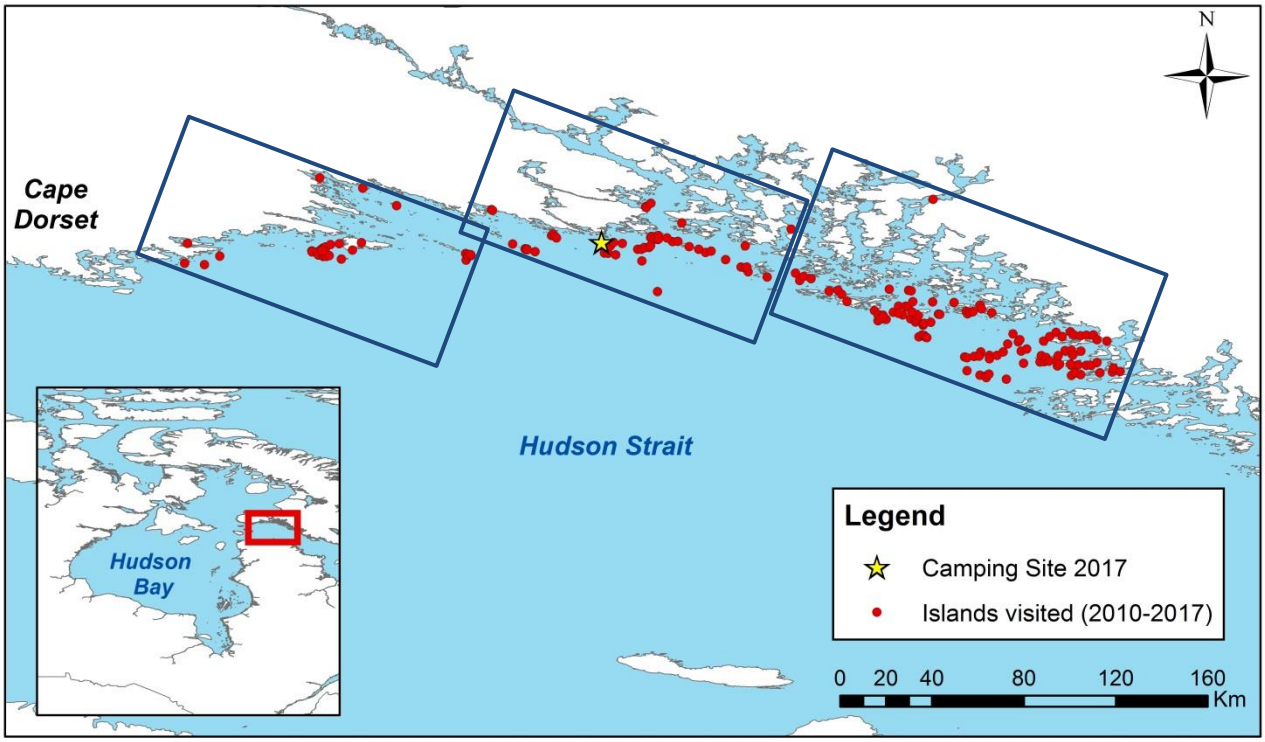
Hudson Strait Common Eider and Polar Bear Surveys

2017 Field Season Report (NUN-SCI-16-02)

Project Overview and Context

The physical characteristics of the Canadian Arctic Ocean have been changing considerably in recent years, due in large part to shifts in the distribution and extent of sea-ice cover. At the same time, industrial interests such as resource extraction are growing in the Arctic. These changes have prompted the development of several marine spatial planning initiatives intended to protect wildlife resources in the context of climate change and accelerating resource development. Marine planning requires accurate and current information to be effective. However, available scientific data for credible habitat assessments of marine wildlife in the eastern Canadian Arctic are limited in number, and in many cases, outdated. This ongoing project in Hudson Strait aims to address these information gaps. We are studying the distribution and abundance of marine birds in the Hudson Strait-Foxe Basin region throughout the year, as well as the biological and physical factors determining those patterns.

