

SUMMER ECOLOGY OF THE PORCUPINE CARIBOU HERD



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Introduction

In the “Sensitive Habitats of the Porcupine Herd” report, the International Porcupine Caribou Board provided information on the annual life cycle of the herd and summarized its distribution over the previous two decades. Based on ecological criteria, the Board identified the calving and immediate post-calving period for cows and calves as the most sensitive period in relation

to environmental stress (Figure 1). In this report, we summarize the most recent research on the status of the herd, the ecological factors affecting its productivity during the calving and immediate post-calving periods, and how climate change and potential hydrocarbon development may affect the herd.

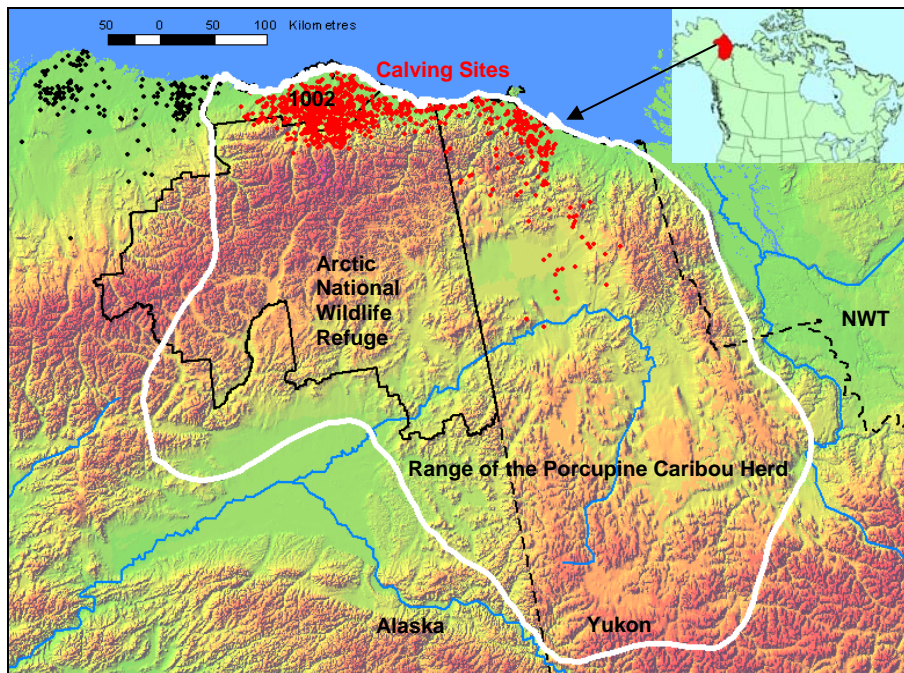


Figure 1: Range (in white) and calving sites (in red) of the Porcupine Caribou Herd and calving sites of the Central Arctic Herd (in black) in relation to the Arctic National Wildlife Refuge. The “1002” land refers to the area potentially open for hydrocarbon development.



Two issues challenge managers within the next few decades – the possibility of oil and gas activity within the calving

and post-calving areas of the herd and the significant climate warming documented within the region (Figure 2).

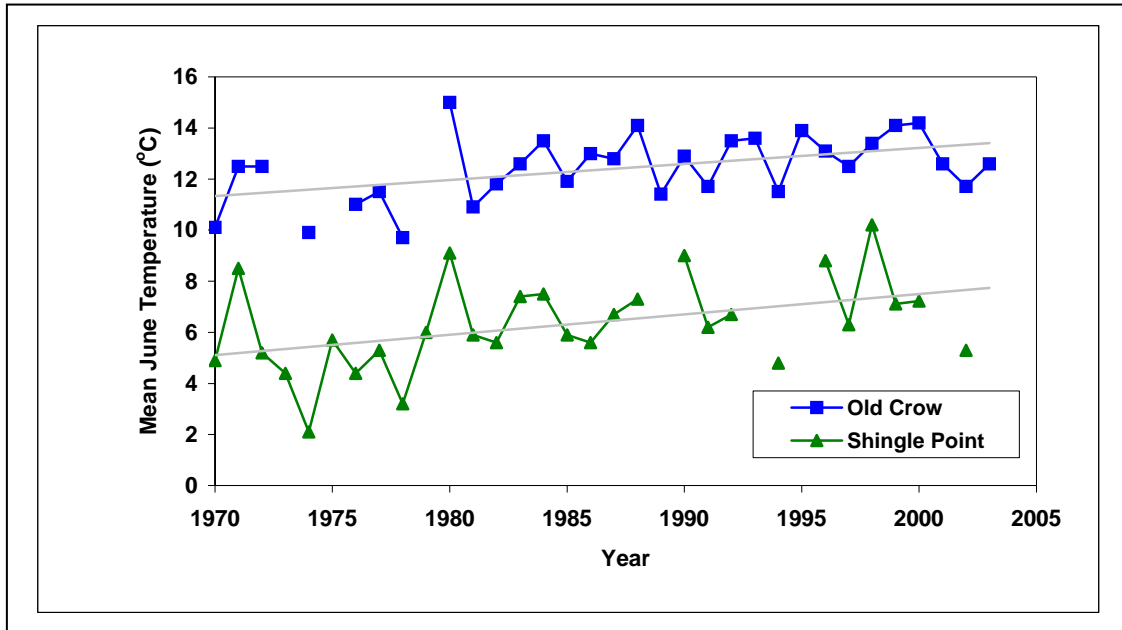


Figure 2: Mean temperatures for the month of June at two weather stations within the annual range of the Porcupine Caribou Herd



The Area

The Porcupine Caribou Herd occupies the transition zone between tundra and taiga straddling the Alaska-Yukon border (Figure 1). In winter, they occupy the river valleys and slopes in the Ogilvie and Richardson Mountains in the Yukon and the southern Brooks Range in Alaska.

During spring migration, the pregnant cows move northeast from the Alaskan winter ranges or north and northwest from the Canadian winter ranges (Figure 3a). If snowmelt is early, they will then move westward along the north slope of the Brooks Range into Alaska.

Calving and early post-calving primarily occur on the Alaskan foothills and coastal plain (Figure 3b), spreading northward onto the plain as the snow recedes (Figure 3c). During the insect season, the herd forages widely into Alaska and Canada (Figure 3d).

