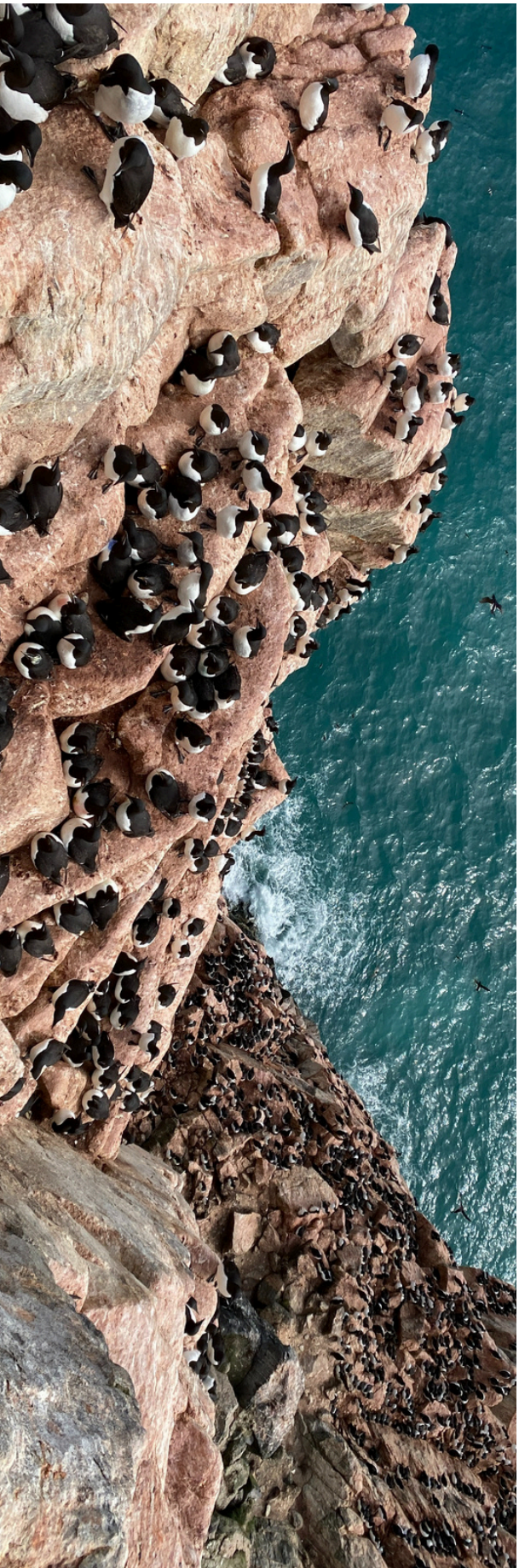
ENVIRONMENT AND CLIMATE CHANGE CANADA

ARCTIC SEABIRDS & ECOSYSTEMS

2025 FIELD SEASON AND RESEARCH REPORT



PROJECT OVERVIEW

Recent ongoing and planned increases in resource development activities are projected to increase shipping traffic in Canada's Eastern Arctic marine regions. However, there is often not enough information to properly assess the potential ecological impacts of expanded shipping activities on marine wildlife. Our program's goal is to work in collaboration with industrial partners and northern communities to determine the distribution and abundance patterns of seabirds, identify their key marine habitats and contribute to the development of protected areas.

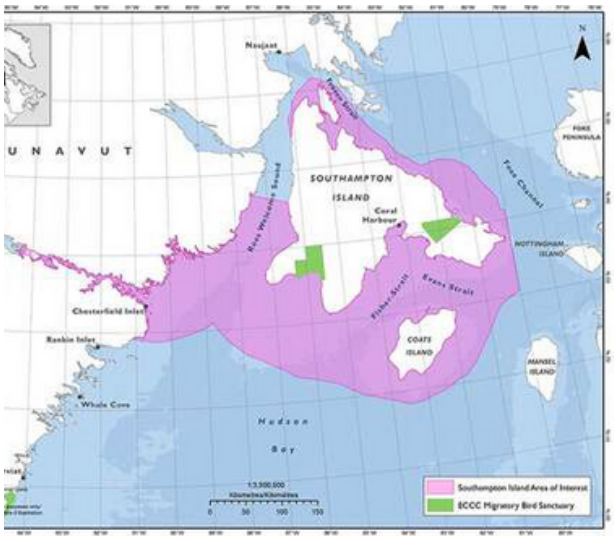
Research efforts in 2025 continued at Coats Island where Environment and Climate Change Canada has been researching thick-billed murres since 1981. With research now completed at Cape Graham Moore in the high Arctic as planned, we have now shifted our focus to the low arctic to resume research at Digges Island, in northern Quebec. These long-term data sets, paired with new tracking technologies and physiological approaches, enable us to establish an ecological baseline to assess potential impacts of planned shipping activity as well as projected changes in climate on seabird populations.

CONTRIBUTING TO MARINE PROTECTED AREAS

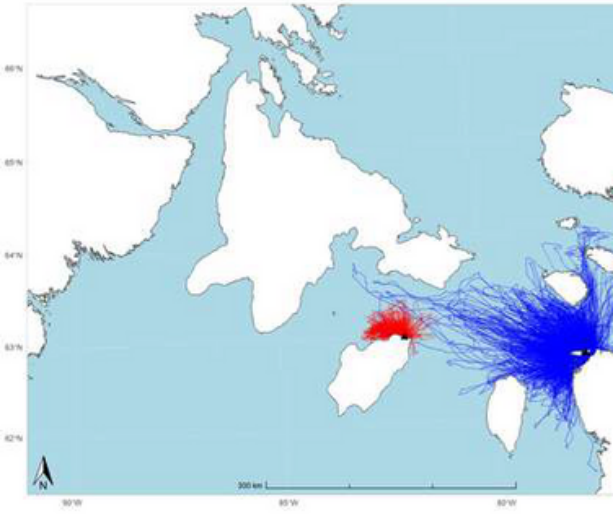
The formal protection of the marine environment is a national priority. In the Arctic, Government Departments and local communities are working together to identify areas worthy of protection. The spatial use of the ocean by wildlife is one element that is considered when designing marine protected areas.

