AMUNDSEN SCIENCE

2024

EXPEDITION SUMMARY REPORT

INTRODUCTION

The 2024 Expedition Summary is an overview of the science activities undertaken on board the CCGS *Amundsen* during the 2024 field season. This expedition was planned and coordinated by Amundsen Science in collaboration with the Canadian Coast Guard. It was built to support 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.

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 2024 Expedition Report, available in English on our website.

Our organization is looking forward to improving the way we share our activities before, during and after the annual *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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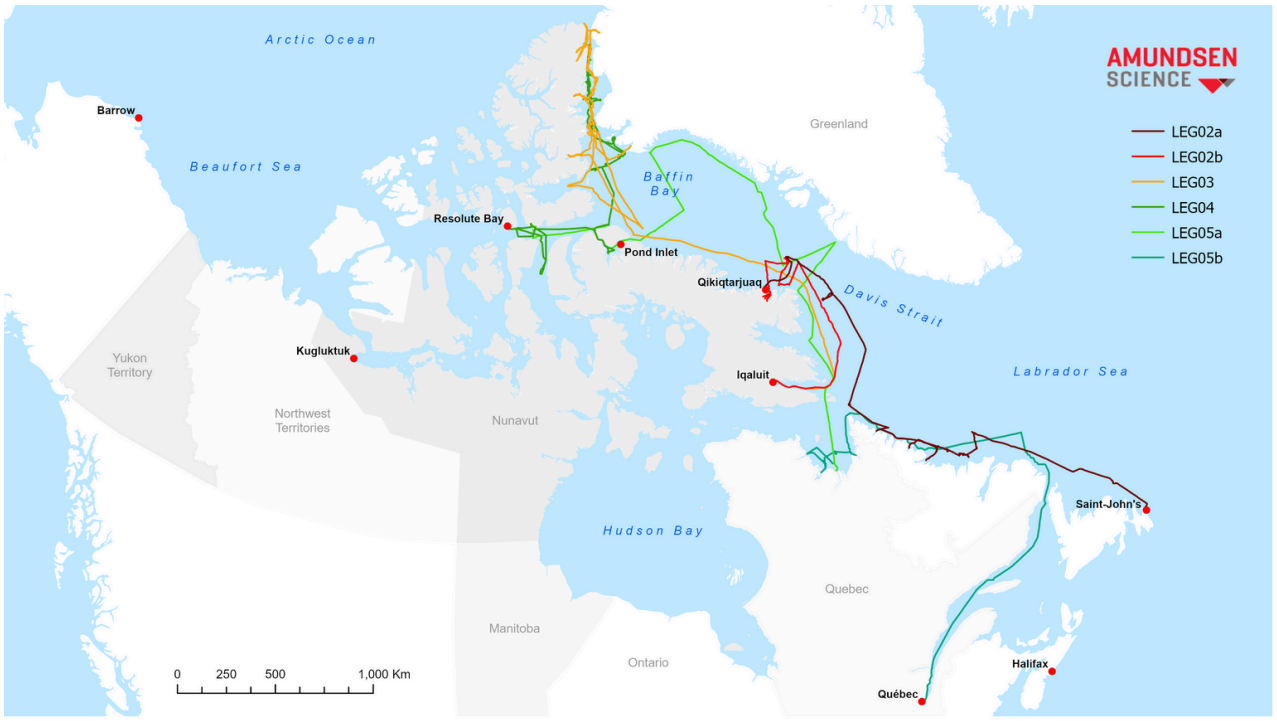
OVERVIEW

On 16 June 2024, the Canadian research icebreaker CCGS *Amundsen* departed Québec City for its mission to the Arctic Ocean.



The 2024 *Amundsen* Expedition took place from June 16 to October 29, after a two-week mobilization period in Québec City in early June. The first Leg of 28 days was dedicated to Canadian Coast Guard operations. It was followed by the scientific mission divided into 4 Legs and 111 days at sea. From June to October 2024, the *Amundsen* successfully completed a 139-day expedition and travelled over 18 405 nautical miles.

AN INTERNATIONAL AND MULTIDISCIPLINARY EXPEDITION !

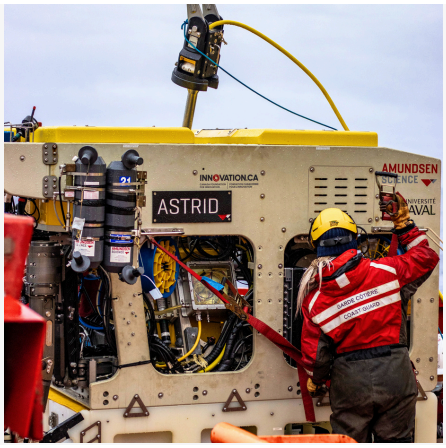
A total of 188 scientists from eight research programs were on board to study the Arctic and subarctic marine ecosystems through multidisciplinary research activities in the Labrador Sea, Baffin Bay, Nares Strait, Lancaster Sound, Ungava Bay, and numerous fjords along the cruise track.

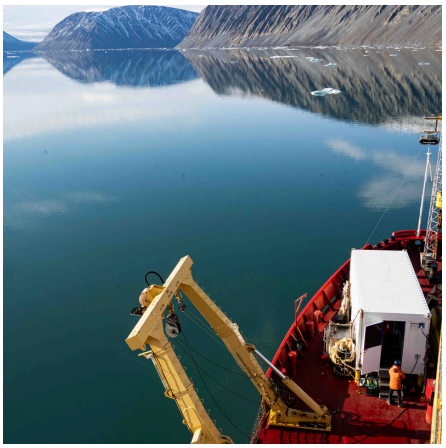
Programs onboard included the Imappivut program, DFO Benthic Refuges, KEBABB/S, Transforming Climate Action (TCA), REFUGE-ARCTIC, ArcticCore, CEOS-CERC Moorings and Sentinel North Grad School program in collaboration with WAGE Circumpolar Partnership. From aquatic organisms and seabirds to melting glaciers, ice floes, ocean dynamics and seabed mapping, numerous aspects of the northern marine environment were studied as part of these programs during this 2024 *Amundsen* Expedition.

