Grizzly Bear Population Ecology and Monitoring in Denali National Park and Preserve

This article was prepared by Patricia Owen, Wildlife Biologist, Denali National Park and Preserve.

Grizzly bears are an important component of Denali National Park and Preserve. The legislation that created the park (formerly Mt. McKinley National Park) established a game refuge for the animals, so grizzly bears have not been hunted there since 1917. The park now supports a naturally regulated grizzly bear population as an active component of a large-mammal predator–prey system that includes wolves, caribou, moose, and Dall's sheep.

Grizzly bears are also a primary reason that many people visit Denali. A recent survey estimated that 90% of visitors travelling the park road observed at least one grizzly bear on their trip. Numerous studies have described the adverse effects of humans and associated development on grizzly bears. Harvest of grizzly bears outside the park and concerns regarding the impacts of human access within the park resulted in the need for objective information on the status and trends of the grizzly bear population in Denali.

This study was initiated in 1991 to examine the role of grizzly bears as predators of caribou calves. The emphasis of the project was redirected early on to describe the characteristics of a sample population of grizzly bears in Denali National Park and to develop and test noninvasive techniques for determining the density of bears in the park. The focus has since shifted to long-term monitoring of cub production and survival.

A National Park Service biologist collecting data from an immobilized bear.

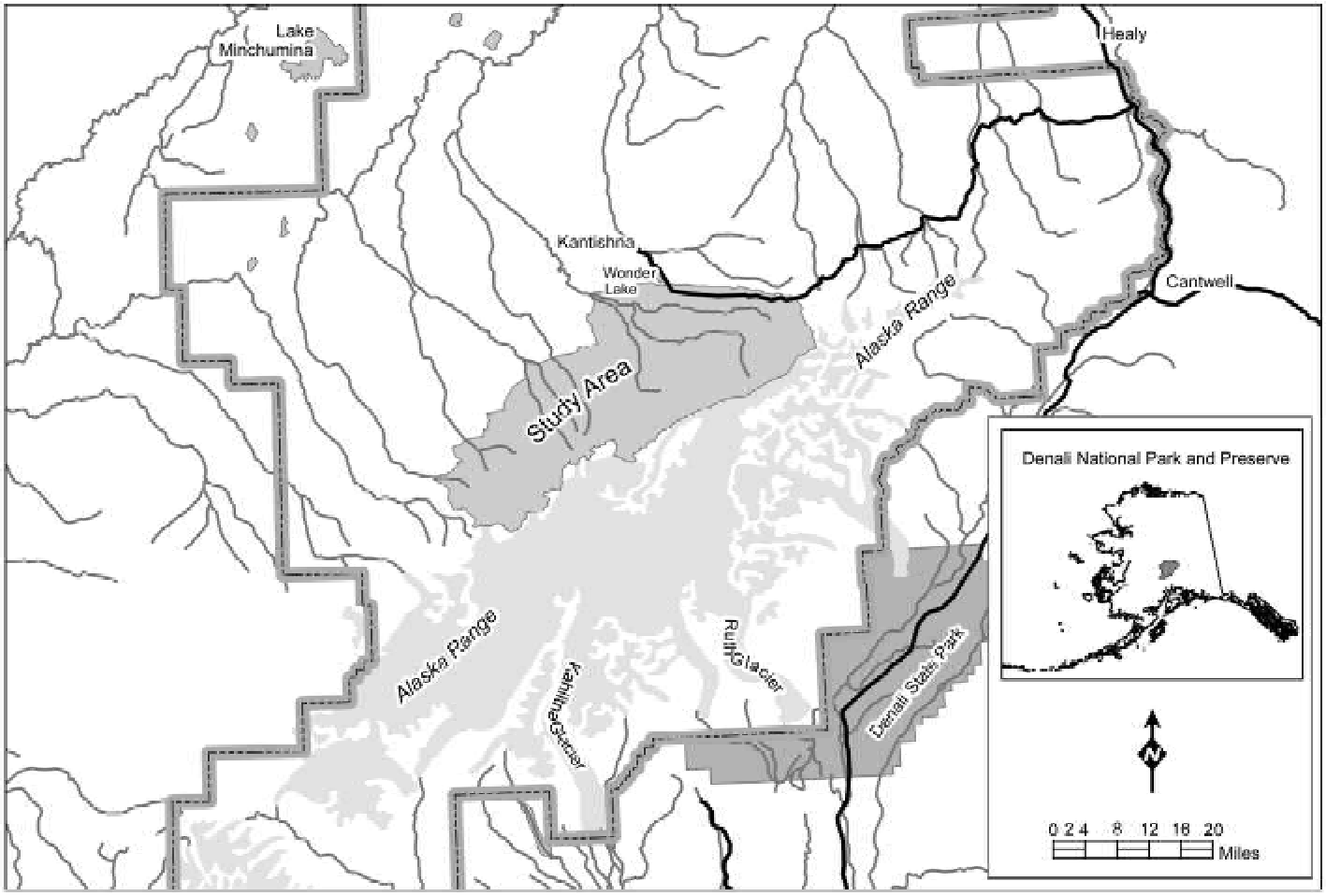
Study Area