The majority of calves are born on the coastal plain of Alaska (Figure 1). In years when snowmelt is early, more calves are born in the “1002” area; when snowmelt is late, more calves are born along the foothills or in Ivavik Park in the Yukon. If snow melt is very late, migration from winter ranges is delayed and calves can be born along spring migration routes.

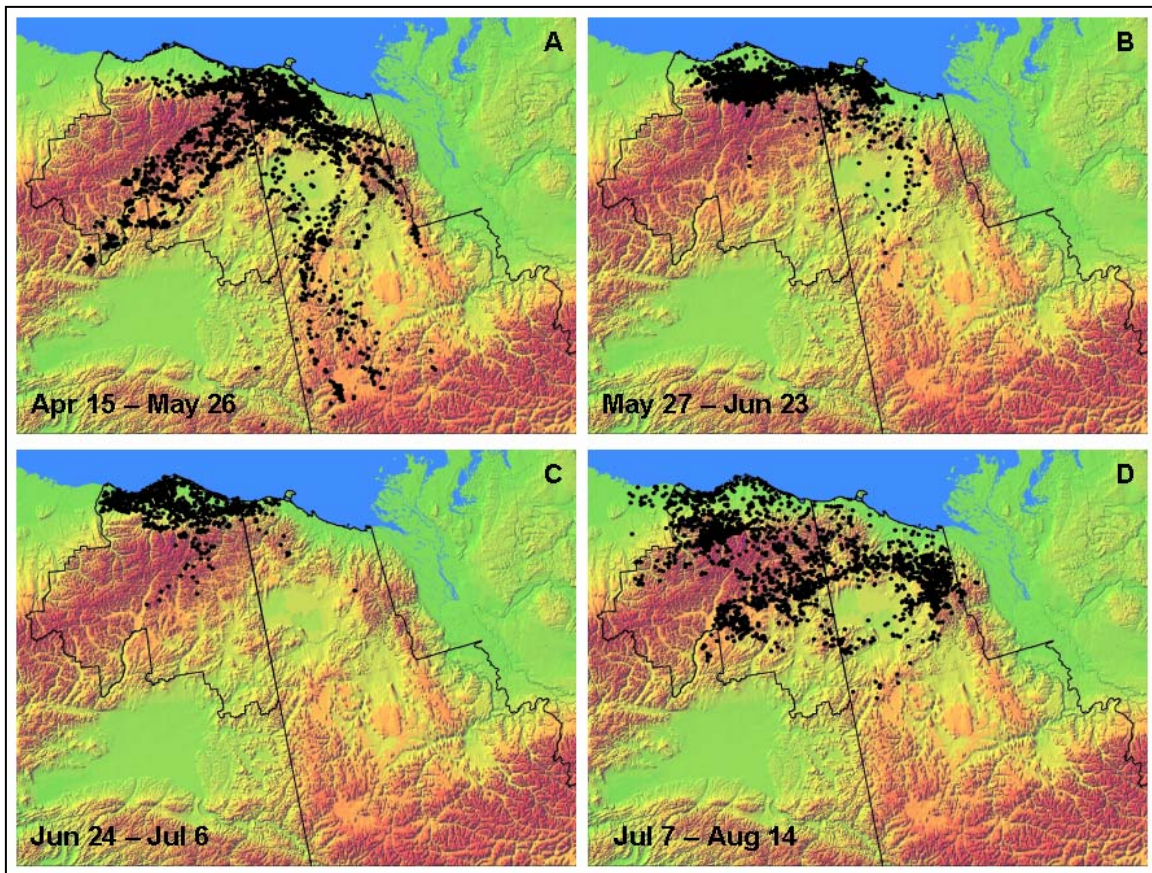


Figure 3: Location of cows of the Porcupine Caribou Herd during A) Spring migration; B) Calving; C) Post-calving; D) Summer insect season

Present Herd Status

The Porcupine Caribou Herd increased from the early 1970's until 1989 and has since been declining at approximately 3.5% per year (Figure 4) with the most recent count indicating 123,000 caribou in the herd, down 55,000 animals from 1989. Most North American herds increased throughout this period. If we compare the growth rates among the

Alaskan barren-ground herds, the Porcupine Caribou Herd has the lowest growth rate (Figure 5) and was the first herd to begin and maintain a decline. From radio-collar studies, we know that only 84% of adult cows survive each year, which is low compared to other herds and this may be responsible for the herd's low growth rate.