OVERVIEW

2024 AMUNDSEN EXPEDITION

The CCGS *Amundsen* first sailed in the Labrador Sea, where a remotely operated vehicule (ROV) dive led to the observation of a vertical coral wall near Makkovik. In addition, the teams on board successfully deployed a 1200 m mooring line in Baffin Bay, and collected a 7 meters long sediment core with the piston corer.





The ship then headed for Nares Strait, where the teams successfully collected numerous samples with the trace metal rosette, a water sampler deployed from the moon pool room, and analysed them in the new clean laboratory. The *Amundsen* visited and mapped five fjords of Ellesmere Island and Greenland, and sampled various glaciers, lakes and rivers. The teams of Leg 3 were also able to carry out 9 scientific operations in the vicinity of the 82nd parallel between Greenland and Canada. Finally, they were able to recover several mooring lines that were deployed last year.

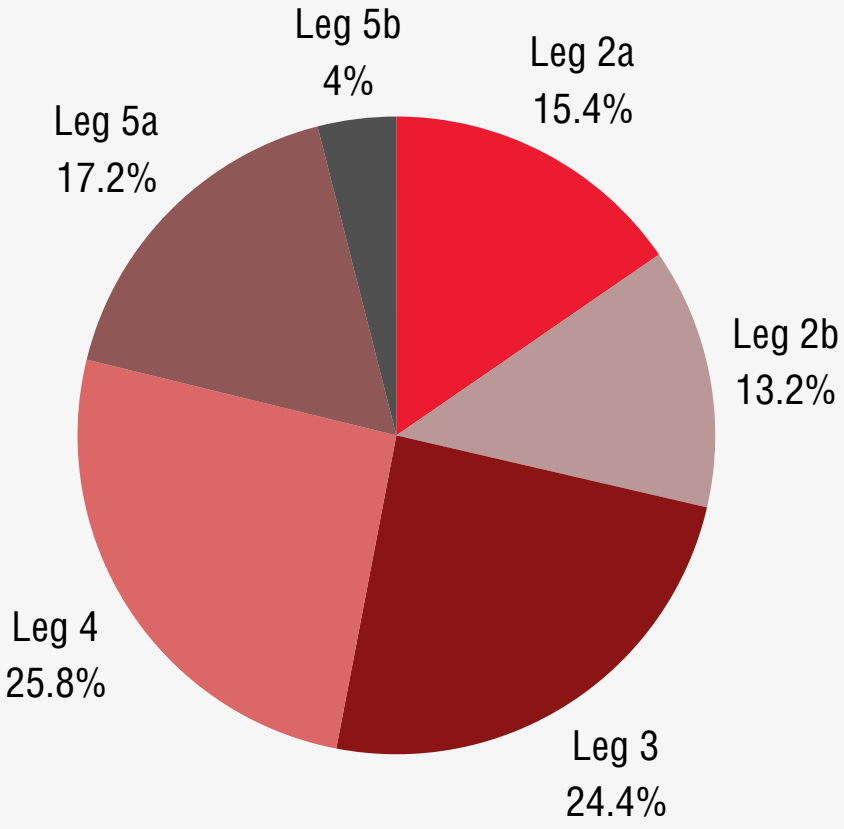
The rotation between Legs 3 and 4 took place at the Pituffik space base, a first in the history of the Canadian icebreaker *Amundsen*. The plan for this fourth Leg was to move rapidly northwards into the Lincoln Sea for 12 days of ice and sea operations. Strong winds and icy conditions prevented the teams on board from reaching the Lincoln Sea. However, they took the opportunity to carry out various operations, including ice coring and experiments on 5 ice floes in Nares Strait. In addition, the CTD-Rosette and Trace-metal Rosette were highly used as the teams concluded the Leg 4 with a total of 85 casts!

OVERVIEW

2024 AMUNDSEN EXPEDITION

The last Leg of the 2024 *Amundsen* Expedition was separated in two parts. The teams in Leg 5a were able to work day and night to accomplish numerous operations across a L-shaped transect that went from the Canadian coast to the Greenlandic coast. Leg 5b welcomed on the Amundsen students and multidisciplinary experts from natural and social sciences for a graduate school. The ship arrived in Québec City on October 29th and its arrival was swiftly followed by a scientific demobilization.

