Habitat Selection and Home Range Dynamics of Eastern Spotted Skunks in the Ouachita Mountains, Arkansas, USA

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ABSTRACT Since the 1940s, eastern spotted skunks (*Spilogale putorius*) have declined dramatically throughout the Midwest. One hypothesis for the decline is the loss of suitable habitat, although little is known about the ecological requirements of this species. To elucidate seasonal home range and habitat selection by eastern spotted skunks, we conducted telemetry-based field work in the Ouachita Mountains of western Arkansas, USA. During 2 years of field work, we collected day- and nighttime radiolocations for 33 eastern spotted skunks. We used kernel-based utilization distributions, volume of intersection indices, and weighted compositional analysis to evaluate seasonal home range dynamics and habitat selection. Although we found moderate adult male site fidelity, there were large seasonal differences in home range size, with ranges of between 76 ha and 175 ha (± 22–62 SE) during summer, fall, and winter, and home ranges of 866 ha (± 235 SE) during spring. Male home range increases in the spring were likely caused by questing behavior in search of reproductive females. Females maintained home ranges of 54 ha to 135 ha (± 7–30 SE) and moderate site fidelity during all seasons. During each season, we observed selection of young shortleaf pine (*Pinus echinata*) and hardwood stands over other available cover types, likely due to a preference for a dense, complex understory and a closed canopy overstory to reduce predation risk. Most habitats in the study region were managed for an herbaceous understory and an older, more open canopy, in part to benefit red-cockaded woodpecker (*Picoides borealis*) populations. Thus, if simultaneous management for these 2 vertebrates is a goal, a balance of early and late successional habitat should be reached. (JOURNAL OF WILDLIFE MANAGEMENT 73(1):18–25; 2009)

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The eastern spotted skunk (*Spilogale putorius*) is a small, omnivorous mephitid that was historically found throughout much of the central and southeastern United States. Although currently localized in distribution, the species was once abundant throughout its range (Kinlaw 1995, Gompper and Hackett 2005). Harvest records for the Great Plains states in the early 20th century indicate that the eastern spotted skunk was a common and economically important furbearer, with annual multistate harvests of >100,000 animals (Gompper and Hackett 2005). However, in the 1940s a decline in harvest of the species began, and by the 1980s harvests were <1% of those during predecline years. This harvest decline likely reflects a real decline in the population and not merely reduced harvest effort (Gompper and Hackett 2005). No primary cause for the decline has been identified, although habitat change, pesticide use, modernization in agriculture, overharvest, and disease outbreaks have been proposed as explanations (Choate et al. 1974, McCullough 1983, Schwartz and Schwartz 2001, Gompper and Hackett 2005). State wildlife agencies throughout most of the Midwest and some southeastern states currently list the eastern spotted skunk as endangered, threatened, or a species of conservation concern (Gompper and Hackett 2005). In Arkansas, USA, the eastern spotted skunk was listed as a species of conservation concern in 2006.

Management decisions for the eastern spotted skunk have been made based on a limited and often anecdotal understanding of the ecology and natural history of the species. Information on the basic spatial ecology of the species is based on 2 studies: one conducted in Iowa, USA, on an agricultural landscape in the 1940s when the species was common (Crabb 1948), and one that examined habitat use and home range size of 4 males in the Missouri Ozarks, USA (McCullough and Fritzell 1984). Thus, knowledge of habitat selection, such as whether the eastern spotted skunk is a forest, prairie, or edge-associated species, remains superficial. Crabb (1948) believed the species to be prairie adapted, whereas McCullough (1983; McCullough and Fritzell 1984) suggested a preference for forest habitats. Locations of 4 captures led Reed and Kennedy (2000) to believe the species was associated with dense undergrowth. Mammal reference sources report that wetlands and dense timber stands are avoided and habitat is selected to avoid predators (Sealander and Heidt 1990, Kinlaw 1995, Nowak 1999). A more detailed assessment of the factors affecting space use by eastern spotted skunks is needed. Thus, our objective was to quantify seasonal home range dynamics and habitat selection of eastern spotted skunks in the Ouachita Mountains of western Arkansas.

