



This project will enable the collection of coastal environmental baseline data, specifically that related to mercury in local biota, to aid in characterizing the current state of the ecosystem in Frobisher Bay. This project is needed as it is expected to strengthen Canada's capacity for ocean science and contribute to oceans scientific data collection in coastal areas of existing or potential commercial and subsistence interest. This project will also build technical and scientific capacity of key parties including community members. Mercury (Hg) contamination is a continuing threat to the health of Arctic ecosystems and inhabitants who rely on country foods. Measuring THg, MeHg, and food web biomarkers in anadromous Arctic Char, key prey, as well as other components of the lower food web will identify pathways of dietary Hg exposure to anadromous Arctic Char. Further insight will be gained by comparing the feeding. Finally, descriptions of fisheries baseline conditions will provide standards against which future changes may be assessed. This is proposed as a 3 year project, with field studies conducted during the open water season (August 1st to September 15th) of 2019, 2020 and 2021 in the intertidal and near shore areas in Frobisher Bay. This project will collect fish using gill nets and benthic invertebrates through kick sampling. Specifically we will measure concentrations of total mercury (THg) and methyl mercury (MeHg) in benthic invertebrates (fish food), Arctic cod, and other forage fish species, and anadromous Arctic Char. There are no impacts to the environment expected; targeted fish species will be collected using best scientific practices and non-targeted fishes will be handled with gloves and quickly released. Data will be managed through an external data provider agreed upon by both Project Authority and DFO, and data will be made accessible via publications, reports and resulting datasets will made available in an external open data forum. Residents from Iqaluit, Nunavut (community members), will be requested for field collections and sampling methods will also be based on consultation with the community to adequately incorporate the interests and views of both those parties and the Project Authority. The University of Waterloo MSc student will be available to assist in sample collections, thereby facilitating reciprocal knowledge transfer between the student and the community. The University of Waterloo MSc student will learn fishing techniques, history, and condition of the subsistence fishery from community members. Community members will gain experience in sampling for trophic biomarkers and contaminants. Curriculum materials and translated handouts (developed by Swanson for previous projects) regarding contaminants in the Arctic and community-driven contaminant survey will also be made available. For workshops, meetings, and training opportunities, the a plain-language (with translated posters) summary of research progress will be developed for distribution in Iqaluit. The results of the studies will be shared annually following field data collection; sampling plans will be shared with the community members and stakeholders prior to open water season.

DΔΛNƆ: Ce projet permettra de recueillir des données de base sur l'environnement côtier, notamment celles relatives au mercure dans le biote local, afin de mieux caractériser l'état actuel de l'écosystème de la baie de Frobisher. Ce projet est nécessaire car il devrait renforcer la capacité du Canada en sciences de la mer et contribuer à la collecte de données scientifiques sur les océans dans les zones côtières présentant un intérêt commercial actuel ou potentiel et à la subsistance. Ce projet renforcera également les capacités techniques et scientifiques des parties clés, y compris des membres de la communauté. La contamination par le mercure (Hg) constitue une menace permanente pour la santé des écosystèmes arctiques et des habitants qui dépendent des aliments traditionnels. La mesure de la THg, du MeHg et des biomarqueurs de la chaîne alimentaire chez l'omble chevalier anadrome, principale proie, ainsi que d'autres composantes de la chaîne trophique inférieure identifiera les voies d'exposition alimentaire au mercure à l'omble chevalier anadrome. Des informations supplémentaires seront obtenues en comparant l'alimentation. Enfin, les descriptions des conditions de base des pêcheries