DISTRIBUTION OF THE 779 OPERATIONS DURING THE 2024 *AMUNDSEN* EXPEDITION



TIMELINE

2024 AMUNDSEN EXPEDITION

JUNE 14TH
Start of the Expedition, Québec City

28 days — Leg 1
Canadian Coast Guard duties

JULY 11TH
Crew Change, St-John's

18 days — Leg 2a
Imappivut & DFO Benthic Refuges

JULY 29TH
Science Rotation, Qikiqtarjuaq

10 days — Leg 2b
KEBABB/S & TCA

AUGUST 8TH
Crew Change, Iqaluit

28 days — Leg 3
REFUGE-ARCTIC & ArcticCORE

SEPTEMBER 5TH
Crew Change, Pituffik Space Base

28 days — Leg 4
REFUGE-ARCTIC, CEOS-CERC Moorings, TCA, KEBABB/S & ArcticCORE

OCTOBER 3RD
Crew Change, Resolute Bay

17 days — Leg 5A
TCA, KEBABB/S

OCTOBER 20TH
Science rotation, Kuujjuaq

9 days — Leg 5B
Sentinel North-WAGE Grad School

OCTOBER 29TH
End of the Expedition, Québec City

LEG 2A

DESCRIPTION OF THE PROGRAMS

Leg 2a begun with a short mobilization in St. John's, followed by transit towards Labrador Sea for the Imappivut marine spatial planning program. This research program led by the Nunatsiavut Government builds upon previous multidisciplinary missions that surveyed benthic biodiversity in Canada's northern oceans, identified fragile habitats from coastal to deep ocean waters, and characterized fish communities.

Along the Labrador Coast and southern Baffin Bay the teams had various research objectives such as to further study biodiversity hotspots and investigate potential new ones, improve our knowledge of pelagic fish and plankton community of these regions and map and sample potential sites of submarine landslides.

In addition, this Leg was promoting Inuit-led research, knowledge co-production and Inuit participation by adhering to the principles of the National Inuit Strategy for Research for Inuit Self-Determination in Research and having a co-chief scientist from Nunatsiavut on the scientific team.

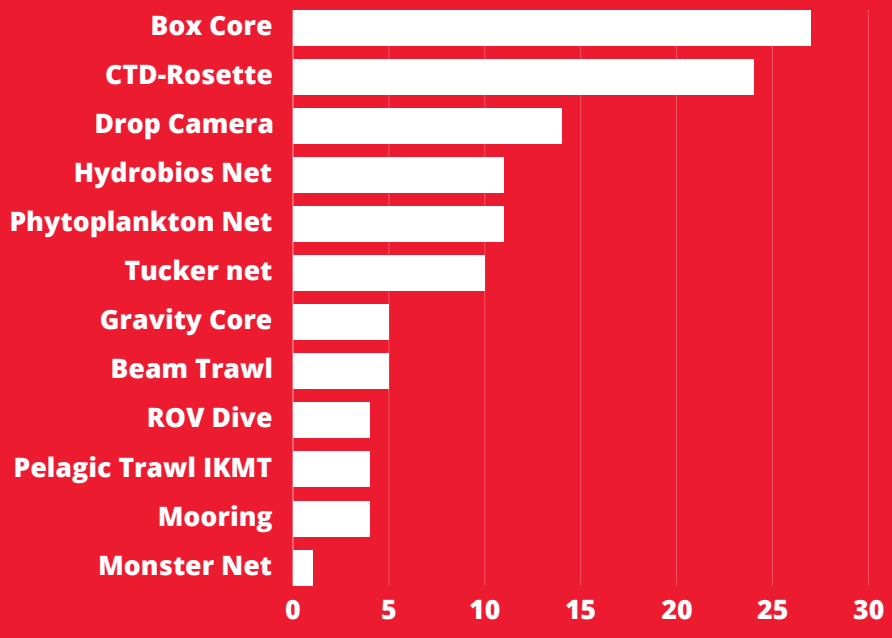
An intern on board the CCGS *Amundsen* being trained to operate the CTD-Rosette.

LEG 2A

RESEARCH ACTIVITIES

To achieve these objectives, the vessel travelled in Labrador Sea and Baffin Bay, sampled 29 stations, and conducted 120 operations including ROV dives at 4 different sites: Makkovik, near Nain, in Davis Strait Conservation Area and in Disko Fan Conservation Area. Although Leg 2a faced challenging sea states, sea ice and strong currents, the mission was able to address most planned objectives. Highlights of the cruise include the observation of dense hanging coral gardens at the Sentinel site near Nain, and the successful completion of complex ROV operations, including installing instrumentation on vertical coral habitats. Thanks to Joey Agnatok, we were able to film these coral gardens. As a location unknown to science, we are grateful to Nunatsiavut Government, Joey and the community of Makkovik for sharing the location scientific onboard the *Amundsen* for this program.

DISTRIBUTION OF THE 120 OPERATIONS



LEG 2B

DESCRIPTION OF THE PROGRAMS

After a science rotation in Qikiqtarjuaq on July 29th, the CCGS *Amundsen* entered the fjords of the Auyuittuq National Park to study the seafloor sediments and the pelagic environment for the program Transforming Climate Action (TCA). This large research program aims at constraining the role of the ocean in the global carbon cycle to reduce uncertainties in its role in climate change.

Scientists waiting on the front deck for their seafloor sediment samples in fjords of the Auyuittuq National Park.

The KEBABB/S (Knowledge and Ecosystem-Based Approach in Baffin Bay/Barrow Strait) program from Fisheries and Oceans Canada was also part of Leg 2b and is a priority for the development and implementation of an ecosystem-based approach to fisheries management in Baffin Bay since 2019. During the cruise, the team aimed to better understand key drivers for the productive capacity, diversity, and ecosystems in the region.

