Arctic Freshwater Biodiversity in Cambridge Bay
Sampling plan for 2024
Field season 2023 report

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PROJECT TITLE : Arctic Freshwater Biodiversity in Cambridge Bay

OBJECTIVES OF RESEARCH :

This project brings together Canadian laboratories in ecology and geomorphology, along with northern collaborators, to develop an improved, integrated understanding of Inuit Nunangat lakes and rivers on Southern Victoria Island and their responses to climate change. Specifically, we will undertake detailed studies on processes that affect the transfer of carbon to the lakes and rivers from the thawing permafrost and how it affects energy, resources and contaminants in Arctic lake food webs. We measure carbon, nutrients, algae, lipids and mercury, and make the link to higher trophic levels by way of studies on zooplankton and macroinvertebrate communities. We combine limnological and geomorphological approaches to estimate how much the freshwaters are influenced by the thawing permafrost and what is the future direction of change in different ecosystem variables.

SAMPLING PLAN FOR 2024

In 2024, we will sample lakes, ponds and rivers in the vicinity of Cambridge Bay. The sampling will be conducted in June, July and August.

In June-July, we will conduct a three-week mesocosm experiment in one small and shallow lake (VG4). Polyethyle bags (12 bags, each 80 L, see photo below) will be installed in the lake and filled with lake water. Some bags will receive leachates prepared from permafrost soils around the lake and some serve as controls. In this experiment we aim to follow how permafrost material change water quality and food web nutritional quality. No chemicals or any other artificial compounds will be added to the mesocosms, and the experiment will not change anything in the lake outside the bags.

In June-July, we will also sample lakes and rivers. Four small lakes, Kitigak Lake and Kitigaq River will be sampled (see map). Sampling protocols will consist of standardized limnological sampling (e.g., removal of water for filtration, plankton tows and benthic macroinvertebrate sampling) and geomorphological measures (catchment-lake area ratio, soil organic carbon content). We will concentrate on studying the physical environment, carbon, nutrients, and invertebrate communities that provide food for fish in some of the key lakes identified by HTO (Kitigaq Lake, Kitigag River) and some smaller lakes (e.g. L01, L08, L10, L11) that feed into these lakes.

Sampling sites near Cambridge Bay (e.g., Greiner lake and some other lakes and rivers) will be reached by an ATV. Lakes and rivers further away will be reached by a helicopter (PSCP support confirmed). An inflatable boat will need to be deployed at each lake. The sampling will be dominantly carried out by students and researchers from different universities (see the list in the beginning of this report).

In August, targeting the warmest month and hence likely the highest production in the lakes, larger lakes important for the Cambridge Bay community as fishing sites will be sampled (Greiner Lake, Second Lake, First Lake, Inuhuktok (CBL5 on the map). Samples and measures will include temperature and oxygen profiles, carbon, nutrients, and invertebrate communities. This sampling will be done by our local collaborators in Cambridge Bay (identified in the list above). These individuals have also earlier independently sampled for us. This part of the sampling contributes to our ongoing long-term studies carried out in Cambridge bay since 2017

Fig. 1. Configuration of the mesocosm bags to be installed to Lake VG4 for a short-term experiment (3 weeks).

Fig. 2. Map showing the lakes and rivers to be samples in June-July, 2024. The mesocosm experiment will be conducted in Lake VG4

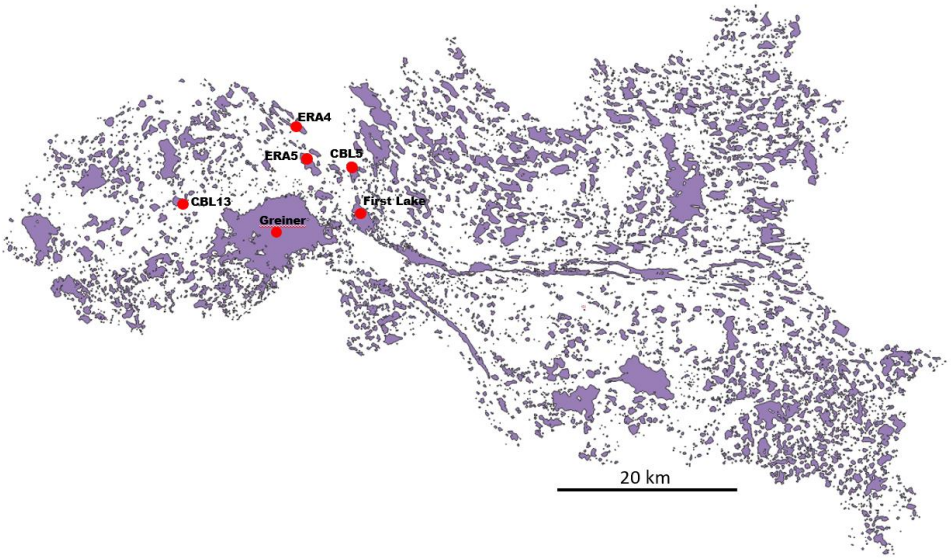

Fig. 3. Large culturally important lakes near Cambridge Bay will be sampled in August. The lake selection has been done with Ekaluktutiak HTO.

