DENNING ECOLOGY OF BLACK BEARS IN THE TENSAS RIVER BASIN OF LOUISIANA

KEITH M. WEAVER,[1] U.S. Fish and Wildlife Service, Route 2, Box 295, Tallulah, LA 71282
MICHAEL R. PELTON, Department of Forestry, Wildlife, and Fisheries, University of Tennessee, P.O. Box 1071, Knoxville, TN 37901

Abstract: We studied denning chronology, den use, and den characteristics of the Louisiana black bear (*Ursus americanus luteolus*) in the remnant bottomland hardwood forests of the Tensas River Basin in northeastern Louisiana. We monitored 20 radio-collared bears (12 F, 8 M) for 30-den years during 1988-89, 1989-90, and 1990-91. Pregnant females (n= 9) entered dens earlier (P = 0.0002), emerged later (P = 0.0003), and denned longer (P = 0.0004) than all other bears. Pregnant females denned for an average of 142 days; they entered dens as early as 26 November and emerged as late as 30 May. At least 45% (n = 13) of bears used >1 den site during a denning season. Some (34%, n = 10) bears displayed some winter activity, and an adult male did not den during 1 year of the study. Bears denned in elevated cavities in bald cypress (*Taxodium distichum*) (n = 17), overcup oak (*Quercus lyrata*) (n = 2) and sycamore (*Platanus occidentalis*) (n = 1), ground nests (n = 17), and brushpiles (n= 7). Tree dens were used by 80% (n = 12) of all adult females and 68% (n =15) of all adults. Only 1 bear, an adult male, reused a den (cypress). Bears denning in trees were less vulnerable to human disturbance than ground-denning bears. Availability of denning sites does not appear to be a limiting population factor but forestry management practices should be directed toward conserving forested wetlands and den trees, maintaining thick cover for ground dens, and reforestation.

Int. Conf. Bear Res. and Manage. 9(1):427-433

The Louisiana black bear once inhabited the forested regions of eastern Texas, Louisiana, and southern Mississippi (Hall 1981). Extensive habitat destruction, mainly a result of land clearing for agriculture, eliminated bear habitat by >80% by 1980 (Neal 1990). The range of the Louisiana bear was reduced to core populations in the Tensas and Atchafalaya River Basins in Louisiana (Weaver et al. 1991) and to small, scattered populations in Mississippi (Shropshire 1991). Concern over the survival of the subspecies, and its vulnerability to habitat loss, prompted the U.S. Fish and Wildlife Service to designate the Louisiana black bear as threatened within its historical range (Fed. Register 1992, 57:588-595). Other black bear subspecies occurring within the historic range of *U. a. luteolus* were designated as threatened due to similarity of appearance. Because limited biological data were available, the U.S. Fish and Wildlife Service initiated research in the Tensas River Basin in 1987 for use in status assessment and development of management strategies for *U. a. luteolus*.

An understanding of denning ecology is essential for proper development of black bear management plans (Pelton 1985, Hillman and Yow 1986, Hellgren and Vaughan 1989, Weaver et al. 1990) and hunting season regulations (Johnson and Pelton 1979, Alt 1980, Lindzey 1981, O'Pezio et al. 1983, Kolenosky and Strathearn 1987). Black bear denning had been extensively studied in North America, except in the coastal plain of southeastern United States. Published accounts exist for the Great Dismal Swamp in Virginia-North Carolina (Hellgren and Vaughan 1989), coastal North Carolina (Hamilton and Marchinton 1980), northcentral Florida (Wooding and Hardisky 1992), and the White River Basin in southeastern Arkansas (Smith 1986). Taylor (1971) described denning activities of 3 radio-collared Minnesota black bears (*U. a. americanus*) that had been introduced into the Upper Atchafalaya Basin of Louisiana during 1964-67 as part of a restocking program. Our account represents the first documented information on the denning ecology of native Louisiana black bears. We studied denning chronology, den use, and den characteristics of a Louisiana black bear population in the remnant bottomland hardwood forests of the Tensas River Basin in northeastern Louisiana.

