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## **Characteristics of Black Bear Dens on Long Island, Washington<sup>1</sup>**

### **Abstract**

Dens of 11 transmitter-equipped black bears (*Ursus americanus*) on Long Island in southwestern Washington were investigated. Preferred den sites were natural cavities under stumps or snags which could be used with little preparation. Adult bears denned in areas cut before 1955; yearlings denned generally in areas cut after 1966. Adult females collected greater amounts of vegetative material for nests than did yearlings.

### **Introduction**

Black bears display considerable flexibility in selection of sites for winter dens. Erickson (1964) found bears in Michigan to den most commonly under stumps and logs or in holes in hillsides. Jonkel and Cowan (1971) reported that the preferred den site in Montana was in the base of a hollow tree, but they also found bears denned in rock caves and holes dug into the ground. Bears in Louisiana were observed to den in hollow trees in which the entrance to the den was above ground level (Taylor, 1971). Poelker and Hartwell (1973) followed the movements of a radio-equipped sub-adult female in western Washington and observed her to enter two dens in hollow logs, one in the base of a rotten stump and another in a natural cavity in the base of a bigleaf maple (*Acer macrophylla*). Manmade structures used as den sites include drainage culverts (Barnes and Bray, 1966) and basements or foundations of buildings (Skinner, 1925; Jonkel and Cowan, 1971). Seven percent of dormant bears in a Michigan study were found in unsheltered depressions (Erickson, 1964). Wakefield (1969) in Pennsylvania states that only pregnant females reportedly require protective dens.

Erickson (1964) reported that females and juveniles more commonly lined their dens with vegetation than did adult males. He theorized that adult males enter dens later than other bears and thus suitable nest material was less available at the time they entered. Jonkel and Cowan (1971) found nest material in 10 of 31 dens examined. Three of the dens with nest material were occupied by females; sex of the occupants of the remaining seven was unknown.

Den site selection and den characteristics may vary between and within regions in

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response to differing requirements of the various sex and age classes of bears. These characteristics have not been investigated for black bears occupying the coastal areas of Oregon and Washington. The present paper reports on the selection of sites and characteristics of the dens of 11 transmitter-equipped bears in southwestern Washington; information on site selection only was provided by three additional adult male bears.

#### Study Area

The study was conducted on Long Island, a 1,953 ha island located in the southern end of Willapa Bay in southwestern Washington. The climate of the island is typically cool marine, characterized by mild winters and cool summers. Precipitation occurs principally as rain and averages 120 cm annually. Logging has dominated land-use of the island. Timber was harvested periodically between the turn of the century and 1968.

The island is located within the *Picea Sitchensis* Zone (Franklin and Dyrness, 1973), a belt of vegetation which extends along the coast of Washington and Oregon. Five major upland types were delineated on the island, based primarily on seral stage. Areas on the island logged between 1963 and 1968, approximately 565 ha (Type 1) were characterized by dense stands of shrubs. Salal (*Gaultheria shallon*) was the most prominent shrub, but evergreen huckleberry (*Vaccinium ovatum*) and red huckleberry (*Vaccinium parvifolium*) were abundant. Thick stands of young western hemlock (*Tsuga heterophylla*) characterized locales cut between 1952 and 1959 (Type 2, 455 ha). Brush species, principally salal, were still abundant and productive in these areas although restricted mainly to borders of secondary logging roads, skid trails, and numerous small openings. Sitka spruce (*Picea sitchensis*) was scattered throughout these stands and western redcedar (*Thuja plicata*) was common locally in more moist sites. Areas either partially logged or clear cut before 1935 (Type 3, 675 ha) were dominated by western hemlock with Sitka spruce a persistent member of each stand and western redcedar locally common. Less frequently, areas clear cut before 1935 supported nearly pure stands of mature red alder (*Alnus rubra*; Type 4, 100 ha). The understory of conifer and alder stands was generally open, with ferns, principally sword fern (*Polystichum munitum*), forming a dense ground cover in the alder stands. Shrub species were dense only in small openings in the conifer stands. The final vegetation type (Type 5, 140 ha) was dominated by virgin redcedar. The stand also included Sitka spruce and western hemlock. Densities of brush in the understory varied from light to moderate.

#### Methods

During the spring and summer of 1973, 16 black bears were captured and fitted with radio transmitters; 14 were still being monitored when they entered dens.

