Bedding Behavior of Black Bears in Tennessee

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Abstract: Two distinct patterns of bedding behavior of black bears (*Ursus americanus*) were observed; all summer beds ($N = 25$) were surface depressions which required no preparation and all winter beds ($N = 9$) were elaborately constructed nest-type structures. Seven summer beds were depressions in association with fallen trees, 3 were at the base of large standing trees, and 1 was adjacent to a large rock. Fourteen beds were not in the immediate vicinity of similar structures. Eight summer beds were in game trails. Eight of 9 winter beds were adjacent to obviously selected structures such as large logs, trees, and rocks. Dimensions of summer and winter beds averaged 1.35 × 0.73 × 0.23 m and 0.79 × 0.62 × 0.21 m (length × width × depth), respectively. Scats ($\bar{x} = 2.5$, range = 1–4) were present at all summer beds and therefore may be indicative of the time spent in beds and reflect the importance of bedding sites as micro-habitat components. Scats were present at only 3 of 9 winter beds. Summer beds occurred in a wide range of forest types ($N = 6$) and understory compositions and densities but the majority of winter beds occurred in open oak-pine forest types (6 of 9) with dense understories (9 of 9).

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Recent radiotelemetry studies on movements and activities of black bears have reported that the bears spend considerable time resting during periods of inactivity (Amstrup and Beecham 1976, Alt et al. 1976), Lindzey and Meslow 1977, and Garshelis and Pelton 1980). Although activity patterns are complex and highly variable among areas, sex and age groups, time and weather factors, and individual animals, all results generally are consistent and indicate that bedding behavior is a significant component of activities. Levels of inactivity as high as 70% were reported for black bears in Idaho (Amstrup and Beecham 1976) and the probability of inactivity ranged from 0.79 to 0.26 for black bears in Tennessee (Garshelis and Pelton 1980). Visual

observations indicated that even periods of diurnal activity were interrupted by frequent, short rest periods when bears would lie down but apparently not sleep (Lindzey and Meslow 1977). Even more time is spent in beds during the pre-denning and post-denning periods of reduced activity. Lindzey and Meslow (1976) reported that inactivity was 6 times greater during the months of October to December and during the month of March than during the remainder of the year. Levels of inactivity as high as 85% occurred during the pre-denning and post-denning periods in Tennessee (Johnson and Pelton 1979).

Mysterud (1980) described bed sites and outlined a seasonal pattern of bedding behavior for European brown bears (*Ursus arctos arctos*) which provided the basis for interesting comparisons among other species of bears. Extensive time also was spent in beds by brown and grizzly bears (*Ursus arctos horribilis*) based on activity studies but no investigations of bedding behavior were published for brown bears (Mysterud 1980). Mysterud (1980) stated that micro-habitat descriptions associated with bed sites were important considerations for protection of brown bear habitat as large-scale road construction and clearcutting operations were expanded.

No reports of bedding behavior and bed site selection have been published in the literature for black bears although denning behavior has been extensively covered (Lindzey and Meslow 1976; Hamilton and Marchinton 1980; Johnson and Pelton 1979, 1981; and Tietje and Ruff 1980) and numerous activity studies indicate the importance of bedding behavior. Our objectives were to describe bedding sites and report on observations of bedding behavior for black bears in the Great Smoky Mountains National Park.

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Methods

The Great Smoky Mountains National Park (GSMNP or Park) comprises 2,074 km^2 in eastern Tennessee and western North Carolina. This study was conducted primarily in the NW quadrant (428 km^2) on the Tennessee side of the Park. The Smokies are part of the Unaka Mountains of the Blue Ridge Province in the southern division of the Appalachian Highlands. The topography is extremely steep and complex with more than 90% of the surface area having a slope of greater than 10%. Most of the study

area was accessible only by foot trails. Elevations ranged from 270 to 2,024 m (Johnson and Pelton 1979).

The climate of the Smokies exhibits much variation due primarily to a large range in elevation. Average annual temperature ranges from about 14° C at elevations below 450 m to 8° C at elevations above 1,900 m. Precipitation, principally rain, averages 140 cm a year at lower elevations to more than 230 cm at the highest elevations. Precipitation maxima occur in late winter to early spring and in July or August (Johnson and Pelton 1979).

The vegetation of the Smokies is dense, diverse, and well-interspersed. Major forest types include spruce-fir, northern hardwood, cove hardwood, hemlock, closed oak, and open oak-pine. Logging dominated the land use until establishment of the Park in 1934 (Johnson and Pelton 1979).

Summer bedding sites were located coincidental to other field investigations and characterized on standardized field data forms. Recorded information included date, location, bed dimensions, bed contents, number of scats, overstory, understory, relative density of understory, slope, aspect, elevation, topographic position, and a verbal description of the structure of the bed and the general vicinity. Winter beds were located in conjunction with radiotelemetry studies of predenning activity patterns, denning behavior, and den site selection (Johnson and Pelton 1979, 1981). Statistical comparisons were made with the Chi-square distribution.

