



Kitikmeot Region Marine Science Study

New

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from 2017-08-10 to 2021-10-01

from 2017-08-10 to 2021-10-01

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$\gamma_b \Delta^c \dot{\gamma} \Pi \sigma^b$ $\Lambda c_n d^b \gamma \sigma d_n d^b l^a \sigma^b$

Project Description: Kitikmeot Region Marine Science Study. The Kitikmeot Region Marine Science Study (KRMSS) is a Fisheries and Oceans Canada led project to gather baseline oceanographic data and evaluate marine ecosystem structure in the Kitikmeot Region between Dolphin and Union Strait in the west and Larsen Sound in the north and east. Scientific collaborators on the project include scientists from Canada, USA and Norway under DFO leadership. Logistically the project is supported by DFO, Polar Knowledge Canada and the Arctic Research Foundation. To collect oceanographic samples and data, and to recover/deploy subsurface oceanographic moorings we use the Arctic Research Foundation's, Transport Canada certified, 62ft long, RV Martin Bergmann during the months of August and September from its home port of Cambridge Bay. The maximum number of people involved at any one time is 12-13 – the maximum capacity of the RV Martin Bergmann and comprises 6 crew and up to 7 scientists. Occasionally a float plane will meet the ship to change crew and scientists, but resupply and crew/scientist change of the RV Martin Bergmann is typically in Cambridge Bay. Travel to and from Cambridge Bay is via Canadian North or First Air and accommodation is with local hotels and the Canadian High Arctic Research Station. To make our measurements we use:

- Electronic sensors (for temperature, salinity, dissolved oxygen, chlorophyll fluorescence, turbidity, underwater light, underwater video, and dissolved carbon dioxide)
- Very low power acoustics (for water velocity and backscatter from zooplankton and fish). These acoustics are similar in power to the depth sounders normally used on boats and ships.
- Hydrophones (to listen for marine mammals and ship noise)
- Water samples for ocean geochemistry, primary production, dissolved nutrients, salinity, dissolved inorganic carbon, dissolved organic matter and stable isotopes.
- Small Bottom grab and box core to collect samples of benthic organisms and seafloor mud.
- Fine mesh net to collect zooplankton samples.
- Small GPS surface drifters to measure surface currents.
- A 16ft skiff, usually launched from the RV

[illegible]