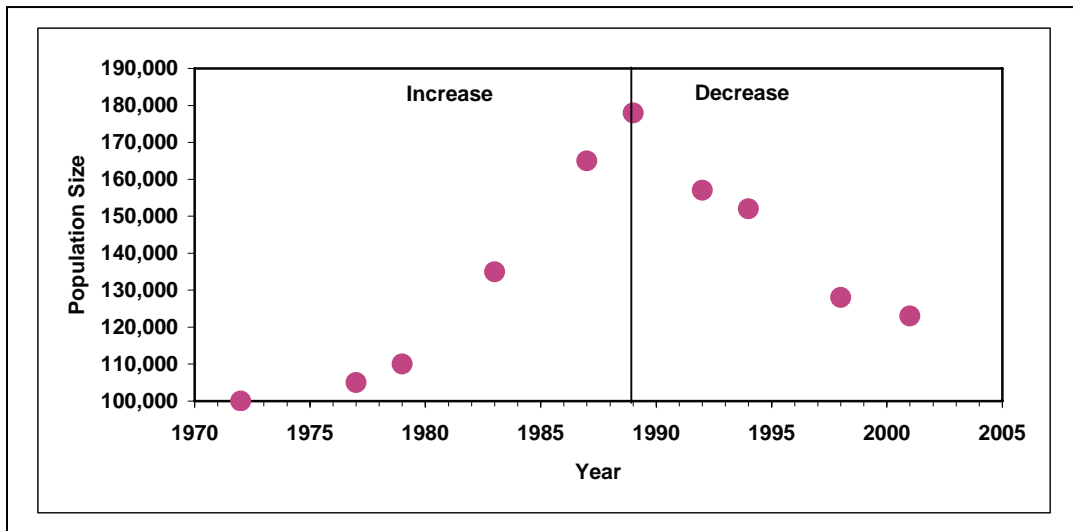


Figure 4: Population size of the Porcupine Caribou Herd

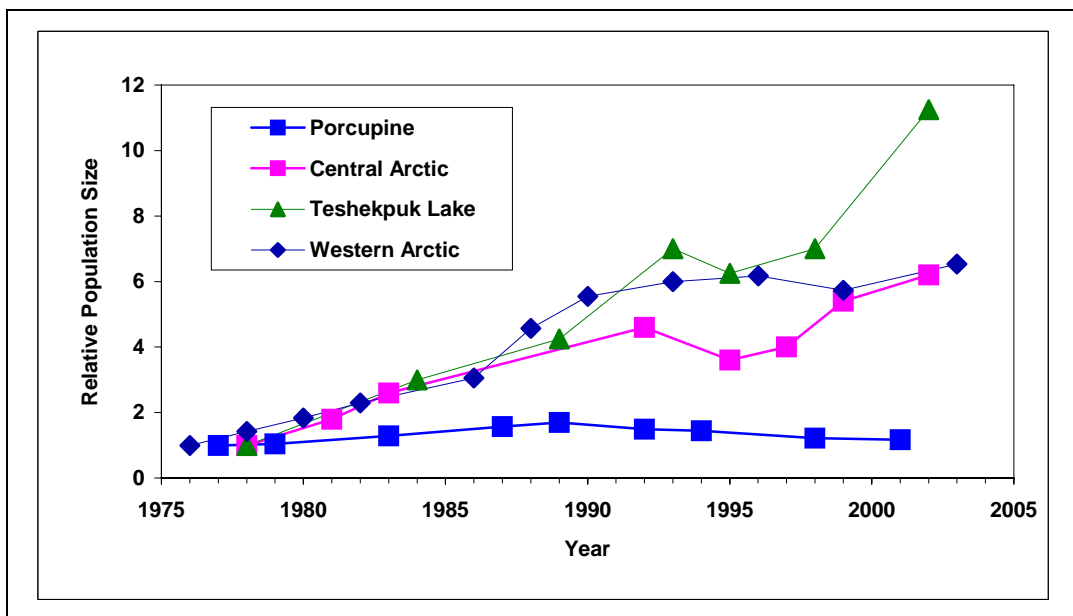


Figure 5: Relative population size of Alaskan Caribou Herds. Steepness of lines indicates relative growth rates.

Birth Rate

The majority of calves are born in the first week of June. From radio-collar studies of animals whose ages are known, we know that most cows give birth for the first time on their third birthday. For every 100 adult cows in the population, normally about 81 calves are born each year (Figure 6). The “birth rate” can vary depending on the

condition of the cows during the fall breeding season and has been as low as 71% and as high as 92%. If we compare birth rates during herd increase (1983-1989) to birth rates since the start of the decline (1990-2004), there is no significant difference in the birth rate of the herd (80% compared to 83%, respectively).

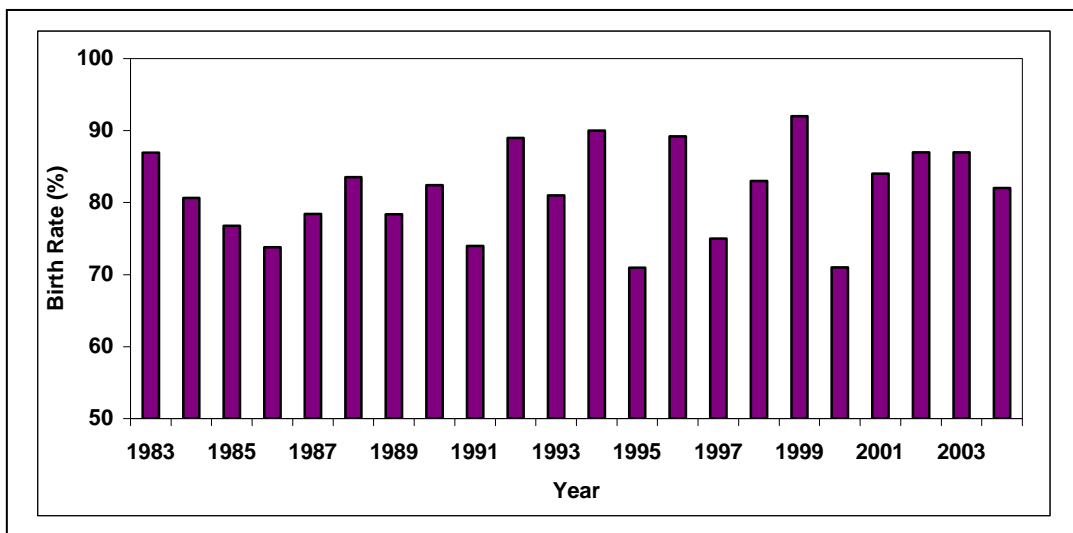


Figure 6: Birth rate of the Porcupine Caribou Herd



Early Calf Growth

Calves are most vulnerable during the first month of life. For the first 3 weeks, they are totally dependent upon their mothers' milk. Their growth rate is directly related to the amount and quality of their mothers' milk. After they begin foraging and digesting food on their own, the milk they receive largely determines their growth rate while the food they eat satisfies their maintenance energy requirements. Biologists consider this early period as the most sensitive for the fate of the calf.

In a three-year study from 1992-1994, biologists estimated that calves gained between 370 g and 430 g per day in the first three weeks after birth.

The size of the calf in the autumn is directly related to its size at birth and to the mother's size at the end of June (Figure 7). This means that if the cows are in poor condition when they provide milk to the calves in June, there is little opportunity for the calves to compensate.

