

OCCURRENCE OF SMALL, NONGAME MAMMALS IN SOUTH DAKOTA'S EASTERN BORDER COUNTIES, 1994-1995

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ABSTRACT

Less is known about small, nongame mammals in South Dakota than other mammal groups. During 1994-95, we collected small, nongame mammals in 3 primary habitat types along eastern South Dakota's 8 border counties. Small mammals were sampled with snap and Sherman live-traps baited with a mixture of oats, peanut butter, and bacon grease. Of nearly 2,000 specimens collected, approximately 200 were archived in the Natural History Museum at the University of Kansas in Lawrence. Sixteen species were captured of which 12 were small nongame species. Species richness did not vary among habitat types but capture rates did vary by habitat type and county.

INTRODUCTION

Considerable information is available on the occurrence and distribution of birds (SDAOU 1991, Peterson 1995), plants (Great Plains Flora Association 1977, Larson 1993), and fish (Neumann and Willis 1994) in South Dakota; however, similar data bases are incomplete for mammals, and especially for the small, nongame species. Several mammalogists have published general distribution maps for species of South Dakota mammals (Over and Churchill 1941, 1945; Hall and Kelson 1959; Chapman and Feldhamer 1982; Jones et al. 1983, 1985; Armstrong et al. 1986), but none map the occurrence of species per county. Except for Blumberg (1993), earlier distribution maps for mammal species in South Dakota were based on specimen collections in museums, a standard procedure for mammalogists but also one which has temporal limitations (Hazard 1982). Collecting and preparing representative specimens for museums or institutional repositories is also expensive. Thus, few intensive collection studies have been conducted on mammals in South Dakota since the 1960's (Blumberg 1993), and particularly for the eastern half of the state. Recent collections in eastern South Dakota have been conducted by Lindell (1971), Moe (1974), Searls (1974), Barnes and Linder (1982), Pendleton and Davison (1982), Pendleton (1983, 1984), Mullican (1992, 1993), Backlund (1995), Kraft (1996), Meeks (1996) and this study. In addition to collections,

several checklists of mammals of South Dakota have been compiled (Choate and Jones 1981; Houtcooper et al. 1985; and Sharps and Benzon 1984).

The purpose of this study was to sample small mammals in 3 primary habitat types in eastern South Dakota's counties bordering on Minnesota and Iowa. Information gained will help fill the information void on small mammal distributions in eastern South Dakota. The South Dakota Department of Game, Fish and Parks currently maintains a natural resource data base on the flora and fauna within the state via its Natural Heritage Program in cooperation with The Nature Conservancy (Houtcooper et al. 1985); data from this study are also important to this data base.

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STUDY AREA AND METHODS

Our study area included 8 eastern South Dakota counties, from north to south, (Roberts, Grant, Deuel, Brookings, Moody, Minnehaha, Lincoln and Union) bordering on western Minnesota and Iowa (Fig. 1). Within each county 3 fields were selected for each of 3 primary habitat types (grassland, wetland-edge, tree belts). Two additional habitats (cropland and woodland) were sampled in Deuel County. Trapping was conducted between mid-May and 31 July in 1994 and 1995 to inventory nongame small mammals. Medium- and large-sized mammals and bats were not sampled. Trap types included Museum Special, regular snap traps and small-sized Sherman-live traps. All traps were baited daily with a mixture of rolled oats, peanut butter and bacon grease. Three traps were set per station (2 snap and 1 live trap) with 10 stations per trap line. One trap line was placed in each of 3 fields per

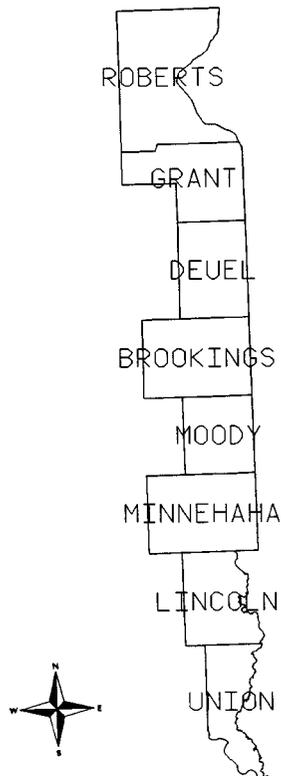


Figure 1. The 8 county study area in eastern South Dakota.

habitat type ($\bar{n} = 3$) per county ($\bar{n} = 8$). Data for 1994 and 1995 were pooled for analysis.