Results and Discussion

Bedding Sites

Twenty-five summer beds and 9 winter beds were characterized. Many other summer beds were observed but data were not recorded because of constraints dictated by primary field studies such as minimizing the time between radiotelemetry locations. This reported sample of summer beds, however, appeared representative of bedding sites and bedding behavior of black bears in the Great Smoky Mountains National Park.

All summer beds occurred singly and were distinct, concave depressions with bear scats ($\bar{x} = 2.5$, range = 1–4) adjacent to the bed. Bedding material consisted mostly of dried deciduous leaves, pine needles, or other litter common to the site. No observations were made of bears raking or carrying material into summer beds. Eight summer beds were in game trails.

Seven summer beds were natural depressions on small level areas formed by fallen trees, 3 were on the upslope side at the base of large standing trees, and one was adjacent to a large rock. However, 14 beds were not in the immediate vicinity of similar structures; the majority (11 of 14) being on ridge tops. Beds on steep slopes were more likely to have adjacent structures than beds on relatively flat ridge tops ($P < 0.05$) indicating that these structures

may be important in forming level bedding sites on the steep slopes of the Smokies.

All winter beds occurred singly and were unsheltered, elaborately constructed nest-type structures. Scats were present at only 3 of 9($\bar{x}$ =2, range = 1–3) winter beds and 8 of 9 winter beds were adjacent to obviously selected vertical objects such as large logs, trees, and rocks. Some winter beds may be used as hibernacula but most likely were used only during the predenning period of significantly reduced activity (Johnson and Pelton 1979). Most den sites actually used during hibernation by radio-instrumented bears were well protected tree cavities or sheltered root or rock dens (Johnson and Pelton 1981, Wathen et al. 1983). Elaborately constructed nests, very similar to the winter beds, also were constructed inside most sheltered ground dens (Johnson and Pelton 1979, 1981). Winter beds were constructed by using available branches and twigs to form a general framework and dried deciduous leaves and pine needles to line the bed.

Dimensions of summer and winter beds averaged 1.35 × 0.73 × 0.23 m and 0.79 × 0.62 × 0.21 m (length × width × depth), respectively. The shortened length and generally more oval shape of winter beds may reflect the curled sleeping posture associated with winter denning (Johnson and Pelton 1979). The more elongated shape and concave configuration of summer beds indicated that bears likely rest their heads on the elevated perimeter of beds; this would provide good visibility and detection of scents from the surrounding area. Concave beds also may provide partial concealment to resting bears. Although the dimensions of the actual bed depressions did not differ greatly between seasons, the major difference was in the size of the overall structure because of the large amounts of vegetative material gathered for the construction of winter beds.

No distinct patterns, other than the possible importance of adjacent objects to form level beds on steep slopes, were evident for the slope, aspect, or elevation of summer or winter beds. Bed sites occurred equally among aspects and the slopes of bed sites averaged 18 and 25 degrees and ranged from 0 to 38 degrees and from 11 to 32 degrees for summer and winter beds, respectively. Elevations of beds averaged 932 m and 800 m and ranged from 624 to 1,308 m and 540 to 912 m for summer and winter beds, respectively. All but 3 beds were in remote sections of the Park; these 3 summer beds were near major campgrounds and were likely used by nuisance bears. No quantitative data were taken but the majority of the study area was composed of steep slopes and narrow valleys with ridge tops being very narrow and much less abundant. However, 13 of 25 summer beds occurred on ridge tops indicating a possible preference for ridge tops as summer bedding sites.

The forest types of summer beds included closed oak ($N = 9$) cove hardwood ($N = 6$), open oak-pine ($N = 5$) closed oak-cove hardwood ecotone ($N = 3$), closed oak-northern hardwood ecotone ($N = 1$) and northern hardwood ($N = 1$). Understory composition also was widely variable and

ranged from almost open understories associated with closed oak forest types to dense rhododendron (*Rhododendron maximum*) and mountain laurel (*Kalmia latifolia*) thickets associated with cove hardwood and open oak-pine forest types. The frequency of summer beds within forest types did not differ ($P > 0.10$) from the frequency of radio-telemetry locations within forest types in the same area of the Park (Beeman 1975).

Bedding Behavior

A distinct seasonal cycle of bedding behavior was observed for black bears in the GSMNP that generally corresponded with the bedding cycle reported for European brown bears (Mysterud 1980). Both studies indicated a progressive series of natural contour beds in summer to structurally more complex and sheltered beds in winter. Mysterud (1980) stated that denning behavior could be regarded as bedding behavior which was adapted to longer duration, extreme concealment, better shelter, and winter instead of summer factors of exposure. This statement also was supported by the present study because winter bedding behavior was strongly exhibited by construction of nearly identical nests inside most sheltered ground dens (Johnson and Pelton 1979, 1981). Bedding material is good insulation and nest building clearly represents a well-developed construction behavior associated with winter bedding as well as denning of black bears.

