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DOI

[10.33265/polar.v38.3393](https://doi.org/10.33265/polar.v38.3393)

Publication date

2019

Document Version

Final published version

Published in

Polish Polar Research

License

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[Link to publication](#)

Citation for published version (APA):

Madsen, J., Jaspers, C., Frikke, J., Gundersen, O. M., Nolet, B. A., Nolet, K., Schreven, K. H. T., Sonne, C., & de Vries, P. P. (2019). A gloomy future for light-bellied brent geese in Tusenøyane, Svalbard, under a changing predator regime. *Polish Polar Research*, 38, Article 3393. <https://doi.org/10.33265/polar.v38.3393>

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RESEARCH NOTE

A gloomy future for light-bellied brent geese in Tusenøyane, Svalbard, under a changing predator regime

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Abstract

The endangered population of light-bellied brent geese (*Branta bernicla hrota*) breeding in Svalbard and north-east Greenland used to have its core breeding area in the archipelago of Tusenøyane in south-east Svalbard. Studies carried out during 1987–1991 showed that the Tusenøyane population was subject to heavy egg predation by polar bears and, in one year, Arctic foxes. Revisiting some key nesting islands in August 2018, we found few nests used by brent geese and no families. The high density of common scurvygrass (*Cochlearia officinalis*), a food favoured by brent geese and therefore formerly depleted by them, indicates that the geese have been absent for some time. Among other bird species, such as barnacle goose and common eider, very few young were observed as well. As potential predators, polar bears, or signs of their recent presence, were observed on most islands, and great skuas occurred on almost all islands, with 60 individuals on Lurøya, formerly an important island for geese. In contrast, only a single pair of great skuas was observed 30 years ago. The observations suggest that recent expansion of great skuas in the North Atlantic, including Svalbard, has led to a novel extreme predation pressure, additional to that caused by mammalian predators. Despite the loss of Tusenøyane as a breeding ground, the population of brent geese has increased in recent decades; so we can infer that the population now recruits from remote but mainly unknown breeding grounds.

Introduction

The majority of Arctic-breeding geese in the Western Palearctic and North America have increased dramatically in population sizes during the past four to five decades (Fox & Leafloor 2018). Some populations remain small and endangered, such as the population of light-bellied brent goose (*Branta bernicla hrota*) breeding in Svalbard, north-east Greenland and Franz Josef Land and wintering in Denmark and north-east England. This is one of the smallest goose populations worldwide. In the 1960s, the population was reduced to ca. 2000 individuals,

probably caused by overexploitation due to hunting on the Danish wintering grounds (Madsen 1987). Following legal protection in Denmark in 1972, the population gradually recovered, reaching 4000–5000 in the late 1980s and 8000–10 000 during 2010–2016 (Clausen & Craggs 2018). The species is Red-listed in Svalbard (Henriksen & Hilmo 2015). Not until the 1980s, the main breeding grounds in Svalbard were surveyed, namely, Tusenøyane in the south-east corner of Svalbard. In 1985, Persen (1986) found 435–600 breeding pairs on the islands, suggesting that this was the core breeding area for the population. By that time, nesting brent

Keywords

Branta bernicla hrota; *Cochlearia officinalis*; great skua; polar bear; predation

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geese suffered from heavy predation by polar bears (*Ursus maritimus*) in most years and, in one year, Arctic foxes (*Vulpes lagopus*) (Madsen et al. 1989; Madsen et al. 1992; Madsen et al. 1998). However, since then, there has been no systematic survey of the breeding numbers and their productivity in the area. Satellite-tracking of individual geese caught on the Danish spring staging areas has suggested that the brent geese do not migrate to the breeding grounds in Tusenøyane anymore but rather go to other sites in Svalbard and north-east Greenland (Clausen et al. 2003, unpubl.). In August 2018, we revisited some of the islands in Tusenøyane that had been surveyed in 1987, 1989 and 1991. The aim of this investigation was (i) to make a status of the light-bellied brent geese and other species of birds through a survey of their nest use and production of offspring and (ii) to look for clues why the brent geese may have abandoned the area.

