

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

<sup>3</sup> **Authors:**

<sup>4</sup> Louis Moisan<sup>1,2</sup>, Azenor Bideault<sup>2,3</sup>, Gilles Gauthier<sup>4</sup>, Éliane Duchesne<sup>1</sup>, Dominique  
<sup>5</sup> Fauteux<sup>5</sup>, Dominique Berteaux<sup>1</sup>, Pierre Legagneux<sup>3,6</sup>, Marie-Christine Cadieux<sup>3</sup> and  
<sup>6</sup> Joël Béty<sup>1</sup>

<sup>7</sup> **Author Affiliations:**

<sup>8</sup> <sup>1</sup> Chaire de Recherche du Canada en Biodiversité Nordique, Centre d'Études Nordiques,  
<sup>9</sup> Centre de la science de la biodiversité du Québec, Département de biologie, chimie et  
<sup>10</sup> géographie, Université du Québec à Rimouski, Rimouski, QC, Canada

<sup>11</sup> <sup>2</sup> Chaire de Recherche du Canada en Écologie Intégrative, Centre d'Études Nordiques,  
<sup>12</sup> Centre de la science de la biodiversité du Québec, Département de Biologie, Université  
<sup>13</sup> de Sherbrooke, Sherbrooke, QC, Canada

<sup>14</sup> <sup>3</sup> Chaire de Recherche Sentinelle Nord sur l'impact des migrations animales sur les  
<sup>15</sup> écosystèmes nordiques, Centre d'Études Nordiques, Centre de la science de la  
<sup>16</sup> biodiversité du Québec, Département de Biologie, Université Laval, Québec, QC,  
<sup>17</sup> Canada

<sup>18</sup> <sup>4</sup> Centre d'études nordiques, Département de Biologie, Université Laval, Québec, QC,  
<sup>19</sup> Canada

<sup>20</sup> <sup>5</sup> Centre d'études nordiques, Centre for Arctic Knowledge and Exploration, Canadian  
<sup>21</sup> Museum of Nature, Ottawa, ON, Canada

<sup>22</sup> <sup>6</sup> Centre d'Études Biologiques de Chizé (CEBC-CNRS), Université de La Rochelle,  
<sup>23</sup> France

<sup>24</sup> **Corresponding Author:**

<sup>25</sup> *louis.moisan.bio@gmail.com*

<sup>26</sup> *joel\_bety@uqar.ca*

<sup>27</sup> **Open Research statement:**

<sup>28</sup> Data are publicly available at <https://datadryad.org/>.

<sup>29</sup> Raw data and codes used to extract the presented data set are publicly available at  
<sup>30</sup> <https://zenodo.org/>.

31      **Introduction**

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

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

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

68 et al., 2012).

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

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

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

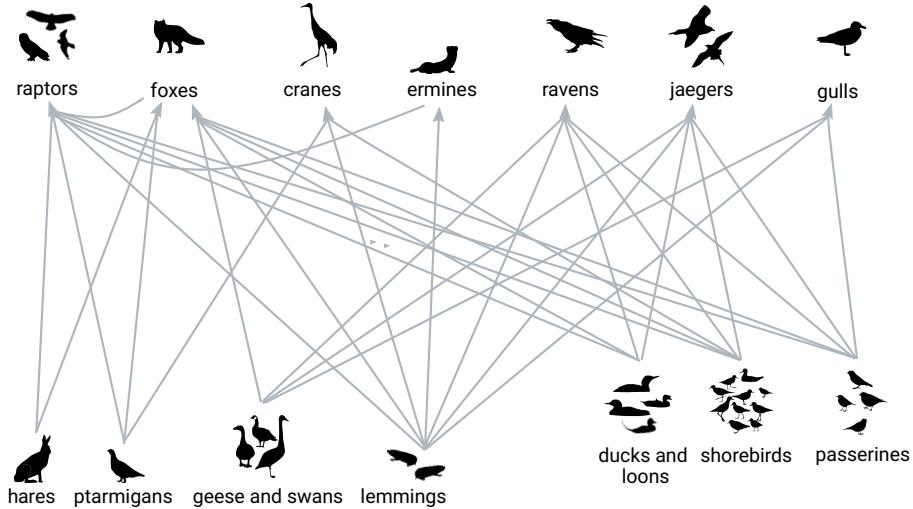


Figure 1: Synthetic vertebrate food web of the south plain of Bylot Island.

## 101 Objective

102 Our main objective is to provide readily accessible, long-term time series of annual abun-  
 103 dances of all vertebrate species within the Arctic terrestrial community of Bylot Island  
 104 during the breeding season (May to August). This includes both breeding and non-  
 105 breeding individuals that stay in the study area for a significant period of time, and ex-  
 106 cludes non-breeding individuals that stop for only a few days during their migration. Our  
 107 focus extends to estimating abundances at the landscape scale, enabling the study of com-  
 108 munity and ecosystem dynamics, trophic interactions and the impacts of global changes  
 109 on high-latitude environments. Additionally, we aim to provide the average body mass  
 110 for each species in the community, enabling the conversion of 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-mean\_species\_abundance.csv  
<sub>119</sub> BYLOT-mean\_species\_body\_mass.csv  
<sub>120</sub> BYLOT-interannual\_variation\_nest\_density.csv

<sub>121</sub>

<sub>122</sub> **C. Data set description**

<sub>123</sub> **1. Originators**

<sub>124</sub> **Gilles Gauthier**, Centre d'études nordiques, Département de Biologie, Université Laval,  
<sub>125</sub> Québec, QC, Canada

<sub>126</sub> **Joël Béty**, Chaire de Recherche du Canada en Biodiversité Nordique, Centre d'Études  
<sub>127</sub> Nordiques, Centre de la science de la biodiversité du Québec, Département de biologie,  
<sub>128</sub> chimie et géographie, Université du Québec à Rimouski, Rimouski, QC, Canada

<sub>129</sub> **Pierre Legagneux**, Chaire de Recherche Sentinelle Nord sur l'impact des migrations  
<sub>130</sub> animales sur les écosystèmes nordiques, Centre d'Études Nordiques, Centre de la sci-  
<sub>131</sub> ence de la biodiversité du Québec, Centre d'Études Biologiques de Chizé (CEBC-CNRS)  
<sub>132</sub> Département de Biologie, Université Laval, Québec, QC, Canada

<sub>133</sub> **2. Abstract**

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

<sup>141</sup> at the landscape level, a prerequisite to conduct community-level analyses. We have stan-  
<sup>142</sup> dardized data obtained with different field methods to provide readily usable long-term  
<sup>143</sup> time series of abundance for 35 vertebrate species (30 birds and 5 mammals) present  
<sup>144</sup> in the study system. Monitoring data includes intensive capture-mark-recapture density  
<sup>145</sup> estimates of lemmings on trapping grids, systematic or opportunistic nest monitoring con-  
<sup>146</sup> ducted across the entire study area or within specific plots for all bird species, transects of  
<sup>147</sup> vertebrate counts distributed throughout the study area, daily incidental observations of  
<sup>148</sup> vertebrates and satellite tracking of fox movements. Annual abundance of species was es-  
<sup>149</sup> timated at the landscape level, accounting for spatial variations. Furthermore, we provide  
<sup>150</sup> body masses for each species, derived from empirical onsite measurements for 18 species  
<sup>151</sup> and from the literature for the remaining species. Body mass is essential to convert species  
<sup>152</sup> abundance into biomass for studies of trophic fluxes and ecosystem processes. Our dataset  
<sup>153</sup> provides a unique opportunity for holistic empirical studies of ecological communities, al-  
<sup>154</sup> lowing a deeper understanding of community structure and dynamics. Considering that  
<sup>155</sup> the study site is a pristine and protected area that has experienced minimal anthropogenic  
<sup>156</sup> impact, it can also provide an ideal baseline for investigating the impacts of global changes  
<sup>157</sup> on high-latitude terrestrial ecosystems.

<sup>158</sup> **D. Key words/phrases**

<sup>159</sup> Bylot Island, Canadian Arctic, Arctic tundra, 1993-2023, long-term monitoring, biodi-  
<sup>160</sup> versity monitoring, community composition, species abundance, species density, species  
<sup>161</sup> biomass, species body mass, food web

<sup>162</sup> **Class II. Research origin descriptors**

<sup>163</sup> **A. Overall project description**

<sup>164</sup> **1. Identity**

<sup>165</sup> Understanding the structure and dynamics of Arctic terrestrial vertebrate communities

<sup>166</sup> **2. Originators:**

<sup>167</sup> **Gilles Gauthier**, Centre d'études nordiques, Département de Biologie, Université Laval,  
<sup>168</sup> Québec, QC, Canada

<sup>169</sup> **Joël Béty**, Chaire de Recherche du Canada en Biodiversité Nordique, Centre d'Études  
<sup>170</sup> Nordiques, Centre de la science de la biodiversité du Québec, Département de biologie,  
<sup>171</sup> chimie et géographie, Université du Québec à Rimouski, Rimouski, QC, Canada

<sup>172</sup> **Pierre Legagneux**, Chaire de Recherche Sentinelle Nord sur l'impact des migrations  
<sup>173</sup> animales sur les écosystèmes nordiques, Centre d'Études Nordiques, Centre de la sci-  
<sup>174</sup> ence de la biodiversité du Québec, Centre d'Études Biologiques de Chizé (CEBC-CNRS)  
<sup>175</sup> Département de Biologie, Université Laval, Québec, QC, Canada

<sup>176</sup> **3. Period of study**

<sup>177</sup> 1989 - continuing

<sup>178</sup> **4. Objectives**

<sup>179</sup> i) Understand the factors that shape the structure and drive the dynamics of Arctic ter-  
<sup>180</sup> restrial vertebrate communities.

