

TERRESTRIAL VERTEBRATES OF SCOTTS BLUFF NATIONAL MONUMENT, NEBRASKA¹

Mike K. Cox² and William L. Franklin³

ABSTRACT.—A survey of terrestrial vertebrates was conducted at the Scotts Bluff National Monument (SBNM), Nebraska, to determine species composition, relative abundance, and distribution by habitat of the existing amphibians, reptiles, birds, and mammals. Various sampling methods were used to detect animal species richness and to estimate population densities. The seven major habitat types at SBNM contained 4 species of amphibians, 8 reptiles, 96 birds, and 28 mammals. The only endangered or threatened species observed was a dead bald eagle (*Haliaeetus leucocephalus*). The racer (*Coluber constrictor*) and prairie rattlesnake (*Crotalus viridis*) were the two most abundant snakes. The prairie falcon (*Falco mexicanus*) was a common raptor that nested in Scotts Bluff. Sympatric populations of mule deer (*Odocoileus hemionus*) and white-tailed deer (*Odocoileus virginianus*) appeared to be hybridizing. The riverine woodland contained the greatest number of fauna species with only 4% surface area of SBNM. Sharp-tailed grouse (*Tympanuchus phasianellus*) and pronghorn antelope (*Antilocapra americana*), absent from the Monument, are two potential native species for reintroduction.

Scotts Bluff National Monument (SBNM), located in the Nebraska Panhandle, is an area characterized by rolling, xeric, short- and mixed-grass prairie intermixed with rocky bluffs and dissected by the North Platte River. In 1820, Major Stephen H. Long, sent by the U.S. Congress, led an expedition along the Platte River to the Rocky Mountains. In his report of the expedition he called this area "The Great Desert." Although many of the large animals that Major Long encountered, such as pronghorn (*Antilocapra americana*), bison (*Bison bison*), and bighorn sheep (*Ovis canadensis*), are no longer present in the Nebraska Panhandle, the remainder of the fauna still may be found on protected land such as SBNM. Though small, SBNM has highly diversified habitat types. There are other protected public lands in the Panhandle of greater acreage, but no other land holding contains both riparian habitat of the North Platte River and pine-studded bluffs.

No wildlife inventory has been conducted at SBNM since its establishment in 1919. Baseline data are needed to give National Park Service resource managers a point of reference to determine true changes in the faunal communities and to document the existence of any threatened or endangered species. The only formal wildlife research conducted at SBNM prior to this study was a

study on population ecology of the prairie vole (*Microtus ochrogaster*) (Meserve 1971) and another on population status of a newly established black-tailed prairie dog (*Cynomys ludovicianus*) colony (Franklin 1983, 1984). Our study involved inventorying the species composition of the existing amphibian, reptilian, avian, and mammalian species, and determining their relative abundance and distribution by habitat at SBNM.

STUDY AREA

SBNM covers 1,200 ha in Scotts Bluff County, Nebraska. It lies on the south side of the North Platte River, directly west of the Gering city limits. Scotts Bluff, elevation 1,417 m, is the major topographical feature. This redstone bluff rises 183 m above the surrounding terrain. On its summit are ponderosa pine (*Pinus ponderosa*) and Rocky Mountain juniper (*Juniperus scopulorum*), along with a sparse coverage of mixed-grass prairie species. Between Scotts Bluff and the river is a small area of badlands (bare ridges and valleys of eroding sandstone). Along SBNM's southern border is South Bluff, a segment of a long bluff that extends east and west through the county. The only water source, besides the adjacent North Platte River, is an irrigation canal that extends across the northern edge of SBNM (Fig. 1).

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²Department of Animal Ecology, Iowa State University, Ames, Iowa 50011. Present address: EG&G Energy Measurements, Box 1912, Las Vegas, Nevada 89125.

³Department of Animal Ecology, Iowa State University, Ames, Iowa 50011.

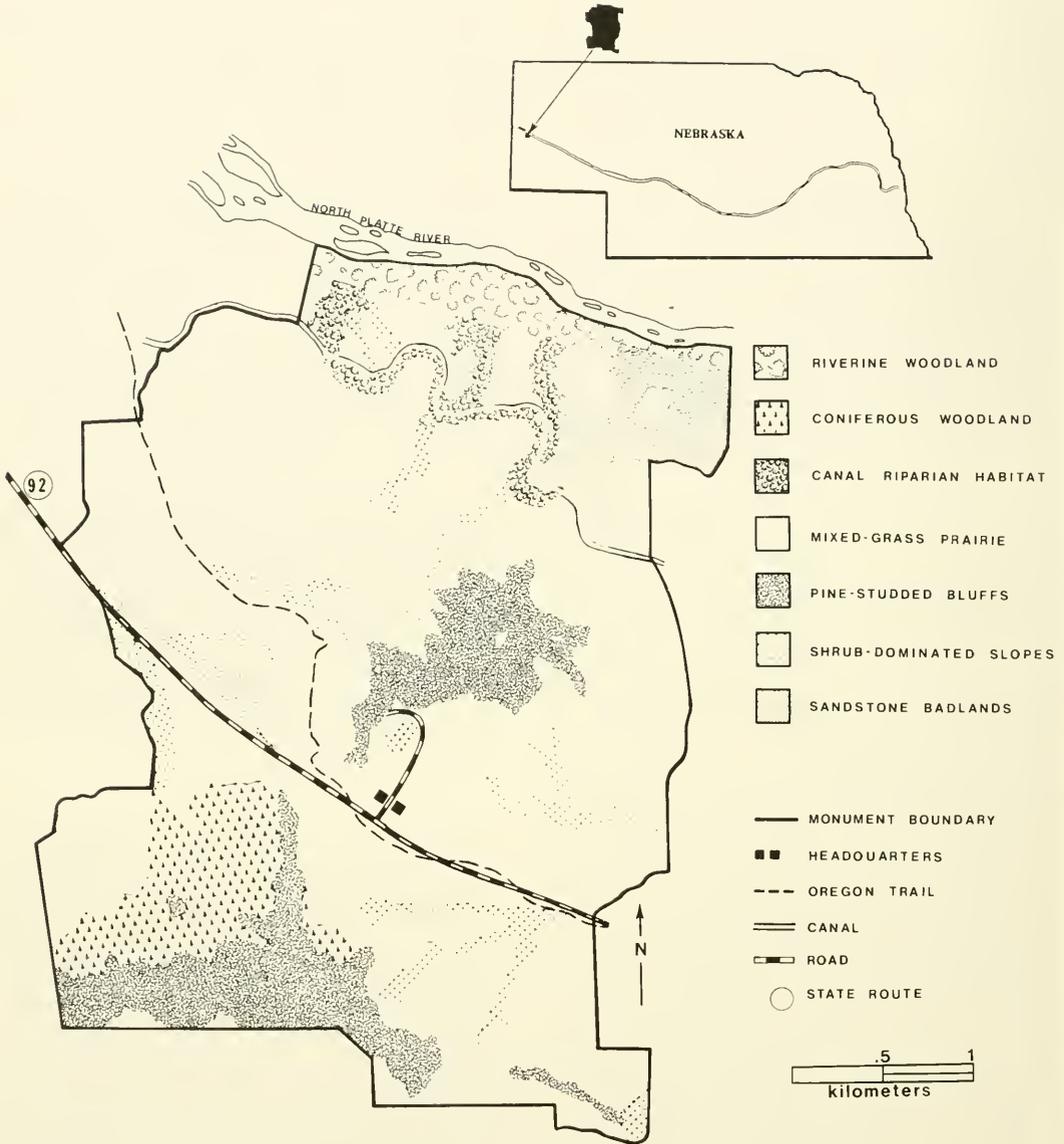


Fig. 1. The seven major habitat types at Scotts Bluff National Monument, Nebraska.

