



Acoustic Monitoring for Bats at Sleeping Bear Dunes National Lakeshore

Data Summary Report for 2015–2019

Natural Resource Data Series NPS/GLKN/NRDS—2021/1323



ON THE COVER

Bat acoustic monitoring equipment at Sleeping Bear Dunes National Lakeshore.
NPS Photo

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Abstract

The Great Lakes Inventory and Monitoring Network initiated an acoustic monitoring program for bats in 2015. This report presents results for 2015–2019 surveys at Sleeping Bear Dunes National Lakeshore. Acoustic recordings were analyzed using the software program Kaleidoscope Pro, and a subset of files were manually reviewed to confirm species identifications. The five bat species previously documented at the park were reconfirmed. These include big brown bat, eastern red bat, hoary bat, silver-haired bat, and little brown bat. Two additional species, the northern long-eared bat and tricolored bat, were also documented. Neither of these have been physically captured in the park, but our acoustic data suggest they are present. Although some acoustic files were identified by the software as Indiana bats, manual review did not confirm any files as this species. Activity levels for big brown bat, hoary bat, and silver-haired bat appear to be stable. Activity levels for eastern red bat, little brown bat, Indiana bat, northern long-eared bat, and tricolored bat show decreasing trends.

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This work would not have been possible without all the park employees, partners, and volunteers who completed field surveys and provided logistical support, including S. Jennings, J. Sidge, E. Adams, S. Harrington, B. Khadka, B. Swift, C. Otto, D. Schroeder, S. Chalup, M. Niemiec, D. Ray, J. Westenfelder, D. Hooper, J. Markiewicz, E. Plesha, A. Rivera, F. Sunnerville, and E. Carley. We thank K. Gilland and others at Normandeau Associates for data processing and manual vetting, and R. Key for database development and assistance with data management. V. Cavalieri and T. Gostomski reviewed earlier drafts of this report. Funding for this monitoring effort was provided by the National Park Service's Natural Resource Stewardship and Science Directorate White-Nose Syndrome program.

Introduction

North American bat populations are threatened by a number of environmental pressures including the fungal disease white-nose syndrome (WNS), mortality from wind turbines, and changing land use and climatic conditions. Due to these conservation concerns, the National Park Service (NPS) and other federal agencies have begun implementing or expanding bat research and monitoring programs (Loeb et al. 2015, Rodhouse et al. 2016, Rodriguez et al. 2019). The NPS has funded over 150 bat-focused research, conservation, and education projects at 78 parks since 2013 (National Park Service 2016).

In 2015, the Great Lakes Inventory and Monitoring Network (GLKN) established a bat acoustic monitoring program in its nine network parks, with a particular focus on documenting the impacts of WNS. When the project was initiated, the Great Lakes region was at the leading edge of the disease's spread, with WNS documented within 50 miles of most parks (U. S. Geological Survey 2019). GLKN's monitoring program is helping parks to document baseline data on their bat populations and assess changes over time. Sleeping Bear Dunes National Lakeshore (SLBE) has participated in this monitoring program since 2015.

Nine species of bats are found in the Great Lakes region (Kurta 2017), detailed in Appendix A. All are insectivores belonging to the Family Vespertilionidae, the largest and most common group of bats in North America. Great Lakes bat species can be divided into two groups: tree-roosting, migratory bats and cavity-roosting, hibernating bats. The hibernating species are highly susceptible to WNS, except for big brown bats (*Eptesicus fuscus*), which show greater resistance to the disease and experience less severe infections (Frank et al. 2014, Moore et al. 2018).

The U.S. Fish and Wildlife Service lists the Indiana bat (*Myotis sodalis*) as federally endangered and the northern long-eared bat (*Myotis septentrionalis*) as federally threatened under the Endangered Species Act (U.S. Fish and Wildlife Service 1967, 2016). Furthermore, all nine Great Lakes bat species are listed by one or more states as endangered, threatened, or of special concern (Michigan Natural Features Inventory 2009, Minnesota Department of Natural Resources 2013, Wisconsin Department of Natural Resources 2016, Indiana Division of Fish and Wildlife 2020) (Appendix A).

Prior to the initiation of the GLKN bat acoustic monitoring program, a total of five species had been documented at SLBE (Table 1). Faunal surveys were completed on North and South Manitou Islands in the 1960s and 1970s. On North Manitou, only the little brown bat (*Myotis lucifugus*) and eastern red bat (*Lasiurus borealis*) were observed (Scharf and Jorae 1980). On South Manitou, the eastern red bat was again observed, along with big brown, hoary (*Lasiurus cinereus*), and silver-haired bats (*Lasionycteris noctivagans*) (Scharf 1973). More recently, mist-netting was conducted in the park during the summers of 2000–2002 and 2015. In 2000, only three species were captured: big brown bat, eastern red bat, and little brown bat (Kurta and Jablonsky 2000). In 2001, 2002, and 2015, five species were captured: the same three as in 2000 plus silver-haired and hoary bats (Kurta and Rice 2001, 2002a; George and Kurta 2016).

Additional records at SLBE have been obtained through methods other than capture and mist-netting. Roost surveys were conducted in 2000, identifying several little brown bat colonies in park buildings (Bohrman 2014). Acoustic surveys were completed in 2010 as part of a study of bird and bat migration along Great Lakes shorelines. The resulting recordings were identified as little brown bats, red bats, and the big brown/silver-haired species pair (these were not separated due to the similarity of their calls) (Gehring and Barton 2011).

Table 1. Bat species occurrences recorded at Sleeping Bear Dunes National Lakeshore prior to the initiation of the GLKN acoustic monitoring program in 2015, and method(s) by which the species were documented. Data sources include Scharf (1973), Scharf and Jorae (1980), Kurta and Jablonsky (2000), Kurta and Rice (2001, 2002), Gehring and Barton (2011), Bohrman (2014), and George and Kurta (2016). Ranges are as shown in Kurta (2017).

Species Name	Prior Records	Methods Used
Big Brown Bat <i>Eptesicus fuscus</i>	Yes	Acoustic*, Capture
Eastern Red Bat <i>Lasiurus borealis</i>	Yes	Acoustic, Capture, Specimen Collected
Hoary Bat <i>Lasiurus cinereus</i>	Yes	Capture
Silver-haired Bat <i>Lasionycteris noctivagans</i>	Yes	Acoustic*, Capture, Direct Observation
Little Brown Bat <i>Myotis lucifugus</i>	Yes	Acoustic, Capture, Direct Observation, Specimen Collected
Northern Long-eared Bat <i>Myotis septentrionalis</i>	No records, within range	n/a
Indiana Bat <i>Myotis sodalis</i>	No, close to edge of range	n/a
Evening Bat <i>Nycticeius humeralis</i>	No, well outside of range	n/a
Tricolored Bat <i>Perimyotis subflavus</i>	No records, within range	n/a

* Indicates acoustic files were identified only to the level of a species pair or group.

The park lies within the documented range for both the northern long-eared bat and tricolored bat (*Perimyotis subflavus*) and near the edge of the range for Indiana bats. However, these three species have not been captured or otherwise identified in-hand at SLBE, despite multiple mist-netting efforts. A habitat assessment for Indiana and northern long-eared bats was completed in 2014. This study determined that high quality foraging and roosting habitat is available for both species at certain locations within the park (Bohrman 2014). The northern long-eared bat is included in the park's NPSpecies list as "Present" and the tricolored bat as "Probably Present", but Indiana bat is not listed

(<https://irma.nps.gov/NPSpecies/Search/SpeciesList/SLBE>). Nearby records from outside the park indicate these species are present in the area at some times of the year. All three species have been observed hibernating at Tippy Dam, less than 50 miles from the park, but it is uncertain where these individuals spend the summer (Kurta and Teramino 1994, Kurta and Rice 2002b, Kurta et al. 2007). In addition, an acoustic survey recorded the northern long-eared bat during fall migration at Leelanau State Park, about 30 miles away from SLBE (Seefelt 2013).

The evening bat (*Nycticeius humeralis*) is the ninth species found in the Great Lakes region. Its range lies further south, so this species is not expected to be present at SLBE.

Methods

Bat acoustic monitoring at SLBE was conducted according to the protocol and standard operating procedures developed by GLKN (Goodwin et al. 2020). Initial protocol development was done in coordination with an outside consultant, Western EcoSystems Technology, Inc. (Gruver et al. 2016). Although methods were revised by GLKN after the 2015 season of monitoring, the majority of the sampling procedures were consistent across all years.

Site Selection

GLKN utilizes a probabilistic sample design based on the creation of a master sample, as described by Larsen et al. (2008). The sampling frame for each park consists of a finite grid of 1-km² cells. For some parks certain areas were excluded from the sampling frame *a priori* based on inaccessibility from roads, trails, or shorelines. Using the Generalized Random Tessellation Stratified (GRTS) algorithm, cells within the sampling frame were arranged into an ordered list, referred to as the “master sample”; this list is both randomized and spatially balanced (Stevens and Olsen 2004). Cells to be sampled were identified by working through the master sample list in numerical order, starting with Cell #001. Each cell was evaluated for accessibility and safety to determine if it should be included. Omitted cells were documented to justify the reason for exclusion.

At SLBE, the GRTS design was used beginning in 2016. A total of 35 cells were selected for sampling, equivalent to approximately 11% of the park’s sampling frame. The selected cells have been used from 2016 onward. For the most part, the 2015 monitoring locations were completely different, but there were four locations that were monitored both in 2015 and in all following years (SLBE007, SLBE011, SLBE016, and SLBE042).

The *cell* is defined as the 1-km² area that is selected for sampling. The *site* is defined as the exact location within the cell where the acoustic recording equipment is placed. Sites were chosen by identifying locations that were reasonably accessible and had suitable bat habitat such as travel corridors (e.g., cut line, road, trail, or forest edge) or foraging areas (e.g., wetland). As much as possible, sites were located away from dense vegetative clutter, buildings, or open water to optimize recording quality. Each site was assigned a Site ID based on the cell’s GRTS order number, in the format SLBE001A. A map of SLBE sample sites is provided in Figure 1.



Figure 1. Bat monitoring sites at Sleeping Bear Dunes National Lakeshore. Sites shown were established in 2016 and used each year since, with the exception of SLBE002, which was relocated from the “A” site to the “B” site in 2017. Sites used only in 2015 are not shown.

Data Collection

Acoustic monitoring is conducted during the summer, from 1 June–15 August. The same sites are monitored each year in approximately the same order and at approximately the same time of year, to facilitate estimation of long-term trends. Each site is sampled once per year, for a period of 7–14 consecutive nights. Detectors are programmed to record every night from 6:00 p.m. to 8:00 a.m.

One acoustic detector with an external ultrasonic microphone is deployed at each survey site to passively record bat echolocation calls. Equipment used at SLBE includes Wildlife Acoustics Song

Meter SM2BAT+, Song Meter SM3BAT, and Song Meter SM4BAT-FS detectors and Wildlife Acoustics SM3-U1 and SMM-U1 microphones. The SM2BAT+ detector model and the SM3-U1 microphone were used for about one-third of the deployments in 2015, and not at all in subsequent years. Recordings are collected in full-spectrum format and stored on SD cards mounted in the detector. In general, files are recorded in WAV file format. However, recordings made in 2015 using the SM2BAT+ detectors were recorded as WAC files and later converted to WAV files. Field technicians complete a datasheet for each deployment and collect site photographs and GPS coordinates. After retrieving equipment, the audio files and detector program/status files are downloaded.

Data Management and Analysis

Field technicians are responsible for data organization and securely storing data at the SLBE office. At the conclusion of the field season, all data are submitted to GLKN for quality assurance/quality control, entry into the bat monitoring database, data analysis, and data archiving.

For 2015–2019 data, GLKN contracted with an outside consultant (Normandeau Associates) to process acoustic files and obtain species classifications. Each deployment was categorized as valid or not valid. Valid deployments were those that had at least four nights of successful recording during the protocol sampling period (1 June–15 August). In some cases, there was more than one valid deployment per year at a particular site. When this occurred, the first valid deployment was categorized as “valid” and the remaining were categorized as “valid (duplicate)”. A deployment categorized as “failed” indicates it was unsuccessful due to equipment malfunction, improper programming, and/or vandalism. “Failed (short)” indicates the deployment was unsuccessful only because the minimum required four nights of recording were not completed. “Early” and “late” categories designate deployments that occurred either before 1 June or after 15 August, and thus were outside the protocol sampling period. Finally, “nonprotocol” indicates deployments that were completed for park-specific monitoring goals at locations that were selected intentionally, rather than following the GRTS sample design. Non-valid deployments (including those categorized as “valid (duplicate)”) were excluded from all further analyses.

Normandeau Associates used an automated acoustic analysis software program to filter out noise and assign species classifications to audio files. The specific program used was Wildlife Acoustics Kaleidoscope Pro Version 4.0.0 (2015–2018) or Version 5.0.3 (2019), with the Bats of North America Classifier Version 3.1.0 and the “–1 More Sensitive” setting. During Kaleidoscope processing, the software assigned each audio file a species-level classification where possible. Files not classified to a particular species were labeled “No ID” if they contained unknown bat calls, otherwise they were labeled “Noise”. The software did not process files that were corrupt or unreadable.

Kaleidoscope Pro allows the user to customize a list of possible bat species that will be considered during the classification process. This allows for the exclusion of any species not found in the study area, reducing the chance of obtaining false positive results. GLKN determined which species have known ranges within the boundaries of SLBE based on published range maps (Harvey et al. 2011, Rodhouse et al. 2016, Kurta 2017). These species were considered the “baseline” species list. We

also created an “expanded” list, adding species that are documented relatively close to the park and may possibly be present. All audio files were run through Kaleidoscope Pro twice, once using the baseline list and once using the expanded list. The baseline and expanded species lists for SLBE are provided in Appendix B. Analysis settings used in Kaleidoscope Pro are provided in Appendix C.

Kaleidoscope Pro and other similar acoustic analysis programs are not 100% accurate. Software classification results are expected to include some errors due to the similarity of echolocation calls among different species, variation of calls within the same species, poor quality or truncated calls, clutter effects, or multiple bats recorded simultaneously (Britzke et al. 2013, Reichert et al. 2018). Therefore, manual review (manual vetting) of call files by a qualified biologist is an important secondary step to verify the results produced by the software.

Due to the enormous quantity of data collected by the GLKN monitoring program, it is not feasible to manually review all files. From each year’s dataset, Normandeau Associates randomly selected approximately 1% of the files that Kaleidoscope Pro identified to the species level (i.e., excluding noise and unknown bats). To ensure all species were proportionally represented, this consisted of 1% of the files identified to each species, with a required minimum of 10 files per species unless there were fewer than 10 files available. This procedure was used for the baseline analysis; for the expanded analysis additional files were selected only for the new species not already represented by the baseline analysis. Files selected for manual vetting were chosen and prepared by a different individual than the biologist doing the reviewing. Potentially revealing information such as site location and date were removed from the file name. Manual vetting was performed by a qualified biologist from Normandeau Associates, who was provided with a list of possible species to consider. However, to ensure an independent assessment, the manual reviewer did not know how the Kaleidoscope software had identified each file. Manual identifications were based on call characteristics such as shape, frequency, and duration using published reference materials and call libraries. The manual reviewer assigned a species or species group (e.g., unknown high frequency or unknown low frequency) to each audio file, assuming it contained bat calls of sufficient quality. The reviewer could also determine that a file did not contain bat echolocation calls and contained only noise. Following processing, results of both automated software classification and manual vetting were incorporated into GLKN’s bat monitoring database.

Acoustic monitoring by the above-described methods does not allow estimation of population size or number of individual bats detected. Instead, data are presented in terms of species composition (percent of total files assigned to each species), activity levels (call files per recording night), and spatial and temporal distribution (percent of sites and percent of recording nights with positive detections), using the results of the Kaleidoscope Pro analysis. Manual vetting results are presented in terms of the number of vetted calls that were verified. For simplicity, results for vetted calls that were not verified are not broken down by species in this report, but those data are available if needed for future analyses. Misclassification rates, as derived from the manual vetting process, have not been applied to the Kaleidoscope Pro results; data presented reflect the original outputs from the software.

Results

Survey Effort

Acoustic monitoring took place at SLBE during the years 2015–2019. There were 14–35 valid deployments per year. This report provides results only for the sites that had valid deployments.