SAMPLING THAT WAS UNDERTAKEN IN 2023:

We carried out both winter and summer sampling of lakes in the vicinity of Cambridge Bay. As part of our year-round studies and objectives to extend the lake research to winter, the dominant but overlooked season in the Arctic, we sampled 6 sentinel lakes (chosen together with Ekaluktutiak EHTO) in April, and one of the lakes (Greiner Lake) consequently 4 times before the ice-off in July. The lakes were also sampled during the short open water period in July and August and in November. Our long-term monitoring sampling of Greiner Lake and the lake's permanent mooring maintenance were instead carried out in August. Our sampling and measures targeted increasing understanding of year-round water quality and food web structure. The questions we are trying to answer include:

Are there threshold conditions that determine the relative importance of zooplankton versus benthic macroinvertebrates as fish diet in winter (e.g., oxygen concentration, secondary production, nutritional quality)?

How will ice-cover duration impact the extent of anoxia? How will this impact survival of benthic invertebrates and impact reliance on littoral habitats and prey for different species of fish?

Do changes in ice cover duration and structure change zooplankton and macroinvertebrate winter reserve fat accumulation? How does this impact the transfer of energy from invertebrate organisms to fish in winter?

We stayed in regular contact with Ekaluktutiak HTO during the year and met with them during some of our visits in Cambridge Bay. Some of the sampling (May-July, November) was also carried out by locals living in Cambridge Bay

PHOTOS OF SAMPLING

FIGURE 1. Sampling Greiner from inside a pop-up tent lake in April 2023 for water and plankton quality indices. Photo by Marie-Pier Hebert.

FIGURE 2. Sampling Greiner Lake in July 2023.

FIGURE 3. August field lab on the shore of Greiner Lake.

Publications of our research results in 2023

Kurth A, Musetta-Lambert J, Rautio M, Culp J, Power M. 2023. Dietary preferences of ninespine stickleback in high Arctic tundra streams. Freshwater Science (accepted).

Amill F, Gauthier J, Rautio M, Derome N. 2024. Characterization of gill bacterial microbiota in wild Arctic char (*Salvelinus alpinus*) across Canadian Arctic freshwater ecosystems. American Society for Microbiology. https://journals.asm.org/doi/10.1128/spectrum.02943-23

Ayala-Borda P, Bogard M, Grosbois G, Preskienis V, Culp J, Power M, Rautio M. 2024. Dominance of net autotrophy in arid landscape low relief polar lakes, Nunavut, Canada. Global Change Biology. e02943-23.

Kurth A, Musetta-Lambert J, Power M, Rautio M, Culp J. 2023. Method choice affects estimates of diet and niche breath for small stream fish. Hydrobiologia. https://doi.org/10.1007/s10750-023-05386-1

Blackburn-Desbiens P, Grosbois G, Power M, Culp J, Rautio M. 2023. Integrating hydrological connectivity and zooplankton in ponds and lakes in Arctic Canada. *Freshwater Biology*. DOI: 10.1111/fwb.14181

Ayala Borda, P., Bogard. M.J., Rautio, M. 2024. Limnological and metabolic data of 35 lakes in the Greiner Lake watershed, Nunavut, Canada, v. 1.0 (2018-2022). Nordicana D129, doi: 10.5885/45867CE-E92D191DAAE14485.

Nunamiutanik Nirgitainik Umayuniklu Ilingaitukhanik tahapkunani Tunungani Taahiutainiklu

2023 nunaini hulidjutinik uniklutiniklu tahapkunanga tahiknit naunaiyainikmun hungnauyakhainiklu naunaitkutakhanik talvani Ikaluktutiami

30-04-2024

Milla Rautio, PhD unalu Kanatami Naunaitkutakhanik Kinikhianikmun Hunauyakhainiklu Ikhivautalik Nunatuttukanit unalu Tununngani Imakmiutaniklu Nirgitainik Umayuniklu Nunamiutaniklu Nirgitainiklu
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Titikiutihimayunik Makpiraat Naunaitkutanik imalu havakhautikhanik hulidjutikhainiklu

