

¹ Long-term abundance time-series of the High Arctic terrestrial vertebrate
² community of Bylot Island, Nunavut

³ Louis Moisan^{1,2}, Azenor Bideault^{2,3}, Gilles Gauthier⁴, Éliane Duchesne¹, Dominique
⁴ Fauteux⁵, Dominique Berteaux¹, Pierre Legagneux^{3,6}, Marie-Christine Cadieux³ and
⁵ Joël Béty¹

⁶ **Author Affiliations:**

⁷ ¹ Chaire de Recherche du Canada en Biodiversité Nordique, Centre d'Études Nordiques,
⁸ Centre de la Science de la Biodiversité du Québec, Département de Biologie, Chimie et
⁹ Géographie, Université du Québec à Rimouski, Rimouski, QC, Canada

¹⁰ ² Chaire de Recherche du Canada en Écologie Intégrative, Centre d'Études Nordiques,
¹¹ Centre de la Science de la Biodiversité du Québec, Département de Biologie, Université
¹² de Sherbrooke, Sherbrooke, QC, Canada

¹³ ³ Chaire de Recherche Sentinelle Nord sur l'Impact des Migrations Animales sur les
¹⁴ Écosystèmes Nordiques, Centre d'Études Nordiques, Centre de la Science de la
¹⁵ Biodiversité du Québec, Département de Biologie, Université Laval, Québec, QC,
¹⁶ Canada

¹⁷ ⁴ Centre d'Études Nordiques, Département de Biologie, Université Laval, Québec, QC,
¹⁸ Canada

¹⁹ ⁵ Centre d'Études Nordiques, Centre de Connaissance et d'Exploration de l'Arctique,
²⁰ Musée Canadien de la Nature, Ottawa, ON, Canada

²¹ ⁶ Centre d'Études Biologiques de Chizé (CEBC-CNRS), Université de La Rochelle,
²² France

²³ **Corresponding Author:**

louis.moisan.bio@gmail.com

joel_bety@uqar.ca

²⁶ **Open Research statement:**

²⁷ The data set is publicly available at <https://datadryad.org/> and the raw data and
²⁸ codes used to extract the data set are publicly available at <https://zenodo.org/>.

29 **Introduction**

30 The composition of ecological communities, defined as the abundance of each species
31 within a given community, is fundamental for understanding patterns and processes in
32 community ecology. Variations in community composition can help to detect spatial pat-
33 terns linked to environmental variations (Kemp et al., 1990), assess temporal trends of
34 different groups of species after disturbances (Philippi et al., 1998; Magurran, 2007), and
35 understand food web structures (Cohen et al., 2003). Additionally, community compo-
36 sition is essential for modeling the dynamics of ecological communities. Dynamic com-
37 munity modelling allows addressing important issues and questions in ecology, such as:
38 determining the relative strength of top-down versus bottom-up forces in communities
39 (Krebs et al., 2003; Legagneux et al., 2014), assessing the ecological resilience of commu-
40 nities under climate change (Griffith et al., 2019) and evaluating the cascading effects of
41 invasive species in food web (David et al., 2017; Goto et al., 2020). Dynamic community
42 modelling can also be applied to address practical challenges, including fishery manage-
43 ment (Plagányi, 2007) and the planning of protected areas (Okey et al., 2004; Dahood
44 et al., 2020). Modeling food webs requires adjusting trophic flows based on the func-
45 tional responses of species, which necessitates time series data on the abundance of all
46 species within a community. However, accurately determining the abundance of all species
47 is rarely achievable. Consequently, empirical community models often reduce taxonomic
48 resolution by grouping species into large functional or taxonomic categories. Additionally,
49 food webs consist of species with varying body sizes depending on their trophic level, with
50 top-level species often being highly mobile and having large home ranges (McCann et al.,
51 2005). Therefore, community models must use landscape-wide estimates of species abun-
52 dance to accurately represent trophic fluxes. Due to these constraints, empirical datasets
53 with high taxonomic resolution that cover entire communities at broad spatial and tem-
54 poral scales are rare and often include incomplete or rough estimates. The composition
55 of ecological communities is influenced by various factors acting at different temporal and
56 spatial scales, leading to noisy data and emphasizing the need for long-term data sets
57 (Magurran et al., 2010; Lindenmayer et al., 2012). Species abundances are influenced by
58 stochastic effects (Hubbell, 2001), environmental changes (e.g., climate warming), and
59 species interactions, contributing to data variability. For instance, the composition of a
60 community could be driven simultaneously by intra-annual seasonal variations, multi-year
61 cyclic variations (e.g., El Niño) and slow but directional long-term variations in the en-
62 vironment (Brown and Heske, 1990; Snyder and Tartowski, 2006). Therefore, long-term
63 data series are required to untangle the relative effects of diverse abiotic and biotic fac-
64 tors on community composition (Magurran et al., 2010; Lindenmayer et al., 2012). Arctic
65 environments are highly valuable systems for studying community patterns and processes
66 due to their relatively low species richness (Payer et al., 2013; Legagneux et al., 2014).

67 However, logistical challenges in the Arctic limit the number of long-term biodiversity
68 monitoring programs. Hence, the small number of Arctic communities with long-term
69 monitoring serve as highly valuable sites for holistic and empirical community studies.
70 Datasets on terrestrial communities are notably scarce, and this scarcity extends to Arc-
71 tic communities as well (Ims et al., 2013). Within terrestrial Arctic sites, the south plain
72 of Bylot Island in the Canadian High Arctic (**Figure 1**) hosts one of the longest and most
73 intensive biodiversity monitoring programs (Gauthier et al., 2024b). Monitoring on Bylot
74 Island began in 1989 with a focus on the snow goose and it gradually expanded to other
75 species over time. Currently, the program encompasses all significant vertebrate species
76 in the community with continuous monitoring spanning more than a decade (Gauthier
77 et al., 2024b). Monitoring is also conducted at multiple spatial scales, including inten-
78 sive and systematic observations conducted across a landscape spanning approximately
79 400 km². This approach allows the scaling of local density measurements to the land-
80 scape level when required and facilitates the estimation of abundance for less common
81 and rare species. Previous work based on the tundra community of Bylot Island has
82 already produced several influential papers (Gauthier et al., 2011; Legagneux et al., 2012,
83 2014; Hutchison et al., 2020; Duchesne et al., 2021; Gauthier et al., 2024a). These stud-
84 ies showed that tundra communities may experience stronger top-down regulation than
85 bottom-up regulation (Legagneux et al., 2012, 2014). They also revealed a heterogeneous
86 response of trophic levels to climate warming (Gauthier et al., 2013) and highlighted the
87 effects of indirect trophic interactions on the occurrence of species across the landscape
88 (Duchesne et al., 2021). However, those earlier papers were built on data from relatively
89 short time series, they were not always scaled at the landscape level, and some species
90 or functional groups were lacking abundance estimates. With over a decade of additional
91 community-wide monitoring compared to earlier studies, our goal is to synthesize and up-
92 scale the data collected on the Bylot Island community since the 1990s to the landscape
93 level. This synthesis aims to provide readily accessible annual time series (or mean values
94 in some cases) of abundance and biomass for all vertebrate species in a tundra landscape,
95 covering approximately 400 km².

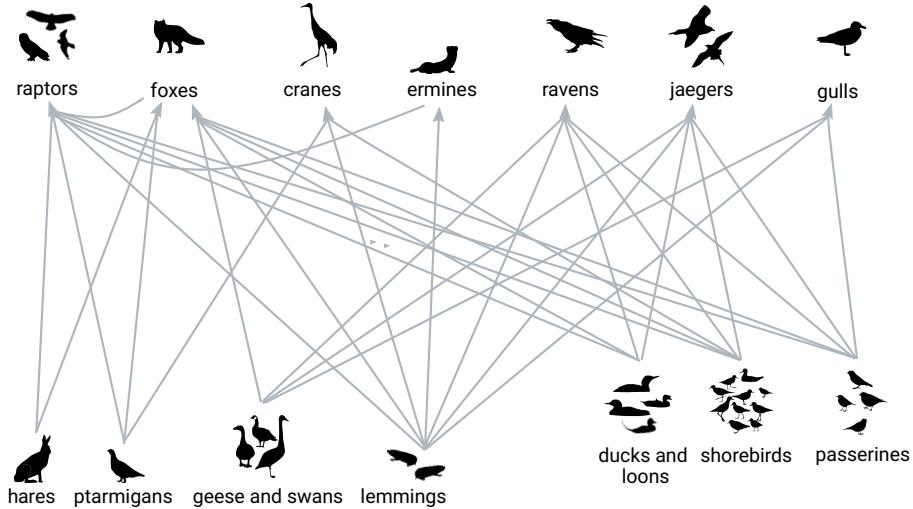


Figure 1: Synthetic vertebrate food web of the south plain of Bylot Island.

96

Objective

97 Our main objective is to provide readily accessible, long-term time series of annual abun-
 98 dances of all vertebrate species within the Arctic terrestrial community of Bylot Island
 99 during the breeding season (May to August). This includes both breeding and non-
 100 breeding individuals that stay in the study area for a significant period of time, and ex-
 101 cludes non-breeding individuals that stop for only a few days during their migration. Our
 102 focus extends to estimating abundances at the landscape scale, enabling the study of com-
 103 munity and ecosystem dynamics, trophic interactions and the impacts of global changes
 104 on high-latitude environments. Additionally, we aim to provide the average body mass
 105 for each species in the community, enabling the conversion of abundances into biomasses.

¹⁰⁶ **Class I. Data Set Descriptors**

¹⁰⁷ **A. Data set identity**

¹⁰⁸ Long-term abundance time-series of the High Arctic terrestrial vertebrate community of
¹⁰⁹ Bylot Island, Nunavut

¹¹⁰ **B. Data set identification codes**

¹¹¹ BYLOT-species_taxonomy.csv
¹¹² BYLOT-species_abundance.csv
¹¹³ BYLOT-mean_species_abundance.csv
¹¹⁴ BYLOT-mean_species_body_mass.csv
¹¹⁵ BYLOT-interannual_variation_nest_density.csv

¹¹⁶

¹¹⁷ **C. Data set description**

¹¹⁸ **1. Originators**

¹¹⁹ **Gilles Gauthier**, Centre d'Études Nordiques, Département de Biologie, Université Laval,
¹²⁰ Québec, QC, Canada

¹²¹ **Joël Béty**, Chaire de Recherche du Canada en Biodiversité Nordique, Centre d'Études
¹²² Nordiques, Centre de la Science de la Biodiversité du Québec, Département de Biologie,
¹²³ Chimie et Géographie, Université du Québec à Rimouski, Rimouski, QC, Canada

¹²⁴ **Pierre Legagneux**, Chaire de Recherche Sentinel Nord sur l'Impact des Migrations
¹²⁵ Animales sur les Écosystèmes Nordiques, Centre d'Études Nordiques, Centre de la Sci-
¹²⁶ ence de la Biodiversité du Québec, Centre d'Études Biologiques de Chizé (CEBC-CNRS)
¹²⁷ Département de Biologie, Université Laval, Québec, QC, Canada

¹²⁸ **2. Abstract**

¹²⁹ Arctic ecosystems present unique opportunities for community-wide monitoring, in part
¹³⁰ due to their relatively low species richness. However, conducting research in these remote
¹³¹ environments poses significant logistical challenges, resulting in long-term monitoring be-
¹³² ing exceedingly rare. Here, we focus on the long-term, intensive ecological monitoring
¹³³ efforts conducted on the south plain of Bylot Island (almost 400 km², Nunavut, Canada),
¹³⁴ which has generated a remarkable dataset spanning up to 30 years, a rarity in tundra
¹³⁵ ecosystems. Our goal is to synthesize this dataset and upscale vertebrate abundance data

136 at the landscape level, a prerequisite to conduct community-level analyses. We have stan-
137 dardized data obtained with different field methods to provide readily usable long-term
138 time series of abundance for 35 vertebrate species (30 birds and 5 mammals) present
139 in the study system. Monitoring data includes intensive capture-mark-recapture density
140 estimates of lemmings on trapping grids, systematic or opportunistic nest monitoring con-
141 ducted across the entire study area or within specific plots for all bird species, transects of
142 vertebrate counts distributed throughout the study area, daily incidental observations of
143 vertebrates and satellite tracking of fox movements. Annual abundance of species was es-
144 timated at the landscape level, accounting for spatial variations. Furthermore, we provide
145 body masses for each species, derived from empirical onsite measurements for 18 species
146 and from the literature for the remaining species. Body mass is essential to convert species
147 abundance into biomass for studies of trophic fluxes and ecosystem processes. Our dataset
148 provides a unique opportunity for holistic empirical studies of ecological communities, al-
149 lowing a deeper understanding of community structure and dynamics. Considering that
150 the study site is a pristine and protected area that has experienced minimal anthropogenic
151 impact, it can also provide an ideal baseline for investigating the impacts of global changes
152 on high-latitude terrestrial ecosystems.

153 D. Key words/phrases

154 Bylot Island, Canadian Arctic, Arctic tundra, 1993-2023, long-term monitoring, biodi-
155 versity monitoring, community composition, species abundance, species density, species
156 biomass, species body mass, food web

¹⁵⁷ **Class II. Research origin descriptors**

¹⁵⁸ **A. Overall project description**

¹⁵⁹ **1. Identity**

¹⁶⁰ Understanding the structure and dynamics of Arctic terrestrial vertebrate communities

¹⁶¹ **2. Originators:**

¹⁶² **Gilles Gauthier**, Centre d'études nordiques, Département de Biologie, Université Laval,
¹⁶³ Québec, QC, Canada

¹⁶⁴ **Joël Béty**, Chaire de Recherche du Canada en Biodiversité Nordique, Centre d'Études
¹⁶⁵ Nordiques, Centre de la science de la biodiversité du Québec, Département de biologie,
¹⁶⁶ chimie et géographie, Université du Québec à Rimouski, Rimouski, QC, Canada

¹⁶⁷ **Pierre Legagneux**, Chaire de Recherche Sentinelle Nord sur l'impact des migrations
¹⁶⁸ animales sur les écosystèmes nordiques, Centre d'Études Nordiques, Centre de la sci-
¹⁶⁹ ence de la biodiversité du Québec, Centre d'Études Biologiques de Chizé (CEBC-CNRS)
¹⁷⁰ Département de Biologie, Université Laval, Québec, QC, Canada

¹⁷¹ **3. Period of study**

¹⁷² 1989 - continuing

¹⁷³ **4. Objectives**

¹⁷⁴ i) Understand the factors that shape the structure and drive the dynamics of Arctic ter-
¹⁷⁵ restrial vertebrate communities.

