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Volume 3, 2025 Journal of North American Bat Research No. 13

Journal of North American Bat Research

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The ***Journal of North American Bat Research*** (ISSN 2994-1075) is published by the Eagle Hill Institute, PO Box 9, 59 Eagle Hill Road, Steuben, ME 04680-0009. Phone: 207-546-2821 Ext. 4. E-mail: office@eaglehill.us. Webpage: https://www.eaglehill.us/nabr. Published on an article by article basis. **Special issue proposals are welcome**. The ***Journal of North American Bat Research*** is an open access journal. **Authors**: Submission guidelines are available at https://www.eaglehill.us/programs/journals/nabr/nabr.shtml. **Co-published journals:** The *Northeastern Naturalist*, *Southeastern Naturalist*, *Caribbean Naturalist*, and *Eastern Paleontologist*, each with a separate Board of Editors. The Eagle Hill Institute is a tax exempt 501(c)(3) nonprofit corporation of the State of Maine (Federal ID # 010379899).

2025 *Journal of North American Bat Research* 13:1–12

Intersexual Differences in Roost-site Use by Little Brown Myotis in Cypress Hills, Saskatchewan

Emma Blanken[1] and R. Mark Brigham[1, *]

Abstract - Roosts are critical to the survival and reproductive success of forest-dwelling bats. While most research on *Myotis lucifugus* (Little Brown Myotis) emphasizes reproductive females, including nonreproductive individuals may better reflect the species' flexible roosting habits. We used radiotelemetry to examine summer roost selection by nonreproductive females and males in Cypress Hills, Saskatchewan. Both sexes used *Picea glauca* (White Spruce) and anthropogenic structures, and exhibited frequent roost switching. Females alternated between maternity-associated structures and trees, while males preferred short, decayed spruce with large diameters. These findings highlight sex-based differences in roost use among nonreproductive individuals and support the need for diverse roosting options in conservation planning.

Introduction

Habitat plays a crucial role in maintaining biodiversity by providing the necessary environmental conditions and resources for animals to reproduce, locate food, and survive. Availability of roost sites is essential for forest-dwelling bats because these spaces support critical activities such as resting, raising young, and socializing (Hayes and Loeb 2007, Kunz and Lumsden 2003). Many forest-dwelling bats use tree cavities as roost sites, often selecting features such as hollow trunks, crevices, or spaces beneath exfoliating bark (Bergeson et al. 2015, Broders and Forbes 2004, Fabianek et al. 2015, Jung et al. 2004, Kunz and Lumsden 2003).

Roost selection is influenced by various factors, including predator avoidance, microclimate conditions, and proximity to foraging sites (Barclay and Brigham 1996, Lausen and Barclay 2006), but also by the sex and reproductive status of individuals (Bergeson et al. 2021, Johnson and Lacki 2014, Lausen and Barclay 2003, Micalizzi et al. 2023). For example, reproductive females select warm roosts during summer, which help accelerate gestation and promote juvenile growth. This selection provides both mothers and young more time to accumulate fat in preparation for winter (Micalizzi et al. 2023). Nonreproductive adults likely benefit from cooler roosts that facilitate torpor, allowing them to conserve energy (Bergeson et al. 2021, Johnson and Lacki 2014, Lausen and Barclay 2003). By supporting energy conservation and juvenile development, roosts play an important role in enhancing survival and fitness (Dzal and Brigham 2013, Lausen and Barclay 2006). Understanding selection of natural roosts is challenging due to the difficulty of identifying these sites and the variability in forest structure and vegetation, which influences species' preferences across regions (Humphrey 1975, Kunz and Lumsden 2003).

Species, like *Eptesicus fuscus* Palisot de Beauvois (Big Brown Bats) and Little Brown Myotis, use natural cavities in trees and rocks, as well as human-made structures like buildings and bat boxes (Bergeson et al. 2015, Jung et al. 2004, Kunz and Lumsden 2003, Micalizzi et al. 2023). For example, *Myotis lucifugus* Le Conte (Little Brown Myotis) roost

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[1]Department of Biology, University of Regina, Regina, SK S4S 0A2, Canada. *Corresponding author: mark.brigham@uregina.ca.

