Fisheries and Oceans Canada | Pêches et Océans Canada

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RE: Scientific Research License #**04 002 23R-M** Annual Report and 2024 plans.

Dear NRI, NIRB and interested parties,

Please accept this letter as our report submission for our 2023 oceanographic sampling and research in the Kitikmeot Sea, under the multiyear NRI licence number: **04 002 23R-M**. This letter further describes our plans for the 2024 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.

2023 Annual Summary:

Ship-based Oceanographic Sampling: We successfully carried out multiple aspects of our ship-based oceanographic sampling program again in 2023. The main oceanographic field program was conducted aboard the *CCGS Sir Wilfrid Laurier* from September 18 to 26th, 2023. 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 2024 (see 2024 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 a second oceanographic investigation of Sherman Inlet and Sherman Basin (August 17th-27th, 2023) 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 seawater (nutrients, inorganic carbon, water isotopes, salinity) using electronic instruments and a rosette water sampler. We also collected zooplankton from the water column using a ring-net towed vertically and collected kelp specimens with a purpose-built rake. For benthic organism collection, we used an underwater camera to take photos of the bottom community and collected sediment and benthic organisms with a van veen grab. We recovered two tilt-current meter moorings from Sherman Inlet that were deployed in 2022, these systems measured the current direction and bottom water temperature over the year (Figure 1). We also collected observations of the bottom depth of the inlet and basin to better assist future navigation in this region, including navigating into the Kaleet River estuary.

Our investigations throughout this area, including the scientific questions we were addressing, were informed by Youth from Gjoa Haven. We also received guidance on our cruise path from Elders from the community who have extensive knowledge of the region. Four Youth from the community of Gjoa Haven were able to participate in different aspects of our marine sampling program, including learning how to deploy electronic instruments, collect water samples and zooplankton from the water column, and conduct sediment grabs and take underwater photos. Youth shared about their experiences aboard the ship with the participants at the Youth-Elder Camp in Sherman Inlet, including showing underwater videos and discussing their interest in better understanding the ocean in the region.

Community-Based Oceanographic Sampling: In 2023, 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. This pas year, CTD and water sampling transects were completed in January, May, August, and October, 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.

2024 Plans:

Our ship-based oceanographic programs will take place between 1 August 2024 and 30 September 2024, with the anticipated participants listed in Table 2.

Ship-based Oceanographic Sampling, CCGS Sir Wilfrid Laurier: As in 2023, we aim to focus our mooring deployment and water sampling activities aboard the *CCGS Sir Wilfrid Laurier* across the Kitikmeot region, including: the Finlayson Islands, Coronation Gulf, Bathurst Inlet, Queen Maud Gulf, and Icebreaker Channel, and if time allows, travelling into Chantry Inlet (St. Roch and Rasmussen Basins), as shown in Figure 1 (SWL). Our focus for 2024 will be the continuation of work carried out previous years (2017-2019, 2022-2023), with a focus on recovering the moorings deployed in 2023. Our planned sampling, instruments, and techniques are the same as in our original permit.

Our proposed observational activities on the *CCGS SWL* 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).

Ship-based Oceanographic Sampling, R/V Martin Bergmann: As in 2023, we aim to focus our water and benthic sampling activities aboard the *RV Martin Bergmann* in the vicinity of Sherman Inlet and Sherman Basin, as shown in Figure 1 (MB). Our planned sampling, instruments, and techniques are the same as in our original permit, these include: a) measurement of physical and geochemical properties of seawater via electronic instruments and via water sample collection; (b) sampling zooplankton; (c) sampling of bottom sediment and benthic organisms; (d) underwater camera recordings and photos of the benthic sea life; and (e) river-to-ocean transects from the Kaleet River into Sherman Basin using a small aluminum skiff (detailed below). As 2024 will be the final year of scientific activities before the *RV Martin Bergmann* is retired, this will also mark the final year of the Kitikmeot Sea Science Study aboard the *RV Bergmann*. Research conducted in future years will be carried out solely on the *CCGS Sir Wilfrid Laurier*.

