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NOTES

RECENT NORTHERN RECORDS OF THE NINE-BANDED ARMADILLO (DASYPODIDAE) IN NEBRASKA

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Northward dispersal of the nine-banded armadillo (*Dasybus novemcinctus*) has been well documented, beginning with Audubon and Bachman's (1854) report of the species in extreme southern Texas and culminating with the survey by Humphrey (1974) in 1972 (see also Kalmbach, 1943; Buchanan and Talmage, 1954; Buchanan, 1958; Galbreath, 1982; McBee and Baker, 1982). Humphrey (1974) stated that "distribution maps that do not distinguish between permanent armadillo populations and areas containing only pioneering individuals are misleadingly simple." He believed that the northern limit of the permanent population of armadillos as of 1972 was in northern Oklahoma Co., Oklahoma. Individuals beyond that area in northern Oklahoma and Kansas were considered to be only pioneers. Humphrey (1974) hypothesized that the northern limit of the permanent population of armadillos could be defined by two climatic conditions—a lower limit of 380 mm of annual precipitation and an approximate upper limit of 9 freeze-days a year.

In 1989, Caire et al. (1989) noted that a permanent population of armadillos was well-established in Payne Co., Oklahoma, in the vicinity of Stillwater, approximately 55 to 65 km north of the previous limit (Humphrey, 1974). Although the population was temporarily reduced, it had survived three successive extremely cold winters in the late 1970s. Caire et al. (1989) proposed that the breeding population had reached the northern limit of its geographic range, and future range expansions and contractions would depend on climatic changes.

Although the northward movement of permanent populations of the nine-banded armadillos has slowed in recent years and may

have reached its northern limit (Caire et al., 1989), the pioneering zone for the species has continued to expand northward and westward on the central Great Plains. Hibbard (1944) reported the first Recent records of the armadillo from Kansas in Chase and Sumner counties. Subsequent authors (Cockrum, 1952; Hall, 1955; Getz, 1961) documented the northward expansion of this pioneering zone in eastern Kansas as far as Osage Co. The first records of the armadillo north of the Arkansas River in central and western Kansas were reported by Smith and Lawlor (1964) based on individuals taken in Sheridan Co. in 1958 and in Saline Co. in 1962. Choate and Fleharty (1975) reviewed the distribution of armadillos in western Kansas, including additional records (see also Bee et al., 1981; Sparks and Choate, 1995).

On 3 July 1963, the first armadillo was recorded in Colorado based on a subadult female taken in the Cimarron River valley in Baca Co. (Hahn, 1966; Armstrong, 1972). Two additional specimens of armadillo have been recorded in eastern Colorado both in association with river systems (Fitzgerald et al., 1994). The first was an adult male found on 26 June 1986 in Prowers Co. in the riparian corridor of the Arkansas River (Meaney et al., 1987) and the second specimen was found on 2 July 1987 in Yuma Co. in northeastern Colorado at a locality near the South Fork of the Republican River (Choate and Pinkham, 1988). Humphrey (1974) noted that *Dasybus novemcinctus* was more numerous in semiarid regions along river valleys and associated riparian habitats, which could be used as dispersal routes. Based on this hypothesis, Choate and Pinkham (1988) proposed that the three records of armadillos from Colorado were the result of westward (upstream) rather than northward

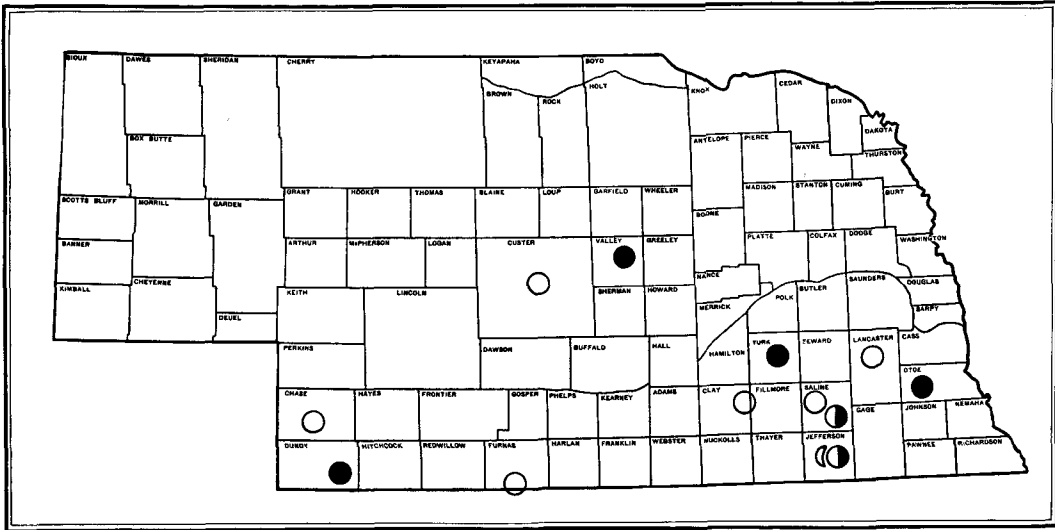


FIG. 1—Map of Nebraska showing records of the nine-banded armadillo, *Dasypus novemcinctus*. Closed circles represent records based upon museum specimens; half-open circles represent confirmed sightings; open circles represent other sightings.

dispersal along the valleys of the Cimarron, Arkansas, and Republican rivers from Kansas.