As one example, our team is contributing seabird spatial tracking information which is being used in the design and assessment of 'The Southampton Island Area of Interest'. This area encompasses the nearshore waters around Southampton and Coats Island in the Kivalliq Region of Nunavut and is under consideration for the Department of Fisheries and Oceans Marine Protected Area Program. This site comprises 93,000 km2 within the Hudson Bay Complex Marine Bioregion, and is approximately 1.6% of Canada's ocean territory.

Southampton Island is the largest island in Hudson Bay, near the confluence of Hudson Bay and Foxe Basin waters; making it an area of high marine productivity. The area is important for key marine species including beluga whales, and bowhead whales. It also contains walrus haul-out sites, polar bear dens, and marine habitats of seabirds. This proposed protected area will encompass two Environment and Climate Change Canada (ECCC) Migratory Bird Sanctuaries: The Ikkattuaq (Harry Gibbons) Migratory Bird Sanctuary, and the Qaqsauqtuuq (East Bay) Migratory Bird Sanctuary.



Proposed marine protected area.



Thick-billed murre foraging tracks.

WELCOME TO THE TEAM!

We are very pleased to announce that Dr. Don-Jean Léandri has recently been hired as an Arctic Wildlife Research Scientist and has joined the Wildlife Research Division of Environment and Climate Change Canada. Currently in Ottawa and soon relocating to Iqaluit, Don-Jean's work will support Canada's Oceans Protection Plan (OPP) through his research on the spatial distribution, movement patterns, and habitat use of Arctic marine birds. His research will help strengthen environmental emergency preparedness and response, identify critical habitats, inform conservation strategies, and assess environmental impacts on bird populations across Canada's Arctic.

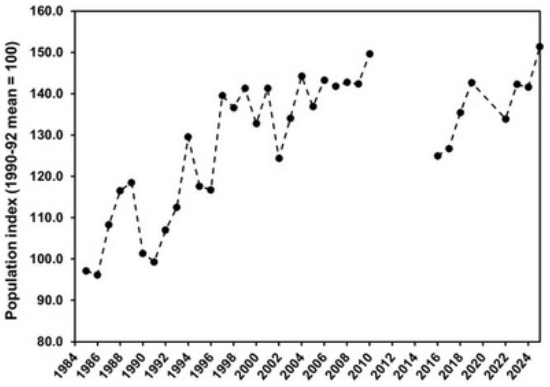
Highly committed to the Arctic, Don-Jean has previously contributed to research in Nunavut, Svalbard, Siberia, and Alaska. His previous research in movement ecology has focused on investigating the energetic, physiological, and ecotoxicological processes driving carry-over effects in migratory seabirds and their responses to climatic change.

Don-Jean will now co-lead the long-term seabird monitoring program at Coats Island with academic partners and in close partnership with the community of

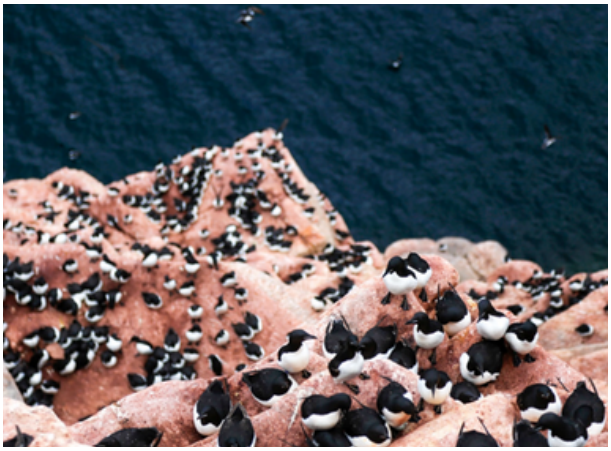
Coral Harbour to continue and expand this cornerstone of Arctic ecological research. He brings to this role a strong enthusiasm for collaborative research and a deep passion for seabirds and for the North.

LONG-TERM POPULATION MONITORING

Thick-billed murres (Uria lomvia), known as akpa in Inuktitut, are the most abundant seabird in the Canadian Arctic, and one of the most abundant by mass in the circumpolar Arctic. Their meat is an important source of protein in winter in west Greenland, Newfoundland, Labrador and Nunatsiavut, and their eggs are an important source of late-spring protein for some communities. Moreover, murres are an ice-associated, Arctic species that act as important indicators for the entire Arctic ecosystem. This is particularly useful given that we are able to easily monitor population and reproductive trends of murres at nesting colonies. This research is difficult to achieve for many other Arctic animals, such as marine mammals and fish.



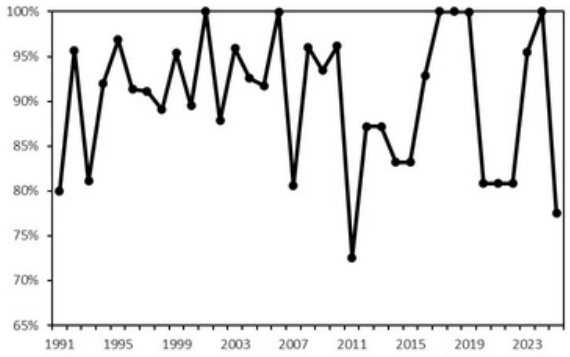
Change in population size index of Coats Island murres across years.



At the Coats Island murre colony, we have recorded the timing of breeding, nestling diet and growth, and population size since the 1980's. This long-term data set allows us to piece together what may cause changes in population sizes and is the only study of its duration for this species in the entire Arctic. Therefore, if we begin to see population declines, we are strongly positioned to identify the causes, and to inform hunting quotas, shipping lanes, and management protocols.

