



## **Environmental gradients and microbiota of a northern ice shelf cryo-ecosystem**

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Over the past century, the  $\sim 9000 \text{ km}^2$  'Ellesmere Ice Shelf' ( $82\text{-}83^\circ\text{N}$ ,  $64\text{-}90^\circ\text{W}$ ) fragmented into 5 ice shelves now totalling almost  $1000 \text{ km}^2$ . These ice shelves along the northern coast of Ellesmere Island in the Canadian High Arctic provide a cryo-habitat for microbial communities, which are found in conjunction with sediments on the ice surface. We undertook a comparative analysis of physical, chemical and biological characteristics of the 5 remnant ice shelves. Each of these remnants is a thick ( $> 20 \text{ m}$ ) mass of ice with substantial sediment overburden that promotes the formation of oligotrophic meltwaters in the summer. Microbiota were associated with all the sediments we collected, forming a continuum of microbial mat types from very sparse to loosely cohesive and pigmented. Using digital images from over-flight transects we determined that 8.4 % of the combined ice shelf area is suitable microbial mat habitat, which we estimated contains up to a total of 34 Gg of organic matter. A gradient of increasing chlorophyll *a*, organic content and conductivity was found from west to east. This is likely related to the surface ice type (marine versus atmospherically-derived) and also to the relative availability of sediment. This ice shelf cryo-ecosystem is the only one of its kind in the Northern Hemisphere and is becoming increasingly fragmented due to ongoing climate warming. Despite this habitat fragmentation, the remnant ice shelves show little loss of biodiversity in their microbial ecosystem properties. There are, however, distinct differences between each ice shelf, and environmental gradients at several scales.