City of Fort Collins Natural Areas
Bat Surveys 2017
Final Report

Report Prepared for:
City of Fort Collins
Natural Areas Program
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Townsend's Big-Eared Bats

Introduction

In Colorado and elsewhere in the West, there continues to be a lack of knowledge concerning the status, distribution, and threat assessments of bats. However, over the last 25 years in Colorado there has been significant progress on some aspects, in part due to the development of acoustic survey technology. As a result, the distribution of species in the state is better known, providing important information necessary for conservation and management of bats in the state. More recent concerns regarding bats have been driven by the threat of White-nose Syndrome (WNS), and a better understanding of all aspects of bat ecology and their status is a critical need for dealing with this emerging threat.

Because the City of Fort Collins is located along the foothills and short-grass prairies, the area is a diverse ecosystem comprised of grassland prairies, wetlands, riparian habitats along the Cache la Poudre River, and the shrublands/forests of the western foothills and mountains. This provides excellent opportunities for a diversity of bot roosting and foraging habitats, and seasonal uses by many species of bats.

The City of Fort Collins Natural Areas Department is responsible for the management of all local and regional natural areas within Fort Collins and Larimer County. Natural Area properties are comprised of approximately 36,100 acres, and range from small areas within the urban environment to large areas located in the western foothills. The City of Fort Collins Natural Areas are grouped into those located along the Poudre River, and four regional natural areas (Gateway, Picnic Rock, Bobcat Ridge, and Soapstone Prairie). The Mission Statement of the Natural Areas Department is “to conserve and enhance lands with natural resource, agricultural, and scenic values, while providing meaningful education and appropriate recreation opportunities”.

The Natural Areas Department has developed Management Plans for wildlife, which includes guidelines for the implementation of long-term conservation strategies related to Species of Interest recovery efforts. Bats are included in the Wildlife Conservation Guidelines developed in 2017, and additional data on the presence and use of City Natural Areas by bats was initiated in the spring of 2017. The information will be used to update and develop conservation plans for various Natural Areas to address conservation planning which includes bats as important components of the City’s Natural Areas. Several species are listed in the City Management Plans for Wildlife “known to occur in the Fort Collins area” (based on Adams, 2003), and from 2001-2005 bats were inventoried on natural areas as part of a larger study on urban maternity roost selection of big brown bats in Fort Collins (Neubaum et al., 2007).

These past surveys have provided documentation of some species on various city natural areas and parks. Species documented include:

- Western long-eared myotis (*Myotis evotis*)
- Little brown myotis (*Myotis lucifugus*)
- Fringed myotis (*Myotis thysanodes*)
- Long-legged myotis (Myotis volans)
- Western small-footed myotis (*Myotis ciliolabrum*)
- Hoary bat (*Lasiurus cinereus*)
- Silver-haired bat (*Lasionycteris noctivagans*)
- Big brown bat (*Eptesicus fuscus*)
- Townsend's big-eared bat (*Corynorhinus townsendii*)
- Eastern red bat (*Lasiurus borealis*)

The importance of conservation planning is highlighted by the additional complications concerning the emerging disease and potential impacts to bats from WNS, first documented in 2007 and responsible for the loss of millions of bats since then (Blehert, et. al. 2009). Roosting habitat, in particular, is a critical component regarding WNS and bat conservation planning. White-nose syndrome is a fatal disease in bats that is leading to rapid and devastating loss of hibernating bat populations in North America (Frick, et. al., 2010). Since its discovery in New York in 2006, WNS has resulted in the death of over 6 million bats in the United States and Canada (Lorch, et. al, 2016). The causative agent of WNS is the psychrophilic fungus *Pseudogymnoascus destructans* (previously named *Geomyces destructans*), and the majority of bat populations where WNS has been detected are in northeastern North America. Until recently, eastern Nebraska was the farthest west that WNS has been confirmed (U.S. Fish and Wildlife Service). Currently, there are no reports of WNS in Colorado, but the recent discovery in 2016 of WNS in several species of bats in the state of Washington, has caused an elevation of concern among western state and federal wildlife management agencies.

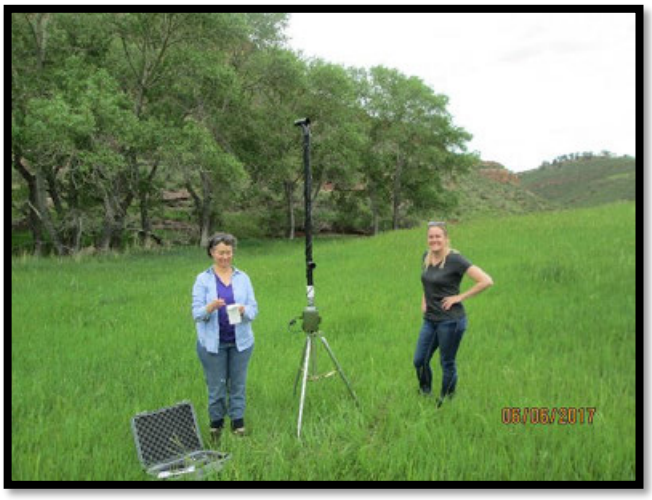
To date, 19 species of bats are known to occur in Colorado. Colorado Parks and Wildlife is responsible for the conservation of all bat species in the state. The State Wildlife Action Plan (SWAP) has identified several species of bats as Species of Greatest Conservation Need (SGCN). These include **Tier 1 species: Fringed myotis, little brown myotis, spotted bat, and Townsend's big-eared bat; and Tier 2 species: Allen's big-eared bat, big free-tailed bat, and the hoary bat.** Based on past surveys, four species of bats considered to be species of interest to the Natural Areas Department are known to occur on Fort Collins natural areas. These are little brown myotis, fringed myotis, hoary bat, and Townsend's big-eared bat. Therefore, the conservation of roosting and foraging habitats on natural areas are important goals for regional bat conservation. Common names, scientific names, and species codes used in this report are found in Tables 1 & 2.

The Natural Areas Department initiated a project in the spring of 2017 to conduct additional bat surveys on selected Natural Areas, to provide additional information to aid in the conservation and management planning of these Natural Area properties.

Project Goals

- Document species of bats in Fort Collins Natural Areas by mist netting at selected sites.
- Collect acoustic call data of bats at all survey sites, during mist netting surveys and passive deployment of acoustic detectors/recorders at selected Natural Areas, to provide species documentation by call analysis.
- Based on information acquired, provide any recommendations related to bat conservation and future actions for the Department.

ACKNOWLEDGEMENTS: Field work and acoustic surveys and analysis were conducted with the assistance of Laura Ellison, VesperWorks, LLC. Field work and support was provided by Jennifer Roberts and other City of Fort Collins Natural Area personnel, and capture surveys were conducted with help by Mike Sherman (CPW), Tanya Dewey, Mark Hayes, Lea Bonewell (USGS), Michelle Verant (NPS), Karen Fox (CPW), Lisa Wolf (CPW), Pepper Canterbury (CPW), Toni Piaggio (USDA), and numerous student volunteers from the CSU Veterinary Medicine and Biomedical Sciences (CVMBS).



Bat Habitat

Generally, the habitats available for bats on Natural Areas can be categorized into foraging and roosting habitats. Roosting habits of bats generally are factors of roost abundance and availability, microclimate conditions, the risks of predation, and the abundance of food and water resources and their availability. Canyon walls and cliff faces can provide abundant roosting habitat in the cracks and crevices that are found there (Neubaum et al.,2006; Lausen and Barclay, 2002; Snider et al, 2013), and research is starting to document the importance of these roost types to western species of bats (Neubaum, et. al., 2006). Studies have provided insights into the use of crevices by bats, including the frequent switching of crevice roosts, selection associated with microclimate of crevice roosts and changing reproductive condition of females, predation risks and individual and group aggregations (Lausen and Barclay, 2003). Crevices are used by bats as maternity roosts, day roosts, and hibernacula (Lausen and Barclay, 2002; Neubaum et al, 2006).

Trees and snags provide roosting habitat for many species of bats (Pierson, 1998; Lacki and Hayes, 2007), in dead or dying trees, with exfoliating bark, vertical cracks or cavities that provide conditions favorable for roost requirements. Some studies in Ponderosa pine forests have documented use of taller trees in a forest stand as roost sites, likely a result of better detection by bats (Campbell, et al, 1996) and in older stands (Arnett and Hayes, 2009). Roost switching among trees by bats and colonies has also been well documented, and suggests that management of snags and timber harvesting should be considered on a landscape level, with more options provided in stands of trees (Mattson, et al, 1996; Arnett and Hayes, 2009; Cryan, et al, 2007; Lacki and Kurta, 2007). Recruitment and retention of snags is an important aspect of management planning and conservation.

Additionally, buildings, bridges, and other man-made structures can also provide roosting habitats for bats. Older buildings, in particular, often provide increased access and microclimate conditions needed for maternity colonies, and several species of “urban” bats frequently make use of such structures. Bridges can be used as day roosts, maternity roosts, and night roosts by many species of bats.

Foraging habitats for bats is more general, as vegetation and aquatic sources provide abundant insect prey for various species of bats. The riparian habitat within Natural Areas can provide a good prey base for foraging during the warm seasons, and the canyon bench forests and forest edge habitats can also provide a variety of insect prey for foraging bats (Pierson, 1998; Morris, et. al, 2010), with seasonal shifts related to insect abundance and movements. Wetland habitats are excellent sources of abundant insect prey, and can be areas associated with high levels of bat activity. Drinking sites are also an important factor for bats. Access to water sites that are more open, and still water situations provide the best opportunity for more species of bats to drink safely (Jackrel and Matlack, 2010). Open water sites that can be found in and around Natural Areas are likely important sources of access for drinking by bats. The juxtaposition of all these variables is important in regards to bat distributions, presence and seasonal use. Persistence of these water sources are also important factors for bats. Information on water site considerations for bats can be found in Taylor and Tuttle (2007), and is available at BCI. http://www.batcon.org/pdfs/water/bciwaterforwildlife.pdf

Survey Methods

Capture surveys were conducted at selected Natural Areas using mist nets over water sources or in potential flyways. Mist nets used were based on the size of the water source, or the area to be covered on suspected flyways from river corridors. At two sites, a three-high stacked net set was used to extend up into the flyways at Gateway and Kingfisher Point Natural Areas. Potential net sites were evaluated on an additional trip to Soapstone Prairie NA with Natural Area Department employees, and CPW wildlife biologist Mike Sherman in mid-May. Locations for deployment of acoustic detectors was also evaluated. Plans were made to access the sites after hours, recruit field assistance from CPW biologists, Natural Area personnel, other bat biologists as volunteers on some surveys.

Four Natural Areas were selected by the Natural Area Department for capture surveys: Soapstone Prairie, Bobcat Ridge, Kingfisher Point, and Gateway. Surveys were conducted for at least several hours after sunset. Nets used included 18 ft. (6m) and 30 ft. (9m) mist nets at the following locations:

Net Site Name	UTM - E	UTM - N
Soapstone Canyon stock tank	489804	4535743
Soapstone Ponderosa Pine stock tank	489807	4533860
Bobcat Ridge Bat Pond	479785	4482080
Kingfisher Point Natural Area	496104	4491833
Gateway Natural Area	479430	4505517
Gateway Natural Area - bridge	479616	4505575
Gateway Water Treatment Plant	479577	4505699

Acoustic detectors/recorders were used for surveys at all targeted Natural Areas. Both active and passive acoustic surveys were used during the project. Passive acoustic deployments were conducted at 5 Natural Areas and at eight locations. Passive deployments were typically for 1 night, and retrieved by HFB and Natural Area personnel. Active acoustic surveys were conducted at 4 Natural Areas, and during all mist net surveys. Active surveys involved walking along paths at Natural Areas carrying acoustic detectors/recorders for approximately 1 hour, or when at net sites, until nets were closed for the night. Active surveys were necessary at some natural areas because they were too open, providing little cover to hide detectors from the public and putting the equipment at potential risk of disturbance or vandalism. Four types of acoustic detectors were used; Wildlife Acoustics model SM4 and SM2BAT (on loan from CPW), Titley Anabat Walkabout and Pettersson D500x. All detectors deployed for passive recording were set to record all night, using standard detector settings appropriate for the area. This provided recordings of bat calls all night until sunrise the following day. The detector locations were as follows:

Passive Acoustic Deployment Surveys			
Detector Site	Detector Type	UTM – E	UTM - N
Soapstone Ranch House	SM2	499275	4536985
Soapstone Canyon	SM4	488880	4536659
Soapstone Ponderosa Pine stock tank	SM2	489783	4533849
Bobcat Ridge Brooks (south) Canyon	SM4	481221	4479946
Bobcat Ridge Rangers House	SM2/D500x	480932	4481243
Bobcat Ridge Bat Pond	SM4	479785	4482080
Gadwall Pond/Kingfisher Pt	SM4	496326	4491540
Gateway Natural Area	SM4	479380	4505850
Reservoir Ridge Natural Area	SM4	487474	4494846

Active Acoustic Deployment Surveys			
Detector Site	Detector Type	UTM – E	UTM - N
Soapstone west canyon net site	Walkabout	489804	4535743
Soapstone Ponderosa Pine net site	Walkabout	489807	4533860
Bobcat Ridge Bat Pond net site	Walkabout	479785	4482080
Kingfisher Point net site	Walkabout	496104	4491833
Gateway 3H net site	D500x	479430	4505517
Gateway bridge net site	Walkabout	479616	4505575
Dixon Reservoir	SM4	487816	4489108
Mallard's Nest Natural Area	Walkabout	494391	4490397
McMurry Ponds Natural Area	Walkabout	492300	4494606
Running Deer Natural Area	SM4	498516	4490574

*A list of species with scientific names and species codes used in this report can be found in Table 1.

Table 1. Species codes used in acoustic files and this report.

Common Name	Scientific Name	Code
Pallid bat	*Antrozous pallidus*	ANPA
Townsend's big-eared bat	*Corynorhinus townsendii*	COTO
Big brown bat	*Eptesicus fuscus*	EPFU
Brazilian free-tailed bat	*Tadarida brasiliensis*	TABR
Hoary bat	*Lasiurus cinereus*	LACI
Western small-footed myotis	*Myotis ciliolabrum*	MYCI
Long-eared myotis	*Myotis evotis*	MYEV
Fringed myotis	*Myotis thysanodes*	MYTH
Long-legged myotis	*Myotis volans*	MYVO
Yuma myotis	*Myotis yumanensis*	MYYU
Canyon bat	*Parastrellus hesperus*	PAHE
Tri-colored bat	*Perimyotis subflavus*	PESU
Silver-haired bat	*Lasionycteris noctivagans*	LANO
Western red bat	*Lasiurus blossevillii*	LABL
Eastern red bat	*Lasiurus borealis*	LABO
Little brown myotis	*Myotis lucifugus*	MYLU

Table 2. Additional Species codes used in Zero Crossing acoustic files in this report.

Common Name / Species Group	Code
Big Brown bat/Silver-haired bat	EPFU/LANO
Myotis species of 40 Khz calls	Myotis40
Low frequency call species, ~30 Khz or less	LowF

Acoustic survey methods

Zero Cross vs. Full Spectrum

Full spectrum is a method of recording bat ultrasound that records the full spectral composition of a signal, usually through Fourier analysis. This is displayed as a spectrogram that displays frequency and amplitude of a signal over time. Full-spectrum recordings store large amounts of data because sampling rates need to be twice that of the highest frequency that is to be recorded. Generally, a file generated by a full-spectrum detector will be approximately 1,000 times as large as a zero-crossing file of the same bat pass.

Zero cross is a method of recording bat ultrasound that provides information about the frequency and timing of bat pulses, but does not retain amplitude data of the original waveform. A zero-cross detector counts the number of times an incoming signal crosses the "zero line" and measures the time associated with each complete cycle to determine frequencies. Bat recordings stored digitally through this method require approximately 1/1,000th of the digital memory that a full-spectrum recording of the same sound requires.

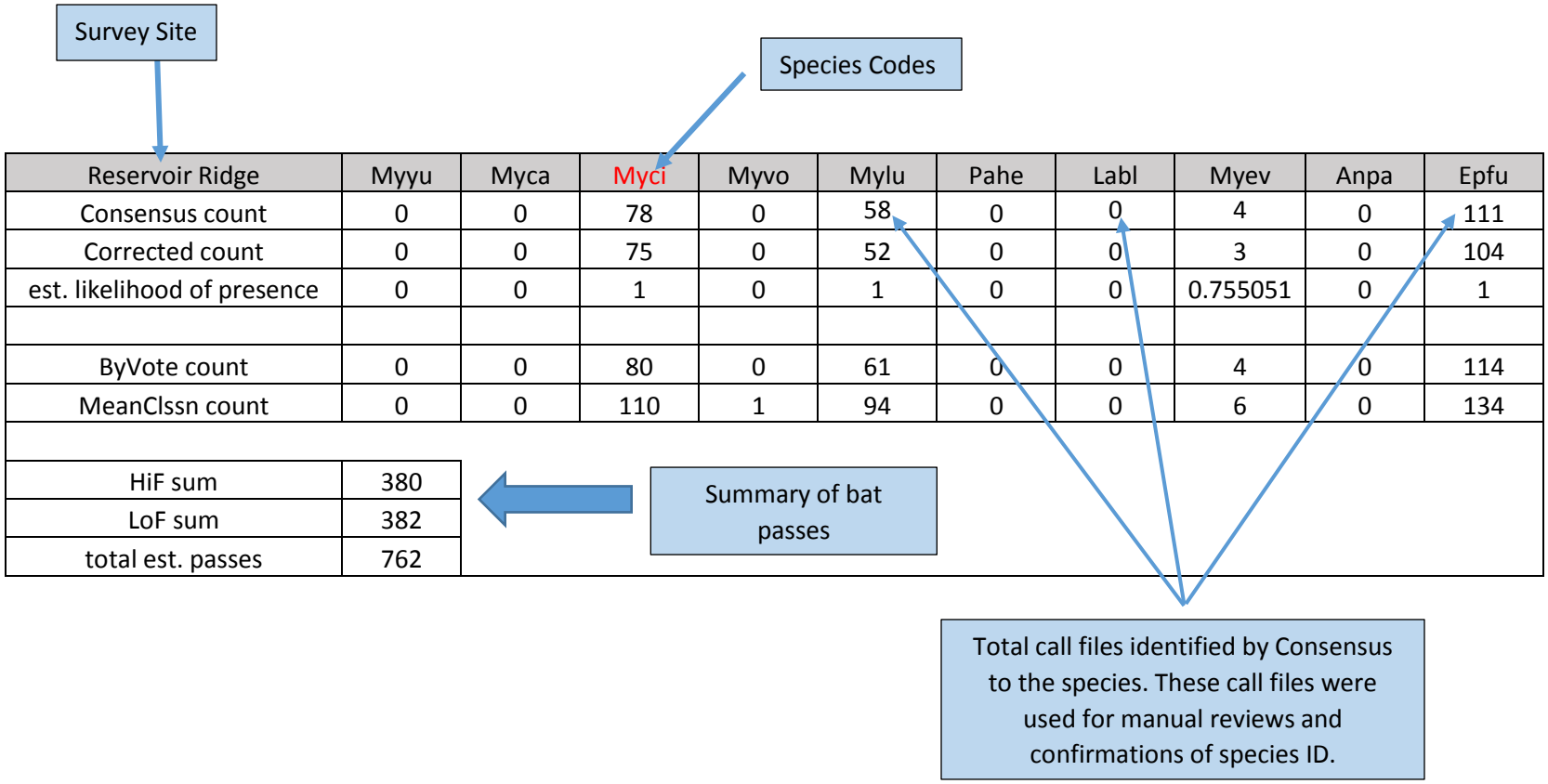
Full Spectrum

Ultrasonic acoustic detectors (Model SM2BAT, SM4BAT, Wildlife Acoustics, Inc., Concord, MA; and Pettersson D500X, (Pettersson Elektronik AB, Sweden) were deployed to record bat vocalizations during the 2017 acoustic surveys. Recordings were analyzed using SonoBat 3.2.1 (SonoBat, Arcata, CA) auto-classification option. Manual review of selected vocalizations was then compared to reference bat calls from the Great Basin bat call library (SonoBat, Arcata, CA), and reviewed by selected parameters for species, as identified by Joe Szewczak, Humboldt State University Bat Lab, March 2011. Call analysis parameters were set to use discriminant probability threshold of 0.9 and an acceptable call quality of 0.8 with a maximum of 8 calls. The discriminant probability refers to the probability of a call sequence falling within the centroid of the multi-dimensional data space for reference calls for a species. Two outputs result from the analysis for assessing the likelihood of a call sequence matching reference calls from a particular species. The "sequence classification by vote" identifies the species by requiring that the species with the greatest number of calls classified be at least twice as prevalent as the sum of the 2nd and 3rd most abundant species classifications. The second output, the "mean sequence classification" is based on the mean parameter values of the most prevalent classification group then uses these mean values (minimum of two calls) through a decision tree engine. When both these criteria meet the threshold, the call is classified as "consensus", and, when enabled, the species code is appended to the file (Fig. 1). If the values fall below the minimum threshold for a classification group, the call is not attributed to that group, but instead is displayed with the species groups that sum to the thresholds for the last decision tree step attained. The call file is tallied as a bat pass.

All recorded call files were processed using a moderate setting and had species codes appended to the files for consensus approved identifications. Approximately 50-100 % of these calls were then manually vetted to confirm agreement on the species identifications of the auto-classification. Output results from Sonobat are provided in 2 formats; a summary of the classification analysis, and a text file of all call files with associated parameter results (Fig. 1). Both outputs were then converted into spreadsheets, and are provided for future reference and use in monitoring efforts. See Appendix A for Sonobat call screen shots of confirmed species, and Appendix B for non-confirmed species.

Figure 1.

Sample Analysis Output from Sonobat Auto-Classification:



Reservoir Ridge	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu
Consensus count	0	0	78	0	58	0	0	4	0	111
Corrected count	0	0	75	0	52	0	0	3	0	104
est. likelihood of presence	0	0	1	0	1	0	0	0.755051	0	1
ByVote count	0	0	80	0	61	0	0	4	0	114
MeanClssn count	0	0	110	1	94	0	0	6	0	134

HiF sum	380
LoF sum	382
total est. passes	762

Manual Review of Full Spectrum Acoustic Calls

The manual review of call files is based on the comparison of individual call pulses and the diagnostic parameters for each species, as defined by Sonobat. These diagnostic parameters vary by species, with some species having few diagnostic features making confirmations more difficult than others. Parameters that were used in the process include call duration, High frequency & Low frequency Khz, calls per second, Fc, Total slope, Low Slope, power center, and others. Most calls are typically not recorded under ideal conditions or bat orientations, and do not provide high quality calls for analysis by manual review. The following classification results were used during manual review:

Confirmed – At least 3 call pulses within a call file met the required diagnostic parameters for the species.

Likely – Call that was not confirmed, but based on call characteristics and known local documentation of the species, it is considered to be an accurate ID.

Possible - Call that was not confirmed, and no known documentation of the species in the area surveyed, but is known to occur in this part of the state. The call was not considered to be inaccurate.

Unknown – Call that could not be verified, and the species is not well documented in the area surveyed.

Out of Range – Call that could not be verified, and the species is not known to occur in this area of the state.

All calls **identified by auto-classification to a species that had not previously been documented on Natural Areas, or are considered rare, or not currently documented in this part of the state were reviewed manually for potential species confirmations.**

Eastern red bats (*Lasiurus borealis*) and western red bats (*Lasiurus blossevillii*), as well as tri-colored bats (*Perimyotis subflavus*) and canyon bats (*Parastrellus Hesperus*) are problematic for acoustic surveys in the state because the software used for analysis does not include the eastern species. The calls of these eastern and western species are similar, and can be mis-identified during the auto-classification process. The western red bat has not been documented in Colorado, but is found in Utah and may eventually be found in western Colorado. The eastern red bat has had more recent documentation in Colorado, on the plains and foothills of the front range. Red bats are a migratory, tree roosting species. Likewise, the tri-colored bat (formerly known as the eastern Pipistrelle) has also had recent new documentation in the state, while the canyon bat (formerly known as the western Pipisrelle) is predominately found in western Colorado, but several records are reported from the southern part of the east plains in Las Animas County.

Pallid bats (*Antrozous pallidus*) are also a species that have been documented in the southern end of the eastern plains of Colorado, and may someday be found further north along the front range, but will require definitive documentation. The calls of this species can be very similar to other species, so because of the potential for range expansions of some species, capture documentation is likely to be necessary.

Zero Crossing

Anabat Walkabout Detector

The Anabat Walkabout is designed for active bat detection. It is an all-in-one detector with a built-in omnidirectional microphone and has a color touchscreen display. The detector records and displays both zero crossings analysis (ZCA) and full spectrum and makes them visible as sonograms (time vs. frequency graphs). The Walkabout is also capable of tracking your movements and location with GPS in real-time.

Analyses

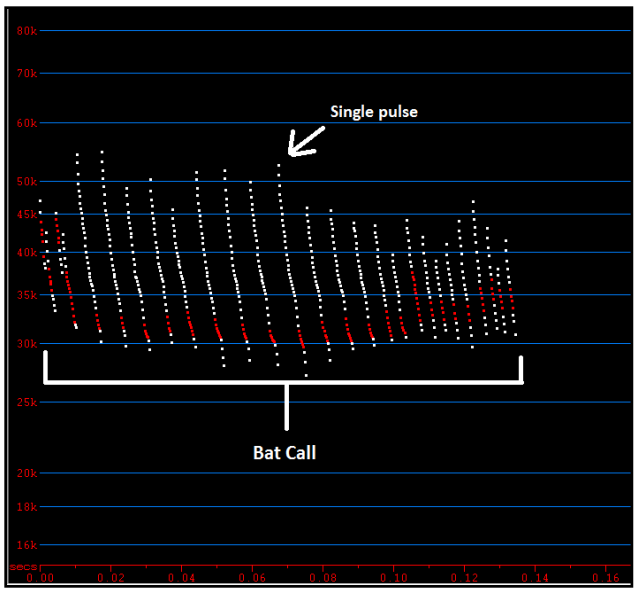
We downloaded data from the Anabat Walkabout memory cards and data were sorted by date and site. Walkabout data were post-processed using a custom AnaLookW filter created by Britzke and Murray (2000). We describe the filter specifications in Table 3. This filter scanned files containing bat calls and marked those simply containing environmental noise. We manually removed all noise files that passed the initial filter and did not include them in our summaries.

Table 3 - Britzke and Murray (2000) filter parameters used to scan all recorded bat data from the Anabat Walkabout detector.

Parameters	**Value**
Smoothness (%)	15
High Start (True/False)	False
Body Over (µs)	240
Sweep (kHz)	6 – 300
Duration (ms)	1 – 30
Minimum Call Rate	2 pulses within 5 seconds

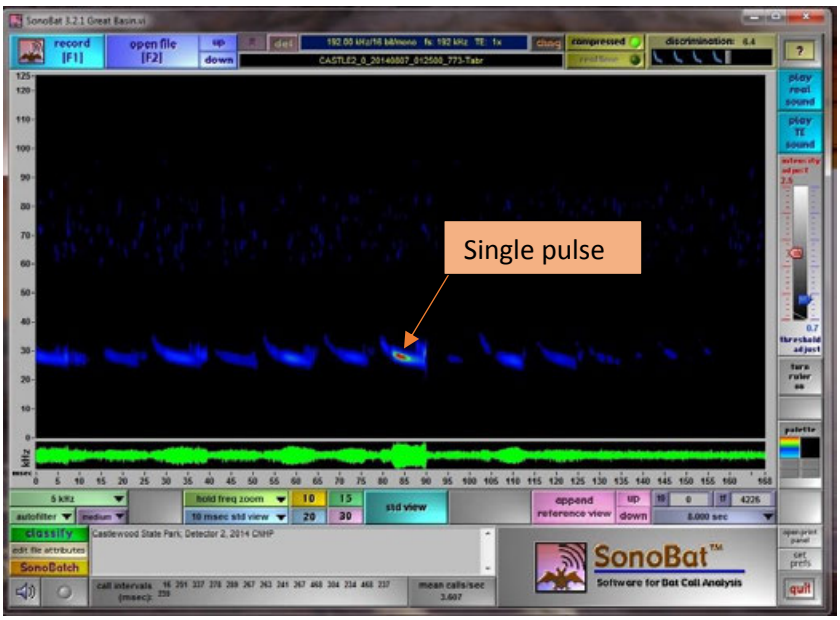
We defined a "bat pass" as a series of ≥2 echolocation pulses within 2 ms emitted by a single bat (Weller and Baldwin 2012). An echolocation pulse is defined as a single sound wave emitted by a bat (Figure 2). We conducted a qualitative analysis manually identifying each call file to species, species group (e.g., EPFU/LANO), or phonic group (e.g., *Myotis*; Table 2). We used an acoustic reference call library for Western bat species to assist with the identification. We used the following call characteristics when making identifications: characteristic frequency (f_c), minimum and maximum call frequencies (f_{min}, f_{max}), call slope, and call duration. We examined every recorded filtered bat call file collected using the Walkabout.

Differentiating between *Myotis* species and separating big brown bat from silver-haired bat calls are sometimes difficult due to overlapping call characteristics (Britzke et al. 2013). If we could not confidently differentiate between big brown and silver-haired bat calls, we lumped these files into a single category, EPFU/LANO. Identification categories are defined in table 2. Lastly, we labeled files containing calls from multiple bats or species with ≥2 identifications. This means that the total number of bat passes recorded in an evening could exceed the total number of files recorded (i.e., there were multiple bats within a file). See Appendix C for AnaLookW call screen shots of confirmed species.



Bat echolocation call file as observed in AnalookW software. This figure visually outlines our definition of a bat call and call pulse.

Fig. 2



Sample of Full Spectrum bat calls displayed in Sonobat analysis software

REGIONAL NATURAL AREAS

SOAPSTONE PRAIRIE

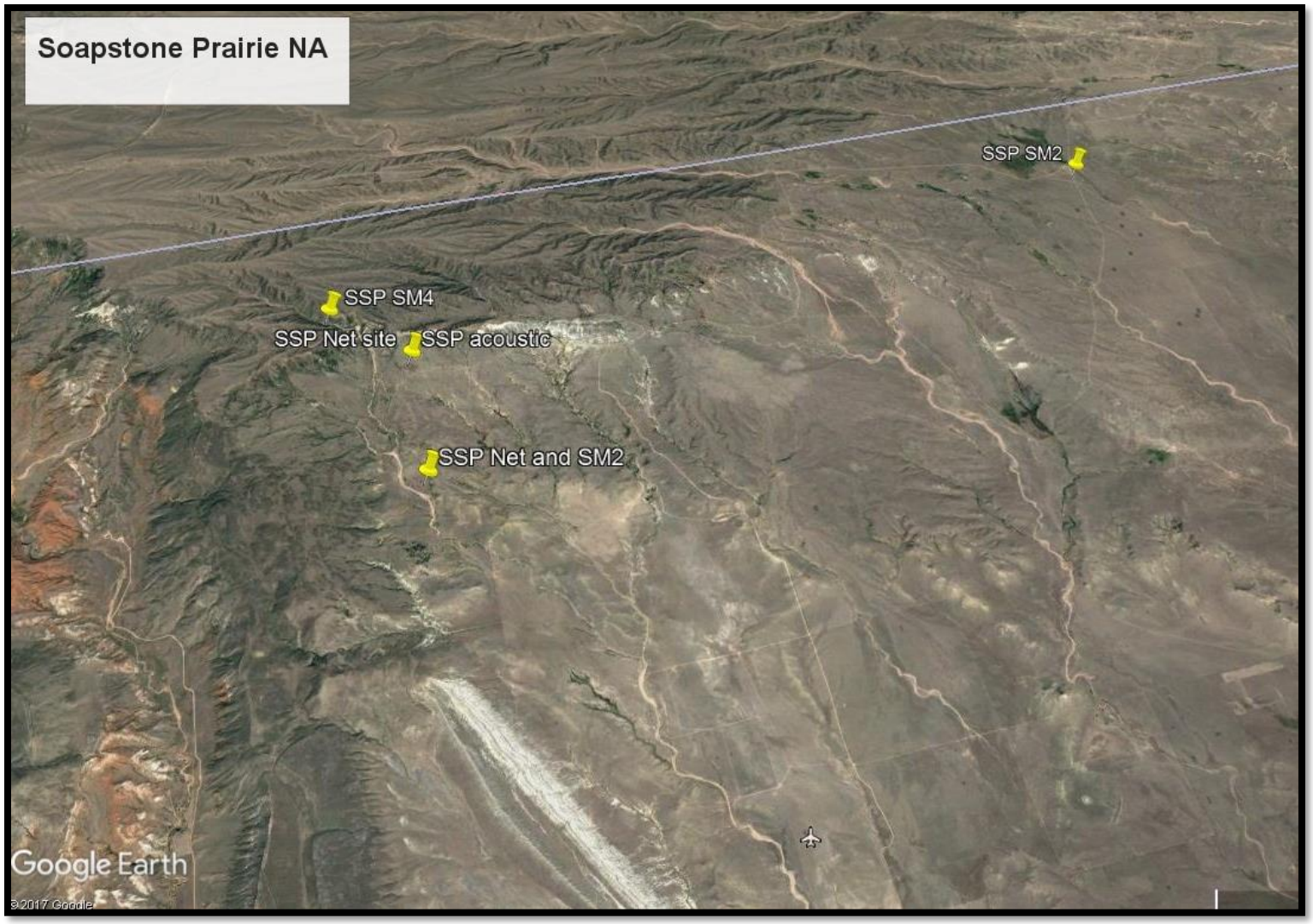
Soapstone Prairie is located in northern Larimer County, north of Fort Collins, and includes about 22,498 acres of shortgrass prairie, foothills shrublands, rock outcrops and cliffs, wetland habitats, springs and streams. The Natural Area ranges in elevation from about 6,000 feet on the east side to about 7,200 feet on the western side of the property. Hillsides and shallow canyons are found on the west side of the property, and grasslands extending to the east. An old stand of Ponderosa Pine is located on the western section of the property, surrounded by old stands of pinon-junipers along the hillsides and canyons. Wetlands and riparian habitats are found on the property in the form of marshes, springs, and seeps, but no permanent streams are found on the property. Several stock tanks are present, and can provide more consistent water sources for wildlife.

