

RABIES in Nebraska

NEBRASKA

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DEPT. OF HEALTH AND HUMAN SERVICES



Background Information

With few exceptions, rabies occurs worldwide. The World Health Organization estimates that up to 55,000 human deaths occur annually, mostly in rural areas of Africa and Asia. In the United States, the number of human deaths attributed to rabies has declined from 100 or more each year in the early 1900's to a current average of only three or fewer cases per year. Two programs have contributed to this substantial reduction. Animal control and vaccination programs started during the 1940's and more recent oral rabies vaccination programs have eliminated domestic dogs as reservoirs of rabies in the United States. Also, effective human rabies vaccines and immunoglobulins have been developed; modern day post-exposure prophylaxis (PEP) has proven nearly 100% successful. From January 2003 to June 2013, 31 cases of human rabies were recorded in the United States. On the basis of historic records at the Nebraska Department of Health and Human Services (NDHHS), the last reported human case of rabies in Nebraska likely occurred in the 1920s.

Rabid bats are increasingly implicated as an important wildlife reservoir of rabies in Nebraska; transmission can occur from minor, underappreciated or unrecognized bites. Wild terrestrial carnivores are also an important rabies reservoir among which skunks are most often found to be infected with the virus in Nebraska. In contrast to eastern US states, raccoons in Nebraska are rarely infected with rabies. Given ongoing presence of this disease in reservoir species, rabies remains a potentially serious threat to public health in Nebraska.

Summary 2015



During 2015, a total of 1,068 animals were tested for rabies in Nebraska (**Table 1**); 28 were positive including 16 bats (57.1%), 8 skunks (28.6%), 2 cattle (7.1%), 1 dog (3.6%), and 1 cat (3.6%). These animals originated from 14 of Nebraska's 93 counties; **Figure 1** depicts the geographic distribution of 2015 cases by species. Among all positive cases in 2015, 35.7% (10/28) were associated with human contact necessitating PEP. A report listing the current year-to-date positive cases and a menu of links to data from previous years are available on the NDHHS website at the following URL: http://dhhs.ne.gov/Pages/srd_rabies.aspx.

TABLE 1: Number of animals tested for rabies and number positive by species, 2015.

Species	Total tested n (%)	Positive n (% of species total)
Bat	609 (57.0)	16 (2.6)
Skunk	16 (1.5)	8 (50.0)
Cattle	36 (3.4)	2 (5.6)
Cat	188 (17.6)	1 (0.5)
Dog	115 (10.8)	1 (0.9)
Horse	6 (0.6)	0 (0.0)
Raccoon	55 (5.1)	0 (0.0)
Other*	43 (4.0)	0 (0.0)
Total	1,068	28 (2.6)

*Other includes badger (1), caprine (4), cervid (1), coati mundi (1), coyote (1), donkey (2), ferret (1), fox (1), llama (1), mink (2), mountain lion (1), opossum (9), ovine (1), rodent (4), squirrel (11), woodchuck (1), and one unknown.

