

Bat abundance and species diversity in the vicinity of wetlands situated in residential versus park wetlands, Central Iowa, U.S.A.

The Batstreet Boys



I WANT IT BAT WAY

Matthew Card, Ross Curry, RJ Green, Riley Henry

Introduction

- **Is there a significant difference in bat diversity and abundance within urban wetlands and reconstructed tallgrass prairie/wetlands?**
- **What did we use to detect bats?**
- **Dixon 2012 study**
 - **Some bat species (Red) thrive with increased residential cover, others (Silver-haired) do not**
 - **Proximity to water is positively correlated with bat abundance**
- **Coleman and Barclay 2011 study**
 - **Urbanization positively affects abundance, but negatively impacts diversity**

**Big
Brown**



Hoary



Bats of Iowa

**Tri
Colored**



**Eastern
Red**



**Little
Brown**



Bats of Iowa Continued



Long-eared



Evening



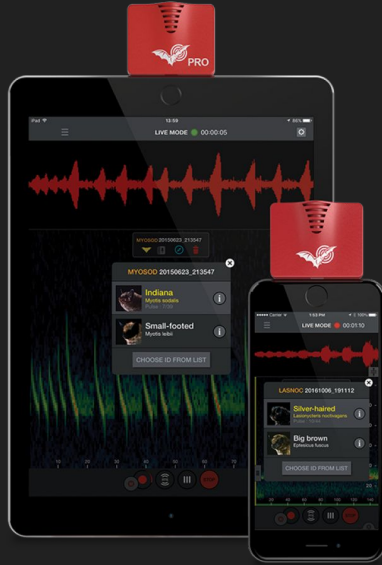
Indiana



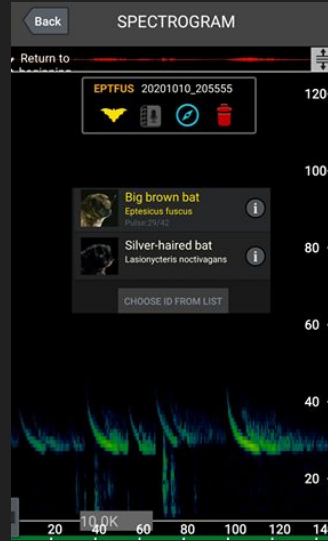
Silver-haired

Methods

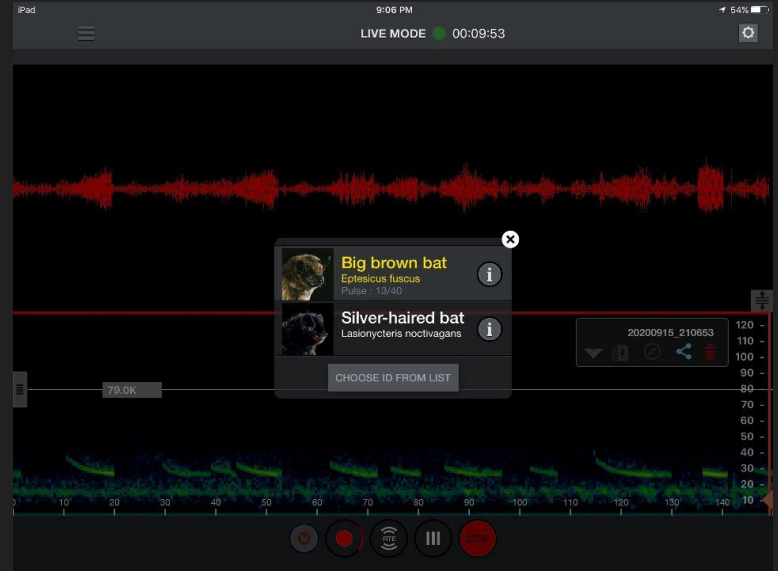
Echo Meter Touch 2 Pro



Detector
Module



Android
View



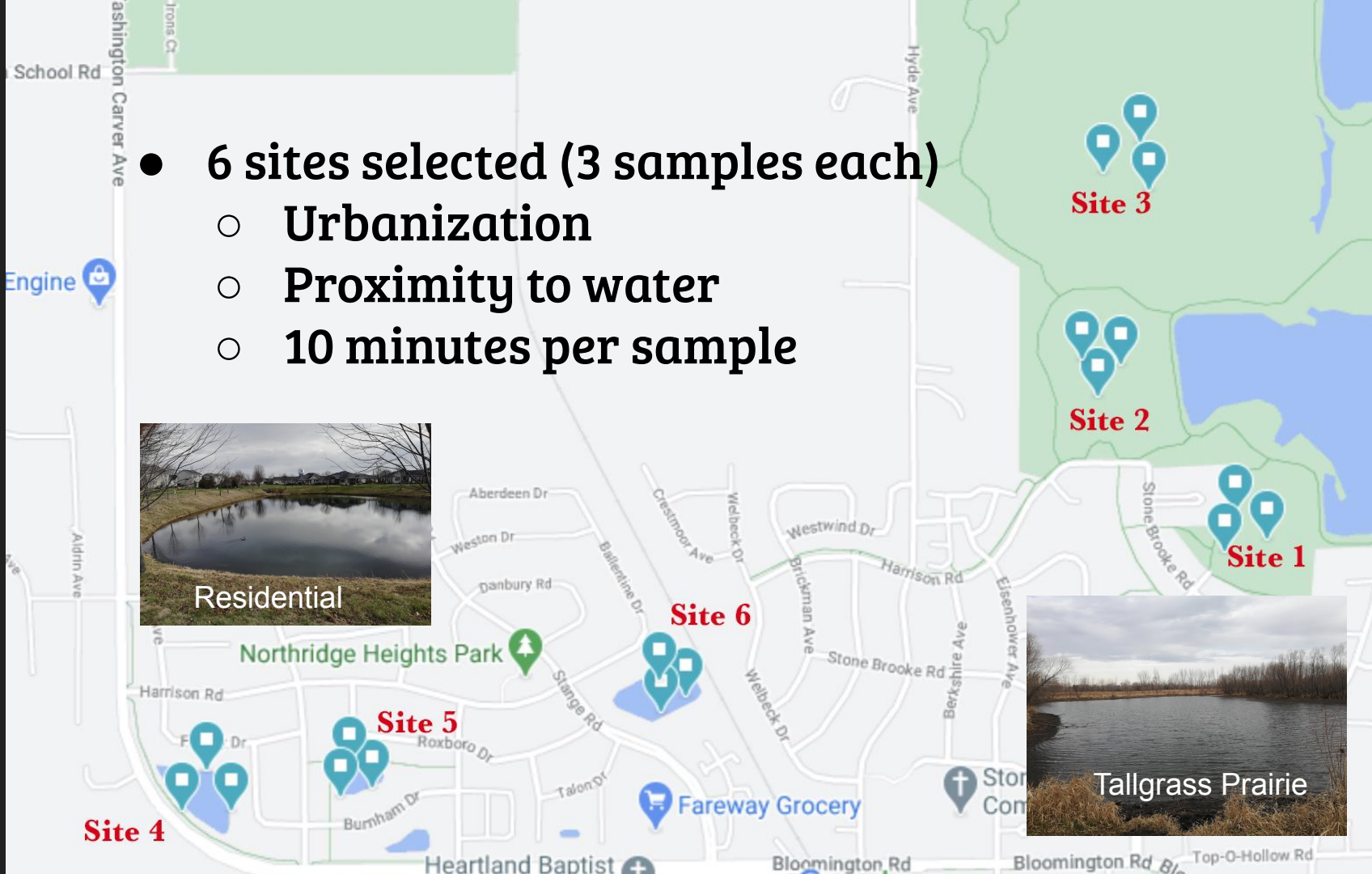
Ipad view

Pilot study

- Determine study feasibility
- Scout location (real vs. GPS)
- Problems we may encounter
- Determine recording length



