

# Impact of the Arctic Fox *Alopex lagopus* on nesting success of geese in southeast Svalbard, 1989

JESPER MADSEN, THOMAS BREGNBALLE and ANNETTE HASTRUP



Madsen, J., Bregnballe, T. & Hastrup, A. 1992: Impact of the Arctic Fox *Alopex lagopus* on nesting success of geese in southeast Svalbard, 1989. *Polar Research* 11(2), 35–39.

Goose populations, with special emphasis on Light-bellied Brent Geese *Branta bernicla hrota*, were censused in Tusenøyane and Tjuvfjorden, southeast Svalbard, July–August 1989. A total of 425 non-breeding Brent Geese, 210 Barnacle Geese *Branta leucopsis* and 421 Pink-footed Geese *Anser brachyrhynchus* and 11, 2 and 3 families of the three species, respectively, were counted. Brent Geese attempted to nest on 6 of the 20 islands surveyed, and were successful on four. Barnacle Geese attempted to nest on three islands and were successful on two. Many islands known to be traditional nesting sites were entirely void of geese. Pink-footed Geese were only seen in Tjuvfjorden. The breeding failure on the islands was linked to the presence of the Arctic Fox *Alopex lagopus* which probably caused the geese to completely give up the attempt to nest. On one island the fox had apparently arrived after nest initiation and ravaged 45 Brent Goose and Barnacle Goose nests. It is likely that the foxes stranded on the islands during ice break-up. As a consequence of the presence of foxes on most of Tusenøyane, more than half of the potential breeding segment of the Svalbard Brent Goose population failed to nest in the summer of 1989.

Jesper Madsen, Thomas Bregnballe and Annette Hastrup, National Environmental Research Institute, Department of Wildlife Ecology, Kalø, DK-8410 Rønde, Denmark.

## Introduction

The Svalbard population of the Light-bellied Brent Goose *Branta bernicla hrota*, which winters in Denmark and northeast England, numbers from 3,000 to 5,000 individuals and is characterised by an average low breeding success (Madsen 1984, 1987, unpubl.). Tusenøyane in the Storfjorden region of southeast Svalbard are the main known breeding resort of the population (Norderhaug 1974; Persen 1986).

In 1987 a study of the breeding ecology of the population in the archipelago was initiated with the overall aim of revealing the factors on the breeding grounds contributing to the regulation of the population (Madsen et al. 1989). It was found that predation by Polar Bears *Ursus maritimus* and Arctic Skuas *Stercorarius parasiticus* severely hampered the nesting success of the geese. On this basis it was hypothesised that in years with the presence of drift ice and consequently high densities of Polar Bears, the overall breeding success of the population could be expected to be low (Madsen et al. 1989).

In the summer of 1989 the study of Light-bellied Brent Geese was followed up by a survey of population levels, nesting attempts and breeding

success in Tusenøyane and Tjuvfjorden north of the archipelago, including the other two goose species present, the Barnacle Goose *Branta leucopsis* and the Pink-footed Goose *Anser brachyrhynchus*. The work was part of the Norwegian Polar Research Institute scientific cruise with RV LANCE to Storfjorden during the period 19 July–17 August.

## Methods

To map the distribution of geese a helicopter reconnaissance of Tusenøyane and Tjuvfjorden (Fig. 1) was carried out on 22 and 23 July, i.e. during the moulting period of the non-breeding geese. Counts were made by one observer in the left front seat and two observers in the back. During surveys the helicopter flew approximately 300 feet a.s.l. and speed was ca. 90 knots.

