Ecology of Brown Bears on Admiralty Island, Alaska: An Overview of Ongoing Research

by

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Abstract

Today, the largest number of brown/grizzly bears in North America occurs in Alaska. In southeastern Alaska, resource development and outdoor recreation are increasing. This paper summarizes an ongoing ecological study, begun in 1981, of brown bears on Admiralty Island. Since that time, 70 bears have been radio-collared and relocated approximately 3,000 times. A major objective of this study was to monitor the effects on brown bears of developing the Greens Creek Mine. The density of brown bears in the study area before mine development was estimated to be 1 bear/2.6 km². Home range characteristics, habitat use, and reproductive data are presented and discussed relative to mine development.

KEY WORDS: Brown/grizzly bears, home range, habitat use, reproduction, mining development, southeastern Alaska.

Once widely distributed across western North America, brown/grizzly bears (*Ursus arctos*) currently range over a significantly reduced portion of the continent and were declared threatened in the United States south of Canada in 1975 (LeFranc et al. 1987). Today, the largest population of brown bears occurs in Alaska (Peek et al. 1987). In southeastern Alaska, logging, mining, and outdoor recreational activities are continually expanding throughout the range of the brown bear. This paper briefly summarizes an ongoing study, begun in 1981, to provide baseline ecological data on brown bears in southeastern Alaska including their seasonal distribution and habitat preference, home range characteristics, reproductive rates and intervals, and den site selection. Additionally, this project was designed to monitor brown bear habitat use before and after mine development near Greens Creek on Admiralty Island.

Study Area and Methodology

Study sites were selected on Admiralty (4,426 km²) and Chichagof (5,341 km²) Islands located within the Tongass National Forest in the northern portion of southeastern Alaska's Alexander Archipelago. Our intensive study site (344 km²) was located on the northern portion of Admiralty Island surrounding Hawk Inlet and included the Greens Creek Mine. This research began in 1981 during the early phase of mine exploration. Major mine development activities began in fall 1985.

Admiralty Island, long considered unique because of its high-density brown bear population, was classified in 1986 by the United Nations' Educational, Scientific and Cultural Organization (UNESCO) as part of the Glacier Bay-Admiralty Island Biosphere Reserve. The lowlands of Admiralty Island are dominated by a dense old-growth rain forest of Sitka spruce (*Picea sitchensis*) and western hemlock (*Tsuga heterophylla*). Broken rock, alpine tundra, and subalpine forests occur above 600 m. Interspersed throughout the forest are poorly-drained muskeg bogs, avalanche slopes vegetated by deciduous shrubs, and numerous rivers and streams which, bordered by riparian spruce communities, provide spawning habitat for several species of anadromous salmon. Extensive wetlands dominated by *Carex* sedge communities occur at the mouths of many streams.

As a consequence of the infrequent opportunities for observing bears inhabiting a dense rain forest, radiotelemetry was chosen as the primary technique for monitoring individual bears. Bears were captured in the alpine zone by darting

with immobilizing drugs fired from a helicopter or were captured in leg-hold snares along fish streams and then immobilized (Schoen 1982). Radio-collared bears were monitored by radio tracking from a fixed-wing aircraft, their locations were plotted on topographic maps, and the habitat attributes (e.g., elevation, slope, aspect, habitat type, distance to fish streams, cover, and human activities) were recorded (Schoen 1982).

Home ranges were determined by connecting the extreme points of the set of relocations to form convex polygons (Mohr 1947). Areas of home ranges were calculated using a polar planimeter. Mark/recapture surveys (using radiocollars as marks) were conducted in alpine habitat during early summer to estimate bear densities in our study area (Schoen and Beier 1988).

Results and Discussion

From 1981 through 1987, 70 brown bears have been radio-collared on Admiralty Island and approximately 3,000 relocations collected. Currently, we are monitoring over 15 bears in the vicinity of the Greens Creek Mine on northern Admiralty Island. Using a mark/recapture survey of radio-collared bears conducted during 1986 and 1987, the density within the northern Admiralty study area was estimated to be approximately 1 bear/2.6 km^2 (1 mi^2). This density is slightly higher than brown bear densities on Kodiak Island (R. Smith, pers. comm.) and considerably higher than densities of brown bears in interior and northern Alaska (Miller et al. 1987, Ballard et al. 1988, Reynolds and Hechtel 1988). This predevelopment density estimate will provide an opportunity to assess long-term effects of the Greens Creek Mine on bear populations.

Significant home range overlap occurred among individual radio-collared bears within the study area. Mean annual home range area for males was 104 km^2 ($\underline{n}$ = 26, SE = 15.4). Mean annual home range area for females was 33 km^2 ($\underline{n}$ = 59, SE = 5.5). Individual bears monitored over multiple years displayed strong fidelity to their home ranges. Admiralty Island home ranges were comparable in size with home ranges of brown bears on Kodiak Island (Smith and Van Daele 1984) but much smaller than home ranges of brown bears in northern Alaska (Miller 1984, Reynolds and Hechtel 1986).

