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# Maternity colony of Northern Long-eared Myotis (*Myotis septentrionalis*) in a human-made structure in Nebraska

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## Abstract

The Northern Long-eared Myotis (*Myotis septentrionalis*) occurs across eastern North America, and its range extends west into the Great Plains of the United States. Summer roosts of *M. septentrionalis* in the Great Plains are not well documented. Herein we describe a maternity colony of *M. septentrionalis* using small, elevated structures (i.e., cabins) in southeastern Nebraska. Cabins were in a small parcel of upland deciduous forest about 1.6 km from the Missouri River. The maternity colony was observed roosting in a space between the outer and inner walls of three different cabins from 21 June to 8 October 2014. Counts of individuals using the cabins suggest that the colony started to disband after mid-August. Identifying and monitoring maternity roosts of *M. septentrionalis* in the Great Plains will be important to effectively manage this federally threatened species, especially as the fungus that causes white-nose syndrome spreads into the region.

**Keywords:** bats, maternity roost, *Myotis septentrionalis*, Nebraska, Northern Long-eared Myotis

The Northern Long-eared Myotis (*Myotis septentrionalis*) occurs across much of eastern North America, and its range extends as far west as British Columbia, Montana, and Wyoming (Caceres and Barclay 2000, Hall 1981). Eastern populations of *M. septentrionalis* have been greatly impacted by white-nose syndrome to the extent that the species was recently listed as federally threatened (USFWS 2015). In the western-most portions of its distribution, *M. septentrionalis* is relatively uncommon (Caceres and Barclay 2000). Limited distribution of the species in the Great Plains is likely because it primarily roosts and forages in forested areas (Broders et al. 2006, Owen et al. 2003), which are relatively scarce in this region.

During summer, *M. septentrionalis* use a variety of day roosts including trees (Broders and Forbes 2004, Foster and Kurta 1999, Timpone et al. 2010) and human-made structures (Henderson and Broders 2008, Whitaker et al. 2006, Timpone et al. 2010). In eastern portions of their range, females typically form maternity colonies with <60 individuals in trees where they bear and raise young (Foster and Kurta 1999, Sasse and Pekins 1996), but artificial structures have also been used by maternity colonies (Henderson and Broders 2008, Whitaker et al. 2006, Timpone et al. 2010). At the western edge of its range in the Great Plains, summer roosts of *M. septentrionalis* are not well documented. In eastern Nebraska, this species is known to roost in mines throughout the year (Jones 1964, Czaplewski et al. 1979). This species has also been found using artificial structures in eastern Nebraska, including one female observed in a barn in summer (Czaplewski et

al. 1979) and one individual in a building in October (Geluso et al. 2004). To date, no published report of a maternity roost is known from the state, despite records of lactating females and volant young in northern, eastern, and southern Nebraska (Benedict 2004, Geluso et al. 2015). In summer 2014, we observed a maternity colony of *M. septentrionalis* roosting in small, elevated, human-made structures (i.e., cabins) in a forested region of southeastern Nebraska. Herein we describe use of those cabins by *M. septentrionalis*, including characteristics of the roosts, length of use, number of individuals occupying roosts, and timing of emergence.

In mid-June 2014, staff at Camp Catron and Retreat Center in Otoe County reported bats roosting in their “sky cabins”; small, paired cabins built on stilts (Figure 1). On 21 June 2014, we confirmed bats in the structures and returned subsequently to monitor the colony. Camp Catron is located about 1.6 km west of the Missouri River in a small area of upland deciduous forest surrounded by agricultural fields and orchards. For a more detailed description of the site see White et al. (2014). Four pairs of cabins were located along the north and west sides of a 42 by 50 m grassy opening in the forest. The opening had eight large bur oak trees (*Quercus macrocarpa*) and no understory. Each pair of cabins had an upper and lower section and faced south or east (Figure 1). The roof overhang of the lower cabins was about 4 m from the ground whereas the overhang of the upper cabins was about 5 m from the ground. The pairs of cabins ranged from 18 to 24 m apart.



**Figure 1.** A pair of “sky cabins” at Camp Catron and Retreat Center in Otoe County, Nebraska where a colony of Northern Long-eared *Myotis* (*Myotis septentrionalis*) roosted in summer and fall 2014. The arrow shows the general location of the roost, but the opening to the roost is hidden by the overhang of the roof. Bats used this roost from 23 July to at least 8 October.

On 21 June 2014, we first documented and identified bats as a maternity colony of *M. septentrionalis* (three adults and one juvenile). Subsequently, we visited the site 11 additional times from 5 July to 6 November 2014. On each visit, we searched the outside of each cabin during the day for roosting bats. On seven visits we conducted emergence counts to determine the number of bats using the cabins. On one visit (5 July), we counted bats as they emerged from the roost. A video camera (Handycam HDR-XR200, Sony Corporation, Tokyo, Japan) and infrared lights were used to count bats as they emerged on four additional visits (12 August, 13 August, 3 September, and 8 October); however, on 12 August bats began emerging before the camera was recording, on 3 September an infrared light failed and it was too dark to easily see bats on video, and on 8 October at least one bat was still in the roost after we finished recording. Thus, the only night when we likely recorded all bats emerging from the roost was 13 August. During two visits (14 and 22 September), a camera triggered by an infrared sensor was used to photograph emerging bats. On the last visit (6

November), a digital videoscope (Maxivideo MV208, Autel Intelligent Technology Corporation, Shenzhen, China) was used to look inside the roost and determine whether bats were still present.

