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HISPID COTTON RAT (*SIGMODON HISPIDUS*) IN NEBRASKA: DISTRIBUTION, REPRODUCTION, AND SEASONAL ACTIVITY

Greg D. Wright¹, Keith Geluso^{1,3}, and Russell A. Benedict²

ABSTRACT.—The hispid cotton rat (*Sigmodon hispidus*) has occurred in Nebraska for about 50 years and entered the state from the south via northward movements through Kansas. However, little is known about its status or distribution in the state in recent decades. We conducted surveys for *S. hispidus* in southern Nebraska at historical sites and sites without previous records to determine its current status. From 2004 to 2008, we documented cotton rats at 9 of 12 historical sites in south-central and extreme southeastern parts of the state, and we captured this species at 13 new sites in southwestern and south-central Nebraska. In the past 3 decades, the distribution of *S. hispidus* has expanded westward but not northward in the state. An explanation for such a shift is unclear. At this northern edge of its geographical range, pregnant females were captured from early April to early October, and nonreproductive females were captured from November to January. Males with enlarged testes occurred from late March to September. Aspects of its natural history in Nebraska are similar to those reported in Kansas.

Key words: *Sigmodon hispidus*, hispid cotton rat, Nebraska, distribution, expansion, reproduction, winter activity, seasonal activity.

The hispid cotton rat (*Sigmodon hispidus*) occurs from northern South America to southern Nebraska and from Virginia to California (Hall 1981, Cameron 1999). This species has occurred in the central Great Plains for only about a century. It was first recorded in Kansas in 1892 after moving northward from Oklahoma (Bailey 1902). The cotton rat continued to expand northward through eastern Kansas at 7 miles per year and approached the southern border of Nebraska by 1947 (Cockrum 1948). In 1958, *S. hispidus* was first reported in southeastern Nebraska (Richardson County; Jones 1960), with subsequent captures in south-central Nebraska in 1965 and 1966 (Adams County; Choate and Genoways 1967, Genoways and Schlitter 1967). From 1948 to 1965, cotton rats expanded at an estimated 5.5 miles per year in northern Kansas and southern Nebraska (Genoways and Schlitter 1967).

By 1975, hispid cotton rats were known from 6 counties in Nebraska—1 in the extreme southeastern corner and 5 in south-central parts of the state (Farney 1975). The northernmost locality was from Kearney County in 1966 and the westernmost was from Harlan County in 1973 (Farney 1975). At many former sites, *S. hispidus* was captured in roadside ditches with dense or

tall vegetation, including brome (*Bromus*), foxtail (*Setaria lutescens*), sunflower (*Helianthus*), prairie cordgrass (*Spartina pectinata*), and switchgrass (*Panicum virgatum*; Jones 1960, Farney 1975). Both abiotic and biotic environmental pressures have been suggested as factors that limited movements of *S. hispidus* farther northward (Sauer 1983, Benedict et al. 2000).

During the last 30 years in Nebraska, at least 20 native species of mammals have expanded their distribution in the state (e.g., Benedict et al. 2000, Roehrs and Genoways 2004, Serbousek and Geluso 2009), but others have contracted their ranges (Benedict et al. 2000). Although *S. hispidus* was last documented moving northward in the 1970s, Benedict et al. (2000) did not report a change in its distribution. A lack of change suggests that the distribution of *S. hispidus* has been stable since the 1970s, the species may be locally extinct, or researchers have not trapped in appropriate habitats in southern parts of the state. The main purpose of our study was to determine the current status of the hispid cotton rat in Nebraska. Herein, we also comment on its distribution, reproductive biology, and seasonal activity in the state.