We gratefully acknowledge the Tensas River National Wildlife Refuge staff for their dedicated assistance with fieldwork, especially L. Watson for many boating expeditions into Lost Brake to locate and monitor denned bears. Many private landowners, particularly Deltic Farm and Timber Co., Inc., graciously provided access to their land for research. H.E. Perry was an invaluable asset to our activities on Deltic lands. C.R. McLaughlin, F.T. Van Manen, D. Brandenburg and E.C. Hellgren provided valuable developmental input into the manuscript. T. White typed all drafts of the manuscript. Funding for this study was provided by the U.S. Fish and Wildlife Service.

[1] Present address: USDA Forest Service, 120 Austin Ave., Greenville, TN 37743.

STUDY AREA

The 620 km^2 Tensas River Basin study area was located in northeastern Louisiana in the alluvial plain of the Mississippi River (Fig. 1). The approximate center of the study area was located at about 32°20' north latitude and 91°23' west longitude. Within the Tensas Basin, bears existed almost exclusively in approximately 40,000 ha of fragmented, bottomland hardwood forest, located in the Parishes of Madison and Tensas and adjoining portions of East Carroll, Richland, and Franklin. About 80% of bear habitat was in public ownership in the 24,000-ha Tensas River National Wildlife Refuge and the adjacent 8,000-ha Big Lake Wildlife Management Area. Approximately 2,800 ha of privately owned forest was located within or adjacent to the Tensas/Big Lake complex, which was entirely surrounded by agricultural lands. The remainder of forest in the study area was located within 21 km of the Tensas/Big Lake complex and existed as insular tracts ranging in size from <16-1,350 ha.

Elevations on the study area ranged from 18 to 26 m and the majority of soils were classified in the Sharkey and Tensas-Sharkey Associations (Weems et al. 1982). The forests were seasonally flooded due to heavy winter and spring rains, flat topography, and poor drainage. This flooding regime contrasted with many other bottomland hardwood forests located in the Lower Mississippi River Valley (e.g., the White River Basin in southeastern Arkansas [Smith 1986]) that were subject to overflow or backwater flooding. The Tensas forests were composed of second- and third-growth stands in the 40- to 80-year age class. The study area was interspersed by the Tensas River, cypress sloughs, bayous, natural lakes, agricultural lands, oil wells, and gravel and hard-surface roads including Interstate 20 that ran east-west across the northern portion of the study area.

Overstory trees included sweetgum (*Liquidambar styraciflua*), cherrybark oak (*Quercus falcata* var. *pagodaefolia*), willow oak (*Q. phellos*), water oak (*Q. nigra*), Nuttall oak (*Q. nuttallii*), overcup oak, sugarberry (*Celtis laevigata*), green ash (*Fraxinus pennsylvanica*), elm (*Ulmus* spp.), and bald cypress. Predominant understory plants included palmetto (*Sabal minor*), switchcane (*Arundinaria gigantea*), greenbriar (*Smilax* spp.), blackberries (*Rubus* spp.), and poison ivy (*Rhus radicans*).

Climatic conditions were characterized by hot, humid summers, mild winters, and abundant rainfall. Average high and low temperatures (°C), and average rainfall (cm), respectively, during the denning seasons of 1988-89, 1989-90, and 1990-91 were: December (13, 1; 17); January (13, 4; 23); February (15, 5; 18); March (19, 12; 14), and April (24, 13; 24). Annual rainfall averaged 156.7 cm. Weather data were recorded in Tallulah, Louisiana, about 12 km east of the study area.

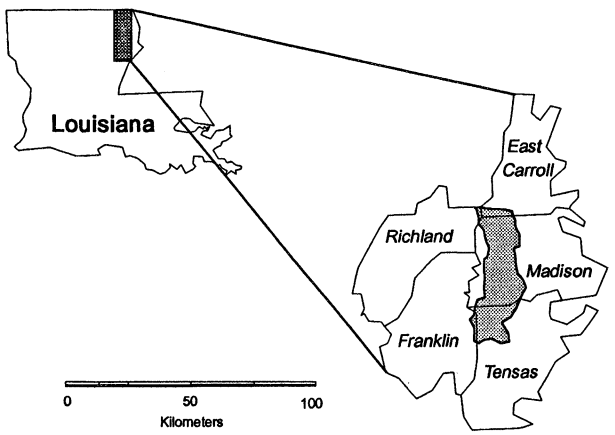

Fig. 1. Location of the Tensas River Basin black bear study area in Louisiana, 1988-91.

