

Section 6: Predators

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Calving caribou (*Rangifer tarandus*) of the Central Arctic herd, Alaska, have avoided the infrastructure associated with the complex of petroleum development areas from Prudhoe Bay to Kuparuk (Cameron et al. 1992, Nellemann and Cameron 1998, and Section 4 of this document). Calving females of the Porcupine caribou herd may similarly avoid any oil field roads and pipelines developed in areas traditionally used during the calving and post-calving periods. This may displace the caribou females and calves to areas east and south of the 1002 Area of the Arctic National Wildlife Refuge.

Increased calf mortality could occur if calving caribou are displaced into areas that have a higher density of predators, higher rates of predation, or where a higher proportion of the predators regularly use caribou as a food source (Whitten et al. 1992).

Our study assessed predation risks to caribou calving in the 1002 Area versus calving in potential displacement areas. Due to funding constraints, our research focused on grizzly bears (*Ursus arctos*), with wolves (*Canis lupus*) and golden eagles (*Aquila chrysaetos*) receiving only cursory attention. Our research objectives were 1) to compare relative abundance of predators within the 1002 Area with that in adjacent peripheral areas, 2) to determine factors affecting predator abundance on the calving grounds, and 3) to quantify the use of caribou as a food source for predators and the importance of caribou to the productivity of predator populations using the coastal plain of the Arctic National Wildlife Refuge.

To accurately describe the activities of predators relative to calving caribou, we divided the study area into 3 naturally occurring physiographic zones: coastal plain, which included virtually all of the 1002 Area (< 300 m elevation); foothills (301-900 m elevation); and mountains (> 900 m elevation).

Landscape use distributions were estimated with fixed-kernel analyses using Least Squares Cross Validation (Silverman 1986, Seaman et al. 1996, 1998, 1999).

Concentrated use areas were defined as the utilization contour that included sites with greater than average density (Seaman et al. 1998). In all cases, sampling was limited to the north slope of the Brooks Range.

Eagle distribution estimates were based on aerial survey locations of 202 nest structures that were no closer than 1 km from adjacent structures. Wolf distribution estimates were based on aerial survey locations of 22 dens in the Arctic Refuge and northwestern Yukon Territory, Canada. Additional wolf dens in the foothills and mountains to the east of the estimated wolf concentrated

use area probably existed, but were not documented in the analyzed data set.

Grizzly bear distributions were estimated annually, based on 23-60 annual locations of radio-collared bears during the first week of June, 1983-1994. No grizzly bears were radio-collared in Canada. Grizzly bear habitat use was investigated using Chi-square tests (Neu et al. 1974). Distance-based tests of independence (Diggle and Cox 1983) as well as analysis of variance procedures were used to compare grizzly bear and calving caribou distributions.

Predator Distributions

Predators (grizzly bears, wolves, and nesting golden eagles) in general were more abundant in the foothills and mountains than on the coastal plain (Fig. 6.1). The distribution of grizzly bear radio-locations relative to the coastal plain, foothill, and mountain zones was non-random ($P < 0.0001$, Chi-square).

In all years, the foothills received greater use by bears than expected, whereas the coastal plain received less use than expected ($P < 0.05$), except in 1990 when the coastal plain was used in proportion to its availability. We hypothesize that bears were more abundant in the foothills because the rolling hills provided greater diversity in topography, vegetation, and phenology than the flatter coastal plain. Other studies have reported lower grizzly bear densities on the arctic coastal plain than in the foothills of the Brooks Range (Miller et al. 1997, Reynolds 1979).

Radio-collared wolves were more likely to be found in the foothills (55%) and mountains (36%) than on the coastal plain (9%). All active wolf dens ($n = 11$) were located in the mountains, with the exception of one den located in the foothills. Since 1982, there have been no reported cases of wolf dens on the coastal plain of the Arctic Refuge.

All 170 golden eagle nest structures, including 22 active nest sites, that were located within 30 km of the 1002 Area were found in the foothills and mountains (Young et al. 1995). Subadult golden eagles, however, were abundant on the Arctic Refuge coastal plain and foothills where their distributions coincided with those of calving caribou.

