Bat Activity Studies for the Rose Creek Wind Project Mower County, Minnesota

April 16 – October 20, 2021

Prepared for:

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WEST

EXECUTIVE SUMMARY

Consolidated Edison Development, Inc., a renewable energy development and operations company doing business as Rose Creek Wind, LLC., is planning to decommission and replace turbines as a part of the repowering effort at the proposed Rose Creek Wind Project in Mower County, Minnesota. Western EcoSystems Technology, Inc. conducted a general acoustic bat survey to estimate levels of bat activity throughout the Project area during the spring, summer, and fall. The objectives for this study were to assess spatial and temporal trends in bat activity within the Project area by recording bat activity in habitat representative of the agricultural area where turbines will be placed. Habitat that contained features attractive to bats was also monitored to determine an upper threshold of bat activity and improve the potential species composition assessment for the Project.

Acoustic surveys were conducted from April 16 – October 20, 2021 at two monitoring stations. At each station, one SM3BAT ultrasonic detector (SM3) was positioned 1.5 meters (4.9 feet) above ground level. One station was located in cropland, which is the dominant land cover type within the Project area and representative of planned turbine locations ('representative station'), and one station was placed along a creek riparian system, which is considered habitat attractive to bats for foraging and drinking('bat feature station').

Activity was higher at the bat feature station RW2g (98.35 ± 14.15 bat passes per detector-night) compared to the representative station at RW1g (6.37 ± 0.73 bat passes per detector-night). The bat feature station on average recorded almost 16 times more activity than the representative station.

Mean bat activity was higher in the summer at representative (8.90 ± 1.63) and bat feature stations (224.82 ± 30.24), followed by fall (6.04 ± 0.82 and 39.98 ± 3.62, respectively), and lowest in the spring (2.00 ± 0.48 and 24.29 ± 7.88, respectively). Weekly acoustic activity at the representative station was relatively low from mid-April to late June, but started increasing in early July, peaking for all bats from July 18 to July 24 (35.5 bat passes per detector-night). Bat activity remained high until it began to decrease mid-September, and was low and decreasing for the remainder of the survey period. Overall bat activity was 6.87 ± 0.77 during the FMP at the representative station. Overall activity at the bat feature station peaked from July 20 to July 26 (685.0 bat passes per detector-night), and then activity decreased and remained low for the rest of the study period.

Overall, 66% of bat passes recorded at the representative station were classified as low frequency (LF; belonging to species such as big brown bats, hoary bats, and silver-haired bats) and 34% were classified as high frequency (HF; belonging to species such as tri-colored bats, eastern red bats, and *Myotis* species). Of the total bat passes recorded at the bat feature station, 72% were classified as LF and 28% were classified as HF. There was significantly more activity by LF bat species than HF bat species at both stations.

Kaleidoscope Pro version 5.4.0 (Kaleidoscope) identified bat calls for eight species with the potential to occur within the Project area. Hoary bats and silver-haired bats were the primary species recorded, present on 83% and 79% of all calendar nights, respectively, followed by big brown bats on 77% of calendar nights. Other commonly detected species included little brown bat (73%), eastern red bat (53%), evening bat (39%), and tri-colored bat (30%). Little brown bats, tri-colored bats, and big brown bats are state-listed in Minnesota as Species of Special Concern.

Possible northern long-eared bat (federally listed as threatened) calls were identified by Kaleidoscope on 9% of all calendar nights at the bat feature station. However, none of the 21 bat calls Kaleidoscope classified as potential northern long-eared bat were confirmed during manual vetting and all were reclassified. Eleven of the 21 calls were reclassified as unknown HF species and 10 were reclassified as little brown bat calls.

STUDY PARTICIPANTS

Maggie Voth	Project Manager
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REPORT REFERENCE

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INTRODUCTION

Consolidated Edison Development, Inc. ("**CED**"), a renewable energy development and operations company doing business as Rose Creek Wind, LLC ("**Rose Creek**"), is planning to repower the existing Rose Wind Project in Mower County, Minnesota. The existing Rose Wind Project, which is owned by CED, contains 11 turbines built in 2004 and 2005. The new wind facility, called the Rose Creek Wind Project ("**Project**"), would consist of up to seven wind turbines and their associated infrastructure, and would deliver up to 17.4 megawatts (MW) of electricity to Dairyland Power.

At CED's request, Western EcoSystems Technology (WEST) conducted acoustic bat activity surveys to characterize bat activity patterns within the Project area. Survey methodologies adhered to the recommendations provided in the U.S. Fish and Wildlife Service (USFWS) *Land-based Wind Energy Guidelines* (USFWS 2012) and the Minnesota Department of Natural Resources (MNDNR) and Minnesota Department of Commerce (MNDOC) *Avian and Bat Survey Protocols for Large Wind Energy Conversion Systems in Minnesota* (Mixon et al. 2014). The approach was discussed with the MNDNR and MNDOC and was approved on February 25, 2021 and March 4, 2021, respectively.

The study assessed spatial and temporal (seasonal) trends in bat activity within the Project area by recording bat activity in habitat representative of the agricultural areas where turbines will be placed. Habitat that contained features attractive to bats was also monitored to determine an upper threshold of bat activity and identify species likely to be present within the Project area. This report describes the results of the acoustic activity study conducted within the Project area from April 16 – October 20, 2021.

SURVEY AREA

Project Area

The Project boundary encompasses approximately 5,258 acres in Mower County, Minnesota (Figure 1). The Project falls within the Western Corn Belt Plains Level III Ecoregion, which is composed of glaciated till plains and undulating loess plains (U.S. Environmental Protection Agency 2012). Historically, tallgrass prairies and oak (*Quercus* spp.) savannas were the primary land covers in the region; however, the majority of the area has since been converted to row-crop agriculture (White 2020). The majority (95.8%) of the Project consists of cultivated cropland (Table 1; Figure 2). Developed open space encompasses an additional 3.4% of the Project, with the rest of the land cover types each comprising less than 1% of the Project area. Forest patches and open water resources are limited within the Project area; however, Little Cedar River, Wapsipinicon River, and their tributaries and forested riparian corridors may provide suitable roosting and foraging habitat near the Project (Figure 2).

Figure 1. Location of the Rose Creek Wind Project in Mower County, Minnesota.