Associate Editor: Craig Willis, University of Winnipeg.

in various tree species across North America, including *Populus tremuloides* Michx. (Trembling Aspen) in British Columbia, *Picea rubens* Sarg. (Red Spruce) in New Brunswick, and *Quercus* spp. (oaks) and *Acer* spp. (maples) in Indiana (Bergeson et al. 2015, Broders and Forbes 2004, Psyllakis and Brigham 2006). This variation reflects the influence of geography, climate, and forest structure on roost selection. In addition to natural roosts, Little Brown Myotis use human-made structures, which are especially valuable for reproductive females, due to their warm, stable microclimates and the protection these sites offer for raising young (Barclay et al. 2024, Benedict et al. 2017, Bergeson et al. 2015, Johnson et al. 2019, Lausen and Barclay 2006, Randall et al. 2014).

While summer roost selection by forest-dwelling bats has been well studied, research examining intersexual differences is limited. Most studies focus on reproductive females or compare females to males, overlooking the potential for nonreproductive individuals to exhibit distinct behaviors. For instance, in the absence of reproductive demands, nonreproductive females may select cool, natural roosts that facilitate energy conservation through torpor. Alternatively, these bats may remain in maternity colonies to gain thermoregulatory advantages and possibly assist in juvenile care, promoting inclusive fitness through social thermoregulation or cooperative breeding (Carter and Wilkinson 2013, Kerth et al. 2002, Kunz et al. 1994). In contrast, nonreproductive males (during the maternity season all males are assumed to be nonreproductive, so henceforth, we simply refer to them as males) often roost solitarily in natural structures like tree cavities or rock crevices, with roost preferences potentially driven by microclimate, proximity to food, and reduced competition (Johnson et al. 2019, Jung et al. 2004, Randall et al. 2014). Both sexes may use similar roost types, but males are more frequently solitary (Johnson et al. 2019, Randall et al. 2014), while nonreproductive females may adopt behaviors intermediate between solitary and social roosting. The variability in roosting behavior of Little Brown Myotis highlights the need for further research aimed at better understanding the priorities influencing roost selection across sex and reproductive status. Protecting a range of roosting environments, including maternity sites and individual roosting structures, ensures that nonreproductive individuals have access to suitable habitat that supports their physiological and behavioral requirements.

Our objective was to identify roost sites used by male and nonreproductive female Little Brown Myotis in Cypress Hills, Saskatchewan, and to assess the characteristics of those sites, compared to unused roosts. Based on prior research showing that Big Brown Bats select cavities in Trembling Aspen trees in the region (Kalcounis and Brigham 1998), and in other areas (Olson and Barclay 2013, Psyllakis and Brigham 2006), we expected Little Brown Myotis to use cavities in Trembling Aspen in the Cypress Hills. We predicted that the roosts selected by males and nonreproductive females would share characteristics advantageous for energy conservation, and that these roosts would be in shorter snags with a smaller DBH (diameter at breast height) than available trees. Such characteristics facilitate cavity formation and cool microclimates that are conducive to torpor (Anderson and Wecker 2011, Clement and Castleberry 2013, Kunz and Lumsden 2003). We also predicted that nonreproductive females would alternate between roosting at a known maternity colony (several barns and a bat box), and natural roosts, leveraging the thermoregulatory, social, and protective benefits of both.

Field-site Description

The Cypress Hills are an elevated plateau, up to 1466 m above sea level and standing ~600 m above the surrounding plains, which results in significant local relief (Acton et al. 1998). This region features grasslands and mixed coniferous and deciduous forests predominantly composed of *Pinus contorta* Douglas ex Loudon (Lodgepole Pine), Trembling Aspen, and *Picea glauca* Moench (White Spruce) (Newsome and Dix 1968). Our work was focused in the West Block of Cypress Hills Interprovincial Park (348 km²; Robinov et al. 2021) in southwest Saskatchewan, Canada (49.57° N, 109.88° W). The area has few buildings and roads, although there is a known maternity colony of Little Brown Myotis using 3 metal-roofed barns, constructed side-by-side with less than 5 m between them, and an associated single-chamber bat box mounted on the north-facing wall of 1 barn.

