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Mammalian Distribution Within Biotic Communities of Northeastern Jewell County, Kansas

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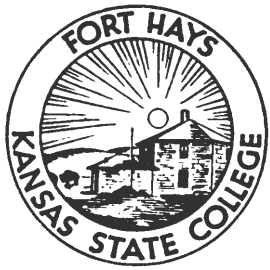

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Eugene D. Fleharty graduated from Hastings College, Nebraska, in 1956. He earned the Master of Science degree in 1958 and the Doctor of Philosophy degree in 1963 from the University of New Mexico. He joined the staff at Fort Hays Kansas State College in 1962 and now holds the rank of Associate Professor of Zoology.

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Mammalian Distribution Within Biotic Communities of Northeastern Jewell County, Kansas

Kenneth W. Andersen and Eugene D. Fleharty

Introduction

The northeastern corner of Jewell County, Kansas, with its streams and grassland provides an interesting and varied array of habitats to be filled by mammalian fauna. Prior to this study, mammals have not been systematically collected or otherwise studied in this area.

Several larger works are available which include this area and therefore aid in the general knowledge of mammals found. However, these papers are primarily concerned with overall geographical distribution and taxonomy and lack for the most part the ecological considerations that are herein attempted. The most recent useful publications are those of Cockrum (1952), who discusses mammalian distribution in Kansas, and Jones (1964) who treats the mammals of Nebraska.

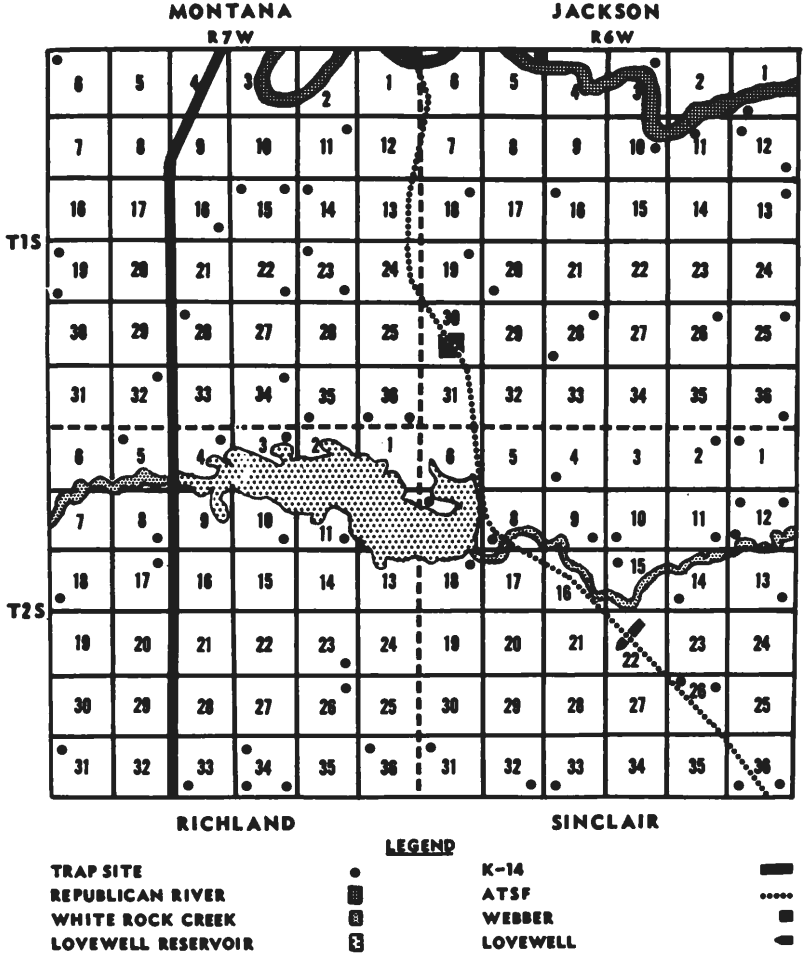
The purpose of this investigation was threefold. First, to obtain as complete a list as possible of mammals occurring in the area through collecting and observational procedures. Second, to determine their specific distribution within the study area, and third, to correlate and elucidate the relationships between their distribution and the major vegetational regions within the study area.

The Study Area

Location and General Description

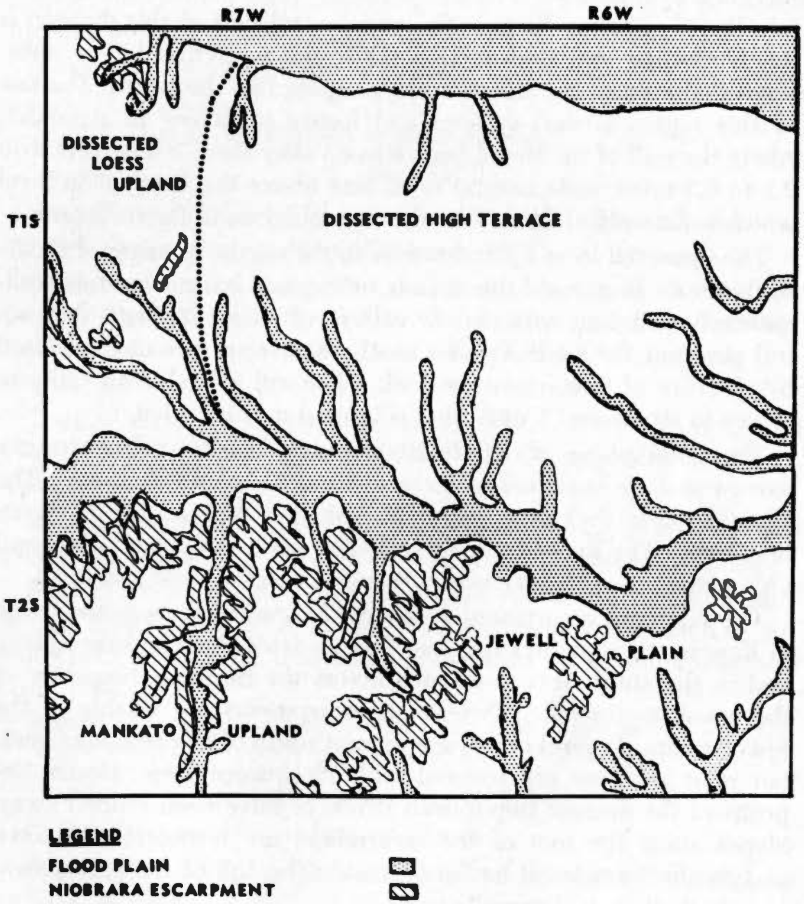
The townships of Montana (R.7W, T.1S), Richland (R.7W, T.2S), Sinclair (R.6W, T.2S), and Jackson (R.6W, T.1S) comprise the study area which is located in the northeastern corner of Jewell County, Kansas. Each township is six miles square. Webber and Lovewell, two small towns in the study area are serviced by the Atchison, Topeka, and Santa Fe Railway. Highway K-14 passes through the study area near its western border. There are two major water courses in the area. The Republican River flows along

the northern border of the study area and White Rock Creek flows eastwardly through its southern half. Many tributaries leading into the creek are within the study area. Lovewell Reservoir occurs in the study area and is situated on White Rock Creek. The reservoir, of about 3000 surface acres, and approximately 2000 acres of land adjacent to it are managed by the Kansas Forestry, Fish and Game Commission for wildlife use. The study area is utilized primarily for farming with corn, maize, wheat, and alfalfa being the principle crops; however, nearly one-half of the land is in grass. Fig. I shows the townships comprising the study area and the locality of the towns, railway, highway, water courses, and reservoir within the townships.



Physiography and Soil

Fishel and Leonard (1955) described eight physiographic divisions within Jewell County, Kansas. Six of these found within the study area are: Jewell plain, Mankato upland, dissected high terrace, dissected loess upland, flood plains, and Niobrara escarpment (Fig. II). By using soil maps of Jewell County, the various soil types within the study area have been incorporated with these physiographic divisions.



The Jewell plain extends into the southeastern corner of the study area and is intensively cultivated. Its topography is gently rolling to level except where remnants of Niobrara escarpment appear. Several small streams are located within the Jewell plain and dark, loamy to clayey, fertile loess soil covers most of this division.

The Mankato upland extends into the southwestern corner of the study area. Cultivation in this region is limited because the land is mostly dissected rolling hills and ridges. The soil is shallow to deep and is characterized as dark-colored loam.

The dissected high terrace includes most of the area between White Rock Creek and the Republican River and is intensively cultivated. The southern margin of this division has moderately dissected slopes which drain into White Rock Creek. The northern margin is deeply dissected and has many "loess canyons" which drain into the Republican River. The east-central part of this division is gently sloping and undissected, while the western edge is indistinguishable from the dissected loess upland to the west. The soil of this region is dark-colored and loamy to clayey in structure. Along the wall of the Republican River Valley there is a narrow strip 0.1 to 0.3 miles wide and 50 to 65 feet above the flood plain level which is flat upland formed by the accumulation of Peoria loess.

The dissected loess upland occurs in the northwestern part of the study area. In general this area is rolling and has moderately well-entrenched streams with narrow valleys. Eolian silt covers the central part but the northern and southern margins are characterized by outcrops of Cretaceous bedrock. The soil is friable and silty to clayey in structure. Cultivation is limited in this region.

The flood plains of White Rock Creek and its tributaries are narrow and are bordered by terraces 10 to 20 feet above them. The alluvial soil is dark to moderately dark and friable silty to clayey in nature. The Republican River Valley has a wide flood plain and only remnants of low terraces. Its soil is alluvial sand and loam.

The Niobrara escarpment is one of the major escarpments found in Kansas. It separates the Jewell plain from the Mankato upland and in the study area it extends across the northern boundary of the Mankato upland. Two small escarpments are visable in the Jewell plain. Several others are present north of White Rock Creek, but most of these are covered with Pleistocene loess, stream deposits of the ancient Republican River, or have been eroded away. Slopes along the foot of the escarpment are intricately dissected and locally form small badland areas. The soil of the escarpment is dark, shallow, and gravelly or rocky.

Vegetation

There are seven major types of habitat which affect the mammalian distribution in the study area. These are moderately to non-grazed grassland, heavily grazed grassland, riparian communities,

other woodlands, wasteland, road ditches, and marshes. As a rule each major type can be easily distinguished from the others but within each of these there is a complex of smaller vegetative habitats which may or may not intergrade with each other. Consequently, the discussion on vegetation has been limited to the more typical characteristics of each habitat and variations have virtually been omitted. For a complete list of vegetation identified in the study area and the scientific names refer to the Appendix.

Moderately to non-grazed grassland

Grassland is almost entirely restricted to hilly land unfit for cultivation and includes a major part of each township. It is especially prominent in the Mankato upland and the dissected loess upland divisions. Big bluestem, switchgrass, and little bluestem are the prominent grasses on all non-grazed to moderately grazed grassland. Little bluestem, with some western wheatgrass and side-oats grama is found mostly on the hills just south of the Republican River. Big bluestem dominates most of the remaining grassland were grazing has not been too intense. Switchgrass is found on much of the deeper soil. Frequently pastures have a combination of dominants or there is a co-dominace of tall grasses with each other or shorter grasses such as western wheatgrass and side-oats grama. Other plants are usually not too prominent in this grassland, but few flowered scurfpea and western ragweed may be locally abundant to scattered. Canada thistle, Baldwin ironweed, pricklypear cactus, and Fremont's leatherleaf are found scattered throughout the habitat. Grassland break sites may have thickets of smooth sumac, buckbrush, or, on occasion, skunkbrush.

