



Ocean Measurements in Frobisher Bay for Ecosystem Science and Spill Response

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Title: Ocean Measurements in Frobisher Bay for Ecosystem Science and Spill Response **Who:** Integrated Marine Response Planning (IMRP) program, Science Sector, Arctic Region, Fisheries and Oceans Canada (DFO). Ryan Galley (ryan.galley@dfo-mpo.gc.ca) is the planning coordinator for the DFO-IMRP program in the Arctic Region. David Capelle (david.capelle@dfo-mpo.gc.ca) is a DFO research scientist and oceanographer in the Arctic Region. **What:** We propose an oceanographic mooring in Frobisher Bay to measure ocean currents throughout the water column, tides, sea ice motion and thickness, wave height and frequency in open water conditions, and the salinity and temperature of the water at depth. The mooring will consist of an anchor (usually one or two train wheels), a release, an RBR CTD, a Nortek 250 khz acoustic doppler current profiler and associated floatation. We envision a multi-year deployment beginning in autumn 2025 from a Canadian Coast Guard (CCG) ship-of-opportunity. There are currently five people involved in this project. **Why:** In their 2019 final report for the strategic environmental assessment in Baffin Bay and Davis Strait (Volume 2), the Nunavut Impact Review Board (NIRB) pointed out a gap in chemical and physical oceanographic knowledge in Davis Strait, Baffin Bay, and Frobisher Bay. This lack of oceanographic data in Frobisher Bay makes it challenging to create reliable oceanographic model results for the region. The objective of this proposal is to gather ocean data in Frobisher Bay to enhance scientific knowledge of the physical environment and the regional ecosystem. These data are necessary to improve models of marine petroleum product spill trajectories and project likely impacts of marine spills over the entire annual cycle. Knowledge and understanding of ocean properties in Frobisher Bay will also improve comprehension of fate and behaviour of a wide variety of other potential pollutants in the region. Our goal is to accurately estimate where pollutants will end up, how fast they will get there. In addition, we will work with the Canadian Hydrographic Service (CHS) to provide information on surface currents for their navigational charts to improve navigational safety in Frobisher Bay. All while ship traffic in the region continues to increase annually. **Where:** We propose to moor oceanographic instrumentation in the water column northwest of Pike-Resor Channel in or near the shipping lane to Iqaluit. The depth of the proposed location is approximately 115 m. This location is about 46 km from Iqaluit, and from the Iqaluit Kuunga (Sylvia Grinnell) and Qaumaarviit Territorial Parks at the northwest end of Frobisher Bay. **When:** Ideally this oceanographic mooring would be initially deployed in autumn 2025. This ship-borne operation performed by 3-4 personnel is anticipated to take a couple of hours. The mooring is designed to be retrieved and replaced once per year in the autumn so the data can be downloaded from the instrumentation and analyzed. The proposed activity is multi-year.

▷Δ&NƆ: Titre: Mesures océaniques dans la baie Frobisher pour la science des écosystèmes et l'intervention en cas de déversement Qui: Programme de planification intégrée des écosystèmes en milieu marin (PIIM), Secteur des sciences, Région de l'Arctique, Pêches et Océans Canada (MPO). Ryan Galley (ryan.galley@dfo-mpo.gc.ca) est le coordonnateur de la planification du programme PIIM du MPO dans la région de l'Arctique. David Capelle (david.capelle@dfo-mpo.gc.ca) est chercheur scientifique et océanographe au MPO dans la région de l'Arctique. Objet: Nous proposons un mouillage océanographique dans la baie Frobisher afin de mesurer les courants océaniques dans la colonne d'eau, les marées, le mouvement et l'épaisseur de la glace de mer, la hauteur et la fréquence des vagues en eaux libres, ainsi que la salinité et la température de l'eau en profondeur. Le mouillage sera composé d'une ancre (généralement une ou deux roues de train), d'un dispositif de largage, d'un RBR CTD, d'un courantomètres acoustiques doppler Nortek 250 kHz et de la flottaison associée. Nous envisageons un déploiement pluriannuel à partir de l'automne 2025 à partir d'un navire d'opportunité de la Garde Côtière Canadienne (GCC). Cinq personnes participent présentement à ce projet. Pourquoi: Dans son rapport final de 2019 pour l'évaluation environnementale stratégique de la baie de Baffin et du détroit de Davis (volume 2), la Nunavut Impact Review Board (NIRB) a souligné une lacune dans les connaissances océanographiques chimiques et physiques du détroit de Davis, de la baie de Baffin et de la baie de Frobisher. Ce manque de données océanographiques pour la baie de Frobisher complique la création de résultats de modèles océanographiques fiables pour la région. L'objectif de ce projet est de recueillir des données océanographiques dans la baie de Frobisher afin d'améliorer les connaissances scientifiques sur l'environnement physique et l'écosystème régional. Ces données sont nécessaires pour améliorer les modèles de trajectoires des déversements de produits pétroliers en mer et pour projeter les impacts probables des déversements en mer sur l'ensemble du cycle annuel. La connaissance et la compréhension des propriétés océaniques de la baie de Frobisher amélioreront également la compréhension du devenir et du comportement d'une grande variété d'autres polluants potentiels dans la région. Notre objectif est d'estimer avec précision où les polluants aboutiront et à quelle vitesse ils y parviendront. De plus, nous collaborerons avec le Service hydrographique du Canada (SHC) pour fournir des renseignements sur les courants de surface pour ses cartes de navigation afin d'améliorer la sécurité de la navigation dans la baie Frobisher. Le trafic