Capture rates (indices of relative abundance) were calculated as the number of individuals captured/100 operable trap nights. An operable trap night was defined as any of those traps containing a specimen or those still set minus those snapped and empty or those containing non-mammal species (e.g., a frog or bird).

All mammal specimens were cross-referenced to data sheets by date, trap number, trap line number, habitat type, and county. Specimens were placed in plastic zip-lock bags with their individual number and cross-reference data and frozen until they could be identified to species. Representative individuals per species by county and habitat types were prepared as voucher specimens and deposited at the Natural History Museum, University of Kansas, Lawrence. Dr. Robert Seabloom of the University of North Dakota, Grand Forks, assisted with species identification verification for all specimens and W.W. Goodpaster prepared the skulls and skins for museum vouchering.

We calculated mean catch rates and standard errors (SE) for all lines/habitat types/county. The General Linear Models procedure in SAS (1990) was used for analysis of variance. Multiple comparisons were performed using Duncan's Multiple Range procedure in Proc GLM.

RESULTS

A total of 2,629 mammals representing 16 species was captured over 38,365 trap nights on 250 traplines in the 8 county study area during 1994-1995 (Fig. 2). Four of the 16 species, cottontail rabbits (*Sylvilagus floridanus*), opossums (*Didelphus marsupialis*), long-tailed weasels (*Mustela frenata*), and least weasels (*M. nivalis*), were not included in the analysis because they were classified as medium-sized game mammals. Distribution and habitats of the remaining 12 small-sized nongame species are discussed below. These 12 species are the: thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), white-footed mouse (*Peromyscus leucopus*), deer mouse (*P. maniculatus*), meadow jumping mouse (*Zapus hudsonicus*), prairie vole (*Microtus ochrogaster*), meadow vole (*M. pennsylvanicus*), western harvest mouse (*Reithrodontomys megalotis*), southern red-backed vole (*Clethrionomys gapperi*), house mouse (*Mus musculus*), northern grasshopper mouse (*Onychomys leucogaster*), masked shrew (*Sorex cinereus*), and short-tailed shrew (*Blarina brevicauda*).

Mean capture rates (captures/100 trap nights) for all species combined declined with trapping session ($F=4.59$, $df=4$, $P=0.0021$). Mean capture rates were 20.2 for rep 1; 19.1 for rep 2; 16.3 for rep 3; 7.1 for rep 4; and 2.3 for rep 5. Declining capture rates may reflect live trap avoidance, or depletion of the populations of vulnerable species at sites where snap traps were used. Declines in capture rates were significant for white-footed mice ($F=2.57$, $df=3$, $P=0.0540$), deer mice ($F=2.97$, $df=4$, $P=0.0195$), meadow voles ($F=7.13$, $df=4$, $P=0.0001$), and house mice ($F=4.42$, $df=2$, $P=0.0574$).

