



▷⁹ḅ_ḥ▷^ḥḤ^c: 6135050303, ḥḅḥ^bḏ^c:

$\epsilon_b \Delta^c \dot{\bar{N}}_0 \sigma^b \wedge c_n d\epsilon^f b^g d n d^a l^a \sigma^b$

ᐅᓂᓄᓇᓂᓗ: Our project is focused on understanding risks from climate change and growth in shipping across Inuit Nunangat and to identify ways to manage these issues that support Inuit self-determined shipping and oceans governance. Our project objectives include to: 1. Analyse past and future ship traffic in Nunavut; 2. Model current and future underwater noise caused by ships; 3. Sample potential air and water pollution from ships; 4. Evaluate potential for non-indigenous species introduction from ships, and; 5. Develop risk maps and evidence-based recommendations. Fieldwork: We will opportunistically conduct water samples from on board ships (Amundsen, Ocean Endeavour, Fram), transiting Nunavut waters from July-September, 2023, and 2024. We will also opportunistically conduct water and sediment samples at shore locations along cruise ship routes (where appropriate). Shore locations may include Dundas Harbour, Fort Ross, Gjoa Haven, Beechey Island, Resolute, and Cambridge Bay. We will also conduct community-based sampling of air, water, and sediment, led by Inuit in Arviat and Pond Inlet from June – September, 2023 and 2024. Methods: Onboard the ships, we will sample seawater from the inlet in the hull and filter it through a mesh to collect plastic and other sediments. We will set up onboard air sampling arrays, where particles in the air will be collected on filters. We will take water samples for eDNA to identify any non-indigenous species upstream and downstream of the ship and at shore locations. At shore locations, we will take sediment samples (100g) in a metal bottles and take pictures of any plastic debris. Community-based sampling in Arviat and Pond Inlet will include setting up air sampling arrays near the communities, water sampling for plastic and eDNA by boat and Remotely Operated Vehicle (ROV) (Pond Inlet in 2023 and 2024, Arviat in 2024). Impacts: There are no expected impacts to the environment, wildlife, or people. Data Storage and Management: The research team follows all procedures for data management and storage that is outlined in the Tri-Council protocols and the National Inuit Strategy on Research. All data and samples are saved and/or stored in locked facilities and password protected computers/servers. Physical samples (air, water, and sediment) will be stored at locked facilities in Ottawa and Cambridge, UK. Nunavut residents involvement: Nunavut residents have been involved in the project since the beginning. We have partnered with Ikaarvik (Pond Inlet, NU) and Aqqiumavvik Society (Arviat, NU) to develop the original project proposal and research questions. In May, 2022 all southern team members attended training on Inuit Qaujimajatuqangit (IQ). In December, northern team members received training on how to collect acoustic data using hydrophones, and, in February, training on water and plastics sampling and analysis. In 2023-24, we plan to conduct similar community researcher sampling training and workshops. Results Sharing: Results validation and sharing workshops in Arviat and Pond Inlet are planned for 2025. These events will be co-led by Inuit Youth. Results will also be shared with Nunavut partners throughout the project.

▷ ΔΑΠΝΩC: N/A

[illegible]

