INTERNATIONAL
OWL CENTER

Passive acoustic monitoring of Barn Owls in southeastern Minnesota

2020 Minnesota Ornithologists' Union Savaloja Grant Report

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INTRODUCTION

Barn Owls *(Tyto alba)* are a highly nocturnal species, making visual observations of healthy, living birds difficult (Marti et al. 2005). Although I have recorded their vocalizations on the security cameras that monitor the International Owl Center's captive owls many times since 2014, I have never seen a Barn Owl nor found evidence of their presence (feathers or pellets) in neighboring barns or the general area, nor have nearby residents seen or otherwise noticed them. Reports of Barn Owls are increasing in Minnesota (Bloem et al. 2018). Passive acoustic monitoring with portable automated recording units is a potential method for detecting the presence of Barn Owls in other locations.

OBJECTIVES

1. Test the feasibility of using passive acoustic monitoring to detect the presence of Barn Owls in southeastern Minnesota.

2. Develop a Barn Owl classifier to extract Barn Owl calls from continuous nighttime recordings.

3. Identify locations and habitats where Barn Owls are found in southeastern Minnesota.

METHODS

I acquired two Song Meter Minis (SMMs) and a one-year license for Kaleidoscope Pro software (both from Wildlife Acoustics, Maynard, MA). The SMMs were first released in April 2020. The basic model is powered by 4 AA batteries, but a lithium lid that would accommodate up to six 18650 rechargeable lithium-ion batteries was to be available shortly thereafter. Due to delays it was not released until December 2020, after my monitoring had ended for the year. The lithium lid with six batteries would allow continuous deployment without the need to change batteries for about five times as long as standard alkaline batteries, which would have been highly desirable for distant deployments. Thus, I restricted my deployments to locations within a 50 km radius of my home in Perkins Valley, rural Houston, Houston County, Minnesota.

I equipped each SMM with four AA alkaline batteries and a 128 GB SanDisk SD card. I used the SMM app on my phone to connect to the SMM via Bluetooth to program each unit, then ran several overnight tests at varying distances from the aviary of the International Owl Center's captive Barn Owl to test the various options. I settled on the following settings:

- Continuous recording from 30 minutes after sunset to 30 minutes before sunrise, although during the spring and summer I adjusted the recordings to end 1 hour before sunrise to avoid the noisy dawn chorus
- Recorder Name: I used a different name each time I moved the recorders, naming them by location. This name is prepended onto the name of each file.