¹⁷⁶ ii) Predict the effects of current global environmental changes on the structure and dy-
¹⁷⁷ namics of Arctic terrestrial vertebrate communities.

¹⁷⁸ **5. Abstract**

¹⁷⁹ Arctic terrestrial vertebrate communities present low species richness, making those rela-
¹⁸⁰ tively simple communities ideal for studying ecological patterns and dynamics in terrestrial
¹⁸¹ environments. Although, they present complex networks of interacting species, extreme
¹⁸² seasonal changes of environmental conditions and a large portion of migratory species,
¹⁸³ which make challenging the identification of the key factors that shape their structure
¹⁸⁴ and dynamics. In the face of rapid global environmental changes, it is crucial to have a
¹⁸⁵ comprehensive understanding of the key processes shaping Arctic terrestrial communities

¹⁸⁶ structure and dynamics in order to predict how global changes will impact them in the
¹⁸⁷ future. Our research emphasizes long-term biodiversity monitoring, a community-wide
¹⁸⁸ perspective and food web modeling to achieve this understanding.

¹⁸⁹ **6. Sources of funding**

¹⁹⁰ Natural Sciences and Engineering Research Council of Canada, Fonds Québécois de
¹⁹¹ Recherche Nature et Technologies, Centre d'études nordiques, Natural Resources Canada
¹⁹² (Polar Continental Shelf Program), Network of Centers of Excellence Canada (Arctic-
¹⁹³ Net), Canada First Research Excellence Fund (Sentinel North Program), Polar Knowledge
¹⁹⁴ Canada, Environment and Climate Change Canada, Canada Foundation for Innovation,
¹⁹⁵ Parks Canada Agency, International Polar Year program of the Government of Canada,
¹⁹⁶ Crown-Indigenous Relations and Northern Affairs Canada (Northern Contaminant Pro-
¹⁹⁷ gram), Duck Unlimited Canada, Kenneth M. Molson Foundation (Kenneth M. Molson
¹⁹⁸ Foundation's donation for wildlife research, conservation, and habitat), Garfield Weston
¹⁹⁹ Foundation, First Air—Canadian North, Nunavut Wildlife Management Board, Uni-
²⁰⁰ versité Laval, Université du Québec à Rimouski

201 **B. Specific subproject description**

202 **1. Site description**

203 **a. Site type**

204 The study area (389 km^2) represents a relatively productive tundra ecosystem in the
205 eastern Canadian High-Arctic. An important biological characteristic of the area is the
206 presence of a large snow goose (scientific names of most vertebrate species can be found
207 in **Table 1**) colony of around 25 000 breeding pairs (Reed et al., 2002) spanning ap-
208 proximately 70 km^2 . The vertebrate community within the study area comprises 30 bird
209 species, with 29 of them being migratory or partially migratory, along with 5 mammal
210 species (**Table 1**; Moisan et al. (2023); Gauthier et al. (2024b)). The study area experi-
211 ences significant temporal fluctuations in the population of small mammals (lemmings),
212 which in turn impact the occurrence and abundance of their avian and mammalian preda-
213 tors such as snowy owls, rough-legged hawks, long-tailed jaegers, ermines and Arctic foxes
214 (Legagneux et al., 2012; Duchesne et al., 2021). We exclude occasional visitors, namely:
215 i) species lacking confirmed breeding occurrences on the study site, ii) species observed
216 solely within a single year, and iii) species primarily breeding and foraging in nearby ma-
217 rine or coastal habitats (Moisan et al., 2023). The case of the red fox (*Vulpes vulpes*) was
218 ambiguous. While the presence of breeding pairs has been confirmed in the study area
219 (Lai et al., 2022), the extent of population establishment remains unclear and sightings
220 are rare. Therefore, we decided to exclude this species.

Table 1: Species composition of the vertebrate community of Bylot Island with the corresponding migratory status (i.e., resident, partial migrant or migrant).

Functional group	Scientific name	English name	Migratory status
Ducks and loons	<i>Gavia pacifica</i>	Pacific loon	migrant
Ducks and loons	<i>Gavia stellata</i>	Red-throated loon	migrant
Ducks and loons	<i>Somateria spectabilis</i>	King eider	migrant
Ducks and loons	<i>Clangula hyemalis</i>	Long-tailed duck	migrant
Geese and swans	<i>Branta hutchinsii</i>	Cackling goose	migrant
Geese and swans	<i>Anser caerulescens</i>	Snow goose	migrant
Geese and swans	<i>Cygnus columbianus</i>	Tundra swan	migrant
Raptors	<i>Buteo lagopus</i>	Rough-legged hawk	migrant
Raptors	<i>Falco peregrinus</i>	Peregrine falcon	migrant
Raptors	<i>Bubo scandiacus</i>	Snowy owl	migrant
Ptarmigans	<i>Lagopus muta</i>	Rock ptarmigan	resident
Cranes	<i>Antigone canadensis</i>	Sandhill crane	migrant
Shorebirds	<i>Pluvialis dominica</i>	American golden-plover	migrant
Shorebirds	<i>Pluvialis squatarola</i>	Black-bellied plover	migrant
Shorebirds	<i>Charadrius hiaticula</i>	Common Ringed plover	migrant
Shorebirds	<i>Arenaria interpres</i>	Ruddy turnstone	migrant
Shorebirds	<i>Calidris canutus</i>	Red knot	migrant
Shorebirds	<i>Calidris melanotos</i>	Pectoral sandpiper	migrant
Shorebirds	<i>Calidris bairdii</i>	Baird's sandpiper	migrant
Shorebirds	<i>Calidris fuscicollis</i>	White-rumped sandpiper	migrant
Shorebirds	<i>Calidris subruficollis</i>	Buff-breasted sandpiper	migrant
Shorebirds	<i>Phalaropus fulicarius</i>	Red phalarope	migrant
Gulls	<i>Larus hyperboreus</i>	Glaucous gull	migrant
Jaegers	<i>Stercorarius longicaudus</i>	Long-tailed jaeger	migrant
Jaegers	<i>Stercorarius parasiticus</i>	Parasitic jaeger	migrant
Ravens	<i>Corvus corax</i>	Common raven	partial migrant
Passerines	<i>Eremophila alpestris</i>	Horned lark	migrant
Passerines	<i>Anthus rubescens</i>	American pipit	migrant
Passerines	<i>Calcarius lapponicus</i>	Lapland longspur	migrant
Passerines	<i>Plectrophenax nivalis</i>	Snow bunting	migrant
Lemmings	<i>Lemmus trimucronatus</i>	Nearctic brown lemming	resident
Lemmings	<i>Dicrostonyx groenlandicus</i>	Nearctic collared lemming	resident
Hares	<i>Lepus arcticus</i>	Arctic hare	resident
Ermines	<i>Mustela richardsonii</i>	Ermine	resident
Foxes	<i>Vulpes lagopus</i>	Arctic fox	partial migrant

b. Geography

Our 463 km² study area is located on the southern plain of Bylot Island, Nunavut, Canada (72.889 N, -79.906 W; **Figure 2**).

c. Habitat

The study area comprises a combination of mesic tundra mainly on hills (64 %), upland plateaus of sedimentary rock with drier/rockier habitat at higher elevation (20 %), low-lying wetlands interspersed with ponds (10 %) and larger bodies of water such as lakes and rivers (6 %).

d. Geology

See Klassen (1993) for a complete and detailed description of the geology of the study area.

232 **e. Hydrology**

233 Wetlands were delineated by photo-interpretation of high-resolution satellite images (30
234 cm; Ouellet, unpublished data), whereas lakes were delineated with aerial photos and
235 rivers with google satellite images, resulting in a coarser delineation.

236 **f. Site history**

237 See Gauthier et al. (2024b,a) for a complete and detailed history of the site.

238 **g. Climate**

239 The mean temperature in July is 6°C, and the study area typically remains free of snow
240 from mid-June to late September (Gauthier et al., 2013). The climate of the southern
241 plain of Bylot Island is generally milder than that of the surrounding latitudes, as the
242 plain present a southern exposure and the mountains to the north protect the plain from
243 cold northerly winds. (Gauthier et al., 2024b).

244 **2. Experimental or sampling design**

245 **a. Permanent plots**

246 The study area is divided into 9 zones based on the sampling method and the level of field
247 effort applied in each zone (**Figure 2**). Long-term monitoring of the community began in
248 the 1990s in the Qarlikturvik valley (Gauthier et al., 2013, 2024b), which represents the
249 zone of the study area with the highest annual sampling effort. Within the Qarlikturvik
250 valley, the sampling is concentrated on the southern side of the glacial river (**Figure 3**),
251 where the main research infrastructure is located. Another zone with extensive sampling
252 efforts is Camp 2, located at the core of the snow goose colony, where the primary focus
253 is to monitor snow goose nests. However, nests of many other avian species are also
254 monitored within and around the colony in this zone. Camp 3, Pointe Dufour, Goose
255 Point, and Malaview are zones where intensive sampling efforts are conducted annually,
256 albeit for a relatively brief period (approximately one week) during the breeding season
257 of most species (Gauthier et al., 2024b). The upland zones in the study area (defined as
258 areas approximately 300 meters above sea level or more) are the Black Plateau, Southern
259 Plateau, and Camp 3 Plateau. These zones are primarily visited to assess raptor nesting
260 activity (Beardsell et al., 2016). The zone between the Qarlikturvik valley and Camp 3
261 received very little sampling effort and is therefore excluded from the study area.

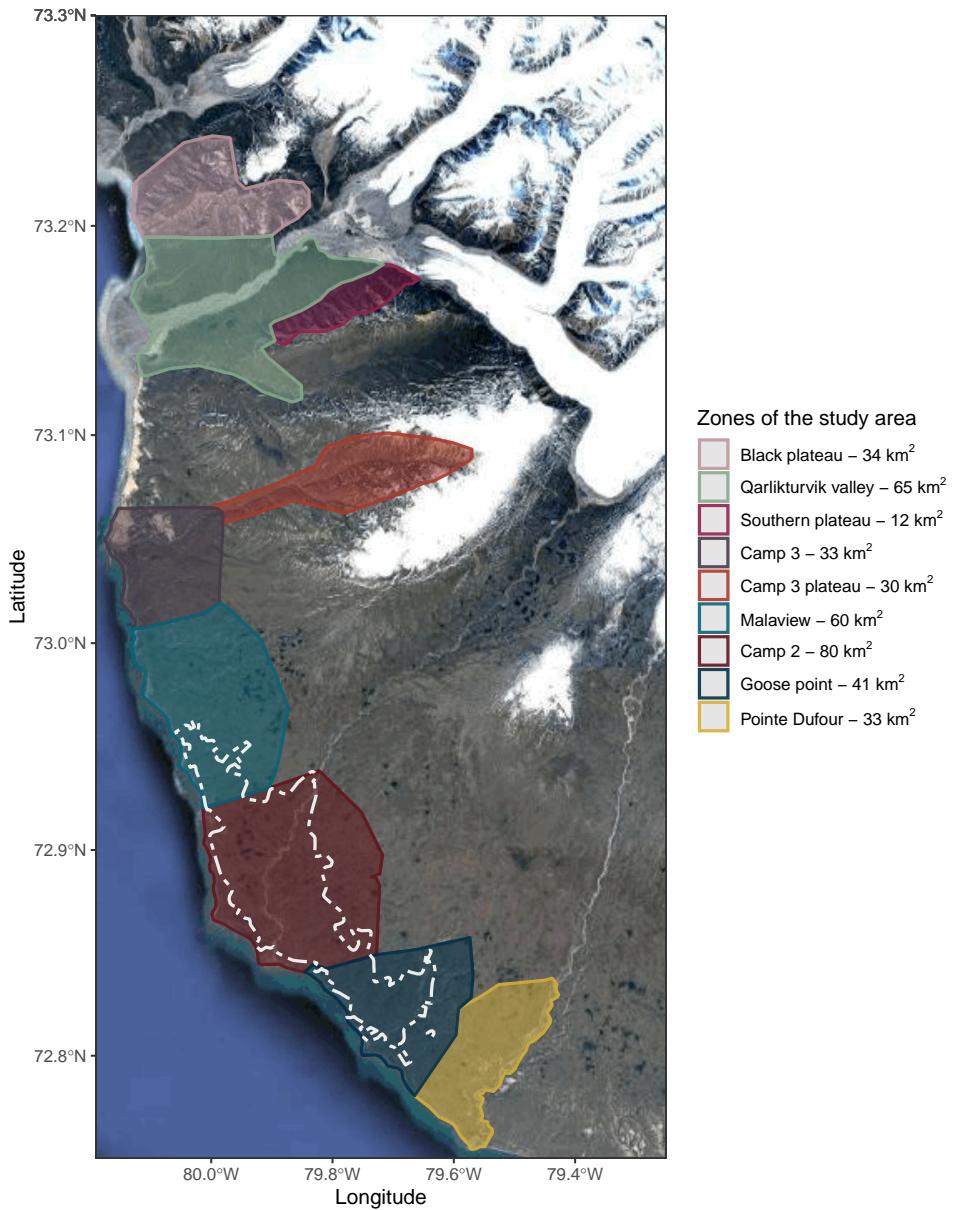


Figure 2: Map of the different zones (colored polygons) of the 463 km^2 study area located on the southern plain of Bylot Island, Nunavut Canada. The outline of the snow goose colony area is presented with white dash; we used the outline of the colony in 2017 since it represents an average colony area (74 km^2).