<sup>181</sup> ii) Predict the effects of current global environmental changes on the structure and dy-  
<sup>182</sup> namics of Arctic terrestrial vertebrate communities.

<sup>183</sup> **5. Abstract**

<sup>184</sup> Arctic terrestrial vertebrate communities present low species richness, making those rela-  
<sup>185</sup> tively simple communities ideal for studying ecological patterns and dynamics in terrestrial  
<sup>186</sup> environments. Although, they present complex networks of interacting species, extreme  
<sup>187</sup> seasonal changes of environmental conditions and a large portion of migratory species,  
<sup>188</sup> which make challenging the identification of the key factors that shape their structure  
<sup>189</sup> and dynamics. In the face of rapid global environmental changes, it is crucial to have a  
<sup>190</sup> comprehensive understanding of the key processes shaping Arctic terrestrial communities

<sup>191</sup> structure and dynamics in order to predict how global changes will impact them in the  
<sup>192</sup> future. Our research emphasizes long-term biodiversity monitoring, a community-wide  
<sup>193</sup> perspective and food web modeling to achieve this understanding.

<sup>194</sup> **6. Sources of funding**

<sup>195</sup> Natural Sciences and Engineering Research Council of Canada, Fonds Québécois de  
<sup>196</sup> Recherche Nature et Technologies, Centre d'études nordiques, Natural Resources Canada  
<sup>197</sup> (Polar Continental Shelf Program), Network of Centers of Excellence Canada (Arctic-  
<sup>198</sup> Net), Canada First Research Excellence Fund (Sentinel North Program), Polar Knowledge  
<sup>199</sup> Canada, Environment and Climate Change Canada, Canada Foundation for Innovation,  
<sup>200</sup> Parks Canada Agency, International Polar Year program of the Government of Canada,  
<sup>201</sup> Crown-Indigenous Relations and Northern Affairs Canada (Northern Contaminant Pro-  
<sup>202</sup> gram), Duck Unlimited Canada, Kenneth M. Molson Foundation (Kenneth M. Molson  
<sup>203</sup> Foundation's donation for wildlife research, conservation, and habitat), Garfield Weston  
<sup>204</sup> Foundation, First Air—Canadian North, Nunavut Wildlife Management Board, Uni-  
<sup>205</sup> versité Laval, Université du Québec à Rimouski

<sup>206</sup> **B. Specific subproject description**

<sup>207</sup> **1. Site description**

<sup>208</sup> **a. Site type**

<sup>209</sup> The study area ( $389 \text{ km}^2$ ) represents a relatively productive tundra ecosystem in the  
<sup>210</sup> eastern Canadian High-Arctic. An important biological characteristic of the area is the  
<sup>211</sup> presence of a large snow goose (scientific names of most vertebrate species can be found  
<sup>212</sup> in **Table 1**) colony of around 25 000 breeding pairs (Reed et al., 2002) spanning ap-  
<sup>213</sup> proximately  $70 \text{ km}^2$ . The vertebrate community within the study area comprises 30 bird  
<sup>214</sup> species, with 29 of them being migratory or partially migratory, along with 5 mammal  
<sup>215</sup> species (**Table 1**; Moisan et al. (2023); Gauthier et al. (2024b)). The study area experi-  
<sup>216</sup> ences significant temporal fluctuations in the population of small mammals (lemmings),  
<sup>217</sup> which in turn impact the occurrence and abundance of their avian and mammalian preda-  
<sup>218</sup> tors such as snowy owls, rough-legged hawks, long-tailed jaegers, ermines and Arctic foxes  
<sup>219</sup> (Legagneux et al., 2012; Duchesne et al., 2021). We exclude occasional visitors, namely:  
<sup>220</sup> i) species lacking confirmed breeding occurrences on the study site, ii) species observed  
<sup>221</sup> solely within a single year, and iii) species primarily breeding and foraging in nearby ma-  
<sup>222</sup> rine or coastal habitats (Moisan et al., 2023). The case of the red fox (*Vulpes vulpes*) was  
<sup>223</sup> ambiguous. While the presence of breeding pairs has been confirmed in the study area  
<sup>224</sup> (Lai et al., 2022), the extent of population establishment remains unclear and sightings  
<sup>225</sup> are rare. Therefore, we decided to exclude this species.

Table 1: Species composition of the vertebrate community of Bylot Island with the corresponding annual cycle strategy (i.e., resident, partial migrant, migrant).

Functional group	Scientific name	Name	Annual cycle strategy
ducks and loons	<i>Somateria spectabilis</i>	king eider	migrant
ducks and loons	<i>Clangula hyemalis</i>	long-tailed duck	migrant
ducks and loons	<i>Gavia pacifica</i>	Pacific loon	migrant
ducks and loons	<i>Gavia stellata</i>	red-throated loon	migrant
geese and swans	<i>Branta hutchinsii</i>	cackling goose	migrant
geese and swans	<i>Anser caerulescens</i>	snow goose	migrant
geese and swans	<i>Cygnus columbianus</i>	tundra swan	migrant
raptors	<i>Buteo lagopus</i>	rough-legged hawk	migrant
raptors	<i>Falco peregrinus</i>	peregrine falcon	migrant
raptors	<i>Bubo scandiacus</i>	snowy owl	migrant
ptarmigans	<i>Lagopus muta</i>	rock ptarmigan	resident
cranes	<i>Antigone canadensis</i>	sandhill crane	migrant
shorebirds	<i>Pluvialis dominica</i>	American golden-plover	migrant
shorebirds	<i>Pluvialis squatarola</i>	black-bellied plover	migrant
shorebirds	<i>Charadrius hiaticula</i>	common-ringed plover	migrant
shorebirds	<i>Arenaria interpres</i>	ruddy turnstone	migrant
shorebirds	<i>Calidris canutus</i>	red knot	migrant
shorebirds	<i>Calidris melanotos</i>	pectoral sandpiper	migrant
shorebirds	<i>Calidris bairdii</i>	Baird's sandpiper	migrant
shorebirds	<i>Calidris fuscicollis</i>	white-rumped sandpiper	migrant
shorebirds	<i>Calidris subruficollis</i>	buff-breasted sandpiper	migrant
shorebirds	<i>Phalaropus fulicarius</i>	red phalarope	migrant
gulls	<i>Larus hyperboreus</i>	glaucous gull	migrant
jaegers	<i>Stercorarius longicaudus</i>	long-tailed jaeger	migrant
jaegers	<i>Stercorarius parasiticus</i>	parasitic jaeger	migrant
ravens	<i>Corvus corax</i>	common raven	partial migrant
passerines	<i>Eremophila alpestris</i>	horned lark	migrant
passerines	<i>Anthus rubescens</i>	American pipit	migrant
passerines	<i>Calcarius lapponicus</i>	Lapland longspur	migrant
passerines	<i>Plectrophenax nivalis</i>	snow bunting	migrant
lemmings	<i>Lemmus trimucronatus</i>	brown lemming	resident
lemmings	<i>Dicrostonyx groenlandicus</i>	collared lemming	resident
hares	<i>Lepus arcticus</i>	Arctic hare	resident
ermes	<i>Mustela richardsonii</i>	ermine	resident
foxes	<i>Vulpes lagopus</i>	Arctic fox	partial migrant

## b. Geography

Our 463 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 complete and detailed description of the geology of the study area.