Monitoring occurred over a total of 129 to 312 nights of recording. The number of audio files collected per year ranged from 26,677 to 69,035. Yearly survey effort and deployment information are summarized in Figure 2 and Appendix D.

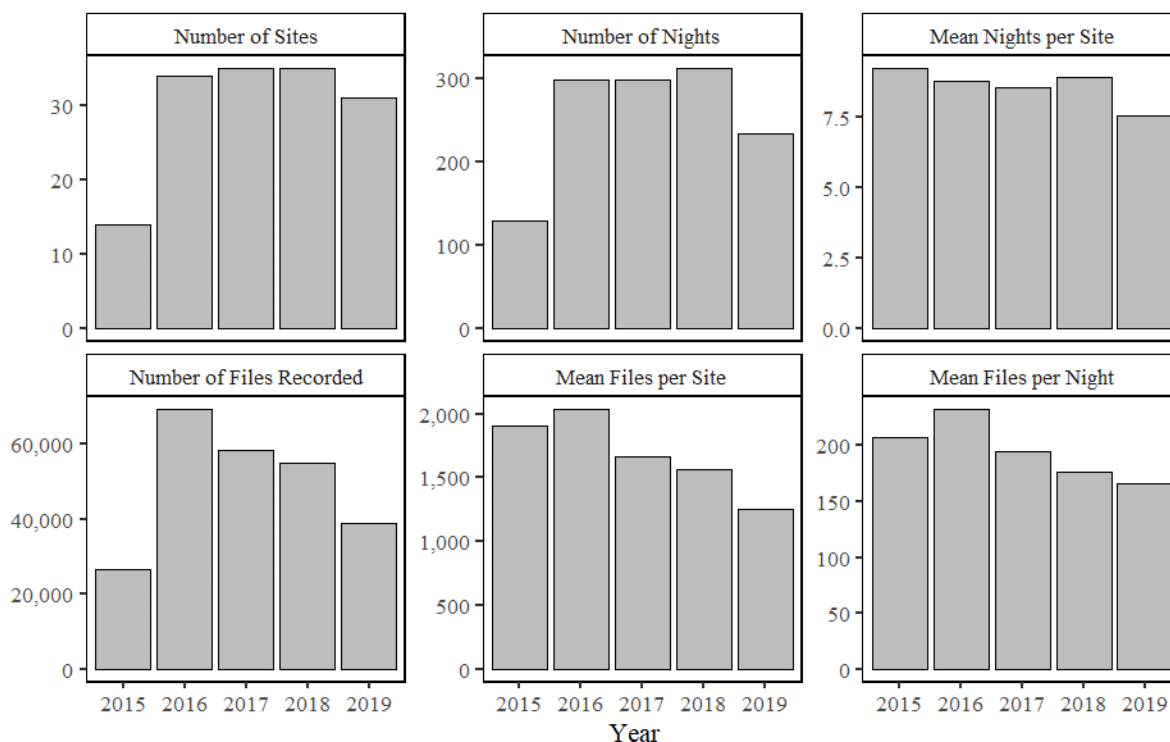


Figure 2. Yearly survey effort for bat monitoring at Sleeping Bear Dunes National Lakeshore, 2015–2019. *Top, left to right:* number of sites, number of nights, and mean nights per site; *bottom, left to right:* total number of audio files recorded, mean files per site, and mean files per night. Number of files is prior to classification (i.e., includes noise).

Automated Classification

The proportion of files identified to the species level by Kaleidoscope Pro each year ranged from 52% to 87%, with the proportion in 2015 significantly lower than other years (Figure 3, Appendix E). The proportion of files assigned to a species versus noise or unknown was similar for the baseline and expanded analyses.

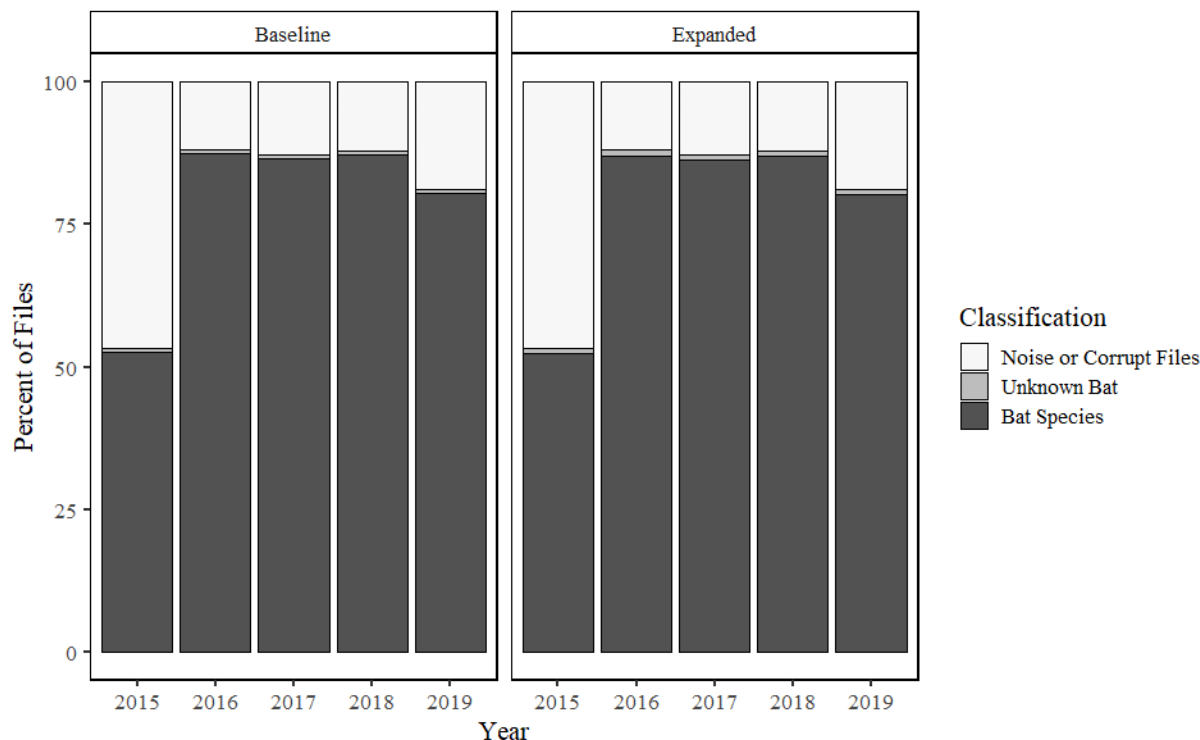


Figure 3. Percent of audio files classified by Kaleidoscope Pro as bat species vs. unknown bats vs. noise or corrupt files, Sleeping Bear Dunes National Lakeshore, 2015–2019. Proportions are shown for the baseline (*left*) and expanded (*right*) analyses.

Kaleidoscope Pro automated classification resulted in a total of six species documented in the baseline analysis and eight species documented in the expanded analysis. For the subset of files that were successfully assigned a species-level classification, the percent classified to each species in each year was similar between the baseline and expanded analyses (Figure 4). In both the baseline and expanded analyses, the largest proportion of files was classified as little brown bat in three out of the five years (2015, 2018, and 2019). In 2016, eastern red bat made up the largest proportion of files, while in 2017 it was silver-haired bat. After 2015, the proportion of files attributed to the four most WNS-susceptible species (little brown, northern long-eared, Indiana, and tricolored bats) decreased relative to the proportion attributed to the other species (Figure 5). The most notable changes from 2015 to 2019 were an increase in the percentage of files attributed to big brown and silver-haired bats, and a decrease in the percentage of files attributed to eastern red and little brown bats. File counts and percentages are provided in Appendix E.

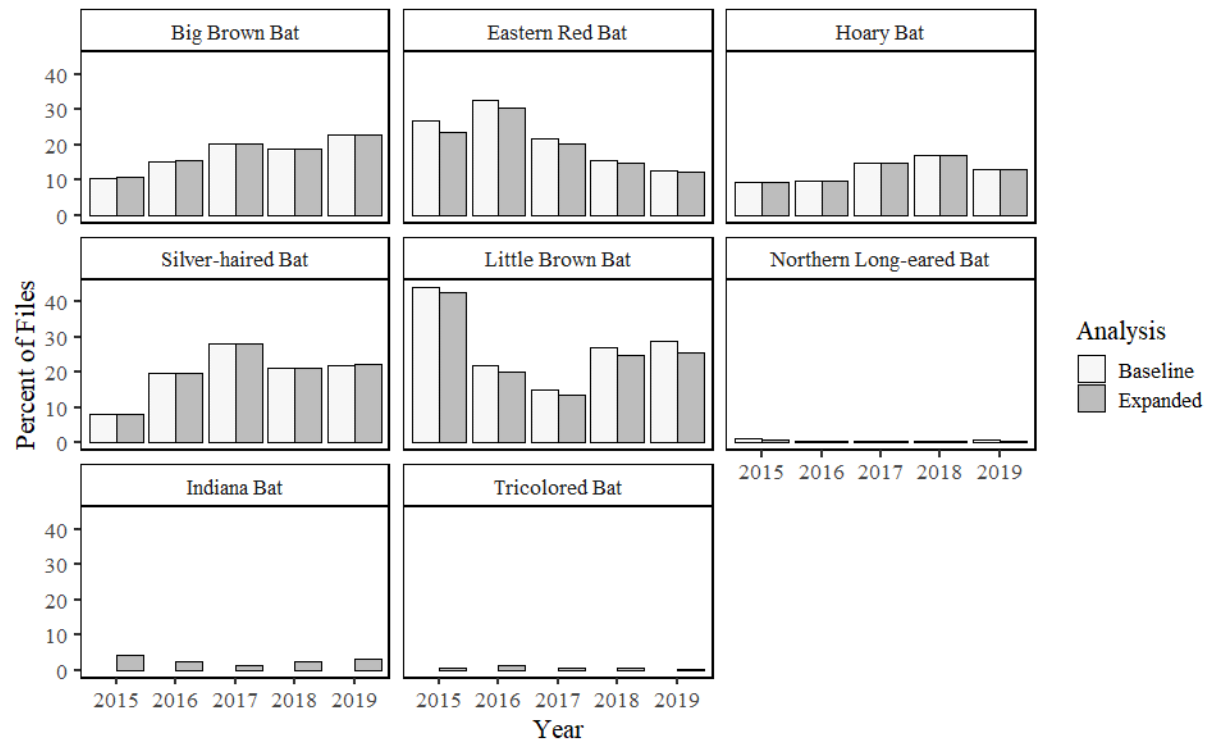


Figure 4. Proportion of files classified to each species each year in the baseline versus expanded analysis, Sleeping Bear Dunes National Lakeshore, 2015–2019. Indiana bat and tricolored bat were only allowed as possible species in the expanded analysis. Includes only the subset of files successfully assigned a species-level classification by Kaleidoscope Pro.

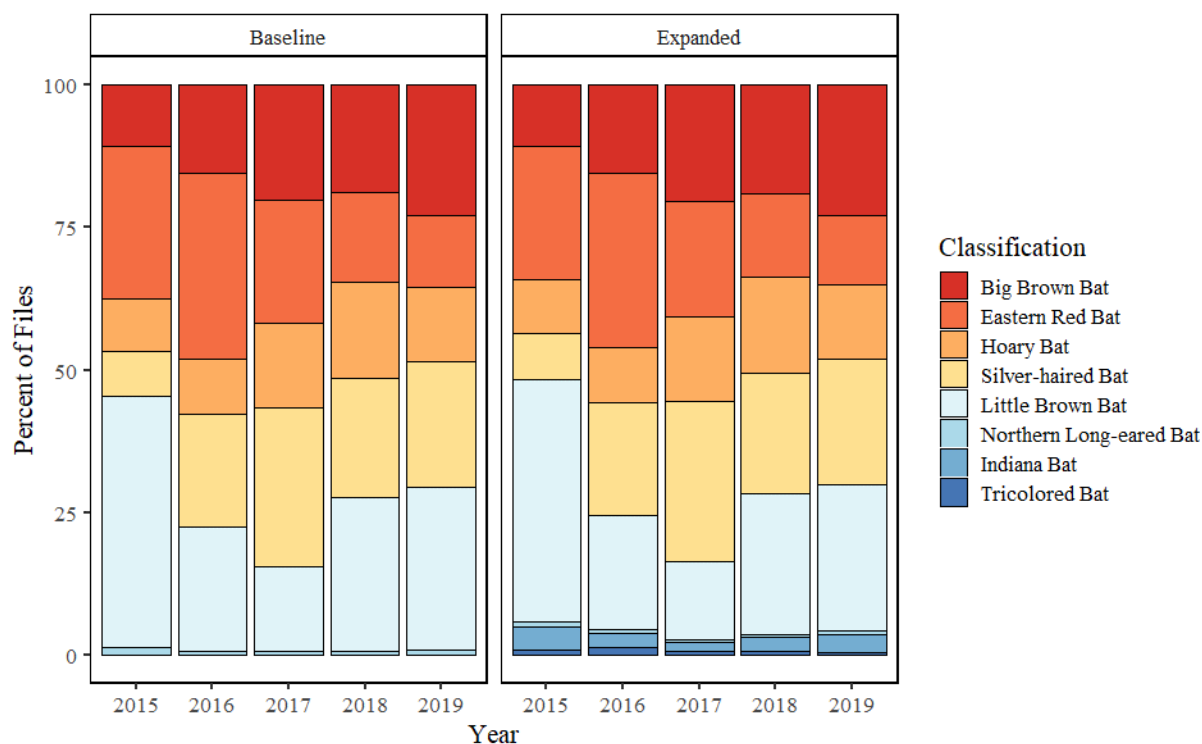


Figure 5. Proportion of files classified to each species each year relative to all other species, Sleeping Bear Dunes National Lakeshore, 2015–2019. The four most WNS-susceptible species (little brown, northern long-eared, Indiana, and tricolored bats) are shown in shades of blue while less susceptible species are shown in red, orange, and yellow. Indiana bat and tricolored bat were only allowed as possible species in the expanded analysis. Includes only the subset of files successfully assigned a species-level classification by Kaleidoscope Pro.

Call files per recording night were calculated on both the park level and individual site level using the results of the automated classification by Kaleidoscope. Parkwide, total call files per recording night were lowest in 2015 and highest in 2016 (Figure 6). The parkwide increase from 2015 to 2016 is tied to increases in the species that are not susceptible to WNS; meanwhile WNS-susceptible species showed little change (Figure 6). Differences between 2015 and the other four years could be at least partially related to the changes in equipment type and monitoring sites that occurred after 2015.

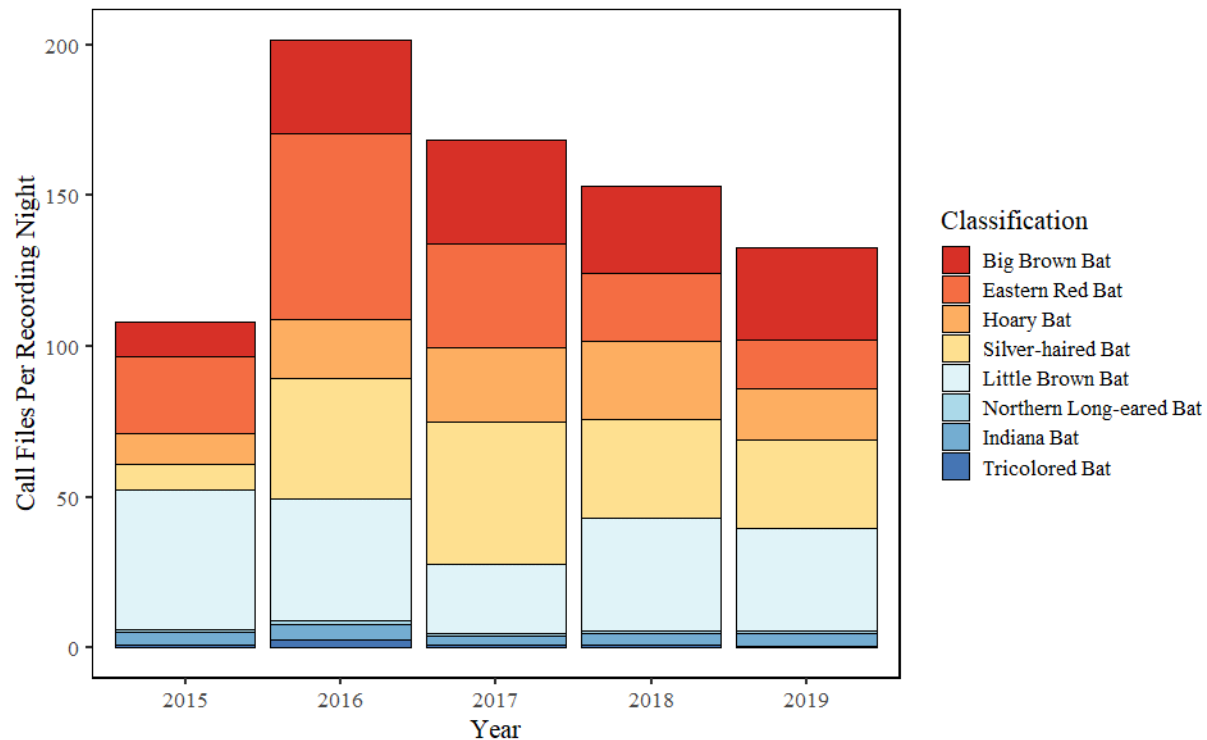


Figure 6. Parkwide call files per recording night by species and year for the expanded analysis, Sleeping Bear Dunes National Lakeshore, 2015–2019. The four most WNS-susceptible species (little brown, northern long-eared, Indiana, and tricolored bats) are shown in shades of blue while less susceptible species are shown in red, orange, and yellow. Results were similar for baseline and expanded analysis so only the expanded analysis is shown.