METHODS

Black bears were captured with Aldrich foot snares. Bears were fitted with motion-sensitive radio collars equipped with leather or cotton breakaway spacers (Hellgren et al. 1988), and released at their capture sites. Ages were estimated from cementum annuli counts in premolar cross-sections (Willey 1974). Age classes were defined as yearlings (1- to 2-year-olds), subadults (2- to 3-year-olds and 3-year-old females that had not reproduced), and adults (all other bears ≥3 years old).

Ground and aerial radiotracking were used in an attempt to locate bears 1-3 times per week. Den entrance was defined as the midpoint date between the last active location and the first location in the den. Den location was determined by ground or aerial observations or by repeated triangulations in the same location. Den emergence was defined as the midpoint date between the last location in the den and first location away from the den site as determined by observation or triangulation. However, we considered bears to be denned as long as they continued to occupy a tree den, nest, or brushpile, even if they changed locations. When den occupancy ceased and continuous movements began we considered their denning period ended. Denning-period length was calculated as the number of days elapsed between the midpoint dates of

den entrance and emergence. Denning-chronology data were analyzed with respect to age-sex group and reproductive status using the Wilcox-Mann-Whitney test (Steel and Torrie 1980).

Den sites were visited to verify onset and cessation of denning and to document den type, den characteristics, site characteristics, den habitat, and reproduction. Dens were classified as tree cavities, ground nests, or brushpiles. Brushpile dens were defined as a felled treetops or other brushpiles that contained beds and provided top cover and cover on ≥ 3 sides. Ground nests were defined as constructed beds with no top cover and cover on <3 sides. Den-cavity heights, tree heights, and tree lean were measured with a clinometer. Height measurements were calculated from ground level to the center of the cavity and to the top of the crown. Cavity directions were determined with a hand-held compass. Tree diameters were measured at breast height (or above the swell on buttressed trees). Visibility at nest and brushpile sites was estimated as the greatest distance from which the denned bears were visible to the observer.

RESULTS

We studied the denning activities of 20 bears (12 F, 8 M) during 1988-89 ($n = 6$), 1989-90 ($n = 12$), 1990-91 ($n = 12$). Data were obtained for 30 den-years (15 adult and 4 subadult females, and 8 adult and 3 subadult males). Nine bears (6 F, 3 M) were monitored for consecutive years and 1 female was monitored in alternate years. Females averaged 6.8 years (range = 2-16) and males averaged 3.5 years (range = 2-5).

Denning Chronology

Denning-chronology data were obtained for 29 bears (Table 1). An adult male did not den during 1989-90 and was not included in calculating denning statistics. Pregnant females entered dens earlier ($P = 0.0002$), emerged later ($P = 0.0003$), and denned longer ($P = 0.0004$) than other bears. Females entered dens earlier ($P = 0.0005$), emerged later ($P = 0.0309$), and denned longer ($P = 0.0013$) than males. Average female denning period was 104 days. Adult bears entered dens earlier ($P = 0.0413$), emerged later ($P = 0.0101$), and denned longer ($P = 0.0276$) than subadults. Average adult denning period was 95 days. Three adult males and 1 subadult male denned for <30 days ($\bar{x} = 21$ days, range = 6-27). Movements not influenced by our activities were recorded for 18 (60%) bears in January, 13 (43%) in February, and 14 (47%) in March. These included pre- and post-denning movements, changing den sites, and foraging and returning to ground nests. Fresh scat were observed throughout the winter at the dens of 10 bears; 80% of these were ground nesters.

Den Use

Three types of dens were used by monitored bears: tree dens (62%), ground nests (28%), and brushpiles (21%) (Table 2). Three bears used 2 different den types during the study.

At least 45% ($n = 13$) of the bears used >1 den site in the course of a denning season. No pattern in sex and age groups was apparent among multiple-site users. One pregnant female changed tree dens in both years that she was monitored. In late December 1989, she changed dens for unknown reasons and whelped at least 1 cub in the second tree. Between 11 and 26 January, after rising floodwaters filled the cavity of her cypress den with about 1 m of water, she moved to another cypress about 100 m away. A dead cub was found floating in the flooded cavity on 27 January. We were unable to determine if any other cubs survived.