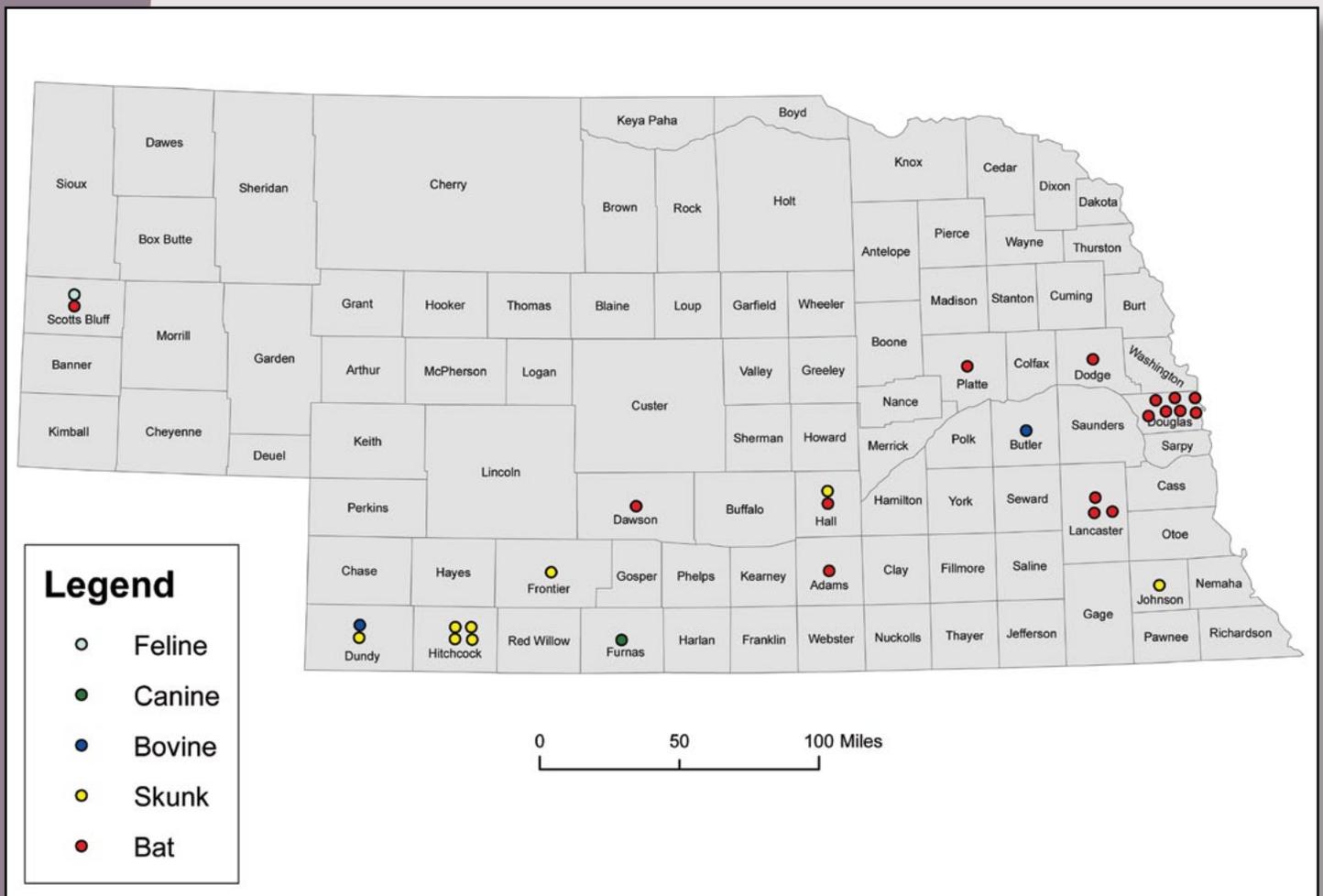


The Nebraska Department of Health and Human Services issues a Rabies Approval (RA) number for testing of animals involved in potential human rabies exposures if criteria as specified by the state's Rabies Control Program are met. Examples include persons who were bitten, had saliva contact in open wounds or mucus membranes, or were in the same room with a bat and cannot be certain that they were not bitten (e.g., sleeping person, unattended child, or mentally disabled or intoxicated person).^{1,2} Fees for tests which qualify for an RA number are paid by the Program. This targeted testing provides rapid evaluation of risk after human exposure to potentially rabid animals.

On the basis of timely results, medical professionals and public health officials are then able to make well-informed decisions and provide recommendations for the exposed person(s) regarding need for post-exposure prophylaxis which is extremely effective at preventing human rabies when administered appropriately. When test results are negative, such findings allow exposed persons to avoid expensive and time-intensive PEP. During 2015, the Nebraska Rabies Control Program issued RA numbers for 477 tests which were associated with documented human exposure events. Of these, nine (1.9%) and seven (1.5%) were positive and unsuitable, respectively; PEP was required among exposed persons in all but one instance. The remaining 96.6% (461/477) of 2015 exposure events were associated with negative tests. Among these, PEP was avoided in a total of 669 exposed persons (median number of persons/event, 1; range [1-7]).