At the site level, when looking at all species combined, the median call files per recording night was lower in 2015 than in the other years and results from 2016–2019 were all similar (Figure 7, lower left panel). Looking at individual species, we observed a slight increase after 2015 in the median call files per recording night for little brown, big brown, and hoary bats, and a more significant increase after 2015 for eastern red and silver-haired bats (Figure 7). Northern long-eared bat was the only species for which we observed a decrease in the median call files per recording night from 2015 to 2016–2019. The median was similar across all years for Indiana bat and tricolored bat. Adding those two as possible species in the expanded analysis did not substantially change the call files per recording night values for other species, because only a small number of files were reassigned.

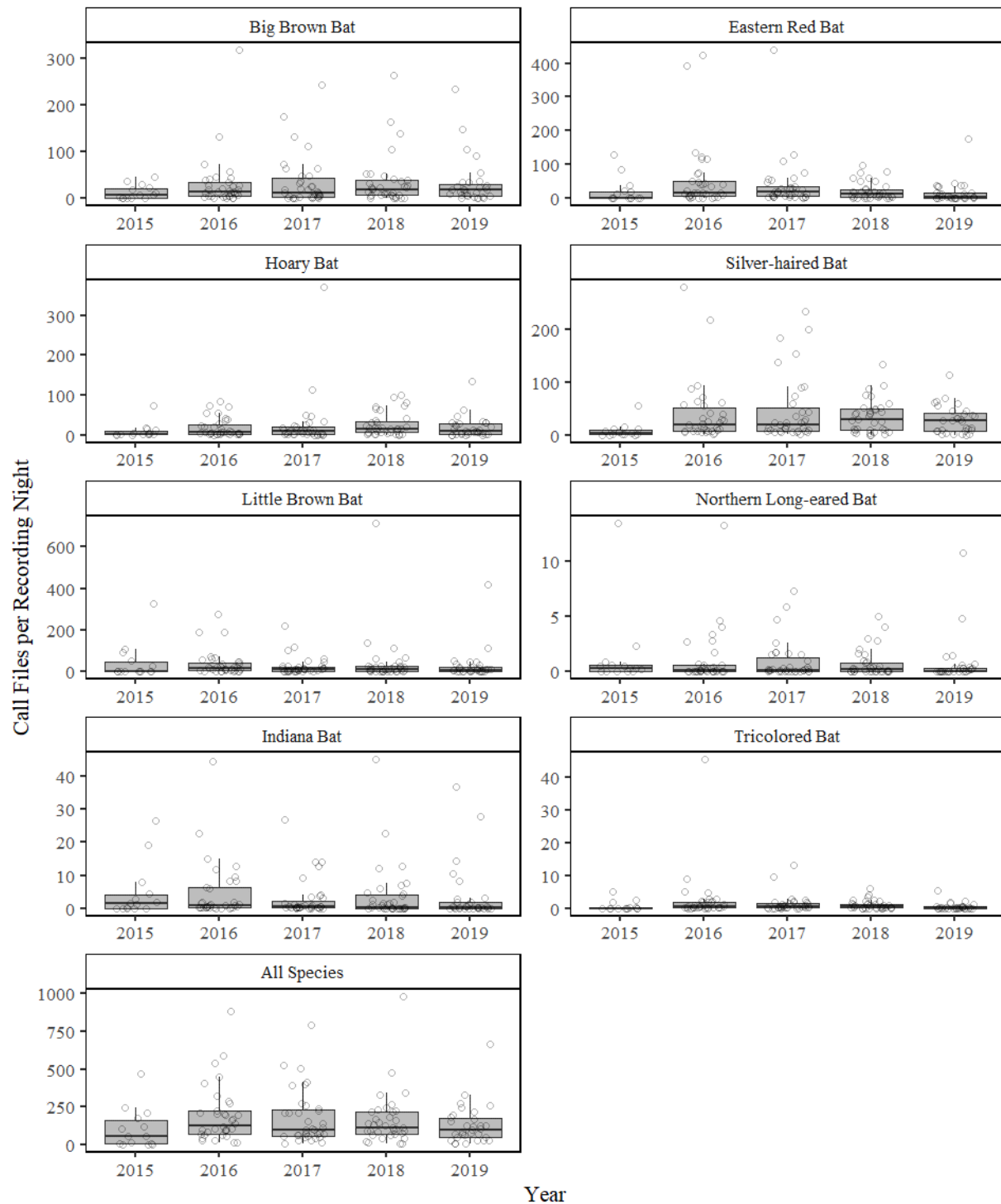


Figure 7. Call files per recording night for each species and for all species combined, by year, for the expanded analysis, Sleeping Bear Dunes National Lakeshore, 2015–2019. Each point represents call files per recording night at a particular survey site. The dark line across the boxplot represents the median. Note y-axis scale is different for each species. Results were similar for baseline and expanded analysis so only expanded is shown.

Spatial and Temporal Distribution

Spatial and temporal species distributions were assessed using the results of the automated classification. A species was considered to be detected at a site or on a night if at least one audio file was classified as that species by Kaleidoscope Pro. Five species (big brown bat, eastern red bat, hoary bat, silver-haired bat, and little brown bat) were widely distributed across the park, with detections at more than 85% of monitoring sites in every year (Figure 8, Appendix E). These same five species were also detected on at least 60% of recording nights every year (Figure 9, Appendix E). The remaining three species were detected much less frequently, both in terms of percentage of sites and percentage of nights. Averaging across all years, we found that the northern long-eared bat was detected at the lowest percentage of both sites and nights.

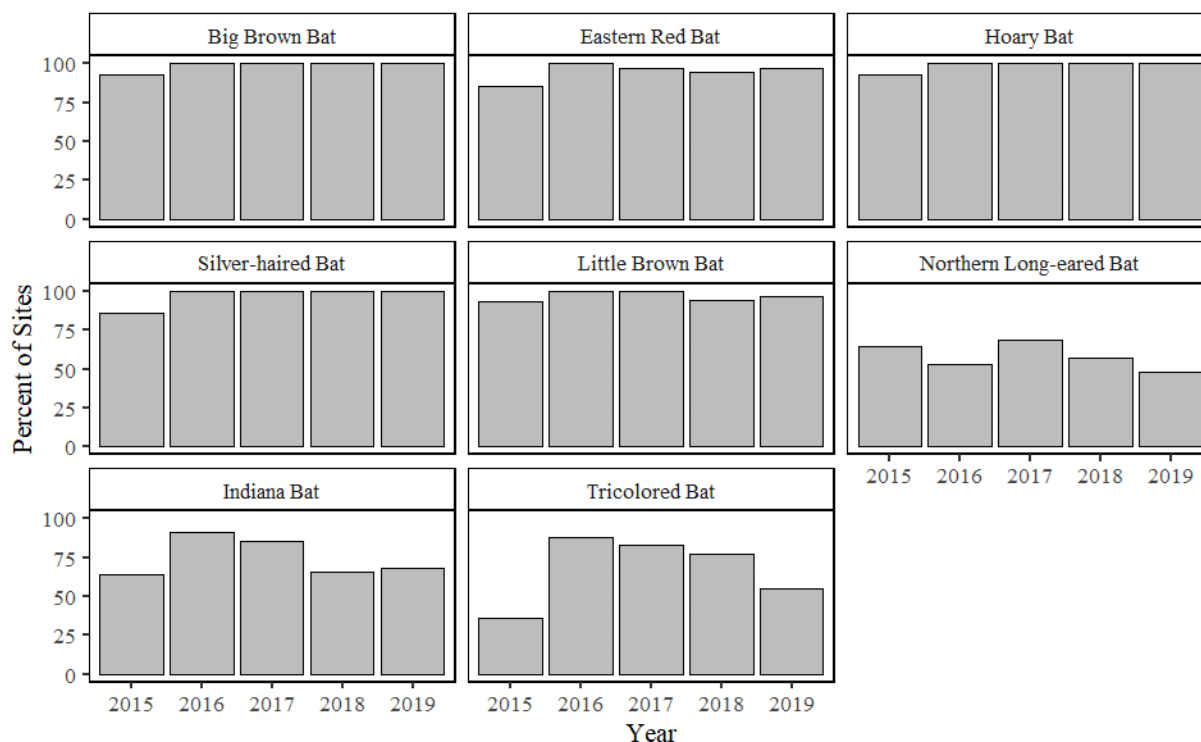


Figure 8. Proportion of monitoring sites where each species was detected each year, Sleeping Bear Dunes National Lakeshore, 2015–2019. A species was considered to be detected at a site if at least one audio file was classified as that species by Kaleidoscope Pro. Results were similar for baseline and expanded analysis so only the expanded analysis is shown.

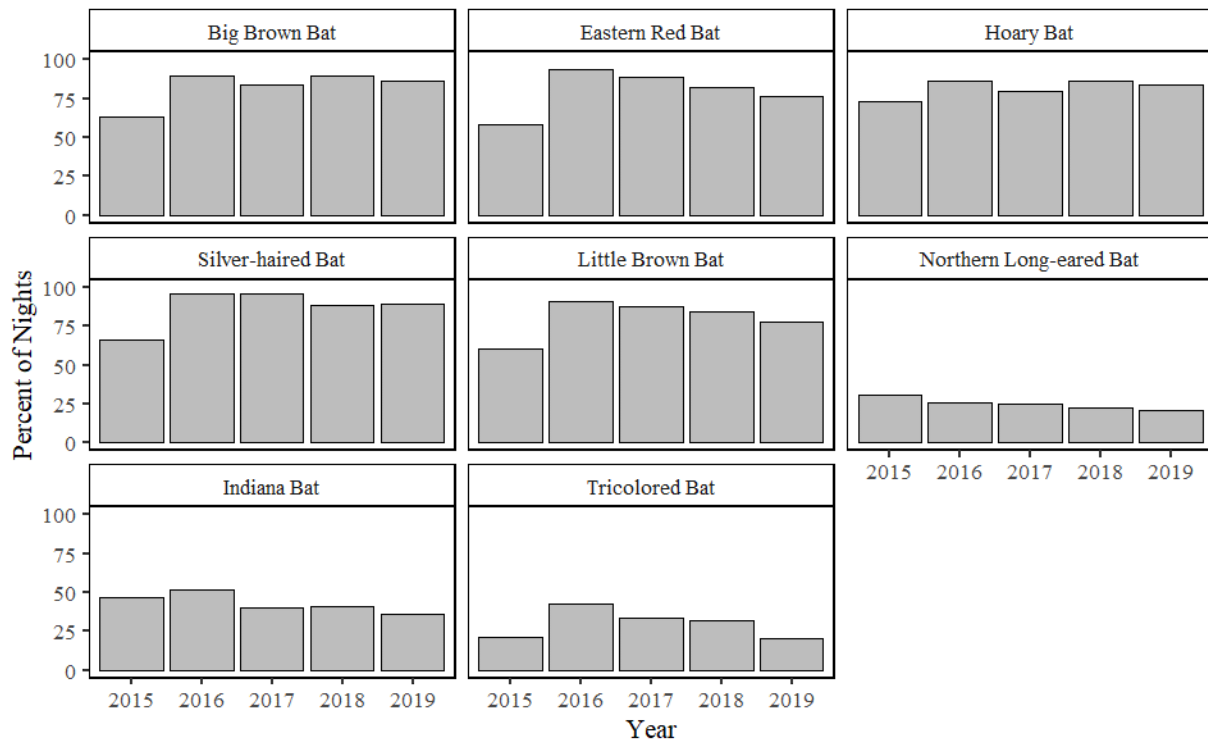


Figure 9. Proportion of recording nights on which each species was detected each year, Sleeping Bear Dunes National Lakeshore, 2015–2019. A species was considered to be detected on a night if at least one audio file was classified as that species by Kaleidoscope Pro. Results were similar for baseline and expanded analysis so only the expanded analysis is shown.

Manual Vetting

A small subset of audio files—approximately 1% of files identified to each species—was manually vetted. Because the 1% sometimes equated to only a few files, we required a minimum of 10 files per species to be vetted unless there were fewer than 10 files available (see Methods). Manual vetting resulted in a total of seven species being verified between 2015 and 2019. The Indiana bat was not verified through manual vetting. Detailed manual vetting results for the park as a whole are provided in Appendix F and for each monitoring site in Appendix G.

The percentage of files that were verified by manual vetting varied widely by species. The mean percentage verified (calculated parkwide, across all survey years) ranged from 0% for the Indiana bat to 84% for the eastern red bat (Appendix F). The variation in percentage verified is related to how difficult the calls are to identify. Ease of identification can depend on both call structure and recording environment. For example, the hoary bat consistently vocalizes at a much lower frequency than any other bat in the region, making its call signature unique and relatively easy to distinguish. On the other hand, the three *Myotis* species (little brown bat, northern long-eared bat, and Indiana bat) all produce very similar calls with highly overlapping call characteristics. Northern long-eared and little brown bat calls tend to be more distinctive from each other in cluttered environments, such as under a closed forest canopy, than in open environments (Broders et al. 2004) and can therefore sometimes be identified.

Summary and Conclusions

The five bat species previously documented at SLBE (see Table 1) were reconfirmed through this monitoring effort: big brown bat, eastern red bat, hoary bat, silver-haired bat, and little brown bat. Two additional species—the northern long-eared bat and tricolored bat—were also documented. Neither of these species have been confirmed at SLBE through physical captures, but our acoustic surveys suggest they are present, as evidenced by manually verified recordings of their calls. The manually verified recordings for the northern long-eared bat came from sites SLBE012A (Lake Manitou on North Manitou Island; two files in 2017) and SLBE021A (Boekeloo Road; one file each in 2017 and 2018). The manually verified recordings for the tricolored bat came from sites SLBE030A (Farm Loop on South Manitou Island; one file in 2016), SLBE023A (Alligator Hill; one file in 2017), SLBE024A (Crescent City on North Manitou Island; one file each in 2018 and 2019), and SLBE043A (Welch Road; one file in 2019). It is important to note that only a small number of the call files identified by the Kaleidoscope software as northern long-eared or tricolored bats have so far been manually reviewed (about 50 files for each species). Conducting additional manual review on the remaining files could increase the number of locations or years with positive records of these species.

Many acoustic files were classified as Indiana bat by the Kaleidoscope software. However, of the 54 files manually reviewed, none were able to be verified. Recordings of Indiana bat calls are extremely difficult to identify due to their overlap with little brown bat calls. To obtain a positive identification of this species, capture and in-hand identification will likely be required. The status of Indiana bat at SLBE remains unknown.

Our results showed a much higher percentage of files classified as noise in 2015 (see Figure 3) and a much lower rate of call files per recording night parkwide in 2015 (see Figure 6). The observed differences between 2015 and all other years are likely related, at least in part, to the change in monitoring locations and/or the change in monitoring equipment after the first year. Only four of the 2015 locations were resampled in later years. The older detector (SM2BAT+) and microphone (SM3-U1) models were used for several sites in 2015 but were not used at all after that first year. In 2015, sites that were surveyed using the SM2BAT+ had 85% of files classified as noise, while sites that were surveyed using the SM3BAT had only about 27% of files classified as noise, which more closely matches the noise levels in 2016–2019.