Study area, material and methods

Tusenøyane (76°57N 22°10'E) is known for hosting a significant proportion of the breeding pairs of the Svalbard/north-east Greenland light-bellied brent goose population. The islands are small (typically less than 1 km in diameter) and rocky and the vegetation is very poor, with patches of wet moss carpets with protruding common scurvygrass (*Cochlearia officinalis*) and *Carex* spp. Freshwater ponds are found on some islands. Brent geese place their nests in patches that become snow-free early, sheltered between rocks, driftwood or whale bones.

Breeding pairs are territorial. Barnacle geese (*Branta leucopsis*) also occur in low numbers (in 1987 with a colony of 17 nests on Hornøya [Madsen et al. 1989]); they place their nests in dry, rocky terrain; however, in contrast to brent geese they are colonial.

During 7–8 August 2018, we visited Tusenøyane in south-east Svalbard by ship and went ashore on islands which had previously been visited during 1987–1991, namely, Lurøya, Kalvøya, Langåra and Hornøya in Tiholmane and Havmerra and Kvalbeinøya in Schareholmane, which were known to host nesting and brood-rearing brent geese (Madsen et al. 1989; Bregnballe & Madsen 1990; Madsen et al. 1992; Madsen et al. 1998). We searched for nests used by geese during the same year by walking in lines, 5–10 m apart, covering the entire islands. Used nests were identified by fresh down in nest bowls and remains of egg shells. Because most nests were well sheltered among rocks, whale bones or driftwood, nest down was intact and not blown away. Goose nests were differentiated from common eider (*Somateria molissima*) nests by white/light grey down and white body feathers. Brent goose nests were differentiated from barnacle goose nests by the lack of faeces on the rim and within close proximity of the nest (barnacle goose males rest in close proximity to the nesting females and produce heaps of faeces, while brent males stay at a distance of the nest) as well as by body feather characteristics (Fig. 1). A nesting attempt was classified as successful if eggshells with membranes were found in the down in the nest cup and as failed if no eggshells were found or there were eggshells with signs of pecking by gulls, indicating predation. Empty nests were

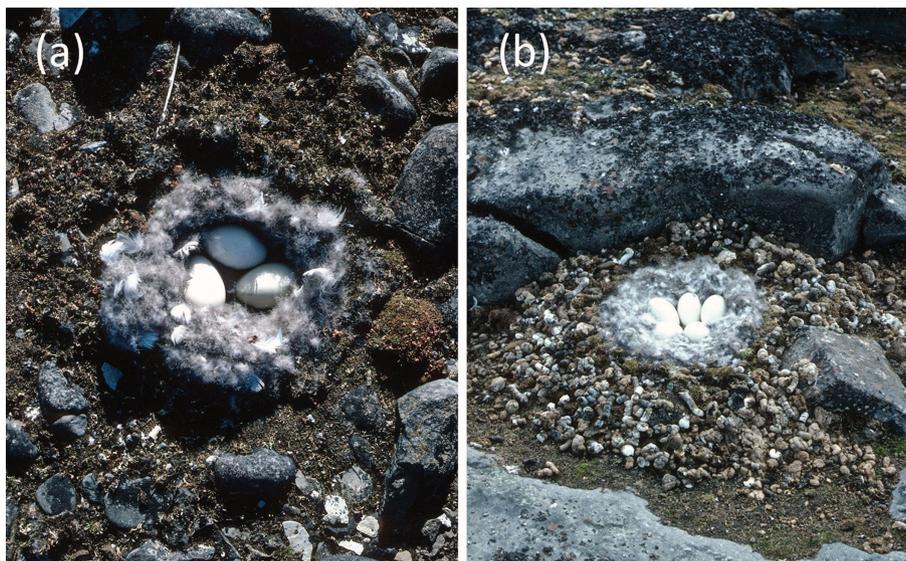


Fig. 1 Nests of (a) light-bellied brent goose and (b) barnacle goose, Tusenøyane, 1987. Photo: Jesper Madsen.

regarded as being predated, either by polar bears (which swallow the entire egg) or by gulls/skuas, which may transport the eggs away from the nest. The entire islands were searched for families of geese and other breeding birds using binoculars and telescopes. Furthermore, we sailed around the islands of Bölscheøya (77°13'N 22°00') and Rugla in Tiholmane and searched for families of geese. Since the islands are very remote from the main islands in south Svalbard, it is highly unlikely that they would swim away from the islands and thereby be missed. Nest searching was similar to the method used in 1987–1991.