Heavily-grazed grassland

Heavily-grazed pastures are found throughout the study area and are predominantly vegetated with buffalo grass and blue grama along with varying amounts of western wheatgrass, side-oats grama, and Japanese brome. Local areas of tall grass are sometimes heavily grazed but still retain the characteristic vegetation. Some forbs such as snow-on-the-mountain, Baldwin ironweed, and pricklypear cactus are present in varying amounts in heavily grazed grassland.

Riparian communities

Riparian communities of the study area are found along the Republican River and White Rock Creek with its tributaries. Trees growing along the stream banks are the dominant vegetation. The

outer edges of the wooded areas are commonly dominated by a dense growth of tall grass such as big bluestem, switchgrass, or smooth brome.

Trees along the Republican River are predominantly plains cottonwood and peach-leaved willow. Willows are found mostly on the north edge of the river while farther back a nearly pure stand of cottonwoods takes over. Trees on the south side are mainly cottonwood but found with them are mulberry, green ash, American elm, and hackberry. Vegetation in the understory of the cottonwoods is virtually absent except for twining plants such as wild grape and poison ivy which are found in restricted areas.

The dendritic part of the White Rock Creek drainage is narrow but is heavily wooded with bur oak and American elm. Other trees commonly present are green ash, hackberry, mulberry, boxelder, black walnut, and plains cottonwood. In the understory of this habitat are thickets of golden currant, gooseberry, wild plum, buckbrush, and chokecherry.

Other woodlands

Ravines south of white Rock Creek are wooded with bur oak with an understory of buckbrush, smooth sumac, and skunkbrush. Small woodlots are found in various places of the study area but generally they are associated with farmyards or with wasteland too rough for cultivation. American and Siberian elm are most common in farmyards, and boxelder, cottonwood, and hackberry are predominantly found in wastelands.

Road ditches

As used here, a road ditch includes that land between the edge of the road and the adjacent fence line. Most road ditches have a heavy cover of vegetation but the kind of vegetation varies somewhat depending on the surrounding habitats. In general, road ditches leading through areas of cultivation are vegetated with smooth brome and those associated with grassland are dominated by tall or midheight grasses such as big and little bluestem, and western wheatgrass. Plants such as yellow and white sweet clover, broadleaf milkweed, sedge, Japanese brome, green and yellow foxtail, and marsh muhly are found in many road ditches which are low and do not drain rapidly. Thickets of wild plum and smooth sumac are frequently found in the road ditches throughout the study area.

Marshes

There are no large marshes in the study area but there are two small marshes worth mentioning. One of these is adjacent to a spring-fed farm pond located in a pasture composed predominantly of western wheatgrass and big bluestem. The upper end of this pond forms a cattail marsh with peach-leaved willow. Next to the cattails is a heavy mat of Kentucky bluegrass with some big bluestem and buckbrush interspersed. Associated with the cattails are some dense stands of slim aster. One small tributary leading into the marsh is dominated by barnyard grass. This marsh habitat extends nearly three-fourths of a mile but it does not average more than 100 feet in width.

The second marsh is also spring-fed but it spreads out into the edge of cultivated land. Cattail is the dominant plant here but the ground at its upper end is raised and is dominated by big bluestem with some western wheatgrass, common sunflower, western ragweed, and a wild plum thicket. Other marshy habitats have recently been formed by the backing of water into coves at Lovewell Reservoir.

Climate

Yearly precipitation recorded from 1955 to 1964 at Lovewell Reservoir ranged from 21.22 to 34.08 inches and averaged 28.78 inches. Precipitation amounts received at this station during the months of major collecting were: June, 1963: 3.48 inches; July, 1963: 4.69 inches; June, 1964: 3.14 inches. Average temperatures for these same months were 75.1, 78.7, and 70.9° F respectively. The first day of frost occurs near the last of November and the last day of frost occurs near the middle of May.

Materials and Methods

Equipment

A variety of equipment is necessary to collect all the kinds of mammals occurring in the study area. Museum Special mouse traps baited with chewed rolled oats were used for collecting mice and shrews. Victor rat traps were employed in catching ground squirrels, and typical mole and gopher traps were used to collect their respective kinds. A .410 gauge shotgun aided in collecting muskrats, rabbits, some carnivores, and bats. Steel traps of various sizes were used in collecting fur bearers in the winter. Tracks of many mammals were identified with the help of Murie (1960).

Procedures

This investigation was carried out primarily during June and July, 1963, and June, 1964. A weekend field trip to the study area in September, 1963, and again in September, 1964, by members of a mammalogy class at Fort Hays Kansas State College aided considerably in completing the work.

Collecting procedures were focused on the small mammals of the area since they are the most abundant. Seventy-two trap sites were selected with the intention of sampling all uncultivated habitats in the study area (Fig. I). Each site was sampled with 10 to 30 traps which were set in a more or less homogeneous type of vegetation. Traps were normally spaced approximately ten paces apart but this was sometimes modified depending on the incidence of rodent sign. The traps were left at a site until the majority of the species believed to be in the area were collected, but at no time were the traps left at the same site more than four nights. Traplines were usually checked about two hours after sunset and about two hours after sunrise. Each trap was reset after an animal had been removed from it as were all other sprung traps. The total number of resets and the number of traps at each site where added and recorded as total trap nights for that trap site. Reset traps were not counted if they had been sprung by rain and strong wind or by being stepped on by cattle.

At each trap site, notes describing the soil, topography, and vegetation were made. When the traps were checked, the amount of cloud cover, wind direction and velocity, moon phase, air temperature, ground temperature, and relative humidity were usually recorded. All specimens caught were identified to species, sexed, classed as adults or subadults and the reproductive condition of females were noted. Any notes deemed helpful in describing the particular habitat of a specimen were made at the trap site.

Locality records of rabbits, carnivores, and deer were largely made from tracks or actual sightings of the different species. Bats were shot as they flew about in late evening. Data recorded while collecting bats usually included time of day, air temperature, wind velocity, and phase and position of the moon.

At least one specimen of each species taken at a trap site was preserved as a standard museum skin with skull or, as in the case of most game mammals, only the skull was preserved. These specimens were placed in the Museum of the High Plains, Fort Hays Kansas State College, Hays, Kansas.

The source used for scientific names of mammals is Hall and Kelson (1959) with the exception of the two *Citellus* which were taken from Miller and Kellogg (1955) and *Mustela nivalis* taken from Novikov (1956). The use of subspecific names has been avoided due to the uncertainty of the actual distribution of many of the subspecies of mammals in Kansas. Most scientific names for plants were taken from Anderson (1961).

The distribution of each species is given for Kansas for a better understanding of their general distribution in relation to the study area.

Words written in capital letters under the heading *Occurrence* refer to habitats discussed under the heading VEGETATION found in the description of the study area.

Localities in the *Records of occurrence* are listed for each township in the following order: Montana, Richland, Jackson, Sinclair. Moreover, localities are arranged according to section numbers of each township and begin with the smallest number. Total specimens represent only those placed in the Museum of the High Plains. Observations include sightings reported by State Game Protector Gary Hesket, as well as personal ones and any obvious signs such as mounds and tracks.

Species Accounts

Approximately 4300 trap nights yielded about 1250 specimens from the study area. Of these, 780 were preserved as museum specimens. In all, 7 orders, 17 families, 30 genera, and 37 species were recorded.

Most species of mammals found in the study area segregate into various habitats but the degree of habitat preference varies considerably among species and for many species it is hard to tell which one of several habitats is the most preferred. An example showing this diversity is *Peromyscus leucopus* which occurs almost entirely in woodland while a closely related species, *P. maniculatus*, occurs in nearly all habitats but woodland.

Table 1 shows preferred habitats of each species in the study area based on present evidence. Records of some species are two few to indicate any habitat preference, consequently the probable preferences of these species are marked with a question mark. *Scalopus aquaticus* and *Geomys bursarius* are omitted from this table as their distribution is controlled by soil and not vegetation. Both species are most common in the flood plains.

TABLE 1.—Preferred habitats of mammalian species in the study area.

Species	Moderately to non-grazed grassland	Heavily grazed grassland	Riparian communities	Other woodland	Road ditches	Wasteland	Marshes
Didelphis marsupialis			X				
Blarina brevicauda			X		X	X	X
Cryptotis parva	X						
Eptesicus fuscus			X				
Lasiurus borealis			X				
Lasiurus cinereus			X				
Nycticeius humeralis			X				
Sylvilagus floridanus			X				
Lepus californicus		X					
Sciurus niger			X	X			
Cynomys ludovicianus		X					
Citellus tridecemlineatus		X			X		
Citellus franklinii						X	
Perognathus hispidus	X						
Castor canadensis			X				
Reithrodontomys montanus		X					
Reithrodontomys megalotis					X	X	X
Peromyscus maniculatus	X				X	X	
Peromyscus leucopus			X	X			
Onychomys leucogaster		?					
Sigmodon hispidus					X	X	
Microtus pennsylvanicus							X
Microtus ochrogaster					X	X	
Ondatra zibethicus							X
Rattus norvegicus					?		
Mus musculus					X	X	
Erethizon dorsatum			?				
Canis latrans	X					X	
Procyon lotor			X				
Mustela nivalis	?						
Mustela vison			X				
Taxidea taxus	X				X		
Mephitis mephitis	X				X		
Odocoileus hemionus				?			
Odocoileus virginianus			X	X			

A more detailed discussion for each of the species recorded in the study area follows.

Didelphis marsupialis Linnaeus

Opossum

Distribution.—The range of the opossum is statewide in Kansas (Cockrum, 1952).

Occurrence.—Fitch and Sandidge (1953) and Sandidge (1953) report that in northeastern Kansas the opossum concentrates its activities in RIPARIAN COMMUNITIES. This is apparently true in the study area, for only one observation of this species was made away from a wooded community. This specimen was collected from a ROAD DITCH some 1.5 miles from White Rock Creek, but an irrigation canal leading to the dam of Lovewell Reservoir was within one-quarter mile. It seems probable that the canal and road ditch were being used as an extended hunting ground for the opossum.

Food.—This omnivorous mammal apparently prefers animal matter over plant matter (Reynolds, 1945), but according to Fitch and Sandidge (1953), the more abundant of the two will be more often utilized. They found a greater consumption of wild fruit than of animal matter in the fall and suggested a reversal of this pattern in spring and early summer. They found that animal matter used by the opossum included a variety of insects, herptiles, and small mammals.

Activity.—The opossum is a nocturnal hunter, is not gregarious, and shows little territoriality (Lay, 1952; Reynolds, 1945; Fitch and Sandidge, 1953).

Reproduction.—There are two breeding seasons a year for opossum in northeastern Kansas. The first litters are born from about the middle of February into early March. Second litters are born usually in early June (Fitch and Sandidge, 1953).

The number of young found in the pouch varies, but the average is near eight (Asdell, 1964). A female with seven hairless young was collected from the area on 21 June 1963.

Records of occurrence.—Total specimens, 1. *R6W, T2S:* NE¼ Sec. 20 (1). Observations. *R7W, T2S:* NE¼ Sec. 1. *R6W, T2S:* SW¼ Sec. 8; Republican River.

Blarina brevicauda (Say)

Short-tailed Shrew

Distribution.—The short-tailed shrew is reported by Cockrum (1952) to occur throughout the eastern two-thirds of Kansas.

Occurrence.—This species is found to inhabit communities of dense vegetation in the study area, including ROAD DITCHES, low WASTELANDS, RIPARIAN COMMUNITIES, and NON-GRAZED GRASSLAND.

Grasses of various kinds are dominant wherever this species is collected. In most cases these are either smooth brome, Japanese brome, switchgrass, bluegrass, marsh muhly, or western wheatgrass. This shrew was not collected in HEAVILY-GRAZED GRASSLAND.

