



REPORT

EXPEDITION SUMMARY

2023

AMUNDSEN
SCIENCE 



INTRODUCTION

The 2023 Expedition Summary is an overview of the science activities undertaken onboard the CCGS Amundsen during the 2023 field season. This document is available in English, French and Inuktitut. A detailed description of the sampling methods and preliminary results is presented in the more exhaustive 2023 Expedition Report, publicly available in English on our [website](#).

Amundsen Science manages the scientific mandate of the research icebreaker CCGS Amundsen by supporting the implementation of innovative and multidisciplinary research programs addressing some of the most pressing challenges of our time, such as climate change, biodiversity loss, ocean pollution, and human health.

Our organization is looking forward to improving the way we share our activities before, during and after the Amundsen Expedition and the way we support local involvement. Comments, suggestions and research initiatives are welcome. Contact us: media@as.ulaval.ca.



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OVERVIEW

For its 20th anniversary, the Canadian research icebreaker CCGS *Amundsen* began its scientific expedition to the Arctic Ocean on July 8 of 2023



After numerous days of mobilization in Québec City and few days of sea trials in the Saguenay fjord, the CCGS Amundsen made to a short transit from Québec City to St. John's, Newfoundland, where further equipment was loaded onboard. From July to October 2023, the Amundsen successfully completed a 111-day expedition and travelled over 14 861 nautical miles for scientific operations.

AN INNOVATIVE EXPEDITION

The 2023 Amundsen Expedition supported seven major research programs to study the Arctic and subarctic marine ecosystems, welcoming onboard 148 scientists from national and international research teams.

Programs onboard included the Imappivut initiative, ITTAQ, KEBABB/S, ArcticNet and Sentinel North programs, NOW Survey, ArcticCore and FOXSIPP. From aquatic microorganisms and seabirds to melting glaciers and seabed mapping, numerous aspects of the northern marine environment were studied as part of these programs during this year's expedition. These research programs supported in 2023 studied the 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 and Foxe Basin.

OVERVIEW

AN INNOVATIVE EXPEDITION

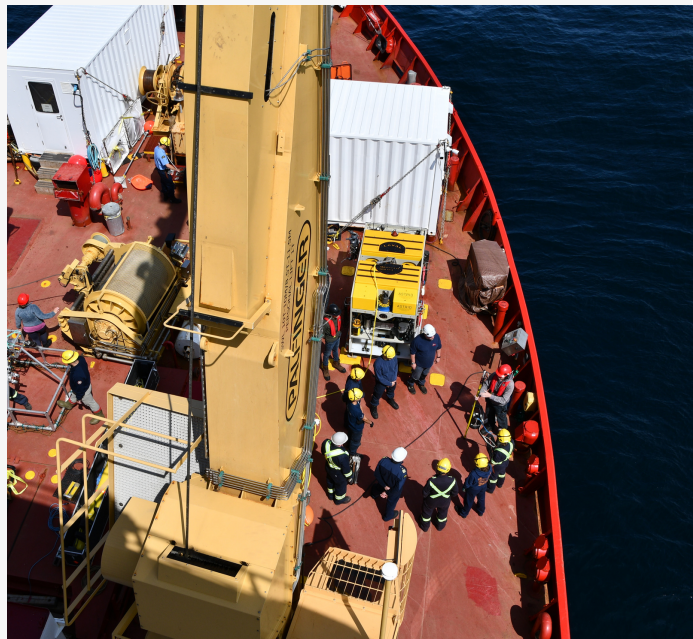
This year's *Amundsen* Expedition marked history with two firsts in one scientific mission.

As a program on Leg 1, the Imappivut initiative was the first primary program led by an Inuit organization in collaboration with key academic and federal partners. The Nunatsiavut Government was leading this initiative with its Director of Environment, Rodd Laing, onboard as a Co-chief Scientist coordinating the science operations.

The CCGS *Amundsen* and its crew carried out scientific operations at the northernmost point ever visited by the ship (latitude of 82°09.32'N) since its inauguration in 2003. The teams deployed a mooring at the entrance of Lincoln Sea and accomplished various other deployments and operations in Archer Fiord, Jones Sound and Nares Strait.

2023 AMUNDSEN EXPEDITION - OVERVIEW

The **first Leg** of the 2023 *Amundsen* Expedition encompassed the Imappivut initiative which aims to enhance the understanding of pelagic fish and primary producer communities in data-poor areas and to provide baseline data for Nunatsiavut's marine planning effort. Other programs participating during this Leg were the DFO Benthic Refuge and ITTAQ which respectively focus on monitoring sensitive benthic areas within the Eastern Arctic Marine Refuges and on acoustic monitoring in collaboration with the community of Clyde River.