Since the beginning of our work in 2010, we have conducted boat-based surveys on more than 200 islands in northern Hudson Strait, to complement our long-term monitoring of common eiders in the East Bay Migratory Bird Sanctuary. Some of these islands have been visited repeatedly to document changes in the colonies between years.



Islands surveyed in northern Hudson Strait between 2010-2017. Blue boxes represent survey areas, from left to right: West Foxe Islands, Chorkbak and Chamberlain.

In 2017, despite very challenging weather, our crew was able to visit 37 islands in the two western sampling areas between July 6 - July 22. The islands surveyed in the Chorkbak area were small and very rocky with low eider nest density and no ponds. A total of 362 active eider nests were found in the Chorkbak area, whereas 1,935 nests were found in the West Foxe Islands area. This year, no polar bears were encountered on the surveyed islands.

Predicting the Effects of Sea Ice Decline on Polar Bears and Arctic Seabirds

In the context of a changing arctic environment in which declines in summer sea ice have been found to increase eider nest predation by polar bears, we are developing computer models to predict how polar bear and common eider interactions will change over time. Earlier ice breakup results in bears coming on land earlier when eider nests still contain eggs, which in turn results in more nests being depredated by bears. Moreover, polar bears are known to be more energetically stressed when sea-ice breaks up earlier, because they do not have as much time to hunt seals on the ice.

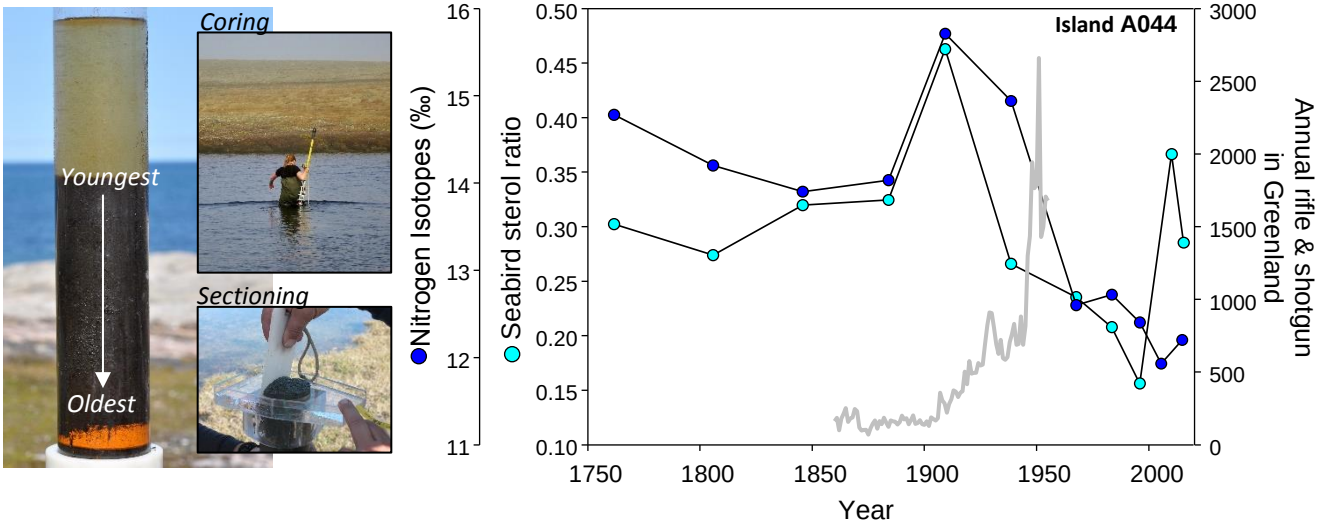
From the years 2015-2017, our team visited 95 islands in Hudson Strait and recorded the number of active and depredated eider nests, number of eggs in the nests and signs of bear activity. These data allowed us to create simulation models to predict future polar bear foraging behaviour and its impact on eider reproduction. Our models predict that polar bear body condition will decline throughout ice-free periods, despite an increase in eider nest predation. This means that the energy gained from the eggs is not sufficient to compensate for the loss of access to their primary prey (seals).