Inuinnaqtun: Havaariyangit Tukiliutaad: Qitirmiut Avikturnia Taryurmiuttat Qauyihagtuqtut Ilittuqhiiyut. Uvani Qitirmiut Avikturnia Taryurmiuttat Qauyihagtuqtut Ilittuqhiiyut (KRMSS) hamna Iqalungnut Taryurmiuttanut Kanata amiriyaavluni havaanut kitihimavlutik kiglikhaanit taryurmiuttait naunaiqhiiyut unalu qimilruqhugit taryurmiuttait avataita ilitquhiita iluani Qitirmiut Avikturnianut uvani Dolphin unalu Union Ikirahak iluani uataani unalu Larsen Kangiqhuani iluani qulvahiktumi kivataanit. Qauyihagatigiiktut hamanngat Kanata, Amialika nunangani, Ungahiktumillu amiriyaavlutik DFO hivuliqtiita. Amiriyaavlutik havaanut ikayuqtauhimayut uumani DFO, Polar Knowledge Kanata unalu Ukiuqtaqtumi Qauyihagqarvik Tunngavingat. Kititiriangani taryurmiuttait iluaniiqtut hivriurningit naunaiqhivlutik, utiqtinnaahuarlugit/aulapkainahuarlugillu qulaaniittut taryurmiuttait iluaniiqtut tulagvingit parnautigivaktavut Ukiuqtaqtumi Qauyiharvik Tunngaviata'p, Agyqtuiniq Kanata ilitariyauningit, 62ft takiyaaqtuq, RV Martin Bergmann tatqiqhiutaanit Niqiliqivik Apitilirvingmilu hamanngat aimaviannit tulagvianit Iqaluktuuttiamit. Una hivituyumik qaffiuningit inungnit ilaliutauhimayut atauttimut 12-13 – hivituyumik inilingnit haffumani RV Martin Bergmann unalu ilaliutiqaqhuni 6 havaktut unalu 7 nit qauyihagtit. Ilaani tingmivangniaqtut puptalik tingmiaq katilviuniaqtangit umiaryuag aallannguqtigattariami havaktiit qauyihagtiillu, kihimi parnautikhainillu unalu havaktiit/qauyihagtit aallannguqtigattangit haffumani RV Martin Bergmann unalu Iqaluktuuttiamiinniaqhutik. Ungmilutik uvannag Iqaluktuuttiamut uumani Kanitiiaqtut First Airkkulluuniit hiniktaqpaglutik hiniktarviit unalu Kaniitina Qulvahiktumi Ukiuqtaqtumi Qauyiharvik. Uuktuutigiyavut aturniaqtavut: • Alruyaqtuqtut mihingnautit (niklaumagiakhaat, taryuqpaallagiakhaat, unguulaqtut anirnigut, taryup iluaniiqtut nauhimayut, atungauyait, ilaurutiqaqtut, imaq ataaniiqtuni qullinga, imaup iluaniiqtunilu qunniarvikhaq, unalu ungaqhimayug ilaurutiingillu) • Hakuittut tuharnaqtut (imaup kayumingnia unalu mallirnut piksalirutit kumaruinut iqalungnilu). Tahapkuat tuharnaqtut aadjigiiktut hakugingnianit hitunianut tuharnaqtut atuqhimavagaat qayait umiuyaillu. • Imarmi ataanip nipiliutaat (naalagiangani taryurmiuttainit amaanmaktittiyuktut niryuutit umiap kuinginningillu) • Imaup ilitturvikhait taryumi nunamilu naunaiyaiyut, hivunnngani nauhimaningit, unguvaqtauhimayut ilaurutit, taryulingnit, uguvaqhimayaayut uumanngittut ilulgit, ungaqtauhimayut uumayuligit aahiillu ilaurutiit. • Mikiyunnuit Ataaniiqtut tigulaqtut qiyuqutinnuaq ilulikhaat kititiriangani ilitturningiit uumani taryum iluani natia uumayut unalu taryum marlungit. • Naitpiaqtut kuvyiqut kititiriangani kumaruit ilitturningit. • Mikiyunnuaq naunaiyainiq GPS qulaanit ingilralaqtut