OVERVIEW

2023 AMUNDSEN EXPEDITION



The **second Leg** supported four programs including KEBABB/S (Knowledge and ecosystem-based approach in Baffin Bay), ArcticNet, Sentinel North and Now Survey. Programs within this Leg were focused on understanding the connected systems of the atmosphere-ice-ocean, and understanding the impact of climate-induced changes in the Arctic Ocean. Most of the stations where scientific operations took place were located along transects in Baffin Bay and its marginal seas, including within the Pikialasorsuaq polynya, in the northern part of Baffin Bay.

During the **third Leg**, the *Amundsen* visited numerous stations in Nares Strait, Kane Basin, Archer Fjord, Jones Sound, Talbot Inlet, Belcher and Crocker Bay Glaciers, to finally reach the latitude of 82°09.32'N in the Lincoln Sea. Numerous moorings as part of ArcticNet, Now Survey, and ArcticCORE (Conservation, Observation, Research & Engagement) programs were deployed. The ArcticCORE program boarding the *Amundsen* aims 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 and the eastern Arctic region.



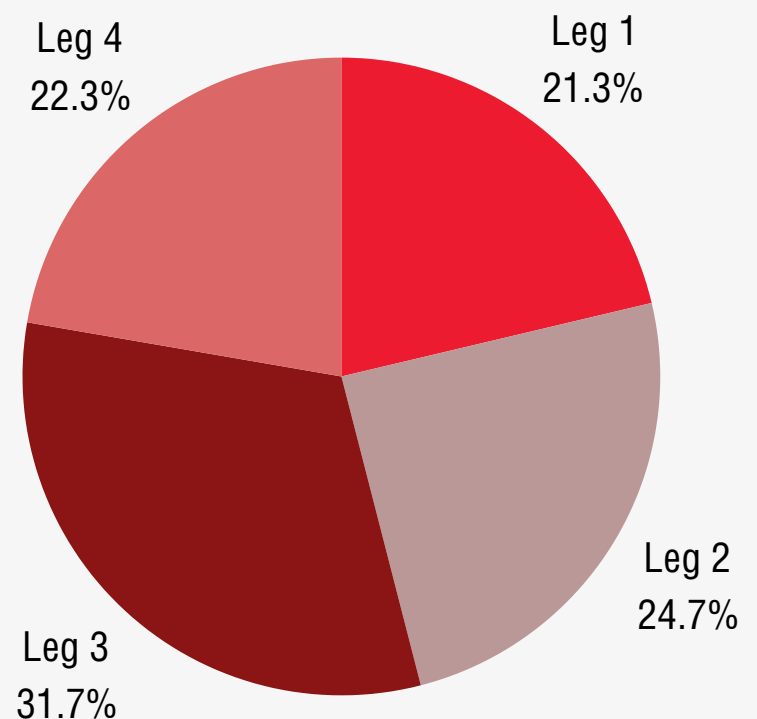
OVERVIEW

2023 AMUNDSEN EXPEDITION



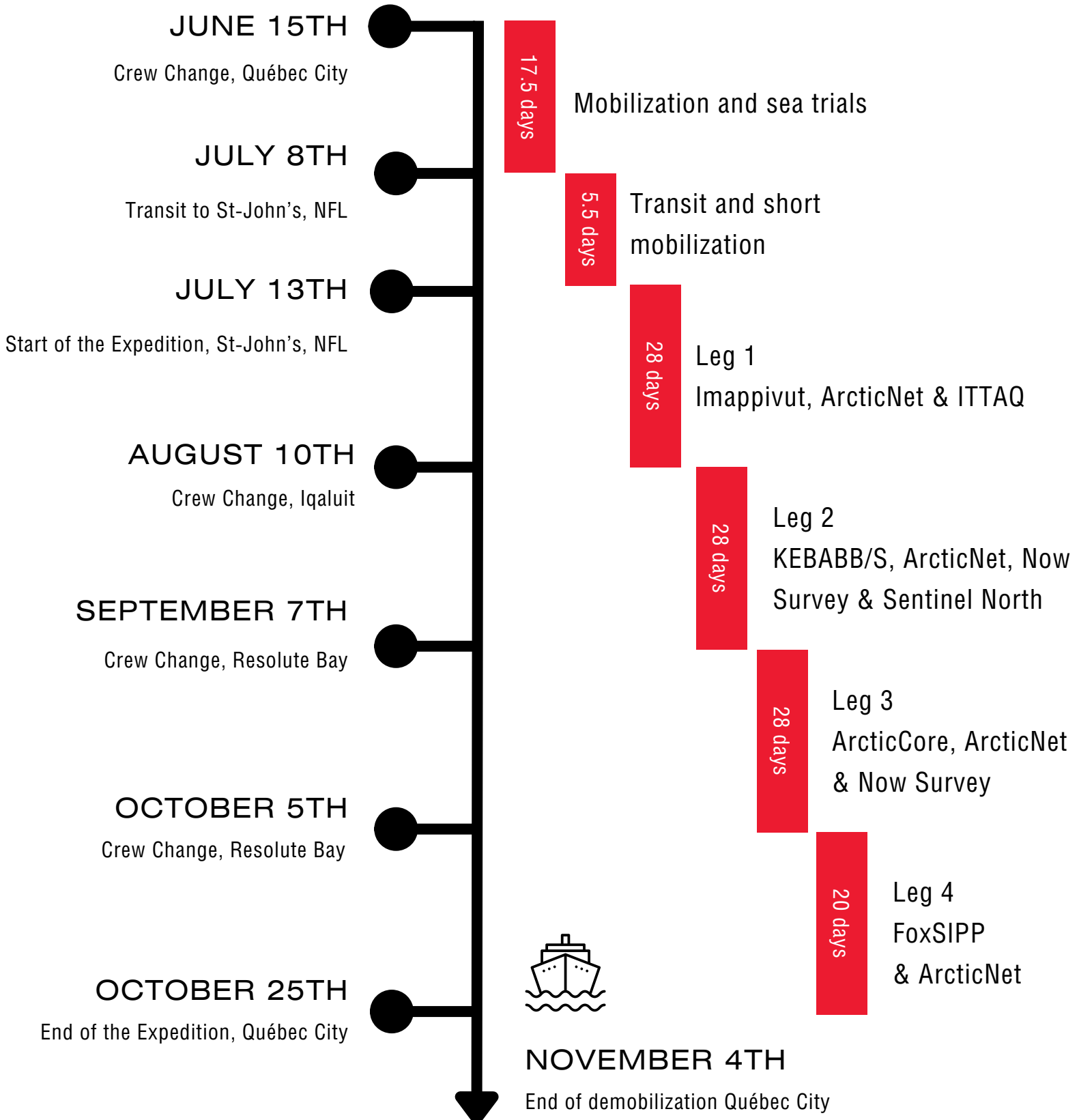
During the **fourth and last Leg**, the *Amundsen* headed back south while conducting sampling activities in various locations, including the Gulf of Boothia, Fury and Hecla Strait, Foxe Basin, Hudson Strait, and Labrador Sea. The two programs part of Leg 4 were ArcticNet and FoxSIPP (the Foxe Basin Sea Ice Pump). The FoxSIPP program aims to investigate the chemistry of the deep water that is formed annually in Foxe Basin and drains into Foxe Channel. A river sampling was carried out using the ship's helicopter near Prince Regent Inlet.

DISTRIBUTION OF THE **911** OPERATIONS DURING THE 2023 AMUNDSEN EXPEDITION



TIMELINE

2023 AMUNDSEN EXPEDITION



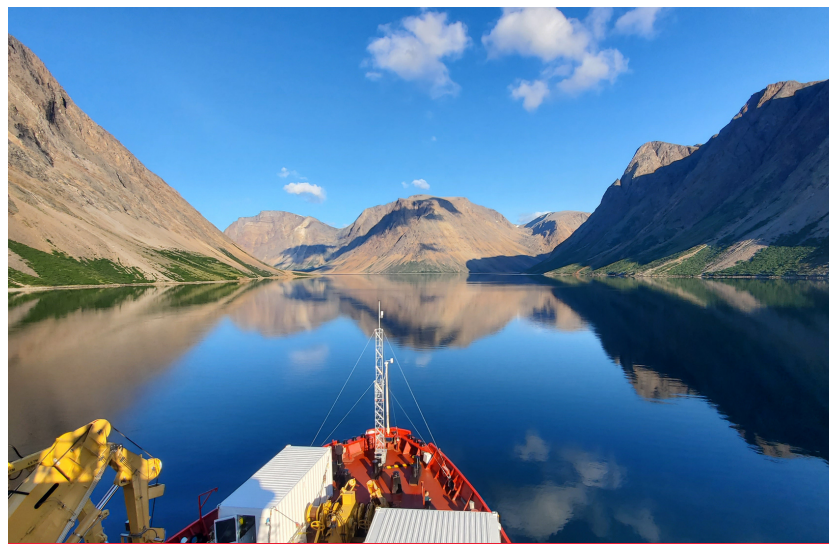
LEG 1

DESCRIPTION OF THE PROGRAMS

The first Leg of the 2023 *Amundsen* Expedition was primarily 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. It was built upon previous projects, focusing on biodiversity, habitat identification, and faunal communities in northern oceans.



