

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

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**25 Open Research statement:**

**26** The complete data set will be published as supporting information should the  
**27** manuscript be accepted for publication. The data set, raw data, codes and metadata  
**28** document are also archived in Dryad: <https://doi.org/10.5061/dryad.44j0zpcnt>.

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).

45      Modeling food webs requires adjusting trophic flows based on the functional responses  
46      of species, which necessitates time series data on the abundance of all species within  
47      a community. However, determining the abundance of all species within a community  
48      is rarely achievable. Consequently, empirical community models often reduce taxonomic  
49      resolution by grouping species into large functional or taxonomic categories. Additionally,  
50      food webs consist of species with varying body sizes depending on their trophic level,  
51      with top-level species often being highly mobile and having large home ranges (McCann  
52      et al., 2005). Therefore, community models must use landscape-wide estimates of species  
53      abundance to accurately represent trophic fluxes. Due to these constraints, empirical  
54      datasets with high taxonomic resolution that cover entire communities at broad spatial  
55      and temporal scales are rare and often include incomplete or rough estimates.

56      The composition of ecological communities is influenced by various factors acting at dif-  
57      ferent temporal and spatial scales, leading to noisy data and emphasizing the need for  
58      long-term data sets (Magurran et al., 2010; Lindenmayer et al., 2012). Species abun-  
59      dances are influenced by stochastic effects (Hubbell, 2001), environmental changes (e.g.,  
60      climate warming), and species interactions, contributing to data variability. For instance,  
61      the composition of a community could be driven simultaneously by intra-annual seasonal  
62      variations, multi-year cyclic variations (e.g., El Niño) and slow but directional long-term  
63      variations in the environment (Brown and Heske, 1990; Snyder and Tartowski, 2006).  
64      Therefore, long-term data series are required to untangle the relative effects of diverse  
65      abiotic and biotic factors on community composition (Magurran et al., 2010; Lindenmayer

66 et al., 2012).

67 Arctic environments are highly valuable systems for studying community structure and  
68 dynamics due to their relatively low species richness (Payer et al., 2013; Legagneux et al.,  
69 2014). However, logistical challenges in the Arctic limit the number of long-term bio-  
70 diversity monitoring programs. Hence, the small number of Arctic communities with  
71 long-term monitoring serve as highly valuable sites for holistic and empirical community  
72 studies. Datasets on terrestrial communities are notably scarce, and this scarcity extends  
73 to Arctic communities as well (Ims et al., 2013).

74 The south plain of Bylot Island in the Canadian High Arctic (**Figure 1**) hosts one of the  
75 longest and most intensive vertebrate monitoring programs in the High-Arctic (Gauthier  
76 et al., 2024b). Monitoring on Bylot Island began in 1989 with a focus on the snow goose  
77 and it gradually expanded to other species over time. The program currently encompasses  
78 all vertebrate species in the community that have a significant influence on the food web  
79 dynamics (Gauthier et al., 2011; Legagneux et al., 2012), with continuous monitoring  
80 spanning more than a decade (Gauthier et al., 2024b). Monitoring is also conducted at  
81 multiple spatial scales, including intensive and systematic observations conducted across  
82 a landscape spanning approximately 400 km<sup>2</sup>. This approach allows the scaling of local  
83 density measurements to the landscape level when required and facilitates the estimation  
84 of abundance for less common and rare species.

85 Previous work based on the tundra community of Bylot Island has already produced  
86 several influential papers (Gauthier et al., 2011; Legagneux et al., 2012, 2014; Hutchison  
87 et al., 2020; Duchesne et al., 2021; Gauthier et al., 2024a). These studies showed that  
88 tundra communities may experience stronger top-down regulation than bottom-up reg-  
89 ulation (Legagneux et al., 2012, 2014). They also revealed a heterogeneous response of  
90 trophic levels to climate warming (Gauthier et al., 2013) and highlighted the effects of  
91 indirect trophic interactions on the occurrence of species across the landscape (Duchesne  
92 et al., 2021). However, those earlier papers were built on data from relatively short time  
93 series, they were not always scaled at the landscape level, and some species or functional  
94 groups were lacking abundance estimates. With over a decade of additional community-  
95 wide monitoring compared to earlier studies, our goal is to synthesize and upscale the  
96 data collected on the Bylot Island community since the 1990s to the landscape level. This  
97 synthesis aims to provide readily accessible annual time series (or mean values in some  
98 cases) of abundance and biomass for all vertebrate species in a tundra landscape, covering  
99 approximately 400 km<sup>2</sup>.

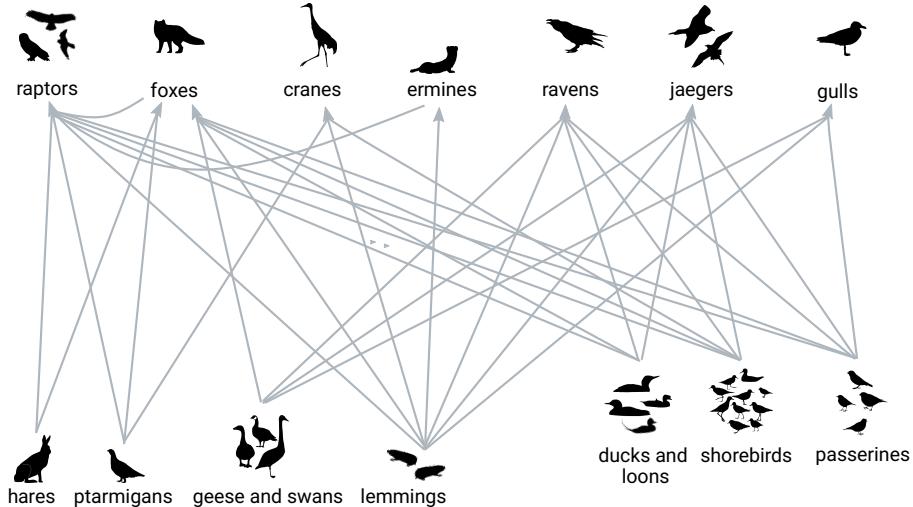


Figure 1: Synthetic vertebrate food web of the south plain of Bylot Island.

100

## Objective

101 Our main objective is to provide readily accessible, long-term time series of annual abun-  
 102 dances of all vertebrate species within the Arctic terrestrial community of Bylot Island  
 103 during the breeding season (May to August). This includes both breeding and non-  
 104 breeding individuals that remain in the study area for a significant period of time (e.g.,  
 105 territorial breeding or non-breeding foxes), and excludes non-breeding individuals that  
 106 stop only briefly during migration (e.g., shorebirds using Bylot Island for a short stopover).  
 107 We focus on the breeding season here due to the absence of monitoring during the non-  
 108 breeding season; however, we note that ecological dynamics during the non-breeding pe-  
 109 riod, for both resident (Hutchison et al., 2020) and migratory species (Moisan et al., 2023),  
 110 can influence the food web during the breeding season. We focus on adults, except for  
 111 lemmings for which we have not distinguished between juveniles and adults. Our focus  
 112 extends to estimating abundances at the landscape scale, enabling the study of commu-  
 113 nity and ecosystem dynamics, trophic interactions and the impacts of global changes on  
 114 high-latitude environments. Additionally, we aim to provide the average body mass for  
 115 each species in the community, enabling the conversion of abundances into biomasses.

<sup>116</sup> **Class I. Data Set Descriptors**

<sup>117</sup> **A. Data set identity**

<sup>118</sup> Long-term abundance time-series of the High Arctic terrestrial vertebrate community of  
<sup>119</sup> Bylot Island, Nunavut

<sup>120</sup> **B. Data set identification codes**

<sup>121</sup> BYLOT-species\_taxonomy.csv  
<sup>122</sup> BYLOT-species\_abundance.csv  
<sup>123</sup> BYLOT-species\_body\_mass.csv  
<sup>124</sup> BYLOT-interannual\_variation\_nest\_density.csv  
<sup>125</sup>

<sup>126</sup> **C. Data set description**

<sup>127</sup> **1. Originators**

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<sup>141</sup>

<sup>142</sup> **2. Abstract**

<sup>143</sup> Arctic ecosystems present unique opportunities for community-wide monitoring, in part  
<sup>144</sup> due to their relatively low species richness. However, conducting research in these remote  
<sup>145</sup> environments poses significant logistical challenges, resulting in long-term monitoring be-

<sup>146</sup> ing exceedingly rare. Here, we focus on the long-term, intensive ecological monitoring  
<sup>147</sup> efforts conducted on the south plain of Bylot Island (almost 400 km<sup>2</sup>, Nunavut, Canada),  
<sup>148</sup> which has generated a remarkable dataset spanning up to 30 years, a rarity in tundra  
<sup>149</sup> ecosystems. Our goal is to synthesize this dataset and upscale vertebrate abundance data  
<sup>150</sup> at the landscape level, a prerequisite to conduct community-level analyses. We have stan-  
<sup>151</sup> dardized data obtained with different field methods to provide readily usable long-term  
<sup>152</sup> time series of abundance for 35 vertebrate species (30 birds and 5 mammals) present  
<sup>153</sup> in the study system. Monitoring data includes intensive capture-mark-recapture density  
<sup>154</sup> estimates of lemmings on trapping grids, systematic or opportunistic nest monitoring con-  
<sup>155</sup> ducted across the entire study area or within specific plots for all bird species, transects of  
<sup>156</sup> vertebrate counts distributed throughout the study area, daily incidental observations of  
<sup>157</sup> vertebrates and satellite tracking of fox movements. Annual abundance of species was es-  
<sup>158</sup> timated at the landscape level, accounting for spatial variations. Furthermore, we provide  
<sup>159</sup> body masses for each species, derived from empirical onsite measurements for 18 species  
<sup>160</sup> and from the literature for the remaining species. Body mass is essential to convert species  
<sup>161</sup> abundance into biomass for studies of trophic fluxes and ecosystem processes. Our dataset  
<sup>162</sup> provides a unique opportunity for holistic empirical studies of ecological communities, al-  
<sup>163</sup> lowing a deeper understanding of community structure and dynamics. Considering that  
<sup>164</sup> the study site is a pristine and protected area that has experienced minimal anthropogenic  
<sup>165</sup> impact, it can also provide an ideal baseline for investigating the impacts of global changes  
<sup>166</sup> on high-latitude terrestrial ecosystems.