A substantial cover of litter prevails in habitats where the short-tailed shrew is found. This litter and the duff or soil beneath the litter are usually well marked with runways used by shrews and rodents.

Food.—The food of short-tailed shrews consists largely of invertebrates with insects of various kinds making up the majority of the diet. Stomach contents also include earthworms, plant material, snails, small mammals, and salamanders; but these are found in much smaller quantities than are insects (Babcock, 1914; Hamilton, 1930, 1941; Eadie, 1944; Whitaker and Ferraro, 1963).

Blarina is the only known North American mammal which immobilizes its prey by toxic saliva produced in the submaxillary glands (Pearson, 1942).

Activity.—The time of activity for *Blarina* may change with the season. Photographic observations of runways show that this shrew is active from one hour before to approximately four hours after sunset; but in spring it is active between six and nine hours after sunset to near dawn, and in autumn it is active as early as three hours prior to sunset (Osterberg, 1962).

Two months of summer collecting in the study area resulted in 28 shrews taken after 10:30 p. m. and only three at an earlier time. In contrast, traps set at various localities on 27 and 28 September yielded 15 *Blarina* before 10:30 p. m. and six after that hour. On 1 November six short-tailed shrews were caught during late afternoon and early evening hours and three were trapped after 9:15 p. m. These came from a marsh habitat where they had been taken only at later hours during the previous summer.

Reproduction.—Short-tailed shrews are reproductively active from early February and produce their first young of the year from mid-April to the end of May. A second litter is usually produced during August and September. Litter size of this species ranges from three to seven (Asdell, 1964). Five lactating females were collected from the research area. These include one on 28 September 1963, one on 2 June 1964, one on 25 September 1964, and two on 26 September 1964.

Records of occurrence.—Total specimens, 98. *R7W, T1S:* SE¼ Sec. 16 (5); NW¼ Sec. 19 (3); SE¼ Sec. 22 (1); NW¼ Sec. 23 (1); SE¼ Sec. 23 (1); NE¼ Sec. 32 (2); SW¼ Sec. 35 (3); SE¼ Sec. 36 (5). *R7W, T2S:* NE¼ Sec. 4 (1); NW¼ Sec. 5 (1); SE¼ Sec. 8 (1); SE¼ Sec. 10 (1); NW¼ Sec. 31 (1); SW¼

Sec. 33 (1); NW¼ Sec. 34 (3). *R6W, T1S:* NE¼ Sec. 3 (1); Sec. 5 (3); NW¼ Sec. 12 (1); NE¼ Sec. 13 (1); NW¼ Sec. 16 (2); NE¼ Sec. 26 (1); NE¼ Sec. 28 (2); SW¼ Sec. 28 (2); SE¼ Sec. 36 (1). *R6W, T2S:* NW¼ Sec. 1 (1); NE¼ Sec. 2 (5); SW¼ Sec. 4 (23); NW¼ Sec. 7 (6); SW¼ Sec. 8 (3); SW¼ Sec. 10 (3); SE¼ Sec. 11 (1); SW¼ Sec. 12 (5); NW¼ Sec. 15 (2); NE¼ Sec. 26 (1); SE¼ Sec. 32 (1); SW¼ Sec. 33 (3).

Cryptotis parva (Say)

Least Shrew

Distribution.—The least shrew probably occurs over all of Kansas; however, Cockrum (1952) reports few records of it in western Kansas.

Occurrence.—Although the least shrew has been reported on occasions to be locally abundant (Davis, 1938, 1940; Getz, 1962), specimens are seldom reported in very large numbers from any area. Consequently, little is known of the ecology of this diminutive mammal. It is reported to have been taken from grasslands, woodlands, along fence rows, and weedy areas which give it cover and food (Davis and Joeris, 1945; Cockrum, 1952).

Four least shrews, collected in September, 1963, were taken from the study area. Each individual came from a different habitat, showing a wide habitat tolerance for the species. The specific habitats given in the order as listed in *Records of occurrence* are: (1) a hillside of pasture dominated by buffalo grass with red threeawn and tall dropseed present; (2) a limy upland slope with co-dominance of little bluestem and side-oats grama, with a scattering of tall dropseed, Japanese brome, and western ragweed; (3) a terraced field reseeded to switchgrass which stood approximately four feet high; and (4) river bottomland covered predominantly with smooth brome, but with ticklegrass and foxtail also present. These areas are all characterized with a moderately-heavy to heavy covering of vegetation.

According to Davis and Joeris (1945) soil is not a limiting factor for this shrew. This is apparently true in the study area, for they were taken from areas of tight clayey soil as well as very sandy soil.

Food.—Like *Blarina,* the food of *Cryptotis* consists almost entirely of invertebrates (Hamilton, 1944; Davis and Joeris, 1945), but vertebrates may occasionally be utilized (Hatt, 1938).

Activity.—Little is known about the activity of least shrews. They are apparently active all hours of the day and have a peak of activity at night (Hamilton, 1944; Davis and Joeris, 1945). Captive shrews observed by Davis and Joeris (1945) spent most of the daylight hours in the nest sleeping or resting.

Reproduction.—Few exact data on the reproduction of *Cryptotis parva* are recorded. In the northern United States it breeds from early March to November, and litter size ranges from two to six (Asdell, 1964).

Records of occurrence.—Total specimens, 4. *R7W, T1S:* SE¼ Sec. 16 (1); NW¼ Sec. 23 (1); SE¼ Sec. 36 (1). *R6W, T1S:* Sec. 5 (1).

Scalopus aquaticus (Linneaus)

Eastern Mole

Distribution.—The eastern mole occurs throughout Kansas (Cockrum, 1952).

Occurrence.—Soil is probably the greatest limiting factor affecting the distribution of this fossorial mammal, with pliable soil which has much humus, moisture, and food being the most favored habitat (Arlton, 1936). In the study area the mole is found in such habitats as GRASSLAND, ROAD DITCHES, WASTELAND, and RIPARIAN COMMUNITIES. It occurs most commonly in the alluvial soils of the latter. Occasional signs of it were found on hilltops of pastures where the topsoil was deep enough to allow burrowing. It was not observed in shallow, rocky soil such as that characteristic of the Niobrara escarpment.

Food.—The eastern mole shows a distinct preference for earthworms, but it also consumes quantities of insect larvae and adults, while vegetable material eaten is negligible (West, 1910; Dyche, 1903; Hisaw, 1923a).

Activity.—The activity of the mole is limited to neither day nor night (Scheffer, 1912; Hisaw, 1923b; Arlton, 1936). Arlton (1936) found three peak periods of activity during the day and noticed more activity in the day than at night.

Reproduction.—An average litter of 3.91 is produced once a year (Asdell, 1964). In Kansas this litter is born in March or the first half of April (Scheffer, 1911).

Records of occurrence.—Total specimens, 5. *R6W, T1S:* Sec. 5 (1). *R6W, T2S:* SW¼ Sec. 8 (4). Observations. *R7W, T2S:* SE¼ Sec. 23. *R6W, T1S:* NE¼ Sec. 10; NW¼ Sec. 12. *R6W, T2S:* SE¼ Sec. 9.

Eptesicus fuscus (Palisot de Beauvois)

Big Brown Bat

Distribution.—All of Kansas is included in the distribution of the big brown bat (Cockrum, 1952).

Occurrence.—Records of this bat hibernating in flood sewers (Black, 1937), caves (Hibbard, 1934; Black, 1937; Cockrum, 1952;

Twente, 1955), and buildings (Cockrum, 1952) are known in Kansas. Little has been recorded about its summer residence. Hibbard (1936) and Cockrum (1952) give records of summer colonies living in buildings.

No reports of this species living in the study area were made by local residents. However, one female was collected at approximately sunset in the RIPARIAN COMMUNITY of the Republican River in June, 1964. Even though four old buildings investigated had no sign of bats, it is probable that *Eptesicus* live in some of the abandoned farm buildings, grain elevators, and other buildings in the study area. It may be that the numerous plains cottonwood trees on the river provide summer homes for the big brown bat.

Food.—Hamilton (1933) reported ten orders of insects involved in the summer food of a small colony of *Eptesicus*. Engler (1943) and Krutzsch (1950) have reported a carnivorous habit displayed by *Eptesicus* when confined in close quarters with smaller species of bats. Krutzsch (1950) believes this is not a natural phenomenon displayed by this species.

Activity.—Very little has been recorded about the activity of this bat. However, contrary to findings of Cockrum (1952), this species was seen flying early in the evening along with *Nycticeius* over the Republican River.

Reproduction.—The big brown bat mates in the fall, and the young are born May through June (Asdell, 1964). There are usually two young per litter in its eastern range (Cockrum, 1955).

Records of occurrence.—Total specimens, 1. *R6W, T1S:* Sec. 1 (1).

Lasiurus borealis (Müller)

Red Bat

Distribution.—Although Cockrum (1952) reports no specimens of the red bat from the northwestern corner of Kansas, he states that it probably occurs throughout the state.

Occurrence.—The red bat is most commonly found in the daytime hanging in well-shaded parts of trees (Hall, 1923; McClure, 1942; Constantine, 1958). Bats described as this species were reported by Randall Cleveland (personal communication) to be found occasionally hanging in wild plum thickets near Lovewell Reservoir. The two females collected from the study area came from the RIPARIAN COMMUNITY of the Republican River in June, 1964.

Food.—According to Ross (1961) this species feeds largely on small moths with a body size of 10 to 16 mm.

Activity.—The red bat is the earliest flying bat in this area (Cockrum, 1952; Jones, 1964). Constantine (1958) suggests that temperature strongly affects its activities. On several evenings during June, 1964, observations of this species at the Republican River were made from approximately 8:20 p. m. until it was too dark to see them clearly.

The first flight pattern displayed by the red bats seen in the evening was to fly from one side of the river to the other usually in small groups. They would travel in a nearly straight line some 30 to 50 feet above the water. Approximately ten minutes later this species would fly lower in an erratic pattern in pursuit of insects.

Reproduction.—The red bat mates in August or early September and produces an average litter of three young in late May and June (Asdell, 1964).

Records of occurrence.—Total specimens, 2. *R6W, T1S:* Sec. 1 (2).

Lasiurus cinereus (Palisot de Beauvois)

Hoary Bat

Distribution.—The hoary bat probably occurs throughout Kansas (Cockrum, 1952).

Occurrence.—According to Jones (1964) the hoary bat hangs in trees or shrubs during the day. Undoubtedly they make use of the extensive RIPARIAN habitat in the study area during their summer stay. On 19 and 20 June 1964 two females were shot while they fed over the Republican River. Approximately six others of this species were seen feeding on 20 June.

Another of this species was seen flying beyond shotgun range on 22 June 1964. It flew in a straight line over a pond which has a few plains cottonwoods and willows at one end. These may well have provided this bat a place to hang during the day.

Food.—According to Schwartz and Schwartz (1959) this bat consumes a great amount of mosquitos. The pursuit of a pipistrelle by a hoary bat as reported by Orr (1950) and Bishop (1947) may suggest the use of this little bat as food where their ranges overlap.

Activity.—The hoary bat is generally considered a late flier (Vaughan, 1953; Provost and Kirkpatrick, 1952), but it has been seen flying at dusk (Orr, 1950) and even in daylight (Provost and Kirkpatrick, 1952).

The specimens observed in the study area were not seen flying until after 8:30 p. m. when it was almost too dark to shoot.

Reproduction.—The hoary bat mates in August and two young

are usually born towards the end of June or early July (Asdell, 1964). The two females collected in the study area contained no embryos nor were they lactating.

