



## Literature Review

Increased temperatures are likely to reduce the extent of the zone of superimposed-ice accumulation and the thickness of superimposed ice formed. This will have a negative effect on glacier mass balance since near-surface ice temperatures will rise<sup>3</sup>. Although such a response could be small in comparison to the changes that could occur as a result from summer warming, this would still be important given the very low specific mass balance of many high-Arctic glaciers<sup>4</sup>. Community members were also concerned about low flying helicopters and increased shipping activity disturbing wildlife<sup>2</sup>.

Attributes	Examples of Environmental Changes and Observations
Sea ice	<ul style="list-style-type: none"> <li>The ice-free season is longer now, with sea ice melting sooner and breaking up faster. As such, sea ice became less stable with less summer ice, which makes travelling more dangerous<sup>2</sup>.</li> </ul>
Multi-year sea ice	<ul style="list-style-type: none"> <li>For much of the 20th century, multiyear land-fast sea ice (MLSI) formed a permanent ice cover in Yelverton Bay, Ellesmere Island. This cover survived intact for 55–60 years until 2005, when &gt;690 km<sup>2</sup> (90%) of MLSI was lost from Yelverton Bay. Further losses occurred in 2008, and the last of the Yelverton Bay MLSI was lost in August 2010<sup>4</sup>.</li> </ul>
Weather	<ul style="list-style-type: none"> <li>There is more wind and less snow in the area<sup>1</sup>.</li> </ul>
Glacier melt	<ul style="list-style-type: none"> <li>Glaciers are melting and receding quickly. Large pieces of ice caps and glaciers are breaking off and less water is running off glaciers in the summer affecting the conditions of trails<sup>2</sup>.</li> <li>For John Evans Glacier, Ellesmere Island, a 1°C rise in mean annual air temperature due solely to winter warming is predicted to reduce the specific mass balance of the glacier by 0.008 m a<sup>-1</sup> because of decreased superimposed-ice formation<sup>3</sup>.</li> </ul>
Erosion	<ul style="list-style-type: none"> <li>There appears to be an increase in coastline erosion due to larger waves<sup>1</sup>.</li> </ul>

Attributes	Examples of Ecosystem Changes and Observations
Polar bears	<ul style="list-style-type: none"> <li>Polar bears are increasing. Not as big as before but are healthy, however other residents think bears are larger, especially in the fall<sup>2</sup>.</li> </ul>
Walrus	<ul style="list-style-type: none"> <li>Fewer walrus on the north side of Jones Sound, on Ellesmere Island but more on the south side of Jones Sound, on Devon Island<sup>2</sup>.</li> <li>Less walrus seen during tagging projects, but numbers seem to be increasing now<sup>2</sup>.</li> </ul>
Seals	<ul style="list-style-type: none"> <li>Fewer harp seals and ringed seals in 2012 but bearded seals have increased<sup>2</sup>.</li> <li>Seals are more variable in size and are generally smaller<sup>2</sup>.</li> </ul>
Whales	<ul style="list-style-type: none"> <li>Decrease in beluga over the past 2-3 years, but more narwhals in the area<sup>2</sup>.</li> </ul>
Fisheries	<ul style="list-style-type: none"> <li>More char now, yet other community members consider char numbers have decreased near town<sup>1</sup>.</li> </ul>
Birds	<ul style="list-style-type: none"> <li>Seen new species of birds and insects in the area. Cackling geese had arrived in the area in the late 1980s<sup>2</sup>.</li> </ul>
Invertebrates	<ul style="list-style-type: none"> <li>Less naked sea butterflies at the floe edge than before. These snails are an important food source for Bowhead whales<sup>2</sup>.</li> </ul>

### Based on the Current Gaps in the Literature, Research Needs Include:

- Erosion mitigation studies:** Current impacts of climate and environmental changes require that the community take necessary steps to protect its shoreline and implement measures to mitigate the impacts to the people<sup>1</sup>.
- Fisheries development:** Residents are concerned that clams could become overharvested if not properly managed. Others thought that there was not enough fish in the area to be used as a commercial resource, but studies are needed to determine feasibility<sup>2</sup>.

### Selected references

- Government of Nunavut (n.d.) *Integrated Community Sustainability Plan (ICSP) Webtool. Grise Fiord community profile.* <https://bit.ly/3ep0WJz> Accessed May 8, 2020.
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- Woodward, J., Sharp, M., and Arendt, A. (1997). The influence of superimposed-ice formation on the sensitivity of glacier mass balance to climate change. *Annals of Glaciology* (24), 186-190. <https://bit.ly/2zD2FuQ>
- Pope, S., Copland, L., & Mueller, D. (2012). Loss of multiyear landfast sea ice from Yelverton Bay, Ellesmere Island, Nunavut, Canada. *Arctic, Antarctic, and Alpine Research*, 44(2), 210-221. <https://bit.ly/2WQmJCa>.

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