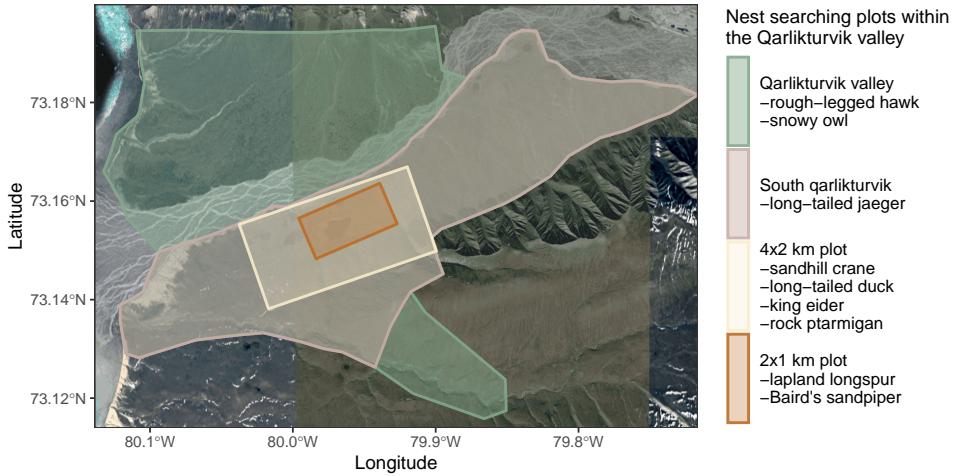


Figure 3: Intensive nests searching plots (8 km^2 and 2 km^2) located in the Qarlikturvik valley.

b. Avian nest monitoring

Avian nest monitoring was not conducted in 2020 and 2021 due to logistical constraints imposed by the COVID-19 pandemic. Systematic nest monitoring refers here to a systematic sampling approach aimed at documenting all nests within a specified area. Monitoring is considered opportunistic when there is a chance that some nests might not have been detected within a specific area. Nest densities derived from nest sampling could be underestimated due to early nest failure (i.e., failure that happened before our sampling period).

Pacific loon, red-throated loon, cackling goose, tundra swan and glaucous gull

Since 2004, systematic searches of wetland areas have been conducted on the southern side of the glacial river in the Qarlikturvik Valley, and since 2017, in other zones of the study area. This sampling aimed to find all nests of the cackling goose and the glaucous gull. Nest locations of other large wetland-nesting species, including the tundra swan, the red-throated loon and the Pacific loon, were also noted, as these species nest in the same habitat (Duchesne et al., 2021; Gauthier et al., 2024b). Each year, all known or potential nesting sites were revisited. Observers detected nests by walking and scanning around ponds and lakeshores to identify any active nesting sites. These large species can be seen from a relatively long distance sitting on the nest or when flushing from the nest. Most of them (geese, swans and gulls)

Table 2: Summary of vertebrate species monitoring in the Bylot Island study area. In this paper, we excluded certain years for specific species due to reduced sampling efforts. As a result, duration of times series presented here may differ slightly from those in Gauthier et al. (2024b).

Species	Zone	Years	Number of years	Monitoring
Snow goose	camp 2	1999-2019, 2023	(22)	systematic
Rough-legged hawk	qarlikt., black & south plat.	2007-2019, 2022	(15)	systematic
Peregrine falcon	qarlikt., black & south plat.	2007-2019, 2022	(15)	systematic
Snowy owl	qarlikt., black & south plat.	1996-2019, 2023	(25)	systematic
Baird's sandpiper	qarlikturvik (2x1 km plot)	2005-2019, 2022-2023	(17)	systematic
Lapland longspur	qarlikturvik (2x1 km plot)	2005-2019, 2022-2023	(17)	systematic
King eider	qarlikturvik (4x2 km plot)	2005-2019, 2022	(16)	opportunistic
Long-tailed duck	qarlikturvik (4x2 km plot)	2005-2019, 2022	(16)	opportunistic
Rock ptarmigan	qarlikturvik (4x2 km plot)	2005-2019, 2022	(16)	opportunistic
Sandhill crane	qarlikturvik (4x2 km plot)	2005-2019, 2022	(16)	opportunistic
Nearctic brown lemming	qarlikturvik (trapping grids)	1995-2019, 2021-2022	(27)	systematic
Nearctic collared lemming	qarlikturvik (trapping grids)	1995-2019, 2021-2022	(27)	systematic
Pacific loon	qarlikturvik valley	2004-2019, 2022	(17)	systematic
Red-throated loon	qarlikturvik valley	2004-2019, 2022	(17)	systematic
Cackling goose	qarlikturvik valley	2004-2019, 2022-2023	(18)	systematic
Tundra swan	qarlikturvik valley	2004-2019, 2022	(17)	systematic
Glaucoous gull	qarlikturvik valley	2004-2019, 2022	(17)	systematic
Long-tailed jaeger	qarlikturvik valley	2004-2019, 2022	(17)	systematic
Parasitic jaeger	qarlikturvik valley	2004-2019, 2022	(17)	systematic
Pacific loon	whole study area	2017-2019, 2022	(4)	systematic
Red-throated loon	whole study area	2017-2019, 2022	(4)	systematic
Cackling goose	whole study area	2017-2019, 2022-2023	(5)	systematic
Tundra swan	whole study area	2017-2019, 2022	(4)	systematic
Rough-legged hawk	whole study area	2013-2019, 2022	(8)	systematic
Peregrine falcon	whole study area	2013-2019, 2022	(8)	systematic
Snowy owl	whole study area	2012-2019, 2022-2023	(10)	systematic
Common Ringed plover	whole study area	2015-2017	(3)	systematic
Glaucoous gull	whole study area	2017-2019, 2022	(4)	systematic
Parasitic jaeger	whole study area	2009-2019, 2022	(12)	opportunistic
Common raven	whole study area	2013-2019, 2022	(8)	systematic
Ermine	whole study area	1993-2019	(27)	opportunistic
Arctic fox	whole study area	2008-2016	(9)	systematic

can also reveal their presence with alarm calls or nest defense displays. We are confident that nest detection probability was high for these species given the open landscape.

Snow goose

Snow geese nest in a large colony in the study area (**Figure 2**), but also in small aggregations distributed on the island, especially in years when snowy owls are nesting (Lepage et al., 1996; Reed et al., 2002). Since 1994, goose nests were systematically monitored on a 0.24 km^2 wetland at the center of the colony. Since 1999, nests were also systematically monitored on a variable number of plots, measuring 0.01 km^2 in wetland habitat and 0.04 km^2 in mesic habitat, randomly distributed throughout the goose colony (Gauthier and Cadieux, 2020b). The total area covered by the randomly distributed plots averaged $0.79 \pm 0.37 \text{ km}^2$ per year. From 2010 onwards, except in 2020 and 2021, we traced the approximate boundary of the goose colony using a GPS receiver aboard a helicopter flying along the colony border (Duchesne

297 et al., 2021).

298 **Rough-legged hawk, peregrine falcon and common raven**

299 Peregrine falcons, rough-legged hawks and common ravens nest on cliffs, near ravines,
300 and on large rocky outcrops and tend to reuse the same nesting sites from one year
301 to the next (Beardsell et al., 2016). Systematic monitoring of every known or poten-
302 tial nesting site has been carried out in the Qarlikturvik valley, Black plateau and
303 Southern plateau since 2007 and throughout the study area since 2013 (Beardsell
304 et al., 2016; Gauthier et al., 2020). Observers walked along ridges and scanned sur-
305 rounding areas from vantage points to detect nesting birds. These large species can
306 be seen from a relatively long distance sitting on the nest or when flushing from the
307 nest. They can also reveal their presence with alarm calls or nest defense displays.
308 We are confident that nest detection probability was high for these species. Each
309 year the observers use slightly different paths to sample the areas, but locate the
310 nests in the same positions, which supports a high probability of detection for these
311 species. Most nesting sites were located in the upland zones of the study area, which
312 include the Black Plateau, Southern Plateau and Camp 3 Plateau.

313 **Snowy owl**

314 Snowy owls predominantly nest in habitats similar to other raptors, favoring ridges
315 in mountainous or hilly regions, although they can occasionally be found nesting
316 on mounds in lowland areas (Seyer et al., 2020). Since 1996, searches for snowy
317 owl nests have been conducted concurrently with searches for other raptor nests
318 in the Black and Southern plateaus, as well as during searches for jaeger nests on
319 the southern side of the glacial river in the Qarlikturvik Valley. Additionally, since
320 2012, nests have been recorded across the entire study area by scanning the land-
321 scape from hills and ridges during the nesting period (Duchesne et al., 2021). Given
322 that snowy owls nest on elevated mounds, exhibit contrasting colors with the land-
323 scape, emit alarm calls, and display defensive behaviors, active nesting sites have a
324 high probability of detection.

325
326 **Long-tailed jaeger and parasitic jaeger**

327 Since 2004, observers have walked parallel transects spaced 400 meters apart, cov-
328 ering the entire southern side of the glacial river in the Qarlikturvik Valley (33 km^2 ;
329 **Figure 3**), during the nesting period. The aim of those transects was to record nests
330 of long-tailed jaegers, parasitic jaegers, and sandhill cranes. Observers listened for
331 alarm calls to detect territorial birds, and then located nests by observing the birds
332 returning to their nests from elevated vantage points. We consider the sampling to
333 be systematic for long-tailed and parasitic jaeger, since those species tend to leave
334 their nest relatively far from the observer to perform mobbing behavior, and thus

335 increasing their detection probability. We do not consider the sampling to be sys-
336 tematic for sandhill cranes as they only display defensive behaviors near their nests
337 at relatively short distances (see opportunistic nest monitoring below).

338

339 ***Common-ringed plover***

340 Between 2015 and 2019, observers conducted surveys of the primary nesting areas of
341 the common-ringed plover. The survey involved walking in stony and sandy shores
342 and gravel bars with scarce vegetation along rivers. Nests were found by detecting
343 individuals exhibiting reproductive behaviors, such as incubation, alarm calls, or
344 distraction displays. The sampling effort was particularly intensive between 2015
345 and 2017. Small areas along the coast or on the banks of smaller rivers that could
346 potentially serve as nesting sites may have been overlooked.

347

348 ***Lapland longspur and Baird's sandpiper***

349 Since 2005, nests of passerines and sandpipers have been extensively monitored
350 across an 8 km² (4x2 km) area in the Qarlikturvik valley. We considered the sam-
351 pling to be most systematic within a core 2 km² (2x1 km) plot in this area (**Figure**
352 **3**). We excluded relatively large water bodies (0.26 km²) to calculate nest density
353 in the plot due to the presence of a large lake, which leaves an area of 1.74 km²
354 available for nesting. An observer conducted systematic searches of this plot during
355 the entire breeding season to locate and monitor as many passerine and shorebird
356 nests as possible. Assuming the observer can detect all nests within a 5 or 10 meter
357 radius, analysis of daily GPS tracks shows that the observer covered a minimum
358 area of 0.72 ± 0.12 (5 m) or 1.09 ± 0.17 km² (10 m) of the core area annually (n=
359 3 years). Additionally, several other observers conducting related field work in the
360 same zone reported all passerine and shorebird nests found opportunistically.

361

362 ***Opportunistic nest monitoring***

363 Since 2005, we also noted the nest location of any other bird species encountered
364 opportunistically during travel or while carrying out the protocols for the previously
365 described species. The sampling was particularly intensive in the defined 8 km² (2x4
366 km plot) area in the Qarlikturvik valley. The accuracy of nest monitoring in this
367 plot thus depends on the species detection probability. We are confident to obtain
368 a realistic order of magnitude for the number of nests present for relatively large
369 bodied species in this area (i.e., sandhill crane, rock ptarmigan, long-tailed duck
370 and king eider). Additionally, starting in 2009, a significant effort has been made
371 each year, though not systematically, to visit known nesting territories of parasitic
372 jaegers throughout the study area.

Table 3: Annual nest density (nests/km²) of selected avian species estimated on different zones of Bylot Island.

Species	Zone	Mean nests/km ² ± SD	Number of years
Lapland longspur	qarlikturvik (2x1 km plot)	13.559 ± 5.849	17
Baird's sandpiper	qarlikturvik (2x1 km plot)	5.000 ± 3.558	17
Rock ptarmigan	qarlikturvik (4x2 km plot)	0.031 ± 0.055	16
Long-tailed duck	qarlikturvik (4x2 km plot)	0.092 ± 0.138	16
King eider	qarlikturvik (4x2 km plot)	0.115 ± 0.138	16
Sandhill crane	qarlikturvik (4x2 km plot)	0.161 ± 0.087	16
Long-tailed jaeger	qarlikturvik valley	0.362 ± 0.380	17
Tundra swan	whole study area	0.001 ± 0.001	4
Common raven	whole study area	0.003 ± 0.003	8
Pacific loon	whole study area	0.005 ± 0.004	4
Parasitic jaeger	whole study area	0.010 ± 0.004	12
Snowy owl	whole study area	0.022 ± 0.058	10
Peregrine falcon	whole study area	0.053 ± 0.007	8
Common Ringed plover	whole study area	0.070 ± 0.012	3
Red-throated loon	whole study area	0.082 ± 0.019	4
Glaucous gull	whole study area	0.091 ± 0.011	4
Rough-legged hawk	whole study area	0.157 ± 0.151	8
Cackling goose	whole study area	0.177 ± 0.064	5

373 c. Observation of individuals

374 *Vertebrate count transects*

375 From 2010 to 2023, observers walked 500-meter linear transects where all vertebrate
 376 individuals observed within 150 meters on either side were counted (146 to 320
 377 transects per year). Transects were distributed across all lowland zones of the study
 378 area, typically in mesic habitat, and were carried out during the nesting period
 379 (between June 21 and July 14; Duchesne et al. (2021); **Figure 4**). Furthermore,
 380 specifically for American golden-plovers, we measured the distance of each observed
 381 individual to the transect path.