From 2004 to 2008, we attempted to capture *S. hispidus* at historical sites and other localities

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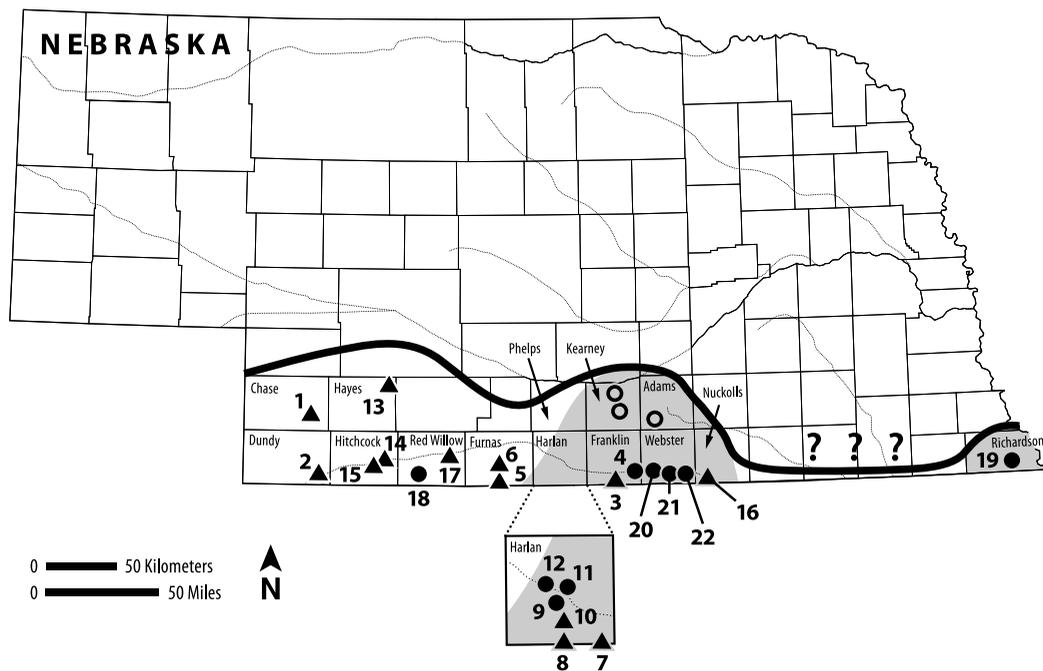


Fig. 1. Distribution of the hispid cotton rat (*Sigmodon hispidus*) in Nebraska. Open circles represent previously published localities where we did not capture individuals during this study; closed circles represent localities with prior records (see Table 1) where we also documented individuals during our survey; and closed triangles represent new localities based on our trapping. For numbered localities, see corresponding numbers in the appendix for specific details about those records. The shaded region represents the distribution of *S. hispidus* in 1975 (Farney 1975), and the area below the solid line represents the current distribution of cotton rats in the state based on this study and museum specimens deposited before our study.

across southern Nebraska. We define historical sites as those with distributional records before 2004, based on published literature and unpublished museum specimens. At a few historical localities, we did not trap the exact site because of a lack of habitat for *Sigmodon*; however, at those sites, we set traps in areas with appropriate habitat <2 km from original localities. We also trapped other areas without prior records in Chase, Dundy, Furnas, Hayes, Hitchcock, Lincoln, Nuckolls, and Phelps counties. To capture *S. hispidus*, we mainly used Sherman live traps (H.B. Sherman Traps, Tallahassee, FL). We identified each captured mammal and recorded its sex and reproductive condition. Individuals weighing >70 g were considered adults, which weight corresponds to approximate onset of reproduction in Nebraska (see *Reproduction* below).

We kept at least 1 voucher specimen of *S. hispidus* from each site. Voucher specimens and corresponding field notes were deposited in the

zoological collection at the University of Nebraska State Museum, University of Nebraska, Lincoln (UNSM; see Appendix). We also searched or queried for unpublished museum records of *S. hispidus* at UNSM, the natural history collections at the University of Nebraska at Kearney (UNK) and at Omaha (UNO), the Natural History Museum at the University of Kansas, Lawrence (KU), Hastings Museum, Hastings, Nebraska (HM), and the Collection of Vertebrates, Hastings College, Hastings, Nebraska (HC). For specimens housed at UNSM and UNK, we also amassed and reported pertinent life history information, such as reproductive condition, from skin tags.

