EXPEDITION REPORT

2023

AMUNDSEN SCIENCE

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2023 Expedition Report

The 2023 Expedition Report is a collection of all the participating research teams' Cruise Reports assembled by the Chief Scientists at the end of each Leg of the 2023 *CCGS Amundsen* Expedition. The 2023 Expedition Report is divided into two parts:

Part I gives an overview of the expedition, presents the cruise track and the stations visited, and provides a synopsis of operations conducted during each of the four 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 2023. The data presented in this report are illustrative only and have not been quality checked or reviewed, thus parties interested in the results should contact the project leader, the researchers who collected the data or Amundsen Science's Data Coordinator (amundsen.data@as.ulaval.ca).

Part III includes a conclusion of the 2023 expedition, the data management process, as well as the objectives of the upcoming expedition.

The sections in Part II provide a detailed description of each research program and the sampling teams on board. Specifically, Sections 1 and 2 discuss multidisciplinary programs that involve various types of sampling techniques. Sections 2 to 18 provide comprehensive information on seabirds, atmospheric conditions, surface ocean properties, water column characteristics, CTD-Rosette operations, physical properties, as well as a range of chemical and biological parameters. Sections 19 and 20 focus on seabed mapping, while sections 21 to 33 delve into benthos and sediment sampling. Finally, Sections 34 to 37 cover the Argo float and mooring operations.

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

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

Following Amundsen Science's data policy, research teams must publish their metadata and insure that their data are archived on the long-term. It is not mandatory to use the PDC to archive on the long-term, as long as a link to the data is provided in the metadata (see http://www.amundsenscience.ulaval.ca/data/data-policy for more details on data policy).

Part I – Overview and Synopsis of Operations

1 Overview of the 2023 *Amundsen* Expedition

1.1 Introduction

The Canadian Arctic Ocean is a vast area cover about 4 million km^2, and including over 70% of Canada's coastline. This area hosts unique and sensitive ecosystems, yet researchers still lack global, robust and reliable baseline data to fully understand the impact of global warming already affecting the region. Indeed, the Arctic is warming twice as fast as the rest of the world, and according to Environment and Climate Change Canada, the summer sea ice extent decreased by 7.5 % per decade over 1968–2020 in the Canadian Arctic, coinciding with increasing air temperatures. In 2023, the region experienced its warmest summer on record, with the July-September mean temperatures reaching unprecedented levels. Climate change does not only affect the temperature and ice cover: it has profound impacts on the fragile Arctic ecosystem. Extreme seasonality in light regime and sea ice cover dictates the energy transfer through the food web in the Arctic Ocean, from micro-algae to large marine mammals. Changes in timing of biological events, northern shift of species along with increased marine traffic and pollution are all known consequences of the climate change and ice retreat in the Canadian Arctic. Satellites and meteorological stations have been providing reliable and rigorous datasets of sea ice and air temperature since the industrialization period. Ice camp, research vessels and moorings have all been tools used to acquire data and to fill gaps in our understanding of the Canadian Arctic Ocean. Community consultations and Inuit Traditional Knowledge are increasingly integrated by research projects and researchers.

Since 2003, the CCGS icebreaker *Amundsen*, equipped with its leading-edge scientific instrumentation, has been monitoring the Canadian Arctic by supporting dozens of large-scale national and international research initiatives from academia, local communities, and the public and private sectors. Amundsen Science manages the scientific mandate of the icebreaker since 2017. Through its integrated operational approach, Amundsen Science is dedicated to optimizing the use of the vessel and increase data usage by the Canadian and international research community. In its 20 years of operations, the ship enabled over 47 large-scale national and international research initiatives that mustered over a hundred teams of scientists from academia, the North and the public and private sectors. During two decades, the *Amundsen* propelled Canada in the leading pack of nations studying the changing Arctic Ocean. The ship's annual presence in the North, its contribution to the large-scale initiatives such as the International Polar Year and its support towards major environmental assessments have bolstered Canada's international stature in the study of the Arctic.

On 8 July 2023, the Canadian research icebreaker *CCGS Amundsen* begun its 20th annual mission to the Arctic Ocean from St. John's, NL. The multidisciplinary expedition ran until 26 October and allowed 140 scientists from national and international research teams to study the marine and coastal environments of the Canadian and Greenlandic Arctic. The research programs supported in 2023 studied the Arctic and subarctic marine ecosystems through multidisciplinary research activities and integrated studies targeting the physical, chemical and biological environments and the geology of the seabed of the Labrador Sea, Baffin Bay, Nares Strait, Lancaster Sound, Foxe Basin and Hudson Strait. From aquatic microorganisms to seabirds to melting glaciers and seabed mapping, all aspects of the northern environment were studied during this 111-day expedition.

1.2 Regional settings

1.2.1 *Labrador Sea*

Between Labrador and Greenland lies the Labrador Sea, a key region where critical exchange processes take place. The Baffin Current flowing from the Baffin Bay brings cold water as well as drifting icebergs and ice islands into the Labrador Sea. Cold waters from Hudson Bay's current circulates through Hudson Strait to the Labrador Sea where it joins warm sub-arctic water from the North Atlantic Current and feeds the source of water mass formation in the Labrador Sea. The water circulation in Labrador Sea is known to affect the global oceanographic circulation. Exchanges processes of carbon dioxide, oxygen and heat with the atmosphere and between water masses are also important in the area. From this perspective, gathering scientific knowledge about the area is of particular importance to inform decision makers, federal departments and the private sector about climate change, its impact on vulnerable ecosystems, and the risks associated with the exploitation of resources offshore.

1.2.2 *Baffin Bay*

Baffin Bay is located between Baffin Island and Greenland and connects the Arctic Ocean to the Northwest Atlantic. It is an important pathway for exchange of heat, salt and ice between these two oceans. Baffin Bay's connection to the Arctic Ocean consists of three relatively narrow passages through the Canadian Arctic Archipelago (CAA): Nares Strait, Jones Sound and Parry Channel.

The world's largest polynya, a year-round expanse of open waters surrounded by ice, is locates in the northern part of Baffin Bay. The North Water Polynya (NOW), also referred to as Pikialasorsuaq or Sarvarjuaq (respectively in canadian and Greenlandic Inuit dialect, is the most productive polynya in the Canadian Arctic and it is of significance to many species of marine mammals, in addition to the tremendous marine bird resources in this area. The NOW polynya has been the subject of intense ecosystem studies, including the Canadian-led study of the NOW Polynya in 1998.

Over the last years, the *CCGS Amundsen* frequently visited Baffin Bay and Northern Baffin Bay for scientific sampling activities, in particular to monitor seawater physics, chemistry nutrients, contaminants, and the biodiversity present along precise transects.

1.2.3 *Canadian Arctic Archipelago*

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

1.2.4 *Nares Strait and Lincoln Sea*

Baffin Bay connects with the Arctic Ocean through Nares Strait and Lincoln Sea, a body of water covered in sea ice yearlong. The thickest and oldest sea ice in the Arctic end up in Lincoln Sea. This makes Lincoln Sea a refuge for ice-dependent marine species affected by climate change and sea ice loss. Although the significance of this region is established, data to study the environmental changes and support the development of protection initiatives is critically lacking. Access to the area via navigation is challenging and very specific ice conditions are required. Furthermore, changes have been observed in the stability of ice arches which are formed during winter in Nares Strait, preventing ice export from Lincoln Sea to the south, in the NOW polynya and in Baffin Bay, where it would melt during summer.

1.2.5 *Foxe Basin*

Foxe Basin is a shallow body of water located north of Hudson Bay, between Baffin Island and the Melville Peninsula, with a deep channel in the south and great tidal activity. It is ice-covered for most of the year except for a few polynyas along its western coast. Waters of the Foxe Basin are also rich in nutrients and home to great variety of wildlife. This complex environment and its unique features make Foxe Basin a key ecosystem to study carbon exchange processes.

1.3 2023 Expedition Plan

1.3.1 *General schedule*

The 2023 *Amundsen* Expedition plan was developed based on the scientific objectives and regions of interest of each research program. The expedition took place from 8 July to 26 October, divided into 4 Legs spaced at 28-day intervals, for a total of 111 days at sea. Nine research programs are allocated ship time during the 2023 Amundsen Expedition. They studied the Arctic and subarctic marine ecosystems through multidisciplinary research activities and integrated studies targeting the physical, chemical and biological environments and the geology of the seabed of the Labrador Sea, Baffin Bay, Nares Strait, Lancaster Sound, Foxe Basin and Hudson Strait.

1.3.2 *Leg 1 – Imappivut – 14 July to 10 August – Labrador Sea*

The main program of the first Leg of the 2023 *Amundsen* expedition is the Imappivut initiative, led by the Nunatsiavut Government, which aims to enhance the understanding of pelagic fish and primary producers' communities in data-poor areas. Additionally, it seeks to identify new vulnerable marine ecosystems along the Labrador Coast, with the valuable guidance of local Nunatsiavut knowledge. Furthermore, this project aims to investigate the presence of contaminants and microplastics within the Labrador Sea, coastal waters, and fjords, examining their impact on the food chain. During this Leg, the remotely operated vehicle (ROV) ASTRID was used to explore the marine ecosystems in designated locations along the Nunatsiavut Coast, Labrador Sea, Baffin Bay, and Baffin Island. The Imappivut project also aims to explore the co-production of knowledge with participants on board, fostering interdisciplinary learning and creating space for collaborative exchanges. Scientific teams and crew members of the *Amundsen* had the opportunity to visit Nain to connect with local community members and discover their territory, while the *CCGS Amundsen* was available for a guided visit of the ship.

1.3.3 *Leg 2 – KEBABB, ArcticNet & Now Survey – 10 August to 7 September – Baffin Bay, CAA*

The KEBABB (Knowledge and ecosystem-based approach in Baffin Bay) program is focused on understanding the connected system of the atmosphere-ice-ocean, and how ongoing changes affect marine ecosystems. The program established in 2019 is a priority for the development and implementation of an ecosystem-based approach to fisheries management in Baffin Bay.

The ArcticNet program aims to assess the long-term impacts of climate change on the marine ecosystem of the Canadian Arctic through comprehensive multidisciplinary sampling. By studying various aspects such as geology, kelp, fish, and biogeochemical processes, this program seeks to understand how climate-induced changes are affecting the Canadian Arctic Ocean and its marginal seas.

The NOW Survey program aims to investigate how changes in the spatial extent and duration of the Pikialasorsuaq polynya might alter the productivity and diversity of Arctic endemic species and its connectivity with southern ecosystems.

1.3.4 *Leg 3 – ArcticCORE & ArcticNet – 7 September to 5 October – Nares Strait & Lincoln Sea*

During this Leg of the expedition, the *Amundsen* studied the ecosystems of Nares Strait, Grise and Archer Fjords, Jones Sound, two glacier terminuses and Lincoln Sea. The ArcticCORE (Conservation, Observation, Research & Engagement) program was onboard to study the connected system of the atmosphere-ice-ocean, and understand how the ongoing changes impact marine ecosystems. These findings will contribute to sustainable management and conservation efforts in Tuvaijuittuq. Moorings were also deployed as part of ArcticNet, Now Survey, and Arctic CORE programs.

The *CCGS Amundsen* helicopter is scheduled to conduct aerial surveys of glaciers and deploy beacons to track icebergs and glacier movements. The glacier monitoring stations will be installed on glaciers located on Ellesmere, Easter, and Devon Islands.

1.3.5 *Leg 4 – FoxSIPP & ArcticNet – 5 October to 26 October – CAA, Foxe Basin*

During the fourth and last Leg of the expedition, the *Amundsen* retraced its way back to Quebec City while conducting sampling activities in various locations, including the Gulf of Boothia, Fury and Hecla Strait, Foxe Basin, Hudson Strait, and Labrador Sea. Two programs took place during Leg 4: the ArcticNet and the FoxSIPP (the Foxe Basin Sea Ice Pump) programs. The FoxSIPP program aims to investigate the chemistry of the deep water that is formed annually in Foxe Basin and drains into Foxe Channel.

2 Leg 1 – 14 July to 10 August – St. John's to Iqaluit

Chief Scientists: Rodd Laing[1] (rodd.laing@nunatsiavut.com) & David Cote[2] (david.cote@dfo-mpo.gc.ca)

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2.1 Introduction and Objectives

Leg 1 of the *CCGS Amundsen*'s 2023 mission was principally designed to support the Nunatsiavut Government's Imappivut marine spatial planning, as well as DFO's marine conservation initiatives in the Labrador Sea and Baffin Bay. The mission extended past multi-disciplinary missions (Integrated Studies and Ecosystem Characterization of the Labrador Sea Deep Ocean - ISECOLD, Integrated Studies in the Coastal Labrador Ecosystem – ISICLE, both DFO-led, and Hidden Biodiversity – HiBio projects) that surveyed benthic biodiversity in Canada's northern oceans, identified habitats from coastal to deep ocean waters, and characterized demersal and pelagic faunal communities. This mission also contributed to additional research programs such as ArcticFish and KEBAAB.

The primary scientific objectives were to 1) further study previously identified biodiversity hotspots (e.g. vulnerable marine ecosystems) and investigate new potential biological hotspots in Baffin Bay (DFO) and along the Labrador Coast with the guidance of local Nunatsiavut knowledge (Imappivut, ISICLE, DFO), 2) improve our knowledge of pelagic fish and plankton community data along data-poor areas of the Labrador Shelf and southern Baffin Bay (ArcticFish, Imappivut, Memorial, DFO), 3) map and sample potential sites of turbid currents, pingos and submarine landslides along the Labrador Coast and Baffin Bay (Imappivut, NRCan), 4) extend ISECOLD, KEBAAB, and ITTAQ multi-year oceanographic and pelagic data time series by recovering moorings in the Labrador Sea and Baffin Bay (DFO, MUNL, Nunatsiavut Government, Scripps Institute of Oceanography, U of New Brunswick - UNB, U of Edinburgh – UofE, KEBAAB, ITTAQ), and 5) understand sediment biogeochemistry, carbon storage, remineralization and microbiomes in the Arctic gateway (Dalhousie, DFO, U of Calgary).

In addition to the scientific objectives, this mission emphasized the promotion of Inuit-focused research, knowledge co-production, and Inuit community participation. The 2023 program followed the principles of the NISR for Inuit Self-Determination in Research and featured a co-chief scientist from Nunatsiavut among other Nunatsiavut representatives on the scientific team. Through community visits, formal on-vessel presentations, and informal interactions, Leg 1 scientists and Coast Guard crew engaged with local and Inuit knowledge holders, learned of the critical relationship between language (Labrador Inuttitut), culture and environment, and were informed about Inuit perspectives.

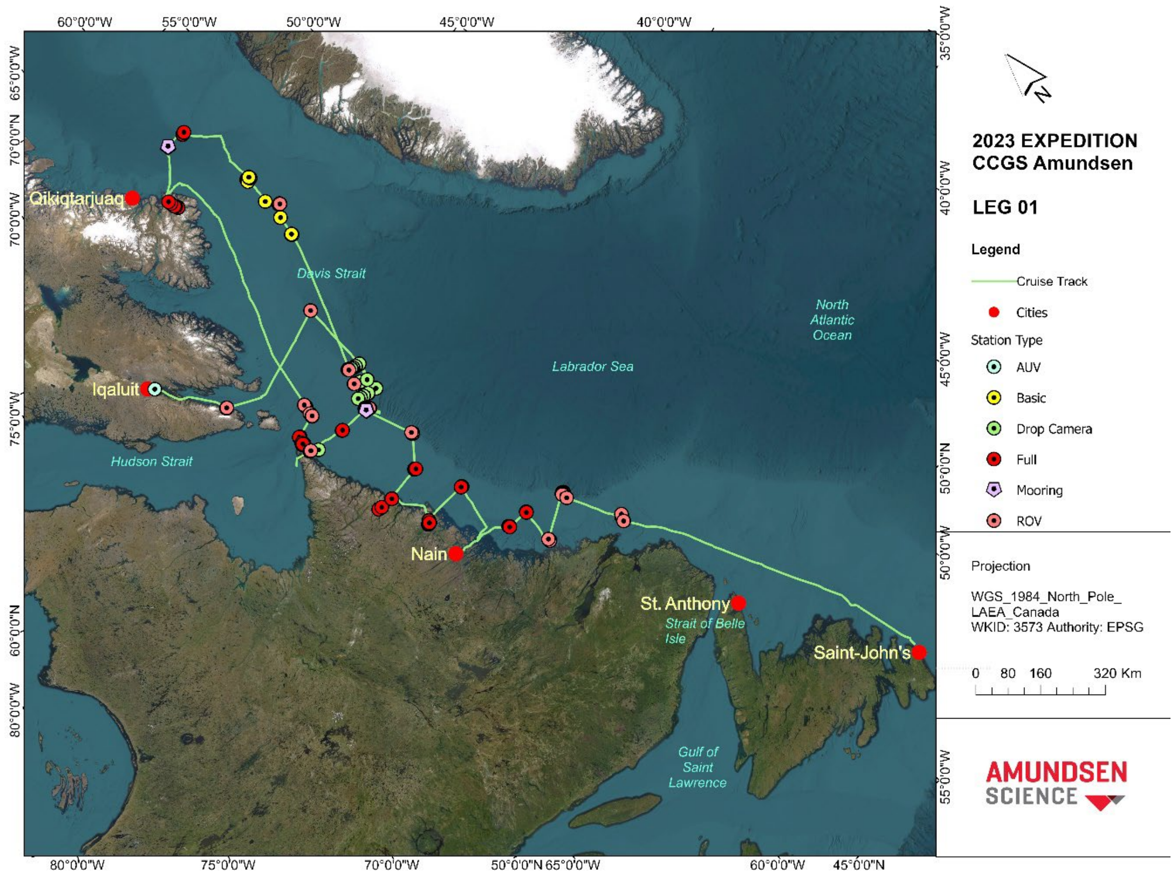

Figure 2-1: Cruise track and stations visited during Leg 1 of the 2023 *Amundsen* scientific expedition.

2.2 Synopsis of operations

While the 2023 Leg 1 mission benefited from favorable sea states, sea ice (ITTAQ stations, Disko Fan) and strong currents (Hatton Basin, Killinek) prevented access or limited operations at some stations. Nevertheless, the mission was able to address most planned objectives, with additional time used to expand operations at existing sites or explore new sites (see Figure 2-1). Many of the scientific results of this mission will require further study but mission highlights already include verified extensions of the Makkovik Hanging Gardens into Nunatsiavut waters, newly discovered *Ptilella grandis* sea pen fields in Disko Fan, and coastal extensions of deep ocean pelagic fish communities off of Nain.

In total, the vessel and the teams aboard

- traveled 6132 nautical miles,
- sampled **50 stations** (28 planned), and
- conducted 68 additional operations beyond the original 112 planned (160% of planned operations).

The following mission reports compiles multidisciplinary contributions from the teams that participated in Leg 1. Each contribution identifies team-specific objectives, methods employed, and samples collected, and in some cases preliminary results, and recommendations for future missions. These data will be the basis of many collaborative scientific papers, help shape management of these study areas, and form the foundation on which future *Amundsen* missions are constructed in the Labrador Sea and Baffin Bay.

A detailed scientific log for all sampling operations conducted during Leg 1 with the positions and depths of the visited stations is available in Appendices 1 and 4.

3 Leg 2 – 10 August to 7 September – Iqaluit to Resolute Bay

Chief Scientists: Jean-Éric Tremblay[1] (Jean-Eric.Tremblay@bio.ulaval.ca) & Alexandre Forest[2] (Alexandre.Forest@as.ulaval.ca)

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3.1 Introduction and Objectives

Leg 2 of the *CCGS Amundsen*'s 2023 mission was designed to support oceanographic sampling for the following programs:

1) The ArcticNet marine program, addressing the impacts of climate change on the marine ecosystem of the Canadian Arctic
2) The KEBABB / KEBABS programs (Knowledge and Ecosystem-Based Approach in Baffin Bay / Barrow Strait) is focused on comprehending the connected system of the atmosphere-ice-ocean, and how ongoing changes affect marine ecosystems. This program contributes to the development and implementation of an ecosystem-based approach to fisheries management in Baffin Bay since 2019, and in Barrow Strait since 2022.
3) The NOW survey is a comprehensive survey of the northern Baffin Bay and Pikialasorsuaq marine ecosystems. Variation in productivity and diversity of Arctic endemic species in the context of changes in the spatial extent and duration of the Pikialasorsuaq polynya, and its connectivity with southern ecosystems were the focuses of this program.

A small team from Sentinel North was also aboard to study light interaction in the water. The teams were very successful in working together to achieve the objectives of the mission.

3.2 Synopsys of operations

Although rough sea state impacted a few days during the cruise, the teams were able to adapt and make up the loss time by showing efficiency and professionalism. Cruise track and stations sampled are shown in Figure 3-1. The following operations were conducted during Leg 2 of the 2023 expedition on the *CCGS Amundsen*.

- 81 CTD-Rosette
- 30 plankton nets
- 29 tucker nets
- 27 box cores and Van Veen grabs
- 26 hydrobios
- 14 IKMT

- 11 beam trawls
- 4 monster nets
- 2 Argo floats recoveries and 2 deployments
- 1 mooring

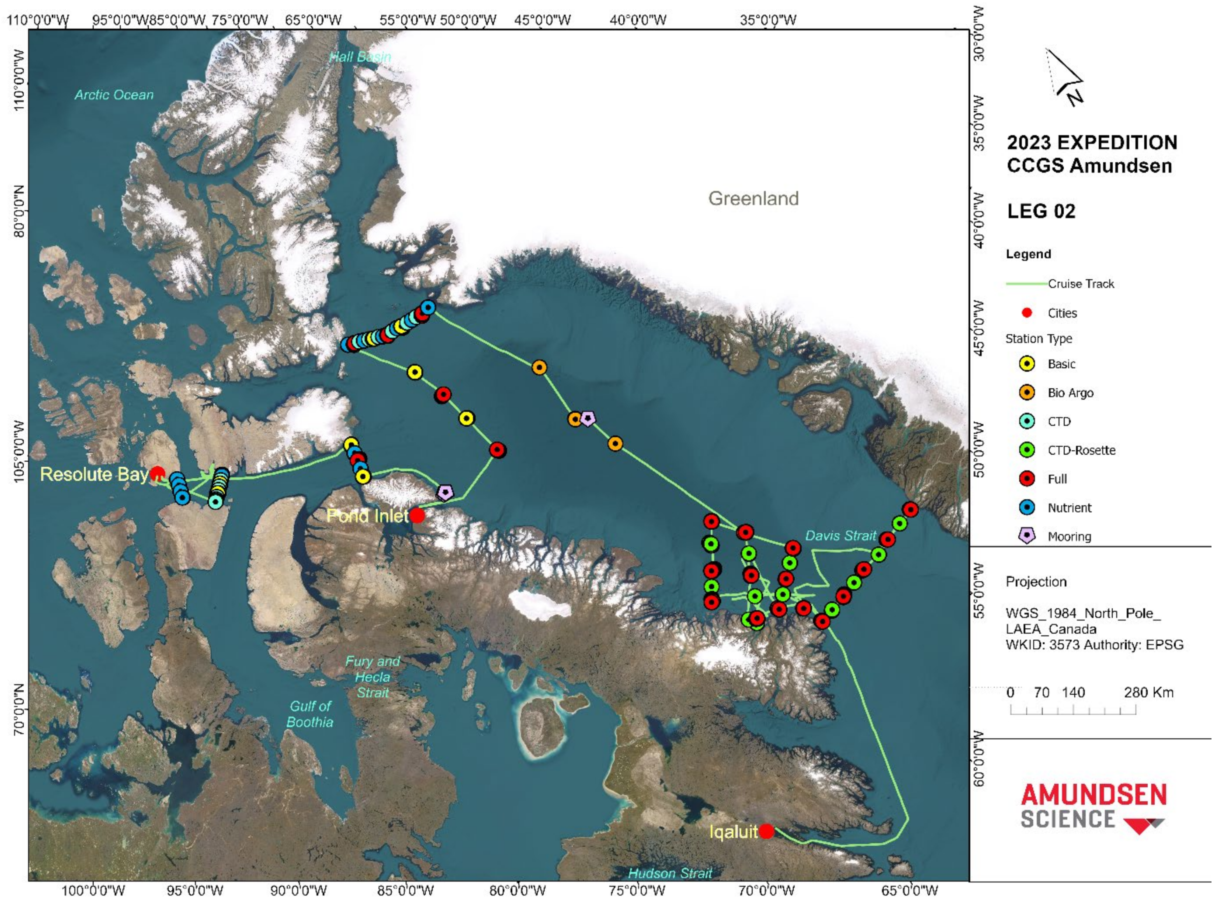


Figure 3-1: Cruise track and stations visited during Leg 2 of the 2023 *Amundsen* scientific expedition.

3.2.1 *Daily synopsys*

Thursday 10 August: The crew change went extremely well and was greatly facilitated by having the ship docked in Iqaluit. This allowed the crew to board the ship rapidly without spending too much energy organizing the logistics of a usual crew change with helicopter and zodiac/barge. The ship was therefore able to rapidly get ready to depart, which it did as planned at 18h15. A first meeting with the captain, the ship's officers and the scientist was held at 19h to introduce participants, present the cruise plan and give the Life On Board presentation.

Friday 11 August: Friday was spent holding familiarization tours for the scientists as well as having the presentations for the deployment of scientific instruments (safety and toolbox) for the Rosette and MVP, the nets (excluding the Monster) and the boxcore. During the day, a decision was made to start sampling at the western station of line E. This decision was motivated by the need to wait for the Greenland permit to complete line A, the fact that ice cover was minimal over line E.

Saturday 12 August: A first cast was done after breakfast to test the rosette and newly attached instruments (e.g., UVP), obtain a vertical density profile for calibrating the multi-beam (speed of sound) and give water to groups that needed it to prepare for sampling. We started sampling at station E1 in the evening and proceeded west.

Sunday 13 August: We continued line E while re-organizing the workflow for the Net team. Since E3 was in the area of heaviest ice concentration at the time, the IKMT could not be done close to the station and we also preferred not to do a second deep Rosette cast there. Since that second cast is not connected to the first (different team), it was deemed acceptable by all to move it to E4. The same was done for the IKMT. A general science meeting was held to debrief on operations so far and to plan for line C.

Monday 14 August: Station E5 was completed in the afternoon, after which we proceeded to C5 at 12 knots. Everyone enjoyed a well-deserved break.

Tuesday 15 August: Station C5 was started shortly after midnight and we proceeded to C4 and C3, which went seamlessly. Based on the incoming weather, it was discussed and decided at the meeting that we would move to station A1 at the end of line C. The reason was that strong southeasterly winds were expected to develop on Friday morning – first in the west and then in the east, where work would then not be possible on Saturday while things start to clear up on Sunday.

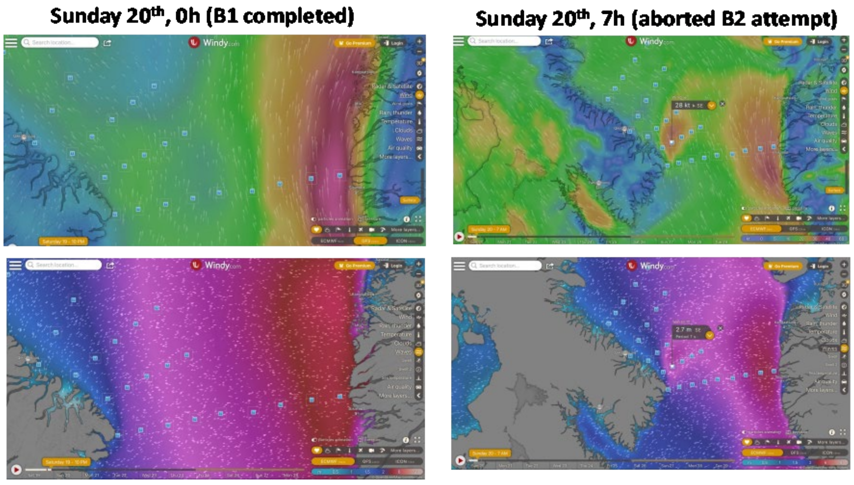
Wednesday 16 August: After finishing C1, we moved to A1 and began operations in mid-afternoon. The MVP was deployed at the end of A1, but did not work properly (automatic deployment mode not engaging and the fish failing to come back up on its own at the end of a downward profile). The transit to A2 was partly completed in 'manual mode' with data acquisition until the instrument's behaviour became truly erratic – at which point is was brought on board. A second attempt was done after A2 after replacing the motherboard but nothing worked due to communication errors. Subsequent attempts to fix the instrument failed and it was deemed safer to not put the fish in the water for the rest of the line. We nevertheless transited at 8 knots between most stations to give more time to the rosette teams to process their samples.

Tuesday 17 August: We moved well along line A, completing stations A3, A4 and A5.

Friday 18 August: We completed A6 and the permit from Greenland arrived just in time to perform net operations on A7. It was confirmed by discussion with Amundsen Science that we could do all the nets at stations A7 and A9. Wind started to pick up during work at A6, with slowly rising waves, but conditions remained suitable for work at A8 and A9. It was apparent by then that another low-pressure system moving North would bring a second round of windy/wavy conditions across Davis Strait.

Saturday 19 August: Most of Saturday was spent moving from A1 to B1 in very strong winds and high waves. The ship progressed at variable speeds (8-12 knots) in a zig-zag pattern to avoid taking the waves sideways, which naturally took a little longer. At roughly 14h in the afternoon, the ship suddenly rolled, with small items (gloves, towels, pens) falling of the counters and several boxes moving slightly. The only significant event worth reporting is the failure of the anchors securing the salinometer. The instrument came free and fell over 'top first' onto the lab floor. It was still on and apparently working, but there was water on the floor, which we suspect came from the inner water bath. The instrument was rotated to its normal position and left on the floor where it was deemed most secure for the time being. The team planned to look the instrument in more favorable weather conditions.

Sunday 20 August: Sampling at B1 began after midnight and was completed successfully with all planned operations. The ship then moved to B2 but the weather window we were counting on had closed earlier than expected with winds of 25-30 knots (gusts at 35-40) and 3-m waves already present on arrival just before 7h am. These local conditions were more severe than those forecasted by the models (Figure 3-2). It was deemed unsafe to do the rosette at this time.


Sunday 20th, 0h (B1 completed)

Sunday 20th, 7h (aborted B2 attempt)

Figure 3-2: Weather forecast for Sunday, August 20th

Given the short-term forecast for stations B3 and B5, the only hope of sampling there entailed 36 hrs of waiting until the earliest possible window. Aware that we would not have enough time to come back to line B later, the only reasonable option was to move toward line D, starting with D2 since conditions at D3-D5 were not expected to improve before the night of Tuesday – possibly given us a window to work 'offshore'. After successfully completing the rosette at D2, we headed toward D1, again in a zig-zag patern that took us first on a northwest heading. While doing the first stretch, a call for SAR came, which was quickly resolved.

Monday 21 August: Station D1 was successfully completed under favorable working conditions in the morning, after which we moved to alternate box coring + rosette locations (D'' in front of Qik and the alternate D1 of 2022) that had been requested by KEBABB at the beginning of the Leg. The window to leave D1 early in the night Tuesday and head East for D3 and perhaps D4 and/or D5 was still open according to forecasts and the timing was just right to leave the Qik area for D3 at ca. 21h, which would allow reaching the station as the wind and waves abated enough. We did not opt to go for D5 directly because our arrival there would be too early to benefit from better wave conditions, which sequentially improved from west to east. We arranged to do a single Rosette cast there and to drop the plankton net (not initially planned anyway) in order save some time to go to D4 and perhaps even D5 (highly unlikely).

Tuesday 22 August: We arrived at D3 at 05h00 and performed all operations planned there except the plankton net and the box core, which Stephen preferred to have at D4. D4 was completed with one Rosette and one Box Core, after which we sailed toward Qik to avoid the worst of the weather.

Wednesday 23 August: At 6 am we had a toolbox and safety meeting with Edouard and the crew to go over procedures for buoy deployment and recovery. The ship remained close to Broughton Island and conducted bottom mapping as all the sampling operations envisioned for the sector were complete the day before.

Thursday 24 August: A small scientific rotation at Qik was was successfully completed around 20PM. Once onboard, it was quickly decided to move on rapidly to KEBABB station D5 in order to complete as much as possible of the program. The ship departed around 21PM. Not scientific meeting was organized on that evening, but all teams were ready to continue the program as planned.

Friday 25 August: KEBABB station D5 was reached at 4AM and was completed at noon without any problem. The ship left southern Baffin Bay to move toward the Takeuse002b Argo float that was deemed possible to recover. At this stage, it is unknown whether the two other Argo floats that made surface will be recoverable. Much discussion took place about the massive storm forecasted for Sunday August 27th (see Figure 3-3). The idea to move north to the NOW polynya was shared with the various teams onboard. If realized, this meant that the stations 148 to 168 would be conducted after the NOW transect, pending favorable weather conditions.

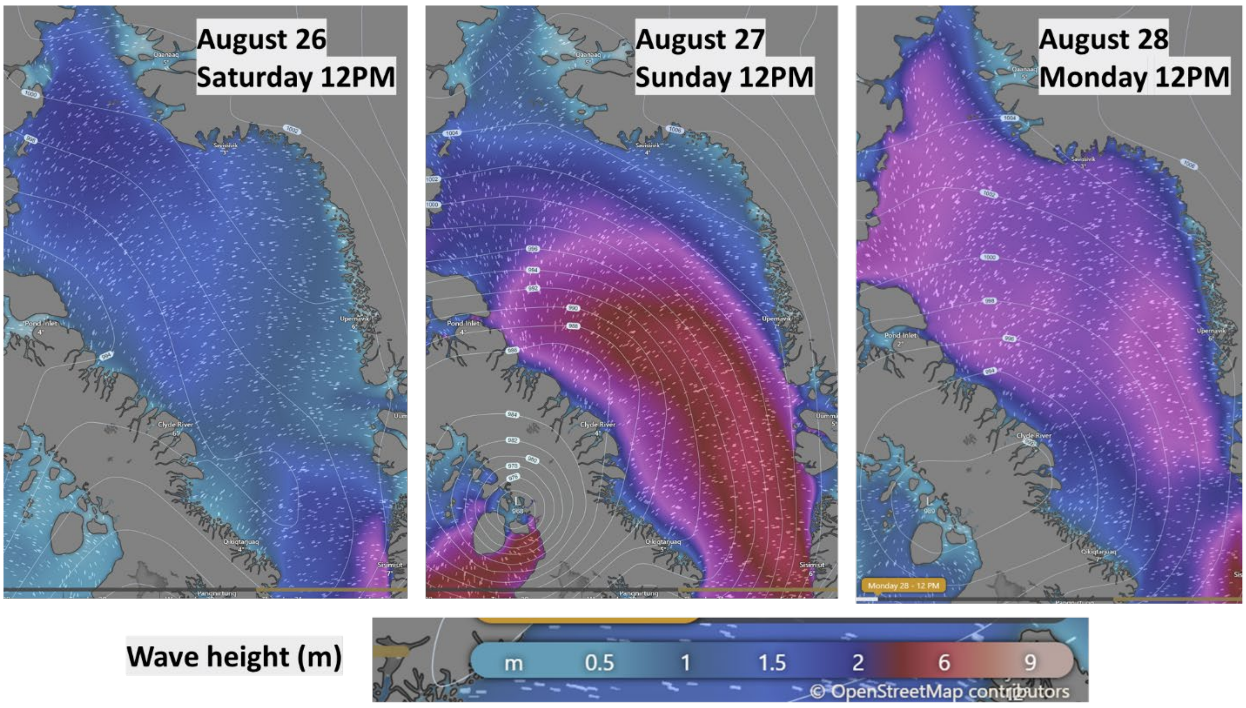


Figure 3-3: Forecast of the storm planned for August 27th in Baffin Bay.

Saturday 26 August: Argo float location Takeuse002b was reached at 4AM, right on spot. The recovery with the zodiac took about an hour. The ship then departed for mooring location BPR, which was reached at 8:30AM. The initial attempts to communicate with the BPR mooring were unsuccessful. The ship had to close all acoustic instruments and move right over the mooring position to obtain a signal. Despite some problems with the communication, the release command was sent and ranges to the equipment were progressively obtained with more clarity. It took about 30 minutes for the mooring to make surface. Wave and wind conditions picked up exactly at this moment (2-3 m wave height), but it was deemed safe to deploy the zodiac to assist with the mooring recovery. After one failed attempt to attach the mooring to the 500HP winch from the zodiac, a second trial was successful. However, during this second operation, a rope got entangled into the zodiac's propeller, creating obstruction and a failure of the engine. Once the mooring on deck, the zodiac could be retrieved slowly and assess for any damage. This operation was completed around 11:30AM.

At this moment of the day, a previous meteorological debrief confirmed the need to move directly to the NOW transect instead of sailing northeast to station 168 because of the upcoming storm. This would possibly provide an opportunity to recover Argo Takeuse007b equipped with a UVP. The location of the Argo float deployment was reached around 1PM. It took about an hour to deploy the floats from deck. A CTD cast down to 1000 m was also conducted following the deployments. Time calculations confirmed the possibility to recover float 007b while en route to the NOW polynya. This operation took place in the evening, but was more complex than the one performed in the early morning due to the unavailability of the 733 zodiac. Instead, the smaller 435 zodiac was used. Although performing well, this zodiac is much more tedious to launch and recover due to its position on the starboard side.

Sunday August 27 to Tuesday August 29: Station 116 of the NOW transect was reached on Sunday at 8:30AM. Wind and wave conditions were calm. Stronger wave conditions were expected overnight between Sunday and Monday, but finally only a long/slowly moving swell affected the sampling sites. Stations 116 to 00 were completed back-to-back without any interruption until Tuesday August 29 at 15:00. Conditions remained relatively comfortable with waves of 2m height maximum. The different teams were however very exhausted at the end of the transect, especially the zooplankton team.

The ship departed station 100 on August 29 late afternoon to reach basic station 148 around 23:00. In the evening a general science meeting was organized to debrief on recent operations conducted in the NOW polynya and provide an overview of the readjusted plan. Given the fact that a sufficient time-window would need to be allocated to mooring operations close to Bylot Island, it was decided to cancel station 168. Instead, some buffer time would be allocated to an opportunistic acoustic survey at the entrance of Eclipse Sound. This opportunistic request came from a joint team from Scripps Institute and Oceans North, who have deployed an acoustic mooring recorded at the entrance of Eclipse Sound to record shop traffic and underwater noise. Through this survey, the acoustic signature of the *Amundsen* would be recorded and compared with previous data (dating from before the Vessel Life Extension). This opportunistic operation would be planned between station 163 and the deployment of the Bylot-23 mooring.

Wednesday August 30: Station 148 was completed at 2:30 AM. Transit to station 153 took about 4 hours. Wind and wave conditions remained calmed throughout the day, but cold temperature prevailed. Snow was observed during mid-day. Station 153 was completed by 11AM, followed by transit to basic station 158, which was completed by 21:00. Waves of 1.5-2 m height were observed in late afternoon. Transit to station 163 was done overnight.

Thursday August 31: Station 163 was completed by 11:30 AM without any problem. The ship started to transit to Eclipse Sound for the acoustic survey, which was conducted in the evening and night at 9knots. In the afternoon, the mooring line Bylot-23 was assembled on deck. A major issue that was met is the lack of secondary clamps within the interior of the top MSI float to attach an external battery pack. A full debrief on this issue will be provided in the mooring report.

Friday September 1: The acoustic survey at the entrance of Eclipse Sound was completed overnight. The ship was in position at the Bylot-23 mooring location for the deployment. After a thorough check-up, the deployment of the line started at 8:30 AM and was completed successfully by 9:20 AM. Calm seas and low wind facilitated the success of operations. However, once in the water, the Benthos acoustic releases did not respond from the ship while the deck box was located at the usual port side location. After several attempts, it was hypothesized that the lack of communication was maybe due to ship noise interference (although all sonars were turned off) or to a too-shallow positioning of the hydrophone at the surface (or a mix of both). Only 25 m of cable connected the deck box to the hydrophone. It was decided to try the communication from the zodiac, away from the vessel. This turned out as a positive decision. Triangulation could be conducted from the Zodiac. Once completed, a multibeam pass and a CTD rosette were conducted. A request for a Van Veen grab and a boxcore, but the latter was cancelled due to a rocky bottom. The ship departed the mooring site for basic station 325 around 14:15 PM. This station was reached around 21:30 in the evening.

Saturday, September 2: Sampling station 325, 324, 323, 300 and 322 were all completed successfully on September 2nd. The ship departed for refuelling at 22:00.

Sunday September 3: Transit to Resolute Bay for refuelling. The Captain had initially negotiated a refuelling operation in Radstock Bay, closer to the KEBABS transect, but owing to restrictions related to Parks Canada, this site cannot be used for fuel transfer. Instead, the ship transited to Resolute Bay at near 15 knots to reach the tanker by 13:30 in the early afternoon. The two ships were docked to each other by 14:00. The refuelling operation took about 8 hours and was completed by 22:30. The ship departed for station S1 (first station of KEBABS transect) at 23:00.

Monday September 4 and Tuesday September 5: Station S1 was reached at 6AM in the morning of September 4. Transect S1 to S11 was completed in about 20 hours, ending at around 2AM during the night of 4-5 September. The ship then navigated west to map unchartered areas close to Beechey Island. Bathymetric survey over the wreckage of the HMS Breadelbane was also conducted at the request of the ocean-mapping group in the early morning of September 5 (see Figure 3-4).

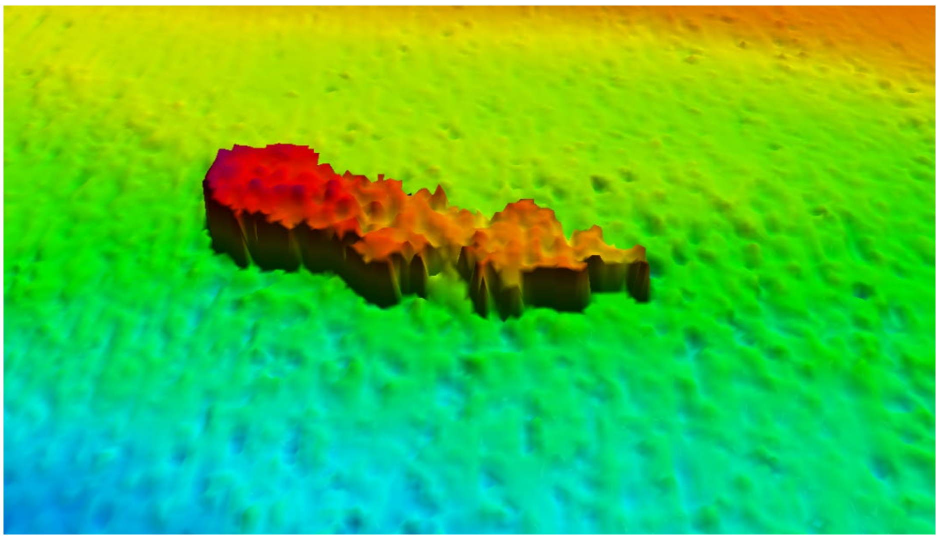


Figure 3-4: Bathymetric survey over the wreckage of the HMS Breadelbane

After the bathymetric survey, the ship transited to Radstock Bay at the request of the Canadian Wildlife Service to proceed with a survey of seabirds in the area. This was completed by 9:30 AM and the ship transited southwest to station 305A. Transect of stations 305 A to D was completed in the afternoon and evening of September 5. This ship then left for Resolute Bay.

Wednesday September 6: Packing and cleaning day. Ship anchored nearby Resolute Bay. End of Leg.

4 Leg 3 – 7 September to 5 October – Resolute Bay to Resolute Bay

Chief Scientists: Audrey Limoges[1] (Audrey.Limoges@unb.ca) & Maxime Geoffroy[2] (Maxime.Geoffroy@mun.ca)

[1] University of New Brunswick

[2] Fisheries and Marine Institute, Memorial University of Newfoundland

Thirty-eight scientists participated in Leg 3 of the *CCGS Amundsen*'s 2023 expedition, between September 7 and October 5 (Table 1.1). The expedition was a collaborative effort between DFO's ArcticCORE (Conservation, Observation, Research, Engagement), the NOW Survey, and several ArcticNet research programs led by academic institutions. It included monitoring transects in Nares Strait, Jones Sound, Lancaster Sound, and three main tidewater glacier bays (Cape Norton Shaw Inlet, Belcher Bay, and Croker Bay). The *CCGS Amundsen* further reached underexplored regions of the High Canadian Arctic, including Archer Fiord, the entrance to the Lincoln Sea, and Norwegian Bay (Figure 4-1).

The main scientific objectives of the mission were to: 1) collect marine baseline data from Archer Fiord and the northernmost end of the Nares Strait to support the implementation and management of the Tuvaijuittuq Marine Protected Area and characterize Tuvaijuittuq's influence on, and connectivity with, the adjacent ecosystems (ArcticCORE, RED-AO); 2) deploy ten oceanographic moorings anchored on the seabed to continuously monitor physical, chemical, and biological processes during a one-year cycle (DFO, CEOS-CERC, RED-AO, ArcticSeafloor). These moorings will be recovered, and some will be redeployed after servicing, during a research cruise that is planned for the summer 2024 on board the *CCGS Amundsen*; 3) conduct *in situ* optical measurements for the calibration and validation of satellite ocean color algorithms (Alg'o Nord, REFUGE-ARCTIC, RED-AO); 4) improve our understanding of the marine carbon cycling, spatial distribution and biogeochemical cycling of inorganic nutrients and dissolved methane, and better understand the biodiversity and distribution of phytoplankton, zooplankton, mesopelagic and demersal organisms in high Arctic fjords and important outflow regions of the Arctic Ocean (ArcticNet Biogeochemistry, ArcticFish, Go-Ice, ArcticSeafloor, NutrientFluxes, RED-AO, & ArcticCORE); 5) study benthic fluxes in relation to sea ice cover along a latitudinal gradient in Nares Strait and Baffin Bay, and quantify benthic activity in fjords (ArcticNet Kelp, RED-AO); 6) map the seafloor and collect surface and core sediment samples to characterize the spatial distribution of contaminants and sedimentary and biogenic proxies, study the vertical export of biogenic matter to the seafloor and reconstruct long-term changes in environmental conditions (ArcticSeafloor, RED-AO); and 7) conduct surveys with the *CCGS Amundsen*'s helicopter to map glacier and iceberg dynamics through the deployment of global navigation satellite system receiving stations and satellite tracking beacons (GO-Ice).

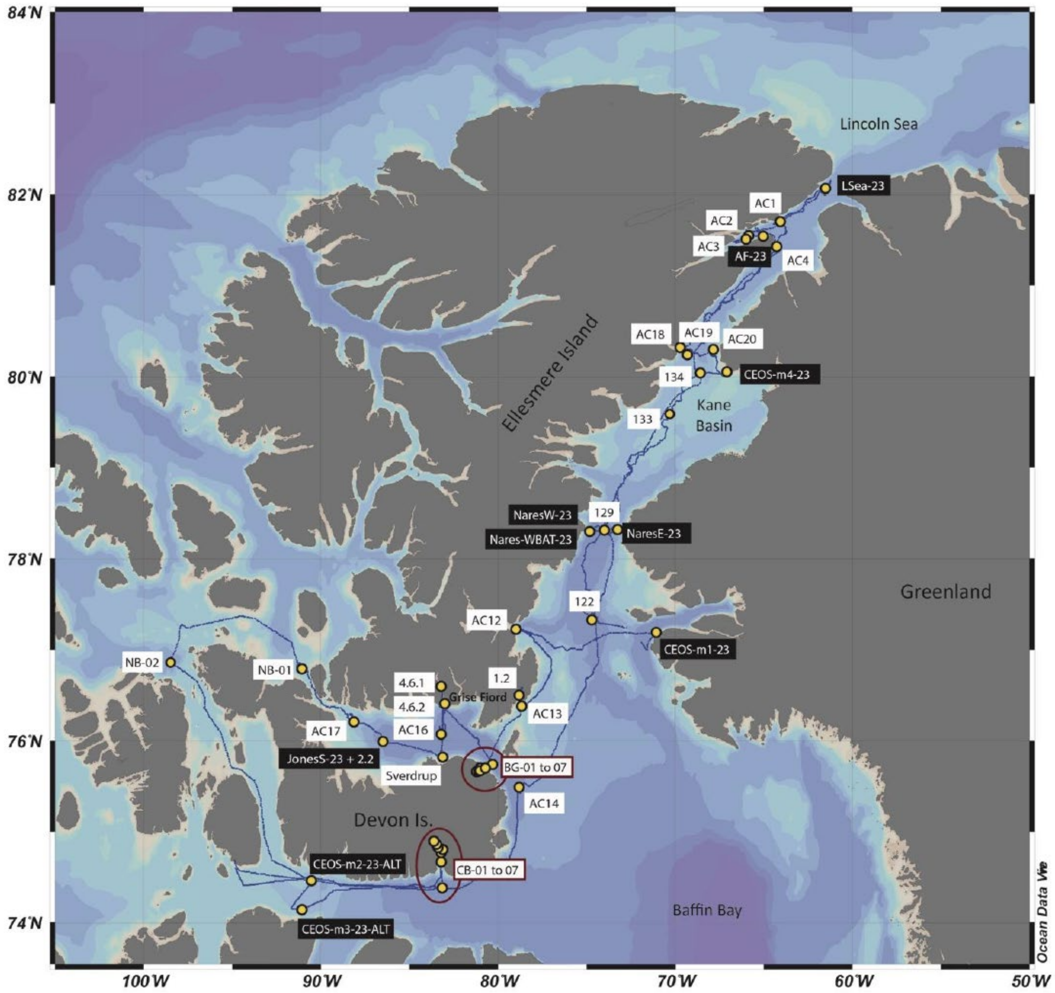


Figure 4-1: Stations sampled from the *CCGS Amundsen* during Leg 3, 2023.

The main scientific objectives of the mission were to: 1) collect marine baseline data from Archer Fiord and the northernmost end of the Nares Strait to support the implementation and management of the Tuvaijuittuq Marine Protected Area and characterize Tuvaijuittuq's influence on, and connectivity with, the adjacent ecosystems (ArcticCORE, RED-AO); 2) deploy ten oceanographic moorings anchored on the seabed to continuously monitor physical, chemical, and biological processes during a one-year cycle (DFO, CEOS-CERC, RED-AO, ArcticSeafloor). These moorings will be recovered, and some will be redeployed after servicing, during a research cruise that is planned for the summer 2024 on board the *CCGS Amundsen*; 3) conduct *in situ* optical measurements for the calibration and validation of satellite ocean color algorithms (Alg'o Nord, REFUGE-ARCTIC, RED-AO); 4) improve our understanding of the marine carbon cycling, spatial distribution and biogeochemical cycling of inorganic nutrients and dissolved methane, and better understand the biodiversity and distribution of phytoplankton, zooplankton, mesopelagic and demersal organisms in high Arctic fjords and important outflow regions of the Arctic Ocean (ArcticNet Biogeochemistry, ArcticFish, Go-Ice, ArcticSeafloor, NutrientFluxes, RED-AO, & ArcticCORE); 5) study benthic fluxes in relation to sea ice cover along a latitudinal gradient in Nares Strait and Baffin Bay, and quantify benthic activity in fjords (ArcticNet Kelp, RED-AO); 6) map the seafloor and collect surface and core sediment samples to characterize the spatial distribution of contaminants and sedimentary and biogenic proxies, study the vertical export of biogenic matter to the seafloor and reconstruct long-term changes in environmental conditions (ArcticSeafloor, RED-AO); and 7) conduct surveys with the *CCGS Amundsen*'s helicopter to map glacier and iceberg dynamics through the deployment of global navigation satellite system receiving stations and satellite tracking beacons (GO-Ice).

On September 26, a community visit was organized in Grise Fiord. A total of five zodiac trips were done from the ship to shore, and thirty-seven community members visited the ship. The success of the day was due to the efforts of the Grise Fiord Hamlet who promoted the activity on social media, the dedication and navigation skills of the coast guard crew (i.e., difficult sea ice conditions), and the contributions of the scientific team who organized the laboratory tours. The following day, through a partnership with NRCan, two members of the Grise Fiord community participated in the sediment coring operations. These two activities were important highlights of the expedition.

4.1 Synopsys of operations

The 2023 Leg 3 expedition required high flexibility in the timing and order of the scientific operations to respond to dynamic sea ice conditions. During the transit north through Nares Strait, meetings with the ice specialist and the commanding officer were organized twice a day after helicopter ice reconnaissance and reception of ice products (e.g., synthetic aperture radar, visible) to evaluate the best route and use navigation windows of opportunity as much as possible. Despite heavy sea ice coverage near the Talbot and Mittie glaciers that prevented us from sampling these areas, most planned stations were completed, and opportunistic stations were added near the Sverdrup glacier and upstream of the Cardigan and Penny Straits (total of 44 stations, see Figure 4-2). In total, the vessel traveled 3620 nautical miles and the team completed 289 operations. Compared to the initial expedition plan, the completion rate of each operation ranges between 22 and 188% (Table 4-2 and Table 4-1). It is worth mentioning that as part of this mission, the CCGS Amundsen reached its northernmost latitude attained to date (82°09’N), contributed to sampling for the first characterization of the marine ecosystem of Archer fiord and sailed through the previously uncharted Cardigan Strait up to Norwegian Bay.

This report summarizes the contributions from the different teams that participated in Leg 3. Each team provided a detailed account of their objectives, methods, samples collected, preliminary results when applicable and recommendations for future expeditions.

Table 4-1: Planned and completed stations during Leg 3 of the 2023 *Amundsen* scientific expedition

Planned	Completed	Opportunistic	Total	Ratio planned (%)	Ratio total (%)
79	70	9	79	89	100

Table 4-2: Planned and completed operations during Leg 3 of the 2023 *Amundsen* scientific expedition.

Operations	Planned	Completed	Ratio total (%)
CTD-rosette	65	68	105
Bucket sampling	9	14	156
Plankton net	19	22	115
Tucker	28	22	79

Monster or Hydrobios	27	27	100
IKMT	14	6	43
Beam trawl	11	8	73
Agassiz	27	6	22
Box core	47	55	117
Gravity core	13	12	93
Mooring	10	10	100
Zodiac and barge	26	24	92
Helicopter	8	15	188
TOTAL	304	289	95

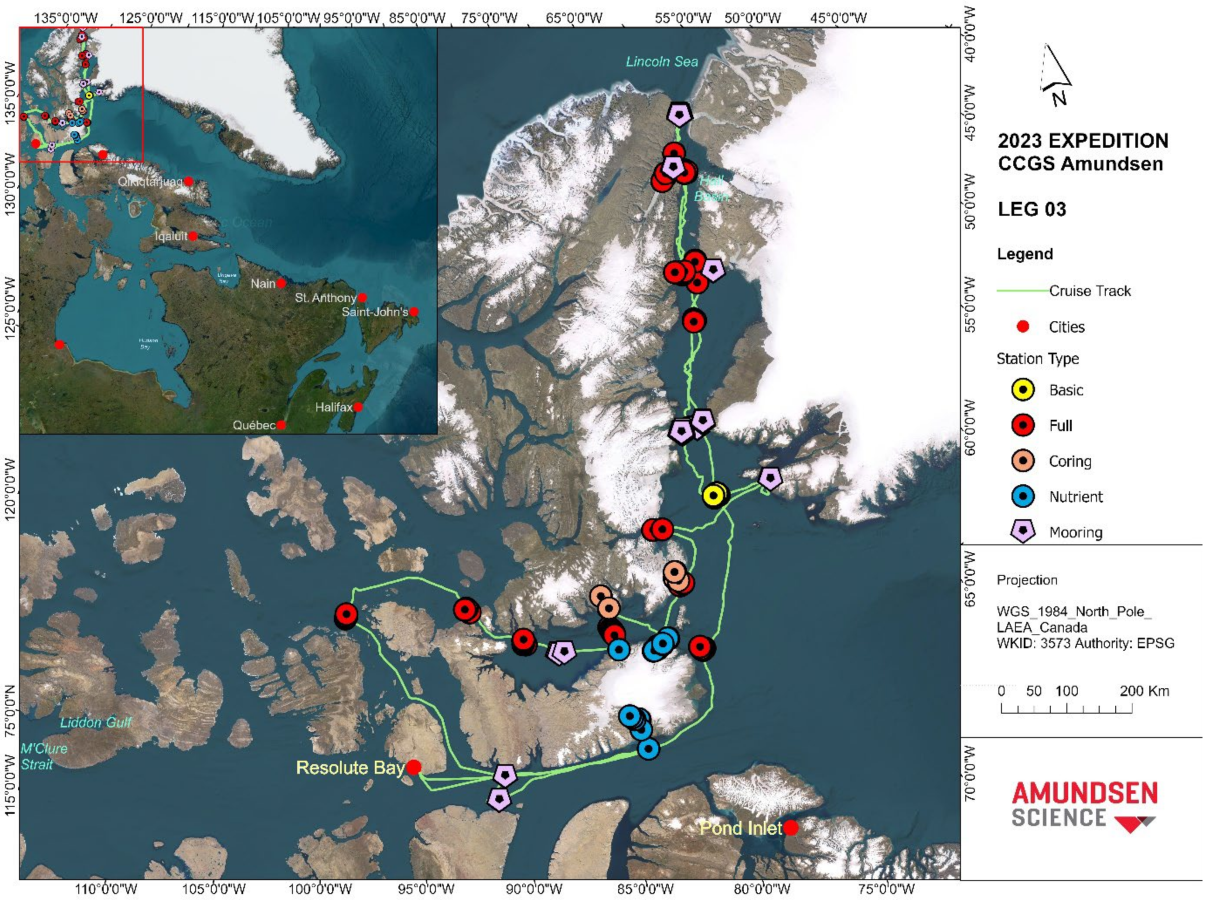


Figure 4-2: Cruise track and stations sampled during Leg 3 of the 2023 *Amundsen* scientific expedition.

5 Leg 4 – 5 to 26 October – Resolute Bay to Quebec City

Chief Scientist: Brent Else[1] (belse@ucalgary.ca)

[1] University of Calgary

5.1 Introduction and objectives

Leg 4 marked the successful completion of the 2023 Amundsen Cruise. Thirty-four scientists from the FoxSIPP and ArcticNet programs were onboard to conduct an integrated study of Foxe Basin and Hudson Strait. The Foxe Basin Sea Ice Pump (FoxSIPP) program aims to investigate the chemistry of the deep water that is formed annually in Foxe Basin and drains into Foxe Channel.

The primary objectives of Leg 4 were to:

1) Complete a synoptic survey of water mass properties and carbon content to determine the magnitude of air-sea exchange in Foxe Basin, the role of coastal polynyas in driving carbon uptake and storage, and the export of deep water to the larger region through gateway exchanges.
2) Install a strategically positioned mooring to measure carbon and physical ocean properties over a complete annual cycle to identify processes associated with deep water formation and carbon storage.
3) Use field data to validate a numerical model of the Foxe Basin-Hudson Bay complex to determine magnitudes/timescales of carbon sequestration, and sensitivity to climate change.

Given the lack of past oceanographic expeditions to Foxe Basin, this cruise will support a multidisciplinary secondary objective that will contribute to a more complete understanding of the Foxe Basin carbon sink:

4) Conduct a general oceanographic survey of Foxe Basin, including primary production, nutrient distributions, characterization of benthic species and sediment composition, fish, plankton, and the air-sea exchange other important greenhouse gases (e.g. N_2O, CH_4).

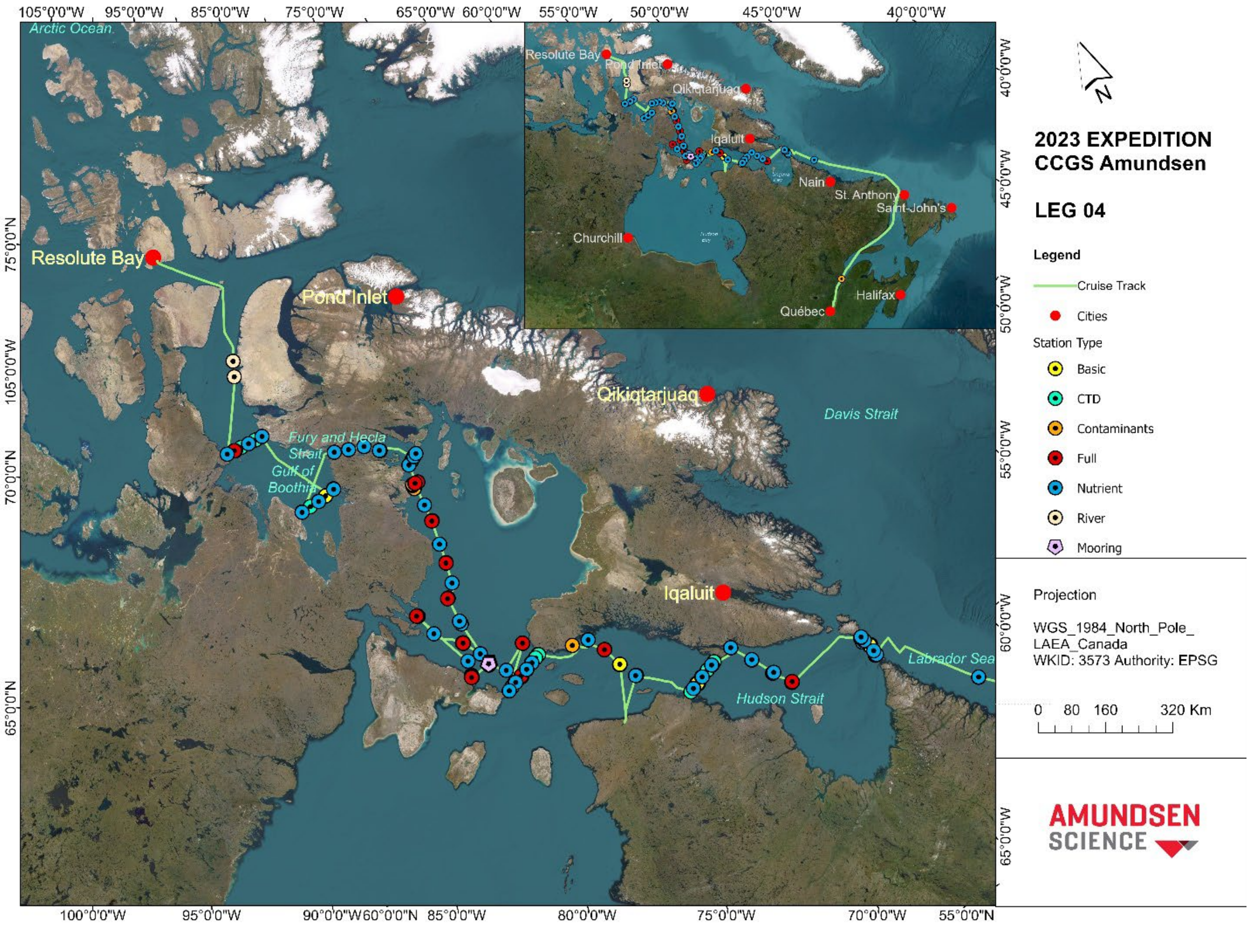


Figure 5-1: Cruise track and stations sampled during Leg 4 of the 2023 *Amundsen* scientific expedition.

5.2 Synopsys of operations

Starting in Resolute Bay on Oct. 5, we began a transit south towards Prince Regent Inlet (see Figure 5-1). Two lines of stations were completed to the north and south of Fury and Hecla Strait; a large pod of Bowhead whales was spotted, a river was sampled by helicopter, and we noted distinct water masses on either side of the inlet. Strong wind and waves were encountered as we completed our work in this region, and as a result, two nutrient stations were missed at the west end of Fury and Hecla Strait. These would be the only planned stations we missed on the entire Leg. Once in the shelter of the strait, we were able to complete several CTD casts and a Rosette cast, with the Captain and crew skillfully navigating strong current conditions. By the time the Amundsen exited Fury and Hecla Strait the weather was good, and we began our southwards transect through Foxe Basin.

By this point in the cruise, the scientists and crew were working together very effectively. Station stops generally took less time than planned, and the favourable weather ensured good cruising speeds. The most notable oceanographic observation made during this portion of the cruise was strong mixing in the near-shore areas, with some stations showing mixing up to 100m in depth. At this point, we began to encounter some difficulties with cases of COVID spreading throughout both the scientific and coast guard crew. Measures were put in place to limit the spread, and were largely effective. At the end of our north-south transect through Foxe Basin, we began an MVP deployment. This instrument was not functioning perfectly, but through the persistence of the Amundsen Science staff, we were able to collect some excellent high-resolution profile measurements. The end of this MVP transect brought us to station 350, the most important station for the FoxSIPP project.

At station 350, we conducted a CTD-Rosette cast, which confirmed the presence of a cold, high-salinity water mass in the bottom 50m (approximately) of the water column. This water mass had been observed in past cruises of Foxe Channel dating back to the 1950s, and the FoxSIPP project was interested in measuring this water mass in hopes of inferring rates of gas exchange during its formation in winter months. Locating this water mass was very gratifying. A mooring was deployed at the station. While we were able to successfully locate biogeochemical sensors in this deep water mass, there was an error in the mooring design that led to too much rope somewhere in the top sections. The uppermost sensor package (designed to be at 30m depth) ended up at the surface, and had to be cut free. The sensors could not be redeployed because no additional anchors were on board. This was a bit of a loss, but the main objective of the mooring was maintained.

After station 350 we conducted a series of stations designed to transect Foxe Channel along both its short and long axes. Here the bottom-mapping team was very helpful in adjusting station positions to target the deepest portions of the channel. This effort seems to have been effective in mapping the distribution of the deep water mass. We left Foxe Channel with most of our objectives complete, and feeling very good about the prospects for the FoxSIPP program.

We then began a series of transects crossing Hudson Strait. The ship was detoured to Salluit to send crew members who were experiencing significant respiratory symptoms to a nursing station. Fortunately, the efficient work and good weather meant that we did not need to cancel any stations. In Hudson Strait we found significantly different biogeochemical conditions than in Foxe Basin. We experienced our first true deep phytoplankton bloom, and noticed significant oceanographic differences between the north and south sides of the channel. We were able to complete the important long-term monitoring stations at the outlet of Hudson Strait, and then we began our transit back to Quebec City.

The trip south through the Labrador Sea was mostly notable for its speed! Facing a strong storm developing around Newfoundland, the Captain decided to cruise at an average speed of about 14 kts. Any opportunistic sampling that was proposed along the coast was cancelled, in favour of trying to beat the storm to the Strait of Belle Isle. In the end, the storm generated mostly following seas, and the voyage was fairly comfortable. With all the time we had made up earlier in the cruise, and the quick transit along the Laborador Coast, we returned to Quebec City one day early. Our arrival at the Coast Guard base was most notable for the warm reception Captain Gariépy received to honour the end of his final Arctic mission. A fitting finish for an excellent Amundsen cruise focused for the first time on Foxe Basin, which will hopefully result in exciting new insights into this fascinating region.

Overall, the following operations were conducted during Leg 4 of the 2024 *Amundsen* expedition:

- 77 CTD-Rosettes
- 35 bongo nets

- 28 box cores
- 26 Agassiz/beam trawls
- 15 tucker nets
- 13 monster net
- 2 IKMT
- 2 baited camera deployments
- 1 hydrobios
- 1 plankton net
- 1 Van Veen grab
- 1 helicopter flight for river sampling
- 1 mooring deployment

Part II – Project reports

1 Nunatsiavut Community Engagement, Inclusion and Participation

Principal Leads: Rodd Laing (rodd.laing@nunatsiavut.com), Michelle Saunders (michelle.saunders@nunatsiavut.com), Elizabeth Tuglavina (elizabeth.tuglavina@nunatsiavut.com)

Cruise Participants: Full science team.

Nunatsiavut Government, Nain, NL.

1.1 Overview

Nunatsiavut is the homeland of Labrador Inuit and is comprised of 72,520 km2 of land a marine zone area of 48,690 km^2 and was established through the signing of the Labrador Inuit Land Claims Agreement in 2005, establishing the Nunatsiavut Government, the first Inuit region in Canada to achieve self-government. Inuit depend on the land, sea ice, and marine areas for their way of life. From food security to health to cultural preservation, the ability to access and use land and waters is paramount. In 2017, the Nunatsiavut Government (NG) initiated a marine planning project, Imappivut (Our Oceans) through the signing of a Statement of Intent with Canada in September 2017. This signing established their joint commitment to work together to implement Imappivut and pursue priorities shared by both levels of government.

The goal of Imappivut is community-driven marine planning in the coastal and marine zone of Nunatsiavut. Imappivut's primary objective is to establish a marine plan which prioritizes conservation objectives and socialcultural priorities to support community well-being, health and coastal stewardship programs within the marine Zone and adjacent waters. Imappivut will increase the Nunatsiavut Government's capacity in decisionmaking in Nunatsiavut waters and ensure that Inuit interests are represented in decision-making and contribute to the protection of important marine resources, with associated ecological and social-cultural benefits. Imappivut will also foster increased capacity within Nunatsiavut by consulting with Labrador Inuit to represent their interests, informing communities of activities, collecting knowledge, and mapping important Indigenous marine locations, uses, and resources for ongoing protection and stewardship. Imappivut ensures that Labrador Inuit have self-determination in research and decisions that affect their environment and way of life. By utilizing Inuit and scientific knowledge, Imappivut guides research activities within and adjacent to Nunatsiavut waters to address community priorities and ensure that Inuit can continue to access, use and enjoy a healthy marine environment. The Nunatsiavut Government and Nunatsiavut Research Centre contributed to the development of the National Inuit Strategy on Research (NISR, 2018). The NISR describes 5 priorities for ensuring effective, impactful and meaningful research for Inuit: 1) Advance Inuit governance in research, 2) Enhance the ethical conduct in research, 3) Align funding with Inuit research priorities, 4) Ensure Inuit access, ownership and control over data and information and 5) Build capacity for Inuit Nunangat research. With the guiding priorities of Imappivut and the NISR, the Nunatsiavut Government partnered with federal government and academic partners to co-lead the Leg 1 Imappivut Amundsen to help further understand the marine environment of Nunatsiavut and adjacent waters, including Baffin Bay. The goal of the research was to be multi-disciplinary in nature and to encompass Inuit values and ways-of-knowing while using a holistic approach to research and science including natural science, social science, art and Inuit Knowledge. The program respected individual areas of expertise while encouraging everyone to consider their research and work in the broader ecosystem and in the realities of the Imappivut Marine Plan of the Nunatsiavut Government.

The mission was co-led with two Chief Scientists, David Cote from DFO and Rodd Laing from the Nunatsiavut Government. The purpose of this was to highlight the existing partnerships that have been developed in the region, but also to have representation from the both the scientific community and the Indigenous government directly in decision making processes. This was very effective in managing scheduling and decisions that needed to be made through the mission.

Additionally, almost all of the scientific projects that were conducted on Leg 1 of the mission have either beenco-developed or directly involve the Nunatsiavut Government, which allowed true collaborative development of scientific objectives for the mission. This also ensured that appropriate and ethical research was taking place, while allowing for adaptations to projects and helped to build further relationships with the Nunatsiavut region.

1.2 Community Engagement and Outreach Activities.

The following specific activities that took place on the mission related to community engagement and outreach:

Figure 1-1: The *CCGS Amundsen* approaching Nain (left panel) and moored in Nain Harbour in front of the Illusuak Cultural Centre (right panel)

1.2.1 *Nain Science Day*

On July 19th, 2023, the Amundsen anchored in the harbor of Nain for an interactive Science Day between the community of Nain, scientific personnel and the crew of the Canadian Coast Guard. The intention was to allow for learning and education for everyone involved. The day consisted of the following components:

a- <u>*CCGS Amundsen* tours for community members of Nain</u>

In the morning, Coast Guard Crew shuttled community members from the Nain wharf to the *CCGS Amundsen* to participate in guided tours throughout the ship, with scientific personnel showing the different scientific equipment and labs of the ship, and the captain and crew showing the operation side of the ship. This allowed community members to learn about the exciting research of the mission, which also learning about the capabilities of the ship.

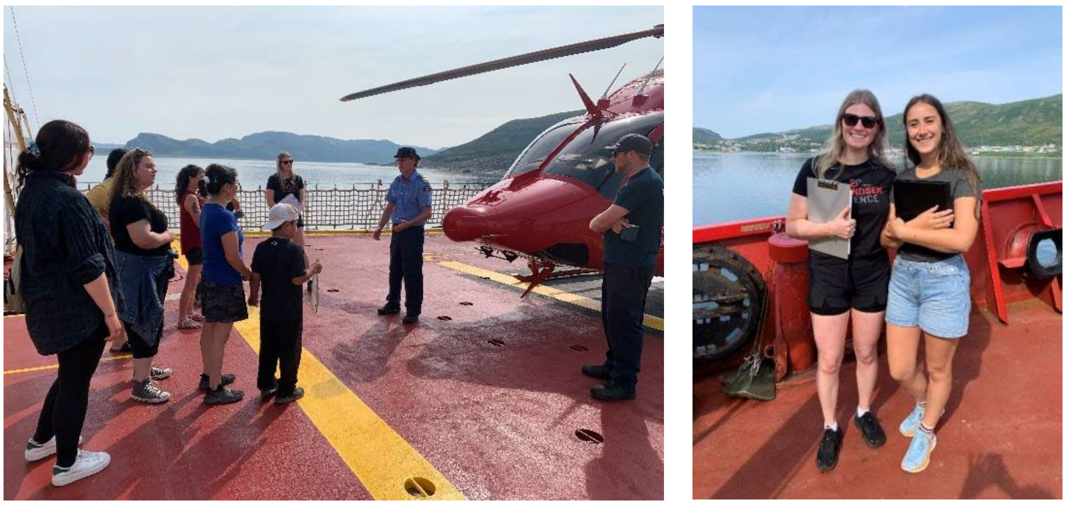


Figure 1-2: Residents of Nain on a tour of the *CCGS Amundsen* (left panel) and the science tour guides for this event

b- Cultural food lunch

Nunatsiavut Research Centre staff and community members prepared a cultural food lunch for scientists and crew that came to shore, including arctic char, partridge soup, and panitsiaks (fried dough bread).

c- Nunatsiavut Research Centre tour

Tours were offered for scientists and crew of the Nunatsiavut Research Centre, showing visitors the laboratory spaces, research centre accommodations, and the operation of the Nain Community Freezer, which is directly connected to ongoing research programs in Nunatsiavut.

d- Illusuak Cultural Centre Tour

There was been a planned tour and event at the Illusuak Cultural Centre, but due to a failure in the fire suppression system two days previous, this event was cancelled.

e- Interactive Science Fair

In the afternoon, community members, researchers and crew from the Amundsen were invited to the community centre for an interactive science fair with other researchers that were not on the Amundsen, but work in the Nunatsiavut region. This allowed researchers onboard the Amundsen to explain their research and equipment to others, and allowed for interactions with other researchers that are currently working in Nunatsiavut.

f- Evening Cultural Event

Hosted at the community centre, there was a successful evening of cultural food and entertainment to wrap up the day. The event included throat singing, local Labrador songs and videos highlighting the work of the Amundsen in the Labrador Sea. It was an excellent collaboration and really allowed for everyone to understand the importance of the region to Labrador Inuit, while also experiencing some Nunatsiavut culture.

Figure 1-3: Throat singers performing at the Evening Cultural Event

1.2.2 *Okak Bay*

Okak Bay has, and continues to be, incredibly important to Labrador Inuit. Okak Bay is home to two former Labrador Inuit communities, Okak and Nutak. Nutak was forcibly relocated in 1956 and in 1918, Okak was decimated by the Spanish Flu. Labrador Inuit continue to use Okak Bay. In preparation for our arrival to Okak Bay on July 20th, we watched the National Film Board documentary. The Last Days of Okak. The video gives historical background and context for the importance of the area for Labrador Inuit. After our sampling was complete at the Okak stations, the ship was brought into harbour of the former community of Okak to allow everyone onboard to see the area and to ground their work in the context of where they are working.

Figure 1-4: Scientists and crew viewing the Okak town site in Okak Bay.

1.2.3 *Saglek Fjord*

Saglek Fjord is also incredibly important to both Nunavik and Labrador Inuit. While stunningly beautiful, it is home to many cultural and archaeological sites that highlight the historical and current occupation and use of Inuit. Due to efficiencies created in the sampling schedule from good weather and minimal delays, additional sampling sites were added in Saglek Fjord.

This allowed for more research on topics of interest to the region, but also allowed for a visit to the Torngat Mountains Basecamp and Research Station, the northern research centre of the Nunatsiavut Government, for some of the scientists and crew. The visit included a tour of the research facilities, a lunch of caribou soup and interactions with the Inuit staff that operate the camp. This was incredibly valuable given this station will be the operational hub for the current Inuit Protected Area that is being developed for these waters.

Figure 1-5: Scientists and crew members preparing to disembark the *CCGS Amundsen* for the Torngat Mountains Basecamp and Research Station

1.2.4 *Ittaq*

In partnership with ArcticNet, Amundsen Science had planned to turn over two sets of moorings for Ittaq in Scott Inlet and Macbeth. Unfortunately, due to unfavourable ice conditions for recover, the Amundsen was unable to retrieve these moorings. Alternative recovery plans are now being considered to ensure these moorings are recovered.

1.2.5 *katimaks and Presentations*

Almost every evening there were presentations that followed the science meetings. These were a mixture of science presentations and katimaks (Inuttitut for meeting). The science presentations gave an overview of researchers work or other unique or relevant topics of interest. The katimaks were overviews of the Nunatsiavut Government research process, introductory Inuttitut lessons, or knowing the region you’re working in. These presentations were held to educate the Amundsen scientists about Nunatsiavut and the importance of ongoing work in the Labrador Sea and coastal Nunatsiavut.

Figure 1-6: Nunatsiavut Community Engagement and Inclusion and Participation leads Michelle Saunders (left) and Elizabeth Tuglavina (right).

1.3 Recommendations

- Ensure all participants on Amundsen missions are provided with a copy of the National Inuit Strategy on Research.

- Continue the collaboration and co-development of research projects and Amundsen scientific missions with Inuit, government and academic institutions.

- Continue to look for capacity building and training opportunities for Inuit, scientific and CCGS personnel.

- Ensure that Amundsen missions continue to provide space to learn and understand the area and the context in which the vessel is operating. This has led to significantly more valuable scientific information being collected, because it is grounded in the context of the region.

- Continue to promote diverse and multidisciplinary mission teams, that include Inuit and scientists, to fully implement the Inuit holistic approach to research.

2 Knowledge and Ecosystem-Based Approach in Baffin Bay (KEBABB) & Knowledge and Ecosystem-Based Approach in Barrow Strait (KEBABS)

Principal Investigators: Kevin Hedges[1], Zou Zou Kuzyk[2], Virginie Roy[3], David Capelle[1], Maxime Geoffroy[4], Clark Richards[5]

Collaborators: Brent Else[6], Jean-Éric Tremblay[7]

Field participants (Leg 2): Monika Pućko[1], Elizabeth Kitching[1], Jillian Reimer[1], Lisa Matthes[1], David Capelle[1], Lenore Vandenbyllaardt[1], Charlie Nakashuk[1], Stephen Ciastek[2]

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2.1 Introduction and objectives

Stock assessment surveys are conducted by Fisheries and Oceans Canada (DFO) in the Eastern Canadian Arctic for major commercial fisheries - Greenland Halibut (*Reinhardtius hippoglossoides*) and Northern and Striped Shrimp (*Pandalus borealis* and *P. montagui*, respectively). However, an ecosystem-based approach to fisheries management requires additional collection of oceanographic data in the region to contribute to the interpretation of changes in major stocks' abundance, dynamics, and distribution. The Knowledge and Ecosystem-Based Approach in Baffin Bay (KEBABB) program, developed by DFO in 2019 in collaboration with university partners, will provide crucial oceanographic data for the development and application of the ecosystem-based approach to fisheries management, as well as for an overall Arctic marine ecosystem monitoring program of Baffin Bay. The general objective of KEBABB is to characterize the variability and trends in physical, chemical, and biological oceanographic conditions in order to evaluate their influence on fisheries resources of western Baffin Bay. Five main components of KEBABB are: 1) physical and chemical oceanographic conditions; 2) abundance and composition of phytoplankton and microbial communities; 3) abundance and composition of zooplankton; 4) benthic communities and biogeochemistry; and 5) ecosystem health and interactions.

Since 2021, DFO has been conducting an additional program onboard the *CCGS Amundsen* – Knowledge and Ecosystem-Based Approach in Barrow Strait (KEBABS). The development of this program was connected to the creation of Tallurutiup Imanga National Marine

Conservation Area (TN MCA) in Lancaster Sound and the associated mandate to monitor this newly created conservation area. The conservation target of the TN MCA is to conserve the biodiversity and cultural heritage of the region. The general KEBABS objective is to collect oceanographic data along the sampling line (line S) already established by DFO, which includes long-term oceanographic moorings and previous oceanographic sampling.

2.2 Methodology

2.2.1 *KEBABB sampling operations*

The KEBABB program in 2023 was carried out during Leg 2 of the *CCGS Amundsen* 2023 expedition by the following teams:

Water biogeochemistry team – Monika, Elizabeth, Jillian, Lisa

Zooplankton team – Lenore and Charlie, working in close collaboration with Maxime Geoffroy's team led by Ashley Oates with assistance from Luiz Da Silva (University of Manitoba)

Sediments team – Stephen with assistance from Luiz Da Silva and Zakhar Kazmiruk (University of Manitoba)

Carbon chemistry team – David in collaboration with Brent Else's team (Gina Nickoloff)

Mooring team – Alexandre Forest (Amundsen Science), Ben Jokinen (University of Washington), Elizabeth, David, Stephen,

The KEBABB program consists of 5 transects (A, B, C, D, and E) located east of Qikiqtarjuaq, each composed of 5 stations. Line A consists of 9 stations which extend across Davis Strait to Greenland coast. KEBABB sites are designed to cover a coastal – offshore gradient, and were sampled between August 10th and August 24th, 2023, a very similar timing to the 2019 sampling period (August 22nd – August 31st) and 2022 sampling period (August 17th – August 29th). The KEBABS program consisted of 4 Basic stations, and 7 CTD (Conductivity, Temperature, Depth) stations distributed along line S, which were sampled on September 4th and 5th 2023. Other stations planned for Leg 2 were also sampled by the KEBABB team (e.g., Northwater transect, Lancaster Sound transect, Baffin Bay transect). A complete list of sampling operations conducted by the KEBABB team during Leg 2 is shown in Table 2-1.

2.2.2 *Water biogeochemistry*

Water from the CTD-Rosette was collected at multiple depths depending on the station bottom depth. Sampled depths and the analyses performed at each of them are listed in Table 2-2 for KEBABB Full stations, and in Table 2-3 for KEBABB Basic stations. Fractionated chlorophyll *a* (total and > 5 µm) concentrations were measured onboard the ship, using a Turner Design fluorometer (model 10-AU), following Parsons *et al* (1984). All other water samples will be analyzed later, at the Freshwater Institute (DFO, Winnipeg), or will be sent to collaborators/contractors for analysis. Genomics (DNA), Particulate Organic Carbon/Particulate Nitrogen (POC/PN), Fatty Acid (FA), phytoplankton pigment composition determined by High Performance Liquid Chromatography (HPLC) and Particulate Absorption (AP) samples were filtered and kept frozen at -80 °C until further analysis. For the other analyses, water was subsampled and kept at 4 °C (Salinity, delO18) or frozen (-80 °C, flow cytometry).

Additionally, water samples from surface and the subsurface chlorophyll maximum (SCM) from the rosette cast of each full station were collected for primary production incubations (P-E, Table 3). The photophysiological characteristics of different phytoplankton communities were investigated using the assimilation method of radiolabeled carbon isotopes ^{14}C and applying photosynthesis–irradiance (P-E) relationships. Incubation experiments were carried out in the Radvan throughout the cruise and samples were analyzed onboard with the Tri-Carb 4910 TR scintillation counter (PerkinElmer, Waltham, MA) provided by Amundsen Science. Weekly wipe tests of the Radvan and scintillation counter room were also performed to prevent contamination of the ship. A detailed description of the ^{14}C assimilation method can be found in Matthes et al. 2021.

2.2.3 *Zooplankton sampling*

Meso and macrozooplankton were sampled for taxonomic composition using a 3-Net Vertical Sampler (3NVS) "*Monster*" net (200, 200 and 50 µm mesh size, 1 m^2 collection area), throughout the entire water column (integrated vertical tow, from 10-20 m over the ocean floor to the surface) and were preserved in HDPE jars in 4 % v/v borate-buffered formaldehyde solution until further taxonomic analysis.

Meso and macrozooplankton for stratified taxonomic composition were sampled using a "*Hydrobios*" closing net MultiNet Type Maxi (200 µm mesh size, 0.5 m^2 collection area, 9 nets) according to the strategy shown in Table 2-4. Samples were preserved in HDPE jars in 4 % v/v borate-buffered formaldehyde solution until further taxonomic analysis. Zooplankton for fatty acid biomarker and stable isotopes analyses were collected using a Double Square Net (DSN) "*Tucker"* net (500, 750 and auxiliary 50 µm mesh size, 1 m^2 collection area), sampling the upper 100 m of the water column in an oblique V-shaped tow. The actual depth of the *Tucker* net during deployment was monitored using a Kongsberg Maritime HiPAP MiniS34 cNODE acoustic transponder system (S/N# 17570) attached to the cable just over the net. After collection, zooplankton were sorted and counted into abundant taxonomic groups down to the lowest taxonomic level possible (species or genus for most specimens and class for more difficult individuals): *Clione limacina*, *limacina helicina*, *Calanus hyperboreus*, *Calanus finmarchicus/glacialis*, *Metridia* sp., *Themisto libellula*, *Themisto abyssorum*, *Parasagitta elegans*, *Eukrohnia hamata*, *Paraeuchaeta* sp., *Boreomysis nobilis*, *Aglantha* sp., *Thysanoessa* sp., *Ostracoda*, *Onisimus littoralis*, *Meganyctiphanes norvegica*, *Hyperia galba*, Ctenophora, Cephalopoda, Cnidaria, *Hyperoche medusarum*, *Apherusa glacialis*, *Sarsia princeps*, *Eusirus cuspidatus*, Mysidae, *Pseudosagitta maxima*, Decapoda; using a dissecting stereomicroscope, and kept frozen at -80 °C in glass vials.

2.2.4 *Sediments biogeochemistry*

Push cores of 10 cm diameter were collected from the box core sampler and stored at 4 °C. They were then sectioned in layers (Table 2-5) within 12 hours after collection and individually bagged. Sectioned samples were kept at -20 °C until further analysis. Analyses that will be performed on these layers include sedimentation rate, radioisotope dating, porosity, total mercury concentration, PAH, n-alkanes, PCBs, total carbon, total inorganic carbon, and C/N isotopes. At a few stations, box core deployments were not successful (please see Table 2-6 for details on box core deployments).

2.2.5 *Carbon chemistry*

Marine carbon chemistry measurements to assess the sea-air flux of CO_2 and ocean acidification were made using multiple approaches, including rosette, and moored CO_2 and pH measurements. Discrete samples from the rosette included dissolved inorganic carbon (DIC) and total alkalinity (TA) –Table 2-2 and Table 2-3. These samples were stored at 4°C and will be analyzed at the Freshwater Institute (DFO - Winnipeg). These results will be supplemented with discrete salinity and oxygen isotope ($\delta^{18}O$) results (water biogeochemistry team) to characterize the relative abundance of meteoric water (river runoff, glacial melt), seawater, and sea-ice melt/brine. Moored CTD, oxygen and pH were measured with an RBR Maestro, while dissolved CO_2 was measured with a Pro-Oceanus CO_2-pro sensor, both deployed at ~200m depth near the east entrance to Eclipse Sound.

Table 2-1: Sampling activities conducted by the KEBABB team during Leg 2 of the 2023 *CCGS Amundsen* expedition

Station name	**KEBABB 23 Station ID**	**Latitude (N)**	**Longitude (W)**	**Rosette Cast**	**Date**	**Water biogeochemistry**	**Genomics**	**P-E curves**	**Zooplankton stratified taxonomy**	**Zooplankton fatty acids**	**Sediment biogeochemistry**
E1	#1	68.2772	65.1412	2	12-08-2023	F[1]	X	X	X	X	
E2	#2	68.5375	64.6581	3	13-08-2023	B[2]					
E3	#3	68.8022	64.1386	4	13-08-2023	F	X	X	X	X	C, S, P
E4	#4	69.2184	63.3473	6	13-08-2023	B					C, S, P
E5	#5	69.6039	62.5446	7	14-08-2023	F	X	X	X	X	C, S, P
C5	#6	68.1464	59.9727	9	15-08-2023	F	X	X	X	X	
C4	#7	67.9567	60.6068	11	15-08-2023	B					C, S, P
C3	#8	67.7510	61.2773	12	15-08-2023	F	X	X	X	X	C, S, P
C2	#9	67.5442	61.9073	14	16-08-2023	B					
C1	#10	67.3458	62.5227	15	16-08-2023	F	X	X	X	X	
A1	#11	66.6058	61.1935	16	16-08-2023	F	X	X	X	X	

A2	#12	66.6713	60.4584	17	16-08-2023	B					
A3	#13	66.7301	59.6093	18	17-08-2023	F	X	X	X	X	C, S
A4	#14	66.8037	58.7661	20	17-08-2023	B					C, S, P
A5	#15	66.8709	57.9615	21	17-08-2023	F	X	X	X	X	
A6	#16	66.8902	56.9221	23	18-08-2023	B					
A7	#17	66.9850	56.0683	24	18-08-2023	F	X	X	X	X	
A8	#18	67.0486	55.0810	25	18-08-2023	B					
A9	#19	67.0878	54.1939	26	18-08-2023	F	X	X		X	V, S
B1	#20	67.0611	61.5235	27	20-08-2023	F	X	X	X	X	
B2	**B2, B3, B4, B5 – cancelled due to weather conditions**										
B3											
B4											
B5											
D2	#21	67.8609	63.1086	28	20-08-2023	B					
D1	#22	67.4724	63.6891	29	21-08-2023	F	X	X	X	X	C, S, P
D1’’	#23	67.5523	64.0857	31	21-08-2023	B	X				V, S
D1-2022	#24	67.3965	63.8498	32	21-08-2023	F	X	X			C, S, P
D3	#25	68.2407	62.5983	33	22-08-2023	B	X	X	X	X	Cancelled due to weather
D4	#26	68.6283	61.9843	34	22-08-2023	F		X			C, S, P
D5	#27	69.0045	61.4081	35	25-08-2023	F	X	X	X	X	
BioARGO	#28	72.9078	65.6129	36	26-08-2023	F		X			
116	#29	76.3814	70.5360	37	27-08-2023	B*					
115	#30	76.3351	71.2079	38	27-08-2023	F	X	X	X	X	C, S
113	#31	76.3184	72.2210	40	27-08-2023	B*					
111	#32	76.3027	73.2766	42	28-08-2023	F		X	X	X	C, S
108	#33	76.2645	74.6042	45	28-08-2023	F	X	X	X	X	C
105	#34	76.3171	75.7793	49	28-08-2023	F		X	X	X	
103	#35	76.3570	76.5932	51	29-08-2023	B*					
101	#36	76.3836	77.4093	53	29-08-2023	F	X	X	X	X	C, S

100	#37	76.4086	77.9641	54	29-08-2023	B*					
148	#38	75.3555	73.9395	55	30-08-2023	B			X	X	
153	#39	74.6940	72.7312	56	30-08-2023	F	X	X		X	C, S
158	#40	74.0514	72.0404	57	30-08-2023	B			X	X	
163	#41	73.1988	71.2057	58	31-08-2023	F	X	X		X	C, S
Bylot-23	#42	72.8726	75.6503	60	01-09-2023	F	X	X			V, S
325	#43	73.8151	80.4851	61	01-09-2023	F		X	X	X	C
323	#44	74.1581	80.4627	63	02-09-2023	B			X	X	C, S, P
322	#45	74.4942	80.5424	66	02-09-2023	F		X	X	X	C, S
S1	CTD Cast	74.0494	91.1573	67	04-09-2023						
S2	CTD Cast	74.0662	91.1251	68	04-09-2023						
S3	#46	74.0968	91.0860	69	04-09-2023	B					
S4	CTD Cast	74.1438	91.0176	70	04-09-2023						
S5	#47	74.2177	90.9043	71	04-09-2023	B			X	X	C
S6	CTD Cast	74.2767	90.8159	72	04-09-2023						
S7	CTD Cast	74.3433	90.7187	73	04-09-2023						
S8	#48	74.4005	90.6310	74	04-09-2023	B			X	X	C, S
S9	CTD Cast	74.4643	90.5359	75	04-09-2023						
S10	#49	74.5445	90.4063	76	04-09-2023	B					
S11	CTD Cast	74.5706	90.3679	77	04-09-2023						
305A	#50	74.2241	93.4888	78	05-09-2023	B*					
305D	#51	74.6026	93.7263	81	05-09-2023	B*					

[1] F – Full station

[2] B – Basic station

* chlorophyll, flow cytometry, cells and Frrf only

V = Van Veen, C = Box Core, S = Bulk Surface, P = Push Core

Table 2-2: Sampling details for water column biochemistry sampled by the KEBABB team during Leg 2 of the 2023 *CCGS Amundsen* at Basic stations.

Depth (m)	**DIC/TA**	**Salinity**	**^{18}O**	**Flow cytometry**		**DAPI**	**Chlorophyll *a***		**Phyto taxonomy**	**Phyto fatty acid**	**POC/PN**	**FRRF**
				Bacteria	**Protist**		**Total**	**> 5µm**				
5	1x	1x	1x	2x	2x	2x	2x	2x	2x*	2x	2x	1x
7	1x	1x	1x									
10		1x	1x				2x	2x				
20	1x	1x	1x	2x	2x		2x	2x				
30		1x	1x				2x	2x				
SCM	1x	1x	1x	2x	2x	2x	2x	2x	2x*	2x	2x	1x
40	1x	1x	1x	2x	2x		2x	2x				
50	1x	1x	1x				2x	2x				
60	1x	1x	1x	2x	2x		2x	2x				
80	1x	1x	1x	2x	2x		2x	2x				
100	1x	1x	1x	2x	2x		2x	2x				
150	3x	1x	1x									
200	1x	1x	1x									
250		1x	1x									
300		1x	1x									
500	1x	1x	1x									
750	1x	1x	1x									
1000	1x	1x	1x									
Bot.	1x	1x	1x	2x	2x						2x	

* one sample preserved with formalin, and one with Lugol's acidic solution

Table 2-3: Sampling details for water column biochemistry sampled by the KEBABB team during Leg 2 of the 2023 *CCGS Amundsen* at Full stations

Depth (m)	**DIC/TA**	**P-E**	**Salinity**	**^{18}O**	**Flow cytometry**		**DAPI**	**Chlorophyll *a***		**Phyto taxonomy**	**DNA**	**Phytofatty acid**	**POC/PN**	**FRRF**	**AP**	**HPLC**
					Bacteria	**Protist**		**Total**	**> 5µm**							
5	1x	1x	1x	1x	2x	2x	2x	2x	2x	2x*	1x	2x	2x	1x	1x	1x
7	1x		1x	1x												
10			1x	1x				2x	2x							
20	1x		1x	1x	2x	2x		2x	2x							
30			1x	1x				2x	2x							
SCM	1x	1x	1x	1x	2x	2x	2x	2x	2x	2x*	1x	2x	2x	1x	1x	1x
40	1x		1x	1x	2x	2x		2x	2x							
50	1x		1x	1x				2x	2x							
60	1x		1x	1x	2x	2x		2x	2x							
80	1x		1x	1x	2x	2x		2x	2x							
100	1x		1x	1x	2x	2x		2x	2x							
150	3x		1x	1x												
200	1x		1x	1x							1x					
250			1x	1x												
300			1x	1x												
500	1x		1x	1x												
750	1x		1x	1x												
1000	1x		1x	1x												
Bot.	1x		1x	1x	2x	2x					1x		2x			

* one sample preserved with formalin, and one with Lugol’s acidic solution

Table 2-4: Zooplankton stratified sampling strategy during Leg 2 of the 2023 *CCGS Amundsen* expedition. The distance between the sea floor and the tow depths for nets #1-2-3 varied depending on the station depth

Strata/net #	Depth end (m)	Depth start (m)
9	2m	20m
8	20m	40m
7	40m	60m
6	60m	100m
5	100m	150m
4	150m	250m
3	250m-bottom divided into 3 strata of equal depth	
2		
1		
Trigger depth	N/A	Bottom -30

Table 2-5: Thickness of layers sectioned from push cores according to their depth in the core

Section (cm)	Layer thickness (cm)
0-10	1
10-20	2
20-Bot	5

Table 2-6: General information on Box Core deployment rationale and degree of success in 2023.

Station	Depth (m)	Comments / Push core recovery[1]
E3	1255.94	Successful, bulk surface taken, Push Core 38.5 cm, Sediment genomics & Micro Biology.
E4	1848.38	Two box cores deployed, both successful, bulk surface taken, Push Core 39.5 cm, Sediment genomics & Micro Biology
E5	1966.32	Successful, bulk surface taken, Push Core 42 cm, Sediment genomics & Micro Biology
C4	1603.85	Successful, bulk surface taken, Push Core 38.5 cm, Sediment genomics & Micro Biology
C3	1563.78	Two box cores deployed, both successful, bulk surface taken, Push Core 39.75 cm, Sediment genomics & Micro Biology
A3	875.40	Two box cores deployed, one successful, bulk surface taken from second box, no space for push core in second box core, Sediment genomics & Micro Biology
A4	908.41	Successful, bulk surface taken, Push Core 27.5 cm, Sediment genomics & Micro Biology

A9	75.99	Van Veen Grab deployed, bulk surface taken, Sediment genomics & Micro Biology, Box Core has issues penetrating the surface due to scalp shell concentration on surface and was not deployed this year
B4	~1453	Station cut due to weather
B3	~1086	Station cut due to weather
D1	649.03	Successful, bulk surface taken, Push Core 29.75 cm, Sediment genomics & Micro Biology
D1"	66.41	Van Veen Grab deployed, was full of sand, bulk surface taken, Sediment genomics & Micro Biology
D1-2022	466.98	Successful, bulk surface taken, Push Core 35.5 cm, Sediment genomics & Micro Biology
D3	1551.09	Box core skipped due to weather affecting ship time
D4	1796.70	Successful, bulk surface taken, Push Core 37.5 cm, Sediment genomics & Micro Biology
115	673.91	Successful, bulk surface taken only, Sediment genomics & Micro Biology
111	591.81	Successful, bulk surface taken only, Sediment genomics & Micro Biology
108	448.81	Box core hit a rock and sample was lost.
101	377.59	Successful, bulk surface taken only, Sediment genomics & Micro Biology
153	905.62	Successful, bulk surface taken only, Sediment genomics & Micro Biology
163	1248.00	Successful, bulk surface taken only
Bylot-23	353.13	Van Veen Grab deployed, full of rocks, bulk surface taken
325	673.55	Box Core was full of rocks and fails to capture a useable sample
323	788.86	Successful, bulk surface taken, Push Core 36.5 cm, Sediment genomics & Micro Biology
322	661.69	Successful, full of rocks, bulk surface taken only, Sediment genomics & Micro Biology
S5	296.01	Box Core was full of rocks and failed to capture a usable sample
S8	195.51	Successful, full of rocks, bulk surface taken only, Sediment genomics & Micro Biology

[1] All push cores have bulk surface samples taken as well.

2.2.6 *Mooring deployment*

A mooring with a suite of oceanographic (CTDs, ADCP), biogeochemical instruments (sediment trap, pCO_2 sensor, pH, O_2 sensor), and biodiversity (fish tag acoustic receiver) was deployed during Leg 2 (September 1, 2023) at the Bylot Island location (72 52.845N, 75 38.938W). Instruments were programmed prior to the start of the Leg, and just required assembly prior to deployment. The deployment team consisted of Alexandre Forest (Amundsen Science), Ben Jokinen (University of Washington), Elizabeth Kitching (DFO), David Capelle (DFO), and Stephen Ciastek (University of Manitoba) with assistance from the crew. The deployment was successful. The major problem encountered was difficulty communicating with the releases (Teledyne) after deployment for the triangulation. It was mitigated by performing the communication and triangulation from a zodiac. A follow-up email with Technicap about the proper installation of the PPS 4/3 and PPS 3/3 sediment trap carousel/bottles to reduce leakage of formalin is advised.

2.3 Preliminary results

2.3.1 *Chlorophyll a concentration*

Depth-integrated chlorophyll *a* concentration (Chl *a*) varied between 33 and 153 mg m^{-2} along the 5 KEBABB transects, the North Water Polynya (NOW) transect and at the entrance of Lancaster Sound (Figure 2-1). Chl a concentration was integrated from surface to 100 m (where applicable depths exist). The SCM depth ranged from 10 m to 54 m with Chl *a* between 0.78 and 6.63 mg m^{-3} Surface Chl *a* ranged from 0.08 to 3.88 mg m^{-3} (Figure 2-2a-c). SCMs with the highest Chl *a* were observed in Southern Baffin Bay along the Kebabb transects (Figure 2-2a, Figure 2-3a), while the deepest SCMs were measured along the NOW transect (Figure 2-2b, Figure 2-3b). High surface Chl *a* >1 mg m^{-3}, indicating a surface bloom, were only observed at stations A8 and B1 of the KEBABB transects, and stations 108 and 113 of the NOW transect (Figure 2-3b).

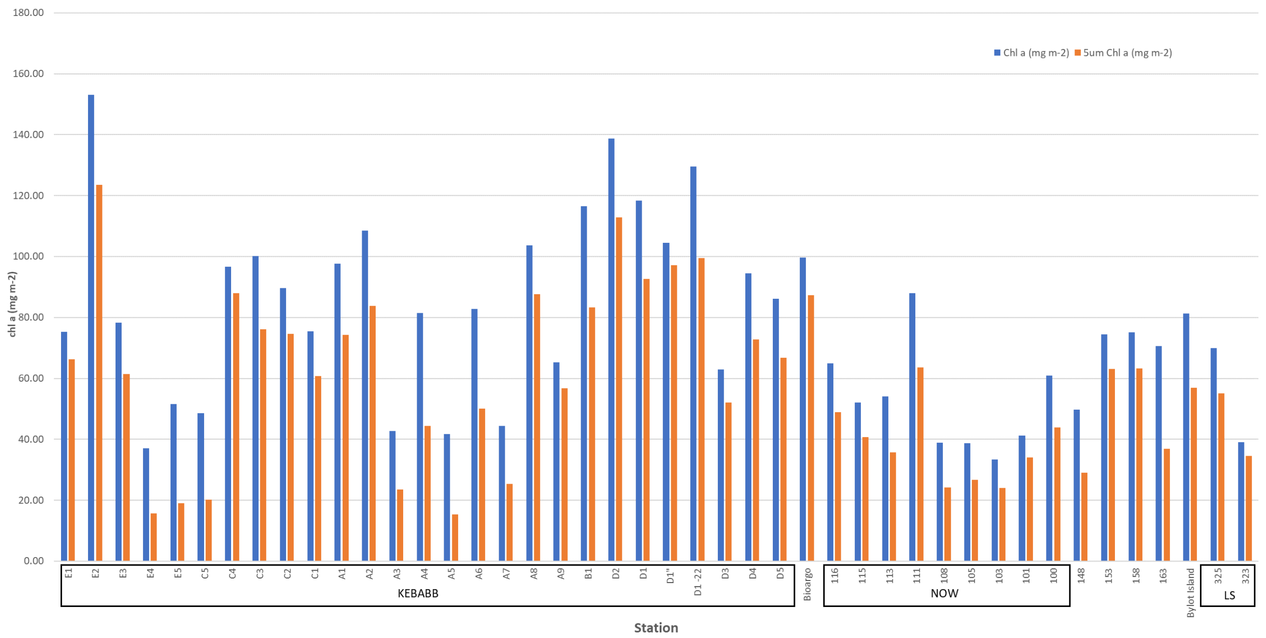
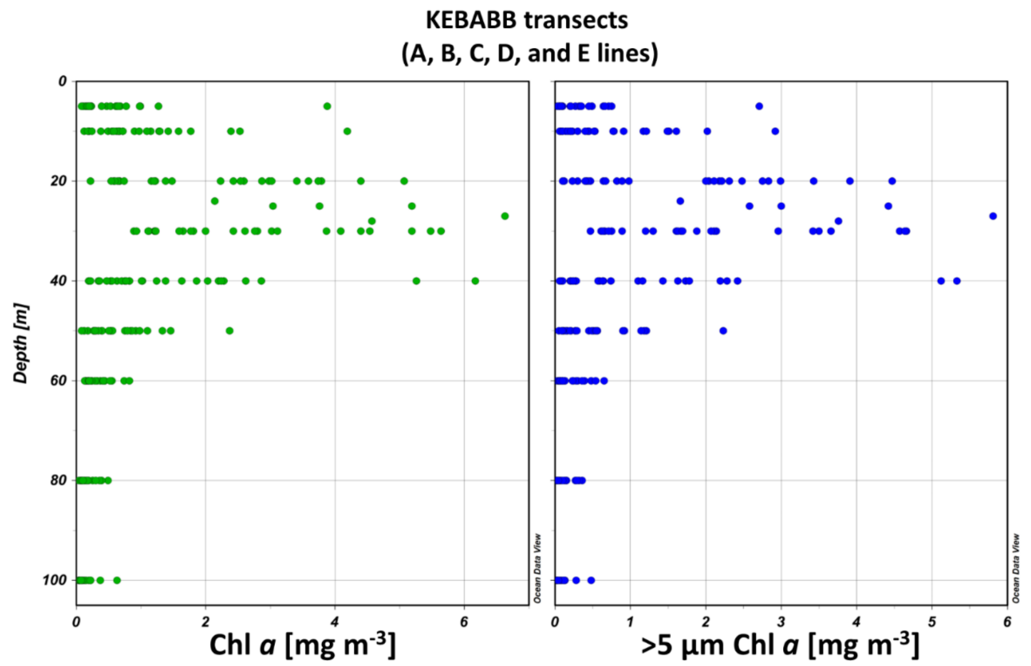
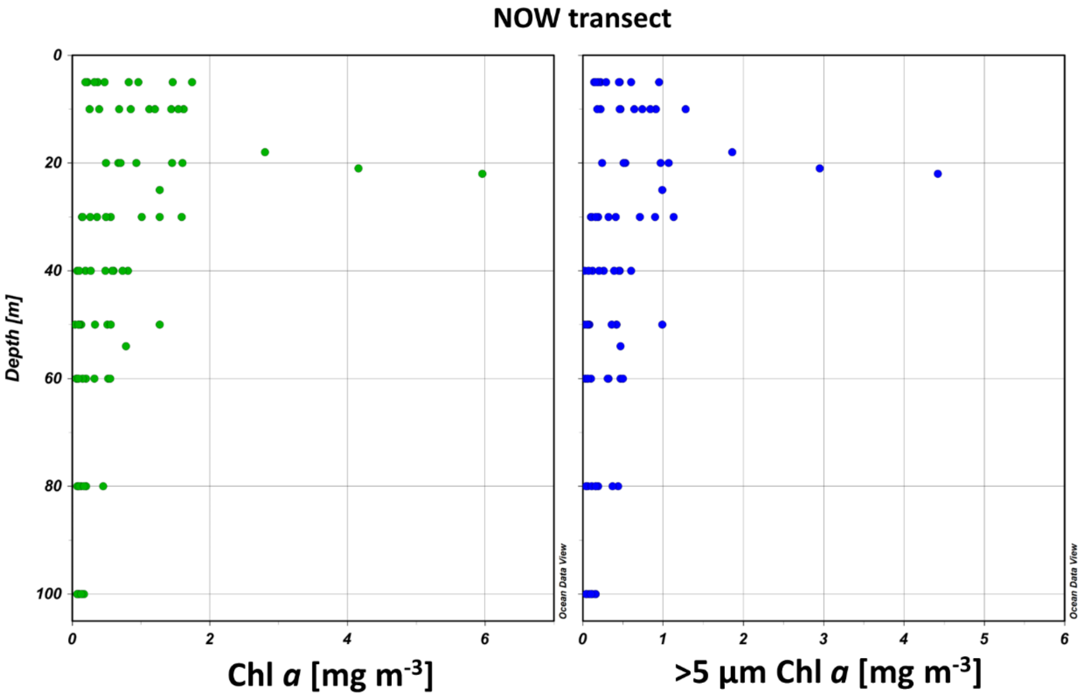


Figure 2-1: Depth-integrated chlorophyll a concentration (Chl a) for each full and basic station. Data is shown for total Chl a (blue) and size-fractionated Chl a >5-µm (orange)

a)



b)



c)

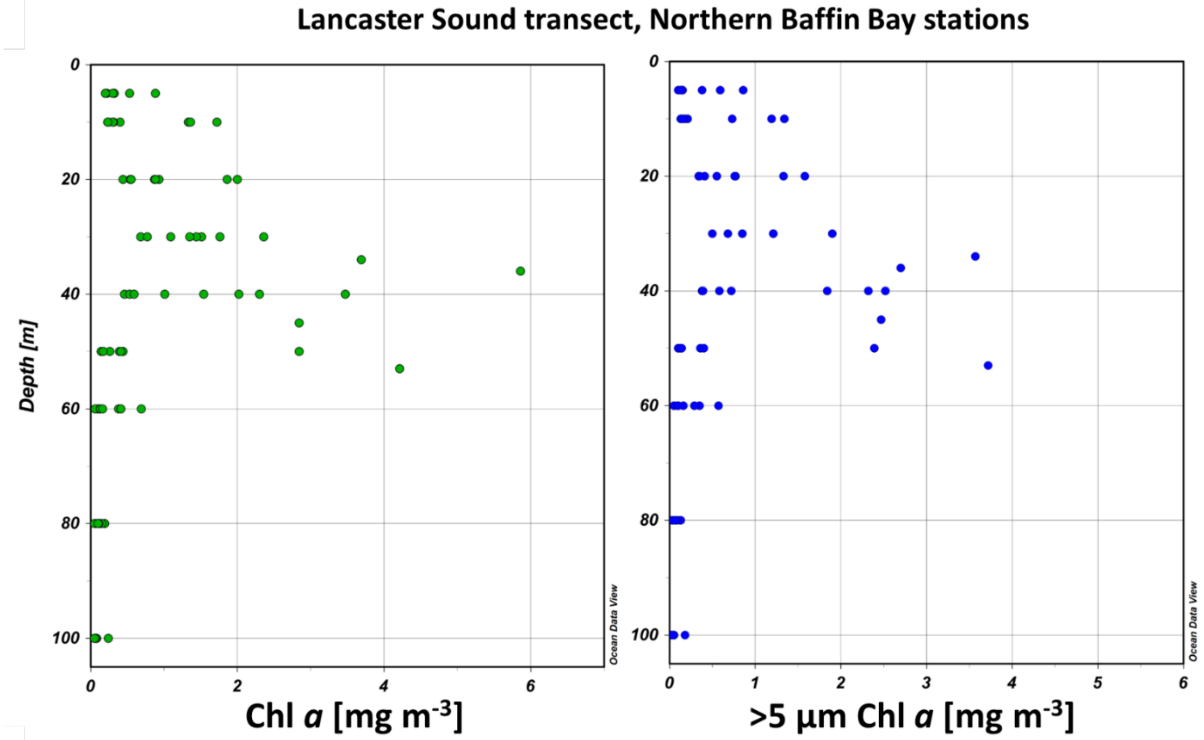


Figure 2-2: Vertical profiles of (left) total chlorophyll a and (right) size-fractionated chlorophyll a >5 µm for all full and basic stations split into 3 groups: a) KEBABB, b) NOW, and c) Lancaster Sound and Northern Baffin Bay stations. KEBABB transects show the stations along the A, B, C, D, and E lines. NOW shows the stations along the North Water Polynya transect (stations 100, 101, 103, 105, 108, 111, 113, 115, 116). Lancaster Sound transect and Northern Baffin Bay stations show stations along the Lancaster Sound transect and in northern Baffin Bay (stations 148, 153, 158, 163, BioArgo float, and Bylot Island mooring deployment)

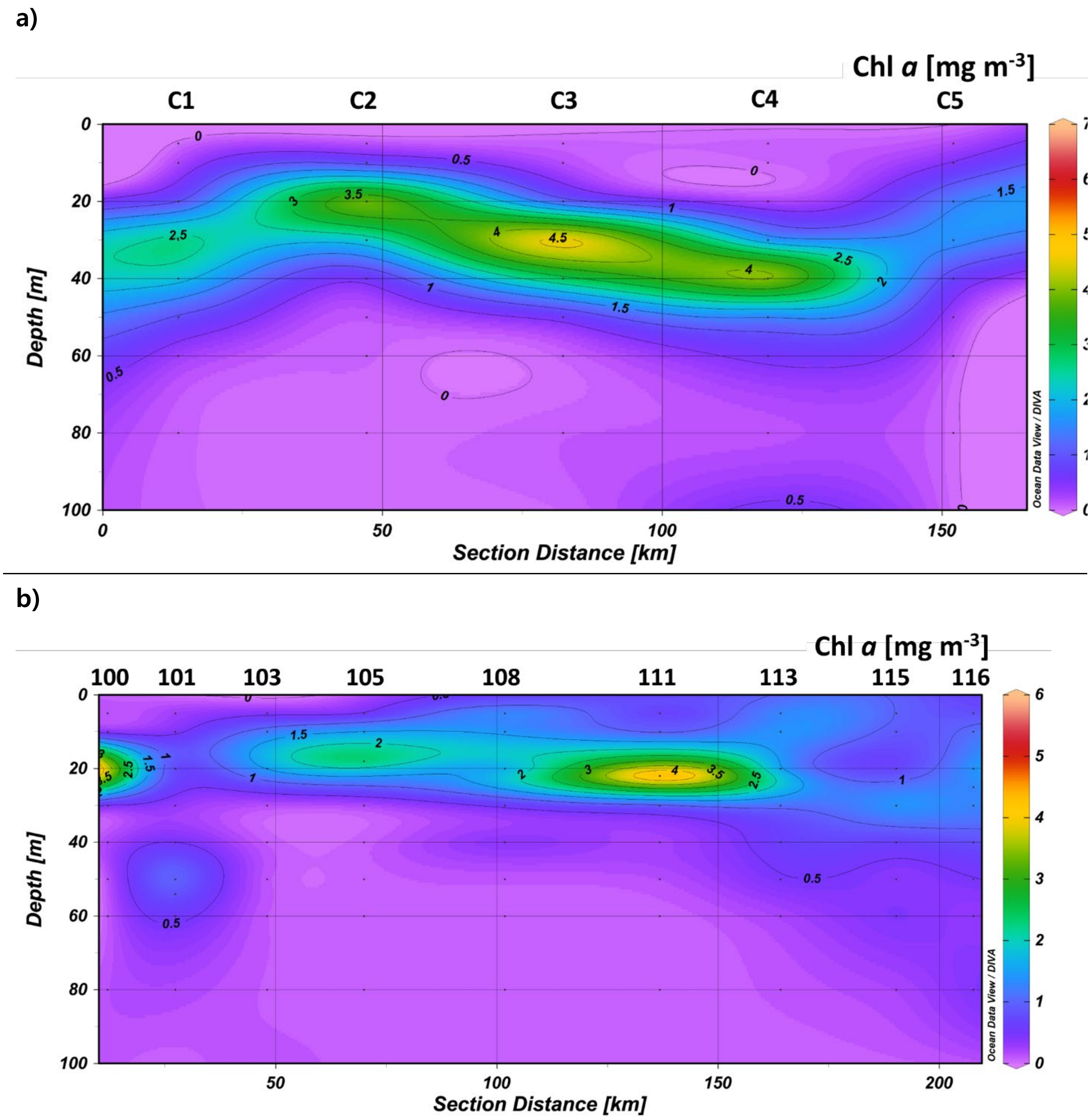


Figure 2-3: Section plots of total chlorophyll a for the a) KEBABB transect C line and b) NOW transect across Baffin Bay

2.3.2 *Phytoplankton photophysiology*

How phytoplankton acclimated to different light intensities encountered at the surface (high light environment) and at the SCM (low light environment) in the different sampling regions was investigated by fitting photosynthesis-irradiance relationships (PE curves) to measured carbon uptake at different light levels. Figure 2-4 shows a measured PE curves for a surface and SCM phytoplankton community at station D5. Phytoplankton communities near the surface showed a greater light acclimation than communities found at the SCM at 25 m, which is displayed in a more gradual slope of the PE curve and a lower maximum photosynthetic rate that was reached at higher light levels compared to the SCM community. Phytoplankton at the SCM was well acclimated to the lower light levels and reached 2-times higher photosynthetic rates after only a small increase in light levels due to the steep slope of the PE curve. At light levels >300 µmol photons m^{-2} s^{-1}, which corresponds to surface light levels measured during the expedition, the SCM community became strongly photoinhibited, while the surface community only showed small photoinhibition at light levels >1000 µmol photons m^{-2} s^{-1}. Overall, the investigated photophysiological characteristics of the different communities indicate that, phytoplankton found at the SCM was very productive. This is supported by the observation of 6-times higher Chl *a* of 3.76 mg m^{-3} at the SCM compared to Chl *a* of 0.65 mg m^{-3} at the surface.

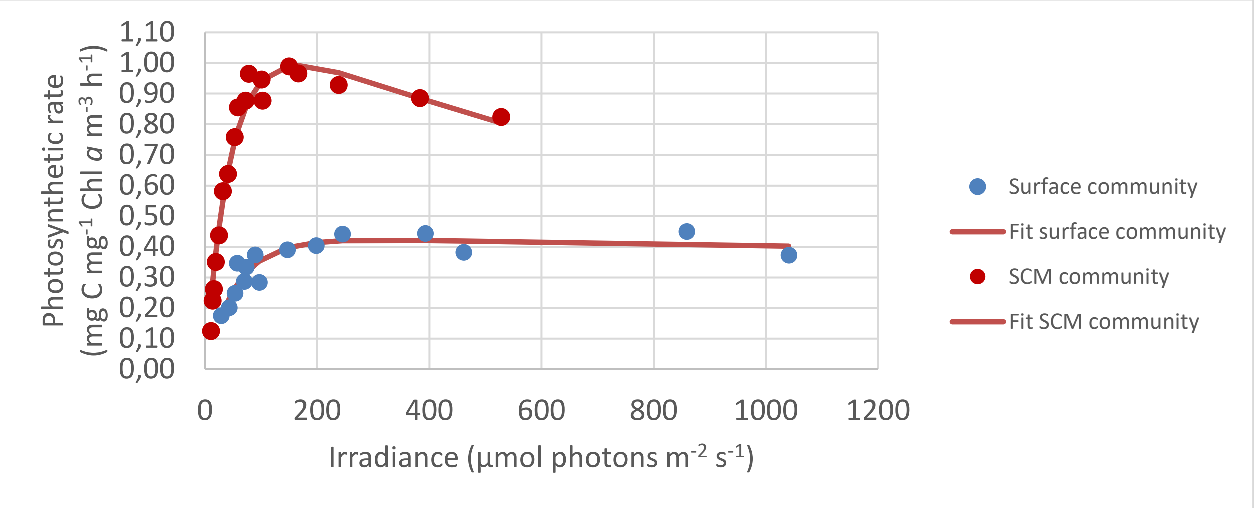


Figure 2-4: Photosynthesis-irradiance relationships of the surface and subsurface chlorophyll maximum (SCM) community at station D5

2.4 Recommendations

Bylot Island Mooring recovery and potential re-deployment 2024: For 2024, it is strongly recommended to procure a longer cable for the hydrophone and to make sure that an autonomous (with battery) Benthos UTS Universal deckbox is available for the cruise. Note that Amundsen Science does not own any Benthos deck box.

In the future, it is not recommended to use Teledyne acoustic releases for moorings as they are known to cause problems with activation during deployments in Arctic areas from the *CCGS Amundsen*. An alternative for 2024 re-deployment could be EdgeTech releases.

2.5 References

Parsons, T.R., Maita, Y., Lalli, C.M. (1984) A manual of chemical and biological methods for seawater analysis. Pergamon, Oxford.

Matthes, LC., Ehn, JK., Dalman, LA., Babb, DG., Peeken, I., Harasyn, M., Kirillov, S., Lee, J., Be´ langer, S., Tremblay, J-E´ ., Barber, DG., Mundy, CJ. 2021. Environmental drivers of spring primary production in Hudson Bay. Elementa: Science of Anthropocene 9(1). DOI: https://doi.org/10.1525/elementa.2020.0016.

3 Eastern Canada Seabirds at Sea (ECSAS) Program

Project leaders: Carine Gjerdrum[1] (carina.gjerdrum@ec.gc.ca)

Cruise participants – Leg 1: Holly Hogan[1]
Cruise participants – Leg 2: Joy, Jonathan[1]
Cruise participants – Leg 4: Jeannine Winkel[1]

[1]Canadian Wildlife Service, Department of Environment and Climate Change Canada

3.1 Introduction and objectives

The east coast of Canada supports millions of breeding marine birds as well as migrants from the southern hemisphere and northeastern Atlantic. In 2005, the Canadian Wildlife Service (CWS) of Environment Canada initiated the Eastern Canada Seabirds at Sea (ECSAS) program with the goal of identifying and minimizing the impacts of human activities on birds in the marine environment. Since that time, a scientifically rigorous protocol for collecting data at sea and a sophisticated geodatabase have been developed, relationships have been established with industry and government to support offshore seabird observers, and over 300,000 km of ocean track have been surveyed by CWS-trained observers. Data from at-sea surveys provide important information on pelagic seabird distribution throughout the year, including patterns of dispersal from breeding areas, migration routes and wintering areas. Over time, these data show trends in species abundance, diversity and distribution. This information can then be used to inform decisions regarding the protection of important marine areas, environmental assessment of proposed development projects, and appropriate response strategies to catastrophic events, such as oil spills as well wildlife disease outbreaks (i.e., Highly Pathogenic Avian Influenza). In addition to the seabird data collected during surveys, data are collected on marine mammals, sea turtles, sharks, and other marine organisms when they are encountered.

3.2 Methods

We conducted seabird surveys from the starboard side of the bridge of the *CCGS Amundsen* on Leg 0, 1, 2, and 4 between 9 July and 25 October 2023. We conducted surveys while the ship was moving at speeds greater than 4 knots, looking forward and scanning a 90° arc to one side of the ship. We recorded all birds observed on the water within a 300m-wide transect, and we used the snapshot approach for flying birds (intermittent sampling based on the speed of the ship) to avoid overestimating abundance of birds flying in and out of transect. We incorporated distance sampling methods to address variation in bird detectability. We also recorded marine mammal and other marine wildlife observations, although surveys were not specifically designed to detect marine mammals. Details of the methods used can be found in the CWS standardized protocol for pelagic seabird surveys from moving platforms[1].

3.3 Results

We surveyed 6227.8 km of ocean track between 9 July and 25 October 2023 (Figure 1-1). During this period, we counted a total of 20,017 marine birds in transect from 9 families (Table 1-1). Bird densities averaged 6.5 ± 43.1 birds/km^2. The highest densities of birds (> 150 birds/km^2) were observed during the breeding season (July and August) near colonies off the northeast coast of NL, Hudson Strait, and eastern Baffin Island (Davis Strait), as well as in Hudson Strait during the fall migration period (October) (Figure 1-1). Seabird sightings were dominated by just four species, Dovekie (30%), Northern Fulmar (29%), Thick-billed Murre (18%), and Common Murre (11%; Table 1-1). All but the Dovekie breed in the eastern Canadian Arctic; Dovekie breed primarily in northwestern Greenland. A total of 322 marine mammals were also observed, including 5 polar bear, 131 seal, and 186 whale and dolphin (Table 1-2).

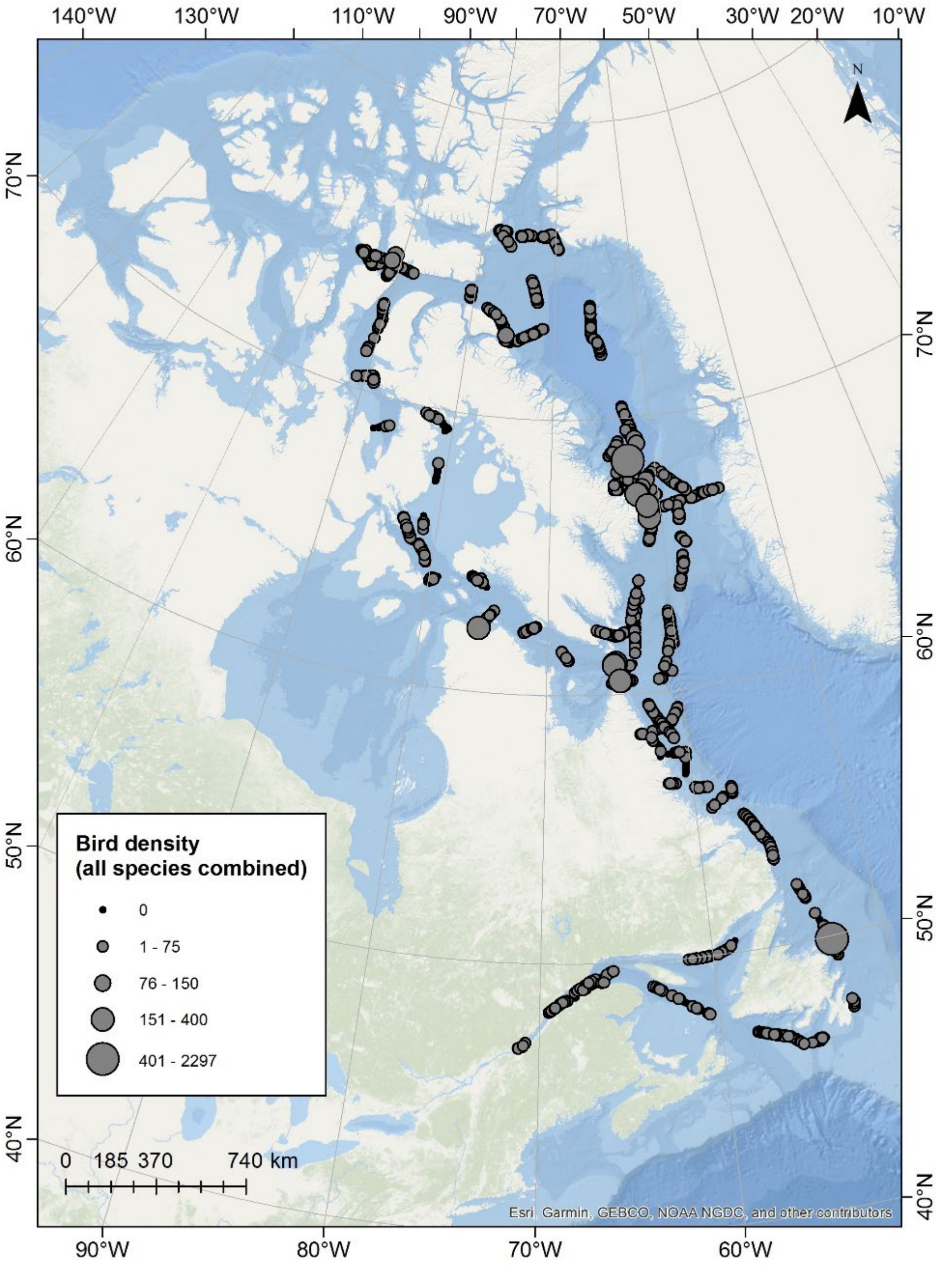


Figure 3-1: Density of birds observed during surveys from *CCGS Amundsen* 9 July to 25 Oct 2023

Table 3-1: List of bird species observed during surveys from *CCGS Amundsen* 9 July to 25 Oct 2023

Family	**Common name**	**Latin**	**Total Sighted**
Gaviidae	Common Loon	*Gavia immer*	2
	Unidentified Loon	Gaviidae	2
Procellariidae	Northern Fulmar	*Fulmarus glacialis*	5866
	Great Shearwater	*Ardenna gravis*	97
	Manx Shearwater	*Puffinus puffinus*	32
	Sooty Shearwater	*Ardenna griseus*	18
Hydrobatidae	Wilson's Storm Petrel	*Oceanites oceanicus*	42
	Leach's Storm-Petrel	*Oceanodroma leucorhoa*	12
	Unidentified Storm-Petrel	Hydrobatidae	3
Sulidae	Northern Gannet	*Morus bassanus*	35
Phalacrocoracidae	Double-crested Cormorant	*Phalacrocorax auritus*	2
	Unidentified Cormorant	*Phalacrocorax*	3
Anatidae	Snow Goose	*Chen caerulescens*	8
	Common Eider	*Somateria mollissima*	419
	King Eider	*Somateria spectabilis*	6
	Long-tailed Duck	*Clangula hyemalis*	17
	White-winged Scoter	*Melanitta fusca*	1
	Unidentified Scoter	*Melanitta*	2
	Unidentified Duck	All duck genera	14
Scolopacidae	Red Phalarope	*Phalaropus fulicaria*	39
	Red-necked Phalarope	*Phalaropus lobatus*	15
	Unidentified Phalarope	*Phalaropus*	9
Laridae	Pomarine Jaeger	*Stercorarius pomarinus*	9
	Parasitic Jaeger	*Stercorarius parasiticus*	5
	Unidentified Jaeger	*Stercorarius*	3
	Black-legged Kittiwake	*Rissa tridactyla*	626
	Glaucous Gull	*Larus hyperboreus*	113
	Herring Gull	*Larus argentatus*	97
	Iceland Gull	*Larus glaucoides*	30
	Great Black-backed Gull	*Larus marinus*	19
	Ring-billed Gull	*Larus delawarensis*	5
	Black-headed Gull	*Larus ridibundus*	1
	Sabine's Gull	*Xema sabini*	1
	Arctic Tern	*Sterna paradisaea*	2
	Unidentified Gull	Laridae	1
Alcidae	Dovekie	*Alle alle*	6005

	Thick-billed Murre	*Uria lomvia*	3545
	Common Murre	*Uria aalge*	2157
	Unidentified Murre	*Uria*	82
	Atlantic Puffin	*Fratercula arctica*	472
	Black Guillemot	*Cepphus grylle*	108
	Razorbill	*Alca torda*	11
	Unidentified Alcid	Alcidae	81
Total			20017

Table 3-2: List of marine mammals observed during surveys from *CCGS Amundsen* 9 July to 25 Oct 2023.

English	**Latin**	**Total Seen**
Polar Bear	*Ursus maritimus*	5
Hooded Seal	*Cystophora cristata*	3
Bearded Seal	*Erignathus barbatus*	2
Ringed Seal	*Pusa hispida*	1
Harp Seal	*Pagophilus groenlandicus*	99
Unidentified Seals	Phocidae	26
Bowhead Whale	*Balaena mysticetus*	26
Fin Whale	*Balaenoptera physalus*	5
Humpback Whale	*Megaptera novaeangliae*	5
Killer Whale	*Orcinus orca*	1
Long-finned Pilot Whale	*Globicephala melas*	81
Sperm Whale	*Physeter catodon*	1
Unidentified Whales	Balaenopteridae	11
Harbour Porpoise	*Phocoena phocoena*	10
White-beaked Dolphin	*Lagenorhynchus albirostris*	23
Unidentified Dolphins	Delphinidae	19
Unidentified cetacean	Cetacea	4
Total		322

4 Carbon Exchange Dynamics, Air-Surface Fluxes and Surface Climate

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Cruise participants – Leg 2: Gina Nickoloff[1]

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4.1 Introduction

Oceanic uptake of atmospheric CO_2 has been the largest sink of anthropogenic emissions, and is responsible for mitigating atmospheric CO_2 by one third, greatly reducing climate impacts. Ocean carbon storage is vulnerable to the impacts of climate change, particularly in rapidly-changing polar seas. Arctic ocean warming, stratification, altered primary production and diminishing sea ice and changes to freshwater cycles all impact CO_2 uptake, yet the magnitude and direction of these changes, and their cumulative impact on air-sea fluxes is largely unknown. Further, these factors are causing acute ocean acidification of the Arctic surface layer, impacting carbon cycling. High-resolution surface pCO_2 datasets on a multi-year time-scale will improve current estimates of Arctic Ocean carbon storage potential and provide insight into physical, chemical, and biological processes impacting pCO_2.

4.2 Specific objectives

1) Develop a process-level understanding of the exchange of CO_2 between the sea surface and atmosphere.
2) Continue a long-term monitoring program to understand how the Arctic marine CO_2 sink may be evolving as a result of climate change.
3) Identify areas at-risk for anthropogenically-induced ocean acidification, and collect long-term data to track rates of ocean acidification in the Arctic.

4.3 Methodology

Observation platforms have been utilized throughout the cruise to collect data pertaining to the atmosphere and surface ocean, including an underway pCO_2 system in the engine room.

Table 4-1: Summary of variable inventory and application

Variable	**Instrumentation**	**Location**	**Purpose**	**Sample/Average Frequency**
upper sea water temperature (Tsw)	General Oceanics 8050 *p*CO2	under-way system, foreward engine room	air-sea flux and ancillary information	1 / 3 minutes
sea water salinity (S)	General Oceanics 8050 *p*CO2	under-way system, foreward engine room	air-sea flux and ancillary information	1 / 3 minutes
dissolved CO2 in seawater	General Oceanics 8050 *p*CO2	under-way system, foreward engine room	air-sea flux and ancillary information	1 / 3 minutes
pH	General Oceanics 8050 *p*CO2	under-way system, foreward engine room	air-sea flux and ancillary information	1 / 3 minutes
dissolved O2 in seawater	General Oceanics 8050 *p*CO2	under-way system, foreward engine room	air-sea flux and ancillary information	1 / 3 minutes

4.3.1 *Underway pCO2 System*

A General Oceanics 8050 pCO_2 system was installed on the ship to measure dissolved CO_2 within the upper 7 m of the sea surface in near real time (Figure 2-1). The system is located in the engine room of the Amundsen, and draws sample water from the ship's clean water intake. The water is passed into a sealed container through a shower head, maintaining a constant headspace. This set up allows the air in the headspace to come into equilibrium with the CO_2 concentration of the seawater, and the air is then cycled from the container into an LI-7000 gas analyzer in a closed loop. A temperature probe is located in the equilibrator to provide the equilibration temperature. The system also passes subsample of the water stream through an Idronaut Ocean Seven CTD, which measures temperature, conductivity, pressure, dissolved oxygen, pH and redox, though water was not running through the CTD for a portion of the Leg due to insufficient water flow to equilibrator. All data is sent directly to a computer using software customized to the instrument. The LI-7000 gas analyzer is calibrated daily using ultra-high purity N_2 as a zero gas, and three gases of known CO_2 concentration as span gas. Spanning of the H_2O sensor is not necessary because a condenser removes H_2O from the air stream before passing into the sample cell.

Figure 4-1: General Oceanics 8050 pCO2 system

4.3.2 *Water Sampling*

Discrete samples for Dissolved Inorganic Carbon (DIC)/Total Alkalinity (TA), and O18 were taken from the rosette. DIC/TA samples were taken at standard depths following the protocol developed by Dickson et al (2007). Samples will be analyzed at the Institute of Ocean Sciences. O18 samples were taken at standard depths in 2 mL bottles and stored at 4°C. Samples will be analyzed at the University of Calgary. An intercalibration cast with the KEBABB team was performed at station D4 where depths bottom, 1000 m, 750 m, 500 m, 200 m, 150 m, 100 m, 80 m, 60 m, 50 m, 40 m, 20 m, 7 m, and surface were sampled.

Stations sampled at standard depths: 115, 111, 108, 105, 101, 325, 323, and 322.

Stations sampled at 7 m and surface: 116, 113, 110, 107, 103, 100, 324, and 300.

Standard sampling depths: Bottom, 600 m, 400 m, 250 m, 200 m, 150 m, 100 m, 70 m, 50 m, 30 m, 20 m, 7 m, Surface. 7 m samples were taken for comparison to underway data where seawater intake is at ~7 m. In a few instances, 450 m was taken in place of 400 meters where bottles were limited. Underway calibration samples were taken in duplicate twice over the Leg: 2023-08-30 and 2023-09-05.

4.4 Recommendations

During this Leg there were few issues with the underway system. Minor scratches were noted on small sections of the tubing to the licor, but after adding additional tape and tubing to cover potential friction points this did not get any worse or cause any leaks. There was a loss of ~15 hours of data due to a power outage caused when the power source to the underway system became unplugged during extremely rough seas. To prevent this from happening again, the power bar and its cordage was secured more tightly, however power status should be inspected during all future visits to the underway system, and inspection frequency should be increased during such rough weather. See ‘Underway Deployment Notes 2023’ for detailed explanation of system function during this Leg.

5 Optical measurements for ALG'O NORD / REFUGEARCTIC / RED-AO

Project leaders: Mathieu Ardyna (Mathieu.Ardyna@takuvik.ulaval.ca)

Cruise participants – Leg 3: Guillaume Barut[1], Guislain Becu[1], David Doxaran[2], Daniela Walch[3]

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[2]Laboratoire d'Océanographie de Villefranche, UMR7093 CNRS/SU, Villefranche-sur-Mer, France Aquatel, Université du Québec à Rimouski, Rimouski, QC, Canada

5.1 Introduction and Objectives

During Leg 3 of the 2023 Amundsen Science expedition, we deployed marine optical sensors to collect *in situ* data of radiometric parameters such as, e.g., multispectral irradiances and radiances, as well as inherent optical properties, such as, e.g., hyperspectral absorption and attenuation coefficients, along profiles ranging from surface to up to 150 m. From the radiometric quantities, apparent optical properties, such as the remote sensing reflectance, will be derived to validate satellite observations. The main goal of this project is to measure and relate the water optical and biogeochemical properties in the major arctic fjords located in the Eastern part of the Canadian Arctic, notably during the melting season, during which massive amounts of terrestrial matter ends up in the Arctic Ocean, for the calibration and validation of satellite ocean color algorithms.

5.2 Methodology

5.2.1 *In-water radiometry*

Apparent Optical Properties (AOP) were derived from radiometric measurements collected from September 09, 2023, till October 04, 2023, using the C-OPS set of radiometers ("Compact-Optical Profiling System") from Biospherical Instruments (San Diego, CA, USA). This instrument is composed of 3 main optical units measuring each a different optical parameter in 19 wavelengths, namely 380, 395, 412, 443, 465, 490, 510, 532, 555, 560, 589, 625, 665, 683, 694, 710, 765, 780 and 875 nm. The 3 optical parameters that have been measured are:

- The downwelling irradiance above the surface, denoted E_d0^+, hereafter referred to as the atmospheric reference,
- The downwelling irradiance at depth (z), denoted $E_d(z)$,
- The upwelling radiance at depth, denoted $L_u(z)$. Note that for several stations, the $L_u(z)$ radiometer was not working properly (its depth and temperature probes were corrupted), so that an upwelling irradiance radiometer ($E_u(z)$) was used instead.

While the atmospheric reference is fixed on a telescopic mast above the surface (and extended until the sensor is above the barge's highest point), both the $E_d(z)$ and the $L_u(z)$ (or $E_u(z)$) units are installed on a kite-shaped frame and deployed at sea, free falling in the water column, with an electro-mechanical cable that is operated manually. Usually, the frame is allowed to reach a depth at which 1 % of the surface light remains, after which the frame is recovered by pulling manually on the cable. Most of the time, 3 profiles are performed at each station.

A moving mask, the so-called shadow band, constituted by a 1-inch-wide metallic band automatically swiped from 0 deg. to 180° above the E_d0^+ sensor, was brought to the site to perform regular measurements of diffuse vs. direct atmospheric irradiance (which will be used for self-shadow correction estimation). A GPS receiver also logs the exact position and UTC time of each measurement.

The radiometric measurements are passive optical ones, i.e., they measure the natural light coming from the Sun and travelling through the atmosphere / ice layers / water column etc. They are therefore very sensitive to any optical pollution, and were performed from the barge, far away from the ship. Also, the frame is left drifting away from the barge (typically 30 m to 50 m) before the free fall begins, so that the barge's hull itself does not contaminate the measurements either. The Figure 3-1 below shows the C-OPS deployed from the barge.

Figure 5-1: Top: The C-OPS is being deployed from the barge. Bottom left: The GPS/shadow band/Ed0+ reference on the telescopic mast. Bottom right: The C-OPS after its recovery.

The code used to process the data was written by Bernard Gentili and updated by Simon Bélanger (https://github.com/belasi01/Cops), based on a recognized and published methodology (Smith and Baker, 1984) that is also used by the NASA for their spatial observations, vicarious calibration and validation activities (Mueller and Austin, 1992, revised in 1995, then updated by Austin in 2000, 2002 and 2003).

5.2.1 *Above-water radiometry*

Above-water spectro-radiometric measurements were carried out using an SVC (Spectra vista Corporation, NY, US) sensor from the ship, to perform matchups with satellite data acquisitions. The SVC was used on stations 134, GF (Grise Fjord), NB01, NB02 as well as on 2 opportunistic stations in Jones Sound (called JS01 and JS02), for which the ship was still sailing during the data acquisition. The downwelling irradiance signal (E_d) was estimated based on downwelling radiance (L_d) measurements when pointing the sensor towards a Spectralon plate hold horizontally and facing up; the (water) upwelling radiance (L_u) and sky radiance (L_s) were measured pointing the sensor with a 40° zenith angle with the nadir/zenith, respectively, both with a 90° azimuth angle compared to the Sun, to minimize sea surface reflection effects (Figure 3-2A). The resulting remote sensing reflectance spectra (R_{rs}) were determined following Mobley (1999) as: $R_{rs} = (L_u - 0.02 * L_s)/E_d$ (Figure 5-2B).

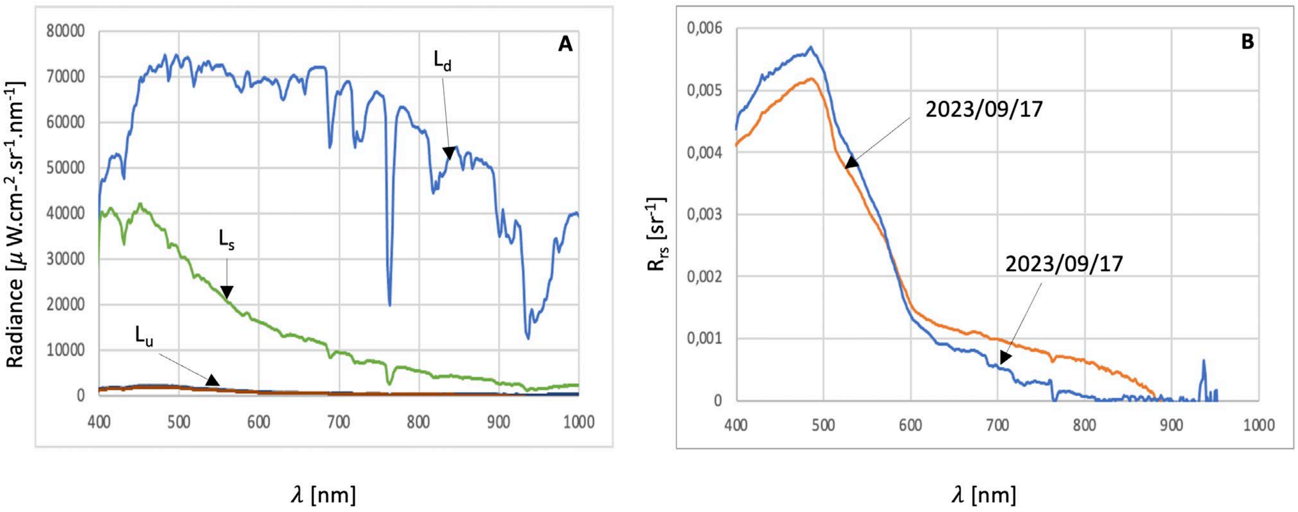

Figure 5-2: (A) Examples of SVC measurements from the *CCGS Amundsen*. The downwelling (Ld), upwelling (Lu) and sky (Ls) radiances are measured from the front of the ship following strict viewing geometries. (B) The resulting remote sensing reflectance (Rrs) spectra will be used for matchups with multi-sensor satellite products.

1.2.3 Optical frame (inherent optical properties)

Inherent Optical Properties (IOP) measurements have been collected at the same stations than the C-OPS ones, using an optical package called an "IOP frame", from Seabird Scientific, Inc. (Philomath, OR, USA). This unit is composed of a data logger onto which a set of optical instruments are connected. The data logger provides power to the instruments and synchronizes their data streams. The whole system is lowered in the water column with an electro-mechanical cable. These optical sensors are active, i.e., they emit a light signal and record the response of the medium. Their measurement ranges are very short (few cm maximum), so that they are not sensitive to any optical pollution; the frame can be lowered close to the ship. Nevertheless, the barge is still the best infrastructure to deploy the IOP frame, as it is barely not mixing the top of the water column. The goal of this cruise being to characterize the fjords /glacier plumes, which usually lie at the top of the water column, the barge use was crucial for the operations (in Croker Bay, the surface layer was only a few cm thick!). In addition to data recorded by the CTD sensor, the following parameters have been collected between the surface and a depth of up to 167 m:

- Absorption and attenuation coefficients between 400 nm and 740 nm, every 3 nm approximately,
- Backscattering coefficients at 13 wavelengths, namely 412, 440, 488, 510, 532, 595, 650, 676, 700, 715, 720, 770 and 870 nm,
- Fluorescence of Chlorophyll-a,
- Fluorescence of CDOM (Coloured Dissolved Organic Matter).

The Figure 3-3 below shows the IOP frame deployed from the barge.

Figure 5-3: Top left: The IOP frame is lying flat on the barge deck, next to the winch. Bottom left: The IOP frame is lowered at sea using the drill-operated winch and the port side davit. Right: The IOP frame is warming-up/flushing its tubing system just under the sea surface (after an initial descent for de-bubbling).

Briefly, the absorption and attenuation coefficients measured with the AC-S will be corrected for temperature and salinity following Rottgers et al (2014) using the temperature and salinity data from the CTD. The absorption will also be corrected from the so-called residual scattering correction following Zaneveld et al (1994). Backscattering (bb) coefficient from the Hydroscat-2 and the ECO-PUCK will be processed following Maffione and Dana (1997) and Wetlabs protocols. The light attenuation correction for bb will be performed following the method described in Doxaran et al (2016) using the corrected absorption coefficient from the AC-S. Particle backscattering (bbp) will be calculated by removing the pure water contribution calculated using the method of Zhang et al. (2009).

The Table 3-1 below details the stations sampled.

Table 5-1: Marine optics stations

date (UTC)	time (UTC)	station	substation	latitude	longitude	operation	number of casts	surf. water sampling
2023-09-09	14:22	AC14	NA	75.490	-78.860	C-OPS (Lu)	3	NA
2023-09-09	16:35	AC14	NA	75.490	-78.860	IOP	1	TRUE
2023-09-13	16:55	AC2	AC21	81.490	-66.280	IOP	1	TRUE
2023-09-13	17:27	AC2	AC21	81.490	-66.280	C-OPS (Lu)	1	NA
2023-09-13	18:06	AC2	AC22	81.500	-66.040	C-OPS (Lu)	2	NA
2023-09-13	18:30	AC2	AC22	81.500	-66.040	IOP	1	TRUE
2023-09-13	19:00	AC2	AC23	81.520	-65.870	IOP	3	TRUE
2023-09-13	19:20	AC2	AC23	81.520	-65.870	C-OPS (Lu)	3	NA
2023-09-14	19:40	AA00	NA	82.010	-61.590	IOP	1	TRUE
2023-09-14	20:00	AA00	NA	82.010	-61.590	C-OPS (NA)	0	NA
2023-09-15	17:25	AC4	NA	81.380	-64.300	IOP	1	TRUE
2023-09-15	18:23	AC4	NA	81.380	-64.300	C-OPS (Eu)	3	NA
2023-09-16	16:30	AC18	NA	80.320	-69.810	IOP	1	TRUE
2023-09-16	17:10	AC18	NA	80.320	-69.810	C-OPS (Eu)	4	NA
2023-09-17	17:52	134	NA	80.044	-68.188	SVC	3	NA
2023-09-17	19:00	134	NA	80.020	-68.680	C-OPS (Eu)	5	NA
2023-09-17	19:50	134	NA	80.020	-68.680	IOP	1	TRUE
2023-09-18	12:25	133	NA	79.610	-70.200	IOP	1	TRUE
2023-09-18	12:42	133	NA	79.610	-70.200	C-OPS (Eu)	3	NA
2023-09-19	16:43	N23W	NA	78.320	-74.850	IOP	2	TRUE
2023-09-19	17:34	N23W	NA	78.320	-74.850	C-OPS (Eu)	3	NA
2023-09-20	15:35	N23E	NA	78.300	-73.680	IOP	1	TRUE
2023-09-20	15:57	N23E	NA	78.300	-73.680	C-OPS (Eu)	3	TRUE
2023-09-22	19:26	AC12	NA	77.240	-79.030	IOP	1	TRUE
2023-09-22	19:46	AC12	NA	77.240	-79.030	C-OPS (Eu)	1	NA
2023-09-23	16:40	AC13	NA	76.390	-78.590	IOP	1	TRUE
2023-09-23	16:59	AC13	NA	76.390	-78.590	C-OPS (Eu/Lu)	4	NA
2023-09-24	17:39	site1point2	NA	76.570	-78.640	IOP	1	TRUE
2023-09-24	18:05	site1point2	NA	76.570	-78.640	C-OPS (Lu)	4	NA
2023-09-24	19:08	site1point2	NA	76.584	-78.609	IOP	1	FALSE
2023-09-25	18:20	BG01	NA	75.670	-81.350	IOP	1	TRUE
2023-09-25	19:10	BG01	NA	75.670	-81.350	C-OPS (Lu)	3	NA
2023-09-27	16:00	GF1	NA	82.599	-76.240	SVC	3	NA
2023-09-27	17:12	GF1	NA	83.137	-76.361	SVC	4	NA
2023-09-28	12:25	SG01	NA	75.740	-83.250	IOP	1	TRUE
2023-09-28	12:48	SG01	NA	75.740	-83.250	C-OPS (Lu)	1	NA
2023-09-28	17:25	JS01	NA	75.975	-85.790	SVC	3	NA
2023-09-28	20:30	JS02	NA	75.976	-86.406	SVC	9	NA
2023-09-29	16:37	NB01	NA	76.820	-91.250	IOP	1	TRUE
2023-09-29	17:18	NB01	NA	76.820	-91.250	COPS (Lu)	3	NA
2023-09-29	17:18	NB01	NA	76.820	-91.250	SVC	3	NA
2023-09-30	16:25	NB02	NA	76.910	-98.390	IOP	1	TRUE
2023-09-30	17:20	NB02	NA	76.910	-98.390	C-OPS (Eu)	3	NA

2023-09-30	17:20	NB02	NA	76.910	-98.390	SVC	3	NA
2023-10-02	15:55	CB01	NA	74.890	-83.630	IOP	1	TRUE
2023-10-02	16:36	CB01	NA	74.890	-83.630	C-OPS (Eu)	3	NA

Few issues occurred during the first stations, the main one being the cold affecting the AC-S sensor. The adopted solution was to keep the sensor as long as possible at room temperature (the AC-S is uninstalled at the end of each sampling day, for a lab-based pure water calibration), and to bring it at the last minute into the barge, and to begin with the IOP frame deployment. In rare cases, that was not sufficient, and the IOP frame acquisition was stopped and restarted as long as the AC-S showed corrupted spectra. Indeed, data acquisition warms up the electronics, which usually fixed the problem (it is longer though, and more uncertain). Another issue, mentioned earlier, was with the $L_u(z)$ radiometer, onto which the depth and temperature channels stopped working. The depth channel being essential for the data processing, the sensor has been replaced by the $E_u(z)$ radiometer while the $L_u(z)$ sensor was fixed (with the help of the manufacturer). The $E_u(z)$ radiometer was used for the stations AC4, AC18, 134, 133, N23W, N23E, AC12, part of AC13, CB01, NB02. The $L_u(z)$ was used elsewhere (including on AC13 where it was tested after repairs and before it failed again on station NB01).

5.3 Preliminary Results

Most of the stations were characterized by very clear waters. Both the AOP and IOP showed blue waters with high transparency. Only at the Belcher Glacier, at the site 1.2 glacier and especially at the Croker Bay (Northernmost) glacier, the data showed one or several layer(s) of turbid to very turbid water (not fluorescent, so more likely a sediment/mineral particle layer). The figure 4 shows on the left the preliminary remote sensing reflectance spectrum at the station 133. The values are very low, indicating very clear waters at the surface. The Figure 3-4 in the center shows preliminary spectra of absorption (a) and attenuation (c) at all depths. The values do not exceed 0.3 m^{-1} (not considering the noise), which is also very low (even at depth). Finally, the Figure 3-4 shows on the right side the profiles of 9 wavelengths of backscattering coefficients, as measured with the BB9 ECO-PUCK. Again, the values show very weak signal, indicating a very low particle load within the water column. The maximum chlorophyll-a concentration (not shown here) was of 0.5 mg.L^{-1}, towards 30 m depth, indicating a very low content in algae.

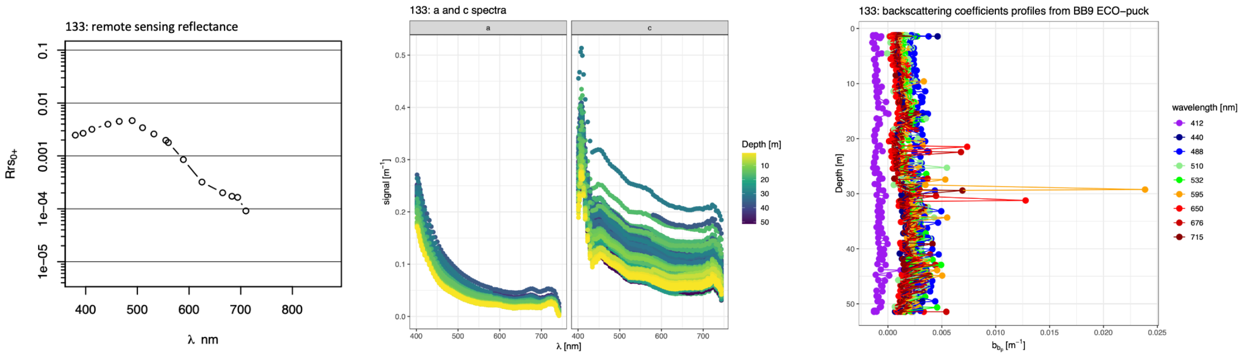

Figure 5-4: Left: Remote sensing reflectance at station 133. Center: profiles of a and c coefficients at all depth. Right: profile of backscattering coefficients at 9 wavelengths.

The Figure 3-5 below shows the same graphs, but with the data acquired in front of the glacier of the so-called site 1.2. While the remote sensing reflectance (left) shows similar values and spectral shape (with slightly higher values), indicating very clear surface waters again, the a and c coefficients (center), as well as the backscattering coefficients (right) towards 50 m depth show much higher values, indicating large particle loads. The chlorophyll-a maximum concentration (not shown here) of 0.3 mg.L^{-1} towards 5 - 10 m depth indicates that there is barely any algae along the water column, especially not at 50 m depth; the high signals at that depth are therefore likely due to a higher suspended sediment concentration. A sub-glacier current might be responsible for either a sediment re-suspension, or a deep glacier plume.

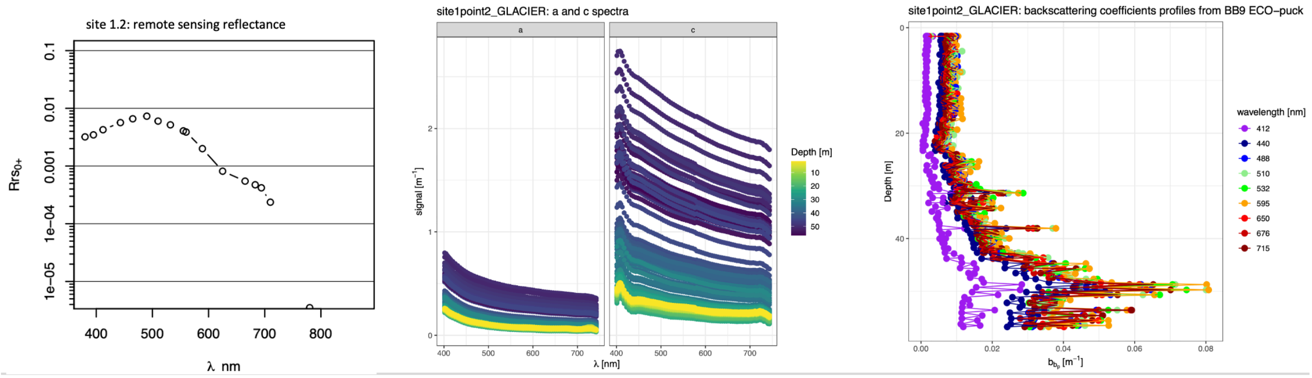

Figure 5-5: Left: Remote sensing reflectance at site 1.2. Center: profiles of a and c coefficients at all depth. Right: profile of backscattering coefficients at 9 wavelengths.

The only station where a plume could be sampled is the Croker Bay one (CB01, which is the last sampled one actually). The plume is a very thin surface layer (few cm thick only), but other turbid layers were also identified deeper in the water column.

The Figure 3-6 below shows the variability in surface absorption/attenuation values, as well as in the remote sensing reflectance for all the stations. The Croker Bay one is very peculiar with much higher values (note that as the instrument that measures the attenuation is saturating towards the shorter wavelengths for the station CB01, and as the attenuation is used to estimate an absorption correction, the absorption spectra is showing an unexpected shape in the shorter wavelengths; this will be addressed later). The Figure 3-7 shows a profile of selected wavelengths of absorption and attenuation coefficients. The turbid deep layers are clearly visible towards 15 and 22 m.

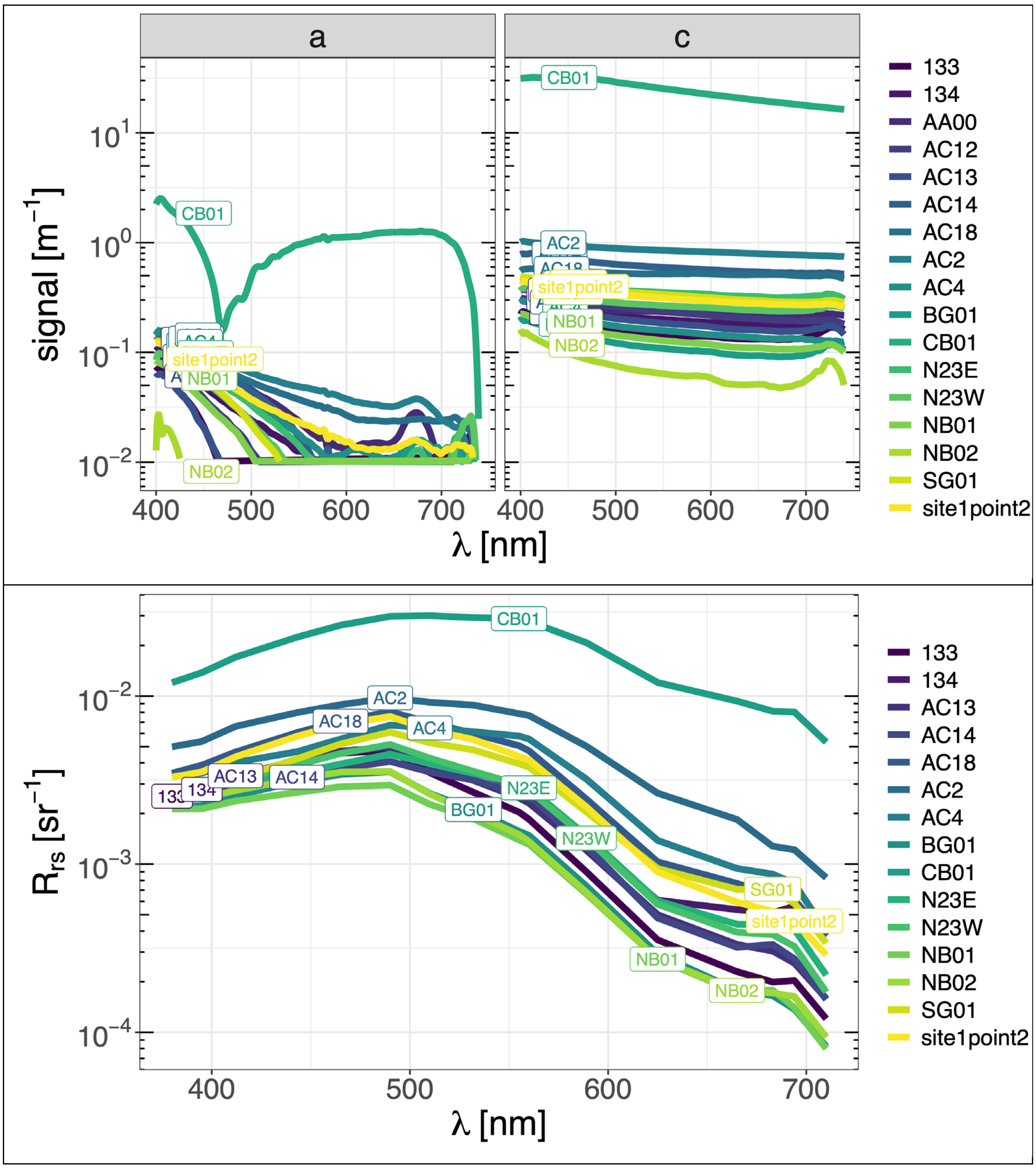

Figure 5-6: Top: absorption and attenuation spectra for all the sampled stations. Bottom: Remote sensing reflectance spectra for all the stations. Again, the Croker Bay station shows much higher values and a peak shifted towards higher wavelengths, compared to all other station.

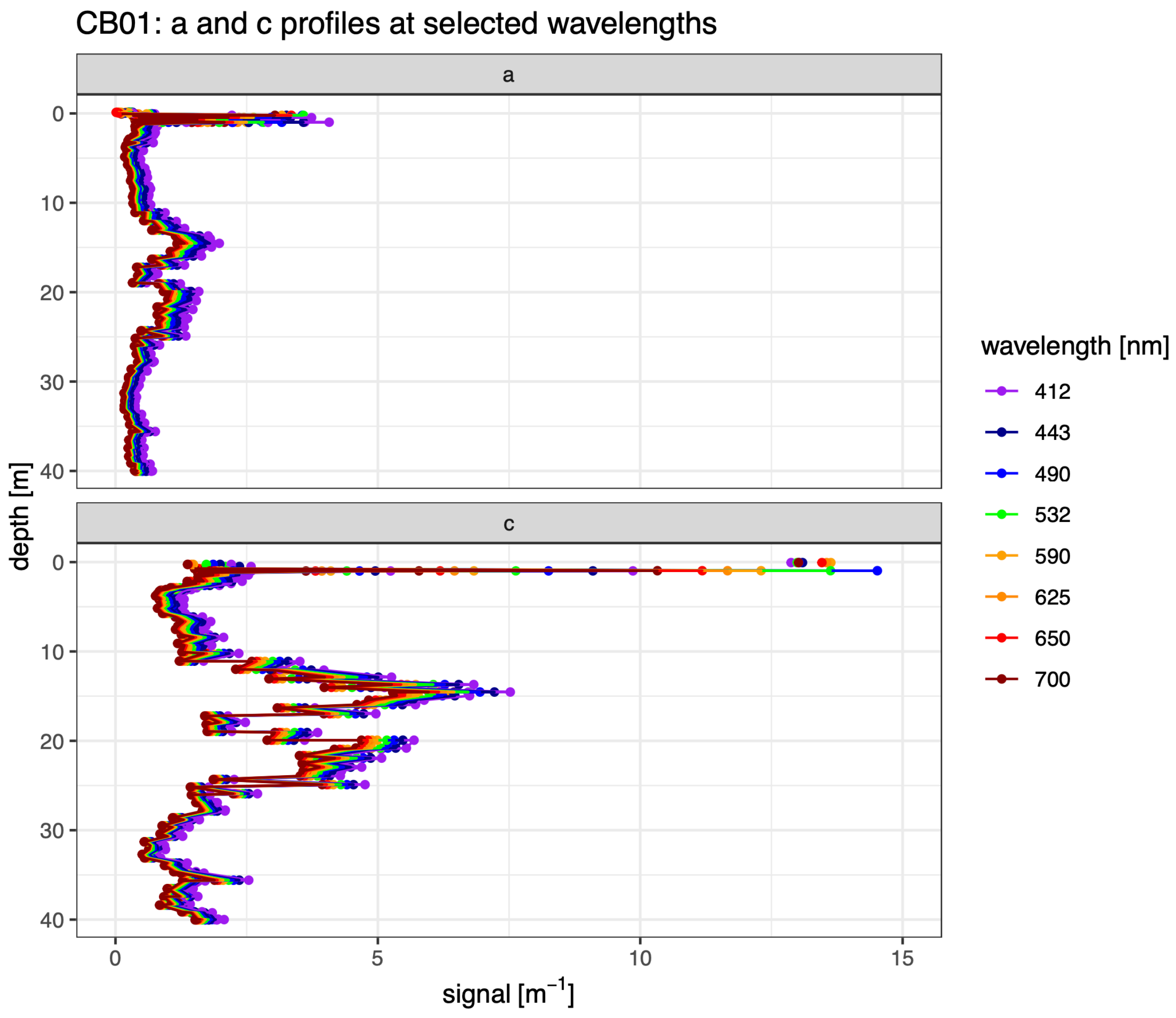

Figure 5-7: Absorption and attenuation profiles for 8 selected wavelengths. 2 deeper layers are clearly visible towards 15 and 22 m, where attenuation values reach up to 6 or 7 m-1.

5.4 Recommendations

The most important recommendation for the next year part of the project would be to anticipate a major use of the barge. Sampling the most upper part of the water column requires an as less invasive structure as possible, the barge being the most adequate one, with her very low draught and yet many deck gears (davit, front lowering gate, power supply availability, high maneuverability, etc.). Also, working in the fjord usually gives the advantage of wind-sheltered area, thus minimizing the risk of weather downtime. Also, sampling the fjords earlier (July or August) would increase the chances to sample turbid plumes from glaciers.

The other main recommendation is about the cold temperature. Not only the AC-S has to be kept as warm as possible, but also, great care was given at the rinsing and drying of optical windows, to prevent the building of ice drops or crystals, which might lower quite drastically and non-obviously the data quality.

The scatterometer lab is ideal for the routine maintenance and pure water calibration of the marine optics sensors. It should be requested whenever marine optics instruments are deployed from the barge.

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6 Marine productivity: Carbon and nutrients fluxes

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6.1 Introduction and Objectives

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

6.2 Methodology

Samples for inorganic nutrients (ammonium, nitrite, nitrate, orthophosphate and orthosilicic acid) were taken at all stations to establish detailed vertical profiles. Samples were stored at 4°C in the dark and analyzed for nitrate, nitrite, orthophosphate and orthosilicic acid within a few hours on a Bran+Luebbe AutoAnalyzer 3 using standard colorimetric methods adapted for the analyzer (Grasshoff et al. 1999). Additional samples for ammonium determination were taken and processed immediately after collection using the fluorometric method of Holmes et al. (1999). In order to examine the potential effects of environmental conditions on energy transfer through food chain, we also realized at targeted stations, filtrations with surface and SCM water to analyse for POC/PN, DON, POP, BSi, isotopic natural abundance of particulate matter, taxonomy and isotopes of nitrate.

6.3 Preliminary Results

No preliminary results available yet.

6.4 Recommendations

- There were discrepancies between our database and Amundsen Science's for the name and locations of some stations (Hudson Strait) and also for the station type (CTD vs NUTS). The chief scientist and I lost an hour trying to figure things out. Our database metadata will be shared for inter-comparison.
- It would be useful to inform people who are sampling the rosette (especially people that are sampling first) to bring vinyl gloves. The other types of gloves contaminate for nutrients.

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7 Understanding Dissolved Organic matter (DOM) by analyticals methods in the Arctic ocean

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7.1 Introduction and Objectives:

The oceanic carbon storage is massive, substantially greater than the atmosphere and terrestrial analogues. As a result, this makes ocean one of the largest carbon sinks with enormous potential for climate change mitigation. Oceanic carbon cycling encompasses a diverse set of physio-chemical and biological processes that contribute to carbon sequestration. These processes are understood through solubility/physical pump, carbonate pump, biological carbon pump (BCP) and Microbial carbon pump (MCP). The pumps aid in the transport of atmospheric Carbon dioxide (CO_2) into the ocean interiors. Cumulatively, these pumps transfer inorganic as well as organic carbon thereby maintaining the surface to deep oceanic vertical carbon gradient. BCP is a major oceanic sink for CO2 of 2 Pg C year -1, which approximately accounts to one-fifth of current anthropogenic emissions (Le Quéré et al. 2009). BCP operates in a cumulative manner, commencing with the formation of organic matter (OM) and biominerals by phytoplankton, progressing through physio chemical as well as biological transformation, and leading to the conversion of allochthonous or autochthonous derived organic matter of various forms (Passow and Carlson 2012). Carbon in the form of organic matter is transported from surface to the interior ocean ultimately leading to storage of organic carbon for longer timescales. In MCP, microorganisms transform the organic matter into more stable forms that are less prone to further decomposition and thereby also changing the chemical composition of organic matter. Organic Matter (OM) acts as a fuel in functioning of the BCP as well as MCP. OM in marine systems is often distinguished by its filtration behaviour, with material retained on a filter (pore size between 0.2 and 0.7 μm) referred to as particulate organic matter (POM), and OM that passes the filter referred to as dissolved organic matter (DOM).

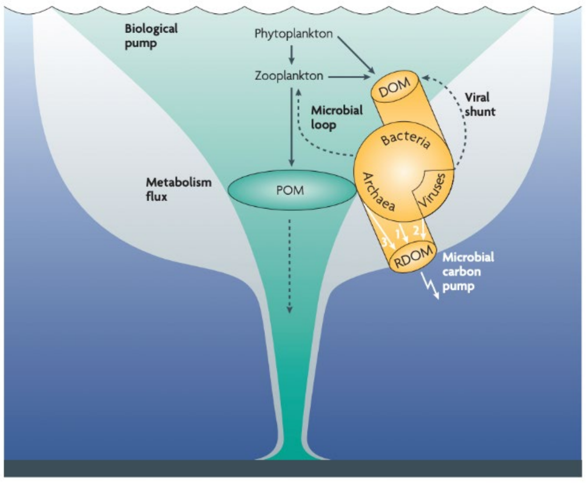

Figure 7-1: Major pathways in Microbial carbon pump (Jiao et al. 2010)

Optical properties such as absorbance and fluorescence have been extensively utilized to identify and trace various fractions of DOM namely, colored dissolved organic matter (CDOM) and fluorescent dissolved organic matter (FDOM). CDOM usually passes through pore filter (usually 0.2–0.4 µm) and absorbs light in ultraviolet and visible range of electromagnetic radiation (280-700 nm) (Nelson and Siegel 2013). Chromophores (i.e., aromatic amino acids, lignin, phenols and humic-like substances) are operationally characterized by their strong optical signatures (Coble 1996). Additionally, a fraction of CDOM that also emit fluorescence when excited by photons of sufficient energy is called fluorescent DOM (FDOM). Fluorophores (aromatic groups or conjugated planar or cyclic molecules) are organic chemical compounds that absorb light (chromophores) and then emit it again. Several different types of FDOM are associated with different sources and environmental conditions and can provide valuable information about the biogeochemical processes occurring in aquatic systems.

Our goal for Leg 4 of the Amundsen science expedition is to characterize dissolved organic matter (DOM) in the Arctic Ocean using diverse analytical techniques such as spectrophotometry and mass spectrometry. Building upon our analyses from the North Atlantic Ocean, we aim to compare the variations between these two oceans in terms of primary productivity, shedding light on their unique characteristics and ecological differences.

7.2 Methodology

During Leg 4 of the 2023 Amundsen Science expedition, we collected water samples from various depths using a rosette sampler. CDOM and FDOM samples were filtered through Whatman polycap filters attached to Niskin bottles and stored in 40mL amber glass vials, which were promptly refrigerated. In the case of dissolved organic carbon (DOC) samples, filtration occurred first, followed by acidification (using 100 micromols of 4M HCl) at a later stage. These DOC samples were also refrigerated immediately. Specific details regarding the depths from which the samples were collected are provided in table Table 5-1.

Table 7-1: Specific details regarding the depths from which the samples were collected

Stations	Latitude (N)	Longitude (W)	Depth(db)
322	70.39904	91.08406	Surface, 20, 50, 100, 160, 200
SPR-003	68.96775	86.68363	Surface, 20, 50,100,160,172
330	69.31964	80.55327	Surface, 20, 50
332	69.18247	80.99845	Surface, 20, 50
FoxSIPP-01	68.25243	80.90458	Surface, 20, 50
FoxSIPP-02	67.34230	80.82745	Surface, 20, 50, 84
FoxSIPP-04	66.45499	80.87330	Surface, 20, 50, 93
FoxSIPP-05	65.61043	81.14901	Surface, 20, 50,100,140,155
350	64.50032	80.50133	Surface, 20, 50,160, 200, 300, 370
FoxSIPP-07	64.36300	81.47215	Surface, 20, 50,100
FoxSIPP-06	64.72742	81.38657	Surface, 20, 50,100,160, 200, 253
FoxSIPP-08	66.00641	83.15105	Surface, 20, 50,100,150, 200, 299
15E	64.03204	79.21638	Surface, 20, 50,100,150, 200, 300

15D	64.12175	78.86445	Surface, 20, 50,100,160, 200, 231
15A	64.32658	78.07642	7, 20, 50,100
14F	62.22046	72.24629	Surface, 20, 50,100,160, 200
14D	62.35600	71.65623	Surface, 20, 50,100,160, 200, 300
14B	62.48652	71.03642	Surface, 20, 50,100,160, 200,
HS22-007	62.61086	69.90301	Surface, 20,50,100
HS22-013	61.27602	68.34668	Surface, 20,50,100
352	61.25978	64.81870	Surface, 20, 50,100
353	61.15578	64.7964	Surface, 20,50,100
354	61.00226	64.72265	Surface, 20, 50, 100, 160, 200, 300, 400, 500
640	58.99911	61.90451	Surface, 20, 50,100,130

7.2.1 *Solid phase extraction (SPE)*

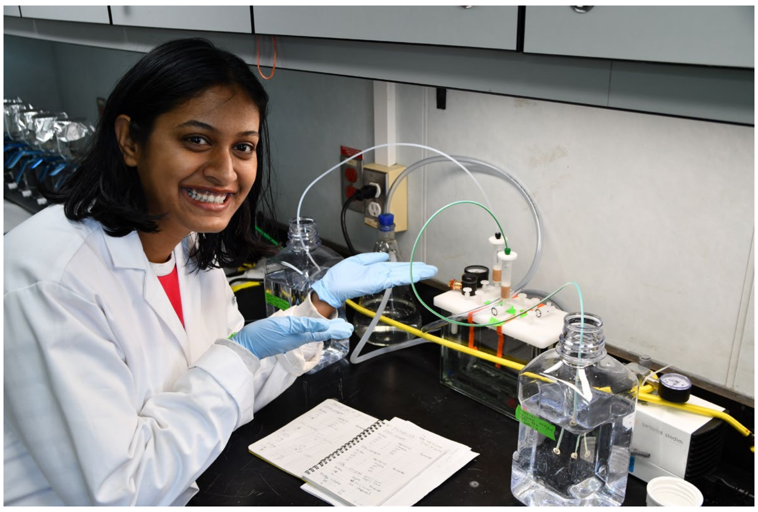

Figure 7-2: Solid phase extraction (SPE)

Onboard, we conducted Solid Phase Extraction (SPE) as part of our research activities Figure 5-2 . The SPE resins were sterilized beforehand by-passing pH 2 water through them prior to the cruise. We collected 2 liters of samples from the subsurface chlorophyll maxima (SCM) and bottom depths. These samples were then passed through the SPE resins at the required flow rate of 10-12 mL/minute. Following the sample processing, the SPE resins were carefully packed in ashed foils and frozen to -20 ^{o}Celsius for further analysis. Detailed information about the samples, along with the corresponding stations, is provided in Table 5-2.

Table 7-2: Detailed information about the samples, along with the corresponding stations

Stations	**Latitude (N)**	**Longitude (W)**	**Depth(db)**
SPR-003	68.96775	86.68363	SCM (40), 172
332	69.18247	80.99845	SCM (30),60
FoxSIPP-04	66.45499	80.87330	SCM (30),93
350	64.50032	80.50133	SCM (26), 370
14D	62.35600	71.65623	SCM (10), 200

The SPE resins will undergo further analysis in the laboratory. They will be extracted using methanol and subsequently analyzed using a mass spectrometer. This analytical approach will provide valuable insights into the molecular weights of the complex organic compounds present in the dissolved organic matter (DOM), enhancing our understanding of the composition of these substances.

7.2.2 *Biodegradation*

We are also keen on understanding the microbial processing of dissolved organic matter over a specific time period. This investigation will provide valuable insights into the overall efficiency of MCP. To meet this objective, we collected unfiltered seawater samples in 500mL Nalgene bottles from various depths using the Rosette sampler. These samples were not acidified. On reaching back to the lab each of the samples will be filtered in different time series and anayzed for CDOM and FDOM.

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8 Inorganic carbon dynamics in the Canadian Arctic

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8.1 Introduction and Objectives

The Canadian Arctic is changing rapidly due to climate change. Shrinking sea ice cover, increasing freshwater inputs, and warming sea surface temperatures are all having an impact on the marine carbon cycle. During Leg 3 of the 2023 Amundsen Science expedition, I managed an underway system in the ship's engine room (General Oceanics model 8050), which collects a measurement of the partial pressure of CO_2 (pCO_2) in the surface seawater approximately every 2 minutes along the ship track. While this system is automated, it does require daily checks to ensure all systems are functioning normally. Maintenance includes cleaning the filter, cleaning the CTD, completing daily maintenance logs and closely monitoring the system during turbulent weather, icy conditions, and shallow seas. In addition to underway measurements, we sampled from the rosette at the five historical ArcticNET stations during this Leg as well as a few opportunistic stations. Samples for DIC/TA were also collected from the underway system for comparison and calibration purposes.

During Leg 4, sampling took place in Foxe Bassin, which is one of the least studied coastal regions in Canada, with only a handful of dedicated oceanographic research programs haven taken place. The Foxe Basin Sea Ice Pump Project (FoxSIPP) is a multi-disciplinary and multi-objective project intending to fill knowledge gaps regarding our understanding of oceanographic processes in the Foxe Basin. Primary goals for FoxSIPP are to: (1) determine the magnitude of air-sea exchange in Foxe Basin and the role of polynyas in driving carbon uptake and deep water storage; (2) install a mooring in Foxe Channel to observe water properties over an annual cycle and identify processes associated with deep water formation; (3) use field observations to evaluate and constrain a numerical model of the Foxe Basin-Hudson Bay complex, and; (4) conduct a general oceanographic survey of the Foxe Basin. Some of these objectives were addressed by the biogeochemistry team in Leg 4 of the *CCGS Amundsen* cruise by collecting water samples of parameters of interest in the Foxe Basin, deploying a biogeochemistry mooring in Foxe Channel, and by maintaining an underway pCO_2 analyzer that continuously measures the partial pressure of CO2 (pCO2) in the surface seawater. River input into Foxe Basin represents a previously uncharacterized source of terrestrial carbon and nutrients to the region and a potentially important seasonal contribution to oceanographic greenhouse gas budget calculations. During this year's FoxSIPP program, we endeavoured to collect river water end members of dissolved inorganic (DIC, TA) and organic (DOC, CDOM) carbon, stable isotopes (del13C-DIC, del18O-H2O, del2H-H2O), nutrients (N,P,Si), major + minor ions (Ca, Mg, Na, K, Cl, SO4, Sr, Ba), and salinity to determine terrestrial influence on the marine system and add context to ship-based observations. Opportunistic bulk water and sediments were also collected for various other groups on board (Table 6-3).

8.2 Methodology

Please see table below for the full list of sample locations and data acquired.

8.2.1 *Rosette Water sampling*

A rosette was used to collect water samples from various depths at each station. For collection of DIC/TA the standard protocol for dissolved gases outlined by Dickson et al (2007) was followed. Salinity was collected in Amundsen salinity bottles and processed on the Salinometer (AutoSal, GCS18226) on board the ship. Stable water isotopes were collected following the LGR/ABB recommendation of running samples through a 0.45μm filter. Samples were collected in 2 mL vials and stored at 4°C until analysis. DIC/TA will be processed at the Institute of Ocean Sciences (IOS) in Sidney, BC under the supervision of Dr. Lisa Miller and δ18O will be run at the University of Calgary under the supervision of Dr. Brent Else.

Details on sampling stations and analytes collected is outlined in Table 6-1. During Leg 4, δ18O samples were collected at 53 stations at all standard depths (surface, 7m, 10m, 20m, 30m, 50m, 70m, 100m, 140m, 200m, 250m, 300m, 400m and bottom). At 29 stations DIC/TA was sampled at all standard depth (denotated as full depth in Table 6-1), while at 19 station DIC/TA was only sampled at the surface and 7m depth. Every time a DIC/TA sample was collected, an associated salinity sample was also taken at the same depths. DIC/TA and salinity samples were taken in duplicate at approximately 10% of all samples taken.

An intercalibration exercise was conducted at station HS22-011. Labs participating in the intercalibration were those of Lisa Miller (DFO-IOS), Brent Else (UCalgary), Dave Capelle (DFO-FWI), Kumiko Azetsu-Scott (DFO-BIO). Standard depths were used for the intercalibration. Each lab also collected a duplicate sample at a different standard depth for each lab.

In addition to the above sample collection, 73 replicates of DIC/TA were collected at station 350 to be used as an internal secondary standard at DFO-FWI at 370 m depth, the same as the mooring depth at that station. No more than 8 samples were collected from any Niskin at the rosette to minimize contamination by atmospheric air.

A total of 157 dissolved organic carbon (DOC) samples were also collected during Leg 4 of the FoxSIPP cruise. A 20 mL syringe was rinsed 3x with sample water, then rinsing a pre-combusted 0.25 μm filter with 20 mL of water. The sample was then collected in an acid-washed and baked vial, and preserved with 100 μL of 2 N HCl and stored at 4°C until analysis. A full list of stations is presented in Table 8-2, and standard sampling depths are surface, 20m, 40m, 60m, 80m, 100m, 150 (or bottom if station is < 150 m and next deepest sample is > 10 m away)/ replaced with 160 m where 150 wasn't collected and SCM (*only if >3 m away from next closest standard depth).

8.2.2 *Underway pCO$_2$*

The underway system is set to collect pCO2 and temperature data every 2 minutes. All raw data was downloaded for post-processing off of the ship. Water samples for DIC from the underway inlet were collected approximately once per week in triplicate for comparison and calibration purposes. They will also be run at the Institute of Ocean Sciences.