Factors Associated with Predator Distributions

Grizzly bear distributions during the caribou calving period in early June appeared to be influenced by a combination of factors including seasonal habitat selection patterns, annual variations in snowmelt, and annual distribution patterns of calving caribou.

Within-year (1983-1993) spatial distribution patterns of radio-collared grizzly bears did not differ among time

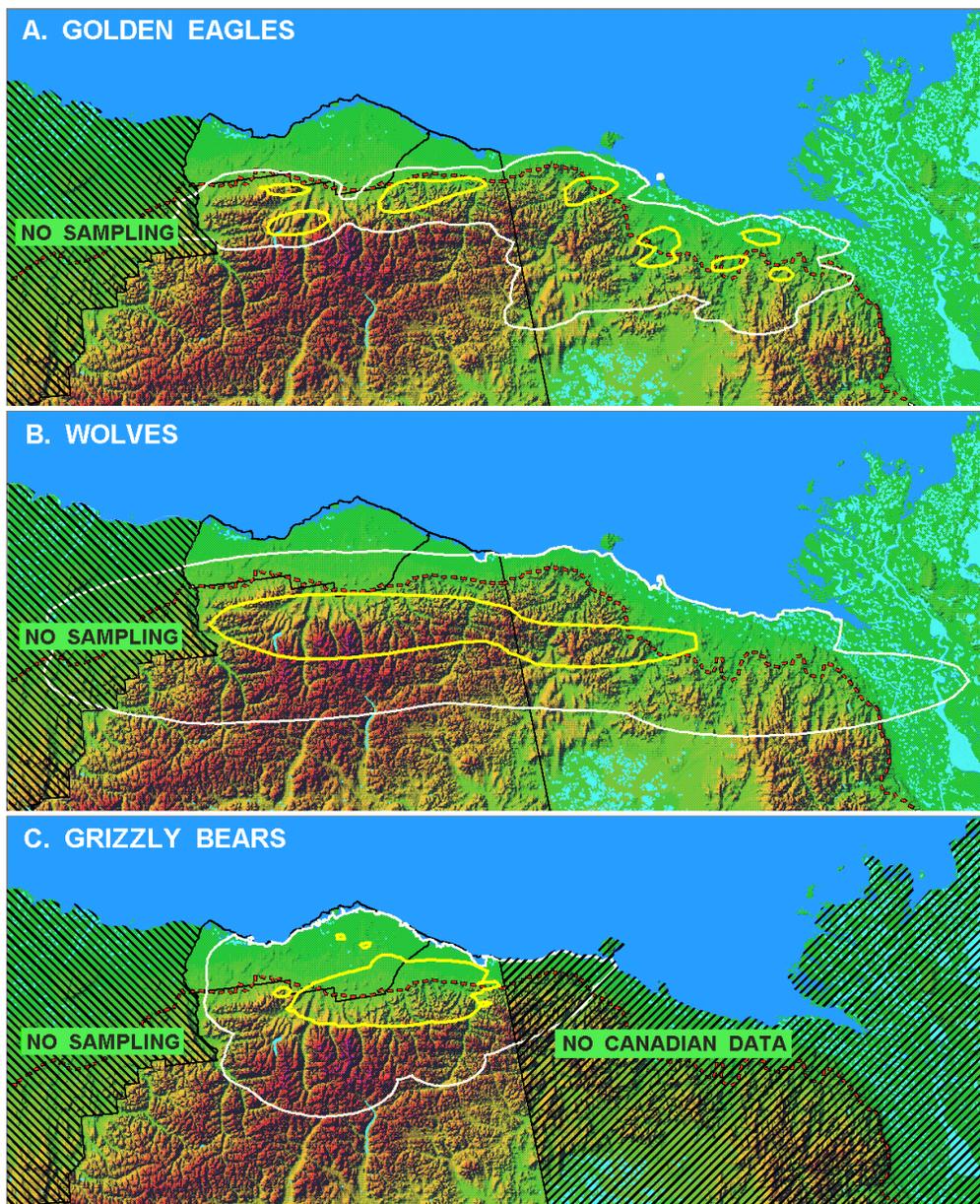


Figure 6.1. Distribution of a) golden eagle (*Aquila chrysaetos*) nest structures, b) wolf (*Canis lupus*) dens, and c) grizzly bears (*Ursus arctos*) near the calving grounds of the Porcupine caribou herd. Solid yellow lines enclose concentrated use areas (CUA, sites with greater than average observation density), solid white lines delineate 99% use distributions (UD), and the dashed red line delineates the approximate 300-m-elevation boundary between the coastal plain and foothill/mountain physiographic zones. The outer perimeters of all annual grizzly bear fixed kernel estimates of CUA and 99% UD are depicted.

periods, whereas concurrent distributions of calving caribou did differ. This suggests that annual grizzly bear distributions were influenced less by the distribution of calving caribou than by other factors (e.g., annual snowmelt patterns). Among-year differences ($P < 0.05$) in grizzly bear spatial distribution patterns suggest that annual variations in snowmelt contribute to annual bear distribution patterns.

Radio-collared grizzly bears were relocated more frequently on the coastal plain in years when snowmelt occurred early (38.9%) or normally (23.8%), as in 1990

and 1989, respectively, than in years when snowmelt occurred late (12.7%), as in 1988. Distributions of radio-collared bears and caribou cows with calves tended to be positively associated in 1988 and 1989 (i.e., years of late and normal snowmelt, respectively, when calving occurred primarily in the foothills), and negatively associated in 1990 (i.e., a year of early snowmelt when calving occurred primarily on the coastal plain) (Young et al. 1994).

Analyses of concurrent grizzly bear and calving caribou distributions in 1983-1993 indicated that bears

selected high or medium caribou density zones in 5 of 9 (56%) years, but avoided the highest density of caribou in 2 (22%) years. Two years were not comparable.

