Albany Pine Bush Preserve
Bat Acoustic Survey

CITY OF ALBANY, ALBANY COUNTY

NEW YORK

JULY 2015

For Submission To:
United States Fish and Wildlife Service
New York Field Office
3817 Luker Rd
Cortland NY 13045

Prepared for:

Neil Gifford
Albany Pine Bush Commission
195 New Karner Road
Albany, NY 12205

By:
Alan C. Hicks
Vesper Environmental, LLC
52 Higgins Road
West Sand Lake, NY 12196

September 16, 2015

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ABSTRACT

Between July 22 and July 29, 2015, staff from Vesper Environmental, LLC (West Sand Lake NY) conducted acoustic surveys for bats at 10 sites (23 site-nights) within the Albany Pine Bush Preserve, Albany NY (Preserve). The 3,200 acre Preserve is comprised of a range of habitat types across multiple parcels but is dominated by the globally rare inland pitch pine shrub oak barrens ecosystem. The study was intended as a preliminary survey of bat species across the entire Preserve and range of habitat types. As such it was not intended to meet United States Fish and Wildlife Service (USFWS) standards for presence-absence surveys and did not focus on habitats most likely to include any particular bat species. Files were recorded using iFR-IV detectors (Binary Acoustics Technology, Tucson AZ). All call files were initially filtered through SCAN'R (Binary Acoustics Technology) then passed files were analyzed using Kaleidoscope Pro v.3.1.1 (Wildlife Acoustics Inc.). There were a total of 1,840 files that passed the initial filter and were identified as bat calls by Kaleidoscope. The Kaleidoscope program attributed files to eight of the nine species typically found in the Northeast. In order of abundance they included the big brown bat, *Eptesicus fuscus* (1,496 files); red bat, *Lasiurus borealis* (152 files); silver-haired bat, *Lasionycteris noctivagans* (92 files); hoary bat, *Lasiurus cinereus* (37 files); little brown bat, *Myotis lucifugus* (29 files); Indiana bat. *Myotis sodalis* (9 files); northern long-eared bat, *Myotis septentrionalis* (1 file); and small-footed bat, Myotis leibii (1 file). No files were attributed to the tri-colored bat, *Perimyotis subflavus*. An additional 23 files were not identified to species. The Maximum Likelihood Estimator (MLE) for Kaleidoscope predicted that six species were likely to be present on at least one site in the Preserve during at least one survey night. In order of abundance these were the big brown bat (20 of 23 site-nights), red bat (13 of 23 site-nights hoary bat (4 of 23 site-nights), little brown (2 of 23 site-nights), Indiana (2 of 23 site nights) and silver-haired bat (1 of 23 site-nights). A qualitative review of calls identified as little brown and Indiana bat at MLE positive sites suggest that some calls are possibly the target species but are not certain. Given the low number of call files attributed to Indiana bats at these MLE positive sites, (four total), their recent extirpation from local hibernacula, and the uncertainties associated with acoustic identifications, predictions of likely presence for this species are questionable. Sampling in open pitch pine/ shrub-grasslands (Asphalt, Bivy and Blueberry Hill) and over open water (Fowlers and Landfill) accounted for 26 percent and 17 percent of the effort respectively but each only 4 percent of the recorded bat calls. The remaining 57 percent of the sampling effort was associated with hardwood forests and accounted for 92 percent of the recorded bat calls.

INTRODUCTION

This report summarizes the results of an acoustic survey for bats that was conducted between July 22 and July 29, 2015 in the Albany Pine Bush Preserve, Albany, NY (Preserve) (Figure 1). The 3,200 acre Preserve is comprised of a range of habitat types across multiple parcels that is dominated by, and managed in favor of, the globally rare inland pitch pine shrub oak barrens ecosystem (Pine Bush Commission 2015). This study was intended as a preliminary survey of bat species across the entire Preserve including the range of habitat types. in particular, there was interest in understanding bat activity levels in pine barrens habitat. As such, it was not intended to meet United States Fish and Wildlife Service (USFWS) standards for presence-absence surveys and did not focus on habitats most likely to include any particular bat species.

