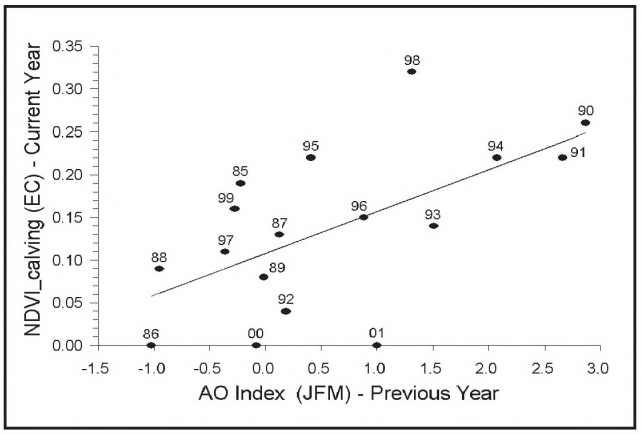

Figure 3.6. Median Normalized Difference Vegetation Index at calving (NDVI_calving) within the aggregate extent of calving (EC) of the Porcupine caribou herd for the current year, and winter Arctic Oscillation index (AO, January, February, March) for the previous calendar year, 1985-2001.

atmospheric conditions (Fig. 3.6). Counteracting the positive trend in forage abundance during peak lactation has been a tendency toward more freeze-thaw cycles on spring and fall transitional ranges of the Porcupine caribou herd (Fig. 3.7*a*,*f*) coincident with a suspected phase shift in the Arctic Oscillation.

These freeze-thaw cycles on transitional and winter ranges may have influenced snow properties, reduced access to forage, increased travel costs, and/or decreased the ability of caribou to escape their predators. These climate-influenced conditions on transitional/winter ranges may have contributed to the decline in size of the Porcupine caribou herd (Fig. 3.5) in spite of favorable conditions on the calving ground. Local and large-scale climate patterns as well as catastrophic events in the Southern Hemisphere (e.g., eruption of Mount Pinatubo) apparently have had major influences on Porcupine caribou herd habitats during the period of study and have set the stage for all observations of Porcupine caribou herd distribution and demographic processes during the past 2 decades.

Herd Dynamics and Demography

The growth curve of the Porcupine caribou herd suggested an approximate 30- to 40-year cycle of increase and decrease in abundance (Fig. 3.8). The herd numbered 178,000 in 1972, increased at about 4.9% per year from 1979 through 1989 when it reached 178,000 animals, then declined at about 3.6% per year from 1989 to 1998 (Fig. 3.8). The decline from 1998 to 2001 was only about 1.5% per year, and the herd now totals ~123,00 animals. If the current decline continues, the herd would be expected to again reach the lowest levels ever recorded during 2005-2010. If the herd continues to decline below ~100,000 animals, then the length of a complete herd cycle may exceed 30 years.