On May 16, a scouting trip was undertaken to Soapstone Prairie to evaluate potential netting sites and acoustic detector locations. Personnel from Fort Collins Natural Area led the excursion, and Mike Sherman, CPW biologist, joined the effort and conducted raptor surveys during the trip. The SE side of the natural area was evaluated, and small parts of rocky hillsides and a stock tank were present, but considered too small and too far from potential roosting sites to prioritize for bat netting. We worked our way to the northwestern side of the property, and hiked up the canyon to evaluate a stock tank located there for possible netting. The tank was small, covered with floating algae and therefore not a good source for bats to drink. The canyon was, however, a good location to conduct an acoustic survey. On the northeast side of the property, near the ranch facility, contained some open water sites near old barns/buildings, and would be another location for an acoustic survey. Most of the natural area is comprised as grasslands, and potential roosting habitat is isolated in the western side, and to a lesser extent on the north end of the property. Water sources, especially more permanent ones, are limited and could be factors in bat use and distribution on the property. Netting surveys was decided to focus on the western side of the natural area.

Canyon Stock Tank

Eastern side of Soapstone Prairie Natural Area – rock outcrops

Stock water tank on the eastern side of Soapstone Prairie Natural Area

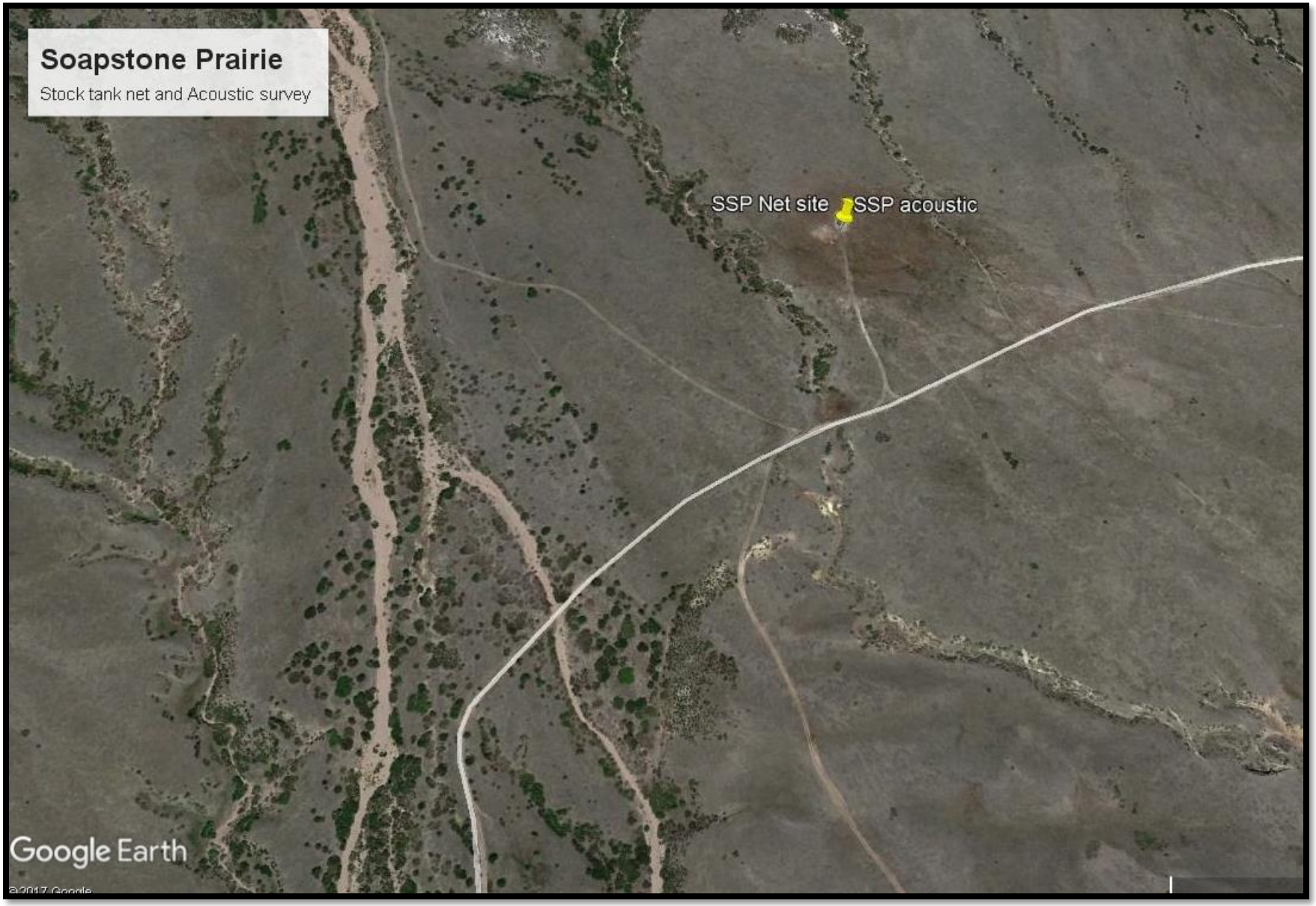


Locations of Soapstone Prairie Surveys

CAPTURE SURVEYS

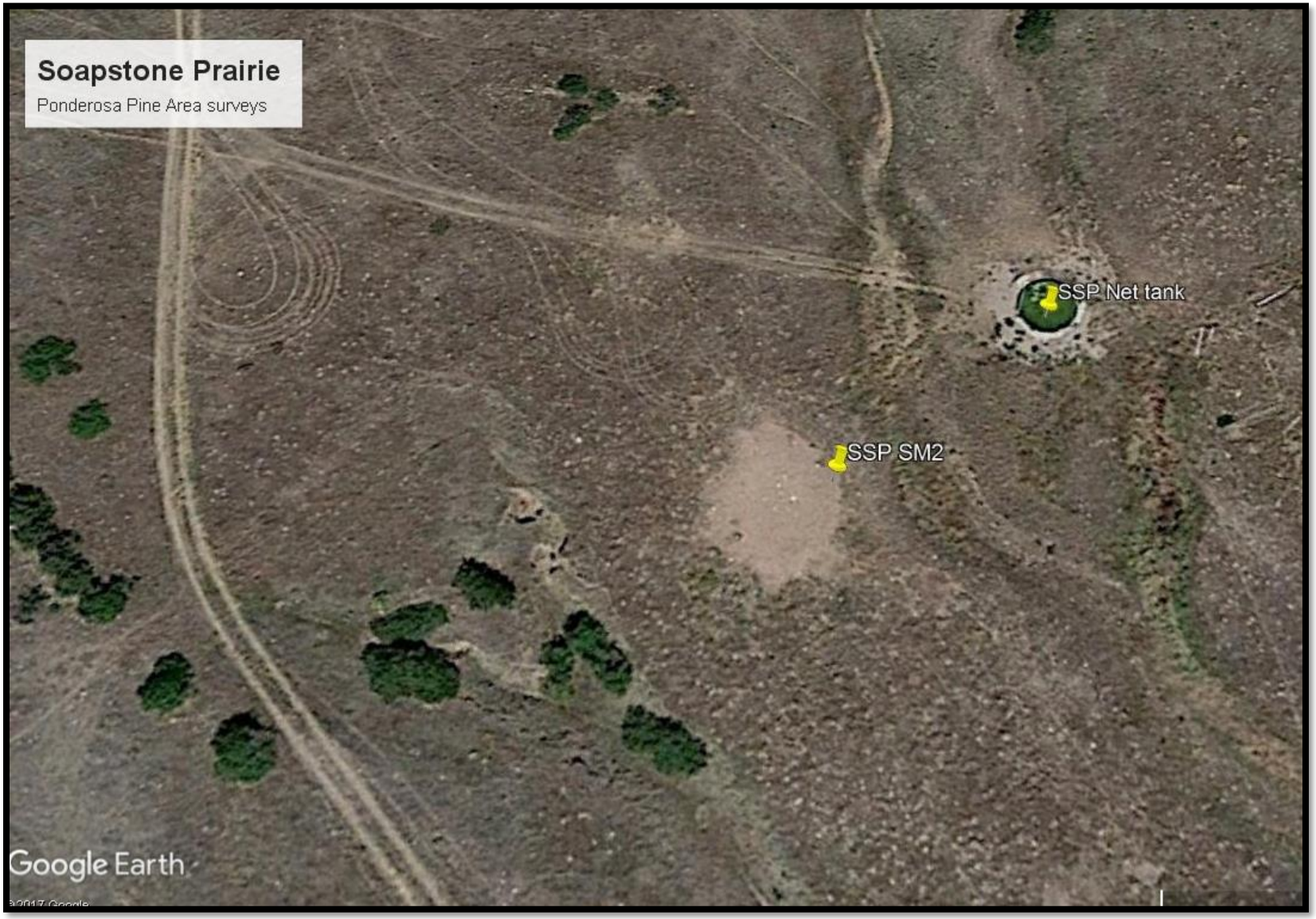
A capture survey was conducted on May 24 at the stock tank near the NW canyon. Natural area personnel and Laura Ellison, Mike Sherman (CPW), and some volunteer help (CSU-CVMBS) assisted with the survey. A 30 ft. (9m) mist net was placed over the stock tank, and the survey was conducted until about 2300 hrs. A small breeze was present during the survey, and the temperature dropped noticeably around 2230 hrs. The nets were opened around 2030 hrs., and little bat activity was observed during the survey. An active acoustic survey was also conducted during the survey at the stock tank. Only a few passes were noted, and no captures of bats were made on the survey.

ACTIVE ACOUSTIC SURVEY RESULTS: Number of files collected: 343 / Number of bat passes (total): 5


Soapstone Prairie
Stock tank net and Acoustic survey
SSP Net site
SSP acoustic
Google Earth
©2017 Google

A second capture survey was conducted on July 26 at the stock tank near the Ponderosa Pine stand in the “Tree Pasture”. The survey was conducted with the assistance of FCNA personnel, Laura Ellison, Mike Sherman (CPW), Emily Snode (CPW), and a CVMBS volunteer. The survey was conducted at a stock tank using three mist nets (1-18 ft. (6m) 2-30 ft. (9m)), and an active acoustic survey was conducted during the netting activity. A brief rain shower halted survey effort for about 30 minutes. A few bats were seen flying around the stock tank before the rain shower, but overall, very little bat activity was observed during the survey. No bats were captured, and the nets were closed up around 2300 hrs.

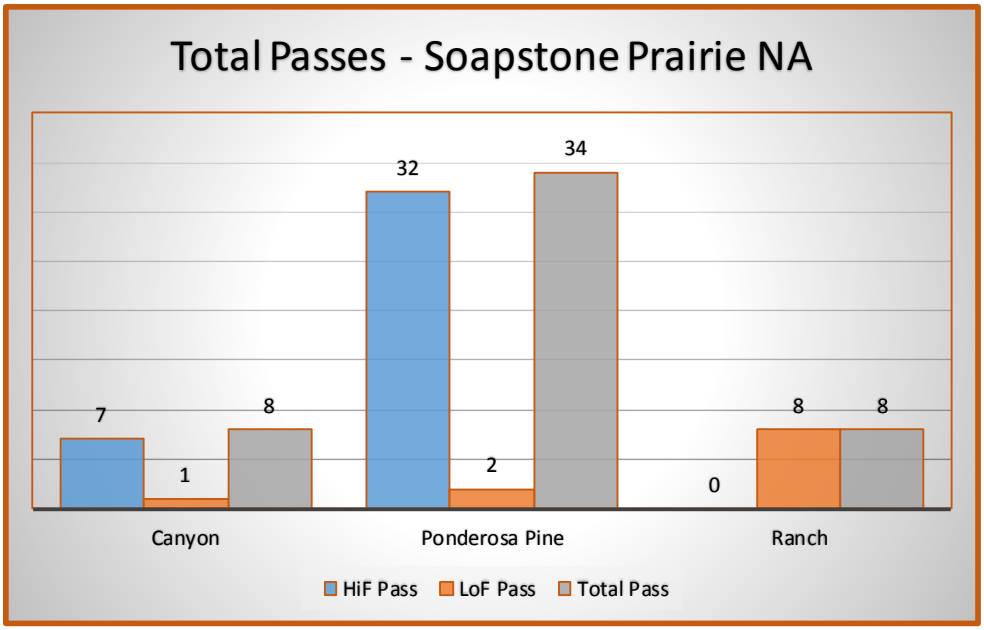
ACTIVE ACOUSTIC SURVEY RESULTS: Number of files collected: 256 / Number of bat passes (total): 24


Soapstone Prairie
Ponderosa Pine Area surveys
SSP Net tank
SSP SM2
Google Earth

Acoustic Surveys

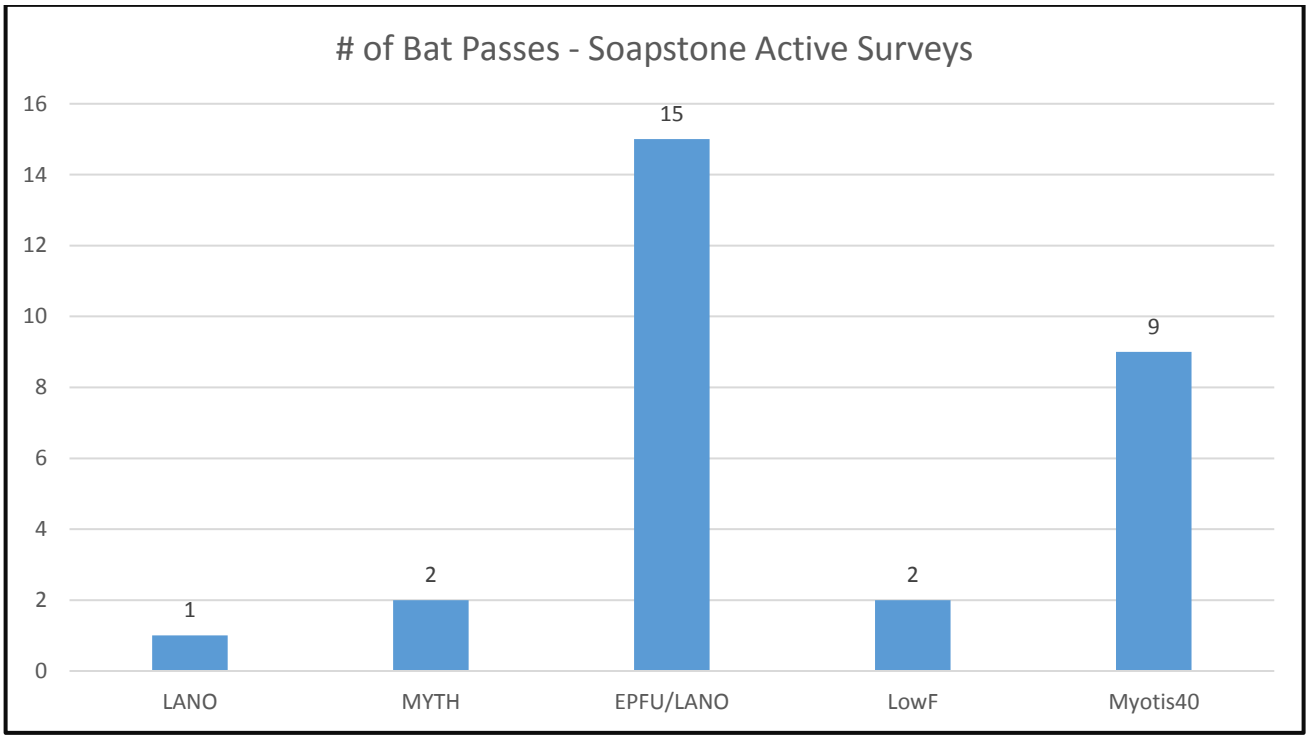
Both passive and active acoustic surveys were conducted at Soapstone Prairie Natural Area. Detectors were set out at 3 locations on 24 May, and deployed for 1 night before being picked up by FCNA personnel. Additionally, acoustic surveys were conducted simultaneously during both mist netting surveys on the natural area. SM4BAT and SM2BAT detectors were deployed for passive surveys, and an Anabat Walkabout was used during the active surveys on May 24 and July 26. As expected, based on the activity levels observed during the mist netting surveys, little bat activity was recorded during any of the acoustic surveys at Soapstone Prairie. However, 7 species were documented by auto-classification, and 4 confirmed by manual review of the call files. Two species were considered "possible" or "likely", based on known distribution of the species in the state, and another was considered unknown because it's an eastern bat species and is not yet considered "common" in the state. The western version of the analysis software doesn't include this eastern species. It does however, include a western species that is very similar with its acoustic calls, but could not be confirmed.

SOAPSTONE PRAIRIE		
Species	Review Results	Number of Calls Reviewed
Myotis lucifugus	confirmed	2
Myotis ciliolabrum	confirmed	7
Myotis evotis	confirmed	2
Lasionycteris noctivagans	Likely	1
Lasiurus cinereus	confirmed	7
Corynorhinus townsendii	possible	1
Lasiurus blossevillii / borealis	Unknown	1



ACTIVE ACOUSTIC SURVEY RESULTS (5/24/2017 and 7/26/2017)

Species or Species Grouping	Number of Bat Passes
EPFU/LANO	12
LANO	1
Myotis40	9
MYTH	2
TOTAL	24

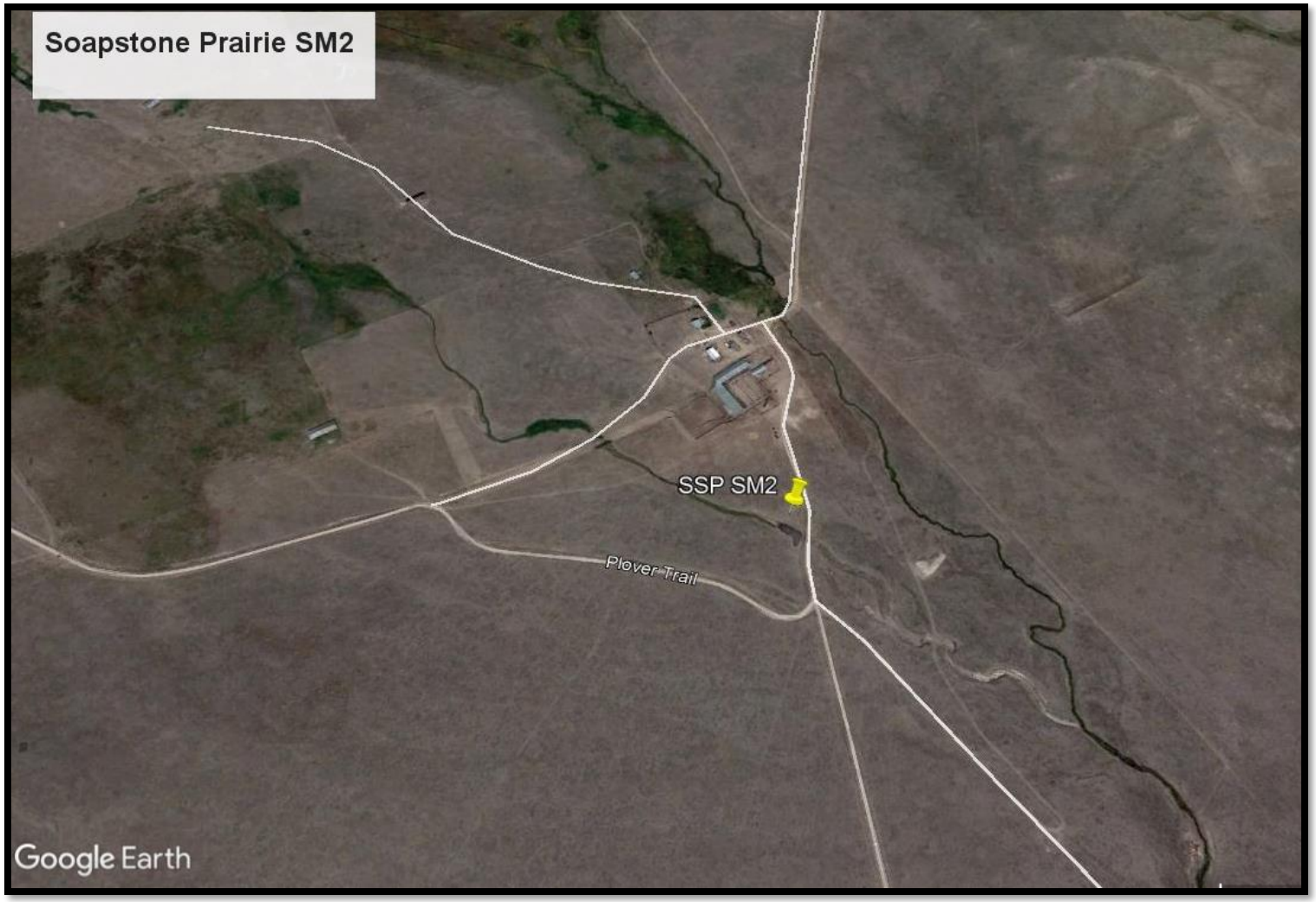


RANCH HOUSE ACOUSTIC SURVEY

An SM2BAT detector was set near an intermittent pond near the ranch house on the eastern side of the natural area on May 24. The detector was set to start recording at sunset and record continuously until sunrise. The detector was picked up the next day, providing one night of data collection. This site was selected to provide some data on the eastern side of the natural area, and because there was open water available for drinking access by bats and nearby structures available for potential roosting. The detector was placed near the pond, and between the pond and old barns located to the north. Generally, this site was located in open grasslands and some distance from potential roosting habitat of cliffs and trees. Only 1 species was identified, a Hoary bat (LACI), and confirmed by manual review.

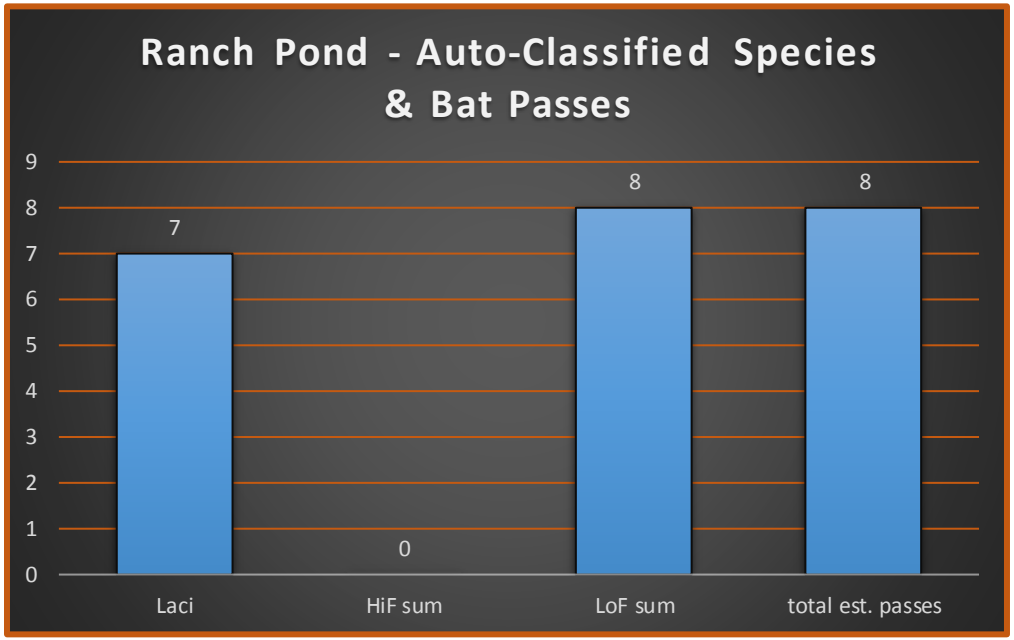
Soapstone Prairie Ranch House Acoustic Site

Soapstone Prairie Ranch House Acoustic Site



Sonobat Auto Classification Output – Ranch House SM2 Detector

Soapstone Ranch	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto	Euma
Consensus count	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0
Corrected count	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0
est. likelihood of presence	0	0	0	0	0	0	0	0	0	0	0	0	0	0.988578	0	0
ByVote count	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0
MeanClssn count	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
HiF sum	0															
LoF sum	8															
total est. passes	8															



WEST CANYON ACOUSTIC SURVEY

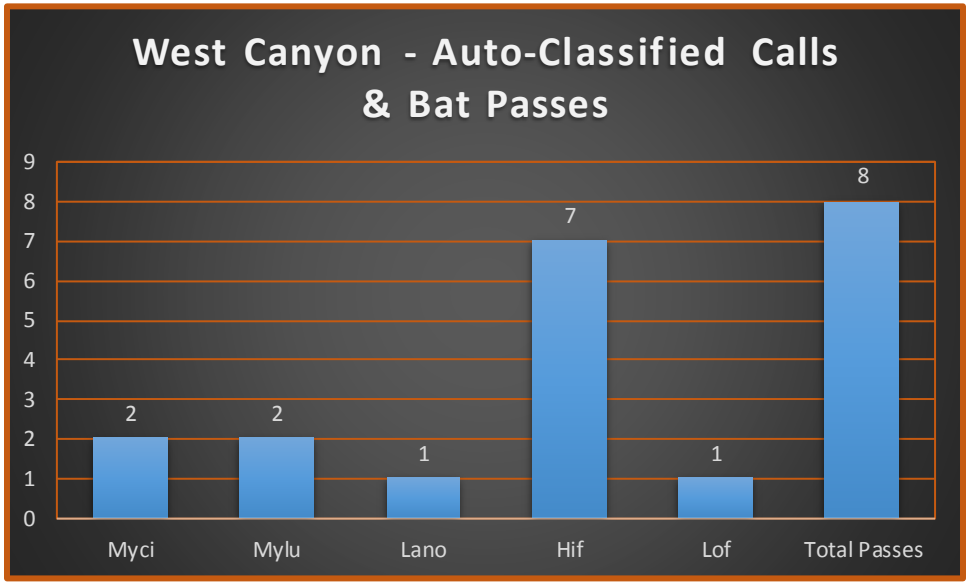
An SM4BAT detector was set up in the western side small canyon on 24 May. The detector was set to start recording at sunset and record continuously until sunrise. The detector was picked up the next day, providing one night of data collection. This site was selected because it was located among canyon rock outcrops and PJ habitats, and could provide potential roosting habitat for bats in this area. A nearby stock tank, checked in late May, was covered in algae and likely not accessible to bats for drinking. The detector was placed in the dry wash of the canyon, to record bat activity as they foraged and used the canyon as a flight path to access the grasslands and stock tank located near the canyon mouth. Three species were identified by auto-classification, including Western small-footed myotis (MYCI), silver-haired bat (LANO), and Little brown myotis (MYLU). MYLU was confirmed to species by manual review of call files.

Soapstone Prairie West Canyon Acoustic Site

Soapstone Prairie West Canyon Acoustic Site

Sonobat Auto Classification Output – West Canyon, SM4 detector

Soapstone Canyon	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto	Euma
Consensus count	0	0	2	0	2	0	0	0	0	0	1	0	0	0	0	0
Corrected count	0	0	2	0	2	0	0	0	0	0	1	0	0	0	0	0
est. likelihood of presence	0	0	0.8	0	0.8	0	0	0	0	0	0.205672	0	0	0	0	0
ByVote count	0	0	2	0	2	0	0	0	0	0	1	0	0	0	0	0
MeanClssn count	0	0	2	0	3	0	0	0	0	0	1	0	0	0	0	0
HiF sum	7															
LoF sum	1															
total est. passes	8															

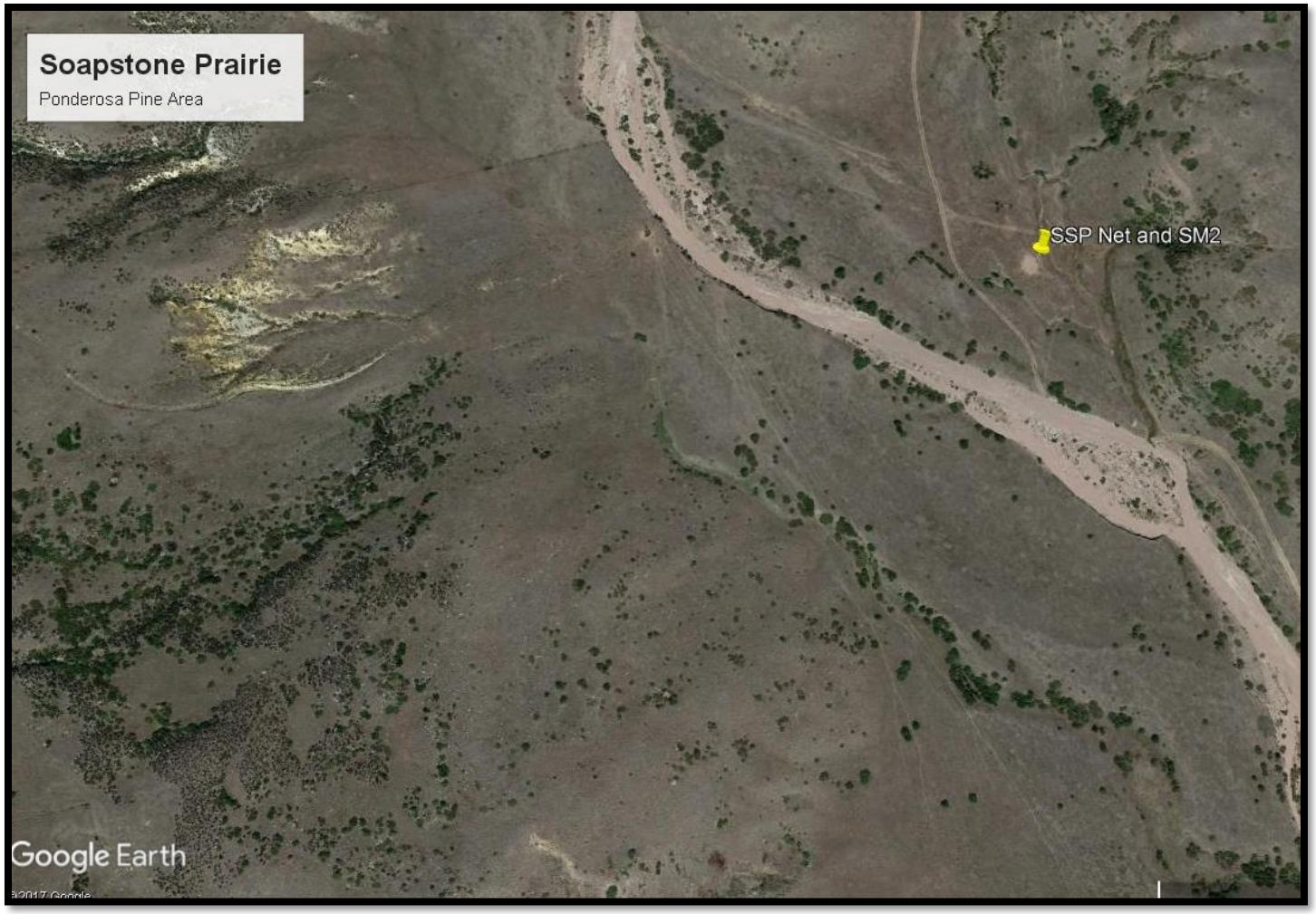


PONDEROSA PINE ACOUSTIC SURVEY

An SM2BAT detector was set up near the stock tank located near the Ponderosa Pine stand on the western side of the natural area on 24 May. The detector was set to start recording at sunset and record continuously until sunrise. The detector was picked up the next day, providing one night of data collection. This site was selected because it was located near a large stand of old ponderosa pine trees, and the potential drinking site provided by the stock tank. The old stand of pine trees could provide potential roosting habitat for bats in this area. The detector was placed a short distance from the stock tank, to avoid potential clutter and call quality issues. Four species were identified by auto-classification, including Western small-footed myotis (MYCI), Western long-eared myotis (MYEV), Townsend's big-eared bat (COTO), and Western red bat (LABL). Two species were confirmed by manual review of call files, MYCI and MYEV. The western red bat is considered "unknown", because of the software issue and confusion with the eastern red bat.