Table 8-1: Station data and sample acquisition for legs 3 and 4

Leg	Station	Date	Latitude (N)	Longitude (W)	Data Collected	Notes
3	LSEA-23	2023/09/14	82 3.839	61 28.856	DIC/TA, δ18O, Salinity	ArcticNET station
	STN 134	2023/09/17	80 2.309	68 37.091	DIC/TA, δ18O, Salinity	ArcticNET station
	STN 133	2023/09/18	79 36.428	70 22.217	DIC/TA, δ18O, Salinity	ArcticNET station
	STN 129	2023/09/19	78 18.349	73 48.570	DIC/TA, δ18O, Salinity	ArcticNET station
	STN 122	2023/09/21	77 20.171	74 36.516	DIC/TA, δ18O, Salinity	ArcticNET station
4	CEOS-M1-23	2023/09/21	77 10.795	71 52.80	δ18O	Opportunistic Station
	Site 1.2	2023/09/24	76 35.263	78 39.242	δ18O	Opportunistic Station
	BG-01	2023/09/25	75 39.478	81 19.547	δ18O	Opportunistic Station
	Jones-S-23	2023/09/28	75 59.479	86 29.677	δ18O	Opportunistic Station
	321-GB	10/6/2023	70 20.975	91 34.630	δ18O	
	322-GB	10/7/2023	70 24.043	91 5.441	DIC/TA, δ18O, Salinity	Full depth
	324-GB	10/7/2023	70 29.971	90 8.378	DIC/TA, δ18O, Salinity	Surface depth
	326-GB	10/7/2023	70 36.116	89 13.520	DIC/TA, δ18O, Salinity	Surface depth
	SPR-005	10/8/2023	69 8.854	85 39.766	DIC/TA, δ18O, Salinity	Surface depth
	SPR-004	10/8/2023	69 3.130	86 12.720	DIC/TA, δ18O, Salinity	Full depth
	SPR-001	10/8/2023	68 49.201	87 46.094	DIC/TA, δ18O, Salinity	Surface depth
	FH20-001	10/9/2023	69 41.002	82 23.357	DIC/TA, δ18O, Salinity	Full depth
	330	10/9/2023	69 19.192	80 33.233	DIC/TA, δ18O, Salinity	Full depth
	332	10/9/2023	69 10.948	81 0.049	DIC/TA, δ18O, Salinity	Full depth
	333	10/10/2023	68 46.081	81 0.563	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-01	10/10/2023	68 15.148	80 54.280	DIC/TA, δ18O, Salinity	Full depth
	334	10/10/2023	67 52.572	80 47.975	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-02	10/10/2023	67 20.497	80 49.610	DIC/TA, δ18O, Salinity	Surface depth
	FoxSIPP-03	10/11/2023	66 54.458	80 49.927	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-04	10/11/2023	66 27.275	80 42.466	DIC/TA, δ18O, Salinity	Surface depth
	338	10/11/2023	66 10.267	81 19.340	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-05	10/11/2023	65 36.578	81 8.984	DIC/TA, δ18O, Salinity	Full depth

	350	10/12/2023	64 30.079	80 30.144	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-07	10/13/2023	64 21.804	81 28.309	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-06	10/13/2023	64 43.610	81 23.167	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-08	10/13/2023	66 0.401	83 8.964	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-09	10/14/2023	65 31.577	82 34.484	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-M	10/14/2023	65 8.088	81 20.048	DIC/TA, δ18O, Salinity	Full depth
	FoxSIPP-10	10/14/2023	64 47.488	80 42.266	DIC/TA, δ18O, Salinity	Full depth
	350	10/14/2023	64 29.867	80 29.676	DIC/TA, δ18O, Salinity	At mooring depth only
	FoxSIPP-11	10/15/2023	64 15.653	79 47.392	DIC/TA, δ18O, Salinity	Full depth
	349	10/15/2023	64 41.290	78 35.442	DIC/TA, δ18O, Salinity	Full depth
	15H	10/15/2023	63 49.008	79 59.384	DIC/TA, δ18O, Salinity	Full depth
	15F	10/15/2023	63 56.567	79 34.306	DIC/TA, δ18O, Salinity	Surface depth
	15E	10/15/2023	64 1.960	79 13.022	DIC/TA, δ18O, Salinity	Surface depth
	15D	10/16/2023	64 7.260	78 51.760	DIC/TA, δ18O, Salinity	Surface depth
	15C	10/16/2023	64 12.823	78 31.151	DIC/TA, δ18O, Salinity	Surface depth
	15A	10/16/2023	64 19.684	78 4.657	DIC/TA, δ18O, Salinity	Full depth
	HS22-001	10/16/2023	64 11.795	75 36.937	DIC/TA, δ18O, Salinity	Full depth
	HS22-003	10/16/2023	63 51.166	75 6.353	DIC/TA, δ18O, Salinity	Full depth
	HS22-005	10/17/2023	63 24.781	74 44.749	DIC/TA, δ18O, Salinity	Surface depth
	HS22-006	10/17/2023	63 2.670	74 18.223	DIC/TA, δ18O, Salinity	Surface depth
	14E	10/18/2023	62 16.441	71 59.069	DIC/TA, δ18O, Salinity	Full depth
	14D	10/18/2023	62 21.404	71 39.635	DIC/TA, δ18O, Salinity	Surface depth
	14B	10/18/2023	62 29.113	71 2.028	DIC/TA, δ18O, Salinity	Surface depth
	HS22-007	10/18/2023	62 36.673	69 54.260	DIC/TA, δ18O, Salinity	Surface depth
	HS22-009	10/19/2023	62 8.972	69 21.932	DIC/TA, δ18O, Salinity	Surface depth
	HS22-011	10/19/2023	61 39.920	68 50.791	DIC/TA, δ18O, Salinity	Full depth
	HS22-013	10/19/2023	61 16.415	68 20.845	DIC/TA, δ18O, Salinity	Surface depth
	352	10/20/2023	61 15.467	64 49.428	DIC/TA, δ18O, Salinity	Full depth
	353	10/20/2023	61 9.308	64 48.953	DIC/TA, δ18O, Salinity	Surface depth
	354	10/20/2023	61 0.233	64 43.090	DIC/TA, δ18O, Salinity	Full depth
	355	10/20/2023	60 51.148	64 43.207	DIC/TA, δ18O, Salinity	Surface depth
	356	10/20/2023	60 44.994	64 43.398	DIC/TA, δ18O, Salinity	Full depth
	640	10/21/2023	58 59.926	61 54.306	-	-

Table 8-2: DOC sampling activities conducted by the biogeochemistry team during Leg 4 of the *CCGS Amundsen* Cruise

Station	**Date**	**Latitude (N)**	**Longitude (W)**	**Number of Samples**
321-GB	07/10/2023	70 20.975	91 34.630	5
324-GB	07/10/2023	70 29.971	090 8.378	8
326-GB	07/10/2023	70 36.116	089 13.520	5
FH20-001	09/10/2023	69 41.002	082 23.357	4
330	09/10/2023	69 19.192	080 33.233	4
333	09/10/2023	68 46.081	081 0.563	3
FSB-01	10/10/2023	68 45.5119	81 9.1571	1

FSB-02	10/10/2023	68 44.1834	81 11.0570	1
FSB-03	10/10/2023	68 39.6800	81 8.8940	1
334	10/10/2023	67 52.572	80 47.975	5
FoxSIPP-03	10/10/2023	66 54.458	80 49.927	6
338	11/10/2023	66 10.267	81 19.340	7
FoxSIPP-05	11/10/2023	65 36.578	81 8.984	8
350	12/10/2023	64 30.079	80 30.144	12
FoxSIPP-07	12/10/2023	64 21.804	81 28.309	8
FoxSIPP-08	13/10/2023	66 0.401	83 8.964	8
FoxSIPP-M	14/10/2023	65 8.088	81 20.048	8
15H	15/10/2023	63 49.008	79 59.384	8
15E	15/10/2023	64 1.960	79 13.022	8
15A	16/10/2023	64 19.684	78 4.657	7
14E	18/10/2023	62 16.441	71 59.069	8
14F	18/10/2023	62 13.228	72 14.776	9
14D	18/10/2023	62 21.404	71 39.635	9
14B	18/10/2023	62 29.113	71 2.028	9

8.2.3 *Rivers*

During Leg4, we traveled via helicopter and sampled 2 rivers. River#29 Oct 6th, Lat: 72 25.24N, Long 89 52.48W. River#6 Oct 13th Lat 67 01.27N, Long 81 51.38W Table 6-3. Inclement weather (mostly fog) prevented travel to the remaining planned river stations. At the two stations noted, we collected samples for dissolved inorganic (DIC, TA) and organic (DOC, CDOM) carbon, stable isotopes (del13C-DIC, del18O-H2O, del2H-H2O), nutrients (N, P, Si), major + minor ions (Ca, Mg, Na, K, Cl, SO4, Sr, Ba), and salinity. These samples will travel back to the University of Manitoba and the Institute of Ocean Sciences in Sidney BC for further analyses. Additional bulk water and sediment collection took place for various groups at the second river and were subsampled as follows microplastic (Granados Galvan, Ingrid Alejandra, ISMER), microbiology, (Kazmiruk, Zakhar U-Manitoba) sediments Ciastek, Stephen, CH4 (Mandryk, Rachel) –* Note that CH4 was collected as a gas sample, not bulk water.

Table 8-3: River sampling conducted in Leg 4 of the *CCGS Amundsen* Cruise

Station	**Date**	**Latitude (N)**	**Longitude (W)**	**Analytes sampled**
RIVER#26	6/10/2023	72 25.24	89 52.48	DIC/TA, 13C-DIC, DOC, nutrients, major ions, salinity, CDOM, Sediments (Ciastek, Stephen U Manitoba)
RIVER#6	13/10/2023	67 01.27	81 51.38	DIC/TA, 13C-DIC, DOC, nutrients, major ions, salinity, CDOM, bulk water, opportunistic water sampling for other groups, microplastic (Granados Galvan, Ingrid Alejandra ISMER, microbiology, (Kazmiruk, Zakhar U MAnitoba sediments (Ciastek, Stephen, CH4 (Mandryk, Rachel)

8.2.1 *Mooring*

Mooring deployment reported separately – the main focus of the biogeochemistry of the mooring is to observe and document the Carbon dynamics and development of deep water in Foxe Basin. To do so, we deployment a Contros HydroC CO2, a deep SeapHox (pH+CTD wO2) (~10m above bottom) and 2 additional microCAT CTD's, (70m and 140m above bottom). Noted below, the upper water column section had to be recovered, Thus, a shallow Seaphox and a ProOceanus ProCV (CO2) was not deployed.

8.3 Preliminary Results

Rosette data for discrete water samples is not available at this time. CTD data is available through Amundsen Science share drive. Raw data from the underway pCO2 machine was obtained, however, processing is still required. Figure 6-1 provides an interesting example of raw data from the underway system.

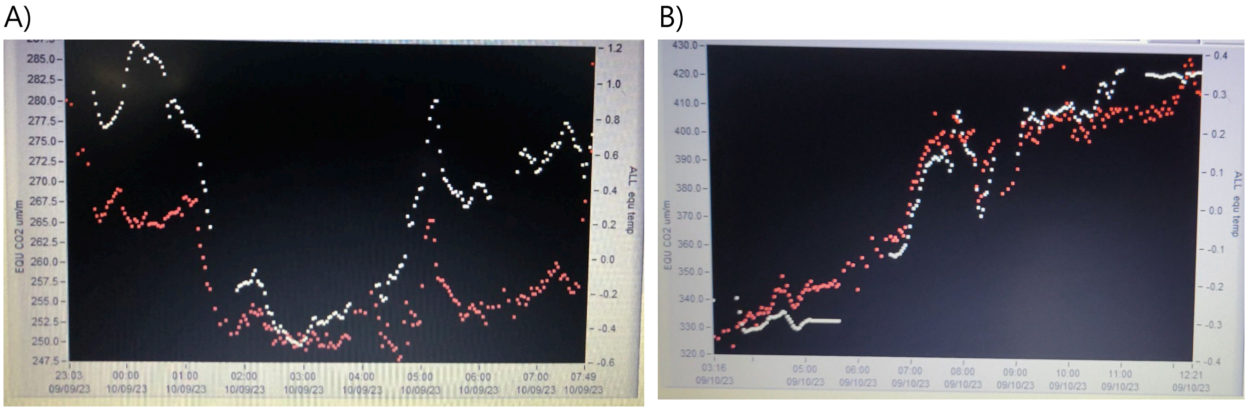

Figure 8-1: Sample underway data from A) September 10, 2023 and B) October 10, 2023. These figures show the raw pCO2 values in μmol mol-1 on the left and the equilibrator temperature in °C on the right over time

8.4 Recommendations

- Flashlight (to easily check to wet box. Also helpful during maintenance).
- Ambient temperature sensor (to contrast engine room temperature to the LICOR temp).
- USB dedicated to underway backup data.
- Creating a block to support the CTD would be ideal for removing the CTD. Currently, it is a two-person job, as the CTD is suspended approximately 5cm from the bottom of the wet box. Building a maneuverable support would allow the CTD to be removed by one person.
- Our bottle count was staggeringly close to being insufficient. Although 4 bottles were used for Kristina Brown's River sampling project, and 1 surface station was cancelled, we still only had 3 bottles remaining after last station. This leaves little room for error (breakage), or opportunistic sampling.
- The underway operated smoothly and without headache throughout Leg 4, apart from one day when there was a blockage in the equilibrator return tube.
- Unfortunately, the mooring deployment did not go perfectly as planned. Post deployment, a section of the top most mooring equipment (planned to be 30m below

surface) was floating at the surface. We are unable to confirm with certainty, but we suspect a measurement error occurred with one of the ropes for top section of the mooring setup, this led to the top section length being too long, and thus the mooring section floating at surface. After discussion various options, we decided to cut this section free and recover it. Leaving the remaining sections deployed unfortunately we didn't have a spare anchor so a full recovery and redeployment was not possible. the section recovered, included an ice profiling system (IPS), Pro-Oceanus (CO2), and a SeaPhox, (pH + CTD), had to be retrieved/recovered, and were not redeployed. The remainder of the mooring depths were confirmed using the ships sounder, and appears to be ad the depths expected.

8.5 References

Dickson, A.G., Sabine, C.L., & Christian, J.R. (Eds). (2007). Guide to Best Practices for Ocean CO2 Measurements. PICES Special Publication 3, 191 pp.

9 Radiocarbon ($\Delta^{14}C$) and stable carbon ($\delta^{13}C$) isotopic measurements of dissolved inorganic carbon (DIC), dissolved organic carbon (DOC), and particulate organic carbon (POC) in seawater in key Arctic gateways

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9.1 Introduction and Objectives

Dissolved inorganic and organic carbon (DIC, DOC) make up the vast majority of carbon in the ocean. The DIC reservoir is ~38,000 GtC, DOC reservoir is ~662GtC, comparable to the total C content in the atmosphere. The particulate organic carbon (POC) reservoir is a small (~35 GtC) but rapidly cycling (<10 yr) pool of marine carbon (Beaupré, 2019). Radiocarbon and stable carbon measurements of these marine carbon pools are powerful tools which can inform us of water mass ages and ventilation rates, fluxes of anthropogenic carbon into the marine environment, and the role of the biological and microbial carbon pumps in mitigating Earth's climate on modern to millennial timescales. Little radiocarbon data currently exists regarding the major marine carbon pools in the Arctic, with none for northern Nares Strait and Jones Sound, important outflows of the Arctic Ocean (Griffith et al., 2012; Druffel et al., 2017).

This study addresses fundamental gaps in our knowledge Arctic carbon cycling by providing much needed quantitative information on the timescale of water mass ventilation, and the cycling of DOC and POC in the northern reaches of the Canadian Arctic. Our specific focus is the radiocarbon age distribution of all marine carbon pools in this region, including constraining outflows from the Arctic Ocean. Our work will help to further understand the marine carbon cycle in a rapidly changing Canadian Arctic. More specifically, these results will tell us: 1) how and where most marine carbon is produced in the northern Canadian Arctic (i.e. by marine phytoplankton or allochthonous input, determining influences of features such as glaciers), 2) how long it will persist (i.e. how marine carbon forms can sequester atmospheric carbon dioxide) and 3) how microbes can use this marine carbon, respiring it back into the atmosphere as carbon dioxide (a powerful greenhouse gas), or instead transforming it into stable forms that can be stored in deep sea. These results will represent the first radiocarbon measurements of marine carbon pools in the northern Canadian Arctic and add to our previously collected datasets from Baffin Bay and the Canadian Arctic Archipelago.

9.2 Methodology

All water samples were collected via CTD-Rosette system. Samples were collected directly from Niskin bottles via acid cleaned silicone tubing to minimize the addition of extraneous carbon and the potential for radiocarbon contamination.

$DO^{14}C$ (as $\Delta^{14}C$) samples were sampled in pre-combusted (540°C/2h) 500mL borosilicate bottles (amber boston rounds). $DO^{14}C$ duplicates were collected at every station at varying depths. Samples at all depths were filtered using pre-combusted 70mm GF/F filters (<0.7µm), acid cleaned silicone tubing and a custom built 316 stainless steel 70mm filter manifold. Samples were immediately frozen after collection and stored at -20°C for analysis at the University of California, Irvine. Once in the lab, samples will be acidified and sparged of dissolved inorganic carbon, and DOC will be converted to CO_2 gas via UV oxidation and vacuum line extraction (Beaupre et al., 2007; Walker et al., 2019). This CO_2 gas will be graphitized, and its radiocarbon content measured via AMS at the Keck Carbon Cycle AMS laboratory at University of California, Irvine (UCI). DOC $\delta^{13}C$ will also be measured in a split of the CO_2 from each sample using light isotope mass spectrometry.

$DI^{14}C$ samples were collected in pre-cleaned (10% HCl soak and MQ water rinse) and combusted (540°C/2h) 250 mL round Pyrex media bottles. Depths sampled for $DI^{14}C$ were the same as those for $DO^{14}C$. Samples were overfilled 3x and collected with zero headspace, poisoned in the lab with 1 drop (50µl) saturated $HgCl_2$ and stored in the dark at room temperature until analysis at the University of Ottawa. DIC samples were not filtered for fear of introducing gas bubbles. Once in the lab, $DI^{14}C$ samples will be acidified and the resulting CO_2 from dissolved inorganic carbon sparged, cryogenically purified and manometrically quantified following the methods of Gao and co-workers (Gao et al., 2014). This CO_2 gas will be graphitized, and its radiocarbon content measured via accelerator mass spectrometry (AMS) at the Keck Carbon Cycle AMS laboratory at UCI or A.E. Lalonde AMS facility at the University of Ottawa. DIC $\delta^{13}C$ will also be measured in a split of the CO_2 from each sample using light isotope mass spectrometry.

Suspended particulate organic matter (POM_{susp}) was filtered onto 70mm QMA in a custom manifold, attached directly to the Niskin bottle via acid-cleaned silicone tubing. POM_{susp} was collected at several chosen depths, but primarily at the fluorometrically-sensed subsurface chlorophyll maximum (SCM), as well as at the bottom at several stations. Approximately 10-12L passed through each filter. QMA filters were removed following sampling and frozen immediately at -20°C for later analysis at the University of Ottawa. Once in the lab, filters are dried and acidified with 12N HCl for four hours to remove inorganic carbon. $\delta^{13}C$, $\delta^{15}N$, and C:N will be measured on filter subsamples via EA-IRMS. Other filter subsamples will be combusted and manometrically purified, with the resultant CO_2 gas graphitized and its radiocarbon content measured via AMS at the Keck Carbon Cycle AMS laboratory at UCI or A.E. Lalonde AMS facility at uOttawa.

Samples for TOC/TN were collected in 40ml amber vials. Sample depths above 400m were filtered in the same manner described above. After collection, 1 drop of 12N HCl was added and the samples frozen at -20°C. Two 10ml glass ampules were taken from each Niskin sampled. Triplicates were taken for one depth per station. After collection, 1 drop of saturated

$HgCl_2$ was added and the ampules flamed sealed using a butane torch. These samples will be measured using nuclear magnetic resonance spectroscopy at the University of Ottawa.

9.3 Preliminary Results

No preliminary results to report, as all actual analyses will be performed either at the University of Ottawa André E. Lalonde Accelerator Mass Spectrometer Facility (AEL-AMS) or at the University of California, Irvine Keck Carbon Cycle Accelerator Mass Spectrometer Laboratory (KCCAMS).

Table 9-1: Overview of samples taken by the Walker Lab group aboard the *CCGS Amundsen* during legs 3 and 4, 2023. Listed sample depths were planned and are only approximations of actual depths fired/collected. A total of 36 stations were sampled over the course of legs 3 and 4. During Leg 3: Six stations were originally planned for full water profile sampling, with two added opportunistically given a change of route through Norwegian Bay and Penny Strait. Ten stations were sampled opportunistically for POM. Two stations were sampled opportunistically for surface sediment from the box corer. During Leg 4: Full water column sampling took place at 17 stations, with one station (FoxSIPP-8) sampled opportunistically solely for POM. Latitude and longitude listed represent the ship's position at the time of rosette recovery

Station	Region	Latitude	Longitude	Date	Time (UTC)	Depth (m)	Cast No.	Sample Types Collected	Depths Sampled (m)
AF-23	Archer Fjord	81.539	64.957	2023/09/12	16:38	315	003	POM	Rosette; 20
AC2	Archer Fjord	81.546	65.859	2023/09/13	17:46	375	007	POM	Rosette; 20
LSea-23	Lincoln Sea	82.081	61.480	2023/09/14	06:51	560	008	POM, DIC, DOC, DOC/TN, NMR	Rosette; 480, 300, 200, 150, 80, 50, 10
AC4	Robeson Channel	81.406	64.318	2023/09/15	18:50	660	010, 011	POM, DIC, DOC, DOC/TN, NMR	Rosette; 676, 500, 300, 200, 100, 50, 30, 15, 0
134	Hall Basin	80.041	68.614	2023/09/17	23:19	250	021	POM	Rosette; 15
133	Hall Basin	79.609	70.364	2023/09/18	10:10	180	022, 023	POM, DIC, DOC, DOC/TN, NMR	Rosette; 183, 150, 100, 50, 40, 33, 0
129	Smith Sound	78.306	73.809	2023/09/19	07:42	700	025	POM, DIC, DOC, DOC/TN, NMR	Rosette; 690, 400, 300, 200, 150, 100, 50, 22, 20, 0
NaresWest-23	Smith Sound	78.305	74.875	2023/09/19	21:42	490	026	POM	Rosette; 484, 31; Box core; surface sediment
CEOS-M1-23	Inglefield Fjord	77.182	71.086	2023/09/21	21:54	610	032	POM	Rosette; 600, 19
AC12	Smith Bay	77.195	78.406	2023/09/22	15:39	310	034	POM	Rosette; 43
Site 1.2	Cape Norton Shaw Inlet	76.588	78.656	2023/09/24	13:11	85	039	POM	Rosette; 20
BG-04	Belcher Glacier Inlet	75.666	81.158	2023/09/25	19:21	300	047	POM	Rosette; 300, 150, 61, 20
AC16	Jones Sound	76.106	83.222	2023/09/27	08:36	765	051	POM, DIC, DOC, DOC/TN, NMR	Rosette; 757, 500, 300, 200, 150, 100, 50, 35, 0
Sverdrup	Jones Sound	75.819	83.118	2023/09/28	11:35	75	053	POM	Rosette; 66, 20
AC17	Jones Sound	76.247	88.258	2023/09/29	06:56	180	056	POM, DIC, DOC, DOC/TN, NMR	Rosette; 170, 70, 20, 0
NB-01	Norwegian Bay	76.839	91.258	2023/09/29	21:10	300	057, 058	POM, DIC, DOC, DOC/TN, NMR	Rosette; 286, 200, 150, 100, 40, 22, 15, 0
NB-02	Belcher Channel	76.918	98.388	2023/09/30	13:57	440	059	POM, DIC, DOC, DOC/TN, NMR	Rosette; 430, 300, 200, 150, 100, 50, 30, 0
CB-04	Croker Bay	74.820	83.168	2023/10/03	10:18	160	067	POM	Rosette; 157, 40
322-GB	Gulf of Boothia	70.39904	91.08406	2023/10/07	06:27	315	003	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 23, 50, 100, 140, 200

SPR-004	Committee Bay	69.05062	86.20480	2023/10/08	11:24	227	008	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 43, 100, 140, 200
FH20-001	Fury & Hecla Strait	69.67794	82.35983	2023/10/09	13:45	114	015	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 50, 95
332	North Foxe Basin	69.18390	81.00439	2023/10/09	23:51	82	022	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 50, 60
FoxSIPP-1	Foxe Basin	68.25083	80.90606	2023/10/10	11:43	69	027	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 30, 60
FoxSIPP-2	Foxe Basin	67.33889	80.82340	2023/10/10	23:21	93	029	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 50, 84
FoxSIPP-4	Foxe Basin	66.45322	80.87760	2023/10/11	09:23	102	031	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 30, 50, 93
FoxSIPP-5	Foxe Basin	65.60623	81.15153	2023/10/11	23:18	165	033	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 50, 100, 140
350	Foxe Channel	64.50736	80.50185	2023/10/12	17:10	385	034	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 26, 50, 80, 140, 200, 300, 379
FoxSIPP-8	Foxe Basin	66.00678	83.14283	2023/10/13	18:14	305	037	POM	Rosette; 30
15H	Foxe Channel	63.81535	79.99452	2023/10/15	13:51	213	044	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 50, 100, 140, 200
15E	Foxe Channel	64.03281	79.22202	2023/10/15	19:34	310	047	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 30, 50, 100, 140, 200, 300
15A	Foxe Channel	64.33509	78.10530	2023/10/16	06:23	120	051	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 50, 100
14F	Hudson Strait	62.22072	72.23486	2023/10/18	06:49	239	059	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 50, 100, 140, 200, 230
14D	Hudson Strait	62.36027	71.67993	2023/10/18	16:59	346	061	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 10, 50, 100, 140, 200, 300
14B	Hudson Strait	62.47872	71.02325	2023/10/18	22:35	331	064	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 24, 50, 100, 140, 200
354	Hudson Strait	61.01042	64.69290	2023/10/20	17:07	530	071	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 9, 20, 40, 100, 140, 200, 300, 400, 500
640	Labrador Coast	58.99600	61.90900	2023/10/21	16:41	139	074	POM, DI^{14}C, DO^{14}C, DOC/TN, NMR	Rosette; 0, 20, 50, 100, 130

9.4 References

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10 Investigating sources and biogeochemical cycling of dissolved methane in Nares Strait using measurements of $\delta_{13}C\text{-}CH_4$, $\delta_{13}C\text{-}CO_2$ and $\delta_{18}O\text{-}H_2O$

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10.1 Introduction and Objectives

Most existing observations of Arctic Ocean methane (CH_4) concentrations are the result of discrete sampling, in open waters (>200 m depth) (Weber et al., 2019), resulting in a poor understanding of the spatial distribution of dissolved methane due to a lack of observations at relevant spatial and temporal scales. To address this, we deployed several underway sensors in the PaleoLab to collect high resolution spatiotemporal datasets of surface gas concentrations (CO_2, CH_4, $\delta_{13}C\text{-}CH_4$, $\delta_{13}C\text{-}CO_2$) and atmospheric measurements of CH_4 and N_2O during legs 3 and 4 of the 2023 Amundsen expedition. In addition to underway measurements, we sampled from the rosette at several stations (see below) to validate our underway measurements with discrete sample measurements of CO_2, CH_4, $\delta_{13}C\text{-}CH_4$, $\delta_{13}C\text{-}CO_2$, $_{18}O\text{-}H_2O$ and N_2O. Our main objective is to combine our underway and on-station measurements to provide a high-resolution characterization of surface methane (dissolved) sources and biogeochemical cycling, across various oceanographic environments.

10.2 Methodology

A continuous, underway system to measure dissolved CO_2, CH_4, $\delta_{13}C\text{-}CH_4$, $\delta_{13}C\text{-}CO_2$ was plumbed directly to the seawater supply line in the Paleo Lab. It consisted of a Picarro 2201-i Isotopic Analyzer coupled to a gas extraction module (Liqui-Cel Membrane, EXF 2.5x8). An LGR Gas Analyzer was also installed in the Paleo lab, and continuously measured atmospheric concentrations of methane (and N_2O) throughout the cruise.

In addition to the continuous underway measurements, discrete samples for CO_2, CH_4, $\delta_{13}C\text{-}CH_4$, $\delta_{13}C\text{-}CO_2$ and $\delta_{18}O\text{-}H_2O$ were taken at stations from the CTD-Rosette at the locations in the following table. At each station, samples were taken at 8 depths throughout the entire water column. During Leg 3, approximately 10 stations, samples were also taken at a depth of 7 m as verification for any artifacts in measurements from the seawater supply line. During Leg 4, 10 stations measurements were taken at 7m to compare with the measurements from the underway system. Additionally, another 10 discrete samples were taken from the underway system at various times while in transit. These additional samples serve to ensure the accuracy and reliability of the OA-ICOS analyzer

Table 10-1: Locations of dissolved gas sampling

Station ID	**Latitude ° N**	**Longitude ° W**	**CO2, CH4, δ 13C-CH4, δ 13C-CO2**	**CH4 & N2O**	**δ 18O-H2O**
AF-23	81° 36.000'	65° 12.000'	x		x
AC-3	81° 29.400'	66° 34.200'	x		x
AC-2	81° 32.400'	65° 53.640'	x		x
LSea-23	82° 06.000'	60° 54.000'	x		x
COSm4-23	80° 01.574'	66° 59.085'	x		x
Station 129	78° 20.068'	74° 08.455'	x		x
AC-11	78° 19.740'	74° 47.940'	x		x
NaresE-23	78° 18.000'	73° 18.000'	x		x
CEOS-m1-23	77° 12.000'	71° 09.000'	x		x
AC-12	77° 11.940'	78° 20.160'	x		x
AC-13	76° 24.000'	78° 24.000'	x		x
Site 1.2	76° 35.262′	78° 39.227′	x		x
Site 1.2 (Second Rosette closer to glacier)	76° 34.940′	78° 36.521′	x		x
BG-02	75° 39.487'	81° 17.058'	x		x
BG-05	75° 40.527'	80° 59.335'	x		x
BG-01	75° 39.493'	81° 19.583'	x		x
AC-16	76° 01.770'	83° 07.620'	x		x
Sverdrup - Rosette	75° 49.188'	83° 14.802'	x		x
Sverdrup (surface sample from zodiac)	75° 44.615'	83° 07.246'	x		x
Site 2.2/ JonesS-23	75° 58.967'	86° 40.241'	x		x
AC-17	76° 24.000'	78° 24.000'	x		x
NB-01	76° 50.114′	91° 17.404′	x		x
NB-02	76° 50.215′	91° 16.358′	x		x
CB-01	74° 53.415'	83° 33.765'	x		x
CB-02	74° 52.197'	83° 29.776'	x		x
CB-03	74° 49.774'	83° 23.148'	x		x
CB-04	74° 49.186'	83° 10.047'	x		x
CB-05	74° 47.051'	83° 12.365'	x		x
CB-06	74° 40.156'	83° 15.407'	x		x
CB-07	74° 23.186'	83° 08.512'	x		x
322-GB	70° 24.090'	91° 06.060'	x	x	x
325-GB	70° 33.180'	89° 40.410'	x	x	x
SPR-005	69° 08.622'	85° 39.986'	x	x	x
FH20-001	69° 41.075'	82° 23.962'	x	x	x
332	69° 10.976'	80° 59.843'	x	x	x
FoxSIPP-02	67° 20.620'	80° 49.762'	x	x	x
FoxSIPP-07	64° 21.722'	81° 28.569'	x	x	x
FoxSIPP-08	66° 00.362'	83° 09.228'	x	x	x
349	64° 41.070'	78° 35.070'	x	x	x
15G	63° 51.900'	79° 49.120'	x	x	x
15B	64° 16.910'	78° 14.950'	x	x	x
14F	62° 13.220'	72° 14.970'	x	x	x
14A	62° 31.550'	70° 52.218'	x	x	x
352	61° 15.960'	64° 48.720'	x	x	x
355	60° 50.966'	64° 42.732'	x	x	x

10.3 Preliminary Results

10.3.1 *Leg 3:*

From the underway data, moderate methane supersaturation was observed in most of Nares Strait, mostly due to ice formation, or perhaps from old ice. There was a strong supersaturation signal on the Greenland side (280% sat), with a light isotopic signature (-70 per mil) indicative of microbial sources (not thermogenic).

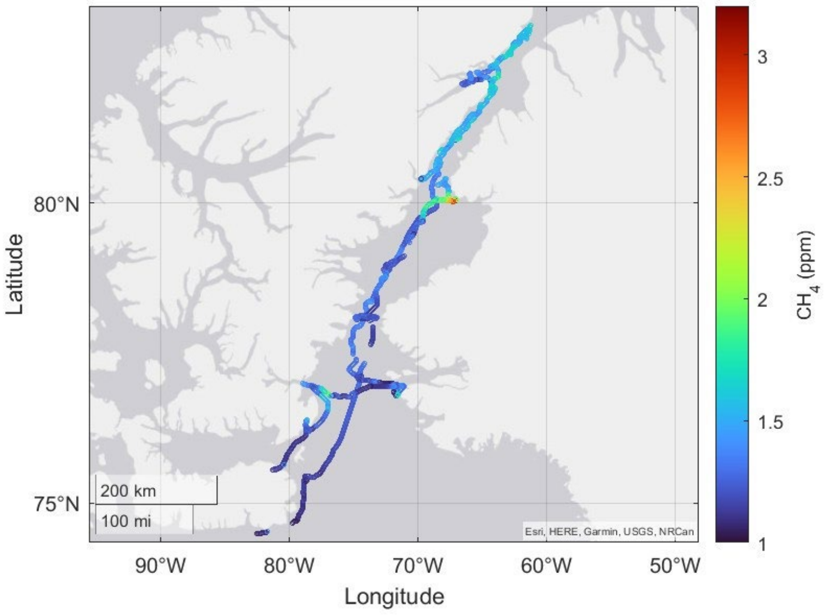


Figure 10-1: Map of raw CH4 data during Leg3. CH4 concentration is in ppm and represents the concentration in the gas stream coming from the membrane only (not a true pCH4 measurement, as the membrane extracts ~55% of the dissolved gases only).

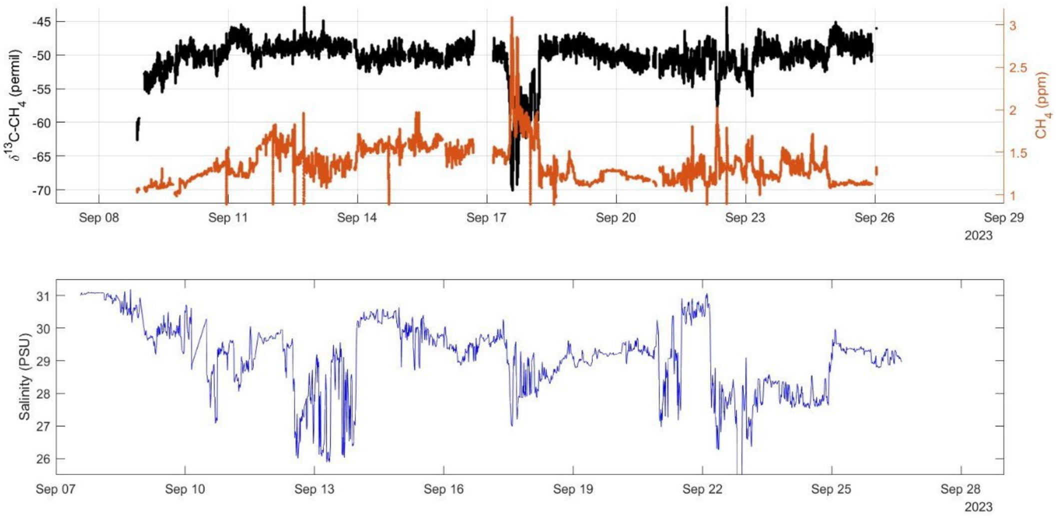


Figure 10-2: Time series of underway data during Leg 3 (with salinity and δ13C-CH4)

The following map shows the methane concentration along the cruise track assuming a 55% extraction efficiency of the gas extraction membrane. Concentrations/saturation states are approximate, and final data will be calibrated with discrete sample taken from the underway line to have exact concentrations/saturation states. Preliminary data shown in this report are estimated to be accurate to +/- 10% saturation.

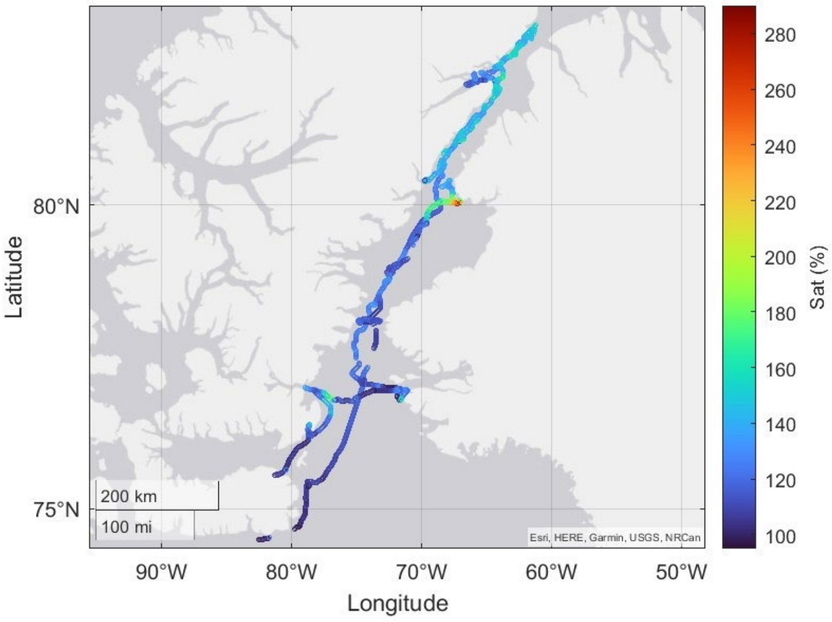


Figure 10-3: Saturation state of dissolved methane along the cruise track during Leg 3, based on an assumed extraction efficiency of 55%

Additionally, while not as high of a concentration (180% Sat), elevated methane was observed at the head of a fjord near Cape Norton. This coincided with higher salinity, than at the mouth of the fjord. During the day (compared to measurements made during night-time mapping), there were strong katabatic winds coming down off the glacier. This coincided with higher methane at the head of the fjord. There may have been katabatic-wind induced upwelling in the fjord bringing methane to the surface, although this will have to be confirmed once the $\delta^{18}O$-H_2O data is available (Perhaps the ^{18}O data will show that there were significant meteoric water inputs, and the upwelling could have instead been induced by subglacial melt).

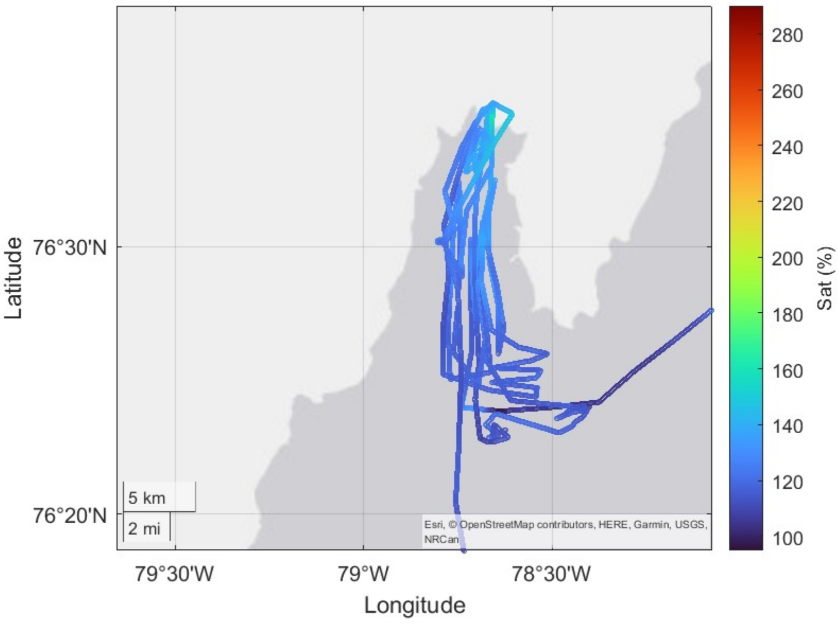


Figure 10-4: Map of underway CH4 data in Cape Norton during Leg 3

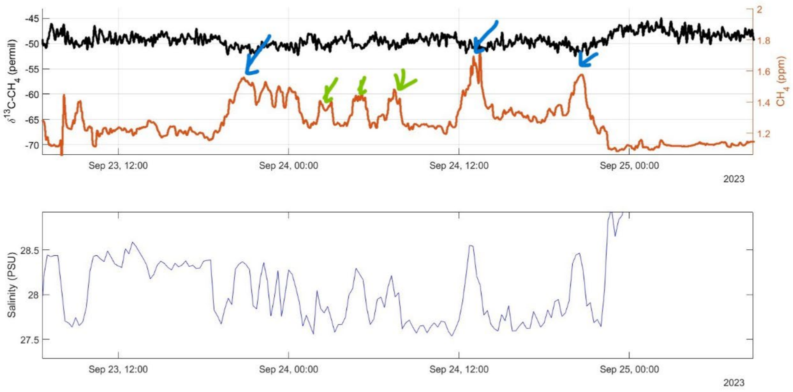
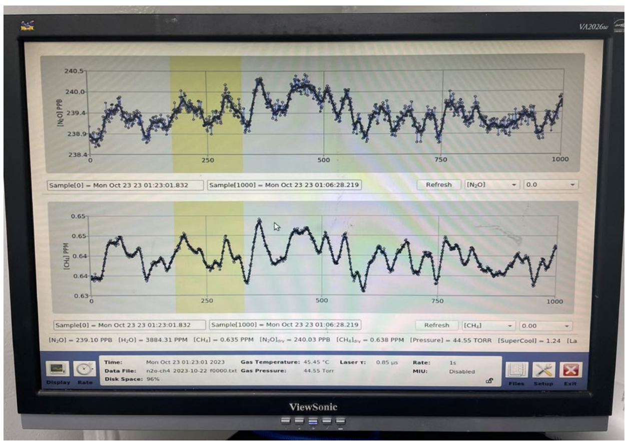


Figure 10-5: Cape Norton time series during Leg 3

10.3.2 *Leg 4:*

Methane was observed to be moderately undersaturated across the entire cruise track, however, this was an observation made of the raw CH4 data coming from the gas stream. The raw data was viewed on the display monitor of the OA-ICOS (Figure 10-6). While the undersaturation may be of interest, this result cannot be confirmed until further analysis is done, and the discrete calibration samples are analyzed to understand the exact concentration and saturation states.



Sample[0] = Mon Oct 23 23 01:23:01.832 Sample[1000] = Mon Oct 23 23 01:06:28.219 [N₂O] 0.0

Sample[0] = Mon Oct 23 23 01:23:01.832 Sample[1000] = Mon Oct 23 23 01:06:28.219 [CH₄] 0.00

```
[N₂O] = 239.10 PPB  [H₂O] = 3884.31 PPM  [CH₄] = 0.635 PPM  [N₂O]dry = 240.03 PPB  [CH₄]dry = 0.638 PPM  [Pressure] = 44.55 TORR  [SuperCool] = 1.24  [La
Time:         Mon Oct 23 01:23:01 2023          Gas Temperature: 45.45 °C   Laser τ:  0.85 µs   Rate: 1s
Data File:    n2o-ch4 2023-10-22 f0000.txt      Gas Pressure:    44.55 Torr                     MIU:  Disabled
Disk Space:   96%
```

Figure 10-6: A picture of the monitor display of the OA-ICOS. Data is able to be viewed in real time as it is analyzed

At station 322-GB, Cyril Aubry, working with the fisheries team, noticed a potential methane seep on one of the detection systems (Figure 10-7). Methane seeps are common in the Arctic and are points of interest for methane cycling beneath the surface (Astrom et al., 2020). Discrete samples were taken at this station which will provide a depth profile. If this anomaly is a methane seep, the analysis of CO2, CH4, δ13C-CH4, δ13C-CO2, δ18O-H2O, and N2O may provide telling information into the biogeochemical cycling surrounding the seep.

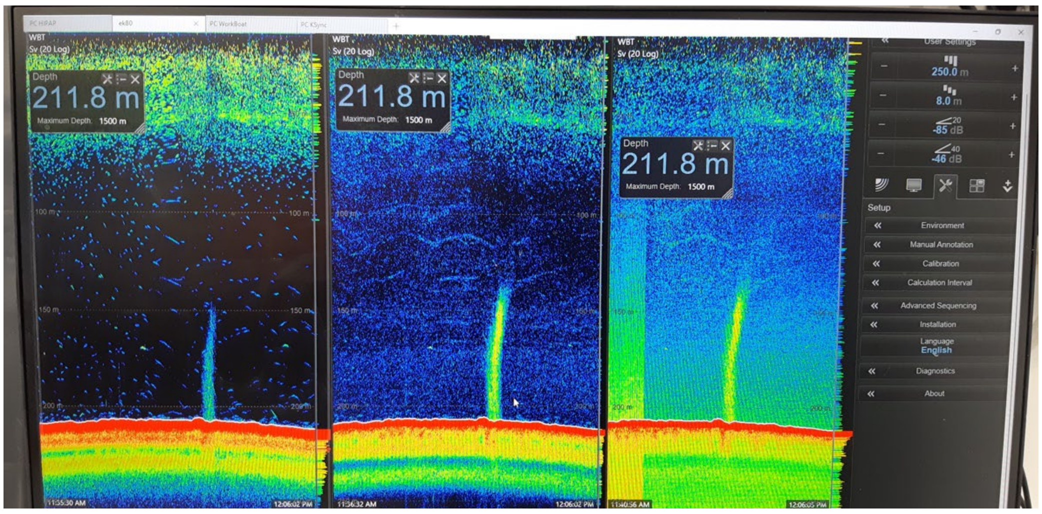


Figure 10-7: A photo of the methane seep on the detection system used by the fisheries team

10.4 Recommendations

Niskin was brand new and was off gassing strong chemical smells (plastic) and did not close properly under environmental conditions in the arctic (-5°C), due to reduced elasticity of the rubber band.

10.5 References

Astrom, E.K.L., Sen, A., Carroll, M.L., and Carroll, J. (2020) Cold Seeps in a Warming Arctic: Insights for Benthic Ecology. Front. Mar. Sci. 7:244. doi: 10.3389/fmars.2020.00244.

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11 Microplastics and Associated Chemicals: Transport to and within the Canadian Arctic: P223

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Cruise participants – Leg 4: Alejandra Granados Galvan[5], Haritha Yespal Subha[5], Denis Nerysoo[6]

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11.1 Introduction and Objectives

Arctic systems are a sink for persistent organic pollutants (POPs) as temperature gradients and prevailing winds transport POPs from emitting sources in warmer climates (mainly North America, Europe, and Asia).

This is of significant concern for Arctic ecosystems and community members as POPs partition into organic matter, which are subsequently taken up by organisms and humans and have the potential to cause adverse health impacts. Research in the Canadian Arctic has played a critical role in developing an understanding of how long-range transport occurs, which is significant for the crafting legislation (such as Canada's Chemical's Management Plan or Europe's REACH program), and international agreements (such as the Stockholm Convention), which regulate the usage and production of POPs.

Further, anthropogenic particles such as microplastics (MPs) and microfibers, have been documented in every region studied, including pristine remote environments such as the Arctic. Long-range atmospheric transport via snow and oceanic currents, in addition to local sources, contribute to microplastics and microfibers in these environments. Recent research by our team (Adams et al., 2021; Athey et al., 2020; Huntington et al., 2020) have shown that Canadian Arctic sediments have comparable levels of anthropogenic cellulose microfibres as sediments in Lake Ontario nearby Toronto, Ontario. Anthropogenic microparticles are of significant concern due to evidence of bioaccumulation and biomagnification in marine ecosystems, while the consequences to Arctic biota and Northern populations are not well understood.

The Amundsen has long been an essential platform for our research, and we were fortunate to collect samples from and participate in the cruise, allowing us to maintain a unique historical dataset. We intend to continue monitoring the emerging anthropogenic contaminants (i.e., MPs and POPs), as well as new and emerging compounds with POP-like behaviour (e.g., current use pesticides) to observe temporal and spatial trends, in addition to impacts from climate change on the behaviour of these contaminants in the Canadian Arctic. Our objective for the research program in legs 3 and 4 is the "ArcticNet" marine program where we focus on the impacts of contaminants on the Marine Ecosystem of the Canadian Arctic. For this we do intensive fieldwork by collecting data and samples from various matrices including water, sediment, biota, and air to measure the concentration of contaminants entering this environment.

11.2 Methodology

During legs 3 and, we obtained samples to be shared amongst 6 teams.

Research teams involved:

1. Centre of Atmospheric Research Experiments, Environment and Climate Change Canada (Dr. Liisa Jantunen; Project Leader)

2. Centre for Earth Observation Science, University of Manitoba (Dr. Gary Stern; Project Leader)

3. Department of Chemical Engineering, McGill University (Dr. Nathalie Tufenkji)

4. Department of Biology, York University (Dr. Elisabeth Clare)

5. School of the Environment, Trent University (Dr. Julian Aherne)

6. Institut des sciences de la Mer de Rimouski, Université du Québec à Rimouski (Dr. Zhe Lu)

7. CanmetENERGY Devon, Natural Resources Canada (M.Sc. Christine Ridenour)

CUP	Current use pesticides
FR	Flame retardants
HV	High volume
MP	Microplastic
OCP	Organochlorine pesticides
PAC	Polycyclic aromatic compounds
PFAS	Poly and per-fluorinated compounds
POP	Persistent organic pollutants
SVOC	Semi-volatile organic compounds

11.2.1 *High Volume Water Samples*

Approximately 100 liters of surface water were obtained by opportunistically using the bucket method from the side of the ship. Subsequently, the water was transported to the aft-clean laboratory, where it was pumped through a preassembled column equipped with a filter and a sorbent material known as XAD, flowing at a rate of 150 mL per minute. The column was refrigerated for future laboratory analysis. During legs 3 and 4, three and 5 samples were collected, respectively.

Table 11-1: High volume sample locations during legs 3 and 4, 2023

Sample ID	Station	Date	Latitude	Longitude
AN23 HV 1	AC12	13-Sept-23	81.54558	-65.86000
AN23 HV 2	AC18	16-Sept-23	80.31819	-69.73000
AN23 HV 3	Nares-West-23	19-Sept-23	78.31106	-74.88000
AN23 HV 4	AC12	22-Sept-23	77.19516	-78.40587
AN23 HV 5	AC17	29-Sept-23	76.27976	-88.23
AN23 HV 6	334	10-oct-23	67.87891	-80.80
AN23 HV 7	Fox-SIPP-8	13-oct-23	66.00641	-83.15
AN23 HV 8	354	20-oct-23	61.00378	-64.72

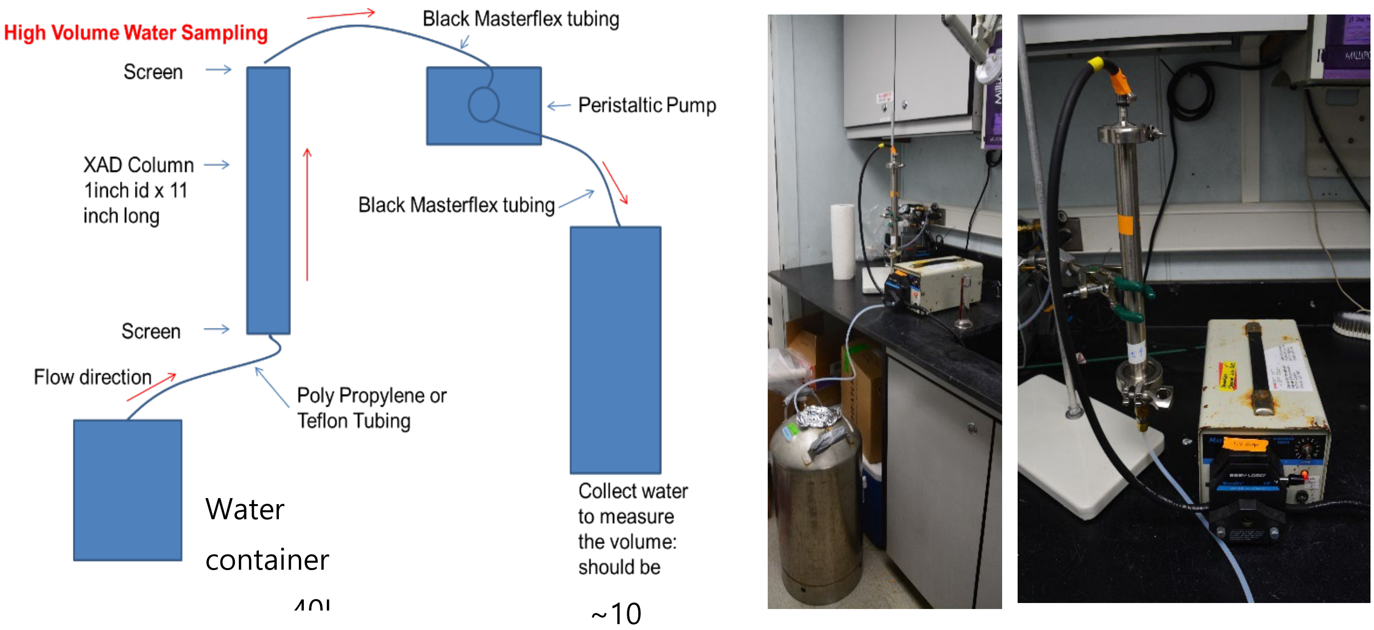

Figure 11-1: High volume sampling via XAD filtration; schematic and set up. Photo credit: Alejandra Granados Galvan

11.2.2 *OPE and PFAS Water samples (low volume)*

One-liter surface water samples were gathered by CTD-Rosette and bucketing methods, for the analysis of Per- and Polyfluorinated Substances (PFAS), Organophosphate Esters (OPEs), Flame Retardants, and Plasticizers. These samples were stored at the aft section of the vessel, for subsequent analysis at ECCC.

Table 11-2: OPE sample locations during legs 3 and 4, 2023.

Sample ID	Station	Date	Latitude (N)	Longitude (W)
AN23 OPE 1	AC3	13-Sept-23	81.47922	66.47044
AN23 OPE 2	LSea23	14-Sept-23	82.08055	61.48024

AN23 OPE 3	AC18	16-Sept-23	80.31757	69.72902
AN23 OPE 4	129	19-Sept-23	78.31233	73.80533
AN23 OPE 5	122	20-Sept-23	77.34345	74.67073
AN23 OPE 6	AC12	22-Sept-23	77.19367	78.42498
AN23 OPE 7	AC16	26-Sept-23	76.02985	83.1259
AN23 OPE 8	JonesS23	28-Sept-23	75.99134	86.48655
AN23 OPE 9	AC17	29-Sept-23	76.28257	88.22158
AN23 OPE 10	NB-01	29-Sept-23	76.83531	91.29667
AN23 OPE 1	322-GB	07-oct-23	70.40058	91.10076
AN23 OPE 2	330	09-oct-23	69.31964	80.55327
AN23 OPE 3	338	11-oct-23	66.16719	81.32622
AN23 OPE 4	350	12-oct-23	64.50794	80.47573
AN23 OPE 5	354	20-oct-23	61.00378	64.71789
AN23 OPE 6	640	21-oct-23	58.99877	61.9051

Table 11-3: OPE sample locations during legs 3 and 4, 2023

Sample ID	Site	Date	Latitude (N)	Longitude (W)
AN23 PFC 1	AC3	13-Sept-23	81.47922	66.47044
AN23 PFC 2	LSea23	14-Sept-23	82.08055	61.48024
AN23 PFC 3	AC18	16-Sept-23	80.31757	69.72902
AN23 PFC 4	129	19-Sept-23	78.31233	73.80533
AN23 PFC 5	Nares-East-23	20-Sept-23	78.32350	73.18000
AN23 PFC 6	122	20-Sept-23	77.34345	74.67073
AN23 PFC 7	AC12	22-Sept-23	77.19367	78.42498
AN23 PFC 9	330	09-oct-23	69.31964	80.55327
AN23 PFC 10	338	11-oct-23	66.16719	81.32622
AN23 PFC 11	350	12-oct-23	64.50794	80.47573
AN23 PFC 13	15G	15-oct-23	64.02436	79.2148
AN23 PFC 14	354	20-oct-23	61.00378	64.71789

11.2.3 *Tire Wear Water Samples*

Two liters of surface water sample are collected using the CTD-Rosette or bucketing from the foredeck during stations stops for tire wear contaminants during Leg 4. These samples will allow us to evaluate the occurrence and distribution of tire wear particles in surface water in the Arctic. For this purpose, two amber glass bottles were used for sample collection. Then, samples were then pushed through a HBL cartridge using a peristaltic pump. The cartridges are covered in aluminum foil and are frozen until analysis.

Table 11-4: Tire wear sampling locations during Leg 4, 2023

Sample ID	Site	Date	Latitude (N)	Longitude (W)
AN23 MP TW-1	Fox-SIPP-3	11-oct-23	66.90856	80.81992
AN23 MP TW-2	350	12-oct-23	64° 30.1760'	80° 30.1382'

AN23 MP TW-Blank	350	12-oct-23	64° 30.1760'	80° 30.1382'
AN23 MP TW-3	River 2	12-oct-23		
AN23 MP TW-4	HS22-003	16-oct-23	63.85282	-75.10603
AN23 MP TW-Blank 2	HS22-003	16-oct-23	63.85282	-75.10603
AN23 TW-5	14E	18-oct-23	62.27416	-71.98469
AN23 TW-6	HS22-013	19-oct-23	61.27379	-68.34732
AN23 TW-7	354	20-oct-23	61.00378	-64.71789
AN23 TW-8	640	21-oct-23	58.99877	-61.9051

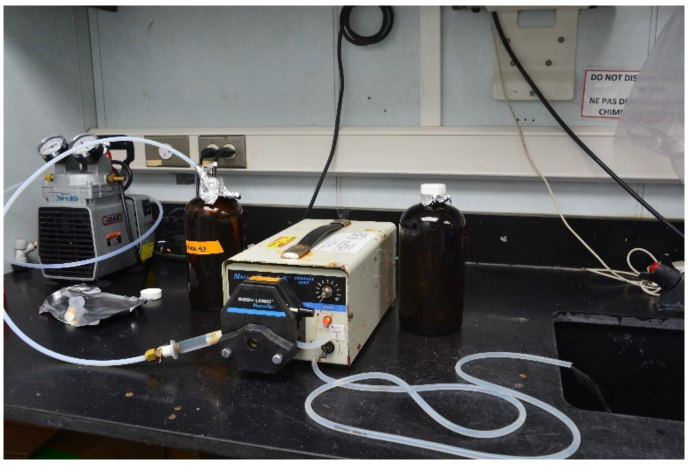

Figure 11-2: Tire wear water filtration setup: samples in 1 L amber glass bottles are extracted by a HBL cartridge. Water flows through filtration unit, and water is discarded. Cartridges are transported to the laboratory for further analysis. Photo credit: Alejandra Granados Galvan.

11.2.4 *Sediment Samples*

Surface sediment samples were collected directly from the box core and stored in the freezer. Using a steel spoon and/or scoop, surface sediment was collected into whirlpaks (Gary Stern, mercury), 500 mL glass jars (Jantunen, microplastics and contaminants), and 250 mL conical centrifuge tubes (Clare, eDNA).

Table 11-5: Sediment sample locations during legs 3 and 4, 2023

Sample ID	**Site**	**Date**	**Depth (m)**	**Latitude (N)**	**Longitude (N)**
AN23 Sed 1	A14	09-Sept-23	534	75.49456	78.83804
AN23 Sed 2	AF23	12-Sept-23	605.02	81.54729	64.94273
AN23 Sed 3	LSea23	14-Sept-23	580.51	82.06306	61.50752
AN23 Sed 4	A18	16-Sept-23	197.48	80.31977	69.73819
AN23 Sed 5	133	18-Sept-23	173.41	79.59433	70.3386
AN23 Sed 6	129	19-Sept-23	159.63	79.60383	70.22304
AN23 Sed 7	AC12	22-Sept-23	570.45	77.19575	78.39842
AN23 Sed 8	Site 1.2	24-Sept-23	129.28	76.50393	78.78729
AN23 Sed 9	AC16	27-Sept-23	672.04	76.07218	83.19073
AN23 Sed 10	CB-02	02-Oct-23	229.40	74.86700	83.47900
AN23 GS Sed 1	AF23	12-Sept-23	605.02	81.54729	64.94273
AN23 GS Sed 2	AC19	16-Sept-23	283.43	80.23787	69.28922

AN23 GS Sed 3	129	19-Sept-23	691.39	78.30587	73.77211
AN23 GS Sed 4	AC12	22-Sept-23	570.45	77.19575	78.39842
AN23 GS Sed 5	AC13	23-Sept-23	220.31	76.38434	78.63625
AN23 GS Sed 6	Site 1.2	24-Sept-23	590	76.50393	78.78729
AN23 GS Sed 7	BG-01	25-Sept-23	322.37	75.66460	81.10053
AN23 GS Sed 8	CB-02	02-Oct-23	229.40	74.86700	83.47900
AN23 GS Sed 9	CB-06	06-Oct-23	402.38	74.66918	83.21284
AN23 eDNA Sed 1	Lseas 24	14-Sep-23	580.51	82.06306	61.50752
AN23 eDNA Sed 2	133	18-Sep-23	173.41	79.59433	70.3386
AN23 eDNA Sed 3	122	20-Sep-23	675.16	77.33581	74.68925
AN23 eDNA Sed 4	AC16	27-Sep-23	672.04	76.07218	83.19073
AN23 # 11	322 GB	07-oct-23	219.55	70.40058	91.10076
AN23 # Blank 1	322 GB	07-oct-23	NA	70.40058	91.10076
AN23 # 12	334	10-oct-23	84.77	67.8808	80.80087
AN23 # 13	338	11-oct-23	136.05	66.16719	81.32622
AN23 # 14	350	12-oct-23	389.85	64.50794	80.47573
AN23 DNASed 5	322 GB	07-oct-23	219.55	70.40058	91.10076
AN23 DNASed 6	334	10-oct-23	84.77	67.8808	80.80087
AN23 DNASed 7	338	11-oct-23	136.05	66.16719	81.32622
AN23 DNASed Blank	338	11-oct-23	NA	NA	NA
AN23 DNASed 8	350	12-oct-23	389.85	64.50794	80.47573
322 GB	322 GB	07-oct-23	219.55	70.40058	91.10076
334	334	10-oct-23	84.77	67.8808	80.80087
338	338	11-oct-23	136.05	66.16719	81.32622
350	350	11-oct-23	389.85	64.50794	80.47573

Figure 11-3: Surface sediment sampling from the box core. Photo credit: Nidhi Yadav, 2023

11.2.5 *Sediment and Water Samples*

Surface sediments were also collected to characterize physical, chemical, and microbiological properties and to perform oil biodegradation experiments.

Using a sterilized scoop, five push cores were collected from the box core and stored in the freezer for microbial and geochemistry analysis. Additionally, three surface sediment samples were collected from the top 5 cm into plastic buckets. Two field blanks were collected by opening the bottles and leaving them open on the deck of the ship for the duration of the sediment sampling. Once the sediment sampling was completed, the bottles were closed and returned into the fridge.

Twenty-two water samples were collected 5 m above the interphase water/sediment at the stations Fox-SIPP-7 and Fox-SIPP-8. They were distributed in corning tubes, glass vials 250 mL HDPE bottles, and 2 L plastic bottles. Water samples in 250 mL HDPE bottles, pH was adjusted to 2 using HCl. Corning tubes were stored in a plastic bag and immediately frozen at -20°C. HDPE 250 mL bottles, and 2 L plastic bottles were stored in a cooler and kept at 4°C until shipment. Samples will be shipped to Devon, Alberta and will be analyzed by CanmetENERGY Devon.

Table 11-6 : Sediment and water sample locations during Leg 4, 2023 for NRCan project

Sample ID	**Sample**	**Site**	**Date**	**Depth (m)**	**Latitude (N)**	**Longitude (W)**
Fox-SIPP-8 (4 box cores)	Sediment	Fox-SIPP-8	13-oct-23	307.60	66.00485′	83.15286′
Fox-SIPP-8 (Box core)	Sediment	Fox-SIPP-8	13-oct-23	307.60	66.00471′	83.15290′
Plastic bucket Fox-SIPP-8 1 to 3	Sediment	Fox-SIPP-8	13-oct-23	307.60	66.00485′	83.15286′
Corning tubes Fox-SIPP-7 1 to 3	Water	Fox-SIPP-7	12-oct-23	267.23	64.36335′	81.47197′
Glass vials Fox-SIPP-7 1 to 4	Water	Fox-SIPP-7	12-oct-23	267.23	64.36335′	81.47197′
HDPE bottles Fox-SIPP-7 1 to 2	Water	Fox-SIPP-7	12-oct-23	267.23	64.36335′	81.47197′
Plastic bottles Fox-SIPP-7 1 to 2	Water	Fox-SIPP-7	12-oct-23	267.23	64.36335′	81.47197′
Corning tubes Fox-SIPP-8 1 to 3	Water	Fox-SIPP-8	13-oct-23	306.59	66.00667′	83.14930′
Glass vials Fox-SIPP-8 1 to 4	Water	Fox-SIPP-8	13-oct-23	306.59	66.00667′	83.14930′
HDPE bottles Fox-SIPP-8 1 to 2	Water	Fox-SIPP-8	13-oct-23	306.59	66.00667′	83.14930′
Plastic bottles Fox-SIPP-8 1 to 2	Water	Fox-SIPP-8	13-oct-23	306.59	66.00667′	83.14930′

Figure 11-4: Surface sediment from the box core on FoxSIPP8 station. © Stocking. M

11.2.6 *Zooplankton and Benthic*

Zooplankton was collected from Monster tows (200 um mesh) by the Zooplankton Team. Using a microscope, specific species of zooplankton were subsampled, including: *Chaetognaths.*

Benthic species were collected opportunistically using the Agassiz. Samples were speciated by the Benthic Team, stored in Ziploc bags and placed in the freezer for future analysis in the laboratory of University of Manitoba.

Table 11-7: Benthic and zooplankton sample locations during legs 3 and 4, 2023

Station	Trawl	Date	N° species collected	Latitude (N)	Longitude (W)
AF23	Tucker	13-Sept	3, ii) speciated, iii) bulk	81.54303	81.54303
AC3	Tucker	13-Sept	2, ii) speciated, iii) bulk	81.48241	66.4787
Lsea23	Tucker	14-Sept	3, i) bulk, ii) speciated, iii) bulk	82.06269	61.3767
AC4	Tucker	15-Sept	2, i) bulk, ii) speciated	81.47928	66.47874
AC18	Tucker	16-Sept	2, i) bulk, ii) speciated	80.31655	69.73293
134	Tucker	17-Sept	3, i) bulk, ii) speciated, iii) bulk	80.04408	68.56623
Nares-West-23	Tucker	19-Sept	3, i) bulk, ii) speciated, iii) bulk	78.31365	74.88548
129	Hydrobios	19-Sept	3, i) bulk, ii) speciated, iii) bulk	78.33541	74.16695
Nares-East-23	Tucker	20-Sept	3, i) speciated, ii) bulk, iii) bulk	78.33029	73.18085
122	Tucker	21-Sept	3, i) speciated, ii) speciated, iii) bulk	77.35322	74.41616
Coes-M1-23	Tucker	21-Sept	3, i) bulk, ii) speciated, iii) bulk	77.189	71.07615
AC12	Tucker	22-Sept	3, i) speciated, ii) bulk, iii) bulk	77.2339	78.97018
AC13	Tucker	23-Sept	1, i) speciated	76.39783	78.45795
BG-04	Tucker	25-Sept	1, i) speciated	75.67851	81.18165
AC17	Tucker	29-Sept	1, i) speciated	76.26594	88.24272
CB-05	Tucker	02-Oct	1, i) speciated	74.78182	83.19854
AN23 Benthic 1	Agassiz	18-Sept	~ 25	79.62322	70.29858
322 GB	Agassiz	07-Oct	6	70.40058	91.10076
SPR 004	Agassiz	08-Oct	13	69.05238	86.19881
333	Agassiz	10-Oct	5	68.77151	80.83265

334	Agassiz	10-Oct	15	67.8808	80.80087
338	Agassiz	11-Oct	10	66.16719	81.32622
Fox-SIPP-3	Agassiz	11-Oct	10	66.90856	80.81992
350	Agassiz	11-Oct	10	64.50794	80.47573
15E	Agassiz	15-Oct	7	64.02436	79.2148
HS22-003	Agassiz	16-Oct	7	63.85282	75.10603
14E	Agassiz	18-Oct	8	62.27416	71.98469
15E	Agassiz	15-Oct	1	64.02927	79.20996
15E	Monster	15-Oct	2	64.02927	79.20996

11.2.7 *Air Samples*

To acquire concentrations of various target POPs and other pollutants, such as MPs, a pre-packed airhead is coupled to a vacuum pump on a pole close to the ship's bow. It has a glass fibre filter (GF/F, 0.1 um cutoff) to collect particles phase impurities and a glass column "sandwich" of XAD-2 resin and polyurethane foam plug (PUF) to collect gas phase. Samples are kept in the freezer for analysis after being run nonstop for a full day (24 hours). Blanks were also collected by running the airheads for 30 seconds. Samples will be analyzed by the ECCC and University of Quebec at Rimouski. During Leg 3, on Monkey Island a NILU air head was attached to the railing on the Starboard side and covered with an Aluminum funnel for microplastic analysis and run back-to-back for 48 hours throughout the cruise, filter papers were subsequently transferred to a petri dish and will be analyzed at Trent University.

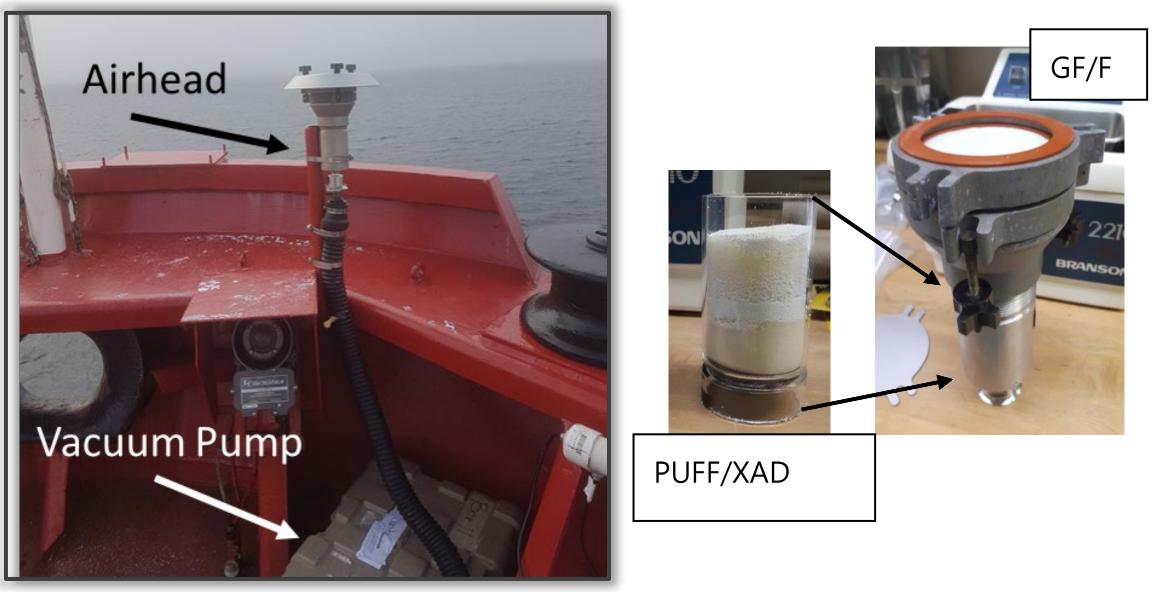

Figure 11-5: Air sampling setup and contents of air head; XAD glass column and glass fibre filter (GF/F)

Table 11-8: Air sample locations during Leg 4, 2023

Sample ID	**Date ON**	**Latitude ON (N)**	**Longitude ON (W)**	**Date OFF**	**Latitude OFF (N)**	**Longitude OFF (W)**
AN23 Air 1	11-Sept	80°22.4419'	68°30.5954'	12-Sept	81°34.7815'	65°5.8168'
AN23 Air 2	13-Sept	81°37.0562'	65 ° 2.2970'	14-Sept	81°53.9802'	62°38.0133'
AN23 Air 3	19-Sept	78°19.0335'	74°51.7838'	20-Sept	78°16.0998'	73°44.1861'
AN23 Air 4	24-Sept	76°30.2403'	78°47.5111′	25-Sept	75°39.5159'	81°19.4789'
AN23 Air 5	30-Sept	76°54.6174'	98°24.63′	1-Oct	74°18.3143'	91°6.4655′
AN23 Air MP 1	10-Sept	77°25.0335′	75°9.8842′	12-Sept	81°27.0529'	64°12.6211′
AN23 Air MP 2	12-Sept	81°32.3913′	64°57.5730′	14-Sept	82°3.8602′	61°30.6880′
AN23 Air MP 3	14-Sept	82°3.8602′	61°30.6880′	16-Sept	80°19.1770′	69°43.7084′
AN23 Air MP 4	16-Sept	80°18.8199′	69°43.8436′	18-Sept	79°35.4791′	70°18.4482′
AN23 Air MP 5	18-Sept	79°35.474′	70°18.3844′	20-Sept	78°18.3775′	73°26.0232′
AN23 Air MP 6	20-Sept	78°17.5421′	73°33.4817′	22-Sept	77°9.7188′	73°7.5685′
AN23 Air MP 7	22-Sept	77°9.7188′	78°43.7084′	24-Sept	76°29.0722′	78°44.4044′
AN23 Air MP 8	24-Sept	76°29.0722′	78°44.4044′	26-Sept	76°25.1008′	82°55.8126′
AN23 Air MP 9	26-Sept	76°25.1008′	82°55.8126′	28-Sept	75°49.8360′	83°18.8118′
AN23 Air MP 10	28-Sept	75°49.8360′	83°18.8118′	30-Sept	76°55.2499'	98°23.9060′
AN23 Air MP 11	20-Sept	76°55.2499'	98°23.9060′	2-Oct	74°53.7635'	83°35.1757′
AN23 Air MP 12	2-Oct	74°53.7258'	83°35.2323′	4-Oct	74°41.3139	94°51.5058′
AN23 Air 13	10-Oct	69°40.4970'	81°51.9990'	11-Oct	66°10.3089'	81°19.1782'
AN23 Air 14	12-Oct	64°29.9066'	80°32.5925'	13-Oct	64°32.4028'	80°31.6443'
AN23 Air 15	13-Oct	64°32.4028'	80°31.6443'	14-Oct	66°0.2197'	83°6.4072'
AN23 Air 16	14-Oct	66°0.2197'	83°6.4072'	15-Oct	64°1.4771'	79°13.1394'
AN23 Air 17	15-Oct	64°1.4771'	79°13.1394'	16-Oct	63°50.8782'	75°6.5709'
AN23 Air Blank 1	16-Oct	63°50.8782'	75°6.5709'	16-Oct	63°50.8782'	75°6.5709'
AN23 Air 11	16-Oct	63°51.1382'	73°7.0611'	17-Oct	63°2.2752'	74°19.5945'
AN23 Air Blank 2	17-Oct	63°2.2752'	74°19.5945'	17-Oct	63°2.2752'	74°19.5945'
AN 23 Lu Air#1	11-Oct	65°38.4184′	81°9.5942′	12-Oct	64°29.9066'	80°32.5925'
AN 23 Lu Air#2	18-Oct	62°30.0320′	70°59.0103′	19-Oct	61°15.7121′	68°23.3537′
AN 23 Lu Air#3	21-Oct	58°40.5549′	61°27.5715′	22-Oct	54°6.4296′	55°53.0471′
AN 23 Lu Air#4	22-Oct	54° 4.6253′	55°51.1820′	23-Oct	50°0.3891′	60°4.9796′
AN 23 Lu Air Blank#1	23-Oct	50°0.3135′	60°6.3313′	23-Oct	50°0.3135′	60°6.3313′
AN 23 Lu Air#5	23-Oct	50°0.2418′	60°8.0213′	23-Oct	49°56.5961′	61°33.0409′
AN 23 Lu Air#6	23-Oct	49°56.5951′	61°33.0409′	24-Oct	49°20.6927′	67°41.8066′
AN 23 Lu Air Blank#2	24-Oct	49°19.7793′	67°44.0009′	24-Oct	49°9.77933′	67°44.0009′
AN 23 Lu Air#7	24-Oct	49°18.4688′	67°47.6549′	24-Oct	48°37.4862′	68°46.1783′

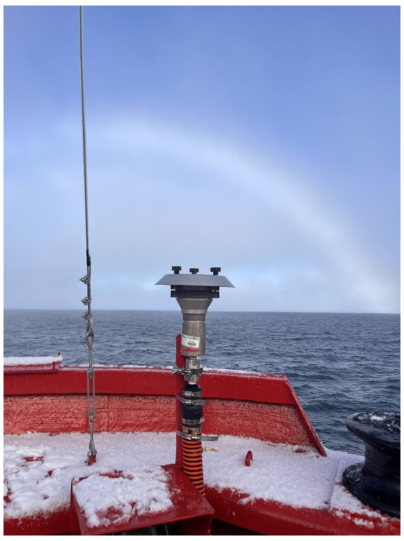

Figure 11-6: Air head set up for OCPs/CUPs/FRs/PFACs/PACs analysis. Photo credit: Haritha Yespal Subha, 2023

11.2.8 *Microplastic Samples*

At the stations, we gathered 40 liters of water samples from the foredeck, employing a metal bucket and wire via surface bucketing. Additionally, to investigate the density-dependent distribution of microplastics (MPs) within the water column, we obtained water samples from near the upper section of the thermocline, with the cooperation of the rosette team. These samples were stored in pressurized stainless-steel containers and subsequently passed through a Manifold filtering unit equipped with a 10 µm polycarbonate filter. The filtered samples were then transferred and preserved in 40 mL vials for further analysis.

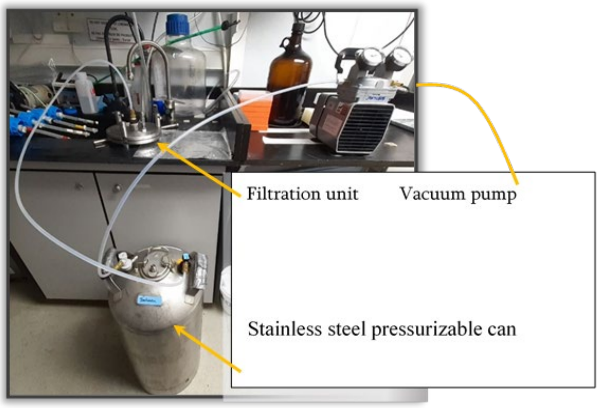

Figure 11-7: Microplastic water filtration setup; 40 L metal 'soda' can is pressurized, and water flows through filtration unit, filtered at 10 μm, and water is discarded

Table 11-9: Microplastic sample locations during legs 3 and 4, 2023. Many blanks were processed via collecting

Sample ID	**Station**	**Date**	**Latitude (N)**	**Longitude (W)**	**Volume (L)**
AN23 MP 1a	AF23	12-Sept-23	81.5398	64.95973	40
AN23 MP 1b	AF23	12-Sept-23	81.5398	64.95973	40
AN23 MP 2a	LSea23	14-Sept-23	82.08055	61.48024	40
AN23 MP 3a	133	18-Sept-23	79.59925	70.36817	40
AN23 MP 3b	133	18-Sept-23	79.59925	70.36817	40
AN23 MP 4a	129	19-Sept-23	78.31233	73.80533	40
AN23 MP 4b	129	19-Sept-23	78.31233	73.80533	40

AN23 MP 5a	122	20-Sept-23	77.34345	74.67073	40
AN23 MP 5b	122	20-Sept-23	77.34345	74.67073	40
AN23 MP 6a	AC16	26-Sept-23	76.02985	83.1259	40
AN23 MP 6b	AC16	26-Sept-23	76.02985	83.1259	40
AN23 MP 7	NB-01	26-Sept-23	76.83019	91.29252	40
AN23 MP 8	Ceos-M2-23	1-Oct-23	74.45932	90.5546	40
AN23 MP 11a	330	09-Oct-23	69.31964	80.55327	40
AN23 MP 11b	330	09-Oct-23	69.31964	80.55327	40
AN23 MP 12a	333	09-Oct-23	68.76755	81.00917	40
AN23 MP 12b	333	09-Oct-23	68.76755	81.00917	40
AN23 MP 13a	333	09-Oct-23	68.77151	80.83265	40
AN23 MP 13b	333	09-Oct-23	68.77151	80.83265	40
AN23 MP 14a	Fox SIPP 003	11-Oct-23	66.90856	80.81992	40
AN23 MP 14b	Fox SIPP 003	11-Oct-23	66.90856	80.81992	40
AN23 MP 15a	338	11-Oct-23	66.16719	81.32622	40
AN23 MP 15b	338	11-Oct-23	66.16719	81.32622	40
AN23 MP 16a	350	12-Oct-23	64.50794	80.47573	40
AN23 MP 16b	350	12-Oct-23	64.50794	80.47573	40
AN23 MP 17a	15G	15-Oct-23	63.86998	79.81671	40
AN23 MP 17b	15G	15-Oct-23	63.86998	79.81671	40
AN23 MP 18a	15E	15-Oct-23	64.02436	79.2148	40
AN23 MP 18b	15E	15-Oct-23	64.02436	79.2148	40
AN23 MP 19a	HS22-003	16-Oct-23	63.85282	75.10603	40
AN23 MP 19b	HS22-003	16-Oct-23	63.85282	75.10603	40
AN23 MP 20a	14E	18-Oct-23	62.27416	71.98469	40
AN23 MP 20b	14E	18-Oct-23	62.27416	71.98469	40
AN23 MP 21a	14C	18-Oct-23	62.43287	71.3093	40
AN23 MP 22a	HS22-011	19-Oct-23	61.66535	68.84603	40

11.2.9 *eDNA in water samples*

This method allows to track the biodiversity, species interactions, and evaluate ecosystem-level responses to alterations. By eDNA analyses, the presence of fish species might be detected by collecting one-liter water sample, filtering in glass microfibre filter, connected to a pressurized filtration system, and analyzing it for traces of DNA. eDNA is based on the principle that fish (and other animals) slough DNA into the water through shed scales, skin cells, feces, and other tissues. After filtration, the recovered samples were stored in scintillation vials and frozen for analysis in York University.

Table 11-10: eDNA sampling locations during Leg 4, 2023

Sample ID	**Site**	**Date**	**Latitude (N)**	**Longitude (W)**	**Volume filtered (mL)**
AN23 DNA Water 5	322 GB	07-Oct-23	70.34888	91.57084	1000
AN23 DNA Water 6	333	09-Oct-23	68.76755	81.00917	1000
AN23 DNA Water 7	334	10-Oct-23	67.87891	80.79962	1000
AN23 DNA Water 8	338	11-Oct-23	66.17122	81.32107	1000
AN23 DNA Water 9	350	12-Oct-23	64.50736	80.50185	1000

AN23 DNA Water 10	15E	15-Oct-23	64.02436	79.2148	1000
AN23 DNA Water 11	HS22-003	16-Oct-23	63.85282	75.10603	1000
AN23 DNA Water 12	14E	18-Oct-23	62.27416	71.98469	2000
AN23 DNA Water 13	HS22-013	19-Oct-23	61.27379	68.34732	1000
AN23 DNA Water 14	354	20-Oct-23	61.00378	64.71789	1000
AN23 DNA Water 15	640	21-Oct-23	58.99877	61.9051	1000

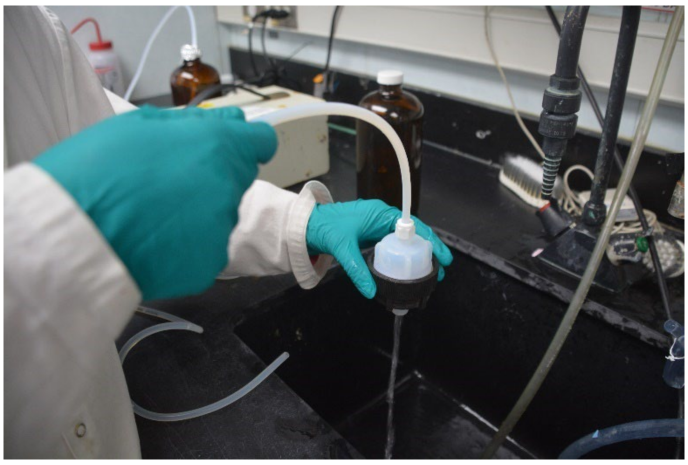

Figure 11-8: eDNA water filtration setup: putting the glass microfibre filter immediately after sampling. 20 L metal 'soda' can is pressurized and one-liter water flows through filtration unit, then water is discarded

11.2.10 *Passive sampler deploy:*

The passive sampler is used to assess contaminants in seawater. It employs a Semipermeable Membrane Device (SPMD) to accumulate residues from the dissolved phase legacy / regulated contaminants, including Polycyclic Aromatic Hydrocarbons (PAHs), Polychlorinated Biphenyls (PCBs), Polybrominated Diphenyl Ethers (PBDEs), Chlorinated Pesticides (DDT, chlordanes, etc), Dioxins and Furans.

The passive sampler was attempted to deploy on 12 October 2023, at the station 350. The cage was installed in mooring at 30 m depth. Once the sampler was installed, it floated to the surface because the cable was longer. In consequence, the mooring with the cage floated and was not immersed. The cage was recovered, it was stored in a cooler, and sent back to the laboratory to ECCC.

Table 11-11: Location for passive sampler deployment in Leg 4, 2023

Sample ID	**Station**	**Date**	**Latitude (N)**	**Longitude (W)**
Passive_1	350	12-oct-23	64.50688	80.52099

Figure 11-9: Passive sampler deploy at 350 station. Photo credit: Alejandra Granados Galvan, 2023

11.3 Preliminary Results

While on the cruise, no samples are analyzed; instead, they were processed thoroughly in clean lab. For target and non-target examination of POPs and MP abundance in all media, (air, sediment, low- and high-volume water), and zooplankton will be examined at the University of Toronto and the Environment and Climate Change Canada's (ECCC) Centre for Atmospheric Research Experiments (CARE) in Egbert, ON. The benthic and zooplankton samples will be analyzed further by Dr. Gary Stern of the University of Manitoba's Centre for Earth Observation Science. Dr. Natalie Tufenkji (McGill University) will analyze surface water samples including MPs and zooplankton for nano/microplastics. The eDNA samples (surface water and sediments) will be submitted to York University for analysis MP air samples will be shipped to Dr. Zhe Lu (University of Quebec at Rimouski, UQAR) for examination, while the OCPs/CUPs/OPFRs air samples will be analyzed by Climate Change Canada's (ECCC) Centre for Atmospheric Research Experiments (CARE).

11.4 Recommendations:

For the safe transportation of biota from the benthos lab to the clean laboratory, we recommend substituting the glass baking dish with a metallic, plastic tray, or a material compatible with the task. This precaution is especially vital during adverse weather conditions or when approaching subsequent stations.

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12 Contaminants associated to (nano)particulate matter in Arctic Ocean

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12.1 Introduction and Objectives

The fragile Arctic environment accumulates a wide variety of anthropogenic contaminants transported from all over the world. Microplastics (MPs<5 mm) have already polluted all environmental systems on Earth, including the Arctic (Peeken et al., 2018). Concerning oceanic transportation of plastic debris, thermohaline circulation is a major route from the North Atlantic to Greenland and the Barents Sea. Model simulations coupled to field measurements have demonstrated that these regions represent 95% of the total plastics accumulated in the Arctic (Van Sebille et al., 2012). MPs are tended to fragment to nanoplastics (NPs<1 μm) which are probably more harmful to human and other environmental organisms (Strungaru et al., 2019). However, there is no data or scientific proof of NPs in the Arctic at present. The same question rises regarding other types of nanoparticulate contaminants, such as black carbon or manufactured nanoparticles, of anthropic origin and potentially transported to the arctic region via air and marine currents.

During Leg 4 of the 2023 Amundsen Science expedition, we sampled from the rosette at 18 stations and filtered water with two size cutoffs through a dead-end filtration system. During each station, surface water and bottom water were collected to compare the differences between depths. Except that, we took sediments in Box Core from 8 stations and stored them in freezer. We will bring back all the filters and sediments to qualify and quantify nanoparticulate contaminants, such as nanoplastics and metal nanoparticles. Our main objective is to analyze the occurrence, concentration, sources, and potential transport behaviors of these nanoparticulate contaminants, and provide a systematic characterization and spatial distribution of nanoparticulate contaminants in Arctic Ocean.

12.2 Methodology

The dead-end filtration system is shown in the picture below (Figure 12-1). During the two-step filtration, the first size cutoff is using a 3 μm membrane filter to filter out large particles, and the filtrate will be recycled to go through the second cutoff which is a 0.2 μm membrane filter for collecting nanoparticulate matters. In addition, to analyse the dissolved species, the filtrate after the second cutoff were recycled and stored in fridge. After the campaign is done on Amundsen Leg 4, these filters containing the particulate matters, the filtrates and the sediments will be brought back to lab for further analysis to qualify and quantify nanoparticulate contaminants.

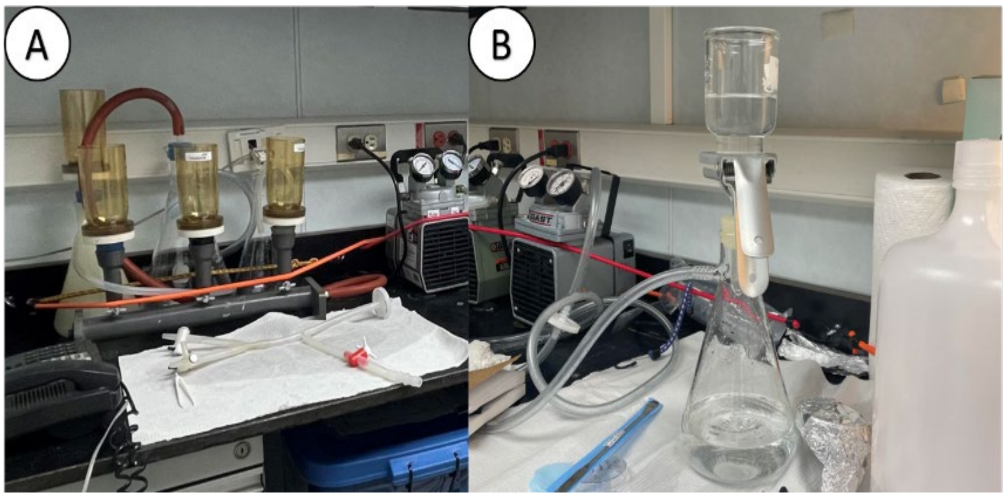

Figure 12-1: The filtration systems used for water samples. A: plastic filtration system for metal nanoparticle samples; B: glass filtration system for nanoplastic samples

Briefly, for plastic analysis, the filters will be digested to remove most of the natural organic matters; the filtrate will be filtered using 0.02 μm filters; the sediment will be put into high-density solution to suspend and extract nanoplastics. Afterwards, plastics will be analyzed using pyrolysis-GC/MS (Blancho et al., 2021). For metal and metal oxide contaminants, of (nano)particulate or dissolved nature, the samples will be first digested in acid + microwave treatment, and then analyzed by ICP-MS for the elementary composition. The size distributions of nanoparticles will be characterized using Asymmetric flow field flow fractionation and Dynamic Light Scattering and their mineralogy will be characterized by X-ray diffraction. Based on these data, we will obtain the pollution features of nanoparticle contaminants in Arctic Ocean.

12.3 Preliminary Results

The results of characterization of nanoparticles will be generated after lab analysis, there are no preliminary results for now. As far, we only have several filters, tubes of seawater, and bags of sediments. What is worthy noting, we found some dark blue microfibers on 3 μm filters of water samples close to a community, as well as a suspected plastic-like film from Tucker net (Figure 12-2).

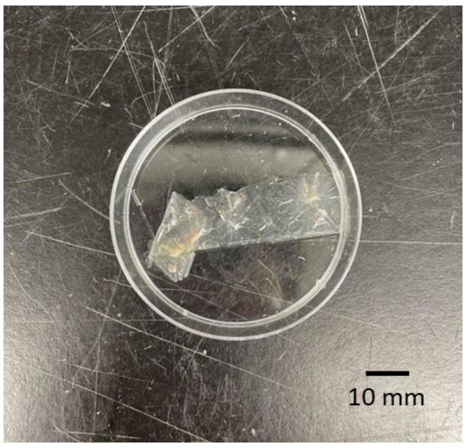

Figure 12-2: A suspected plastic-like film found on Tucker net

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13 ArcticCORE (Conservation, Observation, Research, Engagement)

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13.1 Introduction and Objectives

In August 2019, Fisheries and Oceans Canada established Tuvaijuittuq as a Marine Protected Area (MPA) with interim protection. In an Arctic Ocean with rapidly declining sea ice, the Tuvaijuittuq area retains the oldest and thickest sea ice, and can act as a refuge for ice-dependant species. However, important knowledge gaps persist because of the remote location of the area. Fisheries and Oceans Canada works with its northern partners to develop long term protection in Tuvaijuittuq according to the best scientific knowledge. The Government of Canada created a unique ecosystem research program to study the Tuvaijuittuq region, starting with the establishment of the Multidisciplinary Arctic Program (MAP)-Last Ice, and now the ArcticCORE (Conservation, Observation, Research, Engagement) program. ArcticCORE is a 5-years broader program aiming to characterize Tuvaijuittuq's unique ecosystem and its influence and connectivity with the adjacent ecosystems to inform sustainable management and conservation initiatives in Tuvaijuittuq and the eastern Arctic. The *CCGS Amundsen* research expedition, including mooring deployments for long term data collection and collection of biochemical data from the water column, enables the characterization of the marine ecosystem in the Tuvaijuittuq region and adjacent areas, and the characterization of key physical, chemical, biological and export/food web processes.

In collaboration with the Alg'O Nord, RED-AO and Refuge-Arctic projects (PI Mathieu Ardyna), we collected water samples for the calibration and validation of optical data and remote sensing products from high resolution satellite imagery. The objective is to build a strong and unique biogeochemical dataset to support, calibrate and validate the remote sensing and radiometric measurements that were accomplished concurrently.

13.2 Methodology

Water was collected from the CTD-Rosette at multiple depths for processing in the Aft Lab and the Radvan (Table 13-1). Sampled depths and analyses are reported in Table 13-2. Fractionated chl a concentration (total and >5 μm) were measured onboard using a Turner Designs 10-AU fluorometer (Parsons et al. 1984). Genomics (DNA) samples were filtered sequentially on 3 μm polycarbonate filters and 0.2 μm sterivex capsule, spiked with RNA later and kept frozen at -80 °C until further analysis. Particulate organic Carbon and particulate Nitrogen (POC/PN), fatty acid (FA), phytoplankton pigment composition determined by high performance liquid chromatography (HPLC), and particulate absorption (ap) samples were filtered on GF/F filters (pre-combusted for POC/PN and FA) and kept frozen at -80 °C until further analysis. For the measurement of absorption by CDOM (a_{CDOM}), sample water was filtered through 0.2 μm PES Express filters Whatmann ® or Polycarbonate PCTE Sterlitech filters and stored at 4°C in sealed glass bottles until further analysis by the liquid waveguide system Ultrapath (World Precision Instruments, Inc.). SPM is determined gravimetrically (as [SPM]) following recommendations by Neukermanns et al. (2012). Triplicate subsamples were filtered through pre-rinsed, pre-combusted (450°C for 4 hours), and pre-weighed GF/F filters (Whatman ®) of 25mm diameter, stored at -80°C and dried onboard at 50-60°C for 24 hours. Subsamples for Salinity, 18O, Dissolved Inorganic Carbon and total alkalinity (DIC/TA; poisoned with mercury chloride), dissolved organic Carbon (DOC; spiked with HCl), and taxonomy (preserved with 1% lugol or formol) were kept at 4 °C. Subsamples for nutrients were kept at - 20 °C and subsamples for protists and bacteria abundance measured by flow cytometry (preserved with glutaraldehyde) were kept at -80 °C until further analysis. Additionally, water samples were collected at the surface (5 m depth) and the subsurface chlorophyll maximum (SCM) at 27 stations for primary production incubations (P-E, Table 13-1). The photophysiological characteristics of different phytoplankton communities were investigated using the assimilation method of radiolabeled carbon isotopes 14C and applying photosynthesis–irradiance (P-E) relationships. Incubation experiments were carried out in the Radvan throughout the cruise and samples were analyzed onboard with the Tri-Carb 4910 TR scintillation counter (PerkinElmer, Waltham, MA) provided by Amundsen Science. Weekly wipe tests of the Radvan and scintillation counter room were also performed to prevent contamination of the ship. A detailed description of the 14C assimilation method can be found in Matthes et al. (2021). At 8 stations (Table 13-1), water samples were also collected at surface and SCM from a second rosette cast to perform nutrient enrichment experiments. Phytoplankton communities of these two depths were exposed to different light and nutrient conditions and incubated for 48-h in the on-deck incubator above the rosette shack. The on-deck incubator was provided by Amundsen Science and kept at a constant temperature of 0 °C. Underwater light levels were simulated with different light-attenuating filters (LEE).

The temperature and light levels in the first incubator compartment were monitored by a temperature sensor (HOBO logger) and a planar light sensor (LiCOR) measuring integrated photosynthetically active radiation, respectively. At different time points within the 48-h incubation period, subsamples of both depths were analyzed for several parameters including nutrient concentration, algal pigments, taxonomy, photophysiology, cell counts and particulate organic carbon following the above-mentioned sampling protocols. Additionally, at 19 stations (Table 2.1), surface water samples for optical validation and calibration were collected on the barge and processed for a_p, a_{cdom}, HPLC, as well as SPM (see methodologies above).

Four moorings were deployed as part of the ArcticCORE program by the mooring team onboard the ship, one in Archer Fiord, one in Lincoln Sea, and two in Nares Strait (on the eastern and western sides of the strait) (Figure 13-1). For more information on the mooring deployment, refer to the mooring team report.

Table 13-1: Sampling activities conducted by the ArcticCORE team during Leg 3 of the 2023 *CCGS Amundsen* expedition

Station Name	**Latitude (N)**	**Longitude (W)**	**Rosette Cast**	**Date**	**Water biogeochemistry**	**Barge**	**Genomics**	**Nutrient enrichment experiment**
AC14	75.495	78.855	2	9-Sep	F	X	X	X
AF23*	81.54	64.96	4	12-Sep	F		X	X
AC3	81.48	66.48	5	13-Sep	F		X	
AC2	81.54	65.84	7	13-Sep	F[1]	X	X	
LSea23*	82.07	61.48	8	14-Sep	F		X	
AC1	81.70	64.10	9	14-Sep	F[1]	X	X	
AC4	81.40	64.33	11	15-Sep	F[1]	X	X	X
AC18	80.32	69.72	12	16-Sep	F	X	X	
AC19	80.26	69.02	15	16-Sep	F		X	
AC20	80.30	67.88	18	17-Sep	F		X	
134	80.04	68.62	21	17-Sep	F[1]	X	X	X
133	79.61	70.37	23	18-Sep	F[1]		X	
129	78.31	73.77	25	19-Sep	B[1]			
Nares West-23*	78.31	74.88	27	19-Sep	F		X	
Nares East-23*	78.32	73.18	29	20-Sep	F	X	X	X
122	77.34	74.61	31	21-Sep	F[1]		X	
AC12	77.19	78.40	33	22-Sep	F	X	X	X
AC13	76.39	78.42	36	23-Sep	F	X	X	
Site 1.2	76.59	78.65	39	24-Sep	F[1,4]	X		
BG-02	75.66	81.26	42	25-Sep	B[1]			
BG-01	75.66	81.33	45	25-Sep	F[1,4]	X		
BG-03	75.66	81.21	46	25-Sep	F[1,2,4]			

BG-04	75.66	81.16	47	25-Sep	B[1]			
BG-07	75.76	80.34	49	25-Sep	F[1,4]			
AC16	76.10	83.23	51	27-Sep	F		X	X
Site 4.6.1	76.41	82.98	52	27-Sep	B[1,5]			
Sverdrup out	75.82	83.12	53	28-Sep	B[1]			
Sverdrup in			N/A	28-Sep	B[1,3]	X		
JonesS-23	75.99	86.49	54	28-Sep	F[1,4]		X	
AC17	76.25	88.25	56	29-Sep	F		X	
NB-01	76.84	91.27	58	29-Sep	F[1]	X	X	X
NB-02	76.92	98.40	59	30-Sep	F[1,2]	X	X	
CB-01	74.90	83.59	62	2-Oct	F[1,4]	X		
CB-02	74.87	83.48	63	2-Oct	B[1]			
CB-03	74.83	83.39	64	2-Oct	F[1,2,4]			
CB-05	74.78	83.20	65	2-Oct	F[1,2,4]			
CB-06	74.67	83.21	66	2-Oct	B[1]			
CB-04	74.82	83.17	67	3-Oct	B[1,6]			
CB-07	74.39	83.14	69	3-Oct	F[1,4]			

F=Full Station, B=Basic Station (duplicate of chlorophyll a total and POC/PN at surface and SCM); [1]No DOC; [2]No P-E curves; [3]Only a surface sample collected from the barge; [4]Additionally, sampled Flow cytometry (protist and bacteria) and chlorophyll a (total and >5 μm) at 20 and 80 m and P-E curves, phyto taxonomy, FRRF, HPLC and AP at 5m and SCM.; [5]No DNA; [6]HPLC, a_{CDOM}, SPM and a_P at surface, 20m, SCM and 60m; *Mooring deployed

Table 13-2: Sampling details for water column biochemistry sampled by the ArcticCORE team during Leg 3 of the 2023 *CCGS Amundsen* at Full stations.

Depth (m)	DIC/TA	DOC	Salinity	^{18}O	Flow cytometry		Chlorophyll *a*		Phyto taxonomy	IFCB	DNA	Phyto fatty acid	POC/PN	FRRF	P-E	CDOM	SPM	AP	HPLC
					Bacteria	Protist	Total	> 5μm											
5	1x	1x	1x	1x	2x	2x	2x	2x	2x*	3x	1x	2x	2x	1x	1x	1x	3x	1x	1x
7	1x		1x	1x															
10	1x	1x	1x	1x			2x	2x											
20	1x	1x	1x	1x	2x	2x	2x	2x		3x						1x		1x	1x
30	1x	1x	1x	1x			2x	2x											
SCM	1x		1x	1x	2x	2x	2x	2x	2x*	3x	1x	2x	2x	1x	1x	1x		1x	1x
40	1x	1x	1x	1x	2x	2x	2x	2x											
50	1x	1x	1x	1x			2x	2x											
60	1x	1x	1x	1x	2x	2x	2x	2x		3x						1x**		1x	1x
80	1x	1x	1x	1x	2x	2x	2x	2x											
100	1x	1x	1x	1x	2x	2x	2x	2x											

150	3x	1x	1x	1x															
200	1x		1x	1x							1x								
250	1x		1x	1x															
300	1x		1x	1x															
500	1x		1x	1x															
750	1x		1x	1x															
Btm	1x		1x	1x	2x	2x					1x		2x						

* one sample preserved with formalin, and one with Lugol's acidic solution; ** in case of a deep SCM (>59m), 100m was chosen instead

13.3 Preliminary Results

13.3.1 *Phytoplankton biomass*

Depth-integrated chlorophyll *a* (chl *a*) concentrations ranged from 9.1 to 92.9 mg m^{-2} in the Leg 3 study area (Figure 13-1). Chl *a* concentration was integrated over 100 m or the entire water column when station was shallower than 100 m. Cells larger than 5 µm dominated all sampled stations (Figure 13-2). In Nares Strait and Baffin Bay, large cells represent between 70 and 80 % of the algal biomass. In general, the highest proportion of large (>5 µm) cells were found in the two visited fiords. The highest chl *a* concentration was located at the chlorophyll maximum at AC14, with a value of 3.95 mg m^{-3}. No chlorophyll maximum was found at seven stations (Figure 13-3; 133, Nares-West-23, AC17, NB-02, BG-01, BG-03 and BG-05), and eight stations had a surface chlorophyll maximum (AC3, LSea-23, AC1, AC4, AC20, Site 1.2, JonesS-23 and BG-07). Surface chl *a* concentration higher than 1 mg m^{-3} were found at AC3, AC20, JonesS-23 and BG-07. The deepest chlorophyll maximums were found in Belcher Glacier Bay, at 60-65 m and all the chlorophyll maximums at stations above 80°N were in the first 20 m of the water column.

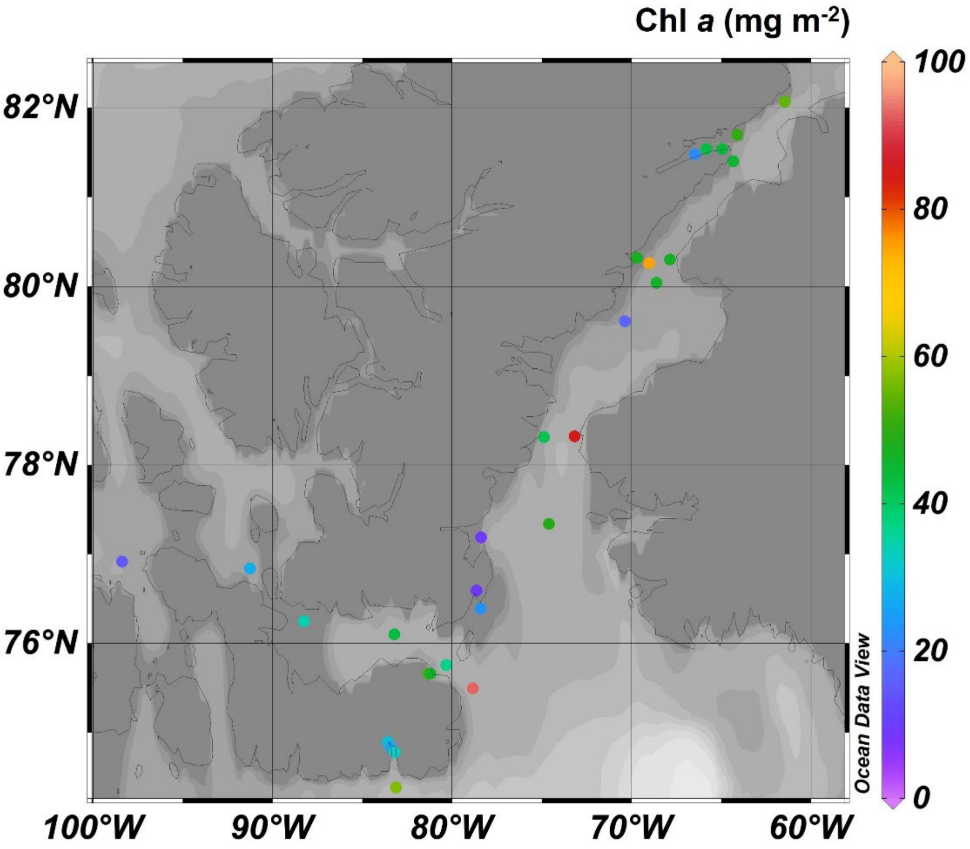

Figure 13-1: Depth-integrated chlorophyll a biomass (mg m-2) at stations sampled by the ArcticCORE team during Leg 3 of the 2023 *CCGS Amundsen*.

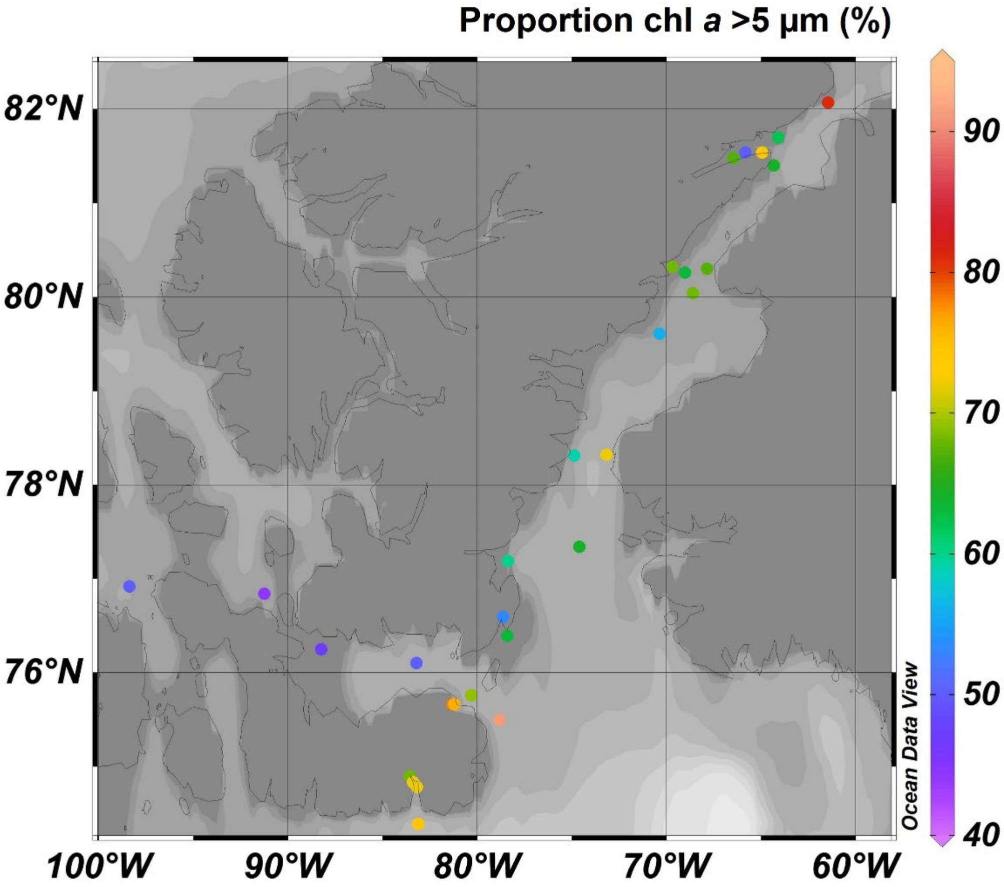

Figure 13-2: Proportion of large cells (>5 µm) at stations sampled by the ArcticCORE team during Leg 3 of the 2023 *CCGS Amundsen*

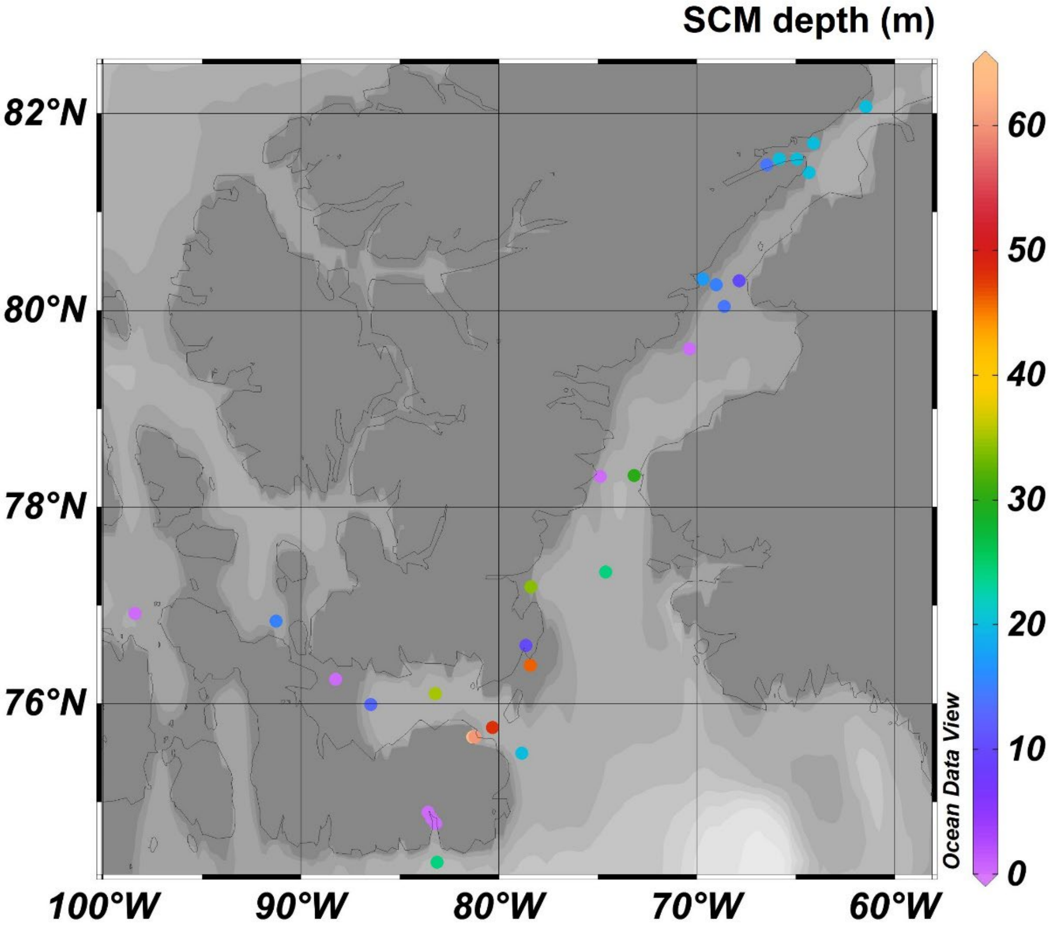

Figure 13-3: Depth of chlorophyll maximum at stations sampled by the ArcticCORE team during Leg 3 of the 2023 *CCGS Amundsen*. Light purple indicates no chlorophyll maximum

13.3.2 *Phytoplankton photophysiology*

How phytoplankton acclimated to different light intensities encountered at the surface (high light environment) and at the SCM (low light environment) in the different sampling regions was investigated by fitting photosynthesis-irradiance relationships (PE curves) to measured carbon uptake at different light levels. Figure 13-4 shows a measured PE curves for a surface and SCM phytoplankton community at stations AC4 and AC18, located in Nares Strait. Phytoplankton communities near the surface showed a greater light acclimation than communities found at deeper depths, which is displayed in a more gradual slope of the PE curve and a lower maximum photosynthetic rate that was reached at higher light levels compared to the SCM community. Phytoplankton at the SCM was well acclimated to the lower light levels, reaching the maximum photosynthetic rate after only a small increase in light levels due to the steep slope of the PE curve. At light levels >300 µmol photons m^{-2} s^{-1}, which corresponds to surface light levels measured during the expedition, the SCM community became photoinhibited, while the surface community only showed photoinhibition at light levels >600 µmol photons m^{-2} s^{-1}. Interestingly, highest photosynthetic rates regularly corresponded with the depth of the chlorophyll a maximum, which was either at the surface or at deeper depths. However, several stations displayed very low chlorophyll a concentration with no chlorophyll a maximum at any depth and low photosynthetic rates. Overall, these results provide new information on the impact of changing environmental conditions during the summer-fall transition on photosynthetic performance and productivity of natural phytoplankton communities.

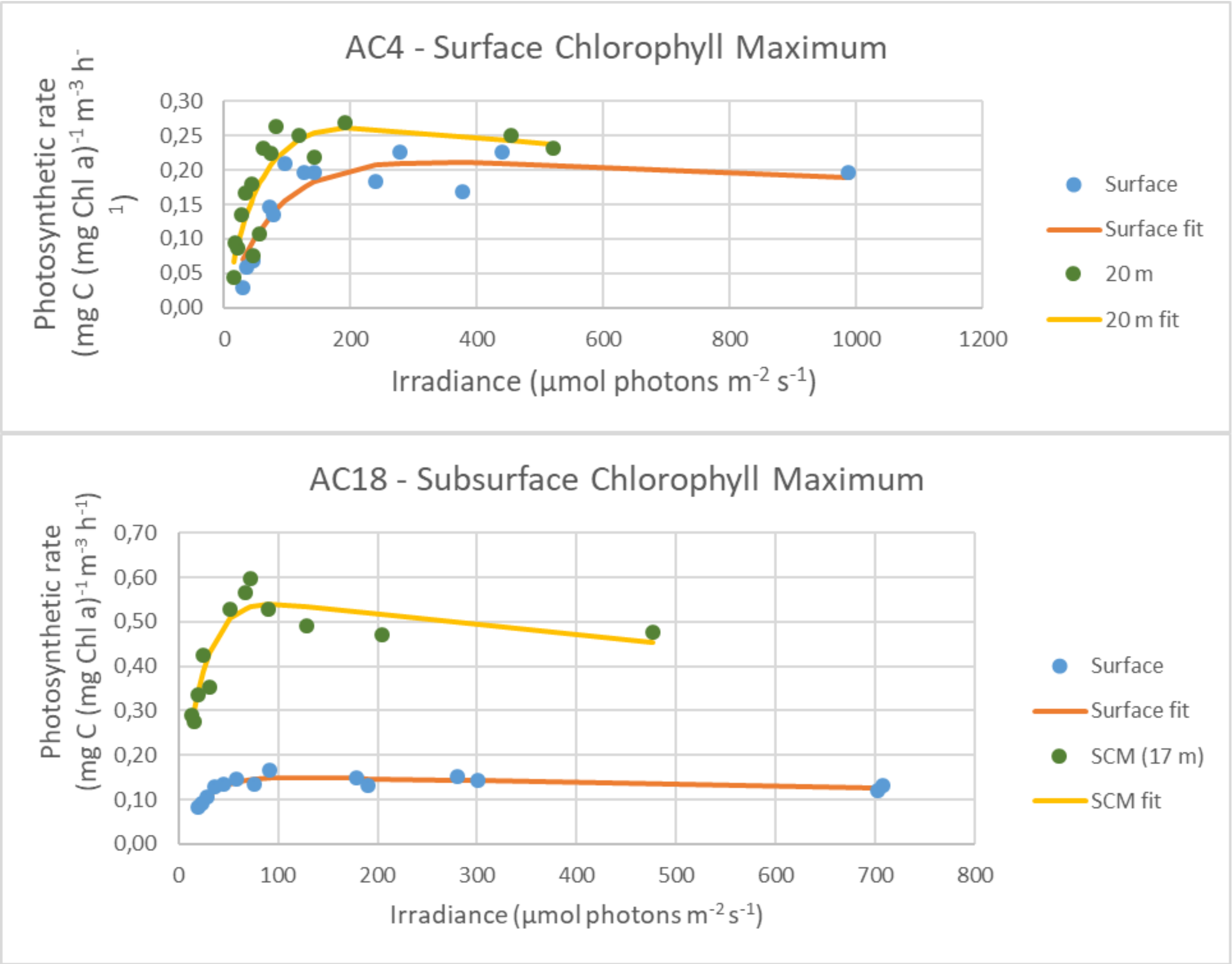

Figure 13-4: Photosynthesis-irradiance relationships of the surface and deeper or subsurface chlorophyll maximum (SCM) community at stations AC4 and AC18

13.4 Recommendations

Some measurements, ^{18}O for example, were taken by many teams onboard, ending up in many replications. For upcoming years, it would be great to coordinate with all the teams to have only one per station responsible for collecting samples for a specific analysis

There are a few things about the on-deck incubators that could be improved in future years for easier use:

- Bungee straps would help to prevent the incubator lids from flying open in heavy seas
- The slide-ins of the incubator compartments, used to install light filters, are a little too tight fit for the slide-in space. They are under high tension and break easily during installment (especially at cold temperatures).
- There was one small slide-in missing from the start
- Rubber mats around the incubator could make it less slippery.
- Could there be a horizontal bar or metal rod installed in one incubator compartment, about 5 – 10 cm below the water surface, which could be used to clamp-on/attach an underwater light sensor to it?
- More attached points should be available in the 4°C container to secure easily and properly coolers or boxes full of samples.

13.5 References

Parsons, T.R., Maita, Y., Lalli, C.M. (1984) A manual of chemical and biological methods for seawater analysis. Pergamon, Oxford.

Matthes, LC, Ehn, JK, Dalman, LA, Babb, DG, Peeken, I, Harasyn, M, Kirillov, S, Lee, J, Be´ langer, S, Tremblay, J-E´, Barber, DG, Mundy, CJ. 2021. Environmental drivers of spring primary production in Hudson Bay. Elementa: Science of Anthropocene 9(1). DOI: https://doi.org/10.1525/elementa.2020.00160

Neukermans, G., Ruddick, K., Loisel, H., & Roose, P. (2012). Optimization and quality control of suspended particulate matter concentration measurement using turbidity measurements. *Limnology and Oceanography: Methods*, *10* (DECEMBER), 1011–1023. https://doi.org/10.4319/lom.2012.10.1011

14 Microbiological survey of the water column and top sediment in Foxe Basin and Hudson Strait

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14.1 Introduction and Objectives

During Leg 2 of the 2023 Amundsen Science expedition, Zakhar sampled and filtered water from Foxe Basin, Hudson Strait, and some other adjacent areas in order to establish the baseline for the local microbial (prokaryotic) communities inhabiting the water column. For about half of the stations, sequential filtration was performed in order to distinguish between microbes associated with particles and algae and free-living microbes. In addition, sediment samples were collected for the top 0.5-1 cm in order to elucidate the microbial communities in the top sediment layer.

14.2 Methodology

Water for microbiological samples was collected from the Rosette (Figure 14-1) and filtered through Sterivex filters using a peristaltic pump. The water was always collected at the surface depth, bottom depth and, if present, chlorophyll maximum depth. This Leg, most of the time, chlorophyll maximum was weak or absent. One or two more depths, usually displaying unique temperature and salinity characteristics indicative of distinct water masses, were sampled. 1-6 L was filtered in order to achieve a satisfactory genomic content. The volume filtered depended on water availability and how fast filters clogged.

Two types of filtrations were performed: sequential and simple. For simple filtration, water was filtered through only 0.2 μm Sterivex filter. For sequential filtration, water was filtered through 20 μm, 3 μm, and 0.2 μm filters sequentially (Figure 14-2) with the goal of identifying the micribial communities associated with particles and algae.

Figure 14-1: Water being sampled from the Rosette

Figure 14-2: Sequential filtration performed in the laboratory shortly after sampling

Surface sediment samples (top 0.5-1 cm) were collected using spatula sterilized with 70% reagent alcohol. Gloves were worn for sampling and sterilized before sampling.

14.3 Preliminary Results

No samples were analyzed on site. Please refer to the table below for the sampling summary.

Table 14-1: sampling summary

Station	Date	Target Depth	Depth, db	Niskin bottle ID	Sequential filtration	Sediment
AMD23_29	6-Oct-23	surf		R	1	0
321-GB	6-Oct-23	surf		23	1	0
		chl max	20	18		
		50 m		16		
		bottom	78	1		
322-GB	7-Oct-23	surf		22	1	1
		chl max	23	17		
		140 m		6		
		bottom	205	1		
324-GB	7-Oct-23	surf		16	1	0
		chl max	16	11		
		40 m		10		
		bottom	120	1		
326-GB	7-Oct-23	surf		24	1	0
		chl max	20	19		
		40 m		18		
		bottom	72	1		
SPR-005	8-Oct-23	surf		23	1	0
		chl max	56	18		
		200 m		7		
		bottom	333	1		
SPR-004	8-Oct-23	surf		24	1	1
		chl max	44	19		
		100 m		13		
		bottom	220	1		
SPR-003	8-Oct-23	surf		23	1	0
		chl max	40	16		
		100 m		11		
		bottom	172	1		
SPR-001	8-Oct-23	surf		23	1	0
		chl max	10	18		
		bottom	17	1		
FH20-001	9-Oct-23	surf		23	1	0
		chl max	20	18		
		bottom	95	1		
330	9-Oct-23	surf		23	1	0
		chl max	20	20		
		bottom	52	1		
332	9-Oct-23	surf		23	0	0
		chl max	20	18		

		bottom	72	1		
333	9-Oct-23	surf		23	1	0
		chl max	10	21		
		bottom	22	1		
FoxSIPP-01	10-Oct-23	surf		24	0	0
		chl max	30	17		
		bottom	60	1		
334	10-Oct-23	surf		23	1	1
		chl max	30	17		
		bottom	74	1		
FoxSIPP-02	10-Oct-23	surf		23	0	0
		chl max	20	18		
		bottom	84	1		
FoxSIPP-03	10-Oct-23	surf		23	1	0
		chl max	10	21		
		bottom	86	1		
FoxSIPP-04	11-Oct-23	surf		23	0	
		chl max	30	19		
		bottom	93	1		
338	11-Oct-23	surf		23	1	1
		chl max	20	20		
		60 m		15		
		bottom	125	1		
FoxSIPP-05	11-Oct-23	surf		23	0	
		chl max	20	20		
		100 m		11		
		bottom		1		
350	12-Oct-23	surf		23	1	1
		chl max	26	18		
		160 m		8		
		bottom	379	1		
FoxSIPP-07	12-Oct-23	surf		24	1	0
		60 m		16		
		150 m		11		
		bottom	260	1		
FoxSIPP-06	13-Oct-23	surf		23	0	0
		chl max	30	19		
		120 m		11		
		bottom	253	1		
FoxSIPP-08	13-Oct-23	surf		24	1	1
		chl max	30	19		
		150 m		11		
		bottom	299	1		
AMD23_6	13-Oct-23	surf		R	1	0
FoxSIPP-09	13-Oct-23	surf		23	0	1
		60 m		15		
		160 m		9		

		bottom	371	1		
FoxSIPP-M	14-Oct-23	surf		23	1	1
		chl max	23	18		
		80 m		13		
		bottom	434	1		
FoxSIPP-10	14-Oct-23	surf		23	0	1
		40 m		17		
		120 m		11		
		bottom	393	1		
FoxSIPP-11	14-Oct-23	surf		24	0	0
		60 m		14		
		160 m		8		
		bottom	290	1		
349	15-Oct-23	surf		23	1	0
		60 m		15		
		bottom	117	1		
15H	15-Oct-23	surf		23	0	0
		chl max	20	20		
		100 m		12		
		bottom	204	1		
15F	15-Oct-23	surf		23	0	0
		60 m		15		
		160 m		9		
		bottom	308	1		
15E	15-Oct-23	surf		23	1	0
		chl max	20	20		
		120 m		11		
		bottom	302	1		
15D	15-Oct-23	surf		23	0	0
		chl max	20	20		
		100 m		12		
		bottom	231	1		
15C	15-Oct-23	surf		23	0	0
		chl max		21		
		120 m		11		
		bottom	259	1		
15A	16-Oct-23	surf		23	0	0
		60 m		15		
		bottom	109	1		
HS22-001	16-Oct-23	surf		23	0	1
		40 m		17		
		bottom	80	1		
HS22-003	16-Oct-23	surf		23	1	0
		30 m		19		
		80 m		13		
		bottom	144	1		
HS22-005	16-Oct-23	surf		23	0	0

		60 m		15		
		140 m		10		
		bottom	296	1		
SAL-01	17-Oct-23	surf		23	0	0
		20 m		20		
		60 m		15		
		bottom	111	1		
HS22-006	17-Oct-23	surf		23	0	1
		100 m		12		
		200 m		7		
		bottom	405	1		
14F	18-Oct-23	surf		23	0	0
		60 m		15		
		120 m		11		
		bottom	230	1		
14E	18-Oct-23	surf		23	1	1
		chl max	30	18		
		140 m		10		
		bottom	325	1		
14D	18-Oct-23	surf		23	0	0
		chl max	10	18		
		160 m		8		
		bottom	339	1		
14B	18-Oct-23	surf		23	1	0
		80 m		13		
		180 m		8		
		bottom	324	1		
HS22-007	18-Oct-23	surf		23	0	0
		80 m		13		
		bottom	179	1		
HS22-009	19-Oct-23	surf		23	0	0
		20 m		20		
		120 m		11		
		bottom	226	1		
HS22-011	19-Oct-23	surf		24	0	0
		100 m		13		
		200 m		8		
		bottom	293	1		
HS22-013	19-Oct-23	surf		24	1	0
		80 m		14		
		180 m		9		
		bottom	398	1		
352	20-Oct-23	surf		23	0	0
		20 m		20		
		100 m		12		
		bottom	260	1		
353	20-Oct-23	surf		22	0	0

		80 m		10		
		160 m		6		
		bottom	438	1		
354	20-Oct-23	surf		24	1	0
		50 m		15		
		200 m		6		
		bottom	522	1		
355	20-Oct-23	surf		23	0	0
		100 m		12		
		200 m		7		
		bottom	410	1		
356	20-Oct-23	surf		20	0	0
		80 m		8		
		180 m		2		
		bottom	289	1		
640	21-Oct-23	surf		23	1	0
		20 m		20		
		50 m		16		
		bottom	130	1		

Water was collected using a tubing with 350 micrometer mesh. It was filtered ASAP, with minimum or green light. Niskin bottle ID R designates a river sample.

Station SAL-01 – the permit for water sampling wasn't obtained for sequential filtration: 1 – sequential filtration, 0 – simple filtration (0.2 μm filter only) for sediment: 1 signifies collected, and 0 – not collected.

15 Plankton sampling

Project leader: André Rochon (Andre_Rochon@uqar.ca)

Cruise participant- legs 2 and 4 : Raphaël Gagné

Cruise participant- Leg 3 : Kelsey Koerner

15.1 Introduction and Objectives

The sampling undertaken during the 2023 *Amundsen* Expedition was framed within the ArcticNet project Arctic Seafloor Mapping Data Processing and Dissemination.

Benefitting from the presence of the *CCGS Amundsen* in Labrador Sea, Baffin Bay, Lancaster Sound, Barrow Strait, Nares Strait, Lincoln Sea, Jones Sound, Gulf of Boothia, Foxe Basin, Foxe Channel and Hudson Strait, the main objective of our team was to collect plankton samples and surface sediment samples in these areas to:

1) Assess the diversity, structure, and distribution of native dinoflagellate communities in the Canadian Arctic;

2) Monitor the introduction of non-indigenous and toxic dinoflagellate species.

15.2 Methodology:

During the 2023 Amundsen Expedition, 7 plankton nets were sampled during Leg 1, 30 during Leg 2, 22 during Leg 3 and 36 during Leg 4 (Table 15-1).

The samples were collected using a 20 µm plankton net (30 cm diameter) (Figure 15-1). A heavy lead weight is fixed to the plankton net, which aids the winch in movement and ensures the vertical stability of the net in the water column. The net is lowered vertically and hauled back to the surface at a constant speed of 1 ms^{-1}. The upper 100 m of the water column is sampled where the water depth is more than 100 m. If the depth is less than 100 m the net is lowered within 5 m of the bottom. Once the net has been brought on board, the outside of the net is washed with seawater and the inside walls of the net are rinsed with filtered local seawater (the seawater is filtered with a 20-micron mesh) to ensure that nothing has stuck to the net and that all plankton are collected in the godend at the base of the net. The godend is then unscrewed and the content is transferred to a 250 mL plastic bottle. 27 mL of 37% formaldehyde (4% formaldehyde solution) are added to the sample. The volume is completed to 250 mL with filtered local seawater and the bottle is sealed with black electrical tape. The bottles were then stored in a 4-degree Celsius refrigerator.

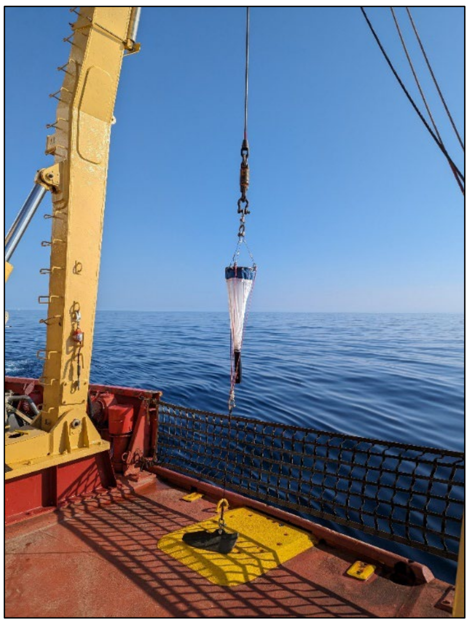

Figure 15-1: Deployment of the plankton net

Table 15-1: Plankton net stations

Leg	Time (UTC)	Time (Local)	STN	Latitude (N)	Longitude (W)	Depth (m)
1	2023/07/22 02:13	2023-07-21 22:13	Saglek Fjord	58.50012	62.68905	137.8
	2023/07/20 16:42	2023-07-20 12:42	ISECOLD-1-200	57.7125	57.7125	217.13
	2023/07/17 02:23	2023-07-16 22:23	Hopedale Saddle	56.02296	57.39005	874.07
	2023/07/23 14:17	2023-07-23 10:17	Sag Bank	59.38225	60.31759	427.25
	2023/07/25 17:12	2023-07-25 13:12	HiBio	60.46285	61.25755	518
	2023/07/27 01:42	2023-07-26 21:42	Killinek Main	60.72895	64.33032	347.23
	2023/08/07 21:13	2023-08-07 17:13	Davon	63.04310	60.32554	790.34
	2023/08/08 21:07	2023/08/08 17:07	Fobar	62,39676	66,24092	391,65
2	2023/08/13 00:32	2023/08/12 20:32	E1	68.27707	65.13754	452.42
	2023/08/13 10:49	2023/08/13 06:49	E3	68.79835	64.17310	1270.13
	2023/08/14 09:19	2023/08/14 05:19	E5	69.60397	62.54086	1966.64
	2023/08/15 04:47	2023/08/15 00:47	C5	68.14677	59.97370	1380.46
	2023/08/15 19:23	2023/08/15 15:23	C3	67.75082	61.27450	1565.04
	2023/08/16 10:12	2023/08/16 06:12	C1	67.34789	62.51909	138.13
	2023/08/16 19:29	2023/08/16 15:29	A1	66.60631	61.18966	107.95
	2023/08/17 06:37	2023/08/17 02:37	A3	66.73276	59.60721	874.67
	2023/08/17 23:43	2023/08/17 19:43	A5	66.87105	57.95519	817.82
	2023/08/18 13:51	2023/08/18 09:51	A7/196	66.98375	56.06751	129.56
	2023/08/18 22:41	2023/08/18 18:41	A9/198	67.08563	54.19937	75.15
	2023/08/20 04:34	2023/08/20 00:34	B1	67.05689	61.51935	105.15
	2023/08/21 12:30	2023/08/21 08:30	D1	67.47294	63.69309	652.26
	2023/08/25 08:14	2023/08/25 04:14	D5	69.00429	61.40423	1828.26
	2023/08/27 14:15	2023/08/27 10:15	115	76.33268	71.19098	656.21
	2023/08/28 03:39	2023/08/27 23:39	111	76.30069	73.24370	569.87
	2023/08/28 14:16	2023/08/28 10:16	108	76.26265	74.59374	448.68
	2023/08/29 01:32	2023/08/28 21:32	105	76.31722	75.76017	329.65
	2023/08/29 10:24	2023/08/29 06:24	102	76.37608	76.99922	251.38
	2023/08/29 11:15	2023/08/29 07:15	101	76.38423	77.41511	366.03

	2023/08/30 03:01	2023/08/29 23:01	148	75.35373	73.91938	589.14
	2023/08/30 10:09	2023/08/30 06:09	153	74.69436	72.72686	906.48
	2023/08/30 23:45	2023/08/30 19:45	158	74.05248	72.04806	1017.09
	2023/08/31 06:24	2023/08/31 02:24	163	73.20392	71.20549	1249.75
	2023/09/01 17:37	2023/09/01 13:37	Bylot-23	72.87030	75.77442	353.91
	2023/09/02 02:37	2023/09/01 22:37	325	73.81719	80.49453	677.52
	2023/09/02 10:41	2023/09/02 06:41	323	74.15763	80.47215	785.55
	2023/09/02 21:15	2023/09/02 17:15	322	74.49809	80.53207	662.74
	2023/09/04 13:47	2023/09/04 09:47	S5	74.21903	90.90109	296.65
	2023/09/04 20:48	2023/09/04 16:48	S8	74.40071	90.64610	197.39
3	2023/09/30 15:04	2023/09/30 11:04	NB-02	76,9212133	98,399920	433,61
	2023/09/29 19:55	2023/09/29 15:55	NB-01	76,8507653	91,1998637	137,55
	2023/09/29 05:51	2023/09/29 01:51	AC17	76,2456100	88,2482187	182,73
	2023/09/27 08:59	2023/09/27 04:59	AC16	76,0954917	83,1880317	761,78
	2023/09/24 14:58	2023/09/24 10:58	Site 1.2	76,5029272	78,7909133	130,87
	2023/09/23 12:34	2023/09/23 08:34	AC13	76,3978152	78,4079070	153,43
	2023/09/22 15:04	2023/09/22 11:04	AC12	77,1976513	78,4099512	603,76
	2023/09/21 10:09	2023/09/21 06:09	122	77,3088912	74,6737322	665,04
	2023/09/20 12:47	2023/09/20 08:47	Nares-East-23	78,3056978	73,2421327	271,25
	2023/09/19 22:00	2023/09/19 18:00	Nares-West-23	78,3111233	74,8810533	545,12
	2023/09/18 08:35	2023/09/18 04:35	133	79,6017062	70,3563795	185,35
	2023/09/17 23:35	2023/09/17 19:35	134	80,0425410	68,6152305	247,26
	2023/09/17 08:37	2023/09/17 04:37	AC20	80,3011592	67,8864275	173,27
	2023/09/17 08:30	2023/09/17 04:30	AC19	80,2996902	67,8924575	283,86
	2023/09/16 14:06	2023/09/16 10:06	AC18	80,3196930	69,7378125	189,3
	2023/09/15 19:31	2023/09/15 15:31	AC4	81,4106025	64,2715727	574,02
	2023/09/15 05:47	2023/09/15 01:47	AC1	81,7000922	64,0902757	540,08
	2023/09/14 10:52	2023/09/14 06:52	Lsea-23	82,0919307	61,3797790	542,62
	2023/09/13 18:43	2023/09/13 14:43	AC2	81,5453985	65,8394358	381,96
	2023/09/13 11:58	2023/09/13 07:58	AC3	81,4780223	66,4815803	379,49
	2023/09/13 01:12	2023/09/12 21:12	AF-23	81,5468902	64,9695798	606,38
	2023/09/09 15:46	2023/09/09 11:46	AC14	75,4935112	78,8681172	542,85
4	2023/10/07 6:56	2023/10/07 2:56	322-GB	70.39687	91.07719	211.89
	2023/10/07 17:01	2023/10/07 13:01	324-GB	70.49902	90.13775	128.43
	2023/10/07 21:23	2023/10/07 17:23	326-GB	70.60111	89.22532	87.03
	2023/10/08 9:07	2023/10/08 5:07	SPR-005	69.15951	85.66427	341.66
	2023/10/08 18:22	2023/10/08 14:22	SPR-003	68.97345	86.68482	182.26
	2023/10/08 22:58	2023/10/08 18:58	SPR-001	68.82570	87.77177	23.56
	2023/10/09 14:07	2023/10/09 10:07	FH20-001	69.68248	82.39316	131.8
	2023/10/09 21:32	2023/10/09 17:32	330	69.32575	80.57030	64.08
	2023/10/10 2:46	2023/10/09 22:46	333	68.76785	81.01758	33.87
	2023/10/10 15:25	2023/10/10 11:25	334	67.87848	80.79908	84.35
	2023/10/11 2:30	2023/10/10 22:30	FoxSIPP-03	66.90812	80.82866	97.67
	2023/10/11 13:26	2023/10/11 9:26	338	66.16839	81.32337	135.8
	2023/10/12 17:28	2023/10/12 13:28	350	64.49790	80.49595	387.73
	2023/10/13 2:10	2023/10/12 22:10	FoxSIPP-07	64.36239	81.47456	257.37
	2023/10/13 18:30	2023/10/13 14:30	FoxSIPP-08	66.00633	83.14059	308.39

	2023/10/14 10:56	2023/10/14 6:56	FoxSIPP-M	65.13895	81.34131	430.47
	2023/10/15 1:33	2023/10/14 21:33	FoxSIPP-11	64.26153	79.7885	300.63
	2023/10/15 6:05	2023/10/15 2:05	349	64.6848	78.58731	137.91
	2023/10/15 14:06	2023/10/15 10:06	15H	63.81867	79.9875	217.43
	2023/10/13 2:10	2023/10/12 22:10	FoxSIPP-07	64.36239	81.47456	257.37
	2023/10/13 18:30	2023/10/13 14:30	FoxSIPP-08	66.00633	83.14059	308.39
	2023/10/14 10:56	2023/10/14 6:56	FoxSIPP-M	65.13895	81.34131	430.47
	2023/10/15 1:33	2023/10/14 21:33	FoxSIPP-11	64.26153	79.7885	300.63
	2023/10/15 6:05	2023-10/15 2:05	349	64.6848	78.58731	137.91
	2023/10/15 14:06	2023/10/15 10:06	15H	63.81867	79.9875	217.43
	2023/10/15 19:47	2023/10/15 15:47	15E	64.03218	79.22212	309.31
	2023/10/16 3:18	2023/10/15 23:18	15C	64.21649	78.52962	270.3
	2023/10/16 21:38	2023/10/16 17:38	HS22-003	63.84825	75.1124	146.31
	2023/10/17 4:37	2023/10/17 0:37	HS22-005	63.41225	74.74102	305.78
	2023/10/17 15:12	2023/10/17 11:12	SAL-01	62.24046	75.62588	122.51
	2023/10/17 23:10	2023/10/17 19:10	HS22-006	63.04859	74.30605	416.35
	2023/10/18 7:42	2023/10/18 3:42	14F	62.21924	72.24938	235.48
	2023/10/18 10:13	2023/10/18 6:13	14E	62.27488	71.97887	337.11
	2023/10/18 19:03	2023/10/18 15:03	14C	62.4354	71.31662	328.88
	2023/10/18 21:12	2023/10/18 17:12	14A	62.52342	70.86845	339.22
	2023/10/19 2:38	2023/10/18 22:38	HS22-007	62.61092	69.90769	210.4
	2023/10/19 7:47	2023/10/19 3:47	HS22-009	62.14188	69.37471	231.91
	2023/10/19 19:08	2023/10/19 15:08	HS22-013	61.27632	68.34758	403.92
	2023/10/20 14:37	2023/10/20 10:37	353	61.16231	64.86645	320.89
	2023/10/20 17:30	2023/10/20 13:30	354	60.9979	64.73855	517.57
	2023/10/21 1:30	2023/10/20 21:30	356	60.74952	64.77428	305.97
	2023/10/21 16:53	2023/10/21 12:53	640	58.99363	61.91108	141.09

15.3 Preliminary results:

At this point, we do not have any results. The samples collected during the 2023 Amundsen expedition are stored in a 4-degree Celsius refrigerator and must be analyzed with an inverted microscope. Unfortunately, there is no such microscope on board. The analyses will have to take place at ISMER-UQAR back on land.

15.4 Recommandations:

Overall, the operations surrounding the plankton net went well. However, the thruster below the A-frame should not be used when the net is hauled to the surface. It disturbs the first few meters of the water column, which can affect the quality of the sample collected.

I would recommend installing a light above the sink in the paleoceanography lab because our team often uses it.

16 Phytoplankton community composition and molecular physiology in Arctic glacierized marine regions

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16.1 Introduction and Objectives

The Canadian Arctic is experiencing rapid environmental change due to climate warming. This warming causes glacial retreat, increased riverine influx, and alters seasonal ice cover which may impact marine ecosystems through shifting salinity stratifications and altered nutrient influxes throughout the year. Marine phytoplankton are especially susceptible to changes in physical and chemical variability in the water column. These phytoplankton form the base of marine food webs, thus changes in their composition may impact regional food chains. During Leg 3 of the 2023 Amundsen Science expedition our focus was to capture and characterize the fall microbial communities within various glaciated and unglaciated fjords in the Canadian Arctic. When available, we also collected samples from open water stations in the Nares Strait, Baffin Bay, Jones Sound and Norwegian Bay. Samples for oxygen isotope, metagenomic, metatranscriptomic, and metaproteomic analyses were collected to capture the community composition and molecular biology of the Canadian Arctic. Our group aims to connect these biological data to the physical and chemical data that was collected in tandem onboard the Amundsen to characterize the structure, status, and drivers of fall microbial community in the region.

16.2 Methodology

16.2.1 *General Methodology*

At each station where water was available, we collected large volumes (12-24 liters) of water from four depths of the euphotic zone using the CTD rosette. The depths chosen were based on the CTD profile at each station. Generally, we targeted the surface (2-5 meters), the subsurface chlorophyll maxima (15-60 meters), the base of the nutricline (40-100 meters), and a depth 50 meters below the last chlorophyll-*a* signal (100-200 meters). Once the CTD-rosette was recovered, water was collected from the Niskin bottles without prefiltering, and immediately transported to the starboard-side temperature controlled aft lab set to 4 °C for sample processing (i.e. filtration for oxygen isotopes and DNA/RNA/Proteins). Oxygen isotopes, DNA, and Protein samples were taken from the same Niskin bottle, while RNA samples were taken from a second bottle closed at the same depth. All samples will be analysed at Dalhousie University after demobilization.

16.2.2 *Oxygen Isotopes*

Oxygen isotope samples were filtered using a filtration apparatus consisting of a 0.2 µm PES filter attached to a 50 mL syringe luor lock. A new filtration apparatus (i.e. syringe and filter) was used for each station but cleaned between depths. The filtration apparatus was washed 3 times by decanting ~10-15 mL of sample seawater into the syringe and shaking before sample was pushed through 0.2 µm PES filter into a 2 mL gas chromatography vial. Each vial was filled so that the meniscus of the water was above the lip of the vial so that no headspace remained in the vial once capped. Each vial was inverted and flicked vigorously to confirm that no bubble remained. If a bubble was present the sample was discarded, and the vial was refilled as before. The lid of each vial was wrapped with electrical tapes before storage at room temperature.

16.2.3 *RNA (MetaT) filtration*

One 10-liter HDPE jerrycan was rinsed 3 times with sample water from a single Niskin bottle before collecting ~6 liter of seawater sample. Each sample was filtered onto a 0.2 µm sterivex filter unit using a peristaltic pump. The filtrate was collected in a LDPE cubitainer and measured via 2-liter graduate cylinder. The filtration ended when all the sample had passed through the unit or 1 hour had elapsed since the recovery of the rosette, whichever came sooner. All sterivex units were frozen at -80 °C immediately after processing. All RNA filters were processed and frozen within 55-65 minutes of the recovery of the rosette.

16.2.4 *DNA filtration*

One 4-liter polycarbonate bottle was rinsed 3 times with sample water from a single Niskin bottle before collecting 2-4 liters of seawater sample. When RNA samples were collected, the water for RNA was processed first while the DNA samples were stored at 4 °C in the dark until a pump was available for processing. Each water sample was filtered onto a 0.2 µm sterivex filter unit using a peristaltic pump. The filtrate was collected in a LDPE cubitainer and measured via 2-liter graduated cylinder. The filtration ended when all the sample had passed through the unit. All sterivex units were frozen at -80 °C immediately after processing. All DNA filters were processed and frozen within 1-3 hours of the recovery of the rosette.

16.2.5 *Protein filtration*

One 10-liter HDPE jerrycan was rinsed 3 times with sample water from a single Niskin bottle before collecting 8-10 liters of seawater sample. Each sample was filtered onto a 0.2 µm sterivex filter unit using a peristaltic pump. The filtrate was collected in a LDPE cubitainer and measured via 2-liter graduate cylinder. The filtration ended when all the sample had passed through the unit or 2 hours had elapsed since the beginning of filtration, whichever came sooner. All sterivex units were frozen at -80 °C immediately after processing. All RNA filters were processed and frozen within 3 hours of the recovery of the rosette.

Table 16-1: Overview of samples taken by the Bertrand Lab group aboard the CCGS Amundsen during Leg 3, 2023

Station Name	Region	Date	Latitude (N)	Longitude (W)	Cast Number	Depths (m)	DNA	Protein	MetaT	O.I.
AM23-AC14	Baffin Bay	9/9/2023	75°29.8863'	78°50.9239'	1	3, 22	x	x		x
AM23-AF23	Archer Fjord	9/12/2023	81°32.3916'	64°57.5755'	3	2, 20, 68	x	x		x
AM23-AC3	Archer Fjord	9/13/2023	81°28.7190'	66°28.4843'	6	2, 15, 70, 150	x	x	x	x
AM23-AC2	Archer Fjord	9/13/2023	81°32.5430'	65°50.2812'	7	2, 19, 80	x	x		x
AM23-AC1	Archer Fjord	9/15/2023	81°42.0320'	64°6.0813'	9	4, 20	x	x		x
AM23-AC4	Nares Strait	9/15/2023	81°24.0526'	64°21.0556'	10	2, 15, 100, 150	x	x		x
AM23-AC18	Nares Strait	9/16/2023	80°19.1925'	69°43.5782'	12	2, 17	x	x		x
AM23-134	Nares Strait	9/17/2023	80°2.3100'	68°36.4764'	20	2, 17, 58, 120	x	x		x
AM23-133	Nares Strait	9/18/2023	79°35.9270'	70°22.2410'	22	3, 40, 50, 125	x	x		x
AM23-129	Nares Strait	9/19/2023	78°18.6148'	73°47.8330'	24	3, 25, 60, 125	x	x		x
AM23-NaresW-23	Nares Strait	9/19/2023	78°19.4362'	74°49.0259'	26	2, 31, 100, 150	x	x		x
AM23-NaresE-23	Nares Strait	9/20/2023	78°19.8132'	73°9.0728'	28	2, 17, 40, 125	x	x		x
AM23-122	Baffin Bay	9/21/2023	77°20.6205'	74°40.1817'	30	3, 22, 70, 125	x	x		x
AM23-AC12	Baffin Bay	9/22/2023	77°11.7245'	78°23.9200'	34	2, 43, 100, 150	x	x		x
AM23-AC13	Cape Norton	9/23/2023	76°24.0451'	78°24.8396'	35	2, 43, 60, 100	x	x		x
AM23-1.2	Cape Norton	9/24/2023	76°35.2496'	78°39.2267'	39	2, 20, 60	x	x	x	x
AM23-BG-06	Belcher Glacier	9/25/2023	75°42.7371'	80°42.3140'	41	4, 35, 80, 125	x	x		x
AM23-BG-02	Belcher Glacier	9/25/2023	75°39.540'	81°15.971'	42	3, 46, 90, 150	x	x		x
AM23-BG-01	Belcher Glacier	9/25/2023	75°39.557'	81°15.974'	44	2, 72, 110, 150	x	x	x	x
AM23-BG-03	Belcher Glacier	9/25/2023	75°39.559'	81°12.607'	46	2, 60, 90, 150	x	x		x
AM23-BG-04	Belcher Glacier	9/25/2023	75°39.814'	81°09.763'	47	2, 61, 90, 150	x	x		x
AM23-BG-07	Belcher Glacier	9/26/2023	75°45.396'	80°21.233'	48	2, 54, 85, 125	x	x		x
AM23-AC16	Jones Sound	9/27/2023	76°01.7906'	83°07.5681'	50	2, 55, 95, 125	x	x	x	x
AM23-4.6.1	Grise Fiord	9/27/2023	76°24.5655'	82°58.5585'	52	2, 30, 80, 125	x	x		x
AM23-SG-01	Sverdrup Glacier	9/28/2023	75°44.615'	83°14.802'	Barge	1	x	x		x
AM23-SG-02	Sverdrup Glacier	9/28/2023	75°49.1669'	83°07.1842'	53	2.5, 20, 33, 66	x	x		x
AM23-AC17	Jones Sound	9/29/2023	76°17.0462'	88°12.8048'	55	2, 25, 60, 125	x	x	x	x
AM23-NB-01	Norwegian Bay	9/29/2023	76°50.1120'	91°17.2310'	57	2, 22, 60, 125	x	x	x	x
AM23-CB-01	Croker Bay	10/2/2023	74°53.7641'	83°35.1522'	62	2, 40, 50, 100	x	x	x	x
AM23-CB-02	Croker Bay	10/2/2023	74°52.0631'	83°28.9512'	63	2, 40, 144, 200	x	x		x
AM23-CB-03	Croker Bay	10/2/2023	74°49.7767'	83°23.5268'	64	2, 25, 90, 125	x	x		x
AM23-CB-05	Croker Bay	10/3/2023	74°47.0054'	83°12.3010'	65	2, 15, 75, 125	x	x		x
AM23-CB-06	Croker Bay	10/3/2023	74°46.1326'	83°12.8185'	66	2, 40, 95, 125	x	x		x
AM23-CB-04	Croker Bay	10/3/2023	74°49.1803'	83°10.1689'	67	2, 40, 80, 125	x	x		x
AM23-CB-07	Croker Bay	10/3/2023	74°23.1937'	83°08.5847'	68	3, 22, 100, 125	x	x		x

16.3 Preliminary Results

No results are available at this time.

16.4 Recommendations

For the first couple of weeks of the cruise, the lights leading from the rosette container to the aft labs were off during the nights and it was difficult to see. These were turned on later in the cruise, but it would be good to have these on from the beginning if sampling is happening.

16.5 References

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17 Fish and Zooplankton Ecology and Acoustics

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17.1 Introduction and Objectives

Communities of mesopelagic organisms and zooplankton in the Canadian Arctic have been deficiently recorded to represent their true biodiversity and abundance, creating a knowledge gap. Mesopelagic organisms, who form dense mid-water aggregations across the global ocean known as deep sound scattering layers (DSLs), are presumed to be responsible for the largest biomass aggregations of animal life on the planet and provide a crucial energy link to the deep ocean (Proud et al. 2017). However, this midwater scattering may be biased by traditional net sampling techniques which introduce selectivity bias based on avoidance behavior and size. In many cases, gelatinous zooplankton and fast-swimming meso-zooplankton avoid capture and thus may be underestimated in the ecosystem.

In this study, to account for the uncertainty, high resolution acoustic imaging were combined (hull-mounted EK80 and a moored AZFP) with traditional midwater trawls (Isaac-Kidd Midwater Trawl –IKMT), depth-stratified plankton net sampling (Hydrobios plankton net) to establish baseline knowledge on the current occurrence and distribution of pelagic fish species in the Canadian Arctic/subarctic; (2) document inter-annual and seasonal variation in fish and zooplankton and identify the biological and environmental drivers of these variations; (3) collect specimens, fisheries acoustic transects, and optical data towards pan-Arctic and/or regional comparisons of trophic relationships, contaminants in benthic and pelagic taxa, and environmental drivers of species distributions with other research groups. (4) describing the condition of Calanus populations in Baffin Bay during 3 at the start of the winter in terms of stage composition, vertical distribution, and lipid content.

Table 17-1: List of sampling sites with their latitude, longitude and associated sampling activity for the 2023 Amundsen Expedition

Leg	Station ID	Date (UTC)	Latitude (N)	Longitude (W)	Monster	Tucker	Hydrobios	Beam Trawl	IKMT	UVP	WBAT
1	Hopedale Saddle	2023/07/17	56.02308	57.38608			x				
	ISECOLD-0-200	2023/07/18	56.28700	58.90713			x	x		x	
	Sentinel	2023/07/18	56.28215	59.75355		x	x		x	x	
	ISECOLD-1-200	2023/07/20	57.71151	60.20215		x	x	x		x	
	Okak Bay	2023/07/21	57.52912	62.07734	x			x		x	
	Saglek Fjord	2023/07/22	58.49971	62.68875			x	x		x	
	ISECOLD-2-200	2023/07/23	58.71508	61.18741		x	x	x		x	
	SagBank	2023/07/23	59.38328	60.32321		x	x		x	x	
	Hatton Basin	2023/07/25	60.49743	61.23324		x	x		x	x	
	ISECOLD-3-200	2023/07/26	60.44416	62.58276		x	x	x		x	
	Killinek Main	2023/07/27	60.72984	64.32838		x	x	x		x	
	Hatton 600	2023/07/28	61.43220	63.24735		x	x		x	x	
	DS1	2023/08/02	66.25761	58.29269					x		
	Otolith 4	2023/08/02	66.21500	58.45597					x		
	DS2	2023/08/03	65.33528	58.01674		x	x		x		
	DS3	2023/08/04	64.64965	58.60654					X		
	E1	2023/08/12	68.276667	65.136443		x	x	x		x	
	E3	2023/08/13	68.801155	64.174442		x	x			x	
	E4	2023/08/13	69.247270	63.312806					x	x	
	E5	2023/08/14	69.606069	62.537480		x	x		x	x	

2	C5	2023/08/15	68.147824	59.978193		x	x		x	x	
	C3	2023/08/15	67.754152	61.296546		x	x		x	x	
	C1	2023/08/16	67.344047	62.530579		x	x	x		x	
	A1	2023/08/16	66.614560	61.192966		x	x	x		x	
	A3	2023/08/17	66.725401	59.609328		x	x		x	x	
	A5	2023/08/17	66.871124	57.952922		x	x		x	x	
	A7/196	2023/08/18	66.985161	56.070123		x	x	x		x	
	A9/198	2023/08/18	67.091499	54.193764	x	x		x		x	
	B1	2023/08/20	67.065459	61.520430		x	x	x		x	
	D1	2023/08/21	67.482479	63.727309		x	x		x	x	
	D3	2023/08/22	68.248891	62.626347		x	x		x	x	
	D5	2023/08/25	69.001627	61.403981		x	x		x	x	
	115	2023/08/27	76.329872	71.214503		x	x		x	x	
	111	2023/08/28	76.303840	73.281565		x	x	x		x	
	108	2023/08/28	76.258716	74.603934	x	x	x		x	x	
	105	2023/08/29	76.320111	75.836638		x	x	x		x	
	101	2023/08/29	76.385391	77.445267		x	x	x		x	
	148	2023/08/30	75.351255	73.927316						x	
	153	2023/08/30	74.691419	72.757458	x	x			x	x	
	158	2023/08/30	74.048740	72.031084		x	x			x	
	163	2023/08/31	73.196194	71.203271	x	x			x	x	
	325	2023/09/02	73.817092	80.520563		x	x			x	
	323	2023/09/02	74.156603	80.471614		x	x		x	x	
	322	2023/09/02	74.497926	80.526019		x	x			x	
	S8	2023/09/04	74.390313	90.646562		x	x	x		x	

	S5	2023/09/04	74.219721	90.937467		x	x	x		x	
3	AC14	2023-09-09	75.493236	78.845234		x	x		x	x	
	AC2	2023-09-13	81.543748	65.835944	x					x	x
	AC3	2023-09-13	81.479280	66.478744	x	x				x	x
	AF-23	2023-09-13	81.547366	64.970891			x			x	x
	Lsea-23	2023-09-14	82.060827	61.484382			x		x	x	x
	AC1	2023-09-15	81.70164	64.095157	x		x			x	x
	AC4	2023-09-15	81.404100	64.368816			x		x	x	x
	AC18	2023-09-16	80.316691	69.729740	x					x	x
	AC19	2023-09-16	80.251802	69.084148			x	x		x	x
	134	2023-09-17	80.039882	68.616200			x			x	x
	AC20	2023-09-17	80.304431	67.901063	x					x	x
	133	2023-09-18	79.598559	70.362128	x					x	x
	129	2023-09-19	78.305683	73.773668			x			x	x
	Nares-West-23	2023-09-19	78.311057	74.881765	x			x	x	x	
	Nares-East-23	2023-09-20	78.323318	73.181957	x					x	
	122	2023-09-21	77.335625	74.653940			x		x	x	
	CEOS-M1-23	2023-09-21	77.185635	71.076200						x	
	AC12	2023-09-22	77.197790	78.407850			x	x		x	
	AC13	2023-09-23	76.401108	78.415069	x			x		x	
	Site 1.2	2023-09-24	76.502009	78.794448				x		x	x
	BG-04	2023-09-25	75.678509	81.174359						x	x
	AC16	2023-09-27	76.050222	83.156199			x		x	x	x
	AC17	2023-09-29	76.281123	88.229665	x			x			

	NB-01	2023-09-29	76.828875	91.291502	x			x			
	NB-02	2023-09-30	76.920881	98.400138			x	x			
	CB-05	2023-10-02	76.502009	78.794448	x		x				
4	SPR-004	2023-10-07	69.05042	86.2111	x	x		x			
	HS22-013	2023-10-19	61.27895	68.3639	x	x		x			
	HS22-003	2023-10-16	63.84941	75.1066		x	x	x			
	FoxSIPP-M	2023-10-14	65.13804	81.3376	x	x		x			
	FoxSipp-08	2023-10-13	66.00559	83.1516	x	x		x			
	FoxSIPP-07	2023-10-13	64.37594	81.456	x	x		x			
	FoxSIPP-03	2023-10-11	66.90975	80.8245	x	x					
	354	2023-10-20	60.9993	64.7356	x	x		x			
	350	2023-10-12	64.50177	80.4895	x	x			x		
	349	2023-10-15	64.68183	78.5862	x	x		x			
	338	2023-10-11	66.16708	81.3255	x	x		x			
	334	2023-10-10	67.87862	80.7944				x			
	333	2023-10-10	68.76797	80.9604	x	x			x		
	322-GB	2023-10-07	70.39946	91.1087	x	x					
	15E	2023-10-15	64.03064	79.2174		x					
	14E	2023-10-18	62.2761	71.9773	x	x		x			

17.2 Methodology:

17.2.1 *Acoustic sampling*

The CCGS *Amundsen* was equipped with a hull mounted EK80 broadband echosounder operating at 38, 120 and 200 kHz. The EK80 operated continuously during the legs in narrowband mode which allowed the groups to monitor the spatial and vertical distribution of zooplankton and fish, thus providing an extensive mapping of where the fishes and zooplankton are along the ship track. The calibration of the EK80 echosounder was done prior to departure.

17.2.2 *Multi-net plankton sampler (Hydrobios)*

Meso-zooplankton were sampled with a Hydrobios multinet plankton sampler (Figure 17-1C). The sampler was equipped with nine 200 µm mesh nets (opening $0.5m^2$) allowing for depth-specific sampling of the water column. The Hydrobios is also equipped with a CTD to record temperature and salinity while collecting biological samples. The multinet is deployed vertically from 1000 m (or 25-60 m off the bottom in depths shallower than 1000 m) to the surface. The nets open and close sequentially while the sampler is pulled up through the water column. The depth at which the different nets open and close is programmed before deployment and the depths programmed are based on bottom depth. Once retrieved, the zooplankton samples are preserved in 10% formalin solution and stored for further taxonomic identification at Laval University. The Hydrobios net was also used to catch live organisms to measure lipid content of Calanus from the deepest layer (approx. 100 m above sea floor) and the surface layer (60-0 m).

17.2.3 *Isaac-Kidd Midwater Trawl (IKMT)*

The IKMT sampled pelagic fish and macro-zooplankton (Figure 17-1D). The rectangular net has a 13.5 m^2 (4.5m x 3m) mouth aperture and mesh size of 11 mm in the first section and 5 mm in the last section. The net was lowered at a target depth, which was determined by the echosounder EK-80 signal, and towed at that depth for 20-30 minutes at a speed of 3 knots. All samples were sorted by species, counted, measured and weighed before being frozen at -80°C for further analyses, including compound specific isotope analysis of amino acids and molecular stomach content analysis.

17.2.4 *Beam trawl*

Demersal and benthic adult fish were sampled with a benthic beam trawl (headline = 4.27 m, footrope= 4.27 m, 9.5 mm codend mesh) (Figure 17-1E). The net was lowered using the 500T cable winch to the bottom depth. Two times the bottom depth of cable was provided to ensure that the beam trawl was securely on the bottom. The nets were deployed from the vessel at two knots and then were trawled along the bottom at the same speed for 3-10 min. All fish samples were sorted at minimum by family, if species identification could not be made. Once identified, the samples were stored in a -80°C freezer until further analysis.

17.2.5 *Double Square Net (DSN or Tucker)*

Ichthyoplankton, meso- and macro-zooplankton were sampled using a double square net (DSN or Tucker net and Monster Net) carrying two 1m^2 aperture nets (mesh size 500 µm) and one small net (50 µm) was deployed obliquely at maximum sampling depths of 100m with a ship speed of two knots (Figure 17-1B) and 0knts for the vertical tow (Figure 17-1A); The Monster net was deployed only once at the shallow Okak station (Table 17-1). If caught, fish larvae were sorted out and individually preserved in 95% ethanol while the rest of the contents in the net were stored in 10% formalin for further analyses.

17.2.6 *Underwater Vision Profiler (UVP)*

An Underwater Vision Profiler 6 High Frequency (UVP6-HF) was mounted on the CTD-rosette to take pictures of zooplankton and marine snow. The UVP took pictures during the CTD-rosette profile casts, which means that a precise depth is associated with each picture. The UVP consists of a camera with an illuminated laser diode emitting constant-power red laser flash (635nm) that takes images at a determined frequency in a precise volume of water (0.7L). The images are then extracted from the UVP with the help of UVP App 2. Subsequently, the metadata for each station are added. The data containing living organisms will then be classified by taxonomy on the EcoTaxa application for further analyses.

During Leg 1, the first deployment of the UVP was on July 18th at ISECOLD-0, and the last deployment was at BB1B on August 1st (Disko Fan). Details about the UVP deployment are present in section 18. During Leg 2, the UVP was deployed at every CTD cast and during Leg 3, the UVP was deployed from 9 to 27 september.

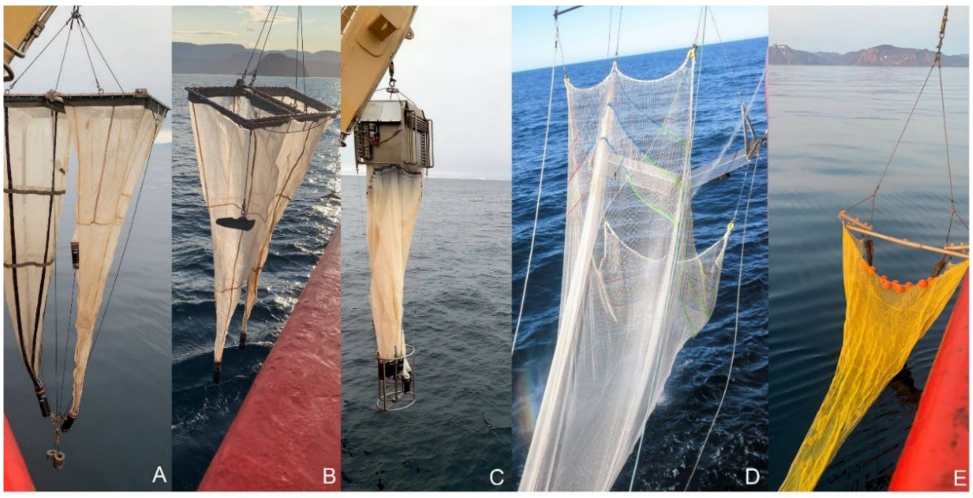

Figure 17-1: The monster (V-Tow) net (A), the tucker (O-Tow) net (B), the Hydrobios net (C), the IKMT net (D), and the beam trawl net (E) which were used to sample the fish and zooplankton communities during the 2023 Amundsen Expedition

17.3 Preliminary results

Throughout the 2023 Amundsen Expedition, a comprehensive sampling effort was carried out to study the fish and zooplankton communities. In the first Leg, 32 net deployments were conducted, followed by a substantial increase to 84 during the second Leg, 61 during the third Leg, and concluding with 42 deployments in the fourth Leg.

17.3.1 *Leg 1*

A total of 188 larval fish were collected from the tucker nets from six different families, identified, counted, and preserved. The most frequently occurring species belonged to the family Cottidae, followed by species from the Liparidae family (Figure 17-2). Larval fish hatch the late fall/early winter and fertilized eggs rise to the ice-water interface to incubate for 45-90 days. The low abundance of larval Arctic cod could be because we are too late in the season and the larval fish have already descended to depths beyond the 100m sampling limit of the Tucker net.

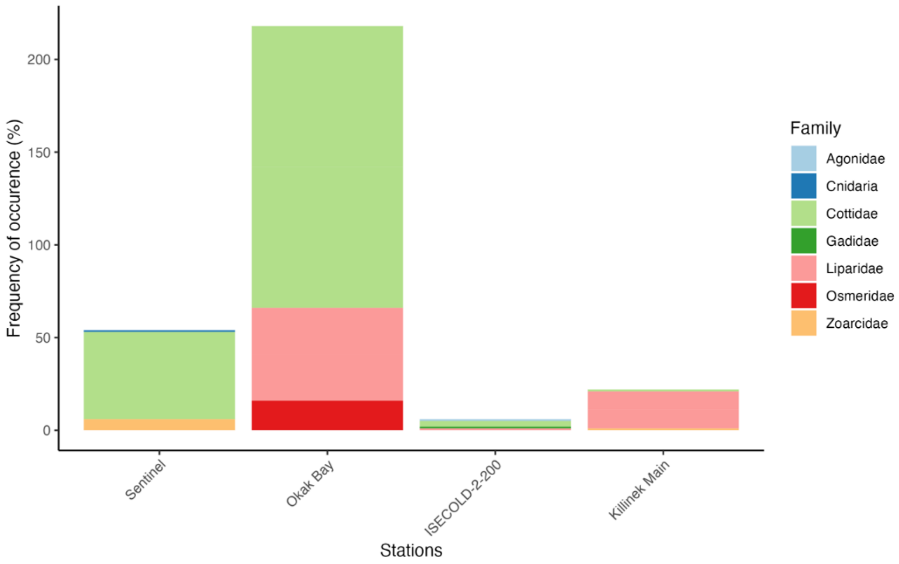

Figure 17-2: Larval fish caught at each station where the predominantly caught family was Cottidae during Leg 1

There were a total of 804 fish from 16 families caught in the Beam trawl (n=197) and IKMT (n=607) (Figure 17-3 Figure 17-4). The most frequently caught adult fish family in the IKMT were Myctophidae, followed by Paralepidae (Figure 17-4). Among the Myctophidae family, *Benthosema glacial*e was most abundant, followed by *Lampanyctus macdonaldi.* The most frequently caught families in the beam trawl were Liparidae, Gadidae, and Stichaeidae (Figure 13-3). Furthermore, 94% of the Gadidae were *Arctogadus glacialis* (polar cod) and the remaining 6% of those were *Boreogadus saida* (Arctic cod). In 2021 and 2022, Arctic cod was the dominant Gadidae caught in the ichthyoplankton nets and beam trawl but this sampling season we caught only five adult Arctic cod. Additionally, in the last two sampling seasons (2020 and 2021), the predominantly caught gadid was Arctic cod, not polar cod. Polar cod are widely distributed in the western part of the Arctic basin and Greenland coast and hatch earlier and larger than Arctic cod. The absence of Arctic cod in the same catches as polar cod could be indicative of the competition that exists between the two species or the mismatch in their life history. Furthermore, one station which had a diverse number of species was the beam trawl at Killinek Main. For example, the catch had two large eelpouts (standard lengths: 470mm and 510mm) (Zoarcidae), two redfish (Sebastidae), and twenty-three snailfish (Liparidae) (Figure 17-5). The assemblage of this catch was different to those that were caught on the Labrador shelf. This is likely because the Labrador shelf receives Arctic water from the Labrador current and therefore resembles Arctic areas, while Killinek is influenced by the Hudson Strait and resembles Hudson Bay fauna. In addition, the high currents in the Hudson Strait could be accounting for the greater productivity of benthic organisms and relatively larger fish compared to the Labrador shelf.

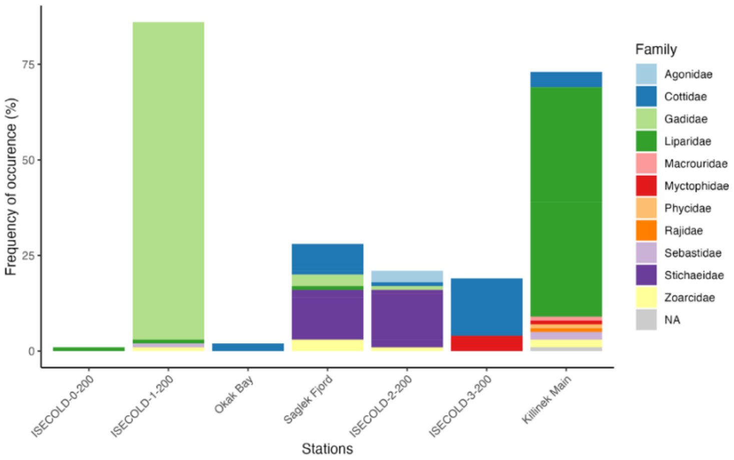

Figure 17-3: Relative abundance of adult fish caught in the benthic beam trawl where the most frequently caught family was Liparidae

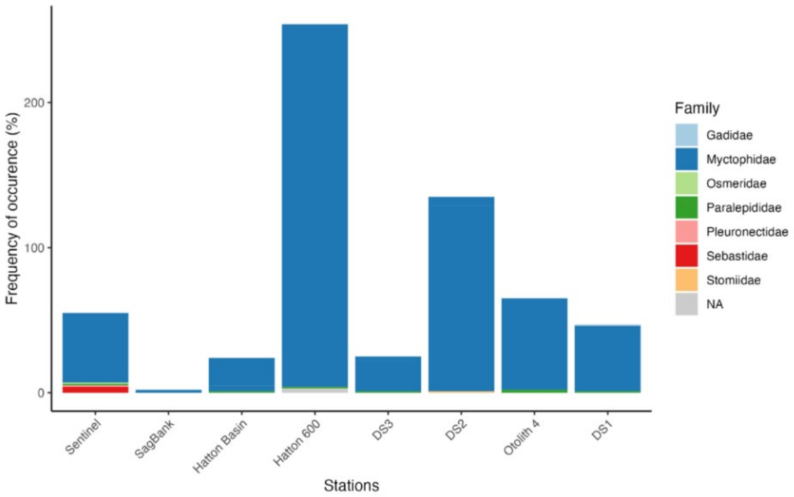

Figure 17-4: Relative abundance of adult fish caught in the IKMT where the most frequently caught family was Myctophidae

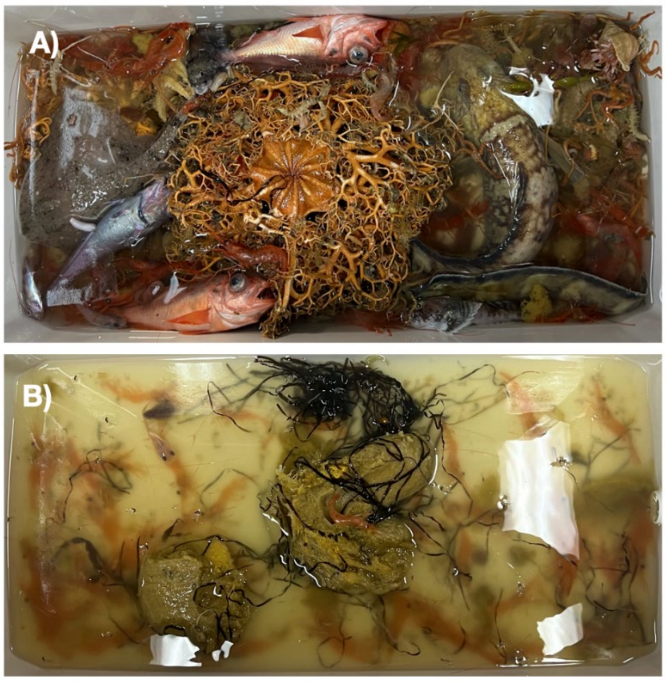

Figure 17-5: Beam trawl catches from Killinek Main (A; July 27, 2023) and ISECOLD-0-200 (B; July 18, 2023)

There were 3 636 zooplankton from 19 identified families, counted, weighed, and preserved from the IKMT and beam trawl. Cnidarians were also captured in the IKMT nets but only entire specimens were preserved for genetic analysis. Pandalidae, Cragonidae and Hyperridae were the most frequently occurring zooplankton groups in the beam trawl (Figure 17-6). Cnidaria, Ctenophora, Euphausiidae, Hyperidae, and Sagittidae typically were the most frequently occurring zooplankton groups in the IKMT (Figure 17-7).

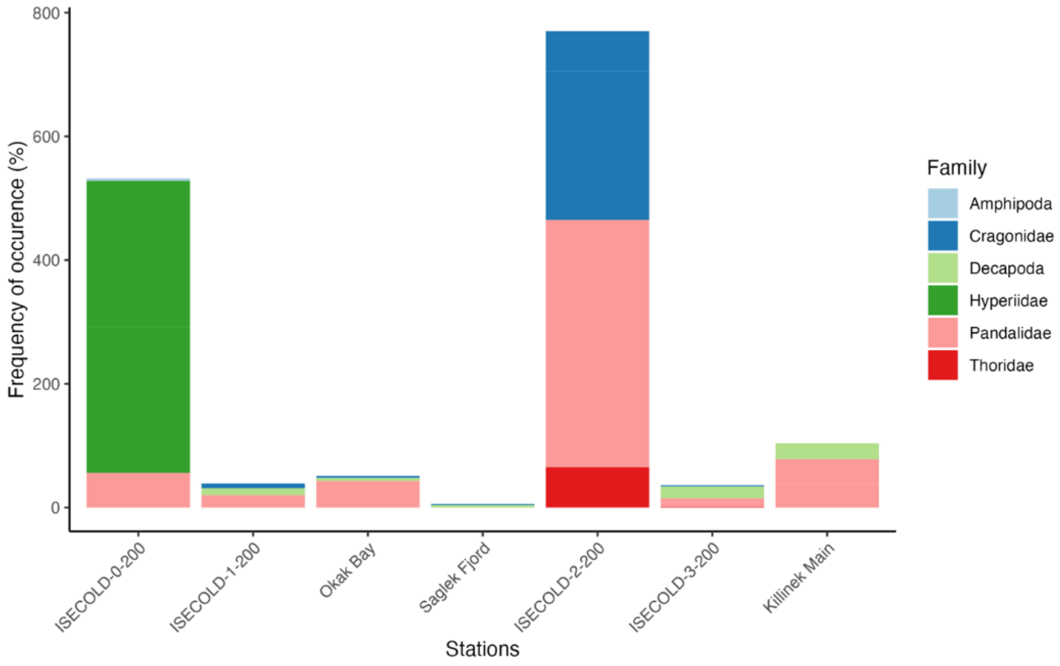

Figure 17-6: Relative abundance of macrozooplankton from the beam trawl

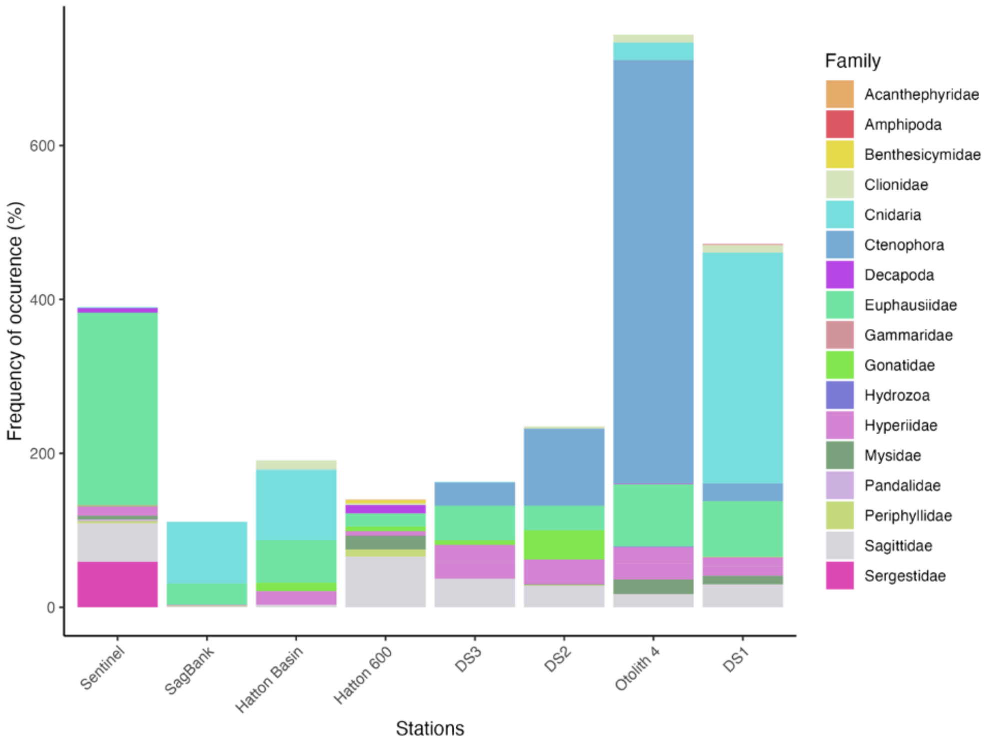

Figure 17-7: Relative abundance of macrozooplankton from the pelagic trawl

17.3.2 *Leg 2*

A total of 84 net deployments were conducted to sample the fish and zooplankton communities (Beam trawl n=11, IKMT n = 14, Tucker n = 29, Monster n = 4, Hydrobios n = 26; Table 17-1). Leïla Brunner received 141 zooplankton and 29 fish samples for stomach content and stable isotope analysis from the Tucker net, IKMT and beam trawl, from stations 163, 153, 108. Zooplankton samples from 29 tucker nets were given to Lenore Vandenbyllaardt with the Arctic fish section, Fisheries and Oceans Canada. Collaboration with multiple teams is an integral part of 'ArcticFish'. These projects help to piece together the puzzle that better understands fish and zooplankton communities in the Arctic.

There were 9216 zooplankton from 15 and 11 groups identified, counted, and preserved from the IKMT nets from the KEBBAB and Northern Open Water (NOW) stations respectively. 1301 Cnidarians and 900 Ctenophora were also captured in the IKMT nets, enumerated and one specimen per species was preserved for Eugenie Jacobsen's genetic analysis. These numbers may be inaccurate due to limited resources and knowledge for identification. Photos and genetic analysis will close the knowledge gap on this. Ctenophora, Clionidae, Cnidaria, Chaetognatha and Mysidae were the most frequently occurring zooplankton groups in the KEBBAB transects (Figure 17-8). Mysidae and Hyperridae had the highest relative abundance for the NOW line (108 and 115) and stations 153, 163, 323 (Figure 17-9).

There were 1760 larval fish collected from the Tucker and Monster nets from four different families identified, counted, and preserved. The most frequently occurring species were Arctic cod, followed by species from the Liparidae families (Figure 17-11 Figure 17-12). Ninety-eight percent (98.3%) of the larval fish captured were from the Gadidae family (n = 1730), followed by Liparidae family (n = 26). The average standard length of these larval Arctic cod was 19.23mm (SD=6.25mm) (Figure 17-10).

There were 486 fish from 10 families caught in the IKMT (n = 270) and Beamtrawl (n = 216) nets. The most frequently caught species were in the families: Cottidae, Liparidae, Gadidae, and Myctophidae (Figure 17-11 Figure 17-12). Myctophids who are considered a sub-arctic species ranging as far as the North Atlantic were found in high numbers in the KEBBAB stations near Greenland beyond Davis Strait.