Distribution and Habitat

From 2004 to 2008, we documented 188 *S. hispidus* at 22 localities in 11 counties across southern Nebraska (Fig. 1, Appendix). At trapping sites with *S. hispidus*, we also captured 16 other species of small mammals, including 309

TABLE 1. Sites of capture for hispid cotton rats (*Sigmodon hispidus*) in Nebraska before 2004. Museum numbers of specimens are given in parentheses after source information. See text for details of museum acronyms. The last column refers to whether we captured *S. hispidus* during our study at that locality and gives our number of trap nights in parentheses.

County	Locality	Date of capture	Citation or source of record	This study
Adams ^a	3.9 mi S, 1.1 mi E Holstein	4 October 1965	Genoways and Schlitter 1967 (HM ^b)	No (160)
		12 August 1966	Choate and Genoways 1967 (KU 105938–105939)	
Franklin ^c	2 mi S Riverton	6 October 1972	Famey 1975 (UNK 2170–2174)	Yes (120)
Harlan	1 mi N Alma	8 September 1973	Famey 1975 (UNK 2175–2177)	Yes (120)
Harlan	1 mi W Alma Vista	17 August 1989	unpublished (UNSM 17306–17307)	Yes (10)
Harlan	1.5 mi S, 1.7 mi E Orleans	16 August 1988	unpublished (UNSM 16926–16928)	Yes (80)
Kearney	3 mi S Kearney	28 September 1966	Famey 1975 (UNK 463)	No (120)
Kearney	2 mi S, 1 mi E Minden	3 November 1968	Famey 1975 (UNK 352)	No (80)
Red Willow	2 mi E of jct. of Hwy. 83 and 89	9 August 2001	unpublished (UNSM 28143)	Yes (80)
Richardson	3.5 mi S, 1 mi W Dawson	16 November 1958	Jones 1960 (KU 79157–79168)	Yes (80)
Webster	1.3 mi S Inavale	19, 21 August 1969	unpublished (UNSM 13191–13192)	Yes (40)
Webster ^d	1 mi S Red Cloud	21 September 1975	Famey 1975 (UNK 2887)	Yes (20)
Webster ^d	1 mi S, 3.2 mi W Red Cloud	22 September 1975	Famey 1975 (UNK 2178)	Yes (10)

^aFamey (1975) reported a capture from Adams County without a specific location. We searched the natural history collection and museum catalog at UNK and found no evidence of such a record.

^bGenoways and Schlitter (1967) reported the single specimen deposited in Hastings Museum. We contacted both Hastings Museum and Hastings College regarding the specimen, but neither could locate the specimen.

^cFamey (1975) reported only 4 specimens from Franklin County, but we observed 5 specimens at UNK, all from the same locality and date.

^dFamey (1975) reported 3 specimens from Webster County, but we observed only 2 specimens at UNK in the collection and museum catalog.

North American deer mice (*Peromyscus maniculatus*), 102 prairie voles (*Microtus ochrogaster*), 98 western harvest mice (*Reithrodontomys megalotis*), 55 white-footed mice (*Peromyscus leucopus*), 45 hispid pocket mice (*Chaetodipus hispidus*), 24 Elliot's short-tailed shrews (*Blarina hylophaga*), 18 house mice (*Mus musculus*), 17 Ord's kangaroo rats (*Dipodomys ordii*), 8 northern grasshopper mice (*Onychomys leucogaster*), 8 eastern woodrats (*Neotoma floridana*), 3 southern bog lemmings (*Synaptomys cooperi*), 1 eastern cottontail (*Sylvilagus floridanus*), 1 North American least shrew (*Cryptotis parva*), 1 meadow vole (*Microtus pennsylvanicus*), 1 meadow jumping mouse (*Zapus hudsonius*), and 1 thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*). The hispid cotton rat was the second most abundant species of mammal captured in our study.