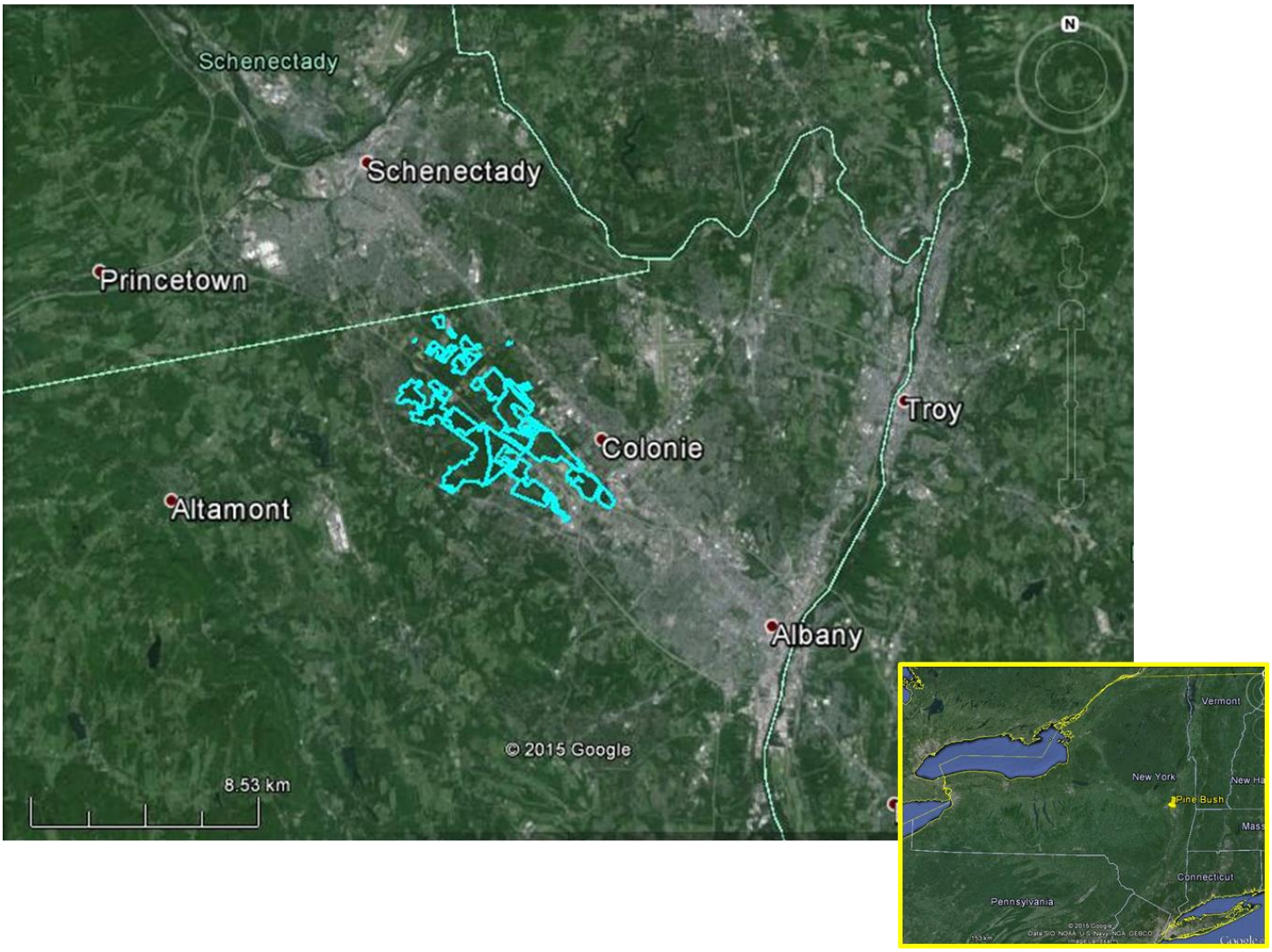

Figure 1. Location of the Albany Pine Bush Preserve, Albany NY (parcel boundaries in blue).

We know of no historic surveys for bats within, or in close proximity to, the Preserve. Historically, based on regional records, the big brown bat (Eptesicus *fuscus),* little brown bat, (*Myotis lucifugus*) northern long-eared bat, (*Myotis septentrionalis*) (northern) and *red* bat, (*Lasiurus borealis)* were likely common on the Preserve and the hoary bat, *(Lasiurus cinereus)* was likely present but in low numbers. The summer presence of the remaining species would have ranged from unusual to unlikely progressing from the tri-colored bat (*Perimyotis subflavus),* small-footed bats (*Myotis leibii).* Indiana bat. (M*yotis sodalis)* to the least likely detection being the silver-haired bat, (*Lasionycteris noctivagans).*

Since the arrival of the disease White Nose Syndrome (WNS) in 2006 (Blehert et. al. 2009) a fungal disease that affects bats during hibernation, most of the species that winter in caves and mines (cave bats) including northern, Indiana, small-footed, little brown and tri-colored have suffered substantial declines that vary in severity. The big brown bat is the only local cave bat species that has not noticeably declined. The red, hoary and silver-haired bats do not typically hibernate for extended periods and are thus not likely to be impacted by

the disease. MYSE are the most severely affected and have declined by over 99% in known hibernacula within New York State (Turner et al. 2011). They are now almost never seen during winter hibernacula surveys in New York State or netted outside of Long Island, Suffolk County, during the summer months (Carl Herzog personal communication 2015). The only known hibernating colony of Indiana bats within the typical dispersal distances from the Preserve was in Hailes Cave, John Boyd Thatcher State Park, Albany County, NY located 12 km to the southwest of the Preserve. Numbers there declined from over 600 Indiana bats to 0 during the first years of WNS. Both Indiana and northern bats are now protected under the Endangered Species Preservation Act of 1966 (32 FR 4001, March 11, 1967), and are currently listed as endangered (Indiana bat) or threatened (northern bat) under the Endangered Species Act (ESA) of 1973, as amended.

