

RESEARCH NOTE

Svalbard reindeer population size and trends in four sub-areas of Edgeøya

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Keywords

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Abstract

In summer 2006 Svalbard reindeer (*Rangifer tarandus platyrhynchus*) in south-western Edgeøya (Plurdalen, Grunnlinjesletta, Siegfjället and Burmeisterfjället) showed a low population (181 animals) and recruitment rate, in terms of both calves (9.4%) and yearlings (1.2%). The low recruitment rates were not accompanied by high winter mortality: of only five carcasses found, none were calves born in 2005. A comparison with survey data from 1969 in a restricted part of the study area (Plurdalen and Grunnlinjesletta) shows a consistently low recruitment rate since 1975, indicating a stable or slowly decreasing population.

Comprising the northernmost populations of *Rangifer*, the insular Svalbard reindeer (*Rangifer tarandus platyrhynchus*) inhabits an environment without grazing competitors or parasitizing insects. Besides polar bears (*Ursus maritimus*), which occasionally prey on Svalbard reindeer (Derocher et al. 2000; Sandal 2008; Hovelsrud 2009), and Arctic fox (*Vulpes lagopus*), which kill a few newborn calves (Tyler 1986), there are no other predators that are part of the natural habitat of reindeer elsewhere. This situation has prevailed for at least 4000 years (Van der Knaap 1986; Tyler & Øritsland 1989). Contrary to *Rangifer* subspecies elsewhere, Svalbard reindeer live individually or in small groups (Alendal & Byrkjedal 1976; Alendal et al. 1979), are seasonally sedentary (Tyler & Øritsland 1989) and are not nomadic. Their ability to build up fat reserves in times of plenty for use in times of scarcity (Reimers et al. 1982) makes them less dependent on the lichens that are easily digestible but are poorly resistant to grazing and trampling; these lichens have been replaced in the Svalbard reindeer's winter diet by far more grazing-resistant vascular plants, woody plants, herbs and graminoids (Hjeljord 1975; Punsvik et al. 1980; Staaland 1984; Wegener & Odasz-Albrigtsen 1998).

Unfavourable winter conditions, leading to starvation and high die-off in some winters along with low recruitment of calves the following summer, has been described as the main factor shaping Svalbard reindeer population dynamics (Reimers 1982a; Tyler 1987a). These "bad

winters" occur frequently, causing the population to fluctuate in size independent of population density (Tyler 1987a). The apparent strong effect of climate influenced Alendal & Byrkjedal (1976) and Reimers (1982a) to hypothesize that frequent "bad winters" keep Svalbard reindeer from reaching numbers that would be subject to the effects of density. These thoughts are challenged by more recent long-term studies suggesting that Svalbard reindeer are affected by both density dependant and climatic processes (Aanes et al. 2000; Solberg et al. 2001; Aanes et al. 2002, 2004; Chan et al. 2005; Tyler et al. 2008).

This short communication provides information from four areas of Edgeøya for which we have detailed population data from 1976 to 2006 and some less detailed survey data from two of the areas during the period 1969–1996.

Study area

In the archipelago of Svalbard, the island Edgeøya (ca. 5150 km²) is located between 77°15' to 78°15'N and 21° to 24°E. The total "vegetated area"—with vegetation coverage ranging as low as 5% and excluding water surfaces, river beds, gravel beds and glaciers—has been estimated at 1651 km² (Brattbakk 1986). The vegetated study area (ca. 120 km²) is located on the west coast of Edgeøya and includes Plurdalen,

Grunnlinjesletta and the plateaus Siegelfjellet and Burmeisterfjellet at about 400 m a.s.l. (Fig. 1). Edgeøya's average reindeer population size in the period 1969–1996 was estimated at 1730 ± 451 SD (Øritsland 1998). Edgeøya is part of a nature reserve and the reindeer population is protected from hunting and tourism.

