Nunavut Research Institute

License Holder Reporting Requirements:

For research undertaken in the 2024 Calendar Year

Project title: An Updated View of the Oceanographic Conditions in the Northern Canadian Arctic.

Project License: 0203924-M

Project Leader: David Babb - University of Manitoba.

Project Team:
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David Capelle - Department of Fisheries and Oceans Canada

Abstract: *A concise summary of what was done, found, and concluded to date, and how the results/information will be used. This summary must be translated into the appropriate dialect of Inuktitut. Suggested length: 250-300 words. *This section will be published in the NRI's annual compendium of licensed research*

As part of this research program a unique set of oceanographic profiles were collected throughout the northern Canadian Arctic from the CCGS Des Groseilliers during August 2024 and a suite of autonomous oceanographic instruments were deployed from the newly formed sea ice in Eureka Sound to observe the seasonal evolution of the ocean and ice in Eureka Sound throughout winter 2024-2025. Together these observations address the pronounced gap that exists in our understanding of the oceanographic conditions across the northern Canadian Arctic, an area that has been sparsely studied since the initial oceanographic observations were collected 50 years ago and is projected to be home to the last sea ice in a warming climate. Preliminary results highlight that there is greater freshwater in the study region compared to 50 years ago, which may be due to greater Pacific water inflowing from the Arctic Ocean. We also find that Pacific water can be well traced by measuring CDOM (Colour Dissolved Organic Material) concentrations in the water column. Work is ongoing to interpret the results of the oceanographic profiles, compare them to historic observations and use a high-resolution ice-ocean model to disentangle the roles of interannual variability and long term climate change in driving differences compared to historic observations. Results will eventually be published through the peer-review process and communicated to local communities and funding agencies. Data will be freely available through an online data repository at the University of Manitoba. This project has addressed a key gap in our understanding of the Canadian Arctic and lays the foundation for future work in this area as we seek to understand how this area will respond to a warming climate.

Key messages: *Concise, plain language summary of key take-away messages of work to date, findings and conclusions. Preferably 3-5 points, in bullet form.*

1. A collection of water samples were collected across the northern Canadian Arctic from the CCGS Des Groseilliers in August 2024 and from the newly formed landfast sea ice in November 2024.
2. Oceanographic profiles highlight strong stratification of the water masses with a surface mixed layer containing freshwater from glacial discharge and sea ice melt, and layers of Pacific and Atlantic waters at depth.
3. Pacific waters are shown to be traced by high concentrations of CDOM (Colour-Dissolved Organic Material).
4. Compared to observations from 50 years ago, there is greater freshwater in the northern Canadian Arctic, suggesting greater inflow of pacific and riverine waters from the Arctic Ocean which in turn may impact the local marine-environment.
5. An oceanographic mooring and ice-mass balance buoy were deployed on the newly formed sea ice in Eureka Sound during November 2024. Together they will collect a unique seven-month long view of the seasonal evolution of the water and ice throughout winter 2024-2025.

Objectives: *Project objectives, preferably in bullet form.*

- Collect oceanographic profiles from the northern Canadian Arctic for comparison to historic observations collected over 50 years ago.
- Deploy oceanographic moorings to collect seasonal/annual time series of the oceanographic properties in the northern Canadian Arctic.
- Deploy an ice mass balance buoy to observe the seasonal growth and subsequent melt of seasonal sea ice in the northern Canadian Arctic

Annual activities: *A description of activities and methods carried out during the current reporting period. This section should answer the questions: What? Where? When? Who? How? Include dates team members conducted research at remote field sites or collected data (including interviews) in communities; append a map with locations and/or coordinates of remote field sites, if applicable.*

During August 2024, David Babb and Igor Dmitrenko collected profiles of the water column from the CCGS Des Groseilliers during its annual re-supply run to Eureka. The two team members boarded the vessel in Coral Harbour on August 7 and departed in Pond Inlet on August 23. They collected 23 profiles using a SeaBird SBE19plus and a SUNA instrument which collectively measured the temperature, salinity, nitrates, CDOM, Chlorophyll, Turbulence, dissolved oxygen, and light through the water column. See the attached field report for sampling locations and preliminary results.

In November 2024, David Babb, Sergei Kirillov and Igor Dmitrenko deployed a suite of autonomous equipment on the newly formed sea ice in Eureka Sound and collected three profiles of the water column across Eureka Sound. Details are available in the attached field report, but the team arrived in Eureka from Yellowknife on November 7 and flew out to Resolute on November 23. The Ice Tethered Profiler and Ice Mass Balance buoy are autonomous instruments that will operate until they are recovered in May 2025 ahead of the landfast ice becoming unstable. The CTD and SUNA instruments were the same ones used in August 2024.

