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WISCONSIN
DEPT. OF NATURAL RESOURCES

October 17, 2024

Acoustic Bat Monitoring (Summer 2024)
Wisconsin Department of Natural Resources
Wisconsin Bat Program

Sampling dates: July 15th – July 21st, 2024
Sampling sites: Adam Birding Conservancy – Bufflehead and Trumpeter blinds
Contact: David Adam
Number of bat calls identified to species: 1,917

Dear David,

Thank you for allowing the Wisconsin Bat Program (WBP) the opportunity to monitor bat activity on City of Madison properties during the summer of 2024. The need to document and monitor North American bat populations is important as ever as this group of mammals continues to face the deadly fungal disease white-nose syndrome and other threats like habitat loss and wind energy development. With your assistance and cooperation, we've been able to document the presence of bat species and determine relative abundance in areas that were previously underrepresented.

This report is a basic summary of the numbers and species of bat calls at the Adam Birding Conservancy property, as determined by an AutoID program (Wildlife Acoustics Kaleidoscope Pro v. 5.6.8). A SMZ acoustic detector (Wildlife Acoustics, Maynard, MA) was programmed to turn on at sunset and off at sunrise while recording all ultrasonic activity at night. The AutoID program Kaleidoscope Pro was used to remove non-bat noise files and to identify all bats to species using a built-in auto classifier (see Appendix 2 for an explanation of call analysis). For a total of 14 nights of monitoring at two sites within the Conservancy, Kaleidoscope identified 1,917 files to species or species group, classifying the remaining files (n=4,634) as No ID or Noise files using the +1 more accurate (conservative) setting in bat analysis mode. In most cases, additional surveys are recommended to better understand the bat species using your property.

Please let us know if you have any follow-up questions.

Sincerely,

J. Paul White

J. Paul White
Mammal Ecologist
Bureau of Natural Heritage Conservation/Division of Fish, Wildlife, and Parks
Wisconsin Department of Natural Resources
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Table 1 –The table below indicates the eight possible bat species in Wisconsin. Orange-colored cells indicate the bat species detected during the surveys at Adam Birding Conservancy.

Common Name	**Scientific Name**	**Abbreviation**
Big Brown Bat	*Eptesicus fuscus*	EPFU
Eastern Red Bat	*Lasiurus borealis*	LABO
Hoary Bat	*Lasiurus cinereus*	LACI
Silver-haired Bat	*Lasionycteris noctivagans*	LANO
Little Brown Bat	*Myotis lucifugus*	MYLU
Northern Long-eared Bat	*Myotis septentrionalis*	MYSE
Evening Bat	*Nycticeius humeralis*	NYHU
Tricolored Bat/Eastern Pipistrelle	*Perimyotis subflavus*	PESU

Table 2. Bat species identified by Kaleidoscope Pro v.5.6.8 through calls recorded at Adam Birding Conservancy.
**Disclaimer: Species identifications are never perfect since bat call structures can be similar (see Appendix 1). All analysis programs use a statistical approach to assign a most-likely species to a bat call. In some cases, the program may identify a bat species (i.e. Evening bat) that may not actually be present and to further validate presence for rare species, in most cases additional surveys are recommended.*

Bufflehead Blind	EPFU	LABO	LACI	LANO	MYLU	MYSE	NYHU	PESU	TOTAL
July 15, 2024	76		116	9			1		202
July 16, 2024	46		120	9	1		2		178
July 17, 2024	28		126	10	1		2	1	168
July 18, 2024	112		119	4	2		1		238
July 19, 2024	88	1	194	6	1		1	1	292
July 20, 2024	65		154	4	2				225
July 21, 2024	61		122	19	1		2	1	206
Total	**476**	**1**	**951**	**61**	**8**		**9**	**3**	**1509**