A beam trawl being deployed from the CCGS *Amundsen* in order to collect biological specimens.



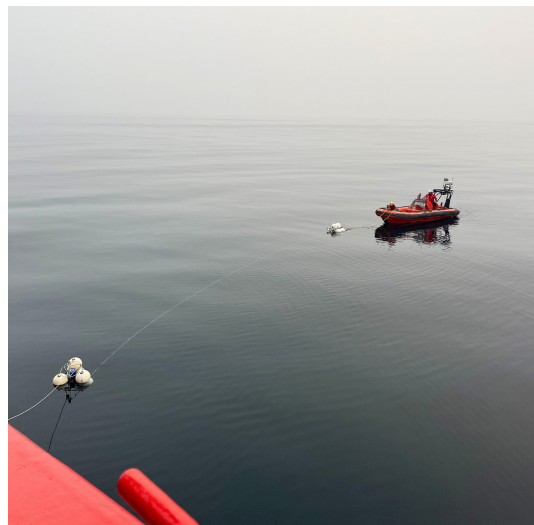
Saglek Fiord, picture by Simon C. Lavoie

Objectives included studying biodiversity hotspots, improving understanding of pelagic ecosystems, mapping turbidity currents, extending oceanographic data series, and investigating sediment biogeochemistry in the Arctic gateway. Additionally, the Imappivut initiative seeks to identify new vulnerable marine ecosystems along the Labrador coast, with the valuable guidance of local Nunatsiavut knowledge.

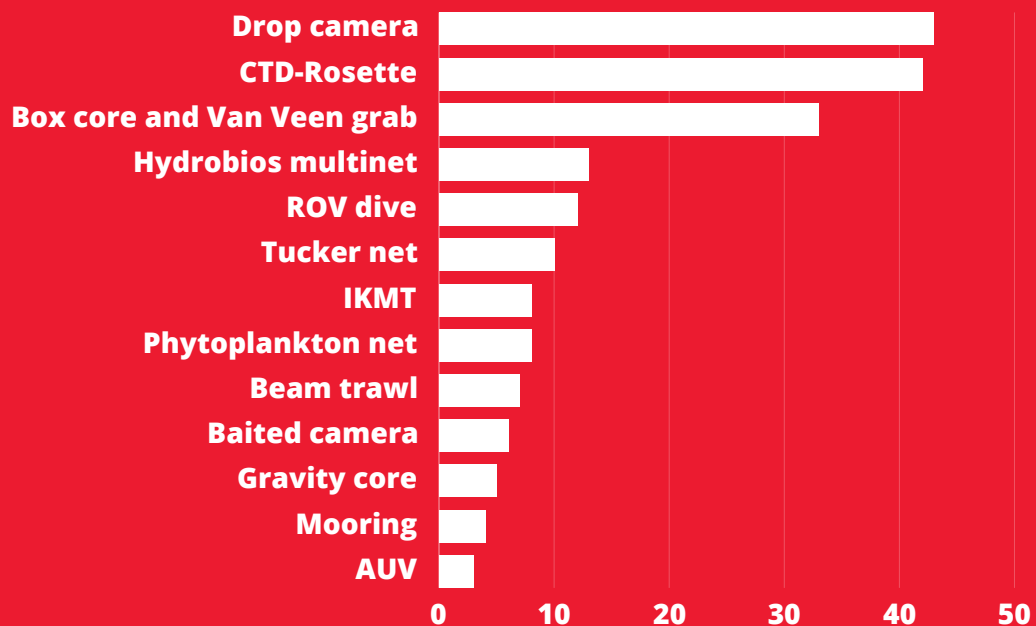
LEG 1

RESEARCH ACTIVITIES

While this first Leg mission benefited from favorable sea state, the sea ice conditions (ITTAQ stations, Disko Fan) and the strong currents (Hatton Basin, Killinek) have prevented access or have limited operations at some stations. Nevertheless, most of the planned objectives were addressed, with additional time used to expand operations at existing sites or to explore new sites.



