

Acoustic Monitoring: Creating a Chiroptera spp. List and Monitoring Bat Activity at Minidoka National Historic Site (MIIN)

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1. Abstract

Minidoka National Historic Site was designated as a National Park Service historical site in 2001, and in 2020, a visitor center opened. Minidoka is a young park and therefore lacks ecological data and infrastructure. The goal of this study was to add to the ecological data by creating a bat species list and determining the presence or absence of bat activity in the historical root cellar ahead of planned rehabilitation of the structure.

Acoustic monitors were set up at three different sites in Minidoka National Historic Site (MIIN) to create a bat species list and determine times of peak activity. Monitors were placed on June 1 and recorded ultrasonic noises 30 minutes before sunset to 30 minutes after sunrise. Monitors were taken down and field work concluded on August 8. Data showed that 12 different bat species were detected at Minidoka, six of which are classified as a species of greatest conservation need by Idaho Fish and Game. The root cellar exhibited significant amounts of activity, suggesting possible use of the structure. However, further research is needed to determine the exact reliance on the root cellar and whether it serves as a hibernaculum and/or maternity colony site.

2. Introduction

2a. Background

In 2001, Minidoka National Historical Site (MIIN) was designated as the 385th unit of the National Park Service. During World War II, MIIN served as a relocation camp for approximately 9,397 Japanese Americans during its peak. Following the decommissioning of the relocation camp in 1945, the site was divided between various agencies and World War II veterans. The historic site we know today as Minidoka was established in 2001 on the original camp site land still owned by the federal government, and a visitor center opened in 2020 to commemorate the hardships and sacrifices endured by the Japanese Americans held there during its three-year tenure (Conservation Fund, n.d.).

MIIN, as a newly designated unit of the Park Service, has very limited ecological data on bats. Bats play crucial roles in ecosystems but face growing threats. The rapid spread of white-nose syndrome (*Pseudogymnoascus destructans*, or *Pd*) is devastating bat populations throughout the United States, and its scope is expanding rapidly. Habitat loss, next to *Pd*, is cited as one of the leading causes of bat population decline (Bat Conservation International, n.d.).

North of MIIN, a proposed wind energy site, titled the Lava Ridge Wind Project, also poses significant threats to bats in the area. Millions of bat die each year at wind energy sites (Bat Conservation International, n.d.). If the Lava Ridge Wind Project were to be established, bat populations at MIIN would likely decline. However, the species and projected populations at MIIN are unknown, as well as the knowledge of the bat use of the historical structures. Due to the lack of desired ecological knowledge, the risk to bats at MIIN is unknown.

2b. Research Goals

The goal of this study was to create a list of bat species found in the park and assess activity level in historic structures. This study aimed to assess activity to help inform conservation efforts and habitat loss mitigation strategies.

Three research questions were posed:

- What bat species are present at Minidoka?
- When are bats most active at Minidoka?
- Is there bat activity in the root cellar, and if so, how much?

Documenting bat use of the root cellar is important to managers at MIIN as the structure is scheduled to undergo drastic changes. Assessing bat use of the structure will allow management to prepare for habitat loss and mitigate its effects when the structure undergoes alterations, which will largely seal the now open and dilapidated structure.

3. Materials and Methodology

3a. Materials

Acoustic monitors, guy lines, and mounting poles were provided by Todd Stefanic (Wildlife Biologist for the Southern Idaho Parks). A license for the SonoBat 30 processing software was also provided by Stefanic. Stakes, electrical tape, and batteries were purchased at the beginning of the study and replaced as necessary. The model of the monitors used was the Wildlife Acoustics Song Meter MiniBat 2.

3b. Methodology

Before the study began, I met with NPS biologist Todd Stefanic to discuss monitoring sites and address proper field protocol. It was determined that the area of greatest research need was the historic root cellar. The root cellar is dilapidated, and due to the safety risks it presents, it is not accessible to the general public. In an effort to reduce these risks and provide access to the public, the NPS plans to rehabilitate the structure. Research was desired to determine the activity in the cellar and plan for potential habitat loss. The root cellar was named as the site of highest priority, and MiniBat 3 was placed within the structure facing north down the long axis of the building.

Two additional sites in MIIN were selected. MiniBat 1 was placed next to the historic maintenance barn near the Robinson House. This location was chosen because the barn presents potential as roosting habitat for bats. For the first four weeks, MiniBat 1 stood on the south side of the barn. The monitor was downed during a windstorm and was then moved to the more sheltered east side of the barn with the microphone facing southeast. MiniBat 2 (MB2) was set up approximately 0.2 miles into the service road along Clover Creek (AKA North Side Canal), also with the microphone facing southeast (see Figure 1). This location was chosen due to its proximity to the water and the thick vegetation along the canal. This presents a likely place for bats to forage. It was recognized that this site may present challenges due to background noise of flowing water.