LEG 2B

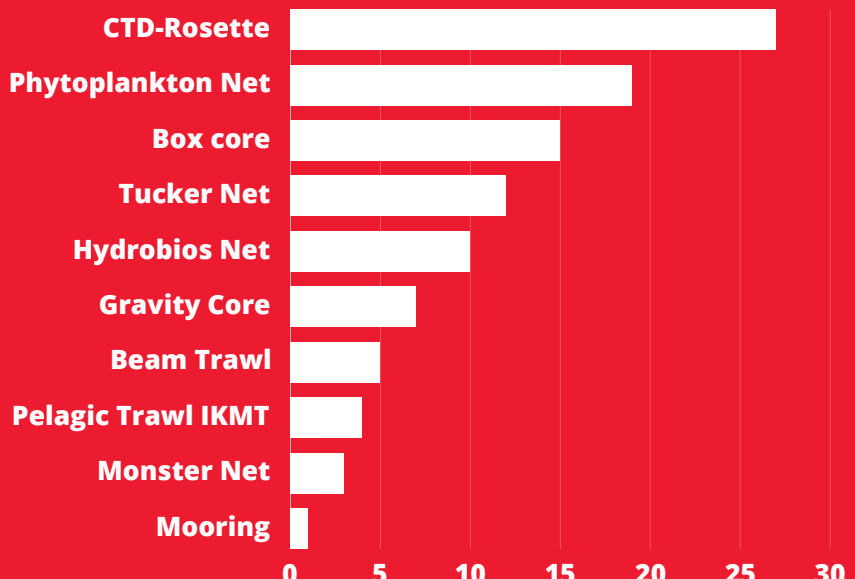
RESEARCH ACTIVITIES

During the three days dedicated to TCA, the teams used the CCGS *Amundsen*'s scientific instruments to sample seawater, sediments, fish and zooplankton in three fjords: Maktak, Coronation and North Pangnirtung. Gravity cores and box cores were collected in each of the fjords. Dedicated mapping to reconstruct the history of the seafloor and glaciers was conducted at night.

In order to answer their research objectives, the KEBABB/S teams planned three transects across Baffin Bay and a mooring turnover for Leg 2b. Due to unusual ice conditions and slower transit time, some stations and operations had to be cancelled, including the recovery of an important mooring. Nonetheless, a mooring was successfully deployed at an alternate location.

Overall, the teams were able to accomplish 103 operations at 31 stations during Leg 2b on the CCGS *Amundsen*, including 24 hours of dedicated mapping.

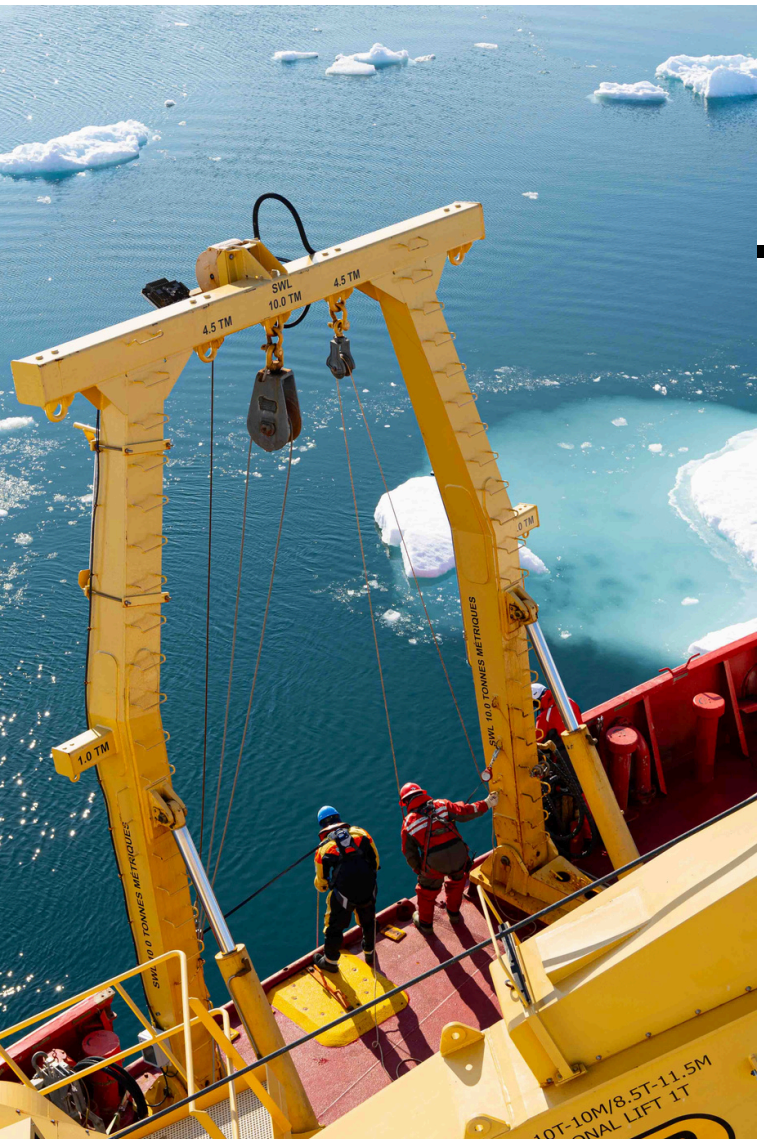
DISTRIBUTION OF THE 103 OPERATIONS



LEG 3

DESCRIPTION OF THE PROGRAMS

The main program during Leg 3 was Refuge-Arctic, an international program studying the last ice area to understand past, present and future changes in the Arctic, assess impacts, and inform Arctic and global communities by providing comprehensive information about the Arctic environment and its ecosystems. The program involves more than 60 researchers from 21 institutions divided into five teams with a focus on physics, geochemistry, marine productivity, paleoceanography and modelling.



Under the A-frame of the CCGS *Amundsen* front deck a scientist and a crew member of the Canadian Coast Guard are recovering a scientific instrument and waiting to collect their samples.