- **6 sites selected (3 samples each)**
 - **Urbanization**
 - **Proximity to water**
 - **10 minutes per sample**



Data Collection

- 4 nights (9/15 - 10/6)
- Between 7-10pm
 - No earlier than 30 mins after sunset

bat survey raw data

Date/Time	Time	Coordinates	Site (or Add 1, 2, 3)	Bat species assessed	Pulse count	Sunset time (GMT)	Weather conditions	Notes	Field type
9/15/2020	8:17 - 8:30	42.06422 N 88.83162 W		1. none 2. Eastern Screech Owl (Brown) 3. Eastern Screech Owl (Secondary winged form) 4. Eastern Screech Owl (Brown)	0	7:43 PM, 16.3°C	Cloudy	John Hayden	
9/15/2020	8:30 PM - 9:15 PM	42.06442 N 88.83162 W		1. Hoary 2. Eastern Screech Owl (Secondary winged form) 3. Eastern Screech Owl (Brown)	0	7:43 PM, 16.3°C	Cloudy	John Hayden	
9/15/2020	8:16 PM	42.06203 N 88.83212 W	Adp 1-1	Lasiurus borealis (Eastern Fall)	14	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond	
9/15/2020	8:29 PM	Adp 1-2	Lasiurus borealis (Eastern Fall)	14	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:48 PM	Adp 1-3	Lasiurus borealis (Eastern Fall)	24	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:15 PM	Adp 2-1	Lasiurus borealis (Eastern Fall)	20	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:17 PM	Adp 2-2	Myotis septentrionalis (Western form)	27	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:33 PM	Adp 2-1	Lasiurus borealis (Eastern Fall)	34	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:39 PM	Adp 2-2	Lasiurus borealis (Eastern Fall)	12	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:39 PM	Adp 2-2	Lasiurus borealis (Eastern Fall)	34	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:43 PM	Adp 2-2	Myotis septentrionalis (Western form)	15	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:38 PM	Adp 2-2	Lasiurus borealis (Eastern Fall)	45	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:47 PM	Adp 2-3	Alecceus americanus (Hoary)	27	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/15/2020	8:55 PM	Adp 2-3	Perimyotis subflavus (Th. Colorado)	26	19:24, 19.8°C	Matthew & Riley	Tolpeltka Prairie marginal pond		
9/20/2020	7:38 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 1	Myotis borealis (Eastern)	3658	8:59	15	Phone dead, no data taken at all	
9/20/2020	7:48 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 1	Alecceus americanus (Hoary)	312	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:18 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 2	Alecceus americanus (Hoary)	14	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:17 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 2	Alecceus americanus (Hoary)	20	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:21 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 2	Myotis borealis (Eastern)	24	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:21 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 2	Alecceus americanus (Hoary)	2022	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:23 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 2	Lasiurus borealis (Eastern)	8	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:23 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 2	Alecceus americanus (Hoary)	27	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:28 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 2	Lasiurus borealis (Eastern)	27	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:28 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 2	Alecceus americanus (Hoary)	86	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:14 - 8:27:04 PM	42.07755 N 87.77575 W	Adp 3	Lasiurus borealis (Eastern)	1017	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond	
9/20/2020	8:04 PM	Adp 1-1	Lasiurus borealis (Eastern)	79	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:04 PM	Adp 1-1	Alecceus americanus (Hoary)	10	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:08 PM	Adp 1-1	Alecceus americanus (Hoary)	10	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:08 PM	Adp 1-1	Alecceus americanus (Hoary)	2707	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:08 PM	Adp 1-1	Lasiurus borealis (Eastern)	1921	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:08 PM	Adp 1-1	Alecceus americanus (Hoary)	79	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:14 PM	Adp 1-2	Alecceus americanus (Hoary)	10	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:14 PM	Adp 1-2	Lasiurus borealis (Eastern)	10	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:18 PM	Adp 1-2	Alecceus americanus (Hoary)	30	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:18 PM	Adp 1-2	Alecceus americanus (Hoary)	1924	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		
9/20/2020	8:17 PM	Adp 1-2	Alecceus americanus (Hoary)	69	18:45, 16.3°C	Matthew	Tolpeltka Prairie marginal pond		

