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ASSESSMENT OF SCENT-STATION SURVEYS AND SPOTLIGHT COUNTS FOR MONITORING RELATIVE ABUNDANCE OF TWO MUSTELIDS

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ABSTRACT—The usefulness of scent-station and spotlight techniques for monitoring relative abundance of the eastern spotted skunk (*Spilogale putorius*) and the striped skunk (*Mephitis mephitis*) in Tennessee was assessed from March 1996 through June 1997. Two spotlight transects were performed in Monroe County, and scent-station transects were conducted in Monroe, Fayette, and Shelby counties. No skunks were observed during spotlight counts. Visitation rates of skunks to scent-stations varied between 1.7% and 13.7%. The most common mammals identified at scent-stations were coyotes, raccoons, and bobcats in Fayette, Shelby, and Monroe counties, respectively. Results suggest that the two survey methods (as employed in the present study) are of limited value for monitoring relative abundance of skunks in Tennessee. However, scent-stations can be used to test for the presence of skunks at a given location.

Population surveys have been widely employed by wildlife managers to assess the relative abundance of furbearers (Johnson and Pelton, 1981; Morrison et al., 1981). Such procedures are advocated because they can be applied over large areas, are easily standardized, are economical to conduct, and require only limited manpower (Linhart and Knowlton, 1975; Johnson and Pelton, 1981; Clark and Andrews, 1982). Scent-station surveys have been reported to be a useful tool for monitoring trends in abundance of selected carnivores (Woods, 1959; Conner et al., 1983; Leberg and Kennedy, 1987; Diefenbach et al., 1994). Additionally, spotlight counts have been successfully employed to survey a number of wildlife species (Lord, 1959; Drew et al., 1988; Hein and Andelt, 1995). However, the application of these procedures for monitoring trends of eastern spotted skunks (*Spilogale putorius*) and striped skunks (*Mephitis mephitis*) have not been examined in detail. Thus, the usefulness of scent-station surveys and spotlight counts for monitoring relative abundance of these species in Tennessee was assessed both seasonally and spatially.

MATERIALS AND METHODS

The study was conducted at three sites in Tennessee from March 1996 to June 1997 (Fig. 1). One site was in eastern Tennessee (Tellico Ranger District, Cherokee National Forest, Monroe County) and two sites in western Tennessee (Ames Plantation, Fayette and Hardeman counties; Edward J. Meeman Biological Station, Shelby County). These sites (hereafter referred to as Tellico, Ames, and Meeman) represented areas with varying habitats and land use, which result in different distributions and abundance of eastern spotted skunks and striped skunks. Both species were known to occur on Tellico, while only striped skunks occurred at the other sites (Kellogg, 1939; Hall, 1981). Based on trapping results of previous studies conducted for carnivores on the study sites (Leberg, 1985; Ladine, 1995; Reed, 1998) and conversations with local trappers and wildlife personnel on the areas, it was assumed a priori that the abundance of striped skunks was highest at Ames and lower at Meeman and Tellico.

The Tellico area was dominated by northern hardwoods (oak, *Quercus* spp.; hickory, *Carya* spp.; yellow popular, *Liriodendron tulipifera*; black cherry *Prunus serotina*; yellow birch, *Betula alleghaniensis*; American beech, *Fagus grandifolia*; sugar maple, *Acer saccharum*; and mountain maple, *A. spicatum*). Common understory trees included sassafras (*Sassafras albidum*) and flowering dogwood (*Cornus florida*). Small clearcuts (<10 ha) with early successional vegetation such as blueberry (*Vaccinium* spp.) and blackberry (*Rubus* spp.) were present throughout the study site. Elevations in the southern Appalachian Mountains ranged from 300 to 2,000 m. No rowcrop or livestock production occurred in the study area. The area was open to hunting and trapping during the seasons regulated by Tennessee Wildlife Resources Agency.

Ames was mostly upland hardwood forest. Dominant trees included oaks and hickories (*Carya* spp.), with some bottomland hardwoods and pine (*Pinus* sp.) plantations. Common understory trees included hackberry (*Celtis* sp.) and flowering dogwood. Agricultural crops, such as corn and cotton, were grown on the area. Cattle were grazed on the 395 ha of pasture at the site. Controlled hunting occurred during the authorized hunting seasons, and some trapping was conducted for predator removal during the spring season.