Material and methods

During a study of vigilance behaviour of Svalbard reindeer in 2006 (Reimers et al. 2011), a complete survey was undertaken from the ground of live reindeer and carcasses from winter 2005/06 in the study area: Plurdalen (30 July), Siegelfjellet and Burmeisterfjellet (31 July) and Grunnlinjesletta (2 August). On the basis of body and antler size and the presence of sexual organs (penis or vaginal tuff), the animals were categorized as females or males two years or older, male or female yearlings and calves. Calves and yearlings were easily recognized on

the basis of their small body size: calves lacked antlers and yearlings had two antler spikes. Reindeer movement from day to day was limited, reducing the chances of double-counting. The migration of animals between the study area and reindeer-inhabited areas to the north and east is unknown, but is probably limited by glaciers and barren lands. The results from 2006 are compared with surveys in the same study area (Table 1) and a smaller part of the area (Table 2).

Results and discussion

In 2006, 181 live animals and five reindeer carcasses were found, compared to 227 animals and 62 carcasses in the same study area in 1976 (Table 1). The number of calves per 100 females aged two years or older was 21.1 in 1976 and 19.5 in 2006 (Table 1). This corresponds to the four lowest reproduction figures recorded in a 21-year study (1979–1999) on Nordenskiöld Land on the larger island of Spitsbergen (Solberg et al. 2001). There is

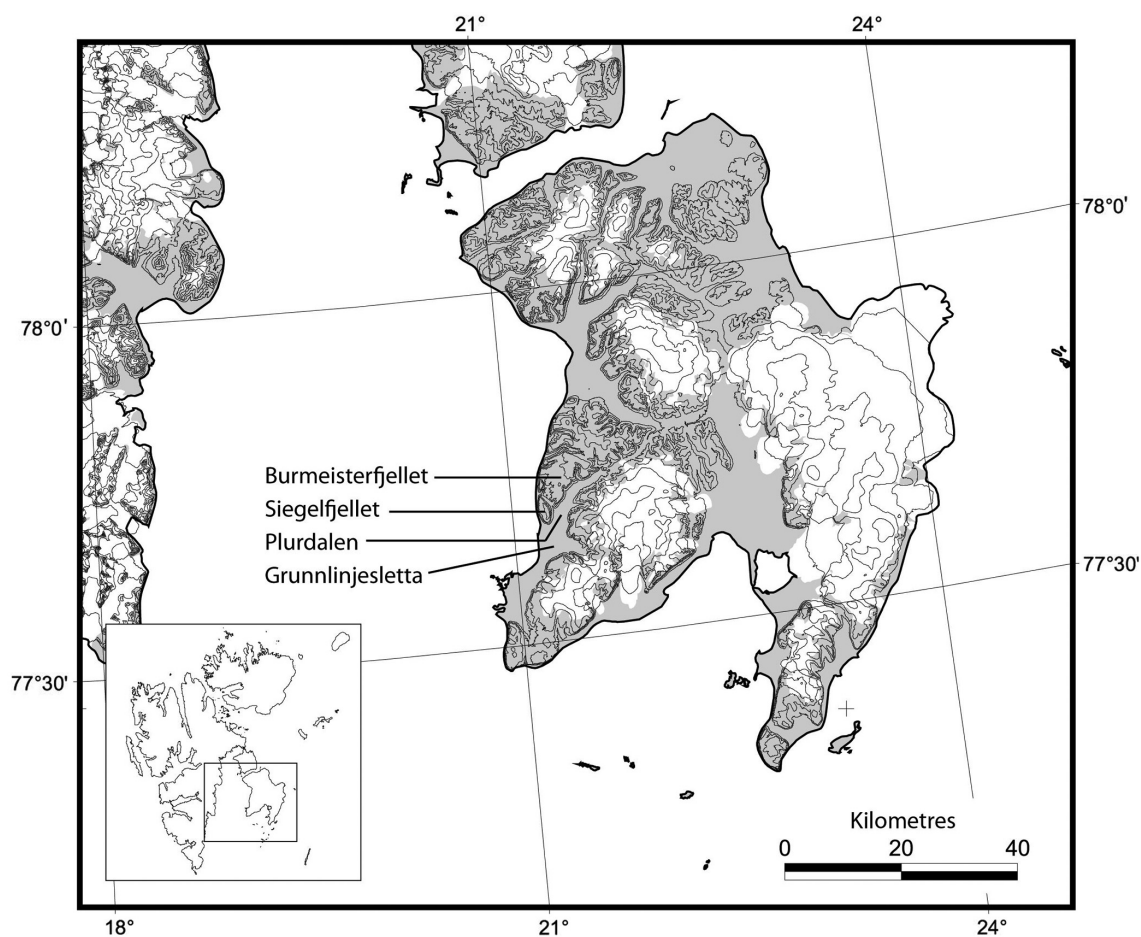


Fig. 1 The study area on Edgeøya, Svalbard.