237           **e. Hydrology**

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

241           **f. Site history**

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

243           **g. Climate**

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

249        **2. Experimental or sampling design**

250        **a. Permanent plots**

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

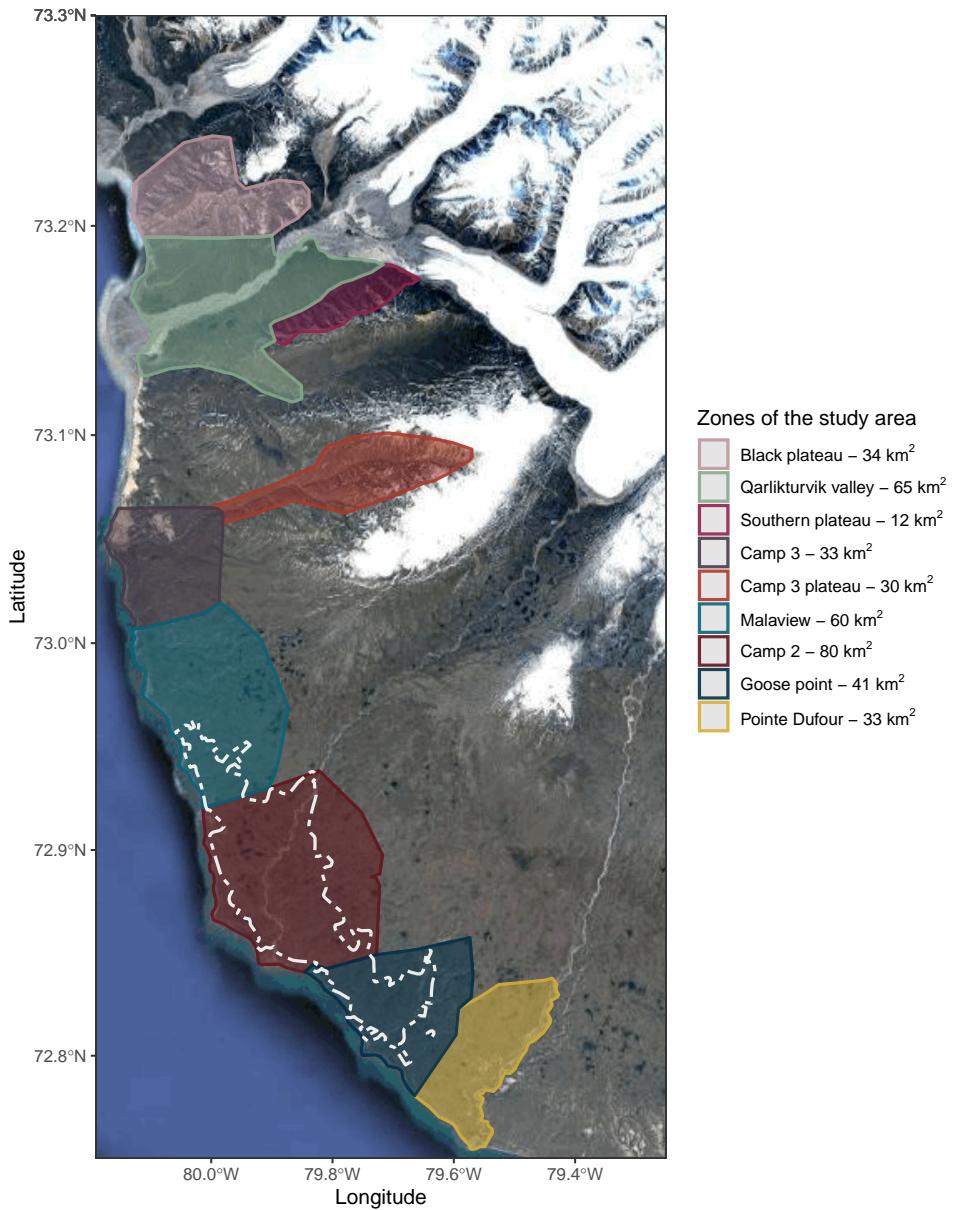


Figure 2: Map of the different zones (colored polygons) of the  $463 \text{ km}^2$  study area located on the southern plain of Bylot Island, Nunavut Canada. The outline of the snow goose colony area is presented with white dash; we used the outline of the colony in 2017 since it represents an average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

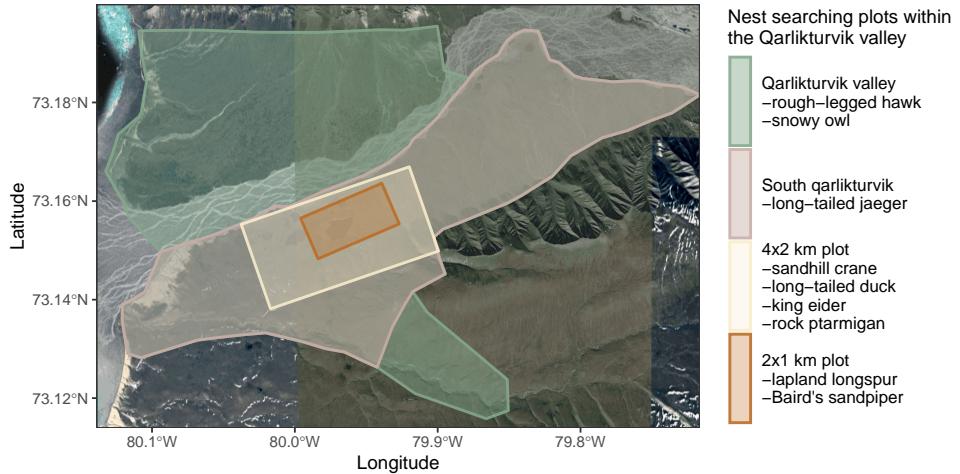


Figure 3: Intensive nests searching plots ( $8 \text{ km}^2$  and  $2 \text{ km}^2$ ) located in the Qarlikturvik valley.

### 267 b. Avian nest monitoring

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

275 ***Pacific loon, red-throated loon, cackling goose, tundra swan and glau-  
 276 couous gull***

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

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

Species	Zone	Years	Monitoring	References
snow goose	camp 2	1999-2019, 2023	systematic	Gauthier et Cadieux, 2020
rough-legged hawk	qarlikt., black & south plat.	2007-2019, 2022	systematic	Gauthier et al., 2020
peregrine falcon	qarlikt., black & south plat.	2007-2019, 2022	systematic	Gauthier et al., 2020
snowy owl	qarlikt., black & south plat.	1996-2019, 2023	systematic	Gauthier et al., 2020
Baird's sandpiper	qarlikturvik (2x1 km plot)	2005-2019, 2022-2023	systematic	Béty, 2020
Lapland longspur	qarlikturvik (2x1 km plot)	2005-2019, 2022-2023	systematic	Gauthier and Béty, 2020
king eider	qarlikturvik (4x2 km plot)	2005-2019, 2022	opportunistic	unpublished data
long-tailed duck	qarlikturvik (4x2 km plot)	2005-2019, 2022	opportunistic	unpublished data
rock ptarmigan	qarlikturvik (4x2 km plot)	2005-2019, 2022	opportunistic	unpublished data
sandhill crane	qarlikturvik (4x2 km plot)	2005-2019, 2022	opportunistic	unpublished data
brown lemming	qarlikturvik (trapping grids)	1995-2019, 2021-2022	systematic	Gauthier, 2020
collared lemming	qarlikturvik (trapping grids)	1995-2019, 2021-2022	systematic	Gauthier, 2020
Pacific loon	qarlikturvik valley	2004-2019, 2022	systematic	unpublished data
red-throated loon	qarlikturvik valley	2004-2019, 2022	systematic	unpublished data
cackling goose	qarlikturvik valley	2004-2019, 2022-2023	systematic	unpublished data
tundra swan	qarlikturvik valley	2004-2019, 2022	systematic	unpublished data
glaucous gull	qarlikturvik valley	2004-2019, 2022	systematic	Gauthier et al., 2020
long-tailed jaeger	qarlikturvik valley	2004-2019, 2022	systematic	Gauthier et al., 2020
parasitic jaeger	qarlikturvik valley	2004-2019, 2022	systematic	unpublished data
Pacific loon	whole study area	2017-2019, 2022	systematic	Duchesne et al., 2021
red-throated loon	whole study area	2017-2019, 2022	systematic	Duchesne et al., 2021
cackling goose	whole study area	2017-2019, 2022-2023	systematic	Duchesne et al., 2021
tundra swan	whole study area	2017-2019, 2022	systematic	Duchesne et al., 2021
rough-legged hawk	whole study area	2013-2019, 2022	systematic	Gauthier et al., 2020
peregrine falcon	whole study area	2013-2019, 2022	systematic	Gauthier et al., 2020
snowy owl	whole study area	2012-2019, 2022-2023	systematic	Gauthier et al., 2020
common-ringed plover	whole study area	2015-2017	systematic	Béty, 2020
glaucous gull	whole study area	2017-2019, 2022	systematic	Gauthier et al., 2020
parasitic jaeger	whole study area	2009-2019, 2022	opportunistic	unpublished data
common raven	whole study area	2013-2019, 2022	systematic	unpublished data
ermine	whole study area	1993-2019	opportunistic	Bolduc et al., 2023
Arctic fox	whole study area	2008-2016	systematic	Dulude-de Broin et al., 2023

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

### Snow goose

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

302 et al., 2021).

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

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

318 **Snowy owl**

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

330

331 **Long-tailed jaeger and parasitic jaeger**

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

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

343

344 ***Common-ringed plover***

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

352

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

367 ***Opportunistic nest monitoring***

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

Table 3: Annual nest density (nests/km<sup>2</sup>) of selected avian species estimated on different zones of Bylot Island.

Species	Zone	Mean $\pm$ SD	Number of years
Baird's sandpiper	qarlikturvik (2x1 km plot)	5.000 $\pm$ 3.558	17
Lapland longspur	qarlikturvik (2x1 km plot)	13.559 $\pm$ 5.849	17
king eider	qarlikturvik (4x2 km plot)	0.115 $\pm$ 0.138	16
long-tailed duck	qarlikturvik (4x2 km plot)	0.092 $\pm$ 0.138	16
rock ptarmigan	qarlikturvik (4x2 km plot)	0.031 $\pm$ 0.055	16
sandhill crane	qarlikturvik (4x2 km plot)	0.161 $\pm$ 0.087	16
long-tailed jaeger	qarlikturvik valley	0.362 $\pm$ 0.380	17
Pacific loon	whole study area	0.005 $\pm$ 0.004	4
red-throated loon	whole study area	0.082 $\pm$ 0.019	4
cackling goose	whole study area	0.177 $\pm$ 0.064	5
tundra swan	whole study area	0.001 $\pm$ 0.001	4
rough-legged hawk	whole study area	0.157 $\pm$ 0.151	8
peregrine falcon	whole study area	0.053 $\pm$ 0.007	8
snowy owl	whole study area	0.022 $\pm$ 0.058	10
common ringed plover	whole study area	0.070 $\pm$ 0.012	3
glaucous gull	whole study area	0.091 $\pm$ 0.011	4
parasitic jaeger	whole study area	0.010 $\pm$ 0.004	12
common raven	whole study area	0.003 $\pm$ 0.003	8