In the eastern Canadian Arctic trends of thick-billed murre populations are largely unknown, but declines have been detected in the eastern Atlantic. While harvest in Newfoundland and Labrador has declined, over the last decade nearly 50,000 murres/year have been harvested. These murres are highly migratory and breeding populations from across the Atlantic mix on the wintering grounds. Harvest in one area can therefore impact declining populations from other regions.

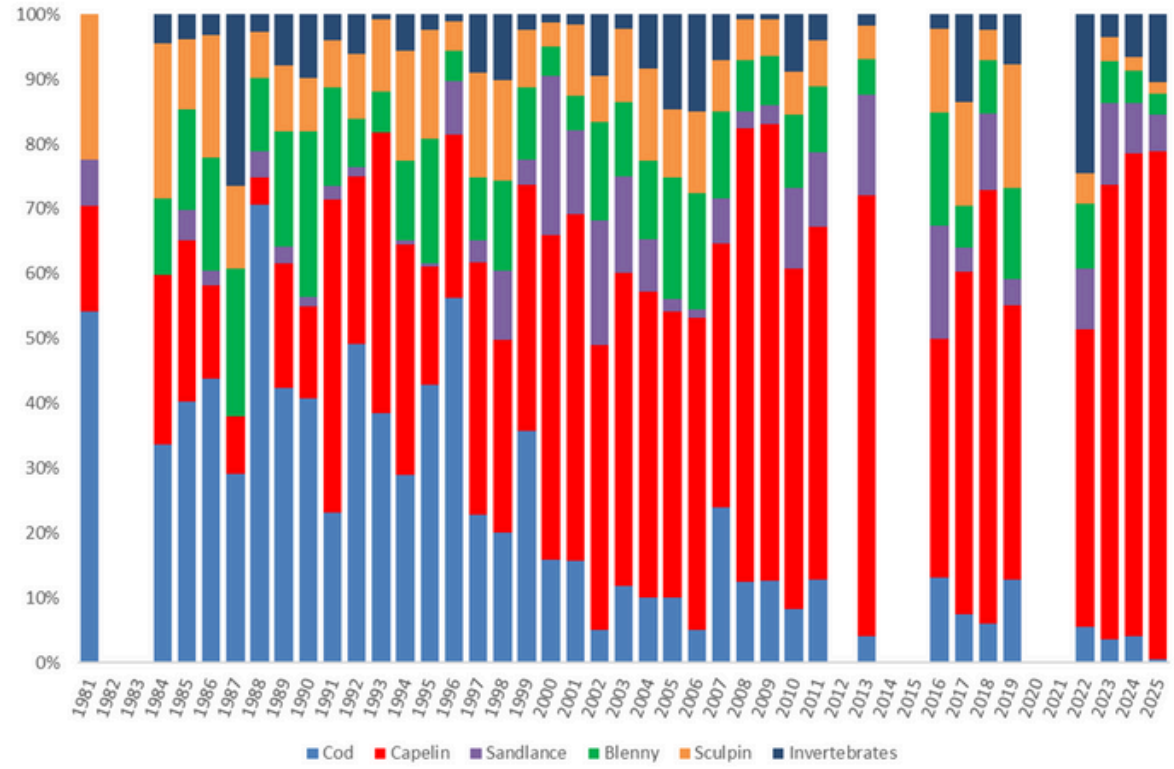
As a long-lived species, survival is an important component of population trends. Typically, survival of adults from one year to the next is near 90%, with only a few years having survival well below 90%. Overall, annual survival has been relatively high implying that avian influenza, present in the colony the last three years, had limited impact on adult survival. Lower survival in 2025 may be an artefact of our analyses.



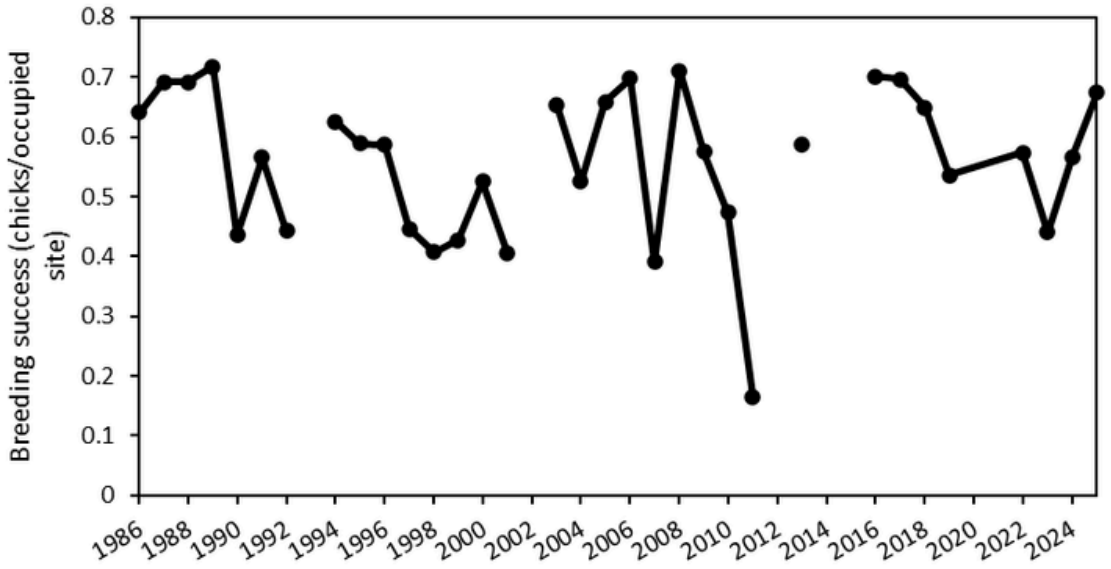
Thick-billed murre survival (%) across years at Coats Island since 1990-91. Each year represents the following breeding season.

Despite the population trend being stable at Coats Island, there have been changes in the murre's diet indicating an 'Atlantification' of the region. Once a dominant prey item, Arctic cod was essentially absent from their diets in 2025 and largely replaced by capelin.