The pioneering zone of the nine-banded armadillo has continued to expand northward from Kansas and Colorado into Nebraska. Hoffmann and Jones (1970) reported a record of armadillo from south-central Nebraska without reference to a specific locality; Choate and Fleharty (1975) documented the first specimen taken in Nebraska from Benkelman, Dundy Co., in the extreme southwestern part of the state (now deposited in the University of Nebraska State Museum). This nine-banded armadillo also was taken along the valley of Republican River. The individual (Choate and Fleharty, 1975) was an adult (see Stangl et al., 1995 for relative age categories) for which the sex was not recorded. It was shot on the morning of 29 November 1972 as it was "rooting for grubs" in the lawn of Leon Baney, Sr. (Anonymous, 1972).

Currently, the northernmost point of the pioneering zone of the armadillo in North America (Fig. 1) is at 8 mi. W Ord, Valley Co. (41°36'N, 98°56'W). The individual from this locality was an old adult male, which was captured on 26 December 1986. It was found in a haystack by members of the William P. Pierson family while they were hunting. It was held in

captivity for two days before it died. This male had well developed testes that measured 19 mm by 12 mm. We compared the climatic conditions at Ord (freeze-days per year from recording site at Burwell, 27 km NW Ord) with those that Humphrey (1974) believed prevailed at the northern limit of the permanent population of nine-banded armadillos. Ord receives on average 550 mm of rainfall per year, which is well above the 380 mm minimum that Humphrey believed necessary, but there are 176 freeze-days (White, 1964; Baldwin, 1973) per year in this region of Nebraska, which is considerably above the 9 freeze-days maximum at the limit of the permanent population. This would seem to indicate that the number of days with temperatures below 0°C is less of a limiting factor for populations of armadillos on the central Great Plains than is rainfall. As average temperatures in this region appear to be increasing and winter climate seems to be ameliorating, the northern limit of the pioneering zone for *Dasypus novemcinctus* may be expected to extent further to the north.

The adult male from south of York (see Specimens Examined) was found in the interchange area of U.S. Highway 81 and Interstate Highway 80. When the animal was found by Bruce Hulse in July 1987, it was alive, but it

seemed stunned as if it had been hit by a car. Inspection of the preserved skin does not show any evidence of major trauma. The animal died within a few hours of being captured. This adult male had well developed testes that measured 25 mm by 15 mm. The adult male from ½ mi. N Unadilla, Otoe Co., was found dead beside Nebraska State Highway 2 on 22 July 1996. This individual had well-developed testes that measured 39 mm by 18 mm and was noted by the preparator as being "very fat."

External measurements (in millimeters) of the specimens from Ord, York, and Unadilla, respectively, were as follows: total length, 712, 675, 732; length of tail, 299, 280, 300; length of hind foot, 103, 93, 96; length of ear, 42, 37, 41; weight, 4.27 kg, 5.80 kg, 5.55 kg. Cranial measurements (after Stangl et al., 1995) of these three individuals followed by those of the individual from Benkelman were as follows: greatest length of skull, 101.0, 97.8, —, 105.0; greatest width of nasals, 10.9, 10.4, 9.1, 10.7; rostral width, 19.1, 19.7, 20.0, 18.2; zygomatic breadth, 44.7, 42.3, 44.0, —, interorbital breadth, 25.7, 23.3, 25.4, 25.3; length of premaxillary, 9.6, 12.6, 11.5, 12.3; occipital breadth, 26.9, —, 27.7, 30.1; length of maxillary toothrow, 24.8, 25.0, —, 27.7; length of mandibular toothrow, 26.1, 24.6, 28.1, 29.2; length of palatine, 16.3, 17.8, 18.5, 14.6. The majority of these measurements fall within the range of samples reported by Stangl et al. (1995) from the Rolling Plains of Texas and Oklahoma, indicating that the material from Nebraska exhibits little to no morphological differentiation from this southern population. Given the rapidity with which the pioneering population of the nine-banded armadillo is expanding westward and northward on the central Great Plains, this result was not unexpected. Fifty percent of the 62 specimens examined by Stangl et al. (1995) were missing teeth so that individuals differed from the normal $P 7/7, M 1/1 = 32$ dental formula for the nine-banded armadillo. The specimen from near Ord possessed 31 teeth, evidently missing the left P1, and the specimen from near Unadilla had only 30 teeth, missing a tooth in each maxillary toothrow, but it was not evident which of the teeth was missing.