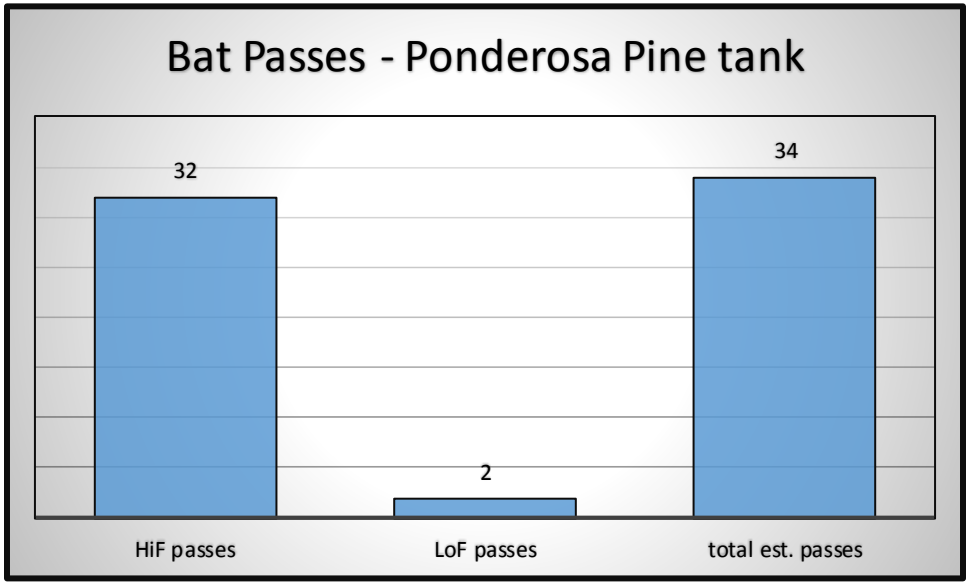
Soapstone Prairie Ponderosa Pine Stock Tank Acoustic Site

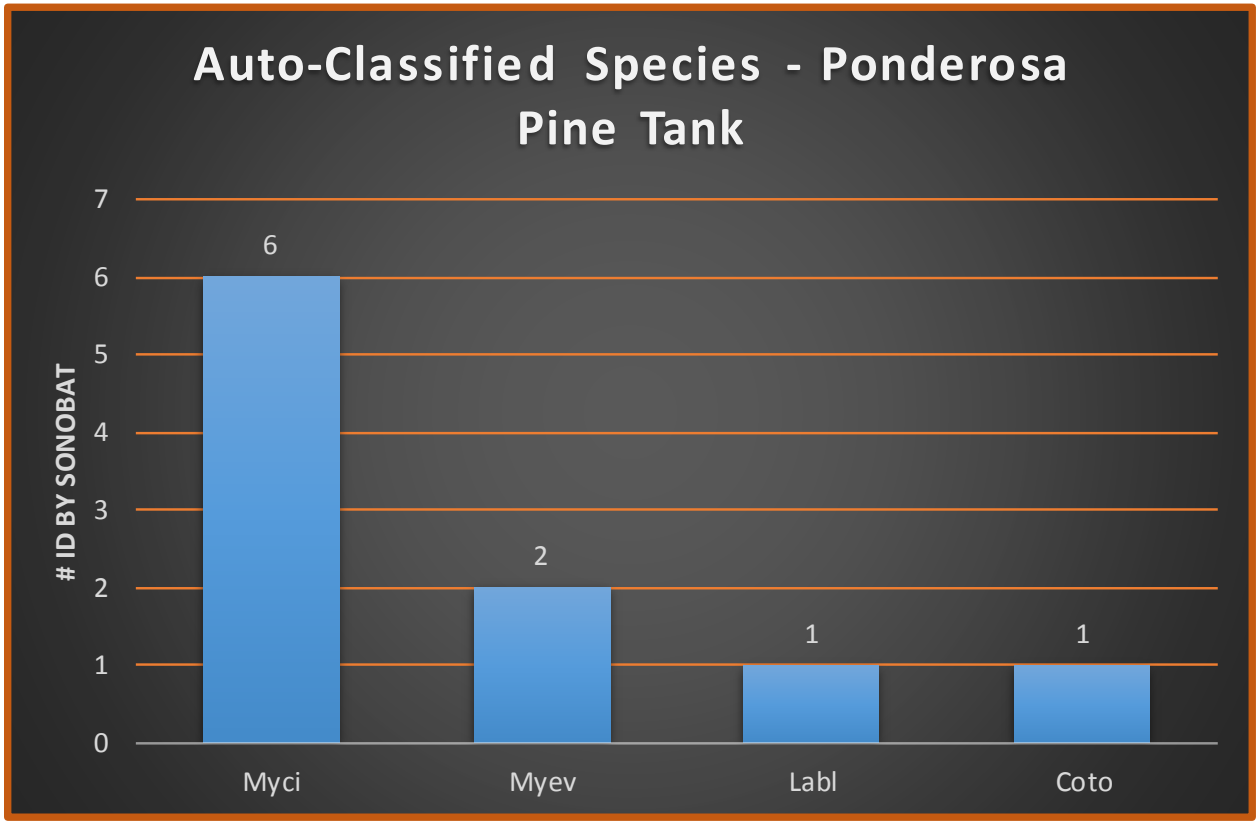
Soapstone Prairie Ponderosa Pine Stock Tank Acoustic Site



Sonobat Auto Classification Output – Ponderosa Pine Stock Tank, SM2 Detector

Soapstone Ponderosa	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto
Consensus count	0	0	6	0	0	0	1	2	0	0	0	0	0	0	1
Corrected count	0	0	5	0	0	0	0	2	0	0	0	0	0	0	1
est. likelihood of presence	0	0	0.982111	0	0	0	0.182	0.608513	0	0	0	0	0	0	0.552786
ByVote count	0	0	7	0	0	0	1	2	0	0	0	0	0	0	1
MeanClssn count	0	0	10	0	5	0	1	3	0	0	0	0	0	0	1
HiF sum	32														
LoF sum	2														
total est. passes	34														




Auto-Classified Species - Ponderosa Pine Tank
ID BY SONOBAT
7
6
5
4
3
2
1
0
6
2
1
1
Myci
Myev
Labl
Coto

ACOUSTIC SURVEYS SUMMARY

The acoustic surveys at Soapstone Prairie provided 7 species of bats identified by auto-classification, 4 of which were confirmed by manual review (MYLU, MYCI, MYEV, LACI). The passive surveys recorded only a total of 50 bat passes, so the number of calls to manual vet for species confirmation was limited. One Tier 1 species, Townsend's big-eared bat (COTO), had a call identified as this species at the Ponderosa pine acoustic site, was considered "possible", but could not be confirmed by manual review. A Tier 2 species, the Hoary bat (LACI) was confirmed by a call collected at the ranch house acoustic survey site. One species identified as a western red bat (LABL) was considered "unknown" as a potential eastern red bat record because it could not be verified. A call identified as a silver-haired bat (LANO) was considered "likely" based on the potential roosting in trees found near the Ponderosa pine survey site. A drop-in temperature during the May acoustic survey may have been a contributing factor in the low level of bat activity documented, but similar results were obtained in the July active survey effort during the capture survey at the Ponderosa pine site.

Summary and Recommendations:

Very little bat activity was documented during surveys on Soapstone Prairie Natural Area. The property is extensive and only a small portion of it was surveyed for bat use and status. Most of the natural area is comprised of grasslands, and roosting habitat is limited mainly to areas on the western and northern ends of the landscape. The crevices found along the rock outcrops on the natural area could provide roosting habitat for bats, for both summer and winter seasons of use. Additionally, the forested stands also provide potential roosting sites for many species of bats. Insects associated with grassland habitats would provide an adequate prey base for foraging bats, but it is unclear if such insect activity levels were abundant during the survey periods. A lack of reliable water sources for drinking may also be a limiting factor for bats on this natural area. While several stock tanks are present on the natural area, their water levels are variable throughout the summer season, some may be too far east on the grasslands, and some may be frequently covered in floating algae, making access to surface water difficult for bats. Also, the bars around some of the larger stock tanks may inhibit access by our larger, less maneuverable species of bats. It is also possible that bats roosting on the natural area fly west to more favorable sources of water and foraging.

Several buildings and structures exist on the property, and project constraints did not allow for evaluation of their potential as roosting sites for bats during this project. One old housing unit, located next to the Natural Area shop on the northern side of the property, was looked at during a lunch break during the scouting trip in May. No clear sign of bat use was noted along the outside of the building, and it appeared to have been recently sealed up to protect entry by rodents. However, it is possible that it could be used by bats if access is available, especially during migration of some species.

While no bats were captured during mist netting surveys, acoustic data documented the presence of some species in Soapstone Prairie. This highlights the importance of using multiple approaches and survey methods to more completely assess the presence of all species of bats.

RECOMMENDATIONS:

- Periodic checks of all stock tanks and removal of floating algae should be undertaken to provide better drinking access by bats.
- Ensure all stock tanks have escape ladders installed and maintained in functional condition.
- Evaluate all building structures prior to removal or remodeling for potential roosting use by bats. If bat colonies are present, considered maintaining the roost for bats, or conducting action during the seasons of non-use. If not feasible or appropriate to preserve a roost, conduct a proper bat exclusion during a season of non-use before destructive action is initiated.
- Promote maintaining tree snags on the natural area.

BOBCAT RIDGE NATURAL AREA

Bobcat Ridge Natural Area, located just west of Masonville, includes 2,606 acres of foothills grasslands, shrublands, and pine forests habitats. The landscape of this natural area ranges from about 5,000 to 7,000 feet in elevation, providing a diverse mixture of vegetation, topography and wildlife. The foothills on the west side are covered by ponderosa pine and Douglas fir forest stands, and sandstone cliffs on the natural area's eastern edge both provide the diverse roosting opportunities for bats in this natural area. There are a number of springs and associated wetlands located around the Mahoney Park area, two ephemeral streams and a small irrigation-fed pond. The concrete lined Hansen Feeder Canal also passes through the eastern side of the property. Buildings and some historic structures remain on the natural area. Most of these are located near the ranger's house at the entrance to the natural area, but only the hayshed was examined for potential bat use. Time constraints did not allow evaluations of the other structures.

Species previously documented at Bobcat Ridge Natural Area include:

Big brown bat (EPFU)

Western small-footed myotis (MYCI)

Silver-haired bat (LANO)

Little brown myotis (MYLU)

Hoary bat (LACI)

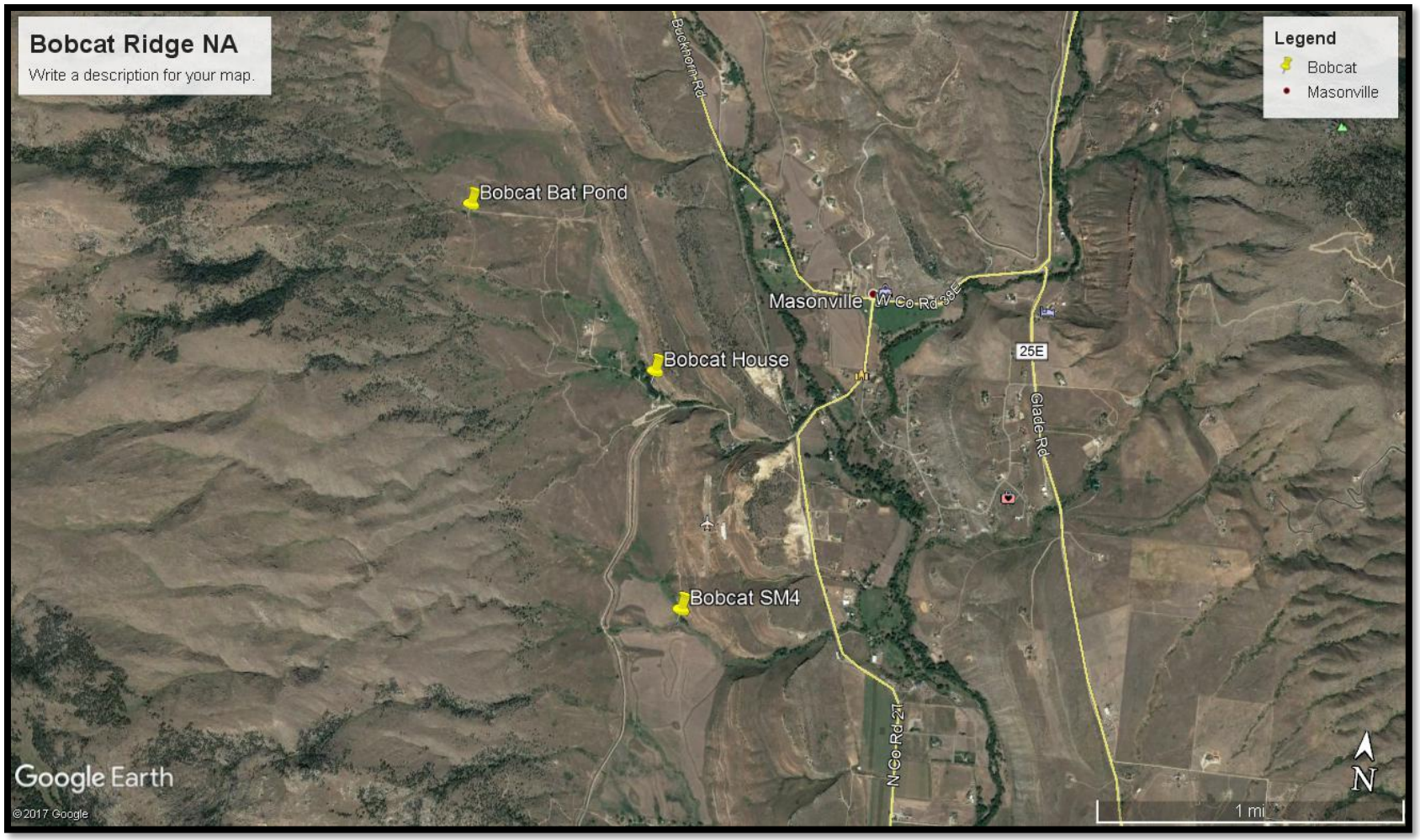
Western long-eared myotis (MYEV)

Long-legged myotis (MYVO)

Townsend's big-eared bat (COTO)

Bat Pond

Bobcat Ridge Survey Sites



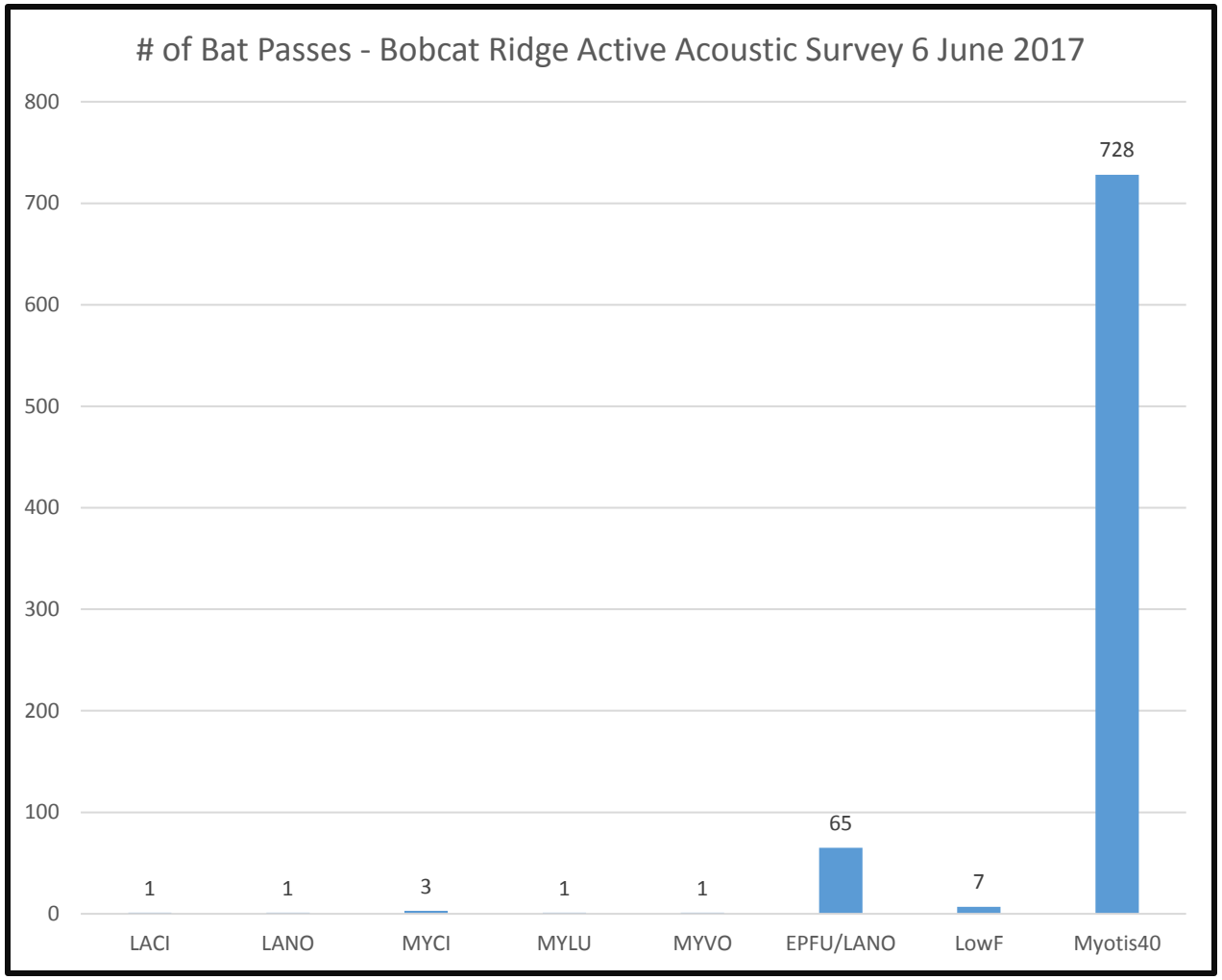
Capture Surveys

Bat capture and acoustic surveys were conducted on Bobcat Ridge on 6 June, and additional acoustic surveys were conducted on 14 August. The capture survey was conducted at an un-named pond on the north side of the natural area, near Mahoney Park. This site is referred to as the "bat pond" in this report. The pond is large from the perspective of mist netting for bats, and provided a challenge to the survey effort. Four mist nets were set up around the pond, using 30 ft. (9m) nets, and an active acoustic detector survey was also conducted. A high level of bat activity was documented at the pond during the entire survey period, but **no bats were captured**. Bats were observed "avoiding the nets", a result of the layout of the netting situation and possibly the moon light effect. A lighting storm was observed to the south around 2200 hrs., and nets were taken down around 2300 hrs. to avoid potential safety concerns to the crew.

ACTIVE ACOUSTIC SURVEY RESULTS (6/6/2017)

Number of Files Collected: 831 / Number of Bat Passes: 807

Species or Species Grouping	Number of Bat Passes
EPFU/LANO	65
LACI	1
LANO	1
LowF	7
Myotis40	728
MYCI	3
MYLU	1
MYVO	1
Total	807

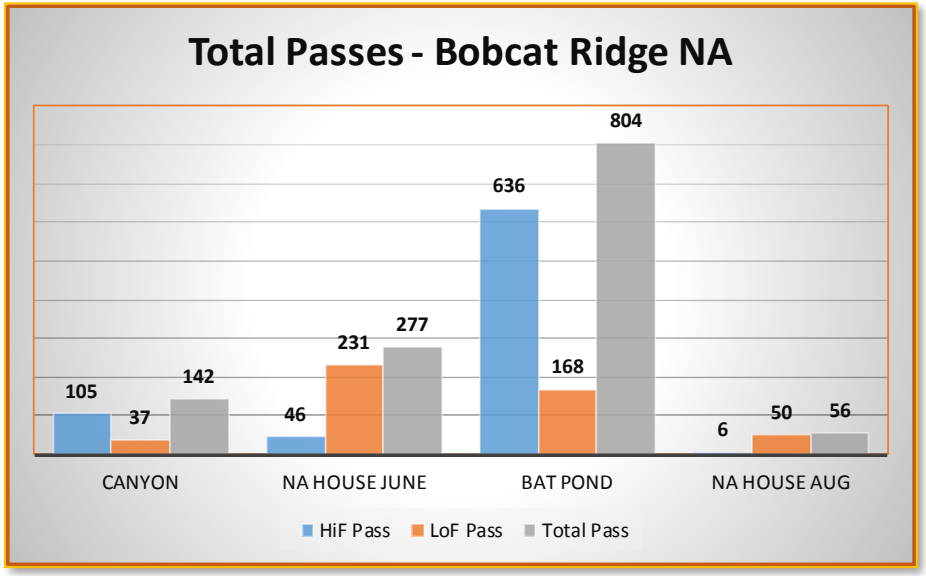

# of Bat Passes - Bobcat Ridge Active Acoustic Survey 6 June 2017
800
700
600
500
400
300
200
100
0
1
1
3
1
1
65
7
728
LACI
LANO
MYCI
MYLU
MYVO
EPFU/LANO
LowF
Myotis40

The Bat Pond Netting Survey

Passive Acoustic Surveys

Both passive and active acoustic surveys were conducted at Bobcat Ridge Natural Area. Detectors were set out at 2 locations on June 6, and again on August 14. All detectors were deployed for 2 nights on the June survey, and 1 night in the August survey. Detectors were picked up by FCNA personnel. Additionally, an active acoustic survey was conducted during the mist netting survey using a Anabat Walkabout detector. SM4BAT, SM2BAT, and Pettersson D500x detectors were deployed for passive surveys. All detectors deployed for passive recording were set to record all night, starting at sunset and shutting down at sunrise, using standard detector settings appropriate for the area. This provided recordings of bat calls all night until sunrise the following day.

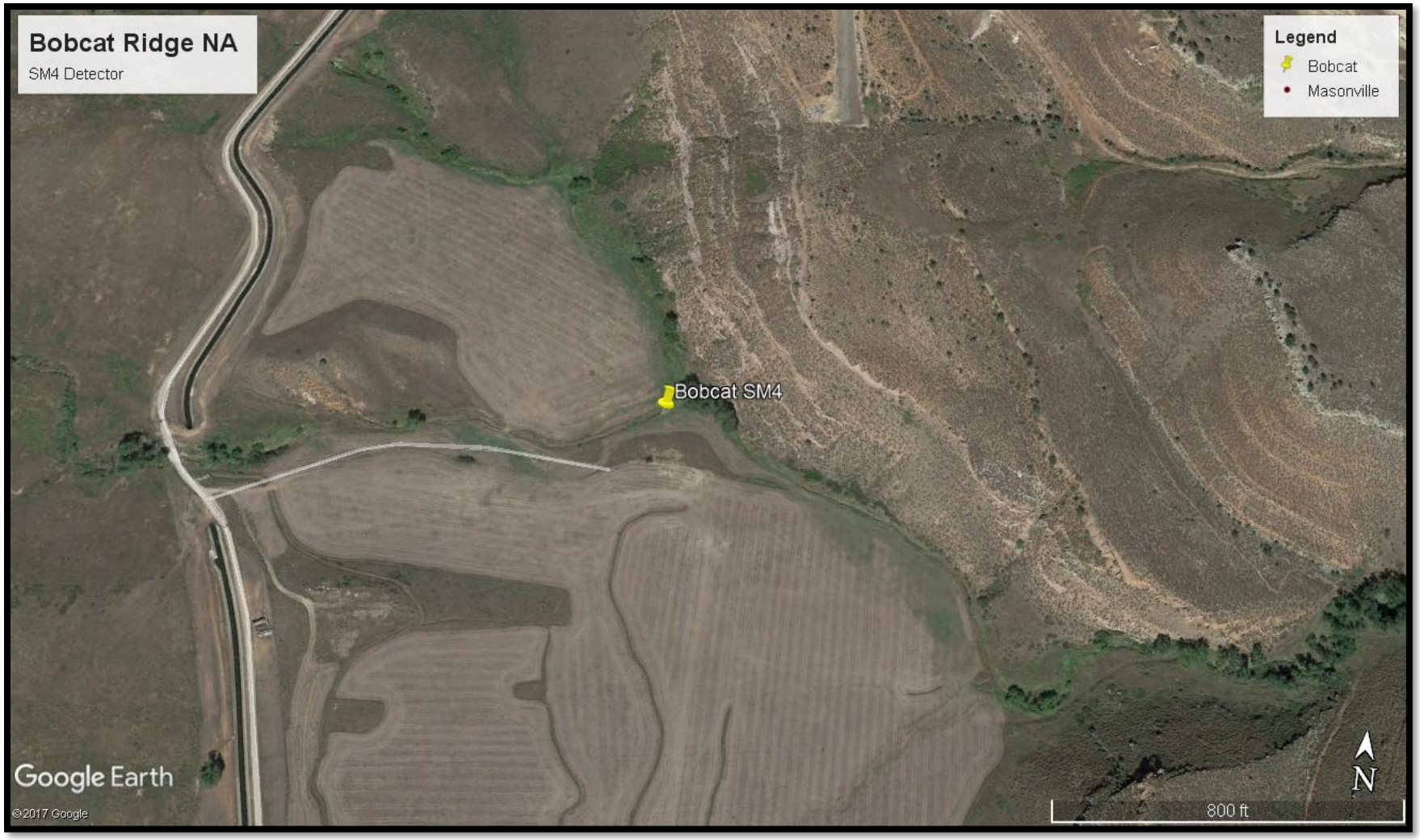
Acoustic data was collected at the west end of Brooks Canyon, the Bat Pond near Mahoney Park and Powerline Road, and behind the old historic structures across the road from the Ranger's residence. Rock outcrops providing cracks and crevices for potential roosting sites were located near the detectors set at Brooks canyon and the natural area housing. The Bat Pond is located near the forested hillsides of western foothills and springs, and provides an evaluation of the foraging and drinking opportunities of the western side of the natural area. The Bat Pond had the most bat activity recorded, followed by the Brooks Canyon, June Ranger's house, and August Ranger's house acoustic surveys.



BROOKS (SOUTH) CANYON

An SM4BAT detector was set up near a small grove of cottonwood trees, near the west end of Brooks Canyon on 6 June. The detector was set to start recording at sunset and record continuously until sunrise. The detector was picked up on June 8, providing 2 nights of data collection. This site was selected because it was located near a stand of trees along an intermittent stream channel, and the roosting habitat provided by the rock outcrops and canyon walls of Brooks Canyon. An irrigation channel also is located just west of the survey site, which may provide potential drinking access for bats. The site provided 10 species of bats identified by auto-classification, 4 of which were confirmed by manual review - Western small-footed myotis (MYCI), Fringed myotis (MYTH), long-eared myotis (MYEV) and Hoary bat (LACI). The survey recorded 142 bat passes. Most passes were identified as species with high frequency calls, and most passes were identified as Western small-footed myotis (MYCI). One new species, the fringed myotis (MYTH), was documented in the natural area, and 2 others were considered "likely"; Big brown bat (EPFU) and silver-haired bat (LANO). Calls identified as Mexican free-tailed bats (TABR) were considered as "unknown" status, and a call classified as a pallid bat (ANPA) is considered "out of range".

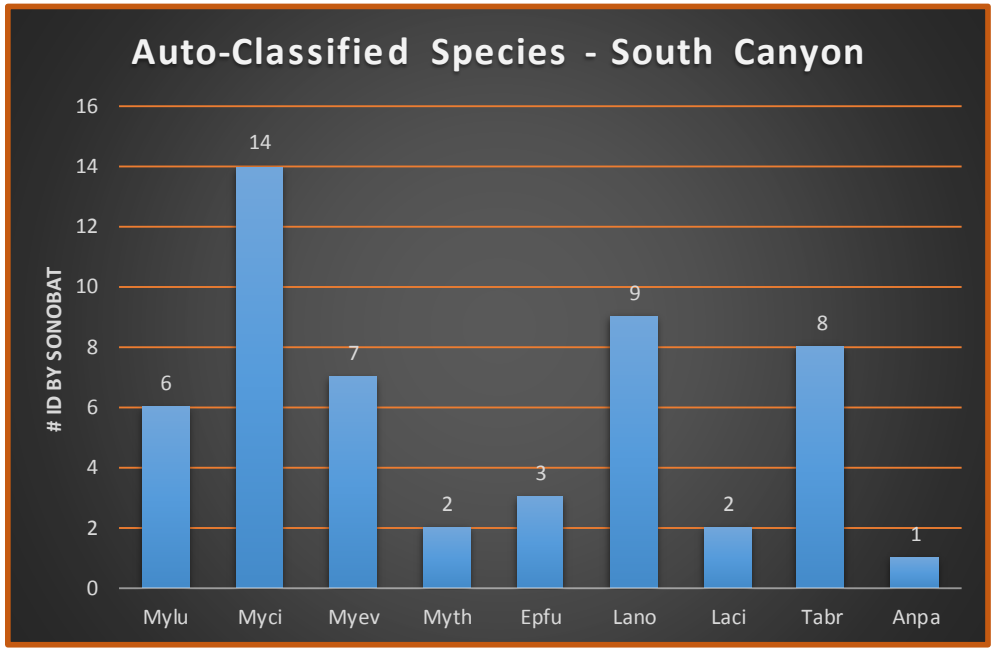
Brooks Canyon Survey Site

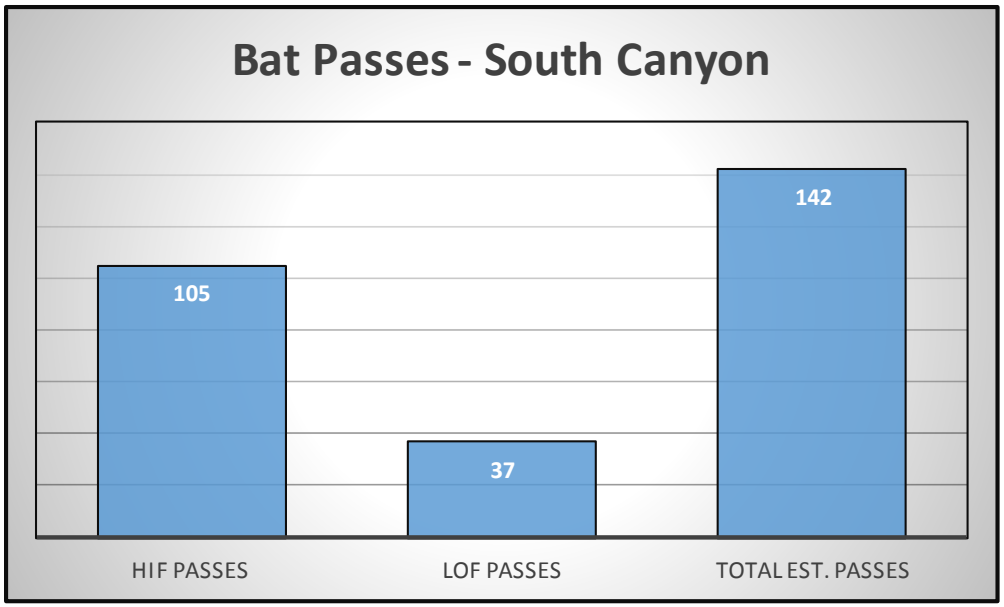


Sonobat Auto Classification Output – Brooks (South) Canyon SM4 Detector

Bobcat Ridge South Canyon	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto
Consensus count	0	0	14	1	6	0	0	7	1	3	9	2	8	2	0
Corrected count	0	0	13	0	4	0	0	6	0	2	8	1	7	1	0
est. likelihood of presence	0	0	0.999963	0.184	0.812902	0	0	0.934582	0.2325	0.219847	0.783477	0.479652	0.992365	0.328839	0
ByVote count	0	0	14	1	9	0	0	7	2	3	11	2	8	2	1
MeanClssn count	0	0	22	1	12	0	0	8	2	4	11	2	8	2	2
HiF sum	105														
LoF sum	37														
total est. passes	142														

BOBCAT RIDGE SOUTH CANYON		
Species	Review Results	Number of Calls Reviewed
Myotis lucifugus	Possible	6
Myotis ciliolabrum	confirmed	11
Myotis thysanodes	confirmed	2
Myotis evotis	confirmed	7
Eptesicus fuscus	Likely	3
Lasionycteris noctivagans	Likely	9
Lasiurus cinereus	confirmed	2
Tadarida brasiliensis	Unknown	7
Myotis volans	Possible	1
Antrozous pallidus	Out of Range	1


Auto-Classified Species - South Canyon
ID BY SONOBAT
16
14
12
10
8
6
4
2
0
6
14
7
2
3
9
2
8
1
Mylu
Myci
Myev
Myth
Epfu
Lano
Laci
Tabr
Anpa


Bat Passes - South Canyon
105
37
142
HIF PASSES
LOF PASSES
TOTAL EST. PASSES

RANGER'S HOUSE – JUNE SURVEY

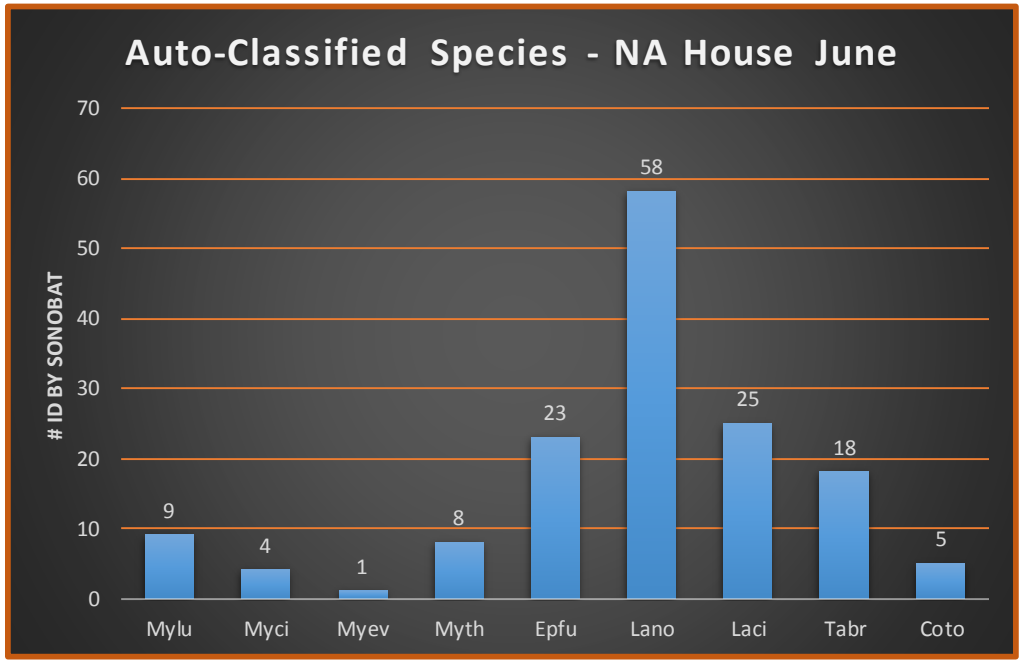
An SM2BAT detector was set up behind the historic buildings/structures across the road from the ranger's house, at the entrance to the natural area on 6 June. The detector was set to start recording at sunset and record continuously until sunrise. The detector was picked up on June 8, providing 2 nights of data collection. This site was selected because it was located near trees, rock cliffs and old structures, all of which could be providing roosting habitat for bats. The detector was placed behind the far west structure to reduce visibility to the public. The site provided 9 species of bats identified by auto-classification, 4 of which were confirmed by manual review - little brown myotis (MYLU), fringed myotis (MYTH), big brown bat (EPFU), and Hoary bat (LACI). The survey recorded 277 bat passes. Most passes were identified as species with low frequency calls, and while not confirmed, the most passes were identified as silver-haired bats (LANO). One new species, the Fringed myotis, was also documented at this site on the natural area. Western small-footed myotis (MYCI) and silver-haired bat were considered "likely" and a Western long-eared myotis (MYEV) call was determined as "possible". Two other species were considered as "unknown" status; Mexican free-tailed bats (TABR) and Townsend's big-eared bat (COTO). While not confirmed by manual review, this was the only survey that recorded a potential Townsend's big-eared bat (COTO), a species that has been documented in the past on the natural area (Bobcat Ridge Natural Area Management Plan, 2005).

