

**PANEL 2: DENNING—CONTROL MECHANISMS, SITE SELECTION AND PHYSIOLOGY**

**Remarks on Denning Habits of Alaska Brown Bears**

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**INTRODUCTION**

Brown bear denning studies were conducted intermittently from 1965 through 1969, by the U.S. Fish and Wildlife Service on the Kodiak National Wildlife Refuge and by the Alaska Department of Fish and Game on the Alaska Peninsula. These are two of the most important brown bear areas in Alaska. This paper presents information on denning habits with emphasis on descriptions of dens. Studies were funded by the Refuge Branch of the U.S. Bureau of Sport Fisheries and Wildlife and Alaska Federal Aid in Wildlife Restoration Projects W-15-R-1, 2, and 3, and W-17-1.

**STUDY AREAS**

The general topography of Kodiak Island is characterized by rugged mountains that ascend to over 4000 feet. The irregular coastline has prominent headlands, cliffs and narrow bays and no point on the island is more than 15 miles from the sea coast. Other prominent features include 11 major watersheds, 15 large lakes and numerous tributaries. Dominant vegetation is alder, willow and grasses, with cottonwood distributed in valley bottoms. The southwest region is characterized by a tundra heathland. Temperatures occasionally go above 70 degrees F. in summer and rarely drop to 0 degrees F. in winter. The annual precipitation averages 60 inches, and the frost-free season averages 171 days. The annual snowfall averages 54 inches, but because of mild temperatures and frequent rain, snow cover readily dissipates from lowland habitat.

The Alaska Peninsula study area is 150 miles in length and extends from Mother Goose Lake on the east to Port Moller on the west. The peninsula averages 50 miles wide in this section. A broad flat tundra belt with many small lakes and meandering drainages extends along Bristol Bay on the north. The steeply-ascending Aleutian Range, with peaks averaging 2800-3200 feet above sea level, lies between the coastal plain to the north and Pacific Ocean to the south. Dominant vegetation is willow and sedge in tundra areas and alder,

willow and grasses in mountainous areas. Weather is characterized by high winds, overcast skies, fog, rain in the summer, and snow in the winter. The human population is sparse, and there are no roads.

## METHODS

On Kodiak, 82 brown bear dens were located, 79 from fixed wing aircraft and 3 from the ground with the aid of binoculars (Fig. 1). A helicopter was used to reach 11 dens and, in six instances when dens were occupied, to haze bears from the immediate denning area.

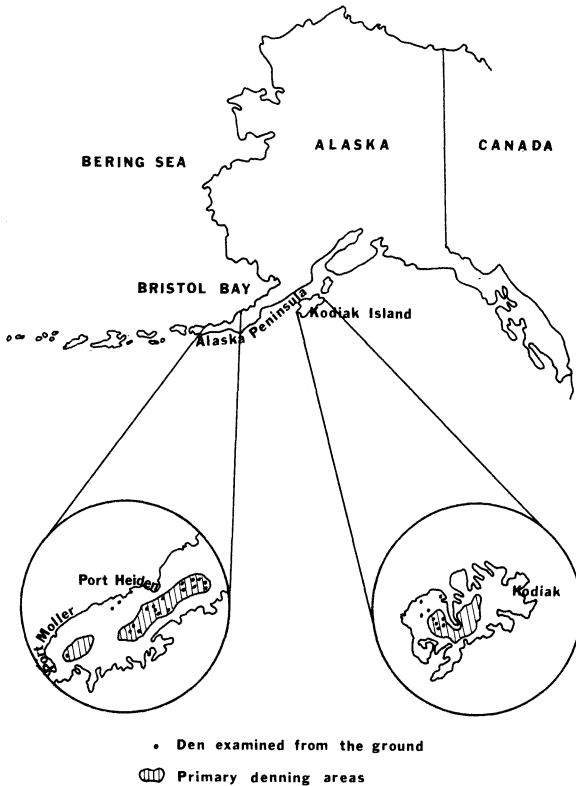


Fig. 1 Study area locations

On the Alaska Peninsula, 52 dens were sighted from fixed wing aircraft. Most searching was done in the mountains, except when a den was reported on the tundra. Professional hunting guides were also asked to report locations of dens, which were then investigated. Of the 52 dens located from the air, 19 were examined by ground crews transported in PA-18 Supercub aircraft equipped with oversize tires. Experienced pilots used short-strip landing procedures to position an investigator close to dens, usually within 4-5 hours walking distance. Twelve dens rechecked late in the fall or in succeeding springs provided information on den re-use.