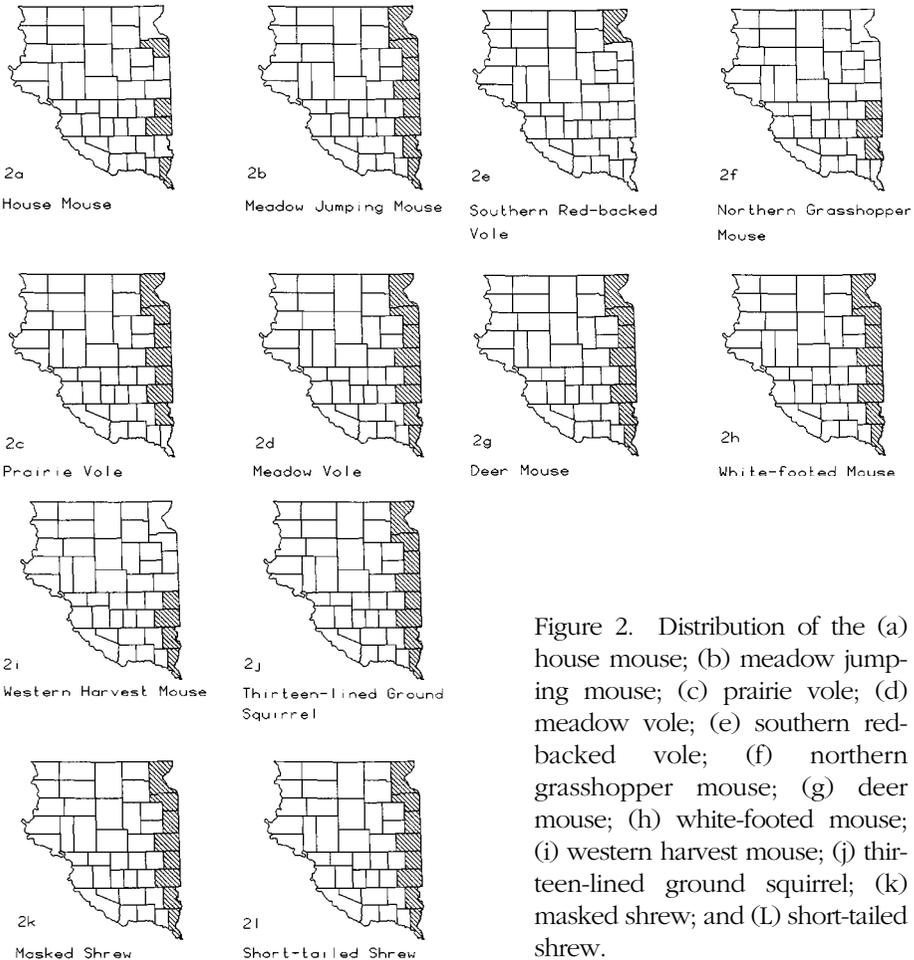


Figure 2. Distribution of the (a) house mouse; (b) meadow jumping mouse; (c) prairie vole; (d) meadow vole; (e) southern red-backed vole; (f) northern grasshopper mouse; (g) deer mouse; (h) white-footed mouse; (i) western harvest mouse; (j) thirteen-lined ground squirrel; (k) masked shrew; and (l) short-tailed shrew.

Species richness did not differ among principal habitat types ($F=0.84$, $df=4$, $P=0.5030$). Mean species richness was 3.9 ($\pm SE=0.45$) for traplines in wetland edges, 3.8 (± 0.37) for traplines in grasslands, and 4.4 (± 0.36) for traplines in tree belts. Capture rates for all species combined varied with habitat types ($F=4.36$, $df=4$, $P=0.0032$) and counties ($F=3.69$, $df=7$, $P=0.0018$) (Table 1). Tree belts, the habitat with the highest mean capture rate (19.7 individuals/100 trap nights), and cropland, the habitat with the lowest mean capture rate (4.7 individuals/100 trap nights), differed. Grasslands (16.4), wetlands (12.1), and other woodlands (6.6) did not differ from tree belts or cropland.

House Mouse

The only exotic species sampled was the house mouse. Ten specimens were captured, representing 4 counties and comprising 0.3% of the total small mammal sample (Fig. 2a). House mice were habitat generalists, occurring with

Table 1. Mean capture rates (captures/100 trap nights) by counties and habitats for all species combined.

County	HABITAT				
	Wetland Edge ^{1,2}	Grassland ^{1,2}	Cropland ²	Tree Belt ¹	Other Woodlands ^{1,2}
Brookings ^a	7.89 ± 5.07	7.67 ± 2.72		4.46 ± 1.46	
Deuel ^b	27.84 ± 8.54	28.19 ± 5.78	4.96 ± 2.18	12.92 ± 2.74	6.58 ± 1.17
Grant ^{a,c}	8.72 ± 4.16	8.82 ± 3.14		7.67 ± 1.70	
Lincoln ^b	9.77 ± 0.61	21.53 ± 8.64		22.98 ± 6.67	
Minnehaha ^b	5.77 ± 1.35	22.38 ± 6.50		43.45 ± 11.25	
Moody ^b	13.04 ± 2.40	12.00 ± 7.08		31.62 ± 9.27	
Roberts ^{a,b,c}	16.90 ± 4.35	13.07 ± 1.19		15.20 ± 4.88	
Union ^{b,c}	6.60 ± 2.83	16.03 ± 5.22		23.19 ± 4.95	

^{a,b,c} Counties with the same letter did not differ in small mammal capture rates.