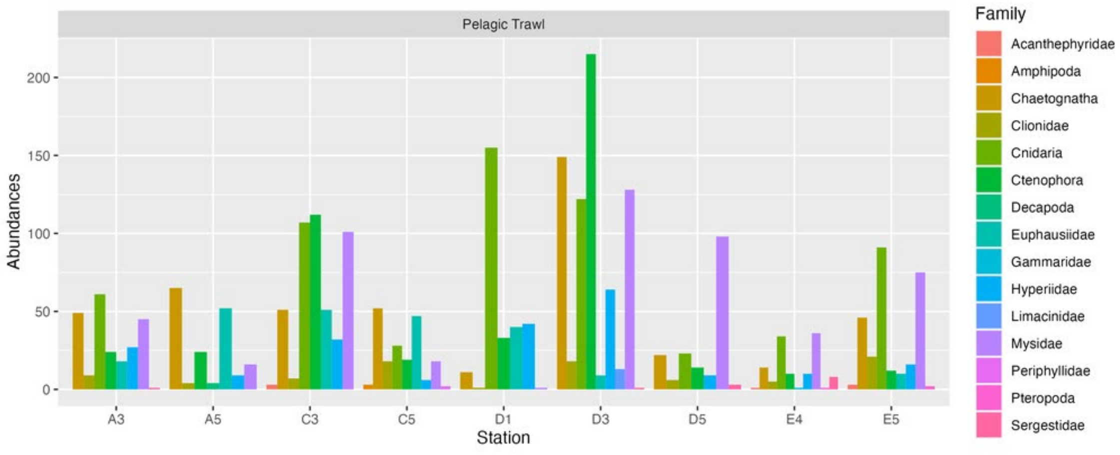

Figure 17-8: Abundance of macrozooplankton from the pelagic trawl for the KEBBAB transects A, C, D and E

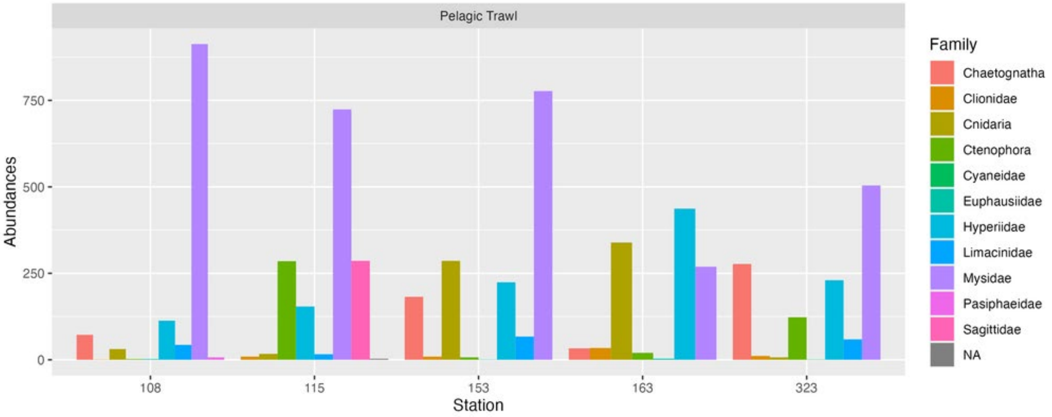

Figure 17-9: Abundance of macrozooplankton from the pelagic trawl for the Northern Open Water line (108 and 115) and stations 153, 163, 323

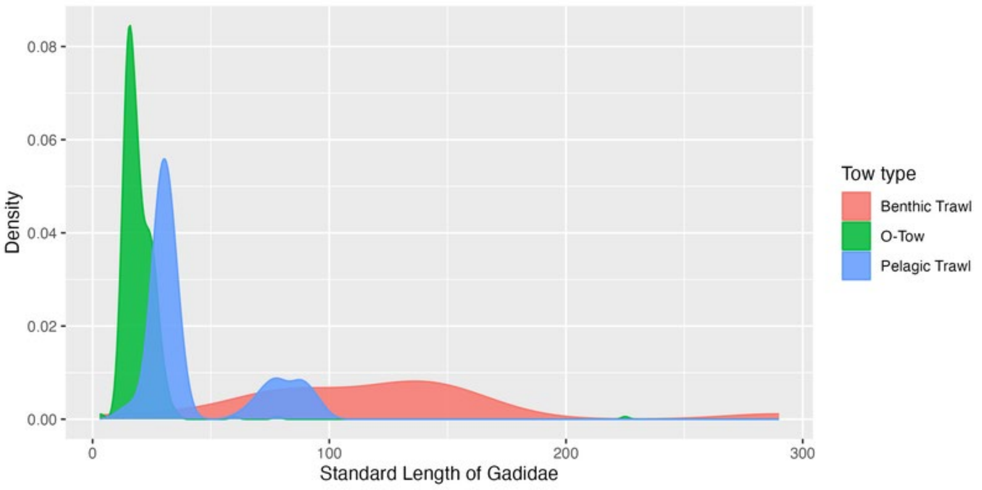

Figure 17-10: Density of standard lengths of Gadidae, adult and larval stages, from all sampling sites using different sampling techniques

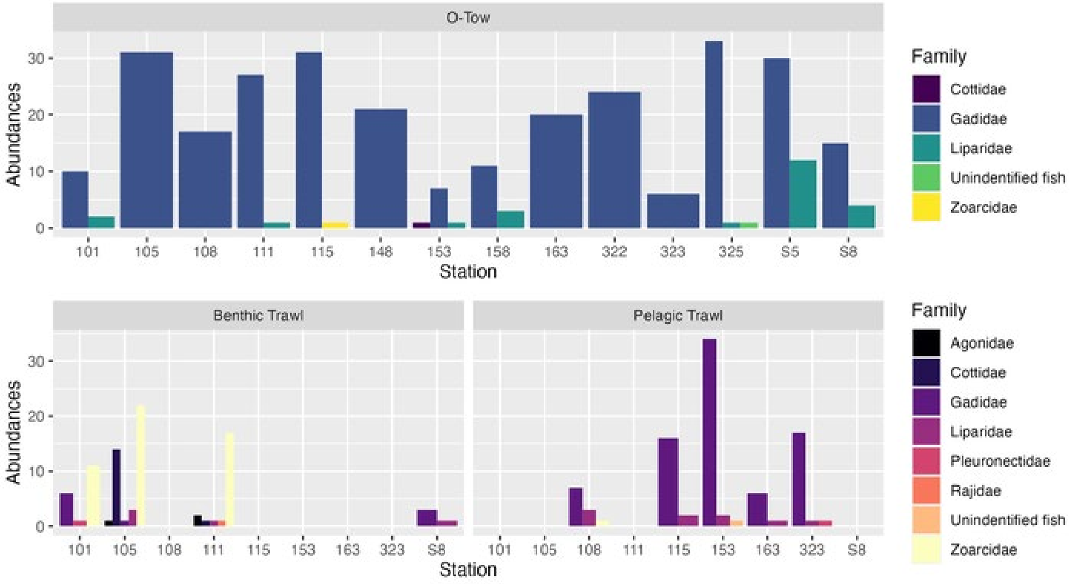

Figure 17-11: Abundance of Arctic fish species caught by the three different trawl types from the KEBBAB transects A, B, C, D and E

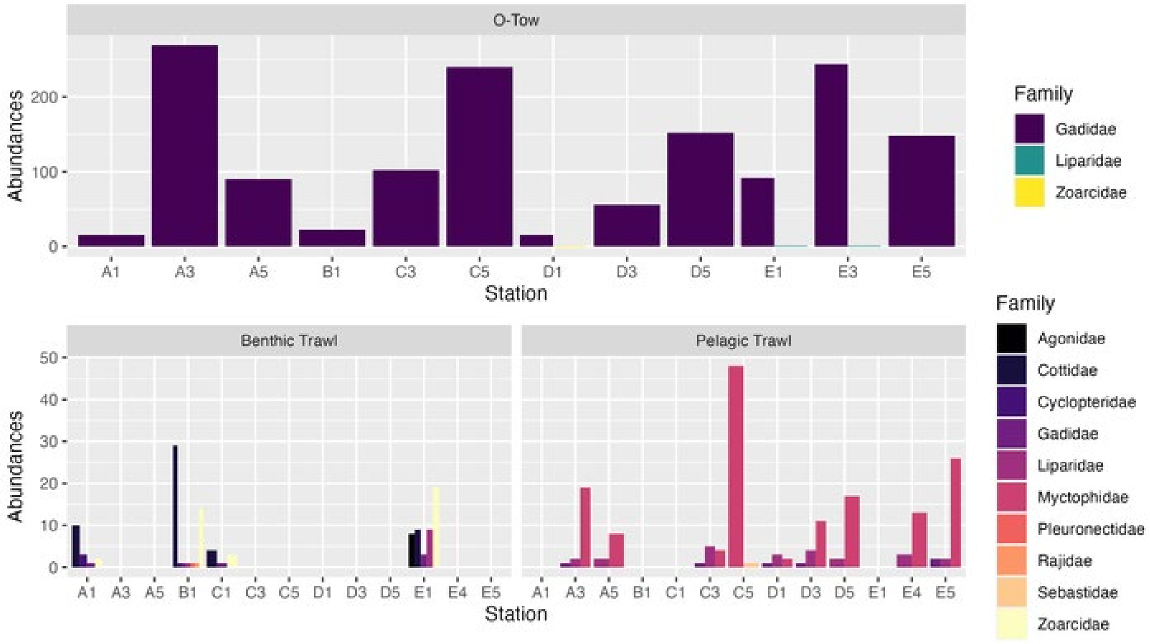

Figure 17-12: Abundance of Arctic fish species caught by the three different trawl types for the Northern Open Water line (101, 105, 108, 111) and stations 153, 163, 323

The Underwater Vision Profiler 6 was deployed during each CTD-Rosette cast, 78 profiles were performed and all of them were successful.

17.3.3 *Leg 3*

A total of 99 larval fish were collected from three different families using the DSN (O-Tow /Tucker). The larval fish were identified, counted, and preserved in 95% ethanol and 1% glycerol. The most frequently occurring species belonged to the family Gadidae (95%), particularly *Boreogadus saida*, followed by species from the Liparidae (2%) and Cottidae (3%) families (Figure 17-13 Figure 17-14).

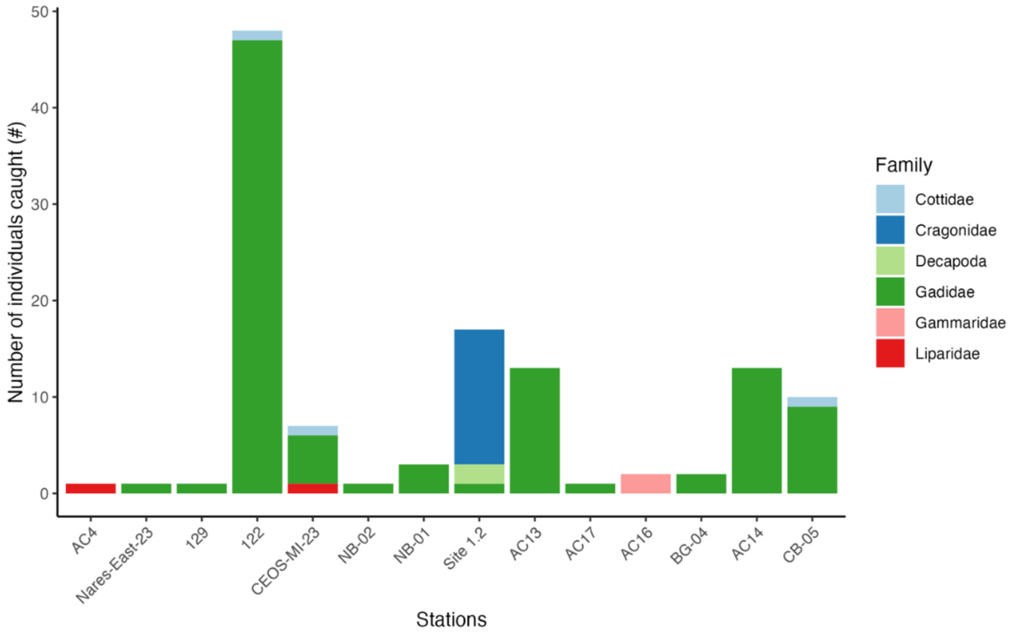

Figure 17-11: The number of larval fish caught at each station where the predominantly caught family was Gadidae

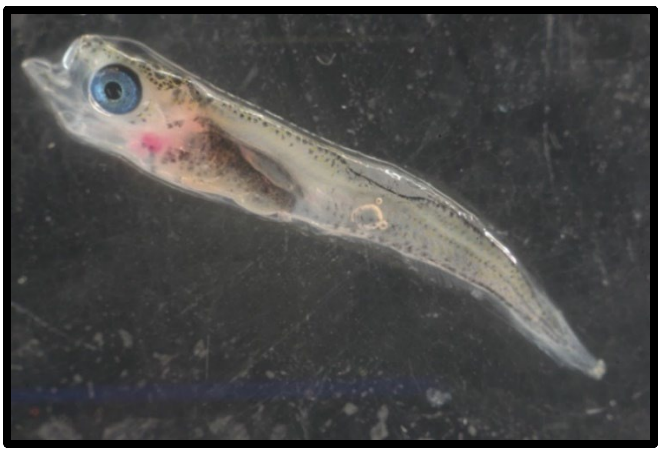

Figure 17-12: *Boreogadus saida* caught in the DSN (Tucker) at station AC13 at 1.7X magnification

There was a total of 272 fish from six families caught in the Beam trawl (n=82) and IKMT (n=190) (Figure 17-15 IKMT catch (A) and echogram (B) from LSea-23 in the Lincoln Sea (Figure 17-18). In the beam trawl total catch, Zoarcidae accounted for 50% (Figure 17-16) with *Lycodes polaris* as the most frequently caught species, Cottidae accounted for 18% with *Artediellus atlanticus* and *Icelus bicornis* as the most frequently caught species, Gadidae accounted for 13% with *Boreogadus saida* as the most frequently caught species, Liparidae accounted for 11% with Liparis spp. as the most frequently caught genus, while Cyclopteridae (*Eumicrotremus spinosus*), Agonidae (*Leptagonus decagonus*), and Stichaeidae (*Leptoclinus maculatus*) accounted for a total of 8% (Figure 17-15).

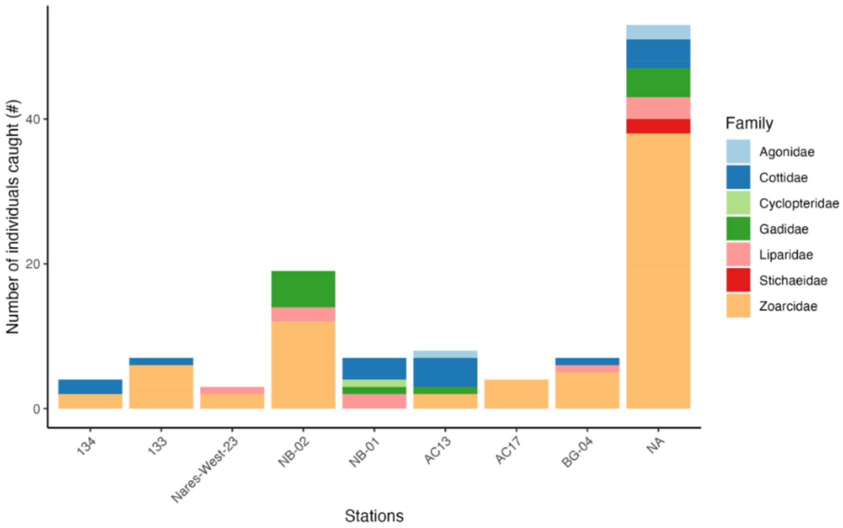

Figure 17-13: Relative abundance of adult fish caught in the beam trawl where the most frequently caught family was Zoarcidae. All fish from the stations 133 or Nares-West-23 and a portion of the fish from station AC17 were collected in the Agassiz trawl

Figure 17-14: Zoarcidae (Lycodes vahlii) (A) and Gadidae (Boreogadus saida) (B) taken from station BG-04 and NB-02

Only three fish families were collected in the IKMT of which Gadidae accounted for 83% of the total catch, Liparidae accounted for 15%, and Cottidae accounted for 2% (Figure 17-17). We observed fewer fish at the most northern stations (Figure 17-18) with the highest catch at station 122 (Figure 17-19). Interestingly, all Gadidae (*Boreogadus saida*) caught at station 122 were between juveniles between 28mm and 73mm in standard length.

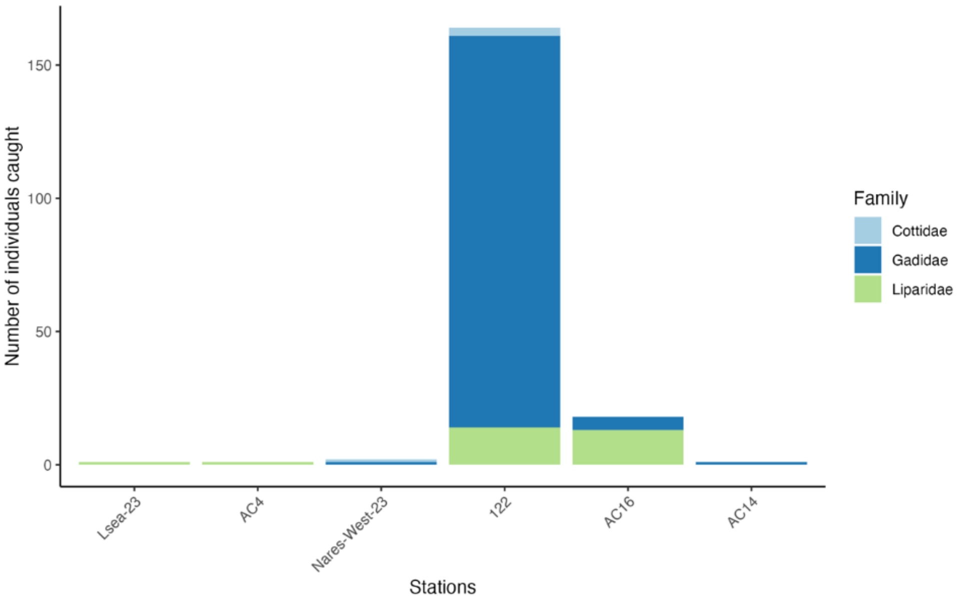

Figure 17-15: Relative abundance of adult fish caught in the IKMT where the most frequently caught family was Gadidae. Stations are from highest latitude to lowest

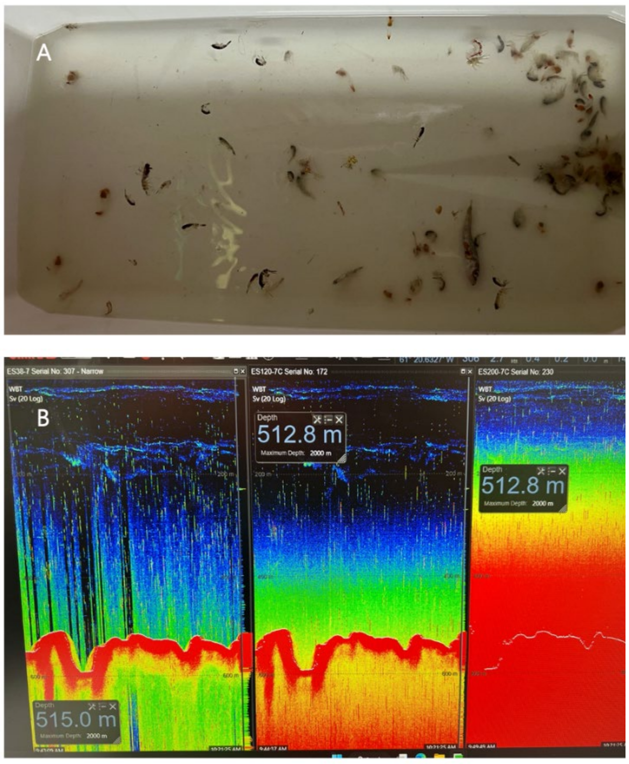

Figure 17-16: IKMT catch (A) and echogram (B) from LSea-23 in the Lincoln Sea

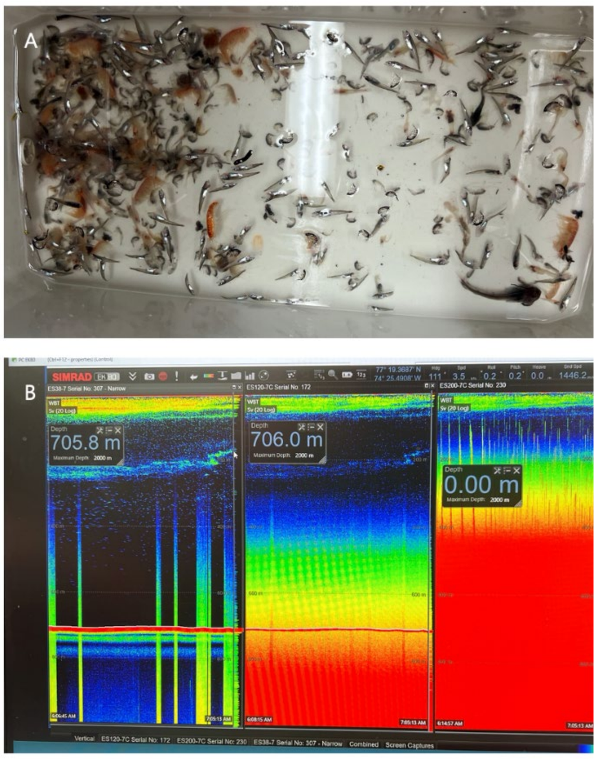

Figure 17-17: IKMT catches (A) and echogram (B) at station 122 in Northern Baffin Bay

17.3.4 *Leg 4*

A total of 390 individually labelled fish samples were collected (alcohol or frozen) and a further 212 zooplankton samples archived and frozen. The distribution of samples with unique IDs among net types is tallied in Table 17-2, illustrating the Beam trawl yielding most fish samples and zooplankton samples. In comparing relative catch rates of fish and zooplankton, the Vertical net captured a higher proportion of zooplankton, while the IKMT captured a higher proportion of fish. In aggregate, samples from all nets contained a total of 1996 individuals. While most taxa were identified to species, some were not but all had accompanying photographs linked in the database to aid future identifications.

Table 17-2: Numbers of samples with unique IDs by taxon within four gear types sampling fish and zooplankton

	Gear type			
Taxa group	**Beam trawl**	**Oblique**	**IKMT**	**Vertical**
Fish	228	95	66	1
Zooplankton	123	57	8	24

Among the fishes, there were samples from within 8 families (Figure 17-20), with the majority of specimens from the families Gadidae (Arctic cod, *Boreogadus saida*) (see also Figure 17-21) and Zoarcidae (eelpouts) (see also Figure 17-22), with Liparidae (snailfishes) and Myctophidae (lanternfishes). Of this total of samples, 165 were larval samples preserved in ethanol.

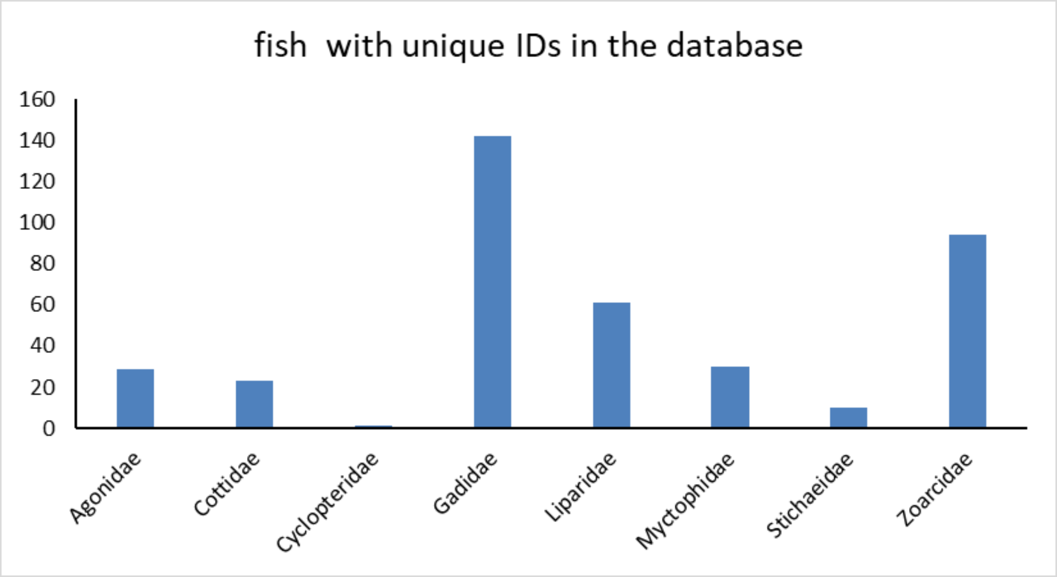

Figure 17-18: Numbers of fish samples with unique IDs in the database. These unique IDs were often individuals, but sometimes groups of the same taxa

Figure 17-19: An example of a large catch of Arctic cod (*Boreogadus saida*) from the Station SPR-004 beam trawl deployment

Figure 17-20: An example of a large catch of eelpouts (*Lycodes* sp.) from the Station 350 beam trawl deployment

Among zooplankton samples retained, most uniquely labelled samples came from Decapoda (mostly shrimp) and Cnidarians (jellyfishes), with secondary abundances of Crangoinid (shrimp-like) and Ctenophores (jellyfish-like) (Figure 17-23). The Foxe Basin zooplankton samples are shown in Figure 13-24, where the jars are placed in order from the most northern site (St. 333) to the most southern site (St. 350) along that transect. The Monster net samples display a depth gradient from the shallowest site (St. 333 at 24m) to the deepest sites (St. FoxSIPP-M at 419m and St. 350 at 377m), where we caught a larger abundance of zooplankton.

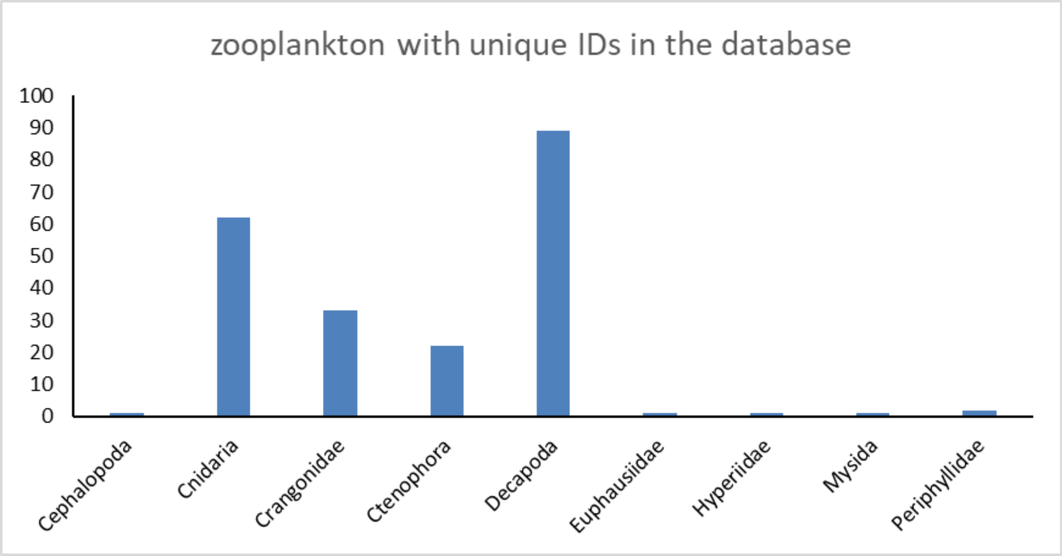

Figure 17-21: Numbers of zooplankton samples with unique IDs in the database. These unique IDs were often individuals, but sometimes groups of the same taxa

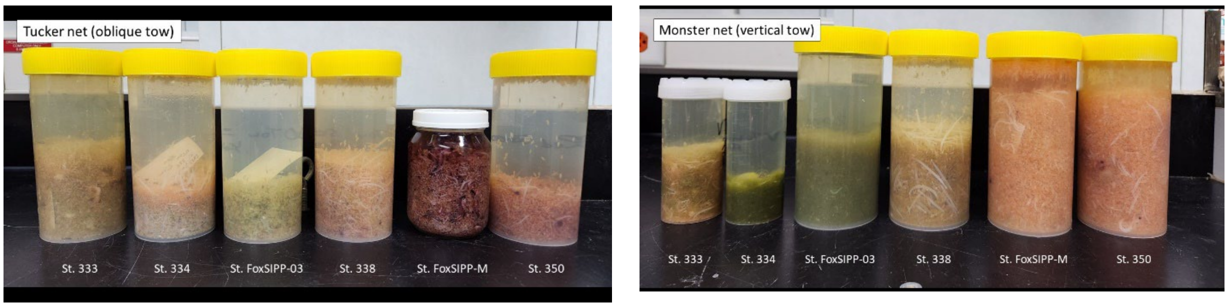

Figure 17-22: Zooplankton samples collected via the Tucker net and Monster net from the Foxe Basin transect. Bottles are aligned from the most northern station (St. 333) to the most southern station (St. 350)

The BRUV was successfully deployed and recovered at stations 334 (86 m) and 338 (135 m). However, in contrast to prior deployments (including >40 deployments in 3 other field programs in 2023), there were initial problems with the main power connection and during both deployments, the footage recorded for only 120 minutes, while it would have been expected to record for 500 minutes, with more time associated with potentially much higher records of diversity and species composition (Devine et al. 2019). At the two sites sampled, turbid waters did not yield records of fish or macroinvertebrates. These challenges (particularly the short duration of recording) had us decide not to deploy it at a planned third station.

17.4 Recommandations

- We recommend for Amundsen Sciene to have a marine scale that is better suited for sea conditions and that can tolerate wave action and be calibrated during the voyage.
- Many issues were encountered when connecting to KPSync to activate the HiPap in the deck. A different way to connect to the computer from the container would greatly help.
- Testing the nets at sea trials would be ideal before the first deployment as it is a test of the equipment, and it is also a practice for the crew and scientists.
- The Bosun suggested to add a double strap with a designated spot to add the 2.5T winch for next year.

- It's recommended to have a depth logger RBR Solo to attach to the Tucker and IKMT nets during deployment so we can verify the depth when the net was deployed.
- We would like to try the Hipap beacon that has a broader transmission beam angle to see if we could get more accurate readings on the position and depth of the IKMT and Tucker.
- It's recommended to invest in S/M and M/L size harnesses used to secure science personnel while working under the A frame, as there is only L/XL universal sized harnesses.
- It's recommended to have a second stereomicroscope with similar magnification as the one in the zooplankton lab.
- It's recommended to use the labelling machine that printed specimen details (ID number, length, weight & station info) onto stickers after entering the data into MS Access and to consider using specimen QR codes in 's future expeditions.
- It's recommended to improve the zooplankton laboratory setup to optimize the ergonomics and facilitate the work in this little space
- It would be a good idea to have discussions with the navigating officers to see if we could improve how the nets get trawled behind the ship.

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17.6 Findings:

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18 Environmental DNA and Plankton Profiling

Principal Investigator: David Cote[1]

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18.1 Introduction

Environmental DNA is an emerging scientific tool that uses DNA fragments shed from animals into the water column to characterize biotic community composition. Multicellular organisms constantly shed cells containing DNA into their environment (skin cells, feathers, hair, feces, urine, saliva, etc.) which can be collected for analysis. The technique has promise as a non-invasive approach that is complementary to other conventional methods, particularly in remote marine areas where specimens are very difficult to collect. The Leg 1 Amundsen mission had two primary objectives: 1) to extend previous collections of eDNA in coastal and shelf areas of the Labrador Sea; and 2) to evaluate the benefits of filtering large volumes of water for assessing biodiversity.

18.2 Methods

18.2.1 *eDNA*

Water was collected with the Rosette at a total of 13 stations during Leg 1 of the 2023 Amundsen Expedition (July 13-August 10). Amongst these 13 stations, 8 stations were selected to collect a single 24L sample of bottom (10m from bottom) water in addition to the 1.5L triplicate samples of surface (2m) and bottom water (Figure 18-1). These depths were selected to assess the effectiveness of this technique compared to more traditional approaches such as oblique midwater trawl or vertical nets that are deployed at similar depths (Cote et al. in press). The Niskin bottles were decontaminated using a 10% bleach solution prior to each deployment. During deployment, the CTD-Rosette was lowered from the vessel using a winch system. The Niskin bottles were open during the down-cast and programmed to close at specified depths during the up-cast. The CTD-Rosette stopped at each sampling depth for a period of 1 minute to ensure the Niskins were filled with water from the desired position in the water column.

Sampling equipment was handled using clean gloves and frequently decontaminated using a combination of distilled water and Eliminase solution. Disposable 2 L Whirlpak bags were used to store water prior to filtration of the 1.5 L samples, whereas a plastic 24 L cannister was decontaminated using Eliminase and then rinsed with sample water three times before filling with 24 L of sample water. Once the samples were filtered, they were placed in small, labeled Whirlpak bags and immediately stored in the freezer. One blank sample consisting of distilled water was filtered on each filtration day. Once in St. John's, the samples will be stored in the walk-in freezer at NAFC in a cooler labeled "DFO-NL-COTE-2023", where they will remain until they are to be delivered to Centre for Environmental Genomic Analyses for analysis. The resulting data will be used to characterize both benthic and pelagic marine communities and investigate concordance with traditional sampling approaches.

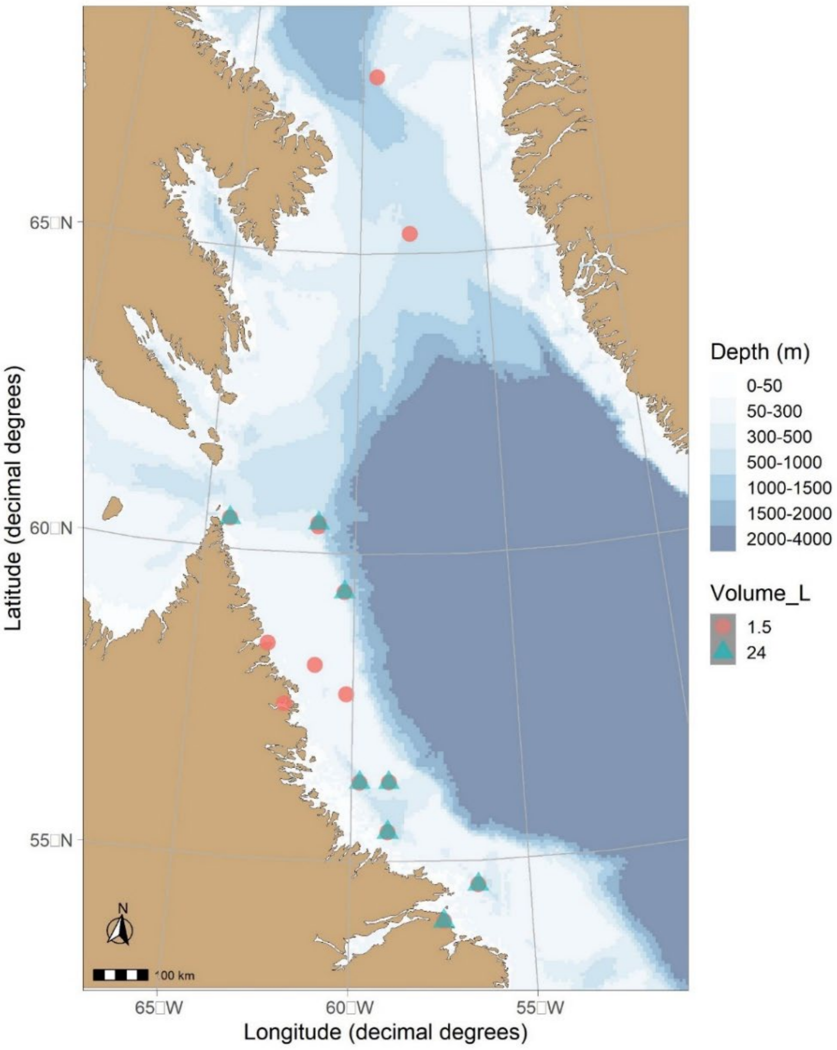

Figure 18-1: Locations sampled for eDNA during Leg 1 of the 2023 Amundsen ExpeditionTable 18-1: eDNA sample information collected during Leg 1 of the 2023 Amundsen Expedition

Date	Station_ID	Depth (m)	Technique	Latitude (N)	Longitude (W)	Sample Depth (m)	Reps	Vol (L)
15-Jul	Joey's Gully	360	eDNA	54.61598	56.43937	2	3	1.5
15-Jul	Joey's Gully	360	eDNA	54.61598	56.43937	350	3	1.5
15-Jul	Joey's Gully	360	eDNA	54.61598	56.43937	350	1	24
16-Jul	Hopedale Saddle	642	eDNA	54.04809	57.41403	2	3	1.5
16-Jul	Hopedale Saddle	642	eDNA	54.04809	57.41403	632	3	1.5
16-Jul	Hopedale Saddle	642	eDNA	54.04809	57.41403	632	1	24
17-Jul	Makkovik Hanging Gardens	574	eDNA	55.48398	58.94345	2	3	1.5
17-Jul	Makkovik Hanging Gardens	574	eDNA	55.48398	58.94345	564	3	1.5
17-Jul	Makkovik Hanging Gardens	574	eDNA	55.48398	58.94345	564	1	24
18-Jul	ISECOLD-0-200	203	eDNA	56.28526	58.90784	2	3	1.5
18-Jul	ISECOLD-0-200	203	eDNA	56.28526	58.90784	193	3	1.5
18-Jul	ISECOLD-0-200	203	eDNA	56.28526	58.90784	193	1	24
18-Jul	ISECOLD-0-200	203	UVP	56.28526	58.90784	NA	1	NA
18-Jul	Sentinel	534	eDNA	56.28071	59.7551	2	3	1.5

18-Jul	Sentinel	534	eDNA	56.28071	59.7551	524	3	1.5
18-Jul	Sentinel	534	eDNA	56.28071	59.7551	524	1	24
18-Jul	Sentinel	534	UVP	56.28071	59.7551	NA	1	NA
20-Jul	ISECOLD-1-200	190	eDNA	57.71145	60.2	2	3	1.5
20-Jul	ISECOLD-1-200	190	eDNA	57.71145	60.2	180	3	1.5
20-Jul	ISECOLD-1-200	190	UVP	57.71145	60.2	180	1	NA
20-Jul	Okak Bay	47.9	eDNA	57.53075	62.07693	2	3	1.5
20-Jul	Okak Bay	47.9	eDNA	57.53075	62.07693	37.9	3	1.5
20-Jul	Okak Bay	47.9	UVP	57.53075	62.07693	37.9	1	NA
21-Jul	Saglek Fjord	134.4	eDNA	58.49953	62.68565	2	3	1.5
21-Jul	Saglek Fjord	134.4	eDNA	58.49953	62.68565	124	3	1.5
21-Jul	Saglek Fjord	134.4	UVP	58.49953	62.68565	124	1	NA
22-Jul	ISECOLD-2-200	203	eDNA	58.175	61.18563	2	3	1.5
22-Jul	ISECOLD-2-200	203	eDNA	58.175	61.18563	193	3	1.5
22-Jul	ISECOLD-2-200	203	UVP	58.175	61.18563	193	1	NA
23-Jul	Saglek Bank	434	eDNA	59.38137	60.31534	2	3	1.5
23-Jul	Saglek Bank	434	eDNA	59.38137	60.31534	424	3	1.5
23-Jul	Saglek Bank	434	eDNA	59.38137	60.31534	424	1	24
24-Jul	HiBio	557	UVP	60.44602	61.24496	547	1	NA
24-Jul	HiBio	557	eDNA	60.44602	61.24496	2	3	1.5
24-Jul	HiBio	557	eDNA	60.44602	61.24496	547	3	1.5
24-Jul	Hatton Basin	629	eDNA	60.498	61.24489	619	3	1.5
24-Jul	Hatton Basin	629	eDNA	60.498	61.24489	619	3	1.5
24-Jul	Hatton Basin	629	eDNA	60.498	61.24489	619	1	24
24-Jul	Hatton Basin	629	UVP	60.498	61.24489	619	1	NA
26-Jul	Killinek Shelf	283	eDNA	60.49714	64.21584	2	3	1.5
26-Jul	Killinek Shelf	283	eDNA	60.49714	64.21584	273	3	1.5
26-Jul	Killinek Shelf	283	eDNA	60.49714	64.21584	273	1	24
26-Jul	Killinek Shelf	283	UVP	60.49714	64.21584	273	1	NA
01-Aug	BB1B-600	562	eDNA	67.98743	59.37617	2	3	1.5
01-Aug	BB1B-600	562	eDNA	67.98743	59.37617	552	3	1.5
01-Aug	BB1B-600	562	UVP	67.98743	59.37617	552	1	NA
03-Aug	DS2	573	eDNA	65.33524	58.01854	2	3	1.5
03-Aug	DS2	573	eDNA	65.33524	58.01854	562	3	1.5

18.2.2 *Underwater Vision Profiler UVP6-HF*

The UVP6-HF was recently acquired by DFO-NL MCT to collect information on lower trophic levels in the Labrador Sea. The system consists of a main camera containing a motherboard with a supervising processor, a mezzanine image processor unit, an image sensor board, a lens and a passband filter centered on 630 nm wavelength, and a pressure sensor. The light unit contains a controlling board, a laser diode, and lenses. It is attached at a fixed distance of the camera using a connecting arm. This unit is then mounted to the 24 bottle CTD-Rosette carousel, though 3 bottles were removed to provide sufficient space (Figure 18-2). The UVP6 has four main types of configuration settings: AUTO, TIME, SUPERVISED, and REMOTE CAMERA. For this cruise, the UVP was set to AUTO-CTD. To deploy the UVP from the UVPapp, select Sensor in the top bar, then Program UVP6, then CTD. The default settings were used for this cruise, and the pressure offset was set to 10dbars, acquisition frequency set to 20. The system would start when powered ON, but would only begin acquiring data when the Rosette would reach a pressure offset of 10dbars. The UVP acquired data on the down cast only and shuts off when the pressure starts going back down as the CTD returns to surface. This mode is commonly used for vertical profiles and provides an analog output. When the cast was complete, the UVP was recharged. The first deployment was on July 18th at ISECOLD-0, and the last deployment was at BB1B on August 1st. The UVP successfully acquired and stored data for a total of 29 casts. The UVP was downloaded on August 3rd and stored on a 5TB external hard drive, where data will be further processed and analyzed using the EcoTaxa web application upon return.

18.3 Results

18.3.1 *Troubleshooting communication issues*

Some difficulties were encountered when attempting to program and download data from the UVP. Changing the IP address of the computer was an important step that was omitted from the UVP manual. The Ethernet and COMS to USB cable should be plugged in the computer. Take note of the added COMS port number indicated in the Device Manager settings on the computer. Change the COMS port on the UVPapp to match the one that was added to the COMS port list in Device Manager by going to the Help option on the UVPapp, followed by Application Settings. Once that is done, the IP address of the computer also needs to be changed. To do so, go to Network Settings, Network and Sharing Center, Ethernet Status, Ethernet Properties, change the IPv4. The IP address used for the Toughbook was 193.49.112.131, Subnet mask: 255.255.255.0, Default Gateway: 193.49.112.1, Preferred DNS server: 8.8.8.8, then select OK. Once these changes are made, exit the UVPapp and re-open it. Attempt to connect to the sensor.

Figure 18-2: UVP-HF6 mounted to the 24 bottle Rosette frame

18.3.2 *Example of result files*

BB1A-600

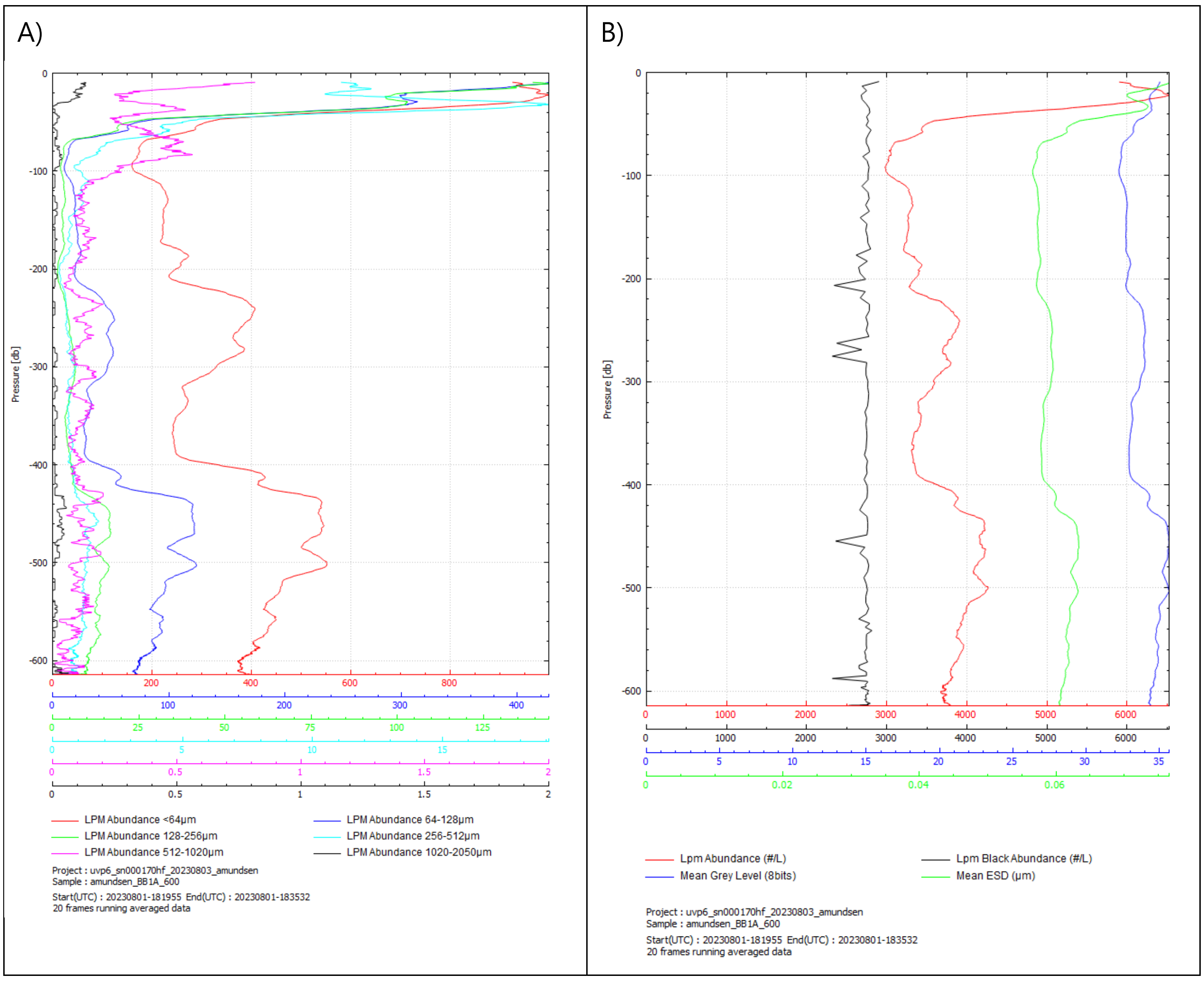

Figure 18-3: **A** provides a profile of Large Particulate Matter (LPM) at station BB1A-600 by size classes, <64 µm, 64-128 µm, 128-256 µm, 256-512 µm, 512-1020 µm, and 1020-2050 µm. LPM <64 µm was found to be abundant throughout the water column while being the dominant size class at greater depths. **B** demonstrates the total abundance of LPM (#/L) throughout the water column. A black frame is sent at preset intervals between particle frames. It contains the number of objects from the images acquired without activating the light. LPM Black Abundance fluctuates throughout the water, however, noticeable decreases can be observed beyond 200m

Image subset

Images retrieved from the UVP on August 3 appeared to have extremely low resolution, causing difficulty to ground truth images. Examples below (Figure 18-4) are some of the higher resolution files. Troubleshooting for better resolution will be required to validate photos prior to next use of UVP.

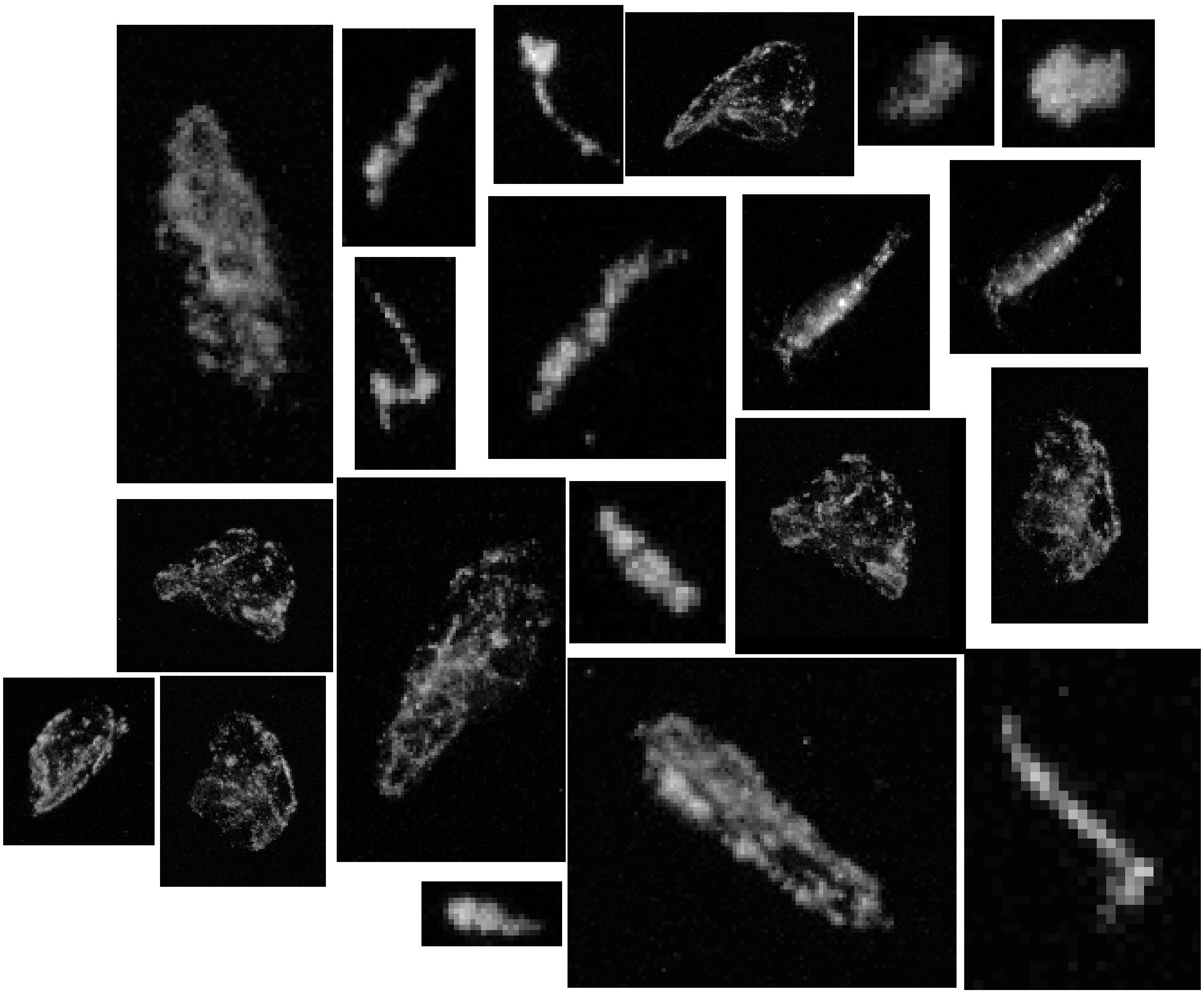

Figure 18-4: Images retrieved from the UVP

19 High-Resolution Tracking and Mapping of Glaciers and Icebergs in the Canadian High Arctic

Project leaders: Luke Copland[1]
Cruise participants – Leg 3: Penelope Gervais[1] and Benoit Lauzon[1]
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19.1 Introduction and Objectives

Tidewater glaciers drain glaciers, ice caps and ice sheets, and terminate in the ocean where they discharge mass through subaqueous melting, meltwater runoff, and calving of icebergs and ice islands (large tabular icebergs). There are currently more than 300 tidewater glaciers in the Canadian Arctic, with a combined total solid ice discharge (dynamic discharge) of >3.0 Gt a-1 (Van Wychen et al., 2021), most of which are rapidly retreating (Cook et al., 2019; Kochtitzky et al., 2022). The Greenland Ice Sheet discharges up to ~100 Gt a-1 of ice to the ocean (King et al., 2020), with the glaciers of west Greenland providing the dominant source of large icebergs in Baffin Bay. Monitoring of ice discharge to the ocean is important for understanding glacier dynamics and how they are changing under a warming climate, to compute freshwater fluxes to the ocean, and to quantify iceberg hazards for shipping. The Canadian Ice Service (CIS) produces ice charts to identify the presence of icebergs in Canadian waters but has little knowledge about the sources and sinks of these ice masses. To improve their forecasting ability, and therefore minimize hazards for shipping operations in ice-infested waters, it is important to understand where these icebergs and ice islands originate from, where they drift to, how they deteriorate and the time scale of these processes. Glacier dynamic instabilities correspond to switches between slow and fast glacier flow in response to sudden change in basal and/or frontal conditions (Nuth et al., 2019). These events can rapidly decrease total ice mass in comparison to the slower processes of accumulation and ablation and can thus contribute significantly to sea level rise (Dunse et al., 2015; Willis et al., 2018; Nuth et al., 2019; Haga et al., 2020).

The most obvious and common instances of glacier dynamic instabilities are glacier surges, during which ice velocities sharply increase over relatively short periods of time (Meier & Post, 1969). The Canadian Arctic is home to the largest surge-type glaciers, with a threshold glacier length for surging that is an order of magnitude greater than the glaciers in the 'Arctic Ring', which includes Svalbard (Sevestre & Benn, 2015; Ou, 2022). Despite this, detailed studies of glacier dynamic instabilities in the Canadian Arctic remain limited and the mechanisms that govern this behaviour still require further analysis (e.g., Copland et al., 2003; Van Wychen et al., 2016, 2022 Medrzycka et al., 2019; Lauzon et al., 2023a, b). The continuous measurements from the glacier velocity trackers deployed on Devon Ice Cap, Manson Icefield, and Sydkap Glacier will provide in situ glacier velocity measurements with an accuracy of <5 cm and at a high (daily) temporal resolution. This will provide significantly more detail about short-term and seasonal variability in ice motion than can obtained from satellite-derived velocities and will be used to validate recent velocities computed from satellite imagery. Ultimately, these data will enable detailed analysis of variations in velocities of a few glaciers that have been previously observed to undergo dynamic instabilities (Southeast-2, Mittie, and Belcher glaciers), which should provide crucial insights into the mechanisms that regulate these ice flow instabilities.

In addition, recent increases in surface melt and runoff have led to the expansion of supraglacial hydrological networks (Lu et al., 2020) which play a crucial role in glacial hydrological systems, influencing surface mass balance (SMB) and glacier dynamics (Pitcher & Smith, 2019). When supraglacial rivers terminate in moulins, a significant volume of water can be directed to the glacier bed, impacting basal water pressure and the expansion of subglacial hydrological systems (Lu et al., 2020). A key unresolved question in climate change assessments is whether this increased subglacial water flow will amplify or diminish glaciers' sensitivity to climate change, either by accelerating glacier motion due to enhanced basal lubrication or by reducing motion due to improved efficiency of the subglacial drainage system (Schoof, 2010; Thomson & Copland, 2017). While some studies have mapped glacial hydrological systems and their connection to ice dynamics in the CAA for single points in time (Wyatt & Sharp, 2015; Thomson & Copland, 2017; Lu et al., 2020), a comprehensive investigation into the temporal evolution and variability of these systems remains lacking.

This project has 3 primary objectives:

1. To deploy satellite tracking beacons on icebergs to track their drift, as well as undertake air photo surveys to quantify their physical characteristics.
2. To deploy multi-frequency Global Navigation Satellite System (GNSS) receiving stations on glaciers to measure their high-resolution in situ ice motion and to validate glacier velocities derived from remote sensing techniques.
3. To conduct aerial photo surveys of glaciers with the aim of generating high-resolution orthomosaics and Digital Elevation Models (DEMs) to validate supraglacial hydrological networks mapped through satellite data.

19.2 Methodology

19.2.1 *Iceberg drift tracking beacons and photo survey*

Between September 11th and 27th, 2023, a total of 6 Cryologger Iceberg Tracking Beacons (ITBs) (https://cryologger.org; Garbo et al., 2021) and one MetOcean Compact Air-Launched Ice Beacon (CALIB) (https://metocean.com/products/calib/) were successfully deployed on icebergs in the Nares Strait, Northern Baffin Bay and Jones Sound region (Figure 19-1: Location of Cryologger iceberg tracking beacon and MetOcean CALIB deployments during Leg 3 of the 2023 Amundsen Expedition.). An additional two Cryologger ITBs (#7 and #8) were deployed on the ice floating tongue of Petermann Glacier in northwestern Greenland to capture its eventual detachment (Figure 19-1).

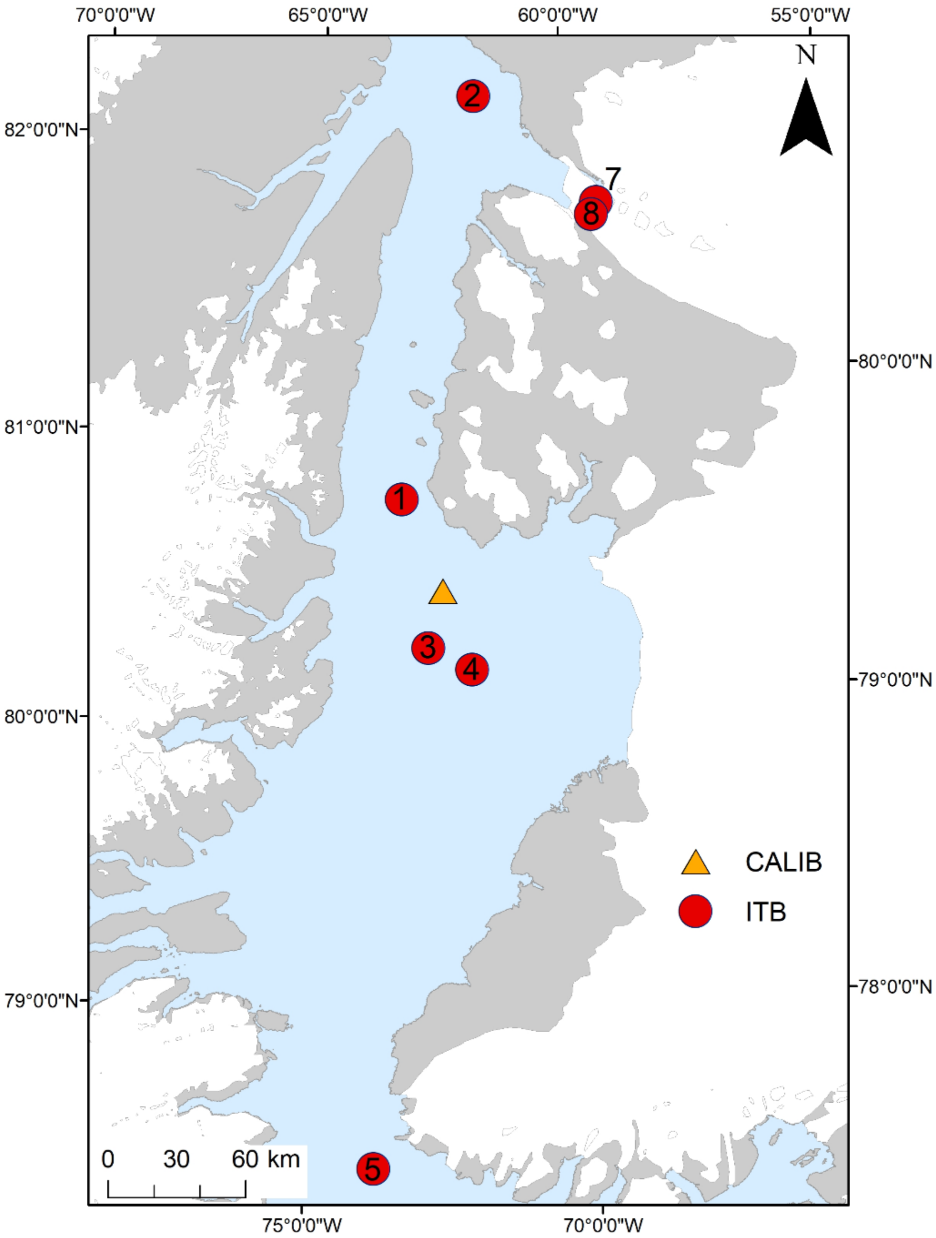

Figure 19-1: Location of Cryologger iceberg tracking beacon and MetOcean CALIB deployments during Leg 3 of the 2023 Amundsen Expedition.

To enhance the stability of the Cryologger ITBs on the ice surfaces, ensuring resistance to strong wind gusts and facilitating potential future recovery, the beacons were securely fastened

to wooden crosses measuring 24 inches by 24 inches (Figure 19-2A). The CALIB beacon, with its cylindrical shape, was stabilized on the iceberg's surface by securely wrapping rope around it to increase friction (Figure 19-2B).

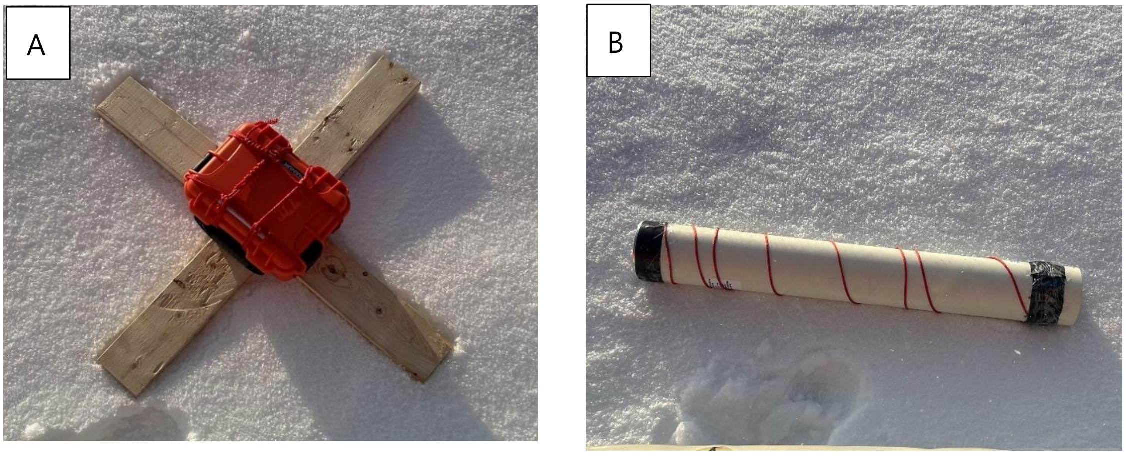

Figure 19-2: Examples of a Cryologger iceberg tracking beacon fastened to a wooden cross (a) and the MetOcean CALIB (b). Pictures were taken from the helicopter after the beacons had been deployed on icebergs.

The selection of suitable iceberg targets for deployment involved an assessment of their size, morphology, location, and the likelihood of drifting southward. Emphasis was placed on deploying these beacons on tabular icebergs due to their flat and stable surfaces. Deployments were done without shutting down the helicopter and with the person deploying the beacon wearing a safety harness attached to the helicopter to ensure their safety in the unlikely situation of an iceberg becoming unstable. The beacons are equipped with a comprehensive suite of sensors to capture data on GPS coordinates, temperature, pressure, pitch, roll, heading, and battery voltage. Updates of their positions, transmitted hourly via an Iridium satellite connection, are readily accessible free of charge on the https://cryologger.org website, and precisely on the https://cryologger.org/tracking-2023/ website for the beacons that were deployed during Leg 3 of the 2023 Amundsen Expedition. Unfortunately, the last beacon deployed malfunctioned and is not transmitting, but all other beacons are successfully transmitting. A summary of iceberg tracking beacon deployments is given in Table 19-1.

Table 19-1: Summary of Cryologger and CALIB iceberg tracking beacon deployments during Leg 3 of the 2023 Amundsen Expedition.

#	Datetime (UTC)	Latitude	Longitude	Location
1	2023-09-15 20:47	80.334133	-68.135017	Kennedy Channel
2	2023-09-11 22:43	81.5203	-62.520867	Hall Basin
CALIB	2023-09-17 19:16	79.968517	-68.135017	Kane Basin
3	2023-09-17 19:31	79.799133	-68.89905	Kane Basin
4	2023-09-17 20:00	79.662183	-68.257083	Kane Basin
5	2023-09-20 22:20	78.0825	-73.572167	Smith Sound
6	2023-09-27 21:29	76.382044	-84.554615	Jones Sound
7	2023-09-13 21:08	80.97188	-61.24051	Petermann Glacier
8	2023-09-13 21:14	80.94266	-61.48380	Petermann Glacier

Following each deployment on an iceberg, a comprehensive aerial survey was conducted using a Nikon D850 camera equipped with a 45-megapixel sensor and a 24 Nikon D850 mm lens and attached to an Emlid Reach M2 multi-frequency and multi-constellation GNSS receiver for precise georeferencing. This survey aimed to precisely quantify the physical characteristics of the iceberg from all angles. Some Example pictures are shown below (Figure 19-3: Examples of icebergs instrumented with tracking beacons in Kane Basin (a, c) Kennedy Channel (b) and Smith Sound (d) between September 11th and 27th, 2023, during the 2023 *Amundsen* Expedition Leg 3.).

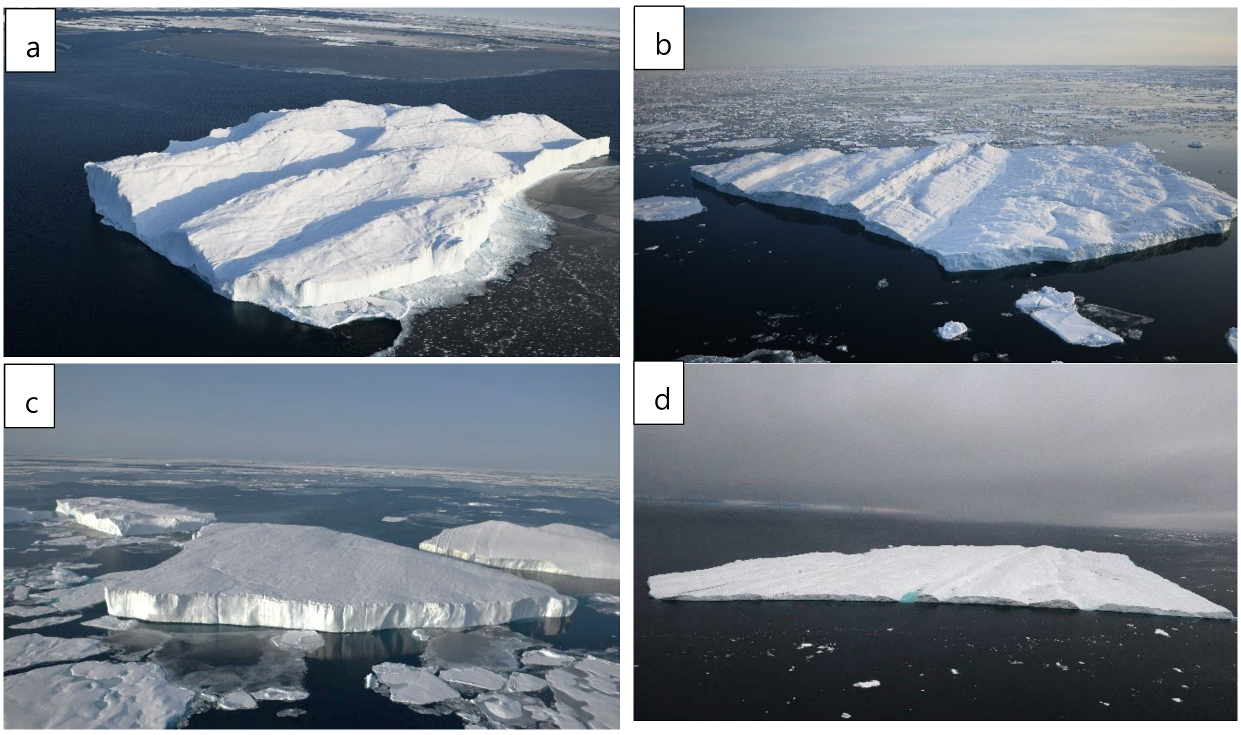

Figure 19-3: Examples of icebergs instrumented with tracking beacons in Kane Basin (a, c) Kennedy Channel (b) and Smith Sound (d) between September 11th and 27th, 2023, during the 2023 *Amundsen* Expedition Leg 3.

19.2.2 *Glacier Velocity Trackers*

Three Cryologger glacier velocity trackers (GVT; https://github.com/adamgarbo/cryologgerglacier- velocity-tracker) deployed during Leg 3 of the 2021 Amundsen Expedition were successfully serviced and retrieved from Devon Ice Cap on September 9, 2023. Among them, one station was retrieved from Southeast 2 Glacier (74.972361°N, 80.840889°W), while the remaining two were retrieved from Belcher Glacier (Lower station 75.600803°N, 81.432948°W; Upper station 75.531148°N, 81.467183°W; Figure 19-4a). These systems operate with the aid of a cost-effective multi-frequency global navigation satellite system (GNSS) receiver (u-blox ZED-F9P), a GNSS antenna, and an open-source Arduino-based data logger (SparkFun Electronics). Their power supply relies on a 38 Ah gel cell battery (Deka Batteries), coupled with an 18 W solar panel sourced (Voltaic Systems) and a solar charge controller (Genasun GV-5). Programmed to activate once daily at noon and record data for a duration of 3 hours, these systems aim to achieve a GNSS position accuracy of <5 cm. Supplementary data was acquired from the stations through a temperature and relative humidity sensor deployed at both the Southeast 2 and Lower Belcher stations, along with a timelapse camera positioned at the latter. Additionally, ablation poles, designed to measure surface melt, were successfully retrieved from both stations. The two Belcher systems recorded for the entire two-year period and had a fully charged battery and ~50% of storage left on their microSD cards upon recovery. Unfortunately, the cable connecting the GVT's solar panel to the solar panel charge controller for the Southeast 2 Glacier system had been cut, either by getting stuck in the ice or by wildlife, yet the instrument still recorded from September 2021 to June 2022.

While the initial plan was to redeploy all three stations on Manson Icefield during this year's expedition, only two of them could be redeployed on September 25, 2023, due to adverse weather conditions, safety considerations, and external constraints on the CCGS Amundsen.

The first station was deployed at a potential subglacial lake filling area where several glacier termini collide and where meltwater visibly pools (76.949313°N, 80.351411°W), while the second station was deployed in the terminus region of Mittie Glacier (76.853561°N, 79.10325°W; Figure 19-4b). Both stations are equipped with a temperature and relative humidity sensor housed in a radiation shield which takes measurements every hour. The first station is also equipped with a hunting-style time-lapse camera programmed to record photos hourly in order to capture a potential lake filling/drainage event and local weather conditions.

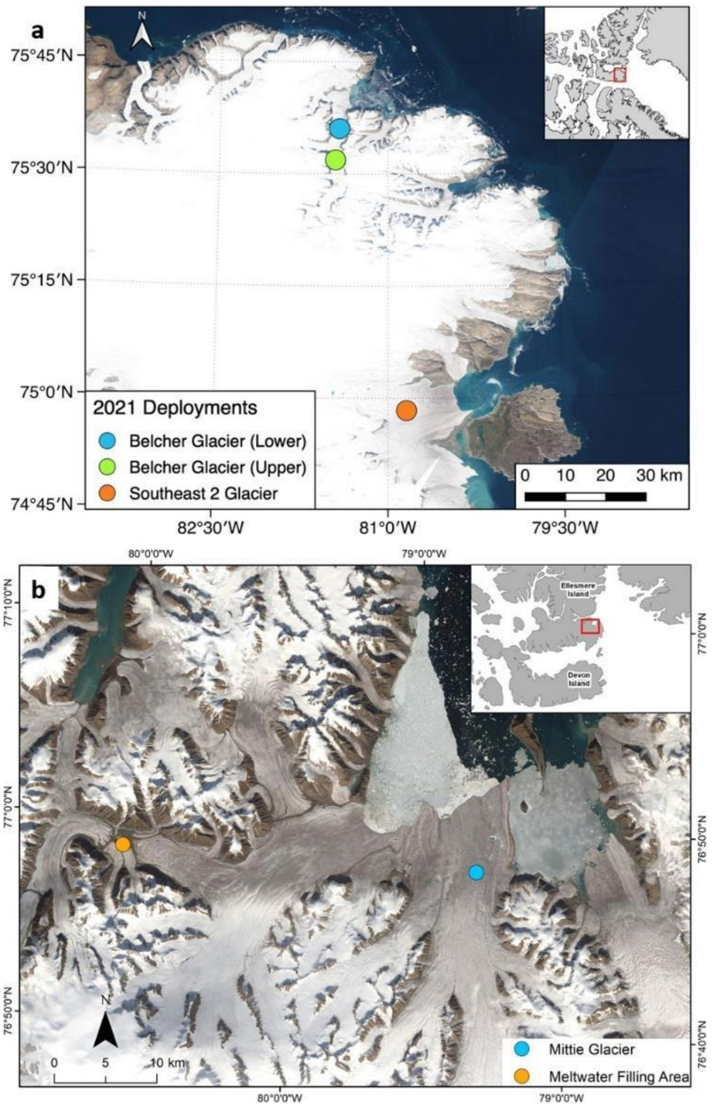

Figure 19-4: (a) Locations of the three glacier velocity trackers that were deployed during Leg 3 of the 2021 *Amundsen* Expedition and recovered during this Leg. (b) Map of the re-deployment locations of two of these systems on Manson Icefield, southeast Ellesmere Island, on September 25, 2023.

Sydkap Glacier

Fieldwork out of Grise Fiord in early August 2022, allowed for the deployment of two GVTs stations on Sydkap Glacier (lower 76.66548°N, 85.24683°W; upper 76.68466°N, 85.43520°W). The objective of this year's Amundsen expedition was not only to service these stations, but also to ensure their continuous operation for extended data collection over the next year(s). Once serviced, the upper GVT was redeployed featuring the addition of a timelapse camera facing an ablation stake drilled 3 m into the glacier (1.5 m exposed above the surface), marked with 5 cm increments to enable monitoring of surface melt rates (Figure 19-5). Due to its proximity to the glacier terminus (<200 m), the lower GVT including a timelapse camera had to be removed after servicing.

Figure 19-5: Example of the upper glacier velocity tracking system and ablation stake installed on Sydkap Glacier during the 2023 Amundsen expedition.

19.2.3 *Timelapse cameras and weather stations*

During Leg 3 of the 2021 Amundsen Expedition, two timelapse cameras and a weather station were installed on the summit of a peak on Easter Island at 77.831417°N, 77.83825°W, near the head of Talbot Inlet (Figure 19-6). These monitoring instruments were serviced on September 10th, 2023, and subsequently redeployed for continued data collection and observation. Notably, the timelapse cameras have been strategically positioned to face the terminus of Trinity and Wykeham Glaciers, draining the Prince of Wales Icefield. These two glaciers accounted for 62% of all dynamic discharge in the Canadian Arctic in winter 2015 and ~50% (~1.5 Gt a-1) in 2019/2020 (Van Wychen et al., 2016, 2022), making their surveillance of high importance. In addition, servicing of three timelapse cameras, initially deployed in August 2022 to monitor calving events at Sydkap Glacier and the movement of icebergs within South Cape Fiord, was performed. The first camera, situated near the shore (76.64706°N, 85.11421°W), was found to be irreparably damaged and, as a result, was not redeployed. Conversely, the two other cameras, located on a mountain top (76.66204°N, 85.11523°W), were still in operational condition following servicing and were redeployed to continue data capture over the subsequent year(s).

Figure 19-6: Timelapse cameras installed on Easter Island, September 3, 2021, and serviced on on September 10, 2023

19.2.4 *Air photo surveys*

During this year's expedition, three opportunistic air photo surveys aimed at documenting the existing supraglacial hydrological networks were planned on different glaciers across Ellesmere Island: John Evans (79.650°N, 74.187°W), Sydkap (76.686°N, 85.461°W), and Unnamed 2 (78.793°N, 76.538°W). Due to poor weather and external constraints on the ship, only one survey was performed over 'Unnamed 2' Glacier. On September 20th, 2023, a total of 1489 oblique photos were collected using a Nikon D850 45 mega-pixel camera with a 24 mm lens from a Coast Guard Bell 429 helicopter following the flight path in Figure 19-7. At an average flying height of 400 m a.g.l., the camera achieved ground resolutions ranging from 0.07 to 0.21 m/pixel. An automatic intervalometer programmed to capture images every 2 seconds enabled 80% image overlap along-track and 60% across-track at an average flying speed of~110 km h^{-1}.

The camera was connected to an Emlid Reach M2 multi-frequency and multi-constellation GNSS receiver, recording an event marker for each image taken. Additionally, a base station positioned near the glacier terminus (78.831406°N, 76.44469°W) continuously recorded GNSS data throughout the survey. Both raw GNSS logs from the base on the ground and the rover (camera connected to Emlid) will be processed to receive accurate positing for each image.

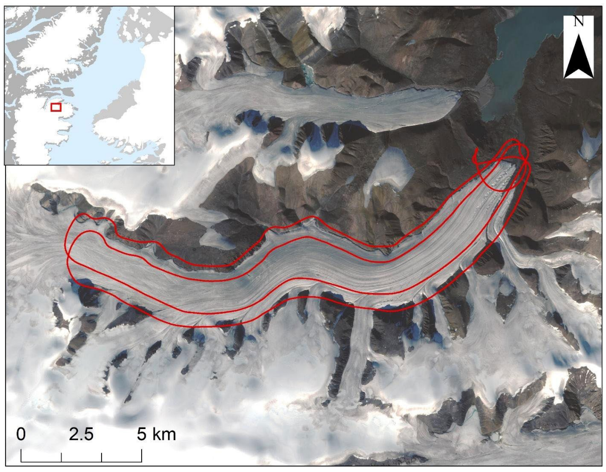

Figure 19-7: Air photo survey path over Unnamed 2 Glacier on September 20th, 2023

These aerial photographs will be processed in Agisoft Metashape Professional using the structurefrom-motion technique to a create a high resolution (~0.5 m) orthomosaic and DEM.

15.2.5. Iceberg and glacier surface sampling

Opportunistic sampling of snow from the surface of icebergs and glaciers was performed on behalf of Liisa Jantunen from Environment and Climate Change Canada. Snow samples were collected from the surface of an ice Island (78.0825°N, 73.572167°W) and the terminus of a glacier (76.949313°N, 80.351411°W), primarily at the locations visited for the deployment of an iceberg tracking beacon and a glacier velocity tracker. The samples were melted and filtered onto polycarbonate papers by Kelly Evans and will be sent to the University of Toronto for microplastics analysis.

19.3 Preliminary Results

19.3.1 *Iceberg drift*

An initial analysis of the drift tracks from all Cryologger beacons and the CALIB deployed in the Nares Strait reveal remarkably varied iceberg drift patterns and speed (Figure 19-8). Since their deployment, these beacons have covered distances ranging from 237 to 500 km. ITB #1, deployed on September 13th, has covered the greatest distance, reaching 500 km, despite being launched two days after ITB #1, which traveled 124 km less. Likewise, the trio of beacons deployed on September 17th displays distinct drift rates. While ITB #4 appears to have remained stationary since deployment, ITB #3 has exhibited a drift rate of 14.81 km d-1, covering 237 km over the 16-day period from September 17th to October 4th. In contrast, the CALIB moved at a faster rate of 23.65 km d-1 during the same timeframe, travelling a total distance of 377 km. Despite being deployed on September 20th, ITB #5 has outpaced the slowest beacon, ITB #3, by covering an additional 98 km, with ITB #5 moving 335 km over the course of only 13 days.

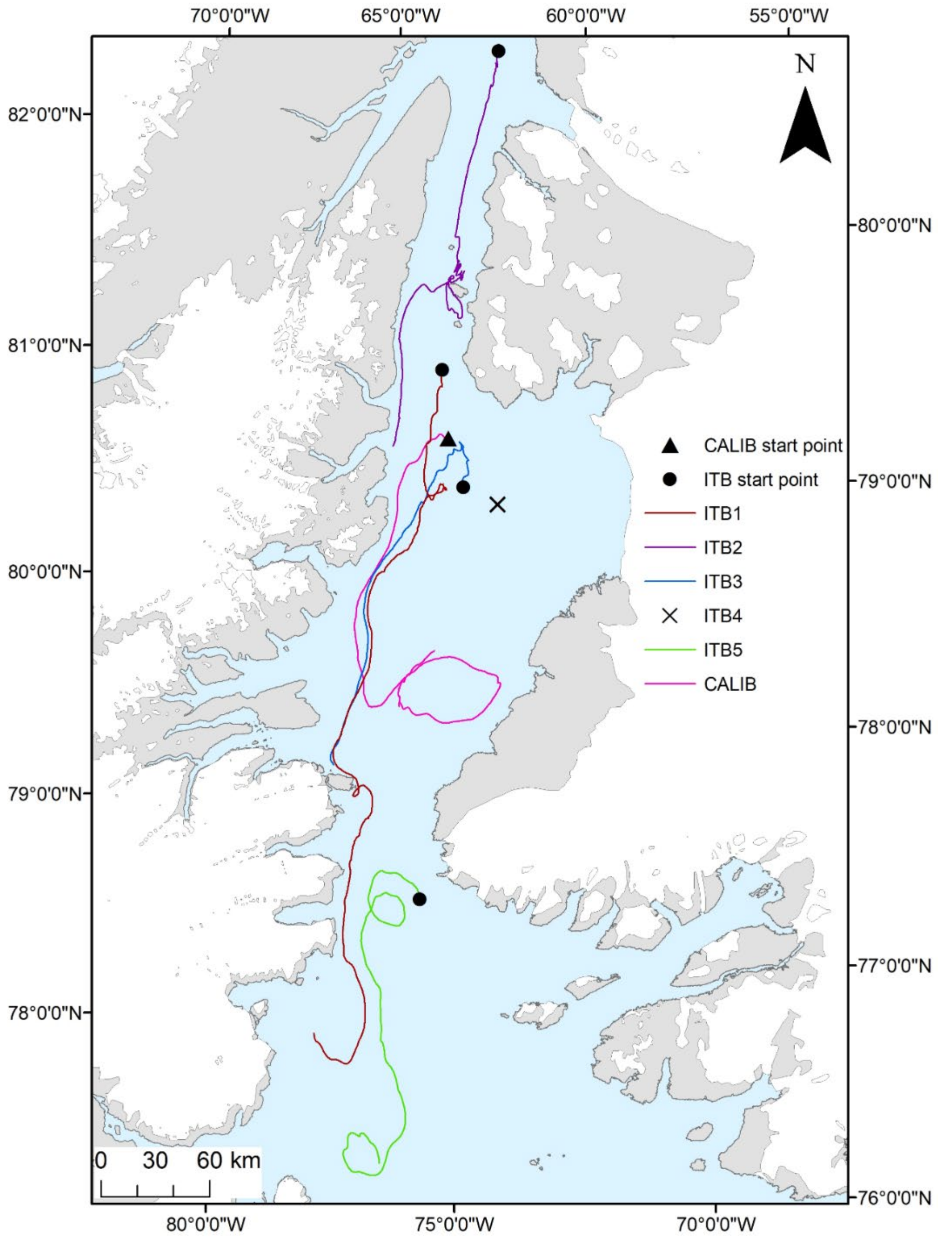

Figure 19-8: Iceberg drift map illustrating the distance covered since the deployment of iceberg tracking beacons (ITBs) between September 11th and 20th, 2023. The black circles denote the initial positions of each ITB, with the triangle indicating the starting point of the CALIB. The "x" marks the location of ITB4, deployed on an iceberg that appears to be grounded. The final position was recorded on October 3rd, 2023.

19.3.2 *Timelapse cameras*

Sydkap Glacier is one of the fastest retreating glaciers in the Canadian Arctic, undergoing ~9.5 km of retreat from 1959 to 2000 (Copland et al., 2003) and additional retreat since then as well as a recent increase in velocities, indicating that it could be undergoing some form of dynamic instability (Cook et al., 2019; Van Wychen et al., 2021). Figure 19-9 shows how the terminus of Sydkap Glacier has changed from August 2022 to late September 2023. These two photographs, taken by one of the timelapse cameras installed in front of the terminus in August 2022, shows notable retreat of the right half of the terminus within a period of just over one year. The timelapse cameras installed in front of Sydkap Glacier as well as those on Easter Island, facing Trinity and Wykeham glaciers, should capture major iceberg calving events of these glaciers.

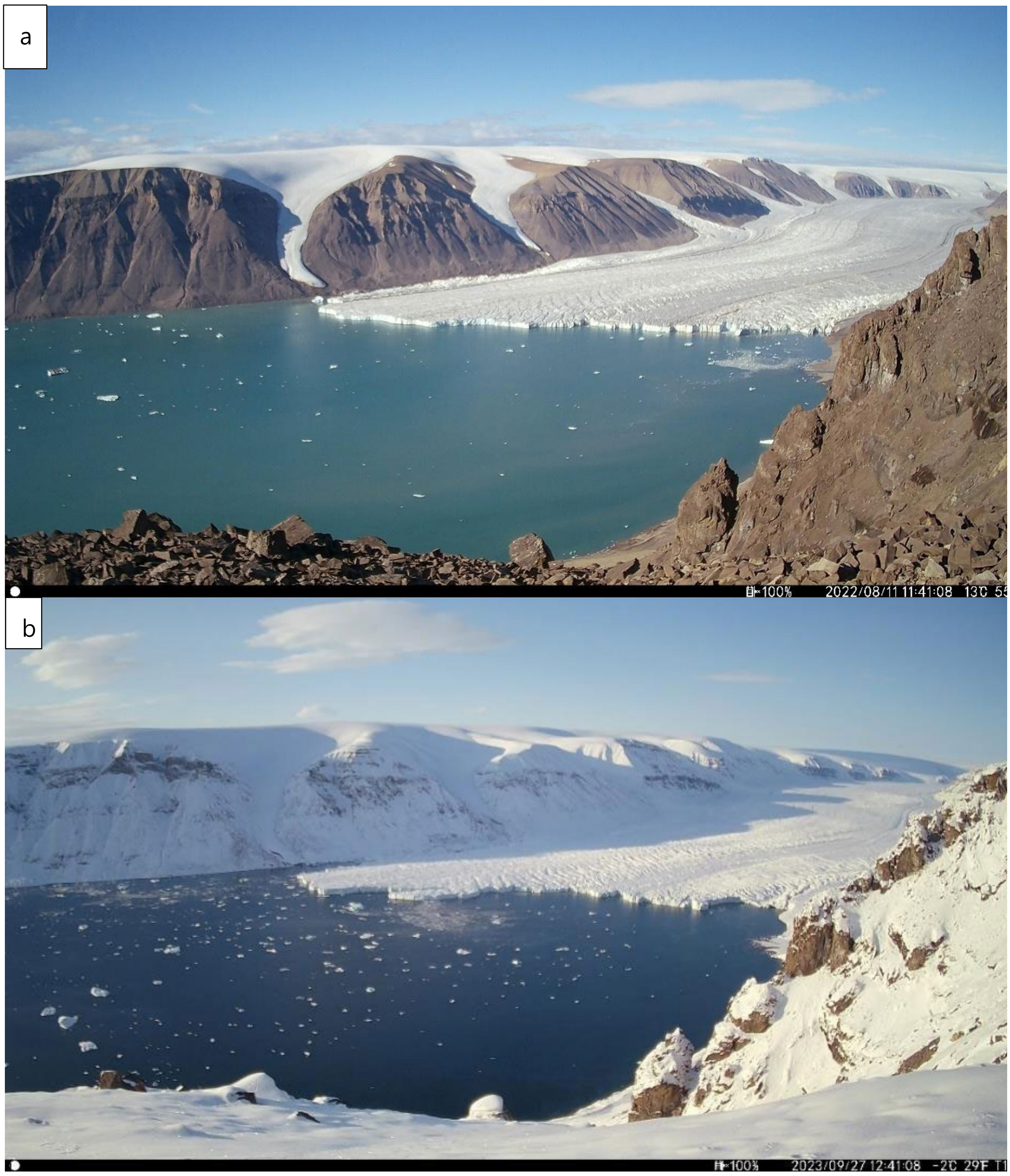

Figure 19-9: Evolution of the terminus position of Sydkap Glacier from August 11, 2022 (top) to September 27, 2023 (bottom).

19.3.3 *Glacier Velocity Measurement Systems and Air Photo Surveys*

The glacier velocity tracking systems deployed during Leg 3 of the 2023 Amundsen expedition record data locally to a microSD card and are set to be recovered during the next field season (2024 or 2025). All timelapse cameras and weather data will also be downloaded at this time. The high-resolution glacier velocity data recovered from Devon Island and Sydkap Glacier will be processed to provide a detailed record of seasonal glacier velocity fluctuations as well as insights into the mechanisms that control multiannual changes in velocities. In addition, images taken during the air photo survey over Unnamed 2 Glacier will be processed into an orthomosaic and DEM to validate satellitederived maps of surface hydrology.

19.4 Recommendations

In the future, it would be useful for us to receive a detailed schedule of the ship's activities planned
for the Leg prior to boarding, so that we could better plan out the location and timing of our iceberg and glacier deployments. This is especially important since the nature of our work is dependent on the amount of daylight available and on snow conditions on glaciers. Ideally, most of our glacier work should be done before any snow precipitation, such as at the beginning of the Leg, as this can pose a risk to travelling on glaciers. For instance, we had to skip our GVT deployment on 'NE Manson' Glacier out of safety concerns due to an abundance of snow on the glacier surface, which hid many of the crevasses, and thus made it difficult to find a suitable location to safely land the helicopter on the glacier. If a glacier surface is free of any snow, it makes it a lot easier to identify crevasses, making landing and walking on a glacier significantly less hazardous.

19.5 References

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20 Multibeam Mapping

Principal Investigator: Amundsen Science

Cruise Participants – Leg 1 : Tony Furey, Victoria Kearley
Cruise Participants – Leg 2 : Kavindu Deraniyagala – Isabelle Emery
Cruise Participants – Leg 3 : Daniel Amirault – Alexis Belko
Cruise Participants – Leg 4: Kerstin Brembach – Joshua Van Dijk

20.1 Introduction and Objectives

The 2023 Amundsen Expedition began in St. John's on July 13th and finished by docking in Quebec City on October 26th. The four legs of the expdition featured a number of opportunistic and dedicated bathymetric surveys, an array of sub-bottom surveys to identify the seabed type for coring teams, mooring positioning surveys, and dedicated mapping using a multibeam installed on the Amundsen's barge. The total of multibeam data collected and their coverage in km^2 are detailed in Table 20-1.

Table 20-1: Total number of Nautical miles and area covered by the Multibeam

Leg	Nautical miles collected	Coverage in km^2
1	6138	18 200
2	3300	13 500
3	3620	7500
4	7468	nr

20.2 Methods

20.2.1 *Kongsberg EM 304 Multibeam Sonar*

The CCGS *Amundsen* is equipped with a Kongsberg EM304 Multibeam Echosounder (MBES) operated through the system's proprietary acquisition software called Seafloor Information System (SIS) version 5.9.3. The Applanix POS-MV V5 integrates attitude and position data to the multibeam to georeference acquired points along the seafloor. The position accuracies were approximatively < 0.035m horizontally and <0.027m vertically. The accuracy of attitude information from the Inertial Measurement Unit (IMU) is 0.017m.

20.2.2 *Knudsen 3260 CHIRP Sub-bottom Profiler*

A Knudsen 3260 deck unit has been installed onboard the Amundsen with a 3.5kHz transducer which is operated from the previous multibeam PC (since 2022). The Knudsen sub-bottom profiler is used to analyse sediments and geological materials as much as 50m below the ocean floor. Coordinates obtained by the CNAV 3050 and attitude data provided by the POSMV's IMU are integrated to the sub-bottom profiler in order to correctly georeferenced recorded data.

20.2.3 *Barge – EM2040 Multibeam Echosounder*

EM2040 multibeam echosounder was installed on the Amundsen's barge to collect multibeam data in areas considered unfeasible for the ship. In addition to increasing survey capabilities, the EM2040 is more effective in shallow water than the Amundsen's EM304. New in 2023, the barge's multibeam pole supports much safer and faster deployment, also the ability to tilt the multibeam to 35 degrees outward. Ancillary equipment to the EM2040 include the Amundsen's previously installed POSMV V4 system with its proprietary IMU and new Trimble AP540 antennas; and a micro SV sensor. AML-3 XSV probe is utilized to obtain Sound Velocity profiles.

20.2.4 *Post-Processing*

All the data acquired during the cruise is post-processed in real-time using the *CARIS HIPS & SIPS 11.3* software. This post-processing phase is essential to rapid detection of any anomalies in the data collection as well as the evaluation of acquired data. Vertical measurements reference Mean Sea Level (MSL) through the integration of Bedford Institute of Oceanography's Webtide Model. Sound Velocity profiles are created from CTD Rosette casts, XSV casts, and profiles retrieved from the World Ocean Atlas Model (WOA13 and WOA09).

20.3 Results

20.3.1 Leg 1:

Mapping outside of the dedicated survey areas

The Amundsen's EM304 MBES and the Knudsen 3260 CHIRP Sub-Bottom Profiler acquired data throughout the entirety of Leg 1 with the goal of extending the spatial coverage of Amundsen Science's Arctic Bathymetry database. Outside of the dedicated survey areas, the Amundsen allocated time for multibeam coverage in search for areas

of interest for future expeditions. These operations involved systematically surveying outside the extents of the Canadian Hydrography Service's (CHS) compilation of bathymetric data collected by Canada's fleet of Coast Guard vessels and other sources. Amundsen Science will share acquired datasets with the CHS to update their database and marine charts. Acquired data will also be useful for ongoing and future research projects.

- Sentinel

On July 18th, 2023, the Amundsen allocated contingency time to complete MBES operations at a location near Nain, NL. An MBES survey was completed at Sentinel because it was a site that the Amundsen 2021 Expedition was unable to visit. A discussion with scientists onboard identified two points of interest that the multibeam covered to gather information about the area for potential ROV dive sites in the future. Figure 20-2 shows the MBES data acquired during this survey overlain on the existing MBES coverage, whereas shows the map resulting from this survey.

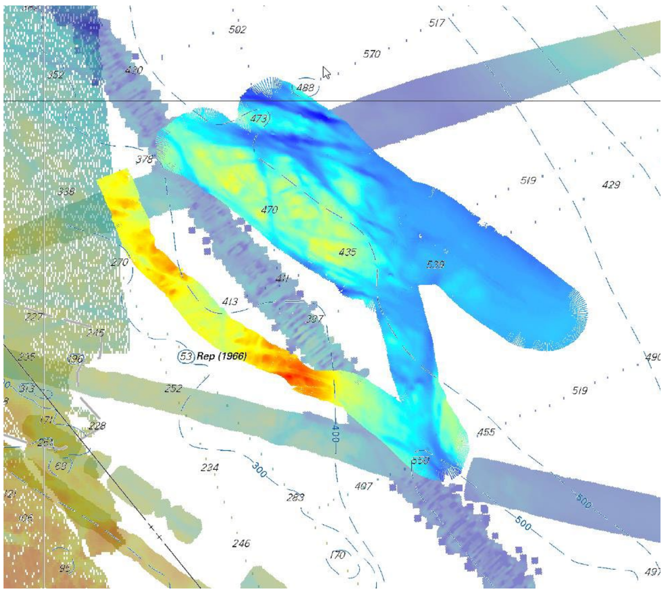


Figure 20-1: The Sentinel site survey

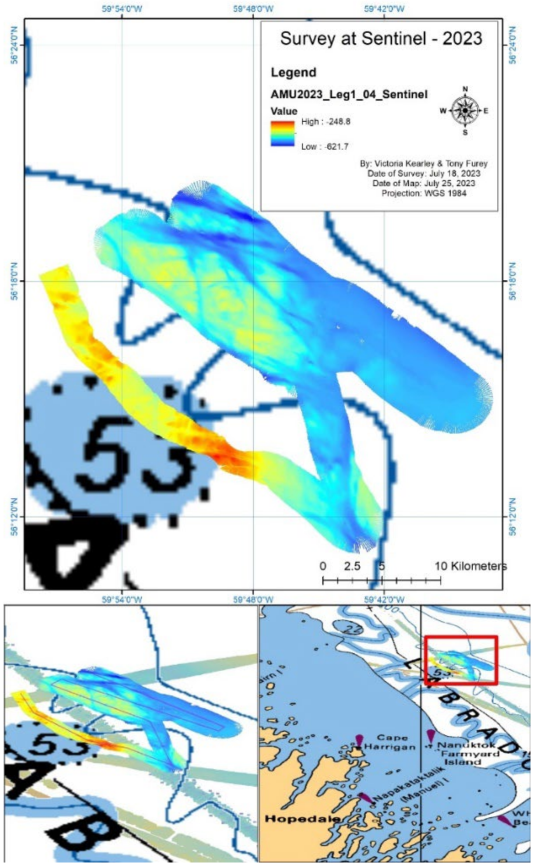


Figure 20-2: The Sentinel survey map

- Hatton Basin

On July 24th, 2023, the Amundsen had extra time given that the ROV came to the surface early and the mooring operation went smoothly; therefore, there was time available for a multibeam survey. The survey was directed towards expanding coverage in the area to identify more of the ridges that were seen in the data from 2020 & 2021.

shows the 2023 operations in relation to previous data whereas Figure 20-3 shows the map resulting from 2023 operations.

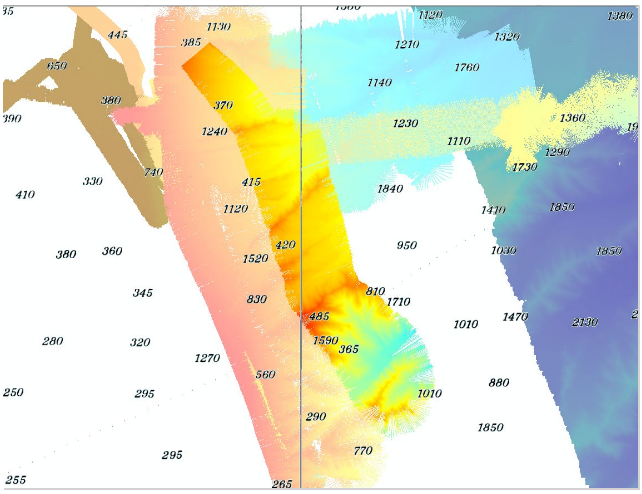


Figure 20-3: Hatton Basin survey

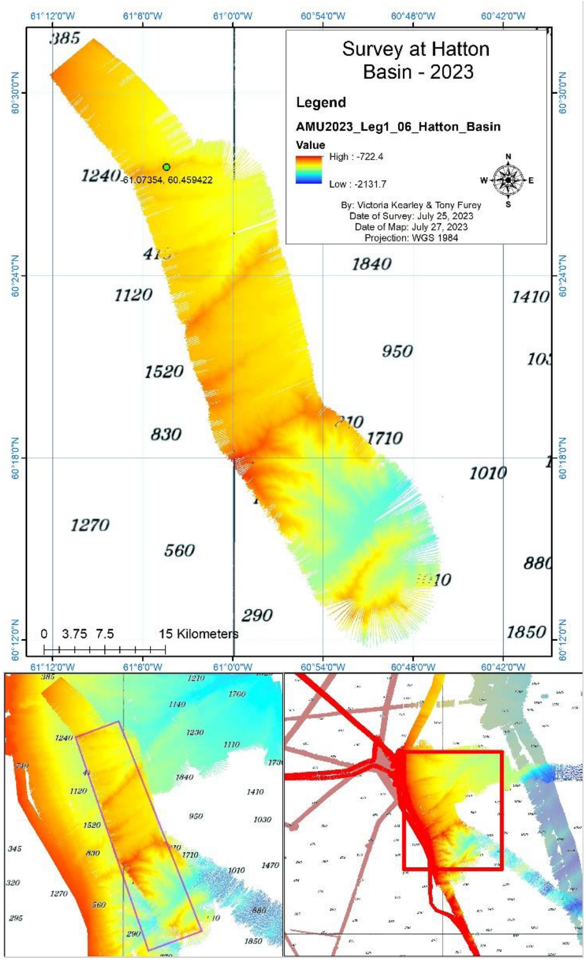


Figure 20-4: Hatton Basin survey map

- Killinek Shelf

On July 26th, 2023, the Amundsen collected data in an area where there was no prior multibeam coverage Figure 16-5. The area was of interest for a potential coral habitat and ROV dive but the MBES data collected showed the seabed did not have the ideal slope for coral.

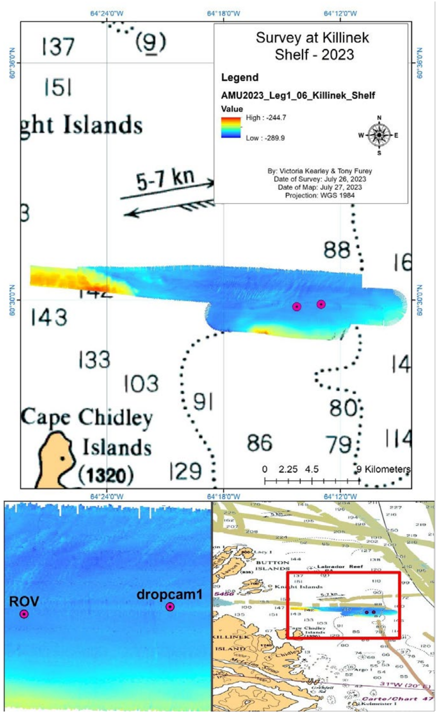


Figure 20-5: Killinek Shelf survey map

Dedicated Mapping Operations

Dedicated mapping operations were focused on collecting data in locations of interest to ROV dives, moorings, and landslides in Southwind Fjord. In the surveys that were completed, 3 were for new and already known ROV dive sites, 2 were for mooring deployment and recovery, and lastly there was one survey done to resurvey the area of a suspected landslide.

- Hopedale Saddle

On July 16th, 2023, the CCGS *Amundsen* performed an MBES survey to extend mapping coverage in the area of Hopedale Saddle. The goal of this survey was to identify sites for a potential ROV dive. In 4 hours, the Amundsen collected four lines of data while extending previous coverage to the west (Figure 20-7). Figure 16-6 shows the resulting map following 2023 operations.

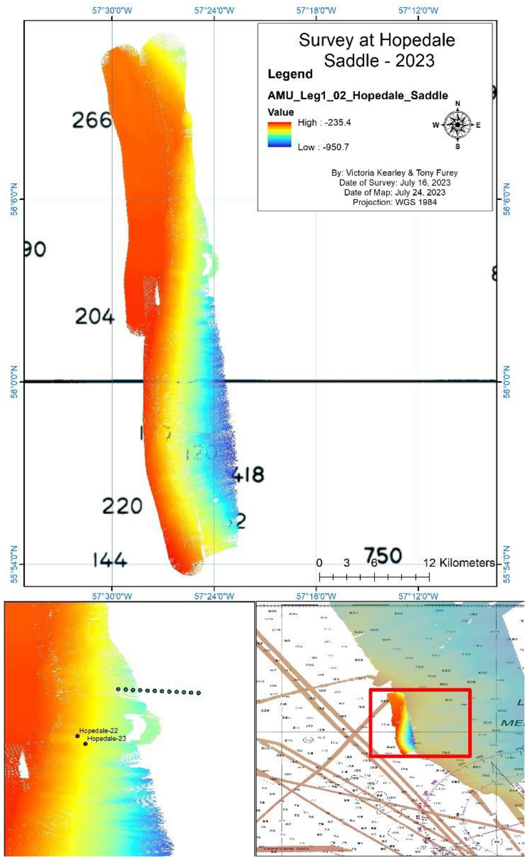


Figure 20-6: Hopedale Saddle survey map

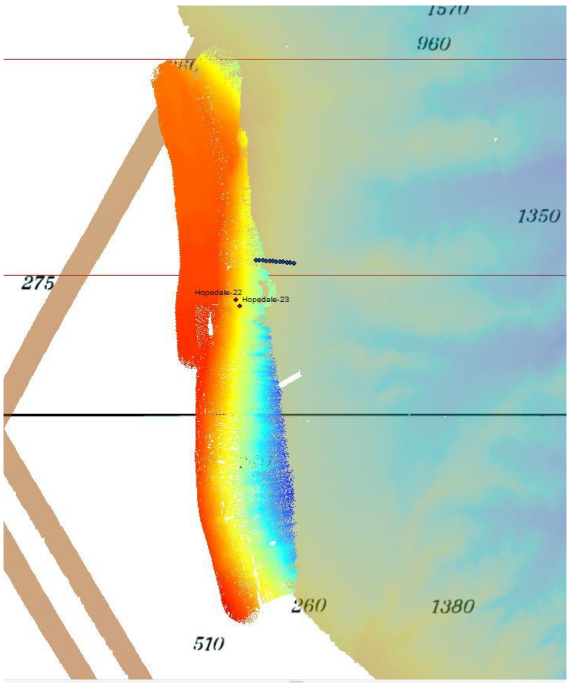


Figure 20-7: Hopedale Saddle survey

- Makkovik Hanging Gardens

On July 17th and 18th, 2023, the Amundsen performed a 4-hour MBES survey at Makkovik Hanging Gardens which is an area due to corals that grow on submarine cliffs at over 400m depth. From the data collected in 2021, this area was chosen to identify the extents of the ridge that extends to the southwest (Figure 20-9). The Amundsen followed the ridge until the bottom depth rose to the thermocline. In the following map, the dark to light blue area, indicate depths below the thermocline and hanging corals were found on slopes of about 50% or greater. The results of this survey identified a large extension of possible hanging coral habitat to be investigated by ROV dives in future expeditions. Figure 20-8 shows the resulting map following 2023 operations.

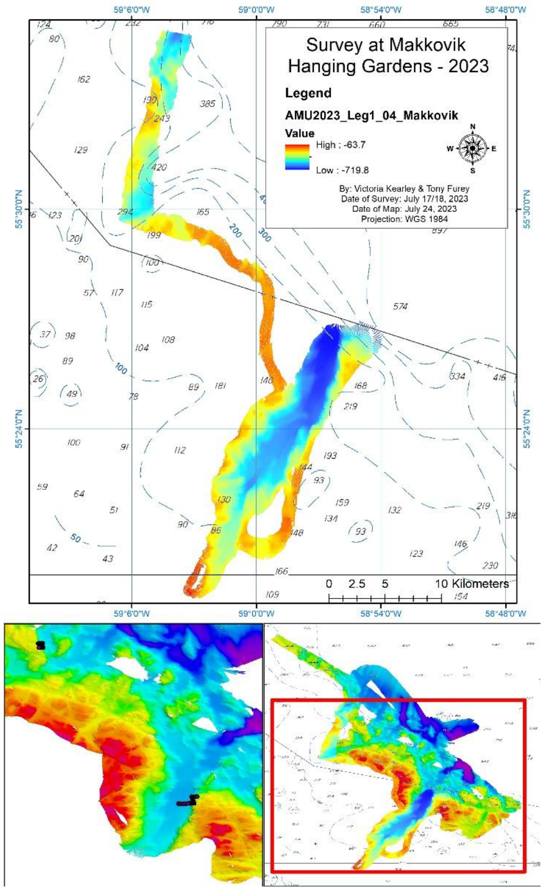


Figure 20-8: Makkovik Hanging Gardens survey map

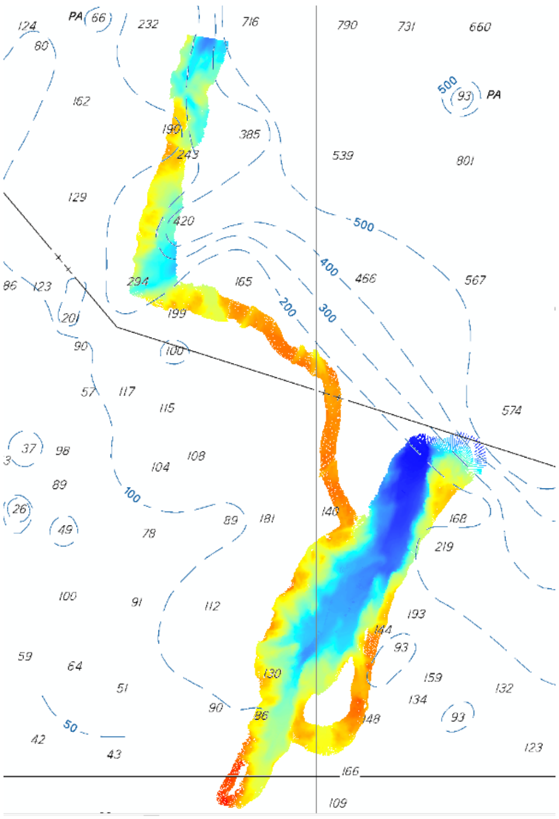


Figure 20-9: Makkovik Hanging Gardens survey

- HiBio

On July 24th 2023, the Amundsen completed a survey to find the moorings HiBio-A-22, HiBio-A-CROM-21, and HiBio-A-CROM-22. Within the multibeam survey there was three stops made to perform trilateration to the beacons of the three moorings. The MBES survey and path travelled is shown in Figure 20-10.

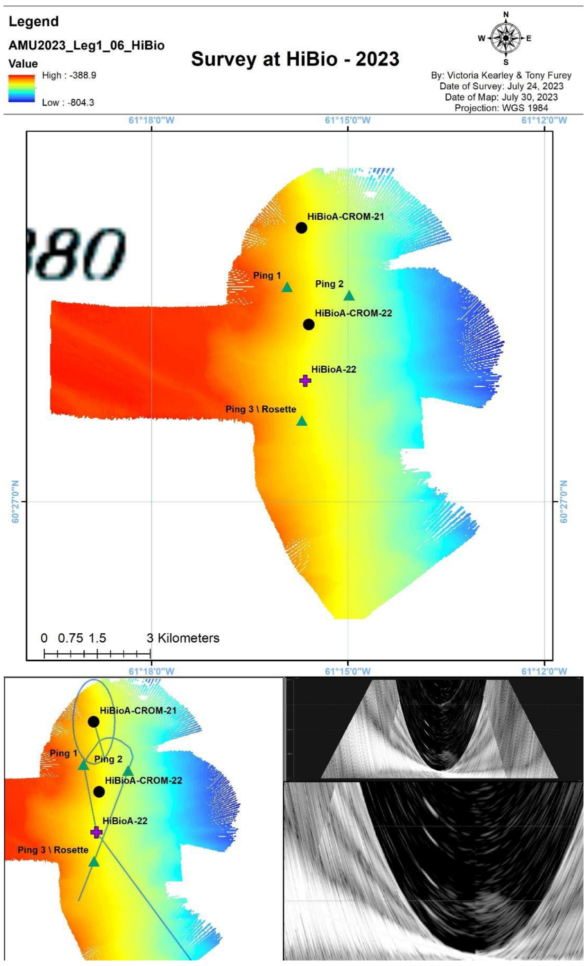


Figure 20-10: HiBio Mooring Site survey map

- Killinek Main

On July 26th 2023, the Amundsen surveyed a site called Killinek Main to northwest of Killinek Shelf to fill in gaps in existing data and identify potential sites for future ROV dives. The Amundsen completed five lines that covered the desired area and discovered that it was not desirable for a dive because of the featureless seafloor. The surveyed area is shown in Figure 20-11.

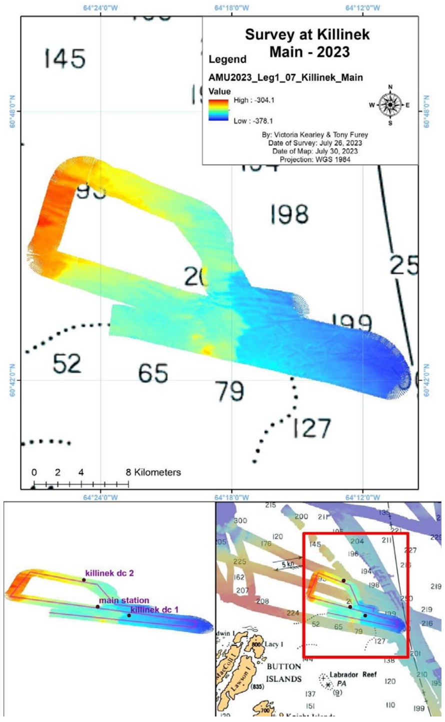


Figure 20-11: Killinek Main survey map

- Southwind Fjord

On July 30th, 2023, the Amundsen dedicated 9 hours to extend multibeam coverage in the area of Southwind Fjord because there was too much sea ice for the night crew to transit to the next station. Coverage was extended by slowly following the edge of existing data, using the port side of the vessel to acquire as much new coverage as possible at a 70° beam angle. This method was employed to ensure the Amundsen never entered an area that was less than 50m in depth. A detailed map of the area covered is shown in Figure 20-12.

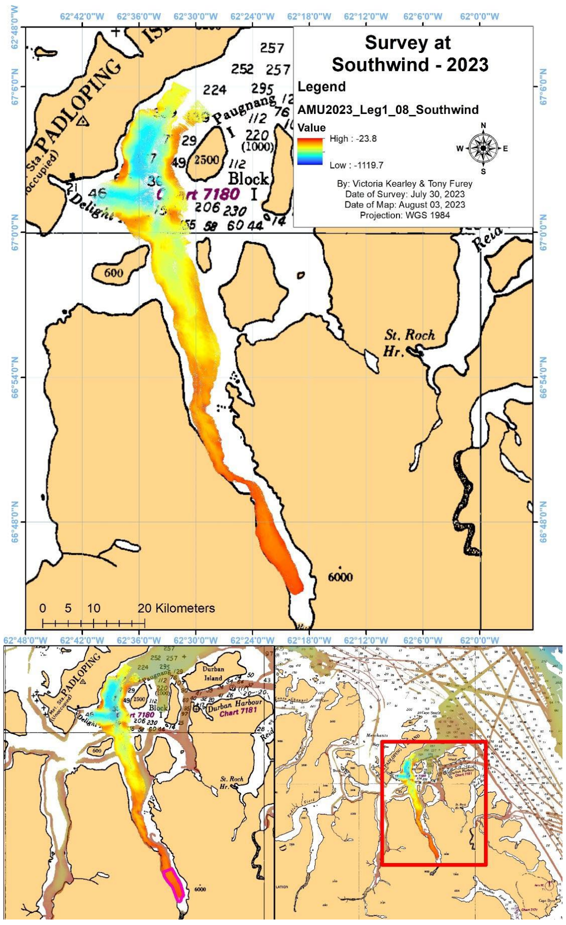


Figure 20-12: Southwind Fjord survey map

- Site C4

On July 31st, 2023, the Amundsen performed a mooring deployment for C4-23 that was about 1200m long and deployed at a depth of 1600m. After deployment, the MBES was used to locate the mooring in the water column as seen in the following water column image (Figure 20-13)

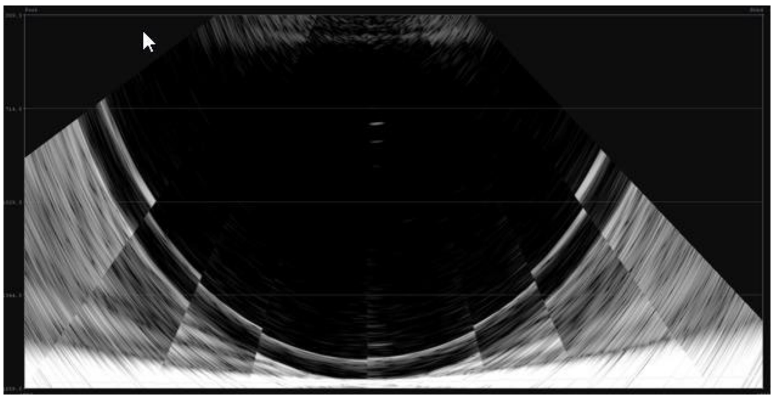


Figure 20-13: C4-23 Mooring positioning in water column

20.3.2 *Leg 2:*

Amundsen's 2023 Leg 2 program focused mapping on transects, and using water-column data for the exact location of a mooring. There was one opportunistic mapping operation. Evaluation of historical or real-time sub-bottom data was used at many stations when requested by the box core team. There were two locations where the ship was anchored and therefor not recording multibeam or sub-bottom data, as well as during the bird survey in Radstock Bay.

Opportunistic Data Acquisition

The EM304 MBES and Knudsen 3260 CHIRP Sub-bottom profiler acquired data throughout Leg 2 expanding the coverage of Amundsen Science's Arctic bathymetric database. The opportunity arose to do a quick shipwreck survey and expand on the Canadian Hydrographic Service's (CHS) coverage of bathymetric data collected by Canada's fleet of Coast Guard vessels. This data will be shared with CHS to be added to the coverage charts.

- HMS Breadalbane

The Amundsen had extra time in the second last day of the Leg, so a survey of the HMS Breadalbane shipwreck too place. The survey took place September 5th, 2023 at 05:06 UTC until 06:51 UTC, covering lines 14-18 of survey project 14. Three lines were run in the west to east direction with two lines, 14, 15 and 16, and one line run in the North to South direction, 18. The shipwreck can be seen in lines 15, 16, and 18 as shown in Figure 16-14 and Figure 20-15. The lines were processed and a 2m CUBE grid was created of the shipwreck.

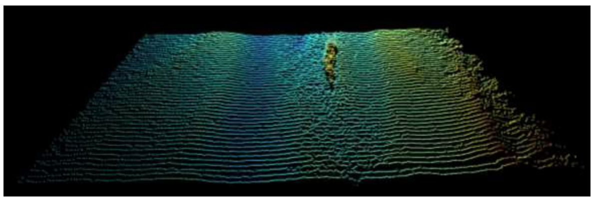


Figure 20-14: HMS Breadalbane in line 16

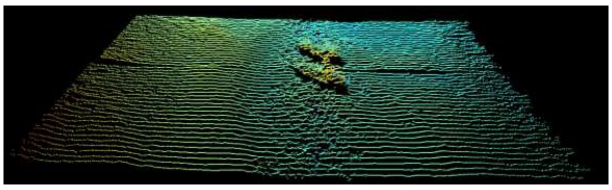


Figure 20-15: HMS Breadalbane in line 18

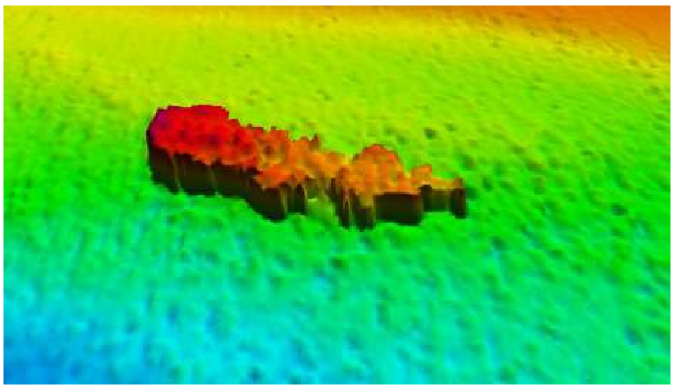


Figure 20-16: HMS Breadalbane 2m CUBE surface of line 16

- Barrow Strait

After the survey of HMS Breadalbane, there was time before entering Radstock Bay to do more survey mapping. Continuation of the Coast Guard bathymetric coverage in Barrow Strait. Two lines of coverage were completed in two hours on September 5, 2023 between 07:50 UTC to 09:40 UTC, covered by four lines, 20-23 of survey project.

Dedicated Operations

- Moorings

A mooring was deployed and mapped at Cape Graham Moore. The multibeam was used to confirm the location found using echolocation and that the mooring was vertical in the watercolumn. The mooring was found in the first pass on September 1st, 2023 at 15:13 UTC. The mooring can be seen in the watercolumn display of line 50 of survey project 12 in Figure 20-17.

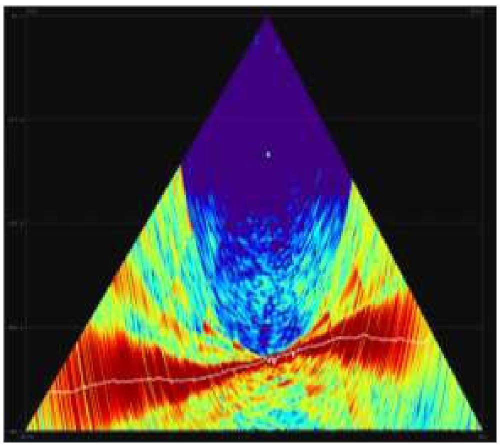


Figure 20-17: Mooring watercolumn data in Line 50

- Box Cores

The box core team required assistant on looking for sediment pockets to a box core or van veen grab in. This would require looking at old and present sub-bottom data to identify the seabed type. The locations seafloor type would be evaluated before stations as the stations covered in Leg 2 have been covered before.

20.3.3 *Leg 3:*

Leg 3 hosted a multitude of dedicated and opportunistic surveys. On most stations, a survey was planned to navigate overtop the planned position of interest. where the operators along with team leads

Opportunistic Data Acquisition

The EM304 MBES and Knudsen 3260 CHIRP Sub-bottom profiler acquired data throughout the entirety of Leg 3 with the goal of extending the spatial coverage of Amundsen Science's Arctic bathymetric database. Outside the scope of dedicated mapping operations, opportunistic data acquisition focuses on systematically surveying outside the extents of the Canadian Hydrographic Service's (CHS) compilation of bathymetric data collected by Canada's fleet of Coast Guard vessels and other sources. Amundsen Science will share acquired datasets with the CHS to update their database and marine charts. Acquired data will also be useful for ongoing and future research.

- Archer Fiord

Archer Fiord had no previous records of multibeam or sub-bottom data prior to 2023. Despite the lack of dedicated multibeam operations in the fiord, some opportunistic lines were completed to extend coverage both in and across the fiord. These data will be used for an upcoming descriptive publication by scientists onboard Leg 3 of the Amundsen expedition. Data collected in this fiord will also assist navigation and data collection during future expeditions.

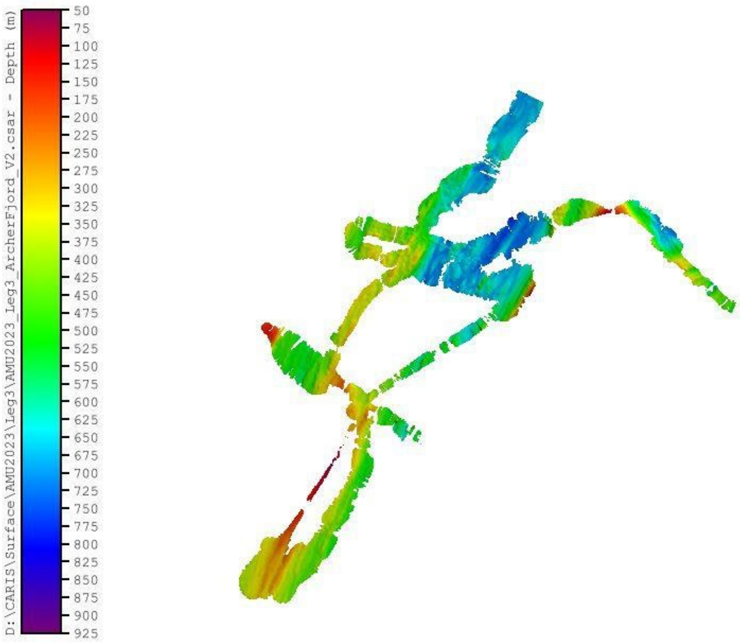


Figure 20-18: Figure 14.3. Multibeam surface of Archer Fiord (20m)

Dedicated Operations

Leg 3 hosted many dedicated multibeam surveys both on the Amundsen with the EM304 and on the barge with the EM2040. The combination of the Amundsen and barge data will support work with recent ice flow reconstitutions.

The barge is utilized to collect data in areas inaccessible to the Amundsen, allowing for extended coverage of the seafloor. During Leg 3, the goal was specifically to obtain more sounding density close to glaciers.

The barge datasets allow researchers to analyse direct interactions between glaciers and the seafloor.

- Cape Norton Shaw Inlet (Amundsen)

Norton mapping occurred during nighttime on October 23rd - 24th for a total of 15hours.

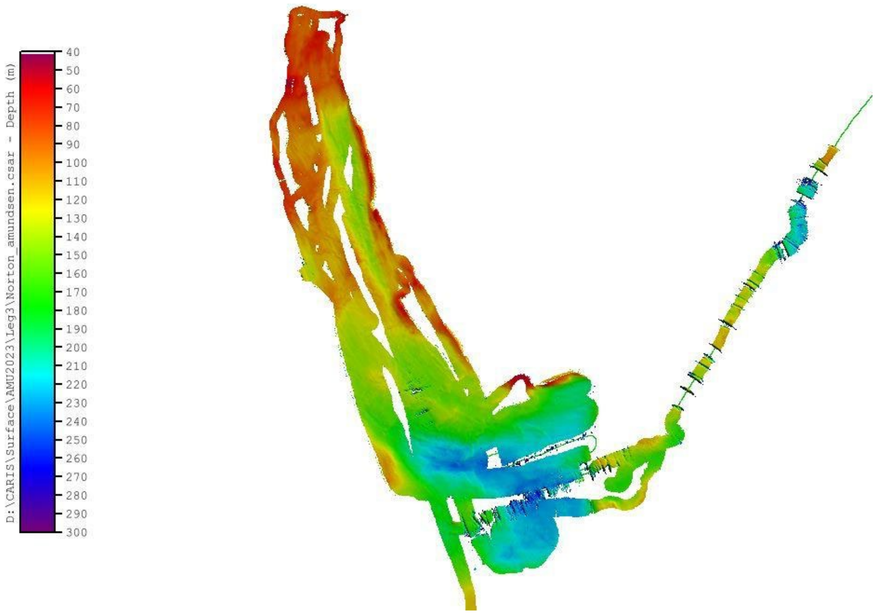


Figure 20-19: Multibeam surface of Norton (20m)

- Grise Fiord (*Amundsen*)

Multibeam coverage was added to previous multibeam data from the MV *Nuliajuk* and other sources included in the NONNA 2023 datasets. This survey supported a recent project of risk and hazard assessments in the Grise Fiord community related to marine landslides.

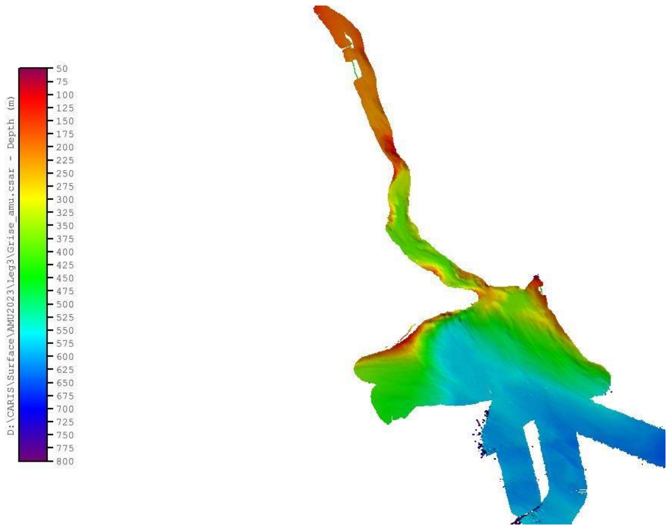


Figure 20-20: Multibeam surface of Grise Foord (20m)

- Cape Norton Shaw Inlet (Barge)

Thanks to clear mapping conditions, the barge collected two high-resolution lines close to the glacier while the Amundsen mapped the rest of the bay.

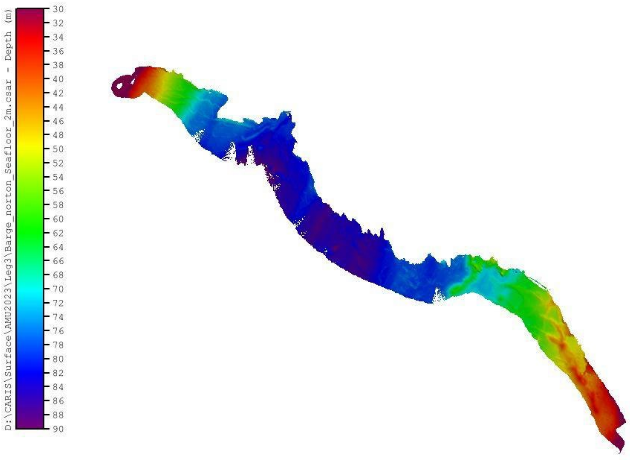


Figure 20-21: Multibeam surface of Norton (2m)

- Belcher Glacier (Barge)

A total of 3h of mapping was conducted in Belcher glacier in good and clear conditions for two highresolution line.

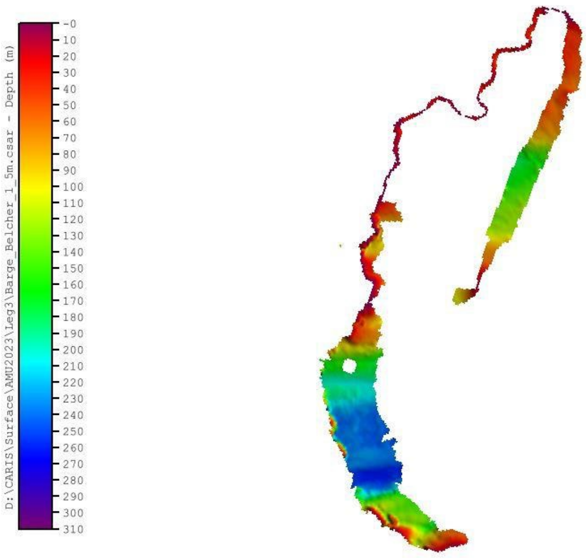


Figure 20-22: Multibeam surface of Belcher (5m)

- Croker Bay (Barge)

Two glacier termini have been mapped for a total of seven hours in two different days. While the terminus at the western end of the bay was clear, the eastern site hosted many patches of ice causing issues for navigation and data quality.

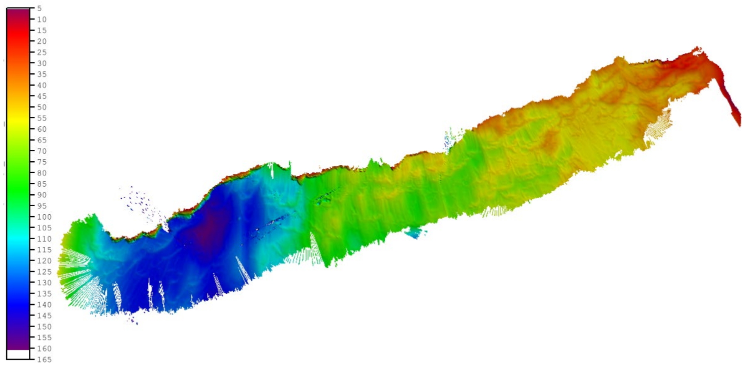


Figure 20-23: Multibeam surface of Crocker_2 (7m)

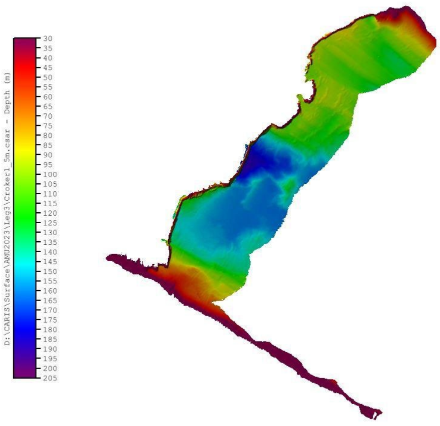


Figure 20-24: Multibeam surface of Crocker_1 (5m)

Moorings

Each Mooring deployed during Leg 3 required the multibeam operators to sight it using the water-column visualisation feature of the EM304. Objects in the water-column can be seen as they reflect sound from the multibeam. Five moorings were successfully located with the multibeam's water-column display.

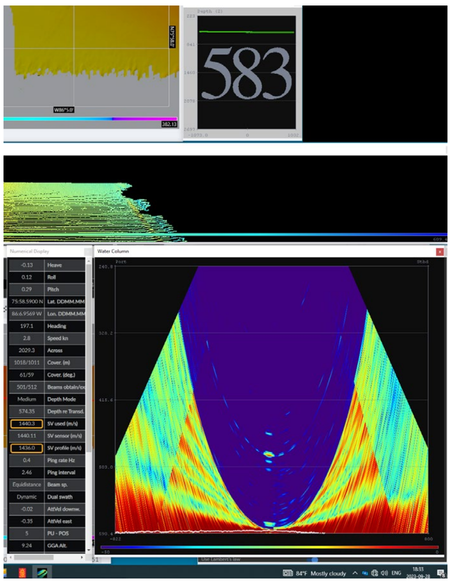


Figure 20-25: SIS Watercolumn display - Mooring in Jones Sound

Coring operations

Coring teams required an evaluation of sub-bottom data in order to identify the bottom type before the use of a gravity core, box core, or Van Veen grab. Sub-bottom surveys were conducted arriving at each station involving coring operations. Some sites were located in a location with previously collected data allowing the team to evaluate the seafloor before arriving to stations.

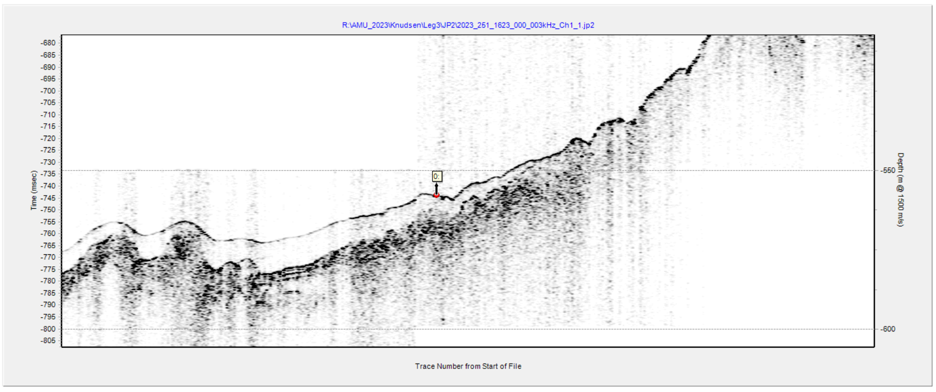


Figure 20-26: Site AC14

20.3.4 *Leg 4:*

Leg 4 had no time dedicated to solely mapping, but several small areas were mapped opportunistically around planned stations as time allowed. Both the EM304 MBES and Knudsen 3260 CHIRP Sub-bottom profiler continuously collected data for the entire duration of Leg 4.

Opportunistic Data Acquisition

The primary aim of the opportunistic mapping is to expand the extents of the Canadian Hydrographic Service's (CHS) existing database of bathymetric coverage previously collected by Canadian Coast Guard vessels, among other sources. The post-processed bathymetric data acquired on Leg 4 will be shared with the CHS to allow updates to the database and nautical charts.

- Opportunistic Survey Location 1

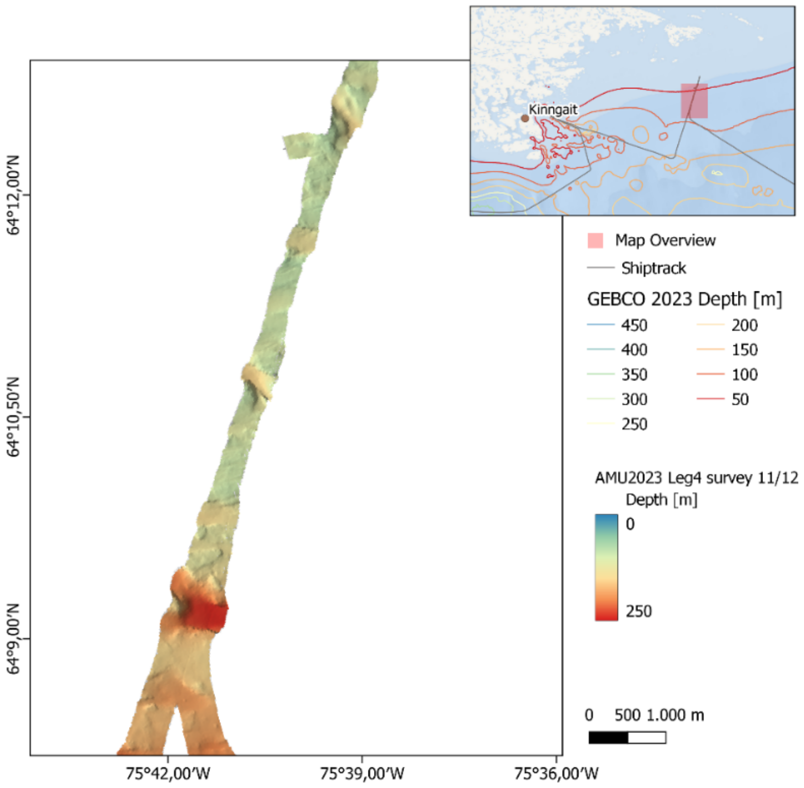


Figure 20-27: Opportunistic mapping in an area without in-situ bathymetry data

- Moorings

One mooring at station 350 was deployed during Leg 4. After deployment, it was identified in the water column provided by the MBES. The SIS watercolumn display allowed an accurate measurement of the depths of the buoys and therefore, confirmed a successful deployment.

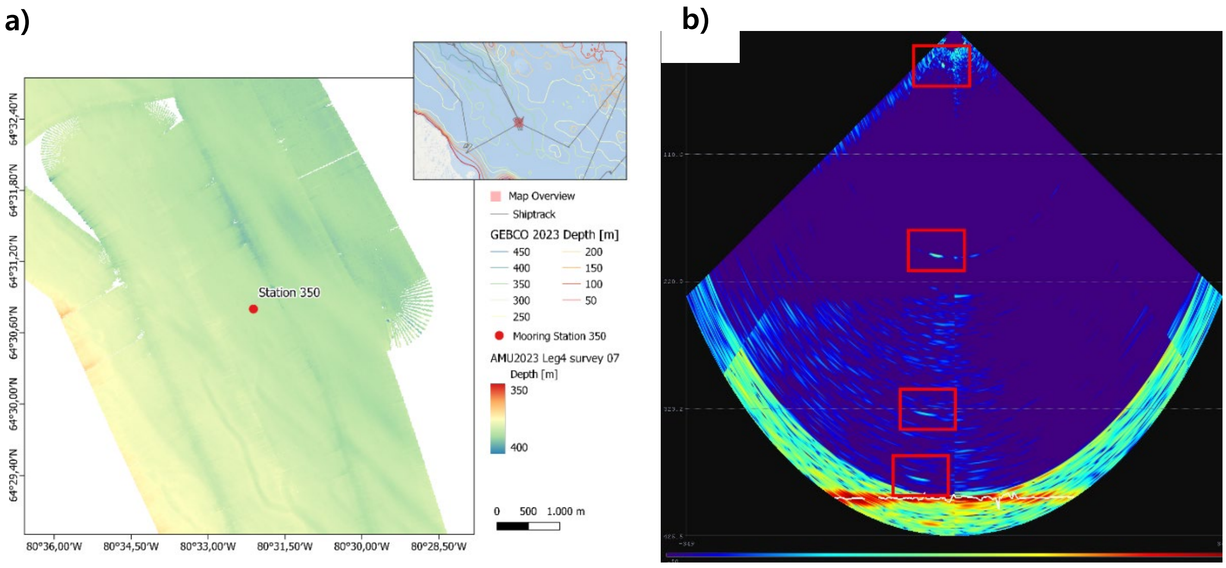


Figure 20-28: Mooring at station 350 in Foxe Channel. a) Mooring location and acquired MBES survey around the station. b) SIS watercolumn display of the mooring. The three strongest reflectors are marked with a red rectangle and correspond to the four buoys.

- Coring Operations

In support of geological operations, the Knudsen sub-bottom data was examined to identify a suitable location for either a box core or Van Veen grab. If the station was ill-suited for a box core, sub-bottom data from approaching the station was examined to find a suitable location within a reasonable distance. Some stations had pre-existing sub-bottom data which allowed to determine coring suitability prior to the station.

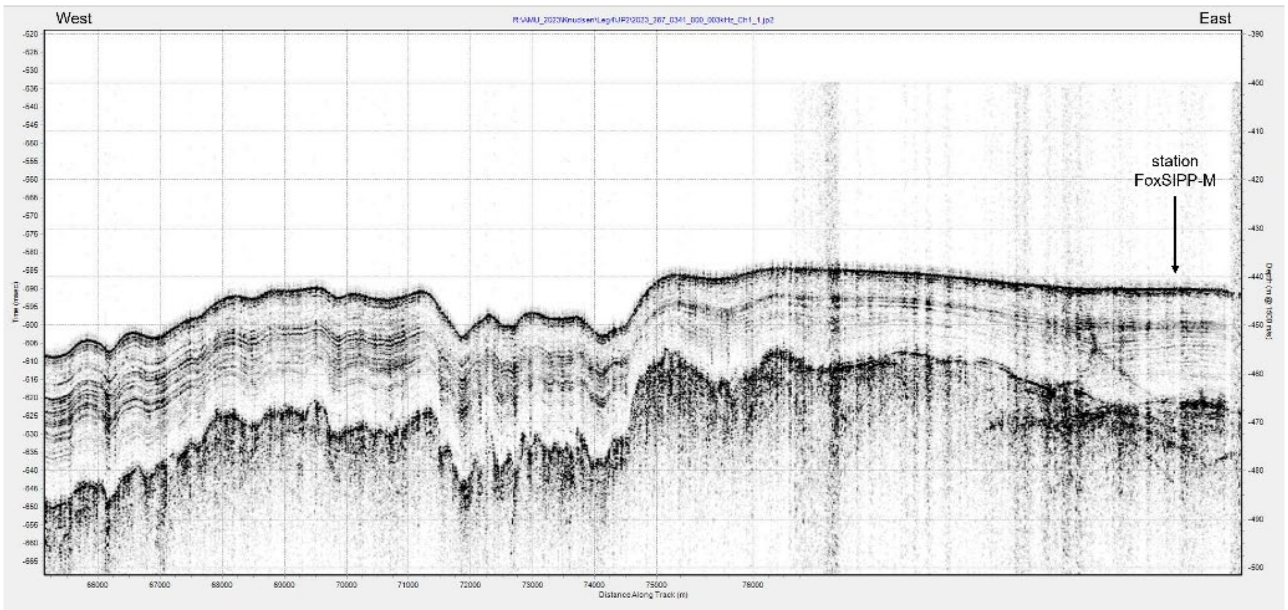


Figure 20-29: Sub-bottom survey 2023_287_0341_000_003kHz_Ch1_1 depicting the box core location at station FoxSIPP-M

20.4 Miscellaneous

20.4.1 *Leg 1:*

Trimble RTX & POSMV Logging

During Leg 1, Trimble RTX corrections were applied to position data in the POSMV inertial navigation system. Ethernet logging was enabled in MV-POSView so the data can be sent to Trimble later for their analysis of the correction system in high latitudes. During the course of the Leg, there were no interruptions of the system, which is likely due to the use of the new Starlink internet system onboard the CCGS *Amundsen*. With the RTX correction service, positional accuracy was maintained at 0.034/0.034 meters in both latitude and longitude directions and 0.027 meters in altitude. Ethernet logging of the POSMV should be enabled in MV-POSView for the remaining legs of the 2023 Amundsen expedition.

SIS Projection Issue

An issue still exists within SIS5 with the projection of geotiffs exported from ArcMap. For Leg 1, it was important to make sure that geotiffs were exported from ArcMap in the WGS84 – World Mercator projection. A good check to make sure the map was projected correctly in SIS was to add a labeled point to the map in ArcMap and check this coordinate against the position given in SIS at that point. In previous years, a temporary solution to the incorrect projection issue was to export the map from ArcMap and load it into CARIS Hips & Sips and then exporting again from CARIS before loading the geotiff in SIS. For later legs at higher latitudes, this issue could present itself more frequently and close attention should be given to the projection whenever a geotiff is loaded in SIS.

CARIS Tide Files

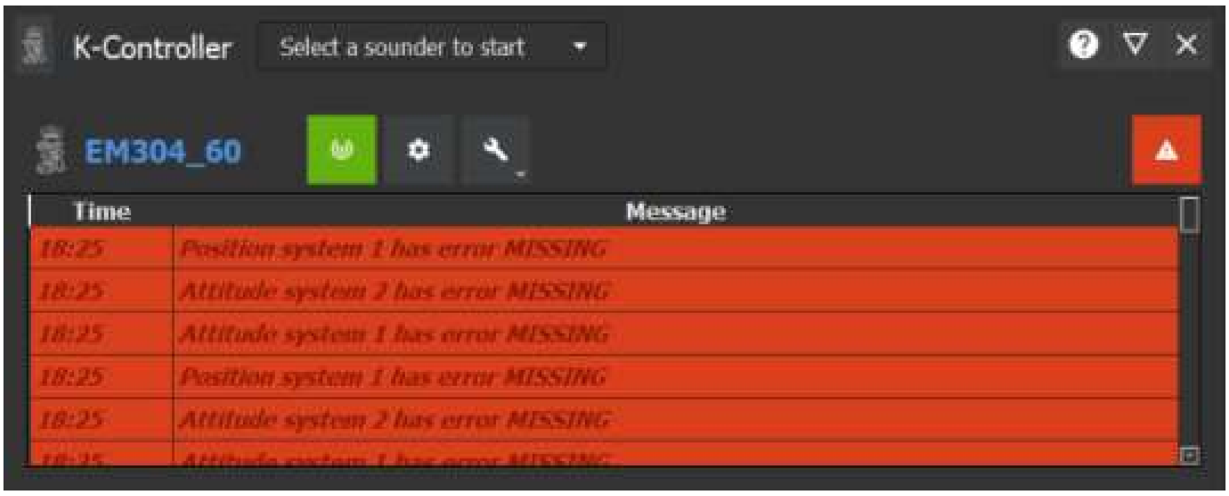
New in 2023 Tide files are no longer generated using the Linux PC. A python script implemented in Jupyter notebooks is executed on the ArcGIS PC. In the "tides – Shortcut" folder located on the ArcGIS PC desktop there is a "README.txt" file that explains the use of the jupyter notebooks for converting nmea strings to Shiptrack files and then converting the WebTide track prediction html file into a CARIS .tid file.

An issue that occurs from time to time is that a decimal point or single numerical digit and decimal point are duplicated in the $INGGA string of the NMEA file. This seems to only happen on the longitude field and will present itself as an error in the jupyter notebook when attempting a conversion from nmea to Shiptrack. The temporary solution is to open the nmea file you are trying to convert, use ctrl+F (Find) to find the ".." and remove one of the decimals, save the nmea file and continue with the conversion to Shiptrack.

20.4.2 *Leg 2:*

POSMV Error

Every Leg Amundsen Science logs POSMV POSPac data to store positions, attitude accuracies, etc. from the POSMV. During Leg 2, there was a "Missing" error for the Position system 1 and Attitude systems 1 and 2, as seen in Figure 16-30. This error would occur every 2-3 days for a large portion of the Leg. This error was assumed to be from satellite week spots as when this error occurred the satellite distribution was sparse in one or two quadrants of the GNSS Data in the MV-POSViewer.

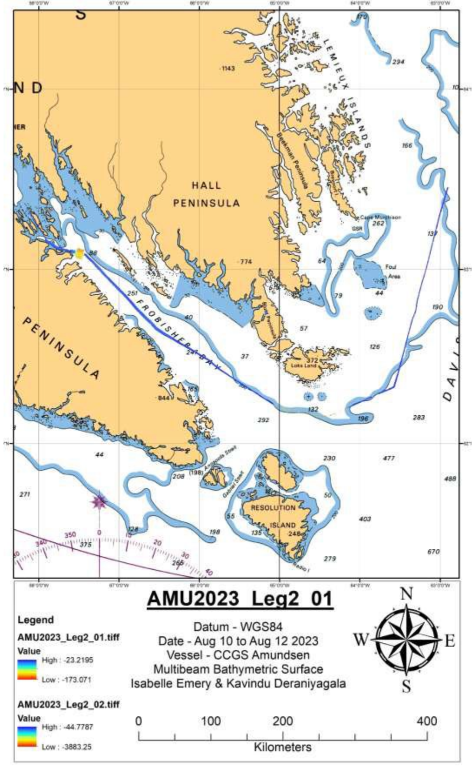


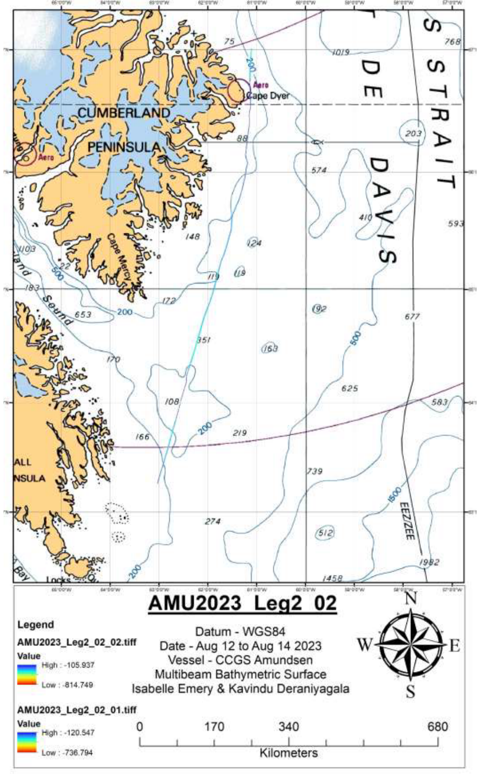
Time	Message
18:25	Position system 1 has error MISSING
18:25	Attitude system 2 has error MISSING
18:25	Attitude system 1 has error MISSING
18:25	Position system 1 has error MISSING
18:25	Attitude system 2 has error MISSING

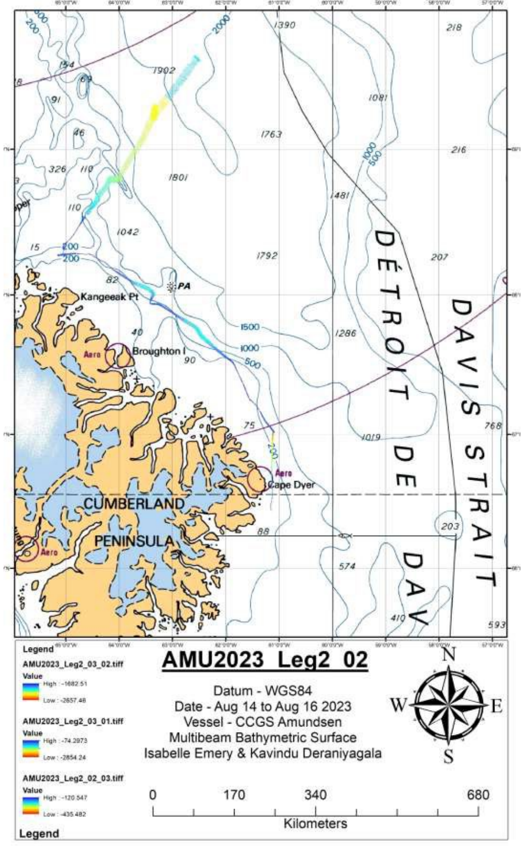
Figure 20-30: POSMV Error

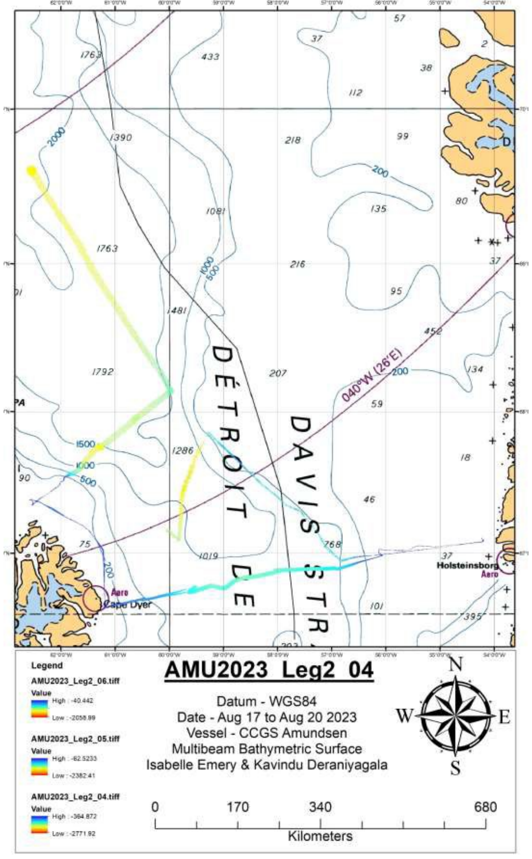
Full Bathymetric Coverage

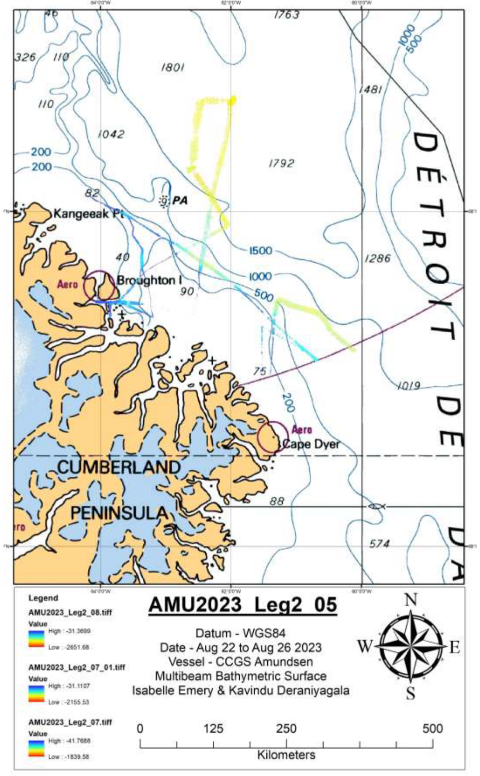
The full coverage of the bathymetric surveys during transects stations, and mapping.

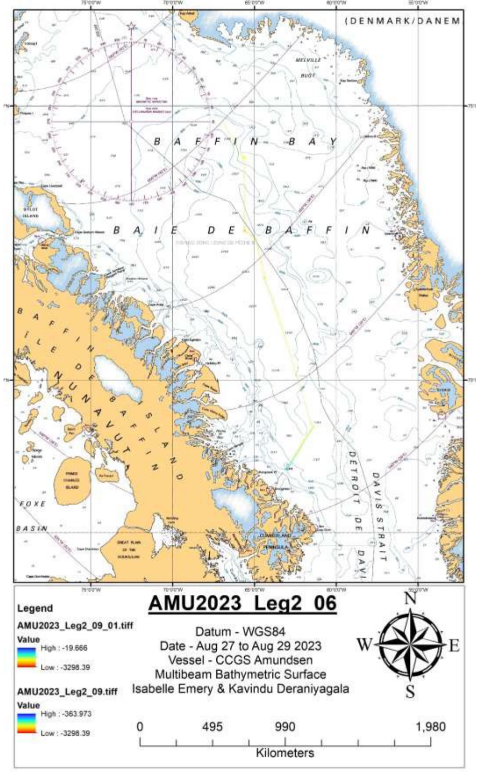


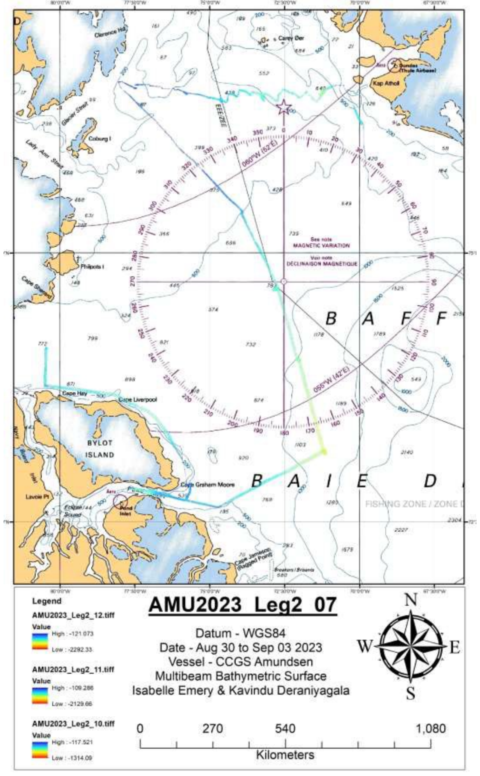


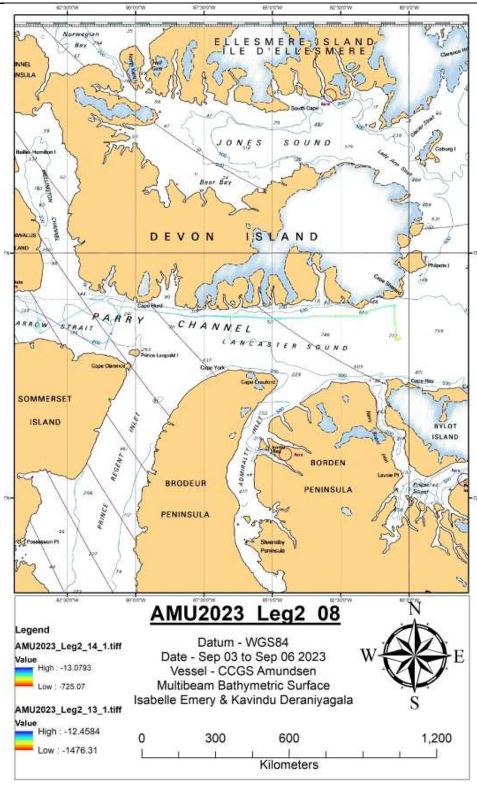












20.4.3 *Leg 3:*

Trimble RTX

2023's operations continued opportunistic testing of the Trimble RTX real time corrections service for marine applications in partnership with Trimble and the University of New Brunswick Ocean Mapping Group. The service continually improved the POSMV's accuracy from 0.5m to 0.03m, however the service was lost in fiords and when the boat reached its highest latitudes above 80 degrees.

Sub-bottom turned off at Grise Fiord

From September 26 to September 28, the sub-bottom profiler was turned off to respect the Grise Fiord community. Some sub-bottom data for sites were found from 2007 and 2019.

20.4.4 *Leg 4:*

Knudsen Computer Issues

At various points throughout the voyage, difficulties were encountered with the onboard PC operating the Knudsen sub-bottom profiler. On more than one occasion, the software froze, and the computer required a reboot to function again properly. When this occurred, all data in the line being actively recorded at the time of the crash was lost. At other times, the software continued functioning, but did not properly record positioning data, requiring either a computer reboot or to refresh the serial ports.

20.5 Recommandations:

- Develop a procedure to replay KMWCD file for mooring positioning
- Upgrade RAM & Graphics in ArcGIS PC

21 Fingerprinting macroalgal contributions to Arctic and Subarctic sediments using eDNA

Project leaders: John O'Brien (John.Obrien@dfo-mpo.gc.ca)

Cruise participants – Leg 1: John O'Brien[1]

[1]Arctic and Aquatic Research Division, Fisheries and Oceans Canada 501 University Crescent Winnipeg, MB R3T 2N6

21.1 Introduction and Objectives

The global marine macroalgal biome is distributed within a relatively thin strip around the world's coastlines, but is comparable in areal extent and net primary productivity to the Amazon rainforest. In temperate to polar regions, subtidal brown macroalgae such as kelp are particularly productive and predicted to expand further throughout the Arctic as open water days increase with continued loss of sea ice cover. Much of the prolific primary productivity generated by kelp forests is exported from those ecosystems as DOC, POC, large fragments, or whole thalli and this material is more recalcitrant than other marine autotrophs (e.g., phytoplankton, benthic microalgae). The export of detritus from these nearshore ecosystems therefore represents a resource subsidy and a flux of carbon into the recipient habitats. However, it remains unresolved over what spatial scale this export occurs, the fate of kelp and macroalgal-derived carbon as it is potentially transported from the nearshore to habitats across the continental shelf or deeper to be remineralized or sequestered, and which species contribute most to this flux. Environmental DNA (eDNA) and new DNA mini-barcodes specific to marine macrophytes provide a new fine-grained tool to identify species-specific macroalgal contributions to recipient communities compared with more broad-stroke methods for evaluating potential sources of carbon (e.g., bulk stable isotopes). During Leg 1, my objective was to collect sediment samples necessary to evaluate the spatial scale that the signature of marine macroalgae could be detected in subarctic and Arctic marine sediments and which species contribute to this export using eDNA.

21.2 Methodology

To evaluate the species-specific occurrence of marine macroalgae in subarctic and Arctic marine sediments, I collected surface sediment samples at stations during Leg 1 at which the boxcore was deployed (Figure 21-1A). From each boxcore, triplicate samples from the top 2 cm of undisturbed sediment were collected using a mini-corer constructed from modified 50-mL falcon tubes and placed in sterile Whirl-Pak® bags. The mini-corers were de-contaminated with 10% bleach, rinsed 3 times with distilled water, and stored in separate sterile Whirl-Pak® bags prior to sampling (Figure 21-1B). To preserve DNA, immediately following collections, 2 mL of RNAlater™ solution was added to each bag containing approximately 10 mL of sediment, mixed thoroughly, and re-sealed (Figure 21-1C). Bags were kept refrigerated at 4°C overnight to allow RNAlater™ to diffuse throughout the sediment sample and transferred to a -20°C freezer the following day for long-term storage.

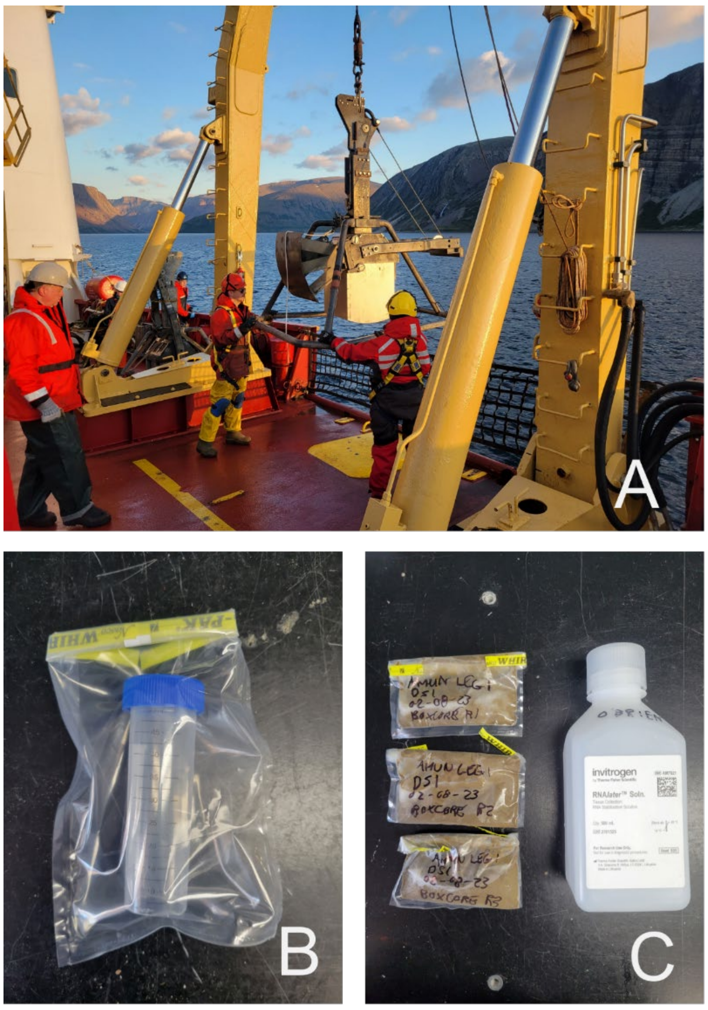


Figure 21-1: Overview of sampling protocol for detection of macroalgae eDNA in marine sediments. A) Deployment of boxcore in Saglek Fjord, B) Sterile mini-core adapted from falcon tube in sterile Whirl-Pak® prior to sampling, C) Three replicate sediments samples preserved with RNAlater™ solution

21.3 Preliminary Results

Sediment samples for eDNA were collected at a total of 18 stations where the boxcore was deployed. Stations covered a latitudinal gradient from the southern end of the Labrador Shelf to Baffin Bay in the North and a depth gradient (40 m to 895 m) across nearshore fjord environments, the continental shelf and into the upper continental slope (Figure 21-2; Table 21-1). At a later date, macroalgal DNA will be extracted from sediments using commercial kits for soils. Macroalgal DNA sequences will be amplified using primers developed specifically for marine macrophytes prior to sequencing. The expected results of bioinformatic analysis will be taxa lists providing an indication of species presence at each sampling location. We encountered evidence of macroalgal export from the shallow subtidal zone throughout Leg 1 including mats of rafting macroalgae floating at the surface (Figure 21-3A), encountered during ROV dives (Figure 21-3B), and collected in beam trawl deployments (Figure 21-3C).

Table 21-1: Event log information on stations at which sediment samples were collected for analysis of macroalgae eDNA

Time (UTC)	Station ID	Latitude (N)	Longitude (W)	Depth (m)
2023/07/18 00:28:41	Makkovik Hanging Gardens	55.4336408	58.9433882	703.37
2023/07/18 12:59:59	ISECOLD-0-200	56.2861247	58.9052262	201.34
2023/07/18 13:35:40	ISECOLD-0-200	56.2868567	58.9038138	202.22
2023/07/20 15:19:31	ISECOLD-1-200	57.7134595	60.2086783	219.18
2023/07/21 05:27:28	Okak Bay	57.5292225	62.0768897	40.77
2023/07/22 08:44:20	North Arm	58.4833333	63.2191180	240.73
2023/07/23 01:44:41	ISECOLD-2-200	58.7145937	61.1839935	203.64
2023/07/23 12:40:34	Sag Bank	59.3832980	60.3195467	427.07
2023/07/26 03:23:49	ISECOLD-3-200	60.4434132	62.5813595	339.73
2023/07/27 22:35:41	Hatton 600	61.1233975	63.2862662	607.64
2023/07/30 05:32:24	Southwind_2	66.9226873	62.4900620	389.89
2023/07/30 22:27:55	Southwind_5	66.7875997	62.3689900	179.77
2023/07/31 00:00:27	Southwind_8	66.7529092	62.3123542	41.38
2023/08/01 07:53:28	BB1B_600	67.9917192	59.3750933	553.86
2023/08/01 11:16:51	Disko Fan	67.9708863	59.5046017	895.08
2023/08/02 01:55:04	BB1D_600	67.3786297	57.9325873	656.86
2023/08/03 21:55:03	DS2	65.3349683	58.0167712	573.77
2023/08/04 14:42:51	DS3	64.6484325	58.6031017	610.63

Figure 21-2: Locations of stations where sediment subsamples from boxcore collections for macroalgae eDNA analysis were made during Leg 1. Yellow points denote boxcore deployment locations. Yellow polygons denote Marine Refuges in Canada’s marine conservation network. Eastern Arctic Marine Refuges (Hatton Basin, Davis Strait, and Disko Fan) are labelled

Figure 21-3: Evidence of macroalgal export from the shallow subtidal encountered during Leg 1. A) Rafting rockweed and kelp detritus at the surface, B) Kelp detritus being collected by the ROV ASTRID manipulator arm during the Frobisher Bay dive (C0048), C) Kelp (*Saccharina latissima*) collected by the beam trawl in Saglek Fjord.

21.4 Recommendations

As the conceptualization for this project was inspired by observations in the early stages of the expedition, the sampling protocols had to be completed with improvised equipment. Considering the improvised nature of the study design, I was able to meet the objectives well with the materials I had on board. However, for future extensions it would be useful to have dedicated tools better equipped to subsample boxcore surface sediments (e.g., syringes). Contingent on the results of the eDNA analysis, more detailed follow-up studies could be arranged involving analyses of the sources of macroalgal-derived carbon using other tracers, its recalcitrance, and rates of accumulation. Similar onboard sediment core incubations to those described in other sections of this cruise report (section 22) could be run to evaluate how this form of carbon is remineralized in deep-sea sediments relative to pelagic or sympagic sources.

22 Sediment biogeochemistry and benthic-pelagic nutrient cycling

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Cruise participants – Leg 1: Christopher Algar, Haley Geizer, Stephan Hamisch, Silas Jones

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22.1 Introduction and Objectives

Sediment sampling was conducted using both ROV push cores and box cores to quantify sediment benthic-pelagic biogeochemical cycling. Quantifying the current rates of these biogeochemical process is important as these processes may be altered by anthropogenic climate change with potential ecosystem wide effects. Coastal and shelf sediments are hotspots of biogeochemical cycling, they are responsible for up to 80% of marine carbon burial and 50% of global denitrification, however knowledge of these processes in the Eastern Canadian Arctic and Subarctic is limited due to the challenge of collecting field measurements in such remote environments. It is also an area particularly sensitive to the effects of anthropogenic climate change. The Arctic is warming 3-5 times faster than the global average, which is changing patterns of phytoplankton primary productivity. For example, a shift from ice algae to free floating phytoplankton communities, may alter the quantity or quality of organic matter reaching the sea floor. In addition, a potential slowing of the Atlantic Meridional Overturning Circulation (AMOC) may decrease ventilation of the bottom waters, altering redox sensitive processes. This provides the motivation for the objectives for this research mission, which are: 1) to quantify the exchange of carbon, oxygen, and nutrients between the sediments and overlying water across a latitudinal gradient stretching from the Sub-Arctic to the Arctic, and from coastal to continental shelf and slope environments, and 2) examine how benthic faunal communities will respond to climate induced changes in organic matter delivery.

Objective 1 will continue work conducted on previous Amundsen expeditions in 2021 and 2022. In these previous expeditions we examined sediment biogeochemistry in Southwind Fjord (2021, Leg 2), Hebron (2020, Leg 1) and Nackvak Fjord (2022, Leg 1). This year we added to this dataset by sampling Okak Bay, Saglek Fjord, and revisited Southwind Fjord. In addition, we also re-sampled a deep coastal site, Makkovik Trough (~700m) and a continental slope site in Davis Strait (~500m). The Makkovik site was push cored for biogeochemistry during Leg 1 of the 2021 Amundsen field season and resampling this site will provide an estimate of temporal variability. It is a site of high biodiversity, recently identified through the sharing of local knowledge. The work for objective 1 is being conducted by Haley Geizer (*Dalhousie University, supervisor: Dr. Christopher Algar*) and is part of her PhD dissertation.

Objective 2 was addressed through a series of manipulated experiments where sediment cores where amended with either freeze dried phytoplankton or ice algae during a series of nutrient pulse trace experiment. These examined the functional change in the benthic community during a sediment flux incubation following a period of enrichment during a sediment flux incubation. This work will form part of Memorial University graduate student Stephan Hamisch's (*supervisor: Dr. Paul Snelgrove*) MSc. dissertation.

22.2 Methodology

In total 28 ROV push cores and 57 sub cores from box core drops were collected from 9 different sites (Table 22-1). The ROV push cores were collected from two sites (Makkovik and Davis Strait) during dives R39 and R43/R44. During each dive, 14 35 cm x 6.7 cm OD push cores were collected. The cores would contain around 20 cm of sediment and 15 cm of overlying water and an undisturbed sediment-water interface. During previous years only 11 push cores could be collected per dive, however the Astrid ROV team increased the number to 14 for this year by adding three additional core holsters to the front of push core rack (see Figure 22-1). The addition of these three cores were a major improvement, as it allowed us to carry out both the nutrient pulse trace experiments and characterise the sediment biogeochemistry with suitable replication. Of the 14 cores collected per dive, 9 cores were used for flux/algae amendment experiments, 2-3 cores were used for porewater geochemistry, a single core was used for microsensor measurements. The latter was then sectioned at 2 cm increments and samples saved for particulate carbon and nitrogen content, porosity, grain size, and genomic sequencing (to be carried out in collaboration Casey Hubert's group). For box cores, 6-7 push cores were sub cored using the same core liners as the ROV push cores. These cores were divided similarly to the ROV cores. A complete description of core locations and analysis conducted are provided in Table 22-1.

Figure 22-1: Cores mounted on the Astrid ROV with three additional cores mounted

Table 22-1: Summary of ROV push core and box core subcores collected for sediment biogeochemistry and nutrient pulse trace experiments. Not all collected cores were used for biogeochemical analysis due to either the quality of the cores or sampling time constraint (processing porewater cores within 24 hours). Some cores were used by the Hubert team for sulfate reducer experiments as described in subsequent sections

Site Name	Latitude (N)	Longitude (W)	Depth (m)	Core type	Core (#)	flux	porewater	Microsensor/ CHN/ microbial
Makkovik	55.4340	58.9416	706.3	ROV	14	9	2	1
Makkovik	55.4336	58.9434	703.4	BC	6	3	2	1
Okak Bay	55.5292	62.0769	40.8	BC	4	2	2	0
Saglek Fjord	58.4833	63.2191	240.8	BC	9	3	4	2
Southwind Fjord (stn-02)	66.9227	69.4901	392.4	BC	6	3	2	1
Southwind Fjord (stn-03)	66.8292	62.4278	86.7	BC	6	3	2	1
Southwind Fjord (stn-05)	66.7876	62.3690	179.8	BC	6	3	2	1
Southwind Fjord (stn-07)	66.7519	62.3126	37.9	BC	6	3	2	1
Southwind Fjord (stn-08)	66.7529	62.3124	41.4	BC	6	3	2	1
Davis Strait 2	65.3366	58.0226	573.9	ROV	14	9	2	1

Davis Strait 2	65.3348	580168	573.8	BC	7	3	3	1
Totals					84	44	25	11

Microsensor Measurements: To determine oxygen penetration into the sediments, microsensor profiling was conducted using Clark Type electrodes (UNISENSE OX-100). Briefly, a 100 µm diameter oxygen electrode was lowered into the sediments at 100 µm increments using a programable stepper motor controlled using UNISENSE SensorTrace profiling software (Figure 22-2A). Oxygen profiling measurements were performed in the cold room (~4°C) at close to ambient *in situ* temperatures and the overlying water was bubbled with air to ensure 100% O_2 saturation. In each core four oxygen profiles were measured and will be combined to create an average profile and standard deviation. In years past this analysis has been difficult while the ship's thrusters are being used due to strong vibrations in the aft cold laboratories. This year to mitigate this issue a sheet of two-layer high density/low density sound dampening foam was placed beneath the microsensor stage (see Figure 22-2C). It was difficult to assess the effectiveness of this strategy, but vibrations did not seem to be as much of an issue as in years past.

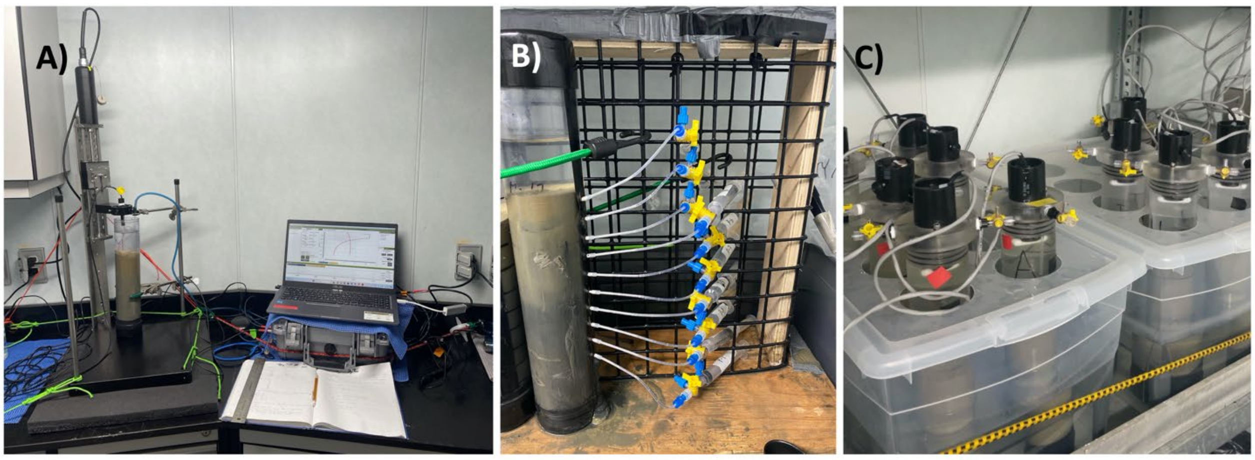

Figure 22-2: Experimental setups for A) microsensor profiling, B) Rhizon porewater extraction, and C) Flux incubations and pulse trace nutrient addition experiments

Porewater geochemistry: At all sites, cores were collected for the characterization of porewater chemistry. When possible, cores were collected in duplicate or triplicate to assess spatial heterogeneity (Table 22-1), the number of cores used for replication was based upon operational constraints and depended upon the number of cores needed for other analysis. After collection porewater was extracted at 2 cm increments using Rhizon samplers (see Figure 22-2B). Extractions were performed in the temperature controlled cold room (~4°C), ideally immediately and always within 24 hours after core fcollection. After porewater collection, samples were sub-divided for analysis. Aliquots were taken for dissolved DIC, TA, dissolved nutrients (NO_x^-, NH_4^+, PO_4^{3+}), Fe^{2+}, and H_2S. Fe^{2+} (fixed with Ferrozine reagent) and H_2S (fixed with zinc acetate reagent) subsamples were stored at ~4°C, while nutrient samples were frozen at -20°C until analysis. Samples will be analyzed post-cruise in Dr. Algar's laboratory at Dalhousie University.

Flux incubations: For flux incubations sediment cores were collected in triplicate with approximately 20 cm of sediment and 15 cm of overlying water. In box core samples the overlying water was sometimes not retained during sampling, in these cases bottom water was slowly and carefully, to prevent sediment resuspension, added to the top of the cores.

Cores were placed in a water bath in the temperature controlled cold room. (see Figure 22-2C). The target temperature was 4°C, however temperature measurements in the water bath consistently read 5.9-6.0°C. Cores were left to sit for 12 hours. After 12 hours overlying water was exchanged with bottom water (~10m above bottom) collected from the CTD rosette. To exchange the bottom water a disk with the inner diameter of the sediment cores was cut from bubble wrap and placed on the water surface, this was to prevent resuspension of the sediment during syphoning off the overlying water and refilling the core liners. After this point the cores were capped to mark the beginning of the flux and stirred at ~60 rpm using motors with a magnetic coupler. Oxygen measurements were collected at 0, 2, 4, 8, 16, 24, 32, and 48 hours during the first 2 days using Fibox non-invasive oxygen dots (Pyroscience). After 48 hours oxygen measurements were made twice per day (~12h). Water sampling was conducted at approximately 8 hours intervals for the first 48 hours and twice a day (~12 hours) thereafter. Water samples were collected through sampling ports in the caps using a 60mL spring and water simultaneously replace with a second syringe. During the first 48 hours samples were collected in 11 mL exetainers for DIC analysis and 12 mL were collected for nutrient analysis (NO_3^-, NO_2^-, NH_4^+, PO_4^{3-}, SiO_2). After 48 hours DIC was no longer collected, but nutrients were collected every 12 hours and fluxes were continued for three more days to serve as controls for the nutrient pulse trace experiments described below.

Nutrient Pulse Trace Experiments: Nutrient pulse trace experiments were conducted by amending cores in triplicate with either phytoplankton or ice algae. For each treatment an equivalent of 250 mg C m^{-2} of algal material (about 25% of annual primary production) was added to each triplicate treatment. For the phytoplankton treatment the planktonic diatom *Chaetoceros sp.* was added, while in the ice algae treatments the ice algal diatom *Frigida cylindrus* was used. Cores were incubated for 4 days, oxygen was monitored in the cores, and overlying water was replaced, using the method described above whenever concentration dropped below 100 μM. Nutrient samples were collected periodically according to the timescale and methods described for the control fluxes.

22.3 Preliminary Results

Makkovik: Push cores (14) were collected at the beginning of the dive. Sediments appeared to be soft cohesive predominately muddy sediments and contained abundant epifauna. Push cores were collected "quasi-randomly", three cores were collected within reach of the ROV 7 function arm spaced approximately equal distances apart (15-20cm). The ROV would collect approximately three cores then moved forward approximately 0.5-2 m and collected another three cores, this pattern was completed until all 14 cores were collected. Cores were dived for use according to Table 22-1. A full set of pulse trace experiments, phytoplankton and ice algae amendments plus controls along with biogeochemical characterization was carried out (flux, porewater, and microsensor cores). After the ROV dive a box core was taken at the ROV dive site and the same set of biogeochemical measurements (flux, porewater microsensors cores) were carried out. The purpose of this was to test for differences/biases in coring method and whether ROV push core and box cores sub cores could be directly compared to each other in biogeochemical studies.

Okak Bay and Saglek Fjord Sites: Box cores were collected in both Okak Bay and Saglek Fjord to add to the data set from 2021 and 2022 characterizing the biogeochemistry of fjords along the Labrador Shelf and Baffin Island. The box core in Okak Bay had low penetration (about 10-25 cm) and upon sectioning sediments appeared coarse grained, this made sub coring difficult, and several cores were lost upon retrieval. This meant only 4 cores could be collected. Two cores were used for flux incubations and two cores for porewater chemistry. No cores were used for microsensor profiling because the sediments were course and the risk of breaking a microsensor was deemed too great. In Saglek Fjord sub bottom profiles were used to find a location of soft sediment for box coring and a box was taken in flat area near the deepest portion of the fjord basin. The box core was successful, and a full suite of biogeochemical cores were collected for fluxes (3 cores), porewater chemistry (2 cores) and microsensor measurements (1 core). The sediment at the Okak Bay coring location were more oxidized than those in the Saglek Fjord location. The Okak Bay cores were brownish color for most of 10 cm – 15cm core depth with black reduced sediments only appearing near the base of the cores. The cores in Saglek Fjord had a narrower brown oxidized zone ~5-7 cm before transitioning to black reduced sediments.

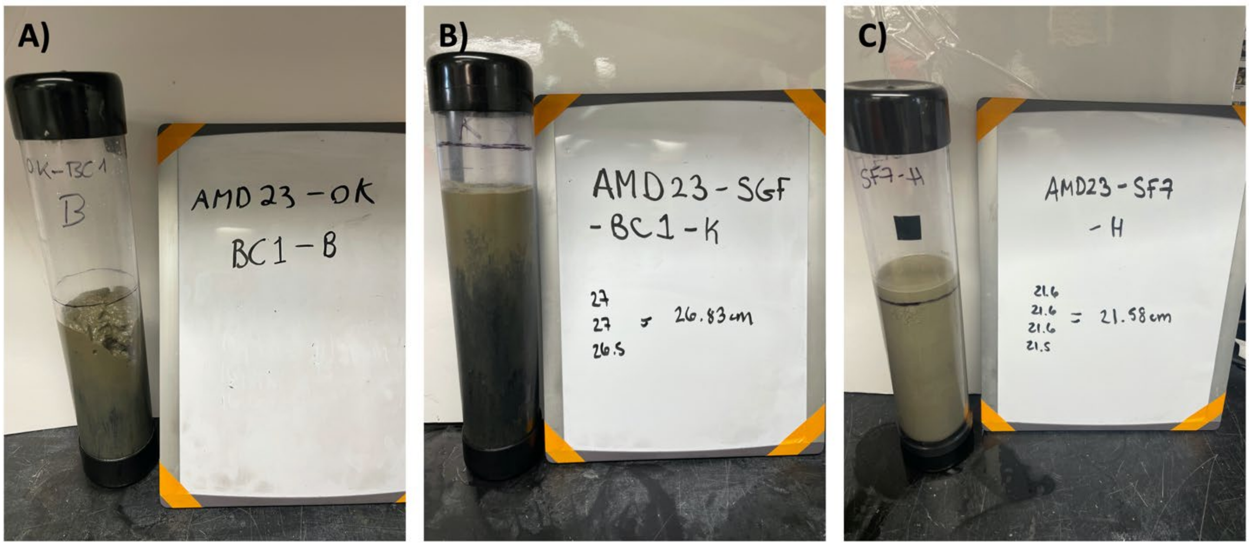

Figure 22-3: Example cores collected from A) Okak Bay, B) Saglek Fjord, and C) Southwind Fjord

Southwind Fjord: In Southwind Fjord sampling was carried out at 8 sites (stns 01-08) first a transect of six CTD stations (stns 01-06) was conducted stretching from mouth of the Fjord to the head. At each station waters samples were collected at the surface, mid depth, and bottom and analyzed carbonate chemistry (DIC, TA, O_2, CH_4 and nutrients). At a subset of these stations (stns 02, 03, and 05) the CTD casts were paired with box cores which were sub cored to assess biogeochemistry. This transect will be used to develop a carbon budget to quantify carbon burial/storage in the fjord. A full list of station locations is provided in Table 22-2.

Table 22-2: Southwind Fjord biogeochemistry stations

Station ID	Latitude (N)	Longitude (W)	Depth (m)	Operation
SF stn-01	66.98676	62.53988	460	CTD, rosette
SF stn-02	66.92349	62.49155	360	CTD, rosette, box core
SF stn-03	66.82940	62.42739	103	CTD, rosette, box core
SF stn-04	66.80571	62.37702	167	CTD, rosette

SF stn-05	66.78808	62.36938	178	CTD, rosette, box core
SF stn-06	66.75221	62.32373	97	CTD, rosette
SF stn-07	66.75292	62.31263	43	box core
SF stn-08	66.75291	62.31235	37	Box core

In addition to the transect, box cores were collected at stn 07 and 08. These stations were repeats of sites sampled in Amundsen 2021, Leg 2 and were sites inside and outside of iceberg triggered submarine landslide that occurred in 2019 (Normandeau et al., 2021). These stations are part an ongoing effort begun during the Amundsen 2021 Leg 2 expedition as to whether re-exposure of old carbon to oxygenated conditions as a result of the landslide may have an effect on biogeochemical process in the sediment, particularly carbon cycling and storage.