Consecutive-year denning data were recorded for 10

Table 1. Denning chronology of black bears in the Tensas River Basin, Louisiana, 1988-91.

		Entrance	Emergence	Denning period
Age-sex group	*n*	$\bar{x}$ (range)	$\bar{x}$ (range)	$\bar{x}$ days (range)
Pregnant F	9	4 Dec (26 Nov-12 Dec)	24 Apr (6 Apr-30 May)	142 (116-186)
F with yearlings	5	12 Jan (3 Jan-29 Jan)	6 Apr (11 Mar-26 Apr)	85 (42-114)
Solitary adult F	1	23 Dec	19 Mar	87
Subadult F	4	14 Jan (3 Jan-23 Jan)	9 Mar (22 Feb-22 Mar)	56 (41-69)
Adult M	7	28 Jan (14 Dec-19 Feb)	17 Mar (26 Feb-29 Mar)	49 (25-95)
Subadult M	3	6 Feb (30 Jan-19 Feb)	14 Mar (23 Feb-5 Apr)	37 (6-66)

Table 2. Types of dens used by black bears in the Tensas River Basin, Louisiana, 1988-91.

Age-sex group	*n*	Den type		
		Tree cavity	Ground nest	Brushpile
Pregnant F[a]	9	7		3
F with yearlings	5	4		1
Solitary adult F	1	1		
Subadult F[b]	4	1	3	2
Adult M	7	3	4	
Subadult M	3	2	1	
Total	29[c]	18	8	6

[a] One pregnant female used brushpile and tree cavity.
[b] Two subadult females used nests and brushpiles.
[c] One bear did not den during 1 year of the study.

bears. Four of these changed the type of den they used. An adult male reused a cypress den. An adult male that did not den during his first year of monitoring used a tree den the following year.

Den Characteristics

Den Trees.—We recorded use of 20 dens in elevated tree cavities. Seventeen (85%) of the den trees were bald cypress, 2 were overcup oak, and 1 was a sycamore stump. Only 1 of the den trees was dead (an overcup oak).

We measured 18 den trees. Crown heights averaged 27 m (range = 8-39 m) above ground. Tree diameters averaged 183 cm (range = 122-257 cm) for cypress and 99 cm (range = 86-117 cm) for overcup oak. Average tree lean was 10° (range = 0-20°).

Cavity entrances were created from broken tops and broken limbs. Top break entrances were formed by the trunk or crown breaking off and creating a chimney-like effect. Limb break entrances were lateral entrances on the main trunk. Cavity entrance heights averaged 14 m (range = 6-27 m) above the ground. Nine cavities (50%) faced southward.

Den trees (n = 20) were located in or adjacent to water. Ten trees (50%) were located in permanent sloughs with normal water depths ranging from 1 to >3 m. The remainder were located in seasonally-flooded flats with water levels varying from 0 to >2 m, or on bayou banks or lake edges.

Ground Nests.—Ground nests (n = 17) were made of circular, matted vegetation or from stacked palmettos. Average dimensions of circular nests (n = 11) were about 83 × 66 × 17 cm. Most (82%) of the circular nests were lined with materials including shredded palmetto, vines, small branches, leaves, and wood chips. Most (73%) circular nests were built in a dug-out depression in the ground.

Stacked nests (n = 6) were composed of palmetto bitten off about 15-46 cm above the ground and carried up to 5 m to the nest site and piled. These nests were not dug out underneath. Average dimensions of stacked nests were 80 × 61 × 15 cm.

Nests were located in wooded habitat. An adult male nested in a cypress drain about 150 m wide surrounded by >1,200 ha of open agricultural lands. Most (72%) nests were located in woods that had received some form of timber harvest within about 5 years. Visibility of the bear on the nest to the observer ranged from about <10-30 m. Most (82%) nests were constructed against objects or backstops such as felled logs, tree tops, or the largest trees in the vicinity.

Brushpile Dens.—Brushpile dens (n = 7) were in tree tops remaining from timber harvest within about 5 years. They contained beds similar to ground nests but less extensively prepared. Four beds in brushpiles were measured; dimensions were 77 × 67 × 15 cm. Chamber dimensions inside brushpile dens averaged 129 × 100 × 78 cm. Visibility of the bear in the brushpile to the observer ranged from about <3-15 m.