## <sup>167</sup> D. Key words/phrases

<sup>168</sup> Arctic tundra, Biodiversity monitoring, Bylot Island, Canadian Arctic, Community com-  
<sup>169</sup> position, Community structure, Food web, Long-term monitoring, Species abundance,  
<sup>170</sup> Species biomass, Species body mass

<sup>171</sup> **Class II. Research origin descriptors**

<sup>172</sup> **A. Overall project description**

<sup>173</sup> **1. Identity**

<sup>174</sup> Structure and functioning of Arctic terrestrial ecosystems

<sup>175</sup> **2. Originators**

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<sup>189</sup>

<sup>190</sup> **3. Period of study**

<sup>191</sup> 1989 - continuing

<sup>192</sup> **4. Objectives**

- <sup>193</sup> i) Develop models for the Arctic tundra food web that incorporate seasonality, migratory  
<sup>194</sup> connectivity and interactions with marine and southern ecosystems.
- <sup>195</sup> ii) Predict the effects of global changes on Arctic terrestrial food webs.

<sup>196</sup> **5. Abstract**

<sup>197</sup> Arctic terrestrial communities, characterized by relatively low species richness, offer unique  
<sup>198</sup> opportunities for studying ecological patterns and dynamics in simplified systems. Despite  
<sup>199</sup> their relative simplicity, these ecosystems feature complex species interactions, extreme

200 seasonal environmental changes, and a significant proportion of migratory species, making  
201 it difficult to identify the key factors shaping their structure and functioning. As global  
202 environmental changes accelerate, it is essential to understand the interacting processes  
203 driving these communities to eventually predict future impacts on Arctic ecosystems. Our  
204 research combines long-term biodiversity monitoring, a community-wide approach, and  
205 food web modeling to address these challenges.

206 **6. Sources of funding**

207 Natural Sciences and Engineering Research Council of Canada, Fonds Québécois de  
208 Recherche Nature et Technologies, Centre d'études nordiques, Natural Resources Canada  
209 (Polar Continental Shelf Program), Network of Centers of Excellence Canada (Arctic-  
210 Net), Canada First Research Excellence Fund (Sentinel North Program), Polar Knowledge  
211 Canada, Environment and Climate Change Canada, Canada Foundation for Innovation,  
212 Parks Canada Agency, International Polar Year program of the Government of Canada,  
213 Crown-Indigenous Relations and Northern Affairs Canada (Northern Contaminant Pro-  
214 gram), Ducks Unlimited Canada, Kenneth M. Molson Foundation (Kenneth M. Molson  
215 Foundation's donation for wildlife research, conservation, and habitat), Garfield Weston  
216 Foundation, First Air—Canadian North, Nunavut Wildlife Management Board, Uni-  
217 versité Laval, Université du Québec à Rimouski

<sup>218</sup> **B. Specific subproject description**

<sup>219</sup> **1. Site description**

<sup>220</sup> **a. Site type**

<sup>221</sup> The study area ( $389 \text{ km}^2$ ) represents a relatively productive tundra ecosystem compared  
<sup>222</sup> to other sites at similar latitudes in the eastern Canadian High Arctic (Gauthier et al.,  
<sup>223</sup> 2024b). An important biological characteristic of the area is the presence of a large  
<sup>224</sup> snow goose (scientific names of most vertebrate species can be found in **Table 1**) colony  
<sup>225</sup> of around 25 000 breeding pairs (Reed et al., 2002) spanning approximately  $70 \text{ km}^2$ .  
<sup>226</sup> The vertebrate community within the study area comprises 30 bird species, with 29 of  
<sup>227</sup> them being migratory or partially migratory, along with 5 mammal species (**Table 1**;  
<sup>228</sup> Moisan et al. (2023); Gauthier et al. (2024b)). The study area experiences significant  
<sup>229</sup> temporal fluctuations in the population of small mammals (lemmings), which in turn  
<sup>230</sup> impact the occurrence and abundance of their avian and mammalian predators such as  
<sup>231</sup> snowy owls, rough-legged hawks, long-tailed jaegers, ermines and Arctic foxes (Legagneux  
<sup>232</sup> et al., 2012; Duchesne et al., 2021). We exclude occasional visitors, namely: i) species  
<sup>233</sup> lacking confirmed breeding occurrences on the study site, ii) species observed solely within  
<sup>234</sup> a single year, and iii) species primarily breeding and foraging in nearby marine or coastal  
<sup>235</sup> habitats (Moisan et al., 2023). The case of the red fox (*Vulpes vulpes*) was ambiguous.  
<sup>236</sup> While the presence of breeding pairs has been confirmed in the study area (Lai et al.,  
<sup>237</sup> 2022), the extent of population establishment remains unclear and sightings are rare.  
<sup>238</sup> Therefore, we decided to exclude this species.

Table 1: Species of the vertebrate community of Bylot Island and their 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>	American ermine	resident
Foxes	<i>Vulpes lagopus</i>	Arctic fox	partial migrant

## b. Geography

Our 389 km<sup>2</sup> 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 detailed description of the geology of the study area.

249           **e. Hydrology**

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

253           **f. Site history**

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

255           **g. Climate**

256   The mean annual air temperature since 1995 is -14.4°C, with mean seasonal temperature  
257   of 4.7°C in summer (June to August), -11°C in fall (September to November), -32.4°C in  
258   winter (December to February) and -19.4°C in spring (March to May; Centre of North-  
259   ern Studies and Laval University (2019)). The climate of the southern plain of Bylot  
260   Island is generally milder than that of the surrounding latitudes, as the plain present a  
261   southern exposure and the mountains to the north protect the plain from cold northerly  
262   winds (Gauthier et al., 2024b). In summer, the study area received on average 77.5 mm of  
263   precipitation. On average, snow depth is relatively thin in December, January, and Febru-  
264   ary (~15 cm) and increases from March, reaching its peak in late May (~27 cm) before  
265   decreasing until mid-June (~3 cm) (Centre of Northern Studies and Laval University,  
266   2019). The study area typically remains free of snow from mid-June to late September  
267   (Gauthier et al., 2013) with an average of 102 frost-free days annually (Centre of Northern  
268   Studies and Laval University, 2019). From September to December, snow depth typically  
269   increases continuously (Centre of Northern Studies and Laval University, 2019). The sum-  
270   mary statistics presented here on the climate of the South Plain of Bylot Island are de-  
271   rived from automatic weather stations located in the Qarlikturvik Valley, which have been  
272   recording data on air temperature, thawing degree days, frost-free days, summer precipi-  
273   tation, snow thickness, and wind speed since 1994 (Centre of Northern Studies and Laval  
274   University, 2019). Raw data from these weather stations are publicly accessible at <https://nordicana.cen.ulaval.ca/fr/publication.php?doi=45039SL-EE76C1BDAADC4890>.

276        **2. Experimental or sampling design**

277        Research installations on Bylot Island are typically active from mid-May to the 20th of  
278        August due to logistical constraints. The period therefore covers the arrival of migratory  
279        species and the entire breeding cycle for most species. However, the sampling period does  
280        not encompass the departure of some species (e.g., xxxxx).

281        **a. Permanent plots**

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

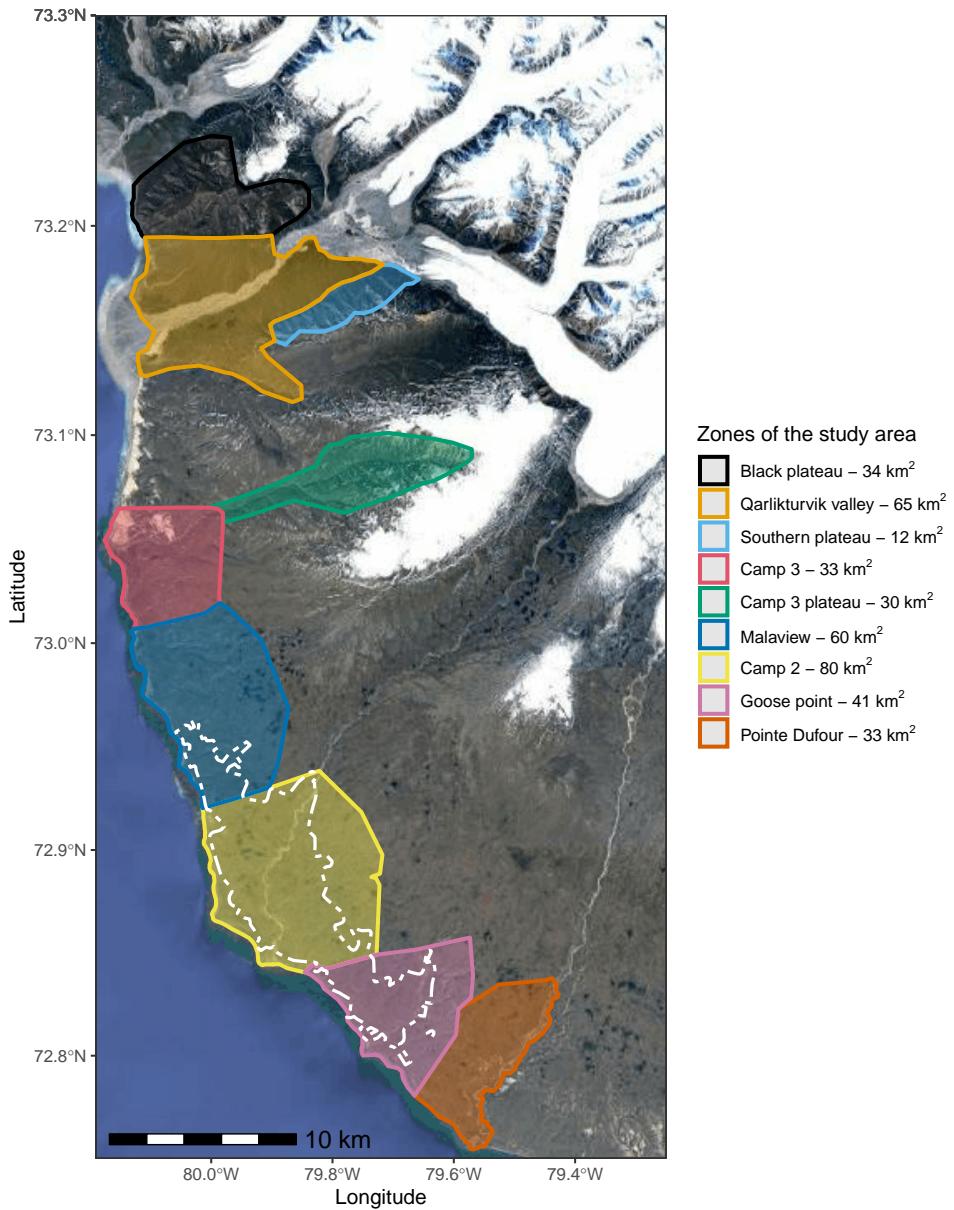


Figure 2: Map of the different zones (colored polygons) of the 389 km<sup>2</sup> study area located on the south plain of Bylot Island, Nunavut Canada. The perimeter of the snow goose colony is delineated by white dashes; we highlighted the perimeter in 2017 since it represents the average colony area (74 km<sup>2</sup>).