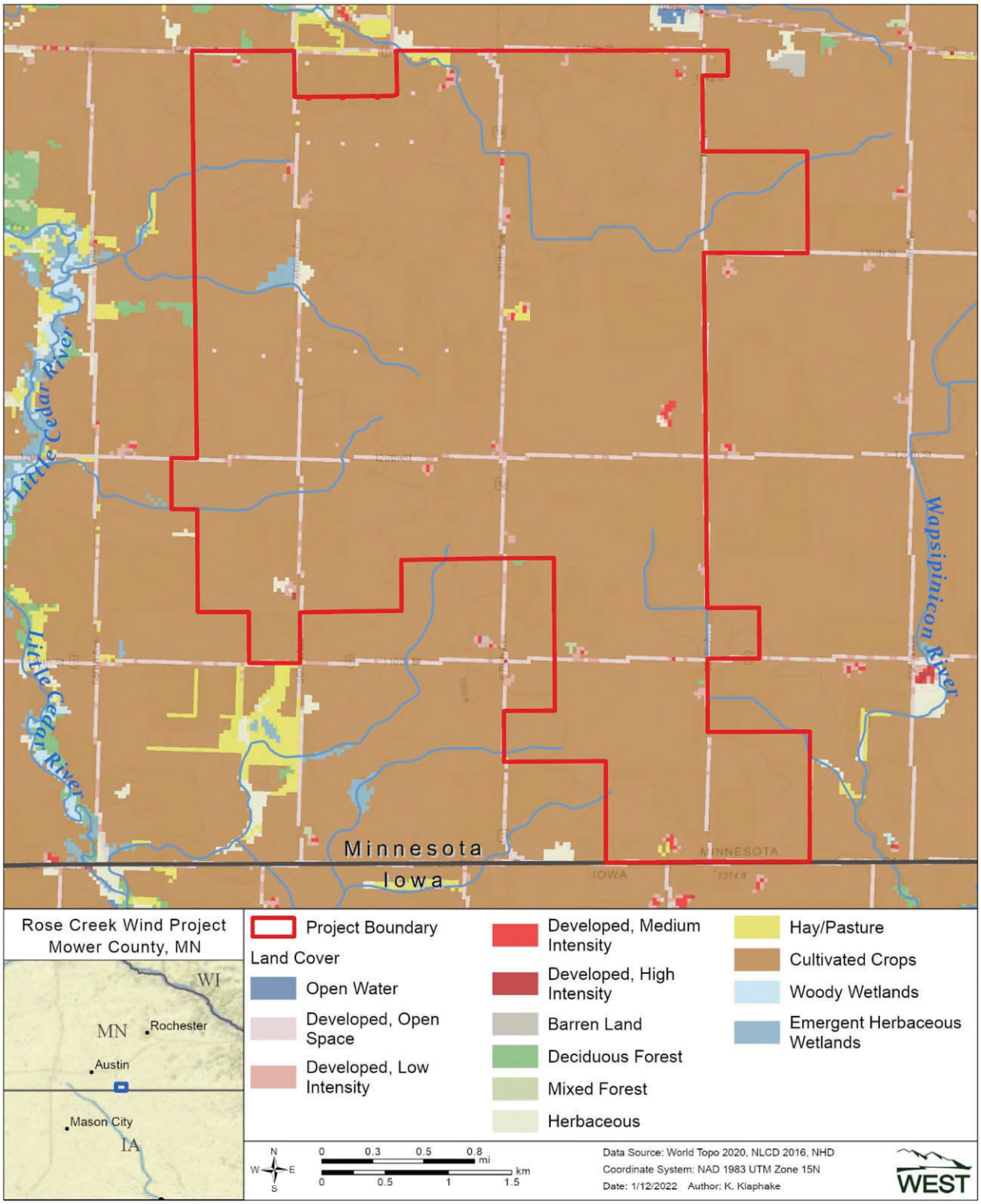

Figure 2. Land use/land cover types within the Rose Creek Wind Project.

Table 1. Land use/land cover types present within the Rose Creek Wind Project.

Cover Type	Acres	Percent (%)
Cultivated Crops	5,038	95.8
Developed	181	3.4
Hay/Pasture	14	0.3
Herbaceous	13	0.3
Emergent Herbaceous Wetlands	10	0.2
Deciduous Forest	1	<0.1
Mixed Forest	1	<0.1
Barren Land	<1	<0.1
Total	**5,258**	**100**

Source: National Land Cover Database 2016

Overview of Bat Diversity

Nine bat species have the potential to occur within the Project area (Table 2), four of which are federally listed or state-listed in Minnesota (MNDNR 2013; MNDNR 2015; Swingen et al. 2016). Northern long-eared bats (*Myotis septentrionalis*) are federally listed as threatened, and big brown bats (*Eptesicus fuscus*), little brown bats (*Myotis lucifugus*), and tri-colored bats (*Perimyotis subflavus*) are state-listed as species of special concern (USFWS 2016; MNDNR 2013). The little brown bat and tri-colored bat are currently being evaluated for listing under the Endangered Species Act and the northern long-eared bat[1] is being evaluated for potential uplisting to endangered status or change to the existing 4(d) rule. Listing decisions for these three species are expected in 2022 (USFWS 2021).

Additionally, in September of 2021, an western small-footed bat (*Myotis ciliolabrum*) was documented for the first time in Ramsey County, Minnesota (Hoff 2021), when a single individual was brought into a wildlife rehabilitation center. This is the only record of the species in the state; however, due to the confirmed presence, this species has been included as a potentially occurring species for the Project (Table 2), though it has yet to be determined if this represents a range expansion or is a vagrant individual (Hoff 2021).

[1] In January 2020, the D.C. District Court found that the USFWS decision to list the northern long-eared bat as threatened rather than endangered was arbitrary and capricious; the D.C. District Court remanded the listing decision back to the USFWS for reevaluation. The current threatened status and 4(d) rule remain in effect while the USFWS re-examines the northern long-eared bat listing decision, which is expected in 2022.

Table 2. Bat species with potential to occur within the Rose Creek Wind Project categorized by echolocation call frequency.

Common Name	Scientific Name
High Frequency (≥30 kHz)	
northern long-eared bat[1,2,4]	*Myotis septentrionalis*
eastern red bat[1,3]	*Lasiurus borealis*
little brown bat[1,4]	*Myotis lucifugus*
tri-colored bat[1,4]	*Perimyotis subflavus*
evening bat[1]	*Nyctecius humeralis*
western small-footed bat	*Myotis ciliolabrum*
Low Frequency (≤30 kHz)	
big brown bat[1,4]	*Eptesicus fuscus*
silver-haired bat[1,3]	*Lasionycteris noctivigans*
hoary bat[1,3]	*Lasiurus cinereus*

[1] species known to have been killed at wind energy facilities (American Wind Wildlife Institute 2018);

[2] federally threatened species (US Fish and Wildlife Service 2016);

[3] long-distance migrant; and

[4] state-listed species of special concern (Minnesota Department of Natural Resources 2013)

kHz = kilohertz

METHODS

Bat Acoustic Surveys

The bat activity survey was conducted to estimate the level of bat activity throughout the Project area from April 16 – October 20, 2021, when bats are typically active or migrating in Minnesota. Acoustic surveys can be used to assess the spatial distribution, timing, and species composition of bats and may provide insights into the possible impacts of wind development (Kunz et al. 2007; Britzke et al. 2013; Loeb et al. 2015).

Survey Stations

Two full-spectrum Song Meter SM3BAT ultrasonic detectors (hereafter “SM3”; Wildlife Acoustics, Maynard, Massachusetts) were deployed at two stations during the survey period (Figure 3). One SM3 detector was positioned 1.5 meters (m; 4.6 feet [ft]) above ground level in cropland, the dominant land cover type at the Project (Table 1). This location is representative of potential turbine locations within the Project area (representative station). The second station was placed in habitat with features considered attractive to bats for foraging, drinking, or roosting opportunities (bat feature station; e.g., riparian forest, forest edges, ponds, streams, and forested flyways). Monitoring at these features provides an upper threshold for bat activity within the Project area that can be used for comparison to representative stations. A federally permitted bat biologist (Brenna Hyzy, M.S.) selected the location of the bat feature station. The bat feature station was located near the ground along a forested riparian stream, which could serve as both foraging and commuting habitat for local bats.