### 378 c. Observation of individuals

#### 379 *Vertebrate count transects*

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

387

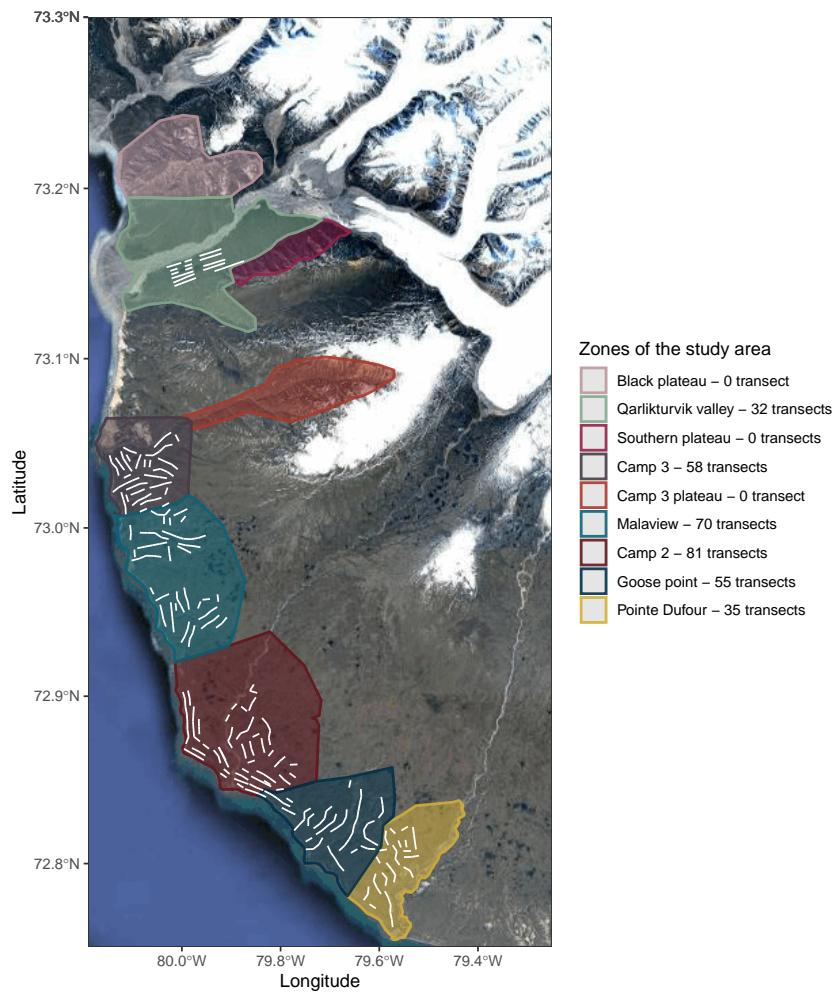


Figure 4: Spatial distribution of vertebrate count transects (white lines) on the south plain of Bylot Island (146 to 320 transects per year).

388            ***Snow goose point count***

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

393

394            ***Incidental observations***

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

406

Table 4: Index of relative abundance (i.e., number of individuals observed per hour) derived from incidental daily observations for selected vertebrate species in lowland (i.e., 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
snow bunting	0.59	0.092	6.4
Arctic hare	0.02	0.009	2

407           ***Testimonials of ermine sightings***

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

418           d. Capture of individuals

419           ***Lemming trapping***

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

433           ***Arctic fox movement tracking***

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

442           ***Parasitic jaeger banding***

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

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

446 **e. Species body mass**

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

457        **3. Research methods**

458        **a. Field/laboratory**

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

467 **Pacific loon, red-throated loon, cackling goose, tundra swan and glau-**  
468 **cous gull**

469 Based on the systematic and intensive search for the glaucous gull, cackling goose,  
470 tundra swan, red-throated loon and Pacific loon nests in wetlands, we are con-  
471 fident that we have found nearly all nests across the study area from 2017 to 2019  
472 and in 2022. We transformed the number of nests to abundance of individuals by  
473 multiplying it by a factor of two.

474 We observed a relatively strong correlation between the nest density of glaucous  
475 gulls in the Qarlikturvik valley and the nest density across the entire study area  
476 ( $R^2 = 0.84$ ,  $p = 0.16$ ,  $n = 4$ ). Consequently, we estimated the density of glaucous  
477 gulls at the scale of the study area between 2004 and 2016 based on the nest density  
478 in the Qarlikturvik valley ( $y = 0.12406x + 0.13775$ ). However, we did not observe  
479 such strong relationships for loons and swans and thus we did not extend the time  
480 series. Regarding cackling geese, we observed signs of an exponential increase over  
481 time based on the annual number of nests found in various zones of the study area.  
482 We thus fitted an exponential model using the number of nests found annually  
483 over two distinct periods: in 1996 when the first nest was discovered, and then  
484 from 2017 to 2023 when sampling effort was systematic across the whole study area  
485 (**Figure 5**). We used the fitted model to estimate abundance between 1996 and  
486 2016 when monitoring was less systematic, which could potentially underestimate  
487 observed abundance as seen on **Figure 5**. We multiplied nest density by two to  
488 obtain the abundance.

489 **Snow goose**

490 Between 1999 and 2023, we assessed the abundance of snow geese in the study area  
491 through a multi-step process. We calculated the mean annual density of snow goose  
492 nests separately in the mesic and wetland habitats of the area occupied by the goose  
493 colony annually. We made slight adjustments to the goose colony perimeter defined  
494 from helicopter surveys to include all snow goose point counts where at least one  
495 breeding pair had been observed (**Figure 6**). To determine the mean density of  
496 nesting geese in wetlands, we divided two times (assuming two individuals per nest)  
497 the total number of nests found during systematic nest searches by the total area  
498 of wetlands sampled. The density of geese nesting in mesic habitat, a less preferred  
499 nesting habitat (Lecomte et al., 2008), was averaged from three independent meth-  
500 ods: systematic nest searches, vertebrate count transects, and snow goose point  
501 counts. Systematic nest searches were highly precise, but covered a relatively small  
502 area, whereas transects and snow goose point counts were less precise but covered  
503 larger areas. For each method, we calculated the mean density of breeding indi-  
504 viduals in mesic habitat by dividing the number of birds (or nests) recorded by

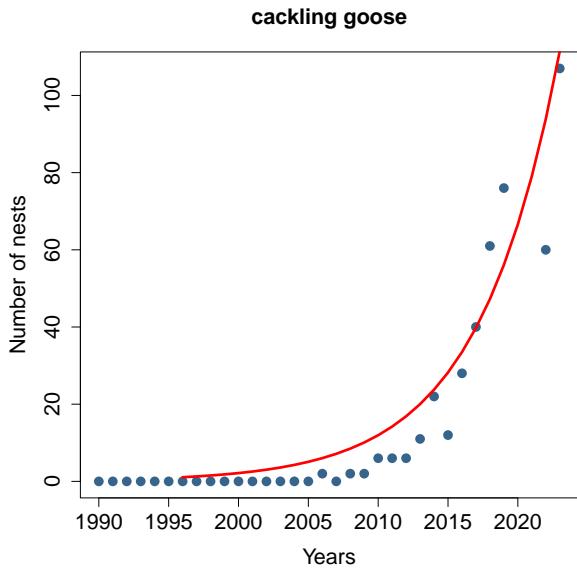


Figure 5: Number of cackling goose nests found across the study area over time. The red line represents the fitted model over the period 1996-2023 ( $y = e^{0.1717x - 342.684}$ ), which was used to estimate the annual abundance of cackling goose between 1996 and 2016. The model presents a strong fit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

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

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

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

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

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

545           ***Rock ptarmigan***

546           We estimated the abundance of rock ptarmigans based on the annual nest density  
547           measured in the 8 km<sup>2</sup> extensive nest search area of the Qarlikturvik valley. While we  
548           acknowledge that the opportunistic monitoring of this species likely underestimates  
549           nest density, the extensive sampling effort deployed annually within this area gives  
550           us confidence in obtaining a realistic number of nests. We then extrapolate the  
551           density to the whole study area, without distinction between mesic, wetland and

552 upland habitats (**Table 4**). Among the 6 nests found in the study area, 4 were  
553 located in mesic habitat, while one nest was found in a wetland and another in  
554 an upland habitat. To convert the number of nests into breeding abundance, we  
555 multiplied it by two.

556 **Sandhill crane**

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

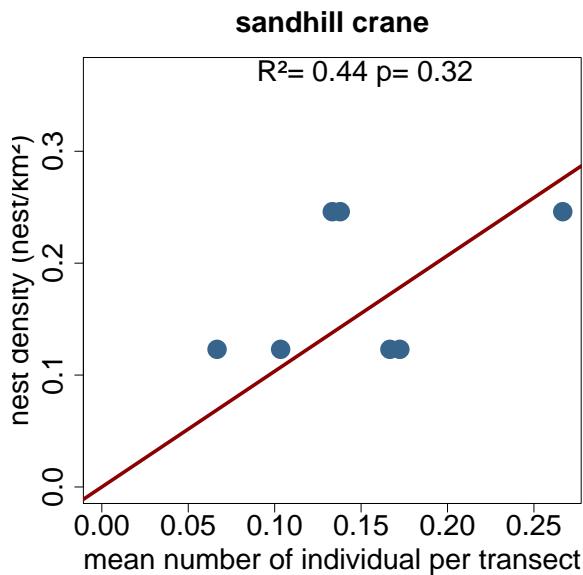


Figure 8: Linear regression between the nest density of sandhill cranes and the number of individuals observed per transect (nest density = 1.12 x number of individuals per transect; regression was forced to pass through the origin). The fit ( $R^2$  and  $p$  value) of the regression (red line) with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

571

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

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 4**).