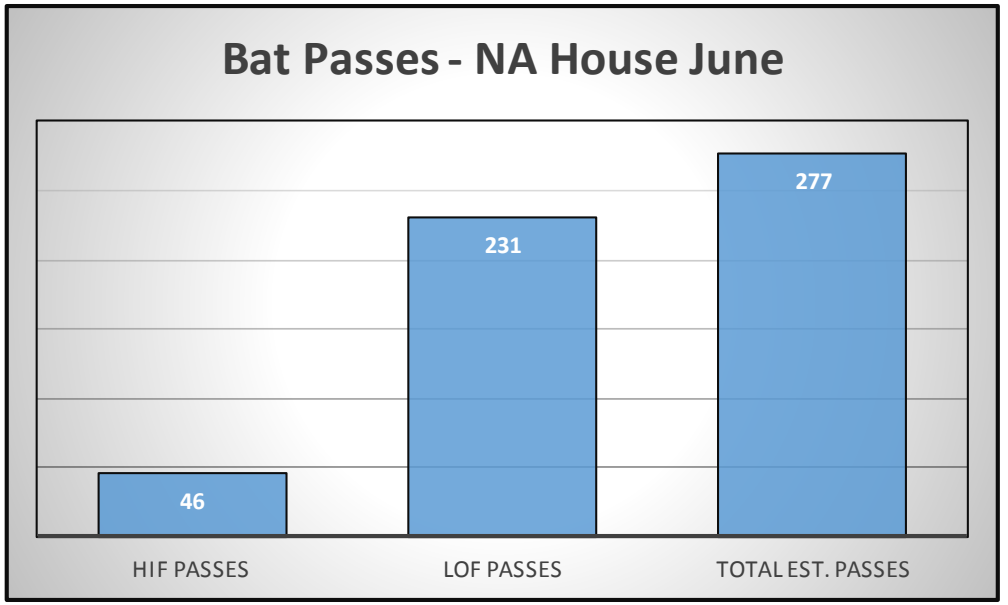
RANGER'S HOUSE ACOUSTIC SITE

Sonobat Auto Classification Output – Ranger's House - June SM2 Detector

Bobcat Ridge Park House June	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto
Consensus count	0	0	4	0	9	0	0	1	0	23	58	8	18	25	5
Corrected count	0	0	3	0	7	0	0	0	0	20	54	7	16	23	4
est. likelihood of presence	0	0	0.881445	0	0.974469	0	0	0.194	0	0.963256	0.999973	0.995237	0.999774	0.999999	0.92878
ByVote count	0	0	4	0	10	0	0	1	0	24	74	8	19	25	5
MeanClssn count	0	0	5	0	12	0	0	6	0	34	75	9	18	25	14
HiF sum	46														
LoF sum	231														
total est. passes	277														

BOBCAT RIDGE PARK HOUSE		
Species	Review Results	Number of Calls Reviewed
Myotis lucifugus	confirmed	4
Myotis ciliolabrum	Likely	4
Myotis thysanodes	confirmed	8
Myotis evotis	Possible	1
Eptesicus fuscus	confirmed	21
Lasionycteris noctivagans	Likely	10
Lasiurus cinereus	confirmed	10
Tadarida brasiliensis	Unknown	18
Corynorhinus townsendii	Unknown	5


Auto-Classified Species - NA House June
ID BY SONOBAT
70
60
50
40
30
20
10
0
9
4
1
8
23
58
25
18
5
Mylu
Myci
Myev
Myth
Epfu
Lano
Laci
Tabr
Coto


Bat Passes - NA House June
46
231
277
HIF PASSES
LOF PASSES
TOTAL EST. PASSES

BAT POND

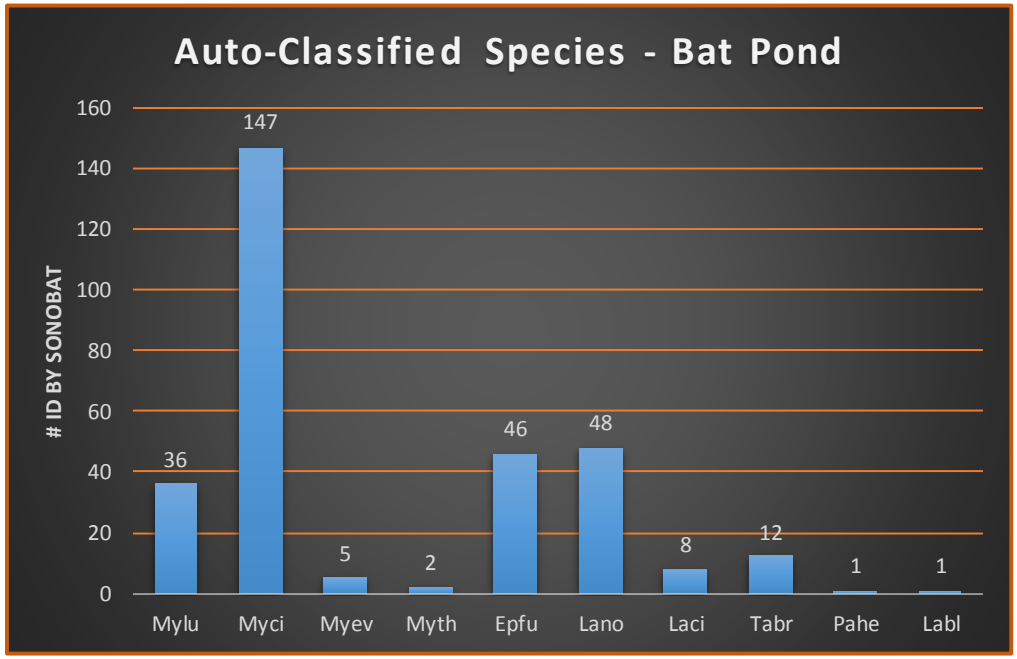
An SM4BAT detector was set up on 4 August at the Bat Pond, located on the northern side of the natural area and under the powerline. The detector was set to start recording at sunset and record continuously until sunrise. The detector was picked up on August 5, providing 1 night of data collection. When the unit was picked up by the ranger, it was found with the upper extension that holds the microphone lying on the ground next to the tripod (see photo). It is unknown why or when this occurred, but a review of the acoustic data did not reflect poor call quality, over-loaded signals or echoes that would produce poor quality calls for analysis. All the calls looked very good, which suggests whatever happened to knock down the microphone, it may have occurred after sunrise. This site was selected because it was located at a large pond, with emergent vegetation, providing both a source for drinking and foraging of bats in the natural area. High levels of bat activity were documented during this survey, and the survey provided 11 species of bats identified by auto-classification, 5 of which were confirmed by manual review; Western small-footed myotis (MYCI), Fringed myotis (MYTH), Western long-eared myotis (MYEV), silver-haired bat (LANO), and Hoary bat (LACI). The survey recorded 804 total bat passes. Calls identified as Long-legged myotis (MYVO) are considered as “possible’, and Little brown myotis (MYLU) and Big brown bat (EPFU) calls were determined as “likely”. Most passes were identified as species with high frequency calls, and most passes were identified as MYCI. One new species to the natural area, Fringed myotis, was also documented in this survey, and 2 others were considered “unknown” status - Mexican free-tailed bats (TABR) and Western red bat (LABL). The LABL, considered a possible eastern red bat (LABO), is a species that has been documented along the front range more recently, but could not be confirmed. Another species, a canyon bat (PAHE) was considered “out of range”, but could be the eastern tri-colored bat (PESU), another species with more recent Colorado records (Wostl, et.al., 2009).

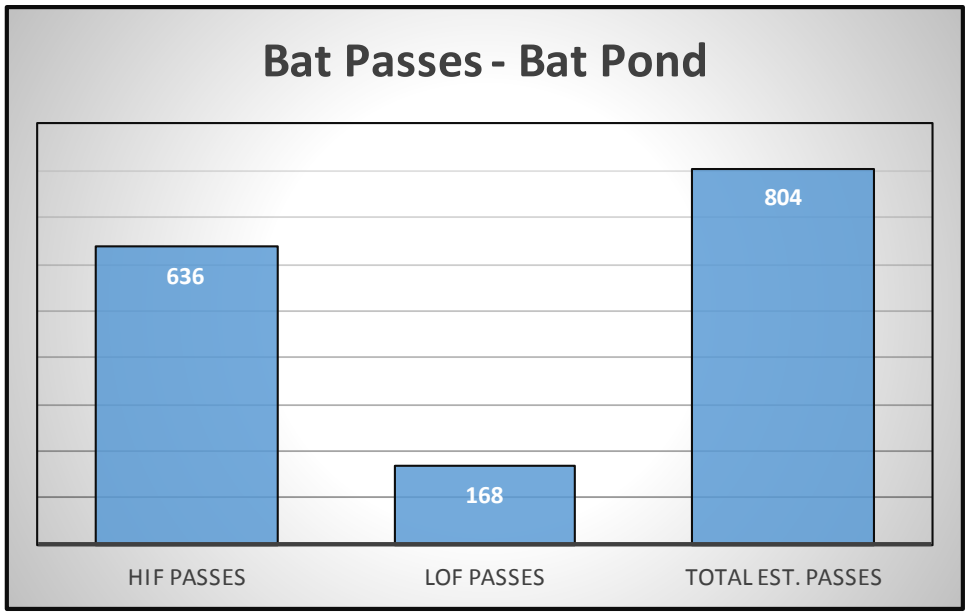
BAT POND SURVEY SITE

Sonobat Auto Classification Output – Bat Pond SM4 Detector

Bobcat Ridge Bat Pond	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto
Consensus count	0	0	147	1	36	1	1	5	0	46	48	2	12	8	0
Corrected count	0	0	143	0	24	0	0	4	0	43	44	1	10	5	0
est. likelihood of presence	0	0	1	0.184	0.999138	0.194	0.182	0.834432	0	0.999836	0.999731	0.479315	0.993969	0.817388	0
ByVote count	0	0	152	1	39	1	1	5	0	47	55	2	12	8	0
MeanClssn count	2	0	231	1	109	8	4	7	0	59	60	2	15	9	0
HiF sum	636														
LoF sum	168														
total est. passes	804														

BOBCAT RIDGE BAT POND		
Species	Review Results	Number of Calls Reviewed
Myotis lucifugus	Likely	20
Myotis ciliolabrum	confirmed	24
Myotis thysanodes	confirmed	2
Myotis evotis	confirmed	5
Eptesicus fuscus	Likely	23
Lasionycteris noctivagans	confirmed	8
Lasiurus cinereus	confirmed	8
Tadarida brasiliensis	Unknown	12
Myotis volans	Possible	1
Parastrellus hesperus	Out of Range	1
Lasiurus blossevillii / borealis	Unknown	1


Auto-Classified Species - Bat Pond
ID BY SONOBAT
160
140
120
100
80
60
40
20
0
36
147
5
2
46
48
8
12
1
1
Mylu
Myci
Myev
Myth
Epfu
Lano
Laci
Tabr
Pahe
Labl


Bat Passes - Bat Pond
636
168
804
HIF PASSES
LOF PASSES
TOTAL EST. PASSES

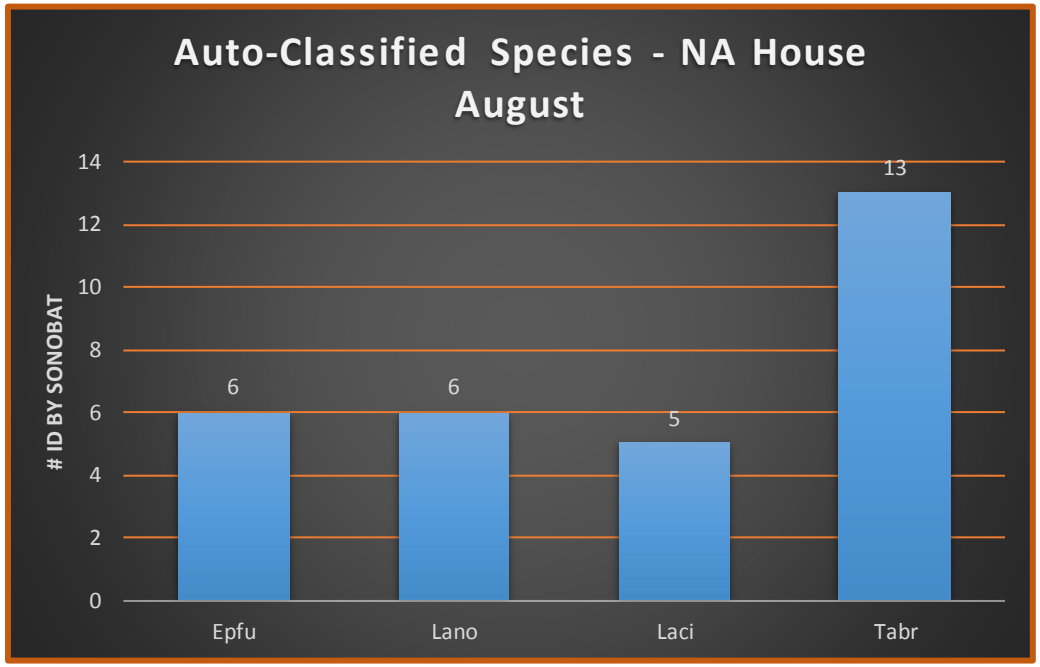
RANGER'S HOUSE – AUGUST SURVEY

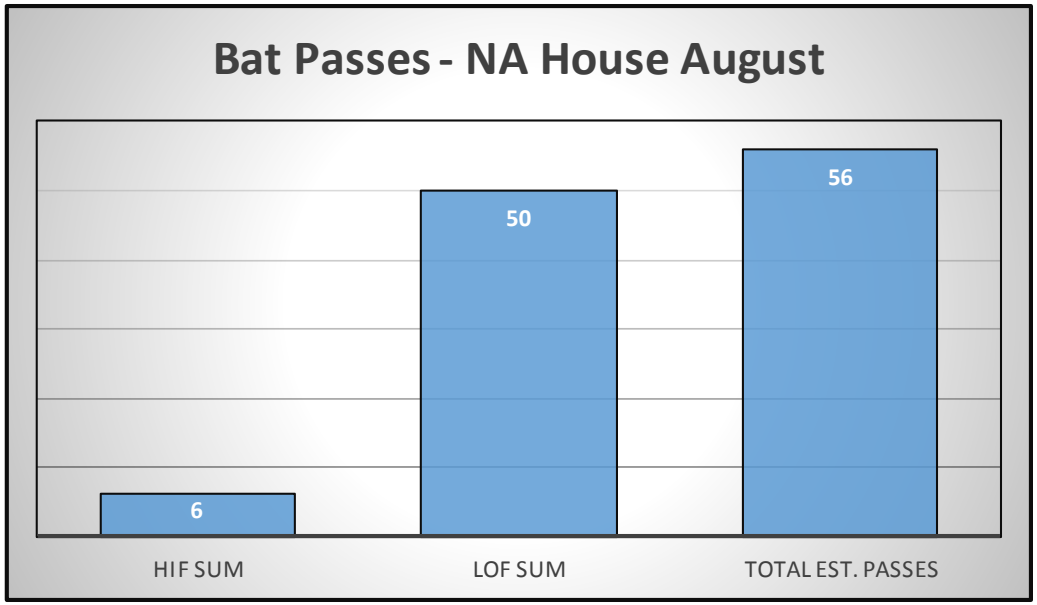
A Pettersson D500x detector was set up behind the historic buildings/structures across the road from the ranger's house, at the entrance to the natural area on August 14, a short distance east of the acoustic site for the June survey. The detector was set to start recording at sunset and record continuously until sunrise. The detector was picked up on August 15, providing 1 night of data collection. This site was selected because it was located near trees, rock cliffs and old structures, all of which could be providing roosting habitat for bats. The detector was placed behind the buildings/structures to reduce visibility to the public. Vegetation had increased significantly since the June visit to this site. The survey provided 4 species of bats identified by auto-classification; Hoary bat (LACI), silver-haired bat (LANO), Mexican free-tailed bats (TABR) and Big brown bat (EPFU). The Hoary bat was confirmed by manual review. The survey recorded only 56 bat passes. This was much less activity than the June acoustic survey in the same area, and highlights the variation in bat use that can be found in different seasons. Most passes were identified as species with low frequency calls, and while not confirmed, the most passes were identified as TABR. This species is difficult to verify from several other species, but survey data collected over the last 30 years indicates the species may be more distributed within the state than previously considered. Additional documentations, by captures and acoustic records will be needed to support its status along the northern front range of Colorado.

Sonobat Auto Classification Output – Ranger's House – August D500X Detector

Bobcat Ridge Park House August	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto
Consensus count	0	0	0	0	0	0	0	0	0	6	6	0	13	5	0
Corrected count	0	0	0	0	0	0	0	0	0	4	4	0	12	4	0
est. likelihood of presence	0	0	0	0	0	0	0	0	0	0.446837	0.439662	0	0.999786	0.869434	0
ByVote count	0	0	0	0	0	0	0	0	0	6	9	0	13	5	0
MeanClssn count	0	0	1	0	0	0	0	0	0	8	9	0	15	5	1
HiF sum	6														
LoF sum	50														
total est. passes	56														

BOBCAT RIDGE BARNS		
Species	Review Results	Number of Calls Reviewed
Eptesicus fuscus	Likely	6
Lasionycteris noctivagans	Likely	5
Lasiurus cinereus	confirmed	4
Tadarida brasiliensis	Unknown	13


Auto-Classified Species - NA House August
ID BY SONOBAT
14
12
10
8
6
4
2
0
6
6
5
13
Epfu
Lano
Laci
Tabr


Bat Passes - NA House August
6
50
56
HIF SUM
LOF SUM
TOTAL EST. PASSES

Summary and Recommendations

While no bats were captured during the mist netting survey, acoustic data documented the presence of many species and high levels of bat activity in Bobcat Ridge Natural Area. This highlights the importance of using multiple approaches and survey methods to more completely assess the presence of all species of bats. Bobcat Ridge Natural Area is a highly used and important natural area for bats. High levels of bat activity across the summer season is now documented, with a high diversity of species. The property provides access to a variety of habitats for foraging by bats, and roosting for both summer and winter requirements. The rock outcrops and cliffs found on the natural area may very likely provide winter hibernation sites for some species of bats documented in the area. Access to the existing water sources is important to local bat populations. Several stock tanks are reported to exist on the property, pools within intermittent streams and earthen dams to retain water provide water for local bat populations. The natural area has several old, historic buildings and structures. Most of these are located around the entrance and parking area of the property. These structures were not evaluated for use by bats, but some potential warm season use by bats is likely. Night roosting of bats at these features is very likely, and some day or maternity use is considered possible and should be evaluated at some point. Outside of potential entry into these structures by the public, little potential impact to bats is anticipated from public recreation in the natural area.

Recommendations

- Ensure all stock tanks have escape ladders installed and maintained in functional condition.
- Periodic checks of all stock tanks and removal of floating algae should be undertaken to provide drinking access by bats.
- Evaluate existing buildings and structures for use by bats.
- Evaluate all building structures prior to removal or remodeling, for potential roosting use by bats. If bat colonies are present, considered maintaining the roost for bats, or conducting action during the seasons of non-use. If not feasible or appropriate to preserve a roost, conduct a proper bat exclusion during a season of non-use before destructive action is initiated.
- Maintain open water at the Bat Pond and prevent emergent wetland vegetation from covering the pond surface.
- Maintain earthen dams, and if water rights allow, expand the size of water containment for more seasonal access and use by bats.
- Initiate periodic acoustic surveys on the natural area to monitor population trends of bats on this important natural area.
- If Bobcat Ridge Natural Area fits into the grid layout of the North American Bat Monitoring project (NABat), consider joining in on the project to monitor natural area bat trends, and contribute to the state effort to monitor bats statewide. Contact CPW for additional information on the NABat program.

GATEWAY NATURAL AREA

Gateway Natural Area is located in the forested landscape of the Roosevelt National Forest, approximately 5 miles up Hwy 14 at the junction of the main fork and north fork of the Cache la Poudre Rivers, at an elevation of approximately 5,300 ft. It lies below Seaman Reservoir, and is highly visited by the public for recreational use. Several buildings are located on the property, providing housing and office for the FCNA ranger, and the now closed City of Fort Collins water treatment plant and associated buildings. Several large picnic shelters are also present. Bat surveys were conducted on the natural area in 2003 (Neubaum and O'Shea, 2006), and several species were documented during August and September mist netting surveys. A trip to the natural area to deploy an acoustic detector and scout potential netting sites was conducted on July 24, with FCNA personnel Jennifer Roberts and Ranger Gabe Johnson. It was discovered that a significant bat roost has taken residence at the abandoned water treatment plant, and upon inspection, roosting bats could be seen under the roof rims, and large guano piles were present along the building. Plans were made to conduct a capture survey at the building, to confirm species and reproductive status of the colony using the building. Several other buildings associated with the treatment plant were also checked, and some sign of potential bat use was observed.

Past surveys had documented 4 species at gateway:

Little brown myotis (MYLU)

Big brown bat (EPFU)

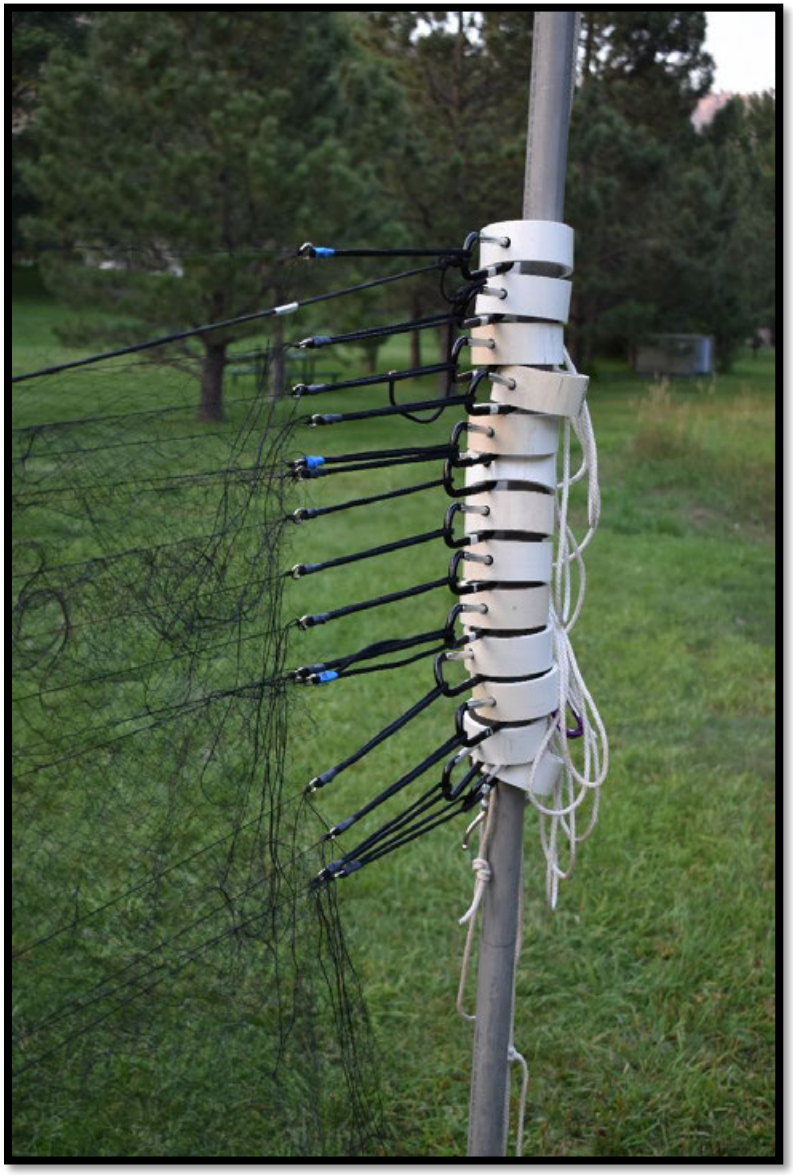
Hoary bat (LACI)

Fringed myotis (MYTH)

GATEWAY NATURAL AREA SURVEY SITES

Capture Surveys – 3H Net

A capture survey trip was conducted on August 29, with 2 net locations selected on the natural area. While water levels on the Poudre River were low, it was considered too difficult to net across the river. A 3H mist net system (3-30 ft. (9m) nets together on a pully system, extending approximately 24 ft. high) was used to cover a potential flyway between the river and the open park area of the property. The nets were opened by dusk, and worked until approximately 2230 hrs. when bat activity had been greatly reduced for 45 minutes. Bats could be seen flying in the area, but no bats were captured at either net site. Late August is the transition period for most bats, when they are moving between summer maternity season roosts to fall transition roosts prior to winter hibernation. The Poudre River is large for mist netting, and Gateway Natural Area does not provide ideal conditions for mist netting of bats. Additionally, lower levels of bat activity would also contribute to success rates of netting during the transition season of bats. Netting was helped by Natural Area personnel, Laura Ellison, Mark Hayes, Michelle Verant (NPS), CPW biologist Lisa Wolf, Emily Snode and Emma Krakoff.



Bridge Net

A second net was also set on August 29 at the south bridge on the North Fork of the Cache la Poudre river. A narrow channel was selected to place a 18 ft. (6m) mist net over the river. Water levels were low there, and moving slowly so biologists could work the nets without safety issues. High levels of bat activity were observed at this location, but no bats were captured. Laura Ellison worked this net, with help rotating from the other net site.

Acoustic Surveys

Both passive and active acoustic surveys were conducted at Gateway Natural Area. An SM4 detector was set out along the Poudre River on July 24 and deployed for 1 night. The Detector was picked up by the Gateway Ranger Gabe Johnson and relayed to the NIX. The detector was set to record all night, starting at sunset and shutting down at sunrise, using standard detector settings appropriate for the area, providing recordings of bat calls all night until sunrise the following day. Additionally, acoustic surveys were conducted during the mist netting survey on 29 August, using a Anabat Walkabout detector at the bridge net location, and a Pettersson D500x detector was used at the 3H net site. Recordings were made during the entire capture survey at both locations.

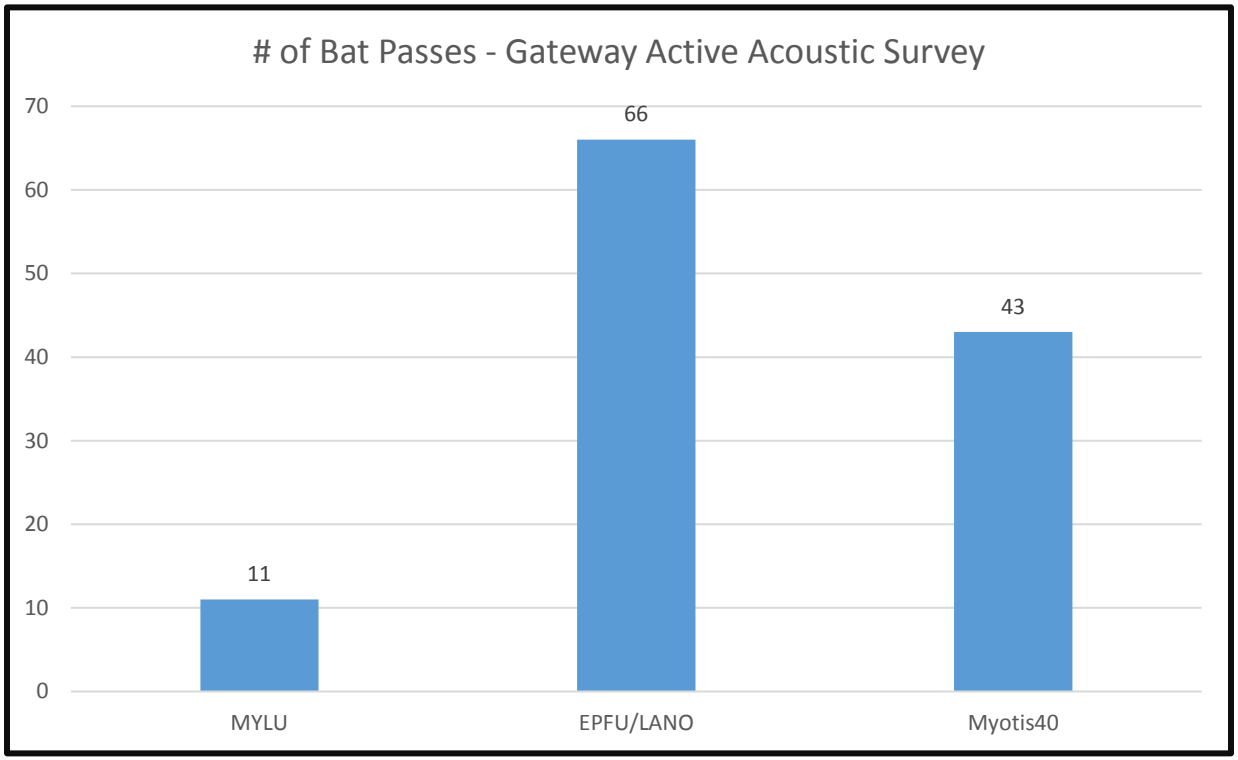
The acoustic survey on July 24 produced 271 bat passes, and 9 species identified by auto-classification. Species confirmed by manual review were the Little brown myotis (MYLU), Western long-eared myotis (MYEV), Western small-footed myotis (MYCI), Fringed myotis (MYTH), and Hoary bat (LACI). Calls of Big brown bats (EPFU) were considered “likely”, silver-haired bat (LANO) “possible”, and Mexican free-tailed bats (TABR) as “unknown”. One species identified by auto-classification as a pallid bat (ANPA), could not be confirmed and is considered out of range in this part of the state. Most calls were classified as MYLU and high frequency species.

The acoustic survey conducted during the netting activity on August 29 at the 3H mist net, recorded only 15 bat passes, and 3 species identified by auto-classification; Little brown myotis (MYLU), Fringed myotis (MYTH), and silver-haired bat (LANO). No calls were confirmed by manual reviews. Because of the nearby roost, calls of Little brown bats were considered “likely”, and silver-haired bats and Fringed myotis were considered as “possible” at Gateway Natural Area.