Methods

We captured Little Brown Myotis in mist nets set over Battle Creek (a river flowing east through the park), on surrounding private land in mixed-forest stands, or outside the maternity roost between 1 June and 30 August in 2022 and 2023. After capture, we kept bats in individual cloth bags until age, sex, mass, right forearm length, and reproductive status were recorded. To assess reproductive status, we relied on external indicators. For females, these encompassed readily identifiable signs of current pregnancy (palpable fetus) or lactation (enlarged, visible nipples with signs of milk production). Females classified as nonreproductive exhibited no physical evidence of pregnancy or lactation. Given that we did not catch animals until 1 June, pregnancy likely was far enough advanced to be easily detectable. We affixed a radio transmitter (Holohil Systems, Ltd., Carp, ON, Canada; Models BD-2 and BD-2N in 2022, Models LB-2 and LB-2N in 2023), using a latex-based surgical glue (Skin Tac Liquid Adhesive, Torbot Group, Inc., Cranston, RI, in 2022; Sauer-Hautkleber Skin Adhesive, Lohmann & Rauscher, Inc., Neuwied, Germany, in 2023). Radio tags weighed <5% of the individual's body mass (Aldridge and Brigham 1988), and we released individuals within 10 minutes after tagging, with no individual being held for >1 h. All protocols were approved by the University of Regina President's Committee on Animal Care (and authorized by both provincial and federal permits).

On the day following release, we tracked tagged individuals to their diurnal roosts, using a handheld receiver (R-1000; Communication Specialists, Inc., Orange, CA) and 3-element Yagi antenna (AF Antronics, Inc., Urbana, IL). We tracked individuals until the telemetry signal could no longer be located, or until the tag was confirmed to have fallen off (e.g., signal remained in 1 location for >5 days or the tag was recovered).

Roost characteristics

When an occupied roost was located, we noted its structure as anthropogenic (e.g., building, bat box) or natural (tree), to assess the proportion of tracked individuals occupying natural versus anthropogenic roosts. We compared characteristics of occupied roost trees to randomly available trees, to characterize natural roost selection. Once a tree was identified, we recorded species, height, DBH, and decay condition, following the 9-stage classification system outlined by Thomas (1979), which ranges from live trees (Class 1) through various stages of decline and decomposition (Classes 2–8), ending with stumps (Class 9).

We identified 4 potentially available trees around each natural roost by selecting 4 directions (NE, NW, SE, SW) and walking a random distance (20–50 m) in each direction. The random distance was determined using a random number generator (Coder Technologies, Inc., Austin, TX). At each point, we selected the nearest tree that met minimum size criteria. We defined an appropriate tree as any woody perennial with a trunk ≥1.5 m in height with a DBH >10 cm, regardless of species or decay condition. We recorded the same characteristics measured at natural roosts for each of the random available trees.

We recorded the number of days an individual remained in a roost to determine the average duration spent in the structure. We excluded individuals whose transmitters remained in a tree for >7 days from this calculation (*n* = 5), as the transmitter was assumed to have detached in the roost. Previous studies investigating roost-switching behavior of tree-roosting bats report that individuals typically occupied a roost for an average of 2 days (Brigham 1991, Lewis 1995, Micalizzi et al. 2023) and that transmitters remained attached for an average of 9 days (Brigham 1991, O'Mara et al. 2014). As a precaution, we tracked individuals long past the 2-day roost-switching average and verified that individuals had not left a roost by radio tracking them every night for the 7-day period. We considered "roost switching" to include both individuals that shifted between types of roosting structures and females that moved between maternity colony structures (e.g., between barns or to the bat box).