382

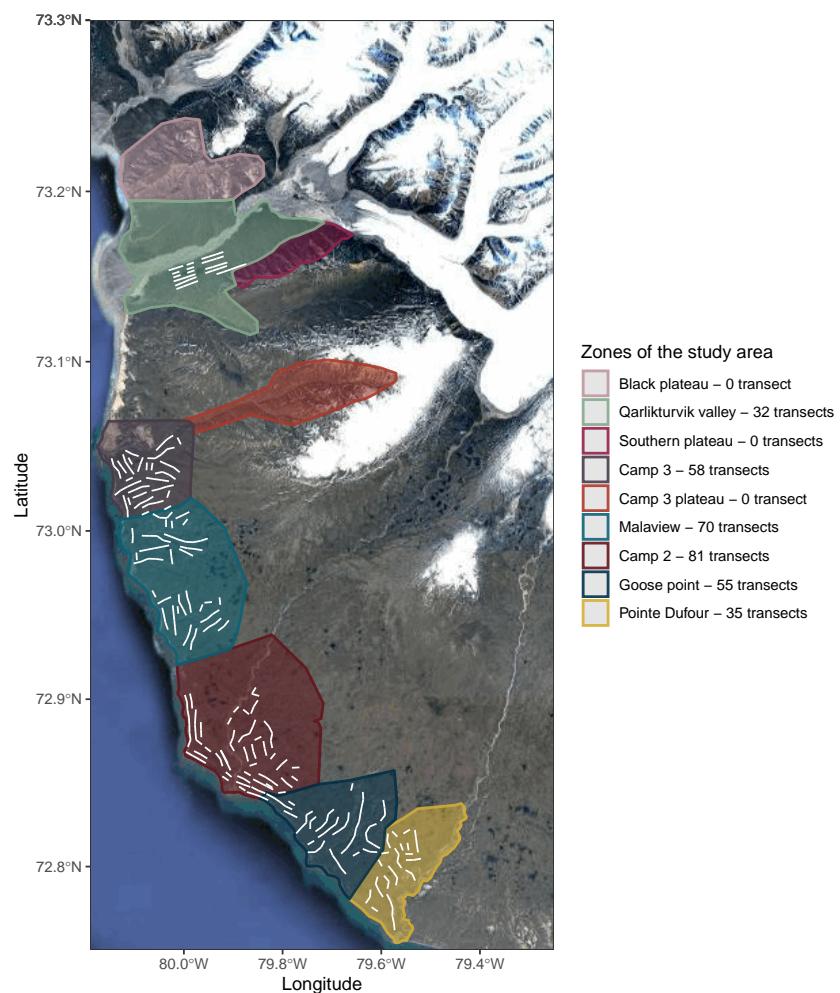


Figure 4: Spatial distribution of vertebrate count transects (white lines) on the south plain of Bylot Island (146 to 320 transects per year).

383 ***Snow goose point count***

384 At the start, middle, and end of each vertebrate count transect, a point count with a
385 radius of 125 meters was conducted to determine the number of snow goose breeding
386 pairs. On average, 613 ± 142 point counts were sampled each year, covering an area
387 of $30 \pm 7 \text{ km}^2$.

388

389 ***Incidental observations***

390 Since 2007, observers have recorded all vertebrate species observed opportunistically
391 during field work and tallied the total number of individuals at the end of each day
392 (Gauthier and Cadieux, 2020a; Gauthier et al., 2024b). The number of hours spent
393 in the field served as a proxy for the sampling effort. We used the number of indi-
394 viduals observed per hour spent in the field calculated by Gauthier et al. (2024b)
395 as an index of relative abundance for each species. However, we separated observa-
396 tions made in lowland from those in upland zones to have a relative abundance of
397 each species in each of these two broad categories (**Table 4**). Given that inciden-
398 tal observations lacked georeferencing, we opted to extract upland observations by
399 focusing on observations made during visits to rough-legged hawk nests, which are
400 mostly located in uplands.

Table 4: Index of relative abundance (i.e., number of individuals observed per hour) derived from incidental daily observations for selected vertebrate species in lowland (i.e., Qarliktuvik valley, Camp 3, Malaview, Camp 2, Goose point and Pointe Dufour) and upland (i.e., Black plateau, Southern plateau and Camp 3 plateau) zones of the Bylot Island study area. The ratio compares relative abundance indexes between these two types of zones, calculated by dividing the upland by the lowland index of relative abundance.

Species	Individuals/hour		
	Upland	Lowland	Ratio
Rock ptarmigan	0.03	0.03	1
Sandhill crane	0.42	0.287	1.5
American golden-plover	0.26	0.394	0.7
Black-bellied plover	0.02	0.032	0.6
Ruddy turnstone	0.01	0.007	1.3
Red knot	0.00	0.033	0
Pectoral sandpiper	0.02	0.034	0.6
Baird's sandpiper	0.31	0.32	1
White-rumped sandpiper	0.04	0.137	0.3
Buff-breasted sandpiper	0.00	0.001	0
Red phalarope	0.01	0.038	0.2
Horned lark	0.24	0.154	1.6
American pipit	0.34	0.024	14.2
Lapland longspur	1.93	2.641	0.7
Snow bunting	0.59	0.092	6.4
Arctic hare	0.02	0.009	2

401

402 ***Testimonials of ermine sightings***

403 There was no direct estimation of ermine abundance on Bylot Island as they are
404 quite difficult to obtain. The density estimates for ermine were derived from an
405 annual abundance index established by Bolduc et al. (2023), which relied on testi-
406 monials provided by observers across the whole study area from 1993 to 2019. The
407 testimonials provided by observers were used to create an abundance index ranging
408 from 0 to 3 (Bolduc et al., 2023). In this index, a score of 0 corresponds to the
409 absence of ermine sightings, 1 indicates a single sighting of a lone individual, 2 rep-
410 resents multiple sightings of lone individuals, and 3 signifies at least one sighting of
411 a family group. Scores of individual participants were averaged annually as detailed
412 in Bolduc et al. (2023).

413 d. Capture of individuals

414 ***Lemming trapping***

415 Since 2004, brown and collared lemmings were live-trapped 3 times during the sum-
416 mer (mid-June, mid-July, and mid-August) in two 11 ha grids. Each grid is made
417 of 144 traps separated by 30 m according to a cartesian plane, one in mesic habitat
418 and the other in wet habitat, located in the Qarlikturvik valley (Fauteux et al.,
419 2015; Gauthier, 2020). Density of each species was estimated at each occasion using
420 spatially explicit capture-recapture methods (see Fauteux et al. (2015) for details).
421 From 1995 to 2016 snap-trapping was performed once a year (mid-July) along 2
422 groups of transects located in the same habitats than the trapping grids (Gruyer
423 et al., 2008). Index of abundance derived from snap-trapping were transformed
424 in density estimates in each habitat for the period 1995-2003 using the equation
425 provided by Fauteux et al. (2018) based on the period of overlap between the two
426 sampling methods (2004 to 2016).

428 ***Arctic fox movement tracking***

429 In order to assess fox abundance based on the size of their home range, 109 Arctic
430 foxes were fitted with Argos Platform Transmitter Terminals mounted on collars
431 between 2008 and 2016 (Lai et al., 2015; Christin et al., 2015; Dulude-de Broin
432 et al., 2023). Foxes were captured between May and August across the study area,
433 within and outside the goose colony (Dulude-de Broin et al., 2023). Sampling of
434 animal locations was set for an interval of 1 or 2 days and only locations between
435 May 1 and October 30 were retained (Dulude-de Broin et al., 2023).

437 ***Parasitic jaeger banding***

438 In 2009, a significant effort was made to band as many parasitic jaegers as possible

439 within the study area. This effort resulted in the banding of 17 adult individuals
440 (Therrien and Gauthier, unpublished data).

441 **e. Species body mass**

442 All vertebrate individuals captured for marking purposes were systematically weighed:
443 snow goose (G. Gauthier, M.-C. Cadieux and J. Lefebvre, unpublished data), snowy owl
444 (Therrien et al., 2012; Robillard et al., 2018), American-golden plovers (Lamarre et al.,
445 2021), common-ringed plovers (Léandri-Breton et al., 2019), other shorebirds (J. Béty,
446 unpublished data), glaucous gulls (Gauthier et al., 2015), long-tailed jaeger (Seyer et al.,
447 2019), parasitic jaegers (J.-F. Therrien and G. Gauthier, unpublished data), Lapland
448 longspurs (J. Béty and G. Gauthier, unpublished data), lemmings (Gauthier, 2020), er-
449 mine (Bilodeau and Bolduc, unpublished data) and Arctic foxes (Lai et al., 2015). Mean
450 body mass of vertebrate species was determined in priority with measurements from Bylot
451 Island. When not available, we extracted mean body mass from the literature (Wilman
452 et al., 2014).

453 **3. Research methods**

454 **a. Field/laboratory**

455 We estimated the abundance of breeding individuals for most species, but there were
456 a few exceptions. For common ravens, parasitic jaegers, long-tailed ducks, and king
457 eiders, we suspect the presence of a significant number of non-breeding individuals in the
458 study area. Therefore, the estimates we provided for these species include both breeding
459 and potentially non-breeding individuals. Additionally, we did not distinguish between
460 breeding and non-breeding individuals for mammals such as brown and collared lemmings,
461 Arctic fox, ermine, and Arctic hare. The methods used for each species are summarized
462 in (**Table 5**).

463 **Pacific loon, red-throated loon, cackling goose, tundra swan and glau-
464 couous gull**

465 Based on the systematic and intensive search for the glaucous gull, cackling goose,
466 tundra swan, red-throated loon and Pacific loon nests in wetlands, we are confident
467 that we have found nearly all nests across the study area from 2017 to 2019 and in
468 2022. We transformed the number of nests to abundance of individuals by multi-
469 plying it by a factor of two. We observed a relatively strong correlation between the
470 nest density of glaucous gulls in the Qarlikturvik valley and the nest density across
471 the entire study area ($R^2 = 0.84$, $p = 0.16$, $n = 4$). Consequently, we estimated the
472 density of glaucous gulls at the scale of the study area between 2004 and 2016 based
473 on the nest density in the Qarlikturvik valley ($y = 0.12406x + 0.13775$). However,
474 we did not observe such strong relationships for loons and swans and thus we did
475 not extend the time series. Regarding cackling geese, we observed signs of an ex-
476 ponential increase over time based on the annual number of nests found in various
477 zones of the study area. We thus fitted an exponential model using the number
478 of nests found annually over two distinct periods: in 1996 when the first nest was
479 discovered, and then from 2017 to 2023 when sampling effort was systematic across
480 the whole study area (**Figure 5**). We used the fitted model to estimate abundance
481 between 1996 and 2016 when monitoring was less systematic, which could poten-
482 tially underestimate observed abundance as seen on **Figure 5**. We multiplied nest
density by two to obtain the abundance.

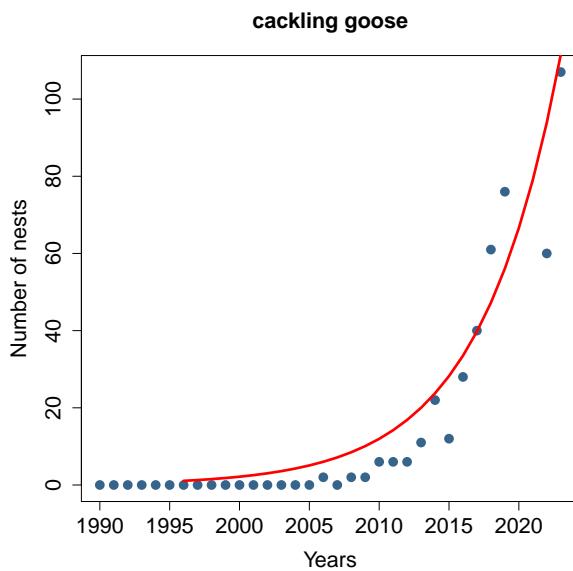


Figure 5: Number of cackling goose nests found across the study area over time. The red line represents the fitted model over the period 1996-2023 ($y = e^{0.1717x - 342.684}$), which was used to estimate the annual abundance of cackling goose between 1996 and 2016. The model presents a strong fit with the number of nests found between 2017 and 2023, when nest monitoring was systematic across the study area ($R^2 = 0.74$, $p = 0.15$, $n = 5$).

483 ***Snow goose***

484 Between 1999 and 2023, we assessed the abundance of snow geese in the study area
485 through a multi-step process. We calculated the mean annual density of snow goose
486 nests separately in the mesic and wetland habitats of the area occupied by the goose
487 colony annually. We made slight adjustments to the goose colony perimeter defined
488 from helicopter surveys to include all snow goose point counts where at least one
489 breeding pair had been observed (**Figure 6**). To determine the mean density of
490 nesting geese in wetlands, we divided two times (assuming two individuals per nest)
491 the total number of nests found during systematic nest searches by the total area
492 of wetlands sampled. The density of geese nesting in mesic habitat, a less preferred
493 nesting habitat (Lecomte et al., 2008), was averaged from three independent meth-
494 ods: systematic nest searches, vertebrate count transects, and snow goose point
495 counts. Systematic nest searches were highly precise, but covered a relatively small
496 area, whereas transects and snow goose point counts were less precise but covered
497 larger areas. For each method, we calculated the mean density of breeding indi-
498 viduals in mesic habitat by dividing the number of birds (or nests) recorded by
499 the area sampled. Despite methodological differences, the three approaches showed
500 similar inter-annual variations, supporting the use of a mean values to estimate
501 nest density in mesic habitat **Figure 7**). Lastly, to transform the densities in total
502 abundance, we determined the annual proportion of wetland and mesic habitats
503 within the goose colony and multiplied the area of each habitat by the density of
504 breeding individuals. For the period 1999 to 2009, we used the average limits of
505 the colony over the period 2010 to 2023 because we did not conduct aerial survey
506 of the colony. Moreover, nest density in the mesic habitat was derived from a single
507 method (**Figure 7**).



