HYDROCARBON-DEGRADING MICROORGANISMS IN THE CANADIAN ARCTIC MARINE ENVIRONMENT: COMMUNITY COMPOSITION AND OPTIMIZATION FOR BIOREMEDIATION

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ABSTRACT

Threats to Arctic marine environments, such as hydrocarbon spills, are expected to multiply as the extent and thickness of sea ice continues to decline, opening shipping lanes and increasing regional development. This research will contribute to the creation of better environmental monitoring and management practices in the Canadian Arctic by employing genomics to identify indigenous oil-degrading microorganisms and probe their potential response to oil contamination. The overarching hypothesis of this project is that oil seeps in seabed sediments naturally seed the ocean with microorganisms capable of metabolising hydrocarbons in the marine environment. Genomics tools will enable for the screening of Arctic regions to see if these putative oil-degrading organisms are present and poised to respond in the event of an oil spill. The objective of this study will be to (i) identify and characterize these oil-degrading marine microorganisms using genomic tools; (ii) determine the baseline microbial community composition of current Arctic waters to use in future environmental monitoring by industry; and (iii) to demonstrate the response of oil-degrading microorganisms in mock Arctic oil spills. Arctic marine samples will be collected during my field expedition aboard the CCGS Amundsen research icebreaker in the summer of 2017. Genomic analysis of these samples will reveal the presence of oil-degrading microorganisms and potentially point to oil-degradation capabilities in the Arctic. Mock oil spill microcosm experiments will be conducted by exposing these microbial communities to varying environmental conditions following pre-established methods. Omics strategies will provide information pertaining to microbial oil-degraders while microcosm experiments will provide insight into the effectiveness of these organisms to degrade petroleum hydrocarbons under unique environmental conditions. This research will have application by end users in making predictions and emergency response measures for dealing with oil spills in Canada's Arctic marine environments.

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