During the caribou calving period, radio-collared wolves were located primarily in the mountains and foothills where their activity was associated with den sites. All known wolf den sites on the North Slope of the Arctic Refuge have been located in the mountains and foothills. Thus, the availability of suitable den sites appears to be the primary factor influencing wolf distributions during the calving period.

Factors affecting the distribution of nesting golden eagles differed from those of subadult birds. Nesting or adult birds sought suitable nesting habitat on cliffs found primarily in the foothills and mountains in proximity to colonies of Arctic ground squirrels (*Spermophilus parryi*), their primary prey (Young et al. 1995). Subadult birds appeared to be associated primarily with distributions of calving caribou.

Rates of predation

Use of caribou as a food source varied among and within predator species. Of 26 grizzly bear observation surveys that were successfully completed (>1 hr), 8 (31%) included a kill of a caribou calf (Young and McCabe 1997). Kill rates of caribou calves ranged from 1.0 to 6.3 kills/bear unit/day; a *bear unit* being a solitary individual, a family group, or a male with 1 or more consorts.

Trends in the data suggested that bears were more likely to encounter and kill caribou calves as calving density decreased. This suggests that predator swamping may be an effective anti-predator strategy by calving females of the Porcupine caribou herd with respect to predation by grizzly bears.

Radio-collared wolves were relocated in the vicinity of caribou 34% of the time and on caribou carcasses 9% of the time. Productivity was similar ($P > 0.05$) between 3 wolf packs with access (4.3 pups/litter) and 1 pack without access (4.2 pups/litter) to the traditional caribou calving grounds. Because there are few wolves (20-40) and their distributions are usually separated from those of calving caribou, wolves kill relatively few caribou during the calving period.

Based on prey remains collected at nest sites, 1988-1990, we observed little evidence of use of caribou by nesting golden eagles. Ground squirrels were their predominant prey (Young et al. 1995). Subadult birds, however, are important predators of calving caribou (Whitten et al. 1992; *see also section 3 of this report*).

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