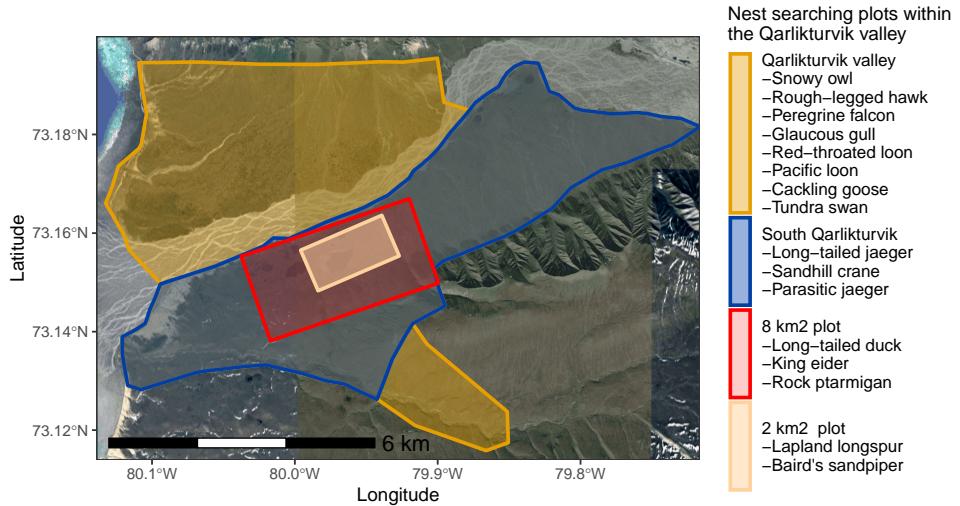


Figure 3: Intensive nests searching plots within the Qarlikturvik valley.

298

## b. Avian nest monitoring

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

306

### ***Pacific loon, red-throated loon, cackling goose, tundra swan and glau- 307 couous gull***

308

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

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
Pacific loon	Qarlikturvik valley	2004-2019, 2022	(17)	systematic
Pacific loon	Whole study area	2017-2019, 2022	(4)	systematic
Red-throated loon	Qarlikturvik valley	2004-2019, 2022	(17)	systematic
Red-throated loon	Whole study area	2017-2019, 2022	(4)	systematic
King eider	Qarlikturvik (8 km <sup>2</sup> plot)	2005-2019, 2022	(16)	opportunistic
Long-tailed duck	Qarlikturvik (8 km <sup>2</sup> plot)	2005-2019, 2022	(16)	opportunistic
Cackling goose	Qarlikturvik valley	2004-2019, 2022-2023	(18)	systematic
Cackling goose	Whole study area	2017-2019, 2022-2023	(5)	systematic
Snow goose	Camp 2	1999-2019, 2022-2023	(23)	systematic
Tundra swan	Qarlikturvik valley	2004-2019, 2022	(17)	systematic
Tundra swan	Whole study area	2017-2019, 2022	(4)	systematic
Rough-legged hawk	Qarlik., Black & South plat.	2007-2019, 2022	(15)	systematic
Rough-legged hawk	Whole study area	2013-2019, 2022	(8)	systematic
Peregrine falcon	Qarlik., Black & South plat.	2007-2019, 2022	(15)	systematic
Peregrine falcon	Whole study area	2013-2019, 2022	(8)	systematic
Snowy owl	Qarlik., Black & South plat.	1996-2019, 2022-2023	(26)	systematic
Snowy owl	Whole study area	2012-2019, 2022-2023	(10)	systematic
Rock ptarmigan	Qarlikturvik (8 km <sup>2</sup> plot)	2005-2019, 2022	(16)	opportunistic
Sandhill crane	South Qarlikturvik valley	2004-2019, 2022	(17)	opportunistic
Common-ringed plover	Whole study area	2015-2017	(3)	systematic
Baird's sandpiper	Qarlikturvik (2 km <sup>2</sup> plot)	2005-2019, 2022-2023	(17)	systematic
Glaucoous gull	Qarlikturvik valley	2004-2019, 2022	(17)	systematic
Glaucoous gull	Whole study area	2017-2019, 2022	(4)	systematic
Long-tailed jaeger	South Qarlikturvik valley	2004-2019, 2022	(17)	systematic
Parasitic jaeger	South Qarlikturvik valley	2004-2019, 2022	(17)	systematic
Parasitic jaeger	Whole study area	2009-2019, 2022	(12)	opportunistic
Common raven	Whole study area	2013-2019, 2022	(8)	systematic
Lapland longspur	Qarlikturvik (2 km <sup>2</sup> plot)	2005-2019, 2022-2023	(17)	systematic
Nearctic brown lemming	Qarlikturvik (trapping grids)	1995-2019, 2021-2022	(27)	systematic
Nearctic collared lemming	Qarlikturvik (trapping grids)	1995-2019, 2021-2022	(27)	systematic
American ermine	Whole study area	1993-2019	(27)	opportunistic
Arctic fox	Whole study area	2008-2016	(9)	systematic

319 confident that nest detection probability was high for these species given the open  
 320 landscape.

### 321 *Snow goose*

322 Snow geese nest in a large colony in the study area (**Figure 2**), but also in small ag-  
 323gregations distributed on the island, especially in years when snowy owls are nesting  
 324 (Lepage et al., 1996; Reed et al., 2002). Since 1994, goose nests were systematically  
 325 monitored on a 0.24 km<sup>2</sup> wetland at the center of the colony. Since 1999, nests were  
 326 also systematically monitored on a variable number of plots, measuring 0.01 km<sup>2</sup> in  
 327 wetland habitat and 0.04 km<sup>2</sup> in mesic habitat, randomly distributed throughout  
 328 the goose colony (Gauthier and Cadieux, 2020b). The total area covered by the  
 329 randomly distributed plots averaged  $0.79 \pm 0.37$  km<sup>2</sup> per year. From 2010 onwards,  
 330 except in 2020 and 2021, we opportunistically traced sections of the approximate  
 331 boundary of the goose colony using a GPS receiver aboard a helicopter, taking ad-  
 332 vantage of regular flights across the study area whenever the flight path passed over  
 333 the colony border (Duchesne et al., 2021).

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

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

349           ***Snowy owl***

350 Snowy owls predominantly nest in habitats similar to other raptors, favoring ridges  
351 in mountainous or hilly regions, although they can occasionally be found nesting  
352 on mounds in lowland areas (Seyer et al., 2020). Since 1996, searches for snowy  
353 owl nests have been conducted concurrently with searches for other raptor nests  
354 in the Black and Southern plateaus, as well as during searches for jaeger nests  
355 on the southern side of the glacial river in the Qarlikturvik Valley. Additionally,  
356 since 2012, nests have been recorded across the entire study area by scanning the  
357 landscape from hills and ridges during the nesting period (Duchesne et al., 2021).  
358 Given that snowy owls nest on elevated mounds, exhibit contrasting colors with the  
359 landscape, emit alarm calls, and display defensive behaviors, active nesting sites  
360 have a high probability of detection.

361           ***Long-tailed jaeger, parasitic jaeger and sandhill cranes***

362 Since 2004, observers have walked parallel transects spaced 400 meters apart, cov-  
363 ering the entire southern side of the glacial river in the Qarlikturvik Valley ( $33 \text{ km}^2$ ;  
364 **Figure 3**), during the nesting period. The aim of those transects was to record nests  
365 of long-tailed jaegers, parasitic jaegers, and sandhill cranes. Observers listened for  
366 alarm calls to detect territorial birds, and then located nests by observing the birds  
367 returning to their nests from elevated vantage points. We consider the sampling to  
368 be systematic for long-tailed and parasitic jaeger, since those species tend to leave  
369 their nest relatively far from the observer to perform mobbing behavior, and thus  
370 increasing their detection probability. We consider the sampling to be opportunistic  
371 for sandhill cranes, as individuals display defensive behaviors only at relatively close

372 distances from their nests (see opportunistic nest monitoring below).

373 ***Common-ringed plover***

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

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

382 Since 2005, nests of passerines and sandpipers have been extensively monitored  
383 across an 8 km<sup>2</sup> (4x2 km) area in the Qarlikturvik valley. We considered the sam-  
384 pling to be most systematic within a core 2 km<sup>2</sup> (2x1 km) plot in this area (**Figure**  
385 **3**). We excluded relatively large water bodies (0.26 km<sup>2</sup>) to calculate nest density  
386 in the plot due to the presence of a large lake, which leaves an area of 1.74 km<sup>2</sup>  
387 available for nesting. An observer conducted systematic searches of this plot during  
388 the entire breeding season to locate and monitor as many passerine and shorebird  
389 nests as possible. Assuming the observer can detect all nests within a 5 or 10 meter  
390 radius, analysis of daily GPS tracks shows that the observer covered a minimum  
391 area of  $0.72 \pm 0.12$  (5 m) or  $1.09 \pm 0.17$  km<sup>2</sup> (10 m) of the core area annually (n=  
392 3 years). Additionally, several other observers conducting related field work in the  
393 same zone reported all passerine and shorebird nests found opportunistically.

394 ***Opportunistic nest monitoring***

395 Since 2005, we also noted the nest location of any other bird species encountered  
396 opportunistically during travel or while carrying out the protocols for the previously  
397 described species. The sampling was particularly intensive in the defined 8 km<sup>2</sup> area  
398 in the Qarlikturvik valley. The accuracy of nest monitoring in this plot thus depends  
399 on the species detection probability. We are confident to obtain a realistic order of  
400 magnitude for the number of nests present for relatively large bodied species in  
401 this area (i.e., sandhill crane, rock ptarmigan, long-tailed duck and king eider).  
402 Additionally, starting in 2009, a significant effort has been made each year, though  
403 not systematically, to visit known nesting territories of parasitic jaegers throughout  
404 the study area.