Results and Achievements: *Findings and results to date of the above activities, highlighting any key research achievements (see guide below for formatting tips regarding tables and figures).*

The key achievements from this program to date are two fold, first a unique set of CTD profiles from the northern Canadian Arctic have been collected and will provide grounds for comparison to historic observations collected in the 1960s and 1970s that can highlight how the oceanography of the region varies and may have changed over time. Second, a suite of autonomous instruments have been deployed on the landfast sea ice in Eureka Sound and will collect a roughly seven month long record of the oceanographic changes and growth of sea ice throughout winter. Both of these are major accomplishments considering how remote and relatively inaccessible this region is, and directly address the gap in scientific observations of this area. Preliminary results are highlighted in the attached field reports and are currently being analyzed deeper for preparation of peer-reviewed journal articles.

Challenges/Obstacles: *In this section, please comment on any challenges/obstacles (if any) that you experienced during this project year. If there were any actions to mitigate or resolve these challenges, please list them here. Were any concerns raised regarding the conduct of research team members or the impacts of the project?*

Our greatest challenges/obstacles to completing this work were related to the natural environment as weather impacted both field seasons. Specifically, ice and poor visibility affected the August survey onboard the CCGS Des Groseilliers, while delayed freeze-up of the ice cover and a prolonged blizzard led to delays in the November deployment. Unfortunately there is nothing we can do about bad weather, so we remain flexible and adaptive in the field and make the most of our time while also ensuring everyone's safety.

Expected Project Completion Date: 2027-04 is when the Canadian Excellence research Chair Program will end at the University of Manitoba.

Project Website: Coming soon.

Citations: Append a complete references list if citations were used in the document

Policy Relevance:

Does this research support policy development of decision-making in Nunavut, if yes, please describe.
This research contributes to our collective understanding of change in the northern Canadian Arctic and the oceanographic processes that are affecting the area that is projected to be home to the Last Ice. Due to its importance as a sea ice habitat, this work contributes to the baseline understanding and ongoing monitoring of the Tuvaijuittuq Marine Protected Area and the downstream areas where changes influence fisheries and Inuit communities. So, we would say there is some relevance to environmental policy within Nunavut.

Research Outcomes: Benefits

Community Engagement: *Briefly list and describe any community consultation, engagement, collaboration and outreach activities that you have undertaken for the project; describe the role(s) that community members and/or specific organizations have played in research co-design and activities.*

Inuit communities were involved in the initial development of the Canada Excellence Research Chair (CERC) program led by Dr. Dorthe Dahl-Jensen at the University of Manitoba. Through the CERC we have been in contact with the HTO and CLARC from Grise Fiord and provided regular updates on the program. During August 2023 one of our team members took part in the CCGS Amundsen's community visit to Grise Fiord where they described our interests and sampling plans. As mentioned earlier we attempted to hire a field assistant from Grise fiord for the November field program but our initial hire backed out at the last minute and two additional contacts never answered our attempts to contact them.

Youth Engagement: *Briefly list and describe any outreach, school or classroom activities that you have undertaken for the project; describe the role(s) that youth have played in your research activities.*

Because we have only briefly travelled through the communities en route to Eureka and while embarking/disembarking the CCGS Des Groseilliers we have not connected with the youth or schools in these communities. This is something we would like to improve upon and will attempt to do during our travel in spring 2025.

Training and Employment:

How many Nunavummiut received training from team members? Please describe training and/or compensation provided.
None. We attempted to hire a research assistant for the November field program who could assist with on-ice travel and be trained on oceanographic sampling but our attempts failed.

How many team members received training from Nunavummiut? Please describe training received and/or what knowledge sharing and/or skills exchange took place.
None. Again, we attempted to hire a research assistant for the November field program who could share their expertise and own expertise with us, but our attempts failed.

How many Nunavummiut received employment? Please describe employment type and length, role(s) and responsibilities, and compensation provided.
None

How many Nunavummiut received honoraria as research participants? Please describe method of participation (interview, observation, sample, survey, etc.), including compensation provided.
None

Please explain how the project directly benefited Nunavut organizations and/or businesses (e.g., through contract services, local purchases, equipment donations, etc.)
Given that this work took place on a Coast Guard icebreaker and was based out of an ECCC Weather Station there was very little time spent in communities. Services were provided in Pond Inlet, Resolute and Iqaluit during travel related to the programs.

Academic Mobility:
Select for which level the data will be used: Research.

Budget:

Please complete the table below to detail your projected and actual research expenditures during the reporting period

Category	Planned/Approved Expenditure	Actual Expenditure
Travel and Accommodation	-	$75,000
Equipment, Materials and Supplies	-	$75,000
Salaries for Nunavut Residents	-	$0
Salaries for non-Nunavut resident Researchers	-	$150,000
Professional Fees and services in Nunavut	-	$0
Professional fees and services outside Nunavut		$0
TOTAL EXPENDITURE		**$300,000**

List the total Dollar amount of funding from each funding source for your full research program, including in-kind support:

Canada Excellence research Chair Program - $300,000
PCSP in-kind equipment - $10,660.00
University of Manitoba in kind equipment - $10,000

Research Outputs/Reporting Tools.

What research outputs were generated? Please list below and append copies of each. Specify which outputs (if any) may be made public on the NRI research licensing database.
A field report describing the logistics, sampling, preliminary results and overall summary of each field program was prepared following the conclusion of each program. These are attached for your reference. Both can be made available as you see fit.