Taking into account these changes after 2015, activity levels for three of the eight species (big brown bat, hoary bat, and silver-haired bat) appeared to be stable. The remaining five species appeared to have decreasing trends in activity levels. Four of these (little brown, Indiana, northern long-eared, and tricolored bats) are highly susceptible to WNS, and the disease is most likely causing the observed declines. The fifth species (eastern red bat) is not susceptible to WNS but is one of the most frequently killed at wind energy facilities (Arnett et al. 2015). There are at least 25 operating wind energy facilities in Michigan, including one in Mason County about 65 miles south of SLBE. Migration routes of migratory bats are not well understood, but red bats are thought to move south and east, concentrating on the Atlantic and Gulf coasts for the winter (Cryan 2003). Hoary and silver-

haired bats also have high fatality rates at wind facilities, but do not seem to be declining at SLBE. The decrease in red bat activity may therefore be due to other unknown factors.

Results for each species are summarized below and in Table 2. For comparison purposes, species composition over time across all GLKN parks is provided in Appendix H. Recommendations for potential future areas of research are also given below.

Big Brown Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at over 90% of survey sites each year.
- Third most commonly recorded species in three out of five years. Accounted for 11%–23% of total files each year with a slight increasing trend.
- Recorded on a majority of nights every year, with the lowest percentage of nights occurring in 2015 (63%). Percentage of nights recorded was higher in the last four years, and consistent at about 84%–89%.
- Median call files per recording night slightly lower in 2015. Higher in 2016–2019 and similar across those four years.

Eastern Red Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at over 85% of survey sites each year.
- Within the top two most commonly recorded species in 2015–2016 but not later years. Accounted for 12%–33% of total files each year, with a decreasing trend in the last three years.
- Recorded on a majority of nights every year, with the lowest percentage of nights occurring in 2015 (about 60%). Percentage of nights recorded was higher in the last four years (76%–94%), but there is a decreasing trend from 2016 through 2019.
- Median call files per recording night lowest in 2015, higher and consistent between 2016 and 2018, then lower again in 2019.

Hoary Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at over 90% of survey sites each year.
- Fourth or fifth most commonly recorded species each year. Accounted for 9%–17% of total files.
- Recorded on a majority of nights every year, from 73%–86%.
- Median call files per recording night lowest in 2015 and higher in the last four years. Highest in 2018, while 2016, 2017, and 2019 were all similar.

Silver-haired Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at over 85% of survey sites each year.

- Within the top three most commonly recorded species in every year except 2015. Percent of total files ranged from 8%–28%, with 2015 significantly lower than the other four years.
- Recorded on a majority of nights every year, with the lowest percentage of nights occurring in 2015 (66%). Percentage of nights recorded was higher in the last four years, and consistent at about 88%–96%.
- Median call files per recording night much lower in 2015 and higher in the last four years. Comparable numbers in 2016 and 2017, and in 2018 and 2019. The highest median values were observed in 2018 and 2019.

Little Brown Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at over 90% of survey sites each year.
- Most commonly recorded species in three out of five years (2015, 2018, and 2019). Percent of total files ranged from 14%–44%, with 2015 significantly higher than the other four years.
- Recorded on a majority of nights every year, with the lowest percentage of nights occurring in 2015 (about 60%). Percentage of nights recorded was higher in the last four years (77%–91%), but there is a decreasing trend from 2016 through 2019.
- Median call files per recording night lowest in 2015. Higher in 2016–2019 and similar across those four years.

Northern Long-eared Bat

- Documented in every year of surveys via automated identification and verified manually in 2017–2018.
- Less widely distributed than other species: Present at 48%–71% of survey sites each year.
- Recorded rarely compared to other species: Less than 2% of total files each year.
- Recorded on only 21%–34% of nights each year, with a slight decreasing trend from 2015 to 2019.
- Median call files per recording night very low compared to all other species. The 2015 median was slightly higher than in 2016–2019, and values were similar among the last four years.

Indiana Bat

- Documented in every year of surveys via automated identification (expanded analysis only), but not manually verified.
- Less widely distributed than other species: Present at 64%–91% of sites each year.
- Recorded rarely compared to other species: About 1%–4% of total files each year.
- Recorded on only 36%–52% of nights each year.
- Median call files per recording night highest in 2015 and decreasing slightly in the following four years.

Tricolored Bat

- Documented in every year of surveys via automated identification (expanded analysis only) and verified manually in 2016–2019.
- Less widely distributed than other species: Present at 36%–88% of sites each year, with a decreasing trend from 2016 to 2019.
- Recorded rarely compared to other species: Less than 2% of total files each year.
- Recorded on only 21%–43% of nights each year, with a decreasing trend from 2016 to 2019.
- Median call files per recording night lowest in 2015. Higher and consistent between 2016 and 2018, then lower again in 2019. One site in 2016 (SLBE030A, Farm Loop on South Manitou Island) had a very high number of calls per recording night compared to all other sites in all years. The same site also had the highest tricolored bat calls per recording night in 2017 and 2018. It is possible that tricolored bats are roosting in the barns/buildings here.

Table 2. Summary of bat species documented at Sleeping Bear Dunes National Lakeshore through automated classification and manual vetting of acoustic files.

Species	Year	Detected	
		Automated	Manual
Big Brown Bat	2015	Yes	Yes
	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Eastern Red Bat	2015	Yes	Yes
	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Hoary Bat	2015	Yes	Yes
	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Silver-haired Bat	2015	Yes	Yes
	2016	Yes	Yes
	2017	Yes	Yes

Table 2 (continued). Summary of bat species documented at Sleeping Bear Dunes National Lakeshore through automated classification and manual vetting of acoustic files.

Species	Year	Detected	
		Automated	Manual
Silver-haired Bat (continued)	2018	Yes	Yes
	2019	Yes	Yes
Little Brown Bat	2015	Yes	Yes
	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Northern Long-eared Bat	2015	Yes	No
	2016	Yes	No
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	No
Indiana Bat	2015	Yes	No
	2016	Yes	No
	2017	Yes	No
	2018	Yes	No
	2019	Yes	No
Tricolored Bat	2015	Yes	No
	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes

Recommendations for Future Work

Future bat research at SLBE could include mist-netting and roost surveys targeting northern long-eared bats, tricolored bats, and Indiana bats. Although both mist-netting and roost surveys have been done in the past, none of these three species have been captured or directly observed. Recommended locations include sites with high numbers of calls per recording night for the target species and/or sites where call files were manually verified. Buildings at Treat Farm, Narada Lake/Goffer Farm, and the South Manitou Farm Loop could be investigated for possible use as roost sites.

- Suggested locations for northern long-eared bats:
 - SLBE007A. Treat Farm. High number of calls per recording night.
 - SLBE042A. Shalda Creek. High number of calls per recording night.
 - SLBE012A. Lake Manitou, North Manitou Island. Manual verification.
 - SLBE021A. Boekeloo Road. Manual verification.
- Suggested locations for Indiana bats:
 - SLBE007A. Treat Farm. High number of calls per recording night.
 - SLBE010A. Narada Lake/Goffer Farm. High number of calls per recording night.
 - SLBE042A. Shalda Creek. High number of calls per recording night.
- Suggested locations for tricolored bats:
 - SLBE030A. Farm Loop, South Manitou Island. High numbers of calls per recording night and manual verification.
 - SLBE023A. Alligator Hill. Manual verification.
 - SLBE024A. Crescent City, North Manitou Island. Manual verification.
 - SLBE043A. Welch Road. Manual verification.

Literature Cited

- Arnett, E. B., E. F. Baerwald, F. Mathews, L. Rodrigues, A. Rodriguez-Duran, J. Rydell, R. Villegas-Patraca, and C. C. Voigt. 2015. Impacts of wind energy development on bats: A global perspective. Pages 295–323 in C. C. Voigt and T. Kingston, editors. *Bats in the Anthropocene: Conservation of Bats in a Changing World*. Open access book available at: <https://link.springer.com/book/10.1007/978-3-319-25220-9>.
- Bohrman, J. 2014. Habitat assessment for the endangered Indiana bat (*Myotis sodalis*) and proposed-for-endangered northern long-eared bat (*Myotis septentrionalis*) at Sleeping Bear Dunes National Lakeshore, Empire, Michigan. Unpublished report to the National Park Service.
- Britzke, E. R., E. H. Gillam, and K. L. Murray. 2013. Current state of understanding of ultrasonic detectors for the study of bat ecology. *Acta Theriologica* 58(2):109–117.
- Broders, H. G., C. S. Findlay, and L. Zheng. 2004. Effects of clutter on echolocation call structure of *Myotis septentrionalis* and *M. lucifugus*. *Journal of Mammalogy* 85(2):273–281.
- Cryan, P. 2003. Seasonal distribution of migratory tree bats (*Lasiurus* and *Lasionycteris*) in North America. *Journal of Mammalogy* 84(2):579–593.
- Frank, C. L., A. Michalski, A. A. McDonough, M. Rahimian, R. J. Rudd, and C. Herzog. 2014. The resistance of a North American bat species (*Eptesicus fuscus*) to white-nose syndrome (WNS). *PLoS ONE* 9(12): e113958.
- Gehring, J., and B. Barton. 2011. Bat migration along the Lake Michigan and Lake Huron coastlines: A pilot study to inform wind turbine siting. Project Number 10-309-06. Michigan Natural Features Inventory, Report Number 2011-19. Prepared for Michigan Department of Environmental Quality.
- George, K., and A. Kurta. 2016. A search for the northern long-eared bat (*Myotis septentrionalis*) at Sleeping Bear Dunes National Lakeshore. Report on Cooperative Agreement P14AC01364 between Sleeping Bear Dunes National Lakeshore and Eastern Michigan University.
- Goodwin, K. R. 2020. Bat monitoring protocol for the Great Lakes Inventory and Monitoring Network: Version 1.0. Natural Resource Report NPS/GLKN/NRR—2020/2126. National Park Service, Fort Collins, Colorado. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2274095>.
- Gruver, J., P. Rabie, L. A. Starcevich, M. Romanski, and B. Route. 2016. Monitoring protocol for bats in the Great Lakes Inventory and Monitoring Network. Unpublished report to the National Park Service, Ashland, Wisconsin.
- Harvey, M. J., J. S. Altenbach, and T. L. Best. 2011. *Bats of the United States and Canada*. The Johns Hopkins University Press, Baltimore, Maryland.

- Indiana Division of Fish and Wildlife. 2020. Endangered and special concern species list. Available at: www.in.gov/dnr/naturepreserve/files/fw-Endangered_Species_List.pdf (accessed 18 September 2020).
- Kurta, A. 2017. Mammals of the Great Lakes Region. Third Edition. University of Michigan Press, Ann Arbor, Michigan.
- Kurta A., and P. Jablonsky. 2000. Chiroptera inventory at Sleeping Bear Dunes National Lakeshore. Investigator's Annual Report to the National Park Service.
- Kurta, A., and H. Rice. 2001. Bats and insects in Sleeping Bear Dunes National Lakeshore. Investigator's Annual Report to the National Park Service.
- Kurta, A., and H. Rice. 2002a. Bats and insects in Sleeping Bear Dunes National Lakeshore. Investigator's Annual Report to the National Park Service.
- Kurta, A., and H. Rice. 2002b. Ecology and management of the Indiana bat in Michigan. *Michigan Academician* 34(2):175–190.
- Kurta, A., and J. A. Teramino. 1994. A novel hibernaculum and noteworthy records of the Indiana bat and eastern pipistrelle (Chiroptera: Vespertilionidae). *American Midland Naturalist* 132(2):410–413.
- Kurta, A., L. Winhold, J. O. Whitaker, Jr., and R. Foster. 2007. Range expansion and changing abundance of the eastern pipistrelle (Chiroptera: Vespertilionidae) in the central Great Lakes region. *American Midland Naturalist* 157(2):404–411.
- Larsen, D. P., A. R. Olsen, and D. L. Stevens, Jr. 2008. Using a master sample to integrate stream monitoring programs. *Journal of Agricultural, Biological, and Environmental Statistics* 13(3):243–254.
- Loeb, S. C., T. J. Rodhouse, L. E. Ellison, C. L. Lausen, J. D. Reichard, K. M. Irvine, T. E. Ingersoll, J. T. H. Coleman, W. E. Thogmartin, J. R. Sauer, C. M. Francis, M. L. Bayless, T. R. Stanley, and D. H. Johnson. 2015. A plan for the North American Bat Monitoring Program (NABat). General Technical Report SRS-208. U.S. Department of Agriculture Forest Service, Southern Research Station, Asheville, North Carolina.
- Michigan Natural Features Inventory. 2009. Michigan's special animals: Endangered, threatened, special concern, and probably extirpated. Available at: <https://mnfi.anr.msu.edu/species/animals> (accessed 18 September 2020).
- Minnesota Department of Natural Resources. 2013. Minnesota's list of endangered, threatened, and special concern species. Available at: http://files.dnr.state.mn.us/natural_resources/ets/endlist.pdf (accessed 18 September 2020).

- Moore, M. S., K. A. Field, M. J. Behr, G. G. Turner, M. E. Furze, D. W. F. Stern, P. R. Allegra, S. A. Bouboulis, C. D. Musante, M. E. Vodzak, M. E. Biron, M. B. Meierhofer, W. F. Frick, J. T. Foster, D. Howell, J. A. Kath, A. Kurta, G. Nordquist, J. S. Johnson, T. M. Lilley, B. W. Barrett, and D. M. Reeder. 2018. Energy conserving thermoregulatory patterns and lower disease severity in a bat resistant to the impacts of white-nose syndrome. *Journal of Comparative Physiology B* 188(1):163–176.
- National Park Service. 2016. Protecting bats in parks. Available at: www.nps.gov/subjects/bats/protecting-bats-in-parks.htm (accessed 18 September 2020).
- Reichert, B., C. Lausen, S. Loeb, T. Weller, R. Allen, E. Britzke, T. Hohoff, J. Siemers, B. Burkholder, C. Herzog, and M. Verant. 2018. A guide to processing bat acoustic data for the North American Bat Monitoring Program (NABat). U.S. Geological Survey Open-File Report 2018–1068. U.S. Geological Survey, Reston, Virginia. Available at: <https://doi.org/10.3133/ofr20181068> (accessed 18 September 2020).
- Rodhouse, T. J., T. E. Phillipi, W. B. Monahan, and K. T. Castle. 2016. A macroecological perspective on strategic bat conservation in the U.S. National Park Service. *Ecosphere* 7:1–17.
- Rodriguez, R. M., T. J. Rodhouse, J. Barnett, K. M. Irvine, K. M. Banner, J. Lonneker, and P. C. Ormsbee. 2019. North American Bat Monitoring Program regional protocol for surveying with 34 stationary deployments of echolocation recording devices: Version 1.0, Pacific Northwestern US. Natural Resource Report NPS/UCBN/NRR—2019/1975. National Park Service, Fort Collins, Colorado.
- Scharf, W. C. 1973. Birds and land vertebrates of South Manitou Island. *The Jack-Pine Warbler* 51(1):2–19.
- Scharf, W. C., and M. L. Jorae. 1980. Birds and land vertebrates of North Manitou Island. *The Jack-Pine Warbler* 58(1):4–15.
- Seefelt, N. 2013. Bird and bat use of islands and coastal areas of northern Lake Michigan. Final Report to the Michigan DEQ Coastal Management Program.
- Stevens, D. L., and A. R. Olsen. 2004. Spatially balanced sampling of natural resources. *Journal of the American Statistical Association* 99:262–278.
- U. S. Fish and Wildlife Service. 1967. Native fish and wildlife—Endangered species. Federal Register 32(48). Available at: www.fws.gov/endangered/species/pdf/32FedReg_pg%204001.pdf (accessed 18 September 2020).
- U. S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; Determination that designation of critical habitat is not prudent for the northern long-eared bat. Federal Register, 81(81). Available at: www.govinfo.gov/content/pkg/FR-2016-04-27/pdf/2016-09673.pdf (accessed 18 September 2020).

U. S. Geological Survey. 2019. White-nose syndrome spread maps (August 30, 2019 version).
Available at: www.whitenosesyndrome.org/resources/map (accessed 18 September 2020).