Figure 1:

Number of animals testing positive for rabies by species and county (N = 28), Nebraska, 2015



Ten-year Report

2006–2015

During 2006–2015, 10,438 animals from Nebraska were tested for rabies of which 429 (4.1%) were positive (**Table 2**). Over this 10 year period, bats were the most commonly submitted animal. Of 5,904 bats submitted for testing, 109 (1.8%) tested positive. The majority of bats testing positive were from counties with larger urban population (**Figure 2**). Skunks represented the species with the largest number of positive tests. Of 296 tested, 215 were positive (72.6%). Compared to bats, the locations of skunks and other animals that tested positive were more widely distributed throughout the state (**Figures 3 and 4**). Please refer to **Table 5** for total numbers of rabies testing and positive results, by species, for each year, from 2006 through 2015.

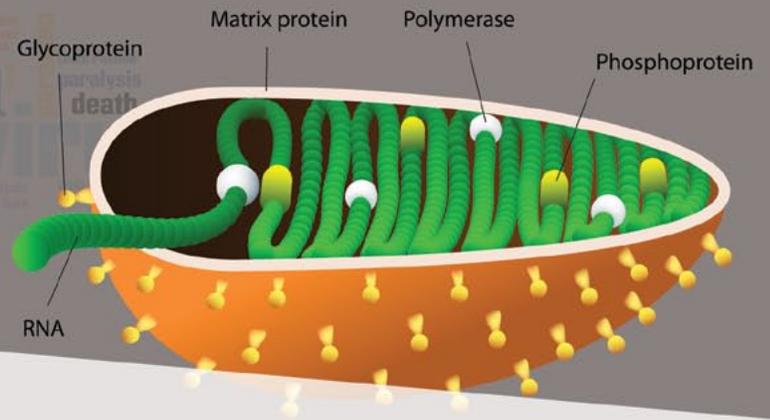
TABLE 2: Number of animals tested for rabies and number of positive by species, 2006–2015.

Species	Total tests		Positive		
	N	median/year (range)	n	(%)	median/year (range)
Skunk	296	26 (13–63)	215	(72.6)	16 (7–53)
Bat	5,904	625.5 (460–715)	109	(1.8)	11.5 (3–16)
Cat	1,884	186.5 (157–218)	33	(1.8)	2.5 (0–9)
Dog	1,157	113 (101–142)	6	(0.5)	1 (0–1)
Cow	391	39 (27–62)	42	(10.7)	4 (1–8)
Raccoon	340	32 (22–55)	2	(0.6)	0 (0–1)
Horse	115	11 (5–21)	16	(13.9)	1 (0–4)
Other	351*	39 (22–45)	6**	(1.7)	0.5 (0–2)
Total	10,438	1,051 (895–1,165)	429	(4.1)	35 (21–90)

*Other species tested includes African wild dog (1), alpaca (2), badger (10), beaver (4), bobcat (2), coati mundi (1), coyote (22), deer (6), donkey (4), elk (1), ferret (8), fox (16), gerbil (1), goat (19), ground squirrel (4), groundhog (1), harbor seal (1), llama (5), mink (7), mole (2), mountain lion (1), mule (1), muskrat (9), opossum (49), prairie dog (5), rabbit (9), reindeer (1), rodent (32), sheep (15), shrew (3), squirrel (86), swine (4), vole (4), weasel (2), woodchuck (9) and 4 non-recorded species.