Trumpeter Blind	EPFU	LABO	LACI	LANO	MYLU	MYSE	NYHU	PESU	
July 15, 2024	4		3						7
July 16, 2024	19		29	2	2				52
July 17, 2024	14		28	1	2		2	5	52
July 18, 2024	58		41	1			3		103
July 19, 2024	36	1	63	1	2		3		106
July 20, 2024	15	1	41	3	1		1		62
July 21, 2024	20		5					1	26
Total	**166**	**2**	**210**	**8**	**7**		**9**	**6**	**408**

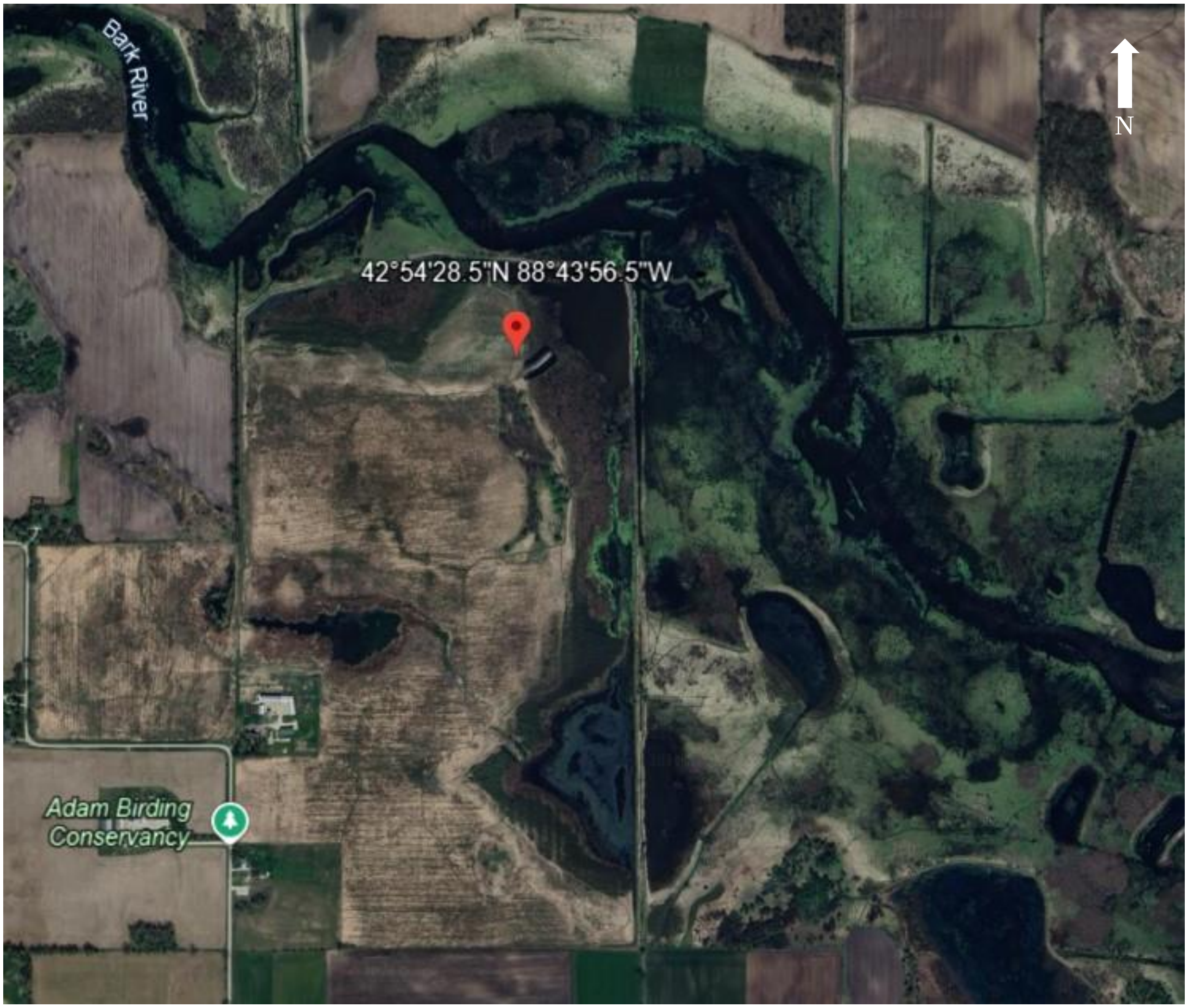


Figure 1. Map of the Bufflehead blind stationary detector location. The microphone was at a height of 2.4 meters and faced east along floodplain of the Bark River in Jefferson County WI. Lat/Long: 42.907915, -88.732358

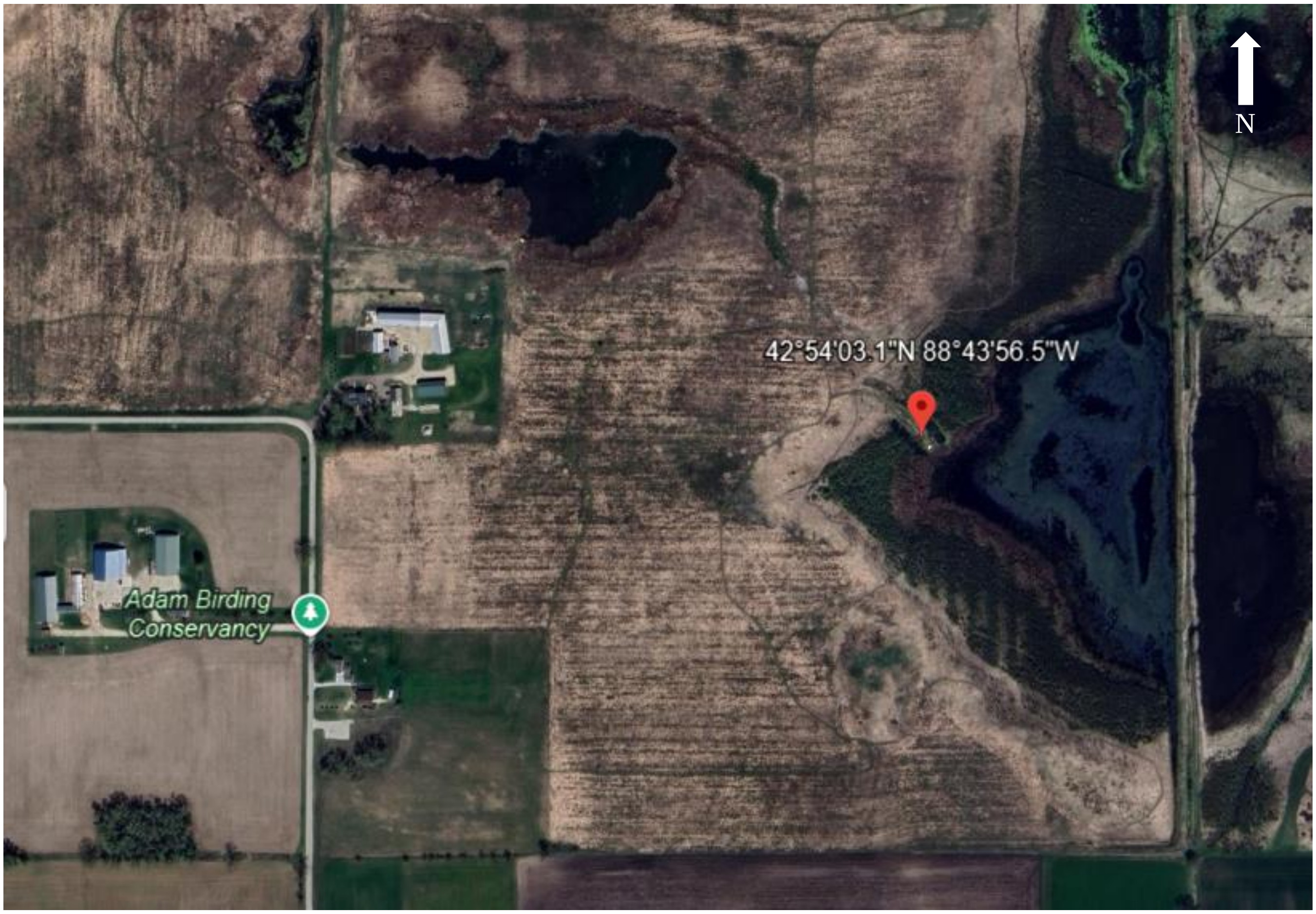
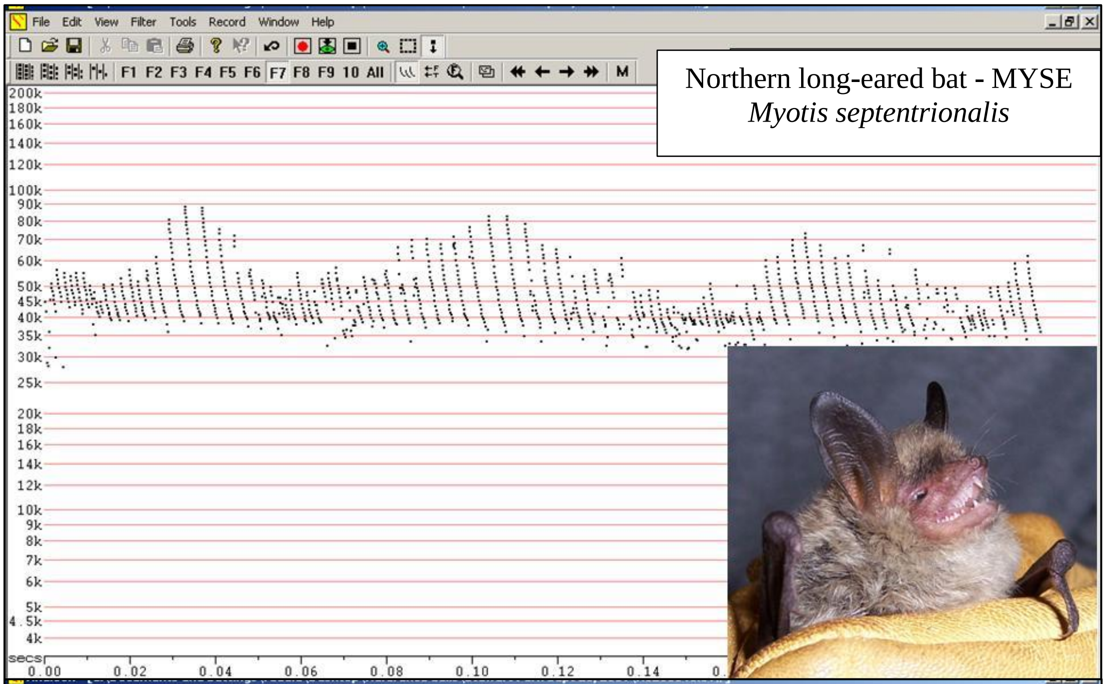