Temperature measurements

We used temperature-sensitive data loggers (HOBO MX2201, Onset Computer Corporation, Inc., Bourne, MA) in 2023 to quantify the ambient temperature surrounding male-occupied roosts. Loggers were placed in 2 trees that had been confirmed as male-occupied roosts that year. We also positioned 1 logger in a tree that had been used by a male in 2022, based on the assumption that similar temperature fluctuations would occur in 2023. For each of these trees, we paired the logger with another placed in a nearby, randomly selected available tree that met similar structural characteristics but showed no evidence of bat use. To select available trees, we used the same approach described previously for identifying potentially available roosts: we chose 1 of 4 directions (NE, NW, SE, SW), and using a random number generator, walked a distance between 20 and 50 m, and selected the nearest tree that met minimum size criteria (≥1.5 m in height, DBH >10 cm), regardless of species. All trees selected for temperature measurements were alive, had a decay class of 1, and lacked visible cavities, because these were the only trees deemed safe to climb. Loggers were affixed with zip ties to a south-facing branch approximately halfway up the tree and adjacent to the main trunk. We assumed that bats were roosting beneath or within dense foliage, so logger placement was intended to reflect the ambient microclimate of these shaded roosting environments. We deployed loggers in 3 male-occupied White Spruce trees and the associated potentially available trees and measured temperatures hourly for 7–25 days. These hourly readings were averaged to obtain a daily temperature value, which was used for all subsequent statistical comparisons. Given that previous studies investigating roost-switching behavior of tree-roosting bats have shown that individuals typically remain in a roost for an average of 2 days (Brigham 1991, Lewis 1995, Micalizzi et al. 2023), and that transmitters were typically attached for an average of 9 days (Brigham 1991, O'Mara et al. 2014), we tracked roost temperatures for a minimum of 7 days. This duration was enough time to account for typical roost-switching behavior, while also providing a robust dataset for temperature comparisons.

Data analysis

Using R version 4.3.3 (R Core Team 2021), we analyzed tree characteristics with generalized linear models (GLMs), assuming a binomial distribution and a logit link function, to compare occupied roosts with available trees. Predictor variables included tree species, decay class, height, and DBH, and we ran separate models for males and nonreproductive females. Tree species was not included for females, as all females roosted in the same species. Confidence intervals were calculated at the 95% level, and we considered predictor variables statistically significant at the *P* = 0.05 level, when their confidence intervals did not include zero. To compare daily temperature between each roost and its associated available tree, we used paired-sample t-tests based on 7 daily average values per pair.

Results

We affixed radio-tags to 30 nonreproductive individuals (14 females and 16 males, including 2 juvenile males) over the 2 summers (2022, 2023) and successfully tracked 19 individuals (10 females and 9 males, including the 2 juveniles) for an average of 6 ± 0.8 (*SE*) days in 2022 and 7.9 ± 1.2 days in 2023. We tracked bats to a total of 25 unique roost sites, including 8 buildings, 1 bat box, and 16 trees (Fig. 1). The remaining 11 individuals were not tracked to roosts due to tag failure or limited detection range. Nonreproductive females predominantly used anthropogenic structures associated with the maternity roost, whereas males primarily used natural roosts, mostly in White Spruce.

