

### LATE SEASONAL CAPTURES OF THE PLAINS POCKET MOUSE (*PEROGNATHUS FLAVESCENS*) IN IOWA

The plains pocket mouse, *Perognathus flavescens*, is a nocturnal granivore that inhabits friable soils in sparsely vegetated areas (Monk and Jones 1996). In the United States, the distribution of the plains pocket mouse extends from Arizona, New Mexico, and Texas through the Great Plains to North Dakota and Minnesota (Hall 1981). This species reaches its easternmost limits in Iowa, where it has been documented from a limited number of grassland sites in eastern, central, and western parts of the state (Bowles 1975, Wilson et al. 1996). Due to loss of grassland habitat, the plains pocket mouse is currently listed as an Endangered Species in Iowa (Iowa Legislature 2009). Because this species is rarely captured in the state (Wilson et al. 1996), little is known about its natural history in Iowa, including details of seasonal activity.

Many species of *Perognathus* are true hibernators and become seasonally dormant during winter (French 1993). Pocket mice store food in their burrows and alternate between episodes of torpor and euthermia to make their stored food last throughout dormancy (French 1993). The plains pocket mouse likely hibernates throughout its range, but timing of dormancy varies among populations (Monk and Jones 1996). From Kansas to Minnesota, the plains pocket mouse appears to enter dormancy in autumn. For example, the latest date of capture is 11 November in Kansas (Reed and Choate 1986) and 26 November in Nebraska (K. Geluso, University of Nebraska at Kearney, personal communication). We suspect that plains pocket mice in other populations north of Kansas enter dormancy in autumn; however, the latest reported date of capture in Iowa is 7 September (Wilson et al. 1996). Hence, our objective was to estimate the timing of seasonal dormancy in a population of plains pocket mice in Iowa. Also, we present observations on reproduction and foraging by individuals in late summer and autumn.

Our study was conducted at Folsom Point Preserve, a 281-acre preserve managed by The Nature Conservancy in Mills and Pottawattamie counties in southwestern Iowa (41°09.202' N 095°47.717' W). Folsom Point Preserve is located in the Loess Hills of western Iowa, a region characterized by hills rising above the floodplain of the Missouri River. Summits of the hills are about 40 m above the plains and connected by narrow ridges. We conducted trapping along a U-shaped prairie ridge that was burned in spring 2009. Several slopes were covered in prairie grasses and others were wooded. Grasses on slopes and summits of the ridge included big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), Indian grass (*Sorghastrum nutans*), wild rye (*Elymus canadensis*), and yellow foxtail (*Setaria pumila*). Common forbs included goldenrod (*Solidago rigida*), blazing-star (*Liatris punctata*), Canada goldenrod (*S. canadensis*), showy goldenrod (*S. speciosa*), western ragweed (*Ambrosia psilostachya*), and sunflower (*Helianthus pauciflorus*). Other flowering plants

consisted of lead plant (*Amorpha canescens*), nine-anther dalea (*Dalea enneandra*), rough gerardia (*Agalinis aspera*), purple prairie clover (*D. purpurea*), snow-on-the-mountain (*Euphorbia marginata*), grooved yellow flax (*Linum sulcatum*), and narrowleaf bluets (*Houstonia nigricans*). Soil was friable, and many patches of exposed soil were evident on summits and slopes of the ridge as the vegetation was sparser and less litter was present in these areas than at the base of hills.

To estimate timing of dormancy in the plains pocket mouse, we set 50 Sherman live traps (7.6 cm × 7.6 cm × 25.4 cm) for 2 consecutive nights every 2 weeks from 11 September to 20 November 2010 (600 trap nights). Each session of trapping occurred during the new- and full-moon phase of each month. We baited traps with rolled oats and mixed birdseed, set them near dusk, and checked them the following morning. We reported the date of capture as the day traps were checked. For animals captured, we recorded species, sex, age (adult or juvenile), and reproductive condition (males—scrotal or nonscrotal; females—pregnant, lactating, postlactating, or nonreproductive). Additionally for plains pocket mice, we weighed individuals with a Pesola spring scale (Rebmatli 19, CH-6340, Baar, Switzerland) and checked their cheek pouches for evidence of foraging. We released all individuals at points of capture, except 3 plains pocket mice captured on 26 June that were deposited as voucher specimens in the natural history collections, Division of Zoology, University of Nebraska State Museum, Lincoln, Nebraska, USA. All capture and animal handling procedures were approved by The Institutional Animal Care and Use Committee of the University of Nebraska (Approval Number 09-075-08-EP) and followed guidelines of the American Society of Mammalogists (Sikes et al. 2011). We obtained information on weather (minimum ambient air temperature and amount of precipitation) from the closest weather station to the study site (Glenwood, IA; NOAA 2011).

