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Gregory M. Wilson  
*Oklahoma State University*


John B. Bowles  
*Bat Conservation International Inc.*

Justin W. Van Zee  
*USDA-ARS Jornada Experimental Range*

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## Current Status of the Plains Pocket Mouse, *Perognathus flavescens*, in Iowa

GREGORY M. WILSON<sup>1</sup>, JOHN B. BOWLES<sup>2</sup>,  
and JUSTIN W. VAN ZEE<sup>3</sup>

<sup>1</sup>Department of Zoology, Oklahoma State University, 430 Life Sciences West,  
Stillwater, Oklahoma 74078-3052

<sup>2</sup>Bat Conservation International Inc., P.O. Box 162603, 500 Capital of Texas,  
Hwy. N, Building 1, Suite 200, Austin, Texas 78746

<sup>3</sup>USDA-ARS Jornada Experimental Range, NMSU Box 30003, Department 3 JER,  
Las Cruces, New Mexico 88003-0003

Published and unpublished accounts of the plains pocket mouse (*Perognathus flavescens*) were utilized to document the existence of extant populations and to summarize and report additional data about the biology of this state endangered Iowa species. Populations of *P. flavescens* exist in western (Harrison, Monona, and Plymouth counties) and extreme eastern (adjacent portions of Louisa and Muscatine counties) Iowa, the latter of which represents the eastern-most record for the species in North America. In addition, we document a new locality for *P. flavescens* from the interior of the state (Benton County). All known populations of *P. flavescens* in Iowa occur in grassland habitats on well-drained substrates (i.e., loess, sandy loam, and sandy soils). Reproductive data suggested that *P. flavescens* in Iowa have at least two litters (early spring and late summer) of three to eight young. We hope this paper will stimulate additional research that will lead to a better understanding of the general distribution and biology of *P. flavescens* in Iowa.

INDEX DESCRIPTORS: Iowa, mammals, Heteromyidae, plains pocket mouse, *Perognathus flavescens*, reproduction, distribution

The plains pocket mouse (*Perognathus flavescens* Osgood), which reaches the eastern limits of its range in Iowa, is the only rodent of the southwestern family Heteromyidae that occurs in the state (Lampe and Bowles 1985, Schmidly et al. 1993). Although published accounts indicate a general preference for grassland communities with sparse vegetation and well-drained, sandy soils (Jones et al. 1983, Jones and Birney 1988), the overall natural history of this nocturnal granivore is poorly documented not only in Iowa, but throughout much of its range in North America (Genoways and Brown 1993). Bowles (1975) presented the distributional patterns of *P. flavescens* in Iowa (based on pre-1970 records), but included little about its biology. This paper reviews published data and reports new information pertaining to the distribution and biology of *P. flavescens* in Iowa, where it is listed as endangered (Endangered and threatened plant and animal species 1994).

### PRE-1970 RECORDS (SEE ALSO BOWLES 1975)

The first specimen of *P. flavescens* from Iowa was a female collected by J.E. Guthrie in Cooper, Greene County in 1914 and was deposited in the National Museum of Natural History in Washington, D.C. (Bowles 1975). Unfortunately, the specimen tag (USNM # 210538) provides neither habitat nor reproductive details for this individual. In his account of mammals of North Dakota, Bailey (1926) alluded to the presence of *P. flavescens* in the prairie country of Iowa and adjacent states, but he did not call attention to the Greene County specimen, nor did Stoner (1918) in his summary of Iowan rodents.

Fichter (1939) reported a female *P. flavescens* "taken in a potato patch on Tama silt-loam soil" in Fremont County in 1935. His map for the eastward and southward extension of the known range of the species included the western two-thirds of Iowa. Fichter (1939), however, gave no reproductive details for the Fremont County specimen, and none were recorded on the specimen tag (University of Nebraska State Museum # 0001).