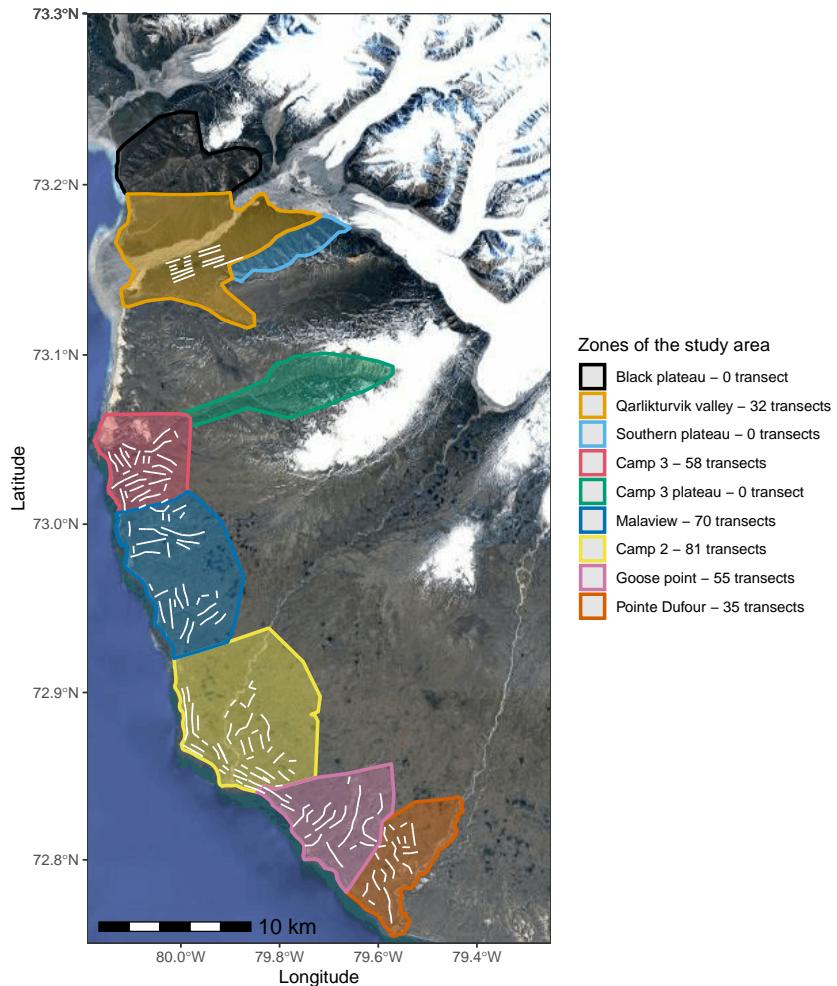


Figure 4: Spatial distribution of vertebrate count transects (white lines) on the south plain of Bylot Island (146 to 320 transects per year).

### 405 c. Observation of individuals

#### 406 *Vertebrate count transects*

407 From 2010 to 2023, observers walked 500-meter linear transects where all vertebrate  
 408 individuals observed within 150 meters on either side were counted (146 to 320  
 409 transects per year). Transects were distributed across all lowland zones of the study  
 410 area, typically in mesic habitat, and were carried out during the nesting period  
 411 (between June 21 and July 14; Lamarre et al. (2017); Duchesne et al. (2021); **Figure**  
 412 **4**). As a calibration, all observers were trained with a rangefinder to estimate  
 413 a distance of 150 m before starting data collection. Furthermore, specifically for  
 414 American golden-plovers, we measured the distance of each observed individual to  
 415 the transect path.

417      ***Snow goose point count***

418      At the start, middle, and end of each vertebrate count transect, a point count with a  
419      radius of 125 meters was conducted to determine the number of snow goose breeding  
420      pairs. On average,  $613 \pm 142$  point counts were sampled each year, covering an area  
421      of  $30 \pm 7 \text{ km}^2$ . Observers were trained with a rangefinder to estimate a distance of  
422      125 m before starting data collection.

423      ***Incidental observations***

424      Since 2007, observers have recorded all vertebrate species observed opportunistically  
425      during field work and tallied the total number of individuals at the end of each day  
426      (Gauthier and Cadieux, 2020a; Gauthier et al., 2024b). Observations are made  
427      from mid-May to the late August, but the effort is highest during the late June  
428      and early July. The number of hours spent in the field served as a proxy for the  
429      sampling effort. We used the number of individuals observed per hour spent in the  
430      field calculated by Gauthier et al. (2024b) as an index of relative abundance for  
431      each species. Moreover, we separated observations made in lowland from those in  
432      upland zones to have a relative abundance of each species in each of these two broad  
433      categories (**Table 3**). Given that incidental observations lacked georeferencing, we  
434      opted to extract upland observations by focusing on observations made during visits  
435      to rough-legged hawk nests, which are mostly located in uplands.

Table 3: 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., Qarlikturvik 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

438            ***Testimonials of ermine sightings***

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

449            **d. Capture of individuals**

450            ***Lemming trapping***

451            Since 2004, Nearctic brown and collared lemmings were live-trapped 3 times during  
452            the summer (mid-June, mid-July, and mid-August) in two 11 ha grids. Each grid is  
453            made of 144 traps separated by 30 m according to a cartesian plane, one in mesic  
454            habitat and the other in wet habitat, located in the Qarlikturvik valley (Fauteux  
455            et al., 2015; Gauthier, 2020). Density of each species was estimated at each occa-  
456            sion using spatially explicit capture-recapture methods (see Fauteux et al. (2015)  
457            for details). From 1995 to 2016 snap-trapping was performed once a year (mid-  
458            July) along 2 groups of transects located in the same habitats than the trapping  
459            grids (Gruyer et al., 2008). Index of abundance derived from snap-trapping were  
460            transformed in density estimates in each habitat for the period 1995-2003 using the  
461            equation provided by Fauteux et al. (2018) based on the period of overlap between  
462            the two sampling methods (2004 to 2016).

464            ***Arctic fox movement tracking***

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

473            ***Parasitic jaeger banding***

474 In 2009, a significant effort was made to band as many parasitic jaegers as possible  
475 within the study area. This effort resulted in the banding of 17 adult individuals  
476 (Therrien and Gauthier, unpublished data).

477 **e. Species body mass**

478 All vertebrate individuals captured for marking purposes were systematically weighed:  
479 snow goose (G. Gauthier, M.-C. Cadieux and J. Lefebvre, unpublished data), snowy  
480 owl (Therrien et al., 2012; Robillard et al., 2018), American-golden plovers (Lamarre  
481 et al., 2021), common-ringed plovers (Léandri-Breton et al., 2019), other shorebirds (J.  
482 Béty, unpublished data), glaucous gulls (Gauthier et al., 2015), long-tailed jaeger (Seyer  
483 et al., 2019), parasitic jaegers (J.-F. Therrien and G. Gauthier, unpublished data), Lap-  
484 land longspurs (J. Béty and G. Gauthier, unpublished data), lemmings (Gauthier, 2020),  
485 American ermine (Bilodeau and Bolduc, unpublished data) and Arctic foxes (Lai et al.,  
486 2015). When not available, we extracted mean body mass from the literature (Wilman  
487 et al., 2014).

488        **3. Research methods**

489        **a. Field/laboratory**

490        We estimated the abundance of breeding individuals for most species, but there were  
491        a few exceptions. For common ravens, parasitic jaegers, long-tailed ducks, and king  
492        eiders, we suspect the presence of a significant number of non-breeding individuals in the  
493        study area. Therefore, the estimates we provided for these species include both breeding  
494        and potentially non-breeding individuals. Additionally, we did not distinguish between  
495        breeding and non-breeding individuals for mammals such as brown and collared lemmings,  
496        Arctic fox, American ermine, and Arctic hare. The methods used for each species are  
497        summarized in (**Table 4**).

498        ***Pacific loon, red-throated loon, cackling goose, tundra swan and glau-***  
499        ***cous gull***

500        Based on the systematic and intensive search for the glaucous gull, cackling goose,  
501        tundra swan, red-throated loon and Pacific loon nests in wetlands, we are con-  
502        fident that we have found nearly all nests across the study area from 2017 to 2019  
503        and in 2022. We observed a relatively strong correlation between the nest density  
504        of glaucous gulls in the Qarlikturvik valley and the nest density across the entire  
505        study area ( $R^2 = 0.7$ ,  $p = 0.16$ ,  $n = 4$ ). Consequently, we estimated the density of  
506        glaucous gulls at the scale of the study area between 2004 and 2016 based on the  
507        nest density in the Qarlikturvik valley ( $y = 0.12409x + 0.13774$ ). However, we did  
508        not observe such strong relationships for loons and swans and thus we did not ex-  
509        tend the time series. Regarding cackling geese, we observed signs of an exponential  
510        increase over time based on the annual number of nests found in various zones of the  
511        study area. We thus fitted an exponential model using the number of nests found  
512        annually over two distinct periods: in 1996 when the first nest was discovered, and  
513        then from 2017 to 2023 when sampling effort was systematic across the whole study  
514        area (**Figure 5**). We used the fitted model to estimate abundance between 1996  
515        and 2016 when monitoring was less systematic, which could potentially underesti-  
516        mate observed abundance as seen on **Figure 5**. We multiplied nest density by two  
517        to obtain the abundance (assuming two individuals per nest).