^{1,2} Habitat types with the same number did not differ in small mammal capture rates.

near equal abundance, as indexed by capture rates, in all habitat types (F=2.14, df=2, P=0.1737) (Table 2).

Meadow Jumping Mouse

Meadow jumping mice occurred in all 8 counties surveyed (Fig. 2b). A total of 287 individuals were captured, comprising 10.9% of the total sample. This species was more abundant in wetland edge habitats than in other habitats (F=13.12, df=4, P=0.0001). Capture rates in wetlands were greater than in woodlands (other than tree belts) or croplands, but did not differ from capture rates in grasslands or tree belts (Table 2). Jones et al. (1983) also reported that meadow jumping mice typically inhabit moist sites with dense cover.

Prairie Vole

Prairie voles were captured in all counties except Union (Fig. 2c). A total of 46 individuals were captured comprising 1.7% of the total sample. This species commonly occupies upland prairies, although they may occur in riparian or swale habitats when meadow voles are absent (Jones et al. 1983). However, capture rates were similar for all habitat types (F=1.92, df=2, P=0.1565) in our study (Table 2).

Meadow Vole

Meadow voles occurred in all 8 counties (Fig. 2d). A total of 419 individuals were captured comprising 15.9% of the total sample. Unlike prairie voles, meadow voles capture rates varied by habitat type (F=7.66, df=4, P=0.0001) (Table 2). Jones et al. (1983) noted that this species typically in-

Table 2. Mean captures rates (captures/100 trap nights) of small mammals by habitat type.

Species	HABITAT TYPE				
	Wetland	Grassland	Cropland	Tree Belt	Other Woodlands
Omnivore					
<i>S. tridecemlineatus</i>	0.69 ± 0.14	4.50 ± 1.92		0.64 ± 0.20	
<i>P. leucopus</i>	3.80 ± 1.34	4.74 ± 1.54	1.19 ± . ^a	29.81 ± 9.44	3.09 ± .
<i>P. maniculatus</i>	4.35 ± 1.93	9.24 ± 2.73	1.11 ± .	19.74 ± 7.63	
<i>Z. hudsonicus</i>	13.86 ± 2.45	4.34 ± 0.92	0.56 ± .	8.15 ± 3.67	1.85 ± .
Insectivore					
<i>S. cinereus</i>	13.09 ± 5.07	13.26 ± 3.80	1.11 ± .	10.15 ± 2.07	5.35 ± .
<i>B. brevicauda</i>	1.97 ± 0.89	3.81 ± 1.12		2.73 ± 1.18	1.36 ± .
<i>O. leucogaster</i>	0.59 ± 0.13	0.71 ± .		1.05 ± .	
Herbivore					
<i>M. ochrogaster</i>	2.39 ± 1.79	2.45 ± 1.36		1.87 ± 0.65	
<i>M. pennsylvanicus</i>	11.58 ± 4.43	14.81 ± 4.60	5.95 ± .	4.16 ± 0.97	0.60 ± .
Granivore					
<i>R. megalotis</i>	0.55 ± 0.10	9.30 ± 2.91		1.10 ± 0.39	
<i>C. gapperi</i>				1.35 ± .	
<i>M. musculus</i>	1.31 ± 0.72	0.82 ± 0.27		1.34 ± .	
Unknown (999)	6.13 ± 2.34	3.74 ± 1.20		5.52 ± 2.09	7.48 ± .

^aN=1

habits moist to wet meadows dominated by lush, dense stands of grasses or sedges, characteristic of wetland edges. In this study, capture rates were higher in grasslands than in wetlands or tree belts (Table 2).

Southern Red-backed Vole

South Dakota is at the southern limit of the range of southern red-backed voles. They (n=37) were captured only in tree belts (Table 2) and only in Roberts County, the northern most edge county in eastern South Dakota (Fig. 2e). These specimens comprised 0.1% of the total sample. Southern red-backed voles are considered a woodland species (Jones et al. 1983).