Polderboer (1937) reported a specimen taken in Black Hawk

County in 1936. Although only one was described in detail, he noted that "All captured specimens... were fully mature (none examined for embryos)." In addition, Polderboer (1937) commented that a "study of contents of the cheek pouches of 15 specimens revealed the following seeds: grass (*Panicum*), sandbur (*Cenchrus*), foxtail (*Setaria*). The sedge seeds composed the major portion of the contents of the cheek pouches." Polderboer went on to discuss "specimens" taken in Union Township, Black Hawk County, and commented that "the higher ridges in the township are mostly sandy prairies... [primarily] covered with Carrington sand and Carrington sand loam soils... [and that a] few sparse plants such as bur clover, panicum, sandburs, roses, sedge and mullein grow here." This probably was where Polderboer trapped the 15 pocket mice. In 1938, he collected a male and female in Backbone State Park, Delaware County (Fichter 1939). The specimen tag of the female indicates it was taken on a sandy prairie, but no habitat information is available for the male specimen. No additional reproductive comments were noted for either specimen. Although reportedly deposited in the mammal collection at Iowa State University (ISU) (Polder 1953), both specimens are currently housed in the National Museum of Natural History in Washington, D.C.

In his survey of mammals of Iowa, Scott (1937) reported two specimens of *P. flavescens* in the ISU collection – one from Guthrie Center, Guthrie County, and the other from Oakland, Pottawattamie County. The former was a female collected in 1930, and the latter, sex unrecorded, was collected in 1928. An additional ISU specimen, sex unrecorded, was taken in 1940 in Boone County (Bowles 1975). No habitat or additional reproductive information is available for any of the ISU specimens. From 1955-1957, four plains pocket mice were collected near Center Point, Linn County, and deposited in the Coe College collection (Bowles, 1975). Although neither reproductive nor habitat information were recorded, all individuals were collected on sandy substrate (Goellner, pers. comm.). Despite further searches for *P. flavescens* near Center Point during the 1960s (Goellner, pers. comm.) and in 1983 (N. P. Bernstein, pers. comm.), no additional specimens were collected.

## RECENT RECORDS SUBSEQUENT TO BOWLES (1975)

In 1978, Christiansen and Sanz (1978) reported the capture of six *P. flavescens* in pitfall and Sherman live traps on sparsely vegetated sand dunes at Big Sand Mound (now Louisa Generating Preserve) in northeastern Louisa County, near the Mississippi River [not Muscatine County, as reported]. Plains pocket mice have continued to be captured in pitfall traps at the edge of scrub vegetation and contiguous sandy habitat at the Louisa Generating Preserve in southeastern Muscatine County, as well as along the west side of Beattys Pond in extreme northeastern Louisa County (Fig. 1; J. L. Christiansen, pers. comm.).

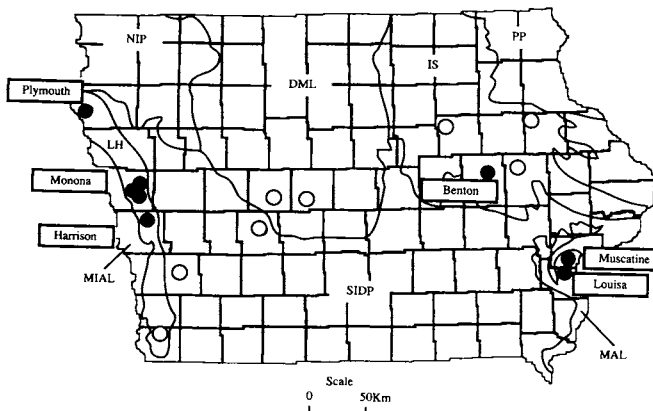


Figure 1. County records of occurrence of *Perognathus flavescens* in Iowa since October 1970 (solid circles). Open circles represent specimens collected prior to November 1970 (Bowles 1975). Abbreviations for Landform Regions in Iowa (Prior 1991) are as follows: DML = Des Moines Lobe, IS = Iowan Surface, LH = Loess Hills, MAL = Mississippi Alluvial Plain, MIAL = Missouri Alluvial Plain, NIP = Northwest Iowa Plain, PP = Paleozoic Plateau, and SIDP = Southern Iowa Drift Plain. County names are in rectangles.