To obtain a more accurate estimate of population composition, nesting attempts and breeding success, land-based surveys were performed in most of the island groups from 24 July to 4 August. Transportation to the islands was made by rubber boat or helicopter. On each island a systematic search was made for nests used by Brent Geese

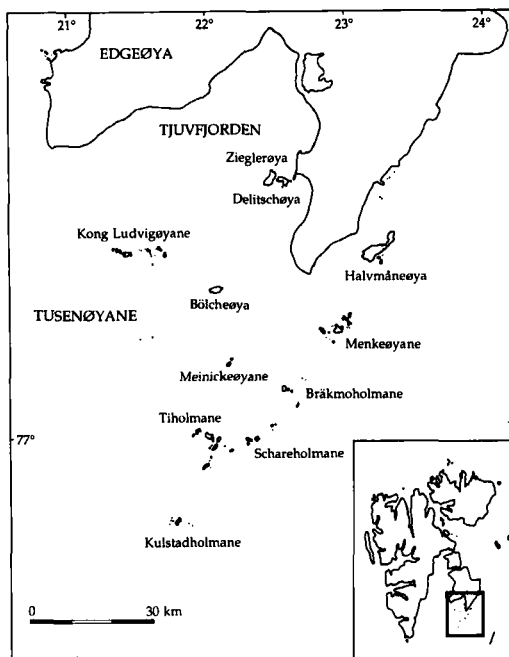


Fig. 1. Location map of Tusenøyane and Tjuvfjorden, southeast Svalbard.

or Barnacle Geese in the same year. Nests of the latter were distinguished from the former by the presence of faeces piles around the nest cup. Nesting attempts were judged from the number of nests found containing fresh down. Brood sizes

were recorded and the age of goslings was visually estimated on the basis of their size and feather development (identification of age categories according to Owen 1987). On 25 July three Brent Goose families were caught and ringed on Menkeøyanne, and the moulting stage of the adults (measured by the length of the second primary) and the weights of the goslings were recorded.

## Results

### *Light-bellied Brent Geese*

The Light-bellied Brent Geese were only distributed on Tusenøyane (Fig. 2, Table 1). A total of 425 non-breeders/failed breeders and 11 families (22 parental geese) were counted. The main non-breeder flocks were found on Menkeøyanne, Tiholmane and Kong Ludvigøyanne. Median flock size was 10 ( $n = 27$ , range 1–60). Families were only seen on Menkeøyanne, probably constituting the only families on Tusenøyane. Mean brood size was 2.36 ( $n = 11$ , range 2–4). The families aggregated in small flocks, usually separated from non-breeding flocks. On 25–26 July gosling age was estimated to vary from 0 to 3 weeks (2 broods 0–1 week, 8 broods 1–2 weeks, and 1 brood 2–3 weeks), indicating that hatching took place from approximately 5 to 23 July, with the majority hatching around 15 July.

When Brent Goose families were caught on 25

Table 1. Composition of goose populations and nesting attempts together with presence of Arctic Fox in Tusenøyane and Tjuvfjorden, July 1989, as revealed by helicopter reconnaissance and land-based surveys. Areas covered during land-based surveys are indicated. — indicates that the area was not covered from the ground. Non-br. = Number of non-breeders; Fam. = Number of families; Yes = foxes and/or tracks were observed; No = no foxes nor tracks were observed; ? = unknown.

Island group	Area covered (%)	<i>Light-bellied Brent</i>			<i>Barnacle Goose</i>			<i>Pink-footed Goose</i>			<i>Arctic Fox</i> presence
		Non-br.	Fam.	Nests	Non-br.	Fam.	Nests	Non-br.	Fam.	Nests	
Kulstadholmmane	0	0	0	—	8	1	—	0	0	—	?
Tiholmane	77	94	0	0	59	1	1	0	0	0	Yes
Schareholmmane	78	39	0	1	0	0	0	0	0	0	?
Bräkholmmane	0	5	0	—	0	0	—	0	0	—	?
Meinickeøyanne	74	0	0	21	0	0	24	0	0	0	Yes
Menkeøyanne	81	174	11	17	0	0	0	0	0	0	No
Halvmåneøya	0	0	0	—	0	0	—	0	0	—	Yes
Bölscheøya	100	0	0	0	0	0	0	0	0	0	Yes
Kong Ludvigøyanne	63	111	0	0	34	0	0	0	0	0	Yes
Tjuvfjorden East	0	0	0	—	0	0	—	222	0	—	Yes
Tjuvfjorden West	0	0	0	—	12	0	—	147	3	—	Yes
Ziegler-/Delitschøya	0	2	0	—	97	0	—	52	0	—	?
<b>Total</b>		<b>425</b>	<b>11</b>	<b>39</b>	<b>210</b>	<b>2</b>	<b>25</b>	<b>421</b>	<b>3</b>	<b>(0)</b>	