Our experiences, and those of Poelker and Hartwell (1973) also in the Northwest, indicated that with the exception of most sows with cubs, bears will leave their dens on approach by humans. Therefore, we visited only the dens of adult females and one yearling during the winter. The remainder of the dens were examined in the spring after the bears had emerged. Measurements were made of the maximum height and width of entrances, and the height, width, and length of chambers. Nests were measured when present, and the volume of nest material estimated. Entrance exposure was determined with a compass, and the degree to which the entrance was obscured by brush

within 60 cm was estimated. Diameter of a tree with a den was measured at breast height (dbh).

## Results

Ten of the 12 dens were associated with dead trees. Six of these were under upright stumps, two under stumps which had been pushed over during logging, one under a fallen tree, and another under a standing snag (Table 1). The two remaining dens were associated with live trees and both occupied by a single yearling.

With one exception, dens of yearlings were in areas cut after 1966 (Type 1). All dens of adult bears (3+ years—no 2-year-olds were present), with the exception of the den of an adult female in a 1966 cut, were in areas either partially cut or clear cut prior to 1956. The female which denned in the 1966 cut moved from her den in early December. Additionally, the dens of three instrumented adult male bears were in areas cut before 1956. The transmitter on these males failed during the winter.

Four (40 percent) of the dens located on the ground were on slopes ( $\bar{x}$  = 20 percent, range = 11-39 percent). Two slopes had west exposures and the other two faced southwest. The average diameter of trees associated with the dens was 163 cm (sd 71 cm). Entrances to dens under upright stumps were formed by roots and those under overturned or fallen trees by the trunk and root mass. Dens of adult females more frequently had two entrances than did dens of yearlings. Entrances to three of four ground dens of yearlings were obscured by brush whereas entrances to dens of adult females were unobscured. The average maximum height of entrances to dens of adult females (38.4 cm) and yearlings (43.13 cm) did not differ significantly ( $P < 0.05$ ,  $t = 0.686$ ,  $df = 11$ ). The mean maximum width of entrances to dens of yearlings (78.5 cm) was, however significantly greater ( $P < 0.05$ ,  $t = 3.528$ ,  $df = 11$ ) than the mean width of entrances to dens of adult females (45.1 cm). Both sides of the den of the adult male, which was under a fallen tree, were open.

Chambers of dens under standing stumps or snags were formed by roots. Soil under the tree, which had been held by the roots, had either eroded or been dug out to form the chamber. Chambers of dens under overturned stumps were formed by the root mass and butt of the stump. Although chambers in dens of adult females appeared larger than those of yearlings, their height ( $t = 0.335$ ,  $df = 7$ ), width ( $t = 0.628$ ,  $df = 7$ ), and length ( $t = 0.945$ ,  $df = 7$ ) did not differ significantly ( $P > 0.05$ ) from the yearlings.

Only three of 10 ground dens appeared to have been constructed or modified during fall 1973 prior to their use. Yearling male 7310 apparently had cleaned the chamber of the den he occupied, and increased the height of the entrance by approximately 7 cm by chewing on the root which formed the top of the entrance. Adult female 7307 dug in the chamber of her den but removed no soil from the den. Only one monitored bear, a yearling female (7314), constructed a den during the fall. She apparently formed the den by enlarging a natural cavity under a stump. A mound of soil approximately 6 liters in volume was found at the den entrance. Dens occupied by the remainder of the bears were either natural cavities which required no modification or dens that were constructed and utilized in previous years. Soil removed from the den before the fall of 1973 was found at entrances of two dens (7307, 7310). Six dens (7303, 7305, 7307, 7309, 7311, 7313) contained nest material from previous years.

Two of the dens on the ground contained no nest material (7301, 7308); however, the floor of the den of 7308 was covered with dried pieces of the decaying stump under which it was located. The two dens in trees were not examined for nest material. Greater amounts of nest material were found in dens of adult females than in dens of yearlings. Female 7305 collected additional nest material (40 liters) in the spring and made a bed outside the den immediately in front of the west-facing entrance. The most common materials used for nests were hemlock, sword fern, and salal. None of these dens were occupied the following winter (1974-75).

### Discussion

The preference exhibited by bears for dens in natural cavities under stumps or snags probably is based on need and convenience. Such sites are readily available to bears and require little or no preparation. The principal function of the den in the Northwest appears to be protection from heavy winter rains. That only pregnant females would require the protection offered by a den or that bears on the island would den in unsheltered depressions such as those found by Erickson (1964) in Michigan seems unlikely.