From 1978-1982, 19 adult *P. flavescens* were captured by Lampe and Bowles (pers. comm.) at five sandy, grass-dominated sites in Harrison, Monona, and Plymouth counties in western Iowa (Fig. 1). These sites were typical of the gently to steeply rolling Loess Hills that lie along much of the Missouri River Valley (Mutel 1989, Prior 1991). Remnant stands of mixed-grass prairie occurred on the ridges and steep bluffs of the western-most hills, which were connected to the main body of mixed prairie along the Missouri River bluffs in South Dakota and Nebraska (Novacek et al. 1985). The vegetation that occurred on the upper slopes and summits was dominated by caespitose grasses, consisting mostly of sideoats grama (*Bouteloua curtipendula* [Michx.] Torr.) and little bluestem (*Andropogon scoparius* Michx.). Woodland and cropland dominated the moist valleys, with the woodland habitats forming an ecotone with the ridge-top prairies, especially along north facing slopes (Mutel 1989, Roosa and Koenig 1990). Although most western Iowa records of *P. flavescens* are from prairie hillsides of the Loess Hills (Lampe and Bowles 1985), a male was collected in 1979 in a patch of marijuana (*Cannabis sativa* L.) at Gleason-Hubel Wildlife Area, Harrison County (J. B. Bowles, unpubl. data), and another male was live-trapped in 1982 in a field of smooth brome (*Bromus inermis* Leyss.) at Little Sioux Boy Scout Ranch, Monona County (J. B. Bowles, unpubl. data; Fig. 1). We suspect these two males may have simply been dispersing through these habitats that could be considered atypical for *P. flavescens*, or they may have been foraging. Unfortunately, the fur-

lined cheek pouches of these individuals were not inspected.

During our trapping efforts on 25 sandy prairie patches in the eastern one-third of Iowa during the summers of 1990 and 1991, we found only one extant population of *P. flavescens* (Bowles 1991). In August 1990, we captured a nonpregnant adult female (with placental scars) at the Cumberland Target Range, Benton County, in east-central Iowa (Fig. 1), an area managed by the Benton County Conservation Board. The mouse was captured in a Museum Special snap trap baited with rolled oats in a small stand of native prairie with dry, loose sandy soil. The predominant plant species at the trap-site were big bluestem (*Andropogon gerardi* Vitman), switchgrass (*Panicum virgatum* L.), and smooth brome, along with several woody invaders that included honey locust (*Gleditsia triacanthos* L.), red cedar (*Juniperus virginiana* L.), and mulberry (*Morus* L. spp.). The small stand of native prairie was bordered by a tilled agricultural field and a freshly cut alfalfa (*Medicago sativa* L.) field.

Despite the increased trapping and capture of the plains pocket mouse in Iowa since the mid-1970s, reproductive data for this species are limited (Table 1). Only two of the five females collected after October 1970 showed signs of reproduction (i.e., pregnant, lactating, or enlarged mammae) – one in May and another in early August. Likewise, only two of the six males for which we have data were reproductively active (i.e., enlarged seminal vesicles) – one collected in late July and the other in early August. The other four males, two of which were captive individuals with testes measurements (length x width in mm) of 4 x 2 and 3 x 2 when they died on 15 December and 9 March, respectively, were not fully developed reproductively at the time of necropsy (i.e., minute to moderately enlarged seminal vesicles and epididymides not clearly visible with a hand lens), or lacked critical data.

Table 1. – Month, day, sex, and reproductive condition and comments of plains pocket mice, *P. flavescens*, collected in Iowa since October 1970<sup>a</sup>.