Percentage annual use of habitat types by radio-collared bears was as follows: upland and beach fringe old-growth forest (33%), riparian old-growth forest (23%), alpine/subalpine (21%), avalanche slopes (14%), wetlands (5%), and other (4%). Habitat use varied seasonally. During early summer (mid-June through mid-July), most bears moved up to subalpine meadows where they foraged on newly emergent vegetation. From mid-July through early September, most bears moved to low-elevation coastal salmon streams. Riparian habitat, which makes up less than 1% of the study site, received 39% of bear habitat use during this period and is considered critical habitat. By mid-September, many bears began moving toward upper-elevation avalanche slopes and subalpine meadows where they fed extensively on late berry crops.

Although most bears were associated with fish streams during late summer, some bears (primarily females) remained in interior regions of the study area (Schoen et al. 1986). For example, two radio-collared females, monitored for seven years, have never moved to the coast to feed on fish.

Mean dates of den entry and emergence on Admiralty Island were 30 October and 2 May, respectively (Schoen et al. 1987b). Males denned later and emerged earlier than females. Mean elevation and slope of Admiralty Island den sites were 713 m ($\underline{n}$ = 86, SE = 23) and 36 degrees ($\underline{n}$ = 86, SE = 1.2), respectively. Fifty-six percent of Admiralty Island dens occurred in forested habitat. Though cave denning was common on Admiralty, many dens were excavated under large-diameter old-growth trees or into the bases of snags. Further details of brown bear denning ecology are provided in Schoen et al. (1987b).

Data collected from 38 marked females over a 6-year period indicated considerable variability in litter size, age at first reproduction, and breeding interval (Schoen and Beier 1988). Age at first reproduction ranged from 7 to 10 years with a mean of 8 years ($\underline{n}$ = 7, SE = 0.6). Mean litter size for cubs of the year was 1.8 ($\underline{n}$ = 30, SE = 0.1). Cub mortality in the first year of life was 40%. Adult (presumably male) predation on cubs is a probable contributor to high cub mortality.

Major road building activities associated with the Greens Creek Mine began in the lower Greens Creek drainage during late fall 1985 after bears had left fish streams. Road building, including blasting and operation of heavy equipment, continued through 1986 and 1987. During those years, we monitored the movements of up to 12 radio-collared bears along lower Greens Creek from July through mid-September when salmon were spawning. With the exception of two males which increased their use of alternate streams outside the zone of major development, all other bears remained associated with Greens Creek, some within several hundred meters of active development. Intensive telemetry surveys conducted three times per day indicated, however, that bears shifted away from the immediate vicinity of construction activity, then moved closer to the road when activity ceased during late evening. I assume the availability of abundant, high-quality food (e.g., spawning salmon) was a prime factor attracting bears to this area during road building. The dense rain forest apparently provided sufficient cover for most bears to remain in the area during construction activity. However, displacement of bears from Zinc Creek (a small stream

immediately adjacent to the road) did occur. One bear, an adult female displaced from Zinc Creek, moved several hundred meters to Greens Creek where she displaced other (presumably subordinate) bears.

Though 40 to 60 workers were involved in construction of the road, few of these people observed bears in the field (presumably because bears used dense cover to avoid humans), and no bear-human encounters were documented (Schoen and Beier 1988). The lack of bear encounters, and consequently "bear problems," is attributed to several enforced camp policies. Most important was the burning of all garbage several times daily in a fuel-fired incinerator. Additionally, workers were prohibited from: (1) discarding trash or food in the field, (2) recreational hiking, (3) carrying firearms, and (4) hunting or trapping while working on site. Roads at Greens Creek were also closed to public access. Though the final results of this long-term study are still incomplete, these policies, particularly the incineration of garbage and the road closure, significantly reduced the opportunity for bear-human contact and habituation of bears to people.

Use of open-pit garbage dumps by logging camps and small communities, as well as increasing road development, are major concerns of resource managers in southeastern Alaska. For example, because of high bear mortality as a result of increased road access and the inadequate garbage policies of several small communities and logging camps, the brown bear season was closed by emergency order on northeastern Chichagof Island by the Department of Fish and Game in October 1988.

Summary and Conclusions

Admiralty Island, with its diverse and productive habitat base, has one of the highest brown bear densities in the world. Though habitat use by bears varies seasonally, important habitats are riparian old-growth spruce stands associated with anadromous salmon streams, alpine/subalpine meadows, avalanche slopes, and wetland sedge meadows. As a result of abundant and densely packed food resources, home ranges are small with extensive overlap among individuals. Relatively low reproductive rates and high cub mortality occur on Admiralty Island, perhaps as a result of intraspecific interactions, particularly infanticide.

Managing productive brown bear populations in the face of increasing pressures on a finite resource base will not be easy, even in Alaska. As land-use activities intensify throughout the range of brown bears, we must define more clearly the nutritional carrying capacity of bear habitats and understand how zones of human influence affect bear mortality. To maximize the limited resources of bear researchers and managers, better interagency and interdisciplinary cooperation will be necessary. Long-term studies of unexploited populations in undeveloped habitat would provide valuable "benchmark data" for comparative analysis. In southeastern Alaska, the Glacier Bay-Admiralty Island Biosphere Reserve offers an excellent opportunity for collecting long-term benchmark data from two contrasting ecosystems in close geographic proximity. In the final analysis, the long-term future of the brown/grizzly bear will likely depend more on creative people management than on wildlife management per se (Schoen et al. 1987a).

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