DISTRIBUTION OF THE 194 OPERATIONS



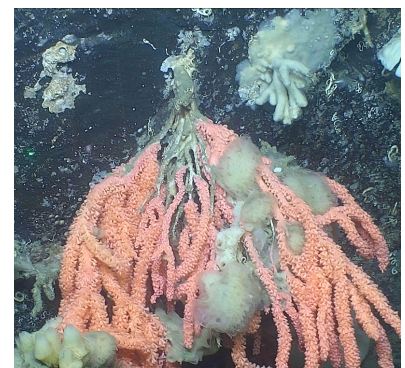
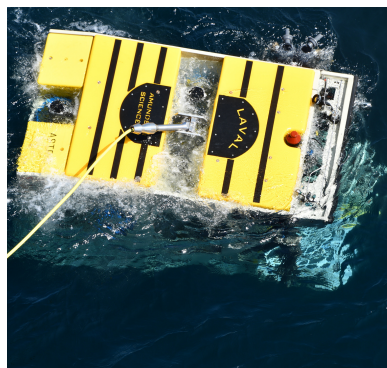
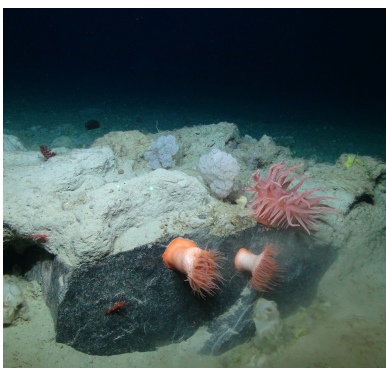
LEG 1

RESEARCH ACTIVITIES



A box core being deployed from the CCGS *Amundsen* in order to collect sediment from the sea floor.

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.



Footage of marine life on the sea floor in coastal Nunatsiavut waters captured with the remotely operated vehicle ASTRID (picture in the middle).

LEG 1

OUTREACH ACTIVITIES

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 and additional 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.



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. This event ended with a gathering at the Nain Community Centre where the Nunatsiavut Government and its team organized cultural presentations for the *Amundsen* crew and scientists.

LEG 2

DESCRIPTION OF THE PROGRAMS

The second Leg of the 2023 *Amundsen* Expedition included the KEBABB/S, the ArcticNet and the Now Survey programs. KEBBAB/S (Knowledge and ecosystem-based approach in Baffin Bay) program is focused on comprehending 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.



A box core being deployed from the CCGS *Amundsen* in order to collect sediment from the seafloor in Baffin Bay.

The ArcticNet program onboard the CCGS *Amundsen* during Leg 2 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.

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

LEG 2

RESEARCH ACTIVITIES



A snapshot of the sea states during Leg 2 taken from the bridge.

Although rough sea state impacted a few days during the cruise, the teams were able to adapt and make up the loss of time through efficiency and professionalism. In the North Water Polynya, the teams recovered one of the biggest catches ever made with the beam trawl on the CCGS *Amundsen*. They found a wide variety of species such as mud sea stars and an octopus. This Leg, where scientific operations were mostly in open waters, saw the accomplishment of 225 operations including a total of 81 CTD-Rosette operations!

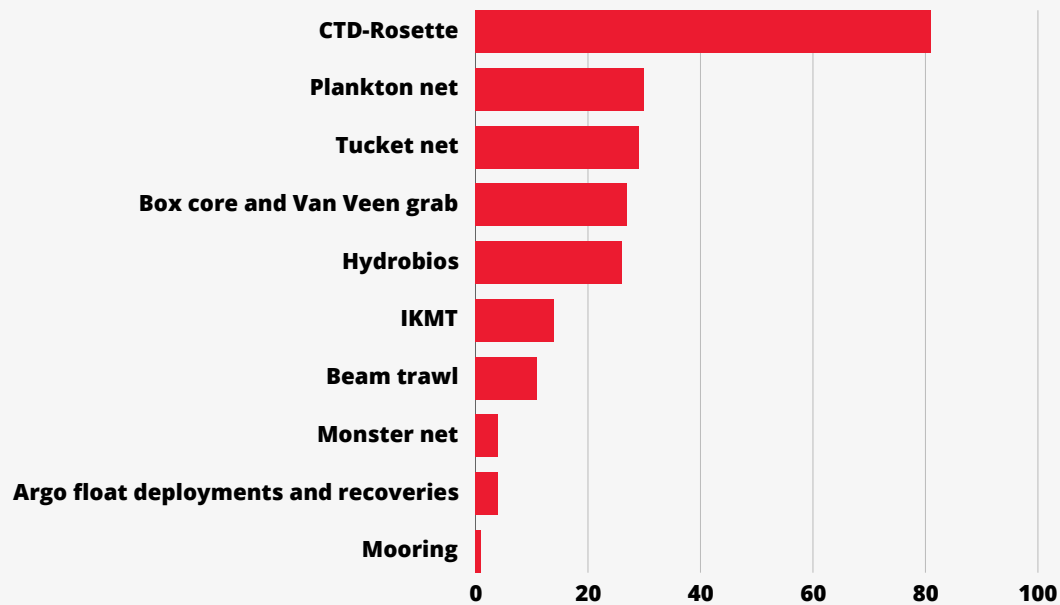


Scientists collecting their water samples from the CTD-Rosette.