From September to November, we recorded 34 captures of plains pocket mice with the latest date of capture on 7 November (Table 1). We did not permanently mark individuals, thus we likely captured many of the same individuals throughout the study. Overall, we captured males more often than females (Table 1). All males were nonscrotal adults, and all females were adults that were not visibly pregnant or lactating; however, 1 female captured on 13 September showed signs of recent lactation (no milk was expressed, but hair was worn around the nipples).

On 10 October 2010, we captured a nonreproductive, adult female with full cheek pouches. Contents of cheek pouches consisted of fruits and associated sterile bracts of purple top (*Tridens flavus*), 2 sterile pieces of big blue stem, and 2 grains of rolled oats (trap bait). Total mass of cheek pouch contents (without oats) was 0.15 grams. Purple top, the major component of cheek pouches, was not present on the prairie ridge where we set traps but was found at the base of hills at the study site. Thus, to collect this grass, this

individual must have been foraging at the base of hills and not exclusively on the prairie ridge. Other species captured were western harvest mice (*Reithrodontomys megalotis*,  $n = 60$ ), prairie voles (*Microtus ochrogaster*,  $n = 24$ ), white-

footed deermice (*Peromyscus leucopus*,  $n = 24$ ), short-tailed shrews (*Blarina* spp.,  $n = 10$ , Thompson et al. 2011), house mice (*Mus musculus*,  $n = 1$ ), and a vole that escaped before we determined the species (*Microtus* sp.,  $n = 1$ ).

Table 1. Number of plains pocket mice (*Perognathus flavescens*) captured above ground in southwestern Iowa, September–November 2010. Mean body mass (g) is provided in parentheses. Environmental factors include minimum ambient air temperature (°C) and moon phase. Temperatures were based on a 2-day average for days we set traps, and all trapping occurred within 4 days of a new or full moon.

Date of capture	Females	Males	Total	Temperature	Moon phase
12–13 September	1 (11.0)	6 (8.7)	7	13.0	New
26–27 September	3 (9.2)	2 (9.5)	5	8.0	Full
09–10 October	4 (9.0)	9 (8.8)	13	6.0	New
23–24 October	4 (9.5)	2 (8.5)	6	4.0	Full
06–07 November	1 (9.0)	2 (8.0)	3	–5.0	New
20–21 November	0	0	0	–5.0	Full
TOTALS	13 (9.4)	21 (8.3)	34		

The capture of plains pocket mice at Folsom Point Preserve is the first reported capture in Mills County, Iowa. Plains pocket mice have previously been documented  $\geq 28$  years ago in the Loess Hills to the north and south of our locality (Easterla 1967, Bowles 1975, Wilson et al. 1996). Additional trapping in prairies of the Loess Hills should be conducted to determine whether other populations of the plains pocket mouse still occur in western Iowa.

Our results extend the latest reported date of capture of the plains pocket mouse in Iowa from 7 September (Wilson et al. 1996) to 7 November. The previous latest date of capture (7 September; Wilson et al. 1996) likely did not represent an accurate estimate of onset of seasonal dormancy for plains pocket mice in Iowa, but represented a lack of captures or trapping effort of this species in autumn. Because we captured individuals during every trapping session except 20–21 November, we estimate this population initiated dormancy from 8 to 20 November, which is consistent with latest seasonal captures in nearby states such as Kansas (11 November; Reed and Choate 1986) and Nebraska (26 November; K. Geluso, personal communication).

Initiation of seasonal dormancy varies among populations of *Perognathus* and among individuals within populations, and initiation appears not to be cued directly by environmental changes (French 1993). Conversely, winter inactivity might occur on an individual basis after reproduction has ended and a sufficient cache of seeds has been accumulated in burrows (French 1993). Little is known about onset of dormancy in the plains pocket mouse, but observations from our study indicate that individual and environmental factors might be involved in the timing of dormancy of this northern population.