RECORDINGS Edit

Sort by Species ▲
Sort by Time ▲

NYCHUM_20200915_201616 7 s >
Sep 15, 2020 at 08:16 PM

LASBOR_20200915_202638 4 s >
Sep 15, 2020 at 08:26 PM

LASBOR_20200915_204819 5 s >
Sep 15, 2020 at 08:48 PM

LASBOR_20200915_211300 15 s >
Sep 15, 2020 at 09:13 PM

MYOSEP_20200915_211316 15 s >
Sep 15, 2020 at 09:13 PM

LASBOR_20200915_211348 12 s >
Sep 15, 2020 at 09:13 PM

LASBOR_20200915_212619 8 s >
Sep 15, 2020 at 09:26 PM

TOTAL FILES
37 (93.4 MB)
Summary



The Prairie

Results

Results

- **Shannon's diversity Index**
 - **Ada Hayden: 1.65**
 - **Northridge Heights: 1.38**
- **Evenness**
 - **Ada Hayden: 0.79**
 - **Northridge Heights: .77**
- **Paired t-tests**

$$H = -\sum(P_i) \times \ln(P_i)$$

Results Explained: Shannon's Diversity Index

- As the number of species goes up, Shannon's value goes up
- As evenness goes up, value goes up
- What is evenness?
 - Separate calculation for each habitat type
- Ada: Evenness= 0.79
- Northridge: Evenness= 0.77
- Not very different... Number of species is mostly causing the difference
- Could try other measures to compare communities

Paired t-tests

- Comparing two data sets
 - Abundance, richness, hoary bat abundance
 - Counts per day used
- Is there zero difference between the means of these samples?
- P-values: is statistically significant if $p = < 0.05$
 - **Abundance: $p = 0.0481$**
 - **Richness: $p = 0.1328$**
 - **Hoary bat abundance: $p = .1999$**