LEG 2

RESEARCH ACTIVITIES

DISTRIBUTION OF THE 225 OPERATIONS



One of the biggest beam trawl catch of the *Amundsen's* history has been collected in the NOW polynya (left). When a net is brought to the surface, the scientists rinse it to ensure that the specimens collected sink into the collection containers (right).

LEG 3

DESCRIPTION OF THE PROGRAM

During the third Leg, the programs onboard the *Amundsen* studied the ecosystems of Nares Strait, Grise and Archer Fiords, Jones Sound, two glacier terminuses and Lincoln Sea. The ArcticCORE (Conservation, Observation, Research & Engagement) program aims to learn more about 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 ArcticCORE programs.



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

As part of this Leg, The CCGS *Amundsen* reached its northernmost latitude attained to date (82°09'N). It 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.



LEG 3

RESEARCH ACTIVITIES

The Leg 3 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, the chief scientists and the captain were organized twice a day after helicopter ice reconnaissance and reception of ice products to evaluate the best route and use navigation windows of opportunity as much as possible.



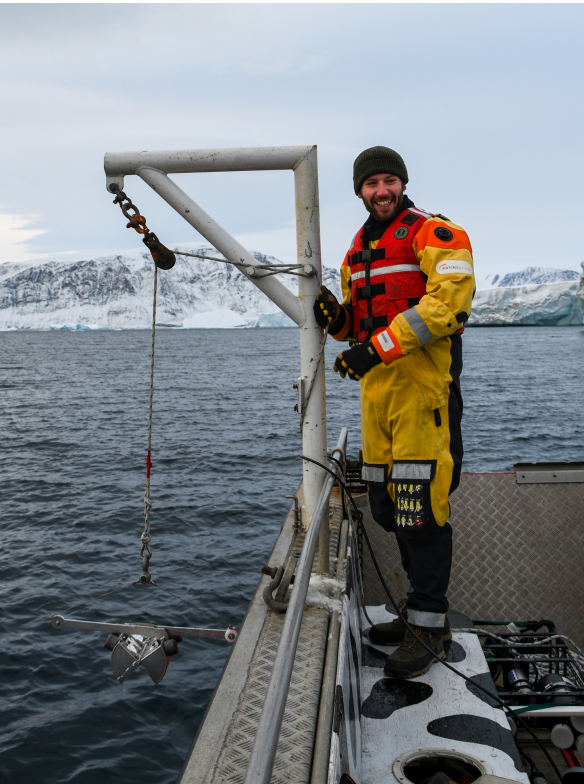
Seafloor sediments and biological specimens collected with the Agassiz net.



A mooring being deployed in close to the entrance of Lincoln sea.