Wisconsin Department of Natural Resources. 2016. Wisconsin Natural Heritage working list.
Available at: <https://dnr.wi.gov/topic/NHI/documents/NHIWorkingList.pdf> (accessed 18 September 2020).

Appendix A. Bat Species of the Great Lakes Region.

Table A1. Nine bat species are found in the Great Lakes region. Species affected by white-nose syndrome (WNS) are listed as “Confirmed” if they have been identified with diagnostic symptoms of the disease, or “Pd Positive” if the causative fungus *Pseudogymnoascus destructans* has been detected but without diagnostic symptoms of the disease. Federal/state status is indicated as E (Endangered), T (Threatened), or SC (Special Concern).

Species Name	Roosting/Wintering Behavior	WNS Affected? ^a	Federal Status ^b	State Status ^c
Big Brown Bat <i>Eptesicus fuscus</i>	Cavity-roosting/ Hibernating	Confirmed WNS	–	T (WI) SC (MN)
Eastern Red Bat <i>Lasiurus borealis</i>	Tree-roosting/ Migratory	Pd Positive	–	SC (IN)
Hoary Bat <i>Lasiurus cinereus</i>	Tree-roosting/ Migratory	–	–	SC (IN)
Silver-haired Bat <i>Lasionycteris noctivagans</i>	Tree-roosting/ Migratory	Pd Positive	–	SC (IN, WI)
Little Brown Bat <i>Myotis lucifugus</i>	Cavity-roosting/ Hibernating	Confirmed WNS	–	E (IN) T (WI) SC (MI, MN)
Northern Long-eared Bat <i>Myotis septentrionalis</i>	Cavity-roosting/ Hibernating	Confirmed WNS	T	E (IN) T (WI) SC (MI, MN)
Indiana Bat <i>Myotis sodalis</i>	Cavity-roosting/ Hibernating	Confirmed WNS	E	E (IN, MI)
Evening Bat <i>Nycticeius humeralis</i>	Tree-roosting/ Migratory	–	–	E (IN) T (MI)
Tricolored Bat <i>Perimyotis subflavus</i>	Cavity-roosting/ Hibernating	Confirmed WNS	–	E (IN) T (WI) SC (MI, MN)

^a White-nose Syndrome Response Team, www.whitenosesyndrome.org

^b U. S. Fish and Wildlife Service (1967, 2016)

^c Indiana Division of Fish and Wildlife (2020), Michigan Natural Features Inventory (2009), Minnesota Department of Natural Resources (2013), Wisconsin Department of Natural Resources (2016)

Appendix B. Baseline and Expanded Species Lists.

Table B1. Bat species included as possible candidates during Kaleidoscope Pro species classification. The first column shows the “baseline” species group (known ranges within the boundaries of the park). The second column shows the “expanded” species group (documented near the park, possibly present).

Species Name	Baseline Analysis	Expanded Analysis
Big Brown Bat <i>Eptesicus fuscus</i>	X	X
Eastern Red Bat <i>Lasiurus borealis</i>	X	X
Hoary Bat <i>Lasiurus cinereus</i>	X	X
Silver-haired Bat <i>Lasionycteris noctivagans</i>	X	X
Little Brown Bat <i>Myotis lucifugus</i>	X	X
Northern Long-eared Bat <i>Myotis septentrionalis</i>	X	X
Indiana Bat <i>Myotis sodalist</i>	—	X
Tricolored Bat <i>Perimyotis subflavus</i>	—	X

Appendix C. Analysis Settings for Kaleidoscope Pro.

The following software settings were used during Kaleidoscope Pro analysis for species classification. Although two different software versions were used, the classifier did not change, so results are still comparable.

Software Version: Kaleidoscope Pro 4.0.0 (2015–2018 data) and Kaleidoscope Pro 5.0.3 (2019 data)

Classifier: Bats of North America 3.1.0

Classifier Sensitivity: –1 More Sensitive/Liberal

Signal Parameters:

Frequency: 8–120 kHz

Duration: 2–500 ms

Maximum inter-syllable gap: 500 ms

Minimum Number of Pulses: 2

Full spectrum WAV files were converted to zero crossing format before analysis.

Zero crossing conversion/analysis was enhanced with advanced signal processing option.

Appendix D. Yearly Deployment Data.

Table D1. Earliest and latest dates equipment was deployed, number of deployments in each category, and total number of files recorded for each survey year at Sleeping Bear Dunes National Lakeshore, 2015–2019.

Year	Earliest	Latest	Deployment Category ¹							Total Files
			Early	Failed	Failed (short)	Late	Non-protocol	Valid	Valid (dupl.)	
2015	24 June	15 September	0	3	2	5	0	14	8	37,768
2016	26 April	13 August	3	2	0	0	0	34	0	69,356
2017	30 May	10 August	0	0	0	0	0	35	0	58,279
2018	3 June	1 August	0	0	0	0	0	35	0	54,890
2019	31 May	12 August	0	2	1	0	0	31	1	39,148

¹ “Early” = deployment occurred before 1 June, outside the protocol sampling period.

“Failed” = deployment was unsuccessful due to equipment malfunction, improper programming, and/or vandalism.

“Failed (short)” = deployment was unsuccessful because the minimum required four nights of recording were not completed.

“Late” = deployment occurred after 15 August, outside the protocol sampling period.

“Non-protocol” = deployments completed for park-specific monitoring goals at locations selected intentionally, rather than following the GRTS sample design.

“Valid” = deployment with at least four nights of successful recording during the protocol sampling period (1 June–15 August).

“Valid (dupl.)” = valid deployment at a particular site in addition to the first valid deployment.

Table D2. Total number of sites, recording nights, files recorded, and mean recording nights per site, mean files per site, and mean files per recording night for each survey year’s valid deployments only, Sleeping Bear Dunes National Lakeshore, 2015–2019. This table corresponds to Figure 2 in the main text.

Year	Total Sites	Total Nights	Mean Nights Per Site	Total Files	Mean Files Per Site	Mean Files Per Night
2015	14	129	9.21	26,677	1,906	207
2016	34	298	8.76	69,035	2,030	232
2017	35	299	8.54	58,279	1,665	195
2018	35	312	8.91	54,890	1,568	176
2019	31	234	7.55	38,705	1,249	165

Appendix E. Automated Classification Results.

Table E1. Total number of audio files recorded, and number and percent classified by Kaleidoscope Pro as bat species vs. unknown bats vs. noise or corrupt files for each year and analysis type, Sleeping Bear Dunes National Lakeshore, 2015–2019. Only data from valid deployments are shown. This table corresponds to Figure 3 in the main text.

Year	Analysis	Total Files	# Bat Species	# Bat Unknown	# Noise	% Bat Species	% Bat Unknown	% Noise
2015	baseline	26,677	14,058	159	12,460	52.70	0.60	46.71
2015	expanded	26,677	13,949	268	12,460	52.29	1.00	46.71
2016	baseline	69,035	60,337	519	8,179	87.40	0.75	11.85
2016	expanded	69,035	60,105	751	8,179	87.06	1.09	11.85
2017	baseline	58,279	50,457	386	7,436	86.58	0.66	12.76
2017	expanded	58,279	50,311	532	7,436	86.33	0.91	12.76
2018	baseline	54,890	47,898	363	6,629	87.26	0.66	12.08
2018	expanded	54,890	47,771	490	6,629	87.03	0.89	12.08
2019	baseline	38,705	31,146	289	7,270	80.47	0.75	18.78
2019	expanded	38,705	31,060	375	7,270	80.25	0.97	18.78

Table E2. Total number of audio files classified as each bat species by Kaleidoscope Pro for each year and analysis type at Sleeping Bear Dunes National Lakeshore, 2015–2019. Indiana bat and tricolored bat were allowed as possible species only in the expanded analysis. Only data from valid deployments are shown.

Year	Analysis	Big Brown Bat	Eastern Red Bat	Hoary Bat	Silver-haired Bat	Little Brown Bat	Northern Long-eared Bat	Indiana Bat	Tricolored Bat
2015	baseline	1,495	3,762	1,307	1,126	6,201	167	n/a	n/a
2015	expanded	1,499	3,263	1,307	1,124	5,952	121	579	104
2016	baseline	9,244	19,735	5,889	11,888	13,180	401	n/a	n/a
2016	expanded	9,268	18,349	5,903	11,903	12,039	340	1,472	831
2017	baseline	10,222	10,873	7,449	14,100	7,502	311	n/a	n/a
2017	expanded	10,231	10,270	7,454	14,119	6,866	252	776	343
2018	baseline	9,029	7,491	8,074	10,113	12,888	303	n/a	n/a
2018	expanded	9,049	7,014	8,102	10,117	11,792	208	1,176	313
2019	baseline	7,105	3,953	4,028	6,858	8,915	287	n/a	n/a
2019	expanded	7,107	3,787	4,035	6,869	7,974	186	992	110

Table E3. Percent of audio files classified as each bat species by Kaleidoscope Pro for each year and analysis type at Sleeping Bear Dunes National Lakeshore, 2015–2019. Indiana bat and tricolored bat were allowed as possible species only in the expanded analysis. Only data from valid deployments are shown. This table corresponds to Figures 4 and 5 in the main text.

Year	Analysis	Big Brown Bat	Eastern Red Bat	Hoary Bat	Silver-haired Bat	Little Brown Bat	Northern Long-eared Bat	Indiana Bat	Tricolored Bat
2015	baseline	10.63	26.76	9.30	8.01	44.11	1.19	n/a	n/a
2015	expanded	10.75	23.39	9.37	8.06	42.67	0.87	4.15	0.75
2016	baseline	15.32	32.71	9.76	19.70	21.84	0.66	n/a	n/a
2016	expanded	15.42	30.53	9.82	19.80	20.03	0.57	2.45	1.38
2017	baseline	20.26	21.55	14.76	27.94	14.87	0.62	n/a	n/a
2017	expanded	20.34	20.41	14.82	28.06	13.65	0.50	1.54	0.68
2018	baseline	18.85	15.64	16.86	21.11	26.91	0.63	n/a	n/a
2018	expanded	18.94	14.68	16.96	21.18	24.68	0.44	2.46	0.66
2019	baseline	22.81	12.69	12.93	22.02	28.62	0.92	n/a	n/a
2019	expanded	22.88	12.19	12.99	22.12	25.67	0.60	3.19	0.35

Table E4. Total number of monitoring sites, and count of sites where each species was detected for each year and analysis type, Sleeping Bear Dunes National Lakeshore, 2015–2019. A species was considered to be detected at a site if at least one audio file was classified by Kaleidoscope Pro to that species. Indiana bat and tricolored bat were allowed as possible species only in the expanded analysis.

Year	Analysis	Total Sites	Big Brown Bat	Eastern Red Bat	Hoary Bat	Silver-haired Bat	Little Brown Bat	Northern Long-eared Bat	Indiana Bat	Tricolored Bat
2015	baseline	14	13	12	13	12	13	8	n/a	n/a
2015	expanded	14	13	12	13	12	13	9	9	5
2016	baseline	34	34	34	34	34	34	20	n/a	n/a
2016	expanded	34	34	34	34	34	34	18	31	30
2017	baseline	35	35	34	35	35	35	25	n/a	n/a
2017	expanded	35	35	34	35	35	35	24	30	29
2018	baseline	35	35	32	35	35	33	22	n/a	n/a
2018	expanded	35	35	33	35	35	33	20	23	27
2019	baseline	31	31	30	31	31	31	16	n/a	n/a
2019	expanded	31	31	30	31	31	30	15	21	17

Table E5. Total number of monitoring sites, and percent of sites where each species was detected for each year and analysis type, Sleeping Bear Dunes National Lakeshore, 2015–2019. A species was considered to be detected at a site if at least one audio file was classified by Kaleidoscope Pro to that species. Indiana bat and tricolored bat were allowed as possible species only in the expanded analysis. This table corresponds to Figure 8 in the main text.

Year	Analysis	Total Sites	Big Brown Bat	Eastern Red Bat	Hoary Bat	Silver-haired Bat	Little Brown Bat	Northern Long-eared Bat	Indiana Bat	Tricolored Bat
2015	baseline	14	92.86	85.71	92.86	85.71	92.86	57.14	n/a	n/a
2015	expanded	14	92.86	85.71	92.86	85.71	92.86	64.29	64.29	35.71
2016	baseline	34	100.00	100.00	100.00	100.00	100.00	58.82	n/a	n/a
2016	expanded	34	100.00	100.00	100.00	100.00	100.00	52.94	91.18	88.24
2017	baseline	35	100.00	97.14	100.00	100.00	100.00	71.43	n/a	n/a
2017	expanded	35	100.00	97.14	100.00	100.00	100.00	68.57	85.71	82.86
2018	baseline	35	100.00	91.43	100.00	100.00	94.29	62.86	n/a	n/a
2018	expanded	35	100.00	94.29	100.00	100.00	94.29	57.14	65.71	77.14
2019	baseline	31	100.00	96.77	100.00	100.00	100.00	51.61	n/a	n/a
2019	expanded	31	100.00	96.77	100.00	100.00	96.77	48.39	67.74	54.84

Table E6. Total number of recording nights, and count of recording nights on which each species was detected for each year and analysis type, Sleeping Bear Dunes National Lakeshore, 2015–2019. A species was considered to be detected on a night if at least one audio file was classified by Kaleidoscope Pro to that species. Indiana bat and tricolored bat were allowed as possible species only in the expanded analysis.

Year	Analysis	Total Nights	Big Brown Bat	Eastern Red Bat	Hoary Bat	Silver- haired Bat	Little Brown Bat	Northern Long- eared Bat	Indiana Bat	Tricolored Bat
2015	baseline	129	81	77	94	85	80	44	n/a	n/a
2015	expanded	129	81	75	94	85	78	40	60	27
2016	baseline	298	266	280	256	284	271	88	n/a	n/a
2016	expanded	298	266	278	256	284	271	78	154	128
2017	baseline	299	251	268	237	286	260	86	n/a	n/a
2017	expanded	299	251	266	237	286	261	75	121	101
2018	baseline	312	279	257	268	276	265	84	n/a	n/a
2018	expanded	312	278	255	268	276	263	71	127	101
2019	baseline	234	202	180	196	208	181	60	n/a	n/a
2019	expanded	234	202	178	196	208	181	49	85	48

Table E7. Total number of recording nights, and percent of recording nights on which each species was detected for each year and analysis type, Sleeping Bear Dunes National Lakeshore, 2015–2019. A species was considered to be detected on a night if at least one audio file was classified by Kaleidoscope Pro to that species. Indiana bat and tricolored bat were allowed as possible species only in the expanded analysis. This table corresponds to Figure 9 in the main text.

Year	Analysis	Total Nights	Big Brown Bat	Eastern Red Bat	Hoary Bat	Silver- haired Bat	Little Brown Bat	Northern Long- eared Bat	Indiana Bat	Tricolored Bat
2015	baseline	129	62.79	59.69	72.87	65.89	62.02	34.11	n/a	n/a
2015	expanded	129	62.79	58.14	72.87	65.89	60.47	31.01	46.51	20.93
2016	baseline	298	89.26	93.96	85.91	95.30	90.94	29.53	n/a	n/a
2016	expanded	298	89.26	93.29	85.91	95.30	90.94	26.17	51.68	42.95
2017	baseline	299	83.95	89.63	79.26	95.65	86.96	28.76	n/a	n/a
2017	expanded	299	83.95	88.96	79.26	95.65	87.29	25.08	40.47	33.78
2018	baseline	312	89.42	82.37	85.90	88.46	84.94	26.92	n/a	n/a
2018	expanded	312	89.10	81.73	85.90	88.46	84.29	22.76	40.71	32.37
2019	baseline	234	86.32	76.92	83.76	88.89	77.35	25.64	n/a	n/a
2019	expanded	234	86.32	76.07	83.76	88.89	77.35	20.94	36.32	20.51

Appendix F. Manual Vetting Results for Entire Park.

Manual vetting was performed on approximately 1% of call files classified to each species by Kaleidoscope Pro (or minimum of 10 files).

Table F1. Total number of files manually vetted, and the results of manual vetting for each year, analysis type, and species at Sleeping Bear Dunes National Lakeshore, 2015–2019. “Verified” indicates that the manual identification matched, and thus verified, the automated identification.