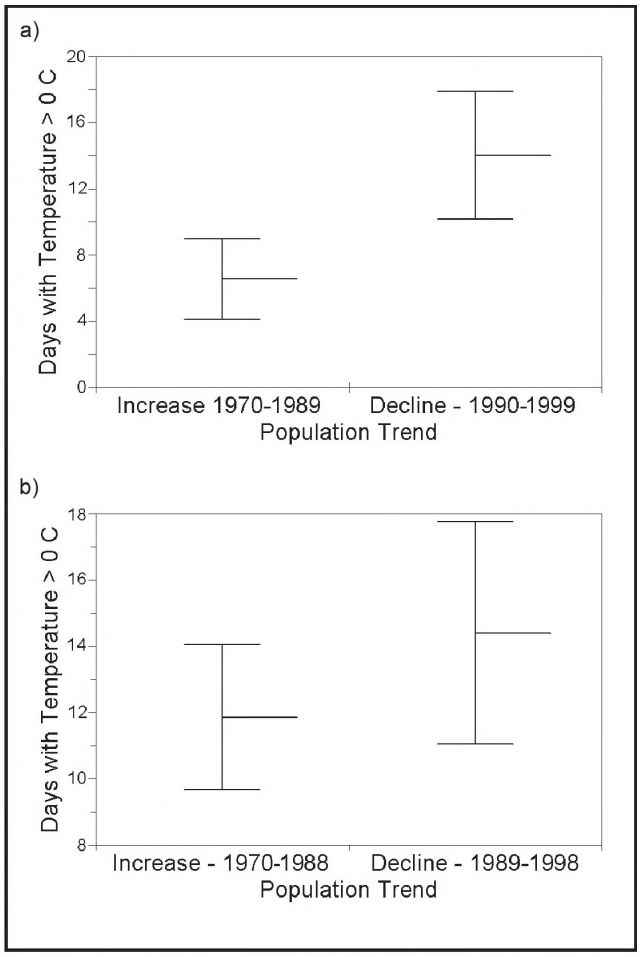

Figure 3.7. Frequency of days with daytime temperatures above freezing in *a*) spring (21 March - 30 April) and *b*) fall (21 September - 20 October) on transitional ranges of the Porcupine caribou herd during the herd increase phase, 1970-1988, and the herd decrease phase, 1989-1998. Brackets indicate 95% confidence intervals on mean values.

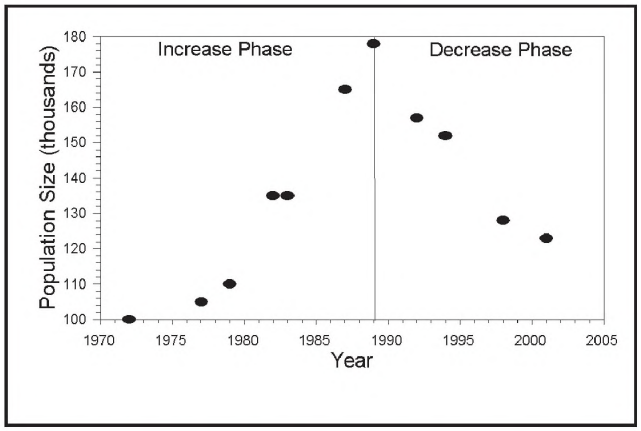

Figure 3.8. Population size of the Porcupine caribou herd, 1972-2001, estimated from aerial photo-censuses by the Alaska Department of Fish and Game.

Porcupine caribou herd size appeared correlated with Arctic Oscillation although there were too few data to conduct a proper time series analysis (Fig. 3.5). In contrast to the Porcupine caribou herd, other Alaska barren-ground caribou herds (Western Arctic, Teshekpuk Lake, Central Arctic), generally continued to increase during the downward trend in the Arctic Oscillation that was evident during the 1990s (Fig. 3.5).

Capacity for growth (defined as the maximum realized long-term growth rate) of the Porcupine caribou herd appeared substantially less than for other Alaska herds. Capacity for growth among herds of dramatically different sizes is best visualized by plotting relative herd sizes (Fig. 3.9). Maximum long-term growth rate (~4.9%, assumed linear, 1979-1989) (Fig. 3.8) of the Porcupine caribou herd was never more than about half the rate observed for other Alaska barren-ground caribou herds [Western Arctic herd (1976-1996, +9.5%), Teshekpuk Lake herd (1978-1993, +13%), Central Arctic herd (1978-1992, +10.3%)] (Fig. 3.9).

The Porcupine caribou herd was the first Alaska barren-ground caribou herd to begin and maintain a prolonged decline in the last 2 decades (Fig. 3.9). Annual survival of Porcupine caribou herd adult females was only about 84% (Fancy et al. 1994, Walsh et al. 1995), which was lower than that generally observed in other caribou herds (Bergerud 1980); and adult female survival may have been responsible for the relatively low growth rate of the Porcupine caribou herd.

Annual calf survival averaged about 48% with about half (56%) of the annual mortality occurring on the calving ground (Whitten et al. 1992, Fancy et al. 1994, Walsh et al. 1995).