We predict this diet shift resulted from decreasing ice cover beginning in the mid 90's. Even in years with late ice breakup, cod was absent from their diet, suggesting these trends cannot be reversed with a year or two of higher ice concentrations.



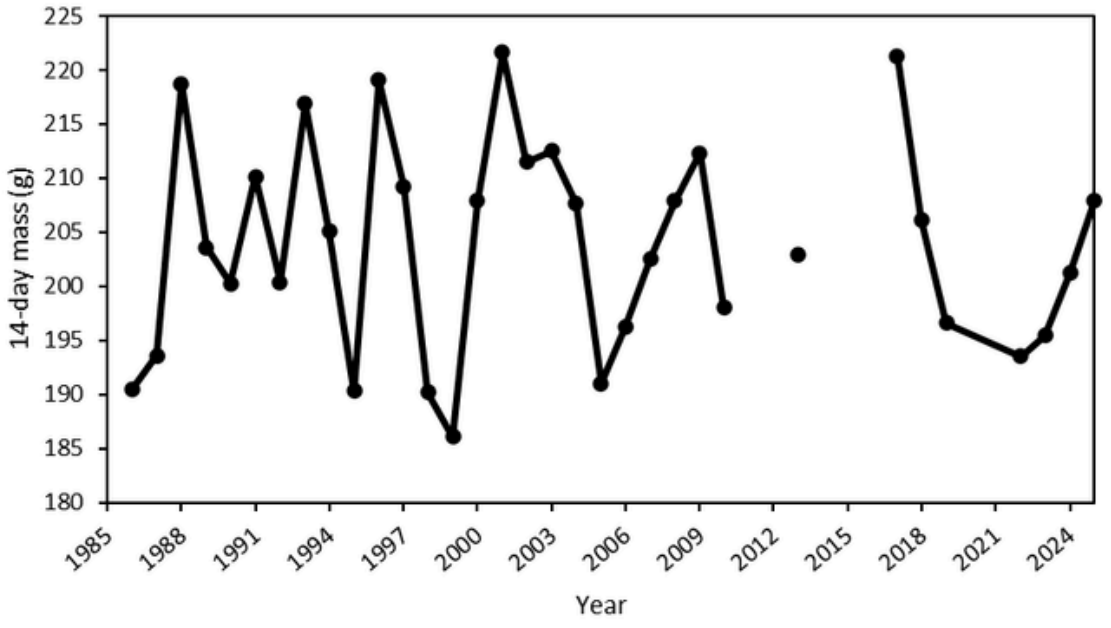
Thick-billed murre prey species delivered to chicks across years at Coats Island.



Thick-billed murre breeding success across years at Coats Island.

Another key parameter we monitor is the growth rates of murre chicks and breeding success. In several years, polar bears foraged on eggs and chicks within the colony, generating higher nest failure rates. In 2011, 2016 and 2017 the impact of bears was quite severe, with up to 30% of the colony failing due to combined bear and mosquito harassment.

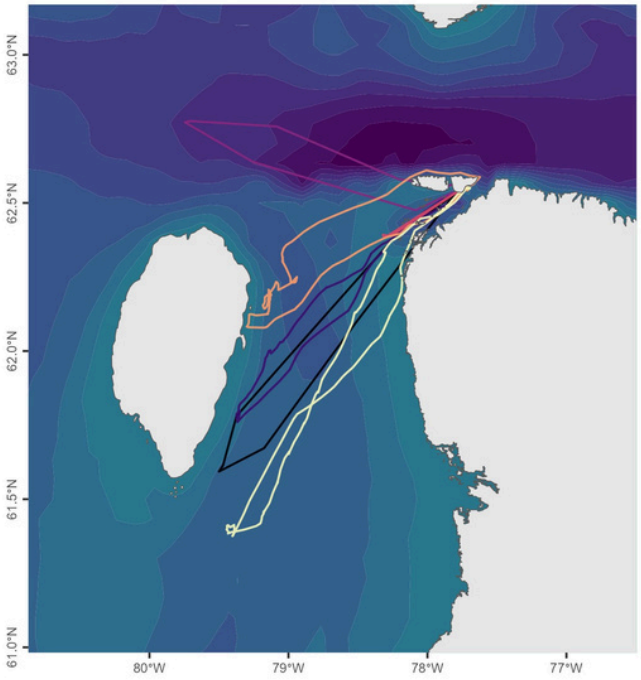
Post-fledging mortality may be another factor contributing to population declines. Chick growth rates, and especially chick mass at fledging (indicated by 14-day body mass), are predicted to be good proxies for survival. Although 14-day masses in chicks have increased recently, adult body mass has been declining, possibly reducing overall survival.



Thick-billed murre chick growth (mass at 14-days) across years at Coats Island.

RETURNING TO DIGGES ISLAND

Between July 8 and 27, we visited the Digges Sound murre colony, funded by the Oceans Protection Plan. The field trip to Digges Island involved both scientific and logistical activities, contributing valuable data for ongoing ecological research. Collaborating with Paulusie Tarriasuk and LNUK, as well as boat captains Charlie Paningajak, Saviarjuk Paningajak, Tivi Kanarjuak and Lucassie Kanarjuak, and their crews, we tagged 54 thick-billed murres with GPS loggers and 15 more with geolocators as part of the SEATRACK project. We also retrieved 7 GLS loggers that were deployed last year as part of this project. In addition, we conducted drone and boat photographic surveys of both Digges Island and Cape Wolstenholme, as well as deployed a SailBouy to determine locations and densities of forage fish.