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SURVEY METHODS

Site Selection and Deployment

Sampling sites were selected by Preserve staff with the intention of sampling a wide range of habitats across the entire Preserve. Locations were not selected based on the likelihood of detecting bats although the specific set were placed at the best sites for sampling bats within those locations. Coordinates of the sampling sites were recorded using the GPS Kit on an iPhone 5s (Apple Inc, Cupertino, CA) or Trimble Geoexplorer XH (Trimble Navigation Limited, Sunnyvale California).

Vocalizations were recorded using the iFR-IV integrated field recorder (Binary Acoustics Technologies, Tucson, AZ), which is a full spectrum recorder. Microphones were affixed to a vertical 3 meter aluminum pole 38 mm (1.5 inch) in diameter using a section of 13 mm x 3 mm (1/2 in x 1/8 in) flat aluminum bar about 230 mm (9 in) long and bent at a 45 degree angle or as needed (Figure 2). The angle could differ when microphones were pointed down slopes or affixed well above surrounding vegetation. Detectors were confirmed to be functioning within manufacturer's specifications prior to the onset of the field season by the manufacturer and were confirmed fully operational each time they were deployed. Activated units began recording at 20:00 hours each evening and stopped recording at 06:00 hours each morning. At the end of each recording session, the unit performed an automated test that documented that the detector was still functioning properly. The recorded files were reviewed for further evidence that the system was working properly as evidenced by the distribution of recorded files throughout the sampling period.

Figure 2. Standard microphone configuration for acoustic monitoring.

Units were deployed at survey sites in compliance with all USFWS survey guidelines (USFWS 2015). Microphones were set 3 meters above the ground on poles, from 1.5 meters to 3 meters above the surrounding vegetation. They were positioned to minimize reflections off nearby clutter within the 45°cone of detection, yet close enough to the most likely areas of bat activity (e. g., forest/ open area interfaces) to record animals that are in the area. Assembled acoustic units and their fields of detection were photographed using an SLR camera (70-D Canon USA) or a variety of cell phone camera.

Data Processing and Analysis

Recordings were made using SPECTOR III software (Binary Acoustics Technologies Tucson AZ). The acoustic data was downloaded from each detector to external drives (Cruzer Guide 64 GB, SanDisk Corporation, Milpitas, CA). Collected data was then copied to external hard drives as both backup copies and copies for processing (Seagate model STBU1000100, Seagate Technologies LLC, Cupertino, CA; Toshiba model E145163, Toshiba American Information Systems Inc. Irvine, CA; WD passport model 3613B, WD My Cloud Mirror, WD My Book, Western Digital Corporation, Irvine, CA,).

All recorded files were first processed using SCAN'R (Binary Acoustic Technology, Tucson, AZ). To ensure that reasonable quality calls were run through the later automated programs, we required at least three pulses per file. All other defaults remained the same as the default settings of the manufacturer. SCAN'R separated the files that included bat calls of sufficient quality for further analysis (passed files) from those files that did not (failed files). Passed files were further analyzed using Kaleidoscope Pro v.3.1.1 (Wildlife Acoustics, Concord, MA). Kaleidoscope Pro analysis was restricted to the 9 species of bats regularly found in New York, including our target species, Indiana and northern long-eared bats. While there are records of other species occurring in New York, they were not included in the review as the likelihood of false positives is significant, and could result in the misidentification of target species.

Maximum Likelihood Estimators

Kaleidoscope applies a Maximum Likelihood Estimators (MLEs), which incorporates the overall number of calls recorded and the classification rates for each species to determine the likelihood that given species are present (Britzke et al. 2002). The programs produce P-values indicating the probability of a species being present at a site. USFWS guidelines set a P value of less than 0.05 as the threshold for likely presence (USFWS 2015)

Qualitative Review

For MLE sites that classified any Myotis species as "likely present" files that had been attributed to any *Myotis* species were manually reviewed to assess the accuracy of the automated identification. Those with pulse intervals of less than 60 milliseconds (ms) or inconsistent across the file (suggesting approach or attack phase calls) were not considered suitable for review. Likewise, files with less than five pulses, or pulses with dB levels too low to clearly show characteristics necessary for identification, were also discarded.