The SM3 microphones are weatherproof, and were secured atop a wooden pole at ground stations with a metal grounding wire. SM3 microphones have a variable detection distance (approximate maximum detection distance of 98 ft [30 m]), influenced by atmospheric attenuation

(e.g., changes with humidity, temperature, and air pressure), surrounding vegetation, and wind, as well as the bat's call frequency, amplitude, and direction.

Survey Schedule

Bat activity surveys were conducted from April 16 – October 20 and detectors were programmed to turn on 30 minutes (min) before sunset and turn off 30 min after sunrise each night. To highlight seasonal activity patterns, the study was divided into three survey periods: spring (April 16 – May 15), summer (May 16 – July 31), and fall (August 1 – October 20). Mean bat activity was also calculated for a standardized Fall Migration Period (FMP), defined here as July 30 – October 14. WEST defined the FMP as a standard for comparison with activity from other wind projects. During this time, North American bats generally begin moving toward wintering areas, and many bat species initiate reproductive behaviors (Cryan 2008). This period of increased landscape-scale movement and reproductive behavior is often associated with increased levels of bat fatalities at operational wind energy facilities (Arnett et al. 2009; Arnett and Baerwald 2013).

Data Collection and Call Analysis

The SM3 is a full-spectrum bat detector that records complete acoustic waveforms by sampling sound waves at a rate of 256 kilohertz (kHz). This high sampling rate enables the detector to make high-resolution recordings of sound amplitude data at all frequencies up to 128 kHz. Full-spectrum data were transformed into zero-crossing data using the program Kaleidoscope Pro version 5.4.0 (hereafter, "Kaleidoscope"; Wildlife Acoustics, Maynard, Massachusetts), allowing data to be viewed in Analook© software as digital sonograms that show changes in echolocation call frequency over time. Frequency versus time displays were used to separate bat calls from other types of ultrasonic noise (e.g., wind, rain, insects, etc.) and to determine the call frequency category. The terms "bat pass" and "bat call" are used interchangeably. A bat pass was defined as a sequence of at least two echolocation calls (pulses) produced by an individual bat with no pause between calls of more than one second (Fenton 1980, Gannon et al. 2003).

For each survey location, bat passes were sorted into two groups based on their minimum call frequency. Bats with high frequency (HF) calls, such as eastern red bats (*Lasiurus borealis*) and *Myotis* species, have minimum frequencies greater than or equal to 30 kHz. Bats with low frequency (LF) calls, such as big brown bats, silver-haired bats (*Lasionycteris noctivagans*), and hoary bats (*Lasiurus cinereus*), typically emit echolocation calls with minimum frequencies at or below 30 kHz. HF and LF species with the potential to occur in the Project area are listed in Table 2.

Call files that were confirmed to contain bat passes were then run through the automated species identification feature in Kaleidoscope using the Bats of North America classifier 5.4.0 (Wildlife Acoustics) at the neutral sensitivity setting to complete initial identification of potentially occurring species. These settings and versions are approved by the USFWS for acoustic analysis of sensitive species[2].

[2] This version of Kaleidoscope is approved by the USFWS for the identification of the Indiana bat (*Myotis sodalis*) and northern long-eared bat in the eastern U.S. (USFWS 2020).

Despite the capabilities of Kaleidoscope, bat species cannot always be classified with absolute certainty; each identification provided by Kaleidoscope has an associated error rate. There are also cases where Kaleidoscope cannot reliably identify a bat call, usually due to insufficient call quality, and these calls are not categorized by the program. For these reasons, the results of the Kaleidoscope analysis should be viewed with caution. Because of Kaleidoscope's limitations, the output will be used to generate a list of potentially occurring bat species present in the Project area. Only files confirmed as bat passes by a bat biologist were included in the Kaleidoscope analysis. Additionally, experienced bat biologists (Dr. Kevin Murray and Larisa Bishop-Boros, M.S.) manually vetted echolocation calls identified by Kaleidoscope as potentially northern long-eared bat through visual comparison of echolocation call metrics (e.g., minimum frequency, slope, and duration) to reference calls of known bat species (Murray et al. 2001, O'Farrell and Gannon 1999, Yates and Muzika 2006).