The similarities between the study of Mysterud (1980) and the present study were likely related to common abiotic exposure, concealment, and defensive/psychological factors; parameters that Mysterud (1980) identified, along with construction factors, as being involved in evolution of seasonal bedding behavior of brown bears. Abiotic factors associated with exposure such as wind, moisture, ambient temperature, and light intensity should present similar influences on bedding behavior and result in better temperature regulation for both black and brown bears. Concealment factors associated with vegetative cover, topographic features, and bed or cavity structure also should be equally important in providing defensive/psychological security for secretive animals such as brown and black bears. Mysterud (1980) stated that psychological and habitat imprinting of bear cubs likely occurred in the generally dark, closed, and vertical den chamber. Thus an association of vertical objects and darkness with protection and safety may become a basic and permanent component of bedding, denning, and general behavior. All brown bear beds were located in dark, shady areas and closer than 1.2 m to vertical objects; this was suggested as fulfilling the imprinted pattern associated with security and necessary for relaxation and hibernation (Mysterud 1980).

A preference for dark areas to relax and hide when frightened also was noted during a study of behavioral development of 2 female black bear cubs from the GSMNP (Burghardt and Burghardt 1972). The exposure, concealment, and defensive/psychological factors discussed by Mysterud (1980) for brown bears appeared to be equally applicable, important, and generally

represented in the seasonal pattern of bedding behavior of black bears in the GSMNP. The above was particularly evident because most summer beds were in remote, densely forested, and shaded areas and 8 of 9 winter beds were adjacent to obviously selected vertical objects; also, tree cavities high above ground, which provided superior protection, were preferred as winter dens (Johnson and Pelton 1981). Little is known concerning the role of psychological and habitat imprinting on habitat selection but these factors may have important implications, especially regarding flexibility and adaptability of bears to rapidly induced changes in land use.

The only major difference in seasonal bedding behavior between Mysterud (1980) and this study appeared to be a greater tendency for brown bears to scratch or dig into humus or mineral soil during summer bedding and excavations of winter dens deep into mineral soil. No observations of scratching or digging occurred in association with summer or winter bedding or winter denning of black bears in the GSMNP (Johnson and Pelton 1979, 1981). Brown bears are better adapted for digging than black bears (Herrero 1972) and this difference in bedding behavior appeared to be an inherent species difference related to the evolution of brown bears in open, nonforested habitats where construction of dens and beds was often necessary. Whereas, black bears evolved in forested habitats where natural cavities, depressions, shade, and vertical objects, that provided adequate security, were readily available.

Literature Cited

Alt, G. L., F. W. Alt, and J. S. Lindzey. 1976. Home range and activity patterns of black bears in northeastern Pennsylvania. Trans. Northeast. Sect. Wildl. Soc. 33:45–56.

Amstrup, S. C. and J. Beecham. 1976. Activity patterns of radio-collared black bears in Idaho. J. Wildl. Manage. 40:340–348.

Beeman, L. E. 1975. Population characteristics, movements, and activities of the black bear (*Ursus americanus*) in the Great Smoky Mountains National Park. Ph.D. Diss. Univ. Tenn., Knoxville. 218pp.

Burghardt, G. W. and L. S. Burghardt. 1972. Notes on behavioral development of two female black bear cubs: the first eight months. Proc. Intl. Conf. Bear Res. Manage. 2:207–220.

Garshelis, D. L. and M. R. Pelton. 1980. Activity of black bears in the Great Smoky Mountains National Park. J. Mammal. 61:8–19.

Hamilton, R. J. and R. L. Marchinton. 1980. Denning and related activities of black bears in the Coastal Plain of North Carolina. Proc. Intl. Conf. Bear Res. Manage. 4:121–126.

Herrero, S. 1972. Aspects of evolution and adaption in American black bears (*Ursus americanus Pallas*) and brown and grizzly bears (*U. arctos Linne'*) of North America. Proc. Intl. Conf. Bear Res. Manage. 2:221–231.

Johnson, K. G. and M. R. Pelton. 1979. Denning behavior of black bears in the

Great Smoky Mountains National Park. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies. 33:239–249.

——— and ———. 1981. Selection and availability of dens for black bears in Tennessee. J. Wildl. Manage. 45:111–119.

Lindzey, F. G. and E. C. Meslow. 1976. Winter dormancy in black bears in southwestern Washington. J. Wildl. Manage. 40:408–415.

——— and ———. 1977. Home range and habitat use by black bears in southwestern Washington. J. Wildl. Manage. 41:413–425.

Mysterud, I. 1980. Characteristics of summer beds of European brown bears in Norway. Proc. Intl. Conf. Bear Res. Manage. 5:208–222.

Tietje, W. D. and R. L. Ruff. 1980. Denning behavior of black bears in boreal forest of Alberta. J. Wildl. Manage. 44:858–870.

Wathen, W. G., K. G. Johnson, and M. R. Pelton. 1983. Characteristics of black bear dens in the Southern Appalachian region. Proc. Intl. Conf. Bear Res. Manage. 6: (In press.)