Before 2004, *S. hispidus* was known from 12 sites in Nebraska: 1 site each in Adams, Franklin, Red Willow, and Richardson counties; 2 sites in Kearney County; and 3 sites each in Harlan and Webster counties (Table 1, Fig. 1). We trapped at all 12 historical sites and captured *S. hispidus* at 75% (9 of 12) of sites (Table 1, Fig. 1). At sites without captures in Adams and Kearney counties, we did not observe any evidence of *S. hispidus*.

We also documented *S. hispidus* at 13 new sites in southwestern and south-central Nebraska (Fig. 1). Most sites trapped were roadside ditches, but some were along railroad right-of-ways, reestablished prairies, and disturbed vegetated areas. Plants at sites varied, but those with *S. hispidus* generally consisted of areas completely covered with vegetation, spanning a continuum from mainly grasses to mainly annual forbs. Some dominant plants at capture sites included Indiangrass (*Sorghastrum nutans*), brome, redroot pigweed (*Amaranthus retroflexus*), and lambsquarters (*Chenopodium album*). Our northernmost record was obtained in northern Hayes County, where a male was captured by a domestic cat (*Felis catus*) on 31 January 2007. Nearby vegetation at that site included brome (*Bromus*), redroot pigweed, foxtail (*Setaria*), lambsquarters, and switchgrass. The surrounding area consisted primarily of farmed plateaus (corn and wheat) interspersed with canyons covered by various grasses and shrubs. Vegetated roadside ditches also surrounded agricultural fields. Our westernmost capture of *S. hispidus* was on 19 June 2007 in southeastern

Chase County in an area dominated by switchgrass, brome, thistles, and other forbs.

Captures of *S. hispidus* at historical and new sites indicate that this species is firmly established in southern Nebraska (Fig. 1). The capture in Hayes County is the northernmost record in North America (Farney 1975, Hall 1981), and our captures in Chase County are the farthest west in the state (Farney 1975). Trapping efforts by Farney (1975), with over 1400 traps set in Red Willow County alone, produced not a single *S. hispidus* west of Harlan County. Thus the distribution of *S. hispidus* has expanded in the state since 1975. In south-central Nebraska, we captured another individual farther east than previous records in this region (Nuckolls County), indicating cotton rats likely occur farther east in south-central Nebraska and may be present along the entire southern border. Cotton rats still occur in extreme southeastern Nebraska and may be more widespread in the area; we only trapped near the original site of capture in Richardson County (Jones 1960).

Lack of captures in Adams, Phelps, and Kearney counties suggests that the species is either limited in abundance or is now absent from the general area. Although we only set limited numbers of traps in those 3 counties, other researchers have trapped intensively in roadside ditches and grassy habitats in those counties without capturing *S. hispidus* (K. Rickert personal communication, Silvia 1995). From 2006 to 2008, K. Rickert trapped roadside ditches in 5 counties in south-central Nebraska without a single capture of *S. hispidus* (Adams County, 1660 trap nights; Buffalo, 2440; Hall, 861; Kearney, 2529; and Phelps, 276). It is not known why *S. hispidus* is absent or rare in Kearney and Adams counties, where it previously occurred, or why it has colonized areas farther westward but not northward in central Nebraska since its last reported distribution (Farney 1975). Different temperature regimes might warrant further investigation and may be a possible limiting factor; mean annual temperatures were correlated with the distribution of *S. hispidus* in New Mexico (Mohllhenrich 1961). We have yet to observe any striking difference in habitats or mammalian fauna between Adam, Kearney, and Phelps counties compared to those 50–60 km to the south in Franklin, Harlan, and Webster counties, where cotton rats are presently common.

