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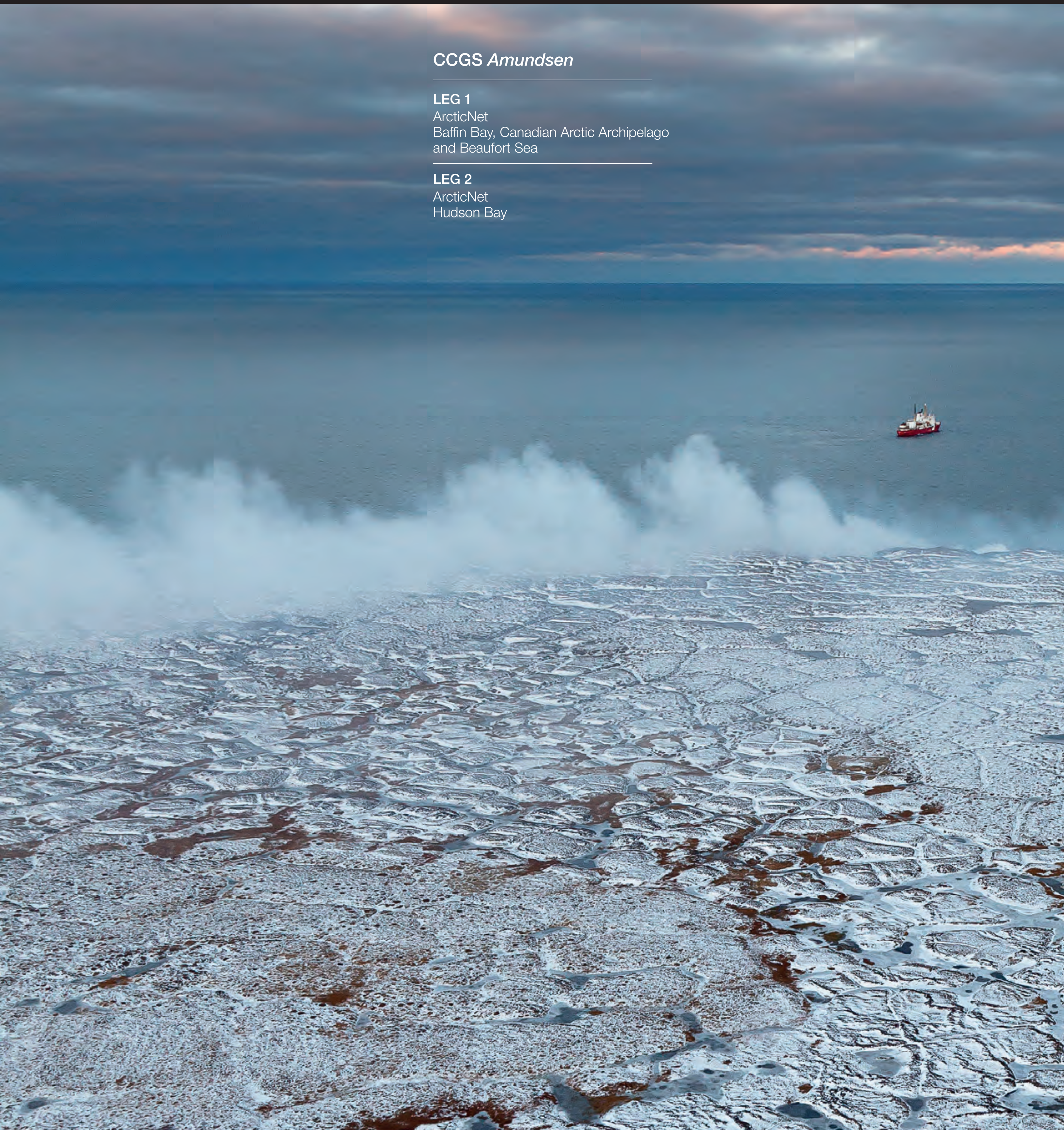
20**05** | Expedition Report

CCGS *Amundsen*

LEG 1
ArcticNet
Baffin Bay, Canadian Arctic Archipelago
and Beaufort Sea

LEG 2
ArcticNet
Hudson Bay



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AMUNDSEN
BRISE-GLACE DE RECHERCHE CANADIEN
CANADIAN RESEARCH ICEBREAKER

Table of content

List of figures

PART I – OVERVIEW AND SYNOPSIS OF OPERATIONS

PART II – PROJECT REPORTS

List of tables

PART II – PROJECT REPORTS

2005 Expedition Report

The 2005 Expedition Report is a collection of all cruise reports produced by the participating research teams and assembled by the Chief Scientists at the end of Legs 1 and 2 of the ArcticNet Expedition on board the CCGS *Amundsen*. The 2005 Expedition Report is divided into two parts:

Part I provides an overview of the expedition, the ship track and the stations visited, and a synopsis of operations conducted during each of the two legs.

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 2005. The data presented in this report are illustrative only and have not been quality controlled, thus parties interested in the results should contact the project leader or the researchers who collected the data.

Project reports in Part II are organized according to research topics. The first project presents the core data and information collected onboard the *Amundsen* (pages 21 to 25). Projects 2 to 5 (pages 26 to 48) cover topics of atmosphere, atmosphere-ocean processes and sea ice. Projects 6 to 10 (pages 49 to 95) cover topics of water column structure, ocean circulation and the physical properties of seawater. Geochemical cycling, biogeochemical processes, and biological productivity are treated in projects 11 to 19 (pages 96 to 150). Projects 20 and 21 present the marine mammals and seabird surveys (pages 151 to154). Seabed mapping and geology are covered in projects 22 and 23 (pages 155 to 174) and finally, a report from the Schools on Board outreach program is presented in project 24 (pages 175 to 178).

The 2005 Expedition Report also includes four appendices: 1) the list of stations sampled, 2) the scientific log of activities conducted, 3) a copy of the CTD logbook and 4) the list of participants onboard during each leg.

The core navigation data (NAV) and meteorological information (AVOS) as well as oceanographic data collected using the CTD-Rosette, the Moving Vessel Profiler (MVP), the ship-mounted current profiler (SM-ADCP) and the thermosalinograph (TSG) are available in the Polar Data Catalogue (PDC) at www.polardata.ca.

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

Part I – Overview and synopsis of operations

1 Overview of the 2005 ArcticNet/*Amundsen* Expedition

1.1 Introduction

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

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

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

In 2005, as part of the ArcticNet the marine-based research program (see Phase 1 projects at www.arcticnet.ulaval.ca/Research/Phase 1), the CCGS *Amundsen* Expedition revisited the sites of major scientific programs in Baffin Bay (NOW Polynya), Beaufort Sea (CASES), Hudson Bay and the Canadian Arctic Archipelago (Figure 1.1).

1.2 Regional settings

Baffin Bay is located between Baffin Island and Greenland and connects the Arctic Ocean and the Northwest Atlantic, providing an important pathway for exchange of heat, salt and other properties between these two oceans (Figure 1.2). In the south, Davis Strait, which is over 300 km wide and 1000 m deep, connects it with the Atlantic but Baffin Bay's direct connection to the Arctic Ocean consists of three relatively small passages through the islands of the Canadian Arctic Archipelago (CAA). Arctic water also enters Baffin Bay/Davis

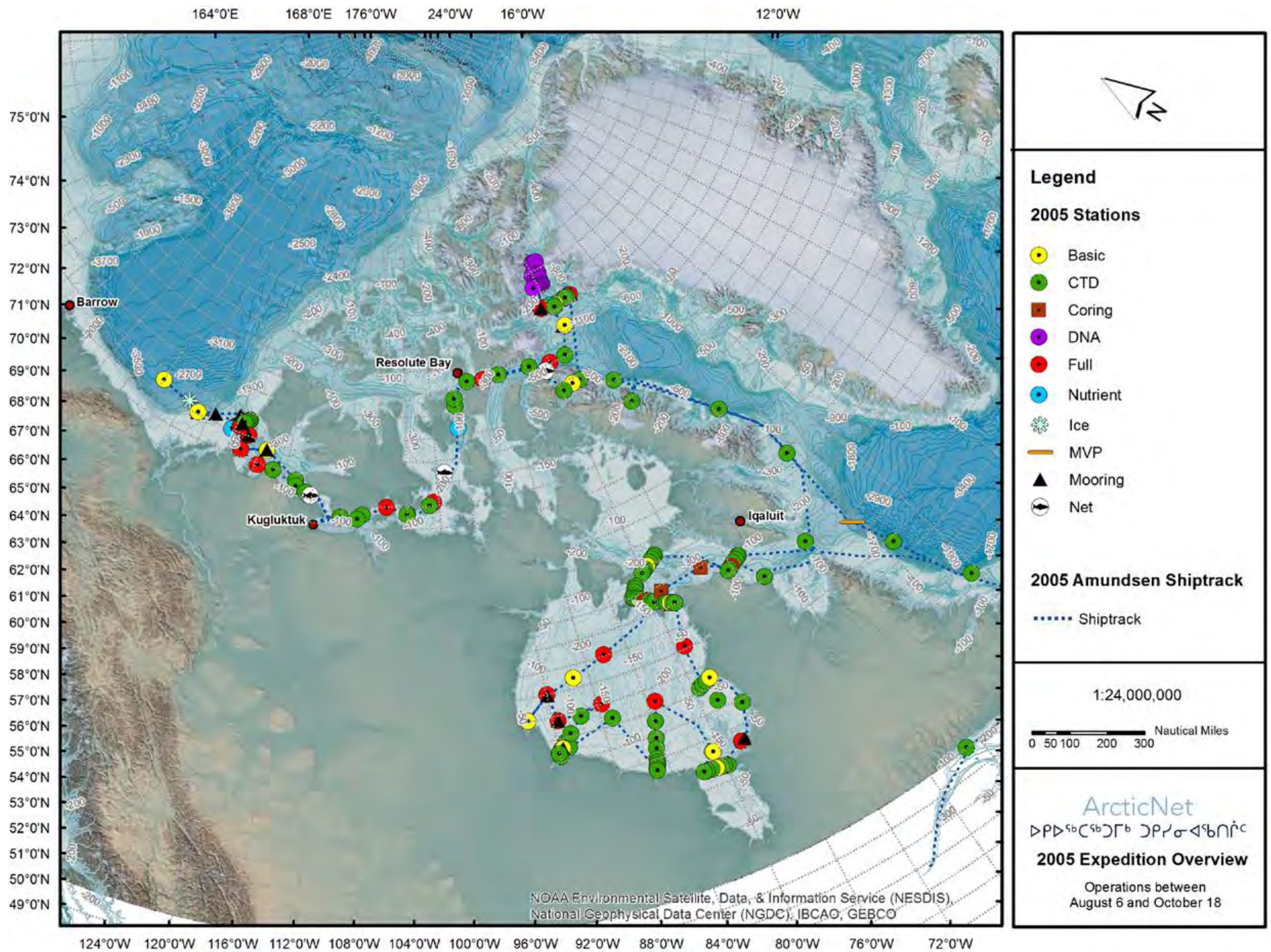

Figure 1.1. Map of the Canadian High Arctic and Hudson Bay showing the CCGS *Amundsen* ship track and the location of stations for the two legs of the 2005 ArcticNet Expedition. Leg 1 sampling sites were located in Baffin Bay, the Northwest Passage and the Beaufort Sea. Leg 2 took place in Hudson Bay, with activities in Foxe Basin and Hudson Strait.

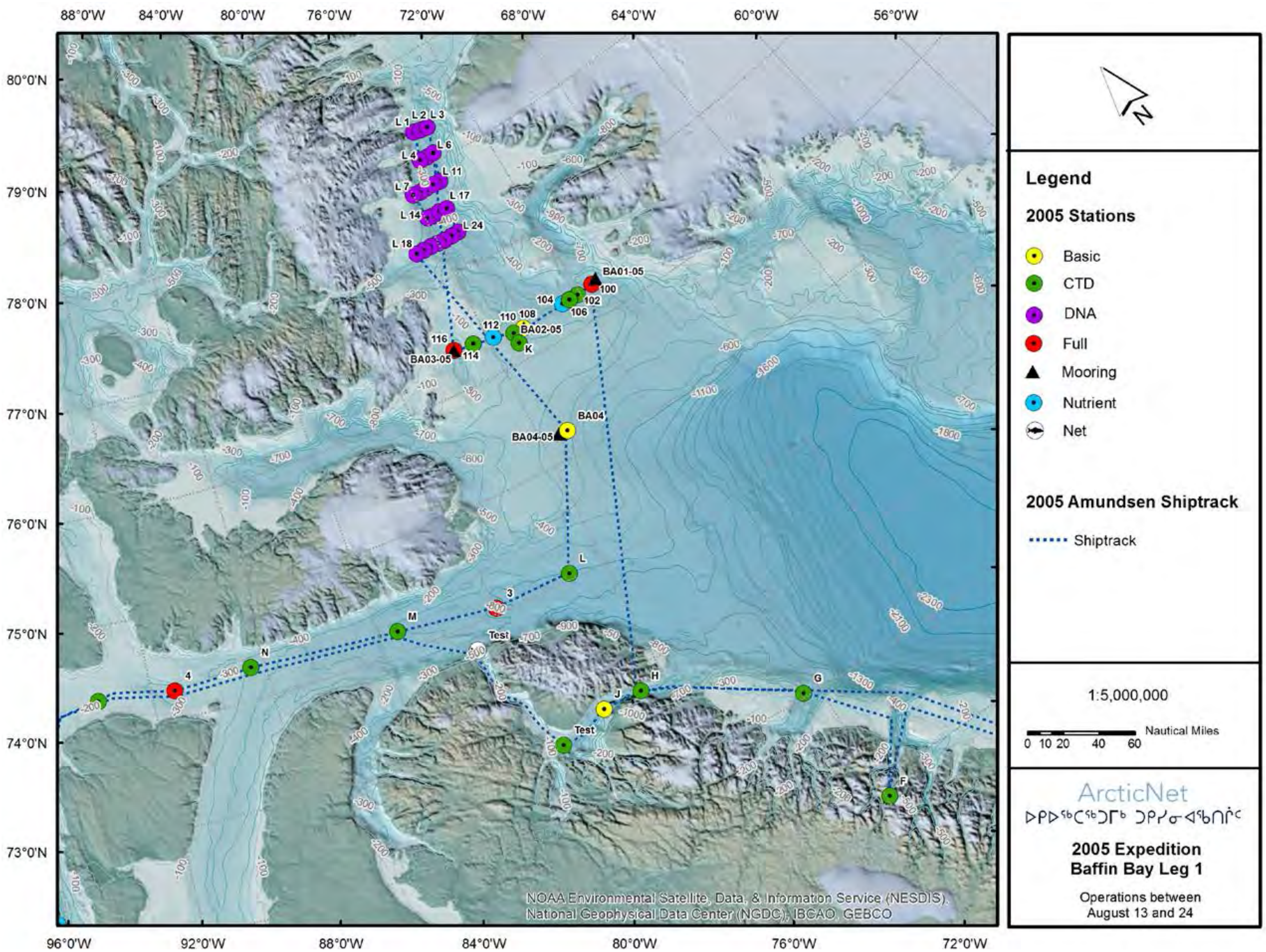

Figure 1.2. Map of northern Baffin Bay, Nares Strait and Lancaster Sound showing the ship track and the location of stations sampled by the CCGS *Amundsen* during Leg 1 of the 2005 ArcticNet Expedition.

Strait via the West Greenland Current, which flows northward along the western coast of Greenland. Melting ice sheets, changing sea ice conditions and changing weather also influence oceanographic conditions in Baffin Bay and Davis Strait.

Located in northern Baffin Bay, between Ellesmere Island and Greenland, the North Water (NOW) Polynya is a large, year-round expanse of open water. North Water is the largest (~80,000km^2) and most productive polynya in the Canadian Arctic and, in addition to the tremendous marine bird resources in this area, it is of significance to many species of marine mammals. The NOW polynya has been the subject of a few ecosystem studies, including the Canadian-led study of the NOW Polynya in 1998. In Baffin Bay, the *Amundsen* served as a research platform to sample at and around the site of the NOW Polynya, visit a series of stations along an east-west transect across the Bay and deploy instrumented moorings that will monitor the meteorology and oceanography of region during the following year.

The Canadian Arctic Archipelago (CAA) is a vast array of islands and channels that lies between Baffin and Ellesmere Islands in the east and Banks Island in the west (Figure 1.3). While transiting through the Northwest Passage, the science teams aboard the *Amundsen* sampled the atmosphere, sea ice and ocean to extend existing time series. This work is aimed at better understanding how the climate, ice conditions and ocean currents and biogeochemistry are changing under the effects of climate change. With diminishing sea ice extent and volume in the Arctic, the Northwest Passage may be ice-free and open to navigation during summer in the near future. Seafloor bathymetry data and sub-bottom information were collected while transiting through the Northwest Passage to map the seafloor and identify potential geohazards and obstacles to the safe navigation of this new seaway.

At the western end of the CAA lies Amundsen Gulf, which widens into the Beaufort Sea past Banks Island. The Canadian Beaufort Sea (Figure 1.4) is characterized by a broad shelf onto which the Mackenzie River, the largest river in North America, carries large amounts of freshwater. The mixing of freshwater from the Mackenzie River and Arctic marine waters of the Beaufort Sea establishes an estuarine system over the shelf, with associated inputs of land-derived nutrients and freshwater biota. The Mackenzie Shelf is covered with ice from October until May to early August. Throughout winter, floe rafting at the edge of the landfast ice builds a stamukhi, a thick ice ridge parallel to the coast. Beyond the stamukhi, a flaw polynya stretches along the entire Shelf and widens in summer to form the Cape Bathurst polynya. The Cape Bathurst polynya hosts two distinct phytoplankton blooms per year, with one peak occurring during spring or early summer, and a second occurring in late summer or fall. This highly productive ecosystem is also exceptional since it provides habitat for some of the highest densities of birds and marine mammals in the Arctic. The Mackenzie Shelf system was extensively studied during the Canadian Arctic Shelf Exchange Study (CASES) in 2003-2004, a Canadian-led international

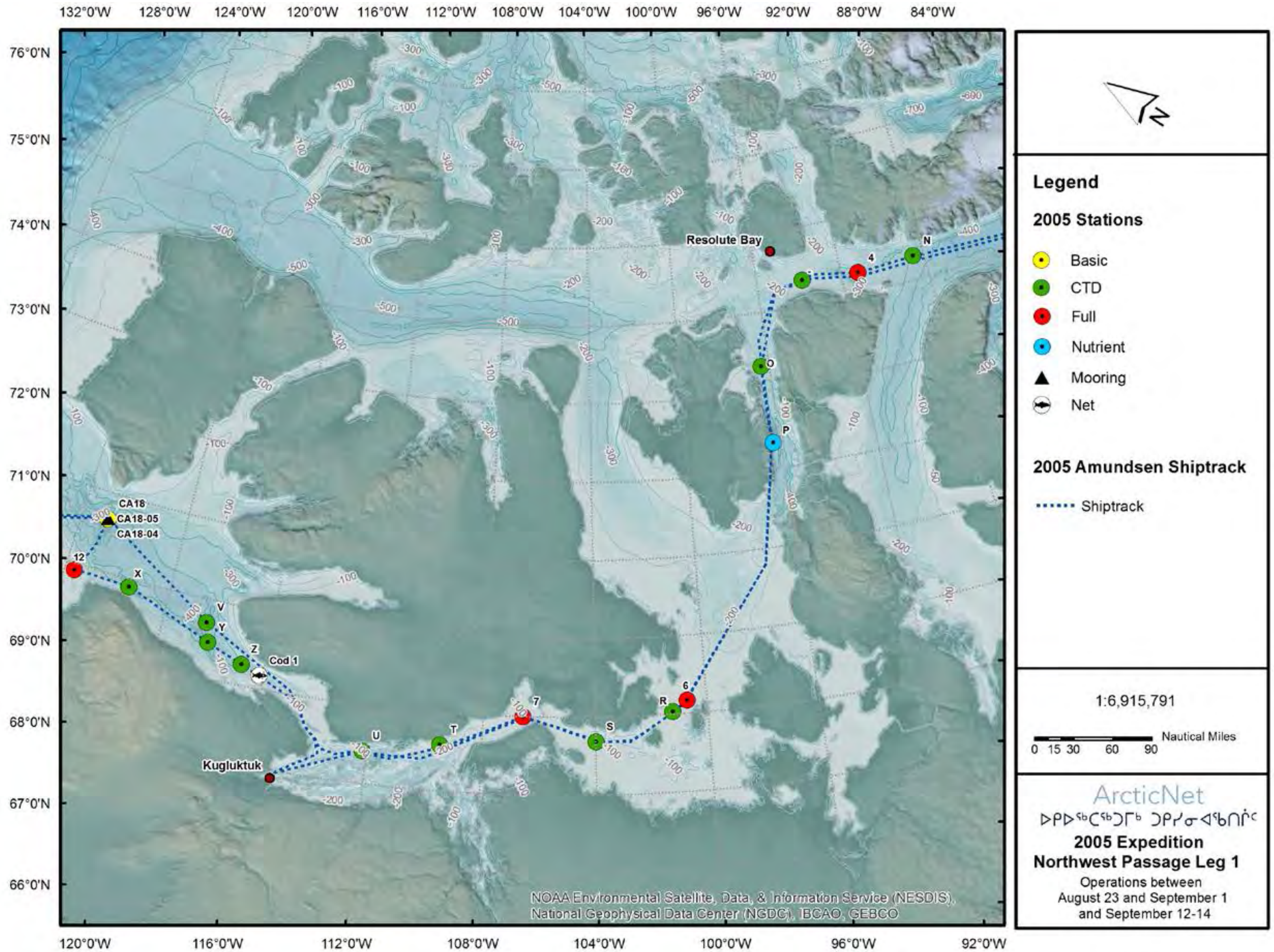

Figure 1.3. Map of the Canadian Arctic Archipelago (Northwest Passage) showing the ship track and the location of stations sampled by the CCGS *Amundsen* during Leg 1 of the 2005 ArcticNet Expedition. The map also shows the eastward trip back through the Northwest Passage during Leg 2 (12-14 September).

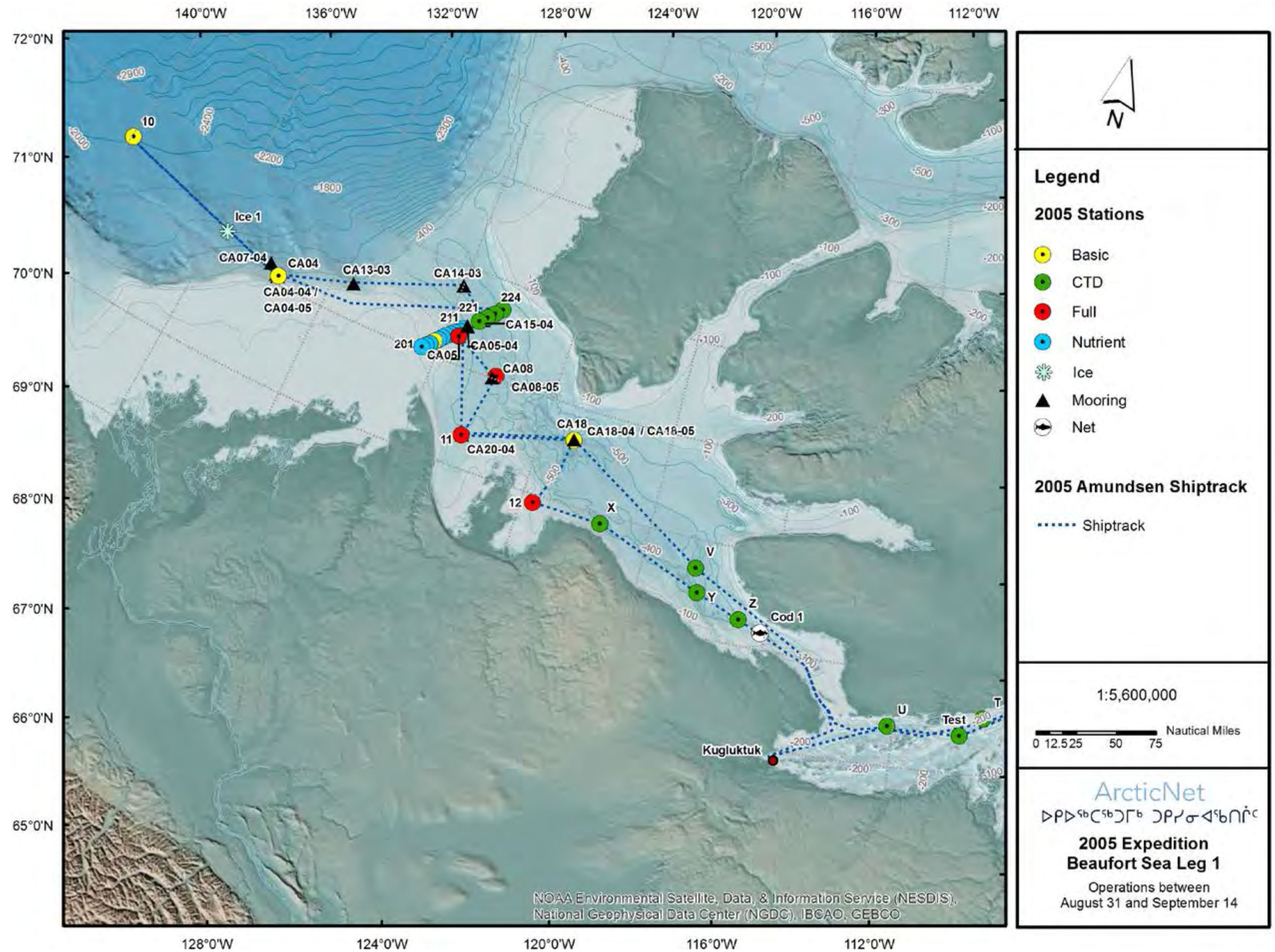

Figure 1.4. Map of the Amundsen Gulf and Beaufort Sea showing the ship track and the location of stations sampled by the CCGS *Amundsen* during Leg 1 of the 2005 ArcticNet Expedition.

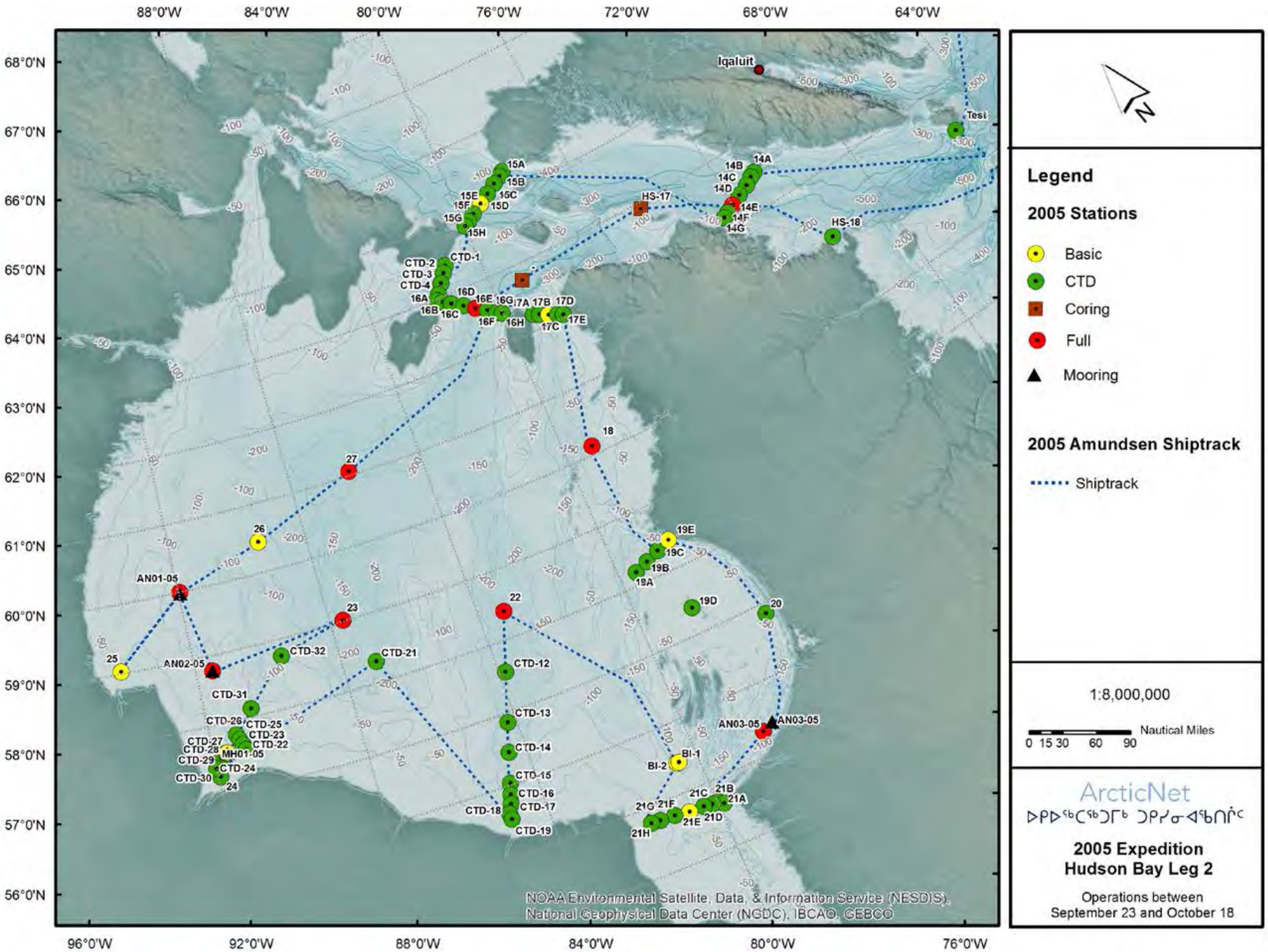

Figure 1.5. Map of Hudson Bay, Foxe Basin and Hudson Strait showing the ship track and the location of stations sampled by the CCGS *Amundsen* during Leg 2 of the 2005 ArcticNet Expedition.

program to understand the biogeochemical and ecological consequences of sea ice variability and change on the complex Mackenzie Shelf ecosystem. During the 2005 Expedition to the Beaufort Sea, the *Amundsen* followed up on the very successful one-year overwintering expedition of the CASES program, to continue looking into the major aspects of the functioning of the Mackenzie Shelf ecosystem as well as retrieving and re-deploying moorings and instruments deployed in previous years.

Hudson Bay is a virtually landlocked, immense inland sea that covers over 832 000 km^2 in the centre of Canada (Figure 1.5). It possesses unique characteristics among the world's oceans: a limited connection with the Arctic and Atlantic Oceans, a low salinity, a high volume of freshwater inputs from numerous rivers that drain central North America, a winter season in which it is completely ice covered while summer is characterized by ice-free conditions. The Bay is also the site of considerable hydroelectric development, with large power-generation projects moderating freshwater flows on both the east and west coasts. In Hudson Bay, where climate change is predicted to occur faster in the coming years and decades, the *Amundsen* sampling program focused on the hydrography of the different waters masses and freshwater sources, on studies of the marine food web components and the deployment of oceanographic moorings in strategic locations around the Bay.

1.3 2005 *Amundsen* Expedition Plan

1.3.1 General schedule

The CCGS *Amundsen* left its home port of Quebec City on 5 August 2005 for an 84-day expedition in the Canadian High Arctic and Hudson Bay in support of ArcticNet oceanographic research program. Over 15 000 nautical miles were covered from Quebec City to Baffin Bay transiting through the Northwest Passage to the Beaufort Sea then back to Hudson Bay before sailing to Quebec City. Over 200 stations were sampled for oceanographic, atmospheric, biological and seabed properties.

Based on the scientific objectives, the *Amundsen* expedition was divided into two legs: Leg 1 from 5 August to 15 September 2005 took the *Amundsen* into the Canadian High Arctic including transit and sampling activities in the Labrador Sea, Baffin Bay, the Northwest Passage and Amundsen Gulf/Beaufort Sea. Leg 2 took the ship to Hudson Bay, including activities in Foxe Basin and Hudson Strait (Figure 1.1).

1.3.2 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

Leaving Quebec City on 5 August, Leg 1 operations took the ship to the Canadian High Arctic for mooring operations and oceanographic sampling. Scientific sampling and seabed mapping were performed along the ship track and at several stations in Baffin Bay, the Northwest Passage and the Beaufort Sea (Figures 1.2 to 1.4). Leg 1 operations ended in Kugluktuk on 15 September and coincided with a Coast Guard and science crew change.

1.3.3 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

Starting in Kugluktuk on 15 September, Leg 2 operations took the *Amundsen* to Hudson Bay where mooring operations and oceanographic sampling was conducted until 16 October (Figure 1.5). After debarking scientists and equipment in Churchill, a contingent of scientists and students from the Schools on Board program made the transit back to Quebec City, where the ship concluded its annual voyage on 26 October.

2 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

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2.1 Introduction and objectives

The science program during Leg 1 of the 2005 *Amundsen* Expedition was centered on ArcticNet oceanographic research program aiming to study the impacts of climate change in the coastal Canadian Arctic, more specifically in Baffin Bay, the Canadian Arctic Archipelago (Northwest Passage), the Amundsen Gulf and the Beaufort Sea. The specific objectives of Leg 1 were to:

- Sample the atmosphere and quantify gas exchanges at the sea ice-seawater-atmosphere interface along the ship track;
- Conduct on-ice sampling at ice features of interest;
- Sample the water column for different physico-chemical properties of the water and components of the marine food web in the Labrador Sea (stations labeled A to J), along a transect across Baffin Bay (Stations 100 to 116), at short DNA stations in Nares Strait (L1 to L24), in the Northwest Passage (Stations K to Z and 3 to 12), along a transect across the Amundsen Gulf (Stations 200 to 224) and at mooring sites;
- Sample the sediments at stations located primarily in the Northwest Passage;
- Retrieve and deploy, or re-deploy, instrumented moorings at key locations in Baffin Bay (deployments at BA01-, BA02-, BA03-, BA04-05) and in the Beaufort Sea (recovery of CA04-, CA05-, CA07-, CA13-, CA14-, CA15-, CA18- and CA20-04; re-deployments at CA05-, CA08- and CA18-05);
- Obtain seafloor bathymetry and sub-bottom information along the cruise track and conduct dedicated surveys in Lancaster Sound and Pond Inlet using the multibeam sonar system.

2.2 Synopsis of operations

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

During this Leg, the *Amundsen* covered 7 000 nautical miles from Quebec City (5 August) to Kugluktuk (15 September), covering three broad regions of the Canadian Arctic (Figures 2.1 and 2.2) and visiting 102 stations with an overall tally of activities as follows:

- 69 CTD casts
- 72 CTD-Rosette casts
- 118 plankton net tows and trawls (including phytoplankton nets, horizontal and vertical zooplankton nets, Bioness, Hydrobios, RMT, etc.)

- 18 box cores and piston cores
- 3 on-ice samplings
- Four moorings deployed in Baffin Bay
- 6 out of 8 moorings recovered and 3 re-deployed in the Beaufort Sea

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

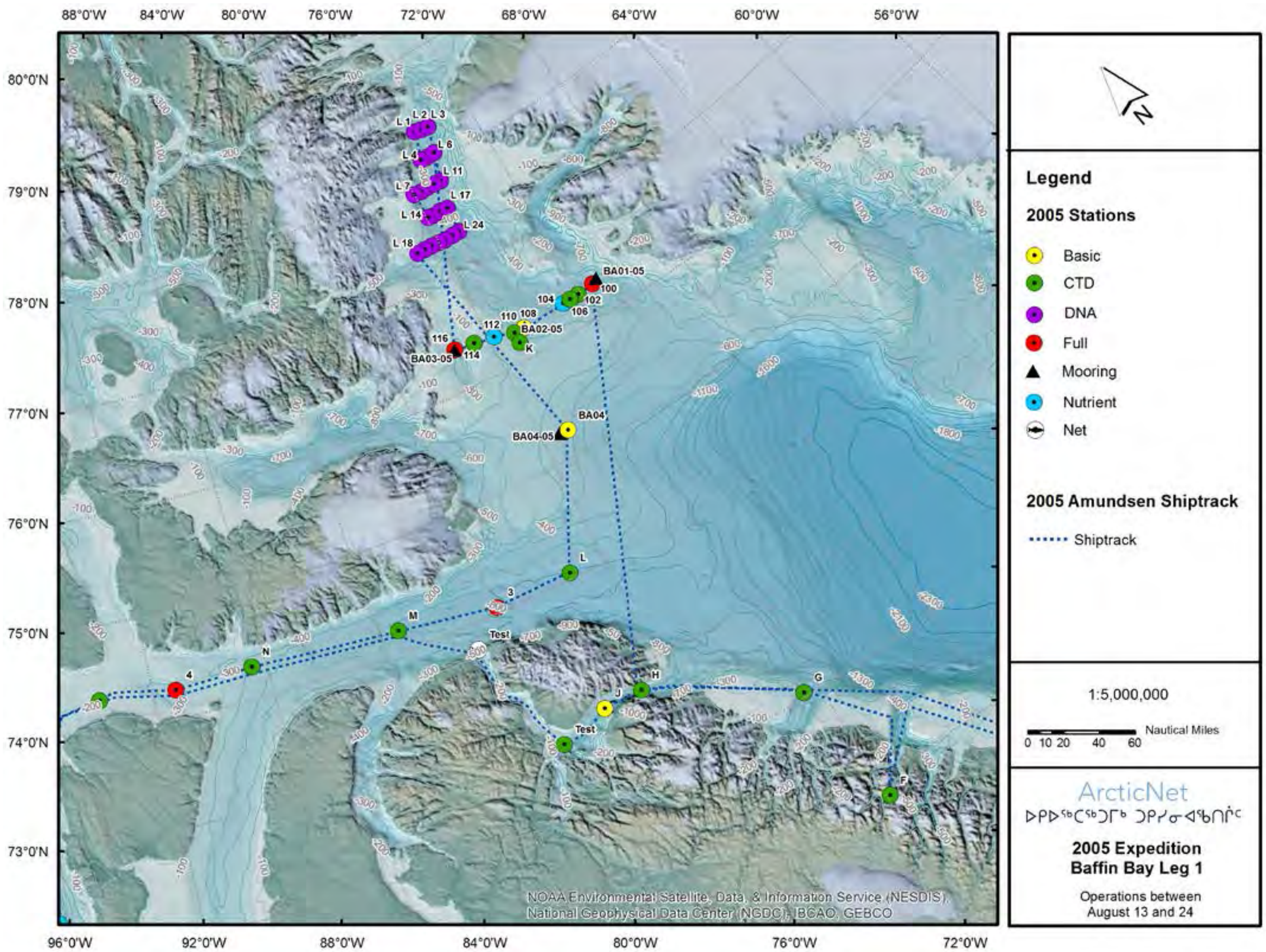

Figure 2.1. Map showing the cruise track and the location of stations sampled in northern Baffin Bay, Nares Strait and Lancaster Sound during Leg 1.

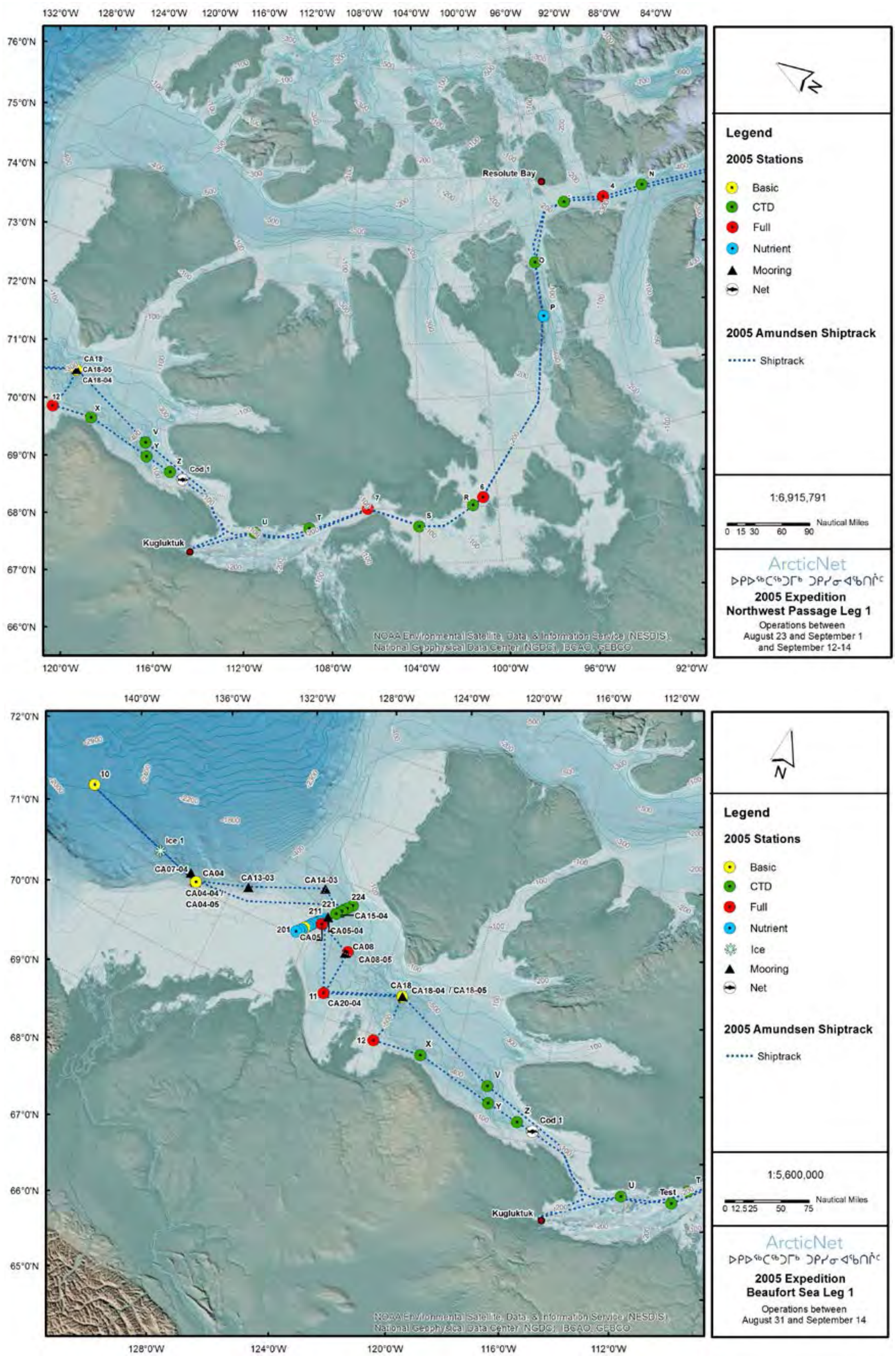

Figure 2.2. Maps showing the cruise track and the location of stations sampled in the Northwest Passage (upper panel) and in the Amundsen Gulf and the Beaufort Sea (lower panel) during Leg 1.

2.2.1 Timeline of operations

The departure from Quebec City on Friday 5 August 2005 was on schedule. After a short stop in Sept-Îles to disembark the technician on board to repair and calibrate the ADCP, the first station of the cruise (Station A) was conducted in Jacques Cartier Strait and CTD data was collected to calibrate the multibeam system. The ship entered the Labrador Sea on the evening of 7 August where high winds (20-25 knots) and rough seas were encountered. On 8 and 9 August, CTD profiles were done at Stations B and C to calibrate the multibeam sonar system and the MVP was tested and used to perform the first MVP survey lines (EM-300). The MVP fish and cable were lost during the night of 10-11 August (see report in Section 6.2.2) and an emergency meeting was convened to assess the situation and devise an alternative sampling strategy.

On 13 August, a multibeam mapping of the southern arm of Gibbs Fjord was conducted, continuing the work started during Leg 9 of the 2004 Expedition. Pond Inlet was reached on the morning of 14 August and after some delays due to problems calibrating instruments for the moorings, the ship departed Pond Inlet for the NOW Polynya in northern Baffin Bay. In Baffin Bay on 16 and 17 August, several CTD-Rosette casts, plankton net tows and sediment core samplings were performed at stations located along the transect between the 3 deployed moorings (BA01-, BA02- and BA03-05) to obtain a coverage of the water column properties in the area and calibrate the multibeam system.

On 18 August, the ship proceeded north to DNA stations in Nares Strait. An iceberg field was encountered in an area that was 75 m deep and the icebergs appeared to be anchored to the bottom. The multibeam images showed multiple ice scours on the bottom. The DNA stations forming the transects across Nares Strait included CTD-rosette casts, surface water collection, zooplankton net tows and sediment coring, and the Zodiac was deployed to make water column turbulence measurements with the SCAMP profiler. Operations were difficult because of heavy ice conditions and two stations located in the dense ice field were abandoned and the ship resumed its transit toward the Northwest Passage.

Many operations (Bioness, piston core) were canceled at Station 3 due to strong winds and heavy seas. The multibeam and sub-bottom surveys at Station 4 revealed a feature that looked like a gas vent, with a plume of gas and sediments shooting up 35 m above the bottom. Station 6 was reached on 27 August and was located in open waters, so a Full station was conducted, including piston coring. The weather conditions worsened overnight and entry into Cambridge Bay for the scientific crew change was delayed. More time than planned was spent anchored in Cambridge Bay to undergo engine repairs and wait for better meteorological conditions. Station 7 located outside Cambridge Bay was carried out on 29 August.

In the Amundsen Gulf on 1 September, the first moorings were retrieved with success followed by a series of CTD-Rosette casts along the CASES transect. On 2 and 3 September, retrieval of the moorings CA05-04 and CA014-03 failed despite multiple recovery attempts. On 4 September, 2 moorings were successfully retrieved, then CTD casts and an ice station were conducted along the way toward Station 10. Multibeam mapping of the sea bottom following the 2500 m isobath in a 60 km-long area took place on 5 September. After crossing a region with heavy ice, mooring work on CA07-04 was done as well as sub-bottom surveys. Attempts to retrieve moorings CA05-04 and CA14-04 were again made on 7 and 8 September without success. Mooring deployment at site CA05-05 was successful and was followed by a 12-hour CTD cast series and multibeam surveys of the seabed. The last station (Station 12) was reached on 13 September, with CTD-Rosette casts and coring activities. A last RMT net trawl was done on the way to Kugluktuk for the crew change.

2.3 Chief Scientist's comments

The overall goals of Leg 1 were met, with the successful deployment of all moorings, the recovery of most moorings from previous years, and the biology, contaminant and geology sampling programs realized to their fullest. Despite this, there were a few problems that could have been solved prior to sailing from Quebec City. The following are constructive comments that should be considered to facilitate sampling operations in future years.

Problems with some of the equipment, notably the thermosalinograph, Rosette and main winch on the foredeck, were easily solved by the technicians. None of these problems created major delays but they could have been dealt with by performing routine tests prior to departure.

Extra logistics planning could have been done, notably in the case of Station 2 (Nares Strait/NOW Polynya) where sampling was not for a single station but rather a series of 24 short stations. Similarly, there was a need for better coordination between the teams in charge of the CTD-Rosette and the multibeam/sub-bottom echosounders. The areas where CTD casts were needed to calibrate the echosounders could easily have been planned in advance and included in the cruise plan, especially since CTD-Rosette casts involve several people that need to be notified in advance that their assistance will be required, sometimes in the middle of the night. The multibeam system was also problematic when it stopped working, most notably during the mapping the 2500 m isobath at Station 10. Given the importance of the multibeam system to realize the objectives of many projects, the problem could have been dealt with before sailing, by having the system serviced, or at least checked, especially since this issue was known from the previous year. Another problem with one of the echosounder arose when the computer controlling the sub-bottom profiler stopped working because the operating system's license (Windows) was not registered when it was installed a few months prior to sailing. Luckily, one of the technicians managed to bypass the registration protocol and have the system operational, but it is another example of a minor problem that could have been dealt with prior to departure.

After sailing from Quebec City, the *Amundsen* Seminar Series began, featuring short presentations to inform researchers, students, as well as officers and crew, of ongoing

ArcticNet science. They were presented in such a way that people with limited scientific background could easily follow. The following seminars were presented during Leg 1:

Phillip Hwang: The use of microwaves in remote sensing.
Yves Gratton: Physical sampling during CASES.
Trecia Schell, Robbie Bennett and André Rochon: Mud 101, paleoceanography of the eastern and Western Arctic. Preliminary data.
Simon Belt: Fondling sediment in search of ice.
Stéphane Julien: CASES 2003 en photos.

Finally, everyone on board, the science personnel and Commanding Officer, officers and crew of the CCGS *Amundsen*, are commended for their hard work and efforts which made a success of this cruise. Special thanks should be extended to the three Québec-Océan technicians, L. Michaud, S. Blondeau and P. Massot, whose work and expertise allowed the quick resolution of various problems and a minimum of delays. Thanks also to all those working behind the scene to make this expedition work the way it did.

3 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

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3.1 Introduction and objectives

The science program during Leg 2 of the 2005 CCGS *Amundsen* Expedition was centered on the study of the impacts of climate change in Hudson Strait, Foxe Basin and Hudson Bay. The specific objectives of Leg 2 were to:

- Sample the atmosphere and quantify gas exchanges at the seawater-atmosphere interface;
- Sample the water column for physico-chemical properties and components of the marine food web at designated stations located along transects across Hudson Strait (labeled 13a-d and 14a-g), across the mouth of Foxe Basin (Stations 15a-h) and the mouth of Hudson Bay (labeled 16a-h and 17a-e) as well as at 44 stations located within Hudson Bay including at 4 mooring locations;
- Sample the sediments for geology and paleoceanography analyses;
- Deploy instrumented moorings at key locations in Hudson Bay (AN01-, AN02-, AN03- and MH01-05);
- Obtain bathymetry and sub-bottom information along the cruise track and to conduct surveys in more specific locations using the multibeam sonar system.

3.2 Synopsis of operations

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

During this Leg, the *Amundsen* covered 8 000 nautical miles taking the *Amundsen* from Kugluktuk (17 September) to Quebec City (26 October). Twenty-two Full (3-12 hours) stations and 62 CTD stations were visited in Hudson Bay. Sampling was also conducted in the estuaries and rivers at 9 sites (see Section 8) either *via* helicopter or Zodiac (Figure 3.1). The overall tally of activities was as follows:

- 123 CTD-Rosette casts
- 76 plankton net tows and trawls (including phytoplankton nets, oblique and vertical zooplankton nets, Bioness, Hydrobios, RMT, etc.)
- 37 box cores and piston cores
- 28 Secchi disks and optical profiles
- 8 drifting sediment traps deployments
- Four moorings (AN01-05, AN02-05, AN03-05, MH01-05) successfully deployed

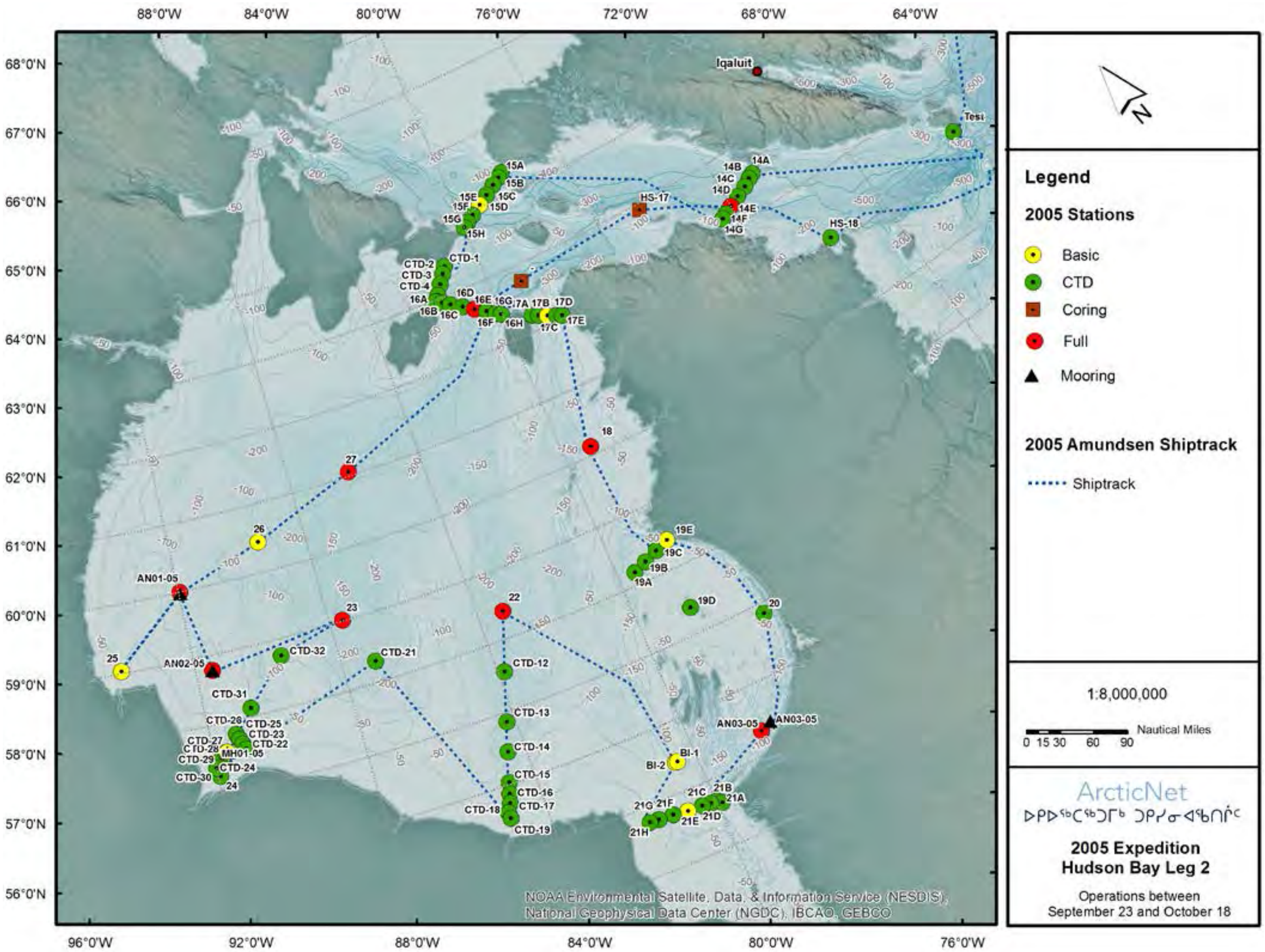

Figure 3.1. Map of the cruise track and the location of stations sampled by the CCGS *Amundsen* in Hudson Bay, Foxe Basin and Hudson Strait during Leg 2.

3.2.1 Timeline of operations

Leg 2 started in Kugluktuk on 16 September and the ship made its way back through the Northwest Passage toward Hudson Bay where most of the leg took place. From 16 to 22 September, a series of short stations were visited along the way, where CTD casts, net tows and optical profiles were conducted.

The *Amundsen* began the transect across Hudson Strait on the morning of 23 September with CTD casts performed at Stations 14A to 14D, and reached the first Full Station (14E) in the evening. Activities started with the deployment of short term drifting sediment traps which were retrieved 12 hours later after the full suite of operations was completed. The end of the transect was accomplished (Stations 14F and 14G) and the ship headed for Foxe Basin.

On 25 September, all the stations on the 15A-H transect were completed, including Basic Station 15E where CTD-Rosettes, net tows, optical profiles and coring activities were carried out. During the night, four quick CTD stations were conducted and the first station on the 16A-H transect at the mouth of Hudson Bay was reached early in the morning. Ten hours were spent at Full Station 16E where activities included the deployment and recovery of drifting sediment traps, CTD-Rosettes and plankton net tows. A special coring station was visited in the deeper channel's head off Mansel Island where two box cores and a piston core of sediments were collected. All the stations along transect 17 (A to E) on the east side of Mansel Island were sampled on 27 September and the vessel entered Hudson Bay.

The first station in Hudson Bay was Full Station 18 on the eastern side, which took 11 hours to carry out, starting and ending with drifting sediment traps operations. On 29 September, Stations 19A to 19E located along an offshore-inshore transect, as well as CTD station 20, were successfully sampled. Two days were spent at the first mooring site (AN03) which involved the successful deployment of the mooring, a 16-h drifting sediment traps experiment, as well as multiple CTD-Rosette casts, plankton net tows, and coring operations.

At the mouth of James Bay, a transect comprising of 8 stations (21A-H), as well as two stations further out into Hudson Bay (BI-1 and BI-2), were conducted between 2 and 5 October, under sometimes difficult working conditions due to high winds and rough seas.

The offshore-inshore transect extending from Station 22 to CTD-19 was conducted on 6 and 7 October, and after a quick detour to visit Station 21 located in the center of the Bay, the *Amundsen* headed for the Nelson River area where extensive sampling was planned.

Scientific activities at the mouth of the Nelson River spanned three days and included mooring operations (deployment of MH01-05 for Manitoba Hydro), a series of CTD stations in concentric arcs from the mouth of the river toward the center of the bay, ending with Full station 23.

The final two moorings and associated Full station sampling took place on 12 and 13 October, then the ship headed for Churchill (MB), where a community visit and VIP tour of the ship took place on 14 October. The Schools on Board outreach program began on 14 October when 6 students and 4 teachers boarded the *Amundsen* at Churchill for the travel back to Quebec City.

Finally, Stations 26 and 27 in the center of Hudson Bay, as well as coring station HS-17 in Hudson Strait, were visited on 15-17 October during the transit back to Quebec City. Leg 2, and the *Amundsen* annual expedition, ended in Quebec City on 26 October 2005.

3.3 Chief Scientist's comments

Leg 2 successfully fulfilled the scientific objectives outlined in the cruise plan. The full program of activities was accomplished even though approximately 5 days were lost to bad weather.

While a few of the students from the Schools on board program were initially quite ill (rough weather was encountered the first few days out), feedback from both the students and teachers (see report in Section 22) and from reading their daily dispatches to their schools and fellow students indicated that the Schools on Board Program was, using their words, an 'awesome' experience. The community visit held while at port in Churchill on 14 October 2005 was also extremely successful.

As noted above the cruise was very successful, however, better preparations could have been made before boarding. For example, while most of the major sampling stations and sites were selected prior to leaving, none of the CTD-Rosette casts locations had been identified until the ship was well underway. This made planning slightly more difficult and time consuming. Problems were also encountered with the selection of incorrect depths and locations for the three ArcticNet moorings, which had to be adjusted. There were also problems with regards to the labeling and storage of waste chemical containers left from Leg 1, but their contents were identified and the containers re-labelled thanks to scientists who were also on Leg 1.

It is unfortunate that things did not work out as hoped for Mr. Samson Tooktoo who departed in Kuujjuaraapik on 29 September (see Section 18). Due to conflicting ship activities such as the availability of the Zodiac and bad weather, the planned ringed seal hunts could not be accommodated. In retrospect, it was likely the correct decision as most of the ringed seals were observed close to shore and the use of the *Amundsen* (or any other large ship) may not be the best platform for this type of activity. While on board, Samson fit in well with all the science and ship crew, and was very excited to be part of this expedition.

As Chief Scientist, on behalf of the science personnel, I would like to thank the Commanding Officer A. Gariépy and the officers and crew of the CCGS *Amundsen* for their tremendous dedication, hard work, professionalism and friendship during this cruise. This scientific mission would not have been the complete success it was without their efforts and enthusiasm. My thanks also to CJ Mundy, the ArcticNet Theme 3 coordinator, for his help during the cruise.

Part II – Project reports

1 Meteorological, oceanographic and navigation data – Legs 1 and 2

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1.1 Introduction

A suite of core data and information is collected during the CCGS *Amundsen's* annual expedition using various systems and instruments. Ship position and navigation data (CNAV and POS-MV) and meteorological information (AVOS, Environment Canada) are collected on a continuous basis. Oceanographic data is collected using a CTD-Rosette, a Moving Vessel Profiler (MVP), a ship-mounted current profiler (SM-ADCP) and an underway thermosalinograph (TSG) system.

The datasets collected are processed, archived and managed by the ArcticNet/*Amundsen* technical and data management team. All variables from the datasets are verified and quality controlled using time series and mapping plots, and spurious data and outliers are flagged. The processed datasets will be archived on the Polar Data Catalogue (PDC) at www.polardata.ca.

1.2 Description of systems and available data

1.2.1 Navigation and ship position information – POS-MV and C-Nav

The *Amundsen* is equipped with a POS-MV (Position and Orientation Systems for Marine Vessels) and a C-Nav DGNSS Precise Point Positioning systems. Both these systems record data continuously, with the POS-MV data having a better resolution and accuracy than the C-Nav data. Thus, C-Nav data are used only when POS-MV data are unavailable for a period of 20 seconds or longer. Both systems use WGS 84 Geographic Coordinates.

Table 1.1. Variables measured by the navigation systems onboard the CCGS *Amundsen*.

Variable	Units
Date	yyyy/mm/dd
Hour UTC	HH:MM:SS
Latitude	deg N
Longitude	deg E
GPS source	POSMV:1 CNAV:0

Variable	Units
Heading	deg N
Roll	deg
Pitch	deg
Heave	m
Track	deg N
Speed	Knt

Three types of datasets are issued from the navigation systems and are available for the two legs of the 2005 *Amundsen* Expedition:

- the complete data
- a 15-minute reduced version
- a ship track

The QA/QC process for the NAV data is described in the README file attached to the archived data on the PDC (CCIN 12447). The README file also includes a data acknowledgement statement and examples for data citations. The full reference for the NAV data is available in the reference section of this project report.

1.2.2 Meteorological information – AVOS (Environment Canada)

An Environment Canada Automated Volunteer Observing Ship (AVOS) system was continuously recording meteorological data on atmospheric pressure, wind speed and direction, air temperature and humidity during the 2005 *Amundsen* Expedition.

Table 1.2. List of meteorological instruments and recorded variables of the AAVOS system.

Instrument	Variable	Specifications
Vaisala Digital Barometer – PTB-210	Atmospheric pressure	Range: 50 to 1100 hPa Accuracy: 0.35 hPa Resolution: 0.1 hPa
Young R.M. Anemometer - 05103	Wind speed	Range: 0 to 100 m/s Initial accuracy: 0.3 m/s
	Wind direction	Range: 0 to 360° Initial accuracy: 3°
Rotronic Meteorological – MP10	Air temperature	Range: -40 to 60°C Initial accuracy: 0.2°C
	Humidity	Range: 0 to 100% RH Initial accuracy: 1% RH

The QA/QC process for the AVOS data is described in the README file attached to the archived data on the PDC (CCIN 12518). The README file also includes a data acknowledgement statement and examples for data citations. The full reference for the AVOS data is available in the reference section of this project report.

1.2.3 CTD-Rosette

The *Amundsen*'s CTD-Rosette was used to perform vertical profiles of water column properties and to collect water samples. A description of the instruments and sensors used on the CTD-Rosette and the variables measured, as well as an account of the operations conducted during Legs 1 and 2, are provided in Section 7. The CTD logbook detailing the location, date and time, and depth of CTD-Rosette casts for both legs of the 2005 Expedition is available in Appendix 3.

The CTD data are available in raw and processed formats on the PDC. The QA/QC process for the CTD data is described in the README file attached to the archived data on the PDC (CCIN 12713). The README file also includes a data acknowledgement statement and examples for data citations. The full reference for the CTD data is available in the reference section of this project report.

1.2.4 Moving Vessel Profiler (MVP)

The Moving Vessel Profiler (MVP) used during the 2005 *Amundsen* Expedition was equipped with the sensors listed in Table 1.3. The MVP was used between 9 and 11 August in the Labrador Sea with 91 casts carried out during this period. More information on MVP operations can be found in Section 7.

Table 1.3. Sensors equipped on the *Amundsen*'s Moving Vessel Profiler (MVP).

Instrument/Sensor	Manufacturer	Type	Serial Number	Max. depth (m)
MVP	Brooke			
CTD	SeaBird	SBE-911	9P31896-0732	6800
Temperature			4336	
Conductivity			2877	
Pressure			89938	
Oxygen	SeaBird	SBE-43	0479	7000
Fluorometer	Sea Point			
Transmisometer	WetLab		CST-685DR	

The MVP data for 2005 is not managed by the ArcticNet/*Amundsen* data management team and readers interested in this dataset should contact the researcher who collected the data (see Section 7).

1.2.5 Ship-mounted current profiler (SM-ADCP)

The *Amundsen* is equipped with a hull-mounted Acoustic Doppler Current Profiler (ADCP) continuously recording current velocity and direction under the ship and along the transit route. Data was collected during both Legs 1 and 2 but datasets are unprocessed.

1.2.6 Underway thermosalinograph (TSG) system

An underway ThermoSalinoGraph (TSG) system was used to continuously record data on surface seawater temperature, salinity, fluorescence and sound velocity along the transit route.

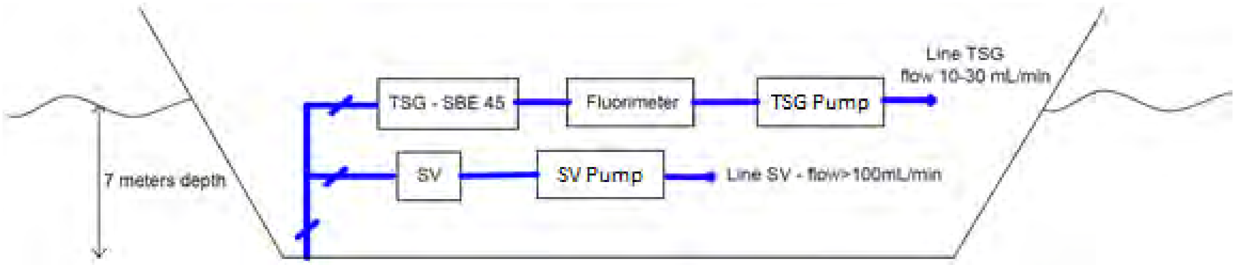

Figure 1.1. Schematic of the configuration of the TSG underway system.

Table 1.4. Instruments and variables measured by the underway TSG system during Legs 1 and 2 of the 2005 *Amundsen* Expedition.

Instrument	Manufacturer	Variable	Specification	
SBE 45 MicroTSG	Sea Bird (SN# 4532465-076)	Temperature	Range (°C) Initial Accuracy (°C) Resolution (°C)	-5 to +35 0.002 0.0001
		Conductivity	Range (S/m) Initial Accuracy (S/m) Resolution (S/m)	0 to 7 0.0003 0.00001
		Salinity (derived value)	Initial Accuracy (psu) Resolution (psu)	0.005 0.0002
WETStar	Wetlabs (SN# 959P)	Fluorescence	Range (µg/l) Initial Accuracy (µg/l)	0.03 to 75 0.03
Smart SV	AML (SN# 4860)	Sound velocity	Range (m/s) Initial Accuracy (m/s) Resolution (m/s)	1400 to 1600 0.05 0.015

A total of 525 files were recorded by the thermosalinograph over the course of the 2 legs of the expedition. The fluorescence sensor failed to properly record data during Leg 1 and the sound velocity sensor did not work throughout the expedition. The flow through the TSG stopped several times during both legs. Periods and regions where the TSG was operational and the post-processed data recovery rates for each sensor are presented for each leg in Table 1.5.

Table 1.5. Periods and regions where the TSG system was operational and processed data recovery for each variable measured for each of the two legs of the 2005 Expedition.

Variable	Period of operation	Total good data (days)	Region(s) of operation [1]	Post-processed data recovery rate [2]
Leg 1				
Temperature	22 Aug – 29 Aug	3.7	CAA	9%
Salinity	22 Aug – 29 Aug	3.7	CAA	9%
Fluorescence	No data	0	-	0%
Sound velocity	No data	0	-	0%
Leg 2				
Temperature	16 Sept – 8 Oct	11.5	CAA, HS, HB	28%
Salinity	16 Sept – 8 Oct	11.5	CAA, HS, HB	28%
Fluorescence	16 Sept – 8 Oct	12.6	CAA, HS, HB	31%
Sound velocity	No data	0	-	0%

[1] CAA = Canadian Arctic Archipelago; HS = Hudson Strait; HB = Hudson Bay
[2] Data recovery rate was calculated based on total number of days in each leg: Leg 1 = 42 days, Leg 2 = 41 days.

The QA/QC process for the TSG data is described in the README file attached to the archived data on the PDC (CCIN 12715). The README file also includes a data acknowledgement statement and examples for data citations. The full reference for the TSG data is available in the reference section of this project report.

References

Amundsen Science Data Collection. CCGS *Amundsen* Navigation (NAV) data recorded during the annual science expeditions in the Canadian Arctic. [years]. Processed data. Version 1. DOI: 10.5884/12447. Archived at www.polardata.ca: https://doi.org/10.5884/12447. Accessed on [Date].

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2 Neutral atmosphere and GPS in the Canadian Arctic – Leg 2

ArcticNet Phase I – Project 1.6: The Opening NW Passage: Resources, Navigation, Sovereignty & Security. ArcticNet/Phase 1/Project 1.6

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Cruise participant Leg 2: Reza Ghoddousi-Fard[1]
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2.1 Introduction

The neutral atmosphere as a non-dispersive medium still remains a limiting factor for high accuracy GPS applications. The situation in the Arctic is even more challenging due to the GPS constellation which forces to use low elevation satellites.

The signals coming from these low elevation satellites are passing through the lower part of the atmosphere more than the signals from higher elevations. Furthermore, due to the sparse data in the Arctic, the performance of GPS atmospheric correction models which are mostly based on long term radiosonde observations may be questionable. The performance of these *a priori* correction models as well as ray tracing through the Numerical Weather Prediction (NWP) models will be evaluated using field observations collected onboard the *Amundsen* in both observation and position domains.

The objectives of this research can be divided in two main parts:

- To study the effect of neutral atmosphere on kinematic GPS positioning in the Canadian Arctic considering the problematic GPS constellation in high latitude regions.
- To retrieve the effect of neutral atmosphere (hydrostatic and non-hydrostatic delays) on GPS signals and to study their error covariance behavior in order to be used for climate studies and assimilation to the NWP models.

The collected field data will be mainly used for the first part and it is expected that the results will improve the real time kinematic GPS positioning accuracy for many applications such as high resolution ocean mapping surveys. Therefore, more detail about the first objective of this research is provided.

2.2 Methodology

The following instruments have been employed for this research:

- Water Vapor Radiometer (WVR)
- High precision barometer
- C-Nav GPS antenna
- POS-MV GPS antenna

The WVR recorded the non-hydrostatic path delay in zenith direction and in some specific elevation angles during the cruise. Surface atmospheric pressure was also recorded in order to be used for hydrostatic delay retrieval. The raw data from the two GPS antennas was recorded in this experiment rather than the commercial outputs used in parallel for bathymetry operations by UNB's Ocean Mapping Group (OMG). These GPS raw data allow a detailed study of atmospheric effects on GPS signals. The roll and pitch and globally corrected C-NAV GPS data will be provided by UNB-OMG for further processing and corrections. The recorded data was backed up daily and graphical output of the pressure and the WVR data were provided for visual control. The high resolution Canadian NWP model was also recorded daily and synchronized with onshore server at UNB. The NWP model will be employed as a redundant option for studying the effect of the neutral atmosphere on the GPS data collected onboard.

All of the equipment was operated continuously during most of the Leg 1 and for all of Leg 2. However, some problems happened on WVR and pressure data recording in both legs. Fortunately, both problems were related to a malfunction of the serial cables connected to the computers and were fixed with the help of one the technicians onboard. Surface atmospheric pressure was also recorded by other people onboard and the gaps in the time series of recorded pressure was filled using their shared data.

2.3 Preliminary results

No results can be provided in this report since data need post processing with scientific software and recorded online data from the web, which were not accessible onboard.

2.4 Comments and recommendations

As some of the people onboard were recording the same data for different applications, it may be a good idea that all science participants introduce their tasks and type of data collected onboard in more detail in the early days of each leg. This may help to foster collaborations, improve data quality control, and/or prevent unnecessary duplicating of sampling and data recording.

3 Atmospheric mercury and herbicides – Legs 1 and 2

ArcticNet Phase I – Project 2.6: Warming the Tundra: Health, Biodiversity, and Greenhouse Gas Implications. ArcticNet/Phase 1/Project 2.6

Project leader: Laurier Poissant[1,2] (Laurier.Poissant@ec.gc.ca)
Cruise participants Leg 1: Laurier Poissant[1,2], Fabien Aulagnier[1], Philippe Constant[1,3] and Martin Pilote[1]
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3.1 Introduction

Atmospheric toxic compounds such as mercury and herbicides released from anthropogenic activities can contribute to Arctic environment contamination. Mercury depletion events in spring time can load more than 300 tonnes of mercury in the whole Arctic. This mercury loading can be retained in the Arctic or be re-emitted back into the atmosphere. Mercury chemistry might be very active in the Arctic through ozone or/and halogens-mercury chemistry, which may change the mercury speciation and its ability to fallout. Herbicides applied in southern Canada may migrate through distillation effects to northern locations. The anthropogenic contribution to the greenhouse gas content in the atmosphere is significant but natural production is also not negligible. Knowledge of the regulatory mechanisms involved in natural greenhouse gas exchange is needed to elaborate models and scenarios under global warming conditions.

The specific objectives of this study were to:

- Measure Total Gaseous Mercury during the cruise
- Measure mercury speciation during cruise (atmospheric mercury chemistry)
- Measure the mercury gradient (deposition/evasion)
- Measure mercury and herbicides in sediments and water
- Measure CO_2, CH_4, CO, O_3, and H_2 in air
- Calibrate the two-layer model for mercury and herbicides
- Apportion potential source of mercury and herbicides in the whole Arctic

3.2 Methodology

3.2.1 Total gaseous mercury

The Total Gaseous Mercury (TGM) analysis was achieved with an automatic analyzer (Tekran® 2537A). Briefly, the analytical train of this instrument is based on amalgamation of mercury onto a pure gold surface followed by a thermodesorption and analysis by Cold

Vapour Atomic Fluorescence Spectrophotometry (CVAFS) (λ=253.7 nm) providing analysis of TGM in air at sub-ng/m^3 levels. A dual cartridge design allows alternate sampling and desorption, resulting in continuous measurement of mercury in the air stream. The analyzer was programmed to sample air at flow of 1.5 L/min for 5 min sampling intervals. Particulate matter was removed by a 47 mm diameter Teflon filter (0.45 μm).

Figure 3.1. Left: Gradient tower profiler at the bow of the ship. This setup permitted air sampling at two heights (delta ~ 2 m) and air temperature gradient measurements at three heights (2, 4 & 6 m) within the marine boundary layer. Wind direction and wind speed as well as solar radiation were monitored in continuous mode. Right: securing set-up for the tower.

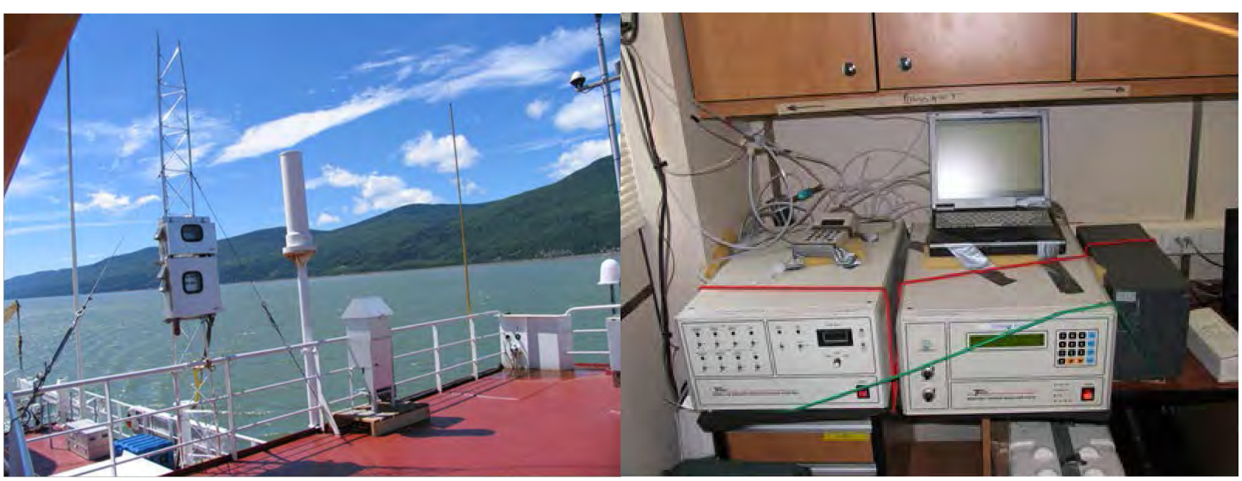

Figure 3.2. Left: Mercury speciation units (Tekran) (left) and Hi-Vol Organic sampler (PS-1) (right). Right: Pump module and Tekran analyser for Hg speciation in the acquisition room.

3.2.2 Mercury speciation

Automated mercury speciation analyzer systems were used concurrently during field measurements. The analyzer systems included a Tekran® Model 2537A which was used together with a Model 1130 Speciation Unit and a Model 1135 Particulate Mercury Unit to simultaneously monitor gaseous elemental mercury (GEM), reactive gaseous mercury (RGM), and particulate mercury (Hg_p: 0.1 - 2.5 μm) in ambient air (Tekran, 2001).

The systems allowed fully automated operation with all three components being concurrently measured. During sampling, reactive gaseous mercury in the atmosphere is captured in the Model 1130 KCl-coated quartz annular denuder module. Particulate mercury (Hg_p) is trapped onto a unique quartz regenerable filter located within the Model 1135. GEM passes through both units and is continuously analyzed by the Model 2537A. The RGM and Hg_p components are then sequentially desorbed during the analysis phase. The 1130 and 1135 speciation units were configured to collect 1-h samples at a 10 L/min flow rate. During the 1-h sampling period, the 2537A analyzer continuously quantified 5-min GEM samples. After the 1-h sampling period, the 1130 and 1135 systems were flushed with Hg-free air during the next 1-h period, and Hg_p as well as RGM were sequentially thermodesorbed and analyzed. The quartz filter was heated to 850°C for 20 min and the annular denuder was heated to 500°C for 15 min. Thus, Hg_p and RGM collected were thermally decomposed into an Hg-free air stream and subsequently analyzed as GEM, respectively. The sampling and analyzing cycle is 2-h for GEM, RGM, and Hg_p. The quartz filter collects fine particles (<0.1-2.5 μm) whereas the denuders collect oxidized reactive gaseous mercury compounds with a diffusion coefficient >0.1 cm^2/s that readily adhere to a KCl coating at 50°C. Hence, some Hg_p fractions larger than 2.5 μm are missing in this study (Landis et al., 2002).

The denuders were reconditioned using the Tekran protocol (Tekran, 2001). Denuder and regenerable particulate filter (RPF) were changed biweekly.

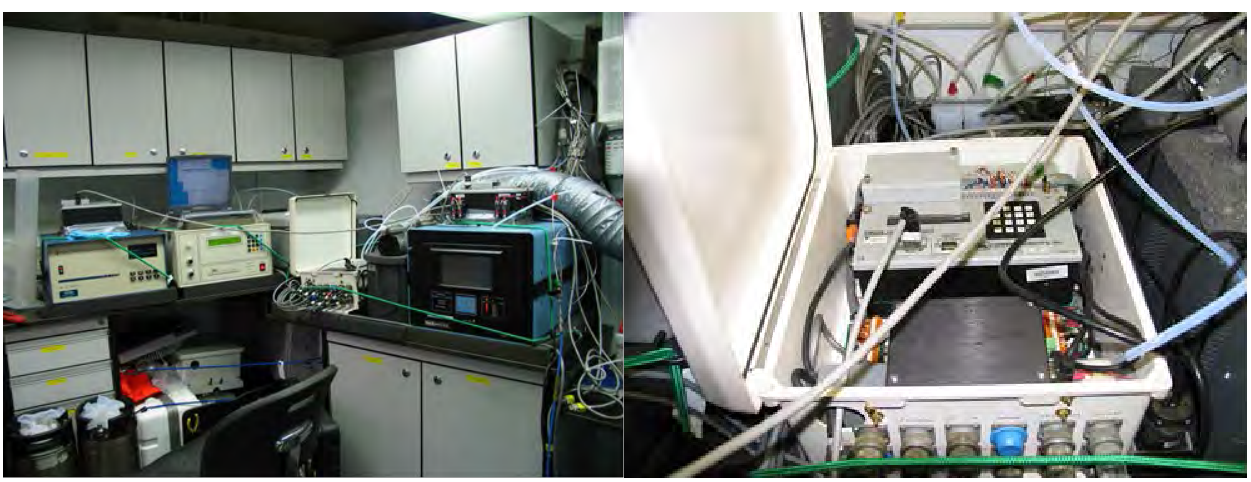

Figure 3.3. Left: Instrumentation in lab 610. TECO 49c Ozone analyzer (5 min reading); Tekran 2537 A for Total Gaseous Mercury (5 min readings); RGA5 from Trace Analytical for CO_2, CO, CH_4 and H_2 analyses (10 min readings). Right: Datalogger CS 23X for control and acquisition.

3.2.3 Ozone

A photometric O_3 analyser was used (Model 49C, Thermo Environmental Instruments Inc., Massachusetts). This instrument sampled the air continuously at 1-3 L min^{-1}. O_3 concentrations were obtained at 5-minute interval with a ± 1 ppbv precision and a lower detection limit of 1 ppbv. Principle of this analyzer is based on the fact that O_3 molecules absorb UV rays at a wavelength of 254 nm. The amount of UV absorbed is related to the O_3 concentration, following Beer-Lambert's laws.

3.2.4 CO_2, CH_4, CO and H_2

Chromatographic RGA5 system (Trace Analytical, Maryland) was used for CO_2, H_2, CO and CH_4 concentrations measurements. This instrument measures compounds continuously (flow of 40 cm^3 min^{-1}) and gives results at 10-min intervals with a reproducibility limit of ±0.3, 0.2 and 2 % for H_2, CO and CH_4 respectively. Two detectors were mounted in parallel: the reductive gas detector (RGD) for H_2 and CO and the flame ionization detector (FID) for CO2 and CH_4. The RGD is made of reactive HgO and when H_2, CO or other reductive compounds make contact, they react with oxygen and an UV lamp detects the Hg^0 emanations. FID is based on the principle of the hydrogen flame ionization. RGA5 instrument was supplied by carrier gases (BOC Gas, Montréal). For the general operation of the instrument (e.g., valves movements), zero air (60-80 psig) was used. Carrier gas was nitrogen grade research (30-70 psig) and for the FID, hydrogen grade research (20-40 psig) and zero air type vehicle emission (20-50 psig) were supplied. Standard gas mixture certified from the National Oceanic and Atmospheric Administration (NOAA; Climate Monitoring and Diagnostics Laboratory) (815 ppbv, 190.5 ppbv, 1875.8 ppbv and 380.3 ppmv of H_2, CO, CH_4 and CO_2 respectively) were used. Calibration was done on regular base.

3.2.5 Herbicides

Samples were collected over 1-week integration periods using PS-1 type samplers at a flow rate of approximately 300 m^3 d^{-1} (~2100 m^3 sample volume), using glass fiber filter for the particle phase and PUF/XAD sandwich for capturing gas-phase chemicals. Extract will be done in the laboratory in Montreal and extracts will be sent to NLET (Burlington, ON) for quantification.

Figure 3.4. Herbicides sampling set-up, canisters and pump.

The following herbicides were sampled: Clopyralid; Mecoprop; Dicamba; MCPA; 2,4-DP; 2,3,6-TBA; 2,4-D; Bromoxynil; Silvex; 2,4,5-T; MCPB;2,4-B; Imazamethabenz(A); Imazamethabenz(B); Picloram; Butylate; d-simazine; d-atrazine; Trifluralin; Diallate 1; Diallate 2; Simazine; Atrazine; Triallate; Metribuzin; Metolachlor;Hoegras; Endaven; and others.

3.2.6 Micrometeorological method

Trace gas (e.g., Mercury, Ozone, CO_2, CH_4, etc.) fluxes cannot be measured directly by the eddy correlation technique due to the absence of a fast-response mercury analyzer. The possible technique is the Modified Bowen Ratio (MBR). The MBR technique allows calculating mercury vapor fluxes (F_{Hg}) by measuring its concentration gradient (ΔHg) over a known height as well as the turbulent transfer coefficient (K) of a reference component at the same height:

$$F_{Hg} = K \; * \Delta Hg$$

The gradient has been measured as qualitative indication of the mercury flux direction (evasion or deposition modes) in connection with the two layer transfer model paradigm. The model is as following:

$$F = \frac{(HCw) - Ca}{1 / Ka + H / Kw}$$

where *H* is the Henry's Law constant, *Ca* the air concentration, *Cw* the dissolved mercury concentration, *Ka* and *Kw* are respectively the air and water transfer coefficients. *Kw* was measured by University of Winnipeg during this expedition whereas dissolved gaseous mercury was measured by University of Edmonton.

3.2.7 Other atmospheric and environmental parameters

A comprehensive set of atmospheric and environmental parameters were collected along with the atmospheric mercury speciation field measurement experiments. Some of them will be used in the discussion and are subsequently described. Temperature (accuracy~0.02 °C) and relative humidity (accuracy~0.7 %) were measured at heights of 10 m using HMP35 humidity/temperature probes (Campbell Scientific®). Net radiation (shortwave and long wave) (Campbell Scientific®), wind speed and direction (RM Young®) were monitored as well.

3.2.8 Sediment samples

Sediment samples were obtained from A. Rochon (UQAR) using the box core at various stations during the cruise. Samples were collected from the first 3 cm of each box core.

3.2.9 Water samples

Surface samples were collected for mercury and herbicides. For mercury, 500 ml samples (replicates) were taken. For herbicides, 200 L were passed through fibre glass filter and XAD-2 resin for extraction.

3.2.10 Parameter details

Table 3.1. List of measured parameters with sampling frequency and degree of completion at the end of Leg 2.

Parameters	Frequency	Completion
TGM	5 min	100%
Hg°	120 min	>95%
RGM	120 min	>95%
TPM	120 min	>95%
O_3	5 min	>95%
CO_2	10 min	>95%
CH_4	10 min	>95%
CO	10 min	>95%
H_2	10 min	>95%
Air Temperature	5 min	>90%
Relative humidity	5 min	>90%
Net Solar Radiation	5 min	>90%
Herbicides	7 days	100%

3.2.11 Sample lists Leg 1

Table 3.2. List of samples stored in the refrigerator (4°C) during Leg 1.

Project	Date	Station	Type	Container	Number
Mercury	2005-08-16	BA01-05	Water	Btl 500 ml	2
Mercury	2005-08-23	Station 3	Water	Btl 500 ml	2
Mercury	2005-08-30	Station 7	Water	Btl 500 ml	2
Mercury	2005-09-03	CA05-05	Water	Btl 500 ml	2
Mercury	2005-09-04	Banquise 71°21' N 135°21' W 18:00	Ice	Btl 500 ml	2
Mercury	2005-09-10	Station 11	Water	Btl 500 ml	2

Table 3.3. List of samples stored in the freezer (-20°C) during Leg 1.