uuktuutikhait qaanganit tagyuat. • Una 16ft qayannuaq, iluaniitpaktut uvanngat RV Martin Bergmann, ihivriuqattariangani imat ilitturnikhait aallatqiinit kukkanit nuvuani nunam naunaiyariangani qauyihaqhimayut kuukkanit qurluaqtunit taryurnit. (pihimayavut laisikhaanit hamanngat CWS nit ihivriuriangani Kuunayungmi iluani Ahiak Iluilliq Utiqtaqtut Tingmidjait Angunahuirviuttailinikhanut.) • Kihait: Ilangit haffumani qaritauyatigut mihingnautit nivyaalaaqtut nuvuaniittuni qaanganiittuni kiharnit aktulaaqtangit hamanngat taryum natianit 15 m ataaniit qaanganiittuni. Haffumani 2017, upalungaiyarumayavut havaqatigilugit umiaqtuqtut uvani RV Martin Bergmann hamanngat 10 Niqiliqivik uvanngat 20 Apitilirvik qanilruani ihivriurlugit hivituyumik-uuktuutingit taryuatigut avikturniani qimilrurlugillu aturnaqtumik taryum hinaanit amiakkungit naittumik ikirahait uumani inuuhimayut nauhivangningit avikturniani. Hivituyumik uuktuutingit taryunikkut ihivriuqtauniaqtuq iluani: Dease Ikirahak, Qingauk, Ahiak unalu Utkuhikhalingmi/ Rasmussen Kaliit/St Roche Kali. Taryum hinaa ikirahat ihivriuqtauniaqtut uumani: Finlayson Qikiqtangit (ilaliutilugillu ininganit uumani taryuugaluut qaangani kalit kihangillu), naitturaliit iluani Qingauk, Simpson Ikirahak, Rae Ikirahak, James Ross Ikirahak unalu Victoria Ikirahak. Ilagivluniuk upalungaiyarumayavut ihivriurlugit kuukkat iluani Qitirmiut Taryua ilagilugit angiyaaqtut kuukkait: Hood Kuugaq, Burnside Kuugaq, Western Kuugaq, Kuunayuk, Utkuhikhalik Kuugaa, Parnaiyaqhimayavut ikaarvikhavut, tukhiutiyavut ihivriuqtakhait nayugaat kihangillu nayugaat takukhauyt ataaniittut. Hamna havaarihimayavut pulahimayut tamainnut Qitirmiut Avikturnia havaqatiginiaqtangit qanilrukkut nunaliit (Iqaluktuutit, Uqhuqtuq, Qingauk, Umingmaktuq, Talurjuaq, Qurluqtuq) hivunikhaqhiurlugillu pivalliyakhaat taryurmiuttanit amiqhainikhainut upalungaiyarningit ilaliuqattautihimalugit nunaliit havaarinahuaqtangit ukiumilu uumani Kaniitian Anguyaqtit Taryurmik Amiqhaiyut. Una taryuliginirnut ihivriuqtangit naunaiyaqhimayangillu kititighutik uumani KRMSS ilitturnaqpiaqtuq taryuliginirnut piliriakhait aadjikkutaanillu taimaa havaariyauyuq uumani C.J. Mundy (U. Manitoba; Ikiuqtaqtuq-HIKUA havaangit) atuqhimayangillu uumani RV Martin Bergmann; una Kaniitian Anguyaktit Taryumik Amiqhaiyut havaangit (CROW; J. Eert, B Williams, DFO), unalu ArcticNet (aulapkaihimayangit qauyihaqhimayut uuminngat CCGS Amundsen), KMRSS aulapkaihimayauyt malikhugu CJ Mundy's NRI laisia uvani 2016 (NRI laisia nampanga 04 018 16R-M-Ilaliutiffaaqtangit), kihimi ihumagiyavut katimayit nunaualiginirnut hivunikhautikhangit aturaaqtakhangillu hivunikhautikhait uumani KRMSS amiriyakhait pinahuaqtakhait ahiqanngittunik laisikhaat. KRMSS tadjia amiriyauyt manngiutit haffumani 2017 mi 2018 milu manirarmiunut havaariyakhaat, kihimi hivunikhaliurumayavut huli pivalliyakhavut taryurnikkut amiqhaivikhangit upalungaiyaut avikturnianut ihivriuriangani kiudjuhiit uumani hilaup uunnakpallianingit uumani taryurmiunut avataita iluani Qitirmiunni.

Personnel

Personnel on site: 14

Days on site: 29

Total Person days: 406

Period of operation: from 2017-08-10 to 2021-10-01

Proposed term of operation: from 2017-08-10 to 2021-10-01

$$\Lambda \subset \mathbb{N} \triangleleft \mathbb{N} \hookrightarrow \mathbb{D} \sigma \triangleleft \mathbb{Q}^b \supset \mathbb{C}$$

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$\epsilon \Delta^{\frac{a}{2}} r^c \wedge J^{\infty} e_D \dot{n} \nabla^{\infty} r^{\frac{b}{2}} C D P L \check{r}^c$

$a^{\dagger} b^{\dagger} c^{\dagger} \rightarrow a^{\dagger} b^{\dagger} c^{\dagger}$

[illegible][illegible]

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Λ⁹δ^c 4⁹Γ²ξ⁶ 4²ξ⁶CDσD⁴Υ⁹ξ⁶ Δ^cξ⁶ΓDΠ^cΓ^c ΔjCΔ^c, Γ^cΔPΠ^c, ξ⁶ξ⁶LCj⁹ξ⁶, μεΓD^c 4Γ⁹Γ^cΔ

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Boat	1	62ft	RV Martin Bergmann used for oceanographic research.
Boat	1	16ft	Aluminum skiff on RV Martin Bergmann, used to go ashore and sample in river mouths.