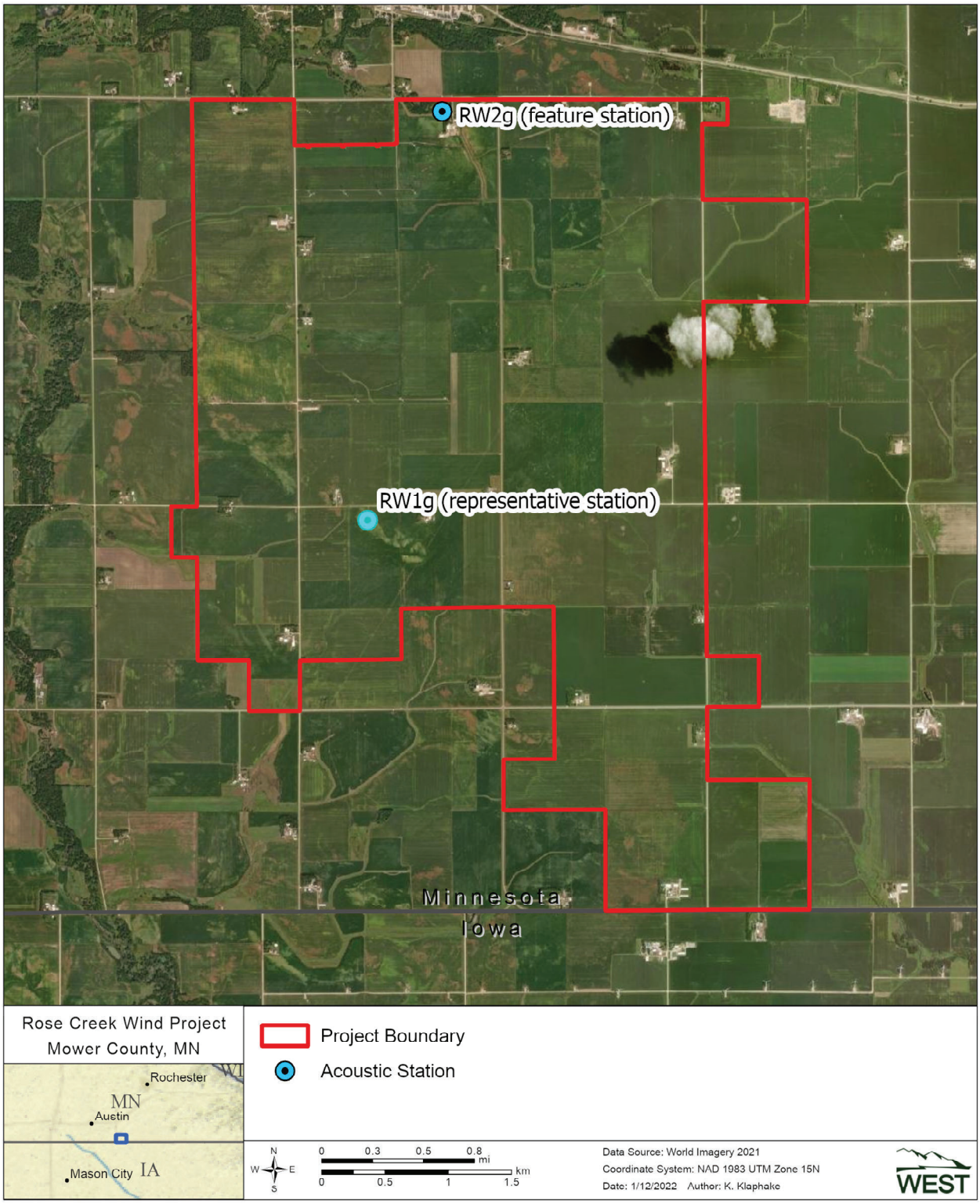

Figure 3. Location of representative and bat feature stations within the Rose Creek Wind Project.

Statistical Analysis

The standard metric used for measuring bat activity is the number of bat passes per detector-night; this metric was used as an index of bat activity in the Project area. A detector-night was defined as one detector operating from 30 min before sunset to 30 min after sunrise. Bat passes per detector-night were calculated for HF and LF bats. SM3 acoustic detectors were deployed on April 15, 2021 per the study plan, but the calculation of bat passes per detector-night for analysis was based on the first (April 16) and last (October 20) call sequence positively identified during the study period, per MNDNR survey protocol (Mixon et al. 2014). Bat pass rates represent indices of bat activity and do not represent numbers of individuals. An experienced bat biologist (Brenna Hyzy, M.S.) determined the number of bat passes per station using Analook. Mean bat activity was calculated by station, by season, and overall; mean bat activity was also analyzed for all bat calls to assess potential differences between frequency groups.

Comparisons were made of mean bat activity during each season to evaluate seasonal variation in bat activity over the survey period. In addition, comparisons were made of mean bat activity between the two stations to evaluate spatial differences in bat activity.

The period of peak sustained bat activity was defined as the seven-day period with the highest average bat activity. If multiple seven-day periods equaled the peak sustained bat activity rate, all dates in these seven-day periods were reported. This and all multi-station averages in this report were calculated as an unweighted average of total activity at each detector.

RESULTS

Bat activity was monitored at two stations for 338 detector-nights from April 16 – October 20, 2021 (Table 3). Detectors and microphones were operating for 88.9% of the survey period for all stations. Each station was inoperable for a total of 21 days during the survey period. Both stations were offline from May 27 – June 9, RW2g was inoperable June 24 – June 30, and RW1g was inoperable August 5 – August 11 (Figure 4). The primary cause of lost data was technical difficulties such as data transfer errors and memory card malfunction.

Table 3. Summary of bat activity recorded at two ground stations within the Rose Creek Wind Project. Passes are separated by call frequency: high frequency (HF) and low frequency (LF).

Station	Location	Type	# of HF Bat Passes	# of LF Bat Passes	Total Bat Passes	Detector-Nights	Mean Bat Passes/Night[1]
RW1g	ground	representative	368 (34%)	708 (66%)	1,076	169	6.37 ± 0.73
RW2g	ground	bat feature	4,600 (28%)	12,021 (72%)	16,621	169	98.35 ± 14.15
Total			**4,968**	**12,729**	**17,697**	**338**	**--**

[1]± bootstrapped standard error.

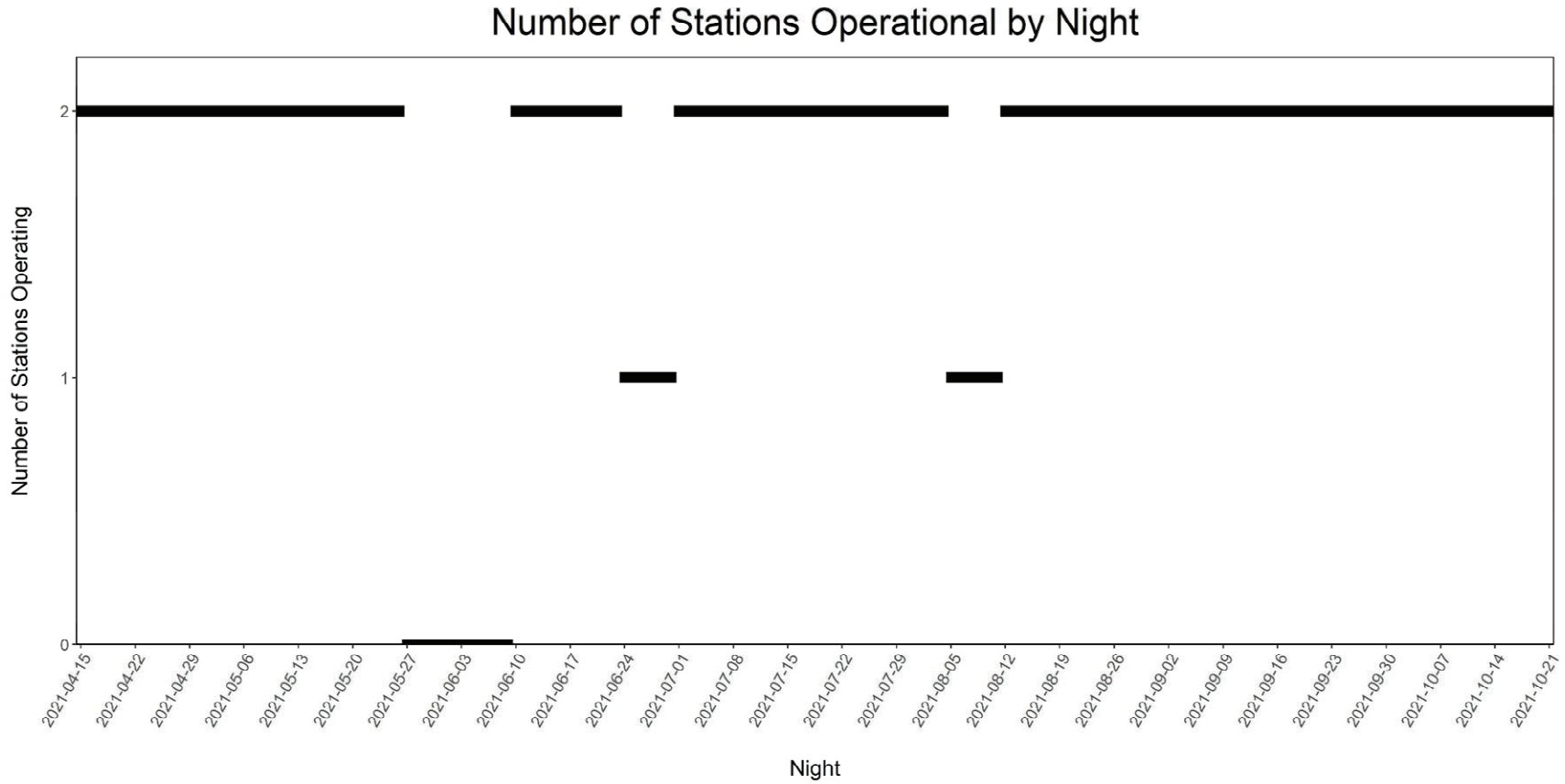

Figure 4. Operational status of all detectors from April 16 – October 20, 2021 at the Rose Creek Wind Project.