STUDY AREA

We conducted field work in the Poteau Ranger District (PRD; 96,755 ha), Ouachita National Forest (ONF;

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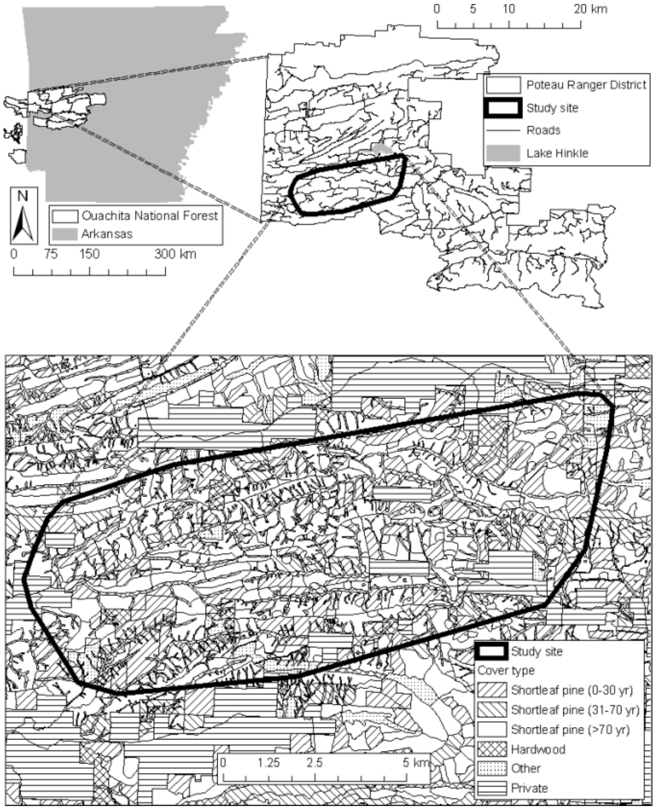

Figure 1. Map of eastern spotted skunk study site (expanded) in west-central Arkansas, USA, Poteau Ranger District (expanded), Ouachita National Forest, 2005–2006. Boundary of the 8,784-ha study site is the minimum convex polygon around the collection of study animal home ranges.

690,000 ha), Scott County, Arkansas (Fig. 1). The Ouachita Mountain physiographic region is located in west-central Arkansas and southeastern Oklahoma, USA (Bailey 1980). Mountain ridges were formed from sedimentary rock formations compressed into great folds. Linear ridges reach maximum elevations of about 790 m and trend east–west. The climate was one of warm winters, hot, dry summers, an average temperature of 17° C, and average annual precipitation of 105 cm. The dry sandstone ridges and south and west aspects of the Ouachita Mountains were covered with as much as 40% shortleaf pine (*Pinus echinata*), and 73% of the study site was managed as shortleaf pine stands. Hardwoods (*Quercus* spp. and *Carya* spp.) dominated the rich alluvial soil bottomlands of the valleys and north aspects of the mountains.

In 1996, the United States Forest Service (USFS) began a large-scale ecosystem restoration project to meet a shortleaf pine–native plant (e.g., bluestem in the genera *Andropogon* and *Schizachyrium*) ecosystem objective on 62,730 ha in the ONF (United States Department of Agriculture [USDA] 1996). This management program created an open canopy with herbaceous vegetation in the understory and provided habitat for a recovered population of federally endangered red-cockaded woodpeckers (*Picoides borealis*; Lochmiller et al. 1994, Bukenhofer and Hedrick 1997, Masters et al. 1998). Ecosystem restoration and maintenance was accomplished by reducing tree basal areas through commercial and noncommercial thinning of shortleaf pine stands and increasing use of prescribed fire (Bukenhofer et al. 1994, Bukenhofer and Hedrick 1997). Additionally, the USFS increased shortleaf pine stand rotation age from 70 years to 120 years to increase the number of fungal heart rot (*Phellinus pinii*)–infected shortleaf pine trees, an important habitat characteristic of the cavity-dependent red-cockaded woodpecker (USDA 1996, Bukenhofer and Hedrick 1997). Another management technique used in the PRD was retention of streamside management zones (SMZs) within the intensively managed shortleaf pine stand mosaic. The SMZs were managed natural hardwood forest stands retained along intermittent and perennial streams and accounted for 87% of the hardwood management stands in the study site (Miller et al. 2004).