በበፍጥነቱ ምሥራቅ አገር ለጋራ ጥራት ለጋራ ጥራት

ሰራተኛ ስም	የክፍል ስም	የቅጽ ቁጥር	የሰራተኛው ስም	የቅጽ ቁጥር	የሰራተኛው ስም	የሰራተኛው ስም
Diesel	fuel	1	8	8	Cubic Meters	RV Martin Bergman fuel tank
Aviation fuel	fuel	1	50	50	Gallons	Refuel a float plane bringing scientists to the Bergmann.
Formaldehyde 38%	hazardous	1	4	4	Liters	Preservation of zooplankton and benthic samples
Mercuric Chloride	hazardous	1	0.2	0.2	Liters	Preservation of water samples.
Gluteraldehyde	hazardous	1	0.1	0.1	Liters	Preservation of phytoplankton samples.
Lugols	hazardous	1	0.1	0.1	Liters	Preservation of phytoplankton samples

$\Delta L^{\text{fb}} \quad \Delta D^{\text{fb}} \quad C D \rightarrow \dot{L}^{\text{fb}} \quad D^{\text{fb}}$

$\mathcal{D}^c \rightarrow \mathcal{C} \overset{\mathfrak{f}_b}{\mathfrak{f}_b} \mathcal{D} \overset{\mathfrak{f}_b}{\mathfrak{f}_b} \mathcal{D} \overset{\mathfrak{f}_b}{\mathfrak{f}_b} \mathcal{D} \overset{\mathfrak{f}_b}{\mathfrak{f}_b}$	$\mathfrak{f}_b \mathfrak{f}_b \Delta \Gamma \mathfrak{f}_b \mathcal{C} \mathfrak{f}_b \mathcal{C} \mathfrak{f}_b \sigma \mathcal{D} \mathfrak{f}_b \mathcal{C}$	$\mathfrak{a} \mathcal{P}^c \Delta \Gamma \mathfrak{f}_b \mathcal{C} \mathfrak{f}_b \mathcal{C} \mathfrak{f}_b \sigma \mathcal{D} \mathfrak{f}_b \mathcal{C}$
0		

 $\triangleleft^b C d^c$
$$\Delta^b C j_c \sim \sigma \Delta^a \sigma^a$$

ᐱᑦᓕᓇᖁᓚᔭᒃᑐᒃᕈᑦ ᐱᑦᓕᓇᖁᓚᔭᒃᑐᒃᕈᑦ	ᖃᓄᐅᑦᑐᖃ ᖁᑦᕕᑦᖃ	ᖃᓄᓂᓯ ᖁᑦᕕᑦᖃ ᙳᖃᓶᖁᑦᖁᖃᑐᓚᔭᒃᑐᑦ	ᖃᓄᖃ ᖁᑦᕕᖃᕕᒃᑐᑦᖁᑦᕕ	ᙳᓗᒪᖃᙳᒃᓂᖁᑦᖁᑦᕕᑦᕕᑦᕕ
Marine Based Activities	ᖁᑦᕕᑦᖃ ᐅᖁᖁᑦᕕᒃᑐᒃᕈᑦ	20 litres/year	Used engine oil is offloaded in pails at the Cambridge Bay dock and disposed of by Kitnuna Corporation at their fuel and oil treatment plant for consumed fuel and oil.	None
Marine Based Activities	ᐅᒪᐅᑦ ᖁᖃᕕᒃᑐᒃᕈᑦ	1000 litres/year	Greywater is cleaned and disposed overboard while at sea, not at port, not at Cambridge bay dock.	RV Martin Bergmann's greywater system (Managem) is compliant with Government of Canada regulations.
Marine Based Activities	ᖁᑦᕕᑦᖃ ᐅᖁᖁᑦᕕᒃᑐᒃᕈᑦ	50 large garbage bags/year	Garbage is bagged and offloaded at Cambridge Bay dock and disposed of at Cambridge Bay landfill.	None
Marine Based Activities	ᖃᓄᕕᑦᓚᓄᖃ	500 litres/year	Pumped out using Cambridge Bay waste services at the dock at the end of the season.	RV Bergmann's sewage system (Managem) is compliant with Transport Canada regulations.