**Other species testing positive include fox (3), ferret (1), llama (1), and sheep (1).

RABIES VIRUS



During 2006–2015, NDHHS issued a total of 4,402 Rabies Approval numbers (median/year, 445.5; range 371–477) (**Table 3**). Of these, 109 (2.5%) were positive (median/year, 11; range 7–16 [1.6–4.1%]), 74 (1.7%) were unsuitable (median/year, 7.5; range 4–10 [0.9–2.3%]), and 4,219 (95.8%) were negative (median/year, 428; range 354–461 [95.4%–96.6%]). Among the exposure events with a corresponding negative test, all potentially exposed individuals were thus found not at risk for rabies. Therefore, each of the exposed persons could confidently avoid costly post-exposure prophylaxis as a direct result of State-funded rapid testing, corresponding timely reporting of the negative results, and evidence based public health recommendations.

TABLE 3: Count of Rabies Approval (RA) numbers and corresponding results by year, 2006–2015.

		Positive	Negative	Unsuitable
Year	N	n (%)	n (%)	n (%)
2006	455	11 (2.4)	440 (96.7)	4 (0.9)
2007	450	7 (1.6)	436 (96.9)	7 (1.6)
2008	436	12 (2.8)	414 (95.0)	10 (2.3)
2009	394	16 (4.1)	370 (93.9)	8 (2.0)
2010	371	12 (3.2)	354 (95.4)	5 (1.3)
2011	441	11 (2.5)	420 (95.2)	10 (2.3)
2012	474	13 (2.7)	455 (96.0)	6 (1.3)
2013	438	10 (2.3)	420 (95.9)	8 (1.8)
2014	466	8 (1.7)	449 (96.4)	9 (1.9)
2015	477	9 (1.9)	461 (96.6)	7 (1.5)
TOTAL	4,402	109 (2.5)	4,219 (95.8)	74 (1.7)

Human Exposure and Treatment

2012–2015

Beginning in 2012, NDHHS began collecting detailed records in advance of animal rabies testing to document all potential human exposures when an RA number was issued. Regardless of test result, local health department staff are then asked to document the post-exposure treatment recommendations which are provided to the exposed person(s) in each event. During 2012–2015, an annual average of 463.5 RA numbers were assigned (**Table 3**). Of 141 total animals with positive results in this time period, 48 (34.0%) were associated with human exposure thus necessitating PEP. Of these, 34 had been reported in advance to the Nebraska Rabies Control Program and were assigned RA numbers (**Table 4**). Overall, post-exposure prophylaxis was recommended to 103 persons on the basis of positive tests; median number of exposed persons requiring PEP per positive test was 2 (range, 1–9). Also during 2012–2015, PEP recommendations were documented among an additional 41 persons exposed to 28 animals whose specimens were unsuitable for testing and thus exposure could not be ruled out.

TABLE 4: Human exposure to animals testing positive with and without Rabies Approval (RA) numbers by year, 2012–2015.

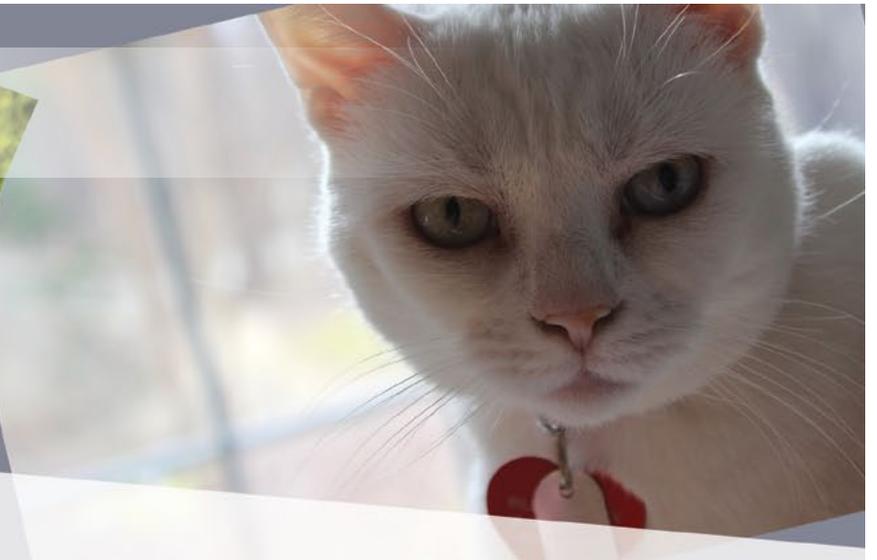
Year	Events with PEP recommended			No. of persons		
	No RA n	RA n	Total N	No RA n	RA n	Total N (median per event, range)
2012	3	10	13	5	14	19 (1, 1–4)
2013	6	10	16	14	25	39 (2, 1–6)
2014	3	6	9	11	13	24 (2, 1–9)
2015	2	8	10	4	17	21 (1.5, 1–5)
TOTAL	14	34	48	34	69	103

