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Community-based monitoring to understand changing tidewater glacier-ocean interactions in the Canadian Arctic Archipelago

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Tidewater glaciers are defining coastal features in Canadian high Arctic marine systems. Rapid Arctic climate warming is dramatically altering the nature of these coastlines and adjacent waters through changing atmospheric forcing, a lengthening open-water season, and accelerating glacier retreat. These changes have a broad range of impacts enhancing glacier meltwater discharge, shifting coastal biological productivity patterns, and changing upper ocean freshwater variability and circulation. For the community of Aujuittuq (Grise Fiord), Canada's northernmost community and 'the place that never thaws', these impacts have critical implications for local infrastructure, travel safety and food security. Over the last decade, Aujuittuq community members have noted significant recession of glaciers, as well as changes in the fjords surrounding their home and hunting grounds. To better understand these changes, for the last several years, we have been collaborating with the community to collect year-round marine observations in Jones Sound, home of the Inuit of Aujuittuq. Our observations span the nearshore coastal zone to the open Sound, comparing glacierized and non-glacierized fjords and multiple glaciers of varying type (land-terminating, tidewater), grounding line depth, and size draining surrounding ice caps. In total these observations represent over 400 casts measuring water column temperature, salinity, turbidity, dissolved oxygen, and chlorophyll a, with paired bottle samples characterizing carbon, nutrient, metal, and phytoplankton community composition and activity to elucidate how these properties evolve with distance from the shore. In 2022, we worked with 12 local youth, adults, and elders to make these observations. Our efforts aim to establish a long-term, community-led monitoring program centered around the co-consideration of Indigenous and scientific knowledge to understand ongoing change in high Arctic coastal environments. Results from this study substantially further our holistic understanding of glacier-ocean impacts in the sparsely sampled Canadian Arctic Archipelago and beyond, while also providing data critical to accurate future projections of high-latitude marine change in regions that are a hotspot for tidewater glacial retreat and meltwater runoff to the ocean.