ACTIVE ACOUSTIC SURVEY RESULTS – Bridge Net Site (8/29/2017)

Number of Files Collected: 85 / Number of Bat Passes: 120

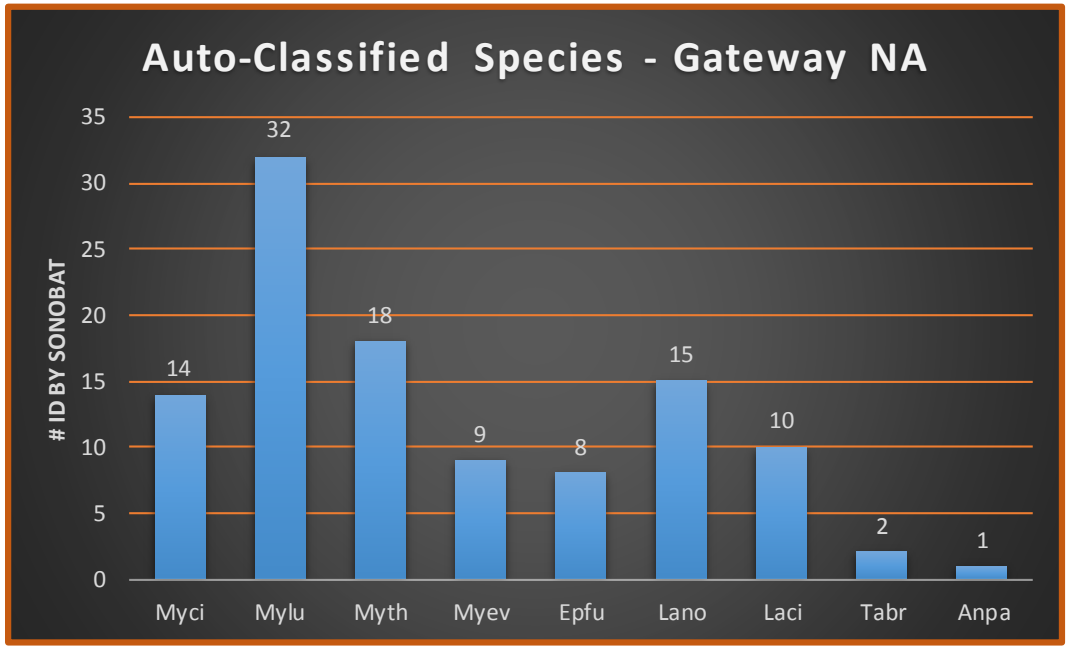
Species or Species Grouping	Number of Bat Passes
EPFU/LANO	66
Myotis40	43
MYLU	11

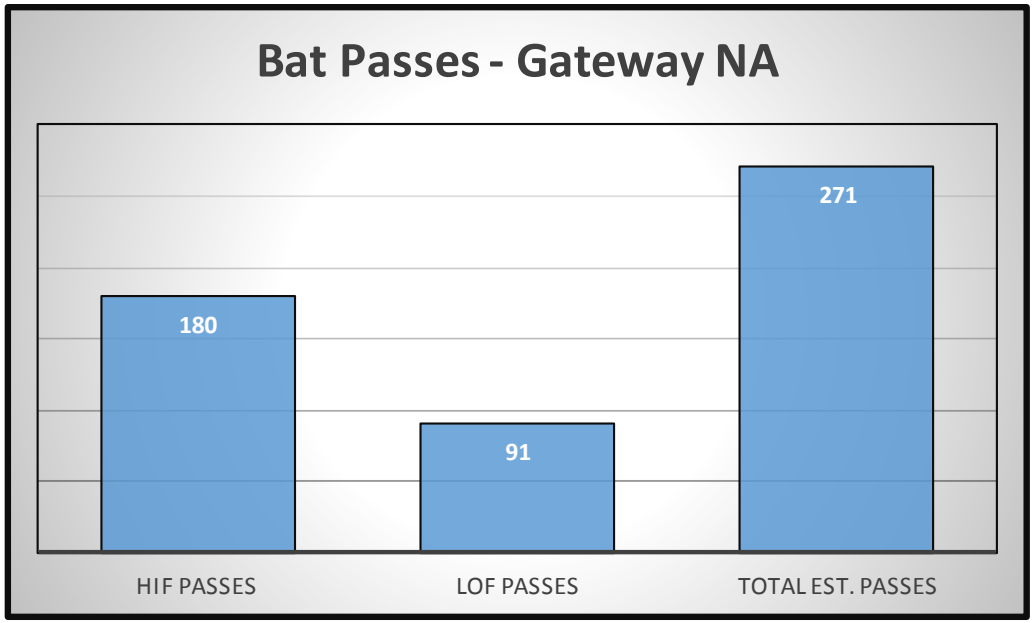


Sonobat Auto Classification Output –Gateway SM4 Detector

Gateway NA	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto	Euma
Consensus count	0	0	14	0	32	0	0	9	1	8	15	18	2	10	0	0
Corrected count	0	0	13	0	29	0	0	8	0	7	14	17	1	8	0	0
est. likelihood of presence	0	0	0.999915	0	1	0	0	0.955166	0.2325	0.726922	0.933088	0.999998	0.293131	0.977938	0	0
ByVote count	0	0	14	0	39	0	0	9	1	8	25	19	2	10	0	0
MeanClssn count	1	0	26	0	53	1	1	11	3	9	23	21	2	11	3	0
HiF sum	180															
LoF sum	91															
total est. passes	271															

GATEWAY		
Species	Review Results	Number of Calls Reviewed
Myotis lucifugus	confirmed	1
Myotis ciliolabrum	confirmed	3
Myotis thysanodes	confirmed	7
Myotis evotis	confirmed	2
Eptesicus fuscus	Likely	8
Lasionycteris noctivagans	Possible	5
Lasiurus cinereus	confirmed	3
Tadarida brasiliensis	Unknown	2
Antrozous pallidus	Out of Range	1


Auto-Classified Species - Gateway NA
ID BY SONOBAT
35
30
25
20
15
10
5
0
14
32
18
9
8
15
10
2
1
Myci
Mylu
Myth
Myev
Epfu
Lano
Laci
Tabr
Anpa


Bat Passes - Gateway NA
180
91
271
HIF PASSES
LOF PASSES
TOTAL EST. PASSES

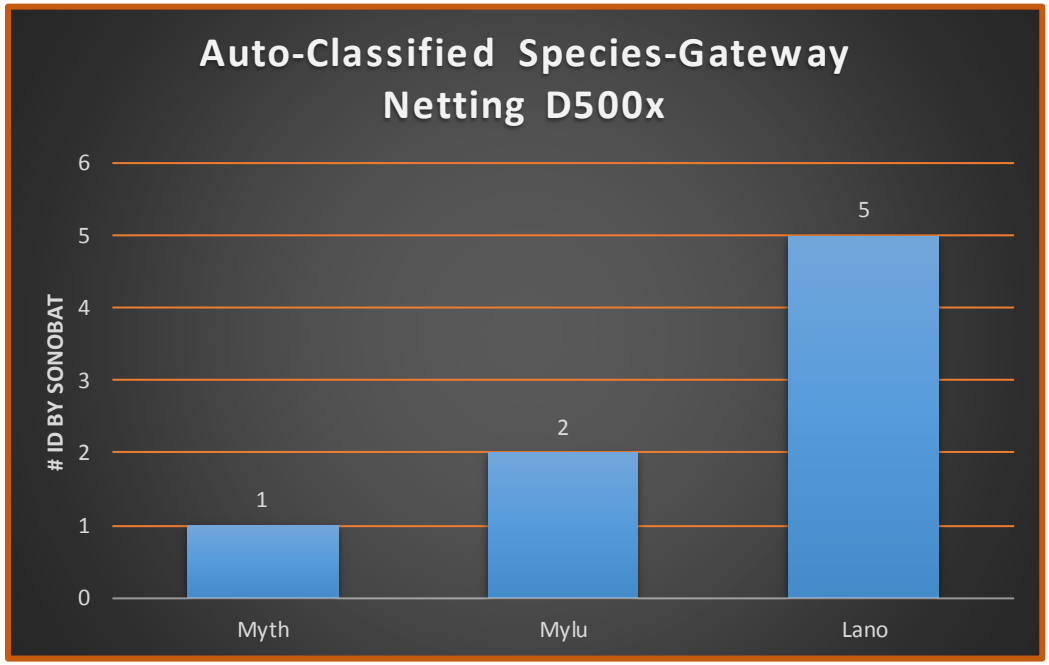

07/24/2017

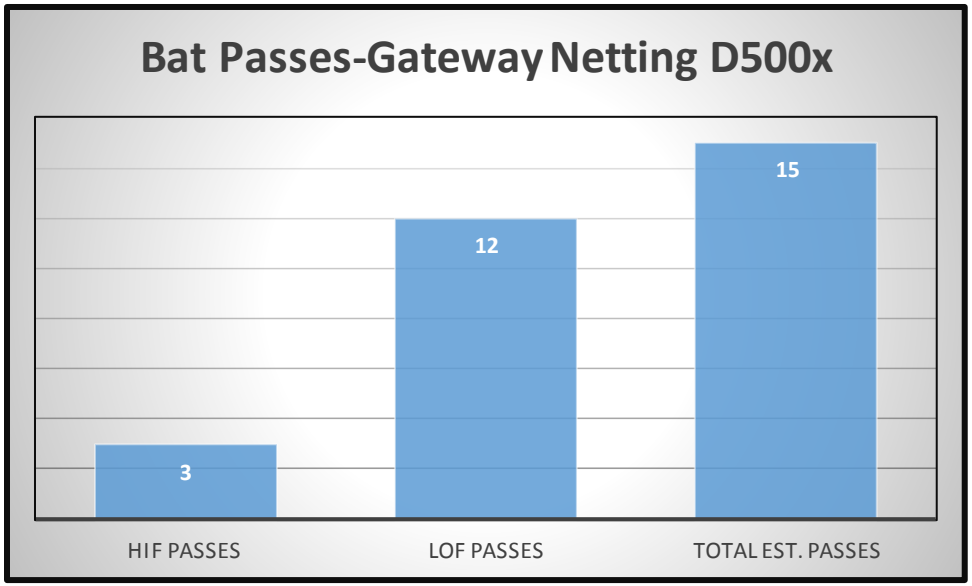

07/24/2017

Gateway 3H Netting Site Active Acoustic Survey Data (8/29/2017)

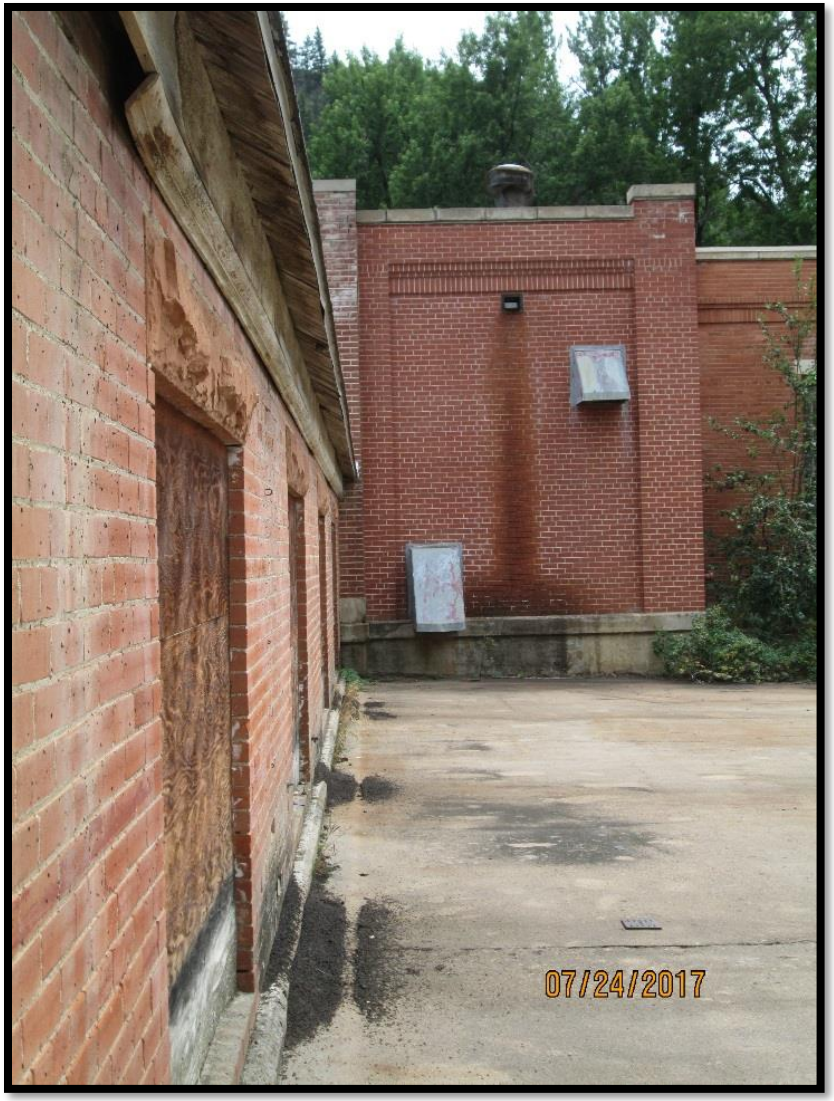
Gateway 500X	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto
Consensus count	0	0	0	0	2	0	0	0	0	0	5	1	0	0	0
Corrected count	0	0	0	0	2	0	0	0	0	0	4	0	0	0	0
est. likelihood of presence	0	0	0	0	0.8	0	0	0	0	0	0.601893	0.194	0	0	0
ByVote count	0	0	0	0	2	0	0	0	0	0	7	2	0	0	0
MeanClssn count	0	0	0	0	2	0	0	0	0	0	7	2	0	0	0
HiF sum	3														
LoF sum	12														
total est. passes	15														

GATEWAY NET SITE		
Species	Review Results	Number of Calls Reviewed
Myotis lucifugus	Likely	2
Myotis thysanodes	Possible	1
Lasionycteris noctivagans	Possible	5


Auto-Classified Species-Gateway Netting D500x
ID BY SONOBAT
6
5
4
3
2
1
0
1
2
5
Myth
Mylu
Lano


Bat Passes-Gateway Netting D500x
3
12
15
HIF PASSES
LOF PASSES
TOTAL EST. PASSES

Water Treatment Plant


07/24/2017


07/24/2017

An additional netting survey was conducted on 9 August, to document the species and status of the colony discovered at the old Filter Building of the water treatment plant. An internal check of the building was conducted first, using air masks and proper lighting to examine the extent and distribution of bats using the building. The building has 2 levels and a sub-level, many vents pipes, and some signs of bat use were documented in many parts of the building. Most sign of use was observed in the upper level (section H in Molnar, 2005 thesis), including some roosting bats that were observed in the attic level of the oldest section of the building.

Mist nets were set up on the east and west side of the north part of the building, to capture bats as they exited out of the roost. Bats were captured quickly at dusk, and the nets were walked back to the far side of the lot to remove bats. Our target number of bats to capture was 10, but we caught 20+ bats as they continued to fly into the nets from across the lot. Approximately 10 or so bats were released after removal from the net, after a quick check to confirm sex and reproductive conditions. After all bats were removed from the nets, they were placed in cotton holding bags, held until the nets were closed down, then taken to a picnic shelter for processing. All protocols for handling bats under the WNS guidelines were followed, and only qualified experienced biologists processed bats. Additionally, for WNS monitoring purposes, all bats were swabbed for fungal spores and taken to CPW labs for storage and processing. This project is intended to collect fungal spore samples from bats and contribute to a project investigating fungal diversity across different species of bats and geographic locations around the state, which will be used to support development of monitoring plans for WNS. Bats were swabbed on both sides of each wing, dorsal and ventral surfaces. Species data will be provided to CPW under the state's Sci-Col permit.

All captured bats were confirmed as little brown bats, *Myotis lucifugus*. All bats but one were females, and all but 1 were juveniles. The site is confirmed to be a maternity roost for this species. Several dead pups were observed in the guano piles. The site is considered to be a very large roost, and despite no mention of bats or signs of bats or wildlife in the Molnar 2005 report, the colony has likely been occupying the building as a roost before 2005. Large numbers of *Myotis lucifugus* were captured during bat surveys at Gateway in 2003 (Neubaum, et. at, 2006).

The capture survey was conducted with the help of Jennifer Roberts (FCNA), Laura Ellison, Mike Sherman and Karen Fox (CPW), Pepper Canterbury (DWM-CPW) and other CPW employees.

Processing bats

Swabbing bats for WNS

Date	Species	Sex	Age	Swab Sample	Biologists	Forearm	Reproductive Status
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	J	#1	NAVO/ELLISON	40.20	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	J	#2	NAVO/ELLISON	39.40	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	J	#3	NAVO/ELLISON	36.90	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	J	#4	NAVO/ELLISON	36.10	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	J	#5	NAVO/ELLISON	39.80	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	J	#6	NAVO/ELLISON	37.90	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	A	#7	NAVO/ELLISON	39.90	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	J	#8	NAVO/ELLISON	37.80	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	M	J	#9	NAVO/ELLISON	36.60	NONB
8/9/2017 0:00	MYOTIS LUCIFUGUS	F	J	#10	NAVO/ELLISON	38.80	NONB

Guano Piles & Dead Pup


Exit & Entry points
Guano piles
07/24/2017

Summary and Recommendations

Other than the capture survey at the water treatment plant bat roost, no bats were captured during the mist netting survey on the natural area. However, acoustic data documented the presence of 5 species of bats at Gateway Natural Area, highlighting the importance of using multiple approaches and survey methods to more completely assess the presence of species of bats in the area of interest. Gateway Natural Area provides a diverse landscape of habitat types for potential roosting of bats and foraging opportunities. Rock outcrops and cliff side provide both summer and potential winter roosting in the cracks and crevices, and forested landscape provides roosting for many species of bats. The riparian habitat of both the north fork and Cache la Poudre rivers provides both foraging of aquatic insect prey, and drinking spots in the flat water and back pools found along the rivers within the natural area.

The Water Treatment Plant Filter Building was first constructed in 1910, followed by additions in 1927 and 1955, and closed in 1987. The building is an established maternity roost for a large colony of *Myotis lucifugus*. The other buildings associated with the water treatment plant (Chemical Buildings 1 & 2) were not fully evaluated for bat use, but some sign of potential use was noted during the initial visit on the day of discovery of the Little brown bat colony. Picnic shelters found on the park area may provide night roosting for bats in the area. All man-made structures on the natural area appear to be sheltered from public access, and/or closed to night time potential encounters with bats.

The maternity colony of little brown bats that were found to be using the old water treatment plant should be considered as an important conservation site. The species using the building are classified as **Tier 1 species** of interest by the State, and concerns of the emerging disease of WNS highlight the importance of this bat colony. This species has suffered high mortalities in eastern populations from WNS, and is considered a high risk to potential impacts from WNS in the West. Because the colony is on the City of Fort Collins property, it is protected from disturbance and can play an important role in the monitoring of WNS in the state. The colony is located relatively close to the city, and may also provide research opportunities on issues related to WNS that could play an important role in advancing our knowledge and planning for the potential arrival of this disease into our state. Exit/entry points are easy to conduct capture surveys, and access to guano for research related studies is easy because large piles are located outside the building walls. The lowest sub-level of the water treatment plant was visited during the quick internal survey, and cold temperatures were noted. The sub-level is accessible from other parts of the building. While no temperatures were documented, it is possible that some winter use may occur by bats if adequate microclimates exist in this below ground level of the building.

Recommendations:

- **Conserve the Little brown bat maternity colony found roosting in the historic water treatment plant**.
- Consider working with Colorado Parks and Wildlife to establish monitoring programs for WNS at the Water Treatment Plant.
- Conduct periodic monitoring of the colony status.
- Evaluate the old chemical buildings associated with the main water treatment plant for possible bat use.

- If necessary, evaluate all the other building structures prior to modifications or removal for potential roosting use by bats. If bat colonies are present, considered maintaining the building as a roost for bats. If not feasible or appropriate to preserve a roost, conduct a proper bat exclusion during a season of non-use, or before destructive action is initiated.
- Conduct an internal winter survey of the bottom level of the Filter Building of the water treatment plant to evaluate potential winter habitat for bats.

FOOTHILLS NATURAL AREAS

RESERVOIR RIDGE NATURAL AREA

This natural area is located below Horsetooth Dam, south of Michaud Lane. The habitats at Reservoir Ridge include mixed grasses, shrublands, and foothills forest. Most of the property is grasslands and foothills shrublands, with about 15% of the landscape ponderosa pine forest. On the western side of the natural area is a large pond, with emergent wetland vegetation and a few scattered cottonwood trees. The pond is off the trail system, and somewhat hidden for public view. An SM4BAT detector was set up near the pond on 12 June, and set to start recording at sunset and record continuously until sunrise. The detector was picked up on the June 14, providing 2 nights of data collection. This site was selected because it is located near the pond and wetland habitat, which would provide potential foraging and drinking resources to bats.

High levels of bat activity were documented during this survey, and the survey provided 7 species of bats identified by auto-classification, 4 of which were confirmed by manual review, and recorded 762 bat passes. Passes were about evenly split between high and low frequency calls, and the species with most passes were identified as Big brown bats (EPFU). Species confirmed by manual review include Little brown myotis (MYLU), Western small-footed myotis (MYCI), Big brown bat, and Western long-eared myotis (MYEV). Two species were considered “possible” the silver-haired bat (LANO) and Hoary bat (LACI), and 1 species, the Mexican free-tailed bat (TABR) was considered as “unknown. The Mexican free-tailed bat is difficult to verify from several other species, but survey data collected over the last 30 years indicates the species may be more well distributed within the state than previously thought. Additional documentations, by captures and acoustic records will be needed to support its status along the northern front range of Colorado. This natural area had the second highest level of bat activity documented during the 2017 surveys.


06/12/2017


06/12/2017

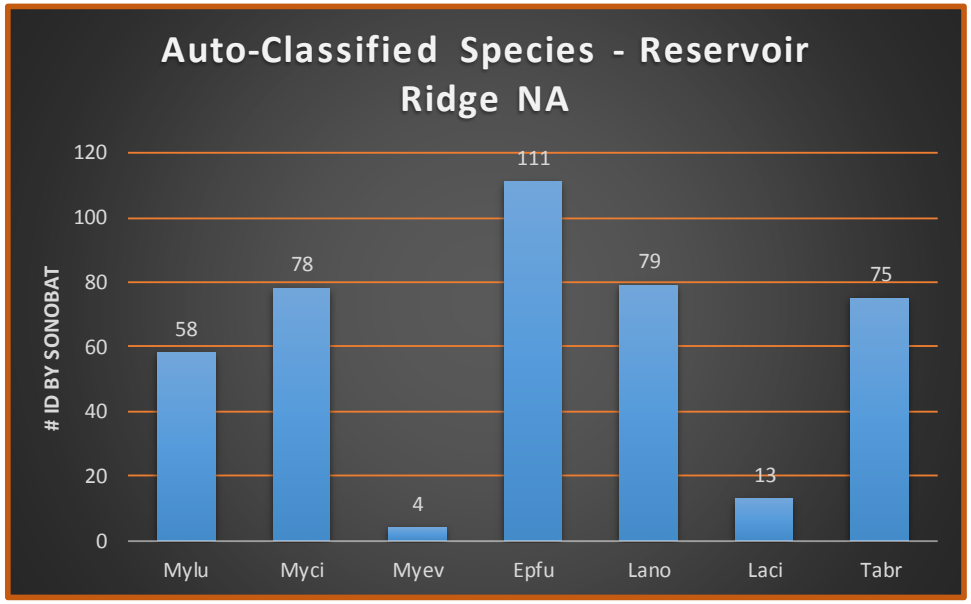
RESERVOIR RIDGE ACOUSTIC SURVEY SITE

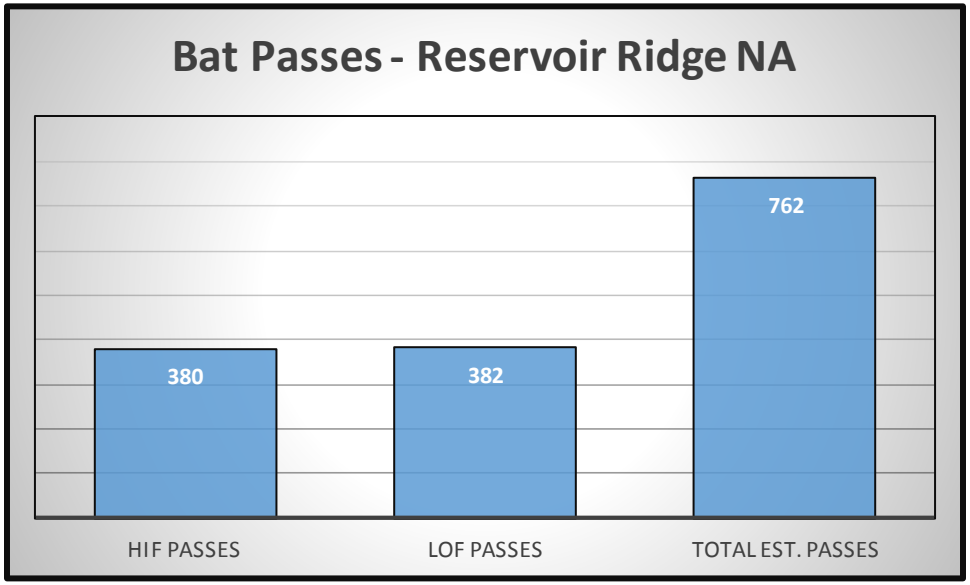
Reservoir Ridge Acoustic Survey

Sonobat Auto Classification Output – Reservoir Ridge SM4 Detector

Reservoir Ridge	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto
Consensus count	0	0	78	0	58	0	0	4	0	111	79	0	75	13	0
Corrected count	0	0	75	0	52	0	0	3	0	104	69	0	71	9	0
est. likelihood of presence	0	0	1	0	1	0	0	0.755051	0	1	0.999987	0	1	0.911719	0
ByVote count	0	0	80	0	61	0	0	4	0	114	93	0	76	14	0
MeanClssn count	0	0	110	1	94	0	0	6	0	134	98	0	75	14	0
HiF sum	380														
LoF sum	382														
total est. passes	762														

RESERVOIR RIDGE		
Species	Review Results	Number of Calls Reviewed
Myotis lucifugus	confirmed	10
Myotis ciliolabrum	confirmed	8
Myotis evotis	confirmed	1
Eptesicus fuscus	confirmed	3
Lasionycteris noctivagans	Possible	12
Lasiurus cinereus	Possible	8
Tadarida brasiliensis	Unknown	58


Auto-Classified Species - Reservoir Ridge NA
ID BY SONOBAT
120
100
80
60
40
20
0
58
78
4
111
79
13
75
Mylu
Myci
Myev
Epfu
Lano
Laci
Tabr


Bat Passes - Reservoir Ridge NA
380
382
762
HIF PASSES
LOF PASSES
TOTAL EST. PASSES

Summary and Recommendations

The Reservoir Ridge Natural Area has high levels of bat activity. It is located near the Horsetooth Reservoir, and contributes to the resources needed by bats in the area. Some roosting potential exists on the natural area in the cottonwood trees and ponderosa pine forest stands found on the property. The high level of bat activity and species diversity indicates the importance of the property to local populations and species of bats. The marsh located on the western side of the natural area provides both foraging and drinking opportunities for many species of bats.

- Maintain wetland habitats on the natural area with management plans that promote conservation of emergent wetland vegetation and open water access on the marsh pond.

PINERIDGE NATURAL AREA – DIXON RESERVOIR

This natural area extends south from County Road 42C, between Horsetooth Reservoir and Spring Canyon Community Park. The vegetation types at Pineridge range from foothills Ponderosa pine forest, shrublands and grasslands. Riparian habitats are found along Dixon Creek and Spring Creek. The natural area includes springs/seeps, rocky outcrops and ridges. Dixon Reservoir is located in the Pineridge Natural Area, and the shoreline forested area, open water and nearby potential roosting habitat provide resources for local bat populations. The natural area was scouted for possible surveys on 12 June. Because of high public use and the open landscape, only an active acoustic survey was conducted at Dixon Reservoir. On July 5, an acoustic survey was conducted using an SM4BAT detector while walking around the western shoreline and trails. The survey was initiated at dusk, and continued for 45 minutes. Several visitors were still present at the reservoir at dusk. Only a few bats were observed during the survey, and moon light was present from the beginning. No visitors remained at the Reservoir by the time the survey was concluded.

Despite little bat activity visually observed, some level of bat activity was documented during this acoustic survey. It is possible that the bat activity associated with the reservoir was high level foraging and flight paths to other nearby areas for foraging. The survey provided 5 species of bats identified by auto-classification, 2 of which were confirmed by manual review (Western small-footed myotis (MYCI) and the Little brown myotis (MYLU). The survey recorded a total of 29 bat passes. Most passes were identified as species with high frequency calls, and most passes were identified as Western small-footed myotis. One species, Big brown bat (EPFU) is considered “likely” and the silver-haired bat (LANO) was considered “possible”. Calls classified as Mexican free-tailed bats (TABR) were considered “unknown” status. This species is difficult to verify from several other species, but survey data collected over the last 30 years indicates the species may be more distributed within the state than previously considered. Additional documentations, by captures and acoustic records will be needed to support its status along the northern front range of Colorado.

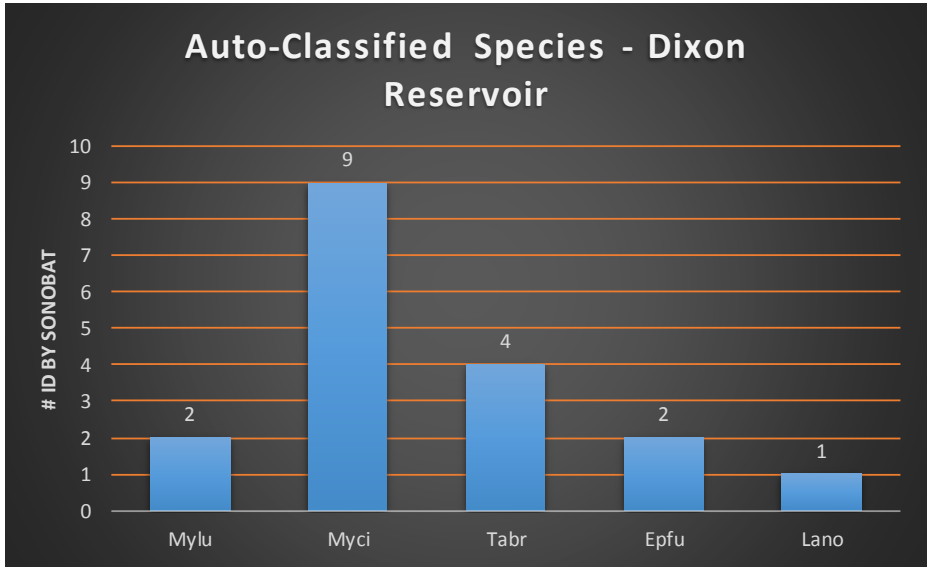
West Side Acoustic Survey Area

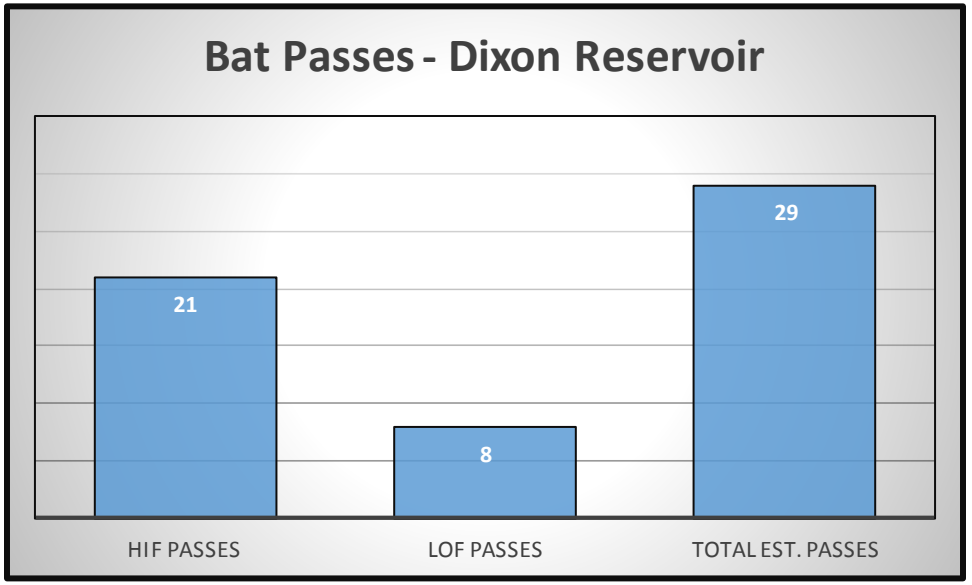
DIXON RESERVOIR ACOUSTIC SURVEY

Dixon Reservoir Active Acoustic Survey

Dixon Reservoir	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto	Euma
Consensus count	0	0	9	0	2	0	0	0	0	2	1	0	4	0	0	0
Corrected count	0	0	7	0	2	0	0	0	0	1	0	0	3	0	0	0
est. likelihood of presence	0	0	0.996422	0	0.8	0	0	0	0	0.14986	0.225	0	0.898499	0	0	0
ByVote count	0	0	9	0	2	0	0	0	0	2	1	0	4	0	0	0
MeanClssn count	0	0	11	0	4	0	0	0	0	3	1	0	4	0	0	0
HiF sum	21															
LoF sum	8															
total est. passes	29															

DIXON RESERVOIR		
Species	Review Results	Number of Calls Reviewed
Myotis lucifugus	confirmed	2
Myotis ciliolabrum	confirmed	9
Eptesicus fuscus	Likely	2
Lasionycteris noctivagans	Possible	1
Tadarida brasiliensis	Unknown	4

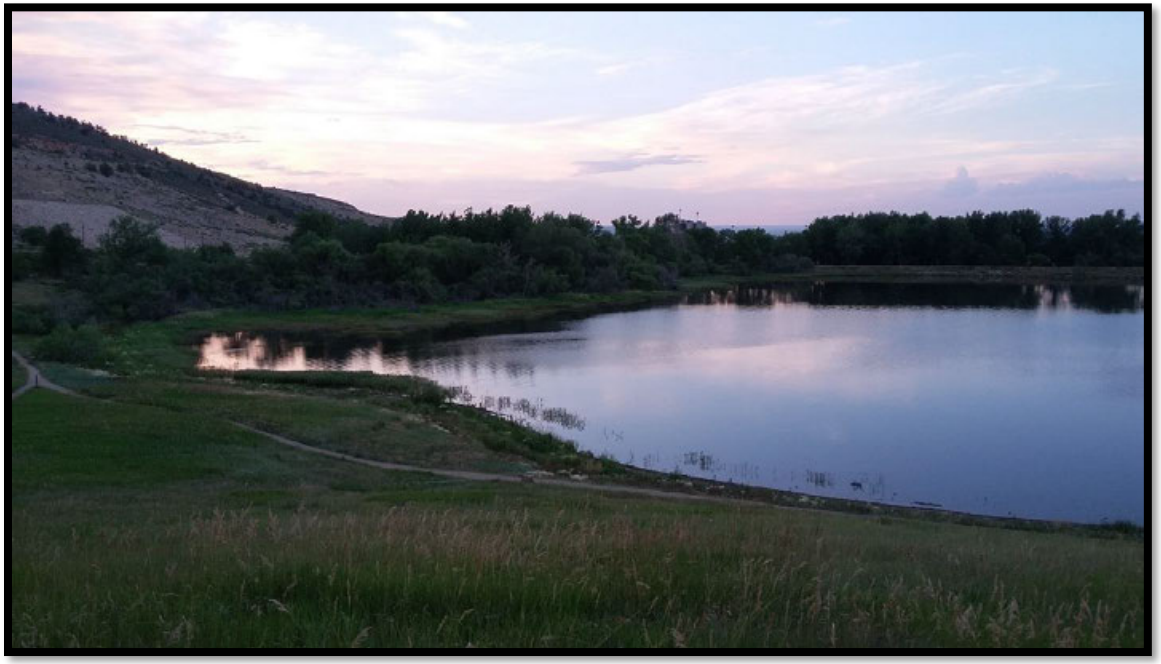

Auto-Classified Species - Dixon Reservoir
ID BY SONOBAT
10
9
8
7
6
5
4
3
2
1
0
2
9
4
2
1
Mylu
Myci
Tabr
Epfu
Lano


Bat Passes - Dixon Reservoir
21
8
29
HIF PASSES
LOF PASSES
TOTAL EST. PASSES

Summary and Recommendations

Bat activity at Dixon Reservoir was limited, but a full night of recording may have provided a more complete assessment of the use of the site by bats. Bat flight activity may have been higher than typically observed, and therefore not well recorded by the detector. The lack of observed bats during the survey, in spite of good moon light conditions may be related to bats flying too high for visual documentation. The grove of cottonwood trees at the west and north ends of the reservoir likely provides some roosting habitat for bats, and the open water of the reservoir access for drinking. A deployment of a passive acoustic recorder may be possible within the tree shoreline, but the cluttered environment would produce poor quality calls for species identification. It would, however, give a more complete assessment of the level of bat activity associated with Dixon Reservoir.

- Consider a passive, over-night acoustic survey at the reservoir to gain a more complete evaluation of bat activity at the reservoir.