LEG 3

RESEARCH ACTIVITIES

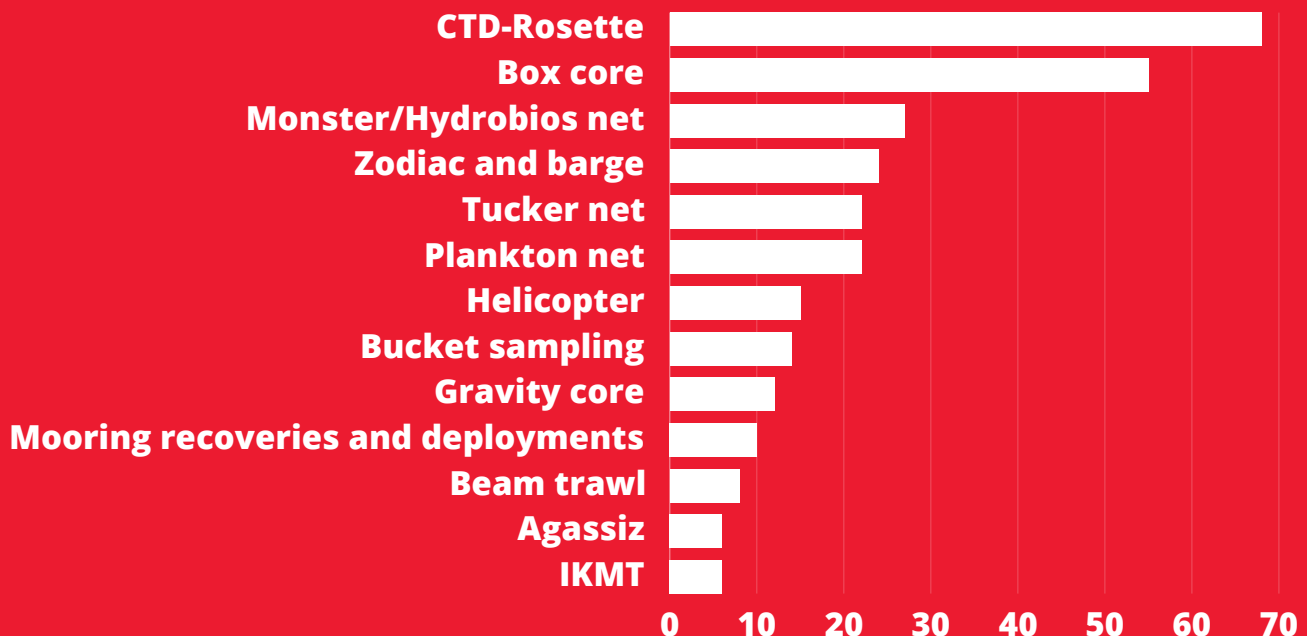


Despite heavy sea ice coverage near the Talbot and Mittie Glaciers that prevented the teams from sampling these areas, most planned stations were completed, and opportunistic stations were added near the Sverdrup Glacier and upstream of the Cardigan and Penny Straits.

The Van Veen grab being deployed from the barge to collect rocks on the seafloor.

In total, the vessel travelled 3,620 nautical miles and the teams completed 289 operations. Compared to the initial Expedition Plan, the completion rate of each operation ranged between 22 and 188%

DISTRIBUTION OF THE 289 OPERATIONS



LEG 3

OUTREACH ACTIVITIES

We had the opportunity to welcome 37 members of the Grise Fiord community onboard for a guided tour of the CCGS *Amundsen* and Amundsen Science's pool of scientific equipment.

Community members were hired the next day to help us with box core operations.



Grise Fiord, Ellesmere island, captured from the CCGS *Amundsen*.



Members of the Grise Fiord community visiting the CCGS *Amundsen* and its pool of scientific equipment (Left). Scientists and members of the Grise Fiord community after a box core operation

LEG 4

DESCRIPTION OF THE PROGRAM

The fourth and last leg of the 2023 *Amundsen* Expedition began in Resolute Bay on October 5th, heading south towards Prince Regent Inlet. During this Leg, the *Amundsen* conducted scientific operations to collect samples for the ArcticNet and the FoxSIPP 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. Given the lack of past oceanographic expeditions to Foxe Basin, this program will contribute to a more complete understanding of the Foxe Basin carbon sink.



Dustin Patar

Crew members and scientists captured through the beam trawl.