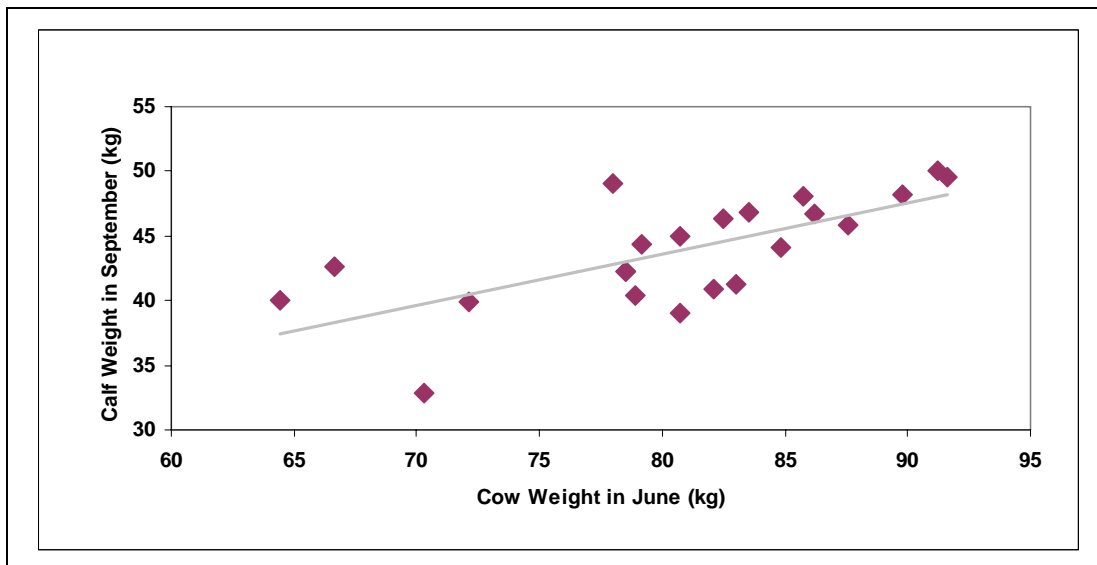


Figure 7: Relationship between cow weight in June and its calf's weight in September for the Porcupine Caribou Herd



Early Calf Mortality

In the first month of life, an average of 25% of the newborn calves will die. A study in 1983 determined that of the calves that die, 52% will die from birth defects or poor nutrition and 48% die from predators. For the Porcupine Caribou Herd, the primary predator on

the calving ground is the golden eagle, followed by grizzly bears and wolves. These predators have higher concentrations in the foothills and mountains just south of the coastal plain where most calving occurs (Figure 8).

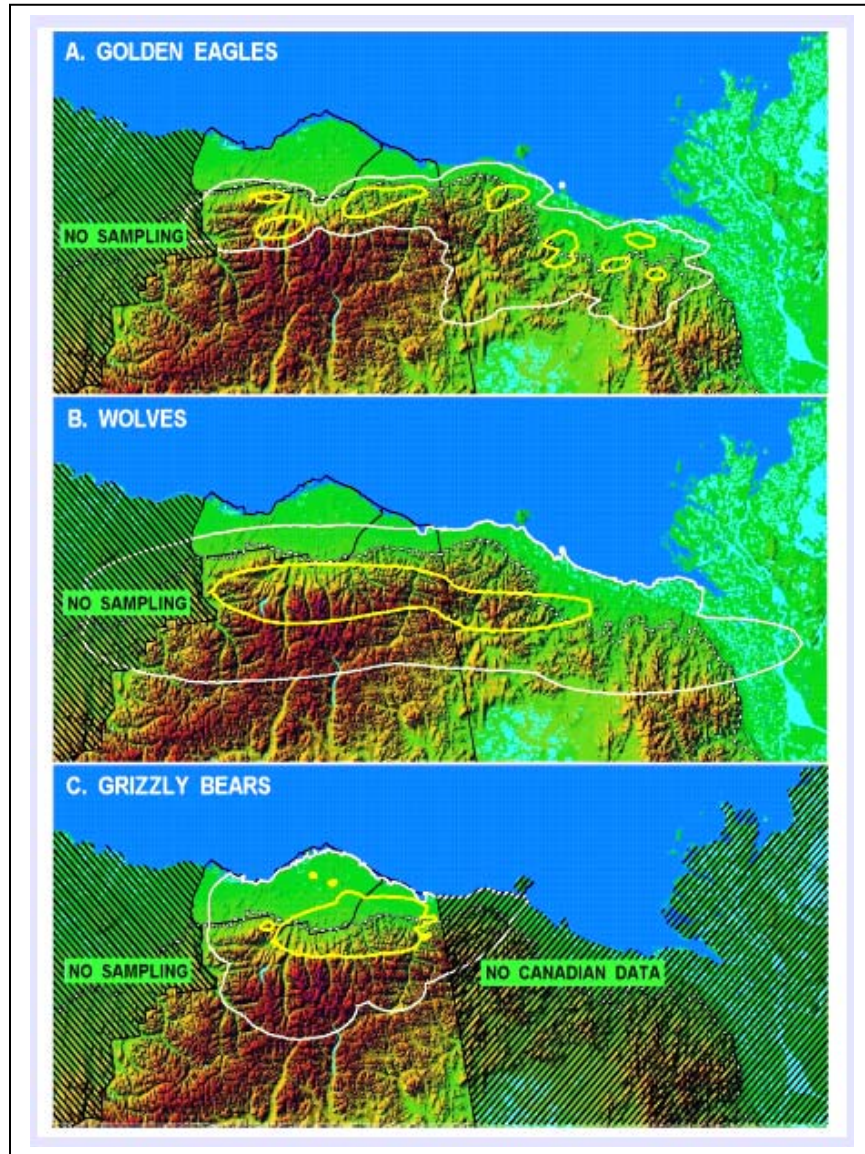


Figure 8: Distribution of predators of the Porcupine Caribou Herd: A) Golden Eagle nests; B) Wolf dens; C) Grizzly Bear radio locations. The yellow contours indicate higher than average densities of predators. The white line contains 99% of all the observations.

Even though the survival rate of calves for the first month of life is 75%, survival can vary from a low of 57% to a high of 94% (Figure 9). In recent years of very late spring snowmelt (2000 and 2001), calves were born during migration and only about 60% survived (Figure 9). Based on survey data, biologists have shown that the survival of calves is 8 to

11% greater if born in the 1002 area or on the coastal plain than if they are born elsewhere. A general rule is that the earlier the snowmelt on the Alaskan coastal plain, the greater the proportion of calves born in 1002. In years with particularly late snowmelt (1986-88, 2000-01, Figure 10) few calves were born in the 1002 area.