Project	Date	Station	Type	Container	Number
Herbicides	2005-08-16	BA01-05	Particules	3 filtres (sac)	1
Herbicides	2005-08-16	BA01-05	Water	XAD / Btl 250 ml	1
Herbicides	2005-08-16	BA01-05	MES	1 filtres D18 (sac)	1
Herbicides	2005-08-16	BA01-05	MES	1 filtres D19 (sac)	1
Herbicides	2005-09-03	CA05-05	Particules	3 filtres (sac)	1
Herbicides	2005-09-03	CA05-05	Water	XAD / Btl 250 ml	1
Herbicides	2005-09-03	CA05-05	MES	2 filtres D17&D20 (sac)	1
Herbicides	2005-08-12	Transit	Air	PUF # 9	1
Herbicides	2005-08-12	Transit	Particules	Filtres # 56 (sac)	1
Herbicides	2005-08-19	Transit	Air	PUF # 7	1
Herbicides	2005-08-19	Transit	Particules	Filtres # 49 (sac)	1

Project	Date	Station	Type	Container	Number
Herbicides	2005-08-26	Transit	Air	PUF # 8	1
Herbicides	2005-08-26	Transit	Particules	Filtres # 55 (sac)	1
Herbicides	2005-09-02	Transit	Air	PUF # 6	1
Herbicides	2005-09-02	Transit	Particules	Filtres # 53 (sac)	1
Herbicides	2005-09-09	Transit	Air	PUF # 3	1
Herbicides	2005-09-09	Transit	Particules	Filtres # 60 (sac)	1
Herbicides	2005-08-20	BA-11	Sediment	Sac	1
Herbicides	2005-08-23	Station 3	Sediment	Sac	1
Herbicides	2005-08-30	Station 7	Sediment	Sac	1
Herbicides	2005-09-10	Station 11	Sediment	Sac	1
Banquise		71° 21.6' N 135° 21.2' W	Ice		
Mercury	2005-09-04	18:00	Snow surface	Sac	1
Mercury	2005-09-04	18:00	Snow surface	Sac	1
Mercury	2005-09-04	18:00	Core A (0-5 cm)	Sac	1
Mercury	2005-09-04	18:00	Core A (5-10 cm)	Sac	1
Mercury	2005-09-04	18:00	Core B (0-5 cm)	Sac	1
Mercury	2005-09-04	18:00	Core B (5-10 cm)	Sac	1
Mercury	2005-09-04	18:00	Core C (0-5 cm)	Sac	1
Mercury	2005-09-04	18:00	Core C (5-10 cm)	Sac	1

Table 3.4. List of samples stored in the freezer (-80°C) during Leg 1.

Project	Date	Station	Type	Container	Number
Poissant/Blaise	2005-08-16	BA01-05	Water	Btl. 1 litre	3
Poissant/Blaise	2005-08-23	Station 3	Water	Btl. 1 litre	3
Poissant/Blaise	2005-08-30	Station 7	Water	Btl. 1 litre	3
Poissant/Blaise	2005-09-03	CA05-05	Water	Btl. 1 litre	3
Poissant/Blaise	2005-09-10	Station 11	Water	Btl. 1 litre	3
Poissant/Blaise	2005-08-20	Station BA-11	Sediment	Sac	1
Poissant/Blaise	2005-08-23	Station 3	Sediment	Sac	1
Poissant/Blaise	2005-08-30	Station 7	Sediment	Sac	1
Poissant/Blaise	2005-09-10	Station 11	Sediment	Sac	1
Poissant/Constant	2005-08-16	BA01-05	MES	2 Filtres (sac)	1
Poissant/Constant	2005-08-23	Station 3	MES	2 Filtres (sac)	1
Poissant/Constant	2005-08-30	Station 7	MES	2 Filtres (sac)	1
Poissant/Constant	2005-09-03	CA05-05	MES	2 Filtres (sac)	1
Poissant/Constant	2005-09-10	Station 11	MES	2 Filtres (sac)	1
Poissant/Constant	2005-08-20	Station BA-11	Sediment	2 tubes (sac)	1
Poissant/Constant	2005-08-23	Station 3	Sediment	2 tubes (sac)	1
Poissant/Constant	2005-08-30	Station 7	Sediment	2 tubes (sac)	1
Poissant/Constant	2005-09-10	Station 11	Sediment	2 tubes (sac)	1

3.2.12 Sample lists Leg 2

Table 3.5. List of samples stored in the refrigerator (4°C) during Leg 2.

Project	Date	Station	Type	Container	Number
Mercure	2005-09-27	Station 16	Water	Btl 500 ml	2
Mercure	2005-09-30	Station YGW (AN03-05)	Water	Btl 500 ml	2
Mercure	2005-10-06	Station 22	Water	Btl 500 ml	2
Mercure	2005-10-09	Station Nelson River	Water	Btl 500 ml	2

Table 3.6. List of samples stored in the freezer (-20°C) during Leg 2.

Project	Date	Station	Type	Container	Number
Herbicides	2005-09-26	17	Particles	6 filtres (sac)	1
Herbicides	2005-09-26	17	Water	XAD / Btl. 250 ml	1
Herbicides	2005-09-26	17	MES	2 filtres F2 & F3 (sac)	1
Herbicides	2005-10-01	AN03-05	Particles	5 filtres (sac)	1
Herbicides	2005-10-01	AN03-05	Water	XAD / Btl. 250 ml	1
Herbicides	2005-10-01	AN03-05	MES	2 filtres F4 & F5 (sac)	1
Herbicides	2005-10-06	22	Particles	4 filtres (sac)	1
Herbicides	2005-10-06	22	Water	XAD / Btl. 250 ml	1
Herbicides	2005-10-06	22	MES	2 filtres F6 & F7 (sac)	1
Herbicides	2005-10-09	24	Particles	11 filtres (sac)	1
Herbicides	2005-10-09	24	Water	XAD / Btl. 250 ml	1
Herbicides	2005-10-09	24	MES	2 filtres F8 & D7 (sac)	1
Herbicides	2005-09-16	Transit	Air	PUF #5	1
Herbicides	2005-09-16	Transit	Particles	Filtres # 58 (sac)	1
Herbicides	2005-09-23	Transit	Air	PUF #2	1
Herbicides	2005-09-23	Transit	Particles	Filtres # 59 (sac)	1
Herbicides	2005-09-30	Transit	Air	PUF #1	1
Herbicides	2005-09-30	Transit	Particles	Filtres # 57 (sac)	1
Herbicides	2005-10-10	Transit	Air	PUF #	1
Herbicides	2005-10-10	Transit	Particles	Filtres # 50 (sac)	1
Herbicides	2005-10-17	Transit	Air	PUF #4	1
Herbicides	2005-10-17	Transit	Particles	Filtres # 46 (sac)	1
Herbicides	2005-10-22	Blanc1	Air	PUF #	1
Herbicides	2005-10-22	Blanc1	Particles	Filtres # 48 (sac)	1
Herbicides	2005-10-22	Blanc2	Air	PUF #12	1
Herbicides	2005-10-22	Blanc2	Particles	Filtres # 51 (sac)	1
Herbicides	2005-10-24	Transit	Air	PUF #7	1
Herbicides	2005-10-24	Transit	Particles	Filtres # 47 (sac)	1
Herbicides (Poissant/Blaise)	2005-09-26	17	Sediment	2 Sac	1
Herbicides	2005-10-01	AN03-05	Sediment	Sac	1
Herbicides	2005-10-02	Station 21	Sediment	Sac	1
Herbicides	2005-10-16	Station 27	Sediment	Sac	1

Table 3.7. List of samples stored in the freezer (-80°C) during Leg 2.

Project	Date	Station	Type	Container	Number
Poissant/Blaise	2005-09-27	Station 16	Water	Btl. 1 litre	3
Poissant/Blaise	2005-09-30	Station YGW (AN03-05)	Water	Btl. 1 litre	3
Poissant/Blaise	2005-10-06	Station 22	Water	Btl. 1 litre	3
Poissant/Blaise	2005-10-09	Station Nelson River	Water	Btl. 1 litre	3
Poissant/Blaise	2005-10-01	AN03-05	Sediment	Sac	1
Poissant/Blaise	2005-10-02	Station 21	Sediment	Sac	1
Poissant/Blaise	2005-10-16	Station 27	Sediment	Sac	1
Poissant/Constant	2005-09-27	Station 16	MES	1 Filtre (sac)	1
Poissant/Constant	2005-09-30	Station YGW (AN03-05)	MES	1 Filtre (sac)	1
Poissant/Constant	2005-10-06	Station 22	MES	2 Filtres (sac)	1
Poissant/Constant	2005-10-09	Station Nelson River	MES	2 Filtres (sac)	1
Poissant/Constant	2005-09-26	17	Sediment	2 tubes (sac)	1
Poissant/Constant	2005-10-01	AN03-05	Sediment	2 tubes (sac)	1
Poissant/Constant	2005-10-02	Station 21	Sediment	2 tubes (sac)	1
Poissant/Constant	2005-10-16	Station 27	Sediment	2 tubes (sac)	1

4 Atmosphere, air-surface fluxes and gas exchange dynamics – Legs 1 and 2

ArcticNet Phase I – Project 3.1: Ocean-Ice-Atmosphere Coupling and Climate Variability.
ArcticNet/Phase 1/ Project 3.1

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4.1 Introduction

Accurate measurements of the surface heat budget of the Arctic are fundamental to improving our understanding of the coupling between ocean, ice and atmosphere, and the feedback loops that connect them and govern the response of the Arctic to climate change. The surface heat budget can be conveniently divided into two components: radiative and turbulent exchanges (ignoring heat flow by conduction). The radiative term has two components: (i) shortwave radiation which is largely in the visible part of the spectrum and which is controlled by the incident sunlight and surface reflectance, and (ii) longwave radiation that is in the infrared and is controlled by temperature and composition of the surface and atmosphere, including clouds. The turbulent heat exchange has two components: the sensible heat exchange caused by the temperature difference across the interface at the base of the atmosphere, and the latent heat exchange which is associated with phase changes of water at the base of the atmosphere. Closely linked with these is the turbulent exchange of gases between the ocean, ice cover and the atmosphere above.

By coupling observations of these energy fluxes with observations of gas concentrations, scientists in recent years have been able to directly study the exchange of gas species between the atmosphere and a surface of interest. Such studies have been made from research vessels around the world in order to understand the magnitude and direction of gas exchange with the world's oceans. Particular attention has been paid to carbon dioxide (CO_2) because of its rapid increase due to anthropogenic processes and because of its greenhouse gas properties. These combined efforts have revealed a global picture of where oceans act as a source or sink of atmospheric CO_2 (Takahashi et al. 1999). However, Hudson Bay and other Arctic regions have not been subject to extensive studies of this kind, and remain a blank spot on most global maps of CO_2 flux. This report describes the meteorological and flux data collected during the ArcticNet High Arctic (Leg 1) and Hudson Bay (Leg 2) scientific expedition in an effort to improve our knowledge on the radiant and turbulent fluxes occurring in these regions.

4.2 Methodology

4.2.1 Flux tower

Instruments to measure the components of the surface heat budget and CO_2 flux were mounted on a telescoping tower located on the foredeck of the CCGS *Amundsen*. Components of the installation are shown in Figures 4.1 and 4.2. The variables monitored by each sensor, their temporal resolution and start/end dates are listed in Tables 4.1 (Leg 1) and 4.2 (Leg 2).

Figure 4.1. The foredeck of the CCGS *Amundsen* equipped with a meteorological tower for surface meteorology and CO_2 flux measurements.

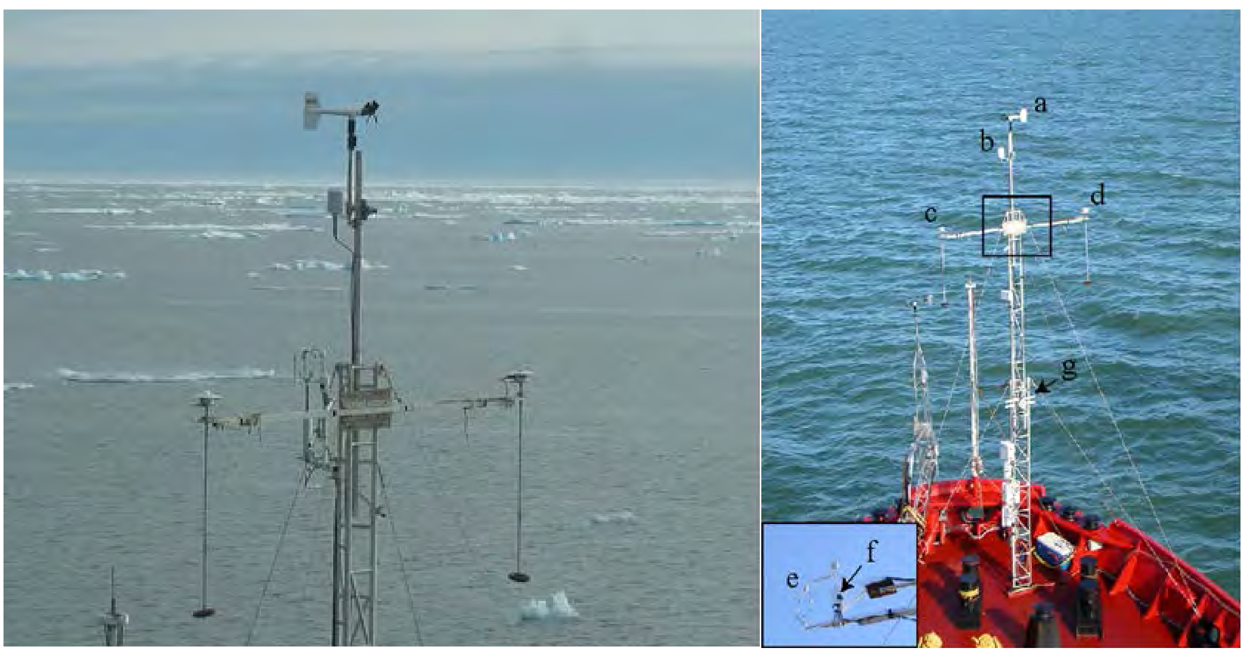

Figure 4.2. Upper section of the tower showing: (a) wind monitor; (b) shielded temperature-relative humidity probe; and gimballed (c) pyranometer and (d) pyrgeometer; (e) sonic anemometer; (f) open-path CO_2/H_2O sensor. (g) The motion sensor is located outside of the picture.

Table 4.1. The meteorological variables monitored during Leg 1 through the Northwest Passage. Item letter corresponds to sensor depicted in Figure 3.2. Heights for items represent distance to the ship's deck (add ~7 m to each for distance to the sea surface).

Item in Fig. 3.2	Variable	Sensor Manufacturer (model)	Ht. (m)	Operation Dates
a	horizontal wind speed and direction	RM Young wind monitor (model 05106 MA)	8.33	
b	temperature and relative humidity	Vaisala (model HMP45C212)	7.77	
c	downwelling shortwave radiation	Eppley pyranometer (model PSP)		
d	downwelling longwave radiation	Eppley pyrgeometer (model PIR)		
e	wind vector (x, y, z coordinates)	Gill sonic anemometer (model R3-50)	6.58	
f	CO_2 and H_2O concentration	LI-COR (model LI-7500)	6.58	
g	3D acceleration and angular rate (x, y, z coordinates) of tower	BEI Systron Donner (MotionPak model MP-GCCCQBBB-100)	3.88	

Table 4.2. The meteorological variables monitored during Leg 2 in Hudson Bay. Item letter corresponds to sensor depicted in Figure 3.2. Heights for items represent distance to the ship's deck (add ~7 m to each for distance to the sea surface).

Instrument (Manufacturor/Model)	Variable	Ht (m)	Temporal Resolution	Operation Dates	Item in Fig. 3.2
RM Young wind monitor (model 15106 MA)	Horizontal wind speed and direction	8.33	2 sec, stored as 1 min avg	Sep. 15 – Oct. 18	a
Vaisala RH/Temp probe (model HMP45C212)	Temperature and relative humidity	7.77	2 sec, stored as 1 min avg	Sep. 15 – Oct. 18	b
Eppley pyranometer (model PSP)	Incoming shortwave radiation		2 sec, stored as 1 min avg	Sep. 15 – Oct. 18	c
Eppley pyrgeometer (model PIR)	Incoming longwave radiation		2 sec, stored as 1 min avg	Sep. 15 – Oct. 18	d
Campbell Scientific sonic anemometer (model CSAT3)	3-dimensional wind vector (x,y,z) and sonic temperature	6.58	10 Hz	Sep. 15 – Oct. 18	e
LI-COR Gas Analyzer (model LI-7500)	CO_2 and H_2O concentration	6.58	10 Hz	Sep. 15 – Oct. 18	f
BEI Systron Donner Motion Pak (Model MP-GCCCQBBB-100)	3D acceleration and angular rate (x,y,z) of tower	3.88	10 Hz	Sep. 15 – Oct. 18	g

The output from the sensors on the meteorological tower was recorded by two Campbell Scientific (Model 23X) microloggers. Measurements of incoming shortwave and longwave radiation, wind speed and direction, temperature and relative humidity were recorded every 2 seconds and stored as 1-minute averages. Data from the CR23X were transferred every hour through a LAN cable to a personal computer located in the foredeck container using Campbell Scientific's LoggerNet software and a NL100/105 network link interface.

Signals from the sonic anemometer, open-path H_2O/CO_2 sensor and the motion sensor on the tower were sampled by a second Campbell Scientific CR23X micrologger at 10 Hz frequency. Data were transferred to the personal computer every 10 minutes. Due to trouble with the sonic anemometer interface box, anemometer data was later captured directly to the computer using a directly connected RS-232 cable and instrument software. Data needs to be synchronized during post processing.

The duration that each sensor was operational for is listed in Table 4.1 and 3.2 for Legs 1 and 2, respectively. The data series is not continuous for each sensor between these dates because of any combination of sensor malfunction and severe weather. Unreliable data is also expected during ice breaking due to the shaking of the tower. A computer crash of the PC downloading flux tower data occurred on 13 October (Leg 2), causing a loss of high-resolution flux data from 11-12 October, along with a loss of some of the low-resolution meteorological data. This data will hopefully be retrieved from the hard drive of the failed PC upon return from the cruise. All data must be processed and analyzed at the University of Manitoba before the number of 'good' hours of operation can be made available.

4.2.2 pCO2 measurements (Leg 2)

To supplement CO_2 flux measurements, the amount of dissolved carbon dioxide in the surface ocean was measured using a custom-designed pump (Figure 4.3). The pump operated at a depth of approximately 1 m and was deployed over the side of the CCGS *Amundsen* whenever the ship was stationary at a sampling station or CTD location. The pump extracts dissolved CO_2 from the water and passes the gas sample through a Licor gas analyzer (model LI-820). pCO_2 data was collected at 2 second intervals using a Campbell Scientific CR10X logger and was stored as one minute averages. Whenever possible, a sample was collected for 30 minutes, but often this time was shortened due to logistical constraints.

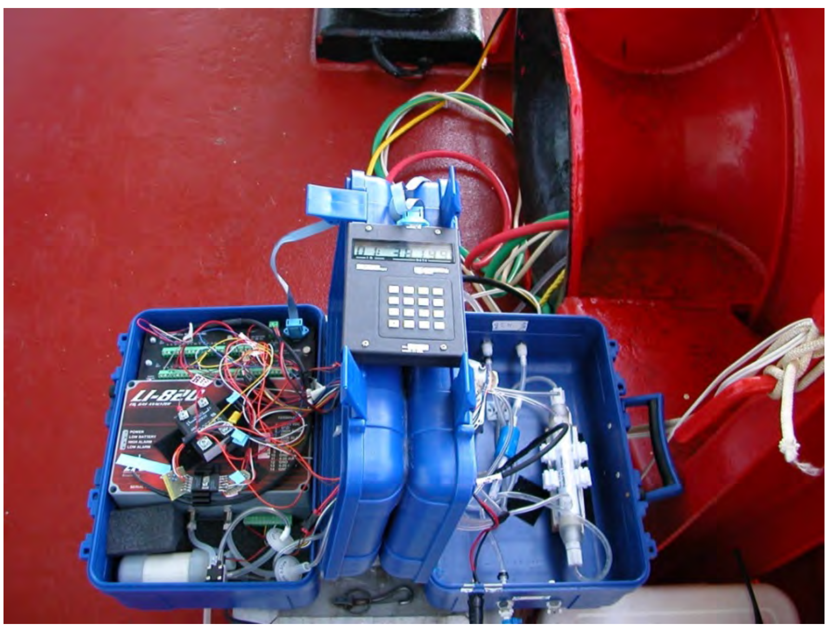

Figure 4.3. Custom-built pCO_2 pump in operation. Note the Licor gas analyzer and CR10X logger on the left side, and the gas extraction chamber on the right side.

4.2.3 Gas analyzer calibration

Periodically throughout the cruise, calibrations were performed on both gas analyzers (flux tower and pCO_2 pump). These calibrations were performed with a calibration gas of known CO_2 concentration and allowed to ensure compatibility of measurements between the two gas analyzers.

4.2.4 *Manual meteorological observations*

Surface-based manual observations (manobs) were conducted during the daytime when the sky condition was visible. These observations were made as close to hourly as possible, however other commitments often prevented a full record. These observed values are largely qualitative, since they rely only on the observer and not scientific instruments. Starting from 25 August, a rough estimation of sea ice fraction was performed, ranging between 0 and 10. Table 4.3 shows the observations that were made and explains the qualitative scales used. Data was saved in Excel files.

Table 4.3. Description of manual weather observations.

Weather Observation	Description of Scale
Cloud fraction	Observed on a scale from 0-10 (1-8 in Leg 1), where 10 is a complete cloud cover and 0 is no cloud cover
Visibility	Observed on the following scale: fog, very poor, poor, fair, good, very good, excellent
Cloud type	Clouds were classified based on structure and height: Lower than 2km: Stratus (St), Stratocumulus (Sc) 2-4 km: Altostratus (As), Altocumulus (Ac), Nimbostratus (Ns) 4km +: Cirrus (Ci), Cirrocumulus (Cc), Cirrostratus (Cs)
Weather	General observations were made here, including observations about current precipitation
Sea state	Observations were made on the Beaufort Scale
Ice concentration	Observations made as fraction out of 10 (10/10 being complete ice coverage, 0/10 being no ice coverage)

4.2.5 *Ceilometer*

A Vaisala CT25K laser ceilometer was continuously running to measure the cloud ceiling height. The instrument automatically recorded ceilings every 60 seconds and a data file were saved hourly on a PC located in the data acquisition room. The instrument ran continuously except for a brief interruption due to a blown fuse on 18 September during Leg 2.

4.2.6 *All-sky camera*

Clouds play an important role in modulating the incident solar radiation and augmenting the downwelling atmospheric infrared radiance. An all sky camera (Figure 4.4) mounted on the top of the bridge was used to capture images of cloud cover and cloud type. It consisted of a video camera directed downwards to a hemispheric mirror, which provides a view of the entire sky. The images are recorded for daylight conditions on a time-lapse video recorder at ~17 sec intervals. These images will be analyzed later to determine cloud type and cloud fraction.

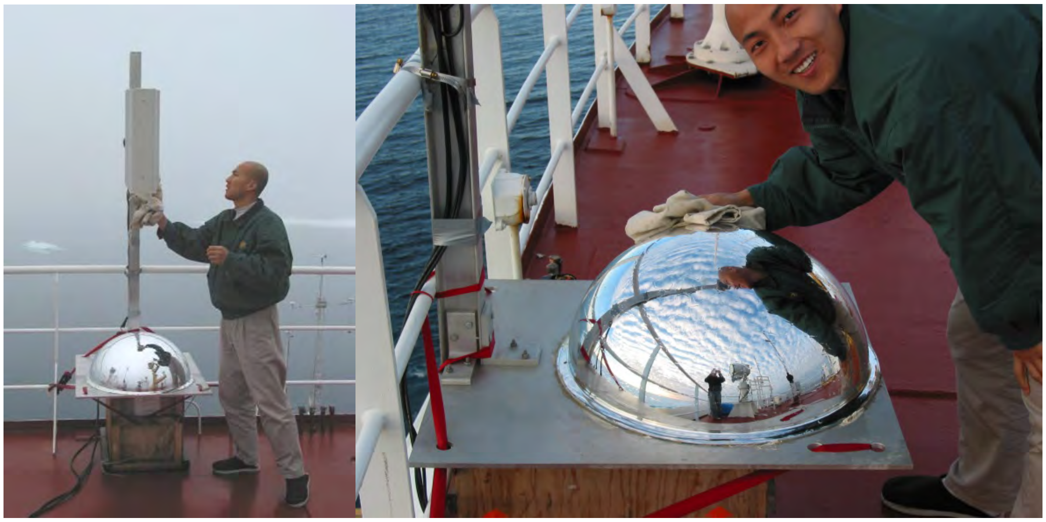

Figure 4.4. The all-sky camera was mounted on the “monkey island” above the wheelhouse. The dome needed to be maintained by removing water droplets and ice.

4.3 Preliminary results

An example of a file recording ceiling conditions (between 10:00 and 11:00 UTC on 31 August, 2005) is shown in Figure 4.5. An earlier study (Hanesiak 1998) reported that the ceilometer could not detect high clouds (>6 km) in high latitude areas. In the case of this instrument, after cleaning the mirror, it could detect most of Cs and Cc higher than 6 km but not Ci uncinus, i.e. the cirrus with a very thin filament structure.

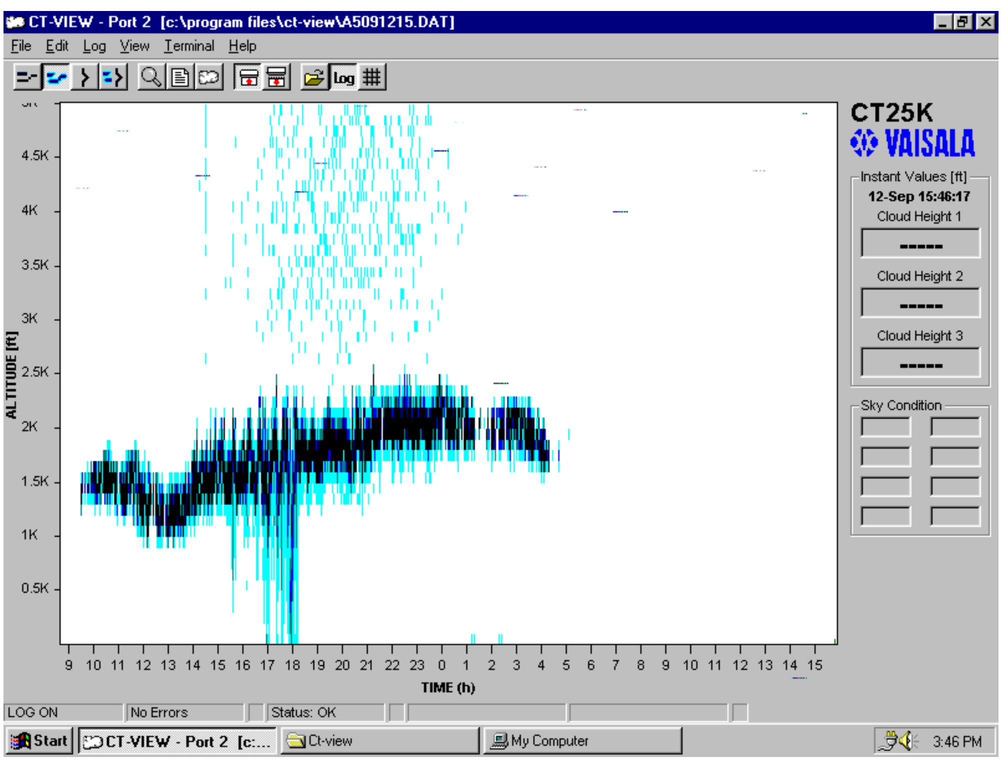

Figure 4.5. The interface of the ceilometer system showing ceiling conditions between 10:00 and 11:00 UTC on 31 August 2005.

4.4 Comments and recommendations (Leg 2)

The main problem encountered during this cruise was contamination of the flux tower by the smokestack of the CCGS *Amundsen*. This problem was most prevalent during times when the ship was stationary. At most locations, the ship was parked with its stern into the wind in order to control the ship during deployment of various instruments (e.g., Rosette). This caused the smokestack effluent to be blown onto the flux tower, making observations taken at such times useless. This data will be eliminated during post-processing by filtering out observations in which the wind direction relative to the boat was unfavorable. Although this problem did result in a significant loss of data, the time that the ship spent in transit far outweighs the time spent on station, therefore a sufficient amount of data is expected to be retained.

The second most serious problem (discussed above) was the loss of a small amount of flux and meteorological data during the PC crash. A few minor problems were encountered when the pCO_2 pump failed, causing missed data for a few of sampling stations.

References

Takahashi, T., R.H. Wannikhof, R.A. Feely, R.F. Weiss, D.W. Chapman, N.R. Bates, J. Olafsson, C.L. Sabine and S.C. Sutherland, 1999. Net sea-air CO_2 flux over the global oceans: An improved estimate based on the air-sea pCO_2 difference. *In*: Nojiri, Y. (ed.), *Proceedings of the 2nd International Symposium on CO_2 in the Oceans,* pp. 9-15, Tsukuba, Japan, January 18-23, 1999.

5 Sea ice: remote sensing and physical processes – Leg 1

ArcticNet Phase I – Project 1.1: Warming Coastal Seas & Shrinking Sea Ice. ArcticNet/Phase 1/Project 1.1
ArcticNet Phase I – Project 3.1: Ocean-Ice-Atmosphere Coupling and Climate Variability. ArcticNet/Phase 1/Project 3.1

Project leaders: David Barber[1] (dbarber@cc.umanitoba.ca) and Tim Papakyriakou[1] (papakyri@cc.umanitoba.ca)
Cruise participants Leg 1: Pyong Jun (Philip) Hwang[1], Jens Ehn[1] and Xin Jin[1]
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5.1 Introduction

Optical and microwave satellite data can provide valuable information to improve the understanding of the key mechanisms involved in causing Arctic climate change. These variables include surface reflectance in the visible and near infrared, surface temperature, as well as passive- and active- microwave signatures. These data are obtained from the space-born sensors using algorithms derived in a variety of ways, but to determine the accuracy of the derived parameters, a comparison with independent high-quality measurements is required. Such measurements were taken from the CCGS *Amundsen*, providing a high quality platform for taking *in situ* measurements of many critical parameters in Atmosphere-Sea ice-Ocean (ASO) system in the Arctic, though these measurements are constrained by the ship's position in space and time. During transit, high-resolution sub-pixel scale measurements were obtained of characteristic surface features that build up the marginal ice zone (MIZ) mosaic of ice, melt ponds and open water.

5.2 Methodology

5.2.1 Sea ice physical and optical measurements (Ice Raids)

Six ice raids were made in Leg 1 (Table 5.1). Four ice raids were made using the ice cage, one from the helicopter and one using the air/ice boat (Table 5.1and Figure 5.1). Physical properties of snow/sea ice were collected opportunistically during the ice raids: snow/ice/melt pond temperature, salinity and capacitance. Visual surface condition and topography, as well as the general sea ice conditions, such as the depth of melt pond, the height of hummock, were also recorded. Still pictures were taken over all surface types. The surface albedo (300-2500 nm with 1nm resolution) was measured on characteristic surface types using an Analytical Spectral Device (ASD) spectroradiometer (Figure 5.2). A calibrated cosine receptor (180° FOV), connected to the ASD through a fiber optic cable, was used for both the down- and upwelling irradiance measurements. First, 10 spectra were measured of the incoming irradiance, then the receptor was turned around and 10 spectra were obtained from the reflected irradiance. In order to reduce noise, each spectrum was further averaged over 25 separate spectra.

Figure 5.1. Ice raid using the ship's cage to access the ice.

Conductivity, temperature and depth (CTD) cast were conducted in melt ponds and through the melt ponds into the water column. For this, a small Idronaut OceanSeven 304 CTD probe ("Manitoba special") was used. This probe was small enough to fit through a 2 inch Kovacs auger hole.

Table 5.1. Summary of ice raids conducted during Leg 1.

Date/Location	Transport	Variables	Comments
2005.08.26 Larsen Sound (70º 40.1674N, 98º 45.8447W)	Ice Cage	Visual surface condition, snow/ice temperature and salinity, snow surface capacitance, Melt pond temperature and salinity	
2005.09.02 2236 UTC Beaufort Sea (XXN, XXW)	Air/Ice Boat	Visual surface condition, snow/ice temperature and salinity, snow surface capacitance, Melt pond temperature and salinity, Spectral albedo over snow/ice and melt ponds	
2005.09.04 0037 UTC Beaufort Sea (71º 29.1060N, 130º 19.9825W)	Ice Cage	Visual surface condition, snow/ice temperature and salinity, snow surface capacitance, Melt pond temperature and salinity, Spectral albedo over snow/ice and melt ponds, CTD	
2005.09.05 1731 UTC Beaufort Sea (XXN, XXW)	Helicopter	Visual surface condition, snow temperature and salinity, snow and frozen melt pond surface capacitance, CTD cast through melt pond	MYI floe with ridges
2005.09.05 2227UTC Beaufort Sea (71º 32.3548N, 140º 01.520W)	Ice Cage	Visual surface condition, snow/ice temperature and salinity, snow surface capacitance, Melt pond temperature and salinity, Spectral albedo over snow/ice and melt ponds, CTD cast through melt ponds	
2005.09.07 0037UTC Beaufort Sea (71º 04.0954N, 133º 36.9200W)	Ice Cage	Visual surface condition, snow/ice temperature and salinity, snow surface capacitance, Melt pond temperature and salinity, Spectral albedo over snow/ice and melt ponds, CTD cast through melt ponds	MYI, ice thickness > 3 m

In general, the ice was in the late stages of the melt season during Leg 1. Melt ponds had rough bottoms and where often connected to the surrounding ocean. Hummocks were hard granular ice or snow (difficult to determine which) and had a white appearance (see Figures 4.1 and 4.4). During the later stages of Leg 1, the pack ice environment appeared to be in the early stages of freeze onset; even salty melt ponds had a ~1 cm refrozen ice layer on the surface, and ice rind was observed in openings between floes. An interesting occasional feature was the melt pond ice that was detached from their supporting ice floes and thereby forced by buoyancy to the surface. The “melt pond floes” formed rough, spiky surfaces.

5.2.2 Ship-based microwave and optical measurements

The sensors mounted onboard the CCGS *Amundsen* are listed and described in Table 5.2. Microwave radiometers were dual polarized (vertical and horizontal) radiometers at 19, 37 and 85 GHz with 15-degree beam width antennas. The radiometers were mounted about 12 m above the sea surface on the portside of the ship (Figure 5.2). The radiometers were kept fixed at an incident angle of 53° taking microwave brightness temperature every 5 seconds, both during transect and at ice stations. A microwave C-band scatterometer system was also deployed onboard the *Amundsen* (Figure 5.2). The scatterometer has four combination of different polarization (VV, HV, VH, HH). The radiometers and scatterometer were protected within a shed from cold and/or moist weather while not in operation.

A network camera was mounted on the railing beside radiometer shed (Figure 5.2). The network camera looked at surface at incident angle of 72° with FOV of 56.67°. The surface pictures were continuously taken every 5 seconds and automatically downloaded to a laptop computer. Furthermore, a hand-held digital camera was used to record the visual surface condition from time to time.

An infrared transducer (model Everest 4000.4ZL) was also fastened to the railing at port-side beside the network camera (Figure 5.2). The infrared transducer has a Field-Of-View (FOV) of 4° and looks out at ~50° off the nadir angle in order to be unaffected by the ship’s wake. Using the infrared transducer, the skin temperature of the surface was measured with 5-10 second intervals. This data is compared to the ship’s flow-through thermosalinograph (TSG) system with a goal to study effects from various surface conditions. Additionally, a dual-headed ASD was used to measure continuous spectra of reflected radiance and incoming irradiance. The instrument was placed on the top of the bridge (Figure 5.2b).

Table 5.2. Sensors mounted onboard the CCGS *Amundsen* for sea surface and sea ice measurements.

Sensor	Variable	Units	Spectral Range
Microwave Radiometers (Dual Polarization, vertical and horizontal)	Microwave brightness temperatures	K	19, 37 and 85 (GHz)
Microwave Scattereometer	Backscattering	dB	C-band
Network Camera (Canon)	Still picture	N/A	RGB color
Everest 4000.4ZL IRTransducer	Surface Temperature	°C	800-1400 nm
Visible and near infrared spectroradiometer (Dual heads)	Spectral reflectance and incoming spectral irradiance	W/m^2	350-1050 nm

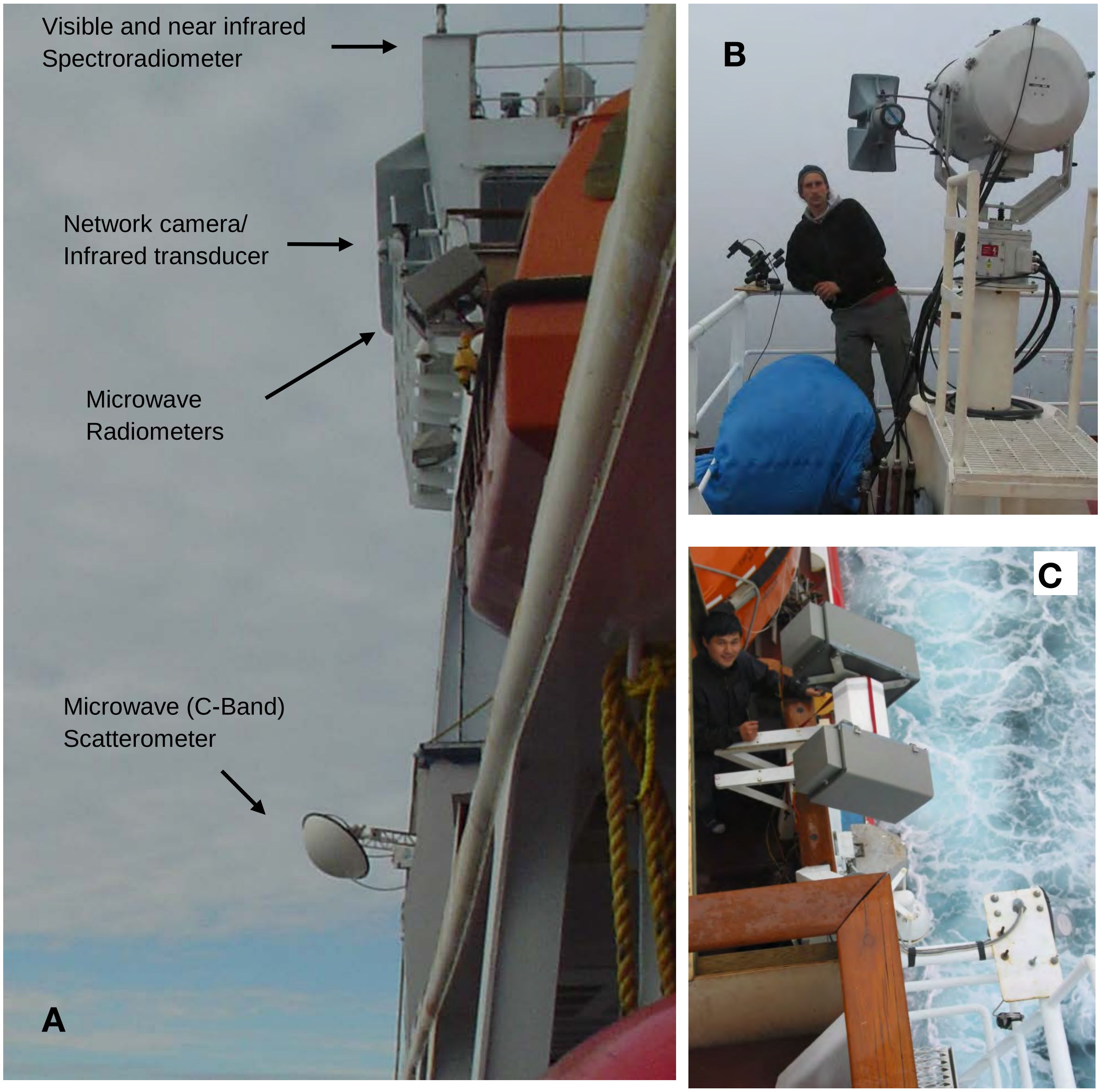

Figure 5.2. (A) Ship-based instruments on port side). (B) Visible and near infrared spectroradiometer (ASD). An 8-degree field-of-view fore-optic is aiming at the surface with a 45° incidence angle and a second cosine receptor was mounted on the top of spotlight measuring incoming irradiance (W/m^2nm). (C) Observing surface condition with microwave radiometers 19GHz (left gray box) and 37 and 85 GHz (right gray box). The network camera and infrared transducer are at the bottom-right of (C).

5.3 Preliminary results

The data are preliminary and have not yet been quality-checked. Two examples of passive microwave radiometer and spectral albedo measurements are shown below. The dramatic transition of passive microwave signatures from open water to ice floe is illustrated in Figure 5.3. The pictures above the plot represent coincident surface photographies. Open water is characterized by warmer brightness temperatures with increased frequencies and higher polarization. In the ice floe depression at higher frequencies occurs and polarization dramatically decreases. This preliminarily data set shows a very good example of how sea ice signatures can be discriminated from open water.

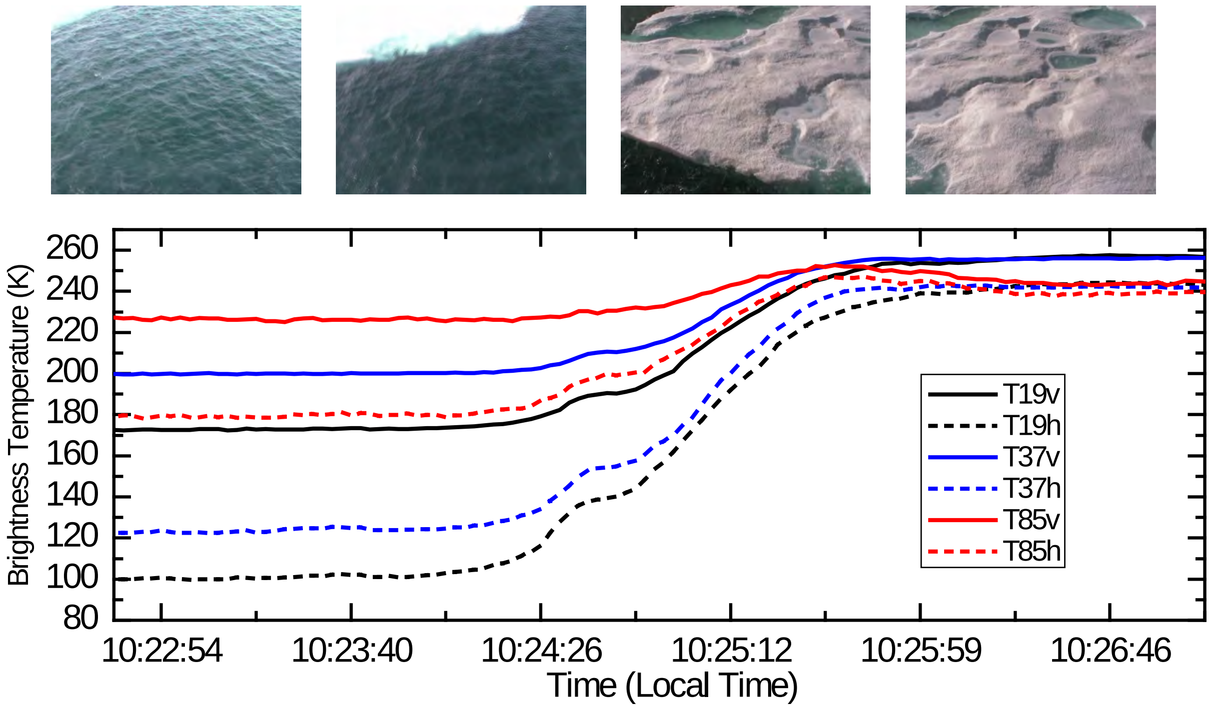

Figure 5.3. Example of ship-based radiometers measurement from open water to MYI floe with coincident pictures from network camera. This preliminary data shows the transition of passive microwave signatures from open water to multi-year ice.

The difference between the reflectance from a melt pond and white ice is shown in Figure 5.4. In the visible (i.e. ~400-700 nm) there is little spectral dependence seen in the snow covered or hummocked ice; the ice appears white. At these wavelengths almost 80-90% of all incoming shortwave radiation is reflected back to the atmosphere. This reduces the amount of energy absorbed within the ice and thus slows down the melting. On the other hand, the melt ponds show large spectral dependence in the visible with a maximum at 400-450 nm; the ice appears blue. The magnitude of the albedo is also much lower. This means that much more solar energy is absorbed in the melt pond than in the white ice.

With time, this causes the ice floe to obtain its hummocky appearance. The high values near 1350 nm and 1850 nm in Figure 5.4 are due to extremely low irradiance levels at these wavelengths as most radiation is already absorbed in the atmosphere.

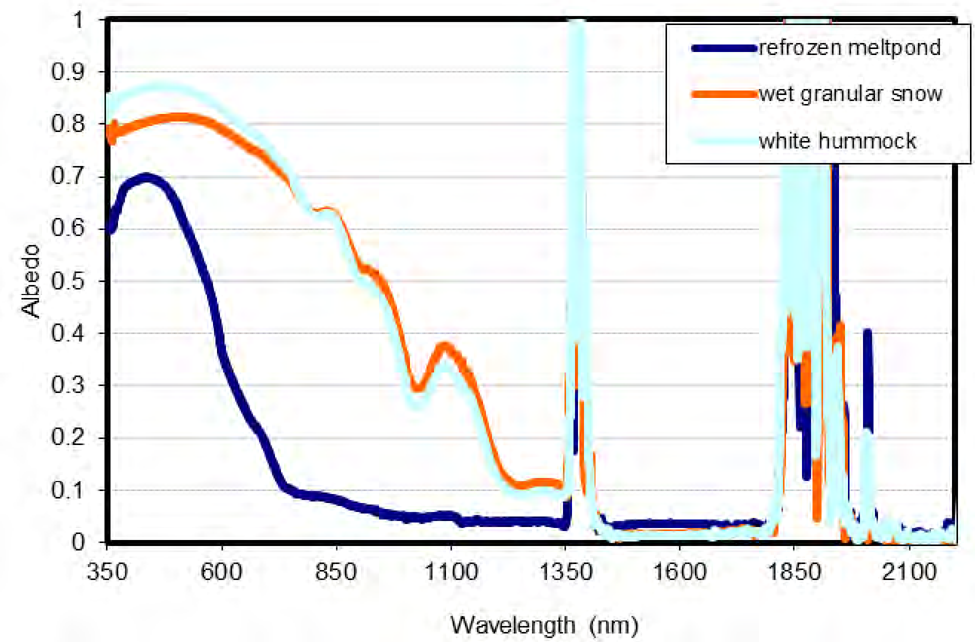

Figure 5.4. Spectral albedo examples encompassing most of the solar shortwave spectra. The spectra were measured on 4 September in the Beaufort Sea multi-year ice during Leg 1.

6 Mooring program – Legs 1 and 2

ArcticNet Phase I – Theme 1: Climate Change Impacts in the Canadian High Arctic: A Comparative Study Along the East-West Gradient in Physical and Societal Conditions.
ArcticNet/Phase 1/Project 1.1

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6.1 Introduction

In 2005, mooring operations were conducted from the CCGS *Amundsen* in three regions of the Canadian North as part of the ArcticNet Mooring Program (Figure 6.1). During Leg 1, four moorings were deployed in Baffin Bay in the North Water (NOW) Polynya region and four moorings were deployed in the Amundsen Gulf/Beaufort Sea region at mooring sites established during the CASES overwintering expedition (2003-2004). In Leg 2, the *Amundsen* sailed to Hudson Bay where three ArcticNet moorings were deployed.

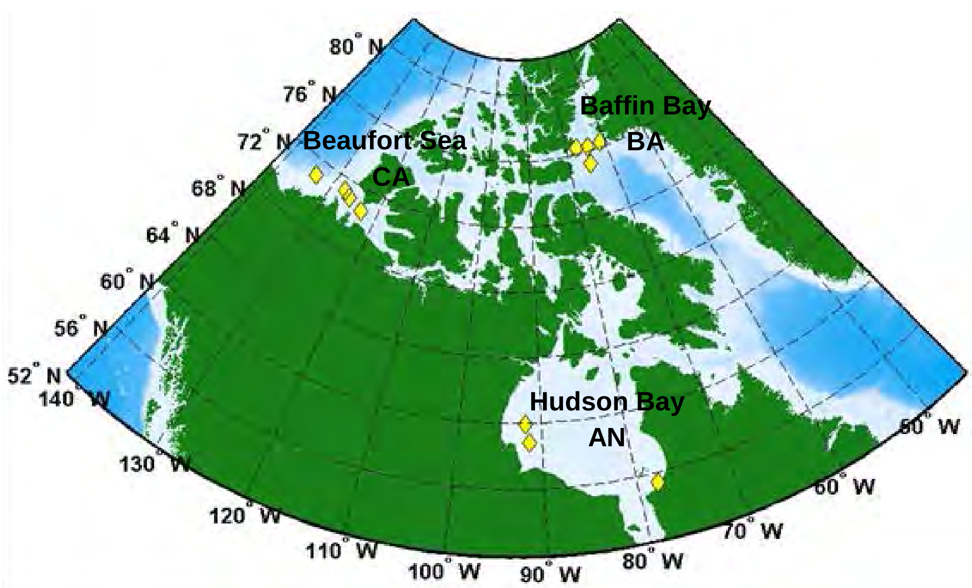

Figure 6.1. Locations of ArcticNet oceanographic moorings deployed in 2005. Mooring deployments in Baffin Bay (BA) and the Beaufort Sea (CA) were carried out during Leg 1, and mooring operations in Hudson Bay (AN) took place during Leg 2.

The primary objectives of the mooring program in 2005 were to:

- Deploy four new North Water Polynya (NOW) moorings in northern Baffin Bay (BA01-, BA02-, BA03- and BA04-05).
- Recover the remaining CASES moorings deployed in 2003 and 2004 in the Beaufort Sea (CA13-03, CA14-03, CA04-04, CA05-04, CA07-04, CA15-04, CA18-04 and CA20-04).
- Re-deploy four of the Beaufort Sea moorings (CA04-, CA05-, CA08- and CA18-05).
- Deploy three new ArcticNet moorings (AN01-, AN02- and AN03-05) and one Manitoba Hydro mooring (AN04(MH)-05) in Hudson Bay.

6.1.1 Regional objectives

The moorings deployed in Baffin Bay in 2005 (labeled BA##-05) aim to investigate the particulate organic carbon (POC) fluxes relative to the oceanographic characteristics (current speeds, temperature, salinity, etc.) in the North Water (NOW) Polynya.

The primary objective of the Beaufort Sea moorings re-deployed in 2005 (labeled CA##-05) aim at better understanding the character and causes of variability and change in the Canada Basin. The secondary objective is to improve understanding of the influence of topography on the exchange of waters between the continental shelf and the ocean basin. The Beaufort Sea moorings carried sediment traps to measure the carbon flux and were equipped with ADCP current profilers and CTD sensors to measure associated oceanographic conditions to investigate the fluid dynamics in relation to detrital transport.

The objective of the Hudson Bay moorings deployed in 2005 (labeled AN##-05) is to study the strength of the anti-cyclonic circulation along the Hudson Bay coast which involves currents very close to shore. The second objective is to investigate the west-east gradient in productivity close to the main rivers. The locations were chosen on the basis of previous mooring positions occupied in the late 1980s by a joint DFO-GIROQ mooring program and to avoid overlap with the MERICA-Nord mooring program (2003-2005) focusing on central Hudson Bay and Hudson Strait.

Table 6.1. ArcticNet moorings deployed in 2005 in Baffin Bay (BA) and the Beaufort Sea (CA) during Leg 1, and in Hudson Bay (AN) during Leg 2.

Mooring ID	Area	Rationale	Program	Latitude N	Longitude W	Depth (m)
Baffin Bay						
BA01-05	Baffin Bay East, near Greenland	Eastern NOW polynya at the location of Mooring S2 deployed in 1998. Eastern end of ArcticNet Baffin Bay transect visited each year.	ArcticNet	76°19.620	071°11.904	649
BA02-05	Baffin Bay, central northern position	Central NOW polynya at the location of Mooring S4 deployed in 1998. Midpoint of ArcticNet transect visited each year.	ArcticNet	76°16.056	074°34.500	444
BA03-05	Baffin Bay West, near Ellesmere Island	Western NOW polynya at the location of mooring S5 deployed in 1998. Western end of ArcticNet transect visited each year.	ArcticNet	76°23.028	077°24.066	358

Mooring ID	Area	Rationale	Program	Latitude N	Longitude W	Depth (m)
BA04-05	Baffin Bay, central southern position	Southern NOW polynya at the location of mooring S3 deployed in 1998. POC flux during NOW was 2 orders of magnitude larger than S2-S4-S5.	ArcticNet	75°15.216	074°58.644	475
Beaufort Sea						
CA04-05	Kugmallit Valley, upper Mackenzie Shelf slope	CASES cross-shelf transect (with CA07 and CA12) to study Shelf-Basin interactions. Enhanced cross-shelf transport during upwelling-favorable surface stress (NE winds), but upwelling not as strong as in the Mackenzie Canyon or near Cape Bathurst. Downward flow of dense water (convection and/or wind-driven downwelling) from the Mackenzie Shelf inducing off-shelf transport of particulate matter. Very strong resuspension events recorded in winter, as for other sites on the slope.	ArcticNet	71°04.812	133°37.752	307
CA05-05	Amundsen Gulf mouth near Mackenzie Shelf	Productivity hotspot on the eastern shelf slope identified from benthic sampling. Intermittent upwelling of cold-saline water despite origin of upwelling being much closer to Cape Bathurst (CA06). Ocean circulation highly variable but along-shelf flow of Pacific-derived water entering the Amundsen Gulf can be monitored at depth. MMP associated with this mooring.	ArcticNet	71°16.836	127°32.178	205
CA08-05	Amundsen Gulf West (central)	Center of the Cape Bathurst polynya (Barber and Hanesiak, 2004). Very good candidate for the long-term monitoring of particle flux to catch both seasonal and inter-annual variability in marine productivity without large terrigenous inputs characterizing moorings close to the Mackenzie Shelf.	ArcticNet	71°00.408	126°04.464	397
CA18-05	Amundsen Gulf East (deepest point)	Location of historical DFO-IOS mooring (Melling & McLaughlin) monitoring the deepest point in Amundsen Gulf. Deep sediment trap (450 m) at this location over 2003-2007 revealed no trend in particle flux signal but strong resuspension.	ArcticNet	70°39.942	122°59.298	540
Hudson Bay						
AN01-05	Hudson Bay West, north of Nelson River	Located very close to shore to study the strength of anti-cyclonic circulation along the HB coast and to investigate W-E gradient in productivity close to main rivers. Sediment traps showed strong local resuspension signal throughout the year and massive amount of non-copepod swimmers (e.g. jellyfish, chaetognaths). Location chosen near 1980s DFO-GIROQ moorings and to avoid overlap with the MERICA mooring program focusing on central Hudson Bay and Hudson Strait. The MERICA program is now terminated.	ArcticNet	59°58.668	91°56.622	107
AN02-05	Hudson Bay W, closer to Nelson R. than AN01	Same as AN01-05	ArcticNet	58°46.926	91°31.392	80
AN03-05	Hudson Bay E, near Great Whale River	Same as AN01-05	ArcticNet	55°24.468	77°55.794	130
AN04 (MH)-05	Hudson Bay W, Nelson R. outer estuary	Same rationale as AN01-05; new partnership with Manitoba Hydro	ArcticNet Manitoba Hydro	57°34.193	91°37.704	45

6.2 Methodology

6.2.1 Mooring design and instrumentation

ArcticNet moorings were designed in a taut-line configuration (Figure 6.2). The first instrument deployed close to the surface was a conductivity-temperature (CT) probe with different models of Sea-Bird or Alec instruments being used. Sediment traps located at 100 m and/or 200 m were always attached 5 to 110 m below a current meter on the mooring line. Acoustic Doppler Current Profilers (ADCPs) were deployed at 100 m so they could provide current velocity and direction data from 100 m upwards while classical RCM11 current meter were used at 200 m and 400 m. Tables 6.6 to 6.16 in Section 6.2.5 detail the mooring line design and instrumentation employed on the individual moorings deployed in 2005, but the configuration of the mooring line generally consisted of:

- a top float
- a Conductivity, Temperature and Depth (CTD) probe to record water characteristics
- a Hydrophone – bioacoustics and underwater noises
- a Conductivity, Temperature and Depth (CTD) probe to record water characteristics
- sediment trap to collect descending sediment for particle flux analysis and accumulation rates
- an Acoustic Doppler Current Profiler (ADCP)
- in-line floatation to balance the weight/ float balance throughout the mooring line
- sediment trap to collect sinking particle fluxes and accumulation rates (deeper water moorings)
- a Conductivity, Temperature and Depth (CTD) probe to record water characteristics
- in-line floatation to balance the weight/ float balance throughout the mooring line
- two tandem mooring releases
- an anchor (one to three train wheels)

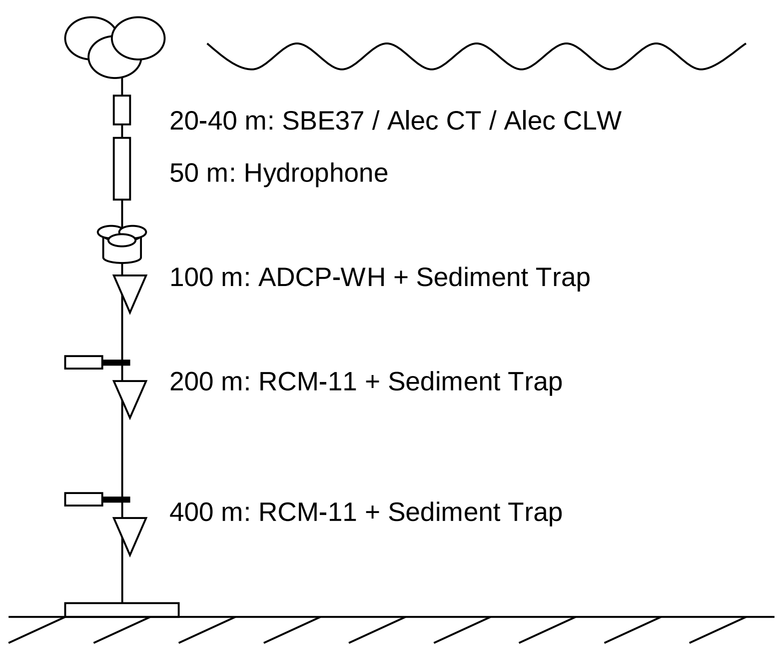

Figure 6.2. Illustration of a typical taut-line ArcticNet mooring.

6.2.2 Mooring equipment calibration and verification

Sensors calibration and validation

The sensors on Aanderaa RCM, SeaBird and JFE-ALEC instruments were calibrated by the manufacturers and were validated by the Université Laval technical team (details on the source and status of calibrations & verifications for all instruments are provided in Rail et al. 2010 and Meredyk 2014).

Field verifications of internal compasses

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. It was therefore important to verify internal compasses near the approximate latitude where they were deployed. Care was taken to eliminate all ferrous material in the mooring cages and in the environment when conducting these verifications.

The internal compasses of all ADCPs and current meters needed for the moorings deployed in each of the three different regions were verified on shore close to their respective deployment sites. However, these compass verifications were considered substandard by the mooring team in 2005 due to problems with magnetic interference at the selected sites and because magnetic North was used (Baffin Bay site) rather than true North. Therefore, in 2006, the recovered instruments were again verified on land close to their deployment locations and were reported as having been properly verified (Rail et al. 2010; Table 6.2).

The compass verification procedure followed standard manufacturer protocols and were conducted with a tilt and rotate jig using a tripod with a spinning top fixture, where the instrument was installed (Meredyk 2014). A Garmin hand-held GPS unit was used to establish a distinct true North sight line from the tripod to a landmark, and the successive instrument direction readings were obtained by rotating the unit relative to this true North direction, in 10-degree increments.

The Baffin Bay verification site was in Pond Inlet, NT (Figure 6.3) where on 14 August 2005, the mooring team went onshore (exact position not recorded) and verified the internal compasses on six Aanderaa RCM4 units (SN# 8214, 8859, 8672, 8673 and 8858); two RCM7 units (SN# 12800 and 10298); and two RDI ADCP Long Ranger (75 kHz) units (SN# 3883 and 3815). Pond Inlet was the only available logistical choice for compass verification in Baffin Bay in 2005 but the quality was considered substandard due to magnetic interference. Pond Inlet is not a recommended site for future compass verifications.

Figure 6.3. 2005 Baffin Bay mooring instrumentation compass verification site near Pond Inlet on Baffin Island.

The Beaufort Sea calibration site was in Cambridge Bay, NWT (Figure 6.4) where the mooring team went on land and verified the compasses of one Aanderaa RCM4 unit (SN# 8677); one RCM7 unit (SN# 10301); seven RCM11 units (SN# 290, 287, 280, 266, 273, 289 and 285); and three RDI ADCP WorkHorse-Sentinel (300 kHz) units (SN# 333, 2645 and 2646).

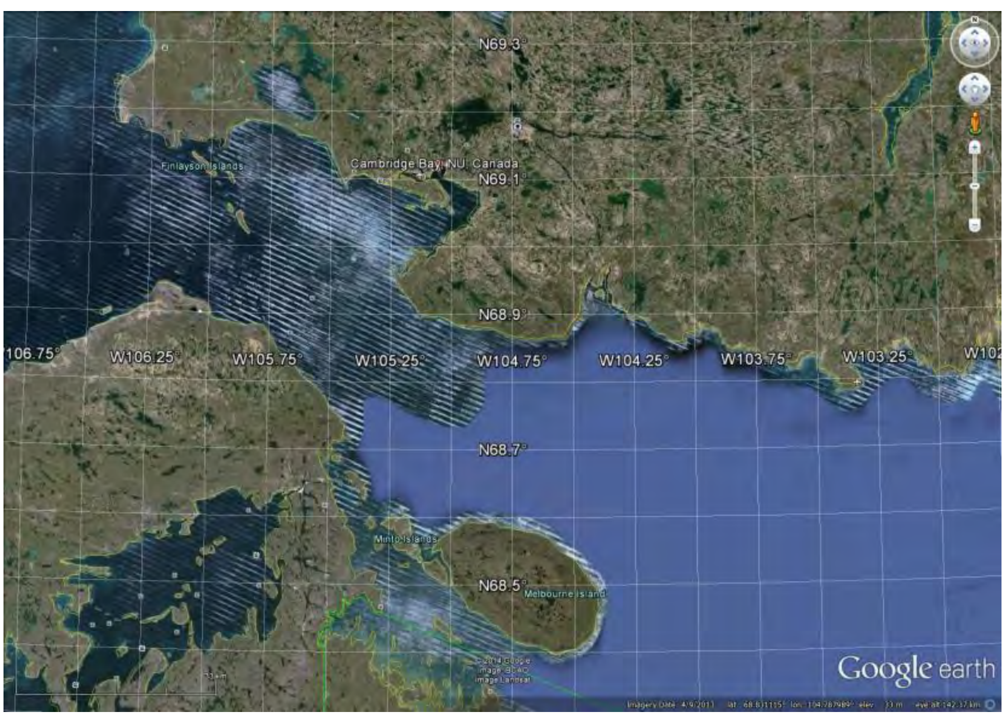

Figure 6.4. 2005 Beaufort Sea mooring instrumentation compass verification site in Cambridge Bay, NT.

The Hudson Bay calibration site was 5 km north of Kuujjuarapik, Québec (Figure 6.5) where on 30 September 2005, the mooring team went on shore and verified compasses one Aanderaa RCM4 unit (SN# 8850); three RCM7 units (SN# 12796, 10306 and 10270); two RDI ADCP WorkHorse-Sentinel (300 kHz) units (SN# 3045 and 23 (from ISMER)) and one RDI ADCP 1200 kHz unit (SN# 2491).

Figure 6.5. 2005 and 2006 ArcticNet mooring compass verification sites in Hudson Bay.

Table 6.2. Compass verification field operations conducted in 2005 and 2006 for mooring intruments deployed in 2005 in Baffin Bay and the Beaufort Sea in Leg 1, and in Hudson Bay during Leg 2.

Instrument	SN	Region	Pre-deploy. site	Pre-deploy. date	Pre-deploy. status	Post-recov. site	Post-recov. date	Post-recov. status
Baffin Bay								
RCM4	8214	BA	Pond Inlet	2005	substandard	Belcher Glacier	2006	substandard
RCM4	8859	BA	Pond Inlet	2005	substandard	Belcher Glacier	2006	substandard
RCM4	8572	BA	Pond Inlet	2005	substandard	Belcher Glacier	2006	substandard
RCM4	8672	BA	Pond Inlet	2005	substandard	Belcher Glacier	2006	substandard
RCM4	8673	BA	Pond Inlet	2005	substandard	Belcher Glacier	2006	substandard
RCM4	8858	BA	Pond Inlet	2005	substandard	Lost	2006	not available
RCM7	12800	BA	Pond Inlet	2005	substandard	Lost	2006	not available
RCM7	10298	BA	Pond Inlet	2005	substandard	found in Iqaluit	2006	not available
WH-LR	3883	BA	Pond Inlet	2005	substandard	Lost	2006	not available
WH-LR	3815	BA	Pond Inlet	2005	substandard	Cape Isabella	2006	substandard
Beaufort Sea								
WHS	333	BS	Cambridge Bay	2005	substandard	Horton River	2006	not available
WHS	2645	BS	Cambridge Bay	2005	substandard	Sachs Harbour	2006	not available
WHS	2646	BS	Cambridge Bay	2005	substandard	Sachs Harbour	2006	not available
RCM4	8677	BS	Cambridge Bay	2005	substandard	Horton River	2006	not available
RCM11	290	BS	Cambridge Bay	2005	substandard	Sachs Harbour	2006	Good: Rail et al. 2010

Instrument	SN	Region	Pre-deploy. site	Pre-deploy. date	Pre-deploy. status	Post-recov. site	Post-recov. date	Post-recov. status
RCM11	287	BS	Cambridge Bay	2005	substandard	Sachs Harbour	2006	Good: Rail et al. 2010
RCM11	280	BS	Cambridge Bay	2005	substandard	Horton River	2006	Good: Rail et al. 2010
RCM11	266	BS	Cambridge Bay	2005	substandard	Horton River	2006	Good: Rail et al. 2010
RCM11	273	BS	Cambridge Bay	2005	substandard	Horton River	2006	Good: Rail et al. 2010
RCM7	10301	BS	Cambridge Bay	2005	substandard	Sachs Harbour	2006	Good: Rail et al. 2010
RCM11	289	BS	Cambridge Bay	2005	substandard	Horton River	2006	Good: Rail et al. 2010
RCM11	285	BS	Cambridge Bay	2005	substandard	Sachs Harbour	2006	Good: Rail et al. 2010
Hudson Bay								
RCM4	8850	HB	Kuujjuarapik	2005	substandard	Island near Kuuj	2006	not available
RCM7	12796	HB	Kuujjuarapik	2005	substandard	Island near Kuuj	2006	substandard
RCM7	10306	HB	Kuujjuarapik	2005	substandard	Island near Kuuj	2006	not available
RCM7	10270	HB	Kuujjuarapik	2005	substandard	Island near Kuuj	2006	not available
WHS	3045	HB	Kuujjuarapik	2005	substandard	Island near Kuuj	2006	not available
WHS	23	HB	Kuujjuarapik	2005	substandard	Island near Kuuj	2006	not available
1200KHz ADCP	2491	HB	Kuujjuarapik	2005	substandard	Island near Kuuj	2006	not available

6.2.3 Mooring recovery and deployment operations

Baffin Bay

In Baffin Bay, moorings were deployed at three locations along the east-west NOW Polynya transect across northern Baffin Bay (BA01, BA02 and BA03) as well as at one station located south of this transect (BA04), Mooring operations were carried out as planned in good weather and without the presence of ice (Figure 6.6).

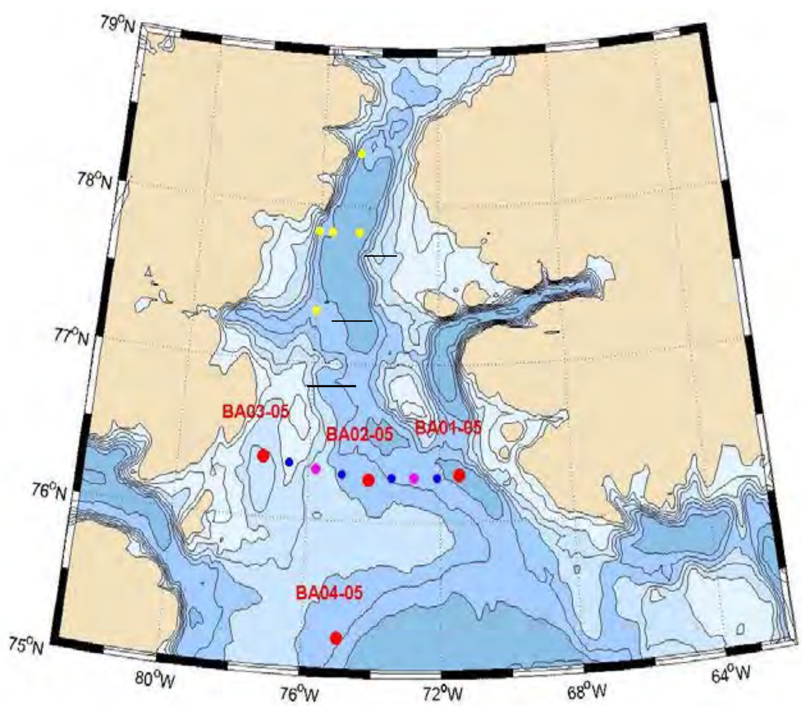

Figure 6.6. Baffin Bay 2005 mooring deployments. Red dots represent the 2005 mooring sites and blue dots are 1998 (NOW) mooring sites.

Table 6.3. Summary of ArcticNet deployment operations conducted in Baffin Bay during Leg 1, with 2006 recovery results. See Tables 6.6 to 6.9 for detailed design and instrumentation on the two successfully recovered moorings (BA01-05 and BA02-05).

Mooring ID	Program	Deploy Year	Recovery Year	Latitude N	Longitude W	Depth (m)
BA01-05	ArcticNet	2005	2006 (top part) & 2008 (lower part with ROV)	76°19.620	071°11.904	649
BA02-05	ArcticNet	2005	2006	76°16.056	074°34.500	444
BA03-05	ArcticNet	2005	LOST	76°23.028	077°24.066	358
BA04-05	ArcticNet	2005	LOST	75°15.216	074°58.644	475

Beaufort Sea

During Leg 1, ArcticNet recovered one of the two moorings deployed in 2003 and five of the six moorings deployed in 2004 during the CASES expedition. Four of these moorings were redeployed for another year of measurements (Figure 6.7 and Table 6.4).

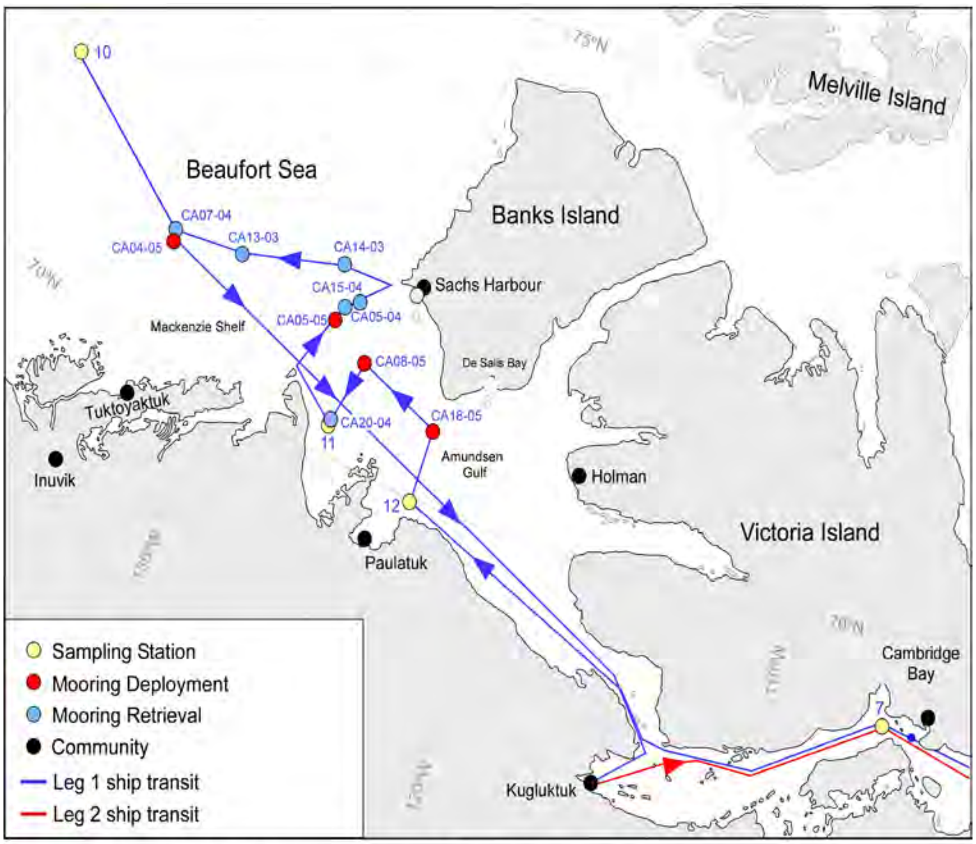

Figure 6.7. Map of the Beaufort Sea showing the *Amundsen* ship track and the mooring sites where recovery and deployment operations took place during Leg 1.

Moorings CA04-04, CA15-04, CA18-04 and CA20-04 were successfully recovered. Mooring CA07-04 was also recovered although it was found down slope 6 km away from its 2004 deployed position. Communications with the acoustic releases of Mooring CA05-04 was unsuccessful and the mooring could not be recovered despite multiple grappling attempts. Efforts to recover mooring CA14-03 were also unsuccessful due to weak intermittent signal reception / transmission with the mooring releases. The release command was sent several times, but the mooring did not surface. Attempts to recover Moorings CA05-04 and CA14-03 will be reiterated in 2006 along with the recovery operations of the four 2005 moorings.

The data from the recovered mooring instruments was downloaded and the instruments were prepared and redeployed for another year of measurements. The CASES 2004-2005 data recovery was only partly successful due to the occurrence of malfunctions on the moored instruments. Details on the CASES 2003-2004 mooring operations, recovered data and results can be found in Ingram et al. (2008).

Table 6.4. Summary of ArcticNet mooring recovery and deployment operations in the Beaufort Sea during Leg 1, with 2005 recovery results of the 2003-2004 CASES moorings and 2006 recovery results of the 2005 moorings. See Tables 6.10 to 6.13 for detailed design and instrumentation on the four successfully recovered 2005 moorings (CA04-, CA05-, CA08- and CA18-05).

Mooring ID	Program	Deploy Year	Recovery Year	Latitude N	Longitude W	Depth (m)
CA13-03	CASES-ArcticNet	2003	2005	71°21.354	131°21.822	300
CA14-03	CASES-ArcticNet	2003	LOST	71°47.461	128°00.817	399
CA04-04	CASES-ArcticNet	2004	2005	71°05.148	133°43.272	306
CA05-04	CASES-ArcticNet	2004	LOST	71°25.146	127°23.778	298
CA07-04	CASES-ArcticNet	2004	2005	71°08.946	133°53.634	490
CA15-04	CASES-ArcticNet	2004	2005	71°32.268	127°01.458	540
CA18-04	CASES-ArcticNet	2004	2005	70°39.942	122°59.298	540
CA20-04	CASES-ArcticNet	2004	2005	70°20.358	126°21.420	251
CA04-05	ArcticNet	2005	2006	71°04.812	133°37.752	307
CA05-05	ArcticNet	2005	2006	71°16.836	127°32.178	205
CA08-05	ArcticNet	2005	2006	71°00.408	126°04.464	397
CA18-05	ArcticNet	2005	2006	70°39.942	122°59.298	540

Hudson Bay

All moorings were deployed in good weather although the mooring locations were modified (Figure 6.8) because water depths at the planned moorings sites wasn't sufficient. The moorings were moved to the required depth while still as close as possible to the original deployment positions (Table 6.6).

Table 6.5. Summary of ArcticNet mooring deployment operations in Hudson Bay during Leg 2, with 2006 recovery results. See Tables 6.15 to 6.17 for detailed design and instrumentation on the two successfully recovered ArcticNet moorings (AN01- and AN03-05).

Mooring ID	Program	Deploy Year	Recovery Year	Latitude N	Longitude W	Depth (m)
AN01-05	ArcticNet	2005	2006	59°58.668	091°56.622	107
AN02-05	ArcticNet	2005	LOST	58°46.926	091°31.392	80
AN03-05	ArcticNet	2005	2006	55°24.468	077°55.794	130
AN04(MH)-05	ArcticNet-ManitobaHydro	2005	2006	57°34.194	091°37.704	45

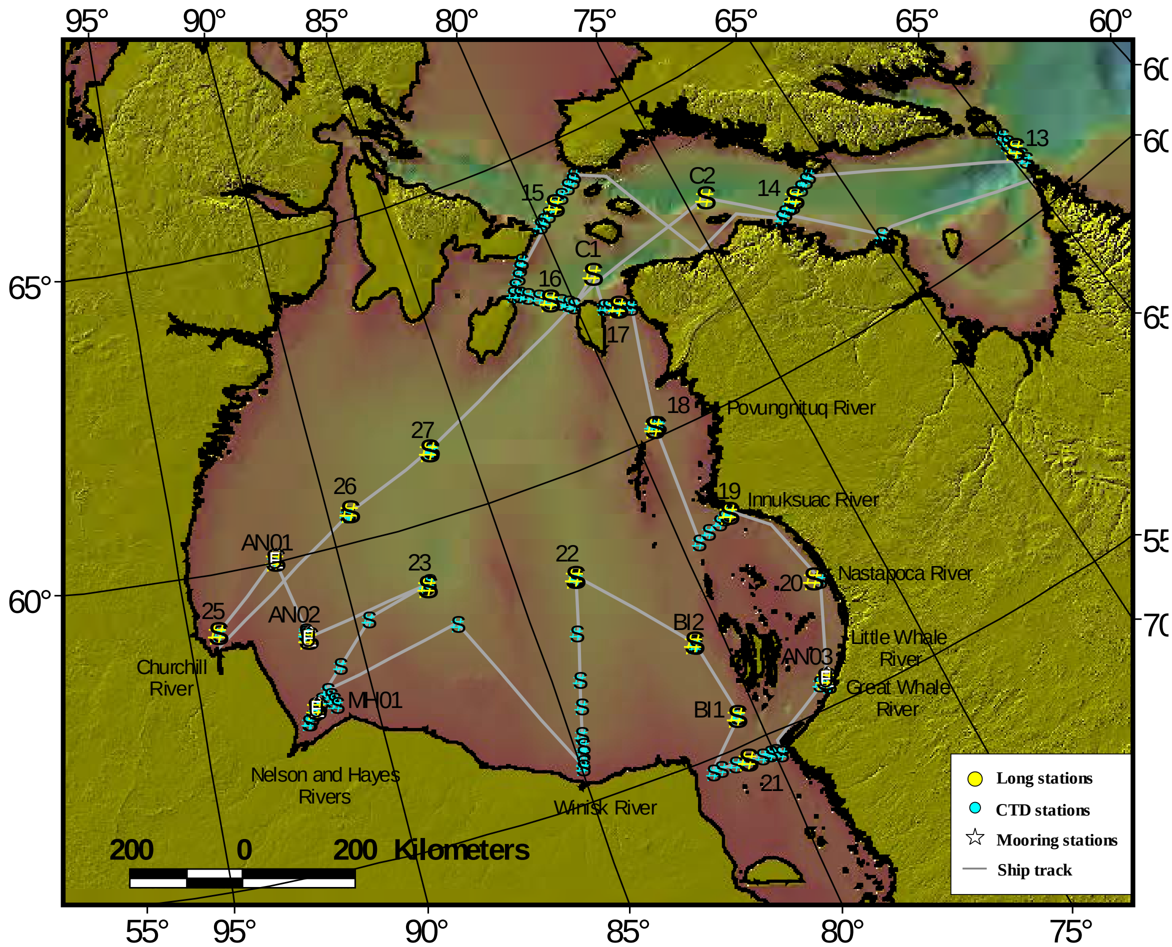

Figure 6.8. Map showing the 2005 ArcticNet Hudson Bay sampling expedition with locations of deployed moorings (AN and MH). Map produced by CJ Mundy.

6.2.4 Mooring deployment and recovery methodology

__Deployment methodology__

In preparation for the deployment, all the instruments were programmed and mounted into their respective frames or floats, and the mooring releases were verified for proper functioning. The mooring was then assembled top-down on the foredeck according to the planned design and instrumentation, and all attachments were double checked.

A Toolbox Meeting with Mooring and Ship's crew was held on the foredeck to identify roles and review safety considerations. The Zodiac was launched (if deemed necessary) and the date and time were recorded at the start of mooring operations.

All components of the mooring were lowered from the deck to the water surface using the A-frame, starting with the top float, until all mooring component were in the water. The Zodiac maintained the mooring line taut as it was deployed to avoid getting the equipment entangled. The final release of the anchor was preceded by the Zodiac releasing its tack of the top float and the confirmation of the correct depth and position for the mooring. The mooring was left to free-fall into position and the time and target location of the last seen position of the top float were noted down.

The vessel verified communications with the acoustic releases and proceeded to 3 triangulation points at ~100 m around the target location to calculate the anchor position using a MatLab® script (Figure 6.9). The resulting triangulated position of the mooring was recorded in the field deployment sheets.

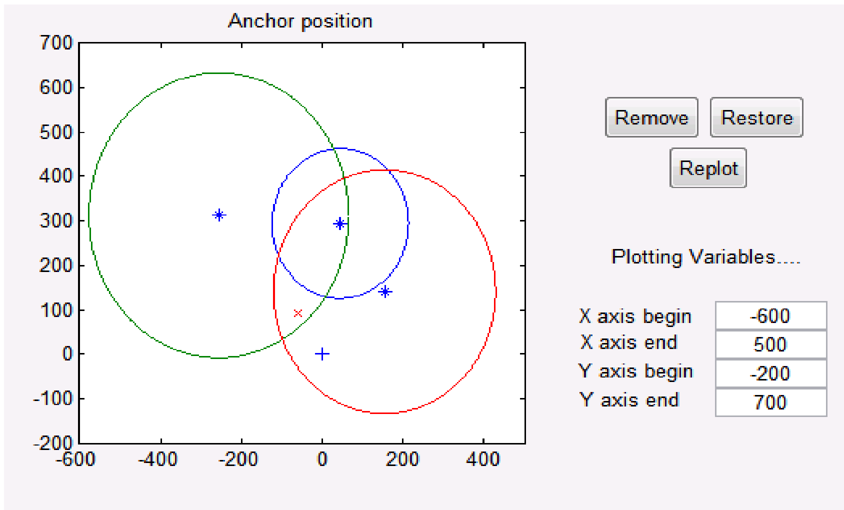

Figure 6.9. Triangulation plot from Mooring BS1-14 obtained using Art's Acoustic Survey Matlab script.

A post-deployment CTD cast was conducted and the CTD profile plots for each mooring site were kept within the field deployment Excel workbook and archived at ArcticNet (Figure 6.10). The foredeck was cleaned and the remaining mooring equipment and cages were secured on the foredeck.

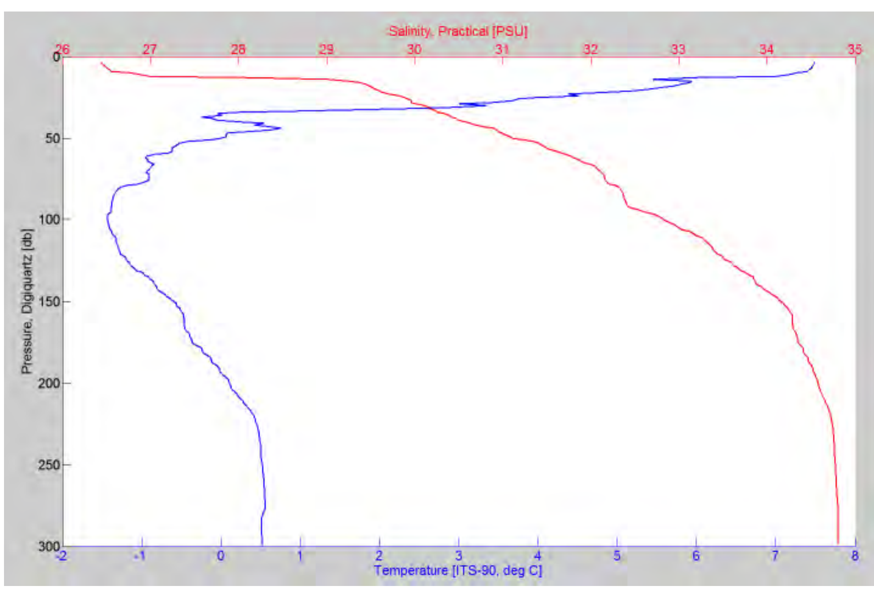

Figure 6.10. Example of temperature and salinity profiles from a CTD-Rosette cast conducted at Mooring BS2-14.

Recovery methodology

A CTD cast was conducted at each mooring site prior to recovery to obtain a profile of water column properties near the mooring while it was still in place. This cast also served to determine possible sensor drift over time for the moored instruments and obtain accurate data on the acoustic properties of the water.

Transducer ranges were taken on the mooring's 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), 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 down-drift from this location and another range was taken before sending the release code and the release time logged.

When the mooring surfaced, the time and its location (distance and direction from the ship's position) were logged. The Zodiac was launched and hooked onto the top float when all floatation components had reached the surface. The Zodiac then pulled the mooring alongside the ship and hooked it onto the A-frame winch hook. As the sections of mooring were lifted on deck, the time was logged when each instrument came out of the water.

6.3 Comments and recommendations

Pond Inlet (NT) was the only available logistical choice for the 2005 Baffin Bay mooring instrumentation compass verifications. However, the results were substandard due to magnetic interference and Pond Inlet is not a recommended verification site. For the same reasons, Belcher Glacier where instruments were post-calibrated in 2006, was also not a suitable compass verification site. In fact, compass verification sites in northern Baffin Bay need to be selected more carefully.

Mooring CA07-04 (Cases slid or was carried 6 km away from the original deployment site. A deeper top float depth of at least 50 m is recommended to minimize the risk that ice displace moorings.

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7 CTD-Rosette, MVP, ADCP and thermosalinograph operations – Legs 1 and 2

ArcticNet Phase I – Theme 1: Climate Change Impacts in the Canadian High Arctic: a Comparative Study Along the East-West Gradient in Physical and Societal Conditions.
ArcticNet/Phase 1/Project 1.1

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Cruise participants Leg 1: Marie-Emmanuelle Rail[1] and Véronique Lago[1]
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7.1 CTD-Rosette

The specifics of each CTD-Rosette cast are detailed in the CTD Logbook (Appendix 3) which includes cast and station numbers, date and time of sampling in UTC, latitude and longitude, bottom and cast depth, as well as any comments concerning the cast. A Rosette sheet was also created for every cast that includes the same information as the CTD Logbook plus the bottle distribution among the different sampling teams. For every cast, data recorded at the moment of bottle closure were averaged and printed in the 'bottle files'. These files included the bottle position, time and date, pressure, temperature, salinity, transmissivity, chlorophyll, oxygen, irradiance and pH measurements. The Rosette was equipped with the sensors listed in Table 7.1.

Table 7.1. Sensors equipped on the CTD-Rosette on Legs 1 and 2 of the 2005 *Amundsen* expedition.

Sensor	Manufacturer	Type	Serial Number	Max. depth (m)
CTD	SeaBird	SBE-911		6800
Temperature			4318	
Conductivity			2876	
Pressure			0679-88911	
Oxygen	SeaBird	SBE-43	0240	7000
pH	SeaBird	SBE-18	0444	1200
Nitrates	Satlantic	MBARI ISUS	015	1000
PAR	Biospherical		4664	
SPAR	Biospherical		20147	
Fluorometer	Sea Point		2443	
Transmissometer 1 (Leg 1 only)	WetLab		CST-558DR	
Transmissometer 2	WetLab		CST-671DR	
Altimeter	Benthos		1044	

Water collected at different depths in the water column with the Rosette was sampled by the different teams for the following measurements: nutrients, pigments, DOC/DON, phytoplankton parameters (chlorophyll *a*, POC/PON, cells for identification and counting, picoplankton, biogenic silica, primary production, nitrification rates, nitrogen status), salinity, O-18, cDOM, contaminants (mercury, organochlorine, etc.), cell sedimentation, fecal pellets, zooplankton, sediments traps, N-15, DIC, and dissolved oxygen.

