marine autonomous recording units (MARUs) used in this project are packaged in positively buoyant glass spheres. A MARU is deployed by being dropped to the seafloor with an anchor such that the MARU floats a few meters above the bottom.

Figure 15.1. Marine Autonomous Recording Unit deployed in the Beaufort Sea during Leg 2a.

Underwater sounds are recorded through a hydrophone (underwater microphone) mounted outside the sphere. These analog sound data are conditioned, digitized, and stored in a binary digital audio format on electronic storage media. At the conclusion of the deployment, the MARU is sent an acoustic command to release itself from its anchor, and it floats to the surface for recovery. After the device is recovered, its recorded audio data are extracted and stored on a server for analysis.

The locations of the recorders are known and the speed of sound underwater can be calibrated using ArcticNet Rosette data. With this information, it will be possible to compute estimates of the locations of bowheads vocalizing in and near the array based on differences among recorders in the arrival times of individual bowhead sounds, provided the bowhead call is recorded on three or more recording units.

The configuration and equipment parameters are critical for determining where bowhead whales are relative to the study area and how many animals are present at a minimum. Depending on the behaviour and density of bowhead whales in the area, it may be possible to determine whether bowheads are moving through or staying the study area. The configuration also enables quantitative characterization of the spatio-temporal dynamics of the ambient noise environment.

An experimental GPS development option, chosen by BP, incorporates a GPS tracking system into each MARU. The system is intended to activate when the MARU is released for recovery to aid in locating the unit during a normal recovery operation. After surfacing and acquiring a GPS fix, the system is expected to broadcast the MARU location to a hand-held receiver, up to a distance of 8 kilometres depending upon environmental conditions. This system was provided as a development project only on an experimental best-effort basis.

### *15.2.1 Deployment (Leg 2a)*

When multiple MARUs are deployed in an array configuration, all units are synchronized at the start and end of deployment and the extracted data are merged into synchronized, multi-channel audio files.

Figure 15.2. Synchronizing the MARUs on the deck of the *Amundsen* before deployment on 15 August 2010 in Leg 2a.


Figure 15.3. MARU deployment from the CCGS *Amundsen* (photo: J. Barrette, ArcticNet).

The array configuration chosen for the 2010 program included 12 MARUs spread over the shelf, slope and deepwater, with 10 MARUs set in an array separated by 5 nautical miles (Figure 15.4).

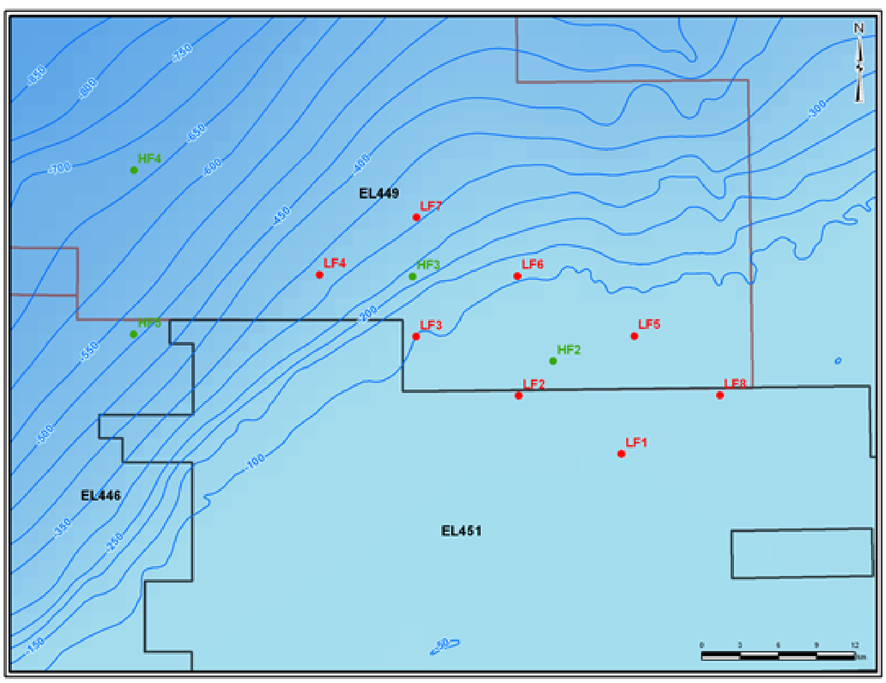


Figure 15.4. MARU array configuration over BP lease blocks EL 449 and EL 451 in the Beaufort Sea.

Eight of the 12 MARUs (LF1-8) were programmed to continuously record at a sampling rate of 2 kHz for an effective frequency bandwidth of 1000 Hz. This frequency band is the range of best acoustic propagation and covers the majority of bowhead vocalizations. This sampling rate also captures some lower frequency beluga vocalizations. Four MARUs (HF2-5) recorded on an approximate 25% duty cycle at a sampling rate of 16 kHz for an effective frequency bandwidth of 8000 Hz. This frequency band covers a wider range of beluga vocalizations in addition to the majority of bowhead vocalizations. Vocalizing belugas cannot be located with this deployment configuration because beluga calls do not propagate far enough to enable localization with the array geometry.

All 12 MARUs were deployed successfully during Leg 2a on 15 August 2010 (Table 15.1).

Table 15.1. Summary of MARU deployments in the BP lease blocks in the Beaufort Sea during Leg 2a.

| Site | Planned Latitude N | | Planned Longitude W | | Deployment Time | Actual Latitude N | | Actual Longitude W | | Water depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| LF1 | 70 | 48.246 | 134 | 19.777 | 0520 | 70 | 48.294 | 134 | 19.749 | 70 |
| LF2 | 70 | 50.782 | 134 | 32.896 | 0555 | 70 | 50.80 | 134 | 32.89 | 78 |
| HF2 | 70 | 52.246 | 134 | 28.300 | 0617 | 70 | 52.24 | 134 | 28.40 | 80 |
| LF3 | 70 | 53.307 | 134 | 46.051 | 0655 | 70 | 53.31 | 134 | 46.06 | 107 |
| HF5 | 70 | 53.410 | 135 | 22.420 | 0807 | 70 | 53.393 | 135 | 22.44 | 525 |
| HF4 | 71 | 00.240 | 135 | 22.420 | 0851 | 71 | 00.311 | 135 | 22.549 | 640 |
| LF4 | 70 | 55.811 | 134 | 58.855 | 0957 | 70 | 55.932 | 134 | 58.478 | 345 |
| HF3 | 70 | 55.832 | 134 | 46.550 | 1024 | 70 | 55.855 | 134 | 46.458 | 228 |
| LF7 | 70 | 58.292 | 134 | 45.772 | 1048 | 70 | 58.338 | 134 | 45.986 | 304 |
| LF6 | 70 | 55.803 | 134 | 32.901 | 1119 | 70 | 55.845 | 134 | 32.933 | 101 |
| LF5 | 70 | 53.244 | 134 | 19.869 | 1151 | 70 | 53.271 | 134 | 17.950 | 103 |
| LF8 | 70 | 50.711 | 134 | 06.744 | 1450 | 70 | 50.72 | 134 | 06.99 | 110 |

### *15.2.2 Recovery (Leg 3a)*

The MARUs were retrieved during Leg 3a on 25 and 26 September 2010.


Figure 15.5. Retrieval plan for the MARUs deployed in the Beaufort sea during Leg 2a and recovered in Leg 3a on 25-26 September.

On 25 September 2010, nine of the 10 MARUs surfaced as expected and were retrieved with little or no trouble. The tenth MARU, from site LF2, ($5^{th}$ of 10 sites visited), responded to its acoustic interrogation, but did not appear on the surface in the expected time period. The process of communication was repeated continuously for over an hour; each time receiving the expected acoustic response but with the MARU not surfacing. With continued communication indicating that the unit was almost certainly still on the sea floor; it was decided between the chief scientist and the Cornell field specialist that further attempts would continue to yield the same results and that in the interest of maintaining the project time-table it would be best to move on to the next location.

On 26 September, the final two MARU locations were visited with the successful retrieval of HF4 and HF5. The 11 and 12 MARUs retrieved were detected at their expected positions, and surfaced within 200m of their deployment locations, within close visual range of the vessel. To avoid confusion; all locations refer to the deployed coordinates of the MARU. Due to the fact that there can be a significant amount of ship movement and drift of the MARU between the time of release and the time it is finally located on the surface, the most certain coordinates are those of deployment. If the MARUs had not responded at the expected locations and a search had to be made to locate them; that data would be included and those coordinates would have been used as the recording location (Table 15.2).

Table 15.2. Summary of MARUs deployments and retrievals in the Beaufort Sea.

| Site | Actual Latitude N | | Actual Longitude W | | Deployed date | Retrieved date | Retrieval time | Water depth (m) |
|---|---|---|---|---|---|---|---|---|
| LF1 | 70 | 48.294 | 134 | 19.749 | 08/15/2010 | 09/25/2010 | 1023 | 70 |
| LF2 | 70 | 50.80 | 134 | 32.89 | 08/15/2010 | Not recovered | | 78 |
| HF2 | 70 | 52.24 | 134 | 28.40 | 08/15/2010 | 09/25/2010 | 1252 | 80 |
| LF3 | 70 | 53.31 | 134 | 46.06 | 08/15/2010 | 09/25/2010 | 1620 | 107 |
| HF5 | 70 | 53.393 | 135 | 22.44 | 08/15/2010 | 09/26/2010 | ?? | 525 |
| HF4 | 71 | 00.311 | 135 | 22.549 | 08/15/2010 | 09/26/2010 | ?? | 640 |
| LF4 | 70 | 55.932 | 134 | 58.478 | 08/15/2010 | 09/25/2010 | 1905 | 345 |
| HF3 | 70 | 55.855 | 134 | 46.458 | 08/15/2010 | 09/25/2010 | 1657 | 228 |
| LF7 | 70 | 58.338 | 134 | 45.986 | 08/15/2010 | 09/25/2010 | 1803 | 304 |
| LF6 | 70 | 55.845 | 134 | 32.933 | 08/15/2010 | 09/25/2010 | 1531 | 101 |
| LF5 | 70 | 53.271 | 134 | 17.950 | 08/15/2010 | 09/25/2010 | 1114 | 103 |
| LF8 | 70 | 50.72 | 134 | 06.99 | 08/15/2010 | 09/25/2010 | 0840 | 110 |

Table 15.3. MARU release times during recovery operations in the Beaufort Sea during Leg 3a.

| Depth | Time to surface |
|---|---|
| 70m | 8 minutes |
| 79m | 12 minutes |
| 82m | 12 minutes |
| 101m | 13 minutes |
| 107m | 13 minutes |
| 240m | 15 minutes |
| 304m | 16 minutes |
| 345m | 18 minutes |
| 525m | 21 minutes |
| 640m | 22 minutes |

Once onboard, the MARUs were then synchronized to assist in the analysis process and powered down. Over the following days, each MARU was disassembled, opened, and the hard-drives and temperature loggers removed for transport to Ithaca, NY by the Field Applications Specialist. The MARUs were then sealed, re-assembled, and packed for shipping to Ithaca upon return of the *Amundsen* to Quebec City.

# 16 Contaminants sampling program – Legs 1a and 2a

ArcticNet Phase 2 – Project titled *Effects of Climate Change on Contaminant Cycling in the Coastal and Marine Ecosystems*.
http://www.arcticnet.ulaval.ca/pdf/phase2/stern_contaminants.pdf.

**Project leaders:** Gary A. Stern[1,2] (Gary.Stern@dfo-mpo.gc.ca), Feiyue Wang[2] and BP (Leg 2a)

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## 16.1 Introduction

### *16.1.1 Mercury and methyl mercury in biota*

The main purpose behind the collection of zooplankton for this study is to link physical and biological processes to mercury (Hg) levels in the food web and to target the pelagic food web biomagnification and bioaccumulation of mercury with stable isotopes and fatty acids. All biological samples collected will be measured for total mercury and MeHg along with stable isotopes to place organisms into their associated trophic levels. These analyses will be performed at the Freshwater Institute, DFO, Winnipeg.

Organisms associated with benthic (sea floor) environments often have higher methyl mercury concentrations than pelagic (water column) organisms. Methyl mercury is the most toxic form of mercury and there is evidence suggesting that the transformation of less toxic forms of mercury to methyl mercury primarily occurs near the water-sediment interface at the seafloor. Thus, to better understand how mercury enters the food chain in the benthic environment, total and methyl mercury in sea floor sediments and benthic biota was measured.

### *16.1.2 Mercury and methyl mercury in water*

Mercury (Hg) levels in marine mammals and fish are an ongoing concern in Arctic regions because of their inclusion in traditional subsistence diets among indigenous peoples in northern regions. This research on Hg in the Arctic is focused on determining the environmental processes responsible for the distribution and speciation of Hg in Arctic marine ecosystems, for the purpose of supporting the development of strategies to lessen the impact of Hg on human and ecosystem health. The main purpose of this program is to understand the uptake of mercury into the aquatic food chain.

### *16.1.3 Sedimentation and flux dynamics of contaminates in Hudson Bay (Leg 1a)*

The vertical flux of contaminants in the water column plays a significant role in their fate and eventual sequestration into aquatic sediments. To better understand how the fate of contaminants like mercury (Hg) may vary thought time, the flux of contaminants will be investigated by examining aquatic sediments collected during Leg 1a. This sampling should fill in a knowledge gap noticed during prior sampling, analysis and distribution.

### *16.1.4 Permafrost degradation and carbon inputs from rivers of Hudson Bay (Leg 1a)*

The amount of surface soil organic carbon (SOC) contained in cryosolic soils is significant and these current carbon sinks may become sources as temperatures in the north are expected to rise and as permafrost degradation increases with climate change. This release of carbon into the river systems draining into Hudson Bay may significantly alter the carbon cycle of this region and may contribute to alterations in primary productivity and ocean atmospheric interfaces. With increased warming in the Arctic, there is the potential for vast amounts of SOC to enter the system and ultimately change the input of terrigenous and petrogenic carbon into coastal seas. By sampling the entire coastal river system of the Hudson Bay during Leg 1a, an improved analysis of permafrost dynamics relative to climate, temperature and vegetation will be possible.

### *16.1.5 Gaseous elemental mercury (Leg 1)*

The interaction of mercury between the water column and the atmosphere could either be a source or sink to the mercury in the water column. Monitoring continuous atmospheric levels during Leg 1 in Hudson Bay will further the understanding of this exchange at the surface.

## 16.2 Methodology

### *16.2.1 Mercury and methyl mercury in biota*

Zooplankton was collected using the vertically towed Monster net (200 µm) designed for integrated water column sampling and the oblique Tucker net (750 µm) which provided water column zooplankton samples from the upper 100 m layer. Immediately after collection, individual zooplankton species are sorted into plastic vials and frozen at -20°C.

Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

Biological samples were collected throughout the Hudson Bay at Basic, Full and Mooring stations along the cruise transect (Table 16.1).

Table 16.1. Zooplankton sampling for contaminants analyses conducted in Hudson Bay and river systems during Leg 1a.

| Station ID (Description) | Date | Latitude N | Longitude W | Tow (mesh size in µm) | Bottom depth (m) | Tow depth (m) |
|---|---|---|---|---|---|---|
| 350 (S. Hampton I.) | 10/07/14 | 64°26.26 | 080°27.62 | Vertical (200)<br>Oblique (750) | 380 | 370 |
| 699 (Puvirnituq area) | 11/07/14 | 59°59.84 | 078°26.28 | Vertical (200)<br>Oblique (750) | 83 | 73 |
| 702 (Great Whale R. area) | 14/07/14 | 55°25.22 | 077°54.75 | Vertical (200)<br>Oblique (750) | 133 | 123 |
| 709 (James B.) | 16/07/14 | 54°43.17 | 080°45.94 | Vertical (200)<br>Oblique (750) | 89 | 79 |
| 735 (W. of Belcher I.) | 17/07/14 | 56°47.56 | 080°50.14 | Vertical (200)<br>Oblique (750) | 184 | 174 |
| 745 (SW of Coats I.) | 17/07/14 | 60°30.40 | 085°00.83 | Vertical (200)<br>Oblique (750) | 186 | 176 |
| 765 (Chesterfield In.) | 19/07/14 | 62°18.58 | 090°39.63 | Vertical (200)<br>Oblique (750) | 103 | 93 |
| 707 (NE of Churchill) | 20/07/14 | 59°58.14 | 091°57.00 | Vertical (200)<br>Oblique (750) | 96 | 86 |
| 706 (E of Churchill) | 22/07/14 | 58°46.95 | 091°32.35 | Vertical (200)<br>Oblique (750) | 78 | 68 |
| 705 A (Nelson R.) | 23/07/14 | 57°25.5 | 091°53.5 | Vertical (200)<br>Oblique (750) | 35 | 25 |
| 705 Mooring (Nelson R.) | 25/07/14 | 57°39.91 | 091°36.31 | Vertical (200)<br>Oblique (750) | 57 | 47 |
| 790 | 29/07/14 | 57°14.859 | 088°52.849 | Vertical (200)<br>Oblique (750) | 40 | 30 |
| 840 (Cental Hudson B.) | 30/07/14 | | | Vertical (200)<br>Oblique (750) | 177 | 157 |

*Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

Zooplankton samples were collected during Leg 2a throughout the study area at stations BP10-001 to BP10-018.

### *16.2.2 Sediments and benthic fauna*

Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

Box cores were deployed and retrieved onboard the *Amundsen*. When retrieved, two 10-centimeter diameter push cores were taken using PVC piping with the assistance of a negative pressure pump to reduce core compaction. Duplicate push cores were sub-sampled at 0.5 cm intervals for the initial 10 cm and 1.0 cm intervals thereafter.

During Leg 1a, only Site 840 was sampled at depth; however, surface sediment samples were taken at all box core locations (Table 16.2). Box cores were shared with MUN, UQAR and U. Laval teams.

Table 16.2. Box core sediments sampling for contaminants analyses conducted in Hudson Bay and river systems during Leg 1a.

| Station ID (Description) | Date | Latitude N | Longitude W | Bottom depth (m) | Sample type | Sampled depth (cm) |
|---|---|---|---|---|---|---|
| 709 (James B.) | 16/07/14 | 54°43.17 | 080°45.94 | 89 | Surface | Surface |
| 735 (W of Belcher Is.) | 17/07/14 | 56°47.56 | 080°50.14 | 184 | Surface | Surface |
| 745 (SW of Coats I.) | 17/07/14 | 60°30.40 | 085°00.83 | 186 | Surface | Surface |
| 707 (NE of Churchill) | 20/07/14 | 59°58.14 | 091°57.00 | 96 | Surface | Surface |
| 706 (E of Churchill) | 22/07/14 | 58°46.95 | 091°32.35 | 78 | Surface | Surface |
| 705 A (Nelson R.) | 23/07/14 | 57°25.50 | 091°53.50 | 35 | Surface | Surface |
| 705 M (Nelson R.) | 25/07/14 | 57°39.91 | 091°36.31 | 57 | Surface | Surface |
| 840 (Cental Hudson B.) | 30/07/14 | 58°24.73 | 083°18.08 | 177 | Push Core x2 | (27.5A, 27B) |

*Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

Benthic organisms were collected using the Agassiz trawl and boxcores at 17 basic stations (Table 16.3). Sediment from the box core was sieved using a 500 μm screen. Organisms were identified by P. Archambault's team (UQAR), frozen in Ziploc bags, and will be analyzed for total and methyl mercury at the Freshwater Institute in Winnipeg, MB. Two push cores (10cm diameter) were inserted into a single box core at Station 14. For the first push core, Falcon tubes were used to collect sediment at 2 cm intervals. The tubes were centrifuged at 2500 rpm to extract the pore water which was subsequently analyzed for total mercury in the onboard PILMS container lab. Sediment was collected from the second push core at 1 cm intervals for the first 10 cm, and 2 cm intervals for the next 10 cm. Sediment samples from the second push core were frozen in Ziploc bags and will be analyzed for mercury in Winnipeg.

Table 16.3. Benthic sampling stations used for mercury analysis during Leg 2a.

| Station # * | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Agassiz | X | X | X | X | X | X | X |  | X | X | X | X | X | X | X | X |  | X |
| Boxcore | X | X |  | X | X |  | X |  | X | X | X | X | X | X | X | X | X | X |
| Push cores |  |  |  |  |  |  |  |  |  |  |  |  |  | X |  |  |  |  |

*Station # is equivalent to BP10-0XX

### *16.2.3 Mercury and methyl mercury in water*

Samples from the 10 m depth to the seafloor were collected with the ship-based CTD-Rosette in PVC 'Niskin-style' sample bottles. Supplementary 'Surface' samples from 0 to 10 m in depth were collected using a PVC Niskin water sampling bottle (General Oceanics, Miami, Florida) from the Zodiac within three hours of the Rosette collection. High resolution profiles for 'total Hg' ($Hg_T$) were generated and some stations were sampled for methylmercury for both filtered, unfiltered and particulates. At each depth sampled, water was also collected for $\delta^{18}O$ analysis in tightly sealed glass scintillation vials. After collection of $\delta^{18}O$ samples, bottles were further sealed with parafilm and stored at 4°C.

Particulate samples were collected using 20-L closed containers from the Rosette. These were brought back to the clean lab and both filtered and unfiltered total mercury and methyl mercury samples were collected using Nalgene filter cups. The remaining 10-11 liters were then filtered through 0.45 μm PP filters using the Masterflex peristaltic pumps. Volume filtered was measured at the end.

Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

Hudson Bay has high suspended particles so numerous filters were needed to get through the samples. An attempt was made to use a 0.2 μm Teflon filter but was unsuccessful. Water samples were collected from the marine water column in Hudson Bay from twenty-nine locations (Table 16.4).

Table 16.4. Water sampling for contaminants analyses conducted in Hudson Bay and river systems during Leg 1a.

| Date | Station | Sample depth (m) | Latitude N | Longitude W | Bottom depth (m) | Cast # |
|---|---|---|---|---|---|---|
| 07-Jul-10 | 356 | 330 | | | | |
| 07-Jul-10 | 352 | 400 | | | | 3 |
| 08-Jul-10 | 362 | 280 | 62°05.058 | 71°42.720 | 410 | 5 |
| 08-Jul-10 | 360 | 330 | 62°26.160 | 71°04.800 | 280 | 6 |
| 09-Jul-10 | 350 | 370 | | | 342 | 7 |
| 10-Jul-10 | 698 | 130 | 62°05.969 | 78°42.708 | 376 | 10 |
| 10-Jul-10 | 710 | 268 | 62°57.950 | 80°13.043 | 140 | 12 |
| 11-Jul-10 | 701B | 100 | 58°25.163 | 79°22.192 | 278 | 11 |
| 11-Jul-10 | 699 | 75 | 59°59.890 | 78°26.231 | 110 | 15 |
| 12-Jul-10 | 720 | 78 | 57°00.122 | 76°53.381 | 85 | 13 |
| 13-Jul-10 | 702 | 97 | 55°25.663 | 77°55.387 | 88 | 16 |
| 14-Jul-10 | 703 | 40 | 54°40.850 | 79°57.433 | 107 | 19 |
| 15-Jul-10 | 709 | 83 | 54°42.930 | 80°46.774 | 49 | 21 |
| 15-Jul-10 | 704 | 21 | 54°45.383 | 81°42.233 | 93 | 23 |
| 15-Jul-10 | 730 | 85 | 55°26.986 | 80°33.692 | 27 | 24 |
| 15-Jul-10 | 735 | 173 | 56°47.747 | 80°50.383 | 95 | 25 |
| 17-Jul-10 | 745 | 175 | 60°30.395 | 85°00.941 | 183 | 27 |
| 18-Jul-10 | 760 | 128 | 63°03.367 | 88°24.960 | 186 | 28 |
| 18-Jul-10 | 765 | 91 | 62°17.918 | 90°39.833 | 135 | 32 |
| 19-Jul-10 | 707 | 95 | 59°58.067 | 91°57.134 | 104 | 34 |
| 21-Jul-10 | 706 | 72 | 58°47.224 | 91°31.207 | 106 | 36 |
| 23-Jul-10 | 705a | 27 | 57°25.298 | 91°53.603 | 79 | 40 |
| 24-Jul-10 | 705 | 43 | 57°40.498 | 91°34.853 | 34 | 48 |
| 27-Jul-10 | 800 | 109 | 58°10.417 | 88°14.922 | 53 | 51 |
| 28-Jul-10 | 790 | 30 | 57°14.863 | 88°52.549 | 119 | 54 |
| 29-Jul-10 | 820 | 41 | 55°41.611 | 84°54.372 | | 56 |
| 29-Jul-10 | 840 | 165 | 58°24.605 | 83°18.116 | 52 | 60 |
| 30-Jul-10 | 740 | 137 | 60°22.261 | 81°58.301 | | 64 |

*Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

Samples were collected from the marine water column in BP lease area in the Beaufort Sea from six locations (Table 16.5). One water sample, at transmissivity max, was filtered in tandem through at 0.2 and 0.45 μm filter.

Table 16.5. Stations sampled for total Hg during Leg 2a.

| Station | Latitude | Longitude | Bottom depth (m) | Cast # |
|---|---|---|---|---|
| BP10-014 | 70° 55.3 | 134° 26.0 | 101 | 003 |
| BP10-004 | 70° 55.110 | 134° 51.439 | 248 | 011 |
| BP10-007 | 71° 5.205 | 135° 33.91 | 839 | 014 |
| BP10-05 | 71° 1.783 | 135° 48.438 | 444 | 015 |
| BP10-002 | 70° 51.134 | 135° 0.160 | 124 | 018 |
| BP10-006 | 71° 59.952 | 135° 36.557 | 700 | 023 |

### *16.2.4 Permafrost degradation and carbon inputs from rivers of Hudson Bay*

A total of 16 rivers were sampled by helicopter in order to gain access further inland to fresh river water and permafrost sites. Fresh, not brackish, river water samples were collected for trace metals, $\delta^{18}O$, salinity and suspended sediments for further analysis. A portable pump with a filter plate was used to run and collect 20 liters of flowing river water through a Whatman GF/F filter to separate out the DOM. Filters were then freeze-dried for further analysis back in Winnipeg. GPS coordinates were also recorded (Table 16.6).

Once on site, a metal rod 1.5 meters in length was used to locate the permafrost as well as to determine the thickness of the active layer. Once permafrost was located, a soil pit was established to analyze the soil profile and active layer characteristics and to extract samples from each soil horizon for further lab analysis. A seven-centimeter by 11-centimeter section was cut out of the active layer with one-centimeter sections being extracted down to the frozen layer. Once core was extracted and removed it was bagged and immediately put in a cooler with freeze packs to preserve the core. In order to properly assess vegetation a variation of the Braun Blanchet method was used. Abundance percentage was recorded for a one meter by one-meter section, randomly selected at the permafrost site to represent the area.

Table 16.6. Permafrost and river water sampling for contaminants analyses conducted in Hudson Bay river systems during Leg 1a.

| | Site | | GPS | Field Work | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Date | Location | # | Latitude N<br>Longitude W | Core | AL (cm) | Water (L) | Trace | Salinity | $\delta^{18}O$ |
| 10-Jul | Pavungnituk River | PAVR | 60°03.870<br>77°13.040 | Y | 43 | 20 | Y | Y | Y |
| 10-Jul | Kogaluk River | KOGR | 56°36.770<br>77°28.964 | N | N/A | 20 | Y | Y | Y |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 10-Jul | Polemund River | POLR | 59°26.860<br>77°18.820 | N | N/A | 20 | Y | Y | Y |
| 11-Jul | Inuksuak River | INUR | 58°27.745<br>78°04.785 | Y | 14 | 20 | Y | Y | Y |
| 12-Jul | Nastapoka River | NASR | 56°55.280<br>76°26.750 | N | 32 | 20 | Y | Y | Y |
| 12-Jul | Little Whale River | PWR | 55°58.093<br>76°40.529 | Y | 29 | 20 | Y | Y | Y |
| 13-Jul | Great Whale River | GWR | 55°16.836<br>77°34.802 | N | 41 | 20 | Y | Y | Y |
| 18-Jul | Josephine River | JOSR | 63°08.320<br>90°59.560 | Y | 46 | 20 | Y | Y | Y |
| 18-Jul | Wilson River | WILR | 62°20.443<br>93°08.563 | N | N/A | 20 | Y | Y | Y |
| 18-Jul | Ferguson River | FEGR | 62°05.229<br>93°21.637 | N | N/A | 20 | Y | Y | Y |
| 19-Jul | Tha-Anne River | THAR | 60°33.480<br>94°55.210 | N | N/A | 20 | Y | Y | Y |
| 19-Jul | Thlewiaza River | THLR | 60°31.060<br>95°01.060 | Y | 22 | 20 | Y | Y | Y |
| | Churchill River | CHUR | 60°31.109<br>95°01.096 | N | N/A | 20 | Y | Y | Y |
| | Nelson River | NELR | N/A | N | N/A | N | N | N | N |
| 28-Jul | Severn River | SEVR | 55°52.833<br>87°49.667 | N | N/A | Y | Y | Y | Y |
| 28-Jul | Winisk River | WSKR | 55°09.300<br>85°18.950 | N | N/A | Y | Y | Y | Y |

### *16.2.5 Gaseous elemental mercury (Leg 1a)*

During Leg 1a, a Tekran 2537 was continuously monitoring gaseous elemental mercury from 03 July through to 01 August 2010. The lamp was changed and adjusted and calibrated at the beginning of the trip.

## 16.3 Preliminary results

Zooplankton collected during Leg 1a included: Euphausiacea, *Limacina helicina*, *Clione limacina*, *Themisto libellula*, *Calanus* sp., *Sagitta* sp., *Onisimus* sp., *Anonyx* sp., *Pandalus* sp., *Euchaeta* sp., *Hyperoche* sp., *Ammodytes* sp. and unknown larval fish species.

Zooplankton collected during Leg 2a included: *Calanus* sp., *Clione limacina*, *Limacina helicina*, *Liparis* sp., *Paraeuchaeta* sp., *Sagitta* sp., *Themisto* sp., Amphipods, Decapods, Euphausiaceans, Ostracods, and jellyfish including Cnidarians and Ctenophores.

## 16.4 Comments and recommendations

It is imperative that the cleanliness of the Rosette bottles be tested on a regular basis. At the beginning of Leg 1a, the bottles were tested by leaving Milli-Q water inside for an hour or more and tested the contaminants levels. Some of the bottles were very high (3-4 ppt). The bottles were cleaned with Triton-X and warm water, left for 6-10 hours, then rinsed well. This successfully removed any contamination.

# 17 BP contaminants sampling program –Leg 2a

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**Cruise participants Leg 2a**: IMG Golder Corporation[3] and AXYS Technologies[4]
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## 17.1 Introduction

The 2010 contaminants program was jointly designed by BP Exploration Operating Company Limited (BP) and IMG-Golder Corporation (IMG) and conducted by ArcticNet and IMG. The 2010 program was based on the 2009 Imperial Oil Resources Ventures Limited (IORVL) that collected sediment, water column, and biological samples for laboratory analysis. The 2010 contaminants program was improved based on lessons learned in 2009, and expanded to include additional requirements related to interpretation and analysis for environmental and biophysical baseline reporting.

The BP led 2010 contaminant program was focused on petroleum hydrocarbons, other organic compounds (including potential emerging contaminants), organic and inorganic carbon (and to some extent, carbonate system parameters), metals (including elements that have the potential to bioaccumulate), sediment particle size distribution, sediment porosity and moisture content, total suspended solids in the water column carbonate, and radiometric dating of sectioned cores from the upper 40-50 cm of the sediment column. The ArcticNet-led component contributed mercury and methyl mercury analyses. Many of the ArcticNet analyses were performed onboard using the *Amundsen*'s Portable In-situ Laboratory for Mercury Speciation (PILMS) laboratory.

The 2010 strategy for sampling and analysis was consistent with the work performed in 2009, with an expanded focus on understanding sediment and water column contaminants in Exploration Licences (ELs) 449 and 451. This included attention to processes that govern exchange or mixing of different contaminants between water masses on the shelf or over the continental slope, and flux (transfer) of different contaminants between water column and seabed (including specific metals and organic compounds that bioaccumulate).

The objective of the BP-led Leg 2a contaminant program was to collect a comprehensive set of sediment and biological samples at up to 18 stations, and water column samples at up to eight stations, in the project area. The samples were obtained in a way that would facilitate the combination of the 2009 and 2010 sample analyses results into one dataset.

## 17.2 Methodology

The Leg 2a biophysical sampling stations and water column transect are shown in Figure 17.1.

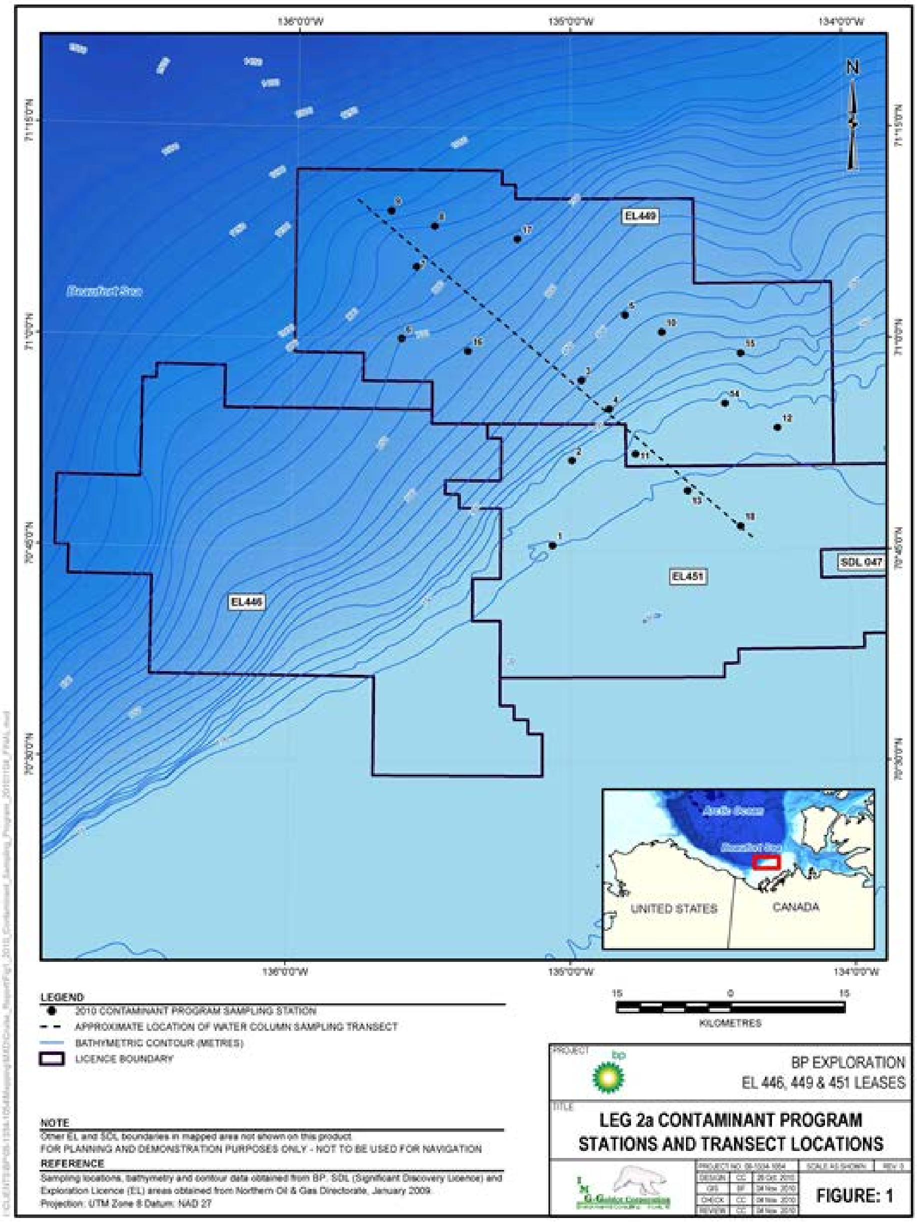


Figure 17.1. Leg 2a biophysical sampling stations located in Exploration Licences 449 and 451 in the Beaufort Sea.

### *17.2.1 Water column sampling (Large-Volume)*

<u>Sample collection</u>

Large-volume sampling was conducted at eight (8) of the 18 biophysical stations during Leg 2a, at up to four depths of interest (Table 17.1). They form a SE to NW transect across the shelf to deeper water on the slope. Large-volume (bulk) sampling was conducted to obtain samples for different types of analysis (Table 17.2) that will occur after the field period. At each station where this water sampling took place, the procedure involved the following steps:

- On arrival at the station, the submersible pump was lowered over the rail on the port side of the foredeck, to roughly 42 m below surface, and the tubing flushed for 2 minutes.
- Once flushed, water was collected into three 20-L stainless steel carboys.
- The tubing was raised to roughly 10 m below surface, and flushed for another 2 minutes.
- Once flushed, water was pumped into four 20-L stainless steel carboys. The extra 20-L carboy was filled from this depth to allow for a duplicate processing sample on the large-volume sample parameters at 10 m depth.
- Water from the two deeper depths (waters of Pacific and Atlantic origin with core properties that were distinct and unambiguous) were obtained with 12 specially prepared 12-L Niskin sampling bottles on the ArcticNet CTD-Rosette system. Six bottles were triggered on the Rosette at each depth of interest during a dedicated cast.
- Water was drawn directly from the Niskin bottles into six 20-L stainless steel carboys (three per depth) after these bottles were transferred to wall racks from the Rosette.
- All carboys were rinsed prior to collection from the first sampling station and the same carboys used for each depth. The carboys were not rinsed between stations.
- Collected water was processed in the foredeck lab.

The 12-L Niskin bottles were moved from wall racks and installed on the Rosette as the “normal” 12-L bottles were being rotated to the wall racks for the dedicated BP cast. The bottles were prepared at AXYS Technologies in Sidney (BC) before transfer to Quebec City for loading on the ship. This involved special cleaning (multiple clean/rinse cycles, and proofing by analyzing for ultra low level organics until the target compounds were not detectable). The bottles were also low level trace metal, or GeoTrace bottles when they were purchased. GeoTrace bottles have Teflon-coated external springs, sprayed Teflon lining, aluminum Nico-press sleeves on lanyards, and Teflon O-rings on the top and bottom of each bottle (these seal the bottle between the end stopper and the barrel).

The actual sampling depths were determined by monitoring temperature, salinity, nitrate, fluorescence, and dissolved oxygen as the Rosette was being lowered through the water column. Six bottles were triggered coming up from the bottom of the cast at or close to core depth, based on properties observed on descent for the two water types of interest (waters of Pacific and Atlantic origin, at roughly 33.1 ppt and 34.5 ppt, respectively). Depending on location along the transect from on the shelf to bottom of the slope, water of Pacific origin was sampled between 120-125 m and 135-140 m. Some anomalies in oxygen and nitrate suggested fingering and other structure at core depth, but these differences were ignored for selecting the trigger depth. Water of Atlantic origin was typically sampled at 300 m or close to the bottom of the cast if station depth was shallower.

Table 17.1. Stations where the water column was sampled for the BP contaminant program during Leg 2a.

| Station ID | Sample date | 10 m[(a)] | 42 m | Pacific Water | Atlantic Water | Small Volume Quality Control Samples |
|---|---|---|---|---|---|---|
| BP10_003 | 24-Aug-10 | Yes | Yes | Yes | Yes | hold time check duplicate[(d)] - 10 m |
| BP10_004 | 17-Aug-10 | Yes | Yes | Yes | Yes | none at this station |
| BP10_007 | 18-Aug-10 | Yes | Yes | Yes | Yes | field blank[(e)] – 10 m duplicate – Atlantic |
| BP10_009 | 16-Aug-10 | Yes | Yes | Yes[(b)] | Yes[(b)] | duplicate10 m |
| BP10_011 | 20-Aug-10 | Yes | Yes | — | — | none at this station |
| BP10_013 | 23-Aug-10 | Yes | Yes | — | — | travel[(f)] and field blank 42 m |
| BP10_016 | 22-Aug-10 | Yes | Yes | Yes[(c)] | Yes[(c)] | none at this station |
| BP10_018 | 15-Aug-10 | Yes | Yes | — | — | none at this station |

(a) A duplicate sample was collected for large volume SPE column sampling at 10 m depth.
(b) Samples collected on 17 August.
(c) Samples collected on 24 August, when CTD/rosette failed during planned sampling on 22 August.
(d) Duplicate samples - prepared by filling a second set of bottles. Duplicates are preserved similar to other water samples and shipped to the appropriate laboratory for analysis.
(e) Field blanks - prepared by filling a set of sample bottles with distilled water (from the lab) in the field. Field blanks are preserved similar to other water samples and shipped to the appropriate laboratory for analysis.
(f) Travel blanks - prepared by filling a set of sample bottles with distilled water (from the lab) and transported to and from the field without being opened. Travel blanks are preserved similar to other water samples and shipped to the appropriate laboratory for analysis.
"—" means "sample not collected"

## Sampling for Solid Phase Extraction (SPE) processing

The following process was used for the SPE processing:

- Collected water was processed using three Infiltrex 300 systems.
- The flow rate was set to one litre per minute. Twenty litres of sample water were pumped through the SPE processing system for waters collected at 10 m and 42 m depth below surface. 32 L of sample water was pumped through this system for waters collected at the two deeper depths to compensate for the reduced number of site samples. This meant that a total volume of 160 L of water was passed through the filter and column at each depth.
- During pumping, manual checks were made to ensure that flow rate and totalizer was calibrated correctly.
- The same process was repeated for waters collected from each depth. A duplicate sample was collected from seawater obtained with the pump at 10 m below surface.

The same columns and filters were used for the same depth or same type of seawater at each station. This meant that a composite sample from all stations sampled was produced for analysis on parameters of interest at 10 m in the mixed layer, at 42 m in the mixed layer, in water of Pacific origin (where the sampling depth varied somewhat based on the core properties of this layer), and in water of Atlantic origin.

## Sampling for Total Suspended Solid (TSS)

Total Suspended Solid (TSS) sampling was conducted as follows:

- Collected water was processed using the same pumping system as that for the SPE column sampling.
- Fifteen to 18 L of seawater was typically pumped from the carboys through a pre-weighed 1 µm filter loaded into a 142 mm flat disc filter holder. The exact volume of pumped water (typically 16 L) was recorded.
- Once pumped dry, the filter paper was carefully removed and the entire contents replaced back into the filter pouch.

<u>Sample storage onboard</u>

After completion of SPE processing in the foredeck container, columns and filters were wrapped in aluminum foil and packed in a cooler chest. Before transporting to shore at the end of Leg 2a, freezer packs were added to this cooler chest the evening before the transfer, and air bubble cushioning was placed around the wrapped columns and filters. The cooler chest was then sealed and taped shut. Chain of custody documentation was part of this process.

Table 17.2. Parameters measured in the water column for the BP contaminant sampling program in Leg 2a.

| Parameter/Group | Container | Preservatives | Storage |
|---|---|---|---|
| **Small-Volume** | | | |
| alkalinity | 250 mL | 50 µL $HgCl_2$ | 2-6°C |
| dissolved inorganic carbon (DIC) | | | |
| pH | 100 mL | — | 25°C water bath for onboard analysis |
| total organic carbon (TOC) | 60 mL | 2 mL 50% $H_2SO_4$ | 2-6°C |
| dissolved organic carbon (DOC) | 60 mL | 2 mL 50% $H_2SO_4$ | filtered onboard 2-6°C |
| salinity | 500 mL | — | 2-6°C |
| sulphide (part of salinity package) | 250 mL | 1 mL ZnAc; 10N NaOH | 2-6°C |
| metals (total) | 120 mL | 2 mL 50% $HNO_3$ | 2-6°C |
| metals (dissolved) | 120 mL | 2 mL 50% $HNO_3$ | filtered onboard 2-6°C |
| **Large-Volume** | | | |
| total suspended solids (TSS) | ca. 16 L volume pumped through filter paper | — | filtered onboard and kept filter paper and filtrate 2-6°C |
| total petroleum hydro-carbons (from particulate) | bulk composite sampling 20L | — | 2-6°C |
| PAHs and alkylated PAHs (from filtrate) | | — | 2-6°C |
| PAHs and alkylated PAHs (from particulate) | | — | 2-6°C |
| alkanes (from filtrate) | | — | 2-6°C |
| alkanes (from particulate) | | — | 2-6°C |

"—" means "preservative not used."

### *17.2.2 Water column sampling (Small-Volume)*

Sample collection

Small-volume sampling was conducted at eight stations forming a transect from the shelf to deeper water, at up to four depths of interest. This matched the depths (or water layers) selected for the large-volume sampling and SPE processing. The small-volume samples will be analyzed for the parameters listed in Table 17.2. At each of the stations in question, the procedure for small-volume sampling consisted of the following steps:

- When the ship arrived on station, the submersible pump was lowered over the rail on the port side of the foredeck to a water depth roughly 42 m below surface, and the tubing flushed for 2 minutes.
- Once flushed, water for the large-volume sampling was collected (see above).
- Following collection of the large-volume sample for SPE processing, water was collected for the small-volume samples from the tubing attached to the pump.
- The submersible pump was raised to a water depth of 10 m below surface, and the tubing flushed for another 2 minutes.
- Once flushed, water was again collected for the large-volume sample, followed by water for the small-volume samples.
- During this time no other sampling activities were occurring on deck.
- All sample bottles were rinsed three times prior to filling. Samples were preserved on deck except for total alkalinity and dissolved inorganic carbon (DIC), which were preserved in the aft lab.
- As dissolved metals and dissolved organic carbon (DOC) required filtering, these samples were collected in a separate 250 mL container, then filtered and preserved in the aft laboratory. Samples were filtered through a 0.45 µm filter using a hand operated vacuum pump.
- pH was measured onboard in the aft lab with a ThermoScientific Orion 610 pH meter. Hold time was four hours or less. Any gas bubbles on the inside surface of the 100 mL sample bottle, after equilibration at 25°C in a constant temperature bath, were removed by slowly rotating the sample bottle and inverting it several times. A ThermoScientific 9102SC refillable Ag/AgCl combination electrode and ThermoScientic automatic temperature compensation (ATC) probe (as specified for this electrode and the Orion pH meter), attached to an articulated arm, were lowered into the equilibrated sample. The electrode and ATC probe were not touched until the pH was stable for several minutes and then the value was recorded. High accuracy pH 7 and pH 10 buffers, traceable to NTIS standards, were used for calibrating the pH meter on a regular basis. It was not possible to use TRIS seawater buffers for this purpose.
- The process for obtaining deeper water samples was explained above. It involved a dedicated CTD-Rosette cast that began after pumping over the side was finished on the foredeck. Water was drawn from one of the six bottles fired at each depth after they were rotated from the rosette to the wall racks. Preservatives were added in the rosette room to samples that did not require filtering. The two samples that required this processing were taken to the aft lab with the rest of the samples, the filtering was done, and preservatives added.

- Quality control samples were collected as outlined in Table 17.2.

The only exception to the above procedure was the small-volume sampling that took place at the first station during Leg 2a. At this station, the water required for the small-volume samples was pumped into a 20-L carboy, taken to the aft lab and a peristaltic pump with Teflon tubing used to slowly pump water into the sample bottles after the rinsing step.

Total alkalinity and pH samples were also obtained on an opportunity basis from a full CTD/rosette cast at station 8, to replicate water column sampling that ArcticNet carried out at a deep water station during the 2009 program.

Sample storage onboard

Water samples were packed into cooler chests and stored at 4°C onboard. Before transfer to shore at the end of Leg 2a, freezer packs were added, and the cooler chests taped shut. Chain of custody documentation was part of this process.

### *17.2.3 Sediment sampling*

Sample collection

The sediment sampling strategy involved multiple locations on the shelf and slope that were either typical of those depths, or were situated at specific features (such as the mud volcano) that were distinct or unique. Sediment sampling was conducted at all 18 biophysical stations occupied during Leg 2a (Table 17.3 and Figure 17.1). Sub-sampling was undertaken for the parameters shown in Table 17.4.

Table 17.3. Stations where the sediments and benthic fauna were sampled for the BP contaminant program during Leg 2a.

| Station | Sample date | Sample depth (m) | Box Core | Push Core | Benthic | Quality control samples |
|---|---|---|---|---|---|---|
| BP10_001 | 21Aug-10 | 74 | Yes | — | Yes | — |
| BP10_002 | 21-Aug-10 | 133 | Yes | Yes | Yes | triplicate box cores[(a)] |
| BP10_003 | 24-Aug-10 | 380 | Yes | — | Yes | — |
| BP10_004 | 17-Aug-10 | 246 | Yes | — | Yes | — |
| BP10_005 | 19-Aug-10 | 432 | Yes | — | Yes | duplicate samples from one box core[(b)] |
| BP10_006 | 22-Aug-10 | 722 | Yes | — | Yes | — |
| BP10_007 | 19-Aug-10 | 848 | Yes | — | Yes | — |
| BP10_008 | 22-Aug-10 | 899 | Yes | — | - | — |
| BP10_009 | 17-Aug-10 | 945 | Yes | — | Yes | — |
| BP10_010 | 16-Aug-10 | 334 | Yes | — | Yes | — |
| BP10_011 | 21-Aug-10 | 88 | Yes | — | Yes | — |
| BP10_012 | 16-Aug-10 | 80 | Yes | Yes | Yes | — |
| BP10_013 | 23-Aug-10 | 72 | Yes | — | Yes | duplicate samples from one box core |

| Station | Sample date | Sample depth (m) | Box Core | Push Core | Benthic | Quality control samples |
|---|---|---|---|---|---|---|
| BP10_014 | 15-Aug-10 | 96 | Yes | — | Yes | triplicate samples from one box core[c] |
| BP10_015 | 15-Aug-10 | 260 | Yes | — | Yes | — |
| BP10_016 | 23-Aug-10 | 628 | Yes | — | Yes | — |
| BP10_017 | 25-Aug-10 | 735 | Yes | — | Yes | — |
| BP10_018 | 15-Aug-10 | 68 | Yes | — | Yes | — |

(a) Discrete sets of sub-samples collected from three separate box cores.
(b) Analytical duplicates.
(c) The surface was divided into three sections, and sub-sampled.
"—" means "sample not collected."

The procedure at each site where sub-sampling took place consisted of the following steps:

- Sediment was obtained with a box corer (50 cm x 50 cm) deployed by Coast Guard and ArcticNet personnel.
- Prior to first use, the box corer (including core boxes) was washed with laboratory-grade detergent and rinsed using seawater. On a daily basis, at a minimum, the core boxes were re-washed and re-rinsed.
- Between cores, the corer was thoroughly rinsed with seawater.
- Care was taken when assembling, deploying and recovering the box corer to avoid contact with the edge or inside surface of the core box.
- Upon retrieval, the box core was assessed for acceptability by ArcticNet and IMG personnel (i.e., properly closed or triggered jaw, with a relatively undisturbed and visually uncontaminated sediment surface).
- Acceptable samples were left for a short period of time to allow standing water to drain off naturally. If that did not occur, a pre-cleaned Teflon tube was used to siphon this water out of the box.
- Typically, the core box was visually divided in half with the top 1 to 2 cm used for contaminant sampling (the other half of the core was used by the Benthic Ecology team. Additional box cores were obtained for QA/QC purposes and for push coring (see below).
- Utensils or implements for transferring sediment to sample containers or bags were washed with laboratory-grade detergent and rinsed with distilled water before use.
- Samples for AVS-SEM analysis were collected using a Teflon spatula and stored in lab-supplied 60 mL glass jars.
- Samples for hydrocarbon analysis were collected using a stainless steel spoon and stored in lab-supplied 250 mL glass jars.
- Samples for metal analysis, carbon content, and grain size were collected using a Teflon spatula and stored in Ziploc bags.
- Samples for BTEX and F1 to F4 analysis were collected with a stainless steel spoon and stored in lab-supplied 60 mL glass jars.
- An additional glass jar and Ziploc bag (as often as possible) were filled with sediment for archive samples.
- A field log sheet was completed characterizing the sample.
- Quality control samples were collected as outlined in Table 17.3.

In addition to sub-sampling from the top 1 to 2 cm of the box core surface, push cores were collected at Sites BP10_002 and BP10_003. A series of push coring tubes were inserted into an undisturbed box core surface, and rotated slowly downward to the bottom of the core box, then retrieved by removing sediment from around the core tubes so the bottom of each tube could be capped. The capped tube was then extracted or pulled out or away from any sediment remaining in the core box. Stainless steel coring tubes were used for sediment being analyzed for hydrocarbons and other organics. Acrylic coring tubes were used for sediment being analyzed for AVS-SEM, metals, carbon, grain size, porosity and radiometric dating.

Sample storage onboard

Sediment samples were packed into cooler chests and stored either in a -20°C freezer or a 4°C refrigerator onboard, depending on the analysis parameter (Table 17.4). Before transfer to shore at the end of Leg 2a, freezer packs were added, and the coolers taped shut. Chain of custody documentation was part of this process.

Table 17.4. Parameters measured in the sediments for the BP contaminant sampling program in Leg 2a.

| Parameter/Group | Container | Preservatives | Storage |
|---|---|---|---|
| **Maxxam** | | | |
| grain size | 1 x sediment bag | — | 2-6°C |
| porosity | | — | 2-6°C |
| moisture content | | — | 2-6°C |
| carbon content (TOC, TIC, TC) | | — | 2-6°C |
| metals (total) | | | 2-6°C |
| acid volatile sulphides – simultaneously extracted metals (AVS-SEM) | 1 x 60 mL glass jar | — | 2-6°C |
| BTEX and F1-F4 fractions | 1 x 60 mL glass jar | — | 2-6°C |
| **AXYS** | | | |
| total petroleum hydrocarbons (TPH) | 1 x 250ml glass jar | — | frozen |
| acid/base/neutral extractable organic compounds (ABNEO) | | — | frozen |
| polycyclic aromatic hydro-carbons (PAHs), alkylated PAHs, and alkanes | | — | frozen |
| total polychlorinated biphenyls (PCBs) | | — | frozen |
| radiometric dating | 1 x sediment bag | — | frozen |

“—” means “preservative not used.”

### *17.2.4 Benthic sampling*

Sample collection

Benthic sampling for contaminants was conducted at the 17 locations (Table 17.3 and Figure 17.1). This part of the contaminant program occurred on an opportunity or incidental basis, since it involved material provided by ArcticNet personnel. The goal was to obtain as much faunal material (tissue) as possible for analysis on the parameters listed in Table 17.5. The BP team received a large amount of assistance from the ArcticNet Benthic Ecology Team in this regard. The process at each location for benthic sampling was somewhat different than sediment and water column sampling, as most of the samples were collected with an Agassiz trawl.

Table 17.5. Parameters measured in benthos for the BP contaminant sampling program in Leg 2a.

| Parameter/Group | Container | Preservatives | Storage |
|---|---|---|---|
| **AXYS** | | | |
| TPH | whole sample collected, wrapped in tin foil then placed in Ziploc bag | — | frozen |
| PCBs - detailed analysis | | — | frozen |
| PAHs and alkylated PAHs | | — | frozen |
| alkanes | | — | frozen |
| metals | whole sample collected, wrapped in Ziploc bag | — | frozen |

"—" means "preservative not used."
Note: Sub-samples for porosity were obtained during push coring only.
Sub-samples for radiometric dating were obtained during push coring only.

The benthic samples received from ArcticNet (with the exception of station BP10-012), were largely sorted and identified to species level (i.e., many of the samples obtained are discreet species samples). Most of the samples are echinoderm species (sea stars [genera – *Icasterias, Ctenodiscus, Pisaster, Pontaster, Solaster, Psilaster, Urasterias*], brittle stars [*Ophiopleura* spp.], basket star [*Gorgoncephalus* sp.]), with some isopods (*Saduria* sp.), bivalves (*Delectopecten* sp., *Astarte* sp.), annelid fanworms (*Pectinaria* sp.) and several fish (eelpout*, Lycodes* sp.).

Sixty-eight faunal samples were obtained for tissue analysis at AXYS Analytical in Sidney (BC), including 52 samples wrapped in foil, bagged, labelled and frozen for PCB and hydrocarbon (TPH, PAH, alkylated PAH, and alkane) analysis, as well as 16 samples bagged (no foil), labelled and frozen for metals analysis.

In addition, 29 faunal samples were packaged, labelled, frozen and provided to Dr. A. Borisenko (University of Guelph) for DNA fingerprinting.

Sample storage onboard

The benthic samples were stored in a -20°C freezer onboard. Prior to transfer ashore at the end of Leg 2a, the samples were packed into cooler chests; ice packs were added, and the coolers taped shut. Chain of custody documentation was part of this process.

## 18 Mercury cycling in the Arctic – Legs 1b

ArcticNet Phase 2 – Project titled *Effects of Climate Change on Contaminant Cycling in the Coastal and Marine Ecosystems*.
http://www.arcticnet.ulaval.ca/pdf/phase2/stern_contaminants.pdf.

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### 18.1 Introduction

Concentrations of the neurotoxin mono-methylmercury (MMHg) are increasing in many marine mammals of the Canadian Arctic to levels that may be toxic to Northern peoples consuming these animals as part of a traditional diet. One of the key processes resulting in the contamination of biota with mercury (Hg) is the formation of methylated Hg species, such as MMHg, from inorganic Hg(II) species which themselves are not as readily bioaccumulated. The objective of this project within ArcticNet is to determine the source of this MMHg to arctic marine foodwebs and builds on work completed during previous ArcticNet expeditions (2005-2007). Previous work has demonstrated that MMHg is produced in marine waters of the Canadian Arctic Archipelago, with *in situ* production accounting for approximately half of the MMHg present at these sites. However, the transfer of MMHg from bulk seawater into the foodweb appears to be remarkably efficient, suggesting that perhaps organisms at the base of the foodweb are exposed to greater concentrations of MMHg than what is measured in bulk seawater. One hypothesis is that particulate matter in the water column provides a favorable microenvironment for the production of MMHg such that MMHg is concentrated on particles and organisms feed on detritus are in fact exposed to higher concentrations of MMHg than what would be predicted from bulk water measurements.

The objectives during this cruise were to quantify particulate-bound MMHg as well as refine existing protocols for sampling and quantifying various methylated forms of mercury. Total Hg (THg), MMHg, dimethyl Hg (DMHg) and dissolved gaseous elemental mercury (DGEM) were also quantified in seawater to continue building a baseline against which potential future changes in the distribution of aqueous Hg species can be compared. The overall understanding of Hg cycling in the Arctic will be enhanced, allowing to better predict changes in this cycle as climate change continues to impact the Arctic.

## 18.2 Methodology

### *18.2.1 Sample collection and processing:*

At each station, the water column was sampled at four different depths: the surface, sub-surface chlorophyll maximum, oxycline and bottom, using the ship's CTD-Rosette system. From each depth water was collected in separate acid-washed bottles for total Hg, monomethyl Hg (MMHg), particulate-bound MMHg, DMHg, total methylated Hg (MeHg) and DGEM using standard ultra-clean procedures such as the "clean hands, dirty hands" protocol. THg and MeHg samples were preserved by acidification, MMHg samples were frozen and DMHg and DGEM were captured on carbo and gold traps, respectively, using purge and trap techniques. Particles for MMHg analysis were collected on 0.2 µm cellulose nitrate membranes, which were then frozen. All samples were processed immediately after collection. Water was also collected and filtered for dissolved organic carbon (DOC) and particulate organic carbon (POC) because in many cases, sampling was carried out deeper than the primary production team who routinely quantify these parameters.

Table 18.1. Summary of stations sampled for mercury cycling measurements during Leg 1b.

| Station ID | Cast # | Depths sampled (m) | Work Conducted |
|---|---|---|---|
| Station 301 | 069 | 1, 25, 315, 663 | Full suite of samples |
| Station BIO | 074 | 1, 22, 100, 275 | Full suite of samples |
| Station 305 | 077 | 1, 25, 80, 157 | Full suite of samples |
| Station 310 | 078 | 1, 32, 70, 126 | Full suite of samples |
| Station 312 | n/a | n/a | Rosette broke down, so no samples were collected |
| Station 314 | 081 | 1, 25, 50, 102 | Full suite of samples minus DMHg and DGEM due to time constraints |

## 18.3 Preliminary Results

Due to the complex analytical nature of the work, it was not feasible to analyze any of the samples while on board of the CCGS *Amundsen*. Therefore, data or results will be obtained after samples are returned to the *Biogeochemistry Lab* and the *Low-Level Mercury Analytical Laboratory* at the University of Alberta for Hg analysis using various isotope dilution mass-spectroscopy techniques.

# 19 Persistent organic pollutants in the Arctic – Leg 1b

ArcticNet Phase 2 – Project titled *Effects of Climate Change on Contaminant Cycling in the Coastal and Marine Ecosystems*.
http://www.arcticnet.ulaval.ca/pdf/phase2/stern_contaminants.pdf.

**Project leader:** Liisa Jantunen[1] (Liisa.Jantunen@ec.gc.ca)

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## 19.1 Introduction

The main objective of this study is to examine the spatial distribution and air-water gas exchange of persistent organic pollutants in the Arctic. Pollutants of interest include: legacy and currently used (CUPs) pesticides, brominated and organophosphate flame retardants, and perfluorinated compounds (PFCs, both ionic and neutral). This is an extension to previous sampling campaigns in ArcticNet 2007 and the Circumpolar Flaw Lead (CFL) study in 2008 which covers the Labrador Sea, Hudson Bay and Beaufort Sea area.

## 19.2 Methodology

### *19.2.1 Air sampling*

Two types of air samplers (PUF and PUF/XAD/PUF) were deployed at the bow of the ship. Each sampler was attached to a suction pump at a flow rate of about 300 L/min for approximately 24 hours. 18 samples in total (9 for the PUF and 9 for the PUF/XAD/PUF) were collected throughout the course of 10 days on the ship. 6 blanks (3 for the PUF and 2 for the PUF/XAD) were also collected. Right after the samplers were taken down from the deck, they were placed in a -20$^{o}$C freezer.

Figure 19.1. Air sampler for organic pollutants located at the bow of the *Amundsen*.

### 19.2.2 Water sampling

High volume surface seawater samples (200 L, n = 3) were collected using the seawater pipe tap that was located in Lab 610. The seawater ran through a GFF filter followed by an XAD column at a flow rate of 100 ml/min. Sample collection dates were 02 to 04 August, 04 to 06 August, and 07 to 09 August.

Figure 19.2. Left: Deployment of the high volume pump for large volume surface sampling and Right: filtration setup for high and medium volume samples.

Medium volume surface seawater samplers (60 L, n = 3) were collected from Stations 301, 305 and 312 using a submersible pump over the starboard side at the front deck. Similar to the high volume water samples, these samples were filtered and passed through the XAD column.

Prior to running the high and medium seawater samples through an XAD column, the XAD was spiked with labeled compounds to monitor chemical recoveries.

Low volume seawater samples (1 L, n = 24) were collected in polypropylene bottles throughout Leg 1b. Two sets of 5 bottles each were collected using the Rosette at Stations 301 and 305 at varying depths (bottom, surface and 3 intervals). The other 14 samples were collected daily from the seawater line tap located in Lab 610. Within those 14 samples, there were 3 duplicate sets. After the water was collected, the samples were spiked with a standard. The low volume seawater samples are going to be used for analysis of perfluorinated compounds.

All water samples were stored in the 4$^{o}$C room.

### 19.3 Preliminary Results:

The air and water samples that were collected throughout Leg 1b will be taken to the laboratory in Toronto to be extracted and analyzed using the gas chromatography-mass spectrometry (GC-MS) and liquid chromatography (LC)-MS/MS. Currently, there are no preliminary results to be shown.

# 20 Seabed mapping – Legs 1a, 1b, 2a, 2b, 3a, 3b and 3c

ArcticNet Phase 2 – Project titled The Canadian Arctic Seabed: Navigation and Resource Mapping. http://www.arcticnet.ulaval.ca/pdf/phase2/hugues_clarke_seabed_mapping.pdf.

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**Cruise participants Leg 2a**: Ian Church[1] and Doug Cartwright[1]
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## 20.1 Introduction

The Ocean Mapping Group (OMG) was on board the *Amundsen* to perform seabed mapping as part of its role in the ArcticNet program. The primary purpose of the mapping was to collect as much bathymetry and sub-bottom information as possible while transiting between science stations.

Aside from rare inclement weather and sea-ice, bathymetry and sub-bottom data were successfully collected during the entire expedition.

During Leg 1, a secondary objective was to test the equipment mounted on the *Amundsen*'s barge. The barge allowed for quick transits to opportunistic survey sites for either reconnaissance surveys or shoal investigations.

During Leg 2a, the water-column imaging capabilities of the EM302 multibeam were used to provide positions of seabed mooring installations. The barge and its seabed mapping equipment was not used during Leg 2a.

During Leg 2b, multibeam and sub-bottom data was collected each night after piston coring operations or during the day on an opportunistic basis and was performed in two stages. The first stage was collection of sub-bottom data over 32 priority sub-bottom lines. The second stage was the collection of multibeam data over the BP exploration block. The block was divided into six areas of ascending priority and data was collected systematically in each area. The water-column imaging capabilities of the EM302 multibeam were also used during Leg 2b to provide positions of seabed mooring installations and images of various instances of venting gas. The *Amundsen's* barge was used on two occasions during Leg 2b.

During Leg 3a, multibeam and sub-bottom data was collected during three dedicated survey periods totalling approximately 37 hours and during transits between science stations. The dedicated mapping allowed for expansion of the multibeam coverage within the BP Pokak lease block, in particular priority zone 2 was completed, and an area near the NE corner of the block was filled in. The water-column imaging capabilities of the EM302 multibeam were also used during the Leg to provide positions of seabed mooring installations. The barge, which is also fitted with seabed mapping equipment, was not used during Leg 3a.

During Leg 3b, multibeam and sub-bottom data were collected with the CCGS *Amundsen* during transits between science stations, opportunistically near stations, and at one dedicated 12-hour survey in Barrow Strait. The water-column imaging capabilities of the EM302 multibeam were also used during the leg to provide positions of seabed mooring installations. The barge was not used during Leg 3b.

During Leg 3c, multibeam and sub-bottom data were collected with the *CCGS Amundsen* during transits between science stations, and opportunistically near stations. In addition, multibeam data were collected with the barge at various locations in each of the four visited fiords. The planned 24-hour survey on the Labrador shelf (both option north and south) was cancelled due to weather.

### *20.1.1 Seabed mapping in the Labrador Fiords (Leg 3c)*

Knowledge of seafloor coastal habitats is relatively limited for the Arctic, and very little information has been gathered on Labrador fiord marine ecosystems. This project seeks to better understand the nature and distribution of benthic habitats within northern Labrador fiords. Benthic habitat mapping is an accurate and efficient way to gather baseline information about substrate type and associated biota. It is essential for development and implementation of resource management practices and conservation. This mapping study could be used to:

- Identify sensitive habitats as well as those important to fisheries.
- Monitor habitats which may be susceptible to the impacts of climate change.
- Provide background information for the creation of policies regulating the harvesting of marine resources.

Multibeam seabed mapping in each fiord is in the process of being completed. The multibeam bathymetry and backscatter information, in combination with seabed sampling (using long-liner vessels and the CCGS *Amundsen*), will be used to generate first-order substrate and habitat maps.

## 20.2 Methodology

### *20.2.1 Equipment*

CCGS *Amundsen*

- Kongsberg EM302 30 kHz multibeam echosounder
- Knudsen K320R 3.5 kHz sub-bottom profiler
- Applanix POS/MV 320 motion and orientation sensor
- C&C Technologies CNAV GPS
- AML Smart Probe surface sound speed probe
- Honeywell Precision Barometer

Barge

- Pole mounted to port side of barge
- Kongsberg EM3002 300 kHz multibeam echosounder
- Coda Octopus F185+ Motion Sensor
- C & C Technologies CNAV 2050 GPS System
- Applied Microsystems Ltd. Micro SVP&T Sensor
- Honda Generator
- Water tight box with server rack mounted inside, containing multibeam transceiver, CNav receiver/logger, and UPS power supply.

### *20.2.2 Onboard logging and processing procedures*

CCGS *Amundsen*

Multibeam and sub-bottom profiler collection began immediately after leaving Quebec City, both systems were logged continuously except during stationary science sampling operations. Occasional bottom mistracking occurred in areas with sea ice and high sea states.

The EM302 30 kHz multibeam data (bathymetry and water column) was logged in the Kongsberg raw format (.all & .wcd) and converted to the OMG format after line completion (new survey lines were automatically generated every hour). The soundings were cleaned and inspected, using the OMG swathed toolkit, in near real-time with two members maintaining a 24-hour watch throughout most of the cruise. After the barge set-up was completed on Leg 1a, the three members switched to 8 hour watches. The soundings were reduced to mean sea level (MSL) using the Arctic-8 WebTidal model.

A secondary navigation source was fed into the EM302 Transceiver from the CNav on JD198 (previously only POS-MV). This allowed for easy switching of navigation source if one navigation system had problems.

All sub-bottom profiling was performed using the Knudsen 320R 3.5 kHz system. The K320R was logged in the Knudsen raw format (.keb and .sgy) and converted to the OMG format after line completion (new survey lines were generated every hour or so. Heave was fed into the Knudsen transceiver on JD198 from the POS-MV.

In addition, the following data was logged at all times:

- CNAV GPS
  - pseudo-ranges
  - NMEA
- POS/MV delayed heave and full POSPac format files
- Air pressure for correction of inverse barometer effect

Sound speed profiles were collected at each station using the Rosette's CTD. Raw cnv files were converted to OMG format, at which time the profiles were visually inspected for spurious data points. The CTD casts were input directly into the EM302 SIS logging software. Post-processing of the multibeam soundings with respect to sound speed profiles will be done upon return to UNB.

Everyday images, in strip map format (two sun-illuminations for bathymetry, a backscatter image, a sub-bottom image, and the navigation track) were created. These images will be posted online (www.omg.unb.ca) after the completion of all legs. The historical bathymetry from all transits, overlaid on the navigation system was also updated regularly to expand coverage.

<u>Barge</u>

Figure 20.1. The *Amundsen*'s barge used to conduct seabed mapping and sub-bottom surveys.

The barge setup had the server rack placed inside the cabin, directly behind the coxswain. The laptops used to log the multibeam and motion data were located inside the cabin on the port side, where the coxswain had a view of the screen showing the real time survey coverage. The pole was mounted on the port side of the barge with the multibeam transducer on the end and directly above it was the surface sound speed probe. The positioning and motion antennas were located on the top of the mast and the motion sensor (F180) was secured to the floor under the coxswain seat. The generator used to power all the equipment was located on the aft deck, tied to the outside of the cabin. The laptops, spare tools, and generator were all stored inside the *Amundsen* upon completion of a survey. The required time to prepare the barge for a survey was around 5 minutes.

Figure 20.2. Barge setup to conduct multibeam mapping surveys: EM302 operator station (upper left), Positioning and motion antennas (upper right), Pole mount with multibeam and surface sound speed probe (bottom left) and Server rack (bottom right).

The pole mounted multibeam was run at a maximum survey speed of 7 knots (usually around 1600 rpm). In areas with strong currents, such as in the Lac Guillaume Delisle (Leg 1a) the barge surveyed with the current, then the pole was lifted out of the water and the barge shot back upstream to run another survey line downstream. The speed of the vessel directly impacted the quality of the survey. At speeds greater than 7 knots, the surface sound speed probe would not get accurate readings because of the amount of air bubbles directly behind the pole. The sea state also had a large impact on the quality of the survey. With even small waves, bubbles created from the bow plowing through the water would go under the multibeam transducer, masking the signal. The solution to this was a slower survey speed, however a more permanent solution would be to increase the length of the pole, or permanently mount the multibeam on the hull of the barge.

The multibeam (bathymetry and water column), CNav and F180 data was logged and then post processed back on the Amundsen. Surveying on the barge and on the *Amundsen* at the same time requires a minimum of three personnel on board. There was only one occasion, in Dexterity fjord during Leg 1a, where two personnel were on board, stretching out the watch hours.

The accuracy of the barge surveys could be improved with a hand lowered CTD done before and after the survey. These sound speed measurements would then be used to post process the multibeam data. For the multibeam calibration a Rosette was done immediately before deployment, the cnv file was converted and loaded directly into the multibeam logging program.

### *20.2.3 Detailed equipment and procedures*

Kongsberg EM302 30 kHz multibeam echosounder

A 1° x 2° Kongsberg EM302, flush-mounted to the hull was used for multibeam mapping operations with a swath up to +/-60°. The normal EM302 swath of +/-70° is not available on the CCGS *Amundsen* due to the presence of titanium polymer ice-reinforcing windows. The receiver array is mounted on the port side tilted up 6° from horizontal to accommodate the non-flat hull form. This results in a slight curl (within specification but notable) to the outer edge of the swath on the starboard side. The system utilizes multiple sectors to achieve two full swaths in a single ping cycle. The pair of swaths are steered forward and back respectively to achieve an even along-track density. The sonar operated in 3 modes in the depth ranges seen in the area:

Shallow Mode - 4 sectors per swath, 2ms CW pulses (750Hz bandwidth), 26.5 to 33.6 kHz
Medium Mode - 4 sectors per swath, 3ms CW pulses (500Kz bandwidth), 26.5 to 31.3 kHz
Deep Mode - 8 sectors per swath, 7ms CW for centre 4 sectors, 25-40ms FM pulse for outer 4 sectors (all 200 Hz bandwidth), 26.5 to 32.5 kHz

Shallow was used by default in less than 200 m. Deep mode was used by default for depths greater than 600 m.

Sea state issues: As noted previously, the flush mounted arrays, unlike gondola mounted systems, are very prone to bubble wash down. Under conditions of less than 15 knots of wind, the system is unaffected and mapping at the full vessel speed of 13.5 knot (or even 16 knots) is viable. Above 20 knots of wind, bubble wash down events are noted, that first corrupt the backscatter imagery, and then start to cause the system to intermittently lose track of the bottom. The exact onset of this is azimuth dependent. Above 25 knots of wind, the bottom tracking becomes notably poorer. Above 30 knots of wind, the EM302 data is unacceptable for surveying even at a slower speed. At this time, the K320R sub-bottom profiler is however, still functional.

Soft sediment issues: A notable bottom tracking bias was intermittently seen throughout the mission. This primarily involved tracking too deep close to nadir. This occurred throughout the mission, particularly in the low impedance (soft) sediment encountered on most of the Beaufort slope. The magnitude of the artifact corresponds to a 0.1 to 0.25% of depth trough (well within IHO Special Order +/-0.75%).

Sound speed reduction: The MVP-300 was used for all sound speed measurements. The MVP was deployed on all of the sub-bottom priority lines to provide an even coverage of sound speed information throughout the survey area. Routine post-cruise reprocessing for ArcticNet will involve applying all of the MVP sound speed data to the multibeam soundings. For real time data collection, a single sound speed cast that well represented the survey area was used.

During all operations the surface sound speed probe was functional and clearly indicated the rapidly changing near surface sound speeds. The inshore areas were generally faster (warmer) with a pronounced gradient in the vicinity of the shelf edge. Analysis of the deeper CTD profiles indicates that the majority of the variability is confined to the near surface ~ 50m layer. Below that depth the sound speed structure was remarkably stable so that for the deeper depths surveyed, the impact was minimal.

Tidal reduction: The Arctic-8 WebTidal model was used for all tidal reductions. Tides in this part of the Beaufort Sea are generally less than +/-50cm so have little impact on the accuracy. C-Nav RTG ellipsoid height solutions were collected at all times. When corrected to the geoid they indicate a faint tidal signature but the noise is at a similar level. Post-cruise reprocessing of the raw GPS observables (logged at all times) through PPP may be done.

Bathymetric data processing: All EM302 data was processed immediately after acquisition using the OMG swathed toolkit. The raw.all data were converted to the OMG “merged” format and the POS RP navigation solution was merged for each shot. Bathymetric data cleaning in line mode was performed (pre-defluffed and median filtered before interactive editing) and a daily grid updated. Gridding of overlapping swaths was weighted based on beam # decaying to the outermost beams. For the purposes of grid interpolation, the beam footprint was calculated based on a nominal projected 1° beam at that depth and incidence angle.

In the creation of the final shipboard grid, regional survey lines (057.4° and 237.4° azimuth) were combined with transits and priority sub-bottom lines. Gale force winds resulted in only one survey line that required resurveying due to noise.

The grid at 10m resolution shows some sounding noise. It should be kept in mind however, that the typical ribbing seen in the data is at the +/-0.2% of depth range (well within the +/- 0.75% for IHO Special Order surveys). The decision was taken to grid at this finer resolution (2% of Z at 500m) as, in the lower sea state periods, there is clearly resolvable morphology.

<u>POS/MV</u>

Vessel orientation, heave and inertially-smoothed differential GPS was provided by the POS/MV system. The system receives RTCM differential corrections from the C-Nav receiver. Throughout the entire cruise there was only one noted POS glitch:

- Lost DGPS on one line (CA solution still within 2m RMS anyway)

Delayed (“True”) Heave was logged for the entire operation.

POS MV Outage (Leg 3b): On 16 October at 05:00 local time while on the science station transect in north Baffin Bay, the POS/MV stopped outputting heading and position. Debugging took the next full two days. On 18 October around 18:00 local time, a new firmware update received from the manufacturer’ support brought the system back running. As there was significant mapping coverage in between science stations from previous visits, there was limited loss of mapping data.

<u>Moving Vessel Profiler (underway sound speed profiling)</u>

The *CCGS Amundsen* is equipped with a Moving Vessel Profiler (MVP) 300 allowing for underway sampling of the water column. Through its ability to continuously cast and retrieve a probe while the vessel is in transit, it is possible to perform a dense sampling regime in a very time efficient method. The MVP is equipped with a sound velocity probe, CTD, flurometer, dissolved oxygen sensor, and a transmissometer.

During Leg 2b, MVP data was collected during all of the priority 1 and 2 sub-bottom data lines at a speed of 8 knots. This provided sound speed data covering the entire Pokak block over a week long period, as shown in Figure 20.3.

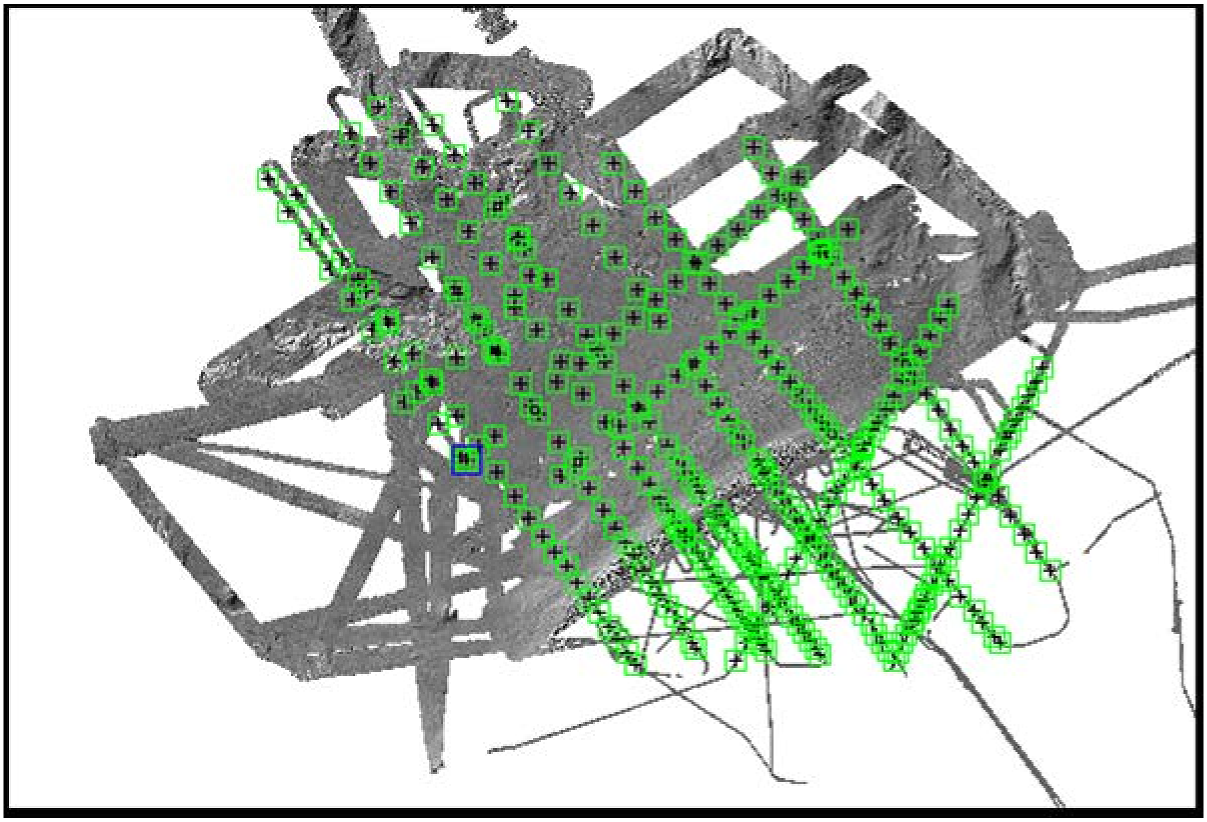


Figure 20.3. MVP cast distribution used in sound speed profile in the BP Pokak block during Leg 2b.

There were no major problems with the MVP and data was successfully collected over the entire area. A de-icing system was installed this year on the MVP to eliminate ice buildup on the sheave. This system worked very well and ice buildup was never a problem. A detailed explanation of the MVP operations can be found in the *CTD Rosette Sampling* section of this report.

At the end of the cruise, a check line was run with the MVP along one of the priority 1 sub-bottom lines. This line provided a method to estimate the change in salinity and temperature over the duration of the survey.

Knudsen K320R 3.5 kHz sub-bottom profiler

All sub-bottom profiling was performed using a Knudsen 320R 3.5 kHz system. The Knudsen system utilizes a 16 element (4x4 Massa TR-1072A) array shooting through the hull (1/2 inch steel). A max ping period of 0.5 seconds was set, although with the 12ms chirp pulse used, the duty cycle limited the system to 1 Hz pinging. The K320R was synchronized to the EM302 (master). The system utilizes a 2-7 kHz bandwidth.

Heave correction**:** Heave was provided from the POS as a custom lever armed solution from the IMU at the 3.5 kHz location (~ 30m forward and 16m down from the RP).

Draft correction**:** 6.7m was used for all post processing

Sound velocity correction: In real time, the default Arctic shelf value of 1465m/s was used for depth estimation. This is an underestimation of the harmonic sound speed for the deeper water (1480ms++). The original two-way travel time can be recovered from the data knowing the input sound speed.

Bottom tracking and range phasing: The K320R does its own bottom tracking. This was used in real time for adjusting the phasing of the logger (the 200m window). The biggest concern is that the system does not phase up or down until ¾ of the available viewed range is water column; designed as such for simple echo sounding. As a result, when going downhill, there may be as little as 50m of sub-bottom record preserved just before phasing. Manual override of the phasing was implemented whenever the operator noticed the issue.

Additionally, in post processing the bottom track is used for masking the water column in the creation of fence diagrams. In all but very soft sediments the tracking was at the sediment surface.

Positioning: Positioning for the K320R originated from the CNav GPS.

Transceiver clock: The K320R clock is fixed only to the PC time. To compensate for this, a GPS based time server was set up to synchronize the PC time to GPS time. This could facilitate merging other navigation solutions if desired.

Barge

EM3002: A Kongsberg EM3002 300 kHz multibeam echo sounder was installed on the barge using an aluminum pole. The pole was mounted to the port side of the barge just ahead of the cabin doors. The pole is traditionally installed on the Ocean Mapping Group research launch, the Heron, but is designed to be portable and a universal fit to almost any vessel. There were no major problems with the multibeam installation on the barge. Even in large swells, the multibeam tracked the bottom with few noise artifacts.

All electronics, including the multibeam transceiver, were installed in a waterproof and shock mounted case which fit well behind the captain's seat. Due to the cable routing, the cover of the case could not be closed, therefore it was not waterproof. In the future it would be desirable to install through case fitting for all the cabling to enable the cover to be closed to protect the electronics from spray. Multibeam data was collected using a Dell Precision M6500 laptop.

Coda Octopus F185+ Motion Sensor: The motion sensor was rigidly installed beneath the captain's chair in the barge on the starboard side. The mount worked well and no movement of the IMU was noted. The antennae for the F185 were installed on an aluminum bar above the radar on the roof of the barge. This installation could be improved in the future, as the rotation of the bar occurred if the bolt at the attachment point became loose.

Additionally, the roof of the barge, where the antennae mast is installed, is very flexible and the mast likely flexes relative to the rest of the vessel.

C&C Technologies CNav 2050 GPS: A CNav GPS receiver was used to provide RTCM corrections to the F185 motion sensor and as an alternative positioning source to the multibeam system. Raw pseudo range observations were recorded from the CNav system. These can be used to post process the data using Precise Point Positioning (PPP).

AML Micro SVP&T Sensor: Surface sound speed measurements were sent to the multibeam system to facilitate beam steering and improve sounding accuracy. The sound speed sensor was mounted to the base of the aluminum pole, just above the multibeam, using a custom mount. The sensor worked well during multibeam surveys.

### *20.2.4 Surveys*

<u>Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay</u>

<u>Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago</u>

During transit between stations, coverage from previous transits was loaded into Aldebaran. This allowed the helmsman to steer coverage and build upon the previously collected data.

Several surveys (one planned, several opportunistic) were accomplished at the following locations during Leg 1:

- Mansel Island, Entrance to Hudson Bay
- Lac Guillaume Delisle, Hudson Bay
- Inukjuak, Hudson Bay
- Kuujjuarapik, Hudson Bay
- Circular Moraine Features in Central Hudson Bay (60.19797, -85.01363)
- Nelson River, Hudson Bay (3 lines during MVP transect)
- Iqaluit
- South of Devon Island, Lancaster Sound

Data quality was very good in most cases as long as the maximum swath width was set to 65 degrees to port and 60 degrees to starboard. This is due to the physical installation of the multibeam transducer (as mentioned in previous cruise reports). Survey line running was mostly performed with Aldebaran and occasionally with SIS.

The barge was launched for mapping on five different occasions during leg 1ab. The first was on 12 July 2010 (all dates according to UTC time) at Lac Guillaume Delisle where the channel was mapped. The second was on 14 July where the barge covered the inshore area of the Kuujjarapik survey, close to the mouth of the Great Whale River. The third deployment was on 26 July near the mouth of the Nelson River to do a patch test for multibeam calibration. The fourth deployment was on 02 August for the Iqaluit shoal investigation. The last deployment was on 05 August in Dexterity fjord to investigate a narrow channel with an older sounding of 30 metres on the chart.

Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea

During transit between stations, coverage from previous transits was loaded into the navigation software, Aldebaran. This allowed the helmsman to steer coverage and build upon the previously collected data.

Two Surveys were accomplished at Station BP10-005. The preliminary survey of the features at BP10-005 provided an overview of the seabed morphology around the station. The following surveys provided tight lined sub-bottom data to describe the sub-seabed geology. The sub-bottom survey followed the suggested lines from BP over the station.

At most of the mooring stations, the EM302 was used to locate and position the buoys on the moorings. This was performed at Stations J-09, I-09, G-09 and H-09.

Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea

The main aim of the mapping program in Leg 2b was to cover core regions within BP's exploration license areas (EL449, EL451 and EL453). The complementary regional mapping program of ArcticNet – Geological Survey of Canada was the secondary objective (which benefitted strongly from the BP block coverage).

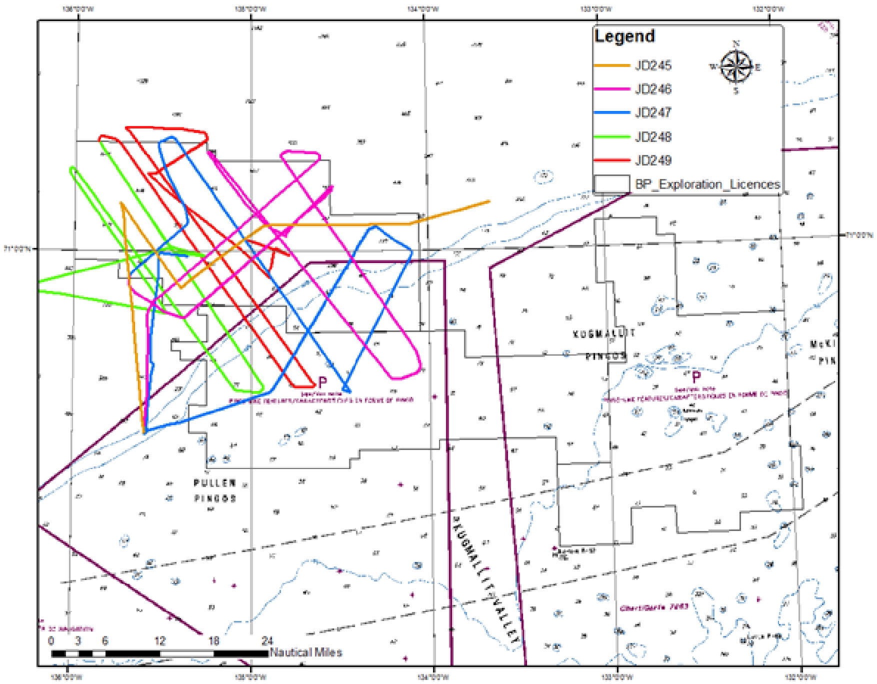



Figure 20.4. *Amundsen* navigation track during the dedicated seabed mapping surveys conducted in the BP Pokak block in the Beaufort Sea during Leg 2b (JD 245 to 249).

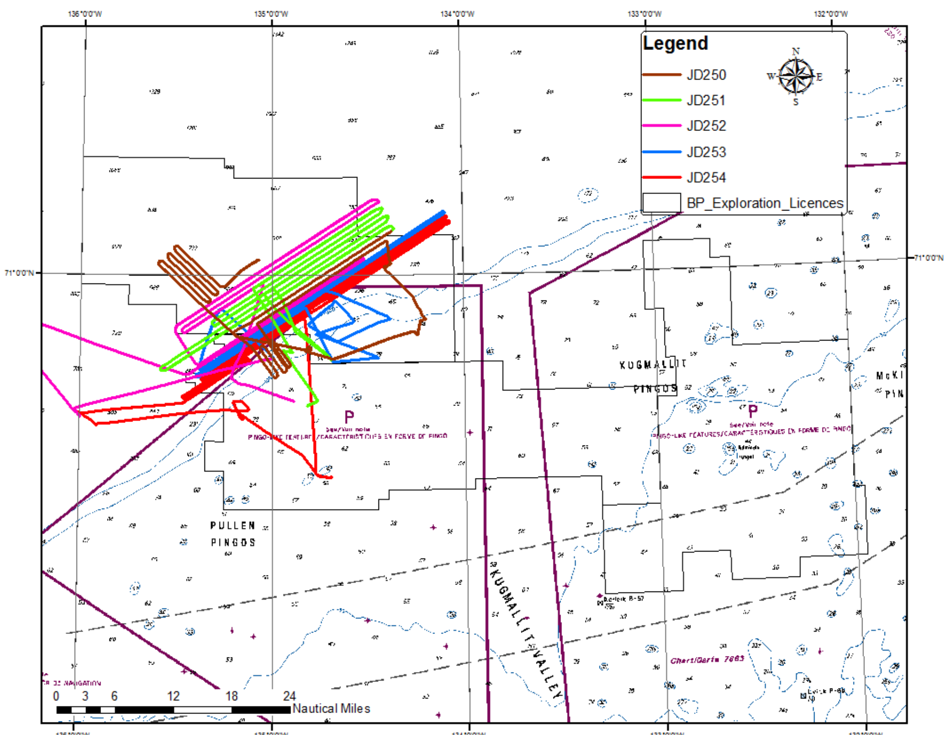



Figure 20.5. *Amundsen* navigation track during the dedicated seabed mapping surveys conducted in the BP Pokak block in the Beaufort Sea during Leg 2b (JD 250 to 254).

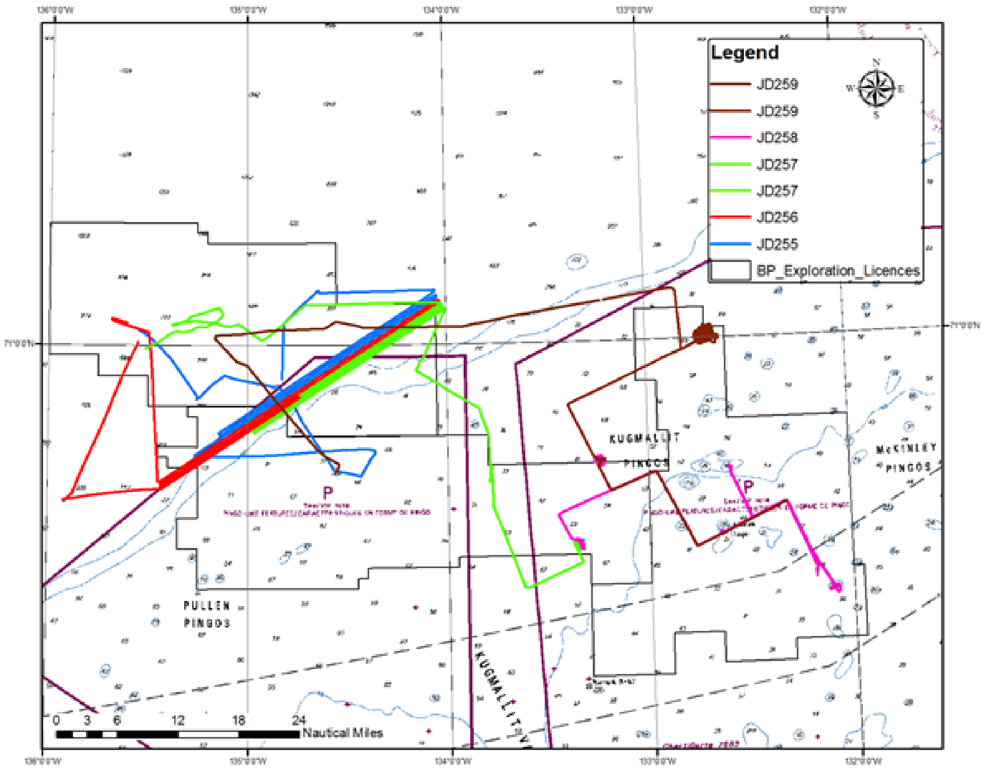



Figure 20.6. *Amundsen* navigation track during the dedicated seabed mapping surveys conducted in the BP Pokak block in the Beaufort Sea during Leg 2b (JD 255 to 259).

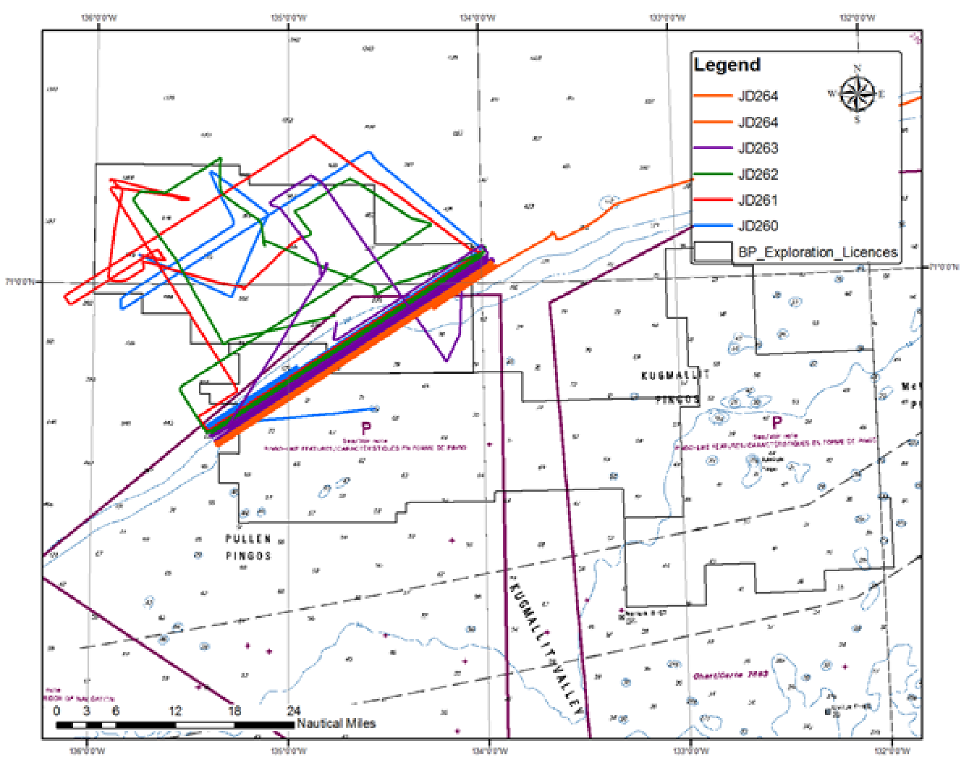



Figure 20.7. *Amundsen* navigation track during the dedicated seabed mapping surveys conducted in the BP Pokak block in the Beaufort Sea during Leg 2b (JD 260 to 264).

Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea

In addition to building coverage in the Beaufort Sea, the main aim of the mapping program during Leg 3a was to expand coverage within the BP Pokak lease block. During dedicated survey time, priority zone 2 was completed, and an area near the NE corner of the Pokak block was filled in. The ship's track within the Pokak block (Figure 20.20, and a maps showing coverage in the Pokak block before and after Leg 3a Figure 20.21 and 24.21). Following the deployment of all moorings, the EM302 water column data was used to mark the location of the moorings, which provides a verification of the position recorded from triangulation.

Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

During Leg 3b, while transiting, mapping was done continuously and when possible expanding existing coverage from previous years. The officers and bridge crew were particularly co-operative with adjusting the ship's course in order to extend the multibeam coverage. Additional mapping is listed below:

- Six hours of mapping at Station 405. Survey lines were run south of existing coverage. (Figure 10)
- Two hours of mapping were available to run two lines at Scott Inlet.
- While waiting for daylight to sail through the narrows towards Iqaluit, eight hours of mapping was done in the Frobisher Bay. Lines were run along existing coverage in the bay.
- A dedicated 12-hour survey was done in Barrow Strait. Because of ice cover around the survey site, priority areas 1 and 2 (respectively, north and west), and the area east of the survey site were not completed. Lines were run south of existing coverage in between ice covered areas. (Figure 11)

Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords

During Leg 3c, while transiting, mapping was done continuously and when possible expanding existing coverage from previous years. The Commanding Officer and bridge crew were particularly cooperative to adjust the ship's course in order to extend the multibeam coverage.

Seabed mapping in support of benthic habitat classification and mapping in Nunatsiavut fiords was undertaken with the support of the hull-mounted multibeam (EM302) aboard the CCGS *Amundsen* and the pole-mounted EM3002 attached to the barge (Figure 20.8) from the *Amundsen*.

Figure 20.8. Deploying the barge for seabed mapping in Okak Bay, Nunatsiavut.

Specific targets were identified in each fiord for this mapping contingency. The barge was used for seabed mapping in each fiord simultaneously with *Amundsen* activities during daylight hours and weather permitting. The barge operation required 3 ship's crew, a multibeam operator and a scientist. The speed of the barge permitted mapping activities to be carried out up to 20 nm away from the *Amundsen*. Initial mapping priorities were identified as follows:

- Nachvak Fiord – Tinutyarvik Cove (nearest to 600; Figure 20.9)
- Saglek Fiord – Nachvak Brook cove (near 613)
- Okak Bay – (1) Okak Island cove (south of 632); (2) Siugak Bay and Cod Fish Cove (between 632 and 633); (3) head of bay (near 630)
- Anaktalak Bay – (1) southeast corner of inner bay (due east of 624); (2) northwest corner of inner bay, along southern shore of Akuliakatak Peninsula.

Figure 20.9. View of the modern delta at the mouth of Nachvak Brook. Flat terraces on either side of the river represent the ancient delta surface when sea level was higher at the end of the last glaciation, roughly 8000 years ago.

Figure 20.10 illustrates the acquisition of multibeam sonar data on the barge. The color image (top right) displays the real-time, coarse resolution bathymetry of the seabed beneath the barge as it navigates along lines parallel to the shoreline. The water depth grades from shallow (red/orange) to deep (blue) and indicates the presence of a large delta-top channel that extends from the river mouth to the delta edge. The greyscale image (top left) shows backscatter intensity, which can be interpreted roughly to represent variations in sediment texture on the seafloor. On this image the backscatter displays a slightly different sediment type on the floor of the delta-top channel recorded in the bathymetry.

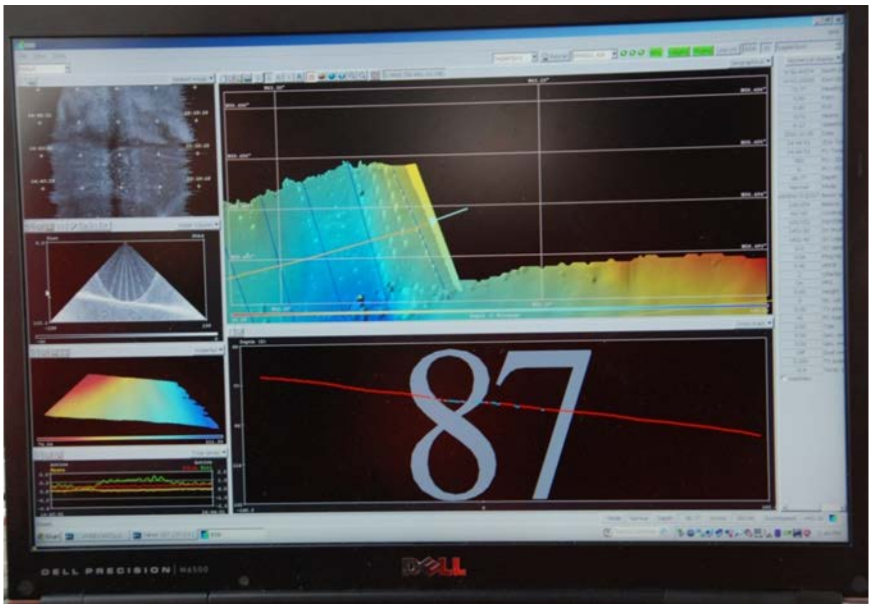



Figure 20.10. Acquisition of multibeam sonar data (bathymetry and backscatter) over Nachvak Brook delta, Saglek Fiord, using the EM3002 pole-mounted on the barge.

An early arrival at the Nachvak fiord yielded two and a half hours of mapping to expand coverage at the outer sill of the fiord.

The planned surveys on the Labrador shelf for both the northern and southern options were cancelled due to weather. The northern survey site was cancelled due to strong winds forecasted in the survey area. On transit towards the southern survey site weather predictions appeared favorable for surveying but the weather deteriorated as we progressed towards the survey site. Winds had increased up to 23 kts and the swell was between 2 and 3 metres. Despite adjusting the heading in the direction of the swell and decreasing survey speed (to 8 kts), the multibeam could not track bottom. The survey was cancelled before starting the first line.

Table 20.1. Locations of completed seabed mapping targets in each of the Nunatsiavut fiords during Leg 3c.

| **Fiord** | ***Amundsen*** | **Barge** | **Date** |
|---|---|---|---|
| Nachvak | Outer sill | Tinutyarvik Cove | Oct 24 |
| Saglek | East of Rose Island | Nachvak Brook delta, Torr Bay | Oct 25 |
| Okak | | Okak Island cove | Oct 26 |
| Anaktalak | | Inner basin | Oct 27 |

Barge: The barge was used for mapping at all four fiords during Leg 3c:

- Nachvak; Tinutyarvik Cove, full day (~8 hours)
- Saglek; Nachvak Brook delta, Torr Bay, full day
- Okak; Okak Island Cove, full day
- Anaktalak; Inner basin, ~6 hours

MVP transects: In each of the four fiords during Leg 3c a MVP transect was performed. The surveys were done at a vessel speed of 8-9 knots. The MVP was operated in auto-deploy mode which allowed for continuous profiling throughout the length of each fiord. The system was calibrated so that the probe remained at 10m below the water surface while in its retrieved position and it stopped 20m above the seabed (depths measured with the EK60 echosounder). As a result of these settings, profiles could only be measured in water depths greater than 30m.

In each fiord there were various seabed features which presented a danger to the probe. These areas were identified in advance using previous multibeam coverage and sampling was paused until the feature was cleared.

On one cast in the Saglek fiord after ~1.5 hours of flawless operation in auto-deploy mode, the MVP controller software failed to automatically engage the break, this was noticed by the operator who manually engaged the break stopping the probe shortly before it hit the seabed. Consequently, it is recommended that there is a person who continually monitors the MVP controller. To ensure that this is possible it is also recommended that there be two people who are capable of operating the MVP in the CTD shack during operations in case one person needs to leave briefly.

## 20.3 Preliminary results

### *20.3.1 Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay*

### *Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

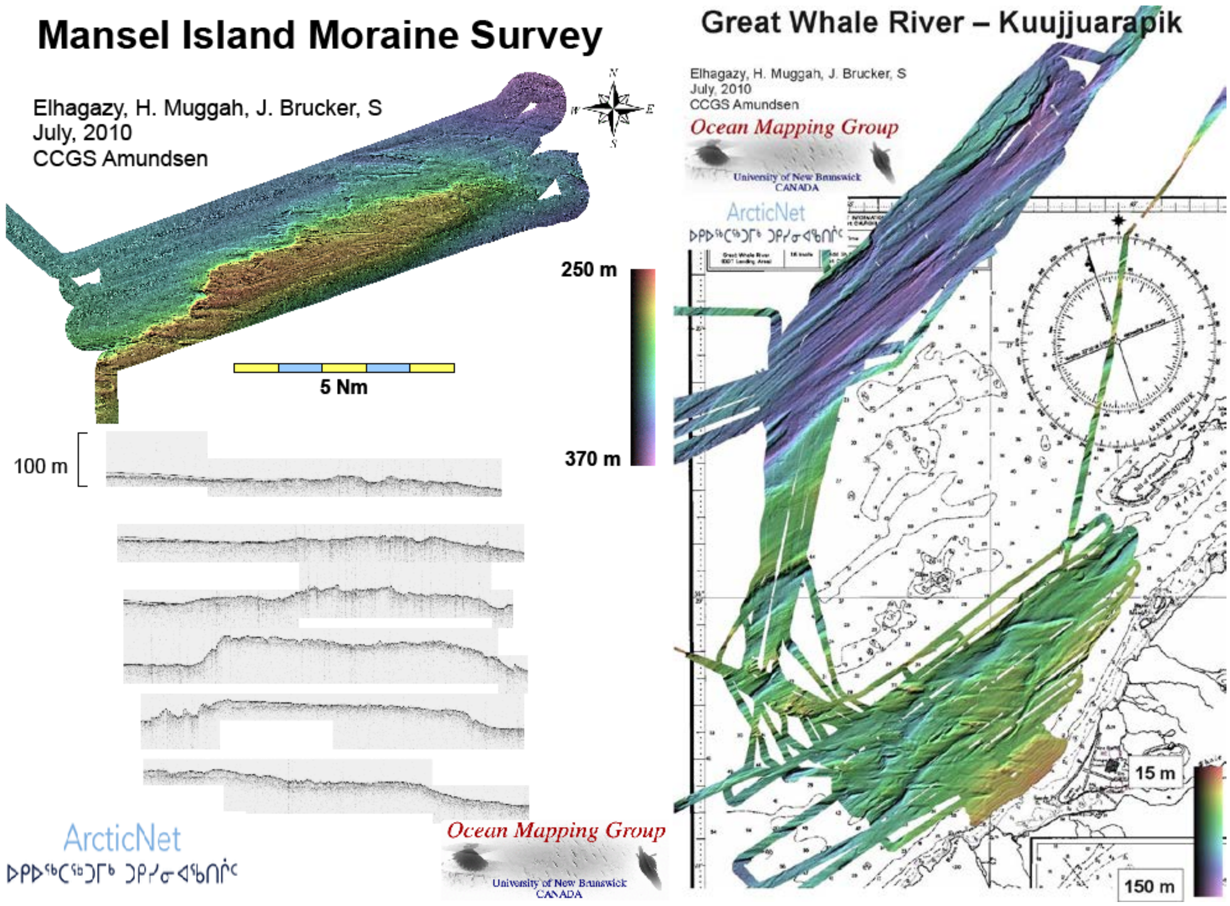



Figure 20.11. (left) Bathymetry of Mansel Island moraine features surveyed at the entrance to Hudson Bay during Leg 1a, (right) bathymetry collected during a survey near Kuujjuarapik in Hudson Bay during Leg 1a.