Inuinnaqtun: Havaavut ihumagilluaqtait kangiqhigiami qajangnautingit hilaup aadlangurninnganit angiklijuumirninngalu agjariami tamainni Inuit Nunangat ilitarigiamilu qanuqtut munarigiami hapkuat ihumaaluutigijaujut ikajuqtuq Inuit inmikkut-naunaiqhimaajuq umiakkuurniq tariurmullu pijunnautinga. Havaavut tikinahuarutait ilaujut hapkununga:1.Ihivriurlugit kinguani uvalu hivunirmi umiakut aulaviit Nunavunmi;2.Tautuktilugu tadsa uvalu hivunirmi ataani imap nipiquqtujuq pidjutiqaqhutik umidjanit;3.Uuktuutit ikiarmit imarmunlu halumailrut umianin;4.Ihivriurlugit piniarungnaqhiuq Nunaqaqqaarhimaajuq huradjat naunaipkaijut umianit, unalu;5.Hanalutik ihumalungnarninginik nunaujat naunaipkutulu atuqujaujut.Maniqqami Havaangit: Pinaqtugut imakkut uuktuutitik ikihimajuq umianut (Amundsen, Ocean Endeavour, Fram), aulagtitilutik Nunavunmi imakkut hamanga Taaqhivaliavia-Apitiirvik, 2023, unalu 2024. Pinaqtugutlu imakkut uvalu nunavaluit uuktuutit naunaijaktakhat hinaani najugaani umiarjuakkut umiat aulaviit (humi ihuaqqat). Hinaani najugait ilaujut Dundas Harbour, Fort Ross, Uqhuqtuuq, Beechey Island, Qausuittuq, uvalu Iqaluktuutiami. Aulatitinaqtugut nunallaani-auladajutikhainik ihivriutaujukkanik ukuninga ikiarmit, imarmik, hiuravalungmik natqani, havaktauniaqtun hapkunanga Inuit Arviami, Mittimatalingmilu tatqiqhiutaini Imauqtirvia- Apitiirvia, 2023 ukiungani 2024. Pityuhit: Umiani, naunaijainiaqtugut tariumit imarmik kangiqhungmit uvani umiarmi halumaqtirlugulu kuvjaujakkut imaalu katitirlugitlu palastivaluit aallaniklu marluvalungnik hiuravalungniklu. Ihuaqhainiaqtugut ikiarmit ihivriutaujukkanik uuktuutitik, humi titiraqhimaajuq ikiani katitiqtauniaqtut halumaqhijutininun. Imarmik aturniaqtugut imarnik ihiviuktaujukkanik talvuuna eDNA pijukkanik ilitugijaujukkanik naliinik nirjutitik qafiutilanginik kuukakkut qunmut imaalu kuukakkut anmut agjautingit hinaanitunik najugainik. Hinaani najugainni, pinaqtugut

hiuravalungmik, nunavalungnik ihivriutaujukharnik (100g) havigalngnut puurlugit imaalu piksaliurlugitlu kituliqaak palastingnik iqakuunik. Nunallaani-pihimajut ihivriutaujukhanik Arviami Mittimatalingmilu ilaujut ihuaqharlugit ikiarmit ihivriutaujukhanik haniani nunallaanit, imarmi ihivriutaujukhanik palastiinun uvalu eDNA qajakkut uvalu Ungahiktukkut Aulajut Akhaluutit (ROV) (Mittimatalik uvani 2023 ukiunganilu 2024, Arviat uvani 2024). Aktumaniit: Piqangittuq nahurijaujunik akturninginik avatiujumi, uumajuliqijit, inungniit. Nampainik tutquumavinga Munarinirlu: Qaujihainikkut havaqatigiiktut malikpaktait tamaita maliqajakhangit naunaitkutikhanik munaqhijutikhanik tutquumavikhaniklu naunaiqtauhimajut uvani Tri-Katimajiit maliktakhangit imaalu Kanadami Inuit Qanuriliurutikhat Qaujihainirmut. Tamaita naunaipkutit ihivriutaujukhatlu ilipqamajaujut unalu/uvaluuniit tutquqhimaniaqtut kiluutaqhimajuni igluqpangni angmaidjutiniklu munaridjutinik qaritaujat/tutquumavingitlu. Ihivriutaujukhanik (ikiarmit, imarmik, hiuravalungmik natqani) tutquqhimaniaqtut kiluutaqhimajuni igluqpangni hamani Ottawa Iqaluktuuttiamilu, UK. Nunavunmi nunaqaqtut ilaudjutaat: Nunavunmi nunaqaqtut ilauhimajut havaakhami aullaqtirninganit. Havaqatigijavut ukua Ikaarvik (Mittimatalik, Nunavut) ukualu Aqqiumavvik Katimajiit (Arviat, Nunavut) havaklugit hivulliq havaakhmut tukhiutit uvalu ihivriurnikkut apiqhuutit. Uvani May, 2022 tamaita hivuraani havaqatigiiktunut ilaujut ajuiqhaqhimajut Inuit Qaujimagatuqaginit (IQ). Uvani Ubluiqtirviani, ukiuqtaqtumi havaqatigiiktunut ilaujut ajuiqhaqtut talvuuna qanuqtut katitirilutik amigaittunik naunaitkutikhanik atuqhugit imakkut hivajautit, imaalu, lidjirurvia, ajuiqharnirmik imarmik imaalu palastingnik ihivriutaujukhanik imaalu qaujihainirmik. Uvani 2023-24, upalungaiqtugut havaarijaagani aadjikkutaanik nunagijaujumi ilituqhaijinik ihivriutaujukhanik ajuiqhanirmik ajuiqhaqatigiikhutik. Qanuriniit Uqautiginikkut: Qanuriliningit naamainaqtut atuqtilugilu ajuiqhaviujut Arviani Mitimatalingmilu upalugaiqtaujut ukiungani 2025. Hapkuat hulipkaidjutikhat hivulliuqtauniaqtut Inuit Inulrammiinit. Qanuriliningit uqautauniarmijurlo Nunavumi ikajuqtiriinik atuqtilugu havaakhaq.