To determine the abundance of black-bellied plovers, we used the mean number of black-bellied plovers and American golden-plovers observed per transect as an index 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.

#### **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

609 observed per transect, we used the mean proportion of transects where at least one  
 610 individual was detected. We made this adjustment because this species was less  
 611 frequently observed. In this relationship, nest density for these two species came  
 612 from the intensive nest sampling conducted within the core 2 km<sup>2</sup> area of the Qar-  
 613 likturvik valley and observations of individuals from transects carried out in the  
 614 larger 8 km<sup>2</sup> area in which the core area was located. This approach allowed us  
 615 to incorporate a larger sample size from the transects while focusing on a measure  
 616 of nest density determined systematically. Transects observations in lowland were  
 617 then converted into nest density using the regressions, and then in total number of  
 618 individuals by multiplying by the area and a factor 2. We estimated the density  
 619 of both species in the upland zones by applying a correction factor to the annual  
 620 mean density in lowland zones. This correction factor was determined based on the  
 621 relative abundance ratio between the upland and lowland zones (**Table 4**). We ac-  
 622 knowledge that the regression for Baird's sandpiper is weak; however, it offers some  
 623 refinement compared to assuming a uniform density throughout the study area.

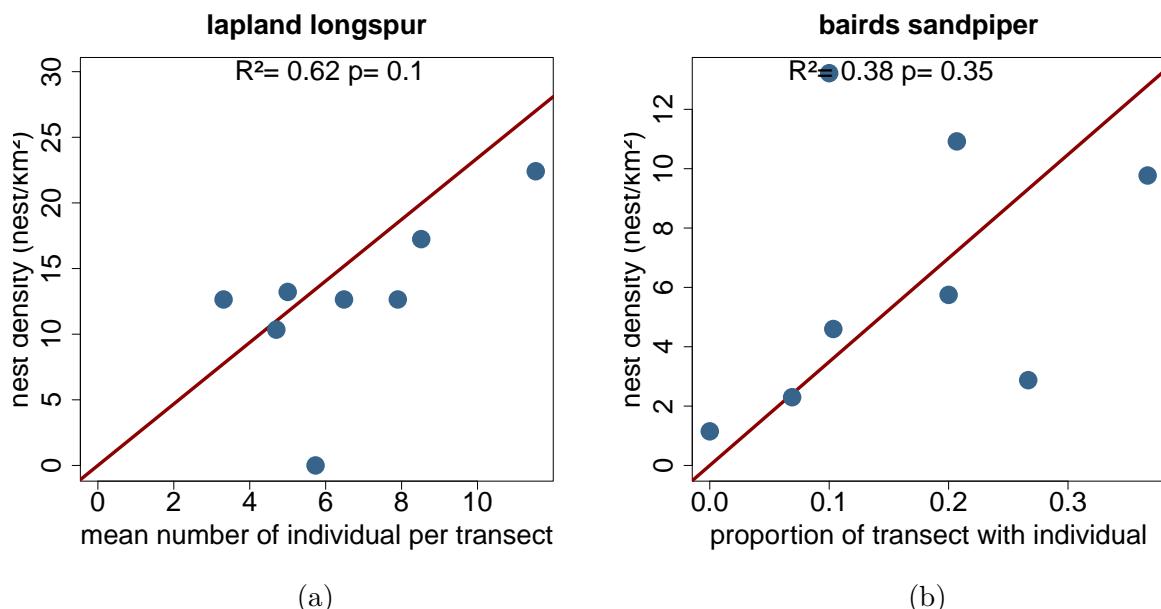


Figure 9: a) Linear regression between the nest density of Lapland longspurs and the number of individuals observed per transect (nest density= 2.3422 x number of individuals per transect; regression was forced through the origin). The fit ( $R^2$  and p value) of the regression (red line) with the empirical data from the Qarliketurvik 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 x 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 Qarliketurvik valley is presented (blue dots). Data points represent annual values.

624            ***Other passerines and sandpipers***

625            We estimated the abundance of other passerines (horned lark, American pipit, and  
626            snow bunting) in the lowland zones of the study area with the regression equa-  
627            tion between number of individuals per transect and nest density of the Lapland  
628            longspur (see section 3.9). We assumed here a similar detection probability for all  
629            species. We used the same approach for other sandpiper species (white-rumped  
630            sandpiper, pectoral sandpiper, buff-breasted sandpiper, red knot, ruddy turnstone  
631            and red phalarope) based on the regression equation for the Baird's sandpiper (see  
632            section 3.9). For all these species, we estimated the density in the upland zones by  
633            applying a correction factor to the mean density in lowland zones. This correction  
634            factor was determined based on the relative abundance ratio between the upland  
635            and lowland zones (**Table 4**). Nest density was then converted in number of in-  
636            dividuals by multiplying by the area and a factor 2. As an alternative approach,  
637            we estimated the abundance of other passerines and sandpipers based on the in-  
638            dices of relative abundance (i.e., the number of individuals observed per 100 hours)  
639            presented by Gauthier et al. (2024b). We assumed that the ratios between relative  
640            and actual abundance are the same (i.e., similar detection probability) among both  
641            passerine and sandpiper species. We therefore derived the absolute abundance of  
642            other passerine and sandpiper species from their relative abundances using respec-  
643            tively, the ratios between relative and absolute abundances of Lapland longspur  
644            (passerines) and Baird's sandpiper (sandpipers) as references.

645            ***Long-tailed jaeger***

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

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<sup>2</sup>. For comparison, Taylor  
664 (1974) measured a density of 0.06 individual/km<sup>2</sup> 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 relative  
674 and actual abundance are the same (i.e., similar detection probability) among  
675 those species. This assumption is reasonable as those species present similarities in  
676 size and foraging strategy. We therefore derived the absolute abundance of common  
677 ravens from their relative abundance using the ratio between relative and absolute  
678 abundances of glaucous gulls as a reference. Independently, we estimated the abun-  
679 dence of common ravens with the same approach but using the indices of relative  
680 abundance presented by Gauthier et al. (2024b), which was derived from incidental  
681 daily observations, rather than observations from the transects.

682 ***Brown and collared lemming***

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

695 ***Arctic hare***

696 Arctic hares are primarily observed in the upland zones of the study area, where  
697 sampling effort is limited. We thus derived abundance of hares from the estimated  
698 abundance of Arctic foxes based on indices of relative abundance presented in (Gau-  
699 thier et al., 2024b), which were derived from incidental daily observations. We dou-

bled 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 4**). 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.

### ***Ermine***

We estimated the annual abundance of ermines by transforming the annual index of relative abundance provided in Bolduc et al. (2023) into individual density. Annual values ranged from 0, indicating no ermine sighting, to 2.88, which signifies that nearly all observers observed at least one family group during their field season. We independently obtained measures of minimum (0.02 ind./km<sup>2</sup>) and maximum (0.4 ind./km<sup>2</sup>) ermine density, which were determined from estimates of individual home range obtained from radio-tracking data, observations on Bylot Island, and existing literature (Legagneux et al., 2012; Bilodeau, 2013). We associated the minimum and maximum scores of relative abundance with the minimum and maximum density of individuals, respectively. Ultimately, we calculated the ermine density by linearly interpolating between these two density extremes using the annual index of relative abundance.

### ***Arctic fox***

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

camera traps (Royer-Boutin, 2015).

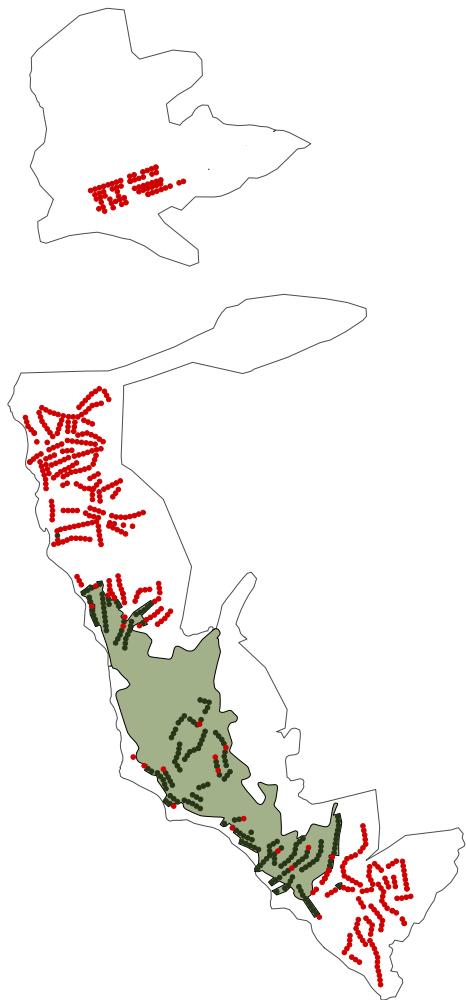


Figure 6: Map showing the region occupied by the snow goose colony in 2017 (green polygon) as an example. The perimeter was first defined from a helicopter surveys and then slightly adjusted to include all snow goose point counts where at least one breeding pair had been observed in that year (green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