Reproduction

Based on our captures and specimens collected previously in Nebraska, the earliest record in the year of a pregnant individual was 2 April 2006 and the latest was 1 October 2006. Mean number of embryos/fetuses was 7.3 across all months (range 4–11, SD = 2.0, $n = 19$) but peaked in August ($\bar{x} = 9.4$, $n = 5$) and September ($\bar{x} = 10$, $n = 1$). Mean numbers for other months were 5.6 in April ($n = 3$), 6.6 in June ($n = 3$), 6.8 in July ($n = 4$), and 6 in October ($n = 3$). Adult nonreproductive females were captured in November, December, and January. Earliest and latest dates in the year for lactation were 29 April 2007 and 1 October 2006, respectively. Based on body weight, onset of reproduction for females in Nebraska was 62.5 g, with the next 3 heaviest individuals weighing 74, 75, and 75 g.

Seasonal patterns of testicular lengths in Nebraska corresponded with timing of pregnancy in the state. Large ratios of testicular length to body weight were consistently observed for males with body weights ≥ 75 g from April to September (March, 0.15; April, 0.16; June, 0.18; July, 0.18; August, 0.16; and September, 0.13) compared to lower ratios in November (0.09) and December (0.06). Based on individuals with body weights of ≥ 75 g, the longest average testicular lengths were reported in July ($\bar{x} = 21.2$ mm, $n = 5$) and August ($\bar{x} = 21.5$ mm, $n = 4$). Mean length of testes for other months was 17 mm in March ($n = 4$), 18 mm in April ($n = 3$), 19 mm in June ($n = 1$), 16 mm in September ($n = 2$), 8 mm in November ($n = 3$), and 7 mm in December ($n = 3$). Juvenile males with body weights of 33, 30, 24, and 25.5 g had testes that measured 7, 5.5, 8, and 7 mm in length, respectively (April, July, July, and August, respectively). On 14 September, we captured a 63-g male with testes that measured 6 mm in length, but a prior specimen (UNK 2173, body weight of 43.5 g, October) reportedly had testes that measured 16 mm in length; we suspect the UNK specimen was reported or measured in error.

Limited information has been reported on the reproductive biology of *S. hispidus* in Nebraska, in part, because relatively few specimens were known from the state (35 prior to 2004, Table 1). Reproductively active individuals have now been recorded from April to early October. Our study indicates that reproductive activity is limited from November to February. Based

on increased reproductive activity of males in March and large fetuses observed in a female on 2 April 2006, we predict pregnant females will be documented in March with additional trapping later in the year. Our data confirm findings of other studies that show the absence of pregnant females during a 5-month period in northern latitudes during colder months (Bancroft 1969). Litters in Kansas are typically observed April–October, with earlier litters being significantly smaller than those observed later in the year (Bancroft 1969). The period of reproductive activity of *S. hispidus* is shorter in Nebraska than in southern United States, where breeding occurs year-round with distinct mid-summer and winter lulls (Bergstrom and Rose 2004).

Visual Sign of Cotton Rats

We observed visual evidence of hispid cotton rats while setting traps before confirming their occurrence at sites. The 3 most diagnostic signs of cotton rat presence included runways, cuttings of vegetation, and fecal pellets. Runways of *S. hispidus* generally measured 4–6 cm in width and were observed in moderately dense grasses. In areas without dense grasses, runways were not obvious, and individuals were captured below dense canopies of tall forbs, such as redroot pigweed and lambsquarters. Cuttings were mainly of grasses 4–10 cm in length and were placed in small piles along or adjacent to runways. Fecal pellets were oblong and averaged 10 mm × 3 mm ($n = 4$).