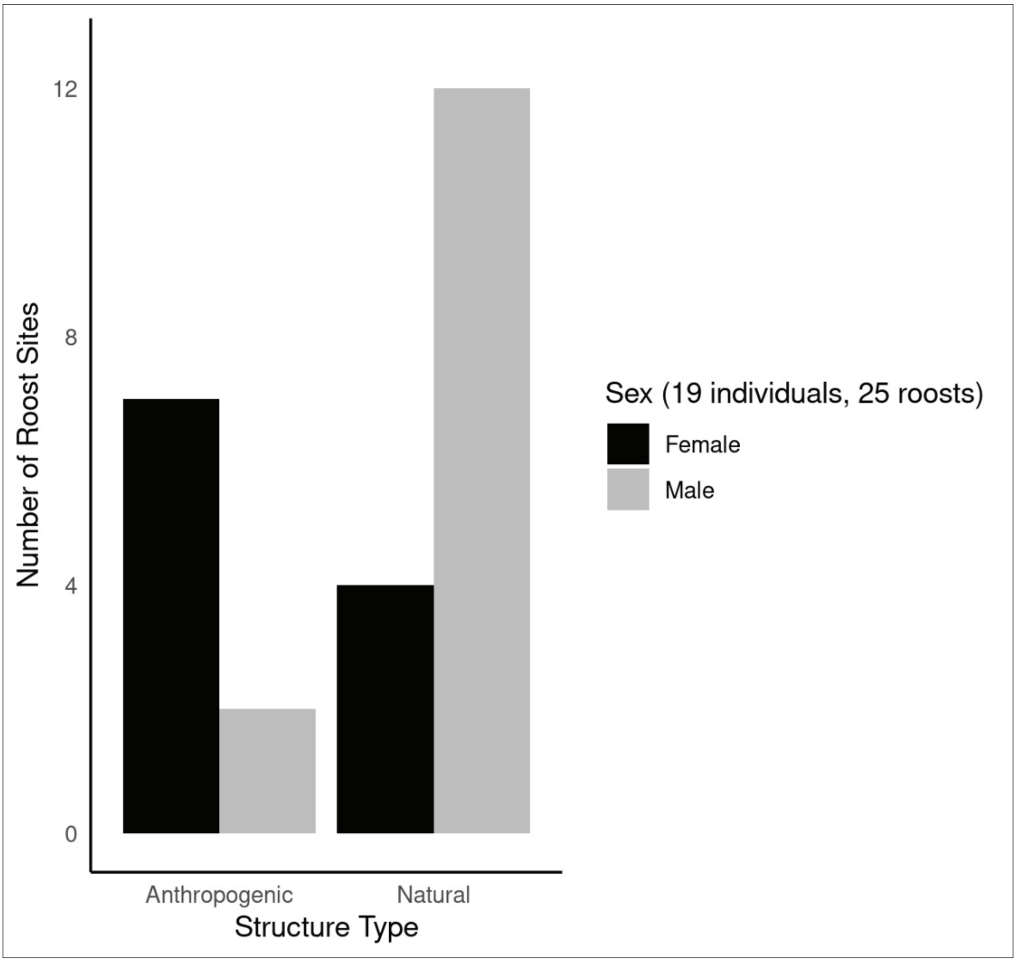

Figure 1. Roost type use by 19 radio-tracked individuals (10 females, 9 males), categorized by sex and roost type (natural vs. anthropogenic). These 19 individuals were tracked to a total of 25 unique roost sites across the 2022 and 2023 field seasons.

Nonreproductive females roosted in White Spruce (4 of 11 total roosts; 4 of 10 individuals), with a mean decay class of 1.3 ± 0.3, indicating an alive condition. The trees had a height of 20.1 ± 2.9 m and DBH of 39.6 ± 6.4 cm. In comparison, available trees had a mean decay class of 2.4 ± 0.2, indicating a declining condition, with a height of 16.4 ± 0.9 m and a DBH of 34.9 ± 2.5 cm. The generalized linear model showed that none of the variables significantly predicted roost occupancy for females ($P > 0.05$; Table 1). The remaining 6 nonreproductive females, which were part of a maternity colony, used a variety of structures which included 3 barns and 1 bat box. A shared characteristic of the anthropogenic roosts used by the colony, excluding the bat box, was the presence of metal roofing, which has been shown to contribute to greater thermal variability and higher daytime temperatures compared to other roofing materials (Law and Chidel 2007, Williams and Brittingham 1997). This solar heat gain may be particularly beneficial for reproductive females. Three individuals switched between these anthropogenic structures and natural roosts. Each of the 8 anthropogenic roosts was treated as separate even though 3 barns and the bat box were used by members of the same colony. Anthropogenic roosts were treated as distinct from the natural White Spruce roosts.

Males predominantly roosted in White Spruce (11 of 14 total roosts; 9 of 9 individuals), although 1 individual also used a Trembling Aspen, and the remaining 2 roosted in 2 separate anthropogenic structures (Fig. 1). Male tree roosts had a mean decay class of 3.3 ± 0.5, indicating a decaying state, a height of 10.8 ± 1.8 m, and a DBH of 37.3 ± 4.4 cm. Available trees had a mean decay class of 2.4 ± 0.2, a height of 16.4 ± 0.9 m, and a DBH of 32.2 ± 1.9 cm. The generalized linear model suggested a trend for males to roost in shorter trees than those available, although this effect did not reach our significance threshold ($P = 0.06$; Table 2).