Fisheries and Oceans Canada's ArcticCORE research program shared similar objectives and was able to join Refuge-Arctic aboard to study the Tuvaijuittuq marine area and understand how the ongoing changes impact marine ecosystems. These findings will contribute to sustainable management, engagement and conservation efforts in the area.

LEG 3

RESEARCH ACTIVITIES

The CCGS *Amundsen* travelling through ice to get to its next station.

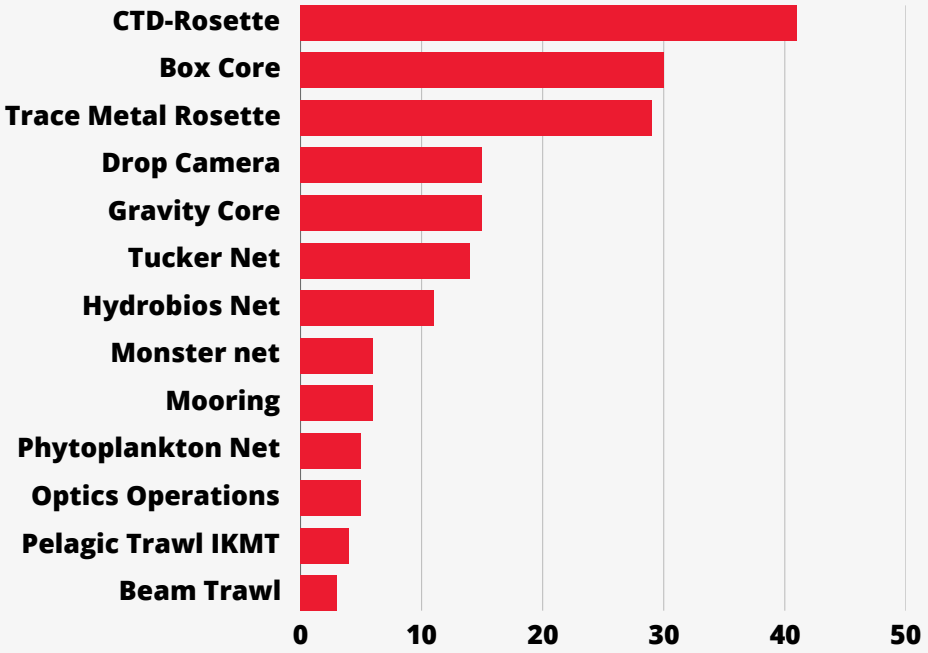
During Leg 3 of the expedition, the teams on board the *Amundsen* studied the ecosystems of five fjords and glacier terminuses of Ellesmere Island and Greenland (Makinson, Dobbin, Archer, Newman, Cadogan fjords). The *Amundsen*'s helicopter was then used on six occasions to collect samples from 5 glaciers, 6 rivers and 3 lakes, and conducted various operations in Nares Strait and at the entrance of the Lincoln Sea. Highlights of Leg 3 include reaching the entrance to the Lincoln Sea (latitude of 82.41°N), successfully recovering six oceanographic moorings that recorded data and collected samples during a full annual cycle and mapping 8200 km^2. The teams completed 190 operations at 25 stations.

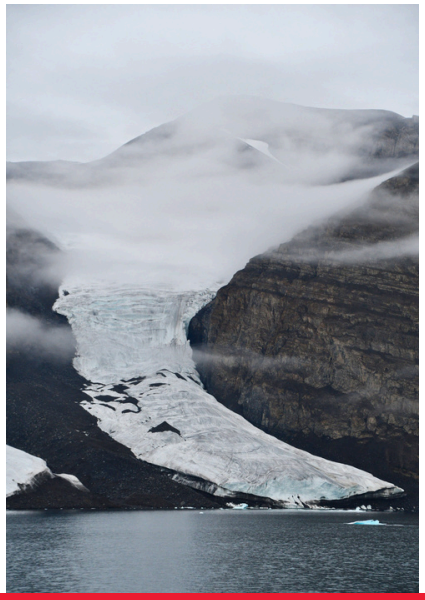
Scientists in the clean lab collecting water samples from the Trace-Metal Rosette.

LEG 3

RESEARCH ACTIVITIES

DISTRIBUTION OF THE 190 OPERATIONS





A marine terminated glacier.

Scientists collecting samples on top of a glacier.

LEG 4

DESCRIPTION OF THE PROGRAM

The fourth Leg of the expedition began after a crew change at the Pituffik Space Base (Greenland) when the icebreaker headed north into Nares Strait. While the plan was to reach Lincoln Sea to study the oceanographic circulation and to sample floes of old ice for the Refuge-Arctic program, these operations were finally undertaken in Nares Strait and Kane Basin. There was a strong focus on understanding the water masses composition by retracing its provenance with various tracers and studying the presence of contaminants (plastics and metals).