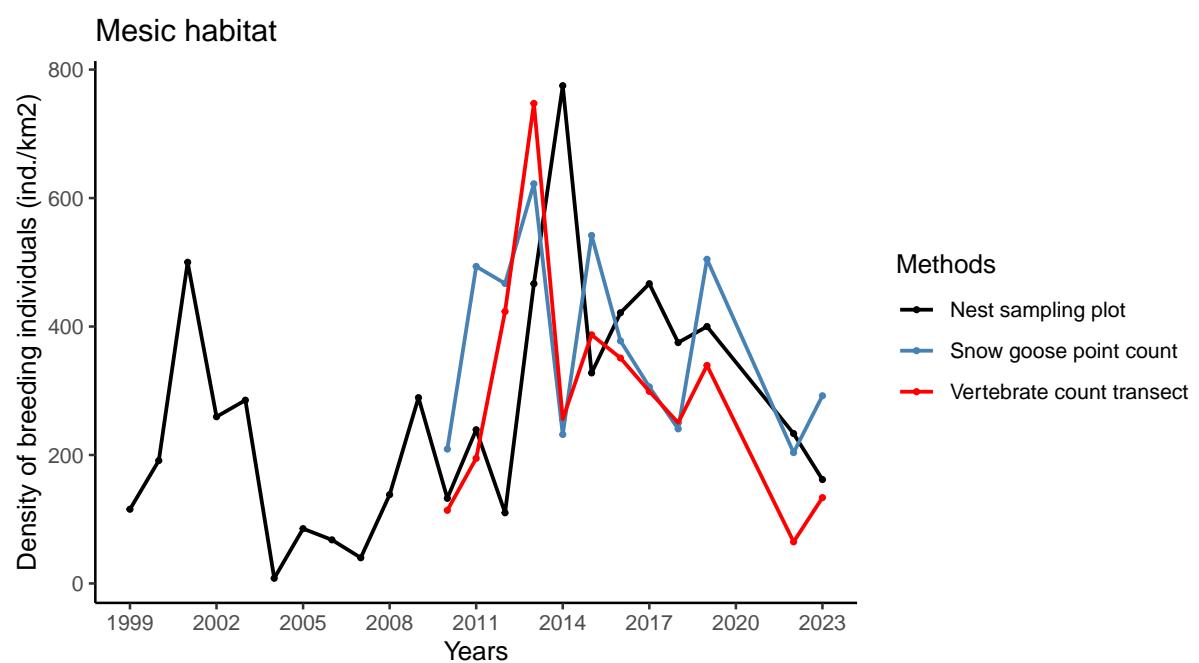


Figure 7: Estimates of breeding goose density in mesic habitat of the Bylot Island study area using three independent methods: Nest sampling plot, Snow goose point count, Vertebrate count transect.

Table 5: Summary of the lowest, highest, mean and standard deviation of the estimated abundance of each vertebrate species in the vertebrate community of the southern plain of Bylot Island (389 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
snow goose	Nest monitoring plots extrapolated to mean goose colony area	low	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)
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)
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)
peregrine falcon	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	8	12	10	1	8 (2013-2019, 2022)
rough-legged hawk	Extrapolation from intensive nest monitoring (111 km <sup>2</sup> , R <sup>2</sup> =0.99, p<0.0001, n=8)	high	Strong correlation with study area-wide nest density	3	59	20	19	8 (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)
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)
cackling goose	Extrapolation from exponential model of growth (R <sup>2</sup> =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)
Arctic fox	Derived from extensive fox home range size studies (n=109)	moderate	Indirect indices, but large sample size			53		
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)
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)

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)
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)
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)
Pacific loon	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	0	6	4	3	4 (2017-2019, 2022)
tundra swan	Intensive study area-wide nest monitoring (389 km <sup>2</sup> )	high	No extrapolation	0	2	1	1	4 (2017-2019, 2022)
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)
black-bellied plover	Derived from the abundance estimate of American golden-plover using transects observations	moderate	Derived from high quality estimate of another species			29		
black-bellied plover	Derived from the abundance estimate of American golden-plover using incidental observations	low	Derived from high quality estimate of another species, but potentially includes transient migratory individuals			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		
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		
sandhill crane	Extrapolation from intensive nest monitoring (8 km <sup>2</sup> ) and transect observations	moderate	Uncertain relation with large scale indices			34		
king eider	Intensive, but opportunistic nest monitoring (8 km <sup>2</sup> ) extrapolated by habitat	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	moderate	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	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	moderate	Derived from high quality estimate of another species			191		

rock ptarmigan	Intensive, but opportunistic nest monitoring (8 km <sup>2</sup> ) extrapolated to study area	low	Intensive, but opportunistic monitoring at relatively small spatial scale and prime nesting habitat not well sampled			24		
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		
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 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		
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		
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		
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		
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		
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		
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		
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		

739           **b. Taxonomy and systematics**

740   Bird scientific names were obtained from the IOC World Bird List 14.2 (Gill et al., 2024).  
741   Mammal scientific names were obtained from the Mammal species of the world: a tax-  
742   onomic and geographic reference (Wilson, 2005). However, we considered here *Mustela*  
743   *erminea richardsonii* as *Mustela richardsonii* due to recent genetic analysis (Colella et al.,  
744   2021).

745           **c. Permit history**

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

750           **d. Project personnel**

751           ***Principal and associated investigators***

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

755           ***Students***

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

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

760 **A. Status**

761 **1. Latest update**

762 19th September 2024

763 **2. Latest archive date**

764 XXXXXX October 2024

765 **3. Metadata status**

766 XXXXXX October 2024

767 **4. Data verification**

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

770 **B. Accessibility**

771 **1. Storage location and medium**

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

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

775 **2. Contact persons**

776 ***Overall project***

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

779 ***Data and codes***

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

<sup>781</sup>        **3. Copyright restrictions**

<sup>782</sup>     None

<sup>783</sup>        **4. Proprietary restrictions**

<sup>784</sup>              **a. Release date**

<sup>785</sup>     None

<sup>786</sup>              **b. Citation**

<sup>787</sup>     Please cite this document when using the data.

<sup>788</sup>              **c. Disclaimer**

<sup>789</sup>     None

<sup>790</sup>        **5. Costs**

<sup>791</sup>     None , the data can be used free of charge.

792 **Class IV. Data structural descriptors**

793 **A. Data set file**

794 **1. Identity**

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

799

800 **2. Size**

- 801 a. 35 records, not including header row (2.3 kB)  
802 b. 273 records, not including header row (17.0 kB)  
803 c. 51 records, not including header row (1.8 kB)  
804 d. 18 records, not including header row (1.1 kB)

805 **3. Format and storage mode**

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

807 **4. Header information**

808       **a. BYLOT-species\_taxonomy.csv**

809 functional\_group; scientific\_name; species; annual\_cycle\_strategy

810       **b. BYLOT-species\_abundance.csv**

811 species; year; status; method; abundance

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

813 species; source; body\_mass\_g

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

815 species; zone; mean\_nest\_density\_km2; sd\_nest\_density\_km2; sample\_size\_nest\_density\_km2

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= 2291027

823     c. BYLOT-species\_body\_mass.csv: body\_mass\_g= 46223

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 definitions, units, and data types for each data set file.

Data file	Variable identity	Variable definition	Units	Type
a.	functional_group	Functional group for each species. The classification of species into functional groups is based on Moisan et al. (2023).		string
a.	scientific_name	Bird scientific names were obtained from the IOC World Bird List 14.2 (Gill et al., 2024). Mammal scientific names were obtained from the Mammal species of the world: a taxonomic and geographic reference (Wilson, 2005). However, we considered here Mustela erminea richardsonii as Mustela richardsonii due to recent genetic analysis (Colella et al., 2021).		string
a.	species	Common species english name.		string

a.	annual_cycle_strategy	Annual cycle strategy of each species (i.e., resident, partially migratory or migratory). The classification of species annual cycle strategy is based on Gauthier et al., (2011) and Moisan et al. (2023).		string
b.	species	Common species english name.		string
b.	year	Year corresponding to the estimate of annual abundance.	years	integer
b.	status	Reproductive status of the individuals (i.e., undetermined or breeding).		string
b.	method	Brief overview of the method used to estimate the species abundance.		string
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	integer
c.	species	Common species english name.		string
c.	source	Source from which estimate were derived (i.e., measurements from the study area or extracted from Wilman et al. 2014).		string
c.	body_mass_g	Mean individual body mass.	grams	numeric
d.	species	Common species english name.		string
d.	zone	Sampled zone of the study area (see figure 2 and 3).		string
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	numeric
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	numeric
d.	sample_size_nest_density_km2	Number of years consider in the calculation of the nest density.	years	integer

## 4. Data type

- 833      a. Storage type: Integer, floating point, character, string, etc.
- 834      b. List and definition of variable codes: Description of any codes associated with variables
- 835      c. Range for numeric values: Minimum, maximum
- 836      d. Missing value codes: Description of how missing values are represented in data set
- 837      e. Precision: Number of significant digits

<sup>840</sup>      **5. Data format**

- <sup>841</sup>      a. Fixed, variable length
- <sup>842</sup>      b. Columns: Start column, end column
- <sup>843</sup>      c. Optional number of decimal places

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

846 **Class V. Supplemental descriptors**

847 **A. Data acquisition**

- 848 1. Data forms or acquisition methods: Description or examples of data forms, auto-  
849       mated data loggers, digitizing procedures, etc.
- 850 2. Location of completed data forms
- 851 3. Data entry verification procedures: Procedures employed to verify that digital data  
852       set is free of errors

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

- 854 Identification and treatment of outliers, description of quality assessments, calibration of  
855 reference standards, equipment performance results, etc.