Files with characteristic frequency (Fc) values of a minimum of 38 kilohertz (kHz) or higher for all pulses and most pulses with Fc values above 40 kHz were considered potential Myotis with any above 43 kHz being

potential MYLE. Those with characteristic slopes of between 100 and 200 octaves per second (oct/sec)were considered possible MYSO; less than 100 oct/sec possible MYLU; and above 180 oct/sec possible MYSE. Myotis calls typically show a faint but precipitous downward turn (tail) at the end of the pulse.

RESULTS

Detectors were deployed at 10 acoustic sampling sites over the nights of 7/22/15, and 7/23/15 (Table 1, Figures 2 to 8). Data for three site-nights were inadequate (Amphibian nights 1 and 2, Siver night 1) and sampling was repeated as needed on 7/27/15 and 7/28/15 at those sites. All weather-related variables were in compliance with USFWS survey standards.

Table 1. Pine Bush Preserve 2015 sample site details. The Amphibian site had two detectors set on the night of 7/28/15 and both were pointed in the same general direction. Habitat types include ROW (powerline right-of-way) Barrens (pitch pine/ shrub /grasses); WF (woods/ field edge); P (open pond); WP (wooded pond); WW (wooded wetland).

Site	Nights surveyed (Detector)	Latitude (N)	Longitude (W)	Microphone Orientation (Degrees Magnetic)	Habitat Type
Amphibian	7/22 (30); 7/23 (30); 7/28(27 and 28)	42°44'8.17"N	73°52'40.08"W	290°	ROW
Asphalt	7/22 (27); 7/23 (27)	42°43'28.95"N	73°52'37.368"W	130°	Barrens
Bivy	7/22 (31);7/23 (31)	42°43'6.22"N	73°52'9.77"W	10°	Barrens
Blueberry Hill	7/22 (29);7/23 (29)	42°42'1.00"N	73°51'49.80"W	90°	Barrens
Cathedral	7/22 (49);7/23 (49)	42°42'18.9"N	73°53'34.58"W	217°	WF
Draperies	7/22 (50);7/23 (50)	42°43'3.83"N	73°53'11.69"W	21°	ROW
Fowlers	7/22 (25);7/23 (25)	42°42'59.10"N	73°51'20.7"W	90°	WP
Landfill	7/22 (52);7/23 (52)	42°42'36.70"N	73°50'56.10"W	170 °	P
Siver	7/22 (8);7/23 (8); 7/28 (51)	42°43'21.36"N	73°54'5.44"W	171°	WW
Trustco	7/22 (53); 7/23(53)	42°44'31.69"N	73°53'47.64"W	260°	WOF