Water samples were also taken for salinity and dissolved oxygen calibration of the CTD sensors equipped on the Rosette. The salinity samples were analyzed at the end of Leg 2 using the Autosal onboard the ship. Dissolved oxygen samples were analyzed with the Winkler titration machine.

7.1.1 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

Between 14 August and 15 September, 137 casts were performed and 1611 bottles were closed. Rosette casts were usually classified into 6 categories with usual depths for each category listed below.

- ***Nutrients*** (J.-É. Tremblay's team): chlorophyll maximum, salinity of 33.1, 0 m, 5 m, 10 m, 15 m, 20 m, 30 m, 40 m, 50 m, 75 m, 100 m, 140 m, 180 m, 200 m, and every 100 m down to the bottom.
- ***Primary Production*** (M. Poulin's team): salinity of 33.1, 200 m, 75 m, 100%, 50%, 30%, 15%, 5%, 1% and 0.2% of light measured with a Secchi disk before the cast.
- ***DNA*** (C. Lovejoy's team): chlorophyll maximum, nitracline, 5 m, 25 m, 80 m, 140 m and 180 m.
- ***Contaminants*** (A. MacHutchon's team): 50 m, 100 m, 200 m and bottom.
- ***Sediment traps*** (M. Sampei's team): 5 m, 15 m, 25 m, 35 m, 45 m, 55 m, 65 m, 75 m and 85 m.
- ***CTD***: no bottle closed.

Problems encountered during Leg 1

Two pumps for the oxygen, salinity and temperature sensors were initially installed on the Rosette in order to get duplicated data but this required too much power and the carousel signal was frequently lost when the Rosette was in operation. The sensor recording was not affected but the bottles would not close. Three Rosette casts were aborted before the problem could be identified and resolved.

Bottles 2, 7 and 9 sometimes didn't close, possibly due to dust accumulating on the top of the carousel. To avoid this problem, the carousel was carefully washed with freshwater after every cast. An alternate explanation would be that the cable passing through the middle of the Rosette was too slack and blocked the bottle closure mechanism.

The batteries of the nitrate sensors were weak and sometimes ran out in the middle of a cast. To avoid this problem, the battery was changed every 24 hours, but even then, the battery sometimes ran out after only 6 hours and a few casts. Acquiring new batteries for the nitrate sensors is recommended.

The Rosette hit the bottom on cast #052 because of a radio miscommunication regarding the bottom depth. To avoid this, the EK60 bottom depth was printed on one of the computers of the Rosette shack. This incident caused the loss of 1 bottle and broke the transmissometer. They were both replaced and the configuration file was modified to include the new transmissometer serial number and configuration coefficient.

Comments and recommendations for Leg 1

Most of the sensors worked well for the entire cruise but main problem were encountered. The first, as mentioned previously, was caused by too many sensors plugged on the CTD at the same time and was fixed by removing duplicated sensors. The second problem was the transmissometer broke when the Rosette hit the bottom. Some minor problems with the transmissometer and the pH sensors were also encountered at great depths from time to time. The oxygen sensor exhibited a delay in the recorded data but the dissolved oxygen measurements made during the leg helped fix that problem.

Three bottles (#1, 11 and 24) were brought onboard by Jane Kirk (U. Alberta) and one of them was lost when the Rosette hit the bottom. All the other bottles worked well.

A few minor difficulties occurred with winch probably caused by dirt in the winch oil.

7.1.2 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

Between 15 September and 27 October, 126 casts were completed and 1745 bottles were closed.

Problems encountered during Leg 2

Bottles #1, 8, 9 and 15 sometimes didn't close, possibly due to dust accumulating on the top of the carousel or to damaged hooks. The carousel was changed twice as well as cleaned and greased several times. After 26 September, the carousel finally worked properly.

The Rosette probably touched the bottom on cast #104. The Rosette was stopped as planned 10 m above the bottom and during the short time needed to close the bottle at this depth, the ship moved a lot and according the EK-60, the depth changed by 12 m. This did not significantly affect the water sample, the sensors or the data since there was no mud on the Rosette or inside the bottles and no glitch in any parameter profiles.

For several casts, the pump of the CTD was slow to start during the soak period and it was brought to greater depth to facilitate the flow of seawater through the tube up to the conductivity cell. Contact with saltwater controls the automatic start of the pump, preventing it from pumping air. Sea-Bird can modify the CTD to allow for manual start of the pump and while this is a bit more dangerous, it could reduce the duration of the soak period and allow its use in fresher water.

Several winch operators worked during Rosette operations and some were inexperienced at the beginning. This led to uneven Rosette descent rate which possibly generated noise in the data as the Sea-Bird CTD is designed to provide best quality data at a regular descent rate of 1 m/s.

In bad weather and rough sea conditions, noisy data can similarly result as the waves impacted the Rosette's descent rate by creating a succession of up and down decelerations and accelerations. In bad weather, the Rosette was lowered to 10 or 20 m for the soak period and the cast began at 10 m depth instead of the surface to prevent the Rosette hitting the hull of the ship.

Comments and recommendations for Leg 2

The sensors worked well throughout this leg. Bottles #1, 11 and 24 were brought onboard by Jane Kirk (U. Alberta). A few minor problems were encountered with the winch possibly caused by dirt in the winch oil.

7.2 Moving Vessel Profiler (MVP)

The MVP was used between 9 and 11 August in the Labrador Sea. During that period, 91 casts of 300 m were performed at the rate of one cast every 30 minutes. Data were recorded on 91 Brooke files and 24 SeaBird files. The MVP was equipped with the sensors listed in Table 7.2.

Table 7.2. Sensors equipped on the MVP

Item	Manufacturer	Type	Serial Number	Max. depth (m)
MVP	Brooke			
CTD	SeaBird	SBE-911	9P31896-0732	6800
Temperature			4336	
Conductivity			2877	
Pressure			89938	
Oxygen	SeaBird	SBE-43	0479	7000
Fluorometer	Sea Point			
Transmisometer	WetLab		CST-685DR	

7.2.1 Problems encountered

The MVP's safety mechanism automatically stops the downcast when it reaches a few meters above the bottom. Often, the signal with the bottom was lost making it difficult to obtain a 300 m cast as planned. On the upcast, the winch sometimes stopped by itself and the operator either had to use the 'recover' function a few times or even reset the software or the deck unit when the recover function didn't work.

7.2.2 Report on the loss of the Moving Vehicle Profiler (MVP)

The Moving Vehicle Profiler (MVP) fish and 1700 m cable were lost on 11 August 2005 at around 05h30 UTC under relatively mild sea conditions (Beaufort scale 3-4). A set of five, 4-km apart, "lawn mowing" Knudsen sections were being profiled for J. Hughes Clarke (U. of New Brunswick Fredericton) to map a region off the mouth of Hudson Strait (approximately 60° N and 60° W). A 300-m MVP profile was launched manually every half-hour with a 800-m profile at the end of each section. At the end of a "routine" 300 m profile, the brakes came on, the drum stopped paying out cable and the probe began, as always, to rise to the surface, being pulled by the ship at approximately 11.5 knots. At that point, 650 m of cable were already in the water. The operator, V. Lago, could not confirm if the "cable out" indicator stopped completely or kept showing some cable still being slowly paid out. After a few seconds, instead of pulling the fish in, the winch began to pay out cable again. The operator tried without success to stop it by clicking the STOP button repeatedly. At 780 m, the maximum allowed "cable length out" for a 13 kt "maximum ship speed", the automatic emergency stop process started but to no avail.

The "cable length out" increased up to 960 m and then froze. The operator tried the RECOVER process many times and then tried a RESET. The sound alarm came on a few seconds later. J. Hughes Clarke was called in and went to check the winch, and found that there was no more cable left! He turned off the winch and saved the last computer screen (see Figure 7.1 below). He also closed the MVP software after the last useful information disappeared from the screen.

The winch most probably stopped working normally at 300 m (302.9 m, exactly) and all the MVP Brooke files were closed correctly, including the "e" ENG files with the latest information about the physical system (see file "lx0501b0.091e" and page 50 in the BOT MVP controller software manual). The profile had therefore ended normally. After that, the brakes failed, the clutch did not engage or we hit something that snagged the MVP towfish at 109 m while we were running away at 11.6 kt. The last depth recorded by the Seabird software (see file "x0501s0024.cnv" and Figure 7.2) was 108.978 m. The Seabird acquisition stopped and the file was closed when the RESET switch was hit. The last position given in this file is 61.40660° N and 60.34326° W. The water depth was 1554 m (see Figure 7.1). There are rumors of buoys sightings in the preceding and/or following hours, mostly the following hours, but none were observed by the bridge personnel. A. Rochon saw two buoys around 06h00, on August 11 and I am trying to identify those who claimed they saw buoys after we lost the MVP.

Yves Gratton
Professor
INRS-Eau, Terre et Environnement

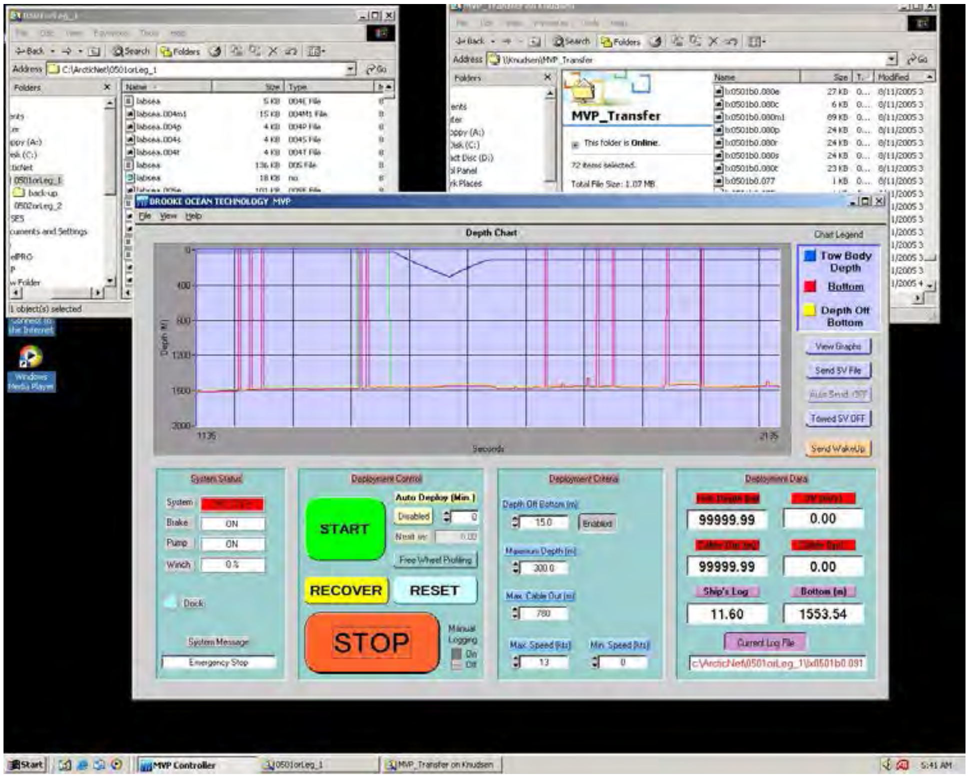

Figure 7.1. Last screenshot of the software before the MVP was lost at the beginning of Leg 1.

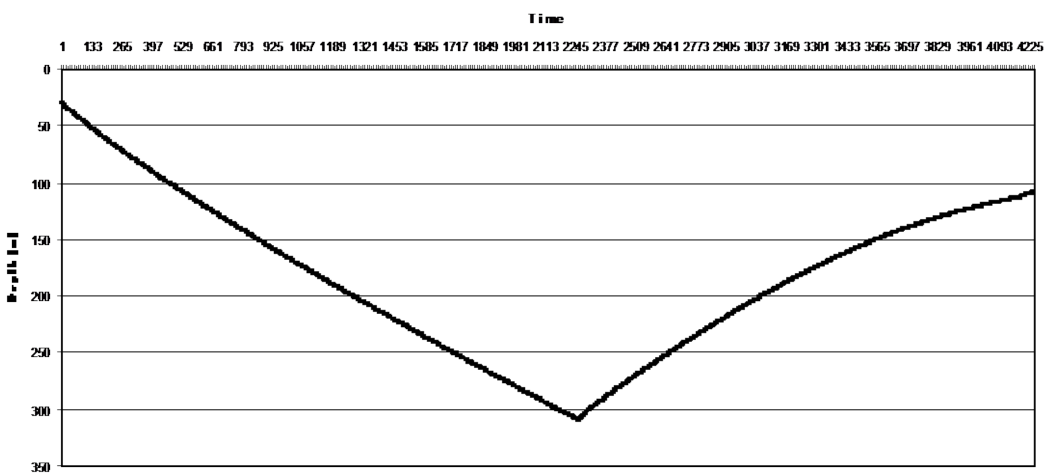

Figure 7.2. Last MVP profile from the SeaBird file.

7.3 ADCP and thermosalinograph (TSG)

An engineer from RDInstruments® was aboard the *Amundsen* from 3 to 6 August to inspect the ADCP and thermosalinograph (TSG) and hopefully correct the problems experienced with it since it was installed in the summer of 2003. Basically, the most important problems were the noise generated by the deck unit and the possible misalignment of the transducers. Data will be logged in both legs with the hope of correcting the dataset after the cruise. The operator checked the acquisition every 2-3 days or even daily when possible. 525 files were recorded from the thermosalinograph over the course of the expedition.

7.4 Preliminary results

The transects conducted at the DNA stations in Nares Strait in northern Baffin Bay for C. Lovejoy's group are presented in Section 12.3. Preliminary graphs of temperature and salinity for transect 400 in the Amundsen Gulf are presented in Figure 7.3.

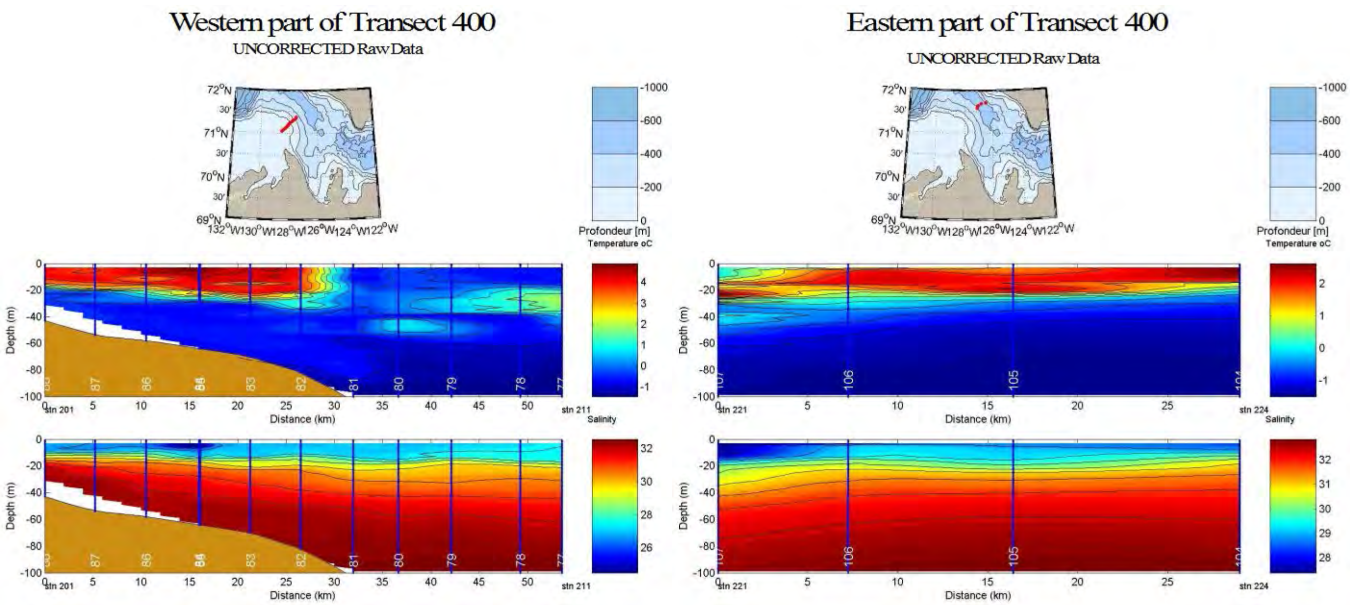

Figure 7.3. Contour plots of profiles conducted along the western (top panel) and eastern (bottom panel) part of transect 400 in the Amundsen Gulf during Leg 1.

8 Self-Contained Autonomous MicroProfiler (SCAMP) – Legs 1 and 2

ArcticNet Phase I – Project 1.1: Warming Coastal Seas & Shrinking Sea Ice. ArcticNet/Phase 1/ Project 1.1

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Cruise participant Leg 1: Yves Gratton[1]
Cruise participant Leg 2: Sophie Caplanne[1]

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8.1 Introduction

The Self-Contained Autonomous MicroProfiler (SCAMP) is a high resolution CTD profiler (Figure 8.1). It samples at a frequency of 100 Hz (i.e., 100 times per second) while freefalling at approximatively 10 cm s-1, giving a vertical resolution of approximatively 1 mm, down to a maximum depth of 100 m. The instrument measured the temperature and salinity fluctuations at the micro-scale in order to estimate the turbulent mixing occurring in the water column. To properly measure (as opposed to "estimate") turbulence, velocity fluctuations should also be measured. Unfortunately, such velocity sensors are too expensive for now. The sensors equipped on the SCAMP include temperature (three sensors), salinity (i.e., conductivity; two sensors), fluorescence and PAR.

Figure 8.1. Photo of the Self-Contained Autonomous MicroProfiler (SCAMP).

Turbulent transports and mixing are among the most important processes in natural systems. They are much more efficient and act much faster than purely diffusive (i.e. molecular) processes. By analogy with the molecular diffusive processes, turbulent mixing is often called "eddy diffusion". Mixing energy is introduced at large scales, often by the wind at sea surface and tides at the bottom. Turbulent mixing is called "eddy diffusion" because energy can be thought as being transferred from larger scales to smaller scales, i.e. cascading from large eddies to smaller and smaller eddies until it reaches the molecular scale where it will be ultimately dissipated into heat. Studying turbulent processes is essential in understanding how the Mixed Layer (ML) forms and how it evolves over daily, seasonal and annual time scales. Better knowledge of ML properties will help determine how biological production is affected by physical processes in the surface layer. Indeed, the mixed layer is the main buffer between the atmosphere and the ocean and it controls most of the heat exchange between the two. The ML evolves hourly which makes it very difficult to parameterize in large numerical circulation models. Hence, a better understanding of ML dynamics will improve forecasting capacities for both oceanic and atmospheric models.

8.2 Methodology

The SCAMP computed the temperature gradient directly from the analog temperature signal for a better accuracy. The temperature gradient was used as an indicator of the location of the mixing processes in the water column. During Leg 1, turbulence measurements could be obtained only at Full Stations and between 08h30 and 19h30.

Table 8.1. List of stations were the SCAMP was deployed during Leg 1 and characteristics of the profiles.

Station	Date (UT)	Time (UT)	# profiles	Profiling depth
DNA-02	2005/09/19	21:00:00	3	100 m
DNA-15	2005/09/20	17:00:00	2	100 m
4	2005/09/24	13:30:00	3	100 m
6	2005/09/27	13:00:00	7	30 m
CA05-05	2005/09/02	21:30:00	6	70 m
10	2005/09/05	19:45:00	7	70 m
CA04-05	2005/09/06	22:45:00	4	70 m
CA08-05	2005/09/09	14:45:00	2	80 m
CA18-05	2005/09/12	18:30:00	4	60 m
12	2005/09/13	18:45:00	6	60 m

Table 8.2. List of stations were the SCAMP was deployed during Leg 2 and characteristics of the profiles.

Stations	13d	15e	16e	17c	19e	A0305	21e	22	AN02-05	AN01-05	27
date (TU)	2005-09-22	2005-09-25	2005-09-26	2005-09-27	2005-09-29	2005_10-01	2005-10-02	2005-10-06	2005-10-12	2005-10-13	2005-10-16
direction du vent	80°	70°	65°	105°	0°	150°	100°	45°	320°	170°	340°
vitesse du vent (nds)	20	20-25	10	10	20	10	15	10	15	7	15
pression atm (Pa)	1009	1002	1005	1011	993	998	1012	1024	1010	1016	1010
humidité	88%	99%	76%	86%	89%	85%	87%	60%	91%	84%	71%
T° air (°C)	3,2	1,3	3,2	7	3,9	9	7,2	0,8	5,3	2,5	-1,3
T° eau (°C)	2,1	1,8	5	6,8	8,5	9	8	4,6	4,3	4,6	4,2
état de la mer (beaufort)	4	6	3	1	5	1	3	3	2	1	1
glace (1/10)	0	0	0	0	0	0	0	0	0	0	0
nuages (1/8)	8	8 brouillard	7	4	5	4	100	8	3	0	5
profiles CTD #	8	24	37	45-46	57-58	64	68-69	81	114		124
profondeur (m)	377	350	185	135	90	70-80	90	190	80	100 m	240 m
numéro profile 1	203212	180308	151339	180758	160543	124839	175956	181606	134206	34204	181127
numéro profile 2	220438	182037	153410	183425	162503	191643	181757	184804	140302	35944	183357
numéro profile 3	211600	183759	155420	190327	164243	193121	183634	191704	141943	41546	185353
numéro profile 4		185530			165938	194541	185736		143759		191549
numéro profile 5									145546		
profondeur visée (m)	100	80	70	70	70	40	60	100	60	80	90
programmation scans	100000	80000	70000	70000	70000	80000	60000	100000	60000	80000	90 000
Chrono (min)	8,5	6.3	10	14	8,5	6.5	10	16	10	12	15

8.3 Preliminary Results

Two examples of SCAMP profiles are shown below for Station 6 in Leg 1 and Station 19e in Leg 2 (Figure 8.2). Vigorous mixing occurred at both stations around 5 m, as shown on the temperature gradient plots on the right-hand panels, indicating that the Mixed Layer Depth (MLD) was increasing. The corresponding temperature and salinity profiles are presented for the first 20 m in the left-hand panels.

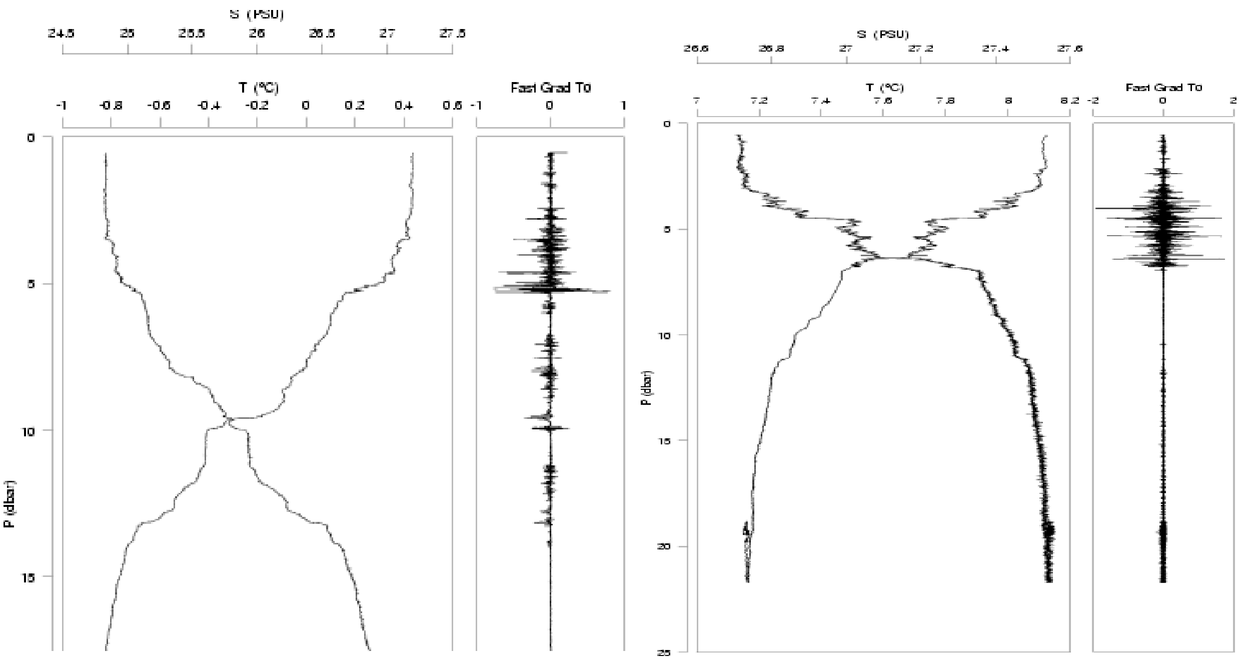

Figure 8.2. SCAMP profiles of temperature, salinity and turbulence from Station 6 in Leg 1 (left) and Station 19e in Leg 2 (right).

There may still be discrepancies in the data even if the CTD sensors and the SCAMP sensors were properly calibrated, because of the different response time and resolution of the sensors and the different descent rates of the instruments (i.e., 0.1 m s^{-1} for the SCAMP, 1 m s^{-1} for the CTD and 5-6 m s^{-1} for the MVP). This is the reason why quality control of the data from each instrument and inter-comparisons are needed. Examples from mooring Station CA18-05 visited on 12 September 2005 during Leg. 1 (Figure 8.3) and Station 17c visited on 27 September 2005 during Leg 2 (Figure 8.4) are shown below.

The SCAMP profiles (blue) were obtained at 18:58 UTC and away from the ship, while the CTD-Rosette (red) was launched fifteen minutes later at 19:14 UTC. For both instruments, the fluorescence structures were similar but the maximum was 5 m shallower on the CTD profile. More striking discrepancies were observed for the temperature and especially the salinity profiles. In the case of temperature, this may be due in part to the higher accuracy of the SCAMP sensor, but the salinity differences were too large to be due to sensor accuracy or the short distance between sampling locations. The calibration of both sensors needs to be checked.

In this case, The SCAMP profile (in black) was obtained 11 minutes before the CTD-Rosette profile (in red). There were significant differences between the salinity and fluorescence profiles possibly due to calibration issues with the instruments. These profiles show the high turbulence induced by the high wind and rough sea conditions in Leg 2 compared with Leg 1.

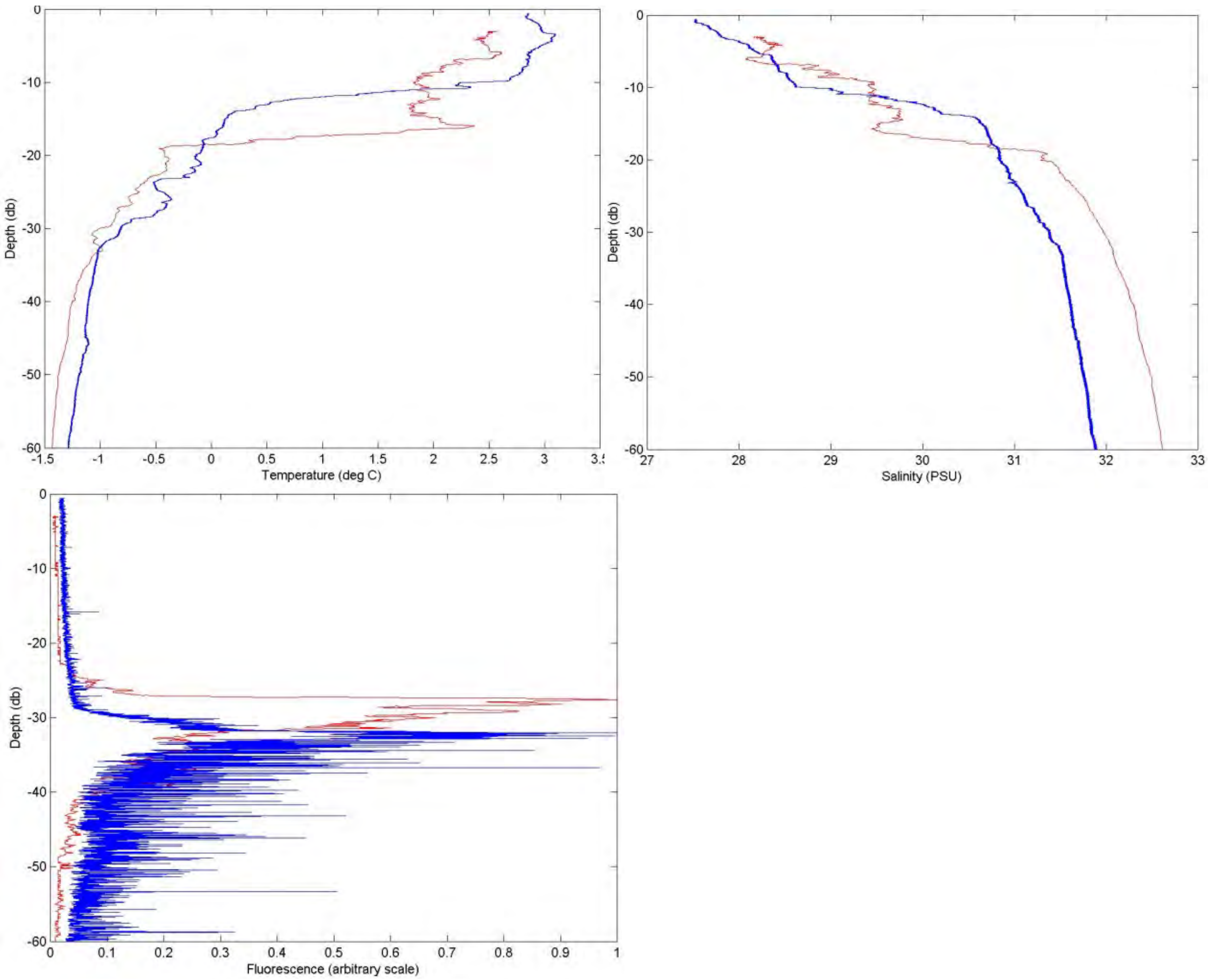

Figure 8.3. Comparison of vertical profiles obtained from SCAMP (blue line) versus CTD (red line) at Station CA18-05 during Leg 1 showing temperature (upper left), salinity (upper right) and fluorescence (bottom).

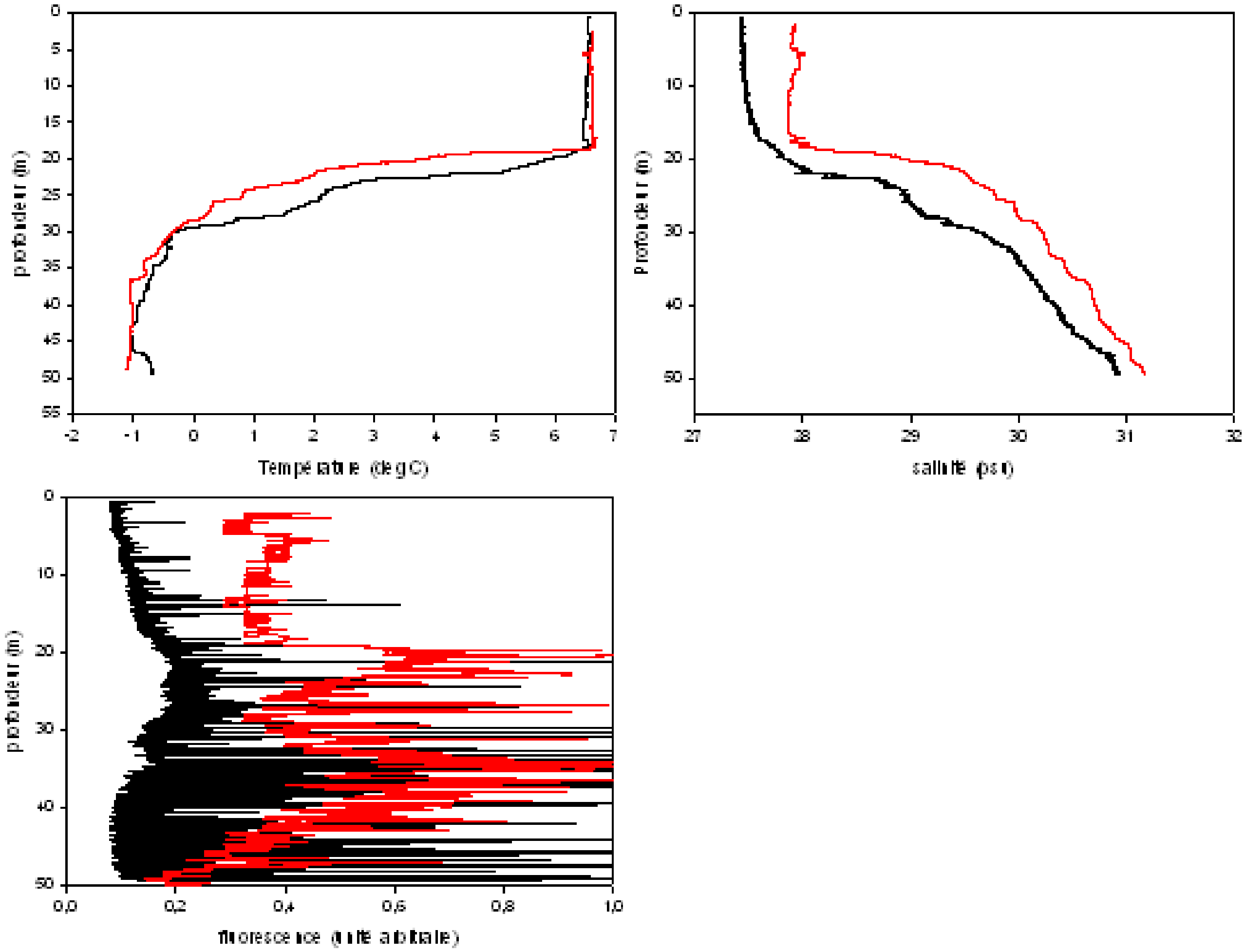

Figure 8.4. Comparison of vertical profiles obtained from SCAMP (black line) versus CTD (red line) at station 17c during Leg 2 for temperature (top left), salinity (top right) and fluorescence (bottom).

9 Observations of freshwater in Hudson Bay – Leg 2

ArcticNet Phase I – Project 3.1: Ocean-Ice-Atmosphere Coupling and Climate Variability. ArcticNet/Phase 1/Project 3.1
ArcticNet Phase I – Project 3.3: Climate Variability / Change and Marine Ecosystem Resources in Hudson Bay. ArcticNet/Phase 1/Project 3.3

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9.1 Introduction

Hudson Bay is a large inland sea, almost completely enclosed by land. Its surface area is in excess of 1 million km^2 (Ingram and Prinsenberg 1998). The catchment area of Hudson Bay extends from the Rocky Mountains (to the west) into Quebec and from Baffin Island (to the north) into parts of North Dakota and Minnesota in the United States. In total, the bay's watershed covers an area of approximately 4 million km^2, in excess of one-third of the area of Canada (Prinsenberg 1980). The ecozones included in the catchment cover a diverse range of environments, including agricultural development in the west (Prairies), forested areas to the south and east (Boreal Forest, Taiga Shield) and tundra environment surrounding the bay (Hudson Plains and Arctic). A number of large of rivers flow into Hudson Bay. The freshwater discharge by these rivers has a strong seasonal signal, with minimum values in mid-April and peaks in late May/early June. The mean annual discharge is estimated to 712 km$^3 \cdot$yr^{-1}, more than twice the flow from the Mackenzie or St. Lawrence Rivers, accounting for 30% of the total flow of Canadian Rivers (Prinsenberg 1980) and equates to 18% of the total discharge in the Arctic Ocean (Déry et al. 2005). Although sea ice melt accounts for a larger input of freshwater into Hudson Bay than river drainage on an annual basis, rivers import new inorganic and organic materials important to the Hudson Bay ecosystem. Therefore, the focus of this project was on mapping and examining the importance of freshwater input by rivers into Hudson Bay during the ArcticNet 2005 expedition.

9.2 Methodology

Data collection was separated into two themes: (1) Bay and (2) Rivers. The Bay Theme focused on mapping the distribution of water masses and freshwater influences along important transects perpendicular to currents entering, exiting and within Hudson Bay, James Bay, Foxe Basin and Hudson Strait (See Chief Scientist's Comments and recommendations in Part I). The Rivers Theme focused on a range of large and small rivers draining into Hudson Bay to characterize their inputs (dissolved and particulate) and to examine the physical and biological properties of their estuaries (Figure 9.1). Sampling was established along salinity gradients within the various estuaries to collect data on variables that will mix conservatively from freshwater to seawater as well as properties that may show non-conservative behaviour. Conservative properties can be very useful (in combination with salinity) as tracers to gain insight into the composition of a particular water mass (e.g., freshwater vs. Hudson Bay water) and potentially the origins of each component (e.g., sea ice melt, river drainage, etc.). The main data collected were temperature, salinity, $\delta^{18}O$ and the spectral absorbance of coloured dissolved organic matter (CDOM), but the basic characterization of each river also included dissolved organic carbon (DOC), nutrients, suspended particulate material, and in some cases, contaminants (mercury). Information on nutrients and contaminants can be found in different sections of this expedition report.

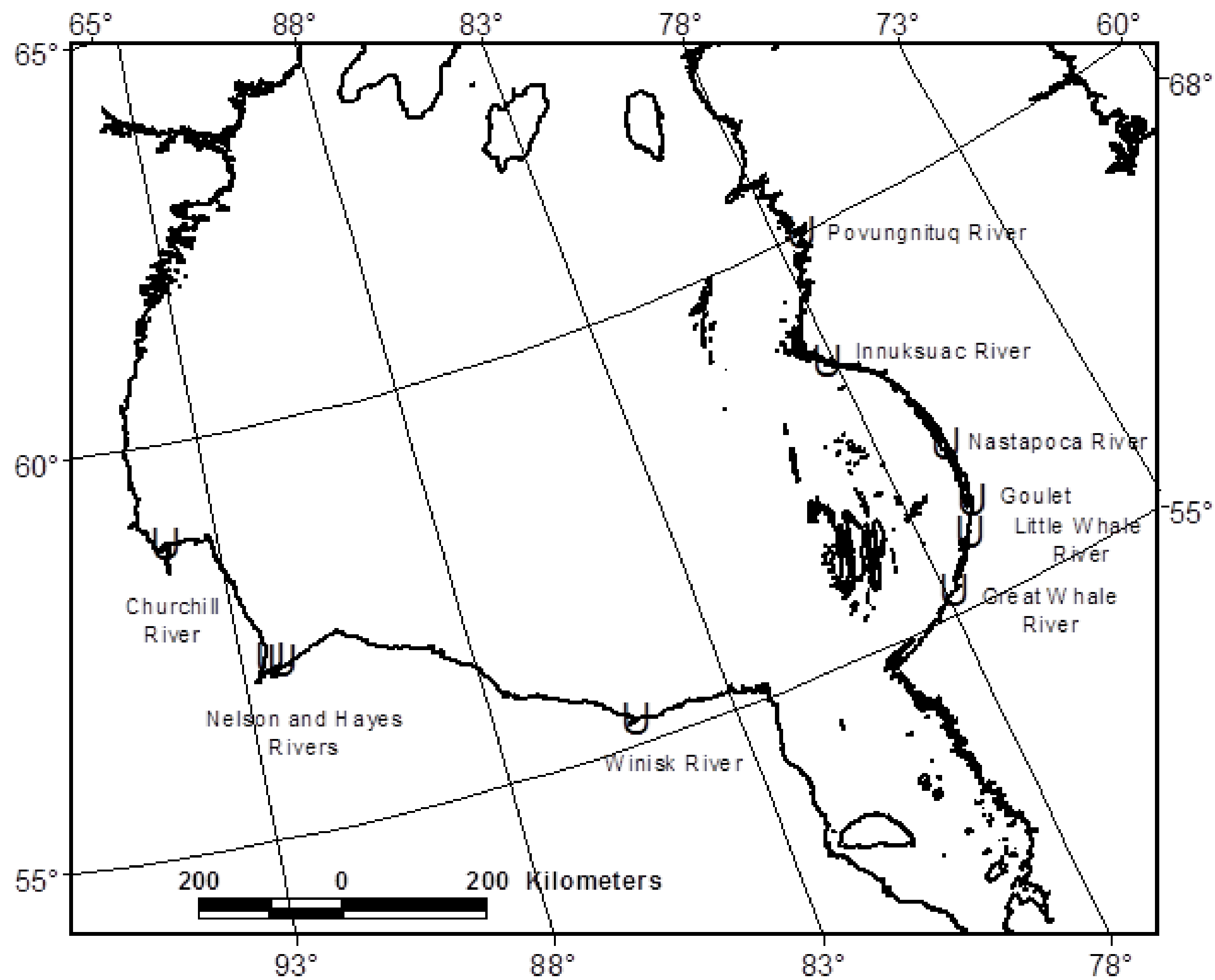

Figure 9.1. Map of rivers visited during Leg 2 of the 2005 ArcticNet Expedition in Hudson Bay.

9.2.1 Bay Theme

Water collection for the Bay Theme was accessed via the *CCGS Amundsen*. At every long station and CTD location, surface water was collected using a bucket from the bow of the ship and water from depth was collected via the ship's rosette. Subsamples for determination of salinity, $\delta^{18}O$ and CDOM were taken from each water sample. At a few important CTD stations, subsamples for DOC and chlorophyll (Chl) *a* concentration were collected. Salinity samples were measured onboard using a Guildline Autosal salinometer, accepting a sample precision of < 0.002 PSU. When being measured, samples were standardised daily against IAPSO Standard Sea Water. Samples for $\delta^{18}O$ were collected into glass scintillation vials, sealed around the lid with Parafilm to minimize evaporation. These samples were brought back to Winnipeg for later analysis. To collect CDOM subsamples, an acid washed syringe was used to draw directly from the Rosette bottles. Whatman GF/F (nominal 0.7 µm pore size) syringe filters were used to filter water samples into acid washed amber glass bottles. Spectral CDOM absorbance was determined using a UV-visible spectrophotometer (S2000, Ocean Optics) with a 10 cm quartz cuvette using Milli-Q water as a reference. The samples were measured as soon as possible after they had been warmed to room temperature while kept in the dark. The electric dark of the spectrophotometer was taken for each single spectra and a reference spectra was measured every 3-6 samples to account for instrument drift. Values of average absorbance at 700 nm were set to zero to correct the spectra for refractive index effects (Green and Blough 1994). The measured absorbance was converted to an absorption coefficient (a_λ; m^{-1}) according to the equation:

$$a_\lambda = 2.303*A_\lambda/L$$

where A_λ is the wavelength dependent absorbance and L is the path-length of the optical cell in meters (0.1m).

Water samples for DOC determination were also collected directly from the Rosette bottles using an acid washed syringe. GF/F filters burned at 450°C for 24 hours were used within an acid washed syringe filter holder to collect filtered water in sterile vials containing acid for measurement down south.

9.2.2 River Theme

The River Theme had participation from many different groups on the ship and therefore details of the samples collected and the sampling methods can be found in several sections of this expedition report, including Freshwater (this section), Optics, Nutrients, Contaminants (which includes Hg and POC & OCs) and Zooplankton. Water from 9 different rivers and one brackish channel (Goulet) was collected (see Figure 9.1). The stations visited and groups that participated at each station are listed in Table 9.1. Rivers were accessed via the Zodiac and, when necessary, the helicopter.

Table 9.1. River stations visited during the Hudson Bay expedition (Leg 2) and the scientific sectors which collected data at the stations.

Date	Station ID	Latitude N	Longitude W	Freshwater	Nutrients	Optics	Hg	POC & OCs	Zooplankton
28-Sep-05	PUV1	60° 02.388	-77° 13.050	x	x	x	x	x	
28-Sep-05	PUV2	60° 00.102	-77° 20.298	x	x		x		
28-Sep-05	PUV3	60° 00.696	-77° 19.836	x	x		x		
29-Sep-05	IR1	58° 27.492	-78° 05.844	x	x	x	x	x	
29-Sep-05	IR2	58° 27.168	-78° 05.898	x	x		x		
29-Sep-05	IR3	58° 27.042	-78° 06.090	x	x				
29-Sep-05	IR4	58° 26.892	-78° 06.132	x	x		x		
29-Sep-05	IR5	58° 36.492	-78° 06.738	x	x		x		
30-Sep-05	Nastapoca	58° 00.000	-77° 05.400	x	x	x	x		
30-Sep-05	Goulet	56° 09.354	-76° 34.686	x	x	x	x		
30-Sep-05	Little Whale	55° 59.664	-76° 43.374	x	x	x	x	x	
30-Sep-05	GWR1	55° 15.996	-77° 46.794	x	x	x	x		
30-Sep-05	GWR2	55° 16.416	-77° 49.038	x	x		x		
30-Sep-05	GWR3	55° 16.602	-77° 49.212	x	x				
30-Sep-05	GWR4	55° 17.208	-77° 52.374	x	x		x		
30-Sep-05	GWR5	55° 17.124	-77° 51.960	x	x		x		
30-Sep-05	GWRCTD2	55° 15.930	-77° 46.944	x	x				
30-Sep-05	GWRCTD3	55° 16.014	-77° 48.618	x	x				
30-Sep-05	GWRCTD4	55° 16.272	-77° 48.942	x	x				
30-Sep-05	GWRCTD5	55° 16.386	-77° 49.068	x	x				
30-Sep-05	GWRCTD7	55° 16.842	-77° 49.962	x	x				
30-Sep-05	GWRCTD8	55° 17.022	-77° 50.040	x	x				
1-Oct-05	Landing Area	55° 16.398	-76° 45.702					x	
1-Oct-05	GWROct1_1	55° 16.309	-77° 49.368	x	x		x		
1-Oct-05	GWROct1_2	55° 16.614	-77° 49.074	x	x		x		
1-Oct-05	GWROct1_3	55° 16.890	-77° 49.590	x	x		x		
7-Oct-05	Winisk River	55° 15.864	-85° 08.832	x	x	x	x	x	
7-Oct-05	WR1a	55° 19.206	-85° 02.244	x	x		x		
7-Oct-05	WR2a	55° 19.188	-85° 02.136	x	x				
7-Oct-05	WR3a (CTD20)	55° 19.590	-85° 01.788	x	x		x		
9-Oct-05	NR_B4	57° 02.580	-92° 33.126	x	x		x		
9-Oct-05	NR_B5	57° 04.638	-92° 29.838	x	x				
9-Oct-05	NR_B6	57° 06.684	-92° 26.496	x	x		x		
9-Oct-05	NR_B7	57° 08.724	-92° 23.166	x	x		x		x
9-Oct-05	NR_B8	57° 10.746	-92° 19.872	x	x		x		x
9-Oct-05	NR_B8.5	57° 11.862	-92° 18.000	x	x		x		x
9-Oct-05	NR_B9	57° 12.804	-92° 16.524	x	x		x		x
9-Oct-05	NR_B10	57° 14.820	-92° 13.194	x	x		x		x
9-Oct-05	NR_B11	57° 16.860	-92° 09.840	x	x		x		x
9-Oct-05	NR_B12	57° 18.894	-92° 06.522	x	x		x		x
9-Oct-05	Port Nelson	57° 02.388	-92° 35.730			x	x	x	
9-Oct-05	Hayes River	56° 57.180	-92° 35.760			x	x	x	
10-Oct-05	HR_D6	57° 11.250	-91° 57.846	x	x		x		x
10-Oct-05	HR_D5	57° 09.204	-92° 01.206	x	x		x		x

Date	Station ID	Latitude N	Longitude W	Freshwater	Nutrients	Optics	Hg	POC & OCs	Zooplankton
10-Oct-05	HR_D4.5	57° 08.388	-92° 02.262	x	x				x
10-Oct-05	HR_D4	57° 07.194	-92° 04.512	x	x		x		
10-Oct-05	HR_D3	57° 05.154	-92° 07.860	x	x		x		x
10-Oct-05	HR_D2	57° 03.120	-92° 11.214	x	x		x		x
10-Oct-05	HR_ND1	57° 01.818	-92° 15.678	x	x		x		
13-Oct-05	CR_Est1	58° 47.424	-94° 11.250	x	x		x		x
13-Oct-05	CR_L4	58° 49.170	-74° 09.192	x	x		x		x
13-Oct-05	CR_BW_1_L4	58° 48.144	-74° 08.196	x	x		x		
13-Oct-05	CR_T1	58° 46.962	-94° 07.584	x	x		x		x
13-Oct-05	CR_Port	58° 46.284	-94° 12.228	x	x		x		x
13-Oct-05	CR_Plume	58° 48.258	-94° 10.650	x	x				x
13-Oct-05	CR_Buoy	58° 49.842	-94° 06.342	x	x				x
14-Oct-05	CR_Est1	58° 47.424	-94° 11.250	x	x				x
14-Oct-05	CR_BB	58° 48.522	-94° 17.220	x	x				x
14-Oct-05	CR_Wier	58° 40.566	-94° 10.686	x	x		x	x	

Sampling targeted both river 'end members' (stations upstream of any saltwater influence) and sites along the salinity gradients of the estuaries. At each estuary site, a profile of water properties was made using a SeaBird 19Plus Conductivity, Temperature and Depth (CTD) instrument equipped with a Seastar transmissometer and Wetlabs Chl *a* and CDOM fluorescence meters. This vertical profile was followed by collection of surface water samples collected directly with sample bottles and, when time permitted, water from depth using a Kemmerer water sampler. Water samples were brought back to the ship for subsample collection of salinity, $\delta^{18}O$, CDOM and DOC as well as parameters of particulate matter via filtration. Pre-weighed 47 mm GF/F filters were used to collect samples for the determination of total suspended solids (TSS). Filters were wrapped in tinfoil and stored at -20°C for measurement in the south. 25 mm GF/F filters were used to collect particulates to measure Chl *a* concentration, the colour of particulate matter (CPM) and particulate organic carbon (POC; burned filters used). Some samples will also be analyzed for stable isotopes. Chl *a* concentration was determined on the ship fluorometrically after >18 hours extraction in 90% acetone. CPM and POC samples were both wrapped in tinfoil (foil for POC samples was burned) and stored at –80°C for measurement in the laboratory after the cruise.

Due to previously planned operations, extended sampling was able to take place at a few rivers. These sites were referred to as super sites and included the Great Whale River, the Nelson and Hayes Rivers and the Churchill River. Figure 9.2 illustrates the sample coverage of the Nelson and Hayes Rivers where the ship spent 2 days in the vicinity.

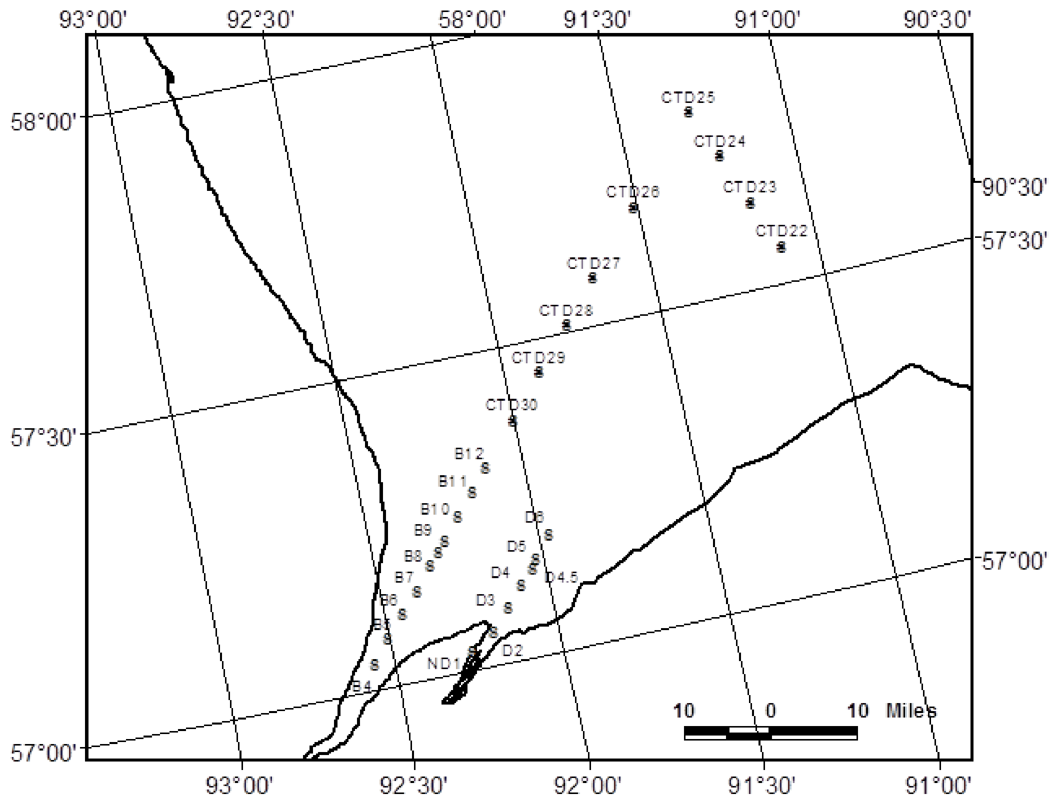

Figure 9.2. Map of the Nelson River super site sample locations. Grey and black dots represent zodiac and ship based water collection, respectively.

9.3 Preliminary results

An example of the change in CDOM absorption with depth in the water column at Station 19a is shown in Figure 9.3. The absorption of CDOM decreases with depth, following the change in salinity (not shown). This observation provides evidence for the application of using CDOM absorption to trace freshwater in Hudson Bay.

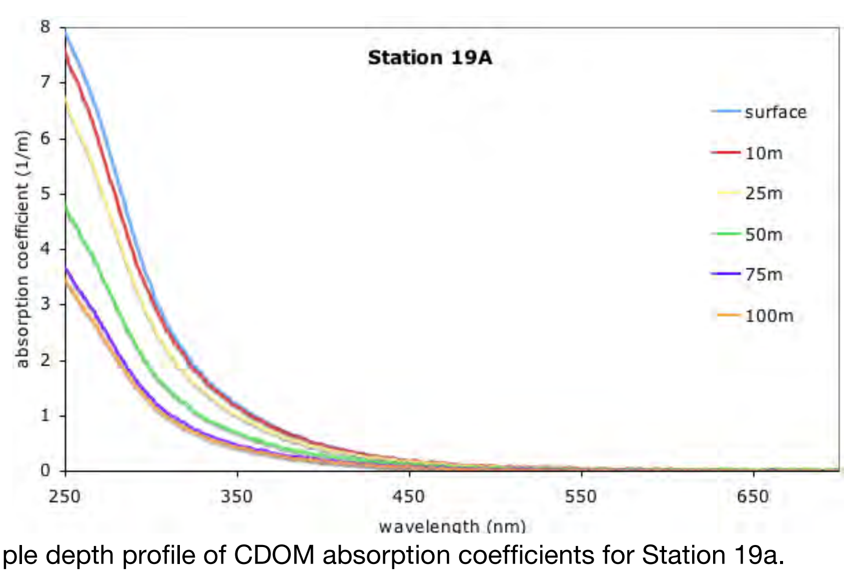

Figure 9.3. Example depth profile of CDOM absorption coefficients for Station 19a.

References

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10 Sea surface properties and remote sensing – Legs 1 and 2

ArcticNet Phase I – Project 1.4: Marine Productivity & Sustained Exploitation of Emerging Fisheries. ArcticNet/Phase 1/Project 1.4
ArcticNet Phase I – Project 3.3: Climate Variability / Change and Marine Ecosystem Resources in Hudson Bay. ArcticNet/Phase 1/Project 3.3

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10.1 Introduction

The general research objective of this study is to measure the *in situ* optical properties of the particulate and dissolved matter in order to better interpret the satellite images of ocean color. Using data from satellites to measure sea surface temperatures as an indicator of physical processes (currents, upwellings, etc.) and SeaWiFS data to measure chlorophyll concentration and evaluate phytoplankton productivity, the ArcticNet data will be used in interpreting and comparing measurements. The optical properties of marine and coastal ecosystems in the Canadian High Arctic, in the Eastern Canadian Arctic, and in Hudson Bay are complex and there is an ongoing need to collect relevant *in situ* data to validate the remote sensing imagery.

Enabling such data comparisons will contribute to the overall goal of quantifying the response of the marine ecosystem to climate-induced variability and change in sea temperature. Further, we will be able to contribute to understanding the environmental variables that govern abundance and species composition of the summer phytoplankton communities in the Canadian High Arctic, from the North Water (NOW) in Baffin Bay to the Mackenzie shelf in the Beaufort Sea, including the Northwest Passage, as well as in the unique subarctic environment of Hudson Bay.

10.2 Methodology

A range of different optical measurements were made during the expedition. The primary instrument was a Wetlabs AC9 measuring absorption and attenuation at 9 wavelengths. Surface water was sampled using a bucket and transferred to a 20-litre carboy. This sampling was timed with a CTD-Rosette cast measuring primary productivity to ensure data comparison. The water from the carboy was passed through the AC9 in the Rosette garage. Three additional samples were taken to measure total suspended matter by filtering on Anodiscs, GF/F and polycarbonate filters allow intercomparison of their respective performance. Organic and inorganic fractions will be determined by burning the GF/F filters at 550°C. All samples were frozen at -80°C and will be processed upon the return of the ship. Filtrations on GF/F filters were also performed for HPLC and pigment absorption and these samples were flash frozen in liquid nitrogen and transferred to a dry shipper for conservation. Samples were also collected for POC, PON and colored dissolved organic matter (cDOM). POC and PON samples were stored in the -80°C freezer while the CDOM samples were stored at -15°C.

The second optical instrument used during the expedition was a Satlantic profiler multichannel radiometer to measure light attenuation in the water column at 13 wavelengths. This instrument needed light so profiles were performed only when sun elevation was appropriate (Table 10.1 and 9.2). Fortunately, this was possible at almost all the planned stations.

A third type of measurement was done using an ASD hyperspectral radiometer measuring light above the water. Since this type of measurement was very sensitive to surface water properties, data were collected only at a few stations when conditions were right (not too many waves, stable illumination). Measurements were also done along a few transects in an attempt to estimate spatial variability of water spectral properties (Tables 9.1 and 9.2). Finally, some measurements were also taken in the Great Whale River (in Hudson Bay, Leg 2) from the Zodiac launch on 1 October and in the Nelson and Hayes rivers (in Hudson Bay, Leg 2) on 9 October using the helicopter. Photos of the water surface and the sky were also taken to complement the optical measurements. Finally, a daily water sample was taken from the Along-Track System (ATS) located in the engine room and processed for temperature, salinity, CDOM and chlorophyll. The chlorophyll samples were processed by the primary production team.

During Leg 1, six stations were sampled in the Baffin Bay region (Pond Inlet, BA01-05, BA02-05, BA03-05, 2, BA04-05), five in the Northwest Passage (3, 4, P, 6, 7) and nine in the Beaufort Sea (204, CA05-05, 10, CA04-05, CA08-05, 201, 11, CA18-05, 12). As well, samples were collected through the onboard thermosalinograph (TSG) system in the engine room. A number of variables were measured using such samples as outlined in Table 10.1. Measurements were also made to validate the ATS during the return of the ship to Quebec City.

Locations of stations and samples collected during Leg 2 in Hudson Bay are listed in Table 10.2. In addition to planned stations, many waters samples from different rivers located along the Hudson Bay coast were also collected and processed in collaboration with the U. of Manitoba team led by C.J. Mundy. This will allow to define the optical properties of inflowing freshwater from different hydrographic basins.

Table 10.1. List of sampling stations and variables collected in the Canadian High Arctic during Leg 1 in August-September 2005.

Station	Date	Sample	Chlorophyll	Chlorophyll µm	POC/PON	HPLC	Pigments	CDOM	Salinity	TSM	TSM (PC)	TSM (Anodisc)
n/a	August 9, 2005	Surface	2	2	1	1	1	1	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
Pond Inlet	August 14, 2005	Surface	2	2	1	1	1	1	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
BA01-05	August 16, 2005	Surface	-	-	1	1	1	1	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
BA02-05	August 17, 2005	Surface	-	-	1	1	1	1	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
BA03-05	August 18, 2005	Surface	2	2	1	1	1	1	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
2	August 19, 2005	Surface	2	2	1	1	1	1	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
BA04-05	August 22, 2005	Surface	-	-	1	1	1	2	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
3	August 23, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
Station 4	August 24, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-
n/a	August 25, 2005	Surface	-	-	-	-	-	-	-	-	-	-
		TSG	2	2	-	-	-	2	1	-	-	-
P	August 26, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-
Station 6	August 27, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	-	-	-	-	-	-	-	-	-	-
7	August 30, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	-	-	-		-	-	-	-	-	-
n/a	August 31, 2005	Surface	-	-	-	-	-	-	-	-	-	-
		TSG	-	-	-	-	-	-	1	-	-	-
204	September 2, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-
CA05-05	September 2, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	-	-	-		-	-	-	-	-	-
n/a	September 3, 2005	Surface	-	-	-	-	-	-	-	-	-	-
		TSG	2	2	-	-	-	2	1	-	-	-
n/a	September 4, 2005	Surface	-	-	-	-	-	-	-	-	-	-
		TSG	2	2	-	-	-	2	1	-	-	-
10	September 5, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-
CA04-05	September 6, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-
n/a	September 7, 2005	Surface	-	-	-	-	-	-	-	-	-	-
		TSG	2	2	-	-	-	2	1	-	-	-
n/a	September 8, 2005	Surface	-	-	-	-	-	-	-	-	-	-
		TSG	2	2	-	-	-	2	1	-	-	-
CA08-05	September 9, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-

Station	Date	Sample	Chlorophyll	Chlorophyll µm	POC/PON	HPLC	Pigments	CDOM	Salinity	TSM	TSM (PC)	TSM (Anodisc)
201	September 10, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-
11	September 11, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-
CA18-05	September 12, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-
12	September 13, 2005	Surface	2	2	1	1	1	2	1	3	3	3
		TSG	2	2	-	-	-	2	1	-	-	-

Table 10.2. List of sampling stations and variables collected in the Canadian High Arctic, Hudson Strait and Hudson Bay during Leg 2 in September-October 2005. The values refer to the number of duplicate samples. ATS refers to the along-track system. For the SPMR. AC9 and ASD instruments, an X refers to measurements taken at that station. The T in the ASD column indicates a transect close to that station.

Station	**Date/Time (UTC)**	**Sample**	**SPMR**	**AC9**	**ASD**	**Chlorophyll**	**Chlorophyll µm**	**POC/PON**	**HPLC**	**Pigments**	**CDOM**	**Salinity**	**Temperature**	**Nutrients**	**TSM (GF/F)**	**TSM (PC)**	**TSM (Anodisc)**
n/a	Sept 16, 12h50	ATS 37	-	-	-	-	-	-	-	-	1	1	1	-	-	-	-
n/a	Sept 17, 02h30	Surface	-	-	-	-	-	1	1	1	1	-	-	-	1	1	1
n/a	Sept 17, 17h34	ATS 38	-	-	-	1	1	-	-	-	1	1	1	1	-	-	-
n/a	Sept 18, 16h32	ATS 39	-	-	-	1	1	-	-	-	1	1	1	1	-	-	-
n/a	Sept 19, 22h39	ATS 40	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
n/a	Sept 20, 18h06	ATS 41	-	-	-	1	1	-	-	-	1	1	1	1	-	-	-
n/a	Sept 21, 0h45	ATS	-	-	-	1	1	-	-	-	1	1	1	1	-	-	-
n/a	Sept 21, 13h00	ATS	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
n/a	Sept 21, 18h21	ATS 42	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-
n/a	Sept 22, 00h10	ATS	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
13A	Sept 22, 13h12	ATS	-	-	-	-	-	-	-	-	-	1	1	1	-	-	-
13D	Sept 22, 21h29	Surface	X	X	X	-	-	3	1	1	1	-	-	-	3	-	3
14A	Sept 23, 16h30	ATS 43	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
14E	Sept 23, 23h45	Surface	-	X	-	-	-	3	1	1	1	-	-	-	3	3	2
n/a	Sept 24, 17h32	ATS 44	-	-	-	-	-	-	-	-	1	1	1	1	-	-	-
S1	Sept 24, 21h22	Surface	-	X	-	1	1	3	1	1	1	-	-	-	3	2	3
15E	Sept 25, 16h25	Surface	X	X	-	-	-	3	1	1	1	-	-	-	3	2	3
15F	Sept 25, 22h02	ATS 45	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
16D	Sept 26, 12h48	ATS 46	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
16E	Sept 26, 15h45	Surface	X	X	T	-	-	3	1	1	1	-	-	-	3	2	3
17C	Sept 27, 17h27	Surface	X	X	-	-	-	3	1	1	1	-	-	-	3	2	3
17C	Sept 27, 13h17	ATS 47	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
18	Sept 28, 14h35	Surface	X	X	-	-	-	3	1	1	1	-	-	-	3	3	3
18	Sept 28, 15h55	ATS 48	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
PUV	Sept 28, ????	Surface	-	X	-	-	-	1	1	1	1	1	-	-	1	1	1
19E	Sept 29, 17h57	Surface	X	X	-	-	-	3	1	1	1	-	-	-	3	3	3

Station	Date/Time (UTC)	Sample	SPMR	AC9	ASD	Chlorophyll	Chlorophyll µm	POC/PON	HPLC	Pigments	CDOM	Salinity	Temperature	Nutrients	TSM (GF/F)	TSM (PC)	TSM (Anodisc)
INU	Sept 29, ????	Surface	-	X	-	-	-	1	1	1	1	1	-	-	1	1	1
20	Sept 30, 6h16	ATS 49	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
20	Sept, 30, 6h16	Surface	-	X	-	-	-	3	1	1	1	-	-	-	3	3	3
R1	Sept 30, ????	Surface	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
R2	Sept 30, ????	Surface	-	X	_	-	-	-	-	-	-	-	-	-	-	-	-
R3	Sept 30, ????	Surface	-	X	-	-	-	-	-	-	-	-	-	-	-	-	-
AN03	Sept 30, 20h15	Surface	X	X	X	-	-	3	1	1	1	-	-	-	3	3	3
AN03	Oct 1, 12h19	ATS 50	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
K1	Oct 1, 19h49	Surface	-	-	X	-	-	-	-	-	-	-	-	-	3	3	3
K2	Oct 1, 20h06	Surface	-	-	X	-	-	-	-	-	-	-	-	-	3	3	3
K3	Oct 1, 21h15	Surface	-	X	-	-	-	3	1	1	1	1	-	-	3	3	3
21C	Oct 2, 13h34	ATS 51	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
21E	Oct 2, 17h10	Surface	X	X	-	-	-	3	1	1	1	-	-	-	3	3	3
n/a	Oct 3, 17h26	ATS 52	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
21H	Oct 3, 19h10	Surface	-	X	XT	1	1	3	1	1	1	1	-	-	3	3	3
n/a	Oct 4, 15h58	ATS 53	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
BI1	Oct 4, 20h55	Surface	-	X	-	1	1	3	1	1	1	-	-	-	3	3	3
BI2	Oct 6, 00h05	Surface	-	X	-	1	1	3	1	1	1	-	-	-	3	3	3
BI2	Oct 6, 01h21	ATS 54	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
22	Oct 6, 19h25	Surface	X	X	-	1	1	3	1	1	1	-	-	-	3	3	3
22	Oct 6, 20h56	ATS 55	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
CTD15	Oct 7, 15h23	ATS 56	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
CTD15	Oct 7, 15h23	Surface	-	X	-	1	1	3	1	1	1	1	-	-	3	3	3
CTD20	Oct 7, 20h35	Surface	-	X	-	1	1	3	1	1	1	1	-	-	3	3	3
WI	Oct 7, 19h20	Surface	-	X	-	-	-	-	-	-	-	-	-	-	3	3	3
WI1	Oct 7, 20h30	Surface	-	X	-	-	-	-	-	-	-	-	-	-	3	3	3
N2	Oct 9, 13h05	Surface	-	X	-	1	1	3	1	1	1	1	-	-	3	3	3
N2	Oct 9, 13h13	ATS 57	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
NE	Oct 9, 19h30	Surface	-	X	X	-	-	-	-	-	-	-	-	-	3	3	3
HA	Oct 9, 20h40	Surface	-	X	X	-	-	-	-	-	-	-	-	-	3	3	3
MH	Oct 10, 14h25	Surface	-	X	T	1	1	3	1	1	1	-	-	-	3	3	3
MH	Oct 10, 16h24	ATS 58	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
23	Oct 11, 18h00	Surface	X	X	X	1	1	3	1	1	1	-	-	-	3	3	3
23	Oct 11, 23h18	ATS 59	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
AN02	Oct 12, 15h48	ATS 60	-	-	-	1	1	-	-	-	1	1	1	-	-	-	-
AN02	Oct 12, 16h05	Surface	-	X	X	1	1	3	1	1	1	-	-	-	3	3	3
AN01	Oct 13, 02h20	Surface	-	X	-	1	1	3	1	1	1	-	-	-	3	3	3
25	Oct 13, 19h00	Surface	?	X	-	1	1	3	1	1	1	1	-	-	3	3	3
CH	Oct 13, XXXX	Surface	-	X	-	-	-	-	-	-	-	-	-	-	3	3	3

10.3 Comments and recommendations

Here are a few recommendations from the optics team to further enhance the scientific capacity of the *Amundsen*. The filtration laboratory in room 610 has a network hub installed but its access was hampered by its location. Ethernet plugs should be installed into the electrical conduit running along the tables as in laboratory #614. The floor of laboratory #610 was very slippery when it was wet, which happened very often due to the nature of the work being done there. This was dangerous for the people working in the laboratory.

The along-track system (ATS) is potentially a very useful scientific instrument but the quality of its data is still unknown. Measurements taken during the 2004 CASES expedition showed many potential problems leading to an increased validation effort during the Arcticnet 2005 Expedition. One of the main problems is the unknown residence time inside the sea chest where the ATS takes its water. A simple experiment with an overboard pump could help evaluate the importance of this effect. Debris were often found on the filters which may be paint flecks or rust originating from inside of the sea chest. Replacing the sea chest would probably be prohibitive, but it could be padded with stainless steel plates or other non-corroding material such as Teflon to prevent this problem in the future. This could probably easily be done at the next dry dock. Stainless steel tubing from the sea chest to the instruments would also improve the quality of the data especially if other detectors such as nutrient analysers are installed. The ATS would also benefit from the installation of a digital flowmeter recording in real time to monitor system performance.

The last recommendation would be to upgrade the CTD-Rosette facilities to increase the space available for sampling the Rosette. When the Rosette is brought into its garage, space was not sufficient to allow many teams to simultaneously sample the different bottles due to the relatively small container and the presence of the Rosette wire which interfered with the sampling operations. A solution would be to build an enclosure in the space between the Rosette garage and the Rosette control room, including the winch location. An electrical door similar to the one of the helicopter hangar would also be part of that project. Moving the Rosette garage to that location would provide more space for everyone sampling the bottles, simplify the rosette operations and eliminate the wire problem. The present Rosette garage could then be converted into a wet/filtration laboratory and would be ideally located right beside the Rosette, thus avoiding the need to transport of large quantities of seawater, which was dangerous especially in rough sea conditions. This would also free the downstairs filtration lab for other uses requiring dry space. Completion of this project before the Polar Year expeditions would be beneficial to all the teams using the Rosette and improve the *Amundsen* scientific capacity.

11 Carbon fluxes in Hudson Bay using short-term sediment traps – Leg 2

ArcticNet Phase I – Project 3.3: Climate Variability / Change and Marine Ecosystem Resources in Hudson Bay. ArcticNet/Phase 1/Project 3.3

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11.1 Introduction

According to global circulation models, global warming will continue over the next decades. This warming will be manifested first and amplified in polar regions, particularly in the Arctic. A better knowledge of the biological pump converting carbon dioxide in the euphotic zone into phytoplankton carbon and exporting it to deeper water depths is needed (Caron et al. 2004).

There are two main pathways for the sedimentation of organic carbon in the water column. Phytoplankton carbon can be transferred to higher trophic levels by zooplankton grazing and part of this carbon may be exported to depth as fecal pellets. Primary production unused by these pelagic herbivores can also be exported out of the euphotic zone through sedimentation of intact cells. The first pathway, called the retention chain, favors transfer to the pelagic ecosystem while the second pathway, the export chain, leads to food input to the benthic community and potentially to carbon sequestration in the sediments. The carbon reaching the seafloor has to be replaced by a new supply of atmospheric carbon in surface waters to maintain the equilibrium of the partial pressure of carbon dioxide between the air and the sea (Caron et al. 2004). The downward export of organic material in Hudson Bay was never studied during the autumn and the pathways it follows are unknown.

The main objectives of this study were to:

- Estimate the sinking export of organic and inorganic material from the euphotic zone
- Determine the microscopic composition of this sedimenting matter.

11.2 Methodology

Free-drifting short-term particle interceptor traps were deployed from the ship at two or three depths below the euphotic zone (from 25 to 150 m) for 8 to 20 hours. Sediment traps were deployed at eight stations in the Hudson Bay system (Table 11.1). The traps consisted of PVC cylinders with an internal diameter of 10 cm and a height/diameter ratio of 7. In order to collect enough material for analyses, five traps were deployed at each depth on the trap line. At the surface, the trap line was attached to a positioning system (Argos and radio beacon) and a series of small floats to minimize vertical motion. A current meter (FSI 1536) was installed at the bottom of the trap line to measure the tilt. During deployment, the traps were filled with deep seawater collected at a previous station and filtered through 0.22 μm filter membranes. Upon recovery, the traps were covered with a tight lid and placed vertically in a dark cold chamber (4°C) for 8 hours. After the sedimentation period, the supernatant was carefully removed and the bottom volume of the traps was kept for subsequent analyses.

Table 11.1. Characteristics of the short-term free-drifting particle interceptor trap moorings deployed in Hudson Bay during Leg 2.

Station	Date	Duration (d)	Deployment		Recovery		Depth (m)	Target depth (m)
			Latitude N	Longitude W	Latitude N	Longitude W		
14	23/09	0.4583	62º16.62'	071º59.11'	62º14.82'	071º57.17'	345	50-100-150
16	26/09	0.3854	62º39.18'	080º03.46'	62º39.83'	080º46.06'	211	50-100-150
18	28/09	0.4720	60º07.52'	079º10.37'	60º10.51'	079º10.71'	140	50-100
AN03-05	30/09	0.8666	55º20.09'	078º13.58'	56º22.60'	078º05.94	138	25-50
22	6/10	0.3229	58º23.83'	083º17.28'	58º22.76'	083º18.28'	181	50-100-150
23	11/10	0.3854	59º00.66'	087º37.45'	59º01.92'	087º32.36'	189	50-100-150
AN01-05	12/10	0.3125	60º00.03'	091º57.06'	60º00.03'	091º58.40'	118	25-50
27	16/10	0.4408	61º03.72	086º11.31'	61º04.18'	086º14.13'	232	50-100-150

Every sediment trap was sampled for analyses of particulate inorganic carbon (PIC), particulate organic carbon (POC), dissolved organic carbon (DOC) particulate organic nitrogen (PON), particulate organic phosphorus (POP), isotopes (^{15}N and ^{13}C), biogenic (BioSi) and lithogenic (LithoSi) silica, chlorophyll *a* (Chl a), phaeopigments (Phaeo), phytoplankton abundance and composition (Cells), fecal pellet abundance and biovolume, and bacterial abundance (Table 11.2).

Table 11.2. List of samples collected from each trap and station in Hudson Bay during Leg 2.

Station	Date	Depth (m)	POC/PON	PIC	POP	BioSi /lithoSi	Chl a /Pheo	Cells	Fecal pellets	Bacteria	Isotopes
14	23/09	345	X	X	X	X	X	X	X	X	X
16	26/09	211	X	X	X	X	X	X	X	X	X
18	28/09	140	X	X	X	X	X	X	X	X	X
AN03-05	30/09	138	X	X	X	X	X	X	X	X	X
22	6/10	181	X	X	X	X	X	X	X	X	X
23	11/10	189	X	X	X	X	X	X	X	X	X
AN01-05	12/10	118	X	X	X	X	X	X	X	X	X
27	16/10	232	X	X	X	X	X	X	X	X	X

Bad sea conditions and/or limited water depths prevented the deployment of the drifting sediment traps at Stations 13, 17, 20, 21, BI-1, BI-2, 24, 25 and 26. Additionally, most of the deployment periods were shorter than 8 hours, which was not ideal since the minimum time is usually 12 hours. Finally, for the last stations (from 22 to 27), the current meter was not used because it was damaged by seawater.

Water samples were also collected at the Rosette from the deep chlorophyll maximum to estimate phytoplankton sinking velocity with a settling column (SetCol) (Table 11.3). Water samples were also collected at six different depths (25 m, 50 m, 75 m, 100 m, 150 m and the deep chlorophyll maximum) and filtered through a 50 µm Nitex mesh to concentrate the fecal pellets (Table 11.3). Pellets were then stored in 100 ml filtered seawater containing 1 ml of 37% formaldehyde borate.

Table 11.3. List of water column samples collected at each station in the Hudson Bay system in September-October 2005.

Station #	Date in 2005	Station depth (m)	Fecal pellet (sampled depth in m)	Sinking velocity (DCM in m)
13	22/09	405	25-50-75-100-150	25
14	23/09	342	25-36-50-75-100-150	36
15	25/09	312	25-40-50-75-100-150	40
16	26/09	220	25-45-50-75-100-150	45
17	27/09	153	25-38-50-75-100-150	38
18	28/09	148	25-28-50-75-100-150	28
19	29/10	80	10-25-50-75-100-150	10
AN 03-05	30/09	86	8-25-50-75	8
21	02/10	100	12-25-50-75	12
BI 1	04/10	103	15-25-50-75	15
BI 2	05/10	140	20-25-50-75-100	20
22	06/10	182	25-35-50-75-100-150	35
24	10/10	60	13-25-50	13
23	11/10	200	25-42-50-75-100-150	42
AN 02-05	12/10	80	10-25-50	10
AN 01-05	13/10	104	22-35-50-75	22
26	15/10	142	22-42-50-75-100	22
27	16/10	242	25-43-50-75-100-150	43

References

Caron G, Michel C, Gosselin M. 2004. Seasonal contributions of phytoplankton and fecal pellets to the organic carbon sinking flux in the North Water. Marine Ecology Progress Series 283:1-13.

12 Nutrients, light and dynamics of deep chlorophyll maxima – Legs 1 and 2

ArcticNet Phase I – Project 1.4: Marine Productivity & Sustained Exploitation of Emerging Fisheries. ArcticNet/Phase 1/Project 1.4

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12.1 Introduction

12.1.1 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

Phytoplankton production varies by two orders of magnitude across the western Arctic, constraining the productivity of marine resources and air-sea fluxes of the greenhouse gas CO_2. In the seasonally ice-free waters of the Canadian Archipelago, the productivity of phytoplankton is severely limited by the supply of allochtonous nitrogen to the euphotic zone. Nitrogen supply is influenced by climate-driven processes, mainly the large-scale circulation, river discharge, upwelling and local mixing processes. At present, most of the phytoplankton chlorophyll in the western Arctic is located within thin, subsurface layers associated with the nutricline. The productivity of these layers is possibly limited by the upward supply of nitrate (via diffusion and tidal or inertial mixing) and irradiance. Despite the importance of subsurface chlorophyll maxima for foodweb and carbon fluxes, little is known about their structure, turnover and susceptibility to environmental variability and change.

12.1.2 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

Hudson Bay is driven by slow cyclonic circulation and can be divided in two distinct zones. The inshore portion is greatly influenced by nutrients supply from runoff, mixing, entrainment and upwelling and is characterized by higher biomass and primary production. Offshore waters possess a strong vertical stratification and are limited by the supply of allochtonous nitrogen to the euphotic zone. Nitrogen supply is influenced by climate-driven processes, mainly the large-scale circulation, river discharge, upwelling and local mixing processes. Phytoplankton chlorophyll forms a maximum in a thin subsurface layer near the nutricline (caused by stratification). Despite the importance of subsurface chlorophyll maxima for foodweb and carbon fluxes, little is known about their structure, turnover and susceptibility to environmental variability and change.

12.1.3 Objectives

The main goals were to (1) establish the horizontal and vertical distributions of phytoplankton nutrients and the influence of different supply processes (e.g., mixing or rivers) on these distributions, (2) characterize the detailed vertical structure of chlorophyll-a with respect to irradiance, nutrient supply and physical structure, and (3) experimentally assess causal relationships between the productivity of chlorophyll maxima and the availability of light and nutrients. Ancillary objectives were to calibrate the SeaPoint fluorometer and ISUS nitrate probe attached to the Rosette sampler.

12.2 Methodology

Samples for inorganic nutrients and dissolved organic nitrogen (DON) were taken at most Rosette stations (see Table 12.1 for Leg 1 and Table 12.2 for Leg 2). Ammonium was determined immediately after collection using a modification of the manual fluorometric method (Holmes et al. 1999). Samples for DON were preserved with acid and stored in the dark at 4°C for post-cruise determinations. The concentrations of nitrate, nitrite, orthophosphate and orthosilicic acid were determined using an Autoanalyzer 3 (Bran+Luebbe) with colorimetric methods adapted from Grasshof (1999). The relationship between light and the uptake of C and N by phytoplankton from the chlorophyll maximum was assessed using dual labelling with stable isotopes of C and N in four light-gradient modules (10 light intensities ranging from 2 to 660 µmol quanta m^{-2} s^{-1}). Temperature was maintained at *in situ* levels with a circulating bath. Samples from all modules were spiked with ^{13}C-bicarbonate, two modules received saturating additions of ^{15}N-nitrate or ^{15}N-ammonium, and the other two trace additions. Incubations were terminated by filtration onto 25-mm GF/F filters. All filters were desiccated at 60°C and stored dry for post-cruise determination of isotopic enrichment and the concentrations of particulate organic carbon and nitrogen content by mass spectrometry. The effects of incubation treatments on the photosynthetic performance of phytoplankton were assessed by Pulse Amplitude Modulated (PAM) fluorometry. Nitrate data were used to calibrate the ISUS nitrate probe. Calibration of the Rosette fluorometer was achieved by comparing the instrument's output with extracted chlorophyll *a* and PAM data from the fluorescence maximum and the steep adjacent gradient.

Table 12.1. List of stations visited and measurements carried out for nutrient determinations during Leg 1.

Station	Cast	Date	Time (UTC)	Latitude N	Longitude W	Depth (m)	Nuts	DON	Incubations
BA01/100	4	2005-08-16	11:00	76° 18.14	071° 24.58	685	X		
100	6	2005-08-16	18:55	76° 17.66	071° 26.30	672	X	X	X
104	9	2005-08-17	09:58	76° 16.97	072° 47.42	577	X		
BA02/108	12	2005-08-17	17:06	76° 16.01	074° 34.72	450	X	X	
112	15	2005-08-18	04:36	76° 19.42	075° 47.02	342	X		
BA03/116	18	2005-08-18	11:58	76° 22.94	077° 23.85	360	X	X	X
L 2	26	2005-08-19	21:39	78° 18.13	074° 28.79	530	X	X	

Station	Cast	Date	Time (UTC)	Latitude N	Longitude W	Depth (m)	Nuts	DON	Incubations
BA04	50	2005-08-22	06:05	75° 14.45	075° 00.27	478	X	X	X
3	54	2005-08-23	12:40	74° 02.81	079° 53.66	814	X	X	
3a	55	2005-08-23	18:44	74° 11.79	083° 20.76	700	X		
4	56	2005-08-24	02:25	74° 18.15	088° 29.43	346	X		
4	58	2005-08-24	12:39	74° 15.75	091° 11.53	335	X	X	X
P	62	2005-08-25	04:47	72° 19.85	096° 17.96	458	X		
6	64	2005-08-27	12:36	69° 10.46	100° 41.88	68	X	X	
7	70	2005-08-30	10:40	68° 59.88	106° 34.81	117	X	X	
211	77	2005-09-02	02:45	71° 22.64	127° 29.70	263	X		
210	78	2005-09-02	03:48	71° 20.57	127° 32.48	233	X		
209	79	2005-09-02	05:00	71° 18.42	127° 41.95	175	X		
208	80	2005-09-02	06:07	71° 16.45	127° 48.48	140	X		
207	81	2005-09-02	07:07	71° 14.94	127° 54.56	103	X		
206	82	2005-09-02	09:10	71° 12.85	128° 00.46	82	X		
205	83	2005-09-02	09:51	71° 10.81	128° 06.24	70	X		
204	84	2005-09-02	10:52	71° 08.85	128° 12.22	64	X		
203	85	2005-09-02	14:25	71° 06.79	128° 18.37	58	X		
202	86	2005-09-02	15:03	71° 04.90	128° 24.63	54	X		
201	87	2005-09-02	15:41	71° 02.95	128° 30.51	43	X		X
CA05-05	89	2005-09-02	22:37	71° 16.66	127° 31.41	201	X	X	
10	98	2005-09-05	16:59	71° 33.85	139° 59.50	2478	X	X	X
CA04-05	100	2005-09-06	21:46	71° 05.22	133° 37.01	334	X	X	
CA08-05	110	2005-09-09	14:05	71° 00.28	125° 55.93	402	X	X	X
11	126	2005-09-11	14:18	70° 20.37	126° 21.40	255	X	X	
CA18-05	129	2005-09-12	15:49	70° 39.99	122° 59.37	500	X	X	X
12	132	2005-09-13	18:04	69° 54.80	122° 57.40	205	X	X	

Table 12.2. List of stations visited and measurements carried out for nutrient determinations during Leg 2.

Station	Cast	Date	Time (UTC)	Latitude N	Longitude W	Bottom (m)	Nuts	DON	Incubations
13a	5	2005-09-22	13:05	61° 16.379	064° 49.026	262	X		
13b	6	2005-09-22	15:25	61° 09.202	064° 49.494	450	X	X	
13c	7	2005-09-22	18:23	61° 00.233	064° 44.630	518	X		
13d	8	2005-09-22	22:04	60° 50.908	064° 42.473	387	X		
13e	9	2005-09-23	00:44	60° 44.873	064° 41.710	303	X		
14e	16	2005-09-24	04:15	62° 15.082	071° 52.529	342	X	X	
15d	22	2005-09-25	11:24	64° 07.230	078° 52.260	245	X	X	
16d	35	2005-09-26	11:59	62° 45.462	081° 03.439	198	X	X	
17c	43	2005-09-27	13:00	62° 08.072	078° 42.868	156	X	X	
18	50	2005-09-28	12:25	60° 09.442	079° 07.459	140	X	X	
19e	57	2005-09-29	11:55	58° 25.162	078° 19.936	116	X	X	
(20)	59	2005-09-30	06:11	56° 50.400	076° 50.063	118	X		
AN-03-05	63	2005-10-01	11:49	55° 17.072	077° 53.754	87	X	X	
21c	67	2005-10-02	13:34	54° 41.315	080° 07.792	60	X	X	
BI-1	75	2005-10-04	23:04	55° 25.790	080° 30.427	99	X	X	
BI-2	78	2005-10-06	01:18	56° 45.066	080° 49.754	178	X	X	
22	81	2005-10-06	20:51	58° 23.887	083° 17.490	181	X	X	X

Station	Cast	Date	Time (UTC)	Latitude N	Longitude W	Bottom (m)	Nuts	DON	Incubations
MH01-05	104	2005-10-10	13:09	57° 34.406	091° 37.176	74	X	X	X
23	113	2005-20-11	23:10	59° 03.566	087° 28.940	200	X	X	
AN02-05	115	2005-10-12	15:45	58° 46.576	091° 30.769	83	X	X	
AN01-05	118	2005-10-13	6:31	59° 59.378	091° 58.134	115	X	X	
26	121	2005-10-16	4:00	60° 26.672	089° 22.002	141	X	X	
27	122	2005-10-16	14:08	61° 03.959	086° 10.891	242	X	X	

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13 Molecular microbial biodiversity of Arctic seas – Leg 1

ArcticNet Phase I – Project 1.4: Marine Productivity & Sustained Exploitation of Emerging Fisheries. ArcticNet/Phase 1/Project 1.4

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13.1 Introduction

Microbes are the dominant form of life in oceans and are responsible for carbon and nutrient cycling on a global scale. Because of their small size, the identity of the majority of these organisms is unknown. Recent advances applying molecular based techniques to probe DNA collected from the sea has revealed surprising diversity of both prokaryotic and eukaryotic microbes in all systems investigated. Preliminary data from the Canada Basin, the Beaufort Sea and Norwegian Arctic waters revealed considerable diversity at different depths and among marine systems.