Wildlife



Skunks and bats remain the two primary wildlife reservoirs for the rabies virus in Nebraska. During 2015, eight of 16 skunks tested (50%) were positive for rabies. During 2006–2015, the median number of skunks testing positive was 16 per year (range, 7–53). Due to the high prevalence of the virus among the skunk population in Nebraska, all skunks should be considered a potential source of the virus. Any bite by a skunk or other wild carnivore or exposure to saliva from such animals should be considered a possible rabies exposure and reported to the regional local health department. All wounds should be thoroughly cleaned with soap and water immediately. Exposed persons should also contact their physician for appropriate medical care. In such instances of exposure, the local health department can provide consultation regarding risk and, if indicated, the Nebraska Rabies Control Program should be contacted for an RA number to facilitate rabies testing if the exposing wild animal can be captured safely.

Transmission of rabies from bats can occur from seemingly minor or unrecognized bites. Bites, scratches, or mucus membrane exposures from bats should be considered potential rabies exposures. Any instance where a person is in the same room as a bat and cannot declare with certainty that they were not bitten should also be considered a potential exposure. Such instances include persons sleeping in a room with a bat in it or an adult witnessing a bat in the room with a child who was unattended, a mentally disabled person, or an intoxicated person.^{1,2} During 2015, 16 of 609 bats tested (2.6%) were positive for rabies (**Table 1**). During 2006–2015, the median number of bats testing positive



per year was 11.5 (range, 3-16). Given their hibernation behavior, bats often enter homes in late summer and early fall. A correspondingly higher level of testing is generally observed during these time periods as are relatively higher numbers of rabid bats. Because capture of bats from homes drives testing, bats with positive test results were more frequently encountered in counties with urban populations (**Figure 2**).



Domestic Animals



Four domestic animals tested positive for rabies in 2015 (bovine, 2; canine, 1; feline, 1). Each were of a species in which a licensed vaccine is currently available. The two bovines were reported as not vaccinated and both the dog and cat had unknown vaccination histories. Further, three were associated with documented human exposure including two in which humans were reportedly bitten by the animals. As a result of exposure to these three animals, potentially avoidable PEP was required among nine exposed persons.

In each of these events involving domestic animals, appropriate vaccination would likely have prevented rabies, thus reducing or eliminating the associated human risk and corresponding necessity for PEP. Vaccination of domestic animals continues to be a critical, safe, and cost-effective component of rabies control to safeguard both animal and public health from this fatal virus.³ All persons keeping domestic animals should consult their veterinarian to establish

and maintain an appropriate vaccination schedule to prevent rabies.

REFERENCES:

1. Nebraska Department of Health and Human Services. *Nebraska Rabies Investigation Guideline*. Available at: http://dhhs.ne.gov/publichealth/Documents/Nebr_Rabies_Inv_Guide.pdf. Accessed August 25, 2016.
2. Manning SE, Rupprecht CE, Fishbein D, et al. *Human rabies prevention—United States, 2008: Recommendations of the Advisory Committee on Immunization Practices*. *MMWR Recomm Rep* 2008; 57 (RR-3): 1-28.
3. National Association of State Public Health Veterinarians. *Compendium of Animal Rabies Prevention and Control, 2016*. *JAVMA* 2016; 248 (5): 505-517.