Additionally, our models predict that eider colonies facing increased predation by polar bears are likely to become smaller as eiders disperse, which could have considerable impact on eggs and down harvesting by Inuit. We are continuing to investigate how polar bears will influence eiders as sea ice declines and how this will affect Inuit who harvest eiders.

Tracking Historical Eider Populations at Nesting Islands Using Paleolimnology

Islands with ponds are attractive breeding sites for eiders because they rely on the freshwater ponds to drink during incubation. At the same time, pond sediments serve as an archive of the environmental history of the island through time. Across 9 nesting islands in Hudson Strait, sediment cores were collected with the aim of improving our understanding of how colony sizes have fluctuated. Sterols and stanols, which are present in varying concentrations and combinations in the feces of animals, were used to track eider inputs to lake sediments over time. A ratio of plant sterols to cholesterol (found in eider guano at high concentrations), has been termed the "seabird ratio", and provides a means, both collectively and independently to nitrogen isotopes, for tracking changes in bird inputs to ponds.

Across all of our study islands in Hudson Strait, both isotopes and sterols corroborate a decline in eider populations over time, with a particularly sharp decline inferred during the mid-20th century (one example is shown below). Since between 60 and 90% of the northern common eiders breeding in the Hudson Strait region migrate to west Greenland to winter we looked to changes in Greenland demographics that may have resulted in a wide decline in nesting eiders. Historically, it is probable that Greenlanders resided closer to eider colonies, utilizing the abundance of resources at these islands (e.g., down, eggs, meat and pelts). Overtime as breeding eider numbers dwindled, Greenlanders transitioned to relying less on local breeding eiders and more on wintering eiders. Concurrent to this transition was the increased availability of rifles and shotguns, as well as motorized boats, which made the rapidly growing population of hunters in Greenland more efficient at reaching and obtaining coastal eiders.

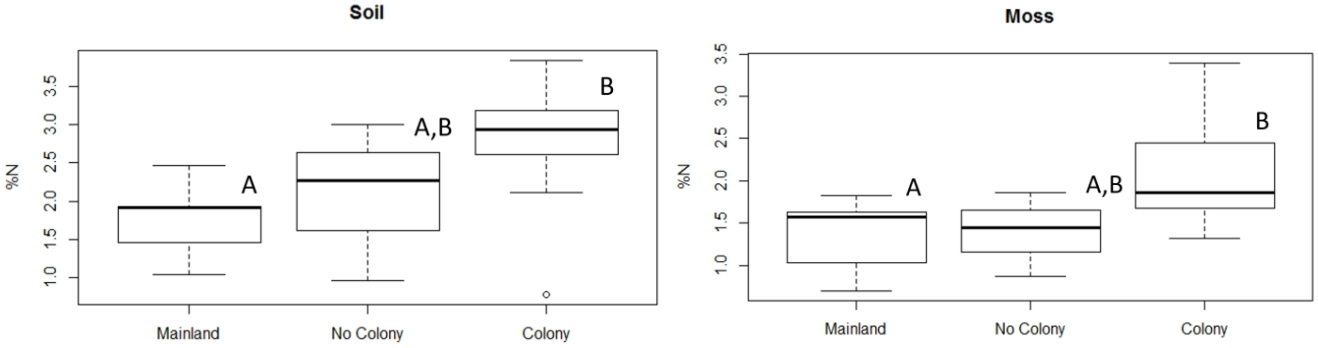


Left: Sediment cores were collected from ponds surrounded by nesting eiders and sectioned into sediment slices which represent discrete periods of time; Right: The profile of two independent tracers of eider presence, measured in a dated sediment core for one island, are shown through time. Plotted in grey is the annual sales and trades of rifles and shotguns in Greenland from 1850 to 1955 (Hargan et al. In prep).