We identified seven major habitats at SBNM: riverine woodland, coniferous woodland, mixed-grass prairie, canal riparian habitat, pine-studded bluffs, shrub-dominated slopes, and badlands (Fig. 1). Dominant tree species in the riverine woodland are cottonwood (*Populus deltoides*), willow (*Salix* sp.), box elder (*Acer negundo*), American elm (*Ulmus americana*), and green ash (*Fraxinus pennsylvanica*). Its understory includes

Carex sp., *Bromus* sp., *Typha glauca*, and *Scirpus* sp. The coniferous woodland is dominated by ponderosa pine and Rocky Mountain juniper. Dominant grass and sedge species found in the mixed-grass prairie are needle-and-thread (*Stipa comata*), western wheatgrass (*Agropyron smithii*), downy brome (*Bromus tectorum*), side-oats grama (*Bouteloua curtipendula*), prairie sandreed (*Calamovilfa longifolia*), and threadlead sedge

(*Carex filifolia*). Common forbs and shrubs in the mixed-grass prairie are western wallflower (*Erysimum asperum*), prickly pear (*Opuntia compressa*), sweet clover (*Melilotus sp.*), kochia (*Kochia scoparia*), yucca (*Yucca glauca*), fringed sage (*Artemisia frigida*), sand sagebrush (*Artemisia filifolia*), winterfat (*Ceratoides lanata*), rubber rabbitbrush (*Chrysothamnus nauseosus*), skunkbush sumac (*Rhus trilobata*), and snowberry (*Symphoricarpos albus*) (Stubben dieck et al. 1986). Dominant tree species in the canal riparian habitat are cottonwood and willow; major shrubs are choke cherry (*Prunus virginiana*), snowberry, and *Ribes sp.*; the most common understory plant is poison ivy (*Toxicodendron rydbergii*). The pine-studded bluffs are dotted with ponderosa pine and Rocky Mountain juniper. Shrub-dominated slopes are primarily covered with skunkbush sumac and Rocky Mountain juniper. Though the badlands are predominantly bare rock, depressions and drainages contain limited cover of *Carex spp.*, downy brome, rubber rabbitbrush, and willow.

Except for a small portion of land (in the extreme northwest corner) purchased in 1970, all vegetation has been protected from grazing by domestic animals since the 1930s. Average annual precipitation from 1978 through 1987 for Scotts Bluff County was 43.50 cm. Over 50% of the precipitation occurred during spring and early summer in the form of violent but brief thundershowers (Meserve 1971). Above-normal rainfall occurred during two years of this survey—55.22 cm in 1986 and 59.03 cm in 1987.

METHODS

Amphibians and reptiles were sampled with two 1 × 15-m drift fences made of aluminum flashing (Vogt and Hine 1982, Campbell and Christman 1982). One was placed in a wet meadow next to the canal and another in mixed-grass prairie. Pitfall traps were located on each end, and one funnel trap was located at the middle of each side of the fence. Traps were left opened and checked every other day from 24 April to 24 July 1987.

Three permanent line transects (1,400 m) were established to estimate avian species density and diversity (Shannon and Weaver 1964) in three selected habitat types (canal

riparian habitat, mixed-grass prairie, and shrub-dominated slopes). Each transect was walked six times during early morning and evening hours in July 1986. Perpendicular distances from the transect were estimated for all visual and auditory avian detections (Burham et al. 1980, Mikol 1980, Emlen 1971).

Small mammals were surveyed in a permanent trapping web and also along various linear transects placed in all habitat types. The 4-ha trapping web consisted of 68 Sherman live traps and 32 pitfall traps located on 16 equidistant lines radiating from a center point (Wilson and Anderson 1985). Baited Sherman live traps and unbaited pitfall traps were opened during four-day trapping periods. Traps were set in early morning and left open for 24 hr. Trapping sessions in the trapping web were conducted 28 April and 11 June 1986 and 20 July 1987. Linear transects of either Sherman live traps (mark-recapture estimation) or snap traps (removal estimation) were placed throughout representative habitat types for four-day trapping periods: 26 June–12 August 1986 and 6 May–25 June 1987.

Prairie dogs were censused 12 June–5 October 1986 and 12 April–31 July 1987, with Tomahawk single-door and double-door live traps baited with rolled oats. All prairie dogs were ear tagged, fur dyed, weighed, sexed, and aged. Five permanent 0.4-ha plots were randomly selected throughout grassland sites to estimate pocket gopher densities on 1 July 1987. Estimation was based on freshly dug gopher mounds (less than one week old) in 10 subsamples (4 m² each) within each plot (Reid et al. 1966).

Deer and furbearer species were spotlighted from the canal road, one hour after sunset, three times during the summer 1987. Bats were mist-netted in the tunnels of the summit road from dusk to 0100 hr in June and July 1986 and 1987 seven times each year.

In addition to the previously defined methods, animals were recorded opportunistically during fieldwork June–August 1986, March–August 1987, and April–June 1988. Interviews with adjacent landowners helped assess the movement of animals on and off SBNM. Sightings by SBNM staff were verified and road kills collected within and adjacent to SBNM. Skulls, nests, and tracks also provided

TABLE 1. Definitions of abbreviations used in tables for residency status, habitat types, and relative abundance.

RESIDENCY STATUS	
P	= Permanent resident, breeding not documented
PB	= Permanent resident, breeding documented
S	= Summer resident (April–October), breeding not documented
SB	= Summer resident, breeding documented
W	= Winter resident (October–April)
M	= Spring or fall migrant
T	= Transient, present for only short duration
HABITAT TYPES	
RW	= Riverine woodland
CW	= Coniferous woodland
CRH	= Canal riparian habitat
MGP	= Mixed-grass prairie
PSB	= Pine-studded bluffs
S	= Shrub-dominated slopes
B	= Sandstone badlands
RELATIVE ABUNDANCE	
A	= Abundant
C	= Common
U	= Uncommon
R	= Rare

useful information on the existing fauna. Taxonomic nomenclature for the herpetofauna was from Lynch (1985), birds from AOU checklist (1983), and mammals from Jones et al. (1983).

RESULTS

Abbreviations used in the species tables for habitat types, residency status, and relative abundance are defined in Table 1. A dead bald eagle (*Haliaeetus leucocephalus*) was the only endangered or threatened species found at SBNM during the two years of the study. The numbers of animal species detected include: 4 amphibians, 8 reptiles, 96 birds, and 28 mammals. These numbers reflect species observed, captured, heard, or positively identified by sign at least once during the two-year period. Other species that may have occurred at low abundance and went undetected will be discussed separately.