Davis Strait 2: Sediment cores were collected both with the ROV (14 cores) and box core (7 cores) at 500 m water depth. A full set of nutrient pulse trace experiments were conducted with the ROV cores, along with 7 cores collected for sediment biogeochemistry. Like the Makkovik, site a comparison of sediment biogeochemistry measured from the box core and ROV push cores was carried out.

22.4 Recommendations

1) The addition of three push cores to the total number of cores that can be collected per ROV dive is a major improvement to the coring capacity of the Astrid ROV. It allows greater replication of samples and a greater amount of push core objectives that can be accomplished per dive.

2) It would be good if the Amundsen event log that can be downloaded had unique event identifiers for each operation, ideally these could be further divided by operation type (for example ctd, box core, etc.).

3) The cold room would receive periodic blasts of warm air that immediately raised the temperature from 4°C to about 10°C for a brief period of time. This would happen in both temperature-controlled rooms, but was noticed more in the port temperature-controlled lab. It would be good if this could be fixed. References

Normandeau, A., MacKillop, K., MacQuarrie, M., Richards, C., Bourgault, D., Campbell D.C., Maselli, V., Philibert, G., and Clarke, J.H., (2021) Submarine Landslides triggered by iceberg collision with the seafloor. Nature Geoscience 14:599-605. DOI:10.1038/s41561-021-00767-4.

23 Microbial Baselines, Hydrocarbon Degradation, and Sulfate Reducing Bacteria

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Cruise participants – Leg 1: Whitney England[1], Francisco Daniel Davila Aleman[1], Oye Adebayo[1], Francesco Bisiach[1]

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23.1 Introduction and Objectives

As climate change reduces the extent and duration of sea ice cover, shipping and industrial development in (sub)Arctic marine environments is expected to escalate and increase the risk of oil and fuel spills in this extreme marine environment. Diesel re-supply to remote northern communities also poses a risk of spill that could affect the marine environment. Microorganisms living in these marine environments are nature's 'first responders' to oil spills and some have the metabolic pathways to degrade toxic hydrocarbons into innocuous CO2 (ZoBell 1946; Atlas 1981). Baseline data enhances the expedient understanding of the structure, diversity, and complexity of bacterial communities and their potential to respond to an oil spill (Angelova et al. 2021) or other environmental perturbations that would similarly provoke a re-organization of resident microbial communities. As such, understanding hydrocarbon-degrading populations within the marine microbiome is important with respect to (1) the potential that these microorganisms have to contribute to clean-up and mitigating the negative effects of oil spills, and (2) providing an environmental signature for the state of the ecosystem, i.e., the presence of or exposure to an input of hydrocarbons. This work can provide critical ecological and epigenomic insights (Beaulaurier et al. 2019) into the Arctic ocean microbiome responses to environmental changes, contributing to our understanding of this essential ecosystem and its vulnerability to anthropogenic impacts. The goal of Nunatsiavut Government's marine management project, Imappivut, is community-driven marine planning in the coastal and marine zones of Nunatsiavut (Saunders and Hubert 2023). Imappivut uses a comprehensive approach to understanding the marine environment, including sequencing of marine microbiomes. A microbiome dataset for the region will allow for monitoring of changes in marine habitats undergoing chronic or acute disruptions, such as those resulting from climate change or oil spills (Saunders and Hubert 2023).

Our sampling and research objectives along the Nunatsiavut coast and beyond are:

a) to collect seawater and sediment samples to establish microbiological baselines to inform the Nunatsiavut Imappivut ocean management plan;

b) to conduct in situ DNA sequencing of sediment microbial communities;

c) to establish microcosm experiments exposing sediment microbial communities to crude oil to simulate an oil spill and closely monitor their molecular and ecological responses during the initial stages of contamination;

d) to measure the activity of in situ sulfate reducing bacteria in the upper layers of sediment.

23.2 Methodology

23.2.1 *Water Sampling*

The CCGS *Amundsen* was equipped with a CTD-Rosette fitted with twenty-one 12L Niskin bottles. Sensors on the CTD captured profiles of chlorophyll fluorescence, dissolved oxygen concentrations, water temperature, and salinity. Samples from the water column were taken at 3 depths from 19 sampling stations using the CTD-Rosette (Table 23-1). At each station, surface and bottom water were sampled, as well as an intermediate depth halfway to the seafloor. Additionally, a surface pump was deployed to collect true surface water in addition to the surface water from the Rosette, which corresponds to about 2 m below the sea surface. All samples were obtained in triplicate; i.e., three Niskin bottles from the rosette for each sampling depth, and the surface pump was used to fill three separate carboys.

Table 23-1: Water Sampling Locations during Leg 1 of the 2023 Amundsen expedition

Station	Date	Latitude (N)	Longitude (W)	Bottom Depth (m)	Middle Depth (m)	Cast
Joey's Gully	15-07	54° 37.020	56° 26.573	362	150	001
Hopedale Saddle	16-07	56° 3.727	57° 25.214	554	277	002
Makkovik Hanging Gardens	17-07	55° 29.039	58° 56.620	581	285	004
ISECOLD-0-200	18-07	56° 17.129	58° 54.448	199	100	005
Sentinel	18-07	56° 16.876	59° 45.300	534	270	006
ISECOLD-1-200	20-07	57° 42.742	60° 12.108	216	104	007
Okak	20-07	57° 31.841	62° 4.627	45	17	008
Saglek Fjord	21-07	58° 29.970	62° 41.146	133	65	009
North Arm	22-07	58° 29.030	63° 13.118	237	115	010
ISECOLD-2-200	22-07	58° 42.898	61° 11.059	200	100	011
SagBank	23-07	59° 23.070	60° 19.063	438	215	014
Hatton Basin	24-07	60° 29.912	61° 14.214	648	325	016
ISECOLD-3-200	26-07	60° 26.651	62° 34.729	338	170	019
Killinek Main	27-07	60° 54.158	64° 17.184	424	210	021
Hatton 600	27-07	61° 7.488	63° 15.905	612	300	022
Southwind (SW2)	30-07	66° 55.385	62° 29.494	396	195	024
Disko Fan	01-08	67° 58.145	59° 30.446	927	468	031
Davis Strait (DS2)	03-08	65° 20.117	58° 1.072	572	285	035
Davis Seep	03-08	65° 5.812	58° 27.703	523	260	037

23.2.2 *Sediment Sampling*

Surface sediment was collected at 18 different stations with three replicates per station using the box cores aboard the Amundsen (Table 23-2). At Hatton Basin, a Van Veen grab was substituted for the box core due to seafloor sediment conditions. Once the box core/Van Veen came back on deck, the overlying water was siphoned off and the surface sediment temperature was recorded. For each box core, ~2mL of surface sediment (0-5cmbsf) was collected using sterilized spatulas in triplicate into 2mL cryovials and frozen at -80°C for future microbial analyses. At Hatton Basin, additional sediment containing microbial mats was collected using a scoop (Mat 2). Three additional sediment samples were collected at, nearby (~2m), and further from a second mat site (Mat 16) using push cores as improvised scoops. Cores were not possible due to seafloor conditions (hard gravel). From some cores, an additional set of triplicate cryovials were collected for onboard sequencing analysis. ~150mL 'bulk' surface sediment (0-5cmbsf) was also collected into 15 or 50mL conical tubes for microcosm incubations. From some cores, sub-cores were taken for radiotracer analysis. Plexiglass coring tubes (31 cm long, 29 mm diameter) with 27 holes sealed with silicone along one side were used to subsample from box cores while preserving stratigraphy. At Makkovik Hanging Gardens, an ROV push core was sub-cored in the same manner.

Table 23-2: Sediment sampling locations

Station	Date	Latitude (N)	Longitude (W)	Depth (m)	Samples/ Experiments
Makkovik Hanging Gardens	17-07	55°29.039	58°56.620	581	Microbial DNA, Radiotracer, Microcosm, Onboard sequencing
ISECOLD-0-200	18-07	56°17.129	58°54.448	199	Microbial DNA, Onboard sequencing
Sentinel	18-07	56°16.876	59°45.300	534	Microbial DNA, Onboard sequencing
ISECOLD-1-200	20-07	57°42.742	60°12.108	216	Microbial DNA, Onboard sequencing
Okak	20-07	57°31.841	62°4.627	45	Microbial DNA, Onboard sequencing
North Arm	22-07	58°29.030	63°13.118	237	Microbial DNA, Radiotracer, Microcosm, Onboard sequencing
ISECOLD-2-200	22-07	58°42.898	61°11.059	200	Microbial DNA, Onboard sequencing
SagBank	23-07	59°23.070	60°19.063	438	Microbial DNA, Microcosm, Onboard sequencing
Hatton Basin	24-07	60°29.912	61°14.214	648	Microbial DNA, Microcosm, Onboard sequencing
ISECOLD-3-200	26-07	60°26.651	62°34.729	338	Microbial DNA, Onboard sequencing
Hatton 600	27-07	61°7.488	63°15.905	612	Microbial DNA, Onboard sequencing
Southwind (SW2, SW3, SW5, SW7, SW8)	30-07	66°55.385	62°29.494	396	Microbial DNA (SW2), Radiotracer (All)
Disko Fan	01-08	67°58.145	59°30.446	927	Microbial DNA, Onboard sequencing
Davis Strait (DS2)	03-08	65°20.117	58°1.072	572	Microbial DNA
Davis Seep	03-08	65°5.812	58°27.703	523	Microbial DNA Microcosm, Onboard sequencing

23.2.3 *Oil Microcosms*

For microcosm experiments, we utilized serum bottles (160 ml max volume). These bottles contained 10 ml of sediment and 40 ml of sterile bottom sea water or a nutrient rich media (ONR7a), along with 0.1% v/v of Macondo crude oil (Murphy et al. 2021). After incubating for three at 4°C and 140 rpm, the sediments were preserved at -80°C for subsequent DNA extraction and sequencing using Nanopore Technology back in our institution's lab at the University of Calgary.

23.2.4 *DNA Extraction and Onboard Sequencing*

For the extraction of high molecular weight DNA of sediment samples, the Quick-DNA HMW MagBead Kit was implemented due to its optimization for third-generation sequencing technology including Oxford Nanopore. Less than 100 mg of sediment per site was used for DNA extraction and diluted in a final volume of 30 µl.

In situ sequencing of DNA using a portable MinION sequencer from Oxford Nanopore Technologies. The Rapid barcoding kit 24 V14 was implemented due to the capacity of multiplex up to 24 samples, short preparation time, and available laboratory equipment. The latest flow cell nanopore chemistry R10.4.1 was used to generate more accurate DNA data. The input per sample was >20 ng of gDNA, multiplexing 12 samples per library (Flow cell 1: Makkovik, ISECOLD-0-200, Sentinel, ISECOLD-1-200, Okak bay, Sag Bank, Hatton Basin, ISECOLD-2-200, North Arm, ISECOLD-3-200 and Hatton 600; Flow cell 2: ISECOLD-0-200, Sentinel, ISECOLD-1-200, Okak bay, Hatton Basin, ISECOLD-2-200, North Arm, ISECOLD-3-200, Hatton 600, Disko Fan and Davis Seep). The sequencing experiment was run for 24 hours before washing the flow cell and running a fresh library.

23.2.5 *Radiotracer experiments for sulfate reducing bacteria*

300 kBq of 35S-SO4 aliquots were injected through the holes of cores at 1 or 2 cm intervals and the cores were incubated at in situ temperature for 12 hours. Cores were then sectioned into 1 or 2 cm sections and stored at -20°C in 20% zinc acetate (Jørgensen & Fenchel 1974). The sediment sections will be analyzed at the University of Calgary for the calculation of in situ sulfate reduction rates. These rates will be paired with geological and geochemical analyses performed on these sites by other groups present on the vessel.

23.3 Preliminary Results

In total, we sequenced 25.3 Gb of DNA reads onboard the CCGS *Amundsen*, ranging from 1.05 kb to 119.2 kb with a maximum sequenced DNA fragment of 1.72 Mb.

The collection of water and sediment samples, oil microcosm experiments, and in situ metagenomic sequencing will directly enable us to progress on all points of our CIRNAC proposal, "Imappivut and the Marine Microbiome", to support Imappivut's comprehensive ocean management approach (Saunders and Hubert 2023).

23.4 References

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23.5 Acknowledgements

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24 Developing non-invasive tools for monitoring marine refuges protecting sensitive benthic areas in the Eastern Canadian Arctic

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Cruise participants – Leg 1: John O'Brien[1]

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24.1 Introduction and Objectives

Marine Refuges are another Effective Area Based Conservation Measure (OECM) implemented under Canada's *Fisheries Act* that provide a complementary conservation tool to *Oceans Act* Marine Protected Areas for meeting Canada's marine conservation goals. In the Eastern Canadian Arctic, 3 Marine Refuges (the Disko Fan, Davis Strait, and Hatton Basin Conservation Areas), have been established to protect sensitive benthic areas hosting habitat-forming coldwater corals (e.g., sea pens, small and large gorgonians) and sponges. Due to their remote location (100s km offshore), large area (7,485 – 42,459 km^2), wide bathymetric range (100s m to > 1000 m), and fragile nature of these slow-growing biogenic habitats, there is a need to develop efficient, costeffective, and non-invasive techniques for monitoring the ecological integrity of these areas.

Advanced benthic image surveying tools (e.g., remotely operated vehicles (ROVs), drop cameras, etc.) provide alternatives to traditional benthic sampling gear (e.g. trawls, dredges) with a smaller footprint on sensitive seabed habitats while also providing numerous other advantages. These include detection of diminutive species or those with low catchability in trawl gear, *in situ* observations of morphology, behaviours and interactions, the collection of voucher samples for taxonomic verification and downstream genetics analyses, and characterization of habitat structural complexity and fine-scale patterns of spatial distribution and abundance. However, the laborious processing of large volumes of imagery and video represents a key bottleneck in realizing the full value of these tools. Photogrammetry and machine learning classification techniques could facilitate faster processing workflows and the detailed characterization of coldwater coral and sponge habitats required for effective long-term monitoring in such protected areas.

Environmental DNA (eDNA) metabarcoding has also emerged as a complementary molecular tool for conducting biodiversity surveys and monitoring in protected areas where non-destructive sampling methods are preferable. The DNA fragments that individual organisms shed into their surrounding environment can be detected from collected water or sediments samples to provide a signature of the general biodiversity patterns in an area and enable detection of target species of interest. Water samples can be collected and processed on board more readily than other benthic biodiversity surveying gears, facilitating spatially comprehensive monitoring and survey designs. Furthermore, cryptic and rare taxa that are overlooked or missed by other sampling gears may also be detected from eDNA in the relatively small volumes of water filtered. Even so, while eDNA metabarcoding methods are being developed and tested, the contemporaneous collection of biodiversity data and voucher specimens from other more direct survey methods (e.g., trawls, grabs, ROV, drop camera, etc.) are needed for comparative purposes and to expand regional reference libraries of metabarcode sequences.

During Leg 1 of the 2023 Amundsen Expedition, my main objective was to implement a suite of non-destructive or less invasive survey techniques to characterize benthic habitats in the 3 Marine Refuges in the Eastern Canadian Arctic. Specifically, I aimed to:

1. Collect data on the distribution, abundance, and diversity of corals of sponges in the

2. Eastern Canadian Arctic for purposes of monitoring Marine Refuges. Expand benthic imagery collections (Drop camera, ROV) in Marine Refuges to build a training data set for building 3D reconstructions of benthic habitats using photogrammetry techniques, characterize their structural complexity (cm scale), and developing a machine learning classification workflow for benthic habitat type using features of the dense point clouds.

3. Obtain paired eDNA water samples with imagery collections to evaluate the occurrence of key species in coldwater coral and sponge habitats and their associated biodiversity and compare patterns between methodologies.

4. Compare eDNA water sampling results with colleagues from the Nunatsiavut Government and Fisheries and Oceans Canada (Newfoundland and Labrador) to facilitate interoperability and data sharing across the region.

24.2 Methodology

Successful ROV diving operations dedicated to surveying and sampling were conducted in the Hatton Basin (n=2) and Davis Strait (n = 1) Conservation Areas using Amundsen Science's ROV ASTRID (Figure 24-1A-C). See Section 24 for more detailed site descriptions, objectives, and results of specific dives. Two planned dives in the Disko Fan Conservation Area on the bamboo coral forests were cancelled due to heavy sea ice conditions. Dive locations ranged in depth from 609 m to 815 m and bottom time varied from 229 min to 271 min. Two additional dives in Hatton Basin and one in Davis Strait were aborted early due to high currents and equipment issues, respectively. Half hour drop camera drift transects were conducted in all three Marine Refuges (Figure 24-1A & 1D) including 18 in Hatton Basin, 5 in Davis Strait, and 4 in the Disko Fan Conservation Areas, respectively, (Figure 24-1A &-1D). Depths of these camera drops ranged Depths of these camera drops ranged from 515 m to 1767 m. See section 26 for a more detailed summary of drop camera equipment and activities and site descriptions.

The high-resolution imagery collected during ROV dives and drop camera transects will be analyzed in image annotation software (BIIGLE) to enumerate the abundance and diversity of coral and sponge taxa and associated benthic diversity. *In situ* photos and voucher specimens will be used to supplement regional identification guides and improve the quality of image annotations. Structure from motion techniques will be used to build 3D reconstructions of coral and sponge habitat in specialized photogrammetry software (Pixpro). The dense point clouds will be used to enumerate the structural complexity (rugosity) of the biogenic habitat provided by corals and sponges (Figure 24-2). Ground-truthed and georeferenced image annotations derived from BIIGLE will also be used to construct a training dataset to develop a machine learning workflow to classify seabed habitat habitat features (e.g., live coral cover) based on point cloud features (x, y, z, R, B, G, Normal$_{\gamma}$). Photogrammetry-derived digital elevation models (DEMs) could be used to complement the AUV methods to characterize the complexity and distribution of coral and sponge habitats tested during Leg 1 (see section 25).

Water collections for eDNA sampling were conducted using the CTD rosette at 10 stations (Figure 24-1A, Figure 24-3B; Table 24-1) located in Hatton Basin (n = 2), Davis Strait (n = 2), and Disko Fan (n = 5) and one station (Sentinel) not within the boundaries of a Marine Refuge (Table 24-1). Water sampling stations ranged in depth from 534 m to 927 m (Table 24-1). At each location, triplicate 3-L water samples were collected 10 m from the bottom in separate niskin bottles. Niskins were de-contaminated with 10% bleach at least 10 min prior to deployment of the rosette. Niskin bottles remained open at the target depth for 1 min prior to firing. Water was then collected using gloved hands into sealed and sterile Whirl-Pak® bags and filtered immediately on board.

The benchtop was sterilized with 10% bleach prior to filtering and rinsed 3 times with distilled water. Water was filtered using the Smith-Root eDNA Citizen Scientist Sampler (Figure 24-3A). For each water sample, a single-use filter pack (Figure 24-3B) consisting of a pre-loaded membrane (1.2 μm pore size) within a housing was removed from a sterile and sealed bag along with a disposable tubing extension and attached to the free end of the intake tubing. The inline filter design eliminates the need to sterilize or change tubing between samples (Figure 24-3A). The sterile tube extension was then placed directly in the sample bag and water vacuum-pumped across the filter membrane. After 3 L of water were filtered, the filter was inverted for 30 s to dry the membrane before turning the pump off. The entire filter housing was then place back in its original, labelled bag and sealed. The hydrophylic housing continues to desiccate the filter membrane and preserve DNA for up to 6 months at room temperature without the addition of ethanol or Longmire's buffer. For each day on which water filtration occurred, a 3 L blank sample of Milli-Q® Ultrapure distilled water was also filtered as a control. Preserved eDNA on filters will be extracted at a later date using commercial kits and amplified with eukaryote primers (COI and 18S) for bioinformatics to evaluate diversity and community composition of the benthic community and compare with results of imagery surveys. At a subset of sites (Table 24-1) team members of DFO NL and the Nunatsiavut Government also filtered bottom water concomitantly using different equipment and filtering protocols. Results of both teams will be compared to evaluate interoperability.

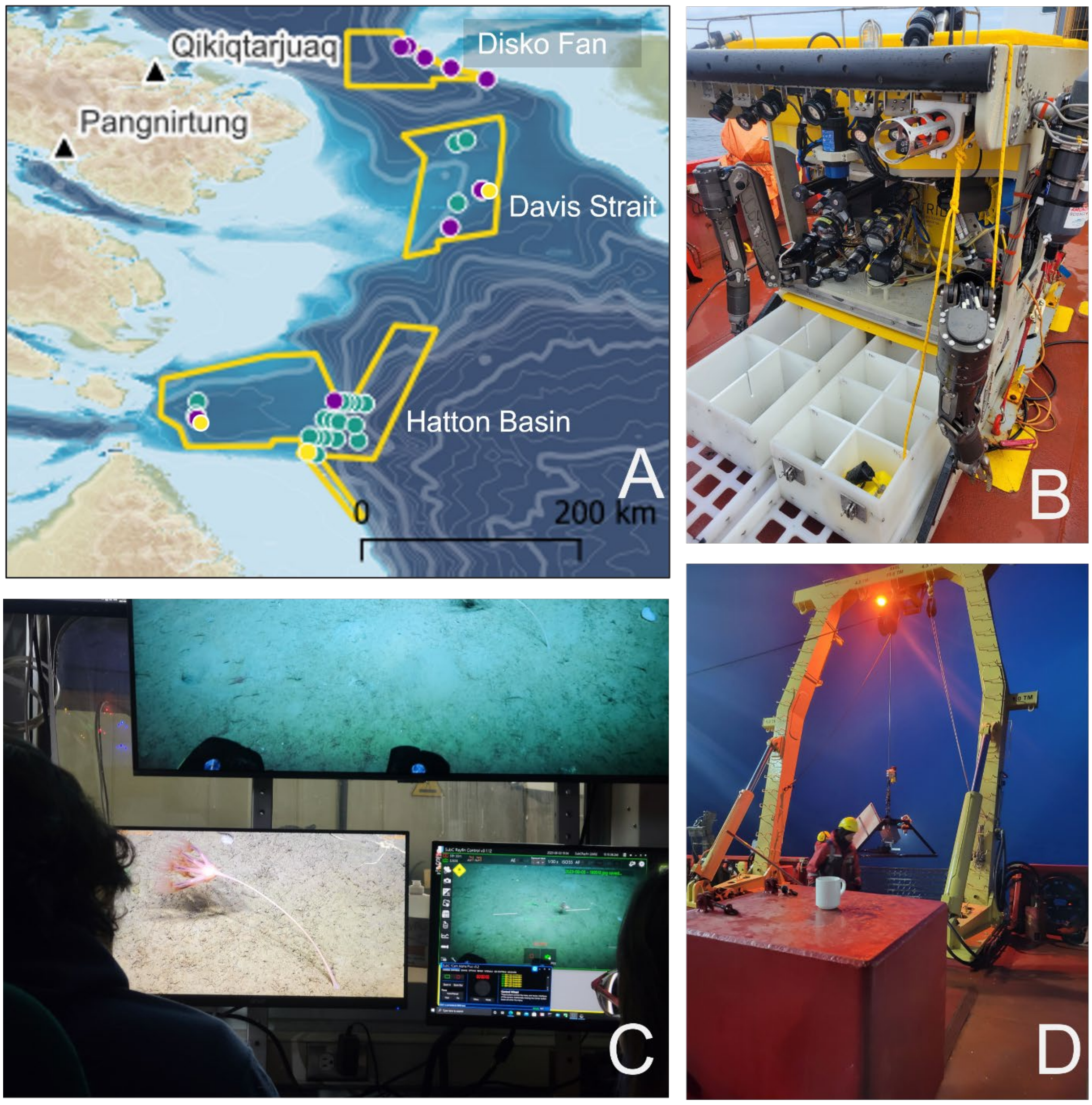

Figure 24-1: Deployments of non-invasive and low footprint sampling gears in Eastern Arctic Marine Refuges (Disko Fan, Davis Strait, Hatton Basin). A) Locations of deployments. Purple symbols denote water sampling for eDNA using the CTD Rosette. B) Amundsen Science ROV ASTRID on deck. C) Investigating the Arctic sea pen *Umbellula* sp. In greater detail from the ROV control room. D) Deploying the drop camera from the A-frame at night.

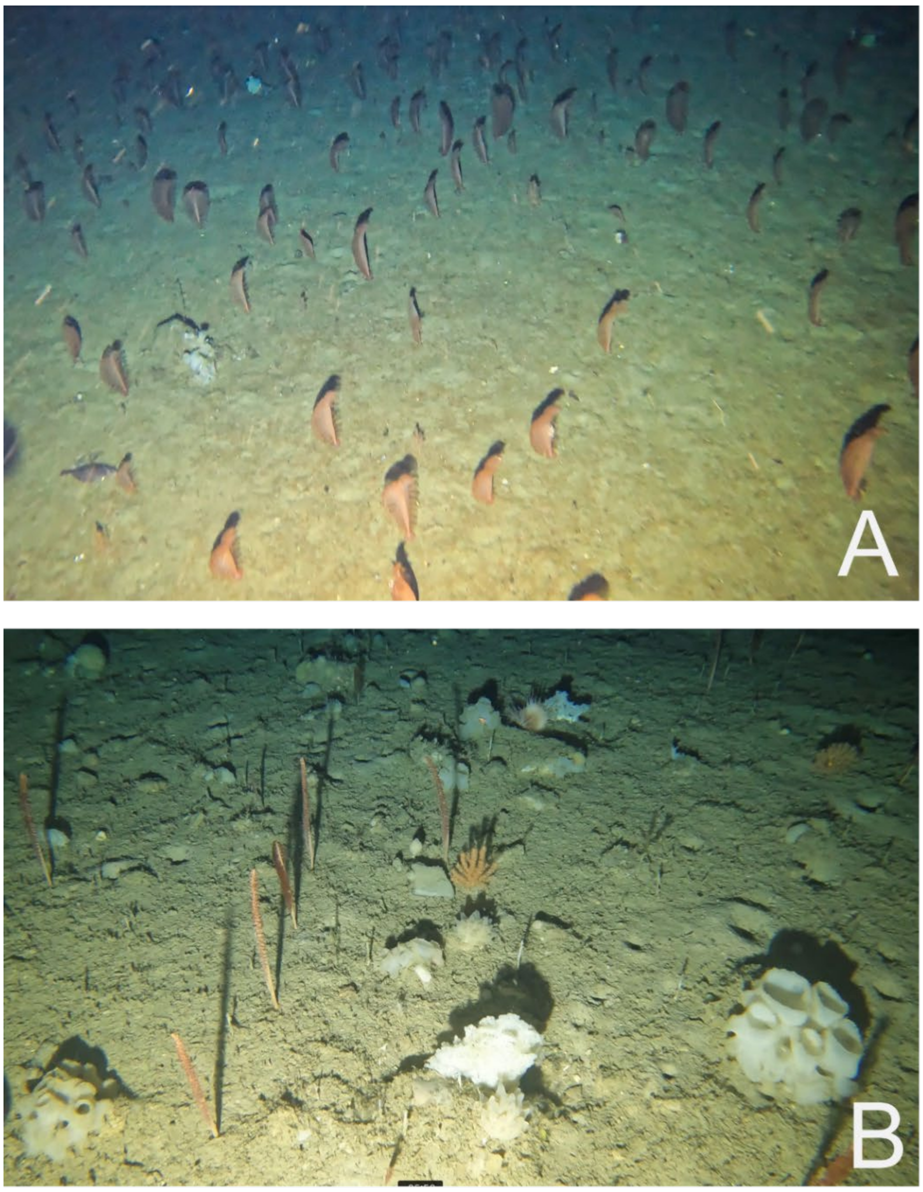

Figure 24-2: Coldwater corals and sponges provide 3-dimensional relief and structural complexity in habitats with otherwise flat bathymetry. A) Sea pen fields of Ptilella grandis in Disko Fan Conservation Area at 600 m. B) Sea pens (Balticina finmarchica) and sponges (*Asconema* sp.) in Hatton Basin Conservation Area ((Photo credits: Jordan Sutton, Jessica Desforges)

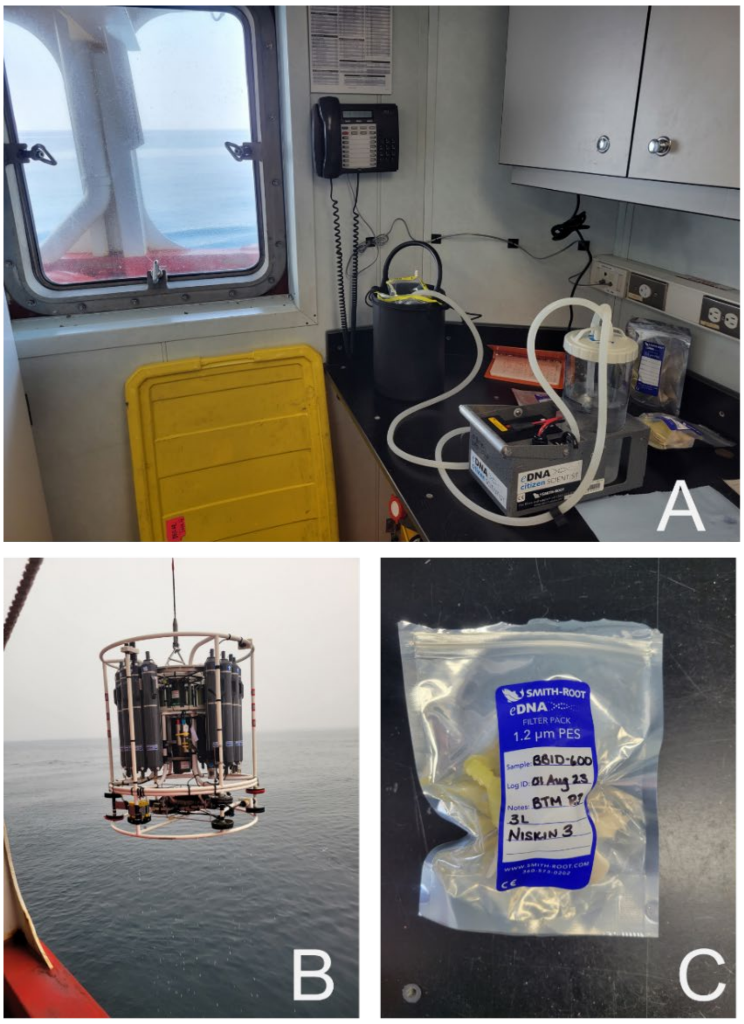

Figure 24-3: eDNA water sampling equipment. A) Smith-Root water filtration system, B) CTD Rosette C) Self-preserving eDNA filter inside hydrophylic housing and sealed in sterile bag

Table 24-1: Event information on locations where water samples were collected for eDNA sampling using the CTD rosette. The Marine Refuge that the station falls within is provided. (HBCA = Hatton Basin Conservation Area, DFCA = Disko Fan Conservation Area, DSCA = Disko Fan Conservation Area, DSCA = Davis Strait Conservation Area. The occurrence of comparative samples indicates that colleagues with DFO NL and the Nunatsiavut Government conducted paired water filtrations using different protocols and equipment for intercomparison. Volume is the amount of water filtered per replicate in litres

Station ID	Marine Refuge	Comparative samples	Time (UTC)	Latitude (N)	Longitude (W)	Depth (m)	Replicates	Vol (L)
Sentinel	NA	Yes	7/18/2023 17:35	56.28071	59.7551	534.33	3	3
Hatton 600	HBCA	Yes	7/27/2023 15:40	61.12343	63.2655	611.81	3 + blank	3
BB1B_600	DFCA	Yes	8/1/2023 5:00	67.98743	59.3762	562.66	3	3
Disko Fan	DFCA	No	8/1/2023 9:20	67.96894	59.5105	927.18	3 + blank	3
BB1A_600	DFCA	No	8/1/2023 14:29	67.7726	59.0664	625.31	3	3
BBC1C_600	DFCA	No	8/1/2023 18:33	67.58567	58.5821	599.6	3	3
BB1D_600	DFCA	No	8/1/2023 23:21	67.3786	57.9226	644.26	3 + blank	3
DS2	DSCA	Yes	8/3/2023 12:48	65.33524	58.0185	573.04	3	3
DS3	DSCA	No	8/4/2023 12:17	64.64858	58.5958	615.41	3 + blank	3
HB AUV	HBCA	No	8/5/2023 14:10	61.45261	60.7315	541.42	3	3

24.3 Recommendations

While the planned ROV dives on the bamboo coral forests in the Disko Fan Conservation Area could not be attempted due to sea ice conditions, the scientific objectives of this program were met and exceeded. The time gained over the course of the expedition due to excellent weather and the omission of mooring operations at sites further north in Baffin Bay due to heavy sea ice allowed for expanded water sampling, drop camera, and ROV operations within the boundaries of the Marine Refuges in Hatton Basin, Davis Strait, and Disko Fan not included on the original expedition plan. Having the drop camera system aboard along with the ROV was extremely valuable. The drop camera provided a quick means by which to scope out potential sites during night operations for ROV dives during the day. The drop camera also allowed for the collection of high-quality benthic imagery and video at sites where sea ice conditions (Disko Fan) or high currents (Hatton Basin) precluded the use of the ROV.

The filtration equipment used for eDNA water sampling performed exceedingly well without any issues with clogged filters. For future applications with this same setup, a larger volume of water could be filtered per replicate (~ 5 L), which could potentially improve eDNA yields and species detections.

25 Deep-water benthic habitat Remotely Operated Vehicle (ROV) surveys

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25.1 Introduction and Objectives

Remotely Operated Vehicle (ROV) operations in 2023 aimed to complement the suite of operations planned as part of the Immappivut marine planning program (Coalescing Research in the Labrador Sea and Nunatsiavut Coast to Support the Imappivut Marine Planning Initiative) led by the Nunatsiavut Government. The ROV ASTRID (Amundsen Science) is equipped with two 7-function manipulator arms, and a suit of accessories for sampling imagery, benthic fauna, water, and sediment samples. This year our general objective was to video-survey and sample at five main locations in coastal Labrador, northern Labrador Sea, and Baffin Bay (Figure 25-1): Hopedale Saddle, Makkovik Bank, Killinek, NE Saglek Bank (Hatton Basin), and Disko Fan. Several different programs benefited from ROV collected data and they will be described in additional reports (e.g., PIs: Algar, Snelgrove, Hubert). During the ROV dives we acquired HD and 4K video data on the occurrence, distribution and abundance of bottom types, corals, sponges, other invertebrates and fish. We also collected invertebrates and sediment samples using the ROV push-cores, collected high resolution underwater images and observations on fauna behavior.

25.2 Methodology

A total of 11 ROV dives took place at 10 sites (Table 25-1,Figure 25-1), not including the test dive at Joey's Gully. Northern dive sites planned for mooring recoveries (MacBeth, Scott Inlet, Mooring retrieval) were cancelled due to heavy ice coverage, preventing operations from occurring at those sites. Mooring-related dives are not described in this report. While ROV dives at some stations were cancelled (described below), new opportunistic sites were added to the survey plan during the expedition. Nevertheless, some of the new sites came with challenges associated with oceanographic conditions such as strong currents (e.g., Hatton Basin) or water visibility (e.g., Frobisher Bay) (Table 25-1). Our plans needed to be adjusted to fit ROV dives during day-time operations and scheduling (i.e., dive duration was determined by arrival time at station, currents, and day-time operations cut-off times).

Overall, the ROV performed well and HD and 4K imagery (videos, photos) as well as 82 biological, sediment, and seawater samples were collected (Table 25-2). Sediment samples from Makkovik (dive C0039) and Davis Strait (dives C0043-0044) were processed by the Algar and Snelgrove teams aboard (C. Algar and S. Hamisch, described as a separate report). Sediment samples from dive C0041 were processed by the Hubert team aboard (also described in as a separate report). Biological samples were shared by DFO-NL (B. Neves/ V. Hayes) and DFO-Arctic (J. O'Brien) and photographed, subsampled for DNA analysis (preserved in 100% ethanol), preserved in 10% formalin or 70% ethanol, and/or frozen at -20 °C and -80 °C. In addition to samples from ROV surveys, V. Hayes and B. Neves (DFO-NL) opportunistically kept samples from beam trawl and box-cores (Table 25-3).

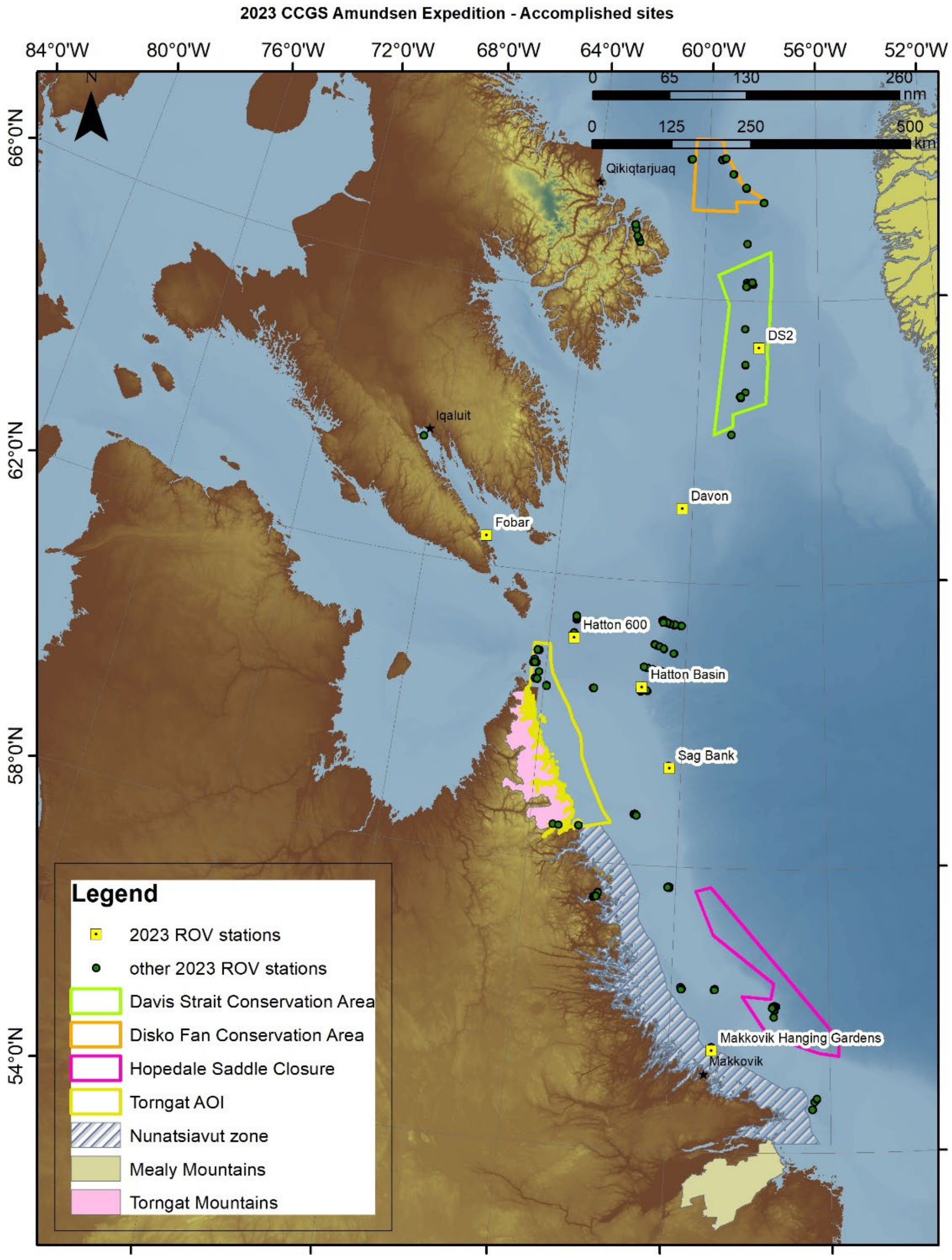

Figure 25-1: Map of general area surveyed during the 2023 Amundsen expedition

Table 25-1: ROV dive operation durations during Leg 1 of the 2023 Amundsen expedition

Dive	Location	Station	Date	Ops duration[1]	Bot time	Status[2]	Originally planned
C0038	Hopedale Saddle	Hopedale Saddle	7/16/2023	2:52:28	na	NA	Yes
C0039	Makkovik	Makkovik	7/17/2023	7:21:16	6:03:41	A	Yes
NA	Killinek	Killinek	na	na	na	C	Yes
C0040	Hatton Basin	HiBio	7/23/2023	3:54:02	2:30:41	A	No
C0041	Hatton Basin	NE Saglek Bank	7/24/2023	4:40:11	3:01:26	A	Yes
C0042	Hatton Basin	Hatton-600	7/27/2023	4:55:03	3:21:06	A	No
NA	Disko Fan	Disko Fan	na	na	na	C	Yes
C0043[3]	Davis Strait	Davis Strait	8/3/2023	1:45:41	0:33:57	A	No
C0044[3]	Davis Strait	Davis Strait	8/3/2023	1:25:08	4:07:08	A	No
C0045	Hatton Basin	Hatton-monster	8/5/2023	0:29:19	na	NA	No
C0046	Hatton Basin	HT2-600	8/6/2023	1:46:36	na	NA	No
C0047	Davis Strait	Davon	8/7/2023	4:26:21	2:45:52	A	No
C0048	Frobisher Bay	Fobar	8/8/2023	4:43:17	3:51:31	A	No

[1] Deck to deck; [2] Status A = accomplished, C = canceled, NA = not accomplished; [3] Dives 43-44 complement each other. Non-accomplished dives still incurred ROV deployment and recovery.

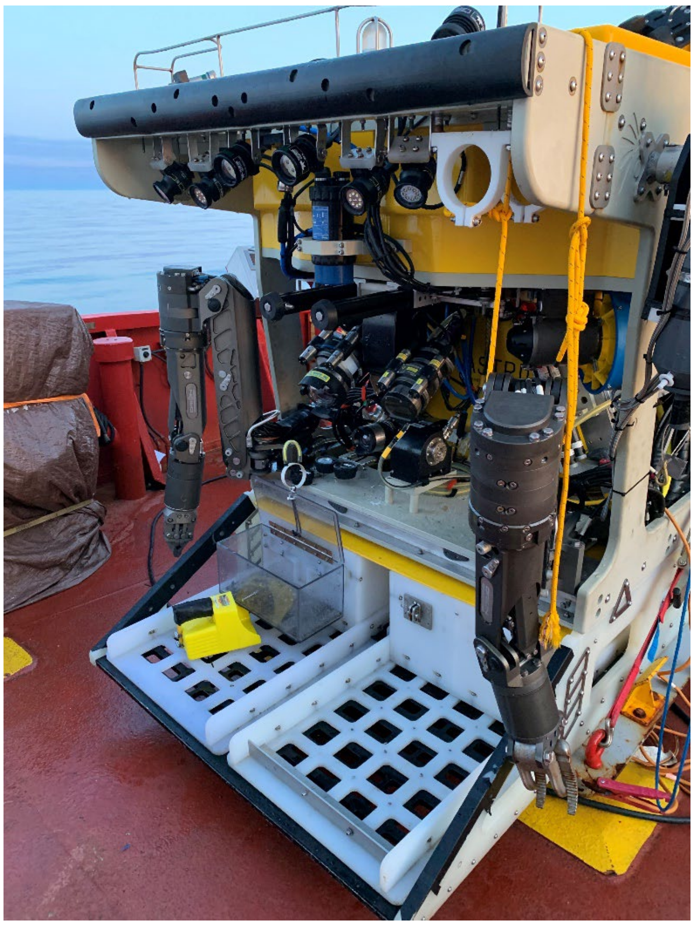

Figure 25-2: ROV ASTRID being deployed during Leg 1 of the 2023 CCGS Amundsen expedition

Table 25-2. List of ROV samples collected during Leg 1 of the 2023 Amundsen expedition.

Time	**Number**	**Identifier**	**Method**	**Latitude**	**Longitude**	**Depth (m)**
7/17/2023 15:06	R39-1	sediment	push core	N55° 26.0382′	W58° 56.4936′	706.8
7/17/2023 15:15	R39-2	sediment	push core	N55° 26.0376′	W58° 56.472′	706.5
7/17/2023 15:21	R39-3	sediment	push core	N55° 26.0376′	W58° 56.4738′	706.6
7/17/2023 15:26	R39-4	sediment	push core	N55° 26.037′	W58° 56.4756′	706.5
7/17/2023 15:36	R39-5	sediment	push core	N55° 26.0346′	W58° 56.475′	706.3
7/17/2023 15:41	R39-6	sediment	push core	N55° 26.0298′	W58° 56.4744′	706
7/17/2023 15:44	R39-7	sediment	push core	N55° 26.031′	W58° 56.4732′	706.1
7/17/2023 15:56	R39-8	sediment	push core	N55° 26.0262′	W58° 56.457′	705.8
7/17/2023 16:00	R39-9	sediment	push core	N55° 26.0274′	W58° 56.4588′	705.9
7/17/2023 16:04	R39-10	sediment	push core	N55° 26.0274′	W58° 56.4576′	705.9
7/17/2023 16:14	R39-11	sediment	push core	N55° 26.0238′	W58° 56.4432′	705.3
7/17/2023 16:16	R39-12	sediment	push core	N55° 26.0238′	W58° 56.4444′	705.4
7/17/2023 16:21	R39-13	sediment	push core	N55° 26.0238′	W58° 56.4408′	705.4
7/17/2023 16:24	R39-14	sediment	push core	N55° 26.0262′	W58° 56.442′	705.3
7/17/2023 19:23	R39-15	sponge	arm	N55° 26.0328′	W58° 56.064′	443.8
7/17/2023 20:09	R39-16	sea anemone	arm	N55° 26.0394′	W58° 55.9656′	396.9
7/24/2023 17:22	R41-1	sediment/rocks	scoop	N60° 29.9346′	W61° 13.5912′	826.7
7/24/2023 17:37	R41-2	coral	arm	N60° 29.9382′	W61° 13.581′	826.6
7/24/2023 18:39	R41-3	coral	arm	N60° 29.8668′	W61° 13.7682′	805.8
7/24/2023 18:57	R41-4	sediment	push core	N60° 29.8548′	W61° 13.8168′	806.3
7/24/2023 19:02	R41-5	sediment	push core	N60° 29.8566′	W61° 13.8174′	806.3
7/24/2023 19:33	R41-6	seawater	niskin	N60° 29.8572′	W61° 13.8084′	805.6
7/24/2023 19:34	R41-6	seawater	niskin	N60° 29.8572′	W61° 13.8084′	805.6
7/24/2023 19:36	R41-8	sediment	push core	N60° 29.862′	W61° 13.794′	805.6
7/27/2023 19:29	R42-1	sponge	arm	N61° 7.4124′	W63° 17.169′	614.4
7/27/2023 20:05	R42-2	sea anemone	arm	N61° 7.3902′	W63° 17.3106′	613.9
7/27/2023 20:08	R42-3	seawater	niskin	N61° 7.3902′	W63° 17.3136′	613.9
7/27/2023 20:14	R42-4	sea pen	arm	N61° 7.3902′	W63° 17.3214′	613.9
7/27/2023 20:23	R42-5	sediment	push core	N61° 7.3866′	W63° 17.3226′	613.8
7/27/2023 20:25	R42-6	sediment	push core	N61° 7.3854′	W63° 17.3298′	613.8
7/27/2023 20:29	R42-7	sediment	push core	N61° 7.3878′	W63° 17.3256′	613.7
7/27/2023 20:35	R42-8	sediment	push core	N61° 7.386′	W63° 17.3274′	613.7
7/27/2023 20:48	R42-9	sediment	push core	N61° 7.3806′	W63° 17.3256′	613.6
7/27/2023 20:52	R42-10	sediment	push core	N61° 7.3812′	W63° 17.3238′	613.6
7/27/2023 20:56	R42-11	sediment	push core	N61° 7.3818′	W63° 17.3244′	613.6
8/3/2023 14:13	R43-1	sediment	push core	N65° 20.196′	W58° 1.356′	573.9
8/3/2023 14:19	R43-2	sediment	push core	N65° 20.1972′	W58° 1.3566′	573.8
8/3/2023 14:22	R43-3	sediment	Push core	N65° 20.1978′	W58° 1.3566′	573.8
8/3/2023 14:32	R43-4	sediment	push core	N65° 20.1966′	W58° 1.3566′	573.8
8/3/2023 14:36	R43-5	sediment	push core	N65° 20.1948′	W58° 1.359′	573.5
8/3/2023 16:41	R44-1	sediment	push core	N65° 20.1516′	W58° 1.2324′	575.6
8/3/2023 16:45	R44-2	sediment	push core	N65° 20.1516′	W58° 1.2342′	575.6
8/3/2023 16:48	R44-3	sediment	push core	N65° 20.1522′	W58° 1.2336′	575.8
8/3/2023 16:49	R44-4	sediment	push core	N65° 20.1516′	W58° 1.2324′	575.8
8/3/2023 16:52	R44-5	sediment	push core	N65° 20.1516′	W58° 1.2342′	575.8
8/3/2023 16:56	R44-6	sediment	push core	N65° 20.1534′	W58° 1.2336′	575.4
8/3/2023 17:05	R44-7	sediment	push core	N65° 20.1534′	W58° 1.233′	575.5
8/3/2023 17:09	R44-8	sediment	push core	N65° 20.1528′	W58° 1.2342′	575.5

Time	Number	Identifier	Method	Latitude	Longitude	Depth (m)
8/3/2023 17:14	R44-9	sediment	push core	65° 20.1534′	58° 1.2348′	575.6
8/3/2023 17:21	R44-10	sediment	push core	65° 20.154′	58° 1.2378′	575.5
8/3/2023 17:41	R44-11	sea pen	arm	65° 20.1744′	58° 1.2744′	574
8/3/2023 18:07	R44-12	coral	arm	65° 20.1702′	58° 1.2918′	573.8
8/3/2023 18:23	R44-13	ascidian	arm	65° 20.1696′	58° 1.296′	574
8/3/2023 18:41	R44-14	sponge	arm	65° 20.1654′	58° 1.437′	572.9
8/3/2023 18:51	R44-15	brittle star	arm	65° 20.1654′	58° 1.4358′	573.1
8/3/2023 19:03	R44-16	holothurian	arm	65° 20.163′	58° 1.4832′	574.5
8/3/2023 19:43	R44-17	coral - sponge	arm	65° 20.157′	58° 1.5822′	574.6
8/3/2023 19:53	R44-18	coral - sea star	arm	65° 20.1576′	58° 1.5834′	574.6
8/3/2023 19:59	R44-19	coral - sea star - crinoid	arm	65° 20.1576′	58° 1.584′	574.9
8/3/2023 20:13	R44-20	coral - brittle star - ascidian - sponge	arm	65° 20.1582′	58° 1.5918′	575.3
8/3/2023 20:17	R44-21	water	niskin	65° 20.1594′	58° 1.5822′	575.3
8/3/2023 20:40	R44-22	ascidian	arm	65° 20.1666′	58° 1.6356′	575.2
8/7/2023 17:48	R47-1	sponge	arm	63° 2.5578′	60° 19.5564′	801.5
8/7/2023 17:55	R47-2	sponge	arm	63° 2.5614′	60° 19.5534′	801.3
8/7/2023 17:57	R47-3	sponge	arm	63° 2.5608′	60° 19.5504′	801.2
8/7/2023 18:05	R47-4	anemone	arm	63° 2.559′	60° 19.5546′	801.2
8/7/2023 18:23	R47-5	sponge	arm	63° 2.598′	60° 19.5432′	800.9
8/7/2023 19:01	R47-6	sponge	arm	63° 2.574′	60° 19.566′	800
8/7/2023 19:37	R47-7	sponge	arm	63° 2.5164′	60° 19.5396′	801.6
8/7/2023 19:48	R47-8	sponge	arm	63° 2.5206′	60° 19.5282′	801.9
8/7/2023 20:03	R47-9	sponge	arm	63° 2.526′	60° 19.5084′	802.2
8/8/2023 18:09	R48-1	basket star	arm	62° 24.0372′	66° 13.9404′	432.9
8/8/2023 18:13	R48-2	kelp	arm	62° 24.0348′	66° 13.9452′	432.8
8/8/2023 18:19	R48-3	basket star and soft coral	arm	62° 24.0366′	66° 13.9404′	432.6
8/8/2023 18:21	R48-4	sponge	arm	62° 24.036′	66° 13.9422′	432.6
8/8/2023 18:36	R48-5	basket star	arm	62° 24.0252′	66° 13.9614′	431.2
8/8/2023 19:02	R48-6	basket star	arm	62° 24.0102′	66° 14.1024′	423.4
8/8/2023 19:29	R48-7	seawater	niskin	62° 23.9766′	66° 14.2644′	406.4
8/8/2023 19:47	R48-8	soft coral	arm	62° 23.9622′	66° 14.3112′	400
8/8/2023 19:57	R48-9	soft coral	arm	62° 23.9616′	66° 14.3112′	399.8
8/8/2023 20:02	R48-10	sponge	arm	62° 23.9622′	66° 14.3064′	399.4
8/8/2023 20:10	R48-11	kelp	arm	62° 23.9574′	66° 14.3346′	397.1

25.3 Preliminary Results

25.3.1 *Joey's Gully – Test Dive (July 15th, 2023)*

During the transit to the first station, a test dive was scheduled at Joey's Gully, which was not listed in the initial dive plan. This was the first Leg of the expedition, and many of the deck crew were new and unfamiliar with operations that were planned. It also provided an opportunity to test and trouble shoot ROV operations including deployment and recover of the ROV with the new deck crew. The dive commenced at 10:00 am and unfortunately it had to be aborted at 50 m due to mechanical issues with the ROV. The issue was quickly resolved and as a result the ROV was ready for the first station at Hopedale Saddle (July 16).

25.3.2 *Dive C0038. Hopedale Saddle (July 16th, 2023)*

The primary objectives of this dive were to perform exploratory video transects and to collect samples for ground-truthing. A secondary objective was to deploy three 3-D-printed *Primnoa resedaeformis* corals as part of a pilot project on the role of cold-water corals as habitat. The dive commenced at 9:25 am local time but shortly after deployment both the ship and the ROV were not able to maintain position due to the extremely high currents at this site. The dive was aborted and the ROV was back on deck by 12:30 pm. Several meetings were held between ROV team and Captain to review the issues encountered.

25.3.3 *Dive C0039. Makkovik Trough (July 17th 2023)*

This dive lasted 6 hours on the seafloor. The dive started at 705 m in a soft sediment area, ~400 m from the planned vertical wall (Figure 25-3). Sediment push-coring started as soon as the ROV was stable with a total of 14 push-cores successfully collected for C. Algar, S. Hamisch and F. Davila Aleman (PI C. Hubert) for sediment geochemistry and microbial studies and will be described separately in their team's reports. After collecting the push-cores (n=14), the ROV proceeded with a straight line, ~ 400 m in length, until reaching an abrupt but expected vertical wall.

During the transect to the rock wall face, observations included many species of fish including rockling (*Gaidropsarus ensis*), eelpout (*Lycodes* sp.), redfish (*Sebastes* sp.), polar sculpin (*Cottunculus microps*), and Greenland halibut/turbot (*Reinhardtius hippoglossoides*). Benthic invertebrates observed included cerianthids (black and light morphologies), sea anemones (large and small varieties, *Liponema* sp.), soft coral *Duva florida*, sea pen *Anthoptilum grandiflorum*, zoanthid spp., sponges (likely *Stylocordyla borealis*, *Mycale (Mycale) lingua*, and *Polymastia* spp.), and sea star *Hippasteria phrygiana*. Several cephalopods (*Bathypolypu*s sp., octopus sp.) were observed and many parasite cocoon 'coils' (*Kronborgia* sp.).

The base of the wall was covered in fine sediment and long polychaete tubes that first appeared dead but on closer inspection were living animals with tentacles extended and actively feeding. At first most of the fauna along of the wall consisted of sponges and sea anemones. At ~650 m, the first *Primnoa resedaeformis* colony was seen, followed by several others in high densities of 3 colonies/m^2 (Figure 25-4). These high densities were seen at several instances along the wall between 650-437 m depth. Other gorgonian corals observed on the wall included *Paragorgia arborea* (n=3 observations; 641-566 m), and *Anthothela grandiflorum*. Soft corals were dominated by *Duva florida* and seemed larger than usual (~ 40+ cm) and were abundant and conspicuous; many basket stars were observed on the *D. florida* colonies – a common association (see Neves et al. 2020). *Drifa* and/or *Pseudodrifa* were also observed but less common; note it is difficult to separate these two species *in situ* without collections. Zoanthids were commonly observed along the wall as individual spp., and as large patches on the wall face (Figure 25-4).

Many species of Demospongiae sponges were observed on the wall and were dominated by *Plicatelopsis bowerbankii*, a large fan sponge (~60 cm diameter) commonly associated with *Primnoa* corals. *Polymastia* sponges (*P. andrica*) were frequently observed, along with large carnivorous sponge (*Cladorhiza* sp.; 445-636 m), stalked lollipop sponge (likely *Stylocordyla borealis*), and an unknown stalked sponge (possible *Lycopodina cupressiformis*) Other sponge morphotypes observed included small 'ball' sponges, groups of tubular sponges as well as many brightly coloured encrusting sponges. Note sponges are difficult to identify to species without voucher collections and/or previous knowledge of the megafauna inhabiting each site/community.

Fish were commonly observed along the wall including redfish (*Sebastes* spp.), eelpouts (*Lycodes* spp.), Greenland halibut (*Reinhardtius hippoglossoides*), Rocklings (*Gaidropsarus* sp.), grenadiers (Macrouridae), and Polar sclupins (*Cottunculus microps*) with the latter being the dominate fish species observed. Atlantic cod (*Gadus morhua)* were observed but only at shallower depths between 323-429 m. One skate (Rajidae) was observed resting on a wall ledge.

Sea stars observed included (*Tremaster mirabilis*, *Novodinia* sp., *Henricia* sp., *Hippasteria phrygiana*, *Ceramaster granularis*) and Ophiuroidea included both basket stars (*Gorgonocephalus* sp.) and brittle stars. Sea cucumbers (Class Holothuroidea) were common on the wall and actively feeding, including the large vibrantly coloured *Psolus* sp., and a small white species found in large aggregations or 'herds'. Ascidians, solitary and colonial, were common along the wall but difficult to distinguish from other fauna. Less common fauna included feather stars (also known as crinoids, Class Crinoidea), bryozoans, lamp shells (Brachiopoda), squid (*Rossia* sp.), shrimp (stripped and glass), octopus, chitons (Polyplacophora), whelks and nudibranch (Gastropoda); most difficult to identify from *in situ* images alone.

Sea anemones were the most abundant group throughout the dive, and were at instances seen in very high densities, providing a vibrant display of colours along the wall portion of the dive transect (Figure 25-4). Mysids were very abundant in some parts of the dive (Figure 21-4), and were also very abundant in the IKMT nets deployed later that day at this station (see Eugenie Jacobsen's report). Overall, the ROV performed well. Two samples were collected during this dive: a sponge (*Cladorhiza* cf. *oxeata*), and a sea anemone, but unfortunately the latter sample was lost during the ROV ascent.

2023 CCGS Amundsen Expedition - Dive C0039 - Makkovik Trough

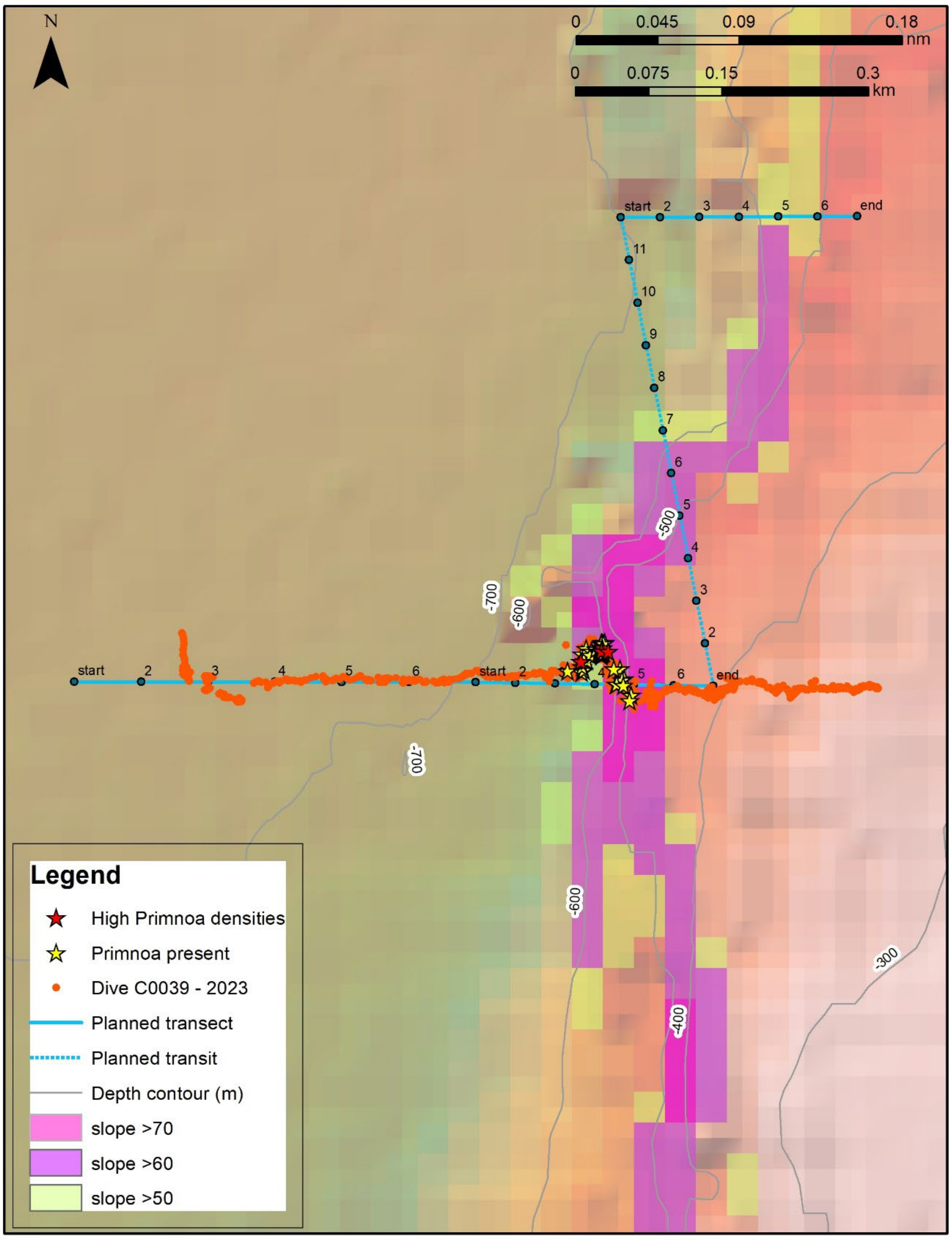

Figure 25-3: Map showing path of accomplished ROV dive C0039 at Makkovik Trough in relation to planned transect line. Areas with Primnoa resedaeformis presence and high abundance are also shown.

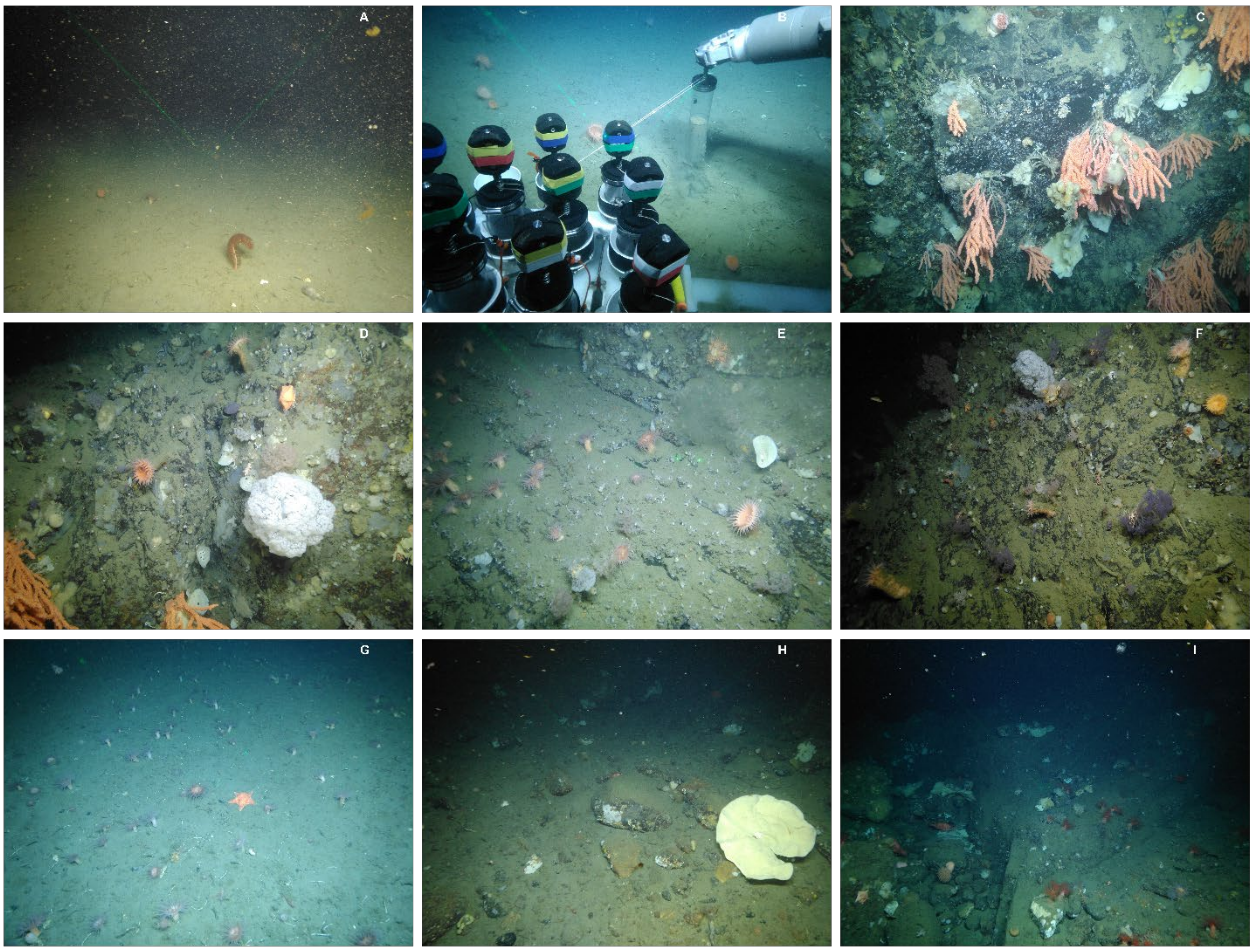

Figure 25-4. Seafloor images at Makkovik Trough. A) start of the dive, sea pen *Anthoptilum grandiflorum*, B) sediment push-core being collected, C) vertical wall with the gorgonian coral *Primnoa resedaformis* and sponges, D), benthic diversity, E) soft corals (*Duva florida*, some with juvenile *Gorgonocephalus* sp.) F), soft bottom covered with sea anemones and sea star, G) large unidentified sponge, H) rocky habitat with several sea cucumbers *Psolus* sp.

25.3.1 *Dive C0040. Mooring Recovery (Saglek mooring recovery (July 24th 2023)*

The main objective of this dive was to recover a mooring deployed in 2020 but which was not released. Therefore, this dive will not be described here and information will be provided by Amundsen Science. Although the videos will still be used for a general megabenthic characterization of the area, lasers were not turned on to avoid a distraction to the pilots and limiting quantitative analyses.

25.3.2 *Dive C0041. NE Saglek Bank Hatton Basin - Cold Seep (July 24th 2023)*

This dive lasted ~3 hours on the seafloor (Table 25-1). The main objective of this dive was to sample sediment push-cores for microbiology studies (see details in the Hubert team's report), to survey the area to better understand the distribution of microbial mats identified for the first time in 2021, and to acquire additional data on benthic diversity in the Hatton Basin Marine Refuge.

Once on the seafloor the ROV proceeded with inspecting the area for microbial mats and sites that looked suitable for push-coring (Figure 25-6). Despite our attempts, push-coring in the area was not successful, which was expected based on our 2021 observations. However, the ROV pilots were able to sample sediment inside a microbial mat using a scoop (n=1), as well as collect additional sediment into push-core holsters by scooping material using push-cores (n=3), for a total of 4 samples collected during this dive (Table 25-2). We also identified a potential area that looked suitable for a Van Veen deployment after the dive which took place July 25 at 11:31 UTC; HiPAP's beacon position 60 29.87231 N, -61 13.93649 W, with depth 786 m (described in a separate report).

The fauna varied throughout the survey, with some areas dominated by the large gorgonian *Primnoa resedaeformis* on boulders. The gorgonian *Paragorgia arborea* was seen much less frequently, with one colony estimated to be 1.5 m in height and 1.3 m wide (Figure 25-6). Dead skeletons of these large gorgonians corals were observed scattered throughout the dive. The soft coral *Duva florida* was also common in parts of the dive, and were so abundant they formed fields.

Mushroom corals (*Anthomastus* sp. and *Pseudoanthomastus* sp.) were observed in small patches inhabiting gravel. Sea pens were less common and included *Balticina finmarchica* and *Anthoptilum* sp.. A unique and rare find was several colonies of hydrocorals (*Stylaster* sp)., of which one was successful sampled (R41-2, Figure 25-7). This coral has not been reported for a large part of the Northwest Atlantic, and observing it *in situ* for the first time is a new finding. A dead *Primnoa* branch was also collected (R41-3) to be used for paleoceanography studies in collaboration with Dr. Owen Sherwood (Dalhousie University) and Dr. Evan Edinger (Memorial University). Overall corals were found near and away from microbial mats.

Among fish, we observed redfish (*Sebastes* sp.), Greenland halibut (*R. hippoglossoides*), Black dogfish (*Centroscyllium fabricii*), a large Northern Wolffish (*Anarhichas denticulatus*), grenadiers (Macrouridae) and Cutthroat/deep sea eels (Synaphobranchidae) (Figure 25-6).

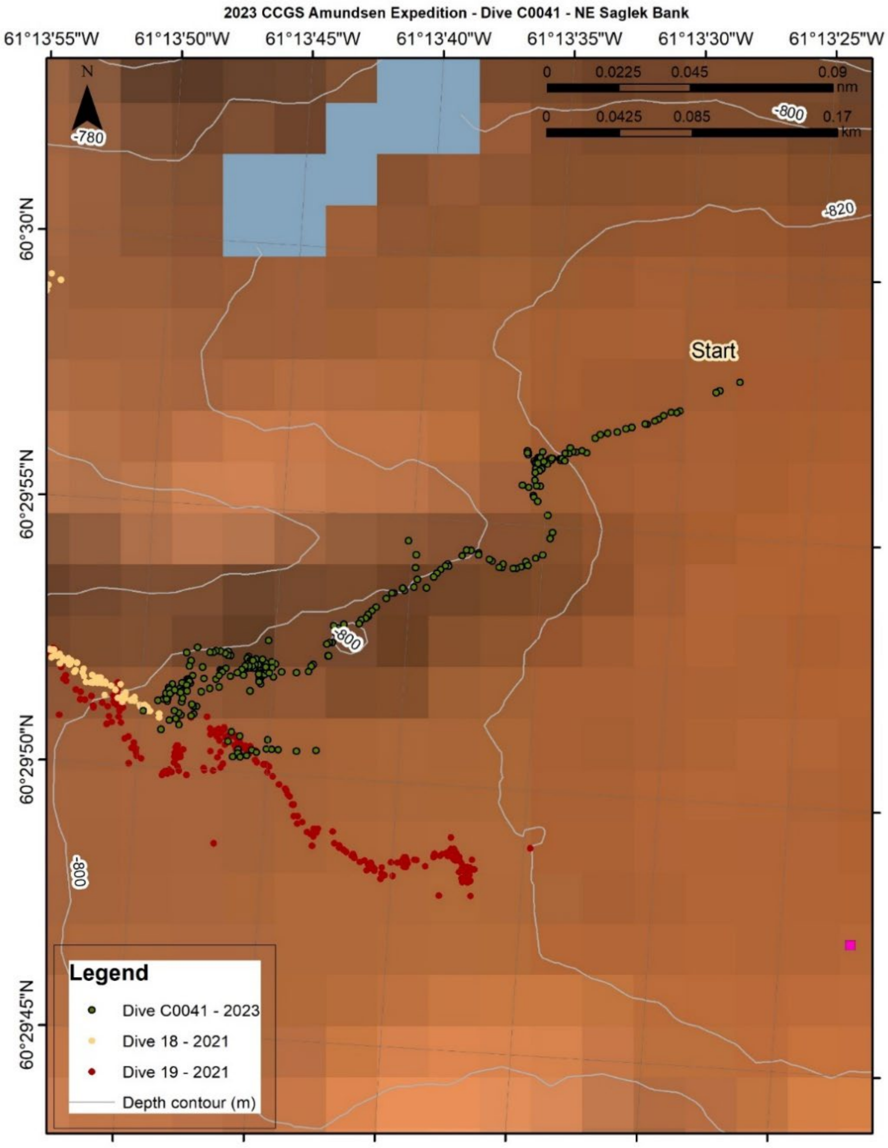

Figure 25-5. Map showing path of accomplished ROV dive C0041 at NE Saglek Bank (Hatton Basin) in relation to planned transect line.

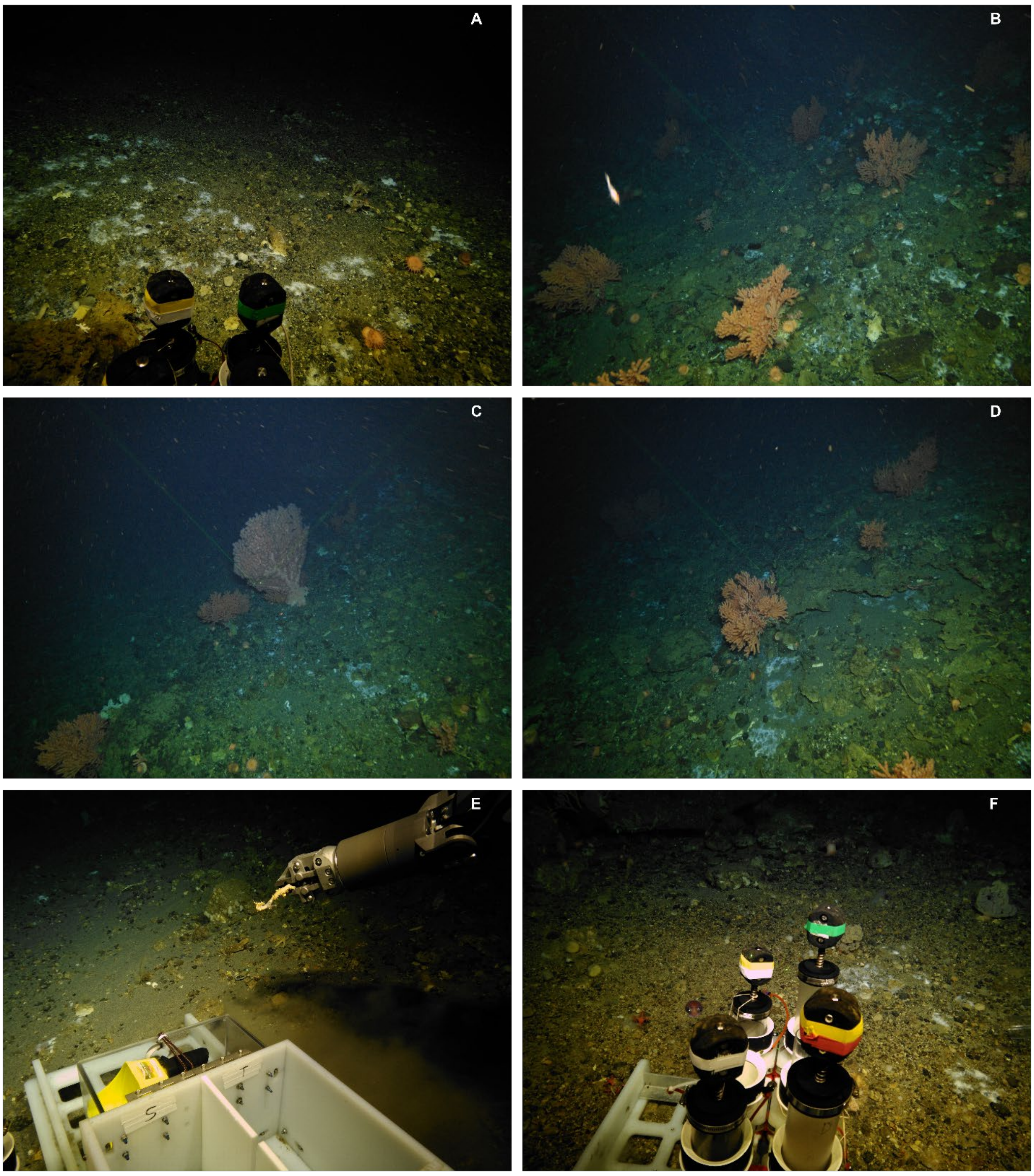

Figure 25-6. Seafloor images at NE Saglek Bank (Hatton Basin) during ASTRID dive C0041. A), B), C), D), E), F), G-H).

Figure 25-7. *Stylaster* coral sampled during ASTRID dive C0041 at NE Saglek Bank (Hatton Basin) (sample R41-2).

25.3.3 *Dive C0042. Hatton Basin-600 (July 27th 2023)*

This dive lasted ~3.5 hours (Table 25-2) and was not initially planned. The main objective of this dive was to sample sediment push-cores for Snelgrove Lab (see Snelgrove team report for details), and to acquire additional data on benthic diversity in the Hatton Basin Marine Refuge, with a focus on the deepest section of Hatton Basin, the centre, where little to no data exists.

The dive started at 610 m (Figure 25-8) with strong currents and poor visibility, mostly due to POM, throughout the descent and dive transect. Large Ctenophores (*Mnemiopsis* sp.) were frequently observed drifting by during the dive. The area is dynamic with well-worked substrates consisting of distinct sand ripples of well-sorted sand peaks and cobble/pebbles in the valleys. Sporadic rocks and boulders, fully encrusted with species, were also encountered throughout the duration of the dive.

Despite multiple attempts during the dive, push-coring in this area was challenging due to sand-gravel substrates with little organic matter to hold the sample within the push core resulting in most cores sampled falling out of the core sleeves. Only 4 out of 9 cores were successfully retained in the holster tubes, and unfortunately those cores were later discarded because they were not suitable for the experiment (see Snelgrove team report for details).

In general, fauna observed was relatively sparse on the sand-gravel ripples, in stark contrast with the large boulders that were heavily occupied by sponges, soft corals, ascidians, and echinoderms. Several species of fish were observed but diversity and abundances were low. Juvenile grenadiers (Macrouridae) were the most common. Other species observed included skates and egg cases/purses (Rajidae), Greenland halibut (*R. hippoglossoides*), redfish (Sebastes sp.), snailfish (Liparidae), Polar sculpins (*C. microps*), Rocklings (*Gaidropsarus* sp.), and blennys or shannys (Stichaeidae sp.) (Figure 25-9).

Corals were observed throughout the dive but were relatively sparse but consistent. Sea pens were the most visible and occupied the sand-gravel substrates. They were dominated by *Balticina finmarchica*, a species that can reach heights exceeding 1.5 m but were unusually stout in stature at this location. *Anthoptilum* sp. were much less common and were thick and bushy in appearance. *Acanella arbuscula*, a small red-bamboo coral, were also common in this substrate. Colonies were short with a wide crown, and thickly covered with deep-red polyps (Figure 25-9; Figure 25-10).

The soft coral *Duva florida* was observed with basket stars attached. Colonies were very large and attached mostly to cobbles and large rocks; other species were observed but difficult to distinguish *in situ*. Many large sea anemones were observed occupying sand-gravel ripples as well as boulder habitats. Decapods consisted of the Northern stone crabs (*Lithodes* sp.) and stripped shrimp (Figure 25-9).

Sponges appeared to be the most diverse group, based on surface characteristics. However, most species were difficult to determine without collections. Almost all species were observed occupying boulders and cobbles for the exception of the carnivorous sponge *Chondrocladia* (*Chondrocladia*) *grandis* (n=1), which was only found in the sand/gravel. The glass sponge *Asconema* sp. (Hexactinellida) and *Polymastia* spp. were frequently observed inhabiting both rock and sand substrates with some animals appearing quite large. In general, *Geodia* type sponges (Demospongiae) were observed but were not frequent. Several fan-shaped morphologies were observed too, most likely *Plicatellopsis* sp. and *Clathria* sp., *Mycale* sp., and several undetermined species (Figure 25-9).

Sea stars of the Asteroidea family were observed but not abundant including *Novodinia* sp., *Ceramaster* sp. and several species of *Henricia*. Feather stars (Crinoidea) were seen attached to sponges on rocks. Cephalopods included squid (*Rossia* sp. and *Illex* sp.), and many observations of octopuses. Many parasite cocoon 'coils' (*Kronborgia* sp.) were observed (Figure 25-9).

25.3.4 *Disko Fan (dive cancelled August 1st 2023)*

Disko Fan was the most northern ROV dive site for this expedition, however, it was realized early on that extreme pack ice would be an issue for all northern sites including this one. We were advised by the ROV team that 2/10's ice coverage (Figure 25-11) would be the absolute minimal coverage for ROV operations, which was based on previous experiences (2021). Upon arrival, ice coverage was 7/10's and as a result the dive was cancelled.

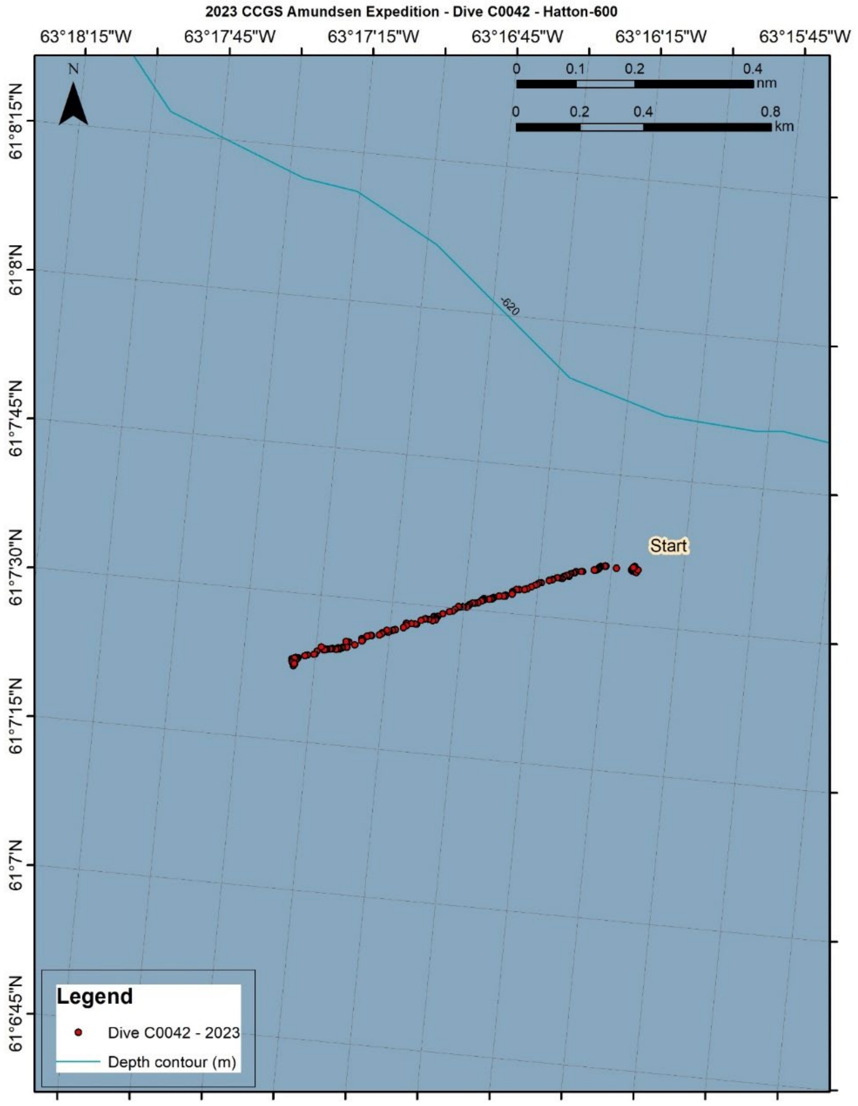

Figure 25-8. Map showing path of accomplished ROV dive C0042 at Hatton-600 (Hatton Basin).

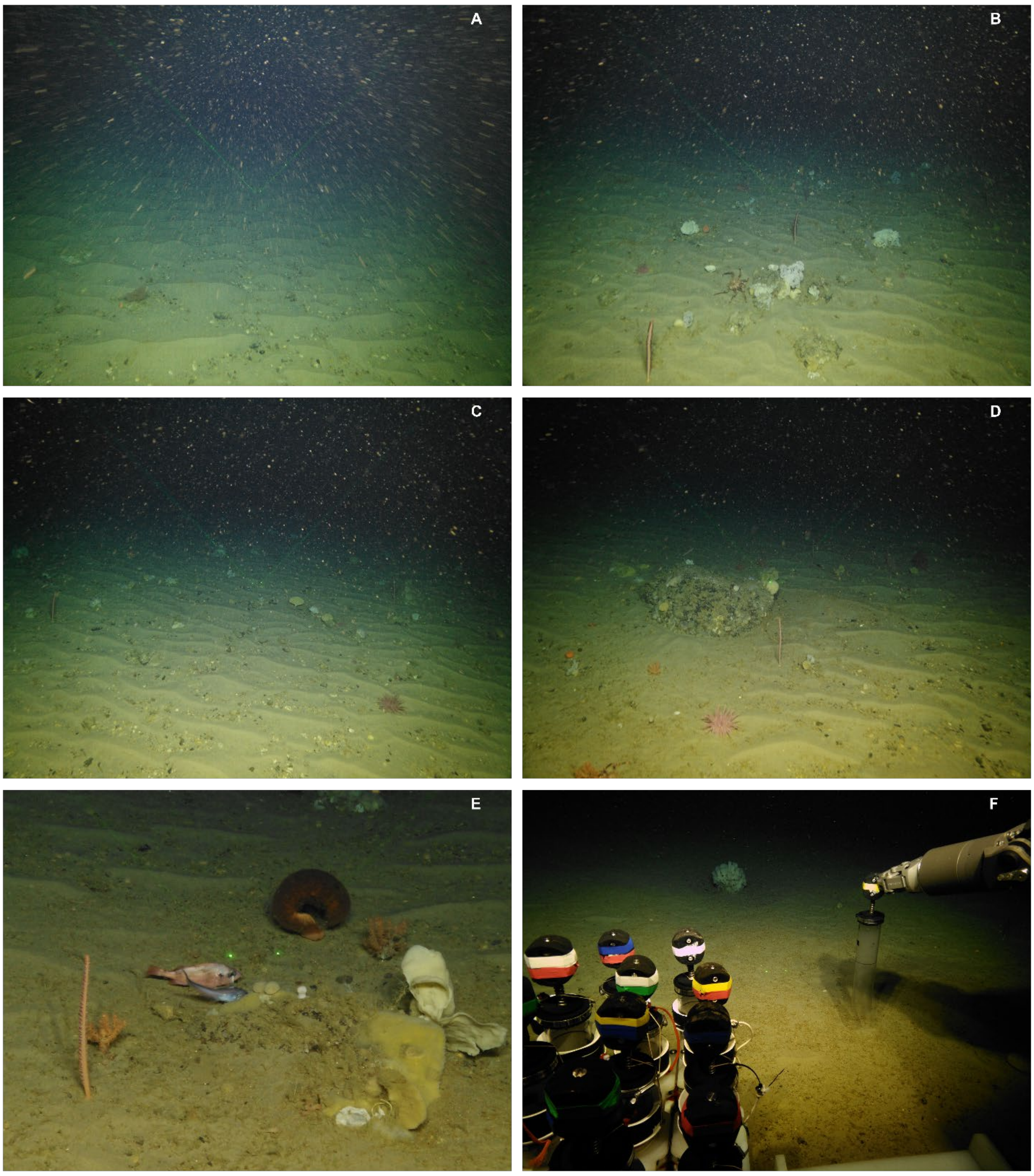

Figure 25-9. Seafloor images at Hatton-600 (Hatton Basin) during ASTRID dive C0042. A) general view of the bottom at this dive site, B) sea pen *B. finmarchica*, crab, and sponges, C-D) rippled seafloor with sea anemones and sea pens, E) close-up of *B. finmarchica*, *Anthoptilum* sp., *Acanella arbuscula*, Redfish *Sebastes* sp., a small Grenadier, and sponges F) area chosen for push-coring, note large *Asconema* sp. sponge in the background.

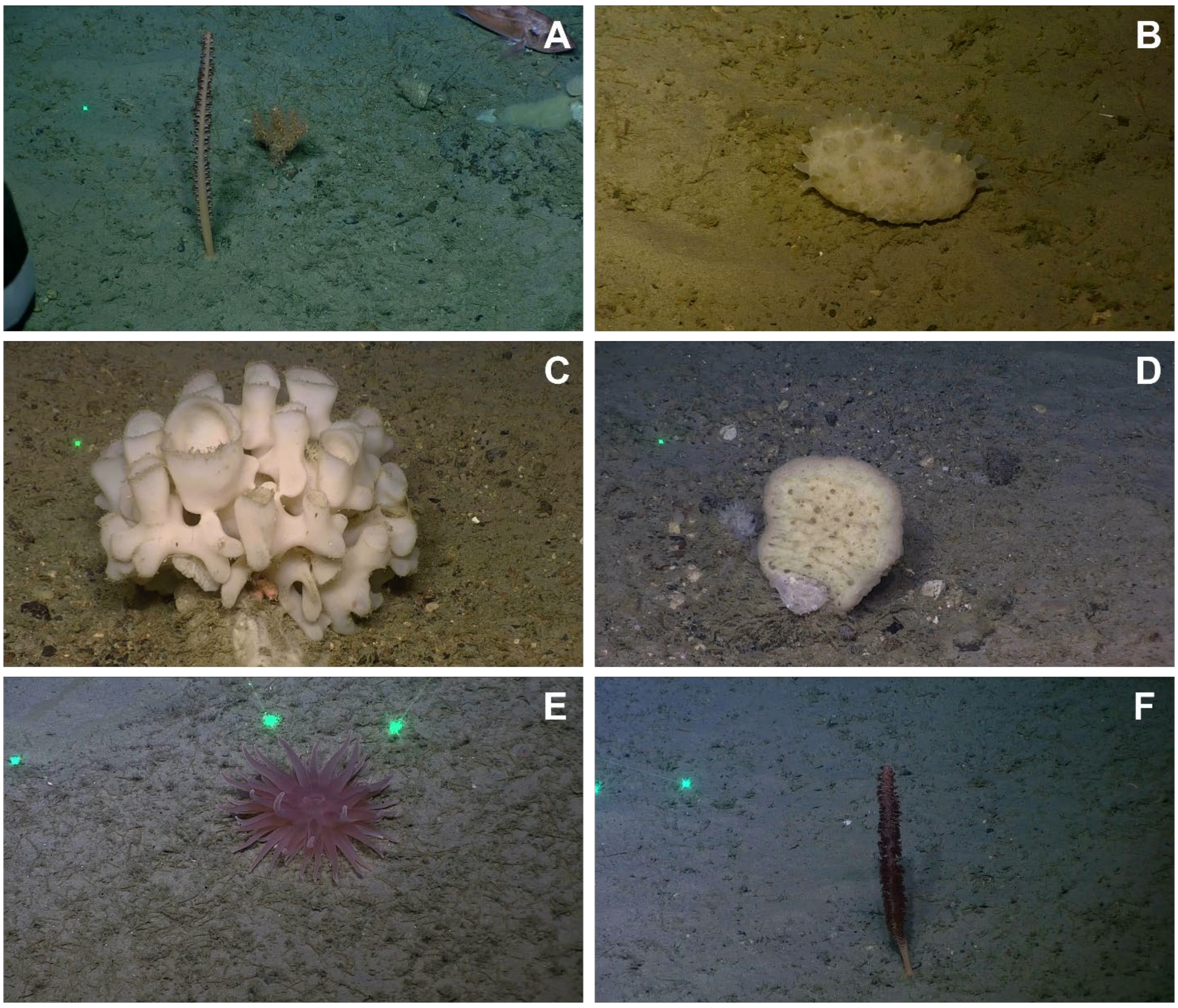

Figure 25-10. Close-up of fauna observed during dive C0042: A and F) *Balticina finmarchica*, B) *Polymastia* sp., C) *Asconema* sp., D) Porifera sp., E) Actiniaria sp.

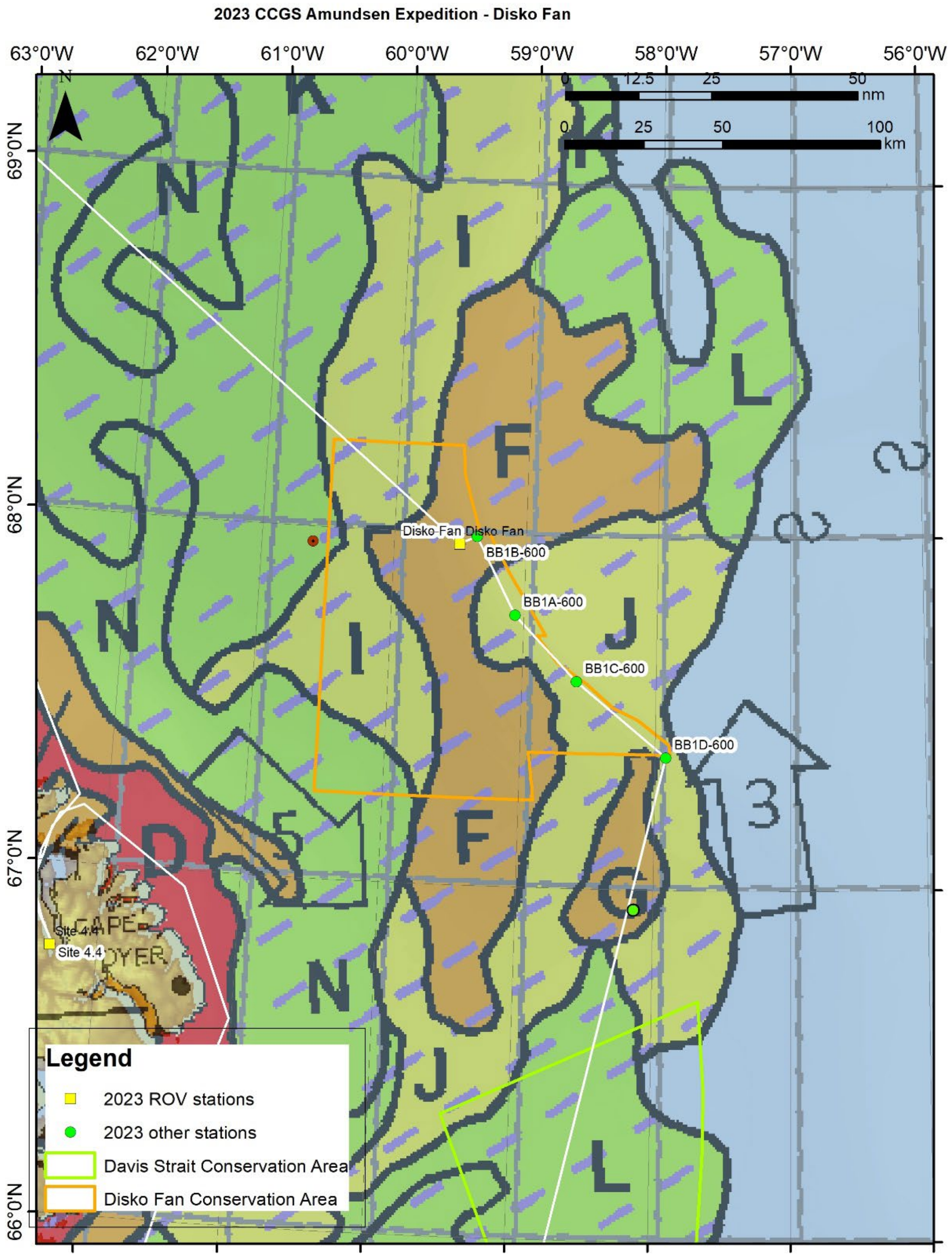

Figure 25-11: Ice chart overlayed on Disko Fan Conservation Area. Note that the dive site sits in the F zone, where ice was 7/10. Note that the overlap is imperfect and only for general interpretation.

25.3.5 *Dives C0043-0044. Davis Strait Conservation Area (August 3rd 2023)*

This site was not listed in the original expedition plan. Dive location was chosen based on the overlap between Significant Benthic Areas (SiBAs; large, small gorgonians, and sponges) in the area, as an attempt to maximize observations of benthic diversity. Dive C0043 started at 575 m and the ROV headed to start push-coring (Figure 25-12). After 30 minutes of coring, the science team noticed an issue with the configuration of push cores and decided to recover the ROV to adjust the cores on deck (adding tape on pore-water cores). At 11:15 am local time the ROV was back on deck and the follow-up dive (C0044) started 50 minutes later. Total seafloor time for both dives combined was 4.5 hours.

The main objective of these dives was to sample sediment push-cores for the Algar and Snelgrove labs (see their team report for details), and to acquire samples and additional video data on benthic diversity in the Davis Strait Conservation Area. The seafloor was very flat and muddy, causing a lot of turbidity during push-coring. Although this site was selected due to an overlap of SiBAs for large and small gorgonians and sea pens, the site did not support unusual biodiversity. The bamboo coral *Acanella arbuscula* was one of the most conspicuous benthic organisms, but most appeared in poor condition - thin, tipped, broken, and partially or completely devoid of polys with exposed skeletons (Figure 25-13, Figure 25-14). Sea pens included *Balticina finamarchica* and *Umbellula* sp., which were rare. This was the first site where the solitary cup coral *Flabellum* (*Flabellum*) *alabastrum* was observed, with many very large and healthy looking unlike the *Acanella* colonies. The black coral *Stauropathes arctica* was observed. Among echinoderms, sea stars (*Ceramaster*, *Hippasteria, Henricia* sp.) and the sea cucumber *Elpidia* sp. were present through the entire dive. The sea urchin *Phormosoma placenta* was also observed, but rare. Sea stars (likely *Hippasteria phrygiana*) were sometimes seen on the surface of *A. arbuscula*, leading us to hypothesize that colonies are being predated by these sea stars. Sponges included *Asconema*, *Craniella* sp., encrusting *Hexadella* sp., and several unidentified species. At one point of the dive several large *Asconema* were observed (50 cm height x 50 cm width), which hosted a large number of associates (Figure 25-13, Figure 25-14).

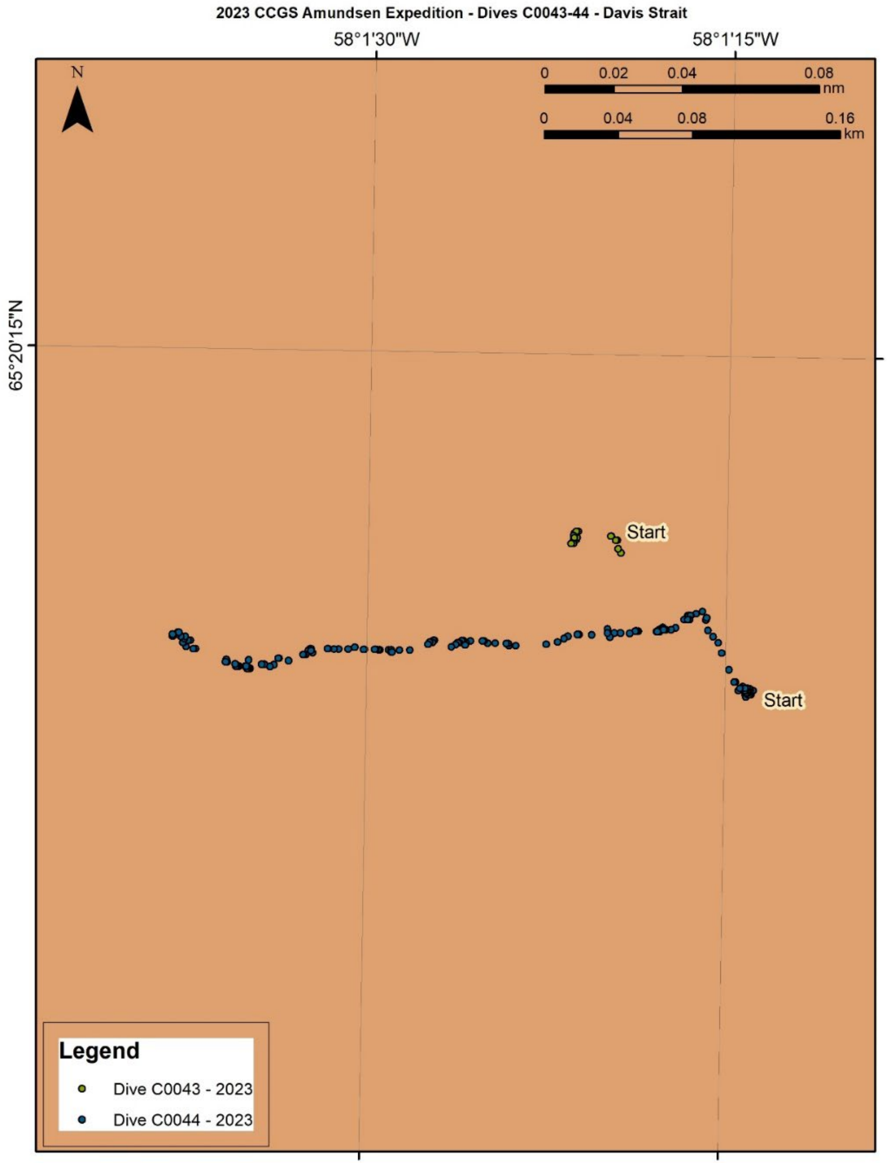

Figure 25-12. Map showing path of accomplished ROV dives C0043-44 at Davis Strait. Dive 43 shows positions where ROV was collecting push-cores.

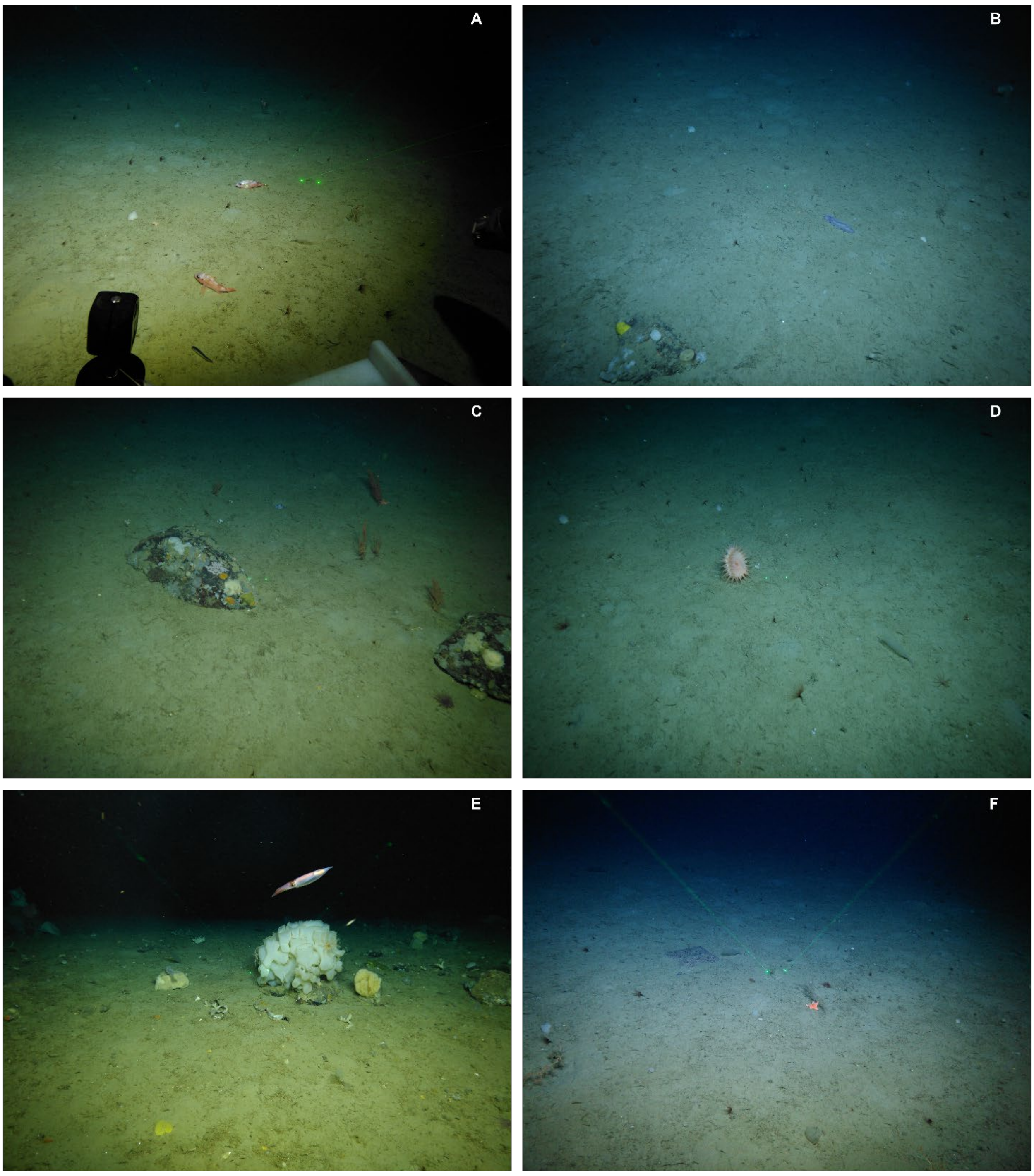

Figure 25-13. Seafloor images at Davis Strait during ASTRID dive C0044. A) Redfish (*Sebastes* sp.), B) general soft bottom area, C) a few *Acanella arbuscula* colonies D) sea anemone, cerianthids, and ascidian (*Ciona* sp.?), E) *Asconema* sp., other sponges, and squid, F) skate and sea star *Hipasteria* predating on unidentified branching organism.

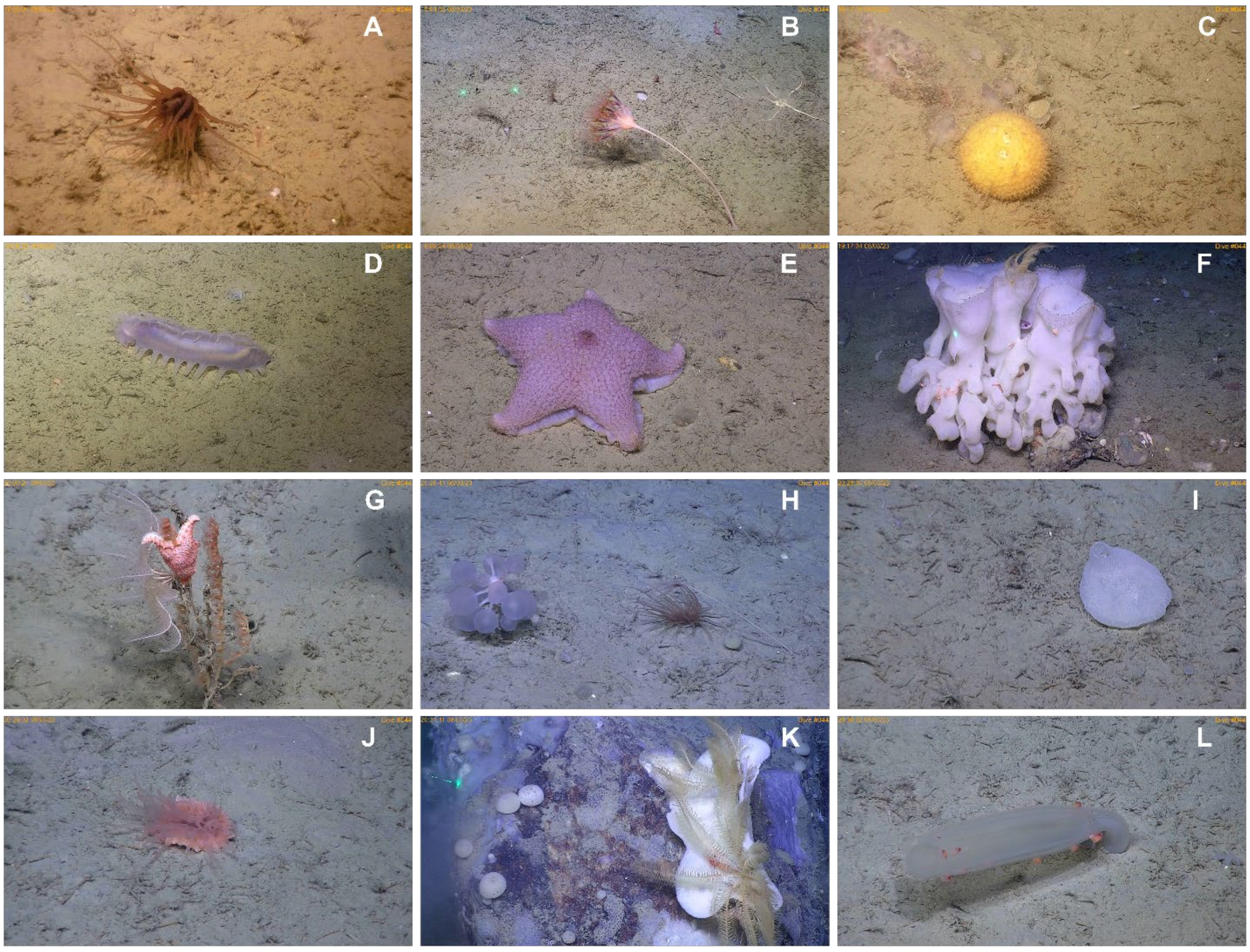

Figure 25-14. Close-up of fauna observed during dive C0044. A) cerianthid, B) *Umbellula* sp., C) sponge *Craniella* sp., D) *Elpidia* sp., E) sea star, F) *Asconema* and associates, G) *Acanella arbuscula* with sea star *Hippasteria* on its surface, H) *Chondrocladia* sp., and cerianthid, I) ascidian, J) *Flabellum allabastrum*, H) sponge and crinoid, L) ascidian (*Ciona* sp.?) with small amphipods (N >10). Distance between lasers = 10 cm.

25.3.6 *Dive C0045. Hatton Mercer (August 5th 2023) – Rosette cast 39*

This site was not initially planned. Dive plan focused on continuing a transect line that was initially started in 2018 using the SuMo ROV (dive 67) where large fields of the sponge *Geodia* were identified. We planned for a transect line, 2 km in length for guidance, starting inside of a sponge SiBA. The dive was cancelled 30 minutes after the ROV was launched due to strong currents of up to 2.7 knots. The rosette cast (conducted during the AUV survey) did not indicate this type of currents (Figure 25-15). This dive started at ~13:30 local time. The morning of this dive the AUV was deployed and currents were not as strong. We might have missed a window for diving here due to the strong tidal influence in this area. We planned for a follow-up dive the next day starting early in the morning.

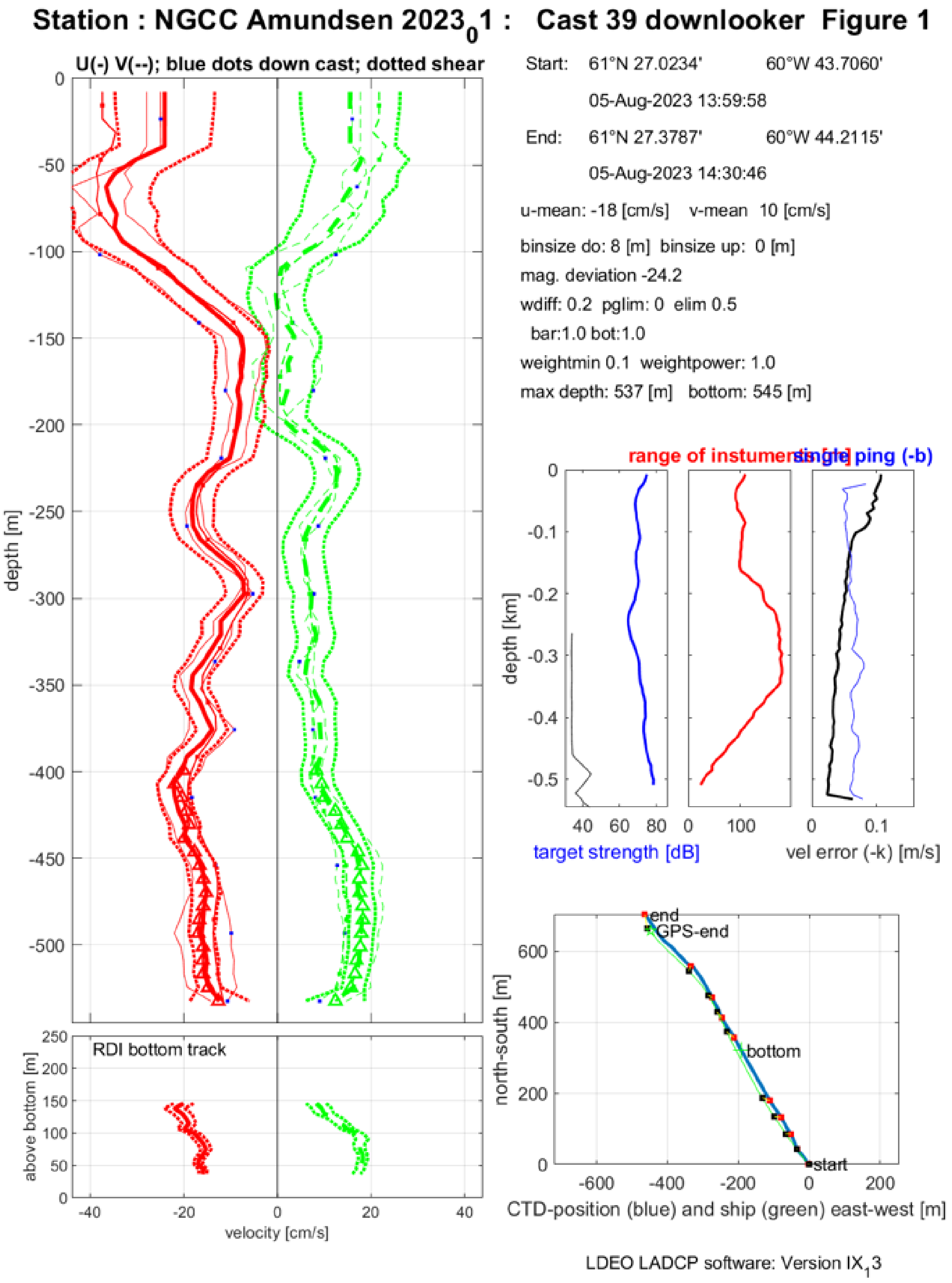

Figure 25-15. ADCP plot for location of dive C0045 (rosette cast 39). Note surface velocities <1 knot.

25.3.7 *Dive C0046. HT2-600 (August 6th 2023) – Rosette cast 40*

This site was not initially listed in the expedition plan. It was chosen as part of a series of three drop camera transect lines in Hatton Basin to be completed during the expedition. This station was located near the first drop cam station in this line at ~600 m, and aimed to survey an area going towards a sponge SiBA. Currents (at surface and within the water column) were not manageable, and the ROV needed to descended to ~480 m, when it could no longer dive. ROV was recovered after 1 hour and 40 minutes. CTD rosette did not indicate currents outside of a dive-able range

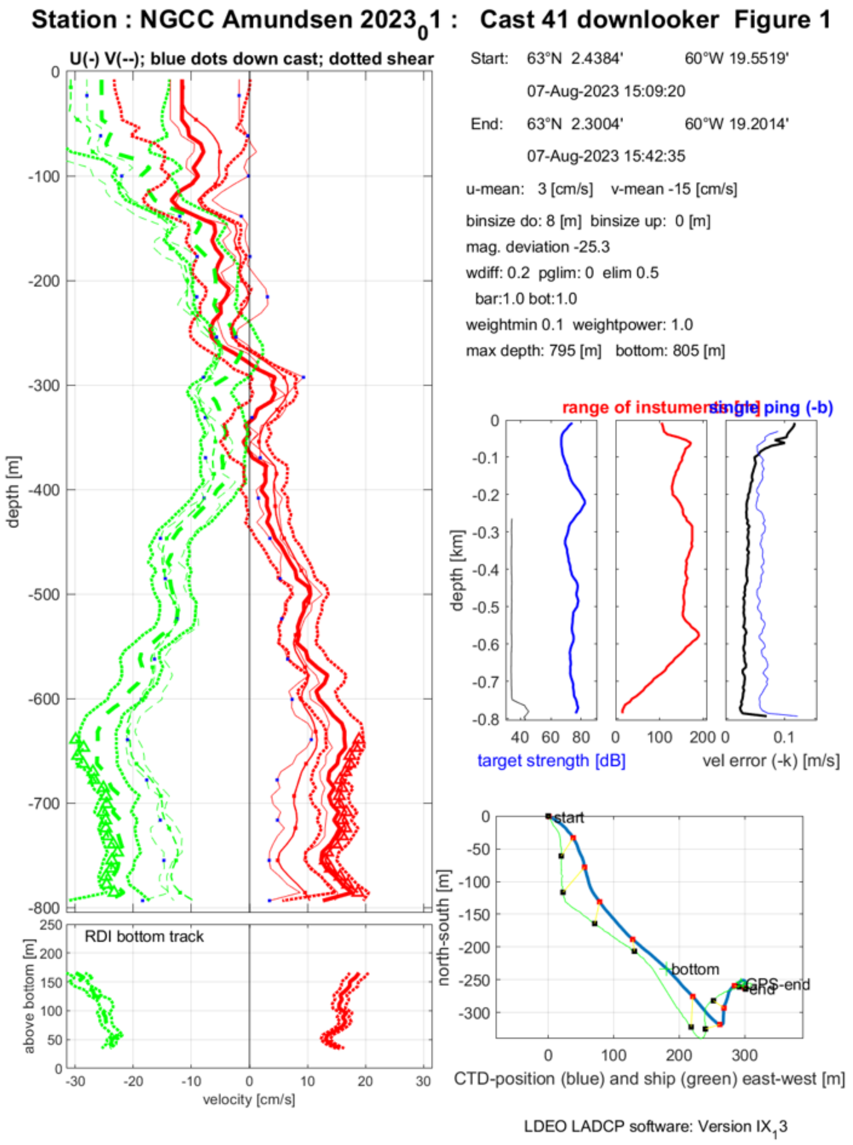

Figure 25-16: ADCP plot for location of dive C0046 (rosette cast 40). Note surface velocities <1 knot

25.3.8 *Dive C0047. Davon (between Davis Strait and Hatton Basin) (August 7th 2023) – Rosette cast 41*

This site was not initially listed in the expedition plan. It was chosen based on its location inside of a sponge SiBA, at a suitable ROV depth, and an area located outside of the tidal currents influence (Figure 21-17). Currents were indeed very manageable and no issues were encountered during the dive, which lasted 2 hours and 45 minutes on the seafloor (time limited by schedule).

Once we reached the seafloor the ROV pilots informed us of a large mark showing on the sonar (Figure 21-18). The mark was suggested to be from a trawl pass or from underwater cables (ROV pilots have seen similar marks), but we are not completely sure yet but suspect it's more likely from a large trawl door. We decided to follow the line to the east for ~200 m. At the end of the line we proceeded in the opposite direction to survey the area adjacent to it, which was unimpacted. At the end of this second line we headed to the second mark seen in the sonar. At one point during the dive there were up to four parallel 'trawl' marks observed.

The most common sponge was the yellow encrusting sponge *Hexadella* sp. (Figure 21-19; Figure 21-20). Other common sponges included *Geodia* and *Asconema*, but not in large abundances (Figure 21-19; Figure 21-20). Sea anemones, the bamboo coral *Acanella arbuscula*, and the sea pens *Anthoptilum grandiflorum* and *Balticina finmarchica* were also observed. Overall, this area looks fished (as expected from fishing footprint and trawl mark evidence on the seafloor). A total of nine specimens were collected during this dive, including eight sponges (including fragments) and a sea anemone (Table 25-2).

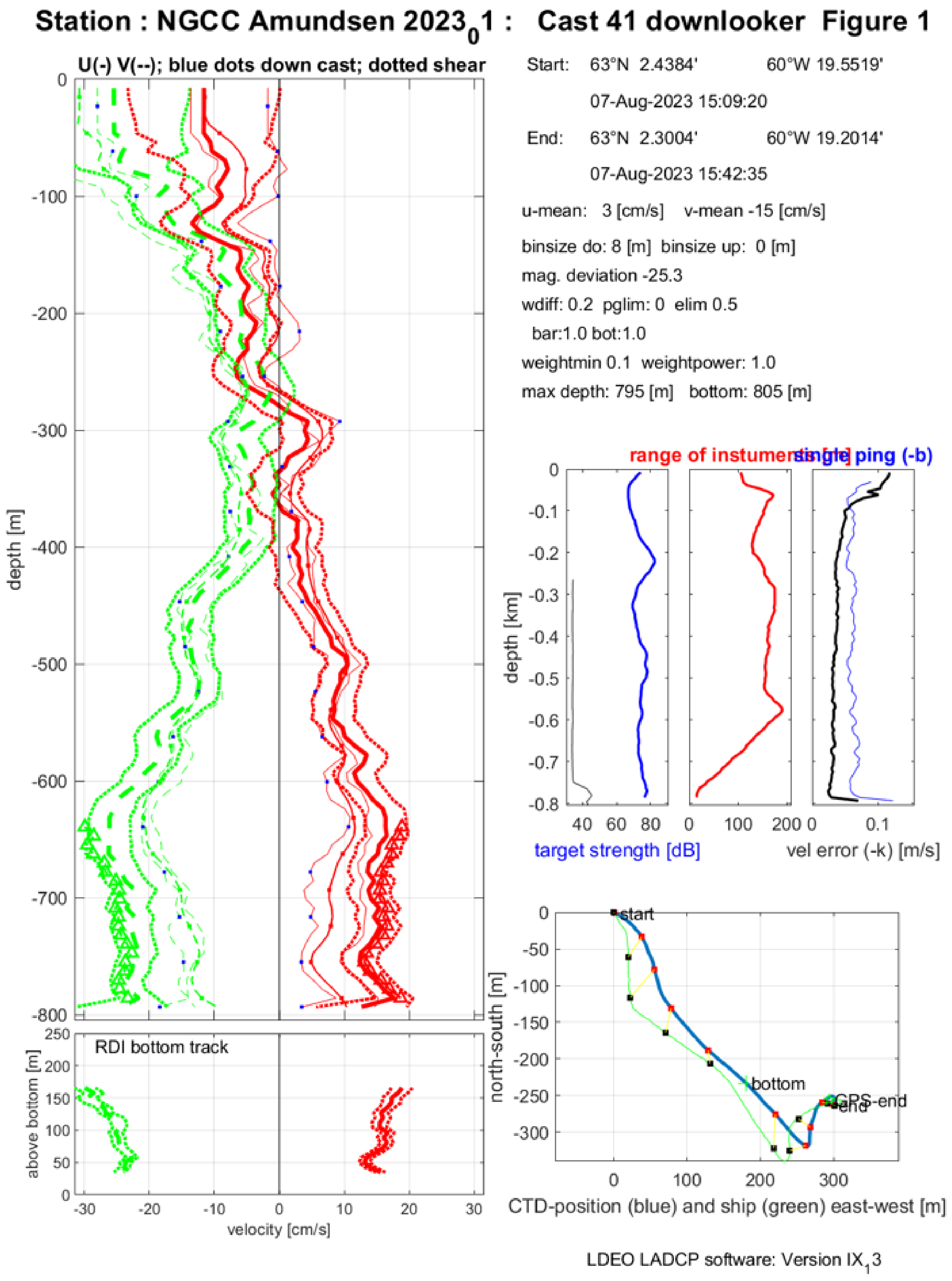

Figure 25-17: ADCP plot for location of dive C0047 (rosette cast 41). Note surface velocities <1 knot

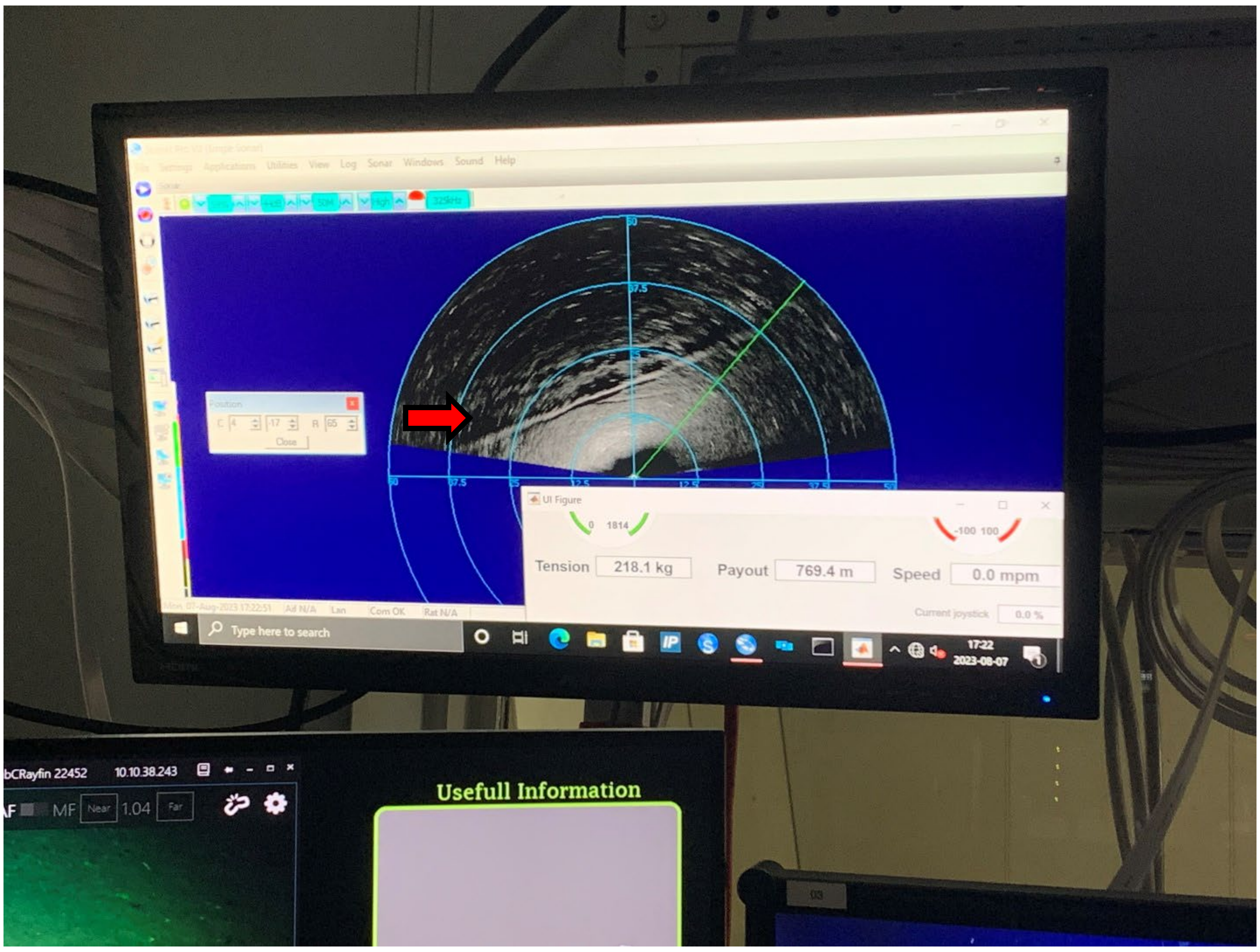

Figure 25-18. Image from ASTRID ROV sonar during dive C0047 (note red arrow).

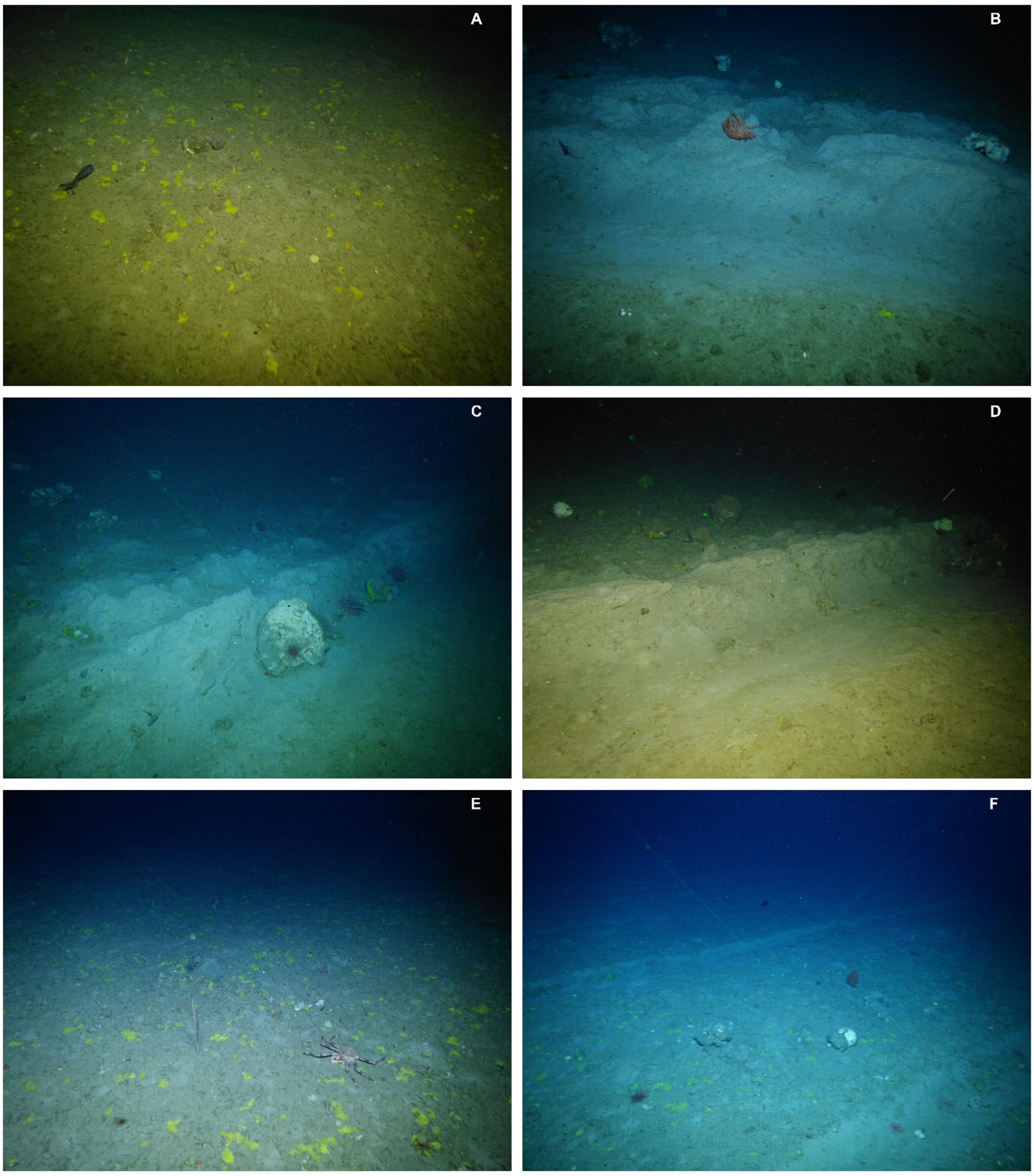

Figure 25-19. Seafloor images at Davis Strait (Davon) during ASTRID dive C0047. A) seafloor covered with sponge *Hexadella* sp., B) potential trawl mark, C) large *Geodia* sponge inside of trawl mark, D) clear trawl mark, E) sea pen *Balticina finmarchica* and crab amongst *Hexadella* sp. sponge, F) additional trawl marks.

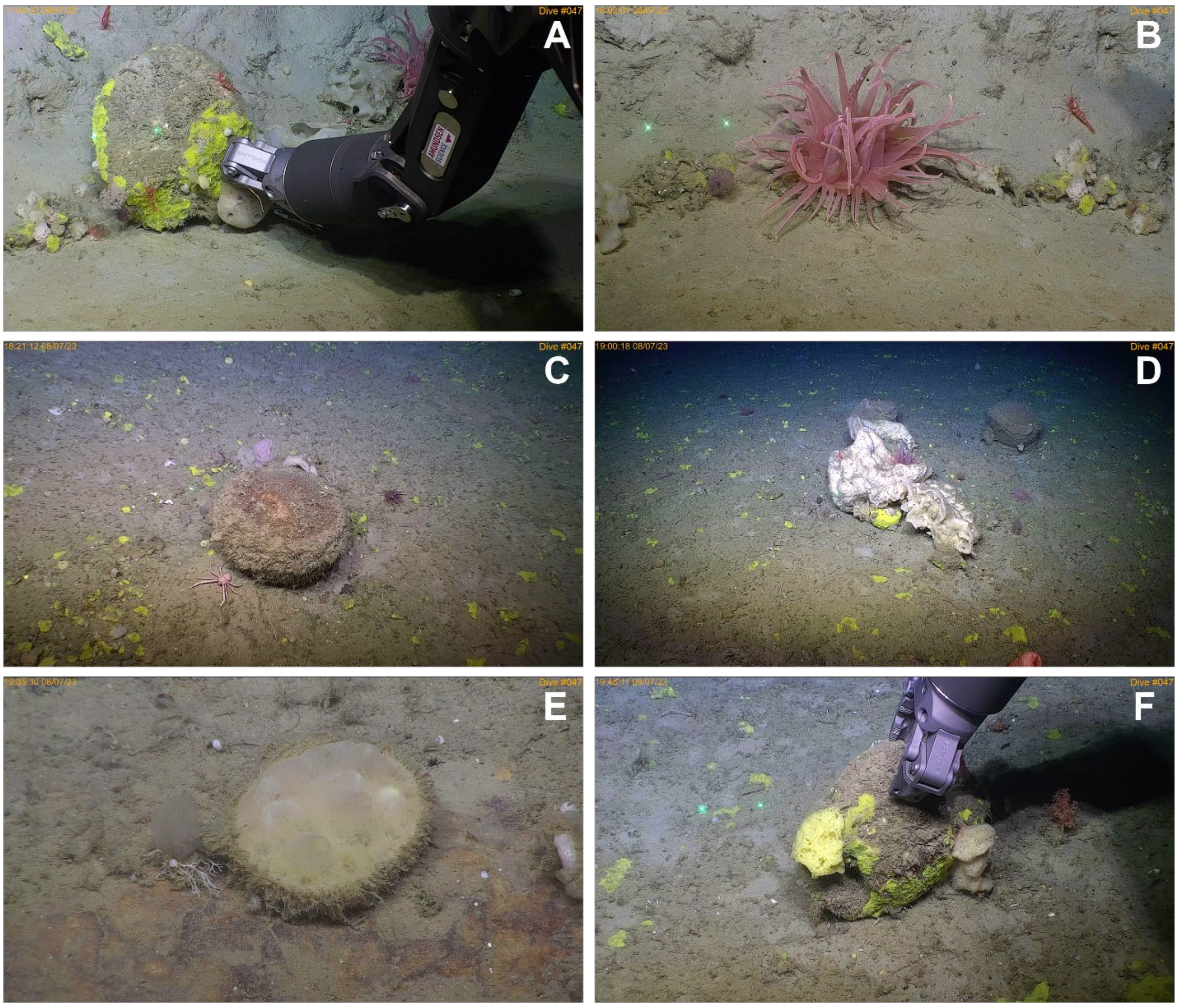

Figure 25-20. Close-up of seafloor images at Davis Strait (Davon) during ASTRID dive C0047. A) large *Geodia* sponge being sampled, B) sea anemone, C) *Geodia* sp., D) *Geodia* and *Stelletta* spp., E) *Polymastia*, F) sponge being sampled. Sponges were identified after collection.

25.3.9 *Dive C0048. Frobisher Bay (August 8th 2023) – Rosette cast 42*

This site was not initially listed in the expedition plan. It was chosen as an opportunity to dive in Frobisher Bay on our way to Iqaluit. Dive site was at ~400 m and survey length was ~1.4 km (Figure 25-21). Seafloor was flat and muddy, with a lot of marine snow making visibility extremely poor throughout the dive (Figure 25-22). Brittle stars were the dominating organism and visibility was very poor for us to further identify other fauna. The basket star *Gorgonocephalus* sp. was observed, along with eelpouts. We started the dive and after 250 m we increased ROV speed to go to waypoint 3 on transit mode. It seems that between waypoints 1-3 we were in a basin, which could have contributed to the bad visibility. A total of 10 samples were collected during this dive, including the basket star *Gorgonocephalus* sp., the soft coral *Gersemia rubiformis*, sponges, and seawater (Table 25-2).

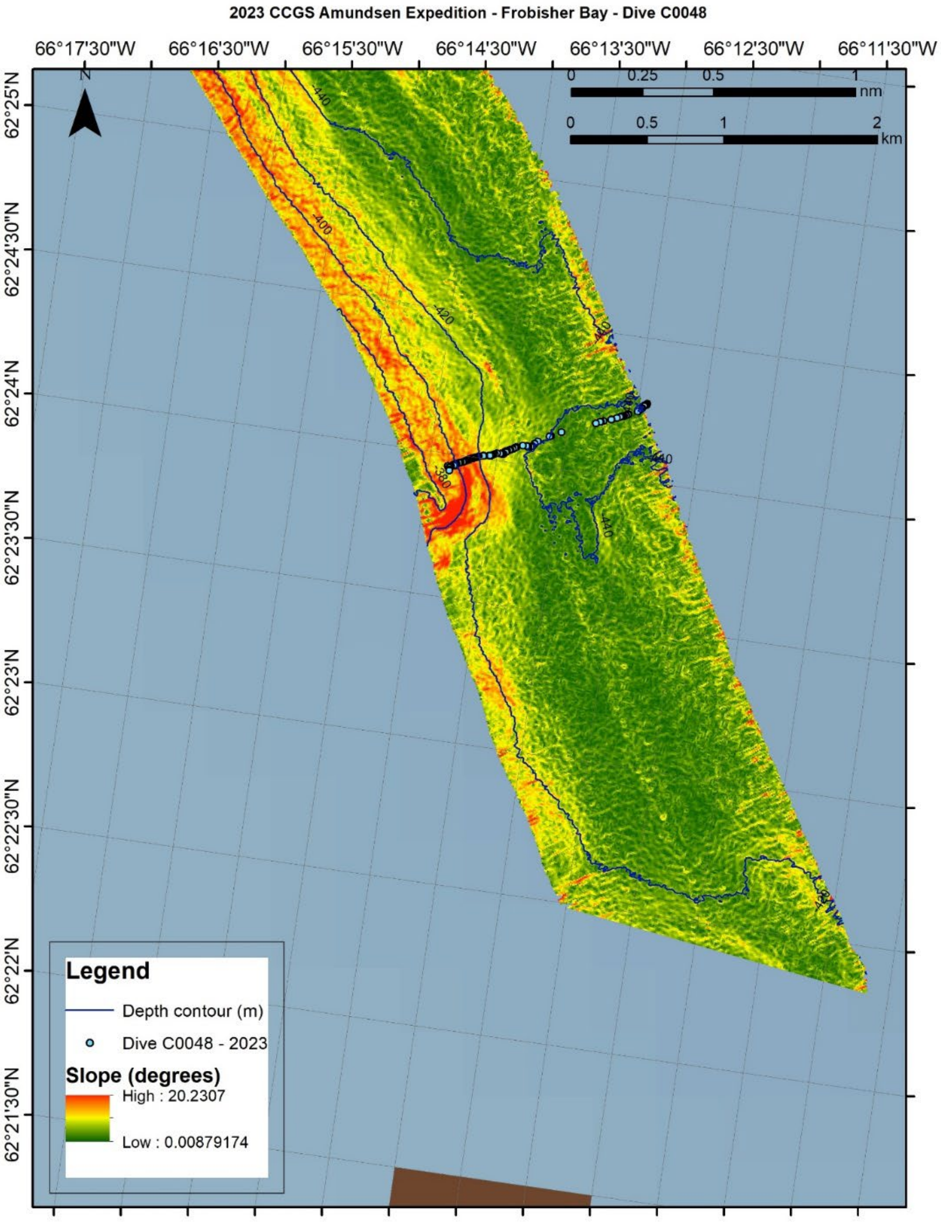

Figure 25-21. Map showing path of accomplished ROV dive C0048 at Frobisher Bay.

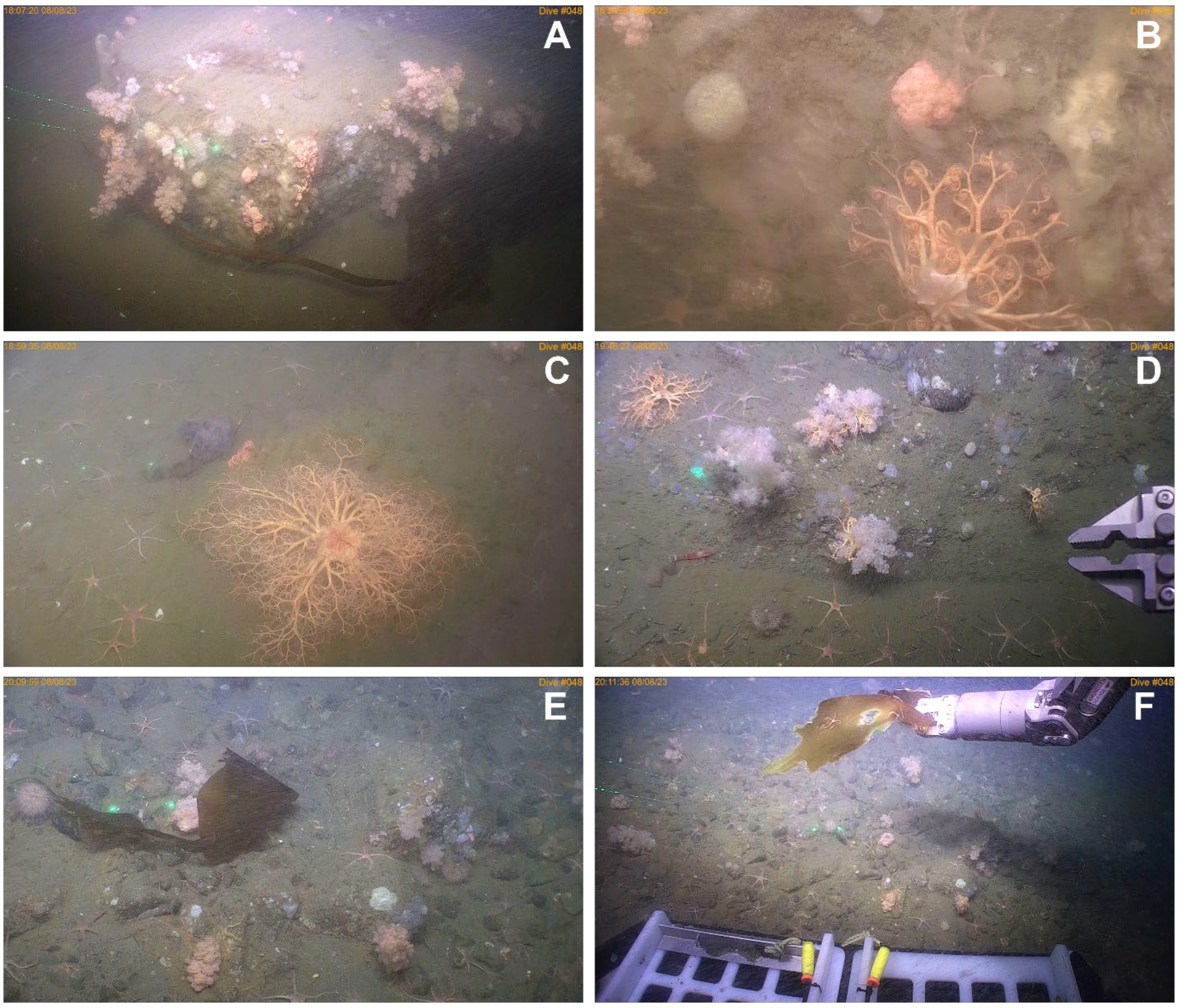

Figure 25-22. Seafloor images at Frobisher Bay (FOBAR) during ASTRID dive C0048. A) boulder with soft corals, sponges, and other invertebrates; B) close-up of boulder with large basket star, C) basket star on seafloor, with ophiuroids; D) sampling soft corals with juvenile basket stars; E) soft corals and large piece of kelp; F) kelp being sampled.

Table 25-3: List of opportunistic samples collected by DFO-NL (V. Hayes, B. Neves) during Leg 1 of the 2023 Amundsen expedition

DATE	LOCATION	STATION	METHOD	DEPLOYMENT ID
18-Jul	ISECOLD	ISECOLD-0-200	Box Core	Box Core-1
18-Jul	ISECOLD	ISECOLD-0-200	Box Core	Box Core-1
18-Jul	ISECOLD	ISECOLD-0-200	Box Core	Box Core-1
18-Jul	Sentinel	Sentinel	Box Core	Box Core-1
18-Jul	ISECOLD	ISECOLD-0-200	Box Core	Box Core-2
18-Jul	ISECOLD	ISECOLD-0-200	Box Core	Box Core-2
18-Jul	ISECOLD	ISECOLD-0-200	Box Core	Box Core-2
18-Jul	ISECOLD	ISECOLD-0-200	Box Core	Box Core-2
20-Jul	ISECOLD	ISECOLD-1-200	Beam Trawl	Beam Trawl
20-Jul	ISECOLD	ISECOLD-1-200	Beam Trawl	Beam Trawl
20-Jul	ISECOLD	ISECOLD-1-200	Beam Trawl	Beam Trawl
20-Jul	ISECOLD	ISECOLD-0-200	Beam Trawl	Beam Trawl
20-Jul	ISECOLD	ISECOLD-1-200	Beam Trawl	Beam Trawl
20-Jul	ISECOLD	ISECOLD-1-200	Beam Trawl	Beam Trawl
20-Jul	ISECOLD	ISECOLD-1-200	Beam Trawl	Beam Trawl
20-Jul	ISECOLD	ISECOLD-1-200	Box Core	Box Core
22-Jul	Saglek Fjord	Saglek Fjord	Beam Trawl	Beam Trawl
22-Jul	Saglek Fjord	Saglek Fjord	Beam Trawl	Beam Trawl
22-Jul	Okak Bay	Okak Bay	Box Core	Box Core-1
22-Jul	Saglek Fjord	Saglek Fjord	Box Core	Box Core-1
22-Jul	Saglek Fjord	Saglek Fjord	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1

DATE	LOCATION	STATION	METHOD	DEPLOYMENT ID
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG bank	Box Core	Box Core-1
23-Jul	Saglek Bank	SAG Bank	Box Core	Box Core-1
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
24-Jul	NE Saglek Bank	NE Saglek Bank	Van Veen	Van Veen
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
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25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
25-Jul	ISECOLD	ISECOLD-3-200	Box Core	Box Core-1
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl

DATE	LOCATION	STATION	METHOD	DEPLOYMENT ID
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
26-Jul	ISECOLD	ISECOLD-3-200	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl

DATE	LOCATION	STATION	METHOD	DEPLOYMENT ID
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
27-Jul	Killinek	Killinek	Beam Trawl	Beam Trawl
2-Aug	Davis Strait	Otolith-4	Box Core	Box Core
3-Aug	Davis Strait	DS - 3	Box Core	Box Core - 2
3-Aug	Davis Strait	DS - 3	Box Core	Box Core - 2
3-Aug	Davis Strait	DS - sweep	Box Core	Box Core - seep
3-Aug	Davis Strait	DS - 2	Box Core	Box Core -1

25.4 Recommendations

Recommendations listed here have been briefly discussed with the ROV team, and are listed for consideration. Specific recommendations may be provided by the other teams involved in ROV work.

1) Expedition planning schedule needs to consider day-time-only operations. While the schedule is clearly adjusted during an expedition, if ROV operations are planned for a whole day at a site and the ship is expected to arrive at station at night, the schedule will need to be substantially adjusted.
2) With the new ROV, the DP system integration has become a must for future ROV dives. Many of the areas that we wish to study are high-current areas where corals and sponges thrive, and DP could facilitate diving in those areas. In many cases we have assessed that surface currents were much stronger than bottom currents, which largely implicates ship handling. In addition, long dives can be exhausting to the ship's captain and can limit dive duration (specially if several dives in a row). We are conscious of the ROV limits for successfully diving in these areas, but if they need to be excluded from our plans, this may limit ROV applications aboard the Amundsen.
3) While we realize that there is no straightforward solution for this, not being able to dive in the presence of ice is an important limitation for using the ROV in Baffin Bay. If ROV operations are planned for this region, then considering a Leg later in the year will increase chances of success. Otherwise, alternatives to allowing the ROV to dive in the presence of ice could be explored.
4) Planning for stations too far from most of the other stations can be a problem. This year we had mooring recoveries planned at Macbeth Fjord and Scott Inlet, and severe ice conditions in the region resulted in both of these stations being cancelled. While that meant gaining several days of ship time, this resulted in a large number of operations at unplanned sites (e.g., Hatton Basin, Davis Strait and Frobisher Bay).

For example, the drop camera team conducted 25 deployments in a very short period of time, which can be quite demanding for both science and ship's crew. Other teams were finished with their sampling and with limited supplies/consumables were unable to sample at these unplanned/opportunistic stations. Some teams finished sampling seven days before the end of the expedition.

5) We find it difficult to relate CTD-rosette cast IDs to stations. It would be beneficial to have the cast IDs listed in the Eventlog for each CTD-rosette deployment. In addition, operations that have replicates, such as box-cores, should also be sequentially numbered in the Eventlog, like ROV dives (the GSC also has a great system for curating their samples). A drop-down menu with standard names could also be useful, as to generate Eventlog files with consistent operation names (e.g., Box-core, as opposed to box-core, Box-Core, boxcore, etc).
6) An ROV suction sampler is still recommended, and it will facilitate the collection of delicate specimens and even sediment (e.g. dive C0041 at NE Saglek Bank). For example, at the NE Saglek seep site, coring was not possible but sediment samples were still creatively collected using the pus-core sleeve to scoop sediment, and the holster as the collection container.
7) Continued access to IRLS for logging during future expeditions is still highly recommended.
8) CTD on ROV only partially worked during the first dive and could not be used during the following dives. Having the CTD working for next expeditions will be valuable.
9) Computer with ArcGIS in acquisition room needs upgrade. The computer was very slow and making it difficult for scientists to access multibeam files during the expedition (and being hard on the multibeam team when using ArcGIS)
10) Better quality of video shown in CCTV system would be a great bonus. In instances where scientists might be prevented from accessing the ROV room during a dive due to capacity issues, this would be beneficial. Better video quality also increases our outreach for the crew. Potentially even a sound system where live narration of dives could be listened to by scientists outside of the ROV room.
11) ROV imagery quality can be improved, but we have been having discussions with the ROV team on solutions.

26 Benthic Surveys of the Labrador Sea Using Drop Camera

Principal investigators: David Coté1, Bárbara Neves1

Cruise participants: David Coté[1], Bárbara Neves[1], Vonda Hayes[1], Jessica Desforges[1], Jordan Sutton[1]

Prepared by: Jessica Desforges

[1]Fisheries and Oceans Canada, Newfoundland and Labrador, Canada

26.1 Introduction

Drop cameras are relatively low-cost yet effective monitoring techniques that assist in characterizing benthic fauna and habitat, particularly when sampling is not required. The drop camera was used in Leg 1 of 2023 to: 1) Extend the surveys of ISECOLD stations and conduct preliminary exploration of the shelf near Joey's Gully, Hopedale Saddle, Okak Bay, Saglek Fjord, and Nachvak Fjord; and 2) Scout areas of interest for potential ROV dives.

26.2 Methods

The deep-sea camera system consisted of two cameras (SubC deep-water camera and GoPro Hero 10 camera with Sony batteries and Anglerfish Deepsea Housing) and two BigBlue 100m rated 2000 lumen lights in underwater GroupB housings. There are two lasers separated by 6.2cm within the OneCam housing. This equipment was fixed to a modified box-core frame Figure 22-1, equipped with additional steel plates for additional weight. The modified box-corer apparatus containing the drop camera setup was to a winch cable system and lowered from the vessel at 80 m/min. When the drop camera was within ~50 m from the last reported depth, it was lowered at 20 m/min until it touched bottom. The deckhand operating the winch used the difference in tension force measured by the tensiometer on the winch. If the tensiometer fails to indicate differences in tension as the frame is lowered to the seafloor, additional weight can be attached to the drop camera frame. From there on, a "yo-yo" method was employed whereby the camera would be raised ~1-2 m off the bottom (as measured by the length of winch cable retracted), flown for 30 seconds above the seafloor while maintaining a 0.5 knot drift speed, and dropped on the bottom again, and this procedure was repeated for 30 minutes.

A record was kept of the time of the camera deployment, coordinates when the frame was on bottom, and time that the camera was lifted back on the deck. Once the camera was back on deck, the camera apparatus was rinsed with fresh water, removed from the box-core frame, and taken to the foredeck lab to have the video footage from both the SubC camera and the GoPro Hero 10 camera downloaded and saved to an external hard drive. The housings were checked for leaks or defects, o-rings were replaced if required, and groves were greased using silicone grease. Drop camera footage was also used to inform the suitability of bottom habitats for other sampling devices (e.g. box-corer, beam trawl, and ROV). A total of 28 drop camera deployments were conducted during Leg 1 of the 2023 Amundsen Expedition (Table 26-1; Figure 26-2). All transects were successful in providing data that will assist in characterizing benthic communities except for those conducted at Hopedale Saddle, where both the GoPro and SubC camera failed to record. A summary of the results is provided in Table 26-2 with accompanying still images retrieved from video footage.

Figure 26-1: The drop camera system attached to a modified box-core frame utilized in Leg 1 of the 2023 Amundsen Expedition

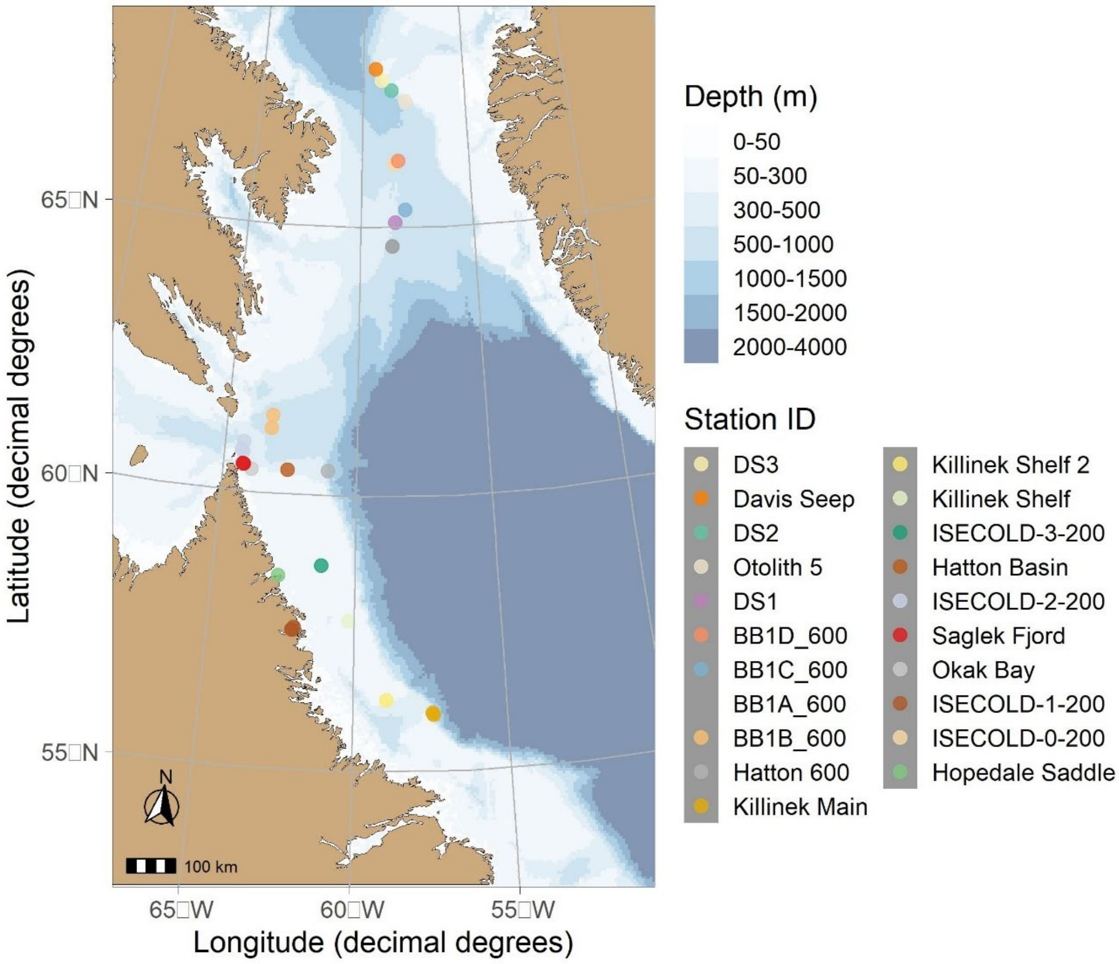

Figure 26-2. Locations of Drop Camera transects during Leg 01 of the Amundsen 2023 Expedition.

Table 26-1: Metadata for drop camera stations of Leg 1, 2023

Station ID	Lat Bottom Start (N)	Long Bottom Start (W)	Lat Bottom End (N)	Long Bottom End (W)	Date	Start time	End time	Mean Bottom Depth (m)
Hopedale Saddle-1	56.01940	57.38315	56.01185	57.37625	16 Jul	2315	0017	929
Hopedale Saddle-2	56.05527	57.40616	56.04858	57.40144	17 Jul	0055	0147	841
ISECOLD-0-200	56.28640	58.90757	56.28962	58.90838	18 Jul	1153	1230	197
ISECOLD-1-200	57.71448	60.20215	57.71487	60.18998	20 Jul	1405	1447	218.5
Okak Bay-1	57.52963	62.07637	57.53395	62.07426	21 Jul	0238	0312	47
Okak Bay-2	57.58044	62.03499	57.58436	62.03072	21 Jul	0338	0417	103
Okak Bay-3	57.52979	62.10818	57.52743	62.11505	21 Jul	0912	0947	53
Saglek Fjord	58.50057	62.68522	58.49987	62.68521	21 Jul	2120	2307	134
ISECOLD-2-200	58.71624	61.18534	58.72141	61.18918	22 Jul	2000	2039	203
Hatton Basin	60.45882	61.06431	60.45297	61.05269	25 Jul	0951	1058	1058
ISECOLD-3-300	60.44465	62.58601	60.44102	62.59077	26 Jul	0219	0254	339
Killinek Shelf 01	60.49951	64.21579	60.50286	64.22309	26 Jul	1718	1754	283
Killinek Shelf 02	60.50294	64.26908	60.50694	64.26677	26 Jul	1923	2000	282
Killinek Shelf 03	60.41203	63.92288	60.41143	63.92751	26 Jul	2119	2153	263
Killinek Main 01	60.71937	64.28406	60.71916	64.28063	27 Jul	0726	0801	357
Killinek Main 02	60.76809	64.34350	60.76642	64.33854	27 Jul	0834	0908	339
Killinek Main 03	60.90594	64.27531	60.90358	64.23988	27 Jul	1023	1102	425
Hatton Basin 600-01	61.19423	63.28305	61.18811	63.27621	28 Jul	0008	0048	625
Hatton Basin 600-02	61.43318	63.25270	61.43503	63.25186	28 Jul	0245	0334	643
BB1B-600	67.98938	59.38680	67.98571	59.40061	01 Aug	0613	0655	590
BB1A-600	67.77224	59.06829	67.77016	59.05295	01 Aug	1120	1202	632
BB1C-600	67.58496	58.58864	67.57810	58.57969	01 Aug	1944	2015	633
BB1D-600	67.38091	57.92027	67.37785	57.92186	02 Aug	2355	0034	646
DS1	66.25848	58.29832	66.26256	58.29513	02 Aug	1408	1448	627
DS2	65.33663	58.01763	65.33662	58.00741	03 Aug	1051	1133	574
Davis Seep	65.09650	58.46149	65.09664	58.47125	04 Aug	0534	0610	525
DS3	64.64835	58.60482	64.64451	58.61018	04 Aug	1022	1102	611

Table 26-2: General Description of Drop Camera Sampling Stations by Bottom Type, Video Quality, Biological Productivity, and an broad overview of biodiversity from preliminary observation of drop camera footage for Leg 1 of the 2023 Amundsen Expedition. Stills of species listed in the biodiversity overview can be found in 'Drop cam stills' folder on the Azure Cloud along with the video footage.

Station ID	Substrate	Video Quality	Biological Productivity	Biodiversity Overview
Hopedale Saddle-1	NA	NA	NA	NA
Hopedale Saddle-2	NA	NA	NA	NA
ISECOLD-0-200	Silty with boulders	Excellent	High	Crynoids, brittle stars, basket stars, sun stars, anemones, branching corals, red fish, eel pout, fish eggs, hermit crabs. Sponges, whelks, scallops, urchins, tunicates?, skate
ISECOLD-1-200	Silty with boulders	Excellent	High	Large sponges, sun stars, hermit crabs, eel pout, small unidentified fish (polar cod maybe?), toad crab, urchins, brittle stars, basket stars, soft corals, branching corals, anemones, chitons, nudibranchs, whelks, fish eggs
Okak Bay-1	Silty	Good but very silty. Lots of plankton, camera has difficulty focusing at times.	High but not as diverse as ISECOLD stations	Brittle stars, whelks, anemones, cerianthids, sponges, eel pout, sun stars, crab, hermit crabs, sculpin
Okak Bay-2	Silty	Good but very silty. Lots of plankton, camera has difficulty focusing at times.	High but not as diverse as ISECOLD stations	Lots of brittle stars, eelpout, cerianthids, sea strawberry corals, branching corals/soft corals but small, kelp detritus. Lots of comb jellies.
Okak Bay-3	Silty	Good but very silty. Lots of plankton, camera has difficulty focusing at times. No SuBc footage.	High but not as diverse as ISECOLD stations	Lots of brittle stars, eelpout, cerianthids, sea strawberry corals, branching corals/soft corals but small, isopods are abundant, kelp detritus
Saglek Fjord	Muddy	Okay, silty and lots of plankton, again, camera seems to have difficulty focusing while flying.		Isopods, lots of brittle stars, eelpout, anemones that burrow in the ground but dark pink/red in colour and circular top.
ISECOLD-2-200	Muddy with occasional boulders	Good but camera sometimes seems to be moving in the housing, making the image go out of focus		Arctic or polar cod, eel pout, pink soft coral, high abundance of shrimp and brittle stars, hermit crab, sea strawberry, anemones, unidentified polychaetes
Hatton Basin	Muddy with occasional boulders	Good, though the bottom facing light was slightly covered by the light housing creating some shadow.		Sponges, soft corals, anemones, blue hake, squid, skates, brittle stars, some small <10cm prey fish (myctophids?), seems to be some fish eggs in places. Branching corals and soft corals. Eel

				like fish. Juvenile grenadier (?). Small white crab with narrow legs and oval shaped body. Shrimp.
ISECOLD-3-200	Rocky with some boulders, occasional mud patches	Great.	High	Seems to be at least 3 octopus, some redfish, roughhead grenadier, skates, shrimp, sculpin like fish. Lots of sponges, encrusting corals, soft corals, some crynoids. Bryozoans. Unidentified polychaetes.
Killinek Shelf 1	Very sandy, sand ridges, occasional boulders	Great.	Low	Some anemones, a hermit crab, sea strawberry, some brittle stars, moon snail.
Killinek Shelf 2	Sandy, fine gravel, occasional boulders	Great.	Low-Med	Skates, urchins, lots of anemones, some barnacles on the boulders, *Pandalus montagui* shrimp, bivalve, brittle stars, skate
Killinek Shelf 3	Rocky	Great.	High	Polar cod, sea cucumbers, *Gersemia* sp., Ascidian sponges, sun star, whelk egg cases, lots of Pandalus montagui shrimp, brittle stars, Drifa corals, bottle brush hydroids, tubed anemone, crynoids, tube sponges, alligator fish, bed of dead bivalves, basket stars, soft bryozoans, hard bryozoans, eel pout
Killinek Main 1	Sandy, scattered boulders	Great.	Med-High	Sponges, brittle stars, blue encrusting sponge, green encrusting sponge, octopus, hydroids, *Gersemia rubiformis*, roughhead grenadier, redfish, soft bryozoan, anemones, large white unidentified flat polychaete, basket stars, pillow sea star
Killinek Main 2	Rocky and sandy	Blurry at times, drift speed was too fast – high current area.	Medium	Duva soft corals, brittle stars, anemones, blue encrusting sponge, bottle brush hydroids, basket stars, hard branching bryozoans, *Gersemia sp.,* variety of unidentified sponges, eel pout.
Killinek Main 3	Sandy and rocky	Good	Medium	Grenadier, sponges, anemones, variety of sea star species, bryozoans, hydroids, skates, shrimp, blue encrusting sponge, liparidae sp.
Hatton Basin 600m-1	Sandy/silty with occasional boulders.	Poor but useable. Inexperienced winch operator, frame dragged along the sea floor but GoPro still has some good images.	Medium-High	Wolffish, octopus, squid, Balticina sea pens. Lots of cauliflower corals. Grenadier. Snow crab, some shrimp. Many sponges. Asconema sponges, Polymastia sponges, Duva corals. Anemones, snake blenny, octopus, redfish, snow crab.

Hatton Basin 600m-2	Sandy with occasional boulders.	Great.	High	Some wolffish, octopus, squid. Lots of Balticina sea pens (field). So short pink/orange corals that branch out, difficult to tell if soft or hard. Some other soft cauliflower corals. Bryozoans. Ascanea sponges and many others unidentified. Some burrows in the sand. Slinky like polychaetes? Others unidentified polychaetes. Demospongiae sp., parasitic coils, Mycal sponges, branching sponges, *Polymastia sp.,* vase sponges, grenadier, redfish, three-bearded rockling, black dogfish, turbot, Ascanella corals, wolffish, squid, *Geodia* sponges, spiny crab, anemones,
BB1B-600	Sand with scattered boulders	Good, but OneCam seemed to be out of focus for part of the video.	Very high	Dense coverage of sea pens, several octopus (GX40019 7:30), Ascanella coral, *Stauropathes arctica* several redfish, glass sponges, large translucent sea cucumbers, hydroids, some large yellow sponges, anemones, large stone crab, grenadier, juvenile skates, eel pout, small turbot, different species of sea stars, Liparidae, shrimp, orange/red bioluminescent ball drifting (GX050019 4:30)
BB1A-600	Sand with scattered rocks and boulders	Good	Very high	Sea pens (at least 2 different species and various life stages), fields of Ascanella, some *Stauropathes arctica*, large unidentified fish (could be Atlantic cod, GX040020), some redfish, octopus, grenadier, several *Liparidae,* large glass sponges, drifa corals, shrimp, unidentified polychaete, hydroids, branching sponges, sea stars, anemones, sea mouse (polycahete), vase sponges, sponges that look like golf balls.
BB1C-600	Sandy with occasional boulders	Great	High	More drifa (cauliflower) corals than anything else, lots of spiny crab, octopus, grenadier, some anemones. Redfish
BB1D-600	Sandy, occasional boulders	Great but GoPro footage needs to be flipped 180	Medium	Bloodybelly comb jellies (red glowing deep sea ctenophore, variety of sponges including *Ascanema*, several stony crab, grenadier, anemones, soft corals, cauliflower corals, sea stars, few sea pens
DS1	Sandy, only a few boulders	Great	Medium	*Umbellula* sea pens, redfish, crab, turbot, many anemones, hydroids, soft corals, shrimp, many threaded fin rockling, grenadier, some skates, sponges, *Ascanema* sponges
Otolith 4	Silty	Great	Medium	Lots of yellow encrusting sponges, carnivorous sponge, *Ascanema*, *Geodia* sp., redfish, grenadier, white polychaetes protruding from the substrate, hydroids, some soft corals

DS2	Muddy	Great	Medium-high	*Ascanema* sponges, carnivorous sponges, redfish, skates, grenadier, flabellum corals, snake blennies, anemones, shrimp, crab, squid, some brittles stars, *Acanella* corals, *Umbellula* sea pens, turbot, sea stars, rockling, translucent worm-like tubes attached to sea floor, skates, several octopus, bivalves
Davis Seep	Silty, occasional boulders	Great	Medium	Acanella corals, *Umbellula* sea pens, grenadier, some crab, squid, cauliflower corals, skates, carnivorous sponges, redfish, sea stars
DS3	Silty, occasional boulders	Great	Medium	*Ascanema* sponges, Drifa cauliflower coral, anemones, carnivorous sponges, squid, anemones, redfish, sea stars, vase sponges, rockling

26.3 Preliminary results: Example images from Amundsen 2023 Leg 1 Drop Camera Operations

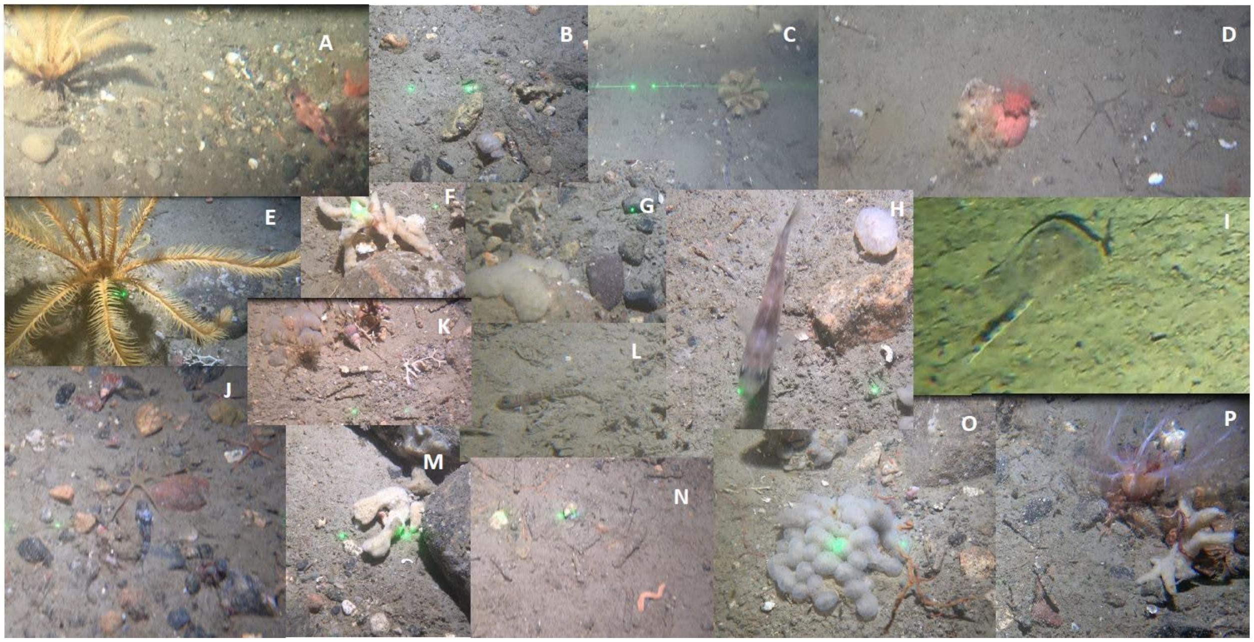

Figure 26-3: Examples of still images retrieved from drop camera footage at ISECOLD-0-200. A. yellow crinoid feather star (Crinoidea) with redfish (Sebastes sp.); B. sponges (Porifera); C. crinoid feather star (Crinoidea); D. sea cucumber (Holothurian); E. crinoid; F. sponge (Porifera); G. ascidian (Ascidiidae); H. fish indet. with ascidian (R); I. skate (Rajidae); J. brittle stars (Ophiuroidea) with fish (Agonidae); K. ascidian (L) with whelk (Gastropoda) and bryozoans (R; Bryozoa); L. fish (likely Zoarcidae); M. sponge; N. indet. worm (Annelida); O. ascidians; P. sea cucumber with extended tentacles, sponge with brittle star. Green lasers = 6.2 cm for all plates.

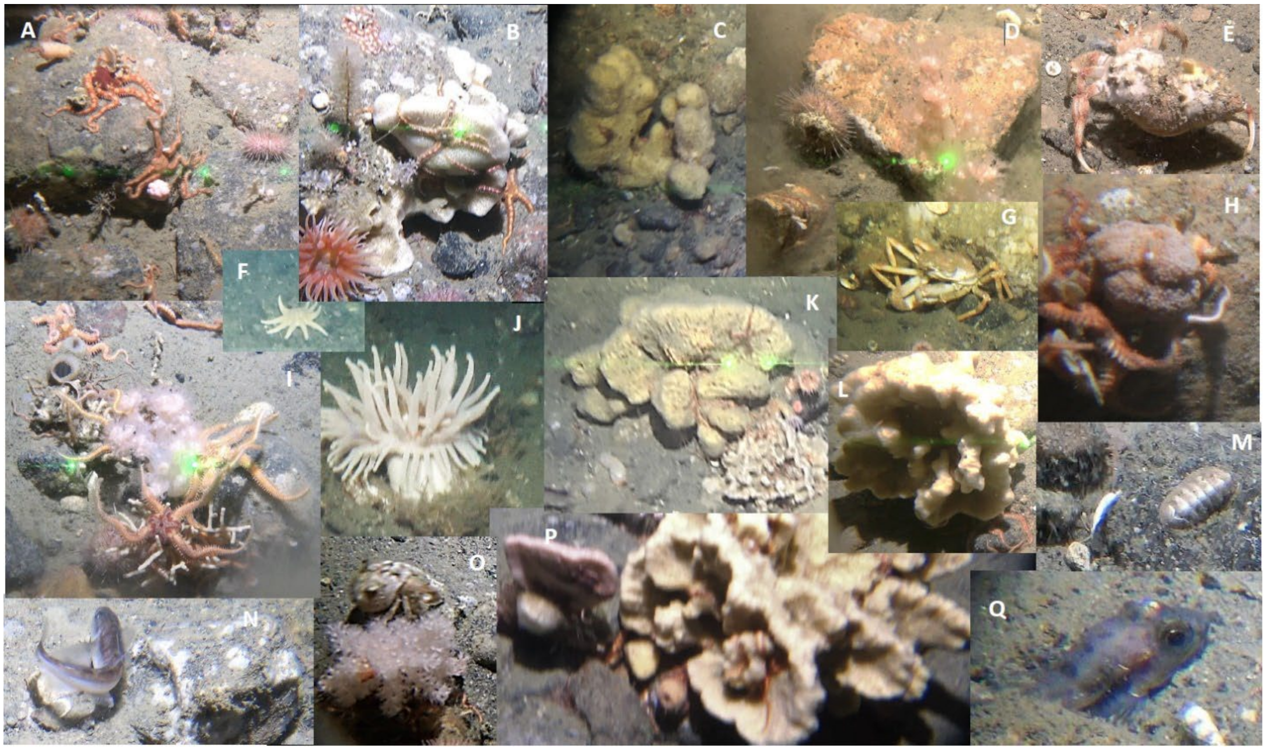

Figure 26-4: Examples of still images retrieved from drop camera footage at ISECOLD-1-200. A. brittle stars with urchins (Echinoidea); B. brittle stars on Demospongiae with bottle brush hydroid (Hydrozoa) and orange sea anemone (Actiniaria); C. Demospongiae sponge; D. soft coral (likely *Gersemia* sp.) and urchins; E. hermit crab (Paguridae); F. sun starfish (Solasteridae); G. crab; H. brittle stars and possible an ascidian; I. soft corals with bryozoans and brittle stars; J. solitary sea anemone; K-L. lobed Demospongiae sponges; M. chiton (Polyplacophora); N. fish indet.; O. soft coral with hermit crab; P. Demosponge sponges with brittle stars; Q. fish indet

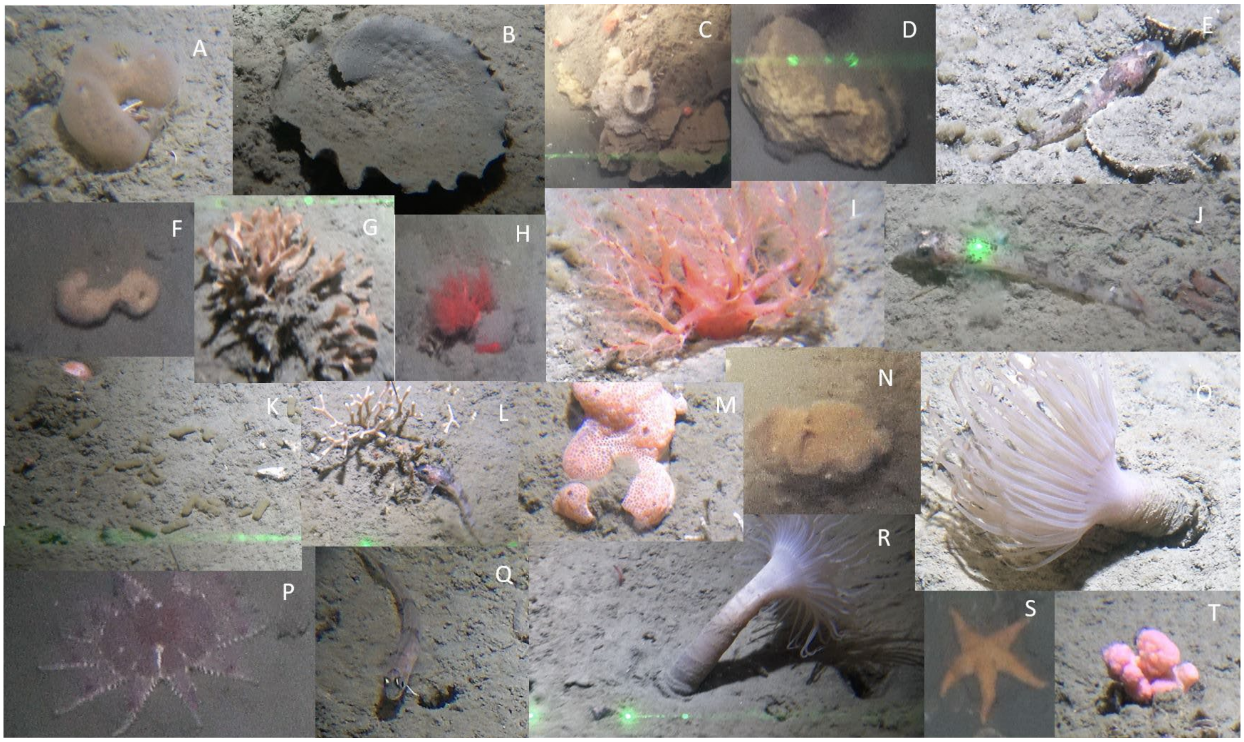

Figure 26-5: Examples of still images retrieved from drop camera footage at Okak Bay 1. A. ascidian; B. indet. taxon; C. multiple sponges with red sea cucumbers; D. sponges; E Lumpenus lampretaeformis.; F. sponge; G. bryozoans; HI. sea cucumber; J. Lumpenus lampretaeformis.; K. indet. taxon.; L. bryozoans with Lumpenus lampretaeformis; M. ascidian; N. sponge; O. cerianthid tube-dwelling anemone (Ceriantharia); P. sun starfish (likely Crossaster sp.); Q. Lumpenus lampretaeformis; R. cerianthid; S. starfish (Ateroidea); T. likely soft coral with polyps retracted.

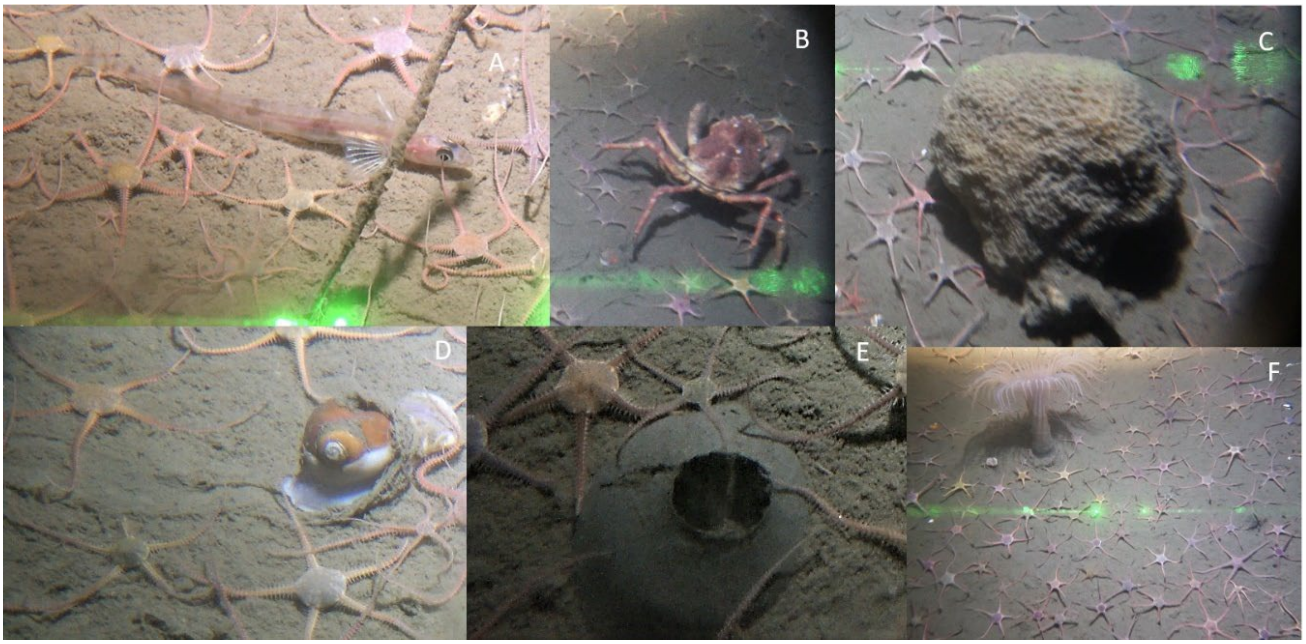

Figure 26-6: Examples of still images retrieved from drop camera footage at Okak Bay 2. A. *Lumpenus lampretaeformis* with brittle stars; B. toad crab (possible *Hyas* sp.) with brittle stars; C. Demospongiae and brittle stars; D. moon snail (likely *Amauropsis islandica*); E. sand collar – moon snail egg case with brittle stars; F. cerianthid with brittle stars.