Year	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2015	baseline	Big Brown Bat	14	5	35.71
2015	baseline	Eastern Red Bat	43	36	83.72
2015	baseline	Hoary Bat	13	8	61.54
2015	baseline	Silver-haired Bat	11	3	27.27
2015	baseline	Little Brown Bat	63	28	44.44
2015	baseline	Northern Long-eared Bat	9	0	0.00
2015	expanded	Indiana Bat	8	0	0.00
2015	expanded	Tricolored Bat	10	0	0.00
2016	baseline	Big Brown Bat	92	16	17.39
2016	baseline	Eastern Red Bat	197	180	91.37
2016	baseline	Hoary Bat	59	42	71.19
2016	baseline	Silver-haired Bat	119	84	70.59
2016	baseline	Little Brown Bat	132	89	67.42
2016	baseline	Northern Long-eared Bat	10	0	0.00
2016	expanded	Indiana Bat	15	0	0.00
2016	expanded	Tricolored Bat	10	1	10.00
2017	baseline	Big Brown Bat	102	60	58.82
2017	baseline	Eastern Red Bat	109	97	88.99
2017	baseline	Hoary Bat	74	49	66.22
2017	baseline	Silver-haired Bat	141	95	67.38
2017	baseline	Little Brown Bat	75	62	82.67
2017	baseline	Northern Long-eared Bat	10	3	30.00
2017	expanded	Indiana Bat	10	0	0.00
2017	expanded	Tricolored Bat	10	1	10.00

Year	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2018	baseline	Big Brown Bat	90	31	34.44
2018	baseline	Eastern Red Bat	75	59	78.67
2018	baseline	Hoary Bat	81	39	48.15
2018	baseline	Silver-haired Bat	101	57	56.44
2018	baseline	Little Brown Bat	129	110	85.27
2018	baseline	Northern Long-eared Bat	10	1	10.00
2018	expanded	Indiana Bat	12	0	0.00
2018	expanded	Tricolored Bat	10	1	10.00
2019	baseline	Big Brown Bat	71	41	57.75
2019	baseline	Eastern Red Bat	40	31	77.50
2019	baseline	Hoary Bat	41	24	58.54
2019	baseline	Silver-haired Bat	69	19	27.54
2019	baseline	Little Brown Bat	90	65	72.22
2019	baseline	Northern Long-eared Bat	10	0	0.00
2019	expanded	Indiana Bat	9	0	0.00
2019	expanded	Tricolored Bat	10	2	20.00

Appendix G. Manual Vetting Results by Site.

Manual vetting was performed on approximately 1% of call files classified to each species by Kaleidoscope Pro (or minimum of 10 files). This was 1% parkwide, so not every combination of monitoring site/species had files vetted.

Table G1. Total number of files manually vetted, and the results of manual vetting for each year, site, analysis type, and species at Sleeping Bear Dunes National Lakeshore, 2015–2019. “Verified” indicates that the manual identification matched, and thus verified, the automated identification.

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2015	BSCR_2015	baseline	Big Brown Bat	3	1	33.33
2015	BSCR_2015	baseline	Eastern Red Bat	17	15	88.24
2015	BSCR_2015	baseline	Little Brown Bat	6	0	0.00
2015	BSCR_2015	baseline	Northern Long-eared Bat	1	0	0.00
2015	BSCR_2015	expanded	Indiana Bat	2	0	0.00
2015	BSCR_2015	expanded	Tricolored Bat	1	0	0.00
2015	CDRS_2015	baseline	Northern Long-eared Bat	1	0	0.00
2015	DELA_2015	baseline	Hoary Bat	1	1	100.00
2015	DELA_2015	baseline	Silver-haired Bat	1	1	100.00
2015	DELA_2015	baseline	Northern Long-eared Bat	1	0	0.00
2015	DRWR_2015	baseline	Big Brown Bat	1	1	100.00
2015	DRWR_2015	baseline	Eastern Red Bat	16	13	81.25
2015	DRWR_2015	baseline	Hoary Bat	4	1	25.00
2015	DRWR_2015	baseline	Little Brown Bat	18	8	44.44
2015	DRWR_2015	baseline	Northern Long-eared Bat	2	0	0.00
2015	DRWR_2015	expanded	Tricolored Bat	6	0	0.00
2015	GTFS_2015	baseline	Big Brown Bat	1	0	0.00
2015	GTFS_2015	baseline	Silver-haired Bat	1	0	0.00
2015	GURA_2015	baseline	Big Brown Bat	4	1	25.00
2015	GURA_2015	baseline	Eastern Red Bat	1	1	100.00
2015	GURA_2015	baseline	Silver-haired Bat	5	1	20.00
2015	GURA_2015	baseline	Little Brown Bat	1	1	100.00
2015	PSFL_2015	baseline	Silver-haired Bat	1	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2015	SLBE007A_2015	baseline	Eastern Red Bat	1	0	0.00
2015	SLBE011A_2015	baseline	Big Brown Bat	3	2	66.67
2015	SLBE011A_2015	baseline	Eastern Red Bat	8	7	87.50
2015	SLBE011A_2015	baseline	Little Brown Bat	2	1	50.00
2015	SLBE011A_2015	expanded	Indiana Bat	2	0	0.00
2015	SLBE011A_2015	expanded	Tricolored Bat	3	0	0.00
2015	SLBE042B_2015	baseline	Big Brown Bat	2	0	0.00
2015	SLBE042B_2015	baseline	Hoary Bat	8	6	75.00
2015	SLBE042B_2015	baseline	Silver-haired Bat	3	1	33.33
2015	SLBE042B_2015	baseline	Little Brown Bat	36	18	50.00
2015	SLBE042B_2015	baseline	Northern Long-eared Bat	4	0	0.00
2015	SLBE042B_2015	expanded	Indiana Bat	4	0	0.00
2016	SLBE001A_2016	baseline	Hoary Bat	1	0	0.00
2016	SLBE001A_2016	baseline	Silver-haired Bat	4	4	100.00
2016	SLBE002A_2016	baseline	Big Brown Bat	1	0	0.00
2016	SLBE002A_2016	baseline	Silver-haired Bat	1	1	100.00
2016	SLBE003A_2016	baseline	Silver-haired Bat	5	5	100.00
2016	SLBE004A_2016	baseline	Big Brown Bat	1	0	0.00
2016	SLBE004A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	SLBE004A_2016	baseline	Silver-haired Bat	23	16	69.57
2016	SLBE004A_2016	baseline	Little Brown Bat	2	0	0.00
2016	SLBE005A_2016	baseline	Big Brown Bat	9	0	0.00
2016	SLBE005A_2016	baseline	Silver-haired Bat	3	2	66.67
2016	SLBE005A_2016	baseline	Little Brown Bat	2	1	50.00
2016	SLBE006A_2016	baseline	Big Brown Bat	5	0	0.00
2016	SLBE006A_2016	baseline	Silver-haired Bat	9	6	66.67
2016	SLBE007A_2016	baseline	Big Brown Bat	4	1	25.00
2016	SLBE007A_2016	baseline	Eastern Red Bat	1	0	0.00
2016	SLBE007A_2016	baseline	Hoary Bat	1	0	0.00
2016	SLBE007A_2016	baseline	Silver-haired Bat	2	2	100.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2016	SLBE007A_2016	baseline	Little Brown Bat	32	26	81.25
2016	SLBE007A_2016	baseline	Northern Long-eared Bat	4	0	0.00
2016	SLBE007A_2016	expanded	Indiana Bat	2	0	0.00
2016	SLBE009A_2016	baseline	Eastern Red Bat	6	6	100.00
2016	SLBE009A_2016	baseline	Silver-haired Bat	1	1	100.00
2016	SLBE009A_2016	baseline	Little Brown Bat	3	3	100.00
2016	SLBE009A_2016	expanded	Indiana Bat	2	0	0.00
2016	SLBE010A_2016	baseline	Big Brown Bat	4	1	25.00
2016	SLBE010A_2016	baseline	Eastern Red Bat	6	3	50.00
2016	SLBE010A_2016	baseline	Hoary Bat	2	1	50.00
2016	SLBE010A_2016	baseline	Silver-haired Bat	7	5	71.43
2016	SLBE010A_2016	baseline	Little Brown Bat	18	14	77.78
2016	SLBE010A_2016	baseline	Northern Long-eared Bat	1	0	0.00
2016	SLBE010A_2016	expanded	Indiana Bat	3	0	0.00
2016	SLBE011A_2016	baseline	Big Brown Bat	1	1	100.00
2016	SLBE011A_2016	baseline	Silver-haired Bat	5	5	100.00
2016	SLBE011A_2016	baseline	Little Brown Bat	1	0	0.00
2016	SLBE012A_2016	baseline	Big Brown Bat	3	2	66.67
2016	SLBE012A_2016	baseline	Eastern Red Bat	3	3	100.00
2016	SLBE012A_2016	baseline	Hoary Bat	9	8	88.89
2016	SLBE012A_2016	baseline	Silver-haired Bat	3	2	66.67
2016	SLBE012A_2016	baseline	Little Brown Bat	3	3	100.00
2016	SLBE012A_2016	baseline	Northern Long-eared Bat	1	0	0.00
2016	SLBE012A_2016	expanded	Indiana Bat	1	0	0.00
2016	SLBE013A_2016	baseline	Big Brown Bat	1	0	0.00
2016	SLBE013A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	SLBE013A_2016	baseline	Silver-haired Bat	1	0	0.00
2016	SLBE013A_2016	expanded	Tricolored Bat	2	0	0.00
2016	SLBE014A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	SLBE014A_2016	baseline	Silver-haired Bat	8	5	62.50

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2016	SLBE014A_2016	baseline	Little Brown Bat	1	1	100.00
2016	SLBE015A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	SLBE015A_2016	baseline	Silver-haired Bat	1	1	100.00
2016	SLBE016A_2016	baseline	Big Brown Bat	1	0	0.00
2016	SLBE016A_2016	baseline	Eastern Red Bat	13	12	92.31
2016	SLBE016A_2016	baseline	Hoary Bat	9	4	44.44
2016	SLBE016A_2016	baseline	Silver-haired Bat	3	1	33.33
2016	SLBE016A_2016	baseline	Little Brown Bat	5	1	20.00
2016	SLBE016A_2016	baseline	Northern Long-eared Bat	1	0	0.00
2016	SLBE018A_2016	baseline	Big Brown Bat	1	0	0.00
2016	SLBE018A_2016	baseline	Eastern Red Bat	2	2	100.00
2016	SLBE019A_2016	baseline	Big Brown Bat	7	5	71.43
2016	SLBE019A_2016	baseline	Eastern Red Bat	10	9	90.00
2016	SLBE019A_2016	baseline	Silver-haired Bat	1	1	100.00
2016	SLBE019A_2016	baseline	Little Brown Bat	9	2	22.22
2016	SLBE019A_2016	expanded	Tricolored Bat	1	0	0.00
2016	SLBE021A_2016	baseline	Big Brown Bat	4	2	50.00
2016	SLBE021A_2016	baseline	Little Brown Bat	3	2	66.67
2016	SLBE021A_2016	expanded	Indiana Bat	1	0	0.00
2016	SLBE022A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	SLBE022A_2016	baseline	Little Brown Bat	3	3	100.00
2016	SLBE023A_2016	baseline	Big Brown Bat	3	1	33.33
2016	SLBE023A_2016	baseline	Silver-haired Bat	3	1	33.33
2016	SLBE023A_2016	baseline	Little Brown Bat	1	0	0.00
2016	SLBE024A_2016	baseline	Eastern Red Bat	11	10	90.91
2016	SLBE024A_2016	baseline	Little Brown Bat	10	8	80.00
2016	SLBE025A_2016	baseline	Eastern Red Bat	1	0	0.00
2016	SLBE025A_2016	baseline	Little Brown Bat	3	3	100.00
2016	SLBE025A_2016	expanded	Indiana Bat	1	0	0.00
2016	SLBE026A_2016	baseline	Eastern Red Bat	3	2	66.67