Figure 6: Map showing the region occupied by the snow goose colony in 2017 (green polygon) as an example. The perimeter was first defined from a helicopter surveys and then slightly adjusted to include all snow goose point counts where at least one breeding pair had been observed in that year (green dots). Snow goose point counts where no breeding geese were observed in that year are presented as red dots.

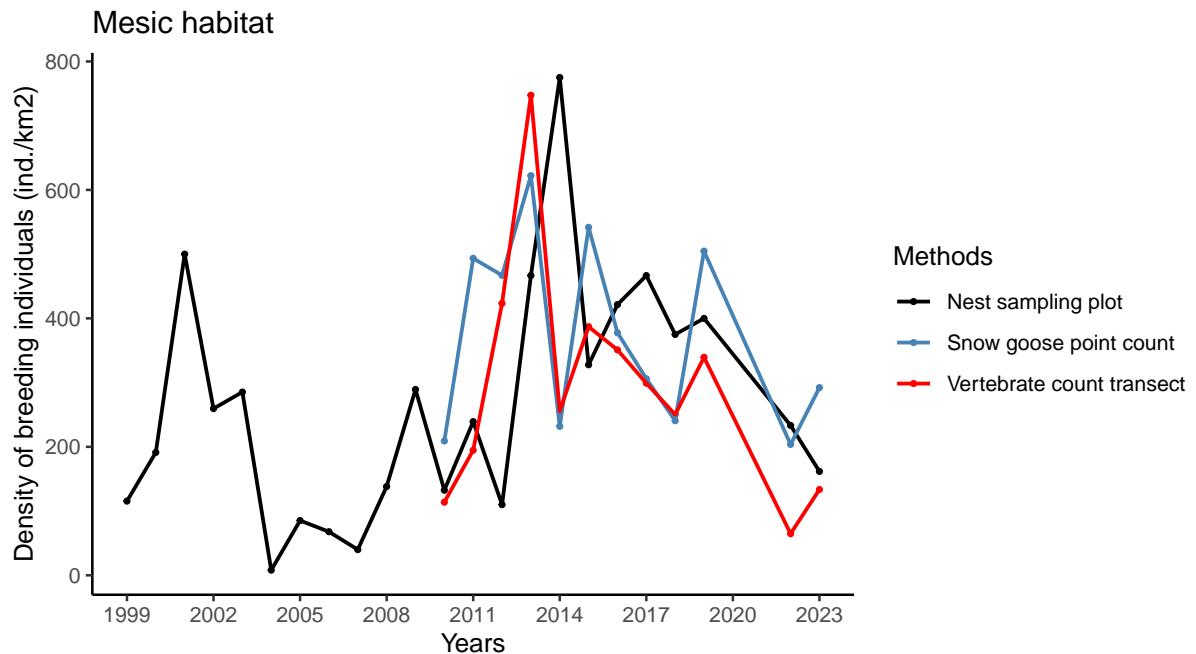


Figure 7: Estimates of breeding goose density in mesic habitat of the Blyot Island study area using three independent methods: Nest sampling plot, Snow goose point count, Vertebrate count transect.

508 King eider and long-tailed duck

509 We estimated the abundance of both king eiders and long-tailed ducks based on
 510 the annual nest density of each species found in the 8 km² extensive nest search
 511 area located in the Qarlikturvik valley. We extrapolated the mean nest density in
 512 the wetlands of the Qarlikturvik valley to the wetlands of the study area (38.35
 513 km²). We transformed nest density to abundance of breeding individuals by mul-
 514 tiplying it by a factor of two. We acknowledge that the opportunistic monitoring
 515 of these species likely underestimated their true nest density. However, considering
 516 the extensive sampling effort deployed annually within this area, we are confident
 517 to obtain a realistic order of magnitude for the number of nests present. Because
 518 duck sightings are frequent, yet only a few nests are found, we believe there may
 519 be non-breeding individuals. Therefore, we employed an additional method to es-
 520 timate the overall duck populations without differentiating between breeding and
 521 non-breeding individuals. As an alternative approach, we estimated the abundance
 522 of ducks based on the indices of relative abundance (i.e., the number of individuals
 523 observed per 100 hours) presented by Gauthier et al. (2024b). We assumed that the
 524 ratios between relative and actual abundance are the same (i.e., similar detection
 525 probability) in duck and loon species. We therefore derived the absolute abundance
 526 of long-tailed ducks and king eiders from their relative abundances using the ratio
 527 between relative and absolute abundances of red-throated loons as a reference.

528 ***Rough-legged hawk, peregrine falcon and snowy owl***

529 We estimated the abundance of breeding rough-legged hawks, peregrine falcons and
530 snowy owls based on systematic nest monitoring conducted throughout the study
531 area for these species. To convert the number of nests into breeding abundance, we
532 multiplied it by two. For snowy owls, we extended the time series from 1996 to 2011
533 based on a linear regression between nest density in the Qarlikturvik valley and
534 nearby plateaus (Black and Southern plateaus) and nest density across the entire
535 study area ($y = 0.68867x - 0.00173$; $R^2 = 0.99$; $p < 0.0001$, $n = 10$). We used the
536 same approach for rough-legged hawks ($y = 0.49851x$, $R^2 = 0.99$, $p < 0.0001$, $n = 8$)
537 to extend the time series from 2007 to 2012. We did not extend the time series for
538 peregrine falcons because the correlation is not as strong ($R^2 = 0.44$, $p = 0.27$, $n = 8$).

539 ***Rock ptarmigan***

540 We estimated the abundance of rock ptarmigans based on the annual nest density
541 measured in the 8 km² extensive nest search area of the Qarlikturvik valley. While we
542 acknowledge that the opportunistic monitoring of this species likely underestimates
543 nest density, the extensive sampling effort deployed annually within this area gives
544 us confidence in obtaining a realistic number of nests. We then extrapolate the
545 density to the whole study area, without distinction between mesic, wetland and
546 upland habitats (**Table 4**). Among the 6 nests found in the study area, 4 were
547 located in mesic habitat, while one nest was found in a wetland and another in
548 an upland habitat. To convert the number of nests into breeding abundance, we
549 multiplied it by two.

550 ***Sandhill crane***

551 We estimated the mean abundance of sandhill cranes in the lowland zones of the
552 study area based on a regression between nest density and the number of individuals
553 observed per transect (**Figure 8**). In this relationship, nest density and transect
554 observations come from the 8 km² area of the Qarlikturvik valley where extensive
555 nest search is performed. We acknowledge that the opportunistic monitoring of
556 this species likely underestimated the true nest density. However, considering the
557 extensive sampling effort deployed annually within this area, we are confident in
558 obtaining a realistic order of magnitude for the number of nests present. Number of
559 individuals observed along transects in each lowland zone was converted into nest
560 density using the regressions, and then in total number of individuals in each zone by
561 multiplying by the area of the zone and a factor 2. We estimated the density in the
562 upland zones by applying a correction factor to the annual mean density in lowland
563 zones. This correction factor was determined based on the relative abundance ratio
564 between the upland and lowland zones (**Table 4**).

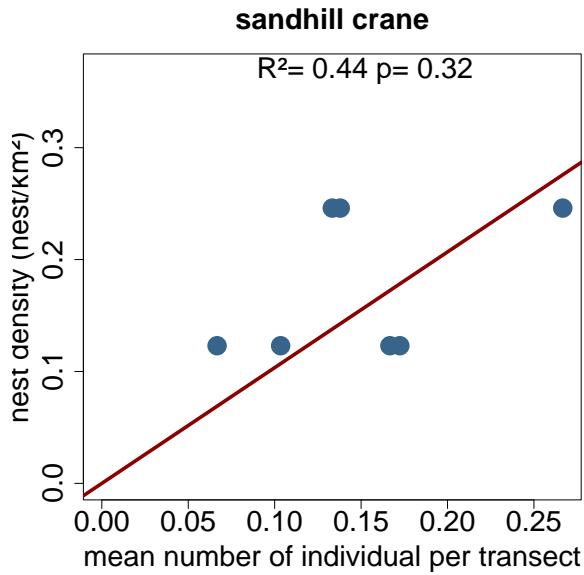


Figure 8: Linear regression between the nest density of sandhill cranes and the number of individuals observed per transect (nest density = $1.12 \times$ number of individuals per transect; regression was forced to pass through the origin). The fit (R^2 and p value) of the regression (red line) with the empirical data from the Qarlikturvik valley is presented (blue dots). Data points represent annual values.

565 **American golden-plover and black-bellied plover**

566 We applied a distance sampling approach to the observations of American golden-
 567 plovers made along vertebrate count transects to estimate the abundance of indi-
 568 viduals in the mesic habitat of the study area between 2014 and 2023. We used
 569 perpendicular distance between detected individuals and transect ($n = 1015$) to es-
 570 timate a detection function with the *ds* function from the *Distance* package (Miller
 571 et al., 2019). We applied a truncation distance of 150 m (i.e., maximum distance on
 572 either side of the observer where observations have been considered). We selected
 573 the model with the lowest AIC, which included a "hn" key and a single "cos" ad-
 574 justment term. We excluded observations of more than four individuals, as these
 575 likely indicated groups of non-breeders passing through the area. We did not esti-
 576 mate abundance in wetland habitat because American golden-plovers nest almost
 577 exclusively in mesic habitat (Parmelee et al., 1967). We estimated the abundance
 578 in the upland zones (i.e., plateaus) by applying a correction factor to the abun-
 579 dance in lowland zones. This correction factor was determined based on the relative
 580 abundance ratio between the upland and lowland zones (**Table 4**).

581 To determine the abundance of black-bellied plovers, we used the mean number of
 582 black-bellied plovers and American golden-plovers observed per transect as an index
 583 of relative abundance. We assumed that the ratios of between relative and actual
 584 abundance are the same (i.e., similar detection probability) among those species.

585 This assumption is realistic as those species present similarities in size, color, and
586 reproductive behavior. We therefore derived the absolute abundance of black-bellied
587 plovers from their relative abundance using the ratio between relative and absolute
588 abundances of American golden-plover as a reference. As an alternative approach to
589 determine black-bellied plover abundance, we used the same approach as previously
590 described, but with the indices of relative abundance presented by Gauthier et al.
591 (2024b), which was derived from incidental daily observations.

592 ***Common-ringed plover***

593 To estimate the abundance of common-ringed plovers in the study area, we relied
594 on the total number of nests recorded annually from 2015 to 2017, during which the
595 primary nesting sites underwent intensive sampling. We multiplied the total nest
596 count by two to represent the abundance of breeding individuals.

597 ***Lapland longspur and Baird's sandpiper***

598 We estimated the mean abundance of Lapland longspur in the different lowland
599 zones of the study area based on a regression between nest density and the num-
600 ber of individuals observed per transect (**Figure 9**). For Baird's sandpiper, we
601 employed a similar approach, but instead of using the mean number of individuals
602 observed per transect, we used the mean proportion of transects where at least one
603 individual was detected. We made this adjustment because this species was less
604 frequently observed. In this relationship, nest density for these two species came
605 from the intensive nest sampling conducted within the core 2 km² area of the Qar-
606 likturvik valley and observations of individuals from transects carried out in the
607 larger 8 km² area in which the core area was located. This approach allowed us
608 to incorporate a larger sample size from the transects while focusing on a measure
609 of nest density determined systematically. Transects observations in lowland were
610 then converted into nest density using the regressions, and then in total number of
611 individuals by multiplying by the area and a factor 2. We estimated the density
612 of both species in the upland zones by applying a correction factor to the annual
613 mean density in lowland zones. This correction factor was determined based on the
614 relative abundance ratio between the upland and lowland zones (**Table 4**). We ac-
615 knowledge that the regression for Baird's sandpiper is weak; however, it offers some
616 refinement compared to assuming a uniform density throughout the study area.

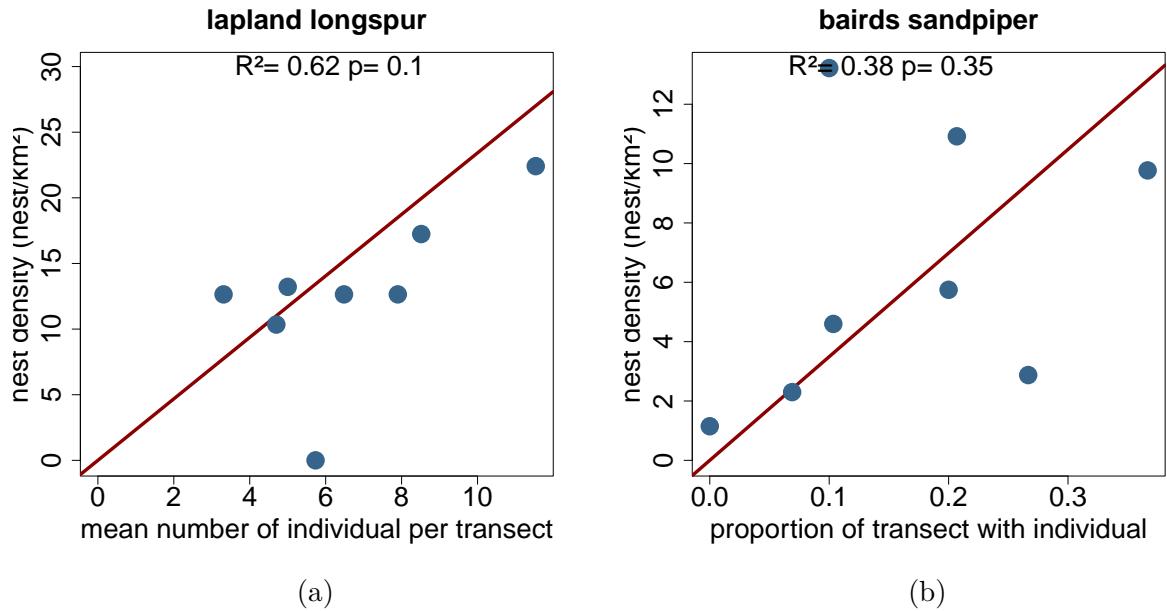


Figure 9: a) Linear regression between the nest density of Lapland longspurs and the number of individuals observed per transect (nest density= $2.3422 \times$ number of individuals per transect; regression was forced through the origin). The fit (R^2 and p value) of the regression (red line) with the empirical data from the Qarlikturvik valley is presented (blue dots). Data points represent annual values. b) Linear regression between the nest density of Baird's sandpiper and the proportion of transect with at least one individual observed (nest density= $34.9248 \times$ proportion of transects with at least one individual; regression was forced through the origin). The fit (R^2 and p value) of the regression (red line) with the empirical data from the Qarlikturvik valley is presented (blue dots). Data points represent annual values.