Table 5:

Number of animals tested for rabies and number positive by species and year, 2006–2015

Species	2006		2007		2008		2009		2010	
	N	Positive n (%)	N	Positive n (%)	N	Positive n (%)	N	Positive n (%)	N	Positive n (%)
Skunk	22	15 (68.2)	20	13* (65.0)	35	25* (71.4)	63	53* (84.1)	36	28* (77.8)
Bat	489	3 (0.6)	460	14 (3.0)	527	10 (1.9)	478	14 (2.9)	658	13* (2.0)
Cat	218	5 (2.3)	203	1 (0.5)	193	1 (0.5)	185	9 (4.9)	216	6 (2.8)
Dog	112	0 (0.0)	124	1 (0.8)	126	0 (0.0)	142	1 (0.7)	105	1 (1.0)
Cow	44	8* (18.2)	27	1 (3.7)	29	4 (13.8)	33	7* (18.8)	38	4 (10.5)
Horse	18	3 (16.7)	12	1 (8.3)	17	2 (11.8)	21	4 (19.0)	12	1 (8.3)
Other	61	1*** (1.6)	49	0 (0.0)	64	1*** (1.6)	79	2*** (2.5)	63	1*** (1.6)
Total	964	35 (3.6)	895	31 (3.5)	991	43 (4.3)	1,001	90 (9.0)	1,128	54 (4.8)

Species	2011		2012		2013		2014		2015	
	N	Positive n (%)								
Skunk	30	17* (56.7)	44	35* (79.5)	17	14* (82.4)	13	7* (53.8)	16	8** (50.0)
Bat	660	10* (1.5)	715	13 (1.8)	666	6 (0.9)	642	10 (1.6)	609	16 (2.6)
Cat	185	2 (1.1)	171	5* (2.4)	157	3 (1.9)	168	0 (0.0)	188	1 (0.5)
Dog	109	0 (0.0)	114	1 (0.9)	101	1 (1.0)	109	0 (0.0)	115	1 (0.9)
Cow	42	2 (4.8)	40	3* (2.6)	40	7* (17.5)	62	4 (6.5)	36	2 (5.6)
Horse	10	4 (40.0)	8	0 (0.0)	5	1 (20.0)	6	0 (0.0)	6	0 (0.0)
Other	88	0 (0.0)	73	2*** (2.7)	59	1*** (1.7)	57	0 (0.0)	98	0 (0.0)
Total	1,124	35 (3.1)	1,165	59 (5.1)	1,045	33 (3.2)	1,057	21 (2.0)	1,068	28 (2.6)

*Rabies tests performed at laboratories other than Kansas State University Rabies Laboratory (KSU RL) were only reported if positive as follows: 2006, 1 cow; 2007, 1 skunk; 2008, 9 skunks; 2009, 1 cow, 11 skunks; 2010, 1 bat, 1 skunk; 2011, 1 bat, 1 skunk; 2012, 5 skunks, 1 cat, 1 cow; 2013, 2 cows, 4 skunks; 2014, 2 skunks.

**During 2015, in addition to KSU RL, University of Nebraska-Lincoln Veterinary Diagnostic Center began reporting both positive and negative rabies results for all animals tested including 2 skunks that tested positive.

***Other species testing positive: 3 foxes (2008, 2009, 2012); 2 raccoons (2006, 2012); 1 ferret (2009); 1 llama (2013); 1 sheep (2010).