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2016	SLBE026A_2016	baseline	Hoary Bat	6	6	100.00
2016	SLBE026A_2016	baseline	Silver-haired Bat	4	4	100.00
2016	SLBE026A_2016	baseline	Little Brown Bat	2	2	100.00
2016	SLBE028A_2016	baseline	Big Brown Bat	9	2	22.22
2016	SLBE028A_2016	baseline	Eastern Red Bat	46	44	95.65
2016	SLBE028A_2016	baseline	Hoary Bat	1	1	100.00
2016	SLBE028A_2016	baseline	Silver-haired Bat	1	0	0.00
2016	SLBE028A_2016	expanded	Tricolored Bat	1	0	0.00
2016	SLBE029A_2016	baseline	Hoary Bat	1	0	0.00
2016	SLBE029A_2016	baseline	Silver-haired Bat	1	1	100.00
2016	SLBE030A_2016	baseline	Eastern Red Bat	52	48	92.31
2016	SLBE030A_2016	baseline	Hoary Bat	3	3	100.00
2016	SLBE030A_2016	baseline	Little Brown Bat	5	2	40.00
2016	SLBE030A_2016	baseline	Northern Long-eared Bat	3	0	0.00
2016	SLBE030A_2016	expanded	Tricolored Bat	4	1	25.00
2016	SLBE035A_2016	baseline	Big Brown Bat	2	0	0.00
2016	SLBE035A_2016	baseline	Eastern Red Bat	4	3	75.00
2016	SLBE035A_2016	baseline	Silver-haired Bat	1	1	100.00
2016	SLBE036A_2016	baseline	Big Brown Bat	27	1	3.70
2016	SLBE036A_2016	baseline	Eastern Red Bat	16	16	100.00
2016	SLBE036A_2016	baseline	Hoary Bat	13	11	84.62
2016	SLBE036A_2016	baseline	Silver-haired Bat	27	18	66.67
2016	SLBE036A_2016	baseline	Little Brown Bat	5	3	60.00
2016	SLBE038A_2016	baseline	Big Brown Bat	2	0	0.00
2016	SLBE038A_2016	baseline	Eastern Red Bat	8	8	100.00
2016	SLBE038A_2016	baseline	Hoary Bat	5	4	80.00
2016	SLBE038A_2016	baseline	Little Brown Bat	2	1	50.00
2016	SLBE041A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	SLBE041A_2016	baseline	Hoary Bat	3	3	100.00
2016	SLBE041A_2016	baseline	Little Brown Bat	1	1	100.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2016	SLBE042A_2016	baseline	Big Brown Bat	2	0	0.00
2016	SLBE042A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	SLBE042A_2016	baseline	Hoary Bat	3	1	33.33
2016	SLBE042A_2016	baseline	Silver-haired Bat	3	1	33.33
2016	SLBE042A_2016	baseline	Little Brown Bat	19	13	68.42
2016	SLBE042A_2016	expanded	Indiana Bat	5	0	0.00
2016	SLBE042A_2016	expanded	Tricolored Bat	1	0	0.00
2016	SLBE043A_2016	baseline	Big Brown Bat	5	0	0.00
2016	SLBE043A_2016	baseline	Eastern Red Bat	8	7	87.50
2016	SLBE043A_2016	baseline	Hoary Bat	2	0	0.00
2016	SLBE043A_2016	baseline	Silver-haired Bat	2	1	50.00
2016	SLBE043A_2016	baseline	Little Brown Bat	2	0	0.00
2016	SLBE043A_2016	expanded	Tricolored Bat	1	0	0.00
2017	SLBE001A_2017	baseline	Big Brown Bat	1	0	0.00
2017	SLBE001A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	SLBE001A_2017	baseline	Hoary Bat	2	0	0.00
2017	SLBE002B_2017	baseline	Silver-haired Bat	1	1	100.00
2017	SLBE003A_2017	baseline	Big Brown Bat	1	0	0.00
2017	SLBE003A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	SLBE003A_2017	baseline	Hoary Bat	2	0	0.00
2017	SLBE003A_2017	baseline	Silver-haired Bat	2	2	100.00
2017	SLBE003A_2017	baseline	Little Brown Bat	1	0	0.00
2017	SLBE004A_2017	baseline	Big Brown Bat	5	1	20.00
2017	SLBE004A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	SLBE004A_2017	baseline	Hoary Bat	2	1	50.00
2017	SLBE004A_2017	baseline	Silver-haired Bat	24	18	75.00
2017	SLBE005A_2017	baseline	Eastern Red Bat	2	2	100.00
2017	SLBE005A_2017	baseline	Hoary Bat	2	2	100.00
2017	SLBE005A_2017	baseline	Silver-haired Bat	5	4	80.00
2017	SLBE005A_2017	baseline	Little Brown Bat	2	2	100.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	SLBE006A_2017	baseline	Big Brown Bat	5	4	80.00
2017	SLBE006A_2017	baseline	Eastern Red Bat	1	0	0.00
2017	SLBE006A_2017	baseline	Hoary Bat	8	2	25.00
2017	SLBE006A_2017	baseline	Silver-haired Bat	11	6	54.55
2017	SLBE007A_2017	baseline	Big Brown Bat	6	3	50.00
2017	SLBE007A_2017	baseline	Eastern Red Bat	5	2	40.00
2017	SLBE007A_2017	baseline	Silver-haired Bat	7	5	71.43
2017	SLBE007A_2017	baseline	Little Brown Bat	22	21	95.45
2017	SLBE007A_2017	baseline	Northern Long-eared Bat	2	0	0.00
2017	SLBE007A_2017	expanded	Indiana Bat	1	0	0.00
2017	SLBE007A_2017	expanded	Tricolored Bat	1	0	0.00
2017	SLBE009A_2017	baseline	Eastern Red Bat	4	3	75.00
2017	SLBE009A_2017	baseline	Silver-haired Bat	4	4	100.00
2017	SLBE009A_2017	baseline	Little Brown Bat	2	2	100.00
2017	SLBE009A_2017	baseline	Northern Long-eared Bat	1	0	0.00
2017	SLBE009A_2017	expanded	Tricolored Bat	1	0	0.00
2017	SLBE010A_2017	baseline	Big Brown Bat	8	6	75.00
2017	SLBE010A_2017	baseline	Eastern Red Bat	2	1	50.00
2017	SLBE010A_2017	baseline	Hoary Bat	1	1	100.00
2017	SLBE010A_2017	baseline	Silver-haired Bat	19	13	68.42
2017	SLBE010A_2017	baseline	Little Brown Bat	13	12	92.31
2017	SLBE010A_2017	expanded	Indiana Bat	5	0	0.00
2017	SLBE011A_2017	baseline	Big Brown Bat	11	6	54.55
2017	SLBE011A_2017	baseline	Eastern Red Bat	4	4	100.00
2017	SLBE011A_2017	baseline	Silver-haired Bat	25	16	64.00
2017	SLBE011A_2017	baseline	Little Brown Bat	1	0	0.00
2017	SLBE012A_2017	baseline	Big Brown Bat	2	2	100.00
2017	SLBE012A_2017	baseline	Eastern Red Bat	4	3	75.00
2017	SLBE012A_2017	baseline	Hoary Bat	1	0	0.00
2017	SLBE012A_2017	baseline	Silver-haired Bat	1	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	SLBE012A_2017	baseline	Little Brown Bat	6	6	100.00
2017	SLBE012A_2017	baseline	Northern Long-eared Bat	4	2	50.00
2017	SLBE012A_2017	expanded	Tricolored Bat	1	0	0.00
2017	SLBE013A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	SLBE013A_2017	baseline	Silver-haired Bat	5	4	80.00
2017	SLBE013A_2017	baseline	Little Brown Bat	1	1	100.00
2017	SLBE014A_2017	baseline	Big Brown Bat	2	1	50.00
2017	SLBE014A_2017	baseline	Hoary Bat	1	0	0.00
2017	SLBE014A_2017	baseline	Silver-haired Bat	14	12	85.71
2017	SLBE015A_2017	baseline	Hoary Bat	1	1	100.00
2017	SLBE015A_2017	baseline	Silver-haired Bat	1	1	100.00
2017	SLBE016A_2017	expanded	Indiana Bat	1	0	0.00
2017	SLBE017A_2017	baseline	Silver-haired Bat	2	2	100.00
2017	SLBE018A_2017	baseline	Big Brown Bat	3	0	0.00
2017	SLBE018A_2017	baseline	Eastern Red Bat	2	2	100.00
2017	SLBE018A_2017	baseline	Silver-haired Bat	2	1	50.00
2017	SLBE019A_2017	baseline	Big Brown Bat	2	2	100.00
2017	SLBE019A_2017	baseline	Silver-haired Bat	2	0	0.00
2017	SLBE019A_2017	baseline	Little Brown Bat	1	0	0.00
2017	SLBE021A_2017	baseline	Big Brown Bat	4	3	75.00
2017	SLBE021A_2017	baseline	Silver-haired Bat	3	1	33.33
2017	SLBE021A_2017	baseline	Little Brown Bat	4	4	100.00
2017	SLBE021A_2017	baseline	Northern Long-eared Bat	1	1	100.00
2017	SLBE022A_2017	baseline	Big Brown Bat	2	1	50.00
2017	SLBE022A_2017	baseline	Eastern Red Bat	3	3	100.00
2017	SLBE022A_2017	baseline	Silver-haired Bat	1	1	100.00
2017	SLBE022A_2017	baseline	Little Brown Bat	1	0	0.00
2017	SLBE023A_2017	baseline	Big Brown Bat	6	4	66.67
2017	SLBE023A_2017	baseline	Eastern Red Bat	6	6	100.00
2017	SLBE023A_2017	baseline	Little Brown Bat	1	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	SLBE023A_2017	expanded	Tricolored Bat	3	1	33.33
2017	SLBE024A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	SLBE025A_2017	baseline	Eastern Red Bat	2	1	50.00
2017	SLBE025A_2017	expanded	Indiana Bat	2	0	0.00
2017	SLBE026A_2017	baseline	Big Brown Bat	4	3	75.00
2017	SLBE026A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	SLBE026A_2017	baseline	Hoary Bat	4	3	75.00
2017	SLBE026A_2017	baseline	Silver-haired Bat	3	2	66.67
2017	SLBE026A_2017	baseline	Little Brown Bat	1	1	100.00
2017	SLBE027A_2017	baseline	Big Brown Bat	1	1	100.00
2017	SLBE027A_2017	baseline	Eastern Red Bat	2	2	100.00
2017	SLBE027A_2017	baseline	Hoary Bat	1	1	100.00
2017	SLBE027A_2017	baseline	Little Brown Bat	2	2	100.00
2017	SLBE028A_2017	baseline	Big Brown Bat	2	1	50.00
2017	SLBE028A_2017	baseline	Eastern Red Bat	5	5	100.00
2017	SLBE028A_2017	baseline	Silver-haired Bat	1	0	0.00
2017	SLBE028A_2017	baseline	Little Brown Bat	1	0	0.00
2017	SLBE028A_2017	baseline	Northern Long-eared Bat	1	0	0.00
2017	SLBE029A_2017	baseline	Eastern Red Bat	3	3	100.00
2017	SLBE029A_2017	baseline	Hoary Bat	2	1	50.00
2017	SLBE030A_2017	baseline	Eastern Red Bat	34	32	94.12
2017	SLBE030A_2017	baseline	Little Brown Bat	3	1	33.33
2017	SLBE030A_2017	expanded	Tricolored Bat	2	0	0.00
2017	SLBE032A_2017	baseline	Eastern Red Bat	4	4	100.00
2017	SLBE032A_2017	baseline	Silver-haired Bat	1	1	100.00
2017	SLBE032A_2017	baseline	Little Brown Bat	1	0	0.00
2017	SLBE035A_2017	baseline	Big Brown Bat	1	1	100.00
2017	SLBE035A_2017	baseline	Eastern Red Bat	2	2	100.00
2017	SLBE035A_2017	expanded	Tricolored Bat	2	0	0.00
2017	SLBE036A_2017	baseline	Big Brown Bat	16	11	68.75