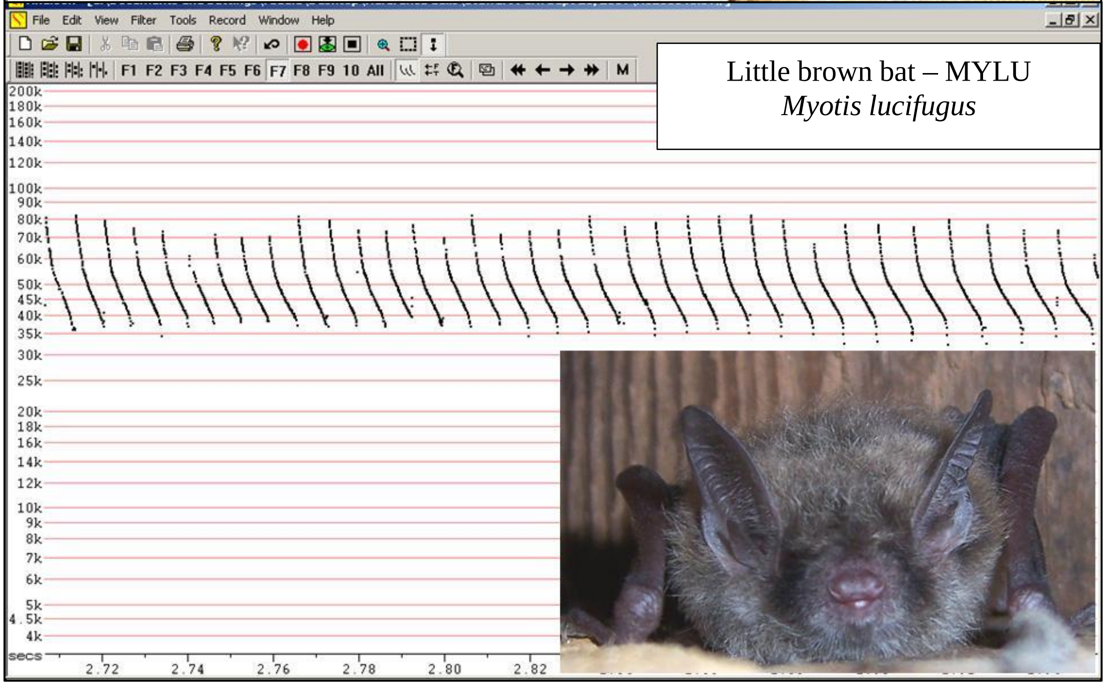
Figure 2. Map of the Trumpeter blind stationary detector location. The microphone was at a height of 2.4 meters and faced east over the floodplain of the Bark River Jefferson County WI. Lat/Long: 42.900854, -88.732353