DISCUSSION

Wide variation in geography and habitat in published accounts of denning make direct comparisons somewhat difficult. Differences exist in denning chronology, den use, and den characteristics. Denning periods were shorter in the Tensas River Basin than those reported in northern and western studies (e.g., Beecham et al. 1983, LeCount 1983, Kolenosky and Strathearn 1987, Schwartz et al. 1987). Entrance dates in these studies were up to 2 months earlier than in the Tensas Basin, but emergence dates were comparable. The results of our study support the notion of decreased denning periods along a north-south latitudinal gradient (Kolenosky and Strathearn 1987, Hellgren and Vaughan 1989, Wooding and Hardisky 1992).

Denning-period lengths for Tensas bears were similar to those reported in coastal plain studies. However, Tensas Basin male bears denned for shorter periods than those in the White River Basin in Arkansas (Smith 1985) and in the Great Dismal Swamp of Virginia-North Carolina (Hellgren and Vaughan 1989). Pregnant females in the Tensas Basin denned about 3 weeks longer than those in the Great Dismal Swamp. Pregnant females in the Tensas Basin and in Florida

(Wooding and Hardisky 1992) denned for similar periods, but nonpregnant Florida black bears denned for shorter periods. Smith (1985), Hellgren and Vaughan (1989), and Wooding and Hardisky (1992) reported that pregnant females entered dens earlier, emerged later, and denned longer than other age-sex groups. This pattern also was evident in the Tensas Basin.

Some bears in this study denned for short periods or changed den sites frequently during the denning season. We also monitored 1 adult male that did not den. Winter activity and nondenning bears were observed in other southeastern coastal plain studies (Hamilton and Marchinton 1980, Smith 1985, Hellgren and Vaughan 1987, Lombardo 1991, Wooding and Hardisky 1992). Fresh scats were found at nest sites throughout our study indicating that bears were occupying nests yet continued to forage. Apparently, some foods remain available to bears throughout the winter in the Tensas Basin.

Our understanding of ground-den chronology was equivocal because we could not approach the bears close enough to observe their den type and actual location without disturbing them. However, bears denning in brushpiles where no visual contact with observers was made did not abandon dens. Ground-nest abandonment by bears in the southeastern coastal plain was also reported by Smith (1986), Hellgren and Vaughan (1989) and Lombardo (1991). Movements of ground-denning bears may also be caused by other human activities, such as hunting or logging in bear habitat during the denning season. Rapidly fluctuating water levels could also stimulate movements of ground-denning bears on flood-prone sites.

It is uncertain what controls the onset and cessation of denning. Factors such as photoperiod, temperature, precipitation, snow cover, food availability, reproductive status, and physical condition have been suggested (Lindzey and Meslow 1976; Johnson and Pelton 1979, 1980; Schwartz et al. 1987, Graber 1990). Corn feeders used by hunters to bait white-tailed deer (*Odocoileus virginianus*), a legal hunting method on private land in Louisiana, commonly attract bears and may artificially prolong winter activity by providing an easily obtainable food source. In late spring, floodwaters may delay den emergence, particularly when females with new cubs are using den trees.

Although we do not claim that tree dens are essential for survival in bottomland hardwood forests (since other types of dens are also used successfully), they appeared to be important den sites in the Tensas Basin. Advantages of tree dens over ground dens could include factors such as energy conservation (Johnson et al. 1978, Lentz et al. 1983), and protection from the elements (Pelton et al. 1980), disturbances from humans (Pelton et al. 1980), and protection against predation by other black bears (Alt and Gruttadauria 1984, Tietje et al. 1986). The swamp habitat, in which a majority of Tensas Basin tree dens were located, would appear to increase the security of these dens compared to ground dens. However, we did not study availability of den trees within bear home ranges. Bears that consistently used ground dens might have used areas that did not have den trees, or perhaps, den trees within their ranges were already occupied by other bears.