Figure 1. Map displaying sites selected for monitoring

Finally, as previously stated, MiniBat 3 (MB3) was set up in the historic root cellar, with the microphone facing north.

Field protocol followed the North American Bat Monitoring Program in the Pacific Northwest. Monitors were placed 3 meters above the ground and, where possible, in areas less visible to the public (Northwest Bat Hub, HERS Lab, Oregon State University-Cascades, 2022). Where possible, sites were also placed roughly 5 meters away from clutter in any direction. MB1 was placed >5 meters away from the maintenance barn and MB2 was placed >5 meters away from the edge of the canal. As stated earlier, MB3 was set up *in* the root cellar. Due to this, it was difficult to ensure that the monitor was placed in an area free of clutter in a 5-meter radius. The point in the root cellar that was least likely to be affected by clutter was selected and used for the duration of the study. According to the PNW NABat Field Reference Manual, MB1 site 1 exhibited a clutter category of 1. After moving MB1 to the east side of the barn, the clutter category became 2. MB2 fell under clutter category 0, and MB3 was clutter category 4 (see Figure 2).

MiniBat monitors were placed at the designated sites on May 31. Once monitors were set up and site observations were made, each monitor was scheduled to start recording on June 1. Each monitor was equipped with a 32 GB SD card to begin. Monitors were set up to record from 30 minutes before sunset through 30 minutes after sunrise. Following set up and programming, the three monitors were left to record calls. Every two weeks, SD cards were replaced and batteries were changed when needed. The monitors were left to record for just under 10 weeks. Upon completion of the study, monitors, guy lines, and stakes were returned to Stefanie and processing of the calls began.



3c. Analytical methods: SonoBat

Calls were processed using SonoBat 30 North America processing software. No calls were hand-vetted. Different species produce different frequency calls, and SonoBat analyzes the recorded sounds and automatically identifies them to species based on their respective sonograms. Recordings can also be classified as “noise,” which is any sound other than a bat echolocation call (insects, cars, water, etc.). Recordings identified as “HiF,” “LoF,” and “HiLo” are calls that are likely bats, but the program cannot identify further. Recordings identified as “blank” are calls that SonoBat cannot identify as bats with certainty.

Data was imported to SonoBatch and processed to completion of each data set. Default settings were used to analyze calls, running off of a 0.60 acceptable call quality and 0.90 sequence decision threshold.

The acceptable call quality analyzes individual echolocation calls, scoring the individual calls on a scale between 0 and 1. This score represents how “clean” the call is. The minimum threshold is 0.6, and anything scored below this threshold will be rejected and classified as “noise.” If the call is accepted, it’s moved into a call sequence and analyzed according to the sequence decision threshold. The sequence decision threshold applies to the entire call sequence (AKA a pass). These passes are then analyzed and given a score, again, on a scale of 0-1. The minimum sequence decision threshold is 0.9. Any score above 0.9 is confidently assigned a species ID. Any pass assigned a score lower than 0.9 is classified as “HiF,” “LoF,” “HiLo,” or “blank.”

Analysis of each dataset took several hours, usually ranging from 6-12 hours. This process was repeated until all datasets had been analyzed. Using the data parameters created by SonoBatch, SonoVet was used to classify and export data to a .csv file. After successfully processing all data sets, analysis using Excel began.

3d. Analytical methods: Excel

Once the .csv files were exported to Excel, the file was renamed and saved as a .xlsx to save the pivot tables and multiple sheets created in the workbook. The 10 weeks of data from each monitor were compiled into Excel. A pivot table was created to summarize the data collected during the study. This showed the number of species detected along with the number of times each species was recorded. Additional work was necessary to determine the time of night with the most recorded calls and the time of year with the most recorded calls. After categorizing data by the time of night and time of year, the calculated and sorted data were then used to form its own respective pivot table. Percentages were calculated and displayed in charts and graphs.