518        ***Snow goose***

519        Between 1999 and 2023, we assessed the abundance of snow geese in the study area  
520        through a multi-step process. We calculated the mean annual density of snow goose  
521        nests separately in the mesic and wetland habitats of the area occupied by the goose  
522        colony annually. We made slight adjustments to the goose colony perimeter defined  
523        from helicopter flights to include all snow goose point counts where at least one

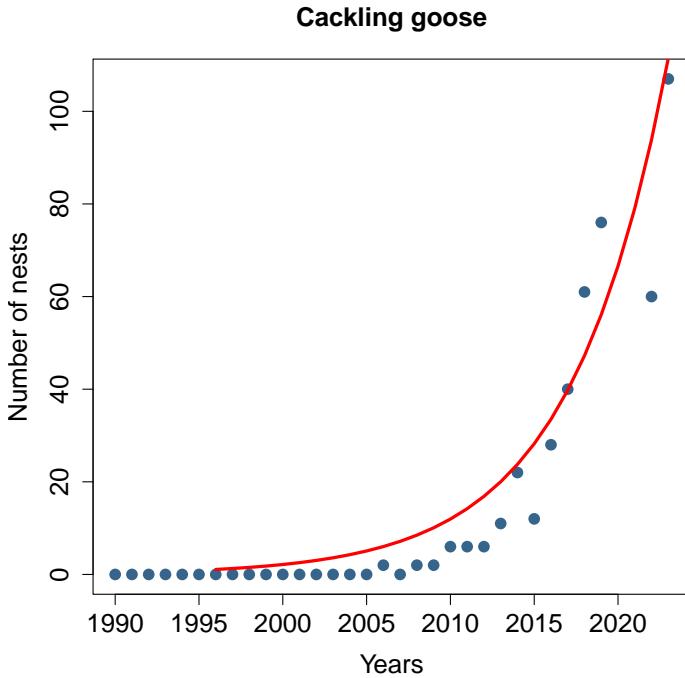


Figure 5: Number of cackling goose nests found across the study area over time. The red line represents the fitted model over the period 1996-2023 ( $y = e^{0.1717x - 342.684}$ ), which was used to estimate the annual abundance of cackling goose between 1996 and 2016. The model presents a strong visual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

breeding pair had been observed (**Figure 6**). To determine the mean density of nesting geese in wetlands, we divided two times (assuming two individuals per nest) the total number of nests found during systematic nest searches by the total area of wetlands sampled. The density of geese nesting in mesic habitat, a less preferred nesting habitat (Lecomte et al., 2008), was averaged from three independent methods: systematic nest searches, vertebrate count transects, and snow goose point counts **Figure 7**). Systematic nest searches were highly precise, but covered a relatively small area, whereas transects and snow goose point counts were less precise but covered larger areas. For each method, we calculated the mean density of breeding individuals in mesic habitat by dividing the number of birds (or nests) recorded by the area sampled. We found a strong and statistically significant correlation between density estimates derived from vertebrate count transects and snow goose point counts (Sperman's rank correlation  $r_s = 0.8$ ;  $p=0.003$ ). However, there was no significant correlation between density estimates from nest sampling plots and either the transect data ( $r_s=0.37$ ;  $p=0.24$ ) or the point counts ( $r_s=0.22$ ;  $p= 0.5$ ). Despite the lack of correlation between observations (transects and point counts) and nest sampling, we chose to average the estimates from all three methods since observations and nest monitoring present complementary strengths and limitations.

542 Transects and point counts offer broader spatial coverage but lower precision, while  
543 nest sampling provides higher precision but limited spatial coverage. Averaging the  
544 three methods allows us to balance these trade-offs and produce estimates that are  
545 less precise individually, but likely more accurate overall. Lastly, to transform the  
546 densities in total abundance, we determined the annual proportion of wetland and  
547 mesic habitats within the goose colony and multiplied the area of each habitat by  
548 the density of breeding individuals. For the period 1999 to 2009, we used the aver-  
549 age limits of the colony over the period 2010 to 2023 because we did not conduct  
550 aerial survey of the colony. Moreover, nest density in the mesic habitat was derived  
551 from a single method (**Figure 7**).

552           ***King eider and long-tailed duck***

553           We first estimated the abundance of both king eiders and long-tailed ducks based on  
554           the annual nest density of each species found in the 8 km<sup>2</sup> extensive nest search area  
555           located in the Qarlikturvik valley. We extrapolated the mean nest density in the  
556           wetlands of the Qarlikturvik valley to the wetlands of the study area (38.35 km<sup>2</sup>).  
557           We transformed nest density to abundance of breeding individuals by multiplying  
558           it by a factor of two (assuming two individuals per nest). We acknowledge that the  
559           opportunistic monitoring of these species likely underestimated their true nest den-  
560           sity. However, considering the extensive sampling effort deployed annually within  
561           this area, we are confident to obtain a realistic order of magnitude for the number  
562           of nests present. Because duck sightings are frequent throughout the breeding pe-  
563           riod, yet only a few nests are found, we believe there may be a significant portion  
564           of non-breeding individuals. Therefore, we employed an additional method to es-  
565           timate the overall duck populations without differentiating between breeding and  
566           non-breeding individuals. As an alternative approach, we estimated the abundance  
567           of ducks based on the indices of relative abundance (i.e., the number of individuals  
568           observed per 100 hours) presented by Gauthier et al. (2024b). We assumed that the  
569           ratios between relative and actual abundance are the same (i.e., similar detection  
570           probability) in duck and loon species. We therefore derived the absolute abundance  
571           of long-tailed ducks and king eiders from their relative abundances using the ratio  
572           between relative and absolute abundances of red-throated loons as a reference.

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

574           We estimated the abundance of breeding rough-legged hawks, peregrine falcons and  
575           snowy owls based on systematic nest monitoring conducted throughout the study  
576           area for these species. To convert the number of nests into breeding abundance,  
577           we multiplied it by two (assuming two individuals per nest). For snowy owls, we  
578           extended the time series from 1996 to 2011 based on a linear regression between  
579           nest density in the Qarlikturvik valley and nearby plateaus (Black and Southern  
580           plateaus) and nest density across the entire study area ( $y = 0.68867x - 0.00173$ ;  
581           R<sup>2</sup>= 0.98; p < 0.0001, n= 10). We used the same approach for rough-legged hawks  
582           ( $y = 0.49851x$ , R<sup>2</sup>= 0.99, p < 0.0001, n= 8) to extend the time series from 2007 to  
583           2012. We did not extend the time series for peregrine falcons because the correlation  
584           is not as strong (R<sup>2</sup>= 0.20, p= 0.27, n=8).

585           ***Rock ptarmigan***

586           We estimated the abundance of rock ptarmigans based on the annual nest density  
587           measured in the 8 km<sup>2</sup> extensive nest search area of the Qarlikturvik valley. While we  
588           acknowledge that the opportunistic monitoring of this species likely underestimates  
589           nest density, the extensive sampling effort deployed annually within this area gives

us confidence in obtaining a realistic number of nests. We then extrapolate the density to the whole study area, without distinction between mesic, wetland and upland habitats (**Table 3**). Among the 6 nests found in the study area, 4 were located in mesic habitat, while one nest was found in a wetland and another in an upland habitat. Nest site selection by rock ptarmigan has not been well documented in the Canadian Arctic; however, a study conducted at Sarcpa Lake (n= 7 nests) also highlight that rock ptarmigan can nests in a variety of habitats (Montgomerie et al., 1983). To convert the number of nests into breeding abundance, we multiplied it by two (assuming two individuals per nest).

### 599 *Sandhill crane*

600 We determined the mean nest density of sandhill cranes from the nest sampling  
601 between 2004 and 2023 on the southern side of the glacial river in the Qarlikturvik  
602 valley. We determined mean nest density by dividing the mean annual number  
603 of nests recorded by the area of the surveyed zone (33 km<sup>2</sup>). We estimated total  
604 abundance by multiplying mean nest density by the total area of the study area.  
605 We assumed a uniform density across the study area, as sandhill crane nests have  
606 been observed in wetland, mesic, and upland habitats.

### 607 *American golden-plover and black-bellied plover*

608 We used a distance sampling approach to estimate the abundance of American  
609 golden-plovers in the lowland zones of the study area between 2014 and 2023. Ob-  
610 servations of plovers were made along vertebrate count transects mainly in mesic  
611 habitat. Perpendicular distance between detected individuals and the transect path  
612 were used (n= 1015) to estimate a detection function with the *ds* function from  
613 the *Distance* package (Miller et al., 2019). To determine the detection function, we  
614 applied a truncation distance of 150 m (i.e., maximum distance on either side of  
615 the observer where observations have been considered) and selected the model with  
616 the lowest AIC, which included a "hn" key and a single "cos" adjustment term. We  
617 excluded observations of groups with more than four individuals, as these likely in-  
618 dicated groups of non-breeders. We did not estimate abundance in wetland habitat  
619 because American golden-plovers nest almost exclusively in mesic habitat (Parmelee  
620 et al., 1967). We estimated the abundance in the upland zones (i.e., plateaus) by  
621 applying a correction factor to the abundance in lowland zones. This correction  
622 factor was based on the relative abundance ratio between the upland and lowland  
623 zones (**Table 3**).

624 To determine the abundance of black-bellied plovers, we used the mean number of  
625 black-bellied plovers and American golden-plovers observed per transect as an index  
626 of relative abundance. We assumed that the ratios between relative and actual

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

### **Common-ringed plover**

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

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

We estimated the mean abundance of Lapland longspurs in the different lowland zones of the study area based on a relation between nest density and the number of individuals observed per transect (**Figure 8**). For Baird's sandpiper, we employed a similar approach, but instead of using the mean number of individuals observed per transect, we used the mean proportion of transects where at least one individual was detected. We made this adjustment because this species was less frequently observed. In this relationship, nest density for these two species came from the intensive nest sampling conducted within the core 2 km<sup>2</sup> area of the Qarlikturvik valley and observations of individuals from transects carried out in the larger 8 km<sup>2</sup> area in which the core area was located (**Figure 3**). This approach allowed us to incorporate a larger sample size from the transects while focusing on a measure of nest density determined systematically. Transects observations in lowland were then converted into nest density using the regressions equation, and then in total number of individuals by multiplying by the area and a factor 2. We estimated the density of both species in the upland zones by applying a correction factor to the annual mean density in lowland zones. This correction factor was based on the relative abundance ratio between the upland and lowland zones (**Table 3**). We acknowledge that the relation for Baird's sandpiper is weaker; however, it offers some refinement compared to assuming a uniform density throughout the study area.