Results

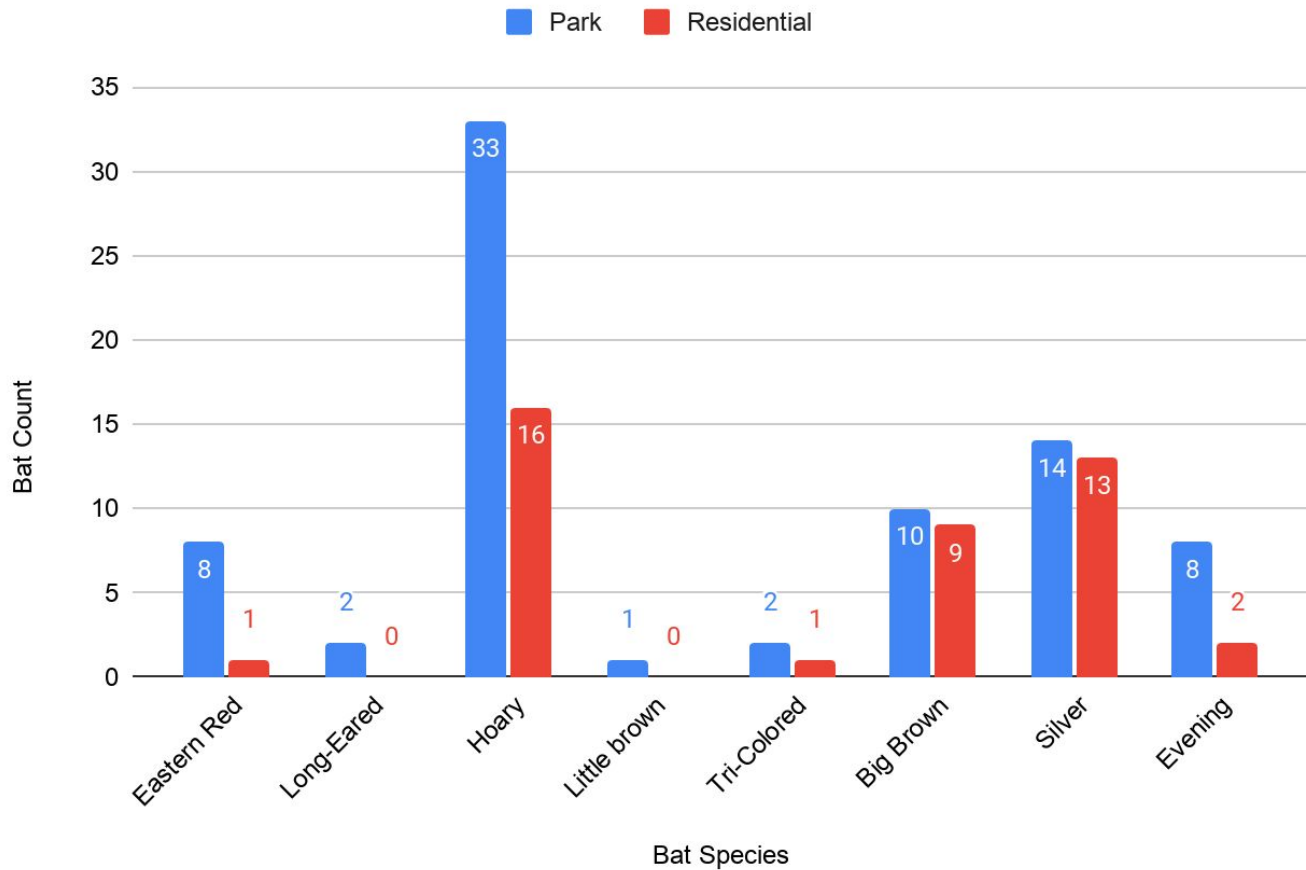
Northridge Heights (residential)	Ada Hayden (park)
43 adjusted detections	78 adjusted detections
85 total detections	106 total detections
6 total species detected	8 total species detected

Discussion

Discussion

- We were pleasantly surprised with the amount of data we were able to gather.
- Although there was no *statistically significant* difference in diversity between study locations
 - There *was* a significant difference (.048) in abundance
 - And an overall appreciable difference in both measures
 - Particularly for Eastern Red and Hoary Bats
- Indiana bats are the *only* species described in Dr. Rentz's field guide that we did not observe

Bat abundance and diversity at park and residential wetland sites



Discussion

- **Fixed-point monitoring made it difficult to determine whether multiple detections of the same species could be attributed to an individual bat**
 - **Our group observed *at least* four separate bats hunting simultaneously during one night of sampling at site 4**
- **This could be ameliorated to some degree in future studies by sampling in a unidirectional manner, increasing the likelihood that each new detection is indeed a separate bat**
- **Perhaps future software/hardware updates will be able to do so automatically.**

References

Coleman, J. and Barclay, R. M. R. 2012. Urbanization and the abundance and diversity of prairie bats. *Urban Ecosystems*. 15, 87–102. <https://doi.org/10.1007/s11252-011-0181-8>

Dixon, M. D. 2012. Relationship between land cover and insectivorous bat activity in an urban landscape. *Urban Ecosystems*. 15, 683–695. <https://doi.org/10.1007/s11252-011-0219-y>

Rentz, M., Evelsizer, V., Shepherd, S. and Janke, A. 2018. Chiroptera. Pages 106-122 *in* *Mammals of Iowa Field Guide*. Iowa State University Extension and Outreach, Ames, IA.

Voigt, C., and Kingston, T. 2016. *Bats in the Anthropocene: Conservation of Bats in a Changing World*. Springer International Publishing AG Switzerland, Cham, Switzerland.