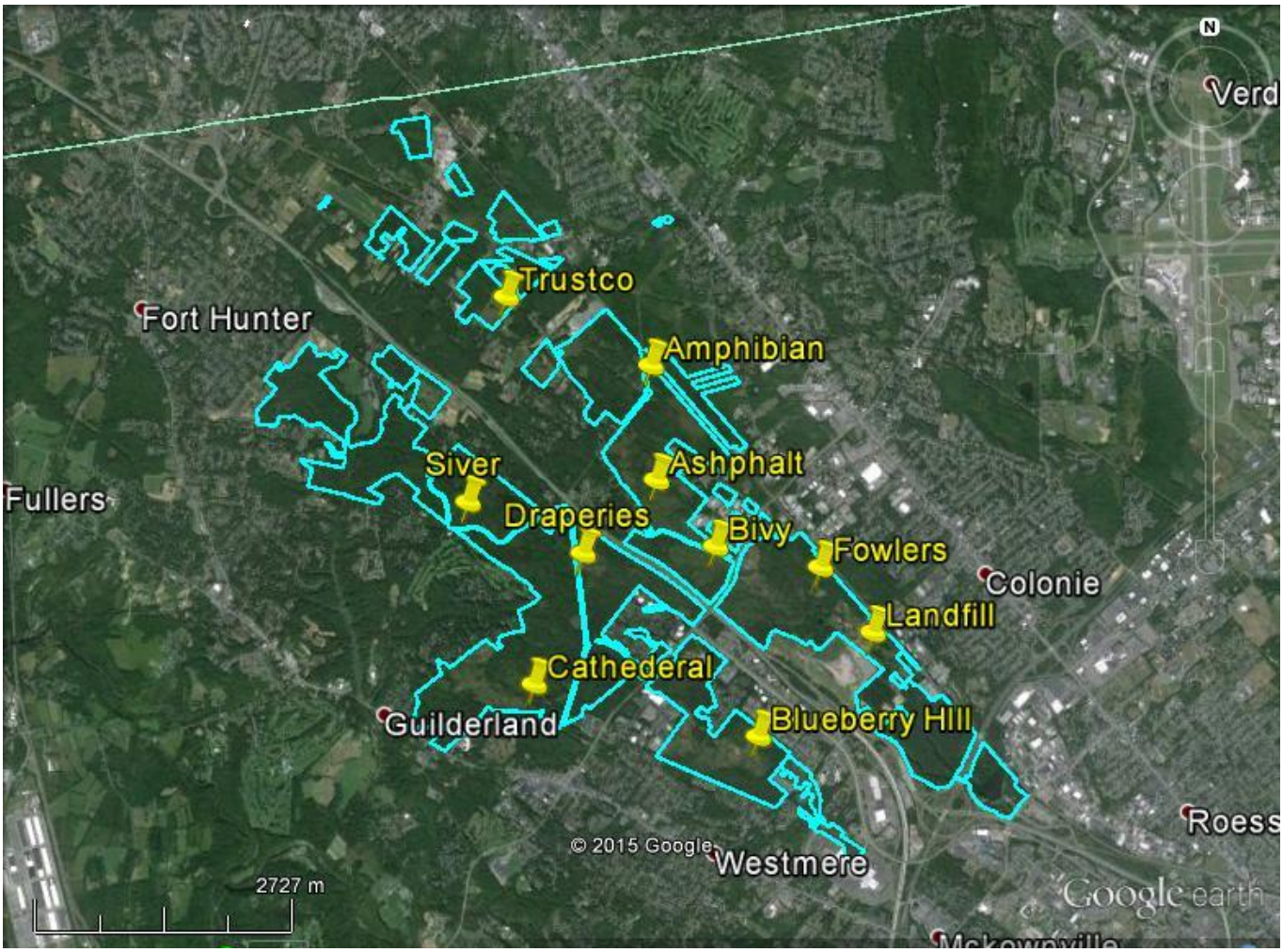

Figure 2. Locations of Pine Bush Preserve acoustic sampling sites. Preserve boundaries are in blue.

Figure 3. Amphibian acoustic site. The yellow line in overhead view (left) indicates microphone direction.

Figure 4. Asphalt and Bivy acoustic sites. The yellow lines in overhead views (left) indicate microphone direction.