Of the 19 individuals we successfully tracked, roost switching was confirmed for 5 bats (2 males, 3 females), each of which was successfully tracked to a series of roost sites. On average, these individuals used the same site for 2.2 ± 0.3 days. Eight additional individuals left their original roosts, but the new locations could not be confirmed due to lost or undetectable signals. Five bats were excluded from switching analyses because their transmitters remained stationary for more than 7 days, suggesting detachment. Therefore, only the 5 individuals presented here were confirmed to have switched roosts. One male first used a live White Spruce, remaining there for 3 days before moving to another live spruce for 5 days. The male then switched to a Trembling Aspen snag for 3 days before relocating to a different live spruce. A second male initially roosted in a live spruce for 3 days, then moved to a spruce snag for 4 days, followed by another spruce snag for 2 days. One female remained in a maternity barn for 3 days, switched to the bat box attached to that barn for 1 day, then moved to another maternity barn for 3 days until the signal was lost. Another

Table 1. Results of a generalized linear model comparing the probability (log-odds) of occupation of identified occupied tree roosts of females ($n = 4$) and potential available roosts for females ($n = 16$), based on decay condition, height, and DBH.

Predictor variable	Estimate	*SE*	*z*	*P*	Confidence interval (95%)
Condition	-0.34	0.67	-0.50	0.62	-2.98–0.57
Height	0.05	0.09	0.57	0.56	-0.12–0.28
DBH	-0.004	0.02	-0.24	0.81	-0.05–0.02

female initially roosted in a live spruce; the signal then went undetected for 1 day but was located in a maternity barn the subsequent day. A third female initially roosted in a maternity barn and then relocated to a stand of mixed spruce and aspen at the base of a cliff. Over the course of 5 days, the individual alternated nightly between this barn and a tree roost at the cliff base. Although the precise tree in the cliff area could not be identified, the roosting location remained within the same general area each time the signal was detected.

Two male-occupied roosts had significantly lower average daily temperatures than their respective available sites: 19.3 ± 0.7 °C vs. 20.2 ± 0.8 °C (t_{12} = -4.3, $P < 0.01$), and 17.9 ± 0.8 °C vs. 18.6 ± 0.7 °C (t_{13} = -9.7, $P < 0.01$). The temperature of the third occupied roost tree in 2022 (19.2 ± 0.7 °C) was not significantly different (t_{16} = -1.7, $P > 0.01$) than that of the available site (19.3 ± 0.7 °C).

Discussion

We found intersexual differences in roost use among Little Brown Myotis in Cypress Hills, Saskatchewan. Nonreproductive females used anthropogenic structures associated with a maternity colony, whereas males predominantly used natural roosts in White Spruce trees. Previous studies on bats, including the Little Brown Myotis, indicated that group roosting can enhance warmth and reduce the energetic costs of maintaining body temperature, which would be particularly beneficial in the cooler, high-elevation environment of the Cypress Hills (Kerth 2008, Lausen and Barclay 2006, Micalizzi et al. 2023). Nonreproductive female bats may assist with juvenile care through grooming and clustering behavior, promoting rapid growth and development (Hoying and Kunz 1975, Kunz et al. 1994) and thus increasing inclusive fitness (Carter and Wilkinson 2013, Kerth et al. 2002).

Roost switching occurred in both sexes but was expressed differently by males and females. Nonreproductive females used both anthropogenic maternity colony roosts and natural roosts, with 1 individual switching daily between maternity roosts and a stand of aspen and spruce trees over a 5-day period. This repeated return to the maternity roosts suggests a degree of fidelity to the structures, even when alternative sites were available. Additionally, 1 female only used the maternity roost barns and the bat box. In contrast, males exclusively switched among natural roosts. Notably, 1 male switched between White Spruce trees and a Trembling Aspen, suggesting flexibility in use of natural roosts based on structural characteristics or microclimatic conditions. For both males and nonreproductive females, the average duration spent in a roost (about 2 days) was consistent with other studies on roost fidelity and suggests that frequent roost switching may be a common strategy to

Table 2. Results of a generalized linear model comparing the probability (log-odds) of occupation of identified occupied tree roosts of males ($n = 12$) and potential available roosts for males ($n = 48$) based on tree species, condition, height, and DBH.

