

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

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<sup>26</sup> **Open Research statement:**

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

29      **Introduction**

30      The composition of ecological communities, defined as the abundance of each species  
31      within a given community, is fundamental for understanding patterns and processes in  
32      community ecology. Variations in community composition can help to detect spatial pat-  
33      terns linked to environmental variations (Kemp et al., 1990), assess temporal trends of  
34      different groups of species after disturbances (Philippi et al., 1998; Magurran, 2007), and  
35      understand food web structures (Cohen et al., 2003). Additionally, community compo-  
36      sition is essential for modeling the dynamics of ecological communities. Dynamic com-  
37      munity modelling allows addressing important issues and questions in ecology, such as:  
38      determining the relative strength of top-down versus bottom-up forces in communities  
39      (Krebs et al., 2003; Legagneux et al., 2014), assessing the ecological resilience of commu-  
40      nities under climate change (Griffith et al., 2019) and evaluating the cascading effects of  
41      invasive species in food web (David et al., 2017; Goto et al., 2020). Dynamic community  
42      modelling can also be applied to address practical challenges, including fishery manage-  
43      ment (Plagányi, 2007) and the planning of protected areas (Okey et al., 2004; Dahood  
44      et al., 2020).

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

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

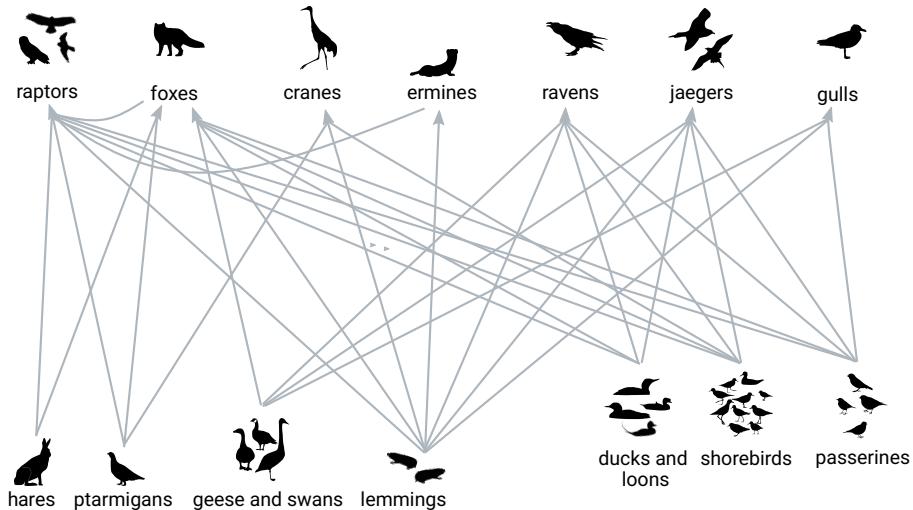


Figure 1: Synthetic vertebrate food web of the south plain of Bylot Island.

99

## Objective

100 Our main objective is to provide readily accessible, long-term time series of annual abund-  
 101 ances of all vertebrate species within the Arctic terrestrial community of Bylot Island  
 102 during the breeding season (May to August). This includes both breeding and non-  
 103 breeding individuals that stay in the study area for a significant period of time, and  
 104 excludes non-breeding individuals that stop for only a few days during their migration.  
 105 We focus on adults, except for lemmings for which we have not distinguished between  
 106 juveniles and adults. Our focus extends to estimating abundances at the landscape scale,  
 107 enabling the study of community and ecosystem dynamics, trophic interactions and the  
 108 impacts of global changes on high-latitude environments. Additionally, we aim to pro-  
 109 vide the average body mass for each species in the community, enabling the conversion of  
 110 abundances into biomasses.

<sub>111</sub> **Class I. Data Set Descriptors**

<sub>112</sub> **A. Data set identity**

<sub>113</sub> Long-term abundance time-series of the High Arctic terrestrial vertebrate community of  
<sub>114</sub> Bylot Island, Nunavut

<sub>115</sub> **B. Data set identification codes**

<sub>116</sub> BYLOT-species\_taxonomy.csv  
<sub>117</sub> BYLOT-species\_abundance.csv  
<sub>118</sub> BYLOT-species\_body\_mass.csv  
<sub>119</sub> BYLOT-interannual\_variation\_nest\_density.csv  
<sub>120</sub>

<sub>121</sub> **C. Data set description**

<sub>122</sub> **1. Originators**

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<sub>132</sub> **2. Abstract**

<sub>133</sub> Arctic ecosystems present unique opportunities for community-wide monitoring, in part  
<sub>134</sub> due to their relatively low species richness. However, conducting research in these remote  
<sub>135</sub> environments poses significant logistical challenges, resulting in long-term monitoring be-  
<sub>136</sub> ing exceedingly rare. Here, we focus on the long-term, intensive ecological monitoring  
<sub>137</sub> efforts conducted on the south plain of Bylot Island (almost 400 km<sup>2</sup>, Nunavut, Canada),  
<sub>138</sub> which has generated a remarkable dataset spanning up to 30 years, a rarity in tundra  
<sub>139</sub> ecosystems. Our goal is to synthesize this dataset and upscale vertebrate abundance data  
<sub>140</sub> at the landscape level, a prerequisite to conduct community-level analyses. We have stan-

<sup>141</sup> dardized data obtained with different field methods to provide readily usable long-term  
<sup>142</sup> time series of abundance for 35 vertebrate species (30 birds and 5 mammals) present  
<sup>143</sup> in the study system. Monitoring data includes intensive capture-mark-recapture density  
<sup>144</sup> estimates of lemmings on trapping grids, systematic or opportunistic nest monitoring con-  
<sup>145</sup> ducted across the entire study area or within specific plots for all bird species, transects of  
<sup>146</sup> vertebrate counts distributed throughout the study area, daily incidental observations of  
<sup>147</sup> vertebrates and satellite tracking of fox movements. Annual abundance of species was es-  
<sup>148</sup> timated at the landscape level, accounting for spatial variations. Furthermore, we provide  
<sup>149</sup> body masses for each species, derived from empirical onsite measurements for 18 species  
<sup>150</sup> and from the literature for the remaining species. Body mass is essential to convert species  
<sup>151</sup> abundance into biomass for studies of trophic fluxes and ecosystem processes. Our dataset  
<sup>152</sup> provides a unique opportunity for holistic empirical studies of ecological communities, al-  
<sup>153</sup> lowing a deeper understanding of community structure and dynamics. Considering that  
<sup>154</sup> the study site is a pristine and protected area that has experienced minimal anthropogenic  
<sup>155</sup> impact, it can also provide an ideal baseline for investigating the impacts of global changes  
<sup>156</sup> on high-latitude terrestrial ecosystems.

## <sup>157</sup> D. Key words/phrases

<sup>158</sup> Bylot Island, Canadian Arctic, Arctic tundra, 1993-2023, long-term monitoring, biodi-  
<sup>159</sup> versity monitoring, community composition, species abundance, species density, species  
<sup>160</sup> biomass, species body mass, food web

<sup>161</sup> **Class II. Research origin descriptors**

<sup>162</sup> **A. Overall project description**

<sup>163</sup> **1. Identity**

<sup>164</sup> Understanding the structure and dynamics of Arctic terrestrial communities

<sup>165</sup> **2. Originators**

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<sup>175</sup> **3. Period of study**

<sup>176</sup> 1989 - continuing

<sup>177</sup> **4. Objectives**

<sup>178</sup> i) Understand the factors that shape the structure and drive the dynamics of Arctic ter-  
<sup>179</sup> restrial communities.

<sup>180</sup> ii) Predict the effects of current global environmental changes on the structure and dy-  
<sup>181</sup> namics of Arctic terrestrial communities.

<sup>182</sup> **5. Abstract**

<sup>183</sup> Arctic terrestrial communities, characterized by relatively low species richness, offer unique  
<sup>184</sup> opportunities for studying ecological patterns and dynamics in simplified systems. Despite  
<sup>185</sup> their relative simplicity, these ecosystems feature complex species interactions, extreme  
<sup>186</sup> seasonal environmental changes, and a significant proportion of migratory species, making  
<sup>187</sup> it difficult to identify the key factors shaping their structure and dynamics. As global  
<sup>188</sup> environmental changes accelerate, it is essential to understand the processes driving these  
<sup>189</sup> communities to eventually predict future impacts on Arctic ecosystems. Our research

<sup>190</sup> combines long-term biodiversity monitoring, a community-wide approach, and food web  
<sup>191</sup> modeling to address these challenges.