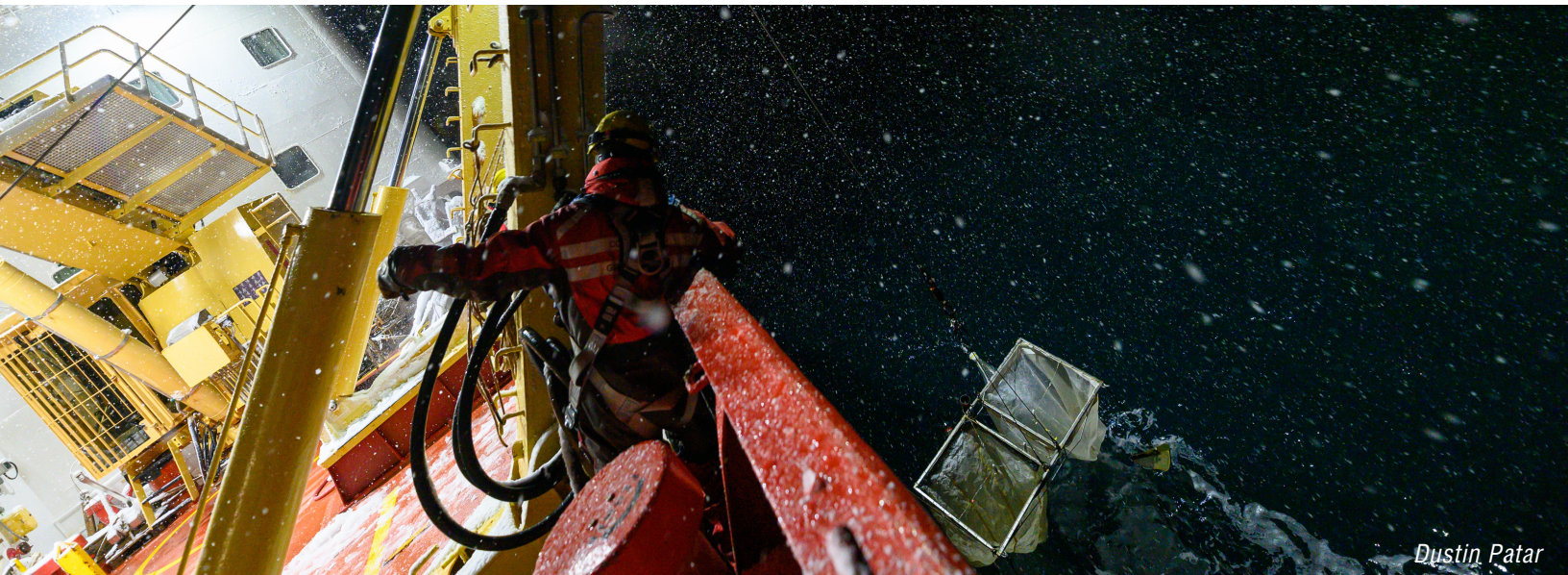
Dustin Patar

Alain Gariépy, Captain of the CCGS *Amundsen*.

The journey of the Leg 4 also celebrated the end of Captain Gariépy's final Arctic expedition on the CCGS *Amundsen* and marked a successful expedition focused on exploring Foxe Basin.

LEG 4

RESEARCH ACTIVITIES



Dustin Patar

Operations take place continuously on the *Amundsen*, even during the night or if it snows.

Despite encountering strong wind and waves during the first-few stations, most planned stations were completed except for two nutrient stations in Fury and Hecla Strait. In Foxe Basin, crew and scientists worked effectively together, with favourable weather speeding up station stops. COVID cases among the crew were managed, and a malfunctioning instrument was addressed with persistence. In Foxe Basin, crew and scientists worked effectively together, with favourable weather speeding up station stops. COVID cases among the crew were managed, and a malfunctioning instrument was addressed with persistence.



Dustin Patar

Crew members and scientists preparing to deploy the beam trawl.

LEG 4

RESEARCH ACTIVITIES

At station number 350, a significant discovery of a cold, high-salinity water mass was made, important for the FoxSIPP project. Some setbacks occurred with a mooring deployment, but overall objectives were met in Foxe Channel. Returning south through the Labrador Sea was swift, with a storm avoided, leading to an early arrival in Québec City.

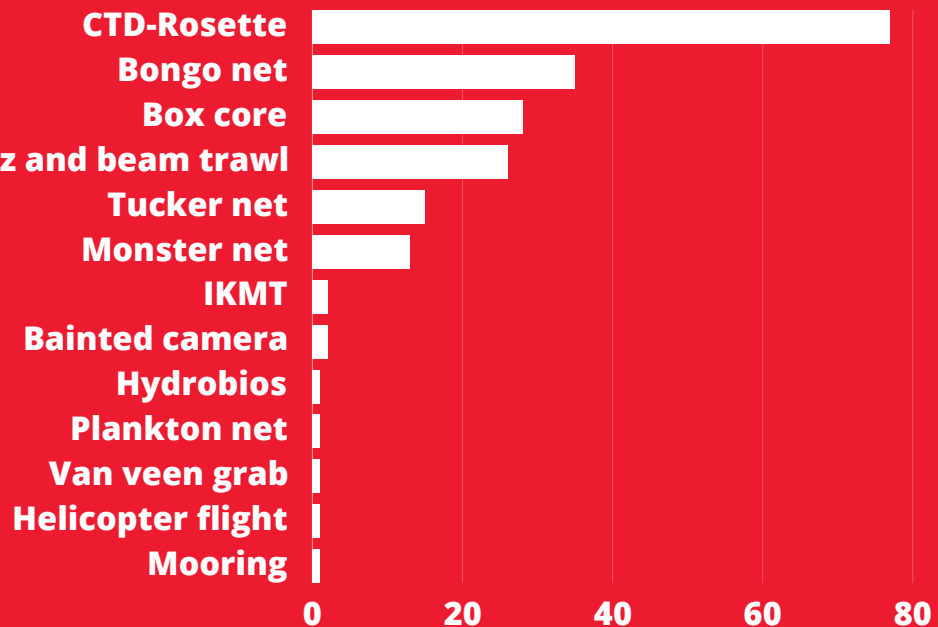


Dustin Patar



Dustin Patar

DISTRIBUTION OF THE 203 OPERATIONS



CONCLUSION

2023 AMUNDSEN EXPEDITION

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.

Planning is already underway for the 2024 *Amundsen Expedition*, which will take place in summer and fall of 2024. We are thrilled about the science ahead of us!