Amphibians

Amphibian species richness was low because of the absence of a permanent, nonflowing water source, important for breeding and egg deposition. The Woodhouse's toad (*Bufo woodhousii*), found on open grasslands, was the most common of the four species of amphibians (Table 2). The Great Plain's toad

(*Bufo cognatus*) was found only on the lawns of the headquarters (Fig. 1). The western striped chorus frog (*Pseudacris triseriata*) and tiger salamander (*Ambystoma tigrinum*) were caught in pitfall traps of the drift fences on days immediately after heavy rains. There are no previous records of tiger salamanders in Scotts Bluff County (Lynch 1985).

Reptiles

Three turtle species were identified (Table 3). The painted turtle (*Chrysemys picta*) was found along the river and infrequently in the mixed-grass prairie. Ornate box turtles (*Terrapene ornata*), the most abundant turtles, were common in open grasslands, and are known to spend winters underground in burrows dug by turtles or rodents (Hammerson 1982). New county records were established for both the painted ornate box turtle and the spiny softshell turtle (*Trionyx spiniferus*) (Lynch 1985).

Of the five snake species identified (Table 3), the racer (*Coluber constrictor*), commonly referred to as a "blue" racer, and the prairie rattlesnake (*Crotalus viridis*) were the two most abundant snakes. Although both species were found in shrubs and dense grass during any part of the day, the prairie rattler was commonly associated with shorter, sparser vegetation than was the racer. The earliest sighting of a prairie rattler in 1987 was 29 April and, in 1988, 17 April. From mid-June through the first week of August 1986, 18 rattlesnakes were observed in separate areas located throughout SBNM. During this same period in 1987, 19 rattlesnakes were seen. Only perennially wet areas, such as those in the riverine woodland, seem to be avoided by rattlesnakes. Bull snakes (*Pituophis catenifer*) were found throughout SBNM where there was an abundant small mammal population. This is a new county record (Lynch 1985).

Birds

PELECANIFORMES, CICONIIFORMES, AND ANSERIFORMES.—Nine species from these orders were found (Table 4). The double-crested cormorant (*Phalacrocorax auritus*) was observed on the banks of the Platte River during the summer. Great blue herons (*Ardea herodias*) were seen frequently in the river and occasionally foraging in the canal. A pair of wood ducks (*Aix sponsa*) and ducklings were seen

TABLE 2. Amphibian species residency status, distribution by habitat, and relative abundance at Scotts Bluff National Monument. Abbreviations are explained in Table 1.

Common name <i>Scientific name</i>	Residency status	Habitat types						
		RW	CW	CRH	MCP	S	PSB	B
Tiger salamander <i>Ambystoma tigrinum</i>	PB	U		U	U			
Great Plains toad <i>Bufo cognatus</i>	PB				U			
Woodhouse's toad <i>Bufo woodhousii</i>	PB	C		C	C	U		U
Western striped chorus frog <i>Pseudacris triseriata</i>	PB	C		U				U

TABLE 3. Reptilian species residency status, distribution by habitat, and relative abundance at Scotts Bluff National Monument. Abbreviations are explained in Table 1.

Common name <i>Scientific name</i>	Residency status	Habitat types						
		RW	CW	CRH	MCP	S	PSB	B
Painted turtle <i>Chrysemys picta</i>	PB	C		C	U			U
Ornate box turtle <i>Terrapene ornata</i>	PB	C		C	C	U	U	U
Spiny softshell turtle <i>Trionyx spiniferus</i>	P	U						
Racer <i>Cohuber constrictor</i>	PB	A	C	A	A	C	U	U
Bull snake <i>Pituophis catenifer</i>	PB	C	C	C	A	C	U	U
Plains gartersnake <i>Thamnophis radix</i>	PB	U		C	U			U
Common gartersnake <i>Thamnophis sirtalis</i>	PB	C		C	R			
Prairie rattlesnake <i>Crotalus viridis</i>	PB	U	C	U	A	C	C	U

consistently in the canal, but no nest was found. The mallard duck (*Anas platyrhynchos*) was the most abundant waterfowl species at SBNM and successfully nested in upland areas including the prairie dog colony.

FALCONIFORMES.—A total of nine raptor species was observed (Table 4). On 5 April 1988 an adult bald eagle was found dead next to the canal in the northwest corner of SBNM. The eagle had been dead less than one week when found, but the cause of death could not be determined from external examination. A necropsy performed at the National Wildlife Disease Laboratory in Madison, Wisconsin, showed that the eagle died of pulmonary hemorrhage, possibly caused by electrocution. The only raptor whose nesting has been confirmed at SBNM is the prairie falcon (*Falco mexicanus*). In 1986 five fledglings from two

successful nests were seen, and in 1987 seven fledglings were produced from the same two nests. Sightings of fledglings were strong evidence that American kestrels (*F. sparverius*) and turkey vultures (*Cathartes aura*) nested within Scotts Bluff, although no nests were located. A pair of adult golden eagles (*Aquila chrysaetos*) were observed in a nest on South Bluff, but no young were observed. A pair of red-tailed hawks (*Buteo jamaicensis*) were consistently seen soaring over South Bluff riding thermals, though no nest was located.

GALLIFORMES.—The introduced ring-necked pheasant (*Phasianus colchicus*) was well established at SBNM. The adult male pheasant population was estimated to be 20–25 during the post-hatch period, May–June 1987. Hailstorms during the middle of the pheasants' 1987 nesting season caused

TABLE 4. Avian species residency status, distribution by habitat, and relative abundance at Scotts Bluff National Monument. Abbreviations are explained in Table 1.

Common name <i>Scientific name</i>	Residency status	Habitat types						
		RW	CW	CRH	MCP	S	PSB	B
Double-crested cormorant <i>Phalacrocorax auritus</i>	S	U						
Great blue heron <i>Ardea herodias</i>	S	C		U				
Snow goose <i>Chen caerulescens</i>	M							
Canada goose <i>Branta canadensis</i>	S	U						
Wood duck <i>Aix sponsa</i>	S	U		U				
Green-winged teal <i>Anas crecca</i>	S	U						
Blue-winged teal <i>Anas discors</i>	S	U						
Mallard <i>Anas platyrhynchos</i>	SB	C		C	U			
Common merganser <i>Mergus merganser</i>	S	U						
Turkey vulture <i>Cathartes aura</i>	SB		U		C		C	
Osprey <i>Pandion haliaetus</i>	T						R	
Northern harrier <i>Circus cyaneus</i>	P				U		R	
Swainson's hawk <i>Buteo swainsoni</i>	S		U		U			
Red-tailed hawk <i>Buteo jamaicensis</i>	P	U	U		U		U	U
Golden eagle <i>Aquila chrysaetos</i>	P		R		R		U	
Bald eagle <i>Haliaeetus leucocephalus</i>	M	R		R				
American kestrel <i>Falco sparverius</i>	SB	R	U	C	C	U	C	U
Prairie falcon <i>Falco mexicanus</i>	SB		U	R	C		C	
Ring-necked pheasant <i>Phasianus colchicus</i>	PB	U	U	U	C	C		R
Wild turkey <i>Meleagris gallopavo</i>	P	R		R				
Northern bobwhite <i>Colinus virginianus</i>	P			U	C	R		
Sora <i>Porzana carolina</i>	S	R						
Killdeer <i>Charadrius vociferus</i>	S	U		U	U			
Upland sandpiper <i>Bartramia longicauda</i>	S				R			
Franklin's gull <i>Larus pipixcan</i>	S				U			
Herring gull <i>Larus argentatus</i>	S				U			
Rock dove <i>Columba livia</i>	P						C	
Mourning dove <i>Zenaida macroura</i>	SB	C	U	C	C	C	U	R
Yellow-billed cuckoo <i>Coccyzus americanus</i>	S	R						
Barn owl <i>Tyto alba</i>	P				R	R		

TABLE 4 continued.