fourniront des normes permettant d'évaluer les modifications futures. Il s'agit d'un projet de trois ans, avec des études sur le terrain conduites pendant la saison des eaux libres (du 1er août au 15 septembre) en 2019, 2020 et 2021 à les zones intertidales et proches du rivage dans la baie de Frobisher. Ce projet permettra de récolter les poissons à l'aide de filets maillants et d'invertébrés benthiques au moyen d'un échantillonnage de coups de pied. Plus précisément, nous mesurerons les concentrations de mercure total (THg) et de méthylmercure (MeHg) dans les invertébrés benthiques (aliments pour poissons), la morue arctique et d'autres espèces de poissons fourrage, ainsi que dans les ombles chevaliers anadromes. Aucun impact sur l'environnement attendu. Les espèces de poissons ciblées seront collectées selon les meilleures pratiques scientifiques et les poissons non ciblés seront traités avec des gants et diffusés rapidement. Les données seront gérées par un fournisseur de données externe agréé par le responsable du projet et le MPO, et les données rendues accessibles via des publications. , les rapports et les ensembles de données résultants seront disponibles sur un forum externe ouvert. Les résidents d'Iqaluit, au Nunavut (membres de la communauté), seront sollicités pour les collections sur le terrain et les méthodes d'échantillonnage seront également basées sur des consultations avec la communauté afin de prendre en compte de manière appropriée de ces deux parties et du responsable du projet. L'étudiant à la maîtrise en sciences de l'Université de Waterloo sera disponible pour aider à la collecte d'échantillons, facilitant ainsi le transfert de connaissances réciproque entre l'étudiant et la communauté. L'étudiant à la maîtrise en sciences de l'Université de Waterloo apprendra les techniques de pêche, l'histoire et l'état de la pêche de subsistance aux membres de la communauté. Les membres de la communauté gagneront en expérience en échantillonnage de biomarqueurs trophiques et de contaminants. Le matériel pédagogique et les documents traduits (développés par Swanson pour des projets antérieurs) concernant les contaminants dans l'enquête sur les contaminants dans l'Arctique et sur les communautés seront également abordés.

Personnel on site: 4  
Days on site: 14  
Total Person days: 56  
Operations Phase: from 2019-08-01 to 2022-03-31

$\Lambda \subset \mathbb{N} \triangleleft \mathbb{N} \hookrightarrow \Sigma \triangleleft^{\text{qb}} \mathcal{D}^c$ 

A	B C	D E	F G H I J K L M N O P Q R S T U V W X Y Z	a b c d e f g h i j k l m n o p q r s t u v w x y z	
Sample Location A	Researching	Marine	No known site history.	N/A	Near-shore and intertidal zone of Frobisher Bay; nearest to Iqualuit
Sample Location B	Researching	Marine	No known site history	N/A	Near-shore and intertidal zone of Frobisher Bay; nearest to Iqualuit
Sample Location C	Researching	Marine	No known site history	N/A	Near-shore and intertidal zone of Frobisher Bay; nearest to Iqualuit
Sample Location D	Researching	Marine	No known site history	N/A	Near-shore and intertidal zone of Frobisher Bay; nearest to Iqualuit

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ᐱᓂᓐᑯᓂᓐ	Pitseolak Alainga	Amaruq Hunters and Trappers Association	2018-08-08

$\epsilon \Delta^{\alpha} j^{\beta} \wedge J^{\alpha} e^{\beta} \dot{n} \cdot d^{\alpha} r^{\beta} C D P L R$

$a^b r^a \sigma^b \wedge c^d r^c \delta \sigma^d \gamma^c \cap \cap \gamma^c \omega^c:$

South Baffin

$\epsilon \Delta t^{\alpha} j^c \wedge J^{\beta} e_D \dot{N} \nabla^{\gamma} r^{\delta} C D P L \downarrow^c$

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ᐸᓇᐸᓂᓄᓇᐅᑦᑎᓈᓂᓄᓇ ᐸᓇᐸᓂᓄᓇᐅᑦᑎᓈᓂᓄᓇ	The NRI authorization will authorize the collection of coastal environmental research and baseline data, specifically that related to mercury in local biota, to aid in characterizing the current state of the ecosystem in Frobisher Bay, specifically related to Total Mercury and Methyl Mercury in the foodweb. This project is needed as it is expected to strengthen Canada's capacity for ocean science and contribute to oceans scientific data collection in coastal areas of existing or potential commercial and subsistence interest. This project will also build technical and scientific capacity of key parties	Active	2019-06-17	

	including community members.			
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### Project transportation types