Predictor variable	Estimate	*SE*	*z*	*P*	Confidence interval (95%)
Species	-1.62	1.12	-1.44	0.15	-4.61–0.25
Condition	-0.02	0.25	-0.09	0.93	-0.53–0.46
Height	-0.16	0.08	-1.87	0.06	-0.35–(-)0.01
DBH	0.01	0.009	1.41	0.16	-0.005–0.03

exploit changing environmental conditions and resource availability, or to interfere with parasite life cycles (Brigham 1991, Lewis 1995, Micalizzi et al. 2023). However, the patterns of roost switching reflect different behavioral strategies in roost use between males and nonreproductive females.

One common characteristic of the anthropogenic structures females used (excluding the bat box) was the presence of metal roofs. While all enclosed wooden structures tend to buffer temperature extremes, metal roofing contributes thermal variability, often leading to conditions that are warmer than ambient during the day and similar to ambient at night (Law and Chidel 2007, Williams and Brittingham 1997). This thermal variability may offer energetic benefits, particularly due to the solar heat gain that occurs during the day. While wooden structures can also retain heat, they are generally more thermally buffered and do not reach the same daytime temperatures as metal-roofed structures did (Law and Chidel 2007). This distinction is important, as the heightened solar gain of metal roofs may offer greater opportunities for energy conservation and more rapid juvenile development (Lausen and Barclay 2006, Williams and Brittingham 1997). Law and Chidel (2007) estimated that lactating *Vespadelus troughtoni* Kitchener, Jones, and Caputi (Eastern Cave Bats) roosting under a metal roof in Australia saved 27–35% of daily energy costs compared to those roosting in caves. Similarly, maternity colonies of Big Brown Bats in Pennsylvania preferred tin-roofed buildings, likely due to elevated temperatures that supported reproduction (Williams and Brittingham 1997). Nonreproductive females may also use metal-roofed structures to maintain high body temperatures at a lower metabolic cost, though direct measurements of energetic savings are needed. Williams and Brittingham (1997) suggested that metal roofs could be more accessible to bats, but Benedict et al. (2017) found no impact of roof structure on Big Brown Bat occupancy. We identified 2 males roosting in buildings separate from roosts used by the maternity colony. These structures did not have metal roofing, suggesting that maintaining high body temperatures may not be a high priority for males during summer, or that, as shown by Benedict et al. (2017), roof structure is not a significant predictor for Little Brown Myotis occupancy in buildings.

Nonreproductive females roosted in taller and larger White Spruce than what was available in the surrounding environment, which was not consistent with the expectation that nonreproductive individuals would roost in cooler sites to facilitate torpor (Johnson and Lacki 2014, Speakman and Rowland 1999). Taller trees are generally warmer due to increased exposure to sunlight, which may reduce the need for metabolic heat production by bats (Anderson and Wecker 2011, Clement and Castleberry 2013, Kunz and Lumsden 2003). A meta-analysis (Kalcounis et al. 2005) highlighted similar selection for tall (and potentially warm) trees by reproductive Little Brown Myotis. However, the use of live trees by nonreproductive females in our study differs from the pattern reported by Kalcounis et al. (2005), who found that Little Brown Myotis typically selected trees in stands with a low ratio of live trees to snags, presumably due to the greater availability of cavities in dead or decaying trees. In contrast, nonreproductive females in our study roosted in living White Spruce. This suggests that factors beyond cavity availability, such as thermal buffering, may influence roost selection. Individuals may roost beneath exfoliating bark or within dense foliage, which facilitates passive heat retention, as in female *Lasiurus cinereus* (Palisot de Beauvois) (Hoary Bat) in the same study area (Willis and Brigham 2005). This behavior contrasts with expectations that Little Brown Myotis would primarily use trees with cavities (Bergeson et al. 2015, Kunz and Lumsden 2003). The tendency of nonreproductive females to roost in live, large White Spruce and anthropogenic structures with metal roofs may be influenced by the short and cool summers characteristic of the high-elevation environment of Cypress Hills. Warm roosts can lower the energetic cost of maintaining body temperature through passive heat retention, and may be advantageous even for nonreproductive individuals (Micalizzi et al. 2023). Additionally, the high fidelity of nonreproductive females to the maternity roost suggests that social factors, such as maintaining social bonds and assisting relatives, may play a role in roost selection as well.

