Acoustic Bat Surveys for the Nottawaseppi Huron Band of the Potawatomi Sherwood Township Property



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For:

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Introduction

We assessed bat habitat suitability during preliminary visits and during natural community and plant surveys at the Sherwood Township Properties. Suitable habitat was present for all bat species known to occur Southern Michigan except for the eastern pipistrelle (Kurta 2008). These species include two federally endangered bat species: Indiana bat (Myotis sodalis) and northern long-eared bat (Myotis septentrionalis). Suitable habitat was also present for the state threatened Evening bat (Nycticeius humeralis). Based on the habitat assessment we determined placement of acoustic bat monitors to ensure the highest likelihood of recording bat echolocation calls. Deployment of acoustic bat monitors is used to complement mist netting efforts and is part of a multi-faceted approach to help predict bat presence and diversity at the Sherwood Township site. Recordings of ultrasonic echolocation calls are used to help assess which bat species may occur in the area and determine which locations are most probable to produce target species captures during mist netting sessions.

Methods

At three locations between July 21, 2017 and August 17, 2017 we deployed Wildlife Acoustics SM2+ monitors equipped with Wildlife Acoustics SMX-U1 omnidirectional microphones following the U.S. Fish and Wildlife Service guidelines (USFWS 2018). Recordings were initiated daily 30 minutes before sunset, and continually operated in 15-minute increments, before recording stopped 30 minutes after sunrise. All microphones were placed 15 feet above the ground. The monitors were placed in prairie fen, dry-mesic southern forest and old field adjacent to a body of water. Monitor placements were chosen based on flight path and foraging characteristics of bats. In 2018 (August 9-August 18) acoustic monitors were redeployed in dry-mesic southern forest.

We analyzed the recorded bat calls with SonoBat Version 4.3 software. It is essential to understand the features and limitations of acoustic analysis software programs to more accurately interpret the nuances of bat activity and occupancy on the landscape. There is substantial overlap between several bat species echolocation call characteristics. Also, certain conditions such as rain or wind as well as ambient noise (in this case M-66) can generate low-quality recordings. These low-quality recordings along with high quality recordings must be carefully analyzed to decide the most likely species of bat that may have emitted a given call. Each of these calls is analyzed and given a probability that species X was recorded, however programs can misclassify a call and manual vetting of the given sonogram is necessary. The results of acoustic monitoring are presented as the best predictor of species identification and species presence.

SonoBat 4.3 calculates a Maximum Likelihood Estimate (MLE) with an algorithm for each species known to the classifier based on the number of classified species and their known overlap and ambiguity of classification. Like all statistical software SonoBat provides a probable estimate. The SonoBat MLE calculation uses adjustments based on the experience of classifier performance on real-world data sets. When SonoBat outputs are interpreted, it is recommended that files which come up as unusual, unexpected, or one of only a few species at a site, should be manually vetted to determine confidence level in the call sequence. Not all acoustic recordings can or should be identified confidently to species and auto generated classification results cannot be taken as absolute evidence of bat occupancy. We manually vetted calls to assist SonoBat classifications paying close attention calls classified as Indiana bat, little brown bat (Myotis lucifugus) and evening bat. These acoustic results are presented in Figures 1, 2, 3 and 4.

Results

Table 1. presents a summary of the number of bat calls identified in each habitat by SonoBat and the (MLE) calculated for each species. MLE values range from 0-1 with a value of 0 having a higher probability and a value of 1 having a low probability of a species identification.

Acoustic analyses results were filtered to only show call sequences where at least eight pulses met the acceptable call quality metric and at least seven call pulses matched the species ID for the sequence. As a result, "filtered" tables and graphs show a smaller number of calls and fewer species than if data had not been filtered.



Figure 1. Location of bat monitors within the Sherwood Township Property.

