

DIFFERENTIAL DISTRIBUTION OF BROWN BEARS ON ADMIRALTY ISLAND, SOUTHEAST ALASKA: A PRELIMINARY ASSESSMENT

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Abstract: Twenty brown bears (*Ursus arctos*) radio-tracked on Admiralty Island in southeast Alaska for 2–13 months were not uniformly distributed during summer in lower-elevation tidal and riparian habitats. These findings differ from the assumption of uniform summer distribution. Our data suggest that a segment of the population remains in upper-elevation interior regions and does not use anadromous salmon (*Onchorynchus* spp.) streams during the summer.

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Brown bears are indigenous to southeast Alaska, where they occur on the islands north of Fredrick Sound and the mainland. As human activity and resource development increase in southeast Alaska, brown bear management concerns include magnitude and composition of harvest, habitat alteration from timber and mineral extraction, and increasing human access associated with resource development and recreation (Johnson 1980). Past research has been directed at basic life history, including litter size, spring and summer distribution, and movements (D. R. Klein, unpubl. rep., Alaska Dep. Fish and Game Fed. Aid Proj. W-3-13, 1958; M. Perenovich, unpubl. rep., U.S. Dep. of Agric., For. Serv. 1966; R. E. Wood, unpubl. rep., Alaska Dep. Fish and Game Fed. Aid Proj. W-17-7, 1976). Although the sport harvest of southeast Alaska brown bears has been intensively monitored (Johnson 1980), relatively few data on seasonal habitat requirements are available.

Southeast Alaska brown bears are believed to leave their high-country dens in spring to feed on emergent vegetation along beaches and tidal flats, move to salmon spawning streams by midsummer, and return to alpine areas to feed on vegetation before denning (Johnson 1980). During fall 1981, the Alaska Dep. of Fish and Game initiated research in northern southeast Alaska to determine seasonal distribution, habitat preference, and home range and den site characteristics of brown bears. This paper describes results of the 1st year of this study.

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STUDY AREA

The study area is in the northern portion of the Alexander Archipelago in southeast Alaska at ap-

proximately 57°–58° North latitude and 134°–136° West longitude. Vegetation is dominated by 2 major habitat types: temperate rain forest and alpine tundra (Harris and Farr 1974, Vierick and Dyrness 1980). Interspersed throughout the forest are poorly-drained muskeg bogs. Forests of this region are typically western hemlock (*Tsuga heterophylla*)-Sitka spruce (*Picea sitchensis*). The climate is maritime, with cool, moist weather predominating. Snow accumulates at sea level during the winter, and higher elevations (> 800 m) are snow-covered for 7–9 months. Annual precipitation averages about 140 cm; January and July temperatures average –6°C and 13°C, respectively (Natl. Ocean. Atmos. Admin. weather records).

The study site is in the Hawk Inlet area on northern Admiralty Island. Admiralty Island (4,430 km²) is the 3rd largest island in the archipelago. The Hawk Inlet site (about 400 km²) encompasses approximately 60 km of marine shoreline, several large tidal flats, numerous small lakes, about 15 anadromous fish streams, and elevations to 1,400 m. Old-growth hemlock-spruce forest dominates 67% of the site; upper-elevation avalanche slope, alpine-subalpine, and rock make up about 30% of the area.

METHODS

Most bears were captured in alpine habitat at about 750 m elevation by immobilizing them with a projectile syringe (0.04 mg/kg etorphine or 3.4 mg/kg phencyclidine hydrochloride) fired from a helicopter. A fixed-wing aircraft used with the helicopter helped locate bears and keep them in sight in heavy cover until immobilization was complete. Other bears were captured along beaches and anadromous fish streams with Aldrich foot snares and then immobilized. Captured bears were instrumented with radio-transmitter collars or ear-transmitters and ear-marked with tags and colored flagging. A premolar was extracted and examined to determine age; sex, standard body measurements, and estimated weight were recorded.