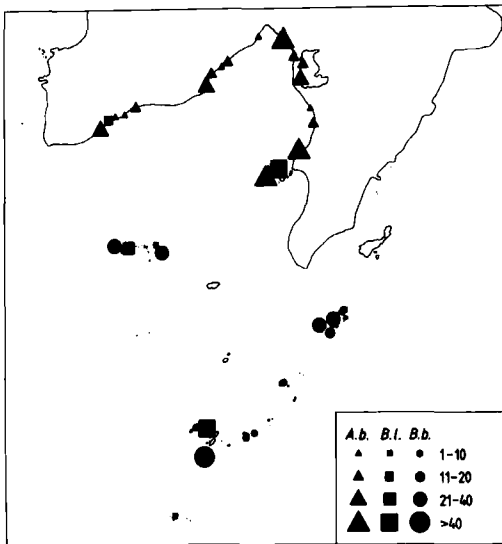


Fig. 2. Distribution and numbers of geese in Tusenøyane and Tjuvfjorden, late July 1989. *A.b.* = *Anser brachyrhynchus* (Pink-footed Goose), *B.l.* = *Branta leucopsis* (Barnacle Goose), and *B.b.* = *Branta bernicla hrota* (Light-bellied Brent Goose).

July, parental birds were moulting remiges, with a mean length of the second primary of 67 mm ( $n = 6$ ). Non-breeders were observed to regain flight ability around 24–26 July.

Brent Geese only attempted to nest on Meinickeøyane and Menkeøyane, whereas virtually no nests were found in the remaining island groups. Thus, Brent Geese only nested on six of the twenty islands surveyed. Nesting was successful only on Menkeøyane. On Meinickeøyane no geese at all were found, in spite of a high number (21) of nests; eggs were spread over the island in evidence of fox predation. Assuming an average clutch size of 4 eggs (Madsen et al. 1989), overall nesting success was 17%.

The large variation in nesting populations was linked to the presence of the Arctic Fox *Alopex lagopus* on the islands. Foxes or fresh tracks of foxes were found in most island groups (Table 1), apart from Menkeøyane where no indications of recent fox presence were observed.

#### Barnacle Geese

A total of 210 non-breeders and two families of Barnacle Geese were observed. Flocks were present on Zieglerøya-Delitschøya in Tjuvfjor-

den, and on Kong Ludvigøyane, Tiholmane and Kulstadholmane in Tusenøyane (Fig. 2, Table 1). Median flock size was 8 ( $n = 11$ , range 2–80).

On Tiholmane only a single nest was found, and on the larger of Meinickeøyane 24 nests. However, on Meinickeøyane no families were seen, and, as it was the case for the Brent Geese there, the nests had probably all been subject to predation by the Arctic Fox. Single families were observed on Kulstadholmane and Tiholmane. Thus, Barnacle Geese seem to have attempted to nest on three islands but were only successful on two. Assuming an average clutch size of 3 eggs (Madsen 1989), nesting success was 5%. The hatching date of a brood of two goslings on Tiholmane was estimated at around 25 July.

The parents to the brood on Tiholmane had not yet started to moult on 31 July; non-breeders regained flight ability around 24–26 July.

#### Pink-footed Geese

A total of 421 non-breeding Pink-footed Geese were observed along the coasts of Tjuvfjorden and on Zieglerøya-Delitschøya. Median flock size was 13 ( $n = 19$ , range 2–90). Three families were observed. No birds nor nests were found on Tusenøyane.