We defined the extent of the study area using a minimum convex polygon around the collection of study animal home ranges, resulting in an 8,784-ha study site (Fig. 1). We defined habitat patches within the study area based on stand age and forest management practices. These patches were heavily managed and relatively homogeneous. We recognized the following cover types: young (0–30 yr old) shortleaf pine (23% of the study site), middle-aged (31–70 yr old) shortleaf pine (6%), mature (>70 yr old) shortleaf pine (44%), hardwood (16%), private property (7%), and other (those habitats occurring in low proportions; 4%; Table 1). The low proportion of middle-aged shortleaf pine in the study site was a result of historic timber harvest practices (W. G. Montague, USFS, personal communication). Because of forest age, species composition, and management approaches, these cover types differed in structure. Mature shortleaf pine forest had more open canopy and typically 10–13 times less dense understory woody vegetation compared to young shortleaf pine forest (Masters 2007; R. W. Perry, USFS, unpublished data; Table 1). These cover types were well delineated and monitored by the USFS, and good historic data existed on their origin, exact location, and maintenance (Fig. 1).

METHODS

Animal captures occurred from March 2005 to November 2006, with tracking continuing until January 2007. We captured eastern spotted skunks, fitted them with radio-transmitters, and tracked them for the duration of the study or until mortality of the study animal occurred. If a radiocollared eastern spotted skunk died, we examined the remains of the animal for evidence of mammalian or avian predation and recorded the location. We attempted to collect $\geq$30 locations per 3-month calendar season for each animal (Seaman et al. 1999, Leban et al. 2001). For trapping and handling of skunks, we followed University of Missouri Animal Care and Use Committee Protocol 4039 and carried out all field work under Arkansas Game and Fish Commission approval (permit 111520042). We trapped eastern spotted skunks with Tomahawk number 103 live traps (Tomahawk Live Traps, Tomahawk, WI), and in 2005

Table 1. Codes and descriptions of cover types in the Ouachita Mountains, Arkansas, USA, used in eastern spotted skunk habitat compositional analysis, 2005–2006. SLP = shortleaf pine.

Cover type	Description
SLP 0–30	Shortleaf pine stands 0–30 yr old, >2.5% winter woody shrub cover, >67% understory vegetation density, >12.5% down woody cover
SLP 31–70	Shortleaf pine stands 31–70 yr old, 0.5–2.5% winter woody shrub cover, 39–67% understory vegetation density, 4–12.5% down woody cover
SLP >70	Shortleaf pine stands >70 yr old, <0.5% winter woody shrub cover, <39% understory vegetation density, <4% down woody cover
Hardwood	Hardwood stands (*Quercus* spp. and *Carya* spp.)
Private	Private property, which is primarily young forest or open pasture land
Other	Loblolly pine (*Pinus taeda*) and mixed hardwood–pine (*Pinus* spp.) stands

we placed traps across cover types in rough proportion to their availability throughout the study site: young shortleaf pine (31% of trap sites), middle-aged shortleaf pine (3%), mature shortleaf pine (42%), hardwood (16%), private property (1%), and other (6%). We placed traplines of 25–100 traps at 100-m to 250-m intervals in grids or along transects that paralleled existing roads and trails (Hackett et al. 2007). We ran traplines for ≥500 trap-nights or 1 week (we exceeded both measures in virtually all trapping sessions) before relocating traps to increase likelihood of capturing new individuals. Because 65% and 20% of captures were in young shortleaf pine and hardwood stands, respectively, in 2006 we placed traps primarily in these cover types to increase capture success. We used burlap and leaf litter to cover traps and various canned fish and commercial fruit-scented paste lures as bait. We checked traps daily between 0600 hours and 0800 hours.

We anesthetized captured eastern spotted skunks using an intramuscular injection of ketamine hydrochloride (10 mg/kg) and xylazine (1 mg/kg). We ear-tagged animals with 1005-1 ear tags (Hasco Tag Company, Dayton, KY). We weighed animals to the nearest 5 g, recorded morphological measurements, sexed individuals, and aged them by body size, tooth wear, and prior capture history. We fitted each eastern spotted skunk with a collar-type 12-g very-high-frequency radiotransmitter prior to release at the capture site.

We used ground-based triangulation radiotelemetry techniques to estimate the location of collared individuals. We chose a 28-hour location interval because it is not a multiple of a known cycle in eastern spotted skunk behavior and provided an approximately equal number of daytime and nighttime locations, which we assumed to be independent. We achieved triangulation by obtaining directional azimuths, using a 3-element Yagi antenna and compass, from ≥3 known locations remote to the collared animal's position (White and Garrott 1990, Kenward 2001). To reduce error due to movements by the animal, we collected all data for each location within 7 minutes.