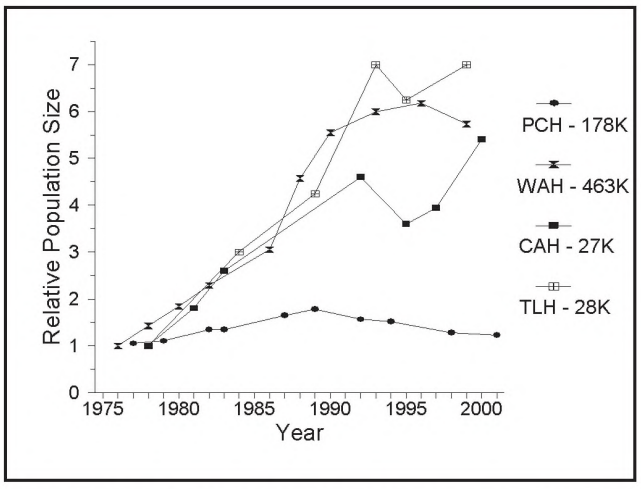

Figure 3.9. Relative post-calving herd sizes (minimum observed = 1.0) of the 4 Alaska barren-ground caribou herds (PCH = Porcupine caribou herd; WAH = Western Arctic herd; CAH = Central Arctic herd; TLH = Teshekpuk Lake herd), 1976-2001. Maximum observed population size for each herd is noted in the legend.

There were no significant differences in mean parturition, calf survival during June, or *net calf production* (defined as the product of parturition rate and June calf survival) (Fig. 3.10*a-c*) between the increase and decrease phases of the herd (Fig. 3.8). Parturition rate averaged 0.81 (range 0.71-0.92) during 1983-2001 (Fig.

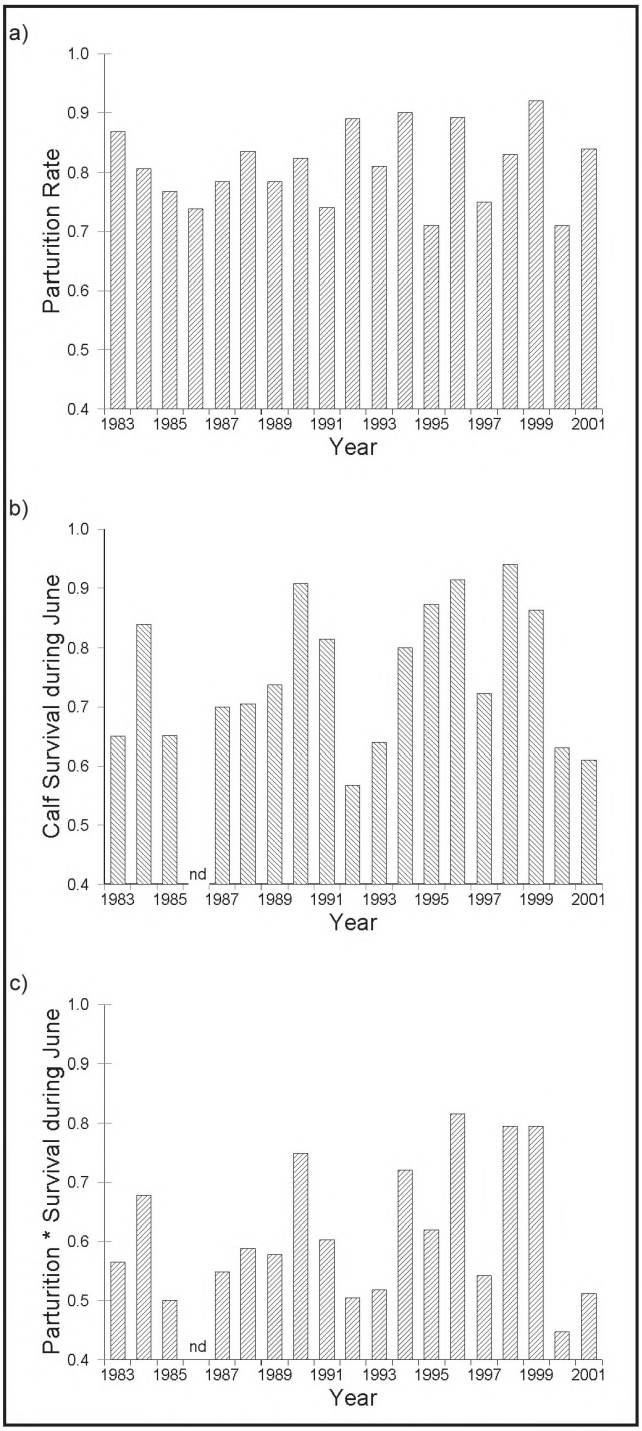

Figure 3.10. Reproductive estimates for the Porcupine caribou herd, 1983-2001: *a*) parturition rate of adult females, *b*) calf survival from birth through the last week of June, and *c*) *net calf production* [the product of parturition rate and calf survival].