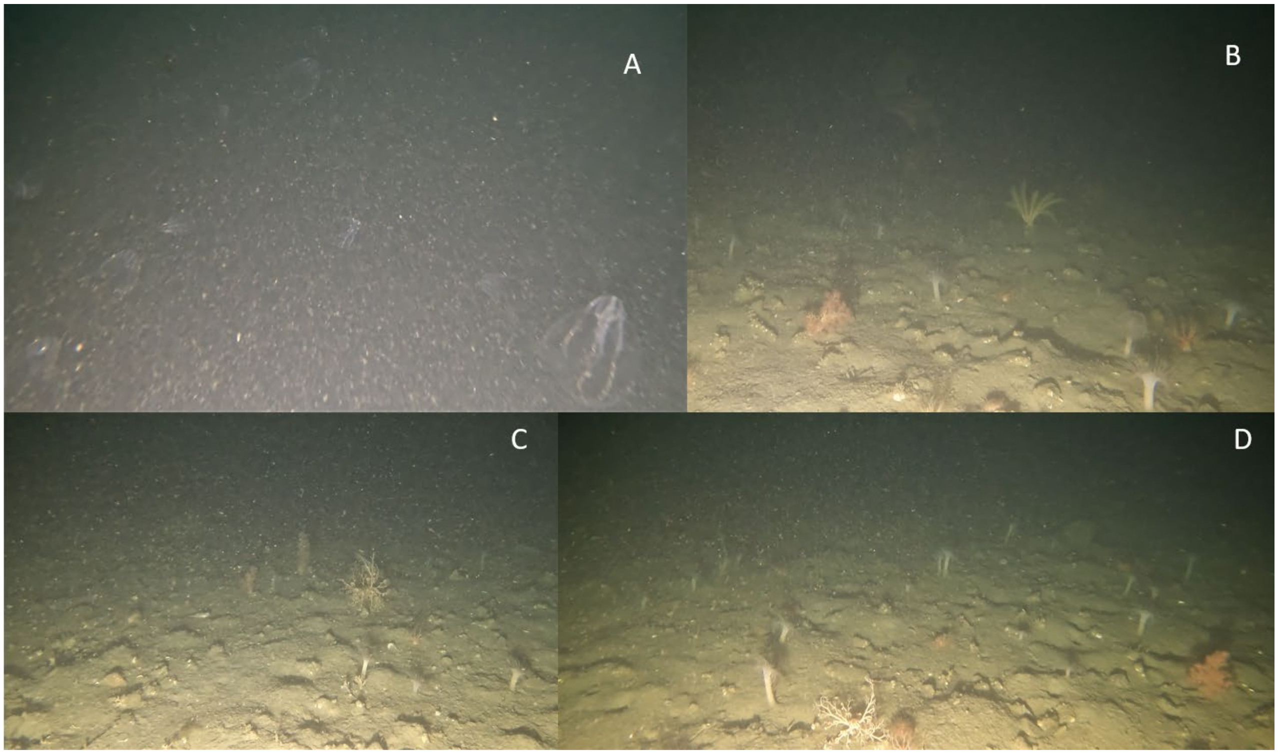

Figure 26-7: Examples of still images retrieved from drop camera footage at Okak Bay 3. A. water column with fine particulate organic matter or 'marine snow', and translucent comb jellies (Ctenophora); B. soft mud habitat with pink soft coral (L), white cerianthids and yellow feather star; C-D. basket stars (*Gorgonocephalus* sp.) with arms vertically extended, white crinoids, and pink soft coral (likely Gersemia sp.).

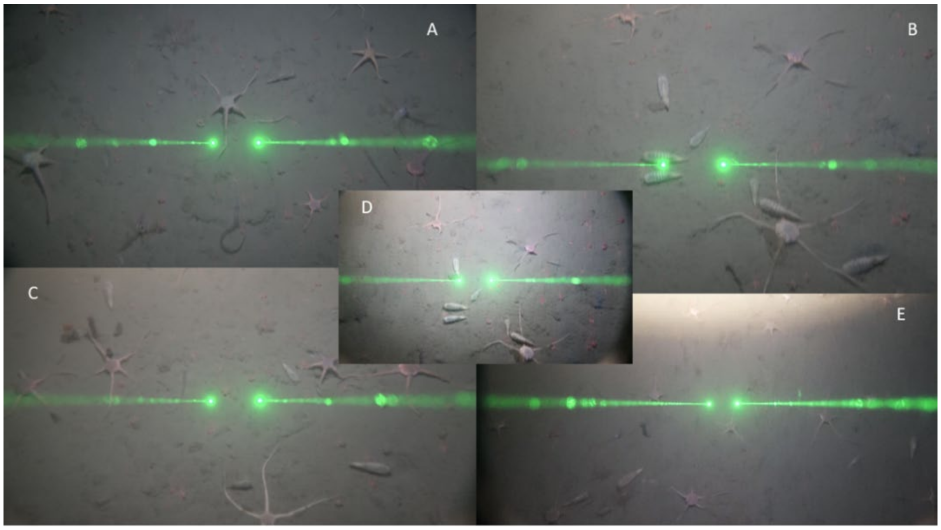

Figure 26-8: Examples of still images retrieved from drop camera footage at Saglek Fjord. A-E. soft mud habitat with brittle stars; B-E. large isopod crustaceans (*Saduria* sp.).

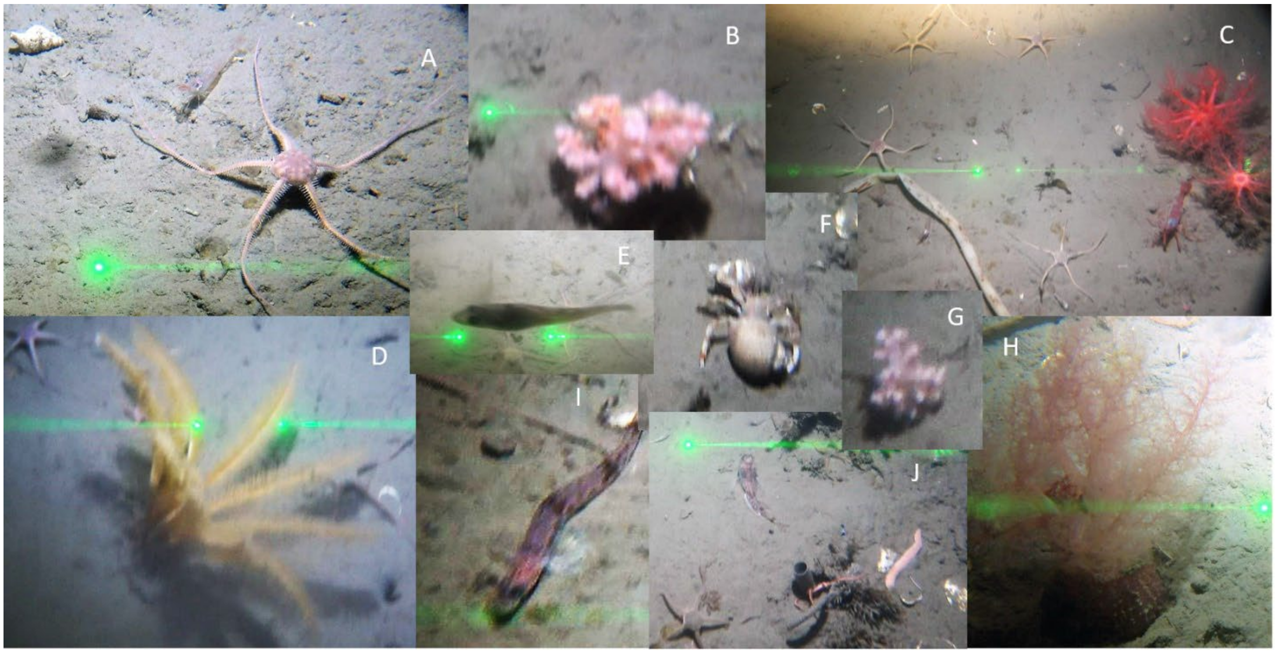

Figure 26-9: Examples of still images retrieved from drop camera footage at ISECOLD-2-200. A. brittle star with shrimp (Decapoda); B. likely soft coral; C. brittle stars with shrimp (Caridea) and red sea cucumbers (likely *Psolus* sp.); D. feather star; E. fish indet.; F. indet. Taxon; G. Gersemia soft coral; H. sea cucumber; I. Lumpenus lampretaeformis.; J. fish indet., brittle stars and worm (Annelida).

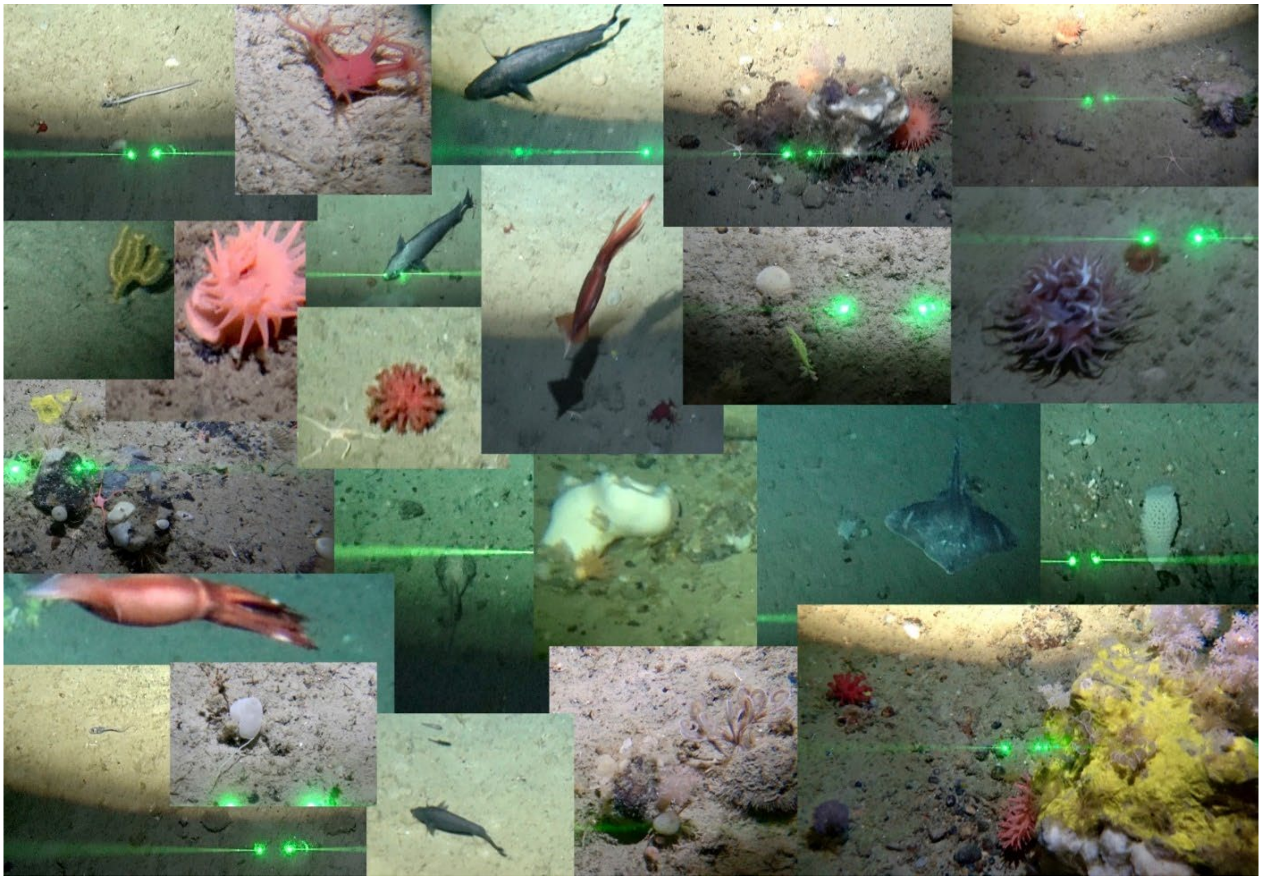

Figure 26-10: Examples of still images retrieved from drop camera footage at Hatton Basin. A. fish indet.; B. mushroom coral (*Heterpolypus sp.*); C. blue hake; D-E. soft corals, sponges and sea anemones; F. indet. taxon; G. solitary sea anemone; H. fish likely blue hake; I. short-fin squid (likely *Illex* sp.); J. Demospongiae sponge; K. sea anemone (likely *Actinernus nobilis*); L. yellow encrusting sponge (likely *Hexadella dedritifera*), brittle stars, sponges and ascidians; M. mushroom coral (likely Anthomastus sp.); N. fish indet.; O. sponge (likely *Geodia* sp.); P. skate; Q. glass sponge (likely Euplectella sp.); R. short-fin squid; S. fish indet.; T. ascidian; U. blue hake; V. feather star with soft coral and ascidians; W. red mushroom coral with purple soft coral (Duva florida), pink sea anemone, and yellow encrusting sponge with many feather stars resting on top.

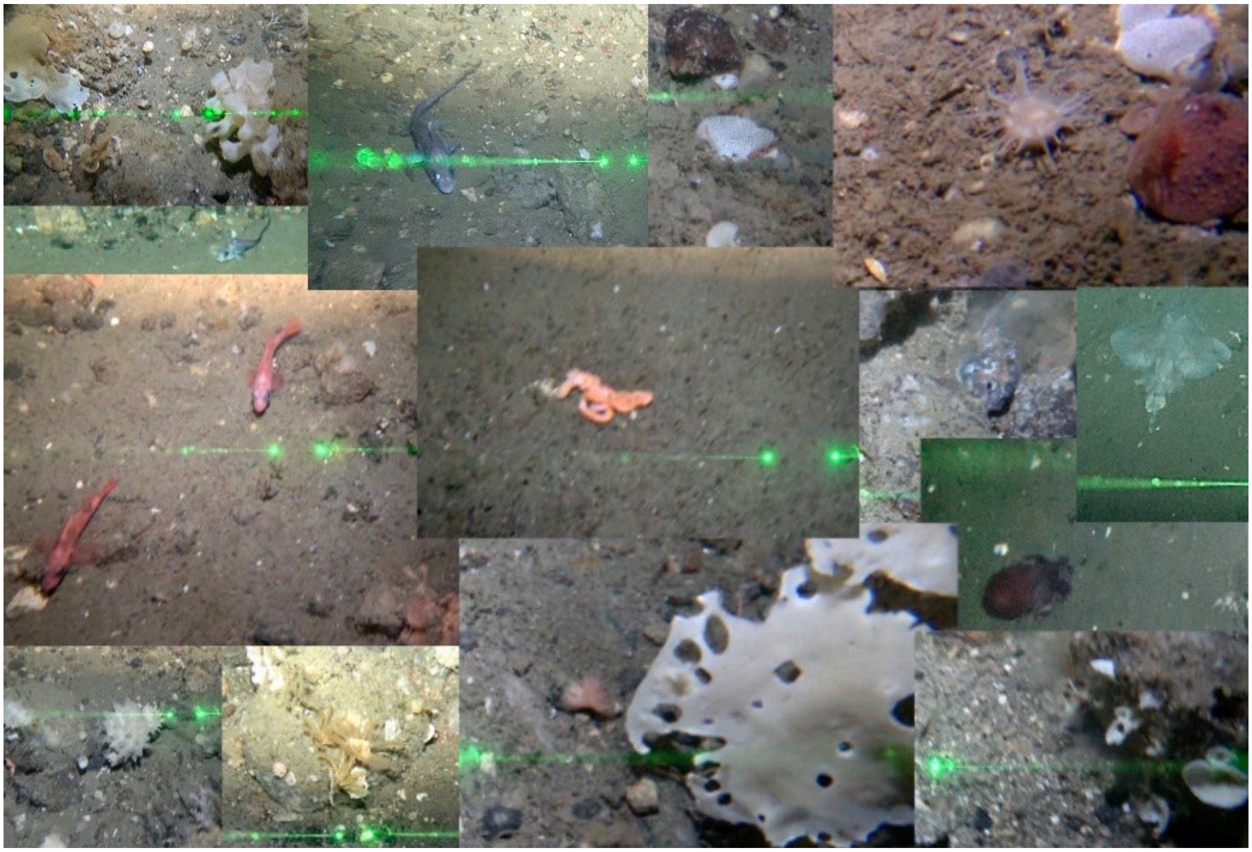

Figure 26-11: Examples of still images retrieved from drop camera footage at ISECOLD-3. A. glass sponge (*Asconema* sp.); B. grenadier fish (Macrouridae); C. erect bryozoan; D. possible cerianthid with ascidians; E. grenadier; F. redfish; G. indet. taxon; H. fish indet.; I. skate; J. octopus (possible *Bathypolypus* sp.); K. Polymastia sponge (Polymastiidae); L. feather stars; M. fan sponge (possible *Plicatellopsis* sp.) with evidence of predation; N. small white fan/vase sponges.

Figure 26-12: Examples of still images retrieved from drop camera footage at Killinek Shelf 1. A. brittle star with unknown cnidarian; B. moon snail; C. hermit crab; D. sea anemone; E. possible sea cucumber with only the feeding appendages exposed.

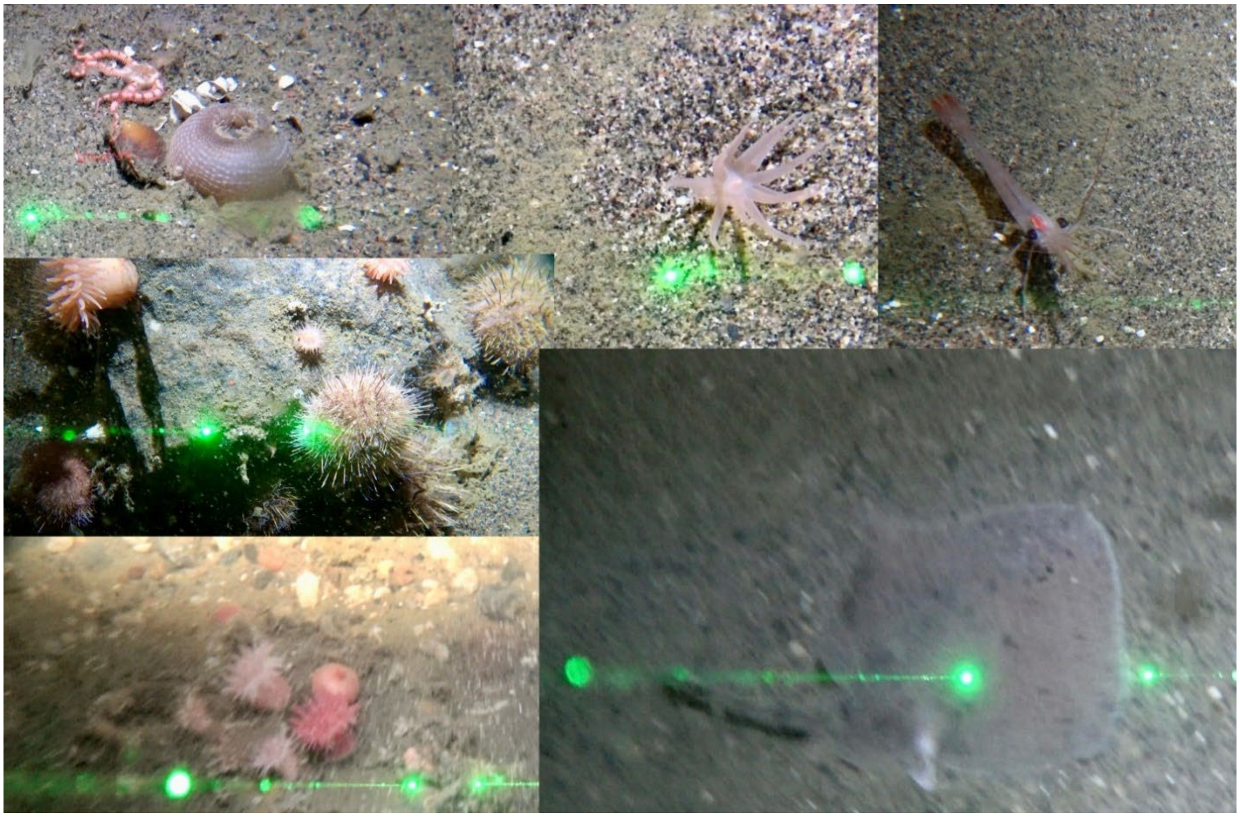

Figure 26-13: Examples of still images retrieved from drop camera footage at Killinek Shelf 2. A. retracted sea anemone with brittle star and bivalve (possible Astarte sp.); B. small sea anemone; C. shrimp; D. sea urchins with sea anemones; E. skate; F. cluster of sea anemones.

Figure 26-14: Examples of still images retrieved from drop camera footage at Killinek Shelf 3. A. eelpout with red sea cucumbers and cluster of ascidians; B. pink soft corals, cluster of grey ascidians and brittle stars; C. hydroid; D. sea cucumber with shrimp and sea urchin; E. shrimp, pink soft corals and red sea cucumbers; F. red sea cucumbers, pink soft coral, and shrimp; G. shrimp, and alligatorfish (Agonidae); H. sun starfish (likely Solasteridae); I. brittle star, shrimp, pink soft coral, sponges and hydroids; J. soft coral (likely *Drifa* sp.), with sea cucumber; K. basket star arms with pink soft coral (*Gersemia* sp.).

Figure 26-15: Examples of still images retrieved from drop camera footage at Killinek Main 1. A. sandy substrate with small sponges; B. pink soft coral with brittle stars, ascidian and white sea anemone; C. redfish with brittle stars and soft coral; D. retracted sea anemone and a large indet. worm; E. boulder with asciadians, encrusting sponges and lampshells (*Brachiopod* sp.); F. grenadier fish; G. small sponges (*Tentorium* sp., *indet. ball-shaped* sp.), and a pink soft coral; H. sand substrate with small sponges and hydrozoans; I. sponge; J. fish indet.; K. redfish; L. cushion starfish (Asteroidea); M. basket star; N. encrusting sponge; O. soft bryozoan (Flustroidea) with hydrozoan (right); P. fan sponge (likely *Plicatellopsis* sp.) covered with brittle stars.

Figure 26-16: Examples of still images retrieved from drop camera footage at Killinek Main 2. A. cobble habitat with Gersemia soft corals, brittle stars, and vibrant pink sea anemones; B. basket star with sea anemones; C. brittle stars and sea anemones; D. eelpout; E. brittle stars, purple Duva florida soft coral, bottle brush hydroid (likely *Thuiaria* sp.); F. sea anemones; G. bryozoan; H. pink Gersemia soft corals extended and retracted, small white lampshells, bottle brush hydroids, orange sea anemones, brittle stars and large yellow Demospongiae sponge; I. bryozoans, sponge, sea anemones and small Gersemia soft coral (L).

Figure 26-17: Examples of still images retrieved from drop camera footage at Killinek Main 3. A. grenadier fish; B. grenadier fish, shrimp, and starfish (likely *Hippasteria phrygiana*); C. grenadier fish; D. Demospongiae sponge and possible small sea anemone (L); E. sculpin fish (Cottidae); F. shrimp; G. Demospongiae sp., with several species of starfish; H. possible blue encrusting colonial ascidian.

Figure 26-18: Examples of still images retrieved from drop camera footage at Hatton Basin 600-1. A. crab; B. several Polymastia sponges, and small octopus; C. soft corals (likely *Duva florida*); D. redfish with Polymastia sponges; E. octopus; F. sponges in the background with a small fish in foreground; G. soft corals, sponges and sea anemones.

Figure 26-19: Examples of still images retrieved from drop camera footage at Hatton Basin 600-2. A. base of sea pens (*Balticina finmarchica*); B. sea anemone (L), ascidians (C), and several species of Polymastia sponges (R); C. dead kelp stipe; D. Greenland halibut (*Reinhardtius hippoglossoides*) with sponges; E. starfish with sponges; F. squid; G. corals in the centre (*Acanella arbuscular* and sea pen) with likely silver rockling (*Gaidropsarus argentatus*); H. small octopus; I. redfish with Polymastia sponges; J. field of sea pens with some sponges; K. Bamboo coral A. arbuscula; L. boulder with sea anemones and sponges; M. black dogfish (possible *Centroscyllium fabricii*); N. short-fin squid.

Figure 26-20: Examples of still images retrieved from drop camera footage at BB1B-600 (Disko Fan). A. small Acanella bamboo coral; B. Acanella and polar sculpin (likely *Cottunculus microps*); C. sea pen (*Ptilella grandis*) with redfish; D. sea cucumber; E. sea pens (*P. grandis*) with shrimp; F. sea pens (*P. grandis*) with eelpout; G. encrusting yellow sponge with white bryozoans; H. grenadier fish; I. redfish; J. sea pen (*Anthoptilum* sp.); K. sea pens field (*P. grandis*); L. several species of sponges including Asconema glass sponges; M. small octopus with sponge; N. eelpout; O. bamboo coral (*A. arbuscula*) colony with sea pen (*P. grandis*); P. close up of the dorsal ridge of P. grandis; Q. Asconema glass sponges with sea pens (*P. grandis*); R. polar sculpin with sea pens; S. small octopus; T. black coral (*Stauropathes arctica*).

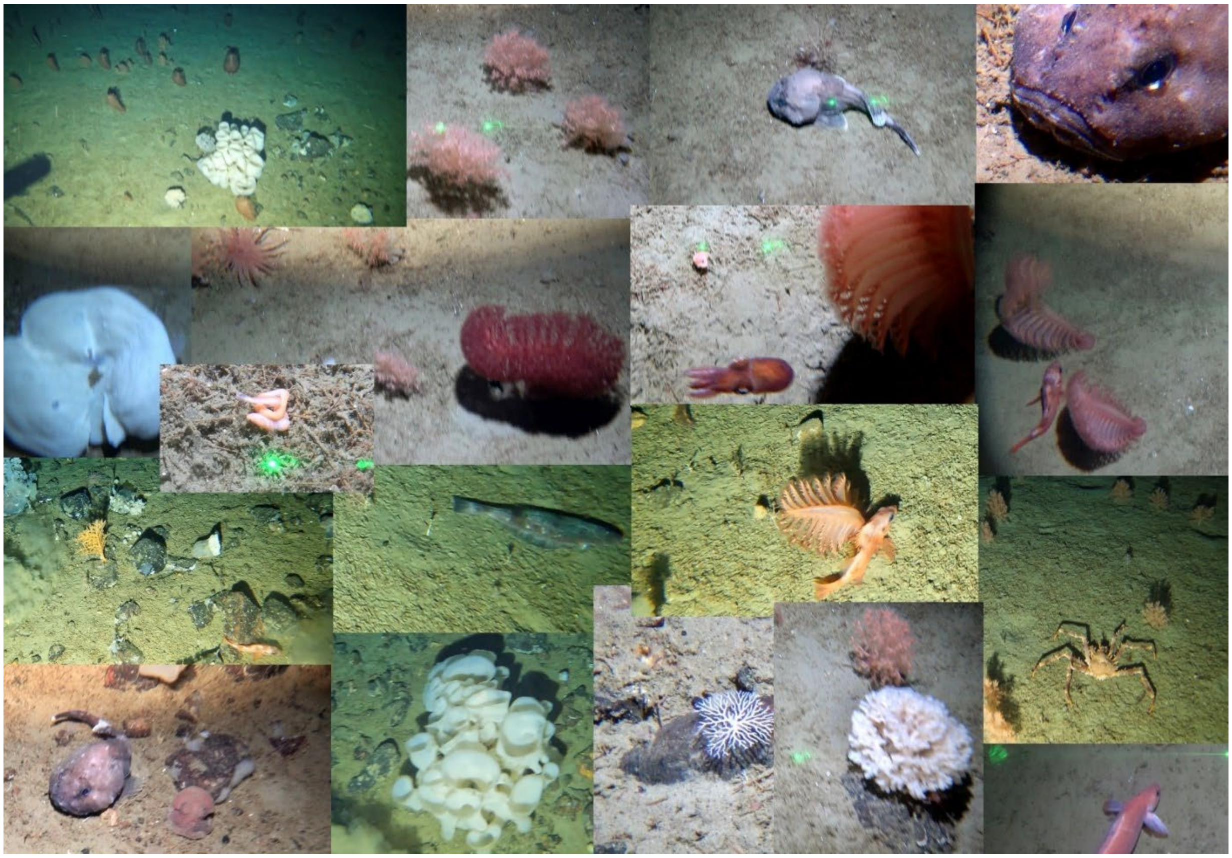

Figure 26-21: Examples of still images retrieved from drop camera footage at BB1A-600 (Disko Fan). A. red sea pens (*P. grandis*) with white Asconema glass sponge; B. bamboo coral colonies (*A. arbuscula*); C. polar sculpin; D. close up of fish likely sculpin; E. fan Demospongiae sponge; F. sea anemones, soft corals and large red sea pen (*Anthoptilum* sp.); G. cephalopod (possible *Rossia* sp.) next to sea pen; H. redfish next to sea pens (*P. grandis*); I. black coral (likely *S. arctica*); J. unidentified worm; K. Greenland halibut; L. redfish and sea pen; M. crab with bamboo corals (*A. arbuscula*); N. polar sculpin and likely Rossia species; O. Asconema glass sponges; P. branching bryozoan; Q. bamboo coral (*A. arbuscula*) and indet. sponge sp.; R. fish likely silver rockling (*Gaidropsarus argentatus*).

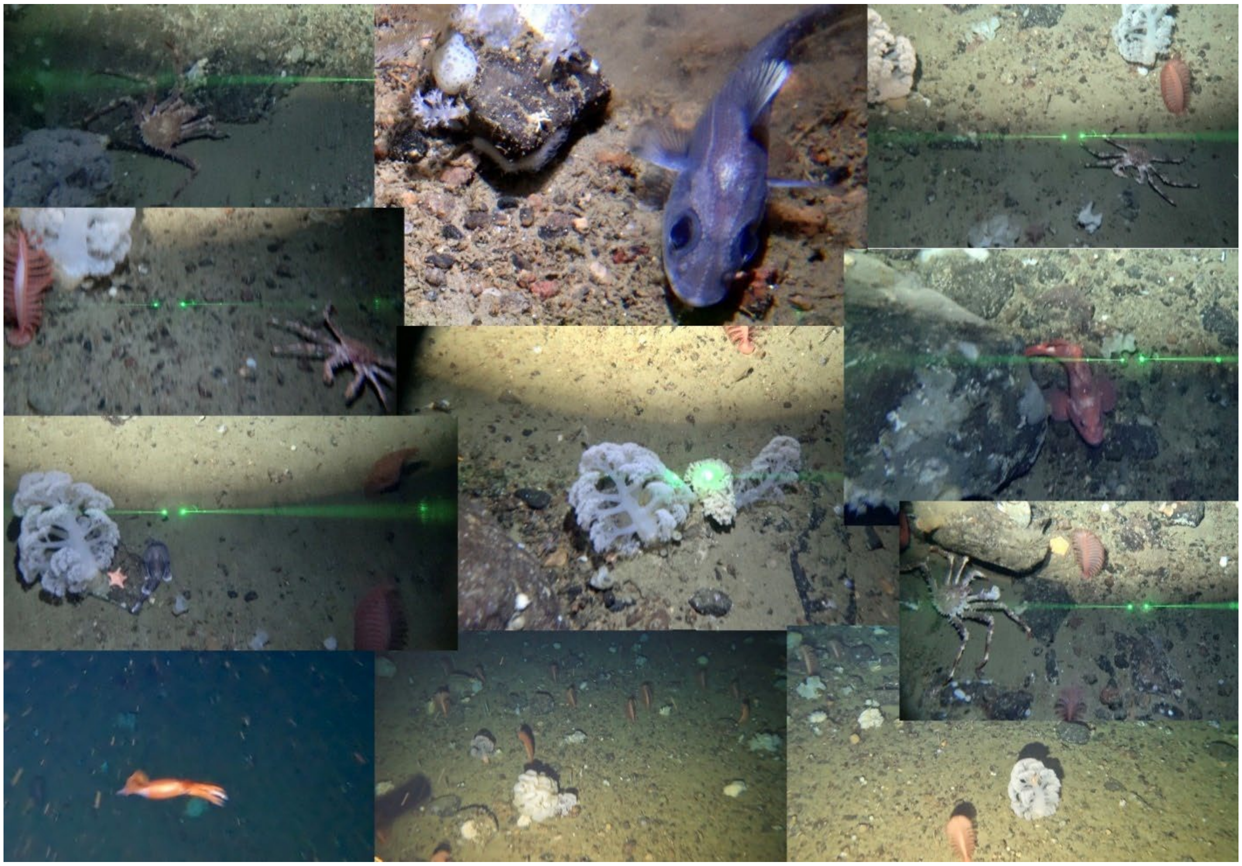

Figure 26-22: Examples of still images retrieved from drop camera footage at BB1C-600 (Disko Fan). A. spiny crab with soft coral (*D. florida*); B. grenadier with soft corals and ascidian; C. crab with soft coral (*D. florida*) and sea pen (likely *P. grandis*); D. crab with soft coral and sea pen; E. soft coral (*D. florida*) with sponge; F. redfish; G. soft coral (*D. florida*) with sea star, sculpin and sea pens; H. short-fin squid; I. Asconema glass sponge and sea pens; J. soft coral (*D. florida*) with sea pen and sponges; K. spiny crab with sea pens.

Figure 26-23: Examples of still images retrieved from drop camera footage at BB1D-600 (Disko Fan). A. grenadier fish with crab; B. comb jellies (Ctenophora); C. cerianthid; D. fish likely polar sculpin; E. grenadier fish; F. sea anemone ; G. sponges, ascidians and bryozoans; H. sea anemone and sponges; I. Asconema glass sponges; J. crab; K. hydroid; L. soft corals; M. soft corals (likely *D. florida*); N. soft corals and sponges; O. soft corals, Asconema glass sponge, starfish (Asteroidea); P-Q. soft corals; R. sponges including *Asconema* and *Polymastia* spp.; S. sea anemone, ascidians and sponges.

Figure 26-24: Examples of still images retrieved from drop camera footage at DS1 (Davis Strait). A. large boulder encrusted with many benthic faunas; B. sea anemones; C. Greenland halibut; D. sponge with sea spider (Pycnogonid), and sea anemone; E. silvery three-beard rockling; F-G. sea pen (*Umbellula* sp.); H. fish likely rockling; I. comb jellies; J. sea anemone.

Figure 26-25: Examples of still images retrieved from drop camera footage at DS2 (Davis Strait). A. octopus; B. sea anemone; C. Greenland halibut; D. octopus; E. bamboo coral (*A. arbuscula*) and carnivorous sponge (*Chondrocladia Chondrocladia grandis*); F. three-bearded rockling; G. Demospongiae fan sponge; H. sea anemone with shrimp at base, and glass sponges (L); I. squat lobster (Galatheidae); J. skate with bamboo coral (*A. arbuscula*) and sea star; K. glass sponge Asconema; L. likely three-bearded rockling.

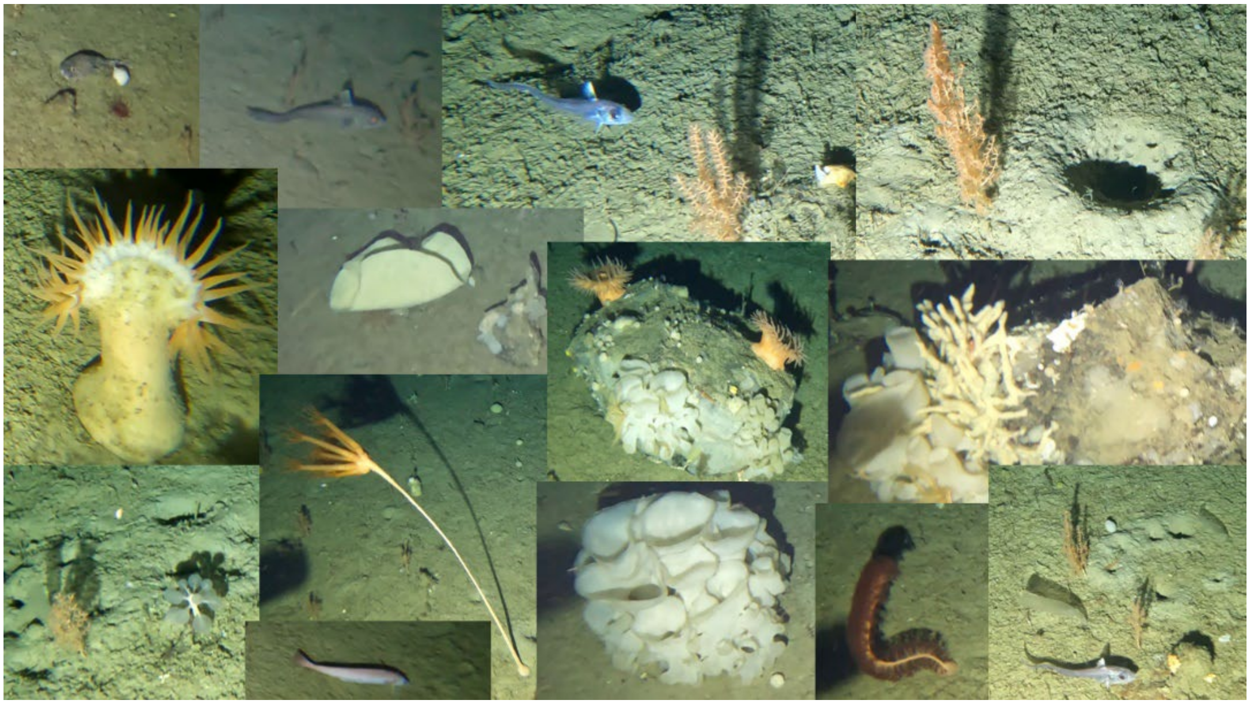

Figure 26-26: Examples of still images retrieved from drop camera footage at Davis Seep. A. sculpin (Cottidae); B. grenadier (Macrouridae) with bamboo coral (*A. arbuscula*); C. grenadier with A. arbuscula; D. Acanella colony next to large burrow; E. sea anemone; F. fan sponge (likely Plicatellopsis); G. sea anemones, glass sponges and Polymastia sponges on large boulder; H. Demospongiae branching sponge and Asconema glass sponges; I. Acanella with Chondrocladia carnivorous sponge; J. sea pen (Umbellula) with Acanella and sponges in the background; K. rockling ; L. Asconema glass sponge; M. sea pen Anthoptilum sp.; N. Acanella with a translucent tubed ascidian, and grenadier fish.

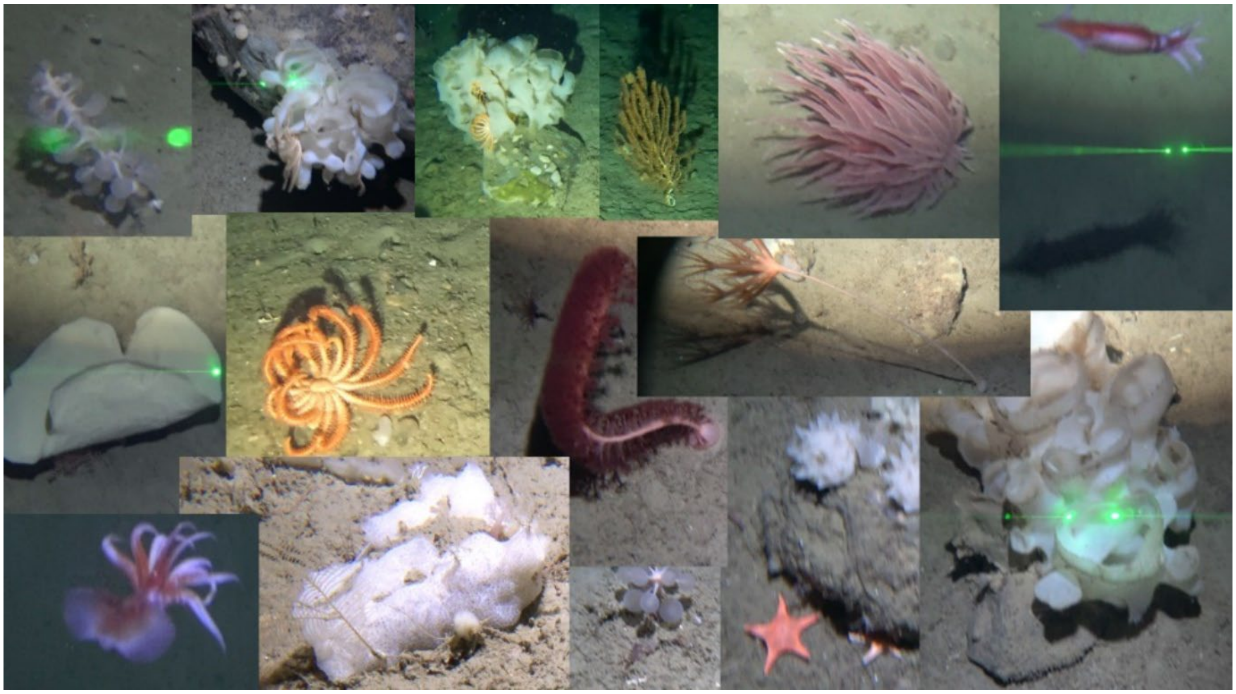

Figure 26-27: Examples of still images retrieved from drop camera footage at DS3 (Davis Strait). **A.** carnivorous sponge (C. grandis); B. Asconema sponge with crinoid feather star; C. Asconema with starfish (Novodinia sp.) and basket star; D. bamboo coral (*A. arbuscula*); E. sea anemone; F. short-fin squid; G. Demospongiae fan sponge; H. *Novodinia* sp; I. sea pen (*Anthoptilum* sp.), and cerianthid (background); J. sea pen (*Umbellula* sp.); K. bob-tail squid (Rossiinae); L. white colonial ascidian with hydroid; M. carnivorous sponge (*C. grandis*); N. Polymastia sp., with sea star (possible *Mediaster* sp.); O. Asconema glass sponge.

26.4 Recommendations

1) Always use Big Blue Dive Lights in the GroupB light housings. The dive lights can be set to the second or third lowest setting to avoid overheating while providing adequate lighting. The GroupB light housing should only have one thin o-ring at each opening (i.e., one near the lens, one at the main opening where the light is inserted, and one at the back end). Ensure grooves are clean and greased prior to each deployment.

2) Use compressed air to remove humidity from the cable inputs. Grease with dielectric grease prior to each deployment.

3) Run a simulation of the SubC one cam deployment prior to each actual deployment to ensure the camera is functioning.

4) Successful deployment relies on the proper functioning of the tensiometer. If in doubt, attach the HiPap to the camera frame.

5) Ensure winch operator does not feed too much excess cable or it may get wrapped around the Anglerfish camera mount.

6) When possible, conduct the transect from shallow to deep to avoid tipping over the frame or dragging along the sea floor.

7) Grind the edges of the metal mount that surrounds the edges of the OneCam lens so the video is not obscured in the corners and the camera remains in focus.

27 Characterizing biodiversity across vertical and latitudinal gradients in Hattin Basin using the drop camera approach

27.1 Introduction:

The Hatton Basin Marine Refuge (Figure 27-1) is a 42,459 km^2 enclosure that prohibits oil and gas activities in attempt to support the conservation of its sensitive benthic marine habitats. While significant efforts to characterize and monitor shallower areas on the west end of the enclosure have already been ongoing for several years, very little is known about the habitat and biodiversity along the depth gradient leading beyond the continental shelf. The fast currents and vast depths have prevented many researchers from successfully acquiring data, particularly when attempting to use sensitive monitoring equipment such as ROVs. However, the drop camera technique is a simple yet cost-effective method that performs visual surveys of the seafloor in conditions that may be less conducive for the operation of alternative approaches. Exploiting the versatility of the drop camera approach by deploying it along this depth gradient facilitates a visual characterization of the benthic habitat and community while providing guidance that will inform more extensive surveys in the future.

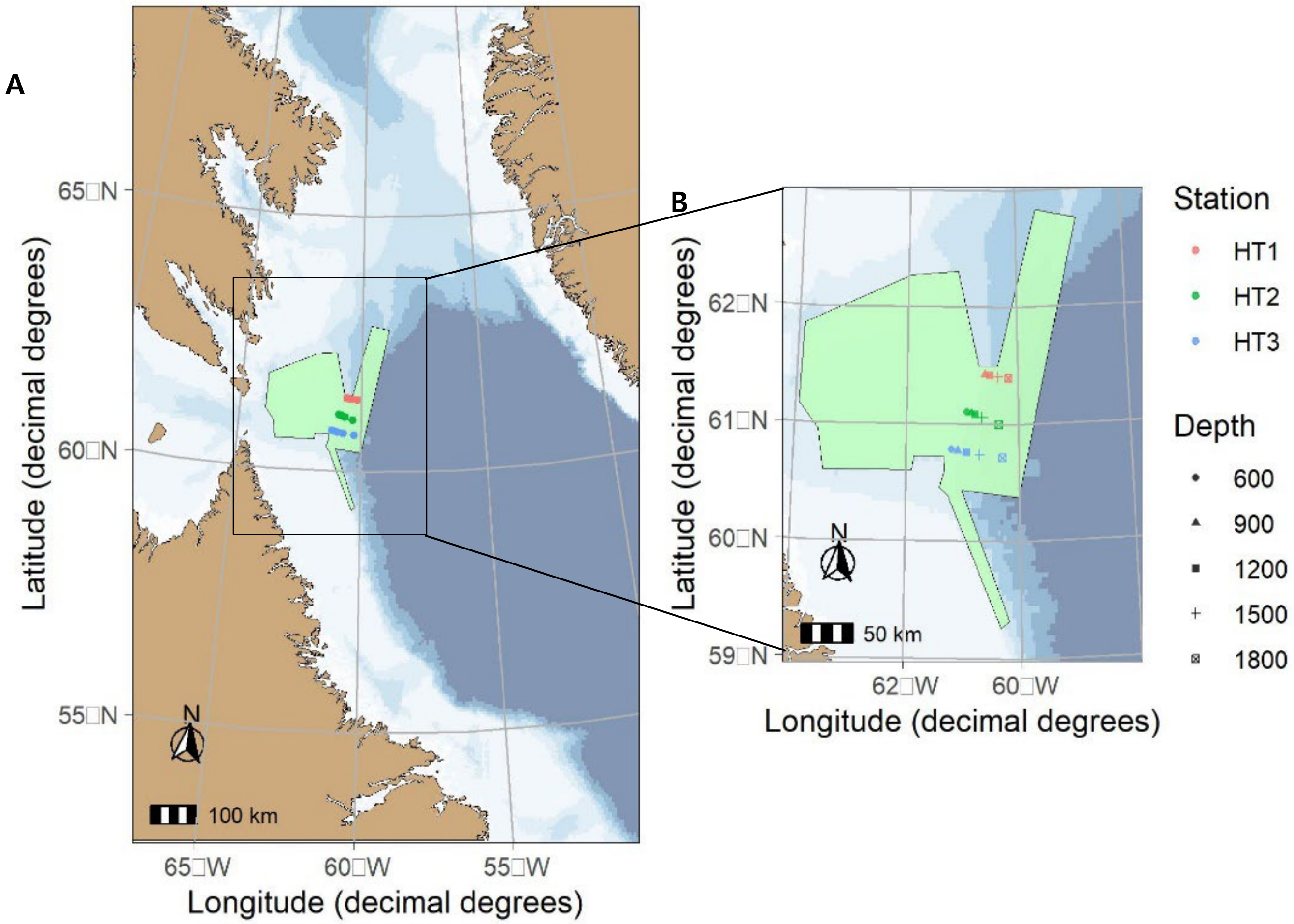

Figure 27-1: A Hatton Basin Marine Refuge. B Each shape within the Hatton Basin Marine Refuge represents a drop camera transect

27.2 Methods

See section: Characterizing biodiversity across vertical and latitudinal gradients in Hattin Basin using the drop camera approach.

27.3 Results

Stations HT2-600 and HT2-900 seem to have the highest biodiversity with lots of large sponges and *Primnoa* corals (Figure 27-2; Figure 27-3). Less common fish species were observed at HT3-600 (black dogfish) and HT2-1500 (Rabbit fish or *Chymera sp.*). Grenadier seemed to be common at most stations. Blue hake were often found at stations deeper than 900m, with occasional cutthroat eels, turbot, and squid.

Table 27-1: Stations selected along a vertical and latitudinal depth gradient within the Hatton Basin Marine Refuge.

Time (UTC)	Station	Transect ID	Latitude (N)	Longitude (W)	Depth (m)	Comments
2023/08/07 05:45:48	HT1	HT1-1800	61.39524	60.1696	1765.86	Second attempt was successful. Dominant species: *Acanella* soft corals and sponges
2023/08/07 00:38:15	HT3	HT3-1800	60.71483	60.2919	1760.47	Frame did not successfully reach bottom. Additional weight or cable should be released in future deployments of 1800m + depths
2023/08/06 22:25:02	HT3	HT3-1500	60.74578	60.7004	1476.81	Silty bottom, sponges, *Acanella* soft corals
2023/08/06 20:36:06	HT3	HT3-1200	60.76616	60.9333	1193.67	Silty bottom, sponges, *Acanella* soft corals, grenadier, *Drifa* corals, *Duva* corals
2023/08/06 19:03:06	HT3	HT3-900	60.78012	61.0807	934.68	Silty bottom with occasional boulders, soft corals and some large yellow sponges
2023/08/06 17:29:08	HT3	HT3-600	60.79071	61.1885	611.48	Silty and rocky bottom, deep blue tunicates, black dogfish, anemones, few sea pens, *Ascanema* sponges
2023/08/06 14:32:52	HT2	HT2-900	61.09943	60.8402	888.36	Rocky bottom with some boulders. Frame was dragged along bottom for a portion of the deployment. Lots of *Primnoa* corals at beginning of deployment (Figure 2), grenadier, *Duva* corals, *Drifa* corals, *Ascanema* sponges
2023/08/06 13:13:53	HT2	HT2-600	61.11219	60.9148	583.14	Rocky. Large unidentified orange branching coral (Figure 3), large *Ascanema* sponges, other larger unidentified white sponges, some *Primnoa* corals, large yellow sponges, anemones, squat lobsters, branching sponges
2023/08/06 08:18:03	HT2	HT2-1200	61.08828	60.771	1184.17	Silty bottom, several grenadier, lots of *Acanella* soft corals, turbot, large unidentified crab, *Ascanema* sponges, brittle stars, anemones, carnivorous sponge, relatively large octopus (Figure 4), shrimp, yellow sponges on boulders, branching sponges, unidentified orange branching coral (Figure 4)

2023/08/06 06:22:40	HT2	HT2-1500	61.06264	60.6472	1470.86	Chymera (Figure 5), large unidentified crab (Figure 5), large white tube sponges anchored to boulders, deep blue tunicates on rocks, squid, myctophids, other unidentified sponges, anemones
2023/08/06 03:53:38	HT2	HT2-1800	60.99925	60.3523	1780	Silty bottom with occasional boulders, stalked crinoids, brittle stars, mostly *Acanella* corals, several blue hake (Figure 6), few red bushy sea pens, rockling, possibly abyssal grenadier, turbot, vase sponge
2023/08/05 22:34:50	HT1	HT1-1500	61.40769	60.3716	1476.54	GoPro failed to record. Footage from OneCam starting at C1010. Sandy bottom with occasional boulders. *Ascanema* sponge, anemones, grenadier, branching yellow coral
2023/08/05 20:45:11	HT1	HT1-1200	61.42051	60.4983	1188.85	Silty, rocky bottom, *Geodia* sponges, yellow branching coral, large white tubed sponges, feather stars, brittle stars, spikey red anemones, grenadier, flytrap anemone, purple encrusting sponge
2023/08/05 18:54:25	HT1	HT1-900	61.43138	60.5935	871.73	Rocky, silty bottom, some boulders, *Duva* corals, *Drifa* corals, sea srars, anemones, large yellow branching corals, myctophid, squid, blue encrusting sponge, redfish, skate, *Ascanema* sponges, lots of sponges covered in silt

Figure 27-2: HT2-900 Primnoa corals

Figure 27-3: HT2-600 Large unidentified coral.

Figure 27-4: HT2-1200 Octopus and unidentified orange branching coral.

Figure 27-5: HT2-1500 Large unidentified crab.

Figure 27-6: HT2-1800 Blue hake

28 Demersal fish diversity - Baited Remote Underwater Video (BRUV)

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Cruise participants: Jordan Sutton[1], Jessica Desforges[1], Margaret Warren[1], Nadine Wells, David Coté[1]

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Prepared by: Jordan Sutton

28.1 Introduction and Objectives:

Baited cameras are a useful tool for characterizing demersal fish communities in areas where data from other sampling methods (i.e. trawling and/or long-lining) are scant, or habitat complexity makes the use of other methods challenging. Baited cameras provide a relatively non-invasive method for surveying sparsely distributed, cryptic and deep-water species. Modelling the arrival times for certain fish taxa allows for relative measures of fish abundance, while the size of the individuals (as interpolated from a pair of laser points separated by a known distance) can be used for biomass estimates. The number of species observed in any given set can be used as a metric for taxa richness—though there are inherent biases associated with using bait as an attractant. All of these data combined contribute to a better understanding of demersal fish communities especially in areas such as coastal Labrador, where data gaps exist.

During Leg 1 of the CCGS Amundsen cruise, the baited camera was deployed 6 times in pursuit of the following objectives: 1) To expand coverage of previous Integrated Studies in the Coastal Labrador Ecosystem (ISICLE) and Integrated Studies and Ecosystem Characterization of the Labrador Sea Deep Ocean (ISECOLD) baited camera surveys (i.e. Clears Cove Pride 2017; Odyssey 2019; Amundsen 2020; What's Happening 2020; Amundsen 2021-2022) in areas of interest (i.e. Joey's Gully) and 2) to Collect pilot data on the inner Labrador Shelf in support of the Imappivut marine planning initiative in collaboration with the Nunatsiavut Government.

28.2 Methods

28.2.1 *Camera system*

The deep-sea camera system was comprised of a 4K GoPro Hero 9 camera with two auxiliary power sources allowing for approximately 12 hours of continuous video recording. The system was included a SubC manta ray paired laser system (distance 10 cm) and a SubC LED light and battery. This system was affixed to an aluminum frame which was weighed down with chain (Figure 28-1). In past deployments (i.e. Amundsen 2022), the frame would tip over once settled onto the bottom; a likely result of high current and/or lateral pulling of the surface buoy. To help prevent this from happening this year, approximately 320 pounds of large chain link was attached to the bottom of the frame (approximately 100 pounds more than previous years) as well as an additional buoy at the surface to help prevent the current from pulling the highflyer under water.

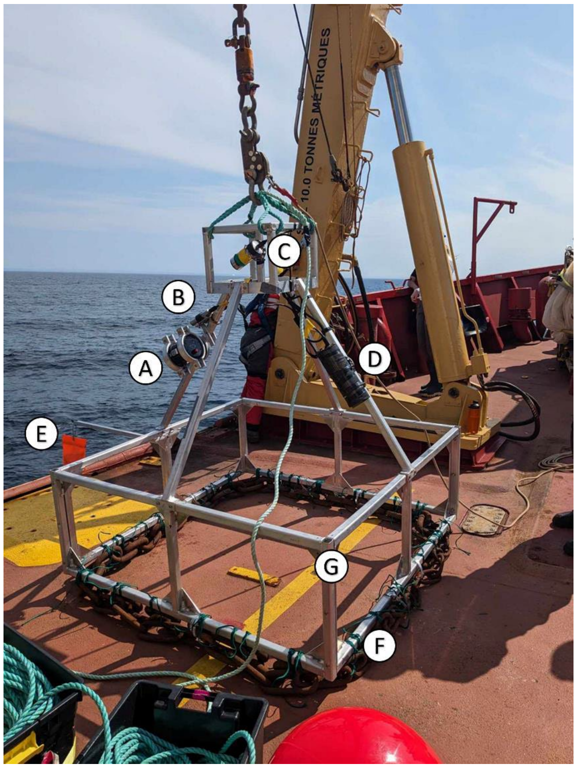

Figure 28-1: Baited camera (BRUV) system comprised of A) GoPro Hero 9 camera in an Anglerfish housing, B) SubC Manta Ray LASER, C) SubC LED light, D) SubC lithium battery, E) Bait arm with squid, F) Chain; and, G) Aluminum frame

28.2.2 *Deployment*

The camera frame was attached to a predetermined amount of rope (approximately two times the depth at station) using spliced eye-hooks and shackles. Rope was "flaked" in a figure 8 pattern in large totes, which were then positioned and secured next to the edge of the deck underneath the Aframe (left hand side) (Figure 28-2). The camera frame was attached to the rope on one end using a shackle and the high-flyer and buoys on the other. The system was lowered into the water using the A-frame and a sea-catch. Once the system was 90% under the surface of the water, the sea-catch was released allowing the frame to sink freely to the bottom. Once the frame reached the bottom, the ship slowly backed away from the site to allow the remaining rope to spool out overboard. As the last of the rope was payed out, the highflyer was positioned at the edge of the deck and thrown overboard. The system was left to soak for an average of 9 hours (Table 28-1), collecting continuous video during this time.

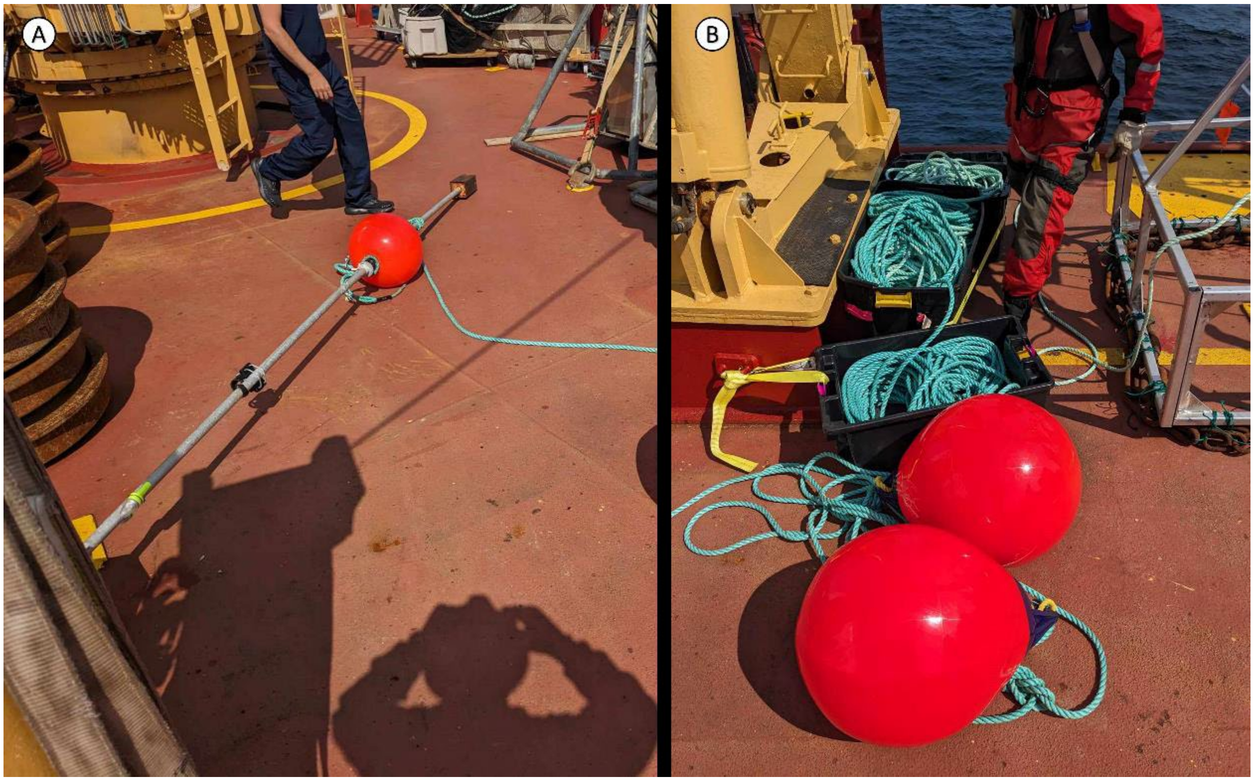

Figure 28-2: Highflyer deployed at terminus of baited camera buoy line; and, B) Buoys and line placed in the deployment position.

Table 28-1: List of stations where baited cameras were deployed during Leg 1 of the 2023 CCGS Amundsen expedition

Station	**Depth**	**Latitude (N)**	**Longitude (W)**	**Soak Time**
Joey's Gully (JG)	324	54° 37′	56° 27′	~6 hrs
Hopedale Saddle (HS)	493	56° 03′	57° 26′	~10 hrs
ISECOLD-0-200 (IC0)	200	56° 18′	58° 24′	~5 hrs
ISECOLD-0-200 (IC1)	200	57° 43′	60° 10′	~9 hrs
ISECOLD-0-200 (IC2)	200	58°42.892′	61°11.260	~11 hrs
Saglek Bank (SB)	450	59° 23′	60° 23′	~13 hrs
Hatton Basin (HB)	660	60° 29′	61° 12′	NA

28.2.3 *Recovery*

To retrieve the baited camera system, the vessel came alongside the high-flyer and buoys. A crew member retrieved the floating portion of the line via a grappling hook and once enough rope was on board, it was fed through the capstan. Once the camera was back on deck, the camera apparatus was rinsed with fresh water, removed from the frame, and taken to the foredeck lab to have the video footage downloaded and saved to an external hard drive.

28.3 Preliminary Results

Of the seven camera deployments, six were successful. Due to high currents and heavy fog during the final deployment (Hatton Basin station), the baited camera system was lost. It was presumed that the buoys and highflyer were pulled underwater by the currents, since the system was undetectable on radar. Unfortunately, midwater dragging was also unsuccessful in recovering the system. Where the system was successfully recovered, multiple species (invertebrates and fishes) were observed. The following is a summary of each camera deployment by station:

28.3.1 *Joey's Gully*

The system was deployed July 15th, 2023 to a depth of 324m. Bottom sediment was muddy with very little in the way of benthic organisms. Visibility was clear during recording, though swarms of zooplankton continuously covered the lens of the camera, leading to partial, and in some instances, complete loss of visibility (Figure 28-3). There were large abundances of snow crab attracted to the bait for the duration of the deployment as well as a single white barracudina (*Arctozenus risso*), which seemed to be attracted to the large number of zooplankton (Figure 28-3).

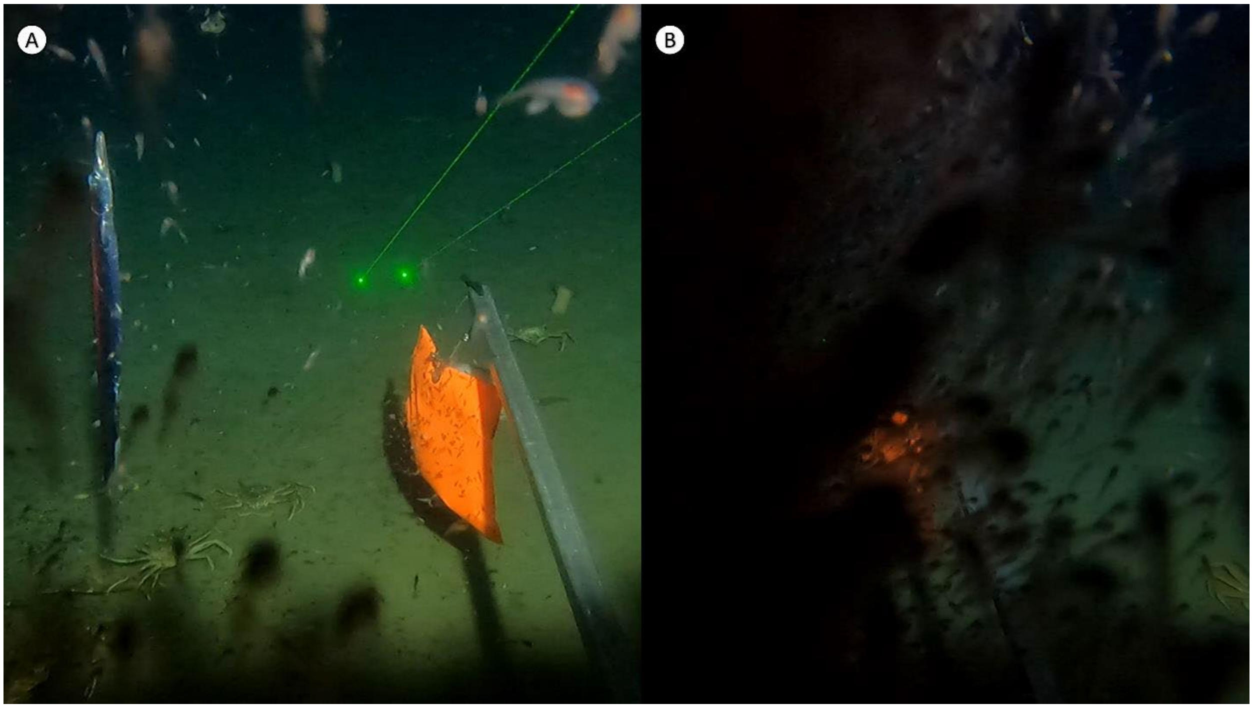

Figure 28-3: A) White barracudina feeding on zooplankton; and, B) large swarms of zooplankton (spp. unknown) obscuring the view of the bait at Joey's Gully.

28.3.2 *Hopedale Saddle*

The system was deployed July 16th, 2023 to a depth of 493m. Bottom sediment was rocky with moderate concentrations of benthic organisms. Visibility was clear during recording with little suspended particulate matter observed. Species observed included toad crabs (*Hyas Araneus*), Greenland halibut (*Reinhardtius hippoglossoides*), and slatjaw cutthroat eel (*Synaphobranchus kaupii*) (Figure 28-4). There were also two Greenland sharks (*Somniosus* *microcephalus*) visible in the same frame during this deployment (Figure 28-4). The current was strong enough to tip the frame backwards on an angle (so the camera was pointed into the water column), producing much darker images, however the Greenland sharks were observable for the majority of this deployment.

Figure 28-4: Species observed at Hopedale Saddle Station: A) Toad Crab (*Hyas Araneus*) and Greenland halibut (*Reinhardtius hippoglossoides*), B) Slatjaw cutthroat eel (*Synaphobranchus kaupii*) and C) Greenland shark (*Somniosus microcephalus*) (note: there are two sharks in this photo).

28.3.3 *ISECOLD-0-200*

The system was deployed on July 18th 2023 to a depth of 200m. Bottom sediment was muddy with a mix of gravel with very little in the way of benthic organisms. Visibility was clear for the duration of the deployment with minimal particulate matter suspended in the water column. Multiple skates (sp. *Amblyraja radiata*) were observed swimming around the bait during this deployment (Figure 28-5). Aside from a small whelk, there were no other species observed at this station.

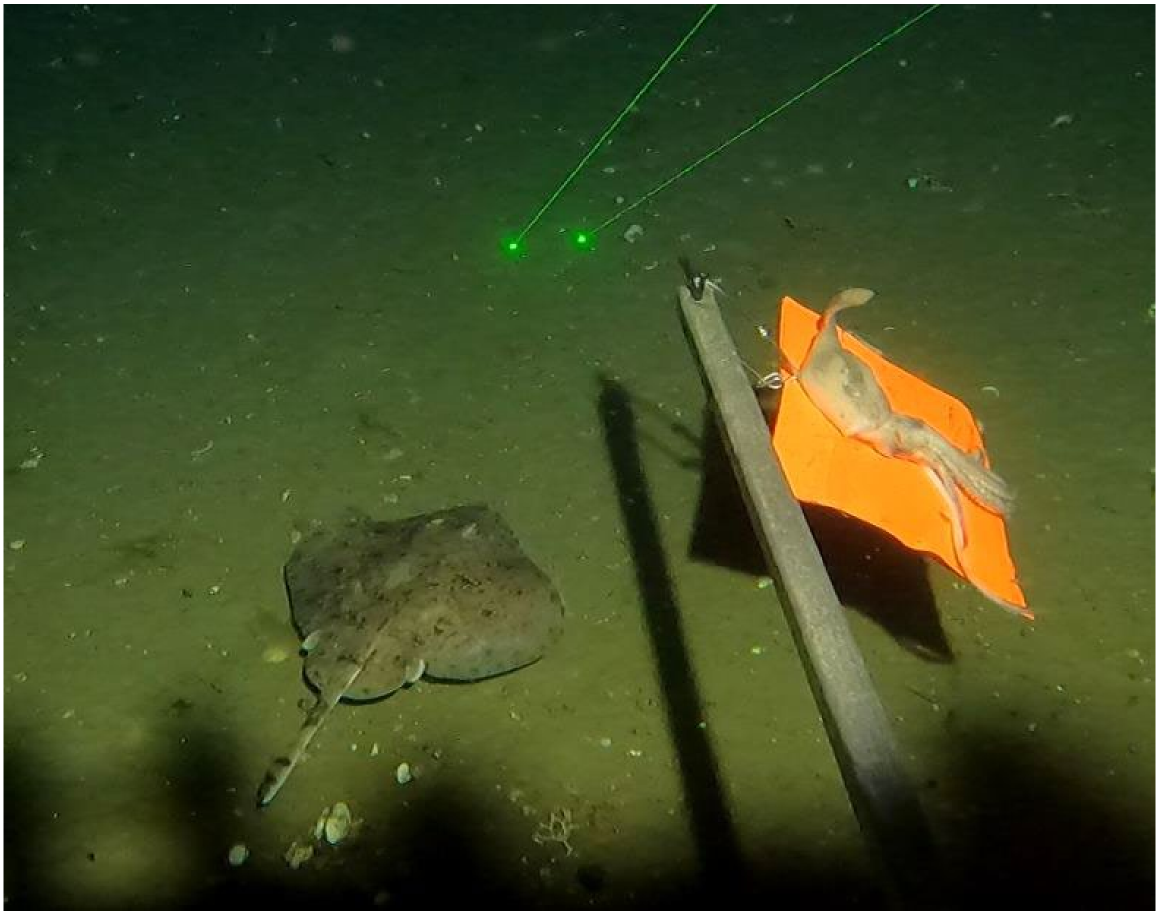

Figure 28-5: *Thorney skate* (A. radiata) observed at ISECOLD 0-200

28.3.4 *ISECOLD-1-200*

The system was deployed on July 20th 2023 to a depth of 200m. Bottom sediment was rocky with a mix of gravel. Visibility was clear for the duration of the deployment with minimal particulate matter suspended in the water column. There was a noticeable current observed in the video footage. Small gadids were observed near the bait at the beginning of the deployment (Figure 28-6). While other species such as toad crab (*Hyas araneus*), shrimp (possibly *Pandalus borealis*) and skates (possibly *A. radiata*) were observed throughout the deployment. Unfortunately, the lights and lasers turned off near the end of the deployment, however it surfaced soon after.

Figure 28-6: A) Small Gadid species (circled in green) observed throughout the deployment; and, B) Askate (possibly *A. radiata*) observed throughout the deployment at ISECOLD-1-200

ISECOLD-2-200

The system was deployed on July 22nd 2023 to a depth of 200m. Bottom sediment was muddy with very few benthic organisms present. Visibility was moderate with suspended particulate matter and a relatively strong current contributing to less intense light. Small gadids were again present during this deployment. Other observed species consisted of toad crab (*Hyas araneus*), snailfish (*Careproctus reinhardti*) and an unknown species (possibly *Anisarchus medius*) (Figure 28-7).

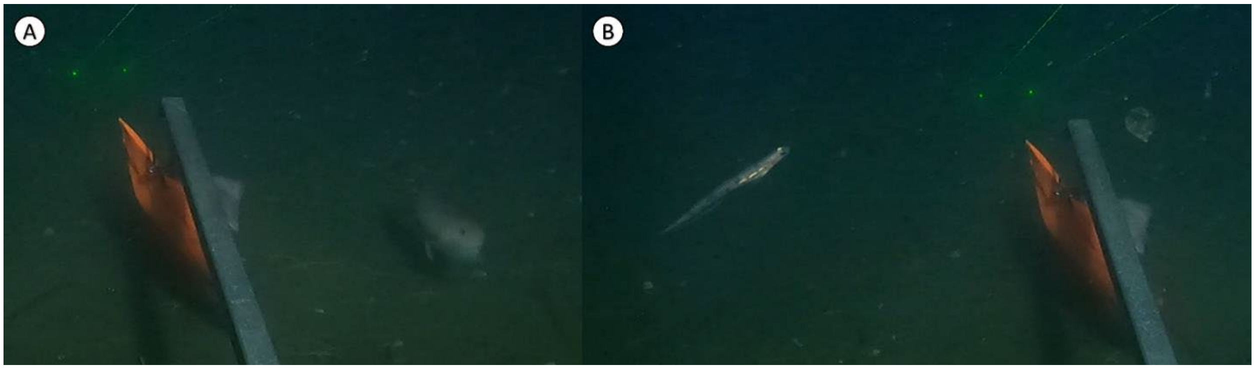

Figure 28-7: A) snailfish observed swimming near the bait arm; and, B) an unknown fish species (possibly *Anisarchus medius*) swimming off bottom towards bait at ISECOLD 2.

Saglek Bank

The system was deployed on July 23rd 2023 to a depth of 450m. Bottom sediment was a mix of sand and gravel with very few benthic organisms present. Visibility was good with little to no suspended particulate matter and a relatively slow current. Myctophid sp., redfish (Sebastes sp.), Roughhead grenadier (*Macrourus berglax*), Spotted wolffish (*Anarhichas minor*), hagfish (*Myxine glutinosa*), Spinytail skate (*Bathyraja spinicuada*), and Greenland shark (*Somniosus microcephalus*; Figure 28-8) were all observed during this deployment (Figure 28-9). After arriving to the bait, the wolffish started to display territorial behaviours, often charging towards other fish species in the area.

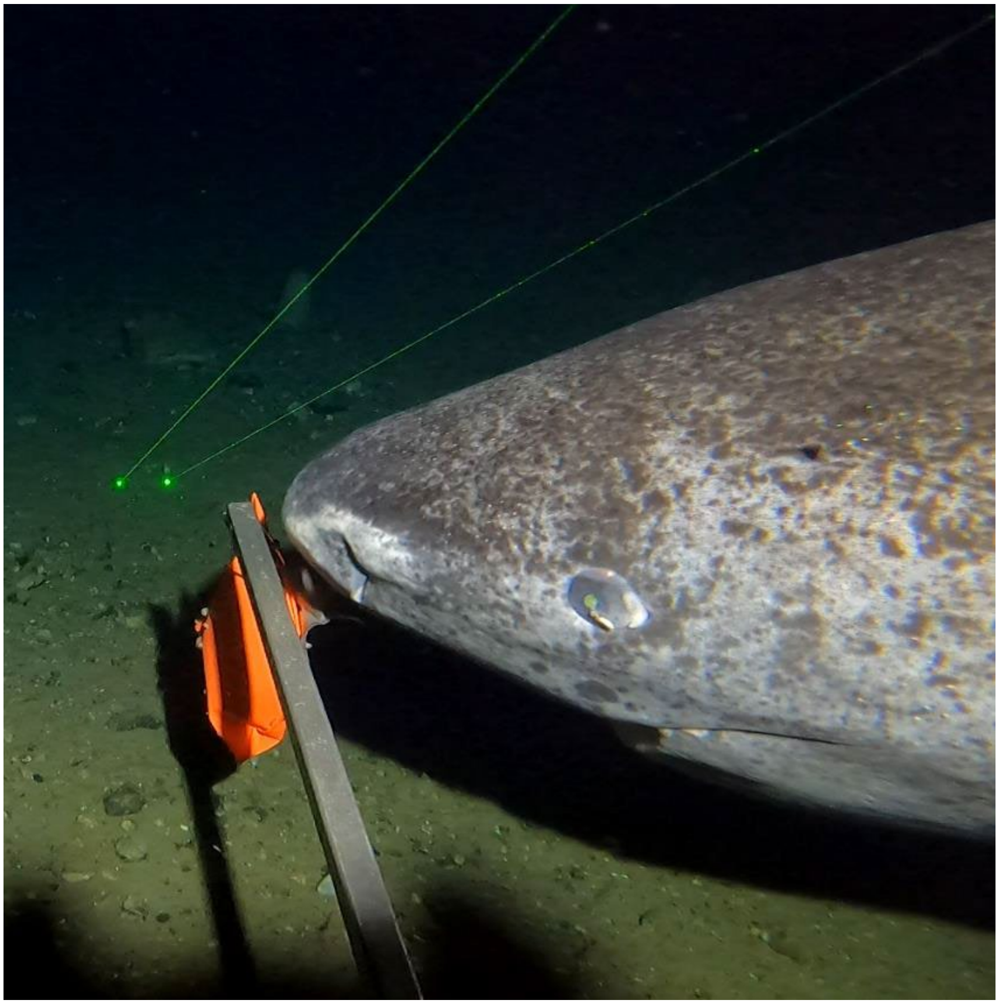

Figure 28-8: Greenland shark observed interacting with bait during baited camera deployment in Saglek Bank

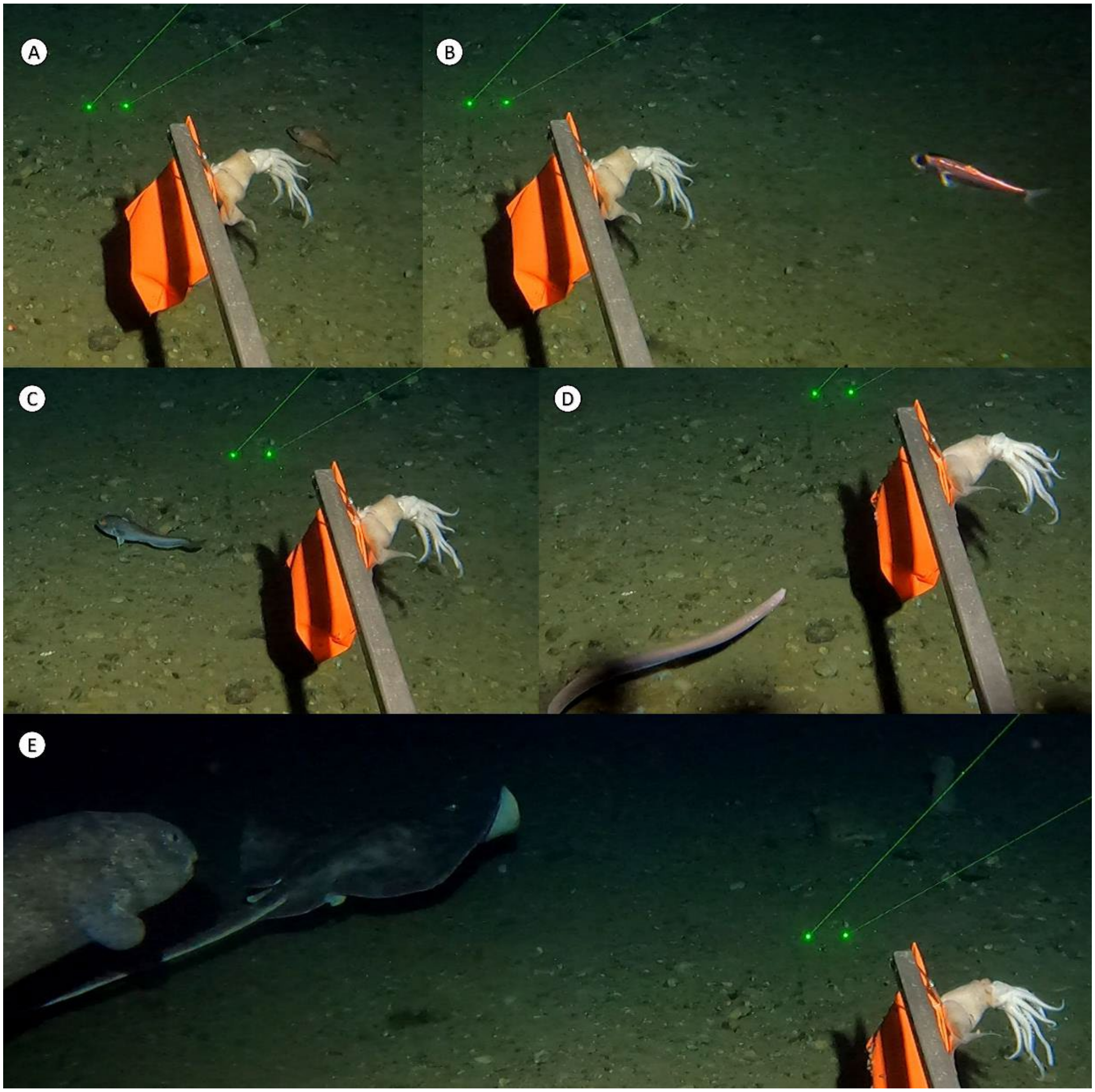

Figure 28-9: Other species observed during the Saglek Bank deployment: A) redfish, B) Myctophid, C) Roughhead grenadier, D) Hagfish, and E) Spotted wolffish and a Thorny-tailed skate.

28.4 Recommendations for future deployments:

Unfortunately, the system was lost at the Hatton Basin station, where 1300m of line was deployed in a depth of 650m. Much like in previous deployments, the currents shifted and the buoys and highflyer became tangled in the submerged line. This tangling caused the line to become taut, sinking the buoys under the surface. A suggested fix for this is to introduce a swivel in-line with the buoy/highflyer. This will allow the buoys to move independent of the submerged rope and prevent tangling and sinking of the highflyer and buoys. Some other suggestions from CCGS crew included adding a bell or other noise making device to the highflyer (for instances where the highflyer is not completely submerged but is not visible on the radar) and to also add a rope bag with attached buoy to the highflyer. If submerged, this rope bag would act on a hydrostatic release, paying out more rope to increase the chance of a successful retrieval in high current areas.

29 Integrated Marine Response Planning Baseline Sampling

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Cruise Participants: J. Higdon, N. Wells, M. Warren

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29.1 Introduction

One of the objectives of the newly formed Integrated Marine Response Planning (IMRP) Program in Newfoundland and Labrador is to capture the baseline measure of hydrocarbons and heavy metals present in marine sediment. In the event of an oil spill, this data will provide information on ecosystem impacts and help inform decisions surrounding the recovery of the region. With its annual survey of the Labrador Sea and Arctic waters, partnering with Amundsen Science to collect such information will help address data gaps on the Labrador Shelf. The Labrador Shelf is characterized by the presence of sea ice and cool Arctic waters carried by a nutrient rich Labrador Current. Given that there is potential for an increase of vessel traffic in the region as sea ice conditions continue to decrease, IMRP Program has identified the Labrador Shelf as a higher priority area. As such, a continued partnership with Amundsen Science would provide a time series of hydrocarbon data.

29.2 Methods

To accomplish this objective, box cores were deployed to collect samples for hydrocarbon and heavy metal analysis. Using a metal spatula, the upper layer of sediment (0 to 2 cm depth) was collected in a glass 250 mL jar. When possible, a duplicate sample was collected either from the same box core or a second box core from the same station. A blank sample was also collected by leaving an empty jar open while collecting the samples. Both the sediment samples and the blank samples were frozen at -20O C. Sample analysis will be completed by The Centre for Offshore Oil, Gas and Energy Research (COOGER) located at the Bedford Institute of Oceanography (BIO) who also provided the sediment sampling protocols. COOGER has partnered with a large number of organizations since 2002 to provide science-based knowledge and advice as well as conduct research on the fate and behaviour of petroleum-based spills. A summary of samples collected for the 2023 season are outlined in the following Table 29-1.

Table 29-1: summary of samples collected for the 2023 season

Station	Date | Time (UTC)	Latitude (N)	Longitude (W)	Depth (m)	Samples Collected
Joey's Gully	15-07-2023 1929	54.7677147	56.3270445	136.42	0; Unsuccessful box core
Makkovik	17-07-2023 0028	55.4336408	58.9433882	703.37	2x Sediment; 1x Blank
Sentinel	18-07-2023 1834	56.2813163	59.7533598	530.81	2x Sediment; 1x Blank
ISECOLD-0-200	18-07-2023 1335	56.2868567	58.9038138	202.22	2x Sediment; 1x Blank
ISECOLD-1-200	20-07-2023 1519	57.7134595	60.2086783	219.18	0; Unsuccessful box core
Okak Bay	21-07-2023 0527	57.5292225	62.0768897	40.77	2x Sediment; 1x Blank
North Arm	22-07-2023 0844	58.4833333	63.2191180	240.73	2x Sediment; 1x Blank
ISECOLD-2-200	22-07-2023 0145	58.7145937	61.1839935	203.64	2x Sediment; 1x Blank
Sag Bank	23-07-2023 1240	59.3832980	60.3195467	427.07	2x Sediment; 1x Blank
Hatton Basin*	24-07-2023 2338	60.4970255	61.2309853	779.57	2x Sediment; 1x Blank
ISECOLD-3-200	25-07-2023 0324	60.4434132	62.5813595	339.73	2x Sediment; 1x Blank
Hatton-600	27-07-2023 2236	61.1233975	63.2862662	607.64	2x Sediment; 1x Blank
Southwind-2	30-07-2023 0532	66.9226873	62.4900620	389.89	1x Sediment; 1x Blank
Southwind-8	30-07-2023 00001	66.7529092	62.3123542	41.38	1x Sediment; 1x Blank
Disko Fan	01-08-2023 1117	67.9708863	59.5046017	895.08	1x Sediment; 1x Blank

* Sample collected with a Van Veen

In planning for the mission, the field team gathered enough supplies for the number of stations on the trip plan as well as some extra. Because of ice conditions and other environmental factors, there were some changes to the operations schedule and a number of box core stations were added. As a result, there weren't enough jars to collect samples for every box core station. Priority was given to the Labrador Shelf with duplicate samples being collected. After which, one sample was collected for additional box core sites in Southwind and Disko Fan stations. While we do not have anticipated results for the samples collected, they will be used to inform sampling plans for future missions.

30 Functioning benthic ecosystem of Canadian Arctic

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30.1 Introduction and Objectives

In benthic ecosystems, the availability and quantity of food and the type of bottom influence the distribution, the abundance and the richness of benthic organisms. Generally, the rocky bottom presents a diverse assemblage of organisms (Posey and Ambrose 1994) whereas the soft bottom is more homogenous and the presence of organisms will depend of the grain size or of the availability of food. These types of bottom create heterogeneity and can be responsible for great concentrations of organisms and for the presence of certain species.

Changes in the export of organic matter due to global changes will have an impact on food webs and benthic ecosystems, where 98% of ocean biodiversity is found. The seabed is the largest habitat on the planet and benthic organisms play an essential role in global carbon budgets. Yet, the role of the benthic component in the global carbon pump is often underestimated or even neglected.

Our main sampling objective for the 2023 expedition is to study ecosystem function in seapen, sponge and coral meadow sites, compared with sites without by performing incubations.

Our second sampling objective of for the 2023 expedition is to advance biodiversity surveys of benthic communities with respect to the physical and chemical environment: elucidate fundamental ecological linkages between this diversity, biological productivity and biogeochemical functions.

30.2 Methodology

30.2.1 *Boxcore*

The box core was deployed to quantitatively sample diversity, abundance and biomass of endobenthic fauna and to obtain sediment cores for sediment analyses and incubations. From 36 box cores, sediments of usually a surface area of 0.125 m2 and 10-15 cm in depth were collected and passed through a 0.5 mm mesh sieve and preserved in a 4 % formaldehyde solution for further identification in the laboratory (Table 30-1 during Leg 2 and Table 30-2 during Leg 3 and Table 30-3 during Leg 4). Sub-cores of sediments were collected for sediment pigment content, organic carbon content, and sediment grain size; for sediment pigments, and organic carbon content, the top 1 cm was collected, although for sediment grain size, the top 5 cm was collected. Samples for sediment pigment were frozen at -80°C, and organic carbon samples and sediment grain size samples were frozen at -20°C. All samples will be transported off the ship for analyses in the lab at the Université Laval.

Table 30-1: Number of samples collected from the box core during Leg 2 of the 2023 *CCGS Amundsen* expedition

Station ID	Date	Latitude (N)	Longitude (W)	Depth (m)	Infauna Boidivesity	Sediment Grain size	Sediment Organic content	Sediment Pigments	Sediment	Microplastics	Foraminifera	Push cores
Full E3	2023-08-13	68.7909482	64.1810895	1298	0	1	1	3	1	5	1	0
Rosette E4	2023-08-13	69.2174307	63.3536515	1871	0	1	1	3	1	5	1	3
Full E5	2023-08-14	69.6040680	62.5362502	1972	0	1	1	3	1	5	1	0
Rosette C4	2023-08-15	67.9554123	60.6164462	1610	1	1	1	3	1	5	1	0
Full C3	2023-08-15	67.7498908	61.2778750	1531	1	1	1	3	1	5	1	3
Full A3	2023-08-17	66.7317233	59.6075757	869	1	1	1	3	1	5	1	3
Rosette A4	2023-08-17	66.8033772	58.7650957	908	1	0	0	0	0	0	0	0
Full D1	2023-08-21	67.4734643	63.7035480	590	1	1	1	3	1	0	1	0
2022 D1	2023-08-21	67.3943752	63.8523902	467	0	0	0	0	0	5	0	0
Rosette D4	2023-08-22	68.6259547	61.9855838	1769	1	1	1	3	1	0	1	0
Full 115	2023-08-27	76.3331678	71.2082812	658	1	1	1	3	1	5	1	3
Basic 111	2023-08-28	76.3058207	73.2510235	586	0	1	1	3	1	5	1	0
Full 108	2023-08-28	76.2630912	74.6010445	446	Rocky bottom – box core damaged							
Full 101	2023-08-29	76.3564810	77.5068280	353	0	1	1	3	1	5	1	3
Full 153	2023-08-30	74.6932980	72.7399373	915	1	1	1	3	1	5	1	0
Full 163	2023-08-31	73.1994842	71.1977522	1240	1	1	1	3	1	5	1	3
Basic 325	2023-09-02	73.8171388	80.5139353	666	Rocky bottom – no box core							
Full 323	2023-09-02	74.1559478	80.4728227	792	1	1	1	3	1	5	1	0
Basic 322	2023-09-02	74.4976162	80.5296395	666	Too many rocks – samples not taken							
Basic S5	2023-09-04	74.2176517	90.9021592	286	Too many rocks – samples not taken							
Basic S8	2023/09/04	74.4016258	90.6294675	195	Too many rocks – samples not taken							

Table 30-2: Sampled variables during Leg 3 (Amundsen 2023) using the box core.

Station ID	Date	Latitude (N)	Longitude (W)	Depth(m)	Diversity	Grain size	Organic	Pigment	Push cores	Porosity
122	2023/09/21	77,3386125	74,6744	677	1	1	1	3	3	0
129	2023/09/19	78,30582	73,775324	692	1	1	1	3	3	0
133	2023/09/18	79,6208965	70,30187583	178	1	1	1	3	3	0
134	2023/09/18	80,04248283	68,60237633	246	1	1	1	3	3	0
AC1	2023/09/15	81,7000415	64,09441	541	1	1	1	3	3	1
AC12	2023/09/22	77,195596	78,396827	562	1	1	1	3	0	0
AC13	2023/09/23	76,38310067	78,656006	213	1	1	1	3	0	0
AC14	2023/09/09	75,495805	78,842897	538	1	1	1	3	0	0
AC16	2023/09/27	76,0689435	83,199213	664	1	1	1	3	0	0
AC17	2023/09/29	76,20717	88,135228	164	1	1	1	3	0	0
AC18	2023/09/16	80,32076517	69,734492	195	1	1	1	3	3	1
AC19	2023/09/17	80,2400205	69,278657	288	1	1	1	3	0	0
AC2	2023/09/13	81,54079483	65,807634	394	1	1	1	3	0	0
AC20	2023/09/17	80,29900233	67,879513	380	1	1	1	3	0	0
AC3	2023/09/13	81,47804617	66,477745	381	1	1	1	3	3	1
AC4	2023/09/15	81,43355717	64,251882	640	1	1	1	3	3	0
AF-23	2023/09/12	81,54792983	64,965464	605	1	1	1	3	3	1
BG-01	2023/09/25	75,66460467	81,100994	322	1	1	1	3	0	0
BG-04	2023/09/25	75,6626965	81,100867	321	1	1	1	3	3	1
BG-07	2023/09/26	75,7499115	80,32214	616	1	1	1	3	3	1
CEOS-M1-23	2023/09/21	77,17988717	71,069964	458	1	1	1	3	0	0
JonesS-23	2023/09/28	75,97586933	86,416511	663	1	1	1	3	0	0
Lsea-23	2023/09/14	82,06350367	61,494766	573	1	1	1	3	3	0
Nares-East-23	2023/09/20	78,2661735	73,739104	673	1	1	1	3	0	0
Nares-West-23	2023/09/20	78,29507933	74,816559	586	1	1	1	3	0	0
NB-02	2023/09/30	76,92137533	98,401527	434	1	1	1	3	0	0
Site 1.2	2023/09/24	76,502762	78,7893	129	1	1	1	3	3	1
Site 4.6.1	2023/09/27	76,409338	82,978385	366	1	1	1	3	3	1
Site 4.6.2	2023/09/27	76,60163983	83,224466	140	1	1	1	3	0	0
AC17	2023/09/29	76,2072495	88,1351652	201	1	1	1	3	0	0

NB01	2023/09/29	76,8360947	91,2780500	293	1	1	1	3	0	0
NB02	2023/09/30	76,9205340	98,3995392	436	1	1	1	3	0	0
CB02	2023/10/02	74,8670085	83,4795798	229	1	1	1	3	3	1
CB06	2023/10/03	74,6689920	83,2134450	402	1	1	1	3	3	1
CB04	2023/10/03	74,8051660	83,1327283	301	1	1	1	3	0	0

Table 30-3: Number of samples collected from the box core during Leg 4 of the 2023 *CCGS Amundsen* expedition for our team and collaborators

Station ID	**Date**	**Latitude (N)**	**Longitude (W)**	**Depth (m)**	**Infauna Boidivesity**	**Sediment Grain size**	**Sediment Organic content**	**Sediment Pigments**	**Selenoneine – Barrette (ULAVAL)**	**Foraminifera - Audet (UQAM)**	**Microplastics – Provencher (MPO)**	**Carotte sediment – Sayago (ULAVAL)**
Full 322-GB	2023-10-07	70.4006057	91.1006205	219	1	1	1	3	1	1	5	3
Basic SPR- 004	2023-10-08	69.0526248	86.2146062	225	1	1	1	3	1	1	0	0
Full 333	2023-10-10	68.7714423	80.8397152	26	1	0	0	0	0	0	0	0
Full 334	2023-10-10	67.8808015	80.8008740	85	1	1	1	3	0	1	0	0
Full FoxSIPP-03	2023-10-11	66.9086927	80.8277442	98	0	1	1	3	1	0	0	0
Full 338	2023-10-11	66.1668280	81.3287573	136	1	1	1	3	1	1	5	3
Mooring 350	2023-10-12	64.5079400	80.4757283	390	1	1	1	3	1	1	5	0
Full FoxSIPP-08	2023-10-13	66.0055953	83.1531250	307	1	1	1	3	1	1	5	3
Full FoxSIPP-M	2023-10-14	65.1394485	81.3408865	430	1	1	1	3	1	1	0	0
Full 349	2023-10-15	64.6846602	78.5839673	135	1	0	0	0	0	0	0	0
Full HS22-003	2023-10-16	63.8520125	75.0922742	168	1	0	0	0	0	0	0	0
Basic 14E	2023-10-18	62.2779615	71.9864155	341	1	1	1	3	1	1	5	0

30.2.2 *Incubation*

During Leg 2, At 6 specific stations, box cores were deployed to study ecosystem function by performing incubations (Table 30-1). At these stations, 3 sub-cores of the box core's sediments were collected to performed incubations. Bottom water was collected from the rosette at those stations to allow incubations. During Leg 3, at 5 specific stations in the Narres Strait, box cores were deployed to study ecosystem function by performing incubations (Table 30-2). At these stations, 3 sub-cores of the box core's sediments were collected to performed incubations. Bottom water was collected from the rosette at those stations to allow incubations.

Incubations were performed in a dark and temperature-controlled room (ca. 3°C) for usually 24 - 48 h. Top sediment cores were carefully topped with bottom water collected with the rosette at the same station. The control cores were filled with rosette water. The cores were then saturated in oxygen with a bubbling device to avoid suboxic conditions. and continuously stirred with a small stirring motor. The cores were then acclimatised 6 to 8h in the dark.

Oxygen and temperature were measured periodically (4-8h intervals) with a Fibox O2 probe, until it has declined by 20%. At around 100, 90 and 80 O2%, water were sampled from the cores to measure nutrients, dissolved inorganic carbon (DIC) and NH4 (see after for details protocols). At the end of incubations (ca. 80% O2), the first 5 cm of sediments were sieved over a 500 microm sieve. In addition, the first centimetre (0-1 cm) of the sediments was collected with a 10mL syringe. The rest of the sediments were sieved, and all the samples were kept in 4% buffered formaldehyde until further analyses in Laval University.

During Leg 3, at 9 specific stations in fjords, an additional box core was deployed to study ecosystem function by performing incubations (Table 30-2). With the help of the multibeam, we aim for a site just behind the sill of every fjord and if time was allowed, we also choose a site near the glacier. Three sub-cores of 10cm in diameter were taken at every of those sites. Sediment porosity was also sample at those station to translate better the oxygen uptake and bioirrigation. Bottom water was collected from the rosette at those stations to allow incubations. The total oxygen uptake aims a consumption of 20% of the original data. The luminophore for the bioturbation was then add for a total of 6 days. The sub-cores were then cut at specific depth (5, 10, 20, 30, 40, 50, 60, 80, 100, 120, 140mm). The sodium bromide was added the last two days to measure bioirrigation and sample every 8 hours.

30.2.3 *Beam trawl*

During Leg 2, at 8 stations, a Beam trawl (headline 4.27 m × footrope 4.27 m, cod end of 9.5 mm mesh size) was towed on the seabed at a speed of 1.5-2 knots for 5 minutes to survey epibenthic species diversity, abundance, and biomass (Table 30-3). Catches were passed through a 2 mm mesh sieve. Specimens were identified to the lowest taxonomic level, then counted and weighted. The unidentified specimens were preserved in a 4% seawater-formalin solution for further identification in laboratory. 7 samples of organisms were kept at -20°C for further analyses of their selenoneine content.

30.2.4 *Van Veen*

During Leg 2, at 3 stations, Van Veens were conducted to determine whether sediment conditions were suitable for a box core. At one of these stations (A9/198 Greenland), sediments were sieved and organisms were kept in 4% formol for identification.

During Leg 4, three Van Veen grabs were deployed to determine whether sediment conditions were suitable for a box core. The content of two of these Van Veen grabs were used in lieu of a box core sample (Table 30-4). Box core deployments were planned at an extra four stations but were canceled due to unsuitable sediment (FoxSIPP-07, 15E, 354) or bad weather conditions (HS22-013).

Table 30-4: Number of samples collected from the Van Veen during Leg 4 of the 2023 CCGS Amundsen expedition

Station ID	**Date**	**Latitude (N)**	**Longitude (W)**	**Depth (m)**	**Infauna Boidivesity**
Full FoxSIPP-03	2023-10-11	66.9086927	80.8277442	98	1
Full FoxSIPP-07	2023-10-12	64.4022787	81.4469955	307	1

30.2.5 *Nutrients, NH_4 and DIC sampling (Leg 3)*

To sample nutrients (nitrite, nitrate, phosphate, and silicate), 15 mL polypropylene conical tubes were used and filled with water from the cores with a 60 mL plastic syringe mounted with a 25 mm glass fiber filter GF/G with a filter holder. To prevent any failures due to storage in the freezer, 2 samples per cores were collected to allow a backup. The samples were then frozen at -20°C for further analysis.

For NH_4 sampling, borosilicate tubes were used to sample NH_4. At each sampling, 5 mL was taken from the cores with a 60 mL plastic syringe mounted with a 25mm glass fiber filter GF/F with on a filter holder. A Turner Design TD-700 fluorometer was used to read NH_4 samples. A calibration curve was performed with a 50 µM solution of NH_4 to allow readings. Then, 1.2 mL of working reagent were added to the tubes and then were incubated at room temperature in the dark for 3h to 7h max. An excel template based on the calibration curve was used to calculate the NH_4 concentration from fluorescence values.

For DIC sampling, 12mL glass vials were used and filled completely to the top with water from the cores to prevent air. Then, under appropriate fumehood, 200 µL of ZnCl2 7M was carefully added with a micropipette, while ensuring that no air bubble is produced. The samples were then preserved in the incubation lab (ca. 3°C) to allow further analyses.

30.2.6 *Agassiz trawl*

During legs 3 and 4, at 6 and 14 stations respectively, an Agassiz trawl (1.5 m width × 0.7 m height, cod end of 0.5 cm mesh size) was towed on the seabed at a speed of 1.5 knots for 3 minutes to survey epibenthic species diversity, abundance, and biomass (Table 30-4 and Table 30-7). Catches were passed through a 2 mm mesh sieve. Specimens were identified to the lowest taxonomic level, then counted and weighted. The unidentified specimens were preserved in a 4% seawater-formalin solution for further identification in laboratory. Certain specimens were taken from the Agassiz trawl or the Beam trawl and preserved at -20°C for A. Barrette (Table 30-8). When requested and when available, specimens were also provided from the Agassiz and Beam trawl for a team studying contaminants. An Agassiz deployment was planned for two extra stations, but were cancelled due to unsuitable sediment (FoxSIPP-07) or bad weather conditions (HS22-013).

Table 30-5: Beam trawl stations during Leg 2 of the 2023 CCGS Amundsen expedition

Station ID	Date	Start			End		
		Latitude (N)	Longitude (W)	Depth (m)	Latitude	Longitude	Depth (m)
Basic 196	2019-07-10	66.9829192	56.0649030	128	66.9807792	56.0587207	128
Basic 198	2019-07-10	67.0885677	54.2107367	83	67.0887707	54.2178973	85
Basic BB16	2019-07-11	69.1421188	51.8659363	506	69.1400647	51.8556913	503
Basic 229	2019-07-13	71.0171533	53.0149475	420	71.0167688	53.0358120	420
Full 226	2019-07-14	70.7057170	59.0298160	591	70.7045670	59.0617737	591
Full 222	2019-07-16	70.0761143	66.6182150	239	70.0756260	66.6099272	245
Basic 204	2019-07-18	73.2758320	58.0428618	893	73.2838492	58.1020048	903
Basic 210	2019-07-19	75.4215250	61.6151052	1049	75.4163213	61.6715598	1127
Full 115	2019-07-20	76.3348873	71.2499210	669	76.3259772	71.2340612	672
Basic 111	2019-07-21	76.3199437	73.1779667	607	76.3266742	73.2086828	601
Full 108	2019-07-21	76.2612317	74.6306542	449	76.2598203	74.6571740	448
Basic 105	2019-07-22	76.3247095	75.7789820	692	76.3276653	75.7992023	705
Full 101	2019-07-23	76.3865707	77.4228122	381	76.3834007	77.4473630	396
Nutrient 324	2019-07-25	73.9784703	80.4935098	772	73.9684032	80.5042188	770
Basic 122	2019-07-28	77.3336608	74.9797648	654	77.3236653	74.9590917	651
Full 133	2019-07-30	79.5918200	70.3208763	173	79.5929718	70.3357443	173
Basic 134	2019-07-31	80.3645395	68.4822682	379	80.3650147	68.4606712	380
Coring / Full 6.4	2019-08-02	81.6428680	63.1886177	779	81.6533100	63.1945060	771

Table 30-6: Agassiz trawl stations during Leg 3

Station ID	Time (UTC)	Start			End			Duration
		Latitude (N)	Longitude (W)	Depth (m)	Latitude	Longitude	Depth(m)	
133	2023/09/18	79,6208965	70,30187583	178	79,6315845	70,28736167	179	1
AC14	2023/09/09	75,45159367	78,69599583	543	75,45087333	78,645015	535	1
AC17	2023/09/29	76,21985167	88,28882417	164	76,22129133	88,2767845	168	1
Nares-West-23	2023/09/19	78,30626867	74,74812367	595	78,32037083	74,70020733	617	1
NB-01	2023/09/29	76,793061	91,02765483	190	76,78916917	91,046648	186	1
NB-02	2023/09/30	76,89225467	98,38855333	338	76,884246	98,40438317	312	1

Table 30-7: Agassiz trawl stations during Leg 4 of the 2023 CCGS Amundsen expedition

Station ID	**Date**	**Start**			**End**			**Duration (min,sec)**
		Latitude (N)	**Longitude (W)**	**Depth (m)**	**Latitude (N)**	**Longitude (W)**	**Depth (m)**	
Full 322-GB	2023-10-07	70.3999615	91.0874230	214	70.3993172	91.071235	207	3
Basic SPR-004	2023-10-08	69.0523817	86.1988105	233	69.0549303	86.186611	232	3
Full 333	2023-10-10	68.7715050	80.8326502	27	68.7741515	80.831997	26	3
Full 334	2023-10-10	67.8790718	80.7981803	86	67.8797397	80.787960	87	3
Full FoxSIPP-03	2023-10-11	66.9085632	80.8199247	97	66.9116317	80.823238	97	3
Full 338	2023-10-11	66.1692507	81.3307585	136	66.1722857	81.335700	136	3
Mooring 350	2023-10-12	64.5064658	80.4774110	389	64.5129303	80.466579	387	3
Full FoxSIPP-08	2023-10-13	66.0052178	83.1424250	305	66.0028115	83.129144	296	3
Full FoxSIPP-M	2023-10-14	65.1401143	81.3368202	432	65.1387068	81.325933	430	3
Full 349	2023-10-15	64.6855517	78.5867883	135	64.6837887	78.593365	143	1,30
Full 15E	2023-10-15	64.0243583	79.2148038	310	64.0175197	79.215654	310	3
Full HS22-003	2023-10-16	63.8543668	75.0907592	171	63.8557687	75.098773	165	3
Basic 14E	2023-10-18	62.2797223	71.9896610	342	62.2749908	71.986709	341	2,40
Basic 354	2023-10-20	61.0033708	64.7171597	525	60.9999712	64.699959	538	3

Table 30-8: Samples collected from the Agassiz trawl or the Beam trawl during Leg 4 of the 2023 *CCGS Amundsen* expedition for A. Barrette

Station ID	**Agassiz trawl**	**Beam trawl**	**Epifauna Biodiversity**	***Mytilus* sp.**	***Alitta virens***	***Strongylocentrotus* sp.**	***Chlamys islandica***	***Hyas coarcticus***	***Sclerocrangon* sp.**	***Leptasterias polaris***	***Eualus gaimardii belcheri***
Full 322-GB	X		X			X					X
Basic SPR-004		X							X		
Full 334	X		X						X		
Full FoxSIPP-03	X		X			X			X		
Full 338	X		X						X		
Full 349	X		X						X		

30.3 Preliminary Results

At this point, we do not know exactly if spatial and temporal variability of benthic diversity is governed by sediment type, food availability or other environmental variables. Samples collected require further analysis. For detailed results, identification of organisms and sediment analyses will be carried on in home laboratories.

30.4 Recommendations

We would like to thank the *CCGS Amundsen* and the ship crew for their help with deploying all equipment. We would also like to thank the chief scientists Jean-Éric Tremblay, Alexandre Forest Maxime Geoffroy, Audrey Limoges and Brent Else for directing the research activities.

31 Seafloor mapping and investigation of geohazards

Project leaders: Alexandre Normandeau[1] & Audrey Limoges[2]

Cruise participants – Leg 1: Robbie Bennett, Laura Broom, Scott Hayward & Margaret Atkinson

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31.1 Introduction and Objectives

The work conducted on the C*anadian Coast Guard Ship (CCGS) Amundsen* was completed under NRCan's Marine Geoscience for Marine Spatial Planning program (MGMSP) and the Arctic Seafloor Mapping project of ArcticNet.

The goal of MGMSP is to ensure that marine geoscience data can support decisions regarding marine spatial planning and impact assessments. This includes obtaining seabed information on surficial geology, geological processes, and geohazards to support decisions on marine geological hazards, marine infrastructure, seabed resources, and marine conservation. This program can also support the work being conducted by Imappivut (Our Oceans), which is working to establish a new indigenous protected area in the Torngat-AOI.

The Arctic Seafloor Mapping project has been conducting research to improve the understanding of geological processes and hazards (geohazards) to support stakeholder decisions on the use of offshore areas and provide northern communities with better knowledge for improving public safety. In addition, our work aims to benefit mapping of seabed habitats in the region.

Since 2021, the NRCan has been investigating the nearshore seabed along the Labrador Margin (Normandeau et al. 2022). Until recently, the geological processes and seabed conditions within the nearshore and fjord environments along the coast of Labrador have not been examined in detail. Fjord environments are susceptible to subaerial and submarine landslides, which can have the potential to produce tsunamis, posing a potential risk to public safety and marine infrastructure. A recent example of this type of event was the 2017 landslide and tsunami in Karrat Fjord, West Greenland (Gauthier et al. 2018). This subaerial landslide generated a tsunami that flooded the village of Nuugaatsiaq resulting in loss of life and infrastructure. Since 2018, Southwind Fjord has been studied to characterize the geohazards and turbidity current processes in glacierized fjords. Further work in the fjord also aims to understand the recovery of iceberg-induced landslides (Normandeau et al. 2021). In addition to geohazard work, improved seafloor mapping utilizing high resolution bathymetry and backscatter data aims to test if these tools can be used in the identification and mapping of sponge/coral communities on the seafloor.

Opportunistic surface sediment samples were collected form the first centimeter of the sediment water interface. The samples will be used to identify microfossil assemblages including dinoflagellate cysts, diatoms, palynomorphs and foraminifera. Lastly, sampling of the water column for phytoplankton was to characterize and document dinoflagellate communities in Labrador.

Objectives:

1. Characterize and constrain the timing of submarine landslide deposits in Northern Labrador utilizing gravity cores.
2. Run experimental deployment of the AUV over areas with potential coral/sponge habitat to determine if they can be resolved by the AUV bathymetry and backscatter.
3. Characterize turbidity current processes in glacierized fjords and the understand the recovery of iceberg-induced landslides.
4. Identify microfossil assemblages in box cores and sampling the water column for phytoplankton to characterize and document dinoflagellate communities in Labrador.

31.2 Methodology

Four participants from Natural Resources Canada (NRCan) participated in Leg 1 of the 2023 Amundsen Science expedition. Alexandre Normandeau executed the planning of the 2023 stations and provided onshore scientific support. The field team included Robbie Bennett, Scott Hayward and Laura Broom. Two participants from UNB participated in Leg 1: Audrey Limoges conducted the planning and onshore support and Margaret Atkinson completed the field work. During Leg one, NRCan completed 22 stations, including from 16 box cores, five giant gravity corer deployments and two Automated Underwater Vehicle (AUV) deployments (Table 31-1; Figure 31-1). UNB completed 22 box core stations and 6 phytoplankton nets (Table 31-1; Table 31-2).

Table 31-1: NRCan and UNB stations during Leg 1 of the 2023 Amundsen Expedition

Time (UTC)	Amundsen Station ID	NRCan Stn ID	Latitude (N)	Longitude (W)	Activity	Event	Depth (m)	For UNB or NRCan
2023/07/15 19:03:48	Joey's Gully	0001	54.7671368	56.3280718	Box Core	Bottom	137.8	NRCan
2023/07/15 18:41:15	Joey's Gully	0001	54.7685478	56.3276153	Box Core	Bottom	134.8	NRCan
2023/07/15 21:32:51	Joey's Gully	0002	54.7575080	56.3270285	AUV	Recovery	134.3	-
2023/07/15 20:55:01	Joey's Gully	0002	54.7593737	56.3260930	AUV	Deployment	129.8	NRCan
2023/07/18 00:28:41	Makkovik Hanging Gardens	0003	55.4336408	58.9433882	Box Core	Bottom	703.4	Both
2023/07/18 09:35	ISECOLD-0-200	N/A	56.28686	58.90381	Box Core	Bottom	202.2	UNB
2023/07/18 14:33	Sentinel	N/A	56.28132	59.75336	Box Core	Bottom	530.8	UNB
2023/07/20 11:19	ISECOLD-1-200	N/A	57.71346	60.20868	Box Core	Bottom	219.2	UNB
2023/07/21 01:27	Okak Bay	N/A	57.52922	62.07689	Box Core	Bottom	40.8	UNB
2023/07/21 11:16:13	Okak Bay	0004	57.5204550	62.1480705	Gravity Core	Bottom	64.0	NRCan
2023/07/21 13:06:16	Okak Bay	0005	57.5169133	62.1428528	Gravity Core	Bottom	69.6	NRCan
2023/07/22 08:44:20	North Arm	0006	58.4833333	63.2191180	Box Core	Bottom	240.7	Both
2023/07/22 11:15:41	North Arm	0007	58.4883655	63.3721275	Gravity Core	Bottom	91.3	NRCan
2023-07-23 08:40	Sag Bank	N/A	59.3833	60.31955	Box Core	Bottom	427.1	UNB
2023-07-25 23:23	ISECOLD-3-200	N/A	60.44341	62.58136	Box Core	Bottom	339.7	UNB
2023-07-27 18:35	Hatton 600	N/A	61.1234	63.28627	Box Core	Bottom	607.6	UNB
2023/07/30 05:32:24	SW2	0008	66.9226873	62.4900620	Box Core	Bottom	389.9	Both
2023/07/30 08:09:56	SW3	0009	66.8306782	62.4295318	Box Core	Bottom	117.8	-

2023/07/30 07:40:54	SW3	0009	66.8292505	62.4278477	Box Core	Bottom	86.7	Both
2023/07/30 13:59:36	SW9	0010	66.7527830	62.3119530	Gravity Core	Bottom	36.9	NRCan
2023/07/30 16:47:21	SW10	0011	66.7883083	62.3684640	Gravity Core	Bottom	179.8	NRCan
2023/07/30 22:27:55	SW5	0012	66.7875997	62.3689900	Box Core	Bottom	179.8	Both
2023/07/30 23:15:31	SW7	0013	66.7519007	62.3126303	Box Core	Bottom	37.1	Both
2023/07/31 00:00:27	SW8	0014	66.7529092	62.3123542	Box Core	Bottom	41.4	Both
2023/08/01 07:53:28	BB1B_600	0015	67.9917192	59.3750933	Box Core	Bottom	553.9	Both
2023/08/01 11:16:51	Disko Fan	0016	67.9708863	59.5046017	Box Core	Bottom	895.1	Both
2023/08/02 08:38:00	Otolith 3	0017	66.7997842	58.4859132	Box Core	Bottom	808.9	Both
2023/08/02 11:24	DS1	N/A	66.25728	58.2972	Box Core	Bottom	625.8	Both
2023/08/02 20:46:32	Otolith 4	0018	66.1994828	58.4967143	Box Core	Bottom	508.3	Both
2023/08/03 08:04:27	Otolith 5	0019	65.5993298	58.4978438	Box Core	Bottom	504.3	Both
2023/08/03 21:55:03	DS2	0020	65.3349683	58.0167712	Box Core	Bottom	573.8	Both
2023/08/04 00:39	Davis Seep	N/A	65.09697	58.46208	Box Core	Bottom	526.4	UNB
2023/08/04 15:20:02	DS3	0021	64.6477755	58.6032630	Box Core	Bottom	610.3	-
2023/08/04 14:42:51	DS3	0021	64.6484325	58.6031017	Box Core	Bottom	610.6	Both
2023/08/05 12:28:39	HB AUV	0022	61.4325402	60.7060933	AUV	Deployment	540.0	NRCan

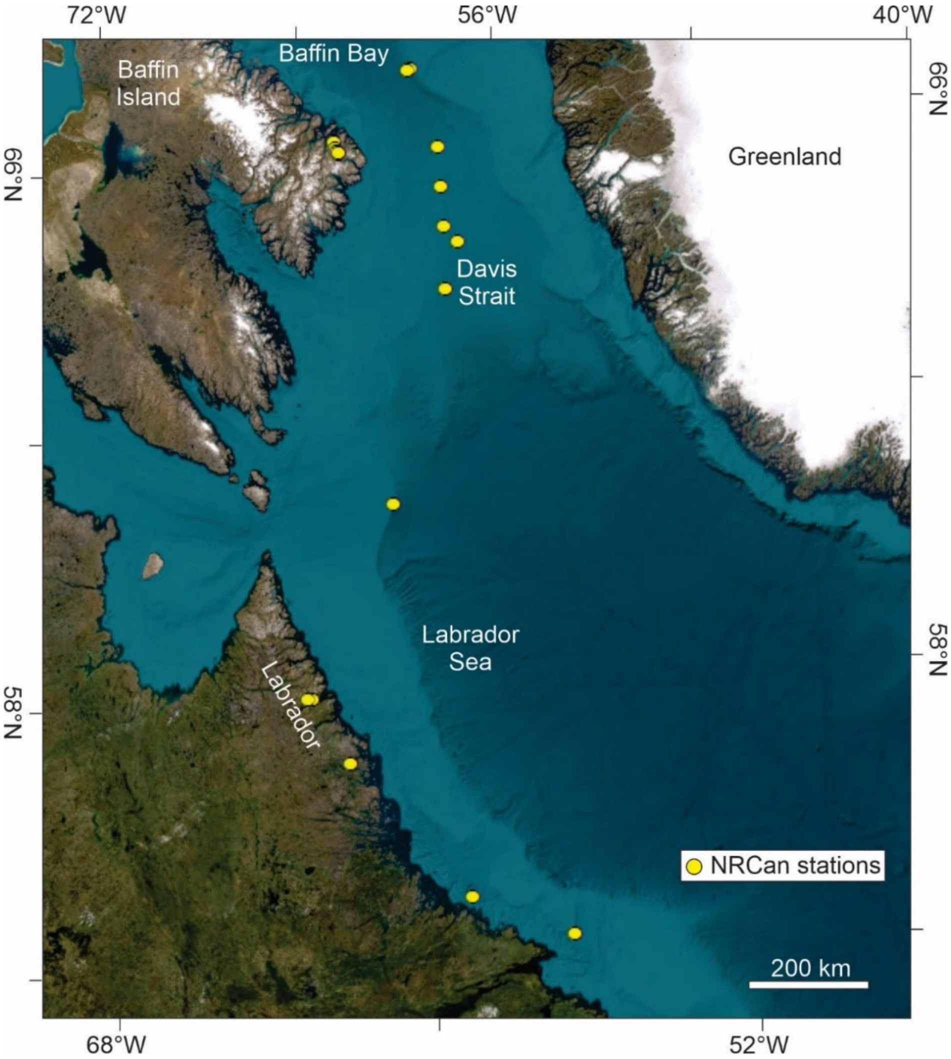

Figure 31-1:NRCan's station locations during Leg 1 of the 2023 Amundsen Expedition

31.3 Coring

31.3.1 *Giant Gravity Core*

For the giant gravity corer stations, the piston corer was deployed as a gravity corer. This set up was used because it performs well in soft sediments (mud) and helps conserves time which is valuable during multidisciplinary cruises. The set up involved installing the piston corer without the trigger weight core and trip arm. The giant gravity corer system includes three 3 m long barrels attached by couplings and a 2000 lb core head (Figure 31-2). Inside of the barrels was nine meters of core liner and a butterfly valve was fitted to the top of the liner in place of the piston.

Figure 31-2: Gravity coring system ready for deployment onboard the *CCGS Amundsen*

In total, there were five deployments of the giant gravity coring system (Table 31-1). Three deployments were in the Labrador Sea including Okak Bay and Saglek Fjord and two deployments were in Southwind Fjord, Baffin Bay (Figure 31-3).

When the gravity core is retrieved, the plastic liners are taken apart, beginning with the base. Each liner is 3 meters long and as they are recovered on deck, they are cut into 1.5 m sections, fitted with end caps and taken into the lab for documentation and preliminary processing (Figure 31-4). If the core cutter or catcher recovered sediment, then the material was extruded into a separate piece of core liner for archiving.

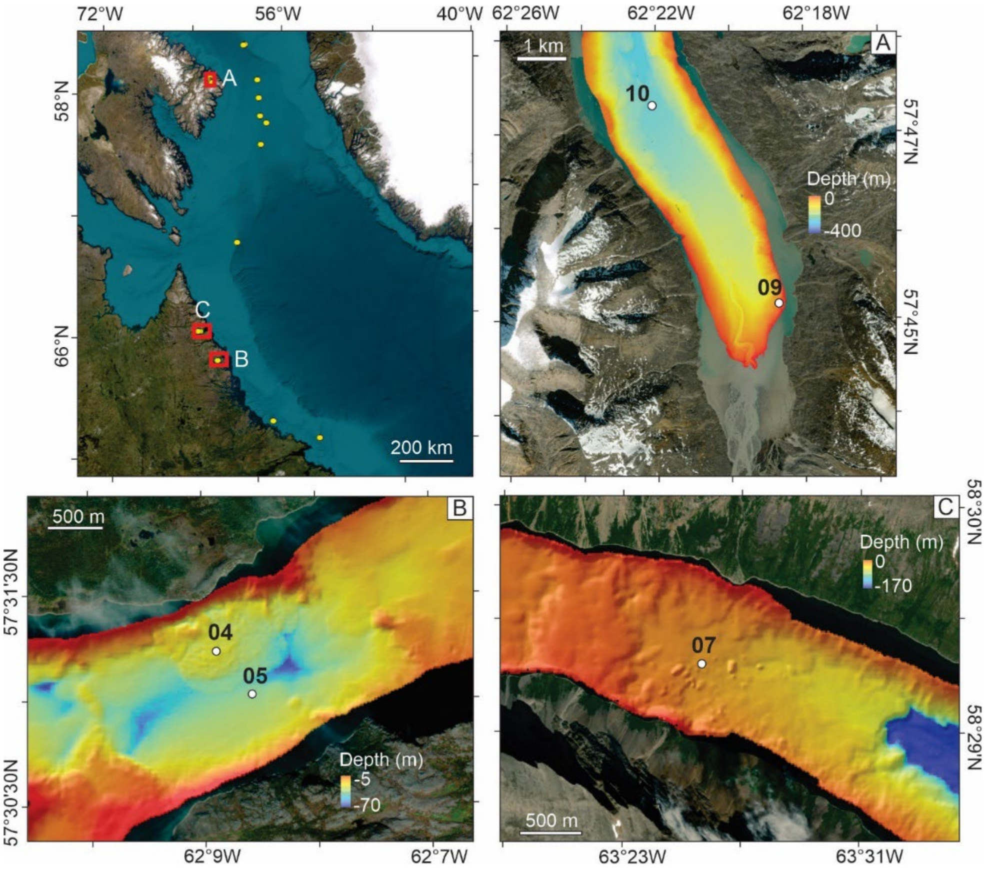

Figure 31-3: NRCan's gravity core stations for Leg 1 of the 2023 Amundsen expedition including: A) Southwind Fjord, B) Okak Bay, and C) Saglek Fjord.

Figure 31-4: Image shows the gravity core system on deck and Margaret and Scott removing the core cutter from the bottom barrel

On board processing of the cores consisted of taking one measurement and a subsample from the top and/or bottom of core sections where the material was suitable. Shear strength measurements were taken using a torvane that was inserted into the sediment at the bottom/top of the core liner and turned at a constant rate until the sediment failed. This measurement is used to help calibrate the shear strength measurements that will be taken along the length of the core at NRCan. Constant volume samples were collected using a cylinder of known volume which will be analysed for bulk density at NRCan. This measurement will help calibrate the bulk density measurements taken along the length of the core at NRCan. Suitable sediment for these procedures is undisturbed mud. Sand, soupy mud or core disturbance will make the measurements unsuitable. The cores were then resealed with tape, the ends were covered with wax and the cores were stored upright in a refrigerated container. These cores will be taken back to NRCan for further processing.

31.3.2 *Box Core*

The box corer was deployed and subsampled 16 times by NRCan and 22 times by UNB during Leg 1 of the 2023 Amundsen expedition (Figure 31-5). For NRCan's stations, the box core was subsampled by inserting a small tube into the sediment (Figure 31-6). Once the push core was inserted, the excess sediment was removed from the box corer with shovels, and the core was capped with endcaps, taped, sealed with wax and stored upright in the refrigerated container. For UNB, opportunistic surface sediment samples were collected from the top 1cm of the sediment water interface, from each box core. The samples will be used to identify microfossil assemblages including dinoflagellate cysts, diatoms, palynomorphs and foraminifera. The samples were collected in whirl-pak bags and stored at -80 degree Celsius.

Figure 31-5: Deployment of the box core system in Saglek Fjord, Labrador Sea

Figure 31-6: Example of push core subsampling from box core station 0012

31.3.3 *Multibeam echosounder: Kongsberg EM304 30kHz*

In 2022, Amundsen Science installed a Kongsberg EM304 30kHz multibeam echosounder to upgrade from the previous system. The ship was also equipped with a POSMV V5 positioning and orientation system. This system was utilized by NRCan during Leg 1 to collect a repeat multibeam survey of inner Southwind Fjord and to fill in data outside of the fjord.

31.3.4 *AUV Missions*

Three AUV missions were conducted during Leg 1 of the 2023 Amundsen expedition. These missions were conducted at Joey's Gully, Hatton Basin, and Inner Frobisher Bay (Figure 31-7; Figure 31-8). Unfortunately, the AUV was not able to collect data at Joey's Gully and Hatton Basin due to technical and environmental difficulties. The AUV mission in Frobisher Bay was conducted after this cruise report was completed so could not be discussed at this time.

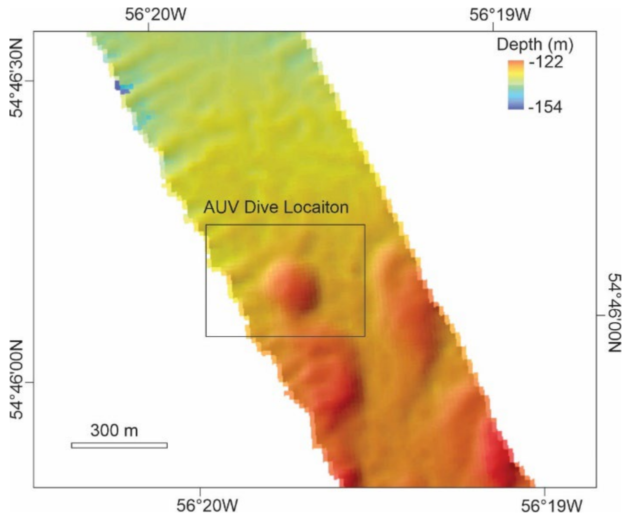

Figure 31-7: Planned AUV dive location in Joey's Gully, Labrador Sea

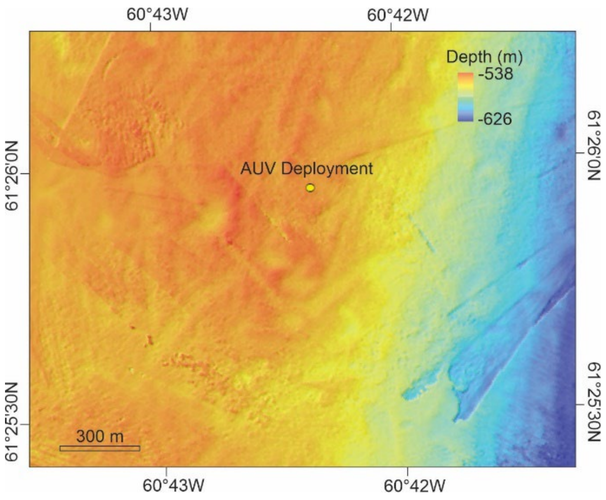

Figure 31-8: Hatton Basin AUV deployment location

The AUV used during this cruise was a Gavia, manufactured by Teledyne Marine (Figure 31-9). It is approximately 12.5' in length and weighs 325 lbs. The main sensors on the AUV are: 1) an EdgeTech bathymetric sonar that collects side scan sonar and multibeam-like bathymetry at ~15 cm resolution; and 2) a sub-bottom profiler which operated between 12 – 23 kHz that is capable of imaging the upper 10 to 15 m of sediment. The Gavia AUV is a fully autonomous vehicle that does not receive corrections from the operator while on a mission.

The AUV is programmed with a mission plan using a laptop computer (or tablet) that is connected through its own wifi network. The AUV is deployed from the foredeck of the Amundsen using the starboard crane (Figure 31-10) and then towed to the mission site using a fast rescue craft (FRC). When at the appropriate release point, the AUV is untied from the FRC and activated using a ruggedized tablet connected via the AUV's wifi network.

Figure 31-9: Photo of the Gavia AUV on deck

Figure 31-10: Photo of the deployment of the Gavia AUV during Leg 1

31.4 Preliminary Results

31.4.1 *Coring*

Two gravity cores were successfully collected from Okak Bay, Labrador Sea. Core 0004 was collected inside of a submarine landslide deposit observed in multibeam bathymetric data, and core 0005 was collected downslope of the landslide deposit in undisturbed sediments (Figure 31-3). Core 0004 was collected at 64 meters below sea level (mbsl) and recovered 2 m of sediment (Table 31-2). Core 0005 was collected downslope of the submarine landslide at 70 mbsl and recovered 6.6 m of sediment. Constant volume samples and shear strength measurements were taken from the ends of each core section where possible (Table 31-3; Table 31-4). In Saglek Fjord, Labrador Sea, a gravity core was deployed at a site that appeared in the multibeam as a blocky deposit, interpreted as a potential submarine landslide. The core was retrieved from 91 m water depth and recovered only 25 cm of sediment. The material consisted of pebbly material. The seabed is likely coarse grained and not conducive to gravity coring.

Table 31-2: Gravity core stations

Station	Depth (m)	Total Length (cm)	Location	Comments
0004	64	207.5	Okak Bay	Inside submarine landslide
0005	70	662.5	Okak Bay	Downslope of submarine landslide
0007	91	25	Saglek Fjord	Inside submarine landslide. Recovered material was very rocky – lots of pebbles.
0010	211	246.5	Southwind Fjord	Outside of landslide target.
0011	180	138	Southwind Fjord	Depocenter target. Winch wire caught on core barrel during retrieval. Core had to be lowered back to seabed, so sample disturbance is possible.

Table 31-3: Constant volume sampling for giant gravity core (GGC) stations during Leg 1

Station	Type	Section	Top/Base	Sampler ID	Bottle ID	Comments
0004	GGC	A/B	Top	A2	A481	Some visible sand partings.
0005	GGC	A/B	Top	A2	A482	
0005	GGC	B/C	Top	A2	A483	
0005	GGC	C/D	Top	A2	A485	
0005	GGC	D/E	Top	A2	A484	Sandy – a couple of small voids at top of sampler.

Table 31-4: Shear strength measurements for giant gravity core (GGC) stations during Leg 1

Station	Type	Section	Top/Base	Torvane used	Reading
0004	GGC	A/B	Top	L	0.22
0005	GGC	A/B	Top	L	0.54
0005	GGC	B/C	Top	L	0.25
0005	GGC	C/D	Top	L	0.53

In Southwind Fjord, Baffin Bay, two gravity cores were collected. Core 0010 targeted undisturbed sediments adjacent to a submarine landslide deposit. It deployed at 211 mbsl and recovered 2.5 m of sediment (Table 31-2). Core 0011 targeted the depocenter for turbidity current processes in the fjord. It was deployed at 180 m water depth and recovered 1.4 m of sediment. When core 0011 was being recovered, the winch wire caught on the core barrel. The coring system had to be relowered to the seabed to untangle the wire. This was effective and the core was successfully recovered, although the sample might have been disturbed when it was lowered back to the seabed.

A total of 16 box core stations were subsampled by NRCan (Table 31-5; Figure 31-11; Figure 31-12; Figure 31-13). All stations were subsampled for other institutions onboard in collaboration with NRCan and will be archived at the Bedford Institute of Oceanography for further processing. Twenty-two box core stations were subsampled by UNB to identify microfossil assemblages (Table 31-1).

Table 31-5: Box core stations subsampled by NRCan.

Station	Depth (m)	Push Core	Core Length (cm)	Location	Comments
0001	137.8	-	0	Joey's Gully, Labrador Sea	Box core only recovered a couple of small cobbles. Suspect the bottom was rocky.
0003	703.4	A push	36.5	Makkovik Hanging Gardens, Labrador Sea	
0006	240.7	A push	48	Saglek Fjord, Labrador Sea	soupy mud
0008	389.9	A push	42.5	Southwind Fjord, Baffin Bay (SW2)	push core taken for Chris Algar to be archived by NRCan
0009	117.8	A push	20.5	Southwind Fjord, Baffin Bay (SW3)	push core taken for Chris Algar to be archived by NRCan
0012	179.8	A push	23	Southwind Fjord, Baffin Bay (SW5)	Deopocenter site. Push core taken for Chris Algar to be archived by NRCan
0013	37.1	A push	30	Southwind Fjord, Baffin Bay (SW7)	Outside landslide deposit. Push core taken for Chris Algar to be archived by NRCan
0014	41.4	A push	29	Southwind Fjord, Baffin Bay (SW8)	Inside landslide deposit. Push core taken for Chris Algar to be archived by NRCan
0015	553.9	A push	16.5	Disko Fan, Baffin Bay (BB1B_600)	Push core taken for DFO to investigate otoliths, to be archived by NRCan
		B push	17.5		
0016	895.1	A push	27	Disko Fan, Baffin Bay	Push core taken for DFO to investigate otoliths, to be archived by NRCan
		B push	21		
0017	808.9	A push	26.5	Davis Strait, Otolith 3	Push core taken for DFO to investigate otoliths, to be archived by NRCan
		B push	26.0		
001	508.3	A push	40	Davis Strait, Otolith 4	Sediment was dense with sponge spicules throughout. Push core taken for DFO to investigate otoliths & sponge spicules to be archived by NRCan.
		B push	35		

0019	504.3	A push	25	Davis Strait, Otolith 5	Few sponge spicules noted in top few cm of box core. Push core taken for DFO to investigate otoliths & sponge spicules to be archived by NRCan
		B push	22		
		C push	25		
0020	573.8	A push	40	Davis Strait, DS2	push core taken for Chris Algar to be archived by NRCan
0021	610.6	A push	32	Davis Strait, DS3	Push core taken for DFO to investigate otoliths, to be archived by NRCan
		B push	36		

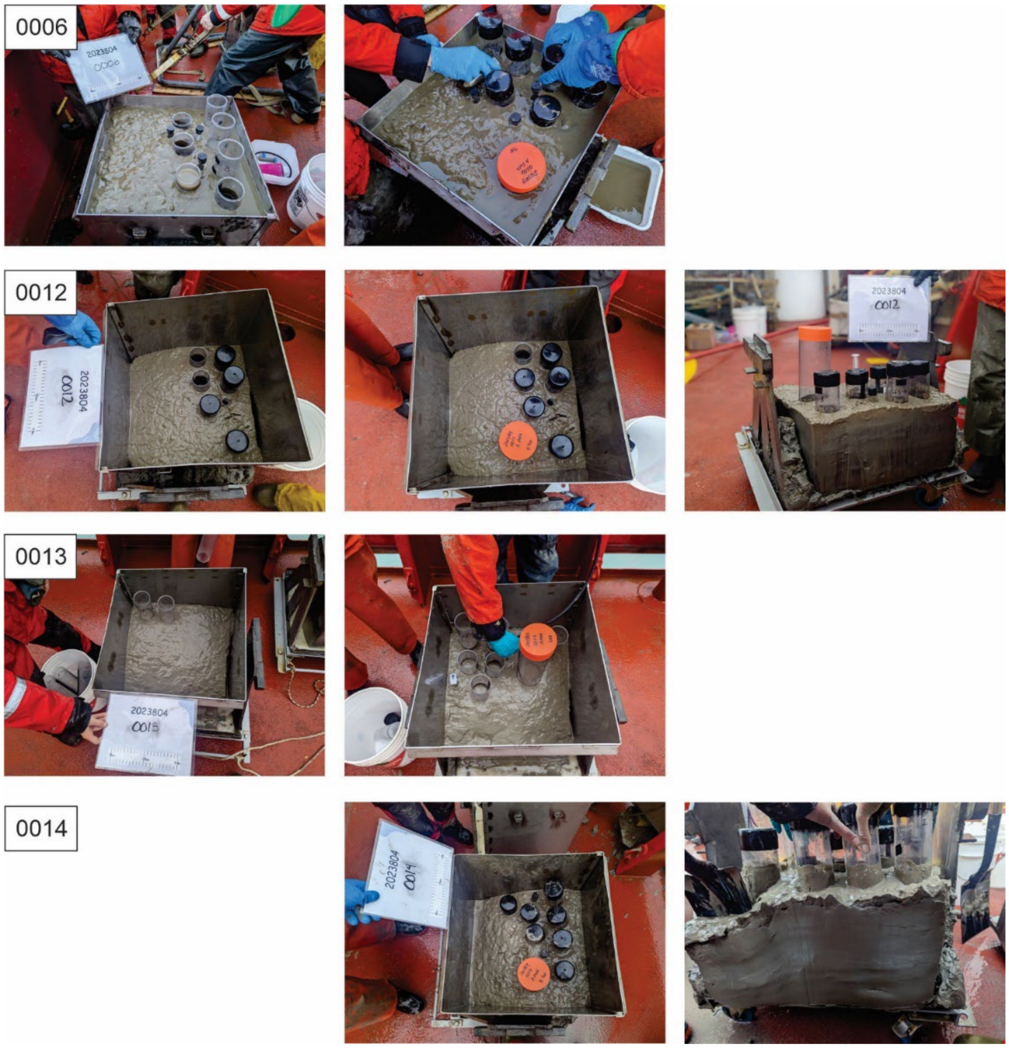

Figure 31-11: Images from box core stations 0006, 0012, 0013 and 0014

Figure 31-12: Images from box core stations 0015, 0016, 0017 and 0018.

Figure 31-13: Images from box core stations 0019, 0020, 0021.

31.4.2 *Phytoplankton Net*

See section 15

31.4.3 *Multibeam Bathymetric data*

Planned and opportunistic multibeam bathymetric data were collected (See section 20).

31.4.4 *AUV*

The AUV was not able to collect data at Joey's Gully or Hatton Basin. The Joey's Gully dive was located in about 140 m water depth. The AUV dove to the programmed altitude (10 m above the seabed) but aborted the mission soon after it reached this depth due to a "failed to track depth" error. This dive plan was using a newly developed diving program in the Gavia software (called Ascent/Descent actions) that has not produced consistent results. At this point in the cruise, all dives were switched to a different diving program in hopes of getting more consistent diving behavior (called Vertical Descent Lines or Vertical Ascent Lines).

The Hatton Basin dive was located in about 650 m water depth to the east of Hudson Strait. The AUV was unable to dive to the programmed altitude due to very strong currents in the area (the ROV dive at this site was also unsuccessful due to the currents). When reviewing the diagnostic data from the dive, the AUV dove to about 450 m water depth but was unable to maintain the desired speed or heading which lead to significant position errors and the Gavia cut power to its thruster and performed an unpowered ascent to the surface. When the AUV arrived at the surface, it took a GPS fix and attempted to dive again. The Gavia dove to about 500 m but the currents caused the same issues as during the first attempt so the AUV did another unpowered ascent to the surface and aborted the mission.

The Inner Frobisher Bay dive was planned for the morning of August 9. This cruise report was completed before that date so no details about that dive can be included at this time. This dive was planned to map a site previously observed by ROV and to image a portion of a nearby slope failure. This dive was located in about 140 m water depth.

1.4 Recommendations

Both of the Amundsen Science box corers were used during this cruise. Boxcore B was used at Joey’s Gully, but it failed to trigger twice when it hit the seabed. The third attempt was successful in obtaining some rocks and gravel. This site was very hard and a difficult test of a box corer, but the trigger mechanism of this corer seemed stiff and the top bolt did not retract well. The decision was made to switch to Boxcore A for the rest of the cruise. The problem with Boxcore B was not certain so it should be examined when the ship returns to Quebec City.

Boxcore A performed very well during the cruise. There are 3 issues that should be examined on its return to Quebec City. These are: 1) one of the screws holding the box in place is stripped (top screw on the left hand side, marked with a *); 2) the plate on the box core cable is bent; 3) one of the cams on the right hand side does not always tighten (this may be an issue with the spades rather than the cam but it should be checked). All the boxes sustained some damage from striking rocks on the sea floor but the damage is minor and can be fixed either at the end of the cruise or by the engineers on the Amundsen. One of the boxes was sent to the engine room for repairs during Leg 1 but the repairs were not completed by the end of the Leg.

The Amundsen Science gravity core worked flawlessly during the cruise. Only regular maintenance is required.

1.5 References

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32 Sediment and phytoplankton sampling for the programs ArcticNet Seafloor Mapping Data Processing and Dissemination & ArcticNet Rapidly changing ecosystem dynamics in the Arctic Ocean's Last Ice Area (RED-AO)

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32.1 Introduction and Objectives

Benefitting from the presence of the Canadian Coast Guard (CCGS) Amundsen in Nares Strait, Lincoln Sea, and Jones Sound, the main objective was to collect surface sediment, sediment cores (box core, gravity core, and giant gravity core), and plankton nets to:

32.1.1 *ArcticNet Seafloor Mapping Data Processing and Dissemination*

1) Characterize the spatial distribution patterns of siliciclastic grain size, bulk minerals, and elemental geochemistry of seafloor sediments;

2) Document the post-glacial melting history of the outlet glaciers;

3) Reconstruct past variations in sediment dynamics and sea-surface conditions (temperature, salinity, seaice cover duration, productivity) related to Late Quaternary climate changes across the Canadian Arctic;

4) Establish a deglacial/Holocene high-resolution magnetostratigraphy for the Canadian Arctic Ocean;

5) Document the evolution of primary and secondary production of the Canadian Arctic ecosystem in relation with climate conditions;

6) Identify and document the dinoflagellate communities living in the Canadian Arctic;

7) Reconstruct the history of submarine landslides in Grise Fiord.

32.1.2 *Rapidly changing ecosystem dynamics in the Arctic Ocean's Last Ice Area*

1) Perform pigment analyses on surface sediment and core samples to evaluate the distribution and assess changes in the contribution of different functional groups of primary producers to export primary production in the Nares Strait/Lincoln Sea region;

2) Apply a suite of sedimentary and biogenic proxies (microfossils, biomarkers, elemental and isotopic geochemical analyses, biogenic silica) to reconstruct changes in primary production and paleo-environmental conditions in the Nares Strait/Lincoln Sea region;

3) Explore the potential of sedimentary ancient DNA as a new tool to unravel ecosystem changes through time in the Nares Strait/Lincoln Sea region. This includes refining and developing micro-algal proxies for Arctic sea-ice changes and improving genetic reference datasets for key species. Microeukaryotes, particularly diatoms and dinoflagellates, are the

sources of the most used biogenic proxies for reconstructing past environmental changes from sedimentary records (i.e. dinoflagellate cysts, diatoms, and sea-ice biomarkers). However, their records are incomplete, and much is still unknown about the biology, taxonomy, and complexity of ecological responses of these groups. Complementary approaches are therefore needed. Sedimentary ancient DNA holds the promise of allowing for ecosystem-wide reconstructions of climate-driven changes for a wide range of species, across all trophic levels.

32.2 Methodology

32.2.1 *Operations conducted during the Leg / Methodology*

Camille Brice, Juliette Girard, Brayden Harker, Kelsey Koerner, Audrey Limoges, Charlotte Stancu and Sofia Ribeiro were responsible for coring operations. The multibeam echosounder (Konsberg EM304) and 3.5-kHz chirp sub-bottom profiler (Knudsen 3260) were used in collaboration with the Amundsen Science tech Daniel Amirault, Alexis Belko and Charlotte Stancu to ensure that the seabed was suitable for deployment of the corers, as well as to identify the thickest apparent deglacial/Holocene sequences with the absence of mass movements and/or sediment perturbations (See section 20). The sub-bottom profiles and bathymetry imagery were useful in choosing coring site locations and validating the composition of the seafloor upon arrival to certain sites with scarce data. It should be noted that the sub-bottom was turned off in Jones Sound.

32.2.2 *Plankton net sampling*

See section 15

32.2.3 *Coring*

Van Veen Sampling from the Zodiac and Barge

A small Van Veen grab was used to sample surface sediment from the zodiac close to Ausuittuq and Qausuittuq (Resolute) coasts (Table 32-3; Figure 32-5). For the Ausuittuq sampling operation, the Van Veen grab was hand-deployed using a pulley system off the side of the zodiac to depths between 5 and 50 m. At Qausuittuq, the barge was used for the sampling and the Van Veen grab was deployed using an automatic winch system. The sediments retrieved from this site were put in Whirl-Paks© and once back on the Amundsen, stored in a refrigerated container (4°C). Benthic organisms collected with the Van Veen grab were also kept and stored at -80°C. The coastal sediment sampling campaign was for the PhD thesis of Camille Brice.

Box Core

The box core (BC) collects up to 0.125 m3 of soft sediments from the seafloor and is suitable for any water depths (limited by winch cable length; Figure 32-1). It is used for minimum disturbance of the sediment/water interface. The BC was lowered at an average speed of 60 m/min (1 m/s). When the sampler was approximately at 100 m above the seabed, wire payout was slowed to approximately 20-25 m/min (0.33 to 0.42 m/s). On contact with the seafloor, an extra 2-3 m was given to allow box penetration, and the winch was stopped. A few seconds thereafter, the corer was uplifted back at a slow rate, at approximately 10 m/min (0.17 m/s). It is at this time that the spade is deployed into the mud and the apparatus is pulled out. Next, the wire speed was increased to 60 m/min (1 m/s). During the expedition, the box corer was deployed and successfully sampled 47 times as part of the ArcticNet programs Seafloor mapping and REDAO (Table 32-1).

When the sediment volume was sufficient (which was the case for most deployments), two push cores (PVC tubes of 10 cm diameter and ~60 cm length) were taken from each box core using a vacuum pump to reduce compaction. The sediment/water interface from each box-core location was subsampled into five whirl-pak bags for dinoflagellate cysts (Rochon), mineralogy (Montero-Serrano), and for sedaDNA, germinations and a suite of biogenic and sedimentary tracers (Limoges, Ribeiro). Occasionally, surface sample was taken for microplastic (Evans) and for benthic biodiversity (Blais, Combaz). At each mooring station, three additional push cores were collected as well as an extra surface sample for pigments analysis (Limoges). RED-AO surface sediment samples were collected from 30 box cores into sterile whirl-pak bags using sterile sampling equipment by a scientist wearing a protection sleeve apron, gloves and mask, and frozen at -80°C immediately after collection (Ribeiro, Limoges). Push cores from selected sites were retrieved using cleaned liners, immediately sealed and kept at 4°C until further analyses (Limoges, Normandeau, Ribeiro). Finally, water samples for eDNA analyses were collected during Rosette operations at several depths: surface, SCM, 200m and bottom (see ArcticCore report section, collaboration with C. Michel and team section 13).

Additionally, pictures were taken of the top and side view of the box core to show sediment characteristics at each site. In some cases, the side profile was not captured due to the collection of half the box core for biodiversity (see ArcticNet report by Philippe Archambault section 30), or due to the soupy nature of the sediment.

Figure 32-1: Deployment of the box corer (photo: Camille Brice)

Gravity Core

The gravity core (GC; Figure 32-2) has a maximum recovery length of ~2.80 m (in a 3.05 m aluminum barrel) using a stainless-steel cutting head and penetrating the sediment under a 136 kg weight. A core catcher keeps the sediment in the corer when the latter is pulled upward. Winch speeds (lowering) ranged from 60 to 80 m/min (1-1.33 m/s) depending on estimated substrate properties and speed is kept until seafloor is reached. An additional 3m was given to let the corer penetrate the sediment. The GC was then retrieved at 10m/min to extract it from the sediments and afterward at 60m/min. During the expedition, the GC was deployed once (Table 32-2; Figure 32-5). Note that BC collected in conjunction with a GC allows recovery of the undisturbed sediment-water interface, which is usually perturbed when the GC enters the sediments. Ideally, push cores from box-cores can be correlated visually, chronostratigraphically, or geochemically with gravity cores from the same site.

Giant gravity corer

A total of 11 giant gravity cores were deployed during the Leg 3. The GGC was deployed once with only one barrel, thus allowing a maximum recovery of 3m long core, and deployed twice with two barrels (Table 32-2; Figure 32-5).

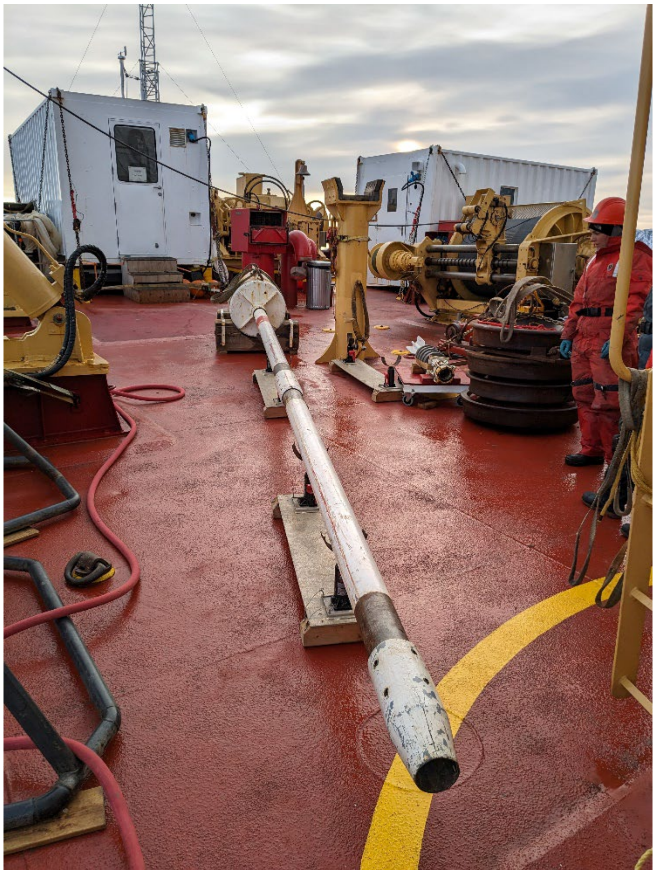

Figure 32-2: Assembly of the giant gravity core (two barrels)

A box core with two push cores were taken at each GGC coring sites in order to collect an intact sediment surface. The GGC was deployed at a speed of 80 m/min until reaching the sediment (if the cable stays straight during the descent). If conditions cause the cable to be angled, a pause is necessary at 50-100m from the bottom to allow the cable to go straight. Once the giant gravity core has penetrated seafloor, an additional 10m of cable is released. The GGC is retrieved at 10m/min until it is free from the sediments, then at 60 m/min until recovery.

Figure 32-3: Butterfly valve (picture Jean-Carlos Montero-Serrano)

Core identification and labelling

The sediment core samples were labelled using the following numbering system:

AMD2303-01BC
AMD = Amundsen
23 = Year 2023
03 = Leg # 3
01 = core number (sequential series; i.e. 1, 2, 3,…., x)
BC = Corer type (e.g., BC = box core, GC= gravity core, GGC = giant gravity core)
AB = Core section if applicable

The 1.5 m subsections of the GC were labelled as per Fig. 4 with A being the base and section AB being the lowest section, followed by BC, CD etc. sequentially. Where multiple push cores were taken from a box core, they were labelled by the addition of a sequential alphabetical identifier, e.g. 03BC-A, 03BC-B, 03BC-C, etc.

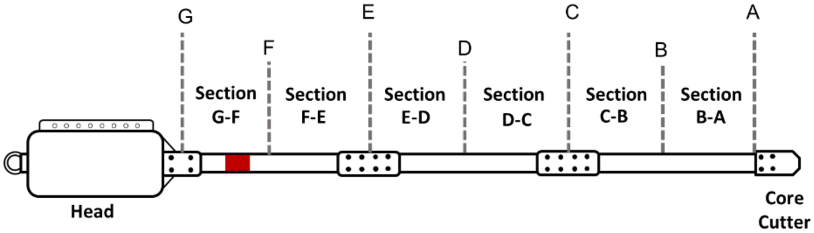

Figure 32-4: Labelling system for sections of gravity cores.

Core samples will be retained in refrigerated storage on the *CCGS Amundsen* during Leg 4 to be removed on demobilization during end of October in Québec City. Cores will then be shipped, and stored, and analyzed in detail at ISMER-UQAR, GSC and UNB.

For stations 4.6.1 and 4.6.2, cores were labeled following Natural Resources Canada (NRCan) system:

2023805 – 0001 push core A
2023 = year
805 = Cruise number
0001 = Station number
Push core = Corer type (GGC = giant gravity core)
A = Push core sequential alphabetical identifier
A/B = Core section for GGC only
Preliminary Results

51 stations were sampled during the cruise for a total of 103 physical samples

- 22 plankton nets,
- 47 box cores;
- 1 gravity core;
- 11 giant gravity cores;
- 11 Van Veen grabs from zodiac at Ausuittuq;
- 11 Van Veen grabs from barge at Qausuittuq;
- ~7000+ km of multibeam bathymetry data

The mission was successful with the collection of multiple phytoplankton (PN), sediment (VV, BC, GC, GGC), and water samples (Table 32-1; Table 32-2; Table 32-3). Despite an ambitious cruise plan containing several contingencies, all priority coring areas have been completed. Only few coring operations failed or got canceled due to the rocky nature of the seafloor. Box cores at stations Sverdrup and AC17 were deployed but were not sampled because only rocks were collected. A giant gravity core was planned at station AC17 but was canceled after the deployment of an unsuccessful box core.

All the sediment samples collected in this expedition will be stored and analyzed in detail in the laboratories at ISMER-UQAR, UNB, Natural Resources Canada in Halifax, and the Geological Survey of Denmark and Greenland (Table 32-1; Table 32-2; Table 32-3). Sediment samples will be studied for their mineralogical, geochemical (elemental and isotopic), biormarker, microfossil (benthic and planktonic foraminifera), palynological (dinoflagellate cysts), sedaDNA, magnetic, and siliciclastic grain-size signatures. Such studies will provide foundational information to improving our understanding on the past and present seafloor sediment composition, glacier-ocean interactions, long-term changes in primary production, dinoflagellate communities living in Canadian Arctic and Holocene sedimentation history of the eastern Canadian Arctic Archipelago.

Finally, from a student and HQP-training perspective, the expedition was a unique opportunity for Juliette Girard, Camille Brice, Kelsey Koerner, Charlotte Stancu, Alexis Belko and Brayden Harker to receive hands on training on ship.

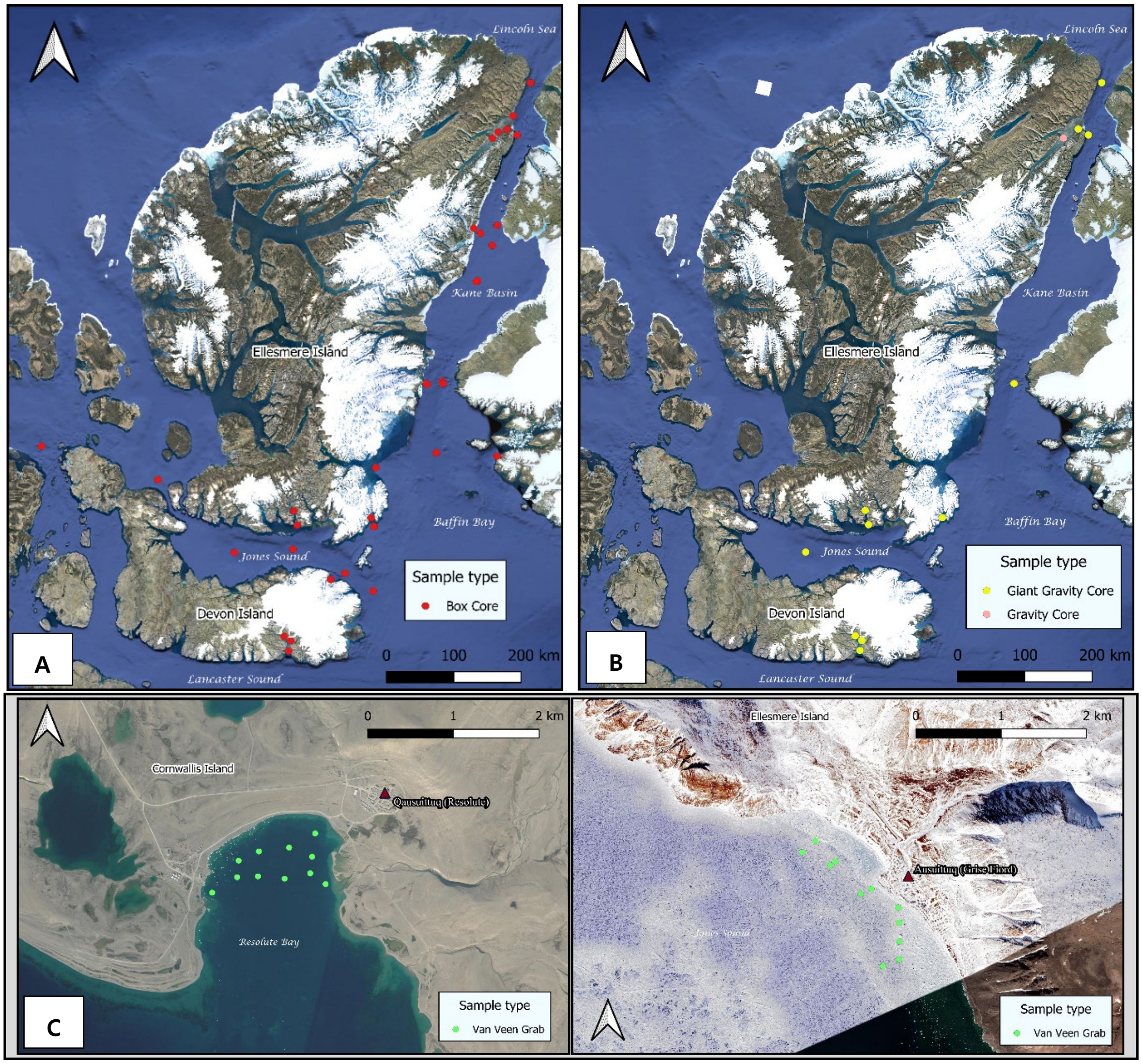

Figure 32-5: Location of sediment sampling sites for a) Box cores, b) Giant and Gravity cores & c) Van Veen grabs

Table 32-1: List of box cores collected

Station ID	Box core ID	Date/Time (UTC)	Latitude	Longitude	Depth (m)	Surface Samples RED-AO	Surface Samples Arctic Seafloor	No. of push cores	Push Cores Length	Archived at	Comment
AC14	AMD2303-01BC	2023/09/09 20:55:38	75.4945582	-78.838044	540.84	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS)	2	A = 51cm (1cm compression) B = 50.5cm (0.5cm compression)	A = ISMER B = ISMER	
AF-23	AMD2303-02BC	2023/09/12 20:05:45	81.5478633	-64.9644608	604.86	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C) Pigments (-80°C , dark)	1 (JCMS)	5	A = 34.5cm (0cm compression) B = 32.5cm (2cm compression) C = 34.5cm (2cm compression) D = 28cm (0cm compression) E = 27cm (1cm compression)	A = UNB [DNA] B = UNB [Pigments] C = UNB [ALL] D = ISMER E = ISMER	Push core A [DNA]: missing sediment 5-6cm long and 3-4cm deep.
AF-23	AMD2303-03BC	2023/09/12 22:50:56	81.5470617	-64.9446663	585.29	---	---	---	---	---	For Phillippe Archambault
AF-23	AMD2303-04BC	2023/09/13 00:20:45	81.547119	-64.977053	605.02	---	1 (JCMS) 1 (AR)	---	---	---	
AC2	AMD2303-05BC	2023/09/13 06:00:19	81.5409193	-65.8072848	393.93	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	3	A = 34.5cm (2.5cm compression) B = 33cm (3cm compression) C = 33.5cm (4.5cm compression)	A = ISMER B = ISMER C = UNB [ALL]	
AC3	AMD2303-06BC	2023/09/13 13:41:15	81.4780172	-66.4774508	380.22	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	3	A = 34cm (2cm compression) B = 36cm (1cm compression) C = 35.5cm (1.5cm compression)	A = ISMER B = ISMER C = UNB [ALL]	
AC3	AMD2303-07BC	2023/09/13 14:17:14	81.4784535	-66.4776275	367.19	---	---	---	---	---	For Phillippe Archambault
Lsea-23	AMD2303-08BC	2023/09/14 14:11:41	82.0620035	-61.490821	534.34	---	---	---	---	---	For Phillippe Archambault
Lsea-23	AMD2303-09BC	2023/09/14 14:53:59	82.0630645	-61.5132912	580.51	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C) Pigments (-80°C , dark)	1 (JCMS) 1 (AR)	5	A = 37cm (0 compression) B = 39cm (2cm expansion) C = 38cm (1cm compression) D = 38cm (0.5cm compression) E = 36cm (1.5cm compression	A = UNB [DNA] B = UNB [Pigments] C = UNB [ALL] D = ISMER E = ISMER	Spatula broke in D or E probably at the base of core
AC1	AMD2303-10BC	2023/09/15 06:25:43	81.7004202	-64.0795375	513.29	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 31.5cm (0cm compression) B = 31.5cm (0cm compression)	A = ISMER B = ISMER	
AC4	AMD2303-11BC	2023/09/15 22:12:43	81.4333435	-64.2515715	639.18	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	3	A = 27cm (0cm compression) B = 27.5cm (2cm compression) C = 27cm (0cm compression)	A = ISMER B = ISMER C = UNB [ALL]	surface sediment (SR/AL, JCMS, AR)
AC4	AMD2303-12BC	2023/09/15 22:59:20	81.4331203	-64.2481123	639.48	---	---	---	---	---	For Phillippe Archambault
AC18	AMD2303-13BC	2023/09/16 16:42:04	80.3197697	-69.7381873	192.48	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (AR)	---	---	---	Surface sediment was disturbed/tilted
AC18	AMD2303-14BC	2023/09/16 17:08:30	80.3212208	-69.7354985	201.18	---	1 (JCMS)	2	A = 17cm (0cm compression) B = 15.3cm (0cm compression)	A = ISMER B = ISMER	Push cores did not make it fully to the bottom of the box
AC19	AMD2303-15BC	2023/09/17 00:44:13	80.2378673	-69.2892165	283.43	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 24.5cm (0cm compression) B = 21cm (1cm compression)	A = ISMER B = ISMER	
AC20	AMD2303-16BC	2023/09/17 09:10:15	80.2991067	-67.8751565	171.52	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS)	---	---	---	sandy/rocky sediment, surface disturbed (box got jammed on rocks and did not fully close)
134	AMD2303-17BC	2023/09/18 01:08:52	80.0419755	-68.6032945	245.88	---	---	---	---	---	For Phillippe Archambault
134	AMD2303-18BC	2023/09/18 01:38:42	80.0412688	-68.5979278	244.77	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	---	---	---	Sediment was collapsed no push cores taken
133	AMD2303-19BC	2023/09/18 12:24:53	79.6038283	-70.2230375	159.63	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	---	---	---	---	
133	AMD2303-20BC	2023/09/18 13:13:48	79.5943305	-70.338602	173.41	Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 28cm (0cm compression) B = 39cm (0cm compression)	A = ISMER B = ISMER	Box core was tilted Push core A: fell on deck. Rock at
129	AMD2303-21BC	2023/09/19 08:30:57	78.3058718	-73.7721142	691.39	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	1	A = 38cm (2cm compression)	A = ISMER	For Phillippe Archambault, snowing during sampling
Nares-West-23	AMD2303-22BC	2023/09/20 00:31:06	78.2860447	-74.7740972	619.45	---	---	---	---	---	All rocks
Nares-West-23	AMD2303-23BC	2023/09/20 01:29:33	78.2975137	-74.8269775	572.03	DNA (-80°C) Microfossils+ (-80°C) Pigments (-80°C , dark)	---	---	---	---	"Surface sediment" collected, had to remove top layer of rocks to collect surface sample

Nares-East-23	AMD2303-24BC	2023/09/20 15:53:34	78.2752563	-73.7300097	688.42	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C) Pigments (-80°C , dark)	---	---	---	---	
Nares-East-23	AMD2303-25BC	2023/09/20 18:25:27	78.270154	-73.7343543	697.33	---	1 (JCMS) 1 (AR)	5	A = 33.5cm (0cm compression) B = 36cm (1cm expansion) C = 33.5cm (0cm compression) D = 33cm (0cm compression) E = 34.5cm (1cm expansion)	A = UNB [DNA] B = UNB [ALL] C = UNB [Pigments] D = ISMER E = ISMER	
122	AMD2303-26BC	2023/09/21 11:06:50	77.3358122	-74.680242	675.16	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (AR)	---	---	---	For Phillippe Archambault
CEOS-M1-23	AMD2303-27BC	2023/09/21 22:27:16	77.1798652	-71.070937	464.14	DNA (-80°C) Microfossils+ (-80°C)	---	---	---	---	Bulk sediment collected flap on the box core got stuck open, barely any
AC12	AMD2303-28BC	2023/09/22 16:44:29	77.1957485	-78.3984195	570.45	---	---	---	---	---	For Phillippe Archambault
AC12	AMD2303-29BC	2023/09/22 17:21:23	77.1949652	-78.3988327	565.43	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	4	A = 44.8cm (0cm compression) B = 41cm (not noted) C = 46.7cm (0.5cm compression) D = 48cm (1cm expansion)	A = UNB [DNA] B = UNB [ALL] C = ISMER D = ISMER	Note for DNA:snowing during sampling
AC13	AMD2303-30BC	2023/09/23 16:49:51	76.3843403	-78.6362462	220.31	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	---	---	---	---	
AC13	AMD2303-31BC	2023/09/23 17:14:50	76.3830582	-78.6576417	214.8	---	1 (JCMS) 1 (AR)	2	A = 51cm (0cm compression) B = 40cm (1cm compression)	A = ISMER B = ISMER	
Site 1.2	AMD2303-32BC	2023/09/24 15:11:14	76.5027363	-78.7910557	131.55	---	---	---	---	---	For Phillippe Archambault
Site 1.2	AMD2303-33BC	2023/09/24 15:34:07	76.5040635	-78.797337	128.59	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 55.5cm (0cm compression) B = 52.5cm (0cm compression)	A = ISMER B = ISMER	
*BG-04	AMD2303-34BC	2023/09/25 12:57:13	75.6645977	-81.1005335	322.37	DNA (-80°C) Microfossils+ (-80°C)	---	1	A = 57cm (0cm compression)	A = ISMER	*labelled as BG-01 in ship records. For Phillippe Archambault
BG-07	AMD2303-35BC	2023/09/26 03:44:48	75.7490313	-80.3248795	617.12	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	---	---	---	---	For Phillippe Archambault
AC16	AMD2303-36BC	2023/09/27 09:44:25	76.0721772	-83.1907265	672.04	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 43cm (expansion ~0-2cm) B = 45cm (1cm compression)	A = ISMER B = ISMER	
Site 4.6.1	AMD2303-37BC	2023/09/27 13:45:28	76.4070082	-83.0003873	368.99	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	3	A = 27.7cm (0cm compression) B = 28cm (0cm compression) **C = 27.2cm (0 compression)	A = ISMER B = ISMER C = NRCan	**NRCan ID = 202305 0001 (Push core A)
Site 4.6.2	AMD2303-38BC	2023/09/27 18:14:37	76.6016112	-83.2292837	140.08	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	---	---	---	---	For Phillippe Archambault No pictures
Site 4.6.2	AMD2303-39BC	2023/09/27 18:37:50	76.6015537	-83.2241658	139.84	---	1 (JCMS) 1 (AR)	3	A = 27cm (0cm compression) B = 21cm (2cm expansion) **C = 24cm (1cm extension)	A = ISMER B = ISMER C = NRCan	**NRCan ID = 2023805 0002 (Push core A)
JonesS-23	AMD2303-40BC	2023/09/28 19:27:53	75.9763408	-86.4147432	662.3	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C) Pigments (-80°C , dark)	1 (JCMS)	5	A = 48.5cm (0cm compression) B = 45.2cm (0cm compression) C = 45cm (0cm compression) D = 45.5cm (0cm compression) E = 45cm (0cm compression)	A = ISMER B = UNB [Pigments] C = UNB [ALL] D = ISMER E = UNB [DNA]	Push core A: lifted slightly while removing the box
NB-01	AMD2303-41BC	2023/09/29 21:34:53	76.8360947	-91.27805	292.99	Microfossils+ (-80°C)	---	---	---	---	Bulk sediment, very little sediment
NB-02	AMD2303-42BC	2023/09/30 17:24:46	76.920534	-98.3995392	436.42	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 41cm (0cm compression) B = 42.5cm (0cm compression)	A = ISMER B = ISMER	
CB-02	AMD2303-43BC	2023/10/02 18:11:43	74.8670085	-83.4795798	229.08	---	---	---	---	---	Box core overshot. For Phillippe
CB-02	AMD2303-44BC	2023/10/02 18:39:38	74.8669973	-83.4789953	229.4	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 48cm (1cm compression) B = 58cm (0cm compression)	A = ISMER B = ISMER	Box core overshot. "Surface sediment" collected Push core A: ~5cm lost from bottom
CB-06	AMD2303-45BC	2023/10/03 05:06:20	74.668992	-83.213445	402.22	---	---	---	---	---	For Phillippe Archambault
CB-06	AMD2303-46BC	2023/10/03 05:44:38	74.6691772	-83.2131112	402.38	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 44cm (0cm compression) B = 46cm (0cm compression)	A = ISMER B = ISMER	
CB-04	AMD2303-47BC	2023/10/03 10:49:36	74.805166	-83.1327283	301.48	DNA (-80°C) Germination (4°C , dark) Microfossils+ (-80°C)	1 (JCMS) 1 (AR)	2	A = 40cm (0cm compression) B = 39.5cm (0cm compression)	A = ISMER B = ISMER	

Table 32-2: List of gravity cores collected

Station ID	Core ID	Date/Time (UTC)	Latitude	Longitude	Corer type	Depth (m)	Corer length (m)	Core length (m)	Section lengths	Program	Archived at	Comment
AC3	AMD2303-01GC	2023/09/13 14:48:32	81.47873	-66.4753	Gravity Core	367.3	3	0.44	AB = 0.44m	Arctic Seafloor/RED-AO	ISMER	
AF-23	AMD2303-01GGC	2023/09/12 21:12:06	81.54773	-64.9606	Giant Gravity Core	603.24	9	3.99	AB = 1.5m BC = 1.53m CD = 0.96m	Arctic Seafloor/RED-AO	NRCan - UNB	
Lsea-23	AMD2303-02GGC	2023/09/14 15:54:05	82.06309	-61.5128	Giant Gravity Core	580.41	3	1.95	AB = 1.5m BC = 0.45m	Arctic Seafloor/RED-AO	NRCan - UNB	
AC4	AMD2303-03GGC	2023/09/15 20:31:41	81.43293	-64.2451	Giant Gravity Core	638.68	6	3.24	AB = 1.5m BC = 1.55m CD = 0.19m	Arctic Seafloor	ISMER	
Nares-East-23	AMD2303-04GGC	2023/09/20 19:17:37	78.27138	-73.7398	Giant Gravity Core	715.13	9	5.822	AB = 1.495m BC = 1.51m CD = 1.51m DE = 1.307m	Arctic Seafloor/RED-AO	NRCan - UNB	
Site 1.2	AMD2303-05GGC	2023/09/24 17:09:13	76.5042	-78.7903	Giant Gravity Core	129.66	9	3	AB = 1.5m BC = 1.5m	Arctic Seafloor	ISMER	10cm lost at the top. Upper 20 cm disturbed
Site 4.6.1	2023805-0001GGC (AMD2303-06GGC)	2023/09/27 14:38:40	76.40727	-82.9981	Giant Gravity Core	369.57	9	~0.5	---	Arctic Seafloor/NRCan	NRCan	Core was not recovered
Site 4.6.2	2023805-0002GGC (AMD2303-07GGC)	2023/09/27 19:11:56	76.60167	-83.2235	Giant Gravity Core	139.61	9	2.08	AB = 1.49m BC = 0.59m	Arctic Seafloor/NRCan	NRCan	Upper 10 cm disturbed
JonesS-23	AMD2303-08GGC	2023/09/28 20:11:19	75.97611	-86.4135	Giant Gravity Core	662.28	6	2.87	AB = 1.5m BC = 1.37m	Arctic Seafloor/RED-AO	ISMER	About 5cm lost between sections AB and BC
CB-02	AMD2303-09GGC	2023/10/02 19:13:55	74.86691	-83.4801	Giant Gravity Core	229.06	9	5.345	AB = 1.5m BC= 1.5m CD = 1.5m DE = 0.845m	Arctic Seafloor	ISMER	
CB-04	AMD2303-10GGC	2023/10/03 12:44:14	74.80533	-83.133	Giant Gravity Core	300.6	9	5.565	AB = 1.5m BC= 1.5m CD = 1.5m DE = 1.065m	Arctic Seafloor	ISMER	
CB-06	AMD2303-11GGC	2023/10/03 14:29:05	74.6691	-83.2105	Giant Gravity Core	402.84	9	4.63	AB = 1.5m BC= 1.5m CD = 1.63m	Arctic Seafloor	ISMER	CD is longer than standard 1.5m core in order to keep last 13cm intact

Table 32-3: List of Van Veen grabs collected

ID	Community	name	latitude	longitude	elevation (m)	time
1	Grise Fiord	AMD2303-3.01	76.42347897	-82.9386	-28.958042	2023-09-27T12:55:13Z
2	Grise Fiord	AMD2303-3.02	76.42134402	-82.9293	6.508791	2023-09-27T13:06:04Z
3	Grise Fiord	AMD2303-3.03	76.41847003	-82.9129	4.013096	2023-09-27T13:30:57Z
4	Grise Fiord	AMD2303-3.04	76.41654597	-82.9006	10.954433	2023-09-27T13:47:21Z
5	Grise Fiord	AMD2303-3.05	76.41489398	-82.8999	5.00842	2023-09-27T13:53:44Z
6	Grise Fiord	AMD2303-3.06	76.41287101	-82.8995	4.019256	2023-09-27T13:59:13Z
7	Grise Fiord	AMD2303-3.07	76.41011998	-82.9065	5.980058	2023-09-27T14:13:22Z
8	Grise Fiord	AMD2303-3.08	76.41788397	-82.9175	8.72801	2023-09-27T15:38:26Z
9	Grise Fiord	AMD2303-3.09	76.42086097	-82.9316	15.131633	2023-09-27T15:46:19Z
10	Grise Fiord	AMD2303-3.10	76.42219604	-82.9444	8.090377	2023-09-27T15:58:02Z
11	Grise Fiord	AMD2303-3.15	76.41092003	-82.8993	3.953898	2023-09-26T19:51:37Z
1	Resolute	AMD2303-3.32	74.69229603	-94.8508	-1.718019	2023-10-04T14:42:48Z
2	Resolute	AMD2303-3.33	74.69016703	-94.8595	5.399942	2023-10-04T14:58:58Z
3	Resolute	AMD2303-3.35	74.68904	-94.8708	1.654317	2023-10-04T15:02:59Z
4	Resolute	AMD2303-3.36	74.68677999	-94.8583	0.699319	2023-10-04T15:52:34Z
5	Resolute	AMD2303-3.37	74.68977098	-94.8498	6.006273	2023-10-04T14:48:05Z
6	Resolute	AMD2303-3.38	74.68638302	-94.8688	3.733037	2023-10-04T15:07:58Z
7	Resolute	AMD2303-3.40	74.68797399	-94.8489	4.911911	2023-10-04T14:53:56Z
8	Resolute	AMD2303-3.41	74.68578698	-94.8767	4.116561	2023-10-04T15:13:34Z
9	Resolute	AMD2303-3.43	74.68355304	-94.8849	-465.227051	2023-10-04T15:22:03Z
10	Resolute	AMD2303-3.44	74.68757199	-94.8777	-2.112825	2023-10-04T15:35:42Z
11	Resolute	AMD2303-3.45	74.68720403	-94.842	4.502372	2023-10-04T15:58:28Z

32.1 Recommendations

There were a few items that could be replaced or upgraded to ensure maximum efficiency and performance when coring:

1. The screws that fix the metal box on the box corer have become stripped and need to be replaced. Additionally, some of the cams fixing the spade on the box corer cannot be tightened and could also be replaced.

2. Many of the jacks that are used to level the giant gravity core are jammed (due to rust from exposure to salt water) and will need to be replaced.

3. Opening system of the container “Science Cargo #10” needs to be fixed: rusty screw

4. Finallly, due to the interest of many teams on board in collection of surface sediment, we recommend a universal naming system for all box cores and gravity cores that can be used interchangeably by all teams that process sediment samples.

33 ArcticNet Community Based Hudson Bay Ice-Ocean Project

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33.1 Objectives

Collect cores to assess sedimentation rates and organic matter composition and accumulation rates.

33.2 Methodology

33.2.1 *Sediments biogeochemistry*

Push cores of 10 cm diameter were collected from the box core sampler and stored at 4 °C. They were then sectioned in layers Table 33-2 within 12 hours after collection and individually bagged. Sectioned samples were kept at -20 °C until further analysis. Analyses that will be performed on these layers include sedimentation rate, radioisotope dating, porosity, total mercury concentration, PAH, n-alkanes, PCBs, total carbon, total inorganic carbon, and C/N isotopes. In addition, surface sediments were collected from river sites during helicopter deployments.

At a few stations, box core deployments were not successful (see Table 33-3 for details on box core deployments).

Table 33-1: Sampling activities conducted during Leg 4 of the 2023 *CCGS Amundsen* expedition

Station name	AM 23 Station ID	Latitude (N)	Longitude (W)	Date	Sediment biogeochemistry	Comments
29	025	72.423333	89.880000	06-10-2023	S	Too much snow and ice up river, sampled at the delta
30		71.929	90.017	06-10-2023		River was frozen and there was a polar bear in the area
322-GB	026	70.40058	91.10076	07-10-2023	C, S, G, P	
322-GB		70.40061	91.10062	07-10-2023	C	
31		70.048	92.469			Canceled due to weather
SPR-004	027	69.05262	86.21461	08-10-2023	C, S, G	
3		70.309689	82.993			Canceled due to weather
2		70.151022	81.6781			Canceled due to weather
21		70.458085	79.482			Canceled due to weather
22		70.405504	78.6941			Canceled due to weather
23		70.262892	77.7714			Canceled due to weather
25		69.983735	76.991			Canceled due to weather
333		68.77116	80.84092	10-10-2023	C	
333		68.77144	80.83972	10-10-2023	C	
334		67.88080	80.80087	10-10-2023	C	
334		67.88044	80.80150	10-10-2023	C	
334	028	67.88163	80.80353	10-10-2023	C, S, G	
5		68.889581	81.9671			Canceled due to weather
4		68.413226	82.5254			Canceled due to weather
FoxSIPP-03		66.90869	80.82774	11-10-2023	V	
FoxSIPP-03	029	66.90875	80.82718	11-10-2023	C	
338		66.16683	81.32876	11-10-2023	C	
338	030	66.16719	81.32622	11-10-2023	C, S, G, P	
7		67.330117	81.3085			Canceled due to weather
350		64.50794	80.47573	12-10-2023	C	

350	031	64.50785	80.47566	12-10-2023	C, S, G, P	
FoxSIPP-07		64.40228	81.44700	13-10-2023	V	
6	032	67.012700	81.860556	13-10-2023	S	Polar bear spotted near coast, moved further up river
FoxSIPP-08		66.00560	83.15313	13-10-2023	C	
FoxSIPP-08		66.00561	83.15304	13-10-2023	C	
FoxSIPP-08		66.00485	83.15286	13-10-2023	C	
FoxSIPP-08	033	66.00471	83.15290	13-10-2023	C, S, G, P	
FoxSIPP-09	034	65.52656	82.57440	14-10-2023	C, S, G, P	
FoxSIPP-M		65.13945	81.34089	14-10-2023	C	
FoxSIPP-M	035	65.13969	81.33908	14-10-2023	C, S, G, P	
FoxSIPP-10	036	64.79048	80.69858	14-10-2023	C, S, G, P	
349		64.68466	78.58397	15-10-2023	C	
12		65.424806	76.7663			Canceled due to weather
8		65.271076	75.8341			Canceled due to weather
HS22-001	037	64.19700	75.62500	16-10-2023	C, S, G, P	
HS22-003		63.85201	75.09227	16-10-2023	C	
HS22-006	038	63.04912	74.31706	17-10-2023	C, S, G, P	
14E	039	62.27796	71.98642	18-10-2023	C, S, G	
0		63.166988	70.7702			Canceled due to weather
1		62.908515	70.5004			Canceled due to weather
26		62.9675	69.7439			Canceled due to weather
28		62.643	69.246			Canceled due to weather
V = Van Veen, C = Box Core, S = Bulk Surface, P = Push Core, G = Sediment genomics & Micro Biology						

Table 33-2: Thickness of layers sectioned from push cores according to their depth in the core

Section (cm)	Layer thickness (cm)
0-10	1
10-20	2
20-Bot	5

Table 33-3: General information on Box Core deployment rationale and degree of success in 2023.

Station	Depth (m)	Comments / Push core recovery
322-GB	219.28	Two box cores deployed, both successful, sampled from the first box, bulk surface taken, Push Core 31 cm, Sediment genomics & Micro Biology
SPR-004	225.11	Successful, bulk surface taken, Sediment genomics & Micro Biology
333	26.42	Two box cores deployed, both unsuccessful, too many clams and rocks
334	84.72	Three box cores deployed, two successful, sampled from the third box, bulk surface taken, Sediment genomics & Micro Biology
FoxSIPP-03	97.56	Van Veen Grab and box core deployed, box core hit rock and sample was lost
338	136.05	Two box cores deployed, both successful, sampled the second box, bulk surface taken, Push Core 31.5 cm, Sediment genomics & Micro Biology
350	389.5	Two box cores deployed, both successful, second box sampled, bulk surface taken, Push Core 25 cm, Sediment genomics & Micro Biology
FoxSIPP-08	306.28	Four box cores deployed, all successful, the third box was disturbed when removing the frame and sample lost, forth box sampled, bulk surface taken, Push Core 41 cm, Sediment genomics & Micro Biology
FoxSIPP-09	378.8	Successful, bulk surface taken, Push Core 24 cm, Sediment genomics & Micro Biology
FoxSIPP-M	431.08	Two box cores deployed, both successful, sampled from the second box, bulk surface taken, Push Core 39 cm, Sediment genomics & Micro Biology
FoxSIPP-10	400.26	Successful, bulk surface taken, Push Core 31 cm, Sediment genomics & Micro Biology
349	134.75	Unsuccessful, too many rocks
HS22-001	109.87	Successful, bulk surface taken, Push Core 25 cm, Sediment genomics & Micro Biology
HS22-003	168.49	Unsuccessful, too many rocks
HS22-006	415.23	Successful, bulk surface taken, Push Core 24 cm, Sediment genomics & Micro Biology
14E	340.87	Successful, bulk surface taken only, Sediment genomics & Micro Biology

33.3 Recommendation

More extensive mapping plans for the areas leading up to and around Foxe Channel would allow for a better sampling grid of the area.

34 BGC Argo Floats Operation and Sampling

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34.1 Introduction and Objectives

During Leg 2 of the 2022 Amundsen Science expedition, we have carried out recovery operations for BGC-Argo profilers deployed by Takuvik, as well as profiler deployments for the ERC REFINE project (https://erc-refine.eu/). The recovery of BGC-Argo profilers is important for ecological and economic reasons (given the high price of these floats), as well as for feedback on these relatively recently developed instruments. Floats deployed as part of the REFINE project are new generation floats that include new sensors such as hyper-spectral radiometry.

We also sampled 20 stations which are representative of the waters visited by the profilers. For these stations, we combined water sampling with optical measurements taken on the rosette with the same instruments used on the profilers. The aim is to better understand and interpret the measurements made by the profilers. This combination of optical measurements and water sampling on the rosette is called "phytofloat" (see Rembauville et al.).

34.2 Methodology

34.2.1 *Float recoveries*

Two floats were recovered during this Leg, both on August 26th. One (WMO 4902602) deployed in October 2021 during the Dark-Edge Leg was at the end of battery. The second float (WMO 4902630) was deployed in 2022 but encountered some issue with the new UVP6 imagery senor. It was important to recover this float in order to understand this failure.

Float WMO 4902602 Float WMO 4902630

Figure 34-1: Float WMO

The UVP6 was found with water inside, highlighting a possible design weakness, especially in cold water.

Operations: Recoveries were conducted by using the https://floatrecovery.euro-argo.eu/ web site to have the position in real time. In both cases, it was easy and fast to find the two floats. The floats were recovered by deploying the Zodiac with two people on board (Chief Officer + deckhand). A rope was attached to the float, which was then gently towed to the A-Frame. In the second recovery, a long rope was sent to the Zodiac from the Amundsen. This allowed the float to be fixed at a safe distance from the ship. The float was then brought back to the ship pulled by the rope and lifted by the A-Frame.

34.2.2 *Float deployments*

Two floats from the ERC-REFINE project (https://erc-refine.eu/) were deployed on August 26th at the BB2 station. These floats are the new Provor CTS5 Jumbo which is 25 cm longer and 10 to 20 kg heavier than previous floats. In addition, these carries more sensors and are particularly fragile and difficult to handle. These two floats are equipped with:

Lovuse025b (WMO 7901124): CTD, pH, DO, ECO Sensor (Chla + Backscattering + CDOM), OCR (3 Irradiances + PAR), SUNA (Nitrate), UVP6 (imagery sensor), CRover (transmissiometer).