Records of occurrence.—Total specimens, 2. *R6W, T1S:* Sec. 1 (2). Observations. *R6W, T2S:* SW¼ Sec. 4.

Nycticeius humeralis (Rafinesque)

Evening Bat

Distribution.—Cockrum (1952) reports only two records for the evening bat in Kansas. These are both in the eastern one-third of the state.

Occurrence.—Evening bats inhabit riparian habitats and probably utilize hollow trees for roosting (Jones and Vaughan, 1959; Jones, 1964). On occasions they are found to inhabit attics (Mumford, 1953).

Five female *Nycticeius* were collected from the RIPARIAN part of the Republican River in June, 1964, and one was collected on 25 September 1964. This is the westernmost record of this species in the northern portion of its range.

Food.—Nothing concerning the food of this species could be found in the literature. Two individuals collected were noted to have an unidentified insect no larger than a pin head in their mouths.

Activity.—Little is known about the habits of this bat. Those collected from the study area were taken from approximately 8:30 p. m. to 9:00 p. m. as they fed from near the river stream to approximately 30 feet above it. Bats, presumably of this species, were on occasion seen after 9:00 p. m. as they fed near the water.

Reproduction.—From one to four young are reared by the evening bat, and pregnant females have been found in April, May, and June (Cockrum, 1955). There are indications that they reproduce in early June in this region. Jones and Vaughan (1959) collected two pregnant females on 1 June 1957 in Nebraska, but two specimens collected by them on 29 June were not pregnant nor lactating. On 13 June 1964 a female with three embryos was collected at the Republican River. A female collected on 9 June was lactating and three others collected in mid-June appeared to have recently weaned their young.

Records of occurrence.—Total specimens, 6. *R6W, T1S:* Sec. 1 (6).

Sylvilagus floridanus (J. A. Allen)

Eastern Cottontail

Distribution.—The range of the eastern cottontail extends throughout Kansas (Cockrum, 1952).

Occurrence.—Haugen (1942) found that low ground cover was necessary for this cottontail, and apparently this is true in the study area. Nearly all cottontails are found at the edge of RIPARIAN COMMUNITIES and in thickets of wild plum and smooth sumac; they are especially noticable in such thickets along ROAD DITCHES. Shelter belts of Russian olive, red cedar, and multiflora rose planted in the wildlife refuge near Lovewell Reservoir are also selected habitats for this species.

The number of cottontails in the area has shown seasonal fluctuations during the past three years. Gary Hesket (personal communication) said that very few rabbits occurred in the area in 1962. In June and July of 1963 they appeared to be quite common, but in the winter months of 1963-64, he once again reported them scarce. The number seen in June of 1964 was comparable with that of the previous summer.

Food.—Leaves, stems and flowers of grasses, sedges, and herbs are the chief foods of the cottontail; but berries, fruits, buds, twigs, and bark often serve an important part in their diet (Dusi, 1952; Schwartz and Schwartz, 1959).

Activity.—Like the jack rabbit, the cottontail is mostly active at night and early morning (Schwartz and Schwartz, 1959).

Reproduction.—Several litters averaging 4.5 young are born each year by the cottontail (Asdell, 1964).

Records of occurrence.—Total specimens, 1. *R6W, T2S:* Sec. 8 (1). Observations. *R7W, T1S:* Sec. 4; SW¼ Sec. 6; Sec. 31. *R7W, T2S:* NW¼ Sec. 5; Sec. 7; Sec. 19. *R6W, T1S:* SE¼ Sec. 1; Sec. 11. *R6W, T2S:* SW¼ Sec. 8; SE¼ Sec. 29.

Lepus californicus Gray

Black-tailed Jack Rabbit

Distribution.—The black-tailed jack rabbit occurs over all of Kansas (Cockrum, 1952).

Occurrence.—The number of jack rabbits seems to be very limited in the study area. Several of the local farmers stated that they were quite common in the 1930's but have since all but disappeared.

Brown (1947) found that the jack rabbit was most abundant on grazed areas which provided succulent herbage for food, short turf for quick escape, and scattered bunches of vegetation for protection. This is apparently true for the study area, because habitats

of sparse or short vegetation were the only places where jack rabbits were seen. Habitat examples are a heavily-grazed smooth brome pasture in the southeastern quarter of section 11 of Jackson Township and a summer-fallowed field north of the river in section one of the same township. The pasture includes no more than 20 acres of a hillside with shallow soil, and the field is characterized by a scattering of annual forbs.

Old fecal pellets from this species were frequently seen in a moderately-grazed little bluestem pasture south of the river. Because no jack rabbits were seen here in the summer, it is assumed that this habitat is used in the winter for protection and food.

Food.—Jack rabbits feed on succulent plants such as pricklypear cactus, broomsnake weed, and various other forbs and grasses in parts of southwest Kansas (Riegel, 1942; Brown, 1947). Damage to field crops by jack rabbits may be considerable in localized areas during periods of drought (Bronson and Tiemeier, 1958a).

Activity.—Brownson and Tiemeier (1958a, 1959) noted that during the day jack rabbits take cover in the bunched vegetation of the hillsides bordering cropland and at night will move into the cropland to forage. Several jack rabbits which occupied the mowed refuge land near the concession building at Lovewell Reservoir were noted to be crepusular and nocturnal. During the day these were frequently flushed from their forms built at the base of small clumps of unmowed grass.

Reproduction.—Bronson and Tiemeier (1958b) found the jack rabbit to be active reproductively from late January until August in Kansas. They recorded an average of 3.8 litters produced a year and 2.6 young per litter.

Records of occurrence.—Total specimens, 2. *R6W, T2S:* Sec. 6 (1); Sec. 10 (1). Observations. *R6W, T1S:* SE¼ Sec. 11; Sec. 1.

Sciurus niger Linnaeus

Fox Squirrel

Distribution.—The range of the fox squirrel has been extended westward in Kansas until it probably can now be found along all major streams except the Cimarron River in extreme southwestern Kansas (Packard, 1956).

Occurrence.—The distribution of the fox squirrel is nearly restricted to RIPARIAN COMMUNITIES in the study area. On occasions this species was observed in Osage orange hedge rows and about homesteads, although these are also in close proximity to streams or tributaries.

A young male squirrel was collected in July, 1963, from what appeared to be a small isolated grove of cottonwood trees. Aerial photos show that these trees are actually established at the beginning of a tributary leading into White Rock Creek. For approximately one-quarter mile from the grove this tributary is treeless, but it is then heavily wooded the remainder of the distance to the creek. This would indicate that this species will travel over land for some distance to fill available habitats. According to Packard (1956) juveniles may disperse over a wide area due to intraspecific competition. This may explain the presence of this young male in such a restricted habitat.

Food.—Available food items for the fox squirrel in the study area closely correspond to those discussed by Packard (1956). Bur oaks and occasional black walnuts produce the necessary mast. Fruit producers include chokecherry, wild plum, mulberry, hackberry, and smooth sumac. No doubt the seeds of elm, green ash, and honey locust are also utilized. Large insects are present in ample number to supplement summer feedings. Corn, which is grown in most of the lowland of the study area and thus in close association with the squirrels' habitat, is another important food mentioned by Packard.

Activity.—Daily activity of the fox squirrel was found by Packard (1956) to reach its peak when there was a combination of low incident light, high relative humidity, moderate temperature, and low wind velocity.

Reproduction.—Packard (1956) found the fox squirrel to breed chiefly in December and January and again in late April. Two to four young were found in litters inspected by him in 1954. A lactating female was collected in the study area on 27 June 1963.

Records of occurrence.—Total specimens, 3. *R7W, T1S:* SW¼ Sec. 21 (1). *R7W, T2S:* NW¼ Sec. 3 (1). *R6W, T2S:* SE¼ Sec. 8 (1). Observations. *R7W, T2S:* SE¼ Sec. 11; SW¼ Sec. 8. *R6W, T1S:* NW¾ Sec. 12.

Cynomys ludovicianus (Ord)

Black-tailed Prairie Dog

Distribution.—Prairie dogs may be found in all but the eastern one-third of Kansas (Cockrum, 1952).

Occurrence.—Five prairie dog towns were found in the study area. Three of these are similar in that they occur in HEAVILY-GRAZED GRASSLAND where blue grama and buffalo grass are dominant. These towns cover from 20 to 30 acres of land situated on hilly ground. Burrows are present from the tops of ridges to the bottom of the

hills, however, they are most numerous on the hillsides, especially those farthest away from the roads. The soil in all instances is deep enough to allow construction of burrows without interference from rocks.

The towns of about 15 acres have been established on the north side of Lovewell Reservoir on old farmland taken over for a wildlife refuge. Unlike the towns found in the pastures, the top soil of one of these is not packed and feels spongy. This habitat is dominated by hairy grama with scattered western wheatgrass, western ragweed, and other forbs.

The possible beginning of a new town was found in May, 1965, on the south side of the reservoir. Several prairie dogs have dug burrows in a patch of millet seeded near the lake's edge. How these dogs got to this new site is unknown. The only colony found near this site is separated by a water barrier about three-quarters of a mile wide. It is suspected that individuals moved from this colony to the south side either early in the spring when there was an "ice bridge" connecting the two sides or they swam over later in the spring.

Food.—Kelso (1939), Smith (1958), and Koford (1958) all agree that grass makes up the greatest part of the yearly food for the prairie dog, but that various forbs are also used. Investigations by Koford (1958) show that there are seasonal changes in food utilization, and that seasonal use may differ greatly due to the nutritive value of the available food as well as the quantity of available food.

Activity.—Smith (1958) found that prairie dogs cannot tolerate high temperatures; therefore, in summer they concentrate their above-ground activities in the early morning and late evening. In winter he found that they would retire long before the sun would set.

The most active feeding time of one colony observed near the reservoir corresponded to that reported by Smith (1958). There was a peak time in mid-morning hours and then again from mid to late afternoon.

Reproduction.—The breeding season of the paririe dog begins near the last of January, and an average litter of four is produced 30 to 32 days later (Smith, 1958).

Records of occurrence.—Total specimens, 2. *R7W, T2S:* NE¼ Sec. 3 (1); NW¼ Sec. 6 (1). Observations. *R7W, T1S:* NW¼ Sec. 15. *R7W, T2S:* NW¼ Sec. 2. *R6W, T2S:* Sec. 25.

Citellus tridecemlineatus (Mitchell)

Thirteen-lined Ground Squirrel

Distribution. — The thirteen-lined ground squirrel is found throughout Kansas (Cockrum, 1952).

Occurrence.—Habitats where this species was commonly found in the study area include HEAVILY GRAZED GRASSLAND, prairie dog towns, and ROAD DITCHES. Although the road ditches most generally have a lush growth of vegetation, these ground squirrels seem to do quite well by building their burrows back in the sides of the ditches and coming out to the edge of the roads to feed. Gravel roads were used more than dirt roads. A patch of ungrazed buffalo grass and western wheatgrass one acre in size was the habitat of one family of this species.

Food.—Lantz (1904) names grain, seeds of grasses and weeds, and insects as the chief foods of the thirteen-lined ground squirrel. Bailey (1893) and Hisaw and Emery (1927) point out that insects are an important summer and fall food for this species.

Activity.—According to Schwartz and Schwartz (1959) this diurnal mammal is active only during bright daylight at which time it is actively feeding and gathering food for storage. In the study area a decline in activity was noticed during mid-day when temperatures were the highest.

Reproduction.—Litter sizes varying from five to 13 are usually produced in May and early June (Asdell, 1964). A female collected on 11 June 1964 and one collected on 13 June in the study area were lactating.

