ArcticNet
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4.2: Human Vulnerability

Sea ice variability and change
Exposure and risk in three Nunavut communities

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INTRODUCTION

Sea ice plays an integral role in the social, economic, and cultural aspects of Inuit life. Often used as an indicator of climate change in arctic regions, sea ice change has both climatic and community implications. The communities of Cape Dorset, Igloolik, and Pangnirtung, Nunavut (Figure 1) all depend on the formation of sea ice to enable travel and hunting. Cape Dorset and Igloolik are located on small islands, and Pangnirtung is in a fiord surrounded by mountains; therefore, community members share the commonality of being stranded in town when the sea ice is unsafe or in transitional stages. While each community is observing similar changes in annual sea ice cycles (i.e. floe edge position, ice thickness, freeze-up/break-up timing) these exposures have differing associated risks and implications depending on the community. Therefore, local sensitivities to, and expertise on, sea ice change are critical inclusions to ensure community-relevant vulnerability assessments.

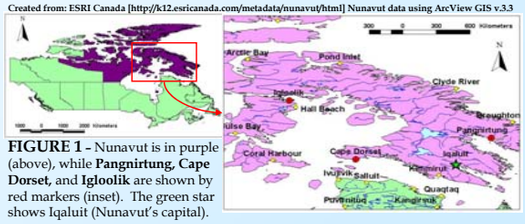


FIGURE 1 - Nunavut is in purple (above), while **Pangnirtung, Cape Dorset,** and **Igloolik** are shown by red markers (inset). The green star shows Iqaluit (Nunavut's capital).

METHODS

Over four separate field seasons, coinciding with different stages of sea ice formation or decay (between April, 2004 and June, 2005), a combination of participatory methods were employed to collect detailed information regarding sea ice conditions, terminology, uses, change, variability, and risks related to each community.

- **Semi-directed interviews** → allowed for flexibility in responses and conversation flow (e.g. Huntington, 1998; Fox, 2002); a total of 84 interviews (with 63 Inuit elders and hunters) were conducted. Experienced and active hunters were recommended for their expertise.
- **Sea ice trips** → getting first-hand experience, and learning about sea ice in context (Fox, 2002), was important; Laidler participated in 14 experiential sea ice trips (e.g. day trips to the floe edge or polynyas, extended sea ice travel to reach hunting/fishing grounds, a dog team excursion); trips were documented with photo and video footage, as well as GPS tracks.

CAPE DORSET

Observations of change have been noted in the last few years (2000 – present) and are typically compared to conditions in the 1960s or earlier.

FLOE EDGE → typically close to town because the strong Hudson Strait currents prevent extensive ice formation, but now increasingly forming within sight of town.

Risks	*Implications*
-- increased potential of break-off events -- main travel routes compromised	-- increased access to marine wildlife -- more dangerous sea ice travel, reduced access to Baffin Island, altered routes

ICE THICKNESS → thinner, as gauged by the depth of seal breathing holes, cracks, fishing holes, multi-year ice size, or in comparison to personal height.

Risks	*Implications*
-- decreased ice resistance to the influence of current and lunar cycles, as well as snowfall	-- occurrence of larger or new polynyas -- less predictable ice safety -- enhanced hunting danger around polynyas

FREEZE-UP → shifted by approximately one month for early freezing (Oct. – Dec. vs. Sept. – Nov.) and when ice becomes travelable (Dec./Jan. vs. late-Oct.).

Risks	*Implications*
-- contributes to thinner ice conditions -- non-uniform freezing	-- hampers/delays ice travel -- potential to exacerbate early break-up

BREAK-UP → shifted by approximately one month for break-up timing (May vs. June) and for the ice-free season (July vs. Aug.).

Risks	*Implications*
-- deteriorating ice conditions -- dangerous with water accumulation -- some areas open 2-3 weeks earlier than others	-- more dangerous travel, altered routes -- increased potential to be stranded away from town -- longer boating season

PANGNIRTUNG

Observations of change have been noted in the last five years and are typically compared to conditions in the 1980s. Ice conditions in the spring and fall of 2004 were also highlighted as unique.

FLOE EDGE → gauged on distance from the mouth of Pangnirtung Fiord and from the northwest portion of Cumberland Sound, now increasingly closer to town.

Risks	*Implications*
-- increased prevalence of open water in Cumberland Sound -- main travel routes compromised	-- dangerous sea ice travel, altered routes -- commercial turbot fishing locations more crowded, less productive, or all together inaccessible

ICE THICKNESS → thinner, as gauged by comparison to personal height, depth of seal breathing holes (used to be tunnel-like), and ice consistency.