Movements, home ranges, and habitat use were determined by locating instrumented bears approximately once per week during daylight hours from a fixed-wing aircraft. In 9 aerial telemetry trials, relocations averaged 24 m from the actual location (J. W. Schoen and M. D. Kirchhoff, unpubl. rep., Alaska Dep. Fish and Game Fed. Aid Proj. W-27-1, 1983). At each location, elevation was estimated with reference to the aircraft altimeter whereas habitat type was visually determined. Slope and aspect were determined from, and locations plotted on, U.S. Geological Survey topographic maps (1:63,360 scale). Home ranges were determined by connecting the outermost locations (Mohr 1947, Hayne 1949). Home range sizes were calculated using a polar planimeter. Significant differences between means were determined by the Mann-Whitney U-test.

RESULTS AND DISCUSSION

Seasonal Distribution

Twenty brown bears (6 males, 14 females) were captured and instrumented with radios on Admiralty Island from August 1981 to August 1982 (Table 1). The data reported here were collected during the 1982

field season from den emergence to 10 November 1982.

Spring.—During the period from den emergence (12 May–1 Jun 1982) through June, 5 instrumented bears that denned in alpine-subalpine areas used alpine, rock, subalpine, and avalanche slope habitats (listed in order of most to least frequent use). The mean elevation of spring telemetry locations was 820 m (SD = 190, $N = 17$) which was similar to den elevations $\bar{x} = 793$ m, SD = 112, $N = 5$). The only marked bear using a coastal area was one that was captured on the beach in June. However, during June we observed unmarked bears and bear sign at sea level, where bears were feeding on new growth of grasses, sedges, and herbaceous vegetation.

Summer.—During the 1st week of July 1982, 7 additional bears (2 males, 5 females) were instrumented in alpine habitat (Table 1), bringing the number of instrumented bears that occurred in alpine or interior areas to 12. On 20 July 1982, 9 of 12 bears captured in high-elevation alpine-subalpine habitat were still there. By 26 July, 5 bears (henceforth referred to as interior bears) were still at higher-elevation interior sites, where they remained throughout the summer and fall (Table 2, Fig. 1). The other bears (henceforth called coastal bears) moved down to or

Table 1. Summary and status of brown bears radio-collared on Admiralty Island.

Sex	Age	Capture location	Area used in summer	1982 home range (km ²)	1982–83 elevation (m)	Capture date
M	2	Alpine	Interior	114	945	Aug 1981
F	20	Alpine	Interior	38	1,098	Sep 1981
F	8	Alpine	Interior	43	1,128	Sep 1981
F ^a	17	Alpine	Interior	14	823	Jul 1982
F	7	Alpine	Interior	39	854	Sep 1981
M	Adult	Alpine	Coastal	210	915	Jul 1982
M	6	Alpine	Coastal	193	617	Jul 1982
M	4	Alpine	Coastal	101	—	Sep 1981 ^b
F	14	Alpine	Coastal	—	—	Sep 1981 ^b
F	23	Alpine	Coastal	17	915	Jul 1982
F ^c	8	Alpine	Coastal	11	396	Jul 1982
F ^c	17	Alpine	Coastal	51	915	Jul 1982
F ^d	2	Alpine	Coastal	7	—	Jul 1982
F	15	Alpine	—	—	—	Sep 1981 ^b
M	17	Stream	Coastal	56	366	Aug 1982
M	Subadult	Stream	Coastal	52	823	Jul 1982
F	14	Beach	Coastal	6	—	Jun 1982
F ^a	13	Stream	Coastal	9	823	Jul 1982
F	10	Stream	Coastal	17	479	Aug 1982
F	9	Stream	Coastal	33	823	Aug 1982

^a With 2-year-old offspring.

^b Radiocollar lost.

^c With yearling offspring.

^d With an adult female.

Table 2. Seasonal distribution of radio-collared brown bears on Admiralty Island, May–November 1982.

Season	Number of radio-collared bears			
	Remained in interior	Moved from interior to coastal	Remained in coastal	Moved from coastal to interior
1 Apr – 30 Jun	3 + (2) ^a	0 + (1) ^a	1 ^b	0
1 July – 16 Sep	5	7	6	0
17 Sep – 30 Nov	5	0	0	10

^a Marked bears (visually identified) that lost their radiocollars over the winter.