The remaining records of the armadillo from Nebraska are based on sightings by the public or staff of the Nebraska Game and Parks

Commission that were reported to the Commission or the Division of Zoology, University of Nebraska State Museum (see Confirmed Sightings and Sightings herein for precise localities). We feel confident that members of the public are able to identify specimens of armadillo (unlike most small mammals), especially those they are able to closely inspect. These sightings support records represented by preserved specimens, making the more northerly localities represented by preserved specimens not appear to be so isolated. In the case of two of these sightings, we have reviewed photographs and talked with local residents, and we consider these to be confirmed sightings. The armadillo from Wilber was found dead on State Highway 103 at the northern edge of town on 30 July 1989 by Whitey Schuerman. Apparently the animal had been "recently hit by a car or truck" (Anonymous, 1989; Jenson, 1989). The armadillo from east of Fairbury in Jefferson Co. was observed by Jeremy Bailey on 11 January 1996 as it attempted to escape into a shallow burrow when it was disturbed from a hedgerow bordering an agricultural field. The burrow proved to be too shallow for the armadillo, which was captured and photographed before it was released at the capture site.

The sighting south of Arapahoe in Furnas Co. is based on a live individual that was captured by a Nebraska game warden at the junction of U.S. Highway 283 and the Kansas state line and was taken to Norton, Kansas. All of the remaining sightings listed herein, except the one from Custer Co. for which we have no data, were individuals that were found dead along highways. Although we have no indication of human involvement in the dispersal of armadillos into Nebraska, we question the sightings from Lancaster and Custer counties. These sightings are fairly far north in the state for the dates in the early 1970s when they were reported; the animal from Lancaster Co. was found dead on a street in Lincoln, which also seems unusual.

Examination of the distribution of nine-banded armadillo in Nebraska (Fig. 1) reveals that these animals may be entering the state from two directions. The animals in Chase, Dundy, and Furnas counties appear to be closely associated with the Republican River and its tributaries and probably reached the

state along these riparian habitats from northwestern Kansas and northeastern Colorado. Records in the central and eastern part of Nebraska are not closely tied to one river system. For the specimen from Ord to have followed watercourses, it would have needed to follow the Big or Little Blue rivers, crossed to the Platte River, and finally reached the North Loup River. Due to the moister climate and extensive center-pivot and ditch irrigation employed in eastern Nebraska, armadillos apparently are not confining their movements to riverine habitats. Nine-banded armadillos appear to be entering this part of Nebraska from north-central Kansas.

Resumen—Los datos de la dispersión al norte desde hace casi 150 años desde el sur de Texas por el armadillo de nueve bandas (*Dasyops novemcinctus*) son revisados. El registro más hacia al norte para esta especie está ahora a 8 mi. O. Ord, Valley Co., Nebraska. Otros tres especímenes de armadillos son reportados en Nebraska. Se discuten nueve avistamientos adicionales de la especie. Dos de estos avistamientos fueron confirmados basándose en datos que no provinieron de especímenes de museos. La mayoría de las medidas de los especímenes de Nebraska caen en el rango de las muestras reportadas de los Rolling Plains de Texas y de Oklahoma, indicando que el material de Nebraska exhibe poca o no diferenciación morfológica con las poblaciones sureñas. Los armadillos de los condados de Chase, Dundy, y Furnas en el suroeste de Nebraska parecen estar cercanamente asociados con el Republican River y sus tributarios y probablemente llegaron al estado por medio de estos habitat riverenos del noroeste de Kansas y del noreste de Colorado. Los registros del centro y del este de Nebraska no están relacionados a un sólo sistema de ríos. Los movimientos de los armadillos no están confinados a los habitat riverenos en el este de Nebraska probablemente por el clima más húmedo y la irrigación de pivote central y de acequia y los armadillos deben estar entrando a esta parte de Nebraska por la parte central norte de Kansas.

We would like to thank J. Springer for allowing us to examine the specimen deposited in the collections of the Department of Biology, University of Nebraska-Kearney (UNK). Specimens listed below as

UNSM are deposited in the collections of the University of Nebraska State Museum, University of Nebraska-Lincoln. We would also like to thank the staff biologists of the Nebraska Game and Parks Commission for access to their sighting records and T. Labedz, who has prepared the specimens in UNSM.

Specimens examined (4)—Dundy Co.: Benkelman, 1 (UNSM 13398). Otoe Co.: ½ mi. NW Unadilla, 1 (UNSM 20908). Valley Co.: 8 mi. W Ord, 1 (UNSM 19014). York Co.: 3.5 mi. S York, 1 (UNK 4041).

Confirmed sightings—Jefferson Co.: 3 to 4 mi. E Fairbury (11 January 1996). Saline Co.: Wilber (30 July 1989).

Sightings—Chase Co.: 1 mi. NE Champion (6 November 1986). Clay Co.: 12 mi. E, 1 mi. S Clay Center (21 June 1992). Custer Co.: no specific locality (early 1970s). Furnas Co.: 21 mi. S Arapahoe (1 September 1972). Jefferson Co.: 1 mi. W Fairbury (28 August 1989). Lancaster Co.: Lincoln (early December 1972). Saline Co.: Friend (early 1980s).

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