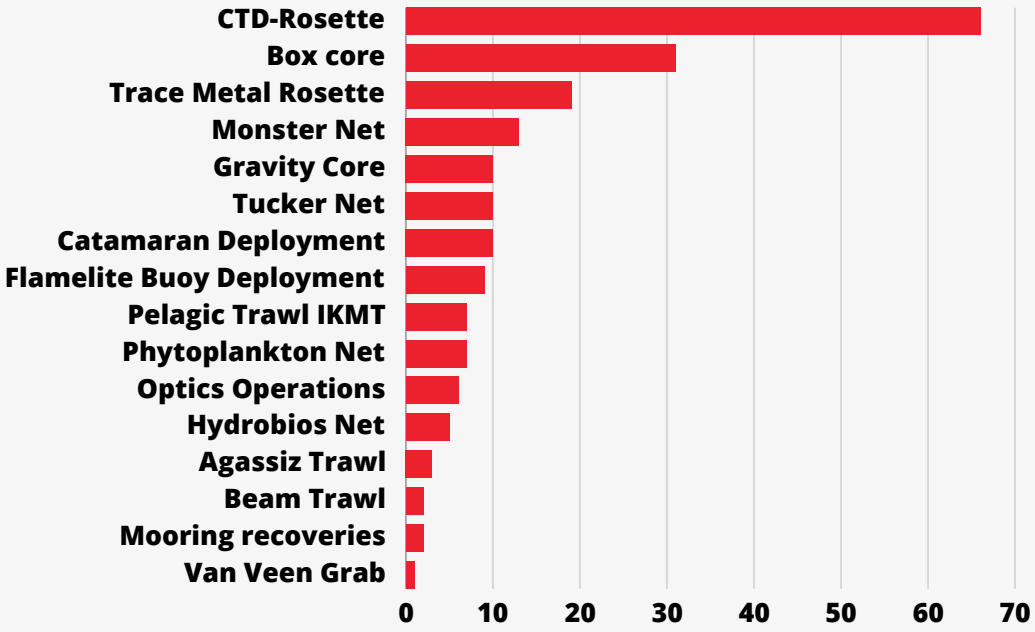
Ice operations on a multi-year ice floe: two scientists mesuring, cutting and packing their ice cores.

LEG 4

RESEARCH ACTIVITIES

Science teams sampled water, sediment, fish and plankton along transects across Kennedy Channel, Kane Basin and Smith Sound. Ice coring and experiments on light interaction and ice deformation took place on five ice floes. Light interaction was also studied from the barge. The *Amundsen* then continued its journey towards Resolute Bay for the next crew change, while sampling the NOW polynya transect and recovering three moorings for the CEOS mooring program.

DISTRIBUTION OF THE 201 OPERATIONS



The Remotely Operated Catamaran during its deployed at sea

The Trace-Metal Rosette being launched in the moonpool.

The nets team collecting biological samples.

LEG 5A

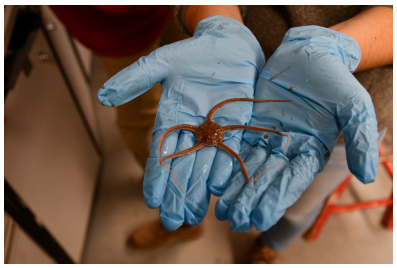
DESCRIPTION OF THE PROGRAMS

Jean-Sebastien Berlinguette

The TCA program was on the CCGS *Amundsen* for a second time during this field season to continue their research program on carbon cycling in the Arctic.

Their objectives for this Leg were to resolve the structure, composition and provenance of waters and constituents entering and exiting Baffin Bay and the Labrador Sea, determine how the waters entering Baffin Bay impact and are impacted by ecosystem processes within the bay and better understand how the above processes affect the transfer of constituents 'downstream.'

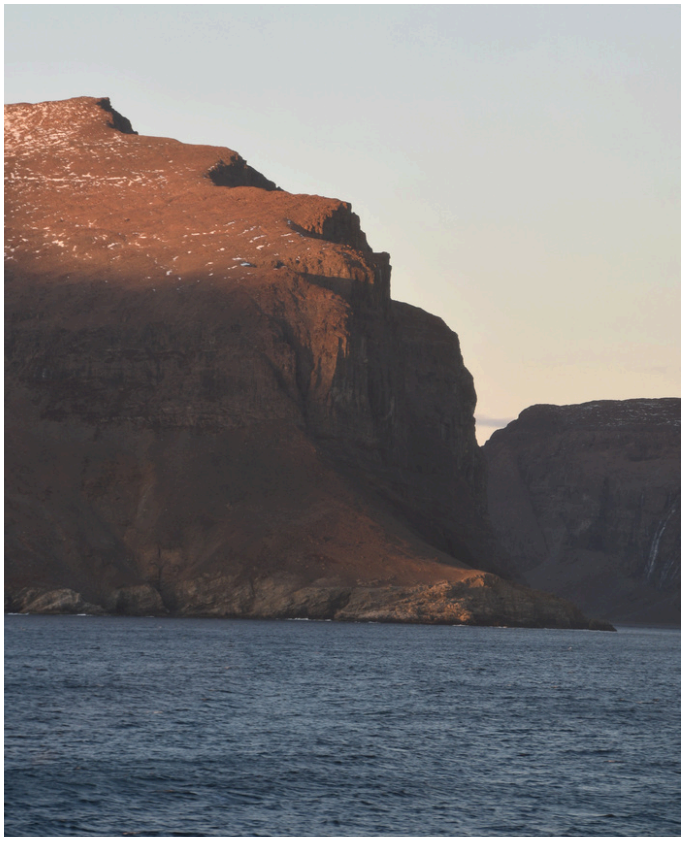
Deployment of the box core to collect seafloor sediment samples.