Records of occurrence.—Total specimens, 9. *R7W, T2S:* NE¼ Sec. 3 (2). *R6W, T1S:* NW¼ Sec. 12 (2); SW¼ Sec. 28 (1). *R6W, T2S:* SW¼ Sec. 8 (2); SE¼ Sec. 32 (2). Observations. *R6W, T2S:* SE¼ Sec. 13.

Citellus franklinii (Sabine)

Franklin's Ground Squirrel

Distribution.—Franklin's ground squirrel can be found in northeastern and northcentral Kansas (Cockrum, 1952).

Occurrence.—One population of Franklin's ground squirrels was discovered in the study area by Gary Hesket in August, 1964. Two adult individuals were collected on 6 September 1964 and one was caught on 25 September. The first two, a male and a female, came from the same burrow.

Their habitat consists of about ten acres of a draw which cuts across one corner of a cultivated field. Smooth brome standing one

to two feet high dominates this habitat. The lower parts of the habitat consist of Maxmillian sunflower, Indian hemp, smartweed, stinging nettle, and smooth sumac. The west side of the habitat is bordered by a road along which several small wild plum thickets grow.

Burrows of this ground squirrel were found on the east slope of the draw next to the cropland. They are high enough to be protected from flood waters, but are well concealed by a heavy growth of smooth brome.

Although there were signs indicating a substantial population in the fall, very few signs were seen in May, 1965. This apparent drop in population number is reported by Sowls (1958) to be common in this species.

Food.—Franklin's ground squirrels are omnivorous and eat a variety of fruits, weed seeds, roots, insects, and mice (Bailey, 1893; Sowls, 1948). A stomach content analysis of two of the ground squirrels from the area revealed that seeds of smartweed, wild plum, and a few beetles were being utilized. An opened cache of a handful of wild plums was found near one of the burrows.

Activity.—Like the thirteen-lined ground squirrel the daily activity of Franklin's ground squirrel is primarily controlled by weather and light (Sowls, 1948). Sowls further indicates that they will not leave their burrows on cloudy days. On 6 September, a cloudy morning, one individual was seen scurrying through the grass. However, the two specimens collected did not come from their burrow until the sun was shining brightly.

Reproduction.—Mating of this species takes place as soon as the female emerges from hibernation, and a single litter of four to 11 is produced (Sowls, 1948).

Records of occurrence.—Total specimens, 3. *R7W, T1S:* NW¼ Sec. 14 (3).

Geomys bursarius (Shaw)

Plains Pocket Gopher

Distribution.—The plains pocket gopher occurs in all but the southeastern corner of Kansas (Cockrum, 1952).

Occurrence.—Two populations of this fossorial mammal were found in the study area. Two individuals were collected in June, 1964 from the remnants of a large population which had occupied an old alfalfa field near the river. The field was plowed in the summer of 1963, thus forcing the gophers to move into an adjacent pasture where the soil is no more than one foot deep before reaching gravel.

All signs left of this population were restricted to an area of about 100 by 75 feet. Although other traps were set here for a week, no other gophers were taken. The area was visited again in September and no new gopher mounds were seen. The adverse burrowing condition presented by the gravel and the lack of food due to heavy grazing of the pasture by cattle apparently cause the gophers to live elsewhere.

The second population was first reported in the spring of 1965 in a bottomland alfalfa field of approximately 20 acres near White Rock Creek. This population inhabits the entire field, but no gopher mounds were found in an adjacent pasture. The soil in the pasture and the alfalfa field is deep, black, and friable.

Food.—Scheffer (1908, 1940) and Smith (1948) report that roots cut in lengths of one to four inches are the most common food found in stores of the plains pocket gopher. Scheffer (1908) points out that a small quantity of succulent vegetation is also eaten.

Activity.—According to Schwartz and Schwartz (1959) pocket gophers are active all hours of the day, but do most of their digging at night, early morning, and late evening. They seldom appear above ground except when the young disperse in the fall and when the males search for mates (Scheffer, 1908).

Reproduction.—According to Scheffer (1908) the plains pocket gopher mates primarily in early spring, but embryos in the uteri have been found as early as January; pregnant females have been found as late as August (Asdell, 1964). Litters of one to six have been reported (Asdell, 1964).

A male and a female collected at the same time and from the same mound on 6 June 1964 may have been a breeding pair. However, Scheffer (1908) occasionally found more than one adult to a burrow out of breeding season.

Records of occurrence.—Total specimens, 2. *R6W, T1S:* NE¼ Sec. 12 (2). Observations. *R7W, T2S:* NW¼ Sec. 9.

Perognathus hispidus Baird

Hispid Pocket Mouse

Distribution.—The hispid pocket mouse ranges over all but approximately the eastern one-third of Kansas (Cockrum, 1952).

Occurrence.—Unlike what Blair (1937) observed in Oklahoma, this pocket mouse was found to occur on a variety of soils and also in a wide assortment of vegetation in the study area. Four typical habitats were: (1) a hillside of shallow, rocky soil with Japanese brome and big bluestem, both being grazed within three inches of

the ground, as dominant vegetation; (2) a hillside with moderately deep soil vegetated with ungrazed tall dropseed; (3) ungrazed western wheatgrass and buffalo grass found on lowland near White Rock Creek; and (4) a heavily-grazed pasture with smooth brome dominant on a shallow top-soil over gravel. Specimens were also collected from ROAD DITCHES. One was caught in a small stand of American elm with smooth brome as ground cover.

Food.—Blair (1937) reports that seeds of forbs and grasses from the immediate habitat were most commonly found in burrows of this pocket mouse. He also found some insects stored with the seeds.

Activity.—Bailey (1905) reports that this species is mainly nocturnal. All specimens collected from the study area were taken at night.

Reproduction.—Several litters of four to seven are born each year to this species (Asdell, 1964). One lactating female was collected in the study area on 26 September 1964.

Records of occurrence.—Total specimens, 29. *R7W, T1S:* NW¼ Sec. 14 (2); Sec. 15 (1); SE¼ Sec. 16 (1); NW¼ Sec. 19 (1); SE¼ Sec. 22 (1); NE¼ Sec. 32 (2); NE¼ Sec. 34 (1). *R7W, T2S:* NW¼ Sec. 5 (1); SE¼ Sec. 3 (3); SW¼ Sec. 18 (1). *R6W, T1S:* NW¼ Sec. 12 (3); SW¼ Sec. 28 (1). *R6W, T2S:* NE¼ Sec. 2 (1); SW¼ Sec. 8 (1); SW¼ Sec. 10 (3); NW¼ Sec. 15 (1); NW¼ Sec. 26 (2); SW¼ Sec. 32 (2); SW¼ Sec. 33 (1).

Castor canadensis Kuhl

Beaver

Distribution.—Henderson (1960) reports that colonies of beaver exist in all counties of Kansas with possible exceptions of those on the southern border from Harper County west and a few near the western border.

Occurrence.—The beaver is especially common on the Republican River, but it also inhabits White Rock Creek and its tributaries.

Although the beaver is known for his engineering abilities, Henderson (1960) reports that the homes of many of these mammals are built in the banks of streams and rivers. This is especially true in the study area. Nearly all beaver dams seen were constructed across narrow streams near Lovewell Reservoir.

Food.—Henderson (1960) found that, while the bark of cottonwood and willow is the preferred food of the beaver, bark of elm, green ash, hackberry, mulberry, boxelder, and other trees is also utilized. All of the above-mentioned species occur in the study area, but it is not certain that they are all used for food. It was not unusual to find sections of willow logs lying in piles of drift wood

or on the river bank that had been stripped of their bark by beaver. Most of these logs were approximately four inches in diameter and one to four feet in length.

Aquatic and terrestrial vegetation near the water provide important food sources in the spring and summer (Henderson, 1960). On one occasion a beaver at the Republican River was observed feeding on vegetation growing at the edge of a river island. This occurred shortly after sunset, but there was ample sunlight to observe its actions. On a September night Gary Hesket (unpublished notes) observed two kits feeding on field corn which had been taken from a nearby field to a spot at the lake's edge.

Activity.—Beaver are usually nocturnal but in the fall they are often busy during the day in preparation for winter (Schwartz and Schwartz, 1959).

Reproduction.—Mating of this species usually occurs in January or February and three or four young are born in April or May (Asdell, 1964).

Records of occurrence.—Total specimens, 4. *R7W, T1S:* SW¼ Sec. 2 (1). *R7W, T2S:* SW¼ Sec. 13 (1). *R6W, T1S:* SE¼ Sec. 3 (2).

Reithrodontomys montanus (Baird)

Plains Harvest Mouse

Distribution.—The plains harvest mouse occurs throughout most of Kansas except the southeastern corner and eastern tier of counties (Cockrum, 1952).

Occurrence.—Jones (1964) indicates that this harvest mouse is strictly an upland species. The specimens taken from the study area were in upland localities of which three were HEAVILY GRAZED GRASSLAND. The fourth locality was being moderately grazed and was dominated by buffalo grass.

Food.—Brown (1946) found that grasshoppers and seeds of buffalo grass and switchgrass made up the bulk of *Reithrodontomys'* food. Although he did not separately discuss the food for the two species he studied, he indicated that *R. montanus* was the more common species. Therefore, it undoubtedly was the source for the majority of his data concerning harvest mice.

Activity.—Nothing has been recorded concerning the activity of the plains harvest mouse, but probably it is almost entirely nocturnal. The four specimens from the study area were collected before 10:00 p. m.

Reproduction.—According to Asdell (1964) this species probably

mates the year around. He reports litter sizes to range from two to five.

Records of occurrence.—Total specimens, 4. *R7W, T1S:* SE¼ Sec. 16 (1). *R7W, T2S:* SE¼ Sec. 23 (1). *R6W, T1S:* NE¼ Sec. 19 (1). *R6W, T2S:* NW¼ Sec. 31 (1).

Reithrodontomys megalotis (Baird)

Western Harvest Mouse

Distribution.—The western harvest mouse is found in the northern half and southwest quarter of Kansas (Cockrum, 1952).

Occurrence.—The western harvest mouse is one of the most abundant mammals in the study area. It is especially common in mesic habitats and seems to prefer such areas as ROAD DITCHES and WASTELAND where forbs are in abundance. Although habitats of mid- and tall grass are frequently inhabited by this species, it was a rare occasion to take it from MODERATELY-GRAZED pastures. On no occasion was it collected from HEAVILY-GRAZED pastures.

Food.—Smith (1936) reports that this species eats the foliage and seeds of grasses. According to Schwartz and Schwartz (1959) some fruits and insects are occasionally utilized as well.

Activity.—Although Cockrum (1952) and Schwartz and Schwartz (1959) state that the western harvest mouse may be active day and night, Carley (1965) found that it is almost entirely nocturnal. He further found its greatest peak of activity to be in early evening and that light intensity was the major determining factor regulating activity.

Reproduction.—This harvest mouse breeds year around but produces the fewest litters in the winter (Asdell, 1964). Asdell further states that litters of one to seven have been reported. Two pregnant females were recorded from the study area on 28 September 1963, one contained six embryos and the other had five.