Lovuse030c (WMO 4903774): CTD, DO, ECO Sensor (Chla + Backscattering + CDOM), Ramses Ed-Lu (Trios Hyperspectral sensors), UVP6 (imagery sensor), CRover (transmissiometer).

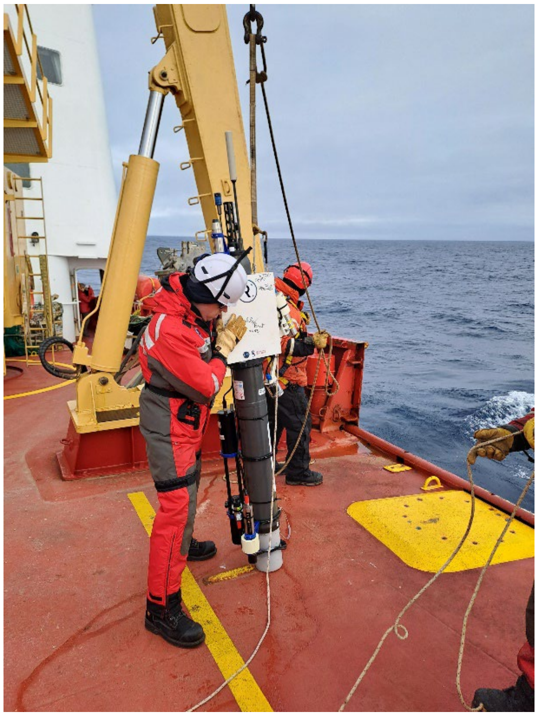
A CTD with nutrients and phytofloat sampling was carried out at BB2 right after the deployment.

Operations: During the mobilisation, floats were stored in the +4°C container on the fly deck. The idea was to have the crates accessible and protected from frost. This wasn't perfect, as the wooden crates began to moss in this wet environment. Boxes were then moved by hand to the Paleo-Lab, which proved to be very handy for floats preparation.

Figure 34-2: 3 float boxes (including Jumbo) in the paleo-Lab

On August 26, the floats were transported to the foredeck and attached to the air vent next to the mooring container 4 hours before deployment. UVP6 sensors have been mounted and floats tested. The positioning of the floats allows testing of GPS and Iridium communication. The floats are then moved by hand under the A-Frame and deployed vertically using a pin blocking a loop placed above the syntactic foam as released system (Figure 34-3).

2 floats secured on the air vent facing the mooring container



Float under the A-Frame ready for deployment

Detail of the axe allowing the release of the float for deployment

Figure 34-3: Detailed picture of the Argo float

34.2.3 *Water Sampling*

During the Leg2, we sampled 20 Stations following 2 protocols:

- 10 "HPLC" stations with 10 depths sampled from 100m up to surface. From 1 to 2L have been filtered for each sample before storage at -80°C.
- 10 "Phytofloat" Stations with 3 depths sampled (below-scm, scm and surface). For each depth we sample for: HPLC, Cytometry, Particulate Organic Carbon, Carbon Total, Nano filtration, microscopy (in Lugol).

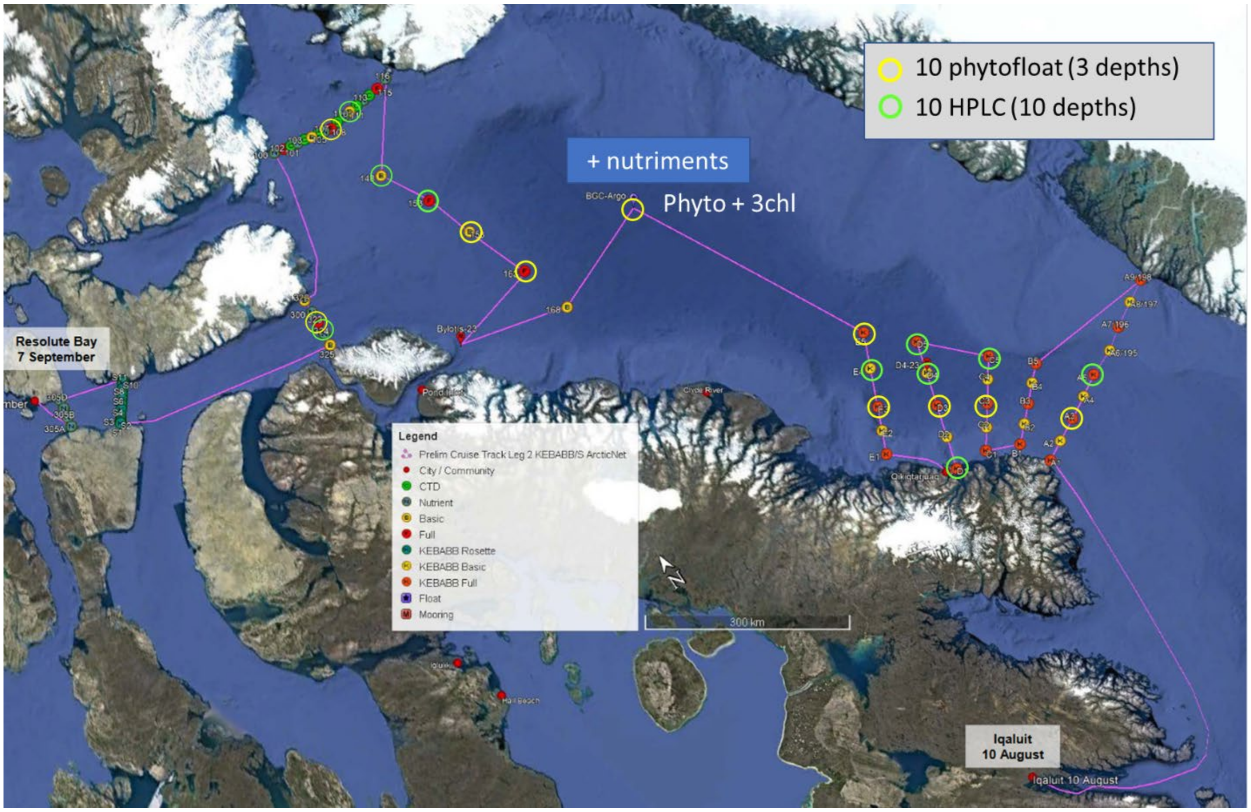
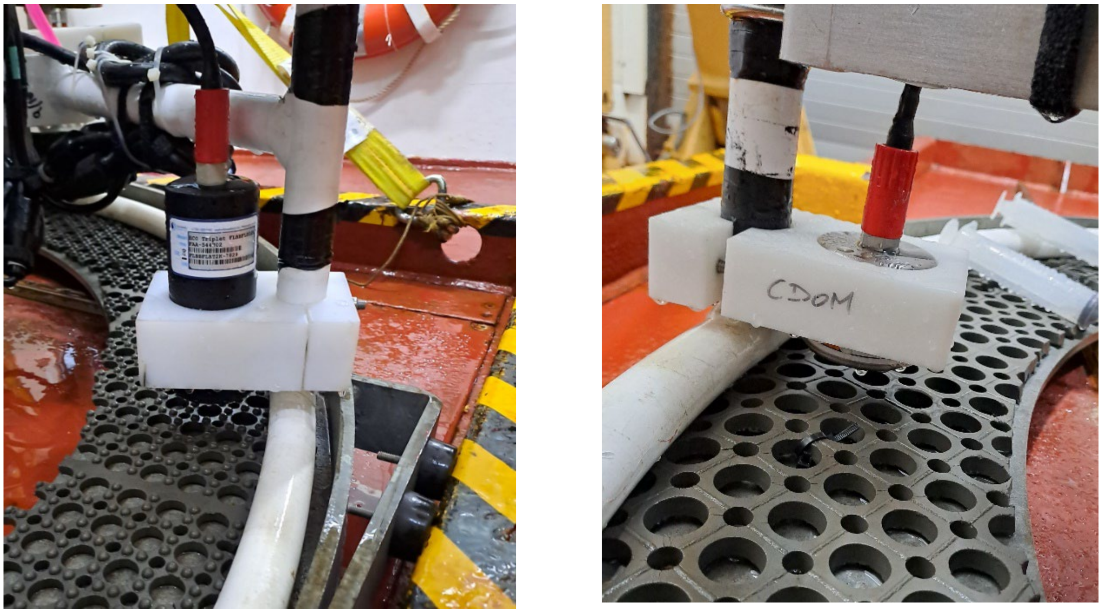


Figure 34-4: Spatial distribution and type of sampled stations

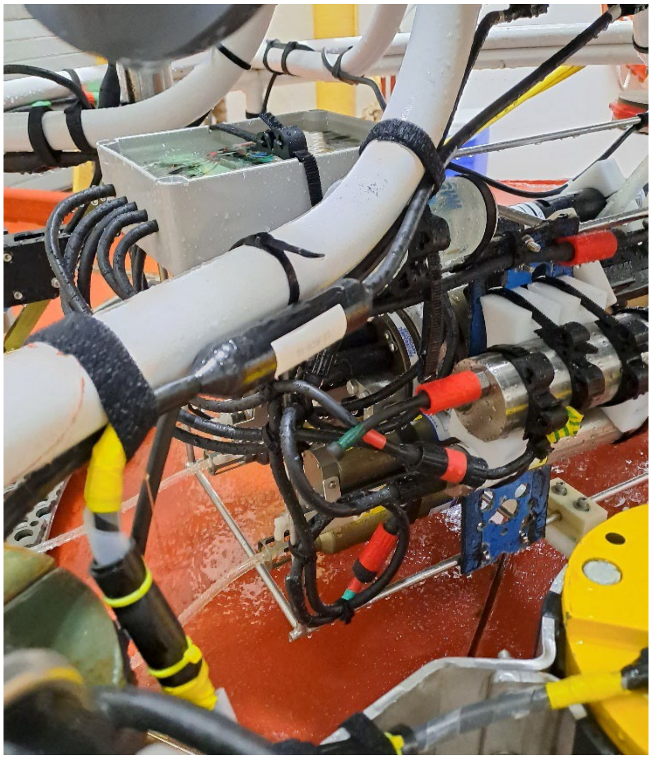
All samples will be shipped back to Villefranche sur Mer after demobilization for laboratory analysis.

34.2.4 *Optical measurements on the rosette (CIDRE)*

An autonomous optical package has been installed on the rosette. The aim is to measure the same variables on the rosette with the same sensors as those used on the floats, in order to establish a relationship with water sampling.



ECO (fLbbfl) New RBR Tridente (Flbbcd)



CIDRE data logger on top of the CTD

Figure 34-5: autonomous optical package has been installed on the rosette

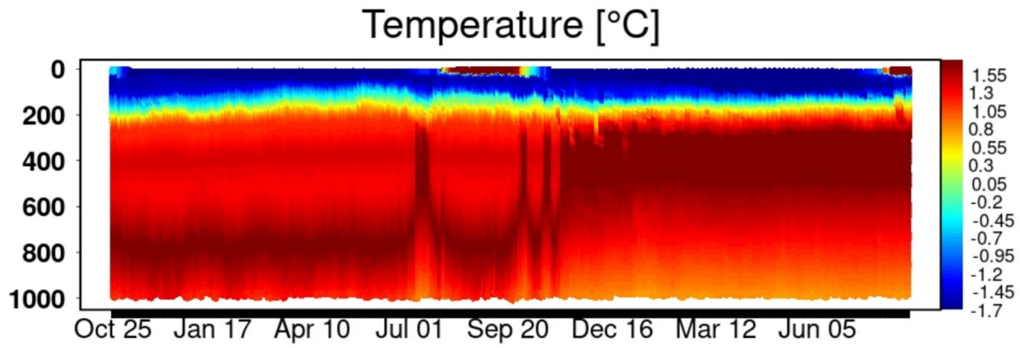
The following equipment have been installed on the rosette:

- ECO flbbfl (SN 7829) measuring Chla (Ex 470 mn), backscattering (700nm) and Chla (Ex 435 nm).
- The new RBR Tridente (SN 215310) measuring Chla (Ex 470 mn), backscattering (700nm) and CDOM
- A CIDRE data logger with his battery
- Seabird depth sensor (SBE 50.1620 SN 50-0350)

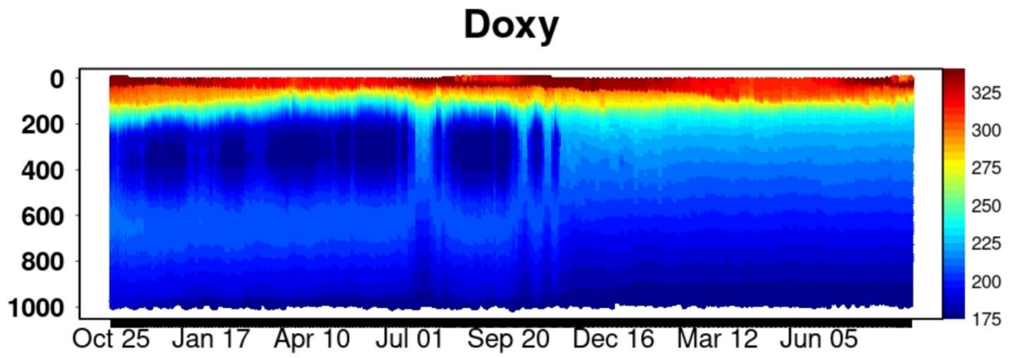
More than 60 profiles have been collected during the cruise.

34.3 Preliminary Results

There is no preliminary data from the cruise as it is mainly filtrations but we can show the 2 years time series recorded by one the recovered float (4902602):



Temperature [°C]



Doxy

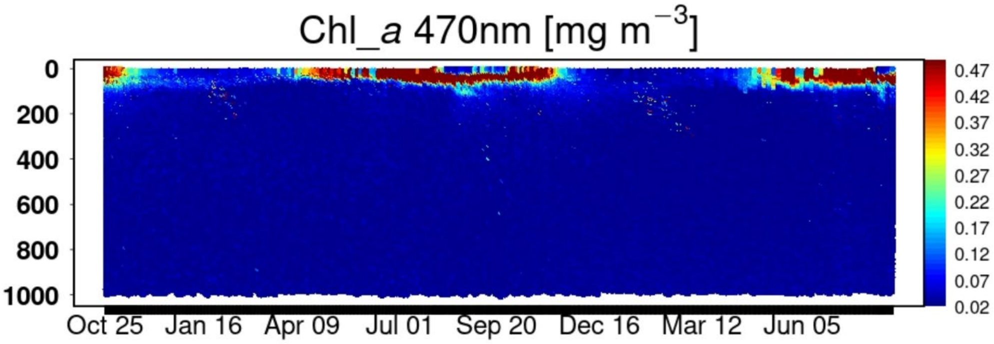


Figure 34-6: Times series recorded by one of the recovered float

34.4 Recommendations

No general recommendation. Operational recommendations were included in above task descriptions.

34.5 References

Paper using float data from Baffin Bay:

Randelhoff, A., Lacour, L., Marec, C., Leymarie, E., Lagunas, J., Xing, X., et al. (2020). Arctic mid-winter phytoplankton growth revealed by autonomous profilers. *Science Advances* 6, eabc2678. doi: 10.1126/sciadv.abc2678.
"Phytofloat" method

Rembauville, M., Briggs, N., Ardyna, M., Uitz, J., Catala, P., Penkerc'h, C., et al. (2017). Plankton Assemblage Estimated with BGC-Argo Floats in the Southern Ocean: Implications for Seasonal Successions and Particle Export. *Journal of Geophysical Research: Oceans* 122, 8278–8292. doi: 10.1002/2017JC013067.

35 Mooring Operations Leg 1

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35.1 Introduction

The 2023 Amundsen Science - DFO (Integrated Studies and Ecosystem Characterization of the Labrador Sea Deep Ocean – ISECOLD and ArcticCore) mooring operations in the Labrador Sea and Baffin Bay were successfully recovered and deployed in favourable weather conditions. The *CCGS Amundsen* mission saw 100% equipment recovery and 95 % data recovery from pre-mission expectations (no Hopedale-22 nor HiBioA-21-CROM). Leg 1 mooring operations onboard the *Amundsen* had 3 successful recoveries (SagBank-21-CROM, HiBioA-22-CROM, HiBioA-22) and 3 successful deployments (Hopedale-23, HiBioA 23, C4-23) for the ISECOLD and ArcticCore programs. The SagBank-21-CROM was also the first ROV assisted mooring recovery performed by Amundsen Science and their ROV ASTRID.

35.2 Mooring Operations

35.2.1 *2022-2023 Mooring Recovery Summary*

Hopedale-22

The first possible recovery for Leg 1 was Hopedale-22, but on Feb 19, 2023 the top float satellite beacon was at the surface for an hour and sent its position after disappearing. The position was ~100nm SE of the deployed position in the fall of 2022. The winter of 2023 was filled with many icebergs and many of large size.

The icebergs were the presumed cause of the displacement of the mooring and it was not expected to recover anything from site Hopedale-22. The multibeam had done a survey of the area and also the deckbox transducer was placed in the water and attempts at communication to the releases were made for 30min without success. This mooring was not expected to be present and we found no evidence of it once we arrived on-site.

SagBank-21-CROM

The Sagbank-21-CROM was not recoverable last year due to poor weather. In 2023, the CROM was successfully recovered using the Amundsen Science ROV ASTRID (Figure 34-1). The ROV was reconfigured with a recovery spool and 750m of Dyneema rope with a polyester jacket with a final buoyancy rating of 1.14 which was acceptable for the ROV ASTRID. The rope was fitted with a recovery hook and the ROV spool was modified to have light resistance but not braking functionality.

The ROV descended to the location where the wire was positioned and where the unit was dropped ~8m offbottom in 2021. Unfortunately, the currents are strong in this area and there wasn't a perceived need to place a HiPaP beacon on the winch wire for better positioning. Thus, once the ROV was at depth the unit was not in it's target location, it was found ~125m NW of the supposed location, which took longer than expected to locate the unit. Fortunately, the CROM was located and with no visible damage and no substantial biofouling.

Once the ROV attached the lifting hook to the top deployment pear link, the ROV came to the surface and was recovered onboard, where the remaining rope from the spool was relocated around the nose of the vessel and through the capstan pulley where after the rope was hauled-in until the CROM was on-deck (Figure 35-1).

HiBioA-22-CROM

The HiBioA-22-CROM was successfully recovered using the Zodiac and the recovery net. This CROM was deployed in 2022 without the recovery drum-rope as strong currents at the site were a major concern and probable cause for the unsuccessful recovery of HiBioA-21-CROM in 2022.

HiBioA-22

HiBioA-22 was successfully recovered using the Zodiac, which dragged the mooring line to the vessel. The mooring was then recovered using the capstan and vessel A-Frame.

HiBioA-21-CROM

The HiBioA-21-CROM that was released last year (2022) but never surfaced and with which communications with the release were lost after 2min into the recovery in 2022. Due to a lack of time, dragging efforts were not possible in 2022 but, in 2023 they were attempted using the Amundsen's barge and a grappling hook with 300m of Amsteel II rope.

The zodiac had snagged something in the water column where the CROM was expected to be found, but upon recovery, no instrument-float package was recovered and in subsequent attempts at grappling, no other snagging occurred and no CROM was seen at the surface for the period of at least 30min. The weather was slightly foggy and it's possible that the strong currents took it out-of-sight of the zodiac crew and the Amundsen's bridge.

Figure 35-1: SagBank-21-CROM ROV recovery bottom image (left) and lifting ops (right).

Table 35-1: Data Recovery Summary from Recovered Moorings 2022-2023 data year

MooringID	InstrumentID	Clock Drift (sec)	First Good Record (UTC)	Last Good Record (UTC)	% Data Recovery	Mooring AVG
HiBioA-22	ASL_AZFP_55134	-736	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	90%

HiBioA-22	RBR_Concerto-CTD-Tu_65774	48	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	
HiBioA-22	OceanInstruments_ST600-STD_6860	0			0%	
HiBioA-22	RDI_LR_12892	-104	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	
HiBioA-22	Vemco_VR2W_138629	-497	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	
HiBioA-22	RBR_XR-420-CT_15274	90	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	
HiBioA-22	Technicap_PPS3-3_motor_12-23	-898	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	
HiBioA-22	Nortek_Aquadopp_8448	-71	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	
HiBioA-22	Vemco_VR2W_138628	-604	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	
HiBioA-22	RBR_XR-420-CT_15262	71	2022-09-21 11:30:00	2023-07-24 11:00:00	100%	
HiBioA-CROM-22	RBR_XR-420-CT_15269	60	2022-09-21 12:10:00	2023-07-24 13:00:00	100%	100%
HiBioA-CROM-22	Nortek_Aquadopp_8457	87	2022-09-21 12:10:00	2023-07-24 13:00:00	100%	
HiBioA-CROM-22	OceanInstruments_ST600-STD_6859	243	2022-09-21 12:10:00	2023-07-24 13:00:00	100%	
SagBank-CROM-21	OceanInstruments_ST600-STD_6179	0	2021-07-23 22:40:00	2022-11-01 16:06:00	128%	128%
SagBank-CROM-21	RBR_XR-420-CT_15264	-100	2021-07-23 22:40:00	2022-08-16 16:10:00	107%	
SagBank-CROM-21	Nortek_Aquadopp_8426	-90	2021-07-23 22:40:00	2023-01-21 05:40:00	150%	
				MissionTotalAvg=	95%	

35.2.2 *Preliminary Data Analysis*

SagBank-21-CROM

SagBank-21-CROM had 100% recovery of all deployed equipment and on average 128% data recovery as the units were programmed for 12 months of recording but were left to record until their batteries had been drained, which was the case for this mooring.

HiBioA-22-CROM

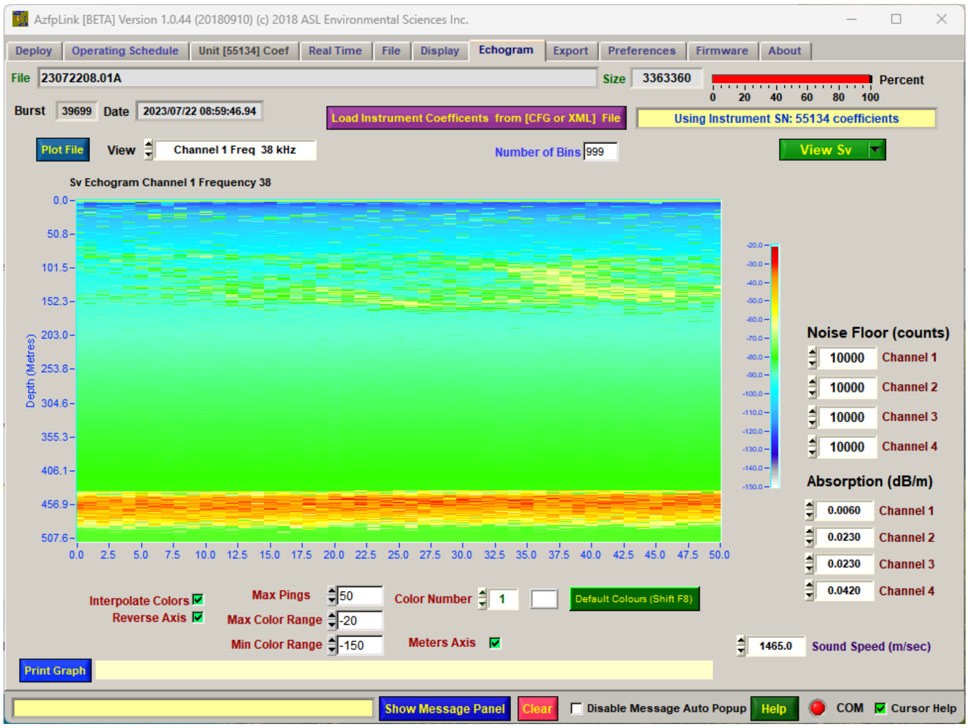
HiBioA-22-CROM had 100% recovery of all deployed equipment and 100% data recovery as the units were programmed for 12 months of recording but were left to record until their batteries had been drained, which was the case for this mooring.

HiBioA-22

HiBioA-22 had 100% equipment recovery and ~90% data recovery; however, one hydrophone failing to start, RBR Concerto CTD-Tu (AZFP) has a drifting conductivity and pressure issue mid-way through the deployment period and ADCP Long Ranger had a ROLL sensor artificially offset itself by +11 degrees on Feb 14, 2023 at 19:30:50. Apart from this odd ROLL sensor offset, the unit performed very well and collected good data all the way to the surface. The mooring was only in the water for a little more than 10 months. Thus, the final 3 bottles from the sediment trap are empty due to the programmed sampling schedule (Figure 34-2).

Figure 35-2: HiBioA-22 Sediment Trap (488m) 2-week samples in series.

The AZFP (55134) worked as programmed and a full dataset was recovered from the unit without any problems (Figure 34-3). A random selection from the AZFP identified a plankton mass between 457m and between 100-150m offshore the Hatton Shelf /Labrador Sea, a couple days before recovering HiBioA-22.



File 23072208.01A

Size 3363360

Burst 39699 Date 2023/07/22 08:59:46.94

View Channel 1 Freq 38 kHz

Number of Bins 999

Noise Floor (counts)

10000	Channel 1
10000	Channel 2
10000	Channel 3
10000	Channel 4

Absorption (dB/m)

0.0060	Channel 1
0.0230	Channel 2
0.0230	Channel 3
0.0420	Channel 4

Interpolate Colors ☑

Reverse Axis ☑

Max Pings 50

Max Color Range -20

Min Color Range -150

Color Number 1

Meters Axis ☑

1465.0 Sound Speed (m/sec)

☐ Disable Message Auto Popup

☑ Cursor Help

Figure 35-3: AZFP link software plotting HiBioA-22 data (July) time series of 2022-2023 data year. Data in plot has not been pressure corrected.

35.2.3 *2023 Mooring Deployment Summary*

Mooring C4-23 (1613m) was successfully deployed near Disko Fan on July 31, 2023, in pack ice conditions.

But, fortunately a large enough lead (mooring length of 1125m) was open directly above the mooring site which allowed for to zodiacs to manage the mooring line and ice flows effectively. There were no surface currents or no wind. Conditions were foggy and immediately after the mooring was released, the fog became very thick, which would have prevented mooring operations. The 500 HP winch was undergoing maintenance so the 2.5T winch wire on the A-Frame was used along with the portside crane. Operations went smoothly with the assistance of Rodd Liang and Jordan Sutton as helpers managing the long rope lengths and attaching a few RBR Duet-TD and Solo-Tu sensors to the line during deployment.

35.2.4 *Re-Deployment Summary*

Moorings HiBioA and Hopedale were successfully re-deployed. The Hopedale-23 mooring was successfully deployed on July 16, 2023. However, the WBAT will most likely not record the desired data due to a series of unfortunate events (time constraints and equipment availability). See Table 34-2 for a full record of the moorings deployed.

Table 35-2: 2023 mooring site deployments.

Leg	Mooring ID	Latitude	Longitude	Latitude (DD)	Longitude (DD)	Depth (m)
1	HiBioA-23	60° 27.6825' N	61° 15.8993' W	60.461375	-61.2649883	498
1	Hopedale-23	56° 03.4310' N	57° 25.7075' W	56.057183	-57.4284583	479
1	C4-23	67° 57.3418' N	60° 38.1981' W	67.955246	-60.636635	1613

35.3 Mooring Operations - Annual Lessons Learned Summary

Amundsen Leg 1

Collaborative Instrumentation Preparation

This year's mooring operations are many and with many collaborators bringing their relative instruments onboard destined for any particular mooring. It was asked that all collaborators requesting their instruments be moored this year for whichever mooring send their preprogrammed instruments, ideally within their respective frame mounts well in advance of the mobilization which took place in Quebec City during June 20 and June 29, then again from July 12-13 in St. John's, Nfld. This way the researchers get their equipment setup the way they need for their research without needing extra people onboard to be responsible for their instrumentation. This request was almost fully respected but there were some exceptions, one of which resulted in an instrument not being adequately labeled and accidentally reprogrammed due to warning messages (WBAT at Hopedale-23). The other exception was the CO2 ProV systems from ArcticCore (C4-23, BylotS-23), which arrived within a frame that wasn't readied for deployment and neither the equipment. The request to connect transducers or resync internal clocks or install CO2 instruments into frames was accommodated this year during Leg 1, but this practise should not continue and researchers will now need to be 100% prepared for their instruments on their own or have their trained technicians perform this duty.

Table 35-3: Summary table of Lessons Learned throughout the Amundsen 20223 Leg 1 Expedition

Problem	Solution	Operation

Inadequately Prepared equipment from collaborators	Researchers will now need to prepare their equipment themselves or using their trained technicians, or the equipment will not be deployed.	Deployment

35.4 Acknowledgement

I would like to acknowledge the teamwork and co-operation of the Coast Guard crew of the *CCGS Amundsen*, CEOS (Emma Ausen) and Amundsen Science Tech (Quentin LaHaye). Working together as a team and performing admirably, the moorings were successfully deployed, recovered as efficiently and safe as possible.

36 Mooring Operations Leg 3

The Principal Investigators of the related projects: Christine Michel [1] (Christine.Michel@dfo-mpo.gc.ca), Dorthe Dahl-Jensen [2] (Dorthe.Dahl-Jensen@umanitoba.ca), Jean Carlos Montero Serrano[3] (Jeancarlos_Monteroserrano@uqar.ca), Mathieu Ardyna[4],(Mathieu.Ardyna@takuvik.ulaval.ca) , Maxime Geoffroy [5] (Maxime.Geoffroy@mi.mun.ca), Audrey Limoges[6] (audrey.limoges@unb.ca)

The mooring team onboard: Sergei Kirillov [2], Christian Boutot [3], Emma Ausen [2]
Other personal helping with mooring operations: Elizabeth Kitching [1], Megan Lee [1]

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36.1 Introduction and objectives

Altogether, 10 oceanographic moorings related to the different scientific projects were deployed during the 3rd Leg of the 2023 Amundsen Science expedition. The following is a brief description of these projects and of the principal tasks assigned to each mooring (or group of moorings).

Four ArcticCORE/RED AO/MUN moorings were deployed in the region connected to the multiyear ice ecosystem in the Lincoln Sea and the ice shelves of Ellesmere Island. These moorings were deployed to characterize physical and chemical changes in the marine system and their impacts on biological processes and species; as well as to inform the sustainable management and conservation of Arctic marine resources and fisheries as well as downstream ecosystems. Specific objectives for these moorings include: the determination of the influence of freshwater and biogeochemical fluxes from the Lincoln Sea to Baffin Bay (moorings LSea-23, NaresW-23, NaresE-23); the relative influence of Ellesmere Island shelves on the structure and seasonality of the ecosystem of Archer Fjord, identified as a unique region within the Marine Protected Area (MPA) of Tuvaijuittuq (mooring ArcherF-23); and the connectivity and influence of Arctic waters from the Lincoln Sea downstream at the confluence/entrance of Pond Inlet (moorings LSea-23, NaresW-23, NaresE-23, Leg 2 KEBABB/RED AO/MUN mooring deployment: Bylot Island-23). All ArcticCore Instruments were programmed prior to the start of the Leg, and just required assembly prior to deployment.

Another group of moorings related to the "Arctic Sea Ice, Freshwater-Marine Coupling and Climate Change" project (Dr. Dorthe Dahl-Jensen, Centre for Earth Observation Science at University of Manitoba) were designed to collect data on the ocean currents and thermohaline properties of the water column in the key regions adjacent to the North Open Water area. The main goal of obtaining this data is to improve our understanding of the local processes affecting the transformation of water masses of the Atlantic, Pacific and Arctic origin in the region, and also to assess the input of glacial meltwater to the regional freshwater balance.

A mooring carrying an upward-looking Wideband Autonomous Transceiver (WBAT) with two broadband transducers (nominal frequencies of 120 and 200 kHz) is a part of RED-AO project, funded by ArcticNet and MITACS, and also by NorthFish project funded by Crown-Indiginous Relation and Northern Affairs Canada. The two main objectives of the experiment are to identify the acoustic signal of shrimps and fish to assess their abundance and frequency of occurrence and to measure changes in the amplitude of the diel vertical migrations across seasons.

And one more mooring carrying a sediment trap was deployed as a part of Arctic seafloor project led by Jean Carlos Montero Serrano (in Jones Sound). Compared to the Nares Strait and Lancaster Sound, few studies provide a general overview on the history of sediment fluxes and the impact of climate change on the marine environment of Jones Sound basin as well as the its deglaciation history. This ArcticNet project provides an opportunity to fill this knowledge gap by i) deploying one bottom-anchored mooring (composed of one sediment trap and a CTD) in the central part of Jones Sound that will collect data and suspended sediment over a one-year cycle and by ii) studying box and gravity sediment cores sampled along Jones Sound. With these samples, we will 1) monitor seasonal variations of suspended sediment provenance and transport, 2) document the seasonal succession and changes in primary production, and 3) investigate the events and processes leading up to the opening of Jones Sound during the last deglaciation.

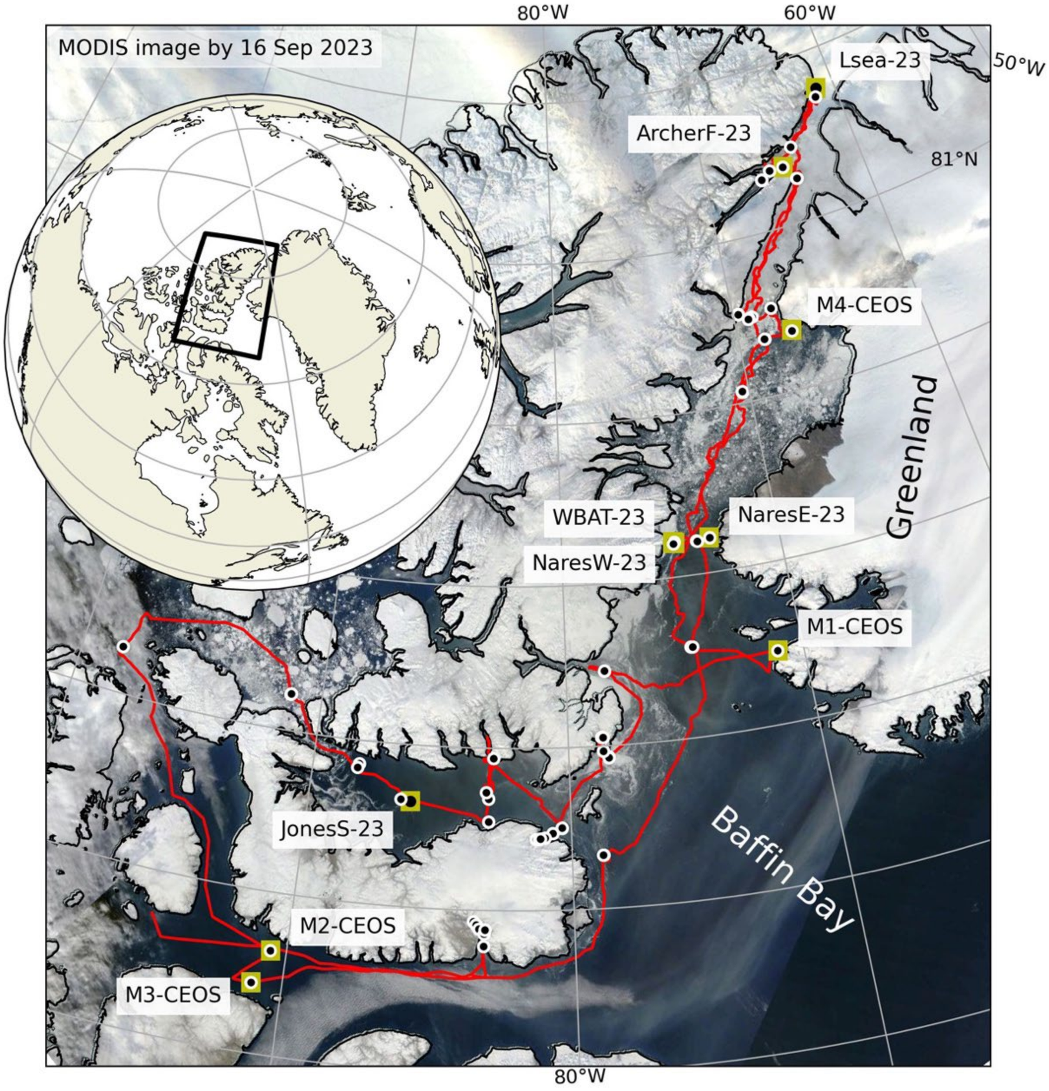

Figure 36-1: The positions of the moorings (yellow squares) deployed during the 3rd Leg of the 2023 Amundsen Science expedition. Note the positions of WBAT-23 and NaresW-23 are very close to each other (~2 km apart). White circles with black dots indicate the positions of other stations with CTD/Rosette sampling.

36.2 Mooring operations

The mooring team managed all ten mooring deployments during Leg 3 (Figure 36-1). These deployements included five moorings for the DFO ArcticCore project (in Nares Strait and Archer Fjord) lead by Dr. Christine Michel, four moorings related to the CEOS CERC project lead by Prof. Dorthe Dahl-Jensen (in Kane Basin, Northern Baffin Bay and Lancaster Sound) and one mooring for Arctic seafloor project lead by Jean Carlos Montero Serrano (in Jones Sound). Safety during operations was of upmost importance, and before beginning mooring operations a safety meeting was held with Coast Guard crew members and mooring scientists. The ship crane and A-Frame winch at the port-side foredeck were used for all deployments. The zodiac was utilized during mooring deployment to tug the subsurface float and mooring line perpendicularly away from the ship (Figure 36-2) to insure there were no entanglements (except the very short M4-CEOS and WBAT-23 moorings deployed without zodiac assistance, see Figure 36-3; Figure 36-4).

Figure 36-2: M1-CEOS mooring deployment in Whale Sound near Qaanaaq (photo by Emma Ausen)

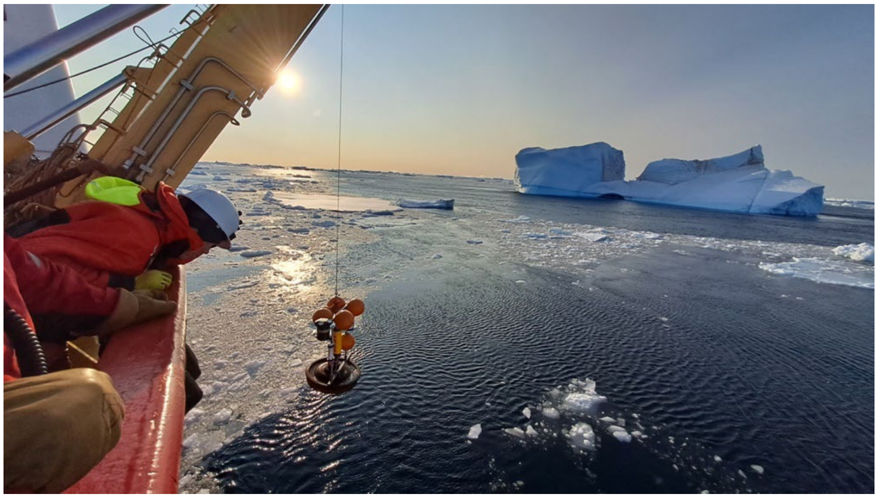

Figure 36-3: Deployment of the M4-CEOS mooring equipped with the auto-release device (photo Emma Ausen).

Figure 36-4: Preparing to deploy WBAT-23 mooring in Smith Sound (photo by Emma Ausen)

A train wheel was used as the anchor for each mooring. Moorings were deployed starting with the flotation and instruments on top, and the last component released was the anchor (Figure 36-5). Post-deployment triangulation of the acoustic release positions was not conducted for two reasons; there was relatively shallow water depth in each position (600 m maximum), and a post-deployment survey conducted with the vessels EK80 and multibeam echosounder were able to detect the large mooring items (like buoys, sediment traps) and their accurate geographical coordinates on echograms (Figure 36-6). Neither triangulation nor echosounding were conducted for CEOS-M4 mooring (deployed at 52 m depth) and CEOS-M3 (deployed at very rough weather that did not allow for precise mooring position detection). All instruments were set to UTC time prior to deploying, and the lists of instruments deployed at each mooring in present in Table 36-1.

Figure 36-5: LSea-23 mooring deployment near the north-eastern coast of Ellesmere Island (photo Emma Ausen)

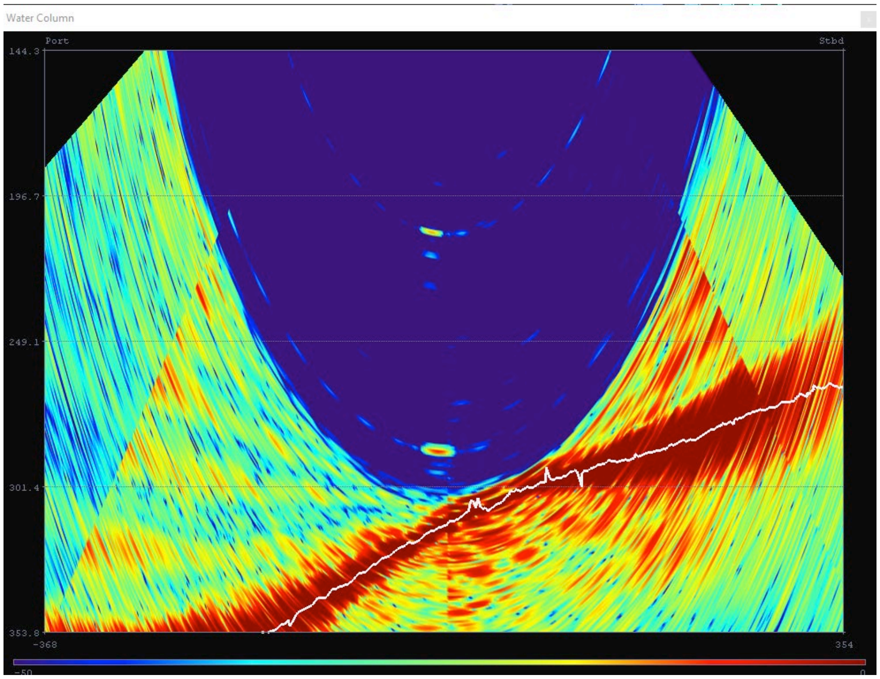

Figure 36-6: An example of multibeam showing the subsurface float and sediment trap at NaresW-23 mooring.

Table 36-1: The key information on all mooring deployed in Leg 3

Mooring	**Coordinates (Lat N, Long W)**	**Deployment date and time (UTC)**	**Water depth (m)**	**Instruments**	**Acoustic releases and codes**
ArcherF-23	81° 32.332′ 64° 57.216′	12 Sep 2023 17:38	260	RDI Sentinel V100 ADCP #125 (119 m) RBR Maestro CTD-FL-DO-Tu-CDOM #214538 (120 m) SBE 37-SM CT #11742 (199 m) RBR solo Tu #79730 (199 m) Technicap PPS 4/3 [see Table 2] #119 (200 m) Vemco hydrophone [1a] #138629 (225 m)	Benthos R500 #80594 Rel: 47826 En: 94 Benthos R500 #80608 Rel: 49840 En: 8
LSea-23	82° 08.366′ 61° 13.567′	14 Sep 2023 12:42	485	Nortek Continental 470 kHz ADCP [2a] #5815 (316 m) SBE 37-SM CT #23120 (317 m) Technicap PPS 3/3 [see Table 3] #04-079 (420 m) Vemco hydrophone [2b] #138628 (462 m)	Benthos R500 #82599 Rel: 49831 En: 99 Benthos R500 #82602 Rel: 49834 En: 2
M4-CEOS	80° 03.398′ 67° 03.411′	17 Sep 2023 15:17	53[3a]	RBR concerto CT [A] #215411 (52 m) Nortek Signature500 ADCP #0261 (52 m)	EdgeTech PORT LF #51801 Rel: 334432 En: 322775 Dis: 323000
WBAT-23	78° 19.00′ 74° 48.05′	19 Sep 2023 11:16	573	Kongsberg WBAT #1474 (571 m)	EdgeTech CART #61324 Rel: 623341 En: 601140 Dis: 601163 EdgeTech CART #61325 Rel: 623362 En: 601201 Dis: 601222

NaresW-23	78° 19.582′ 74° 53.107′	19 Sep 2023 14:15	307	RDI Sentinel V100 ADCP #496 (206 m) RBR concerto CTD #201107 (208 m) Technicap PPS 3/3 see Table 4 #53 (281 m) SBE 37-SM CT #11741 (283 m) Vemco hydrophone #139317 (292 m)	EdgeTech CART #33743 Rel: 224653 En: 203772 Dis: 204016 EdgeTech CART #31091 Rel: 431334 En: 415103 Dis: 415124
NaresE-23	78° 19.438′ 73° 11.636′	20 Sep 2023 10:38	340	RDI Sentinel V100 ADCP #497 (195 m) RBR concerto CTD #201108 (197 m) Technicap PPS 3/3 see Table 4 #52 (273 m) SBE 37-SM CT #11432 (275 m) Vemco hydrophone #138315 (314 m)	Benthos R500 #82600 Rel: 49832 En: 0 Benthos R500 #82606 Rel: 49838 En: 6
M1-CEOS	77° 10.820′ 71° 04.302′	21 Sep 2023 20:25	509	RBR concerto CTD [A] #214873 (100m) RDI Sentinel 300kHz ADCP #23616 (130 m) RBR XR-420 CT [A] #10492 (130 m) RDI Sentinel 300kHz ADCP #20159 (131 m) RBR XR-420 CT [A] #12953 (190 m) RBR concerto CT [A] #215415 (250 m) RBR XR-420 CT [A] #12986 (400 m)	EdgeTech PORT LF #51796 Rel: 334313 En: 322520 Dis: 322545 EdgeTech PORT LF #51794 Rel: 334241 En: 322434 Dis: 322451
JonesS-23	75° 58.59′ 86° 06.957′	28 Sep 2023 19:23	583	SBE 37-SM CT #8086 (486 m) Technicap PPS 3/3 see Table 5 # 9119 (488 m)	EdgeTech 8242XS #58534 Rel: 444743 En: 461562 Dis: 461600

M2-CEOS	74° 27.796′ 90° 32.846′		269	RBR concerto CTD [B] #214874 (30 m) SBE 37-SM CT [B] #10539 (70 m) SBE 37-SM CT [B] #10885 (100 m) RBR XR-420 CT [B] #12959 (130 m) RBR XR-420 CT [B] #10507 (190 m) Nortek Signature250 ADCP #104120 (200 m) RBR concerto CT [B] #215412 (250 m)	EdgeTech PORT LF #51798 Rel: 334355 En: 322627 Dis: 322642 EdgeTech PORT LF-SD #56369 Rel: 144535 En: 161144 Dis: 161167
M3-CEOS	74° 08.752′ 91° 02.828′		224	RBR concerto CTD [B] #214874 (40 m) RBR concerto CT [B] #215413 (80 m) RDI Sentinel 300kHz ADCP #24022 (90 m) RBR concerto CT [B] #215416 (140 m) RBR concerto CT [B] #215414 (200 m)	EdgeTech PORT LF #51837 Rel: 634376 En: 622264 Dis: 622315 EdgeTech PORT LF #51800 Rel: 334411 En: 322733 Dis: 322756

[1a] The acoustic receiver's battery could probably have not been connected before deployment

[2a] In the thread of communication with Shawn Meredyk after the mooring had been deployed already, it was found that "the internal unit clock battery could be weak or dead. In this case the unit would not start as the date would not be synchronized". The ADCP was not reprogrammed after the external battery was connected that implies there is a chance of having no records on this unit. [2b] The acoustic receiver's battery could probably have not been connected before deployment. [3a] The depth in the mooring position is 53 m according to the ship echosounder. However, there might be a chance that the mooring got automatically released before it reached the sea floor. It could happen because the hoist rope was captured and pulled away of the ship by an ice floe. The deck crew team suggested that the mooring got released when it was ~10 m above the bottom still, but this suggestion is not very confident. [A] For validation, all running CT loggers from M1-CEOS and M4-CEOS were placed into the bucket with salt water that was staying on the open deck during a few days before

deployments. [B]For validation, all running CT loggers from M2-CEOS and M3-CEOS were placed into the bucket with salt water that stayed first on the open deck for about 24h, then inside of the mooring lab for about 12h (because of low air temperatures and onset of freezing), and then on the open deck again for another 8h or so.

36.2.1 *Sediment traps deployed in the 3rd Leg*

A total of five time-programmed, multi-cupped sediment traps were deployed at the ArcherF-23, LSea-23, NaresE-23 and NaresW-23 (RED-AO project) and JonesS-23 (ArcticNet Seafloor project) stations (see Table 36-5). Prior to the deployment, the sediment trap cups were filled with a preservative formalin solution (Hargrave et al., 2002). Batches of approximately 20L of 5% (v/v) formalin solution were prepared in advance by Shawn Meredyk. Leftover formalin solution will be used to measure blank values for elemental analyses and chlorophyll measurements (CHN + fluorimeter).

Recipe dense solution:

19 L seawater (~34 salinity)
+ 1.0L buffered formalin (100% formalin =37 % formaldehyde, 1-L of 37% formaldehyde)
+ 38 g NaCl (to adjust the 19-L, 33-salinity, to 36 salinity)
+ 36 g NaCl to adjust the 1-L formaldehyde to 36 salinity (total is 74 g of salt added)
= 20 L filling solution (5% formalin v/v)

Table 36-2: Program used for the sediment trap ArcherF-23. Time and dates given as Universal Time Coordinated (UTC).

ArcherF-23					
Sample	**Start date**	**Days**	**Sample**	**Start date**	**Days**
1	01 Oct 2023, 00:00	61	7	16 Jun 2024, 00:00	15
2	01 Dec 2023, 00:00	62	8	01 Jul 2024, 00:00	15
3	01 Feb 2024, 00:00	60	9	16 Jul 2024, 00:00	16
4	01 Apr 2024, 00:00	30	10	01 Aug 2024, 00:00	15
5	01 May 2024, 00:00	31	11	16 Aug 2024, 00:00	16
6	01 Jun 2024, 00:00	15	12	01 Sep 2024, 00:00	30
				End 01 Oct 2024, 00:00	

Table 36-3: Program used for the sediment trap LSea-23. Time and dates given as Universal Time Coordinated (UTC). One of the cavities of the carousel for the LSea-23 trap was broken. The motor was programmed to avoid this hole during the sampling period (only 11 sampling cups used).

LSea-23					
Sample	**Start date**	**Days**	**Sample**	**Start date**	**Days**
1	01 Oct 2023, 00:00	31	7	16 Jun 2024, 00:00	15
2	01 Nov 2023, 00:00	61	8	01 Jul 2024, 00:00	15
3	01 Jan 2024, 00:00	91	9	16 Jul 2024, 00:00	16
4	01 Apr 2024, 00:00	30	10	01 Aug 2024, 00:00	15
5	01 May 2024, 00:00	31	11	16 Aug 2024, 00:00	15
6	01 Jun 2024, 00:00	15	12	Broken	
				End 30 Aug 2024 00:00	

Table 36-4: Program used for the sediment traps NaresE-23 and NaresW-23. Time and dates given as Universal Time Coordinated (UTC).

NaresE-23 and NaresW-23					
Sample	**Start date**	**Days**	**Sample**	**Start date**	**Days**
1	16 Sep 2023, 00:00	15	13	16 Mar 2024, 00:00	16
2	01 Oct 2023, 00:00	15	14	01 Apr 2024, 00:00	15
3	16 Oct 2023, 00:00	16	15	16 Apr 2024, 00:00	15
4	01 Nov 2023, 00:00	15	16	01 May 2024, 00:00	15
5	16 Nov 2023, 00:00	15	17	16 May 2024, 00:00	16
6	01 Dec 2023, 00:00	15	18	01 Jun 2024, 00:00	15
7	16 Dec 2023, 00:00	16	19	16 Jun 2024, 00:00	15
8	01 Jan 2024, 00:00	15	20	01 Jul 2024, 00:00	15
9	16 Jan 2024, 00:00	16	21	16 Jul 2024, 00:00	16
10	01 Feb 2024, 00:00	15	22	01 Aug 2024, 00:00	15
11	16 Feb 2024, 00:00	14	23	16 Aug 2024, 00:00	16
12	01 Mar 2024, 00:00	15	24	01 Sep 2024, 00:00	15
				End 16 Sep 2024, 00:00	

Table 36-5: Program used for the sediment traps JonesS-23. Time and dates given as Universal Time Coordinated (UTC).

JonesS-23					
Sample	**Start date**	**Days**	**Sample**	**Start date**	**Days**
1	01 Oct 2023, 00:00	31	7	01 Apr 2024, 00:00	30
2	01 Nov 2023, 00:00	30	8	01 May 2024, 00:00	31
3	01 Dec 2023, 00:00	31	9	01 Jun 2024, 00:00	30
4	01 Jan 2024, 00:00	31	10	01 Jul 2024, 00:00	31
5	01 Feb 2024, 00:00	29	11	01 Aug 2024, 00:00	31
6	01 Mar 2024, 00:00	31	12	01 Sep 2024, 00:00	30
				End 01 Oct 2024, 00:00	

36.3 References

Hargrave, B.T., Walsh, I.D., and Murray, D.W., 2002, Seasonal and spatial patterns in mass and organic matter sedimentation in the North Water: Deep Sea Research Part II: Topical Studies in Oceanography, v. 49, p. 5227–5244.

37 Mooring operation Leg 4

Project leader: Brent Else[1]

Mooring Operation Participants: Luc Michaud[2] and Quentin Lahaye[2]

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37.1 Introduction

FoxSIPP is a collaborative program among Universities of Calgary, Winnipeg, and Amundsen Science to conduct research on Fox Bassin. The overarching goal of the project is to study the chemistry of the deep waters that form each year in the Foxe Basin and flow into the Foxe Channel.

The new mooring SHI-23 was newly deployed in 2023 for the FoxSIPP program managed by Dr. Brent Else from University of Calgary (Table 37-1).

Table 37-1: Mooring Site Deployment during Leg 4

Leg	Mooring ID	Latitude (N)	Longitude (W)	Latitude (DD) (N)	Longitude (DD) (W)	Depth (m)
4	SHI-23	64° 30’24. 2199	80°31’16.8985’	64.5067278	80.5213607	385

37.2 Sub-Surface Mooring Instrumentation

The original mooring configuration for the FoxSIPP program consisted of:

i) An ASL IPS5 ice profiler and a iridium satellite beacon unit was part of the top float solution within an ASL dual frame with vinyl trawl floats

ii) A SeaPhox with Co2Pro and EcoTriplet was the other component of the top float package.

iii) A RDI Workhorse ADCP was deployed to collect water column under the top float instruments.

iv) A Nortek Continental 190 kHz unit was installed 150m below facing down.
v) Two SBE Microcat were installed in-line at 140m and 70m from the bottom.
vi) 32-inch ellipsoidal syntactic foam float provided a float solution 100m below the Nortek unit.
vii) Another SeaPhox with a Co2, 1m above the Tandem Benthos acoustic releases was in-line above the bottom.
viii) 2 train wheels were used as an anchor.

The final mooring configuration for the FoxSIPP program consisted of:

i) A RDI Workhorse ADCP was deployed at 40m below the surface (instead 70m) originally to collect water column under the top float instruments.
ii) A Nortek Continental 190 kHz unit was installed 180m (instead 150m) below facing down.
iii) Two SBE Microcat were installed in-line at 140m and 70m from the bottom.
iv) 32-inch ellipsoidal syntactic foam float provided a float solution 100m below the Nortek unit.
v) Another SeaPhox with a Co2, 1m above the Tandem Benthos acoustic releases was in-line above the bottom.
vi) 2 train wheels were used as an anchor.

37.3 Mooring Deployment Summary

Mooring SHI-23 (385m) was successfully deployed in Fox Channel, but, unfortunately, an identification error in the length of a cable, resulted in the upper component of the mooring line floating on the surface.

37.4 Lessons Learned Summary

The challenges this year linked to anchoring operations were numerous. Preparation and programming of devices to be carried out by the different teams involved in these operations, with some failures in certain cases. Different teams in charge of mooring operations on each Leg, which increases the risk of misplacing certain equipment or consumables, or inadvertently causing the use of inadequate components or dedicated to other mooring lines. This was the case for SHI-23 where a 35m line dedicated to this mooring was used during the previous Leg. A new line to be prepared (new splice) accordingly. The numerous modifications made to the versions of the SHI-23 mooring line during the weeks preceding the mobilization may have caused incorrect identification of the length of the cable (180 m instead of 150 m). After analyzing the situation, few options were available to us. Without an available anchor, the option of recovering the anchorage and redeploying it was to be avoided. The only solution was to cut the line under the cage of the SeaPhox floating on the surface (Figure 37-1) and recover this instrument and the IPS5 (Figure 37-2). The negative buoyancy of this Kevlar line eliminated the risk that this mooring would be displaced and possibly lost during the breakup the following spring. Ensuring you have additional wheels train to cover any eventuality would make mooring operations safer.

Figure 37-1: SeaPhox and IPS5 in surface

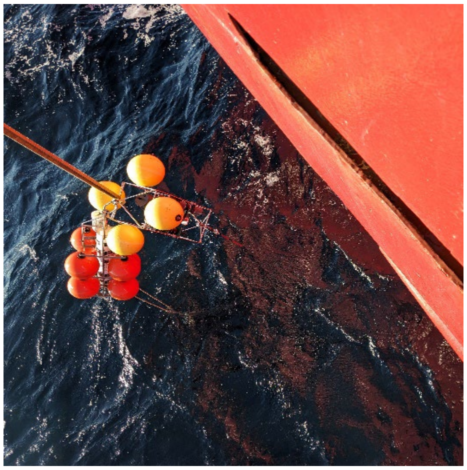

Figure 37-2: SeaPhox and IPS5 recovery

37.5 Acknowledgements

I would like to acknowledge the teamwork and co-operation of the Coast Guard crew of the *CCGS Amundsen*, DFO-MPO-BC (Kyle Simpson) and Amundsen Science Tech (Quentin Lahaye).

Part III – Conclusion

The 2023 *Amundsen* expedition provided to participating scientists, including indigenous researchers, the opportunity to increase their knowledge of the Arctic and Subarctic ecosystems. This was accomplished despite notable challenges, including harsh weather, a busy schedule divided into four Legs, and a limited COVID outbreak aboard the vessel. The expedition could not have been a success without the remarkable support from the Canadian Coast Guard, collaboration from the user programs, and indefatigable efforts from the onboard crew and science participants.

The research activities undertaken onboard the *CCGS Amundsen* in 2023 will allow a better understanding of coastal and marine ecosystems of the Canadian Arctic, help understand how climate change affects fragile marine ecosystems and human health, as well as facilitate locally supported objectives targeting the coastal and offshore Arctic environments.

Detailed mapping conducted throughout the 14 861 nautical miles of the expedition will also increase the safety of future shipping activities. Researchers and technicians are still processing the data and analyzing the samples collected during the expedition.

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

The multidisciplinary research conducted from the *Amundsen* will provide crucial physical, chemical, and biological oceanographic data to support fisheries management and conservation measures, and to monitor and assess the impacts of climate change on the Canadian Arctic marine environments. The core oceanographic data generated by the CTD-Rosette operations, as well as meteorological information and data collected using the Moving Vessel Profiler (MVP), the ship-mounted current meter (ADCP) and the thermosalinograph (TSG) are available in the Polar Data Catalogue (PDC) at www.polardata.ca. Bathymetry data collected will be integrated to the Canadian Hydrographic Service database. Research teams also submit their data of metadata on the PDC or on other open platforms.

Planning of the 2024 expedition is already underway and which will take place in summer and fall of 2024. The 2024 expedition will encompass seven research programs: Imappivut, KEBABB/KEBABS, ArcticCORE, Refuge Arctic, TCA Transforming Climate Action, SN WAGE Grad School and CEOS CERC Moorings. The research programs supported in 2024 have a strong focus on the High Arctic and will study marine ecosystems through multidisciplinary research activities and integrated studies targeting the physical, chemical and biological environments and the geology of the seabed of the Labrador Sea, Baffin Bay and Nares Strait.

Appendix 1 - List of stations sampled during the 2023 *Amundsen* Expedition

Leg	Station ID	Station Type	Date (UTC)	Latitude (N)	Longitude (W)	Depth (m)
Leg 1						
1	Joey's Gully	ROV	2023-07-15	54,6178	56,4429	356
1	Hopedale Saddle	ROV	2023-07-16	56,0793	57,3791	554
1	Makkovik Hanging Gardens	ROV	2023-07-17	55,4339	58,9429	572
1	ISECOLD-0-200	Full	2023-07-18	56,2852	58,9078	203
1	Sentinel	Full	2023-07-18	56,2807	59,7551	534
1	ISECOLD-1-200	Full	2023-07-20	57,7115	60,2000	219
1	Okak Bay	Full	2023-07-21	57,5307	62,0769	130
1	Saglek Fjord	Full	2023-07-21	58,4995	62,6856	135
1	North Arm	Full	2023-07-22	58,4838	63,2186	241
1	ISECOLD-2-200	Full	2023-07-22	58,7150	61,1856	203
1	Sag Bank	ROV	2023-07-23	59,3823	60,3182	427
1	HiBio	Mooring	2023-07-24	60,4460	61,2450	558
1	Hatton Basin	ROV	2023-07-24	60,4980	61,2449	629
1	ISECOLD-3-200	Full	2023-07-25	60,4450	62,5787	342
1	Killinek Shelf	ROV	2023-07-26	60,4979	64,2193	283
1	Killinek Main	Full	2023-07-27	60,9022	64,2817	428
1	Hatton 600	ROV	2023-07-27	61,1234	63,2655	612
1	Southwind	Full	2023-07-30	66,9867	62,5388	457
1	C4	Mooring	2023-07-31	67,9529	60,6491	1610
1	BB1B_600	Full	2023-08-01	67,9874	59,3762	563
1	Disko Fan	Full	2023-08-01	67,9689	59,5105	927
1	BB1A_600	Basic	2023-08-01	67,7726	59,0664	625
1	BB1C_600	Basic	2023-08-01	67,5857	58,5821	599
1	BB1D_600	Basic	2023-08-01	67,3786	57,9226	644
1	Otolith 3	Basic	2023-08-02	66,7999	58,4962	815
1	DS1	Basic	2023-08-02	66,2576	58,2957	627
1	Otolith 4	Basic	2023-08-02	66,2150	58,4560	525
1	Otolith 5	Basic	2023-08-03	66,1995	58,4935	512
1	DS2	ROV	2023-08-03	65,3352	58,0185	573
1	Davis Seep	Basic	2023-08-04	65,0976	58,4621	527
1	DS3	Basic	2023-08-04	64,6486	58,5958	615
1	HB AUV	ROV	2023-08-05	61,4526	60,7315	542
1	HT1-900	Drop Camera	2023-08-05	61,4322	60,5942	867
1	HT1-1200	Drop Camera	2023-08-05	61,4204	60,4979	1189
1	HT1-1500	Drop Camera	2023-08-05	61,4092	60,3730	1465
1	HT1-1800	Drop Camera	2023-08-06	61,3950	60,1710	1762
1	HT2-1800	Drop Camera	2023-08-06	60,9997	60,3546	1772
1	HT2-1500	Drop Camera	2023-08-06	61,0626	60,6468	1472
1	HT2-1200	Drop Camera	2023-08-06	61,0879	60,7729	1181
1	HT2-600	ROV	2023-08-06	61,1133	60,9146	582
1	HT2-900	Drop Camera	2023-08-06	61,0999	60,8406	901
1	HT3-600	Drop Camera	2023-08-06	60,7912	61,1883	609
1	HT3-900	Drop Camera	2023-08-06	60,7798	61,0821	932
1	HT3-1200	Drop Camera	2023-08-06	60,7675	60,9347	1191
1	HT3-1500	Drop Camera	2023-08-06	60,7470	60,7011	1469
1	HT3-1800	Drop Camera	2023-08-06	60,7158	60,2958	1757
1	Davon	ROV	2023-08-07	63,0385	60,3226	804
1	Fobar	ROV	2023-08-08	62,4052	66,2214	444
1	-	AUV	2023-08-09	63,6478	68,6228	80
Leg 2						

2	test	Rosette	2023-08-12	67,0142	61,1004	383
2	E3	Full	2023-08-13	68,7947	64,1333	1337
2	E2	Rosette	2023-08-13	68,5375	64,6581	509
2	E1	Full	2023-08-13	68,2772	65,1412	452
2	E5	Full	2023-08-14	69,6000	62,5320	1966
2	E4	Rosette	2023-08-14	69,2184	63,3474	1850
2	C4	Rosette	2023-08-15	67,9567	60,6068	1603
2	C5	Full	2023-08-15	68,1464	59,9725	1381
2	A1	Full	2023-08-16	66,6058	61,1935	105
2	C1	Full	2023-08-16	67,3459	62,5227	141
2	C2	Rosette	2023-08-16	67,5441	61,9074	397
2	C3	Full	2023-08-16	67,7520	61,2772	1566
2	A4	Rosette	2023-08-17	66,8037	58,7660	907
2	A3	Full	2023-08-17	66,7340	59,6085	875
2	A2	Rosette	2023-08-17	66,6713	60,4583	527
2	A9/198	Full	2023-08-18	67,0877	54,1939	74
2	A8/197	Rosette	2023-08-18	67,0485	55,0811	67
2	A7/196	Full	2023-08-18	66,9850	56,0684	125
2	A6/195	Rosette	2023-08-18	66,8902	56,9221	656
2	A5	Full	2023-08-18	66,8733	57,9610	820
2	D2	Rosette	2023-08-20	67,8609	63,1086	237
2	B1	Full	2023-08-20	67,0613	61,5236	107
2	D1 (2022 site)	Rosette	2023-08-21	67,3965	63,8499	467
2	D1''	Rosette	2023-08-21	67,5523	64,0857	63
2	D1	Full	2023-08-21	67,4732	63,6864	641
2	D4	Rosette	2023-08-22	68,6283	61,9845	1797
2	D3	Full	2023-08-22	68,2407	62,5984	1549
2	D5	Full	2023-08-25	69,0045	61,4081	1829
2	BGC-Argo Floats	Argo	2023-08-26	72,9078	65,6129	
2	113	Nutrient	2023-08-27	76,3189	72,2290	551
2	114	CTD	2023-08-27	76,3287	71,7898	614
2	115	Full	2023-08-27	76,3345	71,2023	656
2	116	Nutrient	2023-08-27	76,3810	70,5327	139
2	107	Nutrient	2023-08-28	76,2818	74,9914	440
2	108	Full	2023-08-28	76,2651	74,6186	450
2	109	CTD	2023-08-28	76,2919	74,1117	454
2	110	Nutrient	2023-08-28	76,3042	73,6524	536
2	111	Basic	2023-08-28	76,3031	73,2755	573
2	112	CTD	2023-08-28	76,3129	72,6778	563
2	100	Nutrient	2023-08-29	76,4090	77,9616	239
2	101	Full	2023-08-29	76,3833	77,4067	361
2	102	CTD	2023-08-29	76,3777	77,0083	253
2	103	Nutrient	2023-08-29	76,3567	76,5911	148
2	104	CTD	2023-08-29	76,3430	76,1635	197
2	105	Basic	2023-08-29	76,3173	75,7747	338
2	106	CTD	2023-08-29	76,3081	75,3678	381
2	158	Basic	2023-08-30	74,0525	72,0519	1015
2	153	Full	2023-08-30	74,6937	72,7274	906
2	148	Basic	2023-08-30	75,3546	73,9333	585
2	163	Full	2023-08-31	73,1995	71,2016	1247
2	Bylot-23	Mooring	2023-09-01	72,8724	75,6522	500
2	322	Basic	2023-09-02	74,4960	80,5371	663
2	300	Nutrient	2023-09-02	74,3174	80,4981	699
2	323	Full	2023-09-02	74,1551	80,4724	788
2	324	Nutrient	2023-09-02	73,9842	80,4732	772

2	325	Basic	2023-09-02	73,8168	80,4908	677
2	S8	Basic	2023-09-04	74,4010	90,6289	197
2	S7	CTD	2023-09-04	74,3435	90,7174	212
2	S6	CTD	2023-09-04	74,2778	90,8141	222
2	S5	Basic	2023-09-04	74,2186	90,9031	297
2	S4	CTD	2023-09-04	74,1439	91,0178	
2	S3	Nutrient	2023-09-04	74,0970	91,0860	
2	S2	CTD	2023-09-04	74,0662	91,1258	
2	S1	CTD	2023-09-04	74,0495	91,1574	
2	305D	Nutrient	2023-09-05	74,6026	93,7237	128
2	305C	Nutrient	2023-09-05	74,4835	93,6470	169
2	305B	Nutrient	2023-09-05	74,3523	93,5743	168
2	305A	Nutrient	2023-09-05	74,2239	93,4939	160
2	S11	CTD	2023-09-05	74,5707	90,3682	104
2	S10	Nutrient	2023-09-05	74,5445	90,4058	183
2	S9	CTD	2023-09-05	74,4645	90,5340	268
Leg 3						
3	AC14	Full	2023-09-09	75,4934	78,8470	542
3	AF-23	Mooring	2023-09-12	81,5398	64,9597	320
3	AC2	Full	2023-09-13	81,5408	65,8076	394
3	AC3	Full	2023-09-13	81,4783	66,4786	368
3	Lsea-23	Mooring	2023-09-14	82,0644	61,4998	591
3	AC1	Full	2023-09-15	81,7001	64,1013	540
3	AC4	Full	2023-09-15	81,4030	64,3566	671
3	AC18	Full	2023-09-16	80,3197	69,7276	185
3	AC19	Full	2023-09-16	80,2639	69,0159	325
3	AC20	Full	2023-09-17	80,3001	67,8898	175
3	CEOS-m4-23	Mooring	2023-09-17	80,0570	67,0542	51
3	134	Full	2023-09-17	80,0385	68,6078	246
3	133	Full	2023-09-18	79,5986	70,3702	188
3	129	Basic	2023-09-19	78,3110	73,7992	593
3	Nares-WBAT-23	Mooring	2023-09-19	78,3178	74,7996	563
3	Nares-West-23	Mooring	2023-09-19	78,3265	74,8836	301
3	Nares-East-23	Mooring	2023-09-20	78,3235	73,1821	327
3	122	Basic	2023-09-21	77,3434	74,6707	681
3	CEOS-M1-23	Mooring	2023-09-21	77,1803	71,0718	480
3	AC12	Full	2023-09-22	77,1949	78,3988	564
3	AC13	Full	2023-09-23	76,4008	78,4136	120
3	Site 1.2	Coring	2023-09-23	76,5852	78,6630	91
3	BG-06	Nutrient	2023-09-25	75,7117	80,7045	620
3	BG-02	Nutrient	2023-09-25	75,6588	81,2703	247
3	BG-05	Nutrient	2023-09-25	75,6727	80,9936	340
3	BG-01	Nutrient	2023-09-25	75,6589	81,3157	230
3	BG-03	Nutrient	2023-09-25	75,6595	81,2073	288
3	BG-04	Nutrient	2023-09-25	75,6630	81,1641	306
3	BG-07	Nutrient	2023-09-26	75,7577	80,3571	614
3	AC16	Full	2023-09-27	76,0299	83,1259	650
3	Site 4.6.1	Coring	2023-09-27	76,4094	82,9789	367
3	Site 4.6.2	Coring	2023-09-27	76,6016	83,2304	140
3	AC17	Full	2023-09-29	76,2843	88,2122	212
3	NB-01	Full	2023-09-29	76,8352	91,2863	296
3	NB-02	Full	2023-09-30	76,9212	98,3997	434
3	CEOS-M2-23	Mooring	2023-10-01	74,4645	90,5462	263
3	CEOS-M3_32	Mooring	2023-10-01	74,1498	91,0311	218
3	CEOS-M3-23	Mooring	2023-10-01	74,1473	91,0383	217

3	CB-01	Nutrient	2023-10-02	74,8961	83,5862	153
3	CB-02	Nutrient	2023-10-02	74,8674	83,4811	228
3	CB-03	Nutrient	2023-10-02	74,8293	83,3885	151
3	CB-05	Basic	2023-10-02	74,7844	83,2044	169
3	CB-06	Nutrient	2023-10-03	74,6690	83,2139	402
3	CB-04	Nutrient	2023-10-03	74,8197	83,1694	154
3	CB-07	Nutrient	2023-10-03	74,3864	83,1426	668
Leg 4						
4	321-GB	Nutrient	2023-10-07	70,3489	91,5708	87
4	322-GB	Full	2023-10-07	70,4008	91,0924	214
4	323-GB	CTD	2023-10-07	70,4481	90,6386	131
4	324-GB	Nutrient	2023-10-07	70,5010	90,1432	128
4	325-GB	CTD	2023-10-07	70,5543	89,6719	164
4	326-GB	Nutrient	2023-10-07	70,6036	89,2243	83
4	SPR-005	Nutrient	2023-10-08	69,1474	85,6632	338
4	SPR-004	Basic	2023-10-08	69,0517	86,2133	229
4	SPR-003	Nutrient	2023-10-08	68,9678	86,6836	181
4	SPR-002	CTD	2023-10-08	68,9009	87,2282	95
4	SPR-001	Nutrient	2023-10-08	68,8195	87,7647	26
4	CTD FH 1	Nutrient	2023-10-09	69,9210	85,0657	220
4	CTD FH 2	Nutrient	2023-10-09	69,8928	84,1815	148
4	CTD FH 3	Nutrient	2023-10-09	69,8647	83,2196	111
4	FH20-001	Nutrient	2023-10-09	69,6856	82,4021	68
4	329	Nutrient	2023-10-09	69,3674	80,3862	38
4	330	Nutrient	2023-10-09	69,3196	80,5533	62
4	331	CTD	2023-10-09	69,2516	80,7669	73
4	332	Nutrient	2023-10-09	69,1825	80,9984	81
4	333	Full	2023-10-10	68,7676	81,0092	33
4	FSB-01	Contaminants	2023-10-10	68,7584	81,1542	26
4	FSB-02	Contaminants	2023-10-10	68,7366	81,1856	23
4	FSB-03	Contaminants	2023-10-10	68,6624	81,1498	24
4	FoxSIPP-01	Nutrient	2023-10-10	68,2524	80,9046	69
4	334	Full	2023-10-10	67,8713	80,8101	86
4	FoxSIPP-02	Nutrient	2023-10-10	67,3423	80,8275	94
4	FoxSIPP-03	Full	2023-10-11	66,9080	80,8317	97
4	338	Full	2023-10-11	66,1611	81,3561	135
4	FoxSIPP-07	Full	2023-10-13	64,3630	81,4722	266
4	FoxSIPP-06	Nutrient	2023-10-13	64,7274	81,3866	262
4	FoxSIPP-08	Full	2023-10-13	66,0064	83,1511	307
4	FoxSIPP-09	Nutrient	2023-10-14	65,5264	82,5742	379
4	FoxSIPP-M	Full	2023-10-14	65,1348	81,3342	442
4	FoxSIPP-10	Nutrient	2023-10-14	64,7909	80,7026	401
4	FoxSIPP-11	Nutrient	2023-10-15	64,2606	79,7893	299
4	349	Full	2023-10-15	64,6881	78,5907	129
4	15H	Nutrient	2023-10-15	63,8176	79,9887	214
4	15G	CTD	2023-10-15	63,8692	79,8152	298
4	15F	Nutrient	2023-10-15	63,9408	79,5669	317
4	15E	Full	2023-10-15	64,0320	79,2164	312
4	15D	Nutrient	2023-10-16	64,1217	78,8644	238
4	15C	Nutrient	2023-10-16	64,2138	78,5163	269
4	15B	CTD	2023-10-16	64,2836	78,2642	209
4	15A	CTD	2023-10-16	64,3266	78,0764	127
4	KCD-01	Contaminants	2023-10-16	64,2255	76,4126	69
4	HS22-001	Nutrient	2023-10-16	64,1965	75,6140	92
4	HS22-003	Full	2023-10-16	63,8525	75,1076	150

4	SAL-01		2023-10-17	62,2384	75,6307	121
4	HS22-006	Nutrient	2023-10-17	63,0455	74,3106	412
4	14G	CTD	2023-10-18	62,1830	72,4151	168
4	14F	Nutrient	2023-10-18	62,2205	72,2463	238
4	14E	Basic	2023-10-18	62,2756	71,9872	335
4	14D	Nutrient	2023-10-18	62,3560	71,6562	346
4	14C	CTD	2023-10-18	62,4326	71,3072	330
4	14A	CTD	2023-10-18	62,5237	70,8679	339
4	14B	Nutrient	2023-10-18	62,4865	71,0364	334
4	HS22-007	Nutrient	2023-10-19	62,6109	69,9031	185
4	HS22-009	Nutrient	2023-10-19	62,1504	69,3639	234
4	HS22-013	Full	2023-10-19	61,2760	68,3467	406
4	352	Nutrient	2023-10-20	61,2598	64,8187	265
4	353	Nutrient	2023-10-20	61,1558	64,7962	434
4	354	Basic	2023-10-20	61,0023	64,7226	392
4	355	Nutrient	2023-10-20	60,8519	64,7214	413
4	356	Nutrient	2023-10-21	60,7491	64,7149	298
4	640	Nutrient	2023-10-21	58,9991	61,9045	141
4	JL-001	Contaminants	2023-10-24	48,8806	68,1675	335

Appendix 2 - Scientific log of science activities conducted during the 2023 *Amundsen* Expedition

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
Leg 1																	
1	Joey's Gully	ROV	2023-07-15	13:37	54,617474	-56,443412	CTD Rosette	Deployment	355	188	7,4	19,8	6,54	28,14	1014,15	100	
1	Joey's Gully	ROV	2023-07-15	14:13	54,615982	-56,439367	CTD Rosette	Recovery	378	180	6,1	15	8,82	27,94	1014,08	101	0
1	Joey's Gully	ROV	2023-07-15	15:14	54,617770	-56,442937	ROV	Deployment	357	169	8,9	19,2	5,54	28,79	1014,01	101	0
1	Joey's Gully	ROV	2023-07-15	15:43	54,615856	-56,438122	ROV	Recovery	380	176	13,1	14,8	8,00	28,35	1013,74	101	0
1	Joey's Gully	ROV	2023-07-15	18:37	54,768412	-56,327419	Box Core	Deployment	135	135	0,4	14,8	7,11	29,71	1012,99	100	0
1	Joey's Gully	ROV	2023-07-15	18:41	54,768548	-56,327615	Box Core	Bottom	135	180	0,8	15,1	7,75	28,40	1013,03	100	0
1	Joey's Gully	ROV	2023-07-15	18:46	54,768718	-56,327607	Box Core	Recovery	137	88	0,4	15	8,26	28,62	1013,01	100	0
1	Joey's Gully	ROV	2023-07-15	18:59	54,767256	-56,328011	Box Core	Deployment	138	192	2,5	15	7,56	30,02	1013,00	101	0
1	Joey's Gully	ROV	2023-07-15	19:03	54,767137	-56,328072	Box Core	Bottom	138	208	2,7	14,9	7,83	29,34	1012,94	101	0
1	Joey's Gully	ROV	2023-07-15	19:07	54,767224	-56,327978	Box Core	Recovery	138	49	1,7	14,6	7,13	29,00	1013,03	100	0
1	Joey's Gully	ROV	2023-07-15	19:25	54,767651	-56,327062	Box Core	Deployment	137	157	13,5	15,5	7,51	30,08	1013,17	101	0
1	Joey's Gully	ROV	2023-07-15	19:29	54,767715	-56,327045	Box Core	Bottom	137	164	12	15	6,77	29,42	1013,17	101	0
1	Joey's Gully	ROV	2023-07-15	19:33	54,767780	-56,327115	Box Core	Recovery	138	193	7,8	15,8	8,08	28,62	1013,01	100	0
1	Joey's Gully	ROV	2023-07-15	20:55	54,759374	-56,326093	AUV	Deployment	130	150	11,2	14,1	9,60	28,03	1012,64	100	0
1	Joey's Gully	ROV	2023-07-15	21:32	54,757508	-56,327029	AUV	Recovery	134	139	12,4	14,3	9,02	28,40	1012,49	101	0
1	Joey's Gully	ROV	2023-07-15	22:55	54,724286	-56,387447	Baited Camera	Recovery	393	192	0,6	16,7	8,71	28,56	1012,22	100	0
1	Hopedale Saddle	ROV	2023-07-16	6:10	55,915843	-57,395843	MBES	Deployment	549	317	9,1	15,2	6,13	30,17	1010,78	100	0
1	Hopedale Saddle	ROV	2023-07-16	11:08	56,041261	-57,437970	Baited Camera	Deployment	399	179	4,8	12,3	6,28	30,20	1010,77	101	0
1	Hopedale Saddle	ROV	2023-07-16	11:58	56,063324	-57,423110	CTD Rosette	Deployment	484	201	10,3	11,4	5,80	30,30	1011,38	101	0
1	Hopedale Saddle	ROV	2023-07-16	12:20	56,060019	-57,415649	CTD Rosette	Bottom	555	210	9,9	14,4	5,33	30,53	1011,27	100	0
1	Hopedale Saddle	ROV	2023-07-16	12:37	56,056787	-57,408116	CTD Rosette	Recovery	658	229	9,9	17,5	1,45	31,13	1011,15	100	0
1	Hopedale Saddle	ROV	2023-07-16	13:25	56,079260	-57,379124	ROV	Deployment	830				6,26	30,43			0
1	Hopedale Saddle	ROV	2023-07-16	16:26	56,063419	-57,339415	ROV	Recovery		266	6,7	16,1	4,56	30,78	1010,73	98	0
1	Hopedale Saddle	ROV	2023-07-16	20:07	56,057403	-57,430122	Mooring	Deployment	452	181	10,7	12,7	6,13	30,15	1010,31	100	0
1	Hopedale Saddle	ROV	2023-07-16	21:08	56,037490	-57,429013	Baited Camera	Recovery	485	185	8,9	12,3	5,69	30,16	1010,38	100	0
1	Hopedale Saddle	ROV	2023-07-16	21:54	56,051347	-57,421848	CTD Rosette	Deployment	529	197	9,7	15,9	5,68	30,22	1010,49	100	0
1	Hopedale Saddle	ROV	2023-07-16	22:17	56,048086	-57,414033	CTD Rosette	Bottom	642	224	9,1	15,4	5,53	30,48	1010,46	100	0
1	Hopedale Saddle	ROV	2023-07-16	22:28	56,045517	-57,411612	CTD Rosette	Recovery	622	184	12,6	14,5	3,34	30,86	1010,49	101	0
1	Hopedale Saddle	ROV	2023-07-16	23:15	56,019398	-57,383147	Drop Camera	Deployment		190	13,9	14,1	4,63	30,77	1010,36	101	0
1	Hopedale Saddle	ROV	2023-07-16	23:34	56,017650	-57,381790	Drop Camera	Bottom	930	195	12,4	13,4	4,52	30,73	1010,48	101	0
1	Hopedale Saddle	ROV	2023-07-17	0:17	56,011853	-57,376253	Drop Camera	Recovery	983	186	5,7	14,3	4,95	30,30	1010,62	101	0
1	Hopedale Saddle	ROV	2023-07-17	0:55	56,055265	-57,406161	Drop Camera	Deployment	656	200	8,8	13,8	4,32	30,72	1010,74	101	0
1	Hopedale Saddle	ROV	2023-07-17	1:07	56,053931	-57,405590	Drop Camera	Bottom	652	198	11,6	13,9	4,85	30,81	1010,68	101	0
1	Hopedale Saddle	ROV	2023-07-17	1:47	56,048579	-57,401441	Drop Camera	Recovery	742	189	10,1	13,8	4,78	30,59	1010,59	100	0
1	Hopedale Saddle	ROV	2023-07-17	2:18	56,023691	-57,390808	Plankton Net	Deployment	862	173	10,9	12,8	4,53	31,24	1010,34	101	0
1	Hopedale Saddle	ROV	2023-07-17	2:22	56,023104	-57,390287	Plankton Net	Bottom	871	177	11,6	12,7	5,19	30,64	1010,24	101	0
1	Hopedale Saddle	ROV	2023-07-17	2:23	56,022962	-57,390054	Plankton Net	Recovery	874	173	11,8	12,7	5,76	30,61	1010,21	101	0
1	Hopedale Saddle	ROV	2023-07-17	3:16	56,023084	-57,386082	Hydrobios	Deployment	915	160	8	11,4	5,71	30,60	1009,96	101	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	Hopedale Saddle	ROV	2023-07-17	3:39	56,019717	-57,382078	Hydrobios	Bottom	948	147	5	10,6	5,12	30,53	1009,93	101	0
1	Hopedale Saddle	ROV	2023-07-17	4:04	56,016190	-57,377544	Hydrobios	Recovery	971	170	3,2	10,3	5,62	30,57	1010,14	101	0
1	Makkovik Hangin	ROV	2023-07-17	12:11	55,483584	-58,943232	CTD Rosette	Deployment	581	110	12,8	15,8	8,12	30,85	1007,15	101	0
1	Makkovik Hangin	ROV	2023-07-17	12:27	55,483980	-58,943454	CTD Rosette	Bottom	573	126	12,4	13,3	8,04	30,82	1007,02	101	0
1	Makkovik Hangin	ROV	2023-07-17	12:47	55,484272	-58,942500	CTD Rosette	Recovery	574	117	7,2	18,5	9,12	30,68	1006,92	100	0
1	Makkovik Hangin	ROV	2023-07-17	14:08	55,433970	-58,943143	ROV	Deployment		122	1,9	15,2	8,89	30,30	1006,05	101	0
1	Makkovik Hangin	ROV	2023-07-17	14:50	55,433954	-58,942929	ROV	Bottom		60	7,4	15,7	9,56	30,34	1005,79	101	0
1	Makkovik Hangin	ROV	2023-07-17	21:20	55,435139	-58,931601	ROV	Recovery	389	133	15,8	17,8	7,27	30,37	1002,20	101	0
1	Makkovik Hangin	ROV	2023-07-18	0:04	55,433207	-58,944947	Box Core	Deployment	702				5,15	30,61			0
1	Makkovik Hangin	ROV	2023-07-18	0:28	55,433641	-58,943388	Box Core	Bottom	703	168	10,9	15,6	6,08	30,61	1001,06	102	0
1	Makkovik Hangin	ROV	2023-07-18	0:42	55,434447	-58,942496	Box Core	Recovery	704	138	1,7	14,9	7,31	30,50	1001,00	102	0
1	ISECOLD-0-200	Full	2023-07-18	7:29	56,286017	-58,907152	CTD Rosette	Deployment	202	219	2,1	-40	7,14	30,05	1000,96	103	0
1	ISECOLD-0-200	Full	2023-07-18	7:38	56,285256	-58,907838	CTD Rosette	Bottom	203	245	8,4	-27	1,03	30,31	1001,00	102	0
1	ISECOLD-0-200	Full	2023-07-18	7:46	56,284930	-58,908784	CTD Rosette	Recovery	203				6,45	30,50			0
1	ISECOLD-0-200	Full	2023-07-18	8:22	56,286999	-58,907125	Hydrobios	Deployment	203	276	10,9	-3,9	6,94	30,58	1001,41	105	0
1	ISECOLD-0-200	Full	2023-07-18	8:26	56,286867	-58,907364	Hydrobios	Bottom	202	255	10,7	-0,8	4,36	30,16	1001,30	105	0
1	ISECOLD-0-200	Full	2023-07-18	8:33	56,286798	-58,907497	Hydrobios	Recovery	202	254	9,9	0,8	5,87	30,36	1001,26	106	0
1	ISECOLD-0-200	Full	2023-07-18	9:37	56,288361	-58,899069	Beam Trawl	Deployment	203	265	7,6	4,3	7,50	30,08	1001,77	105	0
1	ISECOLD-0-200	Full	2023-07-18	9:49	56,293040	-58,891169	Beam Trawl	Bottom	203	260	8	4,8	7,44	30,07	1001,77	105	0
1	ISECOLD-0-200	Full	2023-07-18	10:04	56,303291	-58,897711	Beam Trawl	Recovery	188	264	9,5	5,5	7,11	30,09	1001,77	105	0
1	ISECOLD-0-200	Full	2023-07-18	10:40	56,290717	-58,908237	Baited Camera	Deployment	196	234	9,9	5,3	3,60	30,37	1002,32	105	0
1	ISECOLD-0-200	Full	2023-07-18	11:53	56,286326	-58,907314	Drop Camera	Deployment	202	236	10,3	9,3	3,79	30,60	1002,63	105	0
1	ISECOLD-0-200	Full	2023-07-18	11:57	56,286396	-58,907567	Drop Camera	Bottom	202				3,98	30,73			0
1	ISECOLD-0-200	Full	2023-07-18	12:30	56,289624	-58,908380	Drop Camera	Recovery	197	267	5,1	10,5	5,15	30,31	1002,45	106	0
1	ISECOLD-0-200	Full	2023-07-18	12:54	56,286337	-58,905812	Box Core	Deployment	202	258	3,2	-40	6,79	30,43	1002,58	105	0
1	ISECOLD-0-200	Full	2023-07-18	12:59	56,286125	-58,905226	Box Core	Bottom	202	272	4,2	-13,9	5,65	30,32	1002,52	105	0
1	ISECOLD-0-200	Full	2023-07-18	13:05	56,286426	-58,904778	Box Core	Recovery	202	233	3	-9,5	5,63	30,48	1002,68	105	0
1	ISECOLD-0-200	Full	2023-07-18	13:29	56,287021	-58,904717	Box Core	Deployment	202	215	2,5	-2,7	6,61	30,20	1002,67	105	0
1	ISECOLD-0-200	Full	2023-07-18	13:35	56,286857	-58,903814	Box Core	Bottom	202	190	4,2	-2	6,89	30,19	1002,72	105	0
1	ISECOLD-0-200	Full	2023-07-18	13:41	56,286929	-58,902868	Box Core	Recovery	203	187	4,8	-4,2	6,14	30,21	1002,66	105	0
1	ISECOLD-0-200	Full	2023-07-18	14:25	56,292397	-58,905653	Baited Camera	Recovery	195	172	8,6	-7,8	7,86	30,07	1002,80	104	0
1	Sentinel	Full	2023-07-18	17:16	56,281554	-59,754616	CTD Rosette	Deployment	535	174	8,8	18,9	6,66	30,63	1002,07	108	0
1	Sentinel	Full	2023-07-18	17:35	56,280713	-59,755099	CTD Rosette	Bottom	534	168	5,9	14,2	6,44	30,63	1002,09	110	0
1	Sentinel	Full	2023-07-18	17:57	56,279983	-59,754799	CTD Rosette	Recovery	531	180	1,7	14,8	6,17	30,60	1002,17	110	0
1	Sentinel	Full	2023-07-18	18:20	56,281835	-59,753813	Box Core	Deployment	529	157	9,5	22,5	6,73	30,72	1002,31	110	0
1	Sentinel	Full	2023-07-18	18:33	56,281316	-59,753360	Box Core	Bottom	531				6,89	30,81			0
1	Sentinel	Full	2023-07-18	18:46	56,280557	-59,752944	Box Core	Recovery	534	240	3	14,6	6,77	30,83	1002,89	110	0
1	Sentinel	Full	2023-07-18	22:25	56,282148	-59,753546	Hydrobios	Deployment	528	193	7	19,6	7,40	30,59	1004,29	108	0
1	Sentinel	Full	2023-07-18	22:39	56,282380	-59,753831	Hydrobios	Bottom	527	213	8,9	15,9	7,30	30,55	1004,41	108	0
1	Sentinel	Full	2023-07-18	22:55	56,282516	-59,753792	Hydrobios	Recovery	527	229	15	18,8	7,73	30,38	1004,44	108	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	Sentinel	Full	2023-07-18	23:45	56,282365	-59,747702	IKMT	Deployment	538	218	8,8	22,7	8,44	30,35	1004,72	107	0
1	Sentinel	Full	2023-07-19	0:07	56,291859	-59,738616	IKMT	Bottom	544	236	16,6	20,1	8,70	30,19	1004,48	105	0
1	Sentinel	Full	2023-07-19	0:48	56,312946	-59,768725	IKMT	Recovery	547	231	15,2	19,9	7,54	30,67	1005,26	104	0
1	Sentinel	Full	2023-07-19	1:27	56,284619	-59,749263	Tucker Net	Deployment	534	190	5,3	16,7	8,73	30,29	1005,50	105	0
1	Sentinel	Full	2023-07-19	1:36	56,289164	-59,746004	Tucker Net	Bottom	539	209	8,2	17,3	8,53	30,20	1005,42	105	0
1	Sentinel	Full	2023-07-19	1:43	56,292995	-59,749090	Tucker Net	Recovery	541	194	7,8	16,2	8,46	30,30	1005,36	105	0
1	ISECOLD-1-200	Full	2023-07-20	12:27	57,713384	-60,203695	CTD Rosette	Deployment	219	328	14,3	6,8	4,10	31,34	1001,82	105	0
1	ISECOLD-1-200	Full	2023-07-20	12:37	57,711453	-60,200000	CTD Rosette	Bottom	219	304	11,2	8,7	3,79	31,25	1001,81	104	0
1	ISECOLD-1-200	Full	2023-07-20	12:49	57,710218	-60,196019	CTD Rosette	Recovery	218	331	16	7,3	3,84	31,47	1001,54	105	0
1	ISECOLD-1-200	Full	2023-07-20	13:25	57,719060	-60,170008	Baited Camera	Deployment	226	313	14,9	7	4,88	30,90	1002,10	105	0
1	ISECOLD-1-200	Full	2023-07-20	14:05	57,714477	-60,202150	Drop Camera	Deployment	221	298	15,6	8,1	3,94	31,41	1003,08	105	0
1	ISECOLD-1-200	Full	2023-07-20	14:15	57,714697	-60,198685	Drop Camera	Bottom	220	304	15	7,6	3,84	31,60	1003,36	105	0
1	ISECOLD-1-200	Full	2023-07-20	14:47	57,714873	-60,189985	Drop Camera	Recovery	219	320	9,3	7,4	4,04	31,54	1003,59	105	0
1	ISECOLD-1-200	Full	2023-07-20	15:13	57,713614	-60,209707	Box Core	Deployment	220	323	7,4	7,8	2,34	31,69	1004,01	104	0
1	ISECOLD-1-200	Full	2023-07-20	15:19	57,713460	-60,208678	Box Core	Bottom	219	309	5,7	9	3,46	31,64	1004,32	104	0
1	ISECOLD-1-200	Full	2023-07-20	15:24	57,713655	-60,207199	Box Core	Recovery	219	306	5,7	9,3	2,86	31,61	1004,29	104	0
1	ISECOLD-1-200	Full	2023-07-20	16:36	57,713051	-60,204466	Plankton Net	Deployment	217	277	6,5	10,1	5,30	31,36	1004,75	104	0
1	ISECOLD-1-200	Full	2023-07-20	16:42	57,712505	-60,201640	Plankton Net	Recovery	217	310	4,8	9,5	4,99	31,30	1004,65	104	0
1	ISECOLD-1-200	Full	2023-07-20	17:03	57,711512	-60,202155	Beam Trawl	Deployment	219	8	0	10,9	5,87	31,23	1004,53	104	0
1	ISECOLD-1-200	Full	2023-07-20	17:17	57,708809	-60,187015	Beam Trawl	Bottom	215	128	0	12,3	5,87	31,29	1004,70	104	0
1	ISECOLD-1-200	Full	2023-07-20	17:39	57,709966	-60,156972	Beam Trawl	Recovery	209	197	4,8	9,8	4,99	31,07	1004,87	103	0
1	ISECOLD-1-200	Full	2023-07-20	18:18	57,713467	-60,205246	Hydrobios	Deployment	219	212	4	10,5	2,65	31,57	1005,10	103	0
1	ISECOLD-1-200	Full	2023-07-20	18:26	57,713385	-60,203409	Hydrobios	Bottom	218	267	0,4	11,4	3,00	31,60	1005,05	104	0
1	ISECOLD-1-200	Full	2023-07-20	18:35	57,713424	-60,201347	Hydrobios	Recovery	218	185	3,2	11,7	3,81	31,49	1005,15	104	0
1	ISECOLD-1-200	Full	2023-07-20	19:07	57,714110	-60,203263	Tucker Net	Deployment	219	191	1	11,5	6,09	31,18	1005,24	103	0
1	ISECOLD-1-200	Full	2023-07-20	19:18	57,717921	-60,202585	Tucker Net	Bottom	225	187	10,5	10	5,21	31,22	1005,43	103	0
1	ISECOLD-1-200	Full	2023-07-20	19:27	57,716045	-60,207461	Tucker Net	Recovery	221	183	10,3	9,7	6,68	31,15	1005,47	103	0
1	ISECOLD-1-200	Full	2023-07-20	20:52	57,720340	-60,165162	Baited Camera	Recovery	227	146	10,9	10,9	5,40	31,30	1005,75	103	0
1	Okak Bay	Full	2023-07-21	2:03	57,530483	-62,077476	CTD Rosette	Deployment	46				4,57	30,08			0
1	Okak Bay	Full	2023-07-21	2:09	57,530748	-62,076934	CTD Rosette	Bottom	48	130	4,8	17,7	5,14	30,13	1007,12	102	0
1	Okak Bay	Full	2023-07-21	2:16	57,531188	-62,076702	CTD Rosette	Recovery	49	165	5,7	17,5	5,40	30,03	1007,17	102	0
1	Okak Bay	Full	2023-07-21	2:38	57,529310	-62,076590	Drop Camera	Deployment	43	175	2,3	19,1	2,66	30,89	1007,20	101	0
1	Okak Bay	Full	2023-07-21	2:41	57,529635	-62,076369	Drop Camera	Bottom	43	189	2,3	18	3,72	30,72	1007,19	102	0
1	Okak Bay	Full	2023-07-21	3:12	57,533952	-62,074262	Drop Camera	Recovery	53	141	4	18,4	5,79	29,72	1007,29	102	0
1	Okak Bay	Full	2023-07-21	3:38	57,579824	-62,035917	Drop Camera	Deployment	103	228	6,3	18,2	3,19	30,61	1007,30	101	0
1	Okak Bay	Full	2023-07-21	3:44	57,580437	-62,034988	Drop Camera	Bottom	104	214	3,4	19,4	2,87	31,02	1007,31	101	0
1	Okak Bay	Full	2023-07-21	4:17	57,584357	-62,030723	Drop Camera	Recovery	109	206	6,1	17	4,24	30,73	1007,31	102	0
1	Okak Bay	Full	2023-07-21	4:51	57,529721	-62,077718	Box Core	Deployment	42	236	5	17,2	3,48	30,38	1007,47	102	0
1	Okak Bay	Full	2023-07-21	4:52	57,529703	-62,077662	Box Core	Bottom	42				4,27	30,53			0
1	Okak Bay	Full	2023-07-21	4:55	57,529637	-62,077572	Box Core	Recovery	41	220	5,3	17,4	4,97	29,78	1007,45	102	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	Okak Bay	Box Core	2023-07-21	5:26	57,529237	-62,076985	Box Core	Deployment	41	175	1,5	17,4	5,40	29,45	1007,39	102	0
1	Okak Bay	Box Core	2023-07-21	5:27	57,529223	-62,076890	Box Core	Bottom	41	192	2,5	17,5	4,56	29,76	1007,38	102	0
1	Okak Bay	Box Core	2023-07-21	5:29	57,529218	-62,076737	Box Core	Recovery	41	209	3,2	17,6	4,24	30,29	1007,39	102	0
1	Okak Bay	Full	2023-07-21	6:48	57,529123	-62,077341	Hydrobios	Deployment	40	47	2,9	17,2	2,34	30,80	1007,02	102	0
1	Okak Bay	Full	2023-07-21	6:50	57,529161	-62,077335	Hydrobios	Bottom	40				2,22	30,87			0
1	Okak Bay	Full	2023-07-21	6:52	57,529227	-62,077307	Hydrobios	Recovery	41	46	1,7	17,3	2,64	30,93	1007,00	102	0
1	Okak Bay	Full	2023-07-21	7:34	57,526907	-62,062338	Beam Trawl	Deployment	41	325	4,6	16,1	10,56	25,82	1006,74	102	0
1	Okak Bay	Full	2023-07-21	7:35	57,527283	-62,062334	Beam Trawl	Bottom	41	341	4,6	16	10,67	25,87	1006,74	102	0
1	Okak Bay	Full	2023-07-21	7:46	57,534447	-62,066157	Beam Trawl	Recovery	46	325	0	16	10,31	24,08	1006,69	102	0
1	Okak Bay	Full	2023-07-21	8:14	57,538977	-62,070724	Tucker Net	Deployment	60	345	4,2	16,1	6,26	30,18	1006,65	103	0
1	Okak Bay	Full	2023-07-21	8:19	57,541572	-62,071127	Tucker Net	Bottom	67	325	4,4	15,4	7,15	28,26	1006,65	103	0
1	Okak Bay	Full	2023-07-21	8:23	57,543825	-62,072228	Tucker Net	Recovery	66	317	4,8	15,5	6,84	28,63	1006,68	103	0
1	Okak Bay	Full	2023-07-21	8:26	57,545283	-62,073102	Tucker Net	Bottom	66	314	4,2	15,5	6,83	28,66	1006,72	103	0
1	Okak Bay	Full	2023-07-21	8:32	57,546375	-62,078803	Tucker Net	Recovery	64	259	4,2	15,7	9,34	27,87	1006,70	103	0
1	Okak Bay	Full	2023-07-21	9:12	57,529786	-62,108176	Drop Camera	Deployment	54	230	2,5	16,3	3,01	30,97	1007,05	103	0
1	Okak Bay	Full	2023-07-21	9:14	57,529588	-62,108455	Drop Camera	Bottom	53	202	3,2	16,2	2,95	30,96	1007,11	103	0
1	Okak Bay	Full	2023-07-21	9:47	57,527432	-62,115047	Drop Camera	Recovery	56	318	1,3	15,7	2,84	30,84	1007,01	103	0
1	Okak Bay	Full	2023-07-21	11:12	57,520435	-62,147928	Gravity Core	Deployment	64	48	4,4	16,2	2,36	31,06	1006,81	103	0
1	Okak Bay	Full	2023-07-21	11:16	57,520455	-62,148071	Gravity Core	Bottom	64	38	4,8	16,5	2,47	31,02	1006,78	103	0
1	Okak Bay	Full	2023-07-21	11:19	57,520461	-62,148273	Gravity Core	Recovery	64	50	5,7	16,6	2,30	31,07	1006,77	103	0
1	Okak Bay	Full	2023-07-21	13:03	57,516931	-62,142856	Gravity Core	Deployment	70	51	2,9	18,4	2,34	30,97	1006,44	103	0
1	Okak Bay	Full	2023-07-21	13:06	57,516913	-62,142853	Gravity Core	Bottom	70	58	4	18,3	1,62	31,06	1006,42	103	0
1	Okak Bay	Full	2023-07-21	13:09	57,516892	-62,142846	Gravity Core	Recovery	70	65	3	18,3	1,54	31,21	1006,39	103	0
1	Saglek Fjord	Full	2023-07-21	20:36	58,499695	-62,685280	CTD Rosette	Deployment	135	357	15	12,4	4,17	30,37	1006,07	103	0
1	Saglek Fjord	Full	2023-07-21	20:46	58,499530	-62,685647	CTD Rosette	Bottom	135	31	11,6	11,7	3,94	30,56	1006,66	103	0
1	Saglek Fjord	Full	2023-07-21	20:58	58,500014	-62,684708	CTD Rosette	Recovery	136	53	5	12,3	4,06	30,54	1007,02	103	0
1	Saglek Fjord	Full	2023-07-21	21:20	58,500567	-62,686216	Drop Camera	Deployment	137	72	5,3	12,2	3,47	30,65	1007,23	103	0
1	Saglek Fjord	Full	2023-07-21	21:25	58,500286	-62,685498	Drop Camera	Bottom	136	80	6,7	11,8	5,15	30,14	1007,22	103	0
1	Saglek Fjord	Full	2023-07-21	23:07	58,499871	-62,685207	Drop Camera	Recovery	136	56	9,3	10,7	5,40	30,32	1007,83	103	0
1	Saglek Fjord	Full	2023-07-22	2:08	58,500156	-62,689270	Plankton Net	Deployment	138	305	3,8	9,6	1,38	31,21	1009,57	104	0
1	Saglek Fjord	Full	2023-07-22	2:12	58,500148	-62,689136	Plankton Net	Bottom	138	279	3,8	9,7	1,99	31,33	1009,56	104	0
1	Saglek Fjord	Full	2023-07-22	2:13	58,500125	-62,689049	Plankton Net	Recovery	138	283	3,8	9,9	1,58	31,24	1009,55	104	0
1	Saglek Fjord	Full	2023-07-22	2:34	58,499715	-62,688747	Hydrobios	Deployment	137	279	5,7	10,1	4,25	31,07	1009,62	104	0
1	Saglek Fjord	Full	2023-07-22	2:38	58,499794	-62,688447	Hydrobios	Bottom	137	266	5,5	10	3,45	30,72	1009,66	104	0
1	Saglek Fjord	Full	2023-07-22	2:43	58,499872	-62,688219	Hydrobios	Recovery	137	273	6,5	9,5	4,29	30,92	1009,68	104	0
1	Saglek Fjord	Full	2023-07-22	3:16	58,499919	-62,686091	Beam Trawl	Deployment	137	316	0	9,5	5,88	30,80	1009,89	104	0
1	Saglek Fjord	Full	2023-07-22	3:25	58,502300	-62,678117	Beam Trawl	Bottom	133	307	2,3	9,1	9,09	27,84	1009,92	104	0
1	Saglek Fjord	Full	2023-07-22	3:43	58,502208	-62,696452	Beam Trawl	Recovery	157	232	3,6	9,1	10,55	27,29	1010,05	104	0
1	North Arm	Full	2023-07-22	7:27	58,483789	-63,218502	CTD Rosette	Deployment	241	220	2,3	9,8	2,30	29,78	1010,79	104	0
1	North Arm	Full	2023-07-22	7:38	58,483824	-63,218573	CTD Rosette	Bottom	241	252	1,3	10,3	4,94	30,36	1010,63	104	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	North Arm	Full	2023-07-22	7:47	58,483787	-63,218527	CTD Rosette	Recovery	241	279	5,9	10,7	1,96	30,74	1010,72	104	0
1	North Arm	Full	2023-07-22	8:39	58,483327	-63,219311	Box Core	Deployment	241	257	13,5	11,5	2,05	31,13	1010,81	102	0
1	North Arm	Full	2023-07-22	8:44	58,483333	-63,219118	Box Core	Bottom	241	247	13,9	11,3	1,42	31,16	1010,80	102	0
1	North Arm	Full	2023-07-22	8:49	58,483447	-63,218374	Box Core	Recovery	241				1,05	31,08			0
1	North Arm	Full	2023-07-22	11:12	58,488306	-63,372022	Gravity Core	Deployment	91	118	2,1	14	1,79	31,26	1012,29	102	0
1	North Arm	Full	2023-07-22	11:15	58,488366	-63,372128	Gravity Core	Bottom	91	69	2,5	13,9	1,52	31,24	1012,30	102	0
1	North Arm	Full	2023-07-22	11:19	58,488409	-63,372192	Gravity Core	Recovery	91	102	2,9	14	1,53	31,27	1012,35	102	0
1	ISECOLD-2-200	Full	2023-07-22	22:42	58,700601	-61,151285	Baited Camera	Deployment	202	114	6,1	9,2	4,99	30,72	1016,10	102	0
1	ISECOLD-2-200	Full	2023-07-22	23:08	58,714711	-61,183812	CTD Rosette	Deployment	204	115	6,1	11	4,15	30,93	1016,24	101	0
1	ISECOLD-2-200	Full	2023-07-22	23:20	58,715001	-61,185632	CTD Rosette	Bottom	203	125	5,3	10,9	6,88	30,70	1016,22	101	0
1	ISECOLD-2-200	Full	2023-07-22	23:38	58,715287	-61,186385	CTD Rosette	Recovery	204	118	5,3	11,8	7,07	30,72	1016,18	101	0
1	ISECOLD-2-200	Full	2023-07-23	0:00	58,716239	-61,185343	Drop Camera	Deployment	204	96	2,5	10,6	4,20	30,98	1016,23	101	0
1	ISECOLD-2-200	Full	2023-07-23	0:05	58,716853	-61,185609	Drop Camera	Bottom	203	146	1,9	10	6,69	30,71	1016,21	102	0
1	ISECOLD-2-200	Full	2023-07-23	0:39	58,721409	-61,189178	Drop Camera	Recovery	204	252	0,2	8,4	4,83	30,81	1016,29	102	0
1	ISECOLD-2-200	Full	2023-07-23	1:00	58,716849	-61,187088	CTD Rosette	Deployment	204	93	6,5	9,6	6,98	30,75	1016,49	102	0
1	ISECOLD-2-200	Full	2023-07-23	1:09	58,717343	-61,187315	CTD Rosette	Bottom	204	84	8,2	8,9	6,54	30,79	1016,50	102	0
1	ISECOLD-2-200	Full	2023-07-23	1:14	58,717477	-61,187279	CTD Rosette	Recovery	204	64	4,4	9,1	7,18	30,71	1016,42	102	0
1	ISECOLD-2-200	Full	2023-07-23	1:40	58,714497	-61,184221	Box Core	Deployment	204	100	6,9	8,6	5,58	30,72	1016,44	102	0
1	ISECOLD-2-200	Full	2023-07-23	1:44	58,714594	-61,183994	Box Core	Bottom	204	94	8	8,6	6,56	30,73	1016,49	102	0
1	ISECOLD-2-200	Full	2023-07-23	1:50	58,714892	-61,183751	Box Core	Recovery	204				7,30	30,75			0
1	ISECOLD-2-200	Full	2023-07-23	3:00	58,701596	-61,152093	Baited Camera	Recovery	203	90	8	6,9	4,44	30,75	1016,34	102	0
1	ISECOLD-2-200	Full	2023-07-23	4:25	58,715075	-61,187414	Hydrobios	Deployment	203	102	7,4	8,3	4,88	30,88	1016,15	103	0
1	ISECOLD-2-200	Full	2023-07-23	4:31	58,714985	-61,187192	Hydrobios	Bottom	203				6,72	30,77			0
1	ISECOLD-2-200	Full	2023-07-23	4:37	58,714818	-61,186937	Hydrobios	Recovery	203	82	6,3	7,9	6,67	30,79	1016,23	103	0
1	ISECOLD-2-200	Full	2023-07-23	5:09	58,716301	-61,190551	Tucker Net	Deployment	203	115	7,8	6,8	7,05	30,73	1016,30	103	0
1	ISECOLD-2-200	Full	2023-07-23	5:18	58,718206	-61,198648	Tucker Net	Bottom	203	103	7,2	6,6	7,62	30,72	1016,30	103	0
1	ISECOLD-2-200	Full	2023-07-23	5:24	58,718958	-61,204859	Tucker Net	Recovery	202	109	7,8	6,6	7,48	30,70	1016,23	103	0
1	ISECOLD-2-200	Full	2023-07-23	6:07	58,713009	-61,186923	Beam Trawl	Deployment	202	106	5,7	8,1	7,12	30,73	1016,11	103	0
1	ISECOLD-2-200	Full	2023-07-23	6:18	58,713968	-61,199159	Beam Trawl	Bottom	202	115	8,2	7,3	7,14	30,72	1015,99	103	0
1	ISECOLD-2-200	Full	2023-07-23	6:31	58,711501	-61,213327	Beam Trawl	Recovery	202	107	8,4	7,6	7,32	30,69	1016,00	103	0
1	Sag Bank	ROV	2023-07-23	11:32	59,416284	-60,336899	Baited Camera	Deployment	457	104	7	12,4	4,46	31,84	1016,92	102	0
1	Sag Bank	ROV	2023-07-23	12:31	59,383723	-60,319166	Box Core	Deployment	429	111	13,1	7,4	4,33	31,85	1016,94	102	0
1	Sag Bank	ROV	2023-07-23	12:40	59,383298	-60,319547	Box Core	Bottom	428	104	12,6	7,1	4,37	31,85	1016,92	102	0
1	Sag Bank	ROV	2023-07-23	12:51	59,382762	-60,320146	Box Core	Recovery	424	122	13,9	7,1	4,34	31,85	1017,01	102	0
1	Sag Bank	ROV	2023-07-23	13:23	59,383646	-60,319659	CTD Rosette	Deployment	428				4,16	31,82			0
1	Sag Bank	ROV	2023-07-23	13:36	59,382290	-60,318182	CTD Rosette	Bottom	427	194	0,8	7,1	4,20	31,82	1017,01	102	0
1	Sag Bank	ROV	2023-07-23	13:45	59,381323	-60,316875	CTD Rosette	Recovery	427	147	1,7	8	4,33	31,82	1016,98	102	0
1	Sag Bank	ROV	2023-07-23	14:10	59,383494	-60,318836	Plankton Net	Deployment	429	114	11,2	8	4,30	31,83	1017,05	101	0
1	Sag Bank	ROV	2023-07-23	14:17	59,382252	-60,317589	Plankton Net	Recovery	427	112	12,6	8,4	3,22	31,90	1017,13	101	0
1	Sag Bank	ROV	2023-07-23	15:13	59,383501	-60,321261	ROV	Deployment	426	113	13,1	8,6	4,31	31,82	1016,76	101	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	Sag Bank	ROV	2023-07-23	16:00	59,384575	-60,319256	ROV	Bottom	433	99	11,2	8,4	3,97	31,82	1016,56	101	0
1	Sag Bank	ROV	2023-07-23	19:33	59,384040	-60,323583	ROV	Recovery	419	67	11,6	7,2	4,71	31,82	1016,42	102	0
1	Sag Bank	ROV	2023-07-23	20:25	59,383278	-60,323208	Hydrobios	Deployment	419	65	3	7,9	3,75	31,95	1016,43	102	0
1	Sag Bank	ROV	2023-07-23	20:36	59,380434	-60,323836	Hydrobios	Bottom	415	95	14,1	7,7	3,07	31,89	1016,27	102	0
1	Sag Bank	ROV	2023-07-23	20:50	59,378111	-60,325998	Hydrobios	Recovery	412	91	14,1	7,6	2,95	31,93	1016,33	102	0
1	Sag Bank	ROV	2023-07-23	21:28	59,383983	-60,323689	Tucker Net	Deployment	419	91	12,4	8,2	3,99	31,89	1016,31	102	0
1	Sag Bank	ROV	2023-07-23	21:47	59,378466	-60,340632	Tucker Net	Recovery	406	94	11,2	7,2	4,86	31,83	1016,09	102	0
1	Sag Bank	ROV	2023-07-23	22:32	59,383178	-60,322435	IKMT	Deployment	421	92	11,6	9,1	4,62	31,82	1015,97	102	0
1	Sag Bank	ROV	2023-07-23	22:53	59,372560	-60,323047	IKMT	Bottom	411	99	15,2	7,2	4,44	31,83	1015,88	102	0
1	Sag Bank	ROV	2023-07-23	23:28	59,380965	-60,312314	IKMT	Recovery	444	91	10,1	7,7	4,02	31,85	1015,90	102	0
1	Sag Bank	ROV	2023-07-23	23:50	59,384542	-60,317596	CTD Rosette	Deployment	437	75	10,5	11,3	4,63	31,82	1015,87	102	0
1	Sag Bank	ROV	2023-07-24	0:03	59,383309	-60,316897	CTD Rosette	Bottom	434	100	6,5	8,4	4,59	31,82	1015,77	102	0
1	Sag Bank	ROV	2023-07-24	0:25	59,381365	-60,315342	CTD Rosette	Recovery	435	134	0	7,4	4,57	31,83	1015,64	102	0
1	HiBio	Mooring	2023-07-24	9:48	60,455091	-61,255234	CTD Rosette	Deployment		80	8,2	7,2	2,54	32,01	1014,99	103	0
1	HiBio	Mooring	2023-07-24	10:07	60,446017	-61,244957	CTD Rosette	Bottom	558				2,21	32,06			0
1	HiBio	Mooring	2023-07-24	10:25	60,440236	-61,235172	CTD Rosette	Recovery	597	91	8,2	8,1	2,18	32,08	1015,19	103	0
1	HiBio	Mooring	2023-07-24	11:54	60,455437	-61,265003	Mooring	Recovery		75	7,4	7,8	2,01	32,18	1015,34	103	0
1	Hatton Basin	ROV	2023-07-24	14:10	60,498316	-61,232953	CTD Rosette	Deployment	746				3,71	31,89			0
1	Hatton Basin	ROV	2023-07-24	14:40	60,498004	-61,244887	CTD Rosette	Bottom	629				4,75	31,85			0
1	Hatton Basin	ROV	2023-07-24	14:59	60,498026	-61,245874	CTD Rosette	Recovery	629	64	9,1	7,1	4,02	31,95	1014,76	102	0
1	Hatton Basin	ROV	2023-07-24	16:15	60,501281	-61,217417	ROV	Deployment	776	52	5,3	7,4	5,28	32,34	1014,79	102	0
1	Hatton Basin	ROV	2023-07-24	16:58	60,499852	-61,223741	ROV	Bottom	816	43	7	7,3	5,06	31,98	1014,67	102	0
1	Hatton Basin	ROV	2023-07-24	20:47	60,493554	-61,211836	ROV	Recovery	803	69	10,9	8	4,33	31,98	1015,23	102	0
1	Hatton Basin	ROV	2023-07-24	22:15	60,520243	-61,237558	Baited Camera	Deployment	663	37	0,2	9,7	3,44	32,00	1015,33	102	0
1	Hatton Basin	ROV	2023-07-24	22:15	60,520234	-61,237537	Baited Camera	Bottom	663	356	1,1	9,6	3,36	32,00	1015,32	102	0
1	Hatton Basin	ROV	2023-07-24	23:15	60,497462	-61,230723	Van Veen Grab	Deployment	763	140	0	9,9	3,62	31,97	1015,39	101	0
1	Hatton Basin	ROV	2023-07-24	23:37	60,497026	-61,230985	Van Veen Grab	Bottom	778	75	7,8	8,1	3,61	31,98	1015,36	101	0
1	Hatton Basin	ROV	2023-07-24	23:55	60,497471	-61,232299	Van Veen Grab	Recovery	753	78	7,6	8,3	4,17	31,98	1015,34	101	0
1	Hatton Basin	ROV	2023-07-25	2:52	60,497432	-61,233236	Hydrobios	Deployment	756				4,50	31,89			0
1	Hatton Basin	ROV	2023-07-25	3:10	60,496457	-61,240660	Hydrobios	Bottom	704	49	5,9	6,9	4,45	31,90	1015,56	103	0
1	Hatton Basin	ROV	2023-07-25	3:32	60,494911	-61,245498	Hydrobios	Recovery	705	59	8,4	7	3,83	32,21	1015,47	103	0
1	Hatton Basin	ROV	2023-07-25	4:07	60,495669	-61,242254	Tucker Net	Deployment	726	57	7,6	6,9	5,09	32,26	1015,35	103	0
1	Hatton Basin	ROV	2023-07-25	4:16	60,496632	-61,237521	Tucker Net	Bottom	740	60	9,3	6,9	5,61	32,27	1015,27	103	0
1	Hatton Basin	ROV	2023-07-25	4:23	60,497398	-61,234057	Tucker Net	Recovery	757	61	9,5	6,9	5,69	32,29	1015,31	103	0
1	Hatton Basin	ROV	2023-07-25	5:02	60,496965	-61,231858	IKMT	Deployment	788				5,43	32,24			0
1	Hatton Basin	ROV	2023-07-25	5:23	60,500519	-61,207943	IKMT	Bottom	827	56	12,2	6,8	5,65	32,43	1015,09	103	0
1	Hatton Basin	ROV	2023-07-25	6:04	60,527202	-61,194718	IKMT	Recovery	871				6,44	32,67			0
1	Hatton Basin	ROV	2023-07-25	9:51	60,460650	-61,073038	Drop Camera	Deployment	1057	68	13,1	6,9	4,47	31,93	1014,98	103	0
1	Hatton Basin	ROV	2023-07-25	10:11	60,458818	-61,064310	Drop Camera	Bottom	1059	75	8,9	7,2	4,59	31,93	1015,28	103	0
1	Hatton Basin	ROV	2023-07-25	10:58	60,452972	-61,052689	Drop Camera	Recovery	1146	75	7,6	7	4,58	31,92	1015,21	103	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	HiBio	Mooring	2023-07-25	16:07	60,461443	-61,263612	Mooring	Deployment	504	72	10,7	4,7	4,68	31,98	1014,21	102	0
1	HiBio	Mooring	2023-07-25	17:06	60,462473	-61,257550	Plankton Net	Deployment		96	12,4	5,2	4,86	31,95	1014,16	102	0
1	HiBio	Mooring	2023-07-25	17:10	60,462754	-61,257664	Plankton Net	Bottom		106	10,9	5,2	4,74	31,92	1014,21	102	0
1	HiBio	Mooring	2023-07-25	17:12	60,462847	-61,257546	Plankton Net	Recovery		98	11,6	5,2	4,43	32,02	1014,17	103	0
1	HiBio	Mooring	2023-07-25	17:26	60,463218	-61,258205	CTD Rosette	Deployment		89	9,5	5	4,78	31,97	1014,14	103	0
1	HiBio	Mooring	2023-07-25	18:36	60,465012	-61,262339	CTD Rosette	Deployment	519	159	0,8	5,9	4,40	31,79	1013,75	103	0
1	HiBio	Mooring	2023-07-25	18:51	60,465013	-61,262175	CTD Rosette	Bottom	518	49	12,2	5,8	4,40	31,80	1013,53	103	0
1	HiBio	Mooring	2023-07-25	19:01	60,465060	-61,260295	CTD Rosette	Recovery	526	52	9,7	5,8	4,59	31,79	1013,43	103	0
1	ISECOLD-3-200	Full	2023-07-26	1:22	60,443517	-62,577698	CTD Rosette	Deployment	339	88	11,4	3,1	1,59	31,85	1012,12	103	0
1	ISECOLD-3-200	Full	2023-07-26	1:34	60,444958	-62,578709	CTD Rosette	Bottom	342	39	7,2	5,2	1,57	31,85	1012,25	104	0
1	ISECOLD-3-200	Full	2023-07-26	1:48	60,445554	-62,579794	CTD Rosette	Recovery	339	86	12,6	6,1	1,52	31,87	1012,08	104	0
1	ISECOLD-3-200	Full	2023-07-26	2:13	60,445221	-62,584640	Drop Camera	Deployment	343	81	10,5	3,3	1,55	31,80	1011,81	103	0
1	ISECOLD-3-200	Full	2023-07-26	2:19	60,444651	-62,586009	Drop Camera	Bottom	339	74	10,9	3,4	1,58	31,79	1011,79	103	0
1	ISECOLD-3-200	Full	2023-07-26	2:54	60,441017	-62,590767	Drop Camera	Recovery	340	84	12,6	3,5	1,64	31,80	1011,69	103	0
1	ISECOLD-3-200	Full	2023-07-26	3:15	60,442169	-62,584259	Box Core	Deployment	340				1,60	31,80			0
1	ISECOLD-3-200	Full	2023-07-26	3:23	60,443413	-62,581360	Box Core	Bottom	340	71	11,8	3,4	1,60	31,80	1011,69	103	0
1	ISECOLD-3-200	Full	2023-07-26	3:32	60,443596	-62,581349	Box Core	Recovery	339	80	13,5	3,5	1,43	31,84	1011,58	103	0
1	ISECOLD-3-200	Full	2023-07-26	4:15	60,444157	-62,582763	Hydrobios	Deployment	338	68	12,6	3,2	1,54	31,82	1011,22	103	0
1	ISECOLD-3-200	Full	2023-07-26	4:25	60,444634	-62,582720	Hydrobios	Bottom	345	72	12	6,4	1,68	31,81	1011,19	104	0
1	ISECOLD-3-200	Full	2023-07-26	4:37	60,444707	-62,583866	Hydrobios	Recovery	347	59	6,3	3,9	1,72	31,80	1011,05	103	0
1	ISECOLD-3-200	Full	2023-07-26	5:04	60,444469	-62,585879	Tucker Net	Deployment	341	68	12,8	5,6	1,63	31,82	1010,80	103	0
1	ISECOLD-3-200	Full	2023-07-26	5:13	60,445143	-62,594481	Tucker Net	Bottom	343	70	12,9	3,6	1,59	31,82	1010,92	103	0
1	ISECOLD-3-200	Full	2023-07-26	5:22	60,444855	-62,600735	Tucker Net	Recovery	341	74	12,6	3,5	1,55	31,83	1010,76	103	0
1	ISECOLD-3-200	Full	2023-07-26	5:58	60,443384	-62,579760	Beam Trawl	Deployment	341	72	12,8	5	1,60	31,81	1010,77	104	0
1	ISECOLD-3-200	Full	2023-07-26	6:14	60,444311	-62,590758	Beam Trawl	Bottom	342	72	14,5	3,7	1,48	31,83	1010,64	103	0
1	ISECOLD-3-200	Full	2023-07-26	6:37	60,443905	-62,606455	Beam Trawl	Recovery	340	72	12,2	3,7	1,48	31,84	1010,59	103	0
1	Killinek Shelf	ROV	2023-07-26	17:12	60,498626	-64,214409	Drop Camera	Deployment	282	79	17,1	4,5	1,50	32,00	1008,82	103	0
1	Killinek Shelf	ROV	2023-07-26	17:18	60,499508	-64,215786	Drop Camera	Bottom	283	94	11,6	5,7	1,67	32,00	1008,85	103	0
1	Killinek Shelf	ROV	2023-07-26	17:54	60,502865	-64,223086	Drop Camera	Recovery	282	75	16,4	4,5	1,66	32,00	1008,81	103	0
1	Killinek Shelf	ROV	2023-07-26	18:16	60,497137	-64,215844	CTD Rosette	Deployment	283	82	16	4,7	1,78	32,00	1008,91	103	0
1	Killinek Shelf	ROV	2023-07-26	18:26	60,497889	-64,219303	CTD Rosette	Bottom	283	95	10,5	6,2	1,67	32,00	1008,86	102	0
1	Killinek Shelf	ROV	2023-07-26	18:43	60,500720	-64,222323	CTD Rosette	Recovery	282				2,06	31,98			0
1	Killinek Shelf	ROV	2023-07-26	19:17	60,502241	-64,269780	Drop Camera	Deployment	282	88	9,5	4,3	1,79	31,97	1008,60	103	0
1	Killinek Shelf	ROV	2023-07-26	19:23	60,502937	-64,269080	Drop Camera	Bottom	283	81	17,9	4,3	1,81	31,96	1008,81	103	0
1	Killinek Shelf	ROV	2023-07-26	20:00	60,506939	-64,266775	Drop Camera	Recovery	282	70	16,9	3,6	1,89	31,98	1008,49	103	0
1	Killinek Shelf 2	Drop Camera	2023-07-26	21:14	60,411538	-63,923286	Drop Camera	Deployment	261				2,09	31,70			0
1	Killinek Shelf 2	Drop Camera	2023-07-26	21:19	60,412033	-63,922883	Drop Camera	Bottom	264	85	10,7	8,9	1,96	31,74	1008,53	102	0
1	Killinek Shelf 2	Drop Camera	2023-07-26	21:53	60,411427	-63,927514	Drop Camera	Recovery	263	84	17,9	3,6	2,18	31,66	1008,39	103	0
1			2023-07-26	22:34	60,422943	-63,933489	MVP	Deployment	266				1,98	31,72			0
1			2023-07-27	0:36	60,595624	-64,185915	MVP	Recovery	316	81	2,5	3,2	1,30	31,83	1007,85	103	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	Killinek Main	Full	2023-07-27	1:37	60,729048	-64,328674	Plankton Net	Deployment		71	19,2	2	1,09	31,89	1007,97	103	0
1	Killinek Main	Full	2023-07-27	1:40	60,729048	-64,329429	Plankton Net	Bottom		75	21,9	1,1	1,06	31,88	1007,72	103	0
1	Killinek Main	Full	2023-07-27	1:42	60,728949	-64,330324	Plankton Net	Recovery		67	16,8	3	1,13	31,89	1007,82	103	0
1	Killinek Main	Full	2023-07-27	1:59	60,729841	-64,328377	Hydrobios	Deployment		68	20	1,6	1,21	31,88	1007,76	103	0
1	Killinek Main	Full	2023-07-27	2:07	60,730097	-64,330812	Hydrobios	Bottom		90	11,6	3,2	1,10	31,90	1007,50	103	0
1	Killinek Main	Full	2023-07-27	2:20	60,730085	-64,335510	Hydrobios	Recovery		60	12,2	4,8	1,19	31,88	1007,80	103	0
1	Killinek Main	Full	2023-07-27	2:47	60,730750	-64,332222	Tucker Net	Deployment		74	14,1	5,1	1,04	31,89	1007,73	103	0
1	Killinek Main	Full	2023-07-27	2:58	60,729249	-64,353541	Tucker Net	Bottom		65	16	1,2	1,13	31,90	1007,50	103	0
1	Killinek Main	Full	2023-07-27	3:07	60,725506	-64,368324	Tucker Net	Recovery		63	14,3	1,1	1,13	31,91	1007,47	103	0
1	Killinek Main	Full	2023-07-27	3:48	60,730382	-64,330865	Beam Trawl	Deployment		73	12,2	1,3	1,10	31,89	1007,03	103	0
1	Killinek Main	Full	2023-07-27	4:07	60,723944	-64,356025	Beam Trawl	Bottom		74	14,9	1,6	1,04	31,90	1006,92	103	0
1	Killinek Main	Full	2023-07-27	4:26	60,717961	-64,364777	Beam Trawl	Recovery		63	13,7	1,7	1,00	31,92	1006,91	103	0
1	Killinek Main	Full	2023-07-27	7:19	60,718957	-64,283392	Drop Camera	Deployment	359				1,37	31,98			0
1	Killinek Main	Full	2023-07-27	7:26	60,719366	-64,284058	Drop Camera	Bottom	358	60	12	4,6	1,23	31,99	1005,61	104	0
1	Killinek Main	Full	2023-07-27	8:01	60,719156	-64,280628	Drop Camera	Recovery	359	34	9,3	2,6	1,28	32,01	1005,58	103	0
1	Killinek Main	Full	2023-07-27	8:29	60,768398	-64,344629	Drop Camera	Deployment	341				1,02	31,90			0
1	Killinek Main	Full	2023-07-27	8:34	60,768091	-64,343499	Drop Camera	Bottom	341	349	7,6	2,2	0,97	31,90	1005,73	103	0
1	Killinek Main	Full	2023-07-27	9:08	60,766423	-64,338539	Drop Camera	Recovery	343	60	17,3	2,2	1,11	31,93	1005,45	103	0
1	Killinek Main	Full	2023-07-27	10:17	60,905713	-64,282268	Drop Camera	Deployment	429	41	16,8	2,1	2,62	31,26	1005,20	103	0
1	Killinek Main	Full	2023-07-27	10:23	60,905939	-64,275315	Drop Camera	Bottom	426	43	16,8	1,8	2,58	31,30	1005,13	103	0
1	Killinek Main	Full	2023-07-27	11:02	60,903580	-64,239881	Drop Camera	Recovery	425	62	12,2	2,8	2,59	31,26	1005,45	103	0
1	Killinek Main	Full	2023-07-27	12:10	60,903611	-64,288698	CTD Rosette	Deployment	428	42	17,7	2,5	2,45	31,51	1005,58	103	0
1	Killinek Main	Full	2023-07-27	12:25	60,902152	-64,281688	CTD Rosette	Bottom	428	63	9,1	6,9	2,43	31,48	1005,74	103	0
1	Killinek Main	Full	2023-07-27	12:39	60,899986	-64,274029	CTD Rosette	Recovery	425	135	8	3,8	2,58	31,39	1005,77	103	0
1	Hatton 600	ROV	2023-07-27	15:26	61,125146	-63,264689	CTD Rosette	Deployment	612	26	15,2	3,3	2,17	32,08	1004,76	103	0
1	Hatton 600	ROV	2023-07-27	15:40	61,123434	-63,265472	CTD Rosette	Bottom	612	4	10,5	10,3	2,02	32,12	1004,90	103	0
1	Hatton 600	ROV	2023-07-27	15:59	61,120356	-63,265588	CTD Rosette	Recovery	610	348	11,6	5,8	1,96	32,16	1004,84	103	0
1	Hatton 600	ROV	2023-07-27	17:00	61,127784	-63,267054	ROV	Deployment	611	14	13,1	3,7	2,08	32,07	1004,56	103	0
1	Hatton 600	ROV	2023-07-27	17:40	61,126283	-63,270478	ROV	Bottom	609	20	20,2	4	2,03	32,08	1004,07	103	0
1	Hatton 600	ROV	2023-07-27	21:47	61,118822	-63,286642	ROV	Recovery					1,97	32,10			0
1	Hatton 600	ROV	2023-07-27	22:22	61,123343	-63,284978	Box Core	Deployment					1,95	32,10			0
1	Hatton 600	ROV	2023-07-27	22:35	61,123398	-63,286266	Box Core	Bottom	608	3	18,7	3,7	1,98	32,10	1004,33	103	0
1	Hatton 600	ROV	2023-07-27	22:48	61,122871	-63,286885	Box Core	Recovery	607	6	18,3	3,7	1,94	32,11	1004,22	104	0
1	Hatton 600	ROV	2023-07-27	23:56	61,195945	-63,285051	Drop Camera	Deployment	626	349	17,5	9,4	2,68	32,17	1004,25	104	0
1	Hatton 600	ROV	2023-07-28	0:08	61,194227	-63,283046	Drop Camera	Bottom	625	2	18,1	3,8	2,65	32,17	1004,18	104	0
1	Hatton 600	ROV	2023-07-28	0:48	61,188115	-63,276206	Drop Camera	Recovery	621	273	17,3	4,3	2,60	32,14	1004,14	104	0
1	Hatton 600	ROV	2023-07-28	2:36	61,432572	-63,253682	Drop Camera	Deployment	643	304	17,5	5,2	2,24	32,30	1004,08	104	0
1	Hatton 600	ROV	2023-07-28	2:45	61,433181	-63,252704	Drop Camera	Bottom	642	2	17,3	3,9	2,21	32,30	1004,16	104	0
1	Hatton 600	ROV	2023-07-28	3:34	61,435026	-63,251861	Drop Camera	Recovery	644				2,64	32,17			0
1	Hatton 600	ROV	2023-07-28	4:03	61,432199	-63,247351	Hydrobios	Deployment	643	352	12,9	5,3	2,55	32,16	1003,67	104	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	Hatton 600	ROV	2023-07-28	4:21	61,431269	-63,247343	Hydrobios	Bottom	644	354	19,2	3,9	2,52	32,15	1003,51	104	0
1	Hatton 600	ROV	2023-07-28	4:43	61,431610	-63,251352	Hydrobios	Recovery	643	354	19,4	4,6	2,54	32,12	1003,31	104	0
1	Hatton 600	ROV	2023-07-28	5:11	61,429946	-63,256607	Tucker Net	Deployment	643	346	16,4	3,8	2,48	32,13	1003,33	104	0
1	Hatton 600	ROV	2023-07-28	5:25	61,420012	-63,253383	Tucker Net	Bottom	646	357	16,2	3,8	2,49	32,13	1003,03	105	0
1	Hatton 600	ROV	2023-07-28	5:35	61,413710	-63,248823	Tucker Net	Recovery	646	356	18,3	3,8	2,47	32,14	1002,91	105	0
1	Hatton 600	ROV	2023-07-28	6:05	61,396800	-63,253367	IKMT	Deployment	646	329	8,4	5,9	2,33	32,14	1002,70	105	0
1	Hatton 600	ROV	2023-07-28	6:38	61,373776	-63,241721	IKMT	Bottom	647				2,50	32,19			0
1	Southwind	Full	2023-07-30	3:20	66,987168	-62,538173	CTD Rosette	Deployment	463	8	3,4	1,4	1,21	29,64	1010,07	103	
1	Southwind	Full	2023-07-30	3:37	66,986676	-62,538756	CTD Rosette	Bottom	457	20	3	2,9	-0,43	30,91	1009,96	103	
1	Southwind	Full	2023-07-30	3:51	66,986764	-62,539885	CTD Rosette	Recovery	446	4	0,4	3,8	0,74	30,57	1009,85	103	
1	Southwind	Full	2023-07-30	4:31	66,923487	-62,491551	CTD Rosette	Deployment	399				1,40	30,45			
1	Southwind	Full	2023-07-30	4:47	66,922741	-62,492058	CTD Rosette	Bottom	395	23	0	3,7	2,10	29,77	1009,52	103	
1	Southwind	Full	2023-07-30	5:01	66,922582	-62,492979	CTD Rosette	Recovery	399	354	0,2	3,7	2,04	29,86	1009,44	103	
1	Southwind	Full	2023-07-30	5:24	66,922660	-62,490315	Box Core	Deployment	392	323	2,7	4	2,38	28,55	1009,41	103	
1	Southwind	Full	2023-07-30	5:32	66,922687	-62,490062	Box Core	Bottom	390	331	3,4	4	2,10	29,38	1009,37	103	
1	Southwind	Full	2023-07-30	5:43	66,922617	-62,489710	Box Core	Recovery	388				1,78	30,12			
1	Southwind	Full	2023-07-30	7:01	66,829202	-62,427846	CTD Rosette	Deployment	103				2,67	30,03			
1	Southwind	Full	2023-07-30	7:10	66,829403	-62,427392	CTD Rosette	Bottom	111				1,90	30,43			
1	Southwind	Full	2023-07-30	7:16	66,829579	-62,426914	CTD Rosette	Recovery	114				2,43	29,61			
1	Southwind	Full	2023-07-30	7:37	66,829275	-62,427488	Box Core	Deployment	94	260	1,7	6	1,95	29,27	1008,70	103	
1	Southwind	Full	2023-07-30	7:40	66,829251	-62,427848	Box Core	Bottom	87	242	0,2	5,9	0,72	30,84	1008,69	103	
1	Southwind	Full	2023-07-30	7:44	66,829352	-62,428099	Box Core	Recovery	82	316	4,2	6,3	0,76	30,48	1008,72	103	
1	Southwind	Full	2023-07-30	8:05	66,830558	-62,429196	Box Core	Deployment	118	205	0	6,8	0,77	30,60	1008,71	103	
1	Southwind	Full	2023-07-30	8:09	66,830678	-62,429532	Box Core	Bottom	118	278	0	6,7	0,84	30,63	1008,70	103	
1	Southwind	Full	2023-07-30	8:14	66,830818	-62,429887	Box Core	Recovery	118	292	0,6	6,6	0,93	30,67	1008,66	103	
1	Southwind	Full	2023-07-30	8:48	66,805743	-62,377652	CTD Rosette	Deployment	167				1,78	30,39			
1	Southwind	Full	2023-07-30	8:57	66,805713	-62,377022	CTD Rosette	Bottom	169	179	0,2	6,5	2,16	30,01	1008,43	103	
1	Southwind	Full	2023-07-30	9:05	66,805800	-62,376689	CTD Rosette	Recovery	168	176	1	6,6	2,43	29,93	1008,32	103	
1	Southwind	Full	2023-07-30	13:57	66,752816	-62,311932	Gravity Core	Deployment		326	5,7	8,8	1,64	30,82	1007,69	102	
1	Southwind	Full	2023-07-30	13:59	66,752783	-62,311953	Gravity Core	Bottom		315	5,5	8,7	1,61	30,89	1007,71	102	
1	Southwind	Full	2023-07-30	14:01	66,752713	-62,311926	Gravity Core	Recovery		324	6,5	8,6	1,54	30,96	1007,69	102	
1	Southwind	Full	2023-07-30	15:06	66,788452	-62,368914	CTD Rosette	Deployment	180	339	4,2	11,6	2,18	30,66	1007,60	101	
1	Southwind	Full	2023-07-30	15:16	66,788085	-62,369379	CTD Rosette	Bottom	180	344	2,7	12,3	2,98	29,57	1007,57	101	
1	Southwind	Full	2023-07-30	15:25	66,787919	-62,369914	CTD Rosette	Recovery	180	342	2,1	11,1	3,05	29,59	1007,50	101	
1	Southwind	Full	2023-07-30	16:34	66,788293	-62,367755	Gravity Core	Deployment	180	342	8,9	9,5	1,89	30,26	1007,25	101	
1	Southwind	Full	2023-07-30	16:47	66,788308	-62,368464	Gravity Core	Bottom	180	342	12,4	9,6	1,62	30,82	1007,16	101	
1	Southwind	Full	2023-07-30	17:13	66,788135	-62,368824	Gravity Core	Recovery	180	354	8	10,7	1,78	30,83	1007,12	101	
1	Southwind	Full	2023-07-30	22:23	66,787617	-62,368574	Box Core	Deployment	180	348	8	10,2	2,15	30,66	1007,58	101	
1	Southwind	Full	2023-07-30	22:27	66,787600	-62,368990	Box Core	Bottom	180	351	7,4	10	2,77	30,16	1007,61	102	
1	Southwind	Full	2023-07-30	22:32	66,787519	-62,368999	Box Core	Recovery	180				2,45	30,28			

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	Southwind	Full	2023-07-30	23:14	66,751936	-62,312696	Box Core	Deployment	38	33	3,2	9,6	2,86	29,24	1007,81	102	
1	Southwind	Full	2023-07-30	23:15	66,751901	-62,312630	Box Core	Bottom	37	27	2,9	9,6	2,21	29,66	1007,81	102	
1	Southwind	Full	2023-07-30	23:17	66,751917	-62,312668	Box Core	Recovery	38	350	2,9	9,8	1,56	30,30	1007,83	101	
1	Southwind	Full	2023-07-30	23:59	66,752921	-62,312385	Box Core	Deployment	42	358	2,5	9,4	1,46	29,88	1008,08	102	
1	Southwind	Full	2023-07-31	0:00	66,752909	-62,312354	Box Core	Bottom	41	359	2,3	9,4	1,11	30,81	1008,10	102	
1	Southwind	Full	2023-07-31	0:04	66,752821	-62,312148	Box Core	Recovery	39	351	2,3	9,4	1,19	30,86	1008,09	102	
1	Southwind	Full	2023-07-31	0:34	66,752205	-62,323756	CTD Rosette	Deployment	101	18	1,7	9,8	2,27	30,14	1008,24	102	
1	Southwind	Full	2023-07-31	0:44	66,752005	-62,323732	CTD Rosette	Bottom	100	247	0	10,2	1,65	30,71	1008,25	102	
1	Southwind	Full	2023-07-31	0:51	66,751715	-62,323731	CTD Rosette	Recovery	99	300	2,3	10,5	1,76	30,51	1008,26	102	
1	C4	Mooring	2023-07-31	20:53	67,961953	-60,632411	Mooring	Deployment	1608	249	1,1	3,1	0,97	30,97	1010,06	102	
1	C4	Mooring	2023-07-31	21:55	67,955954	-60,637339	Mooring	Bottom	1607	250	5,5	2,8	0,68	31,00	1010,08	102	
1	C4	Mooring	2023-07-31	22:50	67,952682	-60,643673	CTD Rosette	Deployment		282	3	2,8	1,19	30,79	1010,37	102	
1	C4	Mooring	2023-07-31	23:23	67,952896	-60,649078	CTD Rosette	Bottom	1610	246	9,3	2	2,25	29,89	1010,45	102	
1	C4	Mooring	2023-07-31	23:54	67,954423	-60,652645	CTD Rosette	Recovery	1611	260	7,8	1,9	2,19	30,04	1010,58	103	
1	BB1B_600	Full	2023-08-01	4:44	67,990165	-59,371866	CTD Rosette	Deployment	552	286	7,8	1,2	-0,05	30,63	1011,15	103	
1	BB1B_600	Full	2023-08-01	5:00	67,987427	-59,376174	CTD Rosette	Bottom	563				-0,06	31,41			
1	BB1B_600	Full	2023-08-01	5:15	67,986902	-59,381234	CTD Rosette	Recovery	570	331	2,5	1,2	-0,21	31,34	1011,22	103	
1	BB1B_600	Full	2023-08-01	5:58	67,992078	-59,379459	Drop Camera	Deployment	556	310	7,2	-0,1	0,01	30,63	1011,24	103	
1	BB1B_600	Full	2023-08-01	6:13	67,989380	-59,386797	Drop Camera	Bottom	574	306	6,3	-0,3	0,03	31,09	1011,25	103	
1	BB1B_600	Full	2023-08-01	6:55	67,985715	-59,400610	Drop Camera	Recovery	610	285	5,1	-0,2	0,06	31,16	1011,52	103	
1	BB1B_600	Full	2023-08-01	7:41	67,991826	-59,375022	Box Core	Deployment	554	283	6,1	-0,3	-0,07	30,53	1011,61	103	
1	BB1B_600	Full	2023-08-01	7:53	67,991719	-59,375093	Box Core	Bottom	554	284	8,4	-0,2	0,00	30,50	1011,64	103	
1	BB1B_600	Full	2023-08-01	8:05	67,992040	-59,376082	Box Core	Recovery	554	280	7,8	-0,3	0,05	30,67	1011,64	103	
1	Disko Fan	Full	2023-08-01	8:58	67,969008	-59,506744	CTD Rosette	Deployment		319	2,5	0,5	0,07	30,72	1011,93	103	
1	Disko Fan	Full	2023-08-01	9:20	67,968943	-59,510469	CTD Rosette	Bottom	927	309	1,9	0,6	0,12	30,89	1011,91	103	
1	Disko Fan	Full	2023-08-01	9:44	67,969281	-59,514252	CTD Rosette	Recovery	935	337	3,2	0,8	0,10	31,04	1012,07	103	
1	Disko Fan	Full	2023-08-01	10:54	67,969898	-59,505433	Box Core	Deployment	902	309	4,8	-0,2	0,11	30,96	1012,43	103	
1	Disko Fan	Full	2023-08-01	11:16	67,970886	-59,504602	Box Core	Bottom	895	327	5,3	-0,3	0,17	30,80	1012,42	103	
1	Disko Fan	Full	2023-08-01	11:35	67,971914	-59,501695	Box Core	Recovery	883	319	7,8	-0,4	0,15	30,93	1012,43	103	
1	BB1A_600		2023-08-01	14:13	67,772201	-59,068872	CTD Rosette	Deployment	636	50	1,9	0,2	0,65	30,62	1013,23	103	
1	BB1A_600		2023-08-01	14:29	67,772598	-59,066446	CTD Rosette	Bottom	625	334	9,1	0,6	0,67	30,60	1013,18	102	
1	BB1A_600		2023-08-01	14:42	67,772872	-59,065357	CTD Rosette	Recovery	621	317	1,1	0,7	0,68	30,63	1013,23	103	
1	BB1A_600		2023-08-01	15:08	67,772661	-59,069060	Drop Camera	Deployment	632	315	5,1	0,3	0,78	30,56	1013,30	102	
1	BB1A_600		2023-08-01	15:20	67,772241	-59,068293	Drop Camera	Bottom	632	346	7,2	0,4	0,73	30,64	1013,30	103	
1	BB1A_600		2023-08-01	16:02	67,770156	-59,052952	Drop Camera	Recovery	604	316	8	0,2	0,24	31,09	1013,21	102	
1	BB1C_600		2023-08-01	18:16	67,587930	-58,588060	CTD Rosette	Deployment	591				-0,49	31,56			
1	BB1C_600		2023-08-01	18:33	67,585674	-58,582056	CTD Rosette	Bottom	599	271	8,4	-0,2	-0,31	31,20	1013,53	103	
1	BB1C_600		2023-08-01	19:00	67,582740	-58,567930	CTD Rosette	Recovery	596	272	7	-0,2	-0,38	31,33	1013,65	103	
1	BB1C_600		2023-08-01	19:21	67,588471	-58,595606	Drop Camera	Deployment	609	273	8,8	0,1	-0,41	31,62	1013,66	103	
1	BB1C_600		2023-08-01	19:44	67,584964	-58,588640	Drop Camera	Bottom	633	284	10,3	0,3	-0,17	31,27	1013,71	103	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	BB1C_600		2023-08-01	20:14	67,578101	-58,579687	Drop Camera	Recovery	666	253	8,6	0,1	-0,10	31,01	1013,73	103	
1	BB1D_600		2023-08-01	23:03	67,378003	-57,922977	CTD Rosette	Deployment	647	257	0	0,6	1,47	30,58	1013,82	103	
1	BB1D_600		2023-08-01	23:21	67,378600	-57,922613	CTD Rosette	Bottom	644	296	2,1	0,7	1,52	30,74	1013,84	103	
1	BB1D_600		2023-08-01	23:33	67,379838	-57,922510	CTD Rosette	Recovery	640	357	0,4	0,2	1,24	30,86	1013,85	103	
1	BB1D_600		2023-08-01	23:47	67,380746	-57,920798	Drop Camera	Deployment	637	295	1,7	0,6	1,42	30,87	1013,97	103	
1	BB1D_600		2023-08-01	23:55	67,380912	-57,920266	Drop Camera	Bottom	635	264	6,7	0,4	1,61	30,82	1013,98	103	
1	BB1D_600		2023-08-02	0:34	67,377850	-57,921861	Drop Camera	Recovery	647	283	0,4	0,6	1,45	30,56	1013,93	103	
1	BB1D_600		2023-08-02	1:40	67,378680	-57,932756	Box Core	Deployment	657				0,07	30,73			
1	BB1D_600		2023-08-02	1:55	67,378630	-57,932587	Box Core	Bottom	657	293	3,2	0,3	0,21	30,51	1014,11	103	
1	BB1D_600		2023-08-02	2:08	67,378605	-57,932030	Box Core	Recovery	656	295	4,8	0,2	0,20	30,53	1014,12	103	
1	Otolith 3		2023-08-02	8:22	66,799918	-58,496156	Box Core	Deployment	816	232	5,9	-0,5	-0,55	29,46	1014,12	103	
1	Otolith 3		2023-08-02	8:38	66,799784	-58,485913	Box Core	Bottom	809	231	6,1	-0,4	-0,56	30,39	1014,02	103	
1	Otolith 3		2023-08-02	8:53	66,799686	-58,476302	Box Core	Recovery	808	232	6,3	-0,2	-0,51	29,65	1014,03	104	
1	DS1	Basic	2023-08-02	12:59	66,256928	-58,298221	CTD Rosette	Deployment	627	194	3,8	0,3	1,21	31,65	1014,66	103	
1	DS1	Basic	2023-08-02	13:18	66,257639	-58,295697	CTD Rosette	Bottom	627	170	1,5	2,4	1,39	31,55	1014,56	104	
1	DS1	Basic	2023-08-02	13:41	66,258456	-58,294377	CTD Rosette	Recovery	627	152	0,6	2,6	1,74	31,49	1014,41	104	
1	DS1	Basic	2023-08-02	13:56	66,257278	-58,298388	Drop Camera	Deployment	627	164	3,2	2,1	1,44	31,58	1014,37	103	
1	DS1	Basic	2023-08-02	14:08	66,258476	-58,298318	Drop Camera	Bottom	626	191	4	2,4	1,34	31,60	1014,38	103	
1	DS1	Basic	2023-08-02	14:48	66,262558	-58,295128	Drop Camera	Recovery	627	163	5,5	1,2	0,82	31,78	1014,28	103	
1	DS1	Basic	2023-08-02	15:10	66,257479	-58,297402	Box Core	Deployment	626				0,66	31,87			
1	DS1	Basic	2023-08-02	15:24	66,257276	-58,297195	Box Core	Bottom	626	156	5,3	0,6	1,73	31,61	1014,18	103	
1	DS1	Basic	2023-08-02	15:38	66,257560	-58,295932	Box Core	Recovery	626	155	5,1	0,6	2,01	31,57	1014,15	103	
1	DS1	Basic	2023-08-02	16:57	66,257606	-58,292685	IKMT	Deployment	626	166	5,9	1	2,37	31,56	1014,05	103	
1	DS1	Basic	2023-08-02	17:24	66,244922	-58,314370	IKMT	Bottom	624	170	8,8	1,3	2,27	31,55	1014,07	103	
1	DS1	Basic	2023-08-02	18:09	66,223197	-58,267916	IKMT	Recovery	625	136	4	2,1	1,91	31,29	1014,07	103	
1	Otolith 4	Basic	2023-08-02	20:34	66,200236	-58,500249	Box Core	Deployment	506	152	5,3	2,3	1,33	30,13	1013,66	103	
1	Otolith 4	Basic	2023-08-02	20:46	66,199483	-58,496714	Box Core	Bottom	508	162	7,4	2,5	1,66	31,31	1013,50	103	
1	Otolith 4	Basic	2023-08-02	20:59	66,198092	-58,492811	Box Core	Recovery	512	204	2,3	2	1,52	31,41	1013,48	103	
1	Otolith 4	Basic	2023-08-02	21:58	66,215001	-58,455967	IKMT	Deployment	525	151	0,2	2,3	1,89	31,15	1013,29	103	
1	Otolith 4	Basic	2023-08-02	22:25	66,227935	-58,442982	IKMT	Bottom	520	160	6,3	3,5	2,09	31,42	1013,39	103	
1	Otolith 4	Basic	2023-08-02	23:05	66,252096	-58,472155	IKMT	Recovery	514	152	8,6	1,8	1,75	31,23	1013,14	103	
1	Otolith 5	Basic	2023-08-03	0:35	66,199535	-58,493536	Drop Camera	Deployment	512	163	1,1	1,8	0,32	31,43	1013,28	103	
1	Otolith 5	Basic	2023-08-03	0:48	66,198955	-58,488558	Drop Camera	Bottom	515	217	2,1	1,6	0,37	30,11	1013,30	103	
1	Otolith 5	Basic	2023-08-03	1:30	66,197763	-58,471517	Drop Camera	Recovery	524	176	8,8	1,6	0,84	30,59	1013,28	104	
1	Otolith 5	Basic	2023-08-03	7:53	65,599642	-58,500781	Box Core	Deployment	504	195	2,9	2,8	-0,04	30,86	1012,08	104	
1	Otolith 5	Basic	2023-08-03	8:04	65,599330	-58,497844	Box Core	Bottom	504	137	1,9	2,3	-0,08	30,71	1012,04	104	
1	Otolith 5	Basic	2023-08-03	8:15	65,596804	-58,499253	Box Core	Recovery	506	144	5	1,7	0,12	30,56	1012,02	104	
1	DS2	ROV	2023-08-03	10:39	65,336161	-58,017975	Drop Camera	Deployment	576	154	6,1	4,1	2,74	31,31	1011,64	104	
1	DS2	ROV	2023-08-03	10:51	65,336627	-58,017636	Drop Camera	Bottom	575	131	5,7	3,9	3,22	31,14	1011,49	104	
1	DS2	ROV	2023-08-03	11:33	65,336622	-58,007411	Drop Camera	Recovery	575	151	5,9	3,8	3,54	31,08	1011,58	104	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	DS2	ROV	2023-08-03	12:32	65,335294	-58,017558	CTD Rosette	Deployment	574	150	6,1	4	3,79	31,10	1011,53	104	
1	DS2	ROV	2023-08-03	12:48	65,335238	-58,018536	CTD Rosette	Bottom	573	153	5,9	4,1	3,71	31,12	1011,56	104	
1	DS2	ROV	2023-08-03	13:05	65,335145	-58,019922	CTD Rosette	Recovery	574	166	6,5	4,2	3,76	31,12	1011,56	104	
1	DS2	ROV	2023-08-03	13:33	65,335649	-58,021650	ROV	Deployment		177	5,1	4	3,72	31,14	1011,45	104	
1	DS2	ROV	2023-08-03	15:07	65,335590	-58,023202	ROV	Recovery		199	6,5	3,7	2,87	31,22	1011,30	104	
1	DS2	ROV	2023-08-03	16:08	65,335974	-58,023376	ROV	Deployment		221	6,3	3,5	2,76	31,19	1011,03	104	
1	DS2	ROV	2023-08-03	16:37	65,335511	-58,022286	ROV	Bottom		215	5	3,7	4,01	31,11	1010,97	104	
1	DS2	ROV	2023-08-03	21:08	65,335448	-58,028909	ROV	Recovery		268	2,9	2,5	0,39	31,56	1010,60	103	0
1	DS2	ROV	2023-08-03	21:39	65,334943	-58,016761	Box Core	Deployment	574				1,17	31,43			0
1	DS2	ROV	2023-08-03	21:55	65,334968	-58,016771	Box Core	Bottom	574	292	3,8	2,2	1,39	31,32	1010,61	103	0
1	DS2	ROV	2023-08-03	22:05	65,335048	-58,016734	Box Core	Recovery	574	286	4	2,1	1,27	31,33	1010,56	103	0
1	DS2	ROV	2023-08-03	22:52	65,335279	-58,016738	Hydrobios	Deployment	574				1,87	31,29			0
1	DS2	ROV	2023-08-03	23:06	65,335016	-58,017087	Hydrobios	Bottom	574	266	3,8	1,6	2,20	31,22	1010,52	104	0
1	DS2	ROV	2023-08-03	23:26	65,334858	-58,017959	Hydrobios	Recovery	574	274	3,2	1,7	3,46	30,94	1010,54	104	0
1	DS2	ROV	2023-08-03	23:50	65,336579	-58,019743	Tucker Net	Deployment	575	323	4,6	1,8	3,24	31,05	1010,64	104	0
1	DS2	ROV	2023-08-04	0:00	65,342130	-58,022518	Tucker Net	Bottom	573	313	5,1	2	3,58	30,95	1010,67	104	0
1	DS2	ROV	2023-08-04	0:09	65,344078	-58,034232	Tucker Net	Recovery	573	287	6,3	2	4,01	31,09	1010,60	104	0
1	DS2	ROV	2023-08-04	0:36	65,337776	-58,010918	IKMT	Deployment	576	340	3,4	2	3,87	30,95	1010,59	104	0
1	DS2	ROV	2023-08-04	0:58	65,349302	-58,015717	IKMT	Bottom	573	325	4,2	2,2	3,68	30,89	1010,61	104	0
1	DS2	ROV	2023-08-04	1:38	65,347204	-58,073640	IKMT	Recovery	567	285	2,7	2,6	3,89	31,00	1010,69	104	0
1	Davis Seep	Basic	2023-08-04	3:37	65,096651	-58,461476	CTD Rosette	Deployment	527	19	1,1	1,7	2,40	30,76	1011,01	104	0
1	Davis Seep	Basic	2023-08-04	3:52	65,097611	-58,462105	CTD Rosette	Bottom	527	43	1,7	1,6	3,48	30,57	1010,97	104	0
1	Davis Seep	Basic	2023-08-04	4:07	65,098859	-58,462552	CTD Rosette	Recovery	526	350	1,9	1,5	3,37	30,57	1011,02	104	0
1	Davis Seep	Basic	2023-08-04	4:28	65,097199	-58,461395	Box Core	Deployment	527	45	0	1,4	3,42	30,57	1011,02	104	0
1	Davis Seep	Basic	2023-08-04	4:39	65,096967	-58,462078	Box Core	Bottom	526	46	1,1	1,5	3,60	30,56	1011,09	104	0
1	Davis Seep	Basic	2023-08-04	4:51	65,096888	-58,462639	Box Core	Recovery	526	356	0	1,5	3,03	30,65	1011,21	104	0
1	Davis Seep	Basic	2023-08-04	5:26	65,096640	-58,460844	Drop Camera	Deployment	526	53	1,7	1,8	3,22	30,61	1011,37	104	0
1	Davis Seep	Basic	2023-08-04	5:34	65,096500	-58,461486	Drop Camera	Bottom	526	38	0,4	1,8	2,62	30,71	1011,42	104	0
1	Davis Seep	Basic	2023-08-04	6:10	65,094436	-58,471251	Drop Camera	Recovery	524	102	0,6	2,1	2,57	30,70	1011,61	104	0
1			2023-08-04	6:31	65,089500	-58,469340	MVP	Deployment	525				3,72	30,55			0
1	DS3	Basic	2023-08-04	10:12	64,648937	-58,601511	Drop Camera	Deployment	612	90	8,2	1,9	3,62	30,25	1012,19	104	0
1	DS3	Basic	2023-08-04	10:22	64,648349	-58,604815	Drop Camera	Bottom	611	94	7,8	1,9	2,58	30,68	1012,30	104	0
1	DS3	Basic	2023-08-04	11:02	64,644511	-58,610185	Drop Camera	Recovery	609	83	8,4	2,6	3,18	30,29	1012,55	104	0
1	DS3	Basic	2023-08-04	12:00	64,649710	-58,593241	CTD Rosette	Deployment	616	108	8,2	3,3	3,55	30,14	1012,94	104	0
1	DS3	Basic	2023-08-04	12:17	64,648582	-58,595792	CTD Rosette	Bottom	615	85	6,7	3,6	2,98	30,37	1013,08	104	0
1	DS3	Basic	2023-08-04	12:30	64,647179	-58,597990	CTD Rosette	Recovery	615	77	5,5	3,3	2,94	30,38	1013,04	104	0
1	DS3	Basic	2023-08-04	13:01	64,649646	-58,606544	IKMT	Deployment	609	74	2,3	4	3,67	30,15	1013,45	104	0
1	DS3	Basic	2023-08-04	13:21	64,644788	-58,625604	IKMT	Bottom	601	104	5	3,2	3,66	30,15	1013,66	104	0
1	DS3	Basic	2023-08-04	14:07	64,628379	-58,591472	IKMT	Recovery	630	61	6,3	3,6	3,76	30,15	1013,71	104	0
1	DS3	Basic	2023-08-04	14:28	64,648971	-58,600267	Box Core	Deployment	612	81	2,9	4,6	3,32	30,27	1013,67	104	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	DS3	Basic	2023-08-04	14:42	64,648433	-58,603102	Box Core	Bottom	611	147	1,3	5,5	3,65	30,11	1013,97	104	0
1	DS3	Basic	2023-08-04	14:59	64,648247	-58,604336	Box Core	Recovery	610	92	1,7	4,7	3,26	30,10	1014,20	104	0
1	DS3	Basic	2023-08-04	15:05	64,648081	-58,604501	Box Core	Deployment	610	135	1,3	4,9	2,79	30,20	1014,21	104	0
1	DS3	Basic	2023-08-04	15:20	64,647776	-58,603263	Box Core	Bottom	611	40	0,4	4,8	3,06	30,23	1014,34	104	0
1	DS3	Basic	2023-08-04	15:34	64,647464	-58,602033	Box Core	Recovery	611	122	0,6	5,3	3,03	30,19	1014,36	104	0
1			2023-08-04	17:31	64,708315	-58,442674	MVP	Deployment	656	19	2,5	6,4	3,48	29,67	1015,24	103	0
1			2023-08-04	21:49	64,111990	-58,875745	MVP	Recovery	739	109	9,1	5,8	7,58	32,51	1015,91	103	0
1	HB AUV	ROV	2023-08-05	12:28	61,432540	-60,706093	AUV	Deployment	540	193	7,2	6,6	6,42	32,14	1017,94	103	0
1	HB AUV	ROV	2023-08-05	13:54	61,449954	-60,726390	CTD Rosette	Deployment	542	194	6,1	7,2	6,66	32,15	1018,25	102	0
1	HB AUV	ROV	2023-08-05	14:10	61,452607	-60,731454	CTD Rosette	Bottom	542	330	0	8,5	6,59	32,15	1018,20	102	0
1	HB AUV	ROV	2023-08-05	14:32	61,456497	-60,737129	CTD Rosette	Recovery	542	210	3,4	9,4	6,60	32,11	1018,09	102	0
1	HB AUV	ROV	2023-08-05	17:09	61,452828	-60,719110	ROV	Deployment		175	6,5	6,2	5,63	32,45	1018,51	103	0
1	HB AUV	ROV	2023-08-05	17:32	61,460805	-60,698424	ROV	Recovery		182	2,5	8,5	5,29	32,51	1018,66	102	0
1	HT1-900	Drop Camera	2023-08-05	18:38	61,432197	-60,594156	Drop Camera	Deployment	867	204	0,2	8	6,79	32,36	1018,86	103	0
1	HT1-900	Drop Camera	2023-08-05	18:54	61,431375	-60,593514	Drop Camera	Bottom	872	264	1	7,6	6,69	32,38	1018,98	103	0
1	HT1-900	Drop Camera	2023-08-05	19:42	61,425213	-60,578844	Drop Camera	Recovery	961	175	8,4	6,6	5,47	32,43	1018,99	103	0
1	HT1-1200	Drop Camera	2023-08-05	20:16	61,420405	-60,497881	Drop Camera	Deployment	1189	250	3,2	7,4	7,01	32,35	1019,10	103	0
1	HT1-1200	Drop Camera	2023-08-05	20:45	61,420511	-60,498266	Drop Camera	Bottom	1189	200	10,5	6,9	6,90	32,43	1019,19	103	0
1	HT1-1200	Drop Camera	2023-08-05	21:37	61,412072	-60,495027	Drop Camera	Recovery	1250				6,98	32,33			0
1	HT1-1500	Drop Camera	2023-08-05	22:13	61,409222	-60,373034	Drop Camera	Deployment	1465	195	11,2	7,3	7,42	32,22	1019,25	103	0
1	HT1-1500	Drop Camera	2023-08-05	22:34	61,407689	-60,371645	Drop Camera	Bottom	1477	193	10,5	7,2	7,44	32,20	1019,23	103	0
1	HT1-1500	Drop Camera	2023-08-05	23:22	61,401218	-60,372926	Drop Camera	Recovery	1494	206	6,7	8,3	7,38	32,19	1019,52	103	0
1	HT1-1800	Drop Camera	2023-08-06	0:04	61,394995	-60,171043	Drop Camera	Deployment	1762	200	5,5	8,2	7,01	32,35	1019,62	103	0
1	HT1-1800	Drop Camera	2023-08-06	0:28	61,393431	-60,170786	Drop Camera	Bottom	1767	199	4,2	8,7	7,20	32,34	1019,76	103	0
1	HT1-1800	Drop Camera	2023-08-06	1:19	61,387983	-60,181197	Drop Camera	Recovery	1764	234	3,6	7,9	7,10	32,34	1019,91	104	0
1	HT2-1800	Drop Camera	2023-08-06	3:35	60,999745	-60,354575	Drop Camera	Deployment	1772	226	8,4	5,8	6,84	32,47	1020,11	104	0
1	HT2-1800	Drop Camera	2023-08-06	3:53	60,999253	-60,352250	Drop Camera	Bottom		221	8,4	5,9	6,92	32,47	1020,00	104	0
1	HT2-1800	Drop Camera	2023-08-06	4:48	60,999409	-60,341472	Drop Camera	Recovery	1796	207	9,9	5,6	7,02	32,47	1020,12	104	0
1	HT2-1500	Drop Camera	2023-08-06	6:06	61,062608	-60,646812	Drop Camera	Deployment	1472	212	8,6	4,3	6,21	32,22	1020,31	104	0
1	HT2-1500	Drop Camera	2023-08-06	6:22	61,062640	-60,647221	Drop Camera	Bottom	1471	210	9,1	4	6,17	32,23	1020,46	104	0
1	HT2-1500	Drop Camera	2023-08-06	7:07	61,055884	-60,643101	Drop Camera	Recovery	1478	211	8,6	3,6	6,04	32,29	1020,61	104	0
1	HT2-1200	Drop Camera	2023-08-06	8:05	61,087904	-60,772895	Drop Camera	Deployment	1181	239	6,7	3	5,56	32,35	1020,84	104	0
1	HT2-1200	Drop Camera	2023-08-06	8:18	61,088277	-60,771011	Drop Camera	Bottom	1184	235	5,7	4	5,37	32,40	1020,94	105	0
1	HT2-1200	Drop Camera	2023-08-06	9:02	61,087404	-60,779975	Drop Camera	Recovery	1165	271	4,4	4,4	5,32	32,37	1021,17	105	0
1	HT2-600	ROV	2023-08-06	9:41	61,112823	-60,914760	CTD Rosette	Deployment	584	210	1,7	3,4	5,12	32,48	1021,07	105	0
1	HT2-600	ROV	2023-08-06	9:57	61,113325	-60,914646	CTD Rosette	Bottom	582				5,42	32,38			0
1	HT2-600	ROV	2023-08-06	10:11	61,111987	-60,917377	CTD Rosette	Recovery	582	244	4,8	3,2	5,63	32,34	1021,18	105	0
1	HT2-600	ROV	2023-08-06	10:55	61,110395	-60,909798	ROV	Deployment		296	0	3,6	5,86	32,30	1021,10	105	0
1	HT2-600	ROV	2023-08-06	12:29	61,116632	-60,922978	ROV	Recovery		255	0,6	4,4	5,41	32,44	1021,03	104	0
1	HT2-600	ROV	2023-08-06	13:05	61,111613	-60,912443	Drop Camera	Deployment		203	1,3	3,9	6,04	32,44	1021,21	104	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	HT2-600	ROV	2023-08-06	13:13	61,112190	-60,914785	Drop Camera	Bottom	583	179	3,6	3,6	5,62	32,42	1021,30	104	0
1	HT2-600	ROV	2023-08-06	13:50	61,116189	-60,917626	Drop Camera	Recovery	575	167	1,9	3,3	5,75	32,35	1021,33	103	0
1	HT2-900	Drop Camera	2023-08-06	14:21	61,099878	-60,840591	Drop Camera	Deployment	901	243	2,1	3,8	6,00	32,56	1021,26	103	0
1	HT2-900	Drop Camera	2023-08-06	14:32	61,099427	-60,840198	Drop Camera	Bottom	888	264	1,7	4	5,84	32,38	1021,29	103	0
1	HT2-900	Drop Camera	2023-08-06	15:23	61,096437	-60,846143	Drop Camera	Recovery	888	210	3,2	3,7	5,63	32,40	1021,53	103	0
1	HT3-600	Drop Camera	2023-08-06	17:20	60,791217	-61,188261	Drop Camera	Deployment	609				5,33	32,41			0
1	HT3-600	Drop Camera	2023-08-06	17:29	60,790708	-61,188490	Drop Camera	Bottom	611	181	2,5	4,4	5,18	32,42	1021,48	103	0
1	HT3-600	Drop Camera	2023-08-06	18:06	60,789225	-61,190556	Drop Camera	Recovery	602	144	3,2	4,2	4,66	32,47	1021,56	103	0
1	HT3-900	Drop Camera	2023-08-06	18:49	60,779762	-61,082085	Drop Camera	Deployment	932	176	3	4,9	5,67	32,44	1021,55	103	0
1	HT3-900	Drop Camera	2023-08-06	19:03	60,780121	-61,080689	Drop Camera	Bottom	935	158	3,6	4,7	5,28	32,43	1021,71	103	0
1	HT3-900	Drop Camera	2023-08-06	19:43	60,777549	-61,069735	Drop Camera	Recovery	965	148	5	6	4,71	32,44	1021,71	103	0
1	HT3-1200	Drop Camera	2023-08-06	20:20	60,767523	-60,934689	Drop Camera	Deployment	1191	166	2,9	4,3	4,38	32,53	1021,93	103	0
1	HT3-1200	Drop Camera	2023-08-06	20:36	60,766164	-60,933333	Drop Camera	Bottom	1194	151	1,5	5,4	5,01	32,52	1021,96	103	0
1	HT3-1200	Drop Camera	2023-08-06	21:20	60,761321	-60,927180	Drop Camera	Recovery	1198	289	0	5,5	5,04	32,45	1021,78	103	0
1	HT3-1500	Drop Camera	2023-08-06	22:09	60,746997	-60,701089	Drop Camera	Deployment	1469	165	2,3	4,6	5,53	32,44	1021,70	103	0
1	HT3-1500	Drop Camera	2023-08-06	22:25	60,745783	-60,700351	Drop Camera	Bottom	1477	179	4,4	4,9	4,14	32,59	1021,62	103	0
1	HT3-1500	Drop Camera	2023-08-06	23:11	60,739430	-60,696253	Drop Camera	Recovery	1488	149	2,7	8,4	4,19	32,58	1021,47	102	0
1	HT3-1800	Drop Camera	2023-08-07	0:20	60,715824	-60,295758	Drop Camera	Deployment	1757	129	1,7	4,8	7,76	32,32	1021,59	103	0
1	HT3-1800	Drop Camera	2023-08-07	0:38	60,714826	-60,291905	Drop Camera	Bottom	1760	158	2,7	4,6	7,35	32,38	1021,47	103	0
1	HT3-1800	Drop Camera	2023-08-07	1:25	60,717546	-60,289440	Drop Camera	Recovery	1764	159	2,9	4,3	7,59	32,35	1021,38	104	0
1	HT1-1800	Drop Camera	2023-08-07	5:25	61,394951	-60,168024	Drop Camera	Deployment	1767	200	4	5,7	7,53	32,38	1020,32	105	0
1	HT1-1800	Drop Camera	2023-08-07	5:45	61,395244	-60,169595	Drop Camera	Bottom	1766	221	4,4	5,6	7,51	32,39	1020,42	105	0
1	HT1-1800	Drop Camera	2023-08-07	6:33	61,396525	-60,181816	Drop Camera	Recovery	1740	221	1	5,9	7,38	32,43	1020,46	105	0
1	Davon	ROV	2023-08-07	15:04	63,041487	-60,326952	CTD Rosette	Deployment	792	227	14,9	9,1	5,51	31,06	1017,11	103	0
1	Davon	ROV	2023-08-07	15:24	63,038485	-60,322595	CTD Rosette	Bottom	804	137	2,7	8,2	5,49	31,05	1017,05	103	0
1	Davon	ROV	2023-08-07	15:44	63,038244	-60,320082	CTD Rosette	Recovery	807	358	1,1	7,7	5,47	31,05	1017,11	103	0
1	Davon	ROV	2023-08-07	16:33	63,041462	-60,326401	ROV	Deployment		210	11,6	6,2	5,58	31,11	1017,03	103	0
1	Davon	ROV	2023-08-07	17:20	63,041399	-60,326927	ROV	Bottom		209	11,8	6,1	5,51	31,16	1016,92	103	0
1	Davon	ROV	2023-08-07	20:47	63,041456	-60,324983	ROV	Recovery		208	9,3	4,5	5,74	31,26	1017,28	103	0
1	Davon	ROV	2023-08-07	21:06	63,042827	-60,326741	Plankton Net	Deployment	788	217	9,3	4,2	5,50	31,28	1017,18	103	0
1	Davon	ROV	2023-08-07	21:10	63,042997	-60,326109	Plankton Net	Bottom	789	216	8,6	4,4	5,55	31,27	1017,17	104	0
1	Davon	ROV	2023-08-07	21:13	63,043101	-60,325542	Plankton Net	Recovery	790	213	9,1	4,4	5,57	31,28	1017,13	103	0
1	Fobar	ROV	2023-08-08	14:35	62,403733	-66,219384	CTD Rosette	Deployment	449	125	7,8	7,6	2,18	31,92	1014,18	102	0
1	Fobar	ROV	2023-08-08	14:48	62,405233	-66,221367	CTD Rosette	Bottom	444	114	13,1	3,2	1,34	32,22	1014,06	103	0
1	Fobar	ROV	2023-08-08	14:56	62,406802	-66,221918	CTD Rosette	Recovery	443	112	12,8	2,7	1,44	32,21	1013,94	103	0
1	Fobar	ROV	2023-08-08	16:08	62,405253	-66,215254	ROV	Deployment		127	17,9	2,4	1,77	32,07	1013,38	103	0
1	Fobar	ROV	2023-08-08	16:34	62,405239	-66,214641	ROV	Bottom		134	14,7	2,4	1,93	32,07	1013,37	103	0
1	Fobar	ROV	2023-08-08	20:52	62,398825	-66,239743	ROV	Recovery		124	18,1	2,2	2,12	32,09	1012,83	103	0
1	Fobar	ROV	2023-08-08	21:01	62,398132	-66,239922	Plankton Net	Deployment	386	119	20,2	2,1	1,49	32,20	1012,79	103	0
1	Fobar	ROV	2023-08-08	21:05	62,397081	-66,240478	Plankton Net	Bottom	384	121	18,5	2,1	1,21	32,25	1012,94	103	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
1	Fobar	ROV	2023-08-08	21:07	62,396767	-66,240930	Plankton Net	Recovery	392	119	19	2,1	1,33	32,24	1012,92	103	0
1		AUV	2023-08-09	13:41	63,647250	-68,624413	AUV	Deployment	81	117	12,4	2,9	1,08	31,83	1007,72	104	0
1		AUV	2023-08-09	17:02	63,647762	-68,622777	AUV	Recovery	79	129	13,3	3,1	1,18	31,79	1004,78	105	0
Leg 2																	
2	test	Rosette	2023-08-12	13:05	67,014158	-61,100436	CTD Rosette	Deployment	383	167	25,5	2,1			1011,93	107	1
2	test	Rosette	2023-08-12	13:13	67,014435	-61,101787	CTD Rosette	Bottom	381	154	24,9	2			1011,77	107	1
2	test	Rosette	2023-08-12	13:34	67,015137	-61,103077	CTD Rosette	Recovery	381	155	23	2,1			1011,73	107	1
2	E1	Full	2023-08-13	0:30	68,277197	-65,137396	Plankton Net	Deployment	452	111	6,7	1,9			1014,14	105	2
2	E1	Full	2023-08-13	0:32	68,277074	-65,137538	Plankton Net	Bottom	453	88	6,5	1,9			1014,10	104	2
2	E1	Full	2023-08-13	0:34	68,277057	-65,137694	Plankton Net	Recovery	452	94	7,2	1,8			1014,10	105	2
2	E1	Full	2023-08-13	0:58	68,277207	-65,141213	CTD Rosette	Deployment	452	130	8,4	2,4			1014,04	104	2
2	E1	Full	2023-08-13	1:07	68,277475	-65,140716	CTD Rosette	Bottom	451	128	10,1	2,3			1014,06	104	2
2	E1	Full	2023-08-13	1:40	68,277919	-65,135492	CTD Rosette	Recovery	453								2
2	E1	Full	2023-08-13	2:10	68,276667	-65,136444	Hydrobios	Deployment	454	137	9,7	2,3			1013,93	104	2
2	E1	Full	2023-08-13	2:21	68,276515	-65,137135	Hydrobios	Bottom	454	144	10,7	2,6			1013,83	104	2
2	E1	Full	2023-08-13	2:37	68,275857	-65,137883	Hydrobios	Recovery	452	145	10,7	2,6			1013,77	104	2
2	E1	Full	2023-08-13	3:33	68,283655	-65,046343	Tucker Net	Deployment	404	168	7	3,6			1013,82	104	2
2	E1	Full	2023-08-13	3:38	68,286553	-65,049038	Tucker Net	Bottom	398	159	9,1	2,7			1013,78	104	2
2	E1	Full	2023-08-13	3:43	68,288472	-65,053250	Tucker Net	Recovery	404	162	9,9	2,6			1013,69	104	2
2	E1	Full	2023-08-13	3:51	68,293384	-65,054572	Tucker Net	Recovery	401	162	5,1	3,6			1013,78	104	2
2	E1	Full	2023-08-13	4:19	68,319894	-65,021912	Beam Trawl	Deployment	320	161	1,1	3,2			1013,85	104	2
2	E1	Full	2023-08-13	4:34	68,327048	-65,021605	Beam Trawl	Bottom	283	182	8,4	3,7			1013,74	104	2
2	E1	Full	2023-08-13	4:55	68,331144	-65,055365	Beam Trawl	Recovery	261	179	8,6	3,6			1013,93	104	1
2	E2	Rosette	2023-08-13	7:41	68,537473	-64,658081	CTD Rosette	Deployment	509	189	10,7	4,5			1014,34	104	1
2	E2	Rosette	2023-08-13	7:50	68,537517	-64,656786	CTD Rosette	Bottom	507	210	9,9	6,7			1014,34	104	1
2	E2	Rosette	2023-08-13	8:30	68,537379	-64,652472	CTD Rosette	Recovery	504	187	10,3	5,1			1014,59	104	1
2	E3	Full	2023-08-13	10:47	68,798517	-64,172138	Plankton Net	Deployment	1272	199	14,3	3,7			1014,58	103	2
2	E3	Full	2023-08-13	10:49	68,798349	-64,173102	Plankton Net	Bottom	1270	192	13,5	3,6			1014,59	103	2
2	E3	Full	2023-08-13	10:51	68,798315	-64,173683	Plankton Net	Recovery	1269	197	14,1	3,4			1014,52	103	2
2	E3	Full	2023-08-13	11:22	68,801156	-64,174443	Hydrobios	Deployment	1264	207	12	3,2			1014,69	103	3
2	E3	Full	2023-08-13	11:52	68,803019	-64,175251	Hydrobios	Bottom	1267	194	13,7	3,9			1014,48	103	3
2	E3	Full	2023-08-13	12:31	68,806150	-64,177029	Hydrobios	Recovery	1272	190	13,3	3,5			1014,62	103	3
2	E3	Full	2023-08-13	13:57	68,802218	-64,138499	CTD Rosette	Deployment	1335	198	1	4			1015,01	102	2
2	E3	Full	2023-08-13	14:23	68,802520	-64,121971	CTD Rosette	Bottom	1346	206	0,4	4,2			1014,82	102	2
2	E3	Full	2023-08-13	15:14	68,801005	-64,082538	CTD Rosette	Recovery	1377	181	5,5	4,6			1014,74	102	1
2	E3	Full	2023-08-13	15:41	68,791328	-64,021359	Tucker Net	Deployment	1404	218	3,6	4,9			1014,72	103	1
2	E3	Full	2023-08-13	15:54	68,794618	-64,000716	Tucker Net	Bottom	1421	189	5,9	8,6			1014,73	102	1
2	E3	Full	2023-08-13	16:06	68,798887	-63,984086	Tucker Net	Recovery	1449	194	12	7,8			1014,65	103	1
2	E3	Full	2023-08-13	17:23	68,794657	-64,133261	CTD Rosette	Deployment	1337	187	16,8	5,1			1014,60	102	1
2	E3	Full	2023-08-13	17:33	68,791728	-64,128296	CTD Rosette	Bottom	1340	180	17,5	5,1			1014,47	102	1