<sup>192</sup> **6. Sources of funding**

<sup>193</sup> Natural Sciences and Engineering Research Council of Canada, Fonds Québécois de  
<sup>194</sup> Recherche Nature et Technologies, Centre d'études nordiques, Natural Resources Canada  
<sup>195</sup> (Polar Continental Shelf Program), Network of Centers of Excellence Canada (Arctic-  
<sup>196</sup> Net), Canada First Research Excellence Fund (Sentinel North Program), Polar Knowledge  
<sup>197</sup> Canada, Environment and Climate Change Canada, Canada Foundation for Innovation,  
<sup>198</sup> Parks Canada Agency, International Polar Year program of the Government of Canada,  
<sup>199</sup> Crown-Indigenous Relations and Northern Affairs Canada (Northern Contaminant Pro-  
<sup>200</sup> gram), Duck Unlimited Canada, Kenneth M. Molson Foundation (Kenneth M. Molson  
<sup>201</sup> Foundation's donation for wildlife research, conservation, and habitat), Garfield Weston  
<sup>202</sup> Foundation, First Air—Canadian North, Nunavut Wildlife Management Board, Uni-  
<sup>203</sup> versité Laval, Université du Québec à Rimouski

<sup>204</sup> **B. Specific subproject description**

<sup>205</sup> **1. Site description**

<sup>206</sup> **a. Site type**

<sup>207</sup> The study area ( $389 \text{ km}^2$ ) represents a relatively productive tundra ecosystem in the  
<sup>208</sup> eastern Canadian High-Arctic. An important biological characteristic of the area is the  
<sup>209</sup> presence of a large snow goose (scientific names of most vertebrate species can be found  
<sup>210</sup> in **Table 1**) colony of around 25 000 breeding pairs (Reed et al., 2002) spanning ap-  
<sup>211</sup> proximately  $70 \text{ km}^2$ . The vertebrate community within the study area comprises 30 bird  
<sup>212</sup> species, with 29 of them being migratory or partially migratory, along with 5 mammal  
<sup>213</sup> species (**Table 1**; Moisan et al. (2023); Gauthier et al. (2024b)). The study area experi-  
<sup>214</sup> ences significant temporal fluctuations in the population of small mammals (lemmings),  
<sup>215</sup> which in turn impact the occurrence and abundance of their avian and mammalian preda-  
<sup>216</sup> tors such as snowy owls, rough-legged hawks, long-tailed jaegers, ermines and Arctic foxes  
<sup>217</sup> (Legagneux et al., 2012; Duchesne et al., 2021). We exclude occasional visitors, namely:  
<sup>218</sup> i) species lacking confirmed breeding occurrences on the study site, ii) species observed  
<sup>219</sup> solely within a single year, and iii) species primarily breeding and foraging in nearby ma-  
<sup>220</sup> rine or coastal habitats (Moisan et al., 2023). The case of the red fox (*Vulpes vulpes*) was  
<sup>221</sup> ambiguous. While the presence of breeding pairs has been confirmed in the study area  
<sup>222</sup> (Lai et al., 2022), the extent of population establishment remains unclear and sightings  
<sup>223</sup> are rare. 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>	Glauccous gull	migrant
Jaegers	<i>Stercorarius longicaudus</i>	Long-tailed jaeger	migrant
Jaegers	<i>Stercorarius parasiticus</i>	Parasitic jaeger	migrant
Ravens	<i>Corvus corax</i>	Common raven	partial migrant
Passerines	<i>Eremophila alpestris</i>	Horned lark	migrant
Passerines	<i>Anthus rubescens</i>	American pipit	migrant
Passerines	<i>Calcarius lapponicus</i>	Lapland longspur	migrant
Passerines	<i>Plectrophenax nivalis</i>	Snow bunting	migrant
Lemmings	<i>Lemmus trimucronatus</i>	Nearctic brown lemming	resident
Lemmings	<i>Dicrostonyx groenlandicus</i>	Nearctic collared lemming	resident
Hares	<i>Lepus arcticus</i>	Arctic hare	resident
Ermines	<i>Mustela richardsonii</i>	Ermine	resident
Foxes	<i>Vulpes lagopus</i>	Arctic fox	partial migrant

## b. Geography

Our 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.

234           **e. Hydrology**

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

238           **f. Site history**

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

240           **g. Climate**

241   The mean annual air temperature since 1995 is -14.4°C, with mean seasonal temperature  
242   of 4.7°C in summer (June to August), -11°C in fall (September to November), -32.4°C in  
243   winter (December to February) and -19.4°C in spring (March to May; Centre of Northern  
244   Studies and Laval University (2019)). The climate of the southern plain of Bylot Island  
245   is generally milder than that of the surrounding latitudes, as the plain present a southern  
246   exposure and the mountains to the north protect the plain from cold northerly winds  
247   (Gauthier et al., 2024b). In summer, the study area received on average 77.5 mm of  
248   precipitation (Centre of Northern Studies and Laval University, 2019). Additionnally, 102  
249   days are frost-free annually on average (Centre of Northern Studies and Laval University,  
250   2019) and the study area typically remains free of snow from mid-June to late September  
251   (Gauthier et al., 2013).

252        **2. Experimental or sampling design**

253        **a. Permanent plots**

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

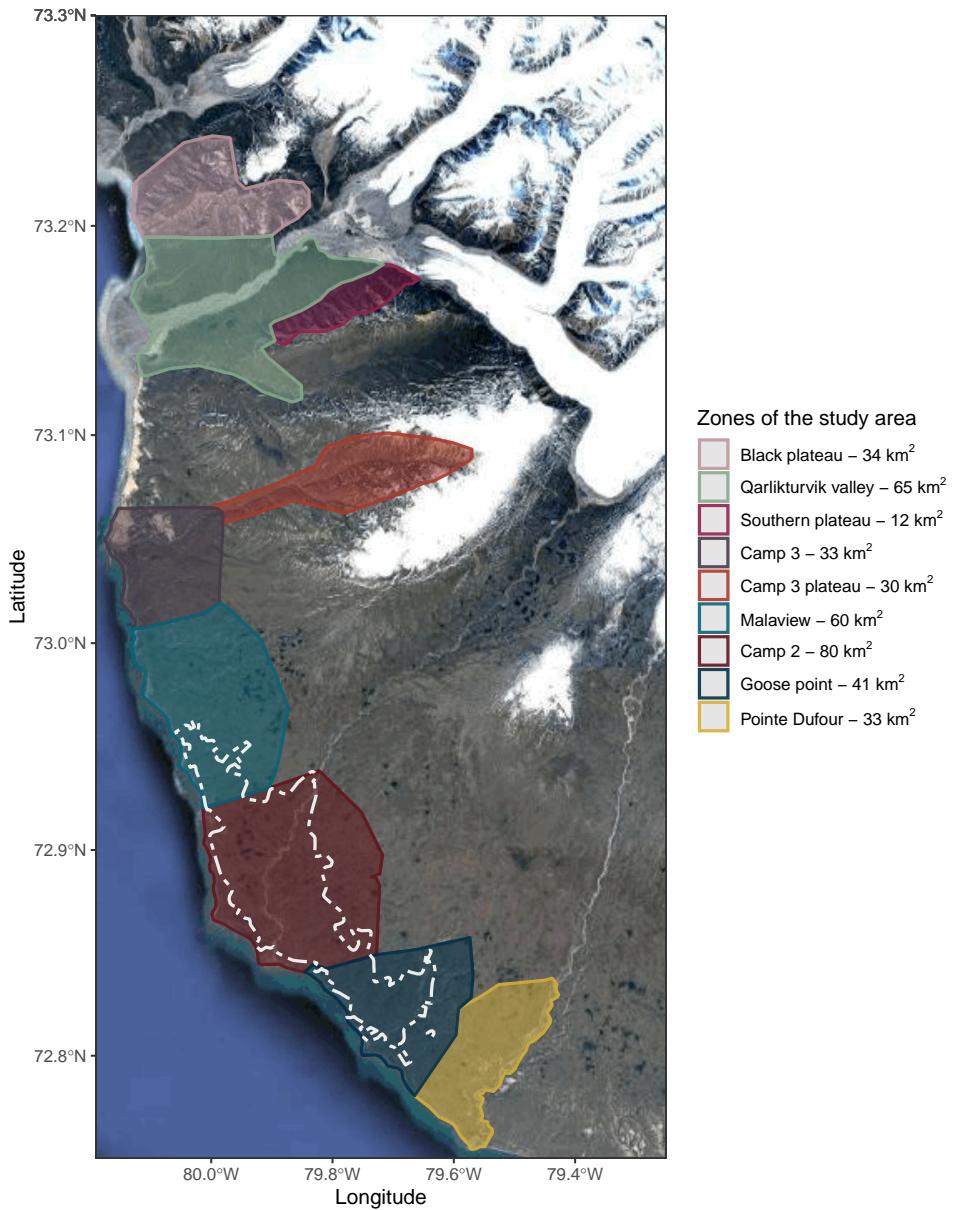


Figure 2: Map of the different zones (colored polygons) of the 389 km<sup>2</sup> study area located on the south plain of Bylot Island, Nunavut Canada. The perimeter of the snow goose colony is delineated by white dashes; we highlighted the perimeter in 2017 since it represents the average colony area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