Visual signs of cotton rats closely resemble those of voles (*Microtus*); but upon closer inspection, *S. hispidus* has wider runways (4–6 cm) and longer clippings (4–10 cm). Runs of *Microtus ochrogaster* generally measured 3–4 cm in width, contained clippings 3–4 cm in length, and generally occurred in denser vegetation than those of cotton rats. Jones et al. (1983) also stated that runs of *S. hispidus* are broader than those constructed by *Microtus*. Clippings made by cotton rats are longer than those made by most other rodents in Nebraska, but we did observe overlap in length of clippings at sites with hispid pocket mice (*Chaetodipus hispidus*). In our study area, the only fecal droppings that might be confused with *S. hispidus*, based on size and shape, belonged to eastern woodrats (*Neotoma floridana*). We captured a few *N. floridana* in the study, but woodrats were generally associated with wooded habitats. We

captured both species in a shelterbelt composed of eastern redcedar (*Juniperus virginiana*) and in a patch of stinging nettles (*Urtica dioica*) in a forested area (Harlan County).

Seasonal activity

We captured *S. hispidus* in every month except February and May; we set only 80 traps for *S. hispidus* in February at one locality and did not trap in May. We trapped periodically in a restored upland prairie dominated by Indian-grass and brome and in roadside ditches in southern Harlan County from January to April 2007. In early January 2007, a severe ice storm affected much of south-central Nebraska. After the storm, we detected individuals in both habitats; but in roadside ditches, individuals were captured only along upper banks and not in low-lying areas where solid masses of ice persisted for at least a month in the bottoms of ditches. Dates of captures after the storm that winter and early spring included 28 January (Localities 8a, 8c, 9, and 11 in the Appendix and Fig. 1), 1 March (Locality 11), 31 March (Locality 11), and 1 April (Locality 10).

In Nebraska, records of *S. hispidus* were previously available only August–November, suggesting that populations did not occur year-round because individuals did not survive at these northern latitudes during winter. Based on our study, the hispid cotton rat is active year-round in the state. Our captures in winter and early spring show that at least some individuals survive throughout the year. We did not mark individuals in our study, but other researchers report that hispid cotton rats experience weight loss and mortality during winter in Kansas and Tennessee during periods of precipitation and extreme cold (Dunaway and Kaye 1961, Sauer 1983). Behaviors such as nest alteration, occupation of deep underground holes below the frost line, and huddling have been observed for *S. hispidus* at other northerly latitudes; these behaviors likely enable cotton rats to exist in more northerly regions (Dunaway and Kaye 1961, Baar et al. 1975, Cameron and Spencer 1981, Sauer 1983). We suspect cotton rats in Nebraska also use such behaviors during winter to survive at this northern latitude.