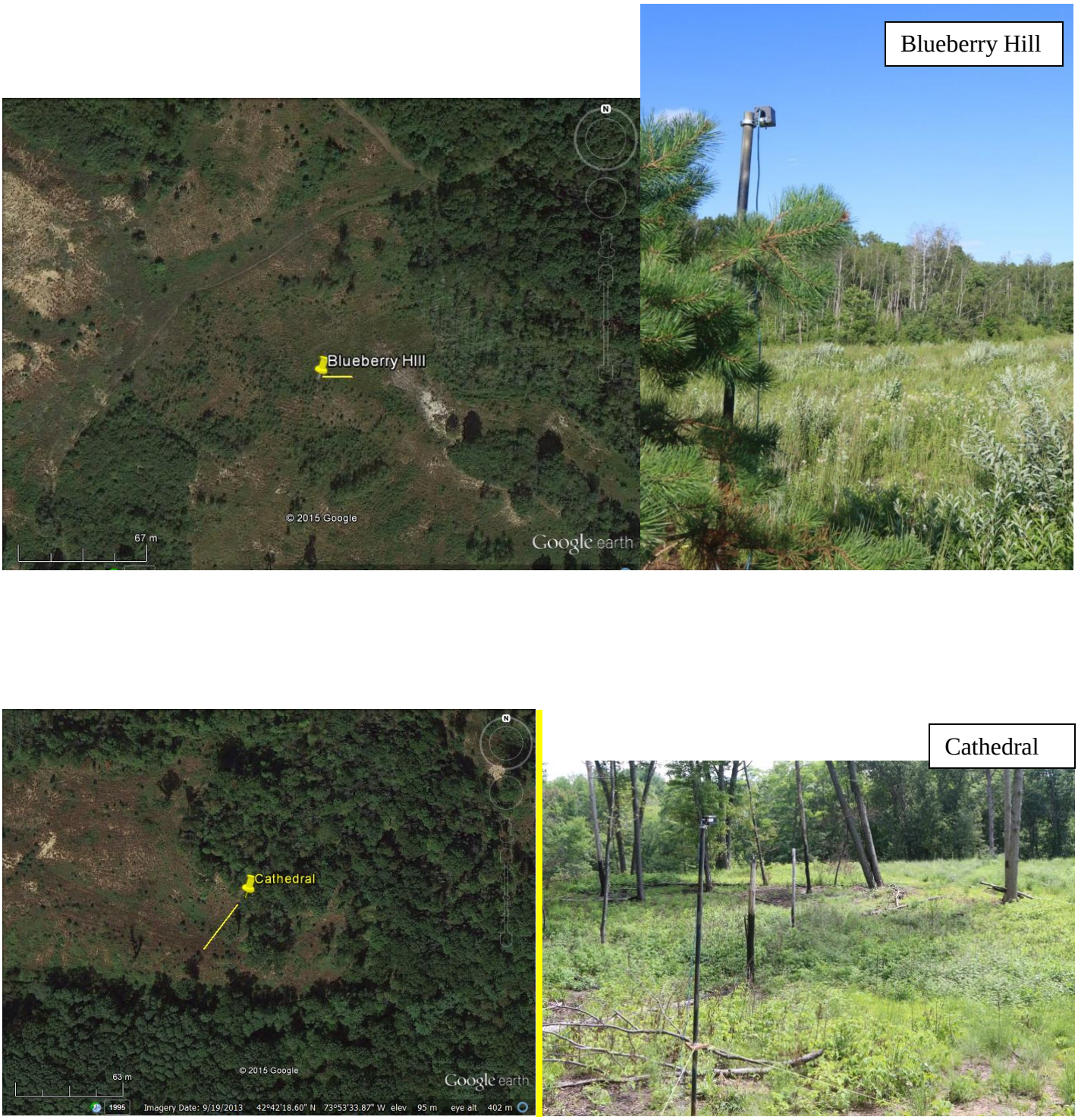

Figure 5. Blueberry Hill and Cathedral acoustic sites. The yellow lines in overhead views (left) indicate microphone direction

Figure 6. Asphalt and Fowlers acoustic sites. The yellow lines in overhead views (left) indicate microphone direction.

Figure 7. Landfill and Siver acoustic sites. The yellow lines in overhead views (left) indicate microphone direction.

Figure 8. Trustco acoustic site. The yellow line in overhead view (left) indicate microphone direction.

There were a total of 1,840 files that passed the initial filter and were identified as bat calls by Kaleidoscope (Table 2). The Kaleidoscope program attributed files to eight of the nine species typically found in the Northeast. Big brown bats (1,496 files) accounted for 81 percent of all calls, followed by red, (152 files), silver-haired (92 files), hoary (37 files), little brown (29 files), Indiana (9 files), northern long-eared (1 file), and small-footed bat (1 file). No files were attributed to the tri-colored bat. An additional 23 files attributed to bats were not identified to species.

The Maximum Likelihood Estimator (MLE) for Kaleidoscope predicted that six species were likely to have been present on at least one site in the Preserve during at least one night. In order of abundance these were the big brown (20 of 23 site-nights), red (13 of 23 site-nights), hoary (4 of 23 site-nights), little brown (2 of 23 site-nights), Indiana (2 of 23 site nights) and silver-haired bat (1 of 23 site-nights). Manual reviews of files attributed to little brown or Indiana bat at MLE positive sites were not conclusive (Table 4) but the presence of these species is possible.

Sampling in open pitch pine/shrub-grasslands (Asphalt, Bivy and Blueberry Hill) and over open water (Fowlers and Landfill) accounted for 26 percent and 17 percent of the effort respectively but each only 4 percent of the recorded bat calls. The remaining 57 percent of the sampling effort was associated with hardwood forests and accounted for 92 percent of the recorded bat calls.

Table 2: Number of files passed by SCAN'R that were attributed to each species per site night by Kaleidoscope. Species abbreviations include big brown (EPFU), silver-haired (LANO), red (LABO), hoary (LACI), small-footed (MYLE), little brown (MYLU), Indiana (MYSO) and tri-colored bats (PESU). There were also bat calls not identified to species (NOID), and files not attributed to bats (NOISE). Shaded cells indicate MLE predictions of likely presence (Table 3).