856 **C. Related materials**

- 857 References and locations of maps, photographs, videos, GIS data layers, physical speci-  
858 mens, field notebooks, comments, etc.

859 **D. Computer programs and data-processing algorithms**

- 860 1. **Program:** R version 4.3.2 (2023-10-31)
- 861 2. **Operating system:** x86\_64-pc-linux-gnu (64-bit) with Ubuntu 22.04.3 LTS
- 862 3. **Packages:** dplyr, tidyverse, sf, stringr, xtable, Distance, ggplot2, lme4, AICmodavg,  
863       scales, ggmap
- 864 4. **Codes:** All raw data and codes are publicly available at [https://github.com/  
865 chaireBioNorth/BYLOT\\_species\\_abundance\\_dataset.git](https://github.com/chaireBioNorth/BYLOT_species_abundance_dataset.git)

866 **E. Archiving**

- 867 1. **Archival procedures:** Data will be archived on Dryad upon acceptance for pub-  
868       lication
- 869 2. **Redundant archival sites:** n/a

<sup>870</sup> **F. Publications and results:** Electronic reprints, lists  
<sup>871</sup> of publications resulting from or related to the study,  
<sup>872</sup> graphical/statistical data representations, etc.

<sup>873</sup> List of publications that include data from the data set:

<sup>874</sup> 1.

<sup>875</sup> **G. History of data set usage**

<sup>876</sup> 1. Data request history: n/a

<sup>877</sup> 2. Data set update history: n/a

<sup>878</sup> 3. Review history: n/a

<sup>879</sup> 4. Questions and comments from secondary users: n/a

880 **References**

- 881 M. Andersson. Breeding behaviour of the long-tailed skua *stercorarius longicaudus* (vieil-  
882 lot). *Ornis Scandinavica*, pages 35–54, 1971.
- 883 A. Beardsell, G. Gauthier, J.-F. Therrien, and J. Bêty. Nest site characteristics, patterns  
884 of nest reuse, and reproductive output in an arctic-nesting raptor, the rough-legged  
885 hawk. *The Auk: Ornithological Advances*, 133(4):718–732, 2016.
- 886 F. Bilodeau. Effet du couvert nival, de la nourriture et de la prédatation hivernale sur la  
887 dynamique de population des lemmings. 2013.
- 888 D. Bolduc, D. Fauteux, C. A. Gagnon, G. Gauthier, J. Bêty, and P. Legagneux. Tes-  
889 timonials to reconstruct past abundances of wildlife populations. *Basic and Applied  
890 Ecology*, 68:23–34, 2023.
- 891 J. H. Brown and E. J. Heske. Temporal changes in a chihuahuan desert rodent community.  
892 *Oikos*, pages 290–302, 1990.
- 893 S. Christin, M.-H. St-Laurent, and D. Berteaux. Evaluation of argos telemetry accuracy  
894 in the high-arctic and implications for the estimation of home-range size. *PLoS One*,  
895 10(11):e0141999, 2015.
- 896 J. Clermont, A. Grenier-Potvin, É. Duchesne, C. Couchoux, F. Dulude-de Broin,  
897 A. Beardsell, J. Bêty, and D. Berteaux. The predator activity landscape predicts the  
898 anti-predator behavior and distribution of prey in a tundra community. *Ecosphere*, 12  
899 (12):e03858, 2021.
- 900 J. E. Cohen, T. Jonsson, and S. R. Carpenter. Ecological community description using  
901 the food web, species abundance, and body size. *Proceedings of the national academy  
902 of sciences*, 100(4):1781–1786, 2003.
- 903 J. P. Colella, L. M. Frederick, S. L. Talbot, and J. A. Cook. Extrinsically reinforced  
904 hybrid speciation within holarctic ermine (*mustela* spp.) produces an insular endemic.  
905 *Diversity and Distributions*, 27(4):747–762, 2021.
- 906 A. Dahood, K. de Mutsert, and G. M. Watters. Evaluating antarctic marine protected  
907 area scenarios using a dynamic food web model. *Biological conservation*, 251:108766,  
908 2020.
- 909 P. David, E. Thebault, O. Anneville, P.-F. Duyck, E. Chapuis, and N. Loeuille. Impacts  
910 of invasive species on food webs: a review of empirical data. *Advances in ecological  
911 research*, 56:1–60, 2017.
- 912 É. Duchesne, J.-F. Lamarre, G. Gauthier, D. Berteaux, D. Gravel, and J. Bêty. Vari-

- able strength of predator-mediated effects on species occurrence in an arctic terrestrial vertebrate community. *Ecography*, 44(8):1236–1248, 2021.
- F. Dulude-de Broin, J. Clermont, A. Beardsell, L.-P. Ouellet, P. Legagneux, J. Béty, and D. Berteaux. Predator home range size mediates indirect interactions between prey species in an arctic vertebrate community. *Journal of Animal Ecology*, 2023.
- D. Fauteux, G. Gauthier, and D. Berteaux. Seasonal demography of a cyclic lemming population in the c anadian a rctic. *Journal of Animal Ecology*, 84(5):1412–1422, 2015.
- D. Fauteux, G. , M. J. Mazerolle, N. Coallier, J. Béty, and D. Berteaux. Evaluation of invasive and non-invasive methods to monitor rodent abundance in the arctic. *Ecosphere*, 9(2):e02124, 2018.
- G. Gauthier. Lemming monitoring on bylot island, nunavut, canada. <https://nordicana.cen.ulaval.ca/dpage.aspx?doi=45400AW-9891BD76704C4CE2>, 2020.
- G. Gauthier and M. Cadieux. Relative abundance of tundra bird and mammal species encountered daily on bylot island, nunavut, canada, v. 1.0 (2007-2019). <https://nordicana.cen.ulaval.ca/dpage.aspx?doi=45645CE-A24D883A6676492E>, 2020a.
- G. Gauthier and M. Cadieux. Monitoring of greater snow goose reproduction on bylot island, nunavut, canada. <https://nordicana.cen.ulaval.ca/dpage.aspx?doi=45570CE-2D00DCA728074FA7>, 2020b.
- G. Gauthier, D. Berteaux, J. Béty, A. Tarroux, J.-F. Therrien, L. McKinnon, P. Legagneux, and M.-C. Cadieux. The tundra food web of bylot island in a changing climate and the role of exchanges between ecosystems. *Ecoscience*, 18(3):223–235, 2011.
- G. Gauthier, J. Béty, M.-C. Cadieux, P. Legagneux, M. Doiron, C. Chevallier, S. Lai, A. Tarroux, and D. Berteaux. Long-term monitoring at multiple trophic levels suggests heterogeneity in responses to climate change in the canadian arctic tundra. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 368(1624):20120482, 2013.
- G. Gauthier, P. Legagneux, M.-A. Valiquette, M.-C. Cadieux, and J.-F. Therrien. Diet and reproductive success of an arctic generalist predator: Interplay between variations in prey abundance, nest site location, and intraguild predation. *The Auk: Ornithological Advances*, 132(3):735–747, 2015.
- G. Gauthier, M. Cadieux, Y. Seyer, and J. Therrien. Monitoring of avian predator reproduction on bylot island, nunavut, canada. <https://nordicana.cen.ulaval.ca/dpage.aspx?doi=45591AW-F9B906CC647948E0>, 2020.

- 948 G. Gauthier, D. Berteaux, J. Béty, P. Legagneux, D. Fauteux, D. Gravel, and M.-C.  
949 Cadieux. Scientific contributions and lessons learned from 30 years of ecological mon-  
950 itoring of the bylot island tundra ecosystem. *Frontiers in Ecology and Evolution*, 12:  
951 1359745, 2024a.
- 952 G. Gauthier, M.-C. Cadieux, D. Berteaux, J. Béty, D. Fauteux, P. Legagneux,  
953 E. Lévesque, and C.-A. Gagnon. Long-term study of the tundra food web at a hotspot  
954 of arctic biodiversity, the bylot island field station. *Arctic Science*, (ja), 2024b.
- 955 F. Gill, D. Donsker, and P. Rasmussen. Ioc world bird list (v14. 2), 2024.
- 956 D. Goto, E. S. Dunlop, J. D. Young, and D. A. Jackson. Shifting trophic control of  
957 fishery–ecosystem dynamics following biological invasions. *Ecological Applications*, 30  
958 (8):e02190, 2020.
- 959 G. P. Griffith, H. Hop, M. Vihtakari, A. Wold, K. Kalhagen, and G. W. Gabrielsen.  
960 Ecological resilience of arctic marine food webs to climate change. *Nature Climate  
961 Change*, 9(11):868–872, 2019.
- 962 N. Gruyer, G. Gauthier, and D. Berteaux. Cyclic dynamics of sympatric lemming popu-  
963 lations on bylot island, nunavut, canada. *Canadian Journal of Zoology*, 86(8):910–917,  
964 2008.
- 965 S. P. Hubbell. *The Unified Neutral Theory of Biodiversity and Biogeography (MPB-32)*.  
966 Princeton University Press, Princeton, 2001. ISBN 9781400837526. doi: doi:10.1515/  
967 9781400837526. URL <https://doi.org/10.1515/9781400837526>.
- 968 C. Hutchison, F. Guichard, P. Legagneux, G. Gauthier, J. Béty, D. Berteaux, D. Fauteux,  
969 and D. Gravel. Seasonal food webs with migrations: multi-season models reveal indirect  
970 species interactions in the canadian arctic tundra. *Philosophical Transactions of the  
971 Royal Society A*, 378(2181):20190354, 2020.
- 972 R. Ims, D. Ehrlich, B. Forbes, B. Huntley, D. Walker, and P. A. Wookey. Arctic biodiversity  
973 assessment. status and trends in arctic biodiversity.: Terrestrial ecosystems.–chapter 12.  
974 In *Arctic Biodiversity Assessment. Status and trends in Arctic biodiversity.*, page 384.  
975 Conservation of Arctic Flora and Fauna (CAFF), 2013.
- 976 W. Kemp, S. Harvey, and K. O’neill. Patterns of vegetation and grasshopper community  
977 composition. *Oecologia*, 83:299–308, 1990.
- 978 R. Klassen. *Quaternary geology and glacial history of Bylot Island, Northwest Territories*,  
979 volume 429. Geological Survey of Canada, 1993.
- 980 C. J. Krebs, K. Danell, A. Angerbjörn, J. Agrell, D. Berteaux, K. A. Bråthen, Ö. Danell,