Records of occurrence.—Total specimens, 130. *R7W, T1S:* NE¼ Sec. 6 (2); SE¼ Sec. 16 (4); NW¼ Sec. 19 (5); SE¼ Sec. 22 (3); NW¼ Sec. 23 (3); SE¼ Sec. 23 (3); NE¼ Sec. 32 (4); NE¼ Sec. 34 (1); SW¼ Sec. 35 (2); SE¼ Sec. 36 (6). *R7W, T2S:* NE¼ Sec. 3 (4); NE¼ Sec. 4 (4); NW¼ Sec. 5 (2); SE¼ Sec. 8 (1); SE¼ Sec. 10 (5); SE¼ Sec. 11 (3); SW¼ Sec. 18 (2); NW¼ Sec. 31 (1); SW¼ Sec. 33 (1); NW¼ Sec. 34 (3); SW¼ Sec. 34 (2); NW¼ Sec. 36 (1). *R6W, T1S:* SW¼ Sec. 1 (4); NE¼ Sec. 3 (1); Sec. 5 (13); NW¼ Sec. 12 (6); SE¼ Sec. 12 (1); NE¼ Sec. 13 (1); SW¼ Sec. 20 (1); NE¼ Sec. 25 (2); NE¼ Sec. 28 (2); SW¼ Sec. 28 (1); SE¼ Sec. 36 (1). *R6W, T2S:* NW¼ Sec. 1 (3); NE¼ Sec. 2 (2); SW¼ Sec. 4 (7); NW¼ Sec. 7 (3); SW¼ Sec. 8 (4); SW¼ Sec. 10 (5); SW¼ Sec. 12 (1); SE¼ Sec. 13 (1); SW¼ Sec. 14 (2); NW¼ Sec. 15 (1); NW¼ Sec. 26 (3); SE¼ Sec. 32 (3).

Peromyscus maniculatus (Wagner)

Deer Mouse

Distribution.—The deer mouse occurs over all of Kansas (Cockrum, 1952).

Occurrence.—The deer mouse occurs in more varied habitats than any other species of small mammal in the study area. All major habitats except woodlands are inhabited by it. Weedy habitats such as ROAD DITCHES and WASTELAND in stages of early succession seem to yield the greatest number of deer mice. Only rarely was it collected from MARSH habitats or from rocky hillsides of the grassland. Wild plum thickets which occur in the upland are inhabited by the deer mouse while these thickets in RIPARIAN COMMUNITIES are inhabited by the white-footed mouse. Trap lines in overgrazed pastures which were near a good cover of vegetation invariably yielded members of this species, while trap lines set in HEAVILY-GRAZED GRASSLAND some distance from heavy vegetation seldom did.

Food.—Almost the entire diet of this species is of seeds of grasses and forbs, but insects are frequently eaten (Brown, 1946; Williams, 1959; Howard and Evans, 1961).

Activity.—This mouse was found by Carley (1965) to be almost strictly nocturnal and it showed a high peak of activity in the early evening and lesser peaks in the early morning. He believes that light is the major determining factor in the activity of the deer mouse.

Reproduction.—According to Asdell (1964) this species tends to breed year around and produces two to seven young per litter. Two females collected from the study area on 28 September 1963 carried six embryos apiece. On 26 September 1964 a female with five embryos and one with seven embryos were collected.

Records of occurrence.—Total specimens, 158. *R7W, T1S:* NE¼ Sec. 6 (4); NE¼ Sec. 11 (1); NW¼ Sec. 14 (2); Sec. 15 (1); SE¼ Sec. 16 (7); NW¼ Sec. 19 (1); SE¼ Sec. 22 (4); NW¼ Sec. 23 (7); SE¼ Sec. 23 (2); NE¼ Sec. 32 (4); NE¼ Sec. 34 (4); SW¼ Sec. 35 (1); SW¼ Sec. 36 (4); SE¼ Sec. 36 (5). *R7W, T2S:* NE¼ Sec. 3 (4); NE¼ Sec. 4 (3); NW¼ Sec. 5 (2); SE¼ Sec. 8 (2); SE¼ Sec. 10 (5); SE¼ Sec. 11 (6); SW¼ Sec. 18 (3); SE¼ Sec. 23 (1); NW¼ Sec. 31 (3); SW¼ Sec. 33 (2); NW¼ Sec. 34 (4). *R6W, T1S:* NE¼ Sec. 3 (3); Sec. 5 (5); NW¼ Sec. 12 (3); SE¼ Sec. 12 (1); NW¼ Sec. 16 (3); NE¼ Sec. 18 (1); SW¼ Sec. 20 (2); NE¼ Sec. 25 (1); NE¼ Sec. 26 (4); NE¼ Sec. 28 (8). *R6W, T2S:* NW¼ Sec. 1 (1); NE¼ Sec. 2 (4); SW¼ Sec. 4 (1); NW¼ Sec. 7 (6); SW¼ Sec. 8 (5); SW¼ Sec. 10 (3); SE¼ Sec. 11 (3); NW¼ Sec. 12 (2); SW¼ Sec. 12 (1); NE¼ Sec. 12 (3); NW¼ Sec. 15 (5); NW¼ Sec. 26 (3); NW¼ Sec. 31 (2); SE¼ Sec. 32 (5); SW¼ Sec. 33 (1).

Peromyscus leucopus (Rafinesque)

White-footed Mouse

Distribution.—Cockrum (1952) indicates that the white-footed mouse occurs throughout Kansas except for a large part of the west-central portion. However, Frydendall (1961) reported this species from Ellis County, which indicates that it probably extends further west along major water courses than is shown by Cockrum.

Occurrence.—This species is typically an inhabitant of the RIPARIAN COMMUNITIES of the study area. In almost all instances it was taken in very close proximity to trees or thickets. Within these habitats an edge of dense grass appears to be somewhat preferred over the lesser vegetated parts. ALL OTHER WOODLANDS are also commonly inhabited by this species.

The occurrence of this species away from wooded habitats has not to our knowledge been previously recorded. Aerial photos show that one specimen was collected a quarter mile from the nearest wooded area. Its particular habitat was a short, narrow ditch which spreads out into level lowland north of White Rock Creek. The vegetation was predominantly smooth brome which was quite dense and stood about four feet high. A few sunflowers were present where this ditch joins a road ditch. The mouse was caught at this junction.

Another occurrence of this species away from wooded habitat was in a weedy swale by the railroad in the extreme southeast corner of the study area. Aerial photos show that one lone tree is present opposite this locality and that the nearest probable habitat for this species is nearly one mile away. The railroad right-of-way is vegetated with grass and forbs and a few scattered thickets which might serve as habitat for white-footed mice.

Food.—Food items of the white-footed mouse consist of a wide variety of seeds, fruits, and insects (Cogshall, 1928; Hamilton, 1941; Whitaker, 1963).

Activity.—White-footed mice have been extensively studied and shown to be almost strictly nocturnal (Johnson, 1926; Behney, 1936; Getz, 1959). The mice seem to show a peak period of activity in early evening and a lesser peak late in the night (Johnson, 1926; Behney, 1936). Orr (1959) suggests that light has little effect on their activity but that relative humidity and temperature are contributing factors.

Reproduction.—Records from Cockrum (1952) indicate that this species probably breeds year around. According to Asdell (1964)

the number of embryos per litter is quite variable, but the average is between four and five.

Records of occurrence.—Total specimens, 125. *R7W, T1S:* NW¼ Sec. 14 (1); Sec. 15 (1); SE¼ Sec. 22 (1); NE¼ Sec. 34 (2); SW¼ Sec. 35 (21). *R7W, T2S:* NE¼ Sec. 4 (1); NW¼ Sec. 5 (4); NE¼ Sec. 8 (2); SE¼ Sec. 8 (1); SE¼ Sec. 11 (1); SW¼ Sec. 18 (1); SE¼ Sec. 23 (1); NE¼ Sec. 26 (8); NW¼ Sec. 34 (2); SW¼ Sec. 34 (2). *R6W, T1S:* SW¼ Sec. 1 (1); Sec. 5 (21); SE¼ Sec. 12 (1); NE¼ Sec. 13 (1); NE¼ Sec. 25 (2). *R6W, T2S:* NE¼ Sec. 2 (2); SW¼ Sec. 4 (8); NW¼ Sec. 7 (17); SW¼ Sec. 8 (5); SE¼ Sec. 9 (1); SW¼ Sec. 10 (6); NE¼ Sec. 18 (5); SW¼ Sec. 32 (6).

Onychomys leucogaster (Wied-Neuwied)

Northern Grasshopper Mouse

Distribution.—The northern grasshopper mouse occurs in all but the eastern one-fourth of Kansas (Cockrum, 1952).

Occurrence.—Jones (1964) states that in western Nebraska ". . . it is most frequently taken along the borders of little used roads and upland grain fields and in relatively undisturbed upland prairie." This is contrary to what was found here. Of the three localities recorded in the study area, two of the habitats are quite similar in that they are both HEAVILY-GRAZED GRASSLAND of smooth brome. The third habitat is a silted-in WASTELAND with a heavy stand of dead Japanese brome providing cover.

Food.—According to Bailey and Sperry (1929) grasshopper mice are highly carnivorous in all seasons but winter. They found that grasshoppers, crickets, caterpillars, moths, and beetles are the major food items; but that small mammals are often captured and eaten. They indicate that this species probably stores seeds for winter food.

Activity.—Grasshopper mice are social mammals which roam at night in search for food (Bailey and Sperry, 1929).

Reproduction.—Several litters of two to six are born from April to September (Asdell, 1964).

Records of occurrence.—Total specimens, 6. *R6W, T1S:* NE¼ Sec. 12 (4); NE¼ Sec. 18 (1); SW¼ Sec. 20 (1).

Sigmodon hispidus Say and Ord

Hispid Cotton Rat

Distribution.—Cockrum (1952) reported that the hispid cotton rat was on a northward movement through Kansas and that it had reached the extreme northeastern corner but was absent from the northern tier of counties west of there. Since then Anderson and Nelson (1957) have reported this species from Norton, Smith, and Marshall counties, thus indicating a nearly state-wide distribution for the species.

Jones (1964) reports but one locality of this species in the extreme southeastern corner of Nebraska. He further indicates that it probably occurs westward along the Blue and Republican rivers.

Occurrence.—This cotton rat was taken only in some of the more mesic habitats of the study area. ROAD DITCHES and WASTELAND near water seem to be the preferred habitats. It was not taken from MARSHES.

Food.—The cotton rat eats seeds, stems and leaves of grass, and other vegetation found along their runways (Bailey, 1905, 1932). To this list Schwartz and Schwartz (1959) add crayfish, insects, eggs and young of ground nesting birds, and dead carcasses.

Activity.—*Sigmodon* is known to be somewhat diurnal but mostly nocturnal in its activities (Bailey, 1905; Schwartz and Schwartz, 1959). It was found by Calhoun (1945) to possess a bimodal nocturnal activity pattern in which the major peak occurred before midnight.

Reproduction.—According to Asdell (1964) this species breeds from early spring to late fall. Cockrum (1952) reported three to 12 embryos taken from pregnant females in Kansas.

Records of occurrence.—Total specimens, 17. *R7W, T1S:* NW¼ Sec. 19 (1). *R7W, T2S:* SE¼ Sec. 10 (3); SE¼ Sec. 11 (2); NW¼ Sec. 34 (2). *R6W, T2S:* SW¼ Sec. 5 (5); NW¼ Sec. 15 (1); NE¼ Sec. 26 (2); SE¼ Sec. 32 (1).

Microtus pennsylvanicus (Ord)

Meadow Vole

Distribution.—The meadow vole has been taken only in the extreme north-central part of Kansas (Fleharty and Andersen, 1964). These findings suggest possibilities of other populations along the southern border of Nebraska and northern Kansas.

Occurrence.—Three populations of the meadow vole have been found in the study area. The habitats of two of these have been described by Fleharty and Andersen (1964). The third population was found subsequently. All three of the habitats are lowlands with lush vegetation. Two of these are associated with spring-fed MARSHES.

Food.—Bailey (1926, 1932) reports that the foliage and seeds of vegetation in their immediate habitat make up the food of the meadow mice. Small piles of freshly cut bluegrass were frequently found in runways used by this species in the study area. According to Lantz (1907) they also store their food in underground galleries.

