Research Note

Habitat Use of Western Spotted Skunks and Striped Skunks in Texas

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ABSTRACT Little information on foraging habitats of sympatric species of skunks in Texas, USA, is available. We compared 11 western spotted skunks (*Spilogale gracilis*) and 10 striped skunks (*Mephitis mephitis*) using radiotelemetry data to assess habitat use during foraging at broad levels of selection in a fragmented habitat. Western spotted skunks used areas with more large mesquite (*Prosopis glandulosa*) trees than did striped skunks and randomly selected points. Striped skunk habitat use was not different from randomly chosen locations. Contrary to previous research, both species appear to avoid agricultural habitat. A habitat management plan may be difficult to implement for striped skunks in Texas because they did not favor any available habitat. Conservation of western spotted skunks in west-central Texas should focus on areas with older mesquite trees, areas that are now often brush controlled for management of livestock. (JOURNAL OF WILDLIFE MANAGEMENT 71(2):583–586; 2007)

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Striped skunk (*Mephitis mephitis*) and western spotted skunk (*Spilogale gracilis*) occur sympatrically throughout much of western North America (Rosatte and Lariviere 2003). Striped skunk is one of the most common medium-sized carnivores in North America (Verts 1967); conversely, spotted skunks have recently been shown to be drastically declining in numbers (Gompper and Hackett 2005). Skunks are important vectors for rabies among many other diseases, and skunks may regularly use urban areas for habitat (Wade-Smith and Verts 1982). Given the close association of skunks with humans and domestic animals, it is surprising that little is known regarding their natural history and management. Most studies of these 2 species have been conducted near the northern portions of their ranges where the habitat and ecology of the animals are considerably different from that in Texas, USA (Carey and Kershner 1996, Lariviere and Messier 2000).

Both western spotted skunks and striped skunks occur throughout the western half of Texas (Schmidly 2004). While habitat use overlaps for both species (Patton 1974), spotted and striped skunks in west-central Texas have recently been shown to select different characteristics in den sites (Doty and Dowler 2006). Spotted skunks use den sites with larger trees and more prickly pear cactus (*Opuntia* spp.) than striped skunks. These data are consistent with the findings of others (Carey and Kershner 1996, Carroll 2000), who suggested that spotted skunks select habitat based on percent cover and number and density of logs and snags. No studies to date have addressed foraging habitat use in areas of sympatry for these 2 species of skunks. In addition, data at several levels of selection should be acquired to best understand how species select habitat (Johnson 1980).

The objective of our study was to compare the foraging habitat use of striped skunks and western spotted skunks in a coarse-grained environment that has previously been managed for livestock and agriculture.

STUDY AREA

We conducted our study 15 km north of San Angelo in Tom Green County, Texas. Our study area consisted of approximately 2,000 ha of the Angelo State University Management, Instruction and Research Center (MIR Center) and the surrounding San Angelo State Park. The dominant vegetation was a mix of mesquite (*Prosopis glandulosa*) and prickly pear cactus. Much of the land had undergone extensive management for wildlife and grazing livestock, including the maintenance of open pastures separated by strips of older-growth mesquite stands approximately 85 m in width and up to 2 km in length, spaced from 100 m to 300 m apart. There were also agricultural areas that were seasonally planted with row crops. The MIR Center was flanked on 2 sides by highways; the third side was adjacent to San Angelo State Park. There were 2 riverbeds running through the study area, one of which contained water throughout most of the year. Both riverbeds have mixed deciduous trees, in conjunction with the mesquite trees, including pecan (*Carya illinoinensis*), western soapberry (*Sapindus drummondii*), and black willow (*Salix nigra*). Vegetation in the pastures included grasses such as grama (*Bouteloua* spp.), bushes such as lotebush (*Ziziphus obtusifolia*), algerita (*Mahonia trifolialata*), and wolfberry (*Lycium berlandieri*), as well as cactus (*Opuntia* spp.).

We conducted our study from 15 May 2003 through 14 May 2004. Rainfall during this period totaled 67.6 cm and was slightly higher than the 30-year average of 59.7 cm. Soils in this area included clay loams and Tulia loams with 13% slope (Wiedenfeld and Flores 1976).

METHODS

For trapping, anesthetizing, and handling animals we followed the guidelines set forth by the American Society of Mammalogists (Animal Care and Use Committee 1998).