We conducted a telemetry error study to estimate precision of directional azimuths (White and Garrott 1990, Withey et al. 2001) by collecting 134 location estimates from 476 azimuths. We determined directional error in 2 ways. First, we placed 5 transmitters 10 cm off the ground at locations unknown to the observer throughout the study area, and we obtained 60 directional bearings for each transmitter from 4 known locations during 15 days (White and Garrott 1990, Withey et al. 2001). Second, prior to using homing techniques to track 13 eastern spotted skunks to 59 den sites, we conducted triangulation and recorded 176 azimuths from known locations. Combining the results of the 2 methods above, we estimated that our telemetry system had a mean bearing error of 1.08 (± 0.48 SE) degrees and mean linear error of 64.7 (± 4.3 SE) m.

We estimated each location for a triangulation event using Lenth's maximum likelihood estimate (White and Garrott 1990) in Program GTM236 (Sartwell 2000; available from J. Sartwell, Missouri Department of Conservation). To account for telemetry error, we excluded all locations with error ellipses larger than the mean study site stand size of 14.3 ha, which were 10.9% of the overall locations. We used only those animals with ≥30 locations for ≥1 season to estimate utilization distributions (UDs) for that particular season given the potential bias associated with home range estimations based on small sample sizes (Seaman et al. 1999). We computed fixed-kernel UDs with plug-in procedures for smoothing using the Kde folder in Matlab (The Mathworks Incorporated, Natick, MA; Beardah and Baxter 1995, Gitzen et al. 2006). We delineated 95% contours of the seasonal UDs using ArcGIS 9.1, based on volume. We used 2-way analysis of variance (ANOVA) and Bonferroni post hoc comparison tests to evaluate gender differences in home range size and to compare mean home range sizes among seasons.

We calculated the volume of intersection (VI) index statistic to assess eastern spotted skunk site fidelity (Kernohan et al. 2001, Millspaugh et al. 2004). The VI measures the degree of overlap between a pair of individual UDs (e.g., spring 2005 and summer 2005; Kernohan et al. 2001, Millspaugh et al. 2004), and ranges between 0 (no overlap) and 1 (complete overlap). To evaluate animal site fidelity we calculated the VI score for all possible combinations of seasonal UDs within all animals. We used 2-way ANOVA and Bonferroni post hoc comparison tests to assess inter- and intrasexual differences in site fidelity as well as seasonal differences in VI scores.

We assessed second-order habitat selection by comparing a UD-weighted measure of habitat use within the home range to available habitat within the study area (Johnson 1980). We treated individual skunks as the experimental

Table 2. Fixed-kernel home ranges (ha; 95% of utilization distribution vol) by season and gender for eastern spotted skunks in the Ouachita Mountains, Arkansas, USA, 2005–2006.

Gender	Season			
	Autumn	Winter	Spring	Summer
M				
n[a]	8	5	6	6
$\bar{x}$[b]	76	175	866	142
SE[c]	22	62	235	21
Range[d]	19–206	37–404	222–1,824	89–224
F				
n[a]	8	4	5	5
$\bar{x}$[b]	65	71	135	54
SE[c]	7	25	30	24
Range[d]	31–90	27–136	31–192	21–148
Locations				
$\bar{x}$[e]	42	46	55	56
SE[f]	2	3	2	4
Range[g]	30–59	32–54	43–67	32–68

[a] Total no. of home ranges by gender and season used to calculate home range size.
[b] Mean home range size by gender and season.
[c] SE of mean home range size by gender and season.
[d] Range of home range size by gender and season.
[e] Mean no. of locations per individual used in analysis by season.
[f] SE of mean no. of locations per individual used to calculate home range size by season.
[g] Range of no. of locations per individual used to calculate home range size by season.

unit to avoid pseudoreplication (Otis and White 1999, Erickson et al. 2001). We used compositional analysis (Aebischer et al. 1993) as modified by Millspaugh et al. (2006) to assign use values based on the UD. We assumed that the UD adequately represents use within the home range boundaries. We defined an individual's habitat use as the proportion of UD volume by cover type within that individual's home range (Millspaugh et al. 2006). Most radiocollared eastern spotted skunks had zero use of ≥1 cover type. To reduce probability of Type I error, we substituted 0.3% for all zero-habitat-use values (Bingham and Brennan 2004). We then used compositional analysis to rank the cover type categories (young shortleaf pine, middle-aged shortleaf pine, mature shortleaf pine, hardwood, private property, other) encompassed within the study area (Aebischer et al. 1993).