Personnel

Personnel on site: 14

Days on site: 21

Total Person days: 294

Operations Phase: from 2022-04-01 to 2025-03-31

$$\Lambda \subset \mathbb{N} \triangleleft \mathbb{N} \xrightarrow{\iota} \Sigma \triangleleft \mathbb{N}^{\mathbb{N}} \supset \mathbb{C}$$

Area	Sampling sites	Municipal	N/A	N/A	We will be sampling the shoreline within or near the community depending on where the ship goes.
Arctic Bay (potential shore location)	Sampling sites	Municipal	N/A	N/A	We will be sampling the shoreline within or near the community depending on where the ship goes.
Gjoa Haven (potential shore location)	Sampling sites	Municipal	N/A	N/A	We will be sampling the shoreline within or near the community depending on where the ship goes.
Cambridge Bay (potential shore location)	Sampling sites	Municipal	N/A	N/A	We will be sampling the shoreline within or near the community depending on where the ship goes.
Resolute Bay (potential shore location)	Sampling sites	Municipal	N/A	N/A	We will be sampling the shoreline within or near the community depending on where the ship goes.
Dundas Harbour (potential shore location)	Sampling sites	Crown	N/A	N/A	N/A
King William Island (potential shore location)	Sampling sites	Crown	N/A	N/A	N/A

shore location)					
Fort Ross (potential shore location)	Sampling sites	Crown	N/A	N/A	N/A
Devon Island (potential shore location)	Sampling sites	Crown	N/A	N/A	N/A
Prince Leopold Island (potential shore location)	Sampling sites	Crown	N/A	N/A	N/A
Pond Inlet - community-based sampling	Sampling sites	Crown	N/A	N/A	We will be working with community members to locate sampling sites near the community on crown land, in a location that does not disrupt any local activities.
Arviat - community-based sampling	Sampling sites	Crown	N/A	N/A	We will be working with community members to locate sampling sites near the community on crown land, in a location that does not disrupt any local activities.
Kugluktuk (potential shore location)	Sampling sites	Municipal	N/A	N/A	We will be sampling the shoreline within or near the

					community depending on where the ship goes.
Grise Fiord (potential shore location)	Sampling sites	Municipal	N/A	N/A	We will be sampling the shoreline within or near the community depending on where the ship goes.
Smith Sound (potential shore location)	Sampling sites	Crown	N/A	N/A	N/A