Month	Day	Sex	Reproductive condition/comments
May	6	f	no embryos
	15	f,f	3 embryos x 6 mm; no embryos
June	24	f	no embryos
	27	m	testes 5 x 4 mm (no other data recorded)
July	20	m	testes 5 x 3 mm, epididymides not visible with hand lens, small seminal vesicles
	26	m	enlarged seminal vesicles <sup>b</sup>
August	3	f	not pregnant, 8 placental scars, mammae enlarged
	6	m	enlarged seminal vesicles <sup>b</sup>

<sup>a</sup> Measurement of testes is length x width; measurement of embryos is crown-rump length.

<sup>b</sup> Testes and epididymides were eaten when the animal was still in the trap.

## COMMENTS

We were encouraged to find and report records of extant populations of *P. flavescens* in at least three of the Iowa landform regions identified by Prior (1991) despite the loss of most tall- and mixed-grass prairie following European settlement (Bowles 1981, Smith 1981). Plains pocket mice occur in at least five sites in the Loess Hills Region (one each in Harrison and Plymouth counties and three sites in Monona County) and one each in the Iowan Surface Region (Benton County) and Mississippi Alluvial Plain Region

(adjacent portions of northeast Louisa and southeast Muscatine counties; Fig. 1). Although most of these sites have at least some measure of protection and management (i.e., prescribed burns) by state and county conservation agencies, most prairie remnants in Iowa do not. In many cases, such as in the Loess Hills, sites where *P. flavescens* have been collected are being invaded by woody plants, such as red cedar, rough-leaved dogwood (*Cornus drummondii* Meyer), and smooth sumac (*Rhus glabra* L.) because of the suppression of naturally occurring prairie fires (Mutel 1989). As a result, the existence of the state endangered plains pocket mouse is threatened at many of these sites due to the loss of species' specific habitat.

All populations of *P. flavescens* in Iowa are known to occur only in grass-dominated habitats on well-drained strata such as loess, sandy loam, and sandy soil. Consequently, the distribution of the plains pocket mouse may be discontinuous throughout the state, as suggested by Bowles (1981). Based on the soil association map for Iowa (Iowa Agriculture and Home Economics Experiment Station, et al. 1978), we suspect other localized populations exist, especially in extreme western (Missouri Alluvial Plain Landform Region) and eastern counties (Mississippi Alluvial Plain Landform Region) of Iowa, and in the extreme northwestern corner of the state (Northwest Iowa Plains Region). Additional populations likely will be found in the remainder of Iowa in sparsely vegetated sand prairies and roadside ditches, as well as in margins of grain fields with well-drained substrates, as shown elsewhere in its range (Hibbard and Beer 1960, Jones et al. 1983, Jones and Birney 1988, Reed and Choate 1986). However, we suspect that *P. flavescens* is not nearly as abundant in the Des Moines Lobe Landform Region in north-central Iowa as it is in the other landform regions. The substrate of the Des Moines Lobe is characterized as mostly prairie-derived soils that developed from Wisconsin till following the Pleistocene glaciation. The soil types in this landform region, which include Webster, Okoboji, Canisteo, and Nicollet, among others (Iowa Agriculture and Home Economics Experiment Station, et al. 1978), are generally characterized as being poorly-drained. If extant populations of plains pocket mice do occur in the Des Moines Lobe Landform Region, we suspect they would be found, as were individuals collected prior to 1970, in the southern portion (Bemis Moraine) of the landform region and near the Des Moines, Boone, Racoon, and Skunk river systems (Fig 1).

Despite the meager reproductive data, we suspect that *P. flavescens* in Iowa has at least two litters of three to eight young (late spring and late summer) as shown elsewhere in its range (Table 1; Asdell 1964, Jones et al. 1983, Jones and Birney 1988). Similarly, food habits of *P. flavescens* in Iowa are probably similar to those found elsewhere (i.e., wide range of grass, sedge, and forb seeds; Jones and Birney 1988, Reed and Choate 1986), but the paucity of information precludes any comment on seeds consumed in Iowa. Likewise, data are needed to define the late fall, winter, and early spring biology of *P. flavescens*. In Iowa, the latest fall and the earliest spring records to our knowledge are 7 September and 23 March, respectively.