Table 1 Reindeer population data from Plurdalen, Siegfjelllet, Burmeisterfjellet and Grunnlinjesletta, Edgeøya, Svalbard, summer 1976 (Reimers 1982b) and 2006.

	Year	No. of animals	Calves	Males 2 yr +	Females 2 yr +	Yearlings	No. of carcasses
Plurdalen	1976	108	13	49	41	5	
	2006	60	4	33	23		
Siegfjelllet	1976	2			2		
	2006	5	1	3	1		
Burmeisterfjellet	1976	15	1		13	1	
	2006	50	5	9	36		
Grunnlinjesletta	1976	102	5	63	30	4	
	2006	66	7	30	27	2	
Total study area	1976	227	19	112	86	10	62
	2006	181	17	75	87	2	5

probably no interaction between the Edgeøya reindeer population and the populations on Spitsbergen.

These low calf figures during summer were accompanied by high mortality rates during the preceding winter in three of the years (Solberg et al. 2001). This harmonizes with results of the 1976 study, which recorded 62 carcasses, of which 19 (30.6%) were calves born the preceding year, and a correspondingly low yearling component at 4.8% among animals one year or older (Reimers 1982b). The low number of calves per 100 females in 2006 was, however, not accompanied by high winter mortality: only five carcasses were found and none of them were calves. Furthermore, in spite of apparently low winter mortality among the animals one year or older only 1.2% were yearlings. The “disappearance” of yearlings may be attributed to low recruitment in 2005 caused by (1) low pregnancy rate during winter or (2) high prenatal and/or neonatal mortality. Pregnancy rates (determined on the basis of progesterone values) in a sample of 660 females aged two years or older captured on Spitsbergen (Colesdalen, Semmeldalen and Reindalen in Nordenskiöld Land) during the period 1995–2002 varied between 56.8% and 92.1% (average for the eight-year period was 76.6%; Milner et al. 2003). It is reasonable to assume that pregnancy rates among adult females on Edgeøya is

of similar magnitude, supporting prenatal and/or neonatal mortality as an explanation for the low percentage of yearlings. Milner et al. (2003) found survival rates from April to May to be 100% in six out of eight years and hence very little prenatal loss between this period and calving. Calving success (percentage females with calves at foot in August) did, however, vary between 7.7% and 90.5%, indicating that mortality in the period after calving may be substantial. In an evaluation of capture stress and its effect on reproduction in Svalbard reindeer, 78% of the 230 females found pregnant (range 11–91%) had calves at foot in summer, indicating an average calf loss of 22% (range 9–89%) during late winter and summer (Omsjoe et al. 2009). Therefore, the Edgeøya summer figures of 22.1% females age two or older with calves at foot in 1976 and 19.5% in 2006 are at the low end of the scale and may be attributed to heavy early calf mortality, from predation and other natural causes.

The reindeer population in Plurdalen and Grunnlinjesletta was down to 126 animals in 2006 from over 200 animals in the 1970s and an all-time high of 551 animals in 1996 (Table 2). There was also a corresponding trend in the percentage of calves from over 20% to below 10% during the same period (Table 2). Although the various subpopulations of Svalbard reindeer tend to be isolated and sedentary (Tyler & Øritsland 1989; Côté et al.

Table 2 Svalbard reindeer population surveys in two sub-areas in the south-western part of Edgeøya: Plurdalen and Grunnlinjesletta. (Siegfjelllet and Burmeisterfjellet were surveyed in 1976 and in 2006 and not during the other surveys. Data from these two areas are excluded in Table 2 for the sake of comparison.)