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ᓄᓇᓕᓯᓴ	Eric Soloman	Ikaarvik	2021-07-27
ᓄᓇᓕᓯᓴ	Shelly Elverum	Ikaarvik	2021-07-27
ᓄᓇᓕᓯᓴ	Justin Milton	Ikaarvik	2021-07-27
ᓄᓇᓕᓯᓴ	Michael Milton	Ikaarvik	2023-02-24
ᓄᓇᓕᓯᓴ	Kukik Baker	Aqqiumavvik Society	2021-07-27
ᓄᓇᓕᓯᓴ	Shirley Tagalik	Aqqiumavvik Society	2021-07-27
ᓄᓇᓕᓯᓴ	Peter Inootik	N/A	2023-02-16
ᓄᓇᓕᓯᓴ	Jamie Enook	ECCC	2022-09-20
ᓄᓇᓕᓯᓴ	Jimmy Muckpah	Aqqiumavvik Society	2023-02-10
ᓄᓇᓕᓯᓴ	Zachariah Owingayak	Aqqiumavvik Society	2023-02-10

$\epsilon \Delta^{\alpha} j^{\beta} \wedge J^{\alpha} e^{\beta} \dot{N} \quad d^{\alpha} r^{\beta} C D P L \dot{r}^{\gamma}$

$a^b r^c \sigma^d \wedge c_1 d_1 e^f \delta \sigma^g \gamma^h$ በበፍጋሮ:

Transboundary

Kitikmeot

Kivalliq

North Baffin

$\Delta^{\alpha} \Gamma^{\beta} \Lambda^{\gamma} \Sigma^{\delta}$

[illegible]

Project transportation types

Transportation Type	Transportation Mode	Length of Use
Water	Ship and local boats	

Project accomodation types

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Λ⁹δ^c Δ⁶ρ²Δ⁵ Δ³Δ⁶σ²Δ⁴Δ⁵ Δ⁴Δ⁶ρ²Δ³Δ⁵ Δ²Δ⁶Δ⁵, Γ⁴Δ³Δ⁵Δ⁶, Δ⁶Δ³Δ⁵Δ⁶, Δ⁶Δ³Δ⁵Δ⁶

ᐃᓕᑦᑲᑦ ᐱᓂᑦ ᐋᑐᒪᐅᓂᐊᓕᑐᓕᑦ ᓖᓄᐃᑦᑐᓂᓕᑦ	ᓖᓕᑦᑯᐅᑦᑦ	ᐃᓕᑦᓂᓕᑦᑦ - >ᓖᓕᑐᓂᓕᑦᑦ	ᑭᐱᑦᑦ ᐋᑐᒪᐅᓂᐊᓕᑦ<
Air sampling array	4	<1m	Optical particle counters, air filtration units and depositional dust gauges to quantify the concentration and size distribution of particulates and allowing for the assessment of black carbon concentration.
Water filters	4	0.5m	Customised filtration system which sample a ship's uncontaminated sea water supply (ambient near-surface waters pumped through the hull). The filtration system has an inline flow meter to record the volume of water filtered and three sequential filters (i.e., mesh size 300, 100 and 50 microns).
Manta net	2	2m x 0.6m	Sampling using manta nets to identify and quantify the concentration of anthropogenic particulates and microplastics in surface waters.
Niskin water sampler	4	0.6m	Collect small water samples (50mL) for environmental DNA(eDNA) meta-barcoding.
Remotely Operated Vehicle (ROV)	2	0.5m x 0.4m	Take surface water samples using syringe sampler and take underwater photographs vessel hulls to determine the extent of biofouling.