Figure 2:

Number of bats testing positive for rabies by county (N = 109),
Nebraska, 2006–2015

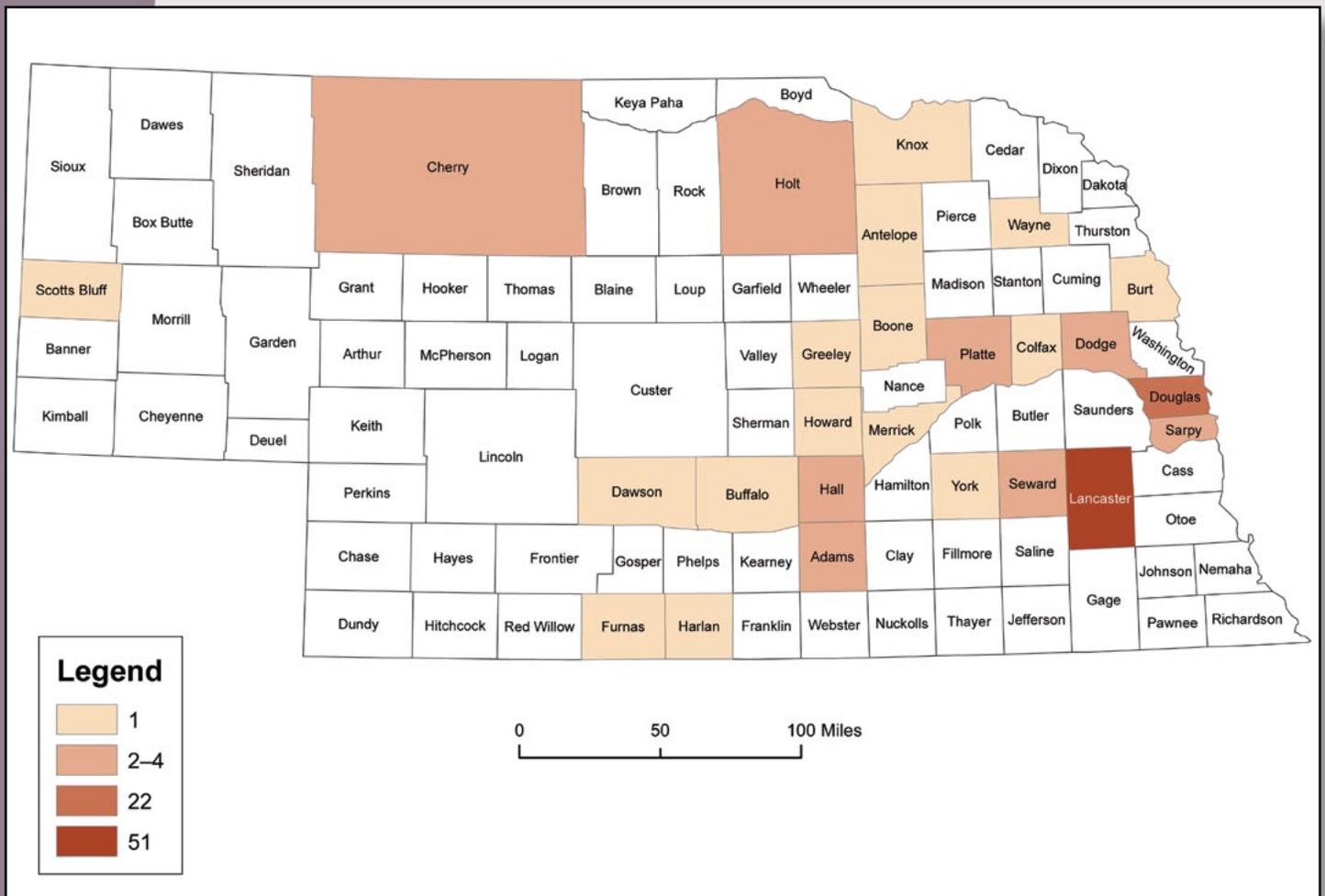


Figure 3:

Number of skunks testing positive for rabies by county (N = 215),
Nebraska, 2006–2015