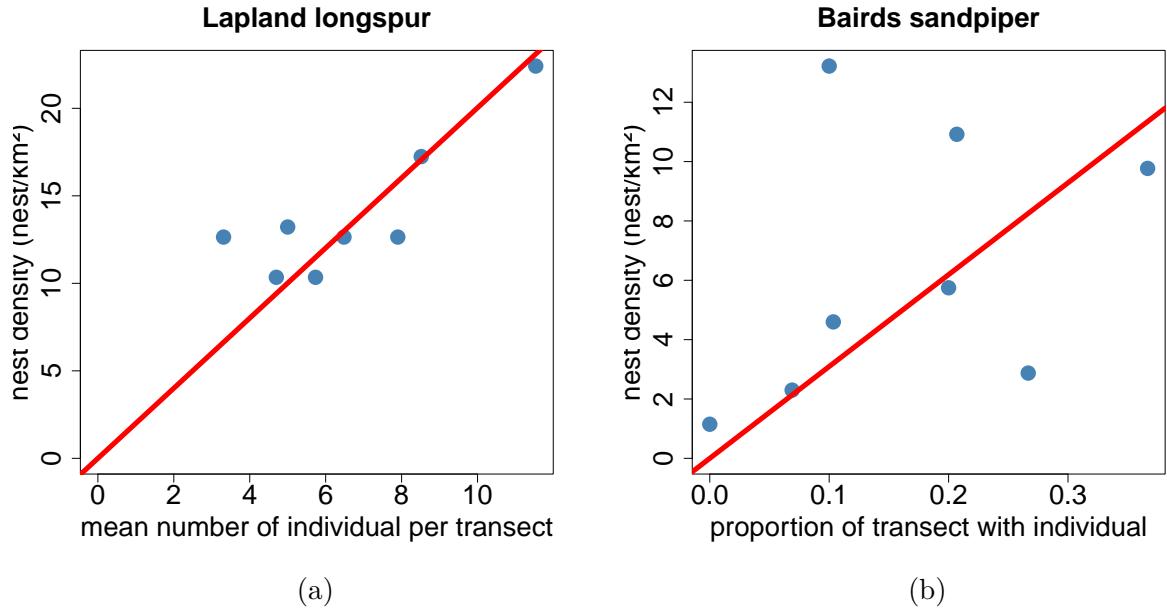


Figure 8: a) The red line shows the linear relation between nest density and the number of individuals observed per transect, described by the equation nest density =  $2.0031 \times$  number of individuals per transect. The relation was forced through the origin. Blue dots represent annual values (2014–2019 and 2022–2023) of nest density and mean number of individuals per transect from the core sampled area of the Qarlikturvik Valley. We assumed that the relation between nest density and observations on transects is linear. b) The red line shows the linear relation between nest density and the proportion of transects with at least an individual, described by the equation nest density=  $30.9519 \times$  proportion of transects with at least one individual. The relation was forced through the origin. Blue dots represent annual values (2014–2019 and 2022–2023) of nest density and mean proportion of transects with at least an individual from the core sampled area of the Qarlikturvik Valley. We assumed that the relation between nest density and observations on transects is linear.

#### 662      *Other passerines and sandpipers*

663      We estimated the abundance of other passerines (horned lark, American pipit, and  
 664      snow bunting) in the lowland zones of the study area with the regression equation  
 665      between number of individuals per transect and nest density of the Lapland longspur  
 666      (see section *Lapland longspur and Baird's sandpiper*). We assumed here a similar  
 667      detection probability for all species. We used the same approach for other sandpiper  
 668      species (white-rumped sandpiper, pectoral sandpiper, buff-breasted sandpiper, red  
 669      knot, ruddy turnstone and red phalarope) based on the regression equation for the  
 670      Baird's sandpiper (see section *Lapland longspur and Baird's sandpiper*). For all  
 671      these species, we estimated the density in the upland zones by applying a correc-  
 672      tion factor to the mean density in lowland zones. This correction factor was based  
 673      on the relative abundance ratio between the upland and lowland zones (**Table 3**).  
 674      Nest density was then converted in number of individuals by multiplying by the

area and a factor 2. As an alternative approach, we estimated the abundance of other passerines and sandpipers based on the indices 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 ( $33 \text{ km}^2$ ). 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 (assuming two individuals per nest).

#### **Parasitic jaeger**

Based on the opportunistic nest monitoring of parasitic jaegers across the study area, an average of 4 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  $0.04 \text{ individuals/km}^2$ . For comparison, Taylor (1974) measured a density of  $0.06 \text{ individual/km}^2$  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 throughout the breeding period. 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 ravens from their relative abundance using the ratio between relative and absolute abundances of glaucous gulls as a reference. Independently, we estimated the abundance of common ravens with the same approach but using the indices of relative abundance presented by Gauthier et al. (2024b), which was derived from incidental daily observations, rather than observations from the transects.

### ***Nearctic brown and collared lemming***

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

### ***Arctic hare***

Arctic hares are primarily observed in the upland zones of the study area, where sampling effort is limited. We thus derived abundance of hares from the estimated abundance of Arctic foxes based on indices of relative abundance presented in (Gauthier et al., 2024b), which were derived from incidental daily observations. We doubled the density of Arctic hares in the upland zones (i.e., plateaus), as twice as many individuals were observed per hour of fieldwork there compared to lowland zones (**Table 3**). However, it is worth noting that assuming a similar detection probability between foxes and hares might lead to an overestimation of hare detection probability due to behavioral differences between the species. Therefore, we most likely underestimate the actual abundance of Arctic hares in the study area.

### ***American ermine***

We estimated the annual abundance of ermines by transforming the annual index of

relative abundance provided in Bolduc et al. (2023) into individual density. Annual values ranged from 0, indicating no ermine sighting, to 2.88, which signifies that nearly all observers observed at least one family group during their field season. We independently obtained measures of minimum (0.02 ind./km<sup>2</sup>) and maximum (0.4 ind./km<sup>2</sup>) ermine density, which were determined from estimates of individual home range obtained from radio-tracking data, observations on Bylot Island, and existing 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.

### ***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 of territorial foxes. 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 km<sup>2</sup> to represent the mean home range of foxes within the goose colony and 20.02 km<sup>2</sup> 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/km<sup>2</sup> 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 km<sup>2</sup> based on camera traps (Royer-Boutin, 2015).

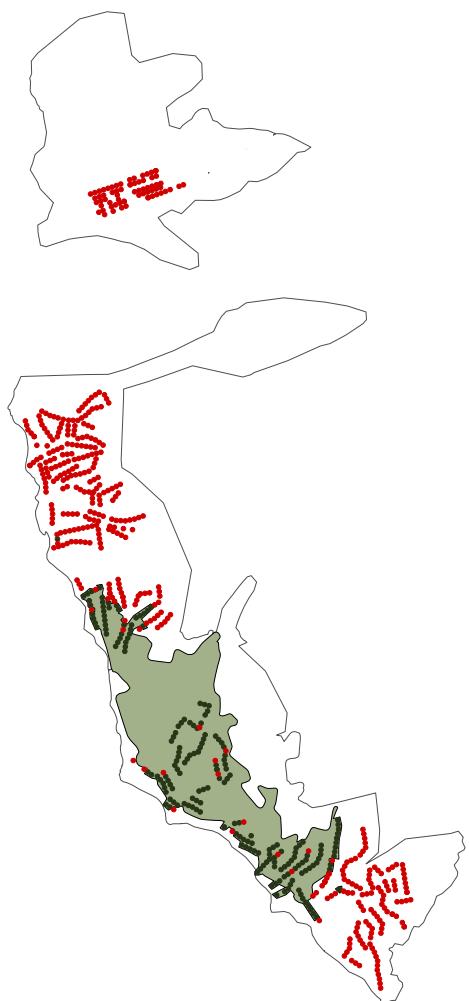


Figure 6: Map showing the region occupied by the snow goose colony in 2017 (green polygon) as an example. The perimeter was first defined opportunistically using a GPS receiver aboard a helicopter, taking advantage of regular flights across the study area whenever the flight path passed over the colony border. The perimeter was 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.

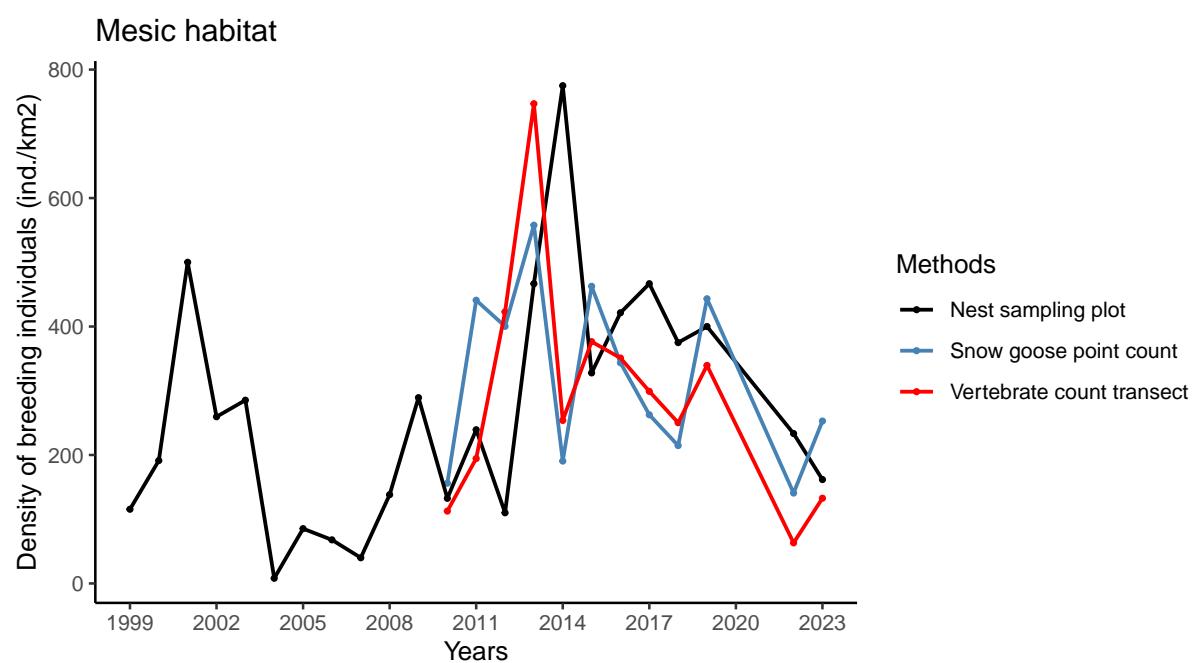


Figure 7: Estimates of breeding goose density in mesic habitat within the Bylot Island snow goose colony using three independent methods: Nest sampling plot, Snow goose point count, Vertebrate count transect.

Table 4: 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 km<sup>2</sup>). 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. The star (\*) refers to the estimate of breeding individuals only.