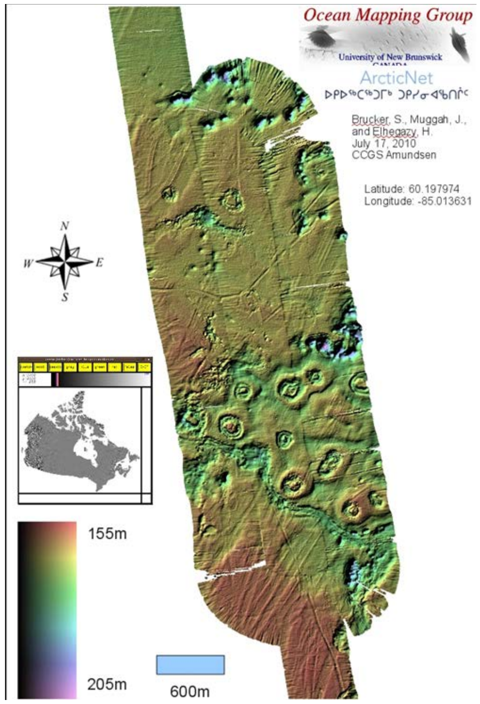



Figure 20.12. Bathymetry of circular moraine features surveyed in Central Hudson Bay (60.19797, -85.01363) during Leg 1a.

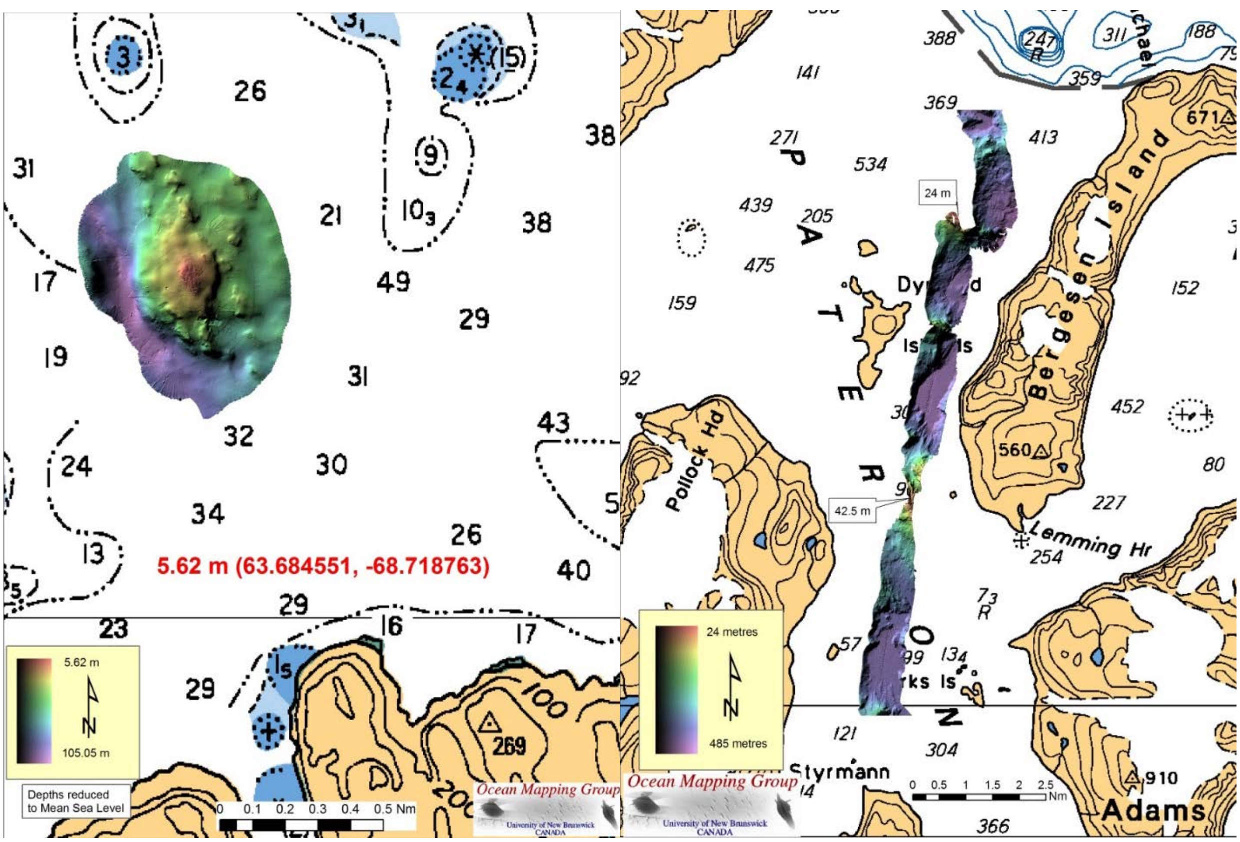



Figure 20.13. Bathymetry collected (left) during a survey near Iqaluit during Leg 1a, (right) near Bergesen Island on the coast of northern Baffin Island during Leg 1a.

### *20.3.2 Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea*

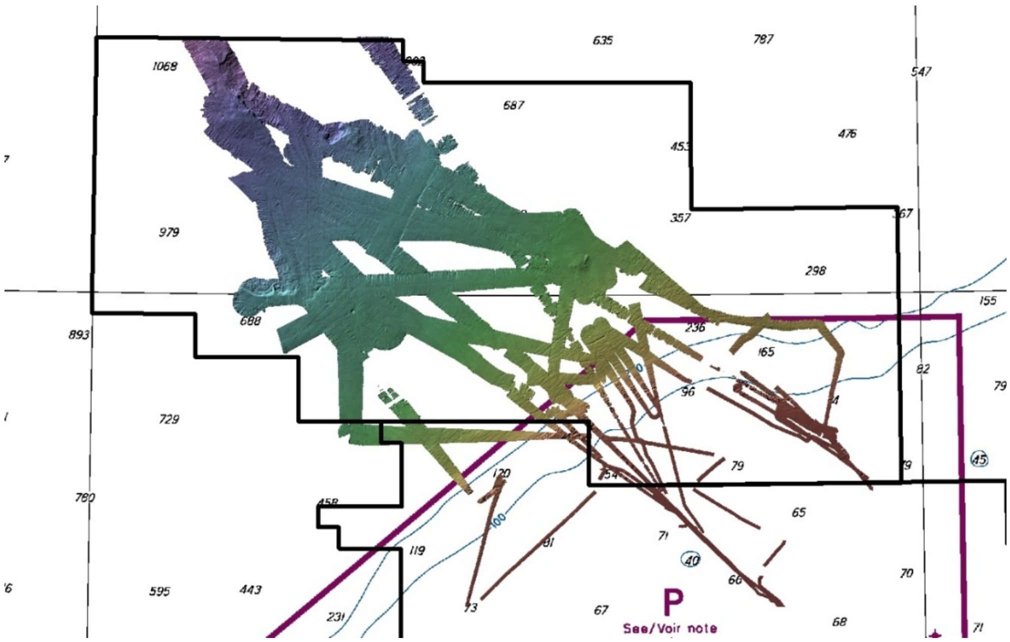


Figure 20.14. Leg 2a multibeam data coverage in the BP lease block in the Beaufort Sea during Leg 2a.

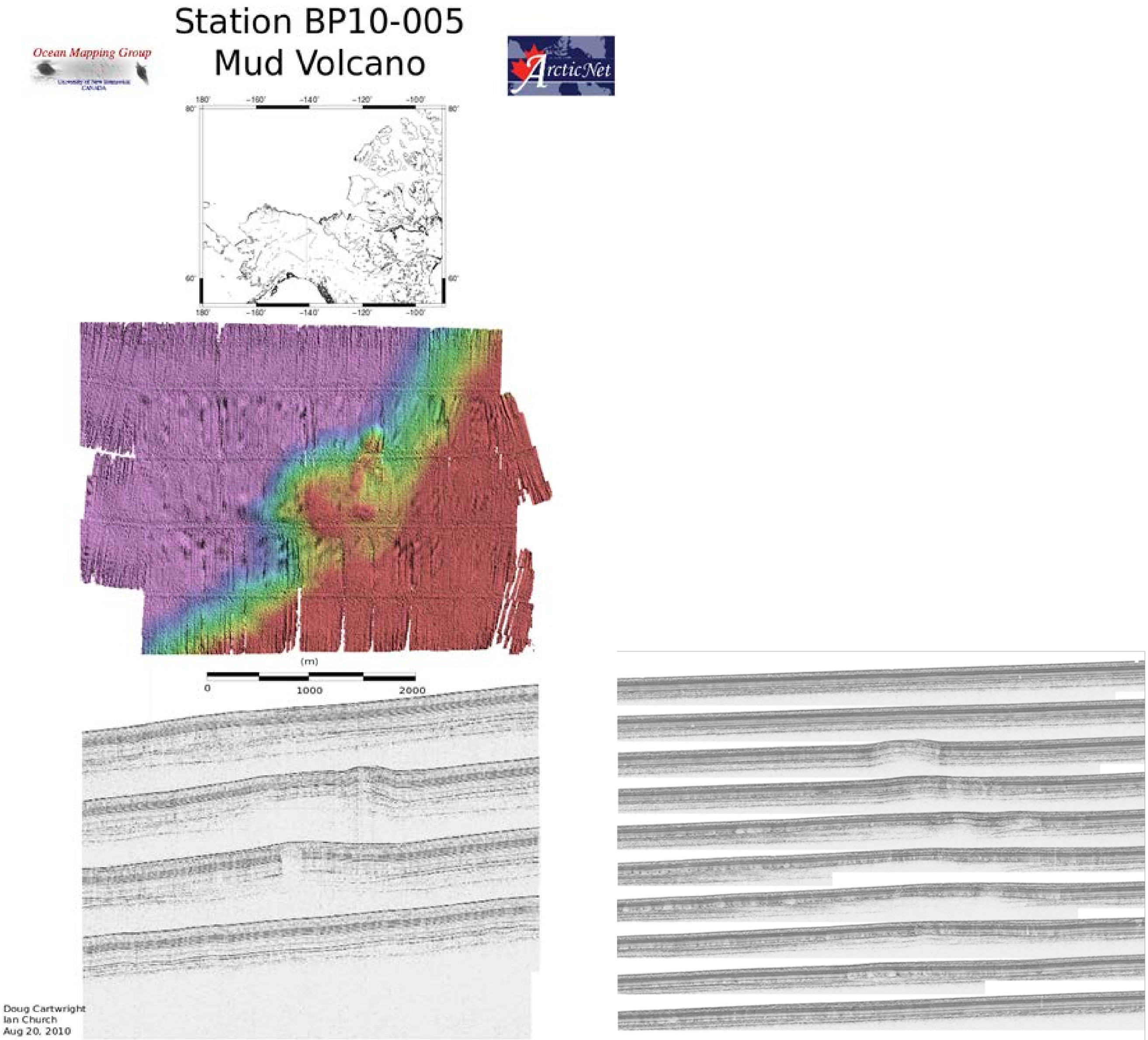



Figure 20.15. Bathymetry and sub-bottom profile of the mud volcano at Station BP10-005 in the BP lease area during Leg 2a.

Mooring J
Station J-09

Location: 70.89765 -134.26090

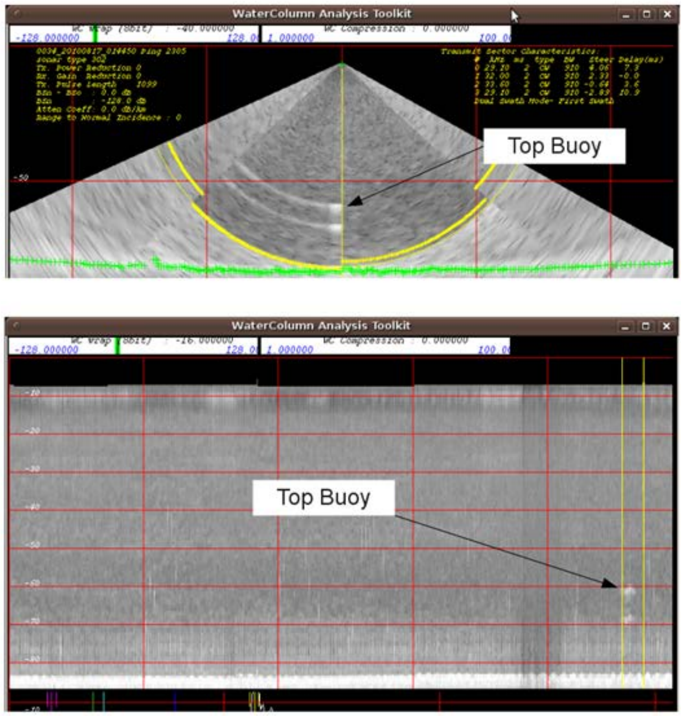



Figure 20.16. Multibeam water column data showing Mooring J at Station J-09 in the BP lease area during Leg 2a.

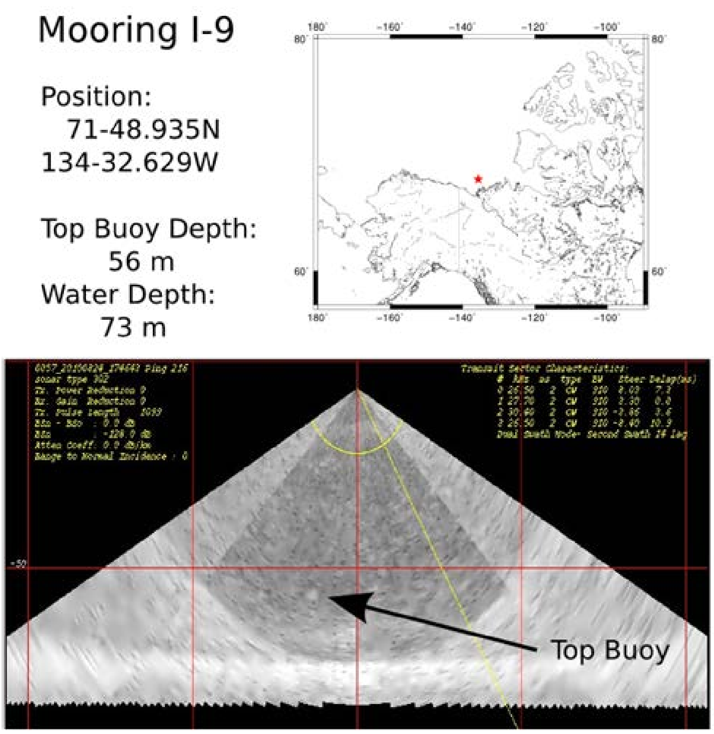



Figure 20.17. Multibeam water column data showing Mooring I-9 in the BP lease area during Leg 2a.

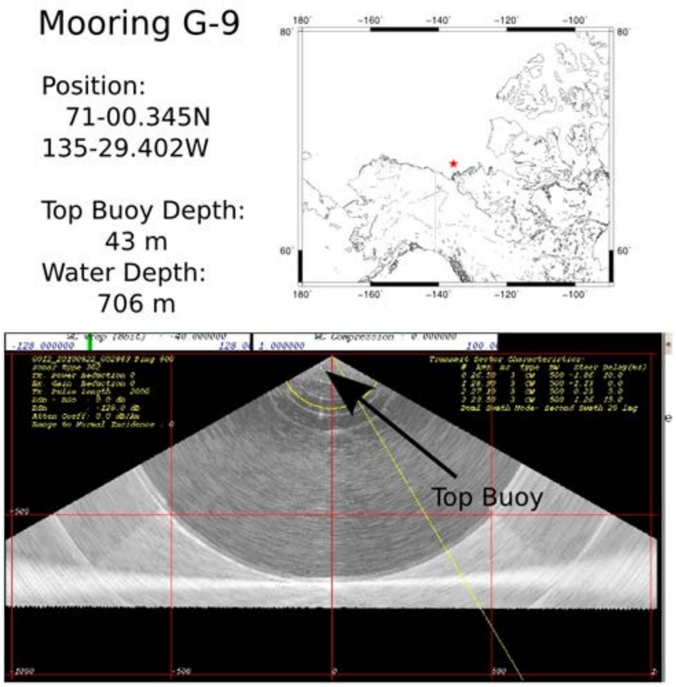



Figure 20.18. Multibeam water column data showing Mooring G-9 in the BP lease area during Leg 2a.

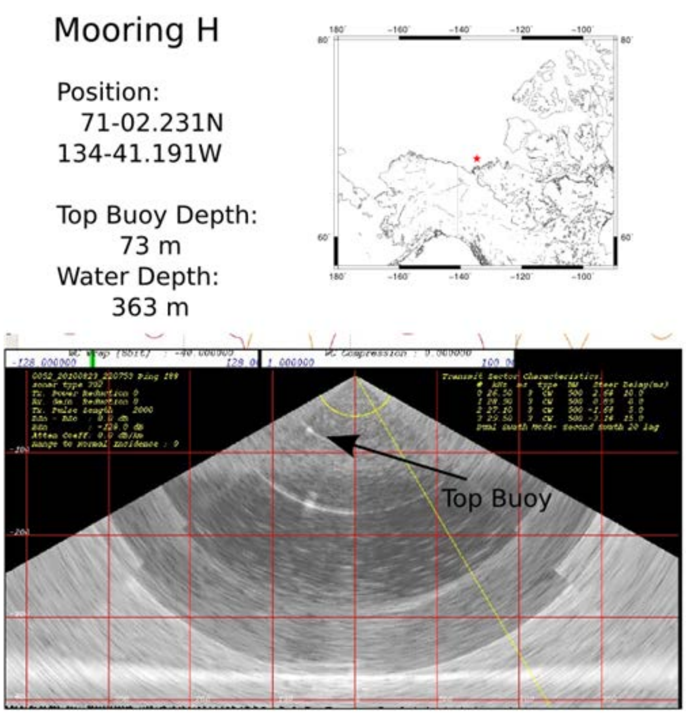



Figure 20.19. Multibeam water column data showing Mooring H in the BP lease area during Leg 2a.

### *20.3.3 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

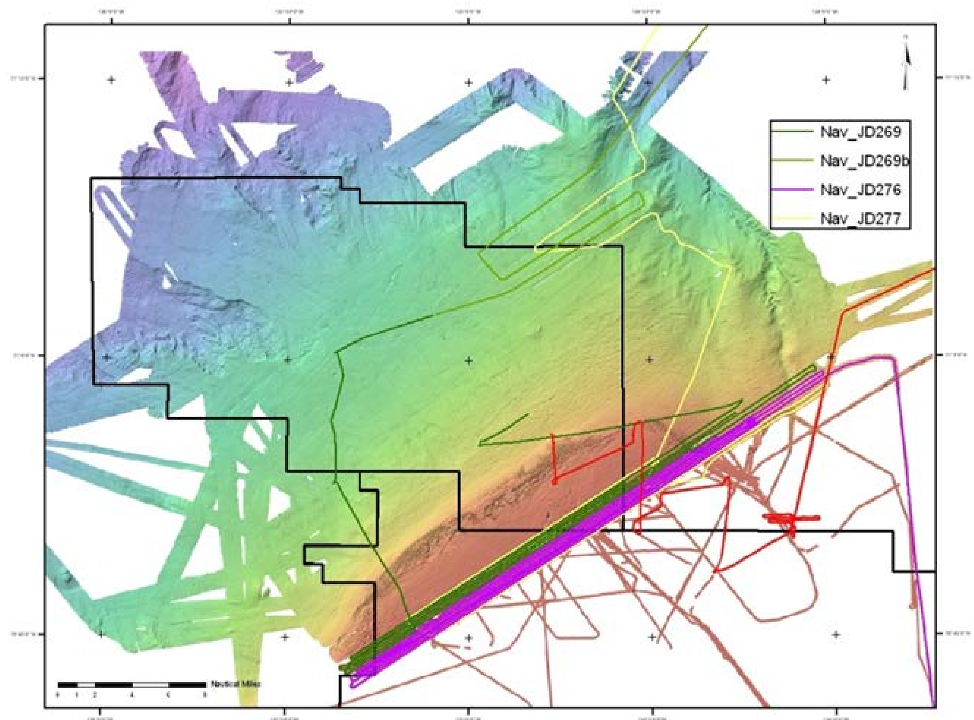



Figure 20.20. Amundsen ship track and survey lines conducted in the BP Pokak lease block in the Beaufort Sea during Leg 3a.

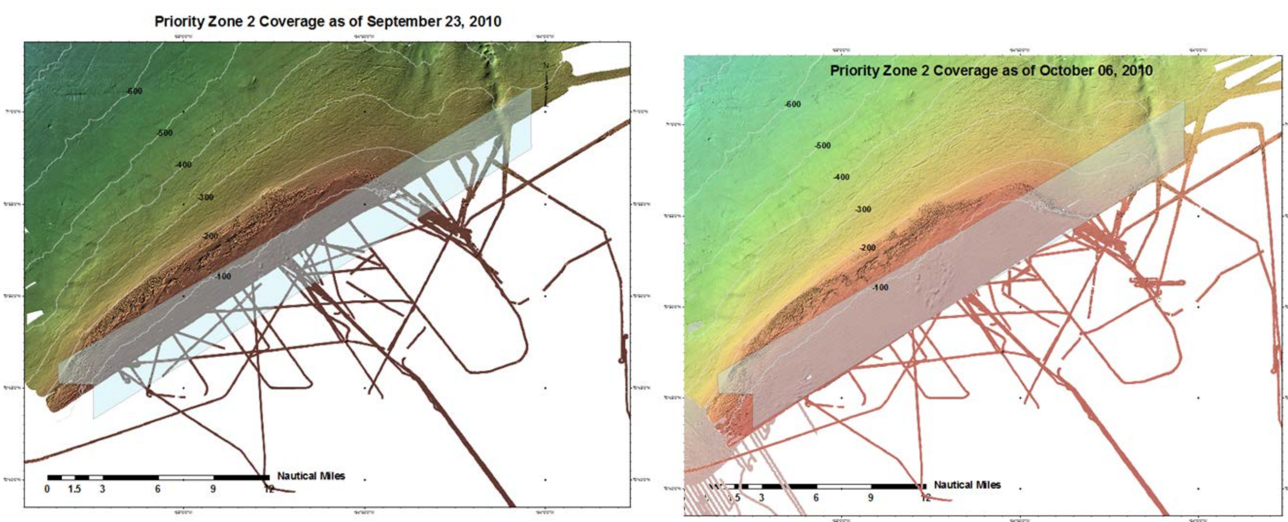



Figure 20.21. Bathymetry maps of the Priority Zone 2 Coverage within the BP lease area in the Beaufort Sea as of 23 September (left) and 06 October (right) conducted during Leg 3a.

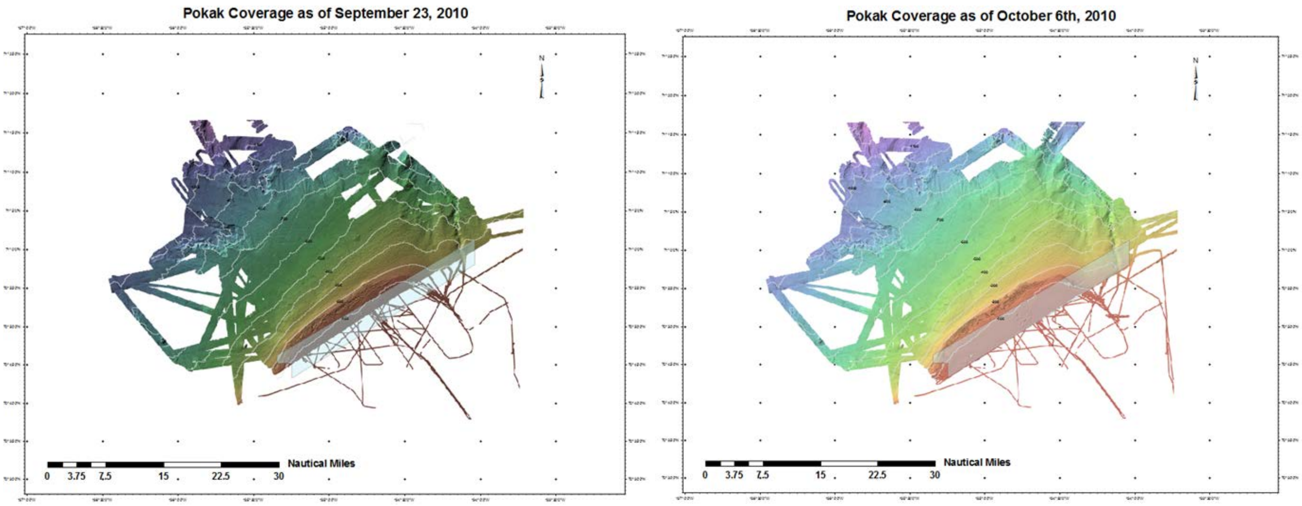
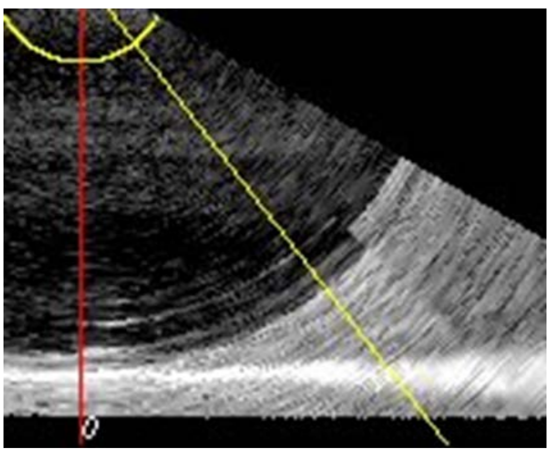



Figure 20.22. Bathymetry maps of the Pokak Coverage in the BP lease area in the Beaufort Sea as of 23 September (left) and 06 October (right) conducted during Leg 3a.



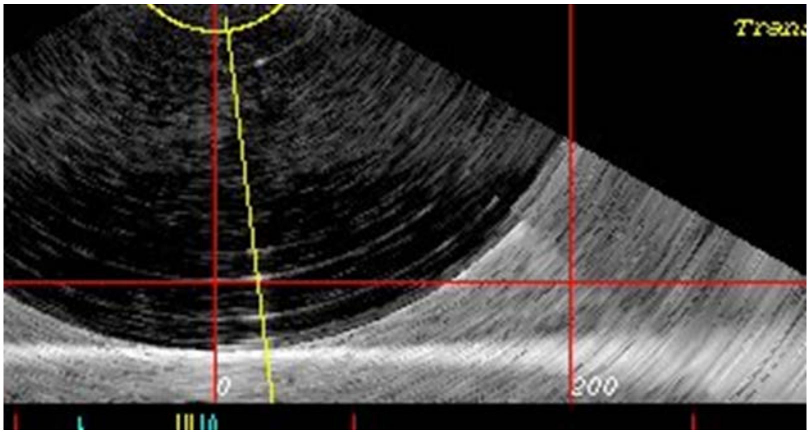
01 October 2010, 1813 UTC

Lat: 71º 25.007 N

Long: 127º 39.678 W

Seabed depth: 237m

Figure 20.23. Multibeam water column data showing Mooring CA 16 MMP-0 in the BP lease area during Leg 3a.



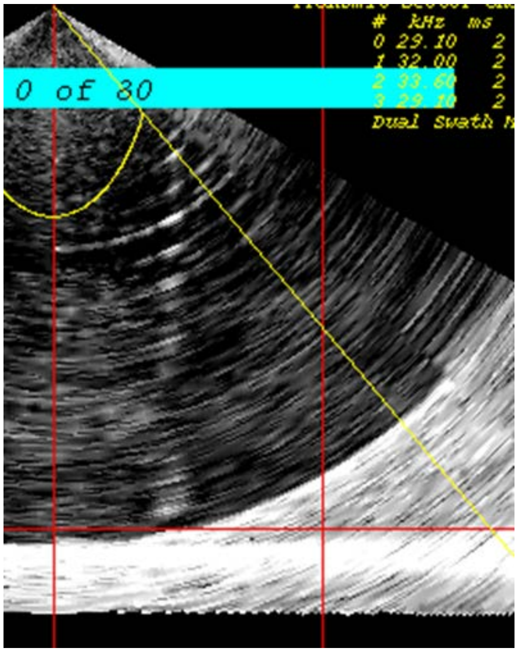

01 October 2010, 1813 UTC

Lat: 71º 25.007 N

Long: 127º 39.678 W

Seabed depth: 237m

Figure 20.24. Multibeam water column data showing Mooring CA05-MMP-10 in the BP lease area during Leg 3a.



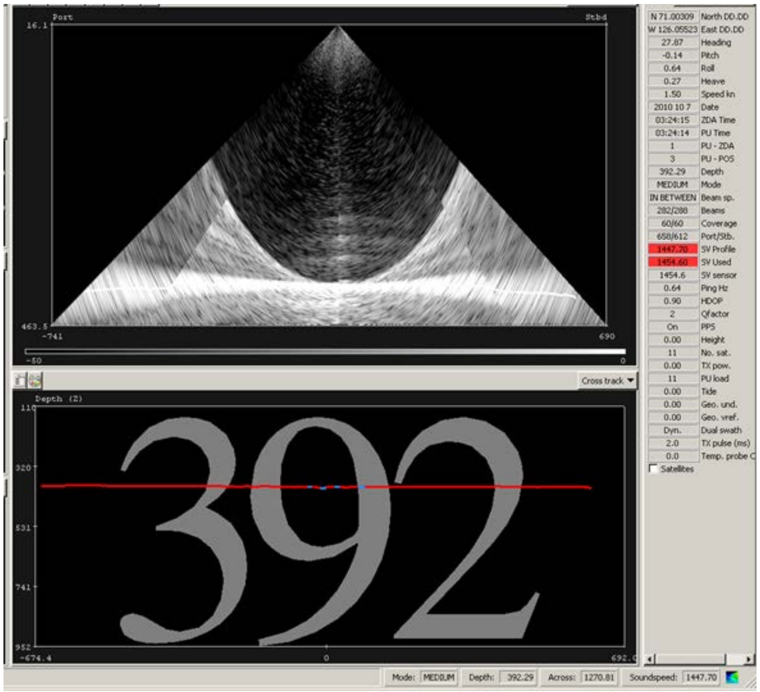

06 October 2010, 2140 UTC

Lat: 71º 19.056 N

Long: 127º 35.662 W

Seabed depth: 205m

Figure 20.25. Multibeam water column data showing Mooring CA05-10 in the BP lease area during Leg 3a.




07 October 2010, 03:24 UTC

Lat: 71.00309 N

Long: 126.05523 W

Seabed depth: 392m

Figure 20.26. Multibeam water column data showing Mooring CA08-10 in the BP lease area during Leg 3a.

### 20.3.4 *Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

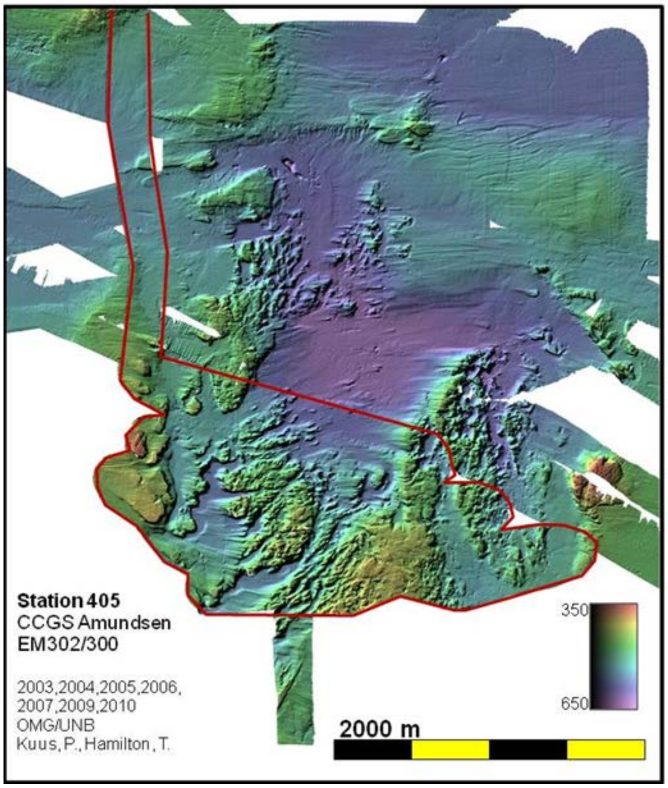



Figure 20.27. Seabed mapping at Station 405 during Leg 3b. Red region outlines coverage completed in 2010.

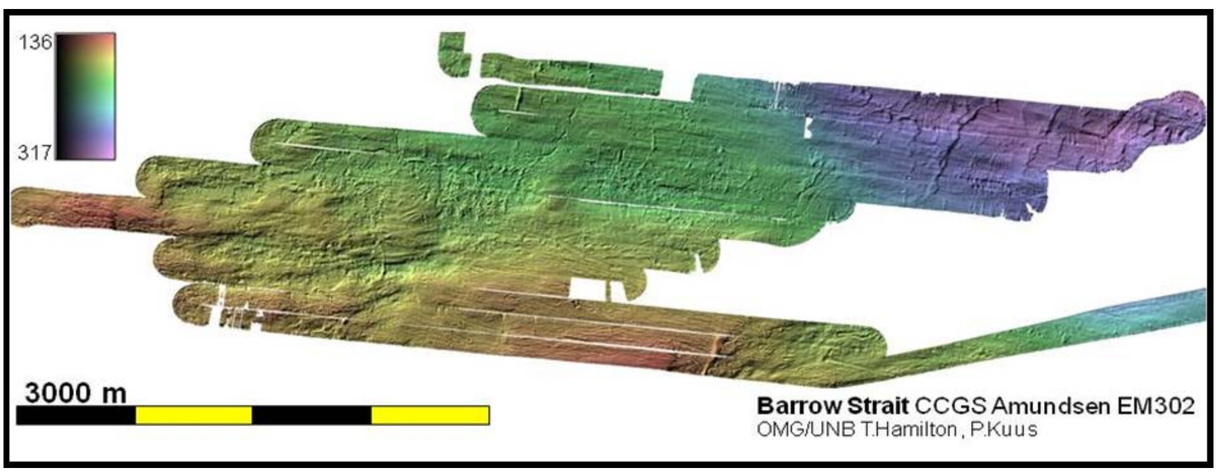



Figure 20.28. Seabed mapping conducted in Barrow Strait during Leg 3b.

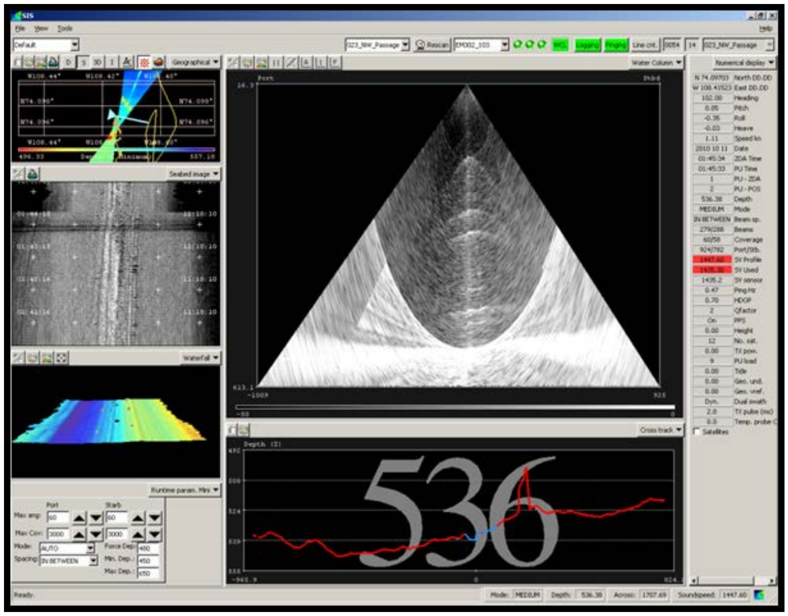


Figure 20.29. Multibeam water column data showing the mooring at Station 308: 74.09703 N 108.41523 W Water depth = 536 m

## 20.3.5 *Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords*

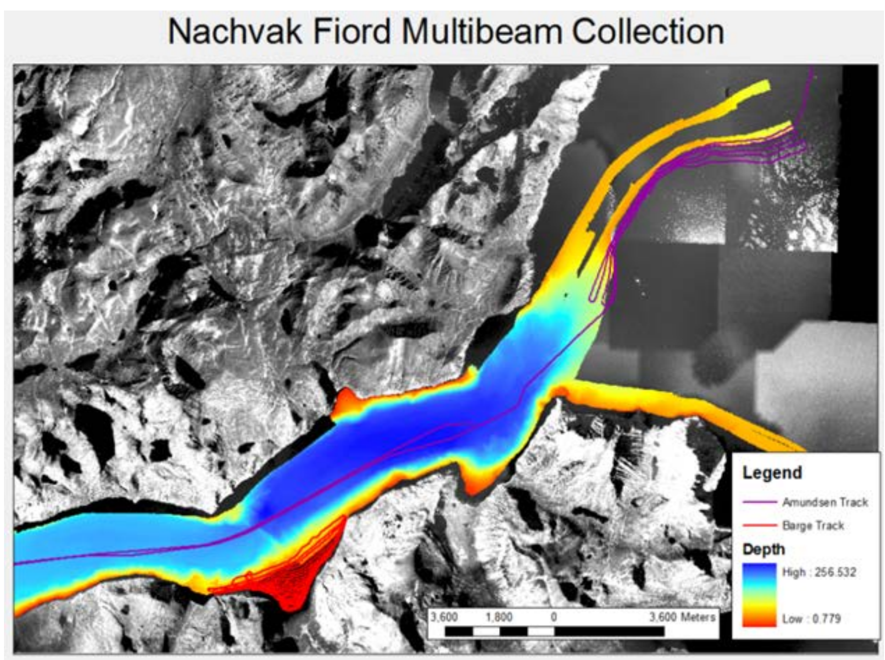



Figure 20.30. Seabed mapping coverage acquired during Leg 3c in Nachvak Fiord. The red and purple lines represent barge and CCGS *Amundsen* vessel navigation in surveyed areas, respectively.

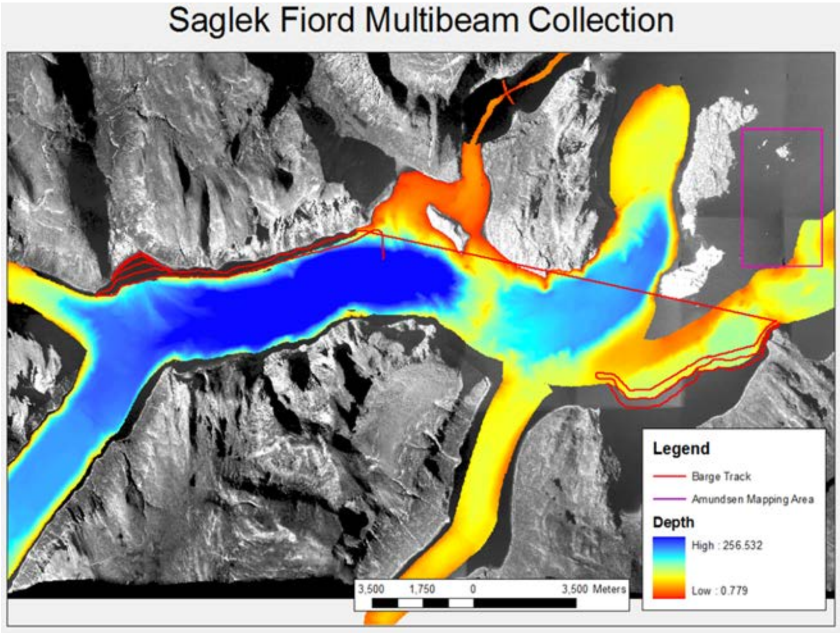



Figure 20.31. Seabed mapping coverage acquired during Leg 3c in Saglek Fiord. The red and purple lines represent barge and *Amundsen* vessel navigation in surveyed areas, respectively.

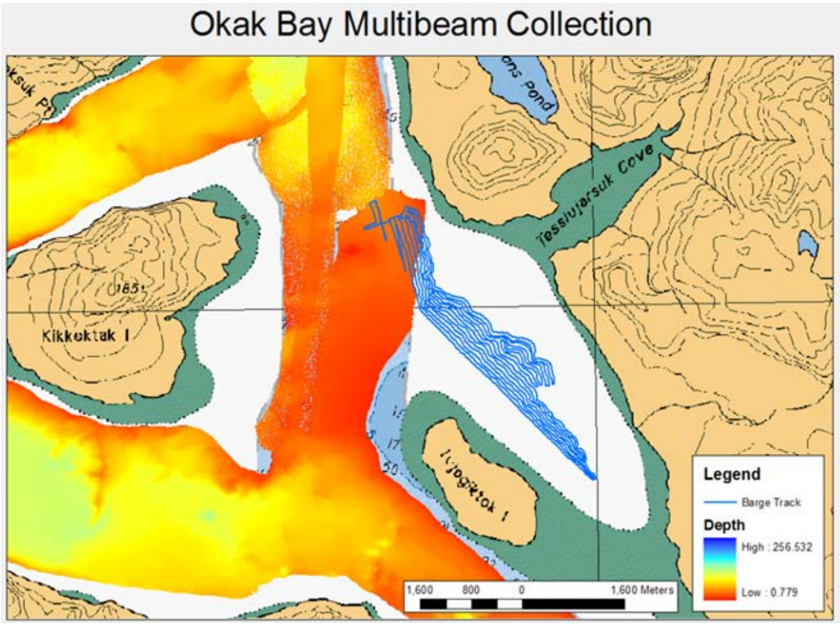



Figure 20.32. Seabed mapping coverage acquired during Leg 3c in Okak Bay. The blue lines represent barge vessel navigation in surveyed areas.

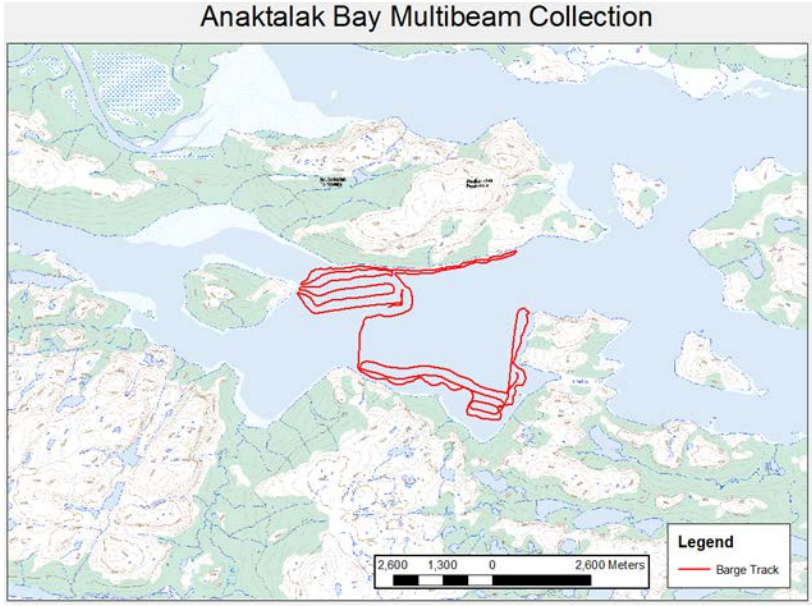



Figure 20.33. Seabed mapping coverage acquired during Leg 3c in Anaktalak Bay. The red lines represent barge vessel navigation in surveyed areas.

## 20.4 Comments and recommendations

The EM302 had a few problems during Leg 1. When passing through the wash of a ship, or wash from the *Amundsen*'s propellers passed under the multibeam transducer, the EM302 would lose bottom tracking. The SIS program would show the navigation as being correct but the system was not pinging. After unravelling a file, it was determined that the navigation telegrams were fine, but the bathy telegrams were empty. The solution to this problem at first was a hard reboot of the EM302 transceiver and after it was determined that setting tighter range gates or forcing the depth worked to get back the bottom detection. This problem is currently being addressed by Kongsberg.

The EM302 had no problems during Leg 2a. The system performed as normal and was not powered down for any reason. The problems encountered on Leg 1 were not observed on Leg 2a.

# 21 Remotely Operated Vehicle (ROV) operations – Leg 2b

**Project leaders**: Steve Blasco[1] (Steve.Blasco@NRCan-RNCan.gc.ca) and BP (Leg 2b)

**Cruise participant Leg 2b**: Ian Murdock[2]
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## 21.1 Introduction

The CGSS *Amundsen* is equipped with an inspection class Super Mohawk remotely-operated vehicle (ROV) that has undergone some recent modifications and improvements. ROV dive targets during Leg 2b were an expulsion feature (or mud volcano) and an area of observed venting gas. Sampling with the ROV was planned for the expulsion feature and venting site to determine the composition of venting gases. The sampling involved video surveying and SIP sampling as well as push core sampling at the gas-venting site.

## 21.2 Methodology

### *21.2.1 ROV preparation*

An extensive amount of time was dedicated to preparation of the ROV for diving, including the installation of new LED lights and a new Bowtech Surveyor colour camera. The surveyor camera required a machined adapter for the bulkhead to fit safely on the pan and allow for tilting. The flexible drive train on the TMS was also repaired and the console remote primary board was replaced. Other minor issues were dealt with during the first week as well.

### *21.2.2 Navigation*

Navigation during this leg was contracted out through BP who installed a Sonardyne Ranger USBL system rented from Ashtead Technology. This is a familiar system and operated reasonably well in the conditions encountered. There was an issue with the wheelhouse's computer not displaying the correct Workboat navigation data. This is believed to have been caused by an inexperienced end-user making accidental changes to offset parameters. The Sonardyne and Workboat systems worked well together without any observed incongruities.

### *21.2.3 Science equipment*

The ROV was equipped with the following instruments for the dive:

- Two Five-Function Manipulators
- Two acrylic cores tubes, Two stainless steel core tubes
- Two pair of SIP samplers
- Tool basket (milk crates)
- Lifting bridle (on TMS)
- Manipulator Knife

### *21.2.4 Dive operations*

One dive was accomplished this trip with limited success. Extensive operations with the ROV were severely curtailed due to the search and rescue operations. The one dive that was carried out was time-limited. A preliminary test dive was conducted prior, and involved a 1m deep dip into the moonpool without the TMS. A second dive was planned and organized for the morning of the 20 September but weather conditions prevented it.

Deployment and recovery of the ROV system is done in a systematic way in a very small space. The *Amundsen*'s crew and science technicians demonstrated excellent coordinated efforts which greatly facilitated the ROV operations, especially considering the very low frequency of use of the ROV. Because of the length of time between deployments (up to one year or more), a period of familiarization with the equipment and operation processes before each dive is required.

Ship positioning was difficult during the dive and, as with the deployment and recovery, more regular use of the ROV system would greatly improve operations and performance. The future involvement of the dynamic positioning system (DP) would greatly improve the ship handling and the safety and ease of ROV operations.

Further training of ROV operators and technicians is still required to operate the ROV in a secure and efficient manner. It is very difficult to gain useful and detailed knowledge with the limited number of dives the CCGS *Amundsen* ROV does in a year. Other training aids, such as a simulator or offshore experience with a different ROV, would help the development of skills and expertise for the personnel involved. To this end, it is recommended that the ROV be used more regularly.

Limited science work was attempted during this dive. The priority was to observe and collect samples of any observed venting gas. As no actual venting was noted, no samples could be collected. The SIP samplers, placed in a tool basket for transport to and from the bottom, were ready to use. Push cores (small tubes for taking sediment samples) were housed in the tool basket with the SIPs. Two acrylic and two stainless steel push cores were fabricated before the first dive. This was the first attempt to take cores with the *Amundsen*'s

ROV. Without finding any venting or material of interest to sample, only one core was taken during the dive, however this core was lost during recovery.

Table 21.1. Summary of ROV dive #27.

| Dive | Location | Position | Duration | Depth | Task |
|---|---|---|---|---|---|
| 27 | BP10-PC43<br>Beaufort Sea | N 70 47.5487<br>W 134 33.1916 | 5:30 | 55m | Visual survey of pockmarks, push core, search for gas venting |

ROV Dive 27 scientific log

Site: BP10_PC43 Mud Volcano
CCGS *Amundsen* 2010 Leg 2b
BP – ArcticNet Collaboration
16-17 September 2010 UTC

Chief Pilot: I. Murdock
Co-pilots: L. Michaud, P. Massot
Observers: J. Dingler, G. De Pascale, K. Blasco, M. Lowings

Notes: PC43 is a PLF site, where gas venting was observed from this year's multibeam water column data. Times recorded in the dive log are in UTC.

23:45 (17:45 local), ROV cage in moonpool
P. Massot piloting
23:50 Cage suspended at 20m
00:02 Cage suspended at 30m, no communication between vessel and ROV – no position
00:09 ROV leaves cage at 30m, still no position
00:12 ROV on bottom at 58m, still no position
Brittle stars
00:20 Communication working, now have position
ROV sitting on bottom
Mud-clay, easily suspended in water column
00:28 Milk crate with sample tools placed on bottom at 55m and released
Start transiting
00:30 Heading towards intersection of north-south and east-west transect lines
Small depression in bottom
Brittle stars, mud at 56m
00:31 Lots of brittle stars 56m
Corals? On bottom
Stirring up bottom sediments, poor visibility
00:34 Waiting for particulate matter in water to dissipate
00:36 Heading down-slope
Fluorescent, translucent pelagic organism
00:37 Large crater (vent?) with low-rise berm surrounding at 49m
Brittle stars around vent on seabed and on top of berm
No venting fluid visible
00:42 Looking into crater

Star inside crater, with some other material? Living?
00:44 Tracking another void area on radar – possibly another crater
00:45 Small ridges on bottom
Crab
00:46 Large mud ridges at 47m
Seabed sloping to left
00:48 At 46m, seabed sloping downwards
00:49 Pile of blocky, clay-like material on-bottom at 47m
Looks like something dropped from above? No box cores taken at this site previously.
00:54 Sitting on bottom at clay pile site
00:56 Transiting
00:57 Switch pilots: L. Michaud piloting
00:58 Steep slope off to left
Basket star
00:59 Sloped, ridges on bottom
01:01 Lumpy, mottled bottom
Basket stars
01:04 On eastern transect line
Start moving northwards and back west to survey lines intersection point
01:05 Blocky pile of sediment
01:07 Depression in seabed
01:10 Looking into crater – worm?
01:12 Transiting, more ridges
01:13 Moving along large slope
01:14 Having difficulty maintaining position of ship and ROV
01:18 Bringing up cage by 10m - moving into shallower water, at 40m
01:19 Sloped bottom, ridges
Basket star
01:23 At 46m, working back west to transect line intersection, waiting for ship to move west
Sitting on bottom, being dragged by ship
01:30 Ship positioning
Bottom stirred up, no visibility
01:39 Transiting west towards milk crate
01:41 Lumps on bottom
01:43 Crater at 55m
Small holes surrounding crater
Brittle stars sitting on edger of crater, something inside?
01:59 Basket star
02:02 Crossing over ROV track in bottom
02:03 Large starfish
02:04 Lots of basket stars
02:07 Large ridge
Back at sample crate - turned on side, covered in mud
02:20 At 43m, having difficulty maintaining position of ship and ROV, poor visibility, were not able to pick up crate
02:45 Having difficulty maintaining position of ship and ROV
02:47 At cage waiting for ship to reposition
02:54 Back on seabed, waiting for ship to reposition further west
I. Murdoch piloting
03:03 Ship has repositioned above survey site, ROV moving back towards sample crate
Lots of suspended particulate matter in water

03:06 Back at sample crate
03:07 Pick up sample crate, transiting back to first crater site
03:21 Pascal piloting
At a crater
03:23 Place crate on bottom at 48m
Looking for original crater
03:37 Back at sample crate
03:40 Poor visibility, water filled with suspended bottom sediments
03:46 Cannot find crater
Will take push core at current location, flat seabed
03:52 Poor visibility, at 49m
04:08 Taking push core
04:11 Retrieving push core
04:20 Placing push core in crate
Rope caught in thruster
Cut rope
04:25 Ian takes over piloting from Pascal for ROV retrieval
Lost crate in low visibility, searching
04:47 Found sample crate
04:57 Crate picked up, transiting to cage
05:05 ROV in cage.

Notes: No active seabed venting or bacterial mats were noted during this dive.

### 21.3 System performance and recommendations

Several problems were noted with the ROV system during the leg. The single most difficult problem was the intermittent loss of telemetry (communications, sonar, and colour camera video) at depth. This problem did not present itself at the surface and no definite source of the problem was found. This has been a recurring issue with the CCGS *Amundsen* ROV system and only occurs while the system is in the water. Trouble shooting this problem would require allocated time trying to reproduce the failure while the ROV is diving.

The new LED lights were repositioned since the last dive, to the location where the sonar head and beacon normally reside. The new LED lights are considerably brighter than the incandescent light that they replaced, so locating them as far away as possible from the cameras is a high priority. This in turn meant moving the sonar and navigation beacon to the front center of the foam pack. It may be possible to set up one of the remaining hydraulic cylinders to move the lights up and away from the frame of the vehicle, however, this was not done because piloting with the lights exposed in this manner requires absolute control over the tether and ROV positioning.

Increasing the height of the cage and adding a tool skid to the bottom of the ROV would be a significant improvement to the system. An increase in cage height would mean modifying the existing lifting equipment. The current sheave that holds the umbilical (the armoured cable that suspends the TMS) would have to be changed. There is enough room to raise the TMS at least 15 inches. The work would require welding to the structural beam in the moonpool room. It might also mean changing the existing gantry winch and small 120VAC winch. Adding a tool skid to the vehicle would allow for collection of samples, carrying of a payload (it currently cannot), and would improve the video quality, all of which would impact the usefulness and productivity of the ROV.

The sonar is an important tool for the ROV and when functioning properly, allows underwater objects to be detected at great distances. Performance of the sonar on the *Amundsen*'s ROV is relatively poor, for unknown reasons. It is suggested that the unit be sent to the manufacturer for evaluation.

The vehicle currently has a very large fibre optic gyro (FOG). In the last year, manufacturers have committed to providing accurate heading near the north pole with newer, smaller FOG models. Replacing the current FOG with a newer model would free up some desperately needed space on the vehicle.

Scaling lasers, which can be used to measure the size of objects within the video frame, would be an inexpensive and useful addition to the ROV especially in terms of using the video for quantitative scientific analysis purposes.

The new Bowtech Surveyor colour camera has been an excellent addition to the vehicle. Working in remote regions greatly extends the time it would take to have a camera replaced or repaired, therefore it would be beneficial to have a spare camera onboard as well as a more conventional video recording system. A DVD recorder combined with a pal converter would also provide a more reliable and accessible medium for video recording, with relatively little expense.

A final long term consideration for the addition of high bandwidth devices such as an HD camera or multibeam sonar would be addition of another fibre optic pathway. There are currently only two fibre optic pathways through the surface winch which are both used by the telemetry system.

# 22 Seabed geological mapping and geotechnical sampling – Legs 2b, 3a and 3b

ArcticNet Phase 2 – Project titled *The Canadian Arctic Seabed: Navigation and Resource Mapping*. http://www.arcticnet.ulaval.ca/pdf/phase2/hugues_clarke_seabed_mapping.pdf.

**Project leaders:** Steve Blasco[1] (Steve.Blasco@NRCan-RNCan.gc.ca) and BP (Legs 2b and 3a)

**Cruise participants Leg 2b**: Steve Blasco[1], Kevin MacKillop[1], Kate Jarrett[1], Greg Middleton[1], Robbie Bennett[1], Justin Buis[1], Carrie Breton[1] and Katie Blasco[1] in collaboration with the Ocean Mapping Group (UNB)[2]
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## 22.1 Introduction

Recent hydrocarbon exploration activity has shifted from the inner shelf to outer shelf/upper slope region of the Beaufort Sea. In this region, very little data exists concerning the type and distribution of seabed geohazards which may have an impact on exploration drilling operations.

During Leg 2b, in collaboration with BP and the University of New Brunswick, the Geological Survey of Canada (Atlantic) conducted a data acquisition program aboard the CCGS *Amundsen* to investigate the extent and dynamics of seabed geohazards. Knowledge gained will feed National Energy Board regulatory processes, industry engineering design scenarios and environmental impact assessment processes.

During Leg 3a/3b, in collaboration with BP and the University of New Brunswick, the GSCA conducted a data acquisition program to 1) map the types and distribution of seabed geohazards which may affect oil exploration drilling operations in the Beaufort Sea; and 2) on an opportunistic basis, map in greater detail the geological features of interest noted on previous cruises, during the transit through the Northwest Passage.

## 22.2 Methodology – Study areas and equipment

The study area during Leg 2b was located on the outer shelf/upper slope region of the Beaufort Sea (Figure 22.1).

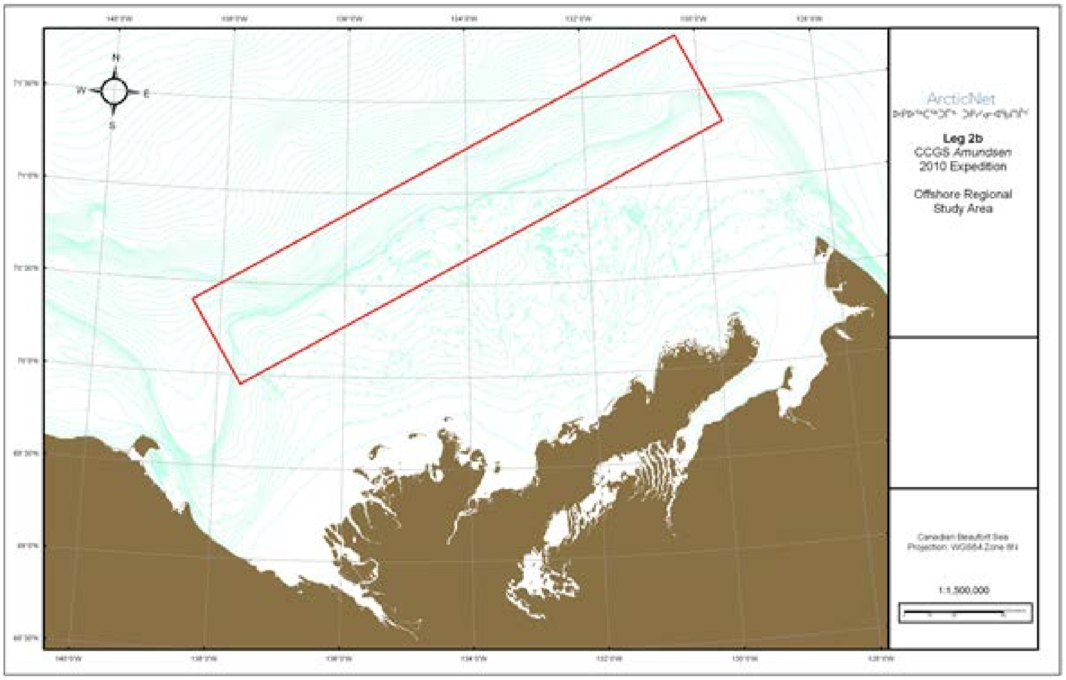


Figure 22.1. Beaufort Shelf Outer Shelf/Upper Slope Regional Study Area where geotechnical sampling was conducted during Leg 2b.

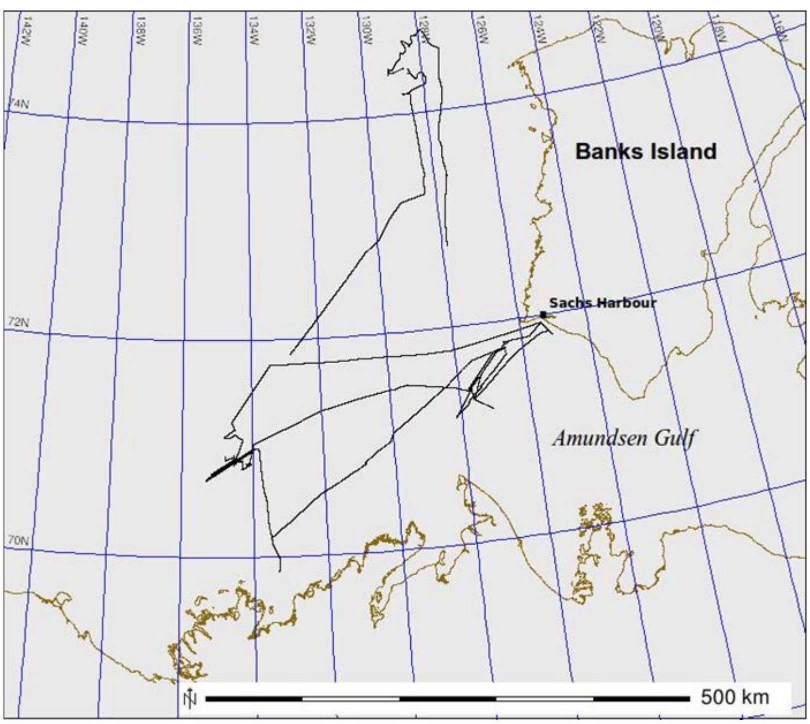


Figure 22.2. CCGS *Amundsen* ship track lines surveyed during Leg 3a, 23 September to 07 October.

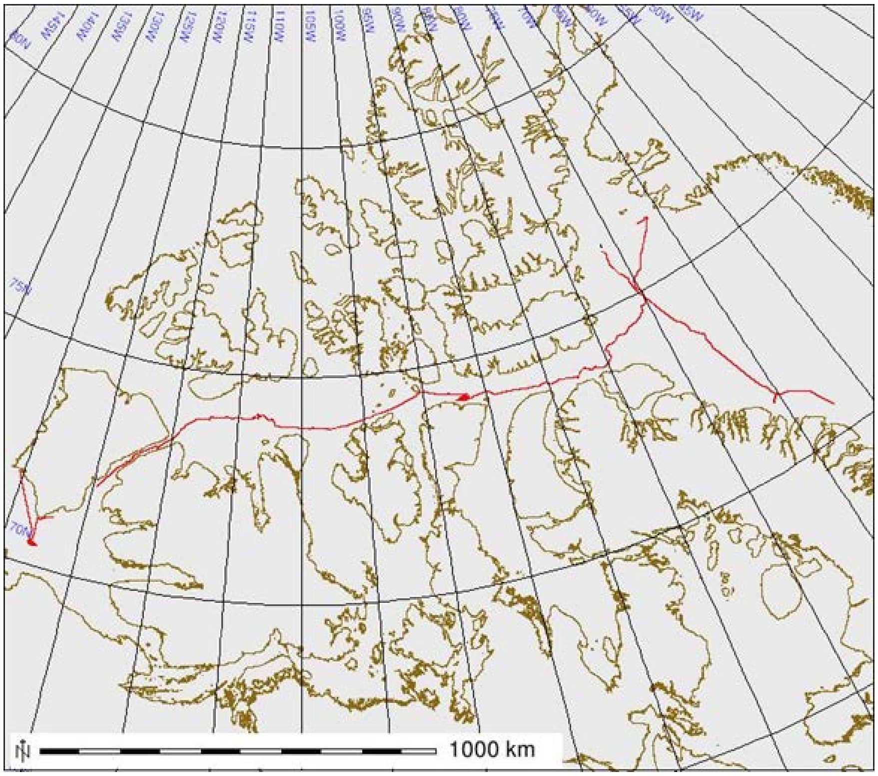


Figure 22.3. CCGS *Amundsen* ship track lines surveyed during Leg 3b, 07 October to 19 October.

### *22.2.1 Mapping*

Specifications and operating parameters for the *Amundsen*'s repertoire of seabed mapping equipment listed below can be found in Section 20.

- Kongsberg EM302 1° x 2° 30 kHz multibeam echosounder flush-mounted behind ice windows
- Knudsen K320R sub-bottom profiler, 16 element hull-mounted 3.5 kHz (12 ms chirp, 2-7 kHz)
- Applanix POS/MV 320 motion and orientation sensor
- C&C Technologies CNAV GPS
- AML Smart Probe surface sound speed probe
- Honeywell Precision Barometer
- Moving Vessel Profiler: MVP 300 under-way profiler
- CTD operated by INRS (Institut national de la recherche scientifique) – salinity and temperature measurements were used by the mapping team to calculate water velocities

### *22.2.2 Piston coring*

The piston corer used on board the *Amundsen* was constructed based on blueprints of the Atlantic Geoscience Centre (AGC) Long Coring Facility (LCF) supplied by the GSCA. The LCF system typically obtains a core sample with an ID of 99.2mm. The 10 ft (305cm) long barrels have an OD of 12.71 cm, wall thickness of 0.95325cm and ID of 10.8035cm. The core head is 1.5m long, 0.6m in diameter and weighs 1800lbs. A 2200lb backup core head was available, but not utilized. The core head is connected to the barrel string using a "half" coupling. The length of the first barrel was 304cm and the second and third barrels were 305cm long. A maximum of 3 barrels can comprise the barrel string on the *Amundsen* due to the deck layout, and are attached to each other with external couplings. Each coupling has 16 holes drilled and tapped for ¾” set screws which mate to the grooves on the core barrels.

Core liner, manufactured to meet GSCA specifications, is made of cellulose acetate butyrate (CAB) plastic and contains the recovered sediment. The liner has an I.D. of 9.923cm and an O.D. of 10.523cm. The liner is inserted inside the core barrels and each length is held together with clear tape.

A split piston with one O-ring and a variable orifice size is used to prevent the corer from plugging and results in greater sediment penetration and reduced sample distortion. The split piston is pinned to an Electroline eye socket termination assembly fitting on the end of the 3/4 “cable that is inserted through the core head. A core cutter (I.D. 10.008cm) houses the core catcher and serves as a replaceable nose cone for the corer. The 10-degree taper on the outside guides the cutter into the sediment. The inside bore channels the recovered sediment into the liner where it is retained during recovery. The cutter is fit over the end of the last core barrel and secured with 8 set screws.

The Trigger Weight Core (TWC) has a dual function. It acts as a trip weight and is used in conjunction with the trip arm to set the piston corer up for a predetermined free fall before sediment penetration. The corer and cable is shackled to the end of the trip arm. In addition, the TWC acts as a gravity core which supplements the data obtained from the piston corer by collecting an undisturbed surface sample. The TWC consists of one barrel, coupling, nose cone, catcher, liner, one-way valve and weight stand. Additional lead weights (donut shaped) may be added around the weight stand. The overall weight of the pilot corer can vary but it is approximately 300 to 400 lbs (140 to 180 kg). The *Amundsen* TWC barrel was 213cm long and weighed 250lbs.

### *22.2.3 Box coring*

The Box core used was a GSCA system based on a Benthos Box corer design. The total weight of the system is 1500lbs.The box corer consists of a 50cm x 50cm x 60cm box and provides an undisturbed sample of the seafloor. The box corer was deployed and retrieved using the 500 horsepower Hawboldt winch and the large block on the A- frame.

### 22.2.4 Sub-Atlantic Super Mohawk ROV

The Sub-Atlantic Super Mohawk is an electrically powered remotely operated vehicle (ROV) with accompanying TMS (Tether management system) owned and operated by Université Laval with support from the Canadian Scientific Submersible Facility (CSSF). Specifications are as follows (after Sub-Atlantic, 2009 and CSSF pers. comm.):

- Depth rating of 2000msw
- Propulsion 6 off CTE-02 440 VAC Thrusters
- Forward thrust 117 kgf
- Lateral thrust 88 kgf
- Vertical thrust 78 kgf
- Tritech Sonar
- Bowtech Colour Zoom Camera
- Tritech Low light Mono Camera
- 2 x 5 Function Hydrolek Manipulators
- Lighting: 2 x 150 Watt LEDs and 1 x 250 Watt Incandescent
- OceanTools MiniFOG Gyrocompass

Further information on ROV Operations can be found at p.240, Remotely Operated Vehicle (ROV) operations – Leg 2b.

### 22.2.5 Facilities

The following areas of the vessel were used by the Seabed Mapping group during Leg 2b of the 2010 expedition:

- Foredeck coring container – used for coring equipment and tool storage, core preparation
- Foredeck A-frame and crane for piston and box core deployment
- Geotechnical:
  - Chemistry aft laboratory (Level 500) – 2 rooms
    - Sealing station – cutting down cores and waxing
    - Torvane measurements and constant volume sampling
- Aft refrigerated core storage container near helideck
- ½ of acquisition room (202) for UNB/GSC use
  - UNB: several laptop and desktop computers plus acquisition hardware
  - GSC: two laptop computers
- HP Designjet T1100 Plotter located in acquisition room
- Storage space for empty core liners

## 22.3 Methodology – Procedures

### *22.3.1 Positioning*

Multibeam and sub-bottom positioning was done by UNB (see 20).

Positioning for piston core, trigger core, boxcore, and ROV was achieved using a RangerPro USBL system correlated with Fugro's Starfix GPS navigation package (see Fugro cruise report for further details). A USBL calibration beacon was deployed before the start of the coring and ROV work to calibrate the position of the on-ship USBL transducer. The transducer was lowered to a fixed position prior to each core and ROV dive from the acoustic well on the 600 level (Figure 22.4). The calibration beacon deployment location was at: 71°04'23.58265" N, 135°43'09.37982" W (NAD83), at a water depth of 876m.

Figure 22.4. USBL transducer deployed in the acoustic well.

### *22.3.2 Seabed mapping*

<u>Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea</u>

Collection and processing of the multibeam and sub-bottom data was carried out by the UNB team working 12 hour shifts in acquisition room 202. UNB made available to the GSC daily geotifs of the multibeam mapping to date, as run line navigation files, raw sub-bottom seg-y files, and pdf images of both multibeam and sub-bottom lines along requested regional areas of interest.

Water column imagery was collected for all transects, however, was only processed by UNB when there was a specific request, for example to locate seabed gas seepages. On-board preliminary regional analysis of bottom features using ArcMap and GSCA Segy-Jp2 (B. Courtney) in-house seismic viewing software was carried out by C. Breton, S. Blasco and K. Blasco.

Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea

Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

The multibeam echosounder and Knudsen 3.5kHz sub-bottom data collection was performed by UNB (see report in Section 20). Collection and processing of the multibeam and sub-bottom data was carried out by the UNB team working 12 hour shifts in acquisition room 202. On a daily basis, UNB made available to the GSC the run line navigation files in ESRI Shapefile format, raw 3.5kHz sub-bottom SEG-Y files, processed and cleaned multibeam bathymetry data in the UNB Ocean Mapping Group's .merged format, water column imagery, as well as the multibeam bathymetry raw data.

The processed and cleaned .merged files were imported into MB-System 5.1.3, an open-source, free, swath sonar bathymetry processing suite, and ESRI Arc grids were generated for each day's coverage. These grids were then imported into GRASS GIS 6.5 for inspection, visualization, and survey planning. The multibeam bathymetry grids were colored according to depth using a rainbow color table, and artificially sun-illuminated at 10x to enhance the visibility of seabed topography.

Water column imagery was collected in all areas that multibeam bathymetry was obtained, however, was only processed by UNB when there was a specific request. Onboard preliminary regional analysis of sea bottom features was carried out using ArcMap 9.3, GRASS GIS 6.5, and GSCA Segy-Jp2 (by B. Courtney), an in-house seismic viewing software.

### *22.3.3 Piston coring (Leg 2b)*

The GSC team was responsible for the set-up, collection and processing of the piston, trigger, box and push cores during Leg 2b (Figure 22.5).

Figure 22.5. Piston coring operations (Photo: C. Breton)

The configuration of the *Amundsen*'s foredeck only allowed for the deployment of the piston corer rigged with three barrels. Each core barrel was supported by a set of hydraulic jacks during assembly and disassembly of the coring system between the A-frame and the port side crane. Once rigged, the corer was raised and rotated, using the port side crane, and lain across the vessel with the base of the corer hanging over the side under the A-frame. A 5/8" cable was attached to the piston core wire and the TWC trip arm was attached to the core head.

The USBL beacon was attached to the 5/8" winch cable above the core head. The crane was used to lift the core to hang vertically below the A-frame. The crane cable was then detached from the core head. The TWC was raised using the capstan on the 500 horsepower Hawboldt winch and the small block on the A-frame. It was then lowered over the side and attached to the trip arm. The coring system was then lowered using the Hawboldt winch and the large block on the A-frame. The reverse procedure was used for retrieval of the TWC and Piston core.

On board processing and subsampling – Piston and TWC cores

All GSCA piston and TWC cores were processed according to standard GSCA core procedures (refer to GSC Open File #1044). All cores were identified alphabetically by section at the time of dismantling individual core barrels from the bottom to the top, commencing with the bottom-most core barrel and proceeding to the uppermost barrel containing sediment. Each 305cm length of liner was extruded from the barrel and cut in half on the foredeck, using a GSCA pipe cutter. The sediment in the liner was cut using a wire saw and the section ends were carefully capped to minimise disturbance to the sediment surface. The top end cap was labelled with the section label and top. The base of the core is designated with the letter A and the top of the base section is designated as B. The base section is AB. All sections were carried to the aft Chemistry Lab and stored horizontally on the bench. Each core, starting with the base section AB, was processed using the following procedure. The core liner was labelled with an up arrow, cruise number, station number, section label and the top and base of the section were labelled with the appropriate letter. End caps were removed if the sediment was not too fluid, and the section length was recorded.

Undrained shear strength measurements and constant volume samples were taken at the top and base of each section where possible. Inert packing was placed in the voids created by the constant volume sampling, and the ends of each core section were re-capped, taped and waxed. The sealed core sections were stored upright in the refrigerated reefer container and maintained at 4°C. All core cutters and catchers were measured, labelled, placed in split liners, waxed and stored upright in buckets in the refrigerated container. All extruded core sections due to sediment expansion or core processing methods were likewise labeled and stored. All samples and subsamples were catalogued and their location information within the container was recorded in an excel spreadsheet.

Station location information, core section lengths, extruded pieces and cutter/catcher lengths, sediment description and core performance information were documented on deck sheets on the foredeck during coring operations. This data was later input into the ED AT SEA laptop. The ED AT SEA data was verified and backed up prior to upload into the GSC ORACLE Expedition Database (ED).

### Physical properties measurements

Undrained torvane shear strength measurements and constant volume samples were taken at the ends of each section of the piston core if the condition of the sediment allowed. The constant volume sampler was inserted into the end of the section, the undrained shear strength measurement was taken and then the constant volume sampler was removed.

The undrained shear strength was measured using a hand-held Hoskin Scientific Torvane. The dial on the Torvane was zeroed, the fins on the vane were completely inserted into the sediment. The dial was rotated at a constant rate until the sediment failed (Figure 22.6 left).

The Torvane dial reading ranges from 0 to 1 and reports values in kg-force/cm$^2$ units (1 kg/cm$^2$ = 98.07 kPa). The Torvane has three adapter vanes as described below:

Figure 22.6. Left: Taking a Torvane measurement on one of the cores. Right: Inserting a constant volume sampler. (Photos: K. Jarrett)

Constant volume samples for bulk density and water content determinations were taken by inserting stainless steel samplers of a known volume. Prior to insertion, the sampler was lightly sprayed with Pam cooking oil and gently wiped with a small Kimwipe tissue. The bevelled edge of the sampler was placed on the flat sediment surface and carefully inserted into the sediment at a constant rate using two flat headed spatulas (Figure 22.6 right). The sampler is inserted at a constant rate to minimize compression of the sediment within the sampler. The sampler was then carefully removed and the sediment was trimmed using a wire saw and extruded into a pre-weighed 1 oz screw-top glass bottle. The bottle cap was then labelled and sealed using electrical tape to prevent the lid from loosening. The samples will be weighed, dried at 105°C for 24 hours and re-weighed to determine bulk density, dry density and water content according to ASTM Test Method D 2216-90 (revision of 2216-63, 2216-80) Standard method for laboratory determination of water (moisture) content of soil and rock. All relevant information for the Torvane measurements and constant volume samples was recorded on data sheets and input into excel spreadsheets and were incorporated into the GSCA physical property database.

### *22.3.4 Box coring (Leg 2b)*

The box corer was deployed and retrieved using 500 horsepower Hawboldt winch through the A-frame (Figure 22.7). Upon retrieval, the box core frame was removed and water was drained from the top of the box. The box was transferred to the starboard side using a trolley. Photographs were taken of the sediment surface, field vane measurements of shear strength were made at 10cm intervals and a surface sample of approximately 100cc was taken for micropaleontology. The T-bar frame was attached to the box and the two T-bar tests for the measurement of tip resistance and sleeve friction were made. Upon completion of the T-bar test the box was transferred to portside where a 50cm length of CAB plastic core liner (push core) was slowly inserted using a vacuum backpressure technique to prevent sample compression. The push cores were taken back to the aft Chemistry Lab and stored vertically. All GSCA push cores were processed according to standard GSC Atlantic core procedures (see above).

Figure 22.7. Box core deployment and sub-sampling (Photos: C. Breton and J.Buis).

A total of 49 piston cores (including 4 gravity cores) and 22 box cores were collected by the GSC in collaboration with Fugro for BP. All of the GSC cores will be split, processed (following standard procedures) and curated at the GSCA core repository located at the Bedford Institute of Oceanography, Dartmouth, Nova Scotia.

Table 22.1. Piston and Box Core locations (coordinates converted from as-taken NAD83) for geotechnical sampling conducted during Leg 2b.

| GSC Station # | BP Station # | Long (WGS84) | Lat (WGS84) | Water Depth (m) (from multibeam) |
|---|---|---|---|---|
| 2010804 0001 | BP10-PC12 | -135.5627147 | 70.79298844 | 419.85 |
| 2010804 0002 | BP10-PC39 | -135.5269059 | 70.99139817 | 676.48 |
| 2010804 0003 | BP10-PC34 | -135.3705599 | 70.98606934 | 633.64 |
| 2010804 0004 | BP10-PC06 | -135.4536459 | 71.00590843 | 682.59 |
| 2010804 0005 | BP10_BX14 | -135.2531465 | 70.99032606 | 595.77 |
| 2010804 0006 | BP10-PC22 | -135.5801145 | 71.14494908 | 953.77 |
| 2010804 0007 | BP10-PC29 | -134.8846344 | 70.95127102 | 326.86 |
| 2010804 0008 | BP10-PC31 | -134.8045376 | 71.02757260 | 432.63 |
| 2010804 0009 | BP10-PC40 | -134.7583369 | 70.99099284 | 347.89 |
| 2010804 0010 | BP10_BX12 | -135.0341533 | 71.02141373 | 554.04 |
| 2010804 0011 | BP10-PC32 | -134.3779523 | 71.01566181 | 338.04 |
| 2010804 0012 | BP10-PC14 | -134.2057024 | 70.92305328 | 101.13 |
| 2010804 0013 | BP10-PC28 | -134.2453143 | 70.89795506 | 83 |
| 2010804 0014 | GSC10_BX01 | -134.6841664 | 70.85579650 | 80.22 |
| 2010804 0015 | BP10_BX06 | -134.8933962 | 70.86600955 | 112.71 |
| 2010804 0016 | BP10_BX07 | -134.8194436 | 70.77644577 | 73.25 |
| 2010804 0017 | BP10_BX08 | -135.1785511 | 70.81565675 | 160.3 |
| 2010804 0018 | BP10-PC26 | -134.9946183 | 70.85939990 | 104.83 |
| 2010804 0019 | GSC10_PC01 | -134.6850551 | 70.85550886 | 80.22 |
| 2010804 0020 | BP10-PC09 | -134.4407224 | 70.85936547 | 78.41 |
| 2010804 0021 | BP10-PC08 | -134.7767415 | 70.89965217 | 141.45 |
| 2010804 0022 | BP10-PC30 | -134.5524565 | 70.92208138 | 94.09 |
| 2010804 0023 | BP10-PC41 | -134.6735224 | 70.95592836 | 239.18 |
| 2010804 0024 | GSC10_PC06 | -134.8080860 | 70.91468747 | 182.39 |
| 2010804 0025 | GSC10_BX06 | -134.8080220 | 70.91470713 | 182.83 |
| 2010804 0026 | BP10_BX09 | -134.3787852 | 70.92556788 | 110.73 |
| 2010804 0027 | BP10_BX13 | -134.7173777 | 70.97422779 | 286.38 |
| 2010804 0028 | BP10-PC18 | -135.1813675 | 70.76953092 | 77.12 |
| 2010804 0029 | BP10-PC44 | -134.6969160 | 70.65591206 | 58.2 |
| 2010804 0030 | GSC10_BX05 | -134.8376495 | 70.92868678 | 254.79 |
| 2010804 0031 | BP10_BX16 | -134.8239756 | 71.03254555 | 454.78 |
| 2010804 0032 | BP10_BX15 | -134.6367544 | 71.08467603 | 462.12 |
| 2010804 0033 | BP10-PC42 | -134.3599326 | 70.82552706 | 70.14 |
| 2010804 0034 | BP10-PC27 | -134.4286994 | 70.78297881 | 68.25 |
| 2010804 0035 | BP10-PC43 | -134.5532180 | 70.79247883 | 61.37 |
| 2010804 0036 | GSC10_PC05 | -134.8377028 | 70.92857825 | 254.62 |
| 2010804 0037 | BP10-PC36 | -135.1188736 | 70.95007970 | 470.78 |
| 2010804 0038 | BP10-PC37 | -135.1655174 | 70.93722071 | 488.9 |
| 2010804 0039 | BP10-PC01 | -135.2578348 | 70.91094039 | 484.73 |
| 2010804 0040 | BP10_BX01 | -135.5504732 | 71.02626556 | 774.12 |
| 2010804 0041 | BP10_BX02 | -135.5853720 | 71.02983944 | 834.18 |
| 2010804 0042 | BP10-PC23 | -135.5676420 | 71.01001340 | 765.79 |
| 2010804 0043 | BP10-PC21 | -135.5478484 | 71.00054269 | 705.61 |
| 2010804 0044 | GSC10_BX04 | -135.1243262 | 71.06354167 | 630.39 |
| 2010804 0045 | BP10_BX10 | -135.2889076 | 71.04284678 | 675.34 |
| 2010804 0046 | BP10-PC25 | -134.1371980 | 70.96531219 | 194.38 |
| 2010804 0047 | BP10-PC10 | -133.7869897 | 70.78748534 | 76.04 |
| 2010804 0048 | BP10-PC13 | -133.3536892 | 70.67101790 | 52.2 |
| 2010804 0049 | BP10-PC16 | -132.6428604 | 70.67942437 | 24.3 |
| 2010804 0050 | BP10-PC17 | -132.5926613 | 70.78422761 | 34.8 |
| 2010804 0051 | BP10-PC07 | -132.0910308 | 70.58528838 | 43.2 |

| GSC Station # | BP Station # | Long (WGS84) | Lat (WGS84) | Water Depth (m) (from multibeam) |
|---|---|---|---|---|
| 2010804 0052 | BP10-PC11 | -133.2272123 | 70.80672774 | 27.2 |
| 2010804 0053 | BP10-PC15 | -132.6894217 | 71.01678608 | 67.4 |
| 2010804 0054 | BP10-PC33 | -135.1678798 | 71.01471317 | 604.28 |
| 2010804 0055 | GSC10_BX02 | -135.3970907 | 71.19014840 | 994.38 |
| 2010804 0056 | GSC10_PC02 | -135.3970801 | 71.19005542 | 993.9 |
| 2010804 0057 | BP10-PC02 | -135.0988763 | 71.11673154 | 684.66 |
| 2010804 0058 | BP10-PC35 | -135.2842185 | 70.98183857 | 601.75 |
| 2010804 0059 | BP10-PC38 | -135.7722023 | 71.04869771 | 984.23 |
| 2010804 0060 | BP10_BX03 | -135.6330151 | 71.03937220 | 882.61 |
| 2010804 0061 | BP10_BX04 | -135.6706464 | 71.05677878 | 852.01 |
| 2010804 0062 | BP10-PC24 | -135.5125477 | 71.14143319 | 908.72 |
| 2010804 0063 | BP10-PC19 | -135.8980464 | 71.17299723 | 1069.85 |
| 2010804 0064 | BP10-PC20 | -135.9174000 | 71.00685300 | 911.28 |
| 2010804 0065 | BP10_BX05 | -135.7495750 | 71.03895056 | 926.74 |
| 2010804 0066 | BP10_PC45 | -135.2286747 | 70.99140316 | 599.3 |
| 2010804 0067 | BP10_BX11 | -134.9240354 | 71.08254115 | 557.73 |
| 2010804 0068 | BP10_PC46 | -134.5512616 | 70.98783244 | 256.47 |
| 2010804 0069 | GSC10_PC04 | -135.1238733 | 71.06372028 | 630.81 |
| 2010804 0070 | GSC10_PC03 | -135.3537808 | 71.17000021 | 879.42 |
| 2010804 0071 | GSC10_BX03 | -135.3537340 | 71.16991243 | 879.38 |

### *22.3.5 ROV deployment (Leg 2b)*

ROV deployment, navigation, and piloting was conducted by I. Murdock (CSSF), L. Michaud and P. Massot (U. Laval technicians) and the ship's crew. The ROV was deployed on the 600 level of the *Amundsen* from the moon pool (Figure 22.8) and operations and navigation were carried out in the adjacent ROV control room (678, Figure 22.9) with communication to the bridge and top level acquisition and mapping teams as needed.

Figure 22.8. The ROV SuperMohawk next to the moonpool where it is deployed (Photo: C. Breton).

The ROV was equipped with a forward-facing sonar, two manipulator arms, two front-mounted cameras – one black and white, and one colour. Only one of the camera feeds could be recorded at any given time. The ROV dive was viewed real-time and documented by the GSC for use as multibeam calibration on seabed features, sediment identification, and future benthic habitat analysis by partners at NRCan, and Museum of Nature. A copy of the dive was stored on external hard drive.

Figure 22.9. The ROV control room (Photo: C. Breton).

One dive was conducted on the Beaufort Shelf on top of a PLF (fluid expulsion feature) during Leg 2b in collaboration with BP. The video footage will be used by the GSC to evaluate sea-bottom geology, calibrate multibeam backscatter data, and evaluate benthic communities.

Detailed dive log from launch to recovery and further details on ROV Dive Operations can be found in Section 21. Water depths ranged from 50m to 60m during the dive. There was a high level of organic particulate matter in the water column, making visibility difficult. Bottom sediments were very fine, easily disturbed muds. Seafloor life consisted of brittle stars, starfish, basket stars, crabs and some corals. No evidence of bacterial mats was immediately visible. Several craters were seen on the bottom, some with distinct berms. No venting gas was noted.

## 22.4 Preliminary results

### *22.4.1 Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea*

Total approximate line kilometers of seabed multibeam and sub-bottom data collected by UNB for Leg 2b (up to 21 September) were 8946.396km.

The majority of the data was collected along the Beaufort Shelf – Beaufort Slope transition region between WGS84 70° 39’ N and 71° 17’ N and 136° 26’ W and 132° 34’ W in collaboration with BP’s mapping group. Opportunistic regional lines were also collected through Amundsen Gulf.

Maximum penetration for the sub-bottom profiler was up to 100m in soft sediments. Data collection speed varied between 7 knots and 14 knots, depending on the mapping region and survey resolution requirements for the sub-bottom and multibeam.

Regional Geology

Beyond the 400m contour the surface sediment appears to be largely undisturbed, except for a slump feature located to the northeast of the survey area. Figure 22.10 shows a northwesterly trending survey line transecting the Beaufort Shelf to Slope transition with GSC piston and box core locations marked along the line.

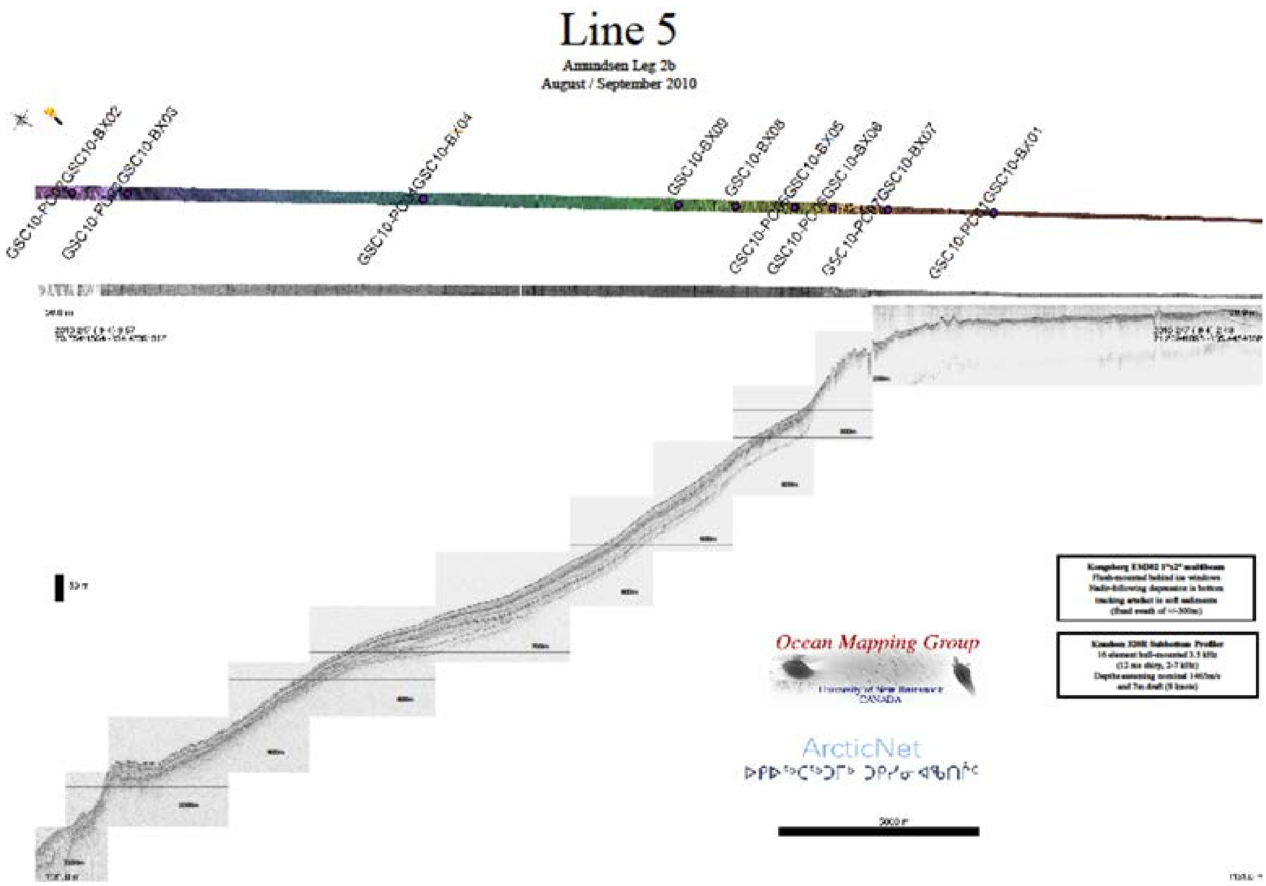


Figure 22.10. Raw 3.5kHz sub-bottom record showing GSC core locations for Leg 2b in the BP lease block.

Ice scours

Several ice scours, determined to be relict events, are visible in water depths greater than 60 metres (Figure 22.11 and Figure 22.12). Scouring processes appear to be constrained to water depths shoaler than 400 metres.

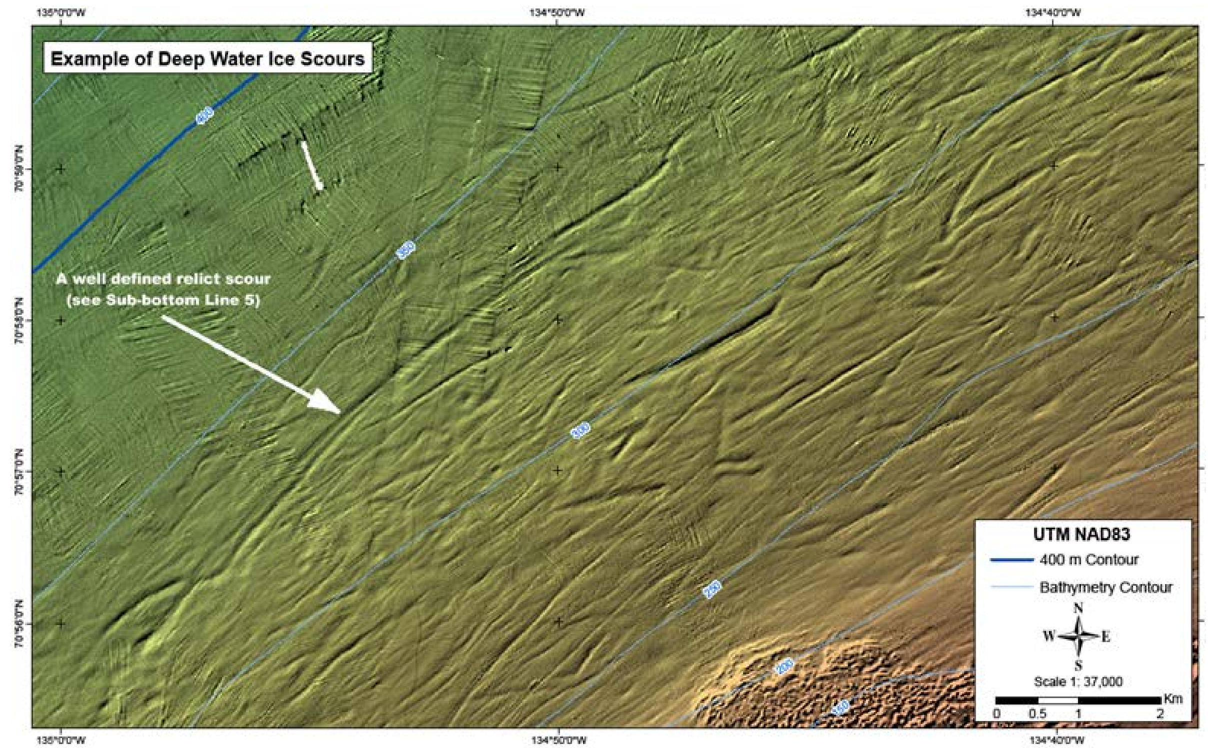


Figure 22.11. An example of a well-defined deep water relict ice scour observed in 300-350m of water in the BP lease block in the Beaufort Sea during Leg 2b.

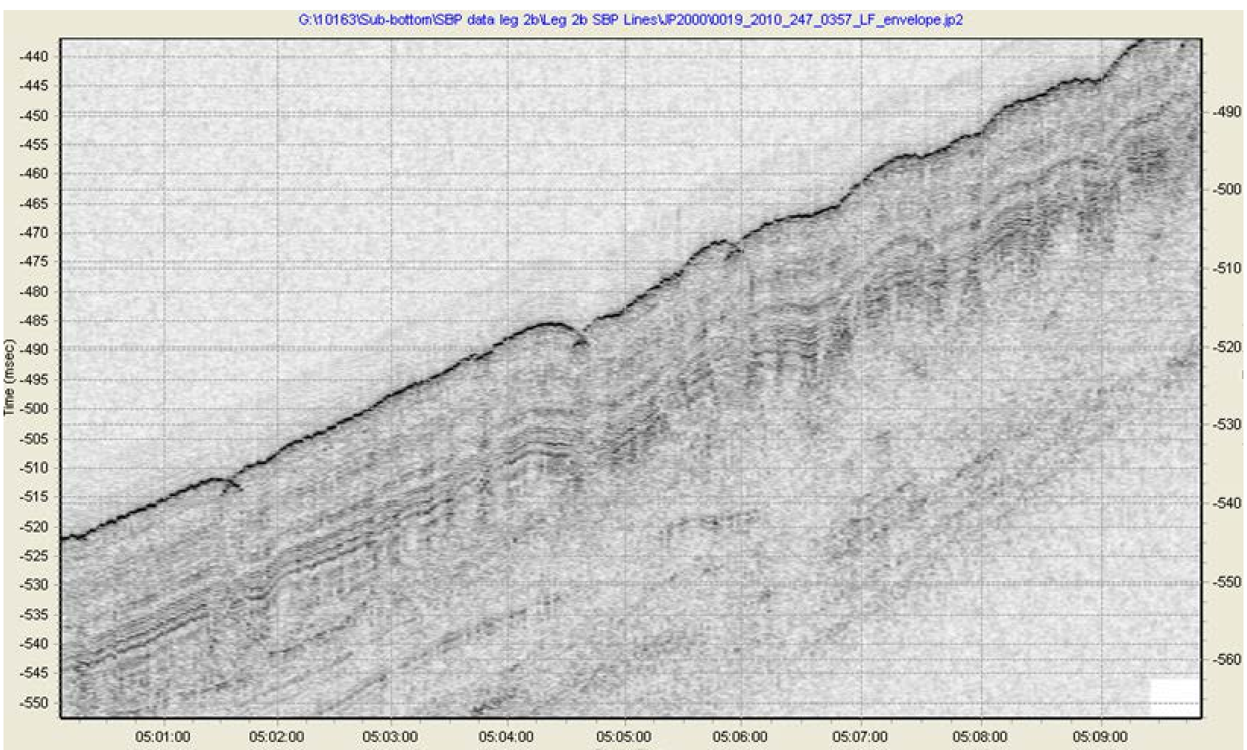


Figure 22.12. Raw 3.5 kHz sub-bottom transect showing a relict ice scour in 300m-350m water depth in the BP lease block in the Beaufort Sea during Leg 2b.

All of the observed ice scours have the same general orientation of southwest-northeast, parallel to the shelf break. The scour orientation appears to be defined by the Beaufort Gyre and not by prevailing winds as is the case for scouring processes on the Beaufort Shelf.

The ice scours observed are quite well defined with visible berms. A lower sedimentation rate past the shelf break results in very little sediment infill, therefore the relict scours are still visible and well-defined. There are some possible ice scours cutting through the ridging and sediment at the shelf break.

Pingo-like features

Approximately 65 plus Pingo-like features (PLFs) were mapped along the shelf break in water depths less than 200 metres (Figure 22.13). These conical seabed mounds may be related to fluid migration through the sediment. The PLFs mapped during Leg 2b have an average diameter of 100 metres, with the largest reaching diameters of 250m to 320m.

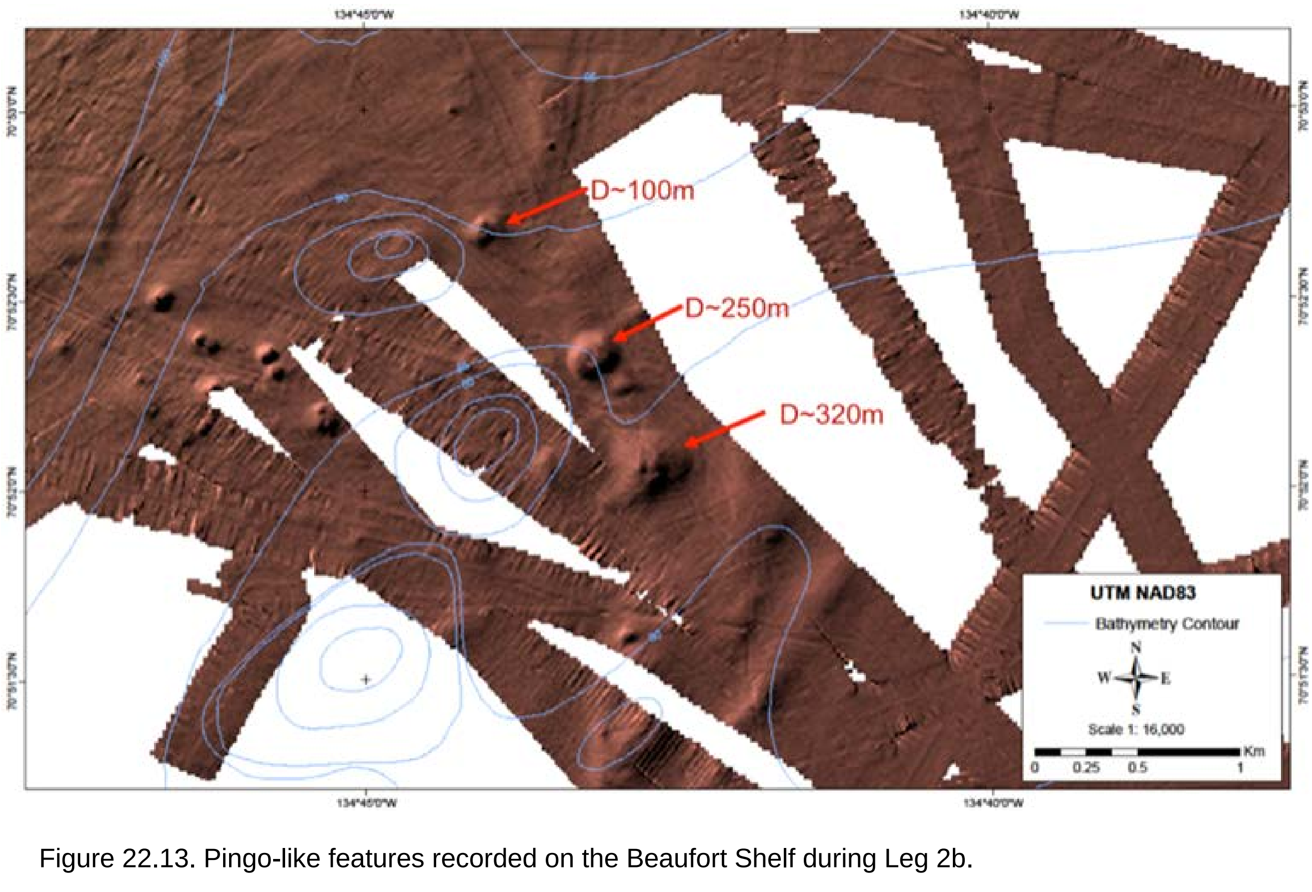


Figure 22.13. Pingo-like features recorded on the Beaufort Shelf during Leg 2b.

*22.4.2 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

*Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

Beaufort Sea

The Beaufort Sea Shelf southwest of Sachs Harbour is extensively ice-scoured in depths shallower than 380m, with nearly 100% of the seafloor incised by overlapping scours. Scours measure anywhere from a few meters to, in some extreme cases, 9m in depth, and are typically oriented west-northwest to east-southeast. Deeper than 380m, ice scours taper off, revealing smooth, undisturbed seabed. The ice scours observed are quite well defined with visible berms. Additionally, dozens of new Pingo-Like Features (PLFs) were observed on the Beaufort Shelf, in water depths of 85-100m.

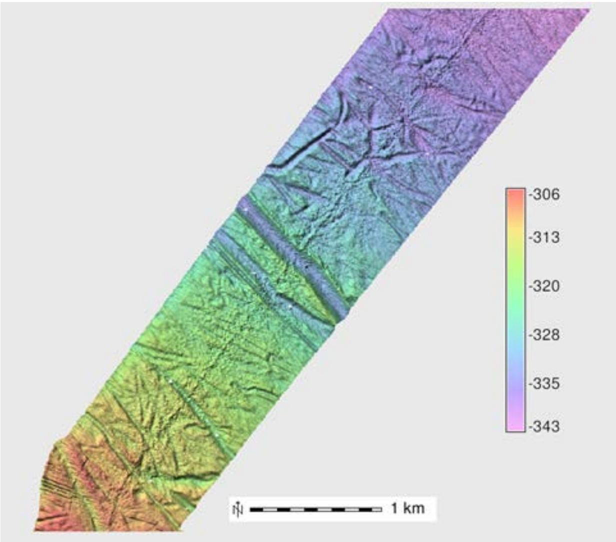


Figure 22.14. Example of heavy ice scouring in the Beaufort Sea.

Northwest Passage

Much of the Northwest Passage was clogged with new ice, multi-year ice, and ice slush causing heavy interference with the multibeam echosounder; consequently, much of the Northwest Passage data is of poor quality.

The GSC-A had been allotted 6 hours to conduct seabed mapping in the Barrow Strait area during the 2010 survey. Gas vents or pockmarks were discovered in Barrow Strait by multibeam echosounder during the 2005 and 2008 surveys. However, a bonus 6 hours of mapping time was made available for this repeat survey in Barrow Strait, totaling 12 hours. The position of the ice field around the ship during this time indicated that the two priority areas identified before the survey would not be accessible. The *Amundsen* instead surveyed an area to the immediate south of Priority Area 2 in Barrow Strait.

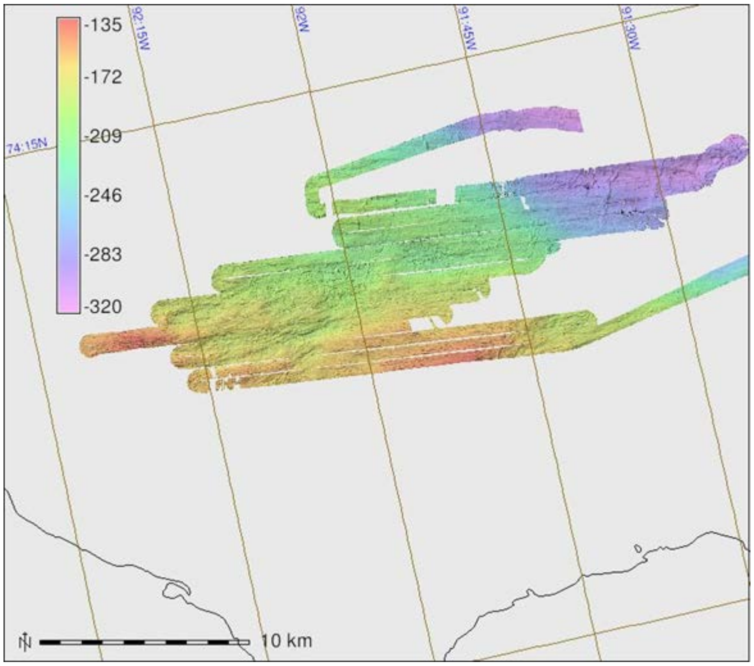


Figure 22.15. Extent of seabed mapping completed during the Barrow Strait repeat survey in 2010.