Results

The results of the nest and goose family surveys in 2018 are summarized in Table 1, with a comparison to the findings in 1987, 1989 and 1991. In 2018, a total of four nests used by brent geese were found, three of which had hatched while one was predated. However, no families were observed. A total of 25 nests of barnacle geese was found, of which 12 had hatched while 13 were predated. However, only two families of barnacle geese were observed, on Bölscheøya. A total of 26 nests of common eider were found, of which 11 had hatched, and six broods were observed. A total of 14 territorial pairs of Arctic skua (*Stercorarius parasiticus*) were observed, but only one juvenile was identified. Among a total of ca. 500 territorial Arctic terns (*Sterna paradisaea*), fewer than 10 juveniles were seen (although probably underestimated because we did not approach the shores where terns settled), and among 23 territorial pairs of glaucous gull (*Larus hyperboreus*), only five pairs had young. Finally, among 17 pairs of red-throated diver (*Gavia stellata*), only two pairs had young. We observed a polar bear resting on Rugla and two on Skråholmen, east of Schareholmane, while fresh bear faeces were found on Lurøya, Kalvøya and Schareholmane. Arctic fox was not observed nor were there signs of their presence in terms of tracks or fox predated bird carcasses. Pairs of

great skua (*Stercorarius skua*), which appeared to be territorial, were present on all islands, except for Havmerra. On Lurøya, ca. 60 birds were present. Young or juveniles were not observed, but swooping behaviour suggested defence of young.

Discussion

Surveys in the 1980s showed that Tusenøyane was the core breeding site for the Svalbard/north-east Greenland population of light-bellied brent geese (Persen 1986; Madsen et al. 1989); however, the reproductive success was highly variable, depending on the presence of polar bears or, in one year (1989), Arctic foxes, which deterred geese from nesting, except from few islands where no foxes were present (Madsen et al. 1992; Madsen et al. 1998). It was observed that the presence of polar bear was related to the presence of drift ice, and most bears moved out of the Tusenyøane Archipelago with the retreat of the sea ice. In years with little drift ice in the area during the nesting period, the population as a whole bred successfully, while in years with dense drift ice, the population bred very poorly. Not only did polar bears predate nests but they also created disturbance, flushing nesting brent goose females from the nests, which were subsequently predated by Arctic skuas. In August 2018, polar bears were in Tusenøyane despite the fact that there was no ice, which suggests that the behaviour of the bears has changed over the 30-year period. On the west coast of Svalbard, it has also been observed that in recent decades, polar bears have roamed along the coast during the summer period, heavily predated on eggs of island-breeding colonial barnacle geese and other species, probably in response to diminishing sea ice with global warming (Prop et al. 2015). Similarly, in western Hudson Bay, Canada, earlier sea-ice break-up has led to an advanced onshore movement of polar bears and consequent increased predation on colonially nesting lesser snow geese (*Chen caerulescens caerulescens* [Rockwell & Gormezano 2009]).

Table 1 Breeding status of light-bellied brent geese in Tusenøyane, Svalbard, in 1987, 1989, 1991 and 2018. Not all islands were visited each year.

	1987		1989		1991		2018	
	nests	families	nests	families	nests	families	nests	families
Lurøya	38	11	0	0	47	10	0	0
Kalvøya	11	7	0	0		5	3	0
Langåra	5	1	0	0		2	0	0
Hornøya	4	0	0	0			0	0
Havmerra	10	2	1	0			1	0
Kvalbeinøya	4	0	0	0			0	0

It is highly likely that polar bears were also present in Tusenøyane in June–July 2018; however, it is remarkable that among the breeding brent and barnacle geese as well as common eiders, we found that a relatively high proportion had actually hatched, namely 47% for the three species pooled. This is higher than what was found in 1987 and 1991, namely, 19% ($n = 413$ nests of all three species) and 17% ($n = 47$ brent goose nests), respectively (Madsen et al. 1989; Madsen et al. 1992; J. Madsen unpubl.). This suggests that it was not the polar bear presence which caused the very poor breeding outcome observed in August 2018. Arctic foxes, which can deter geese from breeding, were not observed.