Tahapkununalu havaktauvuktunik aullaganginakhimayuk mikharut naunaitkutakhanik kinikhianikmun ihiviukhinikmun hungnauyakhainiklu havaagivukgait tahapkunanalu Kanatakmiunit Taryumi Tunungani Taryumi Naunaitkutakhanik Kinikhianikmun Ihiviukhinikmun Hungnauyakhainiklu Havakvik (CHARS) imalu havakhikhimayunik talvunakukhimayunik NSRI naunaitkutak atugakhanik nungudjutilingnik ubluinik atuknianut # 04 008 23R-M. Tahapkununalu 2023 naunaitkutakhanik kinikhianikmun ihiviukhinikmun hungnauyakhainiklu pidjutivukhimayuniklu ikayutauyukhaniklu tahapkununa Taryumi Hilaryuami Kauhimayauvuktunik Kanatami ikayuktauvuktunik havakhautikhanik “Nunamiutanik Nirgitainik Umayuniklu Ilingaitukhaniklu Tunungani Tahiutainiklu” Hilaryuamilu Nunamiutanik Nirgitainik Umayuniklu Munakgiyauyukhanik Ihiviukhinikmunlu Havakhautikhaniklu (CBMP) pidjutauyunik naudjutihimayunik havaagivukgainiklu avakukgutikhanik ilihakatigiknikmunlu atugakhanik pilingnik tamakpianginik hilaryuami nunalaanilu. Ilikuaktunik havakhautikhaniklu malikgakhanik adjikiiktukhanik naunaiyainikmun hungnauyakhainiklu naunaitkutakhanik ataniktuktauyukhaniklu pilingnik havakhautikhanik ikayutauyukhaniklu hivituyunik nakuyunik imalu adjikiikniaklugitlu tukihigiarutinik alangayunit nunainiklu talvani Tununngani imalu piutainiklu nunamiutanik nirgitainik umayuniklu.

Ehivgiogotighavot 2024-mi

Ekaluktutiak tahik holi ehivgiokniakmiyakot taakooklogo kanogilingmagaat opinggaami aoyamilo, okiaghakallo okiokkallo 2024-mi. ehivgiokniaktavot ekalokpikaknigit tattit HTO-kot okagiikhimayait hapkoa Amittikyoaklo, aipagiyaalo haniani, tahiklo hivolikpaak Enoohoktok, (Nunaoyami) kookatlo hakvaktot tattinotlo hapkononga. Okoalo ehivgiokniaktavut tattit ekalokpiakyokaktut tamatkigahoakniaktavot naonaiyaklogit hapkoa nunaoyami takoinnagialgit. (Fig. 4-mi nunaoyami)

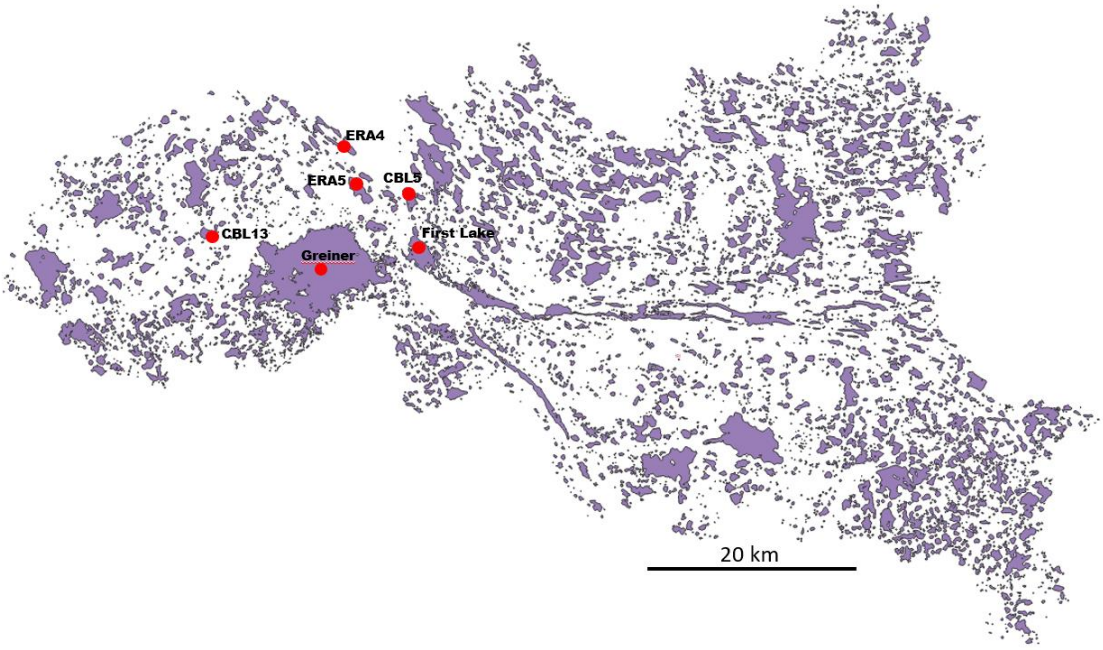

FIG 4. . Nunaoyami naonaitiagotighak tattit takooktaohimayot 2024.