- 981 S. Erlinge, V. Fedorov, K. Fredga, et al. Terrestrial trophic dynamics in the canadian  
982 arctic. *Canadian journal of Zoology*, 81(5):827–843, 2003.
- 983 S. Lai, J. Bêty, and D. Berteaux. Spatio-temporal hotspots of satellite-tracked arctic  
984 foxes reveal a large detection range in a mammalian predator. *Movement ecology*, 3(1):  
985 1–10, 2015.
- 986 S. Lai, C. Warret Rodrigues, D. Gallant, J. D. Roth, and D. Berteaux. Red foxes at  
987 their northern edge: competition with the arctic fox and winter movements. *Journal*  
988 *of Mammalogy*, 103(3):586–597, 2022.
- 989 J.-F. Lamarre, G. Gauthier, R. B. Lanctot, S. T. Saalfeld, O. P. Love, E. Reed, O. W.  
990 Johnson, J. Liebezeit, R. McGuire, M. Russell, et al. Timing of breeding site availability  
991 across the north-american arctic partly determines spring migration schedule in a long-  
992 distance neotropical migrant. *Frontiers in Ecology and Evolution*, 9:710007, 2021.
- 993 D.-J. Léandri-Breton, J.-F. Lamarre, and J. Bêty. Seasonal variation in migration strate-  
994 gies used to cross ecological barriers in a nearctic migrant wintering in africa. *Journal*  
995 *of Avian Biology*, 50(6), 2019.
- 996 N. Lecomte, G. Gauthier, and J.-F. Giroux. Breeding dispersal in a heterogeneous land-  
997 scape: the influence of habitat and nesting success in greater snow geese. *Oecologia*,  
998 155:33–41, 2008.
- 999 P. Legagneux, G. Gauthier, D. Berteaux, J. Bêty, M.-C. Cadieux, F. Bilodeau, E. Bolduc,  
1000 L. McKinnon, A. Tarroux, J.-F. Therrien, et al. Disentangling trophic relationships in  
1001 a high arctic tundra ecosystem through food web modeling. *Ecology*, 93(7):1707–1716,  
1002 2012.
- 1003 P. Legagneux, G. Gauthier, N. Lecomte, N. M. Schmidt, D. Reid, M. Cadieux,  
1004 D. Berteaux, J. Bety, C. Krebs, R. Ims, et al. Arctic ecosystem structure and function-  
1005 ing shaped by climate and herbivore body size. *Nature Climate Change*, 4(5):379–383,  
1006 2014.
- 1007 D. Lepage, G. Gauthier, and A. Reed. Breeding-site infidelity in greater snow geese:  
1008 a consequence of constraints on laying date? *Canadian Journal of Zoology*, 74(10):  
1009 1866–1875, 1996.
- 1010 D. B. Lindenmayer, G. E. Likens, A. Andersen, D. Bowman, C. M. Bull, E. Burns,  
1011 C. R. Dickman, A. A. Hoffmann, D. A. Keith, M. J. Liddell, et al. Value of long-term  
1012 ecological studies. *Austral Ecology*, 37(7):745–757, 2012.
- 1013 A. E. Magurran. Species abundance distributions over time. *Ecology letters*, 10(5):347–  
1014 354, 2007.

- 1015 A. E. Magurran, S. R. Baillie, S. T. Buckland, J. M. Dick, D. A. Elston, E. M. Scott, R. I.  
1016 Smith, P. J. Somerfield, and A. D. Watt. Long-term datasets in biodiversity research  
1017 and monitoring: assessing change in ecological communities through time. *Trends in*  
1018 *ecology & evolution*, 25(10):574–582, 2010.
- 1019 K. S. McCann, J. Rasmussen, and J. Umbanhowar. The dynamics of spatially coupled  
1020 food webs. *Ecology letters*, 8(5):513–523, 2005.
- 1021 D. L. Miller, E. Rexstad, L. Thomas, L. Marshall, and J. L. Laake. Distance sampling in  
1022 R. *Journal of Statistical Software*, 89(1):1–28, 2019. doi: 10.18637/jss.v089.i01.
- 1023 L. Moisan, D. Gravel, P. Legagneux, G. Gauthier, D.-J. Léandri-Breton, M. Somveille,  
1024 J.-F. Therrien, J.-F. Lamarre, and J. Béty. Scaling migrations to communities: An  
1025 empirical case of migration network in the arctic. *Frontiers in Ecology and Evolution*,  
1026 10:1077260, 2023.
- 1027 T. A. Okey, S. Banks, A. F. Born, R. H. Bustamante, M. Calvopiña, G. J. Edgar, E. Es-  
1028 pinoza, J. M. Fariña, L. E. Garske, G. K. Reck, et al. A trophic model of a galápagos  
1029 subtidal rocky reef for evaluating fisheries and conservation strategies. *Ecological Mod-*  
1030 *elling*, 172(2-4):383–401, 2004.
- 1031 D. F. Parmelee, H. Stephens, and R. H. Schmidt. *The birds of southeastern Victoria*  
1032 *Island and adjacent small islands*. Number 78. Queen’s Printer, 1967.
- 1033 D. C. Payer, A. B. Josefson, and J. Fjeldsa. Arctic biodiversity assessment. status and  
1034 trends in arctic biodiversity.: Species diversity in the arctic.–chapter 2. In *Arctic Bio-*  
1035 *diversity Assessment. Status and trends in Arctic biodiversity.*, page 66. Conservation  
1036 of Arctic Flora and Fauna (CAFF), 2013.
- 1037 T. E. Philippi, P. M. Dixon, and B. E. Taylor. Detecting trends in species composition.  
1038 *Ecological applications*, 8(2):300–308, 1998.
- 1039 A. Reed, R. Hughes, and H. Boyd. Patterns of distribution and abundance of greater  
1040 snow geese on bylot island, nunavut, canada 1983-1998. *Wildfowl*, 53(53):53–65, 2002.
- 1041 A. Robillard, G. Gauthier, J.-F. Therrien, and J. Béty. Wintering space use and site  
1042 fidelity in a nomadic species, the snowy owl. *Journal of Avian Biology*, 49(5):jav–01707,  
1043 2018.
- 1044 P. Royer-Boutin. *Effets des cycles de lemmings sur le succès de nidification d’oiseaux*  
1045 *différent par leur taille corporelle et leur comportement*. PhD thesis, Université du  
1046 Québec à Rimouski, 2015.
- 1047 Y. Seyer, G. Gauthier, L. Bernatchez, and J.-F. Therrien. Sexing a monomorphic plumage  
1048 seabird using morphometrics and assortative mating. *Waterbirds*, 42(4):380–392, 2019.

- 1049 Y. Seyer, G. Gauthier, D. Fauteux, and J.-F. Therrien. Resource partitioning among  
1050 avian predators of the arctic tundra. *Journal of Animal Ecology*, 89(12):2934–2945,  
1051 2020.
- 1052 K. Snyder and S. Tartowski. Multi-scale temporal variation in water availability: im-  
1053 plications for vegetation dynamics in arid and semi-arid ecosystems. *Journal of Arid  
1054 Environments*, 65(2):219–234, 2006.
- 1055 P. S. Taylor. Summer population and food ecology of jaegers and snowy owls on bathurst  
1056 island, nwt emphasizing the long-tailed jaeger. Master’s thesis, University of Alberta,  
1057 Edmonton, Alberta, 1974.
- 1058 J.-F. Therrien, G. Gauthier, and J. Béty. Survival and reproduction of adult snowy owls  
1059 tracked by satellite. *The Journal of Wildlife Management*, 76(8):1562–1567, 2012.
- 1060 H. Wilman, J. Belmaker, J. Simpson, C. de la Rosa, M. M. Rivadeneira, and W. Jetz.  
1061 Eltontraits 1.0: Species-level foraging attributes of the world’s birds and mammals:  
1062 Ecological archives e095-178. *Ecology*, 95(7):2027–2027, 2014.
- 1063 D. Wilson. *Mammal species of the world: a taxonomic and geographic reference*. Johns  
1064 Hopkins University Press, 2005.