[illegible]

$$\Delta^b C j_c \sim \sigma \Delta^q \sigma^q$$

$\Delta^{\circ} \text{G}_{\text{f}}^{\circ}(\text{C}_6\text{H}_6) = -123.4 \text{ kJ mol}^{-1}$

Waste: We expect waste to be minimal, limited to small amounts of garbage from sampling equipment. Sampling equipment will be unpacked in the South to reduce waste brought to Nunavut. Any waste produced while sampling will be packed out and transported South for disposal. Wildlife disturbance: All sampling activities will be accompanied by local residents and/or vessel operators trained in the local marine and terrestrial wildlife, in order to reduce any potential disturbances. Environmental disturbance: All research staff are trained in sampling protocols in order to minimize any potential disturbance to the environment. Physical samples taken will be small, and we will not be taking more than is needed for laboratory analysis. Local residents: Our research is being conducted in partnership with local organizations and relies on IQ in order to be of maximum benefit to local residents. Before any research activities are undertaken, we will consult with our Inuit partners, local hunters, and local residents to ensure our activities will not disrupt any traditional practices (e.g. hunting activities).

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

[illegible]

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Miscellaneous Project Information

$a \rightarrow e \Delta^{fb} CD\sigma^{ab} r^c$ $d(b)^{fb} CDPLr^c$ $f_b m \Delta^c \sigma^{ab} r^c$ $\langle c D \Gamma' r^f b CD\sigma d^f \sigma^{ab} r^c \rangle$

Waste: We expect waste to be minimal, limited to small amounts of garbage from sampling equipment. Sampling equipment will be unpacked in the South to reduce waste brought to Nunavut. Any waste produced while sampling will be packed out and transported South for disposal. Wildlife disturbance: All sampling activities will be accompanied by local residents and/or vessel operators trained in the local marine and terrestrial wildlife, in order to reduce any potential disturbances. Environmental disturbance: All research staff are trained in sampling protocols in order to minimize any potential disturbance to the environment. Physical samples taken will be small, and we will not be taking more than is needed for laboratory analysis. Local residents: Our research is being conducted in partnership with local organizations and relies on IQ in order to be of maximum benefit to local residents. Before any research activities are undertaken, we will consult with our Inuit partners, local hunters, and local residents to ensure our activities will not disrupt any traditional practices (e.g. hunting activities).

Cumulative Effects

Impacts

$\omega \rightarrow \omega \Delta^{\epsilon_b} C D \sigma^{-\epsilon_r} C$ $A \rho \cap \Gamma D C \dot{\sigma}^C D^C$ $A^b D^{\epsilon_b} C D \rho L \downarrow^C$

[illegible]
$$(P = \langle b \rangle \dot{\cup} P \cap \langle a \rangle^c, N = \langle b \rangle \dot{\cup} \Gamma^b \setminus \langle D \rangle \langle a \rangle^c, \langle \langle D \rangle \Gamma^b \setminus \Gamma^b \rangle^b \langle D \rangle \langle a \rangle^c, M = \langle b \rangle \dot{\cup} \Gamma^b \setminus \langle D \rangle \langle a \rangle^c, \langle \langle D \rangle \Gamma^b \setminus \Gamma^b \rangle^b \langle D \rangle \langle a \rangle^c, U = \langle b \rangle \dot{\cup} L \langle a \rangle^c \rangle^b)$$

1	polyline	Potential ship route
2	polyline	Potential ship route
3	polyline	Potential ship route
4	point	Pond Inlet - community-based sampling
5	point	Arviat - community-based sampling
6	point	Dundas Harbour (potential shore location)
7	point	King William Island (potential shore location)
8	point	Arctic Bay (potential shore location)
9	point	Gjoa Haven (potential shore location)

10	point	Cambridge Bay (potential shore location)
11	point	Fort Ross (potential shore location)
12	point	Resolute Bay (potential shore location)
13	point	Devon Island (potential shore location)
14	point	Prince Leopold Island (potential shore location)
15	point	Kugluktuk (potential shore location)
16	point	Grise Fiord (potential shore location)
17	point	Smith Sound (potential shore location)