Site-day	Date	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	PESU	NOID	Total
Asphalt- 1	7/22/2015	8	1	0	0	0	0	0	0	0	0	9
Asphalt - 2	7/23/2015	7	3	0	1	0	1	0	0	0	0	12
Amphibian -1	7/22/2015	1	1	0	0	0	0	0	0	0	0	2
Amphibian-2	7/23/2015	1	1	1	1	0	0	0	0	0	1	5
Amphibian-3	7/28/2015	171	10	2	3	0	1	0	0	0	2	189
Amphibian-4	7/29/2015	75	6	2	14	0	2	0	0	0	3	102
Amphibian-4a	7/29/2015	64	6		12	0	2	0	0	0	2	86
Bivy- 1	7/22/2015	17	1	2	0	0	2	0	0	0	1	23
Bivy-2	7/23/2015	6	0	0	0	0	0	0	0	0	0	6
Blueberry Hill-1	7/22/2015	11	0	4	4	0	0	0	1	0	0	20
Blueberry Hill-2	7/23/2015	8	1	2	1	0	0	0	1	0	2	15
Cathederal-1	7/22/2015	119	10	4	2	0	1	0	0	0	1	137
Cathederal-2	7/23/2015	333	14	1	6	0	2	0	2	0	3	361
Draperies-1	7/22/2015	258	47		8	0	10	1	1	0	1	326
Draperies-2	7/23/2015	117	26	2	4	0	3	0	0	0	2	154
Fowlers-1	7/22/2015	33	8	2	3	0	2	0	1	0	1	50
Fowlers-2	7/23/2015	5	2		3	0	0	0	0	0	0	10
Landfill-1	7/22/2015	7	0	7	1	0	0	0	0	0	0	15
Landfill-2	7/23/2015	4	0	7	0	0	1	0	0	0	0	12
Siver-2	7/23/2015	42	1		2	0	0	0	2	0	1	48
Siver-3	7/28/2015	34	8		17	0	0	0	1	0	1	61
Trustco-1	7/22/2015	54	2		5	1	0	0	0	0	0	62
Trustco- 2	7/23/2015	121	4	1	5	0	2	0	0	0	2	135
total all sites		1496	152	37	92	1	29	1	9	0	23	1840

Table 3: Kaleidoscope Maximum Likelihood Estimator (MLE) results. A value of 0 indicates likely presence, 1 indicates likely absence. USFWS guidelines (USFWS 2015) require a P value of 0.05 or lower to meet the regulatory threshold for likely presence. Results meeting that threshold are shaded in green. Species abbreviations are the same as in Table 2.

Site-Survey Day	Date (2015)	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	PESU
Asphalt-1	7/22	7E-07	0.07900	0.99991	0.99991	0.99991	0.99991	1	0.99991	0.99991
Asphalt-2	7/23	2.78E-05	0.00260	0.99993	0.99993	0.99993	0.53445	1	0.99993	0.99993
Amphibian - 1	7/22	0.19324	0.06989	0.99999	0.99999	0.99999	0.99999	1	0.99999	0.99999

Site-Survey Day	Date (2015)	EPFU	LABO	LACI	LANO	MYLE	MYLU	MYSE	MYSO	PESU
Amphibian - 2	7/23	0.47293	0.06876	0.06414	0.80968	0.99998	0.99998	1	0.99998	0.99998
Amphibian - 3	7/28	0	0	0.99483	0.99483	0.99483	0.98654	1	0.99483	0.99483
Amphibian - 4	7/29	0	0.00002	0.67043	0.99639	0.99639	0.27995	1	0.99639	0.99639
Amphibian -4a	7/29	0	0.00001	0.99855	0.99855	0.99855	0.28337	1	0.99855	0.99855
Bivy- 1	7/22	0	0.42496	0.08581	0.99896	0.99896	0.02339	1	0.99896	0.99896
Bivy- 2	7/23	1		1	1	1	1	1	1	1
Blueberry Hill-1	7/22	0	0.99272	0.00015	0.91956	0.99272	0.99272	0.99272	1	0.99272
Blueberry Hill-2	7/23	1E-07	0.08262	0.02184	0.99337	0.99337	0.99337	0.99337	0.05078	0.99337
Cathedral - 1	7/22	0	0	0.28628	0.99553	0.99553	0.9845	1	0.99553	0.99553
Cathedral - 2	7/23	0	0	0.84899	0.84813	0.81343	0.69982	0.75697	0.02130	0.80720
Draperies -1	7/22	0	0	1	1	0.73182	0.04782	0.53831	0.95558	0.85239
Draperies-2	7/23	0	0	0.95132	0.99870	0.99870	0.87347	1	0.99870	0.99870
Fowlers -1	7/22	0	0.00000	0.21909	0.93113	0.93113	0.44362	0.93113	0.25826	0.93113
Fowlers-2	7/23	0.00776	0.00544	0.99993	0.37380	0.99993	0.99993	1	0.99993	0.99993
Landfill-1	7/22	4.98E-05	1	0	1	1	1	1	1	1
Landfill -2	7/23	0.00582	1	0	1	1	0.06840	1	1	1
Siver- 2	7/23	0	0.19392	0.96859	0.96859	0.96859	0.96859	0.96859	0.00243	0.96859
Siver- 3	7/28	0	0	0.99767	0.00673	0.99767	0.99767	0.99767	0.09258	0.99767
Trustco - 1	7/22	0	0.01846	0.96021	0.96021	1	0.96021	0.96021	0.96021	0.96021
Trustco- 2	7/23	0	0.00367	0.99015	0.99015	0.99015	0.15189	1	0.99015	0.99015

Table 4. Qualitative review results. Assessments from MLE positive sites of files attributed to Indiana or little brown bats by Kaleidoscope. "Possible" assessments are files that could be properly identified and have some, but not all, characteristics of the species' call; "uncertain" are less convincing; "inadequate" are files that are inadequate for review, generally due to inappropriate pulse intervals or low dB levels.