POUDRE RIVER NATURAL AREAS

KINGFISHER POINT NATURAL AREA

Kingfisher Point Natural Area is located within the Cache la Poudre River Corridor Natural Areas, downriver from downtown Fort Collins and next to the NIX and Gadwall Pond. This natural area is comprised of about 147 acres and located within the cottonwood riparian habitats of the Poudre River and nearby large, man-made ponds found to the southeast. This natural area has several trails and receives a high level of public use. The natural area contains several buildings and structures that are used to some extent by the natural Areas Program. The historic small Nix farm house was noted on a field trip to the property, but not included in any surveys or evaluations under this project. It is used for office storage, but may have potential for roosting of bats. On July 14, surveys were conducted on the natural area; an acoustic detector deployment and capture survey with the help of FCNA personnel and volunteers.

Kingfisher Point Survey Sites

Capture Survey

On July 14, a capture survey was conducted on the natural area. The original net site location was at an opening along the Poudre River leading into the grasslands to the south, but was determined to be un-safe and too small for the 3H stack net system that was used. The site was right next to the trail, which was reported to have frequent bike rider activity after dark. The potential opening was too small to cover the height of the stack nets, and the guide lines needed to set up the high net would have to stretch across the trail, making it a potential hazard to the public. The netting equipment was re-located to another opening off river, between an opening in a cottonwood stand. The net was opened by dusk, and the survey was conducted for several hours before closing down the net. Some bat activity was observed, and an acoustic detector on site documented bat activity in the net site area, but no bats were captured. A Master Naturalist program public event about bats was conducted on this night, and attendees were able to include observing the netting activity as part of the program.

Acoustic Surveys

Both passive and active acoustic surveys were conducted at Kingfisher Point Natural Area. An SM4 detectors was set out along the shoreline of Gadwall Pond, just NE of the NIX, on July 14 and deployed for 1 night. The detector was set to record all night, starting at sunset and shutting down at sunrise, using standard detector settings appropriate for the area, and providing recordings of bat calls all night until sunrise the following day. High levels of public use made it not possible to deploy a passive detector setting along the Poudre River areas of the natural area. Additionally, acoustic surveys were conducted during the mist netting survey on July 14, using a Anabat Walkabout detector at the net site. Recordings were made during the entire capture survey at Kingfisher Point.

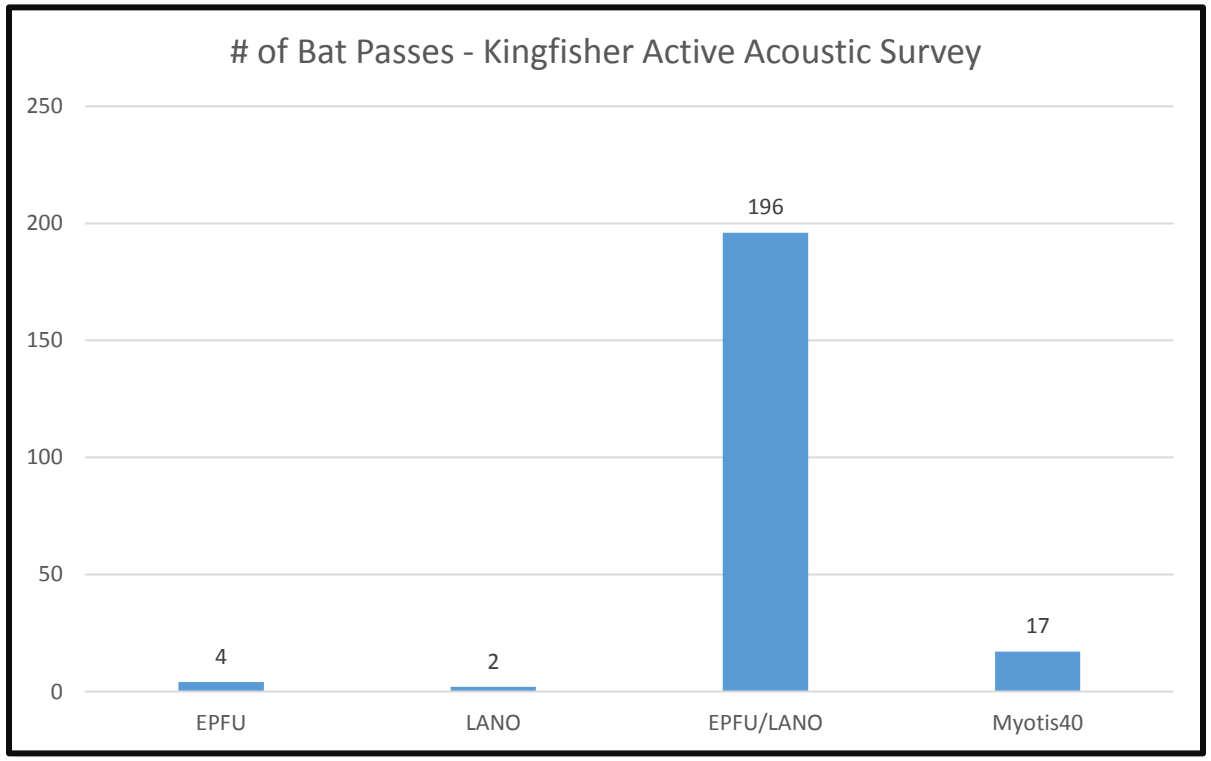
High levels of bat activity were documented during the survey at Gadwall Pond, providing 8 species of bats identified by auto-classification, 3 of which were confirmed by manual review: Little brown myotis (MYLU), Big brown bat (EPFU), and Hoary bat (LACI). The survey recorded 497 total bat passes. Most passes were identified as species with low frequency calls, but the most call passes were identified as little brown bats. One species, the silver-haired bat (LANO) was considered as “possible”, and 2 species were considered as “unknown” status (Mexican free-tailed bats (TABR) and Western red bat (LABL). Calls identified by auto-classification as the Western red bat are considered as possible eastern red bats (LABO) in this part of the state. The eastern red bat is a species that has been documented along the front range more recently, but call files could not be confirmed to this species. The Mexican free-tailed bat (TABR) is difficult to verify from several other species, but survey data collected over the last 30 years indicates the species may be more distributed within the state than previously considered. Additional documentations, by captures and acoustic records will be needed to support its status along the northern front range of Colorado.

Two other species, the Yuma myotis (MYYU) and pallid bat (ANPA) identified by auto-classification were considered “out of range”, and could not be verified by manual reviews. The Yuma myotis, a more western Colorado species, has only been documented in the southern part of the front range and eastern plains, and the 1 call file identified to this species was considered incorrect. The other species identified by auto-classification was a pallid bat, a species that is difficult to verify acoustically from several other species. It has been documented in southern parts of the front range and eastern plains, but survey data in this part of the state is not considered to be complete enough to provide insights into this species and its’ northern distribution in the state. Additional documentations, by captures and acoustic records will be needed to support its status along the northern front range of Colorado.

ACTIVE ACOUSTIC SURVEY RESULTS (7/14/2017)

Number of Files Collected: 912 / Number of Bat Passes: 219

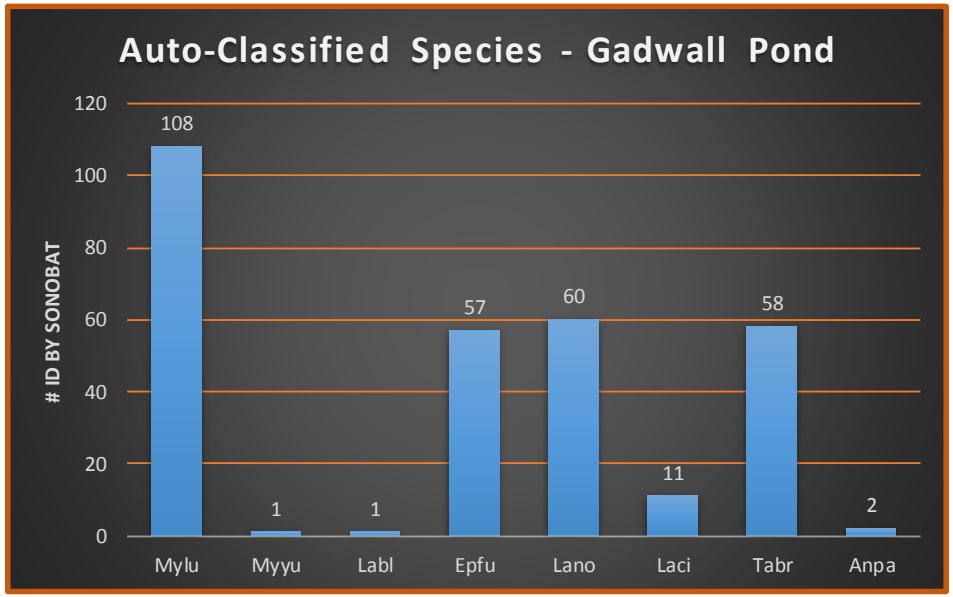
Species or Species Grouping	Number of Bat Passes
EPFU	4
EPFU/LANO	196
LANO	2
Myotis40	17
Total	219

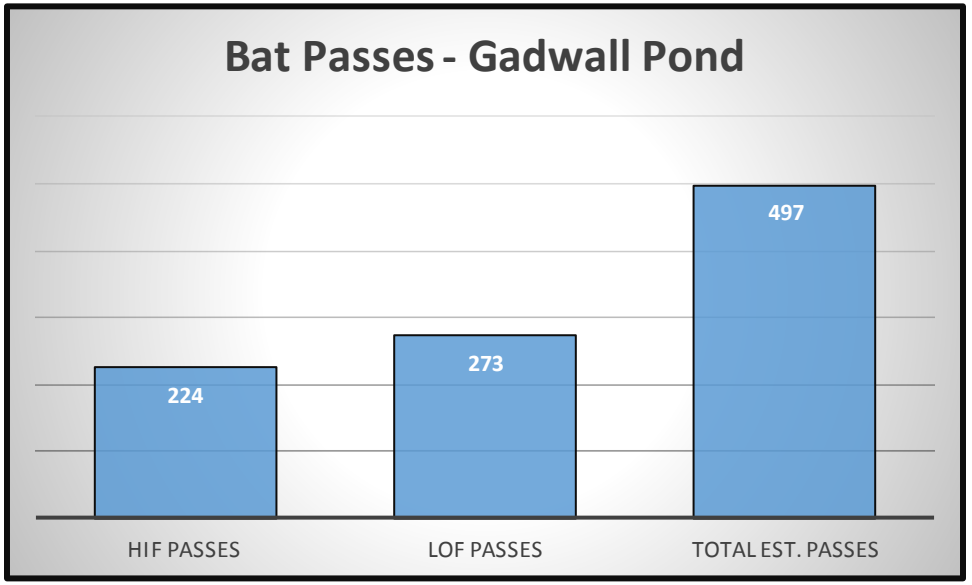


Gadwall Pond Acoustic Survey – SM4 Detector

Gadwall Pond	Myyu	Myca	Myci	Myvo	Mylu	Pahe	Labl	Myev	Anpa	Epfu	Lano	Myth	Tabr	Laci	Coto	Euma
Consensus count	1	0	0	0	108	0	1	0	2	57	60	0	58	11	0	0
Corrected count	0	0	0	0	106	0	0	0	0	52	53	0	55	8	0	0
est. likelihood of presence	0.184	0	0	0	1	0	0.182	0	0.465	0.999908	0.999902	0	1	0.903659	0	0
ByVote count	1	0	0	0	131	0	1	0	2	59	74	0	58	11	0	0
MeanClssn count	1	1	6	0	131	1	2	0	3	68	79	0	60	11	0	0
HiF sum	224															
LoF sum	273															
total est. passes	497															

GADWALL POND		
Species	Review Results	Number of Calls Reviewed
Myotis yumanensis	Out of Range	1
Myotis lucifugus	confirmed	6
Eptesicus fuscus	confirmed	15
Lasionycteris noctivagans	Possible	60
Lasiurus cinereus	confirmed	11
Tadarida brasiliensis	Unknown	58
Antrozous pallidus	Out of Range	2
Lasiurus blossevillii / borealis	Unknown	1


Auto-Classified Species - Gadwall Pond
ID BY SONOBAT
120
100
80
60
40
20
0
108
1
1
57
60
11
58
2
Mylu
Myyu
Labl
Epfu
Lano
Laci
Tabr
Anpa


Bat Passes - Gadwall Pond
224
273
497
HIF PASSES
LOF PASSES
TOTAL EST. PASSES

Summary and Recommendations

While no bats were captured during the mist netting survey, the acoustic data documented the presence of several species of bats in Kingfisher Natural Area. This highlights the importance of using multiple approaches and survey methods to more completely assess the presence of all species of bats in a survey area. The riparian corridor provides many roosting options for bats, and excellent foraging habitat. High levels of bat use would be anticipated along the Cache la Poudre River corridor, during spring, summer, and fall seasons. Good riparian habitat management will maintain good bat habitat and provide continued use by local bat populations. The ponds located around the Kingfisher Point Natural Area provide excellent foraging and drinking access for bats. The high levels of bat activity and species diversity documented at Gadwall Pond support the value of these resources to bats.

Current restoration plans for Gadwall Pond and Poudre River riparian habitats include enhancing wetland emergent vegetation at the Pond, bank restoration, and planting of native shrubs and grasses. Sound riparian habitat and wetland management will provide good conditions for bats for both foraging and roosting. Providing and maintaining open water sources at Gadwall Pond allows drinking access to all species of bats in the area. Additionally, river bank restoration and stabilization typically provide slower moving and open water spots for bats to drink along the river. The restoration plans for the natural area will be beneficial to bats using the natural area, and provide long term support for local bat populations.

Buildings and structures located on the natural area may be providing roosting opportunities for some species of bats. Bats may also use these open structures for night roosting.

- Evaluate all building structures prior to removal or remodeling for potential roosting use by bats. If bat colonies are present, considered maintaining the roost for bats, or conducting action during the seasons of non-use. If not feasible or appropriate to preserve a roost, conduct a proper bat exclusion during a season of non-use before destructive action is initiated.
- When public safety issues are not a factor, promote the retention of tree snags and old growth cottonwood trees for potential roosting habitat for bats.
- Promote emergent vegetation development and maintenance on wetland habitat on the natural area.
- Provide open water access at Gadwall ponds, and where possible, along the Poudre River corridor through river bank restoration projects.
- Continue to use this natural area for educational activities, to promote the conservation of bats and educate the public on the value of bats to the environment and pest control.

McMURRY PONDS NATURAL AREA

McMurry Ponds is located on the Cache la Poudre River, on the north end of Fort Collins. An active acoustic survey was conducted at McMurry Ponds Natural Area on 2 September, using a Walkabout detector while walking around the natural area after sunset and recording bat calls along the trail. Bat activity was documented at the Natural Area, with most calls identified as species associated with low frequency calls. No new or unexpected species were documented during this survey.

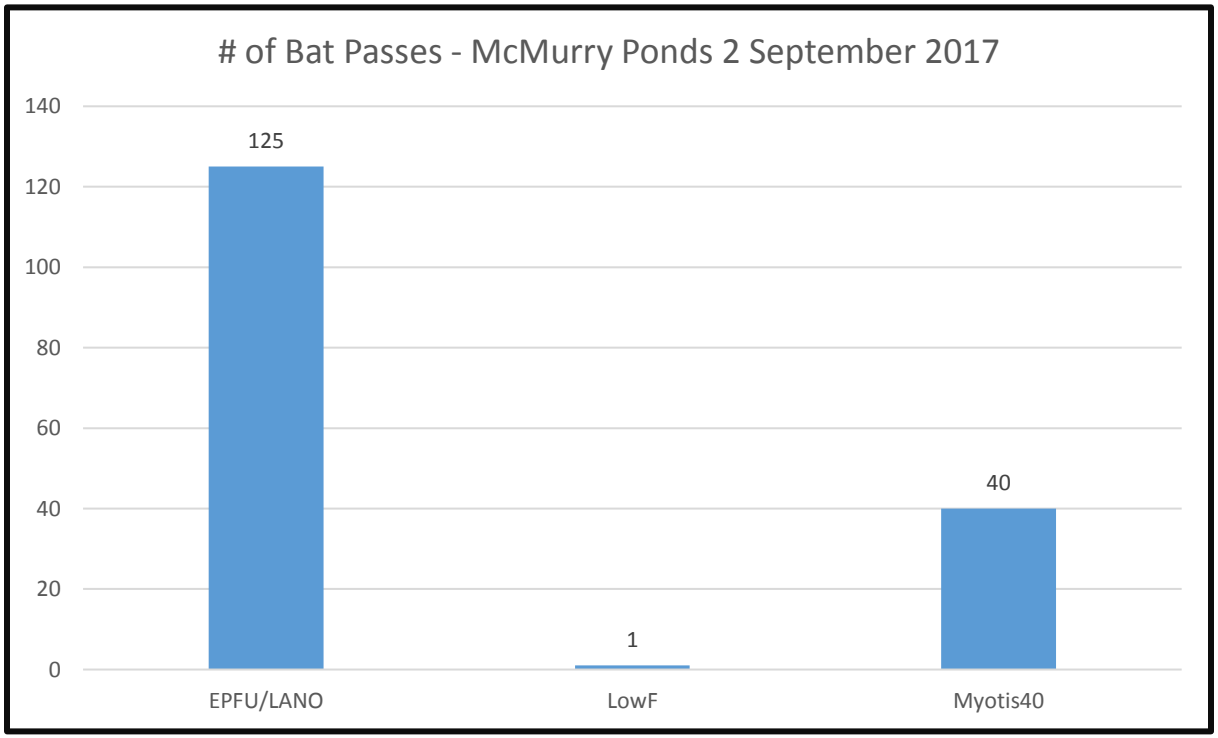
Summary and Recommendations

The survey conducted at McMurry Ponds Natural Area occurred during early September, which is considered a transition season of use by bats. This period of time is when bats are moving/migrating between summer roosts sites and winter hibernation, or migration to southern areas to over-winter. A moderate level of bat activity was documented during this short survey period. Additional summer surveys would be necessary to provide a more accurate view of bat status and use on this natural area.

ACTIVE ACOUSTIC SURVEY RESULTS (9/2/2017)

Number of Files Collected: 266 / Number of Bat Passes: 166

Species or Species Grouping	Number of Bat Passes
EPFU/LANO	125
LowF	1
Myotis40	40
Total	166



RUNNING DEER NATURAL AREA

Running Deer Natural Area is located at the southeastern end of the Cache la Poudre Corridor Natural Areas, along Boxelder Creek. Running Deer includes about 279 acres, and contains several ponds. The property is adjacent to the Colorado Welcome Center and CSU Environmental Learning Center. The largest pond lies along Prospect Road, on the north end of the natural area. An active acoustic survey was conducted on September 13 on the north end of the natural area, using an SN4BAT detector to record calls, and a handheld Pettersson D240x detector to listen for bat calls during the survey.

The natural area was considered too open and visible to the public for an overnight acoustic survey. At the time of the survey, many vehicles were still in the parking lot at the north end, and at the Visitor Center parking areas. The survey was started at dusk, walking along trail on the south side of the pond and access road leading south into the natural area. Lots of biting insects were present after dark, but no bat activity was noted or recorded with the acoustic detectors.

Summary and Recommendations

The survey conducted at Running Deer Natural Area occurred during September, which is considered a transition season of use by bats. This period of time is when bats are moving/migrating between summer roosts sites and winter hibernation, or migration to southern areas to over-winter. Therefore, the lack of any bat calls documented on this survey should not be taken to infer that bats are not using the natural area. Because of the timing of the survey, it is possible that bat activity later in the night or early morning hours could pick up activity of bats moving into the area, or that a survey conducted on another night might produce other results. Additionally, summer use of the natural is possible and might reflect summer roosting on the property and in the area. Additional summer surveys would be necessary to provide a more accurate view of bat status on this natural area.

A discussion with a retired CPW researcher who lives next to the Running Deer Natural Area suggests the possibility of summer seasonal use of the natural area. He stated he has had multiple events of bats night roosting on his porch, and other events that suggest he might have bats roosting in his house, or nearby residences. This would likely provide summer colonies easy access to the natural area for both foraging and drinking during this season of use by bats.

Ongoing restoration activities at Running Deer Natural Area can proceed without concerns to impacts to bats. These efforts would only enhance the habitats and provide opportunities for a better prey base and more foraging for bats. Transition season use by bats is also important, and if bats are using the natural area during these seasons of use, it is providing resources important to bats in that stage of their life history.

CORE NATURAL AREAS

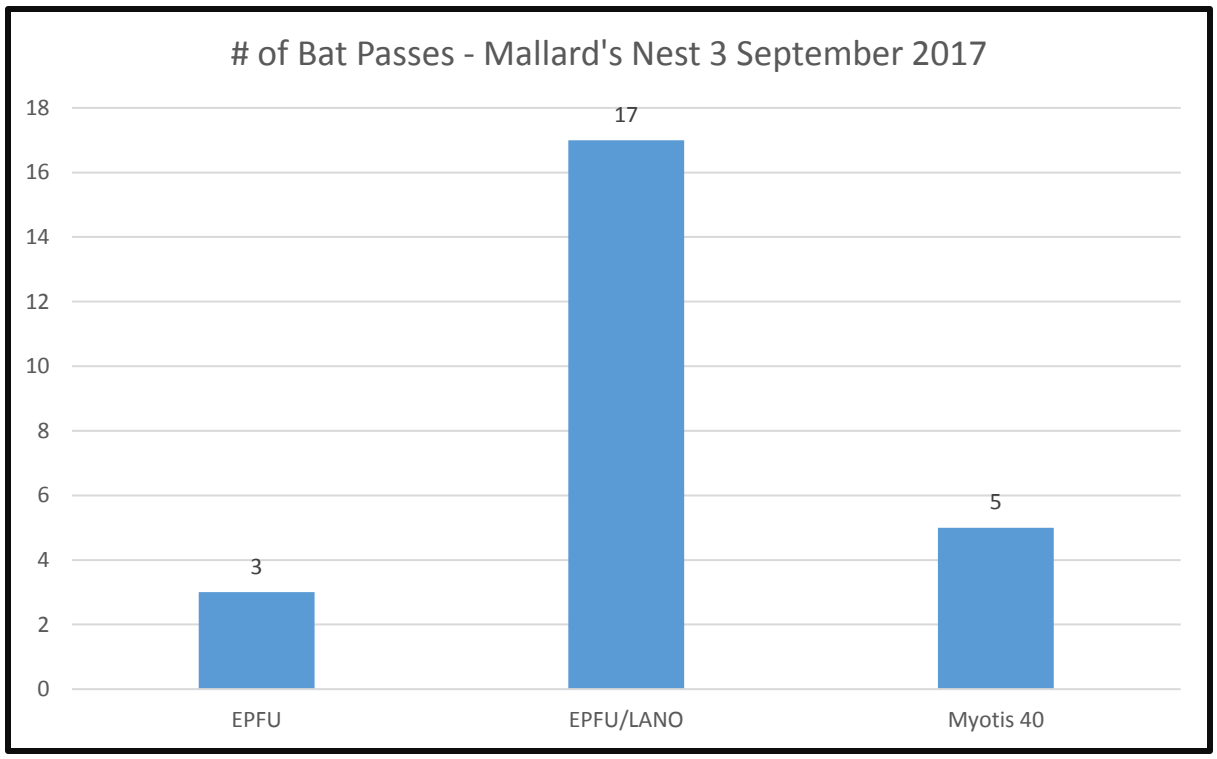
MALLARD'S NEST NATURAL AREA

Mallard's Nest is located along the Spring Creek Trail, south of Prospect Rd. An active acoustic survey was conducted at Mallard's Nest Natural Area on 3 September, using a Walkabout detector while walking down the trail after sunset. A moderate level of bat activity was documented during the survey, with most calls identified as species associated with low frequency calls. No new or unexpected species were documented during this survey.

ACTIVE ACOUSTIC SURVEY RESULTS (9/3/2017)

Number of Files Collected: 80 / Number of Bat Passes: 25

Species or Species Grouping	Number of Bat Passes
EPFU	3
EPFU/LANO	17
Myotis40	5
Total	25



Summary and Recommendations

The survey conducted at Mallard's Nest Natural Area occurred during early September, which is considered a transition season of use by bats. This period of time is when bats are moving/migrating between summer roosts sites and winter hibernation, or migration to southern areas to over-winter. A low level of bat activity was documented during this short survey period. Additional summer surveys would be necessary to provide a more accurate view of bat status and use on this natural area.

General Conclusions and Recommendations

The City of Fort Collins Natural Areas are providing important habitats for bats. Surveys conducted for this project documented two Tier 1, and one Tier 2 species on Natural Area properties. Additionally, while not confirmed by manual review, Townsend's big-eared bat, a Tier 1 species and Species of Special Concern in the state, had acoustic calls recorded. This species is considered a "weak" echolocator, requiring a close pass by bat detectors to capture calls of this species. It is also good at avoiding captures in mist nets. Based on surveys at 9 natural areas, 7 species of bats were documented by acoustic data, and 4 additional species were potentially documented by acoustic call collections. All but two acoustic surveys were deployed for only one night of data collection, and 2,872 bat calls were collected. Active acoustic surveys collected 1,366 bat calls, for a total of 4,238 bat calls collected in this project. Additional nights of deployment would likely increase the number of species documented by an acoustic survey, but results indicated that most natural areas are providing excellent habitat and resources for local and migratory bat populations. More seasonal surveys of some natural areas would provide a more complete analysis of the use by bats. Because of time and budget restrictions, not all buildings and structures were evaluated for potential bat use. That is one aspect that could be evaluated further to provide a more complete perspective of the potential use of the natural areas by bats. In general, habitat conditions appear good for bats, and general guidelines for sound riparian and wetland habitat management will continue to provide habitats necessary for bats on natural area properties. When public safety and/or fire prevention planning allows, retention and recruitment of tree snags should be part of natural area management planning. Colorado water law dictates what can be done regarding the development or expansion of water availability for bats and other wildlife, but an evaluation of the possibilities to promote water resources could be considered for future projects. And finally, a very important bat roost was documented during this project at Gateway Natural Area. The species, *Myotis lucifugus*, using the old water treatment plan as a maternity roost, has important value to Colorado in both monitoring and research related to the emerging threat to bats by White-nose syndrome. Bats are an important component of our ecosystems, and the conservation provided by the protected landscapes of the City of Fort Collins will help provide viable populations of many species of bats in our state.

Based on the current status and information on the bats of City of Fort Collins Natural Areas, the following recommendations are provided for consideration by management to continue progress on bat conservation in the state and on city properties.

1. **Monitoring Surveys:** Consider conducting additional surveys for bats in any city natural area where significant changes to landscape level habitat management is necessary. This would provide a more complete evaluation of bats that use the natural areas for roosting and foraging during all potential seasons of use. Additional capture surveys at some natural areas during the various seasons of use would provide better insights into bat use during seasons of use that were not covered in this project. Surveys should be conducted by both capture and acoustic methods. Acoustic methods provide a cost-effective survey approach, and can cover longer survey periods of time than mist netting. However, mist netting provides verification opportunities to acoustic data, and can also potentially document species that not easily documented by bat detectors (i.e., Townsend's big-eared bat).

2. **Maternity Roosts:** Conserve maternity roosts of bats that get documented on natural area properties. Monitor the status of the little brown bat maternity roost discovered at the old water treatment plant.

Collaborate with Colorado Parks and Wildlife to monitor this important roost, and explore potential WNS research related opportunities for this species at the Gateway roost.

- When appropriate, develop and include any necessary management guidelines in Management Plans for Gateway, or other natural areas found to provide and conserve maternity roosts for bats, especially for species of conservation priority.

3. **Bat Roosts:**
    - Evaluate the roosting potential of buildings and structures in the city natural areas, and conduct surveys where evidence of bat use is observed to determine species, types of roost use and potential management considerations.
    - Evaluate the potential for winter roosting in the sub-level of the water treatment plant, and collaborate with CPW on any conservation issues.

4. **Education:** Develop educational programs to promote conservation of bats, and awareness of bats and their use of natural areas to the public.

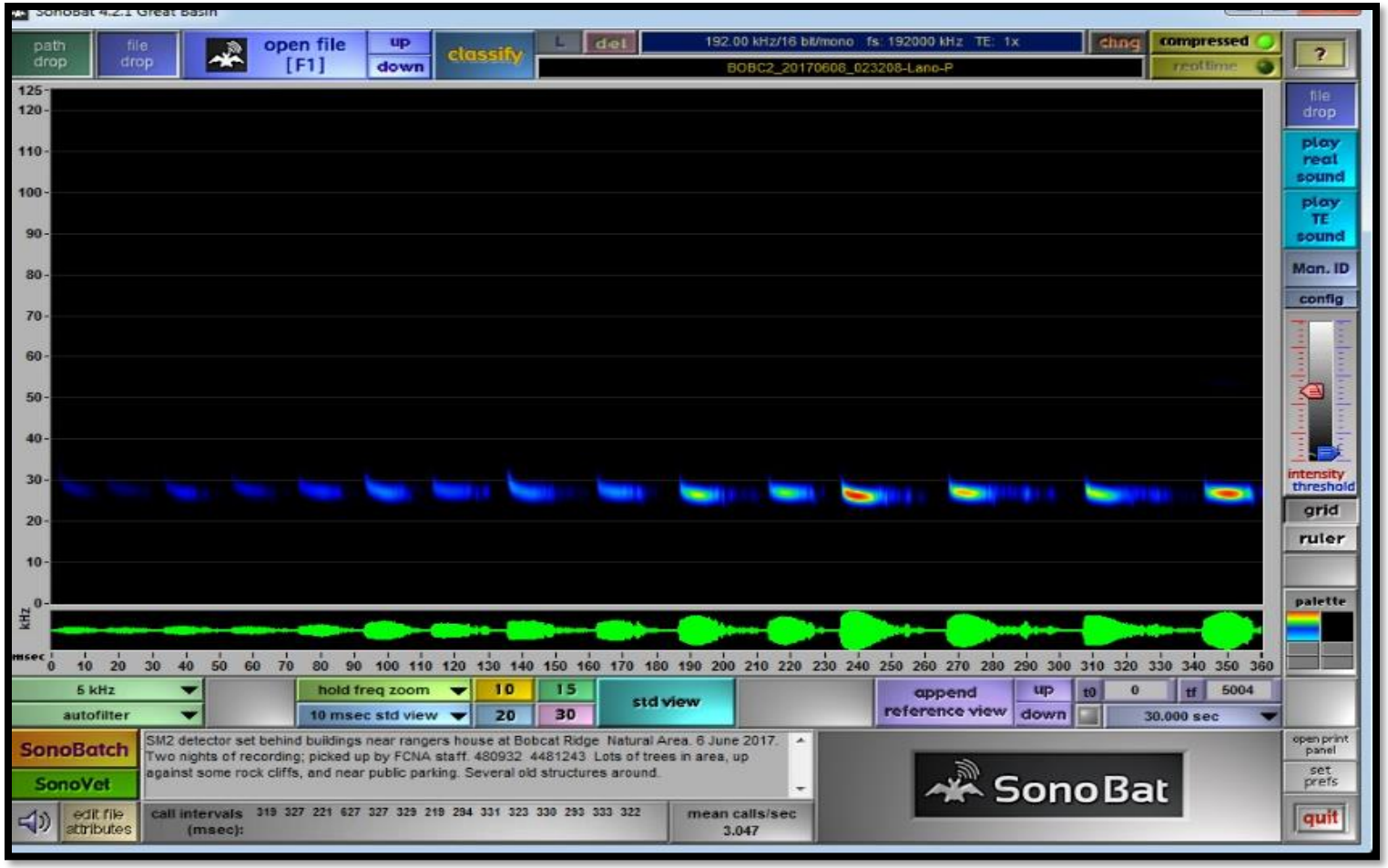
5. **Species Conservation Monitoring:** Consider involvement in on-going bat monitoring programs, such as the NABat program, to contribute to the large-scale monitoring of bats in North America, and long-term monitoring of the bats of Larimer County and Fort Collins Natural Areas.
    - Determine if/what sample units in the NABat Program cover Fort Collins Natural Areas, and encourage acoustic surveys by CPW to participate with the Program.

6. **Habitat:** In general, habitats in the evaluated natural areas are providing excellent resources for bats. The focus of management in the short term should be related to roosting habitats.
    - Promote, when public safety is not a concern, the retention and recruitment of snags for roosting bats.
    - Maintain proper riparian habitat management along streams and river corridors.
    - Develop wetland habitat management plans to conserve these resources for bats and other wildlife, as both foraging and drinking resources for bats in and around natural area properties.