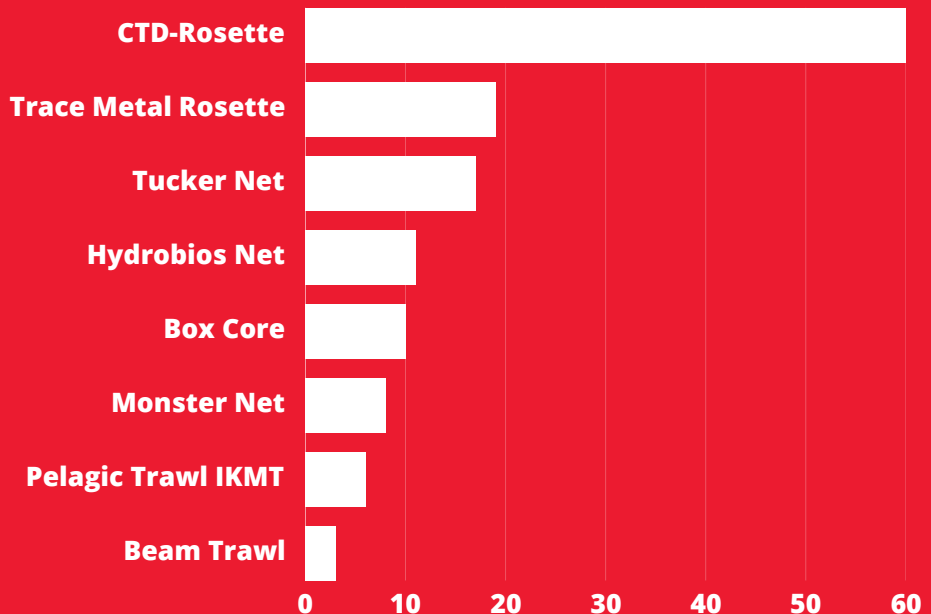
LEG 5A

RESEARCH ACTIVITIES

The teams sampled the deepest areas of Baffin Bay along a L-shaped transect from Canada to Greenland and Davis Strait. The KEBABB/S program was also present to study the ecosystems in Davis Strait and in Lancaster Sound. Leg 5a ended on October 20th in Kuujjuaq, Nunavik, after 134 operations conducted at 38 stations across Baffin Bay and Lancaster Sound.



DISTRIBUTION OF THE 134 OPERATIONS



LEG 5B

DESCRIPTION OF THE PROGRAMS

The participants of the International Graduate School on the Emergence of Innovative Blue Economies in the Arctic (joint initiative of the WAGE Circumpolar Partnership and the Sentinel North program) boarded the *Amundsen* in Kuujjuaq on October 20th. The participants had already been in the community for a week before they joined the vessel, exchanging and learning about the challenges and the opportunities Northern communities are facing in a changing North.

The school focused on equity and local self-determination in innovation and adaptation, including taking advantage of migrating fish stocks, shellfish, and seaweed cultivation, along with emerging small-scale tourism.

Participants of the International Graduate School on the Emergence of Innovative Blue Economies in the Arctic learning about sensors on the CTD-Rosette and how to operate the instrument.

LEG 5B

RESEARCH ACTIVITIES

Science rotation taking place in Kuujjuaq with the *Amundsen*'s helicopter.

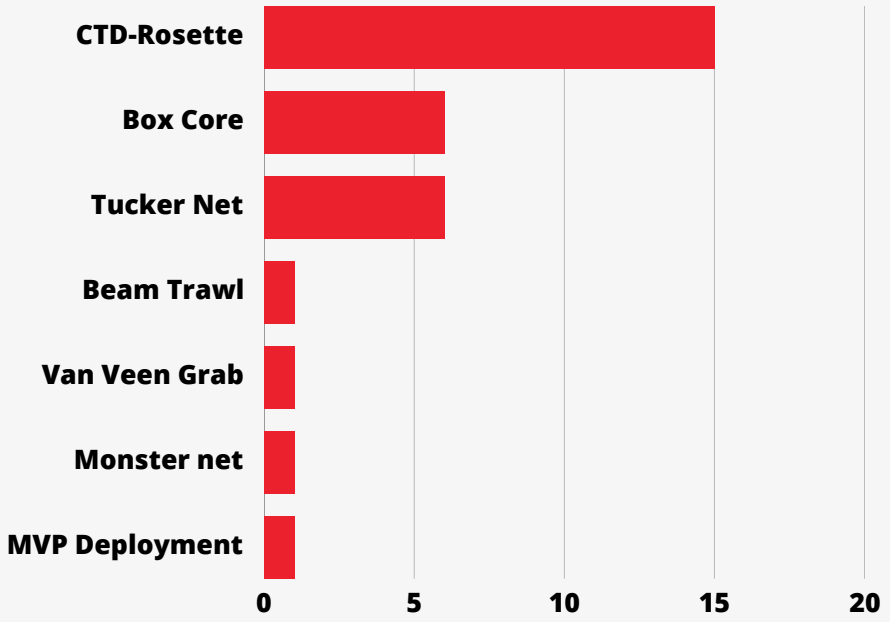
Through an interdisciplinary approach, students integrated biological, chemical, and physical oceanographic data with social science research to better understand the emerging blue economy in Arctic communities. Their work continued as they boarded the CCGS *Amundsen* to spend a few days in Ungava Bay as part of this unique training experience, studying the poorly sampled marine ecosystem and visiting communities of the Bay. The icebreaker then traced its way back for its return to Quebec City on October 29th with some opportunistic sampling stations along the way, ending a 111-day-long scientific journey in the Arctic.

Participants of the International Graduate School on the Emergence of Innovative Blue Economies in the Arctic learning about how to collect biological samples with the Tucker Net.