Our study area lies along the north slope of the central Alaska Range in Denali National Park and Preserve, from the east side of the Muldrow Glacier west to the Herron River. The 1750-square-kilometer (675-square-mile) study area includes elevations ranging from 600 to 2000 meters (2000 to 6500 feet). The area includes important foraging habitats, such as large, concentrated berry patches on glacial moraines and hillsides, as well as winter denning habitat. It also includes the principal calving area for the Denali caribou herd. The climate is generally cool and wet during the summer, with temperatures around 10–15°C (50–60°F). Freezing temperatures and snow may occur during any month. Snow accumulation usually begins in October and dissipates from lowlands and unshaded portions of foothills by mid- to late May.

Methods

The study relies heavily on radiotelemetry to acquire information about individual bears and therefore requires catching animals to attach radio collars. Bears in the study area are located for capture using a small fixed-wing aircraft. Once located, bears are darted from a helicopter using an immobilizing drug delivered in a projectile syringe fired from a syringe rifle. Darted bears are monitored from the aircraft until they are immobilized, at which time the helicopter crew lands to process the bear.

Standard morphological measurements, such as head and neck circumference and body length as

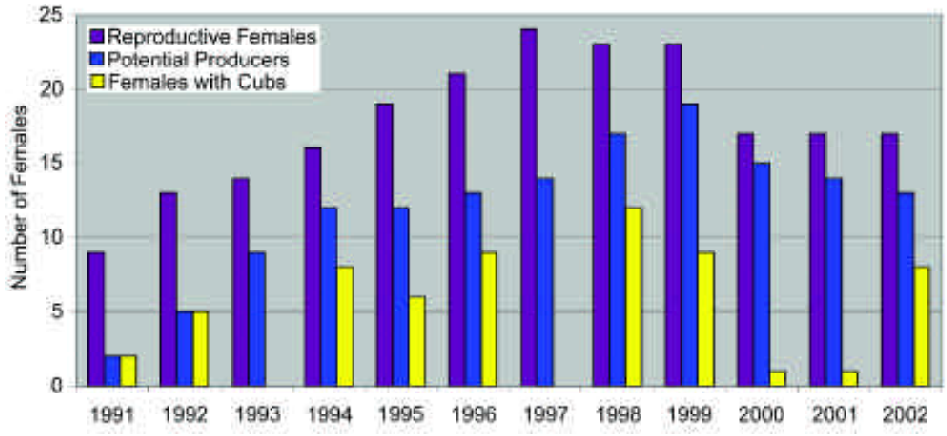


well as weight, are taken to monitor growth and physical condition. Bioelectrical impedance analysis (BIA) is used to determine percent body fat. BIA is the same method used to determine body fat in humans. It is a measure of the body's resistance to the flow of a very weak electrical current. The resistance measurement is entered into a formula specific to grizzly bears to calculate percent body fat. A small vestigial tooth is extracted from independent bears during their initial capture to determine age. Teeth are sent to a laboratory, where they are sliced into thin sections and stained. The rings of cementum on the tooth can then be counted under a microscope, much like the rings on a tree, to determine age. Blood samples are collected to assess disease exposure.