Most often dens were first sighted in both study areas by the mounds of excavated material that contrasted with vegetation and snow-covered landscapes. Bear tracks could on occasion be traced to a den or indicated that a den was in the immediate area.

For dens observed from the air, location, elevation and exposure were recorded on topographic maps (Scale 1:250,000). For dens examined from the ground, measurements of excavated material, tunnels and chambers were recorded on standardized field forms. Dens were photographed and diagrammed with emphasis on den compartments and immediate topographic features.

## **FINDINGS AND DISCUSSION**

### **Den Locations**

A frequency distribution of den elevations is given in Table 1. Dens ranged from 100 to 3300 feet above sea level with the greatest proportion at about 1800 feet on Kodiak Island and at about 1300 feet on the Alaska Peninsula. Dens were at higher elevations on Kodiak where the mountains are higher and vegetative zones are higher. Most dens were above 500 feet on slopes with alder, willow and grass. A few were also found in alpine areas. In some cases, snow concealed vegetation so that it was impossible to determine if a den was in or below the alpine zone. The eight dens found below 500 feet were in open tundra with heath cover or a sparse growth of willow.

The areas where dens commonly occurred were characterized by alder-willow thickets and deep snow cover. Alder and willow provide concealment and, in some instances, bedding material. Roots bind the soil and prevent den collapse. Snow drifted in brushy areas may be important as an insulating layer over dens.

North facing slopes were most often chosen for denning on Kodiak, and east facing slopes were most often chosen on the Alaska Peninsula (Table 2). Factors that might influence choice of slope exposure were not apparent.

For 28 dens examined on the ground, slope of the terrain was 0 to 30 degrees for 9 dens, 30 to 45 degrees for 14 dens, and 45 to 60 degrees for 5 dens. Bears may prefer to den on well-drained sites where water seepage into dens would be minimal. Steep slopes may also be selected as an aid in den construction because excavated material is more easily deposited downhill.

### **Den Structures**

All dens examined on the ground had a single entrance and single denning chamber. Twenty-nine were constructed in soil and one was constructed in snow. About half the den entrances opened directly to the chamber and about half had a tunnel leading to the chamber. Three types of dens are diagrammed in Fig. 2.

Den dimensions are given in Table 3. Entrances were typically oval or arch shaped and averaged 3.0 feet in width and 3.2 feet in height. The length and diameter of tunnels leading from entrance to chamber of 13 dens averaged 5.8 and 3.0 feet, respectively. Chambers were typically cone or arch shaped and averaged 5.3 in width, 7.3 feet in length, and 3.9 feet in height. Dimensions of dens with family groups did not differ significantly from dimensions of dens with single bears.

TABLE 1. FREQUENCY DISTRIBUTION OF BROWN BEAR DEN ELEVATIONS ON KODIAK ISLAND AND THE ALASKA PENINSULA

		Feet Above Sea Level						
		0-499	500-999	1000-1499	1500-1999	2000-2499	2500-2599	3000-3499
<b>Kodiak Island</b>								
Females w/yearlings	1	1	2					
Singles	2	2	1					
Unidentified	1	3	16	23	22	3		6
Total	1(1%)	6(7%)	19(24%)	23(29%)	22(28%)	3(4%)		6(7%)
<b>Alaska Peninsula</b>								
Females w/cubs	3		6		1			
Females w/yearlings	1	1	1			2		
Singles	2	1	4	2			1	
Unidentified	4	5	11	2	1			1
Total	7(14%)	10(20%)	22(45%)	5(10%)	3(6%)	1(2%)		1(2%)

TABLE 2. ORIENTATION OF BROWN BEAR DENS ON KODIAK ISLAND AND THE ALASKA PENINSULA.