RESULTS

From March 2005 to November 2006, we captured 33 eastern spotted skunks (17 M, 16 F) during 12,970 trap-nights with capture success of 0.88%. Of these, 23 animals (12 M, 11 F) had ≥30 locations for ≥1 season, with a mean of 106 (± 13 SE, range = 34–226, $n = 2,441$) locations per individual. We tracked 11 (6 M, 5 F) eastern spotted skunks during spring and summer, 16 (8 M, 8 F) during the autumn, and 9 (5 M, 4 F) during winter (Table 2). We tracked no animal beyond 1 year; thus, we did not pool an individual's locations across years. Home range size was dependent on gender and season (i.e., gender × season interaction; $F_{3,44} = 6.89$, $P < 0.001$; Table 2). Male spring home ranges were 6.4 times larger than female spring home ranges (Table 2). Further, male home ranges were ≥2.5 times larger than female home ranges during winter and summer, but not autumn. With the exception of summer, we also observed ≥2.5 times greater within-season variation in male home range size compared to female home ranges (Table 2).

Male home ranges were ≥4.9 times larger in spring than any other season ($F_{3,21} = 10.04$, $P < 0.001$; Table 2). Conversely, we observed less difference in female home ranges by season ($F_{3,18} = 3.13$, $P = 0.051$). Male home ranges increased from autumn to winter and again in spring, then decreased from spring to summer. Female home ranges showed similar but less dramatic seasonal variance in size (Table 2).

We observed moderate site fidelity by eastern spotted skunks. Mean VI score across all pairs of seasons for every animal ($n = 26$) was 0.32 (± 0.029 SE, range = 0.066–0.623). Neither gender nor season affected degree of site fidelity ($F_{7,18} = 1.44$, $P = 0.251$). Male site fidelity fluctuated between 0.260 and 0.294, whereas female fidelity was between 0.257 and 0.492 (Fig. 2). Female site fidelity was greatest during autumn through spring and then decreased between spring and autumn. Variation in degree of female site fidelity was greatest between summer and winter (Fig. 2).

We observed a consistent pattern of habitat selection across all seasons by eastern spotted skunks (Fig. 3). Young (0–30 yr old) shortleaf pine habitat was ranked highest in all seasons and was selected over all other habitats, except hardwoods during winter and spring (Table 3). Hardwood stands ranked second during each season and during autumn and winter were selected over all other cover types except young shortleaf pine stands. Mature (>70 yr old) shortleaf pine habitat ranked third in all seasons but was only selected over private and middle-aged pine stands in autumn, and "other" in winter (Table 3). "Other," private, and middle-aged pine stands ranked low during all seasons; however, "other" habitats were selected over middle-aged pine stands and private land during autumn.

DISCUSSION

Eastern spotted skunk home range dynamics appear to be influenced by habitat availability during the nonbreeding season and mating tactics during the breeding season, as reported for other small carnivores (Erlinge and Sandell 1986, Sandell and Liberg 1992, Gehring and Swihart 2004, King and Powell 2007). Male home ranges were larger than female home ranges and increased significantly during the spring, as also observed by Crabb (1948) and McCullough and Fritzell (1984). Conversely, female home range size was higher during spring but not significantly. Although male home ranges should be larger than female home ranges because of the increased energetic requirements associated with their approximately 40% larger body size (Sandell 1989, Gompper and Gittleman 1991, Rosatte and Larivière 2003, Lesmeister 2007), we observed a disproportionate

