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Hydrocarbon biodegradation potential of microbial communities from high Arctic beaches in Canada's Northwest Passage

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Abstract:

Sea ice loss is opening shipping routes in Canada's Northwest Passage, increasing the risk of an oil spill. Harnessing the capabilities of endemic microorganisms to degrade oil may be an effective remediation strategy for contaminated shorelines; however, limited data exists along Canada's Northwest Passage. In this study, hydrocarbon biodegradation potential of microbial communities from eight high Arctic beaches was assessed. Across high Arctic beaches, community composition was distinct, potential hydrocarbon-degrading genera were detected and microbial communities were able to degrade hydrocarbons (hexadecane, naphthalene, and alkanes) at low temperature (4 °C). Hexadecane and naphthalene biodegradation were stimulated by nutrients, but nutrients had little effect on Ultra Low Sulfur Fuel Oil biodegradation. Oiled microcosms showed a significant enrichment of *Pseudomonas* and *Rhodococcus*. Nutrient-amended microcosms showed increased abundances of key hydrocarbon biodegradation genes (*alkB* and *CYP153*). Ultimately, this work provides insight into hydrocarbon biodegradation on Arctic shorelines and oil-spill remediation in Canada's Northwest Passage.

Keywords: Northwest Passage, Arctic beaches, hydrocarbon biodegradation, ultra low sulfur fuel oil, biodegradation, microbial communities