



Fisheries and Oceans Pêches et Océans
Canada Canada

Institute of Ocean Sciences Institut des Sciences de la Mer

9860 West Saanich Road
Sidney, B.C. Canada
V8L 4B2

9860 West Saanich Road
Sidney, B.C. Canada
V8L 4B2

December 21, 2022

Mosha Cote
Research liaison
Nunavummi Qaujisaqtulirijikku/Nunavut Research Institute (NRI)
Iqaluit, NU
X0A 0H0

Chairperson
Nunavut Impact Review Board (NIRB)
P.O Box 1360
Cambridge Bay, NU
X0B 0C0

RE: Scientific Research License **#04 002 22R-M 2022** Annual Report and 2023 plans.

Dear NRI, NIRB and interested parties,

Please accept this letter as our report submission for our 2022 oceanographic sampling and research in the Kitikmeot Sea, under the multiyear NRI licence number: **04 002 22R-M**. This letter further describes our plans for the 2023 field season, to be conducted under the same license.

Building on our previous years of work in this region, our research seeks to understand the general oceanography of the Kitikmeot Sea and study the effects on the marine ecosystem of both river inflow and tidally-driven mixing in narrow and shallow straits. Our observations include oceanographic measurements to establish a baseline of physical, biological, and geochemical information across the region and includes focussed sampling in straits and near river mouths where we anticipate enhanced biological production.

2022 Annual Summary:

Ship-based Oceanographic Sampling: We are delighted to report that we successfully carried out multiple aspects of our ship-based oceanographic sampling program in 2022. The main oceanographic field program was conducted aboard the *CCGS Sir Wilfrid Laurier* from August 16 to 30th, 2022. During this program, mooring arrays designed to collect observations year-round were deployed in six different locations throughout the Kitikmeot Sea, including new deployments in Coronation Gulf, Queen Maud Gulf, and Victoria Strait (Figure 1). Each pair of moorings includes sensors for measuring currents and ice thickness and sensors measuring ocean temperature and salinity. These moorings will be recovered in 2023 (see 2023 plans

below). Water column observations of physical and biogeochemical parameters (nutrients, inorganic carbon, water isotopes, salinity) were also collected at each mooring site using electronic instruments deployed from the ship and a rosette sampler to collect water samples from different depths.

In addition, the *RV Martin Bergmann* completed the first preliminary oceanographic investigation of Sherman Inlet and Sherman Basin (August 5-21st, 2022) in support of a Youth-Elder Camp lead by the Community of Gjoa Haven, Arctic Research Foundation, and the National Geographic Perpetual Planet program. During this program we measured physical and geochemical properties of sea water similar to observations collected on *CCGS Sir Wilfrid Laurier* using electronic instruments and rosette water sampler. We deployed two tilt-current meter moorings in Sherman Inlet to measure the current direction over the year (Figure 1), these will be recovered in 2023. We also collected observations of the depth of the inlet and basin to better assist future navigation in this region. Our investigations throughout this area were guided by two Elders from the community of Gjoa Haven who have extensive knowledge of the region.

Community-Based Oceanographic Sampling: In 2022, we worked closely with the Kugluktuk Hunters and Trappers Organization and the Canadian Rangers Ocean Watch (CROW) program to collect physical and geochemical observations from the freshwaters of the Coppermine River into the marine waters of Coronation Gulf. Following training activities conducted in March of 2022, transects were completed in March, June, and August, with another set to be collected in December, once the ice freezes in. This sampling program has contributed to training three community members to collect water samples and deploy instruments from small local boats (summer) and from the sea ice (winter). These year-round observations represent the first view of river-to-ocean exchanges of salt, nutrients, and carbon throughout both the summer and winter seasons, and will help us better understand how rivers influence the coastal marine system in the Kitikmeot.

2023 Plans:

Ship-based Oceanographic Sampling: As in 2022, we aim to focus our mooring deployment and water sampling activities aboard both the *CCGS Sir Wilfrid Laurier* and the *R/V Martin Bergmann* in 2023. These activities will take place in the Finlayson Islands, Coronation Gulf, Bathurst Inlet, Queen Maud Gulf, and Icebreaker Channel, Sherman Inlet, Sherman Basin, and if time allows, travelling into Chantry Inlet (St. Roch and Rasmussen Basins), as shown in Figure 1. Our focus for 2023 will be the continuation of work carried out from 2017-2019, and 2022, and as such, our planned sampling, instruments, and techniques are the same as in our original permit.