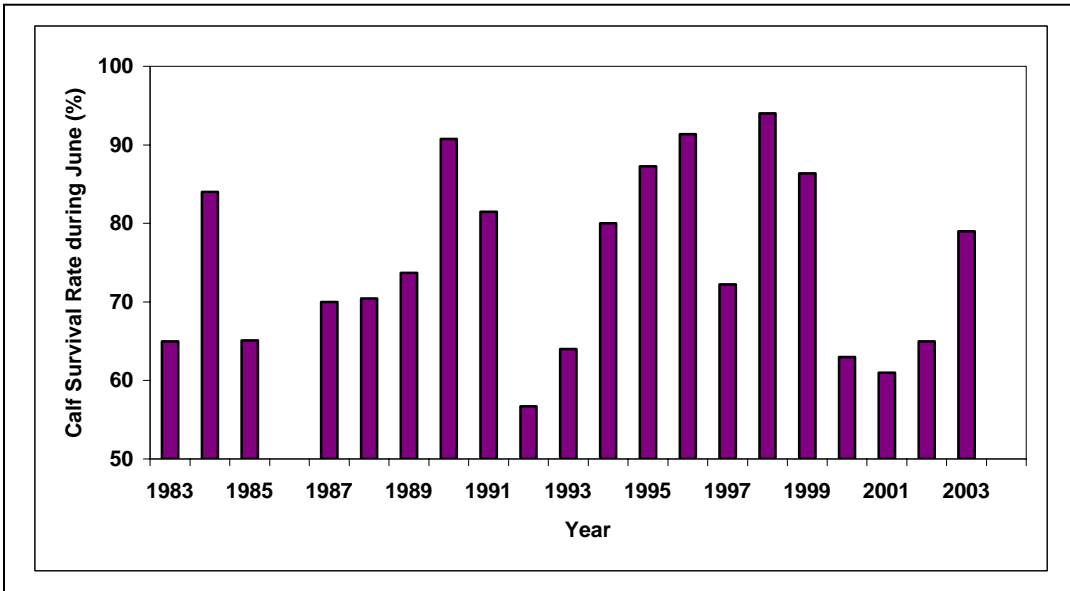


Figure 9: Calf survival rate during June (up to 1 month after birth) for the Porcupine Caribou Herd

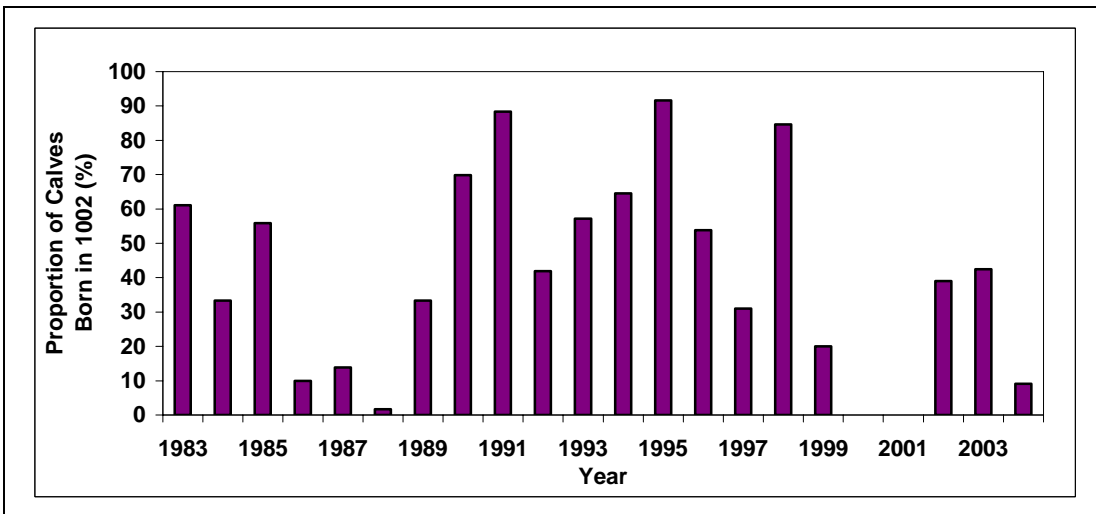


Figure 10: Proportion of calves from the Porcupine Caribou Herd born in the “1002” area of the Arctic National Wildlife Refuge

Role of Climate Change

We can now use satellites to monitor the timing and rate of new plant growth in the spring. Over the last 15 years, there has been a significant increase in the

amount of food available to nursing cows (Figure 11) when their energy demands are highest (during the 3 weeks after giving birth).

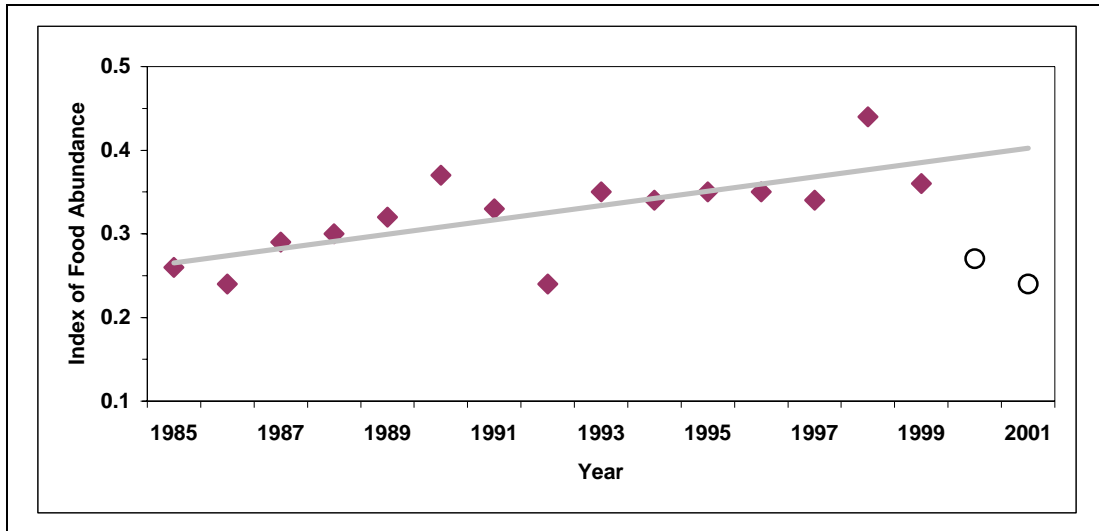


Figure 11: Index of food abundance for the extent of calving of the Porcupine Caribou Herd



Combining our information on plant growth and calf survival during June we have documented a strong relationship between food abundance and calf survival (Figure 12). The amount of green food available to cows accounts for 85% of the annual variation in calf mortality during the first month after birth

(Figure 12). We believe that this strong link between food for cows and calf survival is the reason that calving cows concentrate annually in the region of most rapid plant growth and why the “free location” of calving grounds for this herd is important to the continued productivity of the herd.