The objective of this project was to collect microbial DNA and ancillary data from firstly, the northern limits of the highly productive North Water Polynya (NOW), which is characterized by complex physical structure in the upper water column, and secondly, to obtain DNA from a wide variety of sites with different oceanographic characteristics throughout the Canadian Arctic. The cruise path of the CCGS *Amundsen* on Leg 1 was ideal for this second objective. The first objective, to explore in detail the microbial biodiversity of the northern section of the North Water Polynya was financed by a 2-day NSERC ship time award.

13.2 Methodology

A list of stations sampled is given in Table 13.1, with the variables collected at each station in Table 13.2. Nutrients (nitrate, silica, and soluble reactive phosphorus) were also taken from all depths sampled.

In total, 9 stations were sampled in the North Water Polynya, including five dedicated DNA stations and the four southern ArcticNet mooring sites. In support for this project, five East-West CTD lines were instigated in the northern part of the Polynya to gain information on cold fresh-warm salty interleaving features (Figure 13.1). At the five sites where water was collected, the sampling strategy was to obtain microbial DNA and other biological data from 3 to 4 interleaving features at each station along with samples at the surface, chlorophyll maximum layer and 180 to 200 m deep temperature maximum. Biologically significant features were identified during the downcast of the CTD. In addition to temperature and salinity, the sampling choices were based on readouts from the oxygen, nitrate, fluorescence, transmissometer and pH probes.

Samples were taken on an opportunity basis for the remainder of the 6-week leg. Data from six depths at 10 stations provided valuable information on the depth distribution of microbes from the Northwest Passage to the Beaufort Sea. At three additional stations, DNA at the chlorophyll maximum was collected with the aim of retrieving functional genes from this feature. Similarly, additional DNA was collected from a deep 585 m sample from the Beaufort Sea. At all stations, one depth was subsampled with the aim of obtaining enrichment cultures of small protists to be isolated and studied on shore.

Table 13.1. CTD cast number, location, names and dates of stations sampled for DNA and supporting variables during Leg 1. See Table 12.2 for details.

DNA Station	Cast #	ArcticNet Station	Date Start	Time Start (UTM)	Latitude N	Longitude W	Bottom (m)
BA01	5	100	2005-08-16	16:36	76° 17.93	071° 25.81	678
BA02	11	108	2005-08-17	13:56	76° 15.98	074° 35.25	460
BA03	17	116	2005-08-18	09:05	76° 22.92	077° 23.30	352
MB09	21	Lovejoy 9	2005-08-19	09:03	77° 49.96	075° 20.77	607
MB02	25	Lovejoy 2	2005-08-19	19:13	78° 19.68	074° 21.33	493
MB11	30	Lovejoy 11a	2005-08-20	06:22	77° 49.98	074° 39.70	705
MB07	35	Lovejoy 7	2005-08-20	14:24	77° 49.50	075° 59.24	572
MB21	43	Lovejoy 21	2005-08-21	03:39	77° 20.08	076° 01.24	540
BA04	48	BA04-05	2005-08-21	23:45	75° 14.40	074° 58.92	477
L-03	52	3-Lancaster Sound	2005-08-22	00:00	74° 03.05	079° 55.24	912
L-04	60	4-Barrow Strait	2005-08-24	16:26	74° 16.63	091° 07.59	339
VS-06	65	6-Franklin Strait	2005-08-27	15:41	69° 11.05	100° 42.62	72
AN-07	70	7-Dease Strait	2005-08-30	10:40	68° 59.88	106° 34.81	117
CBa204	85	204	2005-09-02	12:51	71° 08.86	128° 12.04	64
CA05-05	90	CA05-05	2005-09-03	01:57	71° 16.80	127° 30.29	209
CA07-04	96	Mooring retrieval	2005-09-04	19:07	71° 10.44	133° 59.76	625
Beau10	99	10-Beaufort Sea	2005-09-05	20:49	71° 33.65	140° 06.71	2503
CA04-05	101	CA04-05	2005-09-06	01:40	71° 03.75	133° 36.07	265
CA07-04d	103	CA07-04	2005-09-07	08:10	71° 10.75	134° 01.83	634
CA08-05	111	CA08-05	2005-09-09	15:56	71° 00.24	125° 55.49	415
FB11-20	113	11	2005-09-10	23:43	70° 20.37	126° 21.47	255
CA18-05	130	CA18-05	2005-09-12	19:14	70° 39.98	122° 59.58	542
CLyon-12	133	12	2005-09-13	21:18	69° 54.86	122° 57.00	193

At most stations, seawater samples were taken for the following variables: fractionated DNA and Chl a, pigments (HPLC), flow cytometry samples for particle size (FCM), phytoplankton taxonomy sample (FNU), Virus, two methods for estimating bacterial numbers (Sybr Bact and DAPI back) and samples for estimating small protist numbers

(DAPI Euk). Fluorescence in situ hybridization samples were also taken for both Bacteria (FISH Bact) and Protists (FISH Euks).

The epifluorescence microscope on board the *Amundsen* was used for counting bacteria, viruses and small flagellates. Counts for were done within 24 hours of sampling.

Several experiments were also executed by graduate student R. Terrado (U. Laval) as a preliminary investigation into species specific grazing by small phytoplankton and other protists on bacteria in the Arctic.

Table 13.2. Depth, feature, sample number and variables sampled at each station (from Table 12.1) for microbial DNA measurements during Leg 1.

DNA Station ID	Depth (m)	Defining feature*	Sample #	DNA <3um	DNA >3um	Chl a T	Chl a <3um	HPLC T	HPLC <3um	FCM	FNU	Virus	SYBR Bact	DAPI Bact	DAPI Euk	FISH Bact	FISH Euks
BA01	150	Deep T min	005.01	X	X	X	X			X		X	X	X	X	X	X
BA01	80	Nitricline	005.03	X	X	X	X			X		X	X	X	X	X	X
BA01	55	T Intrusion (max)	005.05	X	X	X	X			X		X	X	X	X	X	X
BA01	48	upper T min	005.11	X	X	X	X			X		X	X	X	X	X	X
BA01	22	Chl max	005.15	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BA01	5	Std surf	005.20	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BA02	180	std deep	011.01	X	X	X	X			X		X	X	X	X	X	X
BA02	125	T bump	011.03	X	X	X	X			X		X	X	X	X	X	X
BA02	65	upper T min	011.05	X	X	X	X			X		X	X	X	X	X	X
BA02	40	Nitricline	011.07	X	X	X	X			X		X	X	X	X	X	X
BA02	23	Chl max	011.16	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BA02	5	Std surf	011.18	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BA03	180	Rem T max	017.01	X	X	X	X			X		X	X	X	X	X	X
BA03	140	Major T min	017.04	X	X	X	X			X		X	X	X	X	X	X
BA03	100	T positive bump	017.06	X	X	X	X			X		X	X	X	X	X	X
BA03	60	Nitricline	017.08	X	X	X	X			X		X	X	X	X	X	X
BA03	22	Chl max	017.14	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BA03	5	Std surf	017.19	X	X	X	X	X	X	X	X	X	X	X	X	X	X
09	180	Std deep	021.04	X	X	X	X			X		X	X	X	X	X	X
09	77	Deep T bump	021.14	X	X	X	X			X		X	X	X	X	X	X
09	66	T min	021.16	X	X	X	X			X		X	X	X	X	X	X
09	40	Nitricline	021.18	X	X	X	X			X		X	X	X	X	X	X
09	27	Chl & T max	021.20	X	X	X	X	X	X	X	X	X	X	X	X	X	X
09	5	Std surf	021.22	X	X	X	X	X	X	X	X	X	X	X	X	X	X
02	180	Std deep	025.05	X	X	X	X			X		X	X	X	X	X	X
02	140	Deep T bump	025.08	X	X	X	X			X		X	X	X	X	X	X
02	99	Tmin	025.12	X	X	X	X			X		X	X	X	X	X	X
02	75	Nitricline-T isosurface	025.15	X	X	X	X			X		X	X	X	X	X	X
02	40	Chl max	025.17	X	X	X	X	X	X	X	X	X	X	X	X	X	X
02	5	Std surf	025.20	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	180	Std deep	030.08	X	X	X	X			X		X	X	X	X	X	X
11	85	Nitricline & T	030.17	X	X	X	X			X		X	X	X	X	X	X

DNA Station ID	Depth (m)	Defining feature*	Sample #	DNA <3um	DNA >3um	Chl a T	Chl a <3um	HPLC T	HPLC <3um	FCM	FNU	Virus	SYBR Bact	DAPI Bact	DAPI Euk	FISH Bact	FISH Euks
		dip															
11	62	T max	030.18	X	X	X	X			X		X	X	X	X	X	X
11	45	T dip	030.19	X	X	X	X			X		X	X	X	X	X	X
11	23	Chlor max	030.20	X	X	X	X	X	X	X	X	X	X	X	X	X	X
11	5	Std surf	030.22	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07	180	Tmin	035.01	X	X	X	X			X		X	X	X	X	X	X
07	140	T max	035.05	X	X	X	X			X		X	X	X	X	X	X
07	80	Nitricline	035.08	X	X	X	X			X		X	X	X	X	X	X
07	45	chl max	035.12	X	X	X	X	X	X	X	X	X	X	X	X	X	X
07	25	Tmax	035.17	X	X	X	X			X		X	X	X	X	X	X
07	5	Std surf	035.21	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21	180	Tmin	043.05	X	X	X	X			X		X	X	X	X	X	X
21	90	Tdip	043.12	X	X	X	X			X		X	X	X	X	X	X
21	55	T bump	043.15	X	X	X	X			X		X	X	X	X	X	X
21	32	T dip-chl bump	043.17	X	X	X	X			X		X	X	X	X	X	X
21	15	Chl max	043.19	X	X	X	X	X	X	X	X	X	X	X	X	X	X
21	5	Std surf	043.22	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BA04	200	Std deep	048.06	X	X	X	X			X		X	X	X	X	X	X
BA04	110	T bump	048.12	X	X	X	X			X		X	X	X	X	X	X
BA04	55	Nitricline	048.14	X	X	X	X			X		X	X	X	X	X	X
BA04	23	chl max	048.17	X	X	X	X			X		X	X	X	X	X	X
BA04	12	salinity-chl dip	048.18	X	X	X	X	X	X	X	X	X	X	X	X	X	X
BA04	5	Std surf	048.20	X	X	X	X	X	X	X	X	X	X	X	X	X	X
L-03	400	T dip	052.08	X	X	X	X			4		X	X	X	X	X	X
L-03	270	T bump	052.09	X	X	X	X			X		X	X	X	X	X	X
L-03	240	T dip	052.10	X	X	X	X			X		X	X	X	X	X	X
L-03	200	T bump	052.15	X	X	X	X			X		X	X	X	X	X	X
L-03	80	T min	052.17	X	X	X	X			X		X	X	X	X	X	X
L-03	20	Chl max mixed	052.21	X	X	X	X	X	X	X		X	X	X	X	X	X
L-04	200	Std deep	060.01	X	X	X	X			X		X	X	X	X	X	X
L-04	100	T min	060.04	X	X	X	X			X		X	X	X	X	X	X
L-04	60	T bump	060.06	X	X	X	X			X		X	X	X	X	X	X
L-04	30	T dip	060.13	X	X	X	X			X		X	X	X	X	X	X
L-04	23	Chl max	060.15	X	X	X	X	X	X	X		X	X	X	X	X	X
L-04	5	Std surf	060.20	X	X	X	X	X	X	X		X	X	X	X	X	X
VS-06	20	Chl max	065.14	X	X	X	X			X	X	X	X	X	X	X	X
VS-06	20	Chl max	065.15	X	X	X	X					X	X		X	X	
VS-06	20	Chl max	065.16	X	X	X	X					X	X		X	X	
VS-06	20	Chl max	065.17	X	X	X	X					X	X		X	X	
VS-06	20	Chl max	065.18	X	X	X	X	X	X			X	X		X	X	
VS-06	20	Chl max	065.19	X	X	X	X			X		X	X	X	X	X	X
AN-07	30	Chl max	070.10	X	X	X	X			X		X	X	X	X	X	
AN-07	30	Chl max	070.11	X	X	X	X					X	X	X	X	X	
AN-07	30	Chl max	070.12	X	X	X	X					X	X	X	X	X	X
AN-07	30	Chl max	070.13	X	X	X	X					X	X	X	X	X	
AN-07	30	Chl max	070.14	X	X	X	X					X	X	X	X	X	
AN-07	30	Chl max	070.15	X	X	X	X	X	X	X	X	X	X	X	X	X	

DNA Station ID	Depth (m)	Defining feature*	Sample #	DNA <3um	DNA >3um	Chl a T	Chl a <3um	HPLC T	HPLC <3um	FCM	FNU	Virus	SYBR Bact	DAPI Bact	DAPI Euk	FISH Bact	FISH Euks
CBa204	50	T min	085.04	X	X	X	X			X		X	X	X	X	X	X
CBa204	30	Nitricline	085.08	X	X	X	X			X		X	X	X	X	X	X
CBa204	20	Bottom Chl max	085.13	X	X	X	X			X		X	X	X	X	X	X
CBa204	15	Center Chl max	085.15	X	X	X	X	X	X	X		X	X	X	X	X	X
CBa204	10	Top Chl max	085.17	X	X	X	X			X		X	X	X	X	X	X
CBa204	5	Std surf	085.19	X	X	X	X	X	X	X		X	X	X	X	X	X
CA05-05	180	Std deep	090.04	X	X	X	X			X		X	X	X	X	X	X
CA05-05	70	Nitricline	090.08	X	X	X	X			X		X	X	X	X	X	X
CA05-05	52	T bump	090.10	X	X	X	X			X		X	X	X	X	X	X
CA05-05	44	chl max	090.14	X	X	X	X	2000	2000	X		X	X	X	X	X	X
CA05-05	24	T max	090.17	X	X	X	X			X		X	X	X	X	X	X
CA05-05	5	Std surf	090.20	X	X	X	X	X	X	X		X	X	X	X	X	X
CA07-04	403	T max	096.01	X	X	X	X			X		X	X		X	X	X
CA07-04	141	T min	096.04	X	X	X	X			X		X	X		X	X	X
CA07-04	54	Nitricline	096.08	X	X	X	X			X		X	X		X	X	X
CA07-04	44	Chl max	096.11	X	X	X	X	X	X	X	X	X	X		X	X	X
CA07-04	24	T bump	096.14	X	X	X	X			X		X	X		X	X	X
CA07-04	5	Std surf	096.18	X	X	X	X	X	X	X	X	X	X		X	X	X
Beau10	700	Deep O2 minima	099.01	X	X	X	X			X		X	X		X	X	X
Beau10	380	T max	099.04	X	X	X	X			X		X	X		X	X	X
Beau10	160	T min-Nitrate max	099.07	X	X	X	X			X		X	X		X	X	X
Beau10	72	Nitricline	099.10	X	X	X	X			X		X	X		X	X	X
Beau10	48	Chl max	099.13	X	X	X	X	X	X	X	X	X	X		X	X	X
Beau10	5	Std surf	099.21	X	X	X	X	X	X	X	X	X	X		X	X	X
CA04-05	51	chl max	101.15	X	X	X	X					X	X				
CA04-05	51	chl max	101.17	X	X	X	X					X	X				
CA04-05	51	chl max	101.18	X	X	X	X			X		X	X		X	X	X
CA04-05	51	chl max	101.19	X	X	X	X			X		X	X		X	X	X
CA04-05	51	chl max	101.20	X	X	X	X					X	X				
CA04-05	51	chl max	101.21	X	X	X	X	X	X		X	X	X				
CA07-04d	585	Deep	103.01	X	X							X	X				
CA07-04d	585	Deep	103.02	X	X							X	X				
CA07-04d	585	Deep	103.03	X	X												
CA07-04d	585	Deep	103.04	X	X												
CA07-04d	585	Deep	103.05	X	X												
CA07-04d	585	Deep	103.06	X	X												
CA08-05	380	T max	111.04	X	X	X	X			X		X	X		X	X	X
CA08-05	210	nitrate dip	111.05	X	X	X	X			X		X	X		X	X	X
CA08-05	120	T min	111.10	X	X	X	X			X		X	X		X	X	X
CA08-05	43	Nitricline	111.17	X	X	X	X	X	X	X	X	X	X		X	X	X
CA08-05	30	chl max	111.19	X	X	X	X			X		X	X		X	X	X
CA08-05	5	Std surf	111.20	X	X	X	X	1000	990	X		X	X		X	X	X
FB11-20	211	Deep chl max-O min	113.04	X	X	X	X			X		X	X		X	X	X
FB11-20	135	O bump	113.05	X	X	X	X			X		X	X		X	X	X
FB11-20	100	T min	113.10	X	X	X	X			X		X	X		X	X	X
FB11-20	61	Nitricline	113.11	X	X	X	X			X		X	X		X	X	X

DNA Station ID	Depth (m)	Defining feature*	Sample #	DNA <3um	DNA >3um	Chl a T	Chl a <3um	HPLC T	HPLC <3um	FCM	FNU	Virus	SYBR Bact	DAPI Bact	DAPI Euk	FISH Bact	FISH Euks
FB11-20	35	chl max	113.17	X	X	X	X	X	X	X	X	X	X		X	X	X
FB11-20	5	Std surf	113.19	X	X	X	X	X	X	X		X	X		X	X	X
CA18-05	420	trans min	130.04	X	X	X	X					X	X		X	X	X
CA18-05	213	O min	130.08	X	X	X	X					X	X		X	X	X
CA18-05	90	T min	130.12	X	X	X	X					X	X		X	X	X
CA18-05	40	Nitricline	130.18	X	X	X	X					X	X		X	X	X
CA18-05	32	Chl max	130.19	X	X	X	X	X	X			X	X		X	X	X
CA18-05	5	Std surf	130.20	X	X	X	X	X	X			X	X		X	X	X
CLyon-12	21	Chl max	133.13	X	X					X		X	X		X	X	X
CLyon-12	21	Chl max	133.14	X	X						X						
CLyon-12	21	Chl max	133.16	X	X												
CLyon-12	21	Chl max	133.17	X	X												
CLyon-12	21	Chl max	133.18	X	X												
CLyon-12	21	Chl max	133.19	X	X							X	X		X	X	X
CLyon-12	21	Chl max	133.16B	X	X					X							
CLyon-12	21	Chl max	133.20	X	X	X	X	X	X								
CLyon-12	21	Chl max	133.20	X	X												
CLyon-12	21	Chl max	133.20	X	X												

* Temperature (T), minimum (min), maximum (max), standard (std), Chlorophyll fluorescence (Chl), remnant (rem), Oxygen (O).

13.3 Preliminary results

Five CTD sections plus the ArcticNet (southernmost) sampling transect of temperature and salinity vertical profiles conducted across Nares Strait/Baffin Bay and the North Water Polynya (NOW) are shown in Figure 13.1.

Since it is currently not feasible to analyze DNA on board the ship, results of the DNA survey will be known only after extensive laboratory work on shore. The epifluorescence microscope on board the *Amundsen* was used for counting bacteria, viruses and small flagellates. The access to these data gave us immediate insight into the different regions sampled (Figure 13.2). Viruses were generally ten times more abundant than bacteria and both decreased with depth. The data distribution indicates that a wide variety of different biological systems were sampled.

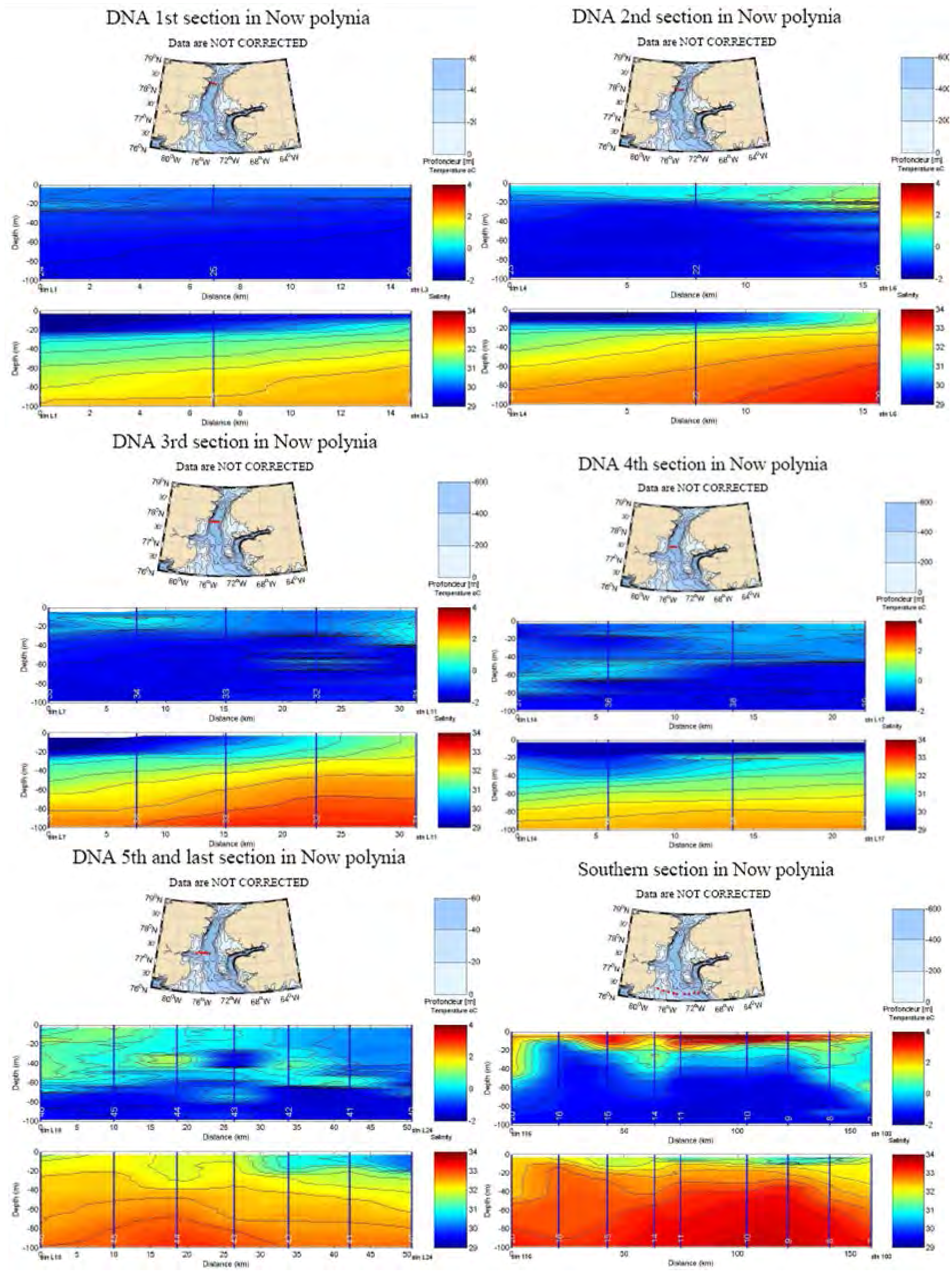

Figure 13.1. Five CTD sections of temperature and salinity vertical profiles across the North Water Polynya (NOW) taken during Leg 1 in August 2005. The five DNA sections were taken in support of this project; the most southern section was in conjunction with regular ArcticNet operations.

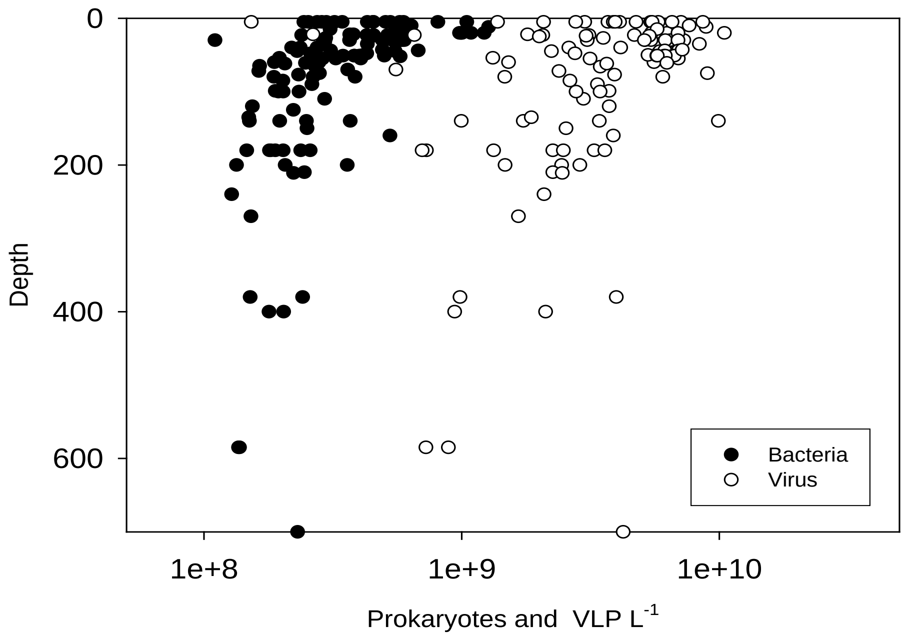

Figure 13.2. Abundance of virus like particles (VLP) and Bacteria (counts include all prokaryotes, that are stained with the nucleic acid specific fluorochrom, Sybr Gold) from the Canadian Arctic.

14 Phytoplankton and primary production – Legs 1 and 2

ArcticNet Phase I – Project 1.4: Marine Productivity & Sustained Exploitation of Emerging Fisheries. ArcticNet/Phase 1/Project 1.4
ArcticNet Phase I – Project 3.3: Climate Variability / Change and Marine Ecosystem Resources in Hudson Bay. ArcticNet/Phase 1/Project 3.3

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14.1 Introduction

14.1.1 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Se

This research component of ArcticNet's marine-based program focused more specifically on understanding the development of the summer phytoplankton communities along an east to west environmental gradient in the Canadian High Arctic. The general research objective of this study was to determine the environmental variables that govern the abundance and the species composition of the summer phytoplankton communities in the Canadian High Arctic from the North Water in Baffin Bay to the Mackenzie shelf in the Beaufort Sea, including the Northwest Passage. The overarching objectives were to compare the phytoplankton communities between the eastern Arctic and the western Arctic in terms of algal species composition and abundance and to establish the relationships between the environmental variables and the changes occurring in the abundance, the species composition and the primary production of the Arctic planktonic microflora. The following hypotheses will be tested: (1) a nutrients gradient from eastern Arctic to western Arctic influences the species composition of the phytoplankton, (2) a temperature and salinity gradient from eastern Arctic to western Arctic affects the species composition of the phytoplankton, and (3) the summer phytoplankton communities of the eastern Arctic are more productive than those of the western Arctic.

14.1.2 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

The objective of this project during Leg 2 was to collect data for major biogeochemical variables related to phytoplankton biomass, production, and carbon flux, as well as variables that are important in the parameterization and verification of carbon cycle model coupled with 3-D ocean circulation model of Hudson Bay.

14.2 Methodology

14.2.1 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Se

Water sampling was conducted with a CTD-Rosette system at optical depths corresponding to 100%, 50%, 30%, 15%, 5%, 1% and 0.2% of incident irradiance, and the chlorophyll maximum. Seven stations were visited in the Baffin Bay region (BA01, 104, BA02, 112, BA03, Lovejoy2, BA04), five in the Northwest Passage (3, 4, P, 6, 7) and ten in the Beaufort Sea (211, 204, 201, CA05-05, 10, CA04-05, CA08-05, 11, CA18-05, 12). Some variables (total and fractionated chlorophyll, particulate organic carbon and nitrogen [POC/PON]) were measured for each corresponding optical depths at each sampling site. A selective sampling of some variables (biogenic silica [BioSi], expolymeric substance [EPS], high pressure liquid chromatography of pigments [HPLC], planktonic cells and picoplankton cytometry [Pico]) were done at 50% and 15% incident light and at the nearest optical depth corresponding to the maximum chlorophyll. In addition, three water depths were sampled at 75 m, 33.1‰ and 200 m for chlorophyll, POC/PON, BioSi and EPS. Analyses performed at each station and depth are detailed in Table 14.1.

Table 14.1. List of stations and samples collected for phytoplankton parameters and primary production in the Canadian High Arctic during Leg 1. Grey-shaded lines correspond to the optical depth nearest to the maximum chlorophyll.

Station	Date in 2005	Depths	Chl	Chl › 5µm	POC/ PON	BioSi	EPS	HPLC	Cells	Pico
BA01-B	08/16	100%	2	2	1					
		50%	2	1	1	2	1	1	2	2
		30%	2	2	1					
		15%	2	2	1	2	1	1	2	2
		5%	2	2	1					
		1%	2	2	1					
		0.2%	2	2	1					
		75m			1	2	1			
		200m			1					
104	08/17	2m							2	
		10m							2	
		20m							2	
BA02	08/17	100%	2	2	1					
		50%	2	1	1	2	1	1	2	2
		30%	2	2	1					
		15%	2	2	1	2	1	1	2	2
BA02 (cont'd)		5%	2	2	1					
		1%	2	2	1	2	1	1	2	2
		0.2%	2	2	1					
		75m	1	2	1	2	1			
		200m	1	1	1					
112	08/18	10m							2	

Station	Date in 2005	Depths	Chl	Chl › 5µm	POC/ PON	BioSi	EPS	HPLC	Cells	Pico
		20m							2	
		30m							2	
BA03	08/18	100%	2	2	1					
		50%	2	2	1	2		1	2	2
		30%	2	2	1					
		15%	2	2	1	2		1	2	2
		5%	2	2	1					
		1%	2	2	1	2		1	2	2
		0.2%	2	2	1					
		75m	2	2	1	2				
		200m	2	2	1					
Lovejoy2	08/19	100%	2	2	1					
		50%	2	2	1	2	1	1	2	2
		30%	2	2	1					
		15%	2	2	1	2	1	1	2	2
		5%	2	2	1					
		1%	2	2	1					
		0.2%	2	2	1	2	1	1	2	2
		75m	2	2	1	2	1			
		33.1‰	2	2	1	2	1			
		200m			1					
BA04	08/22	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1	2	1	1	2	2
		1%	1	2	1	2	1	1	2	2
		0.2%	2	2	1					
		75m	2	2	1	2	1			
		200m			1					
3	08/23	100%	1	1						
		50%	1	1						
		30%	1	1	1	2	1	1	2	2
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1					
		1%	1	1	1	2	1	1	2	2
		0.2%	1	1	1					
		75m	1	1	1	2	1			
		200m			1					
4	08/24	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
4 (cont'd)		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1	2	1	1	2	2
		1%	1	1	1					
		0.2%	1	1	1					
		75m	1	1	1	2	1			
		33.1‰	1	1	1	2	1			
		200m			1					

Station	Date in 2005	Depths	Chl	Chl › 5µm	POC/ PON	BioSi	EPS	HPLC	Cells	Pico
P	08/26	0m	1	1	1					
		5m	1	1	1	2	1	1	2	2
		10m	1	1	1					
		20m	1	1	1	2	1	1	2	2
		35m	1	1	1	2	1	1	2	2
		40m	1	1	1					
		50m	1	1	1					
		80m	1	1	1	2	1			
		33.1‰	1	1	1	2	1			
		200m			1					
6	08/27	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1					
		1%	1	1	1	2	1	1	2	2
		0.2%	1	1	1					
		50m	1	1	1	2	1			
7	08/30	100%	1	1	1					
		50%	1	1	1	2	2	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	2	1	2	2
		5%	1	1	1					
		1%	1	1	1	2	2	1	2	2
		0.2%	1	1	1					
		75m	1	1	1	2	2			
211	09/01	0m	1	1						
		10m	1	1						
		20m	1	1						
		30m	1	1						
		40m	1	1						
		48m	1	1						
		60m	1	1						
		70m	1	1						
204	09/02	0m	1	1	1					
		5m	1	1	1	2	1	1	2	2
		10m	1	1	1					
		20m	1	1	1	2	1	1	2	2
		30m	1	1	1					
204 (cont'd)		40m	1	1	1	2	1	1	2	2
		50m	1	1	1					
201	09/02	20m							2	
CA05-05	09/02	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1					
		1%	1	1	1	2	1	1	2	2
		0.2%	1	1	1					

Station	Date in 2005	Depths	Chl	Chl › 5µm	POC/ PON	BioSi	EPS	HPLC	Cells	Pico
		33.1‰	1	1	1	2	1			
		194m	1	1	1					
10	0905	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1	2	1	1	2	2
		1%	1	1	1					
		0.2%	1	1	1					
		33.1‰	1	1	1	2	1			
		200m	1	1	1		1			
CA04-05	09/06	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1					
		1%	1	1	1	2	1	1	2	2
		0.2%	1	1	1					
		33.1‰	1	1	1	2	1			
		200m	1	1	1		1			
CA08-05	09/09	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1	2	1	1	2	2
		1%	1	1	1					
		0.2%	1	1	1					
		75m	1	1	1	2	1			
		33.1‰	1	1	1	2	1			
		200m	1	1	1					
11	09/11	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1					
		1%	1	1	1					
		0.2%	1	1	1	2	1	1	2	2
11 (cont'd)		75m	1	1	1	2	1			
		33.1‰	1	1	1	2	1			
		200m	1	1	1					
CA18-05	09/12	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1	2	1	1	2	2
		1%	1	1	1					
		0.2%	1	1	1					
		75m	1	1	1	2	1			
		33.1‰	1	1	1	2	1			

Station	Date in 2005	Depths	Chl	Chl › 5µm	POC/ PON	BioSi	EPS	HPLC	Cells	Pico
		200m	1	1	1					
12	09/13	100%	1	1	1					
		50%	1	1	1	2	1	1	2	2
		30%	1	1	1					
		15%	1	1	1	2	1	1	2	2
		5%	1	1	1	2	1	1	2	2
		1%	1	1	1					
		0.2%	1	1	1					
		75m	1	1	1	2	1			
		33.1‰	1	1	1	2	1			

Primary production experiments were conducted at 13 sampling sites in the Canadian High Arctic during Leg 1 in August-September 2005 (BA01, BA03, Lovejoy2, BA04, 3, 4, 6, 7, CA05-05, 10, CA04-05, CA08-05, CA18-05). Water samples were collected at optical depths (100%, 50%, 30%, 15%, 5%, 1% and 0.2%), inoculated with ^{14}C and incubated on the front deck of the ship for 24 hours. After that period, filtrations were performed in the Radvan and scintillation vials were stored in the dark at room temperature in the Radvan.

The incident light was recorded continuously with a PAR sensor located on a flat surface on top of a container in front of the ship. At almost all stations sampled, underwater light profiles were performed with a PNF.

14.2.2 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

Samples were collected from CTD-Rosette's Niskin bottles for analyses of standing stocks of dissolved inorganic carbon (DIC) and total alkalinity (TA), dissolved organic carbon (DOC), chlorophyll *a* (Chl), particulate organic carbon/nitrogen (POC/N), and biogenic silica (BioSi). Some 18-Oxygen samples have also been collected in coordination with Dr. R. McDonald (IOS-DFO) to estimate the contribution of alkalinity from freshwater to total alkalinity.

Table 14.2. Phytoplankton standing stock sampling with the number of depths sampled for each variable in Hudson Bay during Leg 2.

Station	Date	DIC/TA	18-O	DOC	Chl	POC/N	BioSi	Cells	Pico plankton
13b	22/09/05	11	11	9	10	10	3	3	3
13d	22/09/05				8				
14e	24/09/05	12	12	10	10	10	5	5	3
15d	25/09/05	12	12	10	10	10	3	3	3
16d	26/09/05	10	10	10	9	9	3	3	3
17c	27/09/05	10	10	11	10	10	3	3	3
18	28/09/05	9	9	10	10	10	3	3	3
19e	29/09/05	10	10	9	8	8	4	2	2
20	30/09/05	8	8	8	8	8	3		

Station	Date	DIC/TA	18-O	DOC	Chl	POC/N	BioSi	Cells	Pico plankton
AN03-05	01/10/05	8	8	8	8	8	3	3	3
21c	02/10/05	5	5	9	9	9	4	4	4
21e	02/10/05				5				
BI-1	04/10/05	5	5	7	8	8	5	3	3
BI-2	05/10/05	8	8	10	11	11	6	3	3
22	06/10/05	7	7	10	11	11	5	3	3
CTD-18 (Wanisk River)	07/10/05	2	2	2	2	2			
24 (Nelson River)	10/10/05	6	6	10	12	12	5	3	3
23	11/10/05	7	7	12	10	10	4	2	2
AN02-05	12/10/05			10	10	10	5	3	3
AN01-05	13/10/05	6	6	10	10	10	5	3	3
26	15/10/05	8	8	9	9	9	5	3	3
27	16/10/05	10	3	10	13	13	5	3	3

Daily primary production was estimated at 7 photic 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. Short term photosynthesis-irradiance (P-E) curve experiments were conducted at 2 depths (50% surface irradiance, and 1% or Chlmax) to estimate photosynthetic parameters, such as maximum productivity (P_m), the irradiance at which P_m is reached (I_k), and photosynthetic efficiency (α), which have never been determined for Hudson Bay. These values will be used to parameterize the carbon cycle model being developed at UQAR/ISMER.

Table 14.3. Number of depths at which rate measurements experiments were conducted during Leg 2 in Hudson Bay.

Station	Date	Primary production	P-E curves	Nitrification	Nitrogen status
13b	22/09/05	7	2	2	2
14e	23/09/05	7	2	2	2
15d	25/09/05	7	2	2	2
16d	26/09/05	7	2	2	2
17c	27/09/05	7	2	2	2
18	28/09/05	7	2		
19e	29/09/05	7	2	2	2
20	30/09/05		1		
AN03-05	01/10/05	7	2	2	2
21	02/10/05	7	2	2	2
BI-1	04/10/05				
BI-2	05/10/05		2		
22	6/10/05		2		
24 (Nelson River)		7	2	2	2
23	11/10/05	7	2		
AN02-05	12/10/05		2		
AN01-05	13/10/05	7	2		
26	15/10/05		2		
27	16/10/05	7	2	2	2

Incident PAR (photosynthetically available radiation) was continuously recorded with Li-Cor 2pi sensor. Secchi depth was determined at every station at which primary production was conducted to determine the photic depths, except for some stations for which arrival occurred at night.

In addition, nitrification rates were also determined at Chl maximum and 75 m and nitrogen status of phytoplankton at the depth of 50% surface irradiance, and Chl maximum.

At the beginning of the cruise, the liquid scintillation counter onboard the ship was not functional due to hard disk replacement. The team reprogrammed the scintillation counter, and did a quench curve for the instrument. The quench curve was essential for calculating dpm from cpm, as the former is the valid value for quantifying the radioactivity of samples. This enabled to count the samples of P-E experiments and thus obtain results onboard. A protocol was also created to allow future users to count the radioactivity of ^{14}C using this instrument.

Chlorophyll samples were also collected upon request for other groups, such as Drs. P. Larouche (DFO-IML) and T. Papakyriakou (U. Manitoba-CEOS).

As part of the Schools on Board program, the project and research field were presented to the students and some experiments were demonstrated.

This was a rather successful cruise, given the weather conditions encountered. The captain and crew members were professional and cooperative for scientific operations. Particularly, we are indebted to the crew members who helped remove the deck incubator after it was broken during a storm. The crew members repaired the incubator and relocated it to a safe place after the storm was over. This minimized our loss of sampling stations due to storms.

14.3 Preliminary results (Leg 2)

Based on the results of P-E experiments, phytoplankton generally reached P_m around irradiance of ≤100 µmol photons m^{-2} s^{-1}. This was relatively low and indicates that the phytoplankton cells in Hudson Bay were adapted to low light intensity, which is likely due to strong mixing of the upper water column in this season. These values were representative of those reported for phytoplankton in other polar waters.

P_m of surface water (depth of 50% of the surface irradiance) in the Hudson Strait (except for Station 13) was moderate, ranging from 1.2 to 2 mg C m^{-3} h^{-1}. Higher P_m of 2-6 mg C m^{-3} h^{-1} were observed at stations located on the southeast coast and Nelson River estuary. Productivity of offshore stations (22, 23, 26, and 27) and two stations (17 and 18) at the downstream of the current towards the Hudson Strait along the east coast were relatively low (P_m <1 mg C m^{-3} h^{-1}). This is also consistent with the distribution pattern of chlorophyll *a*. Further sample analyses will be carried out in the laboratory in Rimouski upon return of the ship.

14.4 Recommendations

The bench space was very limited onboard the ship and some laboratories were too crowded in this cruise. More bench spaces should be available for research teams who need to filter large volume of seawater and to perform laboratory experiments with live samples.

The fume hood for preparing chemical reagents was not working properly and needs to be fixed.

The temperature of the on-deck incubator was maintained at sea surface temperature by flow-through water pumped from the sea surface to the incubator. In the current cruise, the water pumped to the incubator was 5°C higher than the surface water. The water was not clean and contained particles that affected the light intensity in the incubation tubes. Therefore, a more efficient and cleaner flow-through water circulation system is needed.

Communications: There was only one email connection per day during this cruise. This is obviously not sufficient for scientists to communicate with people on land. In the current situation, if one sends an email today, it will reach the recipient on the second day. Even if the recipient replies immediately upon receiving the email, one could not get the response until the third day. It made it difficult to obtain timely advice from supervisors or colleagues onshore for technicians, students and postdocs onboard the ship. Twice daily connections should be reasonable.

15 Marine productivity: Biochemical markers of diatoms – Leg 1

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15.1 Introduction

The primary aim of this project is to investigate the potential of using compound specific biomarkers from sea-ice associated diatoms to serve as a proxy measure for the past occurrence of sea ice in the Canadian Arctic. The contribution of sea-ice to climate processes is well acknowledged and, although current mapping of sea-ice is accurate and routine, previous records are extremely poor for obvious reasons. An obvious candidate for the determination of previous sea-ice would be the highly specific diatomaceous microflora that exists within the sea-ice during spring, prior to the melting of the ice. However, once deposited in sediments, such diatoms undergo rapid dissolution, rendering them impossible or extremely difficult to identify. An alternative proxy measure exists in the biochemicals present in the organelles of diatoms. Numerous examples of such biochemicals or 'biomarkers' are used routinely in biogeochemistry. In order for a biomarker to be of value within the current context, it must possess the following features. Firstly, the structure of the biomarker must be unambiguously assigned. Secondly, it must have a limited association with sea-ice associated species in order that its occurrence cannot be confused with an open water origin. Thirdly, the biomarker must be sufficiently robust within the water column and in sediments to permit analysis over a meaningful time period. Clearly, such chemicals also need to be present in sufficient concentrations for analysis by a routine analytical method.

Highly branched isoprenoid (HBI) alkenes are unusual lipid-like chemicals that are produced from a limited number of diatom genera. They exist in a number of isomeric forms and their structural differences can be used to distinguish between their sources. In the case of HBI alkenes originating from the *Haslea* spp., the unique positions of unsaturation permits differentiation from related chemicals from genera such as *Rhizosolenia* and *Pleurosigma*. Since unsaturation in these chemicals is strongly temperature dependent, we previously proposed that mono-unsaturated or even saturated HBIs should be produced by *Haslea* spp. at sea-ice temperatures. Indeed, recent analysis (Poulin, Masse and Belt) of extracts from sea-ice containing communities of *Haslea* spp. has shown this to be the case. In contrast, extracts from neighboring open-waters revealed the presence of HBIs of structural types typically associated with *Rhizosolenia* spp and *Pleurosigma* spp. As such, the production of a biomarker unique to sea-ice is becoming established.

15.2 Methodology

In order to strengthen these preliminary observations and to assess for the wider applicability of these biomarkers, two types of sampling have been carried out on Leg 1 of the 2005 ArcticNet cruise of the Canadian High Arctic. Firstly, phytoplankton samples (< 75 μM) were collected from various open-water locations in order that the specificity of the novel biomarker to sea-ice associated species can be further investigated. Following collection by net-trawling, samples (typically 5 l) were concentrated by gravity settling and centrifugation. These samples were then frozen (-20 °C). Where samples were believed to contain an abundant number of phytoplankton cells, aliquots were sub-sampled and preserved with Lugol in order that diatom identification could be achieved in the future. Extraction of lipids from the concentrated cells will be performed using ultrasonication in hexane, while analysis of the lipids (including HBIs) will be carried out using gas chromatography-mass spectrometry (GC-MS) at the University of Plymouth, UK. A summary of the sampling locations can be found in Table 15.1.

Table 15.1. Summary of phytoplankton trawls conducted on Leg 1.

Date	Time	Latitude N	Longitude W	Water Depth (m)	Label	Other
14/08/05					Pond Inlet	
Net In	15.15	72°47.039	078°07.505	751		Needs
Net Out	15.25	72°47.017				clarification
16/08/05					BA01	
Net In	05.45	76°17.924	071°24.525	676		
Net Out	06.04	76°17.924	071°24.525			
17/08/05					BA02	
Net In	12.10	76°15.491	074°36.321	446		
Net Out	12.15	76°15.523	074°36.142			
18/08/05					BA03	
Net In	07.12	76°23.114	077°21.208	348		
Net Out	07.19	76°23.114	077°21.208			
21/08/05					BA04	
Net In	20.42	75°14.280	074°59.075	478		
Net Out	20.47	75°14.282	074°58.505			
22/08/05					Station 3	
Net In	18.55	74°02.895	079°55.684	817		
Net Out	19.00	74°02.897	079°55.392			
24/08/05					Station 4	
Net In	09.41	74°15.519	091°11.273	332		
Net Out	09.46	74°15.552	091°11.372			
27/08/05					Station 6	
Net In	13.21	69°10.092	100°42.145	65		
Net Out	13.24	69°10.094	100°42.198			
30/08/05					Station 7	
Net In	05.50	69°00.054	106°35.009	120		
Net Out	05.53	69°59.957	106°35.217			
02/09/05					204	
Net In	08.50	71°08.473	128°11.283	65		

Date	Time	Latitude N	Longitude W	Water Depth (m)	Label	Other
Net Out	08.56	71°08.448	128°11.370			
03/09/05					CA05-05	
Net In	01:17	71°16.727	127°28.988	211 (4/10)		
Net Out	01:26					
05/09/05					Station 10	
Net In	15.30	71°33.500	140°04.200	220 (4/10)		
Net Out	15.45	71°33.500	140°04.200			
06/09/05					CA04-05	
Net In	23:26	71°05.027	133°34.289	335 (5/10)		
Net Out	23:35	71°05.041	133°34.317			
09/09/05					CA08-05	
Net In	09.30	71°00.000	125°55.000	414		
Net Out	09.45	71°00.000	125°55.000			
11/09/05					Station 11a	
Net In	11.24	70°20.264	126°22.106	263		
Net Out						
11/09/05					Station 11b	
Net In	18.35	70°20.310	126°21.675	256		
Net Out	18.52					
12/09/05					CA18-04	
Net In	22.39	70°39.174	122°59.450	609		
Net Out	22.49	70°39.174	122°59.450			
13/09/05					Station 12	
Net In	16.30	69°54.813	122°57.957	219		
Net Out	16.45	69°54.813	122°57.957			

Secondly, sediments have been collected in Baffin Bay, the Northwest Passage and the Beaufort Sea. Sediments have been collected by box coring (ca. 35 cm), trigger coring (ca. 120 cm) and piston coring (400-600 cm). For each of these, sub-samples (ca. 5-10 g) were collected and frozen awaiting further analysis. Isolation of recent sediment material was limited to box cores, while intermediate sampling of the trigger and piston cores was achieved by sectioning at 50 cm or 100 cm intervals. Extraction and analysis of the hydrocarbons present in the sub-sampled sediment material will also take place at the University of Plymouth. The remaining core material will be shipped to Plymouth upon return of the *Amundsen* to Quebec City in November 2005. Subject to identification of HBI biomarkers in the sub-sampled material and the main cores, core material will be dated via standard methods. The locations of the sediment cores and the sub-sampling details are provided below.

Date: 20/08/05
Station: (NOW)
Core Number: 1 Corer type: Box Core length: 39 cm
Latitude N: 77°49.750 Longitude W: 74°39.971
Water Depth: 703 m

Section number	Section Length	Start - ends	Sampled area
1	39	0-39	none
2	39	0-39	none

Date: 20/08/05
Station: (NOW)
Core Number: 2 Corer type: Box Core length: 39 cm
Latitude N: 77°49.750 Longitude W: 74°39.971
Water Depth: 703 m

Section number	Section Length	Start - ends	Sampled area
1	39	0-39	(top)
2	39	0-39	(bottom)

Date: 23/08/05
Station: 3 (Lancaster Sound)
Core Number: 1 Corer type: Box Core length: 35 cm
Latitude N: 74°02.949 Longitude W: 79°54.411
Water Depth: 811 m

Section number	Section Length	Start - ends	Sampled area
1	35	0-35	(top)
2	35	0-35	(bottom)

Date: 24/08/05
Station: 4 (Barrow Strait)
Core Number: 1 Corer type: Piston Core length: 641 cm
Latitude N: 74°16.047 Longitude W: 91°06.381
Water Depth: 347 m

Section number	Section Length	Start - ends	Sampled area
1	102	641-539	641 (bottom)
2	102	539-437	539
3	102	437-335	437
4	102	335-233	335
5	102	233-131	233
6	105	131-26	131
7	26	26 - 0	(top)

Date: 24/08/05
Station: 4 (Barrow Strait)
Core Number: 1 Corer type: Trigger weight Core length: 108 cm
Latitude N: 74°16.047 Longitude W: 91°06.381
Water Depth: 347 m

Section number	Section Length	Start - ends	Sampled area
1	48	108-60	108 (bottom)
2	60	60-0	60 (top)

Date: 24/08/05
Station: 4 (Barrow Strait)
Core Number: 1 Corer type: Box Core length: 38 cm
Latitude N: 74°16.138 Longitude W: 91°05.048
Water Depth: 340 m

Section number	Section Length	Start - ends	Sampled area
1	38	0-38	0 (top)
1	38	0-38	38 (bottom)

Date: 27/08/05
Station: 6 (Victoria Strait)
Core Number: 1 Corer type: Piston Core length: 469 cm
Latitude N: 69°09.943 Longitude W: 100°41.719
Water Depth: 61 m

Section number	Section Length	Start - ends	Sampled area
1	102	469-367	469 (bottom)
2	102	367-265	367
3	102	265-163	265
4	102	163-61	163
5	61	61-0	61 (top)

Date: 27/08/05
Station: 6 (Victoria Strait)
Core Number: 1 Corer type: Box Core length: 33 cm
Latitude N: 69°09.967 Longitude W: 100°41.719
Water Depth: 61 m

Section number	Section Length	Start - ends	Sampled area
1	33	0-33	0 (top)
1	33	0-33	33 (bottom)

Date: 30/08/05
Station: Station 7
Core Number: 1 Corer type: Piston Core length: cm
Latitude N: 68°59.453 Longitude W: 106°34.271
Water Depth: 112 m

Section number	Section Length	Start - ends	Sampled area
1	102.5	0-102.5	102.5 (bottom)
2	102	102.5-204.5	204.5
3	102	204.5-306.5	306.5
4	102	306.5-408.5	408.5

Date: 30/08/05
Station: Station 7
Core Number: 1 Corer type: Trigger weight Core length: cm
Latitude N: 68°59.453 Longitude W: 106°34.271
Water Depth: 112 m

Section number	Section Length	Start - ends	Sampled area
1	59	0-59	59 (bottom)
2	70	59-129	129 (top)

Date: 30/08/05
Station: Station 7
Core Number: 1 Corer type: Box Core length: 40 cm
Latitude N: 69°00.002 Longitude W: 106°34.541
Water Depth: 117 m

Section number	Section Length	Start - ends	Sampled area
1	40	0-40	0 (top)
1	40	0-40	40 (bottom)

Date: 10/09/05
Station: Station 11
Core Number: 1 Corer type: Box Core length: 28 cm
Latitude N: 70°19.485 Longitude W: 126°23.504
Water Depth: 253 m

Section number	Section Length	Start - ends	Sampled area
1	28 cm	0-28 cm	Top (separate)
1	28 cm	0-28 cm	Not Bottom

Date: 13/09/05
Station: Station 12
Core Number: 1 Corer type: Trigger weight Core length: Approx°35 cm
Latitude N: 69°54.813 Longitude W: 122°57.957
Water Depth: 219 m

Section number	Section Length	Start - ends	Sampled area
1	35 cm	0-35 cm	None

Date: 13/09/05
Station: Station 12
Core Number: 1 Corer type: Box Core length: 40 cm
Latitude N: 69°54.813 Longitude W: 122°57.957
Water Depth: 219 m

Section number	Section Length	Start - ends	Sampled area
1	40 cm	0-40 cm	None (surface separate)

16 Regulation system of photosynthesis in phytoplankton – Legs 1 and 2

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16.1 Introduction

The reduction of excess excitation energy in the photosynthetic system is critical for phytoplankton to tolerate the high light intensity found in surface waters. These mechanisms are highly dynamic, and time scales for acclimation of the individual processes vary from seconds to days in phytoplankton. Active fluorescence can be useful in understanding the nature of high light photoacclimation and the mechanisms involved in dissipation of excess energy. In diatoms, the reversible conversion of the xanthophyll, diadinoxanthin and diatoxanthin, is intimately related to the ability to regulate the dissipation of excess light energy. For psychrophilic algae, the xanthophyll cycle is a very important mechanism since the excess light energy damage is more pronounced for photosynthesis proteins at low temperature.

This project aimed at studying the relationship between activity of photosynthesis and the xanthophyll cycle. During the NOW (North Water Polynya study) expedition in 1999, the photosynthetic properties of phytoplankton in Baffin Bay were analyzed. The xanthophyll cycle was found to be more active in phytoplankton at the surface than at the bottom of the euphotic zone, suggesting that such a protection system in surface phytoplankton resulted in lower apparent photosynthetic property (lower ETRmax [maximum value of electron transport rate]).

In the CASES (Canadian Arctic Shelf Exchange Study) expedition (2004-2005), similar research was conducted in Franklin Bay and Mackenzie shelf ecosystems. The Mackenzie shelf receives high riverine freshwater inputs in the summer which favors the phytoplankton bloom. The xanthophyll cycle and photosynthetic properties in phytoplankton close to the river mouth was higher than at the bottom of the euphotic zone or farther offshore. This suggested that the xanthophyll cycle and photosynthetic properties were modified by freshwater in the Beaufort Sea.

In this ArcticNet expedition, properties of phytoplankton were compared between seasons and in different regions, Franklin Bay versus Hudson Bay.

17 Zooplankton and Ichtyoplankton – Legs 1 and 2

ArcticNet Phase I – Project 1.4: Marine Productivity & Sustained Exploitation of Emerging Fisheries. ArcticNet/Phase 1/Project 1.4

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17.1 Introduction

In Leg 1, operations consisted mainly in monitoring activities following the extensive NOW (Baffin Bay) and CASES (Beaufort Sea) studies that set the boundaries of the ArcticNet East-West Gradient, including the Northwest Passage. In total during Leg 1, 23 stations were visited for zooplankton & fish sampling, 6 mooring lines out of 8 were recovered and 8 new ones were deployed. Acoustics EK60 monitoring was done continuously during the whole cruise.

During Leg 2 in Hudson Bay, the general objective was to investigate the impacts of climate forcings on biogeochemical fluxes, biological production, fish recruitment and marine mammal distribution in Hudson Bay. Fish and zooplankton were sampled at 44 stations during Leg 2 while pelagic organisms were monitored continuously during the entire leg with the EK60 echosounder.

The specific objectives for both legs of the 2005 Expedition were to:

- Sample zooplankton and fish of all life stages with various mesozooplankton nets (plankton nets, Bioness, Hydrobios), a macrozooplankton/small fish rectangular midwater trawl (RMT) and a large mesopelagic trawl, to better describe their biological characteristics, abundance, distribution (both vertically and spatially) and community structure;
- Monitor zooplankton & fish abundance and distribution with a Simrad EK60 echosounder;
- Retrieve the long-term sediment traps recovered from the CASES (2004) mooring lines (Beaufort Sea region), as well as preparing them (traps & moorings) for new deployments in Baffin Bay, Beaufort Sea, and Hudson Bay;
- Install hydrophones on three mooring lines to be deployed in Hudson Bay.

17.1.1 Metazoan zooplankton

Metazoan zooplankton is involved in numerous processes that can modify the magnitude, nature and direction of carbon fluxes. These processes include: the trophic flux of organic carbon and contaminants from primary producers to large vertebrate predators; the repackaging of small particles into larger rapidly-sinking faecal pellets by feeding; the destruction of sinking faecal pellets by coprophagy; the remineralization of organic carbon into CO_2 by respiration, the conversion of particulate carbon into DOC by sloppy feeding and excretion; and the vertical transport of carbon by vertical migration. The main zooplankton groups mediating these processes are copepods, appendicularians, macrozooplankton predators (Amphipods, gelatinous zooplankton…) and fish larvae.

17.1.2 Chaetognaths

Chaetognaths are among the most abundant carnivorous zooplankton in the Arctic, but knowledge of their ecology is very limited. The objective of this project was to assess the importance and impact of chaetognath predation on diverse prey organisms.

17.1.3 Arctic cod and capelin

Arctic cod (*Boreogadus saida*) plays a key role in the transfer of carbon, energy and contaminants from the planktonic domain towards the higher levels of the food web occupied by marine mammals and birds and, ultimately, humans. It was therefore specifically targeted by our sampling program. Preliminary catch statistics of this species are presented in Table 17.5 and Figure 17.3 and 16.4.

Capelin (*Mallotus villosus*) is another forage species that colonizes and reproduces in the coastal waters of Hudson Bay. A circumpolar fish like Arctic cod, it is known to spawn mostly in spring and early summer in the Bay.

17.2 Methodology

17.2.1 Description of sampling nets and trawls (see photos in Figure 17.1)

<u>Vertical tows</u>

The 4X4 Monster Net consists of 4x1-m^2 square nets (2x200 µm mesh size and 2x500 µm mesh size) equipped with a 10 cm diameter net (50 µm mesh) attached to the upper part of the frame and with rigid, semi-closed cod ends for capturing live specimens and flowmeters type TSK (2) & GO (2).

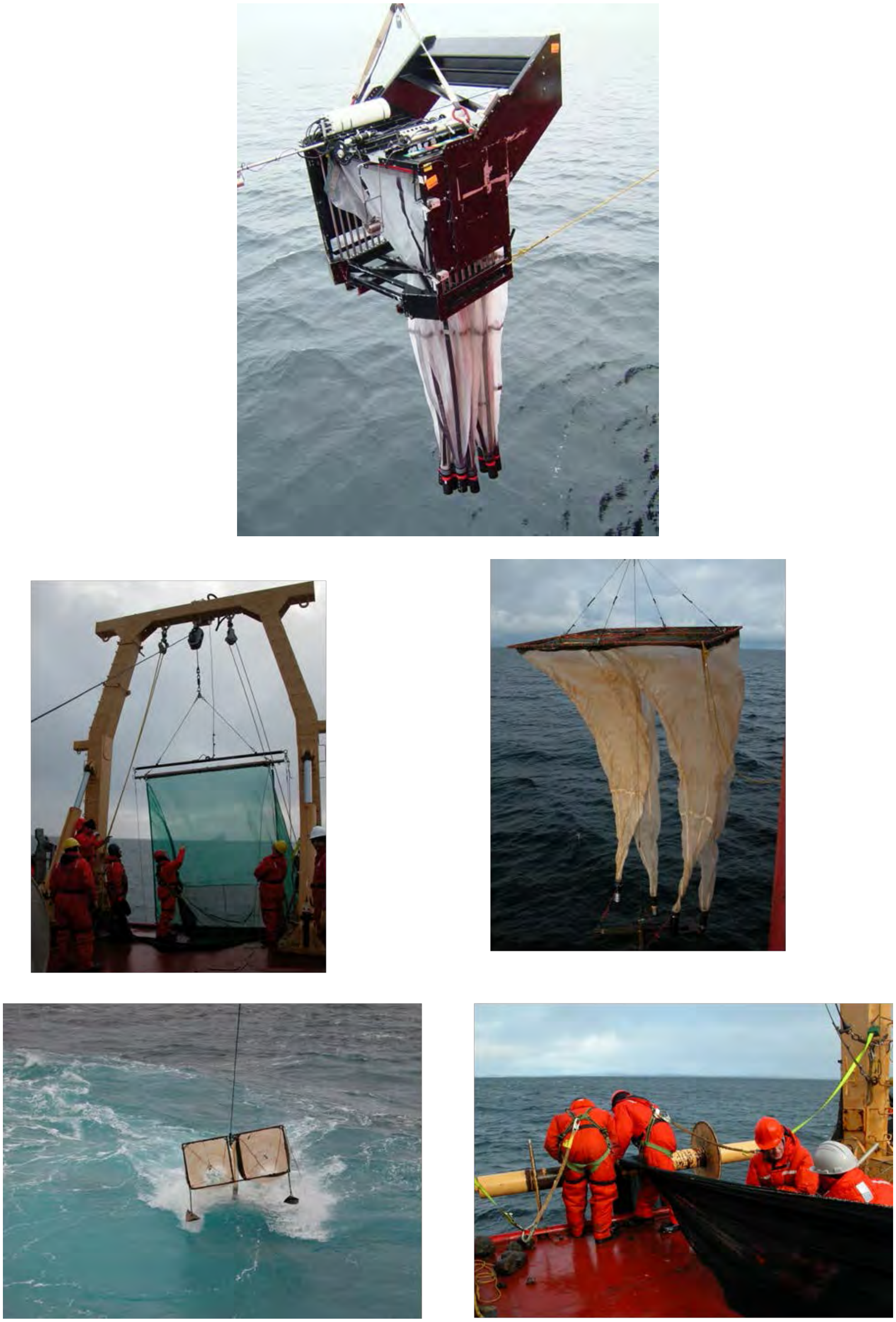

Figure 17.1. Photos of the Bioness (top), RMT (center left), Monster net (center right), double net (bottom left) and pelagic trawl (bottom right) used for sampling zooplankton and fish.

The Hydrobios (Multi Plankton Sampler) is equipped with opening and closing system, 9 nets of 200 µm each and mouth opening of 0.5 m^2 and was used to stratify water column.

Oblique tows

The Tucker consists of 2x1m^2 nets (500 µm mesh size) equipped with 10 cm diameter net (50 µm) attached to the upper part of the metal frame.

The Bioness (Zooplankton Multiple Net Sampling System) is equipped with a system of 9 nets which open and close separately, with an aperture of 1 m^2 and mesh size of 333 µm.

The RMT (Rectangular Midwater Trawl) is fitted with 1600 µm mesh, with a mouth opening of 9 m^2 and was used chiefly for catching young fish and amphipods.

The Mega-Trawl (Experimental Midwater Trawl) is fitted with multiple mesh sizes, with a flexible mouth opening. It also has depth, fish counting and aperture probes, and was tested to catch adult fish to validate the EK 60 sounding.

In Hudson Bay (Leg 2), a light 1 m^2 aperture, 6 m long, 500-µm mesh plankton net was mounted on a metal frame to be towed obliquely from the Zodiac during estuarine samplings. A 0.5 m^2 aperture, 80-µm mesh ring net was also used for vertical tows at the estuarine stations.

Rosette casts

At selected stations, stratified sampling of microzooplankton was carried out with the CTD Rosette. At each 10-meter interval from 90 m to the surface, two 12 L bottles were used for the collection of water that was passed through 50-µm sieves immediately upon retrieval of the Rosette.

17.2.2 Zooplankton and fish sampling

Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

During Leg 1, 4X4 integrated (bottom-surface) vertical tows for zooplankton were completed at 20 stations. Both TSKs 200 µm & 500 µm as well as the 50 µm nets were processed and preserved as quantitative tows for Fortier's lab. The two other nets equipped with a GO flowmeter served as live tows for fresh & intact zooplankton. The 500 µm for Stern & Matsuda teams (contaminants analysis and chaetognaths incubation) and the 200 µm for Fortier's team (microscopic observations to differentiate real swimmers from passive flux within the long-term sediment traps samples). The Hydrobios was under severe repairs for almost all of Leg 1 but the waiting was worth it, because it is working well now with a new direct power supply from the electromecanical winch. Three stations at the end of Leg 1 were sampled for zooplankton vertical stratification with the Hydrobios.

Oblique tow sampling during Leg 1 was specifically aimed towards catching larval fish. Problems that were encountered with the Bioness in CASES were resolved over the last year by mechanical and computer fine-tuning in Quebec City. However, the efficient and reliable Tucker trawl, as well as the RMT, remained generally more efficient than the Bioness at catching fish larvae. Preliminary results of fish larvae caught by the Bioness indicate that they were present only in the upper 20 m of the water column. The Mega-Trawl was deployed only once and no adult fish were caught. A last try was made to catch fish en route to Kugluktuk with a modified RMT, but only some juveniles were caught (preserved for Gagné and Simard).

Table 17.1. List of stations for zooplankton and fish sampling during Leg 1 and the type of tows and casts used for sampling.

Date	Station	Vertical tows		Oblique tows				Rosette sampling
		4X4	Hydrobios	Tucker	Bioness	RMT	Mega-Trawl	
14-Aug-2005	Pond Inlet	X		X				
16-Aug-2005	BA-01	X		X		X		
17-Aug-2005	BA-02	X		X		X		
18-Aug-2005	BA-03	X		X		X		
19-Aug-2005	9-Lovejoy	X		X				
19-Aug-2005	2-Lovejoy	X						
20-Aug-2005	6-Lovejoy			X				
20-Aug-2005	24-Lovejoy				X			
21-Aug-2005	21-Lovejoy	X		X				
21-Aug-2005	BA-04	X		X	X	X		
22-Aug-2005	3	X		X				
23-Aug-2005	Between 3&4						X	
24-Aug-2005	4	X		X	X	X		X
27-Aug-2005	6	X		X	X	X		X
29-Aug-2005	7	X		X	X	X		X
2-Sep-2005	204	X		X				
2-Sep-2005	CA-05(05)	X		X	X	X		X
5-Sep-2005	W (Toward 10)	X		X				
6-Sep-2005	CA-04(05)	X		X	X	X		X
9-Sep-2005	CA-08(05)	X		X	X	X		X
11-Sep-2005	11	X	X	X	X	X		X
12-Sep-2005	CA-18(05)	X	X	X	X	X		X
13-Sep-2005	12	X	X	X	X	X		X

Leg 2 – 15 September to 26 October 2005 – Hudson Bay

Zooplankton samples were collected with the 4X4 Tucker net (4x1-m^2: 2 with 200 µm mesh and 2 with 500 µm mesh). The single warp mesopelagic trawl was set on three occasions during Leg 2 with limited success. On 29 September at Station 19e off Inukjuaq, the trawl hit the bottom in 100 m of water following a very difficult deployment and a moderate left turn by the vessel. It recovered surprisingly well afterwards and was perfectly open when brought back on board 15 minutes later. There was no catch and two fairly minor holes resulting from the incident were quickly repaired. The second set was at Station 21e on 2 October at the entrance of James Bay in 100 m of water. Deployment was again difficult but after over an hour of adjustments to the procedure, the trawl was properly set and behaved as expected during a 70-minute tow. Mouth opening was stable at around 6 m and trawl depth could be easily adjusted by modifying the length of warp paid out. The catch was small and consisted mostly of the amphipod *Themisto libellula* and chaetognaths. Even though there was no trace of fish on the screen of the EK60, the trawl was set once more in the vicinity of Station 25 near Churchill in 50 m of water. The whole operation proceeded rather smoothly. The catch at the end of the 60-minute set consisted mostly of gelatinous zooplankton of various sizes with a few juvenile fish, amphipods and chaetognaths, but no cod or capelin.

Chaetognaths were collected with the 4X4 Tucker net (4x1-m^2: 2 with 200 µm mesh and 2 with 500 µm mesh). The organisms caught by the 200 µm mesh were preserved in 5% buffered formaldehyde and used for gut contents analysis to estimate feeding rate and isotope ratio (C:N). Live chaetognaths collected by the 500 µm mesh were carefully transferred to 2-L polycarbonate bottles filled with GF/F filtered seawater and incubated in the dark at 0ºC in to determine their digestion time. After a 24-h acclimation period, small copepods were added to the bottles as prey. No feeding behaviour was observed. Three chaetognaths with prey in their foregut, suggesting they ingested prey during the net tow sampling, were also incubated, but all specimens regurgitated within a few hours.

Table 17.2. List of stations for zooplankton and fish sampling during Leg 2 and the type of tows and casts used for sampling.

Date	Station	Vertical tows					Oblique tows			Rosette
		Monster	Hydrobios	Ring Net	Double	Zodiac simple	Bioness	RMT	Mega-Trawl	
2005-09-19	Bilot							X		
2005-09-22	13C				X					
2005-09-22	13D	X			X					
2005-09-23	14E	X			X					
2005-09-25	15E	X			X			X		
2005-09-26	16E	X			X			X		
2005-09-27	17C	X			X			X		
2005-09-28	18	X	X		X		X	X		
2005-09-29	19E	X			X				X	X
2005-09-30	AN03-05	X	X		X		X	X		X
2005-10-02	21E	X	X		X		X		X	X
2005-10-04	BI-1				X					X
2005-10-05	BI-2	X			X					X
2005-10-06	22	X	X		X		X			X
2005-10-07	12-20	X			X					
2005-10-09	Nelson River 1	X			X					
2005-10-09	Nelson River 2				X					
2005-10-09	N11					X				
2005-10-09	N10					X				
2005-10-09	N8			X		X				
2005-10-09	N7			X		X				
2005-10-09	N8.2			X						
2005-10-09	N9			X						
2005-10-10	N10			X						
2005-10-11	N11			X						
2005-10-12	N12.2					X				
2005-10-10	Nelson River				X					
2005-10-10	24	X			X					
2005-10-10	D6			X		X				

Date	Station	Vertical tows					Oblique tows			Rosette
		Monster	Hydrobios	Ring Net	Double	Zodiac simple	Bioness	RMT	Mega-Trawl	
2005-10-10	D5			X		X				
2005-10-10	D4.5					X				
2005-10-10	D3			X		X				
2005-10-10	D2					X				
2005-10-11	23	X			X					
2005-10-12	AN-02-05	X	X		X		X			X
2005-10-12	AN-01-05	X			X		X			
2005-10-13	ES1					X				
2005-10-13	L4					X				
2005-10-13	T1					X				
2005-10-13	Port Churchill					X				
2005-10-13	Front					X				
2005-10-13	Buoy					X				
2005-10-13	25								X	
2005-10-14	ES1					X				
2005-10-14	Button Bay					X				
2005-10-15	26	X			X					
2005-10-16	27	X	X		X		X	X		X

17.2.3 Hydroacoustic monitoring

The echosounder of the ship was used to record continuous acoustic data during both legs. The echosounder is a multifrequency SIMRAD EK60 (38 kHz, 120 kHz and 200 kHz). The software was the ER60 2.1.1. The recording of the data started on 7 August. The first few days of operations were dedicated to testing and establishing the optimal settings. The update of the TrList.ini file was done using the results of the calibration done on 3/12/2004.

RAW and HAC files were recorded at the same time with a maximum file size of 100 Mo. A hand written log book was also kept every day. A layer between the surface and the first 100 m of the water column was observable almost all the time.

During Leg 2, tows of trawl nets have been tried twice but no adults have been caught. To achieve complete monitoring of fish presence, a repeater of the EK60 computer screen was installed on the bridge of the Amundsen for the constant surveillance of the personnel on watch.

17.2.4 Moored long-term sediment traps recovery and deployment

Long-term sediment traps were deployed on ArcticNet mooring lines to monitor upper ocean biological processes and productivity as well as deep export of particulate matter, many of them deployed or re-deployed on the previous sites of the CASES and NOW studies. Biogenic elements (POC, PON, BioSi, carbonates), planktonic microorganisms (swimmers, algae cells) and derivate materials (faecal pellets) are major targets that will be analysed. However, the study areas of Baffin Bay, Beaufort Sea and Hudson Bay are complex hydrographic environments with variable transport processes. Thus, considerable biological and lithogenic particles would come from the surrounding shelves and shallow areas as well as terrigenous matter from river plumes, particularly in Beaufort Sea and Hudson Bay. That's why chemical markers and radionuclide of sinking particles (^{13}C, ^{15}C, ^{210}Pb) will also be analysed to verify the exact origin of the trapped particles. Electronic microscopy will also be performed on chosen subsamples to better characterize the composition of particulate matter.

Figure 17.2. Sediment traps deployments during Leg 1.

Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

Several long-term sediments traps have been mounted along 8 mooring lines as part of the CASES program in 2003/2004 in the Beaufort Sea. Six of them were retrieved during this Leg, while 4 were re-deployed in the Beaufort Sea and 4 new ones deployed in the Baffin Bay. Several problems were encountered with moorings operations this year. First, two mooring lines in the Beaufort Sea (CA05 & CA14) were not recovered due to the failure to localize the line (see report in Section 5.2.1). Secondly, all Technicap Traps (except for one at CA15 programmed with a DOS software) turned only for the first two cups, a problem also encountered in previous years. This problem will be fixed by the replacement of all motherboards on future deployments.

Leg 2 – 15 September to 26 October 2005 – Hudson Bay

Four mooring lines, among which one belongs to Hydro-Manitoba, were deployed in Hudson Bay during Leg 2. Two of the three ArcticNet mooring lines were equipped with a

Technicap PP3 long-term sediment traps. The traps allow to monitor the upper ocean biological processes & productivity as well as the deep export of particulate matter. Biogenic elements (POC, PON, BioSi, carbonates), planktonic organisms and faecal pellets are major targets that will be analysed. As well, chemical markers and radionuclide of sinking particles (^{13}C, ^{15}C, ^{210}Pb) will be analysed to assess the exact origin of particles. Electronic microscopy will also be used on selected subsamples to better characterize the composition of particulate matter.

On the first deployment, the planned location was too shallow by at least 50 m and the decision was made to find another spot with the appropriate depth that would be the closest as possible to the proposed one.

Table 17.3. Results of the sediment traps deployed on oceanographic moorings during Leg 1.

	Mooring	Date / Time (Local)	Coordinates		Sediment trap		Samples	
			Latitude	Longitude	Model	Depth	Supposed	Obtained
Recovered	CA-04	9/4/05 9:04	71 05.105	133 43.049	Technicap PP3	107	12	2
					Nichiyu 26	210	26	9
	CA-07	9/4/05 11:32	71 10.404	134 01.357	Technicap PP3	107	12	2
					Nichiyu 26	212	26	26
	CA-13	9/3/05 22:31	71 21.236	131 21.512	Technicap PP3	105	12	2
					Nichiyu 12	200	12	12
	CA-15	9/3/05 4:44	71 32.254	127 01.174	Technicap PP3	107	12	12
					Nichiyu 26	212	26	26
	CA-18	9/1/05 8:03	70 39.998	122 57.577	Nichiyu 26	107	26	26
					Nichiyu 26	212	26	26
					Technicap PP5	413	24	6
	CA-20	9/1/05 14:10	70 20.391	126 21.309	Technicap PP3	105	12	2
					Nichiyu 26	210	26	26
Total	6	-	-	-	13		252	177
Not recovered	CA-14	Only try	N/A	N/A	Technicap PP3	105	12	-
					Nichiyu 12	210	12	-
	CA-05	Only try	71 25.148	127 23.777	Nichiyu 26	107	26	-
					Nichiyu 26	212	26	-
Total	2	-	-	-	4	-	76	-
Deployment	BA-01	8/17/05 0:30	76 19.611	71 11.797	Technicap PP3	200	12	-
					Technicap PP5	520	24	-
	BA-02	8/17/05 18:59	76 04.58	74 34.709	Technicap PP3	200	12	-
	BA-03	8/18/05 18:45	76 23.061	77 24.138	Technicap PP3	200	12	-
	BA-04	8/21/05 18:53	75 15.182	74 58.457	Technicap PP3	200	12	-
	CA-04	9/6/05 14:49	71 04.78	133 37.78	Technicap PP3	100	12	-
					Nichiyu 26	110	26	-
					Nichiyu 26	200	26	-
	CA-05	9/8/05 22:47	71 16.858	127 32.168	Nichiyu 26	100	26	-
	CA-08	9/9/05 23:38	71 00.285	126 04.176	Technicap PP3	100	12	-
					Nichiyu 26	200	26	-
					Nichiyu 26	370	26	-
	CA-18	9/12/05 16:39	70 39.981	122 59.197	Nichiyu 26	100	26	-
					Nichiyu 26	200	26	-
					Technicap PP5	395	24	-
Total	8	-	-	-	15	-	302	-

Table 17.4. Sediment traps installed on moorings deployed in Hudson Bay during Leg 2.

Mooring	Date	Time	Coordinates		Sediment trap	
		(Local)	Latitude N	Longitude W	Model	Depth

AN03-05	2005-09-30	18:40	55°24.456	077°55.743	Technicap PP3	101.7
AN-01-05	2005-10-12	22:15	60°00.000	091°57.060	Technicap PP3	82.7

17.3 Preliminary results

17.3.1 Zooplankton

A quick inspection of the samples supported previous observations that clear differences existed between late summer zooplankton assemblages of western Hudson Bay and Hudson Strait (Harvey et al. 2001). The latter region showed high abundance of large herbivorous copepods of the genus *Calanus* compared to the Hudson Bay assemblages which seemed to be dominated by small copepods and chaetognaths. The predators *Themisto libellula* and gelatinous zooplankton were also very abundant in the Bay.

17.3.2 Capelin and Rainbow smelt (Leg 2)

Samples collected during this leg revealed that capelin also spawned in early fall in southern Hudson Bay, a very unusual phenomenon for that species. Furthermore, capelin larvae caught at stations N8 and N7 belonged to two widely different modal length groups, ~10 mm and 40 mm, indicating that capelin spawned both in spring/early summer and in late summer/early fall in this area. This has never been documented for this species before and raises interesting questions on the reproductive strategy of this Arctic cod competitor.

A series of estuarine samplings were initiated from the Zodiac along transects to the edge of the saltwater wedge at the Winisk River, followed by the Nelson, Hayes and Churchill rivers. The samples hence collected provided information on estuarine fish communities otherwise impossible to obtain from the *Amundsen* in such shallow areas. This allowed for instance to confirm that rainbow smelt (*Osmerus mordax*), a forage species illegally introduced in the watershed of the Nelson River, was now successfully reproducing in southern Hudson Bay.

17.3.3 Arctic cod

Table 17.5. Regional summary of larval and juvenile *Boreogadus saida* catches for Legs 1 and 2.

Region	Number of stations	Number of larval BOSA
Baffin Bay	9	462
Northwest Passage	4	46
Beaufort Sea	8	54
Lancaster Sound	1	156
Hudson Strait	3	9
Hudson Bay	7	38

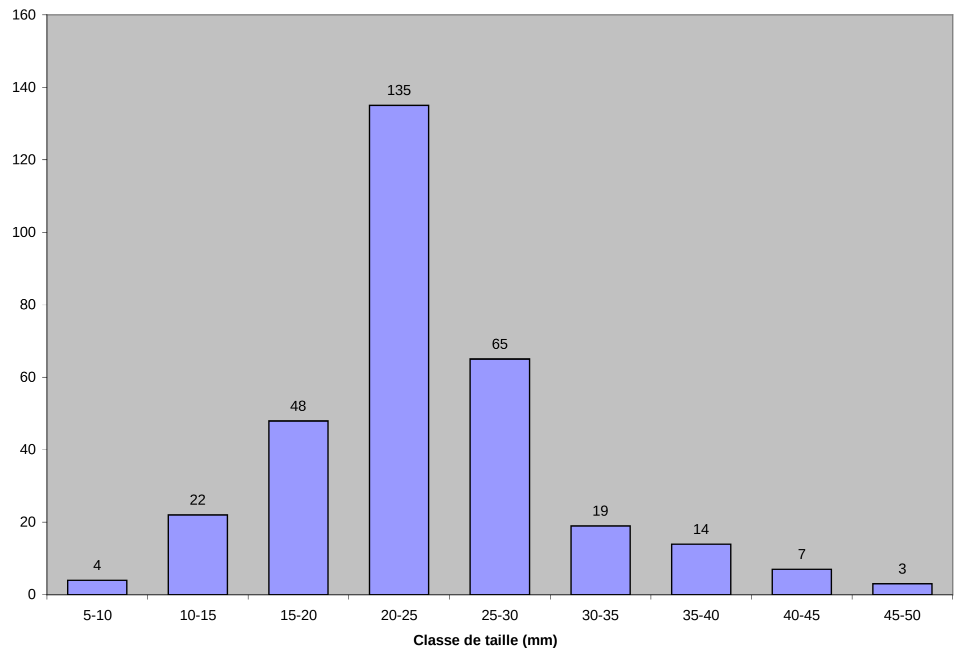

Figure 17.3. Length frequencies of larval and juvenile *Boregadus saida* caught during Leg 1 (Fresh subsampling n=317).

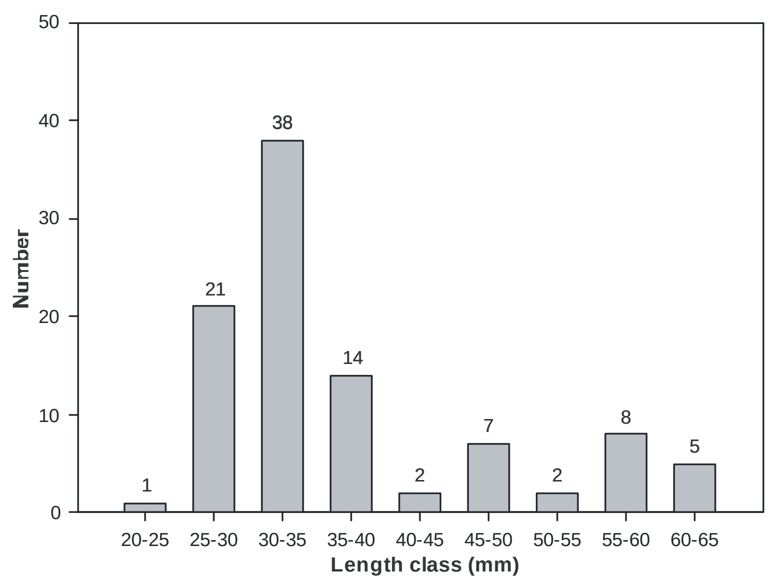

Figure 17.4. Length frequencies of larval and juvenile *Boregadus said*a caught during Leg 2 (n=98).

17.3.4 Hydroacoustic monitoring

The echoes, as a general rule, were quite weak (-90 dB to –65 dB) and according to the nets catches, corresponded in this upper layer to zooplankton such as copepods, amphipods, jelly fish and fish larvae (maximum length of *Boreogadus saida* caught with the nets was 6 cm). When the ship was on station, it was possible to see organisms moving through the beam, ascending or descending. This may help discriminating between plankton and adult fish.

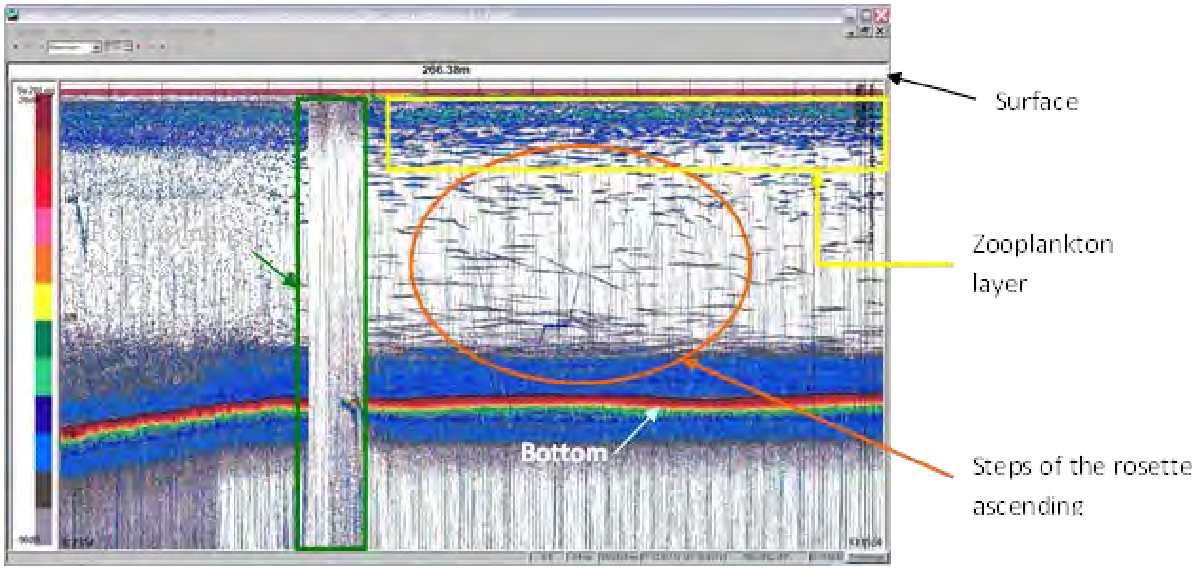

Figure 17.5. Typical features of an echogram of the water column taken with the EK60 echosounder.

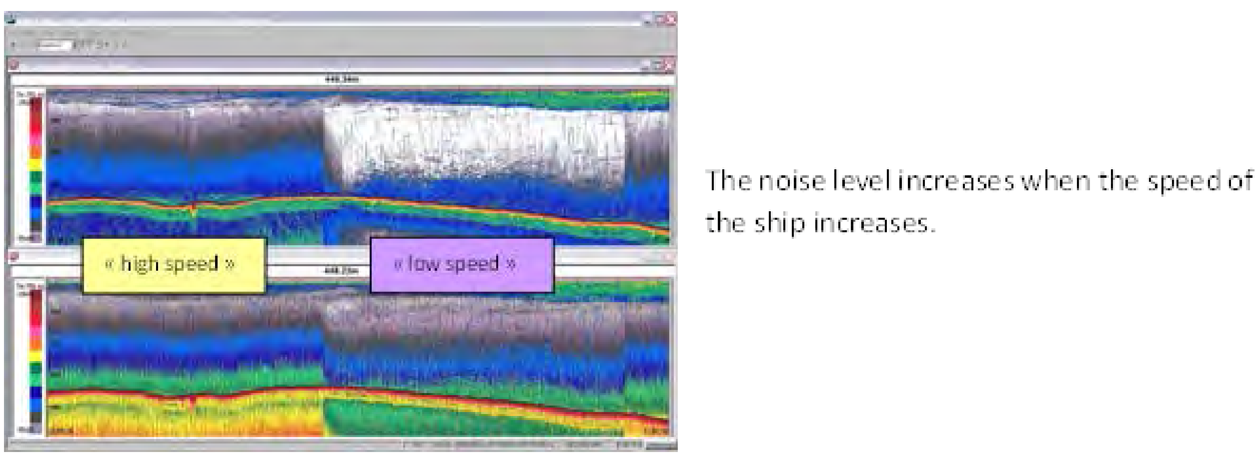

Figure 17.6. Example of an EK-60 echogram with noise generated by the ship's engines.