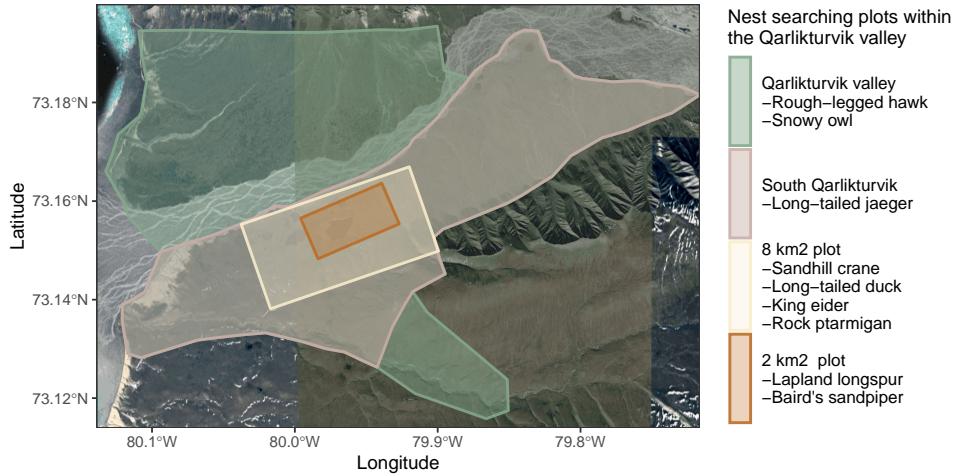


Figure 3: Intensive nests searching plots within the Qarlikturvik valley.

### b. Avian nest monitoring

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

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

Since 2004, systematic searches of wetland areas have been conducted on the southern side of the glacial river in the Qarlikturvik valley, and since 2017, in other zones of the study area. This sampling aimed to find all nests of the cackling goose and the glaucous gull. Nest locations of other large wetland-nesting species, including the tundra swan, the red-throated loon and the Pacific loon, were also noted, as these species nest in the same habitat (Duchesne et al., 2021; Gauthier et al., 2024b). Each year, all known or potential nesting sites were revisited. Observers detected nests by walking and scanning around ponds and lakeshores to identify any active nesting sites. These large species can be seen from a relatively long distance sitting on the nest or when flushing from the nest. Most of them (geese, swans and gulls) 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, 2023	(22)	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, 2023	(25)	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	Qarlikturvik (8 km <sup>2</sup> plot)	2005-2019, 2022	(16)	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
Ermine	Whole study area	1993-2019	(27)	opportunistic
Arctic fox	Whole study area	2008-2016	(9)	systematic

291 confident that nest detection probability was high for these species given the open  
 292 landscape.

### 293 *Snow goose*

294 Snow geese nest in a large colony in the study area (**Figure 2**), but also in small ag-  
 295gregations distributed on the island, especially in years when snowy owls are nesting  
 296 (Lepage et al., 1996; Reed et al., 2002). Since 1994, goose nests were systematically  
 297 monitored on a 0.24 km<sup>2</sup> wetland at the center of the colony. Since 1999, nests were  
 298 also systematically monitored on a variable number of plots, measuring 0.01 km<sup>2</sup> in  
 299 wetland habitat and 0.04 km<sup>2</sup> in mesic habitat, randomly distributed throughout  
 300 the goose colony (Gauthier and Cadieux, 2020b). The total area covered by the  
 301 randomly distributed plots averaged  $0.79 \pm 0.37$  km<sup>2</sup> per year. From 2010 onwards,  
 302 except in 2020 and 2021, we opportunistically traced sections of the approximate  
 303 boundary of the goose colony using a GPS receiver aboard a helicopter, taking ad-  
 304 vantage of regular flights across the study area whenever the flight path passed over  
 305 the colony border (Duchesne et al., 2021).

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

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

321           ***Snowy owl***

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

333           ***Long-tailed jaeger and parasitic jaeger***

334 Since 2004, observers have walked parallel transects spaced 400 meters apart, cov-  
335 ering the entire southern side of the glacial river in the Qarlikturvik Valley ( $33 \text{ km}^2$ ;  
336 **Figure 3**), during the nesting period. The aim of those transects was to record nests  
337 of long-tailed jaegers, parasitic jaegers, and sandhill cranes. Observers listened for  
338 alarm calls to detect territorial birds, and then located nests by observing the birds  
339 returning to their nests from elevated vantage points. We consider the sampling to  
340 be systematic for long-tailed and parasitic jaeger, since those species tend to leave  
341 their nest relatively far from the observer to perform mobbing behavior, and thus  
342 increasing their detection probability. We do not consider the sampling to be sys-  
343 tematic for sandhill cranes as they only display defensive behaviors near their nests

344 at relatively short distances (see opportunistic nest monitoring below).

345 ***Common-ringed plover***

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

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

354 Since 2005, nests of passerines and sandpipers have been extensively monitored  
355 across an 8 km<sup>2</sup> (4x2 km) area in the Qarlikturvik valley. We considered the sam-  
356 pling to be most systematic within a core 2 km<sup>2</sup> (2x1 km) plot in this area (**Figure**  
357 **3**). We excluded relatively large water bodies (0.26 km<sup>2</sup>) to calculate nest density  
358 in the plot due to the presence of a large lake, which leaves an area of 1.74 km<sup>2</sup>  
359 available for nesting. An observer conducted systematic searches of this plot during  
360 the entire breeding season to locate and monitor as many passerine and shorebird  
361 nests as possible. Assuming the observer can detect all nests within a 5 or 10 meter  
362 radius, analysis of daily GPS tracks shows that the observer covered a minimum  
363 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=  
364 3 years). Additionally, several other observers conducting related field work in the  
365 same zone reported all passerine and shorebird nests found opportunistically.

366 ***Opportunistic nest monitoring***

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

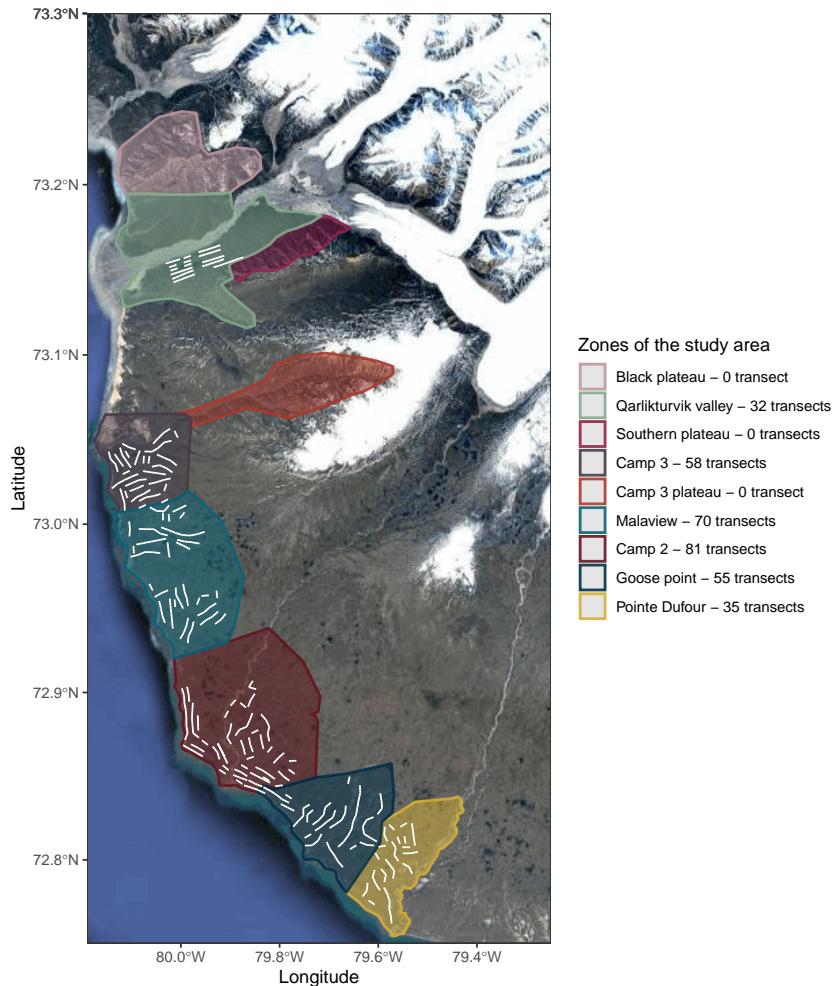


Figure 4: Spatial distribution of vertebrate count transects (white lines) on the south plain of Bylot Island (146 to 320 transects per year).