## Discussion

In 1987 Tiholmane and Schareholmane in Tusenøyane were surveyed for Brent Goose and Barnacle Goose nesting pairs. At least 98 pairs of Brent Geese and 17 pairs of Barnacle Geese attempted nesting (Madsen et al. 1989). However, due to predation of eggs by Polar Bears and Arctic Skuas, nesting success was low. In 1987 no foxes were observed.

In comparison, in 1989 only one pair of each goose species started nesting on those islands. The reciprocity between the presence of geese and foxes strongly suggests that fox presence on the islands in spring caused an almost complete abandonment of nesting attempt by the geese. The observed between-island differences in goose nesting attempts makes it unlikely that other factors were responsible for the nesting failure, e.g. late snow melt, which is known to be a critical factor limiting the number of nesting pairs of Barnacle Geese in Spitsbergen (Prop et al. 1984).

The predation impact caused by foxes is thus

even more severe than that posed by Polar Bears. From nesting colonies of the Common Eider *Somateria mollissima* on islets along the western Spitsbergen coast, a similar impact by foxes has been reported (Ahlén & Andersson 1970; Mehlum 1991; Parker & Mehlum 1991). From Alaska, Raveling (1989) reported severe predation pressure by Arctic Foxes on nesting Black Brant Geese *Branta bernicla nigricans*, especially in areas with low nest densities (comparable to the situation on Tusenøyane), and an experimental removal of foxes from nesting areas increased nesting success (Anthony et al. 1991).

There were no signs of foxes denning or breeding on Tusenøyane and the fox population probably consisted of individuals which had crossed the sea ice in winter. It is anecdotally known that in winter Arctic Foxes disperse from the main islands and move far out on the sea ice (Ø. Wiig, Norwegian Polar Research Institute, pers. comm.). It is likely that in the spring of 1989 foxes stranded on Tusenøyane during ice break-up which, contrary to most years, started from the land side. Satellite images of the ice situation in the Barents Sea (provided by the Norwegian Polar Research Institute) in early June in the 1980s show that in most years the sea ice south of Edgeøya retreated from southwest towards northeast; in 1989, however, the ice broke up along the coast of Edgeøya before the retreat of the sea ice.

Variation in the time of fox presence on the islands was reflected by two different observations. First, the finding of many Brent Goose and Barnacle Goose nests, all of which had failed, on the larger of Meinickeøyane suggests that the fox had arrived after nest initiation and then effectively ravaged the nests. No Common Eiders and Arctic Terns *Sterna paradisaea*, which start egg-laying approximately two weeks after the geese, were observed nesting on the island. Second, on some islands where Common Eiders, Arctic Terns and Arctic Skuas but no geese were found nesting, fox tracks were observed but no foxes. In these cases the foxes had probably left the islands again, or died, when it was too late for the geese to start nesting, but not too late for the other bird species which start egg-laying later than the geese.

The density of nests found on Meinickeøyane was extremely high compared to densities found in 1987 when the geese bred successfully in Tusenøyane in general. In July 1991 Meinickeøyane was revisited (J. Madsen, unpubl.) and

only two nests of Brent Geese and seven nests of Barnacle Geese were found. This indicates that in 1989 the geese were crowding on the island, possibly because the neighbouring islands were inhabited by foxes at the time of egg-laying.

The time of hatching in 1989 was delayed 1–3 weeks compared to Brent Goose hatching dates in 1987 (Madsen et al. 1989), as well as to Barnacle Goose dates in Spitsbergen (Prop et al. 1984). In 1987 on Tiholmane few pairs of Brent Geese, but all pairs of Barnacle Geese, hatched later than mid-July. Observations in 1991 have shown that predation by Polar Bears during egg-laying may cause a delay of the continuation of egg-laying for more than one week as well as result in smaller clutches (J. Madsen, unpubl.). Similar effects of Arctic Fox predation on Common Eider nests in Alaska have been suggested by Quinlan & Lehnhausen (1982).

Furthermore, in 1989 the timing of moulting by non-breeders differed from what was observed in 1987; in 1989 the geese started shedding remiges at least one week earlier than in 1987. It is possible that the earlier start was triggered by the earlier nest abandonment.