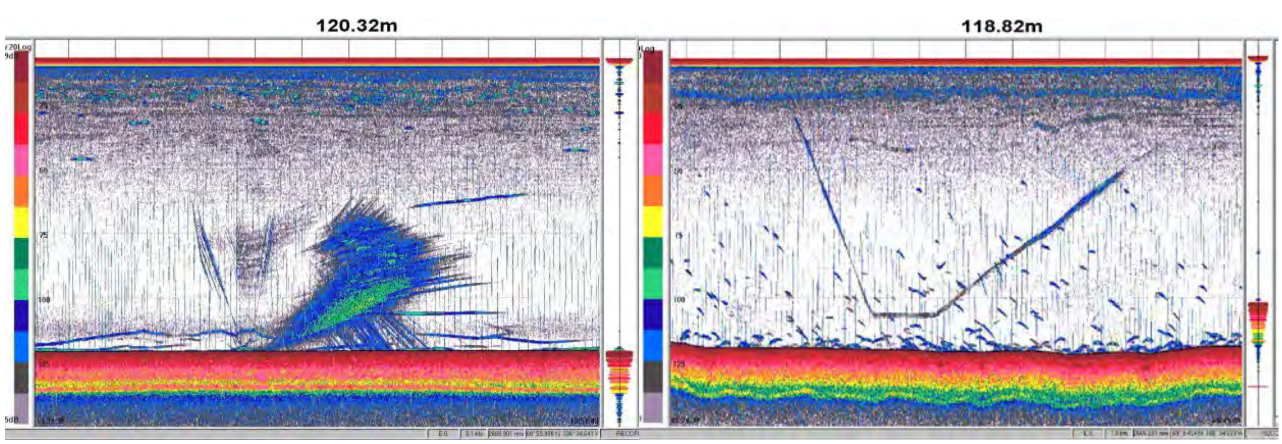

Figure 17.7. Examples of echograms with noise or interferences generated by sampling instruments: ADCP interferences (left) and Bioness (right).

In Leg 2, individual fish targets, possibly from 0-group juveniles (5-6 cm) and adult Arctic cods, were abundant in the vicinity of mooring site AN03-05 near Kuujjuaraapik. Problems with the winches and a very uneven bottom prevented the deployment of either the RMT or the mesopelagic trawl at this location. No other significant concentration of larger fish could be detected during Leg 2.

The EK60 was also used to obtain an image of a mooring line to serve as an example to assist in future mooring retrievals. The moored instruments gave a stronger echo at the 120 KHz frequency.

Reference

Harvey, M., Therriault, J.-C. & Simard, N. 2001. Hydrodynamic Control of Late Summer Species Composition and Abundance of Zooplankton in Hudson Bay and Hudson Strait (Canada). J. Plankton Res., 23(5): 481-496.

18 Contaminants sampling program – Legs 1 and 2

ArcticNet Phase I – Project 1.3 Contaminant Cycling in the Coastal Environment.
ArcticNet/Phase 1/Project 1.3
ArcticNet Phase I – Project 3.4: Carbon & Contaminant Cycling in the Coastal Environment.
ArcticNet/Phase 1/Project 3.4

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Cruise participants Leg 1: Corinne Pomerleau[1], Allyson MacHutchon[1], Debbie Armstrong[3] and Joanne DeLaronde[1]
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18.1 Introduction

18.1.1 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

The overriding question this project hopes to answer is how climate variability in physical forcing and the biogeochemical response to this primary forcing will affect organohalogen and trace metal contaminant cycling. Ultimately, the objective will be to relate changes in delivery and biogeochemical cycling of these contaminants to their levels in fish, marine mammals and the people who consume these tissues as part of their traditional diets. Mercury which cycles globally in the atmosphere, is deposited uniquely in Polar Regions through mercury depletion events (MDEs) and the oxidation of Hg(0) to Hg(II), and these appear highly sensitive to ice and ocean climates variables.

Detailed mass balance and fate studies will be conducted to formulate a mass balance model for mercury in the Beaufort Sea marine system. In conjunction with the work being done to quantify vertical and organic material fluxes, such a model will form an interpretive basis for monitoring components of the system and interpreting proxy records. To conduct these mass balance studies, the following measurements for mercury and organohalogen contaminants in ocean water will be made: water and suspended sediment from the Mackenzie and other smaller rivers, near surface air, snow and ice cores, permafrost, lake and marine sediment cores. Water $\delta^{18}O$ and salinity measurements will also be made to distinguish between freshwater sources (runoff and sea-ice melt) such that the relative roles of import of Hg from the drainage basin versus Hg cycling through ice formation and melting can be evaluated.

C. Pomerleau, a graduate student in the contaminants group, was working on mercury and trace metals contaminants trends in the coastal environment of the High Arctic to assess the level of those contaminants in the trophic level and also to target the pelagic food web biomagnification and bioaccumulation of mercury with stable isotopes and fatty acid. Thus, all biological samples collected will be measured for Hg along with stable isotopes to place organisms into their associated trophic levels.

18.1.2 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

The overall objective of this project was to develop an understanding of contaminant cycling in Hudson Bay and the way this cycling is coupled to the Bay's physical, chemical and biological processes. Ultimately, this knowledge can be used to anticipate the way that climate change will interact with the processes that transport and concentrate contaminants, and to predict effects on contaminant levels in fish, marine mammals and northerners who consume a traditional diet. Hudson Bay represents an excellent model system for studying the impacts of climate change on biogeochemical processes and contaminant cycling because it is virtually a self-contained system (well-constrained terrigenous inputs and marine exchanges), it is expected to undergo relatively massive changes over a very short period of time. It also has a unique coastal region, strongly influenced by freshwater runoff, which has the potential to integrate land-based and marine-based climate effects. This coastal region is very important for organic carbon cycling, energy transfers to higher trophic levels, and presumably also the cycling of contaminants.

Recent studies suggest that Hudson Bay and its drainage basin are the recipients of enhanced loadings of contaminants, especially mercury. Mercury may become an even more important contaminant in the system as the climate warms. This is due to the release of mercury from frozen basin soils upon warming, and through changes in wetland distribution and/or hydro reservoir flooding. Wetlands and flooded areas are sites of enhanced microbial methylation of inorganic Hg (II) to methyl Hg (MeHg), which is a toxic form of mercury that accumulates in food webs.

A wide variety of matrices was sampled, including air, water, suspended particulate matter, sediments, and biota. The sampling addressed four specific themes:

- Water column mercury (Hg) levels and geochemical cycling
- Water column distribution and air-sea exchange of organic contaminants (HCH, toxaphene, etc.)
- Contaminants in the food web
- Sources, distribution and fate of organic carbon and the coupled behaviour of organic contaminants

18.2 Methodology

Due to space, material and safety constraints, no analyses could be performed while on the ship. All samples were preserved or frozen and will be sent to various laboratories for analysis.

Stations were sampled using the CTD-Rosette system, whereas river and estuary sites were sampled using a Kemmerer water sampler or Teflon-lined Niskin bottle. Salinity samples were collected in glass bottles and analyzed aboard the *Amundsen* using a Guildline Autosal salinometer, accepting a sample precision of <0.002 PSU. Samples were standardised daily against IAPSO Standard Sea Water. Samples for δ^{18}O were collected into glass scintillation vials, and sealed around the lid with Parafilm to minimize evaporation. These samples will be brought back to Winnipeg for later analysis. Nutrient samples were collected in 15 ml plastic centrifuge tubes and were analyzed aboard the *Amundsen* by J. Martin (J.-É. Tremblay's team). Samples for trace elements were collected in 15 ml centrifuge tubes pre-spiked with 2.5-ml ultrapure HNO_3. These samples will be analyzed in Winnipeg. Water samples for DOC analysis were filtered through baked (450°C, 24 h) GF/F using an acid-washed syringe filter holder. The sample was collected into sterile vials containing acid for measurement in Winnipeg.

In Hudson Bay (Leg 2), additional information was collected in collaboration with other teams to help characterize the water masses of Hudson Bay and the various river inputs. This involved the collection of water samples for the analysis of salinity and δ^{18}O from sampling stations throughout the Bay and from 9 rivers that were visited by helicopter or Zodiac. Samples to assess dissolved organic carbon (DOC), trace elements, nutrients, and particulate material were collected from the rivers and some of the marine locations to characterize these sites in more detail.

18.2.1 Total mercury (THg) and Methyl Mercury (MeHg)

In Leg 1, water was collected from the Rosette at every Full and Basic station for a total of 91 samples collected for each of the following: THg, MeHg, salinity and $\eth^{8}$O.

In Leg 2, water samples to evaluate total mercury (THg) and methyl mercury (MeHg) in both particulate and dissolved phases were collected at various depths from every station throughout the Bay (see Physics Report for details) using the Rosette. Depths were chosen based on knowledge of the water mass distributions in the station area, as well as the CTD profiles (when available) from previous casts at the sample site. Samples were also collected from all the rivers that were visited and from many of the estuary sites. River and estuary samples were collected using a clean Teflon-lined Niskin.

All THg samples were collected in 25 ml falcon tubes pre-spiked with 2.5-mL ultrapure HCl. All MeHg samples were collected in 250 ml HDPE bottles pre-spiked with 5 ml ultrapure HCl. The "clean hands, dirty hands" technique was used for all Hg sample collection. In addition to 'whole-water' samples for THg and MeHg, filtered samples were collected by filling an acid-washed 2-L Teflon bottle from the Rosette and taking this back to the aft labs. Filtration was done with acid-washed Nuclepore filters and a peristaltic pump setup. Filtered THg, MeHg, and trace element samples were collected into the same type of sample containers described for the unfiltered samples.

18.2.2 Water column distribution and air-sea exchange of organic contaminants

Samples of air and large volumes of water (~40 L) were collected throughout the cruise to obtain data on the distribution of organic contaminants and evaluate the potential for air-sea exchange. The Rosette was used for high volume water collection. Large volumes of water (~40 L/sample) were collected from the Rosette at Full and Basic stations. On average, water was collected from five depths per station and transferred into stainless steel canisters. Water was pumped through baked GF/F (450°C, 24 hr) filters followed by a XAD-2 extraction column. Columns were kept cool but not frozen. Some XAD-2 resin was transferred from the columns to jars and Parafilm was used to seal the jars and minimize leakage or evaporation.

In Leg 1, a total of 77 water samples was collected and filtered. Air sampling was conducted using a high volume air sampler placed on the mast at the bow of the ship. The set up involved a pump that drew air through a baked (450°C, 24 hr) GF/F and then through polyurethane foam (PUF) for the analysis of organic contaminants. Air samples were collected for about 48 hours per sample.

In Leg 2, a total of 8 air samples were collected since this leg was characterized by many storms and high winds with sea spray, which impeded air sampling. Most of the filters were ripped and soaked with sea spray from storms, and the PUFs used to collect the organic contaminants were inadvertently soaked as well. It is uncertain how these conditions will impact the samples.

18.2.3 Contaminants in the food web

Biological samples were collected at all stations as well as along the cruise transects. Various nets were deployed at each station in order to collect different types of fish juveniles and zooplankton families. The most successful net for a live tow was the vertical quadrupole cod end "Monster Net", with 1 m^2 diameter openings and 200 µm or 500 µm pore size nets. This type of net vertically sampled the entire water column at a given station so a representative live tow sample was collected. Another net used was the double cod end oblique tow, which usually trawled at a speed of 2 knots for 10 minutes at a particular depth based on station depth and activity on the fish sonar. The oblique net had a 1 m^2 diameter opening and 500 µm pore size. The advantage of the oblique tow was that a particular region (for ex. 90 m) of the water column could be towed for a short period of time. This allowed for larger amounts of biomass to be collected, thus advantageous for contaminants analysis. The third type of net used was the Rectangular Midwater Trawl (RMT) which trawled (2 kn) between 40-70 m at stations where there was an indication of fish on the sonar. The RMT had a 9 m^2 diameter opening and a mesh size of 1600 µm. The RMT was unsuccessful in catching large fish, however samples of cod juveniles as well as other larger zooplankton families (e.g., Paraeuchaeta, themisto, euphasids) and fish larvae were abundant at stations that deployed this net. The largest pelagic trawl net was deployed in areas that showed biological activity on the Sonar, but unfortunately this net was not successful in catching adult fish.

The various species of macro and mesozooplankton, including *Themisto libellula*, *Themisto abyssorum, Calanus hyperboreus, Paraeuchaeta norvegica, Chaetognaths,* as well as *Mysidacea, Euphausiacea*, decapod and fish larvae, were sorted into families and placed into 30 ml plastic vials and Whirlpak bags. All biological samples were kept frozen at -20°C until further analysis for THg, MeHg and potentially OCs at DFO. Representative sub samples of individual zooplankton families were placed in 4 ml glass vials for stable isotope ^{15}N and ^{13}C analysis. The samples will be analyzed for THg, MeHg, stable isotopes (C and N) and fatty acids.

In Leg 1, a total of 53 tows was collected and sorted. In Leg 2, *Themisto* was the most populous zooplankton family collected. *Themisto* caught in the oblique tow were small enough to be staged by measurement underneath a microscope as a juvenile 1 or 2 at some stations. *Themisto* less than 10 mm were classified as juvenile 1 and those greater than 10 mm but less than 15 mm were classified as juvenile 2. Themisto greater than 15 mm in length were classified as adult. Table 18.1 displays the zooplankton and fish families collected at each station along Leg 2 cruise transect.

Table 18.1. Leg 2 zooplankton collections for contaminants analyses.

Station	Date in 2005	Latitude N	Longitude W	Depth (m)	zooplankton families	fish families
Pond Inlet	Sept 19	73° 45.61	81° 09.16	952	gastropods, cnidarian, clione, themisto, hyperoche, amphipods	arctic cod juvenilles, juvenile fish species, gatorfish
13 C	Sept 22	61° 00.78	64° 44.11	510	gastropods, themisto, copepods	
13 D	Sept 22	60° 51.03	64° 42.66	439	copepods, themisto, calanus, euphasids, paraeuchaeta, chaetognatha	uk fish spp
14 E	Sept 23	62° 16.35	71° 55.32	324	calanus, themisto, clione, copepods: metritia, calanus, gastropods, euphasids, chaetognatha, paraeuchaeta, cnidarians	lumpfish (Liparris), gatorfish, stichidae
15 E	Sept 25	64° 01.88	79° 12.79	260	cnidarians, euphasids, calanus, themisto: J1 & J2, hyperoche, copepods, paraeuchaeta, chaetognatha, clione, gastropods	uk small fish
16 E	Sept 26	62° 38.81	80° 46.20	210	cnidarians, euphasids, calanus, themisto: J1 & J2, clione, gastropods, chaetognatha, paraeuchaeta	lumpfish (Liparris), stichidae, gatorfish, arctic cod juvenilles
17 C	Sept 27	62°.08.32	78° 43.55	158	themisto, euphasids, calanus, paraeuchaeta, clione, gastropods, chaetognatha, cnidarians	lumpfish (Liparris), sculpin, uk fish
18	Sept 28	60° 07.70	79° 09.07	142	euphasids, paraeuchaeta, calanus, chaetognatha, themisto: J1 & J2, clione, gastropods	lumpfish (Liparris), uk fish

Station	Date in 2005	Latitude N	Longitude W	Depth (m)	zooplankton families	fish families
19 E	Sept 29	58° 25.00	78° 20.00	105	large cnidarian, themisto, clione, euphasids, small cnidarian	1 sculpin
AN03-05	Sept 30	55° 17.07	77° 53.45	85	large cnidarian, themisto, clione, euphasids, chaetognatha, hyperoche, Euphasids (krill)	lumpfish (Liparris), sculpin, uk fish spp. 1, uk fish spp. 2
21E	Oct 02	54° 42.27	80° 44.23	97	large cnidarian, themisto, clione, euphasids, calanus, chaetognatha, cnidarians	stichidae, sculpin, arctic cod juvenilles, cyclopterus, stickleback
BI - 1 Belcher Islands	Oct 04	55° 25.95	80° 32.68	105	themisto, clione, chaetognatha, calanus, cnidarians, hyperoche, gastropods	stichidae
BI-2 Belcher Islands	Oct 05	56° 45.83	80° 50.22	182	themisto, euphasids, calanus, paraeuchaeta, hyperoche, clione, chaetognatha, cnidarians	Stichidae, 1 arctic cod
22	Oct 06	58° 22.57	83° 16.74	182	themisto, euphasids, calanus, clione, hyperoche, gastropods, chaetognatha, cnidarians	Stichidae, 2 sculpins
CTD-19	Oct 07	55° 32.08	84° 56.77	34	sm. cnidarians	capelin larvae
24	Oct 09	57° 21.70	91° 58.03	30	sm. Cnidarians	capelin larvae
B9					uk amphipods	rainbow smelt
B10					small euphasids	
MH-1	Oct 10	57° 15.19	91° 56.11	22	cnidarians, hyperoche	capelin larvae, sculpin
24	Oct 10	57° 23.26	91° 46.06	43	clione, cnidarians, hyperoche	capelin larvae
D5	Oct 10					stickleback (D5), capelin larvae (D5)
D6						sculpin (D6)
23	Oct 11	59° 02.13	87° 36.31	196	themisto: J1 & J2, calanus, cnidarians, hyperoche, chaetognatha, clione, gastropods	
AN02-05	Oct 12	58° 45.47	91° 30.03	85	themisto, cnidarians, hyperoche, large cnidarian	sculpin
AN01-05	Oct 12	59° 58.54	91° 57.95	100	themisto: J1 & J2, caetognatha, cnidarians, large cnidarian, hyperoche, euphasids, gastropods	1 capelin larvae, 1 lipparris fish
25	Oct 13	59° 02.56	94° 03.44	59	2 spp. Large cnidarians, themisto, hyperoche	sculpin, stickleback, capelin larvae
26	Oct 15	60° 26.49	89° 21.86	145	themisto: J1 & J2, hyperoche, euphasids, chaetognatha	lumpfish (Liparris), capelin larvae
27	Oct 16	61° 03.5	86° 10.06	244	cnidarians, gastropods, clione, themisto: J1 & J2, hyperoche, calanus, chaetognatha, paraeuchaeta	

18.2.4 Sources, distribution and fate of organic carbon and coupled behaviour of organic contaminants (Leg 2)

A fourth component of Leg 2 was the collection of large-volume (400-1100 L) suspended particulate samples and bottom sediment (box core) samples to study the sources, distribution and fate of organic matter, as well as the behaviour of compounds (e.g., organic contaminants) which are geochemically coupled to organic carbon. Suspended particulate was collected from the surface layer (top 10 m) at 23 marine stations and from 8 rivers (Povungnituk, Inuksuac, Petite Riviere de la Baleine, Grande Riviere de la Baleine, Winisk, Nelson, Hayes, and Churchill). The material was collected on baked (460°C, 4 h)

GF/F (142 or 293 mm) and immediately frozen. Particulate material will be analyzed for carbon, nitrogen, stable isotopes (^{13}C, ^{15}N), carbon biomarkers, and organic contaminants.

Box cores were collected at the sites listed below (Table 18.2). Cores were sectioned immediately and subsampled. Typically, the core was sectioned into 1-cm sections for the top 10 cm, 2-cm sections from 10 to 20 cm, and 5-cm sections below 20 cm depth. After homogenizing the section, subsamples were taken for ^{210}Pb dating and for the analysis of carbon, nitrogen, trace metals, stable isotopes (^{13}C, ^{15}N), carbon biomarkers, and organic and inorganic contaminants. Samples were frozen in chest freezers (-20°C) and will be transported frozen to DFO Freshwater Institute (Winnipeg) for analysis.

Table 18.2. Box cores collected during Leg 2 in Hudson Bay.

Station	Area	Date UTC	Time UTC	Latitude N	Longitude W	Water depth (m)	Core No.	Total length (cm)
Rosette Cast 1	Coronation Gulf	16-Sep-05	13:35	68° 23.51	110° 05.46	248	050201	40
Pond Inlet 2	Inside Bylot Island	19-Sep-05	23:30	72° 37.93	079° 45.22	560	050202	45
Stn 16/17	Foxe Basin	27-Sep-05	7:12	62° 45.44	079° 00.00	395	050203	40
Offshore Stn 18	Off Povingnutuk River	28-Sep-05	16:50	60° 10.98	079° 17.59	153	050204	45
Stn 19	Off Innuksuac River	29-Sep-05	19:22	58° 25.21	078° 21.66	112	050205	35
Stn AN0305	Off Great Whale River	01-Oct-05	23:42	55° 24.15	077° 58.64	119	050206	40
Stn BI1	SW of Belcher Islands	04-Oct-05	23:00	55° 26.13	080° 32.45	106	050207	18
Stn BI2	NW of Belcher Islands	06-Oct-05	3:45	56° 43.22	080° 48.39	150	050208	40
Stn CTD19	Off Winisk River	07-Oct-05	21:45	55° 31.95	084° 56.88	34	050209	25
Stn 23	Offshore, SW Hudson Bay	11-Oct-05	22:15	59° 03.34	087° 33.02	200	050210	40
Stn AN0205	N of Nelson River	12-Oct-05	19:52	58° 43.99	091° 29.37	86	050211	20
Stn AN0105	NE of Churchill River	13-Oct-05	7:30	59° 58.64	091° 57.36	116	050212	25
Stn 26	North-central Hudson Bay	15-Oct-05	4:45	60° 26.23	089° 21.50	145	050213	45
Stn 27	Central Hudson Bay	16-Oct-05	20:40	61° 23.88	086° 13.01	244	050214	45
HS17	Western Hudson Strait	17-Oct-05	3:20	63° 03.01	074° 18.56	430	050215	45

19 Biogeochemical cycling of mercury – Legs 1 and 2

ArcticNet Phase I – Project 3.4: Carbon & Contaminant Cycling in the Coastal Environment.
ArcticNet/Phase 1/Project 3.4

Project leader: Vincent St. Louis[1] (Vince.StLouis@ualberta.ca)
Cruise participant Legs 1 and 2: Jane Kirk[1]
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19.1 Introduction

This project is part of ArcticNet theme 3.4 to study the distribution of mercury (Hg) species in both High Arctic and subarctic waters, including Baffin Bay, the Northwest passage, the Amundsen Gulf, Beaufort Sea visited in Leg 1 and the Hudson Bay system during Leg 2. This research will help to better understand the biogeochemical cycling of mercury (Hg) in polar oceans and therefore the sources of Hg contamination observed in Arctic marine mammals.

19.2 Methodology

Seawater was sampled at different locations (listed in Table 19.1) for analyses of four forms of Hg: dimethyl Hg (DMHg)L, digaseous Hg (DGM; which consists of both Hg(0) and DMHg), methyl Hg (MMHg), and total Hg (THg; containing all forms of Hg in one sample). Seawater samples were collected at different depths (surface, middle, and bottom) to delineate regions of production and/or loss of different Hg species within the water column. Hg isotope incubation experiments were also carried out to test if inorganic Hg(II) was methylated to MMHg, a toxic vertebrate neurotoxin, within the water column. These experiments were conducted at five different sites, twice in the High Arctic, once in the northern part of Hudson Bay, and twice in Hudson Bay with water from two different depths (surface and bottom).

Table 19.1. Location, time, station and samples collected for biogeochemical cycling of mercury.

Site	Date in 2005	Cast #	DGM, DMHg, MMHg, THg	Incubation experiments
Cambridge Bay	16Sept	002	yes	yes
Peel Sound	18Sept	003	yes	yes
Station 13b	22Sept	006	yes	yes
Station 14e	23Sept	014	yes	no
Station 15e	25Sept	023	yes	no
Station 17c	27Sept	045	yes	no
Station 18	28Sept	048	yes	no
Station 19e	29Sept	057	yes	no
AN03-05	30Sept	060	yes	no
Station 21	2Oct	071	yes	no
B1-1	4Oct	076	yes	yes
Station 22	6Oct	081	yes	yes

Site	Date in 2005	Cast #	DGM, DMHg, MMHg, THg	Incubation experiments
Nelson River	10Oct	104	yes	no
Station 23	11Oct	113	yes	no
Station 24	13Oct		yes	no

Seawater samples were collected in three Teflon lined Niskin bottles, which were installed on the Amundsen's Rosette. These Niskin bottles were acid washed and tested for Hg contamination at the University of Alberta Low-Level Hg Analytical Laboratory prior to installation. "Clean hands-dirty hands" standard Hg sampling protocol was used to obtain all samples from the Niskin bottles.

19.2.1 DMHg and DGM samples

Water samples for DMHg and DGM analyses were collected into acid washed 2 L and 1 L glass bottles respectively. DMHg and DGM were obtained from the water samples immediately after sampling using purge and trap techniques. The glass bottles were covered in garbage bags so that the samples would not be affected by light and glass sparge heads were used to purge the sample with ultra-high purity (UHP) nitrogen. Hg purged off the water samples was trapped onto gold traps for DGM determination and onto Carbo® traps for measurements of DMHg.

The gold traps were analyzed for DGM onboard immediately after sparging. DGM was removed from the gold traps by thermal desorption at 360°C and carried to a Tekran model 2500 cold vapor atomic fluorescence spectrophotometer (CVFAS) in a stream of UHP argon. Star Chromatography Workstation software (Varian Inc., Mississauga, ON) was used for integration of peak areas. Hg(0) was determined by subtracting DMHg from the total DGM value.

The Carbo® traps were capped, sealed with Teflon tape, and individually bagged immediately after sparging. They were stored in acid cleaned Mason jars purged with UHP nitrogen and will be sent to H.r Hintelmann at Trent University for analyses by Inductively Coupled Plasma Mass Spectrophotometry (ICPMS).

19.2.2 THg and MMHg samples

Water samples for MMHg and THg analyses were collected into acid washed 250 mL and 125 mL Teflon bottles respectively. THg and MMHg samples were acidified to 0.2% hydrochloric acid and 0.4% sulfuric acid respectively for preservation. All THg and MMHg analyses will be conducted at the University of Alberta Low-Level Mercury Analytical Laboratory using standard protocol and CVAFS.

19.2.3 Isotope incubation experiments

Seawater samples for Hg isotope incubation experiments were collected into 500 mL Boston-round amber glass bottles. At each site, three bottles of surface and bottom seawater were obtained and ^{198}Hg(II) and MM^{199}Hg was added to all six samples. By adding both Hg(II) and MMHg isotopes we will be able to determine if methylation and/or demethylation are occurring in the surface and/or bottom of the water column. One surface and one bottom sample were used as blanks and were therefore acidified to 0.4% sulfuric acid immediately after the isotope addition. One surface and one bottom sample were incubated at 4°C for 12 hours and the last two were incubated for 24 hours. After the incubation period, samples were acidified to 0.4% sulfuric acid to stop any methylation and/or demethylation. These samples were to the lab at U. Alberta and analyzed for THg using a Tekran model 2600 interfaced with an Elan ICPMS and for MMHg by aqueous phase ethylation, separation on a GC, and quantification on an ICPMS.

19.3 Preliminary results

The Tekran worked well for the whole cruise, even in rough sea conditions. Generally, it was a very sensitive instrument but it was well strapped down and stable. Preliminary results appear good and samples collected from middle and bottom depths consistently had much higher concentrations of DGM than those from the surface. Duplicates (water samples taken from the same depth out of the same Niskin but into different glass jugs) also were within ≤10% of each other and blanks were consistently low.

19.4 Recommendations

Better communication to and between scientists when changes are made to the sampling schedule should be set up, for example notes on the whiteboard or announcements. Overall, the expedition was a success.

20 Seal hunt and marine mammal and bird sightings – Leg 2

Cruise participants Leg 2: Manon Simard[1] and Samson Tooktoo[1]
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20.1 Introduction

The objectives of the project were to seal hunt to collect samples for contaminant, diseases and body condition and to observe marine mammals and birds while the ship was steaming.

20.2 Methodology and preliminary results

At this time of year ringed seals stay in the coastal area waiting for the formation of ice. Since most of their activities occur in water, a zodiac, a gun and a harpoon were the equipment needed to accomplish the hunt. Sampling procedures involved weighing the seal and its sculp, taking standard measurements and blubber thickness, sexing, aging, and organ collections for contaminants, stable isotope, DNA analysis and diseases.

20.2.1 Seal hunting

Unfortunately, for the first five days, bad weather prevented all scientific sampling activities planned at night and it was impossible to go out during the day since too many projects needed the zodiac or due to lack of personnel to drive the zodiac. The first opportunity to use the Zodiac resulted in a two-hour outing at Umiujaq on 29 September, where a group of ten harp seals were the only marine mammals seen. The next opportunity was in Kuujjuaraapik on 30 September and 1 October, and Mr. Tooktoo's canoe was used to hunt seals. In the islands north of the town at the mouth of the river, two ringed seals were spotted but it was early evening (18:30) and too dark to hunt. On 1 of October, M. Tawil and G. Ringuet came with the team from 11:00 to 16:00 to film the hunt. We visited the same area as the day before and two seals were seen, but they were not killed.

Mr. Tooktoo did not return to the *Amundsen* 1 October since he didn't believe that sufficient time would be devoted to seal hunt during the remainder of the expedition since already two other groups needed the zodiac and most planned stations were away from the coast. For the few stations closer to shore, the ship remained in 200 m depth, which was still too far to use the Zodiac (20 miles limit). Furthermore, bad weather and rough seas prevented us from seeing marine mammals or many bird species, and the project was abandoned.

On 7 October, one ringed seal was seen at seven nautical miles from the coast, at the mouth of the Winisk River. Two harbour seals were sighted in Nelson River and only one in Hayes River on the 9 October. At Churchill, arrival and departure occurred at night and no seals were observed.

20.2.2 Marine mammal and sea birds sightings

Before 1 October, sighting duration was 50 minutes with a ten-minute rest in between. After 1 October, 3 surveys were done in the morning and 3 in the afternoon. They were conducted in daylight hours when the ship was steaming and not steaming. The data collected were: survey time, GPS location, weather condition, sky, sea, visibility, wind, number of animals and species. Of the 23 days of the expedition, high waves and bad weather prevented observations for 2 days and fog for 1 morning. One day was also spent docked in Churchill so no observations were done.

During the trip from Salluit to Hudson Strait, the following birds were sighted: black legged kittiwakes, glaucous gulls, thick-billed murres, herring gulls, eider ducks, snow geese, and Canada geese, long –tailed ducks, one loon, a peregrine falcon, lapland longspur and a snow bunting followed the ship for most of the trip.

20.3 Comments and recommendations

The trip showed rare wildlife presence and activity in Hudson Bay during fall. Birds were scarce and no marine mammals were seen at more than 14 nautical miles from the coast. Seals were more abundant along the coast, but no aggregations were noticed. Large flocks of Canada and snow geese were seen migrating to the south.

Regarding seal hunting, traditional knowledge shows that ringed seals remain close to the coast and this trip confirmed this. They wait for ice formation in which they build lairs to hide under the ice. Another conclusion is that the numerous scientific activities conducted onboard often conflict with planned hunting activities. Seal hunting is weather dependant, requires ample and flexible zodiac time and should occur close to the coast, especially in the fall. This kind of work is more efficient and cheaper when organized from communities with the local hunters. However, to get more knowledge of population migration patterns during open water periods, the *Amundsen* could be used to conduct transects across the Bay at the beginning of the summer (mid July) or do transects along the coast during summer.

21 Seabird surveys – Leg 2

ArcticNet Phase I – Project 2.1: Changing Food Diversity, Wildlife Patterns and Exploitation. ArcticNet/Phase 1/Project 2.1

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21.1 Introduction

Understanding the effects of climate change on arctic populations of pelagic seabirds requires long term monitoring of their abundance and distribution throughout the year. Seabird surveys are traditionally conducted during the breeding season when most species are easily enumerated in conspicuous colonies, however, information on migratory staging areas or stopover sites are less well studied especially in the far north. ArcticNet's 2005 *Amundsen* Expedition provided the perfect opportunity to survey seabird populations in the High Arctic and Hudson Bay during fall migration, a period when they are rarely studied. The purpose of conducting this survey was to provide valuable baseline information on seabird movements and habitat use during fall migration. More importantly, this information may be combined with other ArcticNet cruise surveys to provide a more comprehensive understanding of seabird population size and distribution throughout the Canadian Arctic.

21.2 Methodology

Pelagic seabird surveys were conducted daily from 17 September until 26 October. Data was collected according to standardized protocols for pelagic seabird surveys from moving and stationary platforms released by the Canadian Wildlife Service (Environment Canada, Atlantic Region 2005). Each survey is composed of an uninterrupted 10-minute observation period during which all seabirds located within a specific transect are documented. The transect extends forward from the moving platform and covers an area 300m wide from the side of the platform. Seabirds floating on the water are recorded continuously throughout the 10-minute observation period while seabirds in flight are recorded instantaneously in short snapshot observations at regular intervals (dependent upon the speed of the platform). Observation period information such as date, time, latitude and longitude at start, visibility, sea state, wind force, platform speed and direction are collected at the beginning of each observation period. Information on each seabird sighted includes species, number of individuals, distance from the platform, association with the platform, whether they are in flight, on water or feeding, behaviour, age, plumage, sex and flight direction. Surveys were only conducted when the platform was moving at a minimum of 4 knots and thus surveys were not conducted while the ship stopped at science stations throughout the trip.

21.3 Preliminary results

21.3.1 The Northwest Passage and Baffin Bay to Hudson Strait

The first decent sightings of seabirds occurred on 16 September in the Victoria Strait just north of King William Island on the way into Larsen Sound. Numerous flocks of Long-tailed Ducks ranging in size from 5 to 100 individuals and several Glaucous Gulls were first documented in this area. Further north in the Franklin Strait and Peel Sound, low numbers of Northern Fulmars, Black Legged Kittiwakes and Ivory Gulls were first documented. Sightings of Dovekies were numerous just north of the Borden Peninsula and south eastwards into the Navy Board Inlet with several groups of 4 or 5 and a few larger groups of 10 and 20 flying either north or east. Dovekie and Northern Fulmar sightings continued to be common along the coast of Baffin Island from Cape Adair and southwards into the Cumberland Sound. Thick-billed Murres were first sighted in the Hudson Strait between Resolution Island and Killiniq in northern Quebec. Larger groups of Dovekies (30 individuals) and Northern Fulmars and Black Legged Kittiwakes (150-400 individuals) were also documented in the Hudson Strait.

21.3.2 Hudson Bay

Surveys were conducted throughout Hudson Bay from 23 September to 16 October. Seabird sightings were greatly decreased throughout this period. There were several days with zero seabird sightings despite consistent coverage. The following species were documented during surveys conducted within the bay; Northern Fulmar, Black-legged Kittiwake, Glaucous Gull, Herring Gull, Dovekie, Thick-billed Murre, Black Guillemot, Pacific Loon, Red-breasted Merganser, Common Eider, Long-tailed Duck, Canada Goose and Snow Goose.

21.3.3 Hudson Strait to the Labrador Sea

Seabird sightings did not increase until we reached the eastern section of Ungava Bay where sightings of Northern Fulmar, Thick-billed Murre and Black Legged Kittiwake increased. The first Great Black-backed Gull was sighted near Killinek.

21.3.4 Conclusions

Seabird sightings were most abundant during the northern portion of the cruise through the Northwest Passage and Baffin Bay. Sightings within Hudson Bay were scarce in comparison. All seabirds were sighted within known wintering and/or migration areas.

22 Seabed mapping – Legs 1 and 2

ArcticNet Phase I – Project 1.6: The Opening NW Passage: Resources, Navigation, Sovereignty & Security. ArcticNet/Phase 1/Project 1.6

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Cruise Participants Leg 1: Jonathan Beaudoin[1] and Ian Church[1]
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22.1 Introduction

22.1.1 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

The Ocean Mapping Group (OMG) was onboard Leg 1 to perform seabed mapping as part of ArcticNet project 1.6. The primary purpose of the mapping on this leg was to collect as much bathymetry and sub-bottom information as possible while transiting through the Northwest Passage and between science stations in Smith Sound, the Beaufort Sea and the Amundsen Gulf (Figure 22.1).

Figure 22.1. Geographic distribution of sound speed profiles during Leg 1.

22.1.2 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

The objective for Leg 2 was to collect bathymetry and sub-bottom data while opportunistically traveling from station to station. During the first week, it was to continue building on previous data collected as part of the requirement for project 1.6. The rest of the leg was to collect bathymetry data as we steamed around Hudson Bay and densify the sounding distribution in the bay, and identify areas of interest for the coring operations in order to optimize data collection.

22.2 Methodology

22.2.1 Equipment

- Kongsberg-Simrad EM300 Multibeam echosounder
- Knudsen K320R Sub-bottom profiler
- Applanix POS/MV 320
- C&C Technologies CNAV GPS
- AML Smart Probe surface sound speed probe
- Surface temperature and salinity probe
- Seabird SBE19 CTD (Leg 1 only)
- Seabird SBE911 CTD, deployed from rosette
- Seabird SBE911 CTD, deployed on Brooke Ocean Technology (BOT) MVP-300 (Leg 1 only)

22.2.2 Onboard logging and processing procedures

Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

Multibeam and sub-bottom profiler collection began shortly after leaving Quebec City. CNAV GPS was logged separately, with this feed of data being augmented by the position, vessel speed, and heading from the POS/MV after 14 August.

Both the multibeam and sub-bottom systems were logged continuously throughout the entire transit, with few interruptions in acquisition during the transit north and through the passage (power outages brought both systems down momentarily during a fire drill off Cambridge Bay and in another power outage later in the cruise). The EM300 system became unstable in the western Beaufort Sea after transiting through multiyear ice to perform a survey of the 2 500 m isobath near the Canadian/American border.

The EM300 data were logged in the Kongsberg-Simrad raw format and converted to the OMG format after line completion (new survey lines were automatically generated every half hour). The soundings were cleaned and inspected in near real-time with the two crew members maintaining a 24-hour watch throughout most of the cruise. Backups of the raw data being were made every few days on DVD (though they were copied to the processing computer on a daily basis). The processed data files were backed up on a separate laptop and an external 160GB USB hard drive.

The K320R data were logged in the Knudsen binary format (.keb). Data were converted to OMG format and then backed up in the manner mentioned earlier.

The CNAV data consisted of NMEA strings and were captured to a text file using HyperTerminal, with a new files being created at approximately midnight (GMT) every day. At the end of each day (GMT), these data were backed up to the processing computer and converted to OMG format. The data were then plotted geographically for visual inspection.

For surface sound speed, the probe data were logged directly into the EM300 raw data files. Sound speed profiles were collected on either the rosette shack PC or the OMG laptop. Raw files (collected in binary format) were converted to text files, copied to the processing PC and finally converted to OMG format, at which time the profiles were visually inspected for spurious data points. High resolution CTD casts were decimated to 1-metre bins using a median filter. Profiles were tagged with time and position in real-time when provided by the rosette shack. The OMG collected profiles were tagged with time and position by hand after the collection since the SeaBird internal clock was not synchronized to UTC. The sound speed profile log below gives the date, time and location of each dip collected for use with the EM300. The BOT MVP-300 data were transferred to the processing computer and backed up to the OMG laptop and external USB disk. Post-processing of the multibeam soundings with respect to sound speed profiles will be done upon return to UNB. If CTD profiles did not extend to full ocean depth, they were extended using the World Ocean Atlas 2001 before being input to the EM300 logging software.

Leg 2 – 15 September to 26 October 2005 – Hudson Bay

Data from both sonar systems were logging continuously while vessel was transiting. All EM300 and K320R data were converted to Ocean Mapping Group format for further processing. Soundings were cleaned and inspected at near real time and gridded into an image for import to our Alderbaron navigation package for viewing in the acquisition room as well as on the bridge.

All sound speed profiles were obtained using the CTD information from the rosette casts. These profiles were converted into OMG format for processing and then into Simrad format which could be imported into the system. New profiles were entered at almost every station to ensure refraction was kept at a minimum and that soundings were accurate during initial data collection. Further processing back at the office will make use of all sound velocity profiles to ensure the best accuracy possible.

GPS data and POS/MV heading data were combined and logged continuously in ASCII format in hyperterminal. A new file was created every day and the put onto the ships network for others to obtain.

All data is backed up to DVD and to external USB hard drive as well as living on two separate computers. This is done to ensure that all data will make it back to the office safely.

22.2.3 Mapping procedures and system performance

Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

Several short surveys were accomplished at the following locations:

- Pond Inlet
- Lancaster Sound (for S. Blasco (GSC), 74°02'N, 77°05'W)
- Station 4
- Station 7
- Station 18
- Station 12

Data quality was quite good in most cases, the exception being the small survey done in Lancaster Sound. In this case, sea state interfered with the bottom tracking of the EM300, reducing the quality of the soundings in the outer portions of the swath. This resulted in a few data holidays in the area to be mapped, however, the holidays did not occur in the areas of interest. CTD profiles were collected at all survey locations and will be applied in post-processing.

Surveys were planned in Aldeberan, with care being taken to overlap the swaths by approximately 50%. Given the differing achievable coverage for port and starboard beams, the survey lines had variable spacing depending on whether the lines were port on port or starboard on starboard. It was found that a line spacing of 2.5x water depth was sufficient for starboard on starboard coverage, whereas a line spacing of 3.3x water depth was used when lines were port on port.

During transit, coverage from previous transits was loaded into Aldeberan. This allowed the helmsman to steer coverage and build upon the previously collected data.

Leg 2 – 15 September to 26 October 2005 – Hudson Bay

The EM300 in general performed as expected. There were two major system crashes related to the hardware (Tranceiver Unit, TRU) which were a result of a different problem than encountered on Leg 1. There seemed to be major communication issues between the SIS (Seafloor Information System) machine and the TRU. The first time it happened, the SIS was shut down and the TRU powered off for an hour or so and the problem was resolved. The second time the same procedure was repeated but it took some more time and extra power off/on sequences to get it running again. The TRU needed to be cleaned as dust was starting to build up around the internal electronics. Additionally, a Simrad engineer should perform a full set of maintenance routines on the unit to ensure its proper operation.

In good weather, the EM300 tracked the sea floor effortlessly and recorded high quality data, however during Leg 2, the system had to perform in high seas and rough weather conditions. It was known that the system was very sensitive to sea state and it was further established that it will not track while the vessel was traveling with the seas (surfing). Several tactics were employed to try and aid the tracking but none suitably worked, including narrowing the effective swath width so the concentration of beams was pointing vertically, limiting the amount of beams trying to track horizontally far from the ship. Another tactic was to keep narrow min/max tracking gates which aid the system by telling where to search for the bottom. Traveling against the seas had mixed results. For the most part, the system would track if employing the above mentioned tactics. The biggest factor while traveling in this direction was speed. The slower the speed, the better it would track.

The Knudsen K320R sub-bottom profiler worked fine for the entire trip as it always does.

The main positioning system (CNAV) performed excellently providing highly accurate positions for the entire cruise with no accuracy drop-outs noted. The main orientation system (POS/MV 320) also performed excellently. The POS had some minor interruptions on leg 1 as well as previous years but none were encountered on Leg 2.

The surface sound speed probe has also performed excellently for the entire leg. This data is being used by the EM300 in real time to control the beam pointing angles. This has been welcomed since in the past there were some problems with it introducing an extra systematic bias that we have to deal with in post-processing. The only issue with this instrument was that there seems to be a 1 – 2 m/s offset between the values derived from the rosette data. This could be simply computational noise but will be independently checked against the other hull mounted probe after the cruise to isolate any unnoticed problems.

22.3 Preliminary results

22.3.1 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

Aside from ~1 day of ice breaking operations during transit through Victoria Strait, bathymetry and sub-bottom data were successfully collected during the entire cruise. The EM300 was malfunctioning from 5 to 11 September, the cause was determined to be faulty soldering on one of the BSP boards, and was repaired in the field by S. Blondeau.

Compared to previous years where the limiting factor in the quality of the bathymetry data was the infrequent sound speed profile collection, there were ample CTD casts from the Rosette (135 at the time of this writing, not counting the 74 casts obtained with the MVP in the Labrador Sea before it was lost).

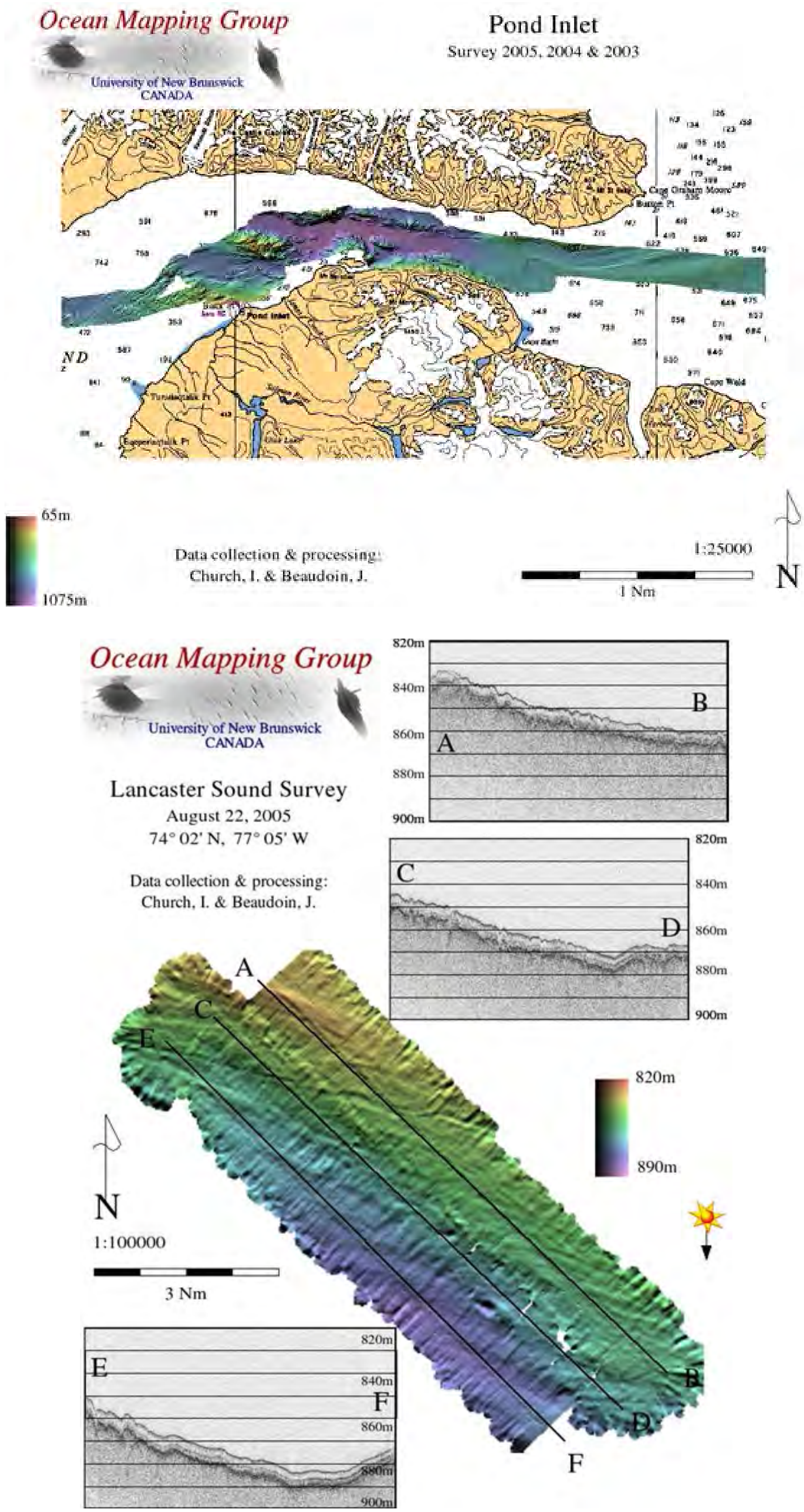

Figure 22.2. Bathymetry of the of the Pond Inlet area (upper panel) and Lancaster Sound area (lower panel) surveyed during Leg 1.

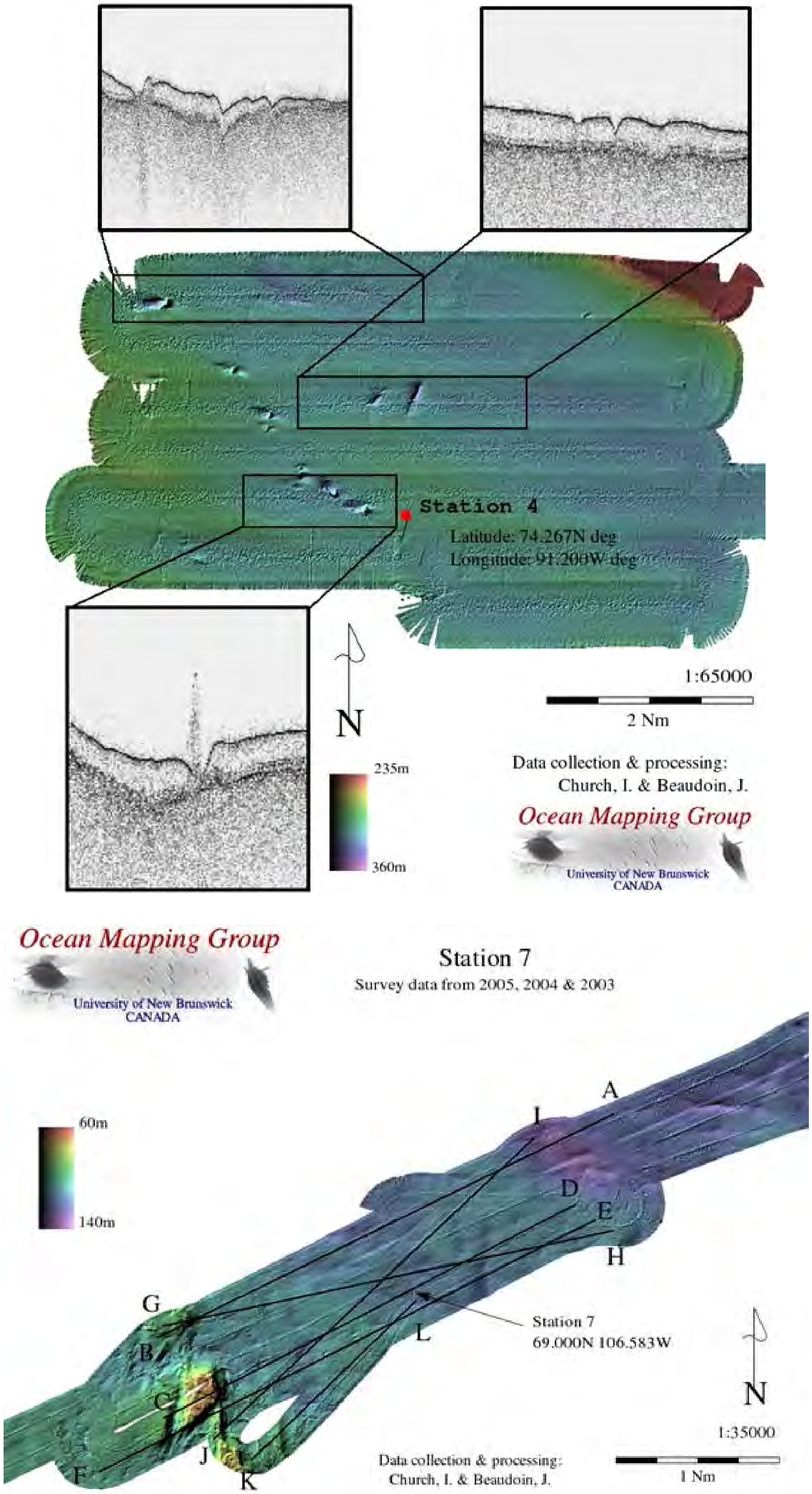

Figure 22.3. Bathymetry of the area at Station 4 (upper panel) and at Station 7 (lower panel) surveyed during Leg 1.

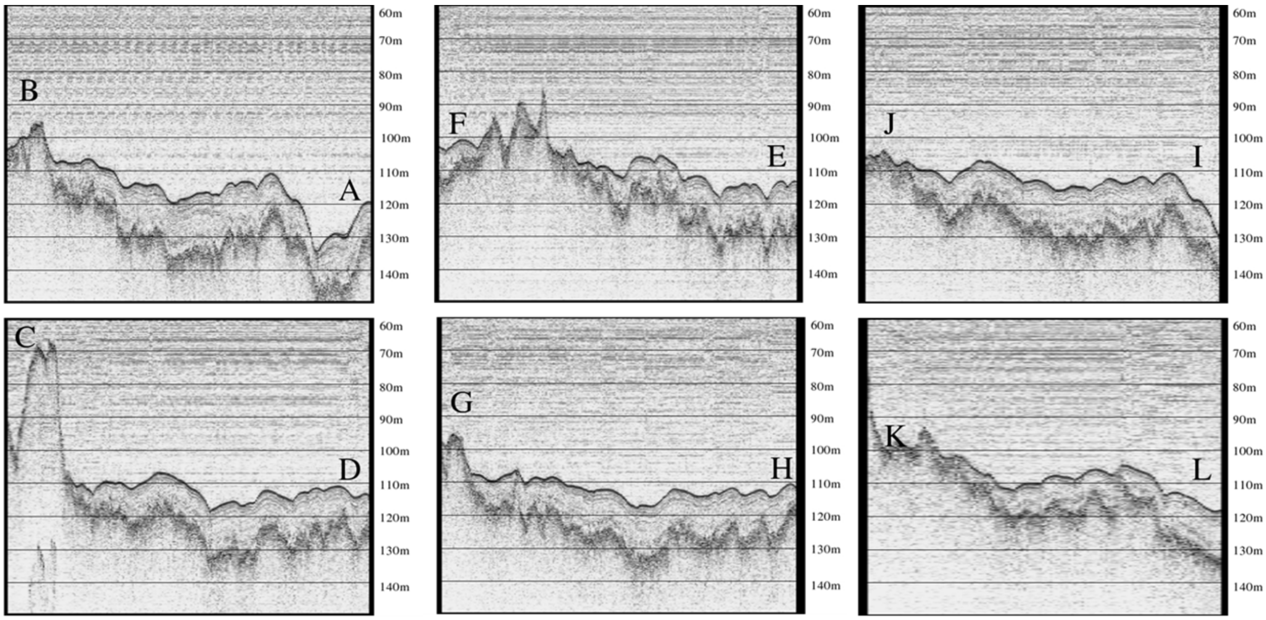

Figure 22.4. Sub-bottom profiling at Station 7. See Fig. 21.3 for location of transects with end-points labeled A to H.

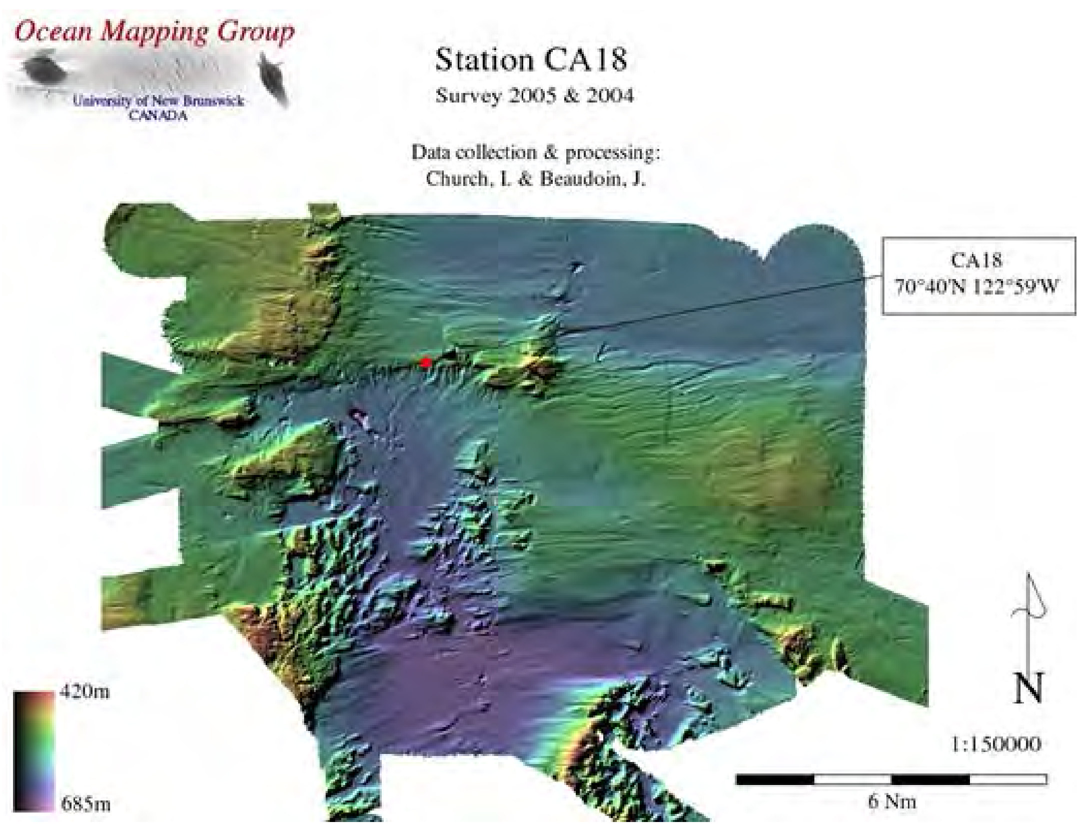

Figure 22.5. Bathymetry of the area at Station CA18 surveyed during Leg 1.

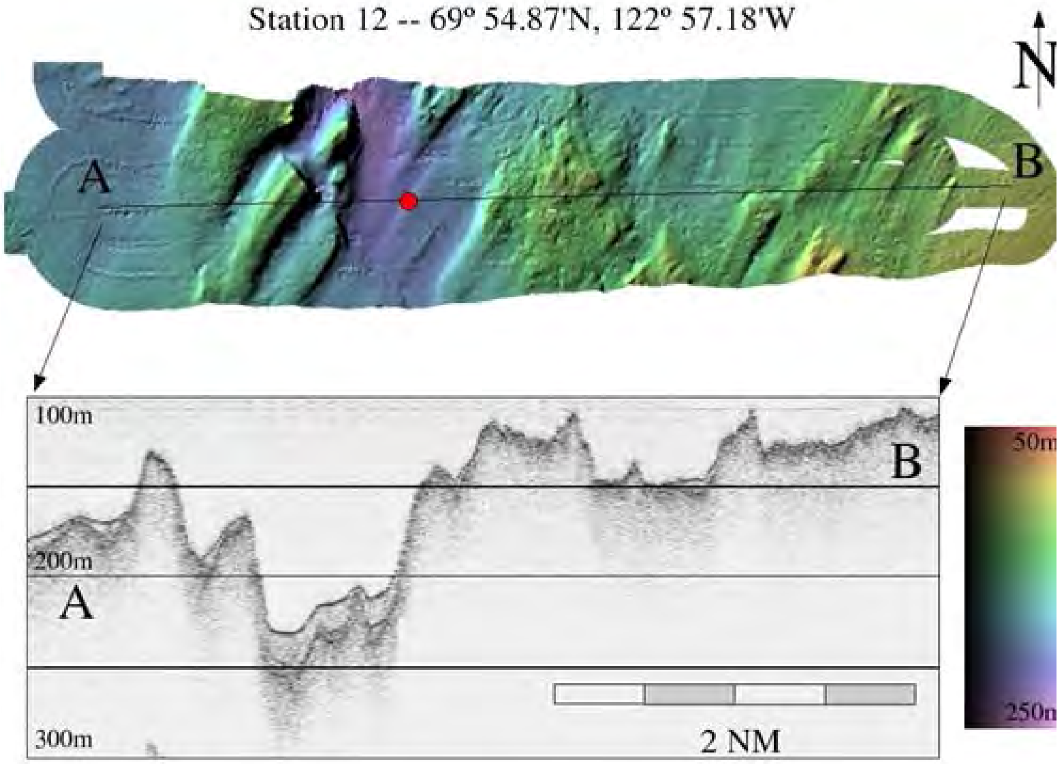

Figure 22.6. Bathymetry and sub-bottom information of the area at Station CA18 surveyed during Leg 1.

Table 22.1. Sound Speed Profile Log for Leg 1

Name	Latitude	Longitude	Profile depth	Year	Month	Day	Time
501001	72° 47.160	-76° 59.400	974	2005	Aug	14	13:59:40
501003	76° 17.970	-71° 24.660	656	2005	Aug	16	7:07:29
501004	76° 18.130	-71° 24.640	662	2005	Aug	16	11:01:43
501005	76° 17.920	-71° 25.800	651	2005	Aug	16	16:36:45
501006	76° 17.640	-71° 26.060	647	2005	Aug	16	18:54:27
501007	76° 17.980	-71° 24.410	652	2005	Aug	17	6:40:17
501008	76° 16.980	-72° 06.120	532	2005	Aug	17	8:32:09
501009	76° 16.970	-72° 47.410	561	2005	Aug	17	9:59:05
501010	76° 16.960	-73° 28.660	530	2005	Aug	17	11:53:12
501011	76° 15.980	-74° 35.220	439	2005	Aug	17	13:56:56
501012	76° 16.010	-74° 34.700	436	2005	Aug	17	17:04:04
501013	76° 15.350	-74° 35.500	433	2005	Aug	17	20:27:36
501014	76° 17.350	-75° 00.580	428	2005	Aug	18	2:58:13
501015	76° 19.420	-75° 47.010	328	2005	Aug	18	4:37:17
501016	76° 21.230	-76° 35.370	134	2005	Aug	18	6:56:08
501017	76° 22.920	-77° 23.290	339	2005	Aug	18	9:05:43
501018	76° 22.930	-77° 23.850	340	2005	Aug	18	11:58:29
501019	76° 23.000	-77° 22.940	342	2005	Aug	18	15:07:08
501020	76° 24.830	-77° 20.920	264	2005	Aug	18	23:38:57
501021	77° 49.950	-75° 20.760	591	2005	Aug	19	9:03:42
501022	78° 04.700	-74° 39.700	651	2005	Aug	19	13:50:14
501023	78° 04.960	-75° 00.210	598	2005	Aug	19	15:25:51
501024	78° 20.320	-74° 39.470	627	2005	Aug	19	18:06:15

Name	Latitude	Longitude	Profile depth	Year	Month	Day	Time
501025	78° 19.680	-74° 21.300	481	2005	Aug	19	19:13:46
501026	78° 18.140	-74° 28.760	510	2005	Aug	19	21:37:43
501027	78° 19.400	-73° 59.750	22	2005	Aug	20	0:56:46
501028	78° 19.150	-74° 00.550	618	2005	Aug	20	1:24:52
501029	78° 05.090	-74° 19.550	692	2005	Aug	20	3:56:48
501030	77° 49.970	-74° 39.700	686	2005	Aug	20	6:22:30
501031	77° 49.970	-74° 39.240	684	2005	Aug	20	7:54:20
501032	77° 49.780	-75° 00.460	652	2005	Aug	20	10:05:37
501033	77° 50.000	-75° 20.700	589	2005	Aug	20	11:08:37
501034	77° 49.830	-75° 40.120	528	2005	Aug	20	12:19:35
501035	77° 49.490	-75° 59.230	556	2005	Aug	20	14:25:18
501036	77° 34.570	-75° 39.590	642	2005	Aug	20	17:10:48
501037	77° 34.940	-75° 54.000	591	2005	Aug	20	18:12:16
501038	77° 35.030	-75° 19.840	624	2005	Aug	20	19:42:20
501039	77° 34.590	-74° 59.190	646	2005	Aug	20	20:53:25
501040	77° 20.100	-75° 01.750	638	2005	Aug	20	22:44:14
501041	77° 20.010	-75° 21.820	533	2005	Aug	21	1:08:41
501042	77° 19.970	-75° 42.940	540	2005	Aug	21	2:38:27
501043	77° 20.080	-76° 01.150	517	2005	Aug	21	3:39:48
501044	77° 19.970	-76° 20.240	442	2005	Aug	21	6:51:57
501045	77° 19.990	-76° 39.920	417	2005	Aug	21	7:48:47
501046	77° 19.910	-77° 00.210	430	2005	Aug	21	8:50:32
501047	76° 10.000	-75° 00.790	378	2005	Aug	21	16:08:01
501048	75° 14.400	-74° 58.690	465	2005	Aug	21	23:38:20
501049	75° 14.420	-74° 59.520	464	2005	Aug	22	4:17:44
501050	75° 14.450	-75° 00.260	461	2005	Aug	22	6:05:47
501051	74° 03.650	-77° 13.220	807	2005	Aug	22	15:20:59
501052	74° 03.020	-79° 55.150	797	2005	Aug	22	23:50:40
501053	74° 03.360	-79° 53.860	779	2005	Aug	23	4:10:16
501054	74° 02.810	-79° 53.580	771	2005	Aug	23	12:40:39
501055	74° 11.790	-83° 20.750	671	2005	Aug	23	18:45:07
501056	74° 18.140	-88° 29.420	328	2005	Aug	24	2:26:23
501057	74° 16.000	-91° 11.750	317	2005	Aug	24	7:45:55
501058	74° 15.750	-91° 11.520	320	2005	Aug	24	12:39:15
501059	74° 16.370	-91° 09.730	320	2005	Aug	24	15:00:44
501060	74° 16.630	-91° 07.590	325	2005	Aug	24	16:26:54
501061	73° 19.020	-96° 20.680	208	2005	Aug	25	22:45:57
501062	72° 19.840	-96° 17.950	436	2005	Aug	26	4:47:54
501063	69° 10.020	-100° 41.970	52	2005	Aug	27	10:19:45
501064	69° 10.450	-100° 41.860	55	2005	Aug	27	12:43:33
501065	69° 11.050	-100° 42.610	61	2005	Aug	27	15:41:19
501066	69° 02.060	-101° 13.900	56	2005	Aug	28	4:31:21
501067	68° 41.170	-103° 59.580	91	2005	Aug	28	10:49:10
501068	68° 59.850	-106° 33.990	105	2005	Aug	30	4:43:28
501069	69° 0.0400	-106° 34.330	98	2005	Aug	30	8:31:55
501070	68° 59.880	-106° 34.820	102	2005	Aug	30	10:40:35
501071	68° 35.540	-109° 28.090	134	2005	Aug	31	5:44:04
501072	68° 25.180	-112° 08.270	186	2005	Aug	31	10:41:52
501073	69° 42.190	-118° 23.630	472	2005	Sep	1	0:13:05
501074	70° 39.970	-122° 58.420	530	2005	Sep	1	10:15:07
501075	70° 20.410	-126° 20.550	239	2005	Sep	1	17:41:16
501076	71° 24.830	-127° 23.470	288	2005	Sep	2	1:43:12

Name	Latitude	Longitude	Profile depth	Year	Month	Day	Time
501077	71° 22.640	-127° 29.680	250	2005	Sep	2	2:45:50
501078	71° 20.560	-127° 32.480	222	2005	Sep	2	3:48:52
501079	71° 18.410	-127° 41.940	162	2005	Sep	2	5:00:09
501080	71° 16.450	-127° 48.480	133	2005	Sep	2	6:07:20
501081	71° 14.940	-127° 54.560	98	2005	Sep	2	7:07:41
501082	71° 12.840	-128° 00.470	69	2005	Sep	2	9:10:33
501083	71° 10.810	-128° 06.200	60	2005	Sep	2	9:51:42
501084	71° 08.830	-128° 12.250	51	2005	Sep	2	10:51:40
501085	71° 08.850	-128° 12.050	52	2005	Sep	2	12:51:40
501086	71° 06.770	-128° 18.360	46	2005	Sep	2	14:26:28
501087	71° 04.890	-128° 24.620	42	2005	Sep	2	15:04:10
501088	71° 02.940	-128° 30.490	30	2005	Sep	2	15:41:18
501089	71° 16.660	-127° 31.450	190	2005	Sep	2	22:36:56
501090	71° 16.790	-127° 30.300	195	2005	Sep	3	1:57:06
501091	71° 17.190	-127° 30.130	199	2005	Sep	3	4:54:10
501092	71° 32.010	-126° 58.350	390	2005	Sep	3	8:53:29
501093	71° 47.740	-127° 59.870	383	2005	Sep	3	15:19:22
501094	71° 21.780	-131° 20.900	336	2005	Sep	4	2:40:37
501095	71° 5.610	-133° 42.530	319	2005	Sep	4	12:21:34
501096	71° 10.440	-133° 59.760	609	2005	Sep	4	19:07:23
501097	71° 35.010	-139° 59.000	959	2005	Sep	5	14:20:37
501098	71° 33.840	-139° 59.490	962	2005	Sep	5	16:59:06
501099	71° 33.650	-140° 06.710	962	2005	Sep	5	20:49:12
501100	71° 05.220	-133° 37.010	322	2005	Sep	6	21:46:48
501101	71° 03.740	-133° 36.060	255	2005	Sep	7	1:40:35
501102	71° 04.940	-133° 34.470	196	2005	Sep	7	4:35:46
501103	71° 10.750	-134° 01.830	619	2005	Sep	7	8:10:40
501104	71° 42.260	-126° 28.950	381	2005	Sep	8	7:58:03
501105	71° 38.310	-126° 40.960	426	2005	Sep	8	10:02:21
501106	71° 34.420	-126° 52.990	407	2005	Sep	8	11:02:17
501107	71° 30.460	-127° 05.140	364	2005	Sep	8	12:02:40
501108	71° 17.120	-127° 32.730	189	2005	Sep	9	5:31:30
501109	71° 00.890	-125° 56.130	388	2005	Sep	9	12:17:50
501110	71° 00.270	-125° 56.050	388	2005	Sep	9	14:05:16
501111	71° 00.230	-125° 55.490	388	2005	Sep	9	15:56:30
501112	71° 00.500	-126° 03.230	381	2005	Sep	10	2:46:06
501113	70° 20.370	-126° 21.470	242	2005	Sep	10	23:43:24
501114	70° 20.480	-126° 21.730	243	2005	Sep	11	2:59:37
501115	70° 20.750	-126° 21.850	243	2005	Sep	11	4:01:01
501116	70° 20.250	-126° 21.700	242	2005	Sep	11	5:00:43
501117	70° 20.530	-126° 21.520	242	2005	Sep	11	5:58:17
501118	70° 20.360	-126° 21.430	243	2005	Sep	11	6:56:07
501119	70° 20.350	-126° 21.450	240	2005	Sep	11	7:56:20
501120	70° 20.360	-126° 21.450	241	2005	Sep	11	8:56:41
501121	70° 20.360	-126° 21.450	241	2005	Sep	11	10:03:05
501122	70° 20.350	-126° 21.450	241	2005	Sep	11	10:59:32
501123	70° 20.360	-126° 21.420	243	2005	Sep	11	11:58:10
501125	70° 20.360	-126° 21.430	242	2005	Sep	11	13:01:46
501126	70° 20.370	-126° 21.390	244	2005	Sep	11	14:17:45
501127	70° 20.340	-126° 21.690	242	2005	Sep	11	16:49:32
501128	70° 20.360	-126° 21.500	240	2005	Sep	11	22:19:56
501129	70° 39.980	-122° 59.370	529	2005	Sep	12	15:49:10

Name	Latitude	Longitude	Profile depth	Year	Month	Day	Time
501130	70° 39.980	-122° 59.580	528	2005	Sep	12	19:14:46
20050806_1715	50° 01.602	-65° 09.900	200	2005	Aug	6	18:37:42
20050808_1800	55° 25.800	-56° 00.300	1500	2005	Aug	8	18:50:20
20050809_1100	58° 43.800	-59° 09.000	1500	2005	Aug	9	11:14:41
20050812_1700	68° 19.770	-63° 05.736	1500	2005	Aug	12	18:16:06
20050813_1600	70° 49.782	-71° 49.290	334.28	2005	Aug	13	16:55:47
20050814_0000	71° 57.732	-72° 31.476	800	2005	Aug	14	1:26:11
20050825_1230	74° 18.936	-93° 50.232	155	2005	Aug	25	12:58:08

22.3.2 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

The transit through the Northwest Passage at the early stages of the leg was fairly successful. First, an alternate pass was made from Kugluktuk to the shipping lane and initial inspection suggests that this could be an alternate shipping lane into the community of Kugluktuk. This was important as it directly related to the navigation component of project 1.6. Corridor extension took place from Kugluktuk to the entrance of Pond Inlet. The Pond Inlet, Eclipse Sound, and Navy Board Inlet have been the biggest successes so far (Figure 22.7), and an additional 1 or 2 passes through Pond Inlet could complete the mapping effort in this region.

The only issues with part of the leg was that only four sound velocity profiles were collected due to time restrictions, when ideally 3 or 4 more would have been collected. Secondly, there was a day or so that we encountered pack ice and data collection was at a minimum.

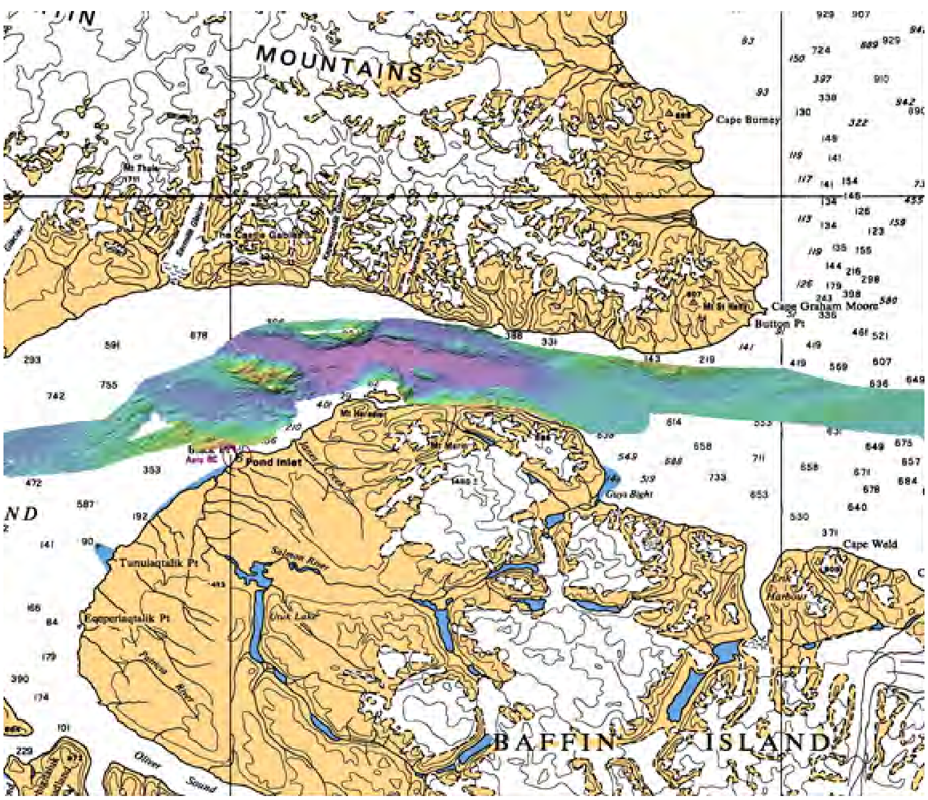

Figure 22.7. Pond Inlet bathymetry surveyed during Leg 2.

Another big success was the opportunistic survey conducted at Killiniq Island while waiting for calmer weather to transit south. The survey was designed as a corridor into the Harbour area and to join an existing dataset compiled in 2001 by the Canadian Hydrographic Service (Figure 22.8).

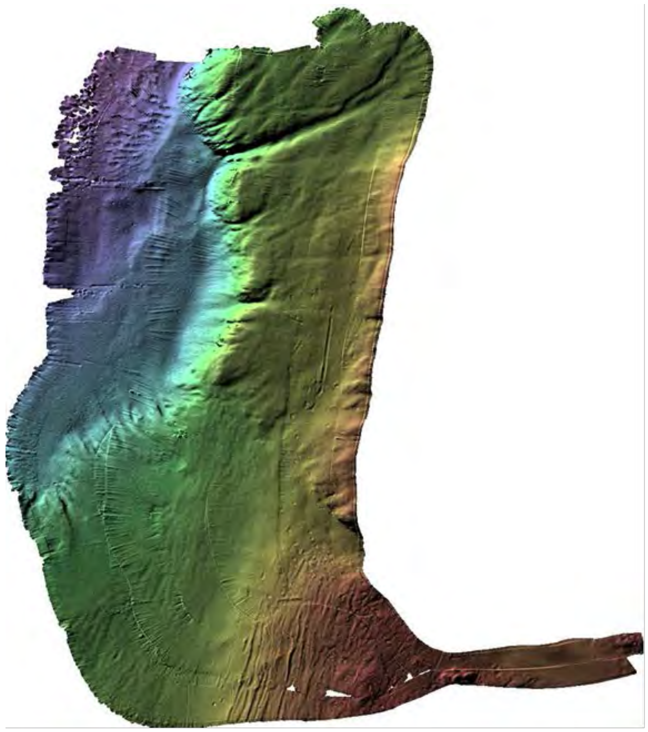

Figure 22.8. Bathymetry collected at Killiniq Island during Leg 2.

The 48-h ship-time window reserved to conduct surveys in the deep waters of the Labrador Sea was not performed as initially planned in Leg 2 schedule. Two sites were selected for mapping operations: one off the mouth of Hudson Strait for the NSERC funded survey and one on the Makkovik Bank survey, funded by NRCan. Both operations were ultimately canceled due to bad weather conditions with swells were too large to conduct effective surveys and collect quality data.

22.4 Comments and recommendations

CTD information was insufficient during transit through the Northwest Passage due to time restrictions. Sufficient time needs to be allocated for the collection of this information for input into the EM300 to ensure quality data. However, sufficient data was collected during the time spent in the Hudson Bay/Strait region.

Instruments that make excessive noise, such as the Mercury Vapour Analyzer, should not be installed in the acquisition room.

23 Geology and paleoceanography – Legs 1 and 2

ArcticNet Phase I – Project 1.6: The Opening NW Passage: Resources, Navigation, Sovereignty & Security. ArcticNet/Phase 1/Project 1.6

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23.1 Methodology

23.1.1 Leg 1 – 5 August to 15 September 2005 – Baffin Bay, Canadian Arctic Archipelago and Beaufort Sea

Piston cores were obtained with trigger weight (or gravity) cores, and accompanying box cores at the sites given in the table below (Table 22.1). With the exception of the first piston coring site, a second piston core was obtained for G. Massé. Sea spider (*Pycnogonida*) samples were recovered from the surface of the box core obtained from Barrow Strait, and these will be archived with the Insectarium & Biodôme in Montreal, QC.

All official core samples were stored upright in 4°C cold storage, except when analyzing them with the MSCL, then they were kept in the Geo-Paleo lab for approximately 24 hours to reach room temperature to allow for proper analysis. In total, 3284 cm of cores were Multisensor Core Logged by R. Bennett for core length, sediment density, gamma, p-wave and magnetic susceptibility.

Following the MSCL core logging, the cores were returned to the cold storage facility. The chilled cores were then split evenly into an Archive half and a Working half, described and photographed (T. Schell), color spectrophotometred (R. Bennett and E. Potvin), and then the designated Working core half was subsampled as outlined in Table 22.1.

Table 23.1. Sediment subsampling protocol used during Leg 1.

Analysis	Amount	Boxcore	Piston + TWC
Foraminifera	10 cc	Every 1 cm	Every 10 cm
Palynology	10 cc	Every 1 cm	Every 10 cm
Diatoms	5 cc	None	Every 10 cm
Grain size	1 cc	Every 5 cm	Every 10 cm
$^{13}C/^{12}C$ (organic C)	1 cc	None	Every 10 cm
^{18}O stable isotopes	1 cc	None	Every 10 cm
^{210}Pb	1 cc	Every 1 cm in upper 15 cm	None
Paleomagnetism (U-channels	Continuous	Continuous	Continuous

In total 2080 subsamples were taken, plus the continuous mini-core for paleomagnetism. In addition, at the time of splitting, any noticeable, quantifiable amounts of shell material were removed for ^{14}C age dating. The split cores were then wrapped completely in Saran wrap, then sealed in a plastic liner bag, and then placed into a sealed D-tube for proper 'flat-lying' storage. In total, -- number of subsamples were taken. In addition, 12 shell samples and 12 rock samples were removed for age dating and identification of sedimentation provenance, respectively.

The cores remained on board the *Amundsen* in cold storage until demobilization in Quebec City, at the end of October, where they were transported to Halifax-Dartmouth and archived with the National Core Collection-Laboratory, Geological Survey of Canada at the Bedford Institute of Oceanography (Dartmouth, Nova Scotia).

Table 23.2 Station locations, information and sample numbers for sediment samples collected during Leg 1.

Site #	Local area	Date (ddmmyy)	Time (start end)	Depth (m)	Latitude N	Longitude W	Sample type	Sections and samples	Sample number (GSC)
BA-02 (108)	Smith Sound/ Nares Strait	17-08-05		445			Boxcore	No recovery!	2005-804-001BC
DNA-11	Smith Sound/ Nares Strait	20-08-05	04:50 05:05	703	77º49.750	74º39.971	Boxcore	Pushcore 1 Pushcore 2 surface – Dinos&Forams	2005-804-002BC
Stn#3	BaffinBay / entrance to Lancaster Sound	23-08-05	02:03 05:00	811	74º03.392	79º51.194	Piston core, trigger wt.	Catcher, AB, BC, CD, DE, twc	2005-804-003PC, TWC
			06:30 07:02	815	74º02.419	79º55.954	Boxcore	Pushcore 1 Pushcore 2 surface – Dinos&Forams	2005-804-003BC
Stn#4	Barrow Strait	24-08-05	22:29 22:45	350	74º16.155	91º05.048	Piston core, trigger wt.	AB, BC,cc[1], C[1]D, DE, EF, twc	2005-804-004PC, TWC
			23:39 00:00	350	74º16.168	91º04.45	Boxcore	Pushcore 1 Pushcore 2 surface – Dinos&Forams	2005-804-004BC
Stn#6	Victoria	27-08-05	15:00	61	69º09.956	100º41.847	Piston	Catcher, AB, BC,	2005-

Site #	Local area	Date (ddmmyy)	Time (start end)	Depth (m)	Latitude N	Longitude W	Sample type	Sections and samples	Sample number (GSC)
	Strait		15:04				core, trigger wt.	CD, DE, twc	804-005PC, TWC
			14:05 14:09	61	69º09.967	100º41.719	Boxcore	Pushcore 1 Pushcore 2 surface – Dinos&Forams (**sea spiders)	2005-804-005BC,
Stn#7	Dease Strait	30-08-05	09:35 09:57	118	68º59.552	106º34.413	Piston core, trigger wt.	AB, BC, CD, DE, twc	2005-804-006PC, TWC
			08:15 08:20	117	68º00.002	106º34.541	Boxcore	Pushcore 1 Pushcore 2 surface – Dinos&Forams (**sea spiders)	2005-804-006BC,
Stn#11	Amundsen Gulf	10-09-05	18:58 19:10	253	70º19.465	126º23.472	Boxcore	surface – Dinos&Forams	2005-804-007BC
Stn#12	Cape Lyons/ Paulatuk	13-09-05	09:24 09:58	174	69º54.436	122º57.296	Piston core, trigger wt.	AB, twc	2005-804-008PC, TWC
			06:37 06:46	219	69º54.813	122º57.957	Boxcore	Pushcore 1 Pushcore 2 surface – Dinos&Forams	2005-804-008BC,

Table 23.3. Core lengths per section for cores collected during Leg 1.

Sample number	Section	MSCL Length (cm)	Measured length (cm)
2005-804-002BC	Pushcore 1	0-37	0-37
	Pushcore 2	0-38	
2005-804-003PC	catcher	-	~ 5
	A-B	430-577	424-571
	B-C	277-430	272-424
	C-D	125-277	120-272
	D-E	0-125	0-120
2005-804-003twc	A-B	0-99	0-98.5
2005-804-003BC	Pushcore 1	0-35	0-35
	Pushcore 2	0-32	
2005-804-004PC	A-B	527-679	521-670.5
	B-C	373-527	367-521
	C-C[1ooze]	-	(~18)
	C-D	221-373	217-367
	D-E	67-221	63-217
2005-804-004PC	E-F	0-67	0-63
2005-804-004twc	A-B	0-109	0-104
2005-804-004BC	Pushcore 1	0-35	0-35
	Pushcore 2	0-40	

Sample number	Section	MSCL Length (cm)	Measured length (cm)
2005-804-005PC	catcher		~10
	A-B	427-579	571-420.5
	B-C	273-427	420.5-268
	C-D	121-273	268-116
	D-E	0-121	116-0
2005-804-005twc	A-B	0-119	0-118
2005-804-005BC	Pushcore 1	0-31	0-31
	Pushcore 2	0-30	
2005-804-006PC	A-B	255-405	251-402
	B-C	101-255	98-251
	C-D	0-101	0-98
2005-804-006twc	A-B	0-75	0-118
2005-804-006BC	Pushcore 1	0-39	0-39
	Pushcore 2	0-40	
2005-804-008PC	A-B	0-129	0-128
2005-804-008twc	A-B	0-78	0-75.5
2005-804-008BC	Pushcore 1	0-42	
	Pushcore 2	0-46	0-47

Stations #003-006 were piston cored using 3 lengths of 3-m barrels, but after recovery of the second PC at Station 006, the cable was deemed unsafe for further use due to a crimping kink, and several of the cable sinews had become frayed. Although apparent penetration was full to the core head, actual core recovery was not obtained into the last upper most barrel. The piston was still ‘splitting early’.

From Station #007 onwards, only two lengths of 3m-barrels were used with the shorter cables, although spare 3x3m-barrel cables were ordered, measuring them onboard showed that the new spare cables were too short and not the length that was requested. Apparent penetrations were of 5-4 m with an active core recovery of 4-5 m, respectively. In this case, the incomplete recovery may be due to the ‘loop’ of the trigger being too short/tripping early or too long.

The trigger weight cores were recovering between 1.2-1.4 m each time, while only one core catcher (PC#004) was obtained; otherwise it was empty in both corers.

Table 23.4 Comparative piston core penetrations versus actual recovery amounts measured during Leg 1.

Sample number	Apparent penetration (cm)	Actual length (cm)
2005-804-003PC	600	577
2005-804-004PC	610	697
2005-804-005PC	920	579
2005-804-006PC	500	405
2005-804-008PC	400	

23.1.2 Leg 2 – 15 September to 26 October 2005 – Hudson Bay

One of the important sites for coring was Hudson Strait where a red mud layer was expected at 2 m depth in the sediment between Station 14 and 15 (Kerwin 1996). Another important site was Kujjuuaraapick, where 2 cores were taken. No good coring sites were found in the western part of Hudson Bay but a number of sites with a good thickness of sediment were found Eastern Hudson Bay. This East-West difference in Hudson Bay was due to differing current regimes which have a significant impact on sedimentation. Two good sites for coring were missed near Nastapoka river. (approx. 10 to 20 m of sediment).

At each station, surface samples (0-1 cm) were taken for the microfossils (dinoflagellate cysts) database (A. de Vernal). The apparent vs. real penetration of piston core were usually different (see Table 22.4 from Leg 1). Box cores with no sections or lengths are surface sediment samples from R. MacDonald's team.

Table 23.5. List of stations where piston or box cores were taken during Leg 2.