Meeman was characterized by gently rolling and steeply sloping terrain, and bottomlands associated with small tributaries of the Mississippi River. Abundant overstory tree species included sweet gum (*Liquidambar styraciflua*), yellow popular (*Liriodendron tulipifera*), cottonwood (*Populus deltoides*), and oaks. Common understory trees at this site included hackberry and sassafras. Patches of kudzu (*Pueraria lobata*) and several old-fields occurred throughout the site. Elevation varied from 70 to 120 m. There was no agricultural production on this site. While

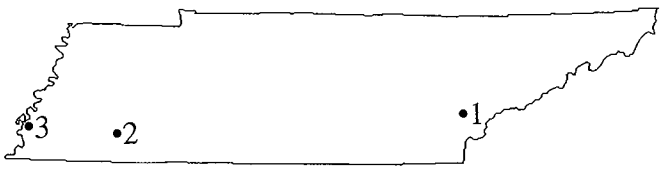

FIG. 1. Sample locations used in a study of scent-station procedures for assessing populations of skunks in Tennessee during 1995 to 1997: 1 = Tellico Ranger District, Monroe County; 2 = Ames Plantation, Fayette and Hardeman counties; 3 = Edward J. Meeman Biological Station, Shelby County.

no hunting or trapping was allowed, these activities were permitted on lands adjacent to the site during the authorized seasons.

Seasonal comparisons of scent-station surveys were conducted at Tellico during March 1996 to June 1997. Specific locations of transects at Tellico, as well as those at Ames and Meeman are given in Reed (1998). Seasons were as follows: summer, June–August; fall, September–November; winter, December–February; spring, March–May. Five scent-station transects were established along roads in Tellico. Each transect consisted of 10 scent stations at 0.32 km intervals (Leberg and Kennedy, 1987). All transects were separated by at least 6.4 km to maintain independence of transects. Scent stations consisted of a patch of cleared ground 1 m in diameter. This patch was covered with a thin layer of sand (10–15 mm). Scent stations were baited with a cotton ball soaked in bobcat urine and suspended on an applicator stick. Bobcat urine was chosen as the attractant as it is easily obtainable through trapping suppliers, has been commonly used as a scent-station attractant throughout the Southeast (Johnson and Pelton, 1981), and has been shown to be useful in attracting skunks (Morrison et al., 1981; Linscombe et al., 1983). Scent stations were checked the day after being established. All tracks present in a scent station were identified and recorded. Any scent station disturbed by human activity or destroyed by weather was recorded as inoperable and not used in further analysis. Scent-station transects on Tellico were performed three times per season. Spatial comparisons of scent-station surveys were conducted at Tellico, Ames, and Meeman from April 1997 through June 1997. The five scent-station transects at Tellico used in the seasonal analysis also were used for spatial analysis. Two scent-station transects were established at Ames and Meeman in April 1997. These transects were established in the same manner as those at Tellico and were performed four and six times, respectively, through June 1997.

Two types of spotlight counts were performed at Tellico: site counts and survey counts. Site counts consisted of spotlighting the area around each scent-station site (ca. 100 m^2) along each of the 5 transects for approximately one min and recording all animals seen. Survey counts consisted of a predetermined route (32 km) driven at 16 km/h where all animals seen on the route were recorded. A map of the route driven is provided in Reed (1998). Both spotlight surveys were started 2 h after sunset and performed by one observer three times per season.

RESULTS

Results by season at Tellico were as follows (the number of scent-station nights, number of visits by skunks, and percent rate of visitation follow the season, respectively): summer (146, 0, 0.0), fall (146, 1, 0.7), winter (143, 0, 0.0), and spring (147, 1, 0.7). An annual visitation rate was calculated as 0.34%. Bobcats were the most common visitor to scent-stations in all seasons.[1] Visitation rates (all species considered) were highest in the summer and spring, 14.4% and 14.3%, respectively.

One striped skunk visitation was recorded in Tellico during the period of spatial comparison (April–June 1997). One hundred and forty-five station nights were recorded during this period (visitation rate = 0.7%). The overall visitation rate during the spatial comparison at this site was 14.3%. Bobcats were the most common species identified at scent-stations during this period.

At Ames, 11 visits by striped skunks to scent stations were recorded during the spatial-comparison period of 79 station nights. This yielded a visitation rate of 13.9%. The most common carnivore to visit scent stations was the coyote (*Canis latrans*) with a rate of 17.7%. The visitation rate when all species were considered was 36.7.

Two scent stations (n = 120) at Meeman were visited by striped skunks during the spatial comparison. This yielded a visitation rate of 1.7%. The most common mammals to visit scent stations were raccoons (*Procyon lotor,* rate = 20%) and opossums (*Didelphis virginiana,* rate = 9.2%) with a total visitation rate (all species) of 45.0%.