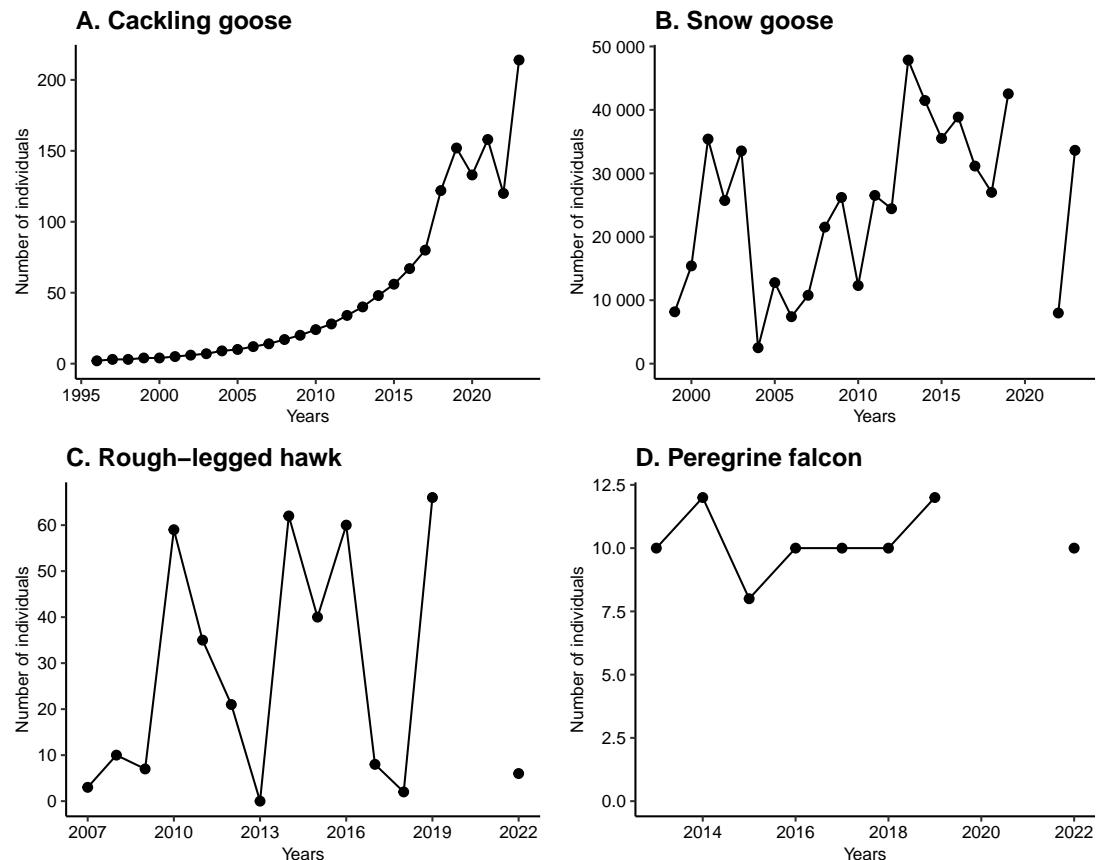
Species	Method	Method quality	Justification	Lowest abundance	Highest abundance	Mean abundance	sd	n
Pacific loon	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	0*	6*	4*	3	4 (2017-2019, 2022)
Red-throated loon	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	42*	76*	64*	15	4 (2017-2019, 2022)
King eider	Intensive, but opportunistic nest monitoring (8 km <sup>2</sup> ) 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 <sup>2</sup> ) 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 (strong visual fit with empirical data)	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 <sup>2</sup> )	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	7982*	47859*	30771*	11962	12 (2010-2019, 2022-2023)
Tundra swan	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	0*	2*	1*	1	4 (2017-2019, 2022)
Rough-legged hawk	Extrapolation from intensive nest monitoring (111 km <sup>2</sup> , R <sup>2</sup> =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 <sup>2</sup> )	high	No extrapolation	0*	66*	30*	29	8 (2013-2019, 2022)

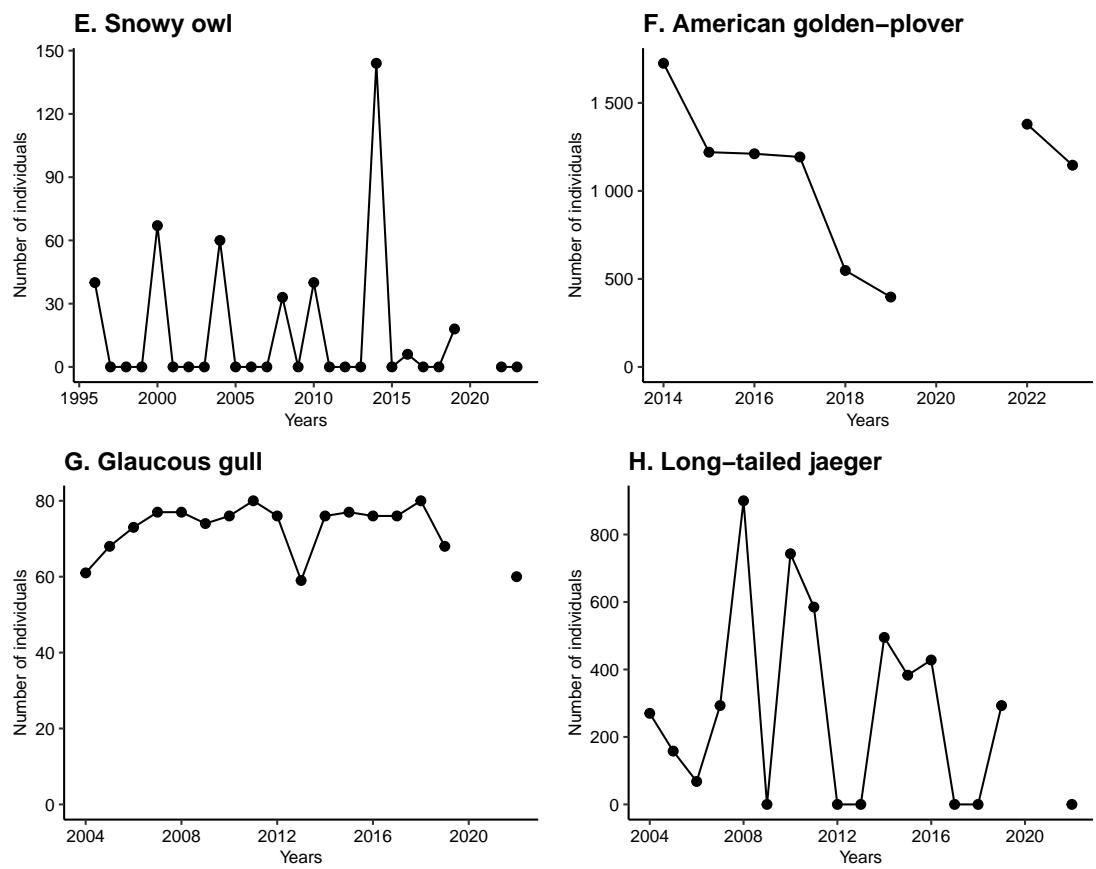
Peregrine falcon	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	8*	12*	10*	1	8 (2013-2019, 2022)
Snowy owl	Extrapolation from intensive nest monitoring (111 km <sup>2</sup> , R <sup>2</sup> =0.98, p<0.0001, n=10)	high	Strong correlation with study area-wide nest density	0*	67*	15*	24	16 (1996-2011)
Snowy owl	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	0*	144*	17*	45	10 (2012-2019, 2022-2023)
Rock ptarmigan	Intensive, but opportunistic nest monitoring (8 km <sup>2</sup> ) 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	Intensive nest monitoring (33 km <sup>2</sup> ) extrapolated to study area	moderate	Nest density is extrapolated uniformly across the study area			36*		
American golden-plover	Distance sampling throughout lowland (313 km <sup>2</sup> )	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 turnstone	Derived from the abundance estimate of Baird's sandpiper using transects observations	low	Derived from moderate quality estimate of another species			36*		
Ruddy turnstone	Derived from the abundance estimate of Baird's sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			47*		
Red knot	Derived from the abundance estimate of Baird's sandpiper using transects observations	low	Derived from moderate quality estimate of another species			59*		
Red knot	Derived from the abundance estimate of Baird's sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			206*		
Pectoral sandpiper	Derived from the abundance estimate of Baird's sandpiper using transects observations	low	Derived from moderate quality estimate of another species			71*		

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			226*		
Baird's sandpiper	Extrapolation from intensive nest monitoring (2 km <sup>2</sup> ) and transects observations	moderate	Uncertain relation between nest density and transects observations			2170*		
White-rumped sandpiper	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			878*		
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			1005*		
Buff-breasted sandpiper	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			5*		
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			7*		
Red phalarope	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			124*		
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			240*		
Glaucous gull	Extrapolation from intensive nest monitoring (111 km <sup>2</sup> , R <sup>2</sup> =0.7, 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 <sup>2</sup> )	high	No extrapolation	60*	80*	71*	9	4 (2017-2019, 2022)
Long-tailed jaeger	Intensive nest monitoring (33 km <sup>2</sup> ) 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			18		
Horned lark	Derived from the abundance estimate of Lapland longspur using transects observations	low	Derived from moderate quality estimate of another species			310*		
Horned lark	Derived from the abundance estimate of Lapland longspur using incidental observations	low	Derived from moderate quality estimate of another species			352*		
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			46*		
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			74*		
Lapland longspur	Extrapolation from intensive nest monitoring (2 km <sup>2</sup> ) and transects observations	moderate	Uncertain relation between nest density and transects observations			6080*		
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			15*		
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			236*		
Nearctic brown lemming	Rigorous density estimates at small spatial scale (0.22 km <sup>2</sup> ) 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 <sup>2</sup> ) 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		
American 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 9: Time series of the estimated annual abundance of vertebrate species on the southern plain of Bylot Island ( $389 \text{ km}^2$ ). 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.





