Epishelf Lakes as Sentinels of Climate Change: Implications of Arctic Ice Shelf Break-up

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**Arctic ice shelves**
- ~40 m thick floating ice sheets formed from multiyear landfast sea ice (MLSI)
- Early 20th century: continuous ice shelf fringe along the northern coastline of Ellesmere Island
- 2000: 6 smaller ice shelf remnants

**Significance**
Northern coastline of Ellesmere at 83°N:
- Hotspot for the study of the impacts of climate change\(^1,2\)
- Warming of a greater amplitude and more rapid than most other parts of the planet

High latitude lakes:
- Among the most sensitive ecosystems on the planet\(^4\)
- Epishelf lakes:
  - Significant bipolar feature
  - Potential as significant indicators of environmental change
  - Their loss is a threshold effect
  - Habitat for vertically stratified communities

**Objectives**
- Define the structure of arctic epishelf lakes
- Evaluate their recent dynamics
- Document longer term changes
- Evaluate the potential of epishelf lakes as sentinels of climate change

**Milne Fiord – 13 July 2007**
- The best current example of a stable arctic epishelf lake
- Dammed by the glacier-fed Milne Ice Shelf
- Freshwater derived from precipitation and ice melt water
- Presence of vertically stratified phototrophic communities
- Photoprotective carotenoids in greater proportion than photosynthetic carotenoids at 5 m, and vice versa at 30 m
- Potential influence of light and nutrients in structuring algal communities

**Survey of past potential epishelf lakes**
- 94% decrease since 1906
- Only Milne Fiord existed in 2007
- However, lakes dammed by MLSI are still numerous in the Arctic
- Satellite imagery used for ice-dammed lake monitoring

**Conclusions**
- Epishelf lakes are indicators of past and ongoing changes in the Arctic and Antarctic
- Ice-dammed lakes are indicators of the presence and minimum thickness of a complete dam at the fiord’s mouth
- Ice-dependant polar ecosystems are highly vulnerable to climate change
- Ice-dammed lakes are important sites for monitoring long term environmental change

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References