Northern Grasshopper Mouse

A total of 4 northern grasshopper mice were captured in wetland edges, grasslands, and tree belts in Moody, Minnehaha, and Lincoln counties (Fig. 2f). This species is an obligate dust bather, and it characteristically inhabits sites with dry sandy or silty soils (Jones et al. 1983). Habitat associations were not detected in this study (F=3.32, df=2, P=0.1738), probably because of the small number captured (Table 2).

Deer Mouse

Deer mice occurred in all 8 counties surveyed (Fig. 2g). A total of 437 were captured, comprising 16.6% of the total sample. Deer mice are commonly considered habitat generalists (Jones et al. 1983). Capture rates varied by habitat type ($F=4.97$, $df=3$, $P=0.0021$) in our study, and captures were more abundant in tree belts than in wetlands, grasslands, or croplands (Table 2).

White-footed Mouse

White-footed mice were captured more often than other species in eastern South Dakota border counties. A total of 503 were trapped, comprising 19.1% of the total sample. They were captured in all 8 counties (Fig. 2h) and their capture rates varied by habitat type ($F=7.28$, $df=4$, $P=0.0001$). Capture rates were greater in tree belts than in any other habitat type (Table 2). Jones et al. (1983) noted that white-footed mice on the northern Great Plains were almost invariably found in woodlands.

Western Harvest Mouse

Western harvest mice were captured in the 4 southernmost border counties (Fig. 2i). A total of 79 were captured comprising 3.0% of the total sample. A preponderance of this species was captured in grasslands, although capture rates did not differ among habitat types ($F=1.17$, $df=2$, $P=0.3153$) (Table 2).

Thirteen-lined Ground Squirrel

Thirteen-lined ground squirrels were captured in all 8 counties (Fig. 2j). Their capture rates did not differ among habitat types ($F=0.56$, $df=2$, $P=0.5766$). A total of 56 thirteen-lined ground squirrels were captured, comprising 2.1% of total captures. This species commonly occupies short grass habitats with well drained soils (Jones et al. 1983). In this study a large variance in the mean grassland capture rate (± 1.92) may have masked a preference for grasslands over wetlands and tree belts (Table 2).

Masked Shrew

Masked shrews were captured in all 8 counties (Fig. 2k). A total of 468 were captured, comprising 17.8% of the total sample, and making them the second most common small mammal captured. Masked shrews prefer moist sites, but they occur in a variety of habitats (Jones et al. 1983). In this study, they occurred in all habitats, and captures/100 trap nights were similar for wetland edges, grasslands, and tree belts, which exceeded capture rates for croplands and other woodlands ($F=6.43$, $df=4$, $P=0.0001$) (Table 2).

Short-tailed Shrew

Short-tailed shrews were captured in all 8 counties (Fig. 2L). A total of 111 specimens were captured, comprising 4.2% of the total sample. Principal habitats of this species are deciduous woodlands, although in eastern South Dakota, short-tailed shrews occurred in a variety of habitats. In this study, capture rates were greater than in grasslands or tree belts, but did not differ from capture rates in other woodlands ($F=9.23$, $df=3$, $P=0.0001$) (Table 2).

DISCUSSION

Twelve species, including 10 rodents and 2 insectivores, comprised the principal small mammal fauna of the 8 eastern South Dakota border counties. Five species (meadow jumping mouse, meadow vole, deer mouse, white-footed mouse, and masked shrew) comprised over 80% of small mammals captured. As expected, croplands supported the lowest density of small mammals. Hayslett and Danielson (1994) stated that small mammal populations are influenced more by vegetation structure than by plant community composition. Croplands that are seasonally denuded of vegetation would be expected to support impoverished small mammal communities. We did not find differences in small mammal species richness among the 3 principal habitat types. However, traplines in tree belts had higher mean capture rates than traplines in other habitat types. A high occurrence of zero captures and the high degree of variability in capture rates likely limited our ability to detect significant differences in some data sets.

Of the 12 species captured in eastern South Dakota border counties, 6 (house mouse, western harvest mouse, prairie vole, northern grasshopper mouse, masked shrew, and short-tailed shrew) were habitat generalists. A preponderance of individuals of deer mice and white-footed mice were captured in tree belts. Thirteen-lined ground squirrels were most commonly captured in grasslands (although habitat use differences were not significant), and meadow jumping mice were most abundant in wetlands. Meadow voles were nearly as abundant in wetlands as in grasslands.

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