4. Results

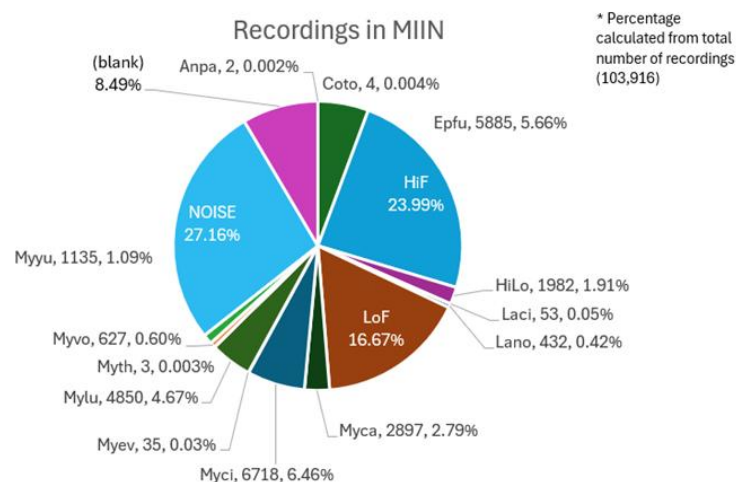


Figure 3. Calls by species and percentage distribution

Over the course of the study, 103,916 recordings were made. Of these recordings, 28,225 were “noise,” and 44,230 were calls that were likely bats but were not assigned to a specific species.

8,820 were categorized as “blank,” which is due to identification uncertainty. 22,641 were confidently identified as bat species (see Figure 3).

From these 103,916 recordings, SonoBat identified and created a list of 12 bat species. Data was assessed and then used to answer the three research questions: What bat species are present at Minidoka, when are they most active, and is there bat activity in the root cellar?

4a. Species list and peak activity time

SonoBat software compiled a list of twelve bat species:

Species Detected in Minidoka		Number of calls
<i>Myotis ciliolabrum</i>	Western small-footed myotis	6718
<i>Eptesicus fuscus</i>	Big brown bat	5885
<i>Myotis lucifugus</i>	Little brown bat	4850
<i>Myotis californicus</i>	California myotis	2897
<i>Myotis yumanensis</i>	Yuma myotis	1135
<i>Myotis volans</i>	Long-legged myotis	627
<i>Lasionycteris noctivagans</i>	Silver-haired bat	432
<i>Lasiurus cinereus</i>	Hoary bat	53
<i>Myotis evotis</i>	Long-eared myotis	35
<i>Corynorhinus townsendii</i>	Townsend’s big-eared bat	4
<i>Myotis thysanodes</i>	Fringed myotis	3
<i>Antrozous pallidus</i>	Pallid bat	2

Of these twelve species, six have a SWAP (Idaho Fish and Game State Wildlife Action Plan, 2023) status of SGCN (species of greatest conservation need). This is largely due to human activity and/or climate change (Idaho Fish and Game, 2023). Data indicates that *Myotis ciliolabrum*, a species of greatest conservation need, is the most commonly detected bat species in MIIN, comprising 30% of the recorded echolocation calls (see Figure 4). *M. ciliolabrum* was followed by *E. fuscus* at 26% and *M. lucifugus*, another SGCN, at 21%.

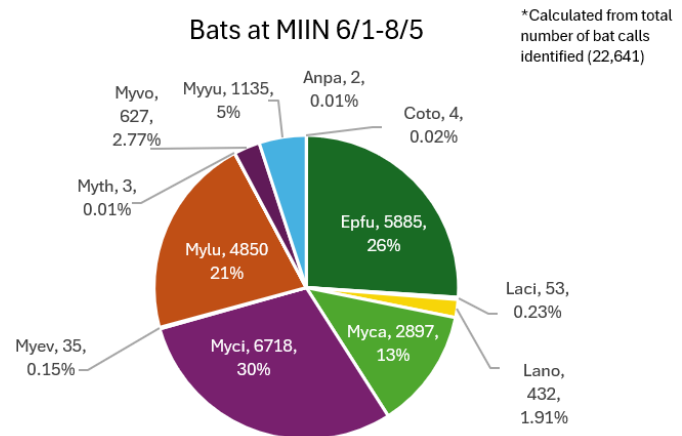


Figure 4. Calls by species and percent distribution

Activity was then categorized into time of night and time of summer. Data showed that bat activity is at its highest from 11:01 p.m.-3:00 a.m., accounting for 58.4% (13,237) of all calls recorded throughout the night. 34.7% (7,848) of the calls were recorded from 30 minutes before

sunset to 11:00 p.m., which is categorized as 7:00 p.m.-11:00 p.m. The remaining 6.9% (1,556) of calls were recorded from 3:01 a.m.-30 minutes after sunrise, also classified as 3:01 a.m.-8:00 a.m. (Figure 5).

Finally, data indicates that bats are more active in early summer. In early summer, from June 1-July 6, 13,063 calls were recorded. Late summer, from July 7-August 8, 9,578 bat echolocation calls were documented. 58% of all bat calls were documented in early summer. (Figure 6).