### 377 c. Observation of individuals

#### 378 *Vertebrate count transects*

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

386

387      ***Snow goose point count***

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

392

393      ***Incidental observations***

394      Since 2007, observers have recorded all vertebrate species observed opportunistically  
395      during field work and tallied the total number of individuals at the end of each day  
396      (Gauthier and Cadieux, 2020a; Gauthier et al., 2024b). The number of hours spent  
397      in the field served as a proxy for the sampling effort. We used the number of indi-  
398      viduals observed per hour spent in the field calculated by Gauthier et al. (2024b)  
399      as an index of relative abundance for each species. Moreover, we separated obser-  
400      vations made in lowland from those in upland zones to have a relative abundance of  
401      each species in each of these two broad categories (**Table 3**). Given that inciden-  
402      tal observations lacked georeferencing, we opted to extract upland observations by  
403      focusing on observations made during visits to rough-legged hawk nests, which are  
404      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

405

406            ***Testimonials of ermine sightings***

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

417            **d. Capture of individuals**

418            ***Lemming trapping***

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

432            ***Arctic fox movement tracking***

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

441            ***Parasitic jaeger banding***

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

445 **e. Species body mass**

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

455        **3. Research methods**

456        **a. Field/laboratory**

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

465        ***Pacific loon, red-throated loon, cackling goose, tundra swan and glau-***  
466        ***cous gull***

467        Based on the systematic and intensive search for the glaucous gull, cackling goose,  
468        tundra swan, red-throated loon and Pacific loon nests in wetlands, we are con-  
469        fident that we have found nearly all nests across the study area from 2017 to 2019  
470        and in 2022. We observed a relatively strong correlation between the nest density  
471        of glaucous gulls in the Qarlikturvik valley and the nest density across the entire  
472        study area ( $R^2 = 0.84$ ,  $p = 0.16$ ,  $n = 4$ ). Consequently, we estimated the density of  
473        glaucous gulls at the scale of the study area between 2004 and 2016 based on the  
474        nest density in the Qarlikturvik valley ( $y = 0.12409x + 0.13774$ ). However, we did  
475        not observe such strong relationships for loons and swans and thus we did not ex-  
476        tend the time series. Regarding cackling geese, we observed signs of an exponential  
477        increase over time based on the annual number of nests found in various zones of the  
478        study area. We thus fitted an exponential model using the number of nests found  
479        annually over two distinct periods: in 1996 when the first nest was discovered, and  
480        then from 2017 to 2023 when sampling effort was systematic across the whole study  
481        area (**Figure 5**). We used the fitted model to estimate abundance between 1996  
482        and 2016 when monitoring was less systematic, which could potentially underesti-  
483        mate observed abundance as seen on **Figure 5**. We multiplied nest density by two  
484        to obtain the abundance (assuming two individuals per nest).

485        ***Snow goose***

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

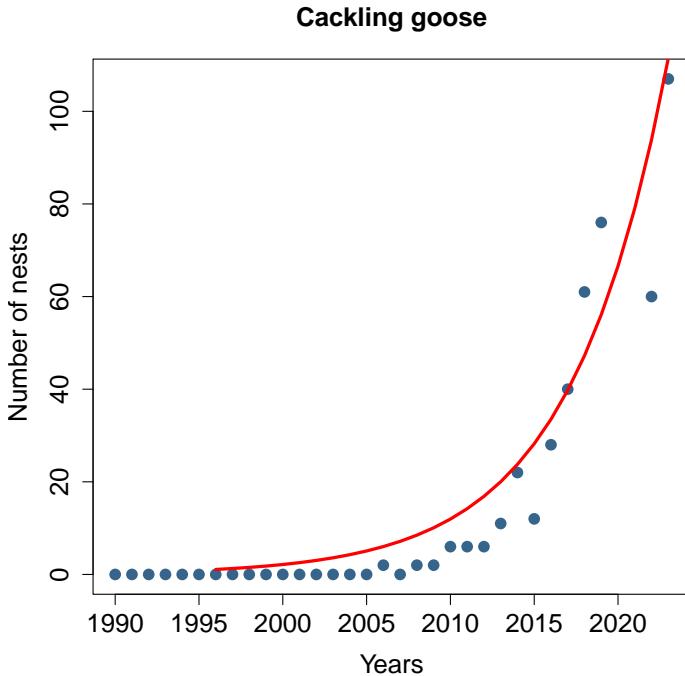


Figure 5: Number of cackling goose nests found across the study area over time. The red line represents the fitted model over the period 1996-2023 ( $y = e^{0.1717x - 342.684}$ ), which was used to estimate the annual abundance of cackling goose between 1996 and 2016. The model presents a strong visual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

one 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. 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. Despite methodological differences, the three approaches showed similar inter-annual variations, supporting the use of a mean values to estimate nest density in mesic habitat **Figure 7**). Lastly, to transform the densities in total abundance, we determined the annual proportion of wetland and mesic habitats within the goose colony and multiplied the area of each habitat by the density of breeding individuals. For the period 1999 to 2009, we used the average limits of the colony over the period 2010 to 2023 because we did not conduct aerial survey of the colony. Moreover, nest density in the mesic habitat was derived from a single

method (**Figure 7**).



Figure 6: Map showing the region occupied by the snow goose colony in 2017 (green polygon) as an example. The perimeter was first defined 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.

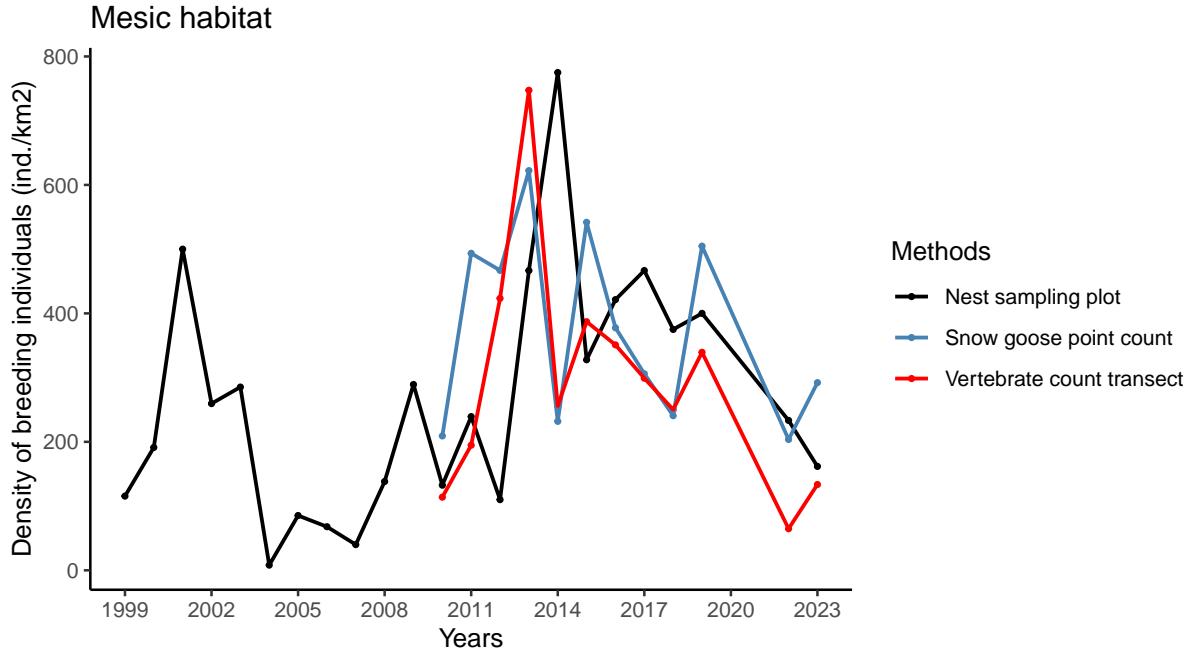


Figure 7: Estimates of breeding goose density in mesic habitat within the Blyot Island snow goose colony using three independent methods: Nest sampling plot, Snow goose point count, Vertebrate count transect.