Spatial Variation

Bat activity was higher at the bat feature station (RW2g), averaging 98.35 ± 14.15 bat passes per detector-night for the study period (Table 3, Figure 5), compared to the representative station (RW1g) mean of 6.37 ± 0.73 bat passes per detector-night. The bat feature station recorded almost 16 times more activity than the representative station, which was expected due to the purposeful sampling of different habitat types.

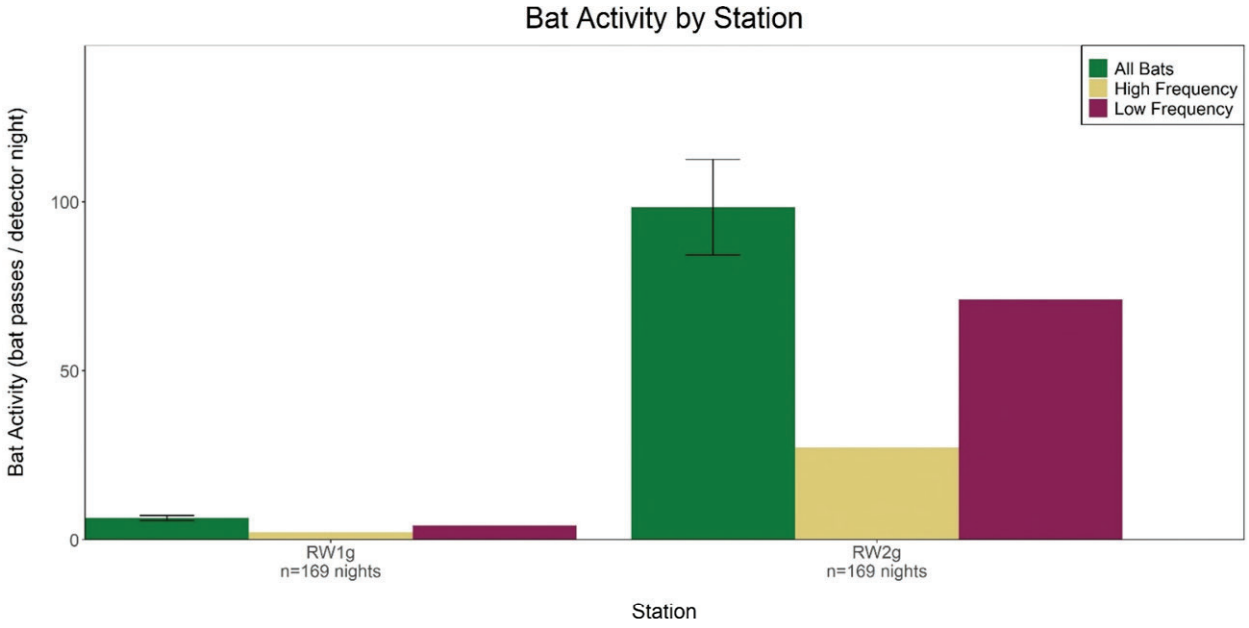

Figure 5. Average number of bat passes per detector-night recorded at the representative station (RW1g) and bat feature station (RW2g) within the Rose Creek Wind Project from April 16 – October 20, 2021. The bootstrapped standard errors are represented by the black error bars on the 'All Bats' columns.

Temporal Variation

Mean bat activity was higher in the summer at representative (8.90 ± 1.63) and bat feature stations (224.82 ± 30.24), followed by fall (6.04 ± 0.82 and 39.98 ± 3.62, respectively), and lowest in the spring (2.00 ± 0.48 and 24.29 ± 7.88, respectively; Table 4 and Figures 7a and 7b). These seasonal trends were also observed for HF and LF bats.

Weekly acoustic activity at the representative station was relatively low from mid-April to late June (Figure 8a), but started increasing in early July, peaking for all bats from July 18 to July 24 (35.5 bat passes per detector-night; Table 5). Bat activity remained high until it began to decrease mid-September, and was low and decreasing for the remainder of the survey period. Bat activity was 6.87 ± 0.77 during the FMP at the representative station (Table 4). Overall activity at the bat feature station peaked from July 20 to July 26 (685.0 bat passes per detector-night), and then activity decreased and remained low for the rest of the study period (Figure 8b).

Table 4. The average number of bat passes per detector-night recorded at the representative station and bat feature station within the Rose Creek Wind Project during each season. Bat passes are separated by call frequency: high frequency (HF), low frequency (LF), and all bats (AB).

Station	Call Frequency	Spring Apr 16 – May 15	Summer May 16 – Jul 31	Fall Aug 1 – Oct 20	Fall Migration Period Jul 30 – Oct 14
Representative (RW1g)	HF	0.48 ± 0.14	3.24 ± 0.67	1.99 ± 0.25	2.30 ± 0.27
	LF	1.52 ± 0.45	5.67 ± 1.05	4.05 ± 0.77	4.57 ± 0.82
	AB	2.00 ± 0.48	8.90 ± 1.63	6.04 ± 0.82	6.87 ± 0.86
Bat Feature (RW2g)	HF	2.26 ± 0.64	58.91 ± 2.65	15.01 ± 1.62	17.05 ± 1.79
	LF	22.03 ± 7.66	165.91 ± 21.78	24.96 ± 2.76	27.84 ± 2.91
	AB	24.29 ± 7.88	224.82 ± 30.24	39.98 ± 3.62	44.90 ± 3.88
Overall Mean	**HF**	**1.37 ± 0.41**	**31.07 ± 7.33**	**8.50 ± 0.95**	**9.68 ± 1.00**
	LF	**11.77 ± 4.03**	**85.79 ±11.05**	**14.51 ± 1.32**	**16.21 ± 1.41**
	AB	**13.15 ± 4.15**	**116.86 ± 6.69**	**23.01 ± 1.92**	**25.88 ± 2.03**

Table 5. Peak activity periods for high frequency (HF), low frequency (LF), and all bats at Rose Creek Wind Project from April 16 – October 20, 2021.