Eiders as `Ecosystem Engineers'

As bear predation on eider colonies is predicted to increase, common eiders may shift from nesting in large, dense colonies as they do now, to a more dispersed pattern. Common eiders feed on marine benthic invertebrates but nest on land on small, offshore islands. They have the potential to transport marine-derived nutrients from their prey species across ecosystem boundaries to the terrestrial environment of their nesting islands. Sources of such nutrients include excreted waste products (*i.e*. guano), carcasses, feathers, and egg fragments. As the tundra ecosystem is classified as severely nutrient limited, there is a high potential that nutrient inputs from common eiders could have large effects over long time periods.

Islands with common eider colonies may have benefitted from these nutrient subsidies, leading to increased growth and productivity of plant communities. Eventually, this can lead to the formation of thick soil layers on eider colonies, which represents better nesting habitat for the birds, as well as aids in retaining the nutrients they deposit. Over long time scales, this process could have led to the formation of the diverse biological communities that we see on islands with eider colonies today, a situation being disrupted by marauding polar bears.
To explore these issues, we performed data collection and mapping of habitat features on islands in the Hudson Strait region. We collected samples of plants, soil, invertebrates, and guano for stable isotope and nutrient analyses.



The difference in percent N values in soil and moss between samples from the mainland, islands with few or no eider ducks, and islands with large colonies of eider ducks. Islands with large colonies had significantly higher levels of nitrogen (a key nutrient) when compared to mainland sites.

Our results show that both soil and plant tissues on islands with large colonies of breeding eider ducks have higher nutrient levels compared to islands with few or no breeding eiders. In addition, the isotopic makeup of these nutrients is different than that found in nearby mainland coastal areas, suggesting a different source of nutrients (*i.e*. eider ducks) from the marine environment.

Disease Monitoring

Since 2012, coastal eider colonies in Nunavut and Nunavik have been monitored to detect evidence of avian cholera outbreaks. To date, cholera has been detected near communities in Nunavik (Aupaluk and Inukjuak), as well as at East Bay, Southampton Island. There has been no evidence of avian cholera near Cape Dorset, but monitoring of the islands is ongoing so that if the disease emerges it can be detected as soon as possible.

For more information or to report suspected avian cholera at a colony contact Catherine Soos (Environment and Climate Change Canada, Catherine.Soos@Canada.ca) or the Canadian Cooperative Wildlife Health Centre (1-800-567-2033).

Future Plans

- Assessing and quantifying the impact of polar bear predation on common eider population size, age structure and colony persistence.
- Identifying particular areas in Hudson Strait where eiders are likely to decline in numbers and areas where they are likely to increase.
- Determining how interactions between polar bears, Arctic fox, gull, and human predation on eiders will influence their populations.
- Investigating links between common eider colonies and other species that utilize the same island habitats (e.g. snow buntings, red-throated loons).
- Continued monitoring of avian cholera and other disease epidemics affecting birds.
- Ongoing handover of basic population monitoring to local communities.

Research Partners and Financial Support

Northern research is logistically complicated and labour intensive, requiring a strong, dedicated crew. We are particularly grateful for the guidance and assistance provided by Numa Ottokie, Salomonie Aningmiuq, Kov Ottokie and Kairili Qiatsuk. We also appreciate very much the continued support provided by Annie Suvega and Members of the Board through the Aiviq HTO in Cape Dorset. Importantly, the Nunavut Inuit Wildlife Secretariat and the Qikiqtaaluk Wildlife Board facilitated efficient payment of guides.

Research in Canada's North is expensive and funding for this work is necessarily provided by a network of partnerships that includes: Environment and Climate Change Canada Wildlife Research Division, the Canadian Wildlife Service, Baffinland Iron Mines, Mitacs, The Pew Charitable Trusts, Oceans North, Nunavut General Monitoring Plan, ArcticNet, Polar Knowledge Canada, Northern Scientific Training Program, NSERC, Carleton University, and the University of Windsor.

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