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

No predicted impact of oceanographic sampling and data collection. Samples are minimal. Oceanographic acoustics very low power. Environmental impact is limited to the operation of the Arctic research foundation's RV Martin Bergmann which is Transport Canada Certified and complies with Nunavut and Government of Canada regulations and guidelines.

$\Lambda \subsetneq \Delta \subseteq \Gamma$ $P \cap \Delta = \emptyset$ $\Delta \cup P \subseteq \Gamma$

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None.

$\Delta^{\circ} \text{J}^{\circ}\text{S}_{\text{L}} \approx -0.8$

 $\Delta^{\epsilon} \Delta^{\delta}$

1. No camps. 2. No camps. 3. The maximum number of people aboard the RV Martin Bergmann is 13.

$\Delta^{\alpha}\Gamma\Delta^{\beta}$ $\Lambda^{\gamma}D^{\epsilon}$ $\Delta\Gamma\Delta\sigma\Delta^{\delta}\Delta^{\eta}$

1. See attached document for a list of the equipment. 2.

 ΔL^{96}

1. The RV Martin Bergmann makes freshwater from seawater. See Section H: Marine Based Activities: Vessel Use. 2. Freshwater is not used. 3. Please see the 'Waste' section of this application and Section H: Marine Based Activities: Vessel Use. 4. Not applicable.

ΔLΔ^c ΔD^{9b}CD^{9b}Δ^c ΔL^{9b}Δ^c, ΔD^{9b}Δ^c, ΔD^{9b}Δ^c

1. Please see the 'Waste' section of this application and Section H: Marine Based Activities: Vessel Use. 2. Not applicable.

▷ 9b 9b 9c

1. Please see the 'Material Use' section of this application. 2. The RV Martin Bergmann complies with Transport Canada regulation for containment of fuel. 3. Refuelling is conducted via fuel truck at the dock in Cambridge Bay.

4^cC₉^{9b} 5^bC₉^c Δ_c 6^b 7^b 8^c 9^c

1. Please see the 'Material Use' section of this application. 2. Hazardous materials and chemicals are contained in the laboratory area of the RV Martin Bergmann. 3. Chemicals are shipped to Cambridge Bay using Dangerous Goods shipment procedures and then secured in the laboratory of the RV Martin Bergmann. 4. We keep laboratory spill kits on the RV Martin Bergmann that are specific to the chemicals onboard.

[illegible]

1. In collaboration with our Canadian Rangers Ocean Watch (CROW) and Ocean Networks Canada (ONC) the Kitikmeot Region Marine Science study aims to develop a long-term marine monitoring program in the Kitikmeot that will be conducted by local people through training and employment. Also the Arctic Research Foundation invites local artists and guides aboard the RV Martin Bergmann as limited space on a small vessel allows. 2. Scientists and ship's crew board and disembark in Cambridge Bay and stay in local hotels and at CHARS accomodation. This year a float plane is planned to bring 3 additional scientists to the ship in southern Bathurst Inlet. 3. No specific hiring policies.

$$\Delta_{\phi} \Delta^c \Delta_{\psi} \cap C \Delta_{\sigma}^{\phi} / \Delta_{\phi} \Delta^c \psi \Delta \gamma L \Delta^{\phi}$$