### 510 *King eider and long-tailed duck*

511 We estimated the abundance of both king eiders and long-tailed ducks based on the  
 512 annual nest density of each species found in the 8 km<sup>2</sup> extensive nest search area  
 513 located in the Qarlikturvik valley. We extrapolated the mean nest density in the  
 514 wetlands of the Qarlikturvik valley to the wetlands of the study area (38.35 km<sup>2</sup>).  
 515 We transformed nest density to abundance of breeding individuals by multiplying  
 516 it by a factor of two (assuming two individuals per nest). We acknowledge that the  
 517 opportunistic monitoring of these species likely underestimated their true nest den-  
 518 sity. However, considering the extensive sampling effort deployed annually within  
 519 this area, we are confident to obtain a realistic order of magnitude for the num-  
 520 ber of nests present. Because duck sightings are frequent, yet only a few nests are  
 521 found, we believe there may be non-breeding individuals. Therefore, we employed  
 522 an additional method to estimate the overall duck populations without differentiat-  
 523 ing between breeding and non-breeding individuals. As an alternative approach, we  
 524 estimated the abundance of ducks based on the indices of relative abundance (i.e.,  
 525 the number of individuals observed per 100 hours) presented by Gauthier et al.  
 526 (2024b). We assumed that the ratios between relative and actual abundance are  
 527 the same (i.e., similar detection probability) in duck and loon species. We there-  
 528 fore derived the absolute abundance of long-tailed ducks and king eiders from their  
 529 relative abundances using the ratio between relative and absolute abundances of  
 530 red-throated loons as a reference.

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

532      We estimated the abundance of breeding rough-legged hawks, peregrine falcons and  
533      snowy owls based on systematic nest monitoring conducted throughout the study  
534      area for these species. To convert the number of nests into breeding abundance,  
535      we multiplied it by two (assuming two individuals per nest). For snowy owls, we  
536      extended the time series from 1996 to 2011 based on a linear regression between  
537      nest density in the Qarlikturvik valley and nearby plateaus (Black and Southern  
538      plateaus) and nest density across the entire study area ( $y = 0.68867x - 0.00173$ ;  
539       $R^2 = 0.99$ ;  $p < 0.0001$ ,  $n = 10$ ). We used the same approach for rough-legged hawks  
540      ( $y = 0.49851x$ ,  $R^2 = 0.99$ ,  $p < 0.0001$ ,  $n = 8$ ) to extend the time series from 2007 to  
541      2012. We did not extend the time series for peregrine falcons because the correlation  
542      is not as strong ( $R^2 = 0.44$ ,  $p = 0.27$ ,  $n = 8$ ).

543      ***Rock ptarmigan***

544      We estimated the abundance of rock ptarmigans based on the annual nest density  
545      measured in the 8 km<sup>2</sup> extensive nest search area of the Qarlikturvik valley. While we  
546      acknowledge that the opportunistic monitoring of this species likely underestimates  
547      nest density, the extensive sampling effort deployed annually within this area gives  
548      us confidence in obtaining a realistic number of nests. We then extrapolate the  
549      density to the whole study area, without distinction between mesic, wetland and  
550      upland habitats (**Table 3**). Among the 6 nests found in the study area, 4 were  
551      located in mesic habitat, while one nest was found in a wetland and another in  
552      an upland habitat. To convert the number of nests into breeding abundance, we  
553      multiplied it by two (assuming two individuals per nest).

554      ***Sandhill crane***

555      We estimated the mean abundance of sandhill cranes in the lowland zones of the  
556      study area based on a regression between nest density and the number of individuals  
557      observed per transect (**Figure 8**). In this relationship, nest density and transect  
558      observations come from the 8 km<sup>2</sup> area of the Qarlikturvik valley where extensive  
559      nest search is performed. We acknowledge that the opportunistic monitoring of  
560      this species likely underestimated the true nest density. However, considering the  
561      extensive sampling effort deployed annually within this area, we are confident in  
562      obtaining a realistic order of magnitude for the number of nests present. Number of  
563      individuals observed along transects in each lowland zone was converted into nest  
564      density using the regressions, and then in total number of individuals in each zone by  
565      multiplying by the area of the zone and a factor 2. We estimated the density in the  
566      upland zones by applying a correction factor to the annual mean density in lowland  
567      zones. This correction factor was determined based on the relative abundance ratio  
568      between the upland and lowland zones (**Table 3**).

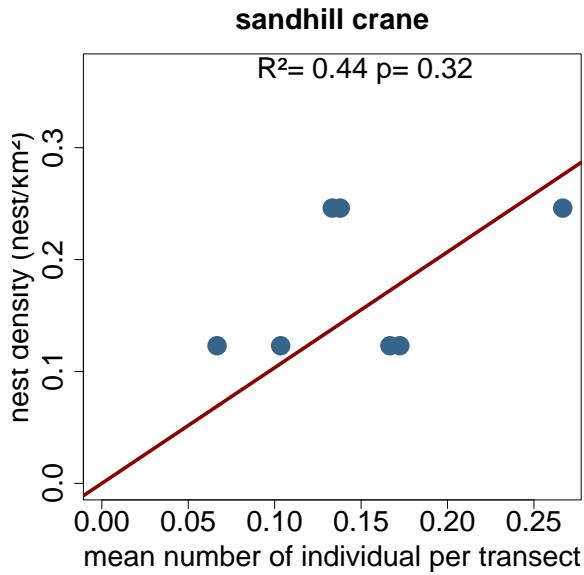


Figure 8: Linear regression between the nest density of sandhill cranes and the number of individuals observed per transect (nest density =  $1.12 \times$  number of individuals per transect; regression was forced to pass through the origin). The fit ( $R^2$  and  $p$  value) of the regression (red line)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

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

570        We applied a distance sampling approach to the observations of American golden-plovers made along vertebrate count transects to estimate the abundance of individuals in the mesic habitat of the study area between 2014 and 2023. We used perpendicular distance between detected individuals and transect ( $n = 1015$ ) to estimate a detection function with the *ds* function from the *Distance* package (Miller et al., 2019). We applied a truncation distance of 150 m (i.e., maximum distance on either side of the observer where observations have been considered). We selected the model with the lowest AIC, which included a "hn" key and a single "cos" adjustment term. We excluded observations of more than four individuals, as these likely indicated groups of non-breeders passing through the area. We did not estimate abundance in wetland habitat because American golden-plovers nest almost exclusively in mesic habitat (Parmelee et al., 1967). We estimated the abundance in the upland zones (i.e., plateaus) by applying a correction factor to the abundance in lowland zones. This correction factor was determined based on the relative abundance ratio between the upland and lowland zones (**Table 3**).

585        To determine the abundance of black-bellied plovers, we used the mean number of  
 586        black-bellied plovers and American golden-plovers observed per transect as an index  
 587        of relative abundance. We assumed that the ratios of 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 longspur in the different lowland zones of the study area based on a regression between nest density and the number of individuals observed per transect (**Figure 9**). 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. 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, 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 determined based on the relative abundance ratio between the upland and lowland zones (**Table 3**). We acknowledge that the regression for Baird's sandpiper is weak; however, it offers some refinement compared to assuming a uniform density throughout the study area.