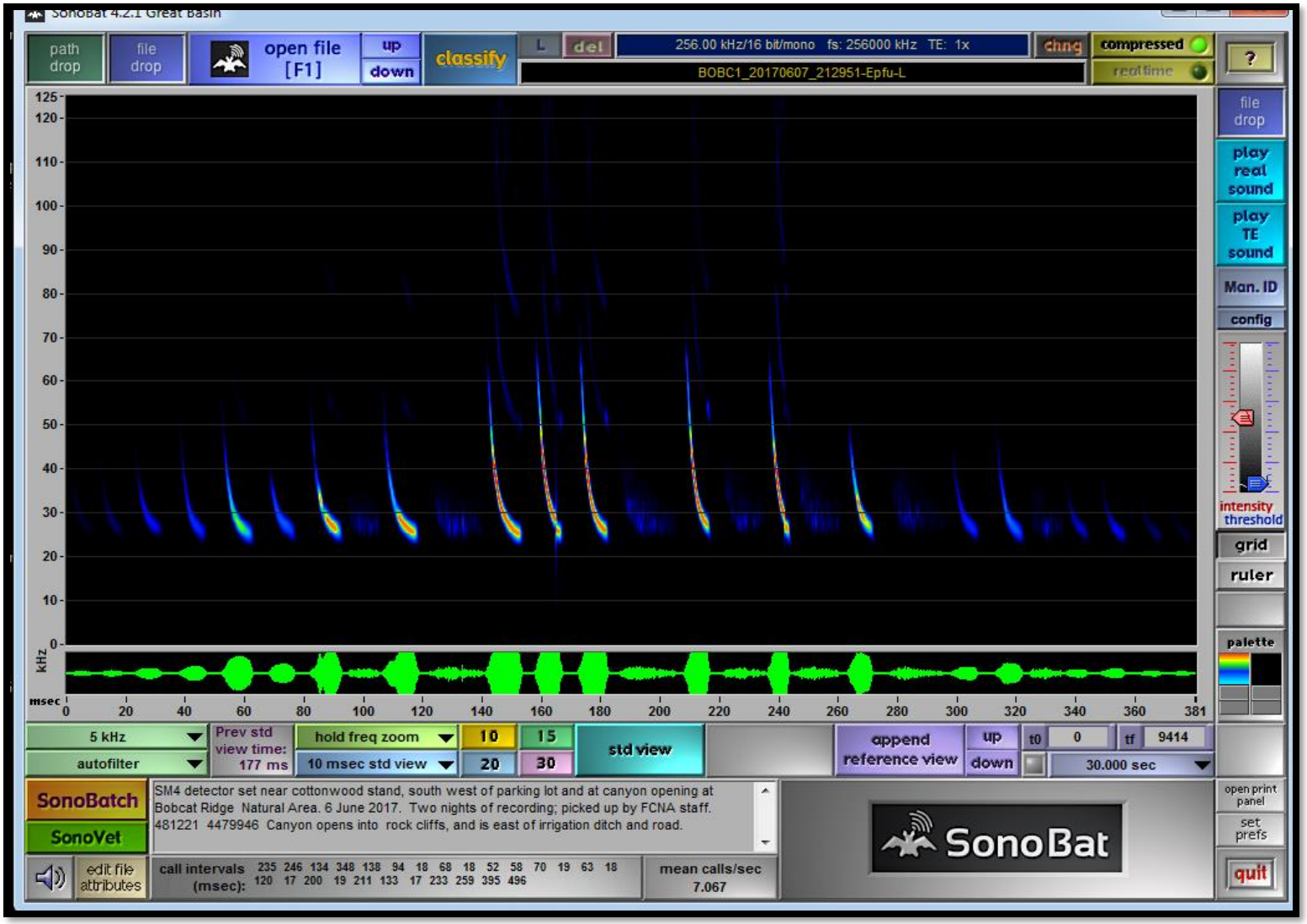
7. **Water:** Maintain, and expand when water rights allow, the opportunity for development of open water sources for bats by stock tanks and retention ponds. Maintain escape ramps, water levels, and remove floating algae situations at stock tanks on natural areas.

APPENDIX A – Full Spectrum Call Samples

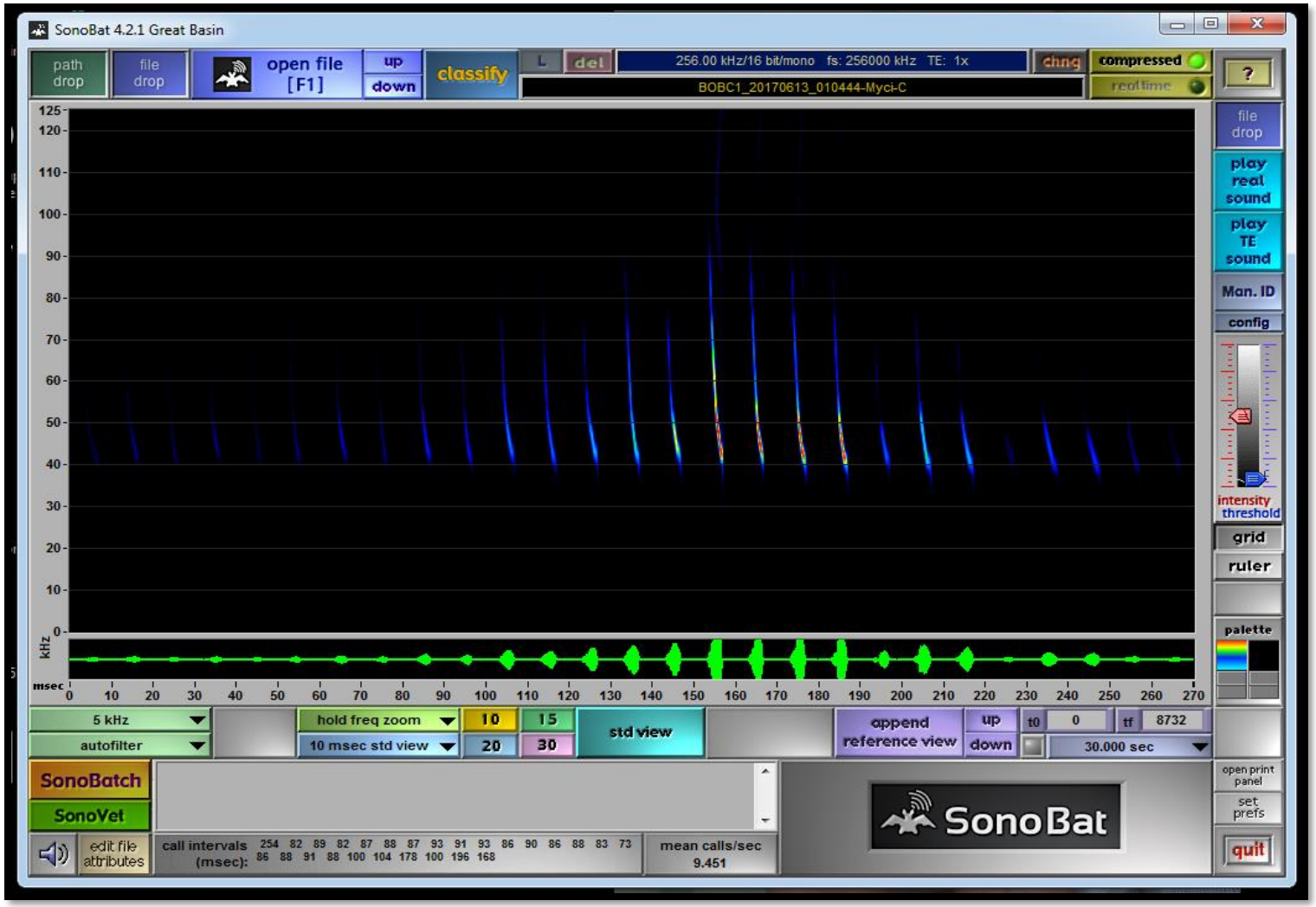
Bobcat Ridge Natural Area – Silver haired bat (Lano)



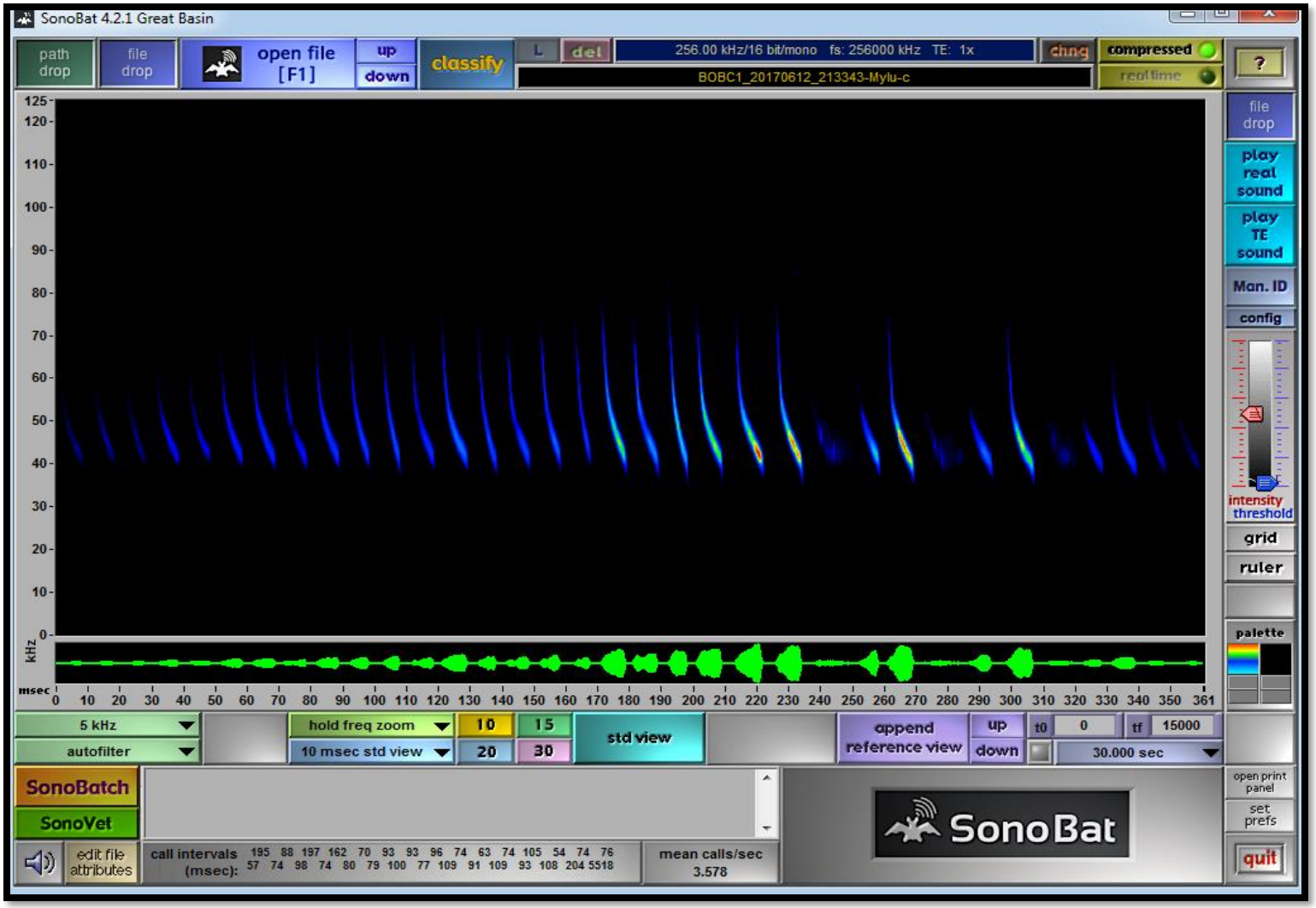
Bobcat Ridge Natural Area – Big Brown Bat (Epfu)



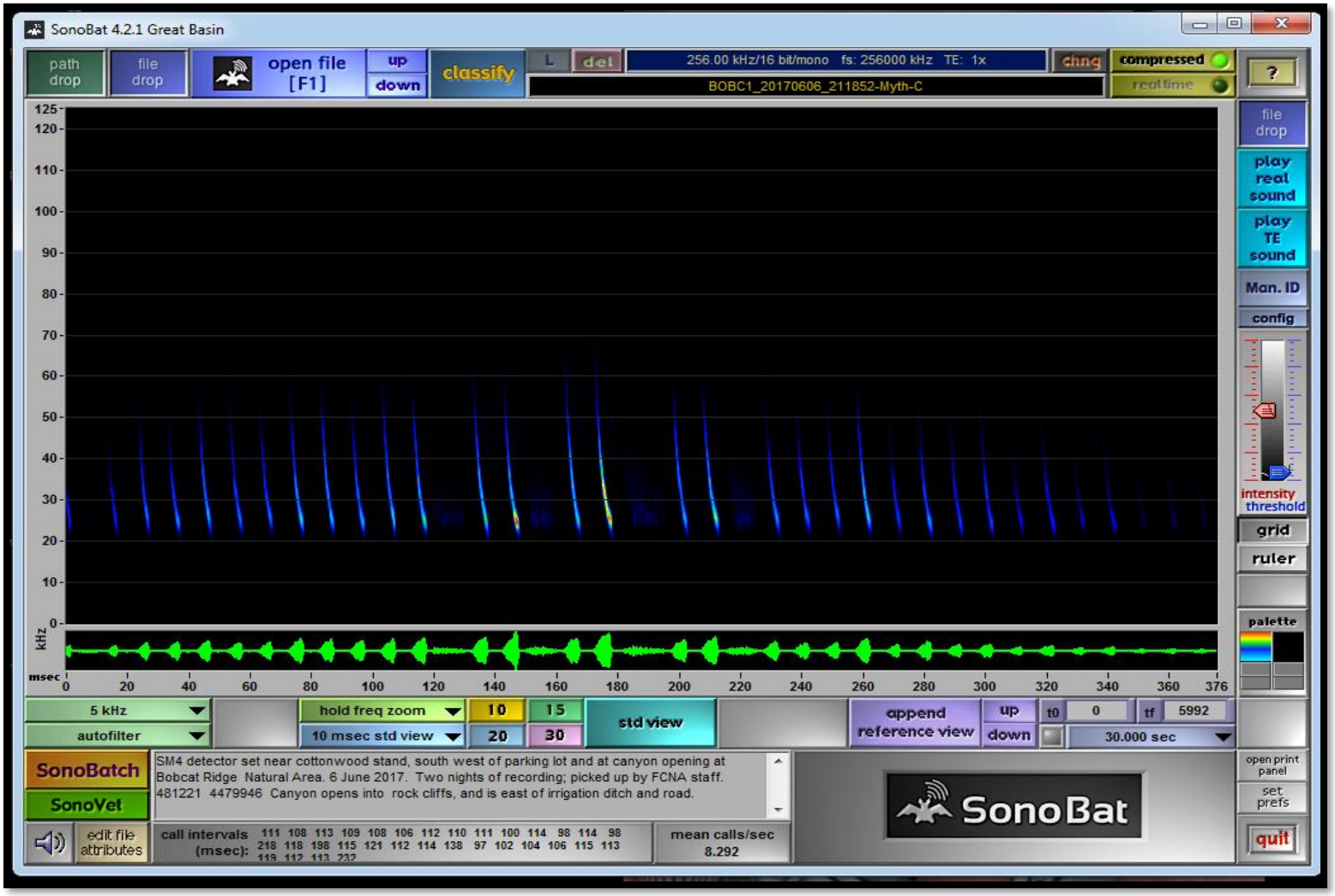
Reservoir Ridge Natural Area – Small-footed Myotis (Myci)



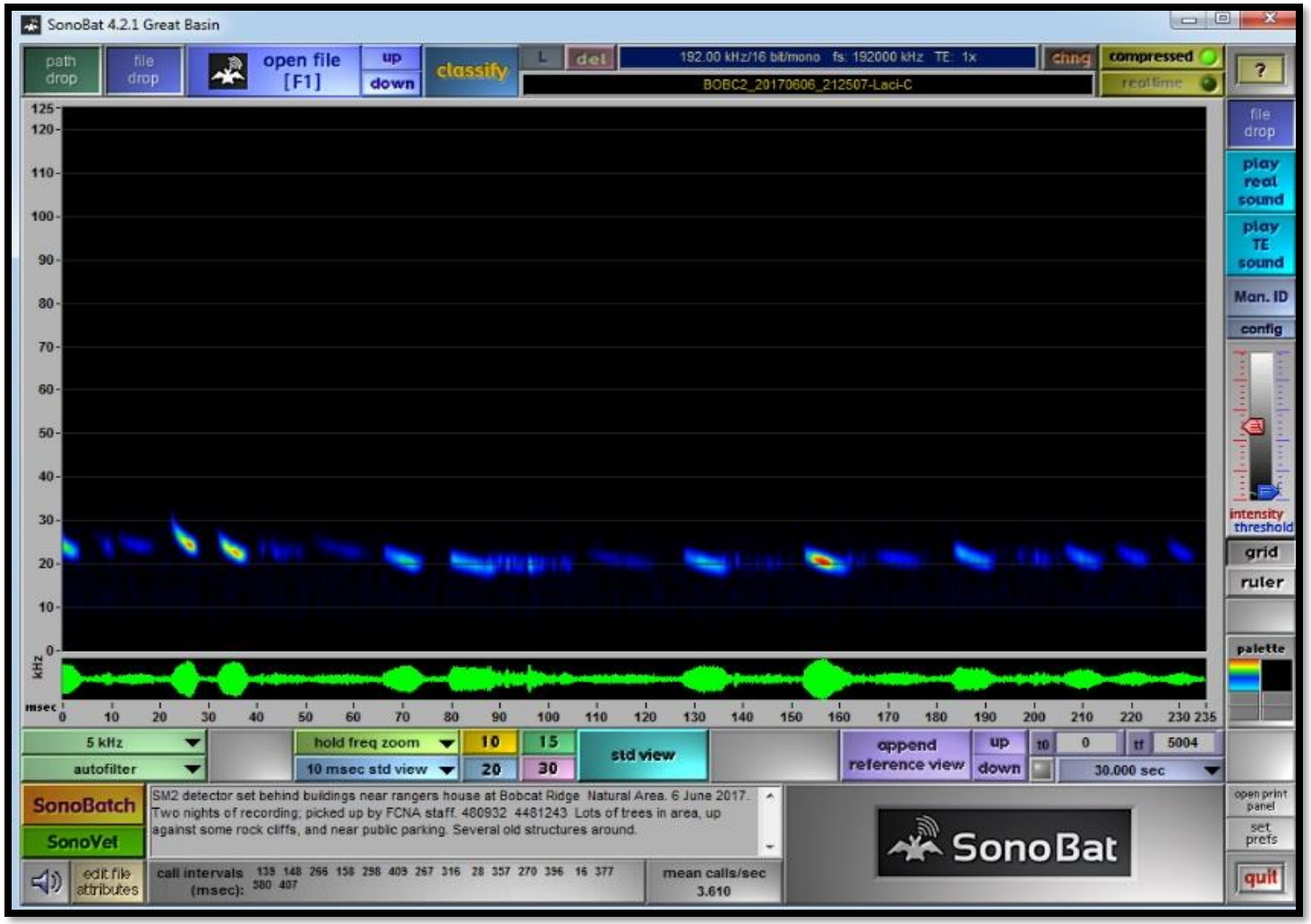
Reservoir Ridge Natural Area – Little Brown Bat (Mylu)



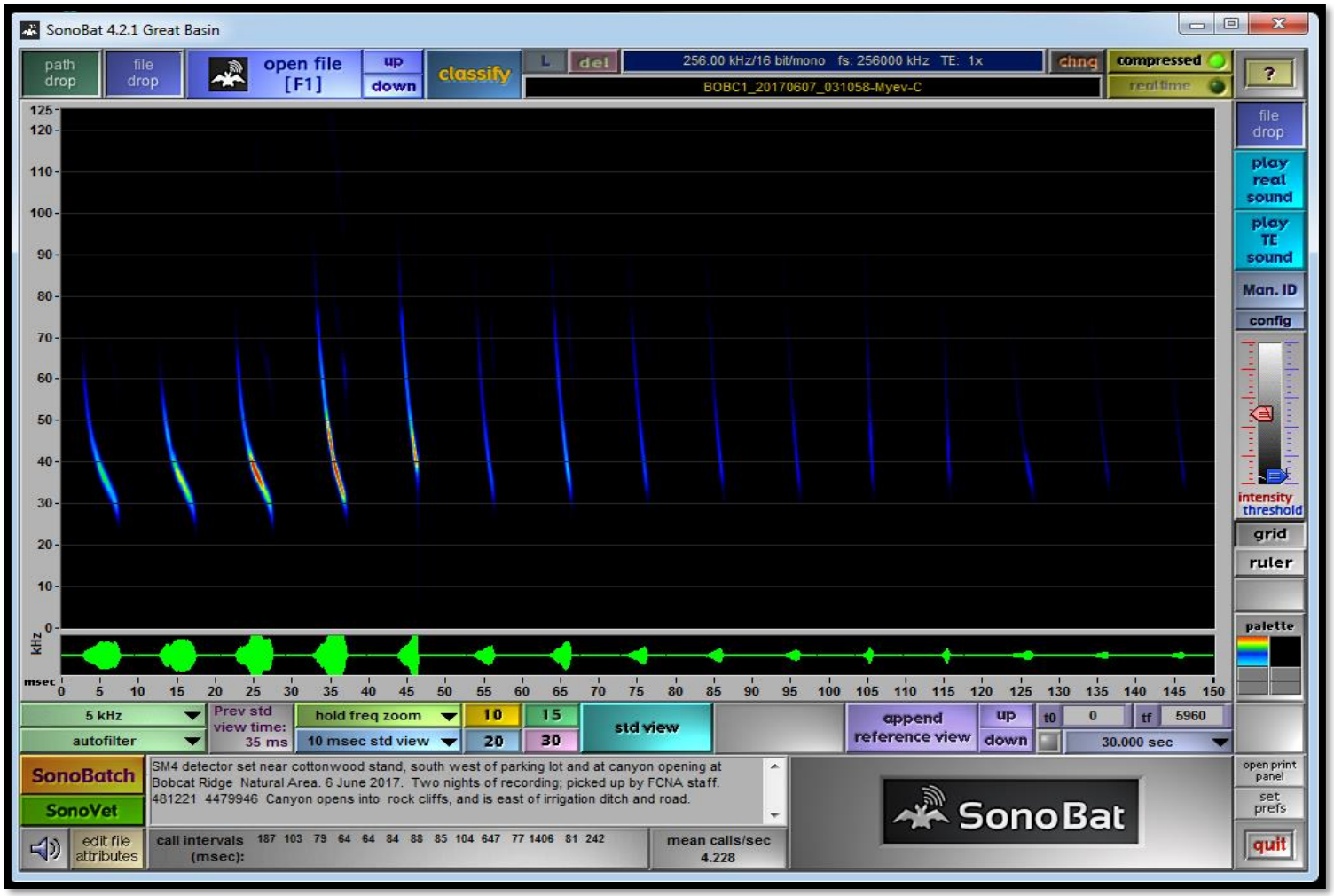
Bobcat Ridge Natural Area – Fringed myotis (Myth)



Bobcat Ridge Natural Area - Hoary Bat (Laci)

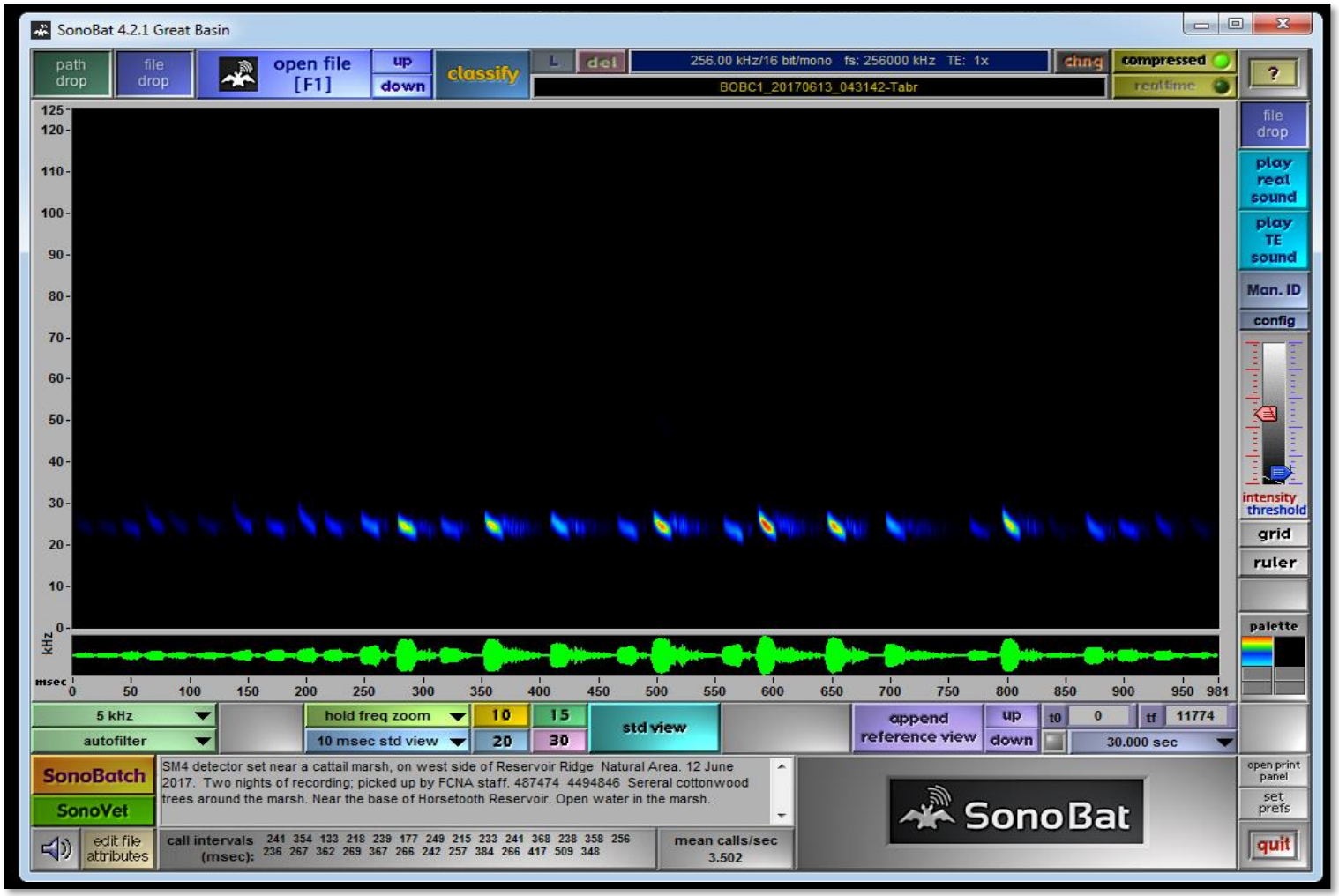


Bobcat Ridge Natural Area – Long eared bat (Myev)

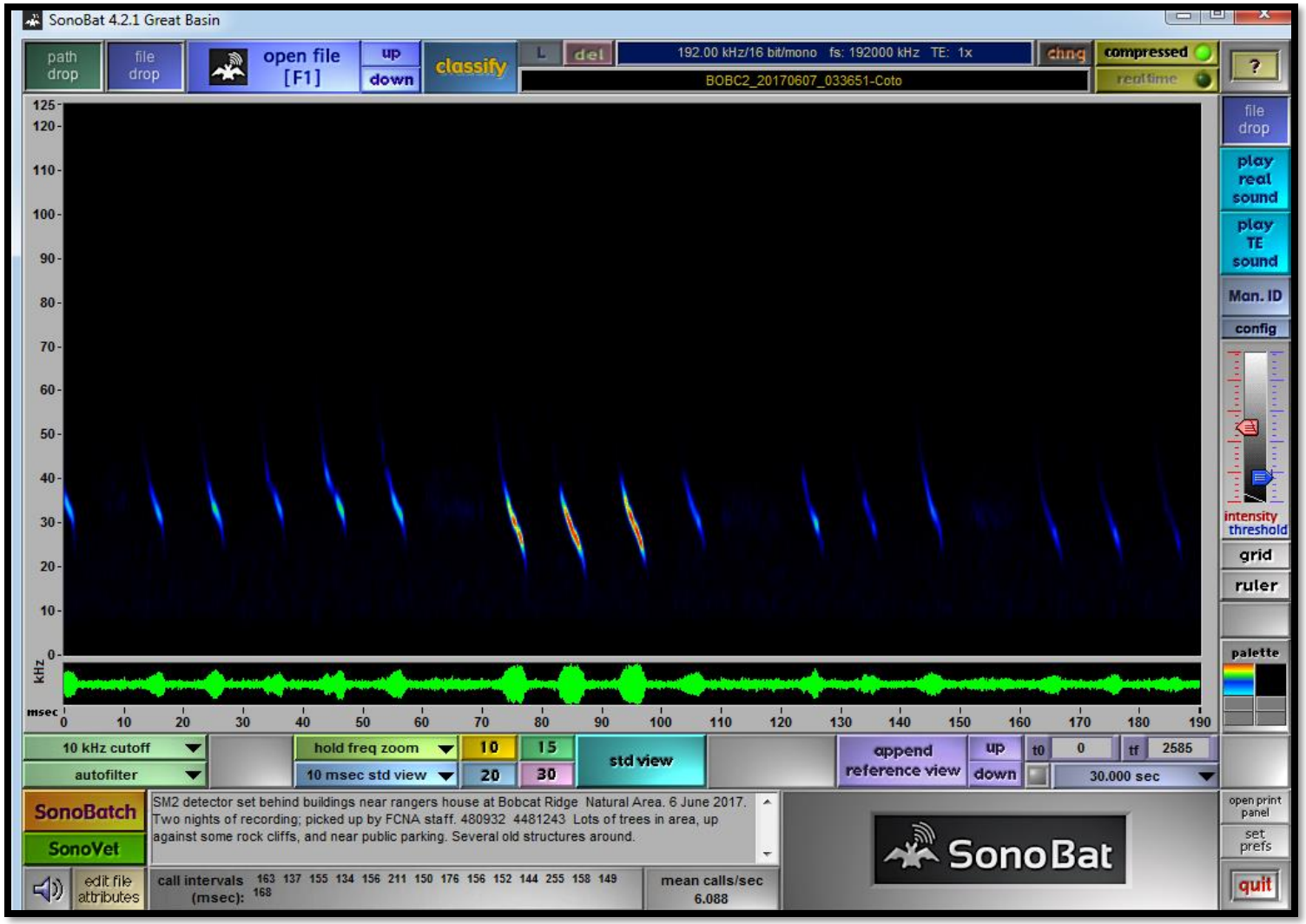


APPENDIX B - Species of Interest: Not Confirmed

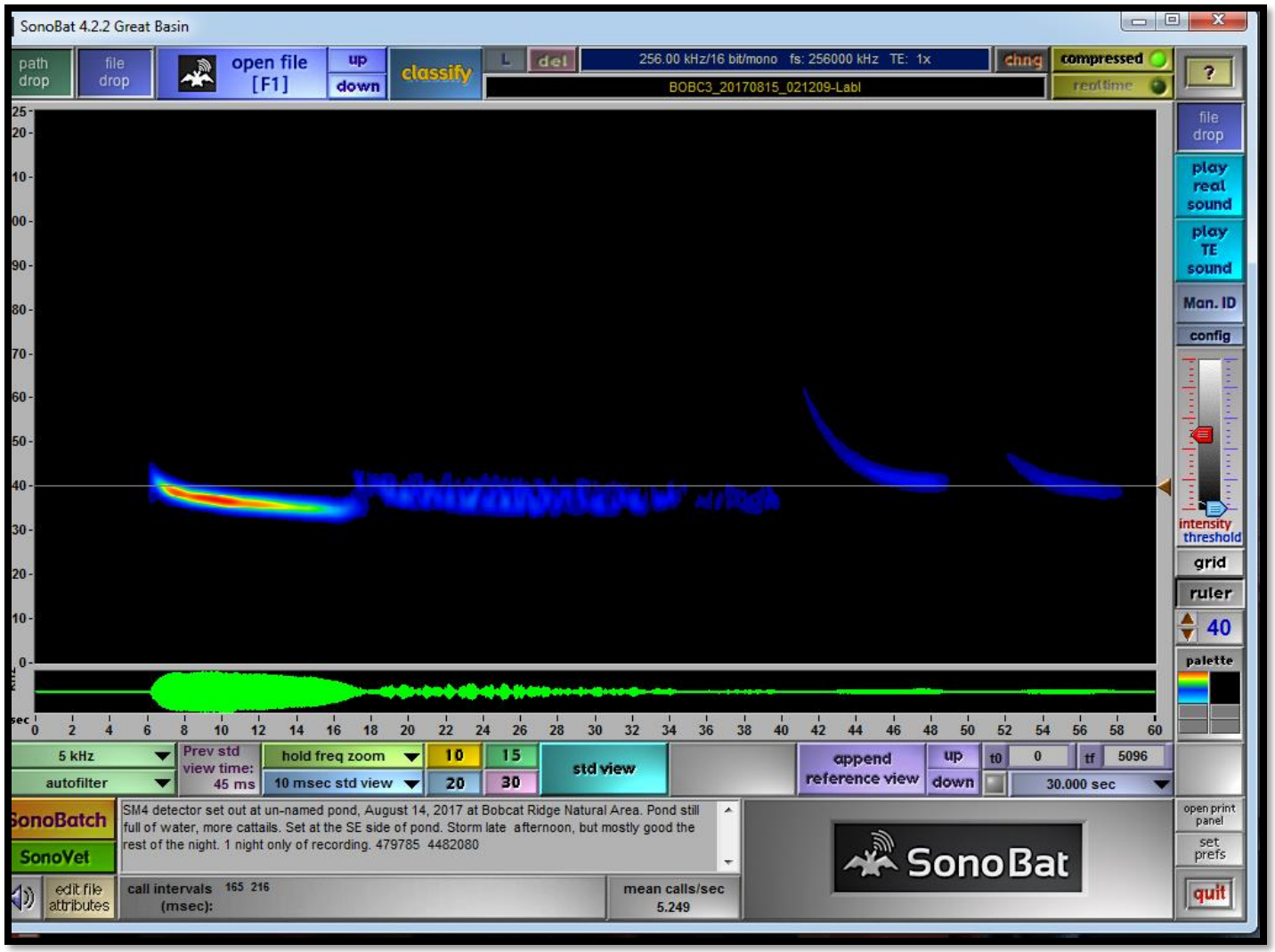
Reservoir Ridge Natural Area – Mexican free-tailed bat (Tabr)