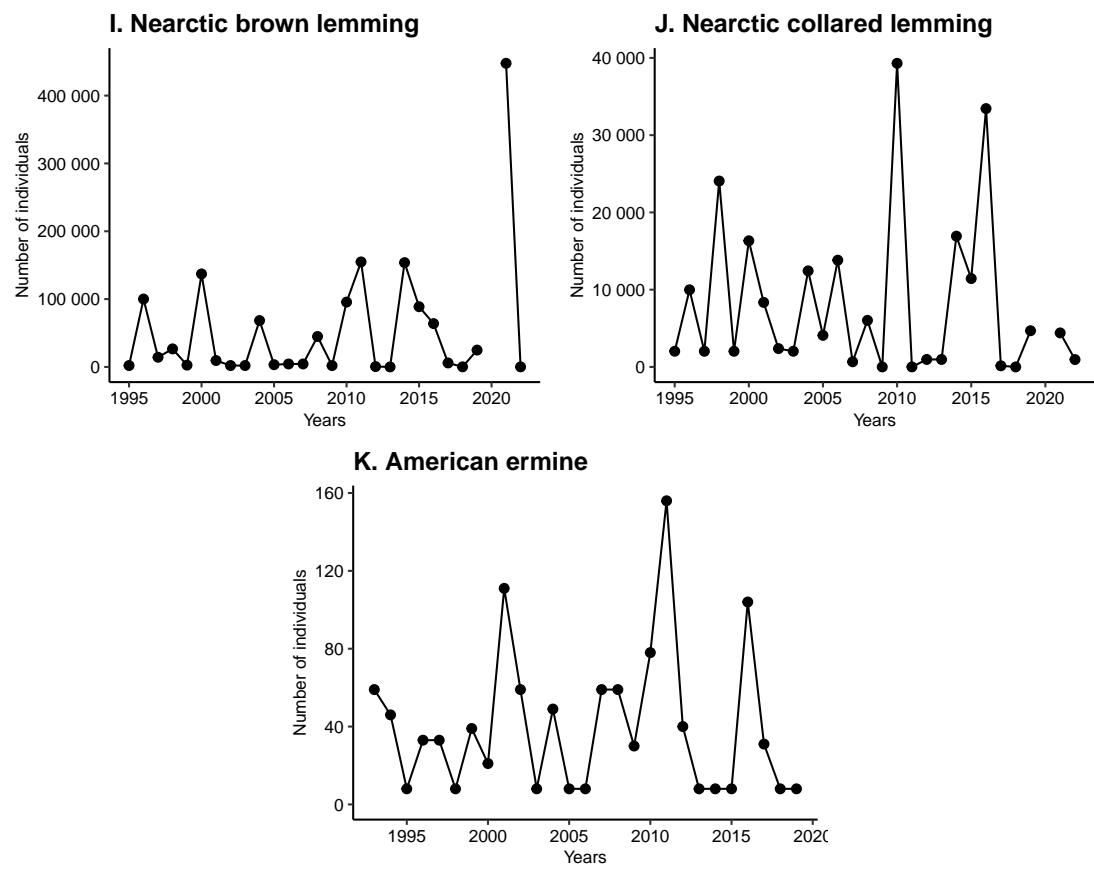


Table 5: Due to the absence of confidence intervals in our abundance estimates, we present uncertainty intervals based on field expert judgment. Experts derived these intervals by considering the given abundance estimate, estimates for other species for comparaison, and their field expertise. For species with time series data (several years of estimates), the intervals are presented for the lowest and highest abundance reached within the given time series. These intervals reflect the interval within which the actual abundance lies according to field experts. For species without time series, the intervals are presented for the mean only.

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

781           **b. Taxonomy and systematics**

782   Birds taxonomy was obtained from the IOC World Bird List 14.2 (Gill et al., 2024) and  
783   mammals taxonomy from the Mammal species of the world: a taxonomic and geographic  
784   reference (Upham et al., 2024).

785           **c. Permit history**

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

790           **d. Project personnel**

791           ***Principal and associated investigators***

792   Gilles Gauthier, Austin Reed, Jean-François Giroux, Dominique Berteaux, Joël  
793   Béty, Josée Lefebvre, Dominique Gravel, Jean-François Therrien, Nicolas Lecomte,  
794   Dominique Fauteux, Pierre Legagneux (see Gauthier et al. (2024a))

795           ***Students***

796   By combining animal and plant ecology, 24 doctoral theses and 56 master theses  
797   have been completed in relation to the study area located on the south plain of  
798   Bylot Island (see Gauthier et al. (2024a)).

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

800 **A. Status**

801 **1. Latest update**

802 November 8, 2024

803 **2. Latest archive date**

804 November 8, 2024

805 **3. Metadata status**

806 November 8, 2024

807 **4. Data verification**

808 The methods employed to estimate species abundance were subject to several rounds of  
809 revision by the authors.

810 **B. Accessibility**

811 **1. Storage location and medium**

812 The complete data set will be published as supporting information should the manuscript  
813 be accepted for publication. The data set, raw data, codes and metadata document are  
814 also archived in Dryad: <https://doi.org/10.5061/dryad.44j0zpcnt>.

815 **2. Contact persons**

816 *Overall project*

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818 mouski, Québec, Canada, G5L 3A1, Office B-002

819 *Specific subproject description*

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

821 **3. Copyright restrictions**

822 None

823        **4. Proprietary restrictions**

824            **a. Release date**

825     None

826            **b. Citation**

827     Please cite this document when using the data.

828            **c. Disclaimer**

829     None

830        **5. Costs**

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

832 **Class IV. Data structural descriptors**

833 **A. Data set file**

834 **1. Identity**

- 835 a. BYLOT-species\_taxonomy.csv  
836 b. BYLOT-species\_abundance.csv  
837 c. BYLOT-species\_body\_mass.csv  
838 d. BYLOT-interannual\_variation\_nest\_density.csv

839

840 **2. Size**

- 841 a. 35 records, not including header row (4.3 kB)  
842 b. 271 records, not including header row (35.1 kB)  
843 c. 53 records, not including header row (3.7 kB)  
844 d. 18 records, not including header row (1.1 kB)

845 **3. Format and storage mode**

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

847 **4. Header information**

848 a. BYLOT-species\_taxonomy.csv

849 class; order; family; genus; species\_scientific; species\_en; species\_fr; species\_code;  
850 functional\_group; migratory\_status

851 b. BYLOT-species\_abundance.csv

852 species\_en; year; breeding\_status; abundance; method\_description; method\_quality

853 c. BYLOT-species\_body\_mass.csv

854 species\_en; site; mean\_body\_mass\_g; sample\_size; reference

855 d. BYLOT-interannual\_variation\_nest\_density.csv

856 species\_en; zone; mean\_nest\_density\_km2; sd\_nest\_density\_km2; number\_years

857       **5. Alphanumeric attributes**

858    Mixed

859       **6. Special characters/fields**

860    Unavailable values are indicated by NA.

861       **7. Authentication procedures**

862    Sums of the numeric columns:

863    b. BYLOT-species\_abundance.csv: abundance= 2278553

864    c. BYLOT-species\_body\_mass.csv: body\_mass\_g= 49617; sample\_size= 13902

865    d. BYLOT-interannual\_variation\_nest\_density.csv: mean\_nest\_density\_km2= 20.447;

866    sd\_nest\_density\_km2= 9.529; sample\_size\_nest\_density\_km2= 186

867       **B. Variable information**

868        **1. Variable identity**

869    See Table 6

870        **2. Variable definition**

871    See Table 6

872        **3. Units of measurement**

873    See Table 6

Table 6: 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 (Upahm et al., 2024).	NA
a.	order	Taxonomic order for birds (Gill et al., 2024) and mammals species (Upahm et al., 2024).	NA
a.	family	Taxonomic family for birds (Gill et al., 2024) and mammals species (Upahm et al., 2024).	NA
a.	genus	Taxonomic genus for birds (Gill et al., 2024) and mammals species (Upahm et al., 2024).	NA
a.	species_scientific	Taxonomic species for birds (Gill et al., 2024) and mammals species (Upahm et al., 2024).	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. 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 <sup>2</sup> 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.	individuals
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

<sup>874</sup> **4. Data type**

<sup>875</sup> **a. Storage type**

<sup>876</sup> See Table 7

<sup>877</sup> **b. List and definition of variable codes**

<sup>878</sup> See Table 7

<sup>879</sup> **c. Range for numeric values**

<sup>880</sup> See Table 7

<sup>881</sup> **d. Missing value codes**

<sup>882</sup> Unavailable values are indicated by NA.

<sup>883</sup> **e. Number of digits**

<sup>884</sup> See Table 7

Table 7: 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	0.001-14.088	3
d.	sd_nest_density_km2	numeric	NA	0.001-4.871	3
d.	number_years	integer	NA	3-17	0

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

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

889 **Class V. Supplemental descriptors**

890 **A. Data acquisition**

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

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

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

894 The raw data and codes are archived in Dryad: <https://doi.org/10.5061/dryad.44j0zpcnt>.

896 **3. Data entry verification procedures**

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

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

900 Final abundance estimate were revised by the authors.

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

902 **1. Program**

903 R version 4.3.2 (2023-10-31)

904 **2. Operating system**

905 Data preparation was performed on x86\_64-pc-linux-gnu (64-bit) with Ubuntu 22.04.3  
906 LTS.

907        **3. Packages**

908        dplyr (Wickham et al., 2023a), tidyverse (Wickham et al., 2024), sf (Pebesma et al., 2018),  
909        stringr (Wickham, 2023), xtable (Dahl et al., 2019), Distance (Miller et al., 2019), ggplot2  
910        (Wickham, 2016), lme4 (Bates et al., 2015), AICcmodavg (Mazerolle, 2023), scales(Wickham  
911        et al., 2023b), ggmap (Kahle and Wickham, 2013)

912        **4. Codes**

913        The raw data and codes are archived in Dryad: <https://doi.org/10.5061/dryad.44j0zpcnt>.

915        **D. Archiving**

916        **1. Archival procedures**

917        The complete data set will be published as supporting information should the manuscript  
918        be accepted for publication. The data set, raw data, codes and metadata document are  
919        also archived in Dryad: <https://doi.org/10.5061/dryad.44j0zpcnt>.

920        **2. Redundant archival sites**

921        None

922        **E. Publications and results**

923        The presented estimates of species abundance have not been integrated in publications  
924        to date. Previous estimates of species abundance on the southern plain of Bylot Island  
925        were presented by Legagneux et al. (2012), however, the temporal series presented here  
926        is longer, the methods are refined and the taxonomic resolution is higher.

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

928        **1. Data request history**

929        None

930        **2. Data set update history**

931        None

932        **3. Review history**

933     None

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

935     None

936        **Acknowledgements**

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942     years. Additionally, we would like to express our special thanks to the Mittimatalik  
943     community and the Mittimatalik Hunters and Trappers Organization for their ongoing  
944     support of ecological monitoring on Bylot Island and for permitting us to conduct research  
945     on their land.

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