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	SLBE036A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	SLBE036A_2017	baseline	Hoary Bat	37	31	83.78
2017	SLBE036A_2017	baseline	Silver-haired Bat	4	1	25.00
2017	SLBE036A_2017	baseline	Little Brown Bat	2	1	50.00
2017	SLBE038A_2017	baseline	Eastern Red Bat	4	4	100.00
2017	SLBE038A_2017	baseline	Hoary Bat	3	2	66.67
2017	SLBE038A_2017	baseline	Little Brown Bat	2	1	50.00
2017	SLBE041A_2017	baseline	Silver-haired Bat	1	0	0.00
2017	SLBE041A_2017	baseline	Little Brown Bat	2	2	100.00
2017	SLBE042A_2017	baseline	Big Brown Bat	3	1	33.33
2017	SLBE042A_2017	baseline	Eastern Red Bat	1	0	0.00
2017	SLBE042A_2017	baseline	Hoary Bat	3	1	33.33
2017	SLBE042A_2017	baseline	Silver-haired Bat	1	0	0.00
2017	SLBE042A_2017	baseline	Little Brown Bat	6	6	100.00
2017	SLBE042A_2017	baseline	Northern Long-eared Bat	1	0	0.00
2017	SLBE042A_2017	expanded	Indiana Bat	1	0	0.00
2017	SLBE043A_2017	baseline	Big Brown Bat	17	9	52.94
2017	SLBE043A_2017	baseline	Eastern Red Bat	12	11	91.67
2017	SLBE043A_2017	baseline	Hoary Bat	4	3	75.00
2017	SLBE043A_2017	baseline	Silver-haired Bat	1	0	0.00
2018	SLBE001A_2018	baseline	Eastern Red Bat	1	1	100.00
2018	SLBE001A_2018	baseline	Hoary Bat	5	2	40.00
2018	SLBE001A_2018	baseline	Silver-haired Bat	6	5	83.33
2018	SLBE001A_2018	expanded	Tricolored Bat	1	0	0.00
2018	SLBE002B_2018	baseline	Big Brown Bat	1	0	0.00
2018	SLBE002B_2018	baseline	Silver-haired Bat	2	0	0.00
2018	SLBE003A_2018	baseline	Hoary Bat	7	0	0.00
2018	SLBE003A_2018	baseline	Silver-haired Bat	3	3	100.00
2018	SLBE003A_2018	expanded	Tricolored Bat	1	0	0.00
2018	SLBE004A_2018	baseline	Big Brown Bat	3	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2018	SLBE004A_2018	baseline	Eastern Red Bat	1	0	0.00
2018	SLBE004A_2018	baseline	Silver-haired Bat	10	6	60.00
2018	SLBE004A_2018	baseline	Little Brown Bat	1	1	100.00
2018	SLBE005A_2018	baseline	Big Brown Bat	2	0	0.00
2018	SLBE005A_2018	baseline	Eastern Red Bat	2	0	0.00
2018	SLBE005A_2018	baseline	Hoary Bat	2	1	50.00
2018	SLBE005A_2018	baseline	Silver-haired Bat	1	1	100.00
2018	SLBE006A_2018	baseline	Big Brown Bat	1	1	100.00
2018	SLBE006A_2018	baseline	Eastern Red Bat	3	3	100.00
2018	SLBE006A_2018	baseline	Hoary Bat	10	1	10.00
2018	SLBE006A_2018	baseline	Silver-haired Bat	8	5	62.50
2018	SLBE007A_2018	baseline	Big Brown Bat	2	0	0.00
2018	SLBE007A_2018	baseline	Eastern Red Bat	8	1	12.50
2018	SLBE007A_2018	baseline	Hoary Bat	6	1	16.67
2018	SLBE007A_2018	baseline	Silver-haired Bat	2	2	100.00
2018	SLBE007A_2018	baseline	Little Brown Bat	51	47	92.16
2018	SLBE007A_2018	baseline	Northern Long-eared Bat	2	0	0.00
2018	SLBE007A_2018	expanded	Indiana Bat	5	0	0.00
2018	SLBE009A_2018	baseline	Big Brown Bat	2	1	50.00
2018	SLBE009A_2018	baseline	Silver-haired Bat	3	1	33.33
2018	SLBE009A_2018	baseline	Little Brown Bat	1	1	100.00
2018	SLBE010A_2018	baseline	Big Brown Bat	1	0	0.00
2018	SLBE010A_2018	baseline	Eastern Red Bat	4	4	100.00
2018	SLBE010A_2018	baseline	Hoary Bat	2	2	100.00
2018	SLBE010A_2018	baseline	Silver-haired Bat	5	3	60.00
2018	SLBE010A_2018	baseline	Little Brown Bat	7	5	71.43
2018	SLBE010A_2018	baseline	Northern Long-eared Bat	2	0	0.00
2018	SLBE011A_2018	baseline	Big Brown Bat	1	0	0.00
2018	SLBE011A_2018	baseline	Hoary Bat	3	0	0.00
2018	SLBE011A_2018	baseline	Silver-haired Bat	4	3	75.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2018	SLBE011A_2018	expanded	Tricolored Bat	1	0	0.00
2018	SLBE012A_2018	baseline	Northern Long-eared Bat	1	0	0.00
2018	SLBE013A_2018	baseline	Silver-haired Bat	1	1	100.00
2018	SLBE014A_2018	baseline	Big Brown Bat	2	0	0.00
2018	SLBE014A_2018	baseline	Hoary Bat	2	0	0.00
2018	SLBE014A_2018	baseline	Silver-haired Bat	8	7	87.50
2018	SLBE015A_2018	baseline	Eastern Red Bat	1	1	100.00
2018	SLBE015A_2018	baseline	Silver-haired Bat	2	2	100.00
2018	SLBE016A_2018	baseline	Big Brown Bat	1	0	0.00
2018	SLBE016A_2018	baseline	Hoary Bat	1	0	0.00
2018	SLBE016A_2018	baseline	Little Brown Bat	4	3	75.00
2018	SLBE016A_2018	baseline	Northern Long-eared Bat	1	0	0.00
2018	SLBE016A_2018	expanded	Indiana Bat	3	0	0.00
2018	SLBE017A_2018	baseline	Eastern Red Bat	1	1	100.00
2018	SLBE017A_2018	baseline	Hoary Bat	3	0	0.00
2018	SLBE017A_2018	baseline	Silver-haired Bat	1	1	100.00
2018	SLBE018A_2018	baseline	Big Brown Bat	13	4	30.77
2018	SLBE018A_2018	baseline	Hoary Bat	3	1	33.33
2018	SLBE018A_2018	baseline	Silver-haired Bat	6	3	50.00
2018	SLBE019A_2018	baseline	Big Brown Bat	1	1	100.00
2018	SLBE019A_2018	baseline	Eastern Red Bat	2	2	100.00
2018	SLBE019A_2018	baseline	Little Brown Bat	2	0	0.00
2018	SLBE021A_2018	baseline	Big Brown Bat	7	2	28.57
2018	SLBE021A_2018	baseline	Silver-haired Bat	3	1	33.33
2018	SLBE021A_2018	baseline	Little Brown Bat	2	2	100.00
2018	SLBE021A_2018	baseline	Northern Long-eared Bat	3	1	33.33
2018	SLBE022A_2018	baseline	Big Brown Bat	1	0	0.00
2018	SLBE022A_2018	baseline	Eastern Red Bat	3	2	66.67
2018	SLBE022A_2018	baseline	Silver-haired Bat	5	5	100.00
2018	SLBE022A_2018	baseline	Little Brown Bat	3	3	100.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2018	SLBE023A_2018	baseline	Big Brown Bat	3	1	33.33
2018	SLBE023A_2018	baseline	Silver-haired Bat	5	1	20.00
2018	SLBE023A_2018	expanded	Tricolored Bat	1	0	0.00
2018	SLBE024A_2018	baseline	Big Brown Bat	1	0	0.00
2018	SLBE024A_2018	baseline	Eastern Red Bat	9	8	88.89
2018	SLBE024A_2018	baseline	Hoary Bat	2	1	50.00
2018	SLBE024A_2018	baseline	Little Brown Bat	4	4	100.00
2018	SLBE024A_2018	expanded	Indiana Bat	2	0	0.00
2018	SLBE024A_2018	expanded	Tricolored Bat	2	1	50.00
2018	SLBE025A_2018	baseline	Big Brown Bat	1	1	100.00
2018	SLBE025A_2018	baseline	Eastern Red Bat	3	2	66.67
2018	SLBE025A_2018	baseline	Silver-haired Bat	1	1	100.00
2018	SLBE025A_2018	baseline	Little Brown Bat	2	1	50.00
2018	SLBE026A_2018	baseline	Big Brown Bat	17	11	64.71
2018	SLBE026A_2018	baseline	Eastern Red Bat	1	0	0.00
2018	SLBE026A_2018	baseline	Hoary Bat	5	5	100.00
2018	SLBE026A_2018	baseline	Silver-haired Bat	3	1	33.33
2018	SLBE026A_2018	expanded	Tricolored Bat	1	0	0.00
2018	SLBE027A_2018	baseline	Hoary Bat	1	0	0.00
2018	SLBE027A_2018	baseline	Silver-haired Bat	2	1	50.00
2018	SLBE027A_2018	baseline	Little Brown Bat	1	0	0.00
2018	SLBE028B_2018	baseline	Big Brown Bat	1	0	0.00
2018	SLBE028B_2018	baseline	Eastern Red Bat	12	11	91.67
2018	SLBE028B_2018	baseline	Hoary Bat	6	6	100.00
2018	SLBE028B_2018	baseline	Silver-haired Bat	6	3	50.00
2018	SLBE028B_2018	baseline	Little Brown Bat	20	19	95.00
2018	SLBE028B_2018	expanded	Indiana Bat	1	0	0.00
2018	SLBE028B_2018	expanded	Tricolored Bat	2	0	0.00
2018	SLBE029A_2018	baseline	Big Brown Bat	4	1	25.00
2018	SLBE029A_2018	baseline	Eastern Red Bat	4	3	75.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2018	SLBE029A_2018	baseline	Hoary Bat	2	0	0.00
2018	SLBE030A_2018	baseline	Eastern Red Bat	9	9	100.00
2018	SLBE030A_2018	baseline	Hoary Bat	9	8	88.89
2018	SLBE030A_2018	baseline	Little Brown Bat	10	6	60.00
2018	SLBE030A_2018	baseline	Northern Long-eared Bat	1	0	0.00
2018	SLBE030A_2018	expanded	Tricolored Bat	1	0	0.00
2018	SLBE032A_2018	baseline	Eastern Red Bat	4	4	100.00
2018	SLBE032A_2018	baseline	Hoary Bat	2	2	100.00
2018	SLBE032A_2018	baseline	Silver-haired Bat	1	0	0.00
2018	SLBE032A_2018	baseline	Little Brown Bat	2	1	50.00
2018	SLBE035A_2018	baseline	Big Brown Bat	4	1	25.00
2018	SLBE035A_2018	baseline	Eastern Red Bat	1	1	100.00
2018	SLBE036A_2018	baseline	Big Brown Bat	9	2	22.22
2018	SLBE036A_2018	baseline	Hoary Bat	4	4	100.00
2018	SLBE036A_2018	baseline	Silver-haired Bat	10	1	10.00
2018	SLBE036A_2018	baseline	Little Brown Bat	3	3	100.00
2018	SLBE038A_2018	baseline	Hoary Bat	2	2	100.00
2018	SLBE038A_2018	baseline	Little Brown Bat	1	1	100.00
2018	SLBE041A_2018	baseline	Eastern Red Bat	1	1	100.00
2018	SLBE042A_2018	baseline	Hoary Bat	2	2	100.00
2018	SLBE042A_2018	baseline	Silver-haired Bat	2	0	0.00
2018	SLBE042A_2018	baseline	Little Brown Bat	13	12	92.31
2018	SLBE042A_2018	expanded	Indiana Bat	1	0	0.00
2018	SLBE043A_2018	baseline	Big Brown Bat	12	5	41.67
2018	SLBE043A_2018	baseline	Eastern Red Bat	5	5	100.00
2018	SLBE043A_2018	baseline	Hoary Bat	2	1	50.00
2018	SLBE043A_2018	baseline	Silver-haired Bat	1	0	0.00
2018	SLBE043A_2018	baseline	Little Brown Bat	2	1	50.00
2019	SLBE001A_2019	baseline	Big Brown Bat	2	2	100.00
2019	SLBE001A_2019	baseline	Hoary Bat	2	2	100.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	SLBE001A_2019	baseline	Silver-haired Bat	3	0	0.00
2019	SLBE002B_2019	baseline	Silver-haired Bat	1	1	100.00
2019	SLBE003A_2019	baseline	Big Brown Bat	1	1	100.00
2019	SLBE003A_2019	baseline	Hoary Bat	2	0	0.00
2019	SLBE003A_2019	baseline	Silver-haired Bat	3	2	66.67
2019	SLBE004A_2019	baseline	Big Brown Bat	2	1	50.00
2019	SLBE004A_2019	baseline	Silver-haired Bat	9	0	0.00
2019	SLBE004A_2019	baseline	Little Brown Bat	1	0	0.00
2019	SLBE005A_2019	baseline	Hoary Bat	2	1	50.00
2019	SLBE005A_2019	baseline	Silver-haired Bat	5	2	40.00
2019	SLBE006A_2019	baseline	Big Brown Bat	2	1	50.00
2019	SLBE006A_2019	baseline	Eastern Red Bat	1	1	100.00
2019	SLBE006A_2019	baseline	Hoary Bat	2	0	0.00
2019	SLBE006A_2019	baseline	Silver-haired Bat	4	3	75.00
2019	SLBE007A_2019	baseline	Big Brown Bat	9	6	66.67
2019	SLBE007A_2019	baseline	Eastern Red Bat	3	0	0.00
2019	SLBE007A_2019	baseline	Hoary Bat	8	0	0.00
2019	SLBE007A_2019	baseline	Silver-haired Bat	6	4	66.67
2019	SLBE007A_2019	baseline	Little Brown Bat	57	43	75.44
2019	SLBE007A_2019	baseline	Northern Long-eared Bat	3	0	0.00
2019	SLBE007A_2019	expanded	Indiana Bat	4	0	0.00
2019	SLBE007A_2019	expanded	Tricolored Bat	2	0	0.00
2019	SLBE009A_2019	baseline	Silver-haired Bat	2	0	0.00
2019	SLBE009A_2019	baseline	Little Brown Bat	1	1	100.00
2019	SLBE010A_2019	baseline	Big Brown Bat	3	3	100.00
2019	SLBE010A_2019	baseline	Eastern Red Bat	2	1	50.00
2019	SLBE010A_2019	baseline	Hoary Bat	1	1	100.00
2019	SLBE010A_2019	baseline	Silver-haired Bat	8	2	25.00
2019	SLBE010A_2019	baseline	Little Brown Bat	12	9	75.00
2019	SLBE010A_2019	baseline	Northern Long-eared Bat	1	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	SLBE010A_2019	expanded	Indiana Bat	4	0	0.00
2019	SLBE011A_2019	baseline	Big Brown Bat	1	1	100.00
2019	SLBE012A_2019	baseline	Big Brown Bat	2	0	0.00
2019	SLBE012A_2019	baseline	Eastern Red Bat	6	2	33.33
2019	SLBE012A_2019	baseline	Hoary Bat	2	2	100.00
2019	SLBE012A_2019	baseline	Silver-haired Bat	1	0	0.00
2019	SLBE012A_2019	baseline	Little Brown Bat	2	1	50.00
2019	SLBE013A_2019	baseline	Silver-haired Bat	1	0	0.00
2019	SLBE014A_2019	baseline	Big Brown Bat	2	1	50.00
2019	SLBE014A_2019	baseline	Silver-haired Bat	7	2	28.57
2019	SLBE015A_2019	baseline	Big Brown Bat	1	0	0.00
2019	SLBE015A_2019	baseline	Silver-haired Bat	1	1	100.00
2019	SLBE017A_2019	baseline	Big Brown Bat	1	1	100.00
2019	SLBE017A_2019	baseline	Silver-haired Bat	2	0	0.00
2019	SLBE018A_2019	baseline	Big Brown Bat	9	4	44.44
2019	SLBE019A_2019	baseline	Big Brown Bat	6	6	100.00
2019	SLBE019A_2019	baseline	Eastern Red Bat	1	1	100.00
2019	SLBE019A_2019	baseline	Little Brown Bat	1	0	0.00
2019	SLBE021A_2019	baseline	Big Brown Bat	5	4	80.00
2019	SLBE021A_2019	baseline	Hoary Bat	1	0	0.00
2019	SLBE021A_2019	baseline	Silver-haired Bat	3	0	0.00
2019	SLBE021A_2019	baseline	Little Brown Bat	1	1	100.00
2019	SLBE021A_2019	baseline	Northern Long-eared Bat	2	0	0.00
2019	SLBE021A_2019	expanded	Tricolored Bat	2	0	0.00
2019	SLBE022A_2019	baseline	Big Brown Bat	3	0	0.00
2019	SLBE022A_2019	baseline	Eastern Red Bat	2	1	50.00
2019	SLBE022A_2019	baseline	Hoary Bat	3	3	100.00
2019	SLBE022A_2019	baseline	Silver-haired Bat	2	0	0.00
2019	SLBE022A_2019	baseline	Little Brown Bat	1	1	100.00
2019	SLBE023A_2019	baseline	Big Brown Bat	1	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	SLBE024A_2019	baseline	Eastern Red Bat	14	14	100.00
2019	SLBE024A_2019	baseline	Hoary Bat	2	2	100.00
2019	SLBE024A_2019	baseline	Little Brown Bat	4	2	50.00
2019	SLBE024A_2019	expanded	Tricolored Bat	3	1	33.33
2019	SLBE025A_2019	baseline	Hoary Bat	1	1	100.00
2019	SLBE026A_2019	baseline	Big Brown Bat	1	1	100.00
2019	SLBE029A_2019	baseline	Eastern Red Bat	1	1	100.00
2019	SLBE029A_2019	baseline	Hoary Bat	1	0	0.00
2019	SLBE029A_2019	baseline	Silver-haired Bat	1	1	100.00
2019	SLBE032A_2019	baseline	Eastern Red Bat	5	5	100.00
2019	SLBE032A_2019	baseline	Hoary Bat	12	11	91.67
2019	SLBE032A_2019	baseline	Silver-haired Bat	1	0	0.00
2019	SLBE032A_2019	baseline	Little Brown Bat	1	1	100.00
2019	SLBE035A_2019	baseline	Big Brown Bat	1	0	0.00
2019	SLBE035A_2019	baseline	Silver-haired Bat	2	0	0.00
2019	SLBE035A_2019	baseline	Little Brown Bat	1	1	100.00
2019	SLBE036A_2019	baseline	Big Brown Bat	11	5	45.45
2019	SLBE036A_2019	baseline	Silver-haired Bat	1	0	0.00
2019	SLBE036A_2019	expanded	Tricolored Bat	1	0	0.00
2019	SLBE038A_2019	baseline	Big Brown Bat	1	1	100.00
2019	SLBE038A_2019	baseline	Eastern Red Bat	1	1	100.00
2019	SLBE038A_2019	baseline	Little Brown Bat	3	2	66.67
2019	SLBE041A_2019	baseline	Eastern Red Bat	2	2	100.00
2019	SLBE041A_2019	baseline	Little Brown Bat	1	1	100.00
2019	SLBE042A_2019	baseline	Hoary Bat	1	0	0.00
2019	SLBE042A_2019	baseline	Silver-haired Bat	3	1	33.33
2019	SLBE042A_2019	baseline	Little Brown Bat	4	2	50.00
2019	SLBE042A_2019	baseline	Northern Long-eared Bat	4	0	0.00
2019	SLBE042A_2019	expanded	Indiana Bat	1	0	0.00
2019	SLBE043A_2019	baseline	Big Brown Bat	7	3	42.86

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	SLBE043A_2019	baseline	Eastern Red Bat	2	2	100.00
2019	SLBE043A_2019	baseline	Hoary Bat	1	1	100.00
2019	SLBE043A_2019	baseline	Silver-haired Bat	3	0	0.00
2019	SLBE043A_2019	expanded	Tricolored Bat	2	1	50.00

Appendix H. Species Composition Across Parks.

Figure H1 is for the baseline analysis only, and it includes all Great Lakes Network parks in which bat monitoring occurred.

APIS Apostle Islands National Lakeshore (Wisconsin)

GRPO Grand Portage National Monument (Minnesota)

INDU Indiana Dunes National Park (Indiana)

ISRO Isle Royale National Park (Michigan)

MISS Mississippi National River and Recreation Area (Minnesota)

PIRO Pictured Rocks National Lakeshore (Michigan)

SACN St. Croix National Scenic Riverway (Wisconsin/Minnesota)

SLBE Sleeping Bear Dunes National Lakeshore (Michigan)

VOYA Voyageurs National Park (Minnesota)

The baseline analysis had Indiana bat and evening bat allowed as possible species only for INDU, and tricolored bat allowed as a possible species only for INDU, MISS, and SACN.

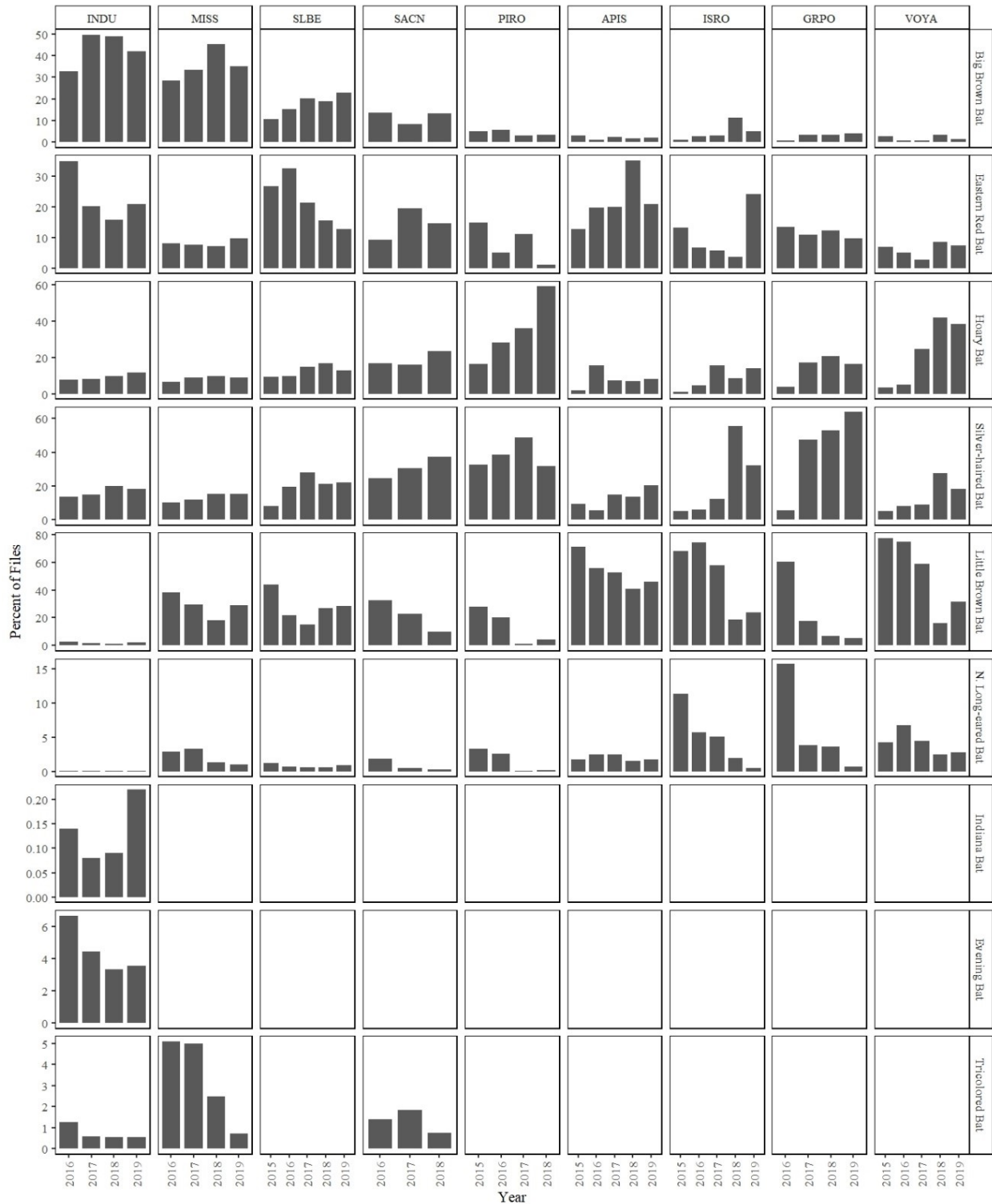


Figure H1. Percent of audio files classified as each bat species by Kaleidoscope Pro in the baseline analysis for each park and year. Note that the y-axis scale is different for each species and not all parks conducted surveys in all years. Only data from valid deployments are shown. Parks are ordered approximately by latitude, from INDU (southernmost) to VOYA (northernmost).

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