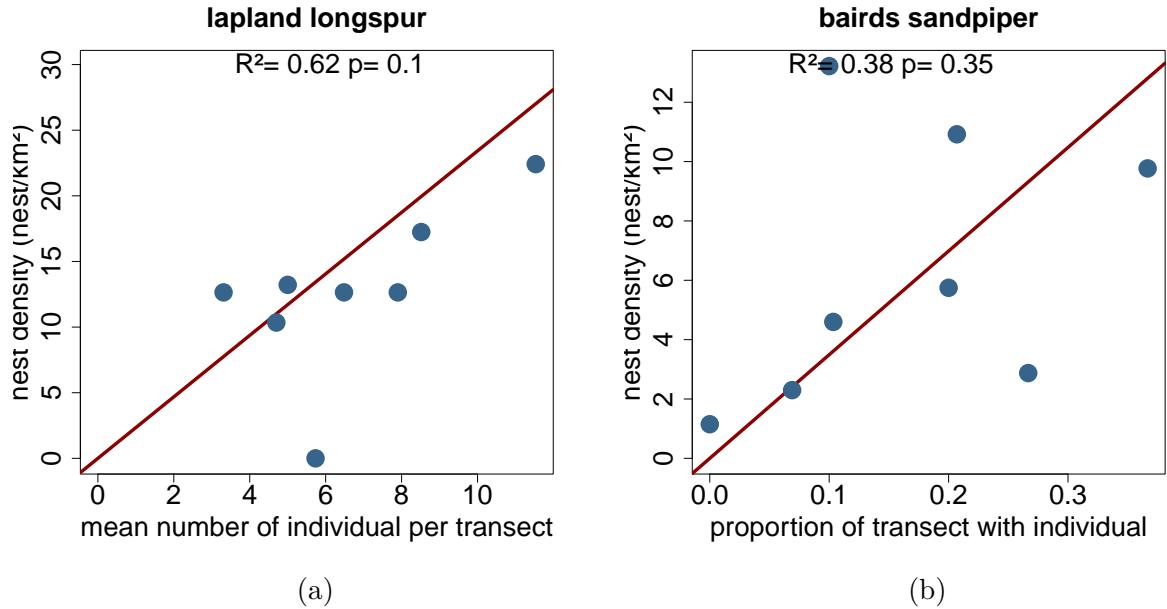


Figure 9: a) Linear regression between the nest density of Lapland longspurs and the number of individuals observed per transect (nest density=  $2.3422 \times$  number of individuals per transect; regression was forced through the origin). The fit ( $R^2$  and p value) of the regression (red line) with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

### 622      *Other passerines and sandpipers*

623      We estimated the abundance of other passerines (horned lark, American pipit, and  
 624      snow bunting) in the lowland zones of the study area with the regression equation  
 625      between number of individuals per transect and nest density of the Lapland longspur  
 626      (see section *Lapland longspur and Baird's sandpiper*). We assumed here a similar  
 627      detection probability for all species. We used the same approach for other sandpiper  
 628      species (white-rumped sandpiper, pectoral sandpiper, buff-breasted sandpiper, red  
 629      knot, ruddy turnstone and red phalarope) based on the regression equation for the  
 630      Baird's sandpiper (see section *Lapland longspur and Baird's sandpiper*). For all  
 631      these species, we estimated the density in the upland zones by applying a correction  
 632      factor to the mean density in lowland zones. This correction factor was determined  
 633      based on the relative abundance ratio between the upland and lowland zones (**Table**  
 634      **3**). Nest density was then converted in number of individuals by multiplying by the  
 635      area and a factor 2. As an alternative approach, we estimated the abundance of  
 636      other passerines and sandpipers based on the indices of relative abundance (i.e., the  
 637      number of individuals observed per 100 hours) presented by Gauthier et al. (2024b).

638 We assumed that the ratios between relative and actual abundance are the same  
639 (i.e., similar detection probability) among both passerine and sandpiper species. We  
640 therefore derived the absolute abundance of other passerine and sandpiper species  
641 from their relative abundances using respectively, the ratios between relative and  
642 absolute abundances of Lapland longspur (passerines) and Baird's sandpiper (sand-  
643 pipers) as references.

644 ***Long-tailed jaeger***

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

653 ***Parasitic jaeger***

654 Based on the opportunistic nest monitoring of parasitic jaegers across the study  
655 area, an average of 3.75 nests is found annually, a small number considering that  
656 parasitic jaegers were frequently observed at the study site (Gauthier et al., 2024b).  
657 This suggests that there may be non-breeding individuals present at the study site,  
658 or alternatively, individuals may regularly travel long distances, potentially from  
659 outside the study area, to forage during the breeding season. Due to limited data  
660 availability for estimating the abundance of non-breeding parasitic jaegers, we relied  
661 on the maximum number of adults banded during a single year (17 individuals in  
662 2009; Therrien, unpublished data) as the minimum abundance on the study area.  
663 This corresponds to a density of 0.04 individuals/km $^2$ . For comparison, Taylor  
664 (1974) measured a density of 0.06 individual/km $^2$  on Bathurst Island.

665 ***Common raven***

666 Despite the intensive nest searches for raptors in upland zones, we never found more  
667 than one common raven nest each year, a small number considering the frequent  
668 raven observations at the study site (Gauthier et al., 2024b). This indicates the  
669 potential presence of non-breeding individuals or individuals that breed outside the  
670 study area but use it for foraging. Therefore, we opted for alternative approaches  
671 based on individual counts to estimate the abundance of both breeding and non-  
672 breeding ravens. As a first approach, we based our estimate of ravens on the number  
673 of glaucous gulls observed per transect. We assumed that the ratios between rela-  
674 tive 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.

### ***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.

### ***Ermione***

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

712 ind./km<sup>2</sup>) ermine density, which were determined from estimates of individual home  
713 range obtained from radio-tracking data, observations on Bylot Island, and existing  
714 literature (Legagneux et al., 2012; Bilodeau, 2013). We associated the minimum and  
715 maximum scores of relative abundance with the minimum and maximum density of  
716 individuals, respectively. Ultimately, we calculated the ermine density by linearly  
717 interpolating between these two density extremes using the annual index of relative  
718 abundance.

719 ***Arctic fox***

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

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.

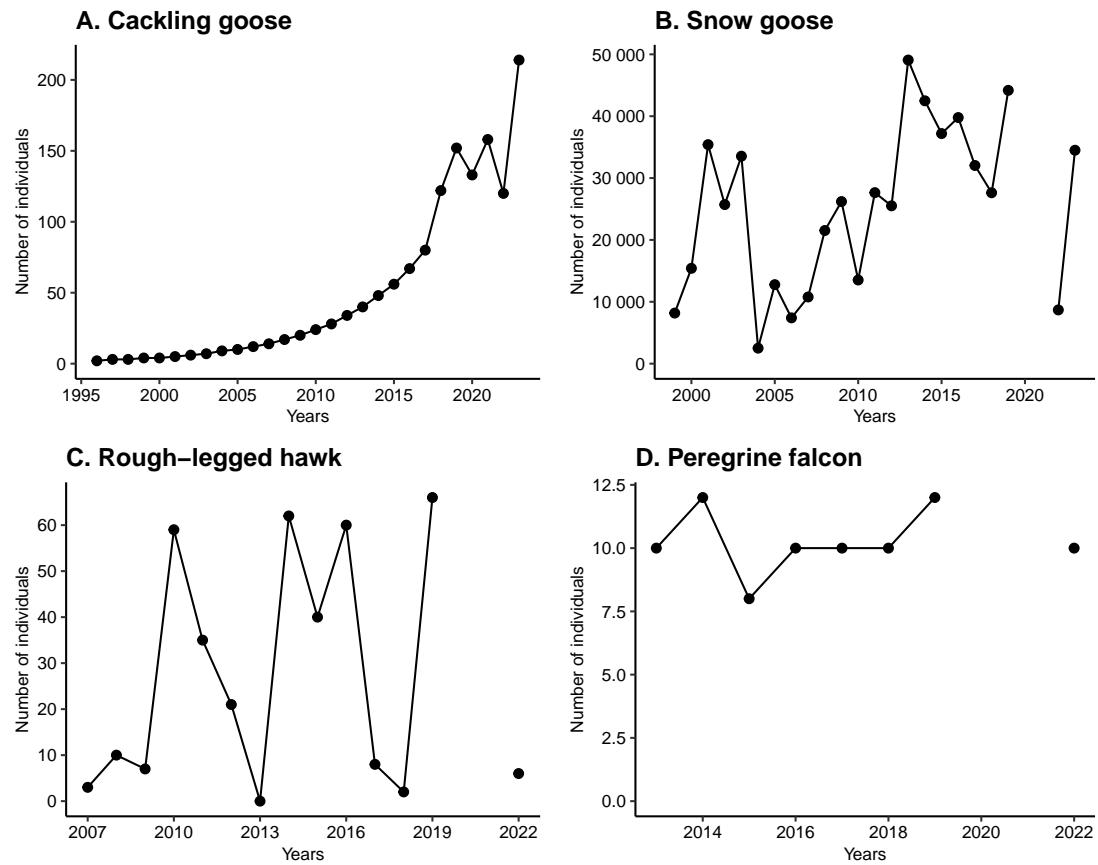
Species	Method	Method quality	Justification	Lowest abundance	Highest abundance	Mean abundance	sd	n
Pacific loon	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	0	6	4	3	4 (2017-2019, 2022)
Red-throated loon	Intensive study area-wide nest monitoring (389 km <sup>2</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 ( $R^2=0.74$ , $p=0.15$ , $n=5$ )	moderate	Strong correlation with opportunistic nest monitoring	2	158	31	41	23 (1996-2016, 2020-2021)
Cackling goose	Intensive study area-wide nest monitoring (389 km <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	8687	49076	31852	12092	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> , $R^2=0.99$ , $p<0.0001$ , $n=8$ )	high	Strong correlation with study area-wide nest density	3	59	22	21	6 (2007-2012)
Rough-legged hawk	Intensive study area-wide nest monitoring (389 km <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)