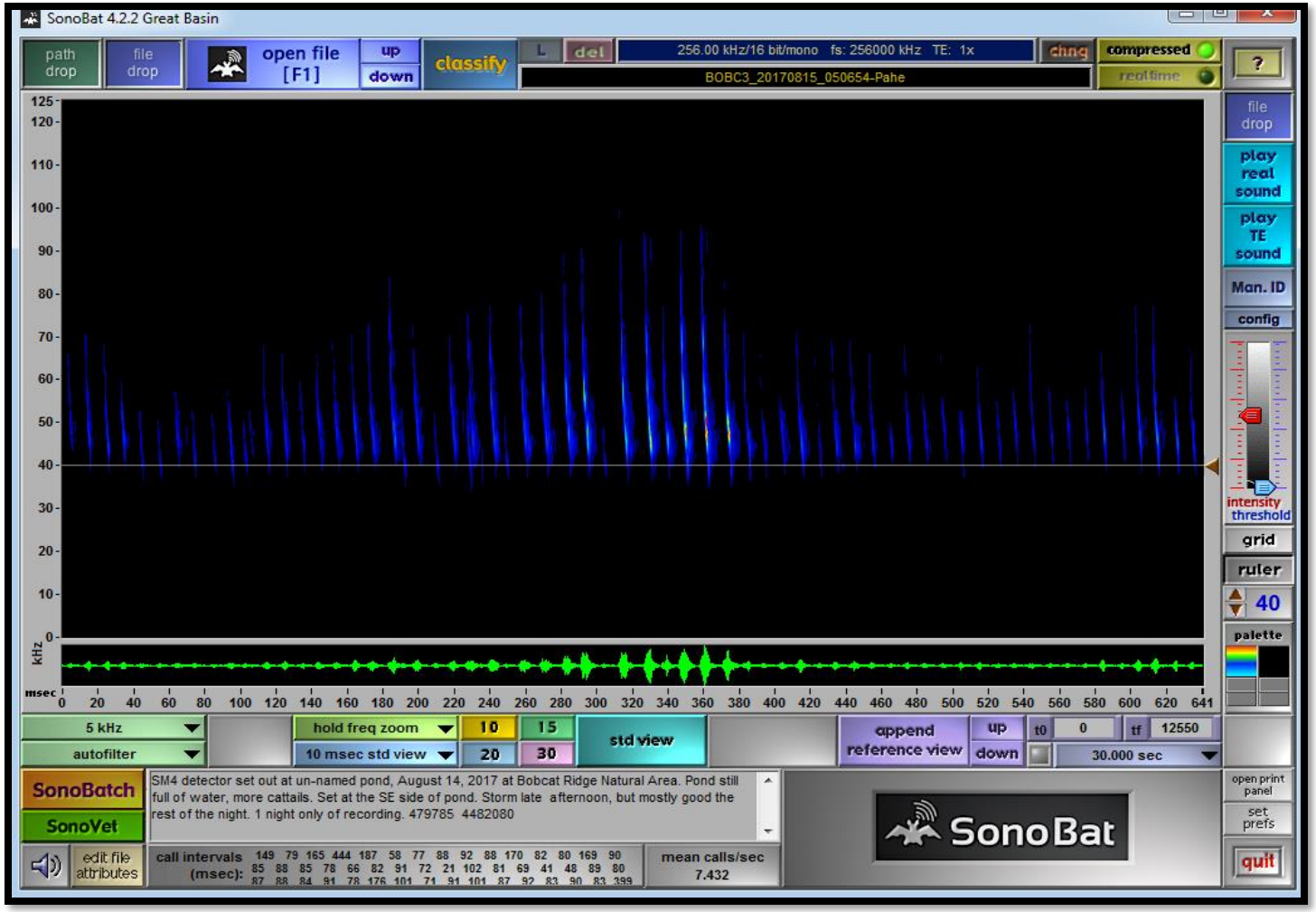
Bobcat Ridge Natural Area – Townsend's big-eared bat (Coto)



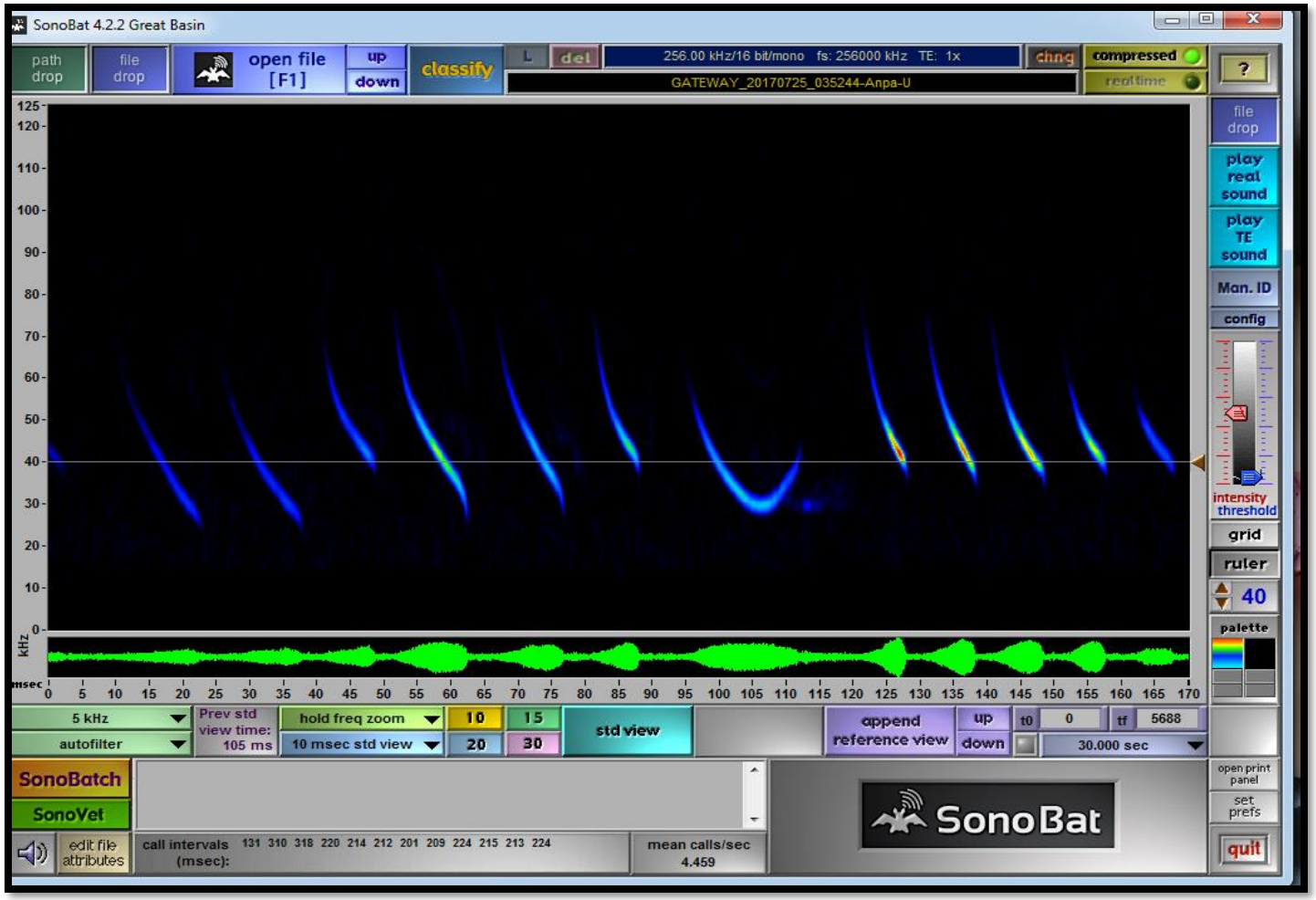
Bobcat Ridge Natural Area – Red bat (Labo/Labl)



Bobcat Ridge Natural Area – Canyon Bat (Pahe)

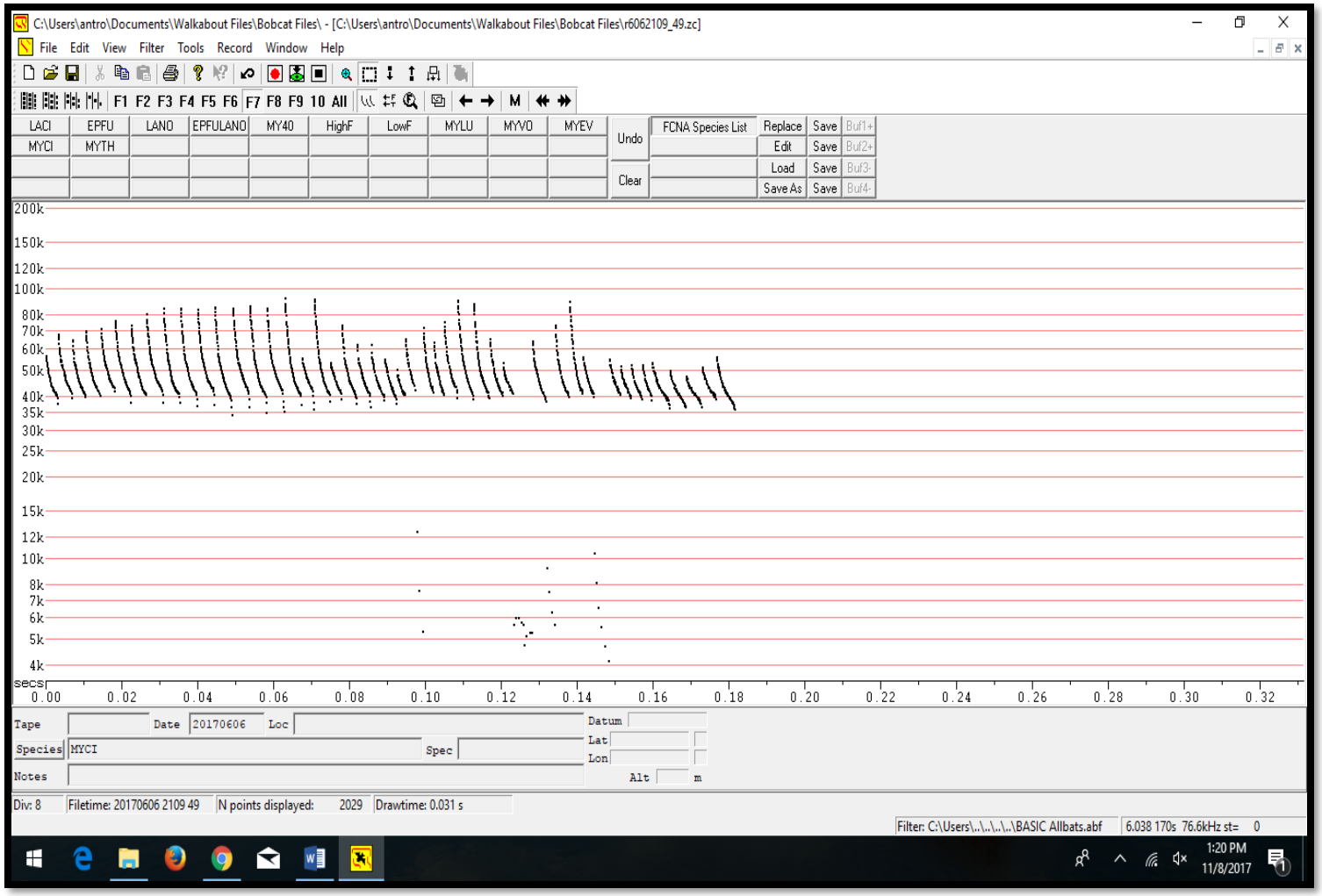


Gateway Natural Area – Pallid bat (Anpa)

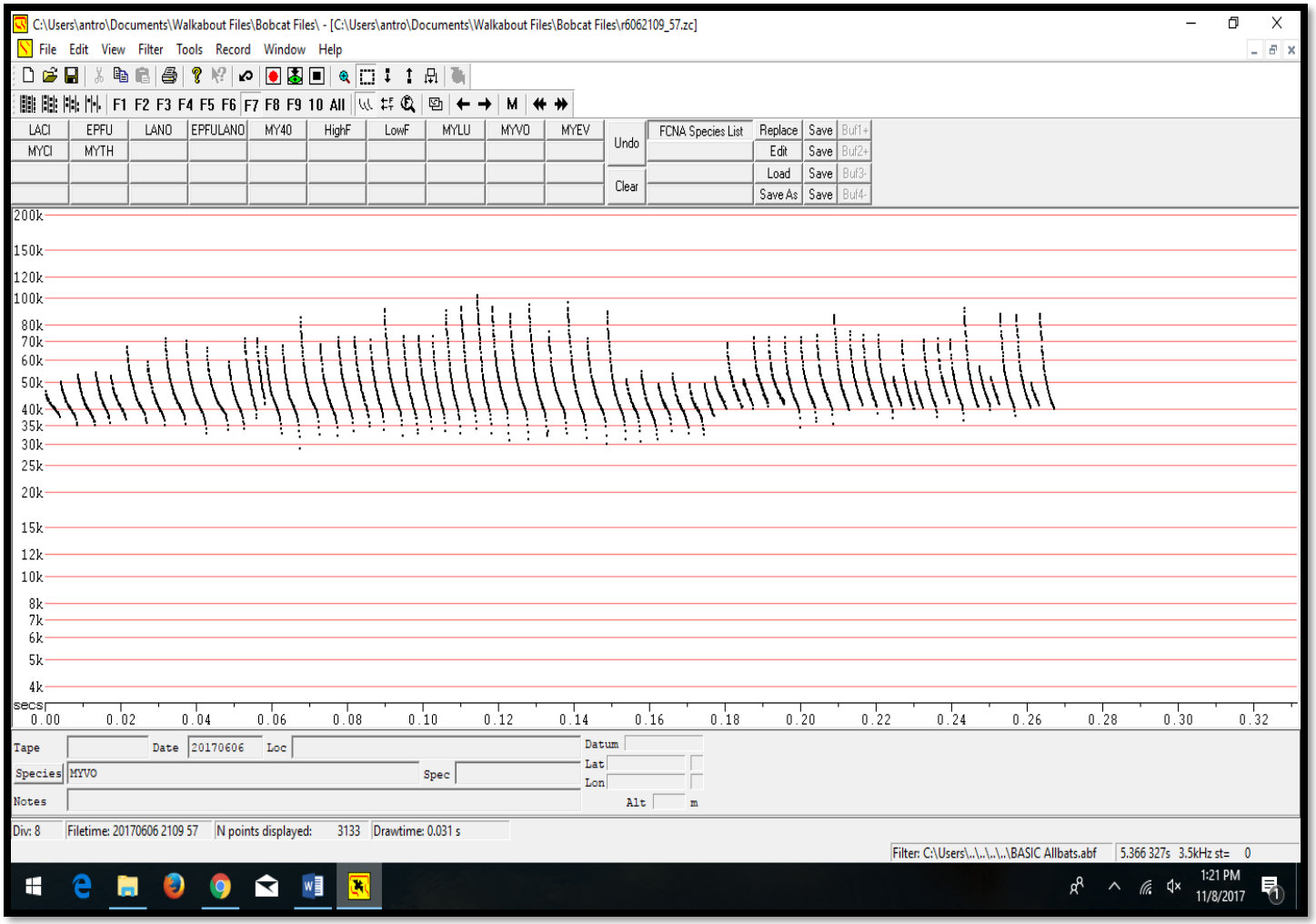


APPENDIX C – Zero-Crossing Call Samples

Bobcat Ridge Natural Area – Small-footed Myotis (Myci)

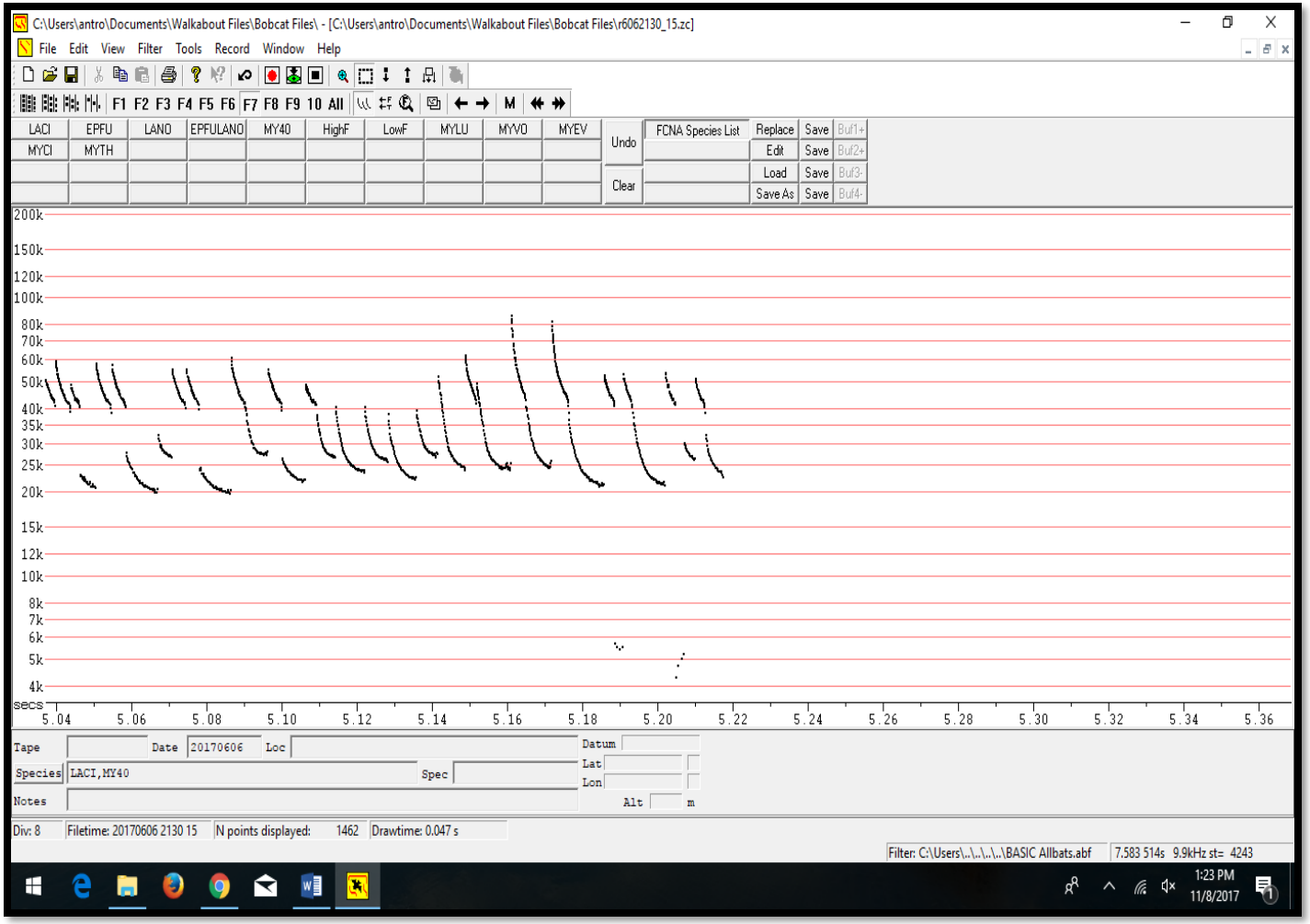


Bobcat Ridge Natural Area – Long Legged Myotis (Myvo)

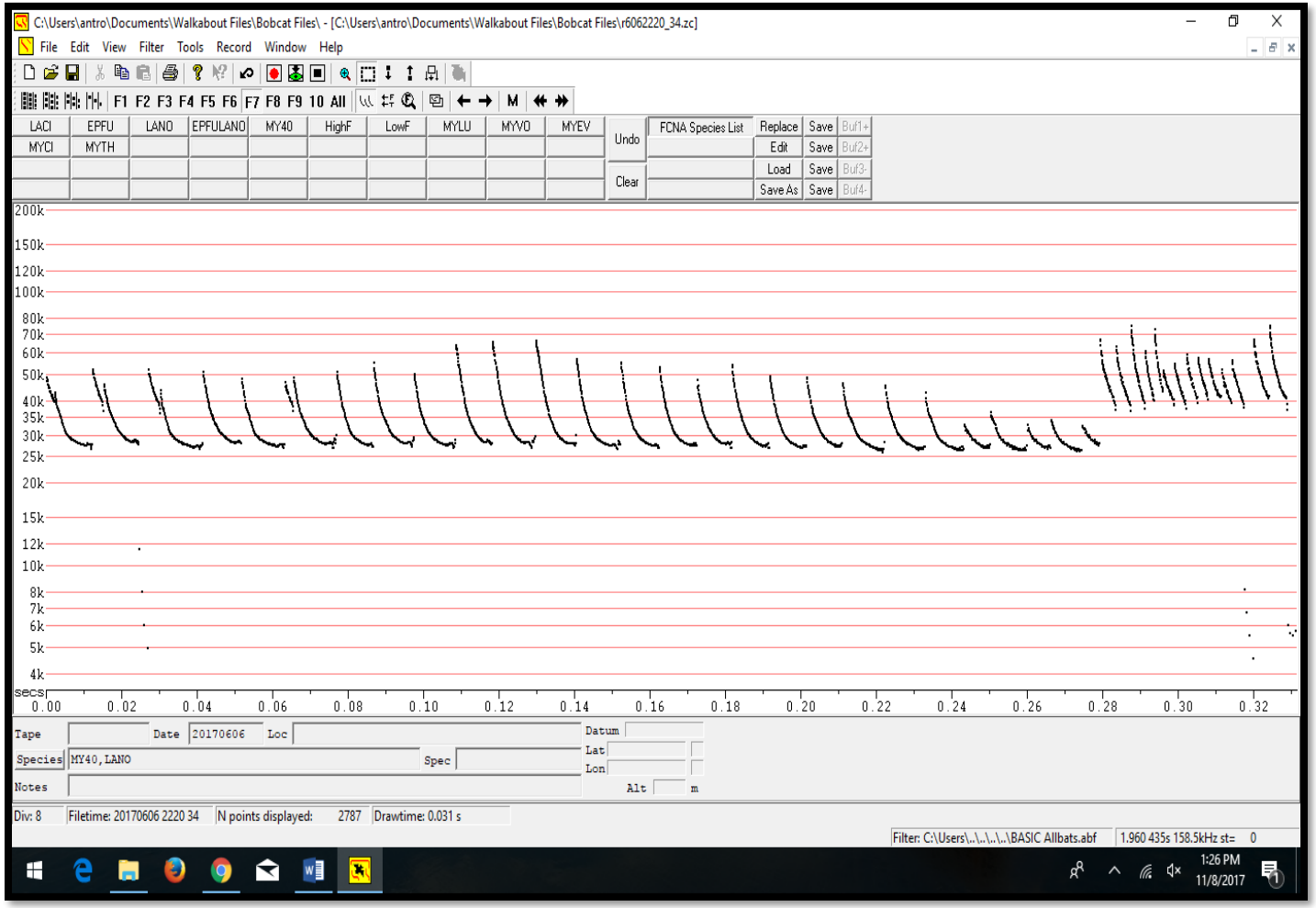


Bobcat Ridge Natural Area - Hoary Bat (Laci)

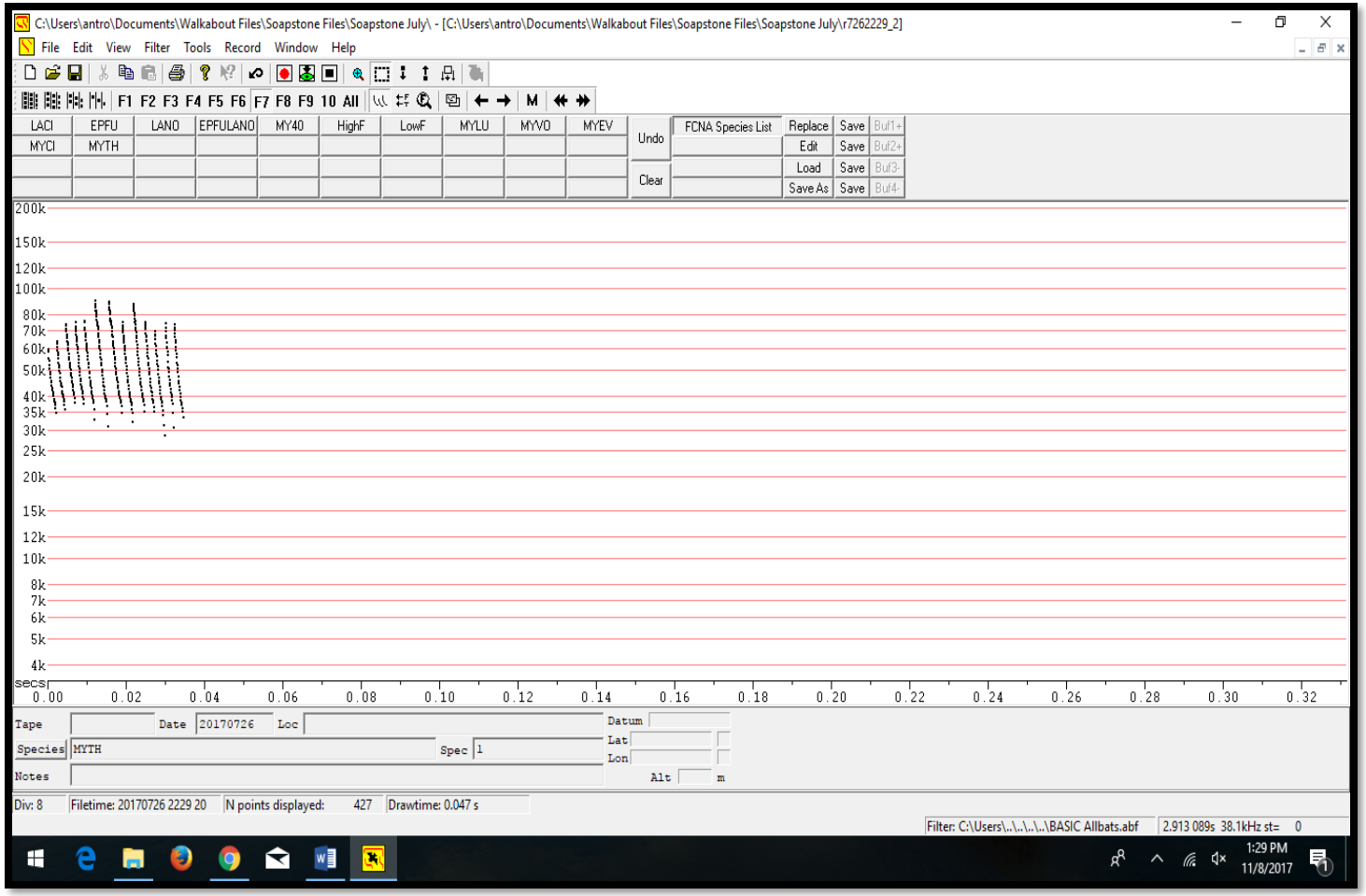
(with a Myotis Spp.)



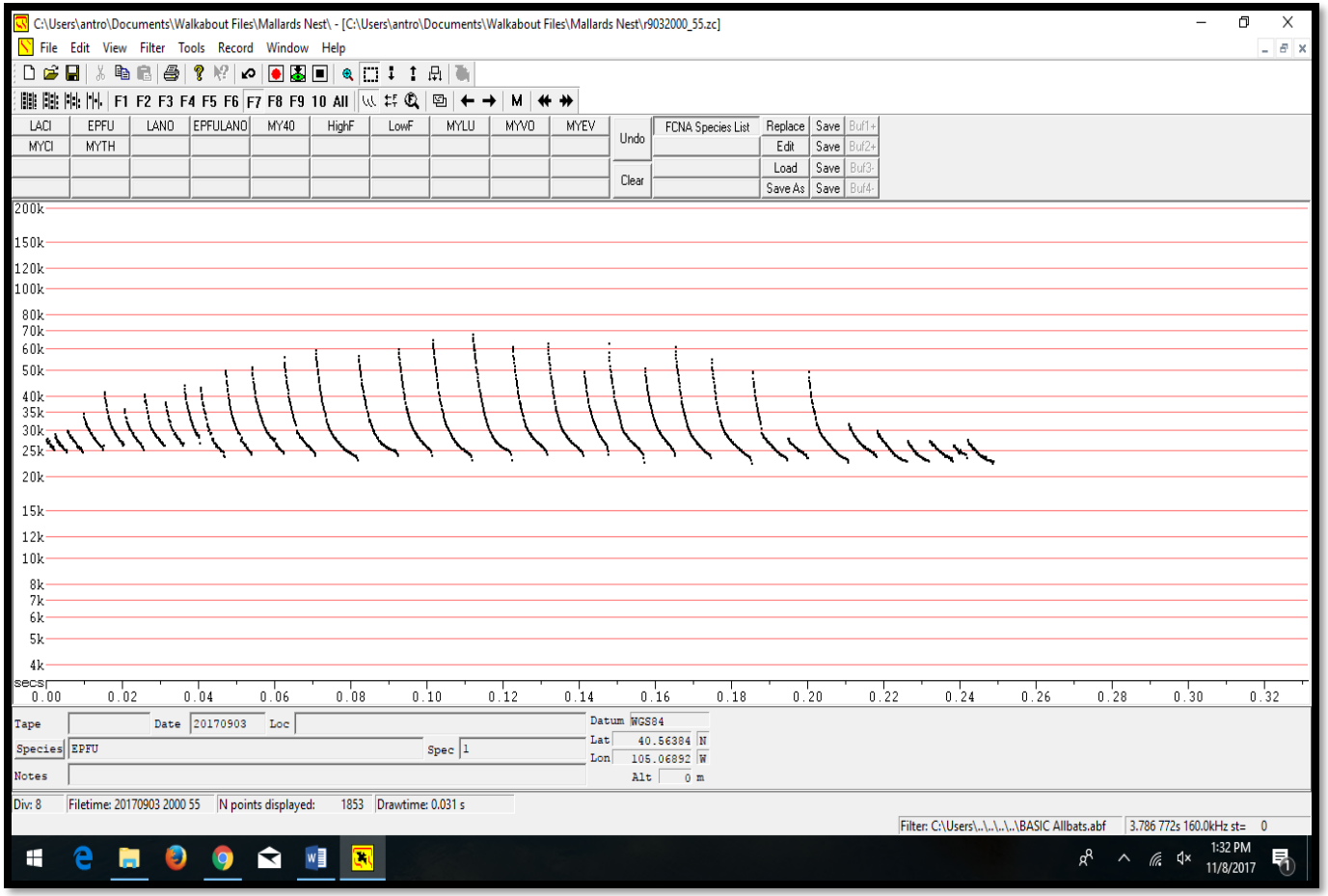
Bobcat Ridge Natural Area – Silver haired bat (Lano)



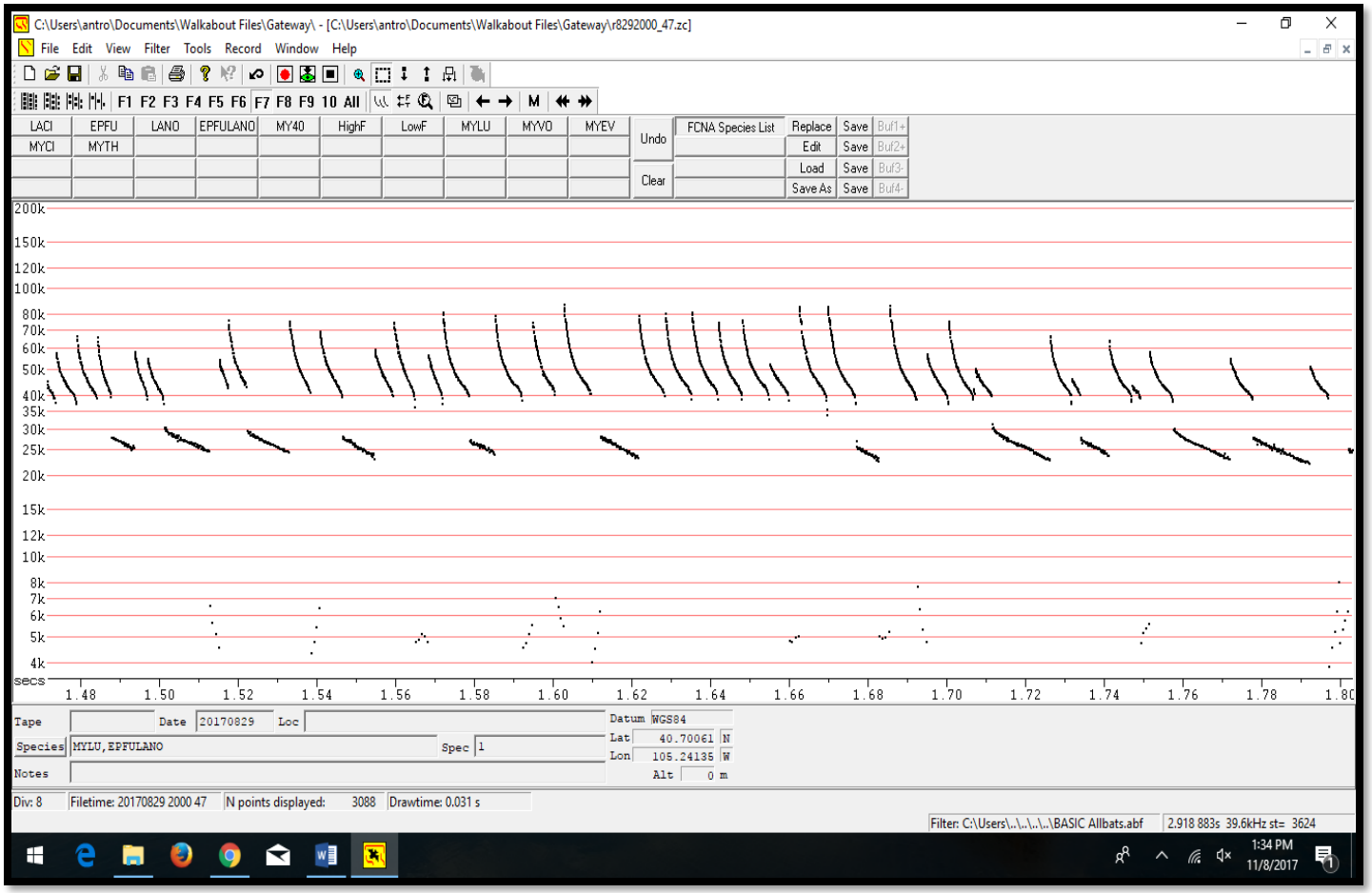
Soapstone Prairie Natural Area – Fringed myotis (Myth)



Mallard's Nest Natural Area – Big Brown Bat (Epfu)



Gateway Natural Area – Little Brown Bat (Mylu)



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