Stn ID	Date in 2005	Latitude N	Longitude W	Water depth (m)	Sample type	No. of sections	Core length (cm)	Core ID	Note
Bylot	19/09	72° 37.93	079° 45.22	560	Box			AMD_0509-BYLOT-BOX	Surface sample only (Robie)
14e	24/09	62° 14.82	071° 54.80	348	Piston	1	72	AMD_0509-14e-PC	
14e	24/09	62° 14.88	071° 54.90	345	Box	1	38,5	AMD_0509-14e-BOX	
15e	25/09	64° 01.97	079° 12.84	320	Gravity	1	128	AMD_0509-15e-LEH	
15e	25/09	64° 02.04	079° 12.91	321	Box	1 (3 Cores)	Archive: 35	AMD_0509-15e-BOX	
15e							Working I: 38	AMD_0509-15e-BOX	
15e							Working II: 38	AMD_0509-15e-BOX	
17a	27/09	62° 45.44	079° 00.07	395	Piston	4	351	AMD_0509-17a-PC	
17a	27/09	62° 45.43	079° 00.04	395	Box	1 (3Cores)	Archive: 35,1	AMD_0509-17a-BOX	
17a							Working I: 36	AMD_0509-17a-BOX	
17a							Working II: 37,2	AMD_0509-17a-BOX	
18	28/09	60° 10.53	079° 09.52	134	Box			AMD_0509-18-BOX	Surface sample only (Robie)
18	28/09	60° 10.98	079 17.59	153	Box			AMD_0509-18'-BOX	Surface sample only (Robie)
19	29/09	58° 25.21	078° 21.66	112	Box			AMD_0509-19-BOX	Surface sample only (Robie)
20	30/09	56° 23.04	076° 34.82	114	Piston	3	410,1	AMD_0509-20-PC	
20	30/09	56° 23.12	076° 34.91	104	Gravity	1	116,6	AMD_0509-20-LEH	Surface sample on gravity core
KUJ-01	01/10	55° 24.15	077° 58.64	119	Box			AMD_0509-KUJ-BOX	Surface sample only (Robie)
KUJ-01	01/10	55° 23.98	077° 58.61	116	Gravity	1	58,8	AMD_0509-KUJ-01-LEH	

Stn ID	Date in 2005	Latitude N	Longitude W	Water depth (m)	Sample type	No. of sections	Core length (cm)	Core ID	Note
KUJ-01	01/10	55° 23.98	077° 58.61	116	Piston	3	395,1	AMD_0509-KUJ-01-PC	
KUJ-02	01/10	55° 26.37	077° 51.18	127	Gravity	1	46,5	AMD_0509-KUJ-02-LEH	I took the surface sample on gravity core
KUJ-02	01/10	55° 26.37	077° 51.18	127	Piston	3	329,4	AMD_0509-KUJ-02-PC	
21e	02/10	54° 43.00	080° 43.71	100	Box	1 (3 Cores)	Archive: 35,8	AMD_0509-21e-BOX	
21e							Working I: 40,1	AMD_0509-21e-BOX	
21e							Working II: 41,5	AMD_0509-21e-BOX	
BI-1	04/10	55° 26.42	080° 31.76	105	Box	1 (2 Cores)	Archive: 25	AMD_0509-BI-1-BOX	
BI-1							Working I: 25,5	AMD_0509-BI-1-BOX	
BI-2	05/10	56° 43.21	080° 48.44	176	Gravity	2	168,4	AMD_0509-BI-2-LEH	
BI-2	05/10	56° 44.53	080° 49.28	200	Box			AMD_0509-BI-2-BOX	Surface sample only (Robie)
22	06/10	58° 22.24	083° 20.06	180	Gravity	1	48,2	AMD_0509-22-LEH	
CTD19	07/10	55° 32.01	084° 56.80	34	Gravity	1	46	AMD_0509-CTD19-LEH	
CTD19	07/10	55° 31.95	084° 56.88	34	Box			AMD_0509-CTD19-BOX	Surface sample only (Robie)
23	11/10	59° 03.29	087° 29.44	203	Gravity	1	59	AMD_0509-23-LEH	
23	11/10	59° 03.34	087° 30.02	200	Box			AMD_0509-23-BOX	Surface sample only (Robie)
AN02-05	12/10	58° 43.88	091° 29.35	87	Gravity	0	0	AMD_0509-AN02-05-LEH	
AN02-05	12/10	58° 43.99	091° 29.37	86	Box			AMD_0509-AN02-05-BOX	Surface sample only (Robie)
AN01-05	13/10	59° 59.94	091° 58.35	119	Gravity	1	71	AMD_0509-AN01-05-LEH	
AN01-05	13/10	59° 59.79	091° 59.50	116	Box			AMD_0509-AN01-05-BOX	Surface sample only (Robie)
26	16/10	60° 25.81	089° 20.94	140	Gravity	1	36	AMD_0509-26-LEH	
26	16/10	60° 26.23	089° 21.50	142	Box			AMD_0509-26-BOX	Surface sample only (Robie)
27	16/10	61° 03.19	086° 13.46	245	Gravity	1	81,3	AMD_0509-27a-LEH	
27	16/10	61° 03.20	086° 12.83	245	Gravity	2	252,5	AMD_0509-27b-LEH	
27	16/10	61° 02.43	086° 13.21	239	Box	1 (3 Cores)	Archive: 43	AMD_0509-27-BOX	
27							Working I: 44	AMD_0509-27-BOX	
27							Working II: 45,5	AMD_0509-27-BOX	
27	16/10	61° 02.388	086° 13.005	244	Box			AMD_0509-27-BOX-02	Surface sample only (Robie)
28	17/10	63° 02.830	074° 18.881	430	Piston	3	410,6	AMD_0509-28-PC	
28	17/10	63° 02.830	074° 18.881	430	Gravity	1	46	AMD_0509-28-LEH	

Stn ID	Date in 2005	Latitude N	Longitude W	Water depth (m)	Sample type	No. of sections	Core length (cm)	Core ID	Note
28	17/10	63° 03.01	074° 18.56	430	Box			AMD_0509-28-BOX	Surface sample only (Robie)

23.2 Comments and recommendations

Coring needs to be done at the very end of a station because sediment resuspension from the coring instruments may affect other sampling for water properties or sediment traps.

When coring is scheduled in the Expedition plan, the best possible site for coring should be searched for when arriving at the Station and the coring conducted near that optimal spot.

The piston core needs to be checked and maintained because on many occasions the apparent penetration was greater than the real penetration.

24 Schools on Board – Leg 2

Program coordinator: Lucette Barber (lucette.barber@umanitoba.ca)
Cruise participants Leg 2: Lucette Barber, Tanya Conners, Shannon Delawsky, Dave Shoesmith, Danielle Baikie, Sarah Canning, Bernice Irish, Kathryn Lapenskie, Sarah Seller, Brian Wasylkowski.

24.1 Introduction

Schools on Board was created to outreach the research activities of ArcticNet and to promote Arctic sciences to high schools across Canada. The field program takes high school students and teachers on-board the CCGS Amundsen where they are integrated into the activities of the various science teams conducting research in the Arctic. In so doing, it blends adventure, curiosity and exposure to create an energized learning environment and provides opportunities where scientists share their passion for science and research with students – both on the ship and in classrooms. The multidisciplinary nature of the field program demonstrates the breadth of opportunities that are available to aspiring young researchers and technicians. Face-to-face interactions with scientists of all levels (masters, PhD's, researchers, CRC chairs) and access to state-of-the-art scientific instrumentation onboard the Canadian research icebreaker are the focus of the on-board field program. It is anticipated that the experiences of those chosen to participate, will be shared with their fellow classmates, families and communities, and that schools, particularly teachers, who participate in the program, will be more inclined to integrate Arctic sciences in their science programs.

24.2 Participants

The 2005 Schools on Board Field Program experienced a very successful year on-board Leg 2 of ArcticNet. The nine available spaces were filled by the following schools:

- Central Middle School, Dawson Creek, British Columbia (1teacher)
- Chetwynd Secondary School, Chetwynd, British Columbia (1student)
- Kugluktuk High School, Kugluktuk, Nunavut (1 teacher; 1 student)
- Windsor Park Collegiate, Winnipeg, Manitoba (1 students)
- Westwood Collegiate, Winnipeg, Manitoba (1 teacher; 1 student)
- Duke of Marlborough School, Churchill, Manitoba (1 students)
- Jens Haven Memorial, Nain, Labrador (1 student).

Participants were selected by their schools to represent their community and region on-board this very unique Arctic research experience. Most of the participants met in Winnipeg where they proceeded to Churchill via ground transport to Thompson, connecting to the Via Rail train to Churchill. Upon arrival, they were introduced to the participant from Churchill, and taken to the Churchill Northern Studies Centre (CNSC). Activities in Churchill included a visit to the Parks Canada Interpretive centre, the museum, and one of the science field stations. Lectures at the CNSC included: 1. Atmospheric Carbon Dioxide

Exchange Dynamics on Coastal Hudson Bay; and 2) On Uncertain Ice: Polar Bears, Hudson Bay and the Climate Change debate. A cultural activity included a talk and discussion with a member of the Dene community about traditional practices and the importance of cultural identity among native populations in the North.

24.3 Activities and outreach

The group boarded the ship at 11:30am on 14 October. They participated in the activities associated with a VIP tour of the Amundsen. These activities included a ship tour; an introduction of our group to the VIP delegates, and a presentation about ArcticNet. We set sail on the evening of the 14th and immediately became integrated in the activities of ArcticNet science teams the following day. The program included science lectures, lab activities and fieldwork. Details of the on-board program are posted on the ArctiNet website (www.arcticnet.ulaval.ca). Daily dispatches including a report, photos and ship location were sent to ArcticNet central to be posted on the website. This two-week adventure into Arctic research exposed students and teachers to the research objectives and methods of numerous science teams representing a number of research disciplines from institutions across Canada.

In addition to hands-on research activities the program included information and sessions on various aspects of Canada's North, including local knowledge, art, culture, history, and politics. Outreach activities of the Schools on Board program include:

- Various newspaper articles and radio interviews prior to departure
- Visit to the Duke of Marlborough School in Churchill
- Newspaper article following the VIP tour in Churchill
- Conference call from the Amundsen.
- This call connected Schools on Board participants and scientists on the ship to participating schools and family members. Schools received instructions for involving their classrooms in this activity. The call was coordinated from Winnipeg with the help of Steve Newton (DFO) and the participation of southern scientists David Barber (University of Manitoba) and Martin Fortier (U. Laval).
- A live interview from the ship with a radio station in BC
- Interviews and media coverage with M.Tawil (producer)
- Interviews and media coverage with Patrick de Bellefleur (Météo Media; Weather Channel)
- A student presentation planned for Oct. 27 at the Quebec High School in Quebec City
- Numerous presentations to be delivered by the students and teachers upon their return

These activities will serve to increase awareness of the Schools on Board program and its educational objective, as well as increase awareness of the ArcticNet program and its scientific objectives.

Table 24.1. Schedule and participating scientists during the Schools on Board Field Program.

Date	Session	Name	Affiliation
Oct. 13	Tour of CNSC	Lee Ann Fishback	Churchill Northern Studies Center
Oct. 13	Bears and Belugas	Lee Ann Fishback	Churchill Northern Studies Center
Oct. 13	Lecture: Atmospheric Carbon Dioxide Exchange Dynamics Visit field station	Glen Scott	University of Manitoba
Oct. 13	Cultural presentation	Caroline Bjorklund	CNSC
Oct. 14-18	S/B scientific advisor	Martin Fortier	ArcticNet, Université Laval
Oct. 14-27	Chief Scientist	Gary Stern	Chief Scientist, Fisheries and Oceans
Oct. 14-27	Commanding Officer	Captain Alain Gariepy	Commanding Officer CCGS
Oct. 14-27	S/B scientific advisor	CJ Mundy	University of Manitoba
Oct. 14	Ship safety orientation	Martin Chouinard	Canadian Coast Guard
Oct. 14	ArcticNet presentation	David Barber Martin Fortier	CEOS, University of Manitoba ArcticNet, Université Laval
Oct. 16	Deployment of instruments Vertical and oblique nets Piston Core Gravitational core Sediment traps Box core Secchi Disk Rosette and CTD Bioness Hydrobios Zodiac – turbulence measurements	Louis Letourneau Gérald Darnis Maxime Paiement Monica Pazerniuk Amandine Lapoussiere Zou Zou Kuzyk Joannie Ferland Marie Emmanuelle Rail Louis Letourneau Gérald Darnis Sophie Caplanne	Université Laval Université Laval Université Laval FWI; University of Manitoba UQAR FWI; University of Manitoba UQAR INRS-ETE (Rimouski) Université Laval Université Laval IML (Rimouski)
Oct. 16	Lab activities Dissolved organic material O_{18}; salinity;conductivity Light intensity Zooplankton in the Hudson Bay; respiration experiments	CJ Mundy Joannie Ferland Melanie Simard Zhi Ping Mei Louis Letourneau Gérald Darnis	University of Manitoba UQAR UQAR UQAR Université Laval Université Laval
Oct. 17	Meteorology – lecture	Brent Esle	University of Calgary
Oct. 17	Build a pyranometer - activity	CJ Mundy	University of Manitoba
Oct. 18	Marine Geology – Marine survey techniques and mapping	Jason Bartlett	University of New Brunswick
Oct. 18	Marine Mammals - Seal study	Manon Simard	Makivik Corporation, Kuujjuuaq
Oct. 18	Arctic marine food web	Martin Fortier	Université Laval
Oct.19	Helicopter ride – Sarah C.		
Oct. 19	Traditional Knowledge - Sachs Harbor video and activity	Materials from IISD; and MB Education and training	
Oct. 20	Physical Geography Lecture: The freshwater cycle of the Hudson Bay Demo: Denisty	Mats Granskog	University of Manitoba
	Physical Geography Lecture: Sea Ice Lab: Salinity experiment	CJ Mundy	University of Manitoba
Oct. 21	Biology (Photosynthesis) Lecture: Overview of projects Lab: Water filtration for chlorophyll *a* Lab: Phytoplankton Field: Secchi Disk	Zhi Ping Mei Joannie Ferland Melanie Simard Joannie Ferland	ISMER –UQAR ISMER –UQAR ISMER –UQAR

Date	Session	Name	Affiliation
Oct. 21	Helicopter – to Killinek	Danielle; Brian; Shannon; Lucette	
Oct. 22	Break		
Oct. 23	Canadian Coast Guard Service Tour of the Bridge Tour of the ships kitchens; storage; and other logistics	Captain Alain Gariépy Martin Chouinard Lucie Bouchard Julie Gagnon	CCGS
Oct. 24	Lecture: Contaminants in the Arctic	Gary Stern	Freshwater Institute, DFO
Oct. 24	Activity: Data analysis Contaminants (Mercury) Chlorophyll *a*	Monica Pazerniuk Joannie Ferland	FWI; University of Manitoba UQAR
Oct. 24	Activity: Instrument take-down; analysis and discussion	CJ Mundy	University of Manitoba
Oct.,25	Lecture: The physics of oceanography CTD/salinity demo	Marie-Emmanuelle Rail Pascal Guillot	INRS-ETE INRS-ETE
Oct. 25	Lecture: Seabirds – indicators to ecosystem health Fieldwork - observations	Laura McKinnon	Carleton University
Oct. 25	Lecture: Climate change	CJ Mundy	University of Manitoba
Oct. 26	Quebec City		
Oct. 27	Quebec City Student presentation to Quebec High School	Schools on Board participants	
Oct. 28	Quebec City Historical tour	Tour agency	
Oct. 29	Transit home		

24.4 Conclusion and perspectives

In conclusion, the 2005 field program successfully met its goals of promoting Arctic sciences, increasing awareness of environmental issues related to the Arctic and climate change, and providing new and exciting learning opportunities to this country's next generation of science enthusiasts. The media attention and the presentations that will follow from the program will successfully showcase ArcticNet and its network of scientists to audiences not previously targeted.

The overwhelming positive feedback received from all stakeholders (students, teachers, schools and scientists) indicates that this program is welcomed in both the science and education communities. The program's success is the catalyst for continued support and plans for expansion.

Teachers' perspective:

"Schools on Board is an excellent opportunity for students and teachers to engage in experiential learning outside of the traditional classroom. We are witnessing current research in the Arctic which makes textbook science more "real" and practical. It was exciting to see the passion that scientists express about their research. These scientists are excellent role models for our students. The knowledge we have gained can be incorporated into current environmental courses and has inspired the development of an environmental course in Dawson Creek. This experience has been a once in a lifetime opportunity, which has enhanced each of us as teachers."

Shannon Delawsky – Central Middle School – Dawson Creek, BC
Tanya Connors – Kugluktuk High School – Kugluktuk, Nunavut
Dave Shoesmith – Westwood Collegiate – Winnipeg, MB

"This whole trip has been an amazing experience – it's made me think of what I can do for the world and what I can do with science. It's been a life changing experience for me."
Student, Winnipeg, MB

"This program is a window into the world of science."
Student, Chetwynd, BC

"This program was an amazing trip into science – learning about what is happening in the north, this trip reminds me of home… it was an experience of a lifetime."
Student, Kugluktuk, Nunavut

Leg	Station ID	Station Type	Local Date	Local Time	UTC to local	Latitude (N)	Longitude (W)
Leg 1							
1	A	CTD	06/Aug/2005	13h20	UTC-4	50°01.484	065°10.019
1	B	CTD	08/Aug/2005	14h55	UTC-4	55°26.461	056°30.607
1	C	CTD	09/Aug/2005	08h45	UTC-4	58°48.200	059°08.400
1	28	MVP	10/Aug/2005	08h30	UTC-4	60°38.600	060°38.500
1	D	CTD	11/Aug/2005	19h00	UTC-4	64°50.160	060°22.300
1	E	CTD	12/Aug/2005	13h14	UTC-4	68°21.656	063°08.721
1	F	CTD	13/Aug/2005	12h18	UTC-4	70°48.482	071°53.973
1	G	CTD	13/Aug/2005	20h15	UTC-4	71°54.087	072°36.528
1	H	N/A	14/Aug/2005	09h50	UTC-4	72°47.210	076°50.400
1	J	Basic	14/Aug/2005	13h18	UTC-4	72°47.003	078°07.520
1	100	Full	16/Aug/2005	03h12	UTC-4	76°17.995	071°24.553
1	BA01-05	Mooring	17/Aug/2005	01h30	UTC-4	76°19.611	071°11.797
1	102	CTD	17/Aug/2005	04h32	UTC-4	76°17.004	072°06.202
1	104	Nutrient	17/Aug/2005	06h00	UTC-4	76°16.986	072°47.448
1	106	CTD	17/Aug/2005	07h52	UTC-4	76°16.927	072°28.484
1	108	Basic	17/Aug/2005	09h58	UTC-4	76°15.991	074°35.290
1	BA02-05	Mooring	17/Aug/2005	18h59	UTC-4	76°16.045	074°34.300
1	110	CTD	17/Aug/2005	22h59	UTC-4	76°16.190	075°00.396
1	112	Nutrient	18/Aug/2005	00h35	UTC-4	76°19.441	075°46.999
1	114	CTD	18/Aug/2005	02h55	UTC-4	76°21.240	076°35.913
1	116	Full	18/Aug/2005	05h04	UTC-4	76°22.935	077°23.336
1	BA03-05	Mooring	18/Aug/2005	18h45	UTC-4	76°23.061	077°24.138
1	L 9	DNA	19/Aug/2005	05h01	UTC-4	77°49.966	075°20.726
1	L 5	DNA	19/Aug/2005	09h50	UTC-4	78°04.719	074°39.682
1	L 4	DNA	19/Aug/2005	11h29	UTC-4	78°04.963	075°00.187
1	L 1	DNA	19/Aug/2005	14h04	UTC-4	78°20.329	074°39.502
1	L 2	DNA	19/Aug/2005	15h12	UTC-4	78°19.693	074°21.355
1	L 3	DNA	19/Aug/2005	21h23	UTC-4	78°19.113	074°00.267
1	L 6	DNA	19/Aug/2005	23h59	UTC-4	78°05.100	074°19.529
1	L 11	DNA	20/Aug/2005	02h31	UTC-4	77°49.630	074°41.553
1	L 10	DNA	20/Aug/2005	06h04	UTC-4	77°49.802	075°00.426
1	L 8	DNA	20/Aug/2005	08h18	UTC-4	77°49.501	075°40.082
1	L 7	DNA	20/Aug/2005	10h25	UTC-4	77°49.871	075°59.661
1	L 15	DNA	20/Aug/2005	13h08	UTC-4	77°34.581	075°39.606
1	L 14	DNA	20/Aug/2005	14h10	UTC-4	77°35.003	075°53.863
1	L 16	DNA	20/Aug/2005	15h40	UTC-4	77°35.056	075°19.902
1	L 17	DNA	20/Aug/2005	16h55	UTC-4	77°34.604	074°59.250
1	L 24	DNA	20/Aug/2005	18h45	UTC-4	77°20.127	075°01.791
1	L 23	DNA	20/Aug/2005	21h09	UTC-4	77°20.009	075°21.592
1	L 22	DNA	20/Aug/2005	22h39	UTC-4	77°19.578	075°43.149
1	L 21	DNA	20/Aug/2005	23h40	UTC-4	77°20.050	076°01.192
1	L 20	DNA	21/Aug/2005	02h54	UTC-4	77°19.976	076°20.307
1	L 19	DNA	21/Aug/2005	03h51	UTC-4	77°20.009	076°39.961
1	L 18	DNA	21/Aug/2005	04h50	UTC-4	77°19.940	076°59.990
1	K	CTD	21/Aug/2005	12h08	UTC-4	76°10.057	075°00.650
1	BA04-05	Mooring	21/Aug/2005	18h53	UTC-4	75°15.182	074°78.457
1	BA04	Basic	21/Aug/2005	19h37	UTC-4	75°14.408	074°58.684
1	L	Mapping	22/Aug/2005	11h20	UTC-4	74°03.389	077°13.129
1	3	Full	22/Aug/2005	18h43	UTC-4	74°02.999	079°56.090
1	M	CTD	23/Aug/2005	14h46	UTC-4	74°11.783	083°20.698
1	N	CTD	23/Aug/2005	22h25	UTC-4	74°18.087	088°29.255
1	4	Full	24/Aug/2005	03h46	UTC-4	74°16.007	091°11.816
1	N/A	CTD	25/Aug/2005	08h35	UTC-4	74°18.963	093°50.644
1	O	CTD	25/Aug/2005	18h45	UTC-4	73°19.060	096°20.600
1	P	Nutrient	26/Aug/2005	00h49	UTC-4	72°19.854	096°17.951

Leg	Station ID	Station Type	Local Date	Local Time	UTC to local	Latitude (N)	Longitude (W)
1	6	Full	27/Aug/2005	06h18	UTC-4	69°10.022	100°41.944
1	R	CTD	28/Aug/2005	04h33	UTC-4	69°02.068	101°13.877
1	S	CTD	28/Aug/2005	06h48	UTC-4	68°41.178	103°59.619
1	7	Full	29/Aug/2005	23h49	UTC-4	69°00.024	106°34.634
1	T	CTD	31/Aug/2005	01h43	UTC-4	68°35.547	109°28.142
1	U	CTD	31/Aug/2005	06h40	UTC-4	68°25.171	112°08.276
1	V	CTD	31/Aug/2005	20h12	UTC-4	69°42.116	118°23.381
1	CA18-04	Mooring	01/Sep/2005	06h14	UTC-4	70°39.977	122°58.470
1	CA20-04	Mooring	01/Sep/2005	13h40	UTC-4	70°20.409	126°20.597
1	CA05-04	Mooring	01/Sep/2005	21h42	UTC-4	71°24.501	127°23.284
1	211	Nutrient	01/Sep/2005	22h45	UTC-4	71°22.386	127°29.436
1	210	Nutrient	01/Sep/2005	23h48	UTC-4	71°20.338	127°32.280
1	209	Nutrient	01/Sep/2005	23h59	UTC-5	71°18.418	127°41.904
1	208	Nutrient	02/Sep/2005	01h06	UTC-5	71°16.454	127°48.447
1	207	Nutrient	02/Sep/2005	02h08	UTC-5	71°14.927	127°54.529
1	206	Nutrient	02/Sep/2005	04h08	UTC-5	71°12.828	128°00.455
1	205	Nutrient	02/Sep/2005	04h49	UTC-5	71°10.799	128°06.200
1	204	Basic	02/Sep/2005	05h48	UTC-5	71°08.821	128°12.247
1	203	Nutrient	02/Sep/2005	09h25	UTC-5	71°06.467	128°18.222
1	202	Nutrient	02/Sep/2005	10h03	UTC-5	71°04.537	128°24.390
1	201	Nutrient	02/Sep/2005	10h40	UTC-5	71°02.566	128°30.285
1	CA05	Full	02/Sep/2005	16h35	UTC-5	71°17.132	127°31.944
1	CA15-04	Mooring	03/Sep/2005	03h54	UTC-5	71°32.015	126°58.335
1	CA14-03	Mooring	03/Sep/2005	09h18	UTC-6	71°47.448	127°59.522
1	CA13-03	Mooring	03/Sep/2005	20h41	UTC-6	71°21.470	131°20.553
1	CA04-04	Mooring	04/Sep/2005	06h24	UTC-6	71°05.601	133°42.527
1	CA07-04	Mooring	04/Sep/2005	11h32	UTC-6	71°10.404	134°01.357
1	Ice 1	Ice	04/Sep/2005	18h00	UTC-6	71°21.658	135°21.211
1	10	Basic	05/Sep/2005	08h21	UTC-6	71°35.008	139°57.008
1	CA04-05	Mooring	06/Sep/2005	14h49	UTC-6	71°04.780	133°37.780
1	CA04	Basic	06/Sep/2005	15h28	UTC-6	71°05.206	133°37.071
1	224	CTD	08/Sep/2005	02h00	UTC-6	71°42.264	126°28.913
1	223	CTD	08/Sep/2005	04h05	UTC-6	71°38.306	126°40.938
1	222	CTD	08/Sep/2005	05h04	UTC-6	71°34.411	126°52.994
1	221	CTD	08/Sep/2005	06h04	UTC-6	71°30.450	127°05.121
1	CA08	Full	09/Sep/2005	04h12	UTC-6	71°01.999	125°57.763
1	CA08-05	Mooring	09/Sep/2005	23h38	UTC-6	71°00.285	126°04.176
1	CA05-04	Mooring	10/Sep/2005	N/A	UTC-6	71°25.148	127°23.777
1	11	Full	10/Sep/2005	17h45	UTC-6	70°20.370	126°21.431
1	CA18	Basic	12/Sep/2005	09h17	UTC-6	70°39.580	122°59.159
1	CA18-05	Mooring	12/Sep/2005	16h39	UTC-6	70°39.981	122°59.197
1	12	Full	13/Sep/2005	06h24	UTC-6	69°54.839	122°97.947
1	X	CTD	13/Sep/2005	22h44	UTC-6	69°54.167	121°30.089
1	Y	CTD	14/Sep/2004	04h39	UTC-6	69°27.398	118°11.267
1	Z	CTD	14/Sep/2008	08h12	UTC-6	69°16.144	116°50.448
1	Cod 1	N/A	14/Sep/2010	10h34	UTC-6	69°10.425	116°08.390
Leg 2							
2		CTD	16/Sep/2005	06h40	UTC-6	68°23.650	110°05.850
2		CTD	16/Sep/2005	20h00	UTC-6	68°40.690	103°62.210
2			17/Sep/2005	16h05	UTC-6	70°26.120	098°59.520
2		CTD	18/Sep/2005	10h40	UTC-6	73°39.173	096°17.061
2			19/Sep/2005	10h10	UTC-6	73°45.610	081°04.160
2		CTD	19/Sep/2005	16h20	UTC-6	72°38.120	079°44.890
2		CTD	22/Sep/2005	08h05	UTC-5	61°19.262	064°59.420
2	14A	CTD	23/Sep/2005	11h20	UTC-5	62°31.550	070°52.218
2	14B	CTD	23/Sep/2005	12h45	UTC-5	62°29.276	071°02.300

Leg	Station ID	Station Type	Local Date	Local Time	UTC to local	Latitude (N)	Longitude (W)
2	14C	CTD	23/Sep/2005	14h25	UTC-5	62°25.090	071°17.000
2	14D	CTD	23/Sep/2005	15h45	UTC-5	62°21.350	071°39.140
2	14E	Full	23/Sep/2005	17h15	UTC-5	62°16.620	071°59.110
2	14F	CTD	24/Sep/2005	05h00	UTC-5	62°13.220	072°14.970
2	14G	CTD	24/Sep/2005	06h10	UTC-5	62°10.900	072°24.960
2	15A	CTD	25/Sep/2005	02h55	UTC-5	64°19.670	078°04.880
2	15B	CTD	25/Sep/2005	03h45	UTC-5	64°16.910	078°14.950
2	15C	CTD	25/Sep/2005	04h50	UTC-5	64°12.890	078°30.930
2	15D	CTD	25/Sep/2005	06h10	UTC-5	64°07.380	078°51.890
2	15E	Basic	25/Sep/2005	08h27	UTC-5	64°01.880	079°12.790
2	15F	CTD	25/Sep/2005	16h50	UTC-5	63°56.310	079°33.630
2	15G	CTD	25/Sep/2005	18h05	UTC-5	63°51.900	079°49.120
2	15H	CTD	25/Sep/2005	19h05	UTC-5	63°49.200	079°59.200
2	CTD-1	CTD	25/Sep/2005	23h10	UTC-5	63°24.190	081°06.300
2	CTD-2	CTD	26/Sep/2005	00h15	UTC-5	63°18.730	081°15.130
2	CTD-3	CTD	26/Sep/2005	01h25	UTC-5	63°11.200	081°27.220
2	CTD-4	CTD	26/Sep/2005	02h35	UTC-5	63°03.030	081°39.180
2	16A	CTD	26/Sep/2005	03h30	UTC-5	62°58.290	081°47.650
2	16B	CTD	26/Sep/2005	04h20	UTC-5	62°55.240	081°37.970
2	16C	CTD	26/Sep/2005	05h25	UTC-5	62°51.150	081°23.280
2	16D	CTD	26/Sep/2005	06h40	UTC-5	62°45.490	081°03.390
2	16E	Full	26/Sep/2005	08h45	UTC-5	62°39.180	080°44.110
2	16F	CTD	26/Sep/2005	18h50	UTC-5	62°33.360	080°24.870
2	16G	CTD	26/Sep/2005	20h00	UTC-5	62°28.090	080°10.470
2	16H	CTD	26/Sep/2005	20h55	UTC-5	62°25.860	080°01.310
2		Coring	27/Sep/2005	00h30	UTC-5	62°45.430	079°00.040
2	17A	CTD	27/Sep/2005	05h44	UTC-5	62°13.820	079°08.430
2	17B	CTD	27/Sep/2005	06h40	UTC-5	62°11.610	078°58.140
2	17C	Basic	27/Sep/2005	07h42	UTC-5	62°07.970	078°42.740
2	17D	CTD	27/Sep/2005	14h45	UTC-5	62°04.840	078°27.250
2	17E	CTD	27/Sep/2005	15h50	UTC-5	62°02.540	078°17.120
2	18	Full	28/Sep/2005	02h05	UTC-5	60°07.520	079°10.370
2	19A	CTD	29/Sep/2005	00h40	UTC-5	58°11.070	079°30.170
2	19B	CTD	29/Sep/2005	01h58	UTC-5	58°15.850	079°06.840
2	19C	CTD	29/Sep/2005	03h15	UTC-5	58°20.530	078°43.410
2	19D	CTD	29/Sep/2005	04h10	UTC-5	57°22.900	078°31.800
2	19E	Basic	29/Sep/2005	05h15	UTC-5	58°25.190	078°19.920
2	20	CTD	30/Sep/2005	01h10	UTC-5	56°50.430	076°50.060
2	AN03-05	Full	30/Sep/2005	13h30	UTC-5	55°20.090	078°13.580
2	AN03-05	Mooring	01/Oct/2005	13h00	UTC-5	55°24.456	077°55.743
2	21B	CTD	02/Oct/2005	06h15	UTC-5	54°41.090	079°58.820
2	21A	CTD	02/Oct/2005	07h10	UTC-5	54°37.980	079°51.570
2	21C	CTD	02/Oct/2005	08h30	UTC-5	54°41.320	080°07.800
2	21D	CTD	02/Oct/2005	10h00	UTC-5	54°42.180	080°21.120
2	21E	Basic	02/Oct/2005	11h40	UTC-5	54°42.910	080°44.010
2	21F	CTD	02/Oct/2005	23h15	UTC-5	54°44.840	081°06.510
2	21G	CTD	03/Oct/2005	00h30	UTC-5	54°45.780	081°28.430
2	21H	CTD	03/Oct/2005	01h26	UTC-5	54°46.440	081°42.910
2	BI-1	Basic	04/Oct/2005	16h00	UTC-5	55°25.930	080°32.680
2	BI-2	Basic	04/Oct/2005	19h10	UTC-5	55°25.730	080°29.260
2	22	Full	06/Oct/2005	13h36	UTC-5	58°23.830	083°17.280
2	CTD-12	CTD	07/Oct/2005	01h35	UTC-5	57°33.560	083°49.180
2	CTD-13	CTD	07/Oct/2005	05h20	UTC-5	56°51.880	084°13.220
2	CTD-14	CTD	07/Oct/2005	07h45	UTC-5	56°27.070	084°27.110
2	CTD-15	CTD	07/Oct/2005	10h30	UTC-5	56°01.620	084°41.290
2	CTD-16	CTD	07/Oct/2005	11h35	UTC-5	55°52.030	084°46.300

Leg	Station ID	Station Type	Local Date	Local Time	UTC to local	Latitude (N)	Longitude (W)
2	CTD-17	CTD	07/Oct/2005	12h45	UTC-5	55°44.480	084°50.420
2	CTD-18	CTD	07/Oct/2005	13h40	UTC-5	55°37.080	084°57.300
2	CTD-19	CTD	07/Oct/2005	14h35	UTC-5	55°31.950	084°56.930
2	CTD-21	CTD	08/Oct/2005	09h05	UTC-5	58°18.140	087°04.260
2	CTD-24	CTD	09/Oct/2005	08h00	UTC-5	57°23.640	091°56.490
2	CTD-29	CTD	09/Oct/2005	19h30	UTC-5	57°26.800	091°53.420
2	CTD-28	CTD	09/Oct/2005	20h35	UTC-5	57°30.640	091°46.890
2	CTD-27	CTD	09/Oct/2005	21h25	UTC-5	57°34.680	091°40.340
2	CTD-26	CTD	09/Oct/2005	23h35	UTC-5	57°48.110	091°16.720
2	CTD-25	CTD	10/Oct/2005	00h20	UTC-5	57°43.270	091°13.480
2	CTD-23	CTD	10/Oct/2005	01h00	UTC-5	57°38.380	091°09.900
2	CTD-22	CTD	10/Oct/2005	01h45	UTC-5	57°33.430	091°05.990
2	MH01-05	Basic	10/Oct/2005	07h00	UTC-5	57°34.410	091°37.240
2	MH01-05	Mooring	10/Oct/2005	10h23	UTC-5	57°34.169	091°37.658
2	24	CTD	10/Oct/2005	13h50	UTC-5	57°15.290	091°56.110
2	CTD-30	CTD	10/Oct/2005	21h05	UTC-5	57°22.870	092°00.010
2	CTD-31	CTD	11/Oct/2005	02h00	UTC-5	58°07.430	090°43.230
2	CTD-32	CTD	11/Oct/2005	06h05	UTC-5	58°45.260	089°32.980
2	23	Full	11/Oct/2005	11h15	UTC-5	59°00.660	087°37.450
2	AN02-05	Full	12/Oct/2005	08h37	UTC-5	58°46.880	091°31.280
2	AN02-05	Mooring	12/Oct/2005	11h35	UTC-5	58°46.988	091°31.539
2	AN01-05	Full	12/Oct/2005	21h15	UTC-5	60°00.030	091°57.060
2	AN01-05	Mooring	12/Oct/2005	22h00	UTC-5	59°58.705	091°56.665
2	25	Basic	13/Oct/2005	13h30	UTC-5	59°01.960	094°02.470
2	26	Basic	15/Oct/2005	21h25	UTC-5	60°26.840	089°22.310
2	27	Full	16/Oct/2005	08h25	UTC-5	63°03.720	086°11.310
2	HS-17	Coring	17/Oct/2005	22h35	UTC-5	63°03.010	074°18.240
2	HS-18	CTD	18/Oct/2005	15h20	UTC-5	61°06.550	069°54.330

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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 1																	
1	A	CTD	06/Aug/2005	13h20	UTC-4	50°01.484	065°10.019	CTD ↓	200	320	240	20	15.5	N/A	1013.6	76	0/10
1	A	CTD	06/Aug/2005	13h27	UTC-4	50°01.602	065°09.932	CTD ↑	201	320	240	20	15.5	N/A	1013.6	76	0/10
1	B	CTD	08/Aug/2005	14h55	UTC-4	55°26.461	056°30.607	CTD ↓↑	679	300	290	20	8.7	N/A	1007.9	86	0/10
1	C	CTD	09/Aug/2005	08h45	UTC-4	58°48.200	059°08.400	CTD ↓↑	2100	230	170	7	6.1	N/A	1005.8	N/A	0/10
1	C	MVP	09/Aug/2005	16h00	UTC-4	59°52.150	057°58.270	MVP ↓	1912	350	110	10/15	8.2	N/A	1002.0	93	0/10
1	C	MVP	09/Aug/2005	16h33	UTC-4	59°54.350	060°01.040	MVP ↑	1912	350	110	10/15	8.2	N/A	1002.0	93	0/10
1	C	MVP	09/Aug/2005	19h00	UTC-4	60°23.800	060°20.600	MVP ↓	1905	345	85	10	7.7	N/A	1002.0	95	0/10
1	28	MVP	10/Aug/2005	08h30	UTC-4	60°38.600	060°38.500	MVP ↑	1511	200	0	12	8.2	N/A	1002.5	99	0/10
1	28	MVP	10/Aug/2005	09h20	UTC-4	60°42.900	060°39.600	MVP ↓	1511	20	0	13	7.3	N/A	1002.0	99	0/10
1	28	MVP	11/Aug/2005	01h45	UTC-4	61°27.500	060°18.600	MVP (lost)	N/A	17	310	10	6.4	N/A	1006.0	99	0/10
1	D	CTD	11/Aug/2005	19h00	UTC-4	64°50.160	060°22.300	CTD ↓	336	39	39	4	4.2	N/A	1011.1	99	0/10
1	D	CTD	11/Aug/2005	19h26	UTC-4	64°50.310	060°22.510	CTD ↑	336	358	39	4	4.2	N/A	1011.1	99	0/10
1	E	CTD	12/Aug/2005	13h14	UTC-4	68°21.656	063°08.721	CTD ↓	330	321	110	5	1.7	N/A	1012.8	99	2/10
1	E	CTD	12/Aug/2005	13h49	UTC-4	69°21.916	063°09.285	CTD ↑	330	341	110	5	3.1	N/A	1012.6	99	2/10
1	F	CTD	13/Aug/2005	12h18	UTC-4	70°48.482	071°53.973	CTD ↓	359	145	25	8	4.4	N/A	1010.0	91	0/10
1	F	CTD	13/Aug/2005	12h46	UTC-4	70°45.361	071°54.412	CTD ↑	462	138	25	7	4.3	N/A	1009.8	90	0/10
1	G	CTD	13/Aug/2005	20h15	UTC-4	71°54.087	072°36.528	CTD ↓	687	315	350	12	2.4	N/A	1009.4	99	0/10
1	G	CTD	13/Aug/2005	21h00	UTC-4	71°59.300	072°36.576	CTD ↑	693	320	290	13	2.5	N/A	1009.6	99	0/10
1	H	N/A	14/Aug/2005	09h50	UTC-4	72°47.210	076°50.400	Secchi Disk ↓↑	991	275	270	10	N/A	N/A	N/A	N/A	N/A
1	H	N/A	14/Aug/2005	10h05	UTC-4	72°47.210	076°50.400	CTD-Rosette ↓	996	283	275	10	N/A	N/A	N/A	N/A	N/A
1	H	N/A	14/Aug/2005	10h48	UTC-4	72°47.010	076°58.380	CTD-Rosette ↑	987	281	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	J	Basic	14/Aug/2005	13h18	UTC-4	72°47.003	078°07.520	Vertical Net Tow ↓	766	268	120	3	4.5	N/A	1009.4	92	0/10
1	J	Basic	14/Aug/2005	13h37	UTC-4	72°47.097	078°07.424	Vertical Net Tow ↑	N/A	301	120	3	7.0	N/A	1009.4	78	0/10
1	J	Basic	14/Aug/2005	14h03	UTC-4	72°47.168	078°07.436	Vertical Net Tow ↓	717	282	60	3	7.0	N/A	1009.4	79	0/10
1	J	Basic	14/Aug/2005	14h18	UTC-4	72°47.219	078°07.440	Vertical Net Tow ↑	703	292	80	3	7.0	N/A	N/A	N/A	0/10
1	J	Basic	14/Aug/2005	14h28	UTC-4	72°08.430	078°07.025	Horizontal Net Tow ↓	668	Var	90	4	7.0	N/A	1009.4	77	0/10
1	J	Basic	14/Aug/2005	14h35	UTC-4	72°08.509	078°07.068	Horizontal Net Tow (bottom)	N/A	Var	N/A	N/A	N/A	N/A	N/A	N/A	0/10
1	J	Basic	14/Aug/2005	14h47	UTC-4	72°47.610	078°07.474	Horizontal Net Tow ↑	682	Var	140	5	6.9	N/A	1009.3	79	0/10
1	J	Basic	14/Aug/2005	15h00	UTC-4	72°47.057	078°07.508	PNF ↓	742	N/A	100	3	5.0	N/A	1009.3	84	0/10
1	J	Basic	14/Aug/2005	15h05	UTC-4	72°47.039	078°07.505	PNF ↑	746	N/A	100	3	5.0	N/A	1009.3	84	0/10
1	J	Basic	14/Aug/2005	15h11	UTC-4	72°47.038	078°07.501	Phytoplankton Net ↓	746	211	Calm	Calm	4.8	N/A	1009.3	90	0/10
1	J	Basic	14/Aug/2005	15h14	UTC-4	72°47.039	078°07.505	Phytoplankton Net ↑	747	N/A	Calm	Calm	4.8	N/A	1009.3	90	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

Leg	Station ID	Station Type	Local Date	Local Time	UTC to local	Latitude (N)	Longitude (W)	Activity	Depth (m)	Heading (°)	Wind Dir	Wind Speed	Air (ºC)	Water (ºC)	Pr Baro	Hum (%)	Ice
1	J	Basic	14/Aug/2005	15h15	UTC-4	72°47.039	078°07.505	Phytoplankton Net ↓	N/A	226	Calm	Calm	4.8	N/A	1009.3	90	0/10
1	J	Basic	14/Aug/2005	15h25	UTC-4	72°47.017	078°07.577	Phytoplankton Net ↑	754	215	Calm	Calm	5.1	N/A	1009.3	85	0/10
1	100	Full	16/Aug/2005	03h12	UTC-4	76°17.995	071°24.553	CTD-Rosette ↓	665	280	330	9	3.1	N/A	1008.2	98	Bergy
1	100	Full	16/Aug/2005	03h55	UTC-4	76°17.750	071°24.378	CTD-Rosette ↑	777	250	350	10	3.4	N/A	1007.9	98	Bergy
1	100	Full	16/Aug/2005	04h01	UTC-4	76°17.428	071°24.370	Water Sampling ↓	660	320	330	10	3.5	N/A	1007.8	98	Bergy
1	100	Full	16/Aug/2005	04h10	UTC-4	76°17.428	071°24.370	Water Sampling ↑	660	320	330	10	3.5	N/A	1007.8	98	Bergy
1	100	Full	16/Aug/2005	05h30	UTC-4	76°17.924	071°24.525	Phytoplankton Net ↓	676	350	345	10	3.6	N/A	1005.3	97	Bergy
1	100	Full	16/Aug/2005	05h43	UTC-4	76°17.924	071°24.525	Phytoplankton Net ↑	676	350	345	10	3.6	N/A	1005.3	97	Bergy
1	100	Full	16/Aug/2005	05h45	UTC-4	76°17.924	071°24.525	Phytoplankton Net ↓	676	350	345	10	3.6	N/A	1005.3	97	Bergy
1	100	Full	16/Aug/2005	06h04	UTC-4	76°17.924	071°24.525	Phytoplankton Net ↑	676	350	345	10	3.6	N/A	1005.3	97	Bergy
1	100	Full	16/Aug/2005	06h35	UTC-4	76°18.145	071°24.711	Secchi Disk ↓	676	20	5	8	3.5	N/A	1007.7	97	Bergy
1	100	Full	16/Aug/2005	06h37	UTC-4	76°18.138	071°24.694	Secchi Disk ↑	676	20	5	8	3.5	N/A	1007.7	97	Bergy
1	100	Full	16/Aug/2005	07h00	UTC-4	76°18.151	071°24.640	CTD-Rosette ↓	685	10	15	8	3.7	N/A	1007.7	98	Bergy
1	100	Full	16/Aug/2005	08h30	UTC-4	76°18.121	071°25.515	CTD-Rosette ↑	680	20	50	7	3.8	N/A	1007.6	98	Bergy
1	100	Full	16/Aug/2005	09h34	UTC-4	76°17.921	071°25.379	Vertical Net Tow ↓	666	30	90	3	3.7	N/A	1007.6	98	Bergy
1	100	Full	16/Aug/2005	10h16	UTC-4	76°17.885	071°25.395	Vertical Net Tow ↑	666	30	Calm	Calm	3.9	N/A	1007.5	96	Bergy
1	100	Full	16/Aug/2005	10h45	UTC-4	76°17.867	071°25.411	CTD-Rosette ↓ (Test)	666	30	Calm	Calm	4.5	N/A	1007.4	93	Bergy
1	100	Full	16/Aug/2005	11h12	UTC-4	76°17.831	071°25.595	CTD-Rosette ↑ (Test)	666	30	Calm	Calm	4.3	N/A	1007.3	94	Bergy
1	100	Full	16/Aug/2005	11h55	UTC-4	76°17.984	071°25.020	PNF ↓	665	142	180	6	4.0	N/A	1007.3	95	Bergy
1	100	Full	16/Aug/2005	12h01	UTC-4	76°17.965	071°25.146	PNF ↑	665	127	180	6	N/A	N/A	1007.3	95	Bergy
1	100	Full	16/Aug/2005	12h35	UTC-4	76°17.936	071°25.798	CTD-Rosette ↓	678	10	180	5	4.3	N/A	1007.3	94	Bergy
1	100	Full	16/Aug/2005	13h22	UTC-4	76°17.963	071°26.707	CTD-Rosette ↑	674	28	170	9	4.9	N/A	1007.5	91	Bergy
1	100	Full	16/Aug/2005	14h05	UTC-4	76°17.789	071°24.648	Horizontal Net Tow ↓	660	Var	185	9	3.1	N/A	1007.4	90	Bergy
1	100	Full	16/Aug/2005	14h15	UTC-4	76°17.601	071°25.371	Horizontal Net Tow ↑	660	Var	180	9	3.1	N/A	1007.5	99	Bergy
1	100	Full	16/Aug/2005	14h52	UTC-4	76°17.662	071°26.067	CTD-Rosette ↓	667	30	170	9	2.9	N/A	1007.6	99	Bergy
1	100	Full	16/Aug/2005	15h52	UTC-4	76°17.815	071°26.998	CTD-Rosette ↑	673	50	190	9	3.5	N/A	1007.7	96	Bergy
1	100	Full	16/Aug/2005	16h40	UTC-4	76°17.98	071°27.34	RMT ↓	674	296	N/A	N/A	N/A	N/A	N/A	N/A	Bergy
1	100	Full	16/Aug/2005	17h00	UTC-4	76°17.98	071°27.34	RMT ↑	674	Var	200	8	2.9	N/A	1007.8	98	Bergy
1	BA01-05	Mooring	17/Aug/2005	01h30	UTC-4	76°19.611	071°11.797	Mooring BA01-05 Deployed	650	0	Calm	Calm	2.8	N/A	1008.7	94	Bergy
1	100	Full	17/Aug/2005	02h37	UTC-4	76°17.965	071°24.464	CTD-Rosette ↓	678	220	330	3	3.1	N/A	1008.8	93	Bergy
1	100	Full	17/Aug/2005	03h20	UTC-4	76°17.721	071°24.171	CTD-Rosette ↑	674	270	350	6	3.2	N/A	1008.9	93	Bergy
1	102	CTD	17/Aug/2005	04h32	UTC-4	76°17.004	072°06.202	CTD ↓	557	350	300	3	3.1	N/A	1009.1	92	Bergy
1	102	CTD	17/Aug/2005	04h55	UTC-4	76°17.046	072°06.425	CTD ↑	557	350	300	5	3.2	N/A	1009.1	92	Bergy

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	104	Nutrient	17/Aug/2005	06h00	UTC-4	76°16.986	072°47.448	CTD-Rosette ↓	577	340	Calm	Calm	3.3	N/A	1009.3	94	Bergy
1	104	Nutrient	17/Aug/2005	06h50	UTC-4	76°16.979	072°47.851	CTD-Rosette ↑	578	350	280	4	3.7	N/A	1009.4	92	Bergy
1	106	CTD	17/Aug/2005	07h52	UTC-4	76°16.927	072°28.484	CTD ↓	547	340	320	5	3.0	N/A	1009.4	93	Bergy
1	106	CTD	17/Aug/2005	08h15	UTC-4	76°16.583	073°29.138	CTD ↑	547	0	320	5	2.3	N/A	1009.6	98	Bergy
1	108	Basic	17/Aug/2005	09h58	UTC-4	76°15.991	074°35.290	CTD-Rosette ↓	447	335	350	14	2.6	N/A	1009.6	86	Bergy
1	108	Basic	17/Aug/2005	10h33	UTC-4	76°15.888	074°35.553	CTD-Rosette ↑	447	0	350	17	2.7	N/A	1009.6	84	Bergy
1	108	Basic	17/Aug/2005	12h03	UTC-4	76°15.486	074°36.551	Phytoplankton Net ↓	443	30	340	14	2.5	N/A	1009.7	84	Bergy
1	108	Basic	17/Aug/2005	12h08	UTC-4	76°15.489	074°36.404	Phytoplankton Net ↑	443	30	340	14	2.5	N/A	1009.7	84	Bergy
1	108	Basic	17/Aug/2005	12h10	UTC-4	76°15.491	074°36.321	Phytoplankton Net ↓	446	20	340	14	2.5	N/A	1009.7	84	Bergy
1	108	Basic	17/Aug/2005	12h15	UTC-4	76°15.523	074°36.142	Phytoplankton Net ↑	446	23	340	14	2.5	N/A	1009.7	83	Bergy
1	108	Basic	17/Aug/2005	12h16	UTC-4	76°15.575	074°36.050	Phytoplankton Net ↓	446	0	340	14	2.5	N/A	1009.7	83	Bergy
1	108	Basic	17/Aug/2005	12h19	UTC-4	76°15.614	074°34.032	Phytoplankton Net ↑	446	0	340	14	2.5	N/A	1009.7	83	Bergy
1	108	Basic	17/Aug/2005	12h23	UTC-4	76°15.633	074°36.001	PNF ↓	448	0	340	14	2.5	N/A	1009.7	83	Bergy
1	108	Basic	17/Aug/2005	12h28	UTC-4	76°15.623	074°36.044	PNF ↑	448	0	340	14	2.5	N/A	1009.7	83	Bergy
1	108	Basic	17/Aug/2005	12h30	UTC-4	76°15.631	074°36.127	Secchi Disk ↓	448	N/A	340	14	2.5	N/A	1009.7	83	Bergy
1	108	Basic	17/Aug/2005	12h31	UTC-4	76°15.633	074°36.169	Secchi Disk ↑	448	345	340	14	2.5	N/A	1009.7	83	Bergy
1	108	Basic	17/Aug/2005	13h00	UTC-4	76°16.029	074°34.719	CTD-Rosette ↓	450	345	345	14	2.5	N/A	1009.6	83	Bergy
1	108	Basic	17/Aug/2005	13h58	UTC-4	76°16.524	074°36.056	CTD-Rosette ↑	448	290	355	14	2.6	N/A	1009.7	85	Bergy
1	108	Basic	17/Aug/2005	14h22	UTC-4	76°15.722	074°34.671	Horizontal Net Tow ↓	447	50	350	15	2.5	N/A	1009.7	85	Bergy
1	108	Basic	17/Aug/2005	14h35	UTC-4	76°15.786	074°34.588	Horizontal Net Tow ↑	447	N/A	340	18	2.5	N/A	1009.7	84	Bergy
1	108	Basic	17/Aug/2005	15h10	UTC-4	76°15.553	074°35.687	Vertical Net Tow ↓	N/A	N/A	345	15	2.9	N/A	1009.8	81	Bergy
1	108	Basic	17/Aug/2005	16h15	UTC-4	76°15.476	074°35.655	Vertical Net Tow ↑	448	350	330	17	2.9	N/A	1009.8	80	Bergy
1	108	Basic	17/Aug/2005	16h26	UTC-4	76°15.366	074°35.517	CTD-Rosette ↓	447	340	325	16	2.9	N/A	1009.9	81	Bergy
1	108	Basic	17/Aug/2005	17h00	UTC-4	76°15.250	074°35.820	CTD-Rosette ↑	441	326	310	15	3.0	N/A	1010.0	81	Bergy
1	BA02-05	Mooring	17/Aug/2005	18h59	UTC-4	76°16.045	074°34.300	Mooring BA02-05 Deployed	447	308	315	18	2.8	N/A	1009.9	86	Bergy
1	BA02-05	Mooring	17/Aug/2005	N/A	UTC-4	76°16.081	074°34.709	Zodiac Deployed (Triangulation)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Bergy
1	108	Basic	17/Aug/2005	19h45	UTC-4	76°16.862	074°34.135	RMT ↓	455	30	340	19	2.9	N/A	1009.9	84	Bergy
1	108	Basic	17/Aug/2005	19h55	UTC-4	76°17.044	074°33.294	RMT ↑	455	20	340	17	3.0	N/A	1009.8	79	Bergy
1	108	Basic	17/Aug/2005	20h45	UTC-4	76°17.007	074°32.505	Box Core ↓	450	330	310	15	3.0	N/A	1009.7	81	Bergy
1	108	Basic	17/Aug/2005	21h04	UTC-4	76°16.546	074°32.390	Box Core ↑	452	N/A	310	15	3.0	N/A	1009.6	81	Bergy
1	108	Basic	17/Aug/2005	21h16	UTC-4	76°16.520	074°32.330	Box Core ↓	447	330	310	15	3.0	N/A	1009.5	81	Bergy
1	108	Basic	17/Aug/2005	21h34	UTC-4	76°16.485	074°32.224	Box Core ↑	449	330	310	14	3.2	N/A	1009.4	79	Bergy
1	110	CTD	17/Aug/2005	22h59	UTC-4	76°16.190	075°00.396	CTD ↓	443	330	310	11	2.7	N/A	1009.3	88	Bergy

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	110	CTD	17/Aug/2005	23h16	UTC-4	76°17.091	075°01.188	CTD ↑	443	295	310	11	2.7	N/A	1009.2	87	Bergy
1	112	Nutrient	18/Aug/2005	00h35	UTC-4	76°19.441	075°46.999	CTD-Rosette ↓	342	0	290	7	2.4	N/A	1009.2	92	Bergy
1	112	Nutrient	18/Aug/2005	01h20	UTC-4	76°19.400	075°47.402	CTD-Rosette ↑	349	0	290	4	2.5	N/A	1009.0	88	Bergy
1	114	CTD	18/Aug/2005	02h55	UTC-4	76°21.240	076°35.913	CTD ↓	149	280	270	10	2.2	N/A	1008.7	90	Bergy
1	114	CTD	18/Aug/2005	03h05	UTC-4	76°21.237	076°35.452	CTD ↑	149	260	290	10	2.2	N/A	1008.7	90	Bergy
1	116	Full	18/Aug/2005	05h04	UTC-4	76°22.935	077°23.336	CTD-Rosette ↓	352	314	325	6	0.6	N/A	1008.7	95	Bergy
1	116	Full	18/Aug/2005	05h38	UTC-4	76°22.870	077°23.654	CTD-Rosette ↑	356	314	310	6	1.3	N/A	1008.5	91	Bergy
1	116	Full	18/Aug/2005	06h04	UTC-4	76°22.856	077°23.123	RMT ↓	357	Var	N/A	N/A	N/A	N/A	N/A	N/A	Bergy
1	116	Full	18/Aug/2005	06h16	UTC-4	76°22.820	077°23.050	RMT ↑	357	Var	300	10	1.7	N/A	1008.2	88	Bergy
1	116	Full	18/Aug/2005	07h00	UTC-4	76°23.007	077°21.418	Phytoplankton Net ↓	352	Var	265	14	1.3	N/A	1007.8	91	Bergy
1	116	Full	18/Aug/2005	07h11	UTC-4	76°23.052	077°21.303	Phytoplankton Net ↑	349	Var	270	14	1.3	N/A	1007.8	91	Bergy
1	116	Full	18/Aug/2005	07h12	UTC-4	76°23.114	077°21.208	Phytoplankton Net ↓	348	Var	270	10	1.3	N/A	1007.8	91	Bergy
1	116	Full	18/Aug/2005	07h19	UTC-4	76°23.114	077°21.208	Phytoplankton Net ↑	348	Var	270	10	1.3	N/A	1007.8	91	Bergy
1	116	Full	18/Aug/2005	07h40	UTC-4	76°22.941	077°23.947	Secchi Disk ↓	360	273	270	13	1.3	N/A	1007.6	91	Bergy
1	116	Full	18/Aug/2005	07h42	UTC-4	76°22.941	077°23.947	Secchi Disk ↑	360	273	270	13	1.3	N/A	1007.6	91	Bergy
1	116	Full	18/Aug/2005	07h55	UTC-4	76°22.936	077°23.894	CTD-Rosette ↓	360	275	260	14	1.4	N/A	1007.6	91	Bergy
1	116	Full	18/Aug/2005	08h44	UTC-4	76°22.871	077°23.361	CTD-Rosette ↑	357	275	260	13	1.6	N/A	1007.2	91	Bergy
1	116	Full	18/Aug/2005	09h02	UTC-4	76°23.101	077°23.236	Horizontal Net Tow ↓	351	0	260	13	1.4	N/A	1007.0	91	Bergy
1	116	Full	18/Aug/2005	09h14	UTC-4	76°23.455	077°22.903	Horizontal Net Tow ↑	351	0	260	13	1.4	N/A	1007.0	91	Bergy
1	116	Full	18/Aug/2005	09h33	UTC-4	76°23.495	077°22.840	Vertical Net Tow ↓	342	255	260	14	1.6	N/A	1006.7	90	Bergy
1	116	Full	18/Aug/2005	09h56	UTC-4	76°23.414	077°22.928	Vertical Net Tow ↑	347	255	260	15	1.8	N/A	1006.6	90	Bergy
1	116	Full	18/Aug/2005	11h06	UTC-4	76°23.018	077°23.003	CTD-Rosette ↓	345	275	260	12	1.8	N/A	1006.4	90	Bergy
1	116	Full	18/Aug/2005	11h37	UTC-4	76°22.695	077°22.788	CTD-Rosette ↑	362	275	260	14	1.8	N/A	1006.2	89	Bergy
1	116	Full	18/Aug/2005	11h58	UTC-4	76°22.476	077°22.720	PNF ↓	355	330	260	14	1.8	N/A	1006.0	89	Bergy
1	116	Full	18/Aug/2005	12h03	UTC-4	76°22.504	077°22.747	PNF ↑	355	330	260	14	1.8	N/A	1006.0	89	Bergy
1	BA03-05	Mooring	18/Aug/2005	18h45	UTC-4	76°23.061	077°24.138	Mooring BA03-05 Deployed	358	45	355	17	2.1	N/A	1007.1	86	Bergy
1	116	Full	18/Aug/2005	19h38	UTC-4	76°24.853	077°20.920	CTD-Rosette ↓	280	355	0	15	2.4	N/A	1006.8	81	Bergy
1	116	Full	18/Aug/2005	19h50	UTC-4	76°24.836	077°21.371	CTD-Rosette ↑	280	350	00	15	2.4	N/A	1006.8	81	Bergy
1	L 9	DNA	19/Aug/2005	05h01	UTC-4	77°49.966	075°20.726	CTD-Rosette ↓	607	20	00	20	0.7	N/A	1007.5	87	Bergy 1/10
1	L 9	DNA	19/Aug/2005	05h57	UTC-4	77°49.901	075°21.590	CTD-Rosette ↑	605	20	00	22	0.6	N/A	1007.3	85	Bergy
1	L 9	DNA	19/Aug/2005	06h28	UTC-4	77°50.018	075°20.384	Vertical Net Tow ↓	609	30	00	19	0.6	N/A	1007.5	85	Bergy
1	L 9	DNA	19/Aug/2005	06h55	UTC-4	77°50.042	075°20.657	Vertical Net Tow ↑	610	30	00	18	0.5	N/A	1007.2	87	Bergy
1	L 9	DNA	19/Aug/2005	07h23	UTC-4	77°49.918	075°20.513	Horizontal Net Tow ↓	609	90	00	16	1.6	N/A	1007.4	83	Bergy

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	L 9	DNA	19/Aug/2005	07h34	UTC-4	77°50.011	075°19.326	Horizontal Net Tow ↑	611	Var	0	18	0.8	N/A	1007.3	84	Bergy 1/10
1	L 5	DNA	19/Aug/2005	09h50	UTC-4	78°04.719	074°39.682	CTD ↓	673	5	0	19	0.4	N/A	1006.3	88	Bergy 4/10
1	L 5	DNA	19/Aug/2005	10h19	UTC-4	78°04.655	074°40.573	CTD ↑	678	0	355	17	0.4	N/A	1006.2	89	Bergy 4/10
1	L 5	DNA	19/Aug/2005	10h27	UTC-4	78°04.505	074°41.010	On Ice Sampling	672	Var	0	17	0.4	N/A	1006.2	89	Bergy 4/10
1	L 4	DNA	19/Aug/2005	11h29	UTC-4	78°04.963	075°00.187	CTD-Rosette ↓	615	20	0	19	1.3	N/A	1005.9	77	Bergy 4/10
1	L 4	DNA	19/Aug/2005	11h50	UTC-4	78°04.852	075°00.592	CTD-Rosette ↑	617	0	0	19	1.0	N/A	1005.9	78	Bergy 4/10
1	L 1	DNA	19/Aug/2005	14h04	UTC-4	78°20.329	074°39.502	CTD-Rosette ↓	645	0	340	13	1.0	N/A	1005.9	77	Bergy 4/10
1	L 1	DNA	19/Aug/2005	14h28	UTC-4	78°19.929	074°39.216	CTD-Rosette ↑	645	N/A	340	13	1.0	N/A	1005.9	77	Bergy 4/10
1	L 2	DNA	19/Aug/2005	15h12	UTC-4	78°19.693	074°21.355	CTD-Rosette	478	0	350	12	0.6	N/A	1005.6	82	Bergy 4/10
1	L 2	DNA	19/Aug/2005	15h55	UTC-4	78°19.120	074°24.339	CTD-Rosette ↓	478	0	350	12	0.6	N/A	1005.6	82	Bergy 4/10
1	L 2	DNA	19/Aug/2005	16h15	UTC-4	78°18.870	074°25.590	Vertical Net Tow ↓	501	350	350	10	0.5	N/A	1005.6	83	6/10
1	L 2	DNA	19/Aug/2005	16h45	UTC-4	78°18.410	074°27.400	Vertical Net Tow ↑	501	350	350	10	0.5	N/A	1005.6	83	6/10
1	L 2	DNA	19/Aug/2005	17h00	UTC-4	78°18.190	074°27.300	PNF ↓	512	2	350	12	0.8	N/A	1005.6	80	N/A
1	L 2	DNA	19/Aug/2005	17h10	UTC-4	78°18.190	074°27.300	PNF ↑	N/A	2	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	L 2	DNA	19/Aug/2005	17h12	UTC-4	78°18.190	074°27.300	Secchi Disk ↓	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	L 2	DNA	19/Aug/2005	17h40	UTC-4	N/A	N/A	CTD-Rosette (bottom)	521	0	350	13	1.0	N/A	1005.4	77	Bergy 7/10
1	L 2	DNA	19/Aug/2005	18h35	UTC-4	78°17.351	074°30.101	CTD-Rosette ↑	569	325	330	12	1.0	N/A	1005.6	77	Bergy 7/10
1	L 3	DNA	19/Aug/2005	21h23	UTC-4	78°19.113	074°00.267	CTD ↓	643	15	10	16	0.4	N/A	1004.5	82	Bergy 7/10
1	L 3	DNA	19/Aug/2005	21h49	UTC-4	78°18.526	074°01.471	CTD ↑	641	60	10	13	0.1	N/A	1004.4	86	Bergy 7/10
1	L 6	DNA	19/Aug/2005	23h59	UTC-4	78°05.100	074°19.529	CTD ↓	709	0	355	17	1.0	N/A	1003.4	94	Bergy 1/10
1	L 6	DNA	20/Aug/2005	00h23	UTC-4	78°04.886	074°19.597	CTD ↑	695	0	350	16	1.0	N/A	1003.2	81	Bergy 1/10
1	L 6	DNA	20/Aug/2005	00h44	UTC-4	78°04.479	074°18.432	Horizontal Net Tow ↓	708	60	350	18	0.8	N/A	1003.4	84	Bergy 1/10
1	L 6	DNA	20/Aug/2005	00h54	UTC-4	78°04.221	074°18.911	Horizontal Net Tow ↑	715	65	350	17	0.7	N/A	1003.3	83	Bergy 1/10
1	L 11	DNA	20/Aug/2005	02h31	UTC-4	77°49.630	074°41.553	CTD-Rosette ↓	705	0	340	21	0.7	N/A	1002.7	80	Bergy 1/10
1	L 11	DNA	20/Aug/2005	03h15	UTC-4	77°49.420	074°42.484	CTD-Rosette ↑	695	300	350	21	1.1	N/A	1002.5	76	Bergy 1/10
1	L 11	DNA	20/Aug/2005	03h53	UTC-4	77°49.994	074°39°286	CTD-Rosette ↓	704	355	350	20	0.7	N/A	1002.6	78	Bergy 1/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	L 11	DNA	20/Aug/2005	04h28	UTC-4	77°49.828	074°39.888	CTD-Rosette ↑	718	355	350	21	0.9	N/A	1002.6	78	Bergy 1/10
1	L 11	DNA	20/Aug/2005	04h50	UTC-4	77°49.750	074°39.971	Box Core ↓ (Test)	703	10	350	18	0.8	N/A	1002.7	78	Bergy 1/10
1	L 11	DNA	20/Aug/2005	05h05	UTC-4	77°49.579	074°39.658	Box Core ↑ (Test)	701	10	350	21	0.5	N/A	1002.6	79	Bergy 1/10
1	L 10	DNA	20/Aug/2005	06h04	UTC-4	77°49.802	075°00.426	CTD ↓	671	20	350	21	1.2	N/A	1002.7	72	Bergy 2/10
1	L 10	DNA	20/Aug/2005	06h31	UTC-4	77°49.658	075°01.194	CTD ↑	667	20	350	20	1.2	N/A	1002.6	72	Bergy 2/10
1	L 9	DNA	20/Aug/2005	07h05	UTC-4	77°50.020	075°20.677	CTD ↓	608	20	350	18	1.6	N/A	1002.8	70	Bergy 3/10
1	L 9	DNA	20/Aug/2005	07h36	UTC-4	77°49.907	075°21.459	CTD ↑	606	20	350	18	1.7	N/A	1002.8	68	Bergy 3/10
1	L 8	DNA	20/Aug/2005	08h18	UTC-4	77°49.501	075°40.082	CTD ↓	550	0	355	12	1.9	N/A	1002.9	69	Bergy 3/10
1	L 8	DNA	20/Aug/2005	08h41	UTC-4	77°49.508	075°40.616	CTD ↑	535	0	355	8	1.9	N/A	1002.7	68	Bergy 3/10
1	L 7	DNA	20/Aug/2005	10h25	UTC-4	77°49.871	075°59.661	CTD ↓	581	325	20	19	2.5	N/A	1002.2	65	Bergy 7/10
1	L 7	DNA	20/Aug/2005	11h12	UTC-4	77°49.295	075°58.969	CTD ↑	597	325	24	13	2.3	N/A	1001.8	68	Bergy 7/10
1	L 15	DNA	20/Aug/2005	13h08	UTC-4	77°34.581	075°39.606	CTD ↓	653	355	0	18	1.6	N/A	1000.9	74	Bergy 3/10
1	L 15	DNA	20/Aug/2005	13h40	UTC-4	77°34.038	075°39.654	CTD ↑	653	0	0	20	1.8	N/A	1000.9	70	Bergy 3/10
1	L 14	DNA	20/Aug/2005	14h10	UTC-4	77°35.003	075°53.863	CTD ↓	615	5	0	18	1.6	N/A	1000.6	72	Bergy 3/10
1	L 14	DNA	20/Aug/2005	14h35	UTC-4	77°34.864	075°54.600	CTD ↑	603	355	0	18	2.0	N/A	1001.1	69	Bergy 2/10
1	L 16	DNA	20/Aug/2005	15h40	UTC-4	77°35.056	075°19.902	CTD ↓	636	355	345	18	1.4	N/A	1001.0	73	Bergy 4/10
1	L 16	DNA	20/Aug/2005	16h15	UTC-4	77°34.407	075°18.348	CTD ↑	651	325	350	20	1.8	N/A	1001.2	70	Bergy 3/10
1	L 17	DNA	20/Aug/2005	16h55	UTC-4	77°34.604	074°59.250	CTD ↓	664	0	350	16	1.3	N/A	1000.6	74	Bergy 3/10
1	L 17	DNA	20/Aug/2005	17h22	UTC-4	77°34.523	074°57.405	CTD ↑	666	350	350	15	1.3	N/A	1000.8	77	2/10
1	L 24	DNA	20/Aug/2005	18h45	UTC-4	77°20.127	075°01.791	CTD ↓	649	0	340	30	1.6	N/A	1000.7	77	1/10
1	L 24	DNA	20/Aug/2005	19h13	UTC-4	77°19.969	075°03.196	CTD ↑	645	0	335	30	1.2	N/A	1000.9	79	1/10
1	L 24	DNA	20/Aug/2005	19h59	UTC-4	77°20.202	075°04.003	Bioness ↓ (Test)	643	5	335	27	0.9	N/A	1000.7	80	1/10
1	L 24	DNA	20/Aug/2005	20h14	UTC-4	77°20.695	075°04.464	Bioness ↑ (Test)	638	5	335	27	0.8	N/A	1000.8	81	1/10
1	L 23	DNA	20/Aug/2005	21h09	UTC-4	77°20.009	075°21.592	CTD ↓	561	349	335	26	1.2	N/A	1001.5	81	1/10
1	L 23	DNA	20/Aug/2005	21h41	UTC-4	77°20.003	095°23.444	CTD ↑	584	24	355	30	1.3	N/A	1001.5	80	1/10
1	L 22	DNA	20/Aug/2005	22h39	UTC-4	77°19.578	075°43.149	CTD ↓	564	357	355	30	3.0	N/A	1001.3	74	1/10
1	L 22	DNA	20/Aug/2005	23h06	UTC-4	77°20.004	075°46.084	CTD ↑	563	12	355	26	2.7	N/A	1001.7	75	1/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	L 21	DNA	20/Aug/2005	23h40	UTC-4	77°20.050	076°01.192	CTD ↓	540	353	355	23	2.6	N/A	1002.5	76	1/10
1	L 21	DNA	21/Aug/2005	00h25	UTC-4	77°20.256	076°03.859	CTD ↑	530	29	350	21	1.6	N/A	1002.9	81	1/10
1	L 21	DNA	21/Aug/2005	00h43	UTC-4	77°20.267	076°03.816	Vertical Net Tow ↓	532	68	350	21	1.3	N/A	1003.0	82	1/10
1	L 21	DNA	21/Aug/2005	01h14	UTC-4	77°20.152	076°03.950	Vertical Net Tow ↑	536	32	350	23	2.3	N/A	1003.0	74	1/10
1	L 21	DNA	21/Aug/2005	01h37	UTC-4	77°20.150	076°00.218	Horizontal Net Tow ↓	537	60	355	30	2.7	N/A	1002.8	70	1/10
1	L 21	DNA	21/Aug/2005	01h47	UTC-4	77°20.314	076°59.471	Horizontal Net Tow ↑	536	45	355	27	3.1	N/A	1002.8	67	1/10
1	L 20	DNA	21/Aug/2005	02h54	UTC-4	77°19.976	076°20.307	CTD ↓	456	20	360	15	2.6	N/A	1003.9	72	1/10
1	L 20	DNA	21/Aug/2005	03h11	UTC-4	77°19.916	076°20.530	CTD ↑	457	10	355	14	2.5	N/A	1004.0	71	1/10
1	L 19	DNA	21/Aug/2005	03h51	UTC-4	77°20.009	076°39.961	CTD ↓	430	355	320	16	1.7	N/A	1004.6	80	1/10
1	L 19	DNA	21/Aug/2005	04h10	UTC-4	77°20.017	076°40.224	CTD ↑	431	10	320	15	1.4	N/A	1004.7	80	1/10
1	L 18	DNA	21/Aug/2005	04h50	UTC-4	77°19.940	076°59.990	CTD ↓	447	0	315	14	2.2	N/A	1004.9	74	1/10
1	L 18	DNA	21/Aug/2005	05h10	UTC-4	77°19.830	077°00.606	CTD ↑	446	15	305	10	1.6	N/A	1005.3	76	1/10
1	K	CTD	21/Aug/2005	12h08	UTC-4	76°10.057	075°00.650	CTD ↓	397	330	315	17	4.0	N/A	1003.6	77	1/10
1	K	CTD	21/Aug/2005	12h28	UTC-4	76°09.921	075°01.238	CTD ↑	389	340	315	20	3.1	N/A	1003.6	80	1/10
1	BA04-05	Mooring	21/Aug/2005	18h53	UTC-4	75°15.182	074°78.457	Mooring BA04-05 Deployed	477	0	300	7	4.4	N/A	1005.4	82	Bergy
1	BA04-05	Mooring	21/Aug/2005	N/A	UTC-4	75°15.254	074°58.712	Zodiac Deployed (triangulation)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Bergy
1	BA04	Basic	21/Aug/2005	19h37	UTC-4	75°14.408	074°58.684	CTD-Rosette ↓	476	10	320	6	4.1	N/A	1005.4	87	Bergy
1	BA04	Basic	21/Aug/2005	20h20	UTC-4	75°14.248	074°59.009	CTD-Rosette ↑	480	349	330	6	4.3	N/A	1005.4	84	Bergy
1	BA04	Basic	21/Aug/2005	20h24	UTC-4	75°14.255	074°59.033	Phytoplankton Net ↓	483	351	330	6	4.3	N/A	1005.3	84	Bergy
1	BA04	Basic	21/Aug/2005	20h30	UTC-4	75°14.263	074°59.068	Phytoplankton Net ↑	481	344	330	4	4.1	N/A	1005.3	84	Bergy
1	BA04	Basic	21/Aug/2005	20h42	UTC-4	75°14.280	074°59°075	Phytoplankton Net ↓	478	88	330	6	4.1	N/A	1005.3	84	Bergy
1	BA04	Basic	21/Aug/2005	20h47	UTC-4	75°14.282	074°58.505	Phytoplankton Net ↑	477	99	330	7	4.1	N/A	1005.3	84	Bergy
1	BA04	Basic	21/Aug/2005	21h05	UTC-4	75°14.179	074°57.594	Vertical Net Tow ↓	477	354	20	5	3.6	N/A	1005.3	87	Bergy
1	BA04	Basic	21/Aug/2005	21h33	UTC-4	75°14.173	074°58.060	Vertical Net Tow ↑	485	340	50	3	4.0	N/A	1005.3	84	Bergy
1	BA04	Basic	21/Aug/2005	21h54	UTC-4	75°14.144	074°57.225	Horizontal Net Tow ↓	480	140	105	5	3.6	N/A	1005.2	86	Bergy
1	BA04	Basic	21/Aug/2005	22h07	UTC-4	75°14.029	074°56.084	Horizontal Net Tow ↑	487	34	90	5	3.6	N/A	1005.3	87	Bergy
1	BA04	Basic	21/Aug/2005	22h40	UTC-4	75°14.147	074°58.164	Bioness ↓	488	20	120	6	4.6	N/A	1005.3	83	Bergy
1	BA04	Basic	21/Aug/2005	22h58	UTC-4	75°14.083	074°57.528	Bioness ↑	479	305	130	4	3.2	N/A	1005.2	92	Bergy
1	BA04	Basic	21/Aug/2005	23h37	UTC-4	75°14.276	074°58.022	RMT ↓	481	312	140	5	3.3	N/A	1005.1	92	Bergy
1	BA04	Basic	21/Aug/2005	23h50	UTC-4	75°14.375	074°58.302	RMT ↑	480	100	140	9	3.4	N/A	1005.1	89	Bergy
1	BA04	Basic	22/Aug/2005	00h19	UTC-4	75°14.438	074°59.559	CTD-Rosette ↓	470	330	140	6	3.2	N/A	1005.2	89	Bergy
1	BA04	Basic	22/Aug/2005	00h52	UTC-4	75°14.377	074°59.833	CTD-Rosette ↑	475	317	150	7	4.6	N/A	1005.0	83	Bergy
1	BA04	Basic	22/Aug/2005	01h28	UTC-4	75°14.441	075°00.025	Secchi Disk ↓	478	40	160	10	3.8	N/A	1005.0	89	Bergy

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	BA04	Basic	22/Aug/2005	01h30	UTC-4	75°14.443	075°00.033	Secchi Disk ↑	478	35	160	10	3.8	N/A	1005.0	89	Bergy
1	BA04	Basic	22/Aug/2005	02h07	UTC-4	75°14.462	075°00.223	CTD-Rosette ↓	478	35	150	9	3.7	N/A	1004.9	87	Bergy
1	BA04	Basic	22/Aug/2005	02h58	UTC-4	75°14.514	075.00.627	CTD-Rosette ↑	478	48	150	10	3.6	N/A	1005.5	88	Bergy
1	L	Mapping	22/Aug/2005	11h20	UTC-4	74°03.389	077°13.129	CTD ↓	839	120	120	24	4.7	N/A	1001.1	86	Bergy
1	L	Mapping	22/Aug/2005	11h52	UTC-4	74°03.720	077°13.246	CTD ↑	841	125	100	27	4.5	N/A	1001.0	88	Bergy
1	3	Full	22/Aug/2005	18h43	UTC-4	74°02.999	079°56.090	Phytoplankton Net ↓	812	85	60	21	4.8	N/A	996.9	90	0/10
1	3	Full	22/Aug/2005	18h50	UTC-4	74°02.943	079°55.916	Phytoplankton Net ↑	817	85	60	24	4.0	N/A	996.4	93	0/10
1	3	Full	22/Aug/2005	18h55	UTC-4	74°02.895	079°55.684	Phytoplankton Net ↓	817	85	60	27	4.0	N/A	996.4	93	0/10
1	3	Full	22/Aug/2005	19h00	UTC-4	74°02.897	079°55.392	Phytoplankton Net ↑	818	85	60	23	4.0	N/A	996.3	93	0/10
1	3	Full	22/Aug/2005	19h51	UTC-4	74°03.024	079°55.140	CTD-Rosette ↓	819	51	60	27	4.0	N/A	996.0	93	0/10
1	3	Full	22/Aug/2005	20h53	UTC-4	74°03.068	079°55.317	CTD-Rosette ↑	816	79	60	21	3.9	N/A	995.5	94	0/10
1	3	Full	22/Aug/2005	21h13	UTC-4	74°03.061	079°55.323	Vertical Net Tow ↓	809	81	60	23	3.8	N/A	995.6	94	0/10
1	3	Full	22/Aug/2005	21h58	UTC-4	74°03.106	079°55.419	Vertical Net Tow ↑	813	80	70	22	3.7	N/A	995.9	95	0/10
1	3	Full	22/Aug/2005	22h15	UTC-4	74°03.117	079°55.153	Horizontal Net Tow ↓	812	102	70	25	3.6	N/A	995.9	95	0/10
1	3	Full	22/Aug/2005	22h29	UTC-4	74°03.011	079°53.493	Horizontal Net Tow ↑	814	101	70	27	3.5	N/A	995.6	95	0/10
1	3	Full	22/Aug/2005	22h50	UTC-4	74°03.046	079°53.212	Vertical Net Tow ↓	811	84	70	22	3.5	N/A	995.6	96	0/10
1	3	Full	22/Aug/2005	23h35	UTC-4	74°03.152	079°53.341	Vertical Net Tow ↑	814	87	60	21	3.4	N/A	995.4	97	0/10
1	3	Full	23/Aug/2005	00h13	UTC-4	74°03.373	079°53.805	CTD-Rosette ↓	804	83	70	20	3.5	N/A	995.6	99	0/10
1	3	Full	23/Aug/2005	00h51	UTC-4	74°03.452	079°54.194	CTD-Rosette ↑	804	83	60	23	3.5	N/A	995.0	97	0/10
1	3	Full	23/Aug/2005	00h52	UTC-4	74°03.387	079°54.244	Water Sampling ↓	802	86	60	23	3.5	N/A	995.0	97	0/10
1	3	Full	23/Aug/2005	01h03	UTC-4	74°03.392	079°24.194	Water Sampling ↑	802	88	65	22	3.5	N/A	994.9	97	0/10
1	3	Full	23/Aug/2005	N/A	UTC-4	N/A	N/A	Piston Core ↓	811	N/A	50	20	3.5	N/A	994.9	98	0/10
1	3	Full	23/Aug/2005	N/A	UTC-4	N/A	N/A	Piston Core ↑	811	N/A	50	18	3.5	N/A	994.9	98	0/10
1	3	Full	23/Aug/2005	06h30	UTC-4	74°02.949	079°56.411	Box Core ↓	811	70	45	19	3.5	N/A	994.9	98	0/10
1	3	Full	23/Aug/2005	07h02	UTC-4	74°02.886	079°55.904	Box Core ↑	816	65	45	22	3.4	N/A	995.2	99	0/10
1	3	Full	23/Aug/2005	07h52	UTC-4	74.02°885	079°55.984	PNF ↓	814	60	45	20	3.7	N/A	995.2	99	0/10
1	3	Full	23/Aug/2005	08h05	UTC-4	74°02.419	079°53.575	PNF ↑	815	50	45	20	3.5	N/A	995.2	99	0/10
1	3	Full	23/Aug/2005	08h15	UTC-4	74°02.426	079°53.586	Secchi Disk ↓	816	50	45	20	3.4	N/A	995.1	99	0/10
1	3	Full	23/Aug/2005	08h18	UTC-4	74°02.426	079°53.586	Secchi Disk ↑	816	50	45	20	3.4	N/A	995.1	99	0/10
1	3	Full	23/Aug/2005	08h40	UTC-4	74°02.440	079°53.353	CTD-Rosette ↓	814	50	45	19	3.5	N/A	995.0	99	0/10
1	3	Full	23/Aug/2005	09h47	UTC-4	74°02.457	079°53.392	CTD-Rosette ↑	816	55	45	18	3.5	N/A	995.2	99	0/10
1	M	CTD	23/Aug/2005	14h46	UTC-4	74°11.783	083°20.698	CTD ↓	700	100	90	27	3.1	N/A	995.6	88	0/10
1	M	CTD	23/Aug/2005	15h23	UTC-4	74°12.163	083°21.358	CTD ↑	700	100	95	28	3.0	N/A	999.6	81	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	N	CTD	23/Aug/2005	22h25	UTC-4	74°18.087	088°29.255	CTD ↓	346	90	55	13	2.0	N/A	998.7	99	0/10
1	N	CTD	23/Aug/2005	22h56	UTC-4	74°18.127	088°29.299	CTD ↑	347	84	55	14	2.0	N/A	998.5	99	0/10
1	4	Full	24/Aug/2005	03h46	UTC-4	74°16.007	091°11.816	CTD-Rosette ↓	334	Var	Calm	Calm	1.8	N/A	999.6	99	0/10
1	4	Full	24/Aug/2005	04h15	UTC-4	74°15.988	091°11.953	CTD-Rosette ↑	342	Var	Calm	Calm	1.9	N/A	1000.0	99	0/10
1	4	Full	24/Aug/2005	04h46	UTC-4	74°15.990	091°12.007	Vertical Net Tow ↓	342	20	Calm	Calm	1.8	N/A	1000.2	99	0/10
1	4	Full	24/Aug/2005	05h05	UTC-4	74°16.021	091°17.058	Vertical Net Tow ↑	334	20	Calm	Calm	1.8	N/A	1000.3	99	0/10
1	4	Full	24/Aug/2005	05h27	UTC-4	74.16.011	091°11.787	Horizontal Net Tow ↓	334	Var	Calm	Calm	1.7	N/A	1000.5	99	0/10
1	4	Full	24/Aug/2005	05h36	UTC-4	74°16.045	091°12.192	Horizontal Net Tow ↑	342	Var	Calm	Calm	2.0	N/A	1000.4	99	0/10
1	4	Full	24/Aug/2005	06h05	UTC-4	74°15.843	091°11.571	Bioness ↓	335	Var	Calm	Calm	1.7	N/A	1000.5	99	0/10
1	4	Full	24/Aug/2005	06h23	UTC-4	74°15.732	091°11.416	Bioness ↑	335	Var	Calm	Calm	1.7	N/A	1000.5	99	0/10
1	4	Full	24/Aug/2005	07h00	UTC-4	74°15.832	091°10.400	RMT ↓	333	Var	300	8	1.1	N/A	1000.7	99	0/10
1	4	Full	24/Aug/2005	07h08	UTC-4	74°15.698	091°10.621	RMT ↑	335	Var	300	8	1.4	N/A	1000.8	99	0/10
1	4	Full	24/Aug/2005	08h09	UTC-4	74°15.496	091°10.327	Horizontal Net Tow ↓	340	336	300	13	1.3	N/A	1001.2	99	0/10
1	4	Full	24/Aug/2005	08h15	UTC-4	74°15.552	091°11.050	Horizontal Net Tow ↑	333	194	300	11	1.3	N/A	1001.2	99	0/10
1	4	Full	24/Aug/2005	08h22	UTC-4	74°15.454	091°11.283	Secchi Disk ↓	335	305	300	11	1.5	N/A	1001.2	99	0/10
1	4	Full	24/Aug/2005	08h25	UTC-4	74°15.455	091°11.286	Secchi Disk ↑	335	306	300	11	1.5	N/A	1001.2	99	0/10
1	4	Full	24/Aug/2005	08h37	UTC-4	74°15.451	091°11.316	CTD-Rosette ↓	335	305	285	12	1.6	N/A	1001.3	99	0/10
1	4	Full	24/Aug/2005	09h26	UTC-4	74°15.476	091°11.250	CTD-Rosette ↑	334	308	290	12	1.3	N/A	1001.3	99	0/10
1	4	Full	24/Aug/2005	09h33	UTC-4	74°15.495	091°11.245	Phytoplankton Net ↓	333	309	290	13	1.3	N/A	1001.4	99	0/10
1	4	Full	24/Aug/2005	09h39	UTC-4	74°15.502	091°11.227	Phytoplankton Net ↑	331	307	290	14	1.4	N/A	1001.4	99	0/10
1	4	Full	24/Aug/2005	09h41	UTC-4	74°15.519	091°11.273	Phytoplankton Net ↓	332	295	290	14	1.4	N/A	1001.4	99	0/10
1	4	Full	24/Aug/2005	09h46	UTC-4	74°15.552	091°11.372	Phytoplankton Net ↑	340	306	280	15	1.4	N/A	1001.4	99	0/10
1	4	Full	24/Aug/2005	11h00	UTC-4	74°16.230	091°09.432	CTD-Rosette ↓	333	306	285	14	1.3	N/A	1001.5	99	0/10
1	4	Full	24/Aug/2005	11h30	UTC-4	74°16.249	091°09.116	CTD-Rosette ↑	336	310	285	16	1.2	N/A	1001.6	99	0/10
1	4	Full	24/Aug/2005	11h35	UTC-4	74°16.310	091°09.064	PNF ↓	337	322	285	16	1.2	N/A	1001.6	99	0/10
1	4	Full	24/Aug/2005	11h41	UTC-4	74°16.309	091°08.531	PNF ↑	337	298	280	15	1.2	N/A	1001.6	99	0/10
1	4	Full	24/Aug/2005	12h27	UTC-4	74°16.632	091°07.688	CTD-Rosette ↓	339	305	290	15	1.2	N/A	1001.9	99	0/10
1	4	Full	24/Aug/2005	13h00	UTC-4	74°16.631	091°06.645	CTD-Rosette ↑	340	298	290	16	1.4	N/A	1001.9	99	0/10
1	4	Full	24/Aug/2005	15h25	UTC-4	74°18.242	091°00.175	Midwater Trawl ↓	213	N/A	280	11	1.1	N/A	1002.5	99	0/10
1	4	Full	24/Aug/2005	16h00	UTC-4	74°18.300	090°58.500	Midwater Trawl (towing)	235	N/A	285	15	1.2	N/A	1002.6	99	0/10
1	4	Full	24/Aug/2005	16h45	UTC-4	74°18.465	090°57.600	Midwater Trawl (towing)	213	N/A	285	15	1.2	N/A	1002.6	99	0/10
1	4	Full	24/Aug/2005	20h08	UTC-4	74°20.801	090°51.881	Midwater Trawl ↑	215	90	325	14	2.8	N/A	1003.9	89	0/10
1	4	Full	24/Aug/2005	22h29	UTC-4	74°16.55	091°05.048	Piston Core ↓	350	300	320	16	2.2	N/A	1005.1	94	0/10