In contrast to nonreproductive females, males roosted in shorter trees with large DBHs, and in advanced decay stages. This use may reflect males' need for cooler microclimates, as shorter trees typically receive less sun, which would facilitate deeper torpor and greater energy conservation (Anderson and Wecker 2011, Clement and Castleberry 2013, Fabianek et al. 2015, Johnson and Lacki 2014, Randall et al. 2014). Temperature data from our male-occupied roosts support this hypothesis, with 2 of the 3 sites exhibiting significantly cooler daily temperatures than randomly selected trees. The use of decayed trees aligns with research highlighting their importance in providing physical protection, which is especially important during torpor when bats are vulnerable to predators (Jung et al. 2004, Randall et al. 2014, Vonhof and Barclay 1996). Unlike nonreproductive females, whose roost selection may be influenced by the potential of roosts to retain heat and provide space for social thermoregulation, males appear to prioritize a cooler microclimate, suggesting that decay stage and temperature affect their roost choice due to the need for protection and energy conservation during torpor.

Our results highlight different roosting strategies between male and nonreproductive female Little Brown Myotis, likely driven by physiological needs and environmental pressures. Nonreproductive females largely roosted in anthropogenic structures, particularly those with metal roofs, possibly due to benefits related to social thermoregulation and energy savings. Males predominantly roosted in decayed White Spruce trees that provided cool microclimates conducive to torpor. This intersexual difference suggests an interplay between ecological constraints, individual energy budgets, and habitat use, and underscores the importance of conserving a diversity of roosting habitats, from anthropogenic structures to natural roosts, to support varying needs of different individual bats. These findings may inform further exploration into how roost availability and microclimate shifts driven by anthropogenic changes influence roost selection.

Understanding intersexual differences in roost selection is essential for the conservation of Little Brown Myotis, particularly in the face of threats such as white-nose syndrome and habitat changes driven by climate, wildfires, and human activities (Henderson et al. 2002). Effective conservation strategies must address the distinct needs of both sexes by preserving and managing roosting habitats. For females, maintaining maternity colonies and associated structures is critical, as these provide roosting habitat for reproductive individuals, their young, and nonreproductive individuals alike. Structures with metal roofs may offer thermoregulatory benefits that enhance reproductive success and survival (Law and Chidel 2007, Williams and Brittingham 1997). The strong fidelity of nonreproductive females to these structures suggests that anthropogenic roosts may offer advantages beyond reproduction, such as energy savings and social bonding. Preserving White Spruce stands is equally important, as these roosts may facilitate energy conservation for males and nonreproductive females. The adaptability in roost use by Little Brown Myotis in the Cypress Hills suggests that individuals can cope with habitat alterations if suitable roosting alternatives are available.

Acknowledgments

This research was conducted on Treaty 4 land, the territory of the Nêhiyawak, Anihšināpēk, Dakota, Lakota, Nakoda, and the homeland of the Métis/Michif Nation. The research was funded by a grant from Environment and Climate Change Canada and by a Grant-in-Aid of research from the American Society of Mammalogists. We thank Bird and Bat Lab members for their help in the field, and we are especially grateful to the staff at Fort Walsh National Historic Site, especially Harvey Kay, for their support in resolving numerous logistical headaches. We also thank Arboriculture Canada Training & Education for their support and resources contributing to fieldwork safety and efficiency.

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