The frequency of antlerless female caribou and reindeer in Alaska

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Abstract: The presence or absence of antlers in female caribou and reindeer may reflect genetic or nutritional effects. We classified antler status of female caribou of the Alaska Central Arctic Herd in 1994, 1995, and 2002, and female reindeer in two captive Alaskan herds in 1994. Of 3091 female caribou classified during three years, 152 (4.9%) were antlerless. Frequency of antlerless females in the Central Arctic Herd was similar to that of other Alaskan caribou herds. There were no antlerless females among 231 classified captive reindeer. We compared the frequency of antlerless females in the Alaskan herds with other herds, and possible nutritional and genetic influences on female antler status are discussed.

Key words: antlers, genetics, nutrition, *Rangifer*.

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Introduction

Caribou and reindeer (*Rangifer tarandus*) are the only members of the deer family in which females typically have antlers. However, frequency of antlered females varies considerably among herds and, over time within a herd (Skoog, 1968; Bergerud, 1971; Thing *et al.*, 1986; Reimers, 1993; Jacobsen *et al.*, 1998). Reimers (1993) suggested that antlers in female caribou may be under genetic selection. Antlers may have a social function that confers a survival and reproductive advantage over antlerless females in the large aggregations typical of the species. Nutrition may also be an important factor influencing the presence or absence of antlers in female caribou. Herds at high densities or in poor habitats tend to have higher frequencies of antlerless females (Reimers, 1993; Thing *et al.*, 1986). Thing *et al.* (1986) also found that calves with antlerless mothers were more likely to have diseases or die than calves with antlered mothers, as well as an inverse relationship between winter range quality and percentage of anterless cows. Reimers (1993) found antlerless females had lower body weights than antlered females, the frequency of antlerless females in two Norwegian herds increased over time as the herds increased in number, and that antlerless females were rare in herds in good physical condition and common in herds in poor condition.

These observations suggest that frequencies of antlerless female *Rangifer* could be used as an indicator of nutritional status and genetic makeup of a herd. We assessed antler status of female caribou in the Central Arctic Herd in northern Alaska because there are concerns that oil fields have had a negative impact on the nutritional status of females (Cameron, 1995; Cameron *et al.*, 2002). The genetic relationship of this and adjacent herds is also of potential man-

Table 1. Numbers and percentages of antlerless caribou and reindeer (*Rangifer tarandus*) females.

Herd/Location	Year	Percent Antlerless (Number Antlerless/Total)	Reference
Tundra Caribou, *R. t. granti*			
Central Arctic, Alaska	2002	5.5% (100/1821)	This Study
Central Arctic, Alaska	1995	6.4% (3/47)	This Study
Central Arctic, Alaska	1994	4.0% (49/1223)	This Study
Central Arctic, Alaska	1994, 1995, 2002	4.9% (152/3091)	This Study
Porcupine, Alaska	1983-1990	5.0% (8/170)	Whitten, 1995
Western Arctic Herd, Alaska	1962-1964	0.9% (1/114)	Skoog, 1968
Western Arctic Herd, Alaska	1961	3.0% (33/1100)	Lent, 1965
Forty Mile, Alaska	1952-1955	0.6% (2/314)	Skoog, 1968
Nelchina, Alaska	1957-1964	2.3% (26/1147)	Skoog, 1968
Nelchina, Alaska	1962	1.4% (14/1009)	Skoog, 1968
West of Hudson Bay, Arctic Canada, *R. t. groenlandicus*	Early 1900s	0.3%	Steffanson, 1913
Queen Charlotte Island, *R. t. dawsoni*	1956	100%	Banfield, 1961; Cowan & Guiguet, 1956
Woodland Caribou, *R. t. caribou*	1957-1986	0.3-92%	Bergerud, 1971; Reimers, 1993; Gagnon & Barrette, 1992
Wild Reindeer, South Norway, *R. t. tarandus*	1948-1983	0-17%	Reimers, 1993
Decendants of Domestic Reindeer, *R. t. tarandus*			
Iceland	1978	0-2.4%	Reimers, 1993
T. Williams' Reindeer, Palmer, Alaska	1994	0% (0/47)	This Study
Pt. Mackenzie Reindeer, Alaska	1994	0% (0/184)	This Study
Seward Peninsula, Alaska	1995	0%	J. Bevins, pers. comm.
Finland, *R. t. fennicus*	1970	7.5%	Espmark, 1971
Greenland Wild Caribou, *R. t. groenlandicus*	1977-1984	21-78%	Reimers, 1993; Thing *et al.*, 1986
Svalbard Reindeer, Svalbard, *R. t. platyrhynchus*	1972-1994	0-50%	Thing *et al.*, 1986; Reimers, 1993; Jacobsen *et al.*, 1998

agement value (Cronin *et al.*, 1995; 2003). We also assessed antler status of female captive reindeer in two Alaskan herds. Our objectives were to quantify and compare the numbers of antlerless and antlered female caribou and reindeer for the herds studied, as well as compare these towards herds in other locations.