In the coastal plain, only Taylor (1971) and Smith (1985) also reported high use of tree dens. The bears studied by Taylor (1971) in the Atchafalaya Basin of Louisiana used elevated cavities in hollow cypress, green ash, and tupelo gum (*Nyssa aquatica*). On White River National Wildlife Refuge, females exclusively used tree dens, but males used trees and ground nests (Smith 1985). Five species of trees were used as dens, mainly overcup oak (61%) and cypress (17%). Reuse of tree dens on White River was 26% compared to 10% on Tensas. The characteristics of the tree dens in the Tensas Basin were similar to those reported by Taylor (1971) and Smith (1985), but Tensas dens were generally larger and cavity entrances higher.

The ground nests observed in our study were similar in size, construction, and site characteristics to nests reported by Smith (1985) and Hellgren and Vaughan (1989). However, we report for the first time the use of brushpiles, an elevated stump cavity, and stacked palmetto nests for ground dens in a southeastern coastal plain population.

MANAGEMENT IMPLICATIONS

Although the availability of den sites did not appear to be a limiting population factor in the bottomland hardwood forests of the Tensas Basin, the conservation of these sites (particularly forested wetlands) should be a part of any bear management program. Private landowners and public land-management agencies should be encouraged to protect den trees and allow for recruitment of potential den trees into bear habitat. The presence of den trees can be promoted by protecting snags and cavity trees from harvest, by implementing no-logging buffer strips around sloughs, lakes, and waterways, and by managing for potential den tree species such as cypress, tupelo gum, overcup oak, sycamore, and green ash. Thick cover for ground denning can be improved by retaining logging slash following timber harvests, protecting switchcane and

palmetto thickets, and reforestation of nonproductive open land. The importance of tree dens to Louisiana black bears was recognized by the U.S. Fish and Wildlife Service in the threatened listing rule for *U. a. luteolus* (Fed. Register 1992, 57(4), pp. 494-5): "Any activities causing destruction of known or candidate den trees, or den tree sites are prohibited." Candidate den trees are defined in the regulation as cypress or tupelo gum with visible cavities and with diameters ≥91 cm, that are located in or along waterbodies or waterways. These regulations not only protect existing and potential den trees but also provide for the maintenance of forest conditions for denning habitat.

LITERATURE CITED

ALT, G.L. 1980. Hunting vulnerability of bears. Penn. Game News. 51(7):7-10.

_____, AND J.M. GRUTTADAURIA. 1984. Reuse of black bear dens in northeastern Pennsylvania. J. Wildl. Manage. 48:236-239.

BEECHAM, J.J., D.G. REYNOLDS, AND M.G. HORNOCKER. 1983. Black bear denning activities and den characteristics in west-central Idaho. Int. Conf. Bear Res. and Manage. 5:79-86.

GRABER, D.M. 1990. Winter behavior of black bears in the Sierra Nevada, California. Int. Conf. Bear Res. and Manage. 8:269-272.

HALL, E.R. 1981. The mammals of North America. Vol. 2. John Wiley and Sons, New York, N.Y. 1,181pp.

HAMILTON, R.J., AND R.L. MARCHINTON. 1980. Denning and related activities of black bears in the coastal plain of North Carolina. Int. Conf. Bear Res. and Manage. 4:121-126.

HELLGREN, E.C., D.W. CARNEY, N.P. GARNER, AND M. R. VAUGHAN. 1988. Use of breakaway cotton spacers in radiocollars. Wildl. Soc. Bull. 16:216-218.

_____, AND M.R. VAUGHAN. 1987. Home range and movements of winter-active black bears in the Great Dismal Swamp of Virginia and North Carolina. Int. Conf. Bear Res. and Manage. 7:227-234.

_____, and _____. 1989. Denning ecology of black bears in a southeastern wetland. J. Wildl. Manage. 53:347-353.

HILLMAN, L.L., AND D.L. YOW. 1986. Timber management for black bear. Proc. East. Workshop. Black Bear Manage. and Res. 8:125-136.

JOHNSON, K.G., D.O. JOHNSON, AND M.R. PELTON. 1978. Simulation of winter heat loss for a black bear in a closed tree den. Proc. East. Workshop Black Bear Manage. and Res. 4:155-166.

_____, and M.R. Pelton. 1979. Denning behavior of black bears in the Great Smoky Mountains National Park. Proc. Annu. Conf. Southeast. Fish and Wildl. Agencies. 33:239-249.