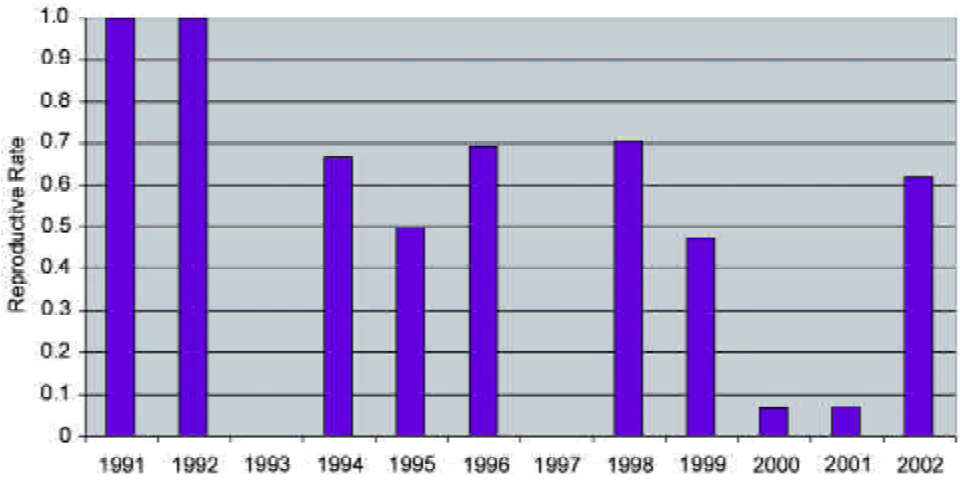
Since much of the study area is not easily accessible from the Denali Park road, bears are subsequently located using a fixed-wing aircraft. The first radiotelemetry flights of the season begin in mid-April each year, continue through the summer, and end in late October once all the bears are determined to be denning. Early-season flights allow us to determine when bears emerge from their dens in the spring so that we can get accurate counts of the number of cubs that each female bear has produced. Flights throughout the summer months enable us to gather information on habitat use and cub mortality as well as mortality of independent bears and family breakup. In the fall we determine den locations and den entrance dates and confirm the remaining numbers of cubs.

Results

Since the study is now focused on cub production and survival, collars have been maintained only on female bears. Each year we examine the previous year's data to determine the number of reproductive females (those six years old or older) and the number of "potential producers" (those reproductive females that were available to breed the previous year). Females are considered available to breed the previous year if they did not produce cubs that year or had cubs but lost them



Female history, 1991–2002.



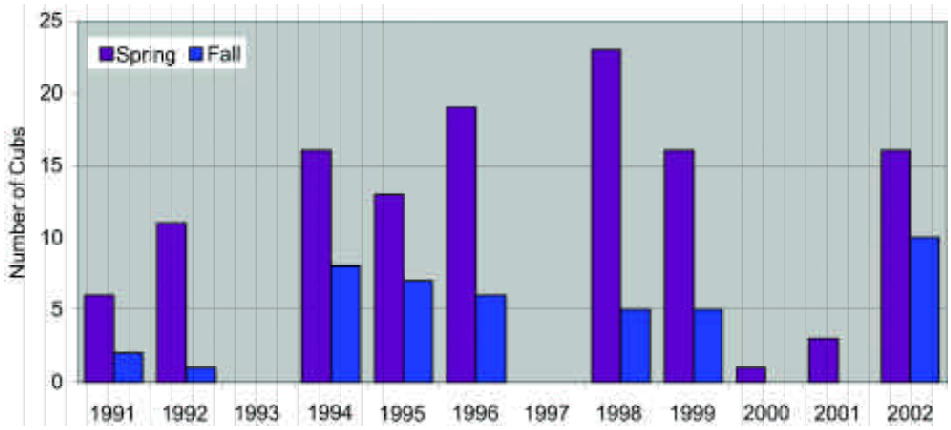
Reproductive rates, 1991–2002.

early enough to breed again. Starting at den emergence, we locate the "potential producers" to determine the number with cubs and the number of cubs produced. The number of females with cubs has varied widely over the years.