Great horned owl <i>Bubo virginianus</i>	PB	U	C	C	U	C	U	C
Burrowing owl <i>Athene cunicularia</i>	SB				C			
Short-eared owl <i>Asio flammeus</i>	P		R		R	R		
Common nighthawk <i>Chordeiles minor</i>	SB	U		U	C		C	U
Common poor-will <i>Phalaenoptilus nuttallii</i>	SB						U	
White-throated swift <i>Aeronautes saxatalis</i>	SB			U	U	U	A	
Chimney swift <i>Chaetura pelagica</i>	S				U		U	
Belted kingfisher <i>Ceryle alcyon</i>	S	U		U				
Northern flicker <i>Colaptes auratus</i>	SB	C		C	U	U		
Hairy woodpecker <i>Picoides villosus</i>	PB	U		U				
Downy woodpecker <i>Picoides pubescens</i>	PB	C		U				
Red-headed woodpecker <i>Melanerpes erythrocephalus</i>	S	R		R				
Western wood-pewee <i>Contopus sordidulus</i>	S		R	R				
Say's phoebe <i>Sayornis saya</i>	S	U	U	U	C	U		
Eastern kingbird <i>Tyrannus tyrannus</i>	SB	U	U	C	C	C	U	
Western kingbird <i>Tyrannus verticalis</i>	SB	U		U	C	U		
Horned lark <i>Eremophila alpestris</i>	P				U			
Northern rough-winged swallow <i>Stelgidopteryx serripennis</i>	S	C		C	U			
Bank swallow <i>Riparia riparia</i>	S	U						
Cliff swallow <i>Hirundo pyrrhonota</i>	SB	C		C	C			
Barn swallow <i>Hirundo rustica</i>	SB	C		C	C	U		
Blue jay <i>Cyanocitta cristata</i>	P	U		U				
Black-billed magpie <i>Pica pica</i>	PB	C	C	C	C	C	C	
American crow <i>Corvus brachyrhynchos</i>	P	R		R				
Black-capped chickadee <i>Parus atricapillus</i>	PB	C	C	C		U	C	U
Rock wren <i>Salpinctes obsoletus</i>	SB	U	U	U		C	A	C
House wren <i>Troglodytes aedon</i>	SB	A		A				
Eastern bluebird <i>Sialia sialis</i>	S	U						
Mountain bluebird <i>Sialia currucoides</i>	S					U		
Townsend's solitaire <i>Myadestes townsendi</i>	W		C					
Swainson's thrush <i>Catharus ustulatus</i>	M	U						
American robin <i>Turdus migratorius</i>	SB	C	A	C	C	C	U	C
Brown thrasher <i>Toxostoma rufum</i>	SB	U		U		U		

TABLE 4 continued.

Cedar waxwing <i>Bombycilla cedrorum</i>	T	U	U				
Loggerhead shrike <i>Lanius ludovicianus</i>	S				U	C	
European starling <i>Sturnus vulgaris</i>	PB	A	C	A		U	U
Warbling vireo <i>Vireo gilvus</i>	S	R					
Yellow warbler <i>Dendroica petechia</i>	S	C		U			
Common yellowthroat <i>Geothlypis trichas</i>	S	C		U			
Yellow-breasted chat <i>Icteria virens</i>	SB	C	U	C	U	C	
Western tanager <i>Piranga ludoviciana</i>	M		R	R			
Black-headed grosbeak <i>Pheucticus melanocephalus</i>	S					R	
Blue grosbeak <i>Guiraca caerulea</i>	SB	U	C	C	U	C	U
Lazuli bunting <i>Passerina amoena</i>	SB	C	U	C		U	
Indigo bunting <i>Passerina cyanea</i>	SB	U	U	C		U	
Rufous-sided towhee <i>Pipilo erythrophthalmus</i>	SB	C	C	C	U	A	C
American tree sparrow <i>Spizella arborea</i>	W					U	
Brewer's sparrow <i>Spizella breweri</i>	M				U	U	
Clay-colored sparrow <i>Spizella pallida</i>	M				U	U	
Chipping sparrow <i>Spizella passerina</i>	SB		U	U	C	U	
Vesper sparrow <i>Poocetes gramineus</i>	S				U	U	
Lark sparrow <i>Chondestes grammacus</i>	SB		U	C	U	C	U
Lark bunting <i>Calamospiza melanocorys</i>	SB				C	U	
Grasshopper sparrow <i>Anmodramus savannarum</i>	SB				C		
White-crowned sparrow <i>Zonotrichia leucophrys</i>	M	C	C	C	U	C	C
Dark-eyed junco <i>Junco hyemalis</i>	W		C			C	
Red-winged blackbird <i>Agelaius phoeniceus</i>	S	C		U			
Western meadowlark <i>Sturnella neglecta</i>	SB		U	C	A	C	
Common grackle <i>Quiscalus quiscula</i>	SB	A		C		C	
Brown-headed cowbird <i>Molothrus ater</i>	SB	C		A	C	C	
Orchard oriole <i>Icterus spurius</i>	SB	U		C			
Northern oriole <i>Icterus galbula</i>	S	U		U	R		
House finch <i>Carpodacus mexicanus</i>	P	U		U		C	U
Pine siskin <i>Carduelis pinus</i>	P			U		U	
American goldfinch <i>Carduelis tristis</i>	PB	C	U	A	C	U	U
House sparrow <i>Passer domesticus</i>	PB	C	U	C	U	C	U

nest destruction. Of three nests located in June 1987, all had been destroyed following a severe hailstorm. The extent of pheasant nest predation was not determined. The greatest concentration of northern bobwhite (*Colinus virginianus*) was along the canal on the west side of SBNM where weedy plant species were abundant. Sightings of fledgings have documented the northern bobwhite's reproduction on adjacent lands, but no nests were located at SBNM.

GRUIFORMES AND CHARADRIIFORMES.—Species of these two orders were uncommon at SBNM (Table 4). In all three field seasons we observed a pair of upland sandpipers (*Bartramia longicauda*) in the prairie dog colony but found no nest. Herring gulls (*Larus argentatus*) and Franklin's gulls (*L. pipixcan*) were seen infrequently flying over SBNM between their feeding bouts in adjacent plowed fields in the spring.