The surveys showed that the geese not only gave up nesting in many islands but also abandoned the area (e.g., Meinickeøyane). Thus, the observed Brent Geese only represent approximately 10% of the total population. Surveys along the coasts of Edgeøya, Barentsøya and parts of Hinlopen later in August 1989 failed to locate major summering areas of Brent Geese, but probably the northern fjords of Spitsbergen hold concentrations of geese (Norwegian Polar Research Institute, unpubl.).

In autumn 1989 in Denmark it was found that the Svalbard Brent Goose population as a whole had experienced a bad breeding season. Only 4.0% juveniles were found in the autumn flocks (P. Clausen, pers. comm.), which was close to the proportion of goslings of 5.5% found in Tusenøyane. This indicates that the population composition on the islands visited in the summer of 1989 was almost representative for the whole population. In turn, this strongly suggests that in 1989 presence of Arctic Foxes in Tusenøyane was the prime factor causing bad breeding success of the population.

*Acknowledgements.* – This study is part of a joint project on Brent Geese between the Norwegian Polar Research Institute and the National Environmental Research Institute, Denmark. We express our deepest gratitude to the Norwegian Polar

Research Institute, and especially to Fridtjof Mehlum, for the invitation to the Svalbard Expedition 1989. The crew on R/V LANCE is thanked for kind hospitality and assistance.

## References

- Ahlén, I. & Andersson, Å. 1970: Breeding ecology of an eider population on Spitsbergen. *Ornis Scand.* 1, 83–106.
- Anthony, R. M., Flint, P. L. & Sedinger, J. S. 1991: Arctic Fox removal improves nest success of Black Brant. *Wildl. Soc. Bull.* 19, 176–184.
- Madsen, J. 1984: Status of the Svalbard population of Light-bellied Brent Goose *Branta bernicla hrota* wintering in Denmark 1980–1983. *Nor. Polarinst. Skr.* 181, 119–124.
- Madsen, J. 1987: Status and management of goose populations in Europe, with special reference to populations resting and breeding in Denmark. *Dan. Rev. Game Biol.* 12(4), 76 pp.
- Madsen, J., Bregnballe, T. & Mehlum, F. 1989: Study of the breeding ecology and behaviour of the Svalbard population of Light-bellied Brent Goose *Branta bernicla hrota*. *Polar Research* 7, 1–21.
- Mehlum, F. 1991: Breeding population size of the Common Eider *Somateria mollissima* in Kongsfjorden, Svalbard, 1981–1987. *Nor. Polarinst. Skr.* 195, 21–29.
- Norderhaug, M. 1974: Studies of Brent Geese (*Branta bernicla hrota*) on Tusenøyane, East Svalbard. *Nor. Polarinst. Årbok* 1972, 89–98.
- Owen, M. 1987: *Barnacle Goose Project, 1986 Report*. Wildfowl Trust, Slimbridge. 88 pp.
- Parker, H. & Mehlum, F. 1991: The influence of sea ice on nesting density in the Common Eider *Somateria mollissima* in Svalbard. *Nor. Polarinst. Skr.* 195, 31–36.
- Persen, E. 1986: Ringgåså – den norske bestanden fremdeles truet. *Vår Fuglefauna* 9, 173–176.
- Prop, J., Eerden, M.R. van & Drent, R.H. 1984: Reproductive success of the Barnacle Goose *Branta leucopsis* in relation to food exploitation on the breeding grounds, western Spitsbergen. *Nor. Polarinst. Skr.* 181, 87–117.
- Raveling, D. G. 1989: Nest-predation rates in relation to colony size of Black Brant. *J. Wildl. Manage.* 53, 87–90.
- Quinlan, S. E. & Lehnhausen, W. A. 1982: Arctic Fox, *Alopex lagopus*, predation on nesting Common Eiders, *Somateria mollissima*, at Icy Cape, Alaska. *Canadian Field-Naturalist* 96, 462–466.