Station Type	Species Group	Start Date of Peak Activity	End Date of Peak Activity	Bat Passes per Detector-Night
Representative (RW1g)	HF	July 19	July 25	14.7
	LF	July 18	July 24	21.0
	All Bats	July 18	July 24	35.5
Bat Feature (RW2g)	HF	July 21	July 27	269.8
	LF	July 15	July 21	451.4
	All Bats	July 20	July 26	685.0

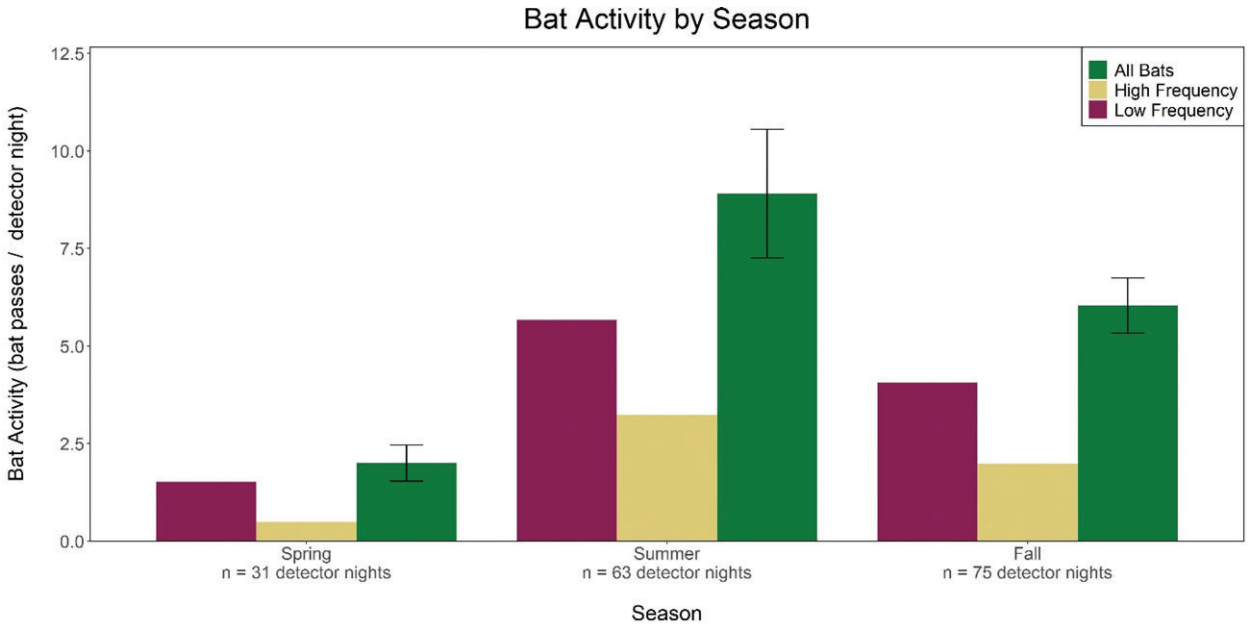

Figure 7a. Average bat activity per season at the representative station within the Rose Creek Wind Project from April 16 – October 20, 2021. The bootstrapped standard errors are represented on the 'All Bats' columns.

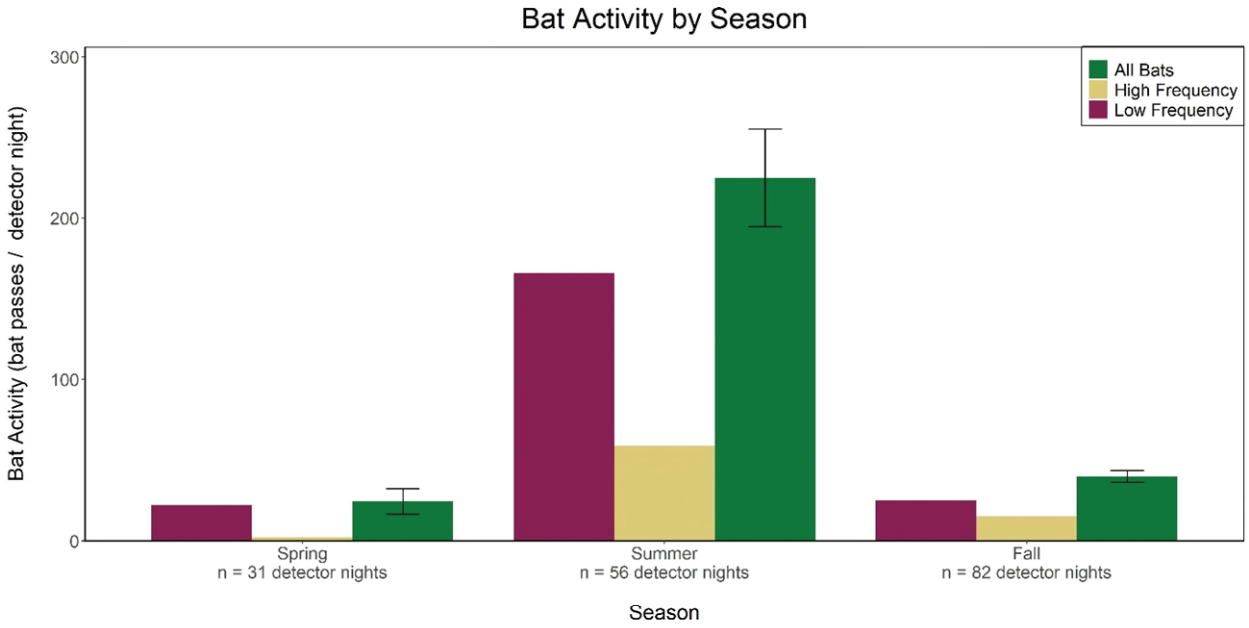

Figure 7b. Average bat activity per season at the bat feature station within the Rose Creek Wind Project from April 16 – October 20, 2021. The bootstrapped standard errors are represented on the 'All Bats' columns.