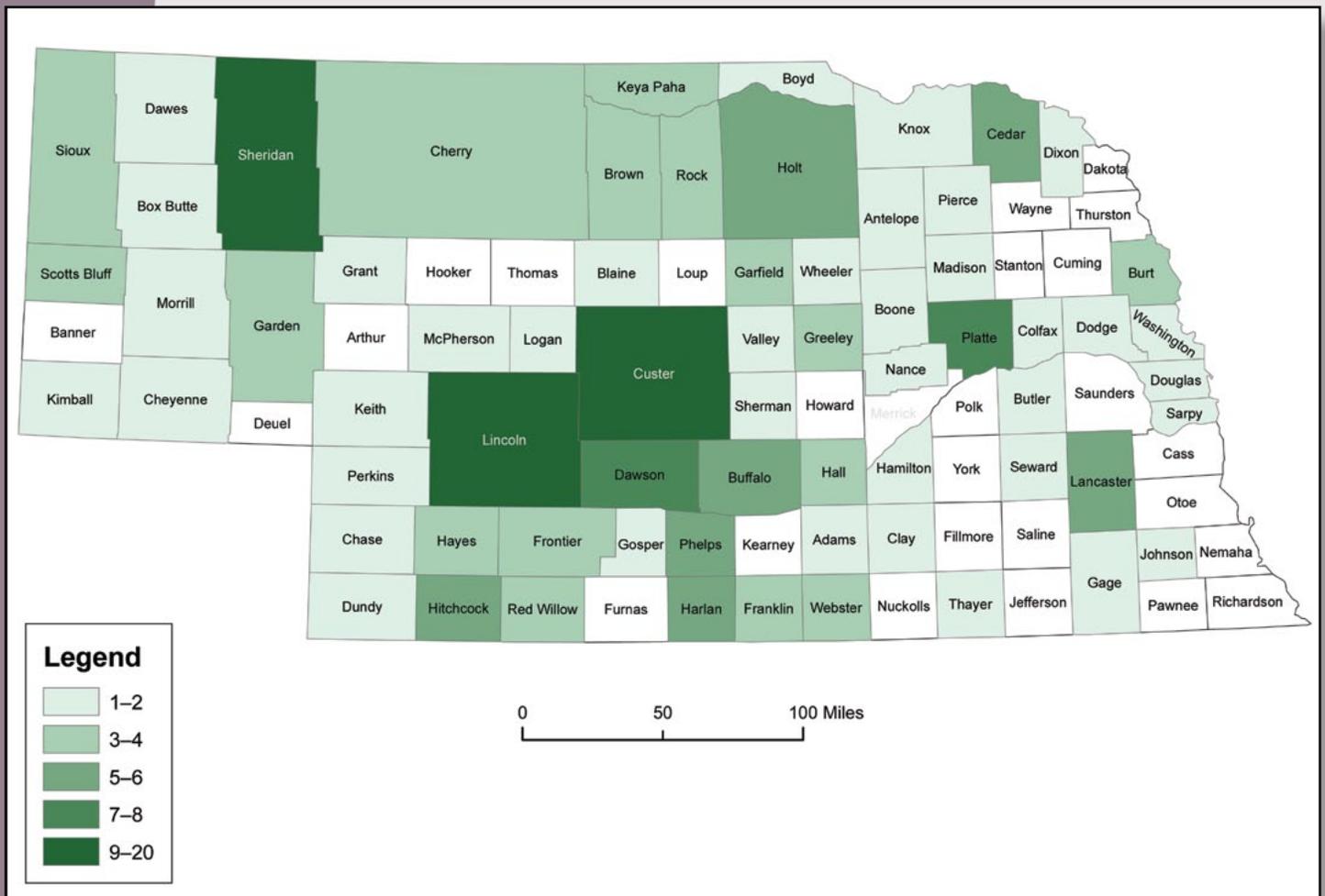


Figure 4:

Number of animals (other than skunks or bats) testing positive for rabies by species and county (N = 105), Nebraska, 2006–2015