617 *Other passerines and sandpipers*

618 We estimated the abundance of other passerines (horned lark, American pipit, and
 619 snow bunting) in the lowland zones of the study area with the regression equa-
 620 tion between number of individuals per transect and nest density of the Lapland
 621 longspur (see section **Lapland longspur and Baird's sandpiper**). We assumed
 622 here a similar detection probability for all species. We used the same approach for
 623 other sandpiper species (white-rumped sandpiper, pectoral sandpiper, buff-breasted
 624 sandpiper, red knot, ruddy turnstone and red phalarope) based on the regression
 625 equation for the Baird's sandpiper (see section **Lapland longspur and Baird's**
 626 **sandpiper**). For all these species, we estimated the density in the upland zones by
 627 applying a correction factor to the mean density in lowland zones. This correction
 628 factor was determined based on the relative abundance ratio between the upland
 629 and lowland zones (**Table 4**). Nest density was then converted in number of in-
 630 dividuals by multiplying by the area and a factor 2. As an alternative approach,
 631 we estimated the abundance of other passerines and sandpipers based on the in-
 632 dices of relative abundance (i.e., the number of individuals observed per 100 hours)

presented by Gauthier et al. (2024b). We assumed that the ratios between relative and actual abundance are the same (i.e., similar detection probability) among both passerine and sandpiper species. We therefore derived the absolute abundance of other passerine and sandpiper species from their relative abundances using respectively, the ratios between relative and absolute abundances of Lapland longspur (passerines) and Baird's sandpiper (sandpipers) as references.

Long-tailed jaeger

We determined the annual nest density of long-tailed jaegers from the systematic nest sampling between 2004 and 2023 on the southern side of the glacial river in the Qarlikturvik valley. We determined nest density by dividing the annual number of nests recorded by the area of the surveyed zone (33 km^2). As long-tailed jaegers typically nest in mesic habitat (Andersson, 1971), we multiplied the area occupied by mesic habitat across the study area by the nest density obtained in the surveyed zone and by two to obtain the total abundance of breeding individuals.

Parasitic jaeger

Based on the opportunistic nest monitoring of parasitic jaegers across the study area, an average of 3.75 nests is found annually, a small number considering that parasitic jaegers were frequently observed at the study site (Gauthier et al., 2024b). This suggests that there may be non-breeding individuals present at the study site, or alternatively, individuals may regularly travel long distances, potentially from outside the study area, to forage during the breeding season. Due to limited data availability for estimating the abundance of non-breeding parasitic jaegers, we relied on the maximum number of adults banded during a single year (17 individuals in 2009; Therrien, unpublished data) as the minimum abundance on the study area. This corresponds to a density of 0.04 individuals/km 2 . For comparison, Taylor (1974) measured a density of 0.06 individual/km 2 on Bathurst Island.

Common raven

Despite the intensive nest searches for raptors in upland zones, we never found more than one common raven nest each year, a small number considering the frequent raven observations at the study site (Gauthier et al., 2024b). This indicates the potential presence of non-breeding individuals or individuals that breed outside the study area but use it for foraging. Therefore, we opted for alternative approaches based on individual counts to estimate the abundance of both breeding and non-breeding ravens. As a first approach, we based our estimate of ravens on the number of glaucous gulls observed per transect. We assumed that the ratios between relative and actual abundance are the same (i.e., similar detection probability) among those species. This assumption is reasonable as those species present similarities in size and foraging strategy. We therefore derived the absolute abundance of common

671 ravens from their relative abundance using the ratio between relative and absolute
672 abundances of glaucous gulls as a reference. Independently, we estimated the abun-
673 dence of common ravens with the same approach but using the indices of relative
674 abundance presented by Gauthier et al. (2024b), which was derived from incidental
675 daily observations, rather than observations from the transects.

676 ***Brown and collared lemming***

677 Between 1995 and 2003, we used the density estimates derived from the snap-
678 trapping indices obtained in late July in each habitat. Between 2004 and 2007,
679 annual abundance of each lemming species was based on the late-July density esti-
680 mates on trapping grid in wet and mesic habitats. However, starting from 2008, es-
681 timates were derived from the mean density recorded in mid-July and mid-August,
682 except for two instances: 2019 and 2021. In 2019, due to an exceptionally early
683 snowmelt and thus an early decline in lemmings during the summer, we only re-
684 tained value from mid-July. In 2021, we relied solely on data gathered in August
685 because it was the only trapping period carried out that year. To scale the esti-
686 mated densities from the wet and mesic grids to the entire study area, we used the
687 proportions of mesic habitats (64%) and wet habitats (10%) measured within the
688 study area.

689 ***Arctic hare***

690 Arctic hares are primarily observed in the upland zones of the study area, where
691 sampling effort is limited. We thus derived abundance of hares from the estimated
692 abundance of Arctic foxes based on indices of relative abundance presented in (Gau-
693 thier et al., 2024b), which were derived from incidental daily observations. We dou-
694 bled the density of Arctic hares in the upland zones (i.e., plateaus), as twice as many
695 individuals were observed per hour of fieldwork there compared to lowland zones
696 (**Table 4**). However, it is worth noting that assuming a similar detection proba-
697 bility between foxes and hares might lead to an overestimation of hare detection
698 probability due to behavioral differences between the species. Therefore, we most
699 likely underestimate the actual abundance of Arctic hares in the study area.

700 ***Ermine***

701 We estimated the annual abundance of ermines by transforming the annual index of
702 relative abundance provided in Bolduc et al. (2023) into individual density. Annual
703 values ranged from 0, indicating no ermine sighting, to 2.88, which signifies that
704 nearly all observers observed at least one family group during their field season.
705 We independently obtained measures of minimum (0.02 ind./km²) and maximum (0.4
706 ind./km²) ermine density, which were determined from estimates of individual home
707 range obtained from radio-tracking data, observations on Bylot Island, and existing
708 literature (Legagneux et al., 2012; Bilodeau, 2013). We associated the minimum and

maximum scores of relative abundance with the minimum and maximum density of individuals, respectively. Ultimately, we calculated the ermine density by linearly interpolating between these two density extremes using the annual index of relative abundance.

713 *Arctic fox*

We estimated the abundance of Arctic foxes in the study area based on their estimated home range size inside and outside the goose colony. We used the data and methodologies outlined in Dulude-de Broin et al. (2023) to estimate home range size. However, here, we did not account for annual variations in lemming density as presented in Dulude-de Broin et al. (2023) in order to obtain mean fox home range. Given that foxes are territorial and exhibit an average spatial overlap with adjacent territories of 18% (Clermont et al., 2021), we converted home range size into individual density using the following formula: $\text{density of individuals} = \frac{2}{0.82 \times \text{home range}}$. We used two as numerator because we assumed each territory was held by a pair of fox, either breeding or non-breeding fox pair, without accounting for potential nomadic or transient individuals. We used values of 12.26 km² to represent the mean home range of foxes within the goose colony and 20.02 km² for foxes outside the goose colony. We estimated the mean density of foxes in each zone of the study area according to the mean proportion of the zone covered by the goose colony. We derived the mean annual proportion of each zone covered by the goose colony from the colony outline between 2010 and 2023. We estimated a mean density of 0.14 individuals/km² for the study area. Previously, the minimum density of foxes in the study area was estimated to be between 0.03 and 0.13 individuals per km² based on camera traps (Royer-Boutin, 2015).

Table 5: Summary of the lowest, highest, mean and standard deviation of the estimated abundance of each vertebrate species in the vertebrate community of the southern plain of Bylot Island (389 km²). In some cases, two independent approaches have been used to estimate the abundance of the same species as a proxy for uncertainty. We provide a qualitative measure of the method quality based on data available, method used for extrapolation (if necessary), and in some cases, from the fit of statistical models to estimate density.

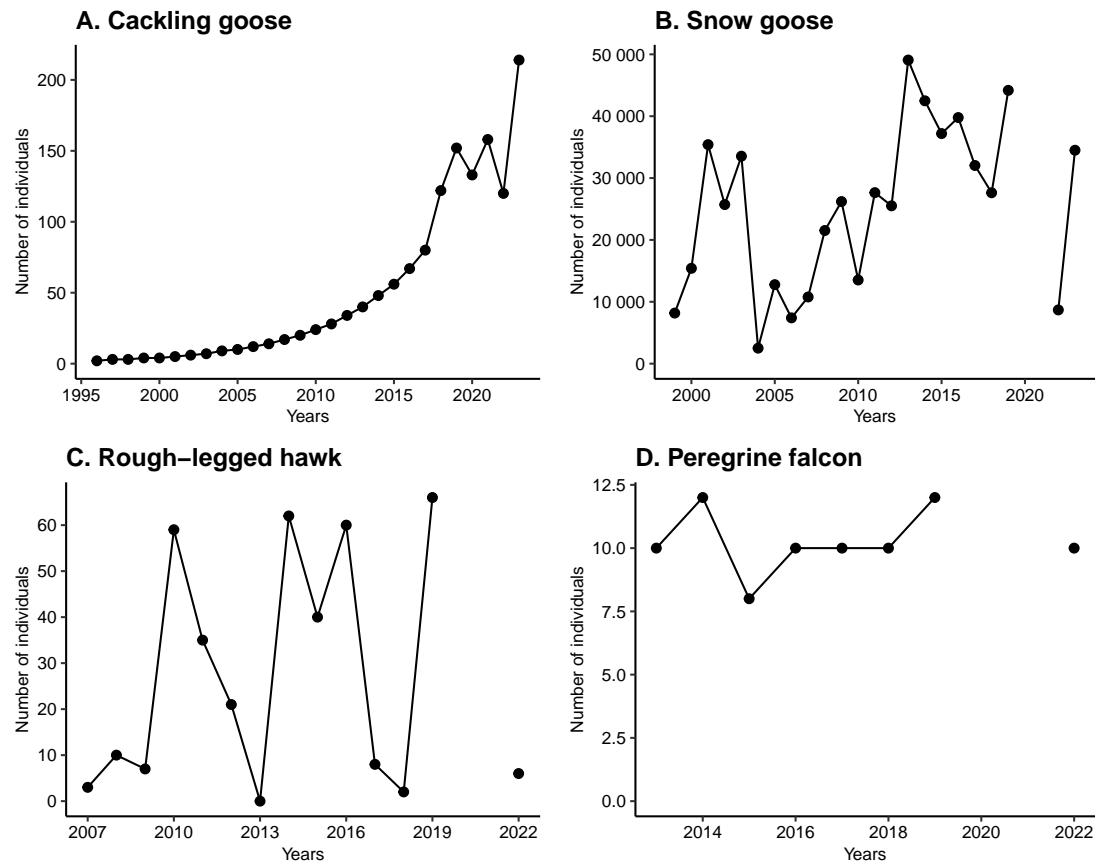
Species	Method	Method quality	Justification	Lowest abundance	Highest abundance	Mean abundance	sd	n
Pacific loon	Intensive study area-wide nest monitoring (389 km ²)	high	No extrapolation	0	6	4	3	4 (2017-2019, 2022)
Red-throated loon	Intensive study area-wide nest monitoring (389 km ²)	high	No extrapolation	42	76	64	15	4 (2017-2019, 2022)
King eider	Intensive, but opportunistic nest monitoring (8 km ²) extrapolated by habitat	very low	Intensive, but opportunistic monitoring at relatively small spatial scale, but does not include potential non-breeding individuals			25		
King eider	Derived from the abundance estimate of red-throated loon using incidental observations	low	Derived from high quality estimate of another species			106		
Long-tailed duck	Intensive, but opportunistic nest monitoring (8 km ²) extrapolated by habitat	very low	Intensive, but opportunistic monitoring at relatively small spatial scale, but does not include potential non-breeding individuals			20		
Long-tailed duck	Derived from the abundance estimate of red-throated loon using incidental observations	low	Derived from high quality estimate of another species			191		
Cackling goose	Extrapolation from exponential model of growth ($R^2=0.74$, $p=0.15$, $n=5$)	moderate	Strong correlation with opportunistic nest monitoring	2	158	31	41	23 (1996-2016, 2020-2021)
Cackling goose	Intensive study area-wide nest monitoring (389 km ²)	high	No extrapolation	80	214	138	50	5 (2017-2019, 2022-2023)
Snow goose	Nest monitoring plots extrapolated to mean goose colony area	moderate	Relatively small sample size and uncertainty on goose colony area	2505	35404	18129	11037	11 (1999-2009)
Snow goose	Intensive study area-wide monitoring based on a combination of methods (transects, point counts and nest monitoring plots) and annual colony outline	high	Multiple independent methods and annual colony outline	8687	49076	31852	12092	12 (2010-2019, 2022-2023)
Tundra swan	Intensive study area-wide nest monitoring (389 km ²)	high	No extrapolation	0	2	1	1	4 (2017-2019, 2022)
Rough-legged hawk	Extrapolation from intensive nest monitoring (111 km ² , $R^2=0.99$, $p<0.0001$, $n=8$)	high	Strong correlation with study area-wide nest density	3	59	22	21	6 (2007-2012)
Rough-legged hawk	Intensive study area-wide nest monitoring (389 km ²)	high	No extrapolation	0	66	30	29	8 (2013-2019, 2022)
Peregrine falcon	Intensive study area-wide nest monitoring (389 km ²)	high	No extrapolation	8	12	10	1	8 (2013-2019, 2022)