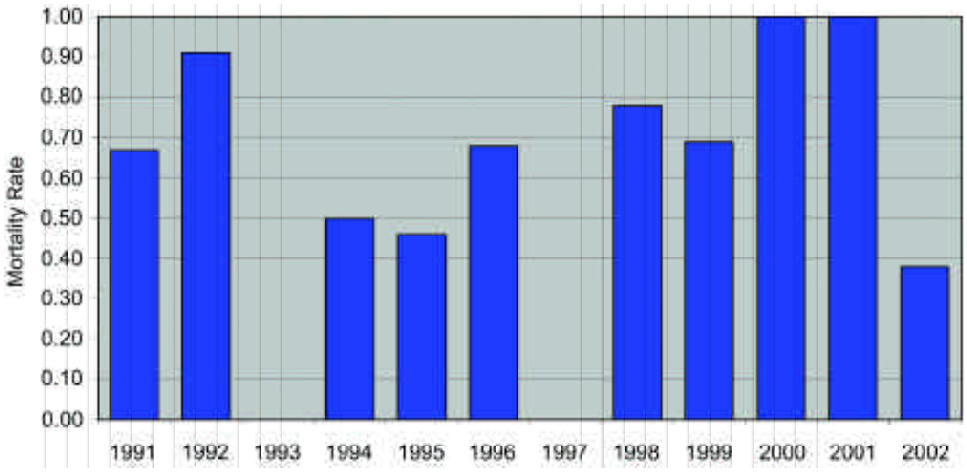
Though the number of collared female bears in the study has varied, we are able to compare years by calculating reproductive rates. Reproductive rates compare the number of females with cubs to the number of potential producers. Reproductive rates of zero in 1993 and 1997 and rates of less than 0.10 in 2000 and 2001 are yet to be fully explained. The lack of productivity in 1993 may be explained by unusual weather patterns that occurred the previous year, when the area received heavy snowfalls in both mid-May and mid-September, resulting in an abbreviated summer season. Female bears may not have had the opportunity to accumulate sufficient fat reserves to maintain themselves and cubs while denning during the winter of 1992-93. Unfortunately, no obvious weather patterns could be identified to explain zero to low productivity in 1997, 2000, or 2001.

Accurate counts of the number of cubs produced each year and the number of cubs still alive at the time of den entrance have allowed us to track cub mortality. Cub mortality was unusually high early in the study. Mortality rates calculated for each year of the study vary from 46 to 100%, with an average mortality rate over the course of the study of about 71%.

We attempted to determine the cause of death in cubs by attaching small radio collars to six cubs in 1994. The collar was designed to enlarge as the cub grew and to fall off before denning. At the time the collars fell off, all six cubs were still alive. Because a small unmarked bear carcass is difficult to locate, we have only been able to determine the cause of death in one cub in the 12 years of the



Numbers of cubs, spring and fall, 1991–2002.



Mortality of cubs of the year, 1991–2002.

study. A necropsy of the carcass revealed that it was killed in a rock slide.

Discussion

Though this study has been in progress for some time, many questions remain about grizzly bears in Denali. From early survey work we have determined that the density of grizzly bears in the study area is about 27 independent bears per 1000 square kilometers (386 square miles). It is difficult, however, to extrapolate this number into an estimate of grizzly bear density for the entire Denali National Park since much of the remainder of the park contains habitat that may or may not support grizzly bears.

We have learned that grizzly bear cub mortality is high and that productivity varies widely, but the underlying reasons for these facts are still largely unknown. Investigations into the role of female physical condition in relation to cub production and survival will continue. The availability of abundant berry crops in the late summer and fall is likely key to the accumulation of adequate fat reserves in bears. Surveys to quantify berry crops in the study area and measure fall body fat are needed to test the relationship between female body condition and cub production and survival. Disease is probably not a significant factor affecting grizzly bear cub survival. Blood samples showed low prevalence when tested for wildlife diseases including infectious canine hepatitis, canine distemper, and leptospirosis.

Even with high cub mortality and variable productivity, the high density, high independent bear survival rates, and lack of human interference suggest that the Denali grizzly bear population is likely stable. Cub production and survival has likely not been monitored long enough to include a pulse in recruitment.