## 22.5 Comments and recommendations

### *22.5.1 Leg 2b – ArcticNet/BP – 26 August to 23 September 2010 – Beaufort Sea*

Bottom Mapping

Interpretation and analysis of the water column data collected during this leg and for all of the 2009 data to look for indications of seafloor seepages is recommended.

A detailed morphological analysis, including measurement of parameters such as height and width of the observed PLFs using the 3.5 kHz sub-bottom and multibeam data is recommended.

Mapping and morphological analysis of relict ice scours observed including measurement of parameters such as scour depth, width, length, and orientation, is recommended to develop an understanding of scour processes on a regional scale.

Piston Core

The set-up and maneuvering required for the piston coring operations was quite complex due to the limited foredeck space. A monorail system, along the port side of the vessel, would allow for the rigging of a longer barrel string and facilitate less complex handling procedures.

Other suggested modifications to the coring system include:

- One 41 foot cable was damaged during coring operations and it is recommended that a new 41 foot cable be made.
- The piston cables supplied consisted of two 41 foot and two 37 foot cables. The 41 foot cables can be used with a three barrel and 38 foot trip wire configuration. The 37 foot cables can be used with a two barrel and 28 foot trip wire configuration but requires the use of a wire clamp on the piston cable. It is recommended that two 31 foot piston cables be made to replace the existing 37 foot cables to allow for a two barrel configuration without the use of a wire clamp.
- Core barrels should be greased or rust checked and stored in another location to prevent the rusting of the barrel ends. If rusting occurs the barrels have to be sand blasted to allow the couplings to fit over them. During and after coring operations the barrels should be greased regularly.
- Currently there are two different size barrels on board. The original 10 foot (305cm) long barrels and the slightly shorter 302cm long barrels. During the cruise a 302cm barrel was used as the top barrel and 305cm long barrels were used for the lower barrels. The majority of the CAB liner sections had to be cut to fit the barrel. It is recommended that the specifications of the liner length be modified to better fit the barrels on board.
- Provide dedicated container space for all coring supplies.

Box Core

Positioning accuracy of the box core on the seafloor during Leg 2b was completed by a dedicated navigation team using a USBL positioning system. This process is recommended for all Box Coring operations on board the *Amundsen*.

ROV and camera systems

The newly installed Bowtech colour camera and LED lighting system provided a vast improvement in imagery. With the current recording system, the resolution of the imagery cannot be fully recorded. After discussions with the CSSF technician, it is recommended that a DVD recording system be put in place. The addition of lasers as a means of measuring features on-screen would facilitate analysis of the video footage for both geologic and benthic purposes.

Subsea positioning

Two crucial elements that should be part of all seabed sampling and ROV operations are a high-accuracy USBL subsea positioning system and a dedicated navigation team. The job of navigator cannot be a multitask position, and must have a sole individual or individuals assigned to it.

Ship positioning

A working dynamic positioning system (DP) would assist with piston coring, box coring and ROV transect operations. The DP would allow for automatic positioning of the ship according to the ROV submersible position, allowing for longer and more accurate bottom transects to be run. Positioning problems during ROV operations arose in 2009 and again in 2010.

Facilities

The geotechnical team operated out of the aft geochemical laboratory during Leg 2b, as the Geo-Paleo laboratory was allotted to BP representatives. This space was adequate for processing and sealing the cores.

The installation of a man-door in the aft refrigerated core storage container would facilitate and provide safer access to the structure. Currently, the only access is through the two large container doors at front. Additionally, the installation of permanent core storage racks and shelves in the container would provide for economization of container space and improved storage capabilities, as well as eliminate the repeated need for on board construction of storage racks each year.

### *22.5.2 Leg 3a – ArcticNet/BP – 23 September to 07 October 2010 – Beaufort Sea*

### *Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay*

Interpretation and analysis of the water column data collected during Leg3a/3b and for all of the 2010 data to look for indications of seafloor seepages is recommended.

A detailed morphological analysis, including measurement of parameters such as height and width of the observed PLFs using the 3.5 kHz sub-bottom and multibeam data is recommended.

Mapping and morphological analysis of relict ice scours observed including measurement of parameters such as scour depth, width, length, and orientation, is recommended to further develop an understanding of scour processes on a regional scale.

The Geological Survey of Canada (Atlantic) would like to thank the Commanding Officer and crew of the NGCC *Amundsen* for their efforts at maximizing the amount of multibeam coverage obtained during the cruise in challenging ice and weather conditions.

## References

Sub-Atlantic. 2009. Super Mohawk: Serial No. 005 TMS: 1273-MAS Serial No. 006 Operation and Maintenance Manual. Supplied to Laval University.

# 23 BP geotechnical and geophysical program – Leg 2b

**Project leaders:** BP and ArcticNet

**Cruise participants Leg 2b**: ArcticNet – Geoteck Inc.[1], Katie Blasco[2], Kevin McKillop[2], Robbie Bennett[2], Greg Middleton[2], Kate Jarrett[2], Justin Buis[2], Ian Church[3], Doug Cartwright[3], Sven Commandeur[3], Jose Sanchez[3], Fugro Jacques Geosurveys Inc.[4] and IMG-Golder Corporation[5]

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[4] *Fugro Jacques Geosurveys Inc., 131 Ilsley Avenue, Dartmouth, NS, B3B 1T1, Canada.*

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## 23.1 Introduction

This report documents the activities and information obtained as part of the geophysical and geotechnical programs conducted as part of a collaboration between ArcticNet and BP Exploration Operating Company Limited (BP), onboard the Canadian Coast Guard Ship (CCGS) *Amundsen.* Field work was conducted by ArcticNet, IMG-Golder (IMG), Fugro Jacques GeoSurveys Inc. (Fugro), the Geological Survey of Canada (GSC) and the University of New Brunswick (UNB). The field program was conducted as Leg 2b of ArcticNet's 2010 *Amundsen* Expedition between 26 August and 22 September 2010 in BP's Exploration Licences (ELs) 449, EL451, and EL453 and in Imperial Oil Resources Ventures Limited (IORVL) EL446. The blocks straddle the continental shelf and slope of the Canadian Beaufort Sea in water depths between 40 m and 1 350 m.

The investigation was carried out to assess near-surface soil strengths and compositions (geotechnical), collect detailed multibeam bathymetry (MBES) and high-resolution seismic sub-bottom profiler data (SBP), and collect samples for geochemical analysis within the BP and IORVL lease blocks. Co-located piston cores and box cores were collected by the Geological Survey of Canada in support of their regional investigations of the Beaufort Sea. Piston, gravity, and box corers were utilized to collect the geotechnical samples.

## 23.2 Methodology

The geotechnical data was collected by taking core samples and testing them for their soil properties and/or preparing them for onshore geochemical testing. Three methods were used for soil sampling: box coring, gravity coring and piston coring. In total, 16 box cores, 4 gravity cores and 39 piston cores were recovered over the BP and IORVL leases during

Leg 2b. An additional 6 box cores and 6 piston cores were recovered by the GSC in support of their regional collection efforts. The core locations and water depths, as collected by the survey and positioning team, are included in the attached tables (Table 23.1for the BP program and Table 23.2 for the GSC collections).

Table 23.1. Cores samples collected for Pokak 2010 Geotechnical Data Collection Program in the Beaufort Sea during Leg 2b (WGS84, UTM zone 8N).

| Core name | Core type | Water depth (m) | Northing | Easting | Core name | Core type | Water depth (m) | Northing | Easting |
|---|---|---|---|---|---|---|---|---|---|
| **Piston and Gravity Cores (for Geotechnical and Geochemical Analysis)** | | | | | | | | | |
| BP10-PC06 | Piston | 682.59 | 7878117.24 | 483522.59 | BP10-PC18 | Piston | 77.12 | 7851702.71 | 493334.29 |
| BP10-PC07 | Gravity | 43.2 | 7833728.56 | 607884.53 | BP10-PC26 | Piston | 104.83 | 7861715.62 | 500198.36 |
| BP10-PC10 | Piston | 76.04 | 7854140.47 | 544549.48 | BP10-PC29 | Piston | 326.86 | 7871965.87 | 504203.74 |
| BP10-PC11 | Gravity | 27.2 | 7856791.55 | 565040.39 | BP10-PC30 | Piston | 94.09 | 7868766.64 | 516327.61 |
| BP10-PC12 | Piston | 419.85 | 7854404.71 | 479340.34 | BP10-PC31 | Piston | 432.63 | 7880483.2 | 507093.9 |
| BP10-PC14 | Piston | 101.13 | 7869004.58 | 528975.13 | BP10-PC32 | Piston | 338.04 | 7879259.28 | 522586.16 |
| BP10-PC15 | Piston | 67.4 | 7880868.13 | 583870.39 | BP10-PC34 | Piston | 633.64 | 7875884.28 | 486525.73 |
| BP10-PC16 | Gravity | 24.3 | 7843332.97 | 587021.8 | BP10-PC43 | Piston | 61.37 | 7854312.46 | 516406.31 |
| BP10-PC17 | Gravity | 34.8 | 7855085.96 | 588410.65 | BP10-PC45 | Piston | 599.3 | 7876453.47 | 491688.58 |
| **Piston Cores (for Geotechnical Analysis only)** | | | | | | | | | |
| BP10-PC01 | Piston | 484.73 | 7867483.85 | 490590.38 | BP10-PC28 | Piston | 83 | 7866187.14 | 527565.11 |
| BP10-PC02 | Piston | 684.66 | 7890418.63 | 496429.85 | BP10-PC33 | Piston | 604.28 | 7879045.99 | 493905.81 |
| BP10-PC08 | Piston | 141.45 | 7866219.89 | 508155.05 | BP10-PC35 | Piston | 601.75 | 7875395.29 | 489664.45 |
| BP10-PC09 | Piston | 78.41 | 7861806.14 | 520468.04 | BP10-PC36 | Piston | 470.78 | 7871833.25 | 495671.05 |
| BP10-PC13 | Piston | 52.2 | 7841530.42 | 560811.85 | BP10-PC37 | Piston | 488.9 | 7870403.09 | 493967.98 |
| BP10-PC19 | Piston | 1069.85 | 7896931.04 | 467656.71 | BP10-PC38 | Piston | 984.23 | 7883006.24 | 472012.19 |
| BP10-PC20 | Piston | 911.28 | 7878413.16 | 466679.01 | BP10-PC39 | Piston | 676.48 | 7876520.5 | 480847.38 |
| BP10-PC21 | Piston | 705.61 | 7877547.1 | 480095.32 | BP10-PC40 | Piston | 347.89 | 7876409.54 | 508786.59 |
| BP10-PC22 | Piston | 953.77 | 7893663.1 | 479077.21 | BP10-PC41 | Piston | 239.18 | 7872513.32 | 511890.89 |
| BP10-PC23 | Piston | 765.79 | 7878610.3 | 479383.2 | BP10-PC42 | Piston | 70.14 | 7858061.63 | 523464.26 |
| BP10-PC24 | Piston | 908.72 | 7893248.99 | 481510.91 | BP10-PC44 | Piston | 58.2 | 7839049.22 | 511206.12 |
| BP10-PC25 | Piston | 194.38 | 7873751.41 | 531406.75 | BP10-PC46 | Piston | 256.47 | 7876099.95 | 516316.91 |
| BP10-PC27 | Piston | 68.25 | 7853291.35 | 520988.24 | | | | | |
| **Box Cores (for Geotechnical Analysis only)** | | | | | | | | | |
| BP10_BX01 | Box | 774.12 | 7880416.73 | 480026.01 | BP10_BX09 | Box | 110.73 | 7869211.31 | 522658.91 |
| BP10_BX02 | Box | 834.18 | 7880827.18 | 478763.5 | BP10_BX10 | Box | 675.34 | 7882200.27 | 489526.35 |
| BP10_BX03 | Box | 882.61 | 7881907.7 | 477046.12 | BP10_BX11 | Box | 557.73 | 7886604.15 | 502750.16 |
| BP10_BX04 | Box | 852.01 | 7883863.64 | 475703.02 | BP10_BX12 | Box | 554.04 | 7879785.21 | 498761.75 |
| BP10_BX05 | Box | 926.74 | 7881908.91 | 472818.85 | BP10_BX13 | Box | 286.38 | 7874546.2 | 510284.29 |
| BP10_BX06 | Box | 112.71 | 7862456.2 | 503901.3 | BP10_BX14 | Box | 595.77 | 7876336.88 | 490798.48 |
| BP10_BX07 | Box | 73.25 | 7852473.81 | 506636.43 | BP10_BX15 | Box | 462.12 | 7886879.94 | 513143.79 |
| BP10_BX08 | Box | 160.3 | 7856846.67 | 493452.96 | BP10_BX16 | Box | 454.78 | 7881035.67 | 506386.97 |

Table 23.2. Core location number, core type, water depth and location for the 2010 GSC Regional Data Collection in the Beaufort Sea during Leg 2b (WGS84, UTM 8N).

| Core name | Core type | Water depth (m) | Northing | Easting | Core name | Core type | Water depth (m) | Northing | Easting |
|---|---|---|---|---|---|---|---|---|---|
| GSC10_PC01 | Piston | 80.22 | 7861311.58 | 511529.08 | GSC10_BX01 | Box | 80.22 | 7861343.83 | 511561.44 |
| GSC10_PC02 | Piston | 993.90 | 7898640.87 | 485709.16 | GSC10_BX02 | Box | 994.38 | 7898650.89 | 485711.68 |
| GSC10_PC03 | Piston | 879.42 | 7896394.09 | 487257.08 | GSC10_BX03 | Box | 879.38 | 7896384.29 | 487258.71 |

| Core name | Core type | Water depth (m) | Northing | Easting | Core name | Core type | Water depth (m) | Northing | Easting |
|---|---|---|---|---|---|---|---|---|---|
| GSC10_PC04 | Piston | 630.81 | 7884507.91 | 495514.83 | GSC10_BX04 | Box | 120.29 | 7884485.24 | 495498.38 |
| GSC10_PC05 | Piston | 254.62 | 7869438.89 | 505920.05 | GSC10_BX05 | Box | 254.79 | 7869451.00 | 505921.96 |
| GSC10_PC06 | Piston | 182.39 | 7867892.83 | 507005.01 | GSC10_BX06 | Box | 182.38 | 7867895.03 | 507007.34 |

### *23.2.1 Sampling and testing*

Box corer

The ~0.5 $m^3$ box cores were utilized primarily for the observation of the surficial layer of seafloor sediment that often is not easily recovered by the piston or gravity corer due to the extremely soft consistency and thinness (approximately 4 cm) of the surficial soils. Individual push cores were collected from the larger box core samples and used for subsequent analysis and archiving. Onboard lab testing consisted of sediment strength testing (t-bar tests, torvanes, lab vane and penetrometer), and soil classification (moisture content and carbonate content). An initial description of the cores based on visual inspection of the surface of the core and exposed end sections was recorded in the lab along with test values.

The coordinates of the box core samples were determined using a USBL beacon attached first to the cable above the box core and subsequently to a bracket built onto the box core frame.

Piston corer

The ~ 0.5 tonne, 8.5 m barrel piston corer with 2 m trigger weight gravity corer was utilized to sample the soils at depth for geotechnical testing or to collect samples for geochemical analysis onshore. Onboard testing included shear strength testing using torvanes, hand-held penetrometers, undrained triaxial tests and lab vanes, as well as determination of unit weights and moisture contents. An initial description of the cores based on visual inspection of the exterior of the cores and exposed end sections was recorded along with test values.

The piston corer had been modified for the 2010 field program with the application of a Teflon epoxy coating on the exterior to increase penetration and reduce pull-out resistance. The coordinates of the piston corer samples were determined using a USBL beacon attached to the cable above the piston corer head.

Gravity corer

At locations with water depths less than ~60 m the piston corer was converted to a gravity corer in order to reduce shock-loading on the winch system during core collection. The piston corer was reconfigured into a gravity corer by shortening the barrel 3 m (removing one of the barrel sections) and deploying it without the trigger weight corer. The samples were processed and tested using the same equipment as for the piston corer samples. The USBL beacon was attached to the cable above the corer head in the same position as on the piston corer except where water depths were too shallow to allow for the tracking of the USBL beacon. In the shallow water depths, the A-frame position was used as the core location.

MSCL (Multi-sensor core logger)

A majority of the piston and gravity cores obtained during Leg 2b were logged by ArcticNet using the Université Laval's GEOTEK Multi-Sensor Core Logger (MSCL). Gamma density, P-wave (ultrasonic) velocity, electrical resistivity and magnetic susceptibility were measured at 2 cm sampling intervals on each of the core sections recovered. The data set provides a record that enables quantitative assessments to be made about core quality, which in turn will help to interpret the geotechnical properties of the site.

Soil sample storage

All core samples were stored in a refrigerated shipping container at +5°C until they could be taken off the ship at the end of the 2010 program in Quebec City. Additional testing and analysis will be performed on the cores onshore under the guidance of BP and Fugro or GSC (core dependent). Geochemical subsamples from 18 designated core locations were stored at -15°C to -20°C until they were taken off the ship at the end of Leg 2b for shipment to the testing laboratory (TDI-Brooks International Inc., College Station, Texas)

ROV Operations

A direct geological seafloor observation was performed by ArcticNet using a Sub-Atlantic "Super Mohawk" ROV, rated for 2,000 m and with two 5-function manipulator arms. Up to four dives were planned, but only one dive was conducted in EL451. Real-time high-definition video was collected during the entire dive. A ten-minute HD video file of highlights from the drive was produced on the ship. A second planned dive was cancelled due to poor sea state, and the remaining dives were cancelled due to time constraints.

Two pairs of Simple and Inexpensive Point (SIP) gas sample canisters were supplied by ArcticNet and were prepared by IMG and Fugro personnel (according to University of Victoria guidelines). The SIP samplers were carried in the ROV toolbox and would be deployed with the two ROV manipulator arms in order to capture gas escaping from the seafloor. No gas seeps were encountered during the ROV dive, so the SIP samplers were not deployed. A procedure for the safe transfer of gases from the SIP samplers to sample tins had been developed but was not required due to the absence of a gas collection sample site. Two sets of stainless steel and acrylic sediment sampling (push coring) devices were fabricated on the ship for the ROV dives, but were not used due to time constraints and lack of gas seeps.

#### *23.2.2 Survey and positioning*

Two GPS antennas were installed and integrated with a gyrocompass, vertical reference unit and USBL (Ultra-short baseline) beacon to obtain accurate seafloor and water column positioning. The data was processed and displayed using proprietary Fugro software. The ship-board USBL head was mounted on a pole in the vessel's acoustic well during coring and ROV operations, except at locations where the water depth was too shallow for equipment operation.

#### *23.2.3 Bathymetry and sub-bottom profiling*

All multibeam echosounder (MBES) and sub-bottom profiling (SBP) data was collected by ArcticNet (University of New Brunswick's (UNB) Ocean Mapping Group personnel) during Leg 2b, and was reviewed and analyzed by Fugro personnel using ArcGIS and SMT Kingdom Suite software. The analyzed data was used to refine and select core sampling locations, and to provide science personnel with high-resolution seafloor and sub-bottom data for geologic interpretation. In addition to the Leg 2b data, the MBES and SBP data collected during Leg 2a were also analyzed and use for core location selection and geologic interpretation. Near real-time bathymetry and sub-bottom mapping was used to select core locations in previously unmapped areas. Water column imaging software written by UNB scientists was used to process the multibeam data to locate and image gas plumes in the water column. The bathymetry measurements were also used to check the USBL depth measurements.

### 23.3 Comments and recommendations

New this year, a MSCL was installed in the Geo-Paleo Lab where all of the geotechnical testing took place. The MSCL utilized a significant amount of space in the lab and the radioactivity associated with the unit limited the use of the lab by persons other than the core logger. Should a similar program be conducted in the future, and knowing that the Geo-Paleo Lab is the only available space for the MSCL, it is recommended that the geotechnical testing be conducted in two of the aft labs.

# 24 Benthic habitat mapping and biodiversity – Legs 1a, 1b, 2a, 3b and 3c

ArcticNet Phase 2 – Project titled *Impact of Climate Change on Arctic Benthos*. http://www.arcticnet.ulaval.ca/pdf/phase2/archambault_arctic_benthos.pdf
ArcticNet Phase 2 – Project titled *The Canadian Arctic Seabed: Navigation and Resource Mapping.* http://www.arcticnet.ulaval.ca/pdf/phase2/hugues_clarke_seabed_mapping.pdf

**Project leaders**: Philippe Archambault[1] (philippe_archambault@uqar.qc.ca) and BP (Leg 2a)

**Cruise participants Legs 1a & 1b**: Anne Fontaine[1] and Virginie Roy[1]
**Cruise participants Leg 2a**: Philippe Archambault[1], Mathieu Cusson[2], Cindy Grant[1] and Mélanie Lévesque[1]
**Cruise participants Leg 3b**: Anne Fontaine[1], Virginie Roy[1] and Frédéric Olivier[1,3]
**Cruise participants Leg 3c**: Anne Fontaine[1] and Virginie Roy[1]
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## 24.1 Introduction

It is widely recognized that large areas of the Arctic are changing from arctic to subarctic conditions. Rapid warming is causing higher water temperatures and reduced ice cover, two factors that will certainly lead to severe ecosystem changes propagating through all trophic levels. Over the past decade, a geographical displacement of marine mammal population distribution has been observed, that coincides with a reduction of benthic prey populations. According to a widely accepted conceptual model, the relative importance of sea-ice, pelagic and benthic biota in the overall carbon and energy flux will shift from a sea-ice algae-benthos to a phytoplankton-zooplankton dominance. In the context of the potential benthic community changes, it is essential to establish benchmarks in biodiversity at key locations in the Canadian Arctic prior to (a) the expected changes in ice cover, ocean chemistry and climate and (b) the future human activities (transport, trawling or dredging, drilling, etc.) that are likely to happen in response to the predicted environmental changes. Unlike Canada's two other oceans, there is an opportunity to document pristine conditions before ocean changes and exploitation occur.

The main objective of this project was to describe and compare benthic biodiversity (using a variety of diversity indices) in different locations of the Canadian Arctic in relation to environmental variables (e.g., substrate type, temperature, salinity, oxygen concentration, primary productivity, current speed, depth, etc.). Secondary objectives were to:

- Develop models of benthic biodiversity and create habitat suitability map in the eastern part of the Canadian Arctic.
- Estimating the strength and form of the relation of biodiversity to habitat diversity at multiple scales in the Canadian Arctic.
- Evaluating leading explanations for the relation (e.g. bottom geomorphology and the above mentioned environmental variables).
- Generate ecosystem scale estimates of biodiversity and function using recent advances in ecological scaling.

### *24.1.1 The Canadian Healthy Oceans Network (CHONe) (Legs 1, 3b and 3c)*

This cruise was also in collaboration between the NSERC Canadian Healthy Oceans Network (CHONe), which is a 5-years strategic partnership between Canadian university researchers, government, and ArcticNet. This network is about aligning Canadian marine science capacities to respond to research challenges and knowledge gaps on biodiversity in frontier oceanic environments, such the Canadian Arctic. CHONe is a new national marine science initiative that is uniting researchers to provide scientific guidelines for policy in conservation and sustainable use of marine biodiversity resources in Canada's three oceans.

The Theme Marine Biodiversity is addressing how patterns of biological biodiversity are related to habitat diversity. Specifically, hypotheses are tested to link functional (ecological) roles of different species, species biodiversity and habitat complexity.

The Theme Ecosystem Function is determining how ecosystem function (processes such as nutrient cycling) and health (whether ecosystems are able to maintain these processes) are linked to biodiversity and natural and anthropogenic disturbances. Specifically, the aim is to understand the role of biodiversity in marine ecosystem services (the "goods" provided to humans by living organisms) by linking biodiversity and ecosystem function measures, and provide predictive models and tools to minimize anthropogenic impacts.

Finally, the outcomes of each of these themes will be synthesized across the Network to identify approaches to bridge science and policy. This collaborative cruise allowed obtaining samples for six different projects inside CHONe in addition to the ArticNet project.

<u>Theme Marine Biodiversity</u>

*Diversity in Space: Estimate the strength and form of the relation of biodiversity to habitat diversity at multiple scales; evaluate leading explanations for the relation; generate ecosystem scale estimates of biodiversity and function using recent advances in ecological scaling.*

<u>P. Archambault and K. Conlan (Biodiversity in Arctic corridor)</u>

The objective is to evaluate the natural benthic diversity along the Arctic Corridor to search for new species, for curation and to establish benchmarks in specify areas of the Arctic. This project is closely related to the Hebert/Dufresne project.

*Diversity in Time: Examine the role of the history of the Arctic in generating biodiversity; uncover cryptic diversity; benchmark current diversity and genetic structure relative to expected reopening of the Arctic during this century.*

<u>P. Hébert and F. Dufresne (Divergence rate and Cryptic species)</u>

The Arctic Corridor Biodiversity study undertaken by CHONe researchers includes an aggressive sampling program that will result in the assembly of both planktonic and benthic samples. A fraction of the specimens in each sample will be preserved in 95% ethanol or through freezing to ensure that DNA is in good condition. Because of the limited funding, it will not be possible to barcode all groups of organisms. As a result, efforts will focus on three groups that make particularly important contributions to invertebrate biomass in arctic waters- echinoderms, polychaete worms (Hébert) and amphipod crustaceans (Dufresne). Analytical protocols are already available which allow the recovery of barcode sequences for these groups of organisms. As well, pilot studies at two arctic sites, Churchill and Resolute, have shown that DNA barcode sequences regularly deliver species-level resolution in these groups. Finally, taxonomic experts have indicated their willingness to identify barcoded specimens and two graduate students (one funded by CHONe and one with NSERC support) are ready to commence work.

The objective is to assemble a comprehensive barcode library for life in Canada's arctic marine waters, the following actions will be taken:

- Coordinate sample acquisition with all CHONe projects
- Focus on key taxonomic groups
- Target additional sampling areas or taxonomic groups as resources permit
- Strengthen the network of associated taxonomists
- Ensure curation of barcoded specimens in major Canadian museums

<u>F. Olivier and N. Ameziane (Cryptic species of echinoderms and comparison with Antarctica)</u>

This project is complementary of both P. Archambault/K. Conlan and P. Hebert/F. Dufresne projects but with more emphasis on echinoderms and on the comparison between Arctic and Antarctic regions. The barcoding of all the collected echinoderms will validate the species and determine if cryptic species are present in Arctic Ocean (as in Antarctica). Once done, taxa between Arctic and Antarctica will be compared and the presence of bipolar taxa will be looked at, and if it occurs the systematic level will be determined. Then, crinoids will be analyzed more finely by using other gene sequences than COI to integrate such species in the global Crinoids phylogeny that is being built: actually more than 200 taxa are integrated and thus constitute the most important Crinoids' phylogeny database. If possible, phylobiogeography will be conducted to integrate an ecological component (environmental parameters coupled with video recording) in the future.

I. Bradbury

The objective is to use neutral and non-neutral genetic markers in marine population studies, to track fish movements, allopatric versus sympatric speciation in marine species, simulation modeling, design and function of marine protected areas.

Theme Ecosystem Function

*To understand and quantify the role of biodiversity in ecosystem services*

P. Archambault and M. Cusson

Compare the ecosystem services (fluxes) by different trophy levels in areas of high and low complexity and to evaluate the influence of the potential changes in species diversity that will happen with any kind of human activities and finally. Finally, describe biodiversity levels and secondary production of macrobenthic communities in areas of enhanced and reduced productivity and diversity ("hotspots" and "coldspots"). Particularly, in Beaufort Sea, if secondary production (individual and community-based) are linked to community structure and composition.

### *24.1.2 Benthic diversity and abundance of the BP Exploration License area (Leg 2a)*

The benthic ecology team was responsible for the benthic sampling of the study area within the BP Pokak lease block for Leg 2a. Two methods were used on board for the sampling of the benthic organisms. A box core was deployed to sample the fauna living in the sediment (infauna) and an Agassiz trawl was used to collect fauna that live on the sediment surface (epifauna).

### *24.1.3 Astarte spp. as proxies for monitoring climate change in the Canadian Arctic (Leg 3b)*

Assessing temporal variability of environmental parameters is crucial in the context of climate change particularly in the Arctic Ocean. In the Canadian Archipelago, scientists monitor since less than one decade fluctuations of water temperature through immerged probes but the acquired data are often local and they rarely allow long-term records. In a view to reconstruct temperature variations, oxygen isotope compositions in carbonate shells of bivalves will be used as a record or proxy. The oxygen isotopic composition of marine carbonates is controlled by the isotopic composition of the water from which the carbonates precipitated and the temperature/salinity of the ambient water. Because of the accretionary growth of bivalve shells, $\delta^{18}O$ profiles taken from along their axis of maximum growth can provide time series of hydrographical variations of the bivalve habitat during its lifetime. Recent data on macrobenthic fauna show that bivalves of the genus *Astarte* cover all the studied area and can be found in abundance.

Within this context, the objectives of this project were to:

- Assess main life traits of *Astarte borealis* (lifetime, growth rates and periods) through geochemical (stables isotopes) and schlerochronological analyses of some shells.
- Assess the paleothermical potential of the shell of *A. borealis* through its $\delta^{18}O$ isotopic composition by comparing shell data to high frequency T/S measurements of probes deployed by ArcticNet (mooring stations).
- Determine if shell concentrations of trace elements (especially the Ba/Ca ratio) may be used as proxies of past and recent variations of the primary production.

## 24.2 Methodology

### *24.2.1 Box coring*

The box corer (Figure 24.1) was deployed to quantitatively sample diversity and abundance of macroendobenthic fauna and to obtain cores for sediment analyses. The latter were used to determine sediment pigment, organic carbon concentration, organic matter content and sediment grain size.

Figure 24.1. Left: Recovery of the box corer. Right: Recovery of the Agassiz Trawl.

The total surface area of the box core sediment was 0.250 $m^2$ varying between 10-15 cm in depth (depending on the depth of the azoic clay layer). From the retrieved box cores, sediments of usually a surface area of 0.125 $m^2$ were collected and sieved through a 0.5 mm mesh sieve and preserved in a 4 % formaldehyde solution for further identification in the laboratory. Depth of the sediment collected (approximatively 12 cm in depth) was measured to standardize data for each sampling station.

For sediment pigment, organic carbon concentration, organic matter content and sediment grain size, seafloor sediments were collected from the box cores with a total of three replicate sub-cores (with 60 mL truncated syringes of an area of 5 $cm^2$ each) (Figure 24.2). For sediment pigment, organic carbon concentration (OC), organic matter content (OM), the top 1 cm was collected. For sediment grain size, the top 5 cm was collected. Sediment pigment samples were frozen at -80°C, OC and OM samples were frozen at –20°C and sediment grain size samples were refrigerated at 4°C. All samples will be analyzed in the lab at the Université du Québec à Rimouski.

At selected stations during Leg 1, P. Lajeunesse's team (U. Laval) was taking push cores (orange caps) from the upper half of the box core.

Figure 24.2. Box core with lower half for diversity/abundance sieving and upper half for OC/OM cores, pigment concentration cores and particle size grain cores (white syringes).

### *24.2.2 Agassiz Trawl*

The Agassiz trawl (Figure 24.1) was deployed for 3 to 5 minutes on the seabed to survey macroepibenthic diversity and abundance of species. Onboard, species were counted or estimated in abundance and identified to the lowest possible taxonomic level. Some specimens were preserved for further identification in the lab.

Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago

During Leg 1, 16 box cores and 17 Agassiz trawls were carried out (Figure 24.1, Table 24.1). Furthermore, several specimens gained from a trawl sample where preserved in 95% Ethanol for genetic analysis (CHONe program).

Table 24.1. Benthic sampling stations during leg 1a-1b, with numbers of samples or cores collected for ArcticNet (AN) and CHONe projects.

| Stn ID | Date in 2010 | Depth (m) | Latitude N | Longitude W | Sampling type | AN | CHONe |
|---|---|---|---|---|---|---|---|

| | | | | | | Archambault Diversity | Hebert & Dufresne | Bradbury | Cusson | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| 350 | 09/07 | 376 | 64.4322 | 80.4748 | Box corer | 1 | | | | Empty box; sandy bottom |
| 699 | 11/07 | 86 | 59.9977 | 78.4243 | Box corer | 1 | 1 | | | ¼ nautical mile away from the station to find a sediment patch |
| 702 | 13/07 | 134 | 55.4120 | 77.9310 | Box corer | 1 | | | | |
| | | 129 | 55.4153 | 77.9412 | Agassiz trawl Start | 1 | | | | |
| | | 119 | 55.4172 | 77.9422 | Agassiz trawl Stop | 1 | | | | |
| 709 | 15/07 | 87 | 54.7156 | 80.7781 | Box corer | 1 | | | | |
| | | 87 | 54.7200 | 80.7705 | Agassiz trawl Start | 1 | | | | |
| | | 87 | 54.7206 | 80.7712 | Agassiz trawl Stop | 1 | | | | |
| 735 | 16/07 | 186 | 56.7942 | 80.8373 | Box corer | 1 | | | | |
| | | 185 | 56.7967 | 80.8392 | Agassiz trawl Start | 1 | 2+1 | | | |
| | | 136 | 56.8013 | 80.8483 | Agassiz trawl Stop | 1 | | | | |
| 745 | 17/07 | 185 | 60.5068 | 85.0177 | Box corer | 1 | | | | Box damaged by cobbles |
| | | 184 | 60.5007 | 85.0095 | Agassiz trawl Start | 1 | | | | |
| | | 184 | 60.4988 | 85.0055 | Agassiz trawl Stop | 1 | | | | |
| 765 | 18/07 | 104 | 62.3040 | 90.6667 | No box corer | | | | | No deployment; rocky bottom |
| | | | | | No Agassiz trawl | | | | | No deployment; rocky bottom |
| 707 | 19/07 | 111 | 59.9682 | 91.9515 | No box corer | | | | | No deployment; rocky bottom |
| | | | | | No Agassiz trawl | | | | | No deployment; rocky bottom |
| 706 Bis | 21/07 | 120 | 59.6122 | -91.8298 | Box corer | 1 | | | | Station added because no deployment during previous stations. Sediment patch found with 2007 sonar data (Ocean Mapping Group) |
| | | 122 | 59.6153 | 91.8320 | Agassiz trawl Start | 1 | | | | |
| | | 121 | 59.6130 | 91.8410 | Agassiz trawl Stop | 1 | | | | |
| 706 | 21/07 | 79 | 58.8057 | 91.5323 | Box corer | 1 | | | | |
| | | 77 | 58.7743 | 91.5422 | Agassiz trawl Start | 1 | | | | |
| | | 77 | 58.7743 | 91.5510 | Agassiz trawl Stop | 1 | | | | |
| 705a | 22/07 | 34 | 57.4268 | 91.8923 | Box corer | 1 | 2 | | 1 | |
| | 23/07 | 37 | 57.4138 | 91.8805 | Agassiz trawl Start | 1 | | | | |
| | | 37 | 57.4078 | 91.8775 | Agassiz trawl Stop | 1 | | | | |
| 705 | 24/07 | 70 | 57.6589 | 91.5948 | Box corer | 1 | 2+1 | | 1 | |
| | | 71 | 57.6582 | 91.5932 | Agassiz trawl Start | 1 | | | | |
| | | 61 | 57.6527 | 91.5987 | Agassiz trawl Stop | 1 | | | | |
| 705a Bis | 26/07 | 18 | 57.2800 | 92.1125 | Box corer | 1 | | | | Core station added during waiting time for river work |
| | | 19 | 57.3030 | 92.0826 | Agassiz | 1 | | | | |

| Stn ID | Date in 2010 | Depth (m) | Latitude N | Longitude W | Sampling type | AN | CHONe | | | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Archambault Diversity | Hebert & Dufresne | Bradbury | Cusson | |
| | | | | | trawl Start | | | | | |
| | | 17 | 57.3058 | 92.0792 | Agassiz trawl Stop | 1 | | | | |
| 790 | 28/07 | 39 | 57.2488 | 88.8827 | Box corer | 1 | 2+1 | | | |
| | | 38 | 57.2493 | 88.8845 | Agassiz trawl Start | 1 | | | | |
| | | 37 | 57.2492 | 88.8900 | Agassiz trawl Stop | 1 | | | | |
| 820 | 29/07 | 53 | 55.6960 | 84.9070 | Box corer | 1 | | | | |
| | | 53 | 55.6953 | 84.9020 | Agassiz trawl Start | 1 | | | | |
| | | 53 | 55.6958 | 84.8902 | Agassiz trawl Stop | 1 | | | | |
| 840 | 30/07 | 179 | 58.4195 | 83.3238 | Box corer | 1 | | | | |
| | | 174 | 58.4225 | 83.3207 | Agassiz trawl Start | 1 | | | | |
| | | 176 | 58.4337 | 83.3283 | Agassiz trawl Stop | 1 | | | | |
| Extra (2) | 31/07 | 317 | 62.6592 | 79.4595 | Box corer | 1 | | | | Core station added for Lajeunesse and Archambault teams; box damaged by cobbles |
| | | 316 | 62.6598 | 79.4625 | Agassiz trawl Start | 1 | | | | Agassiz frame damaged by cobbles |
| | | 325 | 62.6745 | 79.4633 | Agassiz trawl Stop | 1 | | | | |
| 301 | 07/08 | 667 | 74.1830 | 83.9492 | Box corer | 1 | | | | Schools on Board (SOB) students helped during sampling and sieving |
| | | 671 | 74.1887 | 83.9737 | Agassiz trawl Start | 1 | | | | SOB students |
| | | 671 | 74.1940 | 84.0138 | Agassiz trawl Stop | 1 | | | | |
| 305 | 08/08 | 164 | 74.3233 | 93.4123 | Box corer | 1 | | | | First try little penetration; second try successful with rocks at the surface; SOB students |
| | | 172 | 74.3088 | 93.4268 | Agassiz trawl Start | 1 | | | | Trawl full of rocks; SOB students |
| | | 172 | 74.3158 | 93.4047 | Agassiz trawl Stop | 1 | | | | |
| 310 | 09/08 | | | | No box corer | | | | | No deployment; rocky bottom |
| | | 141 | 71.2952 | 97.6455 | Agassiz trawl Start | 1 | | | | Trawl full of rocks |
| | | 152 | 71.2962 | 97.6378 | Agassiz trawl Stop | 1 | | | | |
| 312 | 10/08 | 58 | 69.1683 | 100.6985 | Box corer | 1 | | | | SOB students |
| | | 52 | 69.1672 | 100.6750 | Agassiz trawl Start | 1 | | | | SOB students |
| | | 57 | 69.1684 | 100.6817 | Agassiz trawl Stop | 1 | | | | |

## Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea

The box core was deployed on 25 occasions (i.e. at each station once and twice at station BP10-002, as per industry request) and the Agassiz trawl was deployed at all 18 stations.

Table 24.2. List of stations visited and sampling activities conducted in the BP lease block in the Beaufort Sea during Leg 2a.

| Station ID | Gear/ mesh | Start coordinates | | End coordinates | | Volume (cm³) | Time | | Depth (m) | | Syringes (G; ISO; Chl) | Operator |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Latitude N | Longitude W | Latitude N | Longitude W | | Start | End | Start | End | | |
| BP10-018 | Box core/ 500µm | 70°46.75 | 134°23.30 | | | 14 X 1250 | 02:59 | 03:21 | 687 | 683 | (1; 1; 1) | All 4 |
| BP10-018 | Agassiz | 70°46.82 | 134°23.08 | 70°46.77 | 134°23.26 | | 03:28 | 03:57 | 688 | 687 | | |
| BP10-014 | Box core/ 500µm | 70°55.46 | 134°26.24 | | | 12 X 1250 | 18:12 | 18:20 | 96 | 103 | (3; 3; 3) | All 4 |
| BP10-014 | Box core/ 500µm | 70°55.47 | 134°25.84 | | | contaminants | 18:34 | 18:43 | 98 | 100 | | |
| BP10-014 | Agassiz | 70°55.76 | 134°26.10 | 70°55.91 | 134°26.32 | | 19:01 | 19:24 | 101 | 112 | | |
| BP10-015 | Box core/ 500µm | 70°59.04 | 134°23.00 | | | 12 X 1250 | 23:47 | 23:57 | 260 | 260 | (1; 1, 3) | ML & CG |
| BP10-015 | Box core/ 500µm | 70°59.10 | 134°23.09 | | | contaminants | 00:11 | 00:27 | 263 | 263 | | |
| BP10-015 | Agassiz | 70°59.15 | 134°23.33 | 70°58.56 | 134°28.39 | | 00:39 | 01:30 | 263 | 266 | | |
| BP10-010 | Box core/ 500µm | 71°00.54 | 134°40.08 | | | 12 X 1250 | 04:58 | 05:20 | 334 | 345 | (1; 1, 3) | MC & PA |
| BP10-010 | Agassiz | 71°00.74 | 134°41.07 | 71°02.00 | 134°42.64 | | 05:37 | 06:47 | 347 | 400 | | |
| BP10-012 | Box core/ 500µm | 70°53.70 | 134°15.10 | | | 12 X 1250 | 10:34 | 10:39 | 80 | 79 | (1; 1, 3) | ML & CG |
| BP10-012 | Box core/ 500µm | 70°53.67 | 134°15.32 | | | contaminants | 10:55 | 11:00 | 80 | 79 | | |
| BP10-012 | Agassiz | 70°53.70 | 134°15.44 | 70°53.75 | 134°16.85 | | 11:22 | 11:35 | 80 | 81 | | |
| BP10-009 | Box core/ 500µm | 71°09.35 | 135°39.08 | | | 12 X 1250 | 05:09 | 06:02 | 932 | 950 | (1; 1, 3) | MC & PA |
| BP10-009 | Agassiz | 71°09.35 | 135°33.77 | 71°08.67 | 135°44.65 | | 06:24 | 07:45 | 945 | 981 | | |
| BP10-004 | Box core/ 500µm | 70°55.10 | 134°51.59 | | | 12 X 1250 | 02:32 | 02:40 | 246 | 247 | (1; 1, 3) | ML & CG |
| BP10-004 | Agassiz | 70°55.03 | 134°51.67 | 70°55.05 | 134°54.80 | | 03:06 | 03:31 | 246 | 357 | | |
| BP10-007 | Box core/ 500µm | 71°05.26 | 135°34.04 | | | 14 X 1250 | 06:13 | 06:45 | 846 | 851 | (1; 1, 3) | MC & PA |
| BP10-007 | Agassiz | 71°05.12 | 135°34.95 | 71°04.17 | 135°42.88 | | 03:41 | 05:30 | 856 | 886 | | |
| BP10-005 | Box core/ 500µm | 71°01.74 | 134°48.01 | | | 12 X 1250 | 12:58 | 13:49 | 442 | 430 | (1; 1, 3) | ML & CG |
| BP10-005 | Box core/ 500µm | 71°01.74 | 134°48.01 | | | contaminants | 14:07 | 14:25 | 432 | 433 | | |
| BP10-005 | Agassiz | 71°01.86 | 134°49.30 | 71°01.74 | 134°49.61 | | 14:35 | 15:15 | 449 | 437 | | |
| BP10-011 | Box core/ 500µm | 70°51.88 | 134°45.94 | | | 12 X 1250 | 00:22 | 00:33 | 89 | 88 | (1; 1, 3) | ML & CG |
| BP10-011 | Agassiz | 70°51.76 | 134°46.05 | 70°51.17 | 134°45.84 | | 00:45 | 01:01 | 88 | 89 | | |
| BP10-001 | Box core/ 500µm | 70°44.22 | 135°04.59 | | | 12 X 1250 | 04:25 | 04:31 | 74 | 73 | (1; 1, 3) | MC & PA |
| BP10-001 | Agassiz | 70°45.06 | 135°04.77 | 70°45.85 | 135°04.84 | | 04:45 | 05:05 | 73 | 74 | | |
| BP10-002 | Box core/ 500µm | 70°51.52 | 135°00.00 | | | 15 X 1250 | 09:06 | 09:11 | 130 | 127 | (1; 1, 3) | ML & CG |
| BP10-002 | Box core/ 500µm | 70°51.44 | 135°00.38 | | | contaminants | 09:32 | 09:38 | 133 | 134 | | |
| BP10-002 | Box core/ 500µm | 70°51.53 | 135°00.39 | | | 12 X 1250 | 09:56 | 10:01 | 131 | 131 | | |

| Station ID | Gear/ mesh | Start coordinates | | End coordinates | | Volume (cm$^3$) | Time | | Depth (m) | | Syringes (G; ISO; Chl) | Operator |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Latitude N | Longitude W | Latitude N | Longitude W | | Start | End | Start | End | | |
| BP10-002 | Agassiz | 70°51.36 | 135°00.80 | 70°50.74 | 135°01.56 | | 10:41 | 11:06 | 132 | 128 | | |
| BP10-008 | Box core/ 500µm | 71°08.08 | 135°30.32 | | | 12 X 1250 | 00:53 | 01:40 | 902 | 895 | (1; 1, 3) | MC & |
| BP10-008 | Agassiz | 71°08.09 | 135°30.96 | 71°06.88 | 135°29.12 | | 01:46 | 03:37 | 907 | 892 | | PA |
| BP10-006 | Box core/ 500µm | 71°00.00 | 135°36.85 | | | 12 X 1250 | 20:23 | 20:58 | 726 | 713 | (1; 1; 3) | ML & |
| BP10-006 | Agassiz | 70°59.93 | 135°37.17 | 70°57.70 | 135°32.91 | | 21:09 | 22:40 | 715 | 660 | | CG |
| BP10-016 | Box core/ 500µm | 70°59.18 | 135°22.36 | | | 12 X 1250 | 02:52 | 03:22 | 633 | 627 | (1; 1; 3) | MC & |
| BP10-016 | Agassiz | 70°59.15 | 135°22.47 | 70°57.58 | 135°18.30 | | 03:39 | 04:45 | 622 | 615 | | PA |
| BP10-013 | Box core/ 500µm | 70°49.28 | 134°34.63 | | | 15 X 1250 | 21:36 | 21:40 | 72 | 72 | (1; 1; 3) | ML & |
| BP10-013 | Box core/ 500µm | 70°49.27 | 134°34.64 | | | contaminants | 21:56 | 22:00 | 71 | 71 | | CG |
| BP10-013 | Agassiz | 70°49.20 | 134°35.38 | 70°49.22 | 134°33.83 | | 22:30 | 22:48 | 71 | 71 | | |
| BP10-003 | Box core/ 500µm | 70°57.13 | 134°57.68 | | | 15 X 1250 | 04:41 | 05:12 | 379 | 380 | (1; 1; 3) | ML & |
| BP10-003 | Agassiz | 70°57.27 | 134°57.42 | 70°57.27 | 134°57.47 | | 05:36 | 06:34 | 383 | 382 | | CG |
| BP10-017 | Box core/ 500µm | 71°07.17 | 135°11.72 | | | 15 X 1250 | 01:12 | 01:48 | 731 | 734 | (1; 1; 3) | ML & CG |
| BP10-017 | Agassiz | 71°07.21 | 135°11.99 | 71°05.66 | 135°05.97 | | 01:57 | 03:31 | 732 | 651 | | All 4 |

Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords

A total of nine and eight box cores were collected on Legs 3b and 3c respectively. During Leg 3b, eight surface samples were collected for A. Rochon (UQAR-ISMER) and nine samples for M. Thaler (C. Lovejoy's team, U. Laval) and will be analysed for dinoflagellates and bacteria, respectively (Table 24.3).

During Leg 3c, four surface sediment samples were collected for A. Rochon (UQAR-ISMER) at Basic stations and will be analyzed for dinoflagellates (Table 24.3). At three Nutrient stations during Leg 3c, surface sediment samples were collected for T. Richerol (R. Pienitz' group, U. Laval & CEN) and will be analyzed for diatoms to date sediments (Table 24.4).

Table 24.3. Benthic sampling stations during Leg 3b, with numbers of samples or cores collected for ArcticNet and CHONe projects.

| Stn ID | Date in | Depth (m) | Latitude N | Longitude W | Sampling type | AN | CHONe |
|---|---|---|---|---|---|---|---|

| 2010 | | | | | | Archambault Diversity | Hebert & Dufresne | Bradbury | Cusson | Olivier | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 405 | 08/10 | 609 | 70°38.25 | 123°02.22 | Box core | 1 | - | - | - | - | A.Rochon & M.Thaler samples |
| | | 617 | 70°37.81 | 123°00.24 | Agassiz trawl Start | 1 | 2 | 1 | 1 | 1 | |
| | | 615 | 70°37.82 | 122°59.71 | Agassiz trawl Stop | - | - | - | - | - | |
| 450 | 09/10 | 100 | 72°03.15 | 119°46.77 | Box core | 1 | - | - | - | - | A.Rochon & M.Thaler samples |
| | | 102 | 72°02.98 | 119°46.19 | Agassiz trawl Start | 1 | 2 | 1 | 1 | 2 | M.Best sample |
| | | 101 | 72°03.00 | 119°45.79 | Agassiz trawl Stop | - | - | - | - | - | |
| 308 | 10/10 | 558 | 74°07.27 | 108°26.68 | Box core | 1 | - | - | - | - | A.Rochon & M.Thaler samples |
| | | - | - | - | No Agassiz trawl | - | - | - | - | - | Too much ice |
| 304 | 12/10 | 309 | 74°13.08 | 91°31.14 | Box core | 1 | - | - | - | - | A.Rochon & M.Thaler samples |
| | | 305 | 74°13.30 | 91°33.30 | Agassiz trawl Start | 1 | 1 | - | - | 2 | M.Best sample |
| | | 305 | 74°13.21 | 91°32.99 | Agassiz trawl Stop | - | - | - | - | - | |
| 323 | 14/10 | 783 | 74°12.02 | 79°45.76 | Box core | 1 | - | - | - | - | A.Rochon & M.Thaler samples |
| | | 785 | 74°12.51 | 79°44.03 | Agassiz trawl Start | 1 | 1 | - | 1 | 2 | M.Best sample |
| | | 780 | 74°11.82 | 79°47.60 | Agassiz trawl Stop | - | - | - | - | - | |
| 115 | 15/10 | 644 | 76°21.23 | 71°11.81 | Box core | 1 | - | - | - | - | Little penetration, cobbles;A.Rochon & M.Thaler samples |
| | | 655 | 76°21.60 | 71°15.60 | Agassiz trawl Start | 1 | - | - | - | 1 | M.Best sample |
| | | 652 | 76°21.60 | 71°16.20 | Agassiz trawl Stop | - | - | - | - | - | |
| 111 | 16/10 | 568 | 76°17.32 | 73°15.73 | Box core | 1 | - | - | - | - | A.Rochon & M.Thaler samples |
| | | 572 | 76°17.06 | 73°17.80 | Agassiz trawl Start | 1 | - | - | 1 | 2 | M.Best sample |
| | | 568 | 76°17.02 | 73°18.25 | Agassiz trawl Stop | - | - | - | - | - | |
| 108 | 16/10 | 435 | 76°14.03 | 74°55.82 | Box core | 1 | - | - | - | - | A.Rochon & M.Thaler samples |
| | | 434 | 76°13.70 | 74°55.55 | Agassiz trawl Start | 1 | 1 | - | - | 2 | |
| | | 434 | 76°13.75 | 74°55.07 | Agassiz trawl Stop | - | - | - | - | - | |
| 105 | 17/10 | 338 | 76°15.13 | 75°55.88 | Box core | 1 | - | - | - | - | Little penetration, cobbles; M.Thaler sample |
| | | 363 | 76°17.14 | 75°54.97 | Agassiz trawl Start | 1 | 2 | - | - | 1 | T. Brown sample |
| | | 363 | 76°17.16 | 75°46.64 | Agassiz trawl Stop | - | - | - | - | - | |

Table 24.4. Benthic sampling stations during Leg 3c, with numbers of samples or cores collected for ArcticNet and CHONe projects.

| | | | | | | AN | CHONe | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Stn ID** | **Date in 2010** | **Depth (m)** | **Latitude N** | **Longitude W** | **Sampling type** | **Archambault Diversity** | **Hebert & Dufresne** | **Bradbury** | **Cusson** | **Olivier** | **Comment** |
| 600 | 24/10 | 203 | 59°05.33 | 63°25.73 | Box core | 1 | - | - | - | - | A.Rochon sample |
| | | 207 | 59°09.08 | 63°26.50 | Agassiz trawl Start | 1 | - | - | - | - | |
| | | 210 | 59°05.12 | 63°27.59 | Agassiz trawl Stop | - | - | - | - | - | |
| 602 | 24/10 | 152 | 59°03.22 | 63°51.70 | Box core | 1 | - | - | - | - | A.Rochon sample |
| | | 160 | 59°03.55 | 63°50.63 | Agassiz trawl Start | 1 | - | - | 1 | - | M.Best sample |
| | | 160 | 59°03.52 | 63°50.88 | Agassiz trawl Stop | - | - | - | - | - | |
| 617 | 25/10 | 135 | 58°30.18 | 62°40.90 | Box core | 1 | - | - | - | - | A.Rochon sample |
| | | 134 | 58°30.08 | 62°42.18 | Agassiz trawl Start | 1 | - | - | - | - | M.Best sample |
| | | 136 | 58°30.08 | 62°41.21 | Agassiz trawl Stop | - | - | - | - | - | |
| 613 | 25/10 | 255 | 58°29.02 | 63°13.17 | Box core | 1 | - | - | - | - | T.Rocherol sample |
| | | 255 | 58°29.04 | 63°13.80 | Agassiz trawl Start | 1 | - | - | 1 | - | M.Best sample |
| | | 255 | 58°29.00 | 63°13.93 | Agassiz trawl Stop | - | - | - | - | - | |
| 633 | 26/10 | 176 | 57°36.39 | 61°53.62 | Box core | 1 | - | - | - | - | A.Rochon sample |
| | | 176 | 57°36.25 | 61°53.89 | Agassiz trawl Start | 1 | - | - | - | - | |
| | | 175 | 57°36.27 | 61°53.72 | Agassiz trawl Stop | - | - | - | - | - | |
| 632 | 26/10 | 83 | 57°34.11 | 62°03.14 | Box core | 1 | - | - | - | - | T.Rocherol sample |
| | | 86 | 57°34.27 | 62°03.17 | Agassiz trawl Start | 1 | - | - | - | - | M.Best sample |
| | | 87 | 57°34.34 | 62°03.06 | Agassiz trawl Stop | - | - | - | - | - | |
| 622 | 27/10 | 80 | 56°25.07 | 61°44.03 | Box core | 1 | - | - | - | - | Rocky bottom, be careful; T.Rocherol sample |
| | | 80 | 56°25.21 | 61°44.16 | Agassiz trawl Start | 1 | - | - | - | - | Rocky bottom, be careful |
| | | 80 | 56°25.09 | 61°43.79 | Agassiz trawl Stop | - | - | - | - | - | |
| 620 | 27/10 | 87 | 56°23.86 | 61°12.94 | Box core | 1 | - | - | - | - | Little penetration, sand and gravel; first try empty |
| | | 88 | 56°23.90 | 61°12.76 | Agassiz trawl Start | 1 | - | - | - | - | First try empty;T. Brown sample |
| | | 86 | 56°23.85 | 61°12.99 | Agassiz trawl Stop | - | - | - | - | - | |

### 24.3 Preliminary results

Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago

Composition and abundance of species varied considerably among stations (west, center, and east) in Hudson Bay with the influence of freshwater inputs when sampling sites were located near the mouth of rivers. Great variability in diversity was also observed between the samples collected in Hudson Bay (Leg 1a) and in the Northwest Passage (Leg 1b). Samples need to be analysed for detailed taxonomy in the home lab at UQAR.

Leg 2a – ArcticNet/BP – 12 August to 26 August 2010 – Beaufort Sea

General trend of lower abundance and diversity of benthic organisms was observed at the deepest stations (box core and trawl). The presence of indicator species such as soft corals and sponges was also observed.

At the gas feature station, the expected sulfur odor was not detected. Nevertheless, the presence of bubbles at the water surface for the second box core deployed at station BP10-002 was observed.

Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

During Leg 3b, composition and abundance of species varied considerably among stations (Northwest Passage *vs.* Baffin Bay/NOW). At this point, it is not known exactly if this variability was governed by sediment type, food availability or other environmental variables. More detailed analyses, identification of organisms and sediment characterization will be carried out at UQAR.

Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords

Composition and abundance of species varied considerably among stations visited during Leg 3c. Station 600 (Nachvak Fiord) was dominated by crustaceans and anemones, although Station 602 at the head of the fiord was dominated by polychaeta and one species of bivalve in particular, *Portlandica arctica*. Station 617 (Saglek fiord) was dominated by brittle stars and different species of bivalves, although the inner Station 613 was composed mostly by one species of bivalve, *Portlandica arctica*, and by *Pectinaria* sp. and *Saduria* sp. Stations 632 and 633 (Okak Bay) were close in distance and similar in species composition with brittle stars and bivalves in preponderance. Stations 620 and 622 (Anaktalak Bay) were also similar in species composition with a dominance of crustaceans (crabs and shrimps) and fishes. More analyses will be conducted at UQAR.

## 24.4 Comment and recommendations

Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay

Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago

Problems were encountered on the northeast and northwest parts of Hudson Bay. Sonar profiles showed hard bottoms and it was decided to not deploy the box corer and the Agassiz trawl (with P. Lajeunesse's team – U Laval). Expeditions in Hudson Bay in 2005 and 2007 encountered the same kind of problems. In the future, station locations should be determined based on the feasibility to optimise each anticipated operation and not only the operations done in the water column.

The Agassiz trawl seemed a more appropriate tool to quantify and qualify the benthic diversity than the box corer. The box corer was a more useful to conduct sediment sampling and benthic incubations. Also, both box corer and Agassiz trawl should be done systematically at each Basic station and not only the box corer. During Leg 1, the Agassiz trawl operation was added at each Basic station.

Agassiz trawl frame should be strengthened, maybe with stainless steel rods. In its present configuration, the rods are empty and this makes the frame susceptible to damage on rocky bottom.

ROV surveys would have been useful during Leg 1 when the seafloor was too rocky to deploy the box corer and the Agassiz trawl, especially since high benthic diversity is expected on this type of bottom.

A scientist should be in charge of following the box coring deployment with the EK60 at stations deeper than 500 meters. This is to ensure a better estimation of the box core depth and to avoid entanglement of the cable when the box core reaches the sea floor.

The establishment of a protocol for a situation in which the cable is entangled around the head of the boxcore is strongly recommended for safety reasons. Furthermore, the purchase of a 'crazy hook' strong enough to attach to the boxcore if this situation occurs is also recommended.

Leg 3b – ArcticNet – 07 October to 22 October 2010 – Canadian Arctic Archipelago and Baffin Bay

Leg 3c – ArcticNet – 22 October to 31 October 2010 – Northern Labrador fjords

On Leg 3b, problems were encountered with the box core at Stations 115 and 105 in Baffin Bay/NOW due to the presence of a hard bottom (cobbles). For the Agassiz trawl, only one station was missed (Station 308) due to thick ice cover. No deployments were done at Station 101 in Baffin Bay/NOW due to thick ice cover in this area.

On Leg 3c, problems were encountered with the box core and Agassiz trawl at Station 620 (mouth of Anaktalak fiord). The hard and sandy substrate might be the cause of the unsuccessful box core. In the case of the Agassiz trawl, the chain was not on the right side of the seafloor to scrape adequately the sediments; the second try was successful though. A warning should be given also for Station 622 where cobbles were retrieved from the box core when sieving the sediments; the box was not damaged but future box coring at this station should be considered tricky. It would be useful to have a Van Veen grab sampler onboard the ship.

To allow a good assessment of local heterogeneity, box core replicates (at least two) should be planned for in future cruises.

In parallel to box coring, dredging (Rallier du Batty) could be done to increase harvest of infauna (bivalves and rare species).

ROV surveys should be done to characterize benthic habitats on rocky bottom where the box core and the Agassiz trawl cannot be deployed.

# 25 Modern sedimentation and paleo-river discharge – Leg 1a

ArcticNet Phase 2 – Project titled *Freshwater-Marine Coupling in the Hudson Bay IRIS* http://www.arcticnet.ulaval.ca/pdf/phase2/barber_freshwater-marine_coupling.pdf
ArcticNet Phase 2 – Project titled *The Canadian Arctic Seabed: Navigation and Resource Mapping* http://www.arcticnet.ulaval.ca/pdf/phase2/hugues_clarke_seabed_mapping.pdf

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**Cruise participants Leg 1a**: Kathryn Denommee[1], Jonathan Roger[2] and Claudia Rousseau[2]
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## 25.1 Introduction

### *25.1.1 Paleo-river discharge in Hudson Bay (Leg 1a)*

This project focuses on river water and sediment discharge due to climatic variations. The objective during this cruise was to collect long cores in the Great Whale River and in the Nelson River estuaries to determine long-term and recent fluctuations in river discharge into Hudson Bay. The aim was to place recent variations in river discharge in a larger climatic context by studying paleo-sediment and water discharge and its relation to past climatic events such as the Little Ice Age and the Medieval Warm Period and further back.

### *25.1.2 Hudson Bay sedimentation rates (Leg 1a)*

The goal during Leg 1a was to collect sediment from a series of box-cores taken around Hudson Bay. The sediments collected will provide information about modern sedimentation rates and other environmental parameters.

### *25.1.3 Holocene dedimentation in Lancaster Sound (Leg 1b)*

The objective for Leg 1b was to collect sediments from box cores and a gravity core taken in Lancaster Sound. The sediments collected will provide information about modern sedimentation rates and other environmental parameters.

## 25.2 Methodology

### *25.2.1 Leg 1a – ArcticNet – 01 July to 02 August 2010 – Hudson Bay*

Long cores were collected from the Great Whale and Nelson Estuaries using a combination of gravity and piston corers. Recovered sediment cores were cut into 1-m sections and stored at 4˚C for subsequent transport.

Additionally, a box-core was deployed at several sites around Hudson Bay. Samples were collected from the box-core using a push core inserted into the recovered sediment. These samples were also stored at 4˚C for subsequent transport.

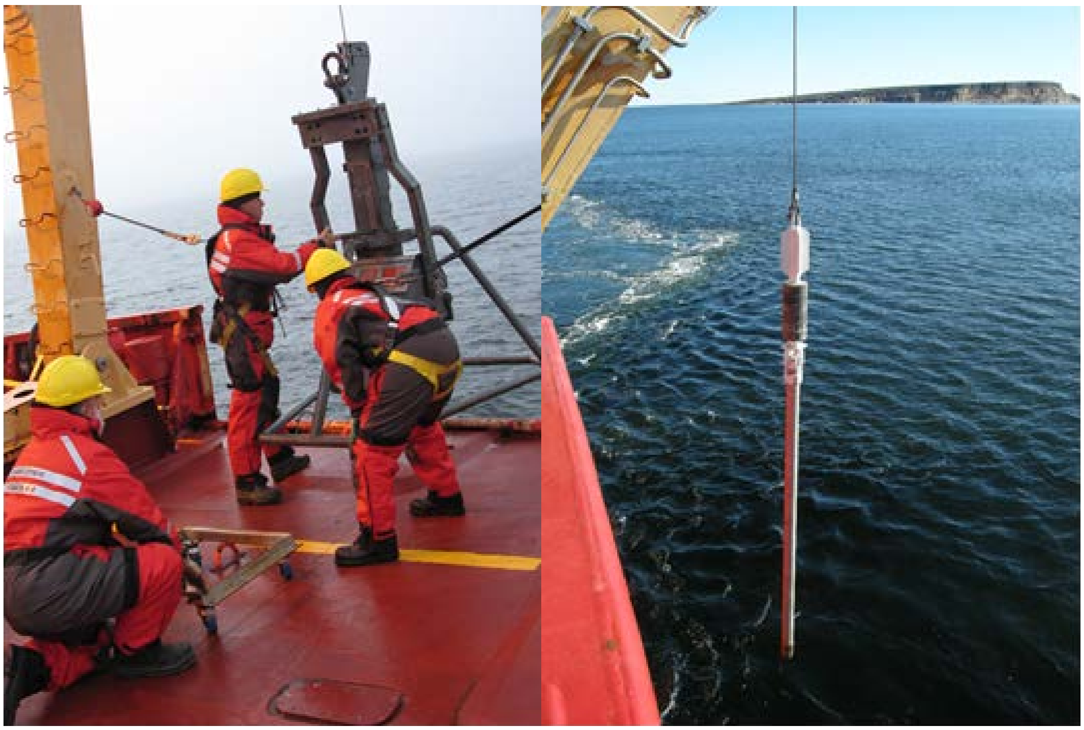

Figure 25.1. Left: Crew of CCGS *Amundsen* deploying a box-core. Right: Deployment of the gravity core.

Table 25.1. Summary of long cores taken in the Great Whake and Nelson River systems in Hudson Bay during Leg 1a.

| Station | Locality | Collection date | Latitude N | Longitude W | Water depth (m) | Notes |
|---|---|---|---|---|---|---|
| AMD10 702 | Great Whale 1 | 07/14/10 | 55˚ 20.85 | 77˚ 45.69 | 95 | Gravity Core |
| AMD10 702 | Great Whale 1 | 07/14/10 | 55˚ 20.85 | 77˚ 45.78 | 98 | Large Gravity Core |
| AMD10 702 | Great Whale 2 | 07/14/10 | 55˚ 19.78 | 77˚ 48.78 | 80 | Large Gravity Core |
| AMD10 702 | Great Whale 3 | 07/14/10 | 55˚ 17.16 | 77˚ 49.85 | 69 | Large Gravity Core |
| AMD10 705a | Nelson 1 | 07/22/10 | 57˚ 25.61 | 91˚ 53.52 | 18 | Large Gravity Core |
| AMD10 705a | Nelson 1 | 07/22/10 | 57˚ 25.61 | 91˚ 53.52 | 18 | Piston & Gravity Core |
| AMD10 705 | Nelson 2 | 07/24/10 | 57˚ 39.55 | 91˚ 35.63 | 35 | Piston & Gravity Core |

Table 25.2. Summary of box cores taken in in Hudson Bay during Leg 1a.

| Station | Locality | Collectio n date | Latitude N | Longitude W | Water depth (m) | Notes |
|---|---|---|---|---|---|---|
| AMD10 350 | | 07/09/10 | 64º 25.93 | 80º 28.49 | 376 | No Recovery |
| AMD10 699 | | 07/11/09 | 59º 59.86 | 78º 25.46 | 86 | 2 push cores recovered |
| AMD10 702 | Great Whale 1 | 07/13/10 | 55º 24.72 | 77º 55.86 | 134 | 2 push cores recovered |
| AMD10 709 | | 07/15/10 | 56º 47.65 | 80º 50.24 | 184 | 2 push cores recovered |
| AMD10 735 | | 07/15/10 | 54 º42.94 | 80º 46.69 | 87 | 2 push cores recovered |
| AMD10 706 | | 07/21/09 | 58º 46.34 | 91º 31.94 | 79 | 1 push core recovered |
| AMD10 705a | Nelson Estuary | 07/22/10 | 57º 25.61 | 91º 53.54 | 35 | 2 Push cores recovered |
| AMD10 705 | Nelson Estuary | 07/24/10 | 57º 16.80 | 92º 06.75 | 18 | 3 push cores recovered |

### *25.2.2 Leg 1b – ArcticNet – 02 August to 12 August 2010 – Baffin Island and Canadian Arctic Archipelago*

A gravity core was collected from Station 301 in Lancaster Sound. Recovered materials were cut into sections and stored at 4˚C for subsequent transport. Additionally, a box-core was deployed at the two stations in Lancaster Sound. Samples were collected from the box-core using a push core inserted into the recovered sediment. These samples were also stored at 4˚C for subsequent transport. Rocks recovered by the box-cores were also collected to analyze their origins and the way they have been transported and deposited.

| Station ID | Sampling type | Date in 2010 | Latitude N | Longitude W | Water depth (m) | Notes |
|---|---|---|---|---|---|---|
| AMD10 301 | Gravity core | 08/07 | 74° 11.03 | 83˚ 56.63 | 668 | Gravity Core |
| AMD10 301 | Box core | 08/07 | 74º 10.98 | 83º 56.95 | 667 | Two push cores recovered |
| AMD10 305 | Box core | 08/08 | 74º 19.40 | 93º 24.74 | 166 | Few rocks were recovered |
| AMD10 305 | Box core | 08/08 | 55º 24.72 | 77º 55.86 | 166 | Two push cores recovered |

## 25.3 Preliminary Results

There are no preliminary results yet.

## Appendix 1: List of Stations

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| **Leg 1a** | | | | | | | | |
| 1a | Labrador Sea | CTD | 05/Jul/2010 | 18h24 | UTC-4 | 54°58.320 | 056°39.850 | 180 |
| 1a | 356 | Nutrient | 07/Jul/2010 | 04h40 | UTC-4 | 60°48.400 | 064°43.834 | 351 |
| 1a | 354 | Nutrient | 07/Jul/2010 | 06h50 | UTC-4 | 60°58.361 | 064°46.295 | 570 |
| 1a | 352 | Nutrient | 07/Jul/2010 | 09h30 | UTC-4 | 61°09.088 | 064°48.392 | 442 |
| 1a | 362 | Nutrient | 08/Jul/2010 | 03h35 | UTC-4 | 62°05.058 | 071°42.720 | 287 |
| 1a | 360 | Nutrient | 08/Jul/2010 | 07h00 | UTC-4 | 62°25.483 | 071°04.749 | 338 |
| 1a | 350 | Water sampling | 09/Jul/2010 | 02h57 | UTC-4 | 64°35.100 | 079°06.400 | 204 |
| 1a | 370 | Nutrient | 09/Jul/2010 | 04h05 | UTC-4 | 64°35.528 | 079°06.343 | 178 |
| 1a | 350 | Basic | 09/Jul/2010 | 07h25 | UTC-4 | 64°26.555 | 080°27.405 | 381 |
| 1a | 710 | Nutrient | 09/Jul/2010 | 23h29 | UTC-4 | 62°57.820 | 080°13.000 | 276 |
| 1a | N/A | Mapping (Start) | 10/Jul/2010 | 03h00 | UTC-4 | 62°40.420 | 079°29.540 | 327 |
| 1a | N/A | Mapping (End) | 10/Jul/2010 | 08h25 | UTC-4 | 62°38.020 | 079°28.670 | 274 |
| 1a | 698 | Nutrient | 10/Jul/2010 | 11h13 | UTC-4 | 62°07.230 | 078°42.150 | 153 |
| 1a | 699 | Basic | 10/Jul/2010 | 23h48 | UTC-4 | 59°59.940 | 078°26.110 | 84 |
| 1a | 701b | Nutrient | 11/Jul/2010 | 12h15 | UTC-4 | 58°24.950 | 079°22.200 | 124 |
| 1a | N/A | Mapping (Start) | 11/Jul/2010 | 16h20 | UTC-4 | 58°25.440 | 078°18.550 | 89 |
| 1a | N/A | Mapping (End) | 11/Jul/2010 | 18h30 | UTC-4 | 58°22.270 | 078°16.230 | 90 |
| 1a | 720 | Nutrient | 12/Jul/2010 | 04h50 | UTC-4 | 57°00.140 | 076°53.390 | 88 |
| 1a | Lovejoy | N/A | 12/Jul/2010 | 09h35 | UTC-4 | 56°32.250 | 076°46.100 | 113 |
| 1a | Lovejoy | N/A | 12/Jul/2010 | 14h30 | UTC-4 | 56°09.180 | 076°41.000 | 105 |
| 1a | 702 | Full | 13/Jul/2010 | 05h27 | UTC-4 | 55°24.520 | 077°56.170 | 134 |
| 1a | AN03-10 | Mooring | 13/Jul/2010 | 18h23 | UTC-4 | 55°24.860 | 077°55.180 | 138 |
| 1a | GW-1 | Piston Core | 14/Jul/2010 | 08h56 | UTC-4 | 55°20.850 | 077°45.690 | 95 |
| 1a | GW-2 | Piston Core | 14/Jul/2010 | 11h19 | UTC-4 | 55°19.780 | 077°48.780 | 80 |
| 1a | GW-3 | Piston Core | 14/Jul/2010 | 12h28 | UTC-4 | 55°17.160 | 077°49.850 | 69 |
| 1a | N/A | Weather Balloon | 14/Jul/2010 | 15h50 | UTC-4 | 55°14.600 | 078°08.530 | 109 |
| 1a | 703 | Nutrient | 14/Jul/2010 | 21h28 | UTC-4 | 54°40.740 | 079°57.460 | 45 |
| 1a | 709 | Basic | 15/Jul/2010 | 00h50 | UTC-4 | 54°42.690 | 080°46.760 | 88 |
| 1a | 704 | Nutrient | 15/Jul/2010 | 08h30 | UTC-4 | 54°45.490 | 081°42.310 | 27 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 13h12 | UTC-4 | 55°26.720 | 080°33.100 | 96 |
| 1a | 735 | Basic | 15/Jul/2010 | 20h47 | UTC-4 | 56°47.760 | 080°49.880 | 177 |
| 1a | 745 | Basic | 16/Jul/2010 | 23h20 | UTC-4 | 60°30.320 | 085°00.850 | 182 |
| 1a | 750 | Nutrient | 17/Jul/2010 | 11h02 | UTC-4 | 60°40.790 | 087°28.200 | 196 |
| 1a | 760 | Nutrient | 17/Jul/2010 | 23h09 | UTC-4 | 63°03.810 | 088°24.130 | 136 |
| 1a | 765 | Basic | 18/Jul/2010 | 06h24 | UTC-4 | 62°18.240 | 090°40.000 | 104 |
| 1a | N/A | Mapping (Start) | 18/Jul/2010 | 15h45 | UTC-4 | 61°30.450 | 092°05.050 | 107 |
| 1a | N/A | Mapping (End) | 18/Jul/2010 | 16h40 | UTC-4 | 61°29.680 | 092°02.520 | 119 |
| 1a | 770 | Nutrient | 18/Jul/2010 | 19h25 | UTC-4 | 60°56.181 | 091°47.758 | 109 |
| 1a | 707 | Full | 19/Jul/2010 | 01h07 | UTC-4 | 59°58.090 | 091°57.090 | 111 |
| 1a | AN01-09 | Mooring | 19/Jul/2010 | 06h42 | UTC-4 | 59°58.225 | 091°57.012 | 105 |
| 1a | AN01-10 | Mooring | 19/Jul/2010 | 11h05 | UTC-4 | 59°58.280 | 091°56.940 | 102 |
| 1a | VIP | VIP | 20/Jul/2010 | 05h58 | UTC-4 | 58°54.714 | 093°57.290 | 32 |
| 1a | N/A | Box Core | 21/Jul/2010 | 03h57 | UTC-4 | 59°36.733 | 091°49.794 | 120 |
| 1a | 706 | Full | 21/Jul/2010 | 08h23 | UTC-4 | 58°47.070 | 091°31.650 | 76 |
| 1a | AN02-09 | Mooring | 21/Jul/2010 | 13h22 | UTC-4 | 58°47.140 | 091°32.040 | 75 |
| 1a | A11 | River (Hayes-Nelson) | 21/Jul/2010 | 21h45 | UTC-4 | 57°44.190 | 091°43.830 | 39 |
| 1a | A12 | River (Hayes-Nelson) | 21/Jul/2010 | 22h16 | UTC-4 | 57°44.970 | 091°36.610 | 51 |
| 1a | A13 | River (Hayes-Nelson) | 21/Jul/2010 | 22h58 | UTC-4 | 57°46.000 | 091°27.890 | 53 |
| 1a | A14 | River (Hayes-Nelson) | 21/Jul/2010 | 23h50 | UTC-4 | 57°46.950 | 091°19.950 | 63 |
| 1a | A15 | River (Hayes-Nelson) | 22/Jul/2010 | 00h34 | UTC-4 | 57°42.780 | 091°20.120 | 45 |
| 1a | A16 | River (Hayes-Nelson) | 22/Jul/2010 | 01h15 | UTC-4 | 57°38°740 | 091°20.310 | 46 |
| 1a | A17 | River (Hayes-Nelson) | 22/Jul/2010 | 01h55 | UTC-4 | 57°34.640 | 091°20.440 | 37 |
| 1a | A7 | River (Hayes-Nelson) | 22/Jul/2010 | 04h10 | UTC-4 | 57°26.094 | 091°34.557 | 28 |
| 1a | A6 | River (Hayes-Nelson) | 22/Jul/2010 | 05h10 | UTC-4 | 57°24.670 | 091°42.230 | 49 |
| 1a | A5 | River (Hayes-Nelson) | 22/Jul/2010 | 05h55 | UTC-4 | 57°23.450 | 091°49.240 | 43 |
| 1a | A4 | River (Hayes-Nelson) | 22/Jul/2010 | 06h53 | UTC-4 | 57°22.060 | 091°56.900 | 34 |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| 1a | A8 | River (Hayes-Nelson) | 22/Jul/2010 | 06h56 | UTC-4 | 57°22.050 | 091°56.950 | 34 |
| 1a | NR-B12 | River (Hayes-Nelson) | 22/Jul/2010 | 07h20 | UTC-4 | 57°19.314 | 092°06.894 | 23 |
| 1a | NR-B10 | River (Hayes-Nelson) | 22/Jul/2010 | 08h45 | UTC-4 | 57°14.820 | 092°13.194 | 11 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 09h09 | UTC-4 | 57°25.530 | 091°53.470 | 36 |
| 1a | NR-B9 | River (Hayes-Nelson) | 22/Jul/2010 | 09h20 | UTC-4 | 57°12.645 | 092°15.738 | 9 |
| 1a | NR-B8 | River (Hayes-Nelson) | 22/Jul/2010 | 09h35 | UTC-4 | 57°10.746 | 092°19.872 | 10 |
| 1a | NR-B7 | River (Hayes-Nelson) | 22/Jul/2010 | 10h15 | UTC-4 | 57°08.784 | 092°23.166 | 19 |
| 1a | NR-B6 | River (Hayes-Nelson) | 22/Jul/2010 | 11h40 | UTC-4 | 57°06.684 | 092°26.496 | 9 |
| 1a | HR-D7 | River (Hayes-Nelson) | 22/Jul/2010 | 13h45 | UTC-4 | 57°12.870 | 091°54.923 | 14 |
| 1a | HR-D8 | River (Hayes-Nelson) | 22/Jul/2010 | 14h30 | UTC-4 | 57°14.442 | 091°52.150 | 16 |
| 1a | NR-BD20 | River (Hayes-Nelson) | 22/Jul/2010 | 15h10 | UTC-4 | 57°14.470 | 091°52.194 | 28 |
| 1a | 705A | Full | 22/Jul/2010 | 19h22 | UTC-4 | 57°25.520 | 091°53.510 | 36 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 04h22 | UTC-4 | 57°42.262 | 090°45.636 | 37 |
| 1a | Intermediate A8-705A | River (Hayes-Nelson) | 23/Jul/2010 | 09h15 | UTC-4 | 57°26.590 | 091°44.520 | 41 |
| 1a | A8 | River (Hayes-Nelson) | 23/Jul/2010 | 09h59 | UTC-4 | 57°29.670 | 091°35.330 | 37 |
| 1a | Intermediate A8-705B | River (Hayes-Nelson) | 23/Jul/2010 | 10h43 | UTC-4 | 57°32.160 | 091°28.370 | 34 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 11h24 | UTC-4 | 57°34.670 | 091°20.750 | 40 |
| 1a | Intermediate 705B-C | River (Hayes-Nelson) | 23/Jul/2010 | 14h12 | UTC-4 | 57°37.020 | 091°11.650 | 44 |
| 1a | Intermediate 705B-C | River (Hayes-Nelson) | 23/Jul/2010 | 14h54 | UTC-4 | 57°38.740 | 091°02.810 | 38 |
| 1a | Intermediate 705B-C | River (Hayes-Nelson) | 23/Jul/2010 | 15h34 | UTC-4 | 57°40.300 | 090°54.810 | 35 |
| 1a | A25 | River (Hayes-Nelson) | 23/Jul/2010 | 18h05 | UTC-4 | 57°47.180 | 090°49.920 | 40 |
| 1a | A24 | River (Hayes-Nelson) | 23/Jul/2010 | 18h41 | UTC-4 | 57°45.553 | 090°56.907 | 47 |
| 1a | A23 | River (Hayes-Nelson) | 23/Jul/2010 | 19h21 | UTC-4 | 57°41.321 | 090°57.477 | 39 |
| 1a | 705M | Full | 24/Jul/2010 | 05h55 | UTC-4 | 57°40.517 | 091°34.801 | 52 |
| 1a | AN04-09 | Mooring | 24/Jul/2010 | 08h55 | UTC-4 | 57°40.150 | 091°36.240 | 59 |
| 1a | AN04-10A | Mooring | 24/Jul/2010 | 14h31 | UTC-4 | 57°40.208 | 091°36.179 | 60 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 11h47 | UTC-4 | 57°16.800 | 092°06.780 | 20 |
| 1a | A8 | N/A | 27/Jul/2010 | 08h42 | UTC-4 | 57°30.420 | 091°37.700 | 67 |
| 1a | N/A | MVP (Start) | 27/Jul/2010 | 10h57 | UTC-4 | 57°36.360 | 091°13.270 | 38 |
| 1a | N/A | MVP (End) | 27/Jul/2010 | 12h50 | UTC-4 | 57°37.640 | 091°07.950 | 35 |
| 1a | 800 | Nutrient | 27/Jul/2010 | 20h47 | UTC-4 | 58°10.160 | 088°14.300 | 119 |
| 1a | 795 | Nutrient | 28/Jul/2010 | 00h18 | UTC-4 | 57°39.530 | 088°33.230 | 72 |
| 1a | 790 | Basic | 28/Jul/2010 | 03h37 | UTC-4 | 57°14.740 | 088°52.630 | 40 |
| 1a | 810 | Nutrient | 28/Jul/2010 | 13h28 | UTC-4 | 50°50.560 | 087°16.040 | 60 |
| 1a | 820 | Basic | 28/Jul/2010 | 22h34 | UTC-4 | 55°41.630 | 084°53.340 | 53 |
| 1a | 825 | Nutrient | 29/Jul/2010 | 04h48 | UTC-4 | 56°10.699 | 084°36.979 | 121 |
| 1a | 830 | Water Sampling | 29/Jul/2010 | 08h22 | UTC-4 | 56°46.600 | 084°16.700 | 162 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 09h04 | UTC-4 | 56°47.230 | 084°15.600 | 163 |
| 1a | 835 | Nutrient | 29/Jul/2010 | 13h55 | UTC-4 | 57°30.280 | 083°51.980 | 169 |
| 1a | 840 | Basic | 29/Jul/2010 | 19h01 | UTC-4 | 58°24.669 | 083°18.918 | 175 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 09h54 | UTC-4 | 60°22.130 | 081°59.160 | 149 |
| 1a | Ex1 | N/A | 30/Jul/2010 | 20h09 | UTC-4 | 62°07.970 | 081°23.960 | 207 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 01h43 | UTC-4 | 62°39.740 | 079°27.710 | 320 |
| 1a | N/A | MVP (Start) | 31/Jul/2010 | 17h38 | UTC-4 | 62°38.440 | 073°22.280 | 223 |
| 1a | N/A | MVP (End) | 31/Jul/2010 | 22h12 | UTC-4 | 62°29.800 | 071°32.490 | 327 |
| **Leg 1b** | | | | | | | | |
| 1b | Cap Haye | MVP (Start) | 06/Aug/2010 | 12h05 | UTC-4 | 73°50.650 | 080°02.700 | 843 |
| 1b | Cap Haye | MVP (End) | 06/Aug/2010 | 16h47 | UTC-4 | 74°32.140 | 080°34.490 | 553 |
| 1b | 301 | Basic | 06/Aug/2010 | 23h44 | UTC-4 | 74°10.980 | 083°56.410 | 669 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 12h51 | UTC-4 | 74°09.730 | 086°10.280 | 522 |
| 1b | 303 | Nutrient | 07/Aug/2010 | 19h59 | UTC-4 | 74°13.340 | 089°37.140 | 236 |
| 1b | LS01-10 | Mooring | 07/Aug/2010 | 22h51 | UTC-4 | 74°28.180 | 090°23.280 | 269 |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| 1b | BIO | CTD | 07/Aug/2010 | 23h40 | UTC-4 | 74°27.690 | 090°22.450 | 282 |
| 1b | 304 | Nutrient | 08/Aug/2010 | 00h42 | UTC-5 | 74°18.420 | 091°20.480 | 328 |
| 1b | 305 | Basic | 08/Aug/2010 | 04h05 | UTC-5 | 74°19.686 | 093°24.527 | 340 |
| 1b | 310 | Basic | 09/Aug/2010 | 03h15 | UTC-5 | 71°17.440 | 097°41.980 | 124 |
| 1b | 312 | Nutrient | 10/Aug/2010 | 01h45 | UTC-6 | 69°09.460 | 100°42.060 | 49 |
| 1b | 314 | Nutrient | 10/Aug/2010 | 18h30 | UTC-6 | 69°00.133 | 106°36.343 | 115 |
| **Leg 2a** | | | | | | | | |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 00h00 | UTC-6 | 70°46.530 | 134°23.120 | 68 |
| 2a | LF-1 | Hydrophone | 15/Aug/2010 | 05h20 | UTC-6 | 70°48.294 | 134°19.749 | 70 |
| 2a | LF-2 | Hydrophone | 15/Aug/2010 | 05h55 | UTC-6 | 70°50.800 | 134°32.890 | 78 |
| 2a | HF-2 | Hydrophone | 15/Aug/2010 | 06h17 | UTC-6 | 70°52.240 | 134°28.400 | 80 |
| 2a | LF-3 | Hydrophone | 15/Aug/2010 | 06h55 | UTC-6 | 70°53.310 | 134°46.060 | 107 |
| 2a | HF-5 | Hydrophone | 15/Aug/2010 | 08h07 | UTC-6 | 70°53.393 | 135°22.440 | 525 |
| 2a | HF-4 | Hydrophone | 15/Aug/2010 | 08h51 | UTC-6 | 71°00.311 | 135°22.549 | 640 |
| 2a | LF-4 | Hydrophone | 15/Aug/2010 | 09h57 | UTC-6 | 70°55.932 | 134°58.478 | 345 |
| 2a | HF-3 | Hydrophone | 15/Aug/2010 | 10h24 | UTC-6 | 70°55.855 | 134°46.458 | 228 |
| 2a | LF-7 | Hydrophone | 15/Aug/2010 | 10h48 | UTC-6 | 70°58.338 | 134°45.986 | 304 |
| 2a | LF-6 | Hydrophone | 15/Aug/2010 | 11h19 | UTC-6 | 70°55.845 | 134°32.933 | 101 |
| 2a | LF-5 | Hydrophone | 15/Aug/2010 | 11h51 | UTC-6 | 70°53.271 | 134°17.950 | 79 |
| 2a | J-09 | Mooring | 15/Aug/2010 | 13h00 | UTC-6 | 70°54.030 | 134°16.550 | 89 |
| 2a | LF-8 | Hydrophone | 15/Aug/2010 | 14h50 | UTC-6 | 70°50.720 | 134°06.990 | 82 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 16h14 | UTC-6 | 70°55.380 | 134°26.620 | 96 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 21h15 | UTC-6 | 70°58.924 | 134°22.750 | 259 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 02h15 | UTC-6 | 71°00.580 | 134°39.820 | 333 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 08h57 | UTC-6 | 70°53.740 | 134°14.900 | 80 |
| 2a | J-10 | Mooring | 16/Aug/2010 | 14h34 | UTC-6 | 70°53.850 | 134°15.650 | 82 |
| 2a | BP10-09 | Biophysical | 16/Aug/2010 | 23h09 | UTC-6 | 71°09.143 | 135°38.359 | 962 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 10h19 | UTC-6 | 70°55.178 | 134°51.188 | 248 |
| 2a | G-09 | Mooring | 18/Aug/2010 | 17h28 | UTC-6 | 71°00.160 | 135°31.740 | 734 |
| 2a | BP10-07 | Biophysical | 18/Aug/2010 | 21h19 | UTC-6 | 71°04.900 | 135°33.650 | 843 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 08h31 | UTC-6 | 71°01.789 | 134°48.485 | 442 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 20h58 | UTC-6 | 70°51.830 | 134°45.864 | 90 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 02h26 | UTC-6 | 70°45.390 | 135°03.740 | 75 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 06h10 | UTC-6 | 70°51.100 | 135°00.200 | 127 |
| 2a | G-10 | Mooring | 21/Aug/2010 | 16h10 | UTC-6 | 71°00.230 | 135°28.460 | 693 |
| 2a | BP10-08 | Biophysical | 21/Aug/2010 | 20h22 | UTC-6 | 71°08.003 | 135°29.581 | 897 |
| 2a | H-09 | Mooring | 22/Aug/2010 | 07h11 | UTC-6 | 71°01.380 | 134°43.720 | 393 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 12h48 | UTC-6 | 70°59.880 | 135°36.630 | 709 |
| 2a | BP10-16 | Biophysical | 22/Aug/2010 | 23h28 | UTC-6 | 70°59.261 | 135°22.525 | 629 |
| 2a | H-10 | Mooring | 23/Aug/2010 | 16h06 | UTC-6 | 71°01.260 | 134°41.230 | 366 |
| 2a | I-09 | Mooring | 23/Aug/2010 | 18h10 | UTC-6 | 70°48.740 | 134°31.700 | 72 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 19h27 | UTC-6 | 70°49.560 | 134°34.410 | 72 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 00h15 | UTC-6 | 70°57.090 | 134°57.720 | 379 |
| 2a | I-10 | Mooring | 24/Aug/2010 | 11h43 | UTC-6 | 70°48.949 | 134°32.604 | 72 |
| 2a | N/A | MOB buoy | 24/Aug/2010 | 17h10 | UTC-6 | 70°56.900 | 134°44.880 | 250 |
| 2a | BP10-16 | Biophysical | 24/Aug/2010 | 19h25 | UTC-6 | 70°59.230 | 135°22.290 | 630 |
| 2a | BP10-17 | Biophysical | 24/Aug/2010 | 23h07 | UTC-6 | 71°07.072 | 135°11.577 | 722 |
| 2a | H-10 | CTD | 25/Aug/2010 | 04h27 | UTC-6 | 71°00.930 | 134°40.690 | 351 |
| 2a | CA04-08 | Mooring | 25/Aug/2010 | 08h45 | UTC-6 | 71°04.862 | 133°38.594 | 294 |
| 2a | N/A | MVP (Start) | 25/Aug/2010 | 14h35 | UTC-6 | 71°20.840 | 131°03.600 | 219 |
| 2a | N/A | MVP (End) | 25/Aug/2010 | 17h47 | UTC-6 | 71°25.940 | 130°10.810 | 72 |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| **Leg 2b** | | | | | | | | |
| 2b | N/A | MVP (Start) | 27/Aug/2010 | 07h29 | UTC-6 | 71°24.960 | 129°55.400 | 90 |
| 2b | N/A | MVP (End) | 27/Aug/2010 | 08h42 | UTC-6 | 71°25.130 | 130°21.040 | 89 |
| 2b | N/A | MVP (Start) | 27/Aug/2010 | 18h18 | UTC-6 | 70°52.230 | 133°53.830 | 79 |
| 2b | N/A | MVP (End) | 27/Aug/2010 | 19h44 | UTC-6 | 70°53.160 | 134°13.300 | 73 |
| 2b | N/A | USBL Beacon | 02/Sep/2010 | 06h09 | UTC-6 | 71°04.440 | 135°42.810 | 886 |
| 2b | B-09 | Mooring | 02/Sep/2010 | 17h26 | UTC-6 | 70°39.960 | 135°35.980 | 153 |
| 2b | N/A | MVP (Start) | 02/Sep/2010 | 20h55 | UTC-6 | 70°54.580 | 135°32.450 | 606 |
| 2b | N/A | MVP (End) | 03/Sep/2010 | 09h27 | UTC-6 | 71°10.886 | 135°13.962 | 660 |
| 2b | N/A | MVP (Start) | 03/Sep/2010 | 13h50 | UTC-6 | 71°06.530 | 134°32.960 | 469 |
| 2b | N/A | MVP (Start) | 03/Sep/2010 | 20h48 | UTC-6 | 71°11.883 | 135°24.863 | 1013 |
| 2b | N/A | MVP (End) | 04/Sep/2010 | 01h00 | UTC-6 | 70°45.000 | 134°27.900 | N/A |
| 2b | N/A | MVP (Start) | 04/Sep/2010 | 01h20 | UTC-6 | 70°45.000 | 134°28.600 | N/A |
| 2b | N/A | MVP (End) | 04/Sep/2010 | 03h25 | UTC-6 | 70°56.800 | 134°10.100 | N/A |
| 2b | N/A | MVP (Start) | 04/Sep/2010 | 04h15 | UTC-6 | 71°02.300 | 134°20.000 | N/A |
| 2b | N/A | MVP (End) | 04/Sep/2010 | 06h48 | UTC-6 | 70°44.900 | 134°52.200 | N/A |
| 2b | B-10 | Mooring | 04/Sep/2010 | 09h25 | UTC-6 | 70°40.121 | 135°35.201 | 150 |
| 2b | BP10-PC12 | Piston Core | 04/Sep/2010 | 12h04 | UTC-6 | 70°47.590 | 135°33.740 | 425 |
| 2b | BP10-PC39 | Piston Core | 04/Sep/2010 | 15h15 | UTC-6 | 70°59.480 | 135°31.550 | 677 |
| 2b | BP10-PC34 | Piston Core | 04/Sep/2010 | 18h15 | UTC-6 | 70°59.170 | 135°22.210 | 630 |
| 2b | N/A | MVP (Start) | 04/Sep/2010 | 20h45 | UTC-6 | 71°02.688 | 135°32.053 | 778 |
| 2b | N/A | MVP (End) | 04/Sep/2010 | 23h32 | UTC-6 | 70°45.160 | 134°56.187 | 66 |
| 2b | N/A | MVP (Start) | 05/Sep/2010 | 00h05 | UTC-6 | 70°45.180 | 135°06.600 | 431 |
| 2b | N/A | MVP (End) | 05/Sep/2010 | 03h44 | UTC-6 | 71°08.940 | 136°01.910 | 1051 |
| 2b | N/A | MVP (Start) | 05/Sep/2010 | 04h45 | UTC-6 | 71°03.540 | 135°50.690 | 1013 |
| 2b | N/A | MVP (End) | 05/Sep/2010 | 06h15 | UTC-6 | 70°54.410 | 135°30.820 | 597 |
| 2b | F-09 | Mooring | 05/Sep/2010 | 08h10 | UTC-6 | 70°55.720 | 136°23.696 | 999 |
| 2b | BP10-PC06 | Piston Core | 05/Sep/2010 | 13h57 | UTC-6 | 71°00.370 | 135°27.250 | 683 |
| 2b | BP10-BX14 | Box Core | 05/Sep/2010 | 16h13 | UTC-6 | 70°59.450 | 135°15.240 | 595 |
| 2b | N/A | Mapping (Start) | 05/Sep/2010 | 17h48 | UTC-6 | 71°00.370 | 135°27.370 | 641 |
| 2b | N/A | Mapping (End) | 05/Sep/2010 | 19h30 | UTC-6 | 71°11.500 | 135°50.800 | 1127 |
| 2b | N/A | Mapping (Start) | 05/Sep/2010 | 20h00 | UTC-6 | 71°11.741 | 135°44.370 | N/A |
| 2b | N/A | Mapping (End) | 06/Sep/2010 | 00h10 | UTC-6 | 70°45.180 | 134°46.080 | 436 |
| 2b | N/A | Mapping (Start) | 06/Sep/2010 | 00h25 | UTC-6 | 70°45.240 | 134°38.820 | 840 |
| 2b | N/A | Mapping (End) | 06/Sep/2010 | 04h35 | UTC-6 | 71°12.130 | 135°39.200 | 1090 |
| 2b | N/A | Mapping (Start) | 06/Sep/2010 | 05h55 | UTC-6 | 71°12.010 | 135°16.160 | N/A |
| 2b | N/A | Mapping (End) | 06/Sep/2010 | 06h25 | UTC-6 | 71°08.500 | 135°32.900 | N/A |
| 2b | BP10-PC22 | Piston Core | 06/Sep/2010 | 07h08 | UTC-6 | 71°08.709 | 135°34.807 | 952 |
| 2b | BP10-PC29 | Piston Core | 06/Sep/2010 | 10h51 | UTC-6 | 70°57.083 | 134°53.056 | 330 |
| 2b | BP10-PC31 | Piston Core | 06/Sep/2010 | 13h09 | UTC-6 | 71°01.640 | 134°48.320 | 433 |
| 2b | BP10-PC40 | Piston Core | 06/Sep/2010 | 15h09 | UTC-6 | 70°59.480 | 134°45.490 | 349 |
| 2b | BP10-BX12 | Box Core | 06/Sep/2010 | 18h42 | UTC-6 | 71°01.280 | 135°01.990 | 557 |
| 2b | N/A | Mapping (Start) | 06/Sep/2010 | 19h40 | UTC-6 | 70°58.980 | 135°16.560 | 618 |
| 2b | N/A | Mapping (End) | 06/Sep/2010 | 20h24 | UTC-6 | 71°02.708 | 135°28.882 | 765 |
| 2b | N/A | Mapping (Start) | 06/Sep/2010 | 20h34 | UTC-6 | 71°02.305 | 135°29.907 | 747 |
| 2b | N/A | Mapping (End) | 06/Sep/2010 | 21h20 | UTC-6 | 70°58.551 | 135°17.600 | 591 |
| 2b | N/A | Mapping (Start) | 06/Sep/2010 | 21h29 | UTC-6 | 70°58.276 | 135°19.157 | 593 |
| 2b | N/A | Mapping (End) | 06/Sep/2010 | 22h11 | UTC-6 | 71°01.908 | 135°31.097 | 752 |
| 2b | N/A | Mapping (Start) | 06/Sep/2010 | 21h21 | UTC-6 | 71°01.537 | 135°32.190 | 758 |
| 2b | N/A | Mapping (End) | 06/Sep/2010 | 23h04 | UTC-6 | 70°57.804 | 135°19.960 | 595 |
| 2b | N/A | Mapping (Start) | 06/Sep/2010 | 23h12 | UTC-6 | 70°57.412 | 135°21.094 | 597 |
| 2b | N/A | Mapping (End) | 06/Sep/2010 | 23h52 | UTC-6 | 71°01.139 | 135°33.451 | 781 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 00h01 | UTC-6 | 71°00.780 | 135°34.620 | 706 |
| 2b | N/A | Mapping (End) | 07/Sep/2010 | 00h49 | UTC-6 | 70°56.780 | 135°21.360 | 597 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 01h25 | UTC-6 | 70°51.960 | 135°04.680 | 269 |
| 2b | N/A | Mapping (End) | 07/Sep/2010 | 01h50 | UTC-6 | 70°49.800 | 134°59.880 | 90 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 02h00 | UTC-6 | 70°50.100 | 134°58.560 | 92 |
| 2b | N/A | Mapping (End) | 07/Sep/2010 | 02h20 | UTC-6 | 70°52.320 | 135°03.360 | 260 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 02h30 | UTC-6 | 70°52.620 | 135°02.040 | 251 |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| 2b | N/A | Mapping (End) | 07/Sep/2010 | 02h50 | UTC-6 | 70°50.400 | 134°57.240 | 91 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 03h00 | UTC-6 | 70°50.700 | 134°55.920 | 94 |
| 2b | N/A | Mapping (End) | 07/Sep/2010 | 03h20 | UTC-6 | 70°52.920 | 135°00.660 | 233 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 03h30 | UTC-6 | 70°53.220 | 134°59.340 | 243 |
| 2b | N/A | Mapping (End) | 07/Sep/2010 | 03h52 | UTC-6 | 70°51.060 | 134°54.540 | 88 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 04h25 | UTC-6 | 70°55.100 | 135°04.300 | 379 |
| 2b | N/A | Mapping (End) | 07/Sep/2010 | 05h40 | UTC-6 | 71°00.400 | 135°21.400 | 360 |
| 2b | BP10-PC32 | Piston Core | 07/Sep/2010 | 06h35 | UTC-6 | 71°00.950 | 134°22.660 | 339 |
| 2b | BP10-PC14 | Piston Core | 07/Sep/2010 | 09h10 | UTC-6 | 70°55.388 | 134°12.301 | 101 |
| 2b | BP10-PC28 | Piston Core | 07/Sep/2010 | 11h03 | UTC-6 | 70°53.879 | 134°14.681 | 83 |
| 2b | GSC10-BX01 | Box Core | 07/Sep/2010 | N/A | UTC-6 | N/A | N/A | 80 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 18h48 | UTC-6 | 71°05.000 | 134°23.200 | 484 |
| 2b | N/A | Mapping (End) | 07/Sep/2010 | 22h47 | UTC-6 | 70°50.370 | 135°32.660 | 512 |
| 2b | N/A | Mapping (Start) | 07/Sep/2010 | 23h00 | UTC-6 | 70°50.795 | 135°33.513 | 546 |
| 2b | N/A | Mapping (End) | 08/Sep/2010 | 03h28 | UTC-6 | 71°05.650 | 134°23.610 | 523 |
| 2b | N/A | Mapping (Start) | 08/Sep/2010 | 03h37 | UTC-6 | 71°05.810 | 134°25.330 | 518 |
| 2b | N/A | Mapping (End) | 08/Sep/2010 | 05h25 | UTC-6 | 70°58.010 | 135°01.000 | N/A |
| 2b | GSC10-BX01 | Box Core | 08/Sep/2010 | 07h15 | UTC-6 | 70°51.350 | 134°40.990 | 80 |
| 2b | N/A | Mapping (End) | 08/Sep/2010 | 08h54 | UTC-6 | 70°58.379 | 135°20.105 | 460 |
| 2b | N/A | Mapping (Start) | 08/Sep/2010 | 09h50 | UTC-6 | 70°55.377 | 135°18.167 | 536 |
| 2b | N/A | Mapping (End) | 08/Sep/2010 | 12h44 | UTC-6 | 71°06.300 | 134°25.890 | 559 |
| 2b | N/A | Mapping (Start) | 08/Sep/2010 | 13h10 | UTC-6 | 71°06.600 | 134°27.530 | 532 |
| 2b | N/A | Mapping (End) | 08/Sep/2010 | 15h10 | UTC-6 | 70°58.500 | 135°05.600 | 551 |
| 2b | BP10-BX06 | Box Core | 08/Sep/2010 | 16h15 | UTC-6 | 70°51.980 | 134°53.560 | 112 |
| 2b | BP10-BX07 | Box Core | 08/Sep/2010 | 17h44 | UTC-6 | 70°46.590 | 134°49.180 | 73 |
| 2b | BP10-BX08 | Box Core | 08/Sep/2010 | 19h00 | UTC-6 | 70°48.940 | 135°10.680 | 159 |
| 2b | N/A | Mapping (Start) | 08/Sep/2010 | 20h42 | UTC-6 | 70°58.885 | 135°04.824 | 507 |
| 2b | N/A | Mapping (End) | 08/Sep/2010 | 21h25 | UTC-6 | 70°55.097 | 135°25.489 | 574 |
| 2b | N/A | Mapping (Start) | 08/Sep/2010 | 21h30 | UTC-6 | 70°55.251 | 135°24.758 | 570 |
| 2b | N/A | Mapping (End) | 08/Sep/2010 | 23h14 | UTC-6 | 71°07.169 | 134°27.748 | 533 |
| 2b | N/A | Mapping (Start) | 08/Sep/2010 | 23h23 | UTC-6 | 71°07.540 | 134°29.260 | 550 |
| 2b | N/A | Mapping (End) | 09/Sep/2010 | 01h05 | UTC-6 | 70°54.740 | 135°29.806 | 581 |
| 2b | N/A | Mapping (Start) | 09/Sep/2010 | 01h29 | UTC-6 | 70°50.960 | 135°22.330 | 459 |
| 2b | N/A | Mapping (End) | 09/Sep/2010 | 03h00 | UTC-6 | 70°01.600 | 134°32.600 | 318 |
| 2b | N/A | Mapping (Start) | 09/Sep/2010 | 03h05 | UTC-6 | 70°01.500 | 134°31.400 | 318 |
| 2b | N/A | Mapping (End) | 09/Sep/2010 | 04h30 | UTC-6 | 70°50.700 | 135°22.100 | 449 |
| 2b | F-10 | Mooring | 09/Sep/2010 | 10h47 | UTC-6 | 70°55.814 | 136°24.801 | 1003 |
| 2b | A1-09 | Mooring | 09/Sep/2010 | 14h05 | UTC-6 | 70°45.410 | 135°59.910 | 672 |
| 2b | BP10-PC26 | Piston Core | 09/Sep/2010 | 19h23 | UTC-6 | 70°51.570 | 134°59.680 | 103 |
| 2b | N/A | Mapping (Start) | 09/Sep/2010 | 21h11 | UTC-6 | 70°50.525 | 70°50.525 | 425 |
| 2b | N/A | Mapping (End) | 10/Sep/2010 | 00h50 | UTC-6 | 71°06.455 | 71°06.455 | 450 |
| 2b | N/A | Mapping (Start) | 10/Sep/2010 | 00h56 | UTC-6 | 71°06.125 | 134°06.145 | 452 |
| 2b | N/A | Mapping (End) | 10/Sep/2010 | 04h15 | UTC-6 | 70°49.900 | 135°22.800 | N/A |
| 2b | N/A | Mapping (Start) | 10/Sep/2010 | 04h20 | UTC-6 | 70°49.600 | 135°22.430 | N/A |
| 2b | N/A | Mapping (End) | 10/Sep/2010 | 05h15 | UTC-6 | 70°56.600 | 135°45.500 | 80 |
| 2b | GSC-PC01 | Piston Core | 10/Sep/2010 | 06h20 | UTC-6 | 70°51.340 | 134°41.090 | 80 |
| 2b | BP10-PC09 | Piston Core | 10/Sep/2010 | 08h49 | UTC-6 | 70°51.571 | 134°26.409 | 78 |
| 2b | BP10-PC08 | Piston Core | 10/Sep/2010 | 10h15 | UTC-6 | 70°53.994 | 134°46.611 | 141 |
| 2b | BP10-PC30 | Piston Core | 10/Sep/2010 | 12h11 | UTC-6 | 70°55.310 | 134°33.150 | 93 |
| 2b | BP10-PC41 | Piston Core | 10/Sep/2010 | 13h19 | UTC-6 | 70°57.350 | 134°40.450 | 238 |
| 2b | GSC10-PC06 | Piston Core | 10/Sep/2010 | 14h43 | UTC-6 | 70°54.870 | 134°48.530 | 190 |
| 2b | GSC10-BX06 | Box Core | 10/Sep/2010 | 15h35 | UTC-6 | 70°54.870 | 134°48.530 | 182 |
| 2b | BP10-BX09 | Box Core | 10/Sep/2010 | 16h55 | UTC-6 | 70°55.530 | 134°22.750 | 111 |
| 2b | BP10-BX13 | Box Core | 10/Sep/2010 | 18h16 | UTC-6 | 70°58.450 | 134°43.110 | 285 |
| 2b | N/A | Mapping (Start) | 10/Sep/2010 | 19h00 | UTC-6 | 70°56.400 | 134°50.660 | 270 |
| 2b | N/A | Mapping (End) | 10/Sep/2010 | 20h25 | UTC-6 | 71°05.857 | 134°05.831 | 460 |
| 2b | N/A | Mapping (Start) | 10/Sep/2010 | 20h30 | UTC-6 | 71°05.533 | 134°06.103 | 465 |
| 2b | N/A | Mapping (End) | 10/Sep/2010 | 22h45 | UTC-6 | 70°49.373 | 135°20.905 | 389 |
| 2b | N/A | Mapping (Start) | 10/Sep/2010 | 22h49 | UTC-6 | 70°49.570 | 135°19.816 | 388 |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| 2b | N/A | Mapping (End) | 11/Sep/2010 | 01h04 | UTC-6 | 71°05.400 | 134°04.810 | 440 |
| 2b | N/A | Mapping (Start) | 11/Sep/2010 | 01h09 | UTC-6 | 71°05.210 | 134°04.270 | 440 |
| 2b | N/A | Mapping (End) | 11/Sep/2010 | 03h53 | UTC-6 | 70°47.440 | 135°26.000 | 355 |
| 2b | N/A | Mapping (Start) | 11/Sep/2010 | 03h52 | UTC-6 | 70°47.700 | 135°25.340 | 220 |
| 2b | N/A | Mapping (End) | 11/Sep/2010 | 04h30 | UTC-6 | 70°51.500 | 135°08.150 | 274 |
| 2b | N/A | Mapping (Start) | 11/Sep/2010 | 04h33 | UTC-6 | 70°51.250 | 135°07.350 | 247 |
| 2b | N/A | Mapping (End) | 11/Sep/2010 | 05h08 | UTC-6 | 70°47.140 | 135°26.400 | 371 |
| 2b | A1-10 | Mooring | 11/Sep/2010 | 09h35 | UTC-6 | 70°45.891 | 136°00.111 | 684 |
| 2b | A2-09 | Mooring | 11/Sep/2010 | 12h30 | UTC-6 | 70°44.610 | 135°54.560 | 607 |
| 2b | BP10-PC18 | Piston Core | 11/Sep/2010 | 15h01 | UTC-6 | 70°46.170 | 135°10.830 | 91 |
| 2b | BP10-PC44 | Piston Core | 11/Sep/2010 | 17h11 | UTC-6 | 70°39.360 | 134°41.840 | 60 |
| 2b | GSC10-BX05 | Box Core | 11/Sep/2010 | 19h09 | UTC-6 | 70°55.730 | 134°50.240 | 254 |
| 2b | BP10-BX16 | Box Core | 11/Sep/2010 | 20h14 | UTC-6 | 71°01.943 | 134°49.352 | 453 |
| 2b | BP10-BX15 | Box Core | 11/Sep/2010 | 21h16 | UTC-6 | 71°05.096 | 134°38.293 | 467 |
| 2b | N/A | Mapping (Start) | 11/Sep/2010 | 22h39 | UTC-6 | 71°04.978 | 134°04.305 | 429 |
| 2b | N/A | Mapping (End) | 12/Sep/2010 | 00h36 | UTC-6 | 70°51.500 | 135°08.000 | 245 |
| 2b | N/A | Mapping (Start) | 12/Sep/2010 | 00h38 | UTC-6 | 70°51.220 | 135°07.680 | 245 |
| 2b | N/A | Mapping (End) | 12/Sep/2010 | 02h31 | UTC-6 | 71°04.810 | 134°03.020 | 417 |
| 2b | N/A | Mapping (Start) | 12/Sep/2010 | 02h34 | UTC-6 | 71°04.660 | 134°02.670 | 417 |
| 2b | N/A | Mapping (End) | 12/Sep/2010 | 04h42 | UTC-6 | 70°49.500 | 135°14.500 | 257 |
| 2b | BP10-PC42 | Piston Core | 12/Sep/2010 | 06h49 | UTC-6 | 70°49.520 | 134°21.610 | 70 |
| 2b | BP10-PC27 | Piston Core | 12/Sep/2010 | 08h22 | UTC-6 | 70°46.989 | 134°25.682 | 69 |
| 2b | BP10-PC43 | Piston Core | 12/Sep/2010 | 09h23 | UTC-6 | 70°47.558 | 134°33.153 | 56 |
| 2b | GSC10-PC05 | Piston Core | 12/Sep/2010 | 10h55 | UTC-6 | 70°55.730 | 134°50.224 | 255 |
| 2b | BP10-PC36 | Piston Core | 12/Sep/2010 | 13h06 | UTC-6 | 70°57.010 | 135°07.110 | 472 |
| 2b | BP10-PC37 | Piston Core | 12/Sep/2010 | 14h23 | UTC-6 | 70°56.240 | 135°09.910 | 489 |
| 2b | BP10-PC01 | Piston Core | 12/Sep/2010 | 15h50 | UTC-6 | 70°54.670 | 135°15.460 | 485 |
| 2b | BP10-BX01 | Box Core | 12/Sep/2010 | 19h18 | UTC-6 | 71°01.550 | 135°33.020 | 772 |
| 2b | BP10-BX02 | Box Core | 12/Sep/2010 | 21h08 | UTC-6 | 71°01.775 | 135°35.157 | 839 |
| 2b | N/A | Mapping (Start) | 12/Sep/2010 | 22h10 | UTC-6 | 71°02.223 | 135°39.184 | 897 |
| 2b | N/A | Mapping (End) | 12/Sep/2010 | 22h26 | UTC-6 | 71°01.282 | 135°30.133 | 730 |
| 2b | N/A | Mapping (Start) | 12/Sep/2010 | 23h35 | UTC-6 | 70°46.573 | 135°25.587 | 248 |
| 2b | N/A | Mapping (End) | 13/Sep/2010 | 02h00 | UTC-6 | 71°04.300 | 134°02.400 | 352 |
| 2b | N/A | Mapping (Start) | 13/Sep/2010 | 02h05 | UTC-6 | 71°04.080 | 134°02.100 | 349 |
| 2b | N/A | Mapping (End) | 13/Sep/2010 | 04h35 | UTC-6 | 70°46.500 | 135°25.000 | N/A |
| 2b | N/A | Mapping (Start) | 13/Sep/2010 | 04h40 | UTC-6 | 70°46.300 | 135°23.800 | N/A |
| 2b | N/A | Mapping (End) | 13/Sep/2010 | 05h50 | UTC-6 | 70°54.600 | 134°45.100 | N/A |
| 2b | N/A | Mapping (Start) | 13/Sep/2010 | 05h55 | UTC-6 | 70°55.000 | 134°43.000 | N/A |
| 2b | N/A | Mapping (End) | 13/Sep/2010 | 07h15 | UTC-6 | 70°46.000 | 134°24.000 | N/A |
| 2b | A2-10 | Mooring | 13/Sep/2010 | 10h56 | UTC-6 | 70°44.652 | 135°54.966 | 609 |
| 2b | BP10-PC23 | Piston Core | 13/Sep/2010 | 15h04 | UTC-6 | 71°00.590 | 135°34.020 | 776 |
| 2b | BP10-PC21 | Piston Core | 13/Sep/2010 | 17h10 | UTC-6 | 71°00.030 | 135°32.850 | 696 |
| 2b | GSC10-BX04 | Box Core | 13/Sep/2010 | 19h27 | UTC-6 | 71°03.810 | 135°07.440 | 629 |
| 2b | BP10-BX10 | Box Core | 13/Sep/2010 | 20h55 | UTC-6 | 71°02.597 | 135°17.388 | 680 |
| 2b | N/A | Mapping (Start) | 13/Sep/2010 | 23h37 | UTC-6 | 71°00.700 | 134°54.150 | 459 |
| 2b | N/A | Mapping (End) | 14/Sep/2010 | 00h05 | UTC-6 | 71°03.900 | 134°41.100 | 429 |
| 2b | N/A | Mapping (Start) | 14/Sep/2010 | 01h10 | UTC-6 | 71°03.820 | 134°02.100 | 375 |
| 2b | N/A | Mapping (End) | 14/Sep/2010 | 02h25 | UTC-6 | 70°55.200 | 134°43.700 | 130 |
| 2b | N/A | Mapping (Start) | 14/Sep/2010 | 02h30 | UTC-6 | 70°55.100 | 134°42.900 | 130 |
| 2b | N/A | Mapping (End) | 14/Sep/2010 | 03h30 | UTC-6 | 71°03.690 | 134°01.580 | N/A |
| 2b | N/A | Mapping (Start) | 14/Sep/2010 | 03h57 | UTC-6 | 71°03.100 | 134°03.500 | 371 |
| 2b | N/A | Mapping (End) | 14/Sep/2010 | 05h37 | UTC-6 | 70°51.700 | 134°57.800 | 290 |
| 2b | N/A | Mapping (Start) | 14/Sep/2010 | 05h46 | UTC-6 | 70°51.700 | 134°57.800 | 290 |
| 2b | N/A | Mapping (End) | 14/Sep/2010 | 07h30 | UTC-6 | 71°51.500 | 134°00.350 | 349 |
| 2b | BP10-PC25 | Piston Core | 14/Sep/2010 | 08h32 | UTC-6 | 70°57.924 | 134°08.281 | 194 |
| 2b | BP10-PC10 | Piston Core | 14/Sep/2010 | 12h12 | UTC-6 | 70°47.170 | 133°47.170 | 81 |
| 2b | BP10-PC13 | Piston Core | 14/Sep/2010 | 19h50 | UTC-6 | 70°40.249 | 133°21.264 | 54 |
| 2b | BP10-PC16 | Piston Core | 15/Sep/2010 | 10h43 | UTC-6 | 70°40.751 | 132°59.300 | 20 |
| 2b | BP10-PC17 | Piston Core | 15/Sep/2010 | 13h13 | UTC-6 | 70°47.040 | 132°35.580 | 30 |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| 2b | BP10-PC07 | Piston Core | 15/Sep/2010 | 16h58 | UTC-6 | 70°35.120 | 132°05.480 | 45 |
| 2b | BP10-PC11 | Piston Core | 15/Sep/2010 | 20h59 | UTC-6 | 70°48.389 | 133°13.641 | 23 |
| 2b | BP10-PC15 | Piston Core | 16/Sep/2010 | 08h34 | UTC-6 | 71°00.992 | 132°41.383 | 67 |
| 2b | BP10-PC33 | Piston Core | 16/Sep/2010 | 14h34 | UTC-6 | 71°00.890 | 135°10.090 | 602 |
| 2b | BP10-PC43 | ROV | 16/Sep/2010 | 17h44 | UTC-6 | 70°47.550 | 134°33.210 | 62 |
| 2b | N/A | Mapping (Start) | 17/Sep/2010 | 00h55 | UTC-6 | 70°46.110 | 135°22.240 | 262 |
| 2b | N/A | Mapping (End) | 17/Sep/2010 | 01h45 | UTC-6 | 70°51.570 | 134°58.280 | 118 |
| 2b | N/A | Mapping (Start) | 17/Sep/2010 | 01h44 | UTC-6 | 70°51.410 | 134°59.080 | 118 |
| 2b | N/A | Mapping (End) | 17/Sep/2010 | 02h30 | UTC-6 | 70°45.990 | 135°24.180 | 254 |
| 2b | N/A | Mapping (Start) | 17/Sep/2010 | 02h35 | UTC-6 | 70°45.680 | 135°23.720 | 250 |
| 2b | N/A | Mapping (End) | 17/Sep/2010 | 05h00 | UTC-6 | 71°02.960 | 134°01.600 | N/A |
| 2b | N/A | Mapping (Start) | 17/Sep/2010 | 06h15 | UTC-6 | 71°13.200 | 134°35.600 | 635 |
| 2b | N/A | Mapping (End) | 17/Sep/2010 | 08h25 | UTC-6 | 70°57.639 | 135°51.482 | 831 |
| 2b | N/A | Mapping (Start) | 17/Sep/2010 | 08h31 | UTC-6 | 70°58.682 | 135°50.749 | 816 |
| 2b | N/A | Mapping (End) | 17/Sep/2010 | 09h28 | UTC-6 | 71°05.660 | 135°18.194 | 731 |
| 2b | GSC10-BX02 | Box Core | 17/Sep/2010 | 10h14 | UTC-6 | 71°11.435 | 135°23.827 | 993 |
| 2b | GSC10-PC02 | Piston Core | 17/Sep/2010 | 12h05 | UTC-6 | 71°11.407 | 135°23.863 | 999 |
| 2b | BP10-PC02 | Piston Core | 17/Sep/2010 | 13h53 | UTC-6 | 71°06.990 | 135°05.930 | 680 |
| 2b | BP10-PC35 | Piston Core | 17/Sep/2010 | 15h37 | UTC-6 | 70°58.900 | 135°17.040 | 600 |
| 2b | BP10-PC38 | Piston Core | 17/Sep/2010 | 18h11 | UTC-6 | 71°02.900 | 135°46.340 | 970 |
| 2b | BP10-BX03 | Box Core | 17/Sep/2010 | 20h06 | UTC-6 | 71°02.374 | 135°38.076 | 883 |
| 2b | BP10-BX04 | Box Core | 17/Sep/2010 | 21h09 | UTC-6 | 71°03.413 | 135°40.252 | 854 |
| 2b | N/A | Mapping (Start) | 17/Sep/2010 | 21h53 | UTC-6 | 71°03.400 | 135°40.600 | 962 |
| 2b | N/A | Mapping (End) | 17/Sep/2010 | 22h40 | UTC-6 | 70°57.982 | 136°06.310 | 960 |
| 2b | N/A | Mapping (Start) | 17/Sep/2010 | 22h47 | UTC-6 | 70°58.738 | 136°08.509 | 979 |
| 2b | N/A | Mapping (End) | 18/Sep/2010 | 01h00 | UTC-6 | 71°14.900 | 134°51.500 | N/A |
| 2b | N/A | Mapping (Start) | 18/Sep/2010 | 02h55 | UTC-6 | 71°03.000 | 134°09.100 | N/A |
| 2b | N/A | Mapping (End) | 18/Sep/2010 | 05h00 | UTC-6 | 70°45.900 | 135°21.400 | 359 |
| 2b | N/A | Mapping (Start) | 18/Sep/2010 | 05h10 | UTC-6 | 70°47.000 | 135°25.500 | 359 |
| 2b | N/A | Mapping (End) | 18/Sep/2010 | 05h35 | UTC-6 | 70°49.200 | 135°15.300 | 300 |
| 2b | BP10-PC24 | Piston Core | 18/Sep/2010 | 08h28 | UTC-6 | 71°08.475 | 135°30.771 | 909 |
| 2b | BP10-PC19 | Piston Core | 18/Sep/2010 | 10h18 | UTC-6 | 71°10°382 | 135°53.910 | 1070 |
| 2b | BP10-PC20 | Piston Core | 18/Sep/2010 | 12h30 | UTC-6 | 71°00.421 | 135°53.053 | 912 |
| 2b | BP10-BX05 | Box Core | 18/Sep/2010 | 14h08 | UTC-6 | 71°02.320 | 135°44.920 | 924 |
| 2b | BP10-PC45 | Piston Core | 18/Sep/2010 | 15h54 | UTC-6 | 70°59.490 | 135°13.710 | 598 |
| 2b | BP10-BX11 | Box Core | 18/Sep/2010 | 18h14 | UTC-6 | 71°04.910 | 134°55.540 | 558 |
| 2b | N/A | Mapping (Start) | 18/Sep/2010 | 20h35 | UTC-6 | 71°05.457 | 134°18.085 | 485 |
| 2b | N/A | Mapping (End) | 18/Sep/2010 | 22h47 | UTC-6 | 70°49.870 | 135°32.133 | 497 |
| 2b | N/A | Mapping (Start) | 18/Sep/2010 | 23h17 | UTC-6 | 70°45.403 | 135°22.807 | 240 |
| 2b | N/A | Mapping (End) | 19/Sep/2010 | 01h50 | UTC-6 | 71°02.950 | 134°00.160 | 320 |
| 2b | N/A | Mapping (Start) | 19/Sep/2010 | 01h55 | UTC-6 | 71°02.810 | 133°59.710 | 317 |
| 2b | N/A | Mapping (End) | 19/Sep/2010 | 04h20 | UTC-6 | 70°45.800 | 135°22.700 | 219 |
| 2b | N/A | Mapping (Start) | 19/Sep/2010 | 04h25 | UTC-6 | 70°45.000 | 135°22.500 | 211 |
| 2b | N/A | Mapping (End) | 19/Sep/2010 | 07h20 | UTC-6 | 71°02.700 | 135°59.500 | N/A |
| 2b | BP10-PC46 | Piston Core | 19/Sep/2010 | 08h42 | UTC-6 | 70°59.268 | 134°33.031 | 259 |
| 2b | BP10-PC04 | Piston Core | 19/Sep/2010 | 10h35 | UTC-6 | 71°03.809 | 134°07.403 | 635 |
| 2b | GSC10-PC03 | Piston Core | 19/Sep/2010 | 12h27 | UTC-6 | 71°10.192 | 135°21.217 | 880 |
| 2b | GSC10-BX03 | Box Core | 19/Sep/2010 | 13h32 | UTC-6 | 71°10.189 | 135°21.209 | 880 |
| 2b | N/A | Mapping (Start) | 19/Sep/2010 | 14h20 | UTC-6 | 71°12.500 | 135°22.100 | 880 |
| 2b | N/A | Mapping (End) | 19/Sep/2010 | 18h00 | UTC-6 | 70°57.000 | 135°45.700 | 251 |
| 2b | N/A | Surface Buoy | 19/Sep/2010 | 18h33 | UTC-6 | 70°56.830 | 134°44.980 | 250 |
| 2b | N/A | Mapping (Start) | 19/Sep/2010 | 20h13 | UTC-6 | 70°54.635 | 134°43.720 | 118 |
| 2b | N/A | Mapping (End) | 19/Sep/2010 | 21h30 | UTC-6 | 71°03.507 | 134°00.850 | 359 |
| 2b | N/A | Mapping (Start) | 19/Sep/2010 | 21h40 | UTC-6 | 71°02.544 | 133°59.386 | 317 |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 00h22 | UTC-6 | 71°02.540 | 133°59.160 | 197 |
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | 00h27 | UTC-6 | 71°44.830 | 135°21.940 | 218 |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 02h50 | UTC-6 | 71°02.400 | 133°58.880 | 305 |
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | 02h53 | UTC-6 | 71°02.270 | 133°58.610 | 305 |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 06h00 | UTC-6 | 70°55.500 | 134°59.700 | N/A |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | N/A | UTC-6 | N/A | N/A | N/A |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 07h10 | UTC-6 | N/A | N/A | 440 |
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | 08h36 | UTC-6 | 71°02.979 | 134°51.398 | 491 |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 09h07 | UTC-6 | 71°07.826 | 135°03.429 | 692 |
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | 09h16 | UTC-6 | 71°08.822 | 135°03.072 | 758 |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 09h37 | UTC-6 | 71°10.867 | 134°52.173 | 733 |
| 2b | N/A | MVP (Start) | 20/Sep/2010 | 09h50 | UTC-6 | 71°10.183 | 134°49.144 | 673 |
| 2b | N/A | MVP (End) | 20/Sep/2010 | 12h40 | UTC-6 | 70°52.200 | 134°11.500 | 70 |
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | 14h20 | UTC-6 | 71°02.130 | 133°58.330 | 300 |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 16h50 | UTC-6 | 70°44.500 | 135°21.400 | 100 |
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | 16h55 | UTC-6 | 70°44.400 | 135°21.000 | 100 |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 19h30 | UTC-6 | 71°01.900 | 133°58.320 | 300 |
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | 19h34 | UTC-6 | 71°01.800 | 133°58.200 | 305 |
| 2b | N/A | Mapping (End) | 20/Sep/2010 | 21h54 | UTC-6 | 70°44.320 | 135°20.874 | 140 |
| 2b | N/A | Mapping (Start) | 20/Sep/2010 | 22h00 | UTC-6 | 70°44.323 | 135°19.872 | 137 |
| 2b | N/A | Mapping (End) | 21/Sep/2010 | 00h41 | UTC-6 | 71°01.730 | 133°57.510 | 303 |
| 2b | N/A | Mapping (Start) | 21/Sep/2010 | 00h43 | UTC-6 | 71°01.670 | 133°57.370 | 303 |
| 2b | N/A | Mapping (End) | 21/Sep/2010 | 03h11 | UTC-6 | 70°44.040 | 135°20.430 | 102 |
| 2b | N/A | Mapping (Start) | 21/Sep/2010 | 03h20 | UTC-6 | 70°43.930 | 135°20.210 | 106 |
| 2b | N/A | Mapping (End) | 21/Sep/2010 | 06h00 | UTC-6 | 71°01.500 | 133°56.700 | 266 |
| 2b | N/A | Mapping (Start) | 21/Sep/2010 | 06h08 | UTC-6 | 71°01.400 | 133°57.000 | 266 |
| 2b | N/A | Mapping (End) | 21/Sep/2010 | 06h40 | UTC-6 | 70°59.700 | 134°14.000 | N/A |
| 2b | N/A | Mapping (Start) | 21/Sep/2010 | 06h50 | UTC-6 | 70°57.700 | 134°13.500 | N/A |
| 2b | N/A | Mapping (End) | 21/Sep/2010 | 07h25 | UTC-6 | 70°59.000 | 134°70.500 | 254 |
| 2b | CA04-10 | Mooring | 21/Sep/2010 | 10h55 | UTC-6 | 71°04.865 | 133°37.866 | 308 |
| 2b | CA16-MMP-09 | Mooring | 22/Sep/2010 | 18h17 | UTC-6 | 71°45.180 | 126°30.040 | 352 |
| **Leg 3a** | | | | | | | | |
| 3a | CA16-09 | Mooring | 24/Sep/2010 | 12h17 | UTC-6 | 71°48.450 | 126°32.150 | 307 |
| 3a | CA16-MMP-09 | Mooring | 24/Sep/2010 | 13h32 | UTC-6 | 71°47.620 | 126°31.780 | 325 |
| 3a | CA05-09 | Mooring | 24/Sep/2010 | 16h43 | UTC-6 | 71°19.660 | 127°35.730 | 214 |
| 3a | CA05-MMP-09 | Mooring | 24/Sep/2010 | 18h44 | UTC-6 | 71°25.630 | 127°39.390 | 255 |
| 3a | LF-8 | Hydrophone | 25/Sep/2010 | 09h22 | UTC-6 | 70°50.870 | 134°06.860 | 68 |
| 3a | LF-1 | Hydrophone | 25/Sep/2010 | 10h25 | UTC-6 | 70°48.360 | 134°19.730 | 69 |
| 3a | LF-5 | Hydrophone | 25/Sep/2010 | 11h25 | UTC-6 | 70°53.340 | 134°17.500 | 80 |
| 3a | HF-2 | Hydrophone | 25/Sep/2010 | 12h52 | UTC-6 | 70°52.280 | 134°28.360 | 81 |
| 3a | N/A | Weather Balloon | 25/Sep/2010 | 12h40 | UTC-6 | 70°52.290 | 134°28.379 | 80 |
| 3a | LF-6 | Hydrophone | 25/Sep/2010 | 15h35 | UTC-6 | 70°55.830 | 134°32.930 | 104 |
| 3a | LF-3 | Hydrophone | 25/Sep/2010 | 16h23 | UTC-6 | 70°53.260 | 134°46.018 | 108 |
| 3a | HF-3 | Hydrophone | 25/Sep/2010 | 17h00 | UTC-6 | 70°55.810 | 134°46.550 | 228 |
| 3a | LF-7 | Hydrophone | 25/Sep/2010 | 18h19 | UTC-6 | 70°58.270 | 134°46.040 | 303 |
| 3a | LF-4 | Hydrophone | 25/Sep/2010 | 19h13 | UTC-6 | 70°55.850 | 134°58.620 | 345 |
| 3a | N/A | Mapping (Start) | 25/Sep/2010 | 20h40 | UTC-6 | 70°56.810 | 134°18.600 | 172 |
| 3a | N/A | Mapping (End) | 25/Sep/2010 | 22h22 | UTC-6 | 70°44.190 | 135°17.360 | 97 |
| 3a | N/A | Weather Balloon | 26/Sep/2010 | 00h30 | UTC-6 | 70°57.484 | 134°14.247 | 181 |
| 3a | HF-4 | Hydrophone | 26/Sep/2010 | 08h00 | UTC-6 | 70°45.540 | 135°08.940 | 77 |
| 3a | HF-5 | Hydrophone | 26/Sep/2010 | 09h33 | UTC-6 | 70°53.330 | 135°22.230 | 524 |
| 3a | HF-4 | Hydrophone | 26/Sep/2010 | 10h55 | UTC-6 | 71°06.042 | 135°23.011 | 641 |
| 3a | N/A | Mapping (Start) | 26/Sep/2010 | 12h15 | UTC-6 | 71°03.877 | 134°52.204 | 519 |
| 3a | N/A | Weather Balloon | 26/Sep/2010 | 12h38 | UTC-6 | 71°06.430 | 134°40.030 | 499 |
| 3a | N/A | Mapping (End) | 26/Sep/2010 | 14h21 | UTC-6 | 71°10.170 | 134°40.000 | 599 |
| 3a | N/A | Weather Balloon | 27/Sep/2010 | 00h00 | UTC-6 | 72°40.560 | 130°37.740 | 1531 |
| 3a | N/A | Weather Balloon | 28/Sep/2010 | 00h35 | UTC-6 | 74°23.770 | 129°09.400 | 411 |
| 3a | N/A | On Ice Sampling | 28/Sep/2010 | 09h05 | UTC-6 | 74°21.840 | 129°10.150 | 428 |
| 3a | N/A | Weather Balloon | 28/Sep/2010 | 12h11 | UTC-6 | 74°24.460 | 129°09.550 | 287 |
| 3a | NWBI-1 | Nutrient | 28/Sep/2010 | 17h01 | UTC-6 | 74°40.280 | 128°32.550 | 379 |
| 3a | N/A | On Ice Sampling | 28/Sep/2010 | 19h29 | UTC-6 | 74°39.930 | 128°15.500 | 378 |
| 3a | N/A | On Ice Sampling | 29/Sep/2010 | 11h25 | UTC-6 | 74°36.960 | 128°21.205 | 379 |
| 3a | N/A | On Ice Sampling | 29/Sep/2010 | 15h30 | UTC-6 | 74°45.340 | 127°56.620 | 367 |
| 3a | N/A | On Ice Sampling | 30/Sep/2010 | 11h20 | UTC-6 | 71°55.860 | 125°20.520 | 17 |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| 3a | N/A | Weather Balloon | 30/Sep/2010 | 13h20 | UTC-6 | 71°55.875 | 125°29.513 | 24 |
| 3a | CA16-10 | Mooring | 30/Sep/2010 | 19h36 | UTC-6 | 71°47.178 | 126°29.762 | 318 |
| 3a | 437 | Full | 30/Sep/2010 | 20h44 | UTC-6 | 71°46.800 | 126°32.600 | 341 |
| 3a | 410 | Nutrient | 01/Oct/2010 | 01h33 | UTC-6 | 71°41.830 | 126°29.490 | 410 |
| 3a | 412 | Nutrient | 01/Oct/2010 | 03h19 | UTC-6 | 71°33.800 | 126°55.150 | 419 |
| 3a | 414 | Nutrient | 01/Oct/2010 | 04h51 | UTC-6 | 71°25.350 | 127°21.780 | 306 |
| 3a | 416 | Nutrient | 01/Oct/2010 | 06h17 | UTC-6 | 71°17.550 | 127°45.330 | 160 |
| 3a | 418 | Nutrient | 01/Oct/2010 | 07h33 | UTC-6 | 71°09.810 | 128°10.230 | 66 |
| 3a | N/A | Mapping | 01/Oct/2010 | 10h00 | UTC-6 | 71°28.300 | 127°30.280 | 312 |
| 3a | CA05-MMP-10 | Mooring | 01/Oct/2010 | 11h25 | UTC-6 | 71°24.990 | 127°39.690 | 238 |
| 3a | N/A | Weather Balloon | 01/Oct/2010 | 12h39 | UTC-6 | 71°24.740 | 127°41.550 | 232 |
| 3a | N/A | Mapping (Start) | 01/Oct/2010 | 13h47 | UTC-6 | 71°24.970 | 127°43.580 | 225 |
| 3a | N/A | Mapping (End) | 01/Oct/2010 | 15h30 | UTC-6 | 71°42.510 | 126°55.181 | 439 |
| 3a | CA16-MMP-10 | Mooring | 01/Oct/2010 | 16h29 | UTC-6 | 71°45.310 | 126°30.520 | 352 |
| 3a | Tuktoyaktuk | Weather Balloon | 02/Oct/2010 | 12h38 | UTC-6 | 69°51.933 | 133°20.440 | 16 |
| 3a | Pullen Pingos | Mapping (Start) | 03/Oct/2010 | 01h18 | UTC-6 | 70°59.363 | 133°58.999 | 218 |
| 3a | Pullen Pingos | Mapping (End) | 03/Oct/2010 | 02h30 | UTC-6 | 70°56.790 | 134°13.777 | 158 |
| 3a | Pullen Pingos | Mapping (Start) | 03/Oct/2010 | 02h30 | UTC-6 | 70°56.790 | 134°13.770 | 158 |
| 3a | Pullen Pingos | Mapping (End) | 03/Oct/2010 | 14h14 | UTC-6 | 70°56.390 | 134°13.510 | 143 |
| 3a | N/A | Mapping | 03/Oct/2010 | 14h37 | UTC-6 | 70°56.543 | 134°11.972 | 149 |
| 3a | N/A | Mapping (Start) | 03/Oct/2010 | 17h15 | UTC-6 | 70°44.149 | 135°16.982 | 86 |
| 3a | N/A | Mapping (End) | 03/Oct/2010 | 23h45 | UTC-6 | 70°53.260 | 134°27.800 | N/A |
| 3a | N/A | Mapping (Start) | 04/Oct/2010 | 00h45 | UTC-6 | 71°05.030 | 134°17.400 | 481 |
| 3a | N/A | Mapping (End) | 04/Oct/2010 | 03h08 | UTC-6 | 71°14.768 | 134°34.793 | 860 |
| 3a | N/A | Weather Balloon | 04/Oct/2010 | 12h52 | UTC-6 | 71°47.200 | 130°00.840 | 289 |
| 3a | N/A | Weather Balloon | 05/Oct/2010 | 13h24 | UTC-6 | 71°55.915 | 125°21.454 | 16 |
| 3a | 408 | Full | 06/Oct/2010 | 14h35 | UTC-6 | 71°19.050 | 127°35.600 | 205 |
| 3a | CA05-10 | Mooring | 06/Oct/2010 | 15h10 | UTC-6 | 71°19.050 | 127°35.540 | 205 |
| 3a | CA08-10 | Mooring | 06/Oct/2010 | 20h40 | UTC-6 | 71°00.220 | 126°04.376 | 392 |
| 3a | 407 | Full | 06/Oct/2010 | 22h00 | UTC-6 | 71°01.050 | 126°02.233 | 393 |
| 3a | N/A | Mapping (Start) | 07/Oct/2010 | 02h27 | UTC-6 | 70°32.890 | 123°15.300 | 419 |
| 3a | N/A | Mapping (End) | 08/Oct/2010 | 07h09 | UTC-6 | 70°27.150 | 123°10.100 | 479 |
| **Leg 3b** | | | | | | | | |
| 3b | 405 | Basic | 08/Oct/2010 | 08h10 | UTC-6 | 70°38.149 | 123°02.376 | 612 |
| 3b | 450 | Basic | 09/Oct/2010 | 00h51 | UTC-6 | 72°03.100 | 119°46.580 | 102 |
| 3b | 308 | Basic | 10/Oct/2010 | 18h07 | UTC-6 | 74°05.210 | 108°24.810 | 564 |
| 3b | MS01-10 | Mooring | 10/Oct/2010 | 19h03 | UTC-6 | 74°05.590 | 108°24.790 | 524 |
| 3b | 308 | Full | 10/Oct/2010 | 20h15 | UTC-6 | 74°06.177 | 108°24.698 | 544 |
| 3b | 304 | Full | 12/Oct/2010 | 15h10 | UTC-6 | 74°15.060 | 091°31.040 | 315 |
| 3b | 324 | Nutrient | 14/Oct/2010 | 12h29 | UTC-4 | 73°52.590 | 080°10.440 | 797 |
| 3b | 323 | Basic | 14/Oct/2010 | 15h41 | UTC-4 | 76°11.260 | 079°46.540 | 778 |
| 3b | 115 | Full | 15/Oct/2010 | 19h26 | UTC-4 | 76°20.000 | 071°11.130 | 655 |
| 3b | 114 | CTD | 16/Oct/2010 | 02h32 | UTC-4 | 76°19.430 | 071°46.470 | 633 |
| 3b | 113 | Nutrient | 16/Oct/2010 | 04h00 | UTC-4 | 76°19.580 | 072°12.930 | 561 |
| 3b | 112 | CTD | 16/Oct/2010 | 05h17 | UTC-4 | 76°19.050 | 072°41.940 | 568 |
| 3b | 111 | Basic | 16/Oct/2010 | 07h14 | UTC-4 | 76°18.530 | 073°15.440 | 608 |
| 3b | 110 | Nutrient | 16/Oct/2010 | 13h15 | UTC-4 | 76°18.120 | 073°36.870 | 548 |
| 3b | 109 | CTD | 16/Oct/2010 | 15h11 | UTC-4 | 76°15.960 | 074°07.410 | 448 |
| 3b | 108 | Full | 16/Oct/2010 | 17h32 | UTC-4 | 76°16.220 | 074°43.430 | 458 |
| 3b | 107 | Nutrient | 17/Oct/2010 | 00h56 | UTC-4 | 76°16.440 | 075°01.650 | 426 |
| 3b | 106 | CTD | 17/Oct/2010 | 02h20 | UTC-4 | 76°18.290 | 075°22.710 | 384 |
| 3b | 105 | Basic | 17/Oct/2010 | 10h10 | UTC-4 | 76°20.580 | 075°48.350 | 330 |
| 3b | 104 | CTD | 17/Oct/2010 | 17h54 | UTC-4 | 76°19.000 | 076°13.740 | 169 |
| 3b | N/A | Mapping (Start) | 19/Oct/2010 | 12h20 | UTC-4 | 71°37.340 | 070°13.960 | 580 |
| 3b | N/A | Mapping (End) | 19/Oct/2010 | 17h49 | UTC-4 | 71°11.300 | 068°03.900 | 555 |
| 3b | N/A | Mapping (Start) | 21/Oct/2010 | 18h32 | UTC-4 | 62°31.990 | 066°11.750 | 380 |
| 3b | N/A | Mapping (End) | 22/Oct/2010 | 05h30 | UTC-4 | 63°06.200 | 067°30.700 | 591 |
| **Leg 3c** | | | | | | | | |
| 3c | N/A | Mapping (Start) | 23/Oct/2010 | 18h30 | UTC-4 | 59°10.800 | 063°15.000 | 80 |