	N	NE	E	SE	S	SW	W	NW
<b>Kodiak Island</b>								
Females w/yearlings	1			1		1		
Singles	1					1		1
Unidentified	20	12	8	8	10	7	3	6
<b>Total</b>	<b>22</b>	<b>12</b>	<b>8</b>	<b>9</b>	<b>10</b>	<b>9</b>	<b>3</b>	<b>7</b>
<b>Alaska Peninsula</b>								
Females w/cubs	2		3	2			1	
Females w/yearlings	1		1		1		1	1
Singles			2	2		2	1	
Unidentified	1	4	4	3	5	2	3	4
<b>Total</b>	<b>4</b>	<b>4</b>	<b>10</b>	<b>7</b>	<b>6</b>	<b>4</b>	<b>6</b>	<b>5</b>
<b>Grand Total</b>	<b>26</b>	<b>16</b>	<b>18</b>	<b>16</b>	<b>16</b>	<b>13</b>	<b>9</b>	<b>12</b>

Snow was melting when dens were examined, and the ground at most den sites had several inches to 15 feet of snow. In most cases, bears tunneled through snow when emerging from dens. One atypical den formed entirely in snow by a single bear on the Alaska Peninsula had an S-shaped tunnel 19 feet long, a small alcove, and a cone-shaped chamber 9 feet high and 6 feet wide (Fig. 2A).

Two dens, each occupied by a female with cubs, contained alder and willow branches. Den floors were evidently lined with branches during the final phase of construction in the fall.

Three family groups and an unidentified bear had beds outside their dens. Some beds were in snow and some in soil. Figure 2C shows the orientation of beds used by a female with two yearlings. It appears bears constructed and used these beds after they first emerged and until they abandoned the den site.

### Other Denning Activities

Investigators revisited 12 dens during succeeding fall and spring periods to determine if bears had used them again. There was only one instance of possible re-use. Most bears probably construct new dens each fall because thawing, seepage and erosion cause dens to collapse during the spring and summer. A few cases of denning in natural rock caves have been reported on Kodiak and the Alaska Peninsula, but none were found during this study. Denning could be expected in such rock caves during successive years.

The one instance of co-occupancy, other than in dens used by females with young, was by two bears judged to be two-year-olds. These animals were probably litter mates that denned for the first time without their mother.

No evidence of mortality associated with denning or parturition was discovered.

TABLE 3. DIMENSIONS IN FEET OF 26 BROWN BEAR DENS EXAMINED ON KODIAK ISLAND AND THE ALASKA PENINSULA.

Den Type and No. <sup>1</sup>	Excavated Material		Entrance		Tunnel		Chamber		
	Width	Length	Width	Height	Length	Average Diameter	Width	Length	Height
<b>Females w/cubs</b>									
A-1-65	2	2	3.1	3.8	0	—	5.0	8.0	4.8
A-5-67	6	15	3.6	3.0	6.0	2.3	ca.3	ca.4	ca.4
A-1-68	8	12	2.5	2.0	0	—	4.8	5.4	3.3
A-2-68	6	25	3.7	2.2	0	—	4.3	11.9	3.9
A-3-68	8	20	2.9	3.6	0	—	5.0	9.2	3.8
A-5-68	7	15	2.6	4.7	9.2	3.2	5.0	5.0	4.3
<b>Mean</b>	7	17	3.1	3.2	7.6 <sup>3</sup>	2.7	4.5	7.2	4.0
<b>Females w/yrnings</b>									
K-1-70	2	2	1.8	1.8	6.3	3.0	4.6	6.3	4.2
K-2-70	2	2	2.4	4.6	3.3	4.5	6.0	8.5	3.0
K-8-70	6	15	3.2	2.2	0	—	4.1	9.0	2.5
<b>Mean</b>	6	15	2.5	2.9	4.8	3.7	4.9	7.9	3.2