LEG 5B

RESEARCH ACTIVITIES

DISTRIBUTION OF THE 31 OPERATIONS



LEG 5B

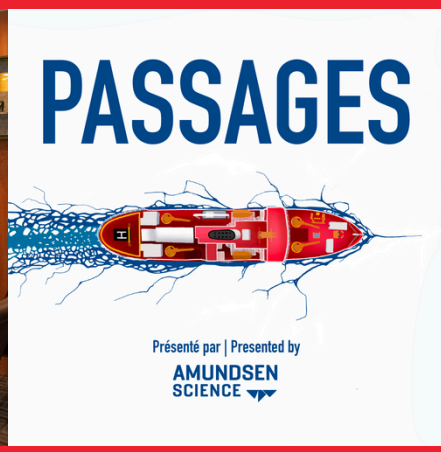
MEDIA ACTIVITIES

During the 2024 *Amundsen* Expedition, we welcomed a team of journalists and cameraman from the scientific show Découverte, at Radio-Canada. They were part of the sea trials and Leg 5B to document scientific activities taking place on board the CCGS *Amundsen*.

In addition, Amundsen Science team has recorded numerous videos during Legs 2, 3 and 4 for Découverte in order to cover the entire expedition in the scientific documentary. The episodes are scheduled to be broadcast during winter 2025 on Radio-Canada.

PASSAGES PODCAST

At Passages, we welcomed scientists aboard the CCGS *Amundsen* who shared their discoveries about unique Arctic phenomena, from climate change to fascinating marine ecosystems. We had the opportunity to record 11 episodes for this first season of Passages podcast.



ENGAGEMENT WITH NORTHERN COMMUNITIES

NORTHERN COMMUNITIES VISITS

Amundsen Science has created a new role within its organization to better engage and solidify collaborations with Northern communities. Myrah Graham was hired as the Northern Research Liaison and organized visits to meet and consult various communities.

The communities of Kinngait, Iqaluit, Pangnirtung, Kuujjuaq and Kangiqsualujjuaq were visited over a six-week period. Previous connections facilitated outreach and engagement in Pangnirtung, Iqaluit and Kinngait, while operations during Leg 5b facilitated access to Kuujjuaq and Kangiqsualujjuaq. All these communities had or will have the CCGS *Amundsen* in their nearshore, making it all the more essential to connect with community members during the Fall 2024 Northern Community Tour.

ENGAGEMENT WITH NORTHERN COMMUNITIES

OUTREACH ACTIVITIES AND OUTCOMES

During the fall 2024 Northern Community Tour, seven schools were visited in three communities, reaching over 85 students. In addition, Myrah participated in three radio interviews across Nunavik and organized two open-house events in Nunavut. Potential Inuit trainees were met, and new municipal and institutional connections were established in each community visited.

The Northern Research Liaison came back with ideas for projects Amundsen Science could develop, such as:

- Scientific communication tools on-board the Amundsen for northern communities;
- In-person or livestream activities to help solidify engagement and collaborations between scientists working on the CCGS Amundsen and northern community members;
- New working opportunities for northern community members to participate on the CCGS Amundsen as trainees or as artists;
- Art projects with Inuit and scientific visual artists to better share the results and experiences onboard the CCGS Amundsen

OTHER EXPEDITIONS RELATED TO THE *AMUNDSEN*

MISSION HORIZON GLACÉ

RQM's research program to mitigate the impacts of commercial shipping on ecosystems (PLAINE) and the Transforming Climate Action (TCA) program coordinated a mission that allowed 13 projects to carry out operations on the CCGS *Amundsen in Saguenay Fjord during winter 2024*. Despite the priority given to Coast Guard icebreaking and escort operations over scientific activities, 9 days of scientific operations were carried out of a total of 15 days at sea.

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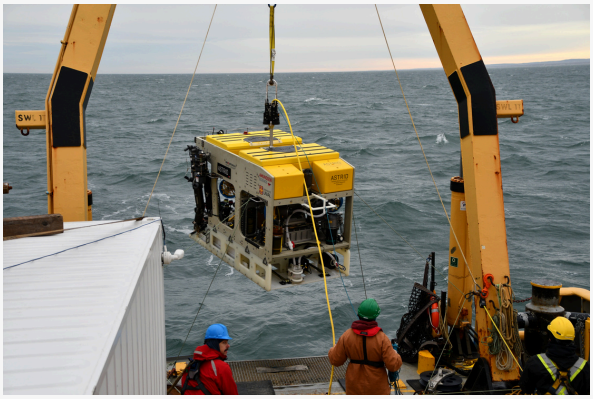
Learn more

OTHER EXPEDITIONS RELATED TO THE *AMUNDSEN*



MISSION ROV ULAVAL – CORIOLIS II

In November 2024, ASTRID and two technicians of Amundsen Science were mobilized for a scientific mission on the Coriolis II operated by Reformar. Funded by ISMER's Transforming Action for Climate (TCA) program, the mission was designed to test the ROV's various functions by recovering instruments for monitoring maritime traffic and gathering information for research projects on the oxygen-depleted zone off Rimouski.

Learn more

CONCLUSION

2024 AMUNDSEN EXPEDITION

The various operations undertaken on board the CCGS *Amundsen* during this field season and outreach activities of this fall Northern Community Tour were an important part of this year's success. The 2024 *Amundsen* Expedition provided to participating scientists, including indigenous researchers, the opportunity to increase their knowledge of the Arctic and subarctic ecosystems. Overall activities of 2024 will help better understand how climate change affects fragile marine ecosystems and human health and will help facilitate locally supported objectives targeting the coastal and offshore Arctic environments.

The expedition could not have been a success without the remarkable support from the Canadian Coast Guard, collaboration from the user programs, and inexhaustible efforts from the onboard crew and science participants.

Planning is already underway for the 2025 *Amundsen* Expedition, which will take place in the summer and fall 2025. We are thrilled about the science ahead of us! Do not hesitate to reach out to media@as.ulaval.ca for any questions or comments about this document or about the annual *Amundsen* Expedition.

2024

www.amundsenscience.com

AMUNDSEN SCIENCE