COLUMBIFORMES AND CUCULIFORMES.—The mourning dove (*Zenaida macroura*), although not abundant, had nests located throughout SBNM. Five nests were located in 1987—three on the ground and two in trees. The only representative of the Cuculiformes order was the yellow-billed cuckoo (*Coccyzus americanus*), an uncommon summer resident in the riverine woodland.

STRIGIFORMES.—Great horned owls were common in the coniferous woodland and badlands. George Oviatt, SBNM resource manager, located a successful nest in a steep bank of the badlands in 1987. Other great horned owl nests were located in steep sandstone, clay banks. Two pairs of burrowing owls (*Athene cunicularia*) were sighted frequently in the prairie dog colony in 1986. In 1987, seven owls fledged from one clutch and five from another during the first week of July. Pellets collected on prairie dog mounds contained mostly prairie voles and various beetle species. The only barn owl (*Tyto alba*) seen was a road kill on 8 July 1987 along Highway 92.

CAPRIMULGIFORMES AND APODIFORMES.—We observed common poor-wills (*Phalaenoptilus nuttallii*) at dusk as they vocalized their distinctive call while flying over Scotts Bluff. Common nighthawks (*Chordeiles minor*) were observed over Scotts Bluff. The white-throated swift (*Aeronautes saxatalis*) was more abundant than the chimney swift (*Chaetura pelagica*), and nests of the former were

located in crevices of Scotts Bluff. Also, fledglings were observed during August.

CORACIFORMES AND PICIFORMES.—Belted kingfishers (*Ceryle alcyon*) were commonly seen along the canal and shores of the Platte River. Although we located no nests, we suspected that the vertical bluffs in the river bottom provided potential nest sites. The northern flicker (*Colaptes auratus*) was the most abundant of the four woodpeckers at SBNM. Both red-shafted and yellow-shafted phases were observed, with SBNM located within their hybridization zone (NGS 1987).

PASSERIFORMES.—Four species of flycatchers were observed at SBNM (Table 4). The Say's phoebe (*Sayornis saya*), eastern kingbird (*Tyrannus tyrannus*), and western kingbird (*T. verticalis*) were found in the prairie dog colony, along the canal, and in mixed-grass prairie with shrub-dominated draws surrounding Scotts Bluff.

Barn swallows (*Hirundo rustica*), cliff swallows (*H. pyrrhonota*), and northern rough-winged swallows (*Stelgidopteryx serripennis*) were common along the canal, river, and their adjoining uplands. Large aggregations of cliff swallows foraged over the prairie dog colony and an adjacent western wheatgrass field.

The black-billed magpie (*Pica pica*) was the most abundant corvid. House wrens (*Troglodytes aedon*) were abundant in the canal riparian habitat and in the riverine woodland, while rock wrens (*Salpinctes obsoletus*) occupied slopes of bluffs, badlands, and shrub-dominated ravines.

Mountain bluebirds (*Sialia currucoides*) and eastern bluebirds (*S. sialis*) were uncommon transients during spring and summer, whereas the Townsend's solitaire (*Myadestes townsendi*) was a common fall migrant in the coniferous woodlands. The American robin (*Turdus migratorius*) was widely distributed throughout SBNM, and brown thrashers (*Toxostoma rufum*) were found where there was abundant tree or shrub cover.

The introduced European starling (*Sturnus vulgaris*) had colonized the canal riparian habitat. It and the brown-headed cowbird (*Molothrus ater*) were the most abundant avian species along the canal. The only vireo species observed was the warbling vireo (*Vireo gilvus*) in the riverine woodland.

Three wood warbler species were present at SBNM (Table 4). The yellow warbler

(*Dendroica petechia*) and common yellow-throat (*Geothlypis trichas*) were seen in the canal riparian and riverine woodland habitats. Yellow-breasted chats (*Icteria virens*), found in these two habitats, were also common in shrub-dominated slopes and in the coniferous woodland.

The black-headed grosbeak (*Pheucticus melanocephalus*) was infrequent in the shrub-dominated slopes. Blue grosbeaks (*Guiraca caerulea*) were abundant in thickets along the canal and in shrub-dominated slopes. Both the lazuli bunting (*Passerina anoena*) and indigo bunting (*P. cyanea*) were common within the same habitats as the blue grosbeak.

Rufous-sided towhees (*Pipilo erythrophthalmus*) were conspicuously abundant at SBNM. They nested in thick vegetation of shrubs and vines and, like the robin, occurred in almost every habitat type at SBNM.

Ten species of sparrows occurred at SBNM (Table 4). Lark buntings (*Calamospiza melanocorys*), lark sparrows (*Chondestes grammacus*), chipping sparrows (*Spizella passerina*), and grasshopper sparrows (*Ammodramus sавannarum*) all bred at SBNM. Lark sparrows utilized juniper stands for nest sites, whereas chipping sparrows nested in and around deciduous trees along the canal. The other summer resident, the vesper sparrow (*Poocetes gramineus*), was uncommon in the grasslands north and west of Scotts Bluff. Large migratory flocks of white-crowned sparrows (*Zonotrichia leucophrys*) were present in the fall and spring. Migrating Brewer's sparrows (*Spizella breweri*) and clay-colored sparrows (*Spizella pallida*) were observed in the trees surrounding the headquarters in May 1988.

The red-winged blackbird (*Agelaius phoeniceus*), the only blackbird at SBNM, was seen exclusively in the canal riparian habitat and the riverine woodland. Western meadowlarks (*Sturnella neglecta*) were prominent throughout the mixed-grass prairie.

Common grackles (*Quiscalus quiscula*) were abundant in the prairie dog colony and common wherever trees were located; most nests were found in cottonwood and willow trees along the canal. The brown-headed cowbird was the most abundant bird on the line transects within the canal riparian habitat.

Orchard orioles (*Icterus spurius*) were more abundant than the bullock's race of the northern oriole (*I. galbula*) at SBNM.

Orchard orioles were concentrated along the canal and in the riverine woodland. Northern orioles were found in both deciduous tree stands and adjacent grasslands.

American goldfinches (*Carduelis tristis*) were abundant throughout SBNM, with highest densities along the canal. House finches (*Carpodacus mexicanus*) were associated with shrubby vegetation within riparian areas, grasslands, and the badlands. Both house finches and pine siskins (*Carduelis pinus*) were permanent residents. The house sparrow (*Passer domesticus*), another introduced North American species, was common around the visitor center and canal riparian habitat.

The canal riparian habitat transect had significantly greater overall bird abundance (41 birds/100 ha \pm 7.39) compared with the two transects in mixed-grass prairie and shrub-dominated slopes ($F = 15.15$, $P < .001$). Species richness was also greatest in the canal riparian habitat transect (22 ± 4.09) compared with the other two transects ($F = 4.79$, $P < .100$). The Shannon diversity index for the canal riparian habitat transect was not significantly different from the other two transects ($F = 1.98$, $P = .100$).