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	E3	Full	2023-08-13	17:56	68,785086	-64,117300	CTD Rosette	Recovery	1340	185	16,9	4,9			1014,41	102	1
2	E3	Full	2023-08-13	18:39	68,794195	-64,186317	Box Core	Deployment	1253	175	19	5,2			1014,04	102	1
2	E3	Full	2023-08-13	19:03	68,793007	-64,187992	Box Core	Bottom	1256	182	14,7	4,7			1014,45	102	1
2	E3	Full	2023-08-13	19:28	68,790948	-64,181090	Box Core	Recovery	1272	180	17,7	4,9			1014,30	102	1
2	E4	Rosette	2023-08-13	23:31	69,247271	-63,312806	IKMT	Deployment	1874	169	17,3	6,3			1013,74	103	0
2	E4	Rosette	2023-08-13	23:53	69,259876	-63,319637	IKMT	Bottom	1877								0
2	E4	Rosette	2023-08-14	0:36	69,287915	-63,348485	IKMT	Recovery	1876	187	19,4	6,5			1013,30	103	0
2	E4	Rosette	2023-08-14	1:29	69,218419	-63,347350	CTD Rosette	Deployment	1850	189	21,1	6,7			1013,28	103	0
2	E4	Rosette	2023-08-14	2:02	69,218163	-63,342805	CTD Rosette	Bottom	1852	192	21,1	6,6			1012,87	103	0
2	E4	Rosette	2023-08-14	3:14	69,215136	-63,326656	CTD Rosette	Recovery	1857								0
2	E4	Rosette	2023-08-14	3:35	69,217431	-63,353652	Box Core	Deployment	1848	207	18,5	6,5			1012,73	103	0
2	E4	Rosette	2023-08-14	4:06	69,216301	-63,351443	Box Core	Bottom	1848	201	17,1	6,6			1012,56	103	0
2	E4	Rosette	2023-08-14	4:42	69,217188	-63,350904	Box Core	Recovery	1849	191	14,3	6,5			1012,26	103	0
2	E4	Rosette	2023-08-14	5:04	69,216867	-63,351024	Box Core	Deployment	1848	201	15,6	6,8			1012,23	103	0
2	E4	Rosette	2023-08-14	5:38	69,216071	-63,350572	Box Core	Bottom	1848	195	12,9	6,7			1012,12	103	0
2	E4	Rosette	2023-08-14	6:07	69,215619	-63,352467	Box Core	Recovery	1848	209	13,9	6,6			1012,24	103	0
2	E5	Full	2023-08-14	9:17	69,604004	-62,540527	Plankton Net	Deployment	1967	231	14,3	6,5			1011,37	104	0
2	E5	Full	2023-08-14	9:19	69,603968	-62,540865	Plankton Net	Bottom	1967	230	15,8	6,6			1011,34	104	0
2	E5	Full	2023-08-14	9:21	69,603921	-62,541401	Plankton Net	Recovery	1967	232	16,6	6,5			1011,27	104	0
2	E5	Full	2023-08-14	9:39	69,603851	-62,544625	CTD Rosette	Deployment	1966	233	15,6	6,5			1011,30	104	0
2	E5	Full	2023-08-14	10:16	69,604617	-62,546342	CTD Rosette	Bottom	1966	241	14,7	6,8			1011,28	104	0
2	E5	Full	2023-08-14	11:20	69,606648	-62,545395	CTD Rosette	Recovery	1967	249	14,7	6,8			1011,38	103	0
2	E5	Full	2023-08-14	12:09	69,606070	-62,537480	Tucker Net	Deployment	1967	242	10,7	6			1011,73	103	0
2	E5	Full	2023-08-14	12:18	69,610271	-62,529780	Tucker Net	Bottom	1968	240	8,4	5,9			1011,77	103	0
2	E5	Full	2023-08-14	12:25	69,614209	-62,527742	Tucker Net	Recovery	1968	230	8,9	5,9			1011,79	103	0
2	E5	Full	2023-08-14	12:55	69,604397	-62,528972	Hydrobios	Deployment	1966	228	10,3	6			1011,90	103	0
2	E5	Full	2023-08-14	13:45	69,610132	-62,520479	Hydrobios	Bottom	1968	239	11	6,3			1011,95	103	0
2	E5	Full	2023-08-14	14:40	69,614060	-62,508099	Hydrobios	Recovery	1968	239	12	6,1			1011,86	103	0
2	E5	Full	2023-08-14	15:17	69,599972	-62,531953	CTD Rosette	Deployment	1966	261	12,2	6,2			1012,02	103	0
2	E5	Full	2023-08-14	15:35	69,597870	-62,526850	CTD Rosette	Bottom	1965	238	12,9	6			1012,01	103	0
2	E5	Full	2023-08-14	16:05	69,596084	-62,520562	CTD Rosette	Recovery	1965	240	9,3	6,1			1011,93	104	0
2	E5	Full	2023-08-14	16:53	69,604068	-62,536250	Box Core	Deployment	1966	228	8,6	6			1012,30	104	0
2	E5	Full	2023-08-14	17:27	69,603841	-62,537822	Box Core	Bottom	1966	224	7,4	6			1012,36	104	0
2	E5	Full	2023-08-14	17:59	69,602824	-62,538706	Box Core	Recovery	1966	215	8,8	6,2			1012,51	104	0
2	E5	Full	2023-08-14	18:27	69,601355	-62,519917	IKMT	Deployment	1966	200	10,7	8,9			1012,35	103	0
2	E5	Full	2023-08-14	18:54	69,614779	-62,529154	IKMT	Bottom	1968	209	11,6	5,9			1012,28	104	0
2	E5	Full	2023-08-14	19:44	69,603117	-62,547985	IKMT	Recovery	1966	213	9,7	5,9			1011,93	104	0
2	C5	Full	2023-08-15	4:45	68,146717	-59,974088	Plankton Net	Deployment	1381	190	11	4,3	0,46	31,76	1013,81	103	0
2	C5	Full	2023-08-15	4:47	68,146766	-59,973699	Plankton Net	Bottom	1380	182	10,9	4,4	1,22	31,49	1013,71	103	0
2	C5	Full	2023-08-15	4:49	68,146693	-59,973593	Plankton Net	Recovery	1381	187	10,7	4,3	1,61	30,93	1013,73	103	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	C5	Full	2023-08-15	5:05	68,146373	-59,972544	CTD Rosette	Deployment	1381	193	10,1	4,4	2,42	30,37	1013,76	103	0
2	C5	Full	2023-08-15	5:30	68,145113	-59,968678	CTD Rosette	Bottom	1383				2,77	30,04			0
2	C5	Full	2023-08-15	6:23	68,139377	-59,965281	CTD Rosette	Recovery	1395	186	10,5	4,2	3,43	29,85	1013,58	103	0
2	C5	Full	2023-08-15	6:48	68,145880	-59,979726	Tucker Net	Deployment	1387	169	4,8	5	3,39	29,91	1013,58	103	0
2	C5	Full	2023-08-15	6:53	68,148302	-59,977164	Tucker Net	Bottom	1376	189	7,4	4,3	3,39	29,89	1013,55	103	0
2	C5	Full	2023-08-15	7:00	68,151319	-59,984005	Tucker Net	Recovery	1375				3,44	30,02			0
2	C5	Full	2023-08-15	7:27	68,147825	-59,978193	Hydrobios	Deployment	1379	184	10,5	4	3,46	30,02	1013,47	103	0
2	C5	Full	2023-08-15	8:03	68,146919	-59,970497	Hydrobios	Bottom	1377	187	9,7	4,3	3,48	30,01	1013,51	103	0
2	C5	Full	2023-08-15	8:46	68,144518	-59,966321	Hydrobios	Recovery	1383				3,57	29,99			0
2	C5	Full	2023-08-15	9:19	68,145259	-59,973944	CTD Rosette	Deployment	1386	186	9,7	4,7	2,43	30,25	1013,49	103	0
2	C5	Full	2023-08-15	9:36	68,143944	-59,972131	CTD Rosette	Bottom	1389				3,55	30,03			0
2	C5	Full	2023-08-15	10:16	68,140166	-59,970066	CTD Rosette	Recovery	1398	198	8	5	3,32	30,21	1013,58	103	0
2	C5	Full	2023-08-15	10:40	68,148999	-59,972781	IKMT	Deployment	1369	194	7,8	6,3	3,39	29,86	1013,54	103	0
2	C5	Full	2023-08-15	11:05	68,151376	-60,002608	IKMT	Bottom	1384	205	8	4,8	3,42	29,83	1013,51	103	0
2	C5	Full	2023-08-15	11:52	68,129077	-59,984484	IKMT	Recovery	1404	205	1,7	4,7	3,65	29,96	1013,57	103	0
2	C4	Rosette	2023-08-15	13:52	67,956694	-60,606759	CTD Rosette	Deployment	1603	166	5	4,6	1,19	31,40	1013,39	103	0
2	C4	Rosette	2023-08-15	14:22	67,954969	-60,605002	CTD Rosette	Bottom	1602	134	3,6	4,5	0,63	31,49	1013,23	103	0
2	C4	Rosette	2023-08-15	15:29	67,950706	-60,606443	CTD Rosette	Recovery	1602	158	6,1	4,7	3,54	30,33	1013,00	103	0
2	C4	Rosette	2023-08-15	16:19	67,955412	-60,616446	Box Core	Deployment	1604	125	3,6	6,8	3,80	30,20	1013,07	103	0
2	C4	Rosette	2023-08-15	16:45	67,956970	-60,614353	Box Core	Bottom	1604	175	5,1	6	3,86	30,11	1013,10	103	0
2	C4	Rosette	2023-08-15	17:13	67,957605	-60,617496	Box Core	Recovery	1605	160	3,8	6,5	3,38	30,64	1012,98	103	0
2	C3	Full	2023-08-15	19:23	67,750817	-61,274501	Plankton Net	Deployment	1565	179	1,9	7,6	2,55	30,85	1012,83	102	0
2	C3	Full	2023-08-15	19:44	67,751013	-61,277446	CTD Rosette	Deployment	1565	42	1,7	9,2	4,14	30,70	1012,87	103	0
2	C3	Full	2023-08-15	20:13	67,750913	-61,278931	CTD Rosette	Bottom	1565	100	1,9	10,1	4,23	30,69	1012,88	103	0
2	C3	Full	2023-08-15	21:06	67,752821	-61,280534	CTD Rosette	Recovery	1567	141	7,8	8,3	4,41	30,59	1012,49	102	0
2	C3	Full	2023-08-15	21:26	67,754152	-61,296546	Tucker Net	Deployment	1568	142	8,9	7,4	5,25	30,72	1012,53	102	0
2	C3	Full	2023-08-15	21:32	67,754615	-61,288652	Tucker Net	Bottom	1568				4,94	30,45			0
2	C3	Full	2023-08-15	21:37	67,757627	-61,288399	Tucker Net	Recovery	1572	133	3,2	7,6	4,77	30,39	1012,58	102	0
2	C3	Full	2023-08-15	22:00	67,753441	-61,287616	Hydrobios	Deployment	1567				3,37	30,27			0
2	C3	Full	2023-08-15	22:39	67,756333	-61,291062	Hydrobios	Bottom	1570	72	3,8	6	3,79	30,04	1012,52	103	0
2	C3	Full	2023-08-15	23:29	67,759816	-61,292044	Hydrobios	Recovery	1573	86	7	5,7	3,90	29,97	1012,53	103	0
2	C3	Full	2023-08-16	0:03	67,752029	-61,277224	CTD Rosette	Deployment	1566	80	6,9	5,2	4,16	29,93	1012,51	103	0
2	C3	Full	2023-08-16	0:21	67,753511	-61,277607	CTD Rosette	Bottom	1567	102	8,9	5,1	3,27	30,21	1012,39	103	0
2	C3	Full	2023-08-16	0:49	67,756415	-61,278817	CTD Rosette	Recovery	1568	93	6,5	5	3,64	29,98	1012,49	103	0
2	C3	Full	2023-08-16	1:04	67,749891	-61,277875	Box Core	Deployment	1564	109	7,6	5	2,03	30,85	1012,40	103	0
2	C3	Full	2023-08-16	1:32	67,751132	-61,283838	Box Core	Bottom	1564	118	8,6	5	2,49	30,62	1012,38	103	0
2	C3	Full	2023-08-16	1:56	67,752013	-61,288546	Box Core	Recovery	1565	104	7,8	4,9	3,33	30,28	1012,36	103	0
2	C3	Full	2023-08-16	2:13	67,750186	-61,276815	Box Core	Deployment	1564	114	9,9	5	3,67	29,99	1012,31	103	0
2	C3	Full	2023-08-16	2:41	67,750827	-61,280380	Box Core	Bottom	1564	104	7,6	4,9	2,90	30,79	1012,15	103	0
2	C3	Full	2023-08-16	3:06	67,750721	-61,285632	Box Core	Recovery	1561	102	8,4	5	3,82	30,30	1012,00	103	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	C3	Full	2023-08-16	3:35	67,751144	-61,276342	IKMT	Deployment	1562				3,88	30,05			0
2	C3	Full	2023-08-16	4:05	67,753833	-61,274783	IKMT	Bottom	1564	76	3,2	5,8	4,11	29,94	1011,84	103	0
2	C3	Full	2023-08-16	4:41	67,750152	-61,318931	IKMT	Recovery	1560	116	12,8	5,1	5,11	30,43	1011,81	103	0
2	C2	Rosette	2023-08-16	7:11	67,544145	-61,907384	CTD Rosette	Deployment	397	112	5,7	3,2	0,76	30,08	1011,56	103	0
2	C2	Rosette	2023-08-16	7:18	67,544110	-61,909293	CTD Rosette	Bottom	396	112	6,5	3,1	1,22	30,16	1011,56	103	0
2	C2	Rosette	2023-08-16	7:59	67,546949	-61,921785	CTD Rosette	Recovery	407	132	1	2,8	1,94	30,57	1011,31	103	0
2	C1	Full	2023-08-16	10:10	67,348241	-62,519232	Plankton Net	Deployment	138				0,12	30,01			0
2	C1	Full	2023-08-16	10:12	67,347892	-62,519093	Plankton Net	Bottom	138	152	5	5,5	0,34	30,02	1011,19	103	0
2	C1	Full	2023-08-16	10:14	67,347474	-62,519138	Plankton Net	Recovery	138	159	5,7	5,5	0,10	29,91	1011,20	103	0
2	C1	Full	2023-08-16	10:30	67,345859	-62,522738	CTD Rosette	Deployment	141	159	4,2	6	0,61	29,46	1011,40	103	0
2	C1	Full	2023-08-16	10:34	67,345551	-62,523796	CTD Rosette	Bottom	142				0,96	28,91			0
2	C1	Full	2023-08-16	10:56	67,344078	-62,529543	CTD Rosette	Recovery	145	157	1,9	7,8	0,69	28,95	1011,35	102	0
2	C1	Full	2023-08-16	11:11	67,344047	-62,530579	Tucker Net	Deployment	146	130	5,7	7,8	1,22	28,73	1011,28	103	0
2	C1	Full	2023-08-16	11:19	67,346548	-62,527294	Tucker Net	Bottom	142	142	2,1	7,3	1,32	28,78	1011,22	103	0
2	C1	Full	2023-08-16	11:24	67,346650	-62,534615	Tucker Net	Recovery	140	156	5,5	7,4	1,12	28,86	1011,21	103	0
2	C1	Full	2023-08-16	12:22	67,347503	-62,532253	Hydrobios	Deployment	140	150	6,1	7,8	1,33	29,15	1011,11	103	0
2	C1	Full	2023-08-16	12:26	67,347335	-62,532850	Hydrobios	Bottom	140	137	5,9	7,3	1,30	29,19	1011,13	103	0
2	C1	Full	2023-08-16	12:31	67,347131	-62,534473	Hydrobios	Recovery	144	152	4,6	7,3	1,21	29,24	1011,08	103	0
2	C1	Full	2023-08-16	13:03	67,384704	-62,538000	Beam Trawl	Deployment	96	156	5,3	8,6	1,25	29,71	1011,01	102	0
2	C1	Full	2023-08-16	13:13	67,386215	-62,549319	Beam Trawl	Bottom	85	128	6,1	7,5	1,22	29,74	1010,96	103	0
2	C1	Full	2023-08-16	13:26	67,381332	-62,569079	Beam Trawl	Recovery	86	132	6,9	7,6	1,40	29,66	1010,94	102	0
2	A1	Full	2023-08-16	19:26	66,606193	-61,188740	Plankton Net	Deployment	109	206	14,9	7,1	0,91	30,84	1009,87	101	0
2	A1	Full	2023-08-16	19:29	66,606312	-61,189663	Plankton Net	Bottom	108	206	14,9	6,6	0,98	30,77	1009,99	102	0
2	A1	Full	2023-08-16	19:31	66,606370	-61,190155	Plankton Net	Recovery	107	206	13,7	6,7	1,06	30,72	1010,03	101	0
2	A1	Full	2023-08-16	19:53	66,605816	-61,193528	CTD Rosette	Deployment	105	207	17,3	7,6	-0,25	31,40	1009,90	101	0
2	A1	Full	2023-08-16	19:57	66,605726	-61,194081	CTD Rosette	Bottom	105	200	17,9	7,7	0,04	31,22	1009,81	101	0
2	A1	Full	2023-08-16	20:17	66,606384	-61,197579	CTD Rosette	Recovery	99	199	19,2	7,9	0,51	30,82	1009,62	101	0
2	A1	Full	2023-08-16	20:38	66,614561	-61,192967	Tucker Net	Deployment	103	205	16,4	8,8	0,76	30,80	1009,62	102	0
2	A1	Full	2023-08-16	20:43	66,617644	-61,193459	Tucker Net	Bottom	102				0,62	30,83			0
2	A1	Full	2023-08-16	20:47	66,620006	-61,195465	Tucker Net	Recovery	101	183	22,5	6,8	0,85	30,81	1008,97	102	0
2	A1	Full	2023-08-16	21:10	66,606277	-61,191254	Hydrobios	Deployment	107	209	19,8	6,3	0,45	30,92	1009,48	102	0
2	A1	Full	2023-08-16	21:13	66,606553	-61,190953	Hydrobios	Bottom	107	205	19,6	6,4	0,08	31,20	1009,32	102	0
2	A1	Full	2023-08-16	21:18	66,606802	-61,192540	Hydrobios	Recovery	106	208	20	6,7	0,60	30,99	1009,31	102	0
2	A1	Full	2023-08-16	21:43	66,613757	-61,185542	Beam Trawl	Deployment	112	198	18,5	6,9	0,63	30,93	1009,31	102	0
2	A1	Full	2023-08-16	21:54	66,621388	-61,195195	Beam Trawl	Bottom	101				0,74	30,86			0
2	A1	Full	2023-08-16	22:19	66,636364	-61,224704	Beam Trawl	Recovery	76				0,44	31,04			0
2	A1	Full	2023-08-16	22:39	66,606793	-61,212423	MVP	Deployment	69	195	26,5	6,3	0,76	30,86	1009,04	102	0
2	A2	Rosette	2023-08-17	1:41	66,671296	-60,458344	CTD Rosette	Deployment	527	196	16,8	3,9	0,88	31,13	1009,65	103	0
2	A2	Rosette	2023-08-17	1:51	66,672076	-60,456978	CTD Rosette	Bottom	528	197	17,5	3,9	1,02	31,09	1009,76	103	0
2	A2	Rosette	2023-08-17	2:31	66,674614	-60,456265	CTD Rosette	Recovery	529	198	16	3,9	1,05	31,10	1009,96	103	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	A2	Rosette	2023-08-17	3:24	66,659661	-60,499258	MVP	Deployment	520	197	12,9	3,5	0,78	31,09	1009,41	103	0
2	A2	Rosette	2023-08-17	3:41	66,665249	-60,470146	MVP	Recovery	526	195	20,6	4,1	0,99	31,08	1009,48	103	0
2	A3	Full	2023-08-17	6:34	66,732616	-59,607716	Plankton Net	Deployment	874	29	0,6	5,5	3,13	29,87	1010,60	103	0
2	A3	Full	2023-08-17	6:37	66,732756	-59,607210	Plankton Net	Bottom	875	303	1,1	5,1	3,13	29,87	1010,63	103	0
2	A3	Full	2023-08-17	6:39	66,732732	-59,607021	Plankton Net	Recovery	875	164	4,6	5,2	3,13	29,87	1010,54	103	0
2	A3	Full	2023-08-17	6:57	66,730036	-59,609400	CTD Rosette	Deployment	873	170	13,5	4,9	1,96	30,51	1010,43	103	0
2	A3	Full	2023-08-17	7:12	66,727886	-59,612207	CTD Rosette	Bottom	872	166	13,1	5,3	2,57	30,58	1010,45	103	0
2	A3	Full	2023-08-17	8:05	66,722736	-59,612382	CTD Rosette	Recovery	869	157	11,8	6,6	2,73	30,33	1010,49	103	0
2	A3	Full	2023-08-17	8:19	66,725402	-59,609328	Tucker Net	Deployment	871	175	9,5	8,2	3,12	29,88	1010,63	103	0
2	A3	Full	2023-08-17	8:25	66,728572	-59,611065	Tucker Net	Bottom	871	167	10,1	5,2	3,15	29,88	1010,49	103	0
2	A3	Full	2023-08-17	8:31	66,730990	-59,614488	Tucker Net	Recovery	873	163	11,4	4,8	3,20	29,88	1010,41	103	0
2	A3	Full	2023-08-17	9:00	66,730344	-59,611821	Hydrobios	Deployment	873	165	14,1	4,8	2,87	30,22	1010,57	103	0
2	A3	Full	2023-08-17	9:21	66,726828	-59,607792	Hydrobios	Bottom	872	175	15,4	4,8	3,02	29,90	1010,54	103	0
2	A3	Full	2023-08-17	9:48	66,721175	-59,603031	Hydrobios	Recovery	872	182	15,8	4,9	3,14	29,93	1010,46	103	0
2	A3	Full	2023-08-17	10:20	66,734028	-59,608500	CTD Rosette	Deployment	875	190	17,5	5,5	2,85	30,26	1010,48	103	0
2	A3	Full	2023-08-17	10:40	66,731284	-59,603577	CTD Rosette	Bottom	877	185	15,4	5,5	3,38	29,85	1010,52	103	0
2	A3	Full	2023-08-17	11:12	66,728343	-59,600982	CTD Rosette	Recovery	877	193	15,6	5,6	2,09	29,85	1010,71	103	0
2	A3	Full	2023-08-17	12:05	66,729774	-59,595690	IKMT	Deployment	879	192	16,2	6,3	3,15	29,80	1011,12	103	0
2	A3	Full	2023-08-17	12:29	66,739365	-59,572366	IKMT	Bottom	886	193	11,8	7,1	3,17	29,86	1011,06	103	0
2	A3	Full	2023-08-17	13:14	66,755555	-59,510973	IKMT	Recovery	909	193	13,9	6,2	3,22	29,91	1011,44	103	0
2	A3	Full	2023-08-17	13:42	66,731723	-59,607576	Box Core	Deployment	875	195	15,8	5,5	1,48	31,72	1011,51	103	0
2	A3	Full	2023-08-17	13:57	66,730649	-59,605697	Box Core	Bottom	875				3,44	30,02			0
2	A3	Full	2023-08-17	14:13	66,731854	-59,603465	Box Core	Recovery	877	183	13,1	5,4	3,50	30,01	1011,48	103	0
2	A3	Full	2023-08-17	14:32	66,729570	-59,609128	Box Core	Deployment	872	201	15,6	5,7	2,18	31,35	1011,66	102	0
2	A3	Full	2023-08-17	14:48	66,729300	-59,605586	Box Core	Bottom	875	182	14,5	5,3	3,55	30,05	1011,31	102	0
2	A3	Full	2023-08-17	15:05	66,730268	-59,605499	Box Core	Recovery	875				3,53	30,11			0
2	A3	Full	2023-08-17	15:27	66,720955	-59,611141	MVP	Deployment	867	198	21,7	5,8	3,60	30,12	1011,37	102	0
2	A3	Full	2023-08-17	15:42	66,720350	-59,637724	MVP	Recovery	856	195	20,9	5,8	3,91	30,07	1011,44	102	0
2	A4	Rosette	2023-08-17	19:00	66,803711	-58,766037	CTD Rosette	Deployment	907	184	12,8	5,5	3,93	30,09	1012,6	102	0
2	A4	Rosette	2023-08-17	19:16	66,803291	-58,763668	CTD Rosette	Bottom	906	186	13,5	5,3	3,79	30,08	1012,73	102	0
2	A4	Rosette	2023-08-17	20:08	66,802984	-58,753290	CTD Rosette	Recovery	902	185	15,2	5,2	3,64	30,25	1012,9	102	0
2	A4	Rosette	2023-08-17	20:27	66,803377	-58,765096	Box Core	Deployment	908	181	12	5,5	1,73	30,95	1012,76	102	0
2	A4	Rosette	2023-08-17	20:42	66,803404	-58,765532	Box Core	Bottom	908	185	14,3	5,7	4,04	30,04	1012,83	102	0
2	A4	Rosette	2023-08-17	20:59	66,804085	-58,766162	Box Core	Recovery	909	187	14,5	5,8	2,18	30,03	1012,83	102	0
2	A5	Full	2023-08-17	23:42	66,871351	-57,954717	Plankton Net	Deployment	818				3,68	29,78			0
2	A5	Full	2023-08-17	23:43	66,871055	-57,955186	Plankton Net	Bottom	818				3,70	29,77			0
2	A5	Full	2023-08-17	23:46	66,871072	-57,955384	Plankton Net	Recovery	818	333	12,6	7,2	3,71	29,77	1013,92	102	0
2	A5	Full	2023-08-18	0:03	66,870889	-57,961523	CTD Rosette	Deployment	820	180	11,8	5	3,68	29,77	1013,99	103	0
2	A5	Full	2023-08-18	0:18	66,871056	-57,967295	CTD Rosette	Bottom	821	227	4,6	5,7	3,64	29,76	1014,07	103	0
2	A5	Full	2023-08-18	1:11	66,875011	-57,979522	CTD Rosette	Recovery	826	243	1,5	5,4	3,79	29,74	1014,32	103	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	A5	Full	2023-08-18	1:40	66,871125	-57,952922	Tucker Net	Deployment	817	180	10,7	5	3,39	29,80	1014,45	103	0
2	A5	Full	2023-08-18	1:55	66,874941	-57,968743	Tucker Net	Recovery	825	181	13,9	4,9	3,63	29,77	1014,32	103	0
2	A5	Full	2023-08-18	2:26	66,873543	-57,940841	IKMT	Deployment	816	172	11,2	4,4	3,33	29,85	1014,27	103	0
2	A5	Full	2023-08-18	2:52	66,878017	-57,975060	IKMT	Bottom	833	176	12,8	4,5	3,41	29,84	1014,29	103	0
2	A5	Full	2023-08-18	3:39	66,877906	-58,055409	IKMT	Recovery	856	179	11,2	4,6	3,50	29,78	1014,38	103	0
2	A5	Full	2023-08-18	4:24	66,873296	-57,961034	CTD Rosette	Deployment	820	173	6,5	10,6	2,20	30,19	1014,76	103	0
2	A5	Full	2023-08-18	4:38	66,874816	-57,964649	CTD Rosette	Bottom	826	149	6,9	7,5	2,53	29,93	1014,64	103	0
2	A5	Full	2023-08-18	5:21	66,879196	-57,975447	CTD Rosette	Recovery	833	157	6,1	5,1	2,16	30,23	1014,63	103	0
2	A5	Full	2023-08-18	5:40	66,873789	-57,951161	Hydrobios	Deployment	818	165	14,3	4,1	2,81	29,85	1014,62	103	0
2	A5	Full	2023-08-18	6:01	66,874133	-57,953670	Hydrobios	Bottom	819				1,10	30,65			0
2	A5	Full	2023-08-18	6:29	66,873987	-57,954306	Hydrobios	Recovery	818	170	15,6	4,1	2,99	29,78	1014,83	104	0
2	A6/195	Rosette	2023-08-18	10:03	66,890213	-56,922135	CTD Rosette	Deployment	656	154	16,6	3,7	1,51	30,47	1016,05	104	0
2	A6/195	Rosette	2023-08-18	10:15	66,889259	-56,918779	CTD Rosette	Bottom	655	150	14,3	3,7	1,74	30,57	1016,01	104	0
2	A6/195	Rosette	2023-08-18	10:57	66,885662	-56,913561	CTD Rosette	Recovery	656	154	16,6	3,7	1,63	30,52	1015,94	104	0
2	A7/196	Full	2023-08-18	13:48	66,983569	-56,067114	Plankton Net	Deployment	130	156	22,3	5,1	6,06	32,08	1016,86	104	0
2	A7/196	Full	2023-08-18	13:51	66,983746	-56,067509	Plankton Net	Bottom	130	160	18,5	5,1	6,06	32,08	1016,94	104	0
2	A7/196	Full	2023-08-18	13:53	66,983935	-56,068562	Plankton Net	Recovery	131	156	17,5	5,2	6,03	32,09	1016,86	104	0
2	A7/196	Full	2023-08-18	14:08	66,985002	-56,068353	CTD Rosette	Deployment	125	155	22,5	5,2	5,89	32,09	1016,78	104	0
2	A7/196	Full	2023-08-18	14:11	66,985709	-56,067908	CTD Rosette	Bottom	125	152	20,4	5,1	5,93	32,09	1016,91	104	0
2	A7/196	Full	2023-08-18	14:34	66,988276	-56,068220	CTD Rosette	Recovery	129	145	0,6	5,4	6,01	32,08	1017,07	104	0
2	A7/196	Full	2023-08-18	14:56	66,985162	-56,070124	Tucker Net	Deployment	130	155	16,8	5,2	5,95	32,09	1016,94	104	0
2	A7/196	Full	2023-08-18	15:03	66,988475	-56,077538	Tucker Net	Bottom	126	143	19,8	5	5,97	32,08	1016,77	104	0
2	A7/196	Full	2023-08-18	15:10	66,991281	-56,083259	Tucker Net	Recovery	131				5,97	32,08			0
2	A7/196	Full	2023-08-18	15:34	66,983902	-56,070026	Hydrobios	Deployment	131	158	22,3	5,3	6,07	32,07	1016,85	104	0
2	A7/196	Full	2023-08-18	15:39	66,984752	-56,071432	Hydrobios	Bottom	131	162	18,1	5,3	6,11	32,07	1016,99	104	0
2	A7/196	Full	2023-08-18	15:44	66,985819	-56,075473	Hydrobios	Recovery	130	162	19,2	5,4	6,05	32,08	1016,96	104	0
2	A7/196	Full	2023-08-18	16:42	66,985209	-56,081333	Beam Trawl	Deployment	131	168	16,6	6,4	5,91	32,09	1017,31	105	0
2	A7/196	Full	2023-08-18	16:58	66,992915	-56,098409	Beam Trawl	Bottom	136	166	18,3	5,2	6,06	32,07	1017,24	104	0
2	A7/196	Full	2023-08-18	17:17	67,004400	-56,123624	Beam Trawl	Recovery	145	163	20,8	5	6,05	32,07	1016,94	104	0
2	A8/197	Rosette	2023-08-18	20:07	67,048548	-55,081082	CTD Rosette	Deployment	67	179	17,5	5,8	5,71	32,30	1018,49	105	0
2	A8/197	Rosette	2023-08-18	20:10	67,048919	-55,079626	CTD Rosette	Bottom	66	188	20,9	5,8			1018,48	105	0
2	A8/197	Rosette	2023-08-18	20:23	67,049974	-55,076950	CTD Rosette	Recovery	65	190	17,9	5,7	5,89	32,27	1018,68	105	0
2	A9/198	Full	2023-08-18	22:41	67,085631	-54,199365	Plankton Net	Deployment	75	147	14,1	6,8	6,49	32,06	1018,81	105	0
2	A9/198	Full	2023-08-18	22:44	67,086066	-54,198288	Plankton Net	Recovery	74	146	13,3	6,9	6,46	32,06	1018,84	105	0
2	A9/198	Full	2023-08-18	23:00	67,087719	-54,193928	CTD Rosette	Deployment	74	155	15,8	6,8	6,23	32,24	1018,81	105	0
2	A9/198	Full	2023-08-18	23:01	67,087928	-54,193445	CTD Rosette	Bottom	73				6,21	32,18			0
2	A9/198	Full	2023-08-18	23:19	67,090845	-54,191744	CTD Rosette	Recovery	70	144	13,7	7	6,35	32,15	1018,64	105	0
2	A9/198	Full	2023-08-18	23:50	67,091499	-54,193765	Tucker Net	Deployment	75	136	11,4	6,8	6,44	32,05	1018,45	105	0
2	A9/198	Full	2023-08-18	23:53	67,093146	-54,197219	Tucker Net	Bottom	78	139	11,4	6,7	6,45	32,06	1018,37	105	0
2	A9/198	Full	2023-08-18	23:56	67,094519	-54,200578	Tucker Net	Recovery	77	135	12,4	6,7	6,38	32,08	1018,36	105	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	A9/198	Full	2023-08-19	0:24	67,085999	-54,199857	Monster Net	Deployment	75	140	18,1	7,1	6,43	32,11	1018,23	105	0
2	A9/198	Full	2023-08-19	0:26	67,086630	-54,199441	Monster Net	Bottom	75	151	16,8	7,2	6,49	32,05	1018,3	105	0
2	A9/198	Full	2023-08-19	0:29	67,087055	-54,197805	Monster Net	Recovery	75	151	15	7,1	6,51	32,04	1018,35	105	0
2	A9/198	Full	2023-08-19	0:53	67,091866	-54,200681	Beam Trawl	Deployment	80	148	8,9	10,5	6,40	32,22	1018,34	105	0
2	A9/198	Full	2023-08-19	1:01	67,096715	-54,206801	Beam Trawl	Bottom	88	140	10,5	7	6,45	32,06	1018,13	105	0
2	A9/198	Full	2023-08-19	1:18	67,105929	-54,228413	Beam Trawl	Recovery	73	147	11,6	6,6	6,33	32,08	1017,95	105	0
2	A9/198	Full	2023-08-19	1:44	67,084621	-54,201222	Van Veen Grab	Deployment	76	162	14,9	6,8	6,52	32,13	1018,18	105	0
2	A9/198	Full	2023-08-19	1:46	67,084757	-54,201357	Van Veen Grab	Bottom	76	159	14,9	6,9	6,52	32,13	1018,09	105	0
2	A9/198	Full	2023-08-19	1:49	67,084877	-54,201508	Van Veen Grab	Recovery	76	159	13,9	6,8	6,53	32,13	1018,15	105	0
2	B1	Full	2023-08-20	4:32	67,056364	-61,518609	Plankton Net	Deployment	104	136	8,6	4,4	-0,12	31,25	1007,71	106	0
2	B1	Full	2023-08-20	4:34	67,056895	-61,519353	Plankton Net	Bottom	105				-0,12	31,25			0
2	B1	Full	2023-08-20	4:37	67,057365	-61,519624	Plankton Net	Recovery	105	130	12,9	3,7	-0,13	31,25	1007,46	106	0
2	B1	Full	2023-08-20	4:51	67,061276	-61,523617	CTD Rosette	Deployment	107	133	16,4	2	-0,11	31,24	1007,38	105	0
2	B1	Full	2023-08-20	4:53	67,061894	-61,524170	CTD Rosette	Bottom	109				-0,10	31,23			0
2	B1	Full	2023-08-20	5:17	67,065689	-61,526519	CTD Rosette	Recovery	115	144	9,9	3,5	-0,07	31,20	1008,11	105	0
2	B1	Full	2023-08-20	5:43	67,065459	-61,520430	Tucker Net	Deployment		140	10,3	7,2	-0,11	31,22	1008,1	105	0
2	B1	Full	2023-08-20	5:49	67,068001	-61,524919	Tucker Net	Bottom	121	132	16,4	2,6	-0,07	31,19	1007,44	105	0
2	B1	Full	2023-08-20	5:54	67,068918	-61,531660	Tucker Net	Recovery	119	123	17,5	1,6	-0,05	31,18	1007,42	105	0
2	B1	Full	2023-08-20	6:17	67,065268	-61,515944	Hydrobios	Deployment	128				-0,08	31,21			0
2	B1	Full	2023-08-20	6:21	67,065883	-61,515177	Hydrobios	Bottom	126	133	18,1	3,6	-0,04	31,20	1007,63	105	0
2	B1	Full	2023-08-20	6:25	67,066178	-61,513828	Hydrobios	Recovery	121	134	15,8	1,9	-0,11	31,22	1007,63	105	0
2	B1	Full	2023-08-20	6:51	67,065433	-61,498620	Beam Trawl	Deployment	119	143	12,8	1,7	-0,10	31,20	1007,55	104	0
2	B1	Full	2023-08-20	7:03	67,067124	-61,511914	Beam Trawl	Bottom	128	150	11,6	1,3	-0,09	31,21	1007,41	104	0
2	B1	Full	2023-08-20	7:24	67,064303	-61,545279	Beam Trawl	Recovery	107	149	13,1	1,6	-0,20	31,31	1007,25	105	0
2	D2	Rosette	2023-08-20	20:23	67,860925	-63,108637	CTD Rosette	Deployment	237	107	17,5	7,1	1,37	30,31	999,52	105	0
2	D2	Rosette	2023-08-20	20:28	67,860545	-63,107853	CTD Rosette	Bottom	237	122	19,6	8,4	1,38	30,30	999,25	105	0
2	D2	Rosette	2023-08-20	21:05	67,859993	-63,103654	CTD Rosette	Recovery	228	128	16,2	8,9	1,40	30,33	999,24	105	0
2	D1	Full	2023-08-21	12:28	67,473086	-63,693385	Plankton Net	Deployment	659	12	10,5	5,1	0,27	30,79	995,69	106	0
2	D1	Full	2023-08-21	12:30	67,472944	-63,693091	Plankton Net	Bottom	654	3	8,8	5,1	0,29	30,98	995,85	106	0
2	D1	Full	2023-08-21	12:33	67,472707	-63,692879	Plankton Net	Recovery	647				0,84	30,48			0
2	D1	Full	2023-08-21	12:55	67,472352	-63,689147	CTD Rosette	Deployment	620	6	4,4	5,6	0,60	30,31	995,74	105	0
2	D1	Full	2023-08-21	13:06	67,472143	-63,689563	CTD Rosette	Bottom	619	18	8,9	5,7	0,24	31,24	995,74	106	0
2	D1	Full	2023-08-21	13:45	67,470650	-63,694627	CTD Rosette	Recovery	633	89	1	7	0,99	30,14	995,81	106	0
2	D1	Full	2023-08-21	14:09	67,482480	-63,727310	Tucker Net	Deployment	396	1	7,8	4,5	1,71	30,06	995,53	105	0
2	D1	Full	2023-08-21	14:20	67,475797	-63,725082	Tucker Net	Bottom	453	357	5,3	4,7	2,36	29,37	995,92	105	0
2	D1	Full	2023-08-21	14:31	67,469319	-63,721745	Tucker Net	Recovery	606	12	7,4	4,7	3,16	28,57	995,7	105	0
2	D1	Full	2023-08-21	14:40	67,469726	-63,698510	Met Tower	Deployment	610	28	13,9	4,9	2,84	28,74	995,36	105	0
2	D1	Full	2023-08-21	15:03	67,466703	-63,687866	Hydrobios	Deployment	634	360	4,4	4,3	1,13	30,27	995,52	105	0
2	D1	Full	2023-08-21	15:19	67,464675	-63,690881	Hydrobios	Bottom	622	61	9,7	4,4	1,45	30,40	995,53	105	0
2	D1	Full	2023-08-21	15:38	67,461720	-63,693237	Hydrobios	Recovery	554	14	8,9	4,2	1,50	30,11	995,37	105	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	D1	Full	2023-08-21	16:50	67,473218	-63,686422	CTD Rosette	Deployment	641	4	7,8	4,9	1,84	29,93	994,75	105	0
2	D1	Full	2023-08-21	17:01	67,472499	-63,687221	CTD Rosette	Bottom	622	17	3,6	5,2	0,10	31,05	994,56	105	0
2	D1	Full	2023-08-21	17:34	67,471880	-63,692916	CTD Rosette	Recovery	649	32	2,9	6,1	-0,03	30,94	994,55	105	0
2	D1	Full	2023-08-21	17:54	67,473464	-63,703548	Box Core	Deployment	614	350	5,3	4,6	1,73	30,13	994,73	105	0
2	D1	Full	2023-08-21	18:06	67,472650	-63,703029	Box Core	Bottom	644	354	4,4	5,2	1,81	29,94	994,74	105	0
2	D1	Full	2023-08-21	18:21	67,471848	-63,705069	Box Core	Recovery	657	358	5,3	5,4	1,27	30,41	994,65	105	0
2	D1	Full	2023-08-21	18:58	67,474459	-63,760983	IKMT	Deployment	416	93	0	7,1	3,01	28,98	994,49	106	0
2	D1	Full	2023-08-21	19:14	67,469536	-63,742266	IKMT	Bottom	511	35	2,9	6,2	1,79	30,04	994,22	105	0
2	D1	Full	2023-08-21	19:49	67,473224	-63,691869	IKMT	Recovery	669	10	7,2	5,2	1,73	29,81	994,71	105	0
2	D1''	Rosette	2023-08-21	21:22	67,552281	-64,085672	CTD Rosette	Deployment	63	65	1,1	5,6	0,27	30,94	994,82	106	0
2	D1''	Rosette	2023-08-21	21:23	67,552318	-64,085507	CTD Rosette	Bottom	63	47	0	5,5	0,63	30,83	994,84	106	0
2	D1''	Rosette	2023-08-21	21:41	67,552284	-64,083282	CTD Rosette	Recovery	57	90	1,9	5,5	0,48	30,81	994,83	106	0
2	D1''	Rosette	2023-08-21	22:00	67,552618	-64,086863	Van Veen Grab	Deployment	67	56	3,4	5,3	0,98	29,84	994,99	106	0
2	D1''	Rosette	2023-08-21	22:01	67,552638	-64,086625	Van Veen Grab	Bottom	66	61	3	5,2	0,76	30,46	994,98	106	0
2	D1''	Rosette	2023-08-21	22:04	67,552631	-64,086334	Van Veen Grab	Recovery	66	61	2,5	5,1	0,52	30,62	994,95	106	0
2	D1 (2022 site)	Rosette	2023-08-21	23:43	67,396453	-63,849872	CTD Rosette	Deployment	467	341	5,7	6,5	0,54	30,33	994,91	107	0
2	D1 (2022 site)	Rosette	2023-08-21	23:51	67,396305	-63,849610	CTD Rosette	Bottom	467	356	2,1	6,6	-0,04	31,05	994,86	107	0
2	D1 (2022 site)	Rosette	2023-08-22	0:26	67,395151	-63,851949	CTD Rosette	Recovery	467	76	5	6,1	0,35	30,33	995,25	107	0
2	D1 (2022 site)	Rosette	2023-08-22	0:39	67,394375	-63,852390	Box Core	Deployment	467	48	4,2	5,8	0,47	30,37	995,47	107	0
2	D1 (2022 site)	Rosette	2023-08-22	0:48	67,394022	-63,852229	Box Core	Bottom	467	53	3	5,8	0,04	30,83	995,69	107	0
2	D1 (2022 site)	Rosette	2023-08-22	0:56	67,393696	-63,851966	Box Core	Recovery	467	95	1,1	6	0,10	30,83	995,61	107	0
2	D3	Full	2023-08-22	9:17	68,240713	-62,598376	CTD Rosette	Deployment	1549	112	13,9	4,1	3,96	30,89	997,03	107	0
2	D3	Full	2023-08-22	9:45	68,239110	-62,599911	CTD Rosette	Bottom	1551	136	13,9	3,3	3,95	30,88	996,75	107	0
2	D3	Full	2023-08-22	10:44	68,238634	-62,608238	CTD Rosette	Recovery	1547	142	14,5	3,2	3,58	30,94	997	107	0
2	D3	Full	2023-08-22	11:10	68,248891	-62,626347	Tucker Net	Deployment	1536	151	17,7	3,4	4,19	30,86	997,11	107	0
2	D3	Full	2023-08-22	11:16	68,245710	-62,632206	Tucker Net	Bottom		146	17,9	3,5	4,19	30,85	997,15	107	0
2	D3	Full	2023-08-22	11:24	68,242128	-62,638343	Tucker Net	Recovery	1528	153	17,3	3,4	4,18	30,84	997,03	107	0
2	D3	Full	2023-08-22	12:20	68,242249	-62,596967	Hydrobios	Deployment	1549	160	16,6	3,2	3,45	30,86	997,47	107	0
2	D3	Full	2023-08-22	12:58	68,244341	-62,600413	Hydrobios	Bottom	1543	177	16,2	3	3,52	30,87	998,03	108	0
2	D3	Full	2023-08-22	13:43	68,247571	-62,606870	Hydrobios	Recovery	1540	190	8,4	3,2	3,55	30,97	998,62	108	0
2	D3	Full	2023-08-22	14:39	68,240667	-62,586302	IKMT	Deployment	1565	205	8,4	3,1	3,89	30,84	999,55	108	0
2	D3	Full	2023-08-22	15:03	68,255085	-62,586310	IKMT	Bottom	1560				4,02	30,71			0
2	D3	Full	2023-08-22	15:45	68,283145	-62,576851	IKMT	Recovery	1587	264	5,5	4,1	3,40	30,85	1000,37	108	0
2	D4	Rosette	2023-08-22	18:58	68,628300	-61,984454	CTD Rosette	Deployment	1797	156	11,8	2,7	1,78	31,31	1002,5	107	0
2	D4	Rosette	2023-08-22	19:30	68,629490	-61,984224	CTD Rosette	Bottom	1798				1,65	31,37			0
2	D4	Rosette	2023-08-22	20:32	68,627648	-61,988871	CTD Rosette	Recovery	1797	117	6,1	2,6	1,79	31,31	1003,04	107	0
2	D4	Rosette	2023-08-22	20:49	68,625955	-61,985584	Box Core	Deployment	1797	147	9,7	2,9	1,79	31,31	1003,43	107	0
2	D4	Rosette	2023-08-22	21:21	68,624314	-61,987254	Box Core	Bottom	1797	135	12,9	2,8	1,79	31,32	1003,3	107	0
2	D4	Rosette	2023-08-22	21:52	68,619776	-61,994794	Box Core	Recovery	1797	129	13,3	2,7	1,53	31,40	1003,42	107	0
2	D5	Full	2023-08-25	8:12	69,004164	-61,403567	Plankton Net	Deployment	1829				1,86	31,03			

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	D5	Full	2023-08-25	8:14	69,004288	-61,404228	Plankton Net	Bottom	1829	153	21,5	2,6	1,83	31,03	1004,86	104	
2	D5	Full	2023-08-25	8:17	69,004497	-61,404409	Plankton Net	Recovery	1829	144	17,7	2,6	1,82	31,03	1005,06	104	
2	D5	Full	2023-08-25	8:29	69,004507	-61,408103	CTD Rosette	Deployment	1829	139	16,2	2,4	1,79	31,05	1005,13	104	
2	D5	Full	2023-08-25	9:01	69,004398	-61,408263	CTD Rosette	Bottom	1829	141	16,2	2,4	1,80	31,03	1005,06	104	
2	D5	Full	2023-08-25	10:04	69,004804	-61,403844	CTD Rosette	Recovery	1829				1,82	31,04			
2	D5	Full	2023-08-25	10:19	69,001628	-61,403981	Tucker Net	Deployment	1827	143	22,1	2,1	1,82	31,03	1004,85	104	
2	D5	Full	2023-08-25	10:26	68,998067	-61,406739	Tucker Net	Bottom		154	19,2	1,9	1,82	31,03	1004,73	104	
2	D5	Full	2023-08-25	10:33	68,994711	-61,406603	Tucker Net	Recovery	1826	149	18,8	1,9	1,82	31,04	1004,9	104	
2	D5	Full	2023-08-25	10:57	68,996917	-61,402993	Hydrobios	Deployment	1826	144	17,9	1,5	1,82	31,03	1005,02	104	
2	D5	Full	2023-08-25	11:41	68,994547	-61,394889	Hydrobios	Bottom	1824	148	16,6	1,5	1,80	31,05	1004,76	104	
2	D5	Full	2023-08-25	12:34	68,993874	-61,388586	Hydrobios	Recovery	1822	144	21,9	1,5	1,48	31,16	1004,19	104	
2	D5	Full	2023-08-25	13:06	69,000503	-61,372354	IKMT	Deployment	1823	130	18,7	2,2	1,83	31,02	1004,49	104	
2	D5	Full	2023-08-25	13:32	69,008832	-61,405168	IKMT	Bottom	1832	132	14,5	1,4	1,84	31,01	1003,95	104	
2	D5	Full	2023-08-25	14:23	69,023876	-61,494485	IKMT	Recovery	1847	135	11,4	1,6	2,24	31,02	1003,72	104	
2	Takeuse002b	Argo	2023-08-26	8:03	72,031277	-64,383250	Argo float	Recovery		165	13,1	3,6	3,56	32,01	997,76	106	
2	BPR	Mooring	2023-08-26	13:50	72,752276	-64,926944	Mooring	Recovery		109	1,3	4,5	4,35	31,70	996,67	106	
2	BGC-Argo Floats	Argo	2023-08-26	16:20	72,896779	-65,611285	Argo float	Deployment					4,68	31,11			
2	BGC-Argo Floats	Argo	2023-08-26	16:36	72,899215	-65,613678	Argo float	Deployment		145	12,8	4,7	4,70	31,22	996,31	106	
2	BGC-Argo Floats	Argo	2023-08-26	17:00	72,907829	-65,612888	CTD Rosette	Deployment		141	12,4	4,6	4,83	31,11	996,27	106	
2	BGC-Argo Floats	Argo	2023-08-26	17:17	72,909012	-65,613052	CTD Rosette	Bottom		145	11	4,5	4,79	31,22	996,33	106	
2	BGC-Argo Floats	Argo	2023-08-26	18:03	72,911995	-65,611733	CTD Rosette	Recovery		129	10,7	4,4	4,63	31,20	996,35	106	
2	Takeuse007b	Argo	2023-08-27	0:22	74,169402	-65,635733	Argo float	Recovery		71	12	3,8	4,38	32,47	996,68	107	
2	116	Nutrient	2023-08-27	12:45	76,380995	-70,532670	CTD Rosette	Deployment	139	44	11,2	6	3,06	30,06	1000,84	105	
2	116	Nutrient	2023-08-27	12:49	76,381360	-70,535989	CTD Rosette	Bottom	139	43	12,6	5,7	2,99	30,06	1000,9	105	
2	116	Nutrient	2023-08-27	13:13	76,384531	-70,561731	CTD Rosette	Recovery	134	45	14,1	5,9	3,06	29,81	1000,76	105	
2	115	Full	2023-08-27	14:13	76,332360	-71,190466	Plankton Net	Deployment	656	57	14,7	5,7	2,33	31,41	1000,73	104	
2	115	Full	2023-08-27	14:15	76,332681	-71,190978	Plankton Net	Bottom	656	58	14,7	5,8	2,41	31,40	1000,71	104	
2	115	Full	2023-08-27	14:18	76,333217	-71,191355	Plankton Net	Recovery	657	59	14,3	5,8	2,38	31,45	1000,73	105	
2	115	Full	2023-08-27	14:35	76,334471	-71,202330	CTD Rosette	Deployment	656	52	14,1	5,7	2,37	31,44	1000,67	104	
2	115	Full	2023-08-27	14:46	76,335132	-71,207895	CTD Rosette	Bottom	658	49	12,9	5,3	2,50	31,11	1000,62	105	
2	115	Full	2023-08-27	15:33	76,338567	-71,225917	CTD Rosette	Recovery	665	52	12,6	5,4	2,46	31,44	1000,63	104	
2	115	Full	2023-08-27	16:20	76,329872	-71,214504	Tucker Net	Deployment	651	25	10,9	5,9	2,51	31,36	1000,89	104	
2	115	Full	2023-08-27	16:30	76,324683	-71,209076	Tucker Net	Bottom	660	21	8,9	4,2	2,47	31,40	1000,75	104	
2	115	Full	2023-08-27	16:39	76,321618	-71,193904	Tucker Net	Recovery	658	21	11,6	4,3	2,47	31,44	1000,81	104	
2	115	Full	2023-08-27	17:32	76,333421	-71,237251	Hydrobios	Deployment	666	16	14,5	6,2	2,55	31,73	1000,82	104	
2	115	Full	2023-08-27	17:50	76,333459	-71,244534	Hydrobios	Bottom	668				2,55	31,65			
2	115	Full	2023-08-27	18:11	76,333673	-71,258424	Hydrobios	Recovery	666	45	10,9	4,3	2,54	31,61	1001,05	104	
2	115	Full	2023-08-27	18:39	76,330748	-71,214848	IKMT	Deployment	646	46	10,5	6,3	2,53	31,32	1001,25	104	
2	115	Full	2023-08-27	18:59	76,322923	-71,250325	IKMT	Bottom	667	92	11,2	5,4	2,47	31,64	1001,17	104	
2	115	Full	2023-08-27	19:40	76,297748	-71,313725	IKMT	Recovery	663	94	11	4,6	3,05	31,97	1001,41	104	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	115	Full	2023-08-27	20:18	76,333168	-71,208281	Box Core	Deployment	674	78	15,2	5,5	2,80	31,11	1001,45	104	
2	115	Full	2023-08-27	20:33	76,332284	-71,202962	Box Core	Bottom	674	72	14,7	5,1	2,87	30,94	1001,41	104	
2	115	Full	2023-08-27	20:45	76,332241	-71,211305	Box Core	Recovery	648	72	19,8	5,1	2,69	31,40	1001,23	104	
2	114	CTD	2023-08-27	22:19	76,328705	-71,789754	CTD Rosette	Deployment	614	89	14,5	4,8	2,48	31,25	1001,24	104	
2	114	CTD	2023-08-27	22:30	76,330559	-71,792468	CTD Rosette	Bottom	614				1,64	30,49			
2	114	CTD	2023-08-27	22:43	76,331441	-71,794527	CTD Rosette	Recovery	614	78	13,7	4,8	2,20	30,92	1001,33	104	
2	113	Nutrient	2023-08-27	23:52	76,318940	-72,229001	CTD Rosette	Deployment	551	64	4,4	4,9	1,04	30,17	1001,19	104	
2	113	Nutrient	2023-08-28	0:02	76,318390	-72,229984	CTD Rosette	Bottom	552	20	8,6	3,9	1,30	30,48	1001,12	104	
2	113	Nutrient	2023-08-28	0:42	76,316690	-72,239957	CTD Rosette	Recovery	546	32	3,2	4,7	0,87	30,06	1000,84	104	
2	112	CTD	2023-08-28	1:52	76,312944	-72,677827	CTD Rosette	Deployment	563	284	2,3	2,7	0,40	29,02	1000,34	103	
2	112	CTD	2023-08-28	2:03	76,311742	-72,679957	CTD Rosette	Bottom	563	29	1,1	3,9	0,35	29,02	1000,15	103	
2	112	CTD	2023-08-28	2:16	76,310295	-72,683168	CTD Rosette	Recovery	563	33	8,2	3,3	0,34	29,19	1000,05	103	
2	111	Basic	2023-08-28	3:37	76,300949	-73,243317	Plankton Net	Deployment	571	343	10,5	2,8	0,22	29,48	999	103	
2	111	Basic	2023-08-28	3:39	76,300687	-73,243695	Plankton Net	Bottom	570	322	12	3,9	0,19	29,54	998,86	103	
2	111	Basic	2023-08-28	3:41	76,300629	-73,243904	Plankton Net	Recovery	570	250	5,3	3,2	-0,42	29,79	998,71	103	
2	111	Basic	2023-08-28	4:02	76,303108	-73,275533	CTD Rosette	Deployment	573	350	18,3	2,2	0,24	29,50	998,45	103	
2	111	Basic	2023-08-28	4:11	76,302725	-73,276600	CTD Rosette	Bottom	573	348	17,5	2,1	0,08	29,64	998,49	103	
2	111	Basic	2023-08-28	4:52	76,301111	-73,271618	CTD Rosette	Recovery	570				0,21	29,54			
2	111	Basic	2023-08-28	5:10	76,303840	-73,281565	Tucker Net	Deployment	573	336	7,6	2,6	0,25	29,51	997,09	103	
2	111	Basic	2023-08-28	5:16	76,301034	-73,271856	Tucker Net	Bottom	569	334	16,4	1,5	0,23	29,51	996,85	103	
2	111	Basic	2023-08-28	5:23	76,299483	-73,252980	Tucker Net	Recovery	565	334	15	1,4	0,23	29,50	996,64	103	
2	111	Basic	2023-08-28	5:53	76,300830	-73,255157	Hydrobios	Deployment	569				0,23	29,52			
2	111	Basic	2023-08-28	6:07	76,299867	-73,249995	Hydrobios	Bottom	567	345	15,4	1,1	0,11	29,61	995,8	103	
2	111	Basic	2023-08-28	6:25	76,298369	-73,244643	Hydrobios	Recovery	562	335	16,9	1,3	0,16	29,56	995,61	103	
2	111	Basic	2023-08-28	7:04	76,291193	-73,287554	Beam Trawl	Deployment	570	354	12,8	1	0,26	29,53	995,46	103	
2	111	Basic	2023-08-28	7:29	76,278714	-73,253515	Beam Trawl	Bottom	577				0,25	29,54			
2	111	Basic	2023-08-28	7:58	76,265026	-73,206063	Beam Trawl	Recovery	572				0,26	29,54			
2	111	Basic	2023-08-28	9:08	76,305821	-73,251024	Box Core	Deployment	592	35	12,4	1,5	0,17	29,48	995,5	103	
2	111	Basic	2023-08-28	9:20	76,305955	-73,253073	Box Core	Bottom	591	31	14,9	1,6	-0,06	29,76	995,5	103	
2	111	Basic	2023-08-28	9:32	76,306738	-73,256802	Box Core	Recovery	598	17	12,9	1,6	0,07	29,62	995,64	103	
2	110	Nutrient	2023-08-28	10:43	76,304160	-73,652409	CTD Rosette	Deployment	536	40	3	1,7	0,12	29,38	996,26	103	
2	110	Nutrient	2023-08-28	10:53	76,304563	-73,654642	CTD Rosette	Bottom	536	43	5,7	1,5	0,04	29,69	996,53	103	
2	110	Nutrient	2023-08-28	11:38	76,308408	-73,663891	CTD Rosette	Recovery	542	33	7,4	1,8	0,03	29,53	996,89	103	
2	109	CTD	2023-08-28	12:48	76,291939	-74,111708	CTD Rosette	Deployment	454	88	1,9	2,6	0,90	30,08	997,48	103	
2	109	CTD	2023-08-28	12:56	76,292737	-74,112666	CTD Rosette	Bottom	455	346	4,4	2,3	0,51	29,68	997,58	103	
2	109	CTD	2023-08-28	13:05	76,293503	-74,113161	CTD Rosette	Recovery	456	184	2,3	2,3	0,75	29,80	997,6	103	
2	108	Full	2023-08-28	14:14	76,262556	-74,592810	Plankton Net	Deployment	449	65	6,3	2,4	1,86	30,68	998,2	103	
2	108	Full	2023-08-28	14:16	76,262649	-74,593741	Plankton Net	Bottom	449	35	7,6	2,5	2,03	31,13	997,98	103	
2	108	Full	2023-08-28	14:20	76,262957	-74,595592	Plankton Net	Recovery	447	56	3,6	2,7	1,48	30,54	998,27	103	
2	108	Full	2023-08-28	14:35	76,264395	-74,603042	CTD Rosette	Deployment	451	62	7,2	2,9	1,45	30,53	998,36	103	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	108	Full	2023-08-28	14:43	76,264517	-74,604158	CTD Rosette	Bottom	451	73	3,6	2,7	1,63	30,56	998,18	103	
2	108	Full	2023-08-28	15:23	76,267466	-74,610254	CTD Rosette	Recovery	451	185	0,8	2,1	1,49	30,71	998,72	103	
2	108	Full	2023-08-28	16:15	76,258717	-74,603934	Tucker Net	Deployment	448	101	7,4	2,3	1,35	30,46	998,96	103	
2	108	Full	2023-08-28	16:24	76,257839	-74,590667	Tucker Net	Bottom	445	148	1,7	2,7	1,31	30,43	999,19	103	
2	108	Full	2023-08-28	16:33	76,263064	-74,593711	Tucker Net	Recovery	447	90	8,6	3	1,38	30,46	999,34	103	
2	108	Full	2023-08-28	17:00	76,267537	-74,607233	Hydrobios	Deployment	450				1,54	30,54			
2	108	Full	2023-08-28	17:10	76,268211	-74,607232	Hydrobios	Bottom	450	87	6,7	3,5	1,79	30,89	999,54	104	
2	108	Full	2023-08-28	17:26	76,269499	-74,610144	Hydrobios	Recovery	449	100	10,9	4	1,64	30,59	999,58	104	
2	108	Full	2023-08-28	17:47	76,271267	-74,615811	Monster Net	Deployment	449	107	9,3	1,9	1,72	30,64	999,85	104	
2	108	Full	2023-08-28	17:58	76,272125	-74,618421	Monster Net	Bottom	450	103	11,4	1,8	1,77	30,68	999,9	104	
2	108	Full	2023-08-28	18:13	76,272428	-74,616753	Monster Net	Recovery	449	95	8,6	3,4	1,80	30,69	1000,29	104	
2	108	Full	2023-08-28	18:46	76,277638	-74,629961	IKMT	Deployment	449	103	5,5	2,7	1,86	30,74	1000,29	104	
2	108	Full	2023-08-28	19:11	76,268282	-74,657793	IKMT	Bottom	448	118	9,3	1,6	1,97	30,98	1000,64	104	
2	108	Full	2023-08-28	19:52	76,245437	-74,611313	IKMT	Recovery	439	116	9,7	2,1	1,81	30,68	1000,7	104	
2	108	Full	2023-08-28	20:32	76,265129	-74,618552	CTD Rosette	Deployment	450				1,68	30,68			
2	108	Full	2023-08-28	20:40	76,264634	-74,620941	CTD Rosette	Bottom	448	95	5,5	2,5	2,44	31,33	1001,09	104	
2	108	Full	2023-08-28	21:02	76,263902	-74,632930	CTD Rosette	Recovery	449	96	6,7	2,2	1,88	30,05	1000,95	104	
2	108	Full	2023-08-28	21:38	76,263091	-74,601045	Box Core	Deployment	451	119	6,9	1,2	0,80	29,54	1000,98	104	
2	108	Full	2023-08-28	21:47	76,262779	-74,603550	Box Core	Bottom	449	117	7,8	1,3	1,49	29,75	1001	104	
2	108	Full	2023-08-28	21:56	76,262330	-74,602822	Box Core	Recovery	448	102	8	1,3	0,84	29,61	1000,97	104	
2	107	Nutrient	2023-08-28	22:58	76,281768	-74,991442	CTD Rosette	Deployment	440	102	6,1	1,9	0,46	29,07	1000,99	104	
2	107	Nutrient	2023-08-28	23:06	76,281694	-74,995037	CTD Rosette	Bottom	440				0,59	29,65			
2	107	Nutrient	2023-08-28	23:48	76,281071	-75,017121	CTD Rosette	Recovery	438	132	3,6	1,6	0,72	30,08	1000,88	104	
2	106	CTD	2023-08-29	0:37	76,308080	-75,367796	CTD Rosette	Deployment	381	90	6,1	2,2	0,15	28,68	1000,93	104	
2	106	CTD	2023-08-29	0:44	76,307815	-75,371350	CTD Rosette	Bottom	379	126	5	2	0,14	28,78	1000,98	104	
2	106	CTD	2023-08-29	0:52	76,307192	-75,375344	CTD Rosette	Recovery	382	121	3,2	2,3	0,10	28,78	1000,95	104	
2	105	Basic	2023-08-29	1:29	76,317400	-75,759109	Plankton Net	Deployment	330	30	5	0,8	0,11	28,56	1000,94	104	
2	105	Basic	2023-08-29	1:32	76,317224	-75,760174	Plankton Net	Bottom	330	24	5	0,5	0,05	29,10	1001,13	104	
2	105	Basic	2023-08-29	1:35	76,317128	-75,762086	Plankton Net	Recovery	331	14	5,3	0,5	0,06	28,81	1000,84	104	
2	105	Basic	2023-08-29	1:47	76,317338	-75,774721	CTD Rosette	Deployment	338	14	3,6	0,4	0,09	28,70	1000,88	104	
2	105	Basic	2023-08-29	1:55	76,317115	-75,779332	CTD Rosette	Bottom	340	53	1,7	0,6	0,17	29,09	1000,62	104	
2	105	Basic	2023-08-29	2:31	76,317118	-75,805524	CTD Rosette	Recovery	339	29	1,3	0,6	0,11	28,62	1000,8	104	
2	105	Basic	2023-08-29	2:51	76,320112	-75,836639	Tucker Net	Deployment	330	20	6,1	0,4	0,13	28,50	1000,57	104	
2	105	Basic	2023-08-29	2:59	76,322246	-75,852438	Tucker Net	Bottom	327	34	0	0,6	0,14	28,50	1000,44	104	
2	105	Basic	2023-08-29	3:09	76,322638	-75,872185	Tucker Net	Recovery	330	147	0	0,1	0,13	28,50	1000,37	104	
2	105	Basic	2023-08-29	3:48	76,318230	-75,761584	Hydrobios	Deployment	333	9	1	0,4	0,40	28,79	1000,3	104	
2	105	Basic	2023-08-29	4:02	76,318122	-75,766940	Hydrobios	Bottom	334	9	1,1	0,4	0,18	28,75	1000,06	104	
2	105	Basic	2023-08-29	4:14	76,318318	-75,772126	Hydrobios	Recovery	337	3	1,7	0,3	0,15	28,61	1000,09	104	
2	105	Basic	2023-08-29	4:44	76,319434	-75,783671	Beam Trawl	Deployment	340	338	5	0,1	0,19	28,60	999,86	104	
2	105	Basic	2023-08-29	5:25	76,310257	-75,765201	Beam Trawl	Bottom	326	346	6,3	0,3	0,19	28,54	999,85	104	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	105	Basic	2023-08-29	5:45	76,320923	-75,779245	Beam Trawl	Recovery	339				0,17	28,56			
2	104	CTD	2023-08-29	7:11	76,343028	-76,163459	CTD Rosette	Deployment	197	7	9,1	-0,1	-0,05	28,93	1000,05	104	
2	104	CTD	2023-08-29	7:15	76,342957	-76,165208	CTD Rosette	Bottom	196	13	7,8	0	-0,26	29,32	999,9	104	
2	104	CTD	2023-08-29	7:23	76,342354	-76,168110	CTD Rosette	Recovery	196	15	8,4	0	0,07	28,75	1000,05	104	
2	103	Nutrient	2023-08-29	8:26	76,356694	-76,591128	CTD Rosette	Deployment	148	7	8,8	-0,3	-0,61	30,65	1000,1	104	
2	103	Nutrient	2023-08-29	8:29	76,357016	-76,593202	CTD Rosette	Bottom	147	21	8,8	-0,3	0,16	28,88	1000,13	104	
2	103	Nutrient	2023-08-29	8:58	76,360873	-76,605072	CTD Rosette	Recovery	147	25	9,1	-0,3	-0,20	29,32	1000,09	104	
2	102	CTD	2023-08-29	9:54	76,377717	-77,008308	CTD Rosette	Deployment	253	36	7,6	-0,3	1,29	30,22	1000,5	104	
2	102	CTD	2023-08-29	9:59	76,378524	-77,011693	CTD Rosette	Bottom	251	34	8,4	-0,3	0,90	30,16	1000,49	104	
2	102	CTD	2023-08-29	10:06	76,379089	-77,013464	CTD Rosette	Recovery	252	22	6,5	-0,4	0,41	28,98	1000,51	104	
2	102	CTD	2023-08-29	10:21	76,375747	-76,996375	Plankton Net	Deployment	250	35	7	-0,4	1,11	29,43	1000,54	104	
2	102	CTD	2023-08-29	10:24	76,376076	-76,999219	Plankton Net	Bottom	251	37	7	-0,3	1,26	30,10	1000,71	104	
2	102	CTD	2023-08-29	10:27	76,376535	-76,999955	Plankton Net	Recovery	251	31	7,4	-0,3	0,70	29,93	1000,68	104	
2	101	Full	2023-08-29	11:12	76,384153	-77,412275	Plankton Net	Deployment	364	39	3,4	-0,1	1,29	30,14	1001,14	104	
2	101	Full	2023-08-29	11:15	76,384232	-77,415107	Plankton Net	Bottom	366	46	2,7	-0,1	1,33	30,10	1001,12	104	
2	101	Full	2023-08-29	11:18	76,384270	-77,418385	Plankton Net	Recovery	371	57	3,4	0	1,30	30,14	1001,08	104	
2	101	Full	2023-08-29	12:06	76,383271	-77,406652	CTD Rosette	Deployment	361	356	2,9	-0,1	1,57	30,40	1001,25	104	
2	101	Full	2023-08-29	12:12	76,383630	-77,409288	CTD Rosette	Bottom	363	334	3	-0,2	1,53	30,33	1001,34	104	
2	101	Full	2023-08-29	12:50	76,385131	-77,424330	CTD Rosette	Recovery	382	306	4,2	-0,2	1,71	30,54	1001,57	104	
2	101	Full	2023-08-29	13:05	76,385391	-77,445267	Tucker Net	Deployment	400	335	6,3	0,3	1,91	30,86	1001,32	104	
2	101	Full	2023-08-29	13:11	76,384430	-77,461548	Tucker Net	Bottom	394	11	1,5	0,7	1,69	30,52	1001,52	105	
2	101	Full	2023-08-29	13:18	76,383332	-77,476475	Tucker Net	Recovery	383	36	0	0,9	1,79	30,65	1001,57	105	
2	101	Full	2023-08-29	13:51	76,384488	-77,404913	Hydrobios	Deployment	359	28	0,8	0,8	2,44	31,37	1001,43	105	
2	101	Full	2023-08-29	14:00	76,385937	-77,407452	Hydrobios	Bottom	358	351	4,4	1	1,92	30,92	1001,53	105	
2	101	Full	2023-08-29	14:12	76,388211	-77,411648	Hydrobios	Recovery	358	75	2,1	0,4	1,87	30,62	1001,63	105	
2	101	Full	2023-08-29	14:32	76,380261	-77,400483	Beam Trawl	Deployment	363	344	0,6	1,1	2,19	31,00	1001,42	105	
2	101	Full	2023-08-29	14:50	76,373647	-77,429354	Beam Trawl	Bottom	396	31	1,1	0,7	2,53	31,55	1001,65	105	
2	101	Full	2023-08-29	15:16	76,358631	-77,454194	Beam Trawl	Recovery	386	28	4,2	0,2	2,53	31,50	1001,76	105	
2	101	Full	2023-08-29	16:37	76,356481	-77,506828	Box Core	Deployment	378	11	4,8	0,7	2,48	31,46	1002,11	105	
2	101	Full	2023-08-29	16:49	76,356666	-77,510057	Box Core	Bottom	378	12	5,3	0,4	2,49	31,42	1002,05	105	
2	101	Full	2023-08-29	16:57	76,356691	-77,505521	Box Core	Recovery	378	33	6,5	0,5	2,48	31,43	1002,28	105	
2	100	Nutrient	2023-08-29	18:18	76,408959	-77,961600	CTD Rosette	Deployment	239	113	2,5	0,8	-0,43	28,97	1002,67	105	
2	100	Nutrient	2023-08-29	18:22	76,408564	-77,964127	CTD Rosette	Bottom	239	331	0,8	0,6	-0,42	28,98	1002,53	105	
2	100	Nutrient	2023-08-29	18:53	76,404805	-77,987371	CTD Rosette	Recovery	234				-0,43	29,01			
2	148	Basic	2023-08-30	2:58	75,353915	-73,917077	Plankton Net	Deployment	590	30	15	3,1	4,08	31,93	999,01	106	
2	148	Basic	2023-08-30	3:01	75,353732	-73,919376	Plankton Net	Bottom	589	41	14,5	3,1	4,08	31,93	999,15	106	
2	148	Basic	2023-08-30	3:03	75,353542	-73,920516	Plankton Net	Recovery	589	43	14,1	3,1	4,07	31,92	999,04	106	
2	148	Basic	2023-08-30	3:20	75,354566	-73,933346	CTD Rosette	Deployment	585	58	7	3,8	4,06	31,93	998,98	105	
2	148	Basic	2023-08-30	3:31	75,355463	-73,939488	CTD Rosette	Bottom	585	31	16,4	3,4	3,95	32,15	998,87	105	
2	148	Basic	2023-08-30	4:18	75,358645	-73,944018	CTD Rosette	Recovery	582				3,98	32,11			

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	148	Basic	2023-08-30	4:37	75,351255	-73,927317	Tucker Net	Deployment	587	14	16	4	4,02	31,86	998,73	105	
2	148	Basic	2023-08-30	4:47	75,345624	-73,926650	Tucker Net	Bottom	592	22	10,9	3,3	3,96	31,84	998,5	105	
2	148	Basic	2023-08-30	4:58	75,340265	-73,919831	Tucker Net	Recovery	595	18	13,7	3,2	3,95	31,84	998,57	105	
2	148	Basic	2023-08-30	5:28	75,349781	-73,901424	Hydrobios	Deployment	591	14	18,1	3,7	4,01	31,86	998,49	105	
2	148	Basic	2023-08-30	5:42	75,349126	-73,909308	Hydrobios	Bottom	591	20	13,5	3	3,96	31,84	998,7	105	
2	148	Basic	2023-08-30	6:02	75,348678	-73,917044	Hydrobios	Recovery	590	27	17,3	3	3,94	31,86	998,59	105	
2	153	Full	2023-08-30	10:06	74,694330	-72,725876	Plankton Net	Deployment	906	48	18,8	3,6	3,58	31,22	997,89	105	
2	153	Full	2023-08-30	10:09	74,694365	-72,726860	Plankton Net	Bottom	907	48	17,1	3,6	3,61	31,28	997,83	105	
2	153	Full	2023-08-30	10:12	74,694572	-72,727526	Plankton Net	Recovery	906	45	16,9	3,5	3,60	31,30	997,91	105	
2	153	Full	2023-08-30	10:28	74,693658	-72,727448	CTD Rosette	Deployment	906	54	16,9	3,4	3,46	31,37	997,84	105	
2	153	Full	2023-08-30	10:45	74,694007	-72,731167	CTD Rosette	Bottom	906	51	16,4	3,5	3,48	31,37	997,93	105	
2	153	Full	2023-08-30	11:34	74,693951	-72,734126	CTD Rosette	Recovery	905	48	13,7	3,3	3,56	31,23	998,12	105	
2	153	Full	2023-08-30	12:22	74,691420	-72,757459	Tucker Net	Deployment	901	48	12,4	4,3	3,61	31,24	998,57	105	
2	153	Full	2023-08-30	12:31	74,689502	-72,776789	Tucker Net	Bottom	899	60	13,5	3	3,62	31,30	998,51	105	
2	153	Full	2023-08-30	12:42	74,687409	-72,794884	Tucker Net	Recovery	897	65	13,3	3	3,21	31,35	998,44	105	
2	153	Full	2023-08-30	13:08	74,693604	-72,740638	Monster Net	Deployment	904	55	15,2	3,2	3,60	31,20	998,48	105	
2	153	Full	2023-08-30	13:31	74,693850	-72,744492	Monster Net	Bottom	903	73	12,9	3,1	3,56	31,25	998,54	105	
2	153	Full	2023-08-30	13:57	74,693261	-72,750018	Monster Net	Recovery	903	79	11,4	2,4	3,40	31,59	998,65	105	
2	153	Full	2023-08-30	14:27	74,694080	-72,781172	IKMT	Deployment	898	85	7,2	3,3	3,62	31,26	998,71	105	
2	153	Full	2023-08-30	14:49	74,691885	-72,824066	IKMT	Bottom	895	79	10,5	1,8	3,25	31,34	998,59	105	
2	153	Full	2023-08-30	15:27	74,676217	-72,906630	IKMT	Recovery	889	76	9,3	1,6	4,07	31,58	998,42	104	
2	153	Full	2023-08-30	16:24	74,693298	-72,739937	Box Core	Deployment	906	81	7,8	0,8	3,69	31,33	998,72	104	
2	153	Full	2023-08-30	16:43	74,693225	-72,738330	Box Core	Bottom	906	76	7,6	0,6	3,55	31,29	998,76	104	
2	153	Full	2023-08-30	16:59	74,693063	-72,738191	Box Core	Recovery	906	65	6,5	0,5	3,72	31,28	998,76	104	
2	158	Basic	2023-08-30	20:49	74,052476	-72,051931	CTD Rosette	Deployment	1015	34	7,2	2,6	2,06	30,72	998,43	104	
2	158	Basic	2023-08-30	21:06	74,051415	-72,040375	CTD Rosette	Bottom	1017				2,14	30,65			
2	158	Basic	2023-08-30	22:04	74,046016	-72,007497	CTD Rosette	Recovery	1021	40	5,9	3,4	2,06	30,58	998,17	104	
2	158	Basic	2023-08-30	23:43	74,052876	-72,050422	Plankton Net	Deployment	1016	20	5,9	2,2	2,07	30,71	998,35	104	
2	158	Basic	2023-08-30	23:45	74,052478	-72,048064	Plankton Net	Bottom	1017	6	5,9	2,2	2,22	30,70	998,36	104	
2	158	Basic	2023-08-30	23:48	74,052111	-72,045183	Plankton Net	Recovery	1016				2,21	30,68			
2	158	Basic	2023-08-30	23:59	74,048740	-72,031084	Tucker Net	Deployment	1019	42	5,3	2,2	2,32	30,64	998,42	104	
2	158	Basic	2023-08-31	0:08	74,045637	-72,005122	Tucker Net	Bottom	1023	30	7	2,3	2,17	30,65	998,47	104	
2	158	Basic	2023-08-31	0:18	74,046380	-71,975361	Tucker Net	Recovery	1026	27	9,3	2,6	2,21	30,66	998,49	104	
2	158	Basic	2023-08-31	0:46	74,053845	-72,063653	Hydrobios	Deployment	1013	44	6,5	2,7	2,39	30,62	998,42	104	
2	158	Basic	2023-08-31	1:12	74,052665	-72,046367	Hydrobios	Bottom	1017	37	2,7	2,4	2,27	30,63	998,32	104	
2	158	Basic	2023-08-31	1:46	74,053489	-72,031149	Hydrobios	Recovery	1019	23	5,9	2,2	2,19	30,68	998,3	104	
2	163	Full	2023-08-31	6:21	73,204219	-71,204634	Plankton Net	Deployment	1251	2	10,7	2,9	3,64	31,22	998,29	104	
2	163	Full	2023-08-31	6:24	73,203923	-71,205486	Plankton Net	Bottom	1250	2	8,2	2,9	3,67	31,23	998,42	104	
2	163	Full	2023-08-31	6:26	73,203836	-71,206078	Plankton Net	Recovery	1249				3,68	31,22			
2	163	Full	2023-08-31	6:45	73,199978	-71,201885	CTD Rosette	Deployment	1249	13	9,7	2,7	3,67	31,22	998,46	104	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	163	Full	2023-08-31	7:06	73,198761	-71,205683	CTD Rosette	Bottom	1247	23	11,8	2,5	3,63	31,23	998,45	104	
2	163	Full	2023-08-31	8:01	73,196541	-71,218245	CTD Rosette	Recovery	1241				3,83	31,21			
2	163	Full	2023-08-31	8:22	73,196194	-71,203272	Tucker Net	Deployment	1245	9	7,2	3,4	3,68	31,22	999,16	104	
2	163	Full	2023-08-31	8:32	73,190224	-71,209057	Tucker Net	Bottom	1243	2	7,6	3,1	3,65	31,23	999,21	104	
2	163	Full	2023-08-31	8:41	73,185262	-71,210909	Tucker Net	Recovery	1246	354	7,8	2,9	3,62	31,23	999,27	104	
2	163	Full	2023-08-31	9:23	73,199670	-71,195115	Monster Net	Deployment	1250	8	9,5	2,3	3,67	31,22	999,7	104	
2	163	Full	2023-08-31	9:55	73,198076	-71,188606	Monster Net	Bottom	1249				3,67	31,21			
2	163	Full	2023-08-31	10:36	73,195856	-71,187434	Monster Net	Recovery	1251	24	7,2	2,7	3,54	31,21	999,82	104	
2	163	Full	2023-08-31	11:02	73,196661	-71,205005	IKMT	Deployment	1244	32	5	2,4	3,65	31,20	1000,19	104	
2	163	Full	2023-08-31	11:22	73,184612	-71,198513	IKMT	Bottom	1249	47	5,9	2,6	3,69	31,20	1000,34	104	
2	163	Full	2023-08-31	12:03	73,165116	-71,126921	IKMT	Recovery	1262	51	7,4	2,8	3,66	31,22	1000,76	104	
2	163	Full	2023-08-31	12:45	73,199459	-71,201644	CTD Rosette	Deployment	1247	57	5,9	2,9	3,62	31,21	1000,91	104	
2	163	Full	2023-08-31	13:07	73,198829	-71,205406	CTD Rosette	Bottom	1246	42	6,7	3	3,61	31,21	1001,07	104	
2	163	Full	2023-08-31	13:53	73,196421	-71,219271	CTD Rosette	Recovery	1241	38	6,5	2,7	3,64	31,20	1001,3	104	
2	163	Full	2023-08-31	14:10	73,199484	-71,197752	Box Core	Deployment	1250	42	6,5	2,6	3,65	31,29	1001,45	104	
2	163	Full	2023-08-31	14:36	73,198294	-71,198649	Box Core	Bottom	1248	45	7,4	2,7	3,60	31,27	1001,49	104	
2	163	Full	2023-08-31	14:56	73,198129	-71,200194	Box Core	Recovery	1248	56	6,5	2,8	3,53	31,25	1001,52	104	
2	Bylot-23	Mooring	2023-09-01	12:53	72,881309	-75,648013	Mooring	Deployment	436	259	8,2	2	2,88	30,52	999,17	103	
2	Bylot-23	Mooring	2023-09-01	13:09	72,881684	-75,647966	Mooring	Bottom	438	275	6,9	2,6	2,60	30,37	999,08	103	
2	Bylot-23	Mooring	2023-09-01	16:17	72,872398	-75,652218	CTD Rosette	Deployment	500	300	2,3	3,5	2,21	30,67	997,59	102	
2	Bylot-23	Mooring	2023-09-01	16:26	72,872644	-75,650322	CTD Rosette	Bottom	498	338	2,9	3,7	2,48	30,51	997,59	102	
2	Bylot-23	Mooring	2023-09-01	17:07	72,872222	-75,637678	CTD Rosette	Recovery	497	340	9,9	2,8	2,45	30,53	997,27	103	
2	Bylot-23	Mooring	2023-09-01	17:34	72,870266	-75,775340	Plankton Net	Deployment	354	354	7,8	2,5	3,15	31,03	997,39	103	
2	Bylot-23	Mooring	2023-09-01	17:37	72,870302	-75,774423	Plankton Net	Bottom	354	355	7,2	2,5	3,05	31,02	997,41	103	
2	Bylot-23	Mooring	2023-09-01	17:40	72,870280	-75,773600	Plankton Net	Recovery	354	6	7,6	2,5	3,05	31,01	997,44	103	
2	Bylot-23	Mooring	2023-09-01	17:44	72,870077	-75,772858	Van Veen Grab	Deployment	354	349	8,4	2,5	3,07	31,07	997,43	103	
2	Bylot-23	Mooring	2023-09-01	17:54	72,870266	-75,770815	Van Veen Grab	Bottom	353	350	6,3	2,3	2,93	31,12	997,35	103	
2	Bylot-23	Mooring	2023-09-01	18:03	72,870173	-75,769720	Van Veen Grab	Recovery	354				3,13	30,93			
2	325	Basic	2023-09-02	2:35	73,817212	-80,496735	Plankton Net	Deployment	677				0,93	30,74			
2	325	Basic	2023-09-02	2:37	73,817194	-80,494531	Plankton Net	Bottom	678	250	15,6	1,4	0,96	30,75	995,79	103	
2	325	Basic	2023-09-02	2:39	73,817197	-80,492304	Plankton Net	Recovery	679	256	16,2	1,4	1,02	30,78	995,75	103	
2	325	Basic	2023-09-02	2:52	73,816824	-80,490831	CTD Rosette	Deployment	677				1,30	30,82			
2	325	Basic	2023-09-02	3:04	73,815145	-80,485151	CTD Rosette	Bottom	671	266	18,3	1,4	1,33	30,85	995,58	103	
2	325	Basic	2023-09-02	3:46	73,813110	-80,455563	CTD Rosette	Recovery	678	261	15,8	1,2	1,56	31,04	995,45	103	
2	325	Basic	2023-09-02	4:12	73,812748	-80,491270	Tucker Net	Deployment	659				1,10	30,81			
2	325	Basic	2023-09-02	4:23	73,810575	-80,461036	Tucker Net	Bottom	665	270	18,3	1,1	0,92	30,90	994,89	103	
2	325	Basic	2023-09-02	4:31	73,810509	-80,435483	Tucker Net	Recovery	675	277	13,9	1	0,61	30,62	995,19	103	
2	325	Basic	2023-09-02	5:09	73,817093	-80,520563	Hydrobios	Deployment	667	281	18,5	1,2	0,80	30,67	994,78	103	
2	325	Basic	2023-09-02	5:26	73,816479	-80,508752	Hydrobios	Bottom	668	275	21,1	1,2	0,79	30,69	994,94	103	
2	325	Basic	2023-09-02	5:49	73,815650	-80,495860	Hydrobios	Recovery	671				0,84	30,71			

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	325	Basic	2023-09-02	6:11	73,817139	-80,513935	Box Core	Deployment	669	258	17,1	1,1	0,62	30,64	994,86	103	
2	325	Basic	2023-09-02	6:24	73,817320	-80,506135	Box Core	Bottom	673	263	17,5	1,1	0,50	30,63	994,84	103	
2	325	Basic	2023-09-02	6:35	73,816675	-80,500200	Box Core	Recovery	673				0,53	30,69			
2	324	Nutrient	2023-09-02	8:28	73,984217	-80,473218	CTD Rosette	Deployment	772	268	14,9	1,6	3,53	31,68	994,31	103	
2	324	Nutrient	2023-09-02	8:42	73,982557	-80,469799	CTD Rosette	Bottom	772				3,57	31,61			
2	324	Nutrient	2023-09-02	9:31	73,977515	-80,453865	CTD Rosette	Recovery	771	275	14,3	1,4	3,73	31,52	994,24	103	
2	323	Full	2023-09-02	10:39	74,157369	-80,472714	Plankton Net	Deployment	786	261	14,3	1,7	3,12	31,62	994,11	103	
2	323	Full	2023-09-02	10:41	74,157633	-80,472147	Plankton Net	Bottom	786	265	16,2	1,7	3,08	31,62	994,12	103	
2	323	Full	2023-09-02	10:44	74,157666	-80,471360	Plankton Net	Recovery	786	267	15,8	1,8	2,93	31,73	994,12	103	
2	323	Full	2023-09-02	11:03	74,157818	-80,462640	CTD Rosette	Deployment	785	268	15,6	1,9	2,94	31,79	994,11	103	
2	323	Full	2023-09-02	11:11	74,158089	-80,462699	CTD Rosette	Bottom	785	259	16,4	1,8	3,03	31,68	994,15	103	
2	323	Full	2023-09-02	12:00	74,158001	-80,448148	CTD Rosette	Recovery	797	280	13,5	1,9	3,09	31,64	994,16	103	
2	323	Full	2023-09-02	12:14	74,157560	-80,470870	Tucker Net	Deployment	785	279	9,3	3,8	3,00	31,65	994,17	103	
2	323	Full	2023-09-02	12:22	74,157700	-80,452137	Tucker Net	Bottom	799	258	10,7	1,9	3,08	31,63	994,06	103	
2	323	Full	2023-09-02	12:29	74,159497	-80,438994	Tucker Net	Recovery	781	255	11,4	1,5	3,08	31,62	993,96	103	
2	323	Full	2023-09-02	12:50	74,156604	-80,471614	Hydrobios	Deployment	786	263	12,4	1,9	2,99	31,69	993,96	103	
2	323	Full	2023-09-02	13:10	74,157210	-80,465271	Hydrobios	Bottom	783				2,95	31,77			
2	323	Full	2023-09-02	13:36	74,158997	-80,453470	Hydrobios	Recovery	795	255	12,9	1,9	3,02	31,79	993,66	103	
2	323	Full	2023-09-02	14:03	74,156438	-80,446185	IKMT	Deployment	795	264	12,9	2,3	3,00	31,67	993,65	103	
2	323	Full	2023-09-02	14:27	74,162654	-80,399915	IKMT	Bottom	783	263	12,8	1,8	3,04	31,64	993,56	103	
2	323	Full	2023-09-02	15:08	74,175727	-80,310012	IKMT	Recovery	787	248	8,8	1,5	2,67	31,87	993,57	103	
2	323	Full	2023-09-02	16:19	74,155098	-80,472354	CTD Rosette	Deployment	788	259	18,7	1,6	3,11	31,71	993,32	103	
2	323	Full	2023-09-02	16:32	74,154769	-80,471940	CTD Rosette	Bottom	789	250	21,9	1,6	2,96	31,74	993,31	103	
2	323	Full	2023-09-02	17:04	74,154767	-80,468666	CTD Rosette	Recovery	790	249	16,6	1,8	3,01	31,71	993,32	103	
2	323	Full	2023-09-02	17:19	74,155948	-80,472823	Box Core	Deployment	789	251	20,6	1,7	3,04	31,68	993,26	103	
2	323	Full	2023-09-02	17:33	74,156345	-80,473152	Box Core	Bottom	789	253	18,7	1,8	3,10	31,68	993,43	103	
2	323	Full	2023-09-02	17:46	74,156711	-80,472640	Box Core	Recovery	788	254	18,5	1,6	2,82	31,72	993,48	103	
2	300	Nutrient	2023-09-02	19:01	74,317362	-80,498147	CTD Rosette	Deployment	699	254	15,4	1,2	2,67	31,61	993,59	103	
2	300	Nutrient	2023-09-02	19:13	74,316790	-80,500788	CTD Rosette	Bottom	701	244	14,3	1,5	2,69	31,72	993,76	103	
2	300	Nutrient	2023-09-02	20:05	74,313851	-80,514795	CTD Rosette	Recovery	703	230	12,4	1,5	2,40	32,00	993,81	103	
2	322	Basic	2023-09-02	21:12	74,498351	-80,530822	Plankton Net	Deployment	663	236	11,2	1,6	0,61	30,06	993,74	103	
2	322	Basic	2023-09-02	21:15	74,498091	-80,532073	Plankton Net	Bottom	663	231	11	1,6	0,67	30,07	993,75	103	
2	322	Basic	2023-09-02	21:17	74,497848	-80,534267	Plankton Net	Recovery	663	226	10,9	1,6	0,65	30,06	993,76	103	
2	322	Basic	2023-09-02	21:32	74,495950	-80,537062	CTD Rosette	Deployment	663	234	11,2	1,6	0,67	30,06	993,78	103	
2	322	Basic	2023-09-02	21:43	74,494243	-80,542363	CTD Rosette	Bottom	662	220	12	1,4	0,63	30,07	993,81	103	
2	322	Basic	2023-09-02	22:23	74,488409	-80,563857	CTD Rosette	Recovery	663	230	12,6	1,4	0,62	30,05	993,92	103	
2	322	Basic	2023-09-02	22:46	74,497926	-80,526020	Tucker Net	Deployment	662	225	9,5	1,3	0,67	30,01	994,03	103	
2	322	Basic	2023-09-02	22:55	74,501186	-80,519729	Tucker Net	Bottom	660				0,71	30,00			
2	322	Basic	2023-09-02	23:01	74,504237	-80,519588	Tucker Net	Recovery	656	235	10,5	1,1	0,76	29,92	994,17	103	
2	322	Basic	2023-09-02	23:36	74,494643	-80,530004	Hydrobios	Deployment	663	258	12,6	1	0,72	29,95	994,56	103	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	322	Basic	2023-09-02	23:52	74,492219	-80,533738	Hydrobios	Bottom	661	255	11	1	0,65	29,96	994,57	103	
2	322	Basic	2023-09-03	0:13	74,490661	-80,539270	Hydrobios	Recovery	660	257	9,7	1,1	0,66	29,96	994,87	103	
2	322	Basic	2023-09-03	0:43	74,497616	-80,529640	Box Core	Deployment	662	257	8,4	0,9	0,59	29,96	995,04	103	
2	322	Basic	2023-09-03	0:56	74,497708	-80,532304	Box Core	Bottom	662	260	7,6	0,6	0,67	29,84	994,97	103	
2	322	Basic	2023-09-03	1:07	74,497528	-80,534995	Box Core	Recovery	662	255	7,8	0,5	0,63	29,78	994,98	103	
2	S1	CTD	2023-09-04	9:16	74,049462	-91,157393	CTD Rosette	Deployment		316	8,6	0,5	1,16	29,43	1001,79	103	
2	S1	CTD	2023-09-04	9:19	74,049365	-91,157312	CTD Rosette	Bottom		313	7,4	0,5	1,24	29,03	1001,82	102	
2	S1	CTD	2023-09-04	9:20	74,049259	-91,157054	CTD Rosette	Recovery		313	8,4	0,6	1,21	28,94	1001,79	102	
2	S2	CTD	2023-09-04	10:01	74,066150	-91,125830	CTD Rosette	Deployment		303	7,4	0,5	1,19	29,12	1001,93	103	
2	S2	CTD	2023-09-04	10:04	74,066165	-91,125133	CTD Rosette	Bottom		302	8,8	0,6	1,26	29,08	1001,9	103	
2	S2	CTD	2023-09-04	10:08	74,066178	-91,124577	CTD Rosette	Recovery		300	8,6	0,5	1,30	28,78	1001,91	103	
2	S3	Nutrient	2023-09-04	10:40	74,097025	-91,085989	CTD Rosette	Deployment		290	8,9	0,5	0,68	30,16	1002,12	103	
2	S3	Nutrient	2023-09-04	10:43	74,096820	-91,085970	CTD Rosette	Bottom		287	8,8	0,5	0,70	30,12	1002,1	103	
2	S3	Nutrient	2023-09-04	11:08	74,094805	-91,085205	CTD Rosette	Recovery		305	13,9	0,3	0,71	30,10	1002,04	102	
2	S4	CTD	2023-09-04	12:02	74,143944	-91,017771	CTD Rosette	Deployment		309	13,9	0,1	0,88	30,38	1002,32	102	
2	S4	CTD	2023-09-04	12:07	74,143771	-91,017558	CTD Rosette	Bottom		312	13,9	0	1,05	30,33	1002,32	102	
2	S4	CTD	2023-09-04	12:13	74,143633	-91,016579	CTD Rosette	Recovery		310	15	0	1,08	30,36	1002,24	102	
2	S5	Basic	2023-09-04	12:58	74,218556	-90,903075	CTD Rosette	Deployment	297	295	10,5	0,3	2,79	30,56	1002,28	102	
2	S5	Basic	2023-09-04	13:03	74,217710	-90,904322	CTD Rosette	Bottom	297	308	12,6	0	2,78	30,69	1002,31	102	
2	S5	Basic	2023-09-04	13:32	74,214985	-90,906380	CTD Rosette	Recovery	295	287	12	-0,3	2,77	30,71	1002,42	102	
2	S5	Basic	2023-09-04	13:45	74,218921	-90,901330	Plankton Net	Deployment	296	277	11,2	-0,4	2,78	30,63	1002,4	102	
2	S5	Basic	2023-09-04	13:47	74,219033	-90,901093	Plankton Net	Bottom	297	281	11,2	-0,3	2,77	30,46	1002,44	102	
2	S5	Basic	2023-09-04	13:51	74,218927	-90,900132	Plankton Net	Recovery	297	287	10,3	-0,3	2,85	30,34	1002,43	102	
2	S5	Basic	2023-09-04	14:06	74,218145	-90,912474	Tucker Net	Deployment	297	299	11,4	0,4	2,85	30,13	1002,36	102	
2	S5	Basic	2023-09-04	14:15	74,215943	-90,895225	Tucker Net	Bottom	294	289	9,5	-0,4	2,89	30,15	1002,39	102	
2	S5	Basic	2023-09-04	14:24	74,213658	-90,876317	Tucker Net	Recovery	291	286	11	-0,4	2,93	30,19	1002,33	102	
2	S5	Basic	2023-09-04	14:47	74,217643	-90,904890	Hydrobios	Deployment	296	294	14,7	-0,2	2,83	30,42	1002,23	102	
2	S5	Basic	2023-09-04	14:55	74,217169	-90,901900	Hydrobios	Bottom	296	298	13,3	-0,3	2,96	30,29	1002,31	102	
2	S5	Basic	2023-09-04	15:06	74,216747	-90,899152	Hydrobios	Recovery	295	319	11,8	-0,3	3,07	30,19	1002,38	102	
2	S5	Basic	2023-09-04	16:10	74,219721	-90,937467	Beam Trawl	Deployment	311	293	8,4	0,9	3,05	30,18	1002,48	102	
2	S5	Basic	2023-09-04	16:26	74,215047	-90,905734	Beam Trawl	Bottom	295	309	10,9	-0,7	3,10	30,25	1002,44	102	
2	S5	Basic	2023-09-04	16:45	74,215190	-90,861110	Beam Trawl	Recovery	286				2,96	30,26			
2	S5	Basic	2023-09-04	17:12	74,217652	-90,902159	Box Core	Deployment	297	307	10,7	-0,5	2,90	30,35	1002,39	102	
2	S5	Basic	2023-09-04	17:18	74,217676	-90,900466	Box Core	Bottom	296				2,91	30,27			
2	S5	Basic	2023-09-04	17:25	74,217461	-90,901667	Box Core	Recovery	297	304	13,5	-0,3	2,92	30,26	1002,35	102	
2	S6	CTD	2023-09-04	18:16	74,277817	-90,814059	CTD Rosette	Deployment	222	296	13,5	-0,2	2,92	30,57	1002,19	102	
2	S6	CTD	2023-09-04	18:21	74,276730	-90,815874	CTD Rosette	Bottom	223	283	12,6	-0,4	2,91	30,17	1002,24	102	
2	S6	CTD	2023-09-04	18:27	74,275826	-90,817705	CTD Rosette	Recovery	225	286	13,3	-0,4	2,86	30,40	1002,13	102	
2	S7	CTD	2023-09-04	19:11	74,343487	-90,717422	CTD Rosette	Deployment	212	285	13,9	0,1	3,16	30,23	1002,01	102	
2	S7	CTD	2023-09-04	19:15	74,343278	-90,718702	CTD Rosette	Bottom	213	276	16	0	3,16	30,26	1002,05	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
2	S7	CTD	2023-09-04	19:22	74,342752	-90,720617	CTD Rosette	Recovery	215	281	16,4	0	3,15	30,25	1002,04	102	
2	S8	Basic	2023-09-04	20:01	74,400988	-90,628907	CTD Rosette	Deployment	197				3,16	30,38			
2	S8	Basic	2023-09-04	20:05	74,400513	-90,631039	CTD Rosette	Bottom	196	299	17,3	0,4	3,20	30,30	1001,7	102	
2	S8	Basic	2023-09-04	20:33	74,401141	-90,640839	CTD Rosette	Recovery	197	293	17,3	0,6	3,23	30,21	1001,68	102	
2	S8	Basic	2023-09-04	20:45	74,400771	-90,644966	Plankton Net	Deployment	198				3,17	30,46			
2	S8	Basic	2023-09-04	20:48	74,400711	-90,646096	Plankton Net	Bottom	197	303	16,6	0,7	3,26	30,40	1001,7	102	
2	S8	Basic	2023-09-04	20:50	74,400824	-90,647214	Plankton Net	Recovery	197				3,23	30,25			
2	S8	Basic	2023-09-04	21:00	74,399414	-90,639678	Tucker Net	Deployment	194				3,24	30,21			
2	S8	Basic	2023-09-04	21:07	74,397158	-90,628774	Tucker Net	Bottom	194	307	14,5	0,5	3,19	30,19	1001,65	102	
2	S8	Basic	2023-09-04	21:13	74,397369	-90,615976	Tucker Net	Recovery	196	309	11,8	0,7	3,18	30,20	1001,78	102	
2	S8	Basic	2023-09-04	21:38	74,399806	-90,633781	Hydrobios	Deployment	193	318	12	2,8	3,24	30,34	1001,83	102	
2	S8	Basic	2023-09-04	21:44	74,399007	-90,636610	Hydrobios	Bottom	195	327	13,5	1,9	3,33	30,36	1001,91	102	
2	S8	Basic	2023-09-04	21:50	74,397825	-90,639942	Hydrobios	Recovery	194	331	16,4	0,9	3,29	30,38	1001,9	101	
2	S8	Basic	2023-09-04	22:14	74,390313	-90,646562	Beam Trawl	Deployment	201	319	11,2	5	3,18	30,22	1001,99	102	
2	S8	Basic	2023-09-04	22:25	74,383964	-90,638312	Beam Trawl	Bottom	206	323	11,4	0,8	3,10	30,15	1002,09	102	
2	S8	Basic	2023-09-04	22:42	74,373411	-90,624254	Beam Trawl	Recovery	216	86	15,2	1	3,04	30,03	1002,2	101	
2	S8	Basic	2023-09-04	23:13	74,401626	-90,629468	Box Core	Deployment	195	310	13,5	1,2	3,14	30,23	1002,23	101	
2	S8	Basic	2023-09-04	23:20	74,401884	-90,630551	Box Core	Bottom	196				3,17	30,25			
2	S8	Basic	2023-09-04	23:25	74,402095	-90,631173	Box Core	Recovery	197	334	14,1	1,3	3,17	30,24	1002,31	101	
2	S9	CTD	2023-09-05	0:18	74,464539	-90,533977	CTD Rosette	Deployment	268	318	15,2	1,1	3,15	30,42	1002,4	101	
2	S9	CTD	2023-09-05	0:23	74,464264	-90,535852	CTD Rosette	Bottom	269	322	14,9	1	3,06	30,29	1002,59	101	
2	S9	CTD	2023-09-05	0:30	74,463873	-90,537742	CTD Rosette	Recovery	268				3,16	30,39			
2	S10	Nutrient	2023-09-05	1:18	74,544527	-90,405770	CTD Rosette	Deployment	183	318	10,7	0,5	2,85	30,52	1002,62	101	
2	S10	Nutrient	2023-09-05	1:21	74,544448	-90,406332	CTD Rosette	Bottom	183	324	11,2	0,5	2,92	30,47	1002,62	101	
2	S10	Nutrient	2023-09-05	1:46	74,544365	-90,407371	CTD Rosette	Recovery	184	317	11,8	0,6	2,94	30,26	1002,54	101	
2	S11	CTD	2023-09-05	2:36	74,570656	-90,368205	CTD Rosette	Deployment	104	302	10,7	0	2,98	30,47	1002,58	101	
2	S11	CTD	2023-09-05	2:39	74,570634	-90,367894	CTD Rosette	Bottom	104	306	11	0,1	2,99	30,42	1002,56	102	
2	S11	CTD	2023-09-05	2:44	74,570697	-90,367102	CTD Rosette	Recovery	104	301	15,6	0	2,98	30,42	1002,52	102	
2	305A	Nutrient	2023-09-05	18:49	74,223934	-93,493916	CTD Rosette	Deployment	160	287	15,2	1,8	0,23	30,02	1007,83	102	
2	305A	Nutrient	2023-09-05	18:52	74,224129	-93,488799	CTD Rosette	Bottom	162				0,07	30,36			
2	305A	Nutrient	2023-09-05	19:18	74,224995	-93,452509	CTD Rosette	Recovery	163	280	12,8	5,5	0,14	30,29	1007,93	102	
2	305B	Nutrient	2023-09-05	20:25	74,352265	-93,574276	CTD Rosette	Deployment	168	299	18,7	0,3	1,25	30,62	1008,05	102	
2	305B	Nutrient	2023-09-05	20:29	74,352179	-93,572006	CTD Rosette	Bottom	168				0,70	30,87			
2	305B	Nutrient	2023-09-05	20:56	74,351100	-93,554974	CTD Rosette	Recovery	169	294	16,8	0,3	0,79	30,79	1008,2	102	
2	305C	Nutrient	2023-09-05	22:12	74,483497	-93,647001	CTD Rosette	Deployment	169	294	19,4	0,6	1,64	30,94	1008,02	102	
2	305C	Nutrient	2023-09-05	22:15	74,483877	-93,646677	CTD Rosette	Bottom	170	287	18,1	0,7	1,57	30,96	1008,05	102	
2	305C	Nutrient	2023-09-05	22:40	74,483277	-93,650601	CTD Rosette	Recovery	168				1,51	30,99			
2	305D	Nutrient	2023-09-05	23:52	74,602640	-93,723725	CTD Rosette	Deployment	128	280	19,2	0,9	1,84	30,75	1007,99	102	
2	305D	Nutrient	2023-09-05	23:55	74,602615	-93,726275	CTD Rosette	Bottom	128	275	16,9	0,9	1,97	30,75	1007,97	102	
2	305D	Nutrient	2023-09-06	0:15	74,602595	-93,740401	CTD Rosette	Recovery	130	285	18,1	0,8	2,02	30,74	1008,23	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
Leg 3																	
3	AC14	Full	2023-09-09	10:33	75,493376	-78,847006	CTD Rosette	Deployment	542	305	4,6	-0,2	-0,22	30,25	1001,52	103	
3	AC14	Full	2023-09-09	10:42	75,493398	-78,844580	CTD Rosette	Bottom	541	297	1,1	1,2			1001,62	103	
3	AC14	Full	2023-09-09	10:54	75,493552	-78,840818	CTD Rosette	Recovery	540	323	3	0,6	-0,26	30,02	1001,74	103	
3	AC14	Full	2023-09-09	11:56	75,493237	-78,845235	Hydrobios	Deployment	542	2	3	0,9	-0,49	30,10	1001,66	103	
3	AC14	Full	2023-09-09	12:09	75,493184	-78,842262	Hydrobios	Bottom	541	3	4,4	-0,1	-0,51	30,11	1001,76	103	
3	AC14	Full	2023-09-09	12:28	75,493412	-78,843184	Hydrobios	Recovery	541	326	5,1	0,8	-0,45	30,03	1001,81	103	
3	AC14	Full	2023-09-09	14:27	75,494925	-78,855092	CTD Rosette	Deployment	542	211	5,7	-0,2	-0,10	30,43	1001,99	103	
3	AC14	Full	2023-09-09	15:32	75,493828	-78,863239	CTD Rosette	Recovery	543	145	3,6	0,4	-0,71	29,79	1001,69	103	
3	AC14	Full	2023-09-09	15:44	75,493501	-78,867936	Phytoplankton Net	Deployment	543	158	2,5	0,4	-0,13	30,08	1001,68	103	
3	AC14	Full	2023-09-09	15:46	75,493511	-78,868117	Phytoplankton Net	Bottom	543	160	2,9	0,3	-0,44	29,97	1001,70	103	
3	AC14	Full	2023-09-09	15:49	75,493506	-78,868271	Phytoplankton Net	Recovery	543	174	2,3	0,3	-0,45	29,89	1001,72	103	
3	AC14	Full	2023-09-09	17:19	75,460727	-78,829620	Tucker Net	Deployment	567	149	0	0,7	-0,42	29,94	1002,01	103	
3	AC14	Full	2023-09-09	17:28	75,457526	-78,817122	Tucker Net	Bottom	569	19	4	0,5	-0,44	29,88	1002,10	103	
3	AC14	Full	2023-09-09	17:36	75,460260	-78,806212	Tucker Net	Recovery	567	352	4,8	0,6	-0,40	30,01	1002,11	103	
3	AC14	Full	2023-09-09	18:01	75,438126	-78,797639	IKMT	Deployment	570	351	4,4	0,4	-0,49	29,87	1002,11	103	
3	AC14	Full	2023-09-09	18:18	75,433546	-78,765960	IKMT	Bottom	572	335	5	-0,3	-0,41	29,72	1002,28	103	
3	AC14	Full	2023-09-09	18:55	75,443318	-78,675512	IKMT	Recovery	540	305	7,4	-0,3	-0,31	29,86	1002,56	103	
3	AC14	Full	2023-09-09	19:18	75,451594	-78,695996	Agassiz Trawl	Deployment	543	309	4,2	1			1002,89	103	
3	AC14	Full	2023-09-09	19:32	75,449437	-78,673874	Agassiz Trawl	Bottom	538	317	10,9	0	-0,33	29,99	1002,83	103	
3	AC14	Full	2023-09-09	19:49	75,450873	-78,645015	Agassiz Trawl	Recovery	535	323	10,1	0,2	-0,25	29,85	1002,97	103	
3	AC14	Full	2023-09-09	20:42	75,495805	-78,842897	Box Core	Deployment	539	319	17,5	0,4	-0,36	29,76	1003,33	103	
3	AC14	Full	2023-09-09	20:55	75,494558	-78,838044	Box Core	Bottom	541	317	16,6	-0,1	-0,29	30,09	1003,41	103	
3	AC14	Full	2023-09-09	21:07	75,493082	-78,834205	Box Core	Recovery	542	316	18,8	-0,4	-0,63	29,79	1003,11	103	
3	AF-23	Mooring	2023-09-12	16:10	81,539800	-64,959734	CTD Rosette	Deployment	320				-1,16	27,67			
3	AF-23	Mooring	2023-09-12	16:21	81,539476	-64,960266	CTD Rosette	Bottom	300	272	5	-3,3	-1,03	27,12	1013,14	102	
3	AF-23	Mooring	2023-09-12	16:38	81,539245	-64,957099	CTD Rosette	Recovery	280	242	4,2	-2,7	-1,18	27,24	1013,15	102	
3	AF-23	Mooring	2023-09-12	17:10	81,538787	-64,953420	Mooring	Deployment	235	220	4	-2,5	-1,13	27,00	1013,19	102	
3	AF-23	Mooring	2023-09-12	17:37	81,538750	-64,954959	Mooring	Bottom	251	258	2,7	-2,4	-1,14	27,14	1012,95	102	
3	AF-23	Mooring	2023-09-12	18:25	81,539450	-64,962752	CTD Rosette	Deployment	288	252	1,5	-2,2	-1,17	27,31	1013,18	102	
3	AF-23	Mooring	2023-09-12	18:36	81,539466	-64,962754	CTD Rosette	Bottom	284	261	1	-1,8	-1,18	27,39	1013,21	102	
3	AF-23	Mooring	2023-09-12	19:18	81,539345	-64,953947	CTD Rosette	Recovery	253	269	2,1	-1,2	-1,15	27,57	1013,11	102	
3	AF-23	Mooring	2023-09-12	19:51	81,547930	-64,965464	Box Core	Deployment	605	211	5,1	-2,6	-1,21	28,00	1013,19	102	
3	AF-23	Mooring	2023-09-12	20:05	81,547863	-64,964461	Box Core	Bottom	605	228	4,6	-2,2	-1,20	27,77	1013,17	101	
3	AF-23	Mooring	2023-09-12	20:18	81,547418	-64,961617	Box Core	Recovery	605	231	3,8	-1,7	-1,20	27,94	1013,19	101	
3	AF-23	Mooring	2023-09-12	20:59	81,547983	-64,964091	Gravity Core	Deployment	605	264	5,3	-2,1	-1,26	28,66	1013,35	102	
3	AF-23	Mooring	2023-09-12	21:12	81,547733	-64,960597	Gravity Core	Bottom	605	202	5,9	-2,3	-1,20	28,23	1013,35	102	
3	AF-23	Mooring	2023-09-12	21:23	81,547660	-64,955555	Gravity Core	Recovery	605	244	5,9	-1,7	-1,12	27,93	1013,46	101	
3	AF-23	Mooring	2023-09-12	22:36	81,546826	-64,948070	Box Core	Deployment	586	241	3,2	-2	-1,25	28,30	1013,54	102	
3	AF-23	Mooring	2023-09-12	22:50	81,547062	-64,944666	Box Core	Bottom	586	199	1,9	-2,1			1013,43	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	AF-23	Mooring	2023-09-12	23:07	81,547288	-64,942733	Box Core	Recovery	586	228	3,2	-1,9	-1,26	27,78	1013,41	102	
3	AF-23	Mooring	2023-09-13	0:06	81,547151	-64,979757	Box Core	Deployment	605	266	4,6	-2,4	-1,14	27,83	1013,50	102	
3	AF-23	Mooring	2023-09-13	0:20	81,547119	-64,977053	Box Core	Bottom	605	198	4,6	-2,6	-1,21	28,25	1013,55	102	
3	AF-23	Mooring	2023-09-13	0:35	81,547480	-64,974979	Box Core	Recovery	605	221	3	-2,3	-1,29	28,67	1013,54	102	
3	AF-23	Mooring	2023-09-13	1:09	81,546903	-64,970121	Phytoplankton Net	Deployment	606	206	3,2	-2,5	-1,43	29,30	1013,65	102	
3	AF-23	Mooring	2023-09-13	1:12	81,546892	-64,969631	Phytoplankton Net	Bottom	606	194	4,2	-2,5	-1,44	29,38	1013,66	102	
3	AF-23	Mooring	2023-09-13	1:14	81,546809	-64,968752	Phytoplankton Net	Recovery	607	203	4	-2,5			1013,66	102	
3	AF-23	Mooring	2023-09-13	1:35	81,547366	-64,970892	Hydrobios	Deployment	605	177	3,4	-2,4	-1,38	29,28	1013,64	102	
3	AF-23	Mooring	2023-09-13	1:52	81,547475	-64,968851	Hydrobios	Bottom	605	205	1	-1,8	-1,34	29,07	1013,55	101	
3	AF-23	Mooring	2023-09-13	2:12	81,547389	-64,963966	Hydrobios	Recovery	606	282	3,4	-1,5	-1,43	29,38	1013,63	102	
3	AF-23	Mooring	2023-09-13	2:48	81,543034	-65,075090	Tucker Net	Deployment	622	225	4,6	-2	-1,23	27,92	1013,73	102	
3	AF-23	Mooring	2023-09-13	2:56	81,540649	-65,056074	Tucker Net	Bottom	579								
3	AF-23	Mooring	2023-09-13	3:10	81,542791	-65,017502	Tucker Net	Recovery	592	250	5,5	-1,3			1013,61	101	
3	AC2	Full	2023-09-13	5:51	81,540795	-65,807634	Box Core	Deployment	394	312	0,8	-1,9	-1,20	27,27	1013,94	102	
3	AC2	Full	2023-09-13	6:00	81,540919	-65,807285	Box Core	Bottom	394	348	3	-1,8	-1,04	27,86	1014,02	101	
3	AC2	Full	2023-09-13	6:09	81,541352	-65,804234	Box Core	Recovery	401	19	1,1	-1,7	-1,09	28,45	1014,07	101	
3	AC3	Full	2023-09-13	9:11	81,478281	-66,478629	CTD Rosette	Deployment	368	205	1,5	-2,1	-0,70	28,79	1015,02	102	
3	AC3	Full	2023-09-13	9:25	81,478597	-66,478594	CTD Rosette	Bottom	366	130	1,5	-2,2	-0,72	28,99	1015,13	101	
3	AC3	Full	2023-09-13	10:13	81,479301	-66,478508	CTD Rosette	Recovery	364	254	2,5	-2	-0,69	29,03	1015,16	102	8
3	AC3	Full	2023-09-13	10:36	81,478797	-66,480714	Monster Net	Deployment	366	137	0	-1,7	-0,97	29,62	1015,27	102	8
3	AC3	Full	2023-09-13	10:46	81,478589	-66,477472	Monster Net	Bottom	374	320	1,1	-1,3	-0,85	29,01	1015,31	102	8
3	AC3	Full	2023-09-13	10:58	81,478959	-66,474964	Monster Net	Recovery	371	267	1	-1,4	-0,92	28,99	1015,35	102	8
3	AC3	Full	2023-09-13	11:27	81,482407	-66,478700	Tucker Net	Deployment	304	280	1,7	-1,6	-0,77	27,77	1015,58	102	8
3	AC3	Full	2023-09-13	11:43	81,479205	-66,502967	Tucker Net	Recovery	358	264	1,3	-1,6	-0,86	27,84	1015,70	101	8
3	AC3	Full	2023-09-13	11:55	81,477994	-66,482380	Phytoplankton Net	Deployment	378	315	0	-2	-0,96	28,52	1015,84	101	8
3	AC3	Full	2023-09-13	11:58	81,478022	-66,481580	Phytoplankton Net	Bottom	379	329	0,2	-1,8	-0,96	29,25	1015,86	102	8
3	AC3	Full	2023-09-13	12:01	81,478057	-66,479731	Phytoplankton Net	Recovery	390	67	0,6	-1,7	-0,98	29,40	1015,90	102	8
3	AC3	Full	2023-09-13	12:44	81,478662	-66,474754	CTD Rosette	Deployment	386	35	2,3	-1,7	-0,82	28,94	1016,04	102	8
3	AC3	Full	2023-09-13	12:56	81,479004	-66,472668	CTD Rosette	Bottom	379	333	0	-0,9	-0,88	29,17	1016,07	102	8
3	AC3	Full	2023-09-13	13:14	81,479216	-66,470442	CTD Rosette	Recovery	379	81	0	-1,8	-0,86	29,04	1016,03	102	8
3	AC3	Full	2023-09-13	13:32	81,478046	-66,477745	Box Core	Deployment	380	50	0	-1,2	-0,81	28,42	1016,00	102	8
3	AC3	Full	2023-09-13	13:41	81,478017	-66,477451	Box Core	Bottom	380	83	0,4	-1,3	-0,83	29,05	1015,94	102	8
3	AC3	Full	2023-09-13	13:51	81,478029	-66,475788	Box Core	Recovery	386	327	0	-1,4	-0,79	28,98	1015,94	102	8
3	AC3	Full	2023-09-13	14:08	81,478333	-66,477683	Box Core	Deployment	368	135	0	-1,9	-0,79	29,18	1015,84	102	8
3	AC3	Full	2023-09-13	14:17	81,478454	-66,477628	Box Core	Bottom	367	188	0	-1,9	-0,92	29,18	1015,77	102	8
3	AC3	Full	2023-09-13	14:26	81,478529	-66,477041	Box Core	Recovery	367	6	2,9	-1,5	-0,91	29,28	1015,85	102	8
3	AC3	Full	2023-09-13	14:42	81,478610	-66,474809	Gravity Core	Deployment	367	42	1,7	-1,2	-0,75	28,92	1015,99	102	8
3	AC3	Full	2023-09-13	14:48	81,478733	-66,475259	Gravity Core	Bottom	367	40	0,8	-0,9			1016,00	102	8
3	AC3	Full	2023-09-13	14:55	81,478747	-66,475672	Gravity Core	Recovery	367	5	1,3	-0,7	-0,90	29,08	1015,99	102	8
3	AC3	Full	2023-09-13	16:14	81,508416	-65,985886	Barge	Deployment	451	329	2,1	-1,6			1015,92	102	8

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	AC2	Full	2023-09-13	16:53	81,542194	-65,833329	CTD Rosette	Deployment	375	90	5	-1,3	-1,05	28,11	1016,00	102	8
3	AC2	Full	2023-09-13	17:05	81,542652	-65,841978	CTD Rosette	Bottom	378	111	5,3	-1,4			1015,99	102	8
3	AC2	Full	2023-09-13	17:46	81,545577	-65,859231	CTD Rosette	Recovery	315	63	5	-1,8	-1,13	27,24	1016,07	102	8
3	AC2	Full	2023-09-13	18:04	81,543749	-65,835945	Monster Net	Deployment	384	116	7,6	-1,9	-1,12	26,72	1016,00	102	8
3	AC2	Full	2023-09-13	18:14	81,544054	-65,838273	Monster Net	Bottom	382				-1,11	28,62			8
3	AC2	Full	2023-09-13	18:27	81,545084	-65,841061	Monster Net	Recovery	379	70	4,4	-2			1015,99	102	8
3	AC2	Full	2023-09-13	18:39	81,545477	-65,839840	Phytoplankton Net	Deployment	381	79	4,8	-2,1			1016,01	102	8
3	AC2	Full	2023-09-13	18:43	81,545399	-65,839436	Phytoplankton Net	Bottom	382	79	5	-2,1			1016,04	102	8
3	AC2	Full	2023-09-13	18:46	81,545342	-65,839336	Phytoplankton Net	Recovery	382	67	3,6	-2,1			1016,02	102	8
3	Lsea-23	Mooring	2023-09-14	5:24	82,064375	-61,499800	CTD Rosette	Deployment	591	208	12,9	1	-1,61	30,29	1013,54	101	8
3	Lsea-23	Mooring	2023-09-14	6:51	82,080551	-61,480237	CTD Rosette	Recovery	549								8
3	Lsea-23	Mooring	2023-09-14	7:30	82,060827	-61,484382	Hydrobios	Deployment	534	35	25,9	-3,5	-1,45	30,50	1012,86	102	8
3	Lsea-23	Mooring	2023-09-14	7:51	82,061137	-61,476816	Hydrobios	Bottom	534	206	24,2	-1,8	-1,52	30,48	1013,06	102	8
3	Lsea-23	Mooring	2023-09-14	8:09	82,061936	-61,467706	Hydrobios	Recovery	520	45	1,9	-1	-1,54	30,42	1012,87	102	8
3	Lsea-23	Mooring	2023-09-14	8:39	82,062689	-61,425082	Tucker Net	Deployment	544	215	28,9	-2,7	-1,59	30,44	1012,62	102	8
3	Lsea-23	Mooring	2023-09-14	8:47	82,059915	-61,376698	Tucker Net	Bottom	532	217	16,6	-2,6	-1,59	30,46	1013,05	102	8
3	Lsea-23	Mooring	2023-09-14	8:57	82,059035	-61,335183	Tucker Net	Recovery	537	209	2,7	-2,2	-1,59	30,35	1012,97	102	8
3	Lsea-23	Mooring	2023-09-14	9:38	82,061090	-61,423513	IKMT	Deployment	521	211	18,8	-1,1	-1,61	30,27	1013,66	102	8
3	Lsea-23	Mooring	2023-09-14	10:33	82,091613	-61,378985	IKMT	Recovery	539	223	27,2	-2,5	-1,56	30,56	1013,27	102	8
3	Lsea-23	Mooring	2023-09-14	10:49	82,091699	-61,379689	Phytoplankton Net	Deployment	547	198	18,3	0,4	-1,56	30,57	1013,17	102	8
3	Lsea-23	Mooring	2023-09-14	10:52	82,091931	-61,379779	Phytoplankton Net	Bottom	543	182	21,7	-0,8	-1,56	30,57	1013,33	102	8
3	Lsea-23	Mooring	2023-09-14	10:55	82,091974	-61,380114	Phytoplankton Net	Recovery	542	224	12,6	1,7			1013,38	102	7
3	LS-23	Full	2023-09-14	11:02	82,092296	-61,375391	Mapping		537	218	17,1	0,6			1013,45	102	7
3	Lsea-23	Mooring	2023-09-14	13:59	82,063504	-61,494766	Box Core	Deployment	573	206	20,4	-2,8	-1,56	30,58	1013,95	102	7
3	Lsea-23	Mooring	2023-09-14	14:11	82,062004	-61,490821	Box Core	Bottom	534	206	20	-1,9	-1,53	30,56	1013,94	102	7
3	Lsea-23	Mooring	2023-09-14	14:23	82,062813	-61,487235	Box Core	Recovery	540	289	20,4	-2,2	-1,57	30,46	1014,01	102	7
3	Lsea-23	Mooring	2023-09-14	14:40	82,063759	-61,503765	Box Core	Deployment	584				-1,55	30,33			7
3	Lsea-23	Mooring	2023-09-14	14:53	82,063065	-61,513291	Box Core	Bottom	581	209	21,9	-2			1013,95	102	7
3	Lsea-23	Mooring	2023-09-14	15:09	82,063739	-61,507523	Box Core	Recovery	592	200	24	-2,4	-1,55	30,38	1013,59	102	7
3	Lsea-23	Mooring	2023-09-14	15:45	82,063511	-61,512369	Gravity Core	Deployment	588	135	17,5	-2	-1,58	30,38	1014,45	102	7
3	Lsea-23	Mooring	2023-09-14	15:54	82,063092	-61,512783	Gravity Core	Bottom	580	214	18,8	-1,9	-1,56	30,39	1014,41	102	7
3	Lsea-23	Mooring	2023-09-14	16:04	82,063772	-61,509635	Gravity Core	Recovery	591	220	19,2	-1,7	-1,57	30,34	1014,46	103	7
3	AC1	Full	2023-09-15	0:55	81,700056	-64,101345	CTD Rosette	Deployment	540	90	4,6	-2,5	-1,52	30,12	1018,75	102	7
3	AC1	Full	2023-09-15	1:11	81,700090	-64,101599	CTD Rosette	Bottom	539	80	3,4	-2,6	-1,50	29,92	1018,94	102	7
3	AC1	Full	2023-09-15	2:00	81,699051	-64,093900	CTD Rosette	Recovery	515	34	2,9	-2,4			1018,96	102	7
3	AC1	Full	2023-09-15	2:25	81,701640	-64,095158	Hydrobios	Deployment	531	95	2,5	-2,4	-1,53	30,08	1019,01	102	7
3	AC1	Full	2023-09-15	2:40	81,701814	-64,093983	Hydrobios	Bottom	530	107	3,8	-2,5	-1,51	29,72	1018,99	102	7
3	AC1	Full	2023-09-15	2:58	81,701929	-64,090727	Hydrobios	Recovery	530	125	3	-2,4	-1,55	30,18	1019,03	102	7
3	AC1	Full	2023-09-15	3:27	81,700670	-64,086833	Tucker Net	Deployment	505	138	2,5	-2,5	-1,55	29,95	1019,10	102	7
3	AC1	Full	2023-09-15	3:42	81,698116	-64,128197	Tucker Net	Recovery	543	109	4	-2,4	-1,54	29,64	1019,00	102	7

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	AC1	Full	2023-09-15	4:52	81,700128	-64,096233	Monster Net	Deployment	540				-1,54	29,74			7
3	AC1	Full	2023-09-15	5:30	81,700686	-64,079493	Monster Net	Recovery	507	206	4,4	-2,2	-1,57	29,70	1019,42	102	7
3	AC1	Full	2023-09-15	5:42	81,700072	-64,094542	Phytoplankton Net	Deployment	542	151	2,1	-2,5	-1,49	29,85	1019,40	102	7
3	AC1	Full	2023-09-15	5:47	81,700092	-64,090276	Phytoplankton Net	Recovery	540	154	3	-2,5	-1,48	30,23	1019,42	102	7
3	AC1	Full	2023-09-15	6:07	81,700042	-64,094410	Box Core	Deployment	542				-1,45	29,97			7
3	AC1	Full	2023-09-15	6:25	81,700420	-64,079538	Box Core	Bottom	513				-1,43	30,30			7
3	AC1	Full	2023-09-15	6:41	81,701010	-64,062526	Box Core	Recovery	522	164	1	-2,5	-1,40	30,29	1019,42	102	7
3	AC4	Full	2023-09-15	12:15	81,402952	-64,356584	CTD Rosette	Deployment	671	185	14,9	-2,5	-1,61	30,34	1019,22	102	7
3	AC4	Full	2023-09-15	12:32	81,401043	-64,349319	CTD Rosette	Bottom	649	156	5,9	-0,7	-1,59	30,39	1019,24	102	7
3	AC4	Full	2023-09-15	12:55	81,398374	-64,362525	CTD Rosette	Recovery	620	206	14,3	3			1019,08	102	3
3	AC4	Full	2023-09-15	13:24	81,404101	-64,368816	Hydrobios	Deployment	671	191	22,1	-2,5	-1,55	29,70	1018,74	102	2
3	AC4	Full	2023-09-15	13:40	81,400388	-64,378364	Hydrobios	Bottom	665	196	18,5	-1,2	-1,49	30,04	1018,80	102	2
3	AC4	Full	2023-09-15	14:01	81,393603	-64,392084	Hydrobios	Recovery	600				-1,51	30,03			2
3	AC4	Full	2023-09-15	14:26	81,395021	-64,120521	Tucker Net	Deployment	539	194	13,9	-2,4	-1,60	29,75	1018,97	102	2
3	AC4	Full	2023-09-15	14:38	81,395911	-64,160994	Tucker Net	Bottom	539	186	14,9	-2,3	-1,60	29,88	1018,88	102	2
3	AC4	Full	2023-09-15	14:46	81,397797	-64,185411	Tucker Net	Recovery	573	194	13,9	-2,1	-1,60	29,96	1018,85	102	2
3	AC4	Full	2023-09-15	15:12	81,384324	-64,189985	IKMT	Deployment	527	191	12,9	-0,3			1018,87	101	2
3	AC4	Full	2023-09-15	15:30	81,393060	-64,211052	IKMT	Bottom	522	195	15	-2,4	-1,55	29,82	1018,51	101	2
3	AC4	Full	2023-09-15	16:14	81,404594	-64,390425	IKMT	Recovery	630	192	23	-2,4	-1,54	29,70	1017,76	102	2
3	AC4	Full	2023-09-15	17:44	81,403729	-64,331692	CTD Rosette	Deployment	664	192	17,3	-1	-1,40	29,46	1017,93	101	2
3	AC4	Full	2023-09-15	18:03	81,403873	-64,331606	CTD Rosette	Bottom	654	194	10,9	1,4	-1,44	29,67	1017,72	101	2
3	AC4	Full	2023-09-15	18:50	81,405779	-64,317710	CTD Rosette	Recovery	614	266	5,1	-1,8	-1,42	29,52	1017,27	102	2
3	AC4	Full	2023-09-15	19:28	81,410546	-64,273101	Phytoplankton Net	Deployment	575	188	19	-2,3	-1,46	29,34	1017,02	102	1
3	AC4	Full	2023-09-15	19:31	81,410603	-64,271573	Phytoplankton Net	Bottom	574	183	20,6	-2,4	-1,50	29,48	1016,94	102	1
3	AC4	Full	2023-09-15	19:33	81,410302	-64,271080	Phytoplankton Net	Recovery	575	331	20,9	-2,1	-1,49	29,58	1016,81	102	1
3	AC4	Full	2023-09-15	20:20	81,433209	-64,246487	Gravity Core	Deployment	639	216	10,3	-1,4	-1,50	29,69	1017,35	102	1
3	AC4	Full	2023-09-15	20:31	81,432932	-64,245093	Gravity Core	Bottom	639	124	6,9	-1,4	-1,52	29,85	1017,41	102	2
3	AC4	Full	2023-09-15	20:41	81,433087	-64,239863	Gravity Core	Recovery	637	186	9,5	-1,2	-1,51	29,82	1017,23	102	2
3	AC4	Full	2023-09-15	21:57	81,433557	-64,251882	Box Core	Deployment	640	175	8,8	-0,5	-1,49	29,78	1016,65	101	2
3	AC4	Full	2023-09-15	22:12	81,433344	-64,251572	Box Core	Bottom	639	191	1,1	-1,4	-1,49	29,77	1016,83	102	2
3	AC4	Full	2023-09-15	22:28	81,432943	-64,251456	Box Core	Recovery	639	313	0	-1,8	-1,51	29,76	1016,83	101	2
3	AC4	Full	2023-09-15	22:43	81,433488	-64,249527	Box Core	Deployment	640	191	12	-2,3	-1,51	29,82	1016,74	102	2
3	AC4	Full	2023-09-15	22:59	81,433120	-64,248112	Box Core	Bottom	639	190	12	-2,4	-1,52	29,78	1016,63	102	2
3	AC4	Full	2023-09-15	23:16	81,433021	-64,249847	Box Core	Recovery	639	197	8,9	-2,3	-1,53	29,78	1016,52	102	2
3	AC18	Full	2023-09-16	12:03	80,319683	-69,727630	CTD Rosette	Deployment	185	313	3,2	-1,6	-1,44	29,43	1013,99	101	2
3	AC18	Full	2023-09-16	12:14	80,319141	-69,724806	CTD Rosette	Bottom	183	280	1,3	-1,7	-1,31	29,29	1013,94	101	2
3	AC18	Full	2023-09-16	12:48	80,317573	-69,729017	CTD Rosette	Recovery	189	260	6,3	-1,7	-1,12	29,20	1013,88	101	2
3	AC18	Full	2023-09-16	13:08	80,316040	-69,730135	Monster Net	Deployment	152	259	5,9	-1,9	-1,33	29,53	1013,63	102	2
3	AC18	Full	2023-09-16	13:13	80,315883	-69,730820	Monster Net	Bottom	150	267	4,2	-1,8	-1,22	29,39	1013,63	101	2
3	AC18	Full	2023-09-16	13:18	80,315825	-69,731379	Monster Net	Recovery	151				-1,30	29,19			2

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	AC18	Full	2023-09-16	13:35	80,313187	-69,729483	Tucker Net	Deployment	135	276	4,2	-1,8	-1,31	29,41	1013,54	102	2
3	AC18	Full	2023-09-16	13:43	80,316550	-69,732934	Tucker Net	Bottom	176				-1,37	29,07			2
3	AC18	Full	2023-09-16	13:53	80,319871	-69,739038	Tucker Net	Recovery	194	307	1,9	-0,7	-1,11	29,29	1013,49	101	2
3	AC18	Full	2023-09-16	14:03	80,319728	-69,738232	Phytoplankton Net	Deployment	190	101	1,5	0,7	-1,37	29,60	1013,45	101	2
3	AC18	Full	2023-09-16	14:06	80,319693	-69,737813	Phytoplankton Net	Bottom	189	118	2,7	1	-1,38	29,63	1013,41	101	2
3	AC18	Full	2023-09-16	14:09	80,319675	-69,737382	Phytoplankton Net	Recovery	189	102	1,5	1	-1,27	29,59	1013,36	101	2
3	AC18	Full	2023-09-16	14:23	80,319095	-69,730361	CTD Rosette	Deployment	189	256	4,2	0,5	-1,35	29,28	1013,27	101	2
3	AC18	Full	2023-09-16	14:35	80,318429	-69,729042	CTD Rosette	Bottom	189	256	2,9	-0,3	-1,41	29,60	1013,26	101	2
3	AC18	Full	2023-09-16	14:39	80,318190	-69,728400	CTD Rosette	Recovery	189	262	5	-0,6	-1,41	29,64	1013,19	101	2
3	AC18	Full	2023-09-16	15:02	80,316896	-69,732991	CTD Rosette	Deployment	177	329	1,1	0,4	-1,19	29,51	1013,05	101	2
3	AC18	Full	2023-09-16	15:10	80,315638	-69,736773	CTD Rosette	Bottom	157				-1,26	29,55			2
3	AC18	Full	2023-09-16	15:18	80,315063	-69,740885	CTD Rosette	Recovery	160	38	3,4	1,5	-1,17	29,23	1012,89	101	2
3	AC18	Full	2023-09-16	16:37	80,319534	-69,735081	Box Core	Deployment	189	192	4	0,2	-1,32	29,11	1012,61	101	2
3	AC18	Full	2023-09-16	16:42	80,319770	-69,738187	Box Core	Bottom	193	218	3	-0,5	-1,25	29,52	1012,61	101	2
3	AC18	Full	2023-09-16	16:48	80,320192	-69,741243	Box Core	Recovery	198	154	0,6	0,4	-1,14	29,32	1012,58	101	2
3	AC18	Full	2023-09-16	17:03	80,320765	-69,734492	Box Core	Deployment	195	183	0	0,2	-1,21	29,26	1012,65	101	2
3	AC18	Full	2023-09-16	17:08	80,321221	-69,735499	Box Core	Bottom	201	108	0,6	-0,1	-1,23	29,43	1012,64	101	2
3	AC18	Full	2023-09-16	17:14	80,321618	-69,736214	Box Core	Recovery	203	110	3,2	-0,1	-1,19	29,35	1012,63	101	2
3	AC19	Full	2023-09-16	20:16	80,263917	-69,015856	CTD Rosette	Deployment	325				-1,54	29,71			8
3	AC19	Full	2023-09-16	20:27	80,262447	-69,022874	CTD Rosette	Bottom	323	19	11,4	2,1	-1,54	29,76	1011,57	101	8
3	AC19	Full	2023-09-16	21:03	80,256565	-69,051666	CTD Rosette	Recovery	322	325	1,5	1	-1,54	29,66	1011,58	101	8
3	AC19	Full	2023-09-16	21:33	80,251803	-69,084148	Hydrobios	Deployment	319	359	14,3	-1,5	-1,53	29,67	1011,34	101	8
3	AC19	Full	2023-09-16	21:43	80,249833	-69,092644	Hydrobios	Bottom	317	354	12	-1,5	-1,53	29,67	1011,53	101	8
3	AC19	Full	2023-09-16	21:53	80,248660	-69,105763	Hydrobios	Recovery	314	2	14,9	-1,6	-1,54	29,72	1011,28	101	8
3	AC19	Full	2023-09-16	22:29	80,279126	-69,221546	Tucker Net	Deployment	306				-1,53	29,59			8
3	AC19	Full	2023-09-16	22:38	80,273207	-69,228973	Tucker Net	Bottom	309	8	13,3	-1,6	-1,53	29,58	1011,66	101	8
3	AC19	Full	2023-09-16	22:46	80,268446	-69,230371	Tucker Net	Recovery	312	1	14,5	-1,7	-1,54	29,62	1011,62	101	8
3	AC19	Full	2023-09-16	23:06			CTD Rosette	Deployment	320	3	18,1	-2,1	-1,55	29,74	1011,65	101	8
3	AC19	Full	2023-09-16	23:59	80,246488	-69,241803	CTD Rosette	Recovery	286	355	6,9	-0,9	-1,57	29,69	1011,71	101	8
3	AC19	Full	2023-09-17	0:08	80,245872	-69,246361	Phytoplankton Net	Deployment	284				-1,54	29,73			8
3	AC19	Full	2023-09-17	0:16	80,244655	-69,254546	Phytoplankton Net	Recovery	285	3	14,5	-0,8	-1,53	29,75	1011,81	101	8
3	AC19	Full	2023-09-17	0:35	80,240021	-69,278657	Box Core	Deployment	288	12	16	-1,7	-1,56	29,79	1011,81	101	8
3	AC19	Full	2023-09-17	0:44	80,237867	-69,289217	Box Core	Bottom	283	0	13,9	-1	-1,55	29,82	1011,74	101	8
3	AC19	Full	2023-09-17	0:52	80,235701	-69,299993	Box Core	Recovery	287	5	13,3	0,8	-1,55	29,78	1011,71	101	8
3	AC20	Full	2023-09-17	5:56	80,300107	-67,889832	CTD Rosette	Deployment	175	159	3	-3,2	-1,53	29,64	1012,91	102	8
3	AC20	Full	2023-09-17	6:12	80,302843	-67,878422	CTD Rosette	Bottom	174	144	4,2	-1,8			1013,07	102	8
3	AC20	Full	2023-09-17	6:42	80,308195	-67,861967	CTD Rosette	Recovery	174	212	1	-1,6	-1,54	29,71	1013,10	102	8
3	AC20	Full	2023-09-17	7:12	80,304431	-67,901063	Monster Net	Deployment	177	206	0,4	-2,4	-1,52	29,93	1013,42	102	8
3	AC20	Full	2023-09-17	7:20	80,306618	-67,893062	Monster Net	Bottom	174	198	9,3	-2,1	-1,51	29,86	1013,48	101	8
3	AC20	Full	2023-09-17	7:25	80,307518	-67,887967	Monster Net	Recovery	172	204	7,4	-2,2	-1,49	30,09	1013,59	101	8

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	AC20	Full	2023-09-17	7:52	80,312681	-67,785056	Tucker Net	Deployment	176	214	2,7	-2,9	-1,61	29,67	1013,89	102	8
3	AC20	Full	2023-09-17	8:04	80,316847	-67,817804	Tucker Net	Bottom	179	199	7,2	-2,9	-1,59	29,75	1013,98	102	8
3	AC20	Full	2023-09-17	8:10	80,316266	-67,837789	Tucker Net	Recovery	173	171	7	-3	-1,54	29,72	1014,06	102	8
3	AC20	Full	2023-09-17	8:30	80,299690	-67,892458	Phytoplankton Net	Deployment	173	171	8,6	-3,4	-1,55	29,68	1014,36	102	8
3	AC20	Full	2023-09-17	8:37	80,301159	-67,886428	Phytoplankton Net	Recovery	172	160	9,1	-3,7	-1,52	30,03	1014,42	102	8
3	AC20	Full	2023-09-17	9:04	80,299002	-67,879513	Box Core	Deployment	172	175	8,4	-4	-1,54	29,97	1014,78	102	8
3	AC20	Full	2023-09-17	9:10	80,299107	-67,875157	Box Core	Bottom	172	182	8,6	-4	-1,52	30,04	1014,79	102	8
3	AC20	Full	2023-09-17	9:16	80,299178	-67,870029	Box Core	Recovery	172				-1,50	30,22			8
3	CEOS-m4-23	Mooring	2023-09-17	15:14	80,057035	-67,054207	Mooring	Deployment	51	121	15,8	-1,8	-1,28	28,84	1016,46	101	8
3	CEOS-m4-23	Mooring	2023-09-17	15:16	80,056827	-67,055116	Mooring	Bottom	53	107	21,5	-2,4	-1,26	28,98	1015,92	101	8
3	CEOS-m4-23	Mooring	2023-09-17	15:37	80,052111	-67,073335	CTD Rosette	Deployment	81	107	15,2	-2,6			1016,37	101	8
3	CEOS-m4-23	Mooring	2023-09-17	15:45	80,051760	-67,074279	CTD Rosette	Bottom	81				-1,23	29,51			8
3	CEOS-m4-23	Mooring	2023-09-17	16:04	80,051881	-67,077321	CTD Rosette	Recovery	81	111	17,5	-2,8	-1,24	29,56	1016,57	101	8
3	134	Full	2023-09-17	20:00	80,038510	-68,607765	CTD Rosette	Deployment	246	159	12,6	-1,7	-1,32	28,20	1016,95	101	3
3	134	Full	2023-09-17	20:07	80,038663	-68,608443	CTD Rosette	Bottom	247	165	10,5	-1,7	-1,30	28,04	1017,01	101	3
3	134	Full	2023-09-17	20:21	80,039255	-68,609303	CTD Rosette	Recovery	247	166	12,6	-1,8	-1,32	27,95	1017,01	101	3
3	134	Full	2023-09-17	20:52	80,039882	-68,616201	Hydrobios	Deployment	248	186	12,2	-1,7	-1,36	27,90	1017,26	101	3
3	134	Full	2023-09-17	20:59	80,040235	-68,616174	Hydrobios	Bottom	249				-1,34	28,04			3
3	134	Full	2023-09-17	21:09	80,040392	-68,616173	Hydrobios	Recovery	248	166	8,4	-2	-1,36	27,89	1017,49	102	3
3	134	Full	2023-09-17	21:39	80,039147	-68,580032	Tucker Net	Deployment	240	181	5,5	-1,2	-1,24	29,06	1017,54	102	3
3	134	Full	2023-09-17	21:48	80,044078	-68,566233	Tucker Net	Bottom	244	179	6,9	-0,8	-1,27	27,93	1017,66	101	3
3	134	Full	2023-09-17	21:57	80,049737	-68,565115	Tucker Net	Recovery	247	182	8,2	-2,3	-1,29	27,96	1017,73	102	3
3	134	Full	2023-09-17	22:31	80,037560	-68,621028	CTD Rosette	Deployment	248	196	5,9	-3,4	-0,98	28,90	1017,93	102	3
3	134	Full	2023-09-17	22:42			CTD Rosette	Bottom		132	4,2	-2	-1,06	29,24	1017,97	102	3
3	134	Full	2023-09-17	23:19	80,041398	-68,613910	CTD Rosette	Recovery	246	172	4	-1,2	-0,96	29,01	1018,06	102	3
3	134	Full	2023-09-17	23:31	80,042250	-68,615330	Phytoplankton Net	Deployment	246	159	7	0	-1,25	28,20	1018,08	102	3
3	134	Full	2023-09-17	23:35	80,042541	-68,615231	Phytoplankton Net	Bottom	247	173	6,5	0,4	-1,05	28,87	1018,10	102	3
3	134	Full	2023-09-17	23:38	80,042739	-68,615187	Phytoplankton Net	Recovery	247	128	5,9	-0,3	-1,07	29,09	1018,03	102	3
3	134	Full	2023-09-18	0:06	80,065366	-68,516857	Beam trawl	Deployment	246	144	8,4	-2	-1,47	28,50	1018,12	102	3
3	134	Full	2023-09-18	0:20	80,061478	-68,547725	Beam trawl	Bottom	248	174	11,8	-2	-1,47	27,99	1017,98	102	3
3	134	Full	2023-09-18	0:36	80,054857	-68,574507	Beam trawl	Recovery	249	182	13,1	-1,5	-1,43	28,14	1017,91	102	3
3	134	Full	2023-09-18	1:00	80,042483	-68,602376	Box Core	Deployment	246	194	5,5	3,3	-1,41	28,96	1017,96	101	3
3	134	Full	2023-09-18	1:08	80,041976	-68,603295	Box Core	Bottom	246	242	4,8	-0,1	-1,42	29,20	1017,99	102	3
3	134	Full	2023-09-18	1:16	80,041955	-68,603071	Box Core	Recovery	246	245	2,3	-0,6	-1,42	29,02	1018,01	102	3
3	134	Full	2023-09-18	1:30	80,041691	-68,600210	Box Core	Deployment	247	263	1,5	-1	-1,43	29,11	1018,08	102	3
3	134	Full	2023-09-18	1:38	80,041269	-68,597928	Box Core	Bottom	245	182	0,2	-1,3	-1,42	28,78	1018,05	102	3
3	134	Full	2023-09-18	1:47	80,040645	-68,594113	Box Core	Recovery	243	250	7,4	-0,8	-1,47	29,05	1018,01	102	3
3	133	Full	2023-09-18	6:51	79,598559	-70,370160	CTD Rosette	Deployment	188	163	11,6	-1,8	-1,14	28,96	1017,98	102	3
3	133	Full	2023-09-18	7:00	79,599246	-70,369064	CTD Rosette	Bottom	188				-1,27	28,68			3
3	133	Full	2023-09-18	7:12	79,599930	-70,368168	CTD Rosette	Recovery	189	150	8,6	-2,4	-1,27	28,67	1018,04	102	3

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	133	Full	2023-09-18	7:47	79,598559	-70,362128	Monster Net	Deployment	185				-1,31	28,69			3
3	133	Full	2023-09-18	7:53	79,598888	-70,361424	Monster Net	Bottom	185	148	10,5	-2,8	-1,34	28,59	1017,87	102	3
3	133	Full	2023-09-18	7:59	79,599284	-70,359941	Monster Net	Recovery	185	151	9,7	-2,8	-1,24	28,73	1017,95	102	3
3	133	Full	2023-09-18	8:32	79,601506	-70,356610	Phytoplankton Net	Deployment	185	145	9,9	-2,9	-1,32	28,53	1017,96	102	3
3	133	Full	2023-09-18	8:35	79,601706	-70,356380	Phytoplankton Net	Bottom	185	142	9,5	-2,9	-1,36	28,50	1017,94	102	3
3	133	Full	2023-09-18	8:39	79,601914	-70,355996	Phytoplankton Net	Recovery	185	143	8,4	-2,9	-1,40	28,46	1017,98	102	3
3	133	Full	2023-09-18	9:28	79,606664	-70,371488	CTD Rosette	Deployment	184	166	7,4	-2,5	-1,36	28,51	1018,18	102	3
3	133	Full	2023-09-18	10:10	79,609011	-70,363501	CTD Rosette	Recovery	182	169	9,5	-2,1	-1,41	28,44	1018,24	102	3
3	133	Full	2023-09-18	10:34	79,620897	-70,301876	Agassiz Trawl	Deployment	178	155	5,9	-0,4	-1,45	28,38	1018,34	102	3
3	133	Full	2023-09-18	10:40	79,623222	-70,298576	Agassiz Trawl	Bottom	177	147	6,3	-0,6	-1,43	28,36	1018,39	102	3
3	133	Full	2023-09-18	10:53	79,631585	-70,287362	Agassiz Trawl	Recovery	179	141	4,2	-0,5	-1,48	28,31	1018,36	102	3
3	133	Full	2023-09-18	12:20	79,603614	-70,223861	Box Core	Deployment	160	151	8,4	-2,7	-1,25	28,61	1018,20	102	6
3	133	Full	2023-09-18	12:24	79,603828	-70,223038	Box Core	Bottom	160	144	8	-2,8	-1,32	28,56	1018,19	102	6
3	133	Full	2023-09-18	12:30	79,604175	-70,221960	Box Core	Recovery	161				-1,38	28,46			6
3	133	Full	2023-09-18	13:09	79,594337	-70,338522	Box Core	Deployment	174	154	9,1	-2,8	-1,42	29,24	1018,02	102	8
3	133	Full	2023-09-18	13:13	79,594331	-70,338602	Box Core	Bottom	173	146	9,3	-2,8	-1,43	28,77	1017,97	102	8
3	133	Full	2023-09-18	13:18	79,594328	-70,337594	Box Core	Recovery	174	142	8,4	-2,8	-1,40	28,71	1017,99	102	8
3	129	Basic	2023-09-19	3:35	78,310974	-73,799210	CTD Rosette	Deployment	593	163	17,1	-1,7	-1,32	29,02	1017,29	102	8
3	129	Basic	2023-09-19	3:47	78,312864	-73,803673	CTD Rosette	Bottom	567	184	22,3	-1,5	-1,30	29,02	1017,28	102	8
3	129	Basic	2023-09-19	3:56	78,312326	-73,805335	CTD Rosette	Recovery	555	174	20,6	-1,5	-1,30	29,02	1017,25	102	8
3	129	Basic	2023-09-19	4:29	78,305684	-73,773669	Hydrobios	Deployment	692	178	16,9	-0,8	-1,30	29,02	1017,40	102	8
3	129	Basic	2023-09-19	4:47	78,305884	-73,774682	Hydrobios	Bottom	693	173	19,6	-0,7	-1,31	29,16	1017,18	102	8
3	129	Basic	2023-09-19	5:09	78,305834	-73,771104	Hydrobios	Recovery	693				-1,30	29,35			8
3	129	Basic	2023-09-19	5:37	78,307282	-73,764445	Tucker Net	Deployment	686				-1,33	29,06			8
3	129	Basic	2023-09-19	5:42	78,309459	-73,756539	Tucker Net	Bottom	682				-1,33	29,00			8
3	129	Basic	2023-09-19	5:51	78,313582	-73,758634	Tucker Net	Recovery	658	169	13,5	-1,5	-1,32	28,97	1017,19	102	8
3	129	Basic	2023-09-19	6:31	78,305637	-73,767697	CTD Rosette	Deployment	689	177	16,8	1,9	-1,32	28,99	1017,60	102	8
3	129	Basic	2023-09-19	6:51	78,305851	-73,774878	CTD Rosette	Bottom	693	191	10,7	4,7	-1,31	28,98	1017,81	102	8
3	129	Basic	2023-09-19	7:42	78,305868	-73,808613	CTD Rosette	Recovery	622	159	9,7	0,2	-1,32	28,92	1017,97	102	8
3	129	Basic	2023-09-19	8:11	78,305820	-73,775324	Box Core	Deployment	692	180	13,5	-1,6	-1,30	28,94	1018,07	102	8
3	129	Basic	2023-09-19	8:30	78,305872	-73,772114	Box Core	Bottom	691	165	14,9	-1,9	-1,30	28,88	1018,03	102	8
3	129	Basic	2023-09-19	8:48	78,306088	-73,772928	Box Core	Recovery	691	154	17,9	-2,2	-1,31	28,87	1018,03	102	8
3	Nares-WBAT-23	Mooring	2023-09-19	11:15	78,317832	-74,799580	Mooring	Deployment	563				-1,33	29,20			8
3	Nares-West-23	Mooring	2023-09-19	14:15	78,326493	-74,883614	Mooring	Deployment	301	177	11,6	-1,8	-1,29	29,32	1019,74	103	8
3	Nares-West-23	Mooring	2023-09-19	14:51	78,323841	-74,817665	CTD Rosette	Deployment	476	192	11,8	0	-1,23	29,27	1019,98	103	8
3	Nares-West-23	Mooring	2023-09-19	15:06	78,323928	-74,819588	CTD Rosette	Bottom	473	182	15,2	0,3	-1,28	29,26	1019,86	103	8
3	Nares-West-23	Mooring	2023-09-19	15:24	78,324517	-74,818354	CTD Rosette	Recovery	470	187	11,6	1,4	-1,21	29,24	1019,97	103	8
3	Nares-West-23	Mooring	2023-09-19	16:34	78,311057	-74,881765	Monster Net	Deployment	548	189	15,8	-1,4	-1,29	29,21	1020,24	102	8
3	Nares-West-23	Mooring	2023-09-19	17:09	78,312242	-74,878871	Monster Net	Recovery	544	182	14,5	-1,3	-1,28	29,21	1020,32	102	8
3	Nares-West-23	Mooring	2023-09-19	17:34	78,313560	-74,868357	Tucker Net	Deployment	539	171	13,1	-1,4	-1,29	29,21	1020,27	102	8

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	Nares-West-23	Mooring	2023-09-19	17:41	78,313655	-74,885483	Tucker Net	Bottom	532	184	13,1	-1,4	-1,29	29,21	1020,25	103	8
3	Nares-West-23	Mooring	2023-09-19	17:49	78,313319	-74,902520	Tucker Net	Recovery	505	173	12,2	-1,4	-1,31	29,22	1020,39	102	8
3	Nares-West-23	Mooring	2023-09-19	19:07	78,306979	-74,736923	IKMT	Deployment	592	182	11,2	-0,3	-1,25	29,13	1020,94	103	1
3	Nares-West-23	Mooring	2023-09-19	19:29	78,318176	-74,718066	IKMT	Bottom	621	191	12	0,7	-1,25	29,15	1021,01	103	1
3	Nares-West-23	Mooring	2023-09-19	20:10	78,343874	-74,677232	IKMT	Recovery	634	179	16,2	-1	-1,25	29,19	1021,12	103	1
3	Nares-West-23	Mooring	2023-09-19	20:48	78,311611	-74,878150	CTD Rosette	Deployment	547	166	14,1	-1,5	-1,30	29,24	1021,41	102	1
3	Nares-West-23	Mooring	2023-09-19	21:42	78,305312	-74,875015	CTD Rosette	Recovery	566	202	6,9	-1,1	-1,29	29,22	1021,92	103	1
3	Nares-West-23	Mooring	2023-09-19	21:57	78,311044	-74,882246	Phytoplankton Net	Deployment	545	193	13,3	-1,6	-1,32	29,22	1021,92	103	1
3	Nares-West-23	Mooring	2023-09-19	22:00	78,311123	-74,881053	Phytoplankton Net	Bottom	545	190	13,9	-1,7	-1,30	29,23	1021,94	102	1
3	Nares-West-23	Mooring	2023-09-19	22:03	78,311207	-74,879822	Phytoplankton Net	Recovery	545	185	12,8	-1,6	-1,30	29,24	1021,95	103	1
3	Nares-West-23	Mooring	2023-09-19	22:21	78,306269	-74,748124	Agassiz Trawl	Deployment	595	185	11,8	-1,1	-1,30	29,20	1022,14	103	1
3	Nares-West-23	Mooring	2023-09-19	22:43	78,310092	-74,706721	Agassiz Trawl	Bottom	585	195	10,1	0,3	-1,26	29,18	1022,32	103	1
3	Nares-West-23	Mooring	2023-09-19	23:08	78,320371	-74,700207	Agassiz Trawl	Recovery	617	186	11,4	-1,5	-1,25	29,20	1022,24	103	1
3	Nares-West-23	Mooring	2023-09-19	23:36	78,286268	-74,765850	Box Core	Deployment	622	178	9,7	-1,6	-1,29	29,21	1022,59	103	1
3	Nares-West-23	Mooring	2023-09-19	23:53	78,285802	-74,769090	Box Core	Bottom	621	184	9,5	-1,6	-1,29	29,20	1022,76	103	1
3	Nares-West-23	Mooring	2023-09-20	0:09	78,285985	-74,771283	Box Core	Recovery	621	176	9,9	-1,6	-1,30	29,21	1022,79	103	1
3	Nares-West-23	Mooring	2023-09-20	0:14	78,286161	-74,773248	Box Core	Deployment	620	187	10,3	-1,6	-1,29	29,21	1022,77	103	1
3	Nares-West-23	Mooring	2023-09-20	0:31	78,286045	-74,774097	Box Core	Bottom	619	173	11	-1,6	-1,28	29,21	1022,70	103	1
3	Nares-West-23	Mooring	2023-09-20	0:47			Box Core	Recovery	620	189	10,9	-1,6	-1,30	29,21	1022,79	103	2
3	Nares-West-23	Mooring	2023-09-20	1:13	78,295079	-74,816559	Box Core	Deployment	587	185	12,4	-1,6	-1,30	29,23	1022,68	102	2
3	Nares-West-23	Mooring	2023-09-20	1:29	78,297514	-74,826978	Box Core	Bottom	572	187	14,1	-1,6			1022,61	103	2
3	Nares-West-23	Mooring	2023-09-20	1:45	78,297601	-74,822774	Box Core	Recovery	565	193	14,5	-1,4	-1,29	29,25	1022,48	103	2
3	129	Full	2023-09-20	3:38	78,334285	-74,157991	Hydrobios	Deployment	489	163	11,6	-1,4	-1,31	29,56	1022,66	103	2
3	129	Full	2023-09-20	3:51	78,335415	-74,166947	Hydrobios	Bottom	491	165	12,8	-1,3	-1,32	29,55	1022,69	103	2
3	129	Full	2023-09-20	4:10	78,337080	-74,178829	Hydrobios	Recovery	489	172	11,6	-1,6	-1,30	29,56	1022,84	103	2
3	Nares-East-23	Mooring	2023-09-20	7:18	78,323488	-73,182103	CTD Rosette	Deployment	327	180	11,2	2,4	-1,35	29,30	1022,95	102	2
3	Nares-East-23	Mooring	2023-09-20	7:30	78,323565	-73,179704	CTD Rosette	Bottom	327	146	1,5	0,2	-1,35	29,31	1023,06	102	2
3	Nares-East-23	Mooring	2023-09-20	7:39	78,323505	-73,179997	CTD Rosette	Recovery	327	190	10,5	2,8	-1,36	29,30	1023,09	102	2
3	Nares-East-23	Mooring	2023-09-20	8:07	78,323319	-73,181957	Monster Net	Deployment	331	187	15,8	-1,2	-1,24	29,41	1022,99	102	2
3	Nares-East-23	Mooring	2023-09-20	8:16	78,323467	-73,176292	Monster Net	Bottom	320				-1,34	29,33			2
3	Nares-East-23	Mooring	2023-09-20	8:28	78,323635	-73,167117	Monster Net	Recovery	311	180	14,9	-1,1	-1,37	29,30	1022,77	103	2
3	Nares-East-23	Mooring	2023-09-20	8:57	78,325301	-73,184211	Tucker Net	Deployment	305	200	13,5	-1,3	-1,31	29,43	1023,17	103	2
3	Nares-East-23	Mooring	2023-09-20	9:06	78,330289	-73,180855	Tucker Net	Bottom	196	189	15	-1,2	-1,38	29,32	1023,01	103	2
3	Nares-East-23	Mooring	2023-09-20	9:15	78,334413	-73,191610	Tucker Net	Recovery	186	197	14,3	-1,2	-1,39	29,36	1023,08	102	2
3	Nares-East-23	Mooring	2023-09-20	10:38	78,323904	-73,192688	Mooring	Deployment	336	172	11,4	-1,2			1023,50	102	2
3	Nares-East-23	Mooring	2023-09-20	11:08	78,321754	-73,175835	CTD Rosette	Deployment	309	190	12,9	-0,7	-1,33	29,47	1023,64	102	2
3	Nares-East-23	Mooring	2023-09-20	11:18	78,322055	-73,176795	CTD Rosette	Bottom	311	203	11	2,1	-1,37	29,41	1023,65	102	2
3	Nares-East-23	Mooring	2023-09-20	12:00	78,322607	-73,176099	CTD Rosette	Recovery	318	170	12,2	-1,5	-1,25	29,60	1023,67	102	2
3	Nares-East-23	Mooring	2023-09-20	12:44	78,305233	-73,241544	Phytoplankton Net	Deployment	274	201	7,6	2,7			1023,84	102	2
3	Nares-East-23	Mooring	2023-09-20	12:47	78,305698	-73,242133	Phytoplankton Net	Bottom	271	166	6,5	1,5			1023,88	102	2

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	Nares-East-23	Mooring	2023-09-20	12:50	78,306244	-73,241803	Phytoplankton Net	Recovery	263	203	9,7	2,5			1023,89	102	2
3	Nares-East-23	Mooring	2023-09-20	13:01	78,305232	-73,250043	Beam Trawl	Deployment	280	184	7,8	1,5	-1,27	29,31	1023,81	102	2
3	Nares-East-23	Mooring	2023-09-20	13:18			Beam Trawl	Bottom									2
3	Nares-East-23	Mooring	2023-09-20	13:41	78,329288	-73,208840	Beam Trawl	Recovery									2
3	Nares-East-23	Mooring	2023-09-20	15:38			Box Core	Deployment									2
3	Nares-East-23	Mooring	2023-09-20	15:53	78,275256	-73,730010	Box Core	Bottom									2
3	Nares-East-23	Mooring	2023-09-20	16:08	78,278936	-73,727613	Box Core	Recovery		177	11	-1,7	-1,36	29,55	1023,34	102	2
3	Nares-East-23	Mooring	2023-09-20	18:05	78,266174	-73,739104	Box Core	Deployment	674	178	11	-1,8	-1,41	29,14	1023,14	102	3
3	Nares-East-23	Mooring	2023-09-20	18:25	78,270154	-73,734354	Box Core	Bottom	699	190	15,4	-1,7	-1,39	29,19	1023,11	102	5
3	Nares-East-23	Mooring	2023-09-20	18:39	78,272458	-73,727948	Box Core	Recovery	706	188	10,7	-2	-1,38	29,16	1023,16	102	5
3	Nares-East-23	Mooring	2023-09-20	19:06	78,270800	-73,738157	Gravity Core	Deployment	703	200	12,9	-1,8	-1,40	29,14	1023,03	102	5
3	Nares-East-23	Mooring	2023-09-20	19:17	78,271376	-73,739813	Gravity Core	Bottom	716	199	12	-1,8	-1,40	29,14	1023,06	102	5
3	Nares-East-23	Mooring	2023-09-20	19:29	78,272047	-73,740728	Gravity Core	Recovery	708	201	10,9	-1,9	-1,39	29,13	1023,14	102	5
3	122	Basic	2023-09-21	2:40	77,343446	-74,670730	CTD Rosette	Deployment	681	220	5,1	-1,6	-1,11	28,25	1022,92	102	5
3	122	Basic	2023-09-21	3:00	77,339324	-74,684063	CTD Rosette	Recovery	676	357	0,6	-2,2	-1,17	28,34	1022,81	102	5
3	122	Basic	2023-09-21	3:29	77,335626	-74,653941	Hydrobios	Deployment	682	191	6,7	-2,9	-1,30	28,96	1022,73	102	5
3	122	Basic	2023-09-21	3:48	77,332811	-74,666104	Hydrobios	Bottom	677				-1,30	28,52			5
3	122	Basic	2023-09-21	4:10			Hydrobios	Recovery									5
3	122	Basic	2023-09-21	5:25	77,348653	-74,424744	Tucker Net	Deployment	705	169	0	-1,9	-0,90	29,43	1022,29	102	5
3	122	Basic	2023-09-21	5:35	77,353215	-74,416157	Tucker Net	Bottom	702	145	3,4	-1,7	-1,29	29,05	1022,22	102	5
3	122	Basic	2023-09-21	5:45	77,357270	-74,403912	Tucker Net	Recovery	701	187	3	-2,2	-1,29	29,05	1022,22	102	5
3	122	Basic	2023-09-21	6:32	77,343494	-74,450867	IKMT	Deployment	703	211	9,7	-2,3	-1,19	29,32	1021,95	102	5
3	122	Basic	2023-09-21	6:51	77,331426	-74,449595	IKMT	Bottom	706	167	8,4	-2,2	-0,60	29,47	1021,97	102	5
3	122	Basic	2023-09-21	7:35	77,315003	-74,347040	IKMT	Recovery	705	175	4,4	-2,1	0,80	30,38	1021,93	102	5
3	122	Basic	2023-09-21	8:32	77,342528	-74,590359	CTD Rosette	Deployment	698	182	3,8	-2,8	-1,26	28,96	1021,68	102	5
3	122	Basic	2023-09-21	8:50	77,336470	-74,607364	CTD Rosette	Bottom	694	189	2,9	-2,9	-1,23	29,48	1021,75	102	5
3	122	Basic	2023-09-21	9:46	77,315857	-74,667934	CTD Rosette	Recovery	668	182	3,6	-2,7	-1,27	29,10	1021,79	102	5
3	122	Basic	2023-09-21	10:06	77,310241	-74,671016	Phytoplankton Net	Deployment	665	186	3	-1,8	-1,26	28,48	1021,75	102	5
3	122	Basic	2023-09-21	10:09	77,308891	-74,673732	Phytoplankton Net	Bottom	665	214	2,9	-2,5	-1,25	29,17	1021,79	102	5
3	122	Basic	2023-09-21	10:12	77,307615	-74,676178	Phytoplankton Net	Recovery	664	214	3	-2,4	-1,24	29,09	1021,82	102	5
3	122	Basic	2023-09-21	10:52	77,338613	-74,674400	Box Core	Deployment	677				-1,31	27,96			6
3	122	Basic	2023-09-21	11:06	77,335812	-74,680242	Box Core	Bottom	675	229	3,2	-2,3	-1,30	28,07	1021,71	102	6
3	122	Basic	2023-09-21	11:21	77,332122	-74,689249	Box Core	Recovery	672	200	2,1	-1	-1,22	28,43	1021,75	102	6
3	CEOS-M1-23	Mooring	2023-09-21	20:25	77,180340	-71,071790	Mooring	Deployment	480	212	1,9	-1,1	0,96	30,42	1019,51	101	6
3	CEOS-M1-23	Mooring	2023-09-21	20:52	77,179570	-71,089553	CTD Rosette	Deployment	584	210	4,2	-1,9	0,90	30,48	1019,47	101	6
3	CEOS-M1-23	Mooring	2023-09-21	21:17	77,179909	-71,088020	CTD Rosette	Bottom	586	217	6,9	-1,9	0,86	30,69	1019,44	101	6
3	CEOS-M1-23	Mooring	2023-09-21	21:54	77,181598	-71,086294	CTD Rosette	Recovery	695	228	5	-2,1	0,75	30,76	1019,31	101	6
3	CEOS-M1-23	Mooring	2023-09-21	22:14	77,179887	-71,069964	Box Core	Deployment	459	242	5,9	-1,4	1,15	30,50	1019,17	101	6
3	CEOS-M1-23	Mooring	2023-09-21	22:27	77,179865	-71,070937	Box Core	Bottom	464	255	5	-1,5	1,21	30,56	1019,08	101	6
3	CEOS-M1-23	Mooring	2023-09-21	22:42	77,179616	-71,075618	Box Core	Recovery	491	271	6,1	-1,6	1,22	30,57	1019,05	101	6

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	CEOS-M1-23	Mooring	2023-09-21	23:22	77,185636	-71,076200	Tucker Net	Deployment	706	294	0,6	-1,7	1,22	30,65	1018,67	101	6
3	CEOS-M1-23	Mooring	2023-09-21	23:30	77,189001	-71,076153	Tucker Net	Bottom	614	206	3	-1,7	1,15	30,50	1018,56	101	6
3	CEOS-M1-23	Mooring	2023-09-21	23:38	77,190938	-71,092070	Tucker Net	Recovery	698	248	5,5	-1,7	0,97	30,39	1018,53	101	6
3	AC12	Full	2023-09-22	10:42	77,194886	-78,398773	CTD Rosette	Deployment	564	48	3,8	-2,1	-1,22	28,31	1015,11	102	6
3	AC12	Full	2023-09-22	10:59	77,193991	-78,401867	CTD Rosette	Bottom	561	25	11,2	-2,2	-1,24	28,19	1014,92	102	6
3	AC12	Full	2023-09-22	11:41	77,193667	-78,424976	CTD Rosette	Recovery	606	18	2,1	-2,3	-1,31	27,51	1014,77	102	6
3	AC12	Full	2023-09-22	13:48	77,197790	-78,407851	Hydrobios	Deployment	605	21	11,6	-1,7	-1,29	27,81	1014,45	102	6
3	AC12	Full	2023-09-22	14:03	77,198106	-78,410691	Hydrobios	Bottom	617	282	1,7	-2	-1,29	27,84	1014,30	102	6
3	AC12	Full	2023-09-22	14:24	77,197415	-78,413468	Hydrobios	Recovery	615	341	3,6	-2	-1,41	27,53	1014,21	102	6
3	AC12	Full	2023-09-22	14:58	77,197312	-78,406050	Phytoplankton Net	Deployment	592	13	12,9	-2,7	-1,39	27,95	1014,05	102	6
3	AC12	Full	2023-09-22	15:04	77,197651	-78,409951	Phytoplankton Net	Recovery	604	10	12,6	-2,9	-1,32	28,11	1014,06	102	6
3	AC12	Full	2023-09-22	15:18	77,195352	-78,399831	CTD Rosette	Deployment	568	2	11,2	-0,9	-1,35	28,05	1014,16	103	6
3	AC12	Full	2023-09-22	15:27	77,195442	-78,401169	CTD Rosette	Bottom	572	11	9,3	-1,6	-1,39	27,65	1014,06	102	6
3	AC12	Full	2023-09-22	15:37	77,195160	-78,405872	CTD Rosette	Recovery	576	5	9,3	-2	-1,41	27,69	1013,99	102	6
3	AC12	Full	2023-09-22	16:32	77,195596	-78,396827	Box Core	Deployment	563	27	15,8	-1,3	-1,32	28,23	1013,63	102	6
3	AC12	Full	2023-09-22	16:44	77,195749	-78,398420	Box Core	Bottom	571	253	2,7	-1,8	-1,36	28,18	1013,57	102	6
3	AC12	Full	2023-09-22	16:54	77,195877	-78,404377	Box Core	Recovery	583	35	14,3	-1,8	-1,35	28,27	1013,45	102	6
3	AC12	Full	2023-09-22	17:08	77,195113	-78,395565	Box Core	Deployment	558	32	8,6	0,3	-1,35	28,29	1013,44	103	6
3	AC12	Full	2023-09-22	17:21	77,194965	-78,398833	Box Core	Bottom	565	20	10,3	-1,1	-1,38	28,07	1013,21	102	6
3	AC12	Full	2023-09-22	17:30	77,195270	-78,402758	Box Core	Recovery	572				-1,31	28,17			6
3	AC12	Full	2023-09-22	19:12	77,235852	-78,950099	Tucker Net	Deployment	584	36	12,6	-0,8	-1,40	26,84	1012,53	103	6
3	AC12	Full	2023-09-22	19:20	77,233905	-78,970179	Tucker Net	Bottom	595	38	17,7	-0,1	-1,40	26,90	1012,45	103	6
3	AC12	Full	2023-09-22	19:28	77,231859	-78,982825	Tucker Net	Recovery	595	28	17,3	-1,7	-1,33	26,42	1012,34	102	6
3	AC13	Full	2023-09-23	10:22	76,400786	-78,413626	CTD Rosette	Deployment	120	32	8,9	0,1	-1,35	28,33	1008,57	104	6
3	AC13	Full	2023-09-23	10:30	76,399504	-78,418639	CTD Rosette	Bottom	139	28	11,6	0,1	-1,34	28,45	1008,56	104	6
3	AC13	Full	2023-09-23	10:39	76,398985	-78,420936	CTD Rosette	Recovery	144	44	10,3	0,3	-1,29	28,41	1008,62	104	6
3	AC13	Full	2023-09-23	11:02	76,401109	-78,415070	Monster Net	Deployment	117	21	12,6	0,2	-1,30	28,42	1008,73	104	6
3	AC13	Full	2023-09-23	11:05	76,400880	-78,415934	Monster Net	Bottom	121	20	12	-0,5	-1,30	28,47	1008,73	104	6
3	AC13	Full	2023-09-23	11:12	76,400893	-78,417049	Monster Net	Recovery	120	28	8,4	0,2	-1,28	28,51	1008,79	104	6
3	AC13	Full	2023-09-23	11:30	76,400342	-78,440725	Tucker Net	Deployment	141	63	5,1	0,3	-1,23	28,42	1008,80	104	6
3	AC13	Full	2023-09-23	11:38	76,397831	-78,457955	Tucker Net	Bottom	140	29	5	0,3	-1,31	28,38	1008,80	104	2
3	AC13	Full	2023-09-23	11:46	76,394644	-78,472245	Tucker Net	Recovery	162	24	11,8	-0,3	-1,31	28,34	1008,81	104	2
3	AC13	Full	2023-09-23	12:31	76,398355	-78,406292	Phytoplankton Net	Deployment	147	33	10,3	-0,7	-1,25	28,46	1008,89	104	6
3	AC13	Full	2023-09-23	12:34	76,397815	-78,407907	Phytoplankton Net	Bottom	154	28	9,5	0	-1,28	28,46	1008,86	104	6
3	AC13	Full	2023-09-23	12:38	76,397259	-78,409453	Phytoplankton Net	Recovery	163	24	10,5	0	-1,27	28,51	1008,83	104	6
3	AC13	Full	2023-09-23	12:50	76,394032	-78,419493	CTD Rosette	Deployment	164	30	6,9	0,4	-1,33	28,49	1008,87	104	6
3	AC13	Full	2023-09-23	12:59	76,393174	-78,422644	CTD Rosette	Bottom	160	33	10,7	0,3	-1,27	28,59	1008,95	104	6
3	AC13	Full	2023-09-23	13:39	76,389142	-78,443406	CTD Rosette	Recovery	121	23	9,7	-0,8	-1,31	28,42	1008,92	104	6
3	AC13	Full	2023-09-23	14:24	76,391828	-78,674898	Beam Trawl	Deployment	201	4	8,4	-0,6	-1,36	28,21	1008,97	104	6
3	AC13	Full	2023-09-23	14:35	76,385675	-78,668505	Beam Trawl	Bottom	215	5	10,1	-0,8	-1,37	28,29	1008,85	104	6

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	AC13	Full	2023-09-23	14:51	76,382359	-78,634966	Beam Trawl	Recovery	218	358	8	-0,9	-1,37	28,36	1008,85	104	6
3	AC13	Full	2023-09-23	16:44	76,384734	-78,634211	Box Core	Deployment	221	7	8,9	0,4	-1,34	28,38	1008,95	104	6
3	AC13	Full	2023-09-23	16:49	76,384340	-78,636246	Box Core	Bottom	221	70	1,9	0,4	-1,32	28,35	1008,93	104	6
3	AC13	Full	2023-09-23	16:54	76,383891	-78,641089	Box Core	Recovery	221	2	1	0,2	-1,33	28,33	1008,92	104	6
3	AC13	Full	2023-09-23	17:09	76,383101	-78,656006	Box Core	Deployment	214	354	2,1	0,4	-1,32	28,33	1008,85	104	6
3	AC13	Full	2023-09-23	17:14	76,383058	-78,657642	Box Core	Bottom	215	14	9,3	0,3	-1,31	28,33	1008,86	104	6
3	AC13	Full	2023-09-23	17:19	76,383021	-78,659713	Box Core	Recovery	216	357	2,1	0,3	-1,30	28,34	1008,88	104	6
3	Site 1.2	Coring	2023-09-23	20:30	76,585224	-78,662965	CTD Rosette	Deployment	91	23	18,1	-0,8	-0,94	28,34	1008,83	103	0
3	Site 1.2	Coring	2023-09-23	20:37	76,584126	-78,665193	CTD Rosette	Bottom	91	20	15	-0,6	-0,94	28,36	1008,66	103	0
3	Site 1.2	Coring	2023-09-23	20:41	76,583884	-78,667100	CTD Rosette	Recovery	88	15	15	-0,7	-0,93	28,39	1008,67	103	0
3	Site 1.2	Coring	2023-09-24	6:12	76,453932	-78,631624	CTD Rosette	Deployment	107	270	3,2	0	-1,13	28,01	1007,80	103	0
3	Site 1.2	Coring	2023-09-24	6:20	76,453528	-78,631541	CTD Rosette	Bottom	108	272	9,3	-0,3	-1,16	27,93	1007,87	103	0
3	Site 1.2	Coring	2023-09-24	6:22	76,453386	-78,631761	CTD Rosette	Recovery	110	284	4,2	-0,9	-1,08	27,95	1007,95	103	0
3	Site 1.2	Coring	2023-09-24	12:39	76,587495	-78,654004	CTD Rosette	Deployment	84	15	13,9	-0,5	-0,99	28,28	1006,95	103	0
3	Site 1.2	Coring	2023-09-24	12:47	76,587860	-78,654150	CTD Rosette	Bottom	84	15	14,5	-0,5	-0,97	28,36	1006,94	103	1
3	Site 1.2	Coring	2023-09-24	13:11	76,587597	-78,655873	CTD Rosette	Recovery	86	12	14,7	-0,8	-0,99	28,27	1006,95	103	0
3	Site 1.2	Coring	2023-09-24	14:55	76,502829	-78,790739	Phytoplankton Net	Deployment	131	19	15,2	-0,8	-1,38	27,60	1006,64	103	0
3	Site 1.2	Coring	2023-09-24	14:58	76,502927	-78,790913	Phytoplankton Net	Bottom	131	12	12,9	-0,8	-1,25	27,80	1006,63	103	0
3	Site 1.2	Coring	2023-09-24	15:00	76,502942	-78,790688	Phytoplankton Net	Recovery	131	9	13,5	-0,8	-1,23	27,79	1006,63	103	0
3	Site 1.2	Coring	2023-09-24	15:07	76,502762	-78,789300	Box Core	Deployment	129	4	14,7	-1,1	-1,33	27,63	1006,55	103	1
3	Site 1.2	Coring	2023-09-24	15:11	76,502736	-78,791056	Box Core	Bottom	132	10	14,3	-1,2	-1,29	27,70	1006,59	103	1
3	Site 1.2	Coring	2023-09-24	15:14	76,502910	-78,792734	Box Core	Recovery	132	13	14,3	-1,1	-1,28	27,71	1006,72	103	1
3	Site 1.2	Coring	2023-09-24	15:30	76,504135	-78,796390	Box Core	Deployment	129	18	16,4	-1	-1,15	27,92	1006,71	103	1
3	Site 1.2	Coring	2023-09-24	15:34	76,504064	-78,797337	Box Core	Bottom	129	19	13,9	-0,9	-1,28	27,78	1006,77	103	1
3	Site 1.2	Coring	2023-09-24	15:37	76,503873	-78,798823	Box Core	Recovery	128	11	13,5	-0,9	-1,34	27,67	1006,66	103	1
3	Site 1.2	Coring	2023-09-24	17:06	76,504152	-78,790149	Gravity Core	Deployment	130	17	15,8	1	-1,24	27,83	1007,08	102	1
3	Site 1.2	Coring	2023-09-24	17:09	76,504200	-78,790327	Gravity Core	Bottom	130	15	18,3	1,2	-1,23	27,83	1007,10	102	1
3	Site 1.2	Coring	2023-09-24	17:13	76,504123	-78,790982	Gravity Core	Recovery	130	20	18,5	0,2	-1,26	27,83	1007,08	102	1
3	Site 1.2	Coring	2023-09-24	17:47	76,502009	-78,794449	Tucker Net	Deployment	131	20	16,8	-0,1	-1,36	27,64	1007,40	102	1
3	Site 1.2	Coring	2023-09-24	17:55	76,503637	-78,777570	Tucker Net	Bottom	112	24	20,2	-0,2	-1,31	27,66	1007,44	102	1
3	Site 1.2	Coring	2023-09-24	18:02	76,506679	-78,770742	Tucker Net	Recovery	103	17	19,6	-0,1	-1,26	27,70	1007,50	102	1
3	Site 1.2	Coring	2023-09-24	18:32	76,504531	-78,776060	Beam Trawl	Deployment	112	10	15,6	0,3	-1,24	27,74	1007,73	102	1
3	Site 1.2	Coring	2023-09-24	18:39	76,507400	-78,764690	Beam Trawl	Bottom	105	9	17,1	-0,3	-1,16	27,87	1007,94	102	1
3	Site 1.2	Coring	2023-09-24	18:50	76,512952	-78,759355	Beam Trawl	Recovery	104				-1,10	27,93			1
3	Site 1.2	Coring	2023-09-24	20:12	76,582701	-78,609101	CTD Rosette	Deployment	61	15	10,9	0,2	-0,91	28,44	1009,21	102	0
3	Site 1.2	Coring	2023-09-24	20:29	76,581658	-78,606293	CTD Rosette	Recovery	56	11	12,8	0,4	-0,87	28,46	1009,38	102	0
3	Site 1.2	Coring	2023-09-24	21:09	76,503930	-78,787102	Box Core	Deployment	129	153	5,3	-0,9	-1,31	27,74	1010,04	102	0
3	Site 1.2	Coring	2023-09-24	21:13	76,503933	-78,787288	Box Core	Bottom	129	153	5,3	-0,8	-1,26	27,95	1010,08	103	0
3	Site 1.2	Coring	2023-09-24	21:16	76,503952	-78,787806	Box Core	Recovery	130	154	5,7	-0,8	-1,26	27,86	1010,14	102	0
3	BG-06	Nutrient	2023-09-25	2:53	75,711736	-80,704489	CTD Rosette	Deployment	620	312	23,6	-0,3	-0,74	29,51	1013,30	102	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	BG-06	Nutrient	2023-09-25	3:09	75,708774	-80,707306	CTD Rosette	Bottom	621	302	23,2	-0,3	-0,73	29,53	1013,49	102	0
3	BG-06	Nutrient	2023-09-25	3:56	75,700115	-80,717287	CTD Rosette	Recovery	617	295	26,7	-0,4	-0,74	29,52	1013,50	102	0
3	BG-02	Nutrient	2023-09-25	5:23	75,658764	-81,270326	CTD Rosette	Deployment	247	142	8,2	1,9	-1,00	29,32	1014,43	101	0
3	BG-02	Nutrient	2023-09-25	5:33	75,658738	-81,260535	CTD Rosette	Bottom	247	331	1,3	2,4	-1,06	29,32	1014,39	101	0
3	BG-02	Nutrient	2023-09-25	6:04	75,656667	-81,238316	CTD Rosette	Recovery	226	275	1,3	1,9	-0,97	29,39	1014,71	101	0
3	BG-05	Nutrient	2023-09-25	7:05	75,672712	-80,993568	CTD Rosette	Deployment	340	324	10,1	2	-0,74	29,43	1015,71	101	0
3	BG-05	Nutrient	2023-09-25	7:15	75,671763	-80,998331	CTD Rosette	Bottom	321	302	13,3	4,1	-0,88	29,26	1015,73	101	0
3	BG-05	Nutrient	2023-09-25	7:47	75,669870	-81,008876	CTD Rosette	Recovery	302	100	0,4	1,2	-0,92	29,24	1015,90	101	0
3	BG-01	Nutrient	2023-09-25	8:48	75,658949	-81,315743	CTD Rosette	Deployment	230	264	12,4	3,4	-1,07	29,34	1016,21	101	0
3	BG-01	Nutrient	2023-09-25	9:01	75,659584	-81,315633	CTD Rosette	Bottom	232	241	3,6	3,7	-1,06	29,36	1016,44	101	0
3	BG-01	Nutrient	2023-09-25	9:14	75,659975	-81,315410	CTD Rosette	Recovery	238	75	1,5	2,8	-1,00	29,37	1016,56	101	0
3	BG-01	Nutrient	2023-09-25	9:54	75,658482	-81,325865	CTD Rosette	Deployment	253	324	0,8	1,5	-0,94	29,37	1016,59	101	0
3	BG-01	Nutrient	2023-09-25	10:04	75,657986	-81,325288	CTD Rosette	Bottom	236	50	1	2	-1,02	29,36	1016,65	101	5
3	BG-01	Nutrient	2023-09-25	12:49	75,664605	-81,100994	Box Core	Deployment	322	98	9,5	-0,7	-0,98	29,27	1016,78	101	1
3	BG-01	Nutrient	2023-09-25	12:57	75,664598	-81,100534	Box Core	Bottom	322	102	7,6	-0,5	-0,96	29,26	1016,79	101	1
3	BG-01	Nutrient	2023-09-25	13:03	75,664948	-81,100953	Box Core	Recovery	323	113	8,6	-0,5	-0,95	29,27	1016,86	101	1
3	BG-03	Nutrient	2023-09-25	14:10	75,659506	-81,207289	CTD Rosette	Deployment	288	166	1,1	-0,6	-1,04	29,35	1017,03	101	1
3	BG-03	Nutrient	2023-09-25	14:24	75,658804	-81,212685	CTD Rosette	Bottom	284	84	6,7	1,1	-1,06	29,34	1016,94	101	1
3	BG-03	Nutrient	2023-09-25	14:59	75,658560	-81,223853	CTD Rosette	Recovery	274	39	0,4	0,6	-1,00	29,36	1017,10	101	1
3	BG-04	Nutrient	2023-09-25	18:33	75,662997	-81,164144	CTD Rosette	Deployment	306	31	0,8	0,4	-1,09	29,29	1016,35	101	2
3	BG-04	Nutrient	2023-09-25	18:44	75,663733	-81,161528	CTD Rosette	Bottom	298	90	2,3	0,4	-1,01	29,30	1016,38	101	2
3	BG-04	Nutrient	2023-09-25	19:21	75,666306	-81,157660	CTD Rosette	Recovery	279	90	8,8	0	-1,08	29,29	1016,09	101	3
3	BG-04	Nutrient	2023-09-25	19:47	75,678509	-81,174360	Tucker Net	Deployment	112	119	7,6	-0,2	-0,97	29,35	1015,84	101	4
3	BG-04	Nutrient	2023-09-25	19:52	75,678501	-81,181648	Tucker Net	Bottom	81	104	9,1	-0,4	-1,01	29,36	1015,78	101	4
3	BG-04	Nutrient	2023-09-25	19:57	75,677175	-81,191747	Tucker Net	Recovery	84	89	7,6	-0,1	-1,08	29,30	1015,85	101	4
3	BG-04	Nutrient	2023-09-25	21:18	75,662697	-81,100867	Box Core	Deployment	321	137	7,8	-0,1	-1,02	29,31	1014,95	101	4
3	BG-04	Nutrient	2023-09-25	21:25	75,662726	-81,100735	Box Core	Bottom	321	113	6,5	-0,2	-0,96	29,38	1014,91	101	4
3	BG-04	Nutrient	2023-09-25	21:33	75,663507	-81,099718	Box Core	Recovery	322	112	6,1	-0,6	-0,97	29,35	1014,81	101	4
3	BG-04	Nutrient	2023-09-25	22:56	75,688963	-80,927227	Beam Trawl	Deployment	403	121	1,5	0,1	-1,03	28,91	1013,93	101	4
3	BG-04	Nutrient	2023-09-25	23:12	75,695833	-80,943271	Beam Trawl	Bottom	341	152	3	-1,3	-1,10	28,91	1013,68	101	4
3	BG-04	Nutrient	2023-09-25	23:38	75,704333	-81,000306	Beam Trawl	Recovery	285	154	2,5	-1,4	-1,12	28,91	1013,33	101	4
3	BG-07	Nutrient	2023-09-26	1:01	75,757702	-80,357056	CTD Rosette	Deployment	614	104	8,8	-1,9	-1,21	28,82	1012,31	102	4
3	BG-07	Nutrient	2023-09-26	1:18	75,753706	-80,346462	CTD Rosette	Recovery	611	98	7,4	-1,4	-1,17	28,83	1011,97	102	4
3	BG-07	Nutrient	2023-09-26	2:03	75,760694	-80,345297	CTD Rosette	Deployment	607	35	1,1	-0,5	-1,24	28,80	1011,31	102	4
3	BG-07	Nutrient	2023-09-26	3:05	75,756635	-80,311527	CTD Rosette	Recovery	609	76	4,2	-0,6	-1,23	28,81	1010,66	102	4
3	BG-07	Nutrient	2023-09-26	3:27	75,749912	-80,322140	Box Core	Deployment	616	121	14,7	-0,9	-1,20	28,86	1010,32	102	4
3	BG-07	Nutrient	2023-09-26	3:44	75,749031	-80,324880	Box Core	Bottom	617	130	1,1	0	-1,12	29,00	1010,22	102	4
3	BG-07	Nutrient	2023-09-26	3:59	75,748345	-80,314153	Box Core	Recovery	613	151	3,6	-0,6	-1,08	29,13	1010,25	102	4
3	AC16	Full	2023-09-27	2:51	76,029851	-83,125903	CTD Rosette	Deployment	650	43	6,9	-2	-0,97	29,59	1008,99	101	4
3	AC16	Full	2023-09-27	3:14	76,039736	-83,138745	CTD Rosette	Recovery	649	349	0	-1,4	-0,80	29,73	1009,14	101	4