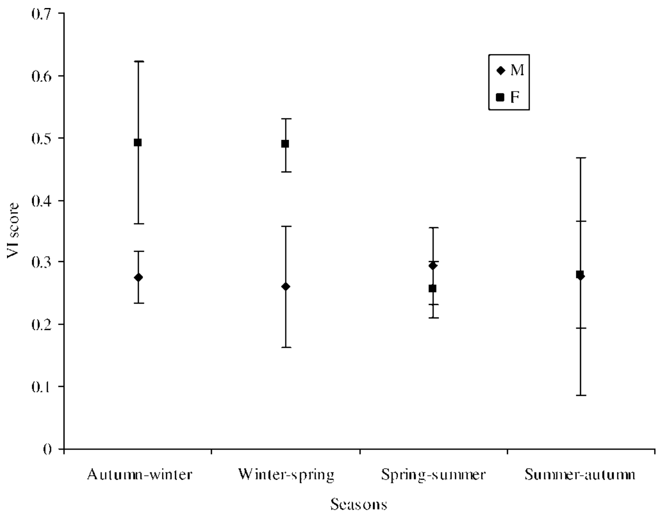

Figure 2. Eastern spotted skunk site fidelity between successive seasons in the Ouachita Mountains, Arkansas, USA, 2005–2006. We present data as mean (including zero values) seasonal volume of intersection (VI) scores (± SE), subdivided by season and gender. Sample sizes are autumn–winter: 4 males, 2 females; winter–spring: 3 males, 3 females; spring–summer: 5 males, 4 females; summer–autumn: 2 males, 3 females.

difference in male and female home range sizes in all seasons with the exception of autumn. Male summer and winter ranges were 2.63 and 2.47 times larger, respectively, than female ranges. The reason for these size differences in male and female home ranges is unclear, but may be due to resource availability and the compounded effects on males of the noncontiguous distribution of selected cover types (Fig. 1).

The pronounced change in male home range size during the breeding season may be attributed to mating tactics. We did not observe the largest home ranges in winter when food may be scarcest, but rather in spring, the eastern spotted skunk breeding season (Mead 1968). In solitary carnivore species, males maximize fitness by adopting one of 2 alternative mating strategies: either they remain in their home ranges and try to monopolize several females whose home ranges they overlap or they roam further to increase opportunities to interact with additional females (Sandell 1989). When females are densely and evenly distributed, the best mating tactic is to maintain exclusive male home ranges. In such a system, little seasonal variation in male home range size should be observed (Sandell and Liberg 1992). However, females were not evenly distributed in the ONF because selected habitat was distributed noncontiguously (Fig. 1). Thus, in the ONF we hypothesize that the mating system of the eastern spotted skunk is similar to that of many small mustelids, where males increase home range size because their decisive resource changes from predictably located habitat and prey items during the nonbreeding season to a more dispersed resource, reproductive females