Risks	*Implications*
-- ice deteriorates from underneath -- decreased ice resistance to snowfall	-- occurrence of larger or new polynyas -- decreased access to the southern coast of Cumberland Sound

FREEZE-UP → slower process, different ice consistency, timing shifted from Oct./Nov. to Jan/Feb. to be able to cross Cumberland Sound.

Risks	*Implications*
-- softer sea ice consistency -- non-uniform freezing -- contributes to thinner ice conditions	-- potential to exacerbate early break-up -- extended boating season -- delayed start to the turbot fishing season

BREAK-UP → melt processes being skipped, Cumberland Sound breaking up almost two months early (Apr./May vs. June/July).

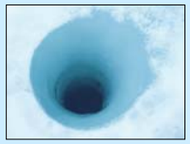
Risks	*Implications*
-- sea ice deteriorating from underneath -- increased potential break-off events -- faster, more sudden melting	-- boat travel to collect eider duck eggs -- shortened turbot fishing season -- more dangerous, altered travel routes

IGLOOLIK

Observations of change have been noted in the last five years and are typically compared to conditions in the 1950s – 1960s. However, the ice conditions in the spring and fall of 2004 were highlighted as very unique.

FLOE EDGE → variable, dependent on multi-year ice (MYI) piling on three key reefs in Fury and Hecla Strait – with less multi-year ice the floe edge is closer to town.

Risks	*Implications*
-- increased potential of break-off events -- highly variable position	-- increased access to moving ice, and wildlife -- altered routes to cross to Melville Peninsula or Baffin Island



ICE THICKNESS → thinner, especially between MYI frozen into landfast ice, as gauged through seal breathing holes and open cracks.

Risks	*Implications*
-- decreased ice resistance to the influence of currents, winds, and snowfall	-- increased snowfall this fall, and blowing snow accumulation between MYI, greatly enhanced travel danger

FREEZE-UP → slower process (tidal zone not freezing first), and crossing of Fury and Hecla Strait delayed until after Christmas (Jan./Feb. vs. Nov./Dec.).

Risks	*Implications*
-- rougher ice conditions due to increased southeast winds -- non-uniform freezing	-- dangerous, less predictable sea ice travel -- delayed access to Baffin Island, altered travel routes

BREAK-UP → skipping some melt stages, breaking up approximately one month sooner (July vs. Aug.).

Risks	*Implications*
-- deteriorating ice conditions -- deeper water accumulation due to decreased number of tidal cracks -- wears out before ice breaks up	-- harder and more dangerous travel -- altered travel routes -- longer transitional stages keep people on the island

ASSESSING COMMUNITY VULNERABILITY

Sea ice travel is hazardous in any season, yet experienced hunters are skilled in managing the associated risks; they can identify dangerous conditions and they understand sea ice interactions with currents, winds, and snowfall. A common method of minimizing risk is to avoid thin ice, strong current, floe edge, or polynya areas, especially during windy conditions, a full or new moon, or after snowfall. However, many of these areas are located on main travel routes, or are desirable hunting destinations. Thus, sea ice changes may exacerbate risks associated with sea ice travel, increasing community sensitivity to long-term implications of change.

LINKS WITH CLIMATE AND CRYOSPHERE SCIENCES → In the eastern Arctic climate and cryosphere scientists are already investigating trends in sea ice freeze-up and break-up timing, sea ice concentration, ice thickness and extent, as well as long-term temperature change and related atmospheric influences (e.g. Wang et al., 1994a; Wang et al., 1994b; Mysak et al., 1996; Gough and Allakhverdova, 1999; Parkinson et al., 1999; Gough and Houser, 2005). With similar interests in sea ice change, and commonly employed indicators, local scale Inuit expertise could complement regional scale satellite monitoring and climate change simulations.

CONTRIBUTIONS TO VULNERABILITY ASSESSMENT → Documenting and understanding Inuit expertise on sea ice processes and change provides local-scale targets for linking social and natural science research in order to determine current and future exposure to sea ice or climate change. However, in order to undertake local scale vulnerability assessments it is also imperative to incorporate Inuit characterizations of social and lifestyle changes that contribute to community adaptive capacity. Working collaboratively with Inuit experts, social scientists, and natural scientists can expand our collective understanding of sea ice exposure, local implications of change (physical, social, economic), and adaptive capacity to manage change (Ford and Smit, 2004). Such cooperative efforts will enable vulnerability assessments that are meaningful at the community level.

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