Year	No. of animals counted	No. of calves	Percentage calves	Source
1969	295	63	21.4	Norderhaug (1971). Helicopter survey in August.
1971	265	47	17.7	Hjeljord (1975) and unpublished data. Ground surveys in July/August.
1975	270	29	10.7	Reimers (1982b). Ground survey in July.
1976	210	19	9.0	Reimers (1982b). Ground survey in July.
1977	126	14	11.1	Alendal et al. (1979). Ground survey in July.
1983	187	8	4.3	Øritsland (1998). Ground survey in March/April from snowmobiles.
1996	551	11	2.0	Øritsland (1998). Ground survey in March/April from snowmobiles.
2006	126	11	8.7	This work. Ground survey in July/August.

2002), migration occurs in response to “locked” winter pastures (Stien et al. 2010). The high number of reindeer (551 animals) found in spring 1996 compared to 187 animals in 1983 (Øritsland 1998)—both surveys were made by the same researcher on a snowmobile—reflects population increase as the entire Edgeøya population increased from an estimated 1417 animals in 1983 to 2384 animals in 1996 (Øritsland 1998). As there was a corresponding population increase during these years in the adjacent areas north (Dyrdalen) and south (Tjuvfjordlaguna to Halvmåneøya) of the study area, the population fluctuation in the Plurdalen/Grunnlinjesletta study area is probably not attributable to immigration.

The low recruitment of calves, and in particular yearlings, found in 2006, may explain the population decrease. But fewer adult males (46.3% in 2006 compared to 56.6% in 1969) may also be a factor (Table 1). As only five carcasses were found, starvation mortality in winter appears unlikely, which suggests reduced reproductive rate, early calf mortality and possibly predation by polar bears as explanatory factors. It is interesting to note that in 1966, 55 of the 181 animals (30.4%) were located on the plateaus compared to 7.5% in 1976 (Table 1). Among animals aged at least two years, 42.5% of the females and 16% of the males were located on the plateaus in 2006 while the corresponding percentages were 17.4% and 0% in 1976. More females and males on the less accessible plateaus and fewer males in the subpopulation in 2006 may be a response to more reindeer–polar bear interactions in Edgeøya in 2006 than in 1976.

What does this tell us, other than that this local herd in Plurdalen/Grunnlinjesletta has undergone some fluctuation, but otherwise has remained reasonably stable over 37 years? It indicates that, in the absence of hunting and predation as regulating factors, this stability is most likely caused by a combination of grazing-resistant pastures and winter climate, as previously suggested (Reimers 1982a; Reimers et al. 1982). There is reason to believe that when reindeer first arrived on Edgeøya several thousand years ago, lowlands were lichen-dominated and that the transition to the moss- and graminoid-dominated present state was herbivore-driven (van der Wal 2006; Hansen et al. 2007). As emphasized by van der Wal (2006), the loss of lichens from tundra ecosystems does not necessarily compromise the viability of herbivore populations as more productive graminoid–moss-dominated systems may develop that have greater resilience to grazer impact. Mosses predominate in the Svalbard reindeer diet (Staaland & Punsvik 1980; Sormo et al. 1999; Van der Wal et al. 2000) and they can better digest the poor-quality mosses than can mainland reindeer and caribou

(*R. t. tarandus*, *R. t. granti*, *R. t. groenlandicus*; Staaland & White 1991). With the replacement of lichens by grazing and trampling-resistant green vegetation in their winter habitats, carrying capacity becomes a floating concept that relates to the randomly distributed bad winters. Mortality in severe winters hits animals that have been unable to build up necessary body reserves to withstand extreme winter conditions, not because of density-dependant competition, but because of internal conditions: lactational stress (females), growth priorities (calves and possibly yearlings) and rutting activities (adult males). These bad winters prevent the population from increasing to summer densities that bring carrying capacity problems relating to overgrazing, food competition and reduced body condition. Supporting data come from a controlled grazing experiment in Adventdalen where Wegener & Odsasz-Albrigtsen (1998) found that reindeer grazing had no significant effect on the live biomass of vascular plants, woody plants, herbs or graminoids. Body composition data (Reimers 1982b; Reimers et al. 1982; Tyler 1987a, b) confirm that during summer Svalbard reindeer rapidly recover from the starvation and greatly reduced body mass that they undergo during the preceding winter.

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