_____, AND _____. 1980. Environmental relationships and the denning period of black bears in Tennessee. J. Mammal. 61:653-660.

KOLENOSKY, G.B., AND S.M. STRATHEARN. 1987. Winter denning of black bears in east-central Ontario. Int. Conf. Bear Res. and Manage. 7:305-316.

LECOUNT, A.L. 1983. Denning ecology of black bears in central Arizona. Int. Conf. Bear Res. and Manage. 5:71-78.

LENTZ, W.M., R.L. MARCHINTON, AND R.E. SMITH. 1983. Thermodynamic analysis of northeastern Georgia black bear dens. J. Wildl. Manage. 47:545-550.

LINDZEY, F.G. 1981. Denning dates and hunting seasons for black bears. Wildl. Soc. Bull. 9:212-216.

_____, AND C.G. MESLOW. 1976. Winter dormancy in black bears in southwestern Washington. J. Wildl. Manage. 40:408-415.

LOMBARDO, C.A. 1991. Denning ecology of black bears on Marine Corps Base, Camp Lejeune, N.C. Proc. East. Workshop Black Bear Manage and Res. 10:189.

NEAL, W.A. 1990. Proposed threatened status for the Louisiana black bear. Fed. Register, 21 June 1990. 5(120):25341-25345.

O'PEZIO, J., S.H. CLARKE, AND C. HACKFORD. 1983. Chronology of black bear denning in the Catskill Region of New York. Int. Conf. Bear Res. and Manage. 5:87-94.

PELTON, M.R. 1985. Habitat needs of black bears in the East. Pages 49-53 *in* D.L. Kulhavy and R.N. Conner, eds. Wilderness and natural areas in the eastern United States: a management challenge. Cent. for Appl. Stud., Stephen F. Austin State Univ., Nacogdoches, Tex.

_____, L.E. BEEMAN, AND D.C. EAGAR. 1980. Den selection by black bears in the Great Smoky Mountains National Park. Int. Conf. Bear Res. and Manage. 4:149-151.

SCHWARTZ, C.C., S.D. MILLER, AND A.W. FRANZMANN. 1987. Denning ecology of three black bear populations in Alaska. Int. Conf. Bear Res. and Manage. 7:281-291.

SHROPSHIRE, C.C. 1991. Mississippi status report. Proc. East. Workshop. Black Bear Manage. and Res. 10:49-50.

SMITH, T.R. 1985. Ecology of black bears in a bottomland hardwood forest in Arkansas. Ph.D. Thesis, Univ. of Tennessee, Knoxville. 208pp.

_____. 1986. Activity and behavior of denned black bears in the Lower Mississippi River Valley. Int. Conf. Bear Res. and Manage. 6:137-143.

STEELE, R.G.D., AND J.H. TORRIE. 1980. Principles and procedures of statistics. 2nd ed. McGraw-Hill, New York, N.Y. 633pp.

TAYLOR, D.F. 1971. A radio-telemetry study of the black

bear (*Euarctos americanus*) with notes on its history and present status in Louisiana. M.S. Thesis, La. State Univ., Baton Rouge. 87pp.

TIETJE, W.D., B.O. PELCHAT, AND R.L. RUFF. 1986. Cannibalism of denned black bears. J. Mammal. 67:762-766.

WEAVER, K.M., J.C. POSEY, AND M.D. ESTERS. 1991. Louisiana black bear status report. Proc. East. Workshop Black Bear Manage and Res. 10:23-29.

_____, D.K. TABBERER, L.U. MOORE, JR. G.A. CHANDLER, J.C. POSEY, AND M.R. PELTON. 1990. Bottomland hardwood forest management for black bears in Louisiana. Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 44:342-350 .

WEEMS, T.A., E.F. REYNOLDS, R.L. VENSON, E.T. ALLEN, AND T.J. SMITH. 1982. Soil survey of Madison Parish, Louisiana. Soil Conserv. Ser. Wash., D.C. 101pp.

WILLEY, C.H. 1974. Aging black bears from first premolar tooth sections. J. Wildl. Manage. 38:97-100.

WOODING, J.B., AND T.S. HARDISKY. 1992. Black bear denning in northcentral Florida. J. Mammal. 73:895-898.