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We trapped skunks using Tomahawk live traps (Tomahawk Live Trap Co., Tomahawk, WI). We set traps at 10-m intervals in 4 straight line transects in an attempt to capture all skunks in the area. We baited traps with canned cat food, fruit, eggs, and 2 types of skunk lures (grubstake, liquid grubs) and anesthetized all captured skunks using a 2:1:1 ratio of ketamine hydrochloride (10 mg/kg), xylazine (5 mg/kg), and acepromazine (1 mg/kg). We weighed, measured, and sexed all skunks, and we fitted each with radiocollars weighing either 24 g (for western spotted skunk) or 30 g (for striped skunk) that featured an activity monitor and mortality sensor (Telemetry Solutions, Concord, CA). Battery life for the collars was approximately 18 months. At the beginning of our study, we also uniquely identified skunks with ear tags; however, passive integrated transponders (PIT tags) proved to be more useful in identifying skunks that were recaptured because the animals often lost their ear tags.

We located skunks weekly via triangulation from permanent telemetry stations using either a handheld 3-element Yagi antenna (Telonics, Mesa, AZ) or a 4-element null peak system (AVM Instrument Co., Colfax, CA) mounted in the back of a truck. We collected 2–3 bearings within 7 minutes to limit error due to movements by the animal, and we estimated locations using LOCATE II (Nams 1990). We followed a focal skunk for up to 8 hours ($\bar{x} = 2.7 \pm 1.5$ hr) and located it every hour while we located all other skunks during the hour intervals. We attempted to evenly distribute the sampling effort across all individuals and all times of the night. To determine accuracy of telemetry, we placed 5 collars throughout the study area in locations unknown to the observer, and we triangulated these 20 times employing the same method used to track skunks. We determined accuracy for triangulation data as linear error of location estimates (Withey et al. 2001) as 34.7 ± 24.6 m (range = 2.8–92.4 m). Accuracy was highly dependent on the distance between the observer and the collar.

For habitat analysis, we performed a minimum distance supervised classification on a 4-m multi-spectral satellite image (Space Imaging, Thornton, CO) with Image Analysis (Leica Geosystems, Atlanta, GA) using field data. This provided a data layer in ArcGIS 8 where each pixel is equivalent to a 4-m^2 area of ground, assigned to 1 of 4 different vegetation classes. These classes were 1) mixed deciduous (mix of >2-m tall deciduous trees, typically riparian habitat such as pecan and oak [*Quercus fusiformis*]); 2) large mesquite (mesquite trees >2 m tall); 3) pasture (areas that have been managed for grazing animals, >50% grass and brush, no trees); and 4) barren (<50% grass, includes roads and mowed areas). After the classification, we added 2 other variables using ArcGIS 8: agriculture (fields regularly farmed) and housing (buildings, houses). We assessed classification accuracy by generating 12 random points throughout the remotely classified vegetation and then ground truthing the points in each of the 4 cardinal directions every 4 m (1 pixel) for 24 m (6 pixels). This provided 25 comparisons per random point. We determined the map to have an accuracy of 81.3%.

We plotted locations for each skunk in ArcGIS 8. Skunks could readily move to any habitat in a very short amount of time because the habitats changed very dramatically and were located in close proximity to other habitat types. Therefore, we used locations approximately 1 hour apart for the habitat analysis. We calculated percent of each habitat variable for the area of a buffer 32 m around each estimated location. We chose this distance based on the size of the habitat patches in the study area to assess higher level (second- to third-order; Johnson 1980) habitat selection by skunks during nightly activity. Because of the road accessibility in our study area, we were able to get close enough to each animal during tracking to establish the actual habitat that a skunk was using. In addition, we employed the same method as above using 30 randomly generated points for each of 11 random individuals to assess habitat use if skunks were not selecting habitat but were instead randomly using the landscape.

We pooled each individual skunk's points into 4 seasons representing basic environmental and biological changes throughout the year: 1) spring or breeding season for striped skunks and implantation for both (1 Feb–14 May), 2) summer or postparturition and pup rearing (15 May–31 Aug), 3) fall or dispersal for both and breeding season for western spotted skunks (1 Sep–14 Nov), and 4) winter (15 Nov–31 Jan). We included an animal in a season if we tracked it during ≥2 months of that season. For each individual per season, we calculated an average percentage of each habitat type and used this as an experimental unit.

To compare habitat use between species and among seasons, we performed a multivariate analysis of variance. We pooled sexes within species because of the low numbers of individuals per season and the relative lack of female spotted skunks. To compare both skunk species to the random individuals, we used an analysis of variance, followed by Scheffé's post hoc analysis to determine which habitats were used more than or less than random.