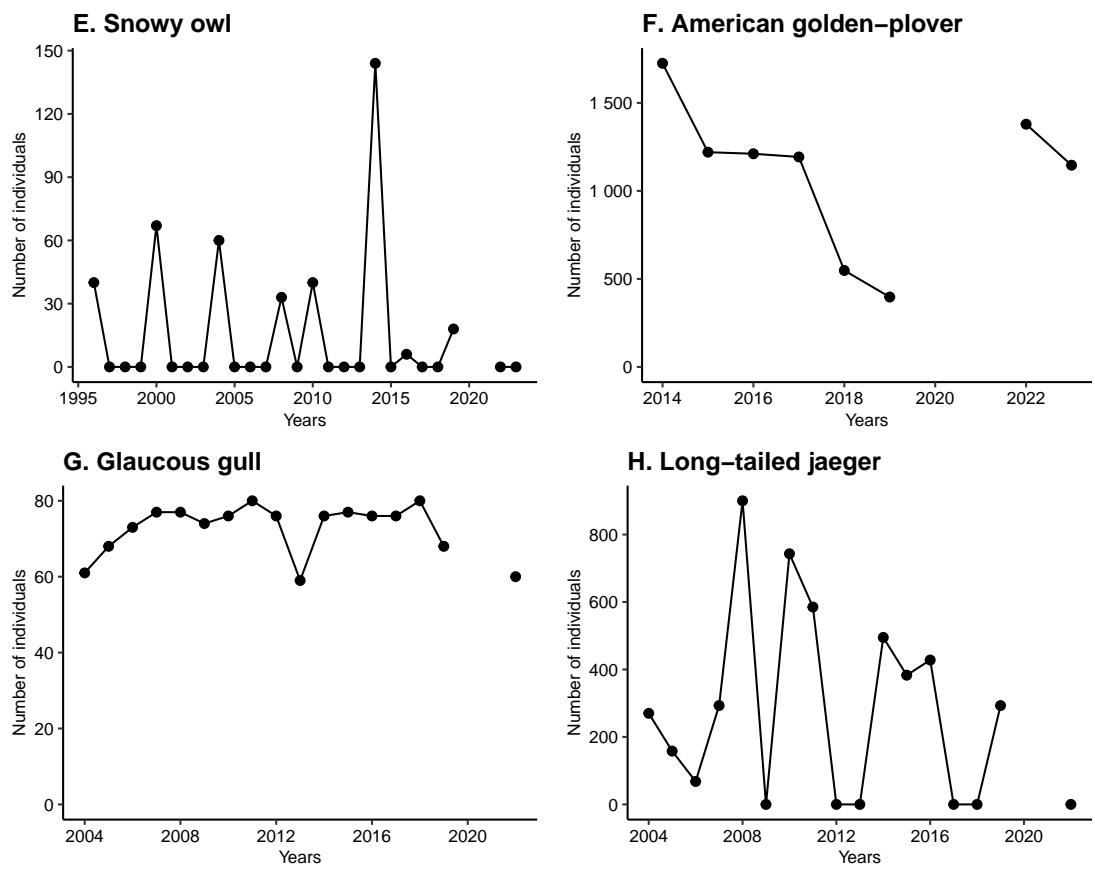
Snowy owl	Extrapolation from intensive nest monitoring (111 km <sup>2</sup> , R <sup>2</sup> =0.99, p<0.0001, n=10)	high	Strong correlation with study area-wide nest density	0	67	15	24	16 (1996-2011)
Snowy owl	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	0	144	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	Extrapolation from intensive nest monitoring (8 km <sup>2</sup> ) and transect observations (R <sup>2</sup> = 0.44 p= 0.32, n=8)	moderate	Uncertain relation with large scale indices			34		
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 turn-stone	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			40		
Ruddy turn-stone	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			53		
Red knot	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			66		
Red knot	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			233		
Pectoral sandpiper	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			80		
Pectoral sandpiper	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			255		

Baird's sandpiper	Extrapolation from intensive nest monitoring (2 km <sup>2</sup> ) and transects observations (R <sup>2</sup> =0.38, p=0.35, n=8)	moderate	Uncertain relation with large scale indices			2448		
White-rumped sandpiper	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			991		
White-rumped sandpiper	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			1134		
Buff-breasted sandpiper	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			6		
Buff-breasted sandpiper	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			8		
Red phalarope	Derived from the abundance estimate of Bairds sandpiper using transects observations	low	Derived from moderate quality estimate of another species			140		
Red phalarope	Derived from the abundance estimate of Bairds sandpiper using incidental observations	very low	Derived from moderate quality estimate of another species, but potentially includes transient migratory individuals			270		
Glaucous gull	Extrapolation from intensive nest monitoring (111 km <sup>2</sup> , R <sup>2</sup> =0.84, p=0.16, n=4)	high	Strong correlation with study area-wide nest density	59	80	73	6	13 (2004-2016)
Glaucous gull	Intensive study area-wide nest monitoring (389 km <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			31		

Horned lark	Derived from the abundance estimate of Lapland longspur using transects observations	low	Derived from moderate quality estimate of another species			362		
Horned lark	Derived from the abundance estimate of Lapland longspur using incidental observations	low	Derived from moderate quality estimate of another species			411		
American pipit	Derived from the abundance estimate of Lapland longspur using transects observations	very low	Derived from moderate quality estimate of another species and prime nesting habitat not sampled			53		
American pipit	Derived from the abundance estimate of Lapland longspur using incidental observations	low	Derived from moderate quality estimate of another species and prime nesting habitat not well sampled			87		
Lapland longspur	Extrapolation from intensive nest monitoring (2 km <sup>2</sup> ) and transects observations (R <sup>2</sup> =0.62, p=0.1, n=8)	moderate	Uncertain relation with large scale indices			7110		
Snow bunting	Derived from the abundance estimate of Lapland longspur using transects observations	very low	Derived from moderate quality estimate of another species and prime nesting habitat not sampled			18		
Snow bunting	Derived from the abundance estimate of Lapland longspur using incidental observations	low	Derived from moderate quality estimate of another species and prime nesting habitat not well sampled			276		
Nearctic brown lemming	Rigorous density estimates at small spatial scale (0.22 km <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		
Ermine	Indices of relative abundance derived from testimonials converted to abundance using home range size	moderate	Indirect indices and uncertainty on ermine home range size estimates	8	156	40	37	27 (1993-2019)
Arctic fox	Derived from extensive fox home range size studies (n=109)	moderate	Indirect indices, but large sample size			53		

Figure 10: Time series of the estimated annual 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.