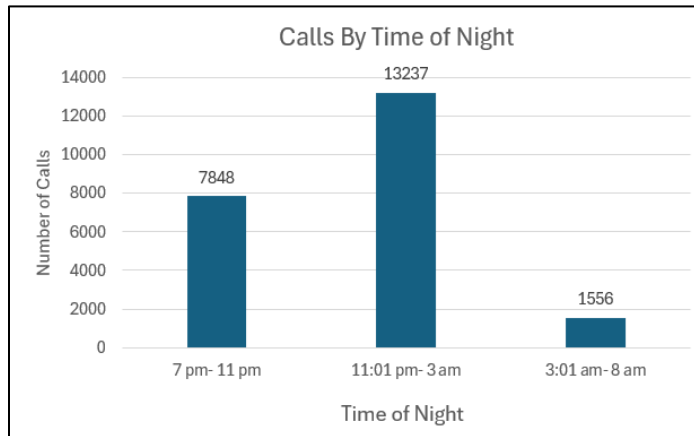


Figure 5. Bat calls by time of night

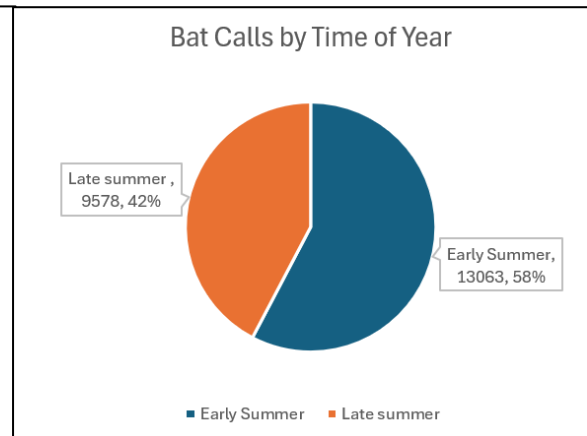


Figure 6. Percent distribution of bat calls in late and early summer

4b. Root cellar activity

Species Detected in the Root Cellar		Number of calls (7,286 total)
<i>Myotis ciliolabrum</i>	Western small-footed myotis	3266
<i>Myotis californicus</i>	California myotis	2497
<i>Myotis lucifugus</i>	Little brown bat	1141
<i>Myotis volans</i>	Long-legged myotis	313
<i>Myotis evotis</i>	Long-eared myotis	34
<i>Myotis yumanensis</i>	Yuma myotis	20
<i>Eptesicus fuscus</i>	Big brown bat	8
<i>Corynorhinus townsendii</i>	Townsend's big-eared bat	4
<i>Lasionycteris noctivagans</i>	Silver-haired bat	2
<i>Myotis thysanodes</i>	Fringed myotis	1

Figure 7. Table displaying species from the historical root cellar

The root cellar exhibited significant levels of activity. MB3 recorded more calls than MB1, but fewer than MB2. MB1 recorded 7,164 bat echolocation calls, MB2 recorded 8,191, and MB3 recorded 7,286. Like the rest of the data, bat nighttime peak activity was from 11:01 p.m. to 3:00 a.m. Early summer represented the majority of calls in the root cellar as well.

From the 7,286 calls recorded on MB3 in the root cellar, ten different species were identified (see Figure 7). Again, of these ten, the same six species (displayed in bold) are listed as SGCN. Although deteriorating, the root cellar shelters MB3, which likely makes it more difficult for the

monitor to record calls outside of the cellar. It is likely that the echolocation calls picked up by MB3 are made very close to or inside of the cellar, signifying usage of the cellar.

5. Discussion

Data indicates that the historic root cellar at MIIN is used by at least ten bat species, supporting significant levels of bat acoustic activity. Six of these species are species of greatest conservation need (SGCN) in Idaho. High detection rates combined with species diversity recorded in the root cellar suggests that it is an ecologically significant habitat. Acoustic monitoring cannot determine the behavioral use of the root cellar, but the detection of calls in the root cellar may indicate that bats use the cellar as a temporary shelter during periods of nighttime activity. The enclosed nature of the cellar reduces the number of sounds detected from outside the structure, meaning that the recorded echolocation calls likely came from within the structure or immediately surrounding it. This also may suggest internal use of the root cellar.

Since the root cellar may undergo rehabilitation in the future, it will be necessary to create habitat loss mitigation projects. This may be accomplished by building bat boxes and stationing them throughout the park or completing rehabilitation of the root cellar in phases. These are especially important when dealing with the presence of multiple SGCN, several of which are highly sensitive to habitat loss.

Moving forward, further research will be needed to provide better information regarding bat activity at MIIN. This study was limited by a short study duration, so a longer, more in-depth study is needed to determine the reliance of bats on the historical root cellar, and other historical sites, throughout the year. This will determine if any of these sites are being used as hibernacula, and subsequent management actions can be taken. Continued monitoring would also be beneficial, ensuring that management has the information necessary to support the at-risk species.

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