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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					
1	4	Full	24/Aug/2005	22h45	UTC-4	74°16.163	091°04.598	Piston Core ↑	340	306	320	15	2.2	N/A	1005.2	95	0/10
1	4	Full	24/Aug/2005	23h39	UTC-4	74°16.168	091°04.450	Box Core ↓	340	304	295	14	2.0	N/A	1005.8	95	0/10
1	4	Full	25/Aug/2005	00h00	UTC-4	74°16.277	091°04.631	Box Core ↑	340	301	295	18	1.7	N/A	1005.8	98	0/10
1	4	Full	25/Aug/2005	01h36	UTC-4	74°16.068	091°06.309	Piston Core ↓	338	307	315	16	1.8	N/A	1006.4	99	0/10
1	4	Full	25/Aug/2005	01h42	UTC-4	74°16.047	091°06.381	Piston Core (Bottom)	347	314	320	18	1.6	N/A	1006.6	99	0/10
1	4	Full	25/Aug/2005	01h48	UTC-4	74°16.052	091°06.385	Piston Core ↑	347	317	315	18	1.6	N/A	1006.6	99	0/10
1	N/A	CTD	25/Aug/2005	08h35	UTC-4	74°18.963	093°50.644	CTD ↓	165	350	255	12	2.0	N/A	1010.2	99	0/10
1	N/A	CTD	25/Aug/2005	08h47	UTC-4	74°19.000	093°50.500	CTD ↑	167	350	255	12	2.0	N/A	1010.2	99	0/10
1	O	CTD	25/Aug/2005	18h45	UTC-4	73°19.060	096°20.600	CTD ↓	222	100	185	11	0.5	N/A	1007.2	96	1/10
1	O	CTD	25/Aug/2005	18h56	UTC-4	73°19.060	096°20.600	CTD ↑	222	100	185	11	0.5	N/A	1007.2	96	1/10
1	P	Nutrient	26/Aug/2005	00h49	UTC-4	72°19.854	096°17.951	CTD ↓	458	280	45	8	1.0	N/A	1004.6	99	1/10
1	P	Nutrient	26/Aug/2005	01h37	UTC-4	72°19.860	096°18.074	CTD ↑	456	312	65	10	1.6	N/A	1004.3	93	1/10
1	6	Full	27/Aug/2005	06h18	UTC-4	69°10.022	100°41.944	CTD-Rosette ↓	65	120	115	13	1.9	N/A	1008.4	99	0/10
1	6	Full	27/Aug/2005	06h39	UTC-4	69°10.124	100°41.808	CTD-Rosette ↑	65	120	115	14	2.0	N/A	1008.4	99	0/10
1	6	Full	27/Aug/2005	07h07	UTC-4	69°10.143	100°41.828	Vertical Net Tow ↓	65	140	115	14	2.0	N/A	1008.2	99	0/10
1	6	Full	27/Aug/2005	07h12	UTC-4	69°10.117	100°41.836	Vertical Net Tow ↑	65	140	110	17	2.2	N/A	1008.0	99	0/10
1	6	Full	27/Aug/2005	07h25	UTC-4	69°10.049	100°42.025	Horizontal Net Tow ↓	65	Var	110	17	2.0	N/A	1008.2	99	0/10
1	6	Full	27/Aug/2005	07h34	UTC-4	69°09.940	100°41.900	Horizontal Net Tow ↑	65	Var	110	18	2.0	N/A	1008.2	99	0/10
1	6	Full	27/Aug/2005	07h52	UTC-4	69°10.133	100°42.034	Secchi Disk ↓	68	116	110	15	2.2	N/A	1008.2	99	0/10
1	6	Full	27/Aug/2005	07h54	UTC-4	69°10.148	100°42.029	Secchi Disk ↑	68	106	110	16	2.2	N/A	1008.2	99	0/10
1	6	Full	27/Aug/2005	08h35	UTC-4	69°10.274	100°41.629	CTD-Rosette ↓	68	155	115	19	1.8	N/A	1008.1	99	0/10
1	6	Full	27/Aug/2005	09h03	UTC-4	69°10.276	100°42.089	CTD-Rosette ↑	68	204	115	19	1.4	N/A	1008.0	99	0/10
1	6	Full	27/Aug/2005	09h31	UTC-4	69°10.379	100°42.175	Bioness ↓	71	358	115	15	1.5	N/A	1007.7	99	0/10
1	6	Full	27/Aug/2005	09h44	UTC-4	69°11.105	100°42.044	Bioness ↑	78	14	115	17	1.8	N/A	1007.8	99	0/10
1	6	Full	27/Aug/2005	10h08	UTC-4	69°11.290	100°42.289	RMT ↓	72	200	115	17	1.3	N/A	1007.5	99	0/10
1	6	Full	27/Aug/2005	10h16	UTC-4	69°11.185	100°42.246	RMT ↑	74	175	115	21	1.2	N/A	1007.5	99	0/10
1	6	Full	27/Aug/2005	10h37	UTC-4	69°11.111	100°42.476	Horizontal Net Tow ↓	72	199	125	19	1.2	N/A	1007.1	99	0/10
1	6	Full	27/Aug/2005	10h44	UTC-4	69°10.571	100°42.486	Horizontal Net Tow ↑	70	179	125	19	1.3	N/A	1007.1	99	0/10
1	6	Full	27/Aug/2005	11h20	UTC-4	69°11.004	100°42.387	Secchi Disk ↓	72	174	115	23	1.6	N/A	1006.9	99	0/10
1	6	Full	27/Aug/2005	11h34	UTC-4	69°11.031	100°42.345	Secchi Disk ↑	72	205	115	20	1.6	N/A	1006.9	99	0/10
1	6	Full	27/Aug/2005	11h40	UTC-4	69°11.031	100°42.375	CTD-Rosette ↓	72	179	115	23	1.9	N/A	1006.6	99	0/10
1	6	Full	27/Aug/2005	12h06	UTC-4	69°11.104	100°42.741	CTD-Rosette ↑	71	209	115	19	1.9	N/A	1006.8	99	0/10
1	6	Full	27/Aug/2005	12h14	UTC-4	69°11.179	100°42.867	PNF ↓	72	203	115	21	2.0	N/A	1006.7	99	1/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	6	Full	27/Aug/2005	12h18	UTC-4	69°11.196	100°42.931	PNF ↑	71	176	115	23	2.2	N/A	1006.5	99	1/10
1	6	Full	27/Aug/2005	13h08	UTC-4	69°10.040	100°41.890	Phytoplankton Net ↓	64	181	120	25	2.6	N/A	1005.9	99	1/10
1	6	Full	27/Aug/2005	13h18	UTC-4	69°10.086	100°42.090	Phytoplankton Net ↑	65	179	120	24	2.6	N/A	1006.0	99	1/10
1	6	Full	27/Aug/2005	13h21	UTC-4	69°10.092	100°42.145	Phytoplankton Net ↓	65	186	120	22	2.6	N/A	1006.0	99	1/10
1	6	Full	27/Aug/2005	13h24	UTC-4	69°10.094	100°42.198	Phytoplankton Net ↑	65	189	120	20	2.6	N/A	1006.0	99	1/10
1	6	Full	27/Aug/2005	14h05	UTC-4	69°09.967	100°41.719	Box Core ↓	61	165	110	25	2.8	N/A	1005.8	99	1/10
1	6	Full	27/Aug/2005	14h09	UTC-4	69°09.966	100°41.707	Box Core ↑	61	160	110	25	2.8	N/A	1005.8	99	1/10
1	6	Full	27/Aug/2005	15h00	UTC-4	69°09.963	100°41.711	Piston Core ↓	61	165	120	21	3.2	N/A	1004.7	99	1/10
1	6	Full	27/Aug/2005	15h04	UTC-4	69°09.956	100°41.847	Piston Core (Bottom)	61	160	120	24	3.2	N/A	1004.7	99	1/10
1	6	Full	27/Aug/2005	15h13	UTC-4	69°09.948	100°41.926	Piston Core ↑	63	213	115	23	3.2	N/A	1004.9	99	1/10
1	6	Full	27/Aug/2005	18h12	UTC-4	69°09.963	100°41.719	Piston Core (Bottom)	61	110	115	25	4.7	N/A	1002.7	99	1/10
1	R	CTD	28/Aug/2005	04h33	UTC-4	69°02.068	101°13.877	CTD ↓	70	215	210	9	6.4	N/A	999.6	97	1/10
1	R	CTD	28/Aug/2005	04h37	UTC-4	69°02.098	101°13.793	CTD ↑	70	210	210	9	6.4	N/A	999.6	97	1/10
1	S	CTD	28/Aug/2005	06h48	UTC-4	68°41.178	103°59.619	CTD ↓	105	254	225	27	5.1	N/A	998.5	90	0/10
1	S	CTD	28/Aug/2005	07h58	UTC-4	68°41.140	103°59.476	CTD ↑	105	254	225	28	5.1	N/A	998.9	89	0/10
1	7	Full	29/Aug/2005	23h49	UTC-4	69°00.024	106°34.634	Vertical Net Tow ↓	118	28	360	18	2.7	N/A	1013.1	83	0/10
1	7	Full	29/Aug/2005	23h58	UTC-4	69°00.009	106°34.059	Vertical Net Tow ↑	114	30	360	19	2.6	N/A	1013.0	82	0/10
1	7	Full	30/Aug/2005	00h43	UTC-4	68°59.857	106°34.040	CTD-Rosette ↓	118	287	360	14	2.9	N/A	1013.3	80	0/10
1	7	Full	30/Aug/2005	01h03	UTC-4	69°59.748	106°34.019	CTD-Rosette ↑	114	271	15	14	3.0	N/A	1013.3	82	0/10
1	7	Full	30/Aug/2005	01h57	UTC-4	69°00.026	106°34.849	Horizontal Net Tow ↓	118	40	25	12	3.0	N/A	1013.3	83	0/10
1	7	Full	30/Aug/2005	02h10	UTC-4	69°00.286	106°34.299	Horizontal Net Tow ↑	120	40	20	15	2.2	N/A	1013.2	86	0/10
1	7	Full	30/Aug/2005	02h26	UTC-4	69°00.372	106°34.996	Bioness ↓	117	Var	21	13	2.1	N/A	1013.2	86	0/10
1	7	Full	30/Aug/2005	02h47	UTC-4	69°00.421	106°35.117	Bioness ↑	117	Var	10	15	2.1	N/A	1013.6	90	0/10
1	7	Full	30/Aug/2005	02h55	UTC-4	68°59.969	106°34.934	Water Sampling ↓↑	117	Var	10	15	1.9	N/A	1013.4	91	0/10
1	7	Full	30/Aug/2005	03h33	UTC-4	69°00.036	106°34.897	RMT ↓	119	Var	15	11	2.0	N/A	1013.7	92	0/10
1	7	Full	30/Aug/2005	03h44	UTC-4	68°59.986	106°34.367	RMT ↑	119	Var	25	13	2.1	N/A	1013.9	91	0/10
1	7	Full	30/Aug/2005	04h30	UTC-4	69°00.040	106°34.358	CTD-Rosette ↓	119	220	25	9	4.4	N/A	1014.0	82	0/10
1	7	Full	30/Aug/2005	04h53	UTC-4	69°00.015	106°34.011	CTD-Rosette ↑	119	220	25	9	2.1	N/A	1014.1	88	0/10
1	7	Full	30/Aug/2005	05h26	UTC-4	68°59.996	106°34.877	Phytoplankton Net ↓	120	250	50	10	2.5	N/A	1014.1	87	0/10
1	7	Full	30/Aug/2005	05h47	UTC-4	69°00.067	106.34.971	Phytoplankton Net ↑	120	250	40	11	2.3	N/A	1014.0	89	0/10
1	7	Full	30/Aug/2005	05h50	UTC-4	69°00.054	106°35.009	Phytoplankton Net ↓	120	230	40	11	2.3	N/A	1014.0	89	0/10
1	7	Full	30/Aug/2005	05h53	UTC-4	68°59.957	106°35.217	Phytoplankton Net ↑	120	230	40	10	2.4	N/A	1013.9	87	0/10
1	7	Full	30/Aug/2005	06h23	UTC-4	68°59.867	106°34.897	Secchi Disk ↓↑	116	240	40	12	3.0	N/A	1013.9	82	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	7	Full	30/Aug/2005	06h40	UTC-4	68°59.872	106°34.839	CTD-Rosette ↓	117	230	40	10	4.7	N/A	1014.0	75	0/10
1	7	Full	30/Aug/2005	07h10	UTC-4	68°59.855	106°34.494	CTD-Rosette ↑	117	230	25	12	2.0	N/A	1014.4	82	0/10
1	7	Full	30/Aug/2005	08h15	UTC-4	69°00.002	106°34.541	Box Core ↓	117	242	40	9	3.0	N/A	1014.6	80	0/10
1	7	Full	30/Aug/2005	08h20	UTC-4	69°00.014	106°34.525	Box Core ↑	117	242	40	11	3.4	N/A	1014.6	80	0/10
1	7	Full	30/Aug/2005	09h35	UTC-4	68°59.552	106°34.413	Piston Core ↓	118	246	40	10	2.2	N/A	1014.9	86	0/10
1	7	Full	30/Aug/2005	09h57	UTC-4	68°59.536	106°34.378	Piston Core ↑	118	245	40	10	1.4	N/A	1014.9	88	0/10
1	7	Full	30/Aug/2005	11h27	UTC-4	68°59.453	106°34.271	Piston Core ↓	112	244	30	11	1.2	N/A	1014.7	89	0/10
1	7	Full	30/Aug/2005	11h50	UTC-4	68°59.776	106°34.487	Piston Core ↑	113	249	30	10	1.2	N/A	1014.6	89	0/10
1	7	Full	30/Aug/2005	12h08	UTC-4	68°59.724	106°34.330	PNF ↓	113	246	35	11	3.0	N/A	1014.5	83	0/10
1	7	Full	30/Aug/2005	12h11	UTC-4	68°59.723	106°34.326	PNF ↑	113	248	35	11	3.0	N/A	1014.5	83	0/10
1	T	CTD	31/Aug/2005	01h43	UTC-4	68°35.547	109°28.142	CTD ↓	151	286	Calm	Calm	1.5	N/A	1014.4	90	0/10
1	T	CTD	31/Aug/2005	01h51	UTC-4	68°35.529	109°28.161	CTD ↑	150	282	11	11	2.0	N/A	1014.2	88	0/10
1	U	CTD	31/Aug/2005	06h40	UTC-4	68°25.171	112°08.276	CTD ↓	206	190	115	6	1.4	N/A	1014.4	91	0/10
1	U	CTD	31/Aug/2005	06h50	UTC-4	68°25.160	112°08.067	CTD ↑	206	190	115	5	1.4	N/A	1014.4	90	0/10
1	V	CTD	31/Aug/2005	20h12	UTC-4	69°42.116	118°23.381	CTD ↓	503	303	300	15	2.7	N/A	1015.3	93	0/10
1	V	CTD	31/Aug/2005	20h32	UTC-4	69°42.144	118°23.295	CTD ↑	503	326	300	19	2.6	N/A	1015.4	94	0/10
1	CA18-04	Mooring	01/Sep/2005	06h14	UTC-4	70°39.977	122°58.470	CTD ↓	541	290	300	11	-0.7	N/A	1019.9	89	0/10
1	CA18-04	Mooring	01/Sep/2005	06h36	UTC-4	70°39.925	122°58.503	CTD ↑	550	290	295	9	-0.5	N/A	1020.0	84	0/10
1	CA18-04	Mooring	01/Sep/2005	08h03	UTC-4	70°39.498	122°57.577	Mooring CA18-04 Recovered	553	230	285	10	-0.6	N/A	1020.0	87	0/10
1	CA20-04	Mooring	01/Sep/2005	13h40	UTC-4	70°20.409	126°20.597	CTD ↓	254	254	Calm	Calm	-0.3	N/A	1020.2	91	N/A
1	CA20-04	Mooring	01/Sep/2005	13h51	UTC-4	70°20.393	126°20.544	CTD ↑	254	256	Calm	Calm	0.5	N/A	1020.3	91	N/A
1	CA20-04	Mooring	01/Sep/2005	14h10	UTC-4	70°20.391	126°21.309	Mooring CA20-04 Recovered	265	260	Calm	Calm	1.1	N/A	1020.2	88	0/10
1	CA05-04	Mooring	01/Sep/2005	21h42	UTC-4	71°24.501	127°23.284	CTD ↓	304	0	Calm	Calm	-0.3	N/A	1017.4	83	4/10
1	CA05-04	Mooring	01/Sep/2005	21h55	UTC-4	71°24.498	127°23.296	CTD ↑	304	34	135	5	0.2	N/A	1017.3	81	4/10
1	CA05-04	Mooring	01/Sep/2005	N/A	UTC-4	71°25.148	127°23.777	Zodiac Deployed (Mooring CA05-04 recovery failed)	260	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	211	Nutrient	01/Sep/2005	22h45	UTC-4	71°22.386	127°29.436	CTD-Rosette ↓	272	323	125	8	-1.6	N/A	1016.7	92	4/10
1	211	Nutrient	01/Sep/2005	23h19	UTC-4	71°22.374	127°30.272	CTD-Rosette ↑	272	32	135	7	-0.3	N/A	1016.4	90	4/10
1	210	Nutrient	01/Sep/2005	23h48	UTC-4	71°20.338	127°32.280	CTD-Rosette ↓	239	80	115	6	-1.4	N/A	1016.1	95	4/10
1	210	Nutrient	01/Sep/2005	23h22	UTC-5	71°20.283	127°32.206	CTD-Rosette ↑	234	98	95	6	-1.2	N/A	1015.8	97	4/10
1	209	Nutrient	01/Sep/2005	23h59	UTC-5	71°18.418	127°41.904	CTD-Rosette ↓	179	80	125	9	-0.6	N/A	1015.1	97	4/10
1	209	Nutrient	02/Sep/2005	00h29	UTC-5	71°18.425	127°42.142	CTD-Rosette ↑	179	85	135	10	-0.2	N/A	1015.0	96	4/10
1	208	Nutrient	02/Sep/2005	01h06	UTC-5	71°16.454	127°48.447	CTD-Rosette ↓	145	86	150	11	0.8	N/A	1014.3	91	4/10
1	208	Nutrient	02/Sep/2005	01h30	UTC-5	71°16.528	127°48.480	CTD-Rosette ↑	146	89	145	10	1.0	N/A	1014.2	92	4/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	207	Nutrient	02/Sep/2005	02h08	UTC-5	71°14.927	127°54.529	CTD-Rosette ↓	109	125	150	12	1.3	N/A	1013.7	93	4/10
1	207	Nutrient	02/Sep/2005	02h29	UTC-5	71°15.049	127°54.504	CTD-Rosette ↑	109	117	160	12	1.8	N/A	1013.5	90	4/10
1	206	Nutrient	02/Sep/2005	04h08	UTC-5	71°12.828	128°00.455	CTD-Rosette ↓	80	160	140	17	2.7	N/A	1011.8	91	0/10
1	206	Nutrient	02/Sep/2005	04h22	UTC-5	71°12.860	128°00.403	CTD-Rosette ↑	82	160	140	19	2.7	N/A	1011.6	91	0/10
1	205	Nutrient	02/Sep/2005	04h49	UTC-5	71°10.799	128°06.200	CTD-Rosette ↓	70	155	140	19	2.8	N/A	1011.0	91	0/10
1	205	Nutrient	02/Sep/2005	05h04	UTC-5	71°10.805	128°06.226	CTD-Rosette ↑	70	155	140	19	2.9	N/A	1011.0	91	0/10
1	204	Basic	02/Sep/2005	05h48	UTC-5	71°08.821	128°12.247	CTD-Rosette ↓	64	155	140	19	3.0	N/A	1009.9	93	0/10
1	204	Basic	02/Sep/2005	06h08	UTC-5	71°08.921	128°12.040	CTD-Rosette ↑	64	155	145	20	3.2	N/A	1009.8	93	0/10
1	204	Basic	02/Sep/2005	06h29	UTC-5	71°08.805	128°12.062	Horizontal Net Tow ↓	64	Var	150	20	3.4	N/A	1009.5	93	0/10
1	204	Basic	02/Sep/2005	06h38	UTC-5	71°09.009	128°11.772	Horizontal Net Tow ↑	64	Var	150	19	3.7	N/A	1008.4	94	0/10
1	204	Basic	02/Sep/2005	06h45	UTC-5	71°09.048	128°11.792	Horizontal Net Tow ↓	64	Var	150	19	3.7	N/A	1008.4	94	0/10
1	204	Basic	02/Sep/2005	06h58	UTC-5	71°09.048	128°11.792	Horizontal Net Tow ↑	64	Var	150	19	3.7	N/A	1008.4	94	0/10
1	204	Basic	02/Sep/2005	07h02	UTC-5	71°09.136	128°12.227	Vertical Net Tow ↓	65	347	150	17	3.8	N/A	1009.2	94	0/10
1	204	Basic	02/Sep/2005	07h07	UTC-5	71°09.138	128°12.200	Vertical Net Tow ↑	65	347	150	17	7.7	N/A	1009.1	80	0/10
1	204	Basic	02/Sep/2005	07h49	UTC-5	71°08.837	128°12.046	CTD-Rosette ↓	64	168	180	10	4.3	N/A	1008.7	95	0/10
1	204	Basic	02/Sep/2005	08h12	UTC-5	71°08.519	128°11.493	CTD-Rosette ↑	64	111	190	11	4.8	N/A	1008.4	92	0/10
1	204	Basic	02/Sep/2005	08h18	UTC-5	71°08.500	128°11.258	Phytoplankton Net ↓	65	190	190	11	5.0	N/A	1008.2	93	0/10
1	204	Basic	02/Sep/2005	08h47	UTC-5	71°08.475	128°11.271	Phytoplankton Net ↑	65	216	210	11	5.0	N/A	1007.9	91	0/10
1	204	Basic	02/Sep/2005	08h50	UTC-5	71°08.473	128°11.283	Phytoplankton Net ↓	65	218	210	11	5.0	N/A	1007.9	91	0/10
1	204	Basic	02/Sep/2005	08h56	UTC-5	71°08.448	128°11.370	Phytoplankton Net ↑	65	223	200	11	4.9	N/A	1007.9	90	0/10
1	203	Nutrient	02/Sep/2005	09h25	UTC-5	71°06.467	128°18.222	CTD-Rosette ↓	58	224	210	10	4.5	N/A	1007.6	90	0/10
1	203	Nutrient	02/Sep/2005	09h37	UTC-5	71°06.483	128°18.304	CTD-Rosette ↑	58	218	210	11	4.4	N/A	1007.6	90	0/10
1	202	Nutrient	02/Sep/2005	10h03	UTC-5	71°04.537	128°24.390	CTD-Rosette ↓	54	215	205	12	4.2	N/A	1007.3	90	0/10
1	202	Nutrient	02/Sep/2005	10h16	UTC-5	71°04.559	128°24.496	CTD-Rosette ↑	54	205	195	12	4.2	N/A	1007.3	89	0/10
1	201	Nutrient	02/Sep/2005	10h40	UTC-5	71°02.566	128°30.285	CTD-Rosette ↓	43	200	195	14	4.2	N/A	1006.8	90	0/10
1	201	Nutrient	02/Sep/2005	10h53	UTC-5	71°02.566	128°30.463	CTD-Rosette ↑	40	187	200	13	4.0	N/A	1006.9	90	0/10
1	CA05-04	Mooring	02/Sep/2005	16h32	UTC-5	71°17.060	127°31.812	Zodiac Deployed (Mooring CA05-04 recovery failed)	204	320	203	18	3.1	N/A	1005.1	96	4/10
1	CA05	Full	02/Sep/2005	16h35	UTC-5	71°17.132	127°31.944	PNF ↓	205	310	205	18	3.1	N/A	1005.0	95	4/10
1	CA05	Full	02/Sep/2005	16h44	UTC-5	71°17.187	127°32.063	PNF ↑	205	270	205	18	3.1	N/A	1005.0	95	4/10
1	CA05	Full	02/Sep/2005	16h54	UTC-5	71°17.200	127°32.099	Skippy Boat Deployed	205	270	210	15	3.3	N/A	1005.1	95	4/10
1	CA05	Full	02/Sep/2005	17h25	UTC-5	71°46.681	127°31.521	Secchi Disk ↓↑	201	208	210	16	3.7	N/A	1005.1	93	4/10
1	CA05	Full	02/Sep/2005	17h35	UTC-5	71°16.659	127°31.472	CTD-Rosette ↓	201	205	210	14	3.7	N/A	1005.1	93	4/10
1	CA05	Full	02/Sep/2005	18h12	UTC-5	71°16.543	127°30.554	CTD-Rosette ↑	204	200	215	15	3.8	N/A	1004.9	92	4/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	CA05	Full	02/Sep/2005	18h36	UTC-5	71°16.308	127°30.008	Vertical Ring Net ↓	201	230	210	15	3.8	N/A	1004.9	92	4/10
1	CA05	Full	02/Sep/2005	18h54	UTC-5	71°16.232	127°29.657	Vertical Ring Net ↑	205	200	220	16	3.6	N/A	1004.9	92	4/10
1	CA05	Full	02/Sep/2005	19h40	UTC-5	71°16.462	127°28.404	Skippy Boat Recovered	212	120	220	17	3.6	N/A	1004.6	90	4/10
1	CA05	Full	02/Sep/2005	19h51	UTC-5	71°16.257	127°27.473	Vertical Net Tow ↓	214	180	215	16	3.7	N/A	1004.6	91	4/10
1	CA05	Full	02/Sep/2005	20h10	UTC-5	71°16.214	127°27.288	Vertical Net Tow ↑	219	246	210	16	3.6	N/A	1004.5	90	4/10
1	CA05	Full	02/Sep/2005	20h25	UTC-5	71°16.271	127°27.501	Horizontal Net Tow ↓	215	300	210	15	3.0	N/A	1004.4	89	4/10
1	CA05	Full	02/Sep/2005	20h40	UTC-5	71°16.407	127°28.089	Horizontal Net Tow ↑	210	304	210	15	3.0	N/A	1004.4	89	4/10
1	CA05	Full	02/Sep/2005	20h56	UTC-5	71°16.475	127°30.174	CTD-Rosette ↓	207	226	215	16	3.4	N/A	1004.2	87	4/10
1	CA05	Full	02/Sep/2005	21h22	UTC-5	71°16.448	127°30.085	CTD-Rosette ↑	207	237	210	17	3.7	N/A	1004.2	86	4/10
1	CA05	Full	02/Sep/2005	21h50	UTC-5	71°16.506	127°30.173	Bioness ↓	209	306	215	15	3.7	N/A	1004.1	87	4/10
1	CA05	Full	02/Sep/2005	22h12	UTC-5	71°17.288	127°30.404	Bioness ↑	214	5	215	12	3.5	N/A	1004.0	88	4/10
1	CA05	Full	02/Sep/2005	22h41	UTC-5	71°17.252	127°31.048	RMT ↓	212	200	210	15	7.0	N/A	1004.1	78	4/10
1	CA05	Full	02/Sep/2005	23h17	UTC-5	71°17.613	127°28.913	RMT ↑	222	350	220	19	7.0	N/A	1004.1	78	4/10
1	CA05	Full	02/Sep/2005	23h54	UTC-5	71°17.183	127°30.156	CTD-Rosette ↓	214	226	235	18	3.7	N/A	1004.2	91	4/10
1	CA05	Full	03/Sept/2005	00h24	UTC-5	71°17.096	127°30.013	CTD-Rosette ↑	214	274	245	15	3.6	N/A	1004.2	93	4/10
1	CA05	Full	03/Sep/2005	00h27	UTC-5	71°17.080	127°30.008	Water Sampling ↓	214	236	245	15	3.3	N/A	1004.3	94	4/10
1	CA05	Full	03/Sep/2005	01h12	UTC-5	71°16.802	127°29.146	Water Sampling ↑	214	160	245	13	3.0	N/A	1004.2	95	4/10
1	CA05	Full	03/Sep/2005	01h17	UTC-5	71°16.727	127°28.988	Phytoplankton Net ↓	211	249	245	14	2.9	N/A	1004.2	96	4/10
1	CA05	Full	03/Sep/2005	01h26	UTC-5	71°16.718	127°28.955	Phytoplankton Net ↑	212	251	245	13	2.9	N/A	1004.2	96	4/10
1	CA05	Full	03/Sep/2005	01h29	UTC-5	71°16.709	127°28.990	Phytoplankton Net ↓	211	251	245	14	2.9	N/A	1004.2	95	4/10
1	CA05	Full	03/Sep/2005	01h34	UTC-5	71°16.695	127°29.099	Phytoplankton Net ↑	210	263	245	15	2.9	N/A	1004.2	95	4/10
1	CA15-04	Mooring	03/Sep/2005	03h54	UTC-5	71°32.015	126°58.335	CTD ↓	400	307	220	12	1.6	N/A	1003.9	96	4/10
1	CA15-04	Mooring	03/Sep/2005	04h09	UTC-5	71°32.013	126°58.135	CTD ↑	400	319	225	12	1.6	N/A	1003.8	98	4/10
1	CA15-04	Mooring	03/Sep/2005	04h44	UTC-6	71°32.254	127°01.174	Mooring CA15-04 Recovered	408	Var	195	13	1.8	N/A	1003.7	98	4/10
1	CA14-03	Mooring	03/Sep/2005	09h18	UTC-6	71°47.448	127°59.522	CTD ↓	409	212	195	15	1.8	N/A	1002.2	99	4/10
1	CA14-03	Mooring	03/Sep/2005	09h33	UTC-6	71°47.444	127°59.506	CTD ↑	423	216	195	14	1.7	N/A	1002.1	99	4/10
1	CA14-03	Mooring	03/Sep/2005	N/A	N/A	N/A	N/A	Mooring CA14-03 Recovery (failed)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	CA13-03	Mooring	03/Sep/2005	20h41	UTC-6	71°21.470	131°20.553	CTD ↓	348	243	230	10	1.2	N/A	1002.9	97	4/10
1	CA13-03	Mooring	03/Sep/2005	20h58	UTC-6	71°21.497	131°21.013	CTD ↑	353	253	230	10	1.4	N/A	1003.1	96	4/10
1	CA13-03	Mooring	03/Sep/2005	22h31	UTC-6	71°21.236	131°21.512	Mooring CA13-03 Recovered	328	165	215	9	0.6	N/A	1002.5	99	4/10
1	CA04-04	Mooring	04/Sep/2005	06h24	UTC-6	71°05.601	133°42.527	CTD ↓	333	180	160	18	2.9	N/A	1000.0	98	4/10
1	CA04-04	Mooring	04/Sep/2005	06h38	UTC-6	71°05.612	133°42.385	CTD ↑	334	180	160	19	3.0	N/A	1000.1	98	4/10
1	CA04-04	Mooring	04/Sep/2005	09h04	UTC-6	71°05.105	133°43.049	Mooring CA04-04 Recovered	308	180	165	14	2.3	N/A	1000.2	98	4/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	CA07-04	Mooring	04/Sep/2005	11h32	UTC-6	71°10.404	134°01.357	Mooring CA07-04 Recovered	628	13	285	10	1.7	N/A	1001.2	98	3/10
1	CA07-04	Mooring	04/Sep/2005	13h08	UTC-6	71°10.419	133°59.770	CTD-Rosette ↓	632	209	310	10	2.3	N/A	1001.8	97	3/10
1	CA07-04	Mooring	04/Sep/2005	13h44	UTC-6	71°10.174	133°59.185	CTD-Rosette ↑	600	221	320	9	2.5	N/A	1007.1	94	3/10
1	Ice 1	Ice	04/Sep/2005	18h00	UTC-6	71°21.658	135°21.211	On Ice Sampling ↓	1281	255	345	5	-1.0	N/A	1005.8	99	4/10
1	Ice 1	Ice	04/Sep/2005	19h15	UTC-6	71°21.695	135°21.465	On Ice Sampling ↑	1282	250	315	8	-1.1	N/A	1006.1	99	4/10
1	10	Basic	05/Sep/2005	08h21	UTC-6	71°35.008	139°57.008	CTD ↓	2481	242	200	12	-1.0	N/A	1006.1	95	4/10
1	10	Basic	05/Sep/2005	09h26	UTC-6	71°34.407	139°58.438	CTD ↑	2482	162	255	9	-0.0	N/A	1006.0	94	4/10
1	10	Basic	05/Sep/2005	09h49	UTC-6	71°34.108	139°58.467	Secchi Disk ↓	2468	232	240	6	-0.1	N/A	1006.5	94	4/10
1	10	Basic	05/Sep/2005	09h52	UTC-6	71°34.095	139°52.481	Secchi Disk ↑	2468	225	240	6	-0.1	N/A	1006.5	94	4/10
1	10	Basic	05/Sep/2005	10h59	UTC-6	71°33.506	139°59.293	CTD-Rosette ↓	2478	N/A	200	8	-0.3	N/A	1007.0	92	4/10
1	10	Basic	05/Sep/2005	12h11	UTC-6	71°33.634	140°00.192	CTD-Rosette ↑	2458	211	200	10	0.1	N/A	1007.5	94	4/10
1	10	Basic	05/Sep/2005	12h41	UTC-6	71°33.865	140°04.052	Phytoplankton Net ↓	2459	227	220	8	0.1	N/A	1007.5	95	4/10
1	10	Basic	05/Sep/2005	13h01	UTC-6	71°33.799	140°04.109	Phytoplankton Net ↑	2458	173	220	9	0.3	N/A	1007.5	94	4/10
1	10	Basic	05/Sep/2005	13h30	UTC-6	71°33.258	140°04.499	Horizontal Net Tow ↓	2448	N/A	220	8	0.6	N/A	1007.5	93	4/10
1	10	Basic	05/Sep/2005	13h37	UTC-6	71°33.435	140°05.113	Horizontal Net Tow ↑	2448	N/A	220	8	0.6	N/A	1007.5	90	4/10
1	10	Basic	05/Sep/2005	13h43	UTC-6	71°33.551	140°05.462	Horizontal Net Tow ↓	2462	N/A	220	9	0.6	N/A	1007.5	90	4/10
1	10	Basic	05/Sep/2005	13h55	UTC-6	71°33.741	140°06.294	Horizontal Net Tow ↑	2462	N/A	220	10	0.6	N/A	1007.5	90	4/10
1	10	Basic	05/Sep/2005	14h03	UTC-6	71°33.737	140°06.531	Vertical Net Tow ↓	2464	212	210	8	0.5	N/A	1007.5	92	4/10
1	10	Basic	05/Sep/2005	14h34	UTC-6	71°33.752	140°06.608	Vertical Net Tow ↑	2464	207	210	9	0.7	N/A	1007.5	91	4/10
1	10	Basic	05/Sep/2005	14h50	UTC-6	71°33.637	140°06.729	CTD-Rosette ↓	2464	204	230	9	0.8	N/A	1007.5	92	4/10
1	10	Basic	05/Sep/2005	15h50	UTC-6	71°33.463	140°06.760	CTD-Rosette ↑	2462	159	195	6	0.8	N/A	1008.6	92	4/10
1	10	Basic	05/Sep/2005	16h20	UTC-6	71°32.424	140°01.572	On Ice Sampling ↓	2431	185	190	7	0.7	N/A	1008.5	92	5/10
1	10	Basic	05/Sep/2005	17h18	UTC-6	71°32.280	140°01.677	On Ice Sampling ↑	2428	178	200	5	0.8	N/A	1008.5	93	5/10
1	CA04-05	Mooring	06/Sep/2005	14h49	UTC-6	71°04.780	133°37.780	Mooring CA04-05 Deployed	306	33	50	12	-1.0	N/A	1006.5	85	5/10
1	CA04-05	Mooring	06/Sep/2005	N/A	UTC-6	71°04.851	133°37.752	Zodiac Deployed (Triangulation)	N/A	N/A	340	N/A	N/A	N/A	N/A	N/A	N/A
1	CA04	Basic	06/Sep/2005	15h28	UTC-6	71°05.206	133°37.071	PNF ↓	333	31	43	13	-1.5	N/A	1006.5	90	5/10
1	CA04	Basic	06/Sep/2005	15h31	UTC-6	71°05.214	133°37.052	PNF ↑	333	8	43	13	-1.5	N/A	1006.5	90	5/10
1	CA04	Basic	06/Sep/2005	15h36	UTC-6	71°05.206	133°37.029	Secchi Disk ↓	334	34	45	15	-1.5	N/A	1006.5	90	5/10
1	CA04	Basic	06/Sep/2005	15h40	UTC-6	71°05.204	133°37.035	Secchi Disk ↑	334	357	45	15	-1.5	N/A	1006.5	90	5/10
1	CA04	Basic	06/Sep/2005	15h47	UTC-6	71°05.228	133°36.971	CTD-Rosette ↓	336	38	45	17	-1.8	N/A	1006.5	92	5/10
1	CA04	Basic	06/Sep/2005	16h36	UTC-6	71°05.128	133°36.407	CTD-Rosette ↑	336	50	45	15	-1.8	N/A	1006.5	93	5/10
1	CA04	Basic	06/Sep/2005	16h46	UTC-6	71°05.149	133°36.328	Zodiac Deployed	339	49	45	15	-1.8	N/A	1006.5	93	5/10
1	CA04	Basic	06/Sep/2005	16h56	UTC-6	71°05.206	133°36.185	Vertical Net Tow ↓	339	57	40	15	-1.6	N/A	1006.5	92	5/10

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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					
1	CA04	Basic	06/Sep/2005	17h17	UTC-6	71°05.184	133°35.776	Vertical Net Tow ↑	344	70	35	15	-1.6	N/A	1006.5	92	5/10
1	CA04	Basic	06/Sep/2005	18h15	UTC-6	71°04.129	133°37.066	On Ice Sampling ↓	281	315	60	16	-0.2	N/A	1006.2	86	5/10
1	CA04	Basic	06/Sep/2005	19h18	UTC-6	71°04.153	133°36.759	On Ice Sampling ↑	287	315	70	17	-0.4	N/A	1006.0	89	5/10
1	CA04	Basic	06/Sep/2005	19h30	UTC-6	71°04.027	133°36.305	Zodiac Recovered	282	Var	70	17	-0.4	N/A	1006.0	89	5/10
1	CA04	Basic	06/Sep/2005	19h42	UTC-6	71°03.750	133°36.028	CTD-Rosette ↓	267	50	65	17	-1.1	N/A	1006.1	93	5/10
1	CA04	Basic	06/Sep/2005	20h04	UTC-6	71°03.474	133°36.072	CTD-Rosette ↑	268	65	55	18	-1.0	N/A	1005.8	94	5/10
1	CA04	Basic	06/Sep/2005	20h22	UTC-6	71°03.575	133°34.138	Horizontal Net Tow ↓	275	53	55	15	-1.0	N/A	1005.8	94	5/10
1	CA04	Basic	06/Sep/2005	20h35	UTC-6	71°04.087	133°34.541	Horizontal Net Tow ↑	289	240	55	13	-0.8	N/A	1006.0	94	5/10
1	CA04	Basic	06/Sep/2005	20h55	UTC-6	71°04.202	133°35.219	Bioness ↓	300	120	55	15	-0.4	N/A	1005.5	94	5/10
1	CA04	Basic	06/Sep/2005	21h17	UTC-6	71°04.173	133°35.382	Bioness ↑	294	196	55	15	0.2	N/A	1005.5	94	5/10
1	CA04	Basic	06/Sep/2005	21h30	UTC-6	71°03.536	133°36.464	Vertical Ring Net ↓	273	62	55	15	-1.2	N/A	1006.6	94	5/10
1	CA04	Basic	06/Sep/2005	21h47	UTC-6	71°03.572	133°36.497	Vertical Ring Net ↑	276	69	55	15	-0.9	N/A	1005.9	95	5/10
1	CA04	Basic	06/Sep/2005	21h53	UTC-6	71°04.048	133°36.369	RMT ↓	285	332	55	15	-0.9	N/A	1005.9	95	5/10
1	CA04	Basic	06/Sep/2005	22h07	UTC-6	71°04.007	133°36.499	RMT ↑	281	58	55	15	-0.9	N/A	1004.9	94	5/10
1	CA04	Basic	06/Sep/2005	22h36	UTC-6	71°04.567	133°34.286	CTD-Rosette ↓	332	67	55	14	-0.9	N/A	1004.9	95	5/10
1	CA04	Basic	06/Sep/2005	23h06	UTC-6	71°05.007	133°34.323	CTD-Rosette ↑	334	68	55	16	-0.8	N/A	1004.8	95	5/10
1	CA04	Basic	06/Sep/2005	23h08	UTC-6	71°05.012	133°34.305	Phytoplankton Net ↓	334	69	55	16	-0.8	N/A	1004.8	95	5/10
1	CA04	Basic	06/Sep/2005	23h23	UTC-6	71°05.024	133°34.297	Phytoplankton Net ↑	335	64	55	15	-0.8	N/A	1004.8	95	5/10
1	CA04	Basic	06/Sep/2005	23h26	UTC-6	71°05.027	133°34.289	Phytoplankton Net ↓	335	64	55	15	-0.8	N/A	1004.8	95	5/10
1	CA04	Basic	06/Sep/2005	23h35	UTC-6	71°05.041	133°34.317	Phytoplankton Net ↑	336	63	55	16	-0.8	N/A	1004.0	95	5/10
1	CA07-04	Mooring	07/Sep/2005	02h12	UTC-6	71°10.756	134°01.800	CTD-Rosette ↓	637	48	70	20	-0.3	N/A	1003.0	92	4/10
1	CA07-04	Mooring	07/Sep/2005	02h40	UTC-6	71°10.764	134°01.656	CTD-Rosette ↑	633	41	70	20	-0.2	N/A	1002.5	95	4/10
1	CA05-04	Mooring	08/Sep/2005	N/A	UTC-6	71°25.148	127°23.777	Mooring CA05-04 Recovery (failed)	260	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	224	CTD	08/Sep/2005	02h00	UTC-6	71°42.264	126°28.913	CTD ↓	396	126	Calm	Calm	3.5	N/A	1003.5	99	0/10
1	224	CTD	08/Sep/2005	02h27	UTC-6	71°42.334	126°28.957	CTD ↑	396	N/A	360	5	3.2	N/A	1003.5	98	0/10
1	223	CTD	08/Sep/2005	04h05	UTC-6	71°38.306	126°40.938	CTD ↓	442	125	10	9	3.4	N/A	1005.1	99	0/10
1	223	CTD	08/Sep/2005	04h23	UTC-6	71°38.277	126°40.977	CTD ↑	442	125	15	9	2.6	N/A	1005.2	99	0/10
1	222	CTD	08/Sep/2005	05h04	UTC-6	71°34.411	126°52.994	CTD ↓	435	135	25	6	2.8	N/A	1005.9	99	0/10
1	222	CTD	08/Sep/2005	05h22	UTC-6	71°34.428	126°52.910	CTD ↑	435	135	20	6	2.5	N/A	1006.0	99	0/10
1	221	CTD	08/Sep/2005	06h04	UTC-6	71°30.450	127°05.121	CTD ↓	385	135	80	6	1.5	N/A	1006.0	99	0/10
1	221	CTD	08/Sep/2005	06h20	UTC-6	71°30.571	127°04.983	CTD ↑	385	135	75	5	1.7	N/A	1006.0	99	0/10
1	CA05-04	Mooring	08/Sep/2005	23h32	UTC-6	71°17.072	127°32.457	CTD ↓	201	341	335	14	0.0	N/A	1012.5	99	3/10
1	CA05-04	Mooring	08/Sep/2005	23h42	UTC-6	71°17.033	127°32.489	CTD ↑	200	4	335	14	0.0	N/A	1012.5	99	3/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	CA05-04	Mooring	08/Sep/2005	N/A	UTC-6	71°25.148	127°23.777	Mooring CA05-04 Recovery (failed)	260	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	CA08	Full	09/Sep/2005	04h12	UTC-6	71°01.999	125°57.763	Horizontal Net Tow ↓	400	Var	325	14	1.4	N/A	1014.0	99	1/10
1	CA08	Full	09/Sep/2005	04h20	UTC-6	71°01.009	125°57.244	Horizontal Net Tow ↑	400	Var	340	16	0.9	N/A	1014.5	99	1/10
1	CA08	Full	09/Sep/2005	04h42	UTC-6	71°00.883	127°57.292	Bioness ↓	400	Var	335	19	0.7	N/A	1014.6	99	1/10
1	CA08	Full	09/Sep/2005	05h01	UTC-6	71°01.427	125°58.458	Bioness ↑	400	Var	320	17	-0.1	N/A	1014.8	99	1/10
1	CA08	Full	09/Sep/2005	05h14	UTC-6	71°01.480	125°57.902	Phytoplankton Net ↓	400	Var	330	17	-0.3	N/A	1015.0	99	1/10
1	CA08	Full	09/Sep/2005	05h30	UTC-6	71°01.229	125°57.481	Phytoplankton Net ↑	400	Var	325	18	-0.3	N/A	1015.2	99	1/10
1	CA08	Full	09/Sep/2005	05h38	UTC-6	71°01.144	125°57017	RMT ↓	400	Var	325	16	-0.3	N/A	1015.2	99	1/10
1	CA08	Full	09/Sep/2005	05h54	UTC-6	71°01.190	125°57.985	RMT ↑	400	Var	335	17	0.0	N/A	1015.2	99	1/10
1	CA08	Full	09/Sep/2005	06h20	UTC-6	71°00.910	125°56.153	CTD-Rosette ↓	407	330	325	15	-0.4	N/A	1015.2	99	1/10
1	CA08	Full	09/Sep/2005	07h00	UTC-6	71°00.773	125°56.273	CTD-Rosette ↑	407	330	330	15	0.2	N/A	1016.0	99	1/10
1	CA08	Full	09/Sep/2005	07h02	UTC-6	71°00.750	125°56.399	Phytoplankton Net ↓	403	330	335	15	0.2	N/A	1016.0	99	1/10
1	CA08	Full	09/Sep/2005	07h22	UTC-6	71°00.737	125°56.367	Phytoplankton Net ↑	404	330	325	15	-0.2	N/A	1016.0	99	1/10
1	CA08	Full	09/Sep/2005	07h44	UTC-6	71°00.524	125°55.960	Secchi Disk ↓	414	Var	330	18	-0.4	N/A	1016.0	99	1/10
1	CA08	Full	09/Sep/2005	07h48	UTC-6	71°00.272	125°45.585	Secchi Disk ↑	414	236	330	14	-0.1	N/A	1016.0	99	1/10
1	CA08	Full	09/Sep/2005	08h16	UTC-6	71°00.166	125°56.040	CTD-Rosette ↓	413	338	330	12	-0.1	N/A	1016.0	99	1/10
1	CA08	Full	09/Sep/2005	08h54	UTC-6	71°00.227	125°55.741	CTD-Rosette ↑	413	334	330	12	0.1	N/A	1016.0	98	1/10
1	CA08	Full	09/Sep/2005	09h11	UTC-6	71°00.221	125°55.678	Vertical Net Tow ↓	414	318	330	10	0.0	N/A	1016.0	97	1/10
1	CA08	Full	09/Sep/2005	09h32	UTC-6	71°00.233	125°55637	Vertical Net Tow ↑	414	337	330	13	-0.1	N/A	1016.0	99	1/10
1	CA08	Full	09/Sep/2005	09h57	UTC-6	71°00.241	125°55.514	CTD-Rosette ↓	415	311	305	11	-0.3	N/A	1016.5	99	1/10
1	CA08	Full	09/Sep/2005	10h40	UTC-6	71°00.216	125°55.540	CTD-Rosette ↑	414	313	310	11	-0.3	N/A	1016.8	99	1/10
1	CA08	Full	09/Sep/2005	10h57	UTC-6	71°00.116	125°55.074	PNF ↓	706	295	315	10	-0.2	N/A	1016.8	99	1/10
1	CA08	Full	09/Sep/2005	11h02	UTC-6	71°00.114	125°55.085	PNF ↑	515	296	315	10	-0.2	N/A	1017.0	99	1/10
1	CA08	Full	09/Sep/2005	20h47	UTC-6	71°00.518	126°03.256	CTD ↓	406	300	275	6	-2.5	N/A	1016.5	99	1/10
1	CA08	Full	09/Sep/2005	21h03	UTC-6	71°00.314	126°03.025	CTD ↑	406	314	275	6	-2.6	N/A	1016.5	99	1/10
1	CA08-05	Mooring	09/Sep/2005	23h38	UTC-6	71°00.285	126°04.176	Mooring CA08-05 Deployed	402	270	275	5	-2.7	N/A	1015.2	99	1/10
1	201	N/A	10/Sep/2005	04h26	UTC-6	71°02.907	128°29.726	Water Sampling ↓	44	100	75	15	0.4	N/A	1013.0	99	1/10
1	201	N/A	10/Sep/2005	04h35	UTC-6	71°02.873	128°29.871	Water Sampling ↑	44	100	75	17	0.5	N/A	1013.0	99	1/10
1	CA 05-04	Mooring	10/Sep/2005	N/A	UTC-6	71°25.148	127°23.777	Mooring CA05-04 Recovery (failed)	260	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	11	Full	10/Sep/2005	17h45	UTC-6	70°20.370	126°21.431	CTD-Rosette ↓	255	95	75	18	2.2	N/A	1013.0	84	0/10
1	11	Full	10/Sep/2005	18h20	UTC-6	70°20.357	126°21.423	CTD-Rosette ↑	255	105	75	21	2.0	N/A	1013.0	84	0/10
1	11	Full	10/Sep/2005	18h22	UTC-6	70°20.348	126°21.458	Water Sampling ↓	255	Var	75	21	2.0	N/A	1013.0	84	0/10
1	11	Full	10/Sep/2005	18h30	UTC-6	70°20.281	126°21.818	Water Sampling ↑	255	Var	80	17	1.9	N/A	1013.0	85	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	11	Full	10/Sep/2005	18h58	UTC-6	70°19.485	126°23.504	Box Core ↓	253	89	80	18	2.1	N/A	1013.1	86	0/10
1	11	Full	10/Sep/2005	19h10	UTC-6	70°19.492	126°23.472	Box Core ↑	253	89	70	19	1.9	N/A	1013.1	85	0/10
1	11	Full	10/Sep/2005	21h00	UTC-6	70°20.303	126°21.441	CTD ↓	263	95	70	19	2.1	N/A	1013.1	86	0/10
1	11	Full	10/Sep/2005	21h15	UTC-6	70°20.320	126°21.433	CTD ↑	263	86	65	11	2.0	N/A	1013.1	86	0/10
1	11	Full	10/Sep/2005	22h02	UTC-6	70°20.459	126°21.518	CTD ↓	263	89	70	21	2.2	N/A	1012.2	85	0/10
1	11	Full	10/Sep/2005	22h14	UTC-6	70°20.482	126°21.551	CTD ↑	263	95	70	20	2.2	N/A	1012.2	85	0/10
1	11	Full	10/Sep/2005	23h02	UTC-6	70°20.163	126°21.416	CTD ↓	261	87	65	20	2.3	N/A	1013.0	85	0/10
1	11	Full	10/Sep/2005	23h14	UTC-6	70°20.194	126°21.450	CTD ↑	261	87	65	20	2.3	N/A	1013.0	85	0/10
1	11	Full	11/Sep/2005	00h01	UTC-6	70°20.534	126°21.499	CTD ↓	255	98	70	20	2.3	N/A	1013.0	84	0/10
1	11	Full	11/Sep/2005	00h10	UTC-6	70°20.537	126°21.479	CTD ↑	255	100	70	20	2.3	N/A	1013.0	84	0/10
1	11	Full	11/Sep/2005	00h58	UTC-6	70°20.366	126°21.387	CTD ↓	258	100	70	22	2.4	N/A	1013.0	84	0/10
1	11	Full	11/Sep/2005	01h10	UTC-6	70°20.373	126°21.377	CTD ↑	258	93	60	22	2.3	N/A	1013.0	82	0/10
1	11	Full	11/Sep/2005	01h57	UTC-6	70°20.360	126°21.433	CTD ↓	257	88	65	21	2.4	N/A	1013.0	83	0/10
1	11	Full	11/Sep/2005	02h08	UTC-6	70°20.406	126°21.491	CTD ↑	255	78	65	20	2.4	N/A	1013.0	82	0/10
1	11	Full	11/Sep/2005	02h58	UTC-6	70°20.361	126°21.414	CTD ↓	255	100	65	21	2.5	N/A	1013.0	80	0/10
1	11	Full	11/Sep/2005	03h09	UTC-6	70°20.399	126°21.444	CTD ↑	255	86	65	20	2.5	N/A	1013.0	82	0/10
1	11	Full	11/Sep/2005	04h05	UTC-6	70.20.360	126°21.418	CTD ↓	255	95	75	20	2.6	N/A	1014.0	81	0/10
1	11	Full	11/Sep/2005	04h17	UTC-6	70°20.370	126°21.411	CTD ↑	264	95	80	14	2.6	N/A	1014.0	82	0/10
1	11	Full	11/Sep/2005	05h01	UTC-6	70°20.351	126°21.424	CTD ↓	262	100	90	19	2.4	N/A	1014.0	81	0/10
1	11	Full	11/Sep/2005	05h14	UTC-6	70°20.413	126°21.451	CTD ↑	262	100	80	20	2.3	N/A	1014.0	81	0/10
1	11	Full	11/Sep/2005	06h00	UTC-6	70°20.368	126°21.413	CTD ↓	264	100	85	16	1.5	N/A	1015.2	84	0/10
1	11	Full	11/Sep/2005	06h12	UTC-6	70°20.377	126°21.431	CTD ↑	264	100	85	17	1.5	N/A	1015.2	84	0/10
1	11	Full	11/Sep/2005	07h00	UTC-6	70°20.357	126°21.417	CTD ↓	263	100	85	18	1.1	N/A	1015.8	84	0/10
1	11	Full	11/Sep/2005	07h12	UTC-6	70°20.372	126°21.415	CTD ↑	264	100	85	19	1.0	N/A	1016.0	84	0/10
1	11	Full	11/Sep/2005	07h56	UTC-6	70°20.214	126°21.289	Secchi Disk ↓	264	106	85	21	0.9	N/A	1016.0	84	0/10
1	11	Full	11/Sep/2005	07h57	UTC-6	70°20.215	126°21.288	Secchi Disk ↑	264	107	85	21	0.9	N/A	1016.0	84	0/10
1	11	Full	11/Sep/2005	08h18	UTC-6	70°20.223	126°21.235	CTD ↓	264	105	70	17	1.1	N/A	1016.0	82	0/10
1	11	Full	11/Sep/2005	09h11	UTC-6	70°20.239	126°21.205	CTD ↑	264	110	75	15	1.0	N/A	1016.5	80	0/10
1	11	Full	11/Sep/2005	10h50	UTC-6	70°20.206	126°21.412	CTD ↓	263	114	80	12	1.0	N/A	1016.8	80	0/10
1	11	Full	11/Sep/2005	11h02	UTC-6	70°20.223	126°21.438	CTD ↑	263	89	50	11	1.0	N/A	1016.8	83	0/10
1	11	Full	11/Sep/2005	11h16	UTC-6	70°20.240	126°22.078	PNF ↓	263	99	75	17	1.0	N/A	1017.0	84	0/10
1	11	Full	11/Sep/2005	11h19	UTC-6	70°20.251	126°22.093	PNF ↑	263	90	75	15	1.0	N/A	1017.0	84	0/10
1	11	Full	11/Sep/2005	11h24	UTC-6	70°20.264	126°22.106	Phytoplankton Net ↓	263	86	75	11	1.1	N/A	1017.0	79	0/10

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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					
1	11	Full	11/Sep/2005	11h49	UTC-6	70°20.610	126°21.208	Phytoplankton Net ↑	256	79	75	11	1.1	N/A	1017.0	78	0/10
1	11	Full	11/Sep/2005	12h23	UTC-6	70°20.612	126°21.262	Vertical Net Tow ↓	256	112	65	15	0.9	N/A	1017.0	84	0/10
1	11	Full	11/Sep/2005	12h38	UTC-6	70°20.611	126°21.349	Vertical Net Tow ↑	256	107	85	14	1.1	N/A	1017.0	78	0/10
1	11	Full	11/Sep/2005	12h56	UTC-6	70°20.283	126°20.737	Horizontal Net Tow ↓	253	134	85	17	1.1	N/A	1017.0	77	0/10
1	11	Full	11/Sep/2005	13h08	UTC-6	70°20.001	126°20.087	Horizontal Net Tow ↑	253	123	75	20	1.1	N/A	1017.0	78	0/10
1	11	Full	11/Sep/2005	13h23	UTC-6	70°20.347	126°19.599	Bioness ↓	251	24	85	15	1.3	N/A	1017.3	77	0/10
1	11	Full	11/Sep/2005	13h44	UTC-6	70°21.038	126°19.575	Bioness ↑	259	28	75	18	1.2	N/A	1017.5	76	0/10
1	11	Full	11/Sep/2005	13h59	UTC-6	70°20.868	126°19.137	Phytoplankton Net ↓	263	103	70	17	1.0	N/A	1017.5	77	0/10
1	11	Full	11/Sep/2005	14h17	UTC-6	70°20.898	126°19.160	Phytoplankton Net ↑	256	101	70	12	1.2	N/A	1017.5	77	0/10
1	11	Full	11/Sep/2005	14h23	UTC-6	70°20.758	126°19.027	RMT ↓	256	148	85	15	1.3	N/A	1017.5	78	0/10
1	11	Full	11/Sep/2005	14h36	UTC-6	70°20.399	126°18.711	RMT ↑	254	137	70	15	1.4	N/A	1017.5	80	0/10
1	11	Full	11/Sep/2005	15h26	UTC-6	70°20.452	126°21347	Hydrobios ↓	255	102	65	15	1.6	N/A	1017.5	76	0/10
1	11	Full	11/Sep/2005	15h46	UTC-6	70°20.511	126°21.391	Hydrobios ↑	256	97	90	14	1.4	N/A	1017.5	74	0/10
1	11	Full	11/Sep/2005	16h22	UTC-6	70°20.363	126°21.484	CTD-Rosette ↓	254	100	70	14	1.6	N/A	1018.0	74	0/10
1	11	Full	11/Sep/2005	16h54	UTC-6	70°20.404	126°21.647	CTD-Rosette ↑	255	102	85	14	1.6	N/A	1018.3	74	0/10
1	11	Full	11/Sep/2005	18h14	UTC-6	70°20.377	126°21.449	Phytoplankton Net ↓	254	115	75	13	1.5	N/A	1018.0	73	0/10
1	11	Full	11/Sep/2005	18h30	UTC-6	70°20.329	126°21.675	Phytoplankton Net ↑	256	115	75	15	1.5	N/A	1018.2	73	0/10
1	11	Full	11/Sep/2005	18h35	UTC-6	70°20.310	126°21.629	Phytoplankton Net ↓	256	115	85	13	1.5	N/A	1018.2	73	0/10
1	11	Full	11/Sep/2005	18h52	UTC-6	70°20.250	126°21.836	Phytoplankton Net ↑	257	115	85	13	1.4	N/A	1018.2	73	0/10
1	CA18	Basic	12/Sep/2005	09h17	UTC-6	70°39.580	122°59.159	Secchi Disk ↓	549	173	45	3	0.6	N/A	1017.0	61	0/10
1	CA18	Basic	12/Sep/2005	09h21	UTC-6	70°39.574	122°59.163	Secchi Disk ↑	549	178	45	3	0.6	N/A	1017.0	61	0/10
1	CA18	Basic	12/Sep/2005	09h49	UTC-6	70°39.591	122°59.221	CTD-Rosette ↓	557	169	20	2	1.2	N/A	1017.2	59	0/10
1	CA18	Basic	12/Sep/2005	10h50	UTC-6	70°40.100	122°59.130	CTD-Rosette ↑	557	219	Calm	Calm	0.5	N/A	1017.5	65	0/10
1	CA18	Basic	12/Sep/2005	13h15	UTC-6	70°39.984	122°59.538	CTD-Rosette ↓	542	83	320	6	1.0	N/A	1016.5	71	0/10
1	CA18	Basic	12/Sep/2005	14h04	UTC-6	70°39.975	122°59.225	CTD-Rosette ↑	540	210	300	5	1.6	N/A	1016.3	72	0/10
1	CA18-05	Mooring	12/Sep/2005	16h39	UTC-6	70°39.981	122°59.197	Mooring CA18-05 Deployed	540	N/A	307	7	1.3	N/A	1014.5	76	0/10
1	CA18-05	Mooring	12/Sep/2005	16h44	UTC-6	70°39.855	122°59.308	Zodiac Deployed (Triangulation)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1	CA18	Basic	12/Sep/2005	17h48	UTC-6	70°38.814	122°58.307	Vertical Net Tow ↓	599	320	315	8	1.3	N/A	1014.8	74	0/10
1	CA18	Basic	12/Sep/2005	18h21	UTC-6	70°38.776	122°58.376	Vertical Net Tow ↑	604	340	315	7	1.2	N/A	1014.8	77	0/10
1	CA18	Basic	12/Sep/2005	18h38	UTC-6	70°38.771	122°58.368	Hydrobios ↓	607	315	315	6	1.2	N/A	1014.8	77	0/10
1	CA18	Basic	12/Sep/2005	19h20	UTC-6	70°38.676	122°58.802	Hydrobios ↑	607	315	315	6	1.7	N/A	1014.5	74	0/10
1	CA18	Basic	12/Sep/2005	19h30	UTC-6	70°38.683	122°58.840	Phytoplankton Net ↓	612	359	330	6	1.6	N/A	1014.8	75	0/10
1	CA18	Basic	12/Sep/2005	19h48	UTC-6	70°38.670	122°58.785	Phytoplankton Net ↑	611	340	330	6	1.6	N/A	1014.5	74	0/10

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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					
1	CA18	Basic	12/Sep/2005	19h54	UTC-6	70°38.448	122°59.042	Horizontal Net Tow ↓	609	272	330	6	1.6	N/A	1014.0	73	0/10
1	CA18	Basic	12/Sep/2005	20h05	UTC-6	70°38.365	122°58.585	Horizontal Net Tow ↑	609	0	330	8	1.7	N/A	1014.0	75	0/10
1	CA18	Basic	12/Sep/2005	20h23	UTC-6	70°38.389	122°59.170	RMT ↓	610	213	330	5	1.6	N/A	1014.0	74	0/10
1	CA18	Basic	12/Sep/2005	20h33	UTC-6	70°38.378	122°59.045	RMT ↑	611	281	330	7	1.5	N/A	1014.0	73	0/10
1	CA18	Basic	12/Sep/2005	20h53	UTC-6	70°38.430	122°59.548	Bioness ↓	613	56	330	8	1.6	N/A	1014.0	68	0/10
1	CA18	Basic	12/Sep/2005	21h16	UTC-6	70°38.360	122°59.350	Bioness ↑	614	220	330	3	1.4	N/A	1014.0	63	0/10
1	CA18	Basic	12/Sep/2005	21h41	UTC-6	70°39.048	122°54.406	CTD-Rosette ↓	608	13	Calm	Calm	1.2	N/A	1013.8	70	0/10
1	CA18	Basic	12/Sep/2005	22h22	UTC-6	70°39.115	122°59.418	CTD-Rosette ↑	606	5	120	5	1.5	N/A	1013.5	66	0/10
1	CA18	Basic	12/Sep/2005	22h29	UTC-6	70°39.122	122°59.427	Phytoplankton Net ↓	609	5	120	5	1.5	N/A	1013.5	66	0/10
1	CA18	Basic	12/Sep/2005	22h38	UTC-6	70°39.133	122°59.440	Phytoplankton Net ↑	609	356	100	6	1.5	N/A	1013.5	66	0/10
1	CA18	Basic	12/Sep/2005	22h39	UTC-6	70°39.134	122°59.442	Phytoplankton Net ↓	606	357	100	6	1.5	N/A	1013.5	66	0/10
1	CA18	Basic	12/Sep/2005	22h49	UTC-6	70°39.141	122°59.459	Phytoplankton Net ↑	604	340	100	8	1.6	N/A	1012.8	71	0/10
1	12	Full	13/Sep/2005	06h24	UTC-6	69°54.839	122°97.947	Phytoplankton Net ↓	220	220	75	10	1.6	N/A	1011.0	79	0/10
1	12	Full	13/Sep/2005	06h33	UTC-6	69°54.816	122°57.971	Phytoplankton Net ↑	234	200	70	11	1.3	N/A	1011.0	79	0/10
1	12	Full	13/Sep/2005	06h37	UTC-6	69°54.813	122°57.957	Box Core ↓	219	200	65	10	1.3	N/A	1011.0	79	0/10
1	12	Full	13/Sep/2005	06h46	UTC-6	69°54.799	122°57.940	Box Core ↑	218	200	65	10	1.1	N/A	1011.0	78	0/10
1	12	Full	13/Sep/2005	09h24	UTC-6	69°54.436	122°58.296	Piston Core ↓	174	239	75	8	1.2	N/A	1010.3	78	0/10
1	12	Full	13/Sep/2005	09h58	UTC-6	68°54.434	122°58.420	Piston Core ↑	184	239	75	7	1.1	N/A	1010.1	80	0/10
1	12	Full	13/Sep/2005	10h47	UTC-6	69°54.430	122°59.116	Small Piston Core ↓	154	234	75	9	1.2	N/A	1010.1	81	0/10
1	12	Full	13/Sep/2005	10h54	UTC-6	69°54.439	122°54.102	Small Piston Core ↑	154	245	75	7	1.4	N/A	1010.1	80	0/10
1	12	Full	13/Sep/2005	11h23	UTC-6	69°54.460	122°57.181	PNF ↓	200	248	75	10	1.8	N/A	1010.1	80	0/10
1	12	Full	13/Sep/2005	11h27	UTC-6	69°54.464	122°57.166	PNF ↑	200	245	75	10	1.8	N/A	1010.1	80	0/10
1	12	Full	13/Sep/2005	11h39	UTC-6	69°54.465	122°57.220	Secchi Disk ↓	204	259	60	9	2.0	N/A	1010.1	79	0/10
1	12	Full	13/Sep/2005	11h42	UTC-6	69°54.466	122°57.234	Secchi Disk ↑	204	264	60	9	2.0	N/A	1010.1	79	0/10
1	12	Full	13/Sep/2005	12h05	UTC-6	69°54.799	122°57.430	CTD-Rosette ↓	207	252	60	10	2.2	N/A	1010.6	79	0/10
1	12	Full	13/Sep/2005	12h44	UTC-6	69°54.826	122°57.510	CTD-Rosette ↑	211	230	60	6	1.5	N/A	1010.5	81	0/10
1	12	Full	13/Sep/2005	12h57	UTC-6	69°54.851	122°57.500	Vertical Net Tow ↓	211	N/A	60	8	1.5	N/A	1010.8	81	0/10
1	12	Full	13/Sep/2005	13h12	UTC-6	69°54.871	122°57.489	Vertical Net Tow ↑	211	N/A	50	8	3.1	N/A	1010.8	77	0/10
1	12	Full	13/Sep/2005	13h27	UTC-6	69°54.862	122°57.360	Vertical Net Tow ↓	210	300	60	9	3.0	N/A	1011.0	77	0/10
1	12	Full	13/Sep/2005	13h40	UTC-6	69°54.878	122°57.349	Vertical Net Tow ↑	210	310	55	10	2.9	N/A	1011.0	77	0/10
1	12	Full	13/Sep/2005	14h06	UTC-6	69°54.858	122°57.128	Hydrobios ↓	209	297	50	8	2.9	N/A	1011.0	77	0/10
1	12	Full	13/Sep/2005	14h20	UTC-6	64°54.875	122°57.112	Hydrobios ↑	199	320	50	8	2.8	N/A	1011.0	79	0/10
1	12	Full	13/Sep/2005	15h15	UTC-6	69°54.877	122°56.957	CTD-Rosette ↓	197	50	20	9	1.6	N/A	1011.0	84	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
1	12	Full	13/Sep/2005	15h39	UTC-6	69°54.850	122°56.999	CTD-Rosette ↑	198	100	40	10	1.6	N/A	1011.2	85	0/10
1	12	Full	13/Sep/2005	16h27	UTC-6	69°54.803	122°56.821	Phytoplankton Net ↓	197	240	40	10	1.4	N/A	1012.0	84	0/10
1	12	Full	13/Sep/2005	16h44	UTC-6	69°54.782	122°56.817	Phytoplankton Net ↑	197	240	40	8	3.1	N/A	1011.8	79	0/10
1	12	Full	13/Sep/2005	17h39	UTC-6	69°55.098	122°57.398	Horizontal Net Tow ↓	209	Var	65	8	1.9	N/A	1012.1	84	0/10
1	12	Full	13/Sep/2005	17h48	UTC-6	69°54.987	122°57.666	Horizontal Net Tow ↑	228	Var	45	9	2.0	N/A	1012.1	84	0/10
1	12	Full	13/Sep/2005	18h08	UTC-6	69°55.148	122°57.709	RMT ↓	227	Var	50	8	1.8	N/A	1012.0	85	0/10
1	12	Full	13/Sep/2005	18h20	UTC-6	69°55.190	122°57.161	RMT ↑	186	Var	60	7	1.8	N/A	1012.0	85	0/10
1	12	Full	13/Sep/2005	18h32	UTC-6	69°55.076	122°57.333	RMT ↓	200	Var	45	8	1.9	N/A	1012.0	84	0/10
1	12	Full	13/Sep/2005	18h42	UTC-6	69°55.218	122°57.447	RMT ↑	207	Var	45	7	1.9	N/A	1012.0	85	0/10
1	12	Full	13/Sep/2005	19h05	UTC-6	69°55.259	122°58.181	Bioness ↓	196	Var	45	10	2.1	N/A	1012.1	84	0/10
1	12	Full	13/Sep/2005	19h30	UTC-6	69°55.310	122°58.012	Bioness ↑	233	Var	50	10	1.8	N/A	1012.2	85	0/10
1	12	Full	13/Sep/2005	19h52	UTC-6	69°54.516	122°57.167	CTD-Rosette ↓	203	166	75	9	1.5	N/A	1012.2	86	0/10
1	12	Full	13/Sep/2005	20h14	UTC-6	69°54.479	122°57.190	CTD-Rosette ↑	214	148	60	8	1.6	N/A	1012.2	87	0/10
1	X	CTD	13/Sep/2005	22h44	UTC-6	69°54.167	121°30.089	CTD-Rosette ↓	272	93	75	4	1.4	N/A	1012.0	84	0/10
1	X	CTD	13/Sep/2005	23h01	UTC-6	69°54.201	121°29.553	CTD-Rosette ↑	274	94	75	4	1.3	N/A	1012.0	84	0/10
1	Y	CTD	14/Sep/2005	04h39	UTC-6	69°27.398	118°11.267	CTD ↓	464	120	195	6	1.6	N/A	1011.2	73	0/10
1	Y	CTD	14/Sep/2005	04h56	UTC-6	69°27.402	118°11.127	CTD ↑	465	120	190	6	1.6	N/A	1011.8	72	0/10
1	Y	CTD	14/Sep/2005	05h20	UTC-6	69°27.358	118°11.068	Vertical Net Tow ↓	467	265	195	6	1.4	N/A	1011.5	73	0/10
1	Y	CTD	14/Sep/2005	05h35	UTC-6	69°27.367	118°11.025	Vertical Net Tow ↑	469	265	200	6	1.5	N/A	1011.5	74	0/10
1	Z	CTD	14/Sep/2005	08h12	UTC-6	69°16.144	116°50.448	CTD ↓	192	264	220	4	1.6	N/A	1011.2	70	0/10
1	Z	CTD	14/Sep/2005	08h28	UTC-6	69°16.145	116°50.319	CTD ↑	193	306	200	4	1.3	N/A	1011.2	70	0/10
1	Cod 1	N/A	14/Sep/2005	10h34	UTC-6	69°10.425	116°08.390	Modified RMT ↓	132	280	200	7	1.4	N/A	1011.0	71	0/10
1	Cod 1	N/A	14/Sep/2005	11h47	UTC-6	69°09.691	116°04.547	Modified RMT ↑	115	136	220	6	1.9	N/A	1011.2	69	0/10
Leg 2																	
2		CTD	16/Sep/2005	06h40	UTC-6	68°23.650	110°05.850	CTD-Rosette	253	184	264	6.4	-1.3	3.4	1010.0	75	0/10
2			16/Sep/2005	07h30	UTC-6	68°23.510	110°05.460	Box Core	253	042	086	1.2	-0.7	3.5	1010.0	70	0/10
2		CTD	16/Sep/2005	20h00	UTC-6	68°40.690	103°62.210	CTD-Rosette	110	112		0	-2.0	1.3	1010.0	90	0/10
2			17/Sep/2005	16h05	UTC-6	70°26.120	098°59.520	Vertical Net Tow	203	248	264	4.6	-2.0	-1.0	1007.0	86	5/10
2		CTD	18/Sep/2005	10h40	UTC-6	73°39.173	096°17.061	CTD-Rosette	254	290	100	10	-2.6	-1.0	1006.0	74	1/10
2			19/Sep/2005	10h10	UTC-6	73°45.610	081°04.160	RMT ↓	932	230	110	25	0.2	0.4	1009.0	96	Bergy
2			19/Sep/2005	11h15	UTC-6	73°44.680	081°03.980	RMT ↑	932	328	065	20	0	0	1009.0	97	Bergy
2		CTD	19/Sep/2005	16h20	UTC-6	72°38.120	079°44.890	CTD-Rosette	546	250	110	7	-0.8	1.6	1009.0	80	Icebergs
2		CTD	19/Sep/2005	17h00	UTC-6	72°37.930	079°45.220	Box Core	560	130	140	5	-0.8	1.6	1009.0	80	Icebergs

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
2		CTD	22/Sep/2005	08h05	UTC-4	61°19.262	064°59.420	CTD-Rosette	260	350	070	15	2.3	2.3	1008.0	94	0/10
2		CTD	22/Sep/2005	10h28	UTC-4	61°09.170	064°47.700	CTD-Rosette	432	40	090	15	2.0	1.7	1008.0	93	0/10
2		CTD	22/Sep/2005	12h40	UTC-4	61°00.778	064°44.110	Oblique Net Tow	510	280	090	15	3.6	1.5	1009.0	91	0/10
2		CTD	22/Sep/2005	13h25	UTC-4	61°00.270	064°44.730	CTD-Rosette	516	220	090	15	3.0	1.4	1009.0	91	0/10
2		CTD	22/Sep/2005	15h30	UTC-4	60°51.329	064°41.522	Light Profile	448	325	080	15	3.8	2.1	1009.0	88	0/10
2		CTD	22/Sep/2005	15h55	UTC-4	60°51.390	064°39.900	Light Profile	405	090	077	18	4.3	2.1	1009.0	88	0/10
2		CTD	22/Sep/2005	16h05	UTC-4	60°51.430	064°38.670	Light Profile	394	097	071	18	4.3	2.1	1009.0	88	0/10
2		CTD	22/Sep/2005	16h25	UTC-4	60°51.510	064°37.580	Light Profile	382	333	071	18	4.3	2.1	1009.0	88	0/10
2		CTD	22/Sep/2005	17h02	UTC-4	60°50.900	064°42.480	CTD-Rosette	393	279	068	18	5.3	2.1	1009.0	84	0/10
2		CTD	22/Sep/2005	17h55	UTC-4	60°51.030	064°42.660	Oblique Net Tow	439	268	070	18	3.3	2.3	1010.0	93	0/10
2		CTD	22/Sep/2005	18h20	UTC-4	60°50.900	064°42.700	Vertical Net Tow	432	250	072	20	3.3	2.3	1010.0	90	0/10
2		CTD	22/Sep/2005	19h40	UTC-4	60°44.660	064°41.090	CTD-Rosette	305	140	080	19	3.0	1.9	1009.0	93	0/10
2	14A	CTD	23/Sep/2005	11h20	UTC-4	62°31.550	070°52.218	CTD-Rosette	355	360	210	20	3.5	2.9	1011.0	83	0/10
2	14B	CTD	23/Sep/2005	12h45	UTC-4	62°29.276	071°02.300	CTD-Rosette	350	295	090	20	3.6	2.8	1011.0	81	0/10
2	14C	CTD	23/Sep/2005	14h25	UTC-4	62°25.090	071°17.000	CTD-Rosette	339	295	110	25	3.9	3.0	1011.0	83	0/10
2	14D	CTD	23/Sep/2005	15h45	UTC-4	62°21.350	071°39.140	CTD-Rosette, Secchi	354	315	115	20	3.3	3.1	1011.5	88	0/10
2	14E	Full	23/Sep/2005	17h15	UTC-4	62°16.620	071°59.110	Sediment Traps Deployment (Start)	345	254	115	20	2.9	3.0	1011.0	91	0/10
2	14E	Full	23/Sep/2005	17h35	UTC-4	62°16.680	071°58.650	Sediment Traps Deployment (End)	343	307	115	20	2.9	3.0	1011.5	91	0/10
2	14E	Full	23/Sep/2005	18h15	UTC-4	62°16.450	071°58.690	CTD-Rosette	345	305	095	20	3.3	3.3	1012.0	90	0/10
2	14E	Full	23/Sep/2005	19h20	UTC-4	62°16.360	071°55.320	Oblique Net Tow	324	302	097	20	3.3	3.1	1012.0	90	0/10
2	14E	Full	23/Sep/2005	20h05	UTC-4	62°16.290	071°57.120	Vertical Net Tow	344	250	110	25	3.3	3.2	1012.0	90	0/10
2	14E	Full	23/Sep/2005	20h45	UTC-4	62°16.100	071°56.960	CTD-Rosette	351	330	110	25	3.3	3.2	1012.0	90	0/10
2	14E	Full	23/Sep/2005	21h55	UTC-4	62°15.040	071°54.560	RMT	345	300	110	25	3.0	3.0	1012.0	90	0/10
2	14E	Full	23/Sep/2005	23h12	UTC-4	62°15.080	071°52.630	CTD-Rosette	335	280	100	20	3.0	3.2	1012.0	90	0/10
2	14E	Full	24/Sep/2005	01h15	UTC-4	62°14.880	071°54.990	Box Core	345	260	110	20	3.0	3.2	1012.0	96	0/10
2	14E	Full	24/Sep/2005	02h35	UTC-4	62°14.820	071°54.880	PistonCore	348	260	110	20	2.2	3.2	1012.0	97	0/10
2	14E	Full	24/Sep/2005	03h47	UTC-4	62°14.820	071°56.990	Sediment Traps Recovery (Start)	342	200	115	20	2.3	3.1	1013.0	97	0/10
2	14E	Full	24/Sep/2005	04h12	UTC-4	62°14.890	071°57.170	Sediment Traps Recovery (End)	336	240	115	20	3.0	3.1	1013.0	97	0/10
2	14F	CTD	24/Sep/2005	05h00	UTC-4	62°13.220	072°14.970	CTD-Rosette	241	295	127	15	3.0	2.4	1013.0	99	0/10
2	14G	CTD	24/Sep/2005	06h10	UTC-4	62°10.900	072°24.960	CTD-Rosette	180	270	135	15	3.5	2.5	1013.0	99	0/10
2	15A	CTD	25/Sep/2005	02h55	UTC-4	64°19.670	078°04.880	CTD-Rosette	125	310	120	5	0.6	0.7	1009.0	99	0/10
2	15B	CTD	25/Sep/2005	03h45	UTC-4	64°16.910	078°14.950	CTD-Rosette	217	300	115	10	0.6	0.6	1008.0	99	0/10
2	15C	CTD	25/Sep/2005	04h50	UTC-4	64°12.890	078°30.930	CTD-Rosette	279	270	080	20	1.7	1.5	1005.0	99	0/10