| Leg | Station ID | Station Type | Local Date | Local Time | UTC to local | Latitude (N) | Longitude (W) | Depth (m) |
|---|---|---|---|---|---|---|---|---|
| 3c | N/A | Mapping (End) | 23/Oct/2010 | 21h15 | UTC-4 | 59°06.700 | 063°23.450 | 140 |
| 3c | N/A | MVP (Start) | 23/Oct/2010 | 21h30 | UTC-4 | 59°06.560 | 063°23.280 | 140 |
| 3c | N/A | MVP (End) | 23/Oct/2010 | 23h55 | UTC-4 | 58°59.290 | 063°53.500 | 55 |
| 3c | 600 | Basic | 24/Oct/2010 | 02h01 | UTC-4 | 59°05.750 | 063°26.340 | 192 |
| 3c | 601 | CTD | 24/Oct/2010 | 08h33 | UTC-4 | 59°03.160 | 063°36.510 | 168 |
| 3c | 602 | Basic | 24/Oct/2010 | 10h27 | UTC-4 | 59°03.240 | 063°52.020 | 165 |
| 3c | 604 | Nutrient | 24/Oct/2010 | 17h24 | UTC-4 | 58°59.880 | 063°53.580 | 60 |
| 3c | Nachvak Fjord | N/A | 24/Oct/2010 | 19h27 | UTC-4 | 59°06.230 | 063°24.340 | 185 |
| 3c | 617 | Basic | 25/Oct/2010 | 01h38 | UTC-4 | 58°30.060 | 062°41.350 | 131 |
| 3c | 610 | Nutrient | 25/Oct/2010 | 06h37 | UTC-4 | 58°31.200 | 062°50.310 | 124 |
| 3c | N/A | Mapping | 25/Oct/2010 | 07h38 | UTC-4 | 58°29.770 | 062°54.490 | 62 |
| 3c | 612 | CTD | 25/Oct/2010 | 09h24 | UTC-4 | 58°28.290 | 062°59.200 | 48 |
| 3c | 613 | Nutrient | 25/Oct/2010 | 10h26 | UTC-4 | 58°29.030 | 063°13.110 | 255 |
| 3c | 614 | CTD | 25/Oct/2010 | 13h47 | UTC-4 | 58°24.080 | 063°23.360 | 93 |
| 3c | 615 | Basic | 25/Oct/2010 | 14h45 | UTC-4 | 58°19.180 | 063°32.450 | 129 |
| 3c | 615 | MVP (Start) | 25/Oct/2010 | 18h18 | UTC-4 | 58°20.060 | 063°31.840 | 141 |
| 3c | 615 | MVP (End) | 25/Oct/2010 | 21h58 | UTC-4 | 58°30.102 | 062°40.788 | 134 |
| 3c | 633 | Basic | 26/Oct/2010 | 08h40 | UTC-4 | 57°36.310 | 061°54.310 | 170 |
| 3c | 632 | Nutrient | 26/Oct/2010 | 14h27 | UTC-4 | 57°34.100 | 062°03.090 | 83 |
| 3c | 631 | Nutrient | 26/Oct/2010 | 16h37 | UTC-4 | 57°29.660 | 062°11.400 | 87 |
| 3c | 630 | Basic | 26/Oct/2010 | 18h09 | UTC-4 | 57°28.330 | 062°26.810 | 43 |
| 3c | N/A | MVP (Start) | 26/Oct/2010 | 20h46 | UTC-4 | 57°27.430 | 062°24.370 | 59 |
| 3c | N/A | MVP (End) | 26/Oct/2010 | 23h23 | UTC-4 | 57°37.230 | 062°51.660 | 161 |
| 3c | N/A | MVP | 27/Oct/2010 | 09h48 | UTC-4 | 56°26.152 | 061°22.677 | 125 |
| 3c | 624 | Basic | 27/Oct/2010 | 13h03 | UTC-4 | 56°25.120 | 062°04.260 | 56 |
| 3c | 623 | Nutrient | 27/Oct/2010 | 16h20 | UTC-4 | 56°26.800 | 061°56.470 | 110 |
| 3c | 622 | Nutrient | 27/Oct/2010 | 17h43 | UTC-4 | 56°25.010 | 061°44.020 | 79 |
| 3c | 621 | CTD | 27/Oct/2010 | 20h54 | UTC-4 | 56°25.000 | 061°31.170 | 110 |
| 3c | 620 | Basic | 27/Oct/2010 | 21h15 | UTC-4 | 56°24.020 | 061°12.700 | 79 |

## Appendix 2: Scientific Log

| 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 | Labrador Sea | CTD | 05/Jul/2010 | 18h24 | UTC-4 | 54°58.320 | 56°39.850 | CTD-Rosette ↓ | 180 | 258 | 248 | 8 | 4.0 | 3.8 | 1020.6 | 93 | N/A |
| 1a | Labrador Sea | CTD | 05/Jul/2010 | 18h28 | UTC-4 | 54°58.300 | 56°39.900 | CTD-Rosette ↑ | 181 | 253 | 245 | 8 | 4.0 | 3.7 | 1020.6 | 93 | N/A |
| 1a | Labrador Sea | CTD | 05/Jul/2010 | 18h30 | UTC-4 | 54°58.296 | 056°39.925 | CTD-Rosette ↓ | 183 | 261 | 241 | 8 | 4.1 | 3.7 | 1020.8 | 92 | N/A |
| 1a | Labrador Sea | CTD | 05/Jul/2010 | 18h36 | UTC-4 | 54°58.240 | 056°39.925 | CTD-Rosette (bottom) | 182 | 225 | 262 | 9 | 4.0 | 3.5 | 1020.8 | 92 | N/A |
| 1a | Labrador Sea | CTD | 05/Jul/2010 | 18h41 | UTC-4 | 54°58.192 | 056°39.939 | CTD-Rosette ↑ | 183 | 220 | 289 | 10 | 3.9 | 3.4 | 1020.9 | 93 | N/A |
| 1a | 356 | Nutrient | 07/Jul/2010 | 04h40 | UTC-4 | 60°48.400 | 064°43.834 | Water Sampling ↓↑ | 351 | 350 | 146 | 13 | 5.7 | 2.8 | 1019.0 | 78 | Bergy |
| 1a | 356 | Nutrient | 07/Jul/2010 | 04h41 | UTC-4 | 60°48.387 | 064°43.500 | CTD-Rosette ↓ | 353 | 120 | 146 | 15 | 5.7 | 2.8 | 1019.2 | 78 | Bergy |
| 1a | 356 | Nutrient | 07/Jul/2010 | 05h27 | UTC-4 | 60°49.044 | 064°41.846 | CTD-Rosette ↑ | 384 | 125 | 151 | 13 | 6.2 | 2.5 | 1019.2 | 77 | Bergy |
| 1a | 356 | Nutrient | 07/Jul/2010 | 05h49 | UTC-4 | 60°42.449 | 064°43.135 | Vertical Net Tow ↓ | 352 | 235 | 153 | 9 | 6.0 | 2.6 | 1019.4 | 75 | Bergy |
| 1a | 356 | Nutrient | 07/Jul/2010 | 05h55 | UTC-4 | 60°48.426 | 064°43.218 | Vertical Net Tow ↑ | 353 | 235 | 156 | 8 | 5.9 | 2.6 | 1019.4 | 75 | Bergy |
| 1a | 354 | Nutrient | 07/Jul/2010 | 06h50 | UTC-4 | 60°58.361 | 064°46.295 | Water Sampling ↓↑ | 570 | 329 | 172 | 13 | 4.3 | 2.7 | 1019.6 | 84 | Bergy |
| 1a | 354 | Nutrient | 07/Jul/2010 | 07h15 | UTC-4 | 60°58.158 | 064°45.734 | CTD-Rosette ↓ | 582 | 275 | 121 | 10 | 4.4 | 3.3 | 1019.4 | 84 | Bergy |
| 1a | 354 | Nutrient | 07/Jul/2010 | 08h15 | UTC-4 | 60°58.500 | 064°42.000 | CTD-Rosette ↑ | 550 | 70 | 190 | 10 | 5.5 | 3.3 | 1019.3 | 80 | Bergy |
| 1a | 352 | Nutrient | 07/Jul/2010 | 09h30 | UTC-4 | 61°09.088 | 064°48.392 | Water Sampling ↓↑ | 442 | 91 | 251 | 5 | 4.9 | 3.6 | 1019.0 | 83 | Bergy |
| 1a | 352 | Nutrient | 07/Jul/2010 | 09h36 | UTC-4 | 61°09.000 | 064°48.200 | CTD-Rosette ↓ | 415 | 105 | 250 | 5 | 4.9 | 3.6 | 1019.0 | 83 | Bergy |
| 1a | 352 | Nutrient | 07/Jul/2010 | 10h15 | UTC-4 | 61°08.600 | 064°48.000 | CTD-Rosette ↑ | 354 | 287 | 225 | 7 | 5.8 | 3.3 | 1019.1 | 77 | Bergy |
| 1a | 352 | Nutrient | 07/Jul/2010 | 10h25 | UTC-4 | 61°08.500 | 064°48.000 | Hg Sampling ↓ | 345 | 341 | 225 | 7 | 5.9 | 3.2 | 1019.1 | 76 | Bergy |
| 1a | 352 | Nutrient | 07/Jul/2010 | 10h30 | UTC-4 | 61°08.400 | 064°48.100 | Hg Sampling ↑ | 338 | 344 | 225 | 7 | 5.5 | 3.2 | 1019.1 | 78 | Bergy |
| 1a | 362 | Nutrient | 08/Jul/2010 | 03h35 | UTC-4 | N/A | N/A | Water Sampling ↓↑ | 287 | 265 | 120 | 13 | 5.1 | 4.6 | 1008.0 | 91 | 0/10 |
| 1a | 362 | Nutrient | 08/Jul/2010 | 03h55 | UTC-4 | N/A | N/A | CTD-Rosette ↓ | 298 | 103 | 103 | 13 | 5.2 | 4.5 | 1007.7 | 90 | 0/10 |
| 1a | 362 | Nutrient | 08/Jul/2010 | 04h29 | UTC-4 | N/A | N/A | CTD-Rosette ↑ | 292 | 74 | 104 | 14 | 5.1 | 4.2 | 1007.4 | 91 | 0/10 |
| 1a | 362 | Nutrient | 08/Jul/2010 | 04h39 | UTC-4 | N/A | N/A | Vertical Net Tow ↓ | 291 | 100 | 99 | 14 | 5.2 | 4.1 | 1007.3 | 91 | 0/10 |
| 1a | 362 | Nutrient | 08/Jul/2010 | 04h41 | UTC-4 | N/A | N/A | Vertical Net Tow ↑ | 291 | 114 | 95 | 15 | 5.2 | 4.1 | 1007.3 | 91 | 0/10 |
| 1a | 360 | Nutrient | 08/Jul/2010 | 07h00 | UTC-4 | 62°25.483 | 071°04.749 | Water Sampling ↓↑ | 338 | 83 | 107 | 15 | 6.4 | 5.0 | 1007.1 | 82 | 0/10 |
| 1a | 360 | Nutrient | 08/Jul/2010 | 07h11 | UTC-4 | 62°25.561 | 071°04.542 | CTD-Rosette ↓ | 335 | 89 | 95 | 15 | 6.5 | 5.0 | 1007.2 | 80 | 0/10 |
| 1a | 360 | Nutrient | 08/Jul/2010 | 07h53 | UTC-4 | 62°26.100 | 071°04.700 | CTD-Rosette ↑ | 336 | 86 | 105 | 17 | 6.8 | 5.2 | 1006.9 | 77 | 0/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 02h57 | UTC-4 | 64°35.100 | 079°06.400 | Water Sampling ↓↑ | 204 | 190 | 70 | 8 | 5.7 | 2.1 | 1005.2 | 84 | 0/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 03h08 | UTC-4 | 64°35.300 | 079°06.400 | CTD-Rosette ↓ | 208 | 57 | 70 | 8 | 5.8 | 2.7 | 1005.2 | 84 | 0/10 |

| 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 | | | | | |
| 1a | 350 | Basic | 09/Jul/2010 | 03h35 | UTC-4 | 64°35.000 | 079°06.000 | CTD-Rosette ↑ | 194 | 34 | 40 | 6 | 5.8 | 3.0 | 1005.1 | 84 | 0/10 |
| 1a | 370 | Nutrient | 09/Jul/2010 | 04h05 | UTC-4 | 64°35.528 | 079°06.343 | SHO Profile ↓ | 178 | 14 | 29 | 14 | 4.7 | 3.7 | 1004.9 | 84 | 1/10 |
| 1a | 370 | Nutrient | 09/Jul/2010 | 04h12 | UTC-4 | 64°35.494 | 079°06.264 | SHO Profile ↓ | 180 | 20 | 29 | 14 | 4.7 | 3.7 | 1004.9 | 84 | 1/10 |
| 1a | 370 | Nutrient | 09/Jul/2010 | 04h20 | UTC-4 | 64°35.431 | 079°06.212 | SHO Profile ↑ | 178 | 8 | 33 | 12 | 4.7 | 3.7 | 1004.9 | 84 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 07h25 | UTC-4 | 64°26.555 | 080°27.405 | PNF ↓↑ | 381 | 50 | 34 | 13 | 4.6 | 4.0 | 1004.9 | 90 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 07h35 | UTC-4 | 64°26.558 | 080°27.810 | Secchi Disk ↓↑ | 381 | 44 | 35 | 11 | 4.6 | 4.0 | 1004.9 | 90 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 07h37 | UTC-4 | 64°26.604 | 080°27.515 | SHO Profile ↓ | 381 | 24 | 34 | 11 | 4.6 | 4.1 | 1004.8 | 90 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 07h46 | UTC-4 | 64°26.624 | 080°27.530 | SHO Profile ↑ | 380 | 18 | 32 | 12 | 4.6 | 4.1 | 1004.8 | 90 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 07h50 | UTC-4 | 64°26.640 | 080°27.547 | SHO Profile ↓ | 380 | 23 | 31 | 13 | 4.6 | 4.1 | 1004.8 | 90 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 08h02 | UTC-4 | 64°26.680 | 080°27.730 | SHO Profile ↑ | 380 | 20 | 40 | 11 | 4.7 | 4.1 | 1004.8 | 89 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 08h08 | UTC-4 | 64°26.690 | 080°27.830 | Water Sampling ↓↑ | 381 | 16 | 45 | 12 | 4.7 | 4.1 | 1004.8 | 89 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 08h13 | UTC-4 | 64°26.720 | 080°27.930 | CTD-Rosette ↓ | 380 | 6 | 45 | 12 | 4.7 | 4.1 | 1004.8 | 89 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 08h57 | UTC-4 | 64°26.900 | 080°28.480 | CTD-Rosette ↑ | 383 | 42 | 50 | 10 | 4.4 | 4.1 | 1004.8 | 90 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 09h15 | UTC-4 | 64°27.030 | 080°28.670 | Zodiac Deployed (water sampling) | 382 | 51 | 55 | 10 | 4.3 | 4.2 | 1004.8 | 89 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 09h30 | UTC-4 | 64°27.110 | 080°28.850 | Vertical Net Tow ↓ | 381 | 66 | 70 | 4 | 3.9 | 4.3 | 1004.7 | 90 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 10h15 | UTC-4 | 64°27.500 | 080°29.000 | Zodiac Recovered | 392 | 9 | 350 | 7 | 3.9 | 4.4 | 1004.6 | 93 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 10h25 | UTC-4 | 64°27.560 | 080°29.060 | Vertical Net Tow ↑ | 413 | 7 | 25 | 7 | 4.0 | 4.4 | 1004.4 | 93 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 10h51 | UTC-4 | 64°27.720 | 080°29.570 | Zodiac Deployed (water sampling) | 386 | 21 | 30 | 10 | 4.3 | 4.5 | 1004.3 | 93 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 11h12 | UTC-4 | 64°27.770 | 080°30.020 | Zodiac Recovered (mechanical problem) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | 350 | Basic | 09/Jul/2010 | 11h43 | UTC-4 | 64°27.740 | 080°30.730 | CTD-Rosette ↓ | 382 | 52 | 45 | 9 | 4.1 | 4.6 | 1004.2 | 93 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 12h28 | UTC-4 | 64°27.920 | 080°31.050 | CTD-Rosette ↑ | 382 | 57 | 50 | 8 | 3.8 | 4.5 | 1004.3 | 94 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 12h42 | UTC-4 | 64°28.020 | 080°31.060 | Zodiac Deployed | 382 | 50 | 50 | 7 | 3.7 | 4.6 | 1004.3 | 95 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 13h17 | UTC-4 | 64°26.260 | 080°27.620 | Vertical Net Tow ↓ | 380 | 40 | 40 | 7 | 3.7 | 4.6 | 1004.0 | 97 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 13h40 | UTC-4 | 64°26.120 | 080°27.750 | Vertical Net Tow ↑ | 378 | 56 | 40 | 10 | 4.1 | 4.7 | 1004.1 | 99 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 14h00 | UTC-4 | 64°26.640 | 080°27.640 | Horizontal Net Tow ↓ | 381 | 16 | 40 | 10 | 3.9 | 4.6 | 1004.2 | 99 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 14h14 | UTC-4 | 64°26.720 | 080°28.440 | Horizontal Net Tow ↑ | 380 | 219 | 40 | 9 | 4.1 | 4.6 | 1004.3 | 99 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 14h25 | UTC-4 | 64°26.490 | 080°28.720 | Vertical Net Tow ↓ | 378 | 203 | 50 | 11 | 4.2 | 4.6 | 1004.4 | 99 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 14h46 | UTC-4 | 64°26.480 | 080°28.720 | Vertical Net Tow ↑ | 378 | 188 | 50 | 7 | 3.8 | 4.6 | 1004.4 | 99 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 14h58 | UTC-4 | 64°26.120 | 080°28.590 | Hg Sampling (test) ↓ | 378 | 159 | 60 | 10 | 3.8 | 4.6 | 1004.4 | 99 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 15h04 | UTC-4 | 64°26.060 | 080°28.570 | Hg Sampling (test) ↑ | 377 | 170 | 50 | 9 | 3.8 | 4.6 | 1004.5 | 99 | 1/10 |

| 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 | | | | | |
| 1a | 350 | Basic | 09/Jul/2010 | 15h09 | UTC-4 | 64°25.990 | 080°28.530 | Zodiac Recovered | 376 | 167 | 50 | 9 | 3.9 | 4.6 | 1004.5 | 99 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 15h18 | UTC-4 | 64°25.930 | 080°28.490 | Box Core ↓ | 376 | 164 | 50 | 9 | 3.9 | 4.6 | 1004.5 | 99 | 1/10 |
| 1a | 350 | Basic | 09/Jul/2010 | 15h59 | UTC-4 | 64°25.696 | 080°28.502 | Box Core ↑ | 374 | 164 | 50 | 9 | 3.6 | 4.5 | 1004.7 | 99 | 1/10 |
| 1a | 710 | Nutrient | 09/Jul/2010 | 23h29 | UTC-4 | 62°57.820 | 080°13.000 | Water Sampling ↓↑ | 276 | 110 | 115 | 11 | 7.3 | 7.5 | 1003.1 | 99 | 0/10 |
| 1a | 710 | Nutrient | 09/Jul/2010 | 23h44 | UTC-4 | 62°57.810 | 080°12.890 | SHO Profile ↓ | 276 | 111 | 130 | 12 | 7.3 | 7.7 | 1003.1 | 99 | 0/10 |
| 1a | 710 | Nutrient | 10/Jul/2010 | 00h05 | UTC-4 | 62°57.900 | 080°12.970 | SHO Profile ↑ | 277 | 98 | 140 | 10 | 7.5 | 7.5 | 1002.9 | 99 | 0/10 |
| 1a | 710 | Nutrient | 10/Jul/2010 | 00h15 | UTC-4 | 62°57.870 | 080°12.900 | CTD-Rosette ↓ | 278 | 122 | 120 | 9 | 7.5 | 7.3 | 1003.0 | 98 | 0/10 |
| 1a | 710 | Nutrient | 10/Jul/2010 | 00h54 | UTC-4 | 62°57.990 | 080°13.000 | CTD-Rosette ↑ | 276 | 104 | 110 | 10 | 7.6 | 7.2 | 1003.1 | 96 | 0/10 |
| 1a | N/A | Mapping | 10/Jul/2010 | 03h00 | UTC-4 | 62°40.420 | 079°29.540 | Bottom Mapping ↓ | 327 | 72 | 82 | 10 | 5.8 | 7.6 | 1002.4 | 98 | 0/10 |
| 1a | N/A | Mapping | 10/Jul/2010 | 08h25 | UTC-4 | 62°38.020 | 079°28.670 | Bottom Mapping ↑ | 274 | 254 | 60 | 8 | 5.3 | 6.6 | 1002.3 | 99 | 0/10 |
| 1a | 698 | Nutrient | 10/Jul/2010 | 11h13 | UTC-4 | 62°07.230 | 078°42.150 | Water Sampling ↓↑ | 153 | 50 | 355 | 10 | 7.4 | 7.1 | 1001.6 | 93 | 0/10 |
| 1a | 698 | Nutrient | 10/Jul/2010 | 11h28 | UTC-4 | 62°07.150 | 078°41.940 | SHO Profile ↓ | 152 | 355 | 0 | 9 | 7.5 | 7.2 | 1001.5 | 93 | 0/10 |
| 1a | 698 | Nutrient | 10/Jul/2010 | 11h47 | UTC-4 | 62°06.880 | 078°42.050 | SHO Profile ↑ | 143 | 0 | 0 | 9 | 7.6 | 7.3 | 1001.5 | 94 | 0/10 |
| 1a | 698 | Nutrient | 10/Jul/2010 | 11h50 | UTC-4 | 62°06.830 | 078°42.070 | Water Sampling ↓↑ | 146 | 0 | 5 | 9 | 7.6 | 7.3 | 1001.4 | 93 | 0/10 |
| 1a | 698 | Nutrient | 10/Jul/2010 | 12h23 | UTC-4 | 62°06.480 | 078°42.280 | CTD-Rosette ↓ | 141 | 8 | 0 | 7 | 7.8 | 7.3 | 1001.4 | 93 | 0/10 |
| 1a | 698 | Nutrient | 10/Jul/2010 | 12h53 | UTC-4 | 62°05.990 | 078°42.690 | CTD-Rosette ↑ | 140 | 14 | 10 | 7 | 8.0 | 7.3 | 1001.6 | 92 | 0/10 |
| 1a | 699 | Basic | 10/Jul/2010 | 23h48 | UTC-4 | 59°59.940 | 078°26.110 | Water Sampling ↓↑ | 84 | 242 | 250 | 7 | 8.2 | 10.1 | 1002.9 | 99 | 0/10 |
| 1a | 699 | Basic | 10/Jul/2010 | 23h55 | UTC-4 | 59°59.900 | 078°26.210 | CTD-Rosette ↓ | 78 | 232 | 240 | 8 | 8.4 | 10.0 | 1003.0 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 00h20 | UTC-4 | 59°55.850 | 078°26.270 | CTD-Rosette ↑ | 84 | 230 | 230 | 11 | 8.4 | 9.8 | 1003.1 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 00h41 | UTC-4 | 59°59.840 | 078°26.280 | Vertical Net Tow ↓ | 83 | 248 | 240 | 15 | 8.4 | 9.5 | 1003.1 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 00h47 | UTC-4 | 59°59.840 | 078°26.250 | Vertical Net Tow ↑ | 84 | 242 | 240 | 15 | 8.4 | 9.5 | 1003.1 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 01h06 | UTC-4 | 60°00.020 | 078°26.850 | Horizontal Net Tow ↓ | 81 | 330 | 240 | 14 | 8.1 | 9.4 | 1003.2 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 01h12 | UTC-4 | 60°00.020 | 078°26.850 | Horizontal Net Tow ↑ | 84 | 240 | 250 | 12 | 8.0 | 9.4 | 1003.2 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 01h25 | UTC-4 | 59°59.990 | 078°27.070 | Vertical Net Tow ↓ | 87 | 257 | 260 | 12 | 8.3 | 9.4 | 1003.1 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 01h30 | UTC-4 | 59°59.990 | 078°27.010 | Vertical Net Tow ↑ | 86 | 260 | 260 | 11 | 8.3 | 9.5 | 1003.1 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 02h14 | UTC-4 | 59°59.920 | 078°26.380 | SHO Profile ↓ | 81 | 256 | 240 | 7 | 8.2 | 9.3 | 1003.1 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 02h34 | UTC-4 | 59°59.960 | 078°26.280 | SHO Profile ↑ | 84 | 233 | 230 | 8 | 8.4 | 9.3 | 1003.1 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 02h43 | UTC-4 | 59°59.980 | 078°26.270 | Water Sampling ↓↑ | 84 | 241 | 240 | 8 | 8.4 | 9.0 | 1003.0 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 02h50 | UTC-4 | 60°00.000 | 078°26.240 | CTD-Rosette ↓ | 83 | 221 | 240 | 7 | 8.3 | 8.9 | 1003.0 | 99 | 0/10 |
| 1a | 699 | Basic | 11/Jul/2010 | 03h22 | UTC-4 | 60°00.000 | 078°26.290 | CTD-Rosette ↑ | 83 | 218 | 220 | 8 | 8.4 | 8.9 | 1003.2 | 99 | 0/10 |

| 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 | | | | | |
| 1a | 699 | Basic | 11/Jul/2010 | 04h10 | UTC-4 | 59°59.860 | 078°25.460 | Box Core ↓↑ | 86 | 228 | 205 | 6 | 8.3 | 9.0 | 1002.9 | 99 | 0/10 |
| 1a | 701b | Nutrient | 11/Jul/2010 | 12h15 | UTC-4 | 58°24.950 | 079°22.200 | Water Sampling ↓↑ | 124 | 98 | 100 | 10 | 6.1 | 7.7 | 1000.8 | 99 | 0/10 |
| 1a | 701b | Nutrient | 11/Jul/2010 | 12h15 | UTC-4 | 58°24.950 | 079°22.200 | SHO Profile ↓ | 124 | 98 | 100 | 10 | 6.1 | 7.7 | 1000.8 | 99 | 0/10 |
| 1a | 701b | Nutrient | 11/Jul/2010 | 12h36 | UTC-4 | 58°25.010 | 079°22.230 | SHO Profile ↑ | 111 | 82 | 90 | 15 | 6.2 | 7.7 | 1000.7 | 99 | 0/10 |
| 1a | 701b | Nutrient | 11/Jul/2010 | 12h46 | UTC-4 | 58°25.030 | 079°22.180 | Water Sampling ↓↑ | 111 | 93 | 90 | 15 | 6.3 | 7.6 | 1000.4 | 99 | 0/10 |
| 1a | 701b | Nutrient | 11/Jul/2010 | 12h48 | UTC-4 | 58°25.050 | 079°22.140 | CTD-Rosette ↓ | 110 | 100 | 100 | 14 | 6.3 | 7.6 | 1000.4 | 99 | 0/10 |
| 1a | 701b | Nutrient | 11/Jul/2010 | 13h20 | UTC-4 | 58°25.170 | 079°22.170 | CTD-Rosette ↑ | 115 | 100 | 100 | 15 | 7.0 | 7.6 | 1000.3 | 99 | 0/10 |
| 1a | N/A | Mapping | 11/Jul/2010 | 16h20 | UTC-4 | 58°25.440 | 078°18.550 | Bottom Mapping ↓ | 89 | 135 | 52 | 20 | 12.1 | 8.0 | 997.8 | 97 | 0/10 |
| 1a | N/A | Mapping | 11/Jul/2010 | 18h30 | UTC-4 | 58°22.270 | 078°16.230 | Bottom Mapping ↑ | 90 | 135 | 120 | 16 | 12.0 | 8.0 | 997.7 | 98 | 0/10 |
| 1a | 720 | Nutrient | 12/Jul/2010 | 04h50 | UTC-4 | 57°00.140 | 076°53.390 | Water Sampling ↓↑ | 88 | 160 | 79 | 6 | 7.2 | 7.6 | 998.3 | 99 | 0/10 |
| 1a | 720 | Nutrient | 12/Jul/2010 | 04h55 | UTC-4 | 57°00.000 | 076°53.300 | SHO Profile ↓ | 88 | 39 | 54 | 5 | 7.3 | 7.6 | 998.3 | 99 | 0/10 |
| 1a | 720 | Nutrient | 12/Jul/2010 | 05h15 | UTC-4 | 56°59.950 | 076°53.500 | SHO Profile ↑ | 81 | 96 | 29 | 6 | 7.0 | 7.5 | 998.2 | 99 | 0/10 |
| 1a | 720 | Nutrient | 12/Jul/2010 | 05h25 | UTC-4 | 57°00.080 | 076°53.320 | CTD-Rosette ↓ | 89 | 38 | 35 | 5 | 7.3 | 7.5 | 998.1 | 99 | 0/10 |
| 1a | 720 | Nutrient | 12/Jul/2010 | 05h41 | UTC-4 | 57°00.000 | 076°53.370 | CTD-Rosette ↑ | 87 | 46 | 50 | 5 | 7.3 | 7.5 | 998.1 | 99 | 0/10 |
| 1a | Lovejoy | N/A | 12/Jul/2010 | 09h35 | UTC-4 | 56°32.250 | 076°46.100 | Water Sampling ↓↑ | 113 | 28 | 40 | 12 | 8.5 | 8.0 | 998.5 | 99 | 0/10 |
| 1a | Lovejoy | N/A | 12/Jul/2010 | 09h41 | UTC-4 | 56°32.290 | 076°46.080 | CTD-Rosette ↓ | 114 | 23 | 35 | 13 | 9.0 | 8.0 | 998.4 | 99 | 0/10 |
| 1a | Lovejoy | N/A | 12/Jul/2010 | 09h59 | UTC-4 | 56°32.520 | 076°46.000 | CTD-Rosette ↑ | 104 | 38 | 55 | 12 | 9.3 | 8.0 | 998.4 | 99 | 0/10 |
| 1a | Lovejoy | N/A | 12/Jul/2010 | 14h30 | UTC-4 | 56°09.180 | 076°41.000 | Calibration (start) | 105 | 210 | 210 | 22 | 9.4 | 9.2 | 1001.7 | 96 | 0/10 |
| 1a | Lovejoy | N/A | 12/Jul/2010 | 15h09 | UTC-4 | 56°09.160 | 076°40.960 | River Crew ↓ | 105 | 210 | 220 | 22 | 10.4 | 9.2 | 1002.1 | 85 | 0/10 |
| 1a | Lovejoy | N/A | 12/Jul/2010 | 16h05 | UTC-4 | 56°09.170 | 076°40.990 | Calibration (end) | 105 | 209 | 209 | 16 | 9.6 | 9.5 | 1003.7 | 93 | 0/10 |
| 1a | 702 | Full | 12/Jul/2010 | 23h56 | UTC-4 | 55°28.800 | 077°48.070 | Hydrography ↓ | 128 | 226 | 240 | 20 | 7.5 | 8.9 | 1007.2 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 05h27 | UTC-4 | 55°24.520 | 077°56.170 | Hydrography ↑ | 134 | 229 | N/A | N/A | 7.3 | 9.4 | 1010.7 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 05h29 | UTC-4 | 55°24.520 | 077°56.180 | PNF ↓ | 134 | 229 | 227 | 13 | 7.3 | 9.4 | 1010.7 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 05h30 | UTC-4 | 55°24.490 | 077°56.180 | PNF ↑ | 134 | 221 | 227 | 13 | 7.3 | 9.4 | 1010.7 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 05h37 | UTC-4 | 55°24.490 | 077°56.180 | Secchi Disk ↓ | 134 | 221 | 227 | 13 | 7.3 | 9.4 | 1010.7 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 05h39 | UTC-4 | 55°24.000 | 077°56.200 | Secchi Disk ↑ | 134 | 230 | 227 | 13 | 7.3 | 9.4 | 1010.7 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 07h25 | UTC-4 | 55°24.506 | 077°55.631 | SHO Profile ↓ | 131 | 230 | 240 | 10 | 7.5 | 9.8 | 1011.6 | 95 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 07h53 | UTC-4 | 55°24.525 | 077°55.756 | SHO Profile ↑ | 141 | 220 | 235 | 9 | 7.4 | 9.8 | 1011.7 | 98 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 07h47 | UTC-4 | 55°24.514 | 077°55.759 | Water Sampling ↓↑ | 141 | 216 | 253 | 8 | 7.2 | 9.8 | 1011.7 | 97 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 08h07 | UTC-4 | 55°24.620 | 077°55.880 | CTD-Rosette ↓ | 136 | 241 | 230 | 9 | 7.4 | 9.8 | 1011.8 | 97 | 0/10 |

| 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 | | | | | |
| 1a | 702 | Full | 13/Jul/2010 | 08h36 | UTC-4 | 55°24.800 | 077°55.890 | CTD-Rosette ↑ | 129 | 225 | 250 | 10 | 7.7 | 9.8 | 1012.0 | 97 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 11h05 | UTC-4 | 55°25.220 | 077°54.750 | Vertical Net Tow ↓ | 135 | 290 | 295 | 9 | 7.3 | 9.7 | 1013.0 | 98 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 11h15 | UTC-4 | 55°25.350 | 077°54.690 | Vertical Net Tow ↑ | 126 | 260 | 285 | 10 | 7.1 | 9.9 | 1013.2 | 98 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 11h38 | UTC-4 | 55°25.710 | 077°55.110 | Horizontal Net Tow ↓ | 117 | 260 | 290 | 10 | 6.8 | 10.0 | 1013.2 | 98 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 11h54 | UTC-4 | 55°25.800 | 077°54.700 | Horizontal Net Tow ↑ | 123 | 330 | 280 | 12 | 6.9 | 10.1 | 1013.5 | 95 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 12h04 | UTC-4 | 55°26.010 | 077°55.640 | Vertical Net Tow ↓ | 117 | 272 | 270 | 12 | 6.5 | 10.1 | 1013.6 | 95 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 12h08 | UTC-4 | 55°26.070 | 077°54.600 | Vertical Net Tow ↑ | 117 | 268 | 270 | 9 | 6.5 | 10.1 | 1013.6 | 95 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 14h25 | UTC-4 | 55°26.530 | 077°55.800 | Barge Recovered | 99 | 269 | 270 | 11 | 6.8 | 10.4 | 1015.3 | 90 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 12h35 | UTC-4 | 55°25.550 | 077°54.420 | CTD-Rosette ↓ | 116 | 267 | 270 | 10 | 7.0 | 10.2 | 1013.9 | 88 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 13h04 | UTC-4 | 55°25.840 | 077°55.490 | CTD-Rosette ↑ | 120 | 287 | 270 | 8 | 6.6 | 10.2 | 1014.2 | 90 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 12h43 | UTC-4 | 55°25.620 | 077°55.420 | Hg Sampling ↓ | 104 | 257 | 260 | 12 | 6.8 | 10.2 | 1014.1 | 89 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 13h30 | UTC-4 | 55°26.230 | 077°55.490 | Water Sampling ↓↑ | 88 | 250 | 260 | 9 | 6.6 | 10.3 | 1014.8 | 89 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 14h46 | UTC-4 | 55°26.640 | 077°55.900 | Hg Sampling ↑ | 97 | 269 | 270 | 11 | 6.8 | 10.4 | 1015.6 | 92 | 0/10 |
| 1a | AN03-10 | Mooring | 13/Jul/2010 | 18h23 | UTC-4 | 55°24.860 | 077°55.180 | Mooring AN03-10 Deployed | 138 | 165 | 245 | 5 | 7.2 | 8.8 | 1017.3 | 98 | 0/10 |
| 1a | AN03-10 | Mooring | 13/Jul/2010 | 18h39 | UTC-4 | 55°24.824 | 077°55.120 | Mooring AN03-10 Deployed (end) | 139 | 176 | 337 | 3 | 8.1 | 8.8 | 1017.3 | 94 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 19h08 | UTC-4 | 55°24.702 | 077°55.672 | CTD-Rosette ↓ | 135 | 293 | 355 | 2 | 8.3 | 8.9 | 1017.3 | 93 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 19h26 | UTC-4 | 55°25.026 | 077°55.844 | CTD-Rosette ↑ | 132 | 32 | 329 | 0 | 7.4 | 9.0 | 1017.4 | 98 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 19h47 | UTC-4 | 55°24.720 | 077°55.860 | Box Core ↓ | 134 | 151 | Calm | Calm | 7.1 | 9.1 | 1017.6 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 19h54 | UTC-4 | 55°24.775 | 077°55.884 | Box Core (bottom) | 134 | 170 | Calm | Calm | 7.2 | 9.2 | 1017.6 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 20h01 | UTC-4 | 55°24.830 | 077°55.990 | Box Core ↑ | 130 | 177 | Calm | Calm | 7.3 | 9.1 | 1017.7 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 20h27 | UTC-4 | 55°24.920 | 077°56.470 | Agassiz Trawl ↓ | 129 | 310 | Calm | Calm | 7.3 | 9.0 | 1017.7 | 99 | 0/10 |
| 1a | 702 | Full | 13/Jul/2010 | 20h45 | UTC-4 | 55°25.030 | 077°56.530 | Agassiz Trawl ↑ | 119 | 28 | 320 | 2 | 7.3 | 8.9 | 1017.7 | 99 | 0/10 |
| 1a | 702 | N/A | 14/Jul/2010 | 08h24 | UTC-4 | 55°20.900 | 077°45.870 | Zodiac Deployed (water sampling) | 83 | 60 | 35 | 2 | 8.6 | 9.9 | 1021.6 | 97 | 0/10 |
| 1a | GW-1 | Piston Core | 14/Jul/2010 | 08h56 | UTC-4 | 55°20.850 | 077°45.690 | Piston Core ↓ | 95 | 180 | 33 | 4 | 9.1 | 9.7 | 1021.7 | 98 | 0/10 |
| 1a | GW-1 | Piston Core | 14/Jul/2010 | 09h07 | UTC-4 | 55°20.800 | 077°45.690 | Piston Core ↑ | 95 | 180 | 33 | 4 | 9.1 | 9.7 | 1021.7 | 98 | 0/10 |
| 1a | GW-1 | Piston Core | 14/Jul/2010 | 09h53 | UTC-4 | 55°20.850 | 077°45.780 | Piston Core ↓ | 98 | 130 | 15 | 5 | 9.4 | 9.4 | 1021.4 | 98 | 0/10 |
| 1a | GW-1 | Piston Core | 14/Jul/2010 | 09h57 | UTC-4 | 55°20.850 | 077°45.690 | Piston Core ↑ | 100 | 116 | 15 | 6 | 9.4 | 9.7 | 1021.6 | 98 | 0/10 |
| 1a | N/A | N/A | 14/Jul/2010 | 11h09 | UTC-4 | 55°19.910 | 077°48.870 | Zodiac Recovered | 74 | 267 | 30 | 10 | 10.3 | 9.4 | 1021.1 | 89 | 0/10 |
| 1a | GW-2 | Piston Core | 14/Jul/2010 | 11h19 | UTC-4 | 55°19.780 | 077°48.780 | Piston Core ↓ | 80 | 203 | 35 | 8 | 10.3 | 9.5 | 1021.2 | 89 | 0/10 |
| 1a | GW-2 | Piston Core | 14/Jul/2010 | 11h24 | UTC-4 | 55°19.770 | 077°48.780 | Piston Core ↑ | 80 | 205 | 35 | 8 | 10.3 | 9.5 | 1021.2 | 89 | 0/10 |

| 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 | | | | | |
| 1a | GW-3 | Piston Core | 14/Jul/2010 | 12h28 | UTC-4 | 55°17.160 | 077°49.850 | Piston Core ↓ | 69 | 19 | 35 | 15 | 10.3 | 9.7 | 1020.9 | 90 | 0/10 |
| 1a | GW-3 | Piston Core | 14/Jul/2010 | 12h34 | UTC-4 | 55°17.200 | 077°49.850 | Piston Core ↑ | 69 | 40 | 31 | 14 | 10.4 | 10.5 | 1021.1 | 89 | 0/10 |
| 1a | N/A | Weather | 14/Jul/2010 | 15h50 | UTC-4 | 55°14.600 | 078°08.530 | Weather Balloon | 109 | 250 | 50 | 18 | 10.9 | 9.2 | 1020.1 | 82 | 0/10 |
| 1a | 703 | Nutrient | 14/Jul/2010 | 21h28 | UTC-4 | 54°40.740 | 079°57.460 | Water Sampling ↓↑ | 45 | 61 | 70 | 20 | 13.0 | 10.9 | 1016.2 | 78 | 0/10 |
| 1a | 703 | Nutrient | 14/Jul/2010 | 21h36 | UTC-4 | 54°40.780 | 079°57.470 | SHO Profile ↓ | 48 | 60 | 70 | 20 | 12.8 | 10.7 | 1016.2 | 80 | 0/10 |
| 1a | 703 | Nutrient | 14/Jul/2010 | 21h48 | UTC-4 | 54°40.770 | 079°57.540 | SHO Profile ↑ | 49 | 80 | 65 | 21 | 12.8 | 10.5 | 1016.2 | 79 | 0/10 |
| 1a | 703 | Nutrient | 14/Jul/2010 | 22h02 | UTC-4 | 54°40.810 | 079°57.430 | CTD-Rosette ↓ | 49 | 70 | 70 | 20 | 12.8 | 10.1 | 1016.2 | 79 | 0/10 |
| 1a | 703 | Nutrient | 14/Jul/2010 | 22h21 | UTC-4 | 54°40.850 | 079°57.470 | CTD-Rosette ↑ | 44 | 85 | 65 | 21 | 12.6 | 10.2 | 1016.1 | 80 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 00h50 | UTC-4 | 54°42.690 | 080°46.760 | Water Sampling ↓↑ | 88 | 104 | 100 | 20 | 12.6 | 10.1 | 1014.5 | 82 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 00h50 | UTC-4 | 54°42.690 | 080°46.760 | CTD-Rosette ↓ | 88 | 104 | 100 | 20 | 13.6 | 10.1 | 1014.5 | 82 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 01h07 | UTC-4 | 54°42.870 | 080°46.520 | CTD-Rosette ↑ | 88 | 113 | 100 | 21 | 13.0 | 10.1 | 1014.1 | 81 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 01h36 | UTC-4 | 54°43.170 | 080°45.940 | Vertical Net Tow ↓ | 89 | 108 | 110 | 21 | 13.7 | 10.2 | 1013.6 | 79 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 01h44 | UTC-4 | 54°43.240 | 080°45.850 | Vertical Net Tow ↑ | 89 | 139 | 110 | 20 | 13.9 | 10.2 | 1013.4 | 78 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 01h59 | UTC-4 | 54°43.590 | 080°44.720 | Horizontal Net Tow ↓ | 89 | 110 | 110 | 23 | 14.0 | 10.2 | 1012.3 | 75 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 02h13 | UTC-4 | 54°43.360 | 080°44.700 | Horizontal Net Tow ↑ | 89 | 21 | 110 | 22 | 14.5 | 10.3 | 1012.5 | 73 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 02h28 | UTC-4 | 54°43.060 | 080°46.330 | Vertical Net Tow ↓ | 88 | 124 | 110 | 24 | 14.3 | 10.2 | 1012.2 | 72 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 02h32 | UTC-4 | 54°43.090 | 080°46.270 | Vertical Net Tow ↑ | 88 | 122 | 110 | 22 | 14.3 | 10.2 | 1012.2 | 72 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 02h56 | UTC-4 | 54°43.360 | 080°45.850 | SHO Profile ↓ | 88 | 123 | 110 | 22 | 14.3 | 10.1 | 1012.1 | 71 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 03h32 | UTC-4 | 54°43.810 | 080°45.470 | SHO Profile ↑ | 89 | 127 | 110 | 21 | 14.2 | 10.1 | 1012.0 | 72 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 03h34 | UTC-4 | 54°43.840 | 080°45.440 | SHO Profile ↓ | 88 | 136 | 110 | 21 | 13.9 | 9.5 | 1011.8 | 76 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 03h47 | UTC-4 | 54°44.010 | 080°45.390 | SHO Profile ↑ | 89 | 139 | 110 | 21 | 13.7 | 9.5 | 1011.7 | 76 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 04h10 | UTC-4 | 54°42.763 | 080°46.867 | CTD-Rosette ↓ | 87 | 121 | 117 | 22 | 13.7 | 9.3 | 1011.3 | 75 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 04h25 | UTC-4 | 54°42.194 | 080°46.746 | CTD-Rosette ↑ | 87 | 116 | 123 | 22 | 13.8 | 9.8 | 1011.1 | 75 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 05h05 | UTC-4 | 54°42.936 | 080°46.685 | Box Core ↓↑ | 87 | 115 | 123 | 23 | 13.9 | 9.5 | 1010.4 | 76 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 05h24 | UTC-4 | 54°43.207 | 080°46.232 | Agassiz Trawl ↓ | 87 | 123 | 121 | 22 | 13.8 | 8.8 | 1010.1 | 76 | 0/10 |
| 1a | 709 | Basic | 15/Jul/2010 | 05h30 | UTC-4 | 54°43.236 | 080°46.271 | Agassiz Trawl ↑ | 87 | 295 | 120 | 22 | 14.2 | 9.3 | 1010.1 | 73 | 0/10 |
| 1a | 704 | Nutrient | 15/Jul/2010 | 08h30 | UTC-4 | 54°45.490 | 081°42.310 | CTD-Rosette ↓ | 27 | 130 | 130 | 30 | 12.8 | 9.8 | 1006.3 | 75 | 0/10 |
| 1a | 704 | Nutrient | 15/Jul/2010 | 08h37 | UTC-4 | 54°45.260 | 081°42.200 | CTD-Rosette ↑ | 27 | 135 | 120 | 23 | 13.3 | 9.7 | 1006.0 | 73 | 0/10 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 13h12 | UTC-4 | 55°26.720 | 080°33.100 | PNF ↓ | 96 | 97 | 100 | 21 | 11.2 | 7.9 | 1006.4 | 86 | 0/10 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 13h17 | UTC-4 | 55°26.690 | 080°33.150 | PNF ↑ | 96 | 95 | 100 | 22 | 11.6 | 7.8 | 1006.1 | 86 | 0/10 |

| 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 | | | | | |
| 1a | 730 | Nutrient | 15/Jul/2010 | 13h22 | UTC-4 | 55°26.680 | 080°33.160 | Water Sampling ↓↑ | 96 | 99 | 100 | 20 | 11.6 | 7.8 | 1006.1 | 86 | 0/10 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 13h27 | UTC-4 | 55°26.690 | 080°33.150 | Secchi Disk ↓↑ | 96 | 95 | 100 | 22 | 11.6 | 7.8 | 1006.1 | 86 | 0/10 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 13h29 | UTC-4 | 55°26.670 | 080°33.250 | SHO Profile ↓ | 96 | 95 | 100 | 20 | 11.7 | 7.2 | 1005.9 | 87 | 0/10 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 13h56 | UTC-4 | 55°26.650 | 080°33.300 | SHO Profile ↑ | 96 | 97 | 100 | 21 | 11.5 | 7.2 | 1005.6 | 89 | 0/10 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 13h57 | UTC-4 | 55°26.650 | 080°33.640 | Water Sampling ↓↑ | 98 | 62 | 100 | 22 | 11.2 | 7.2 | 1005.3 | 89 | 0/10 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 14h09 | UTC-4 | 55°26.890 | 080°33.300 | CTD-Rosette ↓ | 95 | 92 | 100 | 23 | 11.1 | 7.3 | 1005.2 | 89 | 0/10 |
| 1a | 730 | Nutrient | 15/Jul/2010 | 14h32 | UTC-4 | 55°27.000 | 080°33.690 | CTD-Rosette ↑ | 97 | 91 | 100 | 23 | 10.6 | 6.9 | 1005.2 | 90 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 20h47 | UTC-4 | 56°47.760 | 080°49.880 | Water Sampling ↓↑ | 177 | 99 | 100 | 21 | 9.0 | 7.0 | 1003.6 | 97 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 20h51 | UTC-4 | 56°47.730 | 080°49.740 | PNF ↓ | 182 | 98 | 95 | 21 | 9.2 | 7.2 | 1003.9 | 97 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 20h56 | UTC-4 | 56°47.710 | 080°49.740 | PNF ↑ | 181 | 96 | 100 | 21 | 9.2 | 7.2 | 1003.9 | 97 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 20h56 | UTC-4 | 56°47.710 | 080°49.740 | Secchi Disk ↓ | 181 | 96 | 100 | 21 | 9.2 | 7.2 | 1003.9 | 97 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 20h58 | UTC-4 | 56°47.700 | 080°49.750 | Secchi Disk ↑ | 181 | 94 | 100 | 20 | 9.2 | 7.2 | 1003.9 | 97 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 21h06 | UTC-4 | 56°47.670 | 080°49.830 | CTD-Rosette ↓ | 183 | 89 | 95 | 20 | 9.8 | 7.8 | 1004.1 | 96 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 21h31 | UTC-4 | 56°47°550 | 080°50.180 | CTD-Rosette ↑ | 187 | 94 | 95 | 23 | 9.6 | 8.2 | 1003.8 | 98 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 21h53 | UTC-4 | 56°47.560 | 080°50.140 | Vertical Net Tow ↓ | 188 | 90 | 90 | 23 | 10.6 | 8.1 | 1003.3 | 99 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 22h05 | UTC-4 | 56°47.540 | 080°50.170 | Vertical Net Tow ↑ | 186 | 93 | 95 | 25 | 10.7 | 8.1 | 1003.3 | 99 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 22h22 | UTC-4 | 56°47.450 | 080°49.690 | Horizontal Net Tow ↓ | 185 | 86 | 80 | 27 | 10.9 | 8.1 | 1002.8 | 98 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 22h27 | UTC-4 | 56°47.440 | 080°49.560 | Horizontal Net Tow ↑ (canceled) | 182 | 127 | 75 | 27 | 10.9 | 8.1 | 1002.6 | 97 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 22h33 | UTC-4 | 56°47.320 | 080°49.440 | Horizontal Net Tow ↓ | 182 | 135 | 75 | 28 | 10.9 | 7.9 | 1002.6 | 97 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 22h49 | UTC-4 | 56°46.760 | 080°48.580 | Horizontal Net Tow ↑ | 151 | 128 | 80 | 27 | 10.7 | 8.2 | 1002.7 | 96 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 23h05 | UTC-4 | 56°47.000 | 080°49.750 | Vertical Net Tow ↓ | 185 | 106 | 80 | 26 | 10.6 | 7.9 | 1002.7 | 96 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 23h15 | UTC-4 | 56°46.910 | 080°49.730 | Vertical Net Tow ↑ | 186 | 104 | 75 | 26 | 10.6 | 7.7 | 1002.4 | 96 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 23h23 | UTC-4 | 56°46.880 | 080°49.820 | SHO Profile ↓ | 182 | 76 | 75 | 21 | 10.4 | 7.6 | 1002.4 | 97 | 0/10 |
| 1a | 735 | Basic | 15/Jul/2010 | 23h55 | UTC-4 | 56°47.000 | 080°50.200 | SHO Profile ↑ | 181 | 66 | 70 | 23 | 9.9 | 7.5 | 1001.9 | 96 | 0/10 |
| 1a | 735 | Basic | 16/Jul/2010 | 00h37 | UTC-4 | 56°47.650 | 080°50.220 | CTD-Rosette ↓ | 184 | 85 | 90 | 27 | 10.1 | 7.5 | 1001.8 | 98 | 0/10 |
| 1a | 735 | Basic | 16/Jul/2010 | 01h13 | UTC-4 | 56°47.910 | 080°50.500 | CTD-Rosette ↑ | 193 | 76 | 80 | 24 | 10.2 | 8.0 | 1001.4 | 98 | 0/10 |
| 1a | 735 | Basic | 16/Jul/2010 | 01h40 | UTC-4 | 56°47.650 | 080°50.240 | Box Core ↓ | 184 | 73 | 80 | 26 | 10.3 | 8.2 | 1000.7 | 95 | 0/10 |
| 1a | 735 | Basic | 16/Jul/2010 | 01h45 | UTC-4 | 56°47.700 | 080°50.370 | Box Core ↑↓ | 186 | 90 | 80 | 24 | 10.3 | 8.2 | 1000.7 | 95 | 0/10 |
| 1a | 735 | Basic | 16/Jul/2010 | 01h55 | UTC-4 | 56°47.770 | 080°50.530 | Box Core ↑ | 185 | 73 | 80 | 26 | 9.9 | 8.1 | 1000.7 | 96 | 0/10 |
| 1a | 735 | Basic | 16/Jul/2010 | 02h14 | UTC-4 | 56°47.800 | 080°50.350 | Agassiz Trawl ↓ | 185 | 80 | 80 | 21 | 10.0 | 8.2 | 1000.4 | 91 | 0/10 |

| 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 | | | | | |
| 1a | 735 | Basic | 16/Jul/2010 | 02h38 | UTC-4 | 56°48.080 | 080°50.900 | Agassiz Trawl ↑ | 136 | 283 | 80 | 20 | 10.6 | 8.4 | 1000.6 | 88 | 0/10 |
| 1a | 745 | Basic | 16/Jul/2010 | 22h46 | UTC-4 | 60°25.780 | 085°00.420 | PNF ↓ | 180 | 20 | 40 | 16 | 7.7 | 6.3 | 1013.0 | 93 | 0/10 |
| 1a | 745 | Basic | 16/Jul/2010 | 22h50 | UTC-4 | 60°25.800 | 085°00.440 | PNF ↑ | 180 | 37 | 35 | 16 | 7.6 | 6.2 | 1013.4 | 94 | 0/10 |
| 1a | 745 | Basic | 16/Jul/2010 | 22h50 | UTC-4 | 60°25.800 | 085°00.440 | Secchi Disk ↓↑ | 180 | 41 | 35 | 16 | 7.6 | 6.2 | 1013.4 | 94 | 0/10 |
| 1a | 745 | Basic | 16/Jul/2010 | 23h20 | UTC-4 | 60°30.320 | 085°00.850 | Water Sampling ↓↑ | 182 | 35 | 30 | 17 | 7.6 | 6.0 | 1013.4 | 94 | 0/10 |
| 1a | 745 | Basic | 16/Jul/2010 | 23h28 | UTC-4 | 60°30.320 | 085°00.870 | CTD-Rosette ↓ | 185 | 23 | 35 | 17 | 7.6 | 6.0 | 1013.4 | 94 | 0/10 |
| 1a | 745 | Basic | 16/Jul/2010 | 23h32 | UTC-4 | 60°30.340 | 085°00.880 | Water Pumping | 185 | 18 | 35 | 17 | 7.6 | 5.9 | 1013.6 | 94 | 0/10 |
| 1a | 745 | Basic | 16/Jul/2010 | 23h56 | UTC-4 | 60°30.410 | 085°00.910 | CTD-Rosette ↑ | 186 | 33 | 30 | 18 | 7.5 | 5.8 | 1013.6 | 94 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 00h43 | UTC-4 | 60°30.400 | 085°00.840 | Vertical Net Tow ↓ | 186 | 30 | 30 | 15 | 7.5 | 5.9 | 1013.6 | 94 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 00h55 | UTC-4 | 60°30.340 | 085°00.870 | Vertical Net Tow ↑ | 185 | 55 | 30 | 17 | 7.5 | 5.9 | 1013.6 | 94 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 01h10 | UTC-4 | 60°30.400 | 085°00.830 | Horizontal Net Tow ↓ | 184 | 80 | 30 | 15 | 7.3 | 5.7 | 1013.6 | 92 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 01h25 | UTC-4 | 60°30.680 | 085°00.850 | Horizontal Net Tow ↑ | 186 | 256 | 20 | 13 | 7.5 | 5.7 | 1013.5 | 92 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 01h38 | UTC-4 | 60°30.490 | 085°00.660 | Vertical Net Tow ↓ | 183 | 55 | 30 | 17 | 7.5 | 5.8 | 1013.7 | 92 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 01h48 | UTC-4 | 60°30.450 | 085°00.600 | Vertical Net Tow ↑ | 184 | 108 | 30 | 16 | 7.4 | 5.9 | 1013.7 | 92 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 02h01 | UTC-4 | 60°30.350 | 085°00.740 | CTD-Rosette ↓ | 184 | 29 | 30 | 16 | 7.5 | 5.8 | 1013.8 | 91 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 02h21 | UTC-4 | 60°30.400 | 085°00.660 | CTD-Rosette ↑ | 184 | 50 | 30 | 16 | 7.7 | 5.8 | 1013.9 | 91 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 02h40 | UTC-4 | 60°30.440 | 085°00.630 | SHO Profile ↓ | 183 | 37 | 40 | 17 | 7.9 | 5.7 | 1013.9 | 89 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 02h59 | UTC-4 | 60°30.410 | 085°00.640 | Water Sampling ↓↑ | 184 | 33 | 40 | 16 | 8.0 | 5.7 | 1013.9 | 88 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 03h14 | UTC-4 | 60°30.340 | 085°00.700 | SHO Profile ↑ | 183 | 34 | 40 | 15 | 7.9 | 5.7 | 1014.0 | 89 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 03h37 | UTC-4 | 60°30.260 | 085°00.840 | CTD-Rosette ↓ | 185 | 37 | 40 | 15 | 8.0 | 5.8 | 1014.1 | 88 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 04h02 | UTC-4 | 60°30.280 | 085°00.874 | CTD-Rosette ↑ | 186 | 7 | 44 | 16 | 7.9 | 5.8 | 1014.3 | 89 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 04h34 | UTC-4 | 60°30.410 | 085°01.060 | Box Core (bottom) | 185 | 31 | 34 | 17 | 7.6 | 5.5 | 1014.4 | 91 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 04h46 | UTC-4 | 60°30.406 | 085°01.081 | Box Core (bottom) | 185 | 35 | 32 | 16 | 7.5 | 5.4 | 1014.4 | 91 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 05h10 | UTC-4 | 60°30.040 | 085°00.570 | Agassiz Trawl ↓ | 184 | 121 | 30 | 17 | 7.8 | 5.7 | 1014.6 | 91 | 0/10 |
| 1a | 745 | Basic | 17/Jul/2010 | 05h30 | UTC-4 | 60°29.929 | 085°00.334 | Agassiz Trawl ↑ | 184 | 102 | 30 | 16 | 7.8 | 5.7 | 1014.6 | 91 | 0/10 |
| 1a | 750 | Nutrient | 17/Jul/2010 | 11h02 | UTC-4 | 60°40.790 | 087°28.200 | Water Sampling ↓↑ | 196 | 30 | 40 | 12 | 7.3 | 6.3 | 1016.5 | 93 | 0/10 |
| 1a | 750 | Nutrient | 17/Jul/2010 | 11h10 | UTC-4 | 60°40.850 | 087°28.190 | SHO Profile ↓ | 192 | 29 | 40 | 12 | 7.3 | 6.3 | 1016.6 | 92 | 0/10 |
| 1a | 750 | Nutrient | 17/Jul/2010 | 11h33 | UTC-4 | 60°40.920 | 087°28.350 | SHO Profile ↑ | 197 | 37 | 50 | 12 | 7.4 | 6.0 | 1016.7 | 92 | 0/10 |
| 1a | 750 | Nutrient | 17/Jul/2010 | 11h48 | UTC-4 | 60°40.990 | 087°28.410 | CTD-Rosette ↓ | 195 | 26 | 40 | 13 | 7.6 | 5.9 | 1016.7 | 92 | 0/10 |
| 1a | 750 | Nutrient | 17/Jul/2010 | 12h16 | UTC-4 | 60°41.060 | 087°28.490 | CTD-Rosette ↑ | 195 | 30 | 40 | 13 | 7.1 | 5.8 | 1016.8 | 94 | 0/10 |

| 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 | | | | | |
| 1a | 750 | Nutrient | 17/Jul/2010 | 12h26 | UTC-4 | 60°41.110 | 087°28.480 | Vertical Net Tow ↓ | 195 | 29 | 40 | 14 | 7.1 | 5.9 | 1016.8 | 94 | 0/10 |
| 1a | 750 | Nutrient | 17/Jul/2010 | 12h37 | UTC-4 | 60°41.040 | 087°28.560 | Vertical Net Tow ↑ | 195 | 40 | 40 | 13 | 7.2 | 6.0 | 1016.8 | 93 | 0/10 |
| 1a | 760 | Nutrient | 17/Jul/2010 | 23h09 | UTC-4 | 63°03.810 | 088°24.130 | Water Sampling ↓↑ | 136 | 253 | 260 | 9 | 9.6 | 8.9 | 1016.4 | 84 | 0/10 |
| 1a | 760 | Nutrient | 17/Jul/2010 | 23h18 | UTC-4 | 63°03.740 | 088°24.470 | SHO Profile ↓ | 138 | 254 | 250 | 10 | 9.7 | 8.9 | 1016.5 | 84 | 0/10 |
| 1a | 760 | Nutrient | 17/Jul/2010 | 23h49 | UTC-4 | 63°03.570 | 088°24.850 | SHO Profile ↑ | 137 | 243 | 250 | 10 | 9.6 | 8.6 | 1016.7 | 84 | 0/10 |
| 1a | 760 | Nutrient | 17/Jul/2010 | 23h59 | UTC-4 | 63°03.520 | 088°24.940 | CTD-Rosette ↓ | 137 | 250 | 250 | 10 | 9.7 | 8.1 | 1016.7 | 84 | 0/10 |
| 1a | 760 | Nutrient | 18/Jul/2010 | 00h27 | UTC-4 | 63°03.350 | 088°24.920 | CTD-Rosette ↑ | 137 | 151 | 260 | 10 | 9.9 | 8.3 | 1016.7 | 84 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 06h24 | UTC-4 | 62°18.240 | 090°40.000 | Water Sampling ↓↑ | 104 | 319 | 310 | 5 | 7.2 | 7.9 | 1017.3 | 94 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 06h29 | UTC-4 | 62°18.276 | 090°39.958 | PNF ↓ | 106 | 3305 | 310 | 5 | 7.2 | 7.9 | 1017.3 | 94 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 06h34 | UTC-4 | 62°18.319 | 090°39.874 | PNF ↑ | 105 | 300 | 310 | 6 | 7.2 | 7.9 | 1017.3 | 94 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 06h35 | UTC-4 | 62°18.337 | 090°39.846 | Secchi Disk ↓ | 106 | 299 | 300 | 6 | 7.1 | 7.7 | 1017.4 | 95 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 06h38 | UTC-4 | 62°18.345 | 090°39.835 | Secchi Disk ↑ | 106 | 299 | 300 | 6 | 7.1 | 7.7 | 1017.4 | 95 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 06h42 | UTC-4 | 62°18.384 | 090°39.763 | SHO Profile ↓ | 104 | 299 | 301 | 6 | 7.0 | 7.3 | 1017.5 | 95 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 07h03 | UTC-4 | 62°18.537 | 090°39.472 | Water Sampling ↓↑ | 103 | 297 | 287 | 6 | 6.9 | 6.6 | 1017.3 | 95 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 07h07 | UTC-4 | 62°18.558 | 090°39.415 | SHO Profile ↑ | 101 | 297 | 285 | 6 | 6.9 | 6.0 | 1017.3 | 95 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 07h33 | UTC-4 | 62°18.505 | 090°39.716 | CTD-Rosette ↓ | 105 | 305 | 292 | 5 | 7.6 | 6.3 | 1017.1 | 93 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 07h56 | UTC-4 | 62°18.589 | 090°39.580 | CTD-Rosette ↑ | 105 | 286 | 270 | 5 | 7.4 | 6.8 | 1017.1 | 93 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 08h33 | UTC-4 | 62°18.600 | 090°39.550 | Zodiac Deployed | 106 | 270 | 250 | 5 | 7.5 | 6.5 | 1016.9 | 92 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 08h42 | UTC-4 | 62°18.580 | 090°39.630 | Vertical Net Tow ↓ | 106 | 280 | 260 | 5 | 7.6 | 6.4 | 1016.9 | 92 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 08h49 | UTC-4 | 62°18.570 | 090°39.650 | Vertical Net Tow ↑ | 105 | 322 | 250 | 5 | 7.6 | 6.7 | 1016.8 | 91 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 09h05 | UTC-4 | 62°18.440 | 090°39.630 | Horizontal Net Tow ↓ | 106 | 236 | 230 | 3 | 7.6 | 6.9 | 1016.8 | 91 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 09h22 | UTC-4 | 62°18.190 | 090°39.540 | Horizontal Net Tow ↑ | 107 | 35 | 260 | 3 | 8.0 | 6.8 | 1016.9 | 91 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 09h28 | UTC-4 | 62°18.250 | 090°39.530 | Zodiac Recovered | 107 | 326 | 255 | 8 | 8.0 | 6.8 | 1016.9 | 91 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 09h33 | UTC-4 | 62°18.220 | 090°39.690 | Zodiac Deployed | 107 | 304 | 255 | 7 | 7.8 | 7.0 | 1016.7 | 91 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 09h49 | UTC-4 | 62°18.050 | 090°39.800 | CTD-Rosette ↓ | 107 | 266 | 250 | 7 | 7.5 | 7.1 | 1016.6 | 91 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 10h11 | UTC-4 | 62°18.780 | 090°39.980 | CTD-Rosette ↑ | 106 | 269 | 260 | 9 | 8.3 | 6.9 | 1016.2 | 87 | 0/10 |
| 1a | 765 | Basic | 18/Jul/2010 | 11h16 | UTC-4 | 62°16.680 | 090°41.630 | Zodiac Recovered | 107 | 140 | 270 | 8 | 8.1 | 7.0 | 1016.2 | 90 | 0/10 |
| 1a | N/A | Mapping | 18/Jul/2010 | 15h45 | UTC-4 | 61°30.450 | 092°05.050 | Bottom Mapping ↓ | 107 | 166 | 240 | 5 | 7.8 | 6.3 | 1016.2 | 91 | 0/10 |
| 1a | N/A | Mapping | 18/Jul/2010 | 16h40 | UTC-4 | 61°29.680 | 092°02.520 | Bottom Mapping ↑ | 119 | 90 | 245 | 6 | 7.8 | 6.2 | 1016.2 | 90 | 0/10 |
| 1a | 770 | Nutrient | 18/Jul/2010 | 19h25 | UTC-4 | 60°56.181 | 091°47.758 | Water Sampling ↓↑ | 109 | 252 | 202 | 4 | 8.9 | 8.2 | 1015.9 | 93 | 0/10 |

| 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 | | | | | |
| 1a | 770 | Nutrient | 18/Jul/2010 | 19h28 | UTC-4 | 60°56.181 | 091°47.940 | SHO Profile ↓ | 109 | 209 | 210 | 4 | 8.9 | 8.2 | 1015.9 | 93 | 0/10 |
| 1a | 770 | Nutrient | 18/Jul/2010 | 19h55 | UTC-4 | 60°56.260 | 091°47.884 | SHO Profile ↑ | 110 | 208 | 210 | 4 | 9.5 | 7.6 | 1015.8 | 92 | 0/10 |
| 1a | 770 | Nutrient | 18/Jul/2010 | 19h48 | UTC-4 | 60°56.236 | 091°47.844 | Water Sampling ↓↑ | 109 | 214 | 205 | 4 | 9.6 | 7.9 | 1015.9 | 91 | 0/10 |
| 1a | 770 | Nutrient | 18/Jul/2010 | 20h08 | UTC-4 | 60°56.240 | 091°48.000 | CTD-Rosette ↓ | 109 | 171 | 215 | 4 | 9.4 | 7.4 | 1015.8 | 92 | 0/10 |
| 1a | 770 | Nutrient | 18/Jul/2010 | 20h26 | UTC-4 | 60°56.310 | 091°48.090 | CTD-Rosette ↑ | 111 | 118 | 220 | 4 | 9.3 | 7.3 | 1015.6 | 93 | 0/10 |
| 1a | 770 | Nutrient | 18/Jul/2010 | 20h36 | UTC-4 | 60°56.330 | 091°48.190 | Vertical Net Tow ↓ | 110 | 196 | 215 | 4 | 9.6 | 7.3 | 1015.6 | 92 | 0/10 |
| 1a | 770 | Nutrient | 18/Jul/2010 | 20h43 | UTC-4 | 60°56.350 | 091°48.280 | Vertical Net Tow ↑ | 109 | 190 | 200 | 4 | 9.5 | 7.2 | 1015.6 | 92 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 01h07 | UTC-4 | 59°58.090 | 091°57.090 | CTD-Rosette ↓ | 111 | 211 | 215 | 11 | 8.4 | 7.6 | 1015.1 | 97 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 01h26 | UTC-4 | 59°57.850 | 091°57.300 | CTD-Rosette ↑ | 115 | 184 | 215 | 11 | 8.5 | 7.2 | 1015.1 | 97 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 01h41 | UTC-4 | 59°57.970 | 091°57.240 | Hg Sampling ↓ | 112 | 197 | 215 | 11 | 8.5 | 6.9 | 1015.2 | 96 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 03h21 | UTC-4 | 59°57.880 | 091°57.270 | Hg Sampling ↑ | 110 | 320 | 215 | 10 | 8.7 | 6.6 | 1015.1 | 93 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 03h36 | UTC-4 | 59°58.140 | 091°57.000 | Vertical Net Tow ↓ | 107 | 229 | 220 | 9 | 8.6 | 6.6 | 1015.0 | 91 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 03h43 | UTC-4 | 59°58.160 | 091°56.900 | Vertical Net Tow ↑ | 105 | 230 | 220 | 10 | 8.8 | 6.7 | 1015.0 | 90 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 04h18 | UTC-4 | 59°58.648 | 091°56.305 | Horizontal Net Tow ↓ | 103 | N/A | 216 | 8 | 8.9 | 7.0 | 1015.0 | 88 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 04h35 | UTC-4 | 59°58.797 | 091°57.215 | Horizontal Net Tow ↑ | 103 | 180 | 216 | 8 | 8.9 | 7.0 | 1015.0 | 88 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 04h46 | UTC-4 | 59°58.569 | 091°57.192 | Vertical Net Tow ↓ | 104 | 212 | 211 | 8 | 8.9 | 7.0 | 1014.9 | 88 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 04h53 | UTC-4 | 59°58.577 | 091°57.164 | Vertical Net Tow ↑ | 104 | 217 | 207 | 9 | 8.9 | 7.0 | 1014.9 | 88 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 05h05 | UTC-4 | 59°58.578 | 091°57.142 | SHO Profile ↓ | 101 | 204 | 191 | 9 | 8.8 | 7.1 | 1014.9 | 89 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 05h29 | UTC-4 | 59°58.665 | 091°56.996 | Water Sampling ↓↑ | 100 | 197 | 192 | 9 | 8.2 | 6.9 | 1014.8 | 92 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 05h35 | UTC-4 | 59°58.687 | 091°56.957 | SHO Profile ↑ | 104 | 176 | 197 | 10 | 8.2 | 6.9 | 1014.7 | 92 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 05h30 | UTC-4 | 59°58.697 | 091°56.951 | Secchi Disk ↓ | 104 | 186 | 198 | 10 | 8.2 | 6.9 | 1014.7 | 92 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 05h38 | UTC-4 | 59°58.688 | 091°56.927 | Secchi Disk ↑ | 104 | 177 | 199 | 10 | 8.2 | 6.9 | 1014.7 | 92 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 05h41 | UTC-4 | 59°58.686 | 091°56.906 | PNF ↓ | 101 | 198 | 195 | 10 | 8.2 | 6.9 | 1017.7 | 92 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 05h45 | UTC-4 | 59°58.693 | 091°56.891 | PNF ↑ | 102 | 200 | 189 | 10 | 8.4 | 6.8 | 1014.7 | 91 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 05h50 | UTC-4 | 59°58.676 | 091°56.860 | CTD-Rosette ↓ | 101 | 189 | 195 | 9 | 8.5 | 6.8 | 1014.7 | 91 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 06h05 | UTC-4 | 59°58.700 | 091°56.745 | CTD-Rosette ↑ | 102 | 192 | 198 | 10 | 8.5 | 6.8 | 1014.8 | 91 | 0/10 |
| 1a | AN01-09 | Mooring | 19/Jul/2010 | 06h42 | UTC-4 | 59°58.225 | 091°57.012 | Mooring AN01-09 Recovered | 105 | 217 | 205 | 12 | 9.0 | 7.2 | 1014.8 | 87 | 0/10 |
| 1a | AN01-09 | Mooring | 19/Jul/2010 | 07h14 | UTC-4 | 59°58.428 | 091°56.635 | Mooring AN01-09 Recovered (end) | 106 | 211 | 209 | 13 | 9.2 | 6.7 | 1015.0 | 86 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 08h08 | UTC-4 | 59°58.990 | 091°56.540 | Zodiac Deployed | 100 | 280 | 210 | 15 | 8.5 | 6.9 | 1014.9 | 89 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 08h15 | UTC-4 | 59°59.050 | 091°56.520 | Hg Sampling ↓ | 100 | 285 | 210 | 14 | 8.7 | 6.9 | 1014.8 | 88 | 0/10 |