During 1987–1991, only a single pair of great skuas was observed in the study area. In 2018, they were present on almost all islands. In particular, Lurøya held a large concentration. The great skua is confined to the North-east Atlantic, originally mainly breeding in Scotland, with key populations on Orkney and the Shetland islands. During the last century, the population has expanded its breeding range northwards in the Atlantic (Mitchell et al. 2004), recently expanding as far north-east as Franz Josef Land (Gavrilo 2013) and Novaya Zemlya (Pokrovskaya 2016). In the Barents Sea region, the species has occurred on Bjørnøya (Bear Island) since 1970 (Anker-Nilssen et al. 2007), where a large colony of up to 1000 pairs has now been established (H. Strøm pers. comm.). In Svalbard, the great skua is now observed all around the archipelago (H. Strøm pers. comm.). Breeding great skuas are known to feed on young and adults of seabirds as well as fish (Bayes et al. 1964; Jacubas et al. 2018) and discarded fish from fishing boats (Votier et al. 2004). In 1987–1991, we observed great skuas in Tusenøyane foraging on common eider eggs, eider ducklings and adult kittiwakes (*Rissa tridactyla*), and they were also seen attacking family groups of brent geese (J. Madsen unpubl.).

Although we do not have conclusive evidence, we ascribe the almost complete failure of recruitment in geese, eiders and possibly other bird species in 2018 to the increase in great skuas because this is the only species likely to exert a heavy predation pressure on young, whereas polar bears (and Arctic foxes) are mostly preying on eggs. The high additional predation pressure is likely to have contributed to the long-term decline in the breeding numbers. Also, eiders have diminished in the study area: in 1987, we found more than 300 eider nests (J. Madsen unpubl.), which was reduced to 26 in 2018. From Scotland, it is well known that great skuas can exert heavy predation pressure on other seabirds, to an extent that it is of conservation concern (Heubeck et al. 1997; Oro & Furness 2002; Votier et al. 2006). Our observations suggest that the spread of the great skua in the Barents Sea region may be a reason for concern for some coastal

breeding bird populations; however, systematic studies are needed to substantiate this further.

With regard to the light-bellied brent geese, we found indirect evidence that the low number of breeding pairs was not just an erratic phenomenon in a single year. During 1987–1991, we found that brent geese depleted their main food plant *Cochlearia officinalis* on Lurøya, probing for the nutritious roots in the moss carpet, and plants were generally small and in a first-year non-flowering stage (Madsen et al. 1998). In 2018, the moss carpets on Lurøya were densely covered by flowering (two years of age or older) *Cochlearia* plants, and only low densities of holes from goose probing for roots were observed (Fig. 2). Hence, the recovery of *Cochlearia* suggests that geese have not been present in significant numbers for several years.

Despite the functional loss of Tusenøyane as a breeding site for light-bellied brent geese, this has not caused a decline in the overall population size. On the contrary, the population as a whole has doubled within the last two or three decades, indicating that the population now recruits from remote but mainly unknown breeding grounds. The growth has taken place despite low and declining overall productivity (registered by age counts in the autumn flocks) but compensated by increased survival, which is suggested to be caused by improved food conditions and milder winters in the Danish/English wintering quarters (Clausen & Craggs 2018). Brent geese are known to breed scattered in low numbers in north-east Greenland (Boertmann et al. 2015), but, apart from that, there is little information about currently used breeding sites in Svalbard. From a conservation perspective, it is of high importance to identify the breeding areas to safeguard these from anthropogenic influences, such as disturbance from tourism.



Fig. 2 Moss carpet with protruding common scurvygrass (*Cochlearia officinalis*), Lurøya, Tusenøyane, August 2018. Small holes in the moss carpet are caused by geese probing for *Cochlearia* roots. Photo: John Frikke.

Acknowledgements

This study was carried out in conjunction with a project to catch and mark pink-footed geese (*Anser brachyrhynchus*) in western and eastern Svalbard, conducted by Netherlands Institute for Ecology and Aarhus University. We thank the crew of the vessel *Ulla Rinman* for support and the Norwegian Polar Institute for logistical support. The Governor of Svalbard granted permission to visit Tusenøyane.

Disclosure statement

The authors report no conflict of interest.

Funding

The project was funded by the Svalbard Environmental Protection Fund (reference no. 17/88).

Data availability

Observations of birds and mammals will be uploaded to the Norwegian Species Observation System website www.Artsobservasjoner.no.

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