Have peer-reviewed manuscripts been published as a results of your project, if yes, complete the following table:
Not yet.

If not, do you intend to submit a manuscript for peer-reviewed publication?
Yes, we are preparing two manuscripts based on our initial observations from August and November 2024, and pending the successful recovery of the autonomous equipment in May 2025 we expect several other peer-reviewed papers to be written.

Were non-peer reviewed materials produced to either communicate or synthesize results to the public? Examples of these materials include (but are not limited to): websites, reports, brochures, podcasts, webinars, presentations, non-peer reviewed publications, etc.
If Yes, complete the following table:

Title	Description of materials	Link	DOI
Des Groseilliers 2024 Field Report	Field Report	Coming soon	Coming soon
Eureka November 2024 Field Report	Field Report	Coming soon	Coming soon

Did your project develop a communications plan? Please describe communications/reporting tools used, and list the target audience for each and/or who requested which.
As noted, a field report was prepared following the completion of each field program and was provided to PCSP, Eureka and now the NRI. The Field Reports were written for a general

audience and will soon be available on our project website at the University of Manitoba. Further, as part of the CERC we plan to write plain language summaries to accompany our peer-reviewed articles that will be available to funding agencies and communities located near our study area.

How were Nunavummiut credited and/or acknowledged in all project outputs, such as co-authorship, participant biographies, article acknowledgements, etc.
Nunavummiut were not directly part of the research program and are therefore not included as coauthors. Each manuscript to be written will acknowledge that this research took place in the marine environment of Nunavut.

DATA AND INTELLECTUAL PROPERTY

Did you enter into a research agreement, data-sharing agreement and/or intellectual property rights agreement with a community and/or designated Inuit organization (DIO)? If yes, please explain.
No

Do intellectual property rights apply to your research? If yes, please explain.
No

Who owns the data? Has the raw data been shared with the appropriate community and/or DIO? If yes, how? How is data security and storage handled by community-based co-owners?
Data is owned by the University of Manitoba, though once it has been processed and cleaned up it will be publicly available through our online data portal known as CanWin. From there funding agencies, communities and collaborators can easily access the data.

Where is the data stored and will the data be destroyed within a set timeframe?
As noted the data will be posted on our data repository known as CanWin where it will be freely available. Data will not be destroyed as it contains no personal information or local/traditional knowledge. Rather, we hope this data contributes to the long term understanding of the northern Canadian Arctic and will continue to be used for years to come.

Is the data trackable and/or available in a public data repository? If yes, pease provide the appropriate information and/or link to ensure the findability and accessibility of the data?
The data will soon be posted to the online Data Repository CanWin. The oceanographic profiles must first be processed from their initial format, while data from the mooring and ice-mass balance are still being collected.

CLIMATE CHANGE

Is your research about climate change (causes, impacts, mitigation, adaptation, etc.)? If yes, explain.

Yes, our research is partly focused on climate change and the changes that have occurred in the northern Canadian Arctic since the last extensive set of oceanographic observations was collected nearly 50 years ago. In particular we are focused on how the respective water masses in the northern canadian arctic have changed in terms of temperature and salinity. For example, based on observations in the Arctic Ocean, we suspect that there is greater freshwater and that the waters will be warmer than they were 50 years ago. Determining the exact influence of climate change is difficult though, as interannual variability in the source and advection of water from the arctic ocean into the northern Canadian Arctic underlies any long term changes, hence we are also using climate models (FESOM2) to compliment our observations and further our understanding. Similarly, our observations of ice thickness are also relevant to compare to historic observations and the long term record of ice thickness collected at the Eureka Weather Station.

Photographs

If possible, please provide high-resolution photos of licensed research activities that NRI may use in communication materials, organizational reporting, and other promotional purposes. The photographer and all recognizable people in each photo must sign the attached Photo and Video Release form. Please also complete the table below for each photo provided and submit to NRI along with all required NRI photo release forms. The photographer/owner will be credited in all uses of the photograph(s).

File name	Location	Description	Subjects	Photographer	Date
UM_2024_1	Eureka Sound	Preparing the CTD and Suna for deployment on the foredeck of the CCGS Des Groseilliers	Igor Dmitrenko and 2 coast guard employees	David Babb	13/08/2024
UM_2024_2	Eureka Sound	An iceberg in Eureka Sound as observed from the CCGS Des Groseilliers		David Babb	13/08/2024
UM_2024_3	Eureka Sound	Scientists deploying a CTD through a hole in the newly formed sea ice in Eureka Sound.	Igor Dmitrenko and Sergei Kirillov	David Babb	16/11/2024
UM_2024_4	Eureka Sound	Scientists deploying autonomous equipment through the newly formed sea ice in Eureka Sound	Igor Dmitrenko and Sergei Kirillov	David Babb	16/11/2024

UM_2024_5	Eureka Sound	Scientist measuring ice thickness while travelling on the newly formed sea ice in Eureka Sound	David Babb	Igor Dmitrenko	16/11/2024