Mammals

MARSUPIALIA AND INSECTIVORA.—Opussums (*Didelphis virginiana*) were observed along the irrigation canal east and west of SBNM, and tracks were found along the canal within SBNM boundaries (Table 5). The eastern mole (*Scalopus aquaticus*) was the only species of this order found at SBNM. The prairie dog colony, side slopes of draws, and disturbed grassland sites had the highest densities.

CHIROPTERA.—The only bats observed were the small-footed myotis (*Myotis liebigi*) and big brown bat (*Eptesicus fuscus*). The small-footed myotis was the most common bat captured in the tunnels of the summit road. Small-footed myotis were also sighted feeding over the canal.

LAGOMORPHIA.—Desert cottontails (*Sylvilagus audubonii*) were found in the more xeric areas such as the bluffs, grasslands, and shrub-dominated slopes. Small shrubs, like snowberry and skunkbush sumac, were used by desert cottontails for cover and feeding sites within grasslands and associated gullies.

TABLE 5. Mammalian species residency status, distribution by habitat, and relative abundance at Scotts Bluff National Monument. Abbreviations are explained in Table 1.

Common name <i>Scientific name</i>	Residency status	Habitat types						
		RW	CW	CRH	MGP	S	PSB	B
Virginia opossum <i>Didelphis virginiana</i>	P	R		U				
Eastern mole <i>Scalopus aquaticus</i>	PB	C	U	U	C			
Small-footed myotis <i>Myotis leibii</i>	SB	C		C			A	
Big brown bat <i>Eptesicus fuscus</i>	SB						U	
Desert cottontail <i>Sylvilagus audubonii</i>	PB		U		A	C	C	U
Eastern cottontail <i>Sylvilagus floridanus</i>	PB	C	U	C	C	C		
Black-tailed prairie dog <i>Cynomys ludovicianus</i>	PB				C			
Fox squirrel <i>Sciurus niger</i>	PB	U		U				
Plains pocket gopher <i>Geomys bursarius</i>	PB	C	U	U	A	U		
Hispid pocket mouse <i>Perognathus hispidus</i>	PB				C			
Ord's kangaroo rat <i>Dipodomys ordii</i>	PB				U			
Western harvest mouse <i>Reithrodontomys megalotis</i>	PB				C		U	
Deer mouse <i>Peromyscus maniculatus</i>	PB	C	C	C	A	C	C	U
Bushy-tailed woodrat <i>Neotoma cinerea</i>	P						U	
House mouse <i>Mus musculus</i>	PB				C			
Prairie vole <i>Microtus ochrogaster</i>	PB	C		C	A	U		U
Meadow vole <i>Microtus pennsylvanicus</i>	PB	C						
Muskrat <i>Ondatra zibethicus</i>	T			U				
Porcupine <i>Erethizon dorsatum</i>	P		U					
Coyote <i>Canis latrans</i>	PB		U	U	C	C	U	
Red fox <i>Vulpes vulpes</i>	P	U		R	U			
Raccoon <i>Procyon lotor</i>	P	U		C	U		U	
Long-tailed weasel <i>Mustela frenata</i>	P	U			U	U		
Mink <i>Mustela vison</i>	P			U				
Badger <i>Taxidea taxus</i>	T				R			
Striped skunk <i>Mephitis mephitis</i>	P	U		U				
Mule deer <i>Odocoileus hemionus</i>	PB	U	C	U	C	A	U	U
White-tailed deer <i>Odocoileus virginianus</i>	PB	C		U	U	U		

Eastern cottontails (*S. floridanus*) inhabited wooded, more mesic sites but also were found in the grasslands in association with desert cottontails. Both the white-tailed jackrabbit (*Lepus townsendii*) and the black-tailed jackrabbit (*L. californicus*) were absent from SBNM; their extirpation from the park was further substantiated from interviews with ranchers in adjacent areas.

RODENTIA.—Two scuirids occurred at SBNM, the fox squirrel (*Sciurus niger*) and the black-tailed prairie dog. In 1986 two adjoining prairie dog colonies existed in the extreme northwestern corner of SBNM near the irrigation canal; the prairie dogs were discovered at SBNM in 1982, after having been absent since 1941 (Franklin 1983). In 1986 both colonies were censused by live-trapping all individuals—109 in the old colony nearest the canal and 89 in the new colony directly south of the old one. Both colonies combined occupied 5.77 ha in August 1986. In spring 1987, after pup emergence, the old colony had 213 prairie dogs and the new colony 88. Both colonies combined occupied 8.63 ha in August 1987 (1.1% of SBNM's inhabitable grassland). We found a number of animals coexisting with the prairie dogs within this microhabitat, including Woodhouse's toads, prairie rattlesnakes, western box turtles, prairie voles, hispid pocket mice (*Perognathus hispidus*), Ord's kangaroo rat (*Dipodomys ordii*), cottontail rabbits, burrowing owls, upland sandpipers, lark buntings, and kingbirds. The fox squirrel occurred at SBNM in the riverine woodland and canal riparian habitat in low numbers.

Plains pocket gophers (*Geomys bursarius*) were abundant in the grasslands throughout SBNM. Pocket gopher densities were estimated by counting fresh gopher mounds (Reid et al. 1966). With a sampling estimate of 25 mounds/ha, pocket gopher densities were estimated at 4.67/ha within mixed-grass prairie (see Vaughan 1961).

Localized populations of hispid pocket mice occurred in disturbed mixed-grass prairie containing a variety of exotic broadleaf plant species and a large volume of seeds resulting from previous dry land farming. Despite 4,150 trap nights from 6 June to 15 August 1986 and 4 April to 14 June 1987 throughout the entire SBNM, Ord's kangaroo rats were captured only within the prairie dog colony.

Western harvest mice (*Reithrodontomys megalotis*) occurred in the prairie dog colony and other grassland sites. Deer mice (*Peromyscus maniculatus*) were the most widely distributed small mammal at SBNM, as they are in many other regions of the United States. They were captured in all types of grassland sites, ravines, riverine woodland, and on top of Scotts Bluff. Population estimates for deer mice were calculated using the program CAPTURE (Otis et al. 1978). Naive density estimates (calculated by dividing the estimated population size by a naive estimate of the area trapped) from removal trapping at a site predominantly covered by kochia, previously occupied by a feedlot, and on top of Scotts Bluff were 31.5 deer mice/ha and 12.5 deer mice/ha, respectively. The naive density estimate from mark-recapture sampling in a sparsely vegetated area along the base of South Bluff was 11.9 deer mice/ha.

Bushy-tailed woodrats (*Neotoma cinerea*) were uncommon at SBNM. They have been found almost exclusively in rocky areas, with their houses situated in crevices and cracks beneath rocks and occasionally in man-made structures (Jones et al. 1983).

The house mouse (*Mus musculus*), an introduced Eurasian species, occurred in and amongst storage buildings and in exotic broadleaf vegetation sites, such as the old feedlot next to the prairie dog colony. The *Mus* population was sampled along the same transect as the *Peromyscus* population, next to the prairie dog colony. Naive density was estimated to be a minimum of 31.5 house mice/ha—*Mus* trapping success never decreased during the four-day sampling period.