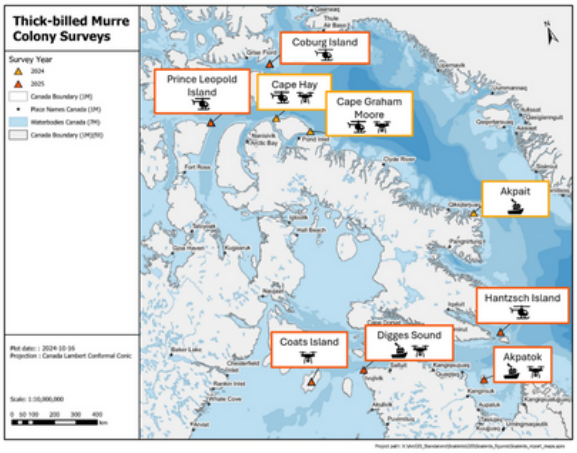
Foraging tracks of thick-billed murres at Digges Island in 2024

Our team also evaluated the condition of the research cabin on Digges Island, finding it functional but in need of maintenance. Overall, the trip combined wildlife monitoring and site maintenance, furthering our understanding of murre migration patterns and supporting infrastructure essential for ongoing studies in the region. We look forward to returning for consultations in Winter 2025 and to continue expanding work on tracking both thick-billed murres and black guillemots in Summer 2026.

SURVEYS OF THICK-BILLED MURRE ARCTIC COLONIES

The Newfoundland and Labrador Thick-billed Murre (*Uria lomvia*) and Common Murre (*Uria aalge*) annual harvest is the only licensed harvest of seabirds in Canada. Though harvest of murres has declined considerably since the 1960-70s, colony declines across the North Atlantic have prompted domestic and international concerns over the sustainability of the harvest in Canada. The impact of current harvest is difficult to assess since there is considerable uncertainty in recent population sizes, trends and demographic rates, particularly in the eastern Canadian Arctic where some colonies have not been surveyed in 40 years.

To inform harvest management, updated information on the Canadian population is required. The objective of this project is to support harvest management decisions for the Atlantic population of Thick-billed Murre by conducting surveys at the nine largest murre colonies in the eastern Canadian Arctic – Digges Sound, Akpatok, Coburg Island, Akpait, Prince Leopold Island, Cape Hay, Cape Graham Moore, Coats Island, and Hanztsch Island.



Thick-billed murre colony surveys in the Canadian Arctic in 2024 (yellow) and 2025 (orange).

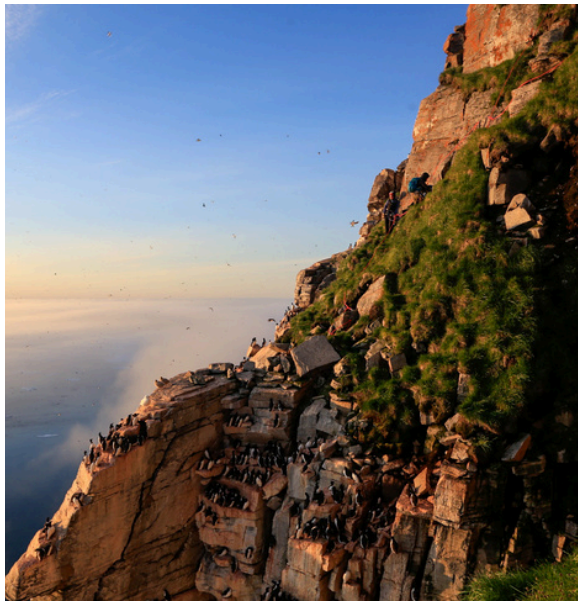
Colony photographic surveys are a collaborative effort between Northern and Quebec regions of Canadian Wildlife Service, Environment and Climate Change Canada Science & Technology Branch, and academic partners (McGill University). In 2024, full colony surveys were conducted at Akpait (boat), Cape Hay (helicopter and drone), and Cape Graham Moore (helicopter and drone). In 2025, Coats Island (drone), Digges Sound (boat and drone), Akpatok (boat and drone), Coburg Island (helicopter), Prince Leopold Island (helicopter), and Hanztsch Island (helicopter) were all surveyed.

Interactive effects of climate change and plastic contaminants on Arctic seabirds

Dr. Anaïs Médieu – Post-doctoral Fellow, McGill University with Drs. Kyle Elliott and Kim Fernie

Climate change and environmental contamination, including plastic pollution, are among the major threats to Arctic wildlife. As Arctic temperatures warm, ice cover decreases, making ice-associated predators adjust their migratory routes and habitat use accordingly. Additionally, there have been increased exposure of Arctic top predators to plastic pollution which may change in relation to changing ice conditions. Therefore, ice-associated top predators may be differentially exposed to the cumulative effects of different plastics-associated chemical contaminants across a changing ice landscape.

Anaïs is investigating the interactive effects of climate change and plastic-related contaminants in thick-billed murres breeding at Coats Island. She will pair individual contaminant concentrations in blood samples with bio-logger deployments to model seabird migration patterns in response to environmental conditions and sea ice cover. She will compare contaminant loads in birds using different migratory routes to understand sources of contaminant exposure. This spatio-temporal mapping of contaminant exposure will inform the interactive effects of climate change and contaminants exposure. Anaïs' work will also provide information on food security to Northern communities, given the importance of murres as a harvested species.



Breeding partners have opposite foraging strategies

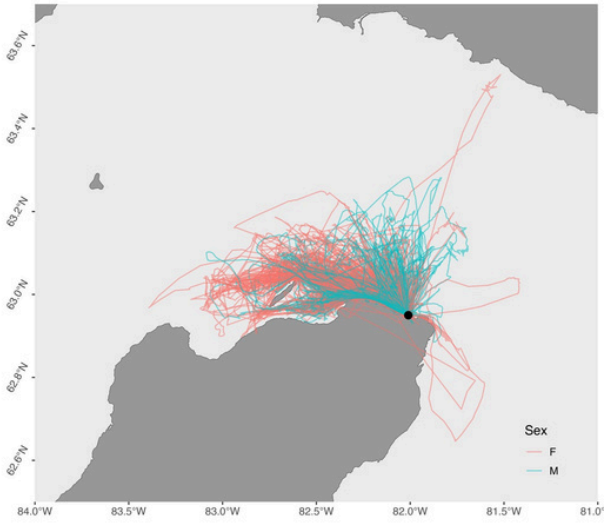
Marianne Gousy-Leblanc - Ph. D. Candidate, McGill University with Drs. Kyle Elliott andVicki Friesen

While foraging success is important to reproductive success, for long-lived species with bi-parental care of offspring, complementary foraging strategies within a pair may be a strategy to enhance the probability of finding prey to provision offspring. Marianne tested whether breeding partners of thick-billed murres nesting at Coats Island used different foraging strategies, a species with long term-pair bonds and bi-parental care. Using GPS trackers and accelerometers, she measured foraging trips (distance and number of dives) of 40 pairs of thick-billed murres and randomized pairs across the colony to compare their similarity in foraging behaviour.