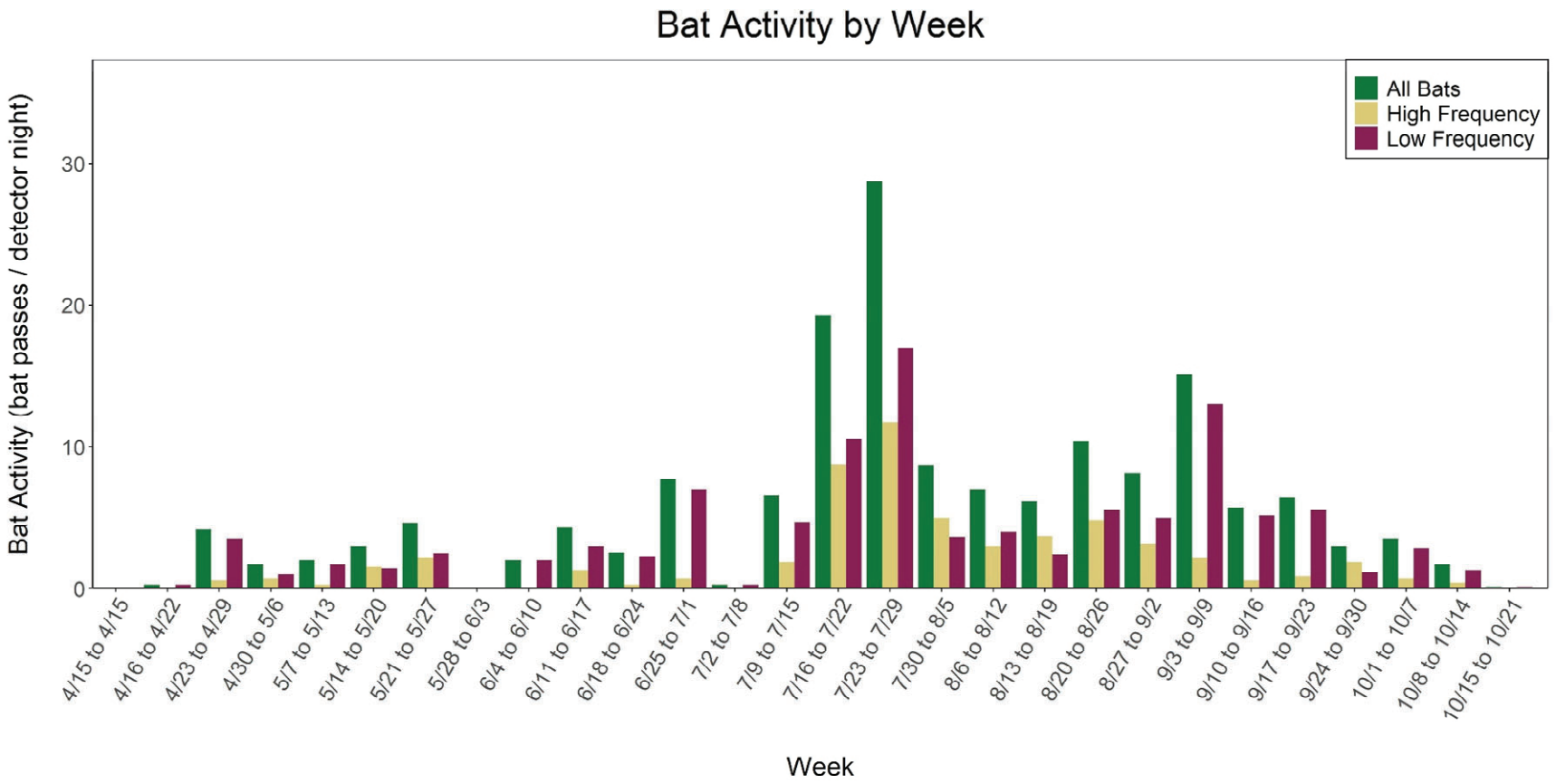

Figure 8a. Weekly bat activity patterns at the representative station within the Rose Creek Wind Project across all three survey seasons: spring (April 16 – May 15), summer (May 16 – July 31), and fall (August 1 – October 20).

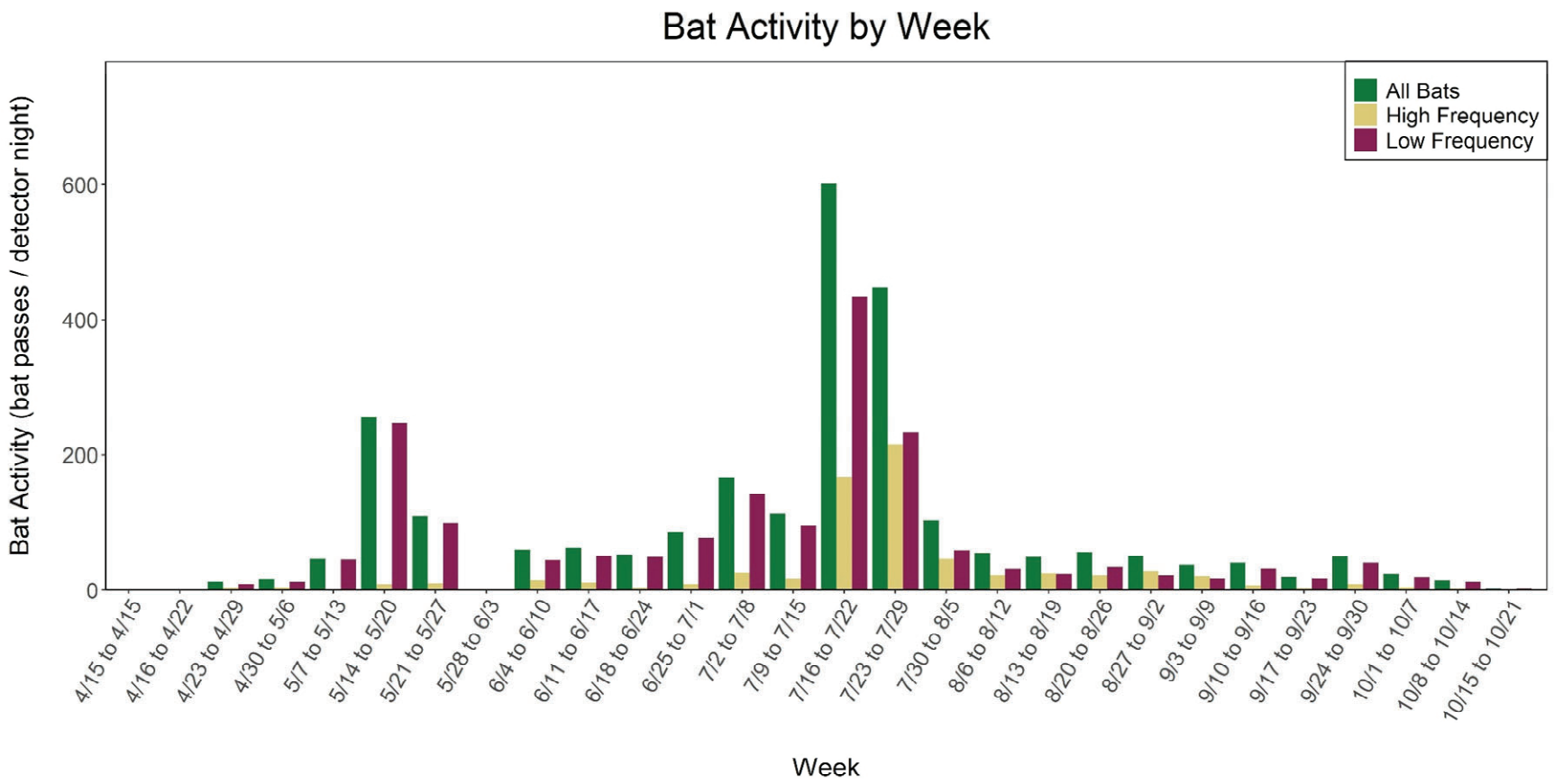

Figure 8b. Weekly bat activity patterns at the bat feature station within the Rose Creek Wind Project across all three survey seasons: spring (April 16 – May 15), summer (May 16 – July 31), and fall (August 1 – October 20).

Species Composition

Overall, the majority of bat passes recorded at both the representative and bat feature stations (66% and 72%, respectively; Table 3) were classified as LF species (e.g., big brown bats, hoary bats, and silver-haired bats; Table 2). The remaining bat passes (34% at the representative station and 28% at the bat feature station) were classified as HF species (e.g., tri-colored bats, eastern red bats, and *Myotis* species; Table 2). There was considerably more activity by LF bat species than HF bat species at both stations overall (Table 3, Figure 5) and per season (Table 4, Figures 7a and 7b).