RESULTS

Habitat use differed between species ($F = 3.052$, df = 6, 21, $P = 0.026$); however, there was no statistical difference in habitat use among seasons ($F = 1.043$, df = 18, 69, $P = 0.427$) and we therefore pooled seasons for the following analyses. Only 2 habitat variables, mesquite and agriculture, were significantly different among the groups (Table 1). Spotted skunks used >50% more mesquite ($\bar{x} = 37.1 \pm 4.0$) than striped skunks ($\bar{x} = 23.7 \pm 3.8$, $P = 0.025$) and random ($\bar{x} = 23.3 \pm 1.0$, $P = 0.017$). Both species used less agricultural habitat (striped skunks: $\bar{x} = 4.4 \pm 2.6$, $P = 0.008$; spotted skunks: $\bar{x} = 2.1 \pm 1.1$, $P = 0.001$) than random ($\bar{x} = 12.8 \pm 1.4$). Although not significantly different from random ($P = 0.29$), spotted skunks never occurred in the housing areas.

DISCUSSION

Our study documented the habitat use of western spotted skunks and striped skunks in west-central Texas. Western

Table 1. Analysis of variance and Scheffé's post hoc analysis of habitat variables for western spotted skunks and striped skunks in west-central Texas, USA, 2003–2004. We show pair-wise comparisons for $P < 0.05$. Degrees of freedom for all variables was 2, 29.

Habitat variable	*F*	*P*	Pair-wise comparisons[a]
Barren	2.830	0.075	
Mesquite	5.986	0.007	S > M, S > R
Pasture	0.862	0.433	
Mixed deciduous	0.277	0.76	
Agriculture	10.841	<0.001	R > S, R > M
Housing	1.064	0.358	

[a] M = striped skunk; R = random; S = western spotted skunk.

spotted skunks are more specialized in their coarse-grained utilization of habitat during foraging than striped skunks. In our study, western spotted skunks had little problem crossing short (<100-m) open-canopy areas to get to other patches of mesquite habitat.

Verts (1963) suggested that it is easier to describe unsuitable habitat for striped skunk than favorable habitat because they are habitat generalists. Our findings support that striped skunks use a wide range of available habitats although none more than they were available. Both Storm (1972) and Verts (1963) reported that striped skunks utilize agricultural fields for foraging; however, in Canada striped skunks selected wetlands more than any other habitat, whereas farmstead and crop land were used significantly less than the other available habitat types (Lariviere and Messier 2000). Similarly, in our study striped skunks used less agricultural habitat while foraging. In Tennessee, USA, striped skunk home ranges were reported to contain equal amounts of both forest and field habitats, leading the authors to conclude that striped skunks were actually utilizing edge habitat (Bixler and Gittleman 2000). Striped skunks do not appear to be using any particular habitat type more than another in our study.

Western spotted skunks are reported from a variety of habitats as well (Verts et al. 2001). A study in Oregon, USA, reported 85% of western spotted skunk captures occurred in old-growth forest (Carey and Kershner 1996). Carroll (2000) suggested that the presence of cover was the most important habitat variable to this species because it provides protection from their main predator, the great horned owl (*Bubo virginianus*). Spotted skunks are also avid climbers (Verts et al. 2001), which may account for the selection of forested habitat. Carroll (2000) reported the presence of shrubs to be important to western spotted skunks in the Sierra Nevada of California, USA. Island spotted skunks selected ravines more than random sites and avoided fennel (*Foeniculum vulgare*) grasslands and scrub oak when in sympatry with island foxes (Crooks and Van Vuren 1995).

Our study documented the importance of cover for western spotted skunk during foraging. In west-central Texas, the western spotted skunk prefers den sites in areas of large mesquite trees, as well (Doty and Dowler 2006). Contrary to previous research that found cropland to be important to spotted skunks (Storm 1972), agricultural fields were rarely used by western spotted skunks in our study. The high use of agricultural fields by skunks in other studies is explained by high abundance of prey items in the fields (Storm 1972). In our study area, agricultural fields may offer a lower food availability or less protection from potential predators, making the habitat less suitable for foraging. Future studies should focus on how prey availability and predators affect habitat selection by western spotted skunks.

MANAGEMENT IMPLICATIONS

These data on foraging habitat suggest that future management efforts for western spotted skunks in Texas should focus on maintaining large mesquite trees and associated prickly pear and underbrush. In agricultural areas, open pastures and crops should be narrow enough (<100 m) to allow western spotted skunks to cross these less suitable habitats to utilize >1 patch of mesquite. Habitat management strategies for striped skunks may be more difficult to implement in west-central Texas because striped skunks do not appear to select specific habitats during foraging.

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