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## Fifth specimen of the nine-banded armadillo (*Dasypus novemcinctus*) from Nebraska

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The nine-banded armadillo (*Dasypus novemcinctus*) has moved northward in the Great Plains in the last century, reaching distributional limits in Nebraska for pioneering individuals. Herein, we report on the fifth specimen from Nebraska. A male individual was obtained from Lincoln County representing a new county record for Nebraska and one of the northwestern-most specimens in the United States.

**Key words:** nine-banded armadillo, *Dasypus novemcinctus*, Nebraska

In the United States, the nine-banded armadillo (*Dasypus novemcinctus*) was first documented in the Rio Grande Valley in southern Texas (Audubon and Bachman 1854), but the species subsequently has expanded northward and eastward, colonizing much of the south-central and southeastern United States (Humphrey 1974, Taulman and Robbins 1996). In the Great Plains, armadillos were reported as far north as northern Oklahoma by 1972 (Humphrey 1974) and have continued to move northward in recent decades. By 1995, reproducing populations were reported as far north as southeastern Kansas and central Missouri (Taulman and Robbins 1996), and by 2003, armadillos possibly were reproducing in southern Illinois (Hofmann 2009). Northern thresholds for reproducing populations in the Great Plains likely correspond to a greater than -2°C mean January temperature, which generally corresponds to less than 24 total days below freezing (Taulman and Robbins 1996). Based on this prediction, armadillos may eventually reside and reproduce throughout the entire southern half of Kansas (Taulman and Robbins 1996), providing the closest source population for pioneering individuals discovered in Nebraska.

Isolated records of armadillos are known in northern Kansas and southern and central parts of Nebraska (Taulman and Robbins 1996, Freeman and Genoways 1998, Merriam 2002). These individuals appear to represent the dispersal of pioneers along this northern advancing front, although some might also represent accidental and intentional releases by humans (e.g., Fitch et al. 1952, Taulman and Robbins 1996). Most pioneering individuals are suspected to perish in winter at these latitudes due to harsh, cold temperatures and frozen ground that limits access to food resources. Observations in central Nebraska represent the northernmost records of pioneering armadillos in the Great

Plains (Freeman and Genoways 1998). Thirteen records are known from the state, but most are represented by sightings whereas only four are documented by published specimens (Freeman and Genoways 1998). Herein, we present details on the fifth specimen of an armadillo from Nebraska.

On 21 July 2013, we salvaged a dead adult *D. novemcinctus* along Interstate-80 in Lincoln County, Nebraska (41.09653°N, 100.67493°W). The individual was hit by a car, as a person called the USFWS office in Grand Island and reported hitting an armadillo near North Platte. The relatively freshly-killed individual was discovered in the flood plain of the Platte River near the confluence of the North Platte and South Platte rivers near the town of North Platte. A large water supply canal associated with the North Platte Diversion Dam was located nearby to the west and south of the site. The individual was a male and was deposited at the University of Nebraska State Museum (Division of Zoology, ZM-30762). External standard measurements were as follows (in mm): total length 585; length of tail 181, length of hind foot 69, length of ear 38, and weight 4.8 kg. This individual represents the first confirmed report of a *D. novemcinctus* from Lincoln County, Nebraska, and one of the northwestern-most specimens in the United States, although we have heard of unconfirmed reports from as far to the northwest as Arthur County. The closest published records are from Chase County to the southwest and Custer County to the northeast (Freeman and Genoways 1998).

All armadillo specimens in Nebraska thus far have been males (Freeman and Genoways 1998, this paper); hence, evidence of potentially reproducing individuals still does not exist in Nebraska. Documentation of only males in Nebraska is not surprising as dispersal of males from natal ranges is more common than fe-

males for other mammalian species (Wolff 1994). Genetic structure of armadillos in Mexico further suggests male-biased dispersal in this species with females being more philopatric (Arteaga et al. 2012). Male armadillos in Nebraska most likely are dispersing from southern Kansas. Although the climate in Nebraska appears to preclude overwintering by individuals, a reproducing population is still possible, especially if winter temperatures increase in future years. However, documentation of pregnant females or females with young in the state still may not provide evidence of an established population, as delays in parturition and gestation lasting up to 24 months are known for armadillos (Storrs et al. 1988).

Many records of pioneering armadillos have been reported along river systems, especially in more arid habitats in the Great Plains (Hahn 1966, Meaney et al. 1987, Choate and Pinkham 1988, Freeman and Genoways 1998). For example, all three individuals known from Colorado have been reported along rivers: the Cimarron River valley (Hahn 1966), the riparian corridor of the Arkansas River (Meaney et al. 1987), and near the South Fork of the Republican River (Choate and Pinkham 1988). However, Freeman and Genoways (1998) did not observe such a relationship between records in Nebraska and river systems in eastern parts of the state, but western observations of armadillos appeared closely associated with the Republican River and its tributaries. Humphrey (1974) suggested that such waterways likely are used as dispersal routes, implying some movements of pioneering individuals are westerly for these west-to-east flowing river systems (Choate and Pinkham 1988). Ultimately, we suspect the individual originated from populations farther to the south in southern Kansas, but it is unclear where the individual entered Nebraska. The most likely possibility includes entering the state directly south of Lincoln County such as from Hitchcock, Red Willow and Furness counties; however, the individual also might have entered the state from areas farther to the east in eastern Nebraska or to the west in Colorado but then arrived in Lincoln County by movements along the Platte or South Platte River, respectively. Future investigations, such as isotope analysis from specimens preserved in natural history collections, may elucidate information on the origins of pioneering individuals.

If populations of *D. novemcinctus* continue to expand northward or westward in Kansas, the frequency of records likely will increase in southern Nebraska. Moreover, if average winter temperatures increase in the central Great Plains, northern limits of pioneering individuals would be expected to extend farther north. Southern Nebraska and northern Kansas appear to represent the distributional limits for a number of vertebrate

species (e.g., Wright et al. 2010, Collins et al. 2010, Fogell 2010) and baseline surveys should continue to monitor the ebb and flow of species distributions in the region, especially in light of predicted climatic fluctuations.

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