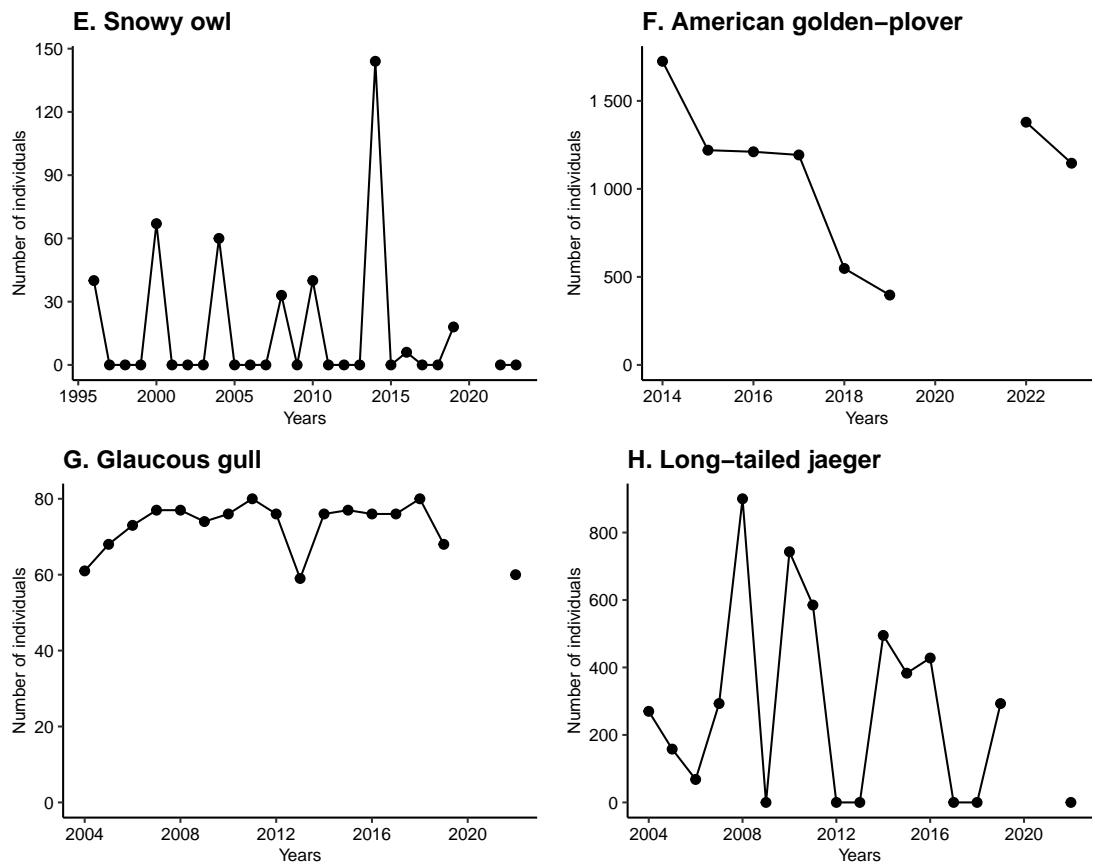
Snowy owl	Extrapolation from intensive nest monitoring (111 km ² , R ² =0.99, p<0.0001, n=10)	high	Strong correlation with study area-wide nest density	0	67	15	24	16 (1996-2011)
Snowy owl	Intensive study area-wide nest monitoring (389 km ²)	high	No extrapolation	0	144	17	45	10 (2012-2019, 2022-2023)
Rock ptarmigan	Intensive, but opportunistic nest monitoring (8 km ²) extrapolated to study area	very low	Intensive, but opportunistic monitoring at relatively small spatial scale and prime nesting habitat not well sampled			24		
Sandhill crane	Extrapolation from intensive nest monitoring (8 km ²) and transect observations (R ² = 0.44 p= 0.32, n=8)	moderate	Uncertain relation with large scale indices			34		
American golden-plover	Distance sampling throughout lowland (313 km ²)	high	Large sample size	397	1725	1102	432	8 (2014-2019, 2022-2023)
Black-bellied plover	Derived from the abundance estimate of American golden-plover using transects observations	low	Derived from high quality estimate of another species			29		
Black-bellied plover	Derived from the abundance estimate of American golden-plover using incidental observations	very low	Derived from high quality estimate of another species, but potentially includes transient migratory individuals			87		
Common Ringed plover	Nest monitoring on the main breeding sites	moderate	Intensive monitoring, but not exhaustive to study area	44	62	55	9	3 (2015-2017)
Ruddy turn-stone	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			40		
Ruddy turn-stone	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			53		
Red knot	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			66		
Red knot	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			233		
Pectoral sandpiper	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			80		
Pectoral sandpiper	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			255		

Baird's sandpiper	Extrapolation from intensive nest monitoring (2 km ²) and transects observations (R ² =0.38, p=0.35, n=8)	moderate	Uncertain relation with large scale indices			2448		
White-rumped sandpiper	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			991		
White-rumped sandpiper	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			1134		
Buff-breasted sandpiper	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			6		
Buff-breasted sandpiper	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			8		
Red phalarope	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			140		
Red phalarope	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			270		
Glaucous gull	Extrapolation from intensive nest monitoring (111 km ² , R ² =0.84, p=0.16, n=4)	high	Strong correlation with study area-wide nest density	59	80	73	6	13 (2004-2016)
Glaucous gull	Intensive study area-wide nest monitoring (389 km ²)	high	No extrapolation	60	80	71	9	4 (2017-2019, 2022)
Long-tailed jaeger	Intensive nest monitoring (33 km ²) extrapolated by habitat	high	Relatively large spatial coverage of sampling	0	900	272	285	17 (2004-2019, 2022)
Parasitic jaeger	Maximum number of individuals banded in a year	low	Based on a single year and potentially not all individuals were captured			17		
Parasitic jaeger	Maximum number of nest found annually during study area-wide opportunistic nest monitoring	very low	Monitoring does not include potential non-breeding individuals			8		
Common raven	Derived from the abundance estimate of glaucous gull using transects observations	very low	Derived from moderate quality estimate of another species, but potential difference in detectability between species			14		
Common raven	Derived from the abundance estimate of glaucous gull using incidental observations	very low	Derived from moderate quality estimate of another species, but potential difference in detectability between species			31		

Horned lark	Derived from the abundance estimate of Lapland longspur using transects observations	low	Derived from moderate quality estimate of another species			362		
Horned lark	Derived from the abundance estimate of Lapland longspur using incidental observations	low	Derived from moderate quality estimate of another species			411		
American pipit	Derived from the abundance estimate of Lapland longspur using transects observations	very low	Derived from moderate quality estimate of another species and prime nesting habitat not sampled			53		
American pipit	Derived from the abundance estimate of Lapland longspur using incidental observations	low	Derived from moderate quality estimate of another species and prime nesting habitat not well sampled			87		
Lapland longspur	Extrapolation from intensive nest monitoring (2 km ²) and transects observations (R ² =0.62, p=0.1, n=8)	moderate	Uncertain relation with large scale indices			7110		
Snow bunting	Derived from the abundance estimate of Lapland longspur using transects observations	very low	Derived from moderate quality estimate of another species and prime nesting habitat not sampled			18		
Snow bunting	Derived from the abundance estimate of Lapland longspur using incidental observations	low	Derived from moderate quality estimate of another species and prime nesting habitat not well sampled			276		
Nearctic brown lemming	Rigorous density estimates at small spatial scale (0.22 km ²) extrapolated by habitat	moderate	Intensive sampling, but small spatial coverage and extrapolation by habitat	0	447630	54043	93530	27 (1995-2019, 2021-2022)
Nearctic collared lemming	Rigorous density estimates at small spatial scale (0.22 km ²) extrapolated by habitat	moderate	Intensive sampling, but small spatial coverage and extrapolation by habitat	0	39302	8128	10334	27 (1995-2019, 2021-2022)
Arctic hare	Derived from the abundance estimate of Arctic fox using incidental observations	very low	Derived from moderate quality estimate of another species, prime nesting habitat not well sampled and difference in detectability between species			6		
Ermine	Indices of relative abundance derived from testimonials converted to abundance using home range size	moderate	Indirect indices and uncertainty on ermine home range size estimates	8	156	40	37	27 (1993-2019)
Arctic fox	Derived from extensive fox home range size studies (n=109)	moderate	Indirect indices, but large sample size			53		

Figure 10: Time series of the estimated annual adult abundance of vertebrate species on the southern plain of Bylot Island (389 km^2). Estimated abundance represents adult individuals, with the exception of lemmings, for which juveniles were also included in the estimate. Time series shorter than 5 years are not presented.





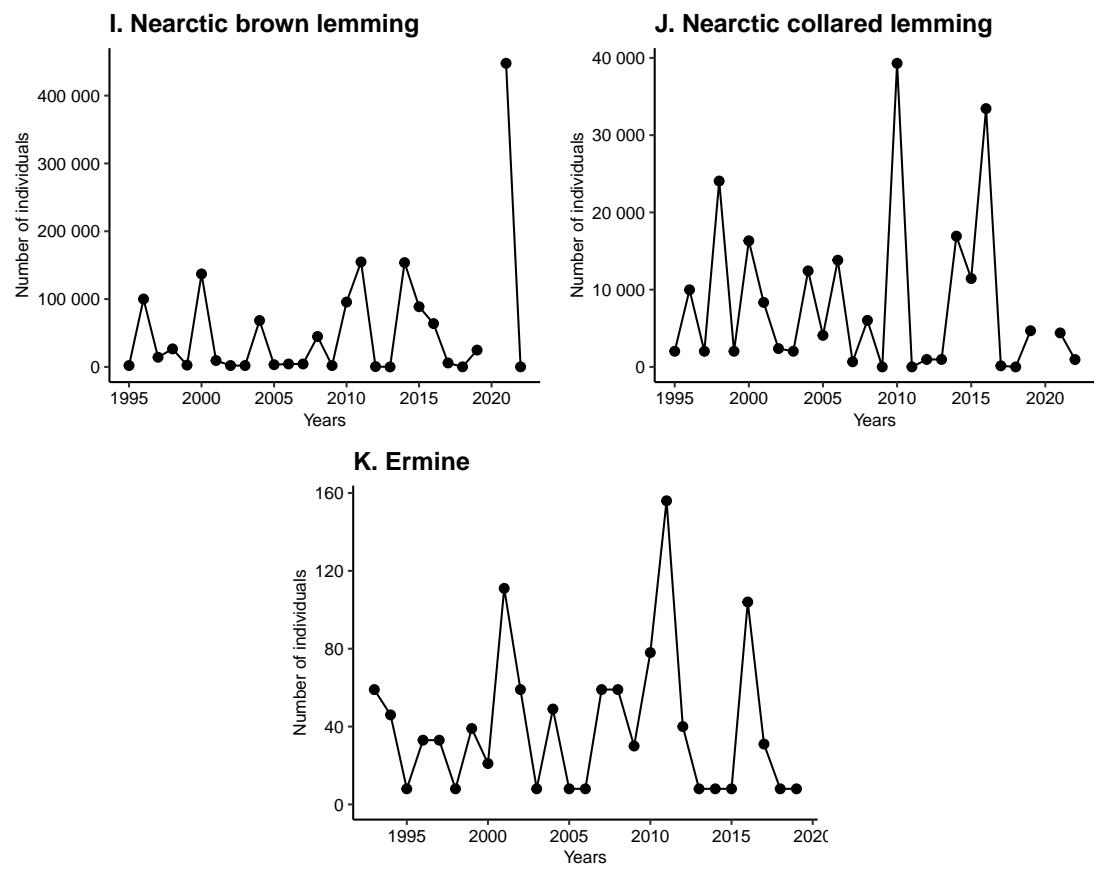


Table 6: Considering the absence of confidence intervals in our abundance estimates, we present below uncertainty intervals on estimated abundance values derived from field expert impressions. The intervals presented represent the minimum and maximum values between which the experts believe the actual abundance values should lie. When annual abundance has been estimated for several years (time series) we present intervals over the minimum and maximum abundance values encountered during the given time series. For other species, the uncertainty interval is estimated on the mean abundance.

Species	Period	Annual abundance (ind.)		
		Lowest	Highest	Mean
Snow goose	1999-2009	[2500-10000]	[35000-60000]	
Snow goose	2010-2019, 2022-2023	[6000-10000]	[45000-60000]	
Snowy owl	1996-2011	0	[50-100]	
Snowy owl	2012-2019, 2022-2023	0	[144-170]	
Glaucous gull	2004-2016	[50-80]	[70-100]	
Glaucous gull	2017-2019, 2022	[60-80]	[80-100]	
Peregrine falcon	2013-2019, 2022	[8-12]	[12-20]	
Rough-legged hawk	2007-2012	[0-8]	[50-90]	
Rough-legged hawk	2013-2019, 2022	[0-4]	[66-86]	
American golden-plover	2014-2019, 2022-2023	[100-500]	[1000-2500]	
Cackling goose	1996-2016, 2020-2021	[2-10]	[58-220]	
Cackling goose	2017-2019, 2022-2023	[80-110]	[214-244]	
Arctic fox	Mean abundance			[30-60]
Nearctic collared lemming	1995-2019, 2021-2022	[100-2000]	[20000-50000]	
Nearctic brown lemming	1995-2019, 2021-2022	[100-2000]	[200000-450000]	
Ermine	1993-2019	[0-10]	[50-156]	
Long-tailed jaeger	2004-2019, 2022	[0-10]	[300-900]	
Red-throated loon	2017-2019, 2022	[42-62]	[76-96]	
Pacific loon	2017-2019, 2022	[0-6]	[6-10]	
Tundra swan	2017-2019, 2022	[0-4]	[2-6]	
Common Ringed plover	2015-2017	[44-60]	[60-85]	
Black-bellied plover	Mean abundance			[6-30]
Lapland longspur	Mean abundance			[7000-10000]
Baird's sandpiper	Mean abundance			[1500-3500]
Sandhill crane	Mean abundance			[15-45]
King eider	Mean abundance			[60-250]
Long-tailed duck	Mean abundance			[80-300]
Rock ptarmigan	Mean abundance			[10-60]
Horned lark	Mean abundance			[200-600]
Ruddy turnstone	Mean abundance			[10-30]
Red phalarope	Mean abundance			[20-80]
Red knot	Mean abundance			[10-30]
White-rumped sandpiper	Mean abundance			[1000-2000]
Buff-breasted sandpiper	Mean abundance			[2-10]
Pectoral sandpiper	Mean abundance			[20-100]
Parasitic jaeger	Mean abundance			[15-50]
Common raven	Mean abundance			[30-75]
American pipit	Mean abundance			[50-300]
Snow bunting	Mean abundance			[100-500]
Arctic hare	Mean abundance			[15-50]

733 **b. Taxonomy and systematics**

734 Bird scientific names were obtained from the IOC World Bird List 14.2 (Gill et al., 2024).
735 Mammal scientific names were obtained from the Mammal species of the world: a tax-
736 onomic and geographic reference (Wilson, 2005). However, we considered here *Mustela*
737 *erminea richardsonii* as *Mustela richardsonii* due to recent genetic analysis (Colella et al.,
738 2021).