Transportation Type	ᐱᓇ ᐸᓚᐅᓂᐳᐃᑦᐅᐊᑦ	Length of Use
Air	Travel to Iqaluit will be via commercial flights	
Water	Travel to sample locations will be by boat	

### Project accomodation types

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$$\Delta^b C d_C \sim \sigma \Delta^q \sigma^q$$
[illegible]
$$\begin{array}{ccccccc} \triangleleft & \triangleleft^{\circ} & \cap & \Gamma & \triangleright & C & \div^C \triangleright^C \\ & & & & & & \triangleleft^b \triangleright^{\circ b} C \triangleright \neg L \neg^C \end{array}$$

The intent of this research is to establish Baseline Fisheries conditions in Frobisher Bay in collaboration with the Department of Fisheries and Oceans. We do not predict environmental impacts due to this undertaking. Based on the objectives of the study, Arctic Cod, four-horned and Arctic Sculpin and Arctic Char will be targeted, however all species caught are relevant; at a minimum length and weight data will be recorded for all fish collected. If the target number of fish of a certain species are achieved, we will mitigate effects to non-targeted fish as they will be handled using wet gloves for less than 30 seconds to 1 minute to measure and release as quickly as possible. If recover time is needed, the fish will be transferred to a cold-water tubs. The total time in the tub will be less than 10 minutes, or until the fish appear healthy and fully recovered.

# **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

## SECTION G1: Well Authorization

## SECTION G2: Onland Exploration

## SECTION G3: Offshore Exploration

## SECTION G4: Rig

## SECTION H1: Vessel Use

## SECTION H2: Disposal At Sea

## SECTION 11: Municipal Development

$\dot{L}^{\infty}_x \nabla \varphi \cap D^{1,p}_{\sigma}(\mathbb{R}^d) \subset L^{\infty}_x D^{1,p}_{\sigma}(\mathbb{R}^d)$ :  $\text{meas } D^{1,p}_{\sigma}(\mathbb{R}^d)$

Although there is little baseline data collected in Frobisher Bay, common to arctic shorelines it is primarily composed of muddy bottom with bedrock structure. Shoals and seabed scours formed by sea ice and icebergs are found to predominate along the shore. The

[illegible]

The marine muddy near-shore habitat is generally a sand-like substrate for ciliate protozoans and benthic environment for sea floor invertebrates. The ice fauna, in shallow water is plankton and into deeper environments includes a meiofauna and macrofauna of the true ice community to include organisms from both the benthos and the plankton. This project will specifically measure concentrations of total mercury (THg) and methyl mercury (MeHg) in bivalves (e.g. clams up to 30), other benthic invertebrates (e.g., starfish, decapod crustaceans, barnacles up to 30 for ~4 species), Arctic cod (up to 100), and other forage fish species (e.g., four-horned and Arctic sculpin, up to 100 total), and anadromous Arctic Char (up to 200, including historical samples).

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Located on southern Baffin Island at the head of Frobisher Bay, Iqaluit's economy consists primarily of waged employment and many Inuit and non-Inuit are attracted to the area for jobs. Iqaluit has been a traditional fishing location used by Inuit for thousands of years. Iqaluit, which means place of many fish continues to grow in population and influence in the region as it is the capital of one of Canada's fastest growing regions which has allowed many to prosper, however inequality in income, employment opportunities, and health outcomes can be pronounced in marginalized subpopulations. Mercury (Hg) contamination is a continuing threat to the health of Arctic ecosystems and inhabitants who rely on country foods. Measuring THg, MeHg, and food web biomarkers in anadromous Arctic Char, key prey, as well as other components of the lower food web will identify pathways of dietary Hg exposure to anadromous Arctic Char. Further insight will be gained by comparing the feeding. Finally, descriptions of fisheries baseline conditions will provide standards against which future changes may be assessed.