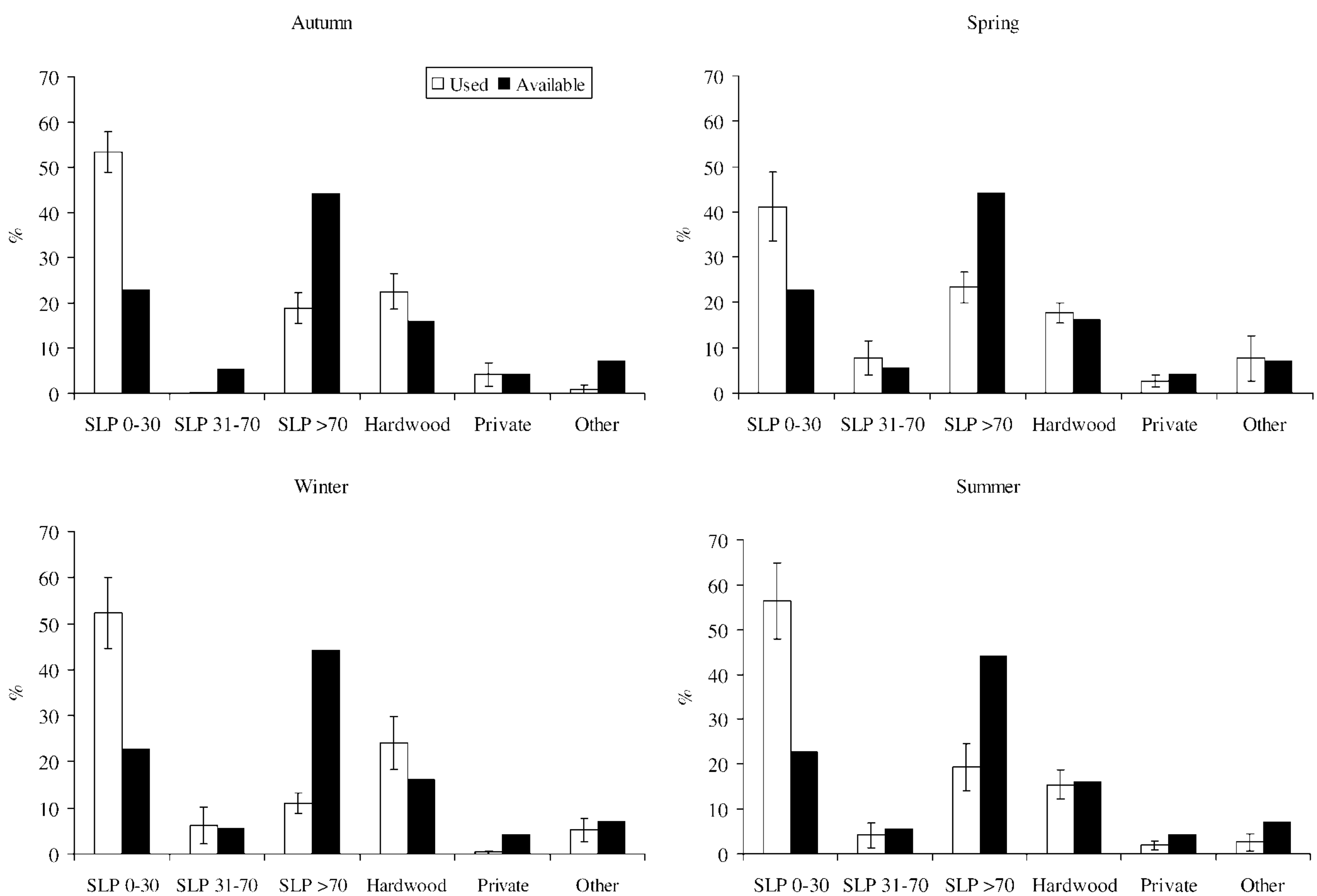

Figure 3. Eastern spotted skunk seasonal percent use (± SE) of cover types compared to percent available within the study site, Ouachita Mountains, Arkansas, USA, 2005–2006. SLP = shortleaf pine.

Table 3. Matrices and habitat ranking of eastern spotted skunk resource selection in the Ouachita Mountains, Arkansas, USA, 2005–2006. The sign of the *t*-values is indicated with + or − signs; +++ and −−− represent significant deviation from random at $P < 0.05$. Lower ranks indicate higher level of selection. SLP = shortleaf pine.

	Cover type						
Cover type	SLP 0–30	SLP 31–70	SLP >70	Hardwood	Private	Other	Rank
Autumn							
SLP 0–30	.	+++	+++	+++	+++	+++	1
Hardwood	−−−	+++	+++	.	+++	+++	2
SLP >70	−−−	+++	.	−−−	+++	+	3
Other	−−−	+++	−	−−−	+++	.	4
SLP 31–70	−−−	.	−−−	−−−	+	−−−	5
Private	−−−	−	−−−	−−−	.	−−−	6
Winter							
SLP 0–30	.	+++	+++	+++	+++	+++	1
Hardwood	−	+++	+++	.	+++	+++	2
SLP >70	−−−	+	.	−−−	+	+++	3
Private	−−−	+	−	−−−	.	+	4
SLP 31–70	−−−	.	−	−−−	−	+	5
Other	−−−	−	−−−	−−−	−	.	6
Spring							
SLP 0–30	.	+++	+++	+	+++	+++	1
Hardwood	−	+	+++	.	+	+++	2
SLP >70	−−−	+	.	−−−	+	+	3
SLP 31–70	−−−	.	−	−	+	+	4
Private	−−−	−	−	−	.	+	5
Other	−−−	−	−	−−−	−	.	6
Summer							
SLP 0–30	.	+++	+++	+	+++	+++	1
Hardwood	−	+	+++	.	+	+++	2
SLP >70	−−−	+	.	−−−	+	+	3
SLP 31–70	−−−	.	−	−	+	+	4
Private	−−−	−	−	−	.	+	5
Other	−−−	−	−	−−−	−	.	6

(Erlinge and Sandell 1986, Sandell and Liberg 1992, Gehring and Swihart 2004). Despite the unusually large home ranges of male eastern spotted skunks during the spring, male and female home ranges during the non-breeding season were typical of what has been reported for other similar sized or closely related carnivores (Lindstedt et al. 1986, Doty 2004, Gehring and Swihart 2004, Jachowski 2007, King and Powell 2007). Although we observed greater variation in male eastern spotted skunk seasonal home range size compared to female home range size, we observed less variation in male site fidelity. Female site fidelity was lowest during the spring–summer and summer–winter. The reason for this is unclear, but the patterns may be a function of the altered home range use by females to use different sites during the parturition period compared to other biological periods.