One opossum and one rat (Rodentia) were seen during survey counts using spotlights. No animals were seen during site counts employing spotlight procedures.

DISCUSSION

A seasonal difference in visitation rates at scent stations by most mammals would be expected due to population fluctuations from natality and mortality as well as differences in behavior and movement patterns (Lindzey et al., 1977; Mutch and Aleksiuk, 1977; Leberg and Kennedy, 1987). However, no seasonal difference in visitation by skunks was detected during the present study. Some previous investigations have found distinctions in scent-station visitation between selected months or among seasons (Sumner and Hill, 1980; Morrison et al., 1981; Connor et al., 1983; Leberg et al., 1983; Leberg and Kennedy, 1987) for selected mammals while others have not (Nottingham et al., 1989). Nottingham et al. (1989) attributed the lack of a seasonal difference to a low abundance of animals on the study site. Additionally, Leberg and Kennedy (1987) were unable to detect differences among seasons in areas of low abundance but demonstrated seasonal variation in visitation rates at sites with higher densities. The overall visitation rate as well as the visitation rate for bobcats did vary seasonally. The highest visitation rates occurred in the spring and summer.

Roughton and Sweeny (1982) cited D. R. Anderson and C. M. Romesburg (pers. comm.) as indicating that, theoretically, the optimal range for detecting percent change in population levels was 40–60% visitation. The low visitation rates recorded in the present study appear to reflect the low density of skunks and other medium-sized mammals reported by Reed (1998) for the southern Appalachian Mountains. However, given that scent-station procedures yielded such low visitation rates, it is doubtful that scent stations will prove to be useful for monitoring trends in population abundance of skunks or other mammals with low densities in the southern Appalachians.

As in the present study, Linhart and Knowlton (1975), Linscombe et al. (1983), and Leberg and Kennedy (1987) demonstrated that visitations to scent stations can vary geographically. Higher visitation rates are usually associated with areas of higher

densities of the study species (Leberg and Kennedy, 1987). This was the case in the present study. Highest rates of visitation by skunks occurred at Ames where population abundance was assumed to be the highest. The results of the present study followed those of prior investigations (Linhart and Knowlton, 1975; Linscombe et al., 1983; Leberg and Kennedy, 1987) in relation to the association of visitation rates and population density. However, the values are still well below the level of visitation suggested by Roughton and Sweeny (1982) as necessary to detect changes in population abundance. It appears that the usefulness of scent-station procedures in studies of skunks will be to determine presence and provide insight as to distribution, rather than to monitor annual trends in population abundance at many sites. Future research that examines scent-station procedures in areas where population densities are high could provide needed information in regard to the application of such techniques for monitoring population trends of skunks.

Spotlighting techniques have been shown to be useful in estimating relative abundance of several wildlife species (Lotze and Anderson, 1979; Smith and Nydegger, 1985). However, some investigations (McCullough, 1982; Fafarman and DeYoung, 1986) have suggested that estimates of populations based on spotlighting procedures are unreliable and easily influenced by factors such as the presence of dense vegetation that reduces spotlight penetration. Spotlight surveys were only performed at Tellico where visibility was usually restricted to a few meters on each side of the road due to the mountainous terrain and dense vegetation. However, considering reduced visibility due to mountainous terrain, behavioral restraints (eastern spotted skunks are known to be a strongly nocturnal species; Kinlaw, 1995), ecological considerations (eastern spotted skunks have been captured only in dense forest in the southern Appalachians; Reed, 1998), and the fact that, overall, very few mammals were observed during survey or site counts in the present study, it seems most likely that spotlight counts will not prove to be an effective means of monitoring populations, especially those of the eastern spotted skunk, in the southern Appalachian Mountains.

Overall, as with scent-station procedures, the present study provides little support for the usefulness of spotlight counts for monitoring trends in skunk populations in the Appalachian Mountains of eastern Tennessee. At present, a reliable means of monitoring annual trends in populations of striped skunks and eastern spotted skunks remains unclear. However, based on the present results and those of Reed (1998), it appears that scent-station procedures could be used to determine presence. In contrast, live-trapping methods, such as the number of animals captured per trap night (Conroy, 1996), could be used to provide relative estimates of population trends in the southern Appalachians. Future research that employs the combined techniques of scent-station and live-trapping methodology to monitor annual trends in striped skunks and eastern spotted skunks could have significant management implications.

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