Exposure of the slope or aspect of den entrance apparently did not influence selection of den sites. Craighead and Craighead (1972) attributed the selection by grizzly bears (*Ursus arctos*) of north-facing slopes on which to den, to the insulative qualities afforded by the greater accumulation of snow on these slopes. We found no evidence that adult females had removed brush immediately in front of entrances to their dens, suggesting that the presence of brush at den entrances was characteristic of the vegetation type in which the bear denned. Brush immediately in front of the den entrance may, however, have blocked rain from being blown directly into the entrances of dens of yearlings which were generally found in areas not protected by an overstory of trees. The small size of den entrances probably reduced the amount of rain entering a den and provided a more defensible position against attack by other bears.

The similarity between chamber size and entrance height of dens of adult females and yearlings may reflect the tendency for bears to occupy dens which had been constructed in previous years. The principal differences observed between dens of adult females, all of which were known to have given birth to cubs during the winter of 1973-74 (except 7307), and dens of yearlings was the vegetation type in which they were found and the amount of nest material used. Because the range of each bear included areas cut before 1956, as well as areas cut since 1966 (Lindzey and Meslow, in preparation), the tendency for yearlings to den in recently cut areas and adults to den in areas dominated by timber suggests a selection for certain vegetation types. Timbered areas apparently offered security to bears on the island. When confronted by a human or chased by another bear in the recently cut areas, bears we observed ran to the nearest stand of timber. Presumably, adult bears selected the most secure habitat in which to den. Timbered sites would be of particular value to females with cubs to protect. Yearlings may have denned in the more open, less secure areas to avoid contact with adult bears. The location of the two dens of 7315 in trees, the only yearling that denned in a timbered area, also probably minimized the chance of contact with other bears.

Dens on the island more frequently (80 percent) contained nest material than did dens in Michigan (39 percent: Erickson, 1964) or dens in Montana (30 percent: Jonkel

TABLE 1. Characteristics of dens and den sites of 11 black bears on Long Island in southwestern Washington.

Bear No.	Sex	Age <sup>a</sup>	Den Location	Vegetation type	No. of entrances	Aspect of entrance	Entrance height-width (cm)	Chamber height-width-length (cm)	Nest material (liter)
7310	M	1	Under overturned stump	1	1	NNW	28-66	44- 52-118	1
7311	M	1	Under upright stump	1	2	W/NE	41-97, 32-82	43- 54-112	10
7308	M	1	Under upright stump	1	1	W	49-45	109-122-170	0
7314	F	1	Under upright stump	1	1	E	42-101	72- 79- 90	9
7315A	F	1	In live tree <sup>b</sup>	3	1	—	—	—	—
B			In live tree <sup>b</sup>	3	1	W	—	—	—
7303	F	5	Base of snag	2	2	W/E	39-31, 39-45	62- 94-121	105 <sup>c</sup>
7305	F	3	Under standing stump	2	2	W/SE	41-41, 32-56	52- 75-128	105
7307	F	5	Under overturned stump	1	2	N/E	56-42, 30-53	76- 58-115	45
7309	F	5	Under standing stump	3	1	NNW	42-32	68-122-165	70

Yearlings  
 $\bar{x}H = 38.4$  (sd 8.4)     $\bar{x}H = 67$  (sd 31.1)  
 $\bar{x}W = 78.4$  (sd 23.3)     $\bar{x}W = 77.5$  (sd 31.9)  
 $\bar{x}L = 122.5$  (sd 33.9)

TABLE 1. (Continued)

7313	F	9	Under standing stump	3	1	S	69-61	93- 97-187	90
							Adult females $\bar{x}H = 43.2$ (sd 12.9) $\bar{x}W = 45.1$ (sd 10.9)	$\bar{x}H = 70.3$ (sd 15.3) $\bar{x}W = 89.2$ (sd 24.2) $\bar{x}L = 143$ (sd 31.1)	
7301	M	3	Under fallen tree	3	open	—	—	—	0

<sup>a</sup> Age in years during Fall 1973

<sup>b</sup> Bear moved from site

<sup>c</sup> Includes material in nest at entrance (see text)

and Cowan, 1971). Because rainfall is much greater in this region, nest material that would insulate the bear from water which might enter the den may be of greater importance. The larger amounts of nest material used by pregnant females probably would insure the insulation of cubs from the ground moisture. A thick layer of nest material might also decrease the chance of a cub being hurt if the female should lie on it.

Intensive logging will decrease the availability of preferred den sites, especially as the time between subsequent cuts is shortened. However, because of the flexibility exhibited by black bear in the selection of den sites, perhaps a decrease in preferred den sites alone would not cause a corresponding decrease in black bear numbers.

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