We observed consistent second-order selection for younger shortleaf pine patches, which were the only early successional cover type prevalent in the study site. Selection was strong annually but was especially strong during the nonbreeding seasons of summer, autumn, and winter. Eastern spotted skunks do not appear to select specifically for pine forest types, as populations have been found in a variety of habitat types (Crabb 1948, McCullough and Fritzell 1984, Kinlaw 1990, Reed and Kennedy 2000) and we also observed selection of hardwood stands. Further, selection of shortleaf pine patches weakens as stand age increases, although the relative lack of middle-aged patches in the study area makes assessing possible linearity of the relationship premature. The multitude of habitat types utilized by eastern spotted skunks and the age component of selected pine stands suggests that eastern spotted skunks are not selecting a cover type per se, but rather base selection on other criteria such as forest structure.

Similar to habitat selected by other small carnivores (Buskirk and Powell 1994, Carroll 2000, Doty and Dowler 2006, King and Powell 2007, Neiswenter and Dowler 2007), forest with closed canopy or dense underbrush are apparently critical features of eastern spotted skunk habitat (Lesmeister 2007). Further, the only areas available on the study site devoid of overhead cover were the open pasture lands on private property and we found no use of such areas; thus, the species may be intolerant of such vegetation types. Although radiocollared animals used and denned on private lands in approximate proportion to their availability, use of private property was limited to young forested areas (D. B. Lesmeister, University of Missouri, unpublished data). Use of sites with closed canopy or dense understory may reduce risk of predation. The primary predators of eastern spotted skunks appear to be owls and mesocarnivores (Kinlaw 1995). Indeed, we observed 18 mortalities of radiocollared skunks, most of which were avian caused and occurred in mature shortleaf pine–bluestem habitat (D. B. Lesmeister, unpublished data). Compared to the dominant cover type (mature shortleaf pine), young shortleaf pine habitat seems to be a less preferred habitat for potential eastern spotted skunk predators, such as coyote (*Canis latrans*), bobcat (*Lynx rufus*), and great horned owl (*Bubo virginianus*), which prefer more open habitats over young dense forest (Litvaitis and Shaw 1980, Ganey et al. 1997, Smith et al. 1999, Chamberlain et al. 2003). Thus, the open canopy conditions of mature shortleaf pine–bluestem habitat (Masters 2007) may be favorable to predators and thereby detrimental to eastern spotted skunks.

Although mature shortleaf pine–native plant cover type facilitated by thinning, midstory removal, and prescribed fire appears to be suboptimal eastern spotted skunk habitat, it is optimal habitat of the endangered and sympatric red-cockaded woodpecker (Kalisz and Boettcher 1991, Bukenhofer et al. 1994, Walters et al. 2002). Low densities of small and medium-sized pines, moderate densities of large pines, and herbaceous ground cover of mature shortleaf pine–bluestem habitat are goals for red-cockaded woodpecker management. Mature pines represent important red-cockaded woodpecker management goals for provision of foraging and nesting habitat because fungal heart rot facilitates cavity creation and is more prevalent in pine trees >70 years old (Bukenhofer and Hedrick 1997, Walters et al. 2002). As a result, the strategy in ONF is to increase stand rotation age from 70 years to 120 years, which in turn creates a landscape dominated by mature forest stands. There has been interest in understanding the impacts of red-cockaded woodpecker management on other species of conservation concern (Thill et al. 2004), such as eastern spotted skunks, yet this has not been the focus of detailed work. Some data suggest other species have been inadvertently affected by management decisions designed to promote red-cockaded woodpecker population growth (Thill et al. 2004). However, most studies concerning nontarget species have considered commercial thinning, midstory reduction, and prescribed fire only in mature stands without simultaneously considering other forest age classes (Wilson et al. 1995, Masters et al. 1998, Cram et al. 2002, Thill et al. 2004).

MANAGEMENT IMPLICATIONS

Our data suggest that eastern spotted skunks select young or dense forest stands, which is likely in part because these cover types provide structural characteristics and complexity that reduce risk of predation. Thus, management for eastern spotted skunks should focus on providing early successional forest or forest with both complex woody vegetative understory structure as well as a closed canopy. Finally, eastern spotted skunks and red-cockaded woodpeckers are sympatric in the Ouachita Mountains and have vastly different habitat needs, so intensive management for one of these 2 species, such as increasing stand rotation age and intensive prescribed fire, could potentially reduce availability of optimal habitat for the other. A balance of early and late successional habitats will be necessary to meet both species habitat requirements.

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