1. Cambridge Bay, Kugluktuk, Gjoa Haven, Taloyoak, Umingmaktok and Bathurst Inlet. 2. The summertime Kitikmeot Marine Region Science Study grew out of the wintertime Canadian Rangers Ocean Watch (CROW) which is developed collaboratively with Rangers in the Kitikmeot. 3. Summary of public involvement measures: Our research in the Kitikmeot Region has been communicated via consultation with Rangers, Hunters and Trappers Organisations/Committees, presentations at schools and to the community. No concerns expressed, only interest. 4. Traditional Knowledge is obtained through conversations with rangers, HTO members and artists in communities in the Kitikmeot and through the collaborative Canadian Rangers Ocean Watch. It is a strong guide and influence for our sampling plan and scientific perspective. 5. We aim to continue to consult annually during our wintertime visits to communities as part of the Canadian Rangers Ocean Watch. Visits include consultations with Hunters and Trappers Organisations/Committees and the Rangers and presentations in schools and to the communities.

$$A_{\infty}^{\otimes L}: C: A_{\infty}^{\otimes L}: C \rightarrow D \quad \wedge \varepsilon_n \nabla n \leq p \leq L+1: d \Delta p \nabla \Delta \sigma^{\otimes b} \quad C_n \rightarrow J^C$$

1. The purpose of the vessel (Research Vessel Martin Bergmann) is to act as a science platform, carrying equipment and scientists to relevant and important locations throughout the Kitikmeot Marine region. The vessel enables science activities, such as underway water sampling in transit, various scientific study when the ship is stopped at a marine station such as vertical rosette water sampling and CTD (conductivity, temperature and depth), Box core samples, underwater video, and deploy of oceanographic moorings. 2. The Research Vessel Martin Bergmann is a Canadian ship, Transport Canada class Workboat, Special Purpose Research. It is a 64' length ship, approx. 100GT with a 9ft draft. The ship has a small 16' aluminum skiff aboard, as a support and safety boat, that periodically is used for work in very shallow areas or accessing shore when needed. 3. The Transport Canada minimum manning is 4 crew and a cook make up a compliment of 5 core crew. Up to 7 scientists can work on board the

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ᐱᓪᑦ ᐸᑦᐅᐅᑦ ᖃᓄᐃᑦᑐᑦᑕᑎᐅᓂᖅ: ᐅᐭᐳᖃᑕᖃᖃᓂᖅ

L'a d'ordenar i rebre el pagament de la multa de 600 euros.

[illegible]

1. Cumulative environmental effects are also anticipated to be very small, limited to the annual operation of the RV Martin Bergmann in the Kitikmeot Region during August and September, its annual oceanographic sampling for small volumes of sediment, zooplankton and seawater, and deployment/recovery of subsurface oceanographic moorings.

Impacts

PHYSICAL																								
Designated environmental areas																								
Ground stability																								
Permafrost																								
Hydrology / Limnology																								
Water quality																								
Climate conditions																								
Eschers and other unique or fragile landscapes																								
Surface and bedrock geology																								
Sediment and soil quality																								
Tidal processes and bathymetry																								
Air quality																								
Noise levels																								
BIOLOGICAL																								
Vegetation																								
Wildlife, including habitat and migration patterns																								
Birds, including habitat and migration patterns																								
Aquatic species, incl. habitat and migration/spawning																								
Wildlife protected areas																								
SOCIO - ECONOMIC																								
Archaeological and cultural historic sites																								
Employment																								
Community wellness																								
Community infrastructure																								
Human health																								

Marine Based Activities																								
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Marine Based Activities																								
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$$(P = \langle b \rangle \langle d \rangle \langle a \rangle \langle c \rangle \langle b \rangle^c, N = \langle b \rangle \langle d \rangle \langle a \rangle \langle c \rangle \langle b \rangle^c \langle c \rangle \langle d \rangle \langle a \rangle \langle b \rangle^c \langle c \rangle, M = \langle b \rangle \langle d \rangle \langle a \rangle \langle c \rangle \langle b \rangle^c \langle c \rangle \langle d \rangle \langle a \rangle \langle b \rangle^c \langle c \rangle, U = \langle b \rangle \langle d \rangle \langle a \rangle \langle c \rangle \langle b \rangle^c)$$

Project Map