Activity.—Activity studies dealing with the meadow vole have been made by Hamilton (1937), Hatfield (1940), Pearson (1959),

and Osterberg (1962). The general consensus of these studies is that the vole is primarily active near sundown and again at sunrise. No particular factor or factors was shown definitely to regulate their activity.

Reproduction.—The meadow vole reproduces year around and may have as many as 17 litters a year. Embryo counts range from one to 11 (Asdell, 1964).

Records of occurrence.—Total specimens, 41. *R6W, T1S:* Sec. 5 (3). *R6W, T2S:* NW¼ Sec. 1 (4); NE¼ Sec. 2 (1); SW¼ Sec. 4 (33).

Microtus ochrogaster (Wagner)

Prairie Vole

Distribution.—The prairie vole can be found throughout Kansas (Cockrum, 1952).

Occurrence.—Lowland with lush vegetation is the preferred habitat of the prairie vole in the study area. Tall grass along the edges of RIPARIAN COMMUNITIES and unburned ROAD DITCHES were the two most common areas for collecting this vole. The latter habitat is nearly the extent of its distribution in the upland. This species was seldom found in any of the grasslands.

Food.—Green and succulent parts of plants are the choice food of the prairie vole, but seeds, fruits, and small stems of woody plants are also eaten (Brown, 1946; Jameson, 1947). In addition to this, Fisher (1945) and Martin (1956) report the vole to be slightly carnivorous.

Activity.—Carley (1965) noted that the prairie vole was somewhat diurnal in the cooler season but nocturnal in the summer. He found one peak of activity to be a few hours after sunrise and a lesser peak in early evening. Results of studies by Calhoun (1945) and Martin (1956) are in close agreement with that of Carley.

Reproduction.—The prairie vole breeds year around, but August and September are the most productive months and December and January are the least productive months (Asdell, 1964). Jones (1964) found an average of 3.6 embryos taken from 110 pregnant females. Two females collected from the study area on 27 September 1963 carried four embryos and another had six.

Records of occurrence.—Total specimens, 90. *R7W, T1S:* NW¼ Sec. 19 (3); SW¼ Sec. 19 (1); SE¼ Sec. 22 (5); NW¼ Sec. 23 (3); NE¼ Sec. 32 (1); NE¼ Sec. 34 (1); SW¼ Sec. 36 (1). *R7W, T2S:* NE¼ Sec. 4 (3); NW¼ Sec. 5 (7); SE¼ Sec. 8 (1); SE¼ Sec. 10 (2); SE¼ Sec. 11 (2); SW¼ Sec. 18 (2); SE¼ Sec. 23 (2); NE¼ Sec. 26 (2); NW¼ Sec. 34 (4). *R6W, T1S:* Sec. 5 (12); NW¼ Sec. 12 (1); NW¼ Sec. 16 (1); NE¼ Sec. 26 (1); SW¼ Sec. 28 (4); SE¼ Sec. 36 (3). *R6W, T2S:* SW¼ Sec. 4 (5); NW¼ Sec. 7 (2); SW¼ Sec. 8 (5); SE¼ Sec. 9 (1); SW¼ Sec. 10 (2); SE¼ Sec. 11 (3); SW¼ Sec. 12 (1); NE¼ Sec. 12 (1); NW¼ Sec. 26 (4); SE¼ Sec. 32 (4).

Ondatra zibethicus (Linnaeus)

Muskrat

Distribution.—The muskrat is found over all of Kansas (Cockrum, 1952).

Occurrence.—This semiaquatic mammal inhabits the Republican River, White Rock Creek, back waters of Lovewell Reservoir, and ponds. In the latter two habitats their homes are frequently made of the aquatic vegetation found at the edge or in the shallow water. On the river and creek their homes are commonly dens dug in banks.

Food.—According to Bellrose (1950) and Lantz (1910) roots and succulent parts of aquatic vegetation are the preferred food but some crustaceans, fish, and other animal matter may be utilized.

Activity.—Muskrats are chiefly nocturnal but are frequently active in the day especially when preparing for winter (Lantz, 1910).

Reproduction.—The breeding season for the muskrat in Iowa is from April to August, and litter size averages 6.5 young (Asdell, 1964).

Records of occurrence.—Total specimens, 2. *R6W, T2S:* SW¼ Sec. 8 (1); Sec. 26 (1). Observations. *R6W, T1S:* SW¼ Sec. 5; SW¼ Sec. 4.

Rattus norvegicus (Berkenhout)

Norway Rat

Distribution.—The Norway rat is found throughout Kansas (Cockrum, 1952).

Occurrence.—It is suspected that the Norway rat makes itself a nuisance to many farmers in the area who store grain and feed on their farms. Droppings of this species were occasionally seen around corn cribs. One specimen was seen dead on a road bordered by pastures on both sides, but a weedy ROAD DITCH or a nearby WASTELAND was probably its habitat.

Food.—Norway rats are omnivorous and eat such things as grain, fruit, garbage, eggs, fish, small mammals, and domestic fowl (Schwartz and Schwartz, 1959).

Activity.—Schwartz and Schwartz (1959) state that rats are primarily nocturnal, but Pisano and Storer (1948) found that wild rats were quite active during the day when not disturbed by humans.

Reproduction.—The Norway rat produces several litters the year around and approximately nine young are born in each litter (Asdell, 1964).

Records of occurrence.—Observations. *R6W, T1S:* NE¼ Sec. 13. *R6W, T2S:* NW¼ Sec. 6; SW¼ Sec. 9.

Mus musculus Linnaeus

House Mouse

Distribution. — The house mouse occurs throughout Kansas (Cockrum, 1952).

Occurrence.—ROAD DITCHES and WASTELAND were the most common places for collecting house mice. These mice undoubtedly are quite common around the many corn cribs and granaries in the study area.

Food.—According to Schwartz and Schwartz (1959) house mice are omnivorous, but they prefer grain and various vegetable matter.

Activity.—A study on a population of house mice in a barn in New England was carried out by Brown (1953). He found that they were active night and day but that they were decidedly more active during the day. This is in contrast to the results of Schwartz and Schwartz (1959) who state that the house mouse is mostly nocturnal.

Reproduction.—House mice produce several litters a year and five to ten is the common litter size (Asdell, 1964).

Records of occurrence.—Total specimens, 23. *R7W, T2S:* NE¼ Sec. 4 (1). *R6W, T1S:* Sec. 5 (1); NW¼ Sec. 12 (1); NE¼ Sec. 25 (1). *R6W, T2S:* NW¼ Sec. 1 (3); NE¼ Sec. 2 (4); NW¼ Sec. 7 (1); SW¼ Sec. 10 (2); SW¼ Sec. 12 (2); SE¼ Sec. 13 (2); NW¼ Sec. 15 (2); SE¼ Sec. 32 (3).

Erethizon dorsatum (Linnaeus)

Porcupine

Distribution.—According to Cochrum (1952) the porcupine has probably never been common in Kansas but it has occasional occurrences recorded in all but the eastern one-sixth of the state.

Occurrence.—One specimen of the porcupine was reported from the study area. This was an individual shot by Thomas Dahl near the first of July, 1964. He reported that it had been living in his fruit trees and with its weight had broken many branches. Mr. Dahl's farm is located about one mile north of White Rock Creek from where this animal undoubtedly came. Although the porcupine was disposed of, its identification was verified by pictures taken by Mrs. Dahl.

Food.—In Oregon the porcupine feeds upon leaves and other succulent vegetation in the summer and upon pine bark in the winter (Gabrielson, 1928). In New York, Shapiro (1949) found that porcupines were not selective in the summer but that in the winter the bark of trees such as hemlock, sugar maple, red spruce, and beech was extensively utilized.

Activity.—Shapiro (1949) reports that porcupines do their exercising and feeding during the night.

Reproduction.—The mating season of the porcupine is during November and after a 16-week gestation period usually one young is born (Asdell, 1964).

Records of occurrence.—Observations. *R6W, T1S:* SW¼ Sec. 31.

Canis latrans Say

Coyote

Distribution.—The coyote has a state-wide distribution in Kansas (Cockrum, 1952).

Occurrence.—The coyote seems not to be limited to any particular habitat in the study area. Its tracks were commonly seen in the sand of the river and on muddy roads in nearly all habitats.

A den being used by a family of coyotes was found on 20 June 1964 on top of a high pasture hill where blue grama and buffalo grass were dominant with large thickets of smooth sumac.

Food.—Rabbits, carrion, and rodents make up nearly 80 per cent of the coyote's yearly food (Sperry, 1941; Fichter et al., 1955; Gier, 1957; Korschgen, 1957). Other food items listed by these authors include insects, chickens, and wild birds.

Activity.—Coyotes do most of their hunting at night but are occasionally seen in the day (Fitch and Packard, 1955; Schwartz and Schwartz, 1959). In the study area coyotes were twice seen in early evening and their howls were commonly heard at night.

Reproduction.—Coyotes mate from February through April and after a gestation period of 60 to 65 days produced litters averaging 5.7 young (Asdell, 1964).

Records of occurrence.—Total specimens, 1. *R6W, T2S:* Sec. 20 (1). Observations. *R7W, T1S:* Sec. 16. *R7W, T2S:* Sec. 34. *R6W, T2S:* Sec. 12; Republican River.

Procyon lotor (Linnaeus)

Raccoon

Distribution.—The raccoon occurs throughout Kansas (Cockrum, 1952).

Occurrence.—In the study area the raccoon is nearly restricted to RIPARIAN COMMUNITIES. It was not unusual to see raccoon tracks along the edges of Lovewell Reservoir, White Rock Creek, Republican River, and occasionally by ponds.

Food.—Stuewer (1943) and Stains (1956) found that animal matter was the most important source of food for raccoons in the winter

and spring and that vegetable matter, especially fruits, and seeds, were the most important food source in summer and fall. They both agree that when acorns are available they are heavily utilized by this species. Stains (1956) further states that corn is the most important year-around food for raccoons.

Activity.—Raccoons are almost entirely nocturnal (Schwartz and Schwartz, 1959).

Reproduction.—In Kansas, raccoons mate from December to June and a peak is reached in February (Stains, 1956). Stains reports that most litters are born in late April and early May and that litters average 4.6 young.

Records of occurrence.—Total specimens, 1. *R6W, T1S:* Sec. 1 (1). Observations. *R6W, T1S:* SW¼ Sec. 7; NE¼ Sec. 19; Republican River; White Rock Creek.

Mustela nivalis Linnaeus

Least Weasel

Distribution.—Only recently has the least weasel been reported from Kansas (Jones, 1965; Hesket and Fleharty, 1966). Both records are from the extreme north-central part of the state.

Occurrence.—One specimen of the least weasel was taken in the study area on 16 January 1965 and is discussed by Hesket and Fleharty (1966). Hall (1951) indicates that this weasel utilizes a variety of habitats ranging from upland to lowland.

Food.—Hall (1951) summarizes the known food of the least weasel to be harvest mice, deer mice, meadow mice, red-backed mice, and probably insects. The least weasel collected in the study area contained hair of *Microtus ochrogaster* in its stomach.

Activity.—Little is known about the life history of the least weasel including its time of activity (Hall, 1951), but it is probably nocturnal.

Reproduction.—Hall (1951) reports that the least weasel may reproduce year around with litter sizes ranging from three to ten.

Records of occurrence.—Total specimens, 1. *R6W, T1S:* Sec. 8 (1).

Mustela vison Schreber

Mink

Distribution.—According to Cockrum (1952) the mink occurs in most of Kansas except the extreme western part.