| 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 | | | | | |
| 1a | 707 | Full | 19/Jul/2010 | 09h11 | UTC-4 | 59°59.690 | 091°56.620 | Zodiac Recovered Hg Sampling ↑ | 107 | 295 | 210 | 12 | 8.5 | 6.9 | 1014.5 | 86 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 09h18 | UTC-4 | 59°59.690 | 091°56.620 | Zodiac Deployed Hg Sampling ↓ | 107 | 295 | 210 | 12 | 8.5 | 6.9 | 1014.5 | 86 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 10h35 | UTC-4 | 59°59.990 | 091°57.160 | Hg Sampling ↑ | 113 | 299 | 210 | 11 | 8.3 | 6.9 | 1014.2 | 90 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 10h44 | UTC-4 | 60°00.010 | 091°57.240 | Zodiac Recovered | 116 | 304 | 210 | 12 | 8.4 | 6.8 | 1014.0 | 90 | 0/10 |
| 1a | AN01-10 | Mooring | 19/Jul/2010 | 11h05 | UTC-4 | 59°58.280 | 091°56.940 | Zodiac Deployed Mooring AN01-10 Deployed | 102 | 135 | 212 | 12 | 8.5 | 6.8 | 1013.9 | 89 | 0/10 |
| 1a | AN01-10 | Mooring | 19/Jul/2010 | 11h27 | UTC-4 | 59°58.172 | 091°56.986 | Mooring AN01-10 Deployed (end) | 106 | 224 | 204 | 13 | 8.7 | 7.1 | 1013.9 | 89 | 0/10 |
| 1a | AN01-11 | Mooring | 19/Jul/2010 | 11h33 | UTC-4 | 59°58.170 | 091°56.990 | Zodiac Recovered | 105 | 282 | 205 | 14 | 8.7 | 7.1 | 1013.9 | 89 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 11h53 | UTC-4 | 59°58.630 | 091°57.120 | CTD-Rosette ↓ | 104 | 186 | 220 | 13 | 8.6 | 7.1 | 1013.8 | 90 | 0/10 |
| 1a | 707 | Full | 19/Jul/2010 | 12h06 | UTC-4 | 59°58.550 | 091°57.180 | CTD-Rosette ↑ | 103 | 190 | 210 | 12 | 8.7 | 7.2 | 1013.8 | 90 | 0/10 |
| 1a | N/A | N/A | 20/Jul/2010 | N/A | UTC-4 | N/A | N/A | Water Sampling ↓↑ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | VIP | N/A | 20/Jul/2010 | 05h58 | UTC-4 | 58°54.714 | 093°57.290 | CTD-Rosette ↓ | 32 | 102 | 104 | 13 | 17.4 | 13.2 | 1011.7 | 63 | 0/10 |
| 1a | VIP | N/A | 20/Jul/2010 | 06h05 | UTC-4 | 58°54.739 | 093°57.205 | CTD-Rosette ↑ | 31 | 107 | 316 | 13 | 17.4 | 13.0 | 1011.9 | 63 | 0/10 |
| 1a | VIP | N/A | 20/Jul/2010 | N/A | UTC-4 | N/A | N/A | Horizontal Net Tow ↓ (canceled) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 1a | N/A | Box Core | 21/Jul/2010 | 03h57 | UTC-4 | 59°36.733 | 091°49.794 | Box Core ↓ | 120 | 164 | 170 | 14 | 10.4 | 10.9 | 1013.0 | 93 | 0/10 |
| 1a | N/A | Box Core | 21/Jul/2010 | 04h05 | UTC-4 | 59°36.764 | 091°49.627 | Box Core (bottom) | 120 | 181 | 123 | 14 | 10.4 | 10.7 | 1013.1 | 92 | 0/10 |
| 1a | N/A | Box Core | 21/Jul/2010 | 04h00 | UTC-4 | 59°36.756 | 091°49.747 | Box Core ↑ | 119 | N/A | 123 | 14 | 10.4 | 10.7 | 1013.1 | 92 | 0/10 |
| 1a | N/A | Box Core | 21/Jul/2010 | 04h21 | UTC-4 | 59°36.915 | 091°49.919 | Agassiz Trawl ↓ | 122 | 300 | 184 | 14 | 10.1 | 10.4 | 1012.9 | 93 | 0/10 |
| 1a | N/A | Box Core | 21/Jul/2010 | 04h38 | UTC-4 | 59°36.778 | 091°50.461 | Agassiz Trawl ↑ | 121 | 192 | 178 | 13 | 10.1 | 10.4 | 1012.9 | 93 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 08h23 | UTC-4 | 58°47.070 | 091°31.650 | PNF ↓ | 76 | 126 | 135 | 9 | 10.0 | 11.1 | 1013.3 | 91 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 08h28 | UTC-4 | 58°47.090 | 091°31.590 | PNF ↑ | 75 | 135 | 135 | 10 | 10.0 | 11.1 | 1013.3 | 91 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 08h28 | UTC-4 | 58°47.090 | 091°31.590 | Secchi Disk ↓↑ | 75 | 135 | 135 | 10 | 10.0 | 11.1 | 1013.3 | 91 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 08h41 | UTC-4 | 58°47.150 | 091°31.490 | SHO Profile ↓ | 76 | 80 | 150 | 10 | 10.1 | 11.1 | 1013.5 | 90 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 09h00 | UTC-4 | 58°47.140 | 091°31.440 | SHO Profile ↑ | 75 | 38 | 150 | 9 | 11.6 | 10.5 | 1013.5 | 85 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 09h12 | UTC-4 | 58°47.150 | 091°31.310 | CTD-Rosette ↓ | 77 | 168 | 160 | 8 | 11.2 | 10.4 | 1013.6 | 87 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 09h39 | UTC-4 | 58°47.290 | 091°31.150 | CTD-Rosette ↑ | 75 | 150 | 165 | 11 | 10.5 | 10.5 | 1013.7 | 86 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 10h38 | UTC-4 | 58°46.770 | 091°31.850 | Zodiac Deployed (Hg sampling) | 80 | 159 | 160 | 12 | 10.8 | 11.1 | 1013.5 | 85 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 10h38 | UTC-4 | 58°46.770 | 091°31.850 | Zodiac Deployment Canceled (mechanical problem) | 80 | 159 | 160 | 12 | 10.8 | 11.1 | 1013.5 | 85 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 12h43 | UTC-4 | 58°47.900 | 091°32.300 | Zodiac Deployed (Hg sampling) | 77 | 175 | 140 | 10 | 10.9 | 10.3 | 1013.7 | 86 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 12h58 | UTC-4 | 58°47.940 | 091°32.300 | Hg Sampling ↑ | 76 | 175 | 140 | 11 | 10.7 | 10.3 | 1013.5 | 87 | 0/10 |
| 1a | AN02-09 | Mooring | 21/Jul/2010 | 13h22 | UTC-4 | 58°47.140 | 091°32.040 | Grappling Mooring AN02-09 | 75 | Var | 143 | 13 | 10.8 | 10.5 | 1013.5 | 87 | 0/10 |

| 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 | | | | | |
| 1a | AN02-09 | Mooring | 21/Jul/2010 | 13h41 | UTC-4 | 58°46.550 | 091°32.050 | Grappling Mooring AN02-09 | 78 | Var | 150 | 11 | 10.7 | 10.7 | 1013.3 | 87 | 0/10 |
| 1a | AN02-09 | Mooring | 21/Jul/2010 | 13h46 | UTC-4 | 58°46.650 | 091°31.620 | Grappling Mooring AN02-09 | 81 | Var | 155 | 12 | 10.7 | 10.7 | 1013.3 | 87 | 0/10 |
| 1a | AN02-09 | Mooring | 21/Jul/2010 | 14h05 | UTC-4 | 58°47.000 | 091°32.170 | Grappling Mooring AN02-09 (not recovered) | 77 | Var | 153 | 12 | 10.5 | 10.9 | 1013.3 | 87 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 14h32 | UTC-4 | 58°46.950 | 091°32.350 | Vertical Net Tow ↓ | 78 | 149 | 160 | 12 | 11.4 | 10.8 | 1013.1 | 85 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 14h38 | UTC-4 | 58°45.950 | 091°32.380 | Vertical Net Tow ↑ | 78 | 169 | 150 | 14 | 11.4 | 10.8 | 1013.1 | 85 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 15h00 | UTC-4 | 58°46.560 | 091°32.400 | Horizontal Net Tow ↓ | 77 | 176 | 150 | 16 | 10.0 | 10.7 | 1012.9 | 87 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 15h10 | UTC-4 | 58°46.130 | 091°32.560 | Horizontal Net Tow ↑ | 78 | 148 | 150 | 14 | 10.8 | 11.0 | 1012.6 | 88 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 15h29 | UTC-4 | 58°46.070 | 091°32.380 | Vertical Net Tow ↓ | 80 | 151 | 150 | 14 | 11.1 | 11.2 | 1012.7 | 89 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 15h34 | UTC-4 | 58°46.070 | 091°32.370 | Vertical Net Tow ↑ | 81 | 156 | 150 | 13 | 11.0 | 11.2 | 1012.6 | 89 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 15h26 | UTC-4 | 58°46.130 | 091°32.560 | Zodiac Recovered | 78 | 229 | 150 | 14 | 10.8 | 11.0 | 1012.6 | 88 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 15h48 | UTC-4 | 58°46.380 | 091°32.020 | CTD-Rosette ↓ | 78 | 152 | 150 | 14 | 11.0 | 11.2 | 1012.5 | 89 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 16h05 | UTC-4 | 58°46.348 | 091°31.956 | CTD-Rosette ↑ | 80 | 151 | 153 | 12 | 11.0 | 11.2 | 1012.4 | 89 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 16h20 | UTC-4 | 58°46.343 | 091°31.941 | Box Core ↓ | 79 | 145 | 150 | 10 | 11.0 | 11.1 | 1012.4 | 89 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 16h24 | UTC-4 | 58°46.334 | 091°31.926 | Box Core (bottom) | 81 | 145 | 149 | 10 | 10.9 | 10.8 | 1012.4 | 89 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 16h27 | UTC-4 | 58°46.328 | 091°31.927 | Box Core ↑ | 81 | 150 | 151 | 11 | 10.9 | 10.8 | 1012.4 | 89 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 16h45 | UTC-4 | 58°46.464 | 091°32.525 | Agassiz Trawl ↓ | 77 | 300 | 141 | 11 | 10.5 | 10.7 | 1012.5 | 89 | 0/10 |
| 1a | 706 | Full | 21/Jul/2010 | 16h55 | UTC-4 | 58°46.456 | 091°33.059 | Agassiz Trawl ↑ | 77 | 238 | 141 | 11 | 10.7 | 10.5 | 1012.5 | 89 | 0/10 |
| 1a | A11 | River (Hayes-Nelson) | 21/Jul/2010 | 21h45 | UTC-4 | 57°44.190 | 091°43.830 | Water Sampling + CTD ↓ | 39 | 280 | 190 | 6 | 11.5 | 9.4 | 1012.2 | 87 | 0/10 |
| 1a | A11 | River (Hayes-Nelson) | 21/Jul/2010 | 21h49 | UTC-4 | 57°44.260 | 091°43.860 | Water Sampling + CTD ↑ | 40 | 288 | 195 | 7 | 11.5 | 9.4 | 1012.2 | 87 | 0/10 |
| 1a | A12 | River (Hayes-Nelson) | 21/Jul/2010 | 22h16 | UTC-4 | 57°44.970 | 091°36.610 | Water Sampling + CTD ↓ | 51 | 88 | 175 | 9 | 13.1 | 9.9 | 1012.1 | 80 | 0/10 |
| 1a | A12 | River (Hayes-Nelson) | 21/Jul/2010 | 22h27 | UTC-4 | 57°45.080 | 091°36.280 | Water Sampling + CTD ↑ | 50 | 74 | 170 | 7 | 11.9 | 10.1 | 1012.0 | 90 | 0/10 |
| 1a | A13 | River (Hayes-Nelson) | 21/Jul/2010 | 22h58 | UTC-4 | 57°46.000 | 091°27.890 | Water Sampling + CTD ↓ | 53 | 84 | 185 | 9 | 12.5 | 10.3 | 1011.5 | 88 | 0/10 |
| 1a | A13 | River (Hayes-Nelson) | 21/Jul/2010 | 23h13 | UTC-4 | 57°46.130 | 091°27.350 | Water Sampling + CTD ↑ | 62 | 70 | 175 | 7 | 14.0 | 10.4 | 1011.0 | 79 | 0/10 |
| 1a | A14 | River (Hayes-Nelson) | 21/Jul/2010 | 23h50 | UTC-4 | 57°46.950 | 091°19.950 | Water Sampling + CTD ↓ | 63 | 110 | 185 | 6 | 12.8 | 9.8 | 1010.3 | 87 | 0/10 |
| 1a | A14 | River (Hayes-Nelson) | 22/Jul/2010 | 00h15 | UTC-4 | 57°46.950 | 091°25.300 | Water Sampling + CTD ↑ | 64 | 120 | 180 | 7 | 12.7 | 9.5 | 1010.3 | 87 | 0/10 |
| 1a | A15 | River (Hayes-Nelson) | 22/Jul/2010 | 00h34 | UTC-4 | 57°42.780 | 091°20.120 | Water Sampling + CTD ↓ | 45 | 199 | 160 | 15 | 13.0 | 9.1 | 1010.1 | 89 | 0/10 |

| 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 | | | | | |
| 1a | A15 | River (Hayes-Nelson) | 22/Jul/2010 | 00h43 | UTC-4 | 57°42.660 | 091°20.190 | Water Sampling + CTD ↑ | 47 | 191 | 160 | 15 | 13.0 | 9.1 | 1010.1 | 89 | 0/10 |
| 1a | A16 | River (Hayes-Nelson) | 22/Jul/2010 | 01h15 | UTC-4 | 57°38°740 | 091°20.310 | Water Sampling + CTD ↓ | 46 | 232 | 190 | 11 | 13.6 | 9.5 | 1010.4 | 87 | 0/10 |
| 1a | A16 | River (Hayes-Nelson) | 22/Jul/2010 | 01h22 | UTC-4 | 57°38°670 | 091°20.430 | Water Sampling + CTD ↑ | 46 | 190 | 180 | 13 | 14.2 | 10.7 | 1010.4 | 85 | 0/10 |
| 1a | A17 | River (Hayes-Nelson) | 22/Jul/2010 | 01h55 | UTC-4 | 57°34.640 | 091°20.440 | Water Sampling + CTD ↓ | 37 | 194 | 200 | 10 | 14.3 | 12.4 | 1010.5 | 89 | 0/10 |
| 1a | A17 | River (Hayes-Nelson) | 22/Jul/2010 | 02h05 | UTC-4 | 57°34.480 | 091°20.390 | Water Sampling + CTD ↑ | 38 | 148 | 200 | 13 | 14.0 | 12.5 | 1010.5 | 90 | 0/10 |
| 1a | A17 | River (Hayes-Nelson) | 22/Jul/2010 | 02h47 | UTC-4 | 57°29.920 | 091°22.660 | Water Sampling + CTD ↓ | 27 | 133 | 220 | 14 | 14.5 | 11.7 | 1010.1 | 91 | 0/10 |
| 1a | A17 | River (Hayes-Nelson) | 22/Jul/2010 | 02h55 | UTC-4 | 57°29.930 | 091°22.660 | Water Sampling + CTD ↑ | 30 | 117 | 210 | 16 | 14.4 | 11.7 | 1010.2 | 93 | 0/10 |
| 1a | A7 | River (Hayes-Nelson) | 22/Jul/2010 | 04h10 | UTC-4 | 57°26.094 | 091°34.557 | Water Sampling + CTD ↓↑ | 28 | 270 | 132 | 1 | 14.5 | 12.5 | 1010.2 | 95 | 0/10 |
| 1a | A7 | River (Hayes-Nelson) | 22/Jul/2010 | 04h21 | UTC-4 | 57°26.000 | 091°34.850 | Water Sampling + CTD ↓↑ | 27 | 273 | 132 | 1 | 14.5 | 12.5 | 1010.2 | 95 | 0/10 |
| 1a | A6 | River (Hayes-Nelson) | 22/Jul/2010 | 05h10 | UTC-4 | 57°24.670 | 091°42.230 | Water Sampling + CTD ↓↑ | 49 | 255 | 180 | 5 | 14.8 | 12.7 | 1009.6 | 95 | 0/10 |
| 1a | A6 | River (Hayes-Nelson) | 22/Jul/2010 | 05h18 | UTC-4 | 57°24.580 | 091°42.580 | Water Sampling + CTD ↓↑ | 49 | 285 | 180 | 5 | 14.8 | 12.7 | 1009.0 | 95 | 0/10 |
| 1a | A5 | River (Hayes-Nelson) | 22/Jul/2010 | 05h55 | UTC-4 | 57°23.450 | 091°49.240 | Water Sampling + CTD ↓↑ | 43 | 288 | 164 | 7 | 15.0 | 12.9 | 1009.5 | 94 | 0/10 |
| 1a | A5 | River (Hayes-Nelson) | 22/Jul/2010 | 06h05 | UTC-4 | 57°23.390 | 091°49.570 | Water Sampling + CTD ↓↑ | 42 | 291 | 164 | 7 | 15.0 | 12.9 | 1009.5 | 94 | 0/10 |
| 1a | A4 | River (Hayes-Nelson) | 22/Jul/2010 | 06h53 | UTC-4 | 57°22.060 | 091°56.900 | Water Sampling + CTD ↓↑ | 34 | 326 | 162 | 3 | 14.5 | 12.8 | 1009.5 | 96 | 0/10 |
| 1a | A8 | River (Hayes-Nelson) | 22/Jul/2010 | 06h56 | UTC-4 | 57°22.050 | 091°56.950 | Water Sampling + CTD ↓↑ | 34 | 328 | 162 | 3 | 14.5 | 12.8 | 1009.5 | 96 | 0/10 |
| 1a | A8 | River (Hayes-Nelson) | 22/Jul/2010 | 06h59 | UTC-4 | 57°21.997 | 091°57.077 | Water Sampling + CTD ↓↑ | 34 | 324 | 162 | 3 | 14.5 | 12.8 | 1009.6 | 96 | 0/10 |
| 1a | N/A | N/A | N/A | N/A | N/A | N/A | N/A | Barge Deployed | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | NR-B12 | River (Hayes-Nelson) | 22/Jul/2010 | 07h20 | UTC-4 | 57°19.314 | 092°06.894 | Sampling from barge | 23 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | NR-B10 | River (Hayes-Nelson) | 22/Jul/2010 | 08h45 | UTC-4 | 57°14.820 | 092°13.194 | Sampling from barge | 11 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | 705B | Nutrient | 22/Jul/2010 | 09h09 | UTC-4 | 57°25.530 | 091°53.470 | PNF ↓↑ | 36 | 350 | 220 | 8 | N/A | N/A | 1009.6 | 97 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 09h20 | UTC-4 | 57°25.530 | 091°53.470 | SHO Profile | 36 | 330 | 222 | 9 | 13.6 | 9.6 | 1009.6 | 97 | 0/10 |

| 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 | | | | | |
| 1a | NR-B9 | River (Hayes-Nelson) | 22/Jul/2010 | 09h20 | UTC-4 | 57°12.645 | 092°15.738 | Sampling from barge | 9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | NR-B8 | River (Hayes-Nelson) | 22/Jul/2010 | 09h35 | UTC-4 | 57°10.746 | 092°19.872 | Sampling from barge | 10 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | 705B | Nutrient | 22/Jul/2010 | 09h52 | UTC-4 | 57°25.530 | 091°53.470 | Water Pumping ↓ | 36 | 328 | 235 | 6 | 13.7 | 9.0 | 1009.6 | 97 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 09h59 | UTC-4 | 57°25.530 | 091°53.470 | CTD-Rosette ↓ | 36 | 316 | 237 | 6 | 13.9 | 8.1 | 1009.6 | 97 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 10h07 | UTC-4 | 57°25.500 | 091°53.500 | CTD-Rosette ↑ | 36 | 326 | 227 | 5 | 13.8 | 7.9 | 1009.6 | 97 | 0/10 |
| 1a | NR-B7 | River (Hayes-Nelson) | 22/Jul/2010 | 10h15 | UTC-4 | 57°08.784 | 092°23.166 | Sampling from barge | 19 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | 705B | Nutrient | 22/Jul/2010 | 10h34 | UTC-4 | 57°25.500 | 091°53.500 | Vertical Net Tow ↓ | 36 | 284 | 223 | 3 | 13.8 | 7.5 | 1009.4 | 96 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 10h39 | UTC-4 | 57°25.500 | 091°53.500 | Vertical Net Tow ↑ | 36 | 280 | 19 | 2 | 14.0 | 7.6 | 1009.3 | 95 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 10h52 | UTC-4 | 57°25.500 | 091°53.500 | Vertical Net Tow ↓ | 36 | 263 | Calm | Calm | 14.6 | 7.6 | 1009.2 | 93 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 10h56 | UTC-4 | 57°25.500 | 091°53.500 | Vertical Net Tow ↑ | 36 | 254 | Calm | Calm | 14.6 | 7.6 | 1009.2 | 93 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 11h21 | UTC-4 | 57°25.500 | 091°53.500 | CTD ↓ | 35 | 193 | 160 | 6 | 14.1 | 7.6 | 1009.4 | 95 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 11h32 | UTC-4 | 57°25.600 | 091°53.500 | CTD ↑ | 35 | 174 | 148 | 7 | 14.0 | 7.4 | 1009.5 | 96 | 0/10 |
| 1a | NR-B6 | River (Hayes-Nelson) | 22/Jul/2010 | 11h40 | UTC-4 | 57°06.684 | 092°26.496 | Sampling from barge (annabelle) | 9 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | 705B | Nutrient | 22/Jul/2010 | 12h14 | UTC-4 | 57°25.600 | 091°53.470 | Water Pumping ↑ | 34 | 180 | 210 | 7 | 14.7 | 7.0 | 1009.6 | 95 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 12h48 | UTC-4 | 57°25.600 | 091°53.480 | CTD-Rosette ↓ | 35 | 180 | 210 | 7 | 14.7 | 7.0 | 1009.6 | 95 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 12h51 | UTC-4 | 57°25.600 | 091°53.480 | Water Pumping ↓ | 35 | 180 | 205 | 5/7 | 15.0 | 7.0 | 1009.6 | 92 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 13h15 | UTC-4 | 57°25.610 | 091°53.540 | Box Core ↓ | 34 | 180 | 200 | 5 | 15.1 | 7.1 | 1009.7 | 90 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 13h21 | UTC-4 | 57°25.610 | 091°53.520 | Box Core ↑ | 35 | 180 | Calm | Calm | 15.5 | 7.1 | 1009.1 | 91 | 0/10 |
| 1a | HR-D7 | River (Hayes-Nelson) | 22/Jul/2010 | 13h45 | UTC-4 | 57°12.870 | 091°54.923 | Sampling from barge | 14 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 1a | 705B | Nutrient | 22/Jul/2010 | 13h50 | UTC-4 | 57°25.600 | 091°53.520 | Piston Core ↓ | 35 | 180 | Calm | Calm | 15.8 | 7.1 | 1009.1 | 89 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 14h00 | UTC-4 | 57°25.580 | 091°53.520 | Piston Core ↑ | 34 | Var | Calm | Calm | 16.0 | 7.1 | 1009.1 | 87 | 0/10 |
| 1a | HR-D8 | River (Hayes-Nelson) | 22/Jul/2010 | 14h30 | UTC-4 | 57°14.442 | 091°52.150 | Sampling from barge | 16 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 14h55 | UTC-4 | 57°25.580 | 091°53.520 | Water Pumping ↑ | 34 | Var | Calm | Calm | 13.0 | 8.3 | 1009.1 | 97 | 0/10 |
| 1a | NR-BD20 | River (Hayes-Nelson) | 22/Jul/2010 | 15h10 | UTC-4 | 57°14.470 | 091°52.194 | Sampling from barge | 28 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 15h15 | UTC-4 | 57°25.580 | 091°53.520 | CTD ↓ | 34 | Var | 0 | 5 | 13.2 | 8.3 | 1009.1 | 97 | 0/10 |
| 1a | 705B | Nutrient | 22/Jul/2010 | 15h28 | UTC-4 | 57°25.580 | 091°53.520 | CTD ↑ | 34 | N/A | 5 | 8 | 13.1 | 8.3 | 1009.1 | 97 | 0/10 |
| 1a | 705A | Full | 22/Jul/2010 | 19h22 | UTC-4 | 57°25.520 | 091°53.510 | Piston Core ↓↑ | 36 | Var | 55 | 3 | 14.2 | 11.5 | 1008.4 | 98 | 0/10 |

| 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 | | | | | |
| 1a | 705C | Nutrient | 23/Jul/2010 | 04h22 | UTC-4 | 57°42.262 | 090°45.636 | Water Sampling ↓↑ | 37 | 107 | 80 | 9 | 8.8 | 11.4 | 1012.3 | 99 | 0/10 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 04h27 | UTC-4 | 57°42.262 | 090°45.636 | Sampling ↓↑ | 38 | 60 | 74 | 7 | 8.8 | 11.4 | 1012.3 | 99 | 0/10 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 04h34 | UTC-4 | 57°42.298 | 090°45.676 | SHO Profile ↓ | 37 | 72 | 86 | 6 | 8.9 | 11.4 | 1012.6 | 99 | 0/10 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 04h40 | UTC-4 | 57°42.323 | 090°45.717 | SHO Profile ↑ | 38 | 74 | 86 | 7 | 8.9 | 11.4 | 1012.6 | 99 | 0/10 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 04h45 | UTC-4 | 57°42.336 | 090°45.851 | SHO Profile ↓ | 39 | 74 | 96 | 7 | 8.9 | 11.4 | 1012.6 | 99 | 0/10 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 04h50 | UTC-4 | 57°42.336 | 090°45.851 | SHO Profile ↑ | 40 | 86 | 87 | 7 | 8.9 | 11.4 | 1012.5 | 99 | 0/10 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 04h53 | UTC-4 | 57°42.337 | 090°45.904 | Water Sampling ↓↑ | 40 | 81 | 91 | 9 | 8.9 | 11.1 | 1012.6 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 05h57 | UTC-4 | 57°25.530 | 091°53.530 | PNF ↓ | 29 | N/A | 22 | 10 | 10.4 | 8.8 | 1009.3 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 06h01 | UTC-4 | 57°25.520 | 091°53.540 | PNF ↑ | 35 | Var | 19 | 10 | 10.4 | 9.0 | 1009.3 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 06h02 | UTC-4 | 57°25.520 | 091°53.540 | Secchi Disk ↓ | 35 | Var | 23 | 10 | 10.4 | 9.0 | 1009.3 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 06h05 | UTC-4 | 57°25.520 | 091°53.540 | Secchi Disk ↑ | 35 | Var | 23 | 10 | 10.4 | 9.0 | 1009.3 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 07h18 | UTC-4 | 57°25.442 | 091°53.475 | CTD-Rosette ↓ | 36 | 17 | 20 | 7 | 9.6 | 8.9 | 1009.4 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 07h36 | UTC-4 | 57°25.330 | 091°53.582 | CTD-Rosette ↑ | 36 | 8 | 13 | 8 | 9.9 | 9.3 | 1009.5 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 07h48 | UTC-4 | 57°24.970 | 091°53.280 | Horizontal Net Tow ↓ | 37 | 105 | 15 | 8 | 10.0 | 9.3 | 1009.6 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 07h53 | UTC-4 | 57°24.860 | 091°52.850 | Horizontal Net Tow ↑ | 37 | 64 | 40 | 7 | 9.8 | 9.0 | 1009.7 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 08h13 | UTC-4 | 57°24.830 | 091°52.830 | Agassiz Trawl ↓ | 37 | 132 | 45 | 7 | 10.9 | 9.4 | 1010.1 | 99 | 0/10 |
| 1a | 705A | Full | 23/Jul/2010 | 08h28 | UTC-4 | 57°24.470 | 091°52.650 | Agassiz Trawl ↑ | 37 | 120 | 45 | 7 | 11.0 | 9.5 | 1010.2 | 99 | 0/10 |
| 1a | Intermediate A8-705A | River (Hayes-Nelson) | 23/Jul/2010 | 09h15 | UTC-4 | 57°26.590 | 091°44.520 | Water Sampling + CTD ↓ | 41 | 46 | Calm | Calm | 11.9 | 12.3 | 1010.5 | 99 | 0/10 |
| 1a | Intermediate A8-705A | River (Hayes-Nelson) | 23/Jul/2010 | 09h22 | UTC-4 | 57°26.630 | 091°44.350 | Water Sampling + CTD ↑ | 41 | 63 | 70 | 5 | 11.8 | 12.7 | 1010.8 | 99 | 0/10 |
| 1a | A8 | River (Hayes-Nelson) | 23/Jul/2010 | 09h59 | UTC-4 | 57°29.670 | 091°35.330 | Water Sampling + CTD ↓ | 37 | 44 | Calm | Calm | 11.4 | 12.6 | 1010.9 | 99 | 0/10 |
| 1a | A8 | River (Hayes-Nelson) | 23/Jul/2010 | 10h07 | UTC-4 | 57°29.780 | 091°35.150 | Water Sampling + CTD ↑ | 39 | 43 | Calm | Calm | 11.3 | 12.5 | 1010.9 | 99 | 0/10 |
| 1a | A8 | River (Hayes-Nelson) | 23/Jul/2010 | 10h07 | UTC-4 | 57°29.780 | 091°35.150 | Zodiac Deployed | 39 | 43 | Calm | Calm | 11.3 | 12.5 | 1010.9 | 99 | 0/10 |
| 1a | Intermediate A8-705B | River (Hayes-Nelson) | 23/Jul/2010 | 10h43 | UTC-4 | 57°32.160 | 091°28.370 | Water Sampling + CTD ↓ | 34 | 62 | 320 | 5 | 11.1 | 12.3 | 1010.9 | 99 | 0/10 |
| 1a | Intermediate A8-705B | River (Hayes-Nelson) | 23/Jul/2010 | 10h52 | UTC-4 | 57°32.280 | 091°28.170 | Water Sampling + CTD ↑ | 34 | 43 | 300 | 6 | 11.0 | 12.6 | 1010.9 | 99 | 0/10 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 11h24 | UTC-4 | 57°34.670 | 091°20.750 | Water Sampling + CTD ↓ | 40 | 302 | 310 | 5 | 10.5 | 12.9 | 1010.8 | 99 | 0/10 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 11h32 | UTC-4 | 57°34.780 | 091°20.780 | Water Sampling + CTD ↑ | 42 | 340 | 325 | 7 | 10.5 | 12.9 | 1010.8 | 99 | 0/10 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 12h04 | UTC-4 | 57°34.940 | 091°20.600 | Zodiac Recovered | 42 | 110 | 350 | 8 | 10.1 | 11.3 | 1010.6 | 99 | 0/10 |

| 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 | | | | | |
| 1a | 705B | Nutrient | 23/Jul/2010 | 12h24 | UTC-4 | 57°35.080 | 091°20.430 | Barge Deployed | 42 | 110 | 20 | 8 | 10.2 | 9.7 | 1010.9 | 99 | 0/10 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 12h47 | UTC-4 | 57°34.710 | 091°20.340 | SHO Profile ↓ | 38 | 357 | 20 | 6 | 10.7 | 10.6 | 1010.9 | 99 | 0/10 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 13h08 | UTC-4 | 57°34.900 | 091°20.210 | SHO Profile ↑ | 38 | 18 | 20 | 8 | 9.8 | 10.4 | 1011.2 | 99 | 0/10 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 13h16 | UTC-4 | 57°34.980 | 091°21.160 | CTD-Rosette ↓ | 38 | 23 | 23 | 8 | 9.9 | 9.7 | 1011.1 | 99 | 0/10 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 13h28 | UTC-4 | 57°35.110 | 091°20.080 | CTD-Rosette ↑ | 39 | 28 | 25 | 10 | 9.7 | 9.1 | 1011.2 | 99 | 0/10 |
| 1a | 705B | Nutrient | 23/Jul/2010 | 13h12 | UTC-4 | 57°34.910 | 091°20.200 | Water Sampling ↓↑ | 38 | 21 | 20 | 8 | 9.9 | 9.7 | 1011.1 | 99 | 0/10 |
| 1a | Intermediate 705B-C | River (Hayes-Nelson) | 23/Jul/2010 | 14h12 | UTC-4 | 57°37.020 | 091°11.650 | Water Sampling + CTD ↓↑ | 44 | 93 | 40 | 8 | 9.3 | 11.3 | 1011.2 | 99 | 0/10 |
| 1a | Intermediate 705B-C | River (Hayes-Nelson) | 23/Jul/2010 | 14h54 | UTC-4 | 57°38.740 | 091°02.810 | Water Sampling + CTD ↓↑ | 38 | 34 | 50 | 9 | 9.1 | 11.5 | 1011.6 | 99 | 0/10 |
| 1a | Intermediate 705B-C | River (Hayes-Nelson) | 23/Jul/2010 | 15h34 | UTC-4 | 57°40.300 | 090°54.810 | Water Sampling + CTD ↓↑ | 35 | 145 | 50 | 8 | 8.8 | 12.0 | 1011.9 | 99 | 0/10 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 17h02 | UTC-4 | 57°42.340 | 090°46.030 | CTD-Rosette ↓ | 41 | 78 | 80 | 6 | 8.9 | 11.1 | 1012.5 | 99 | 0/10 |
| 1a | 705C | Nutrient | 23/Jul/2010 | 17h11 | UTC-4 | 57°42.350 | 090°46.180 | CTD-Rosette ↑ | 43 | 81 | 80 | 8 | 8.9 | 11.0 | 1012.6 | 99 | 0/10 |
| 1a | A25 | River (Hayes-Nelson) | 23/Jul/2010 | 18h05 | UTC-4 | 57°47.180 | 090°49.920 | Water Sampling ↓↑ | 40 | 351 | 96 | 7 | 8.9 | 10.9 | 1012.7 | 99 | 0/10 |
| 1a | A25 | River (Hayes-Nelson) | 23/Jul/2010 | 18h05 | UTC-4 | 57°47.210 | 090°50.070 | Water Sampling + CTD ↓↑ | 40 | 328 | 77 | 7 | 9.0 | 11.1 | 1012.8 | 99 | 0/10 |
| 1a | A24 | River (Hayes-Nelson) | 23/Jul/2010 | 18h41 | UTC-4 | 57°45.553 | 090°56.907 | Water Sampling ↓↑ | 47 | 241 | 60 | 6 | 8.8 | 11.0 | 1012.8 | 99 | 0/10 |
| 1a | A24 | River (Hayes-Nelson) | 23/Jul/2010 | 18h44 | UTC-4 | 57°45.537 | 090°57.054 | Water Sampling + CTD ↓↑ | 45 | 251 | 304 | 1 | 8.8 | 11.0 | 1012.8 | 99 | 0/10 |
| 1a | A23 | River (Hayes-Nelson) | 23/Jul/2010 | 19h21 | UTC-4 | 57°41.321 | 090°57.477 | Water Sampling ↓↑ | 39 | 164 | 67 | 7 | 8.7 | 11.0 | 1012.9 | 99 | 0/10 |
| 1a | A23 | River (Hayes-Nelson) | 23/Jul/2010 | 19h27 | UTC-4 | 57°41.270 | 090°57.548 | Water Sampling + CTD ↓↑ | 40 | 169 | 72 | 7 | 8.7 | 11.0 | 1012.9 | 99 | 0/10 |
| 1a | A23 | River (Hayes-Nelson) | 23/Jul/2010 | 19h56 | UTC-4 | 57°41.190 | 090°57.960 | Barge Recovered | 40 | 138 | 70 | 10 | 8.5 | 11.2 | 1012.9 | 99 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 05h55 | UTC-4 | 57°40.517 | 091°34.801 | PNF ↓ | 52 | 41 | 125 | 4 | 11.7 | 10.7 | 1013.8 | 99 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 05h59 | UTC-4 | 57°40.510 | 091°34.801 | PNF ↑ | 52 | 41 | 125 | 4 | 11.7 | 10.7 | 1013.8 | 99 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 06h00 | UTC-4 | 57°40.517 | 091°34.801 | Secchi Disk ↓ | 52 | 41 | 125 | 4 | 11.7 | 10.7 | 1013.8 | 99 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 06h01 | UTC-4 | 57°40.517 | 091°34.801 | Secchi Disk ↑ | 52 | 41 | 142 | 5 | 11.7 | 10.7 | 1013.8 | 99 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 06h25 | UTC-4 | 57°40.514 | 091°34.814 | SHO Profile ↓ | 52 | 37 | 135 | 5 | 11.8 | 10.9 | 1013.8 | 99 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 06h36 | UTC-4 | 57°40.509 | 091°34.809 | SHO Profile ↑ | 52 | 38 | 147 | 5 | 11.8 | 10.9 | 1014.0 | 99 | 0/10 |

| 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 | | | | | |
| 1a | 705M | Full | 24/Jul/2010 | 06h39 | UTC-4 | 57°40.508 | 091°34.815 | Water Sampling ↓↑ | 53 | 38 | 141 | 5 | 11.8 | 10.9 | 1014.0 | 99 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 06h50 | UTC-4 | 57°40.502 | 091°34.834 | CTD-Rosette ↓ | 53 | 36 | 140 | 5 | 11.8 | 10.9 | 1014.0 | 98 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 07h13 | UTC-4 | 57°40.505 | 091°34.841 | CTD-Rosette ↑ | 53 | 36 | 141 | 6 | 12.1 | 11.0 | 1013.9 | 94 | 0/10 |
| 1a | AN04-09 | Mooring | 24/Jul/2010 | 08h55 | UTC-4 | 57°40.150 | 091°36.240 | Mooring AN04-09 Recovered | 59 | 95 | 133 | 4 | 11.8 | 11.1 | 1012.0 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 09h35 | UTC-4 | 57°39.910 | 091°36.310 | Vertical Net Tow ↓ | 57 | 122 | 145 | 6 | 12.1 | 10.9 | 1014.5 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 09h40 | UTC-4 | 57°39.880 | 091°36.300 | Vertical Net Tow ↑ | 57 | 131 | 135 | 6 | 12.0 | 10.7 | 1014.5 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 09h54 | UTC-4 | 57°39.820 | 091°36.310 | Zodiac Deployed | 57 | 127 | 160 | 5 | 12.1 | 10.6 | 1014.4 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 10h05 | UTC-4 | 57°39.770 | 091°36.110 | Horizontal Net Tow ↓ | 55 | Var | 165 | 5 | 12.4 | 10.6 | 1014.5 | 93 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 10h13 | UTC-4 | 57°39.990 | 091°35.820 | Horizontal Net Tow ↑ | 63 | Var | 150 | 4 | 12.5 | 10.6 | 1014.5 | 93 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 10h24 | UTC-4 | 57°40.120 | 091°35.970 | Vertical Net Tow ↓ | 61 | 320 | 150 | 4 | 12.5 | 10.8 | 1014.4 | 92 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 10h29 | UTC-4 | 57°40.130 | 091°35.970 | Vertical Net Tow ↑ | 61 | 312 | 155 | 5 | 12.5 | 10.8 | 1014.4 | 92 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 10h35 | UTC-4 | 57°40.140 | 091°35.980 | Zodiac Recovered | 61 | 302 | 160 | 6 | 12.1 | 10.9 | 1014.3 | 94 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 10h36 | UTC-4 | 57°40.140 | 091°35.980 | Zodiac Deployed | 61 | 298 | 160 | 5 | 12.1 | 10.9 | 1014.3 | 94 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 10h38 | UTC-4 | 57°40.1530 | 091°35.984 | Hg Sampling ↓ | 61 | 283 | 154 | 6 | 12.1 | 10.9 | 1014.3 | 94 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 11h35 | UTC-4 | 57°40.190 | 091°35.660 | Zodiac Recovered | 63 | 156 | 140 | 5 | 12.2 | 10.6 | 1014.2 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 12h49 | UTC-4 | 57°40.870 | 091°34.790 | Hg Sampling ↑ | 58 | 256 | 180 | 5 | 12.8 | 10.4 | 1013.9 | 93 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 13h00 | UTC-4 | 57°40.430 | 091°35.920 | Mooring AN04-10A + Piston Core (preparing to deploy) | 63 | 268 | 170 | 5 | 12.9 | 11.1 | 1013.9 | 93 | 0/10 |
| 1a | AN04-10A | Mooring | 24/Jul/2010 | 14h31 | UTC-4 | 57°40.208 | 091°36.179 | Mooring AN04-10A Deployed | 60 | 202 | Calm | Calm | 14.7 | 12.2 | 1013.5 | 90 | 0/10 |
| 1a | AN04-10A | Mooring | 24/Jul/2010 | 14h40 | UTC-4 | 57°40.217 | 091°36.201 | Mooring AN04-10A Deployed | 60 | 208 | Calm | Calm | 14.7 | 12.2 | 1013.9 | 89 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 15h04 | UTC-4 | 57°39.540 | 091°35.500 | CTD-Rosette ↓ | 70 | 71 | 20 | 8 | 14.9 | 12.3 | 1013.9 | 87 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 15h20 | UTC-4 | 57°39.670 | 091°35.420 | CTD-Rosette ↑ | 67 | 36 | 20 | 8 | 13.0 | 12.2 | 1013.8 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 15h38 | UTC-4 | 57°39.536 | 091°35.629 | Box Core ↓ | 70 | 65 | 20 | 8 | 12.8 | 12.1 | 1013.8 | 94 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 15h44 | UTC-4 | 57°39.540 | 091°35.610 | Box Core ↑ | 70 | 101 | 30 | 9 | 12.7 | 12.5 | 1013.7 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 16h17 | UTC-4 | 57°39.550 | 091°35.631 | Piston Core ↓ | 70 | 126 | 57 | 8 | 12.2 | 11.8 | 1013.8 | 96 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 16h26 | UTC-4 | 57°39.565 | 091°35.629 | Piston Core (bottom) | 70 | 193 | 68 | 6 | 12.2 | 11.8 | 1013.8 | 96 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 16h31 | UTC-4 | 57°39.568 | 091°35.655 | Piston Core ↑ | 68 | 205 | 73 | 5 | 12.3 | 11.8 | 1013.7 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 17h05 | UTC-4 | 57°39.490 | 091°35.590 | Agassiz Trawl ↓ | 71 | 200 | N/A | N/A | 12.3 | 11.9 | 1013.7 | 95 | 0/10 |
| 1a | 705M | Full | 24/Jul/2010 | 17h18 | UTC-4 | 57°39.160 | 091°35.920 | Agassiz Trawl ↑ | 61 | 170 | N/A | N/A | 12.3 | 12.6 | 1013.6 | 95 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 11h47 | UTC-4 | 57°16.800 | 092°06.780 | Hg Sampling ↓ | 20 | 192 | 235 | 6 | 16.2 | 11.6 | 1005.3 | 99 | 0/10 |

| 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 | | | | | |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 12h53 | UTC-4 | 57°16.810 | 092°06.860 | Zodiac Deployed | 20 | 150 | Calm | Calm | 18.5 | 6.9 | 1005.3 | 97 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 13h18 | UTC-4 | 57°16.820 | 092°06.830 | CTD ↓ | 20 | 179 | Calm | Calm | 18.2 | 6.8 | 1005.2 | 94 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 13h25 | UTC-4 | 57°16.820 | 092°06.820 | CTD ↑ | 20 | 183 | Calm | Calm | 18.2 | 6.8 | 1005.2 | 94 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 13h43 | UTC-4 | 57°16.810 | 092°06.800 | Barge Deployed | 20 | 194 | Calm | Calm | 18.4 | 6.9 | 1004.9 | 95 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 14h28 | UTC-4 | 57°16.800 | 092°06.760 | Zodiac Recovered | 19 | 204 | Calm | Calm | 19.1 | 6.7 | 1004.8 | 88 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 14h44 | UTC-4 | 57°16.800 | 092°06.760 | Hg Sampling ↑ | 19 | 205 | Calm | Calm | 19.2 | 6.3 | 1004.7 | 86 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 14h52 | UTC-4 | 57°16.800 | 092°06.750 | Vertical Net Tow ↓ | 19 | 206 | 90 | 4 | 19.4 | 6.3 | 1004.7 | 85 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 14h55 | UTC-4 | 57°16.800 | 092°06.760 | Vertical Net Tow ↑ | 19 | 206 | 90 | 4 | 19.4 | 6.3 | 1004.7 | 85 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 15h14 | UTC-4 | 57°16.800 | 092°06.750 | Box Core ↓ | 18 | 202 | 90 | 5 | 19.7 | 6.6 | 1004.6 | 81 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 15h17 | UTC-4 | 57°16.800 | 092°06.750 | Box Core ↑ | 18 | 199 | 90 | 5 | 19.7 | 6.6 | 1004.6 | 81 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 15h26 | UTC-4 | 57°16.800 | 092°06.740 | Box Core ↓ | 18 | 208 | 70 | 8 | 19.3 | 6.6 | 1004.5 | 84 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 15h28 | UTC-4 | 57°16.800 | 092°06.750 | Box Core ↑ | 18 | 208 | 70 | 8 | 19.3 | 6.6 | 1004.5 | 84 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 15h29 | UTC-4 | 57°16.800 | 092°06.750 | Box Core ↓ | 17 | 209 | 70 | 8 | 19.3 | 6.6 | 1004.5 | 84 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 15h31 | UTC-4 | 57°16.800 | 092°06.750 | Box Core ↑ | 18 | 209 | 70 | 8 | 19.2 | 6.9 | 1004.6 | 84 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 15h48 | UTC-4 | 57°16.800 | 092°06.750 | Barge Recovered | 17 | 203 | 70 | 8 | 18.8 | 7.2 | 1004.6 | 84 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 16h16 | UTC-4 | 57°17.100 | 092°06.360 | Horizontal Net Tow ↓ | 17 | 34 | 79 | 8 | 18.3 | 6.4 | 1004.4 | 87 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 16h30 | UTC-4 | 57°17.669 | 092°05.592 | Horizontal Net Tow ↑ | 16 | 34 | 79 | 8 | 18.3 | 6.4 | 1004.4 | 87 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 16h43 | UTC-4 | 57°18.183 | 092°04.954 | Agassiz Trawl ↓ | 19 | 34 | 78 | 9 | 18.3 | 6.4 | 1004.4 | 87 | 0/10 |
| 1a | Nelson River mouth | River (Hayes-Nelson) | 26/Jul/2010 | 16h48 | UTC-4 | 57°18.347 | 092°04.752 | Agassiz Trawl ↑ | 17 | 37 | 83 | 9 | 18.4 | 6.1 | 1004.4 | 90 | 0/10 |
| 1a | 705A | Full | 27/Jul/2010 | 07h40 | UTC-4 | 57°26.369 | 091°54.746 | Water Sampling ↓↑ | 33 | 35 | 282 | 11 | 14.6 | 11.8 | 1003.3 | 92 | 0/10 |

| 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 | | | | | |
| 1a | 705A | Full | 27/Jul/2010 | 07h48 | UTC-4 | 57°26.493 | 091°54.593 | CTD ↓↑ | 33 | 69 | 275 | 10 | 14.6 | 11.8 | 1003.2 | 91 | 0/10 |
| 1a | A8 | N/A | 27/Jul/2010 | 08h42 | UTC-4 | 57°30.420 | 091°37.700 | Water Sampling + CTD ↓ | 67 | 65 | Calm | Calm | 14.7 | 12.6 | 1003.3 | 92 | 0/10 |
| 1a | A8 | N/A | 27/Jul/2010 | 08h52 | UTC-4 | 57°30.350 | 091°37.500 | Water Sampling + CTD ↑ | 68 | 66 | 20 | 5 | 14.9 | 13.0 | 1003.6 | 92 | 0/10 |
| 1a | 705B | Nutrient | 27/Jul/2010 | 09h54 | UTC-4 | 57°34.620 | 091°20.660 | Water Sampling + CTD ↓ | 39 | 60 | 135 | 9 | 12.8 | 14.4 | 1003.2 | 99 | 0/10 |
| 1a | 705B | Nutrient | 27/Jul/2010 | 09h58 | UTC-4 | 57°34.620 | 091°20.770 | Water Sampling + CTD ↑ | 40 | 12 | 130 | 10 | 12.8 | 14.4 | 1003.2 | 99 | 0/10 |
| 1a | N/A | MVP | 27/Jul/2010 | 10h57 | UTC-4 | 57°36.360 | 091°13.270 | MVP ↓ | 38 | 253 | 140 | 10 | 12.5 | 12.9 | 1003.2 | 99 | 0/10 |
| 1a | N/A | MVP | 27/Jul/2010 | 12h50 | UTC-4 | 57°37.640 | 091°07.950 | MVP ↑ | 35 | 70 | Calm | Calm | 14.1 | 12.9 | 1003.7 | 97 | 0/10 |
| 1a | Intermediate 705B-C | N/A | 27/Jul/2010 | 13h08 | UTC-4 | 57°38.640 | 091°02.570 | Water Sampling + CTD ↓↑ | 38 | 160 | Calm | Calm | 14.1 | 12.9 | 1003.7 | 97 | 0/10 |
| 1a | 705C | Nutrient | 27/Jul/2010 | 13h59 | UTC-4 | 57°42.090 | 090°46.030 | Water Sampling + CTD ↓↑ | 41 | 79 | 150 | 7 | 11.2 | 12.7 | 1003.5 | 99 | 0/10 |
| 1a | 705C | Nutrient | 27/Jul/2010 | 14h19 | UTC-4 | 57°42.560 | 090°42.830 | Water Sampling + CTD ↓↑ | 48 | 40 | Calm | Calm | 11.2 | 12.7 | 1003.5 | 99 | 0/10 |
| 1a | 705C | Nutrient | 27/Jul/2010 | 14h37 | UTC-4 | 57°43.320 | 090°39.540 | Water Sampling + CTD ↓↑ | 44 | 60 | 180 | 5 | 11.6 | 12.8 | 1003.6 | 99 | 0/10 |
| 1a | 800 | Nutrient | 27/Jul/2010 | 20h47 | UTC-4 | 58°10.160 | 088°14.300 | Water Sampling ↓↑ | 119 | 57 | 60 | 10 | 8.6 | 9.8 | 1004.3 | 99 | 0/10 |
| 1a | 800 | Nutrient | 27/Jul/2010 | 20h51 | UTC-4 | 58°10.190 | 088°14.310 | SHO Profile ↓ | 119 | 84 | 70 | 10 | 8.5 | 9.8 | 1004.5 | 99 | 0/10 |
| 1a | 800 | Nutrient | 27/Jul/2010 | 21h15 | UTC-4 | 58°10.290 | 088°14.510 | SHO Profile ↑ | 121 | 83 | 100 | 10 | 8.4 | 9.7 | 1004.9 | 99 | 0/10 |
| 1a | 800 | Nutrient | 27/Jul/2010 | 21h27 | UTC-4 | 58°10.340 | 088°14.620 | CTD-Rosette ↓ | 118 | 81 | 75 | 11 | 8.5 | 9.7 | 1004.9 | 99 | 0/10 |
| 1a | 800 | Nutrient | 27/Jul/2010 | 21h48 | UTC-4 | 58°10.420 | 088°14.890 | CTD-Rosette ↑ | 116 | 61 | 100 | 9 | 8.4 | 9.6 | 1004.7 | 99 | 0/10 |
| 1a | 795 | Nutrient | 28/Jul/2010 | 00h18 | UTC-4 | 57°39.530 | 088°33.230 | Water Sampling ↓ | 72 | 47 | 45 | 11 | 8.2 | 9.2 | 1005.0 | 99 | 0/10 |
| 1a | 795 | Nutrient | 28/Jul/2010 | 00h22 | UTC-4 | 57°39.530 | 088°33.230 | Water Sampling ↑ | 72 | 47 | 45 | 11 | 8.2 | 9.2 | 1005.0 | 99 | 0/10 |
| 1a | 795 | Nutrient | 28/Jul/2010 | 00h27 | UTC-4 | 57°39.500 | 088°33.220 | SHO Profile ↓ | 72 | 47 | 45 | 11 | 8.1 | 9.2 | 1005.0 | 99 | 0/10 |
| 1a | 795 | Nutrient | 28/Jul/2010 | 00h48 | UTC-4 | 57°39.370 | 088°33.250 | SHO Profile ↑ | 72 | 31 | 50 | 10 | 8.3 | 8.0 | 1005.1 | 99 | 0/10 |
| 1a | 795 | Nutrient | 28/Jul/2010 | 00h45 | UTC-4 | 57°39.400 | 088°33.240 | Water Sampling ↓↑ | 72 | 30 | 50 | 10 | 8.3 | 8.0 | 1005.1 | 99 | 0/10 |
| 1a | 795 | Nutrient | 28/Jul/2010 | 01h04 | UTC-4 | 57°39.540 | 088°33.100 | CTD-Rosette ↓ | 70 | 51 | 60 | 10 | 8.3 | 7.0 | 1005.2 | 99 | 0/10 |
| 1a | 795 | Nutrient | 28/Jul/2010 | 01h22 | UTC-4 | 57°39.420 | 088°33.120 | CTD-Rosette ↑ | 71 | 46 | 70 | 11 | 8.2 | 7.4 | 1005.5 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 03h37 | UTC-4 | 57°14.740 | 088°52.630 | Water Sampling ↓↑ | 40 | 28 | 30 | 14 | 7.4 | 8.1 | 1005.7 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 03h46 | UTC-4 | 57°14.670 | 088°52.410 | SHO Profile ↓ | 41 | 10 | 30 | 13 | 7.5 | 8.4 | 1005.6 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 04h00 | UTC-4 | 57°14.640 | 088°52.070 | SHO Profile ↑ | 38 | 7 | 18 | 13 | 7.5 | 7.8 | 1005.7 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 04h20 | UTC-4 | 57°14.859 | 088°52.849 | Vertical Net Tow ↓ | 40 | 24 | 26 | 12 | 7.3 | 7.7 | 1005.8 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 04h27 | UTC-4 | 57°14.849 | 088°52.789 | Vertical Net Tow ↑ | 40 | 24 | 25 | 11 | 7.3 | 7.7 | 1005.8 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 04h40 | UTC-4 | 57°14.856 | 088°52.497 | Vertical Net Tow ↓ | 41 | 20 | 32 | 12 | 7.2 | 7.4 | 1006.1 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 04h45 | UTC-4 | 57°14.841 | 088°52.433 | Vertical Net Tow ↑ | 40 | 22 | 32 | 10 | 7.2 | 7.4 | 1006.1 | 99 | 0/10 |

| 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 | | | | | |
| 1a | 790 | Basic | 28/Jul/2010 | 05h05 | UTC-4 | 57°14.825 | 088°52.433 | Horizontal Net Tow ↓ | 40 | 150 | 32 | 10 | 7.2 | 7.4 | 1006.1 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 05h14 | UTC-4 | 57°14.688 | 088°51.614 | Horizontal Net Tow ↑ | 40 | 150 | 32 | 10 | 7.2 | 7.4 | 1006.1 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 05h36 | UTC-4 | 57°14.891 | 088°52.826 | Secchi Disk ↓↑ | 39 | 6 | 12 | 14 | 7.1 | 8.2 | 1006.5 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 05h38 | UTC-4 | 57°14.904 | 088°52.804 | PNF ↓ | 39 | 7 | 12 | 14 | 7.1 | 8.2 | 1006.5 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 05h40 | UTC-4 | 57°14.916 | 088°52.776 | PNF ↑ | 39 | 3 | 7 | 13 | 7.2 | 8.1 | 1006.7 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 05h45 | UTC-4 | 57°14.885 | 088°52.711 | CTD-Rosette ↓ | 39 | 12 | 3 | 13 | 7.2 | 8.1 | 1006.7 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 06h05 | UTC-4 | 57°14.871 | 088°52.526 | CTD-Rosette ↑ | 40 | 16 | 16 | 12 | 7.3 | 6.8 | 1007.1 | 99 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 07h07 | UTC-4 | 57°15.072 | 088°53.047 | CTD-Rosette ↓ | 40 | 357 | 357 | 11 | 7.1 | 8.0 | 1007.9 | 107 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 07h18 | UTC-4 | 57°15.149 | 088°53.076 | CTD-Rosette ↑ | 37 | 2 | 359 | 10 | 7.4 | 7.6 | 1008.1 | 106 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 07h38 | UTC-4 | 57°14.932 | 088°52.967 | Box Core ↓ | 39 | 2 | 359 | 10 | 7.5 | 6.7 | 1008.2 | 104 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 07h41 | UTC-4 | 57°14.942 | 088°52.975 | Box Core (bottom) | 39 | 6 | 359 | 10 | 7.5 | 6.7 | 1008.2 | 104 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 07h44 | UTC-4 | 57°14.955 | 088°52.975 | Box Core ↑ | 39 | 6 | 359 | 10 | 7.5 | 6.7 | 1008.2 | 104 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 08h03 | UTC-4 | 57°14.950 | 088°53.070 | Agassiz Trawl ↓ | 38 | 274 | 15 | 13 | 7.4 | 7.0 | 1008.6 | 109 | 0/10 |
| 1a | 790 | Basic | 28/Jul/2010 | 08h15 | UTC-4 | 57°14.980 | 088°53.400 | Agassiz Trawl ↑ | 37 | 231 | 5 | 13 | 8.0 | 7.3 | 1008.8 | 110 | 0/10 |
| 1a | 810 | Nutrient | 28/Jul/2010 | 13h03 | UTC-4 | 56°52.620 | 087°23.350 | Helicopter on Station | 60 | 118 | 330 | 17 | 8.2 | 8.9 | 1010.7 | 98 | 0/10 |
| 1a | 810 | Nutrient | 28/Jul/2010 | 13h28 | UTC-4 | 50°50.560 | 087°16.040 | Water Sampling ↓↑ | 60 | 320 | 330 | 17 | 8.2 | 8.9 | 1010.7 | 98 | 0/10 |
| 1a | 810 | Nutrient | 28/Jul/2010 | 13h37 | UTC-4 | 56°50.550 | 087°16.270 | SHO Profile ↓ | 60 | 327 | 330 | 17 | 8.2 | 8.8 | 1010.6 | 97 | 0/10 |
| 1a | 810 | Nutrient | 28/Jul/2010 | 13h51 | UTC-4 | 56°50.520 | 087°16.470 | SHO Profile ↑ | 59 | 289 | 330 | 17 | 8.5 | 8.5 | 1010.4 | 98 | 0/10 |
| 1a | 810 | Nutrient | 28/Jul/2010 | 13h53 | UTC-4 | 56°50.420 | 087°16.520 | Water Sampling ↓↑ | 60 | 323 | 330 | 17 | 8.5 | 8.5 | 1010.4 | 98 | 0/10 |
| 1a | 810 | Nutrient | 28/Jul/2010 | 14h04 | UTC-4 | 56°50.440 | 087°16.610 | CTD-Rosette ↓ | 60 | 7 | 370 | 18 | 8.5 | 8.4 | 1010.5 | 97 | 0/10 |
| 1a | 810 | Nutrient | 28/Jul/2010 | 14h18 | UTC-4 | 56°50.420 | 087°16.500 | CTD-Rosette ↑ | 60 | 33 | 330 | 17 | 8.4 | 8.3 | 1010.8 | 97 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 21h31 | UTC-4 | 55°41.830 | 085°07.160 | PNF ↓ | 47 | 304 | 335 | 20 | 7.5 | 8.0 | 1012.8 | 96 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 21h35 | UTC-4 | 55°41.820 | 085°07.280 | PNF ↑ | 47 | 313 | 330 | 20 | 7.5 | 8.0 | 1012.8 | 96 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 21h35 | UTC-4 | 55°41.820 | 085°07.280 | Secchi Disk ↓↑ | 47 | 313 | 330 | 20 | 7.5 | 8.0 | 1012.8 | 96 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 22h20 | UTC-4 | 55°41.510 | 084°52.800 | Water Sampling ↓↑ | 53 | 325 | 310 | 20 | 7.2 | 7.8 | 1013.3 | 97 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 22h34 | UTC-4 | 55°41.630 | 084°53.340 | CTD-Rosette ↓ | 53 | 332 | 315 | 20 | 7.4 | 7.7 | 1013.2 | 97 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 22h46 | UTC-4 | 55°41.590 | 084°53.480 | CTD-Rosette ↑ | 53 | 328 | 315 | 21 | 7.3 | 7.7 | 1013.4 | 97 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 23h04 | UTC-4 | 55°41.570 | 084°53.490 | Vertical Net Tow ↓ | 53 | 60 | 325 | 20 | 7.2 | 7.5 | 1013.7 | 97 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 23h08 | UTC-4 | 55°41.570 | 084°53.510 | Vertical Net Tow ↑ | 53 | 68 | 325 | 21 | 7.2 | 7.5 | 1013.7 | 97 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 23h28 | UTC-4 | 55°41.550 | 084°53.580 | Vertical Net Tow ↓ | 53 | 80 | 330 | 22 | 7.1 | 7.6 | 1013.5 | 97 | 0/10 |

| 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 | | | | | |
| 1a | 820 | Basic | 28/Jul/2010 | 23h35 | UTC-4 | 55°41.540 | 084°53.600 | Vertical Net Tow ↑ | 53 | 65 | 325 | 20 | 7.0 | 7.7 | 1013.6 | 97 | 0/10 |
| 1a | 820 | Basic | 28/Jul/2010 | 23h58 | UTC-4 | 55°41.600 | 084°53.830 | SHO Profile ↓ | 53 | 358 | 315 | 19 | 7.2 | 7.7 | 1014.1 | 97 | 0/10 |
| 1a | 820 | Basic | 29/Jul/2010 | 00h11 | UTC-4 | 55°41.580 | 084°54.040 | SHO Profile ↑ | 49 | 6 | 315 | 17 | 7.2 | 7.6 | 1014.2 | 97 | 0/10 |
| 1a | 820 | Basic | 29/Jul/2010 | 00h26 | UTC-4 | 55°41.630 | 084°54.280 | CTD-Rosette ↓ | 53 | 350 | 315 | 18 | 7.2 | 7.6 | 1014.3 | 98 | 0/10 |
| 1a | 820 | Basic | 29/Jul/2010 | 00h42 | UTC-4 | 55°41.660 | 084°54.470 | CTD-Rosette ↑ | 53 | 12 | 315 | 23 | 7.1 | 7.5 | 1014.4 | 98 | 0/10 |
| 1a | 820 | Basic | 29/Jul/2010 | 00h29 | UTC-4 | 55°41.620 | 084°54.300 | Water Sampling ↓↑ | 53 | 7 | 315 | 18 | 7.2 | 7.6 | 1014.3 | 98 | 0/10 |
| 1a | 820 | Basic | 29/Jul/2010 | 01h03 | UTC-4 | 55°41.760 | 084°54.420 | Box Core ↓ | 53 | 64 | 340 | 20 | 6.9 | 7.6 | 1014.4 | 99 | 0/10 |
| 1a | 820 | Basic | 29/Jul/2010 | 01h08 | UTC-4 | 55°41.730 | 084°54.490 | Box Core ↑ | 53 | 84 | 330 | 19 | 6.9 | 7.6 | 1014.3 | 99 | 0/10 |
| 1a | 820 | Basic | 29/Jul/2010 | 01h22 | UTC-4 | 55°41.720 | 084°54.120 | Agassiz Trawl ↓ | 53 | N/A | 340 | 15 | 6.9 | 7.6 | 1014.6 | 99 | 0/10 |
| 1a | 820 | Basic | 29/Jul/2010 | 01h34 | UTC-4 | 55°41.750 | 084°53.410 | Agassiz Trawl ↑ | 53 | N/A | 340 | 14 | 6.8 | 7.6 | 1014.6 | 99 | 0/10 |
| 1a | 825 | Nutrient | 29/Jul/2010 | 04h30 | UTC-4 | 56°10.749 | 084°37.109 | Water Sampling ↓↑ | 120 | 330 | 334 | 13 | 6.0 | 5.6 | 1014.8 | 99 | 0/10 |
| 1a | 825 | Nutrient | 29/Jul/2010 | 04h48 | UTC-4 | 56°10.699 | 084°36.979 | CTD-Rosette ↓ | 121 | 10 | 335 | 15 | 6.0 | 5.6 | 1014.8 | 99 | 0/10 |
| 1a | 825 | Nutrient | 29/Jul/2010 | 05h05 | UTC-4 | 56°10.596 | 084°36.787 | CTD-Rosette ↑ | 120 | 3 | 319 | 15 | 6.0 | 5.6 | 1014.8 | 99 | 0/10 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 08h20 | UTC-4 | 56°46.600 | 084°16.700 | Zodiac Deployed | 162 | 38 | 306 | 15 | 5.8 | 7.9 | 1015.8 | 99 | 0/10 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 08h22 | UTC-4 | 56°46.600 | 084°16.700 | Water Sampling ↓↑ | 162 | 38 | 305 | 15 | 5.8 | 7.9 | 1015.8 | 99 | 0/10 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 08h37 | UTC-4 | 56°46.580 | 084°16.370 | Zodiac Recovered | 162 | 90 | 300 | 10 | 5.7 | 7.9 | 1016.0 | 99 | 0/10 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 09h04 | UTC-4 | 56°47.230 | 084°15.600 | SHO Profile ↓ | 163 | 353 | 295 | 13 | 5.7 | 8.0 | 1016.0 | 99 | 0/10 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 09h25 | UTC-4 | 56°47.220 | 084.15.500 | SHO Profile ↑ | 163 | 2 | 300 | 12 | 5.8 | 7.8 | 1016.1 | 99 | 0/10 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 09h57 | UTC-4 | 56°47.190 | 084°15.420 | CTD-Rosette ↓ | 163 | 338 | 285 | 12 | 5.8 | 7.9 | 1016.2 | 99 | 0/10 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 10h21 | UTC-4 | 56°47.180 | 084°15.300 | CTD-Rosette ↑ | 163 | 12 | 300 | 14 | 5.8 | 7.6 | 1016.3 | 99 | 0/10 |
| 1a | 830 | Nutrient | 29/Jul/2010 | 13h48 | UTC-4 | 57°30.320 | 083°51.960 | Water Sampling ↓↑ | 169 | 260 | 250 | 14 | 7.4 | 8.4 | 1014.9 | 99 | 0/10 |
| 1a | 835 | Nutrient | 29/Jul/2010 | 13h55 | UTC-4 | 57°30.280 | 083°51.980 | SHO Profile ↓ | 169 | 262 | 250 | 14 | 7.4 | 8.4 | 1014.9 | 99 | 0/10 |
| 1a | 835 | Nutrient | 29/Jul/2010 | 14h10 | UTC-4 | 57°30.130 | 083°52.040 | SHO Profile ↑ | 168 | 243 | 250 | 13 | 8.0 | 8.5 | 1014.7 | 97 | 0/10 |
| 1a | 835 | Nutrient | 29/Jul/2010 | 14h05 | UTC-4 | 57°30.190 | 083°52.010 | Water Sampling ↓↑ | 169 | 250 | 260 | 14 | 7.8 | 8.4 | 1014.8 | 98 | 0/10 |
| 1a | 835 | Nutrient | 29/Jul/2010 | 14h18 | UTC-4 | 57°30.020 | 083°52.180 | CTD-Rosette ↓ | 169 | 257 | 250 | 14 | 8.0 | 8.5 | 1014.8 | 96 | 0/10 |
| 1a | 835 | Nutrient | 29/Jul/2010 | 14h46 | UTC-4 | 57°30.030 | 083°52.570 | CTD-Rosette ↑ | 169 | 307 | 250 | 17 | 8.1 | 8.5 | 1014.8 | 96 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 19h01 | UTC-4 | 58°24.669 | 083°18.918 | Water Sampling ↓↑ | 175 | 351 | 248 | 18 | 8.3 | 8.6 | 1012.2 | 92 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 19h13 | UTC-4 | 58°24.737 | 083°18.704 | PNF ↓ | 175 | 241 | 237 | 18 | 8.3 | 8.6 | 1012.2 | 92 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 19h18 | UTC-4 | 58°24.723 | 083°18.608 | PNF ↑ | 175 | 234 | 241 | 18 | 8.8 | 8.5 | 1011.9 | 90 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 19h19 | UTC-4 | 58°24.706 | 083°18.677 | Secchi Disk ↓ | 174 | 239 | 241 | 18 | 8.8 | 8.5 | 1011.9 | 90 | 0/10 |

| 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 | | | | | |
| 1a | 840 | Basic | 29/Jul/2010 | 19h20 | UTC-4 | 58°24.696 | 083°18.677 | Secchi Disk ↑ | 174 | 238 | 241 | 18 | 8.8 | 8.5 | 1011.9 | 90 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 19h24 | UTC-4 | 58°24.690 | 083°18.648 | SHO Profile ↓ | 176 | 234 | 241 | 18 | 8.8 | 8.5 | 1011.9 | 90 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 19h43 | UTC-4 | 58°24.525 | 083°18.400 | SHO Profile ↑ | 176 | 245 | 237 | 18 | 8.8 | 8.5 | 1011.9 | 90 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 19h36 | UTC-4 | 58°24.531 | 083°18.429 | Water Sampling ↓↑ | 176 | 245 | 241 | 18 | 8.8 | 8.5 | 1011.9 | 90 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 20h04 | UTC-4 | 58°24.588 | 083°18.213 | CTD-Rosette ↓ | 176 | 258 | 230 | 15 | 8.6 | 8.6 | 1011.5 | 91 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 20h34 | UTC-4 | 58°24.700 | 083°18.090 | CTD-Rosette ↑ | 175 | 274 | 230 | 17 | 8.4 | 8.6 | 1011.2 | 93 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 20h50 | UTC-4 | 58°24.730 | 083°18.080 | Vertical Net Tow ↓ | 176 | 282 | 230 | 18 | 8.8 | 8.6 | 1011.0 | 91 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 21h02 | UTC-4 | 58°24.810 | 083°17.980 | Vertical Net Tow ↑ | 176 | 276 | 235 | 16 | 8.6 | 8.6 | 1011.1 | 93 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 21h18 | UTC-4 | 58°24.870 | 083°18.320 | Horizontal Net Tow ↓ | 176 | 294 | 235 | 19 | 8.4 | 8.6 | 1010.9 | 94 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 21h36 | UTC-4 | 58°25.320 | 083°19.310 | Horizontal Net Tow ↑ | 176 | 296 | 235 | 19 | 8.5 | 8.5 | 1010.8 | 92 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 21h45 | UTC-4 | 58°25.390 | 083°19.400 | Vertical Net Tow ↓ | 176 | 290 | 240 | 18 | 8.4 | 8.5 | 1010.8 | 93 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 21h56 | UTC-4 | 58°25.460 | 083°19.280 | Vertical Net Tow ↑ | 176 | 316 | 240 | 17 | 8.5 | 8.5 | 1010.7 | 93 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 22h23 | UTC-4 | 58°25.360 | 083°19.240 | CTD-Rosette ↓ | 174 | 265 | 240 | 13 | 8.6 | 8.4 | 1010.5 | 94 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 22h47 | UTC-4 | 58°25.270 | 083°19.210 | CTD-Rosette ↑ | 176 | 269 | 245 | 14 | 8.5 | 8.4 | 1010.5 | 95 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 23h04 | UTC-4 | 58°25.230 | 083°19.330 | Box Core ↓ | 174 | 309 | 245 | 15 | 8.6 | 8.4 | 1010.4 | 95 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 23h16 | UTC-4 | 58°25.270 | 083°19.220 | Box Core ↑ | 176 | 336 | 255 | 14 | 8.5 | 8.4 | 1010.4 | 95 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 23h24 | UTC-4 | 58°25.350 | 083°19.240 | Agassiz Trawl ↓ | 174 | 330 | 260 | 16 | 8.5 | 8.4 | 1010.4 | 95 | 0/10 |
| 1a | 840 | Basic | 29/Jul/2010 | 23h52 | UTC-4 | 58°26.020 | 083°19.700 | Agassiz Trawl ↑ | 176 | 332 | 260 | 14 | 8.5 | 8.4 | 1010.1 | 97 | 0/10 |
| 1a | 840 | Basic | 30/Jul/2010 | 00h22 | UTC-4 | 58°25.170 | 083°19.430 | Box Core ↓ | 179 | 309 | 260 | 14 | 8.6 | 8.4 | 1010.0 | 97 | 0/10 |
| 1a | 840 | Basic | 30/Jul/2010 | 00h35 | UTC-4 | 58°25.180 | 083°19.460 | Box Core ↑ | 175 | 331 | 265 | 14 | 8.5 | 8.4 | 1010.1 | 97 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 09h54 | UTC-4 | 60°22.130 | 081°59.160 | Water Sampling ↓↑ | 149 | 287 | 300 | 10 | 10.0 | 9.8 | 1007.7 | 99 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 09h58 | UTC-4 | 60°22.170 | 081°59.160 | Zodiac Deployed | 153 | 344 | 295 | 12 | 10.0 | 9.8 | 1007.7 | 99 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 10h04 | UTC-4 | 60°22.240 | 081°59.070 | Secchi Disk ↓ | 151 | 288 | 300 | 10 | 10.2 | 9.7 | 1007.8 | 99 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 10h06 | UTC-4 | 60°22.250 | 081°59.050 | Secchi Disk ↑ | 151 | 277 | 305 | 10 | 10.2 | 9.7 | 1007.8 | 99 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 10h09 | UTC-4 | 60°22.260 | 081°59.020 | SHO Profile ↓ | 151 | 268 | 315 | 10 | 10.2 | 9.7 | 1007.8 | 99 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 10h30 | UTC-4 | 60°22.200 | 081°58.870 | SHO Profile ↑ | 150 | 254 | 320 | 12 | 10.5 | 9.7 | 1007.6 | 98 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 10h37 | UTC-4 | 60°22.210 | 081°58.780 | Zodiac Recovered | 151 | 15 | 310 | 13 | 10.5 | 9.7 | 1007.6 | 98 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 10h41 | UTC-4 | 60°22.220 | 081°58.640 | Zodiac Deployed | 150 | 55 | 315 | 12 | 10.4 | 9.7 | 1007.6 | 97 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 10h53 | UTC-4 | 60°22.270 | 081°58.350 | CTD-Rosette ↓ | 147 | 278 | 320 | 12 | 10.3 | 9.8 | 1007.6 | 97 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 11h20 | UTC-4 | 60°22.110 | 081°58.220 | CTD-Rosette ↑ | 152 | 249 | 315 | 11 | 10.6 | 9.7 | 1007.5 | 96 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 11h45 | UTC-4 | 60°22.150 | 081°57.940 | Zodiac Recovered | 152 | 21 | 305 | 12 | 10.5 | 9.8 | 1007.6 | 97 | 0/10 |

| 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 | | | | | |
| 1a | 740 | Nutrient | 30/Jul/2010 | 11h30 | UTC-4 | 60°22.070 | 081°58.140 | Vertical Net Tow ↓ | 153 | 310 | 310 | 12 | 10.6 | 9.8 | 1007.6 | 96 | 0/10 |
| 1a | 740 | Nutrient | 30/Jul/2010 | 11h40 | UTC-4 | 60°22.110 | 081°58.030 | Vertical Net Tow ↑ | 153 | 312 | 310 | 12 | 10.5 | 9.8 | 1007.6 | 97 | 0/10 |
| 1a | Ex1 | N/A | 30/Jul/2010 | 20h09 | UTC-4 | 62°07.970 | 081°23.960 | SHO Profile ↓ | 207 | 265 | Calm | Calm | 10.4 | 11.3 | 1006.6 | 87 | 0/10 |
| 1a | Ex1 | N/A | 30/Jul/2010 | 20h30 | UTC-4 | 62°08.027 | 081°23.960 | SHO Profile ↑ | 209 | 242 | 275 | 4 | 11.1 | 11.0 | 1006.5 | 85 | 0/10 |
| 1a | Ex1 | N/A | 30/Jul/2010 | 20h45 | UTC-4 | 62°08.070 | 081°24.010 | CTD-Rosette ↓ | 208 | 269 | Calm | Calm | 10.9 | 11.1 | 1006.4 | 87 | 0/10 |
| 1a | Ex1 | N/A | 30/Jul/2010 | 21h06 | UTC-4 | 62°08.170 | 081°23.920 | CTD-Rosette ↑ | 208 | 256 | 333 | 3 | 10.9 | 11.1 | 1006.4 | 84 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 01h43 | UTC-4 | 62°39.740 | 079°27.710 | CTD-Rosette ↓ | 320 | 293 | 300 | 9 | 9.5 | 10.4 | 1005.0 | 93 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 02h01 | UTC-4 | 62°39.690 | 079°27.800 | CTD-Rosette ↑ | 317 | 282 | 290 | 6 | 9.6 | 10.6 | 1005.1 | 93 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 02h09 | UTC-4 | 62°39.650 | 079°27.690 | Gravity Core ↓ | 320 | 280 | 280 | 8 | 9.6 | 10.5 | 1005.0 | 93 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 02h25 | UTC-4 | 62°39.590 | 079°27.850 | Gravity Core ↑ | 320 | 284 | 280 | 8 | 9.6 | 10.4 | 1005.0 | 94 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 02h43 | UTC-4 | 62°39.550 | 079°27.570 | Box Core ↓ | 317 | 263 | 250 | 8 | 9.6 | 10.5 | 1004.9 | 94 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 03h02 | UTC-4 | 62°39.450 | 079°27.680 | Box Core ↑ | 315 | 265 | 260 | 7 | 9.7 | 10.3 | 1004.9 | 92 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 03h17 | UTC-4 | 62°39.590 | 079°27.750 | Agassiz Trawl ↓ | 316 | 26 | 250 | 8 | 9.6 | 10.3 | 1004.8 | 92 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 03h26 | UTC-4 | 62°39.870 | 079°27.490 | Agassiz Trawl ↑↓ | 319 | 30 | 250 | 8 | 9.6 | 9.6 | 1004.7 | 92 | 0/10 |
| 1a | Ex2 | N/A | 31/Jul/2010 | 03h51 | UTC-4 | 62°40.470 | 079°27.800 | Agassiz Trawl ↑ | 325 | 303 | 230 | 9 | 9.6 | 9.6 | 1004.7 | 92 | 0/10 |
| 1a | N/A | MVP | 31/Jul/2010 | 17h38 | UTC-4 | 62°38.440 | 073°22.280 | MVP ↓ | 223 | 105 | 140 | 10 | 9.0 | 9.3 | 1003.3 | 93 | Bergy |
| 1a | N/A | MVP | 31/Jul/2010 | 22h12 | UTC-4 | 62°29.800 | 071°32.490 | MVP ↑ | 327 | 74 | 196 | 8 | 6.7 | 6.0 | 1002.2 | 96 | Bergy |
| **Leg 1b** | | | | | | | | | | | | | | | | | |
| 1b | Cap Haye | MVP | 06/Aug/2010 | 12h05 | UTC-4 | 73°50.650 | 080°02.700 | MVP ↓ | 843 | 340 | 240 | 18 | 0.8 | 2.4 | 1004.6 | 95 | 3/10 |
| 1b | Cap Haye | MVP | 06/Aug/2010 | 16h47 | UTC-4 | 74°32.140 | 080°34.490 | MVP ↑ | 553 | 2 | 250 | 15 | 1.9 | 2.9 | 1006.5 | 93 | 3/10 |
| 1b | 301 | Basic | 06/Aug/2010 | 23h44 | UTC-4 | 74°10.980 | 083°56.410 | Hg Sampling ↓ | 669 | 174 | 185 | 5 | 2.0 | 2.3 | 1010.8 | 88 | Bergy |
| 1b | 301 | Basic | 06/Aug/2010 | 23h47 | UTC-4 | 74°10.990 | 083°56.430 | PNF ↓ | 669 | 170 | 175 | 5 | 2.0 | 2.3 | 1010.8 | 88 | Bergy |
| 1b | 301 | Basic | 06/Aug/2010 | 23h51 | UTC-4 | 74°10.990 | 083°56.470 | PNF ↑ | 669 | 172 | 175 | 5 | 2.0 | 2.2 | 1010.9 | 87 | Bergy |
| 1b | 301 | Basic | 06/Aug/2010 | 23h51 | UTC-4 | 74°10.990 | 083°56.470 | Secchi Disk ↓↑ | 669 | 172 | 175 | 5 | 2.0 | 2.2 | 1010.9 | 87 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 00h44 | UTC-4 | 74°11.120 | 083°57.020 | CTD-Rosette ↓ | 670 | 164 | 150 | 7 | 2.6 | 2.7 | 1011.1 | 87 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 01h23 | UTC-4 | 74°11.280 | 083°57.450 | CTD-Rosette ↑ | 671 | 167 | 160 | 4 | 3.0 | 3.0 | 1011.6 | 86 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 01h52 | UTC-4 | 74°11.350 | 083°57.740 | Water Pumping ↓ | 670 | 146 | 130 | 4 | 3.3 | 3.0 | 1011.7 | 86 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 02h18 | UTC-4 | 74°11.390 | 083°58.020 | Water Pumping ↑ | 671 | 149 | 140 | 4 | 3.7 | 3.1 | 1011.8 | 85 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 03h22 | UTC-4 | 74°11.000 | 083°56.440 | CTD-Rosette ↓ | 669 | 117 | 110 | 7 | 2.1 | 2.9 | 1012.3 | 89 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 04h01 | UTC-4 | 74°11.139 | 083°57.324 | CTD-Rosette ↑ | 668 | 348 | 101 | 8 | 2.3 | 2.6 | 1012.7 | 92 | Bergy |

| 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 | | | | | |
| 1b | 301 | Basic | 07/Aug/2010 | 04h10 | UTC-4 | 74°11.192 | 083°57.526 | Hg Sampling ↑ | 669 | 19 | 100 | 7 | 2.5 | 2.6 | 1012.7 | 90 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 04h35 | UTC-4 | 74°11.254 | 083°57.757 | Vertical Net Tow ↓ | 668 | 105 | 94 | 9 | 1.4 | 2.6 | 1012.8 | 93 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 05h17 | UTC-4 | 74°11.360 | 083°58.074 | Vertical Net Tow ↑ | 670 | 98 | 78 | 9 | 1.4 | 2.8 | 1012.8 | 94 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 05h39 | UTC-4 | 74°11.216 | 083°59.062 | Horizontal Net Tow ↓ | 669 | 230 | 84 | 10 | 1.7 | 2.6 | 1013.0 | 92 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 05h54 | UTC-4 | 74°10.785 | 084°00.515 | Horizontal Net Tow ↑ | 669 | 195 | 84 | 10 | 1.7 | 2.6 | 1013.0 | 92 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 06h15 | UTC-4 | 74°10.944 | 083°57.197 | Small Ring Net ↓ | 668 | 103 | 90 | 10 | 2.0 | 2.5 | 1012.8 | 88 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 06h19 | UTC-4 | 74°10.949 | 083°57.151 | Small Ring Net ↑ | 667 | 107 | 90 | 10 | 2.0 | 2.5 | 1012.8 | 88 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 06h44 | UTC-4 | 74°10.978 | 083°56.952 | Box Core ↓ | 667 | 109 | 111 | 9 | 1.8 | 2.7 | 1012.8 | 91 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 06h58 | UTC-4 | 74°11.004 | 083°56.802 | Box Core (bottom) | 669 | 108 | 111 | 9 | 1.8 | 2.7 | 1012.8 | 91 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 07h13 | UTC-4 | 74°11.037 | 083°56.679 | Box Core ↑ | 668 | 125 | 130 | 10 | 1.6 | 3.0 | 1012.9 | 93 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 07h44 | UTC-4 | 74°11.316 | 083°58.424 | Agassiz Trawl ↓ | 671 | 292 | 140 | 11 | 1.9 | 2.9 | 1013.5 | 90 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 08h12 | UTC-4 | 74°11.640 | 084°00.830 | Agassiz Trawl ↑ | 671 | 285 | 140 | 11 | 1.9 | 2.9 | 1013.5 | 90 | Bergy |
| 1b | 301 | Basic | 07/Aug/2010 | 08h55 | UTC-4 | 74°11.030 | 083°56.630 | Gravity Core ↓ | 668 | 150 | 127 | 12 | 2.2 | 2.6 | 1012.9 | 90 | 1/10 |
| 1b | 301 | Basic | 07/Aug/2010 | 09h28 | UTC-4 | 74°10.990 | 083°56.410 | Gravity Core ↑ | 668 | 206 | 120 | 8 | 2.1 | 2.9 | 1013.1 | 90 | 1/10 |
| 1b | N/A | N/A | 07/Aug/2010 | 12h43 | UTC-4 | 74°09.750 | 086°10.330 | Hg Sampling ↓ | 522 | 175 | 180 | 7 | 4.0 | 9.7 | 1012.4 | 91 | 1/10 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 12h51 | UTC-4 | 74°09.730 | 086°10.280 | CTD-Rosette ↓ | 522 | 179 | 190 | 4 | 4.1 | 10.3 | 1012.2 | 91 | 1/10 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 13h28 | UTC-4 | 74°09.690 | 086°10.290 | CTD-Rosette ↑ | 522 | 278 | 240 | 3 | 4.6 | 8.5 | 1012.3 | 88 | 1/10 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 13h58 | UTC-4 | 74°09.700 | 086°10.720 | Secchi Disk ↓ | 522 | 241 | Calm | Calm | 5.1 | 10.1 | 1012.5 | 86 | 1/10 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 14h04 | UTC-4 | 74°09.680 | 086°10.690 | Secchi Disk ↑ | 521 | 227 | Calm | Calm | 5.1 | 10.1 | 1012.5 | 86 | 1/10 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 14h43 | UTC-4 | 74°09.690 | 086°10.540 | CTD-Rosette ↓ | 521 | 267 | Calm | Calm | 3.7 | 8.8 | 1012.9 | 99 | 1/10 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 15h01 | UTC-4 | 74°09.670 | 086°10.620 | CTD-Rosette ↑ | 521 | 258 | 160 | 3 | 5.6 | 8.2 | 1012.6 | 98 | 1/10 |
| 1b | N/A | N/A | 07/Aug/2010 | 15h12 | UTC-4 | 74°09.640 | 086°10.530 | Hg Sampling ↑ | 521 | 218 | 180 | 5 | 4.6 | 8.1 | 1012.6 | 99 | 1/10 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 15h20 | UTC-4 | 74°09.670 | 086°10.670 | Small Ring Net ↓ | 521 | 1 | 140 | 5 | 4.8 | 8.1 | 1012.6 | 99 | 1/10 |
| 1b | 302 | Nutrient | 07/Aug/2010 | 15h24 | UTC-4 | 74°09.672 | 086°10.668 | Small Ring Net ↑ | 521 | Var | 140 | 5 | 4.8 | 8.1 | 1012.6 | 99 | 1/10 |
| 1b | 303 | Nutrient | 07/Aug/2010 | 19h59 | UTC-4 | 74°13.340 | 089°37.140 | PNF ↓ | 236 | 188 | 180 | 12 | 2.3 | 4.7 | 1010.8 | 99 | 1/10 |
| 1b | 303 | Nutrient | 07/Aug/2010 | 20h05 | UTC-4 | 74°13.350 | 089°37.010 | PNF ↑ | 236 | 187 | 180 | 14 | 2.3 | 4.7 | 1010.8 | 99 | 1/10 |
| 1b | 303 | Nutrient | 07/Aug/2010 | 20h06 | UTC-4 | 74°13.250 | 089°37.010 | Secchi Disk ↓↑ | 236 | 187 | 180 | 14 | 2.3 | 4.7 | 1010.8 | 99 | 1/10 |
| 1b | 303 | Nutrient | 07/Aug/2010 | 20h19 | UTC-4 | 74°13.340 | 089°36.720 | CTD-Rosette ↓ | 236 | 197 | 180 | 12 | 2.4 | 4.9 | 1010.8 | 99 | 1/10 |
| 1b | 303 | Nutrient | 07/Aug/2010 | 20h53 | UTC-4 | 74°13.290 | 089°36.000 | CTD-Rosette ↑ | 237 | 187 | 180 | 9 | 2.3 | 5.2 | 1010.8 | 99 | 1/10 |
| 1b | LS01-10 | Mooring | 07/Aug/2010 | 22h51 | UTC-4 | 74°28.180 | 090°23.280 | Mooring LS01-10 Deployed | 269 | 90 | 87 | 17 | 1.6 | 4.6 | 1010.0 | 99 | 2/10 |

| 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 | | | | | |
| 1b | LS01-10 | Mooring | 07/Aug/2010 | 23h15 | UTC-4 | 74°28.176 | 090°23.297 | Mooring LS01-10 Deployed (end) | 270 | 90 | 85 | 17 | 1.6 | 4.7 | 1009.9 | 99 | 2/10 |
| 1b | BIO | CTD | 07/Aug/2010 | 23h40 | UTC-4 | 74°27.690 | 090°22.450 | CTD-Rosette ↓ | 282 | 86 | 90 | 18 | 1.5 | 4.7 | 1010.0 | 99 | 2/10 |
| 1b | BIO | CTD | 07/Aug/2010 | 23h57 | UTC-4 | 74°27.670 | 090°22.720 | CTD-Rosette ↑ | 281 | 81 | 95 | 16 | 1.4 | 4.6 | 1010.0 | 99 | 2/10 |
| 1b | 304 | Nutrient | 08/Aug/2010 | 00h42 | UTC-5 | 74°18.420 | 091°20.480 | CTD-Rosette ↓ | 328 | 80 | 90 | 18 | 1.4 | 4.5 | 1008.4 | 99 | 5/10 |
| 1b | 304 | Nutrient | 08/Aug/2010 | 01h09 | UTC-5 | 74°18.470 | 091°20.950 | CTD-Rosette ↑ | 336 | 88 | 90 | 20 | 1.3 | 4.8 | 1008.2 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 04h05 | UTC-5 | 74°19.686 | 093°24.527 | Hg Sampling ↓ | 340 | 32 | 33 | 19 | 1.1 | 3.7 | 1008.6 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 04h07 | UTC-5 | 74°19.699 | 093°24.514 | PNF ↓ | 335 | 32 | 33 | 19 | 1.1 | 3.1 | 1008.6 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 04h10 | UTC-5 | 74°19.705 | 093°24.524 | PNF ↑ | 332 | 34 | 33 | 19 | 1.1 | 3.1 | 1008.6 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 04h12 | UTC-5 | 74°19.718 | 093°24.569 | Secchi Disk ↓↑ | 323 | 26 | 38 | 18 | 1.1 | 3.1 | 1008.6 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 04h24 | UTC-5 | 74°19.723 | 093°24.628 | CTD-Rosette ↓ | 168 | 26 | 35 | 17 | 1.1 | 3.1 | 1008.6 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 04h38 | UTC-5 | 74°19.866 | 093°24.599 | CTD-Rosette ↑ | 168 | 119 | 30 | 14 | 0.9 | 4.0 | 1009.1 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 04h55 | UTC-5 | 74°19.731 | 093°24.999 | Water Sampling ↓ | 161 | 22 | 40 | 15 | 0.8 | 4.0 | 1009.4 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 05h23 | UTC-5 | 74°19.730 | 093°24.932 | Water Sampling ↑ | 162 | 46 | 39 | 14 | 0.7 | 3.9 | 1009.8 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 05h37 | UTC-5 | 74°19.724 | 093°24.791 | CTD-Rosette ↓ | 162 | 36 | 48 | 14 | 0.8 | 4.0 | 1010.0 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 05h54 | UTC-5 | 74°19.785 | 093°24.362 | Hg Sampling ↑ | 160 | 38 | 64 | 13 | 1.2 | 4.0 | 1010.2 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 06h00 | UTC-5 | 74°19.795 | 093°24.235 | CTD-Rosette ↑ | 159 | 11 | 66 | 13 | 1.2 | 4.0 | 1010.2 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 06h20 | UTC-5 | 74°19.686 | 093°25.544 | Vertical Net Tow ↓ | 166 | 65 | 55 | 11 | 1.5 | 3.8 | 1010.6 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 06h34 | UTC-5 | 74°19.697 | 093°25.242 | Vertical Net Tow ↑ | 165 | 51 | 44 | 10 | 1.5 | 4.0 | 1010.7 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 06h43 | UTC-5 | 74°19.740 | 093°24.080 | Horizontal Net Tow ↓ | 162 | 0 | 45 | 12 | 1.5 | 4.1 | 1010.9 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 07h10 | UTC-5 | 74°20.080 | 093°12.561 | Horizontal Net Tow ↑ | 160 | 6 | 45 | 10 | 1.5 | 4.1 | 1010.9 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 07h24 | UTC-5 | 74°19.680 | 093°25.470 | Small Ring Net ↓ | 163 | 51 | 40 | 13 | 1.5 | 4.0 | 1011.2 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 07h27 | UTC-5 | 74°19.680 | 093°25.320 | Small Ring Net ↑ | 162 | 60 | 40 | 13 | 1.5 | 4.0 | 1011.2 | 99 | 5/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 07h40 | UTC-5 | 74°19.599 | 093°24.950 | Box Core ↓ | 164 | 43 | 48 | 12 | 1.6 | 3.8 | 1011.1 | 99 | 1/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 07h46 | UTC-5 | 74°19.594 | 093°24.870 | Box Core (bottom) | 164 | 41 | 48 | 12 | 1.6 | 3.8 | 1011.1 | 99 | 1/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 07h52 | UTC-5 | 74°19.567 | 093°24.645 | Box Core ↑ | 164 | 47 | 48 | 12 | 1.6 | 3.8 | 1011.1 | 99 | 1/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 08h11 | UTC-5 | 74°19.400 | 093°24.740 | Box Core ↓ | 166 | 39 | 35 | 10 | 1.0 | 4.0 | 1011.3 | 99 | 1/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 08h22 | UTC-5 | 74°19.390 | 093°24.360 | Box Core ↑ | 167 | 30 | 35 | 9 | 0.8 | 4.0 | 1011.5 | 99 | 1/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 08h53 | UTC-5 | 74°18.530 | 093°25.610 | Agassiz Trawl ↓ | 172 | 30 | 37 | 9 | 0.6 | 3.9 | 1011.7 | 99 | 1/10 |
| 1b | 305 | Basic | 08/Aug/2010 | 09h14 | UTC-5 | 74°18.950 | 093°24.280 | Agassiz Trawl ↑ | 172 | 5 | 34 | 10 | 0.7 | 3.9 | 1011.7 | 99 | 1/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 03h15 | UTC-5 | 71°17.440 | 097°41.980 | PNF + Secchi Disk ↓↑ | 124 | 181 | 181 | 18 | 3.7 | 4.3 | 1007.7 | 96 | 4/10 |

| 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 | | | | | |
| 1b | 310 | Basic | 09/Aug/2010 | 03h24 | UTC-5 | 71°17.490 | 097°41.900 | Hg Sampling ↓ | 124 | 181 | 181 | 18 | 3.7 | 4.3 | 1007.7 | 96 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 03h57 | UTC-6 | 71°17.598 | 097°41.432 | CTD-Rosette ↓ | 132 | 179 | 196 | 15 | 3.3 | 4.5 | 1008.6 | 97 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 04h24 | UTC-6 | 71°17.512 | 097°41.235 | CTD-Rosette ↑ | 130 | 194 | 192 | 16 | 3.1 | 4.5 | 1008.6 | 97 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 05h43 | UTC-6 | 71°17.622 | 097°39.949 | Vertical Net Tow ↓ | 142 | 191 | 193 | 14 | 3.1 | 4.6 | 1008.8 | 96 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 05h38 | UTC-6 | 71°17.660 | 097°40.076 | Hg Sampling ↑ | 140 | 190 | 183 | 13 | 3.1 | 4.6 | 1008.8 | 96 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 05h57 | UTC-6 | 71°17.630 | 097°39.840 | Vertical Net Tow ↑ | 143 | 185 | 183 | 13 | 3.1 | 4.6 | 1008.8 | 96 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 06h20 | UTC-6 | 71°17.750 | 097°38.478 | Horizontal Net Tow ↓ | 144 | 200 | 184 | 14 | 2.6 | 4.5 | 1009.1 | 96 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 06h37 | UTC-6 | 71°17.520 | 097°40.980 | Horizontal Net Tow ↑ | 134 | 223 | 184 | 14 | 2.6 | 4.5 | 1009.1 | 96 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 06h51 | UTC-6 | 71°17.667 | 097°40.163 | Small Ring Net ↓ | 139 | 185 | 184 | 14 | 2.6 | 4.5 | 1009.1 | 96 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 06h55 | UTC-6 | 71°17.650 | 097°40.165 | Small Ring Net ↑ | 139 | 187 | 182 | 14 | 2.8 | 4.6 | 1009.1 | 96 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 07h15 | UTC-6 | 71°17.712 | 097°38.730 | Agassiz Trawl ↓ | 141 | 75 | 180 | 13 | 2.6 | 4.6 | 1008.9 | 95 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 07h33 | UTC-6 | 71°17.770 | 097°38.270 | Agassiz Trawl ↑ | 152 | 68 | 180 | 13 | 2.6 | 4.6 | 1008.9 | 95 | 4/10 |
| 1b | 310 | Basic | 09/Aug/2010 | 15h00 | UTC-6 | 70°21.211 | 098°57.560 | Cage Sampling ↓ | 205 | 326 | 320 | 6 | 3.1 | 0.2 | 1011.9 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 01h45 | UTC-6 | 69°09.460 | 100°42.060 | Hg Sampling ↓ | 49 | 45 | 50 | 12 | 3.7 | 3.8 | 1012.2 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 02h04 | UTC-6 | 69°09.630 | 100°41.780 | CTD-Rosette ↓ | 50 | 38 | 50 | 14 | 3.6 | 3.6 | 1012.0 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 02h30 | UTC-6 | 69°10.000 | 100°41.070 | CTD-Rosette ↑ | 55 | 47 | 50 | 11 | 3.4 | 3.5 | 1012.0 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 02h37 | UTC-6 | 69°10.080 | 100°40.920 | Water Sampling ↓ | 66 | 47 | 50 | 13 | 3.4 | 3.5 | 1012.0 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 03h05 | UTC-6 | 69°10.440 | 100°40.110 | Water Sampling ↑ | 53 | 37 | 40 | 13 | 3.3 | 3.4 | 1012.0 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 03h55 | UTC-6 | 69°09.500 | 100°42.110 | PNF + Secchi Disk ↓↑ | 48 | 51 | 50 | 13 | 3.2 | 3.6 | 1011.9 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 04h25 | UTC-6 | 69°09.736 | 100°41.682 | CTD-Rosette ↓ (canceled) | 52 | 35 | 51 | 12 | 3.2 | 3.3 | 1011.8 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 04h46 | UTC-6 | 69°09.534 | 100°42.046 | Hg Sampling ↑ | 48 | 27 | 59 | 12 | 3.1 | 3.3 | 1011.7 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 05h05 | UTC-6 | 69°09.572 | 100°42.093 | Vertical Net Tow ↓ | 49 | 55 | 60 | 12 | 3.3 | 3.6 | 1011.6 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 05h10 | UTC-6 | 69°09.592 | 100°42.068 | Vertical Net Tow ↑ | 47 | 68 | 60 | 12 | 3.3 | 3.6 | 1011.6 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 05h31 | UTC-6 | 69°09.450 | 100°41.559 | Horizontal Net Tow ↓ | 47 | 320 | 65 | 13 | 4.0 | 3.7 | 1011.5 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 05h37 | UTC-6 | 69°09.624 | 100°41.997 | Horizontal Net Tow ↑ | 47 | 300 | 65 | 13 | 4.0 | 3.7 | 1011.5 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 05h48 | UTC-6 | 69°09.715 | 100°41.907 | Small Ring Net ↓ | 50 | 68 | 65 | 11 | 4.0 | 3.8 | 1011.5 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 05h53 | UTC-6 | 69°09.754 | 100°41.843 | Small Ring Net ↑ | 52 | 67 | 65 | 11 | 4.0 | 3.8 | 1011.5 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 06h24 | UTC-6 | 69°10.097 | 100°41.140 | Box Core ↓ | 58 | 66 | 75 | 11 | 3.8 | 3.8 | 1011.5 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 06h25 | UTC-6 | 69°10.127 | 100°41.070 | Box Core (bottom) | 62 | 68 | 73 | 12 | 3.8 | 3.8 | 1011.5 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 06h28 | UTC-6 | 69°10.150 | 100°41.039 | Box Core ↑ | 66 | 78 | 73 | 12 | 3.8 | 3.8 | 1011.5 | 99 | Bergy |

| 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 | | | | | |
| 1b | 312 | Nutrient | 10/Aug/2010 | 06h48 | UTC-6 | 69°10.030 | 100°40.501 | Agassiz Trawl ↓ | 52 | 320 | 73 | 12 | 3.8 | 3.8 | 1011.5 | 99 | Bergy |
| 1b | 312 | Nutrient | 10/Aug/2010 | 06h54 | UTC-6 | 69°10.101 | 100°40.903 | Agassiz Trawl ↑ | 57 | 300 | 73 | 12 | 3.8 | 3.8 | 1011.5 | 99 | Bergy |
| 1b | 314 | Nutrient | 10/Aug/2010 | 18h30 | UTC-6 | 69°00.133 | 106°36.343 | PNF ↓ | 115 | 280 | 281 | 8 | 17.0 | 9.1 | 1006.4 | 72 | 0/10 |
| 1b | 314 | Nutrient | 10/Aug/2010 | 18h36 | UTC-6 | 69°00.154 | 106°36.351 | PNF ↑ | 115 | 267 | 281 | 8 | 17.0 | 9.1 | 1006.4 | 72 | 0/10 |
| 1b | 314 | Nutrient | 10/Aug/2010 | 18h37 | UTC-6 | 69°00.154 | 106°36.351 | Secchi Disk ↓ | 115 | 264 | 281 | 8 | 17.0 | 9.1 | 1006.4 | 72 | 0/10 |
| 1b | 314 | Nutrient | 10/Aug/2010 | 18h40 | UTC-6 | 69°00.168 | 106°36.406 | Secchi Disk ↑ | 116 | 270 | 281 | 8 | 17.0 | 9.1 | 1006.4 | 72 | 0/10 |
| 1b | 314 | Nutrient | 10/Aug/2010 | 18h42 | UTC-6 | 69°00.168 | 106°36.406 | Small Ring Net ↓ | 116 | 269 | 283 | 8 | 16.8 | 9.4 | 1006.3 | 69 | 0/10 |
| 1b | 314 | Nutrient | 10/Aug/2010 | 18h46 | UTC-6 | 69°00.182 | 106°36.431 | Small Ring Net ↑ | 115 | 284 | 283 | 8 | 16.8 | 9.4 | 1006.3 | 69 | 0/10 |
| 1b | 314 | Nutrient | 10/Aug/2010 | 20h04 | UTC-6 | 69°00.170 | 106°35.940 | CTD-Rosette ↓ | 114 | 150 | Calm | Calm | 15.4 | 8.9 | 1006.2 | 75 | 0/10 |
| 1b | 314 | Nutrient | 10/Aug/2010 | 20h27 | UTC-6 | 69°00.220 | 106°35.650 | CTD-Rosette ↑ | 116 | 165 | 130 | 5 | 15.9 | 9.2 | 1006.2 | 74 | 0/10 |
| **Leg 2a** | | | | | | | | | | | | | | | | | |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 00h00 | UTC-6 | 70°46.530 | 134°23.120 | Water Sampling ↓ | 68 | 111 | 110 | 9 | 7.1 | 10.7 | 1027.1 | 96 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 00h45 | UTC-6 | 70°46.510 | 134°23.250 | Water Sampling ↑ | 72 | 101 | 109 | 9 | 7.1 | 10.5 | 1027.3 | 97 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 00h52 | UTC-6 | 70°46.520 | 134°23.260 | CTD-Rosette ↓ | 73 | 94 | 109 | 9 | 7.1 | 10.5 | 1027.3 | 97 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 01h19 | UTC-6 | 70°46.620 | 134°23.320 | CTD-Rosette ↑ | 67 | 73 | 110 | 9 | 7.1 | 10.5 | 1027.3 | 97 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 01h38 | UTC-6 | 70°46.640 | 134°23.290 | Vertical Net Tow ↓ | 71 | 130 | 117 | 9 | 7.1 | 10.5 | 1027.1 | 96 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 01h42 | UTC-6 | 70°46.650 | 134°23.340 | Vertical Net Tow (bottom) | 71 | 127 | 117 | 9 | 7.1 | 10.5 | 1027.1 | 96 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 01h45 | UTC-6 | 70°46.660 | 134°23.390 | Vertical Net Tow ↑ | 71 | 121 | 117 | 9 | 7.1 | 10.5 | 1027.1 | 96 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 02h04 | UTC-6 | 70°46.700 | 134°23.230 | Horizontal Net Tow ↓ | 68 | 11 | 116 | 10 | 7.8 | 10.5 | 1027.1 | 96 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 02h17 | UTC-6 | 70°46.930 | 134°23.460 | Horizontal Net Tow ↑ | 67 | 228 | 115 | 10 | 7.8 | 10.5 | 1027.1 | 96 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 02h59 | UTC-6 | 70°46.740 | 134°23.330 | Box Core ↓ | 69 | 115 | 121 | 9 | 7.8 | 10.6 | 1027.2 | 95 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 03h10 | UTC-6 | 70°46.750 | 134°23.300 | Box Core (bottom) | 68 | 144 | 122 | 9 | 7.8 | 10.6 | 1027.2 | 96 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 03h21 | UTC-6 | 70°46.750 | 134°23.300 | Box Core ↑ | 68 | 152 | 122 | 9 | 7.8 | 10.6 | 1027.2 | 96 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 03h28 | UTC-6 | 70°46.820 | 134°23.080 | Agassiz Trawl ↓ | 69 | 86 | 112 | 9 | 8.1 | 10.6 | 1027.3 | 94 | 0/10 |
| 2a | BP10-018 | Biophysical | 15/Aug/2010 | 03h57 | UTC-6 | 70°46.770 | 134°23.260 | Agassiz Trawl ↑ | 69 | 100 | 113 | 9 | 8.1 | 10.6 | 1027.3 | 94 | 0/10 |
| 2a | LF-1 | Hydrophone | 15/Aug/2010 | 05h20 | UTC-6 | 70°48.294 | 134°19.749 | MARU Buoy Deployed | 70 | 274 | 117 | 10 | 9.0 | 10.5 | 1027.4 | 89 | 0/10 |
| 2a | LF-2 | Hydrophone | 15/Aug/2010 | 05h55 | UTC-6 | 70°50.800 | 134°32.890 | MARU Buoy Deployed | 78 | 249 | 118 | 9 | 8.2 | 10.4 | 1027.5 | 96 | 0/10 |
| 2a | HF-2 | Hydrophone | 15/Aug/2010 | 06h17 | UTC-6 | 70°52.240 | 134°28.400 | MARU Buoy Deployed | 80 | 5 | 129 | 12 | 8.1 | 10.4 | 1027.3 | 97 | 0/10 |
| 2a | LF-3 | Hydrophone | 15/Aug/2010 | 06h55 | UTC-6 | 70°53.310 | 134°46.060 | MARU Buoy Deployed | 107 | 324 | 118 | 9 | 7.1 | 10.3 | 1027.4 | 98 | 0/10 |
| 2a | HF-5 | Hydrophone | 15/Aug/2010 | 08h07 | UTC-6 | 70°53.393 | 135°22.440 | MARU Buoy Deployed | 525 | 114 | 110 | 12 | 7.6 | 10.0 | 1027.3 | 98 | 0/10 |

