

exception. Although Denali encompasses over 6,600 square miles (17,100 km²) of suitable habitat, currently about 100 wolves, 350 grizzly bears, 2,000 caribou, 1,900 moose, and 1,800 Dall sheep occur there. In comparison, areas of the Tanana Flats and northern Alaska Range adjacent to Denali on the east have long been managed for human harvests, and moose occur there at about six times the density of Denali.

Denali's large mammals interact in an age-old drama in their roles as predators and prey. While each species has a substantially different role, each individual has the same goals of survival and reproduction. Predators must find and kill sufficient prey, while ungulates employ strategies to minimize their risks of becoming a meal. For both predators and prey to persist, the capabilities of predators must be roughly counteracted by the vigor and predation-avoidance behaviors of the ungulates. However, the stage for this drama is constantly changing, providing challenges or advantages to the participants, and affecting the numbers that survive at any given time.

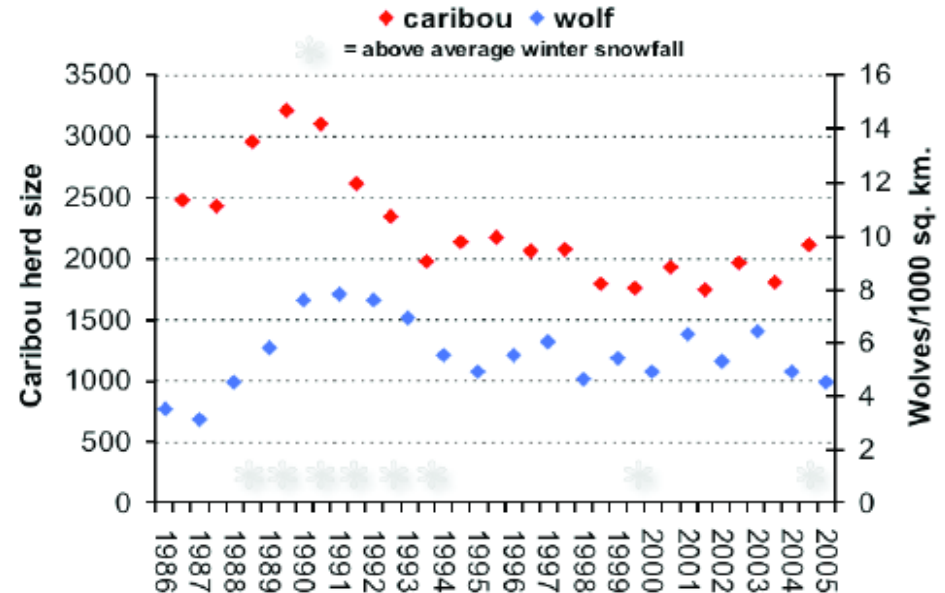
Winter snowfall is probably the most obvious factor that influences predator/prey relationships and population trends (*Mech*

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et al. 1998). Since 1924, total winter snowfall measured at park headquarters has averaged 80 inches (203 cm), but has varied from 31 to 174 inches (79-442 cm), indicating an extreme range of winter conditions experienced by wildlife in Denali.

We know most about the effects of winter snowfall on wolf and caribou populations in Denali because of intensive studies of each species begun in 1986 (*Adams 1996, Mech et al. 1998*). Those studies began near the end of more than a decade of winters with snowfalls that were well below average and continued through six consecutive winters of deep snows of 90 to 155 inches (229-394 cm), providing a powerful opportunity to gain insights into effects of winter conditions on these two species.

In 1986, the Denali Caribou Herd numbered about 2,600 animals and was increasing 7% per year. At the time, the wolf population in Denali included about 60 animals, a number lower than expected based on the abundance of ungulates. Wolf pup production was poor, and dispersal of young wolves was high. With severe winters from 1988 to 1994, wolf numbers rapidly increased, reaching 130 wolves by late winter 1990 and staying high through the 1992-93 winter. The caribou herd reached 3,200 individuals by autumn 1989 but declined to about 2,000 by autumn 1993. Recruitment of calves was poor, averaging only 12 calves per 100 cows in fall 1990-93, compared to 35 per 100 during 1984-89. Further, winter mortality rates of adult cows tripled from about 5% to 15% annually. Winter snowfalls have returned to more average levels since 1994. Wolf numbers declined to an average



Population trends of caribou and wolves in Denali National Park and Preserve relative to severe winters.



A wolf consumes a mature Dall sheep ram killed on the Toklat River.

Photograph courtesy of Rick McIntyre