Appendix 1. Sonogram examples

Wisconsin bats can be identified by their calls and depending on what frequency they use can be classified to a species or species group. In some cases, bat calls can appear similar in intensity, frequency and call structure, which can make it difficult to confidently identify a bat from its call. Below are two sonograms (Frequency – kHz over Time - seconds) that illustrate similar call patterns by two different species.



Northern long-eared bat - MYSE
Myotis septentrionalis



Little brown bat – MYLU
Myotis lucifugus

Appendix 2. P-value tables by sites and Wildlife Acoustics explanation of Maximum Likelihood Estimators (MLE) and P-values used in the AutoID program Kaleidoscope Pro Classifiers.

Bufflehead Blind

Presence P-Values:	EPTFUS	LASBOR	LASCIN	LASNOC	MYOLUC	MYOSEP	NYCHUM	PERSUB
7/15/2024	0	1	0	1	1	1	0.298774	1
7/16/2024	0	1	0	1	0.165364	1	0.10692	1
7/17/2024	0.00000002	1	0	1	0.191842	1	0.125744	0.3061572
7/18/2024	0	1	0	1	0.018373	1	0.338438	1
7/19/2024	0	0.28903	0	1	0.492113	1	0.879062	0.4764005
7/20/2024	0	1	0	1	0.009076	1	1	1
7/21/2024	0	1	0	1	0.191842	1	0.125744	0.3061572
Total	**0**	**0.928249**	**0**	**1**	**2.1E-06**	**1**	**0.000271**	**0.0521742**