739 **c. Permit history**

740 All research involving animals on Bylot Island has been approved by an institutional
741 Animal Care Committee. In 1999, the study area became part of Sirmiliik National Park,
742 managed by Parks Canada. Since then, all research activities in the park have been
743 approved by a Joint Park Management Committee.

744 **d. Project personnel**

745 ***Principal and associated investigators***

746 Gilles Gauthier, Eric Reed, Jean-François Giroux, Dominique Berteaux, Joël Béty,
747 Josée Lefebvre, Dominique Gravel, Jean-François Therrien, Nicolas Lecomte, Do-
748 minique Fauteux, Pierre Legagneux (Gauthier et al., 2024a)

749 ***Students***

750 By combining animal and plant ecology, 24 doctoral theses and 56 master theses have
751 been completed in relation to the Bylot Island South Plain study area (Gauthier
752 et al., 2024a).

753 **Class III. Data set status and accessibility**

754 **A. Status**

755 **1. Latest update**

756 30th September 2024

757 **2. Latest archive date**

758 XXXXXX October 2024

759 **3. Metadata status**

760 XXXXXX October 2024

761 **4. Data verification**

762 The methods used to extract final species abundance estimates were subject to several
763 rounds of revision by the principal investigators.

764 **B. Accessibility**

765 **1. Storage location and medium**

766 The data set is publicly available at <https://datadryad.org/>.

767 Raw data and codes used to extract the presented data set are publicly available at
768 <https://zenodo.org/>.

769 **2. Contact persons**

770 ***Overall project***

771 Joël Béty; *joel_bety@uqar.ca*; 418 723-1986 #1701; 300 allée des Ursulines, Ri-
772 mouski, Québec, Canada, G5L 3A1, Office B-002

773 ***Data and codes***

774 Louis Moisan, *louis.moisan.bio@gmail.com*

⁷⁷⁵ **3. Copyright restrictions**

⁷⁷⁶ None

⁷⁷⁷ **4. Proprietary restrictions**

⁷⁷⁸ **a. Release date**

⁷⁷⁹ None

⁷⁸⁰ **b. Citation**

⁷⁸¹ Please cite this document when using the data.

⁷⁸² **c. Disclaimer**

⁷⁸³ None

⁷⁸⁴ **5. Costs**

⁷⁸⁵ None, the data can be used free of charge.

786 **Class IV. Data structural descriptors**

787 **A. Data set file**

788 **1. Identity**

- 789 a. BYLOT-species_taxonomy.csv
790 b. BYLOT-species_abundance.csv
791 c. BYLOT-species_body_mass.csv
792 d. BYLOT-interannual_variation_nest_density.csv

793

794 **2. Size**

- 795 a. 35 records, not including header row (4.3 kB)
796 b. 271 records, not including header row (34.5 kB)
797 c. 53 records, not including header row (3.5 kB)
798 d. 18 records, not including header row (961 B)

799 **3. Format and storage mode**

800 All files are in a comma-separated value format (.csv).

801 **4. Header information**

802 a. BYLOT-species_taxonomy.csv

803 class; order; family; genus; species_scientific; species_en; species_fr; species_code;
804 functional_group; migratory_status

805 b. BYLOT-species_abundance.csv

806 species_en; year; breeding_status; abundance; method_description; method_quality

807 c. BYLOT-species_body_mass.csv

808 species_en; site; mean_body_mass_g; sample_size; reference

809 d. BYLOT-interannual_variation_nest_density.csv

810 species_en; zone; mean_nest_density_km2; sd_nest_density_km2; number_years

811 **5. Alphanumeric attributes**

812 Mixed

813 **6. Special characters/fields**

814 Unavailable values are indicated by NA.

815 **7. Authentication procedures**

816 Sums of the numeric columns:

817 b. BYLOT-species_abundance.csv: abundance= 2293389

818 c. BYLOT-species_body_mass.csv: body_mass_g= 49617; sample_size= 13902

819 d. BYLOT-interannual_variation_nest_density.csv: mean_nest_density_km2= 19.991;

820 sd_nest_density_km2= 10.539; sample_size_nest_density_km2= 185

821 **B. Variable information**

822 **1. Variable identity**

823 See Table 7

824 **2. Variable definition**

825 See Table 7

826 **3. Units of measurement**

827 See Table 7

Table 7: Summary of variable definition and unit of measurement.

Data file	Variable identity	Variable definition	Units
a.	class	Taxonomic class for birds (Gill et al., 2024) and mammals species (Wilson, 2005).	NA
a.	order	Taxonomic order for birds (Gill et al., 2024) and mammals species (Wilson, 2005).	NA
a.	family	Taxonomic family for birds (Gill et al., 2024) and mammals species (Wilson, 2005).	NA
a.	genus	Taxonomic genus for birds (Gill et al., 2024) and mammals species (Wilson, 2005).	NA
a.	species_scientific	Taxonomic species for birds (Gill et al., 2024) and mammals species (Wilson, 2005). We used <i>Mustela richardsonii</i> instead of <i>Mustela erminea richardsonii</i> due to recent genetic analysis (Colella et al., 2021).	NA
a.	species_en	Common names of species in English.	NA
a.	species_fr	Common names of species in French.	NA
a.	functional_group	Functional group for each species. The classification of species into functional groups is based on Moisan et al. (2023).	NA
a.	migratory_status	Migratory status of each species (i.e., resident, partially migratory or migratory). The classification of species migratory status is based on Gauthier et al., (2011) and Moisan et al. (2023).	NA
b.	species_en	Common names of species in English.	NA
b.	year	Year corresponding to the estimate of annual abundance. If abundance has not been calculated for a given series of years, but rather as a general average, then NA has been assigned.	years
b.	breeding_status	Reproductive status of the individuals.	NA
b.	abundance	Estimate of the annual number of individuals found within the 389 km ² study area located on the southern part of Bylot Island during the breeding season (May to August). This includes both breeding and non-breeding individuals that stay in the study area for a significant period of time, and excludes non-breeding individuals that stop for only a few days during their migration. The estimates only consider adults, with the exception of lemmings, for which no distinction has been made between juveniles and adults.	individuals
b.	method_description	Brief overview of the method used to estimate the species abundance.	NA
b.	method_quality	Qualitative measure of the method quality based on data available, method used for extrapolation (if necessary), and in some cases, from the fit of statistical models to estimate density.	NA
c.	species_en	Common names of species in English.	NA
c.	site	Site where individual body mass measurements were taken.	NA
c.	mean_body_mass_g	Mean individual body mass.	grams
c.	sample_size	Number of individuals measured.	NA
c.	reference	Reference from which estimate of mean body mass were derived.	NA
d.	species_en	Common names of species in English.	NA
d.	zone	Sampled zone of the study area (see figure 2 and 3).	NA
d.	mean_nest_density_km2	Estimate of the mean annual nest density measured within the corresponding zone of the study area.	nests per square kilometer

d.	sd_nest_density_km2	Standard deviation of the annual nest density measured within the corresponding zone of the study area.	nests per square kilometer
d.	number_years	Number of years consider in the calculation of the nest density.	years

828 **4. Data type**

829 **a. Storage type**

830 See Table 8

831 **b. List and definition of variable codes**

832 See Table 8

833 **c. Range for numeric values**

834 See Table 8

835 **d. Missing value codes**

836 Unavailable values are indicated by NA.

837 **e. Number of digits**

838 See Table 8

Table 8: Summary of variable storage type, code definition, range and number of digit.

Data file	Variable identity	Storage type	Definition variable codes	Range	Number digits
a.	class	string	NA	NA	NA
a.	order	string	NA	NA	NA
a.	family	string	NA	NA	NA
a.	genus	string	NA	NA	NA
a.	species_scientific	string	NA	NA	NA
a.	species_en	string	NA	NA	NA
a.	species_fr	string	NA	NA	NA
a.	functional_group	string	NA	NA	NA
a.	migratory_status	string	resident: Individuals performing movements within the study area throughout the annual cycle.; partial migrant: A combination of resident and migratory and/or individuals performing long-distance foraging trips outside the study area during the non-breeding period.; migrant: Individuals performing seasonal and highly synchronous movements between the study area and a distant non-breeding ground.	NA	NA
b.	species_en	string	NA	NA	NA
b.	year	integer	If abundance has not been calculated for a given series of years, but rather as a general average, then NA has been assigned.	1993-2023	0
b.	breeding_status	string	undetermined: Individuals present on the study area during the breeding period (June to August) that might have breed or not.; breeding: Individuals present in the study area during the breeding period (June to August) and having attempted and/or completed breeding.	NA	NA
b.	abundance	integer	NA	0-447630	0
b.	method_description	string	NA	NA	NA
b.	method_quality	string	very low: Sampling might not encompass prime nesting habitat, excludes transient migratory individuals or includes potential non-breeding individuals. If abundance is derived from the abundance estimate of another species based relative abundance, detection probabilities may differ.; low: Abundance is derived from the estimate of another species based on indices of relative abundance.; moderate: Small to intermediate scale sampling with spatial extrapolation.; high: Large scale intensive sampling, with some spatial extrapolation in a few cases.	NA	NA
c.	species_en	string	NA	NA	NA
c.	site	string	bylot: Southern plain of Bylot Island, Nunavut, Canada.; undetermined: Data were not retrieved from original publications.	NA	NA
c.	mean_body_mass_g	integer	NA	21 - 6378	0
c.	sample_size	integer	NA	1 - 6405	0
c.	reference	string	NA	NA	NA

d.	species_en	string	NA	NA	NA
d.	zone	string	qarlikturvik (2x1 km plot): Intensive search plot (2 km2) for Lapland Longspur and Baird's sandpiper nests on the south side of the glacial river in the Qarlikturvik valley.; qarlikturvik (4x2 km plot): Intensive search plot (2 km2) for Sandhill crane, Long-tailed duck, King eider and Rock ptarmigan nests on the south side of the glacial river in the Qarlikturvik valley.; qarlikturvik valley: Intensive search area (33 km2) for long-tailed jaeger nests on the south side of the glacial river in the Qarlikturvik valley.; whole study area: Entire study area (389 km2) located on the southern plain of Bylot Island.	NA	NA
d.	mean_nest_density_km2	numeric	NA	0.001-13.559	3
d.	sd_nest_density_km2	numeric	NA	0.001-5.849	3
d.	number_years	integer	NA	3-17	0

839 **C. Data anomalies: Description of missing data, anomalous data, calibration errors, etc.**

841 If abundance of a given species has not been calculated for a series of years, but rather as
842 a general average, then NA has been assigned as "year".

843 **Class V. Supplemental descriptors**

844 **A. Data acquisition**

845 **1. Data forms or acquisition methods**

846 See Section **2. Experimental or sampling design**

847 **2. Location of completed data forms**

848 Raw data and codes used to extract the data set and the current document are publicly
849 available at <https://zenodo.org/>.

850 **3. Data entry verification procedures**

851 The methods used to extract final species abundance estimates were subject to several
852 rounds of revision by the authors.

853 **B. Quality assurance/quality control procedures**

854 Final abundance estimate were revised by the authors.

855 **C. Computer programs and data-processing algorithms**

856 **1. Program**

857 R version 4.3.2 (2023-10-31)

858 **2. Operating system**

859 Data preparation was performed on x86_64-pc-linux-gnu (64-bit) with Ubuntu 22.04.3
860 LTS

861 **3. Packages**

862 dplyr (Wickham et al., 2023a), tidyR (Wickham et al., 2024), sf (Pebesma et al., 2018),
863 stringr (Wickham, 2023), xtable (Dahl et al., 2019), Distance (?), ggplot2 (Wickham,
864 2016), lme4 (Bates et al., 2015), AICcmodavg (Mazerolle, 2023), scales(Wickham et al.,
865 2023b), ggmap (Kahle and Wickham, 2013)

866 **4. Codes**

867 Raw data and codes used to extract the presented data set are publicly available at
868 <https://zenodo.org/>.

869 **D. Archiving**

870 **1. Archival procedures**

871 Data are publicly available at <https://datadryad.org/>.

872 **2. Redundant archival sites**

873 None

874 **E. Publications and results**

875 The presented estimates of species abundance have not been integrated in publications
876 to date. Previous estimates of species abundance on the souther plain of Bylot Island
877 were presented by Legagneux et al. (2012), however, the temporal series presented here
878 is longer, the methods are more refined and the taxonomic resolution is higher.

879 **F. History of data set usage**

880 **1. Data request history**

881 None

882 **2. Data set update history**

883 None

⁸⁸⁴ **3. Review history**

⁸⁸⁵ None

⁸⁸⁶ **4. Questions and comments from secondary users**

⁸⁸⁷ None

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