Fable 1. Summary of Acoustic Analysis: SonoBat: Version 4.3 Software Sherwood Township Property - Branch Co. MI: Acoustic Stations in Four
Different Habitats

Site and Year										
Prairie Fen: 2017	Myse	Myso	Mylu	Pesu	Nyhu	Labo	Epfu	Lano	Laci	Luso
Number of calls:	0	0	1	0	0	22	13105	462	282	0
Presence - P Values:	1	1	0.99	1	1	0.01	0	1	0.92	1
Old Field: 2017	Myse	Myso	Mylu	Pesu	Nyhu	Labo	Epfu	Lano	Laci	Luso
Number of calls:	0	0	0	1	0	1	117	2571	43	93
Presence - P Values:	1	1	0.99	1	0.99	0	0	1	0.01	1
Oak Hickory Forest: 2017	Myse	Myso	Mylu	Pesu	Nyhu	Labo	Epfu	Lano	Laci	Luso
Number of calls:	0	1	0	0	4	113	1968	6	5	0
Presence - P Values:	1	0.99	1	1	1	0	0	1	0.99	1
Dry Mesic Southern Forest: 2018	Myse	Myso	Mylu	Pesu	Nyhu	Labo	Epfu	Lano	Laci	Luso
Number of calls:	0	0	0	0	1	11	929	33	77	0
Presence - P Values:	1	1	1	1	1	0.09	0	1	0	1

EPFU: big brown bat (Eptesicus fuscus)

LABO: eastern red bat (Lasiurus cinereus)

LACI: hoary bat (Lasiurus cinereus)

LANO: silver-haired bat (Lasionycteris noctivagans)

LUSO: Ambigous: little brown bat\Indiana bat (Myotis lucifugus) & (Myotis sodalis)

MYLU: little brown bat (Myotis lucifugus)

MYSE: northern long-eared bat (Myotis septentrionalis)

MYSO: Indiana bat (Myotis sodalis)

NYHU: evening bat (Nycticeius humeralis)

PESU: eastern pipistrelle (Perimyotis subflavus)

MLE Values- Maximum Likelihood Values approaching zero are considered to have higher

levels of probability and are highlighted. Those values approaching 1 are considered to

have lower levels of probability.

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Between 93% and 96% of the bats calls at each site were identified by SonoBat as characteristic of big brown bat (Eptesicus fuscus) (Table 1). Big brown bats are one of the most widely distributed North American bats species and are by far most prevalent species in the southern Lower Peninsula of Michigan. Calls characteristic of the eastern red bat (Lasiurus borealis) were also classified by SonoBat in all habitats where monitors were placed Table 1). Like big brown bats, eastern red bats are widespread in North America. Calls characteristic of the hoary bat (Lasiurus cinereus) were recorded in the old field and dry mesic southern forest habitats (Table 1). Hoary bats are widespread in North America but are an uncommon summer resident in Michigan. Both the eastern red bat and hoary bats are long distance migrants that summer in Michigan.

Prairie Fen 2017: The filtered table indicates 10,209 calls of five species of bats (big brown bat, eastern red bat, hoary bat, silver-haired bat and little brown bat) (Table 2 and Figure 1). A single call recorded in the prairie fen was auto classified by SonoBat as characteristic of a little brown bat. This call was manually reviewed, and it was determined that the quality of the call was high enough to indicate the possibility of either a little brown bat or Indiana bat being recorded at this site. The call sequence of the little brown bat was manually evaluated and compared to a library of reference calls for the little brown bat and Indiana bat. Indiana bats and little brown bats have substantial overlap in their echolocation call characteristics resulting in only a small portion of their call repertoires having discriminating characteristics. We recommend mist netting is as an additional way to try to determine the presence of one or both species at this site.

Table 2. Filtered results of the auto classifier identification output for bat calls recorded in prairie fen in 2017.

Species	Number of Calls recorded
Big brown bat	9802
Eastern red bat	9
Hoary bat	28
Silver-haired bat	275
Little brown bat	1
Not identified	94
Total number of calls	10209



Figure 1. "Filtered" results of Auto Classifier ID Output of Bat Calls Recorded in Prairie Fen 2017

Old Field 2017: Table 3 shows 1,910 filtered bat calls representing four species of bats (big brown bat, eastern red bat, hoary bat and silver-haired bat) (Table 3 and Figure 2). The filtering process eliminated the call sequences for little brown bat and evening bat since they did not meet the criteria of at least 8 call pulses of acceptable quality and 7 call pulses that

met the standards for auto classification. These calls were manually evaluated and compared to a library of reference calls for these species. As a result, we believe that these recordings should not be completely ruled out as there is a possibility that either the little brown bat or Indiana bat as well as an evening bat could have been recorded at this site.