### Miscellaneous Project Information

N/A

$\mathcal{C} \rightarrow \mathcal{C}^{\text{b}} \rightarrow \mathcal{C}^{\text{c}} \rightarrow \mathcal{C}^{\text{d}} \rightarrow \mathcal{C}^{\text{e}} \rightarrow \mathcal{C}^{\text{f}} \rightarrow \mathcal{C}^{\text{g}} \rightarrow \mathcal{C}^{\text{h}} \rightarrow \mathcal{C}^{\text{i}} \rightarrow \mathcal{C}^{\text{j}} \rightarrow \mathcal{C}^{\text{k}} \rightarrow \mathcal{C}^{\text{l}} \rightarrow \mathcal{C}^{\text{m}} \rightarrow \mathcal{C}^{\text{n}} \rightarrow \mathcal{C}^{\text{o}} \rightarrow \mathcal{C}^{\text{p}} \rightarrow \mathcal{C}^{\text{q}} \rightarrow \mathcal{C}^{\text{r}} \rightarrow \mathcal{C}^{\text{s}} \rightarrow \mathcal{C}^{\text{t}} \rightarrow \mathcal{C}^{\text{u}} \rightarrow \mathcal{C}^{\text{v}} \rightarrow \mathcal{C}^{\text{w}} \rightarrow \mathcal{C}^{\text{x}} \rightarrow \mathcal{C}^{\text{y}} \rightarrow \mathcal{C}^{\text{z}}$

The intent of this research is to establish Baseline Fisheries conditions in Frobisher Bay in collaboration with the Department of Fisheries and Oceans. We do not predict environmental impacts due to this undertaking. Based on the objectives of the study, Arctic Cod, four-horned and Arctic Sculpin and Arctic Char will be targeted, however all species caught are relevant; at a minimum length and weight data will be recorded for all fish collected. If the target number of fish of a certain species are achieved, we will mitigate effects to non-targeted fish as they will be handled using wet gloves for less than 30 seconds to 1 minute to measure and release as quickly as possible. If recover time is needed, the fish will be transferred to a cold-water tubs. The total time in the tub will be less than 10 minutes, or until the fish appear healthy and fully recovered.

## Cumulative Effects

We do not predict environmental impacts due to this undertaking, therefore there are not cumulative effects anticipated as a result of this research project.

## Impacts

$\omega \rightarrow \omega \Delta^{\epsilon_b} C D \sigma^{\epsilon_c} \Gamma^c$      $\Delta^c \cap \Gamma D C \dot{\sigma}^c \dot{\gamma}^c$      $\Delta^b \dot{\gamma}^b C D \Gamma L \dot{\gamma}^c$

[illegible]
$$(P = \langle b \rangle \Delta \langle p \rangle \langle \tau \rangle \langle a \rangle \langle b \rangle^C, N = \langle b \rangle \langle \tau \rangle \langle \tau \rangle \langle \Delta \rangle \langle \tau \rangle \langle a \rangle \langle b \rangle^C \langle \Delta \rangle \langle \tau \rangle \langle \tau \rangle \langle \tau \rangle \langle \Delta \rangle \langle \tau \rangle \langle a \rangle \langle \tau \rangle^C, M = \langle b \rangle \langle \tau \rangle \langle \tau \rangle \langle \Delta \rangle \langle \tau \rangle \langle a \rangle \langle b \rangle^C \langle \Delta \rangle \langle \tau \rangle \langle \tau \rangle \langle \tau \rangle \langle \Delta \rangle \langle \tau \rangle \langle a \rangle \langle \tau \rangle^C, U = \langle b \rangle \langle \tau \rangle \langle \tau \rangle \langle a \rangle \langle \tau \rangle^C \langle b \rangle)$$

1	point	Sample Location A
2	point	Sample Location B
3	point	Sample Location C
4	point	Sample Location D

1	point	Sample Location A
2	point	Sample Location B
3	point	Sample Location C
4	point	Sample Location D