Occurrence.—The mink was found only along RIPARIAN COMMUNITIES in the study area. Gary Hesket (personal communication) has reported a number of mink taken from Lovewell Reser-

voir and the Republican River, indicating that their occurrence in the area is not uncommon.

Food.—According to Hamilton (1936a) mammals make up over 50 per cent of the food consumed by mink with muskrat and mice being the main items. Aquatic vertebrates and insects comprise most of the remainder of their food.

Activity.—Mink are chiefly nocturnal but are also somewhat crepuscular (Schwartz and Schwartz, 1959).

Reproduction.—Litters averaging 4.4 young are usually produced by mink in April or May (Asdell, 1964).

Records of occurrence.—Total specimens, 1. *R7W, T2S:* SW¼ Sec. 13 (1). Observations. *R7W, T2S:* SW¼ Sec. 5. *R6W, T2S:* SW¼ Sec. 9; Republican River.

Taxidea taxus (Schreber)

Badger

Distribution.—The badger occurs over all of Kansas except the extreme east-central counties (Cockrum, 1952).

Occurrence.—The badger is found throughout the study area, but its activities are concentrated in the upland and drier habitats. Banks of ROAD DITCHES, gullies, and wild plum thickets seem to provide favorite digging places for the badger.

Food.—Major food items of the badger found by Errington (1937) and Sneade and Hendrickson (1942) are rodents, rabbits, and insects.

Activity.—Badgers are reported by Schwartz and Schwartz (1959) to be mostly nocturnal but are also somewhat crepuscular.

Reproduction.—The badger bears from one to five young in early April (Asdell, 1964). A female with two young was seen in the study area on 10 June 1963 and another with three young was seen on 22 June.

Records of occurrence.—Total specimens, 1. *R6W, T1S:* Sec. 15 (1). Observations. *R7W, T2S:* NW¼ Sec. 30. *R6W, T2S:* NW¼ Sec. 8. *R6W, T1S:* Sec. 12.

Mephitis mephitis (Schreber)

Striped Skunk

Distribution.—The striped skunk is found throughout Kansas (Cockrum, 1952).

Occurrence.—A female striped skunk was collected near an irrigation canal close to White Rock Creek. Another individual was seen running from a ROAD DITCH into a pasture just south of Lovewell Reservoir. Road killed individuals were seen in both upland and lowland areas.

Food.—Hamilton (1936b) reports that availability largely determines the nature of food consumed by skunks. The general types of food eaten by skunks are insects, fruits, small mammals, carrion, grains, and herptiles (Lantz, 1923; Hamilton, 1936b).

Activity.—Skunks are mainly nocturnal but may be active much of the day when not harassed by enemies (Lantz, 1923).

Reproduction.—Striped skunks produce from four to seven young near the middle of May (Asdell, 1964). A lactating female was collected in the study area on 10 June 1963.

Records of occurrence.—Total specimens, 1. *R6W, T2S:* NW¼ Sec. 17 (1). Observations. *R7W, T2S:* Sec. 14; Sec. 32. *R6W, T2S:* SW¼ Sec. 7; NW¼ Sec. 8.

Odocoileus hemionus (Rafinesque)

Mule Deer

Distribution.—According to Anderson (1964) mule deer occur as far east as Cloud and Republic counties in north-central Kansas and Chase County in east-central Kansas.

Occurrence.—Gary Hesket (personal communication) reports that the number of mule deer is on a definite increase in Jewell County and that in the study area they spend the spring and summer months in the ravines, herein considered in OTHER WOODLAND, just south of Lovewell Reservoir. He has further noted that they do not winter in the same area but evidently move deeper into the hills.

Food.—Mule deer commonly browse on trees and shrubs but also consume grasses and forbs (Martin et al., 1951). Hesket (unpublished notes) has on several occasions observed this species feeding on the lush grass in ROAD DITCHES near Lovewell Reservoir.

Activity.—According to Taylor (1956) mule deer feed primarily in early morning and late evening but are frequently seen at all hours of the day.

Reproduction.—One or two young are usually born to the mule deer in May or June (Asdell, 1964).

Records of occurrence.—Observations. *R7W, T2S:* Sec. 8; Sec. 15; Sec. 22; Sec. 23. *R6W, T2S:* Sec. 19.

Odocoileus virginianus (Zimmerman)

White-tailed Deer

Distribution.—The white-tailed deer probably occurs over all of Kansas (Anderson, 1954).

Occurrence.—White-tailed deer are more common in the study area than are mule deer, and like mule deer inhabit the ravines south of Lovewell Reservoir. The RIPARIAN COMMUNITIES of White

Rock Creek and the Republican River are also inhabited by this species.

Food.—Martin et al. (1951) state that the food of this species is almost entirely of shrubs and herbs. The foods given in order of importance to deer in Iowa are cultivated crops, browse, forbs, grasses, and fungi (Mustard and Wright, 1963).

Activity.—White-tailed deer, like mule deer, may be active at any time of the day, but they usually do their feeding in early morning and late evening hours (Taylor, 1956).

Reproduction.—Usually two young are born to the white-tail deer from late May to early July (Asdell, 1964).

Records of occurrence.—Total specimens, 1. South side of Lovewell Reservoir. Observations. *R7W, T1S:* Sec. 33. *R7W, T2S:* Sec. 2; Sec. 4; Sec. 9; Sec. 10; Sec. 11; Sec. 13; Sec. 14; Sec. 15; Sec. 16; Sec. 21. *R6W, T1S:* Sec. 1; Sec. 3; Sec. 10. *R6W, T2S:* Sec. 8.

Species of Unverified Occurrence

There are 14 mammalian species which are known to have a general geographical range approaching or including the study area. These are listed below with some indication as to their probability of occurring in the study area.

Myotis lucifugus (Leconte)—Little Brown Bat. Cockrum (1952) reports records of this species only from extreme south-central and northeastern Kansas but he suggests that it probably has a state-wide distribution.

Myotis keenii (Merriam)—Keen's Myotis. This species has been reported in Kansas from Marshall County (Cockrum, 1952) and Ellis County (Fleharty and Farney, 1965).

Lasionycteris noctivagans (LeConte)—Silvery-haired Bat. Cockrum (1952) states that this bat probably can be found in Kansas during migration.

Pipistrellus subflavus (F. Cuvier)—Eastern Pipistrelle. The nearest record of this bat to the study area is from a mine in Marshall County, Kansas (Cockrum, 1952).

Tadarida brasiliensis (I Geof. St.-Bilaire)—Brazilian Free-tailed Bat. Cockrum (1952) states that this species may occur in the northern part of Kansas as a straggler.

Perognathus flavescens Merriam—Plains Pocket Mouse. The nearest record of this species to the study area is from Adams County, Nebraska (Jones, 1964).

Dipodomys ordii Woodhouse—Ord's Kangaroo Rat. The nearest record of this kangaroo rat is from Franklin County, Nebraska. The lack of sparsely vegetated, sandy soil probably excludes this species from the study area.

Neotoma floridana (Ord)—Eastern Wood Rat. Rooks County, Kansas, is the nearest record given by Cockrum (1952) of this species to the study area.

Synaptomys cooperi Baird—Southern Bog Lemming. Haines and Gier (1951) report two *Synaptomys* skulls from near Mankato, Jewell County, Kansas. It is highly probable that this species occurs in the study area.

Vulpes fulva (Desmarest)—Red Fox. The closest known record of this species to the study area is in the Museum of the High Plains and was taken near Hastings, Adams County, Nebraska. Although there were no reports of this species in the study area it is highly probable that it occurs there.

Mustela frenata Lichtenstein—Long-tailed Weasel. A specimen of this species is in the personal collection of Gary Hesket. It was taken two miles south of the study area at Section 12, R7W, T2S Jewell County, Kansas. This indicates that this species surely inhabits the study area.

Spilogale putorius (Linnaeus)—Spotted Skunk. Unconfirmed reports of this species living in the riprap of the Lovewell Reservoir dam were received from Randall Cleveland of Webber.

Lynx rufus (Schreber)—Bobcat. Cockrum (1952) gives the nearest record of this species to the study area to be from Decatur and Geary counties, Kansas.

Felis concolor Linnaeus—Puma. Of questionable occurrence in the study area. Several unconfirmed sightings of a large cat in or near the study area have been reported to the local game protector.

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Appendix

Scientific and Common Names of Plants Cited in the Text

A. List of Grasses

Agropyron smithii	Western wheatgrass
Andropogon gerardi	Big bluestem
Andropogon scoparius	Little bluestem
Aristida longiseta	Red threeawn
Bouteloua curtipendula	Side-oats grama
Bouteloua gracilis	Blue grama
Bouteloua hirsuta	Hairy grama
Bromus inermis	Smooth brome
Bromus japonicus	Japanese brome
Buchloë dactyloides	Buffalo grass
Cenchrus pauciflorus	Sandbur
Echinochloa crusgalli	Barnyard grass
Muhlenbergia racemosa	Marsh muhly
Panicum capillare	Ticklegrass
Panicum virgatum	Switchgrass
Poa pratensis	Kentucky bluegrass
Schedonnardus paniculatus	Tumblegrass
Setaria italica	Millet
Setaria lutescens	Yellow foxtail
Setaria viridis	Green foxtail
Sorghum vulgare	Maize
Sporobolus asper	Tail dropseed
Sporobolus cryptandrus	Sand dropseed
Triticum aestivum	Wheat
Zea mays	Corn

B. List of Other Herbaceous Plants

Ambrosia psilostachya	Western ragweed
Ambrosia trifida	Giant ragweed
Asclepias latifolia	Broadleaf milkweed
Aster exilis	Slim aster
Callirhoë involucrata	Purple poppymallow
Cannabis sativa	Indian hemp
Carex sp.	Sedge
Cirsium arvense	Canada thistle
Desmanthus illinoensis	Illinois bundleflower
Erigeron ramosus	Daisy flabane
Euphorbia marginata	Snow-on-the-mountain
Gutierrezia sarothrae	Broom snakeweed
Helianthus annuus	Common sunflower
Kochia scoparia	Fireweed
Medicago sativa	Alfalfa

Melilotus alba	White sweetclover
Melilotus officinalis	Yellow sweetclover
Opuntia macrorhiza	Pricklypear cactus
Polygonum sp.	Smartweed
Psoralea tenuiflora	Few-flowered scurfpea
Rumex altissimus	Tall dock
Salsola pestifer	Russian thistle
Solidago rigida	Stiff goldenrod
Tragopogon pratensis	Goatsbeard
Typha latifolia	Common cattail
Urtica procera	Stinging nettle
Vernonia baldwini	Baldwin ironweed
Viorna fremontii	Fremont's leatherleaf
Xanthium commune	Cocklebur

C. List of Woody Plants

Acer negundo	Boxelder
Celtis occidentalis	Hackberry
Elaeagnus angustifolia	Russian olive
Fraxinus lanceolata	Green ash
Gleditsia triacanthos	Honey locust
Juglans nigra	Black walnut
Juniperus virginiana	Red cedar
Maclura pomifera	Osage orange
Morus rubra	Mulberry
Populus sargentii	Plains cottonwood
Prunus besseyi	Wild plum
Prunus virginiana	Chokecherry
Quercus macrocarpa	Bur oak
Rhus glabra	Smooth sumac
Rhus toxicodendron	Poison ivy
Rhus trilobata	Skunkbrush
Ribes missouriense	Gooseberry
Ribes odoratum	Golden currant
Rosa multiflora	Multiflora rose
Rosa setigera	Prairie rose
Salix amygdaloides	Peach-leaved willow
Symphoricarpos orbiculatus	Buckbrush
Ulmus americana	American elm
Ulmus pumila	Siberian elm
Vitis vulpina	Wild grape

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