| 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 | | | | | |
| 2a | HF-4 | Hydrophone | 15/Aug/2010 | 08h51 | UTC-6 | 71°00.311 | 135°22.549 | MARU Buoy Deployed | 640 | 115 | 114 | 11 | 8.1 | 9.8 | 1027.2 | 93 | 0/10 |
| 2a | LF-4 | Hydrophone | 15/Aug/2010 | 09h57 | UTC-6 | 70°55.932 | 134°58.478 | MARU Buoy Deployed | 345 | 112 | 105 | 12 | 9.1 | 9.9 | 1027.3 | 89 | 0/10 |
| 2a | HF-3 | Hydrophone | 15/Aug/2010 | 10h24 | UTC-6 | 70°55.855 | 134°46.458 | MARU Buoy Deployed | 228 | 95 | 113 | 15 | 9.1 | 9.8 | 1027.0 | 88 | 0/10 |
| 2a | LF-7 | Hydrophone | 15/Aug/2010 | 10h48 | UTC-6 | 70°58.338 | 134°45.986 | MARU Buoy Deployed | 304 | 112 | 105 | 14 | 8.8 | 9.8 | 1027.4 | 90 | 0/10 |
| 2a | LF-6 | Hydrophone | 15/Aug/2010 | 11h19 | UTC-6 | 70°55.845 | 134°32.933 | MARU Buoy Deployed | 101 | 95 | 117 | 14 | 9.0 | 9.7 | 1027.3 | 88 | 0/10 |
| 2a | LF-5 | Hydrophone | 15/Aug/2010 | 11h51 | UTC-6 | 70°53.271 | 134°17.950 | MARU Buoy Deployed | 79 | 103 | 115 | 13 | 8.9 | 10.2 | 1027.3 | 87 | 0/10 |
| 2a | J-09 | Mooring | 15/Aug/2010 | 13h00 | UTC-6 | 70°54.030 | 134°16.550 | CTD ↓ | 89 | 109 | 118 | 15 | 8.9 | 10.2 | 1027.8 | 87 | 0/10 |
| 2a | J-09 | Mooring | 15/Aug/2010 | 13h05 | UTC-6 | 70°54.060 | 134°16.500 | CTD ↑ | 89 | 113 | 118 | 15 | 8.9 | 10.2 | 1027.8 | 87 | 0/10 |
| 2a | J-09 | Mooring | 15/Aug/2010 | 14h10 | UTC-6 | 70°53.970 | 134°15.608 | Mooring J-09 Recovered | 89 | 74 | 110 | 16 | 9.1 | 11.5 | 1027.6 | 82 | 0/10 |
| 2a | J-09 | Mooring | 15/Aug/2010 | 14h25 | UTC-6 | 70°53.990 | 134°16.020 | Mooring J-09 Recovered (end) | 89 | 65 | 110 | 16 | 9.1 | 11.4 | 1027.6 | 82 | 0/10 |
| 2a | LF-8 | Hydrophone | 15/Aug/2010 | 14h50 | UTC-6 | 70°50.720 | 134°06.990 | MARU Buoy Deployed | 82 | 110 | 105 | 17 | 9.1 | 12.3 | 1027.6 | 84 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 16h14 | UTC-6 | 70°55.380 | 134°26.620 | CTD-Rosette ↓ | 96 | 359 | 100 | 15 | 9.8 | 11.1 | 1027.6 | 79 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 16h38 | UTC-6 | 70°55.490 | 134°27.060 | CTD-Rosette ↑ | 93 | 340 | 120 | 20 | 10.7 | 10.9 | 1023.5 | 79 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 16h59 | UTC-6 | 70°55.440 | 134°25.920 | Vertical Net Tow ↓ | 98 | 297 | 111 | 18 | 9.3 | 10.9 | 1027.0 | 83 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 17h09 | UTC-6 | 70°55.500 | 134°25.980 | Vertical Net Tow ↑ | 98 | 312 | 102 | 18 | 9.3 | 10.9 | 1027.0 | 83 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 17h25 | UTC-6 | 70°55.650 | 134°26.220 | Horizontal Net Tow ↓ | 100 | 273 | 124 | 18 | 13.0 | 10.7 | 1027.0 | 69 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 17h40 | UTC-6 | 70°55.400 | 134°26.520 | Horizontal Net Tow ↑ | 95 | 138 | 120 | 17 | 10.0 | 10.6 | 1026.9 | 83 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 18h12 | UTC-6 | 70°55.460 | 134°26.240 | Box Core ↓ | 96 | 240 | 113 | 17 | 11.0 | 10.6 | 1026.7 | 81 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 18h20 | UTC-6 | 70°55.520 | 134°26.440 | Box Core ↑ | 103 | 214 | 110 | 20 | 9.5 | 10.6 | 1026.0 | 83 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 18h34 | UTC-6 | 70°55.470 | 134°25.840 | Box Core ↓ | 98 | 229 | 110 | 17 | 9.6 | 10.8 | 1026.3 | 83 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 18h43 | UTC-6 | 70°55.550 | 134°25.900 | Box Core ↑ | 100 | 1 | 110 | 20 | 9.6 | 10.8 | 1026.4 | 80 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 19h01 | UTC-6 | 70°55.760 | 134°26.100 | Agassiz Trawl ↓ | 101 | 302 | 90 | 17 | 10.9 | 10.7 | 1026.3 | 76 | 0/10 |
| 2a | BP10-04 | Biophysical | 15/Aug/2010 | 19h24 | UTC-6 | 70°55.910 | 134°26.320 | Agassiz Trawl ↑ | 112 | 266 | 111 | 19 | 10.0 | 10.7 | 1026.2 | 77 | 0/10 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 21h15 | UTC-6 | 70°58.924 | 134°22.750 | CTD-Rosette ↓ | 259 | 306 | 93 | 18 | 10.9 | 10.9 | 1025.5 | 71 | 0/10 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 21h56 | UTC-6 | 70°58.940 | 134°23.110 | CTD-Rosette ↑ | 255 | 292 | 99 | 22 | 13.6 | 11.1 | 1025.4 | 65 | 0/10 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 22h28 | UTC-6 | 70°59.051 | 134°23.461 | Horizontal Net Tow ↓ | 272 | 222 | 107 | 23 | 10.2 | 11.2 | 1025.3 | 73 | 0/10 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 22h41 | UTC-6 | 70°59.120 | 134°23.921 | Horizontal Net Tow ↑ | 259 | 125 | 101 | 21 | 8.9 | 11.9 | 1025.0 | 77 | 0/10 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 22h58 | UTC-6 | 70°59.262 | 134°23.017 | Vertical Net Tow ↓ | 272 | 302 | 96 | 22 | 9.0 | 12.0 | 1024.9 | 77 | 0/10 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 23h17 | UTC-6 | 70°59.305 | 134°23.177 | Vertical Net Tow ↑ | 273 | 306 | 99 | 24 | 12.3 | 11.8 | 1025.0 | 68 | 0/10 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 23h47 | UTC-6 | 70°59.017 | 134°22.913 | Box Core ↓ | 260 | 305 | 98 | 21 | 9.8 | 11.5 | 1024.6 | 78 | 0/10 |

| 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 | | | | | |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 23h54 | UTC-6 | 70°59.040 | 134°23.000 | Box Core (bottom) | 260 | 308 | 104 | 11 | 10.9 | 11.8 | 1024.8 | 73 | 0/10 |
| 2a | BP10-015 | Biophysical | 15/Aug/2010 | 23h57 | UTC-6 | 70°59.060 | 134°23.050 | Box Core ↑ | 260 | 310 | 104 | 11 | 10.9 | 11.8 | 1024.8 | 73 | 0/10 |
| 2a | BP10-015 | Biophysical | 16/Aug/2010 | 00h11 | UTC-6 | 70°59.090 | 134°23.050 | Box Core ↓ | 263 | 306 | 104 | 11 | 10.9 | 11.8 | 1024.8 | 73 | 0/10 |
| 2a | BP10-015 | Biophysical | 16/Aug/2010 | 00h15 | UTC-6 | 70°59.100 | 134°23.090 | Box Core (bottom) | 263 | 310 | 104 | 11 | 10.9 | 11.8 | 1024.8 | 73 | 0/10 |
| 2a | BP10-015 | Biophysical | 16/Aug/2010 | 00h27 | UTC-6 | 70°59.120 | 134°23.170 | Box Core ↑ | 263 | 305 | 104 | 11 | 10.9 | 11.8 | 1024.8 | 73 | 0/10 |
| 2a | BP10-015 | Biophysical | 16/Aug/2010 | 00h39 | UTC-6 | 70°59.150 | 134°23.330 | Agassiz Trawl ↓ | 263 | 300 | 103 | 13 | 10.9 | 11.8 | 1024.9 | 73 | 0/10 |
| 2a | BP10-015 | Biophysical | 16/Aug/2010 | 01h30 | UTC-6 | 70°58.560 | 134°28.390 | Agassiz Trawl ↑ | 266 | 180 | 101 | 14 | 13.1 | 11.5 | 1024.5 | 71 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 02h15 | UTC-6 | 71°00.580 | 134°39.820 | CTD-Rosette ↓ | 333 | 308 | 113 | 19 | 10.3 | 12.0 | 1024.3 | 83 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 03h10 | UTC-6 | 71°00.640 | 134°40.420 | CTD-Rosette ↑ | 336 | 299 | 115 | 13 | 10.2 | 11.7 | 1024.9 | 83 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 03h20 | UTC-6 | 71°00.810 | 134°41.330 | Horizontal Net Tow ↓ | 342 | 317 | 114 | 13 | 10.2 | 11.7 | 1023.7 | 83 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 03h40 | UTC-6 | 71°00.780 | 134°41.990 | Horizontal Net Tow ↑ | 354 | 232 | 115 | 13 | 10.2 | 11.7 | 1023.4 | 83 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 03h55 | UTC-6 | 71°00.530 | 134°40.220 | Vertical Net Tow ↓ | 335 | 302 | 116 | 19 | 10.5 | 11.9 | 1022.8 | 83 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 04h26 | UTC-6 | 71°06.630 | 134°40.830 | Vertical Net Tow ↑ | 343 | 174 | 105 | 25 | 10.1 | 11.8 | 1022.9 | 86 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 04h58 | UTC-6 | 71°00.540 | 134°40.080 | Box Core ↓ | 334 | 317 | 103 | 25 | 11.0 | 11.7 | 1022.7 | 82 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 05h20 | UTC-6 | 71°00.670 | 134°40.720 | Box Core ↑ | 345 | 295 | 113 | 24 | 10.0 | 11.8 | 1022.6 | 85 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 05h37 | UTC-6 | 71°00.740 | 134°41.070 | Agassiz Trawl ↓ | 347 | 329 | 110 | 24 | 10.2 | 11.8 | 1022.6 | 89 | 0/10 |
| 2a | BP10-010 | Biophysical | 16/Aug/2010 | 06h47 | UTC-6 | 71°02.000 | 134°42.640 | Agassiz Trawl ↑ | 400 | 351 | 120 | 25 | 9.6 | 11.9 | 1021.9 | 89 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 08h57 | UTC-6 | 70°53.740 | 134°14.900 | CTD-Rosette ↓ | 80 | 337 | 111 | 27 | 10.6 | 10.7 | 1021.7 | 82 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 09h25 | UTC-6 | 70°53.810 | 134°15.640 | CTD-Rosette ↑ | 81 | 332 | 109 | 24 | 10.9 | 10.3 | 1021.4 | 85 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 09h37 | UTC-6 | 70°53.701 | 134°14.716 | Horizontal Net Tow ↓ | 80 | 302 | 117 | 19 | 10.8 | 10.5 | 1021.3 | 84 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 09h47 | UTC-6 | 70°53.767 | 134°15.684 | Horizontal Net Tow ↑ | 81 | 269 | 125 | 22 | 10.6 | 10.6 | 1021.1 | 83 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 09h59 | UTC-6 | 70°53.785 | 134°15.129 | Vertical Net Tow ↓ | 81 | 303 | 116 | 21 | 10.6 | 10.5 | 1021.1 | 84 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 10h05 | UTC-6 | 70°53.813 | 134°15.184 | Vertical Net Tow ↑ | 81 | 308 | 112 | 23 | 10.6 | 10.5 | 1021.1 | 84 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 10h34 | UTC-6 | 70°53.704 | 134°15.080 | Box Core ↓ | 80 | 302 | 114 | 25 | 13.8 | 10.2 | 1021.1 | 73 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 10h36 | UTC-6 | 70°53.699 | 134°15.095 | Box Core (bottom) | 80 | 306 | 108 | 23 | 13.8 | 10.2 | 1021.1 | 73 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 10h39 | UTC-6 | 70°53.686 | 134°15.093 | Box Core ↑ | 79 | 309 | 112 | 21 | 13.8 | 10.2 | 1020.9 | 77 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 10h55 | UTC-6 | 70°53.671 | 134°15.298 | Box Core ↓ | 80 | 302 | 115 | 25 | 12.0 | 10.3 | 1020.8 | 79 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 10h57 | UTC-6 | 70°53.667 | 134°15.321 | Box Core (bottom) | 79 | 302 | 111 | 25 | 12.0 | 10.3 | 1020.8 | 79 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 11h00 | UTC-6 | 70°53.667 | 134°15.350 | Box Core ↑ | 79 | 291 | 111 | 22 | 13.6 | 10.2 | 1020.8 | 74 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 11h17 | UTC-6 | 70°53.635 | 134°15.149 | Agassiz Trawl ↓ | 80 | 315 | 103 | 24 | 10.9 | 10.2 | 1020.7 | 84 | 0/10 |

| 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 | | | | | |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 11h19 | UTC-6 | 70°53.653 | 134°15.230 | Agassiz Trawl ↑ | 80 | 349 | 114 | 24 | 10.9 | 10.2 | 1020.7 | 84 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 11h22 | UTC-6 | 70°53.699 | 134°15.444 | Agassiz Trawl ↓ | 80 | 284 | 116 | 20 | 12.7 | 10.2 | 1020.7 | 76 | 0/10 |
| 2a | BP10-012 | Biophysical | 16/Aug/2010 | 11h35 | UTC-6 | 70°53.752 | 134°16.853 | Agassiz Trawl ↑ | 81 | 242 | 116 | 23 | 11.1 | 10.3 | 1020.6 | 84 | 0/10 |
| 2a | J-10 | Mooring | 16/Aug/2010 | 14h34 | UTC-6 | 70°53.850 | 134°15.650 | Mooring J-10 Deployed | 82 | 290 | 110 | 21 | 12.9 | 13.0 | 1017.5 | 73 | 0/10 |
| 2a | J-10 | Mooring | 16/Aug/2010 | 20h15 | UTC-6 | 70°54.020 | 134°16.329 | CTD ↓ | 81 | 303 | 102 | 24 | 13.7 | 13.1 | 1017.0 | 76 | 0/10 |
| 2a | J-10 | Mooring | 16/Aug/2010 | 20h23 | UTC-6 | 70°53.997 | 134°16.387 | CTD ↑ | 82 | 291 | 109 | 24 | 14.4 | 13.2 | 1016.9 | 71 | 0/10 |
| 2a | BP10-09 | Biophysical | 16/Aug/2010 | 23h09 | UTC-6 | 71°09.143 | 135°38.359 | Water Sampling ↓ | 962 | 301 | 106 | 26 | 11.1 | 5.8 | 1015.0 | 81 | 0/10 |
| 2a | BP10-09 | Biophysical | 16/Aug/2010 | 23h55 | UTC-6 | 71°09.040 | 135°38.550 | Water Sampling ↑ | 925 | 283 | 108 | 24 | 9.2 | 4.7 | 1014.7 | 86 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 00h05 | UTC-6 | 71°09.040 | 135°38.630 | CTD-Rosette ↓ | 925 | 247 | 109 | 24 | 9.2 | 4.7 | 1014.7 | 86 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 00h49 | UTC-6 | 71°08.820 | 135°39.100 | CTD-Rosette ↑ | 906 | 281 | 106 | 26 | 9.1 | 4.7 | 1014.7 | 85 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 01h09 | UTC-6 | 71°09.460 | 135°39.270 | Horizontal Net Tow ↓ | 967 | 302 | 112 | 19 | 9.4 | 4.1 | 1014.2 | 88 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 01h21 | UTC-6 | 71°09.350 | 135°40.950 | Horizontal Net Tow ↑ | 953 | 253 | 105 | 23 | 9.7 | 3.7 | 1014.1 | 85 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 01h37 | UTC-6 | 71°09.200 | 135°40.830 | Vertical Net Tow ↓ | 943 | 264 | 104 | 23 | 9.0 | 3.6 | 1013.9 | 87 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 02h55 | UTC-6 | 71°08.850 | 135°41.540 | Vertical Net Tow ↑ | 944 | 292 | 105 | 22 | 8.7 | 3.5 | 1013.9 | 86 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 03h05 | UTC-6 | 71°08.320 | 135°39.230 | CTD-Rosette ↓ | 923 | 244 | 103 | 26 | 9.5 | 3.4 | 1013.1 | 86 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 04h41 | UTC-6 | 71°09.130 | 135°40.330 | CTD-Rosette ↑ | 932 | 285 | 117 | 22 | 9.4 | 3.2 | 1013.0 | 86 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 05h09 | UTC-6 | 71°09.390 | 135°39.300 | Box Core ↓ | 932 | 280 | 119 | 26 | 9.8 | 3.1 | 1012.7 | 84 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | N/A | UTC-6 | 71°09.350 | 135°39.080 | Box Core (bottom) | 945 | 268 | 119 | 26 | 9.2 | 2.3 | 1012.6 | 86 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 06h02 | UTC-6 | 71°09.370 | 135°40.220 | Box Core ↑ | 950 | 296 | 121 | 23 | 9.5 | 2.8 | 1012.0 | 83 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 06h24 | UTC-6 | 71°09.350 | 135°33.770 | Agassiz Trawl ↓ | 945 | 307 | 108 | 27 | 12.2 | 3.3 | 1012.0 | 79 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 07h45 | UTC-6 | 71°08.670 | 135°44.650 | Agassiz Trawl ↑ | 981 | 232 | 114 | 26 | 8.9 | 6.2 | 1011.3 | 85 | 0/10 |
| 2a | BP10-09 | Biophysical | 17/Aug/2010 | 08h01 | UTC-6 | 71°08.862 | 135°44.664 | Surface Temperature Buoy Deployed | 982 | 116 | 108 | 24 | 9.0 | 5.7 | 1011.2 | 85 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 10h19 | UTC-6 | 70°55.178 | 134°51.188 | Water Sampling ↓ | 248 | 298 | 107 | 25 | 11.2 | 10.2 | 1010.2 | 81 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 11h00 | UTC-6 | 70°55.285 | 134°51.765 | Water Sampling ↑ | 256 | 305 | 100 | 29 | 10.8 | 10.4 | 1009.4 | 82 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 11h06 | UTC-6 | 70°55.313 | 134°52.050 | CTD-Rosette ↓ | 258 | 309 | 94 | 28 | 10.8 | 10.4 | 1009.4 | 82 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 11h33 | UTC-6 | 70°55.262 | 134°52.779 | CTD-Rosette ↑ | 262 | 312 | 98 | 28 | 12.7 | 10.7 | 1009.3 | 77 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 12h25 | UTC-6 | 70°55.080 | 134°51.220 | Horizontal Net Tow ↓ | 242 | 290 | 112 | 23 | 11.0 | 11.0 | 1008.9 | 82 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 12h45 | UTC-6 | 70°55.110 | 134°52.830 | Horizontal Net Tow ↑ | 261 | 290 | 110 | 26 | 11.0 | 11.1 | 1008.9 | 83 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 12h52 | UTC-6 | 70°55.150 | 134°53.040 | Vertical Net Tow ↓ | 261 | 293 | 110 | 25 | 11.1 | 10.9 | 1006.3 | 82 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 13h15 | UTC-6 | 70°55.160 | 134°53.110 | Vertical Net Tow ↑ | 262 | 300 | 105 | 25 | 14.0 | 10.0 | 1008.4 | 71 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 13h36 | UTC-6 | 70°55.120 | 134°51.480 | CTD-Rosette ↓ | 248 | 302 | 107 | 27 | 14.0 | 10.1 | 1008.4 | 71 | 0/10 |

| 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 | | | | | |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 14h09 | UTC-6 | 70°55.110 | 134°51.630 | CTD-Rosette ↑ | 247 | 296 | 105 | 33 | 14.0 | 10.6 | 1008.0 | 72 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 14h32 | UTC-6 | 70°55.090 | 134°51.590 | Box Core ↓ | 246 | 299 | 105 | 30 | 13.4 | 10.6 | 1007.7 | 75 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 14h36 | UTC-6 | 70°55.100 | 134°51.590 | Box Core (bottom) | 246 | 298 | 105 | 30 | 13.4 | 10.6 | 1007.7 | 75 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 14h40 | UTC-6 | 70°55.110 | 134°51.530 | Box Core ↑ | 247 | 295 | 105 | 30 | 13.4 | 10.6 | 1007.7 | 75 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 15h06 | UTC-6 | 70°55.030 | 134°51.670 | Agassiz Trawl ↓ | 246 | 225 | 127 | 25 | 13.9 | 10.6 | 1006.9 | 76 | 0/10 |
| 2a | BP10-04 | Biophysical | 17/Aug/2010 | 15h31 | UTC-6 | 70°55.050 | 134°54.800 | Agassiz Trawl ↑ | 357 | 244 | 180 | 22 | 11.4 | 10.8 | 1007.0 | 82 | 0/10 |
| 2a | BP10-04 | Biophysical | 18/Aug/2010 | 10h40 | UTC-6 | 71°47.650 | 136°43.430 | EM Sampling | 2102 | 9 | 100 | 20 | 3.2 | 1.1 | 1008.7 | 95 | 8/10 |
| 2a | G-09 | Mooring | 18/Aug/2010 | 17h28 | UTC-6 | 71°00.160 | 135°31.740 | CTD ↓ | 734 | 275 | 81 | 16 | 10.3 | 9.0 | 1010.6 | 85 | 0/10 |
| 2a | G-09 | Mooring | 18/Aug/2010 | 18h00 | UTC-6 | 71°00.170 | 135°32.240 | CTD ↑ | 738 | 270 | 81 | 16 | 10.3 | 9.0 | 1010.6 | 85 | 0/10 |
| 2a | G-09 | Mooring | 18/Aug/2010 | 19h10 | UTC-6 | 71°00.152 | 135°28.758 | Mooring G-09 Recovered | 701 | 270 | 88 | 19 | 12.0 | 11.1 | 1011.3 | 77 | 0/10 |
| 2a | G-09 | Mooring | 18/Aug/2010 | 19h45 | UTC-6 | 71°00.280 | 135°28.969 | Mooring G-09 Recovered (end) | 701 | 287 | 88 | 19 | 12.6 | 11.5 | 1011.5 | 77 | 0/10 |
| 2a | BP10-07 | Biophysical | 18/Aug/2010 | 21h19 | UTC-6 | 71°04.900 | 135°33.650 | Water Sampling ↓ | 843 | 267 | 86 | 15 | 9.5 | 10.4 | 1012.2 | 88 | 0/10 |
| 2a | BP10-07 | Biophysical | 18/Aug/2010 | 22h05 | UTC-6 | 71°05.065 | 135°33.587 | Water Sampling ↑ | 844 | 260 | 90 | 18 | 9.7 | 10.3 | 1012.3 | 88 | 0/10 |
| 2a | BP10-07 | Biophysical | 18/Aug/2010 | 22h13 | UTC-6 | 71°05.112 | 135°33.581 | CTD-Rosette ↓ | 843 | 256 | 90 | 20 | 10.1 | 10.3 | 1012.4 | 87 | 0/10 |
| 2a | BP10-07 | Biophysical | 18/Aug/2010 | 22h55 | UTC-6 | 71°05.291 | 135°33.329 | CTD-Rosette ↑ | 842 | 281 | 77 | 21 | 12.1 | 10.2 | 1012.7 | 79 | 0/10 |
| 2a | BP10-07 | Biophysical | 18/Aug/2010 | 23h14 | UTC-6 | 71°05.310 | 135°33.699 | Horizontal Net Tow ↓ | 845 | 294 | 80 | 21 | 10.9 | 10.2 | 1012.9 | 85 | 0/10 |
| 2a | BP10-07 | Biophysical | 18/Aug/2010 | 23h28 | UTC-6 | 71°05.334 | 135°35.262 | Horizontal Net Tow ↑ | 860 | 247 | 96 | 22 | 11.7 | 10.3 | 1013.1 | 88 | 0/10 |
| 2a | BP10-07 | Biophysical | 18/Aug/2010 | 23h48 | UTC-6 | 71°04.998 | 135°33.556 | Vertical Net Tow ↓ | 841 | 264 | 88 | 15 | 10.7 | 10.3 | 1013.2 | 83 | 0/10 |
| 2a | BP10-07 | Biophysical | 19/Aug/2010 | 00h40 | UTC-6 | 71°05.330 | 135°33.420 | Vertical Net Tow ↑ | 842 | 277 | 180 | 21 | 11.3 | 9.9 | 1013.7 | 81 | 0/10 |
| 2a | BP10-07 | Biophysical | 19/Aug/2010 | 01h43 | UTC-6 | 71°05.200 | 135°33.330 | CTD-Rosette ↓ | 839 | 285 | 97 | 22 | 9.2 | 10.2 | 1013.4 | 89 | 0/10 |
| 2a | BP10-07 | Biophysical | 19/Aug/2010 | 03h21 | UTC-6 | 71°05.330 | 135°33.250 | CTD-Rosette ↑ | 843 | 298 | 80 | 13 | 11.5 | 10.0 | 1014.9 | 80 | 0/10 |
| 2a | BP10-07 | Biophysical | 19/Aug/2010 | 03h41 | UTC-6 | 71°05.120 | 135°34.950 | Agassiz Trawl ↓ | 856 | 331 | 97 | 15 | 8.9 | 10.0 | 1014.9 | 86 | 0/10 |
| 2a | BP10-07 | Biophysical | 19/Aug/2010 | 05h30 | UTC-6 | 71°04.170 | 135°42.880 | Agassiz Trawl ↑ | 886 | 225 | 92 | 21 | 8.8 | 10.0 | 1015.4 | 86 | 0/10 |
| 2a | BP10-07 | Biophysical | 19/Aug/2010 | 06h13 | UTC-6 | 71°05.160 | 135°33.670 | Box Core ↓ | 846 | 258 | 99 | 20 | 9.0 | 10.3 | 1015.4 | 86 | 0/10 |
| 2a | BP10-07 | Biophysical | 19/Aug/2010 | 06h30 | UTC-6 | 71°05.260 | 135°34.040 | Box Core (bottom) | 848 | 262 | 96 | 21 | 8.6 | 10.0 | 1015.7 | 86 | 0/10 |
| 2a | BP10-07 | Biophysical | 19/Aug/2010 | 06h45 | UTC-6 | 71°05.330 | 135°34.270 | Box Core ↑ | 851 | 282 | 86 | 19 | 8.6 | 10.0 | 1015.8 | 86 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 08h31 | UTC-6 | 71°01.789 | 134°48.485 | CTD-Rosette ↓ | 442 | 290 | 77 | 19 | 8.7 | 10.4 | 1016.4 | 85 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 09h24 | UTC-6 | 71°01.768 | 134°48.237 | CTD-Rosette ↑ | 432 | 285 | 80 | 16 | 10.3 | 10.2 | 1016.6 | 75 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 09h35 | UTC-6 | 71°01.759 | 134°48.871 | Horizontal Net Tow ↓ | 442 | 265 | 83 | 17 | 11.7 | 10.2 | 1016.6 | 71 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 09h48 | UTC-6 | 71°01.592 | 134°50.112 | Horizontal Net Tow ↑ | 448 | 220 | 91 | 17 | 12.2 | 10.3 | 1016.6 | 70 | 0/10 |

| 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 | | | | | |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 10h05 | UTC-6 | 71°01.767 | 134°48.567 | Vertical Net Tow ↓ | 442 | 255 | 85 | 16 | 9.9 | 10.4 | 1016.7 | 78 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 10h34 | UTC-6 | 71°01.855 | 134°48.686 | Vertical Net Tow ↑ | 442 | 261 | 77 | 17 | 8.8 | 10.3 | 1016.8 | 84 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 12h58 | UTC-6 | 71°01.770 | 134°48.060 | Box Core ↓ | 442 | 285 | 70 | 12 | 9.3 | 10.5 | 1017.2 | 81 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 13h41 | UTC-6 | 71°01.740 | 134°48.010 | Box Core (bottom) | 432 | 268 | 71 | 10 | 11.4 | 10.6 | 1017.7 | 75 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 13h49 | UTC-6 | 71°01.770 | 134°48.010 | Box Core ↑ | 430 | 292 | 71 | 10 | 11.4 | 10.6 | 1017.7 | 74 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 14h07 | UTC-6 | 71°01.750 | 134°48.020 | Box Core ↓ | 432 | 292 | 72 | 8 | 10.3 | 11.0 | 1017.8 | 79 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 14h17 | UTC-6 | 71°01.740 | 134°48.010 | Box Core (bottom) | 430 | 298 | 72 | 8 | 10.3 | 11.0 | 1017.8 | 79 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 14h25 | UTC-6 | 71°01.750 | 134°48.060 | Box Core ↑ | 433 | 296 | 76 | 9 | 11.2 | 11.3 | 1017.9 | 77 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 14h35 | UTC-6 | 71°01.860 | 134°49.300 | Agassiz Trawl ↓ | 449 | 208 | 79 | 8 | 10.4 | 11.4 | 1018.0 | 78 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | 15h15 | UTC-6 | 71°01.740 | 134°49.610 | Agassiz Trawl ↑ | 437 | 201 | 78 | 8 | 9.0 | 10.9 | 1017.8 | 77 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | N/A | UTC-6 | N/A | N/A | MOB ↓ | N/A | N/A | 66 | 15 | 9.1 | 11.0 | 1018.1 | 87 | 0/10 |
| 2a | BP10-05 | Biophysical | 19/Aug/2010 | N/A | UTC-6 | N/A | N/A | MOB ↑ (canceled) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 20h58 | UTC-6 | 70°51.830 | 134°45.864 | Water Sampling ↓ | 90 | 181 | 10 | 16 | 7.6 | 11.0 | 1015.5 | 84 | 0/10 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 21h38 | UTC-6 | 70°51.714 | 134°46.053 | Water Sampling ↑ | 87 | 192 | 12 | 17 | 8.5 | 11.1 | 1015.5 | 83 | 0/10 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 21h44 | UTC-6 | 70°51.723 | 134°46.141 | CTD-Rosette ↓ | 88 | 207 | 350 | 22 | 9.4 | 11.2 | 1015.5 | 83 | 0/10 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 22h14 | UTC-6 | 70°51.697 | 134°46.214 | CTD-Rosette ↑ | 88 | 194 | 359 | 21 | 10.3 | 11.2 | 1015.3 | 78 | 0/10 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 22h28 | UTC-6 | 70°51.687 | 134°46.350 | Horizontal Net Tow ↓ | 88 | 196 | 355 | 20 | 9.7 | 11.2 | 1015.3 | 82 | 0/10 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 22h42 | UTC-6 | 70°51.169 | 134°46.238 | Horizontal Net Tow ↑ | 87 | 121 | 2 | 24 | 7.9 | 11.2 | 1015.0 | 89 | 0/10 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 23h02 | UTC-6 | 70°51.729 | 134°45.943 | Vertical Net Tow ↓ | 89 | 199 | 3 | 21 | 7.3 | 11.2 | 1014.6 | 94 | 0/10 |
| 2a | BP10-011 | Biophysical | 20/Aug/2010 | 23h09 | UTC-6 | 70°51.723 | 134°45.999 | Vertical Net Tow ↑ | 89 | 189 | 5 | 22 | 9.0 | 11.2 | 1014.9 | 88 | 0/10 |
| 2a | BP10-011 | Biophysical | 21/Aug/2010 | 00h22 | UTC-6 | 70°51.910 | 134°45.920 | Box Core ↓ | 89 | 210 | 360 | 15 | 8.8 | 11.1 | 1014.6 | 89 | 0/10 |
| 2a | BP10-011 | Biophysical | 21/Aug/2010 | 00h27 | UTC-6 | 70°51.880 | 134°45.940 | Box Core (bottom) | 88 | 232 | 360 | 15 | 8.8 | 11.1 | 1014.6 | 89 | 0/10 |
| 2a | BP10-011 | Biophysical | 21/Aug/2010 | 00h33 | UTC-6 | 70°51.840 | 134°45.920 | Box Core ↑ | 88 | 241 | 360 | 15 | 8.8 | 11.1 | 1014.6 | 89 | 0/10 |
| 2a | BP10-011 | Biophysical | 21/Aug/2010 | 00h45 | UTC-6 | 70°51.760 | 134°46.050 | Agassiz Trawl ↓ | 88 | 179 | 355 | 16 | 8.8 | 11.1 | 1014.6 | 88 | 0/10 |
| 2a | BP10-011 | Biophysical | 21/Aug/2010 | 01h01 | UTC-6 | 70°51.170 | 134°45.840 | Agassiz Trawl ↑ | 89 | 173 | 355 | 16 | 8.7 | 11.1 | 1014.4 | 92 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 02h26 | UTC-6 | 70°45.390 | 135°03.740 | CTD-Rosette ↓ | 75 | 195 | 357 | 16 | 9.6 | 11.2 | 1013.9 | 90 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 02h57 | UTC-6 | 70°45.330 | 135°03.740 | CTD-Rosette ↑ | 74 | 207 | 355 | 16 | 9.6 | 11.2 | 1013.8 | 91 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 03h10 | UTC-6 | 70°45.340 | 135°03.770 | Horizontal Net Tow ↓ | 75 | 196 | 4 | 15 | 10.2 | 11.2 | 1013.7 | 92 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 03h27 | UTC-6 | 70°45.370 | 135°04.120 | Horizontal Net Tow ↑ | 75 | 183 | 10 | 15 | 10.2 | 11.2 | 1013.2 | 98 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 03h41 | UTC-6 | 70°45.440 | 135°04.230 | Vertical Net Tow ↓ | 75 | 178 | 10 | 18 | 10.2 | 11.1 | 1013.2 | 98 | 0/10 |

| 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 | | | | | |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 03h50 | UTC-6 | 70°45.360 | 135°04.180 | Vertical Net Tow ↑ | 75 | 203 | 8 | 17 | 8.1 | 11.2 | 1013.7 | 96 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 04h35 | UTC-6 | 70°45.230 | 135°04.610 | Box Core ↓ | 74 | 216 | 0 | 22 | 7.7 | 11.1 | 1013.4 | 96 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 04h28 | UTC-6 | 70°44.220 | 135°04.590 | Box Core (bottom) | 74 | 216 | 0 | 22 | 7.7 | 11.1 | 1013.4 | 96 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 04h31 | UTC-6 | 70°45.060 | 135°04.610 | Box Core ↑ | 73 | 208 | 0 | 22 | 7.7 | 11.1 | 1013.4 | 96 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 04h45 | UTC-6 | 70°45.060 | 135°04.770 | Agassiz Trawl ↓ | 73 | 150 | 25 | 21 | 8.9 | 11.1 | 1013.4 | 91 | 0/10 |
| 2a | BP10-01 | Biophysical | 21/Aug/2010 | 05h05 | UTC-6 | 70°45.850 | 135°04.840 | Agassiz Trawl ↑ | 74 | 220 | 7 | 22 | 6.5 | 11.1 | 1013.2 | 98 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 06h10 | UTC-6 | 70°51.100 | 135°00.200 | CTD-Rosette ↓ | 127 | 205 | 33 | 17 | 5.5 | 11.1 | 1013.1 | 99 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 06h42 | UTC-6 | 70°50.910 | 135°00.170 | CTD-Rosette ↑ | 118 | 218 | 19 | 18 | 8.8 | 11.1 | 1013.3 | 90 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 06h55 | UTC-6 | 70°51.400 | 135°59.730 | Horizontal Net Tow ↓ | 123 | 192 | 32 | 19 | 7.5 | 11.0 | 1013.1 | 94 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 07h12 | UTC-6 | 70°50.980 | 135°58.970 | Horizontal Net Tow ↑ | 113 | 96 | 21 | 18 | 5.7 | 11.0 | 1013.2 | 99 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 07h32 | UTC-6 | 70°51.370 | 135°00.070 | Vertical Net Tow ↓ | 129 | 216 | 22 | 18 | 5.7 | 11.0 | 1012.9 | 99 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 07h44 | UTC-6 | 70°51.340 | 135°00.170 | Vertical Net Tow ↑ (problem winch) | 128 | 216 | 12 | 18 | 6.3 | 11.0 | 1013.1 | 99 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 07h53 | UTC-6 | 70°51.285 | 135°00.216 | Vertical Net Tow ↓ | 130 | 206 | 25 | 16 | 8.1 | 11.0 | 1013.1 | 95 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 08h03 | UTC-6 | 70°51.279 | 135°00.185 | Vertical Net Tow ↑ | 126 | 206 | 33 | 14 | 6.4 | 11.0 | 1013.0 | 97 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 09h06 | UTC-6 | 70°51.135 | 135°00.030 | Box Core ↓ | 130 | 200 | 16 | 36 | 6.8 | 11.0 | 1012.9 | 95 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 09h07 | UTC-6 | 70°51.522 | 135°00.080 | Box Core (bottom) | 125 | 202 | 15 | 21 | 6.8 | 11.0 | 1012.9 | 95 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 09h11 | UTC-6 | 70°51.510 | 135°00.030 | Box Core ↑ | 127 | 200 | 15 | 21 | 6.8 | 11.0 | 1012.8 | 98 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 09h32 | UTC-6 | 70°51.435 | 135°00.357 | Box Core ↓ | 133 | 208 | 25 | 18 | 6.2 | 11.0 | 1012.6 | 96 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 09h35 | UTC-6 | 70°51.437 | 135°00.379 | Box Core (bottom) | 133 | 204 | 28 | 15 | 6.2 | 11.0 | 1012.6 | 96 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 09h38 | UTC-6 | 70°51.446 | 135°00.397 | Box Core ↑ | 134 | 205 | 23 | 17 | 6.2 | 11.0 | 1012.6 | 96 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 09h56 | UTC-6 | 70°51.524 | 135°00.355 | Box Core ↓ | 131 | 202 | 39 | 19 | 6.5 | 10.9 | 1012.6 | 95 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 09h58 | UTC-6 | 70°51.527 | 135°00.385 | Box Core (bottom) | 132 | 209 | 26 | 17 | 6.5 | 10.9 | 1012.6 | 95 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 10h01 | UTC-6 | 70°51.529 | 135°00.399 | Box Core ↑ | 131 | 214 | 26 | 20 | 6.4 | 10.9 | 1012.6 | 95 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 10h41 | UTC-6 | 70°51.360 | 135°00.795 | Agassiz Trawl ↓ | 132 | 215 | 15 | 40 | 6.2 | 10.9 | 1012.5 | 97 | 0/10 |
| 2a | BP10-02 | Biophysical | 21/Aug/2010 | 11h06 | UTC-6 | 70°50.743 | 135°01.564 | Agassiz Trawl ↑ | 128 | 176 | 15 | 40 | 5.3 | 11.0 | 1012.4 | 96 | 0/10 |
| 2a | G-10 | Mooring | 21/Aug/2010 | 16h10 | UTC-6 | 71°00.230 | 135°28.460 | Mooring G-10 Deployed | 693 | 226 | 30 | 16 | 5.1 | 10.8 | 1012.3 | 99 | 0/10 |
| 2a | G-10 | Mooring | 21/Aug/2010 | 17h15 | UTC-6 | 71°00.360 | 135°29.530 | Mooring G-10 Deployed (end) | 706 | 143 | 19 | 13 | 5.2 | 11.2 | 1012.2 | 99 | 0/10 |
| 2a | G-10 | Mooring | 21/Aug/2010 | 18h53 | UTC-6 | 71°00.320 | 135°27.560 | CTD ↓ | 689 | 217 | 12 | 17 | 5.2 | 11.1 | 1012.2 | 99 | 0/10 |
| 2a | G-10 | Mooring | 21/Aug/2010 | 19h22 | UTC-6 | 71°00.210 | 135°27.820 | CTD ↑ | 693 | 232 | 4 | 19 | 6.5 | 11.0 | 1012.2 | 98 | 0/10 |
| 2a | BP10-08 | Biophysical | 21/Aug/2010 | 20h22 | UTC-6 | 71°08.003 | 135°29.581 | CTD-Rosette ↓ | 897 | 204 | 351 | 19 | 6.2 | 10.0 | 1012.0 | 99 | 0/10 |

| 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 | | | | | |
| 2a | BP10-08 | Biophysical | 21/Aug/2010 | 21h50 | UTC-6 | 71°08.059 | 135°29.935 | CTD-Rosette ↑ | 904 | 230 | 15 | 19 | 10.2 | 10.1 | 1011.7 | 83 | 0/10 |
| 2a | BP10-08 | Biophysical | 21/Aug/2010 | 22h00 | UTC-6 | 71°08.012 | 135°30.119 | Horizontal Net Tow ↓ | 903 | 226 | 14 | 20 | 9.0 | 10.1 | 1011.7 | 89 | 0/10 |
| 2a | BP10-08 | Biophysical | 21/Aug/2010 | 22h16 | UTC-6 | 71°07.486 | 135°30.618 | Horizontal Net Tow ↑ | 884 | 142 | 25 | 21 | 7.9 | 10.1 | 1011.6 | 91 | 0/10 |
| 2a | BP10-08 | Biophysical | 21/Aug/2010 | 22h38 | UTC-6 | 71°08.121 | 135°29.848 | Vertical Net Tow ↓ | 898 | 220 | 8 | 17 | 7.0 | 10.1 | 1011.6 | 97 | 0/10 |
| 2a | BP10-08 | Biophysical | 21/Aug/2010 | 23h40 | UTC-6 | 71°08.286 | 135°30.619 | Vertical Net Tow ↑ | 908 | 203 | 23 | 15 | 8.6 | 9.5 | 1011.8 | 89 | 0/10 |
| 2a | BP10-08 | Biophysical | 22/Aug/2010 | 00h53 | UTC-6 | 71°08.040 | 135°29.740 | Box Core ↓ | 902 | 226 | 14 | 15 | 6.2 | 9.7 | 1011.7 | 97 | 0/10 |
| 2a | BP10-08 | Biophysical | 22/Aug/2010 | 01h14 | UTC-6 | 71°08.080 | 135°30.320 | Box Core (bottom) | 899 | 134 | 20 | 15 | 6.2 | 9.6 | 1011.6 | 96 | 0/10 |
| 2a | BP10-08 | Biophysical | 22/Aug/2010 | 01h40 | UTC-6 | 71°08.060 | 135°30.700 | Box Core ↑ | 895 | 226 | 13 | 10 | 7.7 | 9.9 | 1011.7 | 93 | 0/10 |
| 2a | BP10-08 | Biophysical | 22/Aug/2010 | 01h46 | UTC-6 | 71°08.090 | 135°30.960 | Agassiz Trawl ↓ | 907 | 225 | 15 | 12 | 77 | 9.9 | 1011.7 | 93 | 0/10 |
| 2a | BP10-08 | Biophysical | 22/Aug/2010 | 03h37 | UTC-6 | 71°06.880 | 135°29.120 | Agassiz Trawl ↑ | 892 | 84 | 15 | 14 | 6.8 | 10.2 | 1012.0 | 99 | 0/10 |
| 2a | H-09 | Mooring | 22/Aug/2010 | 07h11 | UTC-6 | 71°01.380 | 134°43.720 | CTD ↓ | 393 | 270 | 40 | 17 | 7.0 | 10.3 | 1011.9 | 99 | 0/10 |
| 2a | H-09 | Mooring | 22/Aug/2010 | 07h32 | UTC-6 | 71°01.290 | 134°43.870 | CTD ↑ | 392 | 262 | 44 | 17 | 7.9 | 10.3 | 1012.1 | 97 | 0/10 |
| 2a | H-09 | Mooring | 22/Aug/2010 | 09h33 | UTC-6 | 71°01.142 | 134°41.667 | Mooring H-09 Recovered | 368 | 17 | 54 | 15 | 7.7 | 12.5 | 1012.6 | 98 | 0/10 |
| 2a | H-09 | Mooring | 22/Aug/2010 | 09h49 | UTC-6 | 71°01.139 | 134°41.803 | Mooring H-09 Recovered (end) | 370 | 31 | 47 | 16 | 7.5 | 12.6 | 1012.6 | 99 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 12h48 | UTC-6 | 70°59.880 | 135°36.630 | CTD-Rosette ↓ | 709 | 238 | 26 | 14 | 7.5 | 11.0 | 1013.7 | 99 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 13h58 | UTC-6 | 70°59.640 | 135°36.920 | CTD-Rosette ↑ | 710 | 247 | 26 | 14 | 7.5 | 11.0 | 1014.0 | 94 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 13h24 | UTC-6 | 70°59.770 | 135°36.850 | Weather Balloon | 712 | 267 | 34 | 11 | 9.1 | 10.9 | 1014.0 | 92 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 13h48 | UTC-6 | 70°59.690 | 135°36.900 | Weather Balloon (end) | 714 | 222 | 34 | 11 | 9.2 | 11.0 | 1014.0 | 93 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 14h31 | UTC-6 | 70°59.940 | 135°36.600 | Horizontal Net Tow ↓ | 716 | 235 | 37 | 14 | 7.3 | 11.0 | 1014.0 | 99 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 14h43 | UTC-6 | 70°59.610 | 135°37.080 | Horizontal Net Tow ↑ | 715 | 199 | 37 | 14 | 7.3 | 11.0 | 1014.0 | 98 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 14h51 | UTC-6 | 70°59.960 | 135°36.540 | Vertical Net Tow ↓ | 714 | 62 | 40 | 15 | 7.3 | 11.0 | 1014.1 | 98 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 15h42 | UTC-6 | 70°59.840 | 135°36.720 | Vertical Net Tow ↑ | 716 | 98 | 30 | 14 | 8.3 | 11.0 | 1014.5 | 94 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 15h52 | UTC-6 | 70°59.950 | 135°36.520 | CTD-Rosette ↓ | 723 | 239 | 30 | 14 | 8.1 | 11.0 | 1014.6 | 95 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 17h06 | UTC-6 | 70°59.680 | 135°37.170 | CTD-Rosette ↑ | 714 | 249 | 267 | 16 | 8.1 | 11.0 | 1014.9 | 97 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 20h23 | UTC-6 | 71°00.047 | 135°36.777 | Box Core ↓ | 726 | 231 | 19 | 12 | 8.0 | 11.0 | 1015.7 | 95 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 20h38 | UTC-6 | 71°00.000 | 135°36.854 | Box Core (bottom) | 722 | 129 | 27 | 13 | 8.6 | 11.0 | 1015.7 | 94 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 20h58 | UTC-6 | 70°59.967 | 135°37.091 | Box Core ↑ | 713 | 230 | 11 | 14 | 7.4 | 11.0 | 1015.7 | 96 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 21h09 | UTC-6 | 70°59.929 | 135°37.165 | Agassiz Trawl ↓ | 715 | 197 | 30 | 12 | 8.9 | 11.0 | 1015.7 | 90 | 0/10 |
| 2a | BP10-06 | Biophysical | 22/Aug/2010 | 22h40 | UTC-6 | 70°57.704 | 135°37.909 | Agassiz Trawl ↑ | 660 | 62 | 7 | 14 | 6.4 | 11.0 | 1015.9 | 99 | 0/10 |
| 2a | BP10-16 | Biophysical | 22/Aug/2010 | 23h28 | UTC-6 | 70°59.261 | 135°22.525 | Water Pumping ↓ | 629 | 200 | 17 | 13 | 8.2 | 11.0 | 1015.9 | 94 | 0/10 |

| 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 | | | | | |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 00h12 | UTC-6 | 70°59.160 | 135°22.790 | Water Pumping ↑ | 632 | 210 | 8 | 7 | 7.5 | 11.0 | 1016.2 | 97 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 00h32 | UTC-6 | 70°59.280 | 135°22.770 | CTD-Rosette ↓ | 366 | 202 | 9 | 7 | 7.5 | 11.0 | 1016.2 | 97 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 00h55 | UTC-6 | 70°59.180 | 135°22.840 | CTD-Rosette ↑ | 627 | 210 | 9 | 7 | 7.5 | 11.0 | 1016.1 | 97 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 01h13 | UTC-6 | 70°59.110 | 135°22.690 | Horizontal Net Tow ↓ | 628 | 245 | 10 | 7 | 7.5 | 10.8 | 1016.2 | 92 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 01h26 | UTC-6 | 70°58.810 | 135°22.400 | Horizontal Net Tow ↑ | 627 | 231 | 10 | 7 | 7.5 | 10.7 | 1016.2 | 91 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 01h35 | UTC-6 | 70°58.880 | 135°21.940 | Vertical Net Tow ↓ | 620 | 181 | 1 | 12 | 6.4 | 11.0 | 1016.3 | 99 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 02h29 | UTC-6 | 70°58.800 | 135°21.810 | Vertical Net Tow ↑ | 621 | 207 | 10 | 13 | 6.3 | 11.0 | 1016.3 | 98 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 02h52 | UTC-6 | 70°59.190 | 135°22.270 | Box Core ↓ | 633 | 207 | 4 | 14 | 6.4 | 11.0 | 1016.5 | 98 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 03h11 | UTC-6 | 70°59.180 | 135°22.360 | Box Core (bottom) | 628 | 204 | 4 | 14 | 6.4 | 10.9 | 1016.5 | 98 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 03h22 | UTC-6 | 70°59.190 | 135°22.390 | Box Core ↑ | 627 | 191 | 5 | 14 | 6.4 | 10.9 | 1016.5 | 99 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 03h39 | UTC-6 | 70°59.150 | 135°22.470 | Agassiz Trawl ↓ | 622 | 158 | 8 | 13 | 7.0 | 10.9 | 1016.8 | 97 | 0/10 |
| 2a | BP10-16 | Biophysical | 23/Aug/2010 | 04h45 | UTC-6 | 70°57.580 | 135°18.300 | Agassiz Trawl ↑ | 615 | 114 | 10 | 13 | 6.4 | 10.9 | 1016.9 | 99 | 0/10 |
| 2a | H-10 | Mooring | 23/Aug/2010 | 16h06 | UTC-6 | 71°01.260 | 134°41.230 | Mooring H-10 Deployed | 366 | 135 | 33 | 11 | 5.5 | 11.2 | 1018.9 | 99 | 0/10 |
| 2a | I-09 | Mooring | 23/Aug/2010 | 18h10 | UTC-6 | 70°48.740 | 134°31.700 | CTD ↓ | 72 | 205 | 21 | 6 | 6.5 | 10.8 | 1019.2 | 99 | 0/10 |
| 2a | I-09 | Mooring | 23/Aug/2010 | 18h17 | UTC-6 | 70°48.730 | 134°31.740 | CTD ↑ | 76 | 221 | 21 | 6 | 6.4 | 10.8 | 1019.2 | 99 | 0/10 |
| 2a | I-09 | Mooring | 23/Aug/2010 | 18h49 | UTC-6 | 70°48.870 | 134°32.790 | Mooring I-09 Recovered | 72 | 15 | 38 | 6 | 7.2 | 10.8 | 1019.4 | 96 | 0/10 |
| 2a | I-09 | Mooring | 23/Aug/2010 | 18h51 | UTC-6 | 70°48.880 | 134°32.800 | Mooring I-09 Recovered (end) | 73 | 9 | 34 | 7 | 6.7 | 10.9 | 1019.4 | 97 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 19h27 | UTC-6 | 70°49.560 | 134°34.410 | CTD-Rosette ↓ | 72 | 260 | 36 | 8 | 6.7 | 11.2 | 1019.6 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 19h39 | UTC-6 | 70°49.520 | 134°34.500 | Water Sampling ↓ | 72 | 255 | 36 | 7 | 6.8 | 11.0 | 1019.8 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 19h44 | UTC-6 | 70°49.500 | 134°34.500 | CTD-Rosette ↑ | 74 | 266 | 36 | 7 | 6.7 | 11.0 | 1019.8 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 20h26 | UTC-6 | 70°49.363 | 134°34.530 | Water Sampling ↑ | 72 | 232 | 22 | 6 | 6.9 | 10.9 | 1019.9 | 98 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 20h44 | UTC-6 | 70°49.279 | 134°34.703 | Horizontal Net Tow ↓ | 72 | 229 | 43 | 6 | 6.0 | 10.9 | 1020.0 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 20h55 | UTC-6 | 70°48.983 | 134°34.606 | Horizontal Net Tow ↑ | 71 | 109 | 22 | 6 | 6.3 | 10.9 | 1020.0 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 21h07 | UTC-6 | 70°49.282 | 134°34.606 | Vertical Net Tow ↓ | 72 | 36 | 10 | 5 | 6.0 | 10.9 | 1020.0 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 21h14 | UTC-6 | 70°49.286 | 134°34.552 | Vertical Net Tow ↑ | 72 | 57 | 8 | 4 | 6.0 | 10.9 | 1020.0 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 21h36 | UTC-6 | 70°49.280 | 134°34.629 | Box Core ↓ | 72 | 57 | 36 | 4 | 5.9 | 10.8 | 1020.2 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 21h37 | UTC-6 | 70°49.283 | 134°34.632 | Box Core (bottom) | 72 | 52 | 43 | 5 | 5.9 | 10.8 | 1020.2 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 21h40 | UTC-6 | 70°49.285 | 134°34.633 | Box Core ↑ | 72 | 57 | 20 | 5 | 5.8 | 10.8 | 1020.2 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 21h55 | UTC-6 | 70°49.268 | 134°34.634 | Box Core ↓ | 72 | 73 | 51 | 5 | 5.9 | 10.8 | 1020.2 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 21h57 | UTC-6 | 70°49.266 | 134°34.638 | Box Core (bottom) | 72 | 73 | 41 | 5 | 5.9 | 10.8 | 1020.2 | 99 | 0/10 |

| 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 | | | | | |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 22h00 | UTC-6 | 70°49.265 | 134°34.639 | Box Core ↑ | 71 | 70 | 29 | 3 | 6.0 | 10.8 | 1020.2 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 22h11 | UTC-6 | 70°49.274 | 134°34.545 | Agassiz Trawl ↓ | 72 | 38 | 38 | 4 | 6.0 | 10.9 | 1020.3 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 22h28 | UTC-6 | 70°49.265 | 134°35.475 | Agassiz Trawl ↑ | 72 | 157 | 36 | 4 | 6.2 | 10.9 | 1020.3 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 22h30 | UTC-6 | 70°49.202 | 134°35.380 | Agassiz Trawl ↓ | 71 | 144 | 52 | 5 | 6.2 | 10.8 | 1020.3 | 99 | 0/10 |
| 2a | BP10-13 | Biophysical | 23/Aug/2010 | 22h48 | UTC-6 | 70°49.221 | 134°33.833 | Agassiz Trawl ↑ | 71 | 342 | 69 | 4 | 6.1 | 10.8 | 1020.4 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 00h15 | UTC-6 | 70°57.090 | 134°57.720 | Water Sampling ↓ | 379 | 225 | 50 | 8 | 6.0 | 10.7 | 1020.8 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 01h01 | UTC-6 | 70°57.070 | 134°57.070 | Water Sampling ↑ | 379 | 235 | 60 | 8 | 6.0 | 10.7 | 1020.8 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 01h07 | UTC-6 | 70°57.070 | 134°57.080 | CTD-Rosette ↓ | 381 | 220 | 60 | 8 | 6.0 | 10.7 | 1020.8 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 01h32 | UTC-6 | 70°57.030 | 134°58.110 | CTD-Rosette ↑ | 382 | 212 | 56 | 7 | 6.2 | 10.7 | 1021.2 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 01h48 | UTC-6 | 70°57.070 | 134°57.860 | Horizontal Net Tow ↓ | 381 | 227 | 55 | 7 | 6.2 | 10.7 | 1021.3 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 02h05 | UTC-6 | 70°56.770 | 134°57.460 | Horizontal Net Tow ↑ | 367 | 22 | 61 | 6 | 6.4 | 10.7 | 1021.4 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 02h21 | UTC-6 | 70°57.130 | 134°57.250 | Vertical Net Tow ↓ | 375 | 45 | 60 | 6 | 6.4 | 10.7 | 1021.4 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 02h53 | UTC-6 | 70°57.140 | 134°57.470 | Vertical Net Tow ↑ | 379 | 244 | 58 | 6 | 6.4 | 10.7 | 1021.5 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 03h24 | UTC-6 | 70°57.130 | 134°57.450 | CTD-Rosette ↓ | 378 | 235 | 60 | 6 | 6.4 | 10.7 | 1021.4 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 04h20 | UTC-6 | 70°57.080 | 134°57.820 | CTD-Rosette ↑ | 380 | 244 | 66 | 5 | 6.3 | 10.7 | 1022.0 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 04h41 | UTC-6 | 70°57.130 | 134°57.580 | Box Core ↓ | 379 | 231 | 84 | 7 | 6.2 | 10.7 | 1022.0 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 04h51 | UTC-6 | 70°57.130 | 134°57.680 | Box Core (bottom) | 380 | 202 | 80 | 7 | 6.2 | 10.7 | 1022.0 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 05h12 | UTC-6 | 70°57.170 | 134°57.900 | Box Core ↑ | 380 | 220 | 87 | 8 | 6.1 | 10.6 | 1022.3 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 05h30 | UTC-6 | 70°57.180 | 134°57.600 | Agassiz Trawl ↓ | 383 | 264 | 77 | 5 | 7.4 | 10.6 | 1022.3 | 99 | 0/10 |
| 2a | BP10-03 | Biophysical | 24/Aug/2010 | 06h34 | UTC-6 | 70°57.270 | 134°57.470 | Agassiz Trawl ↑ | 382 | 266 | 75 | 5 | 6.7 | 10.7 | 1022.7 | 99 | 0/10 |
| 2a | I-10 | Mooring | 24/Aug/2010 | 11h43 | UTC-6 | 70°48.949 | 134°32.604 | Mooring I-10 Deployed | 72 | 137 | 32 | 13 | 6.2 | 10.9 | 1023.4 | 99 | 0/10 |
| 2a | I-10 | Mooring | 24/Aug/2010 | 12h38 | UTC-6 | 70°48.670 | 134°31.910 | CTD ↓ | 72 | 36 | 35 | 10 | 7.6 | 11.7 | 1023.5 | 98 | 0/10 |
| 2a | I-10 | Mooring | 24/Aug/2010 | 12h48 | UTC-6 | 70°48.640 | 134°32.020 | CTD ↑ | 71 | 121 | 35 | 10 | 7.6 | 11.7 | 1023.5 | 98 | 0/10 |
| 2a | N/A | N/A | 24/Aug/2010 | 17h10 | UTC-6 | 70°56.900 | 134°44.880 | MOB ↓ | 250 | 140 | 34 | 11 | 6.8 | 12.2 | 1024.3 | 99 | 0/10 |
| 2a | N/A | N/A | 24/Aug/2010 | 18h05 | UTC-6 | 70°56.948 | 134°44.593 | MOB ↑ | 250 | 125 | 21 | 11 | 6.9 | 12.5 | 1024.3 | 99 | 0/10 |
| 2a | BP10-16 | Biophysical | 24/Aug/2010 | 19h25 | UTC-6 | 70°59.230 | 135°22.290 | CTD-Rosette ↓ | 630 | 211 | 1 | 11 | 7.3 | 11.4 | 1024.5 | 98 | 0/10 |
| 2a | BP10-16 | Biophysical | 24/Aug/2010 | 20h00 | UTC-6 | 70°59.158 | 135°22.783 | CTD-Rosette ↑ | 627 | 249 | 15 | 13 | 8.2 | 11.2 | 1024.5 | 94 | 0/10 |
| 2a | BP10-16 | Biophysical | 24/Aug/2010 | 20h33 | UTC-6 | 70°59.123 | 135°22.536 | CTD-Rosette ↓ | 623 | 174 | 24 | 14 | 6.6 | 11.1 | 1024.8 | 98 | 0/10 |
| 2a | BP10-16 | Biophysical | 24/Aug/2010 | 21h41 | UTC-6 | 70°59.231 | 135°22.484 | CTD-Rosette ↑ | 622 | 165 | 0 | 12 | 6.2 | 11.2 | 1024.3 | 98 | 0/10 |
| 2a | BP10-17 | Biophysical | 24/Aug/2010 | 23h07 | UTC-6 | 71°07.072 | 135°11.577 | CTD-Rosette ↓ | 722 | N/A | 5 | 13 | 6.1 | 10.4 | 1024.1 | 98 | 0/10 |

| 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 | | | | | |
| 2a | BP10-17 | Biophysical | 25/Aug/2010 | 00h13 | UTC-6 | 71°07.080 | 135°11.840 | CTD-Rosette ↑ | 727 | 78 | 358 | 12 | 5.4 | 10.3 | 1024.1 | 99 | 0/10 |
| 2a | BP10-17 | Biophysical | 25/Aug/2010 | 00h26 | UTC-6 | 71°07.050 | 135°12.140 | Horizontal Net Tow ↓ | 728 | 180 | 357 | 12 | 5.4 | 10.3 | 1024.1 | 99 | 0/10 |
| 2a | BP10-17 | Biophysical | 25/Aug/2010 | 01h01 | UTC-6 | 71°07.080 | 135°12.830 | Horizontal Net Tow ↑ | 723 | 178 | 356 | 12 | 5.4 | 10.3 | 1024.1 | 99 | 0/10 |
| 2a | BP10-17 | Biophysical | 25/Aug/2010 | 01h12 | UTC-6 | 71°07.150 | 135°11.580 | Box Core ↓ | 731 | 254 | 7 | 11 | 7.2 | 9.8 | 1024.1 | 94 | 0/10 |
| 2a | BP10-17 | Biophysical | 25/Aug/2010 | 01h35 | UTC-6 | 71°07.170 | 135°11.720 | Box Core (bottom) | 735 | 263 | 10 | 5 | 6.7 | 9.9 | 1024.1 | 99 | 0/10 |
| 2a | BP10-17 | Biophysical | 25/Aug/2010 | 01h48 | UTC-6 | 71°07.190 | 135°11.910 | Box Core ↑ | 734 | 218 | 10 | 5 | 6.7 | 9.9 | 1024.1 | 99 | 0/10 |
| 2a | BP10-17 | Biophysical | 25/Aug/2010 | 01h57 | UTC-6 | 71°07.210 | 135°11.990 | Agassiz Trawl ↓ | 732 | 235 | 10 | 5 | 6.7 | 9.9 | 1024.1 | 99 | 0/10 |
| 2a | BP10-17 | Biophysical | 25/Aug/2010 | 03h31 | UTC-6 | 71°05.660 | 135°05.970 | Agassiz Trawl ↑ | 651 | 117 | 356 | 11 | 5.7 | 9.7 | 1023.8 | 99 | 0/10 |
| 2a | H-10 | CTD | 25/Aug/2010 | 04h27 | UTC-6 | 71°00.930 | 134°40.690 | CTD ↓ | 351 | 238 | 12 | 9 | 5.7 | 9.9 | 1023.4 | 99 | 0/10 |
| 2a | H-10 | CTD | 25/Aug/2010 | 04h46 | UTC-6 | 71°00.870 | 134°41.060 | CTD ↑ | 350 | 239 | 11 | 9 | 6.5 | 9.4 | 1023.4 | 99 | 0/10 |
| 2a | CA04-08 | Mooring | 25/Aug/2010 | 08h45 | UTC-6 | 71°04.862 | 133°38.594 | Mooring CA04-08 Lost | 294 | 287 | 34 | 14 | 4.7 | 10.0 | 1022.4 | 99 | 0/10 |
| 2a | N/A | MVP | 25/Aug/2010 | 14h35 | UTC-6 | 71°20.840 | 131°03.600 | MVP ↓ (test) | 219 | 67 | 50 | 10 | 4.7 | 6.4 | 1021.6 | 99 | 0/10 |
| 2a | N/A | MVP | 25/Aug/2010 | 17h47 | UTC-6 | 71°25.940 | 130°10.810 | MVP ↑ (test) | 72 | 63 | 35 | 11 | 4.6 | 7.0 | 1021.4 | 99 | 0/10 |
| **Leg 2b** | | | | | | | | | | | | | | | | | |
| 2b | N/A | MVP | 27/Aug/2010 | 07h29 | UTC-6 | 71°24.960 | 129°55.400 | MVP ↓ (test) | 90 | 264 | 98 | 13 | 5.6 | 9.1 | 1018.0 | 99 | 0/10 |
| 2b | N/A | MVP | 27/Aug/2010 | 08h42 | UTC-6 | 71°25.130 | 130°21.040 | MVP ↑ (test) | 89 | 253 | 90 | 15 | 5.3 | 7.0 | 1017.0 | 99 | 0/10 |
| 2b | N/A | MVP | 27/Aug/2010 | 18h18 | UTC-6 | 70°52.230 | 133°53.830 | MVP ↓ | 79 | 237 | 89 | 17 | 9.5 | 7.3 | 1014.8 | 99 | 0/10 |
| 2b | N/A | MVP | 27/Aug/2010 | 19h44 | UTC-6 | 70°53.160 | 134°13.300 | MVP ↑ | 73 | 330 | 93 | 15 | 10.9 | 9.0 | 1013.0 | 99 | 0/10 |
| 2b | USBL Beacon | N/A | 02/Sep/2010 | 06h09 | UTC-6 | 71°04.440 | 135°42.810 | CTD ↓ | 886 | 284 | 44 | 10 | 4.8 | 8.9 | 1013.0 | 96 | 0/10 |
| 2b | USBL Beacon | N/A | 02/Sep/2010 | 06h46 | UTC-6 | 71°04.180 | 135°43.140 | CTD ↑ | 885 | 239 | 46 | 12 | 5.6 | 8.3 | 1013.0 | 93 | 0/10 |
| 2b | USBL Beacon | N/A | 02/Sep/2010 | 07h15 | UTC-6 | 71°04.390 | 135°43.020 | USBL Beacon Calibration | 891 | 203 | 58 | 13 | 4.6 | 8.6 | 1013.0 | 97 | 0/10 |
| 2b | B-09 | Mooring | 02/Sep/2010 | 17h26 | UTC-6 | 70°39.960 | 135°35.980 | CTD ↓ | 153 | 306 | 65 | 17 | 5.0 | 10.8 | 1014.5 | 93 | 0/10 |
| 2b | B-09 | Mooring | 02/Sep/2010 | 17h36 | UTC-6 | 70°39.930 | 135°36.110 | CTD ↑ | 155 | 291 | 57 | 14 | 6.0 | 10.8 | 1014.5 | 91 | 0/10 |
| 2b | B-09 | Mooring | 02/Sep/2010 | 18h10 | UTC-6 | N/A | N/A | Mooring B-09 Recovered | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 2b | N/A | MVP | 02/Sep/2010 | 20h55 | UTC-6 | 70°54.580 | 135°32.450 | MVP ↓ | 606 | 50 | 35 | 16 | 3.3 | 10.6 | 1015.7 | 93 | 0/10 |
| 2b | N/A | MVP | 03/Sep/2010 | 09h27 | UTC-6 | 71°10.886 | 135°13.962 | MVP ↑ | 660 | 326 | 50 | 11 | 0.9 | 7.9 | 1019.1 | 98 | 0/10 |
| 2b | BP10-PC31 | Piston Core | 03/Sep/2010 | 11h15 | UTC-6 | N/A | N/A | Piston Core (problem with winch) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 2b | N/A | MVP | 03/Sep/2010 | 13h50 | UTC-6 | 71°06.530 | 134°32.960 | MVP ↓ | 469 | 248 | 30 | 10 | 1.1 | 8.6 | 1020.3 | 94 | 0/10 |
| 2b | N/A | MVP | 03/Sep/2010 | 20h48 | UTC-6 | 71°11.883 | 135°24.863 | MVP ↓ | 1013 | 138 | 30 | 15 | 1.3 | 8.1 | 1020.4 | 99 | 0/10 |
| 2b | N/A | MVP | 04/Sep/2010 | 01h00 | UTC-6 | 70°45.000 | 134°27.900 | MVP ↑ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

| 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 | | | | | |
| 2b | N/A | MVP | 04/Sep/2010 | 01h20 | UTC-6 | 70°45.000 | 134°28.600 | MVP ↓ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 2b | N/A | MVP | 04/Sep/2010 | 03h25 | UTC-6 | 70°56.800 | 134°10.100 | MVP ↑ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 2b | N/A | MVP | 04/Sep/2010 | 04h15 | UTC-6 | 71°02.300 | 134°20.000 | MVP ↓ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 2b | N/A | MVP | 04/Sep/2010 | 06h48 | UTC-6 | 70°44.900 | 134°52.200 | MVP ↑ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 2b | B-10 | Mooring | 04/Sep/2010 | 09h25 | UTC-6 | 70°40.121 | 135°35.201 | Mooring B-10 Deployed | 150 | 194 | 65 | 19 | 6.7 | 11.4 | 1018.9 | 78 | 0/10 |
| 2b | B-10 | Mooring | 04/Sep/2010 | 10h20 | UTC-6 | 70°39.900 | 135°35.414 | CTD ↓ | 142 | 67 | 73 | 14 | 5.6 | 11.2 | 1018.9 | 77 | 0/10 |
| 2b | B-10 | Mooring | 04/Sep/2010 | 10h31 | UTC-6 | 70°39°892 | 135°35.505 | CTD ↑ | 144 | 84 | 65 | 16 | 5.6 | 11.0 | 1018.9 | 77 | 0/10 |
| 2b | BP10-PC12 | Piston Core | 04/Sep/2010 | 12h04 | UTC-6 | 70°47.590 | 135°33.740 | Piston Core ↓ | 425 | 225 | 82 | 14 | 7.0 | 11.8 | 1019.0 | 78 | 0/10 |
| 2b | BP10-PC12 | Piston Core | 04/Sep/2010 | 12h39 | UTC-6 | 70°47.590 | 135°33.740 | Piston Core ↑ | 425 | 225 | 82 | 14 | 7.0 | 11.8 | 1019.0 | 78 | 0/10 |
| 2b | BP10-PC39 | Piston Core | 04/Sep/2010 | 15h15 | UTC-6 | 70°59.480 | 135°31.550 | Piston Core ↓ | 677 | N/A | 73 | 19 | 3.9 | 11.0 | 1019.0 | 87 | 0/10 |
| 2b | BP10-PC39 | Piston Core | 04/Sep/2010 | 16h04 | UTC-6 | 70°59.480 | 135°31.550 | Piston Core ↑ | 677 | N/A | 73 | 19 | 3.9 | 11.0 | 1019.0 | 87 | 0/10 |
| 2b | BP10-PC34 | Piston Core | 04/Sep/2010 | 18h15 | UTC-6 | 70°59.170 | 135°22.210 | Piston Core ↓ | 630 | N/A | 69 | 15 | 4.5 | 11.7 | 1018.0 | 84 | 0/10 |
| 2b | BP10-PC34 | Piston Core | 04/Sep/2010 | 19h12 | UTC-6 | 70°59.170 | 135°22.210 | Piston Core ↑ | 630 | N/A | 69 | 15 | 4.5 | 11.7 | 1018.0 | 84 | 0/10 |
| 2b | N/A | MVP | 04/Sep/2010 | 20h45 | UTC-6 | 71°02.688 | 135°32.053 | MVP ↓ | 778 | 141 | 60 | 15 | 3.4 | 10.9 | 1017.6 | 86 | 0/10 |
| 2b | N/A | MVP | 04/Sep/2010 | 23h32 | UTC-6 | 70°45.160 | 134°56.187 | MVP ↑ | 66 | 140 | 40 | 17 | 3.6 | 10.5 | 1016.5 | 92 | 0/10 |
| 2b | N/A | MVP | 05/Sep/2010 | 00h05 | UTC-6 | 70°45.180 | 135°06.600 | MVP ↓ | 431 | 322 | 76 | 17 | 4.2 | 10.3 | 1016.2 | 89 | 0/10 |
| 2b | N/A | MVP | 05/Sep/2010 | 03h44 | UTC-6 | 71°08.940 | 136°01.910 | MVP ↑ | 1051 | 322 | 80 | 17 | 3.9 | 10.2 | 1013.2 | 78 | 0/10 |
| 2b | N/A | MVP | 05/Sep/2010 | 04h45 | UTC-6 | 71°03.540 | 135°50.690 | MVP ↓ | 1013 | 139 | 85 | 23 | 3.7 | 9.8 | 1015.2 | 94 | 0/10 |
| 2b | N/A | MVP | 05/Sep/2010 | 06h15 | UTC-6 | 70°54.410 | 135°30.820 | MVP ↑ | 597 | 144 | 88 | 20 | 3.5 | 10.2 | 1023.0 | 95 | 0/10 |
| 2b | F-09 | Mooring | 05/Sep/2010 | 08h10 | UTC-6 | 70°55.720 | 136°23.696 | CTD ↓ | 999 | 266 | 85 | 13 | 4.6 | 10.1 | 1014.6 | 94 | 0/10 |
| 2b | F-09 | Mooring | 05/Sep/2010 | 08h54 | UTC-6 | 70°55.638 | 136°23.648 | CTD ↑ | 1000 | 286 | 80 | 18 | 4.4 | 10.1 | 1014.6 | 96 | 0/10 |
| 2b | F-09 | Mooring | 05/Sep/2010 | 09h50 | UTC-6 | 70°55.600 | 136°26.186 | Mooring F-09 Recovered | 998 | 100 | 86 | 16 | 4.5 | 10.7 | 1014.6 | 97 | 0/10 |
| 2b | F-09 | Mooring | 05/Sep/2010 | 10h56 | UTC-6 | 70°55.127 | 136°27.885 | Mooring F-09 Recovered (end) | 1009 | 66 | 97 | 17 | 4.8 | 10.6 | 1014.6 | 97 | 0/10 |
| 2b | BP10-PC06 | Piston Core | 05/Sep/2010 | 13h57 | UTC-6 | 71°00.370 | 135°27.250 | Piston Core ↓ | 683 | N/A | 90 | 13 | 5.7 | 11.3 | 1014.9 | 89 | 0/10 |
| 2b | BP10-PC06 | Piston Core | 05/Sep/2010 | 14h39 | UTC-6 | 71°00.370 | 135°27.250 | Piston Core ↑ | 683 | N/A | 90 | 13 | 5.7 | 11.3 | 1014.9 | 89 | 0/10 |
| 2b | BP10-BX14 | Box Core | 05/Sep/2010 | 16h13 | UTC-6 | 70°59.450 | 135°15.240 | Box Core ↓ | 595 | 282 | 69 | 18 | 5.2 | 11.8 | 1015.0 | 96 | 0/10 |
| 2b | BP10-BX14 | Box Core | 05/Sep/2010 | 16h28 | UTC-6 | 70°59.430 | 135°15.190 | Box Core (bottom) | 595 | 226 | 94 | 17 | 7.9 | 11.8 | 1014.7 | 85 | 0/10 |
| 2b | BP10-BX14 | Box Core | 05/Sep/2010 | 16h44 | UTC-6 | 70°54.430 | 135°15.440 | Box Core ↑ | 595 | 250 | 71 | 18 | 4.7 | 11.8 | 1014.6 | 99 | 0/10 |
| 2b | N/A | Mapping | 05/Sep/2010 | 17h48 | UTC-6 | 71°00.370 | 135°27.370 | Bottom Mapping ↓ | 641 | 277 | 77 | 18 | 6.4 | 11.3 | 1015.0 | 94 | 0/10 |
| 2b | N/A | Mapping | 05/Sep/2010 | 19h30 | UTC-6 | 71°11.500 | 135°50.800 | Bottom Mapping ↑ | 1127 | 330 | 104 | 17 | 4.6 | 9.6 | 1015.0 | 98 | 0/10 |

| 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 | | | | | |
| 2b | N/A | Mapping | 05/Sep/2010 | 20h00 | UTC-6 | 71°11.741 | 135°44.370 | Bottom Mapping ↓ | N/A | 139 | 115 | 20 | 3.9 | 9.1 | 1015.1 | 97 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 00h10 | UTC-6 | 70°45.180 | 134°46.080 | Bottom Mapping ↑ | 436 | 139 | 85 | 15/20 | 4.9 | 10.3 | 1015.7 | 99 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 00h25 | UTC-6 | 70°45.240 | 134°38.820 | Bottom Mapping ↓ | 840 | 322 | 90 | 15 | 4.6 | 10.1 | 1015.1 | 99 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 04h35 | UTC-6 | 71°12.130 | 135°39.200 | Bottom Mapping ↑ | 1090 | 327 | 95 | 20 | 4.5 | 10.3 | 1018.0 | 99 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 05h55 | UTC-6 | 71°12.010 | 135°16.160 | Bottom Mapping ↓ | N/A | 237 | 98 | 20 | 4.4 | 10.5 | 1018.3 | 97 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 06h25 | UTC-6 | 71°08.500 | 135°32.900 | Bottom Mapping ↑ | N/A | 237 | 98 | 19 | 4.4 | 11.0 | 1019.2 | 97 | 0/10 |
| 2b | BP10-PC22 | Piston Core | 06/Sep/2010 | 07h08 | UTC-6 | 71°08.709 | 135°34.807 | Piston Core ↓ | 952 | 294 | 91 | 20 | 4.6 | 11.3 | 1019.0 | 97 | 0/10 |
| 2b | BP10-PC22 | Piston Core | 06/Sep/2010 | 08h02 | UTC-6 | 71°08.709 | 135°34.807 | Piston Core ↑ | 952 | 294 | 91 | 20 | 4.6 | 11.3 | 1019.0 | 97 | 0/10 |
| 2b | BP10-PC29 | Piston Core | 06/Sep/2010 | 10h51 | UTC-6 | 70°57.083 | 134°53.056 | Piston Core ↓ | 330 | 307 | 111 | 22 | 6.3 | 11.3 | 1021.2 | 88 | 0/10 |
| 2b | BP10-PC29 | Piston Core | 06/Sep/2010 | 11h17 | UTC-6 | 70°57.083 | 134°53.056 | Piston Core ↑ | 330 | 307 | 111 | 22 | 6.3 | 11.3 | 1021.2 | 88 | 0/10 |
| 2b | BP10-PC31 | Piston Core | 06/Sep/2010 | 13h09 | UTC-6 | 71°01.640 | 134°48.320 | Piston Core ↓ | 433 | N/A | 95 | 17 | 4.2 | 10.1 | 1022.0 | 94 | 0/10 |
| 2b | BP10-PC31 | Piston Core | 06/Sep/2010 | 13h45 | UTC-6 | 71°01.640 | 134°48.320 | Piston Core ↑ | 433 | N/A | 95 | 17 | 4.2 | 10.1 | 1022.0 | 94 | 0/10 |
| 2b | BP10-PC40 | Piston Core | 06/Sep/2010 | 15h09 | UTC-6 | 70°59.480 | 134°45.490 | Piston Core ↓ | 349 | N/A | 100 | 13 | 5.0 | 9.2 | 1023.0 | 90 | 0/10 |
| 2b | BP10-PC40 | Piston Core | 06/Sep/2010 | 16h15 | UTC-6 | 70°59.480 | 134°45.490 | Piston Core ↑ | 349 | N/A | 100 | 13 | 5.0 | 9.2 | 1023.0 | 90 | 0/10 |
| 2b | BP10-BX12 | Box Core | 06/Sep/2010 | 18h42 | UTC-6 | 71°01.280 | 135°01.990 | Box Core ↓ | 557 | 301 | 105 | 17 | 4.2 | 10.4 | 1024.0 | 94 | 0/10 |
| 2b | BP10-BX12 | Box Core | 06/Sep/2010 | 19h00 | UTC-6 | 71°01.370 | 135°02.690 | Box Core ↑ | N/A | N/A | 100 | 19 | 6.4 | 10.4 | 1024.6 | 85 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 19h40 | UTC-6 | 70°58.980 | 135°16.560 | Bottom Mapping ↓ | 618 | 311 | 100 | 17 | 4.1 | 10.5 | 1024.6 | 94 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 20h24 | UTC-6 | 71°02.708 | 135°28.882 | Bottom Mapping ↑ | 765 | 312 | 108 | 18 | 5.2 | 10.3 | 1024.9 | 92 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 20h34 | UTC-6 | 71°02.305 | 135°29.907 | Bottom Mapping ↓ | 747 | 137 | 110 | 19 | 5.0 | 10.4 | 1022.5 | 91 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 21h20 | UTC-6 | 70°58.551 | 135°17.600 | Bottom Mapping ↑ | 591 | 131 | 100 | 19 | 4.4 | 10.2 | 1024.5 | 91 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 21h29 | UTC-6 | 70°58.276 | 135°19.157 | Bottom Mapping ↓ | 593 | 313 | 110 | 18 | 4.5 | 10.0 | 1024.9 | 92 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 22h11 | UTC-6 | 71°01.908 | 135°31.097 | Bottom Mapping ↑ | 752 | 313 | 100 | 15/20 | 5.2 | 10.1 | 1025.0 | 91 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 21h21 | UTC-6 | 71°01.537 | 135°32.190 | Bottom Mapping ↓ | 758 | 135 | 90 | 22 | 4.8 | 10.2 | 1024.8 | 91 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 23h04 | UTC-6 | 70°57.804 | 135°19.960 | Bottom Mapping ↑ | 595 | 130 | 105 | 24 | 4.6 | 10.2 | 1024.6 | 91 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 23h12 | UTC-6 | 70°57.412 | 135°21.094 | Bottom Mapping ↓ | 597 | 305 | 100 | 16 | 4.6 | 10.0 | 1024.7 | 90 | 0/10 |
| 2b | N/A | Mapping | 06/Sep/2010 | 23h52 | UTC-6 | 71°01.139 | 135°33.451 | Bottom Mapping ↑ | 781 | 313 | 90 | 22 | 5.4 | 10.1 | 1025.3 | 90 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 00h01 | UTC-6 | 71°00.780 | 135°34.620 | Bottom Mapping ↓ | 706 | 130 | 105 | 19 | 4.6 | 10.2 | 1024.0 | 91 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 00h49 | UTC-6 | 70°56.780 | 135°21.360 | Bottom Mapping ↑ | 597 | 130 | 115 | 19 | 4.9 | 10.2 | 1024.0 | 92 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 01h25 | UTC-6 | 70°51.960 | 135°04.680 | Bottom Mapping ↓ | 269 | 138 | 110 | 20 | 5.0 | 9.8 | 1024.0 | 94 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 01h50 | UTC-6 | 70°49.800 | 134°59.880 | Bottom Mapping ↑ | 90 | 138 | 110 | 20 | 5.2 | 10.0 | 1024.5 | 94 | 0/10 |

| 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 | | | | | |
| 2b | N/A | Mapping | 07/Sep/2010 | 02h00 | UTC-6 | 70°50.100 | 134°58.560 | Bottom Mapping ↓ | 92 | 323 | 110 | 20 | 5.2 | 10.0 | 1024.6 | 94 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 02h20 | UTC-6 | 70°52.320 | 135°03.360 | Bottom Mapping ↑ | 260 | 323 | 120 | 18 | 5.9 | 10.3 | 1025.2 | 94 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 02h30 | UTC-6 | 70°52.620 | 135°02.040 | Bottom Mapping ↓ | 251 | 133 | 96 | 21 | 5.9 | 10.3 | 1025.2 | 94 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 02h50 | UTC-6 | 70°50.400 | 134°57.240 | Bottom Mapping ↑ | 91 | 133 | 98 | 20 | 5.2 | 10.3 | 1024.6 | 96 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 03h00 | UTC-6 | 70°50.700 | 134°55.920 | Bottom Mapping ↓ | 94 | 323 | 111 | 18 | 5.3 | 10.3 | 1024.7 | 96 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 03h20 | UTC-6 | 70°52.920 | 135°00.660 | Bottom Mapping ↑ | 233 | 323 | 107 | 20 | 6.0 | 10.4 | 1025.1 | 95 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 03h30 | UTC-6 | 70°53.220 | 134°59.340 | Bottom Mapping ↓ | 243 | 140 | 93 | 20 | 5.6 | 10.4 | 1024.8 | 95 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 03h52 | UTC-6 | 70°51.060 | 134°54.540 | Bottom Mapping ↑ | 88 | 142 | 106 | 21 | 5.1 | 10.3 | 1022.0 | 97 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 04h25 | UTC-6 | 70°55.100 | 135°04.300 | Bottom Mapping ↓ | 379 | 57 | 120 | 20 | 5.5 | 10.3 | 1024.5 | 97 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 05h40 | UTC-6 | 71°00.400 | 135°21.400 | Bottom Mapping ↑ | 360 | 57 | 103 | 27 | 4.5 | 8.5 | 1024.2 | 99 | 0/10 |
| 2b | BP10-PC32 | Piston Core | 07/Sep/2010 | 06h35 | UTC-6 | 71°00.950 | 134°22.660 | Piston Core ↓ | 339 | 285 | 105 | 25 | 4.1 | 9.5 | 1025.0 | 99 | 0/10 |
| 2b | BP10-PC32 | Piston Core | 07/Sep/2010 | 07h07 | UTC-6 | 71°00.950 | 134°22.660 | Piston Core ↑ | 339 | 285 | 105 | 25 | 4.1 | 9.5 | 1025.0 | 99 | 0/10 |
| 2b | BP10-PC14 | Piston Core | 07/Sep/2010 | 09h10 | UTC-6 | 70°55.388 | 134°12.301 | Piston Core ↓ | 101 | 291 | 112 | 23 | 5.1 | 10.6 | 1023.8 | 98 | 0/10 |
| 2b | BP10-PC14 | Piston Core | 07/Sep/2010 | 09h27 | UTC-6 | 70°55.388 | 134°12.301 | Piston Core ↑ | 101 | 291 | 112 | 23 | 5.1 | 10.6 | 1023.8 | 98 | 0/10 |
| 2b | BP10-PC28 | Piston Core | 07/Sep/2010 | 11h03 | UTC-6 | 70°53.879 | 134°14.681 | Piston Core ↓ | 83 | 295 | 114 | 21 | 5.7 | 10.8 | 1023.0 | 96 | 0/10 |
| 2b | BP10-PC28 | Piston Core | 07/Sep/2010 | 11h15 | UTC-6 | 70°53.879 | 134°14.681 | Piston Core ↑ | 83 | 295 | 114 | 21 | 5.7 | 10.8 | 1023.0 | 96 | 0/10 |
| 2b | GSC10-BX01 | Box Core | 07/Sep/2010 | N/A | UTC-6 | N/A | N/A | Box Core (canceled) | 80 | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 18h48 | UTC-6 | 71°05.000 | 134°23.200 | Bottom Mapping ↓ | 484 | N/A | 115 | 27 | 6.3 | 8.9 | 1018.0 | 91 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 22h47 | UTC-6 | 70°50.370 | 135°32.660 | Bottom Mapping ↑ | 512 | 233 | 115 | 28 | 8.4 | 10.6 | 1014.1 | 88 | 0/10 |
| 2b | N/A | Mapping | 07/Sep/2010 | 23h00 | UTC-6 | 70°50.795 | 135°33.513 | Bottom Mapping ↓ | 546 | 66 | 118 | 28 | 8.8 | 10.7 | 1013.7 | 88 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 03h28 | UTC-6 | 71°05.650 | 134°23.610 | Bottom Mapping ↑ | 523 | 66 | 114 | 26 | 7.1 | 9.0 | 1013.9 | 92 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 03h37 | UTC-6 | 71°05.810 | 134°25.330 | Bottom Mapping ↓ | 518 | 237 | 115 | 25 | 7.1 | 9.0 | 1013.9 | 92 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 05h25 | UTC-6 | 70°58.010 | 135°01.000 | Bottom Mapping ↑ | N/A | 237 | 115 | 25 | 7.0 | 10.0 | 1012.0 | 91 | 0/10 |
| 2b | GSC10-BX01 | Box Core | 08/Sep/2010 | 07h15 | UTC-6 | 70°51.350 | 134°40.990 | Box Core ↓ | 80 | N/A | 130 | 17 | 8.2 | 10.8 | 1012.0 | 91 | 0/10 |
| 2b | GSC10-BX01 | Box Core | 08/Sep/2010 | 07h30 | UTC-6 | 70°51.340 | 134°41.020 | Box Core (bottom) | 80 | 304 | 120 | 17 | 8.0 | 11.8 | 1012.5 | 90 | 0/10 |
| 2b | GSC10-BX01 | Box Core | 08/Sep/2010 | 07h35 | UTC-6 | N/A | N/A | Box Core ↑ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 08h54 | UTC-6 | 70°58.379 | 135°20.105 | Bottom Mapping ↑ | 460 | 231 | 120 | 14 | 8.5 | 10.9 | 1011.9 | 89 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 09h50 | UTC-6 | 70°55.377 | 135°18.167 | Bottom Mapping ↓ | 536 | 63 | 120 | 20/25 | 8.8 | 10.7 | 1011.2 | 86 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 12h44 | UTC-6 | 71°06.300 | 134°25.890 | Bottom Mapping ↑ | 559 | 62 | 120 | 21 | 6.5 | 7.8 | 1011.0 | 92 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 13h10 | UTC-6 | 71°06.600 | 134°27.530 | Bottom Mapping ↓ | 532 | 244 | 125 | 18 | 6.2 | 7.4 | 1011.7 | 91 | 0/10 |

| 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 | | | | | |
| 2b | N/A | Mapping | 08/Sep/2010 | 15h10 | UTC-6 | 70°58.500 | 135°05.600 | Bottom Mapping ↑ | 551 | 237 | 130 | 20 | 8.2 | 10.4 | 1009.7 | 91 | 0/10 |
| 2b | BP10-BX06 | Box Core | 08/Sep/2010 | 16h15 | UTC-6 | 70°51.980 | 134°53.560 | Box Core ↓ | 112 | 300 | 124 | 15 | 11.9 | 11.0 | 1010.4 | 77 | 0/10 |
| 2b | BP10-BX06 | Box Core | 08/Sep/2010 | 16h21 | UTC-6 | 70°51.970 | 134°53.560 | Box Core (bottom) | 112 | 290 | 124 | 15 | 11.9 | 11.0 | 1010.4 | 77 | 0/10 |
| 2b | BP10-BX06 | Box Core | 08/Sep/2010 | 16h26 | UTC-6 | 70°51.990 | 134°53.520 | Box Core ↑ | 112 | 272 | 132 | 16 | 11.1 | 11.4 | 1010.4 | 80 | 0/10 |
| 2b | BP10-BX07 | Box Core | 08/Sep/2010 | 17h44 | UTC-6 | 70°46.590 | 134°49.180 | Box Core ↓ | 73 | 320 | 114 | 18 | 9.0 | 11.8 | 1010.2 | 87 | 0/10 |
| 2b | BP10-BX07 | Box Core | 08/Sep/2010 | 17h48 | UTC-6 | 70°46.590 | 134°49.140 | Box Core (bottom) | 73 | 294 | 124 | 14 | 12.0 | 11.9 | 1010.2 | 76 | 0/10 |
| 2b | BP10-BX07 | Box Core | 08/Sep/2010 | 17h52 | UTC-6 | 70°46.590 | 134°49.130 | Box Core ↑ | 73 | 301 | 122 | 16 | 12.0 | 11.9 | 1010.2 | 76 | 0/10 |
| 2b | BP10-BX08 | Box Core | 08/Sep/2010 | 19h00 | UTC-6 | 70°48.940 | 135°10.680 | Box Core ↓ | 159 | 270 | 134 | 10 | 9.0 | 11.9 | 1009.9 | 88 | 0/10 |
| 2b | BP10-BX08 | Box Core | 08/Sep/2010 | 19h08 | UTC-6 | 70°48.940 | 135°10.680 | Box Core (bottom) | 159 | 270 | 134 | 10 | 9.0 | 11.9 | 1009.9 | 88 | 0/10 |
| 2b | BP10-BX08 | Box Core | 08/Sep/2010 | 19h13 | UTC-6 | 70°48.930 | 135°10.770 | Box Core ↑ | 159 | 299 | 133 | 13 | 8.5 | 11.9 | 1009.9 | 90 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 20h42 | UTC-6 | 70°58.885 | 135°04.824 | Bottom Mapping ↓ | 507 | 236 | 17 | 128 | 8.8 | 11.1 | 1010.0 | 90 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 21h25 | UTC-6 | 70°55.097 | 135°25.489 | Bottom Mapping ↑ | 574 | 56 | 13 | 135 | 8.6 | 10.9 | 1009.9 | 92 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 21h30 | UTC-6 | 70°55.251 | 135°24.758 | Bottom Mapping ↓ | 570 | 56 | 14 | 135 | 8.7 | 10.9 | 1009.8 | 92 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 23h14 | UTC-6 | 71°07.169 | 134°27.748 | Bottom Mapping ↑ | 533 | 58 | 17 | 120 | 6.0 | 8.0 | 1010.0 | 96 | 0/10 |
| 2b | N/A | Mapping | 08/Sep/2010 | 23h23 | UTC-6 | 71°07.540 | 134°29.260 | Bottom Mapping ↓ | 550 | 234 | 120 | 18 | 5.7 | 7.6 | 1010.1 | 96 | 0/10 |
| 2b | N/A | Mapping | 09/Sep/2010 | 01h05 | UTC-6 | 70°54.740 | 135°29.806 | Bottom Mapping ↑ | 581 | 234 | 105 | 7 | 8.5 | 10.4 | 1010.3 | 93 | 0/10 |
| 2b | N/A | Mapping | 09/Sep/2010 | 01h29 | UTC-6 | 70°50.960 | 135°22.330 | Bottom Mapping ↓ | 459 | 57 | 105 | 7 | 8.5 | 10.4 | 1010.3 | 93 | 0/10 |
| 2b | N/A | Mapping | 09/Sep/2010 | 03h00 | UTC-6 | 70°01.600 | 134°32.600 | Bottom Mapping ↑ | 318 | 57 | 135 | 15 | 8.1 | 10.4 | 1010.7 | 93 | 0/10 |
| 2b | N/A | Mapping | 09/Sep/2010 | 03h05 | UTC-6 | 70°01.500 | 134°31.400 | Bottom Mapping ↓ | 318 | 237 | 135 | 15 | 8.1 | 10.4 | 1010.7 | 93 | 0/10 |
| 2b | N/A | Mapping | 09/Sep/2010 | 04h30 | UTC-6 | 70°50.700 | 135°22.100 | Bottom Mapping ↑ | 449 | 234 | 130 | 13 | 8.8 | 10.9 | 1010.7 | 92 | 0/10 |
| 2b | F-10 | Mooring | 09/Sep/2010 | 10h47 | UTC-6 | 70°55.814 | 136°24.801 | Mooring F-10 Deployed | 1003 | 50 | 120 | 5 | 8.6 | 12.5 | 1012.4 | 96 | 0/10 |
| 2b | F-10 | Mooring | 09/Sep/2010 | 12h18 | UTC-6 | 70°55.870 | 136°24.530 | CTD ↓ | 1009 | N/A | 160 | 6 | 8.1 | 12.4 | 1012.6 | 98 | 0/10 |
| 2b | F-10 | Mooring | 09/Sep/2010 | 12h50 | UTC-6 | 70°55.290 | 136°24.230 | CTD ↑ | 985 | N/A | 160 | 6 | 8.1 | 12.4 | 1013.0 | 99 | 0/10 |
| 2b | A1-09 | Mooring | 09/Sep/2010 | 14h05 | UTC-6 | 70°45.410 | 135°59.910 | CTD ↓ | 672 | N/A | 150 | 8 | 8.3 | 11.5 | 1013.3 | 98 | 0/10 |
| 2b | A1-09 | Mooring | 09/Sep/2010 | 14h36 | UTC-6 | 70°45.370 | 136°00.210 | CTD ↑ | 672 | N/A | 150 | 7 | 8.2 | 11.5 | 1013.3 | 97 | 0/10 |
| 2b | A1-09 | Mooring | 09/Sep/2010 | 15h58 | UTC-6 | 70°45.880 | 136°00.890 | Mooring A1-09 Recovered | 689 | N/A | 169 | 5 | 8.2 | 12.5 | 1014.1 | 98 | 0/10 |
| 2b | A1-09 | Mooring | 09/Sep/2010 | 16h35 | UTC-6 | 70°45.880 | 136°00.890 | Mooring A1-09 Recovered (end) | 689 | N/A | 169 | 5 | 8.2 | 12.5 | 1014.1 | 98 | 0/10 |
| 2b | BP10-PC26 | Piston Core | 09/Sep/2010 | 19h23 | UTC-6 | 70°51.570 | 134°59.680 | Piston Core ↓↑ | 103 | 242 | 192 | 5 | 9.2 | 12.4 | 1015.3 | 94 | 0/10 |
| 2b | N/A | Mapping | 09/Sep/2010 | 21h11 | UTC-6 | 70°50.525 | 70°50.525 | Bottom Mapping ↓ | 425 | 56 | 300 | 10 | 6.7 | 12.5 | 1015.9 | 99 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 00h50 | UTC-6 | 71°06.455 | 71°06.455 | Bottom Mapping ↑ | 450 | 100 | 278 | 6 | 3.8 | 7.5 | 1017.0 | 99 | 0/10 |

| 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 | | | | | |
| 2b | N/A | Mapping | 10/Sep/2010 | 00h56 | UTC-6 | 71°06.125 | 134°06.145 | Bottom Mapping ↓ | 452 | 240 | 278 | 5 | 3.8 | 3.8 | 1016.9 | 99 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 04h15 | UTC-6 | 70°49.900 | 135°22.800 | Bottom Mapping ↑ | N/A | 237 | 315 | 10 | 4.8 | 4.8 | 1018.0 | 96 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 04h20 | UTC-6 | 70°49.600 | 135°22.430 | Bottom Mapping ↓ | N/A | 57 | 315 | 10 | 4.8 | 4.8 | 1018.4 | 96 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 05h15 | UTC-6 | 70°56.600 | 135°45.500 | Bottom Mapping ↑ | 80 | 57 | 315 | 10 | 4.8 | 4.8 | 1018.0 | 96 | 0/10 |
| 2b | GSC-PC01 | Piston Core | 10/Sep/2010 | 06h20 | UTC-6 | 70°51.340 | 134°41.090 | Piston Core ↓ | 80 | N/A | 325 | 10 | 3.7 | 3.7 | 1017.0 | 93 | 0/10 |
| 2b | BP10-PC09 | Piston Core | 10/Sep/2010 | 08h49 | UTC-6 | 70°51.571 | 134°26.409 | Piston Core ↓ | 78 | 265 | 330 | 11 | 4.1 | 4.1 | 1018.9 | 92 | 0/10 |
| 2b | BP10-PC09 | Piston Core | 10/Sep/2010 | 08h57 | UTC-6 | 70°51.571 | 134°26.409 | Piston Core ↑ | 78 | 265 | 330 | 11 | 4.1 | 4.1 | 1018.9 | 92 | 0/10 |
| 2b | BP10-PC08 | Piston Core | 10/Sep/2010 | 10h15 | UTC-6 | 70°53.994 | 134°46.611 | Piston Core ↓ | 141 | 203 | 321 | 8 | 3.9 | 3.9 | 1019.1 | 96 | 0/10 |
| 2b | BP10-PC08 | Piston Core | 10/Sep/2010 | 10h23 | UTC-6 | 70°53.994 | 134°46.611 | Piston Core ↑ | 141 | 203 | 321 | 8 | 3.9 | 3.9 | 1019.1 | 96 | 0/10 |
| 2b | BP10-PC30 | Piston Core | 10/Sep/2010 | 12h11 | UTC-6 | 70°55.310 | 134°33.150 | Piston Core ↓ | 93 | N/A | 290 | 2 | 5.2 | 5.2 | 1019.4 | 90 | 0/10 |
| 2b | BP10-PC30 | Piston Core | 10/Sep/2010 | 12h30 | UTC-6 | 70°55.310 | 134°33.150 | Piston Core ↑ | 93 | N/A | 290 | 2 | 5.2 | 5.2 | 1019.4 | 90 | 0/10 |
| 2b | BP10-PC41 | Piston Core | 10/Sep/2010 | 13h19 | UTC-6 | 70°57.350 | 134°40.450 | Piston Core ↓ | 238 | N/A | 320 | 3 | 4.5 | 4.5 | 1019.6 | 94 | 0/10 |
| 2b | BP10-PC41 | Piston Core | 10/Sep/2010 | 13h41 | UTC-6 | 70°57.350 | 134°40.450 | Piston Core ↑ | 238 | N/A | 320 | 3 | 4.5 | 4.5 | 1019.6 | 94 | 0/10 |
| 2b | GSC10-PC06 | Piston Core | 10/Sep/2010 | 14h43 | UTC-6 | 70°54.870 | 134°48.530 | Piston Core ↓ | 190 | N/A | 10 | 5 | 4.7 | 4.7 | 1019.7 | 94 | 0/10 |
| 2b | GSC10-PC06 | Piston Core | 10/Sep/2010 | 15h04 | UTC-6 | 70°54.870 | 134°48.530 | Piston Core ↑ | 190 | N/A | 10 | 5 | 4.7 | 4.7 | 1019.7 | 94 | 0/10 |
| 2b | GSC10-BX06 | Box Core | 10/Sep/2010 | 15h35 | UTC-6 | 70°54.870 | 134°48.530 | Box Core ↓ | 182 | N/A | 15 | 6 | 4.7 | 4.7 | 1019.6 | 95 | 0/10 |
| 2b | GSC10-BX06 | Box Core | 10/Sep/2010 | 15h39 | UTC-6 | 70°54.870 | 134°48.530 | Box Core (bottom) | 182 | N/A | 15 | 6 | 4.7 | 4.7 | 1019.6 | 95 | 0/10 |
| 2b | GSC10-BX06 | Box Core | 10/Sep/2010 | 15h44 | UTC-6 | 70°54.870 | 134°48.530 | Box Core ↑ | 182 | N/A | 10 | 6 | 4.7 | 4.7 | 1019.6 | 95 | 0/10 |
| 2b | BP10-BX09 | Box Core | 10/Sep/2010 | 16h55 | UTC-6 | 70°55.530 | 134°22.750 | Box Core ↓ | 111 | N/A | 7 | 5 | 3.1 | 3.1 | 1019.7 | 99 | 0/10 |
| 2b | BP10-BX09 | Box Core | 10/Sep/2010 | 16h57 | UTC-6 | 70°55.530 | 134°22.760 | Box Core (bottom) | 111 | N/A | 8 | 4 | 3.1 | 3.1 | 1019.7 | 99 | 0/10 |
| 2b | BP10-BX09 | Box Core | 10/Sep/2010 | 17h00 | UTC-6 | 70°55.530 | 134°22.780 | Box Core ↑ | 111 | N/A | 7 | 3 | 3.1 | 3.1 | 1019.8 | 99 | 0/10 |
| 2b | BP10-BX13 | Box Core | 10/Sep/2010 | 18h16 | UTC-6 | 70°58.450 | 134°43.110 | Box Core ↓ | 285 | N/A | 345 | 6 | 3.3 | 3.3 | 1019.9 | 99 | 0/10 |
| 2b | BP10-BX13 | Box Core | 10/Sep/2010 | 18h26 | UTC-6 | 70°58.440 | 134°43.090 | Box Core (bottom) | 288 | N/A | 345 | 6 | 3.3 | 3.3 | 1019.9 | 99 | 0/10 |
| 2b | BP10-BX13 | Box Core | 10/Sep/2010 | 18h33 | UTC-6 | 70°58.440 | 134°43.200 | Box Core ↑ | 287 | N/A | 353 | 4 | 3.1 | 3.1 | 1019.9 | 99 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 19h00 | UTC-6 | 70°56.400 | 134°50.660 | Bottom Mapping ↓ | 270 | 57 | 325 | 7 | 3.7 | 11.1 | 1019.9 | 98 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 20h25 | UTC-6 | 71°05.857 | 134°05.831 | Bottom Mapping ↑ | 460 | 55 | 313 | 4 | 3.5 | 8.8 | 1020.1 | 98 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 20h30 | UTC-6 | 71°05.533 | 134°06.103 | Bottom Mapping ↓ | 465 | 236 | 313 | 1 | 3.5 | 9.0 | 1020.2 | 98 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 22h45 | UTC-6 | 70°49.373 | 135°20.905 | Bottom Mapping ↑ | 389 | 237 | 358 | 1 | 4.2 | 10.6 | 1020.4 | 99 | 0/10 |
| 2b | N/A | Mapping | 10/Sep/2010 | 22h49 | UTC-6 | 70°49.570 | 135°19.816 | Bottom Mapping ↓ | 388 | 55 | 350 | 1 | 4.2 | 10.6 | 1020.4 | 99 | 0/10 |
| 2b | N/A | Mapping | 11/Sep/2010 | 01h04 | UTC-6 | 71°05.400 | 134°04.810 | Bottom Mapping ↑ | 440 | 57 | 120 | 3 | 3.4 | 9.1 | 1020.5 | 99 | 0/10 |