^b Radio-collared bear captured on beach on 16 June 1982.

near coastal salmon streams (Fig. 2). The shift from high-elevation interior sites to low-elevation coastal areas corresponded to the movement of salmon into streams to spawn. By the 1st week of August, an additional 6 bears (2 males, 4 females) had been captured and instrumented along salmon streams or beaches (Table 1). Once established near low-elevation salmon streams, all of the radio-collared coastal bears remained there until about mid-September.

Interior and coastal bears differed markedly in their use of habitat from July through mid-September (Table 3). Interior bears primarily used subalpine, alpine, and avalanche slope habitats whereas coastal bears used mostly old-growth and riparian forest. On Kodiak Island in the Gulf of Alaska, Atwell et al. (1980) also reported extensive use of alpine habitat by brown bears from the last week of June through early August with a peak in mid-July. Heaviest bear use on Kodiak Island was associated with sedge (*Carex* spp.) meadows. By mid-August, the Kodiak bears left the alpine, presumably for salmon streams.

R. Smith (pers. commun.) also reported substantial use of alpine habitat by radio-instrumented bears on Kodiak during summer 1982. All of these bears used fish streams later in the summer.

During August, when all the instrumented coastal bears were on or near salmon streams, the interior bears had moved to steep avalanche slopes dominated by alder (*Alnus* spp.), salmonberry (*Rubus spectabilis*), and devils club (*Oplopanax horridum*). During this period, the interior bears were rarely (<10%) observed during radiotelemetry flights. In contrast, they were often (>40%) observed during June and early July when they used open alpine-subalpine habitats. The difficulty of observing bears in these upper-elevation avalanche slopes may have contributed to the widespread belief that most bears use anadromous fish streams during late July and August. However, Klein (unpubl. rep., Alaska Dep. Fish and Game Fed. Aid Proj. W-3-R-13, 1958) reported that in years of good berry crops and poor fish runs, fewer bears or their sign were observed along fish streams and that

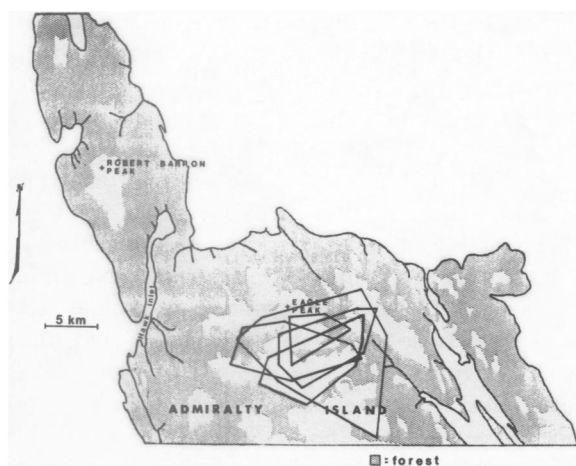


Fig. 1. Home ranges of 5 radio-collared bears that remained in interior regions after capture in the alpine on Admiralty Island.

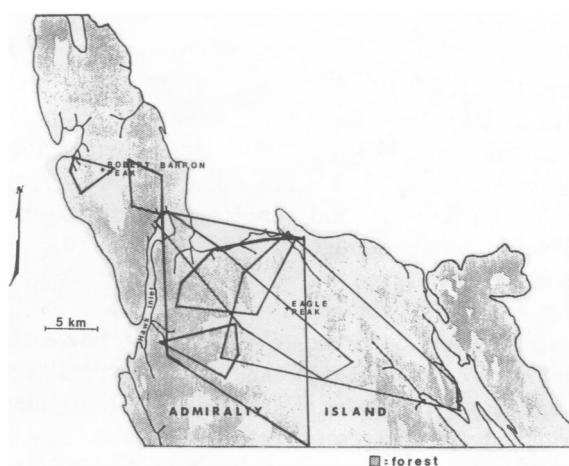


Fig. 2. Home ranges of 7 radio-collared bears that moved to coastal regions after capture in the alpine on Admiralty Island.

Table 3. Habitat use by instrumented brown bears on Admiralty Island during summer (1 Jul–16 Sep) and fall (17 Sep–8 Nov) 1982.