She found that individuals within a breeding pair were more dissimilar in their foraging trip distance and the number of dives during foraging trips compared to random pairs. Breeding pairs were also more similar in wing length than random pairs, either because individuals select similar sized (i.e., quality) partners, select sites that lead to similar sized (quality) partners, or to migration distance.

Diversity in foraging strategies in this breeding colony may be maintained either through selection of partners with differing strategies, or by divergence in strategies over their long-term pair bond.

A thick-billed murre bringing fish to feed its chick.



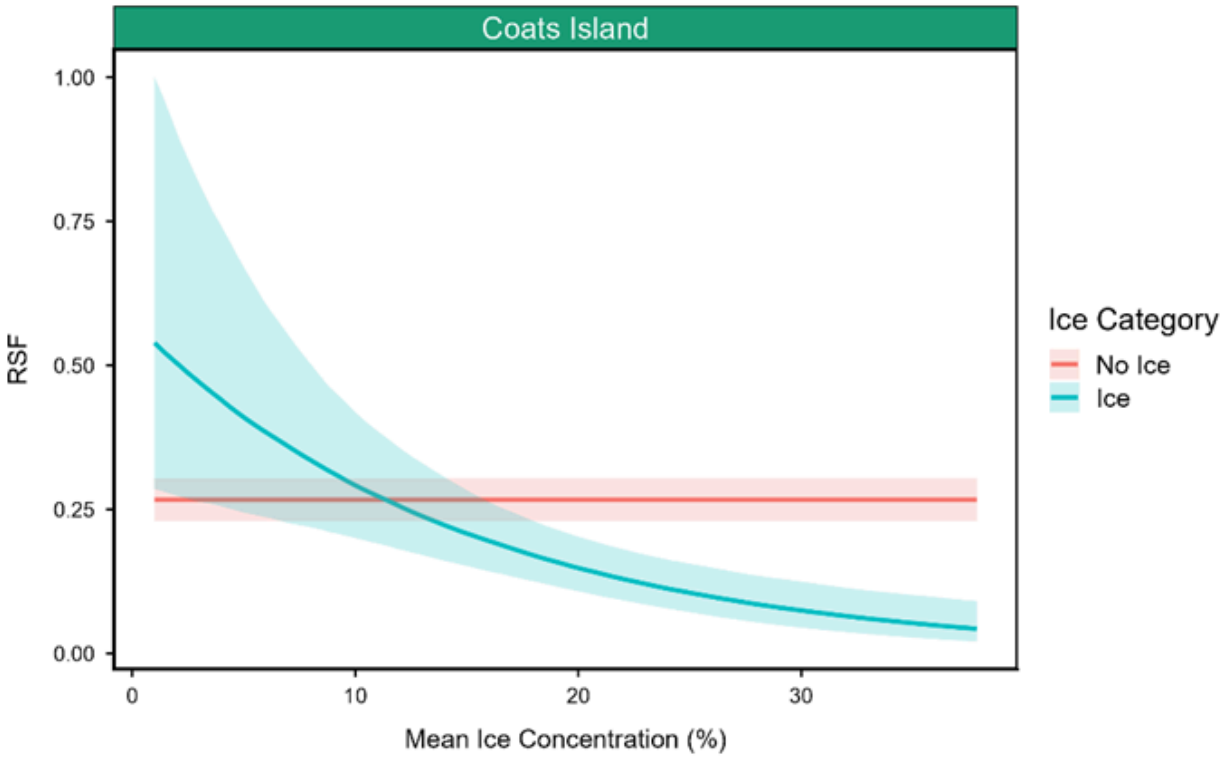
Foraging tracks of male and female thick-billed murres at Coats Island.

Influence of sea ice concentration on the foraging ecology of an Arctic seabird

Alyssa Eby - Ph. D. Candidate, McGill University with Drs. Kyle Elliott and Grant Gilchrist

Climate change is resulting in sea ice loss in Arctic regions, directly impacting ice-associated species, including marine mammals and seabirds. Thick-billed murres, an Arctic seabird, are likely to be impacted by changing ice conditions, as one of their prey items, Arctic cod is sea ice associated. Alyssa compared sea ice use by thick-billed murres at a low Arctic colony (Coats Island, Nunavut) and a high Arctic colony (Cape Graham Moore, NU) using foraging movements measured from GPS data and sea ice data measured from satellite imagery during the breeding season (July-August) across multiple years (2014, 2016, 2018, 2019, 2022, and 2023).

At both colonies murres foraged near the colony (0-25 km), however sea ice use differed between low and high Arctic colonies. Murres from a high Arctic colony exhibited avoidance of sea ice while foraging, where as, murres from a low Arctic colony selectively foraged near ice only when there was less ice available within the overall foraging range (Figure 1). Alyssa's study highlights regional differences in sea ice use, which impact the responses of Arctic murre colonies to climate change.



Relationship between normalized predicted resource selection function (RSF) probabilities and daily mean ice concentration (%) for murres foraging near ice (blue) and open water (no ice; red) at Coats Island, NU during the incubation stage in 2018, 2019, 2022, and 2023.