Our ship-based oceanographic programs will take place between 1 August 2023 and 30 September 2023, with the anticipated participants listed in Table 2. Our proposed observational activities for 2023 include: a) recovery and re-deployment of long-term moorings (Figure 1); and, b) measurement of physical and geochemical properties of seawater via electronic instruments deployed from the ship and via water sample collection. As described in our original permit, mooring instrumentation will be mounted on recoverable sub-surface moorings that reach from the bottom to within 15m of the surface. Pairs of moorings include sensors for

measuring currents and ice thickness and sensors measuring temperature and salinity and optically observed biological parameters (fluorescence, light intensity, turbidity, etc). We also anticipate conducting several river-to-ocean transects from the Kaleet River into Sherman Basin using a small aluminum boat. These transects will include measurements of seawater physical and geochemical properties and the collection of water samples along the mixing gradient. As the Kaleet River extends into the Queen Maud Gulf Migratory Bird Sanctuary, we will seek permission from the Canadian Wildlife Service for any research activities carried out in and near the river.

Community-Based Oceanographic Sampling: We also have plans to work with community partners in Kugluktuk and Cambridge Bay to conduct local sampling activities in 2023-2024. As in 2022/2023, we will continue to work with the Kugluktuk Hunters and Trappers Organization and the Canadian Rangers Ocean Watch program to collect year-round observations of river to ocean gradients from the Coppermine River into Coronation Gulf. This sampling will include collecting observations of physical and geochemical parameters using local platforms in Kugluktuk and will take place from early throughout the year in the new year (January to - December 2023). There will be approximately 5 – 6 sampling events throughout the year, depending on weather conditions and safe travel considerations. Wintertime transects will be conducted by snow machine and summertime transects will be conducted by small boat.

Wintertime observations of oceanographic conditions within Dease Strait will also be conducted by community partners in Cambridge Bay and through the Canadian Rangers Ocean Watch program, once safe-travel on sea ice is possible. This will include conducting a transect across Dease Strait from Cape Colborne to the Kent Peninsula and another through the Finlayson Islands. These transects will collect physical observations of the entire ocean water column through the sea ice to observe wintertime conditions of the water temperature, salinity, and dissolved oxygen concentrations.

As our program covers the entire year, we request that our research license allow sample collection activities in the above-mentioned regions from January 2023 to December 2023.

Summary:

Our research uses a suite of oceanographic tools and year-round moorings to investigate the oceanography of the Kitikmeot Sea, including the flow of river water to the sea, and the tidally influenced narrow straits. We have an overall goal of understanding the structure and function of the region's ecosystem, which would provide NRI and the Canadian High Arctic Research Station a scientific basis for long-term ecological ocean monitoring and research.

We greatly appreciate your support of these investigations and we welcome any comments, suggestions, and ideas you may have related to this research. We would be happy to answer any questions you may have, so please contact us at your convenience. We look forward to working with you in 2023.

Sincerely,

Dr. Bill Williams - Research Scientist
Fisheries and Oceans Canada, Ocean Sciences Division
Institute of Ocean Sciences, 9860 West Saanich Road
Sidney, BC, V8V 4L1
Tel: (250) 363-6343
Email: Bill.Williams@pac.dfo-mpo.gc.ca

On behalf of the project's co-PIs:

Bodil Bluhm, Professor, University of Tromsø, Norway
Email: bodil.bluhm@uit.no

Kristina Brown, Assistant Professor, Department of Environment and Geography, University of Manitoba, Email: Kristina.Brown@umanitoba.ca

Eddy Carmack, Emeritus Research Scientist, Fisheries and Oceans Canada, Institute of Ocean Sciences, Email: Eddy.Carmack@dfo-mpo.gc.ca

Seth Danielson, Associate Professor, University of Alaska Fairbanks.
Email: sldanielson@alaska.edu

Brent Else, Assistant Professor, Geography, University of Calgary
Email: belse@ucalgary.ca

C.J. Mundy, Associate Professor, Biological Oceanography, University of Manitoba
Email: CJ.Mundy@umanitoba.ca

John Nelson, Research Scientist, Fisheries and Oceans Canada, Institute of Ocean Sciences,
Email: John.Nelson@dfo-mpo.gc.ca

Adrian Schimnowski, Executive Director, Arctic Research Foundation,
Email: adrian@arcticresearchfoundation.ca

Bill Williams, Research Scientist, Fisheries and Oceans Canada, Institute of Ocean Sciences,
Email: Bill.Williams@pac.dfo-mpo.gc.ca

Figures and tables:

Figure 1. Map showing the 2023 proposed route and areas of interest for ship-based oceanographic sampling from approximately 1 August 2023 to 30 September 2023. Anticipated and potential cruise tracks shown with solid and dashed lines, respectively; tidal mixing and river-ocean focal points highlighted with circles. The locations of year-round moorings deployed in 2022 are identified with triangles.