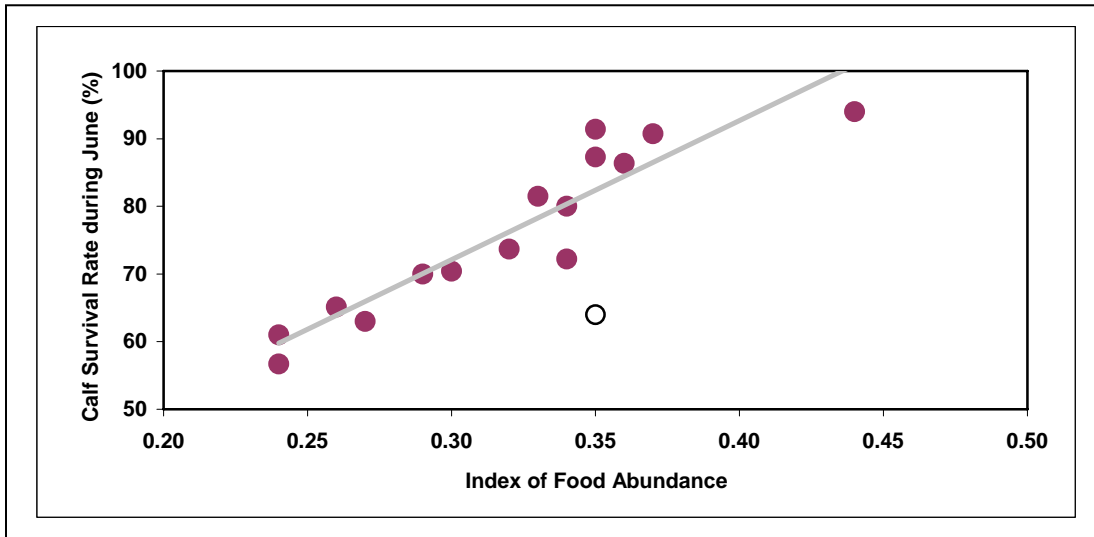
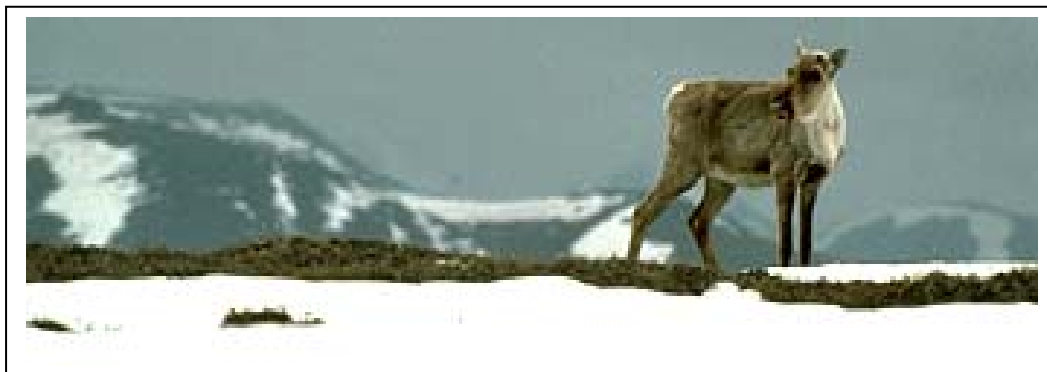


Figure 12: Relationship between early calf survival and food abundance in the extent of calving of the Porcupine Caribou Herd

One predicted characteristic of climate change is that extremes in weather will become more frequent. Within the range of the herd we have seen unprecedented late snowmelt during 2000 and 2001. This has resulted in

unusual calving distributions (Figure 13) and very high early calf mortality caused by cows continuing on with migration after giving birth and newborns struggling to keep up.