Table 3. Filtered results of the auto classifier identification output for bat calls recorded inold field in 2017.

Species	Number of Calls recorded
Big brown bat	1794
Eastern red bat	54
Hoary bat	19
Silver-haired bat	10
Not identified	33
Total number of calls	1910



Figure 2. "Filtered" results of Auto Classifier ID Output of Bat Calls Recorded in Old Field 2017

Oak Hickory Forest 2017: The filtered table indicates 1,537 calls of two species of bats (big brown bat, and eastern red bat) (Table 4 and Figure 3). A single call with characteristics of the Indiana bat was recorded in the oak-hickory forest but only 4 of 9 call pulses matched the species ID for the sequence. Although

this recording did not meet the criteria for acceptable call quality, it should not be completely dismissed as there were some pulses that were characteristic of the Indiana bat which suggest that there is a possibility that this species was recorded at this site.

Table 4. Filtered results of the auto classifier identification output for bat calls recorded in oak-hickory forest in 2017.

Species	Number of Calls recorded
Big brown bat	1441
Eastern red bat	39
Not identified	57
Total number of calls	1537



Figure 3. "Filtered" results of auto classifier id output of bat calls recorded in oak hickory forest 2017.

Dry Mesic Southern Forest: The filtered table indicates 709 calls of five species of bats (big brown bat, eastern red bat, hoary bat silver-haired bat and evening bat) (Table 5 and Figure 4). A single call recorded in the southern dry mesic forest in 2018 was classified by SonoBat as characteristic of the state threatened evening Bat. This call was manually vetted, and the quality of the call suggests the possibility of this species occurring at this site. The evening bat lives primarily in the Eastern United States and has a very restricted distribution in Michigan as well as declining populations in neighboring states. All extant populations in Indiana and Michigan are found in trees, including tree cavities as well as in crevices and under sloughing bark. These bats avoid hunting in developed areas or above ponds and lakes and

concentrate their foraging over fields, pastures and woodlots. Evening bats begin migrating south during August, but researchers still do not know for certain where they overwinter.

We did identify a call characteristic of the Indiana bat at this site, but it did not meet the criteria of at least 8 pulses of acceptable quality and 7 or more call pulses matching the AutoID classification. Rather only 4 of the 9 pulses recorded in the call sequence were classified as possible Indiana bat. The results of manual vetting suggest a call sequence that is characteristic of this species, so it is possible that this species may occur here. Mist netting is recommended as an additional way to try to determine the presence of Indiana bat at this site.

Table 3. Filtered results of the auto classifier identification output for bat calls recorded in dry-mesic southern forest in 2017.

Species	Number of Calls recorded
Big brown bat	1794
Eastern red bat	54
Hoary bat	19
Silver-haired bat	10
Not identified	33
Total number of calls	1910



Figure 4. Filtered results of Auto Classifier ID Output of Bat Calls Recorded in Dry Mesic Southern Forest 2018

Conclusions

SonoBat classifiers identified most calls recorded at the four habitats as belonging to the big brown bat, followed by eastern red bats. Calls characteristic of hoary bats were classified by SonoBat in the old field and dry mesic southern forest habitats that were sampled, and calls characteristic of silver-haired bats were recorded in prairie fen, old field and dry mesic southern forest habitats.

Acoustic monitoring is one tool that can be helpful in determining the likely presence of bat species at a site. As discussed earlier, there are many qualifications that must be considered when interpreting acoustic results, but this type of monitoring can be very helpful in predicting the presence of specific bat species. Our results indicated a likely presence of big brown bat, eastern red bat, hoary bat and silver-haired bat at Sherwood Township Property with the possibility that the Evening Bat and Little Brown Bat or Indiana Bat may also occur here.

We look forward to conducting mist netting at this site in 2019 as these surveys have the potential to provide confirmation of the occurrence of specific bat species at this site. As with any survey tool, there are limitations to mist netting that need to be considered. Bats may avoid flying into the nets or may not be in the area during the evenings that surveys are conducted. Not capturing a specific bat species does not indicate that it is not present. The use of mist net surveys in conjunction with the results of acoustic monitoring, is a useful approach to provide the NHBP with a better understanding of the bat species that likely occur at the Sherwood Township property. This information can help guide land management decisions in the future.



Bat monitor setup. Photo by Aaron Kortenhoven.

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