Species	Site (Day)	File	Assessment
Indiana bat	Cathedral (2)	49_D20150723T214628m453.wav	uncertain
Indiana bat	Cathedral (2)	49_D20150724T023849m052.wav	uncertain
Indiana bat	Siver (2)	08_D20150723T204606m511.wav	inadequate
Indiana bat	Siver (2)	08_D20150724T044242m793.wav	possible
Little brown bat	Draperies (1)	50_D20150722T225057m743.wav	possible
Little brown bat	Draperies (1)	50_D20150722T225134m972.wav	inadequate
Little brown bat	Draperies (1)	50_D20150722T225143m632.wav	possible
Little brown bat	Draperies (1)	50_D20150722T235743m270.wav	inadequate
Little brown bat	Draperies (1)	50_D20150723T003145m634.wav	inadequate
Little brown bat	Draperies (1)	50_D20150723T003322m603.wav	inadequate
Little brown bat	Draperies (1)	50_D20150723T010020m620.wav	inadequate
Little brown bat	Draperies (1)	50_D20150723T024348m125.wav	inadequate
Little brown bat	Bivy (1)	31_D20150723T030004m804.wav	possible
Little brown bat	Bivy (1)	31_D20150723T031248m161.wav	inadequate

DISCUSSION AND CONCLUSIONS

This was only a preliminary survey of the bat species in the Preserve as there was no effort to select sampling locations to maximize the detections of bats in general or any particular bat species. Also, effort was inadequate relative to the US Fish and Wildlife Service (USFWS) guidelines for bat presence/absence acoustic surveys (USFWS 2015). Those require four detector nights of acoustic surveys for every 123 acres of suitable bat habitat. For the Preserve, this would have required 52 sampling locations (104 site nights), five times the sampling effort of this study.

Both the large number of all call files that were attributed to big brown bats (81 percent of total) and MLE determinations of likely presence for that species (20 of 23 site-nights) was expected. Big browns were likely to have been historically common in the Preserve and are the cave bat species least affected by WNS.

The silver-haired MLE positive site is suspicious as, prior to WNS, the silver-haired bat were the species least frequently captured in the state during the summer (Carl Herzog personal communication). There is a reasonable chance that these calls could have either been accurately identified early migrants or misidentified big brown calls that were mistaken for silver-haired bats. A small percentage of big brown calls are indistinguishable from those of silver-haired.

The MLE positive predictions of Indiana bats during 2 of the 23 site- nights of sampling may also be inaccurate, in part because of the low number of call files attributed to Indiana bats at those site-nights (four total) and the lack of multiple definitive files among those four. The Siver site, although meeting USFWS (2015) survey standards was the most cluttered of all survey sites, and thus, most likely to have little brown bat produce uncharacteristic calls that could be misinterpreted as being Indianas . The accuracy of the identifications is also in question because the probability of Indiana bats having ever been on the Preserve is low. Odds are against Indiana bats having historically been present in the Preserve simply because of the low numbers known to hibernate locally, their concentration into summer colonies and the abundance of apparently suitable habitat within their normal summer dispersal distances from that hibernaucla. In short, there was probably a great deal of potential habitat that was unoccupied in the region even when Indiana bats were most common This already low probability of presence at the Preserve plummeted with the apparent extirpation of those local winter colonies due to WNS. Combined with the uncertainties associated with acoustic identifications using automatic software programs (Ford 2015) or even manual reviews given such a small sample, acceptance of predictions of likely presence for Indiana bats should be done with caution.

Little browns are more likely to be present than Indiana bats although also predicted in just 2 of 23 sampling sites. There were a larger number of files attributed to them (12) and historically there was no reason to doubt that little browns were common to abundant in the Preserve. Over two thousand are currently known to hibernate in Hailes Cave, 12 km away (Carl Herzog personal communication 2015).

One of the goals of this study was to determine the activity levels of bats in the Pine Barrens habitat type. The proportion of detections of any bat species in open pitch pine/shrub-grasslands (26 percent of site-nights sampled, 4 percent of detections) was low relative to hardwood forest habitats, which is not surprising as bats often feed along forest canopies and forest edges, where insects may be more abundant. Some species tend to stay closer to where escape cover is readily available. The low proportion of detections over open water (17 percent of site-nights sampled, 4 percent of detections) is unusually low but consistent with the low detection rates of little browns in the Preserve; the species that most commonly feeds over water.

If a presence/absence survey for bats is undertaken in the future it should focus on the hardwood forest and open water components of the Preserve as those areas are where the greatest number and greatest diversity of bats is likely to be found. It will also require greater survey effort to meet standards set by the USFWS.

CITATIONS

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