Both prairie voles and meadow voles (*Microtus pennsylvanicus*) occurred at SBNM. The prairie vole, the most abundant small mammal in the grassland habitat, also inhabited the badlands, riverine woodland, canal riparian habitat, and rocky areas. Program TRANSECT was used to estimate vole densities in the trapping web (Anderson et al. 1983). Prairie vole density for the late-April trapping session in 1987 was 38.54 voles/ha (S.E. \pm 14.16).

Muskrats (*Ondatra zibethicus*) occurred mostly as transients along the canal. The North Platte River does not flood far enough inland to create standing water at a level for muskrat dens to be constructed; thus,

muskrat shelter was limited to dens burrowed in the riverbank.

The porcupine (*Erethizon dorsatum*) was found in the coniferous woodland in all seasons and in adjacent prairie during the spring, summer, and fall. Pine tree girdling was evident but not excessive in the coniferous woodland and slopes of South Bluff. The entire population of porcupines at SBNM was estimated to be less than 10.

CARNIVORA.—In July 1986 three coyote (*Canis latrans*) pups were observed in draws west of Scotts Bluff. On 7 August 1987 four juvenile coyotes and an adult were observed foraging at the northwestern base of Scotts Bluff. Coyote scats were found throughout the prairie dog colony; these contained remains of prairie voles, but not of prairie dogs. The coyote population in August 1987 was estimated to be 10–20 individuals. Red fox (*Vulpes vulpes*) tracks were encountered occasionally along the canal. Our only sighting of a red fox was in a drainage next to the riverine woodland. In 1985 a red fox was chased from the top of Scotts Bluff and over a cliff by a domestic dog.

Raccoons (*Procyon lotor*) occurred in the canal riparian habitat, river woodland, areas of dense cover, and water drainages. Estimates based on tracks and observations indicated that SBNM's raccoon population was 5–20 individuals.

A long-tailed weasel (*Mustela frenata*) skull was found along the southwest boundary fence in 1987. In June 1988 a long-tailed weasel was captured during our live-trapping of prairie dogs. The weasel was possibly using an abandoned prairie dog burrow as a den site. In June 1988 a mink (*Mustela vison*) was observed along the canal bank on the east side of the SBNM. A three-quarter grown badger was sighted by a park employee in a snow-berry thicket directly north of the visitor center in July 1987. In April 1988 we found 36 prairie dog burrow mounds in the new colony that had been dug out by a badger. Striped skunks (*Mephitis mephitis*) were observed during spotlighting along the canal and adjacent lands in 1987. Tracks also were found within the river woodland. Insufficient information was available to estimate their numbers.

ARTIODACTYLA.—Both mule deer (*Odocoileus hemionus*) and white-tailed deer

(*O. virginianus*) occurred at SBNM. Mule deer used all habitat types. In the spring and summer, they tended to graze more on grasses and forbs than to browse on trees and shrubs. Sightings of white-tailed deer were mostly restricted to the riverine woodland and mixed-grass prairie north of Scotts Bluff. We suspect that hybridization occurs at SBNM. A male deer having a distinct white-tailed antler formation but with a black tail was observed next to the canal during the summer of 1986.

Recruitment by the deer population indicated a growing and healthy population. In 1987 fawns were observed throughout the entire fawning period. Ten different mule and three different white-tailed deer fawns were detected. Because SBNM is small and deer movement across its boundaries is common (especially during the winter), large variations in population estimations were observed. In broad terms, the 1987 population was estimated to be between 50 and 100 individuals (86% mule deer, based on daily records of deer species throughout the study).

Species Richness by Habitat

Figure 2 shows the distribution of species by habitat type. The riverine woodland, which accounts for only 4% of the total area, had 57% of the total species. The canal riparian habitat, which makes up 6% of the area, had 54% of the total species. The mixed-grass prairie's surface area of 47% was proportional to its 50% species occurrence. The riverine woodland and canal riparian habitat had the greatest percentage of bird species at 58% and 54%, respectively. The richest mammalian habitat was the mixed-grass prairie, with 71% of the total mammalian species. The herpetofauna species richness was greatest in the riverine woodland. Fourteen wildlife species were unique in the riverine woodland and 12 in the mixed-grass prairie.

Potentially Present Species

Of the possible 234 wildlife species recorded in the local vicinity of SBNM, only 136, or 58% were found to occur at SBNM. Herpetofauna cited by Lynch (1985) as occurring in Scotts Bluff County but not observed during the survey were: northern leopard frog (*Rana pipiens*), bullfrog (*Rana catesbeiana*), short-horned lizard (*Phrynosoma*

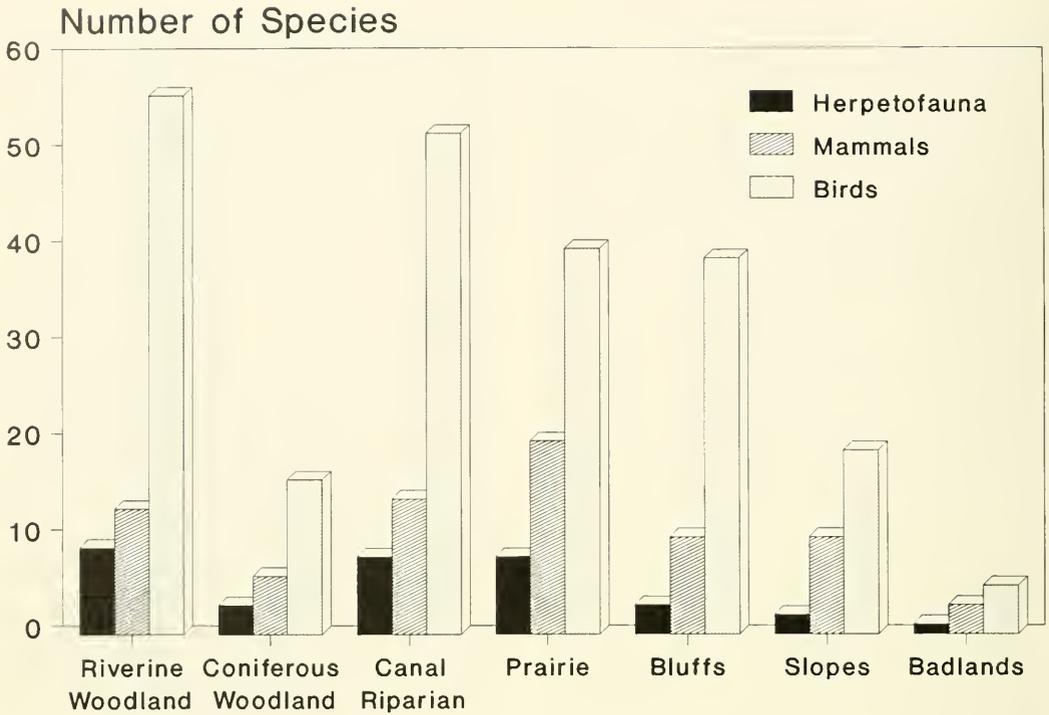


Fig. 2. Wildlife species richness for seven habitat types at Scotts Bluff National Monument.

douglassii), lesser earless lizard (*Holbrookia maculata*), northern prairie lizard (*Sceloporus undulatus*), western hognose snake (*Heterodon nasicus*), and milk snake (*Lampropeltis triangulum*).