Thermo- and insect tolerance in thick-billed murres

Jolie Nguyen - M. Sc., McMaster University with Dr. Emily Choy

As Arctic temperatures continue to warm as a result of climate change, cold-adapted species with a limited tolerance to heat will face increasing challenges. Thick-billed murres experience heat stress at relatively low air temperatures, which may make their populations particularly at risk. Using 3D-printed biophysical models of murres fitted with temperature loggers, Jolie assessed operative temperature (temperature the murres experience) of the murres at various microclimates on the cliffs where the murres nest. In the 2024 and 2025 field seasons, operative temperatures reached as high as 45.5°C. Jolie also used GPS-accelerometers to track their movements and determine if murres spend less time on their nests by tracking when operative temperature is high.

Four biophysical models of thick-billed murres deployed at Coats Island in 2025.

In addition to heat stress, nesting thick-billed murres are exposed to mosquito parasitism during the breeding season, which may further contribute to mortality in hot weather conditions. At the sites where her 3D models were deployed, Jolie also collected sweep samples to quantify mosquito abundance and assess exposure. Jolie aims to assess how mosquito abundance at murre nesting sites changes in different weather conditions, and determine how much blood murres lose to mosquitoes on hot weather days.

PUBLICATIONS

Albert C, B Moe, H Strøm, D Grémillet, M Brault-Favrou, A Tarroux, S Descamps, V Sandøy Bråthen, B Merkel, J Åström, F Amélineau, F Angelier, T Anker-Nilssen, O Chastel, S Christensen-Dalsgaard, J Danielsen, K Elliott, K Einar Erikstad, A Ezhov, P Fauchald, GW Gabrielsen, M Gavrilo, Sveinn Are Hanssen, HH Helgason, M Kjellstadli Johansen, Y Kolbeinsson, Y Krasnov, M Langset, J Lemaire, S-H Lorentsen, B Olsen, A Patterson, C Plumejeaud-Perreau, TK Reiertsen, G Helge Systad, PM Thompson, T Lindberg Thórarinsson, P Bustamante, J Fort. 2024. Seabirds reveal mercury distribution across the North Atlantic. **Proceedings of the National Academy of Sciences** 121 (21), e2315513121.

Auger-Méthé M, F Dupont, A Eby, K H Elliott, N Hussey, DA Lyons, M Marcoux, A Patterson, S Shadloo, CR Shuert. Including fitness and health proxies can alter our understanding of habitat selection. **Ecology Letters** *in prep*.

Bonnet-Lebrun AS, J Matthiopoulos, R Lemaire-Patin, T Deville, R Barrett, MI Bogdanova, M Bolton, S Christensen-Dalsgaard, F Daunt, N Dehnhard, S Descamps, KH Elliott, K Einar Erikstad, M Frederiksen, HG Gilchrist, M Harris, Y Kolbeinsson, J Fries Linnebjerg, S-H Lorentsen, M Mallory, F Merkel, A Mosbech, Ee Owen, A Patterson, I Pratte, H Strøm, Þ Lindberg Þórarinsson, S Wanless, N Ratcliffe. 2025. Drivers of interspecific spatial segregation in two closely related seabird species at a pan-Atlantic scale. **Journal of Biogeography** 52: 408-421.

Brisson-Curadeau É, R Lacombe, M Gousy-Leblanc, V Poirier, L Jackson, C Petalas, E Miranda, A Eby, J Baak, DJ Léandri-Breton and E Choy. 2024. A meta-analysis of the impact of drones on birds. **Frontiers in Ecology and the Environment** p.e2809.

Cruz-Flores M, J Lemaire, M Brault-Favrou, S Christensen-Dalsgaard, C Churlaud, S Descamps, KH Elliott, KE Erikstad, A Ezhov, M Gavrilo, D Grémillet, G Guillou, S Hatch, N Per Huffeldt, AS Kitaysky, Y Kolbeinsson, Y Krasnov, M Langset, S Leclaire, JF Linnebjerg, E Lorentzen, ML Mallory, FR Merkel, W Montevecchi, A Mosbech, A Patterson, S Perret, JF Provencher, TK Reiertsen, H Renner, H Strøm, A Takahashi, J-B Thiebot, T Lindberg Thórarinsson, A Will, P Bustamante, J Fort. Spatial distribution of selenium-mercury in Arctic seabirds. 2024. **Environmental Pollution** 343, 123110.

Eby A, A Patterson, S Whelan, KH Elliott, HG Gilchrist, OP Love. 2024. Influence of sea ice concentration, sex, and chick age on foraging flexibility and success in an Arctic seabird. **Conservation Physiology** 12 (1), coae057.

Gousy-Leblanc M, T Merkling, L Colston-Nepali, E Lachance Linklater, KH Elliott, VL Friesen. 2024. Differences between mates at the TLR1Lb locus are associated with lower reproductive success in a long-lived seabird. **Scientific Reports** 14: 31608.

Gousy-Leblanc M, A Patterson, HG Gilchrist, VL Friesen and KH Elliott. 2025. Breeding partners have dissimilar foraging strategies in a long-lived Arctic seabird. **Ecology and Evolution** 15: e70816.

Lazarus T, HG Gilchrist, G Sorenson, OP Love, M Janssen, T White, KH Elliott. 2024. Integrating behavior and physiology supports Storer-Ashmole's halo in a central place forager. **Marine Biology** 171: 224.

Patterson A, M Auger-Methe, and K Elliott. Using wingbeat frequency to estimate mass gained in wild seabirds. In review **Methods in Ecology and Evolution**: MEE-25-05-357.

Patterson, A, HG Gilchrist, OP Love, KH Elliott. 2025. Climate change could disrupt migratory patterns for an arctic seabird population. **Marine Ecology Progress Series** 757: 181-198.

Patterson A, AJ Gaston, A Eby, M Gousy-Leblanc, JF Provencher, BM Braune, JM Hipfner, HG Gilchrist, J Nakoolak, K Woo, KH Elliott. 2024. Monitoring colonial cliff-nesting seabirds in the Canadian Arctic: The Coats Island field station. **Arctic Science** 10: 240-260.