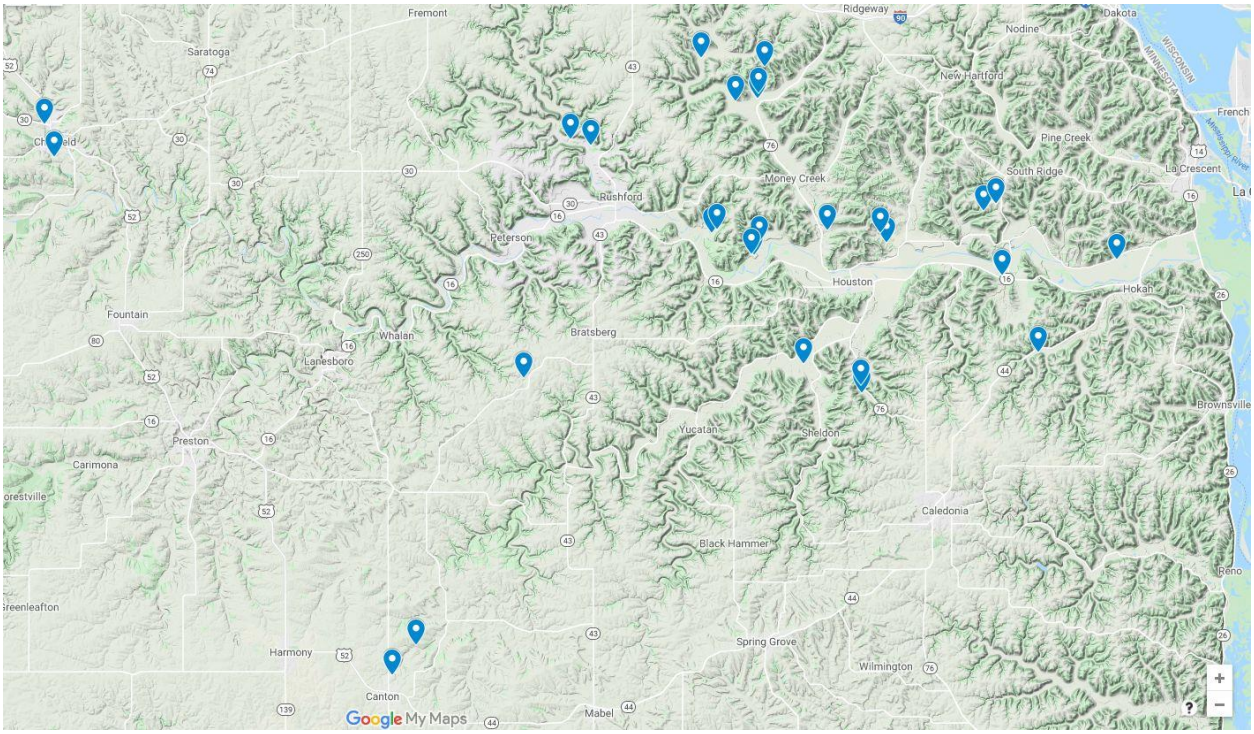
- Sample rate: 12000 Hz (at least twice the highest frequency I expected to need)
- Maximum recording length: 30 min (was initially 1 hour, but 30 minutes was easier to manage in Kaleidoscope Pro)
- Gain: 24 dB (this allowed detection of the Center's captive Barn Owl up to 1 km away)
- Location was reset for each new deployment, so the correct GPS coordinates were embedded into each sound file
- SD cards were formatted by the recorders prior to each reuse.

Using these settings, four AA batteries lasted roughly one month. The SD cards could have been deployed for at least three months, which is important if using the lithium lids in the future.

During the testing phase from 17 to 23 April 2020 I used the resulting recordings to fine tune the settings needed to detect Barn Owl calls in Kaleidoscope Pro. I also attended many of the free training and drop-in Zoom sessions offered by Wildlife Acoustics throughout the spring to learn how to most effectively use their software and hardware.

All detected Barn Owl calls were manually labeled, and the results were saved in Kaleidoscope Pro.

Song Meter Minis were deployed nearly continuously from 23 April through 26 November 2020. I strapped SMMs to trees, posts or other elevated structures using a locking cable (see the image to the left.) Often, but not always, I deployed the SMMs in pairs 1-5 km apart to create one larger detection area. Eighteen locations were selected in Houston County, 6 in Fillmore County, 1 in Olmsted County and 5 in Winona County. All 30 locations were used once until the end of September. At that time I started revisiting sites used during the summer that had the most promising habitat since Barn Owls do not seem to be vocally active during the summer months (based on observations of our captive Barn Owl). SMMs were most often deployed for two weeks per location (range 1-18 days), but fall deployments were shorter to cover more locations during a period of peak vocal activity.



Song Meter Mini deployment locations

RESULTS

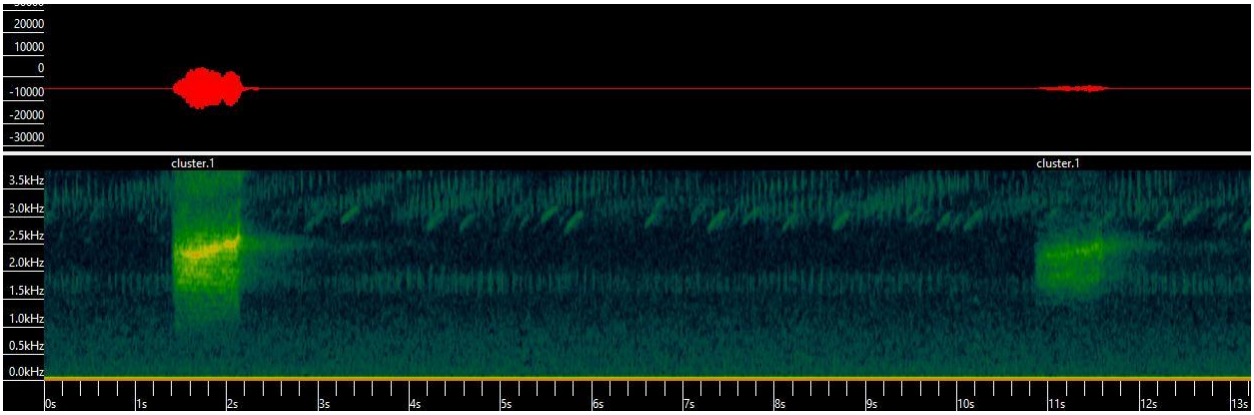
Barn Owl calls were best detected using the following settings in Kaleidoscope Pro:

- Minimum and Maximum Frequency Range: 1500-3300 Hz (although an upper limit of 2200 Hz was necessary in the spring to reduce extreme overlap with spring peeper choruses)
- Minimum and Maximum Length of Detection: 0.3 – 1.2 seconds
- Maximum inter-syllable gap: 0.001 – 0.1 (shorter durations were needed to reduce overlap with gray treefrogs and Whip-poor-wills, but full separation from gray treefrogs was not possible)
- Max distance from cluster center to include outputs in cluster.csv: 1.5
- FFT Window 10.67ms
- Max states: 12
- Max distance to cluster center for building clusters: 0.5
- Max clusters: 500

I attempted to create a Barn Owl classifier in Kaleidoscope, but due to the ever-changing variety of other wildlife sounds that occurred throughout the seasons and at different locations, coupled with the broad-spectrum nature of the Barn Owl call, this did not prove useful.

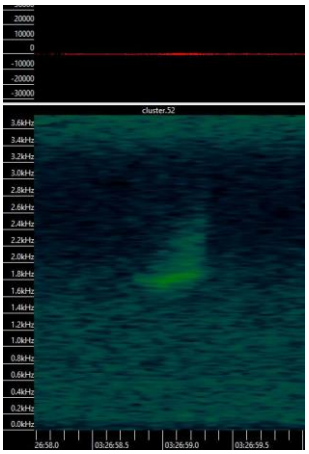
Because Barn Owls call so infrequently, Kaleidoscope Pro's clustering feature was only moderately helpful. The software clustered sounds that occurred frequently well, so when I tested it with our captive Barn Owl who was calling regularly in the spring, it worked well. By fall when other sounds were infrequent sometimes no clusters could be identified, so I had to ask the software to simply pull out all

detected sounds within the given parameters with no clustering. Regardless of the method used, I need to manually scroll through all detected sounds to visually scan for Barn Owl spectrograms. A batch of recordings from one to two weeks could produce from 400 – 10,000+ detections to review, but Kaleidoscope Pro was still far more efficient to use than manually scrolling through the entirety of all recordings.



Spectrograms of wild Barn Owl calls in Kaleidoscope Pro

Wild Barn Owls were detected at three different locations in Houston County, but not in Fillmore, Olmsted or Winona counties. At paired locations northwest of Houston, one or more wild Barn Owls called on 24, 25, 26, and 30 April and 2, 3 and 4 May. These locations were within acoustic range of our captive owl, so I had to review SMM timestamps against the video of our owl to discern which calls were made by wild owls.



At a single location south of Houston a probable wild Barn Owl uttered one or two slightly modified calls on 19 September (see spectrogram to the left). While they were not the standard “scream” call I normally record, they fit within the repertoire of the species and bear no resemblance to any other sounds recorded at that site. At a different single location northwest of Houston, a single call was recorded on 13 October and another single call was recorded on 16 October.

The Barn Owl recorded on 13 October was recorded 4 minutes before a wild Barn Owl was recorded on our security cameras. If it was the same bird, it would have had to fly 3 km over the top a bluff or 7.7 km around the bluff in 4 minutes. Also, the owl recorded on 19 September was recorded 37 minutes and 11 km away from two individual wild Barn Owls that were recorded on our fixed recorders and my handheld Sony M-10. I am not able to identify individual Barn Owls by voice, so cannot say if these were the same owls or not, although one of the owls recorded on our fixed system and my Sony M-10 had a much higher and raspier voice than those I normally record, leading me to wonder if it was a younger individual with an adult.