| 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 | | | | | |
| 2b | N/A | Mapping | 11/Sep/2010 | 01h09 | UTC-6 | 71°05.210 | 134°04.270 | Bottom Mapping ↓ | 440 | 237 | 120 | 3 | 3.4 | 9.1 | 1020.5 | 99 | 0/10 |
| 2b | N/A | Mapping | 11/Sep/2010 | 03h53 | UTC-6 | 70°47.440 | 135°26.000 | Bottom Mapping ↑ | 355 | 237 | 215 | 3 | 4.7 | 10.7 | 1020.0 | 96 | 0/10 |
| 2b | N/A | Mapping | 11/Sep/2010 | 03h52 | UTC-6 | 70°47.700 | 135°25.340 | Bottom Mapping ↓ | 220 | 368 | 220 | 6 | 4.8 | 10.7 | 1020.6 | 96 | 0/10 |
| 2b | N/A | Mapping | 11/Sep/2010 | 04h30 | UTC-6 | 70°51.500 | 135°08.150 | Bottom Mapping ↑ | 274 | 368 | 220 | 6 | 4.8 | 10.7 | 1020.0 | 96 | 0/10 |
| 2b | N/A | Mapping | 11/Sep/2010 | 04h33 | UTC-6 | 70°51.250 | 135°07.350 | Bottom Mapping ↓ | 247 | 237 | Calm | Calm | 4.5 | 11.0 | 1020.5 | 99 | 0/10 |
| 2b | N/A | Mapping | 11/Sep/2010 | 05h08 | UTC-6 | 70°47.140 | 135°26.400 | Bottom Mapping ↑ | 371 | 237 | Calm | Calm | 4.5 | 11.0 | 1020.5 | 99 | 0/10 |
| 2b | A1-10 | Mooring | 11/Sep/2010 | 09h35 | UTC-6 | 70°45.891 | 136°00.111 | Mooring A1-10 Deployed | 684 | 325 | 232 | 4 | 5.2 | 12.7 | 1020.5 | 99 | 0/10 |
| 2b | A1-10 | Mooring | 11/Sep/2010 | 10h22 | UTC-6 | 70°46.029 | 135°59.764 | CTD-Rosette ↓ | 692 | 284 | 207 | 6 | 5.6 | 12.8 | 1020.6 | 99 | 0/10 |
| 2b | A1-10 | Mooring | 11/Sep/2010 | 11h24 | UTC-6 | 70°46.005 | 135°59.643 | CTD-Rosette ↑ | 690 | 240 | 198 | 7 | 5.8 | 13.0 | 1020.5 | 99 | 0/10 |
| 2b | A2-09 | Mooring | 11/Sep/2010 | 12h30 | UTC-6 | 70°44.610 | 135°54.560 | Mooring A2-09 Recovered | 607 | N/A | 145 | 4 | 6.2 | 12.0 | 1020.5 | 99 | 0/10 |
| 2b | BP10-PC18 | Piston Core | 11/Sep/2010 | 15h01 | UTC-6 | 70°46.170 | 135°10.830 | Piston Core ↓ | 91 | N/A | 160 | 11 | 6.6 | 12.7 | 1020.5 | 95 | 0/10 |
| 2b | BP10-PC18 | Piston Core | 11/Sep/2010 | 15h30 | UTC-6 | 70°46.170 | 135°10.830 | Piston Core ↑ | 91 | N/A | 160 | 11 | 6.6 | 12.7 | 1020.5 | 95 | 0/10 |
| 2b | BP10-PC44 | Piston Core | 11/Sep/2010 | 17h11 | UTC-6 | 70°39.360 | 134°41.840 | Piston Core ↓ | 60 | N/A | 168 | 6 | 6.0 | 12.9 | 1020.6 | 99 | 0/10 |
| 2b | BP10-PC44 | Piston Core | 11/Sep/2010 | 17h16 | UTC-6 | 70°39.360 | 134°41.840 | Piston Core ↑ | 60 | N/A | 168 | 6 | 6.0 | 12.9 | 1020.6 | 99 | 0/10 |
| 2b | GSC10-BX05 | Box Core | 11/Sep/2010 | 19h09 | UTC-6 | 70°55.730 | 134°50.240 | Box Core ↓ | 254 | N/A | 198 | 6 | 6.2 | 12.7 | 1020.7 | 99 | 0/10 |
| 2b | GSC10-BX05 | Box Core | 11/Sep/2010 | 19h16 | UTC-6 | 70°55.730 | 134°50.260 | Box Core (bottom) | 254 | N/A | 198 | 6 | 6.3 | 12.7 | 1020.0 | 99 | 0/10 |
| 2b | GSC10-BX05 | Box Core | 11/Sep/2010 | 19h23 | UTC-6 | 70°55.750 | 135°50.090 | Box Core ↑ | 254 | N/A | 198 | 6 | 6.5 | 12.7 | 1020.0 | 99 | 0/10 |
| 2b | BP10-BX16 | Box Core | 11/Sep/2010 | 20h14 | UTC-6 | 71°01.943 | 134°49.352 | Box Core ↓ | 453 | 205 | 177 | 7 | 6.4 | 12.7 | 1020.0 | 99 | 0/10 |
| 2b | BP10-BX16 | Box Core | 11/Sep/2010 | 20h24 | UTC-6 | 71°01.954 | 134°49.461 | Box Core (bottom) | 454 | 162 | 203 | 8 | 6.5 | 12.9 | 1019.9 | 99 | 0/10 |
| 2b | BP10-BX16 | Box Core | 11/Sep/2010 | 20h38 | UTC-6 | 71°02.077 | 134°49.222 | Box Core ↑ | 454 | 77 | 189 | 7 | 6.5 | 12.9 | 1019.9 | 99 | 0/10 |
| 2b | BP10-BX15 | Box Core | 11/Sep/2010 | 21h16 | UTC-6 | 71°05.096 | 134°38.293 | Box Core ↓ | 467 | 142 | 192 | 6 | 6.3 | 12.2 | 1019.9 | 99 | 0/10 |
| 2b | BP10-BX15 | Box Core | 11/Sep/2010 | 21h26 | UTC-6 | 71°05.076 | 134°38.260 | Box Core (bottom) | 467 | 136 | 195 | 6 | 6.2 | 11.7 | 1019.9 | 99 | 0/10 |
| 2b | BP10-BX15 | Box Core | 11/Sep/2010 | 21h38 | UTC-6 | 71°05.076 | 134°38.299 | Box Core ↑ | 467 | 96 | 200 | 6 | 6.4 | 11.5 | 1019.9 | 99 | 0/10 |
| 2b | N/A | Mapping | 11/Sep/2010 | 22h39 | UTC-6 | 71°04.978 | 134°04.305 | Bottom Mapping ↓ | 429 | 233 | 126 | 6 | 5.2 | 9.7 | 1019.9 | 99 | 0/10 |
| 2b | N/A | Mapping | 12/Sep/2010 | 00h36 | UTC-6 | 70°51.500 | 135°08.000 | Bottom Mapping ↑ | 245 | 237 | 310 | 6 | 4.2 | 10.9 | 1020.1 | 99 | 0/10 |
| 2b | N/A | Mapping | 12/Sep/2010 | 00h38 | UTC-6 | 70°51.220 | 135°07.680 | Bottom Mapping ↓ | 245 | 57 | 310 | 6 | 4.2 | 10.9 | 1020.1 | 99 | 0/10 |
| 2b | N/A | Mapping | 12/Sep/2010 | 02h31 | UTC-6 | 71°04.810 | 134°03.020 | Bottom Mapping ↑ | 417 | 57 | 300 | 10 | 4.4 | 12.5 | 1019.6 | 99 | 0/10 |
| 2b | N/A | Mapping | 12/Sep/2010 | 02h34 | UTC-6 | 71°04.660 | 134°02.670 | Bottom Mapping ↓ | 417 | 237 | 300 | 10 | 4.4 | 12.5 | 1019.6 | 99 | 0/10 |
| 2b | N/A | Mapping | 12/Sep/2010 | 04h42 | UTC-6 | 70°49.500 | 135°14.500 | Bottom Mapping ↑ | 257 | 237 | 304 | 7 | 4.5 | 11.0 | 1020.0 | 99 | 0/10 |
| 2b | BP10-PC42 | Piston Core | 12/Sep/2010 | 06h49 | UTC-6 | 70°49.520 | 134°21.610 | Piston Core (bottom) | 70 | N/A | 320 | 9 | 4.4 | 12.2 | 1020.1 | 98 | 0/10 |

| 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 | | | | | |
| 2b | BP10-PC27 | Piston Core | 12/Sep/2010 | 08h22 | UTC-6 | 70°46.989 | 134°25.682 | Piston Core (bottom) | 69 | 255 | 303 | 4 | 3.9 | 12.6 | 1020.4 | 99 | 0/10 |
| 2b | BP10-PC43 | Piston Core | 12/Sep/2010 | 09h23 | UTC-6 | 70°47.558 | 134°33.153 | Piston Core (bottom) | 56 | 257 | 304 | 7 | 3.6 | 12.5 | 1020.3 | 99 | 0/10 |
| 2b | GSC10-PC05 | Piston Core | 12/Sep/2010 | 10h55 | UTC-6 | 70°55.730 | 134°50.224 | Piston Core (bottom) | 255 | 245 | 287 | 7 | 2.9 | 12.4 | 1020.6 | 99 | 0/10 |
| 2b | BP10-PC36 | Piston Core | 12/Sep/2010 | 13h06 | UTC-6 | 70°57.010 | 135°07.110 | Piston Core (bottom) | 472 | N/A | 270 | 5 | 3.0 | 12.0 | 1020.5 | 95 | 0/10 |
| 2b | BP10-PC37 | Piston Core | 12/Sep/2010 | 14h23 | UTC-6 | 70°56.240 | 135°09.910 | Piston Core (bottom) | 489 | N/A | 236 | 10 | 4.3 | 12.6 | 1020.1 | 99 | 0/10 |
| 2b | BP10-PC01 | Piston Core | 12/Sep/2010 | 15h50 | UTC-6 | 70°54.670 | 135°15.460 | Piston Core (bottom) | 485 | N/A | 220 | 11 | 4.9 | 12.8 | 1019.8 | 99 | 0/10 |
| 2b | BP10-BX01 | Box Core | 12/Sep/2010 | 19h18 | UTC-6 | 71°01.550 | 135°33.020 | Box Core ↓ | 772 | N/A | 280 | 22 | 6.5 | 11.5 | 1018.3 | 95 | 0/10 |
| 2b | BP10-BX01 | Box Core | 12/Sep/2010 | 19h38 | UTC-6 | 71°01.570 | 135°33.140 | Box Core (bottom) | 772 | N/A | 305 | 19 | 6.3 | 11.5 | 1018.5 | 95 | 0/10 |
| 2b | BP10-BX01 | Box Core | 12/Sep/2010 | 19h55 | UTC-6 | 71°01.475 | 135°33.350 | Box Core ↑ | 783 | 148 | 288 | 19 | 4.6 | 11.6 | 1018.6 | 99 | 0/10 |
| 2b | BP10-BX02 | Box Core | 12/Sep/2010 | 21h08 | UTC-6 | 71°01.775 | 135°35.157 | Box Core ↓ | 839 | 321 | 275 | 17 | 6.2 | 12.2 | 1019.3 | 95 | 0/10 |
| 2b | BP10-BX02 | Box Core | 12/Sep/2010 | 21h24 | UTC-6 | 71°01.785 | 135°35.082 | Box Core (bottom) | 832 | 332 | 277 | 17 | 4.5 | 12.0 | 1019.4 | 99 | 0/10 |
| 2b | BP10-BX02 | Box Core | 12/Sep/2010 | 21h45 | UTC-6 | 71°01.815 | 135°35.066 | Box Core ↑ | 848 | 335 | 277 | 17 | 4.9 | 12.8 | 1019.5 | 99 | 0/10 |
| 2b | N/A | Mapping | 12/Sep/2010 | 22h10 | UTC-6 | 71°02.223 | 135°39.184 | Bottom Mapping ↓ | 897 | 104 | 288 | 13 | 5.2 | 11.7 | 1019.2 | 99 | 0/10 |
| 2b | N/A | Mapping | 12/Sep/2010 | 22h26 | UTC-6 | 71°01.282 | 135°30.133 | Bottom Mapping ↑ | 730 | 108 | 285 | 14 | 5.3 | 10.8 | 1019.7 | 99 | 0/10 |
| 2b | N/A | Mapping | 12/Sep/2010 | 23h35 | UTC-6 | 70°46.573 | 135°25.587 | Bottom Mapping ↓ | 248 | 54 | 270 | 18 | 7.4 | 11.1 | 1020.1 | 99 | 0/10 |
| 2b | N/A | Mapping | 13/Sep/2010 | 02h00 | UTC-6 | 71°04.300 | 134°02.400 | Bottom Mapping ↑ | 352 | 57 | 284 | 19 | 6.1 | 8.8 | 1018.7 | 99 | 0/10 |
| 2b | N/A | Mapping | 13/Sep/2010 | 02h05 | UTC-6 | 71°04.080 | 134°02.100 | Bottom Mapping ↓ | 349 | 237 | 277 | 19 | 6.1 | 8.8 | 1018.7 | 99 | 0/10 |
| 2b | N/A | Mapping | 13/Sep/2010 | 04h35 | UTC-6 | 70°46.500 | 135°25.000 | Bottom Mapping ↑ | N/A | 237 | 285 | 20 | 6.8 | 10.0 | 1019.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 13/Sep/2010 | 04h40 | UTC-6 | 70°46.300 | 135°23.800 | Bottom Mapping ↓ | N/A | 57 | 285 | 20 | 6.8 | 10.0 | 1019.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 13/Sep/2010 | 05h50 | UTC-6 | 70°54.600 | 134°45.100 | Bottom Mapping ↑ | N/A | 57 | 280 | 20 | 7.0 | 11.0 | 1019.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 13/Sep/2010 | 05h55 | UTC-6 | 70°55.000 | 134°43.000 | Bottom Mapping ↓ | N/A | 237 | 280 | 20 | 8.0 | 11.0 | 1019.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 13/Sep/2010 | 07h15 | UTC-6 | 70°46.000 | 134°24.000 | Bottom Mapping ↑ | N/A | 237 | 280 | 20 | 8.0 | 11.0 | 1019.0 | N/A | 0/10 |
| 2b | A2-10 | Mooring | 13/Sep/2010 | 10h56 | UTC-6 | 70°44.652 | 135°54.966 | Mooring A2-10 Deployed | 609 | 140 | 290 | 18 | 10.2 | 12.5 | 1019.9 | 83 | 0/10 |
| 2b | A2-10 | Mooring | 13/Sep/2010 | 12h22 | UTC-6 | 70°44.010 | 135°55.210 | CTD ↓ | 570 | N/A | 290 | 10 | 6.6 | 13.2 | 1019.8 | 99 | 0/10 |
| 2b | A2-10 | Mooring | 13/Sep/2010 | 12h47 | UTC-6 | 70°43.980 | 135°54.950 | CTD ↑ | 571 | N/A | 290 | 21 | 6.6 | 13.3 | 1019.7 | 99 | 0/10 |
| 2b | BP10-PC23 | Piston Core | 13/Sep/2010 | 15h04 | UTC-6 | 71°00.590 | 135°34.020 | Piston Core ↓ | 776 | N/A | 315 | 21 | 2.3 | 11.4 | 1020.0 | 99 | 0/10 |
| 2b | BP10-PC23 | Piston Core | 13/Sep/2010 | 15h36 | UTC-6 | 71°00.590 | 135°34.020 | Piston Core ↑ | 776 | N/A | 315 | 21 | 2.3 | 11.4 | 1020.0 | 99 | 0/10 |
| 2b | BP10-PC21 | Piston Core | 13/Sep/2010 | 17h10 | UTC-6 | 71°00.030 | 135°32.850 | Piston Core ↓ | 696 | N/A | 343 | 19 | 1.9 | 11.9 | 1021.0 | 97 | 0/10 |
| 2b | BP10-PC21 | Piston Core | 13/Sep/2010 | 17h38 | UTC-6 | 71°00.030 | 135°32.850 | Piston Core ↑ | 696 | N/A | 343 | 19 | 1.9 | 11.9 | 1021.0 | 97 | 0/10 |
| 2b | GSC10-BX04 | Box Core | 13/Sep/2010 | 19h27 | UTC-6 | 71°03.810 | 135°07.440 | Box Core ↓ | 629 | N/A | 351 | 17 | 0.8 | 12.0 | 1020.9 | 95 | 0/10 |
| 2b | GSC10-BX04 | Box Core | 13/Sep/2010 | 19h48 | UTC-6 | 71°03.810 | 135°07.400 | Box Core (bottom) | 629 | N/A | 356 | 21 | 0.6 | 12.0 | 1023.0 | 96 | 0/10 |

| 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 | | | | | |
| 2b | GSC10-BX04 | Box Core | 13/Sep/2010 | 20h01 | UTC-6 | 71°03.835 | 135°07.659 | Box Core ↑ | 629 | N/A | 351 | 17 | 0.6 | 12.0 | 1023.4 | 96 | 0/10 |
| 2b | BP10-BX10 | Box Core | 13/Sep/2010 | 20h55 | UTC-6 | 71°02.597 | 135°17.388 | Box Core ↓ | 680 | 237 | 3 | 22 | 3.3 | 11.8 | 1024.2 | 86 | 0/10 |
| 2b | BP10-BX10 | Box Core | 13/Sep/2010 | 21h09 | UTC-6 | 71°02.575 | 135°17.343 | Box Core (bottom) | 676 | 159 | 339 | 18 | 2.1 | 11.7 | 1024.2 | 90 | 0/10 |
| 2b | BP10-BX10 | Box Core | 13/Sep/2010 | 21h23 | UTC-6 | 71°02.612 | 135°17.406 | Box Core ↑ | 672 | 189 | 350 | 18 | 1.1 | 11.7 | 1024.4 | 90 | 0/10 |
| 2b | N/A | Mapping | 13/Sep/2010 | 23h37 | UTC-6 | 71°00.700 | 134°54.150 | Bottom Mapping ↓ | 459 | 60 | 340 | 22 | -1.3 | 9.9 | 1025.7 | 88 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 00h05 | UTC-6 | 71°03.900 | 134°41.100 | Bottom Mapping ↑ | 429 | 60 | 0 | 28 | -1.5 | 9.3 | 1025.1 | 86 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 01h10 | UTC-6 | 71°03.820 | 134°02.100 | Bottom Mapping ↓ | 375 | 237 | 0 | 19 | -1.4 | 7.4 | 1025.2 | 89 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 02h25 | UTC-6 | 70°55.200 | 134°43.700 | Bottom Mapping ↑ | 130 | 237 | 0 | 22 | -1.2 | 8.4 | 1025.5 | 85 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 02h30 | UTC-6 | 70°55.100 | 134°42.900 | Bottom Mapping ↓ | 130 | 57 | 0 | 22 | -1.2 | 8.4 | 1025.5 | 85 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 03h30 | UTC-6 | 71°03.690 | 134°01.580 | Bottom Mapping ↑ | N/A | 57 | 356 | 17 | -0.5 | 7.6 | 1026.0 | 89 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 03h57 | UTC-6 | 71°03.100 | 134°03.500 | Bottom Mapping ↓ | 371 | 237 | 356 | 17 | -0.5 | 7.6 | 1026.0 | 89 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 05h37 | UTC-6 | 70°51.700 | 134°57.800 | Bottom Mapping ↑ | 290 | 237 | 16 | 20 | -0.8 | 8.4 | 1027.8 | 87 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 05h46 | UTC-6 | 70°51.700 | 134°57.800 | Bottom Mapping ↓ | 290 | 57 | 16 | 20 | -0.8 | 8.4 | 1027.8 | 87 | 0/10 |
| 2b | N/A | Mapping | 14/Sep/2010 | 07h30 | UTC-6 | 71°51.500 | 134°00.350 | Bottom Mapping ↑ | 349 | 57 | 25 | 18 | -0.3 | 7.6 | 1027.8 | 81 | 0/10 |
| 2b | BP10-PC25 | Piston Core | 14/Sep/2010 | 08h32 | UTC-6 | 70°57.924 | 134°08.281 | Piston Core ↓ | 194 | 150 | 5 | 13 | 2.4 | 9.8 | 1029.1 | 75 | 0/10 |
| 2b | BP10-PC25 | Piston Core | 14/Sep/2010 | 09h14 | UTC-6 | 70°57.924 | 134°08.281 | Piston Core ↑ | 194 | 150 | 5 | 13 | 2.4 | 9.8 | 1029.1 | 75 | 0/10 |
| 2b | BP10-PC10 | Piston Core | 14/Sep/2010 | 12h12 | UTC-6 | 70°47.170 | 133°47.170 | Piston Core ↓ | 81 | N/A | 12 | 30 | -0.1 | 10.6 | 1029.6 | 91 | 0/10 |
| 2b | BP10-PC10 | Piston Core | 14/Sep/2010 | 12h36 | UTC-6 | 70°47.170 | 133°47.170 | Piston Core ↑ | 81 | N/A | 12 | 30 | -0.1 | 10.6 | 1029.6 | 91 | 0/10 |
| 2b | BP10-PC13 | Piston Core | 14/Sep/2010 | 19h50 | UTC-6 | 70°40.249 | 133°21.264 | Piston Core ↓ | 54 | N/A | 6 | 23 | -0.1 | 11.0 | 1029.9 | 87 | 0/10 |
| 2b | BP10-PC13 | Piston Core | 14/Sep/2010 | 19h51 | UTC-6 | 70°40.247 | 133°21.295 | Piston Core (bottom) | 53 | N/A | 6 | 358 | 0.5 | 11.0 | 1029.7 | 80 | 0/10 |
| 2b | BP10-PC13 | Piston Core | 14/Sep/2010 | 19h54 | UTC-6 | 70°40.330 | 133°21.258 | Piston Core ↑ | 53 | 72 | 4 | 340 | 0.5 | 10.9 | 1029.7 | 80 | 0/10 |
| 2b | BP10-PC16 | Piston Core | 15/Sep/2010 | 10h43 | UTC-6 | 70°40.751 | 132°59.300 | Piston Core | 20 | 48 | 13 | 15 | 0.1 | 10.7 | 1026.4 | 71 | 0/10 |
| 2b | BP10-PC17 | Piston Core | 15/Sep/2010 | 13h13 | UTC-6 | 70°47.040 | 132°35.580 | Piston Core ↓ | 30 | N/A | 30 | 14 | -0.7 | 10.3 | 1027.6 | 79 | 0/10 |
| 2b | BP10-PC17 | Piston Core | 15/Sep/2010 | 13h28 | UTC-6 | 70°47.040 | 132°35.580 | Piston Core ↑ | 30 | N/A | 30 | 14 | -0.7 | 10.3 | 1027.6 | 79 | 0/10 |
| 2b | BP10-PC07 | Piston Core | 15/Sep/2010 | 16h58 | UTC-6 | 70°35.120 | 132°05.480 | Piston Core ↓ | 45 | N/A | 0 | 15 | 0.2 | 10.5 | 1028.6 | 83 | 0/10 |
| 2b | BP10-PC07 | Piston Core | 15/Sep/2010 | 17h01 | UTC-6 | 70°35.120 | 132°05.480 | Piston Core ↑ | 45 | N/A | 0 | 15 | 0.2 | 10.5 | 1028.6 | 83 | 0/10 |
| 2b | BP10-PC11 | Piston Core | 15/Sep/2010 | 20h59 | UTC-6 | 70°48.389 | 133°13.641 | Piston Core ↓ | 23 | 37 | 10 | 10 | -0.8 | 10.8 | 1029.2 | 88 | 0/10 |
| 2b | BP10-PC11 | Piston Core | 15/Sep/2010 | 21h02 | UTC-6 | 70°48.389 | 133°13.641 | Piston Core ↑ | 23 | 37 | 10 | 10 | -0.8 | 10.8 | 1029.2 | 88 | 0/10 |
| 2b | BP10-PC15 | Piston Core | 16/Sep/2010 | 08h34 | UTC-6 | 71°00.992 | 132°41.383 | Piston Core ↓ | 67 | 45 | 44 | 6 | 0.1 | 9.9 | 1028.0 | 94 | 0/10 |
| 2b | BP10-PC15 | Piston Core | 16/Sep/2010 | 08h40 | UTC-6 | 71°00.992 | 132°41.383 | Piston Core ↑ | 67 | 45 | 44 | 6 | 0.1 | 9.9 | 1028.0 | 94 | 0/10 |

| 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 | | | | | |
| 2b | BP10-PC33 | Piston Core | 16/Sep/2010 | 14h34 | UTC-6 | 71°00.890 | 135°10.090 | Piston Core ↓ | 602 | N/A | 130 | 10 | 1.3 | 8.6 | 1026.7 | 95 | 0/10 |
| 2b | BP10-PC33 | Piston Core | 16/Sep/2010 | 15h00 | UTC-6 | 71°00.890 | 135°10.090 | Piston Core ↑ | 602 | N/A | 130 | 10 | 1.3 | 8.6 | 1026.7 | 95 | 0/10 |
| 2b | BP10-PC43 | ROV | 16/Sep/2010 | 17h44 | UTC-6 | 70°47.550 | 134°33.210 | ROV ↓ | 62 | N/A | 134 | 14 | 3.4 | 9.5 | 1025.0 | 85 | 0/10 |
| 2b | BP10-PC43 | ROV | 16/Sep/2010 | 20h00 | UTC-6 | 70°47.572 | 134°33.169 | ROV (bottom) | N/A | 167 | 120 | 13 | 2.3 | 11.7 | 1024.5 | 89 | 0/10 |
| 2b | BP10-PC43 | ROV | 16/Sep/2010 | N/A | UTC-6 | N/A | N/A | ROV ↑ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 00h55 | UTC-6 | 70°46.110 | 135°22.240 | Bottom Mapping ↓ | 262 | 57 | 150 | 11 | 4.3 | 10.1 | 1022.6 | 82 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 01h45 | UTC-6 | 70°51.570 | 134°58.280 | Bottom Mapping ↑ | 118 | 237 | 150 | 12 | 4.2 | 10.1 | 1022.6 | 82 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 01h44 | UTC-6 | 70°51.410 | 134°59.080 | Bottom Mapping ↓ | 118 | 237 | 150 | 12 | 4.2 | 10.1 | 1022.6 | 82 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 02h30 | UTC-6 | 70°45.990 | 135°24.180 | Bottom Mapping ↑ | 254 | 237 | 146 | 8 | 4.6 | 10.0 | 1022.1 | 81 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 02h35 | UTC-6 | 70°45.680 | 135°23.720 | Bottom Mapping ↓ | 250 | 57 | 146 | 8 | 4.6 | 10.0 | 1022.1 | 81 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 05h00 | UTC-6 | 71°02.960 | 134°01.600 | Bottom Mapping ↑ | N/A | 57 | 0 | 12 | 2.0 | 6.2 | 1023.4 | 92 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 06h15 | UTC-6 | 71°13.200 | 134°35.600 | Bottom Mapping ↓ | 635 | 237 | 0 | 12 | 2.0 | 6.2 | 1023.4 | 92 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 08h25 | UTC-6 | 70°57.639 | 135°51.482 | Bottom Mapping ↑ | 831 | 0 | 90 | 13 | 2.8 | 9.3 | 1023.2 | 93 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 08h31 | UTC-6 | 70°58.682 | 135°50.749 | Bottom Mapping ↓ | 816 | 48 | 80 | 14 | 3.0 | 9.2 | 1023.0 | 94 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 09h28 | UTC-6 | 71°05.660 | 135°18.194 | Bottom Mapping ↑ | 731 | 60 | 73 | 12 | 2.6 | 9.3 | 1022.7 | 88 | 0/10 |
| 2b | GSC10-BX02 | Box Core | 17/Sep/2010 | 10h14 | UTC-6 | 71°11.435 | 135°23.827 | Box Core ↓ | 993 | 141 | 81 | 7 | 2.4 | 9.9 | 1023.7 | 85 | 0/10 |
| 2b | GSC10-BX02 | Box Core | 17/Sep/2010 | 10h32 | UTC-6 | 71°11.409 | 135°23.878 | Box Core (bottom) | N/A | 155 | 80 | 8 | 2.3 | 10.8 | 1023.7 | 90 | 0/10 |
| 2b | GSC10-BX02 | Box Core | 17/Sep/2010 | 10h55 | UTC-6 | 71°11.414 | 135°23.858 | Box Core ↑ | 993 | 158 | 60 | 8 | 2.3 | 11.2 | 1023.9 | 88 | 0/10 |
| 2b | GSC10-PC02 | Piston Core | 17/Sep/2010 | 12h05 | UTC-6 | 71°11.407 | 135°23.863 | Piston Core ↓ | 999 | N/A | 45 | 11 | 2.1 | 12.0 | 1024.5 | 93 | 0/10 |
| 2b | GSC10-PC02 | Piston Core | 17/Sep/2010 | 13h00 | UTC-6 | 71°11.407 | 135°23.863 | Piston Core ↑ | 999 | N/A | 45 | 11 | 2.1 | 12.0 | 1024.5 | 93 | 0/10 |
| 2b | BP10-PC02 | Piston Core | 17/Sep/2010 | 13h53 | UTC-6 | 71°06.990 | 135°05.930 | Piston Core ↓ | 680 | N/A | 46 | 11 | 2.2 | 11.0 | 1025.2 | 89 | 0/10 |
| 2b | BP10-PC02 | Piston Core | 17/Sep/2010 | 14h33 | UTC-6 | 71°06.990 | 135°05.930 | Piston Core ↑ | 680 | N/A | 46 | 11 | 2.2 | 11.0 | 1025.2 | 89 | 0/10 |
| 2b | BP10-PC35 | Piston Core | 17/Sep/2010 | 15h37 | UTC-6 | 70°58.900 | 135°17.040 | Piston Core ↓ | 600 | N/A | 44 | 9 | 2.3 | 10.2 | 1025.7 | 89 | 0/10 |
| 2b | BP10-PC35 | Piston Core | 17/Sep/2010 | 16h50 | UTC-6 | 70°58.900 | 135°17.040 | Piston Core ↑ | 600 | N/A | 44 | 9 | 2.3 | 10.2 | 1025.7 | 89 | 0/10 |
| 2b | BP10-PC38 | Piston Core | 17/Sep/2010 | 18h11 | UTC-6 | 71°02.900 | 135°46.340 | Piston Core ↓ | 970 | N/A | 26 | 9 | 1.6 | 10.0 | 1027.2 | 94 | 0/10 |
| 2b | BP10-PC38 | Piston Core | 17/Sep/2010 | 19h24 | UTC-6 | 71°02.900 | 135°46.340 | Piston Core ↑ | 970 | N/A | 26 | 9 | 1.6 | 10.0 | 1027.2 | 94 | 0/10 |
| 2b | BP10-BX03 | Box Core | 17/Sep/2010 | 20h06 | UTC-6 | 71°02.374 | 135°38.076 | Box Core ↓ | 883 | N/A | 40 | 11 | 0.3 | 10.1 | 1027.6 | 99 | 0/10 |
| 2b | BP10-BX03 | Box Core | 17/Sep/2010 | 20h24 | UTC-6 | 71°02.355 | 135°37.973 | Box Core (bottom) | 883 | N/A | 29 | 12 | 0.0 | 10.2 | 1027.7 | 99 | 0/10 |
| 2b | BP10-BX03 | Box Core | 17/Sep/2010 | 20h43 | UTC-6 | 71°02.377 | 135°38.039 | Box Core ↑ | 883 | 50 | 21 | 12 | -0.1 | 10.2 | 1027.9 | 99 | 0/10 |
| 2b | BP10-BX04 | Box Core | 17/Sep/2010 | 21h09 | UTC-6 | 71°03.413 | 135°40.252 | Box Core ↓ | 854 | 66 | 5 | 12 | 0.3 | 10.3 | 1027.8 | 99 | 0/10 |

| 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 | | | | | |
| 2b | BP10-BX04 | Box Core | 17/Sep/2010 | 21h27 | UTC-6 | 71°03.409 | 135°40.260 | Box Core (bottom) | 850 | 138 | 33 | 10 | -0.1 | 10.2 | 1028.0 | 99 | 0/10 |
| 2b | BP10-BX04 | Box Core | 17/Sep/2010 | 21h48 | UTC-6 | 71°03.416 | 135°40.248 | Box Core ↑ | 850 | 157 | 30 | 9 | -0.4 | 10.2 | 1028.1 | 99 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 21h53 | UTC-6 | 71°03.400 | 135°40.600 | Bottom Mapping ↓ | 962 | 233 | 37 | 9 | -0.2 | 10.2 | 1028.3 | 99 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 22h40 | UTC-6 | 70°57.982 | 136°06.310 | Bottom Mapping ↑ | 960 | 235 | 2 | 9 | 0.3 | 9.9 | 1028.7 | 99 | 0/10 |
| 2b | N/A | Mapping | 17/Sep/2010 | 22h47 | UTC-6 | 70°58.738 | 136°08.509 | Bottom Mapping ↓ | 979 | 56 | 9 | 12 | 0.3 | 9.9 | 1028.7 | 99 | 0/10 |
| 2b | N/A | Mapping | 18/Sep/2010 | 01h00 | UTC-6 | 71°14.900 | 134°51.500 | Bottom Mapping ↑ | N/A | N/A | 30 | 10 | -0.5 | 9.9 | 1028.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 18/Sep/2010 | 02h55 | UTC-6 | 71°03.000 | 134°09.100 | Bottom Mapping ↓ | N/A | 237 | 350 | 10 | -0.6 | 7.9 | 1029.7 | N/A | 0/10 |
| 2b | N/A | Mapping | 18/Sep/2010 | 05h00 | UTC-6 | 70°45.900 | 135°21.400 | Bottom Mapping ↑ | 359 | 237 | 21 | 7 | 0.2 | 10.0 | 1030.0 | 98 | 0/10 |
| 2b | N/A | Mapping | 18/Sep/2010 | 05h10 | UTC-6 | 70°47.000 | 135°25.500 | Bottom Mapping ↓ | 359 | 57 | 21 | 7 | -0.5 | 10.0 | 1030.0 | 98 | 0/10 |
| 2b | N/A | Mapping | 18/Sep/2010 | 05h35 | UTC-6 | 70°49.200 | 135°15.300 | Bottom Mapping ↑ | 300 | 57 | 12 | 8 | 0.0 | 9.0 | 1030.2 | 98 | 0/10 |
| 2b | BP10-PC24 | Piston Core | 18/Sep/2010 | 08h28 | UTC-6 | 71°08.475 | 135°30.771 | Piston Core ↓ | 909 | 59 | 22 | 10 | -0.2 | 10.1 | 1030.8 | 99 | 0/10 |
| 2b | BP10-PC24 | Piston Core | 18/Sep/2010 | 09h00 | UTC-6 | 71°08.475 | 135°30.771 | Piston Core ↑ | 909 | 59 | 22 | 10 | -0.2 | 10.1 | 1030.8 | 99 | 0/10 |
| 2b | BP10-PC19 | Piston Core | 18/Sep/2010 | 10h18 | UTC-6 | 71°10°382 | 135°53.910 | Piston Core ↓ | 1070 | 134 | 75 | 6 | -.04 | 9.9 | 1031.0 | 96 | 0/10 |
| 2b | BP10-PC19 | Piston Core | 18/Sep/2010 | 10h58 | UTC-6 | 71°10°382 | 135°53.910 | Piston Core ↑ | 1070 | 134 | 75 | 6 | -.04 | 9.9 | 1031.0 | 96 | 0/10 |
| 2b | BP10-PC20 | Piston Core | 18/Sep/2010 | 12h30 | UTC-6 | 71°00.421 | 135°53.053 | Piston Core ↓ | 912 | N/A | N/A | N/A | 1.5 | 9.7 | 1031.5 | 86 | 0/10 |
| 2b | BP10-PC20 | Piston Core | 18/Sep/2010 | 13h16 | UTC-6 | 71°00.421 | 135°53.053 | Piston Core ↑ | 912 | N/A | N/A | N/A | 1.5 | 9.7 | 1031.5 | 86 | 0/10 |
| 2b | BP10-BX05 | Box Core | 18/Sep/2010 | 14h08 | UTC-6 | 71°02.320 | 135°44.920 | Box Core ↓ | 924 | N/A | 80 | 2 | 0.0 | 9.9 | 1031.5 | 95 | 0/10 |
| 2b | BP10-BX05 | Box Core | 18/Sep/2010 | 14h28 | UTC-6 | 71°02.340 | 135°44.970 | Box Core (bottom) | 924 | N/A | 150 | 3 | 0.6 | 10.0 | 1031.5 | 91 | 0/10 |
| 2b | BP10-BX05 | Box Core | 18/Sep/2010 | 14h46 | UTC-6 | 71°02.350 | 135°44.890 | Box Core ↑ | 924 | N/A | 155 | 3 | 0.4 | 10.1 | 1031.5 | 92 | 0/10 |
| 2b | BP10-PC45 | Piston Core | 18/Sep/2010 | 15h54 | UTC-6 | 70°59.490 | 135°13.710 | Piston Core ↓ | 598 | N/A | 158 | 4 | 0.5 | 9.9 | 1031.2 | 97 | 0/10 |
| 2b | BP10-PC45 | Piston Core | 18/Sep/2010 | 16h20 | UTC-6 | 70°59.490 | 135°13.710 | Piston Core ↑ | 598 | N/A | 158 | 4 | 0.5 | 9.9 | 1031.2 | 97 | 0/10 |
| 2b | BP10-BX11 | Box Core | 18/Sep/2010 | 18h14 | UTC-6 | 71°04.910 | 134°55.540 | Box Core ↓ | 558 | N/A | 170 | 6 | 1.1 | 7.8 | 1031.0 | 95 | 0/10 |
| 2b | BP10-BX11 | Box Core | 18/Sep/2010 | 18h30 | UTC-6 | 71°04.960 | 134°55.430 | Box Core (bottom) | 558 | N/A | 170 | 6 | 1.1 | 7.8 | 1031.0 | 95 | 0/10 |
| 2b | BP10-BX11 | Box Core | 18/Sep/2010 | 18h44 | UTC-6 | 71°05.000 | 134°55.460 | Box Core ↑ | 559 | N/A | 180 | 5 | 0.7 | 7.9 | 1031.0 | 92 | 0/10 |
| 2b | N/A | Mapping | 18/Sep/2010 | 20h35 | UTC-6 | 71°05.457 | 134°18.085 | Bottom Mapping ↓ | 485 | 233 | 160 | 6 | 1.1 | 7.6 | 1031.1 | 93 | 0/10 |
| 2b | N/A | Mapping | 18/Sep/2010 | 22h47 | UTC-6 | 70°49.870 | 135°32.133 | Bottom Mapping ↑ | 497 | 236 | 130 | 14 | 1.5 | 9.6 | 1030.0 | 96 | 0/10 |
| 2b | N/A | Mapping | 18/Sep/2010 | 23h17 | UTC-6 | 70°45.403 | 135°22.807 | Bottom Mapping ↓ | 240 | 58 | 150 | 17 | 2.1 | 9.9 | 1029.1 | 95 | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 01h50 | UTC-6 | 71°02.950 | 134°00.160 | Bottom Mapping ↑ | 320 | 57 | 140 | 14 | 1.9 | 8.4 | 1028.9 | 99 | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 01h55 | UTC-6 | 71°02.810 | 133°59.710 | Bottom Mapping ↓ | 317 | 237 | 140 | 14 | 1.9 | 8.3 | 1028.8 | 99 | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 04h20 | UTC-6 | 70°45.800 | 135°22.700 | Bottom Mapping ↑ | 219 | 237 | 155 | 20 | 3.2 | 9.5 | 1022.0 | N/A | 0/10 |

| 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 | | | | | |
| 2b | N/A | Mapping | 19/Sep/2010 | 04h25 | UTC-6 | 70°45.000 | 135°22.500 | Bottom Mapping ↓ | 211 | 57 | 155 | 20 | 3.2 | 9.5 | 1022.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 07h20 | UTC-6 | 71°02.700 | 135°59.500 | Bottom Mapping ↑ | N/A | 57 | 160 | 22 | 3.9 | 7.7 | 1025.0 | 88 | 0/10 |
| 2b | BP10-PC46 | Piston Core | 19/Sep/2010 | 08h42 | UTC-6 | 70°59.268 | 134°33.031 | Piston Core ↓ | 259 | 308 | 179 | 16 | 6.9 | 8.1 | 1025.0 | 77 | 0/10 |
| 2b | BP10-PC46 | Piston Core | 19/Sep/2010 | 08h52 | UTC-6 | 70°59.268 | 134°33.031 | Piston Core ↑ | 259 | 308 | 179 | 16 | 6.9 | 8.1 | 1025.0 | 77 | 0/10 |
| 2b | BP10-PC04 | Piston Core | 19/Sep/2010 | 10h35 | UTC-6 | 71°03.809 | 134°07.403 | Piston Core ↓ | 635 | 340 | 167 | 19 | 5.8 | 9.2 | 1022.9 | 82 | 0/10 |
| 2b | BP10-PC04 | Piston Core | 19/Sep/2010 | 10h59 | UTC-6 | 71°03.809 | 134°07.403 | Piston Core ↑ | 635 | 340 | 167 | 19 | 5.8 | 9.2 | 1022.9 | 82 | 0/10 |
| 2b | GSC10-PC03 | Piston Core | 19/Sep/2010 | 12h27 | UTC-6 | 71°10.192 | 135°21.217 | Piston Core ↓ | 880 | N/A | 190 | 12 | 7.0 | 10.0 | 1021.5 | 81 | 0/10 |
| 2b | GSC10-PC03 | Piston Core | 19/Sep/2010 | 13h14 | UTC-6 | 71°10.192 | 135°21.217 | Piston Core ↑ | 880 | N/A | 190 | 12 | 7.0 | 10.0 | 1021.5 | 81 | 0/10 |
| 2b | GSC10-BX03 | Box Core | 19/Sep/2010 | 13h32 | UTC-6 | 71°10.189 | 135°21.209 | Box Core ↓ | 880 | N/A | 190 | 12 | 7.0 | 10.0 | 1021.4 | 81 | 0/10 |
| 2b | GSC10-BX03 | Box Core | 19/Sep/2010 | 13h48 | UTC-6 | 71°10.187 | 135°21.203 | Box Core (bottom) | 880 | N/A | 190 | 12 | 7.0 | 10.0 | 1021.4 | 81 | 0/10 |
| 2b | GSC10-BX03 | Box Core | 19/Sep/2010 | 14h03 | UTC-6 | 71°10.189 | 135°21.201 | Box Core ↑ | 880 | N/A | 190 | 12 | 7.0 | 10.0 | 1021.4 | 81 | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 14h20 | UTC-6 | 71°12.500 | 135°22.100 | Bottom Mapping ↓ | 880 | 237 | 193 | 12 | 4.1 | 10.1 | 1021.0 | 94 | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 18h00 | UTC-6 | 70°57.000 | 135°45.700 | Bottom Mapping ↑ | 251 | 76 | 0 | 11 | 4.0 | 10.3 | 1019.0 | 99 | 0/10 |
| 2b | N/A | N/A | 19/Sep/2010 | 18h33 | UTC-6 | 70°56.830 | 134°44.980 | Surface Buoy Recovered | 250 | N/A | 0 | 10 | 4.0 | 9.9 | 1019.3 | 99 | 0/10 |
| 2b | N/A | N/A | 19/Sep/2010 | 19h20 | UTC-6 | 70°56.840 | 134°44.720 | Surface Buoy Recovered (end) | 252 | N/A | 344 | 15 | 3.4 | 9.7 | 1019.2 | 99 | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 20h13 | UTC-6 | 70°54.635 | 134°43.720 | Bottom Mapping ↓ | 118 | 57 | 344 | 19 | 3.6 | 9.5 | 1019.4 | 99 | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 21h30 | UTC-6 | 71°03.507 | 134°00.850 | Bottom Mapping ↑ | 359 | 54 | 330 | 14 | 2.6 | 8.2 | 1018.6 | 96 | 0/10 |
| 2b | N/A | Mapping | 19/Sep/2010 | 21h40 | UTC-6 | 71°02.544 | 133°59.386 | Bottom Mapping ↓ | 317 | 233 | 333 | 14 | 2.7 | 8.1 | 1018.6 | 97 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 00h22 | UTC-6 | 71°02.540 | 133°59.160 | Bottom Mapping ↑ | 197 | 237 | 320 | 22 | 2.7 | 9.4 | 1018.3 | 97 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 00h27 | UTC-6 | 71°44.830 | 135°21.940 | Bottom Mapping ↓ | 218 | 57 | 310 | 23 | 2.7 | 9.4 | 1018.3 | 97 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 02h50 | UTC-6 | 71°02.400 | 133°58.880 | Bottom Mapping ↑ | 305 | 57 | 310 | 24 | -0.8 | 7.8 | 1017.8 | 91 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 02h53 | UTC-6 | 71°02.270 | 133°58.610 | Bottom Mapping ↓ | 305 | 237 | 325 | 22 | -0.8 | 7.8 | 1017.8 | 91 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 06h00 | UTC-6 | 70°55.500 | 134°59.700 | Bottom Mapping ↑ | N/A | 237 | 340 | 24 | -0.7 | 7.8 | 1017.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | N/A | UTC-6 | N/A | N/A | Bottom Mapping ↓ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 07h10 | UTC-6 | N/A | N/A | Bottom Mapping ↑ | 440 | 0 | 335 | 19 | -0.6 | 8.3 | 1018.0 | 78 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 08h36 | UTC-6 | 71°02.979 | 134°51.398 | Bottom Mapping ↓ | 491 | 333 | 323 | 24 | 0.3 | 8.0 | 1017.9 | 82 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 09h07 | UTC-6 | 71°07.826 | 135°03.429 | Bottom Mapping ↑ | 692 | N/A | 326 | 20 | 0.1 | 7.9 | 1017.8 | 83 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 09h16 | UTC-6 | 71°08.822 | 135°03.072 | Bottom Mapping ↓ | 758 | 54 | 322 | 23 | -0.1 | 7.9 | 1017.8 | 90 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 09h37 | UTC-6 | 71°10.867 | 134°52.173 | Bottom Mapping ↑ | 733 | 107 | 310 | 20 | -0.3 | 7.8 | 1018.3 | 88 | 0/10 |
| 2b | N/A | MVP | 20/Sep/2010 | 09h50 | UTC-6 | 71°10.183 | 134°49.144 | MVP ↓ | 673 | 143 | 326 | 15 | -0.3 | 7.4 | 1018.4 | 90 | 0/10 |

| 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 | | | | | |
| 2b | N/A | MVP | 20/Sep/2010 | 12h40 | UTC-6 | 70°52.200 | 134°11.500 | MVP ↑ | 70 | 57 | 315 | 21 | -0.4 | 7.1 | 1017.4 | 96 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 14h20 | UTC-6 | 71°02.130 | 133°58.330 | Bottom Mapping ↓ | 300 | 237 | 315 | 22 | -0.4 | 7.1 | 1017.4 | 96 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 16h50 | UTC-6 | 70°44.500 | 135°21.400 | Bottom Mapping ↑ | 100 | 237 | 340 | 25 | 0.4 | 9.1 | 1017.9 | 96 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 16h55 | UTC-6 | 70°44.400 | 135°21.000 | Bottom Mapping ↓ | 100 | 57 | 340 | 25 | 0.4 | 9.1 | 1017.9 | 96 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 19h30 | UTC-6 | 71°01.900 | 133°58.320 | Bottom Mapping ↑ | 300 | 57 | 328 | 22 | -0.9 | 7.4 | 1017.0 | 93 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 19h34 | UTC-6 | 71°01.800 | 133°58.200 | Bottom Mapping ↓ | 305 | 237 | 328 | 22 | 0.9 | 7.4 | 1017.0 | 93 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 21h54 | UTC-6 | 70°44.320 | 135°20.874 | Bottom Mapping ↑ | 140 | 237 | 339 | 21 | -0.4 | 8.6 | 1017.5 | 91 | 0/10 |
| 2b | N/A | Mapping | 20/Sep/2010 | 22h00 | UTC-6 | 70°44.323 | 135°19.872 | Bottom Mapping ↓ | 137 | 54 | 347 | 27 | -0.5 | 8.7 | 1017.6 | 91 | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 00h41 | UTC-6 | 71°01.730 | 133°57.510 | Bottom Mapping ↑ | 303 | 57 | 330 | 26 | 0.2 | 7.1 | 1015.8 | 91 | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 00h43 | UTC-6 | 71°01.670 | 133°57.370 | Bottom Mapping ↓ | 303 | 237 | 330 | 25 | 0.1 | 7.1 | 1015.7 | 91 | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 03h11 | UTC-6 | 70°44.040 | 135°20.430 | Bottom Mapping ↑ | 102 | 237 | 335 | 23 | 0.2 | 8.9 | 1017.2 | 92 | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 03h20 | UTC-6 | 70°43.930 | 135°20.210 | Bottom Mapping ↓ | 106 | 57 | 335 | 23 | 0.2 | 8.9 | 1017.2 | 92 | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 06h00 | UTC-6 | 71°01.500 | 133°56.700 | Bottom Mapping ↑ | 266 | 57 | 330 | 20/25 | 0.0 | 9.0 | 1016.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 06h08 | UTC-6 | 71°01.400 | 133°57.000 | Bottom Mapping ↓ | 266 | 237 | 330 | 20/25 | 0.0 | 9.0 | 1016.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 06h40 | UTC-6 | 70°59.700 | 134°14.000 | Bottom Mapping ↑ | N/A | 237 | 330 | 20 | 0.0 | 9.0 | 1016.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 06h50 | UTC-6 | 70°57.700 | 134°13.500 | Bottom Mapping ↓ | N/A | 57 | 330 | 20 | 0.0 | 9.0 | 1016.0 | N/A | 0/10 |
| 2b | N/A | Mapping | 21/Sep/2010 | 07h25 | UTC-6 | 70°59.000 | 134°70.500 | Bottom Mapping ↑ | 254 | 57 | 350 | 23 | -1.0 | 6.9 | 1015.0 | 97 | 0/10 |
| 2b | CA04-10 | Mooring | 21/Sep/2010 | 10h55 | UTC-6 | 71°04.865 | 133°37.866 | Mooring CA04-10 Deployed | 308 | 142 | 340 | 22 | -0.2 | 7.5 | 1015.0 | 88 | 0/10 |
| 2b | CA04-10 | Mooring | 21/Sep/2010 | 11h43 | UTC-6 | 71°04.776 | 133°37.085 | CTD ↓ | 310 | 159 | 352 | 22 | -0.2 | 7.5 | 1015.1 | 89 | 0/10 |
| 2b | CA04-10 | Mooring | 21/Sep/2010 | 11h58 | UTC-6 | 71°04.690 | 133°36.970 | CTD ↑ | 309 | 185 | 340 | 18 | 1.8 | 7.5 | 1015.3 | 80 | 0/10 |
| 2b | CA16-MMP-09 | Mooring | 22/Sep/2010 | 18h17 | UTC-6 | 71°45.180 | 126°30.040 | CTD ↓ | 352 | N/A | 20 | 11 | -1.5 | 8.2 | 1017.2 | 89 | 0/10 |
| 2b | CA16-MMP-09 | Mooring | 22/Sep/2010 | 18h35 | UTC-6 | 71°45.010 | 126°30.450 | CTD ↑ | 352 | N/A | 30 | 12 | -0.8 | 8.4 | 1017.3 | 83 | 0/10 |
| 2b | CA16-MMP-09 | Mooring | 22/Sep/2010 | 18h54 | UTC-6 | 71°45.200 | 126°30.740 | Mooring CA16-MMP-09 Recovered | 356 | N/A | 40 | 10 | -1.5 | 8.6 | 1017.0 | 90 | 0/10 |
| 2b | CA16-MMP-09 | Mooring | 22/Sep/2010 | 19h26 | UTC-6 | 71°44.970 | 126°31.260 | Mooring CA16-MMP-09 Recovered (end) | 359 | N/A | 40 | 13 | -1.1 | 8.3 | 1017.0 | 91 | 0/10 |
| **Leg 3a** | | | | | | | | | | | | | | | | | |
| 3a | CA16-09 | Mooring | 24/Sep/2010 | 12h17 | UTC-6 | 71°48.450 | 126°32.150 | CTD ↓ | 307 | N/A | 31 | 8 | -3.6 | 6.1 | 1014.6 | 93 | 0/10 |
| 3a | CA16-09 | Mooring | 24/Sep/2010 | 12h30 | UTC-6 | 71°48.470 | 126°32.140 | CTD ↑ | 303 | N/A | 41 | 6 | -3.8 | 6.0 | 1014.6 | 93 | 0/10 |
| 3a | CA16-09 | Mooring | 24/Sep/2010 | 12h41 | UTC-6 | 71°47.990 | 126°30.860 | Mooring CA16-09 Recovered | 302 | N/A | 43 | 8 | -3.8 | 6.0 | 1014.6 | 93 | 0/10 |
| 3a | CA16-MMP-09 | Mooring | 24/Sep/2010 | 13h32 | UTC-6 | 71°47.620 | 126°31.780 | Mooring CA16-09 Recovered (end) | 325 | N/A | 25 | 4 | -3.6 | 6.0 | 1014.3 | 90 | 0/10 |
| 3a | CA05-09 | Mooring | 24/Sep/2010 | 16h43 | UTC-6 | 71°19.660 | 127°35.730 | CTD-Rosette ↓ | 214 | 33 | 30 | 8 | -1.8 | 6.8 | 1013.4 | 87 | 0/10 |

| 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 | | | | | |
| 3a | CA05-09 | Mooring | 24/Sep/2010 | 16h55 | UTC-6 | 71°19.710 | 127°35.690 | CTD-Rosette ↑ | 211 | 2 | 10 | 6 | -1.8 | 6.8 | 1013.1 | 88 | 0/10 |
| 3a | CA05-09 | Mooring | 24/Sep/2010 | 17h16 | UTC-6 | 71°19.060 | 127°35.490 | Mooring CA05-09 Recovered | 209 | N/A | 20 | 7 | -1.8 | 6.8 | 1012.9 | 87 | 0/10 |
| 3a | CA05-09 | Mooring | 24/Sep/2010 | 17h30 | UTC-6 | 76°19.052 | 127°35.290 | Mooring CA05-09 (line broken) | 423 | 350 | 20 | 5 | -1.6 | 6.8 | 1012.8 | 88 | 0/10 |
| 3a | CA05-MMP-09 | Mooring | 24/Sep/2010 | 18h44 | UTC-6 | 71°25.630 | 127°39.390 | CTD-Rosette ↓ | 255 | 32 | 30 | 7 | -1.9 | 6.5 | 1012.0 | 85 | 0/10 |
| 3a | CA05-MMP-09 | Mooring | 24/Sep/2010 | 18h57 | UTC-6 | 71°25.630 | 127°39.150 | CTD-Rosette ↑ | 253 | 43 | 30 | 7 | -1.8 | 6.5 | 1011.9 | 86 | 0/10 |
| 3a | CA05-MMP-09 | Mooring | 24/Sep/2010 | 19h20 | UTC-6 | 71°24.930 | 127°39.610 | Mooring CA05-MMP-09 Recovered | 238 | 153 | 60 | 5 | -1.9 | 6.5 | 1011.7 | 87 | 0/10 |
| 3a | CA05-MMP-09 | Mooring | 24/Sep/2010 | 19h51 | UTC-6 | 71°24.760 | 127°39.810 | Mooring CA05-MMP-09 Recovered (end) | 235 | 193 | 70 | 6 | -1.9 | 6.4 | 1011.4 | 85 | 0/10 |
| 3a | LF-8 | Hydrophone | 25/Sep/2010 | 09h22 | UTC-6 | 70°50.870 | 134°06.860 | MARU Buoy Recovered | 68 | 200 | 187 | 23 | 1.0 | 6.4 | 1001.6 | 73 | 0/10 |
| 3a | LF-1 | Hydrophone | 25/Sep/2010 | 10h25 | UTC-6 | 70°48.360 | 134°19.730 | MARU Buoy Recovered | 69 | 215 | 171 | 25 | 0.8 | 6.6 | 1001.2 | 71 | 0/10 |
| 3a | LF-5 | Hydrophone | 25/Sep/2010 | 11h25 | UTC-6 | 70°53.340 | 134°17.500 | MARU Buoy Recovered | 80 | 133 | 184 | 19 | 1.0 | 6.5 | 1001.2 | 71 | 0/10 |
| 3a | HF-2 | Hydrophone | 25/Sep/2010 | 12h52 | UTC-6 | 70°52.280 | 134°28.360 | MARU Buoy Recovered | 81 | 185 | 175 | 20 | 0.9 | 6.5 | 1000.9 | 70 | 0/10 |
| 3a | N/A | Weather | 25/Sep/2010 | 12h40 | UTC-6 | 70°52.290 | 134°28.379 | Weather Balloon | 80 | 189 | 187 | 21 | 0.8 | 6.6 | 1000.9 | 70 | 0/10 |
| 3a | LF-6 | Hydrophone | 25/Sep/2010 | 15h35 | UTC-6 | 70°55.830 | 134°32.930 | MARU Buoy Recovered | 104 | 112 | 211 | 20 | 1.1 | 6.1 | 1000.8 | 74 | 0/10 |
| 3a | LF-3 | Hydrophone | 25/Sep/2010 | 16h23 | UTC-6 | 70°53.260 | 134°46.018 | MARU Buoy Recovered | 108 | 80 | 185 | 16 | 1.1 | 5.9 | 1000.9 | 78 | 0/10 |
| 3a | HF-3 | Hydrophone | 25/Sep/2010 | 17h00 | UTC-6 | 70°55.810 | 134°46.550 | MARU Buoy Recovered | 228 | 51 | 192 | 16 | 1.2 | 5.4 | 1000.8 | 81 | 0/10 |
| 3a | LF-7 | Hydrophone | 25/Sep/2010 | 18h19 | UTC-6 | 70°58.270 | 134°46.040 | MARU Buoy Recovered | 303 | 204 | 330 | 16 | -0.8 | 5.3 | 1001.3 | 98 | 0/10 |
| 3a | LF-4 | Hydrophone | 25/Sep/2010 | 19h13 | UTC-6 | 70°55.850 | 134°58.620 | MARU Buoy Recovered | 345 | 204 | 330 | 14 | -0.5 | 5.4 | 1002.1 | 81 | 0/10 |
| 3a | N/A | Mapping | 25/Sep/2010 | 20h40 | UTC-6 | 70°56.810 | 134°18.600 | Bottom Mapping | 172 | 237 | 338 | 16 | -0.1 | 5.6 | 1002.4 | 78 | 0/10 |
| 3a | N/A | Mapping | 25/Sep/2010 | 22h22 | UTC-6 | 70°44.190 | 135°17.360 | Bottom Mapping | 97 | 57 | 318 | 9 | 0.5 | 5.6 | 1002.9 | 65 | 0/10 |
| 3a | N/A | Weather | 26/Sep/2010 | 00h30 | UTC-6 | 70°57.484 | 134°14.247 | Weather Balloon | 181 | 237 | 240 | 1 | 0.1 | 5.6 | 1003.2 | 66 | 0/10 |
| 3a | HF-4 | Hydrophone | 26/Sep/2010 | 08h00 | UTC-6 | 70°45.540 | 135°08.940 | CTD ↓↑ | 77 | 315 | 323 | 6 | 0.5 | 6.2 | 1002.1 | 77 | 0/10 |
| 3a | HF-5 | Hydrophone | 26/Sep/2010 | 09h33 | UTC-6 | 70°53.330 | 135°22.230 | MARU Buoy Recovered | 524 | 300 | 265 | 8 | 5.0 | 0.5 | 1004.6 | 75 | 0/10 |
| 3a | HF-4 | Hydrophone | 26/Sep/2010 | 10h55 | UTC-6 | 71°06.042 | 135°23.011 | MARU Buoy Recovered | 641 | 82 | 259 | 6 | 1.3 | 4.0 | 1004.3 | 78 | 0/10 |
| 3a | N/A | Mapping | 26/Sep/2010 | 12h15 | UTC-6 | 71°03.877 | 134°52.204 | Bottom Mapping ↓ | 519 | 57 | 280 | 9 | 0.8 | 4.2 | 1005.2 | 79 | 0/10 |
| 3a | N/A | Weather | 26/Sep/2010 | 12h38 | UTC-6 | 71°06.430 | 134°40.030 | Weather Balloon | 499 | 58 | 275 | 5 | 0.8 | 4.3 | 1005.3 | 79 | 0/10 |
| 3a | N/A | Mapping | 26/Sep/2010 | 14h21 | UTC-6 | 71°10.170 | 134°40.000 | Bottom Mapping ↑ | 599 | 54 | 340 | 7 | 0.2 | 4.3 | 1005.5 | 88 | 0/10 |
| 3a | N/A | Weather | 27/Sep/2010 | 00h00 | UTC-6 | 72°40.560 | 130°37.740 | Weather Balloon | 1531 | 40 | 190 | 5 | -1.8 | 1.2 | 1006.0 | 89 | Frasil |
| 3a | N/A | N/A | 27/Sep/2010 | 22h13 | UTC-6 | 74°23.774 | 129°08.154 | EM Sampling | 404 | 107 | 160 | 7 | -4.1 | 0.3 | 1000.9 | 93 | 8/10 |
| 3a | N/A | Weather | 28/Sep/2010 | 00h35 | UTC-6 | 74°23.770 | 129°09.400 | Weather Balloon | 411 | 35 | 164 | 8 | -3.8 | 0.2 | 999.9 | 97 | 9/10 |
| 3a | N/A | N/A | 28/Sep/2010 | 09h05 | UTC-6 | 74°21.840 | 129°10.150 | On Ice Sampling ↓ | 428 | 73 | 120 | 6 | -3.3 | 0.2 | 997.7 | 76 | 9/10 |

| 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 | | | | | |
| 3a | N/A | N/A | 28/Sep/2010 | 10h00 | UTC-6 | 74°21.660 | 129°11.050 | On Ice Sampling ↑ | 428 | 73 | 161 | 6 | -3.5 | 0.9 | 1000.2 | 88 | 9/10 |
| 3a | N/A | Weather | 28/Sep/2010 | 12h11 | UTC-6 | 74°24.460 | 129°09.550 | Weather Balloon | 287 | 22 | 156 | 6 | -3.9 | 1.2 | 1000.1 | 93 | 3/10 |
| 3a | NWBI-1 | Nutrient | 28/Sep/2010 | 17h01 | UTC-6 | 74°40.280 | 128°32.550 | CTD-Rosette ↓ | 379 | 80 | 180 | 6 | -4.1 | 1.3 | 1000.6 | 96 | 8/10 |
| 3a | NWBI-1 | Nutrient | 28/Sep/2010 | 17h35 | UTC-6 | 74°40.170 | 128°32.300 | CTD-Rosette ↑ | 385 | 88 | 150 | 7 | -4.0 | 1.3 | 1000.7 | 97 | 8/10 |
| 3a | N/A | N/A | 28/Sep/2010 | 19h29 | UTC-6 | 74°39.930 | 128°15.500 | On Ice Sampling ↓ | 378 | 281 | 61 | 2 | -3.5 | 0.5 | 1000.7 | 97 | 8/10 |
| 3a | N/A | N/A | 28/Sep/2010 | 20h43 | UTC-6 | 74°39.930 | 128°15.500 | On Ice Sampling ↑ | 378 | 281 | 61 | 2 | -3.5 | 0.5 | 1000.7 | 97 | 8/10 |
| 3a | N/A | N/A | 29/Sep/2010 | 10h37 | UTC-6 | 74°37.250 | 128°20.864 | Scatterometer | 381 | 355 | 227 | 5 | -5.8 | 1.7 | 1000.8 | 99 | 7/10 |
| 3a | N/A | N/A | 29/Sep/2010 | 11h25 | UTC-6 | 74°36.960 | 128°21.205 | On Ice Sampling ↓ | 379 | 0 | 213 | 2 | -5.3 | 1.8 | 1001.0 | 99 | 8/10 |
| 3a | N/A | N/A | 29/Sep/2010 | 14h45 | UTC-6 | 74°36.900 | 128°21.300 | On Ice Sampling ↑ | 380 | 0 | 220 | 8 | -5.8 | 2.2 | 1001.3 | 99 | 9+/10 |
| 3a | N/A | N/A | 29/Sep/2010 | 15h30 | UTC-6 | 74°45.340 | 127°56.620 | On Ice Sampling ↓ | 367 | 130 | 234 | 9 | -4.1 | 2.4 | 1001.8 | 99 | 9+/10 |
| 3a | N/A | N/A | 29/Sep/2010 | 17h47 | UTC-6 | 74°45.490 | 127°54.220 | On Ice Sampling ↑ | 367 | 130 | 230 | 8 | -8.9 | 2.1 | 1002.4 | 95 | 9+/10 |
| 3a | N/A | N/A | 30/Sep/2010 | 11h20 | UTC-6 | 71°55.860 | 125°20.520 | Calibration Team On Ice | 17 | 268 | 277 | 22 | -0.8 | 5.2 | 1006.4 | 67 | 0/10 |
| 3a | N/A | Weather | 30/Sep/2010 | 13h20 | UTC-6 | 71°55.875 | 125°29.513 | Weather Balloon | 24 | 291 | 282 | 20 | -1.1 | 0.1 | 1010.3 | 66 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 18h37 | UTC-6 | 71°47.183 | 126°29.969 | Secchi Disk ↓ | 318 | 330 | 280 | 10 | -1.4 | 5.6 | 1013.9 | 67 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 18h39 | UTC-6 | 71°47.191 | 126°29.951 | Secchi Disk ↑ | 317 | 347 | 273 | 6 | -1.5 | 5.6 | 1014.1 | 67 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 18h40 | UTC-6 | 71°47.193 | 126°29.943 | PNF ↓ | 315 | 2 | 278 | 6 | -1.5 | 5.6 | 1014.1 | 67 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 18h47 | UTC-6 | 71°47.184 | 126°29.916 | PNF ↑ | 316 | 16 | 260 | 7 | -1.5 | 5.6 | 1014.1 | 67 | 0/10 |
| 3a | CA16-10 | Mooring | 30/Sep/2010 | 19h36 | UTC-6 | 71°47.178 | 126°29.762 | Mooring CA16-10 Deployed | 318 | 252 | 240 | 13 | -1.4 | 5.5 | 1014.2 | 64 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 19h48 | UTC-6 | 71°46.948 | 126°29.415 | Triangulation | 321 | 50 | 270 | 10 | -1.3 | 5.5 | 1014.4 | 65 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 20h02 | UTC-6 | 71°47.437 | 126°29.364 | Triangulation | 304 | 30 | 263 | 11 | -1.6 | 5.5 | 1014.5 | 64 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 20h13 | UTC-6 | 71°47.303 | 126°30.443 | Triangulation | 318 | 165 | 264 | 9 | -1.6 | 5.5 | 1014.5 | 64 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 20h44 | UTC-6 | 71°46.800 | 126°32.600 | CTD-Rosette ↓ | 341 | 283 | 232 | 5 | -1.3 | 5.5 | 1012.4 | 64 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 21h13 | UTC-6 | 71°46.800 | 126°33.000 | CTD-Rosette ↑ | 342 | 303 | 253 | 8 | -1.6 | 5.4 | 1014.8 | 63 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 21h39 | UTC-6 | 71°46.400 | 126°32.200 | Horizontal Net Tow ↓ | 344 | 97 | 236 | 9 | -1.1 | 5.4 | 1014.7 | 64 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 21h56 | UTC-6 | 71°46.800 | 126°31.600 | Horizontal Net Tow ↑ | 335 | 348 | 237 | 9 | -1.1 | 5.4 | 1012.3 | 61 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 22h40 | UTC-6 | 71°47.100 | 126°34.400 | Vertical Net Tow ↓ | 350 | 21 | 230 | 8 | -1.2 | 5.5 | 1012.4 | 64 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 23h06 | UTC-6 | 71°47.000 | 126°34.400 | Vertical Net Tow ↑ | 351 | 10 | 234 | 9 | -1.2 | 5.5 | 1012.5 | 62 | 0/10 |
| 3a | 437 | Full | 30/Sep/2010 | 23h50 | UTC-6 | 71°47.000 | 126°35.000 | CTD-Rosette ↓ | 355 | 333 | 222 | 7 | -1.0 | 5.6 | 1012.6 | 64 | 0/10 |
| 3a | 437 | Full | 01/Oct/2010 | 00h35 | UTC-6 | 71°47.020 | 126°35.840 | CTD-Rosette ↑ | 360 | 210 | 242 | 9 | -0.6 | 5.6 | 1014.9 | 64 | 0/10 |
| 3a | 437 | Full | 01/Oct/2010 | 23h11 | UTC-6 | 71°47.000 | 126°34.500 | Phytoplankton Net ↓ | 351 | 9 | 243 | 8 | -1.2 | 5.5 | 1012.5 | 61 | 0/10 |

| 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 | | | | | |
| 3a | 437 | Full | 01/Oct/2010 | 23h23 | UTC-6 | 71°47.000 | 126°34.500 | Phytoplankton Net ↑ | 352 | 21 | 246 | 9 | -1.1 | 5.5 | 1012.5 | 62 | 0/10 |
| 3a | 410 | Nutrient | 01/Oct/2010 | 01h33 | UTC-6 | 71°41.830 | 126°29.490 | CTD-Rosette ↓ | 410 | 205 | 199 | 9 | -0.4 | 5.6 | 1015.1 | 66 | 0/10 |
| 3a | 410 | Nutrient | 01/Oct/2010 | 02h06 | UTC-6 | 71°41.790 | 126°29.580 | CTD-Rosette ↑ | 411 | 208 | 186 | 8 | -0.2 | 5.6 | 1015.1 | 66 | 0/10 |
| 3a | 412 | Nutrient | 01/Oct/2010 | 03h19 | UTC-6 | 71°33.800 | 126°55.150 | CTD-Rosette ↓ | 419 | 178 | 192 | 10 | -0.1 | 5.5 | 1014.8 | 70 | 0/10 |
| 3a | 412 | Nutrient | 01/Oct/2010 | 03h43 | UTC-6 | 71°33.670 | 126°54.750 | CTD-Rosette ↑ | 418 | 176 | 208 | 10 | 0.2 | 5.7 | 1014.9 | 71 | 0/10 |
| 3a | 414 | Nutrient | 01/Oct/2010 | 04h51 | UTC-6 | 71°25.350 | 127°21.780 | CTD-Rosette ↓ | 306 | 183 | 179 | 10 | 0.4 | 5.7 | 1014.6 | 72 | 0/10 |
| 3a | 414 | Nutrient | 01/Oct/2010 | 05h14 | UTC-6 | 71°25.280 | 127°21.200 | CTD-Rosette ↑ | 312 | 172 | 170 | 9 | 0.4 | 5.8 | 1014.6 | 73 | 0/10 |
| 3a | 416 | Nutrient | 01/Oct/2010 | 06h17 | UTC-6 | 71°17.550 | 127°45.330 | CTD-Rosette ↓ | 160 | 184 | 187 | 10 | 0.7 | 5.6 | 1013.9 | 80 | 0/10 |
| 3a | 416 | Nutrient | 01/Oct/2010 | 06h33 | UTC-6 | 71°17.440 | 127°44.610 | CTD-Rosette ↑ | 160 | 178 | 178 | 10 | 0.9 | 5.6 | 1014.4 | 82 | 0/10 |
| 3a | 418 | Nutrient | 01/Oct/2010 | 07h33 | UTC-6 | 71°09.810 | 128°10.230 | CTD-Rosette ↓ | 66 | 203 | 240 | 6 | 0.7 | 5.5 | 1014.0 | 80 | 0/10 |
| 3a | 418 | Nutrient | 01/Oct/2010 | 07h43 | UTC-6 | 71°09.810 | 128°10.050 | CTD-Rosette ↑ | 65 | 204 | 230 | 6 | 0.7 | 5.5 | 1014.1 | 80 | 0/10 |
| 3a | N/A | Mapping | 01/Oct/2010 | 10h00 | UTC-6 | 71°28.300 | 127°30.280 | Bottom Mapping ↓ | 312 | 41 | 274 | 9 | 1.0 | 5.6 | 1013.7 | 75 | 0/10 |
| 3a | CA05-MMP-10 | Mooring | 01/Oct/2010 | 11h25 | UTC-6 | 71°24.990 | 127°39.690 | Mooring CA05-MMP-10 Deployed | 238 | 5 | 298 | 9 | 0.3 | 5.6 | 1013.7 | 90 | 0/10 |
| 3a | CA05-MMP-10 | Mooring | 01/Oct/2010 | 11h37 | UTC-6 | 71°25.023 | 127°39.677 | Mooring CA05-MMP-10 Deployed (end) | 238 | 321 | 272 | 7 | 0.1 | 5.6 | 1013.7 | 91 | 0/10 |
| 3a | CA05-MMP-10 | Mooring | 01/Oct/2010 | 11h52 | UTC-6 | 71°25.223 | 127°40.077 | Triangulation | 248 | 341 | 266 | 12 | 0.2 | 5.5 | 1011.4 | 88 | 0/10 |
| 3a | CA05-MMP-10 | Mooring | 01/Oct/2010 | 12h01 | UTC-6 | 71°24.760 | 127°39.884 | Triangulation | 242 | 178 | 262 | 9 | 0.7 | 5.5 | 1013.8 | 87 | 0/10 |
| 3a | CA05-MMP-10 | Mooring | 01/Oct/2010 | 12h07 | UTC-6 | 71°25.076 | 127°38.850 | Triangulation | 242 | 270 | 262 | 9 | 0.7 | 5.5 | 1013.8 | 87 | 0/10 |
| 3a | CA05-MMP-10 | Mooring | 01/Oct/2010 | 12h58 | UTC-6 | 71°24.670 | 127°41.600 | CTD ↓ | 229 | 219 | 221 | 12 | 0.7 | 5.4 | 1013.5 | 85 | 0/10 |
| 3a | CA05-MMP-10 | Mooring | 01/Oct/2010 | 13h04 | UTC-6 | 71°24.610 | 127°41.590 | CTD ↑ | 230 | 205 | 218 | 8 | 0.2 | 5.4 | 1013.4 | 93 | 0/10 |
| 3a | N/A | Weather | 01/Oct/2010 | 12h39 | UTC-6 | 71°24.740 | 127°41.550 | Weather Balloon | 232 | 262 | 260 | 5/10 | 0.9 | 5.4 | 1013.6 | 80 | 0/10 |
| 3a | N/A | Mapping | 01/Oct/2010 | 13h47 | UTC-6 | 71°24.970 | 127°43.580 | Bottom Mapping ↓ | 225 | 41 | 262 | 7 | 0.8 | 5.4 | 1013.3 | 85 | 0/10 |
| 3a | N/A | Mapping | 01/Oct/2010 | 15h30 | UTC-6 | 71°42.510 | 126°55.181 | Bottom Mapping ↑ | 439 | 41 | 310 | 14 | 0.6 | 5.6 | 1012.9 | 76 | 0/10 |
| 3a | CA16-MMP-10 | Mooring | 01/Oct/2010 | 16h29 | UTC-6 | 71°45.310 | 126°30.520 | Mooring CA16-MMP-10 Deployed | 352 | 354 | 300 | 12 | 0.6 | 5.4 | 1012.6 | 75 | 0/10 |
| 3a | CA16-MMP-10 | Mooring | 01/Oct/2010 | 16h54 | UTC-6 | 71°45.270 | 126°30.540 | Mooring CA16-MMP-10 Deployed (end) | 353 | 21 | 290 | 9 | 0.6 | 5.4 | 1012.6 | 75 | 0/10 |
| 3a | CA16-MMP-10 | Mooring | 01/Oct/2010 | 16h57 | UTC-6 | 71°45.640 | 126°30.404 | Triangulation | 353 | 320 | 280 | 12 | 0.6 | 5.4 | 1012.6 | 75 | 0/10 |
| 3a | CA16-MMP-10 | Mooring | 01/Oct/2010 | 17h15 | UTC-6 | 71°41.051 | 126°31.343 | Triangulation | 393 | 96 | 264 | 9 | 0.6 | 5.4 | 1012.6 | 75 | 0/10 |
| 3a | CA16-MMP-10 | Mooring | 01/Oct/2010 | 17h25 | UTC-6 | 71°45.311 | 126°29.436 | Triangulation | 249 | 262 | 270 | 10 | 0.5 | 5.4 | 1012.5 | 75 | 0/10 |
| 3a | CA16-MMP-10 | Mooring | 01/Oct/2010 | 17h57 | UTC-6 | 71°45.410 | 126°32.700 | CTD ↓ | 366 | 269 | 300 | 10 | 0.5 | 5.4 | 1012.5 | 75 | 0/10 |
| 3a | CA16-MMP-10 | Mooring | 01/Oct/2010 | 18h13 | UTC-6 | 71°45.370 | 126°33.060 | CTD ↑ | 369 | 270 | 270 | 10 | 0.4 | 5.4 | 1012.3 | 76 | 0/10 |
| 3a | Tuktoyaktuk | Weather | 02/Oct/2010 | 12h38 | UTC-6 | 69°51.933 | 133°20.440 | Weather Balloon | 16 | 93 | 71 | 28 | 0.1 | 4.4 | 1000.4 | 97 | 0/10 |
| 3a | Pullen Pingos | Mapping | 03/Oct/2010 | 01h18 | UTC-6 | 70°59.363 | 133°58.999 | Bottom Mapping ↓ | 218 | 237 | 56 | 21 | -0.6 | 6.8 | 1003.3 | 87 | 0/10 |

| 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 | | | | | |
| 3a | Pullen Pingos | Mapping | 03/Oct/2010 | 02h30 | UTC-6 | 70°56.790 | 134°13.777 | Bottom Mapping ↑ | 158 | 237 | 56 | 19 | -0.7 | 6.2 | 1005.3 | 86 | 0/10 |
| 3a | Pullen Pingos | Mapping | 03/Oct/2010 | 02h30 | UTC-6 | 70°56.790 | 134°13.770 | Bottom Mapping ↓ | 158 | 237 | 56 | 19 | -0.7 | 6.2 | 1005.3 | 86 | 0/10 |
| 3a | Pullen Pingos | Mapping | 03/Oct/2010 | 14h14 | UTC-6 | 70°56.390 | 134°13.510 | Bottom Mapping ↑ | 143 | 60 | 51 | 20 | -2.2 | 6.9 | 1009.1 | 87 | 0/10 |
| 3a | N/A | Mapping | 03/Oct/2010 | 14h20 | UTC-6 | 70°56.467 | 134°13.117 | CTD ↓ | 144 | 58 | 55 | 21 | -2.4 | 6.8 | 1009.5 | 87 | 0/10 |
| 3a | N/A | Mapping | 03/Oct/2010 | 14h30 | UTC-6 | 70°56.509 | 134°13.204 | CTD ↑ | 146 | 52 | 51 | 22 | -2.4 | 6.8 | 1009.9 | 87 | 0/10 |
| 3a | N/A | Mapping | 03/Oct/2010 | 14h37 | UTC-6 | 70°56.543 | 134°11.972 | Bottom Mapping | 149 | 237 | 62 | 22 | -1.1 | 6.8 | 1009.8 | 93 | 0/10 |
| 3a | N/A | Mapping | 03/Oct/2010 | 16h45 | UTC-6 | 70°42.667 | 135°18.900 | CTD ↓ | 87 | 70 | 70 | 21 | -1.1 | 6.8 | 1009.8 | 93 | 0/10 |
| 3a | N/A | Mapping | 03/Oct/2010 | 16h59 | UTC-6 | 70°42.727 | 135°19.150 | CTD ↑ | 88 | 50 | 70 | 22 | -0.9 | 6.8 | 1009.6 | 91 | 0/10 |
| 3a | N/A | Mapping | 03/Oct/2010 | 17h15 | UTC-6 | 70°44.149 | 135°16.982 | Bottom Mapping ↓ | 86 | 57 | 70 | 23 | -0.8 | 6.8 | 1009.4 | 91 | 0/10 |
| 3a | N/A | Mapping | 03/Oct/2010 | 23h45 | UTC-6 | 70°53.260 | 134°27.800 | Bottom Mapping ↑ | N/A | N/A | 85 | 25 | -1.3 | 6.9 | 1008.7 | N/A | 0/10 |
| 3a | N/A | Mapping | 04/Oct/2010 | 00h45 | UTC-6 | 71°05.030 | 134°17.400 | Bottom Mapping ↓ | 481 | 304 | 71 | 25 | -1.4 | 6.8 | 1011.2 | 76 | 0/10 |
| 3a | N/A | Mapping | 04/Oct/2010 | 03h08 | UTC-6 | 71°14.768 | 134°34.793 | Bottom Mapping ↑ | 860 | 35 | 75 | 28 | -1.7 | 6.4 | 1012.7 | 80 | 0/10 |
| 3a | N/A | Weather | 04/Oct/2010 | 12h52 | UTC-6 | 71°47.200 | 130°00.840 | Weather Balloon | 289 | 92 | 99 | 35 | -3.4 | 5.9 | 1015.5 | 74 | 0/10 |
| 3a | N/A | Weather | 05/Oct/2010 | 13h24 | UTC-6 | 71°55.915 | 125°21.454 | Weather Balloon | 16 | 86 | 83 | 27 | -6.5 | 5.1 | 1007.8 | 91 | 0/10 |
| 3a | 408 | Full | 06/Oct/2010 | N/A | UTC-6 | N/A | N/A | CTD-Rosette ↓ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 3a | 408 | Full | 06/Oct/2010 | N/A | UTC-6 | N/A | N/A | CTD-Rosette ↑ | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 3a | 408 | Full | 06/Oct/2010 | 14h35 | UTC-6 | 71°19.050 | 127°35.600 | PNF ↓ | 205 | 25 | 48 | 16 | -4.2 | 6.0 | 1008.2 | 81 | 0/10 |
| 3a | 408 | Full | 06/Oct/2010 | 14h40 | UTC-6 | 71°19.050 | 127°35.680 | PNF ↑ | 207 | 16 | 40 | 14 | -4.9 | 6.0 | 1008.1 | 79 | 0/10 |
| 3a | 408 | Full | 06/Oct/2010 | 14h40 | UTC-6 | 71°19.060 | 127°35.690 | Secchi Disk ↓ | 208 | 14 | 42 | 15 | -4.9 | 6.0 | 1008.1 | 79 | 0/10 |
| 3a | 408 | Full | 06/Oct/2010 | 14h43 | UTC-6 | 71°19.060 | 127°35.730 | Secchi Disk ↑ | 205 | 13 | 34 | 13 | -4.9 | 6.0 | 1008.1 | 79 | 0/10 |
| 3a | CA05-10 | Mooring | 06/Oct/2010 | 15h10 | UTC-6 | 71°19.050 | 127°35.540 | Mooring CA05-10 Deployed | 205 | 30 | 56 | 15 | -5.2 | 6.1 | 1008.1 | 79 | 0/10 |
| 3a | CA05-10 | Mooring | 06/Oct/2010 | 15h37 | UTC-6 | 71°19.050 | 127°35.590 | Mooring CA05-10 Deployed (end) | 206 | 31 | 25 | 10 | -5.1 | 6.2 | 1008.2 | 78 | 0/10 |
| 3a | CA05-10 | Mooring | 06/Oct/2010 | 15h51 | UTC-6 | 71°19.062 | 127°36.212 | Triangulation | 202 | 147 | 30 | 16 | -4.0 | 6.2 | 1008.2 | 79 | 0/10 |
| 3a | CA05-10 | Mooring | 06/Oct/2010 | 15h56 | UTC-6 | 71°18.912 | 127°35.394 | Triangulation | 207 | 96 | 29 | 20 | -4.0 | 6.2 | 1008.2 | 79 | 0/10 |
| 3a | CA05-10 | Mooring | 06/Oct/2010 | 16h01 | UTC-6 | 71°19.230 | 127°35.514 | Triangulation | 209 | 318 | 44 | 18 | -4.7 | 6.2 | 1008.0 | 82 | 0/10 |
| 3a | CA08-10 | Mooring | 06/Oct/2010 | 20h40 | UTC-6 | 71°00.220 | 126°04.376 | Mooring CA08-10 Deployed | 392 | 30 | 11 | 14 | -3.5 | 5.6 | 1007.2 | 88 | 0/10 |
| 3a | CA08-10 | Mooring | 06/Oct/2010 | 21h14 | UTC-6 | 71°00.274 | 126°04.275 | Mooring CA08-10 Deployed (end) | 394 | 71 | 22 | 18 | -3.6 | 5.5 | 1007.4 | 88 | 0/10 |
| 3a | CA08-10 | Mooring | 06/Oct/2010 | 21h47 | UTC-6 | 71°00.025 | 126°04.704 | Triangulation | 394 | 143 | 27 | 14 | -3.6 | 5.5 | 1007.4 | 88 | 0/10 |
| 3a | 407 | Full | 06/Oct/2010 | 22h00 | UTC-6 | 71°01.050 | 126°02.233 | CTD-Rosette ↓ | 393 | 36 | 15 | 14 | -3.5 | 5.4 | 1007.2 | 93 | 0/10 |
| 3a | 407 | Full | 06/Oct/2010 | 22h41 | UTC-6 | 71°01.070 | 126°02.627 | CTD-Rosette ↑ | 396 | 20 | 25 | 13 | -3.9 | 5.4 | 1007.1 | 94 | 0/10 |

| 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 | | | | | |
| 3a | 407 | Full | 06/Oct/2010 | 22h56 | UTC-6 | 71°00.987 | 126°02.136 | Horizontal Net Tow ↓ | 392 | 123 | 20 | 15 | -4.1 | 5.4 | 1007.6 | 94 | 0/10 |
| 3a | 407 | Full | 06/Oct/2010 | 23h17 | UTC-6 | 71°00.618 | 126°00.009 | Horizontal Net Tow ↑ | 393 | 107 | 20 | 16 | -4.2 | 5.4 | 1007.7 | 96 | 0/10 |
| 3a | 407 | Full | 06/Oct/2010 | 23h27 | UTC-6 | 71°00.529 | 125°59.767 | Phytoplankton Net ↓ | 397 | 90 | 20 | 16 | -4.3 | 5.4 | 1007.7 | 95 | 0/10 |
| 3a | 407 | Full | 06/Oct/2010 | 23h35 | UTC-6 | 71°00.473 | 125°59.784 | Phytoplankton Net ↑ | 394 | 114 | 15 | 14 | -4.3 | 5.4 | 1007.7 | 95 | 0/10 |
| 3a | 407 | Full | 06/Oct/2010 | 23h57 | UTC-6 | 71°00.440 | 125°59.720 | Vertical Net Tow ↓ | 397 | 52 | 18 | 13 | -4.1 | 5.4 | 1007.8 | 94 | 0/10 |
| 3a | 407 | Full | 07/Oct/2010 | 00h25 | UTC-6 | 71°00.420 | 125°59.460 | Vertical Net Tow ↑ | 394 | 47 | 24 | 13 | -4.1 | 5.4 | 1007.9 | 95 | 0/10 |
| 3a | 407 | Full | 07/Oct/2010 | 00h54 | UTC-6 | 71°00.480 | 125°59.850 | CTD-Rosette ↓ | 395 | 5 | 13 | 13 | -4.1 | 5.4 | 1008.2 | 96 | 0/10 |
| 3a | 407 | Full | 07/Oct/2010 | 01h12 | UTC-6 | 71°00.520 | 126°00.230 | CTD-Rosette ↑ | 396 | 10 | 0 | 12 | -4.3 | 5.4 | 1008.3 | 96 | 0/10 |
| 3a | N/A | Mapping | 07/Oct/2010 | 02h27 | UTC-6 | 70°32.890 | 123°15.300 | Bottom Mapping ↓ | 419 | 119 | 136 | 1 | -1.4 | 4.9 | 1007.8 | 98 | 0/10 |
| **Leg 3b** | | | | | | | | | | | | | | | | | |
| 3b | N/A | Mapping | 08/Oct/2010 | 07h09 | UTC-6 | 70°27.150 | 123°10.100 | Bottom Mapping ↑ | 479 | 12 | 328 | 10 | -0.9 | 5.2 | 1007.7 | 96 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 08h10 | UTC-6 | 70°38.149 | 123°02.376 | CTD-Rosette ↓ | 612 | 317 | 332 | 12 | -1.2 | 5.0 | 1007.6 | 97 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 08h36 | UTC-6 | 70°38.130 | 123°02.591 | CTD-Rosette ↑ | 609 | 330 | 328 | 13 | -0.9 | 5.3 | 1007.7 | 94 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 08h48 | UTC-6 | 70°38.320 | 123°02.334 | Horizontal Net Tow ↓ | 611 | 63 | 343 | 15 | -0.9 | 5.3 | 1007.6 | 93 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 09h08 | UTC-6 | 70°38.582 | 123°01.079 | Horizontal Net Tow ↑ | 611 | 65 | 341 | 15 | -1.1 | 5.4 | 1007.6 | 92 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 09h20 | UTC-6 | 70°38.947 | 123°00.538 | Phytoplankton Net ↓ | 607 | 85 | 338 | 12 | -1.1 | 5.4 | 1007.7 | 91 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 09h33 | UTC-6 | 70°38.907 | 123°00.632 | Phytoplankton Net ↑ | 607 | 67 | 355 | 10 | -1.1 | 5.4 | 1007.7 | 90 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 09h37 | UTC-6 | 70°38.923 | 123°00.664 | Vertical Net Tow ↓ | 609 | 78 | 345 | 10 | -1.0 | 5.4 | 1007.7 | 91 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 10h18 | UTC-6 | 70°38.780 | 123°01.453 | Vertical Net Tow ↑ | 610 | 78 | 337 | 12 | -1.0 | 5.3 | 1008.2 | 92 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 10h19 | UTC-6 | 70°38.769 | 123°01.506 | PNF ↓↑ | 609 | 68 | 340 | 9 | -1.0 | 5.3 | 1008.2 | 92 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 10h23 | UTC-6 | 70°38.750 | 123°01.612 | Secchi Disk ↓↑ | 609 | 89 | 340 | 10 | -1.0 | 5.3 | 1008.3 | 93 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 10h40 | UTC-6 | 70°38.790 | 123°01.910 | CTD-Rosette ↓ | 605 | 330 | 343 | 8 | -0.8 | 5.4 | 1008.5 | 90 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 11h13 | UTC-6 | 70°38.780 | 123°02.270 | CTD-Rosette ↑ | 670 | 329 | 340 | 10 | -0.7 | 5.5 | 1008.5 | 87 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 12h21 | UTC-6 | 70°38.150 | 123°02.000 | Agassiz Trawl ↓ | 614 | 123 | 333 | 7 | -0.2 | 5.5 | 1008.7 | 89 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 12h39 | UTC-6 | 70°37.810 | 123°00.240 | Agassiz Trawl ↓ | 617 | 105 | 297 | 6 | 0.3 | 5.6 | 1008.9 | 82 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 12h46 | UTC-6 | 70°37.820 | 122°59.710 | Agassiz Trawl ↑ | 615 | 82 | 321 | 8 | -0.1 | 5.5 | 1009.0 | 82 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 13h35 | UTC-6 | 70°38.250 | 123°02.220 | Box Core ↓↑ | 609 | 327 | 318 | 6 | 0.0 | 5.3 | 1009.0 | 86 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 14h13 | UTC-6 | 70°39.040 | 123°02.860 | CTD-Rosette ↓ | 601 | 342 | 326 | 6 | 0.0 | 5.5 | 1009.2 | 85 | 0/10 |
| 3b | 405 | Basic | 08/Oct/2010 | 14h53 | UTC-6 | 70°39.130 | 123°03.510 | CTD-Rosette ↑ | 602 | 300 | 313 | 7 | -0.5 | 5.6 | 1009.3 | 84 | 0/10 |
| 3b | 405 | Basic | 09/Oct/2010 | 00h23 | UTC-6 | 72°01.203 | 119°47.409 | Weather Balloon | 107 | 3 | 215 | 1 | -1.5 | 2.8 | 1010.2 | 100 | 0/10 |

| 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 | | | | | |
| 3b | 450 | Basic | 09/Oct/2010 | 00h51 | UTC-6 | 72°03.100 | 119°46.580 | CTD-Rosette ↓ | 102 | 214 | Calm | Calm | -1.8 | 2.7 | 1010.3 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 01h11 | UTC-6 | 72°03.080 | 119°46.740 | CTD-Rosette ↑ | 100 | 233 | Calm | Calm | -1.5 | 2.7 | 1010.4 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 01h40 | UTC-6 | 72°02.930 | 119°46.550 | Horizontal Net Tow ↓ | 103 | 291 | Calm | Calm | -1.8 | 2.7 | 1010.4 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 01h56 | UTC-6 | 72°02.800 | 119°47.760 | Horizontal Net Tow ↑ | 104 | 197 | Calm | Calm | -1.8 | 2.6 | 1010.4 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 02h07 | UTC-6 | 72°03.090 | 119°46.730 | Phytoplankton Net ↓ | 102 | 356 | 60 | 1 | -1.9 | 2.6 | 1010.4 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 02h12 | UTC-6 | 72°03.080 | 119°46.740 | Phytoplankton Net ↑ | 103 | 356 | 53 | 1 | -1.8 | 2.5 | 1001.5 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 02h27 | UTC-6 | 72°03.110 | 119°46.700 | Vertical Net Tow ↓ | 102 | 22 | 51 | 1 | -1.8 | 2.5 | 1010.5 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 02h35 | UTC-6 | 72°03.090 | 119°46.760 | Vertical Net Tow ↑ | 102 | 42 | 48 | 1 | -1.9 | 2.5 | 1010.6 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 02h59 | UTC-6 | 72°03.150 | 119°46.770 | Box Core ↓↑ | 100 | 6 | 59 | 4 | -1.9 | 2.5 | 1010.6 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 03h36 | UTC-6 | 72°02.980 | 119°46.190 | Agassiz Trawl ↓ | 102 | 87 | 4 | 6 | -2.2 | 2.5 | 1010.6 | 100 | 0/10 |
| 3b | 450 | Basic | 09/Oct/2010 | 03h41 | UTC-6 | 72°03.000 | 119°45.790 | Agassiz Trawl ↑ | 101 | 68 | 0 | 6 | -2.2 | 2.5 | 1010.6 | 100 | 0/10 |
| 3b | 308 | Basic | 10/Oct/2010 | 18h07 | UTC-6 | 74°05.210 | 108°24.810 | PNF ↓ | 564 | 129 | 137 | 18 | -4.8 | 1.4 | 1010.6 | 94 | 0/10 |
| 3b | 308 | Basic | 10/Oct/2010 | 18h12 | UTC-6 | 74°05.240 | 108°24.830 | PNF ↑ | 511 | 118 | 134 | 16 | -4.8 | 1.4 | 1019.3 | 95 | 0/10 |
| 3b | 308 | Basic | 10/Oct/2010 | 18h12 | UTC-6 | 74°05.250 | 108°24.820 | Secchi Disk ↓ | 510 | 118 | 130 | 17 | -4.7 | 1.4 | 1019.3 | 95 | 0/10 |
| 3b | 308 | Basic | 10/Oct/2010 | 18h15 | UTC-6 | 74°05.260 | 108°24.810 | Secchi Disk ↑ | 510 | 124 | 131 | 16 | -4.7 | 1.4 | 1019.3 | 95 | 0/10 |
| 3b | MS01-10 | Mooring | 10/Oct/2010 | 19h03 | UTC-6 | 74°05.590 | 108°24.790 | Mooring MS01-10 Deployed | 524 | 132 | 132 | 18 | -4.4 | 3.6 | 1018.9 | 97 | 6/10 |
| 3b | MS01-10 | Mooring | 10/Oct/2010 | 19h33 | UTC-6 | 74°05.760 | 108.24.794 | Mooring MS01-10 Deployed (end) | 528 | 131 | 129 | 19 | -4.4 | 4.6 | 1018.7 | 99 | 6/10 |
| 3b | 308 | Full | 10/Oct/2010 | 20h15 | UTC-6 | 74°06.177 | 108°24.698 | CTD-Rosette ↓ | 544 | 113 | 115 | 14 | -4.1 | 5.1 | 1018.5 | 99 | 7/10 |
| 3b | 308 | Full | 10/Oct/2010 | 20h38 | UTC-6 | 74°06.296 | 108°22.755 | CTD-Rosette ↑ | 541 | 112 | 120 | 14 | -4.3 | 4.5 | 1018.3 | 99 | 7/10 |
| 3b | 308 | Full | 10/Oct/2010 | 21h00 | UTC-6 | 74°06.352 | 1018°25.260 | Phytoplankton Net ↓ | 541 | 131 | 128 | 17 | -3.4 | 5.8 | 1017.9 | 99 | 7/10 |
| 3b | 308 | Full | 10/Oct/2010 | 21h05 | UTC-6 | 74°06.377 | 108°25.353 | Phytoplankton Net ↑ | 543 | 131 | 121 | 16 | -3.9 | 5.8 | 1017.9 | 99 | 7/10 |
| 3b | 308 | Full | 10/Oct/2010 | 21h25 | UTC-6 | 74°06.463 | 108°25.371 | Vertical Net Tow ↓ | 555 | 137 | 129 | 16 | -3.7 | 4.3 | 1017.7 | 99 | 7/10 |
| 3b | 308 | Full | 10/Oct/2010 | 22h00 | UTC-6 | 74°06.711 | 108°25.677 | Vertical Net Tow ↑ | 560 | 138 | 147 | 24 | -3.2 | 5.2 | 1017.1 | 99 | 7/10 |
| 3b | 308 | Full | 10/Oct/2010 | 22h22 | UTC-6 | 74°06.860 | 108°25.898 | CTD-Rosette ↓ | 555 | 128 | 138 | 17 | -3.1 | 5.2 | 1017.6 | 99 | 7/10 |
| 3b | 308 | Full | 10/Oct/2010 | 22h50 | UTC-6 | 74°07.058 | 108°26.260 | CTD-Rosette ↑ | 555 | 127 | 129 | 18 | -3.3 | 6.5 | 1017.4 | 99 | 7/10 |
| 3b | 308 | Full | 10/Oct/2010 | 23h25 | UTC-6 | 74°07.273 | 108°26.684 | Box Core ↓↑ | 558 | 130 | 128 | 16 | -3.2 | 6.8 | 1017.1 | 99 | 7/10 |
| 3b | 308 | Full | 11/Oct/2010 | 11h12 | UTC-6 | 74°05.946 | 107°17.744 | On Ice Sampling ↓ | 571 | 328 | 90 | 21 | -3.2 | 2.3 | 1010.2 | 99 | 9+/10 |
| 3b | 308 | Full | 11/Oct/2010 | 11h42 | UTC-6 | 74°04.946 | 107°17.744 | On Ice Sampling ↑ | 571 | 328 | 92 | 17 | -3.5 | 2.4 | 1009.6 | 99 | 9+/10 |
| 3b | 308 | Full | 11/Oct/2010 | 13h05 | UTC-6 | 74°00.450 | 107°07.770 | Weather Balloon | 476 | 158 | 86 | 27 | -3.6 | 2.1 | 1007.4 | 99 | 6/10 |
| 3b | 304 | Full | 12/Oct/2010 | 15h10 | UTC-6 | 74°15.060 | 091°31.040 | PNF ↓ | 315 | 112 | 104 | 27 | -2.4 | 3.0 | 1003.7 | 82 | 5/10 |

| 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 | | | | | |
| 3b | 304 | Full | 12/Oct/2010 | 15h14 | UTC-6 | 74°15.080 | 091°31.010 | PNF ↑ | 316 | 110 | 105 | 24 | -2.4 | 3.0 | 1003.7 | 82 | 5/10 |
| 3b | 304 | Full | 12/Oct/2010 | 15h15 | UTC-6 | 74°15.110 | 091°31.010 | Secchi Disk ↓ | 317 | 110 | 106 | 25 | -2.5 | 3.6 | 1003.5 | 82 | 5/10 |
| 3b | 304 | Full | 12/Oct/2010 | 15h17 | UTC-6 | 74°15.110 | 091°31.020 | Secchi Disk ↑ | 317 | 110 | 106 | 25 | -2.5 | 3.6 | 1003.5 | 82 | 5/10 |
| 3b | 304 | Full | 12/Oct/2010 | 15h19 | UTC-5 | 74°15.110 | 091°31.020 | CTD-Rosette ↓ | 317 | 110 | 106 | 25 | -2.5 | 3.6 | 1003.5 | 82 | 5/10 |
| 3b | 304 | Full | 12/Oct/2010 | 15h47 | UTC-5 | 74°15.150 | 091°31.040 | CTD-Rosette ↑ | 318 | 120 | 104 | 27 | -2.5 | 5.2 | 1003.4 | 79 | 5/10 |
| 3b | 304 | Full | 12/Oct/2010 | 16h10 | UTC-5 | 74°13.160 | 091°29.460 | Horizontal Net Tow ↓ | 318 | 145 | 110 | 20 | -2.5 | 5.9 | 1003.5 | 78 | 5/10 |
| 3b | 304 | Full | 12/Oct/2010 | 16h38 | UTC-5 | 74°12.810 | 091°28.640 | Horizontal Net Tow ↑ | 305 | 145 | 110 | 23 | -2.5 | 5.9 | 1003.5 | 78 | 5/10 |
| 3b | 304 | Full | 12/Oct/2010 | 16h43 | UTC-5 | 74°12.760 | 091°29.090 | Phytoplankton Net ↓ | 307 | 112 | 112 | 23 | -2.6 | 6.0 | 1004.3 | 79 | 2/10 |
| 3b | 304 | Full | 12/Oct/2010 | 16h49 | UTC-5 | 74°12.790 | 091°29.220 | Phytoplankton Net ↑ | 307 | 110 | 110 | 20 | -2.6 | 6.1 | 1004.4 | 79 | 2/10 |
| 3b | 304 | Full | 12/Oct/2010 | 17h00 | UTC-5 | 74°12.820 | 091°29.510 | Vertical Net Tow ↓ | 305 | 109 | 92 | 18 | -2.6 | 6.1 | 1004.4 | 79 | 2/10 |
| 3b | 304 | Full | 12/Oct/2010 | 17h22 | UTC-5 | 74°12.860 | 091°29.940 | Vertical Net Tow ↑ | 307 | 116 | 110 | 24 | -2.7 | 6.2 | 1004.0 | 78 | 2/10 |
| 3b | 304 | Full | 12/Oct/2010 | 17h34 | UTC-5 | 74°12.920 | 091°30.130 | CTD-Rosette ↓ | 307 | 91 | 110 | 22 | -2.6 | 6.3 | 1003.7 | 78 | 2/10 |
| 3b | 304 | Full | 12/Oct/2010 | 17h51 | UTC-5 | 74°12.970 | 091°30.430 | CTD-Rosette ↑ | 307 | 114 | 112 | 22 | -2.5 | 6.2 | 1003.6 | 77 | 2/10 |
| 3b | 304 | Full | 12/Oct/2010 | 18h13 | UTC-5 | 74°13.040 | 091°30.970 | Box Core ↓ | 309 | 119 | 110 | 24 | -2.6 | 6.2 | 1003.5 | 77 | 0/10 |
| 3b | 304 | Full | 12/Oct/2010 | 18h20 | UTC-5 | 74°13.080 | 091°31.140 | Box Core (bottom) | 309 | 127 | 110 | 25 | -2.6 | 6.2 | 1003.5 | 77 | 0/10 |
| 3b | 304 | Full | 12/Oct/2010 | 18h28 | UTC-5 | 74°13.040 | 091°31.220 | Box Core ↑ | 310 | 124 | 110 | 23 | -2.6 | 6.2 | 1003.5 | 77 | 0/10 |
| 3b | 304 | Full | 12/Oct/2010 | 18h47 | UTC-5 | 74°13.510 | 091°33.870 | Agassiz Trawl ↓ | 305 | 135 | 115 | 30 | -2.6 | 6.0 | 1002.5 | 76 | 1/10 |
| 3b | 304 | Full | 12/Oct/2010 | 19h25 | UTC-5 | 74°12.762 | 091°35.564 | Agassiz Trawl ↑ | 315 | 140 | 130 | 21 | -3.0 | 5.5 | 1003.4 | 81 | 2/10 |
| 3b | 304 | Full | 12/Oct/2010 | 19h00 | UTC-5 | 74°13.302 | 091°33.300 | Agassiz Trawl ↓ | 305 | 130 | 117 | 30 | -2.6 | 6.0 | 1002.6 | 76 | 3/10 |
| 3b | 304 | Full | 12/Oct/2010 | 19h04 | UTC-5 | 74°13.213 | 091°32.991 | Agassiz Trawl ↑ | 305 | 130 | 116 | 32 | -2.6 | 6.0 | 1002.6 | 76 | 1/10 |
| 3b | 304 | Full | 12/Oct/2010 | 20h20 | UTC-5 | 74°13.100 | 091°50.110 | Bottom Mapping ↓ | 239 | 260 | 116 | 25 | -3.1 | 4.5 | 1003.6 | 76 | 3/10 |
| 3b | 304 | Full | 13/Oct/2010 | 07h50 | UTC-5 | 74°07.300 | 091°41.700 | Bottom Mapping ↑ | 168 | 80 | 126 | 16 | -2.6 | 2.9 | 1003.2 | 80 | 1/10 |
| 3b | 304 | Full | 13/Oct/2010 | 13h00 | UTC-5 | 74°04.640 | 088°00.840 | Weather Balloon | 420 | 96 | 80 | 24 | -4.0 | 3.0 | 1003.6 | 99 | 2/10 |
| 3b | 324 | Nutrient | 14/Oct/2010 | 12h29 | UTC-4 | 73°52.590 | 080°10.440 | CTD-Rosette ↓ | 797 | 106 | 10 | 99 | -3.0 | 2.9 | 1008.8 | 99 | 2/10 |
| 3b | 324 | Nutrient | 14/Oct/2010 | 13h17 | UTC-4 | 73°53.070 | 080°04.590 | CTD-Rosette ↑ | 826 | 71 | 6 | 96 | -3.0 | 2.9 | 1004.3 | 99 | 2/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 15h41 | UTC-4 | 76°11.260 | 079°46.540 | PNF ↓ | 778 | 67 | 8 | 60 | -3.1 | 2.8 | 1010.3 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 15h45 | UTC-4 | 74°11.200 | 079°31.490 | PNF ↑ | 781 | 61 | 9 | 51 | -3.1 | 2.8 | 1010.3 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 15h49 | UTC-4 | 74°11.240 | 079°46.530 | Secchi Disk ↓↑ | 779 | 49 | 9 | 60 | -3.2 | 2.8 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 15h53 | UTC-4 | 74°11.240 | 079°46.530 | Water Sampling ↓↑ | 779 | 49 | 9 | 60 | -3.2 | 2.8 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 15h58 | UTC-4 | 74°11.230 | 079°46.520 | CTD-Rosette ↓ | 779 | 45 | 9 | 60 | -3.1 | 2.7 | 1010.4 | 99 | 3/10 |