Kaleidoscope identified bat calls for eight species with the potential to occur within the Project area (Table 2; Table 6). Hoary bats and silver-haired bats were the primary species identified by Kaleidoscope, present on 83% and 79% of all calendar nights, respectively. Big brown bats were the third most frequently identified species (77% of calendar nights). Other commonly detected species included little brown bat (73%), eastern red bat (53%), evening bat (*Nycticeius humeralis*; 39%), and tri-colored bat (30%).

Possible northern long-eared bat calls were identified at the bat feature station (RW2g) by Kaleidoscope on 9% of all calendar nights (Table 6). Two qualified bat biologists (Dr. Kevin Murray and Larisa Bishop-Boros, M.S.) manually vetted all 21 bat calls Kaleidoscope classified as potential northern long-eared bat (Appendix A). None of the 21 possible northern long-eared bat calls were confirmed during qualitative review, and all were reclassified. Eleven of the 21 calls were reclassified as unknown HF species and 10 were reclassified as little brown bat calls.

Table 6. The number of nights and percent of calendar nights (in parentheses) that bat species were detected using Kaleidoscope Pro 5.4.0 at the Rose Creek Wind Project from April 16 – October 20, 2021. Project Total represents the number of nights (percent) a species was detected regardless of location within the Project.

Species	Representative (RW1g)	Bat Feature (RW2g)	Project Total[2]
High Frequency Species (≥30kHz)			
little brown bat	46 (28%)	118 (71%)	128 (73%)
eastern red bat	47 (28%)	77 (46%)	92 (53%)
evening bat	37 (22%)	55 (33%)	69 (39%)
tri-colored bat	20 (12%)	45 (27%)	53 (30%)
northern long-eared bat[1]	0 (0%)	16 (10%)	16 (9%)
Low Frequency Species (≤30kHz)			
hoary bat	101 (60%)	122 (73%)	145 (83%)
silver-haired bat	76 (46%)	130 (78%)	139 (79%)
big brown bat	62 (37%)	125 (75%)	135 (77%)

[1] All species were identified by Kaleidoscope Pro 5.4.0, but only northern long-eared bat calls were reviewed by bat biologists.

[2] Project Total differs from detector-nights because a specific calendar night is only counted once regardless of the number stations deployed at the Project. For each species, the percentage is based on whether that species was detected anywhere in the Project on each given calendar night.

DISCUSSION

Although it is unclear if pre-construction bat activity is useful for assessing post-construction bat fatality risk (Hein et al. 2013), pre-construction acoustic surveys still provide useful information about species composition and seasonal activity. Overall bat activity at the Project was 6.87 ± 0.86 bat passes per detector-night at the ground representative station during the FMP. This station was deployed in cropland representative of the agricultural areas where turbines are planned. Open habitats, such as croplands, typically exhibit decreased bat activity relative to habitat near open water, forested, or riparian habitat attractive to bats (Brooks and Ford 2005).

Weekly acoustic activity at the representative station increased in early-July, peaking from July 18 to July 24 (35.5 bat passes per detector-night; Table 5; Figure 8a). Bat activity at the bat feature station peaked from July 20 to July 26 (685.0 bat passes per detector-night; Figure 8b). Due to the bat feature station being located in habitat considered attractive to bats, activity also increased in spring until mid-May, which likely captures the arrival of bats to their summer maternity grounds. The activity peaks observed in mid- to late July at both the bat feature station and representative station likely capture the recruitment of juvenile bats following the reproductive season (born in June through early July, volancy in mid- to late July). This increase in activity at the representative station likely indicates the timing of fall migration, when bats move away from their summer habitat toward their winter hibernacula. However, it is worth noting that this study only consisted of two stations and represents only one year of data, so any trends presented should not be considered statistically or biologically conclusive due to the small sample size.

No federally listed bat species were confirmed at the Project. The 21 calls that were identified by Kaleidoscope as potential northern long-eared bat calls were all recorded at the bat feature station (RW2g), which was purposefully targeting quality bat habitat within the Project. Two qualified bat biologists manually reviewed all 21 bat calls Kaleidoscope classified as northern long-eared bat (Appendix A). After qualitative review was completed, none of the 21 northern long-eared bat calls were confirmed. Eleven of the 21 calls were reclassified unknown HF species, and 10 were reclassified as a little brown bat, which is considered a state species of special concern (MNDNR 2013). No potential northern long-eared bat calls were recorded at the representative station.

This study was designed to estimate general activity levels of all bats at the Project; it does not meet the requirements of a presence/probable absence survey (USFWS 2020). The bat feature station where all of the potential northern long-eared bat calls were recorded was also where the majority of calls from state-listed Species of Special Concern (big brown bat, little brown bat, and tri-colored bat) were most frequently recorded (Table 6). The bat feature station was situated near the northern border of the Project boundary, along a stream that flows into the northern portion of the Project. This is a small stream, and only reaches about 0.5 miles into the Project area before being dissolved into drainage ditches associated with agricultural fields. The vast majority of the Project is open agricultural land, and there are no large forest patches (patches greater than 10 acres) connected by any stream systems that could provide potentially suitable roosting and foraging habitat.

Any conclusions drawn from the data presented in this study should be made with caution, given the limited sample size. The data collected during this study suggest that bat activity at the Project is largely driven by LF species, and peaks briefly during the reproductive season and the initiation of fall migration. The results of the species composition analysis suggest that northern long-eared bats were not present at locations surveyed within the Project during the time of this study.

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Appendix A. Qualitative Review

Appendix A1. Summary of qualitative review of 21 northern long-eared bat calls identified by Kaleidoscope at the bat feature station (RW2g) at Rose Creek Wind Project, Mower County, Minnesota.

Station	Night	Kscope ID	KLM qualitative ID[1]	Justification
RW2g	4/22/21	MYSE	HF	slope way too low for MYSE
RW2g	5/24/21	MYSE	HF	slope and Fmin too low; borderline approach-phase
RW2g	6/11/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	7/4/21	MYSE	HF	low slope; variable Fmin
RW2g	7/5/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	7/5/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	7/6/21	MYSE	HF	low slope, bandwidth and Fmax
RW2g	7/6/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	7.8.21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	7/8/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	7/10/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	7/15/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	7/15/21	MYSE	HF	variable Fmin; low slope, bandwidth and Fmax
RW2g	7/25/21	MYSE	HF	low bandwidth and Fmax
RW2g	7/31/21	MYSE	HF	LABO or MYLU; low slope, bandwidth, Fmax
RW2g	8/1/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	8/4/21	MYSE	HF	low slope, bandwidth and Fmax
RW2g	8/5/21	MYSE	HF	low slope, bandwidth and Fmax
RW2g	8/13/21	MYSE	MYLU	low slope, bandwidth and Fmax
RW2g	8/22/21	MYSE	HF	fragmentary calls; cannot ID to species; slope, bandwidth, Fmax not characteristic of MYSE
RW2g	8/23/21	MYSE	HF	LABO or MYLU; low slope, bandwidth, Fmax

[1] KLM = Kevin Murray

HF = high frequency, LF = low frequency

Fmin = minimum frequency, Fmax = maximum frequency

MYSE = northern long-eared bat, MYLU = little brown bat, LABO = eastern red bat