



Acoustic Monitoring for Bats at Mississippi National River and Recreation Area

Data Summary Report, 2016–2019

Natural Resource Data Series NPS/GLKN/NRDS—2021/1322



ON THE COVER

Bat acoustic monitoring equipment at Mississippi National River and Recreation Area.
NPS Photo

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Data Summary Report, 2016–2019

Natural Resource Data Series NPS/GLKN/NRDS—2021/1322

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Abstract

The Great Lakes Inventory and Monitoring Network initiated an acoustic monitoring program for bats in 2015. Monitoring began in 2016 at Mississippi National River and Recreation Area. This report presents results for the 2016–2019 surveys. Acoustic recordings were analyzed using the software program Kaleidoscope Pro and a subset of files were manually reviewed to confirm species identifications. The four bat species previously documented at the park were reconfirmed: big brown bat, hoary bat, silver-haired bat, and little brown bat. Four additional species were documented through both automated Kaleidoscope classification and manual vetting: eastern red bat, northern long-eared bat, tricolored bat, and evening bat. With the exception of the evening bat, the presence of these species was expected since the park lies well within their known ranges. Although the park is north of the typical evening bat range, this species was observed by other researchers in both Wisconsin and Minnesota in 2016, prompting us to include it in our expanded analysis. We obtained a total of 12 manually verified evening bat recordings, suggesting that this species is at least occasionally present in the park. Activity levels for big brown bat, eastern red bat, hoary bat, silver-haired bat, and evening bat appear to be stable. Activity levels for little brown bat, northern long-eared bat, and tricolored bat appear to be declining.

Acknowledgments

This work would not have been possible without all the park employees, partners, and volunteers who completed field surveys and provided logistical support, including N. Duncan, A. Holdhusen, S. House, A. Boettcher, K. Gullickson, N. Smarjesse, H. Anton, C. Johnson, L. Vue, C. Mclean, A. Sturz, C. Macke, M. Sciamanda, and C. Jaeger Mountain. 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. N. Duncan 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) and the network parks established a bat acoustic monitoring program 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. Mississippi National River and Recreation Area (MISS) has participated in this monitoring program since 2016.

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, only four species had been documented at MISS (Table 1). Big brown bats were visually observed and detected acoustically during bat surveys at Fort Snelling State Park in 1995 (Minnesota County Biological Survey 1995). Two preserved specimens of hoary bats (*Lasiurus cinereus*) are in the collection at the Bell Museum of Natural History (Minnesota Biodiversity Atlas 2020). The specimens were collected at Fort Snelling and near Cherokee Park. A silver-haired bat (*Lasionycteris noctivagans*) and little brown bat (*Myotis lucifugus*) were observed by MISS natural resource management staff in the MISS office parking ramp (N. Duncan, personal communication).

Table 1. Bat species occurrences recorded at Mississippi National River and Recreation Area prior to the initiation of the GLKN acoustic monitoring program in 2016 and methods by which the species were documented. Data sources include N. Duncan, MISS Natural Resource Program Manager (personal communication, March 2019), Minnesota County Biological Survey (1995), and Minnesota Biodiversity Atlas (2020). Ranges are as shown in Kurta (2017).

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

There are several sources documenting bats within the general vicinity of MISS, which suggest that additional species are almost certainly present within the park. The Minnesota Department of Natural Resources undertook comprehensive bat surveys in the 1980s (Nordquist and Birney 1985). Their results indicate seven species were present in the five counties around MISS, though it is unclear where within those counties the records occurred. Their list of known hibernacula did not include any locations within the MISS corridor. The MISS Environmental Impact Statement included a list of wildlife species found in the MISS corridor, which contained six species of bats (National Park Service 1995). However, no details were provided on how or where these were observed or the source of the underlying data. The same report stated that bat colonies were known from one location in Saint Paul and one location in Minneapolis, however the species associated with each colony were not provided (National Park Service 1995). Dixon (2012) completed acoustic surveys in the Twin Cities area and reported five species plus the *Myotis* group. The specific locations of each species were not provided but some of the survey sites were very close to the Mississippi River.

Recent acoustic survey and mist-netting efforts conducted in 2015–2017 by the Minnesota Department of Natural Resources and the University of Minnesota Duluth’s Natural Resources Research Institute included sites in Hennepin and Ramsey Counties, some as close as about 5 miles to the MISS corridor. Six species were captured in mist nets: little brown bat, big brown bat, eastern red bat (*Lasiurus borealis*), hoary bat, silver-haired bat, and evening bat (*Nycticeius humeralis*; a single individual and the first record for the state) (Swingen et al. 2018). The same six species were detected acoustically, plus a seventh, the tricolored bat (*Perimyotis subflavus*) (Moen et al. 2018). With the possible exception of the evening bat, it is very likely that all these species are present at MISS. The range of the Indiana bat lies further south and east, therefore this species is not expected to be present at MISS.

Methods

Bat acoustic monitoring at MISS was conducted according to the protocol and standard operating procedures developed by GLKN (Goodwin 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 MISS, the GRTS design was used beginning in 2016. A total of 28 cells were selected for sampling, equivalent to approximately 16% of the park’s sampling frame. The selected cells have been used from 2016 onward.

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 MISS001A. A map of MISS sample sites is provided in Figure 1.