Material and methods

We assessed antler status of female caribou in the Prudhoe Bay, Kuparuk, and Milne Point oil fields in northern Alaska during July 1994, July 1995, and July 2002. Female caribou begin antler growth around calving time (May–June), and antlers are readily observable by mid-July (Skoog, 1968). Groups of caribou on or near oil field roads or gravel pads were approached by observers on the ground or in vehicles, and sex and presence or absence of antlers was identified (< 800 m with a spotting scope). We also assessed antler status of female reindeer in two captive herds: the T. Williams herd at Palmer, Alaska, and a herd at the Point MacKenzie Prison, Alaska. These reindeer were kept in fenced pastures and direct observations, with or without binoculars, were made from a distance of 2–50 meters. The Point Mackenzie herd was composed of animals surviving the extermination of reindeer on Haegemeister Island by the U.S. Fish and Wildlife Service (Stimmelmeyer & Renecker, 1998). Data for other herds were obtained from the literature and personal communications.

Results and discussion

We classified antler status of 1223 female caribou in the Central Arctic Herd in 1994, 47 female caribou in 1995, and 1821 female caribou in 2002 (Table 1). In 1994, 49 of 1223 females (4.0%) were antlerless; in 1995, 3 of 47 females (6.4%) were antlerless; and in 2002, 100 of 1821 (5.5%) females were antlerless. The three-year average was 4.9% antlerless females. There were no antlerless females among the 47 classified reindeer in the Williams' herd or among the 184 animals in the Point MacKenzie herd (Table 1).

The frequency of antlerless females in the Central Arctic Herd (4.9%) was similar to that of other Alaskan herds (Table 1). The Porcupine Caribou Herd occupies adjacent summer ranges to the east of the Central Arctic Herd and had essentially the same frequency of antlerless females (5%; Whitten, 1995) as the Central Arctic Herd. These two herds were also similar genetically and may constitute an interbreeding population (Cronin *et al.*, 2003). The Western Arctic Herd in northwest Alaska occupies ranges to the west of the Central Arctic Herd and had antlerless female frequencies of 0.9%–3.0% during the 1960s (Lent, 1965; Skoog, 1968). The Nelchina and Forty Mile herds in interior Alaska had frequencies of 0.6%–2.3% antlerless females during the 1950s and 1960s (Skoog, 1968). These Alaskan herds have relatively low frequencies of antlerless females compared to some other herds (Table 1). A caribou herd west of Hudson Bay, Canada, also had a low frequency of antlerless females (0.3%) in the early 1900s. In contrast, woodland caribou in North America and reindeer in Greenland, Svalbard, and Norway often have high frequencies of antlerless females (Table 1).

Reimers (1993) noted that both genetics and nutrition affected the presence or absence of antlers in female caribou and reindeer. Poor nutrition and resulting poor body condition may result in lifetime or annual antlerlessness. Body growth, gestation, and lactation may take precedence over growth of antlers, which are a tissue of relatively low growth priority (Thing *et al.*, 1986; Geist, 1987). The relatively low frequency of antlerless females in the Alaskan caribou and reindeer herds (Table 1) suggest there is not enough nutritional stress to prevent antler growth in these herds. Relatively high recruitment rates in the Central Arctic herd (Cronin *et al.*, 1998; 2000) also indicate that nutritional stress is probably not severe in this herd.

Different frequencies of antlerless females in various caribou and reindeer herds may also reflect genotypes at one or a few loci controlling this trait. Bergerud (1971) suggested the frequency of antlerless females could be used to estimate gene flow among herds. Genotypes at other loci have been shown to vary considerably among caribou and reindeer herds (*e.g.*, Røed & Whitten, 1986; Cronin, 1992; Cronin *et al.*, 1995; 2003). The high frequencies of antlerless females in woodland caribou, and low frequencies in tundra caribou, may reflect genetic selection in different environments (Reimers, 1993). Woodland caribou generally occur in smaller groups and selection for antler presence in females may be less than in the large aggregations found in tundra areas. The mechanism for such selection is quite plausible when one considers that in cattle a single gene locus (the polled locus) controls the presence or absence of horns (Georges *et al.*, 1993). One or two additional loci also affect size and form of the horn. Depending on the genotypes at all three loci, phenotypes may include horned males and females, hornless males and females, or horned males and hornless females. The latter condition is analogous to the standard condition in most deer species (and some caribou): antlered males and antlerless females. If one or a few loci control the presence or absence of antlers, relatively

rapid changes in gene frequency, and hence phenotype frequency (*e.g.*, antlerless females) could occur. There may be conflicting pressures between the social advantages of having antlers and the increased energetic costs of growing them. A combination of selection, mutation, and genetic drift could account for much of the variation in frequency of antlerless females among herds and geographic areas. The genetic mechanisms controlling antler presence or absence in female caribou, and the relative contribution of genetics and nutrition to this trait need to be assessed with breeding and genetic studies.

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