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LITERATURE CITED

- BAAR, S.L., E.D. FLEHARTY, AND M.F. ARTMAN. 1975. Utilization of deep burrows and nests by cotton rats in west-central Kansas. *Southwestern Naturalist* 19:440–444.
- BAILEY, V. 1902. Synopsis of the North American species of *Sigmodon*. *Proceedings of the Biological Society of Washington* 15:101–116.
- BANCROFT, W.L. 1969. Notes on reproduction of three rodents of Douglas County, Kansas. *Transactions of the Kansas Academy of Science* 72:67–69.
- BENEDICT, R.A., H.H. GENOWAYS, AND P.W. FREEMAN. 2000. Shifting distribution patterns of mammals in Nebraska. *Transactions of the Nebraska Academy of Science* 26:55–84.
- BERGSTROM, B.J., AND R.K. ROSE. 2004. Comparative life histories of Georgia and Virginia cotton rats. *Journal of Mammalogy* 88:1077–1086.
- CAMERON, G.N. 1999. Hispid cotton rat/*Sigmodon hispidus*. Pages 593–595 in D.E. Wilson and S. Ruff, editors, *The Smithsonian book of North American mammals*. Smithsonian Institution Press, Washington, DC.
- CAMERON, G.N., AND S.R. SPENCER. 1981. *Sigmodon hispidus*. *Mammalian Species* 158:1–9.
- CHOATE, J.R., AND H.H. GENOWAYS. 1967. Notes on some mammals from Nebraska. *Transactions of the Kansas Academy of Science* 69:238–241.
- COCKRUM, E.L. 1948. The distribution of the hispid cotton rat in Kansas. *Transactions of the Kansas Academy of Science* 51:306–312.
- DUNAWAY, P.B., AND S.V. KAYE. 1961. Cotton rat mortality during severe winter. *Journal of Mammalogy* 42:265–268.
- FARNEY, J.P. 1975. Natural history and northward dispersal of the hispid cotton rat in Nebraska. *Platte Valley Review* 3:11–16.
- GENOWAYS, H.H., AND D.A. SCHLITTER. 1967. Northward dispersal of the hispid cotton rat in Nebraska and Missouri. *Transactions of the Kansas Academy of Science* 69:356–357.
- HALL, E.R. 1981. *The mammals of North America*. 2nd edition. John Wiley & Sons, New York, NY. Volume 2:601–1181 + 90.
- JONES, J.K., JR. 1960. The hispid cotton rat in Nebraska. *Journal of Mammalogy* 41:132.
- JONES, J.K., JR., D.M. ARMSTRONG, R.S. HOFFMANN, AND C. JONES. 1983. *Mammals of the northern Great Plains*. University of Nebraska Press, Lincoln, NE.
- MOHLHENRICH, J.S. 1961. Distribution and ecology of the hispid and least cotton rats in New Mexico. *Journal of Mammalogy* 42:13–24.
- ROEHRS, Z.P., AND H.H. GENOWAYS. 2004. Historical biogeography of the woodchuck (*Marmota monax bunkeri*) in Nebraska and northern Kansas. *Western North American Naturalist* 64:396–402.
- SAUER, J.R. 1983. Mortality associated with severe weather in a northern population of cotton rats. *American Midland Naturalist* 113:188–189.
- SERBOUSEK, M.R., AND K. GELUSO. 2009. Bats along the Republican River and its tributaries in southwestern Nebraska: distribution, abundance, and reproduction. *Western North American Naturalist* 69:180–185.
- SILVIA, T.D. 1995. Riparian habitats of the central Platte as a corridor for dispersal of small mammals in Nebraska. Master's thesis, University of Nebraska, Lincoln, NE. 69 pp.

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APPENDIX. Localities of capture for the hispid cotton rat (*Sigmodon hispidus*) in Nebraska, 2004–2008. Localities, number of trap nights, number of *S. hispidus* captured, and specimen numbers (if kept) are given below. Latitude and longitude were obtained with handheld global positioning systems using North American Datum 1983, except where otherwise noted. Voucher specimens were deposited in collections at the University of Nebraska State Museum (UNSM) in the Division of Zoology. Numbers in parentheses before each locality refer to those in Figure 1; some locality numbers refer to multiple sites in close proximity to each other, and these sites are represented by a letter following the locality number, such as 4a, 4b, and 4c.

Chase Co.: (1) Enders Reservoir SWMA, Below Dam, Frenchman Creek, 40°25.251'N, 101°30.772'W (40 trap nights; 2 individuals; UNSM 29354, 29355). **Dundy Co.:** (2) 0.1 mi SE MAX, Ave 345 and U.S. Hwy. 34, 40°06.799'N, 101°23.974'W (30 trap nights; 5 individuals; UNSM 29340, 29341). **Franklin Co.:** (3) N shoulder County Road D at Hwy. 10, 40°02.760'N, 098°56.022'W (40 trap nights; 3 individuals; UNSM 28920, 29236, 29237); (4a) 0.6 km W Riverton, 40°05.353'N, 098°45.971'W (45 trap nights; 2 individuals; UNSM 29524, 29525); (4b) 3.4 km S, 1.1 km W Riverton, 40°03.549'N, 098°46.307'W (35 trap nights; 1 individual; UNSM 29527); (4c) 2.5 km S, 1.0 km W Riverton, 40°04.023'N, 098°46.280'W (20 trap nights; 11 individuals; UNSM 29528–29531); and (4d) 2 mi S Riverton, Road 41.5 (20 trap nights; no *Sigmodon*). **Furnas Co.:** (5a) Hwy. 283, ca. 0.9 mi S of Sappa Creek, 40°01.865'N, 099°53.470'W (50 trap nights; 8 individuals; UNSM 28924, 29356); (5b) Hwy. 283, ca. 0.3 mi S Sappa Creek, 40°02.472'N, 099°53.455'W (80 trap nights; 13 individuals; UNSM 28933, 29349, 29350); and (6) Hwy. 283, 0.35 mi S of Hwy. 89 (40 trap nights; 1 individual; UNSM 29243). **Harlan Co.:** (7a) County Road V, 6.8 mi S, 0.1 mi E of Republican City (40 trap nights; 21 individuals; UNSM 28916, 28917, 29235, 29247); (7b) County Road V, 6.5 mi S, 0.1 mi E of Republican City (30 trap nights; 1 individual); (8a) Harlan County Reservoir near Prairie Dog Creek, 40°02.191'N, 099°