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Operations Phase: from 2025-07-13 to 2028-09-11

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Approximate polygon delineating the sea lane from Pike-Resor to Iqaluit. Mooring to be placed in the sea lane at a location agreed upon in consultation with the Amaruq HTA	Marine Based Activities	Marine	in recent years this polygon represents the area of inner Frobisher Bay most used by ships navigating between Pike-Resor Channel and Iqaluit.	Unknown.	the west end of this polygon is proximal to Iqaluit and Apex, NU
Approximate location of the proposed mooring (z ~ 115m)	Scientific/International Polar Year Research	Marine	Unknown.	Unknown.	this proposed location for the proposed ocean mooring is 46 km from Iqaluit.

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አማራ ህዝብ ልማትና ጥበቃ ሚኒስቴር	ድርጅቱ	የአማራ ህዝብ ልማትና ጥበቃ ሚኒስቴር	2025-05-13
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Project transportation types

Transportation Type	Location	Length of Use
Water	The mooring will be deployed in Frobisher Bay by a ship to be determined upon project approval.	

Project accomodation types

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A^cd^c d^ar^t^b d^c^bCd^cσd^ah^t^b Δc^bh^tp^an^ar^c ΔjCΔ^c, Γ^c→d^ap^an^c, ^bh^aLCr^b, qe^ap^ad^c d^ar^al^c→

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$\Delta L^{\zeta_b} \triangleleft^{\zeta_b} C \triangleright^{\zeta_b} \dot{L}^{\zeta_b} \triangleright^{\zeta_b}$

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0	Water will not be required to deploy the mooring. Potable water will presumably be sourced from the ship eventually used to deploy the mooring. Water will not be sourced from Iqaluit.	

$\triangle^b \subset d^c$
$$\Delta^b C d \Gamma n \sigma \Delta^c \sigma^c$$
[illegible]

$\triangleleft \nabla \cap \Gamma \triangleright C^{\sigma} \supset C^c \triangleleft^b \supset^{cb} C \triangleright \gamma L \vee^c$

Anchoring a mooring requires that a train wheel (~60cm in diameter) be placed on the seafloor to hold the rest of the mooring line and instruments in place. The seabed (conservatively 2-3m²) will be disturbed as a result of mooring placement which unfortunately cannot be mitigated.