| 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 | | | | | |
| 3b | 323 | Basic | 14/Oct/2010 | 16h41 | UTC-4 | 74°11.310 | 079°46.570 | CTD-Rosette ↑ | 779 | 26 | 8 | 60 | -3.1 | 2.6 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 17h42 | UTC-4 | 74°11.810 | 079°11.490 | Horizontal Net Tow ↓ | 779 | 50 | 9 | 60 | -3.2 | 2.8 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 17h56 | UTC-4 | 74°11.490 | 079°44.740 | Horizontal Net Tow ↑ | 780 | 52 | 9 | 60 | -3.2 | 2.8 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 18h11 | UTC-4 | 74°11.990 | 079°43.330 | Phytoplankton Net ↓ | 780 | 225 | 8 | 50 | -3.2 | 2.7 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 18h15 | UTC-4 | 74°11.850 | 079°44.300 | Phytoplankton Net ↑ | 779 | 230 | 8 | 40 | -3.3 | 2.7 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 18h20 | UTC-4 | 74°11.970 | 079°43.330 | Vertical Net Tow ↓ | 779 | 50 | 8 | 40 | -3.3 | 2.6 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 19h12 | UTC-4 | 74°11.860 | 079°44.260 | Vertical Net Tow ↑ | 782 | 50 | 9 | 30 | -3.3 | 2.5 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 19h26 | UTC-4 | 74°11.890 | 079°44.570 | CTD-Rosette ↓ | 782 | 23 | 8 | 40 | -3.3 | 2.5 | 1010.4 | 99 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 19h55 | UTC-4 | 74°11.950 | 079°45.198 | CTD-Rosette ↑ | 783 | 48 | 8 | 30 | -3.3 | 2.5 | 1010.4 | 98 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 20h18 | UTC-4 | 74°20.990 | 079°75.270 | Box Core ↓ | 783 | 40 | 8 | 38 | -3.3 | 2.5 | 1010.4 | 98 | 3/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 20h35 | UTC-4 | 74°12.020 | 079°45.760 | Box Core (bottom) | 783 | 41 | 7 | 48 | -3.2 | 2.4 | 1010.4 | 98 | 7/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 21h10 | UTC-4 | 74°12.570 | 079°44.030 | Agassiz Trawl ↓ | 785 | 55 | 8 | 42 | -3.2 | 3.2 | 1010.4 | 98 | 7/10 |
| 3b | 323 | Basic | 14/Oct/2010 | 22h15 | UTC-4 | 74°11.820 | 079°41.600 | Agassiz Trawl ↑ | 780 | 227 | 9 | 33 | -3.0 | 2.2 | 1010.4 | 96 | 7/10 |
| 3b | 115 | Full | 15/Oct/2010 | 19h26 | UTC-4 | 76°20.000 | 071°11.130 | CTD-Rosette ↓ | 655 | 110 | 18 | 130 | -1.2 | 3.2 | 1008.5 | 99 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 20h06 | UTC-4 | 76°20.260 | 071°11.040 | CTD-Rosette ↑ | 658 | 117 | 17 | 127 | -1.3 | 3.1 | 1008.9 | 99 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 20h20 | UTC-4 | 76°20.380 | 071°10.870 | Horizontal Net Tow ↓ | 655 | 145 | 21 | 123 | -1.3 | 3.0 | 1008.9 | 98 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 20h36 | UTC-4 | 76°20.090 | 071°09.700 | Horizontal Net Tow ↑ | 650 | 93 | 19 | 134 | -1.4 | 3.0 | 1008.8 | 98 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 20h48 | UTC-4 | 76°20.260 | 071°09.500 | Phytoplankton Net ↓ | 640 | 122 | 19 | 126 | -1.4 | 3.0 | 1008.9 | 98 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 20h54 | UTC-4 | 76°20.370 | 071°09.530 | Phytoplankton Net ↑ | 635 | 128 | 19 | 127 | -1.6 | 3.0 | 1009.0 | 99 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 21h04 | UTC-4 | 76°20.420 | 071°09.690 | Vertical Net Tow ↓ | 639 | 131 | 17 | 127 | -1.6 | 3.2 | 1009.0 | 99 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 21h46 | UTC-4 | 76°20.580 | 071°10.970 | Vertical Net Tow ↑ | 657 | 120 | 20 | 126 | -1.6 | 3.9 | 1009.0 | 99 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 21h58 | UTC-4 | 76°20.680 | 071°10.880 | CTD-Rosette ↓ | 651 | 117 | 20 | 125 | -1.6 | 3.9 | 1009.1 | 99 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 22h25 | UTC-4 | 76°20.880 | 071°11.450 | CTD-Rosette ↑ | 653 | 132 | 19 | 121 | -1.6 | 3.7 | 1009.2 | 99 | Icebergs |
| 3b | 115 | Full | 15/Oct/2010 | 23h05 | UTC-4 | 76°21.230 | 071°11.810 | Box Core ↓↑ | 644 | 140 | 22 | 123 | -1.5 | 3.3 | 1009.4 | 99 | Icebergs |
| 3b | 115 | Full | 16/Oct/2010 | 00h12 | UTC-4 | 76°21.600 | 071°15.600 | Agassiz Trawl ↓ | 655 | 217 | 20 | 126 | -2.1 | 3.4 | 1009.4 | 99 | Icebergs |
| 3b | 115 | Full | 16/Oct/2010 | 00h17 | UTC-4 | 76°21.600 | 071°16.200 | Agassiz Trawl ↑ | 652 | 213 | 22 | 124 | -2.1 | 3.0 | 1009.4 | 99 | Icebergs |
| 3b | 114 | CTD | 16/Oct/2010 | 02h32 | UTC-4 | 76°19.430 | 071°46.470 | CTD ↓ | 633 | 126 | 18 | 115 | -2.3 | 3.9 | 1009.8 | 99 | Icebergs |
| 3b | 114 | CTD | 16/Oct/2010 | 02h53 | UTC-4 | 76°19.640 | 071°46.940 | CTD ↑ | 636 | 119 | 119 | 22 | -2.1 | 6.2 | 1009.9 | 99 | Icebergs |
| 3b | 113 | Nutrient | 16/Oct/2010 | 04h00 | UTC-4 | 76°19.580 | 072°12.930 | CTD-Rosette ↓ | 561 | 105 | 110 | 22 | -1.9 | 5.3 | 1009.9 | 99 | Icebergs |
| 3b | 113 | Nutrient | 16/Oct/2010 | 04h30 | UTC-4 | 76°19.870 | 072°12.830 | CTD-Rosette ↑ | 563 | 101 | 130 | 23 | -2.1 | 6.5 | 1009.8 | 99 | Icebergs |

| 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 | | | | | |
| 3b | 112 | CTD | 16/Oct/2010 | 05h17 | UTC-4 | 76°19.050 | 072°41.940 | CTD ↓ | 568 | 110 | 110 | 17 | -2.3 | 4.3 | 1009.9 | 99 | Icebergs |
| 3b | 112 | CTD | 16/Oct/2010 | 05h37 | UTC-4 | 76°19.150 | 072°42.260 | CTD ↑ | 573 | 109 | 110 | 20 | -2.1 | 6.2 | 1009.8 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 07h14 | UTC-4 | 76°18.530 | 073°15.440 | CTD-Rosette ↓ | 608 | 150 | 140 | 10 | -2.1 | 2.7 | 1010.4 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 07h39 | UTC-4 | 76°18.520 | 073°15.060 | CTD-Rosette ↑ | 605 | 102 | 140 | 10 | -2.0 | 2.8 | 1010.5 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 08h05 | UTC-4 | 76°18.320 | 073°15.040 | Horizontal Net Tow ↓ | 588 | 215 | 130 | 11 | -2.0 | 2.7 | 1010.6 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 08h25 | UTC-4 | 76°17.910 | 073°16.630 | Horizontal Net Tow ↑ | 571 | 212 | 134 | 12 | -2.2 | 3.0 | 1010.7 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 08h35 | UTC-4 | 76°17.700 | 073°16.800 | Phytoplankton Net ↓ | 568 | 144 | 133 | 10 | -2.2 | 3.1 | 1010.8 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 08h40 | UTC-4 | 76°17.670 | 073°16.800 | Phytoplankton Net ↑ | 568 | 140 | 131 | 9 | -2.1 | 3.1 | 1010.8 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 08h52 | UTC-4 | 76°17.660 | 073°16.920 | Vertical Net Tow ↓ | 568 | 139 | 130 | 9 | -2.2 | 3.2 | 1010.9 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 09h27 | UTC-4 | 76°17.580 | 073°16.530 | Vertical Net Tow ↑ | 566 | 130 | 132 | 8 | -2.2 | 3.2 | 1011.0 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 09h41 | UTC-4 | 76°17.560 | 073°16.520 | CTD-Rosette ↓ | 569 | 126 | 129 | 7 | -2.3 | 3.0 | 1011.1 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 10h11 | UTC-4 | 76°17.480 | 073°16.330 | CTD-Rosette ↑ | 567 | 155 | 113 | 8 | -2.3 | 2.8 | 1011.1 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 10h40 | UTC-4 | 76°17.320 | 073°15.730 | Box Core ↓↑ | 568 | 125 | 121 | 8 | -2.3 | 2.7 | 1011.2 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 11h27 | UTC-4 | 76°17.060 | 073°17.800 | Agassiz Trawl ↓ | 572 | 240 | 136 | 6 | -2.5 | 2.5 | 1011.2 | 99 | Icebergs |
| 3b | 111 | Basic | 16/Oct/2010 | 11h37 | UTC-4 | 76°17.020 | 073°18.250 | Agassiz Trawl ↑ | 568 | 240 | 137 | 6 | -2.5 | 2.5 | 1011.2 | 99 | Icebergs |
| 3b | 110 | Nutrient | 16/Oct/2010 | 13h15 | UTC-4 | 76°18.120 | 073°36.870 | CTD-Rosette ↓ | 548 | 139 | 125 | 2 | -2.2 | 3.1 | 1011.4 | 99 | Icebergs |
| 3b | 110 | Nutrient | 16/Oct/2010 | 13h42 | UTC-4 | 76°18.160 | 073°36.520 | CTD-Rosette ↑ | 555 | 155 | 78 | 2 | -2.6 | 3.2 | 1011.5 | 99 | Icebergs |
| 3b | 109 | CTD | 16/Oct/2010 | 15h11 | UTC-4 | 76°15.960 | 074°07.410 | PNF ↓ | 448 | 30 | 58 | 4 | -2.7 | 3.2 | 1011.7 | 99 | Icebergs |
| 3b | 109 | CTD | 16/Oct/2010 | 15h14 | UTC-4 | 76°15.970 | 074°07.360 | PNF ↑ | 448 | 30 | 59 | 4 | -2.7 | 3.2 | 1011.7 | 99 | Icebergs |
| 3b | 109 | CTD | 16/Oct/2010 | 15h16 | UTC-4 | 76°15.970 | 074°07.340 | Secchi Disk ↓ | 450 | 35 | 59 | 4 | -2.7 | 3.2 | 1011.7 | 99 | Icebergs |
| 3b | 109 | CTD | 16/Oct/2010 | 15h18 | UTC-4 | 76°15.970 | 074°07.300 | Secchi Disk ↑ | 452 | 39 | 52 | 4 | -2.7 | 3.2 | 1011.7 | 99 | Icebergs |
| 3b | 109 | CTD | 16/Oct/2010 | 15h26 | UTC-4 | 76°15.960 | 074°07.250 | PNF ↓ | 452 | 31 | 51 | 4 | -2.7 | 3.1 | 1011.8 | 99 | Icebergs |
| 3b | 109 | CTD | 16/Oct/2010 | 15h27 | UTC-4 | 76°15.960 | 074°07.190 | PNF ↑ | 452 | 42 | 41 | 4 | -2.7 | 3.1 | 1011.8 | 99 | Icebergs |
| 3b | 109 | CTD | 16/Oct/2010 | 15h33 | UTC-4 | 76°15.950 | 074°07.080 | CTD-Rosette ↓ | 448 | 45 | 40 | 5 | -2.7 | 3.1 | 1011.8 | 99 | Icebergs |
| 3b | 109 | CTD | 16/Oct/2010 | 15h53 | UTC-4 | 76°15.950 | 074°06.850 | CTD-Rosette ↑ | 448 | 10 | 30 | 5 | -2.7 | 3.1 | 1011.9 | 99 | Icebergs |
| 3b | 108 | Full | 16/Oct/2010 | 17h32 | UTC-4 | 76°16.220 | 074°43.430 | CTD-Rosette ↓ | 458 | 34 | 20 | 6 | -2.6 | 3.1 | 1012.2 | 99 | Icebergs |
| 3b | 108 | Full | 16/Oct/2010 | 18h05 | UTC-4 | 76°16.050 | 074°44.540 | CTD-Rosette ↑ | 452 | 24 | 60 | 7 | -2.2 | 3.2 | 1012.3 | 99 | Icebergs |
| 3b | 108 | Full | 16/Oct/2010 | 18h24 | UTC-4 | 76°15.578 | 074°50.752 | Horizontal Net Tow ↓ | 470 | 42 | 56 | 7 | -2.3 | 3.3 | 1012.4 | 99 | Icebergs |
| 3b | 108 | Full | 16/Oct/2010 | 18h46 | UTC-4 | 76°15.610 | 074°50.080 | Horizontal Net Tow ↑ | 470 | 65 | 50 | 8 | -2.3 | 3.3 | 1012.3 | 99 | Icebergs |
| 3b | 108 | Full | 16/Oct/2010 | 19h01 | UTC-4 | 76°15.270 | 074°47.850 | Phytoplankton Net ↑ | 478 | 60 | 50 | 9 | -2.3 | 3.3 | 1012.3 | 99 | 9/10 |

| 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 | | | | | |
| 3b | 108 | Full | 16/Oct/2010 | 19h55 | UTC-4 | 76°15.880 | 074°45.300 | Vertical Net Tow ↓ | 465 | 58 | 56 | 8 | -2.2 | 3.4 | 1012.7 | 99 | 9/10 |
| 3b | 108 | Full | 16/Oct/2010 | 20h25 | UTC-4 | 76°15.590 | 074°46.180 | Vertical Net Tow ↑ | 466 | 56 | 36 | 7 | -2.1 | 3.4 | 1012.8 | 99 | 9/10 |
| 3b | 108 | Full | 16/Oct/2010 | 20h10 | UTC-4 | 76°15.740 | 074°45.680 | Weather Balloon | 464 | 53 | 53 | 8 | -2.2 | 3.4 | 1012.7 | 99 | 9/10 |
| 3b | 108 | Full | 16/Oct/2010 | 20h39 | UTC-4 | 76°15.430 | 074°46.760 | CTD-Rosette ↓ | 465 | 36 | 35 | 7 | -2.2 | 3.4 | 1012.8 | 99 | 9/10 |
| 3b | 108 | Full | 16/Oct/2010 | 20h58 | UTC-4 | 76°15.250 | 074°47.640 | CTD-Rosette ↑ | 462 | 43 | 32 | 7 | -2.2 | 3.4 | 1012.9 | 99 | 9/10 |
| 3b | 108 | Full | 16/Oct/2010 | 21h35 | UTC-4 | 76°14.030 | 074°55.820 | Box Core ↓↑ | 435 | 35 | 14 | 8 | -2.3 | 3.5 | 1012.8 | 99 | 9/10 |
| 3b | 108 | Full | 16/Oct/2010 | 22h23 | UTC-4 | 76°13.700 | 074°55.550 | Agassiz Trawl ↓ | 434 | 55 | 4 | 9 | -2.3 | 3.5 | 1012.9 | 99 | 9/10 |
| 3b | 108 | Full | 16/Oct/2010 | 22h29 | UTC-4 | 76°13.750 | 074°55.070 | Agassiz Trawl ↑ | 434 | 55 | 5 | 9 | -2.3 | 3.5 | 1012.9 | 99 | 9/10 |
| 3b | 107 | Nutrient | 17/Oct/2010 | 00h56 | UTC-4 | 76°16.440 | 075°01.650 | CTD-Rosette ↓ | 426 | 33 | 2 | 10 | -3.6 | 3.4 | 1013.0 | 99 | 9/10 |
| 3b | 107 | Nutrient | 17/Oct/2010 | 01h24 | UTC-4 | 76°16.580 | 075°02.650 | CTD-Rosette ↑ | 428 | 33 | 7 | 16 | -3.8 | 3.4 | 1013.1 | 99 | 9/10 |
| 3b | 106 | CTD | 17/Oct/2010 | 02h20 | UTC-4 | 76°18.290 | 075°22.710 | CTD ↓ | 384 | 308 | 20 | 18 | -4.1 | 3.5 | 1013.6 | 97 | 9/10 |
| 3b | 106 | CTD | 17/Oct/2010 | 02h33 | UTC-4 | 76°13.520 | 075°29.260 | CTD ↑ | 382 | 307 | 16 | 15 | -4.1 | 3.5 | 1013.7 | 97 | 9/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 10h10 | UTC-4 | 76°20.580 | 075°48.350 | PNF ↓↑ | 330 | 342 | 350 | 11 | -6.1 | 4.0 | 1016.0 | 90 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 10h17 | UTC-4 | 76°20.550 | 075°48.510 | Secchi Disk ↓↑ | 340 | 2 | 348 | 12 | -6.1 | 4.0 | 1016.9 | 90 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 10h21 | UTC-4 | 76°20.520 | 075°48.570 | CTD-Rosette ↓ | 339 | 356 | 346 | 12 | -6.2 | 4.0 | 1016.2 | 90 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | N/A | UTC-4 | N/A | N/A | CTD-Rosette ↑ (canceled) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| 3b | 105 | Basic | 17/Oct/2010 | 10h37 | UTC-4 | 76°20.310 | 075°48.900 | CTD-Rosette ↓ | 336 | 350 | 350 | 13 | -6.3 | 4.0 | 1016.3 | 90 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 11h00 | UTC-4 | 76°20.020 | 075°49.520 | CTD-Rosette ↑ | 341 | 350 | 346 | 12 | -6.4 | 4.1 | 1016.4 | 91 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 11h17 | UTC-4 | 76°19.714 | 075°51.317 | Horizontal Net Tow ↓ | 328 | 60 | 348 | 16 | -6.4 | 4.0 | 1016.5 | 91 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 11h30 | UTC-4 | 76°19.700 | 075°50.130 | Horizontal Net Tow ↑ | 332 | 83 | 355 | 12 | -6.7 | 3.8 | 1016.6 | 92 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 11h40 | UTC-4 | 76°19.600 | 075°50.170 | Phytoplankton Net ↓ | 336 | 347 | 348 | 10 | -6.6 | 3.7 | 1016.7 | 92 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 11h45 | UTC-4 | 76°19.540 | 075°50.240 | Phytoplankton Net ↑ | 330 | 351 | 343 | 12 | -6.6 | 3.7 | 1016.7 | 92 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 11h50 | UTC-4 | 76°19.490 | 075°50.320 | Vertical Net Tow ↓ | 330 | 350 | 346 | 11 | -6.7 | 3.6 | 1016.9 | 93 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 12h10 | UTC-4 | 76°16.510 | 075°58.840 | Vertical Net Tow ↑ (canceled) | 330 | 358 | 339 | 13 | -7.1 | 3.4 | 1016.9 | 93 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 12h23 | UTC-4 | 76°19.150 | 075°50.720 | Vertical Net Tow ↓ | 330 | 353 | 336 | 12 | -7.2 | 3.4 | 1017.0 | 92 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 12h42 | UTC-4 | 76°18.940 | 075°50.800 | Vertical Net Tow ↑ | 327 | 350 | 335 | 14 | -7.6 | 3.3 | 1017.2 | 92 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 13h08 | UTC-4 | 76°16.120 | 075°59.230 | CTD-Rosette ↓ | 327 | 328 | 332 | 11 | -7.7 | 3.2 | 1017.3 | 91 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 13h23 | UTC-4 | 76°18.760 | 075°51.370 | CTD-Rosette ↑ | 331 | 317 | 343 | 10 | -7.4 | 3.1 | 1017.5 | 91 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 14h42 | UTC-4 | 76°15.280 | 075°55.820 | Box Core ↓↑ (canceled) | 337 | 354 | 335 | 9 | -7.0 | 3.1 | 1018.2 | 93 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 15h00 | UTC-4 | 76°15.130 | 075°55.880 | Box Core ↓↑ | 338 | 352 | 331 | 13 | -6.9 | 3.4 | 1018.4 | 94 | 9+/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 15h41 | UTC-4 | 76°17.140 | 075°54.970 | Agassiz Trawl ↓ | 363 | 51 | 342 | 14 | -7.3 | 3.6 | 1018.8 | 95 | 7/10 |

| 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 | | | | | |
| 3b | 105 | Basic | 17/Oct/2010 | 15h46 | UTC-4 | 76°17.160 | 075°46.640 | Agassiz Trawl ↑ | 363 | 43 | 346 | 13 | -7.3 | 3.6 | 1018.8 | 95 | 7/10 |
| 3b | 105 | Basic | 17/Oct/2010 | 16h05 | UTC-4 | 76°17.410 | 075°53.780 | Agassiz Trawl (on board) | 358 | 360 | 340 | 10 | -7.1 | 3.3 | 1018.9 | 95 | 7/10 |
| 3b | 104 | CTD | 17/Oct/2010 | 17h54 | UTC-4 | 76°19.000 | 076°13.740 | CTD-Rosette ↓ | 169 | 334 | 350 | 12 | -8.4 | 3.3 | 1019.8 | 90 | 8/10 |
| 3b | 104 | CTD | 17/Oct/2010 | 18h06 | UTC-4 | 76°18.960 | 076°13.690 | CTD-Rosette ↑ | 175 | 338 | 340 | 14 | -8.5 | 3.3 | 1019.9 | 88 | 8/10 |
| 3b | N/A | Mapping | 19/Oct/2010 | 12h20 | UTC-4 | 71°37.340 | 070°13.960 | Bottom Mapping ↓ | 580 | N/A | 58 | 14 | -2.2 | 3.6 | 1021.5 | 93 | Bergy |
| 3b | N/A | Mapping | 19/Oct/2010 | 17h49 | UTC-4 | 71°11.300 | 068°03.900 | Bottom Mapping ↑ | 555 | 126 | 58 | 17 | -1.2 | 4.5 | 1018.5 | 94 | Bergy |
| 3b | N/A | Mapping | 21/Oct/2010 | 18h32 | UTC-4 | 62°31.990 | 066°11.750 | Bottom Mapping ↓ | 380 | 290 | 111 | 13 | 1.7 | 5.5 | 1010.3 | 99 | 0/10 |
| 3b | N/A | Mapping | 22/Oct/2010 | 05h30 | UTC-4 | 63°06.200 | 067°30.700 | Bottom Mapping ↑ | 591 | 275 | 122 | 28 | 2.6 | 5.4 | 1010.3 | 93 | Bergy |
| **Leg 3c** | | | | | | | | | | | | | | | | | |
| 3c | N/A | Mapping | 23/Oct/2010 | 18h30 | UTC-4 | 59°10.800 | 063°15.000 | Bottom Mapping ↓ | 80 | 190 | Calm | Calm | 2.1 | 5.9 | 1014.3 | 99 | 0/10 |
| 3c | N/A | Mapping | 23/Oct/2010 | 21h15 | UTC-4 | 59°06.700 | 063°23.450 | Bottom Mapping ↑ | 140 | 180 | Calm | Calm | 1.9 | 6.0 | 1014.1 | 98 | 0/10 |
| 3c | N/A | MVP | 23/Oct/2010 | 21h30 | UTC-4 | 59°06.560 | 063°23.280 | MVP ↓ | 140 | 228 | Calm | Calm | 1.9 | 6.0 | 1014.1 | 98 | 0/10 |
| 3c | N/A | MVP | 23/Oct/2010 | 23h55 | UTC-4 | 58°59.290 | 063°53.500 | MVP ↑ | 55 | 170 | 336 | 5/10 | 2.4 | 5.7 | 1013.6 | 86 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 02h01 | UTC-4 | 59°05.750 | 063°26.340 | Horizontal Net Tow ↓ | 192 | 197 | 58 | 4 | 1.6 | 5.9 | 1013.2 | 94 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 02h16 | UTC-4 | 59°05.350 | 063°26.330 | Horizontal Net Tow ↑ | 205 | 147 | 80 | 3 | 1.5 | 5.9 | 1013.3 | 95 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 02h36 | UTC-4 | 59°05.270 | 063°26.240 | Vertical Net Tow ↓ | 209 | 68 | 91 | 1 | 1.5 | 6.0 | 1013.2 | 94 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 02h48 | UTC-4 | 59°05.280 | 063°26.200 | Vertical Net Tow ↑ | 209 | 76 | Calm | Calm | 1.6 | 6.0 | 1013.1 | 93 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 03h06 | UTC-4 | 59°05.280 | 063°26.130 | CTD-Rosette ↓ | 207 | 184 | 175 | 4 | 1.9 | 6.1 | 1013.0 | 93 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 03h30 | UTC-4 | 59°05.230 | 063°26.130 | CTD-Rosette ↑ | 204 | 172 | 44 | 2 | 1.3 | 6.1 | 1013.0 | 94 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 04h33 | UTC-4 | 59°05.370 | 063°25.870 | Hydrobios ↓ | 204 | 45 | 70 | 5 | 1.6 | 6.2 | 1012.8 | 91 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 04h54 | UTC-4 | 59°05.350 | 063°25.810 | Hydrobios ↑ | 205 | 41 | 60 | 7 | 1.3 | 6.1 | 1012.8 | 90 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 05h15 | UTC-4 | 59°05.330 | 063°25.730 | Box Core ↓ | 203 | 43 | 60 | 4 | 1.3 | 6.2 | 1012.8 | 90 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 05h24 | UTC-4 | 59°05.300 | 063°25.730 | Box Core ↑ | 203 | 46 | 60 | 4 | 1.2 | 6.1 | 1012.9 | 90 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 05h40 | UTC-4 | 59°05.080 | 063°26.500 | Agassiz Trawl ↓ | 207 | 80 | 60 | 5 | 1.3 | 6.1 | 1012.6 | 89 | 0/10 |
| 3c | 600 | Basic | 24/Oct/2010 | 06h16 | UTC-4 | 59°05.120 | 063°27.590 | Agassiz Trawl ↑ | 210 | 88 | Calm | Calm | 1.5 | 5.9 | 1012.6 | 89 | 0/10 |
| 3c | 601 | CTD | 24/Oct/2010 | 08h33 | UTC-4 | 59°03.160 | 063°36.510 | Barge Deployed | 168 | 115 | 30 | 2 | 1.4 | 6.0 | 1012.4 | 85 | 0/10 |
| 3c | 601 | CTD | 24/Oct/2010 | 09h03 | UTC-4 | 59°03.100 | 063°36.120 | CTD ↓ | 170 | 108 | Calm | Calm | 1.6 | 6.0 | 1012.4 | 84 | 0/10 |
| 3c | 601 | CTD | 24/Oct/2010 | 09h10 | UTC-4 | 59°03.110 | 063°36.100 | CTD ↑ | 170 | 118 | Calm | Calm | 1.8 | 6.0 | 1012.4 | 83 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 10h27 | UTC-4 | 59°03.240 | 063°52.020 | PNF ↓↑ | 165 | 270 | Calm | Calm | 1.7 | 6.8 | 1012.2 | 87 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 10h37 | UTC-4 | 59°03.240 | 063°52.010 | Secchi Disk ↓↑ | 165 | 271 | Calm | Calm | 2.0 | 5.8 | 1012.2 | 81 | 0/10 |

| 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 | | | | | |
| 3c | 602 | Basic | 24/Oct/2010 | 10h39 | UTC-4 | 59°03.240 | 063°51.990 | CTD-Rosette ↓ | 155 | 276 | 320 | 4 | 2.2 | 5.8 | 1012.1 | 79 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 11h00 | UTC-4 | 59°03.210 | 063°51.960 | CTD-Rosette ↑ | 155 | 264 | 340 | 4 | 2.5 | 5.9 | 1011.9 | 79 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 11h27 | UTC-4 | 59°03.199 | 063°49.550 | Horizontal Net Tow ↓ | 161 | 320 | Calm | Calm | 2.6 | 5.9 | N/A | 76 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 11h43 | UTC-4 | 59°03.380 | 063°50.830 | Horizontal Net Tow ↑ | 171 | 254 | Calm | Calm | 2.5 | 5.9 | 1011.8 | 76 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 12h48 | UTC-4 | 59°03.250 | 063°51.970 | Vertical Net Tow ↓ | 151 | 276 | 241 | 3 | 2.8 | 5.9 | 1011.3 | 74 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 12h58 | UTC-4 | 59°03.260 | 063°51.960 | Vertical Net Tow ↑ | 151 | 275 | 196 | 2 | 2.7 | 6.0 | 1011.2 | 74 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 13h31 | UTC-4 | 59°03.210 | 063°51.810 | Hydrobios ↓ | 152 | 191 | 213 | 3 | 2.8 | 6.0 | 1010.9 | 73 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 13h43 | UTC-4 | 59°03.210 | 063°51.690 | Hydrobios ↑ | 151 | 161 | 233 | 3 | 2.9 | 6.0 | 1010.8 | 72 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 14h05 | UTC-4 | 59°03.220 | 063°51.700 | Box Core ↓↑ | 152 | 268 | 219 | 3 | 2.8 | 6.0 | 1010.9 | 72 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 14h39 | UTC-4 | 59°03.550 | 063°50.630 | Agassiz Trawl ↓ | 160 | 263 | 247 | 4 | 2.9 | 5.9 | 1010.7 | 72 | 0/10 |
| 3c | 602 | Basic | 24/Oct/2010 | 14h44 | UTC-4 | 59°03.520 | 063°50.880 | Agassiz Trawl ↑ | 160 | 254 | 277 | 1 | 2.9 | 5.9 | 1010.7 | 72 | 0/10 |
| 3c | 604 | Nutrient | 24/Oct/2010 | 17h24 | UTC-4 | 58°59.880 | 063°53.580 | CTD-Rosette ↓ | 60 | 33 | 350 | 11 | 2.8 | 5.8 | 1010.4 | 67 | 0/10 |
| 3c | 604 | Nutrient | 24/Oct/2010 | 17h33 | UTC-4 | 58°59.880 | 063°53.590 | CTD-Rosette ↑ | 60 | 34 | 20 | 6 | 3.0 | 5.8 | 1010.4 | 65 | 0/10 |
| 3c | Nachvak Fjord | N/A | 24/Oct/2010 | 19h27 | UTC-4 | 59°06.230 | 063°24.340 | Agassiz Trawl ↓ | 185 | 230 | 240 | 10 | 1.8 | 6.0 | 1009.5 | 80 | 0/10 |
| 3c | Nachvak Fjord | N/A | 24/Oct/2010 | 19h50 | UTC-4 | 59°06.010 | 063°25.210 | Agassiz Trawl ↑ | 188 | 250 | 240 | 10 | 1.8 | 6.0 | 1009.5 | 85 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 01h38 | UTC-4 | 58°30.060 | 062°41.350 | Horizontal Net Tow ↓ | 131 | 35 | 248 | 8 | 2.0 | 6.0 | 1008.1 | 76 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 01h46 | UTC-4 | 58°30.250 | 062°41.110 | Horizontal Net Tow ↑ | 115 | 11 | 244 | 8 | 2.0 | 6.0 | 1008.1 | 76 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 02h17 | UTC-4 | 58°30.000 | 062°41.210 | Vertical Net Tow ↓ | 130 | 24 | 265 | 6 | 1.7 | 6.0 | 1007.9 | 77 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 02h26 | UTC-4 | 58°29.990 | 062°41.100 | Vertical Net Tow ↑ | 130 | 7 | 268 | 5 | 1.5 | 6.0 | 1007.9 | 77 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 02h52 | UTC-4 | 58°29.970 | 062°41.310 | Hydrobios ↓ | 130 | 250 | 260 | 7 | 2.0 | 6.0 | 1007.8 | 75 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 03h08 | UTC-4 | 58°29.870 | 062°41.240 | Hydrobios ↑ | 130 | 226 | 264 | 7 | 2.0 | 6.0 | 1007.9 | 75 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 03h27 | UTC-4 | 58°30.090 | 062°41.380 | CTD-Rosette ↓ | 132 | 231 | 269 | 7 | 1.9 | 6.0 | 1007.8 | 75 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 03h46 | UTC-4 | 58°29.940 | 062°41.250 | CTD-Rosette ↑ | 127 | 238 | 263 | 5 | 2.0 | 6.0 | 1007.7 | 75 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 04h32 | UTC-4 | 58°30.140 | 062°40.900 | Box Core ↓ | 135 | 335 | 265 | 6 | 2.0 | 6.1 | 1007.5 | 70 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 04h40 | UTC-4 | 58°30.180 | 062°40.870 | Box Core ↑ | 130 | 330 | 270 | 7 | 2.0 | 6.1 | 1007.5 | 70 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 05h19 | UTC-4 | 58°30.080 | 062°42.180 | Agassiz Trawl ↓ | 134 | 76 | 275 | 6 | 2.2 | 6.1 | 1007.5 | 70 | 0/10 |
| 3c | 617 | Basic | 25/Oct/2010 | 05h39 | UTC-4 | 58°30.090 | 062°41.210 | Agassiz Trawl ↑ | 136 | 71 | 290 | 5 | 2.4 | 6.1 | 1007.5 | 69 | 0/10 |
| 3c | 610 | Nutrient | 25/Oct/2010 | 06h37 | UTC-4 | 58°31.200 | 062°50.310 | CTD-Rosette ↓ | 124 | 335 | 20 | 4 | 1.9 | 6.0 | 1007.6 | 78 | 0/10 |
| 3c | 610 | Nutrient | 25/Oct/2010 | 06h50 | UTC-4 | 58°31.210 | 062°50.350 | CTD-Rosette ↑ | 127 | 352 | 350 | 3 | 1.9 | 6.0 | 1007.6 | 80 | 0/10 |
| 3c | N/A | Mapping | 25/Oct/2010 | 07h38 | UTC-4 | 58°29.770 | 062°54.490 | Bottom Mapping ↓ | 62 | 20 | 0 | 4 | 1.9 | 5.9 | 1007.8 | 74 | 0/10 |

| 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 | | | | | |
| 3c | 612 | CTD | 25/Oct/2010 | 09h24 | UTC-4 | 58°28.290 | 062°59.200 | CTD ↓ | 48 | 312 | Calm | Calm | 2.2 | 5.8 | 1008.1 | 75 | 0/10 |
| 3c | 612 | CTD | 25/Oct/2010 | 09h28 | UTC-4 | 58°28.120 | 062°59.250 | CTD ↑ | 48 | 325 | Calm | Calm | 2.2 | 5.8 | 1005.8 | 75 | 0/10 |
| 3c | 613 | Nutrient | 25/Oct/2010 | 10h26 | UTC-4 | 58°29.030 | 063°13.110 | CTD-Rosette ↓ | 255 | 268 | 232 | 5 | 2.6 | 5.7 | 1008.4 | 69 | 0/10 |
| 3c | 613 | Nutrient | 25/Oct/2010 | 10h44 | UTC-4 | 58°29.040 | 063°13.080 | CTD-Rosette ↑ | 255 | 228 | Calm | Calm | 2.7 | 5.7 | 1008.7 | 68 | 0/10 |
| 3c | 613 | Nutrient | 25/Oct/2010 | 11h11 | UTC-4 | 58°29.020 | 063°13.170 | Box Core ↓↑ | 255 | 250 | Calm | Calm | 3.1 | 5.7 | 1008.8 | 64 | 0/10 |
| 3c | 613 | Nutrient | 25/Oct/2010 | 11h43 | UTC-4 | 58°29.040 | 063°13.800 | Agassiz Trawl ↓ | 255 | 256 | 288 | 12 | 3.4 | 5.7 | 1008.7 | 61 | 0/10 |
| 3c | 613 | Nutrient | 25/Oct/2010 | 11h47 | UTC-4 | 58°29.000 | 063°13.930 | Agassiz Trawl ↑ | 255 | 247 | 288 | 10 | 3.4 | 5.7 | 1008.7 | 61 | 0/10 |
| 3c | 614 | CTD | 25/Oct/2010 | 13h47 | UTC-4 | 58°24.080 | 063°23.360 | CTD ↓ | 93 | 231 | 6 | 2 | 3.8 | 5.5 | 1009.3 | 58 | 0/10 |
| 3c | 614 | CTD | 25/Oct/2010 | 13h53 | UTC-4 | 58°24.070 | 063°23.390 | CTD ↑ | 94 | 248 | 42 | 3 | 4.3 | 5.5 | 1009.4 | 59 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 14h45 | UTC-4 | 58°19.180 | 063°32.450 | PNF ↓ | 129 | 265 | 281 | 6 | 4.2 | 5.6 | 1009.8 | 58 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 14h49 | UTC-4 | 58°19.180 | 063°32.450 | PNF ↑ | 135 | 255 | 246 | 7 | 4.2 | 5.6 | 1009.8 | 58 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 14h50 | UTC-4 | 58°19.180 | 063°32.440 | Secchi Disk ↓ | 134 | 248 | 279 | 10 | 4.0 | 5.6 | 1009.9 | 58 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 14h51 | UTC-4 | 58°19.180 | 063°32.440 | Secchi Disk ↑ | 128 | 234 | 284 | 11 | 4.0 | 5.6 | 1009.9 | 58 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 15h01 | UTC-4 | 58°19.160 | 063°32.440 | CTD-Rosette ↓ | 132 | 264 | 240 | 8 | 4.0 | 5.6 | 1009.9 | 58 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 15h17 | UTC-4 | 58°19.170 | 063°32.430 | CTD-Rosette ↑ | 128 | 270 | 262 | 9 | 3.9 | 5.6 | 1010.0 | 58 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 15h43 | UTC-4 | 58°19.540 | 063°31.920 | Horizontal Net Tow ↓ | 131 | 58 | 309 | 10 | 4.1 | 5.7 | 1010.3 | 59 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 15h55 | UTC-4 | 58°19.140 | 063°32.690 | Horizontal Net Tow ↑ | 135 | 37 | 310 | 14 | 3.8 | 5.7 | 1010.3 | 60 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 16h21 | UTC-4 | 58°19.160 | 063°32.560 | Vertical Net Tow ↓ | 133 | 294 | 290 | 7 | 3.7 | 5.7 | 1010.3 | 58 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 16h29 | UTC-4 | 58°19.160 | 063°32.600 | Vertical Net Tow ↑ | 134 | 293 | 300 | 13 | 3.7 | 5.7 | 1010.5 | 57 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 16h41 | UTC-4 | 58°19.160 | 063°32.590 | Hydrobios ↓ | 134 | 298 | 292 | 15 | 3.5 | 5.7 | 1010.4 | 57 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 16h53 | UTC-4 | 58°19.170 | 063°32.560 | Hydrobios ↑ | 134 | 296 | 295 | 14 | 3.4 | 5.8 | 1010.4 | 57 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 17h17 | UTC-4 | 58°18.910 | 063°32.840 | Agassiz Trawl ↓ | 126 | 33 | 303 | 17 | 3.2 | 5.8 | 1010.4 | 52 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 17h23 | UTC-4 | 58°18.980 | 063°32.640 | Agassiz Trawl ↑ | 127 | 353 | 306 | 20 | 3.0 | 5.8 | 1010.8 | 54 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 18h18 | UTC-4 | 58°20.060 | 063°31.840 | MVP ↓ | 141 | 32 | 301 | 28 | 3.2 | 5.6 | 1011.2 | 54 | 0/10 |
| 3c | 615 | Basic | 25/Oct/2010 | 21h58 | UTC-4 | 58°30.102 | 062°40.788 | MVP ↑ | 134 | 90 | 308 | 9 | 2.8 | 5.8 | 1012.2 | 67 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 08h40 | UTC-4 | 57°36.310 | 061°54.310 | PNF ↓↑ | 170 | 257 | 282 | 10 | 1.9 | 6.4 | 1017.6 | 70 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 08h45 | UTC-4 | 57°36.290 | 061°54.300 | Secchi Disk ↓↑ | 169 | 272 | 264 | 10 | 1.9 | 6.4 | 1017.6 | 70 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 09h10 | UTC-4 | 57°36.300 | 061°54.260 | CTD-Rosette ↓ | 178 | 267 | 272 | 11 | 1.9 | 6.4 | 1017.8 | 69 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 09h34 | UTC-4 | 57°36.230 | 061°54.240 | CTD-Rosette ↑ | 178 | 256 | 288 | 11 | 2.6 | 6.5 | 1018.0 | 66 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 09h54 | UTC-4 | 57°36.250 | 061°52.820 | Horizontal Net Tow ↓ | 149 | 320 | 280 | 11 | 3.0 | 6.5 | 1018.2 | 67 | 0/10 |

| 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 | | | | | |
| 3c | 633 | Basic | 26/Oct/2010 | 10h08 | UTC-4 | 57°36.550 | 061°53.300 | Horizontal Net Tow ↑ | 185 | 306 | 299 | 17 | 3.0 | 6.5 | 1018.2 | 66 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 10h30 | UTC-4 | 57°36.450 | 061°53.930 | Vertical Net Tow ↓ | 192 | 343 | 306 | 20 | 3.2 | 6.5 | 1018.2 | 62 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 10h40 | UTC-4 | 57°36.470 | 061°53.810 | Vertical Net Tow ↑ | 192 | 323 | 306 | 18 | 3.2 | 6.5 | 1018.2 | 62 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 10h54 | UTC-4 | 57°36.430 | 061°53.770 | Hydrobios ↓ | 186 | 315 | 311 | 17 | 3.4 | 6.5 | 1018.3 | 61 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 11h09 | UTC-4 | 57°36.390 | 061°53.730 | Hydrobios ↑ | 184 | 312 | 305 | 18 | 3.9 | 6.5 | 1018.4 | 60 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 12h07 | UTC-4 | 57°36.390 | 061°53.620 | Box Core ↓↑ | 176 | 330 | 316 | 14 | 3.8 | 6.6 | 1018.7 | 59 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 12h37 | UTC-4 | 57°36.250 | 061°53.890 | Agassiz Trawl ↓ | 176 | 45 | 308 | 17 | 3.7 | 6.6 | 1018.9 | 62 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | 12h41 | UTC-4 | 57°36.270 | 061°53.720 | Agassiz Trawl ↑ | 175 | 43 | 309 | 14 | 3.5 | 6.6 | 1019.0 | 63 | 0/10 |
| 3c | 633 | Basic | 26/Oct/2010 | N/A | UTC-4 | N/A | N/A | Agassiz Trawl (canceled) | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | 0/10 |
| 3c | 632 | Nutrient | 26/Oct/2010 | 14h15 | UTC-4 | 57°34.100 | 062°03.100 | CTD-Rosette ↓ | 83 | 328 | 324 | 12 | 5.2 | 6.5 | 1019.9 | 52 | 0/10 |
| 3c | 632 | Nutrient | 26/Oct/2010 | 14h27 | UTC-4 | 57°34.100 | 062°03.090 | CTD-Rosette ↑ | 83 | 309 | 332 | 16 | 4.3 | 6.5 | 1019.9 | 54 | 0/10 |
| 3c | 632 | Nutrient | 26/Oct/2010 | 14h46 | UTC-4 | 57°34.110 | 062°03.140 | Box Core ↓↑ | 83 | 317 | 323 | 11 | 4.6 | 6.5 | 1020.1 | 54 | 0/10 |
| 3c | 632 | Nutrient | 26/Oct/2010 | 15h09 | UTC-4 | 57°34.270 | 062°03.170 | Agassiz Trawl ↓ | 86 | 21 | 313 | 15 | 4.4 | 6.5 | 1020.5 | 53 | 0/10 |
| 3c | 632 | Nutrient | 26/Oct/2010 | 15h13 | UTC-4 | 57°34.340 | 062°03.060 | Agassiz Trawl ↑ | 87 | 23 | 298 | 13 | 4.4 | 6.5 | 1020.5 | 55 | 0/10 |
| 3c | 631 | Nutrient | 26/Oct/2010 | 16h37 | UTC-4 | 57°29.660 | 062°11.400 | CTD-Rosette ↓ | 87 | 261 | 270 | 10 | 2.9 | 6.3 | 1021.3 | 60 | 0/10 |
| 3c | 631 | Nutrient | 26/Oct/2010 | 16h48 | UTC-4 | 57°29.610 | 062°11.440 | CTD-Rosette ↑ | 85 | 255 | 285 | 10 | 2.7 | 6.2 | 1021.7 | 60 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 18h09 | UTC-4 | 57°28.330 | 062°26.810 | CTD-Rosette ↓ | 43 | 268 | 230 | 4 | 1.0 | 5.7 | 1022.7 | 66 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 18h19 | UTC-4 | 57°28.320 | 062°26.820 | CTD-Rosette ↑ | 43 | 263 | 306 | 3 | 1.0 | 5.7 | 1022.7 | 66 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 18h50 | UTC-4 | 57°27.730 | 062°25.100 | Horizontal Net Tow ↓ | 45 | 314 | 250 | 3 | 0.8 | 5.7 | 1022.9 | 68 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 18h58 | UTC-4 | 57°27.730 | 062°27.850 | Horizontal Net Tow ↑ | 43 | 310 | 250 | 2 | 0.6 | 5.7 | 1022.9 | 69 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 19h17 | UTC-4 | 57°28.330 | 062°26.860 | Vertical Net Tow ↓ | 43 | 290 | Calm | Calm | 0.4 | 5.7 | 1023.1 | 71 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 19h21 | UTC-4 | 57°28.330 | 062°26.880 | Vertical Net Tow ↑ | 43 | 288 | Calm | Calm | 0.4 | 5.7 | 1023.1 | 71 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 19h35 | UTC-4 | 57°28.330 | 062°26.890 | Hydrobios ↓ | 43 | 282 | 238 | 3 | 0.2 | 5.6 | 1023.2 | 69 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 19h41 | UTC-4 | 57°28.330 | 062°26.900 | Hydrobios ↑ | 43 | 283 | Calm | Calm | 0.1 | 5.6 | 1023.3 | 69 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 20h16 | UTC-4 | 57°27.200 | 062°24.250 | Agassiz Trawl ↓ | 57 | 340 | 300 | 6 | -0.2 | 5.6 | 1023.1 | 73 | 0/10 |
| 3c | 630 | Basic | 26/Oct/2010 | 20h19 | UTC-4 | 57°27.280 | 062°24.270 | Agassiz Trawl ↑ | 58 | 335 | 300 | 6 | -0.2 | 5.6 | 1023.1 | 73 | 0/10 |
| 3c | N/A | MVP | 26/Oct/2010 | 20h46 | UTC-4 | 57°27.430 | 062°24.370 | MVP ↓ | 59 | 126 | 306 | 9 | -0.1 | 5.5 | 1023.1 | 72 | 0/10 |
| 3c | N/A | MVP | 26/Oct/2010 | 23h23 | UTC-4 | 57°37.230 | 062°51.660 | MVP ↑ | 161 | 56 | 235 | 9 | -0.3 | 6.1 | 1022.6 | 76 | 0/10 |
| 3c | N/A | MVP | 27/Oct/2010 | 09h48 | UTC-4 | 56°26.152 | 061°22.677 | MVP ↓ | 125 | 270 | Calm | Calm | -0.1 | 7.2 | 1022.2 | 78 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 13h03 | UTC-4 | 56°25.120 | 062°04.260 | PNF ↓ | 56 | 65 | 68 | 9 | 0.2 | 6.5 | 1019.2 | 77 | 0/10 |

| 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 | | | | | |
| 3c | 624 | Basic | 27/Oct/2010 | 13h07 | UTC-4 | 56°25.170 | 062°04.230 | PNF ↑ | 56 | 54 | 65 | 9 | 0.2 | 6.2 | 1019.2 | 77 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 13h08 | UTC-4 | 56°25.170 | 062°04.230 | Secchi Disk ↓ | 56 | 48 | 65 | 9 | 0.2 | 6.2 | 1019.2 | 77 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 13h10 | UTC-4 | 56°25.170 | 062°04.230 | Secchi Disk ↑ | 56 | 38 | 66 | 9 | 0.2 | 6.2 | 1018.8 | 78 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 13h18 | UTC-4 | 56°25.190 | 062°04.240 | CTD-Rosette ↓ | 59 | 48 | 70 | 8 | 0.2 | 6.2 | 1018.8 | 78 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 13h27 | UTC-4 | 56°25.240 | 062°04.230 | CTD-Rosette ↑ | 62 | 74 | 66 | 7 | 0.3 | 6.2 | 1018.6 | 79 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 13h42 | UTC-4 | 56°25.650 | 062°03.420 | Horizontal Net Tow ↓ | 84 | 237 | 75 | 7 | 0.6 | 6.2 | 1018.4 | 76 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 13h49 | UTC-4 | 56°25.540 | 062°03.700 | Horizontal Net Tow ↑ | 81 | 227 | 90 | 7 | 0.6 | 6.2 | 1018.4 | 76 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 14h05 | UTC-4 | 56°25.150 | 062°04.290 | Vertical Net Tow ↓ | 54 | 50 | 51 | 6 | 0.6 | 6.1 | 1018.2 | 76 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 14h09 | UTC-4 | 56°25.150 | 062°04.260 | Vertical Net Tow ↑ | 52 | 40 | 50 | 7 | 0.6 | 6.1 | 1018.2 | 76 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 14h25 | UTC-4 | 56°25.180 | 062°04.300 | Hydrobios ↓ | 60 | 52 | 64 | 7 | 1.0 | 6.1 | 1017.9 | 75 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 14h33 | UTC-4 | 56°25.000 | 062°04.280 | Hydrobios ↑ | 60 | 55 | 68 | 6 | 1.1 | 6.1 | 1017.6 | 73 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 14h51 | UTC-4 | 56°25.680 | 062°03.420 | Agassiz Trawl ↓ | 87 | 231 | 90 | 8 | 1.4 | 6.1 | 1017.5 | 72 | 0/10 |
| 3c | 624 | Basic | 27/Oct/2010 | 14h54 | UTC-4 | 56°25.620 | 062°03.560 | Agassiz Trawl ↑ | 81 | 229 | 86 | 8 | 1.4 | 6.1 | 1017.5 | 72 | 0/10 |
| 3c | 623 | Nutrient | 27/Oct/2010 | 16h20 | UTC-4 | 56°26.800 | 061°56.470 | CTD-Rosette ↓ | 110 | 74 | 70 | 9 | 1.6 | 6.1 | 1016.3 | 74 | 0/10 |
| 3c | 623 | Nutrient | 27/Oct/2010 | 16h36 | UTC-4 | 56°26.790 | 061°56.490 | CTD-Rosette ↑ | 110 | 80 | 70 | 8 | 1.7 | 6.1 | 1016.0 | 75 | 0/10 |
| 3c | 622 | Nutrient | 27/Oct/2010 | 17h43 | UTC-4 | 56°25.010 | 061°44.020 | CTD-Rosette ↓ | 79 | 72 | 80 | 13 | 2.1 | 6.1 | 1014.9 | 80 | 0/10 |
| 3c | 622 | Nutrient | 27/Oct/2010 | 17h54 | UTC-4 | 56°25.080 | 061°44.010 | CTD-Rosette ↑ | 80 | 81 | 80 | 9 | 2.2 | 6.1 | 1014.3 | 80 | 0/10 |
| 3c | 622 | Nutrient | 27/Oct/2010 | 18h11 | UTC-4 | 56°25.070 | 061°44.030 | Box Core ↓ | 80 | 99 | 90 | 11 | 2.2 | 6.1 | 1014.0 | 80 | 0/10 |
| 3c | 622 | Nutrient | 27/Oct/2010 | 18h16 | UTC-4 | 56°25.070 | 061°44.060 | Box Core ↑ | 81 | 100 | 90 | 14 | 2.2 | 6.1 | 1014.0 | 80 | 0/10 |
| 3c | 622 | Nutrient | 27/Oct/2010 | 18h33 | UTC-4 | 56°25.210 | 061°44.160 | Agassiz Trawl ↓ | 80 | 110 | 100 | 12 | 2.2 | 6.1 | 1013.9 | 80 | 0/10 |
| 3c | 622 | Nutrient | 27/Oct/2010 | 18h44 | UTC-4 | 56°25.090 | 061°43.790 | Agassiz Trawl ↑ | 80 | 143 | 120 | 9 | 2.3 | 6.1 | 1013.9 | 79 | 0/10 |
| 3c | 621 | CTD | 27/Oct/2010 | 20h54 | UTC-4 | 56°25.000 | 061°31.170 | CTD-Rosette ↓ | 110 | 109 | 114 | 13 | 2.8 | 6.2 | 1011.5 | 79 | 0/10 |
| 3c | 621 | CTD | 27/Oct/2010 | 20h57 | UTC-4 | 56°25.000 | 061°31.140 | CTD-Rosette ↑ | 110 | 112 | 113 | 14 | 2.8 | 6.2 | 1011.5 | 79 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 21h15 | UTC-4 | 56°24.020 | 061°12.700 | CTD-Rosette ↓ | 79 | 126 | 136 | 17 | 3.1 | 6.4 | 1010.3 | 81 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 21h25 | UTC-4 | 56°24.040 | 061°12.670 | CTD-Rosette ↑ | 73 | 140 | 139 | 18 | 3.0 | 6.4 | 1010.0 | 82 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 21h40 | UTC-4 | 56°23.960 | 061°12.490 | Horizontal Net Tow ↓ | 83 | 250 | 140 | 18 | 2.8 | 6.5 | 1009.6 | 82 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 21h50 | UTC-4 | 56°23.910 | 061°13.120 | Horizontal Net Tow ↑ | 93 | 257 | 157 | 10 | 2.5 | 6.5 | 1009.7 | 81 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 22h10 | UTC-4 | 56°24.030 | 061°12.400 | Vertical Net Tow ↓ | 60 | 153 | 142 | 16 | 2.5 | 6.5 | 1009.1 | 82 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 22h15 | UTC-4 | 56°24.030 | 061°12.400 | Vertical Net Tow ↑ | 60 | 167 | 142 | 14 | 2.5 | 6.5 | 1009.1 | 82 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 22h29 | UTC-4 | 56°24.020 | 061°12.500 | Hydrobios ↓ | 80 | 159 | 135 | 16 | 2.3 | 6.5 | 1008.9 | 82 | 0/10 |

| 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 | | | | | |
| 3c | 620 | Basic | 27/Oct/2010 | 22h37 | UTC-4 | 56°24.040 | 061°12.430 | Hydrobios ↑ | 80 | 155 | 154 | 14 | 2.2 | 6.5 | 1008.5 | 84 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 23h04 | UTC-4 | 56°23.960 | 061°12.520 | Flowmeter (test) ↓ | 87 | 170 | 135 | 12 | 1.5 | 6.5 | 1008.2 | 94 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 23h36 | UTC-4 | 56°23.960 | 061°12.450 | Flowmeter (test) ↑ | 85 | 176 | 139 | 11 | 1.2 | 6.6 | 1007.4 | 97 | 0/10 |
| 3c | 620 | Basic | 27/Oct/2010 | 23h51 | UTC-4 | 56°23.960 | 061°12.450 | Box Core ↓↑ | 82 | 162 | 347 | 8 | 1.4 | 6.6 | 1006.8 | 97 | 0/10 |
| 3c | 620 | Basic | 28/Oct/2010 | 00h53 | UTC-4 | 56°23.920 | 061°12.870 | Agassiz Trawl ↓ | 85 | 236 | 133 | 19 | 1.4 | 6.6 | 1004.9 | 97 | 0/10 |
| 3c | 620 | Basic | 28/Oct/2010 | 00h58 | UTC-4 | 56°23.880 | 061°13.090 | Agassiz Trawl ↑ | 86 | 237 | 140 | 15 | 1.4 | 6.6 | 1004.9 | 97 | 0/10 |
| 3c | 620 | Basic | 28/Oct/2010 | 00h26 | UTC-4 | 56°23.860 | 061°12.940 | Box Core ↓↑ | 87 | 152 | 136 | 14 | 1.1 | 6.6 | 1005.9 | 98 | 0/10 |
| 3c | 620 | Basic | 28/Oct/2010 | 01h21 | UTC-4 | 56°23.900 | 061°12.760 | Agassiz Trawl ↓ | 88 | 237 | 150 | 15 | 1.9 | 6.6 | 1004.3 | 96 | 0/10 |
| 3c | 620 | Basic | 28/Oct/2010 | 01h26 | UTC-4 | 56°23.850 | 061°12.990 | Agassiz Trawl ↑ | 86 | 237 | 135 | 14 | 1.9 | 6.6 | 1004.3 | 96 | 0/10 |

## Appendix 3: CTD Logbook

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Leg 1a** | | | | | | | | | | | |
| 1a | 1 | St-Laurent | 2010-07-03 | 09:44 | 48°51.683 | 068°01.444 | 325 | 315 | Winch and CTD test. MVP comparison. | CTD | DB |
| 1a | 2 | Labrador Sea | 2010-07-05 | 22:24 | 54°58.328 | 056°39.821 | 182 | 167 | Bottles 9 to 11 didn't close | Zoo + Optics | DB |
| 1a | 3 | 356 | 2010-07-07 | 08:44 | 60°48.336 | 064°43.700 | 351 | 336 | No problem | Nutrients | DB |
| 1a | 4 | 354 | 2010-07-07 | 11:08 | 60°58.117 | 064°46.226 | 572 | 559 | Pump took a long time to start, had to go down to 20 meters. Had to go back down to 35 meters. | Nutrients | CH |
| 1a | 5 | 352 | 2010-07-07 | 13:35 | 61°09.030 | 064°48.305 | 410 | 400 | No problem. | Nutrients | DB |
| 1a | 6 | 362 | 2010-07-08 | 07:56 | 62°05.080 | 071°43.024 | 290 | 280 | No problem. | Nutrients | DB |
| 1a | 7 | 360 | 2010-07-08 | 11:11 | 62°25.568 | 071°04.566 | 342 | 330 | No problem. | Nutrients | CH |
| 1a | 8 | 370 | 2010-07-09 | 07:06 | 64°35.372 | 079°06.559 | 208 | 191 | No problem. | Nutrients | DB |
| 1a | 9 | 350 | 2010-07-09 | 12:13 | 64°26.704 | 080°27.940 | 388 | 371 | Basic station | Primary Prod | DB |
| 1a | 10 | 350 | 2010-07-09 | 15:44 | 64°27.730 | 080°30.803 | 376 | 370 | Basic station | Nutrients | CH |
| 1a | 11 | 710 | 2010-07-10 | 04:20 | 62°57.900 | 080°12.941 | 278 | 268 | No problem. | Nutrients | DB |
| 1a | 12 | 698 | 2010-07-10 | 16:26 | 62°06.426 | 078°42.324 | 143 | 130 | No problem. | Nutrients | CH |
| 1a | 13 | 699 | 2010-07-11 | 03:59 | 59°59.897 | 078°26.215 | 83 | 75 | Basic station | Nutrients | DB |
| 1a | 14 | 699 | 2010-07-11 | 06:55 | 60°00.025 | 078°26.222 | 83 | 73 | Basic station | Primary Prod | DB |
| 1a | 15 | 701b | 2010-07-11 | 16:45 | 58°25.101 | 079°22.045 | 111 | 100 | No problem. | Nutrients | CH |
| 1a | 16 | 720 | 2010-07-12 | 09:26 | 57°00.620 | 076°53.322 | 88 | 79 | No problem. | Nutrients | DB |
| 1a | 17 | C. Lovejoy | 2010-07-12 | 13:59 | 56°32.278 | 076°46.098 | 110 | 102 | No problem | C. Lovejoy | CH |
| 1a | 18 | 702 | 2010-07-13 | 12:04 | 55°24.680 | 077°55.852 | 134 | 126 | Full Station. AN03-09 (mooring lost) | Primary Prod | CH |
| 1a | 19 | 702 | 2010-07-13 | 16:36 | 55°25.556 | 077°55.406 | 110 | 97 | Full station. | Nutrients | CH |
| 1a | 20 | 702 | 2010-07-13 | 23:10 | 55°24.721 | 077°55.66 | 135 | 125 | Full station. AN03-10 calibration. | Micro +DMHg | DB |
| 1a | 21 | 703 | 2010-07-15 | 02:01 | 54°40.779 | 079°57.431 | 51 | 42 | No problem. | Nutrients | CH |
| 1a | 22 | 709 | 2010-07-15 | 05:25 | 54°42.710 | 080°46.812 | 88 | 83 | Basic Station. No problem. | Micro +DMHg | DB |
| 1a | 23 | 709 | 2010-07-15 | 08:10 | 54°42.779 | 080°46.877 | 93 | 83 | Basic Station. No problem. | Nutrients | DB |
| 1a | 24 | 704 | 2010-07-15 | 12:31 | 54°45.383 | 081°42.233 | 30 | 21 | No problem. Waves. | Nutrients | DB |
| 1a | 25 | 730 | 2010-07-15 | 18:09 | 55°26.880 | 080°33.304 | 95 | 87 | No problem. | Nutrients | CH |
| 1a | 26 | 735 | 2010-07-16 | 01:06 | 56°47.603 | 080°49.716 | 178 | 170 | Basic station | Micro+DMHg | CH |
| 1a | 27 | 735 | 2010-07-16 | 04:40 | 56°47.678 | 080°50.360 | 183 | 170 | Basic station | Nutrients+++ | CH |
| 1a | 28 | 745 | 2010-07-17 | 03:30 | 60°30.317 | 085°00.895 | 185 | 176 | Basic station | Nutrients+++ | DB |
| 1a | 29 | 745 | 2010-07-17 | 06:03 | 60°30.346 | 085°00.757 | 184 | 174 | Basic station | Micro +DO | DB |
| 1a | 30 | 745 | 2010-07-17 | 07:38 | 60°30.250 | 085°00.870 | 185 | 175 | Basic station | PP+DMHg+JET | DB |
| 1a | 31 | 750 | 2010-07-17 | 15:50 | 60°40.992 | 087°28.517 | 195 | 186 | Bottle 14 didn't close | Nutrients | CH |
| 1a | 32 | 760 | 2010-07-18 | 04:01 | 63°03.526 | 088°24.925 | 137 | 128 | Bottle 14 didn't close. Double chlorophyll maximum | Nutrients | DB |
| 1a | 33 | 765 | 2010-07-18 | 11:32 | 62°18.505 | 090°39.692 | 104 | 91 | Bottle 14 didn't close | DmHg+Micro+PP | CH |
| 1a | 34 | 765 | 2010-07-18 | 13:50 | 62°18.048 | 090°39.770 | 104 | 91 | No problem | Nutrients | CH |
| 1a | 35 | 770 | 2010-07-19 | 00:10 | 60°56.252 | 091°48.017 | 107 | 100 | Bottle 14 didn't close | Nutrients | DB |
| 1a | 36 | 707 | 2010-07-19 | 05:08 | 59°58.082 | 091°57.112 | 106 | 101 | No problem | Nutrients ++ | DB |
| 1a | 37 | 707 | 2010-07-19 | 09:52 | 59°58.681 | 091°56.832 | 101 | 91 | No problem. Calibration AN01-09 | Primary Prod | DB |
| 1a | 38 | 707 | 2010-07-19 | 15:55 | 59°58.625 | 091°57.140 | 101 | 93 | No problem. Calibration AN01-10 | Micro | DB |

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1a | 39 | VIP | 2010-07-20 | 22:00 | 58°54.720 | 093°57.288 | 31 | 20 | No problem | VIP | DB |
| 1a | 40 | 706 | 2010-07-21 | 13:14 | 58°47.178 | 091°31.310 | 79 | 71 | AN02-09 | Nutrients | CH |
| 1a | 41 | 706 | 2010-07-21 | 19:51 | 58°46.368 | 091°31.978 | 79 | 70 | AN02-10 | Micro+DMHg | DB |
| 1a | 42 | 705a | 2010-07-22 | 14:01 | 57°25.517 | 091°53.456 | 36 | 25 | Mouth of Nelson River | Optics | DB |

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1a | 43 | 705a | 2010-07-22 | 15:23 | 57°25.591 | 091°53.485 | 35 | 25 | Mouth of Nelson River | CTD | DB |
| 1a | 44 | 705a | 2010-07-22 | 15:26 | 57°25.595 | 091°53.490 | 35 | 25 | Mouth of Nelson River | CTD | DB |
| 1a | 45 | 705a | 2010-07-22 | 15:31 | 57°25.600 | 091°53.489 | 35 | 25 | Mouth of Nelson River | CTD | DB |
| 1a | 46 | 705a | 2010-07-22 | 16:47 | 57°25.621 | 091°53.479 | 35 | 23 | Mouth of Nelson River | Nutrients+O18+CDOM | CH |
| 1a | 47 | 705a | 2010-07-22 | 19:18 | 57°25.573 | 091°53.550 | 34 | 23 | Mouth of Nelson River | CTD | CH |
| 1a | 48 | 705a | 2010-07-23 | 11:17 | 57°25.433 | 091°53.478 | 34 | 27 | Mouth of Nelson River | Nutrients+~ ∞ | CH |
| 1a | 49 | 705b | 2010-07-23 | 17:17 | 57°34.972 | 091°20.173 | 36 | 26 | No problem | Nutrients | CH |
| 1a | 50 | 705c | 2010-07-23 | 21:03 | 57°42.347 | 090°46.080 | 40 | 31 | No problem | Nutrients | DB |
| 1a | 51 | 705 | 2010-07-24 | 10:58 | 57°40.499 | 091°34.847 | 53 | 43 | No problem | Nutrients ++ | DB |
| 1a | 52 | 705 | 2010-07-24 | 19:06 | 57°39.548 | 091°35.513 | 68 | 59 | No problem | Micro+DMHg | DB |
| 1a | 53 | Mapping | 2010-07-26 | 17:20 | 57°16.829 | 092°06.827 | 20 | 10 | Mapping calibration | CTD | DB |
| 1a | 54 | 800 | 2010-07-28 | 01:30 | 58°10.303 | 088°14.586 | 119 | 109 | No problem | Nutrients | CH |
| 1a | 55 | 795 | 2010-07-28 | 05:08 | 57°39.501 | 088°33.124 | 70 | 60 | No problem | Nutrients | CH |
| 1a | 56 | 790 | 2010-07-28 | 09:50 | 57°14.875 | 088°52.674 | 39 | 29 | No problem | Nutrients ++ | DB |
| 1a | 57 | 790 | 2010-07-28 | 11:11 | 57°15.091 | 088°53.065 | 36 | 28 | No problem | Micro+DMHg | DB |
| 1a | 58 | 810 | 2010-07-28 | 18:07 | 56°50.423 | 087°16.618 | 60 | 49 | No problem | Nutrients ++ | DB |
| 1a | 59 | 820 | 2010-07-29 | 02:35 | 55°41.610 | 084°53.340 | 53 | 45 | Big waves | Micro + DMHg | DB |
| 1a | 60 | 820 | 2010-07-29 | 04:28 | 55°41.608 | 084°54.907 | 51 | 41 | Medium Waves | Nutrients ++ | CH |
| 1a | 61 | 825 | 2010-07-29 | 08:50 | 56°10.687 | 084°36.959 | 121 | 109 | No problem | Nutrients | DB |
| 1a | 62 | 830 | 2010-07-29 | 14:00 | 56°47.178 | 084°15.406 | 163 | 157 | No problem | Nutrients | DB |
| 1a | 63 | 835 | 2010-07-29 | 18:19 | 57°30.028 | 083°52.162 | 176 | 166 | No problem | Nutrients | CH |
| 1a | 64 | 840 | 2010-07-30 | 00:04 | 58°24.590 | 083°18.174 | 176 | 166 | Basic. No problem | Nutrients ++ | CH |
| 1a | 65 | 840 | 2010-07-30 | 02:22 | 58°25.364 | 083°19.219 | 176 | 166 | Basic. No problem | Micro + DMHg | CH |
| 1a | 66 | 740 | 2010-07-30 | 14:56 | 60°22.261 | 081°58.301 | 147 | 137 | No problem | Nutrients | DB |
| 1a | 67 | 850 | 2010-07-31 | 00:46 | 62°08.072 | 081°23.989 | 208 | 198 | No problem | P. Larouche | DB |
| 1a | 68 | Core | 2010-07-31 | 05:46 | 62°39.736 | 079°27.740 | 320 | 311 | No problem | Core | DB |
| **Leg 1b** | | | | | | | | | | | |
| 1b | 69 | 301 | 2010-08-07 | 04:47 | 74°11.162 | 083°57.012 | 669 | 663 | Basic. No problem | PP+DMHg | CH |
| 1b | 70 | 301 | 2010-08-07 | 07:23 | 74°11.010 | 083°56.498 | 668 | 664 | Basic. Inconsistent pressure reading (-9200 dbar) | Nutrients | CH |
| 1b | 71 | 302 | 2010-08-07 | 16:52 | 74°09.746 | 086°10.273 | 522 | 514 | No problem | Nutrients | DB |
| 1b | 72 | 302 | 2010-08-07 | 18:46 | 74°09.684 | 086°10.517 | 521 | 100 | No problem. SonB operator | SonB | DB |
| 1b | 73 | 303 | 2010-08-08 | 00:21 | 74°13.339 | 089°36.649 | 235 | 225 | Problem with the caroussel | Nutrients+++ | DB |
| 1b | 74 | BIO | 2010-08-08 | 03:43 | 74°27.684 | 090°22.580 | 282 | 275 | BIO-10 Mooring. Lancaster Sound | CTD + Hg | DB |
| 1b | 75 | 304 | 2010-08-08 | 05:46 | 74°18.432 | 091°20.574 | 333 | 324 | No problem | Nutrients | CH |
| 1b | 76 | 305 | 2010-08-08 | 09:21 | 74°19.716 | 093°24.654 | 167 | 157 | No problem | PP+contaminants | CH |
| 1b | 77 | 305 | 2010-08-08 | 10:43 | 74°19.748 | 093°24.610 | 167 | 157 | Problems with deck unit | Nutrients+DMHg | CH |
| 1b | 78 | 310 | 2010-08-09 | 10:05 | 71°17.608 | 097°41.432 | 136 | 126 | Bottle 15 didn't close | Nutrients+++ | CH |
| 1b | 79 | 312 | 2010-08-10 | 08:07 | 69°09.679 | 100°41.712 | 47 | 47 | Communication problem with water sampler. Two data files. Second data file = bottles closed at surface | Nutrients | DB |
| 1b | 80 | 314 | 2010-08-11 | 02:08 | 69°00.181 | 106°35.968 | 112 | 102 | No problem. Last Rosette of leg 1. | Nutrients+~ ∞ | CH |
| **Leg 2a** | | | | | | | | | | | |
| 2a | 1 | BP10-018 | 2010-08-15 | 06:59 | 70°46.526 | 134°23.315 | 68 | 50 | bottle closed at 26 m: bizarre! | Nutrients | YG |

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2a | 2 | J-09 | 2010-08-15 | 18:55 | 70°54.040 | 134°16.590 | 80 | 71 | First interval 0-10 m not deleted. | CTD | AF |
| 2a | 3 | BP10-014 | 2010-08-15 | 22:15 | 70°55.380 | 134°26.620 | 101 | 89 | weak chloro. max. | Nuts+CON | JB |

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2a | 4 | BP10-015 | 2010-08-16 | 03:15 | 70°58.908 | 134°22.708 | 259 | 245 | First interval 0-10 m not deleted. Initialisation problem. | Nuts+CON | JB |
| 2a | 5 | BP10-010 | 2010-08-16 | 08:28 | 71°00.590 | 134°39.828 | 334 | 325 | Initialisation problem | Nuts+CON | JB |
| 2a | 6 | BP10-012 | 2010-08-16 | 14:57 | 70°53.576 | 134°14.872 | 80 | 71 | No problem | Nutrients | AF |
| 2a | 7 | J-10 | 2010-08-17 | 02:19 | 70°54.007 | 134°16.291 | 81 | 71 | Station name is J-09 on raw files | CTD | JB |
| 2a | 8 | BP10-009 | 2010-08-17 | 06:05 | 71°09.040 | 135°38.630 | 926 | 917 | BP dedicated cast: BP-1 | BP-1 | JB |
| 2a | 9 | BP10-009 | 2010-08-17 | 09:21 | 71°09.317 | 135°39.173 | 937 | 927 | No problem | Nutrients | AF |
| 2a | 10 | BP10-004 | 2010-08-17 | 17:07 | 70°55.302 | 134°51.924 | 258 | 248 | No problem (BP-2 cast) | BP-2 | AF |
| 2a | 11 | BP10-004 | 2010-08-17 | 13:33 | 70°55.110 | 134°51.439 | 248 | 237 | No problem | Nuts+CON | AF |
| 2a | 12 | G-09 | 2010-08-18 | 11:34 | 71°00.030 | 135°30.800 | 740 | 730 | No problem | CTD | JB |
| 2a | 13 | BP10-007 | 2010-08-19 | 04:18 | 71°05.213 | 135°35.492 | 850 | 839 | No problem (BP-3 cast) | BP-3 | JB |
| 2a | 14 | BP10-007 | 2010-08-19 | 07:52 | 71°05.020 | 135°33.910 | 848 | 848 | spikes in Oxygen profil | Nuts+CON | JB |
| 2a | 15 | BP10-005 | 2010-08-19 | 14:31 | 71°01.783 | 135°48.438 | 444 | 435 | spikes in Oxygen profil | Nuts+CON | AF |
| 2a | 16 | BP10-011 | 2010-08-21 | 03:48 | 70°51.710 | 134°46.110 | 88 | 78 | spikes in Fluorescence profil | Nuts | JB |
| 2a | 17 | BP10-001 | 2010-08-21 | 08:33 | 70°45.400 | 135°03.730 | 75 | 64 | No problem | Nuts | JB |
| 2a | 18 | BP10-002 | 2010-08-21 | 12:10 | 70°51.134 | 135°00.160 | 124 | 115 | Spikes upward. | Nuts+CON | AF |
| 2a | 19 | G-10 | 2010-08-22 | 00:56 | 71°00.319 | 135°27.502 | 689 | 679 | 2 files for LADCP | CTD | JB |
| 2a | 20 | BP10-008 | 2010-08-22 | 02:23 | 71°08.011 | 135°29.564 | 905 | 895 | 2 files for LADCP | Nuts | JB |
| 2a | 21 | H-09 | 2010-08-22 | 13:13 | 71°01.379 | 134°46.676 | 393 | 384 | No problem | CTD | AF |
| 2a | 22 | BP10-006 | 2010-08-22 | 18:49 | 70°59.887 | 135°36.628 | 711 | 703 | Nitrate sensor didn't work | Nutrients | AF |
| 2a | 23 | BP10-006 | 2010-08-22 | 22:02 | 70°59.952 | 135°36.557 | 708 | 698 | 2 files for LADCP | Hg | JB |
| 2a | 24 | BP10-016 | 2010-08-23 | 06:36 | 70°59.280 | 135°22.816 | 627 | 423 | lost CTD signal | CTD aborted | JB |
| 2a | 25 | I-09 | 2010-08-24 | 00:10 | 70°48.748 | 135°31.680 | 69 | 59 | No problem | CTD | JB |
| 2a | 26 | BP10-013 | 2010-08-24 | 01:30 | 70°49.547 | 135°34.472 | 72 | 62 | No problem | Nuts | JB |
| 2a | 27 | BP10-003 | 2010-08-24 | 07:05 | 70°57.080 | 134°58.002 | 385 | 375 | No problem(BP-4 cast) | BP-4 | JB |
| 2a | 28 | BP10-003 | 2010-08-24 | 09:26 | 70°57.148 | 134°57.409 | 379 | 370 | btl 14 did not close | Nuts | JB |
| 2a | 29 | I-10 | 2010-08-24 | 18:39 | 70°48.686 | 134°31.900 | 70 | 63 | No problem | CTD | AF |
| 2a | 30 | BP10-016 | 2010-08-25 | 01:28 | 70°59.250 | 135°22.285 | 629 | 619 | No problem(BP-5 cast) | BP-5 | JB |
| 2a | 31 | BP10-016 | 2010-08-25 | 02:37 | 70°59.134 | 135°22.525 | 628 | 618 | No problem | Nuts | JB |
| 2a | 32 | BP10-017 | 2010-08-25 | 05:10 | 71°07.064 | 135°11.606 | 726 | 716 | No problem | Nuts | JB |
| 2a | 33 | H-10 | 2010-08-25 | 10:28 | 71°00.923 | 134°40.698 | 350 | 343 | No problem | CTD | AF |
| **Leg 2b** | | | | | | | | | | | |
| 2b | 34 | USBL | 2010-09-02 | 12:11 | 71°04.428 | 135°42.770 | 893 | 884 | No problem | CTD | AF |
| 2b | 35 | B-09 | 2010-09-02 | 23:30 | 70°39.947 | 135°35.952 | 150 | 141 | No problem | CTD | JB |
| 2b | 36 | B-10 | 2010-09-04 | 16:23 | 70°39.990 | 135°35.464 | 144 | 135 | No problem | CTD | AF |
| 2b | 37 | B-09 | 2010-09-05 | 14:17 | 70°55.697 | 136°23.620 | 1007 | 997 | No nitrate probe | CTD | AF |
| 2b | 38 | F-10 | 2010-09-09 | 18:23 | 70°55.472 | 136°24.124 | 993 | 983 | No nitrate probe | CTD | JB |
| 2b | 39 | A1-09 | 2010-09-09 | 20:12 | 70°45.400 | 135°59.922 | 675 | 664 | No nitrate probe | CTD | JB |
| 2b | 40 | A1-10 A2-09 | 2010-09-11 | 16:26 | 70°46.030 | 135°59.730 | 696 | 687 | btl 15 did not close | DO | JB |
| 2b | 41 | A2-10 | 2010-09-13 | 18:25 | 70°44.032 | 135°55.164 | 566 | 557 | No problem | CTD | AF |
| 2b | 42 | CA04-10 | 2010-09-21 | 17:44 | 71°04.774 | 133°37.087 | 310 | 301 | No problem | CTD | AF |
| 2b | 43 | CA16MMP-09 | 2010-09-23 | 00:21 | 71°45.172 | 126°30.016 | 358 | 348 | No problem | CTD | JB |
| **Leg 3a** | | | | | | | | | | | |

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3a | 1 | CA16-09 | 2010-09-24 | 18:20 | 71°48.462 | 126°32.144 | 307 | 296 | Mooring recovery CA16-09 | CTD | DB |
| 3a | 2 | CA05-09 | 2010-09-24 | 22:47 | 71°19.662 | 127°35.737 | 211 | 202 | Mooring recovery CA05-09 | CTD | DB |

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3a | 3 | CA05MMP-09 | 2010-09-25 | 00:47 | 71°25.620 | 127°39.408 | 254 | 240 | Mooring recovery CA05MMP-09 | CTD | DB |
| 3a | 4 | Mapping 1 | 2010-09-26 | 14:12 | 70°45.559 | 135°08.940 | 77 | 73 | No problem | CTD | DB |
| 3a | 5 | NWBI-1 | 2010-09-28 | 23:05 | 74°40.267 | 128°32.636 | 379 | 369 | Some bottles not fired. Ice work station. | PP+Micro+Nuts | MG |
| 3a | 6 | 437 | 2010-10-01 | 02:43 | 71°46.781 | 126°32.533 | 341 | 331 | CA16-10 calibration. No problem | PP + Nuts | MG |
| 3a | 7 | 437 | 2010-10-01 | 06:18 | 71°46.997 | 126°35.842 | 356 | 349 | No problem | Micro | MG |
| 3a | 8 | 410 | 2010-10-01 | 07:36 | 71°41.851 | 126°29.478 | 410 | 401 | No problem | Nuts | DB |
| 3a | 9 | 412 | 2010-10-01 | 09:21 | 71°33.808 | 126°55.114 | 419 | 410 | Bottle 15 didn't close | Nuts | DB |
| 3a | 10 | 414 | 2010-10-01 | 10:53 | 71°25.364 | 127°21.739 | 306 | 298 | No problem | Nuts | DB |
| 3a | 11 | 416 | 2010-10-01 | 12:19 | 71°17.572 | 127°45.268 | 160 | 150 | No problem | Nuts | DB |
| 3a | 12 | 418 | 2010-10-01 | 13:36 | 71°09.836 | 128°10.170 | 65 | 55 | No problem | Nuts + PP | DB |
| 3a | 13 | CA05MMP-10 | 2010-10-01 | 18:55 | 71°24.684 | 127°41.557 | 229 | 219 | No problem | CTD | MG |
| 3a | 14 | CA16MMP-10 | 2010-10-01 | 23:58 | 71°45.407 | 126°32.696 | 367 | 358 | No problem | CTD | MG |
| 3a | 15 | Mapping 2 | 2010-10-03 | 20:22 | 70°56.486 | 134°13.170 | 144 | 135 | No problem | CTD | DB |
| 3a | 16 | Mapping 3 | 2010-10-03 | 22:55 | 70°42.697 | 135°19.094 | 88 | 79 | No problem | CTD | DB |
| 3a | 17 | 408 | 2010-10-06 | 22:32 | 71°18.707 | 127°34.813 | 175 | 165 | CA05-10 | Nuts+PP+div | DB |
| 3a | 18 | 407 | 2010-10-07 | 04:09 | 71°01.045 | 126°02.246 | 395 | 386 | CA08-10 | Nuts+pp | DB |
| 3a | 19 | 407 | 2010-10-07 | 06:56 | 71°00.476 | 125°59.947 | 395 | 385 | CA08-10 | Diversity | DB |
| **Leg 3b** | | | | | | | | | | | |
| 3b | 20 | 405 | 2010-10-08 | 14:12 | 70°38.140 | 123°02.316 | 607 | 604 | No problem | Diversity | MG |
| 3b | 21 | 405 | 2010-10-08 | 16:43 | 70°38.777 | 123°01.945 | 606 | 600 | No problem | PP | DB |
| 3b | 22 | 405 | 2010-10-08 | 20:15 | 70°39.036 | 123°02.897 | 601 | 599 | No problem | Nuts | DB |
| 3b | 23 | 450 | 2010-10-09 | 06:53 | 72°03.100 | 119°46.590 | 102 | 90 | No problem | Nuts+PP+Div | DB |
| 3b | 24 | 308 | 2010-10-11 | 02:16 | 74°06.193 | 108°24.779 | 541 | 538 | No problem | Diversity | MG |
| 3b | 25 | 308 | 2010-10-11 | 04:22 | 74°06.889 | 108°25.979 | 554 | 549 | No problem | PP+Nuts | MG |
| 3b | 26 | 304 | 2010-10-12 | 20:22 | 74°15.121 | 091°31.057 | 314 | 307 | No problem | PP+Nuts | DB |
| 3b | 27 | 304 | 2010-10-12 | 22:35 | 74°12.961 | 091°30.200 | 308 | 297 | No problem | Micro+DO | DB |
| 3b | 28 | 324 | 2010-10-14 | 16:33 | 73°52.645 | 080°10.304 | 810 | 803 | No problem | Nuts+PP+Chem | DB |
| 3b | 29 | 323 | 2010-10-14 | 20:01 | 74°11.218 | 079°46.559 | 779 | 776 | No problem | Nuts+pp | DB |
| 3b | 30 | 323 | 2010-10-14 | 23:28 | 74°11.880 | 079°44.651 | 782 | 779 | No problem | Micro | MG |
| 3b | 31 | 115 | 2010-10-15 | 23:29 | 76°20.048 | 071°11.112 | 655 | 654 | No problem | Nuts+PP+DO | MG |
| 3b | 32 | 115 | 2010-10-16 | 02:00 | 76°20.710 | 071°10.924 | 651 | 647 | No problem | Diversity | MG |
| 3b | 33 | 114 | 2010-10-16 | 06:33 | 76°19.469 | 071°46.628 | 618 | 608 | No problem | CTD | MG |
| 3b | 34 | 113 | 2010-10-16 | 08:00 | 76°19.595 | 072°13.000 | 561 | 553 | No problem | Nuts | MG |
| 3b | 35 | 112 | 2010-10-16 | 09:19 | 76°19.073 | 072°42.077 | 565 | 560 | No problem | CTD | MG |
| 3b | 36 | 111 | 2010-10-16 | 11:16 | 76°18.515 | 073°15.440 | 603 | 594 | No problem | Micro | DB |
| 3b | 37 | 111 | 2010-10-16 | 13:43 | 76°17.574 | 073°16.561 | 567 | 559 | No problem | Nuts+PP | DB |
| 3b | 38 | 110 | 2010-10-16 | 17:17 | 76°18.140 | 073°36.875 | 533 | 530 | No problem | Nuts | DB |
| 3b | 39 | 109 | 2010-10-16 | 19:34 | 76°15.955 | 074°07.100 | 448 | 434 | No problem | CTD+PP | DB |
| 3b | 40 | 108 | 2010-10-16 | 21:34 | 76°16.205 | 074°43.556 | 458 | 450 | No problem | Nuts+pp | DB |
| 3b | 41 | 108 | 2010-10-17 | 00:40 | 76°15.414 | 076°46.859 | 466 | 457 | No problem | Diversity | MG |
| 3b | 42 | 107 | 2010-10-17 | 04:26 | 76°16.421 | 075°04.151 | 426 | 413 | No problem | Nuts | MG |
| 3b | 43 | 106 | 2010-10-17 | 06:21 | 76°18.281 | 075°22.723 | 378 | 367 | No problem | CTD | MG |

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3b | 44 | 105 | 2010-10-17 | 14:39 | 76°20.260 | 075°48.948 | 336 | 326 | No problem | PP + Nuts | MG |
| 3b | 45 | 105 | 2010-10-17 | 17:09 | 76°18.863 | 075°50.959 | 322 | 313 | No problem | Diversity | MG |

| Leg | Cast# | Station | Date UTC | Time Start UTC | Latitude N | Longitude W | Bottom depth (m) | Cast depth (m) | Comments | Rosette Type | Init |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3b | 46 | 104 | 2010-10-17 | 21:57 | 76°18.982 | 076°13.707 | 169 | 162 | No problem | PP | MG |
| **Leg 3c** | | | | | | | | | | | |
| 3c | 47 | 600 | 2010-10-24 | 07:08 | 59°05.293 | 063°26.131 | 207 | 193 | bottle 21 not completely full | PP + Nuts | MG |
| 3c | 48 | 601 | 2010-10-24 | 13:04 | 59°03.106 | 063°36.133 | 170 | 156 | No problem | CTD | MG |
| 3c | 49 | 602 | 2010-10-24 | 14:43 | 59°03.239 | 063°51.959 | 154 | 141 | No problem | PP + Nuts | MG |
| 3c | 50 | 604 | 2010-10-24 | 21:25 | 58°59.872 | 063°53.610 | 60 | 53 | No problem | Nuts | MG |
| 3c | 51 | 617 | 2010-10-25 | 07:28 | 58°30.019 | 062°41.365 | 135 | 126 | No problem | PP + Nuts | MG |
| 3c | 52 | 610 | 2010-10-25 | 10:38 | 58°31.189 | 062°50.308 | 121 | 117 | No problem | Nuts | MG |
| 3c | 53 | 612 | 2010-10-25 | 13:25 | 58°28.118 | 062°59.204 | 48 | 38 | No problem | CTD | MG |
| 3c | 54 | 613 | 2010-10-25 | 14:27 | 58°29.028 | 063°13.090 | 255 | 229 | No problem | Nuts | MG |
| 3c | 55 | 614 | 2010-10-25 | 17:48 | 58°24.089 | 063°23.350 | 93 | 89 | No problem | CTD | MG |
| 3c | 56 | 615 | 2010-10-25 | 19:01 | 58°19.166 | 063°32.412 | 128 | 121 | No problem | PP + Nuts | MG |
| 3c | 57 | 633 | 2010-10-26 | 13:13 | 57°36.292 | 061°54.251 | 178 | 167 | No problem | PP + Nuts | MG |
| 3c | 58 | 632 | 2010-10-26 | 18:18 | 57°34.102 | 062°03.126 | 83 | 79 | No problem | Nuts | MG |
| 3c | 59 | 631 | 2010-10-26 | 20:38 | 57°29.654 | 062°11.381 | 85 | 80 | No problem | Nuts | MG |
| 3c | 60 | 630 | 2010-10-26 | 22:10 | 57°28.333 | 062°26.783 | 42 | 38 | No problem | PP + Nuts | MG |
| 3c | 61 | 624 | 2010-10-27 | 17:19 | 56°25.217 | 062°04.254 | 60 | 53 | No problem | PP + Nuts | MG |
| 3c | 62 | 623 | 2010-10-27 | 20:22 | 56°26.803 | 061°56.509 | 110 | 104 | No problem | Nuts | MG |
| 3c | 63 | 622 | 2010-10-27 | 21:45 | 56°25.031 | 061°44.056 | 79 | 73 | No problem | Nuts | MG |
| 3c | 64 | 621 | 2010-10-27 | 23:54 | 56°25.014 | 061°31.144 | 107 | 98 | No problem | CTD | MG |
| 3c | 65 | 620 | 2010-10-27 | 01:16 | 56°24.029 | 061°12.712 | 79 | 67 | No problem | PP + Nuts | MG |

## Appendix 4: List of Participants

| Leg | Name | Position | Affiliation | Network Investigator/supervisor | Embark place | Embark date | Disembark place | Disembark date |
|---|---|---|---|---|---|---|---|---|
| Leg 1a | Armstrong, Debbie | Research associate | University of Manitoba | Stern, Gary/Wang, Feiyue | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Bailey, Joscelyn | Msc Student | University of Manitoba | Stern, Gary | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Barber, Jeremy | Undergraduate Student | University of Manitoba | Barber, Dave | Quebec City | 2-Jul-10 | Churchill | 20-Jul-10 |
| Leg 1a | Brucker, Steve | Technician | UNB | Hughes-Clark, John | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Capelle, David | Undergraduate Student | University of Manitoba | Barber, Dave | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Courtemanche, Bruno | MSc Student | Université Laval | Lovejoy, Connie | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Curry, Michelle | Undergraduate Student | University of Manitoba | Barber, Dave | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Delaronde, Joanne | Technician | University of Manitoba | Stern, Gary | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Denommee, Kathryn | Msc Student | MUN | Bentley, Sam | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Gagnon, Jonathan | Research assistant | Université Laval | Tremblay, Jean-Éric | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Godin, Pam | Technician | University of Manitoba | Stern, Gary | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Gunn, Geoffrey | Msc Student | University of Manitoba | Barber, Dave | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Johnson, Bruce | Technician | University of Manitoba | Papakyriakou, Tim | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Koziol, Conrad | PhD student | IOS | Miller, Lisa | Quebec City | 2-Jul-10 | Churchill | 20-Jul-10 |
| Leg 1a | Lapoussière, Amandine | PDF | Université Laval | Tremblay, Jean-Éric | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Larouche, Pierre | Research Scientist | MLI-DFO | Larouche, Pierre | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Latonas, Jeffrey | Msc Student | University of Manitoba | Stern, Gary/Wang, Feiyue | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Lorrain, Stéphane | Consultant | Environment Illimitée (for Manitoba Hydro) | Barber, Dave | Churchill | 20-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | McCullough, Greg | Research associate | University of Manitoba | Barber, Dave | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Miller, Lisa | Research scientist | IOS | Miller, Lisa | Churchill | 21-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Osipa, Andrew | Undergraduate Student | University of Manitoba | Barber, Dave | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Pedneault, Estelle | Research associate | Université Laval | Lovejoy, Connie | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Stern, Gary | Chief scientist | DFO | Stern, Gary | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a | Tang, Shilin | PDF | FWI-DFO | Larouche, Pierre | Quebec City | 2-Jul-10 | Iqaluit | 2-Aug-10 |
| Leg 1a Leg 1b | Ardyna, Mathieu | MSc student | UQAR | Gosselin, Michel | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Aubry, Cyril | Technician | Université Laval | Fortier, Louis | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Baya, Anabelle | PhD student | Trent University | Hintelmann, Holger | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Boisvert, Dominique | Technician | INRS | Gratton, Yves | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Dupuis, Vincent | Technician | Université Laval | Michaud, Luc | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Elhegazy, Hesham | Msc Student | UNB | Hughes-Clark, John | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Falardeau, Marianne | Technician | Université Laval | Fortier, Louis | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Ferland, Joannie | Research assistant | UQAR | Gosselin, Michel | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Fontaine, Anne | PhD student | UQAR | Archambault, Philippe | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Gagné, Steeve | Technician | Université Laval | Michaud, Luc | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Gagnon, Sylvain | Technician | Université Laval | Michaud, Luc | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Hamel, Camil | Technician | INRS | Gratton, Yves | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Muggah, James | Msc Student | UNB | Hughes-Clark, John | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |

| Leg | Name | Position | Affiliation | Network Investigator/supervisor | Embark place | Embark date | Disembark place | Disembark date |
|---|---|---|---|---|---|---|---|---|
| Leg 1a Leg 1b | Perreault, Marie-Claude | Technician | Université Laval | Fortier, Louis | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Pind, Meredith | Technician | University of Manitoba | Papakyriakou, Tim | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Roger, Jonathan | MSc Student | Université Laval | Lajeunesse, Patrick | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Rousseau, Claudia | MSc Student | Université Laval | Lajeunesse, Patrick | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1a Leg 1b | Roy, Virginie | PhD student | UQAR | Archambault, Philippe | Quebec City | 2-Jul-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Adamson, Sheena | Program Leader | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Akana, Suzannah | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Barber, Lucette | Program Leader | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Bergeron, Myriam | MSc student | Université Laval | Tremblay, Jean-Éric | Iqaluit | 2-Aug-10 | Sachs Habour | 12-Aug-10 |
| Leg 1b | Bruce, Kayla | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Cormier, Marc-André | MSc student | UQAR | Rochon, André | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | De Angelis, Vince | MCP engineer | Govt. Canada | Julien, Stéphane | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Gawor, Anna | Msc Student | University of Toronto | Jantunen, Liisa | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | George, Jane | Journalist | Iqaluit media | Fortier, Martin | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Hill, Ken | MCP engineer | Govt. Canada | Julien, Stéphane | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Kazlowski, Steven | Photographer | ArcticNet | Levesque, Keith | Iqaluit | 2-Aug-10 | Kugluktuk | 12-août-10 |
| Leg 1b | Le Blanc, Catherine | MCP engineer | Govt. Canada | Julien, Stéphane | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Lehnherr, Igor | Post-Doctoral Fellow | University of Alberta | St. Louis, Vincent | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Martel, Karine | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Miller-Anderson, Kelcie | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Moreau, Jeremy | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | O'Connell, Katharine | Teacher | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | O'Neil, Daniel | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Pineault, Simon | MSc student | Université Laval | Tremblay, Jean-Éric | Iqaluit | 2-Aug-10 | Sachs Habour | 12-Aug-10 |
| Leg 1b | Rochon, André | Chief scientist | UQAR | Rochon, André | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Vlanich, John | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Watters, Baruch | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Wong, Fiona | PhD student | University of Toronto | Jantunen, Liisa | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 1b | Zhou, Linghong (Linda) | Student | SonB | Barber, Lucette | Iqaluit | 2-Aug-10 | Kugluktuk | 12-Aug-10 |
| Leg 2a | Archambault, Philippe | Professor | UQAR | Archambault, Philippe | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Bergeron, Myriam | MSc student | Université Laval | Tremblay, Jean-Éric | Iqaluit | 13-Aug-10 | Sachs Habour | 26-Aug-10 |
| Leg 2a | Blaseckie, Mark | Contaminant Sampling | Axys Analytical | Lowings, Malcolm | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Bouchard, Caroline | PhD student | Université Laval | Fortier, Louis | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Cadieux, Marc | PhD student | University of Manitoba | Stern, Gary | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Carpenter, Robin | Marine wildlife monitor | IMG- Golder | Lowings, Malcolm | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Chaulk, Amanda | MSc Student | University of Manitoba | Stern, Gary/Wang, Feiyue | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Cote, Jessica | Moorings | IMG- Golder | Lowings, Malcolm | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Coughlin, Tom | Contaminant Sampling | IMG- Golder | Lowings, Malcolm | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Cusson, Mathieu | Professor | UQAC | Archambault, Philippe | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |

| Leg | Name | Position | Affiliation | Network Investigator/supervisor | Embark place | Embark date | Disembark place | Disembark date |
|---|---|---|---|---|---|---|---|---|
| Leg 2a | Doxey, David | MARU Deployment | Cornell University | Pyć, Cynthia | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Fortier, Martin | Chief scientist | ArcticNet | Fortier, Martin | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Galley, Ryan | Research Associate | University of Manitoba | Barber, Dave | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Grant, Cindy | Technician | UQAR | Archambault, Philippe | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Gratton, Yves | Research scientist | INRS | Gratton, Yves | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Lemes, Marcos | PhD student | University of Manitoba | Stern, Gary/Wang, Feiyue | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Lévesque, Mélanie | Technician | UQAR | Archambault, Philippe | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | MacHutchon, Allison | Technician | University of Manitoba | Stern, Gary | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Mortimer, James | Contaminant / Mooring | IMG- Golder | Lowings, Malcolm | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Pineault, Simon | MSc student | Université Laval | Tremblay, Jean-Éric | Iqaluit | 13-Aug-10 | Sachs Habour | 26-Aug-10 |
| Leg 2a | Pyć, Cynthia | Project Manager | BP | Pyć, Cynthia | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Robert, Dominique | Research fellow | Université Laval | Fortier, Louis | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Sampei, Makoto | Research associate | Université Laval | Fortier, Louis | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Stainton, Emmelia | Research Associate | University of Manitoba | Papakyriakou, Tim | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Suzuki, Keita | Postdoctoral fellow | Université Laval | Fortier, Louis | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a | Warner, Kerri | MSc student | University of Manitoba | Barber, Dave | Kugluktuk | 12-Aug-10 | Sachs Harbour | 26-Aug-10 |
| Leg 2a Leg 2b | Babb, David | MSc student | University of Manitoba | Barber, Dave | Kugluktuk | 12-Aug-10 | Paulatuk | 23-Sep-10 |
| Leg 2a Leg 2b | Barette, Jessy | Technician | INRS | Gratton, Yves | Kugluktuk | 12-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2a Leg 2b | Cartwright, Doug | EM-302 Operator | UNB | Hughes-Clark, John | Kugluktuk | 12-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2a Leg 2b | Church, Ian | EM-302 Operator | UNB | Hughes-Clark, John | Kugluktuk | 12-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2a Leg 2b | Elias, James | Marine wildlife monitor | IMG- Golder | Lowings, Malcolm | Kugluktuk | 12-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2a Leg 2b | Forest, Alexandre | Postdoctoral fellow | INRS | Gratton, Yves | Kugluktuk | 12-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2a Leg 2b | Jardine, Scott | HSSE | RPS | BP | Kugluktuk | 12-Aug-10 | Paulatuk | 23-Sep-10 |
| Leg 2a Leg 2b | Johnson, Bruce | Technician | University of Manitoba | Papakyriakou, Tim | Kugluktuk | 12-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2a Leg 2b | Levesque, Keith | Research coordinator | ArcticNet | Fortier, Martin | Kugluktuk | 12-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2a Leg 2b | Lowings, Malcolm | Technical Team Leader | IMG- Golder | Pyć, Cynthia | Kugluktuk | 12-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2a Leg 2b | Massot, Pascal | Technician | Université Laval | Michaud, Luc | Kugluktuk | 12-Aug-10 | Paulatuk | 23-Sep-10 |
| Leg 2a Leg 2b | Memorana, Roger | Marine wildlife monitor | IMG- Golder | Lowings, Malcolm | Kugluktuk | 12-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2a Leg 2b | Michaud, Luc | Equipment manager | Université Laval | Michaud, Luc | Kugluktuk | 12-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2a Leg 2b | Simard, Pierre-Yves | Technician | Université Laval | Michaud, Luc | Kugluktuk | 12-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2a Leg 2b | Stacey, Michele | Marine wildlife monitor | IMG- Golder | Lowings, Malcolm | Kugluktuk | 12-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Baker, Dee | Geotechnical Engineer | Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Bennett, Robbie | Technician | GSC | Blasco, Steve | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Blasco, Katie | Research assistant | GSC | Blasco, Steve | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Blasco, Steve | Chief scientist | NRCan | Blasco, Steve | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Borghouts, Dennis | T-Bar Operator | Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Breton, Kerry | Research assistant | GSC | Blasco, Steve | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Buis, Justin | Technician | GSC | Blasco, Steve | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Commandeur, Sven | Msc student | UNB | Hughes-Clark, John | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |

| Leg | Name | Position | Affiliation | Network Investigator/supervisor | Embark place | Embark date | Disembark place | Disembark date |
|---|---|---|---|---|---|---|---|---|
| Leg 2b | Curtiss, Greg | Met-Ocean & Moorings | IMG-Golder | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Day, Justin | Lead Surveyor | Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | De Pascale, Greg | Marine Geoscientist | SBP Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Dingler, Jeff | Project Manager | BP | BP | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Fougere, Lee | Geotechnical Engineer | Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Garven, Elizabeth | Geotechnical Engineer | Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Jarrett, Kate | Technician | GSC | Blasco, Steve | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | McKillop, Kevin | Technician | GSC | Blasco, Steve | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Middleton, Greg | Technician | GSC | Blasco, Steve | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Murdock, Ian | ROV Pilot | CSSF | Juniper, Kim | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Osborne, Phil | Met-Ocean & Moorings | IMG-Golder | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Park, Tim | Geotechnical Engineer | Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Powell, Robert | Lead Geotechnical Engineer | Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Sanchez, Jose | Msc student | UNB | Hughes-Clark, John | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 23-Sep-10 |
| Leg 2b | Sanford, Nathan | Surveyor | Fugro | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b | Zottenberg, Katelyn | Marine wildlife monitor | IMG-Golder | Lowings, Malcolm | Sachs Harbour | 26-Aug-10 | Sachs Harbour | 22-Sep-10 |
| Leg 2b Leg 3a | Morgan, Sally | MSCL Operator | ArcticNet | Fortier, Martin | Sachs Harbour | 26-Aug-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Babb, David | MSc student | University of Manitoba | Barber, Dave | Kugluktuk | 24-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Blasco, Katie | GIS tech | ArcticNet | Fortier, Louis | Sachs Harbour | 24-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Channel, Fred | MARU Deployment | Cornell University | Pyć, Cynthia | Kugluktuk | 22-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Galley, Ryan | Research Associate | University of Manitoba | Barber, Dave | Sachs Harbour | 23-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Holub, Curtis | Research associate | Exxon Upstream Research | Jardine, Scott | Sachs Harbour | 22-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Illasiak, Joseph | Wildlife monitor | ArcticNet | Fortier, Martin | Sachs Harbour | 23-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Jardine, Scott | HSSE | RPS | IORVL | Kugluktuk | 24-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Komarov, Alexander | PhD student | University of Manitoba | Barber, Dave | Sachs Harbour | 23-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Levesque, Keith | Chief scientist | ArcticNet | Fortier, Martin | Sachs Harbour | 23-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Massot, Pascal | Technician | Université Laval | Michaud, Luc | Kugluktuk | 24-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Matskevich, Dmitri | Research Team leader | Exxon Upstream Research | Jardine, Scott | Sachs Harbour | 22-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Ouellet, Jean | Technician | Université Laval | Michaud, Luc | Sachs Harbour | 23-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a | Warner, Kerri | MSc student | University of Manitoba | Barber, Dave | Sachs Harbour | 23-Sep-10 | Paulatuk | 7-Oct-10 |
| Leg 3a Leg 3b | Asplin, Matthew | PhD student | University of Manitoba | Barber, Dave | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b | Davidson, Michael | Media | Discovery Channel | Fortier, Martin | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b | Gagné, Steeve | Technician | Université Laval | Michaud, Luc | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b | Gagnon, Jonathan | Research assistant | Université Laval | Tremblay, Jean-Éric | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b | Hall, Colin | Media - Camera Assist | Discovery Channel | Fortier, Martin | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b | Loo, Ao | Media - Sound Man | Discovery Channel | Fortier, Martin | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b | Medrinal, Emmanuelle | PhD student | Université Laval | Lovejoy, Connie | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b | Patton, Eric | Technician | GSC | Blasco, Steve | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |

| Leg | Name | Position | Affiliation | Network Investigator/supervisor | Embark place | Embark date | Disembark place | Disembark date |
|---|---|---|---|---|---|---|---|---|
| Leg 3a Leg 3b | Swystun, Kyle | Msc student | University of Manitoba | Papakyriakou, Tim | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b | Thaler, Mary | PhD student | Université Laval | Lovejoy, Connie | Sachs Harbour | 23-Sep-10 | Iqaluit | 22-Oct-10 |
| Leg 3a Leg 3b Leg 3c | Blais, Marjolaine | Technician | UQAR | Gosselin, Michel | Sachs Harbour | 23-Sep-10 | Quebec City | 2-Nov-10 |
| Leg 3a Leg 3b Leg 3c | Boisvert, Dominique | Technician | INRS | Gratton, Yves | Sachs Harbour | 23-Sep-10 | Quebec City | 2-Nov-10 |
| Leg 3a Leg 3b Leg 3c | Cloutier, Hélen | Technician | Université Laval | Fortier, Louis | Sachs Harbour | 23-Sep-10 | Québec | 2-Nov-10 |
| Leg 3a Leg 3b Leg 3c | Ferland, Joannie | Research assistant | UQAR | Gosselin, Michel | Sachs Harbour | 23-Sep-10 | Quebec City | 2-Nov-10 |
| Leg 3a Leg 3b Leg 3c | Geoffroy, Maxime | Msc student | Université Laval | Fortier, Louis | Sachs Harbour | 23-Sep-10 | Quebec City | 2-Nov-10 |
| Leg 3a Leg 3b Leg 3c | Gervais, Mélissa | Technician | INRS | Gratton, Yves | Sachs Harbour | 23-Sep-10 | Quebec City | 2-Nov-10 |
| Leg 3a Leg 3b Leg 3c | Hamilton, Travis | EM-302 Operator | UNB | Hughes-Clark, John | Sachs Harbour | 23-Sep-10 | Quebec City | 2-Nov-10 |
| Leg 3a Leg 3b Leg 3c | Kuus, Pim | EM-302 Operator | UNB | Hughes-Clark, John | Sachs Harbour | 23-Sep-10 | Quebec City | 2-Nov-10 |
| Leg 3b | Chytil, Damir | Media | Polar Cap Productions | Fortier, Martin | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b | Huard, David | PDF | University McGill | Tremblay, Bruno | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b | McNamee, Steven | Media | Polar Cap Productions | Fortier, Martin | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b | Olivier, Frédéric | Professor | UQAR | Archambault, Philippe | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b | Regan, Christopher | DFO engineer | DFO | Julien, Stéphane | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b | Routhier, Michel | DFO engineer | DFO | Julien, Stéphane | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b | Terry, Marc | Media | Polar Cap Productions | Fortier, Martin | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b | Tremblay, Bruno | Professor | University McGill | Tremblay, Bruno | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b | Tremblay, Jean-Éric | Chief scientist | Université Laval | Tremblay, Jean-Éric | Paulatuk | 7-Oct-10 | Iqaluit | 22-Oct-10 |
| Leg 3b Leg 3c | Dupuis, Vincent | Technician | Université Laval | Michaud, Luc | Paulatuk | 7-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3b Leg 3c | Fontaine, Anne | PhD student | UQAR | Archambault, Philippe | Paulatuk | 7-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3b Leg 3c | Roy, Virginie | PhD student | UQAR | Archambault, Philippe | Paulatuk | 7-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3c | Bell, Trevor | Professor | Memorial University | Bell, Trevor | Iqaluit | 22-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3c | Brown, Tanya | PhD Student | University of Victoria / RMC | Reimer, Ken/Ross, Peter | Iqaluit | 22-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3c | Carpenter, Mallory | Msc student | Memorial University | Bell, Trevor | Iqaluit | 22-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3c | Estrada, Esteban | Research Associate | RMC | Reimer, Ken | Iqaluit | 22-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3c | Gara, James | PhD student | UQAR | Gosselin, Michel | Iqaluit | 22-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3c | Gosselin, Michel | Chief scientist | UQAR | Gosselin, Michel | Iqaluit | 22-Oct-10 | Quebec City | 2-Nov-10 |
| Leg 3c | Ouellet, Jean | Technician | Université Laval | Michaud, Luc | Iqualuit | 22-Oct-10 | Quebec City | 2-Nov-10 |