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	AC16	Full	2023-09-27	3:40	76,050223	-83,156200	Hydrobios	Deployment	654				-0,71	29,95			4
3	AC16	Full	2023-09-27	4:05	76,064435	-83,166539	Hydrobios	Bottom	661	102	3,6	-2,3	-0,98	29,67	1009,19	101	4
3	AC16	Full	2023-09-27	4:21	76,075190	-83,164757	Hydrobios	Recovery	686	113	2,9	-2,4	-0,77	30,06	1009,22	101	4
3	AC16	Full	2023-09-27	4:37	76,086377	-83,163772	Hydrobios	Deployment	738	200	0,6	-1,9	-0,85	29,76	1009,34	101	4
3	AC16	Full	2023-09-27	4:55	76,092836	-83,166557	Hydrobios	Bottom	757	199	5,5	-1,9	-0,73	30,14	1009,43	101	4
3	AC16	Full	2023-09-27	5:20	76,098653	-83,171507	Hydrobios	Recovery	773	196	6,3	-2,3	-0,91	29,81	1009,54	101	4
3	AC16	Full	2023-09-27	5:50	76,118072	-83,223731	IKMT	Deployment	768	157	5,5	-2,2	-0,70	31,01	1009,76	101	4
3	AC16	Full	2023-09-27	6:08	76,127488	-83,241396	IKMT	Bottom	754	125	5,7	-2,4	-0,75	31,21	1009,92	101	4
3	AC16	Full	2023-09-27	6:48	76,156383	-83,287868	IKMT	Recovery	713	181	4,6	-2,1	-0,69	31,29	1010,17	101	4
3	AC16	Full	2023-09-27	7:33	76,089462	-83,226619	CTD Rosette	Deployment	743	214	4	-1	-0,71	30,56	1010,49	101	4
3	AC16	Full	2023-09-27	7:52	76,095069	-83,230516	CTD Rosette	Bottom	757	190	5,9	-1,9	-0,60	30,80	1010,58	101	4
3	AC16	Full	2023-09-27	8:36	76,106035	-83,221584	CTD Rosette	Recovery	779	228	4,8	-1,9	-0,68	30,86	1010,92	101	4
3	AC16	Full	2023-09-27	8:55	76,094174	-83,188454	Phytoplankton Net	Deployment	757	227	4,4	-1,9	-0,64	30,24	1011,01	101	4
3	AC16	Full	2023-09-27	8:59	76,095492	-83,188032	Phytoplankton Net	Bottom	762	223	5,3	-2	-0,52	30,40	1011,01	101	4
3	AC16	Full	2023-09-27	9:02	76,096360	-83,188066	Phytoplankton Net	Recovery	765	226	4,8	-1,9	-0,55	30,32	1011,04	101	4
3	AC16	Full	2023-09-27	9:29	76,068944	-83,199213	Box Core	Deployment	665	193	6,7	-2	-0,68	30,26	1011,13	101	4
3	AC16	Full	2023-09-27	9:44	76,072177	-83,190727	Box Core	Bottom	672	213	7	-2	-0,73	29,97	1011,18	101	4
3	AC16	Full	2023-09-27	9:56	76,074779	-83,192288	Box Core	Recovery	677	239	5,5	-1,9	-0,77	29,86	1011,29	101	4
3	Site 4.6.1	Coring	2023-09-27	12:53	76,409421	-82,978947	Box Core	Deployment	367	57	6,7	-1,4	-0,99	29,39	1011,73	100	4
3	Site 4.6.1	Coring	2023-09-27	13:00	76,409477	-82,979522	Box Core	Bottom	367	3	15	-1,6	-1,09	29,22	1011,63	100	4
3	Site 4.6.1	Coring	2023-09-27	13:07	76,409421	-82,979116	Box Core	Recovery	367	325	9,7	-1,6	-1,11	29,19	1011,70	100	4
3	Site 4.6.1	Coring	2023-09-27	13:37	76,406775	-82,998772	Box Core	Deployment	369	11	21,7	-1,5	-1,19	29,15	1011,45	100	4
3	Site 4.6.1	Coring	2023-09-27	13:45	76,407008	-83,000387	Box Core	Bottom	369	353	17,7	-1,7	-1,20	29,15	1011,82	100	1
3	Site 4.6.1	Coring	2023-09-27	13:52	76,407004	-82,998722	Box Core	Recovery	369	359	26,8	-1,7	-1,18	29,15	1011,29	100	1
3	Site 4.6.1	Coring	2023-09-27	14:33	76,407233	-82,997273	Gravity Core	Deployment	369	334	18,3	-1,6	-1,09	29,22	1011,67	100	1
3	Site 4.6.1	Coring	2023-09-27	14:38	76,407274	-82,998103	Gravity Core	Bottom	369	344	21,1	-1,5	-1,07	29,30	1011,41	100	1
3	Site 4.6.1	Coring	2023-09-27	14:45	76,406744	-83,000254	Gravity Core	Recovery	370	240	19,6	-0,7	-1,08	29,26	1011,18	99	1
3	Site 4.6.2	Coring	2023-09-27	18:10	76,601649	-83,230401	Box Core	Deployment	140	5	5,9	-2,5	-1,06	29,34	1013,32	100	1
3	Site 4.6.2	Coring	2023-09-27	18:14	76,601611	-83,229284	Box Core	Bottom	140	39	6,7	-2,5	-1,03	29,34	1013,24	100	1
3	Site 4.6.2	Coring	2023-09-27	18:18	76,601599	-83,227930	Box Core	Recovery	140	357	4,4	-2,4	-1,03	29,35	1013,33	100	1
3	Site 4.6.2	Coring	2023-09-27	18:33	76,601640	-83,224466	Box Core	Deployment	140	297	5,3	-2,7	-1,00	29,35	1013,45	100	1
3	Site 4.6.2	Coring	2023-09-27	18:37	76,601554	-83,224166	Box Core	Bottom	140	303	3,8	-2,3	-0,91	29,40	1013,47	100	1
3	Site 4.6.2	Coring	2023-09-27	18:41	76,601641	-83,223905	Box Core	Recovery	140	294	5,1	-2,1	-0,88	29,42	1013,47	100	1
3	Site 4.6.2	Coring	2023-09-27	19:09	76,601694	-83,223655	Gravity Core	Deployment	140	314	7,6	-1,7	-0,86	29,42	1013,52	99	1
3	Site 4.6.2	Coring	2023-09-27	19:11	76,601669	-83,223527	Gravity Core	Bottom	140	310	8,2	-1,7	-0,86	29,42	1013,54	99	1
3	Site 4.6.2	Coring	2023-09-27	19:18	76,601656	-83,222626	Gravity Core	Recovery	139	297	7,6	-1,8	-0,75	29,46	1013,67	99	1
3	Site 4.6.1	Coring	2023-09-27	22:07	76,409430	-82,975736	CTD Rosette	Deployment	366	295	9,1	-2,2	-1,12	29,18	1014,56	100	1
3	Site 4.6.1	Coring	2023-09-27	22:19	76,409294	-82,977661	CTD Rosette	Bottom	366	314	12,9	-2,1	-1,11	29,19	1014,61	100	1
3	Site 4.6.1	Coring	2023-09-27	22:37	76,409663	-82,976896	CTD Rosette	Recovery	366	300	13,5	-2,3	-1,11	29,19	1014,70	100	1
3	Site 4.6.1	Coring	2023-09-27	22:59	76,409338	-82,978385	Box Core	Deployment	367	305	14,5	-2,4	-1,11	29,21	1014,56	100	1

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	Site 4.6.1	Coring	2023-09-27	23:08	76,408719	-82,980594	Box Core	Bottom	366	317	13,7	-2,4	-1,12	29,20	1014,59	100	1
3	Site 4.6.1	Coring	2023-09-27	23:18	76,408316	-82,980784	Box Core	Recovery	366	300	13,7	-2,4	-1,12	29,20	1014,64	100	1
3	AC16	Full	2023-09-28	6:57	76,035160	-83,115837	Hydrobios	Deployment	649	235	19	-2,3	-1,32	29,16	1016,51	101	1
3	AC16	Full	2023-09-28	7:13	76,039817	-83,110929	Hydrobios	Bottom	648	242	19,2	-2,3	-1,28	29,17	1016,64	101	1
3	AC16	Full	2023-09-28	7:37	76,045888	-83,101649	Hydrobios	Recovery	665	256	9,3	-2	-1,30	29,17	1017,43	101	1
3	Sverdrup	Nutrient	2023-09-28	11:18	75,819498	-83,119558	CTD Rosette	Bottom	75	108	13,5	-1,8	-0,85	31,05	1019,23	101	0
3	Sverdrup	Nutrient	2023-09-28	11:35	75,818908	-83,117656	CTD Rosette	Recovery	72	248	6,7	0,8	-0,74	31,32	1019,24	100	0
3	Sverdrup	Nutrient	2023-09-28	12:18	75,819571	-83,114734	Box Core	Deployment	76	270	11,4	-2,8	-0,83	31,32	1019,23	100	0
3	Sverdrup	Nutrient	2023-09-28	12:22	75,819825	-83,113408	Box Core	Bottom	77	285	10,5	-2,7	-0,96	31,16	1019,28	100	0
3	Sverdrup	Nutrient	2023-09-28	12:24	75,819951	-83,112725	Box Core	Recovery	78	274	8,9	-2,7	-1,06	30,81	1019,33	100	0
3	Sverdrup	Nutrient	2023-09-28	12:41	75,825558	-83,113700	Box Core	Deployment	102	280	10,9	-3	-0,73	31,56	1019,30	100	0
3	Sverdrup	Nutrient	2023-09-28	12:44	75,825585	-83,113341	Box Core	Bottom	102				-0,73	31,54			0
3	Sverdrup	Nutrient	2023-09-28	12:48	75,825446	-83,113446	Box Core	Recovery	102	281	9,3	-2,7	-0,75	31,49	1019,32	100	0
3	JonesS-23	Mooring	2023-09-28	18:23	75,976777	-86,115994	Mooring	Bottom	574	333	1,7	0,7	-0,93	31,02	1018,92	100	0
3	JonesS-23	Mooring	2023-09-28	19:13	75,975869	-86,416511	Box Core	Deployment	663	308	5,5	-2,2	-1,20	31,11	1019,12	100	0
3	JonesS-23	Mooring	2023-09-28	19:27	75,976341	-86,414743	Box Core	Bottom	662	341	7,2	-1,6	-1,18	31,13	1019,03	101	0
3	JonesS-23	Mooring	2023-09-28	19:37	75,976060	-86,412506	Box Core	Recovery	663	344	4,6	-0,2	-1,18	31,12	1019,23	101	0
3	JonesS-23	Mooring	2023-09-28	20:02	75,975968	-86,413565	Gravity Core	Deployment	662	342	4,2	-1,2	-1,21	31,13	1019,44	101	0
3	JonesS-23	Mooring	2023-09-28	20:11	75,976111	-86,413543	Gravity Core	Bottom	662	22	3,2	-0,7	-1,21	31,12	1019,44	100	0
3	JonesS-23	Mooring	2023-09-28	20:23	75,976103	-86,411854	Gravity Core	Recovery	662	336	5,9	-0,8	-1,21	31,12	1019,58	100	0
3	JonesS-23	Mooring	2023-09-28	21:31	75,991150	-86,497631	CTD Rosette	Deployment	660	320	3,4	-2	-1,31	30,96	1019,60	100	0
3	JonesS-23	Mooring	2023-09-28	21:50	75,991339	-86,494558	CTD Rosette	Bottom	660				-1,28	30,97			0
3	JonesS-23	Mooring	2023-09-28	22:36	75,991702	-86,486554	CTD Rosette	Recovery	658	281	4	-2,7	-1,26	30,98	1019,62	100	0
3	AC17	Full	2023-09-29	3:51	76,284295	-88,212170	CTD Rosette	Deployment	212	296	8,8	-4,1	-0,92	30,84	1018,74	101	0
3	AC17	Full	2023-09-29	4:00	76,283504	-88,217325	CTD Rosette	Bottom	213	321	8	-4,2	-0,92	30,86	1018,71	100	0
3	AC17	Full	2023-09-29	4:12	76,282571	-88,221581	CTD Rosette	Recovery	213	328	6,5	-4,2	-0,93	30,87	1018,71	100	0
3	AC17	Full	2023-09-29	4:30	76,281124	-88,229666	Monster Net	Deployment	216				-0,96	30,86			0
3	AC17	Full	2023-09-29	4:37	76,280447	-88,232468	Monster Net	Bottom	214	316	6,9	-4,2	-0,97	30,87	1018,63	100	0
3	AC17	Full	2023-09-29	4:47	76,279755	-88,234730	Monster Net	Recovery	213	312	8,2	-4,2	-0,92	30,95	1018,57	100	0
3	AC17	Full	2023-09-29	5:10	76,270086	-88,253901	Tucker Net	Deployment	205	151	0,2	-4,2	-1,00	30,90	1018,55	101	0
3	AC17	Full	2023-09-29	5:20	76,265943	-88,242724	Tucker Net	Bottom	204				-1,04	30,92			0
3	AC17	Full	2023-09-29	5:48	76,245554	-88,247894	Phytoplankton Net	Deployment	183	310	6,1	-4,7	-0,97	31,35	1018,56	101	0
3	AC17	Full	2023-09-29	5:51	76,245610	-88,248219	Phytoplankton Net	Bottom	183	311	7	-4,5	-0,91	31,45	1018,58	101	0
3	AC17	Full	2023-09-29	5:53	76,245655	-88,248548	Phytoplankton Net	Recovery	183	313	5,7	-4,6	-0,90	31,50	1018,60	101	0
3	AC17	Full	2023-09-29	6:13	76,245323	-88,252737	CTD Rosette	Deployment	182	302	7,2	-4,5	-1,11	31,28	1018,58	101	0
3	AC17	Full	2023-09-29	6:25	76,245593	-88,254971	CTD Rosette	Bottom	182	289	5,5	-4,7	-0,98	31,41	1018,59	101	0
3	AC17	Full	2023-09-29	6:56	76,247032	-88,257806	CTD Rosette	Recovery	181	287	6,5	-4,8	-1,05	31,44	1018,64	101	0
3	AC17	Full	2023-09-29	7:18	76,219852	-88,288824	Agassiz Trawl	Deployment	164	267	7,6	-5,2	-1,13	30,76	1018,78	101	0
3	AC17	Full	2023-09-29	7:26	76,217521	-88,292640	Agassiz Trawl	Bottom	169	282	1,3	-5,7	-1,05	30,79	1018,81	101	0
3	AC17	Full	2023-09-29	7:35	76,221291	-88,276785	Agassiz Trawl	Recovery	168	295	4,2	-5,6	-1,01	30,78	1018,78	101	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	AC17	Full	2023-09-29	8:10	76,207170	-88,135228	Box Core	Deployment	202				-0,84	30,80			0
3	AC17	Full	2023-09-29	8:16	76,207250	-88,135165	Box Core	Bottom	202	248	4,6	-5,9	-0,78	30,83	1018,81	101	0
3	AC17	Full	2023-09-29	8:22	76,207442	-88,135695	Box Core	Recovery	202	287	5,5	-5,9	-0,82	30,84	1018,78	101	0
3	NB-01	Full	2023-09-29	17:34	76,835182	-91,286340	CTD Rosette	Deployment	296	295	0,4	-6,4	-1,50	28,39	1017,20	102	0
3	NB-01	Full	2023-09-29	17:42	76,835235	-91,290144	CTD Rosette	Bottom	296	213	3,4	-5,7	-1,51	28,41	1017,27	102	0
3	NB-01	Full	2023-09-29	17:57	76,835312	-91,296675	CTD Rosette	Recovery	296	194	2,3	-5,3			1017,17	102	0
3	NB-01	Full	2023-09-29	18:14	76,826731	-91,280466	Barge	Recovery	296	191	5,5	-6,1			1017,04	102	0
3	NB-01	Full	2023-09-29	18:42	76,828875	-91,291502	Monster Net	Deployment	294	174	5,3	-5,7			1017,17	102	0
3	NB-01	Full	2023-09-29	18:50	76,829311	-91,292520	Monster Net	Bottom	293								0
3	NB-01	Full	2023-09-29	19:00	76,830189	-91,295701	Monster Net	Recovery	294	174	8,6	-5,6			1017,17	102	0
3	NB-01	Full	2023-09-29	19:23	76,841896	-91,155003	Tucker Net	Deployment	150	147	11,6	-5,5	-1,50	28,86	1016,95	102	0
3	NB-01	Full	2023-09-29	19:31	76,844223	-91,170464	Tucker Net	Bottom	142	166	10,9	-5,4	-1,54	28,81	1016,93	102	0
3	NB-01	Full	2023-09-29	19:39	76,846242	-91,186513	Tucker Net	Recovery	146	173	7,6	-5,6	-1,51	28,80	1017,03	101	0
3	NB-01	Full	2023-09-29	19:52	76,850393	-91,199942	Phytoplankton Net	Deployment	138	168	7,6	-5,1	-1,53	28,76	1017,04	101	0
3	NB-01	Full	2023-09-29	19:55	76,850765	-91,199864	Phytoplankton Net	Bottom	138	156	9,1	-5,2	-1,46	28,81	1017,02	101	0
3	NB-01	Full	2023-09-29	19:57	76,851009	-91,200640	Phytoplankton Net	Recovery	135	155	8	-5,3	-1,36	29,07	1017,09	101	0
3	NB-01	Full	2023-09-29	20:16	76,836560	-91,273242	CTD Rosette	Deployment	293	185	5,5	-4,7	-1,51	28,61	1017,04	101	0
3	NB-01	Full	2023-09-29	20:26	76,837272	-91,272137	CTD Rosette	Bottom	291	162	5,3	-4,7	-1,33	28,80	1017,08	101	0
3	NB-01	Full	2023-09-29	21:10	76,839431	-91,258112	CTD Rosette	Recovery	279				-1,42	28,66			0
3	NB-01	Full	2023-09-29	21:26	76,835884	-91,281493	Box Core	Deployment	295	183	11,2	-5,1	-1,29	29,13	1017,08	101	0
3	NB-01	Full	2023-09-29	21:34	76,836095	-91,278050	Box Core	Bottom	293	177	11	-5,3	-1,46	28,76	1017,05	101	0
3	NB-01	Full	2023-09-29	21:43	76,836351	-91,273057	Box Core	Recovery	293	173	11	-5,6	-1,51	28,66	1016,95	101	0
3	NB-01	Full	2023-09-29	22:57	76,786715	-91,014381	Beam Trawl	Deployment	170				-1,55	28,64			0
3	NB-01	Full	2023-09-29	23:11	76,787309	-91,038941	Beam Trawl	Bottom	174				-1,52	28,66			0
3	NB-01	Full	2023-09-29	23:27	76,784742	-91,040603	Beam Trawl	Recovery	169				-1,43	29,29			0
3	NB-01	Full	2023-09-29	23:48	76,793061	-91,027655	Agassiz Trawl	Deployment	190				-1,53	28,70			0
3	NB-01	Full	2023-09-29	23:54	76,794171	-91,035226	Agassiz Trawl	Bottom	206				-1,54	28,64			0
3	NB-01	Full	2023-09-30	0:04	76,789169	-91,046648	Agassiz Trawl	Recovery	186				-1,53	28,63			0
3	NB-02	Full	2023-09-30	13:05	76,921164	-98,399692	CTD Rosette	Deployment	434	235	3,4	-3,7	-1,20	30,38	1014,70	101	0
3	NB-02	Full	2023-09-30	13:18	76,920891	-98,398562	CTD Rosette	Bottom	435	231	4,6	-3,8	-1,55	30,09	1014,69	101	9
3	NB-02	Full	2023-09-30	13:57	76,917658	-98,387938	CTD Rosette	Recovery	446	217	4,2	-3,5	-1,56	30,10	1014,76	101	9
3	NB-02	Full	2023-09-30	14:18	76,920882	-98,400139	Hydrobios	Deployment	435	233	3,2	-3,6	-1,56	30,01	1014,72	101	9
3	NB-02	Full	2023-09-30	14:30	76,919485	-98,396214	Hydrobios	Bottom	437	211	4	-3,7	-1,32	30,22	1014,65	101	9
3	NB-02	Full	2023-09-30	14:45	76,917157	-98,391509	Hydrobios	Recovery	449	236	4,4	-3,6	-1,28	30,30	1014,56	101	9
3	NB-02	Full	2023-09-30	15:01	76,921634	-98,400745	Phytoplankton Net	Deployment	433				-1,57	30,00			9
3	NB-02	Full	2023-09-30	15:04	76,921213	-98,399921	Phytoplankton Net	Bottom	434	233	4,4	-3,6	-1,39	30,09	1014,48	101	9
3	NB-02	Full	2023-09-30	15:07	76,920717	-98,399031	Phytoplankton Net	Recovery	435	221	4,6	-3,6	-1,30	30,27	1014,46	101	9
3	NB-02	Full	2023-09-30	16:36	76,918579	-98,423076	Tucker Net	Deployment	434	219	3,6	-2,8	-1,54	29,89	1014,29	101	9
3	NB-02	Full	2023-09-30	16:43	76,914405	-98,417260	Tucker Net	Bottom	463	219	3,8	-3,1	-1,55	29,91	1014,26	101	9
3	NB-02	Full	2023-09-30	16:50	76,910290	-98,410498	Tucker Net	Recovery	492	236	4	-3	-1,57	29,85	1014,22	101	9

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	NB-02	Full	2023-09-30	17:14	76,921375	-98,401527	Box Core	Deployment	435	222	3,8	-3,1	-1,41	30,14	1014,13	101	7
3	NB-02	Full	2023-09-30	17:24	76,920534	-98,399539	Box Core	Bottom	437	212	2,3	-3,2	-1,48	29,98	1014,08	101	7
3	NB-02	Full	2023-09-30	17:32	76,919476	-98,398688	Box Core	Recovery	441	253	3,6	-3	-1,45	30,05	1013,96	101	7
3	NB-02	Full	2023-09-30	17:58	76,894685	-98,388523	Barge	Recovery	340	234	2,1	-2,9	-1,44	29,99	1013,84	101	7
3	NB-02	Full	2023-09-30	18:18	76,892255	-98,388553	Agassiz Trawl	Deployment	338	262	4,2	-3	-1,25	30,42	1013,87	101	7
3	NB-02	Full	2023-09-30	18:27	76,888520	-98,396323	Agassiz Trawl	Bottom	311	272	3,4	-3	-1,50	29,98	1013,90	101	7
3	NB-02	Full	2023-09-30	18:37	76,884246	-98,404383	Agassiz Trawl	Recovery	312	264	4	-3	-1,51	30,00	1013,91	101	7
3	NB-02	Full	2023-09-30	19:01	76,879475	-98,414610	Beam Trawl	Deployment	348	287	3	-2,9	-1,38	30,14	1013,80	101	7
3	NB-02	Full	2023-09-30	19:24	76,868645	-98,445495	Beam Trawl	Bottom	405	60	1	-2,8	-1,57	29,93	1013,69	101	7
3	NB-02	Full	2023-09-30	19:45	76,858491	-98,469002	Beam Trawl	Recovery	497	42	4	-3,3	-1,57	29,95	1013,61	101	7
3	CEOS-M2-23	Mooring	2023-10-01	13:20	74,464467	-90,546176	Mooring	Deployment	263	337	11	-1,8	0,18	30,60	1008,12	101	7
3	CEOS-M2-23	Mooring	2023-10-01	13:33	74,464043	-90,545648	Mooring	Bottom	262	356	14,1	-1,5	0,25	30,60	1008,03	101	7
3	CEOS-M2-23	Mooring	2023-10-01	14:03	74,463801	-90,553352	CTD Rosette	Deployment	267	253	0	-2,7	0,30	30,64	1008,26	101	7
3	CEOS-M2-23	Mooring	2023-10-01	14:13	74,460946	-90,556379	CTD Rosette	Bottom	261	3	7,6	-2,4	0,31	30,67	1008,14	102	0
3	CEOS-M2-23	Mooring	2023-10-01	14:19	74,459320	-90,554603	CTD Rosette	Recovery	258	92	1	-2,1	0,21	30,61	1007,92	101	0
3	CEOS-M3_32	Mooring	2023-10-01	19:00	74,149849	-91,031077	Mooring	Deployment	218	9	23,8	-2,2	-0,12	30,87	1006,36	102	0
3	CEOS-M3_32	Mooring	2023-10-01	19:13	74,145987	-91,048453	Mooring	Bottom	220	10	23,2	-2,1	-0,18	30,87	1006,03	102	0
3	CEOS-M3-23	Mooring	2023-10-01	19:45	74,147296	-91,038349	CTD Rosette	Deployment	217	20	24,8	-2	-0,46	31,04	1006,46	102	0
3	CEOS-M3-23	Mooring	2023-10-01	19:55	74,145270	-91,039342	CTD Rosette	Bottom	216	17	24,8	-2	-0,68	31,22	1006,52	102	0
3	CEOS-M3-23	Mooring	2023-10-01	20:02	74,145296	-91,037769	CTD Rosette	Recovery	216	18	21,9	-1,9	-0,66	31,23	1006,83	102	0
3	CB-01	Nutrient	2023-10-02	12:37	74,896063	-83,586187	CTD Rosette	Deployment	153	75	6,5	1	-0,32	29,99	1010,38	100	0
3	CB-01	Nutrient	2023-10-02	12:47	74,895428	-83,587194	CTD Rosette	Bottom	159	65	15,4	1,2	-0,20	30,01	1010,28	100	0
3	CB-01	Nutrient	2023-10-02	13:18	74,895334	-83,590101	CTD Rosette	Recovery	161	165	3,6	0	-0,25	30,01	1010,78	100	0
3	CB-02	Nutrient	2023-10-02	16:15	74,867417	-83,481104	CTD Rosette	Deployment	228	62	6,7	0,9	0,25	30,30	1010,90	100	0
3	CB-02	Nutrient	2023-10-02	16:30	74,867470	-83,481491	CTD Rosette	Bottom	227	346	6,7	1	-0,11	30,13	1010,81	100	0
3	CB-02	Nutrient	2023-10-02	17:05	74,863896	-83,473878	CTD Rosette	Recovery	224	301	8	0,1	-0,38	29,95	1010,71	100	0
3	CB-02	Nutrient	2023-10-02	17:37	74,867465	-83,477610	Barge	Recovery	229	54	11	0,5	-0,20	30,02	1010,68	100	0
3	CB-02	Nutrient	2023-10-02	18:06	74,866850	-83,479576	Box Core	Deployment	229	63	12	1,2	0,01	30,18	1010,59	100	0
3	CB-02	Nutrient	2023-10-02	18:11	74,867009	-83,479580	Box Core	Bottom	229	71	13,3	1,2	-0,17	30,05	1010,59	100	0
3	CB-02	Nutrient	2023-10-02	18:17	74,867068	-83,480048	Box Core	Recovery	229	72	18,1	1,2	-0,22	30,00	1010,54	100	0
3	CB-02	Nutrient	2023-10-02	18:33	74,867005	-83,479537	Box Core	Deployment	229	59	18,3	1,1	-0,30	29,94	1010,49	100	0
3	CB-02	Nutrient	2023-10-02	18:39	74,866997	-83,478995	Box Core	Bottom	229	50	13,5	1	-0,19	30,05	1010,72	100	0
3	CB-02	Nutrient	2023-10-02	18:44	74,867008	-83,478877	Box Core	Recovery	229	50	14,9	1	-0,37	29,90	1010,68	100	0
3	CB-02	Nutrient	2023-10-02	19:11	74,866856	-83,479563	Gravity Core	Deployment	229	66	19,6	1,4	-0,29	30,00	1010,43	99	0
3	CB-02	Nutrient	2023-10-02	19:13	74,866912	-83,480129	Gravity Core	Bottom	229	74	18,1	1,4	-0,23	29,99	1010,75	100	0
3	CB-02	Nutrient	2023-10-02	19:19	74,866888	-83,481653	Gravity Core	Recovery	229	82	20,4	1,4	-0,20	30,02	1010,48	100	0
3	CB-03	Nutrient	2023-10-02	21:05	74,829316	-83,388451	CTD Rosette	Deployment	151	71	9,3	1,7			1011,39	100	0
3	CB-03	Nutrient	2023-10-02	21:13	74,829742	-83,393329	CTD Rosette	Bottom	144	50	12,2	1,6	-0,33	29,96	1011,38	100	0
3	CB-03	Nutrient	2023-10-02	21:46	74,829936	-83,386360	CTD Rosette	Recovery	155	82	4,4	1,7	-0,31	29,96	1011,70	100	0
3	CB-05	Basic	2023-10-02	22:40	74,784402	-83,204395	Hydrobios	Deployment	169	10	0,4	1,6	0,22	30,36	1011,78	100	0

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
3	CB-05	Basic	2023-10-02	22:45	74,783611	-83,202331	Hydrobios	Bottom	168	356	8,6	1,6	0,23	30,45	1011,82	100	0
3	CB-05	Basic	2023-10-02	22:51	74,783281	-83,201005	Hydrobios	Recovery	177	49	3,8	1,7	0,20	30,45	1011,87	100	0
3	CB-05	Basic	2023-10-02	23:12	74,783255	-83,201904	Tucker Net	Deployment	167	346	10,1	1,4	0,08	30,28	1011,84	100	0
3	CB-05	Basic	2023-10-02	23:21	74,781817	-83,206312	Tucker Net	Bottom	169	18	2,7	1,2	-0,02	30,12	1011,92	100	0
3	CB-05	Basic	2023-10-02	23:27	74,779706	-83,198542	Tucker Net	Recovery	224	59	2,5	1,3	0,01	30,14	1011,98	100	0
3	CB-05	Basic	2023-10-02	23:56	74,783550	-83,205883	CTD Rosette	Deployment	169	354	9,5	0,8	-0,02	30,11	1012,04	100	0
3	CB-05	Basic	2023-10-03	0:07	74,782884	-83,203829	CTD Rosette	Bottom	168	346	5	0,6	0,20	30,24	1012,18	100	0
3	CB-05	Basic	2023-10-03	0:40	74,778164	-83,195500	CTD Rosette	Recovery	255	323	3,8	1	0,28	30,36	1012,27	100	0
3	CB-05	Basic	2023-10-03	1:01	74,784213	-83,207337	Beam trawl	Deployment	180	304	3	1,1	0,02	30,15	1012,38	100	0
3	CB-05	Basic	2023-10-03	1:26	74,771642	-83,190957	Beam trawl	Recovery	301	311	5,3	0,3	0,16	30,26	1012,51	100	0
3	CB-06	Nutrient	2023-10-03	3:38	74,668988	-83,213853	CTD Rosette	Deployment	402	21	10,9	0,7	-0,03	30,12	1012,69	100	0
3	CB-06	Nutrient	2023-10-03	3:50	74,668882	-83,213683	CTD Rosette	Bottom	402				-0,03	30,12			0
3	CB-06	Nutrient	2023-10-03	4:34	74,669158	-83,213113	CTD Rosette	Recovery	403	15	11,4	0,4	-0,08	30,08	1012,70	100	0
3	CB-06	Nutrient	2023-10-03	4:56	74,669183	-83,212859	Box Core	Deployment	403	14	10,5	0,3	-0,10	30,07	1012,75	100	0
3	CB-06	Nutrient	2023-10-03	5:06	74,668992	-83,213445	Box Core	Bottom	403	11	10,9	0,3	-0,11	30,06	1012,78	100	0
3	CB-06	Nutrient	2023-10-03	5:17	74,669155	-83,213162	Box Core	Recovery	403	24	9,9	0,3	-0,11	30,06	1012,87	100	0
3	CB-06	Nutrient	2023-10-03	5:34	74,669227	-83,213570	Box Core	Deployment	403	14	10,3	0,2	-0,10	30,06	1012,85	100	0
3	CB-06	Nutrient	2023-10-03	5:44	74,669177	-83,213111	Box Core	Bottom	402	22	8,6	0,2	-0,12	30,05	1012,77	100	0
3	CB-06	Nutrient	2023-10-03	5:55	74,669146	-83,212838	Box Core	Recovery	403	21	9,5	0,2	-0,10	30,06	1012,81	100	0
3	CB-04	Nutrient	2023-10-03	9:40	74,819678	-83,169430	CTD Rosette	Deployment	154	17	2,5	-1,9	-0,23	30,44	1013,54	100	0
3	CB-04	Nutrient	2023-10-03	9:52	74,819715	-83,168357	CTD Rosette	Bottom	154	354	1,1	-1,8	-0,17	30,78	1013,67	100	0
3	CB-04	Nutrient	2023-10-03	10:18	74,819857	-83,168335	CTD Rosette	Recovery	152	328	3	-1,9	-0,21	30,67	1013,71	100	0
3	CB-04	Nutrient	2023-10-03	10:42	74,805269	-83,132533	Box Core	Deployment	301	112	0	-0,9	0,02	30,78	1013,77	100	0
3	CB-04	Nutrient	2023-10-03	10:49	74,805166	-83,132728	Box Core	Bottom	301	272	0,2	-0,7	0,04	30,68	1013,78	100	0
3	CB-04	Nutrient	2023-10-03	10:56	74,805289	-83,133013	Box Core	Recovery	301	292	0	-0,7	0,04	30,52	1013,79	100	0
3	CB-04	Nutrient	2023-10-03	12:40	74,805390	-83,132893	Gravity Core	Deployment	301	167	2,7	-1,5			1013,98	100	0
3	CB-04	Nutrient	2023-10-03	12:43	74,805339	-83,133004	Gravity Core	Deployment	301	170	3,2	-1,4			1014,00	100	1
3	CB-04	Nutrient	2023-10-03	12:44	74,805330	-83,133036	Gravity Core	Bottom	301	158	3,2	-1,5			1013,99	100	1
3	CB-04	Nutrient	2023-10-03	12:49	74,805367	-83,133464	Gravity Core	Recovery	301	177	5,7	-1,4			1014,07	100	1
3	CB-06	Nutrient	2023-10-03	14:23	74,669550	-83,211069	Gravity Core	Deployment	403	271	5,1	-0,4	0,15	30,17	1014,13	100	0
3	CB-06	Nutrient	2023-10-03	14:29	74,669105	-83,210505	Gravity Core	Bottom	403	289	5,3	-0,8	-0,17	30,03	1014,09	100	0
3	CB-06	Nutrient	2023-10-03	14:35	74,668756	-83,209416	Gravity Core	Recovery	402	326	1,5	-0,5	-0,11	30,04	1014,05	100	0
3	CB-07	Nutrient	2023-10-03	17:49	74,386422	-83,142607	CTD Rosette	Deployment	668	91	17,5	-1,1	-0,53	29,87	1013,64	100	0
3	CB-07	Nutrient	2023-10-03	17:56	74,386091	-83,141037	CTD Rosette	Bottom	668	84	17,3	-1	-0,55	29,85	1013,62	100	0
3	CB-07	Nutrient	2023-10-03	18:06	74,386307	-83,133918	CTD Rosette	Recovery	667	90	16,4	-1	-0,57	29,84	1013,69	100	0
3	CB-07	Nutrient	2023-10-03	18:29	74,386286	-83,140386	CTD Rosette	Deployment	668	97	9,9	1,5	-0,57	29,83	1013,96	100	0
3	CB-07	Nutrient	2023-10-03	18:46	74,385975	-83,139201	CTD Rosette	Bottom	668	94	9,3	1,6	-0,57	29,83	1013,99	100	0
3	CB-07	Nutrient	2023-10-03	19:41	74,385396	-83,144651	CTD Rosette	Recovery	669	89	12	-1,4	-0,57	29,82	1013,89	100	0
Leg 4																	
4		River	2023-10-06	17:43	72,312250	-90,227541	Helicopter	Deployment	119	255	10,3	-2,3	-0,76	29,06	1000,95	101	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4		River	2023-10-06	19:25	71,978339	-90,326199	Helicopter	Recovery	112	214	8,2	-2,5	-0,72	29,25	1001,06	101	
4	321-GB	Nutrient	2023-10-07	3:54	70,348881	-91,570837	CTD Rosette	Deployment	87	306	2,9	-1,1	0,47	30,29	1001,68	101	
4	321-GB	Nutrient	2023-10-07	3:56	70,349217	-91,571445	CTD Rosette	Bottom	86	288	3,8	-1,1	0,46	30,29	1001,72	101	
4	321-GB	Nutrient	2023-10-07	4:16	70,350581	-91,576033	CTD Rosette	Recovery	74	309	6,1	-1,1	0,51	30,29	1001,67	101	
4	322-GB	Full	2023-10-07	5:43	70,400838	-91,092361	CTD Rosette	Deployment	214	325	11,2	-1,7	0,44	30,33	1001,78	101	
4	322-GB	Full	2023-10-07	5:48	70,400695	-91,091008	CTD Rosette	Bottom	214	320	11	-1,5	0,32	30,21	1001,79	101	
4	322-GB	Full	2023-10-07	6:27	70,399042	-91,084064	CTD Rosette	Recovery	212	324	10,1	-1,5	0,41	30,20	1001,92	101	
4	322-GB	Full	2023-10-07	6:38	70,398138	-91,079277	Surface Bucket	Deployment	211	331	11,8	-1,5	0,32	30,22	1001,92	101	
4	322-GB	Full	2023-10-07	6:53	70,397140	-91,077541	Surface Bucket	Bottom	212	323	11,4	-1,4	0,30	30,20	1002,00	101	
4	322-GB	Full	2023-10-07	6:53	70,397126	-91,077506	Surface Bucket	Recovery	212	320	11,2	-1,4	0,30	30,20	1002,02	101	
4	322-GB	Full	2023-10-07	6:54	70,397049	-91,077352	Bongo Net	Deployment	212	325	12,2	-1,4	0,30	30,20	1002,02	101	
4	322-GB	Full	2023-10-07	6:56	70,396873	-91,077188	Bongo Net	Bottom	212	319	12,4	-1,4	0,30	30,20	1001,98	101	
4	322-GB	Full	2023-10-07	6:59	70,396624	-91,076938	Bongo Net	Recovery	212	322	11,4	-1,4	0,30	30,20	1002,01	101	
4	322-GB	Full	2023-10-07	7:22	70,401796	-91,103606	Hydrobios	Deployment	219	320	13,3	-1,7	0,29	30,19	1002,04	101	
4	322-GB	Full	2023-10-07	7:28	70,401472	-91,102750	Hydrobios	Bottom	220	320	13,3	-1,6	0,29	30,19	1002,15	101	
4	322-GB	Full	2023-10-07	7:38	70,401262	-91,101470	Hydrobios	Recovery	219	331	12,8	-1,6	0,33	30,21	1002,11	101	
4	322-GB	Full	2023-10-07	9:19	70,400176	-91,114912	Tucker Net	Deployment	221	321	10,1	-1,3	0,47	30,20	1002,57	101	
4	322-GB	Full	2023-10-07	9:30	70,397688	-91,097132	Tucker Net	Bottom	217	318	10,1	-2	0,44	30,20	1002,44	101	
4	322-GB	Full	2023-10-07	9:42	70,395577	-91,078633	Tucker Net	Recovery	212	305	12,6	-2	0,40	30,20	1002,49	101	
4	322-GB	Full	2023-10-07	10:09	70,401097	-91,099713	Box Core	Deployment	219	324	14,7	-1,9	0,45	30,25	1002,66	100	
4	322-GB	Full	2023-10-07	10:16	70,400583	-91,100756	Box Core	Bottom	220	326	12,6	-1,9	0,44	30,20	1002,78	101	
4	322-GB	Full	2023-10-07	10:23	70,400520	-91,100924	Box Core	Recovery	220	318	13,3	-2,1	0,45	30,20	1002,78	101	
4	322-GB	Full	2023-10-07	10:49	70,400883	-91,099697	Box Core	Deployment	219				0,44	30,23			
4	322-GB	Full	2023-10-07	10:55	70,400606	-91,100621	Box Core	Bottom	219	325	12,9	-2,2	0,46	30,20	1003,08	101	
4	322-GB	Full	2023-10-07	11:01	70,400160	-91,101234	Box Core	Recovery	217	321	13,1	-2,2	0,46	30,20	1003,04	101	
4	322-GB	Full	2023-10-07	11:20	70,401356	-91,097906	Agassiz Trawl	Deployment	216	316	12,4	-2,6	0,47	30,20	1003,32	101	
4	322-GB	Full	2023-10-07	11:29	70,399962	-91,087423	Agassiz Trawl	Bottom	214	309	12,4	-2,5	0,43	30,21	1003,20	101	
4	322-GB	Full	2023-10-07	11:42	70,399317	-91,071235	Agassiz Trawl	Recovery	207	303	12,6	-2,5	0,37	30,21	1003,31	101	
4	322-GB	Full	2023-10-07	12:45	70,396414	-91,107604	Beam Trawl	Deployment	223	314	10,9	-2,1	0,42	30,20	1003,72	101	
4	322-GB	Full	2023-10-07	12:56	70,395032	-91,089703	Beam Trawl	Bottom	216	303	10,5	-2,4	0,42	30,20	1003,87	101	
4	322-GB	Full	2023-10-07	13:23	70,394443	-91,034674	Beam Trawl	Recovery	203				0,34	30,22			
4	323-GB	CTD	2023-10-07	14:42	70,448077	-90,638634	CTD Rosette	Deployment	131	306	9,9	-1,9	0,65	30,38	1004,19	101	
4	323-GB	CTD	2023-10-07	14:46	70,447916	-90,638182	CTD Rosette	Bottom	131	318	12,4	-1,8	0,59	30,36	1004,20	101	
4	323-GB	CTD	2023-10-07	14:54	70,447725	-90,638510	CTD Rosette	Recovery	132	310	14,5	-2	0,57	30,36	1004,19	101	
4	324-GB	Nutrient	2023-10-07	16:15	70,500987	-90,143243	CTD Rosette	Deployment	128	326	17,3	-1,9	0,43	30,27	1004,61	101	
4	324-GB	Nutrient	2023-10-07	16:18	70,500895	-90,142856	CTD Rosette	Bottom	129	336	17,7	-1,9	0,56	30,37	1004,62	101	
4	324-GB	Nutrient	2023-10-07	16:45	70,499569	-90,140434	CTD Rosette	Recovery	130	331	16,4	-2	0,47	30,30	1004,99	101	
4	324-GB	Nutrient	2023-10-07	16:59	70,499240	-90,138001	Bongo Net	Deployment	128	333	18,7	-2,2	0,56	30,29	1005,04	101	
4	324-GB	Nutrient	2023-10-07	17:01	70,499021	-90,137750	Bongo Net	Bottom	128	335	15,4	-2,2	0,63	30,40	1005,12	101	
4	324-GB	Nutrient	2023-10-07	17:04	70,498716	-90,137238	Bongo Net	Recovery	129	323	17,7	-2,1	0,52	30,34	1004,95	101	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	325-GB	CTD	2023-10-07	18:15	70,554285	-89,671887	CTD Rosette	Deployment	164	319	16,9	-2,2	0,75	30,34	1005,69	101	
4	325-GB	CTD	2023-10-07	18:19	70,554233	-89,671478	CTD Rosette	Bottom	164	324	15,4	-2,2	0,77	30,35	1005,79	101	
4	325-GB	CTD	2023-10-07	18:25	70,554051	-89,671542	CTD Rosette	Recovery	164	339	16,4	-1,9	0,75	30,34	1005,76	101	
4	326-GB	Nutrient	2023-10-07	20:43	70,603636	-89,224328	CTD Rosette	Deployment	83	313	16,9	-2,3	-0,40	29,22	1007,43	101	
4	326-GB	Nutrient	2023-10-07	20:46	70,603278	-89,223161	CTD Rosette	Bottom	83	296	17,3	-2,5	-0,51	29,15	1007,48	101	
4	326-GB	Nutrient	2023-10-07	21:07	70,602819	-89,225976	CTD Rosette	Recovery	84	325	17,1	-2,5	0,17	30,05	1007,81	101	
4	326-GB	Nutrient	2023-10-07	21:20	70,601336	-89,224558	Bongo Net	Deployment	86	322	20,4	-2,3	0,36	30,24	1007,84	101	
4	326-GB	Nutrient	2023-10-07	21:23	70,601105	-89,225318	Bongo Net	Bottom	87	317	19,8	-2,3	0,33	30,23	1007,81	100	
4	326-GB	Nutrient	2023-10-07	21:26	70,600698	-89,225117	Bongo Net	Recovery	87	316	19,4	-2,1	0,40	30,13	1007,91	100	
4	SPR-005	Nutrient	2023-10-08	7:52	69,147433	-85,663188	CTD Rosette	Deployment	338	301	13,7	-2,8			1015,39	99	
4	SPR-005	Nutrient	2023-10-08	8:00	69,149524	-85,660769	CTD Rosette	Bottom	339	289	18,5	-2,6	-0,64	29,32	1015,40	100	
4	SPR-005	Nutrient	2023-10-08	8:49	69,154061	-85,665591	CTD Rosette	Recovery	336	286	13,3	-2,8	-0,59	29,26	1016,26	100	
4	SPR-005	Nutrient	2023-10-08	9:04	69,158493	-85,664276	Bongo Net	Deployment	341	266	15,2	-3	-0,77	29,21	1016,42	99	
4	SPR-005	Nutrient	2023-10-08	9:07	69,159507	-85,664274	Bongo Net	Bottom	342	261	12	-3	-0,72	29,22	1016,43	100	
4	SPR-005	Nutrient	2023-10-08	9:10	69,160143	-85,663771	Bongo Net	Recovery	342	268	10,9	-3	-0,71	29,28	1016,48	100	
4	SPR-004	Basic	2023-10-08	10:43	69,051703	-86,213274	CTD Rosette	Deployment	229	235	14,7	-3,5	-0,84	29,14	1017,36	100	
4	SPR-004	Basic	2023-10-08	10:48	69,052197	-86,212079	CTD Rosette	Bottom	228	237	15,2	-3,3	-0,63	29,11	1017,30	100	
4	SPR-004	Basic	2023-10-08	11:24	69,050619	-86,204797	CTD Rosette	Recovery	230	250	23,6	-3	-0,57	29,71	1017,62	100	
4	SPR-004	Basic	2023-10-08	12:15	69,048801	-86,210689	Tucker Net	Deployment	223	216	22,1	-2,2	-1,04	28,87	1017,90	100	
4	SPR-004	Basic	2023-10-08	12:25	69,050964	-86,196494	Tucker Net	Bottom	232	237	17,9	-3,2	-1,03	28,91	1017,87	100	
4	SPR-004	Basic	2023-10-08	12:38	69,056078	-86,180711	Tucker Net	Recovery	228	237	21,1	-3,4	-0,97	29,01	1017,62	100	
4	SPR-004	Basic	2023-10-08	13:10	69,052439	-86,212052	Monster Net	Deployment	227	230	22,8	-3,7	-0,85	28,91	1018,06	100	
4	SPR-004	Basic	2023-10-08	13:18	69,054014	-86,213358	Monster Net	Bottom	223	234	23,4	-3,6	-1,05	28,85	1018,00	100	
4	SPR-004	Basic	2023-10-08	13:25	69,054174	-86,212408	Monster Net	Recovery	223	226	16,9	-3,6	-0,81	28,91	1018,12	100	
4	SPR-004	Basic	2023-10-08	13:50	69,052568	-86,214327	Box Core	Deployment	229	217	20,6	-3,7	-0,99	28,91	1018,17	100	
4	SPR-004	Basic	2023-10-08	13:55	69,052625	-86,214606	Box Core	Bottom	229	220	22,1	-3,6	-1,05	28,81	1018,13	100	
4	SPR-004	Basic	2023-10-08	13:59	69,052973	-86,216338	Box Core	Recovery	226	232	24,4	-3,5	-1,08	28,79	1018,19	100	
4	SPR-004	Basic	2023-10-08	14:26	69,049666	-86,211233	Agassiz Trawl	Deployment	225	225	18,3	-1,2	-1,10	28,77	1018,43	99	
4	SPR-004	Basic	2023-10-08	14:35	69,052382	-86,198811	Agassiz Trawl	Bottom	233	213	23,6	-3,6	-1,07	28,81	1017,82	100	
4	SPR-004	Basic	2023-10-08	14:44	69,054930	-86,186612	Agassiz Trawl	Recovery	232	207	21,3	-3,4	-1,04	28,87	1018,05	100	
4	SPR-004	Basic	2023-10-08	15:03	69,050028	-86,210695	Beam Trawl	Deployment	229	223	15,6	-2,1	-1,11	28,76	1018,5	100	
4	SPR-004	Basic	2023-10-08	15:15	69,053573	-86,194077	Beam Trawl	Bottom	225	210	24,2	-3,1	-1,05	28,83	1018,06	100	
4	SPR-004	Basic	2023-10-08	15:32	69,060182	-86,170152	Beam Trawl	Recovery	229	206	21,5	-3,3	-1,02	28,99	1018,19	100	
4	SPR-003	Nutrient	2023-10-08	17:27	68,967750	-86,683627	CTD Rosette	Deployment	181	199	20,8	-3,2	-0,99	28,81	1017,53	100	
4	SPR-003	Nutrient	2023-10-08	17:34	68,969365	-86,684807	CTD Rosette	Deployment	182	203	24,2	-3	-1,00	28,91	1017,63	100	
4	SPR-003	Nutrient	2023-10-08	17:37	68,969668	-86,685159	CTD Rosette	Bottom	182	208	26,7	-3	-1,01	28,84	1017,53	100	
4	SPR-003	Nutrient	2023-10-08	18:09	68,973200	-86,686200	CTD Rosette	Recovery	179	206	28,8	-3,4	-0,99	28,84	1016,86	100	
4	SPR-003	Nutrient	2023-10-08	18:19	68,973660	-86,685949	Bongo Net	Deployment	182	208	29,9	-3,4	-0,94	29,15	1016,78	100	
4	SPR-003	Nutrient	2023-10-08	18:22	68,973445	-86,684822	Bongo Net	Bottom	182	205	28	-3,4	-0,94	29,08	1016,63	100	
4	SPR-003	Nutrient	2023-10-08	18:25	68,973841	-86,683842	Bongo Net	Recovery	183	203	26,7	-3,5	-0,77	29,00	1016,76	100	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	SPR-002	CTD	2023-10-08	20:19	68,900909	-87,228206	CTD Rosette	Deployment	95	181	32,2	-2,5			1014,43	101	
4	SPR-002	CTD	2023-10-08	20:21	68,901037	-87,229035	CTD Rosette	Bottom	94	186	32,4	-2,5			1014,7	101	
4	SPR-002	CTD	2023-10-08	20:25	68,900984	-87,230381	CTD Rosette	Recovery	93	190	31	-2,4			1014,57	101	
4	SPR-001	Nutrient	2023-10-08	22:39	68,819498	-87,764713	CTD Rosette	Deployment	26	194	28	-0,7	-0,17	30,00	1012,47	101	
4	SPR-001	Nutrient	2023-10-08	22:40	68,819911	-87,765223	CTD Rosette	Bottom	26	203	34,1	-0,6	-0,14	30,00	1012,4	101	
4	SPR-001	Nutrient	2023-10-08	22:47	68,822055	-87,767259	CTD Rosette	Recovery	26	204	27,4	-0,8	-0,17	30,00	1012,73	101	
4	SPR-001	Nutrient	2023-10-08	22:57	68,825339	-87,771529	Plankton Net	Deployment	24	203	29,7	-0,8	-0,16	29,99	1012,58	101	
4	SPR-001	Nutrient	2023-10-08	22:58	68,825702	-87,771767	Plankton Net	Bottom	24	206	31,8	-0,8	-0,10	29,99	1012,39	101	
4	SPR-001	Nutrient	2023-10-08	23:00	68,825950	-87,772523	Plankton Net	Recovery	24				-0,17	29,99			
4	CTD FH 1	Nutrient	2023-10-09	7:15	69,921000	-85,065700	CTD Rosette	Deployment	220	215	27	-0,7	-0,97	29,24	1008,27	101	
4	CTD FH 1	Nutrient	2023-10-09	7:19	69,921023	-85,062571	CTD Rosette	Bottom	219	211	28,4	-0,6	-0,98	29,25	1008,08	101	
4	CTD FH 1	Nutrient	2023-10-09	7:26	69,921391	-85,060274	CTD Rosette	Recovery	219	214	28,6	-0,5	-0,97	29,24	1008,15	101	
4	CTD FH 2	Nutrient	2023-10-09	9:20	69,892780	-84,181529	CTD Rosette	Deployment	148	227	20,8	0			1009,11	101	
4	CTD FH 2	Nutrient	2023-10-09	9:23	69,892627	-84,180048	CTD Rosette	Bottom	147	224	19,6	0	-0,90	29,11	1009,22	101	
4	CTD FH 2	Nutrient	2023-10-09	9:29	69,892559	-84,177585	CTD Rosette	Recovery	145	226	18,5	0	-0,90	29,11	1009,25	101	
4	CTD FH 3	Nutrient	2023-10-09	11:23	69,864743	-83,219584	CTD Rosette	Deployment	111	252	9,9	0,2	-0,49	30,29	1010,95	101	
4	CTD FH 3	Nutrient	2023-10-09	11:26	69,864100	-83,219787	CTD Rosette	Bottom	108	253	7,8	0,2	-0,52	30,28	1010,95	101	
4	CTD FH 3	Nutrient	2023-10-09	11:30	69,863416	-83,219516	CTD Rosette	Recovery	109	248	8	0,2	-0,51	30,30	1010,97	101	
4	FH20-001	Nutrient	2023-10-09	13:21	69,685585	-82,402061	CTD Rosette	Deployment	68	230	9,9	0,7	-0,53	30,35	1011,98	101	
4	FH20-001	Nutrient	2023-10-09	13:28	69,683366	-82,389309	CTD Rosette	Bottom	112	234	10,1	0,7	-0,50	30,41	1011,93	101	
4	FH20-001	Nutrient	2023-10-09	13:45	69,677944	-82,359831	CTD Rosette	Recovery	70	235	9,3	0,6	-0,46	30,41	1012,11	101	
4	FH20-001	Nutrient	2023-10-09	14:04	69,683816	-82,397771	Bongo Net	Deployment	100	251	3,6	0,5	-0,52	30,37	1012,11	101	
4	FH20-001	Nutrient	2023-10-09	14:07	69,682482	-82,393160	Bongo Net	Bottom	132	250	4,2	0,4	-0,53	30,41	1012,13	101	
4	FH20-001	Nutrient	2023-10-09	14:11			Bongo Net	Recovery		261	5	0,6	-0,55	30,39	1012,16	101	
4			2023-10-09	15:28	69,693753	-81,964133	CTD Rosette	Deployment	107	204	6,1	0	-0,48	30,53	1012,47	101	
4			2023-10-09	15:31	69,693530	-81,963772	CTD Rosette	Bottom	108	203	6,5	-0,1	-0,47	30,52	1012,42	102	
4			2023-10-09	15:36	69,693192	-81,963257	CTD Rosette	Recovery	112	206	6,1	-0,1	-0,42	30,52	1012,39	102	
4			2023-10-09	16:47	69,611040	-81,482645	CTD Rosette	Deployment	136	223	7,4	0	0,01	30,62	1012,63	102	
4			2023-10-09	16:50	69,611268	-81,483344	CTD Rosette	Bottom	137	220	8,9	0,1	0,01	30,61	1012,67	102	
4			2023-10-09	16:55	69,611549	-81,483164	CTD Rosette	Recovery	130	223	7,6	0,1	0,01	30,62	1012,71	102	
4			2023-10-09	18:34	69,451164	-80,959178	CTD Rosette	Deployment	98	222	7,8	0,1	0,31	30,58	1012,96	102	
4			2023-10-09	18:36	69,451505	-80,958784	CTD Rosette	Bottom	97	229	8,6	0,1	0,30	30,58	1012,95	102	
4			2023-10-09	18:41	69,451888	-80,958966	CTD Rosette	Recovery	98	216	7,8	0	0,31	30,58	1013	102	
4	329	Nutrient	2023-10-09	20:10	69,367447	-80,386246	CTD Rosette	Deployment	38				0,73	30,63			
4	329	Nutrient	2023-10-09	20:11	69,367600	-80,386406	CTD Rosette	Bottom	38	248	7,4	0,3	0,73	30,63	1013,14	102	
4	329	Nutrient	2023-10-09	20:14	69,367965	-80,386843	CTD Rosette	Recovery	38	241	7,4	0,2	0,73	30,63	1012,99	102	
4	330	Nutrient	2023-10-09	20:56	69,319637	-80,553268	CTD Rosette	Deployment	62	258	6,5	0,2	0,65	30,67	1012,97	102	
4	330	Nutrient	2023-10-09	20:58	69,319866	-80,553908	CTD Rosette	Bottom	62	258	5,9	0,2	0,62	30,67	1013,06	102	
4	330	Nutrient	2023-10-09	21:01	69,320315	-80,554915	CTD Rosette	Recovery	62	269	5,9	0,2	0,59	30,66	1013,05	102	
4	330	Nutrient	2023-10-09	21:28	69,325406	-80,567750	Bongo Net	Deployment	62	269	6,3	0,2	0,57	30,66	1012,88	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	330	Nutrient	2023-10-09	21:32	69,325754	-80,570296	Bongo Net	Bottom	64	279	5	0,2	0,53	30,65	1013,05	102	
4	330	Nutrient	2023-10-09	21:33	69,325996	-80,570971	Bongo Net	Recovery	64	274	4,8	0,1	0,53	30,64	1013,06	102	
4	331	CTD	2023-10-09	22:27	69,251613	-80,766945	CTD Rosette	Deployment	73	259	1,3	0,6	0,37	30,58	1013,11	102	
4	331	CTD	2023-10-09	22:29	69,251664	-80,767080	CTD Rosette	Bottom	73	324	1,3	0,5	0,38	30,58	1013,1	102	
4	331	CTD	2023-10-09	22:34	69,251696	-80,767868	CTD Rosette	Recovery	73	215	0	0,3	0,39	30,58	1013,1	102	
4	332	Nutrient	2023-10-09	23:21	69,182469	-80,998446	CTD Rosette	Deployment	81	307	4	0,3	0,21	30,54	1013,17	102	
4	332	Nutrient	2023-10-09	23:29	69,182476	-80,999999	CTD Rosette	Bottom	83	56	0,4	-0,3			1013,16	102	
4	332	Nutrient	2023-10-09	23:51	69,183904	-81,004390	CTD Rosette	Recovery	85	8	5,5	0,1	0,22	30,54	1013,19	102	
4	333	Full	2023-10-10	2:22	68,767551	-81,009171	CTD Rosette	Deployment	33	16	7,6	0			1012,61	102	
4	333	Full	2023-10-10	2:24	68,767868	-81,009916	CTD Rosette	Bottom	33	17	6,5	0	0,61	30,57	1012,6	102	
4	333	Full	2023-10-10	2:33	68,769124	-81,011346	CTD Rosette	Recovery	34	21	5,3	0,1	0,52	30,50	1012,73	102	
4	333	Full	2023-10-10	2:45	68,767787	-81,017487	Bongo Net	Deployment	34	350	8,2	-0,6	0,68	30,57	1012,83	102	
4	333	Full	2023-10-10	2:46	68,767851	-81,017576	Bongo Net	Bottom	34	347	8,2	-0,6	0,70	30,57	1012,89	102	
4	333	Full	2023-10-10	2:48	68,767960	-81,017619	Bongo Net	Recovery	34	351	8,8	-0,7			1012,92	102	
4	333	Full	2023-10-10	2:58	68,765426	-81,021984	Tucker Net	Deployment	34	348	6,3	0,1	0,67	30,56	1013,02	102	
4	333	Full	2023-10-10	3:00	68,763983	-81,020293	Tucker Net	Bottom	34	360	7	-0,6	0,60	30,56	1012,92	102	
4	333	Full	2023-10-10	3:06	68,765469	-81,013635	Tucker Net	Recovery	34	7	10,7	-0,3	0,55	30,51	1012,95	102	
4	333	Full	2023-10-10	3:28	68,765855	-81,022458	Monster Net	Deployment	34	358	10,5	0,2	0,71	30,59	1013,16	102	
4	333	Full	2023-10-10	3:30	68,766099	-81,022904	Monster Net	Bottom	34	359	8	0,3	0,71	30,59	1013,18	102	
4	333	Full	2023-10-10	3:32	68,766438	-81,023502	Monster Net	Recovery	34	336	6,7	0,3	0,71	30,59	1013,22	102	
4	333	Full	2023-10-10	4:22	68,770884	-80,840465	Box Core	Deployment	27	350	8	-0,1	0,64	30,61	1013,37	102	
4	333	Full	2023-10-10	4:24	68,771157	-80,840923	Box Core	Bottom	26	349	8,8	-0,3	0,58	30,62	1013,52	102	
4	333	Full	2023-10-10	4:26	68,771646	-80,841065	Box Core	Recovery	26	347	7,8	-0,4	0,62	30,61	1013,52	102	
4	333	Full	2023-10-10	4:43	68,771483	-80,839496	Box Core	Deployment	27	359	9,1	0,4	0,52	30,60	1013,73	102	
4	333	Full	2023-10-10	4:45	68,771442	-80,839715	Box Core	Bottom	27	4	7,2	-0,3	0,50	30,60	1013,67	102	
4	333	Full	2023-10-10	4:47	68,771413	-80,839872	Box Core	Recovery	27	356	8	-0,3	0,50	30,60	1013,62	102	
4	333	Full	2023-10-10	5:04	68,770885	-80,837099	Agassiz Trawl	Deployment	27	359	7,8	-0,2	0,52	30,61	1013,64	102	
4	333	Full	2023-10-10	5:07	68,771505	-80,832650	Agassiz Trawl	Bottom	27	360	10,7	0	0,51	30,60	1013,62	102	
4	333	Full	2023-10-10	5:12	68,774152	-80,831998	Agassiz Trawl	Recovery	26	359	11,2	0,2	0,50	30,60	1013,54	102	
4	333	Full	2023-10-10	5:35	68,772641	-80,836682	Beam Trawl	Deployment	26	350	14,3	-0,3	0,61	30,63	1013,85	102	
4	333	Full	2023-10-10	5:38	68,774113	-80,837681	Beam Trawl	Bottom	27	345	16	-0,1	0,57	30,62	1013,84	102	
4	333	Full	2023-10-10	5:46	68,772298	-80,841082	Beam Trawl	Recovery	27	350	13,3	-0,6	0,61	30,63	1013,95	102	
4	333	Full	2023-10-10	5:47	68,772788	-80,839170	Beam Trawl	Deployment	27	351	15,8	-0,4	0,60	30,63	1013,72	102	
4	333	Full	2023-10-10	5:49	68,773739	-80,837407	Beam Trawl	Bottom	27	355	14,7	-0,5	0,59	30,63	1013,9	102	
4	333	Full	2023-10-10	5:56	68,774468	-80,841555	Beam Trawl	Recovery	27	354	12,2	-0,9	0,59	30,63	1013,91	102	
4	FSB-01	Contaminants	2023-10-10	7:05	68,758389	-81,154177	CTD Rosette	Deployment	26	357	11	-1,6	0,53	30,51	1014,8	102	
4	FSB-01	Contaminants	2023-10-10	7:10	68,758520	-81,152618	CTD Rosette	Recovery	26	345	11,8	-1,9	0,54	30,51	1014,97	102	
4	FSB-02	Contaminants	2023-10-10	7:41	68,736648	-81,185575	CTD Rosette	Deployment	23	333	12,8	-2	0,52	30,49	1015,09	102	
4	FSB-02	Contaminants	2023-10-10	7:46	68,736390	-81,184283	CTD Rosette	Recovery	24	342	11,8	-2	0,52	30,49	1015,26	102	
4	FSB-03	Contaminants	2023-10-10	8:54	68,662350	-81,149814	CTD Rosette	Deployment	24	351	12,2	-2,4	1,60	30,61	1015,87	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	FSB-03	Contaminants	2023-10-10	8:59	68,661333	-81,148235	CTD Rosette	Recovery	24	336	11,4	-2,5	1,59	30,61	1015,88	102	
4	FoxSIPP-01	Nutrient	2023-10-10	11:25	68,252426	-80,904584	CTD Rosette	Deployment	69	359	9,5	-2	1,01	30,92	1016,88	102	
4	FoxSIPP-01	Nutrient	2023-10-10	11:26	68,252243	-80,904499	CTD Rosette	Bottom	69	349	11	-1,8	1,01	30,92	1016,85	102	
4	FoxSIPP-01	Nutrient	2023-10-10	11:43	68,250835	-80,906057	CTD Rosette	Recovery	68	3	10,1	-1,8	1,01	30,91	1017,08	102	
4	334	Full	2023-10-10	14:22	67,871347	-80,810054	Baited Cam	Deployment	86	352	0	-1,5			1017,51	102	
4	334	Full	2023-10-10	14:25	67,871117	-80,809092	Baited Cam	Bottom	86	332	0	-1,5			1017,58	102	
4	334	Full	2023-10-10	14:54	67,878908	-80,799623	CTD Rosette	Deployment	85	346	0	-1,4			1017,86	102	
4	334	Full	2023-10-10	14:56	67,878550	-80,799578	CTD Rosette	Bottom	85	345	0	-1,4			1017,89	102	
4	334	Full	2023-10-10	15:14	67,876626	-80,799747	CTD Rosette	Recovery	85	353	0	-1,3			1017,98	102	
4	334	Full	2023-10-10	15:23	67,878414	-80,798897	Bongo Net	Deployment	84	356	0	-1,3			1018,12	102	
4	334	Full	2023-10-10	15:25	67,878476	-80,799075	Bongo Net	Bottom	85	347	0	-1,4			1018,06	102	
4	334	Full	2023-10-10	15:28	67,878569	-80,798996	Bongo Net	Recovery	84	349	0	-1,3	0,92	31,32	1018,11	102	
4	334	Full	2023-10-10	16:31	67,879039	-80,798841	Tucker Net	Deployment	85	350	0	-0,7	0,92	31,32	1018,56	102	
4	334	Full	2023-10-10	16:41	67,875392	-80,791124	Tucker Net	Bottom	86	340	0	-1,4	0,92	31,33	1018,41	102	
4	334	Full	2023-10-10	16:49	67,876742	-80,779767	Tucker Net	Recovery	87	335	0	-1,5			1018,46	102	
4	334	Full	2023-10-10	17:11	67,879349	-80,800141	Monster Net	Deployment	84	346	0	-1			1018,61	103	
4	334	Full	2023-10-10	17:14	67,879356	-80,800435	Monster Net	Bottom	84	341	0	-1	0,96	31,33	1018,56	103	
4	334	Full	2023-10-10	17:18	67,879367	-80,800632	Monster Net	Recovery	84	346	0	-1	0,94	31,33	1018,59	103	
4	334	Full	2023-10-10	17:38	67,880664	-80,800648	Box Core	Deployment	85	345	0	-1,1	0,94	31,33	1018,73	103	
4	334	Full	2023-10-10	17:41	67,880802	-80,800874	Box Core	Bottom	85	351	0	-1,1	1,01	31,33	1018,71	103	
4	334	Full	2023-10-10	17:44	67,880753	-80,801113	Box Core	Recovery	85	351	0	-1,1	0,96	31,33	1018,78	103	
4	334	Full	2023-10-10	17:49	67,880456	-80,801580	Box Core	Deployment	85	347	0	-1,2	1,01	31,34	1018,81	103	
4	334	Full	2023-10-10	17:52	67,880442	-80,801501	Box Core	Bottom	85	346	0	-1,1	1,00	31,34	1018,79	103	
4	334	Full	2023-10-10	17:54	67,880648	-80,801481	Box Core	Recovery	85	352	0	-0,9	0,95	31,34	1018,91	103	
4	334	Full	2023-10-10	18:12	67,881711	-80,803378	Box Core	Deployment	85	352	0	-0,5	1,04	31,34	1018,89	103	
4	334	Full	2023-10-10	18:14	67,881628	-80,803532	Box Core	Bottom	85	343	0	-0,6			1018,93	103	
4	334	Full	2023-10-10	18:16	67,881607	-80,803537	Box Core	Recovery	85	349	0	-0,5	1,02	31,34	1018,94	103	
4	334	Full	2023-10-10	18:36	67,880804	-80,805625	Agassiz Trawl	Deployment	84	339	9,7	-0,9	0,90	31,33	1019,23	103	
4	334	Full	2023-10-10	18:43	67,879072	-80,798180	Agassiz Trawl	Bottom	85	331	10,9	-1	0,91	31,33	1019,16	102	
4	334	Full	2023-10-10	18:50	67,879740	-80,787961	Agassiz Trawl	Recovery	87	339	12,8	-1	0,97	31,35	1019,15	102	
4	334	Full	2023-10-10	19:07	67,877459	-80,784151	Beam Trawl	Deployment	86	349	11,8	-1,3	0,99	31,36	1019,04	103	
4	334	Full	2023-10-10	19:13	67,876811	-80,775770	Beam Trawl	Bottom	90	358	12,2	-1	1,02	31,38	1019,16	103	
4	334	Full	2023-10-10	19:32	67,881099	-80,784401	Beam Trawl	Recovery	86	11	9,1	-1	1,01	31,37	1019,31	103	
4	334	Full	2023-10-10	20:10	67,871441	-80,809768	Baited Cam	Recovery	84	358	8,9	-1,4	0,80	31,28	1019,28	103	
4	FoxSIPP-02	Nutrient	2023-10-10	23:00	67,342298	-80,827455	CTD Rosette	Deployment	94	333	11,8	-1,3	1,45	30,87	1020,25	103	
4	FoxSIPP-02	Nutrient	2023-10-10	23:03	67,341736	-80,826961	CTD Rosette	Bottom	94	340	12,9	-1,3	1,45	30,88	1020,24	103	
4	FoxSIPP-02	Nutrient	2023-10-10	23:21	67,338887	-80,823403	CTD Rosette	Recovery	94	1	9,7	-1,3	1,44	30,88	1020,36	103	
4	FoxSIPP-03	Full	2023-10-11	1:55	66,908006	-80,831702	CTD Rosette	Deployment	97				1,26	31,13			
4	FoxSIPP-03	Full	2023-10-11	1:57	66,907849	-80,831756	CTD Rosette	Bottom	97	51	9,9	-0,7	1,26	31,13	1020,56	103	
4	FoxSIPP-03	Full	2023-10-11	2:17	66,906098	-80,834218	CTD Rosette	Recovery	98	65	10,1	-0,7	1,40	31,13	1020,62	103	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	FoxSIPP-03	Full	2023-10-11	2:28	66,908102	-80,828807	Bongo Net	Deployment	97	59	8,9	-0,7	1,28	31,12	1020,6	103	
4	FoxSIPP-03	Full	2023-10-11	2:30	66,908117	-80,828665	Bongo Net	Bottom	97				1,27	31,13			
4	FoxSIPP-03	Full	2023-10-11	2:32	66,908090	-80,828326	Bongo Net	Recovery	98				1,26	31,13			
4	FoxSIPP-03	Full	2023-10-11	2:45	66,910868	-80,824495	Tucker Net	Deployment	96	53	5,3	-0,3	1,26	31,12	1020,55	103	
4	FoxSIPP-03	Full	2023-10-11	2:52	66,909198	-80,831671	Tucker Net	Bottom	97	78	7	-0,8	1,25	31,13	1020,6	103	
4	FoxSIPP-03	Full	2023-10-11	3:00	66,904997	-80,832028	Tucker Net	Recovery	97	89	8	-0,9	1,25	31,13	1020,66	103	
4	FoxSIPP-03	Full	2023-10-11	3:15	66,908264	-80,829471	Monster Net	Deployment	98	65	8,4	-0,7	1,25	31,15	1020,64	103	
4	FoxSIPP-03	Full	2023-10-11	3:18	66,908505	-80,829276	Monster Net	Bottom	98	71	8,8	-0,7	1,24	31,13	1020,62	103	
4	FoxSIPP-03	Full	2023-10-11	3:22	66,908748	-80,829052	Monster Net	Recovery	98	67	7,4	-0,8	1,25	31,15	1020,65	103	
4	FoxSIPP-03	Full	2023-10-11	4:17	66,908689	-80,827786	Box Core	Deployment	98	96	4,8	-0,7	1,24	31,13	1020,69	103	
4	FoxSIPP-03	Full	2023-10-11	4:19	66,908693	-80,827744	Box Core	Bottom	98	105	5,3	-0,7			1020,68	103	
4	FoxSIPP-03	Full	2023-10-11	4:22	66,908704	-80,827616	Box Core	Recovery	98	102	4,8	-0,6			1020,66	103	
4	FoxSIPP-03	Full	2023-10-11	4:42	66,908755	-80,827214	Box Core	Deployment	98	107	4	-0,8			1020,64	103	
4	FoxSIPP-03	Full	2023-10-11	4:44	66,908754	-80,827179	Box Core	Bottom	98	119	3,8	-0,7	1,23	31,13	1020,62	103	
4	FoxSIPP-03	Full	2023-10-11	4:47	66,908757	-80,827173	Box Core	Recovery	97	122	4,2	-0,6			1020,61	103	
4	FoxSIPP-03	Full	2023-10-11	5:05	66,907850	-80,825781	Agassiz Trawl	Deployment	98	128	6,7	-0,6	1,22	31,13	1020,53	103	
4	FoxSIPP-03	Full	2023-10-11	5:10	66,908563	-80,819925	Agassiz Trawl	Bottom	98	147	3,4	-0,3			1020,53	103	
4	FoxSIPP-03	Full	2023-10-11	5:17	66,911632	-80,823238	Agassiz Trawl	Recovery	97	129	5,3	-0,7	1,21	31,13	1020,48	103	
4	FoxSIPP-03	Full	2023-10-11	5:37	66,910107	-80,819592	Beam Trawl	Deployment	97	138	8,8	-0,5			1020,22	103	
4	FoxSIPP-03	Full	2023-10-11	5:44	66,911705	-80,813325	Beam Trawl	Bottom	97	86	2,3	-0,1			1020,26	103	
4	FoxSIPP-03	Full	2023-10-11	6:00	66,913964	-80,832392	Beam Trawl	Recovery	95				1,18	31,14			
4	FoxSIPP-03	Full	2023-10-11	6:10	66,908536	-80,826913	Surface Bucket	Deployment	97	171	9,5	-0,4	1,20	31,13	1020,13	103	
4	FoxSIPP-03	Full	2023-10-11	6:27	66,911652	-80,831024	Surface Bucket	Recovery	96	161	8,6	-0,8	1,20	31,14	1020,29	103	
4		Nutrient	2023-10-11	9:03	66,454992	-80,873304	CTD Rosette	Deployment	102	154	7,4	-2,3	1,06	31,98	1020,59	103	
4		Nutrient	2023-10-11	9:05	66,454664	-80,874000	CTD Rosette	Bottom	102	148	4,6	-2,3	1,05	31,99	1020,68	103	
4		Nutrient	2023-10-11	9:23	66,453222	-80,877597	CTD Rosette	Recovery	102	152	6,3	-2,1	1,01	31,99	1020,8	103	
4	338	Full	2023-10-11	12:02	66,161112	-81,356138	Baited Cam	Deployment	135	150	7	-2,1	1,13	32,16	1020,84	103	
4	338	Full	2023-10-11	12:09	66,160338	-81,359117	Baited Cam	Bottom	135	167	8,6	-2,4	1,20	32,23	1020,81	103	
4	338	Full	2023-10-11	12:42	66,171220	-81,321075	CTD Rosette	Deployment	135	168	6,1	-0,5	1,19	32,31	1021,11	103	
4	338	Full	2023-10-11	12:45	66,171252	-81,321841	CTD Rosette	Bottom	135	157	5,7	-0,2	1,19	32,31	1021,1	103	
4	338	Full	2023-10-11	13:10	66,171142	-81,329422	CTD Rosette	Recovery	135	124	8,9	-0,1	1,14	32,28	1020,91	103	
4	338	Full	2023-10-11	13:23	66,168383	-81,323461	Bongo Net	Deployment	136	155	8,8	-1,5	1,23	32,27	1020,89	103	
4	338	Full	2023-10-11	13:26	66,168391	-81,323372	Bongo Net	Bottom	136	154	10,9	-1,7	1,19	32,31	1020,91	103	
4	338	Full	2023-10-11	13:30	66,168305	-81,323261	Bongo Net	Recovery	136	155	9,7	-1,6	1,22	32,30	1020,83	103	
4	338	Full	2023-10-11	13:42	66,166888	-81,318640	Tucker Net	Deployment	136	139	5	-1,3	1,19	32,32	1020,78	103	
4	338	Full	2023-10-11	13:48	66,169796	-81,322182	Tucker Net	Bottom	136	158	6,3	-2	1,14	32,31	1020,67	103	
4	338	Full	2023-10-11	13:53	66,171162	-81,329207	Tucker Net	Recovery	136	145	8	-2,1	1,12	32,29	1020,6	103	
4	338	Full	2023-10-11	14:14	66,167640	-81,329991	Monster Net	Deployment	136	153	9,3	-1,9	1,14	32,27	1020,55	103	
4	338	Full	2023-10-11	14:17	66,167319	-81,330266	Monster Net	Bottom	136	156	9,7	-1,8	1,07	32,24	1020,55	103	
4	338	Full	2023-10-11	14:23	66,166704	-81,330483	Monster Net	Recovery	136	134	9,9	-1,9	1,08	32,24	1020,42	103	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	338	Full	2023-10-11	14:44	66,166771	-81,328959	Box Core	Deployment	136	153	9,9	-1,3	1,16	32,40	1020,43	103	
4	338	Full	2023-10-11	14:46	66,166828	-81,328757	Box Core	Bottom	136	163	9,1	-1,3	1,16	32,40	1020,44	103	
4	338	Full	2023-10-11	14:51	66,167037	-81,328397	Box Core	Recovery	137	150	8	-1,3	1,11	32,31	1020,47	103	
4	338	Full	2023-10-11	15:03	66,167336	-81,326955	Box Core	Deployment	136	154	6,1	-1,1	1,03	32,18	1020,42	103	
4	338	Full	2023-10-11	15:08	66,167194	-81,326222	Box Core	Bottom	136	158	5,9	-1,2	1,07	32,23	1020,29	103	
4	338	Full	2023-10-11	15:12	66,167405	-81,325617	Box Core	Recovery	136	154	5,3	-1,2	1,15	32,29	1020,27	103	
4	338	Full	2023-10-11	15:25	66,166068	-81,329035	Agassiz Trawl	Deployment	137	147	2,5	-0,4	1,07	32,23	1020,33	103	
4	338	Full	2023-10-11	15:33	66,169251	-81,330759	Agassiz Trawl	Bottom	137	137	5,9	-1,2	1,00	32,14	1020,23	103	
4	338	Full	2023-10-11	15:42	66,172286	-81,335700	Agassiz Trawl	Recovery	136	149	5,1	-1,3	1,09	32,20	1020,19	103	
4	338	Full	2023-10-11	16:39	66,166705	-81,327897	Beam Trawl	Deployment	136	148	10,5	-0,4	0,98	32,09	1019,44	103	
4	338	Full	2023-10-11	16:47	66,167480	-81,318777	Beam Trawl	Bottom	136	147	4,2	0,3	0,98	32,08	1019,42	103	
4	338	Full	2023-10-11	17:00	66,173059	-81,326203	Beam Trawl	Recovery	136								
4	338	Full	2023-10-11	17:46	66,160763	-81,358809	Baited Cam	Recovery	136	161	11,2	0,4			1018,94	103	
4			2023-10-11	18:20	66,151455	-81,342244	MVP	Deployment	137	177	12,8	0,5	0,92	32,12	1019,15	103	
4	FoxSIPP-05	Nutrient	2023-10-11	22:24	65,614727	-81,151348	MVP	Recovery	150	188	12,6	0,3	0,23	32,49	1018,53	103	
4	FoxSIPP-05	Nutrient	2023-10-11	22:41	65,610429	-81,149009	CTD Rosette	Deployment	165	184	9,5	0,1	0,23	32,49	1018,73	103	
4	FoxSIPP-05	Nutrient	2023-10-11	22:47	65,609578	-81,149788	CTD Rosette	Bottom	166	192	10,1	0,1	0,24	32,50	1018,85	103	
4	FoxSIPP-05	Nutrient	2023-10-11	23:18	65,606233	-81,151530	CTD Rosette	Recovery	169	207	7	0,2	0,19	32,50	1018,86	103	
4	FoxSIPP-05	Nutrient	2023-10-11	23:58	65,542783	-81,107419	MVP	Deployment	174	182	13,3	0,3	0,24	32,50	1018,8	103	
4	350	Mooring	2023-10-12	8:18	64,502843	-80,494944	MVP	Recovery	387	197	16,8	-0,6			1018,21	103	
4	350	Mooring	2023-10-12	12:47	64,506787	-80,523437	Mooring	Deployment	384	207	14,5	-0,4	0,91	32,04	1018,37	103	
4	350	Mooring	2023-10-12	13:21	64,506877	-80,520995	Mooring	Bottom	385	216	12,4	0,3	0,94	32,04	1018,29	103	
4	350	Mooring	2023-10-12	16:22	64,500319	-80,501335	CTD Rosette	Deployment	387	225	14,7	0,9	1,07	32,04	1018,01	103	
4	350	Mooring	2023-10-12	16:29	64,501105	-80,502353	CTD Rosette	Bottom	387	231	15	1	1,05	32,04	1017,96	103	
4	350	Mooring	2023-10-12	17:10	64,507362	-80,501853	CTD Rosette	Recovery	388	221	13,9	1,1	1,03	32,05	1017,69	102	
4	350	Mooring	2023-10-12	17:26	64,497926	-80,495596	Bongo Net	Deployment	387	231	16	1,3	0,98	32,05	1017,57	102	
4	350	Mooring	2023-10-12	17:28	64,497902	-80,495954	Bongo Net	Bottom	388	232	17,3	1,3	0,98	32,05	1017,54	102	
4	350	Mooring	2023-10-12	17:31	64,497922	-80,496865	Bongo Net	Recovery	388	237	17,9	1,3	1,00	32,05	1017,38	102	
4	350	Mooring	2023-10-12	17:41	64,499429	-80,497620	Tucker Net	Deployment		232	13,5	1,1	0,99	32,07	1017,31	102	
4	350	Mooring	2023-10-12	17:49	64,502202	-80,504539	Tucker Net	Bottom		242	20,2	1,2	0,99	32,05	1017,29	102	
4	350	Mooring	2023-10-12	17:55	64,501567	-80,512612	Tucker Net	Recovery		235	20,9	1,4	1,01	32,05	1017,17	102	
4	350	Mooring	2023-10-12	18:15	64,497349	-80,497278	Monster Net	Deployment	388	235	20	1,4	1,06	32,06	1017,13	102	
4	350	Mooring	2023-10-12	18:27	64,499034	-80,498140	Monster Net	Bottom	387	237	17,9	1,3	1,06	32,07	1017,26	102	
4	350	Mooring	2023-10-12	18:41	64,500559	-80,498527	Monster Net	Recovery	386	238	18,1	1,4	1,17	32,06	1017,35	102	
4	350	Mooring	2023-10-12	19:05	64,507968	-80,475784	Box Core	Deployment	390	228	16,4	1,5	1,04	32,06	1017,49	102	
4	350	Mooring	2023-10-12	19:14	64,507940	-80,475728	Box Core	Bottom	390	218	16,4	1,4	1,03	32,06	1017,25	102	
4	350	Mooring	2023-10-12	19:25	64,507975	-80,475661	Box Core	Recovery	390	230	22,5	1,4	1,04	32,06	1017,05	102	
4	350	Mooring	2023-10-12	19:43	64,508013	-80,475830	Box Core	Deployment	390	228	21,7	1,5	1,04	32,06	1017,2	102	
4	350	Mooring	2023-10-12	19:53	64,507845	-80,475658	Box Core	Bottom	390	230	20	1,5	1,04	32,06	1017,35	102	
4	350	Mooring	2023-10-12	20:01	64,508365	-80,474977	Box Core	Recovery	389	234	18,1	1,6	1,15	32,12	1017,26	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	350	Mooring	2023-10-12	20:28	64,501455	-80,492449	Agassiz Trawl	Deployment	386	240	11	4,8	1,05	32,06	1017,26	102	
4	350	Mooring	2023-10-12	20:42	64,506466	-80,477411	Agassiz Trawl	Bottom	389	228	16,2	1,3	1,04	32,06	1016,87	102	
4	350	Mooring	2023-10-12	20:57	64,512930	-80,466579	Agassiz Trawl	Recovery	387	228	17,1	1,3	1,03	32,07	1016,82	103	
4	350	Mooring	2023-10-12	21:16	64,508532	-80,473560	Beam Trawl	Deployment	389	233	16,2	1,2	1,04	32,06	1016,94	102	
4	350	Mooring	2023-10-12	21:35	64,517265	-80,455786	Beam Trawl	Bottom	386	232	16,9	1,1	1,05	32,06	1017,19	103	
4	350	Mooring	2023-10-12	22:07	64,535509	-80,427079	Beam Trawl	Recovery	384	219	13,3	1	1,10	32,03	1017,06	103	
4	FoxSIPP-07	Full	2023-10-13	1:14	64,362999	-81,472151	CTD Rosette	Deployment	266	226	21,7	1,2			1016,61	103	
4	FoxSIPP-07	Full	2023-10-13	1:21	64,363348	-81,471973	CTD Rosette	Bottom	267	233	23,2	1,2			1016,62	103	
4	FoxSIPP-07	Full	2023-10-13	1:57	64,363519	-81,471013	CTD Rosette	Recovery	269	210	6,1	0,8			1017,02	103	
4	FoxSIPP-07	Full	2023-10-13	2:02	64,363122	-81,471951	Sub-bottom Survey		267	213	10,1	0,8	0,66	31,75	1016,9	103	
4	FoxSIPP-07	Full	2023-10-13	2:08	64,362409	-81,474503	Bongo Net	Deployment	258	210	10,9	0,7	0,62	31,75	1016,78	103	
4	FoxSIPP-07	Full	2023-10-13	2:10	64,362392	-81,474556	Bongo Net	Bottom	257	227	15,4	0,6	0,62	31,74	1016,68	103	
4	FoxSIPP-07	Full	2023-10-13	2:14	64,362441	-81,474252	Bongo Net	Recovery	258	222	16,4	0,5			1016,52	103	
4	FoxSIPP-07	Full	2023-10-13	2:37	64,361996	-81,449661	Tucker Net	Deployment	272	218	19,8	1,1	0,62	31,74	1015,9	103	
4	FoxSIPP-07	Full	2023-10-13	2:47	64,367640	-81,447243	Tucker Net	Bottom	285	214	17,5	0,3	0,61	31,72	1015,57	103	
4	FoxSIPP-07	Full	2023-10-13	2:56	64,373155	-81,446407	Tucker Net	Recovery	294	221	21,7	0,4	0,61	31,71	1015,56	103	
4	FoxSIPP-07	Full	2023-10-13	3:30	64,362844	-81,474990	Monster Net	Deployment	260	227	21,7	0,3	0,72	31,76	1015,69	103	
4	FoxSIPP-07	Full	2023-10-13	3:37	64,363611	-81,475017	Monster Net	Bottom	266	229	22,3	0,4	0,65	31,77	1015,37	103	
4	FoxSIPP-07	Full	2023-10-13	3:46	64,364562	-81,475668	Monster Net	Recovery	270	228	23,4	0,5	0,63	31,76	1015,39	103	
4	FoxSIPP-07	Full	2023-10-13	5:24	64,402243	-81,446922	Vanveen Grab	Deployment	307	206	20,2	0	0,75	31,74	1015,23	103	
4	FoxSIPP-07	Full	2023-10-13	5:32	64,402279	-81,446996	Vanveen Grab	Bottom	307	208	22,8	-0,1	0,65	31,74	1014,92	103	
4	FoxSIPP-07	Full	2023-10-13	5:41	64,402170	-81,446900	Vanveen Grab	Recovery	307	207	19,6	0	0,64	31,74	1015,24	103	
4	FoxSIPP-07	Full	2023-10-13	6:16	64,402992	-81,443395	Beam Trawl	Deployment	307	209	17,1	-0,2	0,63	31,74	1015,06	103	
4	FoxSIPP-07	Full	2023-10-13	6:31	64,409084	-81,451915	Beam Trawl	Bottom	305	206	20	-0,2	0,62	31,73	1014,79	103	
4	FoxSIPP-07	Full	2023-10-13	6:54	64,406317	-81,438627	Beam Trawl	Recovery	304	201	14,1	-0,3	0,62	31,74	1014,92	103	
4	FoxSIPP-06	Nutrient	2023-10-13	8:53	64,727417	-81,386574	CTD Rosette	Deployment	262	116	3,4	1,5	0,60	31,97	1014,19	103	
4	FoxSIPP-06	Nutrient	2023-10-13	8:58	64,726974	-81,386407	CTD Rosette	Bottom	262	79	1,9	2,1	0,65	31,98	1014,25	102	
4	FoxSIPP-06	Nutrient	2023-10-13	9:31	64,724313	-81,384230	CTD Rosette	Recovery	264	47	0,8	2,9	0,46	31,90	1014,22	102	
4	FoxSIPP-08	Full	2023-10-13	17:29	66,006405	-83,151050	CTD Rosette	Deployment	307	309	16,4	1,7			1016,75	102	
4	FoxSIPP-08	Full	2023-10-13	17:37	66,006670	-83,149300	CTD Rosette	Bottom	307	318	16,4	1,8	0,92	31,42	1016,75	102	
4	FoxSIPP-08	Full	2023-10-13	18:14	66,006778	-83,142829	CTD Rosette	Recovery	308	322	20	2,1	0,96	31,42	1016,89	102	
4	FoxSIPP-08	Full	2023-10-13	18:26	66,006663	-83,140484	Bongo Net	Deployment	308	318	18,5	1,9	0,94	31,41	1017,11	102	
4	FoxSIPP-08	Full	2023-10-13	18:30	66,006325	-83,140589	Bongo Net	Bottom	308				0,94	31,41			
4	FoxSIPP-08	Full	2023-10-13	18:34	66,006172	-83,140249	Bongo Net	Recovery	308	313	16,8	2	0,94	31,41	1017,25	102	
4	FoxSIPP-08	Full	2023-10-13	19:13	66,005631	-83,153018	Box Core	Deployment	308	318	16,9	2,4	0,91	31,44	1017,82	102	
4	FoxSIPP-08	Full	2023-10-13	19:21	66,005595	-83,153125	Box Core	Bottom	307	324	20,8	2,4	0,91	31,45	1017,73	102	
4	FoxSIPP-08	Full	2023-10-13	19:28	66,005602	-83,153052	Box Core	Recovery	307	319	18,3	2,4	0,91	31,45	1018,1	102	
4	FoxSIPP-08	Full	2023-10-13	19:42	66,005582	-83,152991	Box Core	Deployment	307	327	29,7	2,4	0,90	31,45	1017,7	102	
4	FoxSIPP-08	Full	2023-10-13	19:48	66,005609	-83,153043	Box Core	Bottom	307				0,91	31,45			
4	FoxSIPP-08	Full	2023-10-13	19:55	66,005567	-83,153075	Box Core	Recovery	307	326	20,6	2,2	0,91	31,45	1018,23	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	FoxSIPP-08	Full	2023-10-13	20:17	66,004076	-83,154571	Box Core	Deployment	309	318	15,4	1,9	0,90	31,45	1018,73	102	
4	FoxSIPP-08	Full	2023-10-13	20:24	66,004851	-83,152859	Box Core	Bottom	308	326	15,4	2,1	0,90	31,45	1018,68	102	
4	FoxSIPP-08	Full	2023-10-13	20:31	66,004928	-83,153650	Box Core	Recovery	308	326	19	2	0,90	31,45	1018,46	102	
4	FoxSIPP-08	Full	2023-10-13	20:45	66,005691	-83,152400	Box Core	Deployment	306	327	19	1,8	0,91	31,45	1018,55	102	
4	FoxSIPP-08	Full	2023-10-13	20:58	66,004710	-83,152897	Box Core	Bottom	308	322	21,3	2	0,91	31,45	1018,76	102	
4	FoxSIPP-08	Full	2023-10-13	21:05	66,005012	-83,149670	Box Core	Recovery	306	311	11,4	1,7	0,91	31,45	1019,07	102	
4	FoxSIPP-08	Full	2023-10-13	21:21	66,007172	-83,149861	Agassiz Trawl	Deployment	304	317	12,2	1,4	0,88	31,46	1019,22	102	
4	FoxSIPP-08	Full	2023-10-13	21:29	66,005218	-83,142425	Agassiz Trawl	Bottom	305				0,91	31,46			
4	FoxSIPP-08	Full	2023-10-13	21:41	66,002812	-83,129144	Agassiz Trawl	Recovery	296	302	11,8	1,5	0,89	31,45	1019,11	102	
4	FoxSIPP-08	Full	2023-10-13	22:09	66,005588	-83,151577	Beam Trawl	Deployment	306	308	11	6,5	0,86	31,47	1019,04	101	
4	FoxSIPP-08	Full	2023-10-13	22:25	66,002566	-83,131185	Beam Trawl	Bottom	297	297	12,8	1,4	0,87	31,47	1019,4	102	
4	FoxSIPP-08	Full	2023-10-13	22:45	66,003077	-83,101936	Beam Trawl	Recovery	252	298	13,9	1,4	0,87	31,45	1019,44	102	
4	FoxSIPP-08	Full	2023-10-13	23:22	65,990671	-83,074963	MVP	Deployment	196	343	2,3	2,3	0,90	31,41	1019,95	102	
4			2023-10-14	3:28	65,536234	-82,588720	MVP	Recovery	379	329	15,6	-0,1	0,46	32,29	1020,92	102	
4	FoxSIPP-09	Nutrient	2023-10-14	3:55	65,526355	-82,574222	CTD Rosette	Deployment	379	338	21,1	0,2	0,45	32,31	1020,6	102	
4	FoxSIPP-09	Nutrient	2023-10-14	4:02	65,526320	-82,574718	CTD Rosette	Bottom	378								
4	FoxSIPP-09	Nutrient	2023-10-14	4:46	65,525735	-82,571054	CTD Rosette	Recovery	380	334	18,3	0,1			1020,85	102	
4	FoxSIPP-09	Nutrient	2023-10-14	5:04	65,526709	-82,574403	Box Core	Deployment	380	328	24,2	0,1	0,46	32,30	1020,33	102	
4	FoxSIPP-09	Nutrient	2023-10-14	5:13	65,526562	-82,574399	Box Core	Bottom	379	332	19,8	0	0,57	32,30	1020,73	102	
4	FoxSIPP-09	Nutrient	2023-10-14	5:23	65,526604	-82,574259	Box Core	Recovery	380	320	23	0	0,59	32,29	1020,46	102	
4	FoxSIPP-M	Full	2023-10-14	9:35	65,134796	-81,334188	CTD Rosette	Deployment	442	283	4,4	1	0,76	32,13	1021,86	101	
4	FoxSIPP-M	Full	2023-10-14	9:43	65,133932	-81,333559	CTD Rosette	Bottom	443	340	6,9	3,2	0,82	32,13	1022,11	101	
4	FoxSIPP-M	Full	2023-10-14	10:29	65,125822	-81,325938	CTD Rosette	Recovery	445	337	7,8	2,8	0,74	32,14	1022,29	101	
4	FoxSIPP-M	Full	2023-10-14	10:53	65,139484	-81,341424	Bongo Net	Deployment	430	330	10,7	0	0,87	32,10	1022,15	101	
4	FoxSIPP-M	Full	2023-10-14	10:56	65,138948	-81,341315	Bongo Net	Bottom	430	337	10,7	-0,1	0,90	32,10	1022,15	101	
4	FoxSIPP-M	Full	2023-10-14	10:59	65,138329	-81,340742	Bongo Net	Recovery	431	334	11,6	0	0,89	32,10	1022,17	101	
4	FoxSIPP-M	Full	2023-10-14	11:18	65,137012	-81,338960	Tucker Net	Deployment	436	308	9,1	0,9	0,87	32,10	1022,46	101	
4	FoxSIPP-M	Full	2023-10-14	11:21	65,135217	-81,337095	Tucker Net	Bottom	442	311	7,2	-0,1	0,86	32,10	1022,47	102	
4	FoxSIPP-M	Full	2023-10-14	11:33	65,128081	-81,331553	Tucker Net	Recovery	445	19	4	0,8	0,85	32,11	1022,61	101	
4	FoxSIPP-M	Full	2023-10-14	12:21	65,139549	-81,340568	Monster Net	Deployment	430	308	8,8	-0,1	0,79	32,17	1022,49	101	
4	FoxSIPP-M	Full	2023-10-14	12:32	65,138461	-81,337758	Monster Net	Bottom	433	297	9,3	0	0,80	32,17	1022,51	101	
4	FoxSIPP-M	Full	2023-10-14	12:47	65,137515	-81,335521	Monster Net	Recovery	435	298	10,3	0	0,81	32,17	1022,63	102	
4	FoxSIPP-M	Full	2023-10-14	13:06	65,139743	-81,339899	Box Core	Deployment	431	307	10,5	0	0,78	32,18	1022,38	102	
4	FoxSIPP-M	Full	2023-10-14	13:14	65,139449	-81,340887	Box Core	Bottom	431	297	8,6	-0,2	0,82	32,18	1022,46	102	
4	FoxSIPP-M	Full	2023-10-14	13:22	65,139602	-81,340475	Box Core	Recovery	431	297	9,1	-0,1	0,77	32,17	1022,49	102	
4	FoxSIPP-M	Full	2023-10-14	13:36	65,139774	-81,339497	Box Core	Deployment	431	293	9,3	0	0,79	32,17	1022,36	101	
4	FoxSIPP-M	Full	2023-10-14	13:44	65,139690	-81,339083	Box Core	Bottom	431	295	8,4	-0,1	0,77	32,17	1022,23	101	
4	FoxSIPP-M	Full	2023-10-14	13:53	65,139672	-81,338929	Box Core	Recovery	432	294	8,8	0	0,78	32,18	1022,29	102	
4	FoxSIPP-M	Full	2023-10-14	14:10	65,142246	-81,348044	Agassiz Trawl	Deployment	431	136	4,4	0,6	0,77	32,17	1022,07	101	
4	FoxSIPP-M	Full	2023-10-14	14:24	65,140114	-81,336820	Agassiz Trawl	Bottom	432	294	9,9	0	0,77	32,18	1022,1	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	FoxSIPP-M	Full	2023-10-14	14:35	65,138707	-81,325933	Agassiz Trawl	Recovery	430	286	7,2	-0,1	0,76	32,18	1022,04	102	
4	FoxSIPP-M	Full	2023-10-14	14:59	65,137547	-81,333322	IKMT	Deployment	434	290	10,3	0	0,77	32,18	1021,82	102	
4	FoxSIPP-M	Full	2023-10-14	15:14	65,144787	-81,328756	IKMT	Bottom	423	291	9,5	0	0,75	32,18	1021,8	102	
4	FoxSIPP-M	Full	2023-10-14	15:47	65,142371	-81,361596	IKMT	Recovery	433	290	6,1	0,6	0,77	32,18	1021,54	102	
4	FoxSIPP-10	Nutrient	2023-10-14	18:47	64,790876	-80,702587	CTD Rosette	Deployment	401	213	8,8	0,4	1,10	32,02	1021,25	102	
4	FoxSIPP-10	Nutrient	2023-10-14	18:54	64,791360	-80,704552	CTD Rosette	Bottom	401	196	6,3	0,4	1,29	32,02	1021,27	102	
4	FoxSIPP-10	Nutrient	2023-10-14	19:36	64,794102	-80,713296	CTD Rosette	Recovery	400	198	7,4	0,4	1,15	31,97	1021,26	102	
4	FoxSIPP-10	Nutrient	2023-10-14	20:00	64,790317	-80,697718	Box Core	Deployment	401								
4	FoxSIPP-10	Nutrient	2023-10-14	20:08	64,790481	-80,698577	Box Core	Bottom	400				0,96	32,12			
4	FoxSIPP-10	Nutrient	2023-10-14	20:16	64,789763	-80,698914	Box Core	Recovery	400	183	11,6	0,7	1,11	31,98	1020,86	102	
4	350	Nutrient	2023-10-14	22:07	64,498444	-80,495695	CTD Rosette	Deployment	385	204	15	0,8	0,99	32,07	1020,35	102	
4	350	Nutrient	2023-10-14	22:14	64,497798	-80,494698	CTD Rosette	Bottom	385	216	16,8	1	0,98	32,07	1020,2	102	
4	350	Nutrient	2023-10-14	22:32	64,494609	-80,489523	CTD Rosette	Recovery	385	215	16	1,1	0,98	32,07	1020,1	102	
4	FoxSIPP-11	Nutrient	2023-10-15	0:43	64,260554	-79,789345	CTD Rosette	Deployment	299	202	15,8	1	1,36	31,92	1019,45	102	
4	FoxSIPP-11	Nutrient	2023-10-15	0:49	64,260853	-79,789999	CTD Rosette	Bottom	300	204	16,4	1,2	1,33	31,93	1019,37	102	
4	FoxSIPP-11	Nutrient	2023-10-15	1:23	64,261241	-79,786090	CTD Rosette	Recovery	301	229	20,2	1,1	1,33	31,90	1018,83	102	
4	FoxSIPP-11	Nutrient	2023-10-15	1:31	64,261233	-79,787790	Bongo Net	Deployment	301	223	18,5	1	1,33	31,90	1018,64	102	
4	FoxSIPP-11	Nutrient	2023-10-15	1:33	64,261534	-79,788500	Bongo Net	Bottom	301	226	20	1,1	1,37	31,90	1018,64	102	
4	FoxSIPP-11	Nutrient	2023-10-15	1:35	64,261602	-79,789300	Bongo Net	Recovery	301	222	19,6	1,2	1,34	31,90	1018,6	102	
4	349	Full	2023-10-15	5:26	64,688143	-78,590697	CTD Rosette	Deployment	129	251	10,9	0,7	0,40	32,51	1016,29	103	
4	349	Full	2023-10-15	5:29	64,689357	-78,591618	CTD Rosette	Bottom	127	254	11,6	0,8	0,30	32,51	1016,22	103	
4	349	Full	2023-10-15	5:49	64,694211	-78,596207	CTD Rosette	Recovery	119	258	9,3	0,7	0,30	32,51	1016,2	103	
4	349	Full	2023-10-15	6:03	64,684548	-78,587039	Bongo Net	Deployment	138				0,29	32,51			
4	349	Full	2023-10-15	6:05	64,684801	-78,587307	Bongo Net	Bottom	138	268	9,1	0,8	0,28	32,52	1016,22	103	
4	349	Full	2023-10-15	6:08	64,685409	-78,587498	Bongo Net	Recovery	137	272	8,4	0,9	0,27	32,52	1016,17	103	
4	349	Full	2023-10-15	6:14	64,681421	-78,586027	Tucker Net	Deployment	116	257	6,3	0,5	0,28	32,51	1016,15	103	
4	349	Full	2023-10-15	6:22	64,686197	-78,587878	Tucker Net	Bottom	140	261	9,5	0,6	0,28	32,52	1016,07	103	
4	349	Full	2023-10-15	6:28	64,688106	-78,598712	Tucker Net	Recovery	129	250	10,1	0,7	0,27	32,52	1015,92	103	
4	349	Full	2023-10-15	6:45	64,682231	-78,586403	Monster Net	Deployment	117	254	7,6	0,8	0,27	32,52	1015,94	103	
4	349	Full	2023-10-15	6:48	64,682428	-78,586359	Monster Net	Bottom	117	246	7,6	0,8	0,27	32,52	1015,96	103	
4	349	Full	2023-10-15	6:53	64,682645	-78,586738	Monster Net	Recovery	120	244	8	0,7	0,29	32,52	1016,01	103	
4	349	Full	2023-10-15	7:11	64,684827	-78,584224	Box Core	Deployment	134	247	6,7	0,8	0,33	32,52	1016,05	103	
4	349	Full	2023-10-15	7:14	64,684660	-78,583967	Box Core	Bottom	135	246	5,9	0,7	0,46	32,52	1016,05	103	
4	349	Full	2023-10-15	7:18	64,684347	-78,583801	Box Core	Recovery	135	238	5,9	0,6	0,28	32,52	1016,13	103	
4	349	Full	2023-10-15	7:34	64,683974	-78,583136	Agassiz Trawl	Deployment	134	262	5,5	0,4	0,28	32,52	1016,13	103	
4	349	Full	2023-10-15	7:39	64,685552	-78,586788	Agassiz Trawl	Bottom	135	259	7,2	0,6	0,28	32,52	1016,16	103	
4	349	Full	2023-10-15	7:45	64,683789	-78,593366	Agassiz Trawl	Recovery	143	247	6,9	0,7	0,28	32,52	1016,16	103	
4	15H	Nutrient	2023-10-15	13:12	63,817641	-79,988726	CTD Rosette	Deployment	214	283	7,6	0,9	0,67	31,79	1016,69	103	
4	15H	Nutrient	2023-10-15	13:17	63,816998	-79,989350	CTD Rosette	Bottom	215	283	7,6	1	0,67	31,79	1016,66	103	
4	15H	Nutrient	2023-10-15	13:51	63,815348	-79,994517	CTD Rosette	Recovery	213	267	7	0,9	0,65	31,82	1016,7	103	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4			2023-10-15	14:03	63,818963	-79,987799	Bongo Net	Deployment	217	271	5,7	1,4	0,64	31,86	1016,66	103	
4			2023-10-15	14:06	63,818667	-79,987498	Bongo Net	Bottom	217	293	7,6	1,6	0,64	31,86	1016,62	103	
4			2023-10-15	14:10	63,818301	-79,987311	Bongo Net	Recovery	217	288	6,3	1,8	0,64	31,86	1016,6	103	
4	15G	CTD	2023-10-15	15:25	63,869167	-79,815214	CTD Rosette	Deployment	298	295	8,9	1,1	1,06	32,11	1016,18	103	
4	15G	CTD	2023-10-15	15:32	63,869984	-79,816710	CTD Rosette	Bottom	297	305	7,8	1	1,05	32,11	1016,17	103	
4	15G	CTD	2023-10-15	15:43	63,871769	-79,819371	CTD Rosette	Recovery	300	303	7,8	1	1,06	32,11	1016,1	104	
4	15F	Nutrient	2023-10-15	16:44	63,940836	-79,566938	CTD Rosette	Deployment	317				0,80	31,94			
4	15F	Nutrient	2023-10-15	16:51	63,942395	-79,570668	CTD Rosette	Bottom	318	300	7	0,7	0,82	31,94	1015,99	104	
4	15F	Nutrient	2023-10-15	17:29	63,954897	-79,589571	CTD Rosette	Recovery	319	316	10,1	0,9	0,79	31,91	1015,9	104	
4	15E	Full	2023-10-15	18:41	64,032040	-79,216378	CTD Rosette	Deployment	312	355	7,6	0,9	1,63	31,80	1015,95	104	
4	15E	Full	2023-10-15	18:47	64,032567	-79,216850	CTD Rosette	Bottom	312	7	8,8	1,2	1,63	31,78	1015,93	104	
4	15E	Full	2023-10-15	19:34	64,032807	-79,222024	CTD Rosette	Recovery	311	18	2,9	1,8	1,66	31,75	1016,23	104	
4	15E	Full	2023-10-15	19:43	64,032353	-79,222174	Bongo Net	Deployment	310	202	0,6	1,5	1,67	31,75	1016,23	104	
4	15E	Full	2023-10-15	19:47	64,032176	-79,222123	Bongo Net	Bottom	309	230	0,8	1,5	1,67	31,75	1016,25	104	
4	15E	Full	2023-10-15	19:51	64,031953	-79,222066	Bongo Net	Recovery	309	308	0,4	1,7	1,67	31,75	1016,29	104	
4	15E	Full	2023-10-15	19:58	64,032353	-79,225696	Tucker Net	Deployment	311	33	2,1	1,8	1,66	31,75	1016,29	104	
4	15E	Full	2023-10-15	20:07	64,030234	-79,235376	Tucker Net	Bottom	311	42	3,4	1,5	1,65	31,76	1016,32	104	
4	15E	Full	2023-10-15	20:17	64,025017	-79,233136	Tucker Net	Recovery	310	41	5,3	1	1,69	31,74	1016,28	104	
4	15E	Full	2023-10-15	20:36	64,029889	-79,212915	Monster Net	Deployment	307	45	6,7	1,1	1,65	31,76	1016,2	104	
4	15E	Full	2023-10-15	20:44	64,029275	-79,209956	Monster Net	Bottom	307	42	6,9	1,1	1,69	31,75	1016,21	104	
4	15E	Full	2023-10-15	20:54	64,027977	-79,204588	Monster Net	Recovery	309	63	5,3	1,2	1,71	31,75	1016,15	104	
4	15E	Full	2023-10-15	21:06	64,028709	-79,206428	Agassiz Trawl	Deployment	308	30	1,3	1,7	1,65	31,76	1016,21	104	
4	15E	Full	2023-10-15	21:20	64,024358	-79,214804	Agassiz Trawl	Bottom	310	70	5,3	1	1,63	31,78	1016,24	104	
4	15E	Full	2023-10-15	21:35	64,017520	-79,215654	Agassiz Trawl	Recovery	310	69	5,3	0,9	1,67	31,75	1016,06	104	
4	15E	Full	2023-10-15	22:01	64,029668	-79,213654	Beam Trawl	Deployment	308	46	0,6	1,6	1,66	31,75	1016,33	104	
4	15E	Full	2023-10-15	22:18	64,021530	-79,218063	Beam Trawl	Bottom	311	90	4,8	0,9			1016,45	104	
4	15E	Full	2023-10-15	22:37	64,009849	-79,210630	Beam Trawl	Recovery	306	90	5,9	1			1016,46	104	
4	15D	Nutrient	2023-10-16	0:13	64,121749	-78,864449	CTD Rosette	Deployment	238	126	2,9	1,2	1,36	31,93	1016,71	104	
4	15D	Nutrient	2023-10-16	0:18	64,121144	-78,863147	CTD Rosette	Bottom	239	131	4,2	1	1,42	31,93	1016,64	104	
4	15D	Nutrient	2023-10-16	0:55	64,118054	-78,856992	CTD Rosette	Recovery	240	83	3,6	1,4	1,37	31,93	1016,31	104	
4	15C	Nutrient	2023-10-16	2:19	64,213763	-78,516270	CTD Rosette	Deployment	269	110	7	1,3	1,24	31,93	1015,85	103	
4	15C	Nutrient	2023-10-16	2:24	64,213744	-78,518714	CTD Rosette	Bottom	269	94	7,2	1,1			1015,84	103	
4	15C	Nutrient	2023-10-16	3:01	64,217505	-78,541416	CTD Rosette	Recovery	271				1,24	31,94			
4	15C	Nutrient	2023-10-16	3:16	64,216489	-78,528057	Bongo Net	Deployment	271	120	9,1	0,1	1,23	31,93	1015,45	103	
4	15C	Nutrient	2023-10-16	3:18	64,216485	-78,529617	Bongo Net	Bottom	270	117	8,6	0	1,24	31,93	1015,4	103	
4	15C	Nutrient	2023-10-16	3:21	64,216559	-78,531895	Bongo Net	Recovery	269	117	8,4	-0,1	1,27	31,94	1015,39	103	
4	15B	CTD	2023-10-16	4:29	64,283577	-78,264207	CTD Rosette	Deployment	209	135	9,1	-0,7	0,35	32,57	1014,65	103	
4	15B	CTD	2023-10-16	4:33	64,284923	-78,271075	CTD Rosette	Bottom	209	138	8,2	-0,6	0,41	32,57	1014,66	103	
4	15B	CTD	2023-10-16	4:40	64,287726	-78,280146	CTD Rosette	Recovery	207				0,35	32,57			
4	15A	CTD	2023-10-16	5:34	64,326583	-78,076423	CTD Rosette	Deployment	127	127	8,9	-1,2	0,37	32,57	1014,7	103	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	15A	CTD	2023-10-16	5:37	64,327268	-78,079652	CTD Rosette	Bottom	124	134	9,5	-1	0,39	32,58	1014,66	103	
4	15A	CTD	2023-10-16	5:40	64,328109	-78,083291	CTD Rosette	Recovery	123				0,35	32,58			
4	15A	CTD	2023-10-16	5:56	64,326861	-78,073283	CTD Rosette	Deployment	121	114	8,9	-1,2	0,38	32,58	1014,37	103	
4	15A	CTD	2023-10-16	5:59	64,327884	-78,076979	CTD Rosette	Bottom	121	127	8,6	-1,1	0,39	32,58	1014,42	103	
4	15A	CTD	2023-10-16	6:23	64,335087	-78,105300	CTD Rosette	Recovery	111	105	11	-1,2	0,38	32,58	1014,04	103	
4	KCD-01	Contaminants	2023-10-16	11:49	64,225532	-76,412554	CTD Rosette	Deployment	69	139	2,9	-1,5	1,33	32,36	1013,02	102	
4	KCD-01	Contaminants	2023-10-16	11:51	64,225790	-76,412730	CTD Rosette	Bottom	67	141	1,9	-1,5	1,33	32,36	1012,98	102	
4	KCD-01	Contaminants	2023-10-16	11:55	64,226101	-76,413715	CTD Rosette	Recovery	62	117	5,7	-1,5	1,34	32,36	1012,85	102	
4	HS22-001	Nutrient	2023-10-16	15:27	64,196526	-75,613972	CTD Rosette	Deployment	92	145	2,1	-1	1,49	32,31	1010,41	102	
4	HS22-001	Nutrient	2023-10-16	15:29	64,196584	-75,615595	CTD Rosette	Bottom	88	169	1,9	-0,9			1010,41	102	
4	HS22-001	Nutrient	2023-10-16	15:45	64,197086	-75,624518	CTD Rosette	Recovery	109	228	1,7	-0,7	1,49	32,31	1010,2	102	
4			2023-10-16	16:29	64,196993	-75,624274	Box Core	Deployment	109	147	2,7	-1,1			1009,89	102	
4			2023-10-16	16:32	64,197001	-75,624998	Box Core	Bottom	110	134	3	-1	1,51	32,29	1009,86	102	
4			2023-10-16	16:37	64,197112	-75,625538	Box Core	Recovery	111	160	4,2	-1	1,51	32,29	1009,84	102	
4			2023-10-16	17:02	64,182936	-75,636134	MVP	Deployment	93				1,50	32,30			
4			2023-10-16	20:23	63,853991	-75,122631	MVP	Recovery	135	154	10,3	0,4	1,48	32,42	1008,71	104	
4	HS22-003	Full	2023-10-16	20:48	63,852488	-75,107613	CTD Rosette	Deployment	150	148	8,4	0,2	1,49	32,42	1008,46	104	
4	HS22-003	Full	2023-10-16	20:51	63,852822	-75,106034	CTD Rosette	Bottom	153	149	8	0,3	1,48	32,42	1008,45	104	
4	HS22-003	Full	2023-10-16	21:18	63,851345	-75,093249	CTD Rosette	Recovery	166	146	9,9	0,5	1,40	32,44	1008,21	103	
4	HS22-003	Full	2023-10-16	21:35	63,848580	-75,113486	Bongo Net	Deployment	146	139	9,3	0,5	1,46	32,42	1008,11	104	
4	HS22-003	Full	2023-10-16	21:38	63,848246	-75,112399	Bongo Net	Bottom	146	146	11	0,6	1,46	32,42	1008,09	104	
4	HS22-003	Full	2023-10-16	21:41	63,848050	-75,110340	Bongo Net	Recovery	148	149	11,4	0,7	1,44	32,43	1008,08	104	
4	HS22-003	Full	2023-10-16	21:50	63,849563	-75,102096	Tucker Net	Deployment	159	154	8,6	1,4	1,47	32,43	1007,97	105	
4	HS22-003	Full	2023-10-16	22:01	63,854357	-75,105916	Tucker Net	Bottom	156	145	9,7	0,4	1,49	32,42	1007,76	104	
4	HS22-003	Full	2023-10-16	22:11	63,853185	-75,117592	Tucker Net	Recovery	139	145	10,9	0,5	1,28	32,46	1007,7	104	
4	HS22-003	Full	2023-10-16	22:28	63,849247	-75,111163	Monster Net	Deployment	146	149	9,9	0,3	1,27	32,45	1007,52	104	
4	HS22-003	Full	2023-10-16	22:32	63,849364	-75,108029	Monster Net	Bottom	151	357	1	0,8	1,27	32,45	1007,47	104	
4	HS22-003	Full	2023-10-16	22:37	63,849560	-75,105002	Monster Net	Recovery	156	332	0,4	0,8	1,27	32,46	1007,39	104	
4	HS22-003	Full	2023-10-16	22:51	63,851856	-75,093927	Agassiz Trawl	Deployment	166	220	1,9	0,7	1,24	32,46	1007,29	104	
4	HS22-003	Full	2023-10-16	22:55	63,854367	-75,090759	Agassiz Trawl	Bottom	171	156	8,6	0,6	1,21	32,47	1007,18	104	
4	HS22-003	Full	2023-10-16	23:03	63,855769	-75,098773	Agassiz Trawl	Recovery	165	155	10,9	0,5	1,29	32,45	1007,04	104	
4	HS22-003	Full	2023-10-16	23:15	63,851693	-75,093485	Box Core	Deployment	166	147	10,9	0,3	1,21	32,47	1006,8	104	
4	HS22-003	Full	2023-10-16	23:20	63,852013	-75,092274	Box Core	Bottom	168	145	10,7	0,4	1,23	32,47	1006,72	104	
4	HS22-003	Full	2023-10-16	23:23	63,852351	-75,091001	Box Core	Recovery	171	144	8,9	0,6	1,19	32,47	1006,78	104	
4	HS22-003		2023-10-16	23:47	63,843581	-75,088585	MVP	Deployment	163	178	13,5	1,2	1,15	32,47	1006,51	104	
4	HS22-005	Basic	2023-10-17	3:10	63,420849	-74,743057	MVP	Recovery	301	211	10,9	1,7			1004,82	104	
4	HS22-005	Basic	2023-10-17	3:42	63,412728	-74,742554	CTD Rosette	Deployment	307	220	6,1	2,4	1,81	32,25	1004,62	104	
4	HS22-005	Basic	2023-10-17	3:47	63,413014	-74,745744	CTD Rosette	Bottom	306	263	5	1,8			1004,54	104	
4	HS22-005	Basic	2023-10-17	4:22	63,416077	-74,766159	CTD Rosette	Recovery	304	268	3,6	2,3	1,77	32,23	1004,33	104	
4	HS22-005	Basic	2023-10-17	4:35	63,412246	-74,740379	Bongo Net	Deployment	305	247	8,4	1,2	1,78	32,19	1004,28	104	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	HS22-005	Basic	2023-10-17	4:37	63,412251	-74,741025	Bongo Net	Bottom	306	246	6,9	1,2	1,78	32,19	1004,32	104	
4	HS22-005	Basic	2023-10-17	4:39	63,412185	-74,742847	Bongo Net	Recovery	306	243	6,9	1,2	1,78	32,19	1004,26	104	
4	SAL-01		2023-10-17	14:33	62,238414	-75,630731	CTD Rosette	Deployment	121	236	8,4	4,4	3,43	29,49	1002,14	103	
4	SAL-01		2023-10-17	14:36	62,238707	-75,630211	CTD Rosette	Bottom	121	239	10,7	3,7	3,48	29,45	1002,09	103	
4	SAL-01		2023-10-17	14:58	62,240534	-75,628658	CTD Rosette	Recovery	121	235	10,9	5,9	3,45	29,36	1001,93	104	
4			2023-10-17	15:09	62,240307	-75,626676	Bongo Net	Deployment	122	235	10,9	4,6	3,41	28,96	1001,96	104	
4			2023-10-17	15:12	62,240461	-75,625882	Bongo Net	Bottom	122	240	12,8	4,3	3,44	29,16	1001,94	103	
4			2023-10-17	15:16	62,240746	-75,625365	Bongo Net	Recovery	123	234	11,4	4,2	3,46	29,26	1001,96	103	
4			2023-10-17	15:27	62,238023	-75,631535	Box Core	Deployment	121	229	8,6	4,1	3,41	28,90	1001,87	103	
4			2023-10-17	15:30	62,238086	-75,631821	Box Core	Bottom	120	233	8,4	4,1	3,41	28,89	1001,82	103	
4			2023-10-17	15:34	62,238289	-75,631927	Box Core	Recovery	120	231	8,2	4	3,42	28,92	1001,79	103	
4	HS22-006	Nutrient	2023-10-17	22:00	63,045496	-74,310580	CTD Rosette	Deployment	412				1,78	32,19			
4	HS22-006	Nutrient	2023-10-17	22:07	63,044675	-74,304674	CTD Rosette	Bottom	412	106	3	2,2	1,78	32,23	1001,12	103	
4	HS22-006	Nutrient	2023-10-17	22:49	63,040001	-74,271637	CTD Rosette	Recovery	414	132	5,3	1	1,79	32,19	1000,99	103	
4	HS22-006	Nutrient	2023-10-17	23:08	63,048546	-74,307074	Bongo Net	Deployment	416	119	5,5	0,8	1,78	32,17	1000,75	104	
4	HS22-006	Nutrient	2023-10-17	23:10	63,048591	-74,306054	Bongo Net	Bottom	416	120	5,1	0,8	1,77	32,17	1000,75	104	
4	HS22-006	Nutrient	2023-10-17	23:13	63,048649	-74,304430	Bongo Net	Recovery	416	116	5	0,9	1,78	32,17	1000,75	103	
4	HS22-006	Nutrient	2023-10-17	23:21	63,049133	-74,316280	Box Core	Deployment	415	136	3,8	0,9	1,79	32,16	1000,74	103	
4	HS22-006	Nutrient	2023-10-17	23:22	63,049117	-74,317062	Box Core	Bottom	415	129	4,8	0,9	1,79	32,16	1000,71	103	
4	HS22-006	Nutrient	2023-10-17	23:39	63,048925	-74,311487	Box Core	Recovery	416	121	5,9	0,9	1,79	32,16	1000,63	104	
4	14G	CTD	2023-10-18	5:59	62,183012	-72,415109	CTD Rosette	Deployment	168	267	10,9	5,5	2,70	30,81	999,16	103	
4	14G	CTD	2023-10-18	6:02	62,183676	-72,415268	CTD Rosette	Bottom	164	265	12	5,5	2,72	30,77	999,12	103	
4	14G	CTD	2023-10-18	6:08	62,184594	-72,416136	CTD Rosette	Recovery	166	281	13,3	5,6	2,68	30,81	998,91	103	
4	14F	Nutrient	2023-10-18	6:49	62,220457	-72,246291	CTD Rosette	Deployment	238	214	7	4,6			999,4	103	
4	14F	Nutrient	2023-10-18	6:54	62,220482	-72,245369	CTD Rosette	Bottom	240	247	9,1	4,8	2,63	30,76	999,38	103	
4	14F	Nutrient	2023-10-18	7:29	62,220724	-72,234858	CTD Rosette	Recovery	238	245	8,9	5			999,5	103	
4			2023-10-18	7:40	62,219508	-72,250032	Bongo Net	Deployment	237	274	12,9	5,1	2,68	30,75	999,27	103	
4			2023-10-18	7:42	62,219239	-72,249380	Bongo Net	Bottom	235	261	10,9	4,9			999,21	103	
4			2023-10-18	7:45	62,219024	-72,248157	Bongo Net	Recovery	236	265	13,3	4,8	2,68	30,75	999,26	103	
4	14E	Basic	2023-10-18	9:05	62,275619	-71,987195	CTD Rosette	Deployment	335	258	7,4	4,8	2,50	30,97	999,41	103	
4	14E	Basic	2023-10-18	9:11	62,274162	-71,984695	CTD Rosette	Bottom	334	236	5	4,5			999,37	103	
4	14E	Basic	2023-10-18	9:51	62,263364	-71,965416	CTD Rosette	Recovery	333	212	4,4	4,8			999,13	103	
4	14E	Basic	2023-10-18	10:10	62,275560	-71,980751	Bongo Net	Deployment	337	207	4,2	4,7	2,64	30,85	999,1	103	
4	14E	Basic	2023-10-18	10:13	62,274884	-71,978867	Bongo Net	Bottom	337	233	4,2	4,8			999,07	103	
4	14E	Basic	2023-10-18	10:17	62,274072	-71,977169	Bongo Net	Recovery	337	249	4,6	5	2,64	30,85	999,03	103	
4	14E	Basic	2023-10-18	10:27	62,270517	-71,966128	Tucker Net	Deployment	334	179	2,3	5,1	2,63	30,85	999,07	103	
4	14E	Basic	2023-10-18	10:41	62,271301	-71,942855	Tucker Net	Bottom	342	265	1,3	4,7	2,62	30,85	998,93	103	
4	14E	Basic	2023-10-18	10:53	62,275178	-71,929966	Tucker Net	Recovery	339	215	2,3	4,5	2,55	30,93	998,87	103	
4	14E	Basic	2023-10-18	11:18	62,279805	-71,986762	Monster Net	Deployment	336	163	5,1	4,3	2,58	30,93	998,65	103	
4	14E	Basic	2023-10-18	11:27	62,277716	-71,982494	Monster Net	Bottom	337	169	4,2	3,8	2,62	30,90	998,55	103	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	14E	Basic	2023-10-18	11:38	62,275764	-71,978079	Monster Net	Recovery	337	168	5,1	4,3	2,64	30,86	998,48	103	
4	14E	Basic	2023-10-18	12:37	62,278430	-71,987373	Box Core	Deployment	342	167	7,2	4,4	2,65	30,85	998,06	103	
4	14E	Basic	2023-10-18	12:44	62,277962	-71,986416	Box Core	Bottom	341	169	5	4,5	2,65	30,85	998,04	103	
4	14E	Basic	2023-10-18	12:51	62,277791	-71,985985	Box Core	Recovery	341	164	6,1	4,5	2,64	30,86	998,01	103	
4	14E	Basic	2023-10-18	13:05	62,278728	-71,983793	Agassiz Trawl	Deployment	342	115	1,1	5,2	2,64	30,86	997,88	103	
4	14E	Basic	2023-10-18	13:17	62,279722	-71,989661	Agassiz Trawl	Bottom	342	162	5,5	4,7	2,62	30,88	997,8	103	
4	14E	Basic	2023-10-18	13:30	62,274991	-71,986710	Agassiz Trawl	Recovery	341	178	5	4,8	2,65	30,86	997,7	103	
4	14E	Basic	2023-10-18	13:45	62,277968	-71,978971	Beam Trawl	Deployment	342	194	4,4	4,6	2,62	30,88	997,62	103	
4	14E	Basic	2023-10-18	14:01	62,286196	-71,982734	Beam Trawl	Bottom	343	212	6,9	4,6	2,62	30,88	997,45	103	
4	14E	Basic	2023-10-18	14:27	62,291112	-72,007533	Beam Trawl	Recovery	345	229	7,8	4,3	2,55	30,95	997,17	103	
4	14D	Nutrient	2023-10-18	16:14	62,355998	-71,656229	CTD Rosette	Deployment	346	210	6,7	4,4	1,86	31,69	996,92	103	
4	14D	Nutrient	2023-10-18	16:21	62,356529	-71,660106	CTD Rosette	Bottom	348	228	5	4,8	2,01	31,62	996,91	103	
4	14D	Nutrient	2023-10-18	16:59	62,360270	-71,679928	CTD Rosette	Recovery	346	242	0,2	5	1,97	31,60	996,87	103	
4	14C	CTD	2023-10-18	18:34	62,432636	-71,307199	CTD Rosette	Deployment	330	119	9,3	1,8	2,01	31,76	997,12	103	
4	14C	CTD	2023-10-18	18:41	62,432871	-71,309298	CTD Rosette	Bottom	331	118	8,9	1,9	1,98	31,81	997,23	103	
4	14C	CTD	2023-10-18	18:52	62,433736	-71,312890	CTD Rosette	Recovery	329	126	8	2	2,00	31,79	997,27	103	
4	14C	CTD	2023-10-18	19:01	62,435008	-71,315725	Bongo Net	Deployment	330	124	8,9	1,9	2,01	31,84	997,3	103	
4	14C	CTD	2023-10-18	19:03	62,435397	-71,316620	Bongo Net	Bottom	329	122	8,4	1,9	2,02	31,82	997,29	103	
4	14C	CTD	2023-10-18	19:07	62,435619	-71,317377	Bongo Net	Recovery	329	122	9,3	1,9	1,99	31,82	997,27	103	
4	14A	CTD	2023-10-18	20:37	62,523659	-70,867850	CTD Rosette	Deployment	339	105	16,4	0,9	2,15	31,94	997,68	104	
4	14A	CTD	2023-10-18	20:43	62,523544	-70,866045	CTD Rosette	Bottom	339	114	16,9	1,7	2,13	31,96	997,55	104	
4	14A	CTD	2023-10-18	20:54	62,521756	-70,862688	CTD Rosette	Recovery	342	115	14,5	1,3	2,10	31,99	997,61	104	
4	14A	CTD	2023-10-18	21:10	62,523520	-70,869094	Bongo Net	Deployment	339	119	13,3	1,6			997,6	104	
4	14A	CTD	2023-10-18	21:12	62,523420	-70,868455	Bongo Net	Bottom	339	114	5,3	1,5			997,64	104	
4	14A	CTD	2023-10-18	21:16	62,523176	-70,867698	Bongo Net	Recovery	339	103	12,6	1,6	2,20	31,92	997,61	104	
4	14B	Nutrient	2023-10-18	21:56	62,486523	-71,036425	CTD Rosette	Deployment	334	82	12,8	1,3	2,30	31,83	997,36	104	
4	14B	Nutrient	2023-10-18	22:02	62,485326	-71,034367	CTD Rosette	Bottom	334	103	14,3	1,4	2,24	31,88	997,41	104	
4	14B	Nutrient	2023-10-18	22:35	62,478722	-71,023246	CTD Rosette	Recovery	334	96	14,7	1,3			997,24	104	
4	HS22-007	Nutrient	2023-10-19	1:58	62,610856	-69,903101	CTD Rosette	Deployment	185	119	14,7	0,4	0,63	32,66	996,77	104	
4	HS22-007	Nutrient	2023-10-19	2:02	62,611238	-69,904167	CTD Rosette	Bottom	187	123	13,9	0,1	0,66	32,66	996,78	104	
4	HS22-007	Nutrient	2023-10-19	2:26	62,612238	-69,911835	CTD Rosette	Recovery	224	130	17,7	0,4	0,62	32,66	996,56	104	
4	HS22-007	Nutrient	2023-10-19	2:36	62,610655	-69,907420	Bongo Net	Deployment	210	138	20	0,3	0,61	32,67	996,44	104	
4	HS22-007	Nutrient	2023-10-19	2:38	62,610919	-69,907692	Bongo Net	Bottom	211	135	20,6	0,3	0,61	32,67	996,41	104	
4	HS22-007	Nutrient	2023-10-19	2:40	62,610969	-69,908555	Bongo Net	Recovery	217	137	21,7	0,4	0,61	32,67	996,3	104	
4	HS22-007	Nutrient	2023-10-19	2:52	62,606260	-69,904715	MVP	Deployment	208	134	24,8	0,3	0,60	32,67	996,3	104	
4	HS22-009	Nutrient	2023-10-19	7:03	62,150352	-69,363943	CTD Rosette	Deployment	234	105	14,9	0,4	0,48	32,72	996,46	104	
4	HS22-009	Nutrient	2023-10-19	7:07	62,149661	-69,365112	CTD Rosette	Bottom	235	106	14,5	0,5	0,47	32,73	996,49	104	
4	HS22-009	Nutrient	2023-10-19	7:37	62,144668	-69,373407	CTD Rosette	Recovery	233	103	14,1	0,3	0,48	32,73	996,43	104	
4	HS22-009	Nutrient	2023-10-19	7:45	62,142365	-69,374803	Bongo Net	Deployment	232	110	16,8	0,5	0,48	32,73	996,51	104	
4	HS22-009	Nutrient	2023-10-19	7:47	62,141875	-69,374706	Bongo Net	Bottom	232	101	15,8	0,4	0,48	32,73	996,54	104	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	HS22-009	Nutrient	2023-10-19	7:49	62,141428	-69,374954	Bongo Net	Recovery	232	107	16,4	0,4	0,48	32,73	996,56	104	
4	HS22-011	Nutrient	2023-10-19	12:14	61,661176	-68,822219	MVP	Recovery	300	98	17,3	1,1			995,44	104	
4	HS22-011	Nutrient	2023-10-19	12:47	61,665452	-68,842396	CTD Rosette	Deployment		96	15,6	1			995,28	104	
4	HS22-011	Nutrient	2023-10-19	12:53	61,665345	-68,846030	CTD Rosette	Bottom		86	17,3	0,6			995,22	104	
4	HS22-011	Nutrient	2023-10-19	13:33	61,663961	-68,871369	CTD Rosette	Recovery	304	90	16,6	1,7			995,2	104	
4	HS22-011	Nutrient	2023-10-19	13:51	61,657426	-68,885262	MVP	Deployment	308	77	17,3	0,7			994,97	104	
4	HS22-013	Full	2023-10-19	17:49	61,276017	-68,346681	CTD Rosette	Deployment	406	89	23,4	1	0,92	32,49	993,88	105	
4	HS22-013	Full	2023-10-19	17:57	61,273791	-68,347318	CTD Rosette	Bottom	406	69	9,7	1,7	0,95	32,45	994,08	105	
4	HS22-013	Full	2023-10-19	18:38	61,266984	-68,349690	CTD Rosette	Recovery	404	93	14,3	4,2	0,74	32,63	994,22	104	
4	HS22-013	Full	2023-10-19	19:05	61,277659	-68,347878	Bongo Net	Deployment	404	93	27,2	0,6			993,94	104	
4	HS22-013	Full	2023-10-19	19:08	61,276319	-68,347583	Bongo Net	Bottom	404	84	24,2	0,5	0,73	32,66	994,09	104	
4	HS22-013	Full	2023-10-19	19:12	61,274958	-68,346929	Bongo Net	Recovery	404	86	23,6	0,5	0,72	32,68	994,04	104	
4	HS22-013	Full	2023-10-19	19:33	61,278945	-68,363899	Tucker Net	Deployment	403	83	24	0,7	0,72	32,65	993,92	104	
4	HS22-013	Full	2023-10-19	19:44	61,270142	-68,372094	Tucker Net	Bottom	398	77	18,7	0,2	0,78	32,62	994,34	104	
4	HS22-013	Full	2023-10-19	19:56	61,262261	-68,380562	Tucker Net	Recovery	400	88	20,8	0,2	0,85	32,56	994,31	104	
4	352	Nutrient	2023-10-20	11:09	61,259783	-64,818698	CTD Rosette	Deployment	265	77	11,6	-0,7	0,04	32,28	999,29	101	
4	352	Nutrient	2023-10-20	11:24	61,256498	-64,829483	CTD Rosette	Bottom	266	80	8	-0,5	0,02	32,28	999,29	101	
4	352	Nutrient	2023-10-20	11:48	61,249771	-64,861261	CTD Rosette	Recovery	274	70	7,4	0,7	0,05	32,25	999,43	101	
4	353	Nutrient	2023-10-20	13:18	61,155776	-64,796235	CTD Rosette	Deployment	434	71	10,1	-0,5	0,00	32,24	999,58	101	
4	353	Nutrient	2023-10-20	13:28	61,155144	-64,815420	CTD Rosette	Bottom	436	76	11	-0,5	0,01	32,23	999,33	101	
4	353	Nutrient	2023-10-20	14:08	61,152172	-64,900429	CTD Rosette	Recovery	326	82	10,5	-0,1	0,04	32,23	999,42	101	
4			2023-10-20	14:32	61,162179	-64,858835	Bongo Net	Deployment	316	78	10,7	-0,3	0,43	32,04	999,54	101	
4			2023-10-20	14:37	61,162305	-64,866451	Bongo Net	Bottom	321				0,49	32,05			
4			2023-10-20	14:40	61,162301	-64,871808	Bongo Net	Recovery	351	78	11,4	-0,2	0,45	32,05	999,38	101	
4	354	Basic	2023-10-20	16:13	61,002264	-64,722647	CTD Rosette	Deployment	392	75	13,3	-0,1	1,42	32,06	999,21	101	
4	354	Basic	2023-10-20	16:23	61,003776	-64,717885	CTD Rosette	Bottom	400	75	10,3	-0,4	1,54	31,94	999,48	101	
4	354	Basic	2023-10-20	17:07	61,010425	-64,692903	CTD Rosette	Recovery	504	69	11,8	-0,5	1,51	31,97	999,4	101	
4	354	Basic	2023-10-20	17:27	60,997468	-64,741342	Bongo Net	Deployment	515	70	10,3	-0,4	1,25	32,20	999,28	101	
4	354	Basic	2023-10-20	17:30	60,997905	-64,738547	Bongo Net	Bottom	518	85	11	-0,3	1,37	32,08	999,43	102	
4	354	Basic	2023-10-20	17:33	60,998518	-64,735089	Bongo Net	Recovery	522	83	10,3	-0,4	1,46	32,12	999,49	102	
4	354	Basic	2023-10-20	17:43	60,999035	-64,727078	Tucker Net	Deployment	529	80	9,5	-0,4			999,44	101	
4	354	Basic	2023-10-20	17:51	60,998204	-64,708884	Tucker Net	Bottom	537	77	15,8	0,1	1,35	32,14	999,24	102	
4	354	Basic	2023-10-20	18:00	61,003999	-64,698351	Tucker Net	Recovery	521	71	8,6	-0,1	1,21	32,16	999,6	101	
4	354	Basic	2023-10-20	18:24	60,998302	-64,739437	Monster Net	Deployment	518	71	10,3	-0,4			999,42	102	
4	354	Basic	2023-10-20	18:38	60,999208	-64,723324	Monster Net	Bottom	530	78	12,4	0,3	0,98	32,45	999,41	102	
4	354	Basic	2023-10-20	18:55	60,999974	-64,703718	Monster Net	Recovery	536	96	13,5	0	0,95	32,44	999,48	102	
4	354	Basic	2023-10-20	19:15	60,999340	-64,742573	Agassiz Trawl	Deployment	516	80	9,9	-0,2			999,81	102	
4	354	Basic	2023-10-20	19:30	61,003371	-64,717160	Agassiz Trawl	Bottom	525				0,85	32,50			
4	354	Basic	2023-10-20	19:49	60,999971	-64,699960	Agassiz Trawl	Recovery	538	295	2,3	-0,1			999,84	102	
4	354	Basic	2023-10-20	20:10	61,000574	-64,740393	IKMT	Deployment	509	76	13,9	0,1	0,99	32,39	999,66	102	

Leg	Station ID	Station Type	UTC Date	UTC time	Latitude	Longitude	Activity	Event	Depth (m)	Wind		Air (°C)	Water (°C)	Surface Salinity	Pr Baro	Hum (%)	Ice
										Dir	Speed						
4	354	Basic	2023-10-20	20:32	60,997373	-64,706944	IKMT	Bottom	535	86	16,4	0	1,13	32,28	999,48	102	
4	354	Basic	2023-10-20	21:06	60,997986	-64,675370	IKMT	Recovery	543	88	7,4	-0,1	1,18	32,26	999,76	102	
4	355	Nutrient	2023-10-20	22:22	60,851869	-64,721376	CTD Rosette	Deployment	413	65	13,1	0,4	2,08	31,60	999,72	102	
4	355	Nutrient	2023-10-20	22:29	60,852322	-64,719901	CTD Rosette	Bottom	424	85	12,8	0,7	2,08	31,61	999,64	102	
4	355	Nutrient	2023-10-20	23:11			CTD Rosette	Recovery									
4	356	Nutrient	2023-10-21	0:22	60,749056	-64,714915	CTD Rosette	Deployment	298	98	10,1	0,9	1,94	31,87	998,94	103	
4	356	Nutrient	2023-10-21	0:28	60,749854	-64,722248	CTD Rosette	Bottom	299	90	10,9	0,9	1,95	31,93	999,1	103	
4	356	Nutrient	2023-10-21	1:06	60,752802	-64,761119	CTD Rosette	Recovery	313	89	10,3	0,9	1,92	32,01	998,68	103	
4	356	Nutrient	2023-10-21	1:28	60,749625	-64,770264	Bongo Net	Deployment	307	78	8	0,5	1,85	32,09	999,05	103	
4	356	Nutrient	2023-10-21	1:30	60,749522	-64,774276	Bongo Net	Bottom	306	78	7,4	0,5	1,85	32,10	998,79	103	
4	356	Nutrient	2023-10-21	1:33	60,749183	-64,779067	Bongo Net	Recovery	304	87	6,5	0,6	1,84	32,11	998,67	103	
4	640	Nutrient	2023-10-21	16:12	58,999114	-61,904512	CTD Rosette	Deployment	141	46	1,5	2	2,46	32,13	1000,38	105	
4	640	Nutrient	2023-10-21	16:15	58,998770	-61,905104	CTD Rosette	Bottom	141	321	3,6	2,7	2,50	32,12	1000,55	105	
4	640	Nutrient	2023-10-21	16:41	58,995995	-61,908998	CTD Rosette	Recovery	141	341	1,1	3	2,48	32,12	1000,57	105	
4	640	Nutrient	2023-10-21	16:49	58,994376	-61,910421	Bongo Net	Deployment	142	36	2,1	2,6	2,50	32,12	1000,36	105	
4	640	Nutrient	2023-10-21	16:53	58,993629	-61,911077	Bongo Net	Bottom	141	17	2,7	2,4	2,49	32,12	1000,34	105	
4	640	Nutrient	2023-10-21	16:57	58,993121	-61,911690	Bongo Net	Recovery	141	358	1	3,2	2,47	32,13	1000,59	105	
4	JL-001	Contaminants	2023-10-24	21:41	48,880612	-68,167543	CTD Rosette	Deployment	335	219	17,7	9	8,77	25,94	1017,97	103	
4	JL-001	Contaminants	2023-10-24	21:48	48,880620	-68,166456	CTD Rosette	Bottom	334	220	14,7	9,1	8,74	25,93	1018,23	103	
4	JL-001	Contaminants	2023-10-24	21:57	48,880665	-68,166287	CTD Rosette	Recovery	334	216	14,3	9,1	8,80	25,88	1018,42	103	

Appendix 3 - CTD Logbook for the 2023 *Amundsen* Expedition

Leg	Cast #	Station	Start date UTC	Time UTC	Latitude (N)	Longitude (W)	Cast depth (m)	Bottom depth (m)
Leg 1								
1	001	Joey's Gully	2023-07-15	13:43:00	54.617	-56.44288	352	362
1	002	Hopedale Saddle	2023-07-16	12:07:00	56.06212	-57.42024	542	554
1	003	Hopedale Saddle	2023-07-16	22:00:00	56.05042	-57.41826	645	659
1	004	Makkovik Hanging Gardens	2023-07-17	12:15:00	55.48398	-58.94366	571	581
1	005	ISECOLD-0-200	2023-07-18	07:34:00	56.28548	-58.90746	190	199
1	006	Sentinel	2023-07-18	17:22:00	56.28126	-59.755	525	534
1	007	ISECOLD-1-200	2023-07-20	12:32:00	57.71236	-60.2018	207	216
1	008	Okak Bay	2023-07-21	02:08:00	57.53068	-62.07712	35	45
1	009	Saglek Fjord	2023-07-21	20:42:00	58.4995	-62.68576	123	133
1	010	North Arm	2023-07-22	07:32:00	58.48384	-63.21864	227	237
1	011	ISECOLD-2-200	2023-07-22	23:13:00	58.71496	-61.18432	191	200
1	012	ISECOLD-2-200	2023-07-23	01:04:00	58.71722	-61.1874	191	200
1	013	Sag Bank	2023-07-23	13:28:00	59.38312	-60.31906	418	427
1	014	Sag Bank	2023-07-23	23:55:00	59.3845	-60.31772	430	438
1	015	HiBio	2023-07-24	09:56:00	60.45068	-61.25094	549	561
1	016	Hatton Basin	2023-07-24	14:15:00	60.49854	-61.2369	634	648
1	017	HiBio	2023-07-25	17:33:00	60.46306	-61.25914	528	524
1	018	HiBio	2023-07-25	18:40:00	60.4652	-61.26284	515	525
1	019	ISECOLD-3-200	2023-07-26	01:27:00	60.44418	-62.57882	331	338
1	020	Killinek Shelf	2023-07-26	18:20:00	60.49742	-64.21688	273	280
1	021	Killinek Main	2023-07-27	12:17:00	60.90264	-64.2864	414	424
1	022	Hatton 600	2023-07-27	15:28:00	61.1248	-63.26508	602	612
1	023	Southwind 1	2023-07-30	03:27:00	66.98664	-62.53808	451	457
1	024	Southwind 2	2023-07-30	04:36:00	66.92308	-62.49156	386	396
1	025	Southwind 3	2023-07-30	07:06:00	66.8293	-62.4275	94	105
1	026	Southwind 4	2023-07-30	08:53:00	66.80568	-62.37726	154	164
1	027	Southwind 5	2023-07-30	15:11:00	66.78824	-62.369	166	176
1	028	Southwind 6	2023-07-31	00:40:00	66.75212	-62.32382	89	99
1	029	C4	2023-07-31	22:54:00	67.95222	-60.64484	1601	1611
1	030	BB1B	2023-08-01	04:49:00	67.98896	-59.3728	553	563
1	031	Disko Fan	2023-08-01	09:03:00	67.96908	-59.50744	915	927
1	032	BB1A	2023-08-01	14:17:00	67.77226	-59.06804	616	626
1	033	BB1C	2023-08-01	18:20:00	67.5874	-58.58626	596	609
1	034	BB1D	2023-08-01	23:07:00	67.37798	-57.92282	637	646
1	035	DS1	2023-08-02	13:06:00	66.25682	-58.29714	617	626
1	036	DS2	2023-08-03	12:37:00	65.33528	-58.01786	562	572
1	037	Davis Seep	2023-08-04	03:42:00	65.09686	-58.46172	515	523
1	038	DS3	2023-08-04	12:04:00	64.64976	-58.5934	603	611
1	039	HB AUV	2023-08-05	13:59:00	61.45022	-60.72798	537	544
1	040	HT2-600	2023-08-06	09:45:00	61.11328	-60.91488	578	587
1	041	Devon	2023-08-07	15:08:00	63.04082	-60.32616	795	805
1	042	Fobar	2023-08-08	14:39:00	62.4041	-66.22066	428	439
Leg 2								
2	001	test	2023-08-12	13:05:00	67.01418	-61.10048	368	376

2	002	E1	2023-08-13	00:58:00	68.2772	-65.1412	435	445
2	003	E2	2023-08-13	07:41:00	68.53752	-64.65808	492	502
2	004	E3	2023-08-13	13:57:00	68.80222	-64.13856	1329	1339
2	005	E3	2023-08-13	17:23:00	68.79462	-64.13318	495	495
2	006	E4	2023-08-14	01:29:00	69.21842	-63.34732	1846	1855
2	007	E5	2023-08-14	09:40:00	69.60386	-62.54458	1962	1971
2	008	E5	2023-08-14	15:17:00	69.59998	-62.53198	989	1972
2	009	C5	2023-08-15	05:05:00	68.1464	-59.97268	1374	1385
2	010	C5	2023-08-15	09:19:00	68.14526	-59.97394	988	1383
2	011	C4	2023-08-15	13:52:00	67.95672	-60.6068	1594	1603
2	012	C3	2023-08-15	19:43:00	67.75096	-61.2773	1556	1565
2	013	C3	2023-08-16	00:04:00	67.75208	-61.27728	988	1564
2	014	C2	2023-08-16	07:11:00	67.54416	-61.90726	384	392
2	015	C1	2023-08-16	10:30:00	67.3458	-62.5227	130	139
2	016	A1	2023-08-16	19:53:00	66.60584	-61.1935	93	103
2	017	A2	2023-08-17	01:41:00	66.67134	-60.4584	515	524
2	018	A3	2023-08-17	06:57:00	66.73014	-59.6093	860	869
2	019	A3	2023-08-17	10:20:00	66.73402	-59.60844	867	877
2	020	A4	2023-08-17	19:00:00	66.8037	-58.76614	898	908
2	021	A5	2023-08-18	00:03:00	66.87088	-57.96152	814	823
2	022	A5	2023-08-18	04:23:00	66.87318	-57.96098	817	826
2	023	A6	2023-08-18	10:03:00	66.8902	-56.92212	650	658
2	024	A7 196	2023-08-18	14:08:00	66.98498	-56.06834	117	124
2	025	A8 197	2023-08-18	20:07:00	67.04862	-55.081	57	66
2	026	A9	2023-08-18	23:00:00	67.0878	-54.19394	63	73
2	027	B1	2023-08-20	04:51:00	67.06114	-61.52354	98	107
2	028	D2	2023-08-20	20:23:00	67.86092	-63.10864	223	232
2	029	D1	2023-08-21	12:55:00	67.47236	-63.68914	614	622
2	030	D1	2023-08-21	16:50:00	67.47326	-63.68628	640	648
2	031	D1''	2023-08-21	21:22:00	67.55228	-64.08566	51	61
2	032	D1_2022	2023-08-21	23:43:00	67.39646	-63.84982	451	462
2	033	D3	2023-08-22	09:17:00	68.24068	-62.59828	1546	1556
2	034	D4	2023-08-22	18:58:00	68.6283	-61.98434	1796	1804
2	035	D5	2023-08-25	08:29:00	69.0045	-61.4081	1827	1836
2	036	BGC-Argo	2023-08-26	16:59:00	72.9078	-65.61292	988	2343
2	037	116	2023-08-27	12:45:00	76.38096	-70.53286	129	137
2	038	115	2023-08-27	14:34:00	76.3344	-71.20222	649	656
2	039	114	2023-08-27	22:19:00	76.3287	-71.78976	603	611
2	040	113	2023-08-27	23:52:00	76.31894	-72.229	539	549
2	041	112	2023-08-28	01:52:00	76.31296	-72.6776	549	559
2	042	111	2023-08-28	04:01:00	76.30312	-73.27544	560	568
2	043	110	2023-08-28	10:44:00	76.30412	-73.65228	523	533
2	044	109	2023-08-28	12:48:00	76.29188	-74.11154	445	453
2	045	108	2023-08-28	14:35:00	76.26438	-74.603	440	448
2	046	108	2023-08-28	20:32:00	76.26514	-74.61886	438	446
2	047	107	2023-08-28	22:58:00	76.28176	-74.99146	429	438
2	048	106	2023-08-29	00:37:00	76.30808	-75.36776	367	379
2	049	105	2023-08-29	01:47:00	76.31732	-75.7743	326	335
2	050	104	2023-08-29	07:10:00	76.34302	-76.16326	185	194
2	051	103	2023-08-29	08:26:00	76.3567	-76.5912	137	146

2	052	102	2023-08-29	09:54:00	76.37772	-77.0083	241	249
2	053	101	2023-08-29	12:06:00	76.38326	-77.4065	351	360
2	054	100	2023-08-29	18:18:00	76.40896	-77.96122	227	236
2	055	148	2023-08-30	03:21:00	75.35458	-73.93364	578	585
2	056	153	2023-08-30	10:29:00	74.69362	-72.7275	898	906
2	057	158	2023-08-30	20:49:00	74.05244	-72.05202	1007	1016
2	058	163	2023-08-31	06:44:00	73.20002	-71.20176	1239	1248
2	059	163	2023-08-31	12:45:00	73.19946	-71.20164	1237	1246
2	060	Bylot-23	2023-09-01	16:17:00	72.87238	-75.65236	488	499
2	061	325	2023-09-02	02:52:00	73.81682	-80.49082	666	674
2	062	324	2023-09-02	08:28:00	73.98422	-80.473	760	770
2	063	323	2023-09-02	10:57:00	74.15802	-80.46404	777	787
2	064	323	2023-09-02	16:18:00	74.1551	-80.47246	778	788
2	065	300	2023-09-02	19:01:00	74.31736	-80.49802	693	703
2	066	322	2023-09-02	21:31:00	74.49604	-80.53686	650	659
2	067	S1	2023-09-04	09:16:00	74.04946	-91.15726	42	52
2	068	S2	2023-09-04	10:01:00	74.06614	-91.12578	99	108
2	069	S3	2023-09-04	10:40:00	74.09702	-91.086	142	152
2	070	S4	2023-09-04	12:02:00	74.14394	-91.01776	202	212
2	071	S5	2023-09-04	12:58:00	74.21854	-90.90308	285	293
2	072	S6	2023-09-04	18:16:00	74.2779	-90.8138	215	221
2	073	S7	2023-09-04	19:11:00	74.34352	-90.71734	203	211
2	074	S8	2023-09-04	20:01:00	74.40098	-90.6289	184	194
2	075	S9	2023-09-05	00:18:00	74.46454	-90.53378	256	266
2	076	S10	2023-09-05	01:18:00	74.5445	-90.40554	171	181
2	077	S11	2023-09-05	02:36:00	74.57066	-90.3682	93	103
2	078	305A	2023-09-05	18:49:00	74.22392	-93.4945	151	160
2	079	305B	2023-09-05	20:25:00	74.35226	-93.57424	156	165
2	080	305C	2023-09-05	22:11:00	74.48344	-93.64708	160	167
2	081	305D	2023-09-05	23:52:00	74.60262	-93.72366	116	126
Leg 3								
3	001	AC14	2023-09-09	10:38:00	75.4933	-78.84568	111	540
3	002	AC14	2023-09-09	14:32:00	75.4949	-78.8549	528	538
3	003	AF-23	2023-09-12	16:14:00	81.53962	-64.96052	299	307
3	004	AF-23	2023-09-12	18:29:00	81.53954	-64.9636	310	319
3	005	AC3	2023-09-13	09:17:00	81.47844	-66.47896	353	363
3	006	AC3	2023-09-13	12:49:00	81.47876	-66.47364	368	377
3	007	AC2	2023-09-13	16:58:00	81.54234	-65.83732	367	374
3	008	LSea-23	2023-09-14	05:50:00	82.06384	-61.48094	559	569
3	009	AC1	2023-09-15	01:01:00	81.70016	-64.1022	543	549
3	010	AC4	2023-09-15	12:20:00	81.40294	-64.35066	649	661
3	011	AC4	2023-09-15	17:49:00	81.4037	-64.32964	667	676
3	012	AC18	2023-09-16	12:09:00	80.31946	-69.72522	172	183
3	013	AC18	2023-09-16	14:29:00	80.31878	-69.73	105	189
3	014	AC18	2023-09-16	15:07:00	80.31606	-69.73548	119	179
3	015	AC19	2023-09-16	20:20:00	80.26312	-69.01898	317	331
3	016	AC19	2023-09-16	23:11:00	80.2574	-69.19448	89	330
3	017	AC19	2023-09-16	23:49:00	80.24992	-69.23386	92	295
3	018	AC20	2023-09-17	06:07:00	80.30244	-67.88126	165	175
3	019	CEOS-m4-23	2023-09-17	15:43:00	80.05178	-67.07428	72	81

3	020	134	2023-09-17	20:04:00	80.0386	-68.6081	119	242
3	021	134	2023-09-17	22:36:00	80.0382	-68.6187	240	251
3	022	133	2023-09-18	06:55:00	79.59894	-70.36982	124	187
3	023	133	2023-09-18	09:33:00	79.60688	-70.37116	173	184
3	024	129	2023-09-19	03:41:00	78.31222	-73.80344	124	570
3	025	129	2023-09-19	06:37:00	78.30572	-73.7688	689	699
3	026	NaresW-23	2023-09-19	14:55:00	78.32382	-74.8182	480	490
3	027	NaresW-23	2023-09-19	20:52:00	78.31172	-74.87918	541	551
3	028	NaresE-23	2023-09-20	07:24:00	78.32356	-73.17988	124	321
3	029	NaresE-23	2023-09-20	11:12:00	78.32182	-73.1762	303	314
3	030	122	2023-09-21	02:45:00	77.34236	-74.67534	125	670
3	031	122	2023-09-21	08:36:00	77.34104	-74.59462	693	701
3	032	CEOS-M1-23	2023-09-21	21:05:00	77.18002	-71.089	602	608
3	033	AC12	2023-09-22	10:47:00	77.19464	-78.39922	560	569
3	034	AC12	2023-09-22	15:23:00	77.1954	-78.40036	149	586
3	035	AC13	2023-09-23	10:27:00	76.39988	-78.41732	100	136
3	036	AC13	2023-09-23	12:55:00	76.39354	-78.42144	154	161
3	037	Site 1.2	2023-09-23	20:35:00	76.58446	-78.66414	81	91
3	038	Site 1.2	2023-09-24	06:16:00	76.45374	-78.63168	101	112
3	039	Site 1.2	2023-09-24	12:44:00	76.5877	-78.65378	76	85
3	040	Site 1.2	2023-09-24	20:17:00	76.58234	-78.60868	48	58
3	041	BG-06	2023-09-25	02:55:00	75.7115	-80.7046	618	627
3	042	BG-02	2023-09-25	05:28:00	75.659	-81.26618	247	253
3	043	BG-05	2023-09-25	07:09:00	75.67202	-80.99544	318	325
3	044	BG-01	2023-09-25	08:53:00	75.65928	-81.31624	149	232
3	045	BG-01	2023-09-25	09:58:00	75.65822	-81.32574	244	255
3	046	BG-03	2023-09-25	14:15:00	75.65932	-81.21012	277	286
3	047	BG-04	2023-09-25	18:38:00	75.66356	-81.16272	296	304
3	048	BG-07	2023-09-26	01:05:00	75.75664	-80.35388	126	609
3	049	BG-07	2023-09-26	02:08:00	75.76016	-80.34356	605	613
3	050	AC-16	2023-09-27	02:55:00	76.03216	-83.13062	124	665
3	051	AC-16	2023-09-27	07:38:00	76.09154	-83.22648	756	764
3	052	4.6.1	2023-09-27	22:12:00	76.40938	-82.97674	359	369
3	053	Sverdrup	2023-09-28	11:16:00	75.8198	-83.12076	66	75
3	054	JonesS-23	2023-09-28	21:36:00	75.99124	-86.49796	657	667
3	055	AC17	2023-09-29	03:55:00	76.28394	-88.21456	124	212
3	056	AC17	2023-09-29	06:18:00	76.24526	-88.2545	172	182
3	057	NB-01	2023-09-29	17:39:00	76.83526	-91.28854	125	289
3	058	NB-01	2023-09-29	20:21:00	76.83692	-91.27264	283	293
3	059	NB-02	2023-09-30	13:09:00	76.92118	-98.39912	429	440
3	060	CEOS-M2-23	2023-10-01	14:07:00	74.46276	-90.5543	258	266
3	061	CEOS-M3-23	2023-10-01	19:50:00	74.14614	-91.0399	208	216
3	062	CB-01	2023-10-02	12:41:00	74.89574	-83.58648	138	149
3	063	CB-02	2023-10-02	16:20:00	74.86752	-83.48168	218	228
3	064	CB-03	2023-10-02	21:10:00	74.82958	-83.39178	137	147
3	065	CB-05	2023-10-03	00:02:00	74.78342	-83.20498	158	173
3	066	CB-06	2023-10-03	03:42:00	74.66894	-83.21456	395	405
3	067	CB-04	2023-10-03	09:45:00	74.8197	-83.16902	156	167
3	068	CB-07	2023-10-03	17:53:00	74.38632	-83.14254	125	660
3	069	CB-07	2023-10-03	18:34:00	74.38618	-83.1407	665	675

Leg 4								
4	001	321-GB	2023-10-07	03:53:00	70.34878	-91.57076	78	85
4	002	322-GB	2023-10-07	05:44:00	70.40074	-91.09214	204	214
4	003	323-GB	2023-10-07	14:42:00	70.44798	-90.63842	121	131
4	004	324-GB	2023-10-07	16:15:00	70.501	-90.14308	118	128
4	005	325-GB	2023-10-07	18:16:00	70.55426	-89.67172	153	164
4	006	326-GB	2023-10-07	20:44:00	70.60354	-89.2241	72	83
4	007	SPR-005	2023-10-08	07:53:00	69.14756	-85.66276	331	339
4	008	SPR-004	2023-10-08	10:44:00	69.05172	-86.21304	218	227
4	009	SPR-003	2023-10-08	17:34:00	68.96942	-86.6847	171	182
4	010	SPR-002	2023-10-08	20:19:00	68.9009	-87.2282	83	93
4	011	SPR-001	2023-10-08	22:39:00	68.81962	-87.76488	17	26
4	012	CTD FH 1	2023-10-09	07:15:00	69.92108	-85.06524	209	219
4	013	CTD FH 2	2023-10-09	09:20:00	69.8928	-84.18138	137	147
4	014	CTD FH 3	2023-10-09	11:23:00	69.8647	-83.21938	98	108
4	015	FH20-001	2023-10-09	13:24:00	69.68468	-82.3957	106	114
4	016	CTD JM 1	2023-10-09	15:28:00	69.69376	-81.96414	95	106
4	017	CTD JM 2	2023-10-09	16:47:00	69.61108	-81.48256	122	132
4	018	CTD JM 3	2023-10-09	18:34:00	69.45126	-80.95906	87	98
4	019	329	2023-10-09	20:10:00	69.36752	-80.38624	27	37
4	020	330	2023-10-09	20:56:00	69.31966	-80.55334	52	62
4	021	331	2023-10-09	22:27:00	69.25166	-80.76704	62	72
4	022	332	2023-10-09	23:28:00	69.18248	-80.99996	72	82
4	023	333	2023-10-10	02:23:00	68.76768	-81.00938	22	33
4	024	FSB-01	2023-10-10	07:04:00	68.75845	-81.1534	3	25
4	025	FSB-02	2023-10-10	07:44:00	68.7366363	-81.18463	4	23
4	026	FSB-03	2023-10-10	08:57:00	68.66179	-81.14895	3	24
4	027	FoxSIPP-01	2023-10-10	11:24:00	68.25246	-80.90466	60	69
4	028	334	2023-10-10	14:54:00	67.87892	-80.79962	74	83
4	029	FoxSIPP-02	2023-10-10	23:01:00	67.34226	-80.82734	84	93
4	030	FoxSIPP-03	2023-10-11	01:55:00	66.908	-80.8317	85	96
4	031	FoxSIPP-04	2023-10-11	09:03:00	66.45498	-80.87342	93	102
4	032	338	2023-10-11	12:42:00	66.17122	-81.3211	125	134
4	033	FoxSIPP-05	2023-10-11	22:41:00	65.6104	-81.14902	155	165
4	034	350	2023-10-12	16:23:00	64.50038	-80.50134	375	385
4	035	FoxSIPP-07	2023-10-13	01:14:00	64.36308	-81.47212	262	268
4	036	FoxSIPP-06	2023-10-13	08:53:00	64.72738	-81.38652	252	261
4	037	FoxSIPP-08	2023-10-13	17:31:00	66.00636	-83.15026	296	305
4	038	FoxSIPP-09	2023-10-14	03:55:00	65.52636	-82.57422	368	377
4	039	FoxSIPP-M	2023-10-14	09:36:00	65.1348	-81.33414	430	441
4	040	FoxSIPP-10	2023-10-14	18:47:00	64.79088	-80.70248	390	399
4	041	350	2023-10-14	22:07:00	64.49846	-80.49558	372	382
4	042	FoxSIPP-11	2023-10-15	00:44:00	64.2606	-79.7894	288	297
4	043	349	2023-10-15	05:26:00	64.68816	-78.5907	117	123
4	044	15H	2023-10-15	13:12:00	63.81762	-79.98874	203	213
4	045	15G	2023-10-15	15:26:00	63.8692	-79.8153	286	295
4	046	15F	2023-10-15	16:44:00	63.94088	-79.56712	306	316
4	047	15E	2023-10-15	18:41:00	64.03206	-79.21644	299	309
4	048	15D	2023-10-16	00:13:00	64.12164	-78.86434	230	238
4	049	15C	2023-10-16	02:19:00	64.21376	-78.5164	258	267

4	050	15B	2023-10-16	04:29:00	64.28374	-78.2651	199	209
4	051	15A	2023-10-16	05:57:00	64.32696	-78.07368	109	120
4	052	KCD-01	2023-10-16	11:49:00	64.22554	-76.41262	59	68
4	053	HS22-001	2023-10-16	15:27:00	64.19654	-75.6141	79	89
4	054	HS22-003	2023-10-16	20:48:00	63.85246	-75.10772	143	154
4	055	HS22-005	2023-10-17	03:42:00	63.41274	-74.74266	294	303
4	056	Sal-01	2023-10-17	14:33:00	62.23844	-75.63068	111	120
4	057	HS22-006	2023-10-17	22:00:00	63.04548	-74.31036	401	410
4	058	14G	2023-10-18	05:59:00	62.183	-72.415	156	164
4	059	14F	2023-10-18	06:49:00	62.22046	-72.24626	229	239
4	060	14E	2023-10-18	09:05:00	62.27554	-71.98706	322	332
4	061	14D	2023-10-18	16:14:00	62.356	-71.65628	338	346
4	062	14C	2023-10-18	18:34:00	62.43266	-71.30732	319	328
4	063	14A	2023-10-18	20:37:00	62.52366	-70.86788	328	337
4	064	14B	2023-10-18	21:56:00	62.48652	-71.03644	322	331
4	065	HS22-007	2023-10-19	01:58:00	62.61084	-69.90308	178	189
4	066	HS22-009	2023-10-19	07:03:00	62.15034	-69.36396	224	234
4	067	HS22-011	2023-10-19	12:47:00	61.66544	-68.84248	291	301
4	068	HS22-013	2023-10-19	17:49:00	61.27602	-68.34678	400	405
4	069	352	2023-10-20	11:10:00	61.25968	-64.81896	258	268
4	070	353	2023-10-20	13:18:00	61.15574	-64.79646	438	447
4	071	354	2023-10-20	16:14:00	61.00232	-64.72242	522	530
4	072	355	2023-10-20	22:22:00	60.85194	-64.72146	408	422
4	073	356	2023-10-21	00:22:00	60.74904	-64.71512	288	298
4	074	640	2023-10-21	16:12:00	58.9991	-61.90452	130	139
4	075	JL-001	2023-10-24	21:42:00	48.88064	-68.1671	322	332

Appendix 4 - List of participants on the 2023 *Amundsen* Expedition

Leg	Name	Position	Affiliation	Network Investigator/Supervisor	Embark place	Embark date	Disembark place	Disembark date
Leg 1	Adebayo, Oye	Research Staff	University of Calgary	Casey Hubert and Rodd Laing	St. John's	2023-07-13	Nain	2023-07-19
Leg 1	Algar, Christopher	Researcher/Professor	Dalhousie University	Christopher Algar	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 3	Amirault, Daniel	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 1	Atkinson, Margaret	MSc Student	University of New Brunswick	Audrey Limoges	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 4	Aubry, Cyril	Research Staff	Université Laval	Maxime Geoffroy / Frédéric Ma	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 1	Ausen, Emma	Professional	University of Manitoba	Dorthe Dahl-Jensen	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 3	Ausen, Emma	Research Staff	University of Manitoba	Dorthe Dahl Jensen	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Barut, Guillaume	PhD Student	Université Laval - Takuvik	Mathieu Ardyna	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Bécu, Guislain	Professional	Université Laval - Takuvik	Mathieu Ardyna	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Belko, Alexis	PhD Student	Université Laval	Patrick Lajeunesse / Alexandre	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 1	Bennett, James Robert (Robbie	Research Staff	Natural Resources Canada - Geological Sur	Alexandre Normandeau	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 1	Bisiach, Francesco	MSc Student	University of Calgary	Casey Hubert / Rodd Laing	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 3	Blais, Guillaume	PhD Student	Université Laval	Philippe Archambault	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 2	Bories, Amélie	Professional	Amundsen Science	Alexandre Forest	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 1	Bourreau, Lucie	PhD Student	Université Laval	Maxime Geoffroy / Frédéric Ma	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 3	Boutôt, Christian	Research Staff	Université du Québec à Rimouski - ISMER	Jean-Carlos Montero-Serrano	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 4	Brembach, Kerstin	PhD Student	Université Laval	Patrick Lajeunesse	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 3	Brice, Camille	PhD Student	Université du Québec à Rimouski - ISMER	Jean-Carlos Montero-Serrano	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 1	Broom, Laura	Research Staff	Natural Resources Canada - Geological Sur	Alexandre Normandeau	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 3	Brunner, Leïla	MSc Student	Université Laval	Frédéric Maps / Maxime Geoff	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Burgers, Tonya	Research Staff	Department of Fisheries and Oceans - FWI	David Capelle	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 4	Cai, Huiwen	PhD Student	Université Laval - Takuvik	Julien Gigault	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Capelle, David	Research Staff	Department of Fisheries and Oceans - FWI	David Capelle	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 3	Charette, Joannie	Research Staff	Department of Fisheries and Oceans - FWI	Christine Michel	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 2	Ciastek, Stephen	Technician	University of Manitoba	Zou Zou Kuzyk	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 4	Ciastek, Stephen	Technician	University of Manitoba	Zou Zou Kuzyk	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 3	Combaz, Thibaud	PhD Student	Université Laval - Takuvik	Philippe Archambault	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 2	Corbeil-robitaille, Madeleine-z	Media/Artist	Université du Québec à Rimouski		Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 1	Cote, David	Chief Scientist	Department of Fisheries and Oceans - NL	David Cote	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 2	Da Silva, Luiz Henrique	PhD Student	University of Manitoba	Kristina Brown	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 3	Daase, Malin	Researcher/Professor	UiT The Arctic University of Norway	Maxime Geoffroy	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 2	Dale, Jacob	MSc Student	Université Laval	Philippe Archambault	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 1	Darnis, Gérald	Research Staff	Memorial University	Maxime Geoffroy	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 1	Davila Aleman, Francisco Danie	Postdoctoral Fellow	University of Calgary	Casey Hubert / Rodd Laing	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 2	Deraniyagala, Kavindu	Professional	Memorial University of Newfoundland	Alexandre Forest	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 1	Desforges, Jessica	Research Staff	Department of Fisheries and Oceans - NL	David Cote	Nain	2023-07-19	Iqaluit	2023-08-10

Leg 4	Deslongchamps, Gabrièle	Research Staff	Université Laval	Jean-Éric Tremblay	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 3	Desmarais, Amélie	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Dezutter, Thibaud	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 2	Dhifallah, Fatma	Professional	Amundsen Science	Alexandre Forest	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 3	Doxaran, David	Researcher/Professor	Laboratoire d'Océanographie de Villefranc	David Doxaran	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 4	Else, Brent	Chief Scientist	University of Calgary	Brent Else	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Emery, Isabelle	BSc Student	University of New Brunswick	Ian Church	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 1	England, Whitney	Researcher/Professor	University of Calgary	Casey Hubert / Rodd Laing	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 3	Evans, Kelly	MSc Student	Trent University	Liisa Jantunen	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 1	Fernandes, Luiz Filipe	Professional	Amundsen Science	Alexandre Forest	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 4	Fisher, Jonathan	Researcher/Professor	Memorial University	Jonathan Fisher	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 4	Forbes, Rachel	MSc Student	Memorial University	Jonathan Fisher	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Forest, Alexandre	Chief Scientist	Amundsen Science	Alexandre Forest	Qikiqtarjuaq	2023-08-23	Resolute Bay	2023-09-07
Leg 3, 4	Fox, Aislinn	PhD Student	University of Ottawa	Brett Walker	Resolute Bay	2023-09-07	Quebec City	2023-10-26
Leg 1	Furey, Tony	MSc Student	University of New Brunswick	Ian Church	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 2	Gagné, Raphaël	MSc Student	Université du Québec à Rimouski - ISMER	André Rochon	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 4	Gagné, Raphaël	MSc Student	Université du Québec à Rimouski - ISMER	André Rochon	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Gagnon, Diane	Research Staff	Université Laval	Philippe Archambault	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 2	Gagnon, Jonathan	Research Staff	Université Laval	Jean-Éric Tremblay	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 1	Geizer, Haley	PhD Student	Dalhousie University	Christopher Algar	Nain	2023-07-19	Iqaluit	2023-08-10
Leg 3	Geoffroy, Maxime	Chief Scientist	Memorial University	Maxime Geoffroy	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Gervais, Penelope	MSc Student	University of Ottawa	Luke Copland	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Girard, Juliette	PhD Student	Université du Québec à Rimouski - ISMER	Jean-Carlos Montero-Serrano /	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 4	Granados Galvan, Ingrid Alejar	PhD Student	Université du Québec à Rimouski - ISMER	Gary Stern / Liisa Jantunen	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 4	Grant, Cindy	Research Staff	Université Laval	Philippe Archambault	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Guillot, Pascal	Professional	Amundsen Science	Alexandre Forest	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 4	Guillot, Pascal	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 4	Gyllestad, Joachim	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 1	Hamisch, Stephan	MSc Student	Memorial University	Paul Snelgrove	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 3	Harker, Brayden	MSc Student	University of New Brunswick	Audrey Limoges	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 1	Hayes (Wareham), Vonda	Research Staff	Department of Fisheries and Oceans - NL	Barbara Neves	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 1	Hayward, Scott	Technician	Natural Resources Canada - Geological Sur	Alexandre Normandeau	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 1	Higdon, Jennifer Joan	Professional	Department of Fisheries and Oceans - NL	Jennica Seiden	Nain	2023-07-19	Iqaluit	2023-08-10
Leg 1	Hogan, Holly	Wildlife/Bird Observer	Canadian Wildlife Service	Carina Gjerdrum	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 1	Jacobsen, Eugenie	PhD Student	Memorial University	Maxime Geoffroy / Dave Cote	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 3	Jacobsen, Eugenie	PhD Student	Memorial University	Maxime Geoffroy / Dave Cote	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 4	Jasperse, Liam	MSc Student	University of Ottawa	Brett Walker	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Jokinen, Ben	Professional	Amundsen Science	Alexandre Forest	Qikiqtarjuaq	2023-08-23	Resolute Bay	2023-09-07
Leg 1	Jones, Silas	Research Staff	Memorial University	Paul Snelgrove	St. John's	2023-07-13	Iqaluit	2023-08-10

Leg 1	Jones, Simon	Professional	CSSF	Keith Shepherd	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 2	Joy, Jonathan	Wildlife/Bird Observer	Canadian Wildlife Service	Carina Gjerdrum	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 2	Kazmiruk, Zakhar	PhD Student	University of Manitoba	Eric Collins	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 4	Kazmiruk, Zakhar	PhD Student	University of Manitoba	Eric Collins	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 1	Kearley, Victoria	BSc Student	Memorial University	Alexandre Forest	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 1	Kilgour Prevost, Rhys Samuel	Professional	CSSF	Keith Shepherd	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 3	Kirillov, Sergei	Researcher/Professor	University of Manitoba - CEOS	Dorthe Dahl-Jensen	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 2, 3	Kitching, Elizabeth	Research Staff	Department of Fisheries and Oceans - FWI	Christine Michel	Iqaluit	2023-08-10	Resolute Bay	2023-10-05
Leg 3	Koerner, Kelsey	PhD Student	Université du Québec à Rimouski - ISMER	André Rochon	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 4	Labille, Jérôme	Researcher/Professor	Université Laval - Takuvik	Julien Gigault	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 1	Lahaye, Quentin	Professional	Amundsen Science	Alexandre Forest	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 3, 4	Lahaye, Quentin	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-09-07	Quebec City	2023-10-26
Leg 1	Laing, Rodd	Chief Scientist	Nunatsiavut Government	Rodd Laing	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 3	Lauzon, Benoit	PhD Student	University of Ottawa	Luke Copland	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Lee, Megan	Research Staff	Department of Fisheries and Oceans - FWI	Christine Michel	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 2	Lemasson, Pierrick	PhD Student	Centre National de la Recherche Scientifiqu	Marcel Babin	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 2	Leymarie, Edouard	Professional	Centre National de la Recherche Scientifiqu	Marcel Babin	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 3	Limoges, Audrey	Researcher/Professor	University of New Brunswick	Audrey Limoges	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 1	Lockhart, Peter	Professional	CSSF	Keith Shepherd	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 4	Mandryk, Rachel	Research Staff	Department of Fisheries and Oceans - FWI	David Capelle	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2, 3	Matthes, Lisa	Postdoctoral Fellow	Department of Fisheries and Oceans - FWI	Christine Michel	Iqaluit	2023-08-10	Resolute Bay	2023-10-05
Leg 1	Matthews, Ty Damon	BSc Student	Memorial University	Alexandre Forest	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 1	Meredyk, Shawn	Professional	Amundsen Science	Alexandre Forest	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 4	Michaud, Luc	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 4	Morisset, Simon	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 1	Morrissey, Christopher	Professional	Amundsen Science	Alexandre Forest	Quebec City	2023-07-08	Iqaluit	2023-08-10
Leg 2	Nakashuk, Charlie	Research Staff	Department of Fisheries and Oceans - FWI	Christine Michel	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 4	Nerysoo, Denis	BSc Student	Aurora College	Liisa Jantunen	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 1	Neves, Barbara	Researcher/Professor	Department of Fisheries and Oceans - NL	Barbara Neves	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 2	Nickoloff, Gina	Technician	University of Calgary	Brent Else	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 2	Oates, Ashley	MSc Student	Memorial University	Maxime Geoffroy / Christine M	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 1	O'Brien, John	Researcher/Professor	Department of Fisheries and Oceans - FWI	John O'Brien	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 4	O'Reilly, Lauren	MSc Student	University of Ottawa	Brett Walker	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 4	Pagé, Sonia	Research Staff	Université Laval	Philippe Archambault	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 4	Patar, Dustin	Media/Artist	Freelance Journalist		Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Pearson, Marcia	Professional	Amundsen Science	Alexandre Forest	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 2	Perugini, Gabrielle	MSc Student	Memorial University	Maxime Geoffroy	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 3	Pollara, Scott	PhD Student	Dalhousie University	Erin Bertrand	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 2	Pucko, Monika	Research Staff	Department of Fisheries and Oceans - FWI	Christine Michel	Iqaluit	2023-08-10	Resolute Bay	2023-09-07

Leg 4	Purdon, Cassandra	MSc Student	University of Calgary	Brent Else	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 4	Ratsimbazafy, Tahiana	Professional	Amundsen Science	Alexandre Forest	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Reimer, Jillian	Research Staff	Department of Fisheries and Oceans - FWI	Christine Michel	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 3	Ribeiro, Sofia	Researcher/Professor	Geological Survey of Denmark and Greenla	Sofia Ribeiro	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 1	Rochefort, Véronique	Professional	Amundsen Science	Alexandre Forest	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 4	Rust, Rebecca	PhD Student	University of British Columbia	Philippe Tortell	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 1	Saunders, Michelle	Research Staff	Nunatsiavut Government	Rodd Laing	St. John's	2023-07-13	Nain	2023-07-19
Leg 3	Schuler, Katrina	PhD Student	University of British Columbia	Philippe Tortell	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 4	Simpson, Kyle	Technician	Department of Fisheries and Oceans - IOS	Lisa Miller	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 3	Stancu, Charlotte	MSc Student	Université du Québec à Rimouski - ISMER	Alexandre Normandeau	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 4	Stocking, Madelyn	PhD Student	University of Manitoba	Zou Zou Kuzyk	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 1	Sutton, Jordan	Research Staff	Department of Fisheries and Oceans - NL	David Cote	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 2	Tremblay, Jean-Éric	Chief Scientist	Université Laval	Tremblay, Jean-Éric	Iqaluit	2023-08-10	Qikiqtarjuaq	2023-08-23
Leg 1	Tuglavina, Elizabeth	Research Staff	Nunatsiavut Government	Rodd Laing	St. John's	2023-07-13	Nain	2023-07-19
Leg 4	Van Dijk, Joshua	MSc Student	University of New Brunswick	Ian Church	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Vandenbyllaardt, Lenore	Technician	Department of Fisheries and Oceans - FWI	Kevin Hedges	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 2	Vilgrain, Laure	Postdoctoral Fellow	Memorial University	Maxime Geoffroy	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 3	Walch, Daniela	PhD student	Université du Québec à Rimouski - ISMER	Simon Bélanger	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 3	Walker, Zoe	Professional	University of Calgary	Brent Else	Resolute Bay	2023-09-07	Resolute Bay	2023-10-05
Leg 1	Warren, Margaret	Research Staff	Department of Fisheries and Oceans - NL	David Cote	St. John's	2023-07-13	Nain	2023-07-19
Leg 1	Wells, Nadine	Professional	Department of Fisheries and Oceans - NL	David Cote	St. John's	2023-07-13	Nain	2023-07-19
Leg 1	Wilhelmy, Camille	Professional	Amundsen Science	Alexandre Forest	St. John's	2023-07-13	Iqaluit	2023-08-10
Leg 4	Winkel, Jeannine	Wildlife/Bird Observer	Canadian Wildlife Service	Carina Gjerdrum	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 4	Yadav, Nidhi	PhD Student	Memorial University	Reader Heather/ Brent Else	Resolute Bay	2023-10-05	Quebec City	2023-10-26
Leg 2	Yazdanpanah, Maryam	PhD Student	Université Laval	Jean-Éric Tremblay / Frédéric N	Iqaluit	2023-08-10	Resolute Bay	2023-09-07
Leg 4	Yespal Subha, Haritha	PhD Student	Université du Québec à Rimouski - ISMER	Gary Stern / Liisa Jantunen	Resolute Bay	2023-10-05	Quebec City	2023-10-26