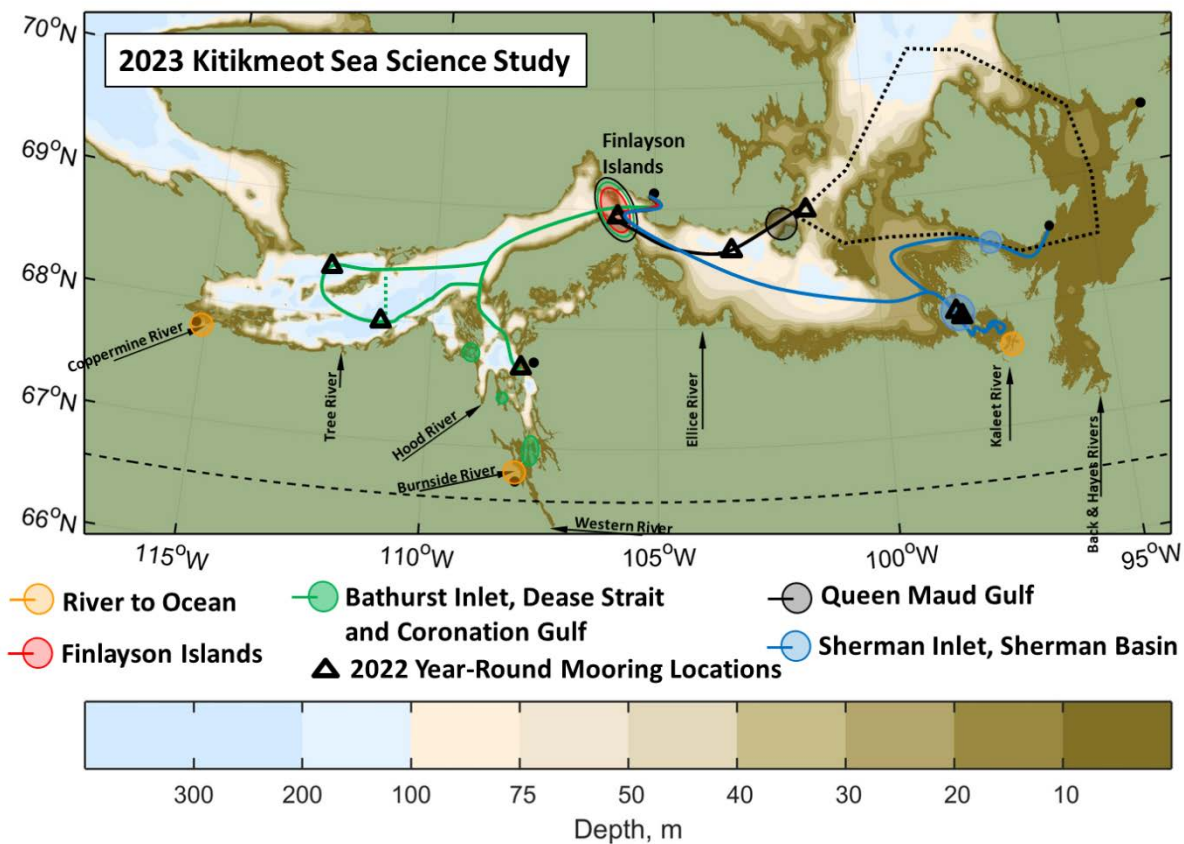


Table 2. Expected participants for 2023 ship-based oceanographic sampling

01 August 2023 – 30 September 2023 (dates to be confirmed)			
Participant	Role	Institution	Research Focus
Bill Williams	Co-PI	DFO	Physical Oceanography
Seth Danielson	Co-PI	U. of Alaska Fairbanks	Physical Oceanography
Eddy Carmack	Co-PI	DFO	Ocean Ecosystem Concepts
Bodil Bluhm	Co-PI	U. of Tromso, Norway	Benthic Ecology
Kristina Brown	Co-PI	U. Manitoba	River and Ocean Geochemistry
John Nelson	Co-PI	DFO	Zooplankton
Brent Else	Co-PI	U. of Calgary	Carbon Dioxide Chemistry
Mike Dempsey	Technician	DFO	Mooring recovery/deployment
Chis Clarke	Technician	DFO	Mooring recovery/deployment
Paul Macoun	Technician	DFO	Mooring recovery/deployment
Kurtis Anstey	Technician	DFO	Mooring recovery/deployment
Shawn Marriott	Technician	U. of Calgary	Water sampling