*Myotis septentrionalis* were observed roosting in three different cabins from 21 June to 8 October, and bats had vacated the cabins by 6 November. Presence of a juvenile (on the basis of size) hanging on the outside wall of a cabin near two adult bats on 21 June confirmed the group as a maternity colony. The colony was observed in a cabin on 21 June (roost one), a different cabin on 5 July (roost two, which was 24 m from roost one), and a third cabin on each subsequent visit from 23 July to 8 October (roost three, which was 18 m from roost two). All three roosts were on the front side of the cabins in a space between the outer and inner walls above the windows (Figure 1). On 5 July, we observed six bats emerge from roost two, but we heard more bats in the roost that did not emerge. On 13 August, we recorded 11 bats leaving roost three. Emergence lasted about 8 minutes; the first bat emerged 19 minutes after sunset and the last bat left the roost 27



**Figure 2.** A Northern Long-eared Myotis (*Myotis septentrionalis*) photographed on 22 September 2014 emerging from the cabin roost shown in Figure 1. The bottom of the vertical opening where the bat exited the roost is adjacent to the beam above the bat. Photo: NEBRASKAland Magazine/Nebraska Game and Parks Commission.

min after sunset. On 14 September four bats were photographed leaving roost three, and on 22 September, seven bats were photographed at the entrance of roost three, but one bat appeared to be returning to the roost. On 8 October, we recorded two bats leaving roost three; the first bat left 35 min after sunset and the second bat left 43 min after sunset, but at least one bat was still in the roost after we finished recording. All openings used as exits to roosts were 1-1.2 cm wide vertical openings that were 15-17.5 cm long (Figure 2). The opening to roost one faced south and the openings to roosts two and three faced east.

In addition to the maternity colony, a single *M. septentrionalis* was observed roosting on the outside of a pair of cabins, underneath the overhang of the roof, on six visits from 5 July to 14 September (we do not know if it was the same individual on each visit). Big Brown Bats (*Eptesicus fuscus*) were observed roosting alone on the outside of the cabins underneath the overhang of the roof from 21 June to 3 September.

The maternity colony of *M. septentrionalis* consistently was observed using cabins as roosts in southeastern Nebraska in summer and autumn 2014 before they vacated the roosts sometime between 8 October and 6 November. Some individuals might have used alternate roosts during this period, but at least some bats were observed using the cabin roosts from 21 June to 8 October. Regular use of these cabins was somewhat surprising as *M. septentrionalis* often is reported to roost in trees in summer (Garroway and Broders 2008, Foster and Kurta 1999) and commonly switch roosts (Foster and Kurta 1999, Sasse and Pekins 1996). Despite the fact that these cabins were frequently occupied by people during June, July, and August, and potential roost trees seemed to be common in the surrounding forest, the maternity colony roosted in these cabins for 3.5 months. Characteristics of the cabin roosts might help explain why this colony used these roosts so consistently.

The cabins were located at the edge of a grassy opening in the forest. The opening had a relatively closed

canopy and no understory, and the overhang of the porch roof of the cabins shaded entrances to the roosts (Figure 1). Other studies have reported that maternity roosts of *M. septentrionalis* were more shaded than those favored by other species (Broders and Forbes 2004; Timpone et al. 2010). However, Garroway and Broders (2008) observed that during the lactation period, *M. septentrionalis* used tall, well-exposed trees relative to pre- and post-lactation periods. They suggested that those roosts were selected because they received more sun exposure, raising the temperature of the cavity. The cabin roosts in our study were below the forest canopy, but several gaps in the canopy allowed sunlight to periodically strike the roofs of the cabins, possibly raising the temperature of the roosts (Figure 1). Garroway and Broders (2008) also suggested that an open canopy provided an uncluttered area, which might be important for volant young to practice flying. Entrances to the cabin roosts faced the forest opening, which provided an open area near the roost (Figure 1). Perhaps *M. septentrionalis* selected these roosts partly due to the proximity to the forest clearing, but more research is needed to determine whether this is an important component for selection of maternity roosts. Another potentially important characteristic of the roosts was the size of the openings. The vertical openings were just large enough for *M. septentrionalis* to fit through, as individuals observed exiting the roosts on video wiggled through the openings (Figure 2). Big Brown Bats were also observed roosting on the outside walls of the cabins, but the openings to the three roosts used by *M. septentrionalis* were likely too small for Big Brown Bats, as well as potential predators such as Western Rat Snakes (*Scotophilis obsoletus*, Sparks et al. 2000), to access.

Size of the maternity colony using the cabins was similar to those observed in other areas. In Michigan, maternity colonies averaged 17 individuals, but many colonies contained <12 individuals (Foster and Kurta 1999), and in New Hampshire, 75% of maternity roosts had <10 individuals (Sasse and Pekins 1996). From our observations and recordings, the number of volant individuals emerging from the roosts peaked in August and decreased slowly thereafter with some individuals still using the roost until at least early October. Smaller numbers of bats exiting the roost in September and October suggests that the colony started to disband after 13 August, with some individuals using other roosts or moving to a hibernaculum. However, at least in October, not all bats emerged during our recordings so we are not certain of the total number of bats that occupied the roost. The closest known hibernacula to our site are mines about 25 km away (Benedict 2004). We suspect that *M. septentrionalis*

roosting at Camp Catron in summer move to those mines to hibernate. Although little is known about timing of movements from summer to winter habitats for *M. septentrionalis*, the decrease in the size of this small colony agrees with a study in Indiana, where *M. septentrionalis* gradually arrived at a hibernaculum from late July to late October (Whitaker and Rissler 1992).

This is the first description of a maternity roost used by *M. septentrionalis* in the state. This species has suffered large population declines due to white-nose syndrome, and the fungus that causes the disease was recently discovered at a mine in southeastern Nebraska (White-nose-syndrome.org 2016). As white-nose syndrome spreads into the Great Plains, it is essential to identify and monitor populations of *M. septentrionalis* in this region, including maternity colonies.

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