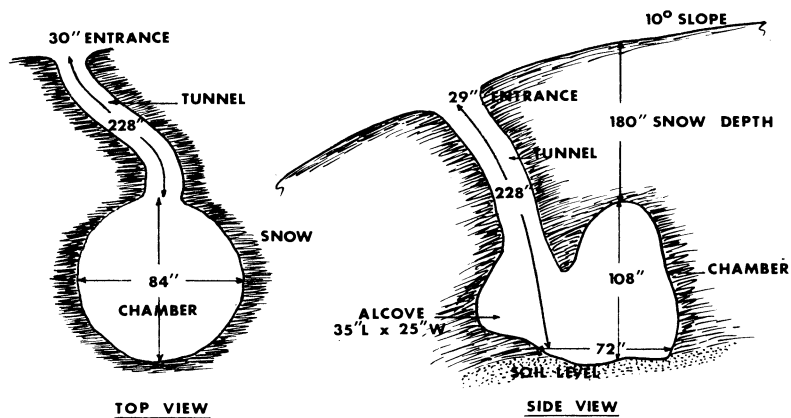
Singles

K-9-69	2	2	2.9	3.0	1.5	2.1	5.5	6.6	3.5
K-4-70	2	2	2.0	3.5	<sup>2</sup>	1.9	5.3	8.5	2.8
K-6-70	5	10	2.5	2.5	2.2	3.1	4.1	6.2	3.7
A-1-66	7	8	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>	<sup>2</sup>
A-1-67	7	16	2.8	2.5	7.0	2.0	6.9	6.1	4.6
A-4-67	2	2	4.8	4.2	0	—	7.0	10.0	6.8
A-7-67	10	15	3.1	2.8	10.0	3.0	7.0	5.0	4.2
Mean	7	12	3.0	3.1	5.2	2.4	6.0	7.1	4.3
Unidentified									
K-3-70	2	2	2	2	2	2	8.0	11.0	2.6
K-5-7	10	14	3.0	3.0	6.5	3.5	6.8	6.8	4.5
K-10-70	5	9	4.2	2.6	6.5	3.1	5.2	5.2	2.6
A-2-66	5	7	2.5	<sup>2</sup>	4.8	2.5	ca. 5	ca. 5	ca. 4.5
A-3-67	12	15	3.3	3.6	0	—	3.3	9.0	4.3
A-6-67	8	12	2.2	4.3	0	—	6.5	6.2	3.8
A-8-67	8	15	4.3	4.3	6.0	4.3	5.0	4.7	4.6
A-4-68	5	15	3.0	<sup>2</sup>	0	—	4.9	6.7	4.6
A-6-68	8	8	3.1	3.9	0	—	4.2	9.6	3.3
A-7-68	10	15	<sup>2</sup>	<sup>2</sup>	0	—	6.3	9.2	4.2
Mean	8	12	3.2	3.6	5.9	3.3	5.5	7.3	3.9
Mean for all dens	7	14	3.0	3.2	5.8	3.0	5.3	7.3	3.9

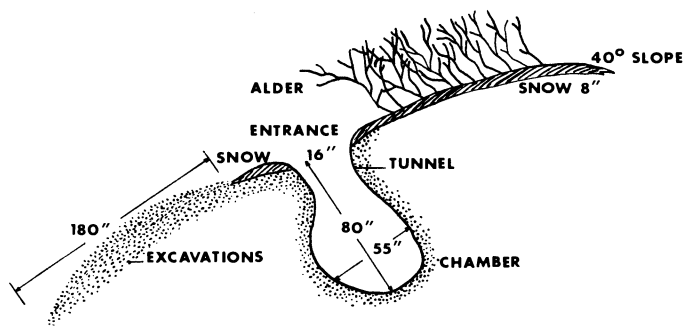
<sup>1</sup> K refers to Kodiak, A refers to Alaska Peninsula, and last 2 digits refer to year.

<sup>2</sup> Not measured because of snow cover or partial den collapse.

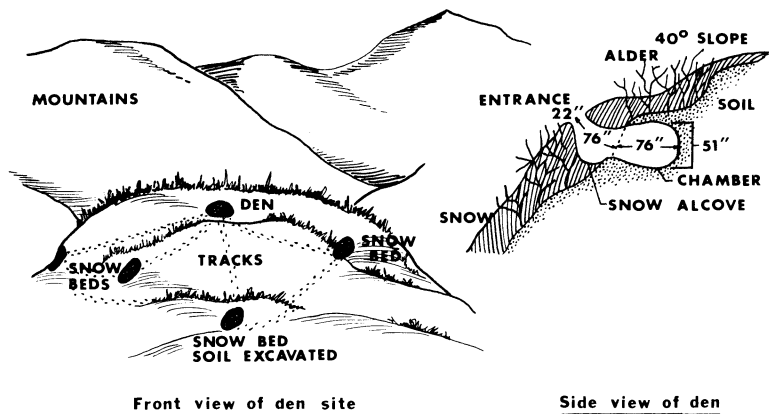
<sup>3</sup> Dens without tunnels not included in mean dimensions of tunnels.



A. SINGLE BEAR



B. SIDE VIEW — NATAL DEN



C. DEN — FEMALE WITH TWO YEARLINGS

Fig. 2 Three den types: (A) atypical snow den used by a mature bear; (B) natal den used by a female and three cubs; (C) den and beds used by a female and two yearlings.