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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					
2	15D	CTD	25/Sep/2005	06h10	UTC-4	64°07.380	078°51.890	Secchi	246	340	080	20	2.0	1.8	1005.0	99	0/10
2	15D	CTD	25/Sep/2005	06h20	UTC-4	64°07.290	078°52.200	CTD-Rosette	248	220	080	20	2.0	1.8	1005.0	99	0/10
2	15E	Basic	25/Sep/2005	08h27	UTC-4	64°01.880	079°12.790	Oblique Net Tow	260	255	075	15	0.8	1.2	1004.0	98	0/10
2	15E	Basic	25/Sep/2005	09h10	UTC-4	64°01.810	079°12.710	Vertical Net Tow	317	250	080	15	2.4	2.2	1003.0	99	0/10
2	15E	Basic	25/Sep/2005	09h45	UTC-4	64°01.760	079°12.910	CTD-Rosette	320		070	20	1.4	2.3	1002.0	99	0/10
2	15E	Basic	25/Sep/2005	10h25	UTC-4	64°01.560	079°13.470	Light Profile	350		080	15	2.0	2.2	1002.0	97	0/10
2	15E	Basic	25/Sep/2005	10h40	UTC-4	64°01.420	079°16.340	CTD-Rosette	321		075	20	1.6	1.8	1002.0	98	0/10
2	15E	Basic	25/Sep/2005	13h50	UTC-4	64°00.200	079°15.300	RMT	320	130	080	20	1.3	1.8	1002.0	99	0/10
2	15E	Basic	25/Sep/2005	15h20	UTC-4	64°02.040	079°12.910	Box Core	321	270	080	20	1.6	2.2	1002.0	99	0/10
2	15E	Basic	25/Sep/2005	15h50	UTC-4	64°01.970	079°12.540	Gravity Core	320	270	100	20	1.4	22	1002.0	99	0/10
2	15F	CTD	25/Sep/2005	16h50	UTC-4	63°56.310	079°33.630	CTD-Rosette	325	210	096	22	3.0	1.7	1002.0	97	0/10
2	15G	CTD	25/Sep/2005	18h05	UTC-4	63°51.900	079°49.120	CTD-Rosette	292	285	080	20	1.2	1.5	1002.0	95	0/10
2	15H	CTD	25/Sep/2005	19h05	UTC-4	63°49.200	079°59.200	CTD-Rosette	216	280	095	20	1.5	1.2	1002.0	93	0/10
2	CTD1	CTD	25/Sep/2005	23h10	UTC-4	63°24.190	081°06.300	CTD-Rosette	70	270	060	15	0.9	1.2	1003.0	96	0/10
2	CTD2	CTD	26/Sep/2005	00h15	UTC-4	63°18.730	081°15.130	CTD-Rosette	118	270	065	15	0.9	1.5	1003.0	92	0/10
2	CTD3	CTD	26/Sep/2005	01h25	UTC-4	63°11.200	081°27.220	CTD-Rosette	180	250	060	15	1.1	2.2	1003.0	94	0/10
2	CTD4	CTD	26/Sep/2005	02h35	UTC-4	63°03.030	081°39.180	CTD-Rosette	230	250	050	10	1.4	2.6	1003.0	92	0/10
2	16A	CTD	26/Sep/2005	03h30	UTC-4	62°58.290	081°47.650	CTD-Rosette	220	240	060	10	1.5	2.8	1004.0	91	0/10
2	16B	CTD	26/Sep/2005	04h20	UTC-4	62°55.240	081°37.970	CTD-Rosette	218	285	045	15	2.0	2.9	1003.0	92	0/10
2	16C	CTD	26/Sep/2005	05h25	UTC-4	62°51.150	081°23.280	CTD-Rosette	205	270	080	12	2.6	2.7	1003.0	87	0/10
2	16D	CTD	26/Sep/2005	06h40	UTC-4	62°45.490	081°03.390	Secchi	198	250	080	10	3.0	4.3	1003.0	83	0/10
2	16D	CTD	26/Sep/2005	07h00	UTC-4	62°45.480	081°03.460	CTD-Rosette	198	250	080	10	3.0	4.3	1003.0	83	0/10
2	16E	Full	26/Sep/2005	08h45	UTC-4	62°39.180	080°44.110	Sediment Traps Deployment (Start)	211		085	10	2.7	4.0	1004.0	78	0/10
2	16E	Full	26/Sep/2005	09h15	UTC-4	62°38.920	080°44.300	Sediment Traps Deployment (End)	211		080	10	2.9	4.3	1004.0	79	0/10
2	16E	Full	26/Sep/2005	09h28	UTC-4	62°38.600	080°44.800	CTD	215		085	12	2.6	4.9	1005.0	78	0/10
2	16E	Full	26/Sep/2005	10h05	UTC-4	62°38.380	080°45.870	Light Profile	215		065	12	3.6	5.0	1005.0	75	0/10
2	16E	Full	26/Sep/2005	11h05	UTC-4	62°38.810	080°46.200	Oblique Net Tow	210	210	065	10	9.6	5.0	1005.0	81	0/10
2	16E	Full	26/Sep/2005	11h30	UTC-4	62°39.220	080°46.750	Vertical Net Tow	207		065	10	3.9	5.0	1005.0	80	0/10
2	16E	Full	26/Sep/2005	12h12	UTC-4	62°39.420	080°47.330	CTD-Rosette	220	270	085	7	3.5	5.0	1006.0	76	0/10
2	16E	Full	26/Sep/2005	13h15	UTC-4	62°39.200	080°47.820	RMT ↓	210	230	090	10	2.4	5.1	1006.0	78	0/10
2	16E	Full	26/Sep/2005	15h15	UTC-4	62°34.580	080°59.310	RMT ↑	210	230	060	12	2.6	5.0	1006.5	78	0/10
2	16E	Full	26/Sep/2005	17h20	UTC-4	62°39.830	080°46.060	Sediment Traps Recovery (Start)	216	060	040	12	2.7	4.9	1008.0	82	0/10
2	16F	CTD	26/Sep/2005	18h50	UTC-4	62°33.360	080°24.870	CTD-Rosette	207	135	030	10	3.0	5.0	1007.5	82	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
2	16G	CTD	26/Sep/2005	20h00	UTC-4	62°28.090	080°10.470	CTD-Rosette	190	240	060	10	2.2	5.0	1008.0	80	0/10
2	16H	CTD	26/Sep/2005	20h55	UTC-4	62°25.860	080°01.310	CTD-Rosette	175	250	055	15	2.2	5.0	1007.0	80	0/10
2		Coring	27/Sep/2005	00h30	UTC-4	62°45.430	079°00.040	Box Core #1	395	270	070	10	3.1	4.9	1008.0	82	0/10
2		Coring	27/Sep/2005	01h10	UTC-4	62°45.440	079°00.000	Box Core #2	395	270	080	10	3.7	4.9	1008.0	83	0/10
2		Coring	27/Sep/2005	02h18	UTC-4	62°45.440	079°00.070	Piston Core	395	270	080	10	3.5	5.0	1008.0	85	0/10
2	17A	CTD	27/Sep/2005	05h44	UTC-4	62°13.820	079°08.430	CTD-Rosette	139	270	114	13	3.2	5.9	1007.0	89	0/10
2	17B	CTD	27/Sep/2005	06h40	UTC-4	62°11.610	078°58.140	CTD-Rosette	184	028	160	10	4.4	6.0	1008.0	86	0/10
2	17C	Full	27/Sep/2005	07h42	UTC-4	62°07.970	078°42.740	Secchi	155	352	135	12	5.8	6.0	1008.0	89	0/10
2	17C	Full	27/Sep/2005	07h50	UTC-4	62°08.030	078°42.800	CTD-Rosette	155	317	130	12	5.8	6.0	1008.0	89	0/10
2	17C	Full	27/Sep/2005	08h40	UTC-4	62°08.320	078°43.550	Oblique Net Tow	158		140	12	6.5	6.8	1008.0	82	0/10
2	17C	Full	27/Sep/2005	09h05	UTC-4	62°08.110	078°43.470	Vertical Net Tow	160		140	10	7.5	6.8	1009.0	77	0/10
2	17C	Full	27/Sep/2005	10h08	UTC-4	62°08.300	078°45.700	RMT ↓	160	210	150	12	4.9	6.8	1009.0	84	0/10
2	17C	Full	27/Sep/2005	11h15	UTC-4	62°06.270	078°51.060	RMT ↑	205	210	150	14	5.1	6.8	1010.0	82	0/10
2	17C	Full	27/Sep/2005	11h40	UTC-4	62°06.340	078°47.100	CTD-Rosette	178		150	12	5.3	6.8	1010.0	78	0/10
2	17C	Full	27/Sep/2005	12h10	UTC-4	62°07.800	078°47.620	Light Profile	174	015	150	7	7.8	6.8	1010.0	72	0/10
2	17C	Full	27/Sep/2005	13h00	UTC-4	62°05.060	078°48.430	Launch Zodiac	180		170	10	6.9	6.8	1010.0	74	0/10
2	17C	Full	27/Sep/2005	13h25	UTC-4	62°08.280	078°42.860	CTD-Rosette	156	010	160	10	5.1	6.9	1010.0	80	0/10
2	17D	CTD	27/Sep/2005	14h45	UTC-4	62°04.840	078°27.250	CTD-Rosette	72	340	105	5	4.4	6.9	1011.0	86	0/10
2	17E	CTD	27/Sep/2005	15h50	UTC-4	62°02.540	078°17.120	CTD-Rosette	48	090	070	5	4.1	6.9	1011.0	87	0/10
2	18	Full	28/Sep/2005	02h05	UTC-4	60°07.520	079°10.370	Sediment Traps Deployment	140	270	120	25	5.3	6.8	1007.0	83	0/10
2	18	Full	28/Sep/2005	02h20	UTC-4	60°07.550	079°09.980	CTD-Rosette	139	325	115	25	6.7	6.8	1007.0	78	0/10
2	18	Full	28/Sep/2005	02h55	UTC-4	60°07.700	079°09.070	Oblique Net Tow	142	280	135	25	7.7	6.9	1006.0	74	0/10
2	18	Full	28/Sep/2005	03h32	UTC-4	60°08.070	079°05.230	Bioness	137	300	125	25	4.2	7.1	1007.0	85	0/10
2	18	Full	28/Sep/2005	04h10	UTC-4	60°07.400	079°07.560	Vertical Net Tow	141	340	120	25	4.9	7.3	1007.0	82	0/10
2	18	Full	28/Sep/2005	05h00	UTC-4	60°07.840	079°08.030	RMT ↓	135	320	100	30	4.9	7.3	1007.0	82	0/10
2	18	Full	28/Sep/2005	05h15	UTC-4	60°07.570	079°07.620	RMT ↑	138	320	100	30	4.9	7.3	1007.0	82	0/10
2	18	Full	28/Sep/2005	05h25	UTC-4	60°07.740	079°07.170	CTD-Rosette	130	250	120	25	5.3	7.3	1007.0	82	0/10
2	18	Full	28/Sep/2005	06h47	UTC-4	60°09.140	079°07.030	Hydrobios	135	270	107	28	5.3	7.4	1005.0	84	0/10
2	18	Full	28/Sep/2005	07h11	UTC-4	60°09.400	079°07.310	Secchi	130	320	102	28	4.8	7.4	1005.0	84	0/10
2	18	Full	28/Sep/2005	07h22	UTC-4	60°09.400	079°07.460	CTD-Rosette	130	320	102	28	4.8	7.4	1005.0	84	0/10
2	18	Full	28/Sep/2005	08h55	UTC-4	60°10.120	079°08.700	Light Profile	134	132	100	30	6.5	6.8	1005.0	80	0/10
2	18	Full	28/Sep/2005	09h30	UTC-4	60°10.530	079°09.520	Box Core #1	134	230	100	25	5.0	6.7	1005.0	83	0/10
2	18	Full	28/Sep/2005	10h55	UTC-4	60°10.990	079°20.940	CTD-Rosette	150	260	090	32	4.7	6.8	1004.0	84	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
2	18	Full	28/Sep/2005	11h50	UTC-4	60°10.980	079°17.540	Box Core #2	153	115	080	30	4.7	6.9	1005.0	84	0/10
2	18	Full	28/Sep/2005	13h24	UTC-4	60°10.510	079°10.710	Sediment Traps Recovery	136	090	090	30	5.3	6.7	1002.0	82	0/10
2	19A	CTD	29/Sep/2005	00h40	UTC-4	58°11.070	079°30.170	CTD-Rosette	108	180	290	10	6.2	7.9	993.0	93	0/10
2	19B	CTD	29/Sep/2005	01h58	UTC-4	58°15.850	079°06.840	CTD-Rosette	77	270	090	5	5.3	6.6	993.0	98	0/10
2	19C	CTD	29/Sep/2005	03h15	UTC-4	58°20.530	078°43.410	CTD-Rosette	105	270	050	15	5.2	7.1	993.0	95	0/10
2	19D	CTD	29/Sep/2005	04h10	UTC-4	57°22.900	078°31.800	CTD-Rosette	100	250	045	12	4.6	7.7	993.0	91	0/10
2	19E	Full	29/Sep/2005	05h15	UTC-4	58°25.190	078°19.920	CTD-Rosette	104	275	016	12	4.3	8.0	993.0	89	0/10
2	19E	Full	29/Sep/2005	05h50	UTC-4	58°25.000	078°20.000	Oblique Net Tow	105	180	026	15	4.3	8.4	993.0	91	0/10
2	19E	Full	29/Sep/2005	06h30	UTC-4	58°25.320	078°19.670	Vertical Net Tow	107	242	030	15	4.3	8.4	993.0	91	0/10
2	19E	Full	29/Sep/2005	06h32	UTC-4	58°25.350	078°19.720	Secchi	105	242	030	15	4.3	8.4	993.0	91	0/10
2	19E	Full	29/Sep/2005	06h54	UTC-4	58°25.150	078°19.900	CTD-Rosette	106	100	036	15	4.3	8.4	993.0	91	0/10
2	19E	Full	29/Sep/2005	08h35	UTC-4	58°25.460	078°21.840	Trawl ↓	109	130	030	15	4.3	8.5	993.0	90	0/10
2	19E	Full	29/Sep/2005	09h05	UTC-4	58°25.160	078°21.780	Trawl ↑	109		025	15	4.3	8.5	993.0	90	0/10
2	19E	Full	29/Sep/2005	12h00	UTC-4	58°25.070	078°24.370	Trawl (end)	100	145	015	20	4.1	8.5	993.0	89	0/10
2	19E	Full	29/Sep/2005	12h50	UTC-4	58°25.140	078°20.230	Light Profile	115	100	010	20	4.4	8.2	994.0	87	0/10
2	19E	Full	29/Sep/2005	13h43	UTC-4	58°25.130	078°20.280	CTD-Rosette	112	215	010	20	5.0	8.4	994.0	81	0/10
2	19E	Full	29/Sep/2005	14h22	UTC-4	58°25.210	078°21.660	Box Core	112	250	015	20	6.8	8.5	994.0	76	0/10
2	19E	Full	29/Sep/2005	18h00	UTC-4	58°02.640	077°38.200	RMT	123	222	012	20	5.7	8.7	995.0	78	0/10
2	20	CTD	30/Sep/2005	01h10	UTC-4	56°50.430	076°50.060	CTD-Rosette	118	170	330	15	5.9	8.1	997.0	71	0/10
2	20	CTD	30/Sep/2005	04h00	UTC-4	56°23.120	076°34.910	Piston Core ↓	104	117	320	20	5.1	9.4	995.0	68	0/10
2	20	CTD	30/Sep/2005	04h15	UTC-4	56°23.040	076°34.820	Piston Core ↑	104	117	320	15	5.1	9.4	995.0	68	0/10
2	AN03-05	Mooring	30/Sep/2005	13h30	UTC-4	55°20.090	078°13.580	Sediment Traps Deployment	138	270	230	10	7.4	9.2	1002.0	72	0/10
2	AN03-05	Mooring	30/Sep/2005	14h50	UTC-4	55°16.890	077°54.280	Light Profile	90	200	255	5	7.5	9.4	1002.0	74	0/10
2	AN03-05	Mooring	30/Sep/2005	15h20	UTC-4	55°17.080	077°53.910	CTD-Rosette	86	180	205	5	7.7	9.3	1002.0	76	0/10
2	AN03-05	Mooring	30/Sep/2005	16h00	UTC-4	55°17.070	077°53.450	Oblique Net Tow	85	217		0	8.0	9.3	1002.0	76	0/10
2	AN03-05	Mooring	30/Sep/2005	16h46	UTC-4	55°17.070	077°53.480	Vertical Net Tow	95	230		0	8.3	9.3	1002.0	72	0/10
2	AN03-05	Mooring	30/Sep/2005	18h47	UTC-4	55°17.350	077°54.350	RMT ↓	82	215	135	10	8.1	9.1	1002.0	70	0/10
2	AN03-05	Mooring	30/Sep/2005	20h00	UTC-4	55°16.030	077°55.470	RMT ↑	90	200	135	10	8.1	9.1	1002.0	70	0/10
2	AN03-05	Mooring	30/Sep/2005	20h25	UTC-4	55°17.070	077°54.260	Hydrobios	90		150	10	8.4	9.2	1002.0	76	0/10
2	AN03-05	Mooring	30/Sep/2005	21h05	UTC-4	55°17.390	077°54.600	CTD-Rosette	90		150	10	8.0	9.0	1002.0	76	0/10
2	AN03-05	Mooring	30/Sep/2005	21h45	UTC-4	55°17.970	077°54.580	Bioness	67		150	15	8.0	9.2	1002.0	76	0/10
2	AN03-05	Mooring	30/Sep/2005	22h30	UTC-4	55°17.690	077°53.740	CTD-Rosette	87		150	20	8.6	9.0	1002.0	77	0/10
2	AN03-05	Mooring	01/Oct/2005	06h45	UTC-4	55°16.990	077°53.830	Secchi	98	130	164	17	8.7	9.3	997.0	88	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
2	AN03-05	Mooring	01/Oct/2005	06h50	UTC-4	55°17.080	077°53.770	CTD-Rosette	90	020	160	17	8.7	9.3	997.0	88	0/10
2	AN03-05	Mooring	01/Oct/2005	09h00	UTC-4	55°22.500	078°06.030	CTD-Rosette	90		170	5	10.0	9.3	998.0	85	0/10
2	AN03-05	Mooring	01/Oct/2005	09h35	UTC-4	55°22.600	078°05.940	Sediment Traps Recovery	110		150	5	9.5	9.0	998.0	90	0/10
2	AN03-05	Mooring	01/Oct/2005	13h00	UTC-4	55°24.456	077°55.743	Mooring	132	025	250	10	9.3	9.5	1000.00	95	0/10
2	AN03-05	Mooring	01/Oct/2005	15h50	UTC-4	55°17.320	077°54.620	RMT ↓	81	180	290	25	8.3	9.6	1005.0	86	0/10
2	AN03-05	Mooring	01/Oct/2005	16h00	UTC-4	55°17.090	077°54.290	RMT ↑	86		290	26	8.3	9.6	1008.0	86	0/10
2	AN03-05	Mooring	01/Oct/2005	18h42	UTC-4	55°24.150	077°58.640	Box Core	119	065	250	15	8.0	9.2	1008.0	83	0/10
2	AN03-05	Mooring	01/Oct/2005	19h12	UTC-4	55°23.980	077°58.610	Piston Core	116	080	254	15	8.0	9.2	1008.0	83	0/10
2	AN03-05	Mooring	01/Oct/2005	21h15	UTC-4	55°26.370	077°51.180	Piston Core	127	060	275	22	9.3	9.5	1010.0	83	0/10
2	AN03-05	Mooring	02/Oct/2005	21h20	UTC-4	55°26.587	077°51.949	9-m Piston Core	127		275	22	9.3	9.5	1010.0	83	0/10
2	21B	CTD	02/Oct/2005	06h15	UTC-4	54°41.090	079°58.820	CTD-Rosette	68	115	300	7	7.9	9.2	1015.0	73	0/10
2	21A	CTD	02/Oct/2005	07h10	UTC-4	54°37.980	079°51.570	CTD-Rosette	43	122	300	5	7.5	9.1	1015.0	75	0/10
2	21C	CTD	02/Oct/2005	08h30	UTC-4	54°41.320	080°07.800	Secchi, CTD-Rosette	64		290	3	7.3	9.1	1016.0	77	0/10
2	21D	CTD	02/Oct/2005	10h00	UTC-4	54°42.180	080°21.120	CTD-Rosette	112			0	7.1	9.1	1016.0	77	0/10
2	21E	Full	02/Oct/2005	11h40	UTC-4	54°42.910	080°44.010	Light Profile	99		090	5	7.2	8.0	1016.0	78	0/10
2	21E	Full	02/Oct/2005	12h50	UTC-4	54°42.270	080°44.230	Trawl	97		060	12	7.1	9.0	1017.0	80	0/10
2	21E	Full	02/Oct/2005	17h00	UTC-4	54°42.930	080°43.780	CTD-Rosette	99	336	090	22	8.6	8.9	1013.0	87	0/10
2	21E	Full	02/Oct/2005	17h35	UTC-4	54°42.680	080°44.200	Oblique Net Tow	99	245	093	17	9.2	8.4	1013.0	86	0/10
2	21E	Full	02/Oct/2005	18h02	UTC-4	54°42.610	080°43.660	Bioness	98	266	068	20	9.5	8.6	1013.0	87	0/10
2	21E	Full	02/Oct/2005	18h15	UTC-4	54°42.560	080°43.240	Bioness	99	250	073	18	9.8	8.5	1012.0	87	0/10
2	21E	Full	02/Oct/2005	18h45	UTC-4	54°43.030	080°43.800	CTD-Rosette	100	250	100	22	9.3	8.7	1012.0	90	0/10
2	21E	Full	02/Oct/2005	19h25	UTC-4	54°42.850	080°43.800	Vertical Net Tow	100	279	095	25	9.7	8.7	1012.0	83	0/10
2	21E	Full	02/Oct/2005	20h15	UTC-4	54°42.880	080°44.380	Hydrobios	100		100	25	9.0	8.7	1012.0	83	0/10
2	21E	Full	02/Oct/2005	20h45	UTC-4	54°43.200	080°45.120	CTD-Rosette	98	260	090	25	9.0	8.7	1012.0	83	0/10
2	21E	Full	02/Oct/2005	21h45	UTC-4	54°43.000	080°43.710	Box Core	100	240	100	27	9.0	8.2	1012.0	90	0/10
2	21F	CTD	02/Oct/2005	23h15	UTC-4	54°44.840	081°06.510	CTD-Rosette	108	220	100	27	9.2	8.7	1007.0	92	0/10
2	21G	CTD	03/Oct/2005	00h30	UTC-4	54°45.780	081°28.430	CTD-Rosette	43	315	135	30	9.8	8.3	1004.0	94	0/10
2	21H	CTD	03/Oct/2005	01h26	UTC-4	54°46.440	081°42.910	CTD-Rosette	32	315	160	25	9.8	7.7	1002.0	95	0/10
2	21H	CTD	03/Oct/2005	14h10	UTC-4	54°46.100	081°42.820	Light Profile	32	200	300	20	11.6	7.8	1002.0	78	0/10
2	BI-1	Basic	04/Oct/2005	16h00	UTC-4	55°25.930	080°32.680	Oblique Net Tow	105	130	303	22	7.4	8.5	1020.0	62	0/10
2	BI-1	Basic	04/Oct/2005	16h20	UTC-4	55°26.100	080°32.810	Oblique Net Tow	106	130	296	20	7.4	8.5	1020.0	62	0/10
2	BI-1	Basic	04/Oct/2005	17h00	UTC-4	55°26.130	080°32.245	Box Core	106	130	287	20	7.4	8.5	1020.0	62	0/10
2	BI-1	Basic	04/Oct/2005	17h30	UTC-4	55°26.420	080°31.760	Box Core	105	145	287	10	7.0	8.6	1022.0	60	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
2	BI-1	Basic	04/Oct/2005	18h07	UTC-4	55°25.760	080°30.360	CTD-Rosette	100	145	300	18	7.3	8.7	1022.0	58	0/10
2	BI-2	Full	04/Oct/2005	19h10	UTC-4	55°25.730	080°29.260	CTD-Rosette	97	145	280	20	6.8	8.7	1021.0	56	0/10
2	BI-2	Full	04/Oct/2005	20h25	UTC-4	55°25.810	080°32.210	CTD-Rosette	100	145	280	15	7.0	8.2	1021.0	54	0/10
2	BI-2	Full	05/Oct/2005	19h05	UTC-4	56°45.830	080°50.220	Oblique Net Tow	182	135	354	20	1.1	6.2	1028.0	82	0/10
2	BI-2	Full	05/Oct/2005	19h40	UTC-4	56°45.480	080°50.060	Vertical Net Tow	189	152	340	12	1.1	6.2	1028.0	82	0/10
2	BI-2	Full	05/Oct/2005	20h15	UTC-4	56°45.080	080°49.770	CTD-Rosette	180	160	340	15	1.9	7.2	1029.0	64	0/10
2	BI-2	Full	05/Oct/2005	21h02	UTC-4	56°44.534	080°49.275	Box Core	200	150	360	18	1.9	7.2	1029.0	67	0/10
2	BI-2	Full	05/Oct/2005	22h02	UTC-4	56°43.650	080°48.550	CTD-Rosette	130	130	015	15	1.2	6.8	1029.0	60	0/10
2	BI-2	Full	05/Oct/2005	22h45	UTC-4	56°43.223	080°48.391	Box Core	150	150	360	15	1.5	7.0	1029.0	69	0/10
2	BI-2	Full	05/Oct/2005	23h10	UTC-4	56°43.207	080°48.437	Gravity Core	176	175	360	15	1.5	7.2	1029.0	70	0/10
2	BI-2	Full	05/Oct/2005	23h30	UTC-4	56°43.020	080°48.430	CTD-Rosette	180		360	15	1.7	7.2	1029.0	70	0/10
2	22	Full	06/Oct/2005	13h36	UTC-4	58°23.830	083°17.280	Sediment Traps Deployment	181	160	025	10	0.7	4.8	1024.0	62	0/10
2	22	Full	06/Oct/2005	14h00	UTC-4	58°23.400	083°17.180	Light Profile	182	270	030	10	0.4	4.8	1024.0	61	0/10
2	22	Full	06/Oct/2005	14h35	UTC-4	58°22.570	083°16.740	Oblique Net Tow	182	070	015	10	1.8	4.8	1024.0	60	0/10
2	22	Full	06/Oct/2005	15h01	UTC-4	58°21.740	083°16.770	Hydrobios	182	195	040	10	0.3	4.7	1024.0	62	0/10
2	22	Full	06/Oct/2005	15h42	UTC-4	58°23.950	083°17.630	Secchi	181	200	030	10	0.6	4.7	1024.0	64	0/10
2	22	Full	06/Oct/2005	15h50	UTC-4	58°23.870	083°17.500	CTD-Rosette	181	182	044	6	0.5	4.6	1024.0	64	0/10
2	22	Full	06/Oct/2005	16h45	UTC-4	58°23.470	083°17.560	Bioness	178	196	050	10	0.4	4.6	1024.0	65	0/10
2	22	Full	06/Oct/2005	17h00	UTC-4	58°23.430	083°17.310	Vertical Net Tow	182	196	050	10	0.4	4.6	1024.0	65	0/10
2	22	Full	06/Oct/2005	17h40	UTC-4	58°23.350	083°17.320	CTD-Rosette	184	215	010	10	0.7	4.6	1024.0	65	0/10
2	22	Full	06/Oct/2005	18h40	UTC-4	58°22.910	083°18.340	RMT	179	006	054	10	0.7	4.6	1023.0	66	0/10
2	22	Full	06/Oct/2005	19h30	UTC-4	58°22.770	083°18.460	CTD-Rosette	177	190	071	14	1.9	4.6	1023.0	66	0/10
2	22	Full	06/Oct/2005	20h25	UTC-4	58°22.366	083°19.727	Box Core	182	200	015	15	1.6	4.5	1023.0	67	0/10
2	22	Full	06/Oct/2005	20h45	UTC-4	58°22.236	083°20.064	Gravity Core	180	200	015	15	1.6	4.5	1023.0	67	0/10
2	22	Full	06/Oct/2005	21h15	UTC-4	58°22.761	083°18.283	Sediment Traps Recovery	175	215	015	15	1.0	4.0	1023.0	67	0/10
2	CTD-12	CTD	07/Oct/2005	01h35	UTC-4	57°33.560	083°49.180	CTD-Rosette	180	245	035	20	1.1	5.0	1019.0	72	0/10
2	CTD-13	CTD	07/Oct/2005	05h20	UTC-4	56°51.880	084°13.220	CTD-Rosette	175	180	016	17	2.2	5.5	1018.0	70	0/10
2	CTD-14	CTD	07/Oct/2005	07h45	UTC-4	56°27.070	084°27.110	CTD-Rosette	147	195	356	20	2.7	5.7	1018.0	72	0/10
2	CTD-15	CTD	07/Oct/2005	10h30	UTC-4	56°01.620	084°41.290	CTD-Rosette	92	200	340	15	2.8	6.8	1019.0	74	0/10
2	CTD-16	CTD	07/Oct/2005	11h35	UTC-4	55°52.030	084°46.300	CTD-Rosette	86	200	330	13	1.8	6.1	1020.0	74	0/10
2	CTD-17	CTD	07/Oct/2005	12h45	UTC-4	55°44.480	084°50.420	CTD-Rosette	63	200	340	10	1.7	6.0	1020.0	72	0/10
2	CTD-18	CTD	07/Oct/2005	13h40	UTC-4	55°37.080	084°57.300	CTD-Rosette	40	200	356	9	1.7	6.1	1020.0	71	0/10
2	CTD-19	CTD	07/Oct/2005	14h35	UTC-4	55°31.950	084°56.930	CTD-Rosette	32	200	330	10	2.1	6.7	1020.0	72	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
2	CTD-19	CTD	07/Oct/2005	16h45	UTC-4	55°31.950	084°56.880	Box Core	34	195	200	10	1.8	6.9	1020.0	68	0/10
2	CTD-19	CTD	07/Oct/2005	17h20	UTC-4	55°32.010	084°56.800	Piston Core	34	194	132	5	2.1	6.8	1021.0	67	0/10
2	CTD-19	CTD	07/Oct/2005	17h30	UTC-4	55°32.080	084°56.770	Oblique Net Tow	34	190	117	4	2.1	6.8	1021.0	67	0/10
2	CTD-19	CTD	07/Oct/2005	17h50	UTC-4	55°32.115	084°56.730	Vertical Net Tow	34	200	180	1	2.1	5.8	1020.0	68	0/10
2	CTD-21	CTD	08/Oct/2005	09h05	UTC-4	58°18.140	087°04.260	CTD-Rosette	175	350	180	30	3.2	5.6	1011.0	80	0/10
2	CTD-24	CTD	09/Oct/2005	08h00	UTC-4	57°23.640	091°56.490	Sample (P. Larouche)			214	25	7.5	5.7	1007.0	85	0/10
2	CTD-24	CTD	09/Oct/2005	11h25	UTC-4	57°21.600	091°58.250	Oblique Net Tow	30	015	235	15	6.0	5.7	1009.0	90	0/10
2	CTD-24	CTD	09/Oct/2005	11h50	UTC-4	57°21.700	091°58.030	Vertical Net Tow	30	080	240	19	6.2	5.7	1009.0	90	0/10
2	CTD-24	CTD	09/Oct/2005	17h00	UTC-4	57°21.760	091°57.300	CTD-Rosette	33	117	280	20	7.2	6.0	1010.0	82	0/10
2	CTD-24	CTD	09/Oct/2005	17h15	UTC-4	57°21.500	091°57.020	Oblique Net Tow	33	100	280	18	7.0	6.0	1010.0	82	0/10
2	CTD-29	CTD	09/Oct/2005	19h30	UTC-4	57°26.800	091°53.420	CTD-Rosette	35	041	250	16	6.9	6.0	1011.0	81	0/10
2	CTD-28	CTD	09/Oct/2005	20h35	UTC-4	57°30.640	091°46.890	CTD-Rosette	35	050	245	18	6.9	5.9	1011.0	80	0/10
2	CTD-27	CTD	09/Oct/2005	21h25	UTC-4	57°34.680	091°40.340	CTD-Rosette	45	150	270	19	6.0	5.0	1012.0	82	0/10
2	CTD-27	CTD	09/Oct/2005	22h25	UTC-4	57°40.450	091°30.370	CTD-Rosette	100	100	275	21	6.1	6.5	1012.0	83	0/10
2	CTD-26	CTD	09/Oct/2005	23h35	UTC-4	57°48.11	091°16.720	CTD-Rosette	58		270	20	5.8	5.9	1012.0	82	0/10
2	CTD-25	CTD	10/Oct/2005	00h20	UTC-4	57°43.270	091°13.480	CTD-Rosette	49	150	270	15	5.7	5.1	1013.0	86	0/10
2	CTD-23	CTD	10/Oct/2005	01h00	UTC-4	57°38.380	091°09.900	CTD-Rosette	40	150	270	15	5.8	5.3	1014.0	87	0/10
2	CTD-22	CTD	10/Oct/2005	01h45	UTC-4	57°33.430	091°05.990	CTD-Rosette	29	100	275	15	6.0	5.6	1014.0	87	0/10
2	MH01-05	Mooring	10/Oct/2005	07h00	UTC-4	57°34.410	091°37.240	CTD-Rosette	60		287	18	6.2	5.5	1016.0	79	0/10
2	MH01-05	Mooring	10/Oct/2005	07h45	UTC-4	57°34.430	091°37.110	Secchi	59	112	287	20	6.2	5.5	1016.0	79	0/10
2	MH01-05	Mooring	10/Oct/2005	08h10	UTC-4	57°34.360	091°36.560	CTD-Rosette	59	160	285	15	6.2	5.5	1016.0	79	0/10
2	MH01-05	Mooring	10/Oct/2005	10h23	UTC-4	57°34.169	091°37.658	Mooring	45	340	275	11	4.0	5.5	1019.0	85	0/10
2	MH01-05	Mooring	10/Oct/2005	10h44	UTC-4	57°33.875	091°37.731	Hydrophone distance measurement 588 m									
2	MH01-05	Mooring	10/Oct/2005	10h51	UTC-4	57°34.282	091°37.208	Hydrophone distance measurement 549 m									
2	MH01-05	Mooring	10/Oct/2005	10h59	UTC-4	57°34.109	091°38.158	Hydrophone distance measurement 520 m									
2	MH01-05	Mooring	10/Oct/2005	11h20	UTC-4	57°33.610	091°37.950	CTD-Rosette	62		260	13	4.8	5.8	1022.0	84	0/10
2	24	CTD	10/Oct/2005	13h50	UTC-4	57°15.290	091°56.110	Oblique Net Tow	22	290	200	10	5.5	6.0	1020.0	84	0/10
2	24	CTD	10/Oct/2005	14h10	UTC-4	57°15.130	091°56.230	Oblique Net Tow	22	300	220	10	5.9	5.9	1020.0	79	0/10
2	24	CTD	10/Oct/2005	15h30	UTC-4	57°23.260	091°46.060	Oblique Net Tow	43	300	210	10	6.7	6.0	1020.0	78	0/10
2	24	CTD	10/Oct/2005	16h00	UTC-4	57°23.140	091°46.000	Vertical Net Tow	41	236	195	10	6.4	5.8	1020.0	80	0/10
2	30	CTD	10/Oct/2005	21h05	UTC-4	57°22.870	092°00.010	CTD-Rosette	21	300	183	20	7.2	6.3	1020.0	77	0/10

Appendix 2 - Scientific log of activities conducted during the 2005 ArcticNet Amundsen Expedition

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					
2	CTD-31	CTD	11/Oct/2005	02h00	UTC-4	58°07.430	090°43.230	CTD-Rosette	81	045	190	25	7.5	5.0	1016.0	77	0/10
2	CTD-32	CTD	11/Oct/2005	06h05	UTC-4	58°45.260	089°32.980	CTD-Rosette	94	030	196	24	7.7	4.6	1012.0	77	0/10
2	23	Full	11/Oct/2005	11h15	UTC-4	59°00.660	087°37.450	Sediment Traps Deployment (Start)	189		190	24	5.9	5.3	1012.0	90	0/10
2	23	Full	11/Oct/2005	11h37	UTC-4	59°00.777	087°36.720	Sediment Traps Deployment (End)	189		190	24	5.9	5.3	1012.0	90	0/10
2	23	Full	11/Oct/2005	12h10	UTC-4	59°01.430	087°37.080	CTD-Rosette	194		186	27	7.9	5.3	1011.0	82	0/10
2	23	Full	11/Oct/2005	12h50	UTC-4	59°01.400	087°37.000	Light Profile	194		180	29	6.5	5.3	1011.0	88	0/10
2	23	Full	11/Oct/2005	13h45	UTC-4	59°02.130	087°36.310	Oblique Net Tow	196		183	26	8.8	5.3	1010.0	80	0/10
2	23	Full	11/Oct/2005	14h05	UTC-4	59°01.870	087°35.330	Oblique Net Tow	199		190	25	5.4	5.3	1010.0	92	0/10
2	23	Full	11/Oct/2005	14h35	UTC-4	59°01.740	087°34.500	CTD-Rosette	199		184	28	5.5	5.3	1010.0	91	0/10
2	23	Full	11/Oct/2005	15h30	UTC-4	59°02.270	087°33.320	Oblique Net Tow	200		180	29	7.2	5.3	1009.0	84	0/10
2	23	Full	11/Oct/2005	15h50	UTC-4	59°02.290	087°31.860	Vertical Net Tow	204		180	32	5.7	5.2	1009.0	90	0/10
2	23	Full	11/Oct/2005	16h20	UTC-4	59°02.790	087°31.410	Secchi	202	044	180	32	5.7	5.2	1009.0	90	0/10
2	23	Full	11/Oct/2005	16h35	UTC-4	59°03.080	087°31.020	CTD-Rosette	200		182	30	5.7	5.2	1009.0	90	0/10
2	23	Full	11/Oct/2005	17h15	UTC-4	59°03.340	087°30.020	Box Core	200		187	31	5.7	5.2	1009.0	90	0/10
2	23	Full	11/Oct/2005	17h55	UTC-4	59°03.290	087°29.440	Gravity Core	203	030	190	30	8.5	5.3	1007.0	80	
2	23	Full	11/Oct/2005	18h10	UTC-4	59°03.570	087°28.830	CTD-Rosette	202	040	190	33	7.0	5.3	1007.0	77	
2	23	Full	11/Oct/2005	20h05	UTC-4	59°01.920	087°32.360	Sediment Traps Recovery (Start)	200	030	195	29	6.2	5.2	1005.0	90	
2	23	Full	11/Oct/2005	20h30	UTC-4	59°01.960	087°32.570	Sediment Traps Recovery (End)	200	035	195	30	6.2	5.2	1005.0	90	0/10
2	AN02-05	Mooring	12/Oct/2005	08h37	UTC-4	58°46.880	091°31.280	CTD-Rosette	80	183	308	15	5.2	4.5	1010.0	91	0/10
2	AN02-05	Mooring	12/Oct/2005	10h30	UTC-4	58°46.500	091°30.700	Hydrobios, Secchi	80		315	15	5.6	4.6	1012.0	87	0/10
2	AN02-05	Mooring	12/Oct/2005	10h45	UTC-4	58°46.570	091°30.740	CTD-Rosette	81		300	15	5.5	4.6	1011.0	91	0/10
2	AN02-05	Mooring	12/Oct/2005	11h35	UTC-4	58°46.988	091°31.539	Mooring (start)	83	050	320	12	4.3	4.6	1012.0	96	0/10
2	AN02-05	Mooring	12/Oct/2005	11h50	UTC-4	58°46.892	091°31.363	Mooring (End)	80		320	15	3.3	4.6	1012.0	98	0/10
2	AN02-05	Mooring	12/Oct/2005	12h12	UTC-4	58°46.777	091°30.826	Hydrophone distance measurement 645 m									
2	AN02-05	Mooring	12/Oct/2005	12h24	UTC-4	58°47.152	091°31.539	Hydrophone distance measurement 507 m									
2	AN02-05	Mooring	12/Oct/2005	12h35	UTC-4	58°46.756	091°31.855	Hydrophone distance measurement 579 m									
2	AN02-05	Mooring	12/Oct/2005	12h52	UTC-4	58°45.640	091°30.050	CTD-Rosette	85	170	340	7	4.7	4.6	1013.0	92	0/10
2	AN02-05	Mooring	12/Oct/2005	13h25	UTC-4	58°45.470	091°30.030	Oblique Net Tow	85		320	12	5.5	4.6	1013.0	91	0/10
2	AN02-05	Mooring	12/Oct/2005	13h50	UTC-4	58°44.550	091°30.090	Bioness	86	195	315	15	4.2	4.7	1013.0	94	0/10
2	AN02-05	Mooring	12/Oct/2005	14h15	UTC-4	58°44.600	091°29.280	Vertical Net Tow	85	100	320	14	4.8	4.7	1013.0	91	0/10
2	AN02-05	Mooring	12/Oct/2005	14h52	UTC-4	58°43.986	091°29.369	Box Core	86	150	325	12	4.4	4.8	1014.0	90	0/10

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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					
2	AN02-05	Mooring	12/Oct/2005	15h20	UTC-4	58°43.880	091°29.349	Gravity Core	87	270	350	12	3.6	4.7	1014.0	91	0/10
2	AN01-05	Mooring	12/Oct/2005	21h15	UTC-4	60°00.030	091°57.060	Sediment Traps Deployment (Start)	118			0	2.6	4.5	1016.0	81	0/10
2	AN01-05	Mooring	12/Oct/2005	21h30	UTC-4	60°00.070	091°57.070	Sediment Traps Deployment (End)	118			0	2.6	4.5	1016.0	81	0/10
2	AN01-05	Mooring	12/Oct/2005	22h00	UTC-4	59°58.705	091°56.665	Mooring (start)	105		150	6	2.6	4.5	1016.0	82	0/10
2	AN01-05	Mooring	12/Oct/2005	22h15	UTC-4	59°58.670	091°56.623	Mooring (End)	107		150	6	2.0	4.5	1016.0	82	0/10
2	AN01-05	Mooring	12/Oct/2005	22h50	UTC-4	59°58.640	091°57.380	CTD-Rosette	104		150	9	2.6	4.5	1016.0	83	0/10
2	AN01-05	Mooring	12/Oct/2005	22h30	UTC-4	59°58.485	091°56.220	Hydrophone distance measurement 589 m									
2	AN01-05	Mooring	12/Oct/2005	22h35	UTC-4	59°58.917	091°56.408	Hydrophone distance measurement 574 m									
2	AN01-05	Mooring	12/Oct/2005	22h45	UTC-4	59°58.630	091°57.320	Hydrophone distance measurement 683 m									
2	AN01-05	Mooring	12/Oct/2005	23h20	UTC-4	59°58.540	091°57.950	Oblique Net Tow	100		170	7	2.5	4.6	1015.0	83	0/10
2	AN01-05	Mooring	12/Oct/2005	23h55	UTC-4	59°59.310	091°56.780	Vertical Net Tow	104	170	170	10	3.2	4.6	1016.0	84	0/10
2	AN01-05	Mooring	13/Oct/2005	01h05	UTC-4	59°59.690	091°57.620	Hydrobios	113	350	160	13	4.0	4.6	1016.0	82	0/10
2	AN01-05	Mooring	13/Oct/2005	01h32	UTC-4	59°59.390	091°58.120	CTD-Rosette	113	030	160	12	4.3	4.6	1016.0	83	0/10
2	AN01-05	Mooring	13/Oct/2005	02h30	UTC-4	59°59.790	091°58.500	Box Core	116	280	175	12	3.6	4.6	1016.0	86	0/10
2	AN01-05	Mooring	13/Oct/2005	02h52	UTC-4	59°59.940	091°58.350	Gravity Core	119	300	180	15	2.6	4.6	1015.0	89	0/10
2	AN01-05	Mooring	13/Oct/2005	04h30	UTC-4	60°00.030	091°58.405	Sediment Traps Recovery	119	195	158	13	1.9	4.6	1015.0	97	0/10
2	25	Basic	13/Oct/2005	13h30	UTC-4	59°01.960	094°02.470	Light Profile	53	020	130	28	3.4	5.0	1008.0	98	0/10
2	25	Basic	13/Oct/2005	14h00	UTC-4	59°02.500	094°02.470	CTD-Rosette	51		130	28	6.3	4.8	1006.0	84	0/10
2	25	Basic	13/Oct/2005	14h55	UTC-4	59°02.560	094°03.440	Trawl (Start)	59	223	130	25	3.4	4.8	1006.0	95	0/10
2	25	Basic	13/Oct/2005	16h10	UTC-4	58°59.600	094°03.500	Trawl (end)	50	200	130	20	3.6	5.4	1006.0	99	0/10
2	25	Basic	13/Oct/2005	16h45	UTC-4	58°59.900	094°02.800	Oblique Net Tow	50		128	22	5.9	5.0	1006.0	91	0/10
2	26	Basic	15/Oct/2005	21h25	UTC-4	60°26.840	089°22.310	CTD-Rosette	145	165	350	20	-0.6	3.2	1010.0	87	0/10
2	26	Basic	15/Oct/2005	21h55	UTC-4	60°26.490	089°21.860	Oblique Net Tow	145	190	350	20	-0.6	3.2	1010.0	87	0/10
2	26	Basic	15/Oct/2005	22h35	UTC-4	60°26.850	089°22.140	Vertical Net Tow	145	180	330	25	-0.6	3.2	1010.0	87	0/10
2	26	Basic	15/Oct/2005	23h00	UTC-4	60°26.660	089°22.020	CTD-Rosette	145	190	350	15	-0.3	3.6	1010.0	83	0/10
2	26	Basic	15/Oct/2005	23h45	UTC-4	60°26.230	089°21.500	Box Core	142		320	15	2.5	3.9	1010.0	73	0/10
2	26	Basic	16/Oct/2005	00h15	UTC-4	60°25.809	089°20.942	Gravity Core	140		345	18	-0.1	3.9	1011.0	79	0/10
2	27	Full	16/Oct/2005	08h25	UTC-4	61°03.720	086°11.310	Sediment Traps Deployment (Start)	245		350	7	-1.1	4.5	1010.0	74	0/10
2	27	Full	16/Oct/2005	08h45	UTC-4	61°03.670	086°11.250	Sediment Traps Deployment (End)	245		350	7	-1.1	4.5	1010.0	74	0/10
2	27	Full	16/Oct/2005	08h50	UTC-4	61°03.710	086°11.340	Secchi	245		350	7	-1.1	4.5	1010.0	74	0/10
2	27	Full	16/Oct/2005	09h10	UTC-4	61°03.950	086°10.880	CTD-Rosette	244		340	11	-1.0	4.4	1010.0	71	0/10

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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					
2	27	Full	16/Oct/2005	10h00	UTC-4	61°03.500	086°10.600	Oblique Net Tow	244		335	5	0.2	4.6	1010.0	70	0/10
2	27	Full	16/Oct/2005	10h45	UTC-4	61°03.760	086°10.250	Bioness	245		330	5	0.5	4.0	1010.0	69	0/10
2	27	Full	16/Oct/2005	10h45	UTC-4	61°02.600	086°11.240	CTD-Rosette	244			0	0.5	4.6	1011.0	68	0/10
2	27	Full	16/Oct/2005	11h45	UTC-4	61°02.360	086°11.390	CTD-Rosette	235			0	0.6	4.7	1011.0	68	0/10
2	27	Full	16/Oct/2005	13h15	UTC-4	61°02.000	086°11.950	RMT	231	190	150	5	-1.0	4.7	1011.0	74	0/10
2	27	Full	16/Oct/2005	13h50	UTC-4	61°02.820	086°12.370	CTD-Rosette	232	085	210	3	-0.4	4.7	1011.0	75	0/10
2	27	Full	16/Oct/2005	14h25	UTC-4	61°02.660	086°12.460	Hydrobios	244	245	175	4	-0.7	4.7	1011.0	75	0/10
2	27	Full	16/Oct/2005	15h00	UTC-4	61°02.540	086°12.640	Vertical Net Tow	243	244	170	5	-0.6	4.7	1011.0	75	0/10
2	27	Full	16/Oct/2005	15h40	UTC-4	61°02.388	086°13.008	Box Core	244	250	165	6	-0.5	4.7	1011.0	75	0/10
2	27	Full	16/Oct/2005	16h25	UTC-4	61°03.190	086°13.460	Gravity Core	245		156	7	-0.6	4.7	1010.0	76	0/10
2	27	Full	16/Oct/2005	16h05	UTC-4	61°02.430	086°13.210	Box Core	239	003	160	10	0.6	4.7	1010.0	76	0/10
2	27	Full	16/Oct/2005	17h15	UTC-4	61°03.196	086°12.831	Gravity Core	245	039	165	11	1.0	4.6	1009.0	73	0/10
2	27	Full	16/Oct/2005	19h00	UTC-4	61°04.180	086°11.320	Sediment Traps Recovery	232		155	17	0.6	4.5	1008.0	78	0/10
2	HS-17	Coring	17/Oct/2005	22h35	UTC-4	63°03.010	074°18.240	Box Core	436		130	25	1.2	1.4	1005.0	93	0/10
2	HS-17	Coring	17/Oct/2005	23h20	UTC-4	63°03.010	074°18.560	Box Core	430		130	25	2.1	1.4	1005.0	92	0/10
2	HS-17	Coring	17/Oct/2005	00h10	UTC-4	63°02.830	074°18.881	Piston Core	430	290	130	25	1.4	2.5	1005.0	82	0/10
2	HS-18	CTD	18/Oct/2005	15h20	UTC-4	61°06.550	069°54.330	CTD-Rosette	165	290	090	25	2.6	1.7	1007.0	91	0/10

Appendix 3 - CTD logbook for the 2005 ArcticNet Amundsen Expedition

Leg	Cast#	Station	Date UTC	Time Start UTC	Latitude N	Longitude W	Bottom depth (m)	Cast depth (m)	Comments	Rosette Type	Init.
Leg 1											
1	001	Pond Inlet	2005-08-14	14:07	72° 47.10	076° 59.05	989	975	lost signal at bottom		MER
1	002	Pond Inlet	2005-08-14	14:48	72° 47.10	076° 59.05	989	31	last 25 m of 001 upcast		MER
1	003	100	2005-08-16	7:07	76° 17.98	071° 24.64	666	656	lost signal at bottom	CONT	MER
1	004	100	2005-08-16	11:00	76° 18.14	071° 24.58	685	663	lost signal at bottom up to 50 m	PP + NUT	VL
1	005	100	2005-08-16	16:36	76° 17.93	071° 25.81	678	652	btl 2, 9, 10 & 16 didn't close	CONT + DNA	VL
1	006	100	2005-08-16	18:55	76° 17.66	071° 26.30	672	656	nitrate battery dead; problem with oxygen	PP + NUT	VL
1	007	100	2005-08-17	6:39	76° 17.98	071° 24.41	678	660	problem with pH	CONT	MER
1	008	102	2005-08-17	8:31	76° 17.98	072° 06.21	557	540	problem with pH on downcast	CTD	MER
1	009	104	2005-08-17	9:58	76° 16.97	072° 47.42	577	569	btl 2 & 9 didn't close	PP + NUT	MER
1	010	106	2005-08-17	11:52	76° 16.96	073° 28.67	547	538	new btl 2 & 9. Problem with oxygen up to 250m	CTD	MER
1	011	108	2005-08-17	13:56	76° 15.98	074° 35.25	460	443	Problem with oxygen up to 200m; btl 2 &9 didn't close	CONT + DNA	MER
1	012	108	2005-08-17	17:06	76° 16.01	074° 34.72	450	442	btl 2 closed, 9 didn't. Probl with oxygen; nitrate battery	PP + NUT	VL
1	013	108	2005-08-17	20:30	76° 15.32	074° 35.61	448	439	btl 2 & 9 closed, probl with oxygen	CONT	VL
1	014	110	2005-08-18	2:57	76° 17.35	075° 00.58	443	433	btl 2 & 9 closed, probl with oxygen	CTD	VL
1	015	112	2005-08-18	4:36	76° 19.42	075° 47.02	342	332	problem with oxygen. Nitrate battery dead, btl 9 didn't close	PP + NUT	VL
1	016	114	2005-08-18	8:03	76° 21.24	076° 35.38	151	137	problem with oxygen	CTD	MER
1	017	116	2005-08-18	9:05	76° 22.92	077° 23.30	352	344	btl 2 & 9 didn't close	CONT + DNA	MER
1	018	116	2005-08-18	11:58	76° 22.94	077° 23.85	360	345	btl 2&9 not closed	PP + NUT	MER
1	019	116	2005-08-18	15:05	76° 23.00	077° 22.94	355	347	all closed (pilone cleaned)	CONT	MER
1	020	116	2005-08-18	23:38	76° 24.84	077° 20.94	280	268		CTD	VL
1	021	L 9	2005-08-19	9:03	77° 49.96	075° 20.77	607	604		DNA	VL
1	022	L 5	2005-08-19	13:49	78° 04.70	074° 39.70	671	661		CTD	VL
1	023	L 4	2005-08-19	15:25	78° 04.96	075° 00.22	614	607	Problem with pH	CTD	MER
1	024	L 1	2005-08-19	18:05	78° 20.32	074° 39.48	645	636	Problem with pH	CTD	MER
1	025	L 2	2005-08-19	19:13	78° 19.68	074° 21.33	493	487	winch stop at 219m mecanical problem. Ship moved a lot because of ice. First 10 m mixed. Problem with oxygen	DNA	MER
1	026	L 2	2005-08-19	21:39	78° 18.13	074° 28.79	530	517	Btl 2 & 7 didn't close. Ship moved a lot.	PP + NUT	VL
1	027	L 3	2005-08-20	0:56	78° 19.41	073° 59.76	615	24	Seringe forgotten on pump	CTD	VL
1	028	L 3	2005-08-20	1:24	78° 19.15	074° 00.58	643	626	nitrate battery dead	CTD	VL
1	029	L 6	2005-08-20	3:56	78° 05.10	074° 19.55	709	700		CTD	VL
1	030	L 11	2005-08-20	6:22	77° 49.98	074° 39.70	705	695	btl 2 did not close	CONT + DNA	VL
1	031	L 11	2005-08-20	7:54	77° 49.98	074° 39.25	704	695	btl 2, 7 & 9 didn’t close	CONT	MER
1	032	L 10	2005-08-20	10:05	77° 49.78	075° 01.03	671	661		CTD	MER
1	033	L 9	2005-08-20	11:08	77° 50.08	075° 20.72	608	597		CTD	MER
1	034	L 8	2005-08-20	12:19	77° 49.83	075° 40.13	550	536		CTD	MER
1	035	L 7	2005-08-20	14:24	77° 49.50	075° 59.24	572	562		DNA	MER
1	036	L 15	2005-08-20	17:10	77° 34.57	075° 39.60	663	653	first 10 m mixed by ship movement	CTD	MER
1	037	L 14	2005-08-20	18:12	77° 34.94	075° 54.01	609	600		CTD	MER
1	038	L 16	2005-08-20	19:41	77° 35.03	075° 19.83	636	632		CTD	VL

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Leg	Cast#	Station	Date UTC	Time Start UTC	Latitude N	Longitude W	Bottom depth (m)	Cast depth (m)	Comments	Rosette Type	Init.
1	039	L 17	2005-08-20	20:54	77° 34.57	074° 58.96	663	655		CTD	VL
1	040	L 24	2005-08-20	22:43	77° 20.11	075° 01.78	648	644	ship moved a lot; problem with pH	CTD	VL
1	041	L 23	2005-08-21	1:10	77° 19.99	075° 22.69	561	540	many waves, hard to take rosette out of water; problem with temperature on first 15 m	CTD	VL
1	042	L 22	2005-08-21	2:38	77° 19.97	075° 43.01	564	548	problem with temperature on first 15 m; problem with pH	CTD	VL
1	043	L 21	2005-08-21	3:39	77° 20.08	076° 01.24	540	522		DNA	VL
1	044	L 20	2005-08-21	6:52	77° 19.97	076° 20.28	456	448	problem with pH	CTD	VL
1	045	L 19	2005-08-21	7:48	77° 22.00	076° 39.33	430	422		CTD	VL
1	046	L 18	2005-08-21	8:50	77° 19.21	077° 00.23	445	436		CTD	MER
1	047	K	2005-08-21	16:07	77° 19.82	077° 00.63	384	384	first 10 m mixed; problem with pH	CTD	MER
1	048	BA04-05	2005-08-21	23:45	75° 14.40	074° 58.92	477	470		CONT + DNA	VL
1	049	BA04-05	2005-08-22	4:17	75° 14.42	074° 59.53	479	470		Sed Traps	VL
1	050	BA04-05	2005-08-22	6:05	75° 14.45	075° 00.27	478	467		PP + NUT	VL
1	051	L	2005-08-22	15:21	74° 03.65	077° 13.22	838	819		CTD	MER
1	052	3	2005-08-22	23:53	74° 03.05	079° 55.24	912	808	Rosette hit bottom	CONT + DNA	VL
1	053	3	2005-08-23	4:12	74° 03.38	079° 54.09	804	788	trans. didn't work	CONT	VL
1	054	3	2005-08-23	12:40	74° 02.81	079° 53.66	814	780	problem Trans	PP + NUT	MER
1	055	3a	2005-08-23	18:44	74° 11.79	083° 20.76	700	680	problem Trans	NUT	MER
1	056	4a	2005-08-24	2:25	74° 18.15	088° 29.43	346	333	problem Trans	NUT	VL
1	057	4	2005-08-24	7:43	74° 15.99	091° 11.80	334	322	problem Trans	CONT 1	VL
1	058	4	2005-08-24	12:39	74° 15.75	091° 11.53	335	324	problem Trans. btl # 12 leaking	PP + NUT	MER
1	059	4	2005-08-24	15:00	74° 16.38	091° 09.72	333	325	problem Trans	Sed Traps	MER
1	060	4	2005-08-24	16:26	74° 16.63	091° 07.59	339	329	problem Trans	DNA + CONT 2	MER
1	061	O	2005-08-25	22:45	73° 19.05	096° 20.57	222	211	problem Trans resolved	CTD	VL
1	062	P	2005-08-26	4:47	72° 19.85	096° 17.96	458	442		PP + NUT	VL
1	063	6	2005-08-27	10:19	69° 10.03	100° 41.97	65	54	nitrate battery dead; problem with oxygen	CONT	VL
1	064	6	2005-08-27	12:36	69° 10.46	100° 41.88	68	57		PP + NUT	VL
1	065	6	2005-08-27	15:41	69° 11.05	100° 42.62	72	63		Sed Traps + DNA	VL
1	066	R	2005-08-28	4:31	69° 02.06	101° 13.90	68	58	problem with oxygen	CTD	MER
1	067	S	2005-08-28	10:49	68° 41.18	103° 59.57	105	93		CTD	VL
1	068	7	2005-08-30	4:43	68° 59.86	106° 33.99	118	108		CONT	MER
1	069	7	2005-08-30	8:31	69° 00.05	106° 34.33	111	100		ZOO	MER
1	070	7	2005-08-30	10:40	68° 59.88	106° 34.81	117	104		PP + NUT	VL
1	071	T	2005-08-31	5:44	68° 35.55	109° 28.10	151	137		CTD	MER
1	072	U	2005-08-31	10:42	68° 25.18	112° 08.26	206	190		CTD	VL
1	073	V	2005-09-01	0:12	69° 42.20	118° 23.63	489	479		CTD	MER
1	074	CA18-05	2005-09-01	10:15	70° 39.97	122° 58.43	548	537		CTD	VL
1	075	CA20-04	2005-09-01	17:40	70° 20.41	126° 20.55	254	242		CTD	VL
1	076	CA05-04	2005-09-02	1:43	71° 24.84	127° 23.48	301	292		CTD	MER
1	077	211	2005-09-02	2:45	71° 22.64	127° 29.70	263	253		PP + NUT	MER
1	078	210	2005-09-02	3:48	71° 20.57	127° 32.48	233	226		NUT	MER

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Leg	Cast#	Station	Date UTC	Time Start UTC	Latitude N	Longitude W	Bottom depth (m)	Cast depth (m)	Comments	Rosette Type	Init.
1	079	209	2005-09-02	5:00	71° 18.42	127° 41.95	175	165		NUT	MER
1	080	208	2005-09-02	6:07	71° 16.45	127° 48.48	140	134		NUT	MER
1	081	207	2005-09-02	7:07	71° 14.94	127° 54.56	103	98	nitrate battery dead	NUT	MER
1	082	206	2005-09-02	9:10	71° 12.85	128° 00.46	82	70		NUT	VL
1	083	205	2005-09-02	9:51	71° 10.81	128° 06.24	70	62		NUT	VL
1	084	204	2005-09-02	10:52	71° 08.85	128° 12.22	64	53		PP + NUT	VL
1	085	204	2005-09-02	12:51	71° 08.86	128° 12.04	64	54		CONT + DNA	VL
1	086	203	2005-09-02	14:25	71° 06.79	128° 18.37	58	47		NUT	VL
1	087	202	2005-09-02	15:03	71° 04.90	128° 24.63	54	44		NUT	MER
1	088	201	2005-09-02	15:41	71° 02.95	128° 30.51	43	32		NUT	MER
1	089	CA05-05	2005-09-02	22:37	71° 16.66	127° 31.41	201	195		PP + NUT	VL
1	090	CA05-05	2005-09-03	1:57	71° 16.80	127° 30.29	209	202	btl 9 didn't close	CONT + DNA	VL
1	091	CA05-05	2005-09-03	4:54	71° 17.19	127° 30.13	210	201		ZOO	MER
1	092	CA15-04	2005-09-03	8:53	71° 32.02	126° 58.36	407	396		CTD	MER
1	093	CA14-03	2005-09-03	15:19	71° 47.75	127° 59.87	409	389		CTD	VL
1	094	CA13-03	2005-09-04	2:40	71° 21.78	131° 20.91	348	341		Sed Traps	MER
1	095	CA04-04	2005-09-04	12:21	71° 05.62	133° 42.53	331	324		CTD	VL
1	096	CA07-04	2005-09-04	19:07	71° 10.44	133° 59.76	625	617		DNA	VL
1	097	10	2005-09-05	14:20	71° 35.02	139° 59.00	2481	976	trans. problem	CONT	VL
1	098	10	2005-09-05	16:59	71° 33.85	139° 59.50	2478	975	problem with Trans. under 600m. Btl 9 didn't close	PP + NUT	VL
1	099	10	2005-09-05	20:49	71° 33.65	140° 06.713	2503	975	btl 9 didn't close; problem with trans.	DNA	VL
1	100	CA04-05	2005-09-06	21:46	71° 05.22	133° 37.01	334	326	btl 9 didn't close	PP + NUT	MER
1	101	CA04-05	2005-09-06	1:40	71° 03.75	133° 36.07	265	257	btl 9 closed; btl 20 leaking	CONT + DNA	MER
1	102	CA04-05	2005-09-07	4:35	71° 04.94	133° 34.48	331	196		ZOO + PIGM	MER
1	103	CA07-04	2005-09-07	8:10	71° 10.75	134° 01.83	634	628	first 10 m mixed; problem Trans	DNA	MER
1	104	224	2005-09-08	7:57	71° 42.26	126° 28.96	397	385	problem trans.; winch stopped at 28 m on upcast	CTD	MER
1	105	223	2005-09-08	10:02	71° 38.31	126° 40.97	442	430	problem with trans.	CTD	MER
1	106	222	2005-09-08	11:02	71° 34.42	126° 52.99	428	412	problem Trans past 340m	CTD	VL
1	107	221	2005-09-08	12:03	71° 30.47	127° 05.14	384	370		CTD	VL
1	108	CA05-05	2005-09-09	5:31	71° 17.13	127° 32.74	198	190		CTD	MER
1	109	CA08-05	2005-09-09	12:17	71° 00.90	125° 56.13	404	393	Bottle 9 has closed	ZOO + PIGM	VL
1	110	CA08-05	2005-09-09	14:05	71° 00.28	125° 55.93	402	394	Bottle 9 didn't close	PP + NUT	VL
1	111	CA08-05	2005-09-09	15:56	71° 00.24	125° 55.49	415	394	Bottle 9 didn't close	CONT + DNA	VL
1	112	CA08-05	2005-09-10	2:46	71° 00.509	126° 03.234	395	386		CTD	MER
1	113	11	2005-09-10	23:43	70° 20.374	126° 21.469	255	246	btl 15 didn't trip	CONT + DNA	MER
1	114	11	2005-09-11	2:59	70° 20.491	126° 21.737	263	246		CTD	MER
1	115	11	2005-09-11	4:00	70° 20.755	126° 21.857	254	247		CTD	MER
1	116	11	2005-09-11	5:00	70° 20.491	126° 21.737	252	246		CTD	MER
1	117	11	2005-09-11	5:58	70° 20.533	126° 21.528	253	246		CTD	MER
1	118	11	2005-09-11	6:56	70° 20.364	126° 21.434	256	247		CTD	MER
1	119	11	2005-09-11	7:56	70° 20.356	126° 21.456	255	245		CTD	MER

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Leg	Cast#	Station	Date UTC	Time Start UTC	Latitude N	Longitude W	Bottom depth (m)	Cast depth (m)	Comments	Rosette Type	Init.
1	120	11	2005-09-11	8:56	70° 20.366	126° 21.450	255	245		CTD	MER
1	121	11	2005-09-11	10:02	70° 20.362	126° 21.461	256	244		CTD	VL
1	122	11	2005-09-11	10:59	70° 20.356	126° 21.460	256	244		CTD	VL
1	123	11	2005-09-11	11:58	70° 20.358	126° 21.422	256	247		CTD	VL
1	124	11	2005-09-11	12:57	70° 20.358	126° 21.437	256	10	Acquisition stopped on surface	CTD	VL
1	125	11	2005-09-11	13:02	70° 20.358	126° 21.437	256	245	Suite de 124	CTD	VL
1	126	11	2005-09-11	14:18	70° 20.370	126° 21.396	255	248		PP + NUT	VL
1	127	11	2005-09-11	16:49	70° 20.344	126° 21.691	254	246		CTD	VL
1	128	11	2005-09-11	22:22	70° 20.358	126° 21.492	252	244	Bottle 15 didn't close	ZOO + PIGM	VL
1	129	CA18-05	2005-09-12	15:49	70° 39.988	122° 59.374	544	537	Bottle 15 didn't close	PP + NUT	VL
1	130	CA18-05	2005-09-12	19:14	70° 39.980	122° 59.584	542	535	Bottle 15 didn't close; trans had problems after 400 m	CONT +DNA	VL
1	131	CA18-05	2005-09-13	3:39	70° 39.073	122° 59.690	608	598	problem with trans after 400m	ZOO	MER
1	132	12	2005-09-13	18:04	69° 54.802	122° 57.391	205	196	Bottles 9 and 15 didn't close	PP + NUT	VL
1	133	12	2005-09-13	21:18	69° 54.870	122° 56.981	193	186	Bottle 15 didn't close	CONT + DNA	VL
1	134	12	2005-09-14	1:52	69° 54.863	122° 57.280	199	197	Bottle 15& 9 didn't close	ZOO + PIGM	MER
1	135	X	2005-09-14	4:48	69° 54.266	121° 30.211	266	261		CTD	MER
1	136	Y	2005-09-14	10:35	69° 27.402	118° 11.332	465	454		CTD	VL
1	137	Z	2005-09-14	14:12	69° 16.244	116° 50.755	192	186	Bottle 15 didn't close	CTD + ZOO	VL
Leg 2											
2	1	T2	2005-09-16	12:43	68° 23.620	110° 05.869	246	236	btl 15 didn't trip	CTD	MER
2	2	S2	2005-09-17	2:06	68° 40.654	103° 52.152	108	102	btl 9, 15, 23 didn't trip	CONT	MER
2	3	O2	2005-09-18	16:39	73° 39.212	096° 17.011	252	240	btl 9 & 15 didn't trip	CONT	MER
2	4	Pond Inlet 2	2005-09-19	22:28	72° 38.147	079° 45.179	545	535		CTD	PG
2	5	13a	2005-09-22	13:05	61° 16.379	064° 49.026	262	245	btl 9 didn't trip, strong current	CONT	PG
2	6	13 b	2005-09-22	15:25	61° 09.202	064° 49.494	450	435	btl 15 didn't trip	PP + NUT + Hg	PG
2	7	13c	2005-09-22	18:23	61° 00.233	064° 44.630	518	502	btl 9 & 15 didn't trip, strong current	Sed Traps + ZOO	PG
2	8	13d	2005-09-22	22:04	60° 50.908	064° 42.473	387	377	btl 9 did not trip	Pellets + NUT	PG
2	9	13e	2005-09-23	0:44	60° 44.873	064° 41.710	303	291	very strong current	CONT	PG
2	10	14a	2005-09-23	16:22	62° 31.468	070° 52.079	344	330	stong current	CTD	PG
2	11	14b	2005-09-23	17:53	62° 29.300	071° 02.417	342	330	the ship has been re-stabilized during the soak period.	Pellets	PG
2	12	14c	2005-09-23	19:21	62° 25.740	071° 17.839	331	324		CTD	PG
2	13	14d	2005-09-23	20:48	62° 21.398	071° 39.383	343	334		CTD	PG
2	14	14e	2005-09-23	23:17	62° 16.468	071° 58.700	338	330		CTD	MER
2	15	14e	2005-09-24	1:46	62° 16.105	071° 56.918	343	330		Organo. Chlo	MER
2	16	14e	2005-09-24	4:15	62° 15.082	071° 52.529	342	340	pump long to start. Btl 17 is leaking.	PP + NUT	MER
2	17	14f	2005-09-24	10:07	62° 13.234	072° 14.976	233	225	btl 11 is leaking.	Sed Traps + CONT	PG
2	18	14g	2005-09-24	11:13	62° 10.902	072° 24.944	200	179		CTD	PG
2	19	15a	2005-09-25	7:54	64° 19.691	078° 05.021	115	108		CTD	MER
2	20	15b	2005-09-25	8:46	64° 16.980	078° 15.086	209	202		CTD	PG
2	21	15c	2005-09-25	9:53	64° 12.914	078° 31.010	271	261		CTD	PG
2	22	15d	2005-09-25	11:24	64° 07.230	078° 52.260	245	237		PP + NUT	PG

Appendix 3 - CTD logbook for the 2005 ArcticNet Amundsen Expedition

Leg	Cast#	Station	Date UTC	Time Start UTC	Latitude N	Longitude W	Bottom depth (m)	Cast depth (m)	Comments	Rosette Type	Init.
2	23	15e	2005-09-25	14:44	64° 01.745	079° 12.882	311	304	Nitrates no signal; Btl 8 did not trip	Pellets	PG
2	24	15e	2005-09-25	16:39	64° 01.421	079° 16.297	312	303		CONT + OC	PG
2	25	15f	2005-09-25	21:54	63° 56.300	079° 33.702	325	310		CTD	MER
2	26	15g	2005-09-25	23:09	63° 51.899	079° 49.164	292	290		CTD	MER
2	27	15h	2005-09-26	0:08	63° 49.250	079° 59.268	216	211		CTD	MER
2	28	CTD1	2005-09-26	4:15	63° 24.178	081° 06.248	69	61		CTD	MER
2	29	CTD2	2005-09-26	5:15	63° 18.733	081° 15.112	120	112		CTD	MER
2	30	CTD3	2005-09-26	6:22	63° 11.266	081° 27.083	182	173		CTD	MER
2	31	CTD4	2005-09-26	7:33	63° 03.637	081° 39.024	230	216		CTD	MER
2	32	16a	2005-09-26	8:27	62° 58.298	081° 47.587	220	206		CTD	MER
2	33	16b	2005-09-26	9:22	62° 55.237	081° 37.944	218	209		CTD	PG
2	34	16c	2005-09-26	10:28	62° 51.149	081° 23.286	205	198		CTD	PG
2	35	16d	2005-09-26	11:59	62° 45.462	081° 03.439	198	189	btl 8 did not trip	PP + NUT	PG
2	36	16e	2005-09-26	14:26	62° 38.561	080° 44.779	205	197	btl 8 did not trip	CONT + OC	PG
2	37	16e	2005-09-26	17:10	62° 39.407	080° 47.263	220	209		Pellets + Sed Traps	PG
2	38	16f	2005-09-26	23:48	62° 33.362	080° 24.856	205	195		CTD	MER
2	39	16g	2005-09-27	0:58	62° 28.981	080° 10.422	187	179		CTD	MER
2	40	16h	2005-09-27	1:58	62° 25.859	080° 01.337	174	160		CTD	MER
2	41	17a	2005-09-27	10:49	62° 13.846	079° 08.550	140	129		CTD	PG
2	42	17b	2005-09-27	11:44	62° 11.634	078° 58.106	186	175	btl 1 did not trip	CTD	PG
2	43	17c	2005-09-27	13:00	62° 08.072	078° 42.868	156	147	btl 1 did not trip	PP + NUT	PG
2	44	17c	2005-09-27	16:38	62° 07.316	078° 47.092	176	164	btl 1 did not trip	CONT + OC	PG
2	45	17c	2005-09-27	18:23	62° 08.268	078° 42.859	153	141		Pellets + Hg	PG
2	46	17d	2005-09-27	19:45	62° 04.856	078° 27.251	71	60		CTD	PG
2	47	17e	2005-09-27	20:53	62° 02.620	078° 17.240	47	37		CTD	MER
2	48	18	2005-09-28	7:12	60° 07.513	079° 09.953	140	128	10 first m all mixed	Pellets + Hg	MER
2	49	18	2005-09-28	10:27	60° 07.763	079° 07.702	136	123	10 first m all mixed (upcast)	CONT + OC	PG
2	50	18	2005-09-28	12:25	60° 09.442	079° 07.459	140	126		PP + NUT	PG
2	51	18	2005-09-28	15:49	60° 10.963	079° 20.780	155	145		CTD	PG
2	52	19a	2005-09-29	5:38	58° 11.081	079° 30.228	107	95		CTD	MER
2	53	19b	2005-09-29	6:58	58° 15.845	079° 06.815	75	66		CTD	MER
2	54	19c	2005-09-29	8:15	58° 20.533	078° 43.393	106	91		CTD	MER
2	55	19d	2005-09-29	9:12	58° 22.784	078° 31.562	103	93		CTD	PG
2	56	19e	2005-09-29	10:16	58° 25.196	078° 19.891	106	96		Pelots + zoo	PG
2	57	19e	2005-09-29	11:55	58° 25.162	078° 19.936	116	104		PP + NUT	PG
2	58	19e	2005-09-29	18:42	58° 25.144	078° 20.351	114	102		DOC	PG
2	59	20	2005-09-30	6:11	56° 50.400	076° 50.063	118	112		PP + CONT + Hg	MER
2	60	AN-03-05	2005-09-30	20:20	55° 17.077	077° 53.927	92	82		ZOO	PG
2	61	AN-03-05	2005-10-01	2:04	55° 17.695	077° 54.721	86	76		Sed Traps	MER
2	62	AN-03-05	2005-10-01	3:21	55° 17.717	077° 53.450	89	75		CONT	MER
2	63	AN-03-05	2005-10-01	11:49	55° 17.072	077° 53.754	87	77		PP + NUT	PG

Appendix 3 - CTD logbook for the 2005 ArcticNet Amundsen Expedition

Leg	Cast#	Station	Date UTC	Time Start UTC	Latitude N	Longitude W	Bottom depth (m)	Cast depth (m)	Comments	Rosette Type	Init.
2	64	AN-03-05	2005-10-01	13:57	55° 22.483	078° 06.368	98	87		CTD	PG
2	65	21b	2005-10-02	11:19	54° 41.105	079° 58.842	67	57	10 first m all mixed (upcast)	CTD	PG
2	66	21a	2005-10-02	12:07	54° 37.931	079° 51.605	49	39	10 first m all mixed (upcast)	CTD	PG
2	67	21c	2005-10-02	13:34	54° 41.315	080° 07.792	60	52	swell	PP + NUT	PG
2	68	21d	2005-10-02	14:58	54° 42.197	080° 21.100	112	102	swell	CTD	PG
2	69	21e	2005-10-02	22:02	54° 42.937	080° 43.765	99	91		ZOO	MER
2	70	21e	2005-10-02	23:52	54° 43.016	080° 43.784	100	89		Sed Traps + CONT	MER
2	71	21e	2005-10-03	1:49	54° 43.201	080° 45.119	98	87		Hg + OC	MER
2	72	21f	2005-10-03	4:04	54° 44.802	081° 06.450	68	58		CTD	MER
2	73	21g	2005-10-03	5:28	54° 45.773	081° 28.429	43	33		CTD	MER
2	74	21h	2005-10-03	6:25	54° 46.374	081° 42.852	32	22		CTD	MER
2	75	BI-1	2005-10-04	23:04	55° 25.790	080° 30.427	99	82	rough sea	Phyto + NUT	PG
2	76	BI-1	2005-10-05	0:14	55° 25.754	080° 29.244	97	84	rough sea	CONT	PG
2	77	BI-1	2005-10-05	1:29	55° 25.805	080° 32.178	103	87	rough sea; btl 20 leaking	ZOO + Pellets	PG
2	78	BI-2	2005-10-06	1:18	56° 45.066	080° 49.754	178	163	rough sea	CONT + NUT + Phyto	PG
2	79	BI-2	2005-10-06	3:01	56° 43.684	080° 48.562	141	128	rough sea; btl 22 leaking	ZOO + Pellets	PG
2	80	BI-2	2005-10-06	4:28	56° 43.048	080° 48.444	185	170	rough sea	CONT	PG
2	81	22	2005-10-06	20:51	58° 23.887	083° 17.490	181	168		PP + NUT	MER
2	82	22	2005-10-06	22:43	58° 23.250	083° 17.346	181	169	little swell	Hg + OC	PG
2	83	22	2005-10-07	0:34	58° 22.813	083° 18.528	178	165	little swell	Hg + OC	PG
2	84	CTD12	2005-10-07	6:35	57° 33.576	083° 49.162	181	170		CTD	PG
2	85	CTD13	2005-10-07	10:21	56° 51.889	084° 13.230	178	165	rough sea	CTD	MER
2	86	CTD14	2005-10-07	12:44	56° 27.068	084° 27.119	146	128	rough sea, stop 15m from bt; first 10 m missing	CTD	MER
2	87	CTD15	2005-10-07	15:19	56° 01.934	084° 40.993	100	90	rough sea; first 10 m missing	CTD	MER
2	88	CTD16	2005-10-07	16:39	55° 52.019	084° 46.294	91	80	rough sea; first 10 m missing	CTD	MER
2	89	CTD17	2005-10-07	17:43	55° 44.489	084° 50.404	64	53	rough sea; first 10 m missing	CTD	MER
2	90	CTD18	2005-10-07	18:43	55° 37.057	084° 54.343	41	31	rough sea; killed a jelly fish; first 10 m missing	CTD	MER
2	91	CTD19	2005-10-07	19:37	55° 31.730	084° 57.041	30	22	rough sea; first 10 m missing	CTD	MER
2	92	CTD21	2005-10-08	14:06	58° 18.130	087° 04.218	180	170	really rough sea; first 10 m missing	CTD	MER
2	93	24	2005-10-09	22:03	57° 21.856	091° 57.286	33	23		CTD	PG
2	94	CTD29	2005-10-10	0:31	57° 26.825	091° 53.434	35	25		CTD	PG
2	95	CTD29	2005-10-10	0:49	57° 26.915	091° 53.341	35	25		CTD	PG
2	96	CTD28	2005-10-10	1:34	57° 30.659	091° 46.926	41	31		CTD	PG
2	97	CTD27	2005-10-10	2:24	57° 34.682	091° 40.346	52	42		CTD	PG
2	98	CTD26	2005-10-10	3:24	57° 40.450	091° 30.401	56	50		CTD	PG
2	99	CTD25	2005-10-10	4:37	57° 48.118	091° 16.727	64	55		CTD	PG
2	100	CTD24	2005-10-10	5:19	57° 43.289	091° 13.514	48	38		CTD	PG
2	101	CTD23	2005-10-10	5:58	57° 38.389	091° 09.926	40	30		CTD	PG
2	102	CTD22	2005-10-10	6:45	57° 33.437	091° 05.965	29	20		CTD	PG
2	103	MH01-05	2005-10-10	12:00	57° 34.406	091° 37.176	60	50		Pellets	MER
2	104	MH01-05	2005-10-10	13:09	57° 34.427	091° 36.718	74	60	may have touched bottom	PP + NUT	MER

Appendix 3 - CTD logbook for the 2005 ArcticNet Amundsen Expedition

Leg	Cast#	Station	Date UTC	Time Start UTC	Latitude N	Longitude W	Bottom depth (m)	Cast depth (m)	Comments	Rosette Type	Init.
2	105	MH01-05	2005-10-10	16:18	57° 33.647	091° 37.967	59	52		CONT	MER
2	106	CTD30	2005-10-11	2:06	57° 22.864	092° 00.018	21	11		CTD	PG
2	107	CTD31	2005-10-11	6:55	58° 07.495	090° 43.201	81	70		CTD	PG
2	108	CTD32	2005-10-11	11:09	58° 45.233	089° 32.929	95	85		CTD	MER
2	109	23	2005-10-11	16:48	59° 00.680	087° 36.680	192	40	aborted; ship moved too close to sediment traps		MER
2	110	23	2005-10-11	17:04	59° 01.200	087° 36.712	194	179		ZOO	MER
2	111	23	2005-10-11	19:33	59° 01.700	087° 34.446	199	185		CONT + OC	MER
2	112	23	2005-10-11	21:36	59° 02.995	087° 30.961	200	188	rough sea	Pellets + Sed Traps	PG
2	113	23	2005-10-11	23:10	59° 03.566	087° 28.940	200	188	rough sea	PP + NUT	PG
2	114	AN02-05	2005-10-12	13:37	58° 46.904	091° 31.250	80	70		ZOO + Pellets	MER
2	115	AN02-05	2005-10-12	15:45	58° 46.576	091° 30.769	83	73		PP + NUT	MER
2	116	AN02-05	2005-10-12	17:56	58° 45.641	091° 30.060	85	73		CONT + OC	MER
2	117	AN01-05	2005-10-13	3:52	59° 58.643	091° 57.358	104	91	btl 11 is leaking	CONT + Sed Traps	PG
2	118	AN01-05	2005-10-13	6:31	59° 59.378	091° 58.134	115	103		PP + NUT	PG
2	119	25	2005-10-13	18:58	59° 02.459	094° 02.458	55	45			MER
2	120	26	2005-10-16	2:24	60° 26.791	089° 22.290	141	133	rough sea	CONT	PG
2	121	26	2005-10-16	4:00	60° 26.672	089° 22.002	141	129	rough sea	Pellets + NUT	PG
2	122	27	2005-10-16	14:08	61° 03.959	086° 10.891	242	229		PP + NUT	MER
2	123	27	2005-10-16	16:43	61° 02.576	086° 11.244	242	229		ZOO + Pellets	MER
2	124	27	2005-10-16	18:50	61° 02.822	086° 12.394	244	229		CONT + OC	MER
2	125	HS-17	2005-10-18	19:20	61° 06.576	069° 54.334	165	150		CTD	MER
2	126	HS-18	2005-10-21	21:06	60° 23.587	064° 54.554	65	55		CTD	PG

Appendix 4 - List of participants on Legs 1 and 2 of the 2005 ArcticNet Amundsen Expedition

Leg	Name	Position	Affiliation	Embark Date	Disembark Date
Leg 1	Armstrong, Debbie	Graduate Student	Department of Fisheries and Oceans - Freshwater Institute	5-Aug-05	15-Sep-05
Leg 1	Beaudoin, Jonathan	Technician	University of New Brunswick	5-Aug-05	15-Sep-05
Leg 1	Belt, Simon	Research scientist	University of Plymouth	5-Aug-05	15-Sep-05
Leg 1	Bennett, James Robbie	Technician	Natural Resource Canada	5-Aug-05	15-Sep-05
Leg 1	Benoit, Delphine	Graduate Student	Laval University	5-Aug-05	15-Sep-05
Leg 1	Blondin, Sophie-Andrée	Media	Radio Canada	5-Aug-05	15-Sep-05
Leg 1	Braithwaite, Leah	Senior scientist	Department of Fisheries and Oceans	5-Aug-05	15-Sep-05
Leg 1	Chamberland, Martin	Photograph ?	La Presse	5-Aug-05	15-Sep-05
Leg 1	Church, Ian	Technician	University of New Brunswick	5-Aug-05	15-Sep-05
Leg 1	Cockney, Candice	Student	?	5-Aug-05	15-Sep-05
Leg 1	Côté, Charles	Journalist	La Presse	5-Aug-05	15-Sep-05
Leg 1	Delaronde, Joanne	Technician	Department of Fisheries and Oceans - Freshwater Institute	5-Aug-05	15-Sep-05
Leg 1	Ehn, Jens	Graduate Student	University of Manitoba	5-Aug-05	15-Sep-05
Leg 1	Forest, Alexandre	Graduate Student	Laval University	5-Aug-05	15-Sep-05
Leg 1	Galand, Pierre	Graduate Student	Laval University	5-Aug-05	15-Sep-05
Leg 1	Gratton, Yves	Senior scientist	Institut National de la Recherche Scientifique - Eau Terre Environnement	5-Aug-05	15-Sep-05
Leg 1	Hamilton, Andrew	Graduate Student	University of British Columbia	5-Aug-05	15-Sep-05
Leg 1	Hippe, Ronald		RDI Teledyne	5-Aug-05	15-Sep-05
Leg 1	Hughes Clarke, John	Research scientist	University of New Brunswick	5-Aug-05	15-Sep-05
Leg 1	Hwang, Pyong Jun (Philip)	Graduate Student	University of Manitoba	5-Aug-05	15-Sep-05
Leg 1	Jin, Xin	PhD Student	University of Manitoba	5-Aug-05	15-Sep-05
Leg 1	Lago, Véronique	Research scientist	Institut National de la Recherche Scientifique - Eau Terre Environnement	5-Aug-05	15-Sep-05
Leg 1	Lloyd, Georgina	Technician	Department of Fisheries and Oceans	5-Aug-05	15-Sep-05
Leg 1	Lovejoy, Connie	Research scientist	Laval University	5-Aug-05	15-Sep-05
Leg 1	Machutchon, Allison	Technician	Department of Fisheries and Oceans - Freshwater Institute	5-Aug-05	15-Sep-05
Leg 1	Masse, Guillaume	Research scientist	University of Plymouth	5-Aug-05	15-Sep-05
Leg 1	Michaud, Luc	Ship Coordinating Manager	Laval University	5-Aug-05	15-Sep-05
Leg 1	Ovilok, Lori	Student	?	5-Aug-05	15-Sep-05
Leg 1	Pednault, Estelle	Graduate Student	Université du Québec à Rimouski/Laval University	5-Aug-05	15-Sep-05
Leg 1	Pilote, Martin	Research assistant	Environnement Canada	5-Aug-05	15-Sep-05
Leg 1	Poissant, Laurier	Research scientist	Environnement Canada	5-Aug-05	15-Sep-05
Leg 1	Pomerleau, Corinne	Graduate Student	Department of Fisheries and Oceans - Freshwater Institute	5-Aug-05	15-Sep-05
Leg 1	Potvin, Éric	Graduate Student	Université du Québec à Rimouski	5-Aug-05	15-Sep-05
Leg 1	Potvin, Marie–Anne	Graduate Student	Laval University	5-Aug-05	15-Sep-05
Leg 1	Poulin, Michel	Research scientist	Canadian Museum of Nature	5-Aug-05	15-Sep-05

Appendix 4 - List of participants on Legs 1 and 2 of the 2005 ArcticNet Amundsen Expedition

Leg	Name	Position	Affiliation	Embark Date	Disembark Date
Leg 1	Rochon, André	Chief scientist	Institut des Sciences de la Mer de Rimouski (ISMER-UQAR)	5-Aug-05	15-Sep-05
Leg 1	Sampei, Makoto	PDF	Laval University	5-Aug-05	15-Sep-05
Leg 1	Schell, Trecia	PDF	Dalhousie University	5-Aug-05	15-Sep-05
Leg 1	Terrado, Ramon	Graduate Student	Laval University	5-Aug-05	15-Sep-05
Leg 1	Tremblay, Geneviève	Graduate Student	Institut des Sciences de la Mer de Rimouski (ISMER-UQAR)	5-Aug-05	15-Sep-05
Leg 1	Tremblay, Jean-Éric	Senior scientist	Laval University	5-Aug-05	15-Sep-05
Leg 1, Leg 2	Aikawa, Shimpei	Graduate Student	University of Hyogo, Japan	5-Aug-05	27-Oct-05
Leg 1, Leg 2	Blondeau, Sylvain	Technician	Laval University	5-Aug-05	27-Oct-05
Leg 1, Leg 2	Kirk, Jane	Graduate Student	University of Alberta	5-Aug-05	15-Sep-05
Leg 1, Leg 2	Martin, Johannie	Graduate Student	Laval University	5-Aug-05	27-Oct-05
Leg 1, Leg 2	Massot, Pascal	Technician	Laval University	5-Aug-05	27-Oct-05
Leg 1, Leg 2	Matsuda, Sohei	Graduate Student	Tohoku University, Japan	5-Aug-05	27-Oct-05
Leg 1, Leg 2	Rail, Marie-Emmanuelle	Technician	Institut National de la Recherche Scientifique - Eau Terre Environnement	5-Aug-05	27-Oct-05
Leg 2	Aulagnier, Fabien	PDF	Environnement Canada	15-Sep-05	27-Oct-05
Leg 2	Baikie, Danielle	Student	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Barber, Lucette	Teacher	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Bartlett, Jason	Technician	University of New Brunswick	15-Sep-05	27-Oct-05
Leg 2	Bilodeau, Nicolas	Media	Quebec	15-Sep-05	27-Oct-05
Leg 2	Blanchart, Jerome	Media	France	15-Sep-05	27-Oct-05
Leg 2	Canning, Sarah	Student	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Caplanne, Sophie	Graduate Student	Department of Fisheries and Oceans - Institut Maurice Lamontagne	15-Sep-05	27-Oct-05
Leg 2	Champagne, Ane-Louise	Media	Quebec	15-Sep-05	27-Oct-05
Leg 2	Conners, Tanya	Teacher	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Constant, Philippe	Graduate Student	Institut National de la Recherche Scientifique - Eau Terre Environnement	15-Sep-05	27-Oct-05
Leg 2	Coulombe, Rémy	Technician	Department of Fisheries and Oceans - Institut Maurice Lamontagne	15-Sep-05	27-Oct-05
Leg 2	Darnis, Gérald	Graduate Student	Laval University	15-Sep-05	27-Oct-05
Leg 2	De Bellefeuille, Patrick	Media	Quebec	15-Sep-05	27-Oct-05
Leg 2	Delawsky, Shannon	Teacher	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Else, Brent	Graduate Student	University of Calgary	15-Sep-05	27-Oct-05
Leg 2	Ferland, Joannie	Technician	Institut des Sciences de la Mer de Rimouski (ISMER-UQAR)	15-Sep-05	27-Oct-05
Leg 2	Fortier, Martin	Executive Director	ArcticNet	15-Sep-05	27-Oct-05
Leg 2	Gagné, Jacques	PI	Department of Fisheries and Oceans - Institut Maurice Lamontagne	15-Sep-05	27-Oct-05
Leg 2	Ghoddousi-Fard, Reza	Graduate Student	University of New Brunswick	15-Sep-05	27-Oct-05
Leg 2	Granskog, Mats	PDF	University of Manitoba	15-Sep-05	27-Oct-05
Leg 2	Guillot, Pascal	Technician	Institut National de la Recherche Scientifique - Eau Terre Environnement	15-Sep-05	27-Oct-05

Appendix 4 - List of participants on Legs 1 and 2 of the 2005 ArcticNet Amundsen Expedition

Leg	Name	Position	Affiliation	Embark Date	Disembark Date
Leg 2	Hare, Alex	Graduate Student	University of Manitoba	15-Sep-05	27-Oct-05
Leg 2	Irish, Bernice	Student	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Kuzyk, Zou Zou	Graduate Student	University of Manitoba	15-Sep-05	27-Oct-05
Leg 2	Lajeunesse, Patrick	PI	Laval University	15-Sep-05	27-Oct-05
Leg 2	Lapenskie, Kathryn	Student	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Lapoussiére, Amandine	Graduate Student	ISMER-UQAR	15-Sep-05	27-Oct-05
Leg 2	Larouche, Pierre	PI	Department of Fisheries and Oceans - Institut Maurice Lamontagne	15-Sep-05	27-Oct-05
Leg 2	Létourneau, Louis	Technician	Laval University	15-Sep-05	27-Oct-05
Leg 2	Macdonald, Robie	PI	Department of Fisheries and Oceans - Institute of Ocean Sciences	15-Sep-05	27-Oct-05
Leg 2	Mckinnon, Laura	Graduate Student	Carleton University	15-Sep-05	27-Oct-05
Leg 2	Mei, Zhi-Ping	PDF	Institut des Sciences de la Mer de Rimouski (ISMER-UQAR)	15-Sep-05	27-Oct-05
Leg 2	Mundy, Christophe	Graduate Student	University of Manitoba	15-Sep-05	27-Oct-05
Leg 2	O’Brien, Mary	Technician	Department of Fisheries and Oceans - Institute of Ocean Sciences	15-Sep-05	27-Oct-05
Leg 2	Paiement, Maxime	Graduate Student	Laval University	15-Sep-05	27-Oct-05
Leg 2	Pazerniuk, Monica	Graduate Student	University of Manitoba	15-Sep-05	27-Oct-05
Leg 2	Poiret, Anne	Media	France	15-Sep-05	27-Oct-05
Leg 2	Ringuet, Geneviéve	Media	Quebec	15-Sep-05	27-Oct-05
Leg 2	Rouault, Sesilina	Graduate Student	Université Laval	15-Sep-05	27-Oct-05
Leg 2	Seller, Sarah	Student	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Shoesmith, Dave	Teacher	Schools on Board	15-Oct-05	27-Oct-05
Leg 2	Simard, Manon	Technician	Makivik Corporation	15-Sep-05	27-Oct-05
Leg 2	Simard, Mélanie	Technician	Institut des Sciences de la Mer de Rimouski (ISMER-UQAR)	15-Sep-05	27-Oct-05
Leg 2	Stern, Gary	Chief Scientist	Department of Fisheries and Oceans	15-Sep-05	27-Oct-05
Leg 2	Tawil, Marc	Media/Film Director	Anémone Chroma/Quebec - Ocean	15-Sep-05	27-Oct-05
Leg 2	Tooktoo, Samson	Wildlife observer	Kuujjuaraapik	15-Sep-05	27-Oct-05
Leg 2	Wasylkoski, Brian	Student	Schools on Board	15-Oct-05	27-Oct-05