Habitat where Barn Owls were detected included extensive pasture in two locations and short-grass prairie in two locations, with all locations surrounded by wooded bluffs.

DISCUSSION

A large amount of time and effort (roughly 150 hours and 1,008 miles) were invested in this year's research for very few detections. Based on observations of our captive Barn Owl, paired with the dates that I have recorded wild Barn Owls in this study and prior, summer appears to be a time when Barn Owls vocalize very little, if at all (this may be different if nesting occurs). In 393 recorder-nights, Barn Owls were detected 10 nights at a total of four locations (two locations were relatively close together and recorded the same owls.) If sites within acoustic range of our captive owl are eliminated, only 3-4 Barn Owls calls were detected during 3 nights at 2 locations.

Barn Owls may potentially call more frequently around our aviaries since there is a live Barn Owl here to respond to their calls. Perhaps pairing SMMs with intermittent broadcasting of Barn Owl calls could increase future detection rates at other locations. However, one landowner broadcast Barn Owl calls at night just prior to and including part of our sampling period on his property. No wild owls were detected.

Detections could also potentially increase if recorders were deployed at fixed locations for an entire season (late March through the end of November) rather than just at a location for two weeks, as was tested in this pilot study. This would require the purchase of additional recorders with the optional lithium lids so they could be deployed for up to three months at a time and data could be analyzed every three months instead of every two weeks. This would save substantial amounts of driving and analysis time and could produce better results, as Kaleidoscope Pro clusters sounds better with more data.

Finally, we installed Barn Owl nest boxes in locations where owls were detected as well as one other location with excellent habitat.

AKNOWLEDGEMENTS

I would like to thank the Minnesota Ornithologists' Union for a grant from the Savaloja Fund to purchase equipment for this pilot study. I would also like to thank all the landowners who allowed me to place recorders (and some also allowed us to install Barn Owl nest boxes) on their property: Lucille Omodt Crow, Dale & June Omodt, Paul Schutte, Robert & Kristi Frickson, Tom & Ginny Johnson, Pope & Young Club, Lynn & Kathryn Steinbrink, Chad Steinfeldt/MLO Partnership, Jerry Mueller, Zephyr Valley Community Co-op, Ken Fordahl & Marlene Schuler, The Nature Conservancy, Randy White, Mike & Kelly Beckman, Eli & Danny Yoder, Andrew & Verna Slabaugh, Mike Gudmundson, James Conniff, Tom & Linda McPeak, Terry & Sandy Ask, Joel Johnson, and Joan Redig & Wayne Purtzer. Thank you to Jerry Pruett, Jim Peterson and Mike Banks for providing nest boxes for us to install in suitable locations. I would also like to thank my husband, Hein Bloem, for his assistance, patience, and all the ice cream he bought me while on the road between locations.

LITERATURE CITED

Bloem, Karla A., Marjon Savelsberg, and Rose A. Yoakum. 2018. Recent Barn Owl Records in Minnesota. *The Loon* 90:39-41.

Marti, Carl D., Alan F. Poole and L. R. Bevier. 2005. Barn Owl (Tyto alba), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/001

BUDGET

Savaloja Grant Accounting

INCOME		**EXPENSE**	
Savaloja Grant	$1,632.90	2 Song Meter Minis	$1,024.41
Staff Time	$4,500.00	Kaleidoscope software	$399.00
Mileage (1,008 miles)	$580.00	2 cable locks	$35.38
		4 SD cards	$107.89
		Alkaline batteries	$119.63
	$6,712.90		**$1,686.31**

Budget notes:
In my proposed budget I did not realize that the lithium lids would cost an additional $149 each, or that the specific type of 18650 battery required would cost $30 EACH (since no details were yet available on the Wildlife Acoustics website when I submitted my grant request). I simply used a lot of alkaline batteries this year.