F Tremblay, ES Choy, DA Fifield, GJ Tattersall, F Vézina, R O'Connor, OP Love, HG Gilchrist, KH Elliott. 2025. Dealing with the heat: Assessing heat stress in an Arctic seabird using 3D-printed thermal models. **Comparative Biochemistry and Physiology Part A: Molecular & Integrative Physiology** 306: 111880. https://doi.org/10.1016/j.cbpa.2025.111880

STUDENTS AND POST DOCS

Dr. Anaïs Médieu

(Post-doctoral Fellow 2024-2026, McGill University) is studying the interactive effects of climate change and plastic-related contaminants in Arctic seabirds.

Marianne Gousy-Leblanc

(Ph. D. 2021-2025, McGill University) is studying the importance of partnership and mate choice on reproductive success in thick-billed murres (Natural Sciences and Engineering Research Council of Canada).

Alyssa Eby

(Ph.D. 2021-2025, McGill University) is studying the impacts of changing sea ice conditions and shipping on the foraging ecology and nutritional state of thick-billed murres (Ph.D. Weston Family Award in Northern Research).

Jolie Nguyen

(M. Sc. 2024-2026, McMaster University) is examining researching heat stress and mosquito parasitism in thick-billed murres.

INUIT PARTICIPATION

Josiah Nakoolak

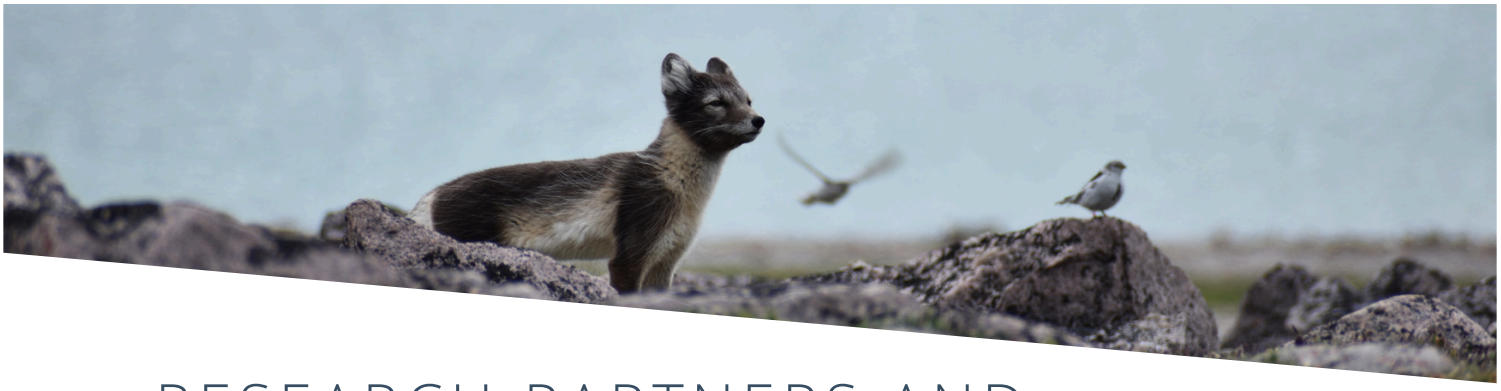
has worked with us as a guide and research assistant since 1997 and was awarded the Community Contribution to Research Award by the Northern Contaminants Program of the federal government. Josiah also operates as a mentor to our younger field workers.

Mark Eetuk

participated in the Inuit Field Training Program in 2018, was recruited to East Bay Island in 2019 to work as a research assistant, and has joined our team every year since. This was his first season on the Coats Island team.

Marvin Shimout

joined our East Bay Island team and the Inuit Field Training Program in 2024. This summer he was hired through the Inuit Field Research Assistant Program for this season for his first field season at Coats Island.



RESEARCH PARTNERS AND FINANCIAL SUPPORT

Our research at Coats Island is a combined effort of many people and organizations. In 2025, the program was co-lead by Drs. Kyle Elliott (McGill University), Grant Gilchrist (Environment and Climate Change Canada (ECCC)), and Emily Choy (McMaster University). Dr. Kim Fernie (ECCC) co-leads a project on the effects of contaminants on the resilience to climate change in seabirds. We thank Dr. Tony Gaston whose insights continue to benefit the Seabird program.

Remote research is logistically complicated and labour intensive. Our work would not be possible without our extensive crew of climbers, students, technicians, biologists and local guides. The Coats Island crew included J Nakoolak, A Turmaine, A Médieu, J Nguyen, S Kroeze, J Kreller, A Hartshorne, H Hennin, M Eetuk, M Shimout, K Lalla, and K Elliott. The Digges Island crew included D Noblet, K Elliott, J Henschell, A Turmaine, A Krug-MacLeod, and A Lippold. Photos are provided by J Nguyen, K Lalla, S Kroeze and D Noblet.

Research in Canada's North is expensive and funding for this work is necessarily provided by a network of partnerships that includes but is not limited to: Environment and Climate Change Canada (ECCC) Wildlife Research Division, Canadian Wildlife Service, Oceans Protection Plan, Baffinland Iron Mines Corporation, Carleton University, McGill University, McMaster University, ArcticNet, Polar Continental Shelf Program, NSERC, Wildlife Habitat Canada Murre Fund, The Weston Family Foundation, and the Northern Contaminants Program.

CONTACT FOR MORE INFORMATION

Grant Gilchrist
National Wildlife Research Centre
ECCC
Tel: (613) 222-6846
Email: grant.gilchrist@ec.gc.ca

Holly Hennin
National Wildlife Research Centre
ECCC
Tel: (343) 548-2649
Email: holly.hennin@ec.gc.ca

Kyle Elliott
Dept of Natural Resource Sciences
McGill University
Tel: (514) 398-7907
Email: kyle.elliott@mcgill.ca