Additional Information

SECTION A1: Project Info

SECTION A2: Allweather Road

SECTION A3: Winter Road

SECTION B1: Project Info

SECTION B2: Exploration Activity

SECTION B3: Geosciences

SECTION B4: Drilling

SECTION B5: Stripping

SECTION B6: Underground Activity

SECTION B7: Waste Rock

SECTION B8: Stockpiles

SECTION B9: Mine Development

SECTION B10: Geology

SECTION B11: Mine

SECTION B12: Mill

SECTION C1: Pits

SECTION D1: Facility

SECTION D2: Facility Construction

SECTION D3: Facility Operation

SECTION D4: Vessel Use

SECTION E1: Offshore Survey

SECTION E2: Nearshore Survey

SECTION E3: Vessel Use

SECTION F1: Site Cleanup

A graphical description of the marine biological and physical environment in Frobisher Bay is contained in the DFO-Integrated Marine Response Plan regional ecosystem factsheet document attached to this application as Project Application Documents in English and Inuktitut (Regional_Ecosystem_Factsheet_Iqaluit.png, Regional_Ecosystem_Factsheet_Iqaluit_Inuktitut.png). This factsheet is largely based on data from the Nunavut Coastal Resource Inventory (NCRI) and the Nunavut Land Use Plan (NLUP). The factsheet contains spatial information on marine plants, benthic invertebrates, fishes, marine mammals (whales, seals, walrus) and text description of important areas within Frobisher Bay, including habitat, species migration areas, and an area of high cultural use. It also outlines physical oceanographic and biological considerations that relate more specifically to potential marine spills in the region. This factsheet represents the ecological information the Integrated Marine Response Planning program would initially provide to the Environment and Climate Change Canada (ECCC) National Environmental Emergencies Centre (NEEC) if there were to be a response activated in Frobisher Bay. The primary reason for this project proposal is the Nunavut Impact Review Boards recognition of the dearth of oceanographic knowledge in Frobisher Bay, Davis Strait, and Baffin Bay (Nunami Stantec, 2018, MacIsaac et al., 2023), and our proposal to try and improve oceanographic knowledge in Frobisher Bay specifically. We propose to moor oceanographic instrumentation in the water column northwest of Pike-Resor Channel in or near the shipping lane to Iqaluit. The depth of the proposed location is approximately 115 m. This location is about 46 km from Iqaluit, and from the Iqaluit Kuunga (Sylvia Grinnell) and Qaumaarviit Territorial Parks at the northwest end of Frobisher Bay. It is not anticipated that the proposed mooring will have any effect on eskers and other unique landscapes (e.g. sand hills, marshes, wetlands, floodplains), ground, slope or rock instability, seismicity, thermokarsts, ice lenses, surface and bedrock geology, topography, permafrost, sediment and soil quality, or hydrology/limnology. It may improve knowledge of tidal processes in the area,, but will not affect bathymetry, water quality and quantity, air quality, climate conditions, or noise levels. It may improve predicted future climate trends. References: MacIsaac, B. I., King, T. L., Ortmann, A. C. 2023. State of knowledge on fate and behaviour of ship-source petroleum spills: Volume 8, Iqaluit, Nunavut. Canadian Manuscript Report of Fisheries and Aquatic Sciences 3254: vi + 19p. Nunami Stantec Ltd. 2018. Strategic environmental assessment

for Baffin Bay and Davis Strait - Environmental setting and review of potential effects of oil and gas activities. Report prepared for Nunavut Impact Review Board, Cambridge Bay, NU, project number 123221001

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This proposed work is 46km from Iqaluit, anchored at the bottom of the water column within inner Frobisher Bay near the north end of Pike-Resor Channel. Instrumentation will exist solely in the water column in the middle of the Bay at a depth necessary for safety from sea ice and ship traffic. Conversations with the Amaruq HTA indicate the mooring will not interfere with land and resource use in the area, including subsistence harvesting, tourism, trapping and guiding operations, nor will it affect local and regional traffic patterns. It is anticipated that this mooring will not affect human health or other valued socioeconomic components. It is expected the data generated through this mooring work will improve the measured and subsequently modelled knowledge of the ocean and sea ice environment in inner Frobisher Bay. This information may be socioeconomically beneficial, reducing uncertainty in ocean currents throughout the annual cycle for both commercial marine operators using the Port of Iqaluit and for individuals travelling in the marine environment. The data collected will also likely be used to refine tidal predictions in the Frobisher Bay region.

Miscellaneous Project Information

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No negative socioeconomic impacts, including to human health, are anticipated as a result of this proposed mooring. There are no anticipated or potential transboundary effects related to the proposed project. No SARA species, their critical habitat or residences will be adversely affected as a result of this proposed work. We are not proposing any mitigation measures for the identified negative impact to the seabed from placement of the mooring anchor.

Cumulative Effects

It is highly unlikely that this project will interact with the effects of relevant past, present and reasonably foreseeable projects in a regional context to create negative cumulative effects. No negative cumulative effects are envisioned as a result of this proposed mooring.

Impacts

$\mathbb{A}^b \mathbb{C} \triangleright \sigma^a \tau^c \triangleleft \mathbb{N} \Gamma \triangleright \mathbb{C} \dot{\sigma}^c \mathbb{D}^c \triangleleft \mathbb{D}^b \mathbb{C} \triangleright \gamma \mathbb{L} \gamma^c$

[illegible]
$$(P = \langle b \rangle_{\mathcal{A} \cap \mathcal{B}}^{\mathcal{A} \cup \mathcal{B}}, N = \langle b \rangle_{\mathcal{A} \cap \mathcal{C}}^{\mathcal{A} \cup \mathcal{C}}, M = \langle b \rangle_{\mathcal{A} \cap \mathcal{D}}^{\mathcal{A} \cup \mathcal{D}}, U = \langle b \rangle_{\mathcal{A} \cap \mathcal{E}}^{\mathcal{A} \cup \mathcal{E}})$$

1 polygon	Approximate polygon delineating the sea lane from Pike-Resor to Iqaluit. Mooring to be placed in the sea lane at a location agreed upon in consultation with the Amaruq HTA
2 point	Approximate location of the proposed mooring (z ~ 115m)

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|-----------|---|
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