Habitat type	Percent relocations			
	Interior bears (<i>N</i> = 5)		Coastal bears (<i>N</i> = 13)	
	Summer (<i>N</i> = 42)	Fall (<i>N</i> = 24)	Summer (<i>N</i> = 88)	Fall (<i>N</i> = 60)
Old-growth forest	10	0	61	43
Riparian forest	0	0	22	7
Subalpine	36	4	5	5
Alpine	21	0	7	0
Avalanche slope	28	71	0	30
Rock	5	25	1	13
Muskeg	0	0	2	0
Beach	0	0	2	0
Tidal grass flats	0	0	0	2

greater numbers of bears used higher elevations and interior regions. Although we have not yet begun diet studies, our observations indicated interior bears were foraging extensively on berries at this time.

Fall.—By mid-September, coastal bears moved away from fish streams, whereas interior bears continued using avalanche slopes (Table 2). Fall habitat use of these 2 groups from 17 September to denning is presented in Table 3. Interior bears primarily used avalanche slopes, followed by rock and subalpine habitat. Coastal bears began moving to higher elevations and used old-growth forest, avalanche slope, rock, riparian, and subalpine habitat in that order.

Winter.—Most bears had denned by the 1st week of November. The mean den elevation of 15 instrumented bears during November 1982 was 799 m (SD = 228). Most bears (81%) denned in alpine-rock habitat. Three coastal bears denned in old-growth forest habitat at about 450 m. The 5 interior bears denned at a mean elevation of 970 m (SD = 139), which was significantly ($P < 0.05$) higher than coastal bear dens.

Home range.—Home ranges were calculated for 18 bears during 1982. Male home ranges averaged 115 km² (SD = 75) and were larger ($P < 0.05$) than females, which averaged 24 km² (SD = 16). The average home range area of 8 coastal females was 19 km² (SD = 15) compared to 33 km² (SD = 13) for those of 4 interior females ($P = 0.13$). Coastal females use the concentrated forage resource, spawning salmon, whereas interior females exploit the more widely distributed resource of vegetation and berries. Most coastal females remained on a particular stream system once established there. In contrast, most coastal males moved to several streams during the

fishing season, and their home ranges were much larger.

CONCLUSIONS AND MANAGEMENT RECOMMENDATIONS

Data presented here, although preliminary, suggest that brown bears on Admiralty Island are not uniformly distributed along anadromous fish streams during late summer as originally hypothesized, nor does it appear that all seek out coastal grass flats following den emergence. Whether this represents differences in learned behavior remains to be determined. It appears, however, that adult males (with much larger home ranges than females) all use anadromous fish streams during mid to late summer. We must also learn if individual bears are consistent from year to year in their distribution and preference for specific habitats. Data reported here are from 1982 only, but 1983 field work supported initial observations of differential distribution, i.e., individual bears showed the same coastal or interior preference in 1983 as in 1982. Findings also indicate that bears are widely distributed and use a variety of habitats throughout their active period.

Increasing resource development and other activities in this area will require intensified brown bear management. Clear-cut logging and associated activities will cause major habitat changes and disturbances, primarily at lower elevations whereas mining and mineral exploration may occur in a variety of locations.

Currently, the brown bear hunting season on Admiralty Island ends 20 May. Most brown bear hunting in this area is conducted in the spring from boats

and is concentrated at lower elevations at the head of bays and along tidal flats (Johnson 1980). Our data indicate that a portion of the bear population was either denned or in alpine habitat throughout early May and thus unavailable to sport hunters during spring 1982.

This study indicates that some Admiralty Island brown bears are safer from hunting and habitat destruction than previously thought because a portion of the population does not use the more accessible, lower-elevation coastal areas. Knowledge of the distribution of brown bears on Admiralty and other areas in southeast Alaska is an important element in managing bear populations and their habitat. For example, techniques for censusing and estimating population densities should be developed, based on and understanding of differential distribution.

ADDENDUM

Radiotelemetry data collected subsequent to the 1982 field season continued to support the hypothesis of differential distribution. Two adult females remained in interior regions of Admiralty for 4 con-

secutive years and 2 other adult females used those areas for 5 consecutive years. Only females or subadult offspring of interior females displayed this kind of distribution. All adult males we have monitored used coastal regions during the salmon runs.

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