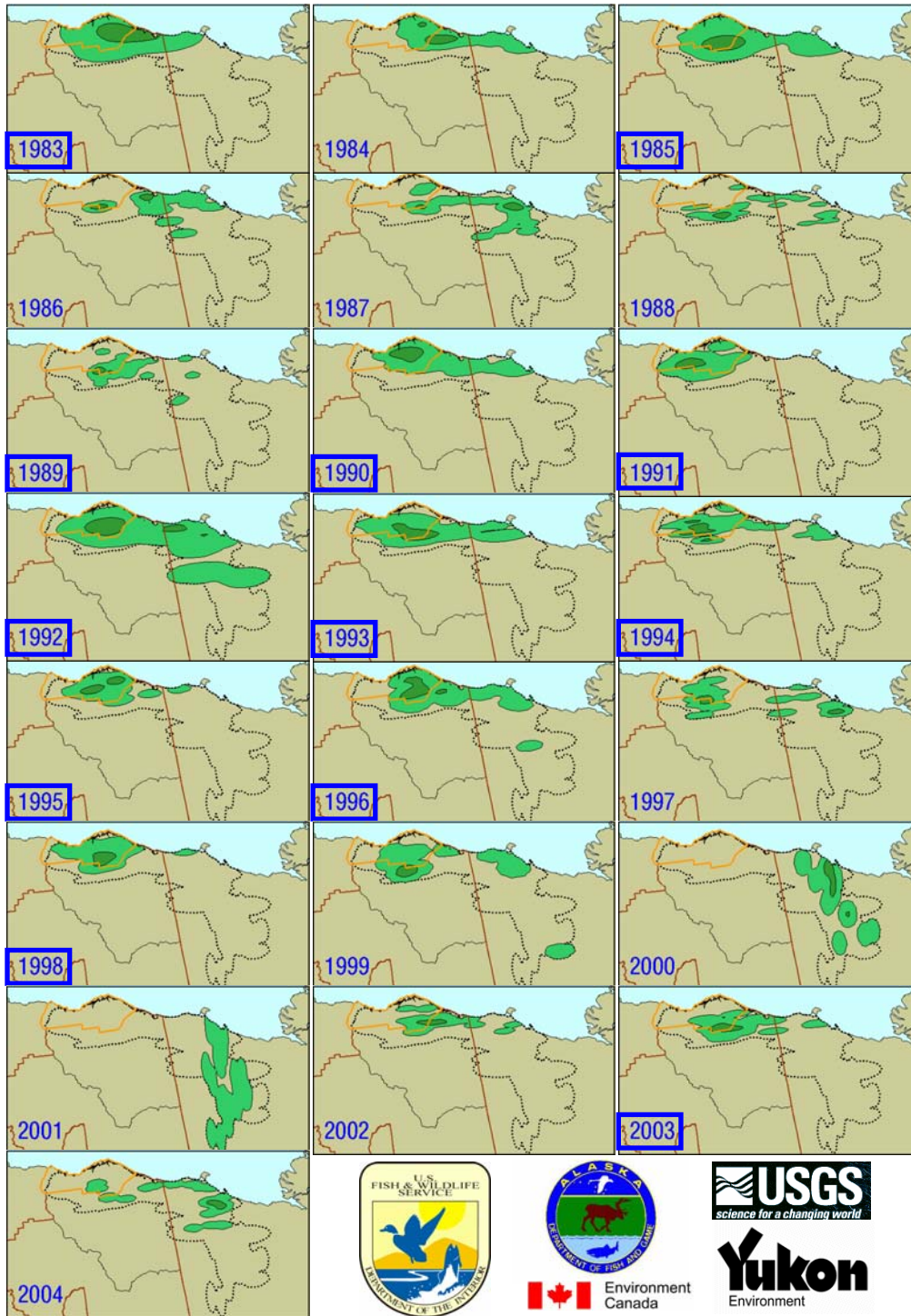


Figure 13: Porcupine Caribou Herd Calving Distributions, 1983-2004. Dark Green represents Concentrated Calving, Medium Green represents the Annual Calving Ground and the Dashed Line represents the Extent of Calving. Concentrated calving was primarily in the 1002 Area in 12 of 22 years (outlined with a blue box).

Role of Development

The largest oilfield in North America is located at Prudhoe Bay, west of the range of the Porcupine Caribou Herd. A large number of development-related studies have been conducted in relation to potential effects on the Central Arctic Herd. Even though the population continued to grow, two important effects have been documented.

- There has been measurable avoidance by cows and calves of the zone within 4 km of roads and pipelines.
- As development progressed west of Prudhoe Bay, the western portion of concentrated calving shifted to the south (Figure 14) to an area with reduced food for nursing cows when their needs were the greatest.

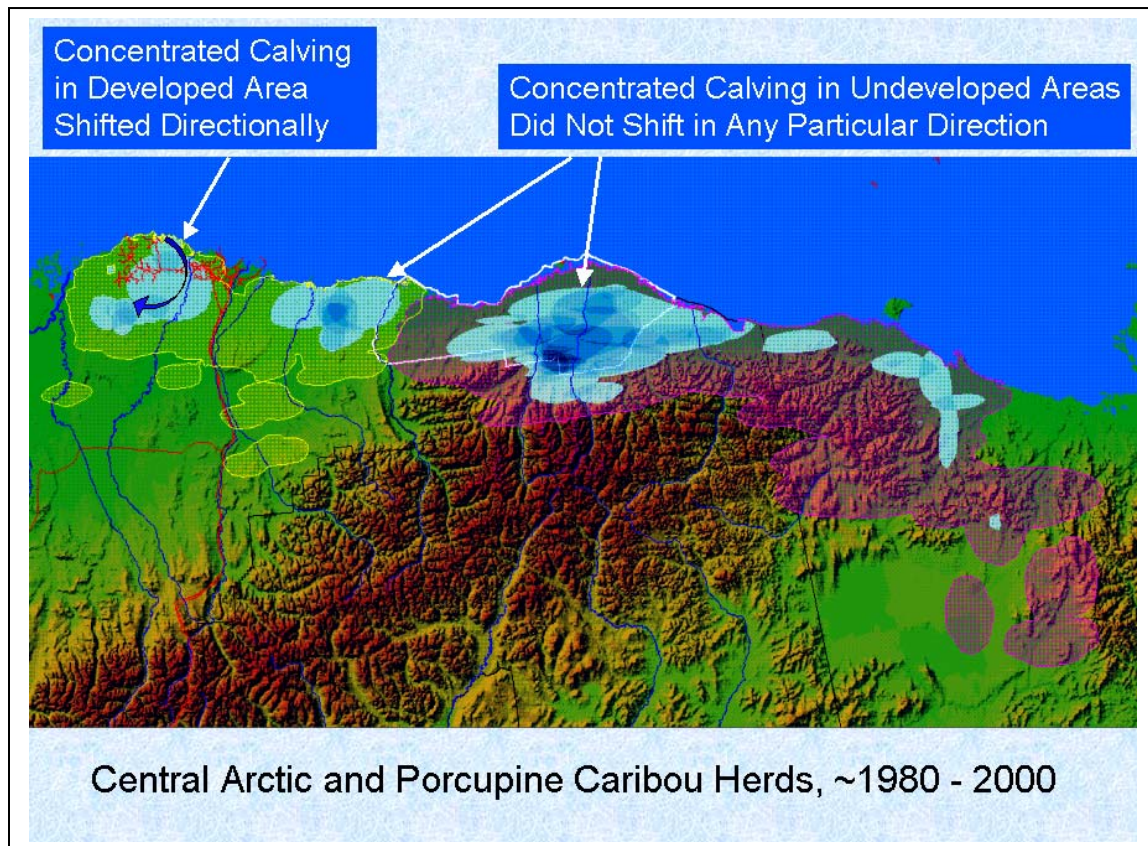


Figure 14: Comparison of the concentrated calving areas of the Central Arctic Herd and the Porcupine Caribou Herd. Caribou exposed to industrial development shifted away from the pipelines and roads.