Trumpeter Blind

Presence P-Values:	EPTFUS	LASBOR	LASCIN	LASNOC	MYOLUC	MYOSEP	NYCHUM	PERSUB
7/15/2024	0.0009231	1	0.0115206	1	1	1	1	1
7/16/2024	0	1	0	1	0.0090759	1	1	1
7/17/2024	0.0000002	1	0	1	0.0372051	1	0.1796529	0.0000599
7/18/2024	0	1	0	1	1	1	0.0266704	1
7/19/2024	0	0.5773943	0	1	0.1013375	1	0.1822912	1
7/20/2024	0.0000016	0.2916203	0	1	0.443928	1	0.8431855	1
7/21/2024	0	1	0.0282227	1	1	1	1	0.0898819
Total	**0**	**0.5374162**	**0**	**1**	**0.0001507**	**1**	**0.0037753**	**0.00177**

The U.S. Fish Wildlife Service Indiana Bat Summer Survey Guidance: http://www.fws.gov/midwest/endangered/mammals/inba/inbasummersurveyguidance.html describes the use of approved software programs. As part of their software testing criteria:

"As species identifications are never perfect, all analysis programs must utilize a maximum- likelihood estimator approach to determine species presence at the site rather than relying on a single sequence. Post-hoc maximum-likelihood estimator p-values will be used to determine acceptance thresholds for final identification determination."

The maximum-likelihood estimator used by Kaleidoscope Pro is based on a 2002 paper by Britzke, Murray, Heywood, and Robbins: Acoustic Identification.

http://www.fwspubs.org/doi/suppl/10.3996/082013-JFWM-057/suppl_file/082013-jfwm-057r1- s05.pdf

The method described takes two inputs. First, there are the classification results e.g. how many detections of each bat did the classifier find. Second, there is the confusion matrix representing the known error rates across all the classifiers. For example, 70% of MYLU calls are correctly classified as MYLU while 3% of MYLU calls are misclassified as MYSO, etc. The maximum likelihood estimator determines what the most likely distribution of different species are that would result in the observed classifications given the classifier error rate. Then, to calculate P- values, a given species is clamped as absent and the most likely distribution is recalculated. The ratio of the clamped likelihood divided by the original likelihood is the P-value.

In layman's terms, if we run an automated classifier on a data set, we will end up with a number of classifications for each species found in the data. From this, we want to determine the likelihood of presence or absence by calculating the P-value corresponding to the null hypothesis of absence. A low (near zero) p-value would therefore suggest presence.

For example, suppose we have a classification result with 70 MYLU detections and 3 MYSO detections. Given the error rate between MYLU and MYSO, the 3 MYSO detections are easily explained away as false positives from actual MYLU calls, so the P-value for MYSO in this case would be expected to be very high (unlikely present). On the other hand, if we have 70 MYLU detections and 20 MYSO detections, it is harder to explain away all 20 MYSO detections as false positives from actual MYLU calls, so the P-value for MYSO in this case would be expected to be very low (likely present).

There are some important caveats:

First, an important input to the calculation is the known confusion matrix of the classifier. Unfortunately, there is no such thing. The error rates of a bat classifier will vary from one site to the next, because the bats will produce different calls in different habitats with different levels of clutter. In a high clutter environment, for example, it might be expected to see a higher error rate than in a low clutter environment. It is also exceedingly difficult to measure the error rate without significant independently collected and verified data. For Kaleidoscope Pro, we split our data in half using one half to train our classifiers and the other half to measure the error rates. This is a as good an estimate of the average confusion matrix that we can measure. But, it is not going to be the actual confusion matrix for any particular deployment. Therefore, the P- value calculations can't be determined exactly. They are only estimates.

Second, while the P-value is perhaps the best statistical tool we have to work with, it is not perfect. A high P-value is not proof of absence. It simply means there is not sufficient statistical evidence of presence. And a low P-value is not proof of presence, it simply means the null hypothesis of absence cannot be explained by the data. A low P-value might suggest that an alternate hypothesis is more likely. That could be presence. But it could also be that the classification error matrix was not a good fit for the data.

MLE P-values are a convenient way to aggregate a lot of data and provide a useful statistic to estimate presence or absence of species. But, it is an imperfect statistic and should not be relied upon without some other means of verification of presence or likely absence.