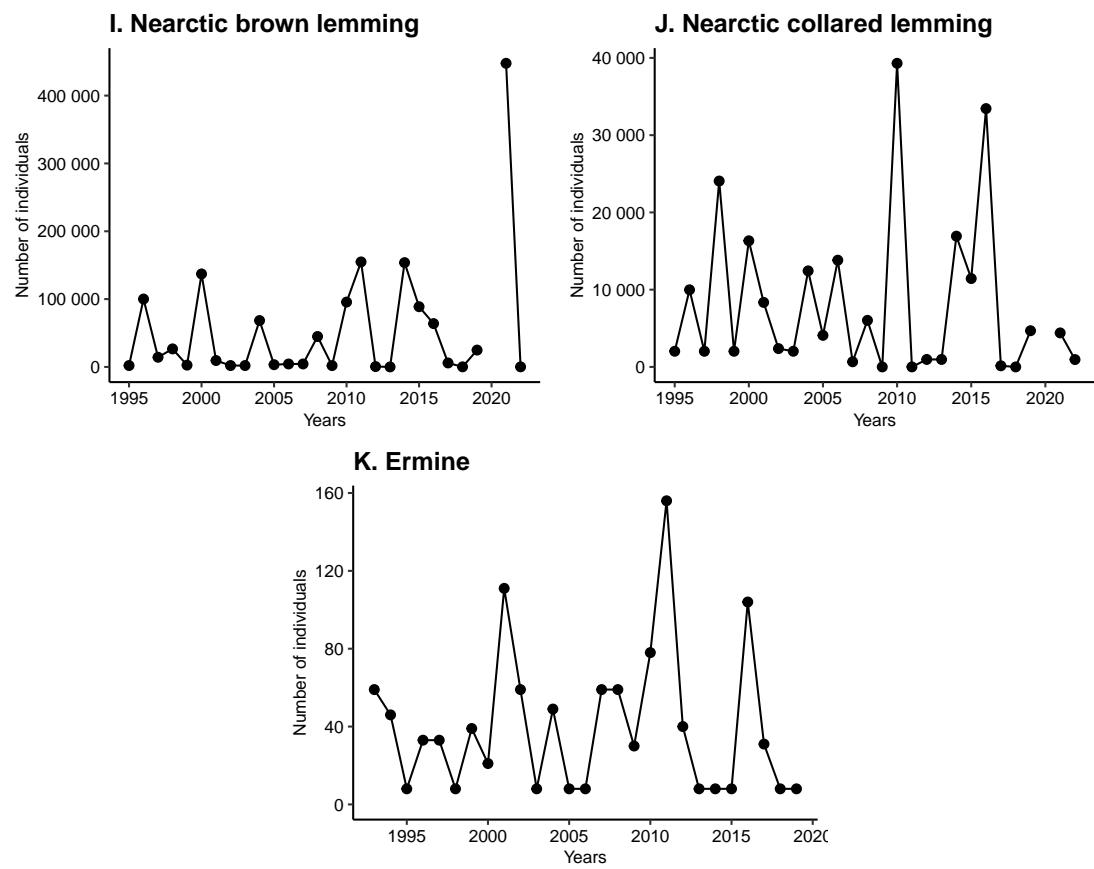


Table 5: Considering the absence of confidence intervals in our abundance estimates, we present below uncertainty intervals on estimated abundance values derived from field expert impressions. The intervals presented represent the minimum and maximum values between which the experts believe the actual abundance values should lie. When annual abundance has been estimated for several years (time series) we present intervals over the minimum and maximum abundance values encountered during the given time series. For other species, the uncertainty interval is estimated on the mean abundance.

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

739

## b. Taxonomy and systematics

740 Birds taxonomy was obtained from the IOC World Bird List 14.2 (Gill et al., 2024) and  
741 mammals taxonomy from the Mammal species of the world: a taxonomic and geographic  
742 reference (Wilson, 2005). We considered here *Mustela erminea richardsonii* as *Mustela*  
743 *richardsonii* due to recent genetic analysis (Colella et al., 2021).

744

## c. Permit history

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

749

## d. Project personnel

750

### *Principal and associated investigators*

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

754

### *Students*

755

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

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

759 **A. Status**

760 **1. Latest update**

761 30th September 2024

762 **2. Latest archive date**

763 XXXXXX October 2024

764 **3. Metadata status**

765 XXXXXX October 2024

766 **4. Data verification**

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

769 **B. Accessibility**

770 **1. Storage location and medium**

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

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

774 **2. Contact persons**

775 ***Overall project***

776 Joël Béty; *joel\_bety@uqar.ca*; 418 723-1986 #1701; 300 allée des Ursulines, Ri-  
777 mouski, Québec, Canada, G5L 3A1, Office B-002

778 ***Data and codes***

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

<sup>780</sup>        **3. Copyright restrictions**

<sup>781</sup>        None

<sup>782</sup>        **4. Proprietary restrictions**

<sup>783</sup>              **a. Release date**

<sup>784</sup>        None

<sup>785</sup>              **b. Citation**

<sup>786</sup>        Please cite this document when using the data.

<sup>787</sup>              **c. Disclaimer**

<sup>788</sup>        None

<sup>789</sup>        **5. Costs**

<sup>790</sup>        None, the data can be used free of charge.

791 **Class IV. Data structural descriptors**

792 **A. Data set file**

793 **1. Identity**

- 794 a. BYLOT-species\_taxonomy.csv  
795 b. BYLOT-species\_abundance.csv  
796 c. BYLOT-species\_body\_mass.csv  
797 d. BYLOT-interannual\_variation\_nest\_density.csv

798

799 **2. Size**

- 800 a. 35 records, not including header row (4.3 kB)  
801 b. 271 records, not including header row (33.0 kB)  
802 c. 53 records, not including header row (3.7 kB)  
803 d. 18 records, not including header row (961 B)

804 **3. Format and storage mode**

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

806 **4. Header information**

807 a. BYLOT-species\_taxonomy.csv

808 class; order; family; genus; species\_scientific; species\_en; species\_fr; species\_code;  
809 functional\_group; migratory\_status

810 b. BYLOT-species\_abundance.csv

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

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

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

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

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

816 **5. Alphanumeric attributes**

817 Mixed

818 **6. Special characters/fields**

819 Unavailable values are indicated by NA.

820 **7. Authentication procedures**

821 Sums of the numeric columns:

822 b. BYLOT-species\_abundance.csv: abundance= 2293389

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

824 d. BYLOT-interannual\_variation\_nest\_density.csv: mean\_nest\_density\_km2= 19.991;

825 sd\_nest\_density\_km2= 10.539; sample\_size\_nest\_density\_km2= 185

826 **B. Variable information**

827 **1. Variable identity**

828 See Table 6

829 **2. Variable definition**

830 See Table 6

831 **3. Units of measurement**

832 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 (Wilson, 2005).	NA
a.	order	Taxonomic order for birds (Gill et al., 2024) and mammals species (Wilson, 2005).	NA
a.	family	Taxonomic family for birds (Gill et al., 2024) and mammals species (Wilson, 2005).	NA
a.	genus	Taxonomic genus for birds (Gill et al., 2024) and mammals species (Wilson, 2005).	NA
a.	species_scientific	Taxonomic species for birds (Gill et al., 2024) and mammals species (Wilson, 2005). We used Mustela richardsonii instead of Mustela erminea richardsonii due to recent genetic analysis (Colella et al., 2021).	NA
a.	species_en	Common names of species in English.	NA
a.	species_fr	Common names of species in French.	NA
a.	functional_group	Functional group for each species. The classification of species into functional groups is based on Moisan et al. (2023).	NA
a.	migratory_status	Migratory status of each species (i.e., resident, partially migratory or migratory). The classification of species migratory status is based on Gauthier et al., (2011) and Moisan et al. (2023).	NA
b.	species_en	Common names of species in English.	NA
b.	year	Year corresponding to the estimate of annual abundance. If abundance has not been calculated for a given series of years, but rather as a general average, then NA has been assigned.	years
b.	breeding_status	Reproductive status of the individuals.	NA
b.	abundance	Estimate of the annual number of individuals found within the 389 km <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.	NA
c.	reference	Reference from which estimate of mean body mass were derived.	NA
d.	species_en	Common names of species in English.	NA
d.	zone	Sampled zone of the study area (see figure 2 and 3).	NA
d.	mean_nest_density_km2	Estimate of the mean annual nest density measured within the corresponding zone of the study area.	nests per square kilometer

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

833      **4. Data type**

834      **a. Storage type**

835    See Table 7

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

837    See Table 7

838      **c. Range for numeric values**

839    See Table 7

840      **d. Missing value codes**

841    Unavailable values are indicated by NA.

842      **e. Number of digits**

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

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

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

848 **Class V. Supplemental descriptors**

849 **A. Data acquisition**

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

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

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

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

855 **3. Data entry verification procedures**

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

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

859 Final abundance estimate were revised by the authors.

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

861 **1. Program**

862 R version 4.3.2 (2023-10-31)

863 **2. Operating system**

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

866 **3. Packages**

867 dplyr (Wickham et al., 2023a), tidyR (Wickham et al., 2024), sf (Pebesma et al., 2018),  
868 stringr (Wickham, 2023), xtable (Dahl et al., 2019), Distance (Miller et al., 2019), ggplot2  
869 (Wickham, 2016), lme4 (Bates et al., 2015), AICcmodavg (Mazerolle, 2023), scales(Wickham  
870 et al., 2023b), ggmap (Kahle and Wickham, 2013)

871 **4. Codes**

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

874 **D. Archiving**

875 **1. Archival procedures**

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

877 **2. Redundant archival sites**

878 None

879 **E. Publications and results**

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

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

885 **1. Data request history**

886 None

887 **2. Data set update history**

888 None

<sup>889</sup>        **3. Review history**

<sup>890</sup>     None

<sup>891</sup>        **4. Questions and comments from secondary users**

<sup>892</sup>     None

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<sup>901</sup>     ecological monitoring on Bylot Island and for permitting us to conduct research on their  
<sup>902</sup>     land.

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