We did not capture any reproductively active pocket mice during autumn; thus, it appears that individuals were not actively pursuing mates aboveground in that season. Instead, we suspect pocket mice were actively foraging and collecting seeds on the surface in autumn as we captured one individual on 10 October with full cheek pouches. As French (1993) hypothesized, pocket mice might become dormant after they accumulate enough seeds in their burrows, which would result in asynchronous dormancy within the population. In our study, we captured fewer individuals in early November than early October (during new moon nights; Table 1), indicating that some individuals in our population might have accumulated enough food to initiate dormancy before November. O'Farrell et al. (1975) observed that Great Basin pocket mice (*P. parvus*) alternated between periods of surface activity and inactivity throughout the year. The activity period lasted an average of 60 days during years of normal food availability, which was suggested as the amount of time to accumulate enough seeds (O'Farrell et al. 1975).

Although plains pocket mice might become inactive on the surface in response to a full cache of seeds in their burrow, environmental factors (e.g., frozen soil) could be important to the initiation of seasonal dormancy in northern populations. For example, after pocket mice reach a minimum cache size, they may continue to accumulate seeds until the soil freezes. From our latest capture date (7 November) to the last trapping session (20–21 November; no pocket mice captured), the first snowfall of the year occurred (13 November), and the minimum temperature was  $\leq 0^\circ\text{C}$  on most days (11 of 15 days), likely causing soil to freeze. Similarly in Minnesota, Bailey (1929) noted that plains pocket mice were active on the surface in autumn until the ground froze. Thus, soil conditions and cache size

might be important to the timing of dormancy in northern populations of the plains pocket mouse. Future research on the initiation of dormancy in pocket mice, and on details of their activity and food-storing behavior would be informative.

We thank S. Hickey (Loess Hills Project Director for The Nature Conservancy) for allowing us to conduct our study at Folsom Point Preserve. D. M. Sutherland provided assistance with identification of plant material. We thank S. Brooner, M. Elnes, A. Ciurej, T. Gatz, Z. Heenan, C. Otto, B. Otto, K. Penney, and L. Vaughan for field assistance, and three anonymous reviewers for providing helpful comments on an earlier draft of our manuscript.—*Hans W. Otto and Jeremy A. White*<sup>1</sup>. *Department of Biology, University of Nebraska at Omaha, Omaha, NE 68182, USA.*  
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#### LITERATURE CITED

- Bailey, B. 1929. Mammals of Sherburne County, Minnesota. *Journal of Mammalogy* 10:153–164.
- Bowles, J. B. 1975. Distribution and biogeography of mammals of Iowa. Special Publications, The Museum, Texas Tech University 9:1–184.
- Easterla, D. A. 1967. First specimens of plains pocket mouse from Missouri. *Journal of Mammalogy* 48:479–480.
- French, A. R. 1993. Physiological ecology of the heteromyidae: economics of energy and water utilization. Pages 509–520 in H. Genoways, and J. H. Brown, editors. *Biology of the heteromyidae*. Special Publication No. 10, The American Society of Mammalogists.
- Hall, E. R. 1981. *The Mammals of North America*. Volume I. Second edition. John Wiley and Sons, New York, USA.
- Iowa Legislature. 2009. Endangered and threatened plant and animal species. Iowa Administrative Code, Chapter 77, page 2.
- Monk, R. R., and J. K. Jones, Jr. 1996. *Perognathus flavescens*. *Mammalian Species* 525:1–4.
- NOAA (National Oceanic and Atmospheric Administration). 2011. Climatological data, National Climate Data Center, Asheville, North Carolina, USA. Accessed February 2011.
- O'Farrell, T. P., R. J. Olson, R. O. Gilbert, and J. D. Hedlund. 1975. A population of Great Basin pocket mice, *Perognathus parvus*, in the shrub-steppe of south-central Washington. *Ecological Monographs* 45:1–28.
- Reed, K. M., and J. R. Choate. 1986. Natural history of the plains pocket mouse in agriculturally disturbed sadsage prairie. *The Prairie Naturalist* 18:79–90.
- Sikes, R. S., W. L. Gannon, and the Animal Care and Use Committee of the American Society of Mammalogists. 2011. Guidelines of the American Society of Mammalogists for the use of wild mammals in research. *Journal of Mammalogy* 92:235–253.
- Thompson, C. W., R. S. Pfau, J. R. Choate, H. H. Genoways, and E. J. Fink. 2011. Identification and characterization of the contact zone between short-tailed shrews (*Blarina*) in Iowa and Missouri. *Canadian Journal of Zoology* 89:278–288.
- Wilson, G. M., J. B. Bowles, and J. W. Van Zee. 1996. Current status of the plains pocket mouse, *Perognathus flavescens*, in Iowa. *Journal of the Iowa Academy of Science* 103:52–55.

*Submitted 12 July 2011. Accepted 6 December 2011. Associate Editor was Christopher S. DePerno.*