

# McGill University

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**March 31, 2022**

**Jamal Shirley**

**Nunavut Research Institute**

Iqaluit, NT  
X0A 0H0

**Re: Nunavut Research License renewal for NRI # 02 032 21R-M - Annual Summary of 2021 Field Season and Proposed 2022 Research Activities – DFO Project**

**Dear Jamal,**

Hope all is well for yourself and the NRI staff. Please find enclosed the Annual Summary of the 2019 and 2021 Research Activities for my PCSP-funded DFO project. as required to renew my NRI research license for 2022, as part of my multiyear Nunavut Research License for this project. Please also be advised that I am in the process of having the Inuktitut translation completed and will have it forwarded to your office as soon as it is available. I will be submitting a request to the Resolute Bay Municipal Council in the coming weeks for their approval.

I have successfully applied to PCSP for a field trip to provide logistical support for this project as follows:

**a. Summer field trip: ~ 7 days between ~ July 1 to ~ August 15, 2022**

If further information is required or if you have any questions, please do not hesitate to contact me.

Sincerely,



**Lyle Whyte**  
Professor

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## Annual Summary of NRI # 02 032 21R-M 2021 Research Activities

In 2020 the field season was cancelled due to Covid 19. In July 2019 our team members, Dr. Y. Altshuler (PDF), E. Gongoras (PhD), M. Ellis (MSc) collected beach sediment and marine water samples from five beaches around Resolute Bay, Assistance Bay, and Allen Bay. The samples are currently being processed to characterize the baseline microbial communities and environmental and chemical data. In addition, the samples were being used for laboratory microcosm experiments to investigate marine fuel degradation rates under various remediation treatments including the application of a nutrient amendment. The result has been published in Marine Pollution Bulletin, titled “Hydrocarbon biodegradation potential of microbial communities from high Arctic beaches in Canada's Northwest Passage”. Furthermore, *in-situ* beach microcosms buried in July 2019 at Assistance Bay to test in situ fuel degradative ability of native microorganisms under ambient conditions were retrieved in August 2019 after a month-long in situ incubation and are currently being analyzed for hydrocarbon content and microbial community analyses. We also performed field sequencing with the MinION with DNA extracted from three of the intertidal beach sediment samples to start long term monitoring of the beaches. These DNA sequences will be used to further characterize the beach microbiota and help to evaluate the feasibility of the MinION as a real-time monitoring tool during a fuel spill. Sediment and water samples were also collected from these Northwest Passage (NWP) beaches and transported back to my McGill University laboratory where they are being used for beach column studies designed to mimic a NWP intertidal beach and test and optimize different bioremediation treatments in the event of a marine fuel spill in the NWP. Our results to date indicate that while there are some hydrocarbon biodegradative microorganisms present in these high Arctic beaches, there biodegradative activity is somewhat limited by the cold temperatures of the site.

In August 2021, our team members, Dr. Y.J. Chen (PDF) and A. Lirette (MSc) collected sediments from five beaches around Resolute Bay shorelines. They set up *in-situ* microcosms with two different types of fuel (Ultra Low Sulfur Oil and marine diesel) and treated with nutrient amendments (inorganic monoammonium phosphate and oleophilic S-200 OilGone fertilizers) at the Assistance Bay field study site (Cornwallis Island) as in the 2019 experiment. This *in-situ* experiment was set for one year incubation over the Arctic winter to test nutrient amendments in response to fuel contamination on an Arctic beach. Moreover, beach sediments from Tupirvik beach were used to design a 3-month column experiment to mimic a NWP intertidal beach as the previous 1-month column experiment with sediment beach from 2019. This longer experiment will bring us more acute knowledge on bioremediation in a cold environment.

**Can condense the above and focus on the 2021 field season.**

## Proposed 2022 Field Research Activities

We are requesting a summer trip (7 days) for 2022 between July 17 – July 23 with Dr. Y.J. Chen (PDF), Dr. N. J. Freyria (PDF), E. Gongoras (PhD) to Cornwallis Island. In 2022 we plan to retrieve *in-situ* microcosms after a year of incubation period throughout the winter for comprehensive microbial, genomic, and hydrocarbon analyses. These analyses will offer an insight on the feasibility of nutrient amendments as a bioremediation strategy in an Arctic beach sediment. We will also collect small amounts of beach sediment material and seawater samples from five different beaches along Resolute Bay shorelines. Samples will be transported back to my lab in Montreal where they will be used to set up further laboratory investigations. Sediment and seawater samples

will be compared to obtain a solid knowledge on the endemic microbial communities and their intricate interactions. In addition, DNA sequencing will also be performed on these beaches at the PCSP lab using the MinION sequencer to further develop the protocol for real-time monitoring of a fuel spill. The questions addressed by these research activities are: What is the hydrocarbon degradation potential of microbial communities in beach sediments along the Northwest Passage? How does nutrient amendment affect the degradation rates of fuel? We aim to determine the optimal bioremediation treatments for fuel contamination in Northwest Passage Arctic beaches. This will eventually inform public policy for remediation strategies of hydrocarbon contaminated Arctic beaches in the event of an accidental spill in the Northwest passage. Please note that we will strictly adhere to all required Canadian and Nunavut CV19 protocols and all field team members travelling to Resolute Bay will be fully vaccinated in Quebec prior to travel to Nunavut. Team members will stay only within the PCSP Facility bubble in Resolute Bay and will not enter the Resolute Bay Community. Travel to the Assistance Bay field site will occur by helicopter back and forth from PCSP Resolute.