Considering this information and using our ability to predict early calf survival from food for cows and predator density, we can estimate the effect of development on calf survival by shifting the calving distribution of the Porcupine Caribou Herd (Figure 15) away from

hypothetical developments and then recalculating calf survival. From this exercise, we estimate that displacing calving would result in a systematic decline in calf survival (Figure 16) due to increased risk of predation and a decline in accessible habitat quality.

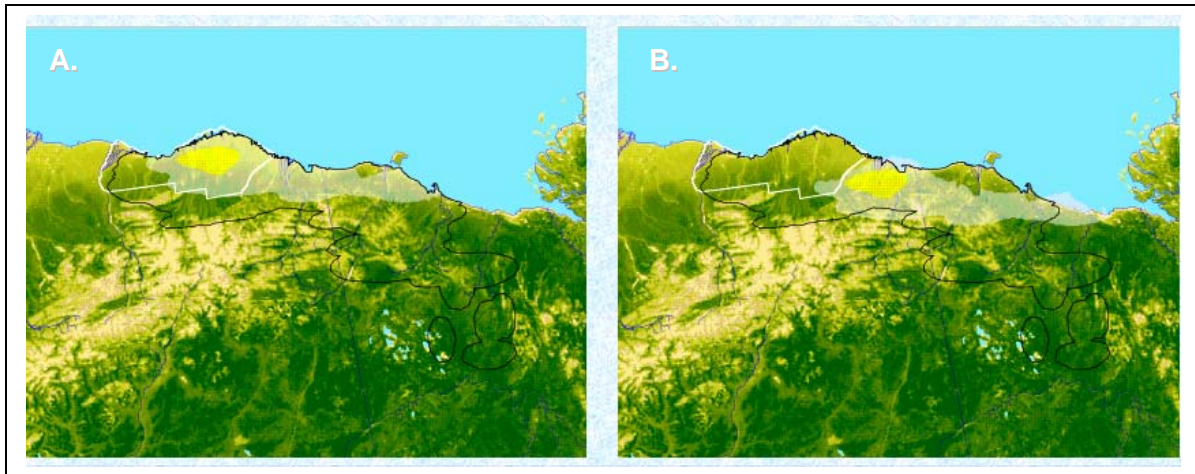


Figure 15: An example of A) Current calving distribution of the Porcupine Caribou Herd and B) Modeled displacement away from hypothetical development in the “1002” area of the Arctic National Wildlife Refuge

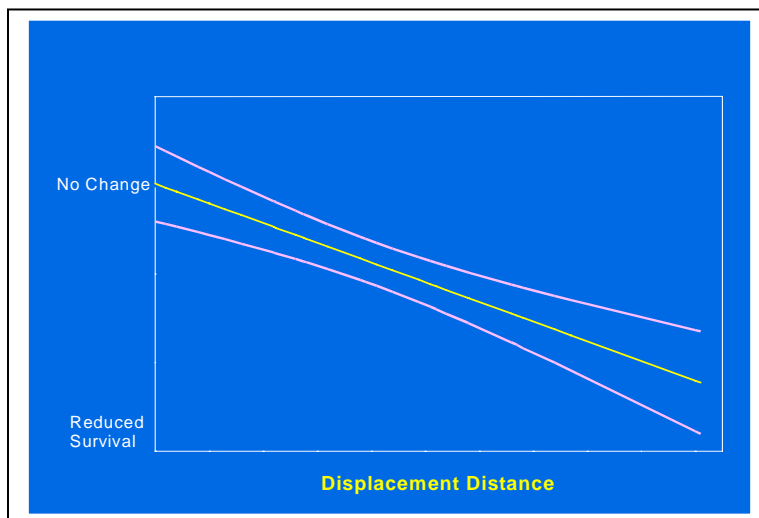


Figure 16: Modeled change in calf survival with displacement from the current calving area for the Porcupine Caribou Herd. Survival decreases as displacement increases.

Possible Impacts of “1002” Development

As researchers and managers, we can only use the best information available to predict the impacts of oil and gas development within the “1002” area on the Porcupine Caribou Herd. We have the luxury however of a tremendous amount of information on this herd, probably more than for any other wild caribou or reindeer herd in the world. We therefore use the following five research-based observations to argue that this herd would be particularly sensitive to development within the “1002” portion of the calving ground.

Low productivity of the Porcupine Caribou Herd - The Porcupine Caribou Herd has the lowest population growth among Alaskan arctic calving herds and is the only Alaskan arctic herd known to be in decline in the 1990's. This suggests that the Porcupine Caribou Herd is less able to withstand natural or man-made stresses to its ecosystem. For example even a 5% reduction in calf survival would be enough to halt the growth of the Porcupine Caribou Herd but would not be enough to halt growth of the other Alaskan arctic calving herds.

Demonstrated shift of the Central Arctic Herd concentrated calving away from development - Avoidance of disturbance by female caribou during the first few weeks of the life of calves is the most consistent behavioural response of caribou to development that has been observed. It is assumed that the Porcupine Caribou Herd calving will shift away from development in a similar manner as observed for the Central Arctic Herd if development of the 1002 area occurs.

Lack of high-quality alternate calving habitat - Calving areas in Canada and off the Alaskan coastal plain were used only when the Alaskan coastal plain and 1002 areas were unavailable due to late snow melt. Diet quality on Canadian portions of the calving ground was substantially lower than on the Alaskan coastal plain and 1002 portions of the calving ground. When cows were not able to access the Alaskan coastal plain and 1002 area for calving, calf mortality was up to 19% higher than when they calved on the Alaskan coastal plain and/or 1002 area.

Strong linkage between calf survival and free movement of cows - The location of the annual calving grounds and concentrated calving areas has varied among years in response to variable habitat conditions and often coincided with the 1002 area. The relationships between calf survival, food availability for nursing cows, and predation risk predict that June calf survival for the Porcupine Caribou Herd will decline if the calving grounds are displaced, and that the effect will increase with displacement distance. Higher calf mortality will occur because of poorer feeding and higher predation.

No evidence that Porcupine Caribou calves or cows can compensate later in the summer for poor late June physical condition - The condition of the cows and calves of the Porcupine Caribou Herd at the end of June predicts their condition during the autumn breeding season. If animals are in poor condition in fall, then pregnancy rate is reduced, age of first reproduction may be delayed, and winter mortality will increase.