21.867'W (1120 trap nights; 56 individuals; UNSM 29367, 29425, 29427–29430, 29507, 29508, 29512–29522); (8b) Harlan County Reservoir, Prairie Dog Creek, near Hwy. 183, 40°00.797'N, 099°21.874'W (NAD27) (20 trap nights; 2 individuals; UNSM 29509); (8c) 0.7 mi W of Hwy. 183 on Corp Road 11, 40°01.230'N, 099°21.372'W (120 trap nights; 3 individuals; UNSM 29345); (9) 1.5 mi S, 1 mi W Alma, 40°04.906'N, 099°23.603'W (10 trap nights; 3 individuals; UNSM 29346; this site represents the same locality as 1 mi W Alma Vista, Table 1); (10) 1.4 mi S Hwy. 189 on U.S. Hwy. 183, 40°01.943'N, 099°22.037'W (40 trap nights; 3 individuals; UNSM 29342, 29343); (11) 1 mi N Alma, Hwy. 183 and Road 710, 40°06.503'N, 099°22.592'W (120 trap nights; 6 individuals; UNSM 29054–29057); and (12) 1.25 mi S, 1.5 mi E Orleans, 40°06.880'N, 099°25.439'W (80 trap nights; 8 individuals; UNSM 29510, 29511). **Hayes Co.:** (13) 0.1 mi S of County Line Road, Hayes Center Road, 40°41.977'N, 100°47.879'W (230 trap nights; 1 individual captured by a domestic cat; UNSM 29358). **Hitchcock Co.:** (14) Culbertson, 40°13.328'N, 100°50.373'W (40 trap nights; 7 individuals; UNSM 29335–29338) and (15) 2 mi S, 1.5 mi W Culbertson, 40°11.661'N, 100°51.960'W (25 trap nights; 7 individuals; UNSM 29339). **Nuckolls Co.:** (16) 4 mi N, 7 mi W Superior, Hwy. 136 (20 trap nights; 1 individual; UNSM 29059). **Red Willow Co.:** (17) E shoulder of County Road 407, 0.3 mi N Hwy. 6/34 and Road DR720, 0.1 mi E Road 407, 40°16.552'N, 100°12.756'W (110 trap nights; 5 individuals; UNSM 29318, 28936, 29357) and (18) Hwy. 89, 2 mi E Hwy. 83, 40°00.996'N, 100°32.026'W (80 trap nights; 3 individuals; UNSM 29347, 29348). **Richardson Co.:** (19) 3.2 mi S Dawson, Hwy. 75, 40°05.050'N, 095°49.368'W (80 trap nights; 9 individuals; UNSM 29060–29062). **Webster Co.:** (20) 1.3 mi S Inavale, Road 500 (40 trap nights; 1 individual; UNSM 29058); (21) 1.4 km S, 4.5 km W Red Cloud, 40°04.563'N, 098°34.367'W (10 trap nights; 4 individuals; UNSM 29526); and (22) 1.75 km S, 2.5 km W Red Cloud, 40°04.381'N, 098°32.936'W (20 trap nights; 1 individual; UNSM 29523).