In 2023 we were able to find safe passage towards the mouth of the Kaleet River with our small science support vessel (16ft dolphin skiff). River-ocean transects proposed for 2024 will include measurements of seawater physical and geochemical properties and the collection of water and sediment samples along the mixing gradient. We have communicated with the Canadian Wildlife Service and determined that our activities do not pose a risk to the Queen Maud Gulf Migratory Bird Sanctuary; however, we will keep them updated as to our planned scientific activities in the region in 2024, as was done in 2023. As in 2023, the 2024 sampling program aboard the RV MB will be informed by Youth and Elders in Gjoa Haven through community meetings in Winter & Spring 2024.

Community-Based Oceanographic Sampling: We also have plans continue to work with community partners in Kugluktuk to conduct local sampling activities in 2024-2025. As in 2023/2024, 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 2024). 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.

As our program covers the entire year, we request that our research license allow sample collection activities in the above-mentioned regions from January 2024 to December 2024.

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 2024.

Sincerely,

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Figures and tables:

Figure 1. Map showing the 2024 proposed route and areas of interest for ship-based oceanographic sampling from approximately 1 August 2024 to 30 September 2024. 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 2023 are identified with triangles.

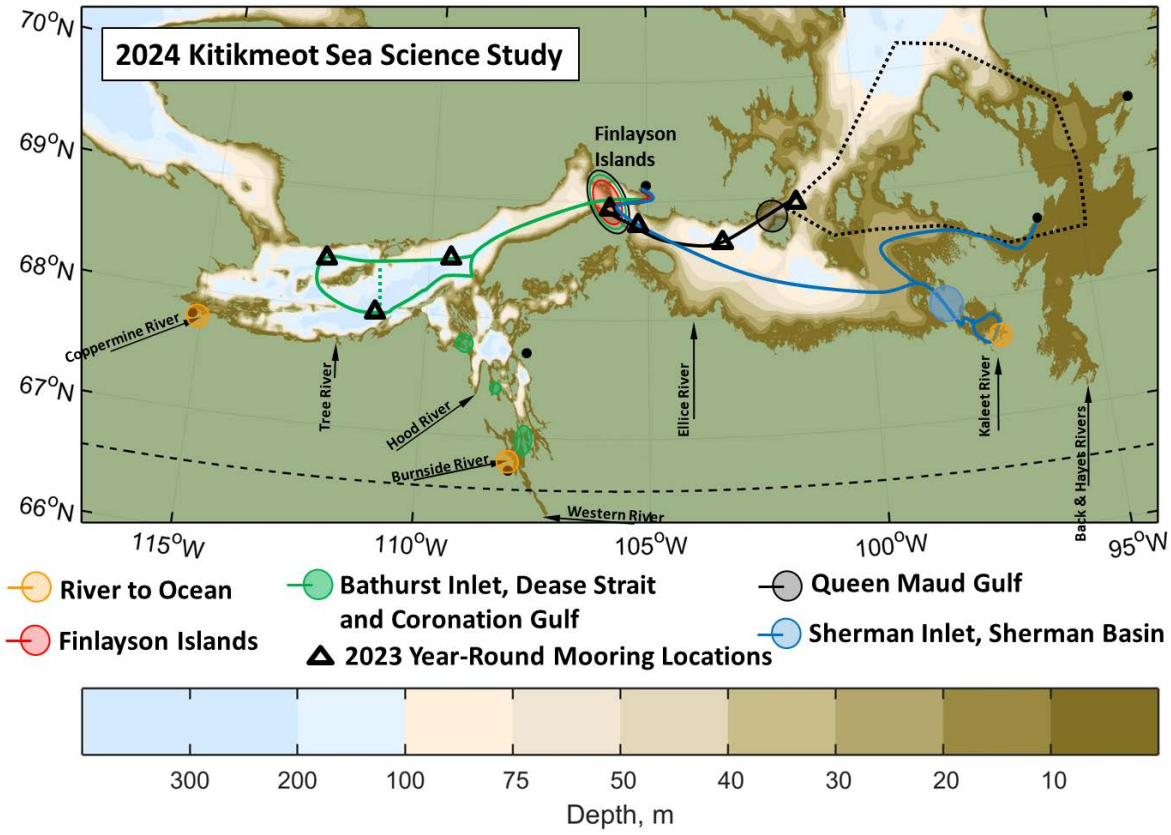

Table 2. Expected participants for 2024 ship-based oceanographic sampling

01 August 2024 – 30 September 2024 (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