The survival of at least a few populations of the state endangered plains pocket mouse affords an excellent opportunity to learn more about its biology. Efforts should be made to search for new records of locality and monitor known populations of *P. flavescens* by using Sherman live traps, pit fall traps, or mesh live traps. Such methods of trapping will maximize capture (Christiansen and Sanz 1978, O'Farrell et al. 1994, Reed and Choate 1986) and minimize mortality. Once specimens are captured, fluorescent pigments could be used to obtain information on habitat requirements and movement patterns of this nocturnal rodent (Lemen and Freeman 1986). Cheek pouch contents and reproductive condition of individuals should be carefully examined and recorded. If mortality occurs, we *strongly* urge that the skin, complete skeleton, stomach

contents, and tissues such as heart, liver, spleen, and kidney be saved and incorporated into an accredited systematic collection that is equipped for long-term storage of such material. The use of molecular assays, such as restriction fragment length polymorphism (RFLP) analysis of mitochondrial DNA (mtDNA), gene sequences of mtDNA, and allozymic data (Patton et al. 1981, Riddle 1995) would help to better understand both gene flow and the effects of isolation within and among populations of *P. flavescens* in Iowa.

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## APPENDIX

*Post-October 1970 capture records*

This list includes 27 specimens of *P. flavescens* collected in Iowa subsequent to October 1970, 23 of which are deposited in the following institutions (acronyms in parentheses): Buena Vista College, Storm Lake (BV); Central College, Pella (CUI); Drake University, Des Moines (DU); Ecology Consultants, Inc. Collection, Ft. Collins, CO (ECIC); University of Iowa Museum of Natural History, Iowa City (IOWA). Localities listed correspond to locations plotted in Fig. 1. See Bowles (1975) for distributional details for specimens collected prior to November 1970.

*Specimens examined* (13). – BENTON CO.: Cumberland Target Range, 1½ mi. N Vinton, 1 (IOWA). HARRISON CO.: Gleason-Hubel Wildlife Area, 1¼ mi. S, 1 mi. E Little Sioux, 1 (IOWA). LOUISA CO.: Louisa Generating Preserve [Big Sand Mound], NE ¼ Sec. 4, T 75 N, R 2 W, 3 (DU); Louisa Generating Preserve [Windy Hills Hunt Club], NE ¼ Sec. 9, T 75 N, R 2 W, 1 (DU). MONONA CO.: Loess Hills Wildlife Area, 1½ mi. N, 3 mi. W Castana, 3 (1 CUI, 2 IOWA); Loess Hills Preserve, 1½ mi. N Turin, 2 (1 CUI, 1 IOWA); Little Sioux Scout Ranch, 3 mi. S, 5½ mi. E Blencoe [=4 mi. N Pisgah], 1 (IOWA). MUSCATINE CO.: Louisa Generating Preserve [Big Sand Mound], SE ¼ Sec. 33, T 76 N, R 2 W, 1 (DU).

*Other records* (14). – HARRISON CO.: Gleason-Hubel Wildlife Area, 1¼ mi. S, 1 mi. E Little Sioux, 1 (BV). LOUISA CO.: Louisa Generating Preserve [Big Sand Mound], 3 (1 ECIC, 2 captured and released [Christiansen and Sanz 1978]). MONONA CO.: Loess Hills Wildlife Area, 1½ mi. N, 3 mi. W Castana, 1 (BV); Loess Hills Preserve, 1½ mi. N Turin, 3 (1 BV, 2 captured and released by J. B. Bowles, unreported); Little Sioux Scout Ranch, 3 mi. S, 5½ mi. E Blencoe [=4 mi. N Pisgah], 4 (BV). PLYMOUTH CO.: Five Ridge Prairie Preserve, 4 mi. SE Westfield, 3 (BV); Five Ridge Prairie Preserve, 4½ mi. S, 3½ mi. E Westfield, 1 (BV).