Numerous avian species cited by observers in Nebraska Bird Review since 1985 and Johnsgard (1979) as occurring or breeding in the Nebraska Panhandle were not observed during this study. These included: 1 species of loon, 3 grebes, 1 pelican, 4 herons and bitterns, 14 waterfowl species, 4 raptors, 1 crane, 19 shorebirds, 1 cuckoo, 3 owls, 2 hummingbirds, 1 woodpecker, and 20 passerines.

Mammalian species cited by Jones et al. (1983) and Jones and Choate (1978) as occurring in the Panhandle but not found during the survey were: masked shrew (*Sorex cinereus*), silver-haired bat (*Lasiorycteris noctivagans*), red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), fringed-tailed myotis (*Myotis thysanodes*) (all bat species are seasonal migrants), black-tailed jackrabbit, white-tailed jackrabbit, northern pocket gopher (*Thomomys talpoides*), olive-backed pocket mouse (*Perognathus fasciatus*), plains pocket

mouse (*Perognathus flavescens*), silky pocket mouse (*Perognathus flavus*), plains harvest mouse (*Reithrodontomys montanus*) northern grasshopper mouse (*Onychomys leucogaster*), spotted ground squirrel (*Spermophilus pilosoma*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), beaver (*Castor canadensis*), bobcat (*Felis rufus*), and gray fox (*Urocyon cinereoargenteus*). Future work at SBNM may find some of these species to be present.

DISCUSSION

The relatively low wildlife species richness compared to the potential species richness at SBNM was due to either species absence or species presence in low densities difficult to detect. Species presence in low densities can be attributed to the limited area of SBNM. Species absence was mainly due to the lack of sandy-soil blowouts, indicative of sandhill prairies, and wetland complexes. Absence was due also to the limited area of the existing habitat types and possibly to land practices and human activity adjacent to SBNM. One

could describe the Monument as an insular park (Buechner 1985), surrounded by agricultural land.

No species was exceedingly abundant in any habitat, but a few were quite rare in various habitats. Species distribution was in three major habitats—riverine woodlands, canal riparian habitat, and mixed-grass prairie. The riverine woodland was the major habitat type providing avian diversity at SBNM. Anderson et al. (1987) found that moist habitats of riparian and wetland areas had the greatest species richness and diversity. Even though the man-created canal riparian habitat along the irrigation canal was only 6% of the SBNM area, avian species richness and abundance was greater there than in the native prairie or shrub-dominated slopes.

The low species richness of amphibian life at SBNM probably is normal for a vicinity that lacks shallow water basins and is typified by low annual precipitation. Efforts should be made to preserve small drainages leading into the river and shallow water basins and prevent any disturbance during the spring and summer. Though the prairie rattlesnake was abundant throughout the mixed-grass prairie, its densities are not thought to be in excess. With exceptions of isolated populations of house mice, the prairie vole may be the major prey species for rattlesnakes at SBNM. In addition, it seemed that bullsnakes were in association with abundant house mice populations. Bullsnakes have been reported by other investigators (Hammerson 1982) in areas of locally abundant small mammal populations.

A black-footed ferret (*Mustela nigripes*) reintroduction would not be feasible at SBNM because of the extremely small prairie dog population. The present prairie dog population size of approximately 250 individuals is far below the recommended population of 766 prairie dogs required to support one black-footed ferret (Fagerstone and Biggins 1986). Both the prairie dog and the pocket gopher were found to provide microhabitat for other wildlife species at SBNM during our study. Agnew et al. (1986) found similar wildlife species to be abundant on prairie dog colonies in western South Dakota. The pocket gopher, a fossorial mammal like the prairie dog, has the potential to locally impact the native plant species composition on SBNM's native prairie. Though pocket gophers have been found to

reduce forage production on rangeland sites primarily for cattle grazing (Foster and Stubbendieck 1980), SBNM is not a rangeland for cattle nor is forage production a major concern at this time. Pocket gopher mounds function in providing shelter for a variety of amphibians, reptiles, and small mammals (see Vaughan 1961), a vital link in the grassland ecosystem.

The occurrence of kangaroo rats only in the prairie dog colony was probably because of their selection of seeds from the weedy plant species associated with the colony and abandoned burrow sites. Meserve (1971) calculated densities of 10–14 prairie voles/acre (25–35/ha) at SBNM, slightly lower than our estimates. This could be interpreted as little change having occurred since 1971 in the litter depth and plant species of the prairie.

Red fox numbers may be regulated by the coyote population through interspecific competition (Major and Sherburne 1987), but the low numbers also may have been because of the preference of red foxes for more riparian habitats and wooded areas (Jones et al. 1983). The SBNM raccoon population may be quite mobile and cover large distances along drainages in search of easily accessible food sources such as the garbage dumpster sites at SBNM. Densities have been reported to range from 0.5/km² on the prairies of North Dakota (Fritzell 1978) to 20/km² in bottomlands and marshes of Alabama (Johnson 1970).

With an increase in wooded riparian habitat and agricultural practices and a reduction of rangeland, white-tailed deer populations have increased in the Nebraska Panhandle in recent years (Menzel 1984). Little is known about the interaction of sympatric populations of mule and white-tailed deer. Though they are considered two separate species, hybridization has been documented in Texas, Kansas, Nebraska, Washington, and Alberta (Stubblefield et al. 1986, Day 1980, Wishart 1980, Kramer 1973). Wishart (1980), studying a captive herd in Alberta, found that some hybrids were fertile and produced viable offspring.

Though SBNM is relatively small, there is the potential for the National Park Service to reintroduce absent native wildlife species. We believe that with cooperation and support from adjacent landowners and local citizens, pronghorn antelope (*Antilocapra americana*)

and the sharp-tailed grouse (*Tympanuchus phasianellus*) are two possible candidates for reintroduction. SBNM's small size of 1,200 ha is an important factor in determining whether it would accommodate the average home range size of pronghorn. Home ranges have been found to vary from 440 to more than 1,200 ha for nursery and bachelor herds in Palouse Prairie habitat (Kitchen 1974), averaging 1,385 ha for male and females in Idaho (Reynolds 1984), and ranging from 165 to 2,300 ha in central Montana (Bayless 1969). We believe pronghorn could greatly enhance the existing fauna, but the decision must be made on the basis of a thorough evaluation of SBNM's food base and the potential impact on surrounding private lands.

Booming grounds for breeding purposes are an important part of the sharp-tailed grouse life cycle. Booming grounds are established year after year in areas of bare or grassy knolls (Swenson 1985). Male grouse often show preferential use of arenas burned by fire (Sexton and Gillespie 1970). If grouse were reintroduced to SBNM, a small, elevated area of prairie should be burned the first year they are transplanted to entice males to set up booming grounds on the burn site.

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Mike K. Cox

Iowa State University, Ames, Iowa

William L. Franklin

Iowa State University, Ames, Iowa

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