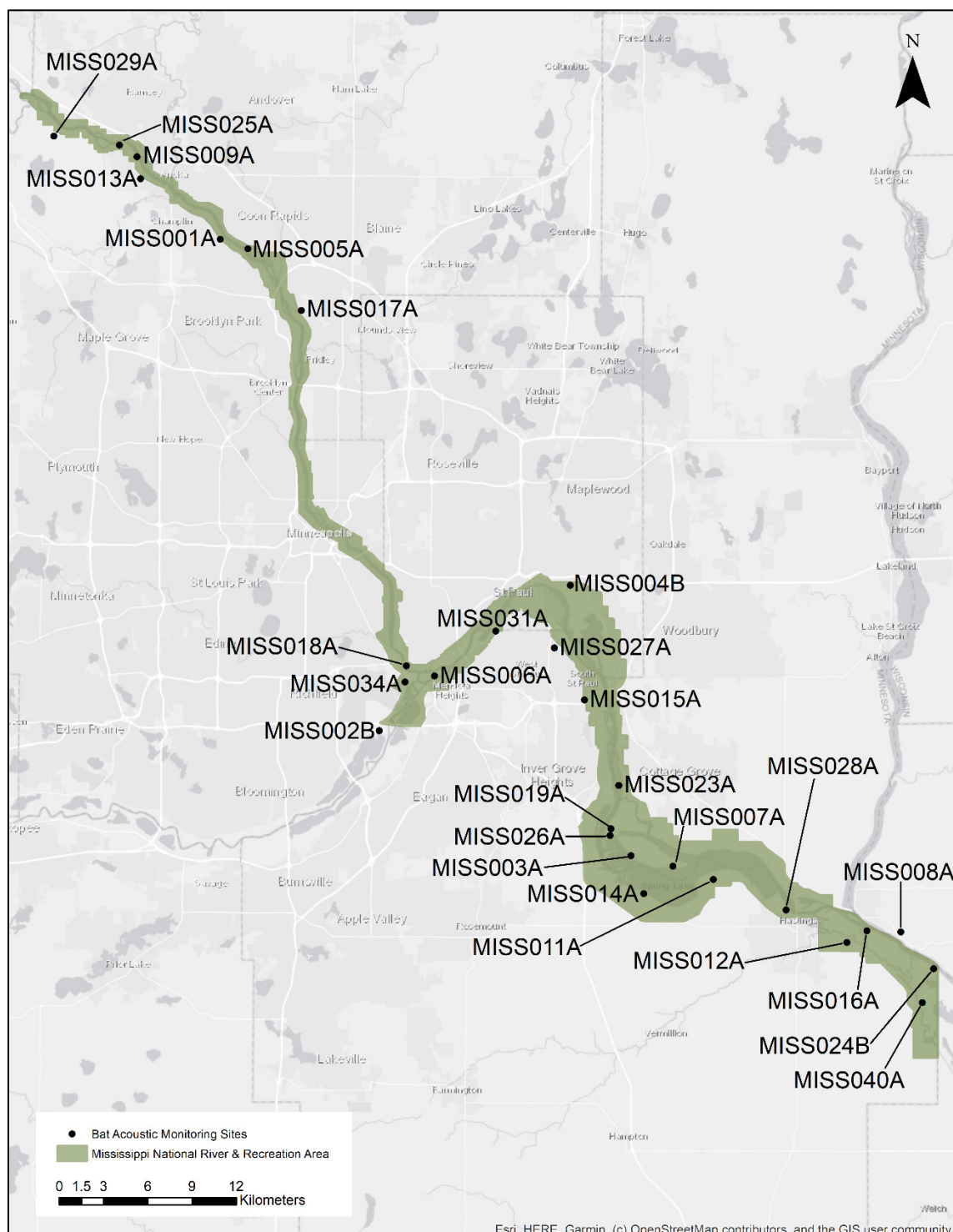


Figure 1. Bat monitoring sites at Mississippi National River and Recreation Area. Sites shown were established in 2016 and used each year since, except for the following: MISS004 was relocated from the “A” site to the “B” site in 2016. MISS002 and MISS024 were relocated from the “A” site to the “B” site in 2017. MISS023A was sampled in 2016, 2018, and 2019 (accidentally moved to a different site in 2017). MISS017A was sampled in 2016 and 2017, not sampled at all in 2018, and moved to a new “B” site in 2019 (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 MISS includes Wildlife Acoustics Song Meter SM3BAT and Song Meter SM4BAT-FS detectors and Wildlife Acoustics SMM-U1 microphones. Recordings are collected in full-spectrum format and stored as WAV files on SD cards mounted in the detector. Field technicians complete a datasheet for each deployment and collect site photographs and GPS coordinates. After retrieving equipment, the WAV 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 MISS 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 2016–2019 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 (2016–2018) 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. Files from incomplete recording nights (less than six hours of recording) were also excluded from processing.

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 MISS 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 MISS 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 identifying 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 MISS during the years 2016 to 2019. There were 21 to 28 valid deployments per year. This report provides results only for the sites that had valid deployments.

Monitoring occurred over a total of 200 to 331 nights of recording. The number of audio files collected per year ranged from 58,321 to 114,059. Yearly survey effort and deployment information are summarized in Figure 2 and Appendix D.

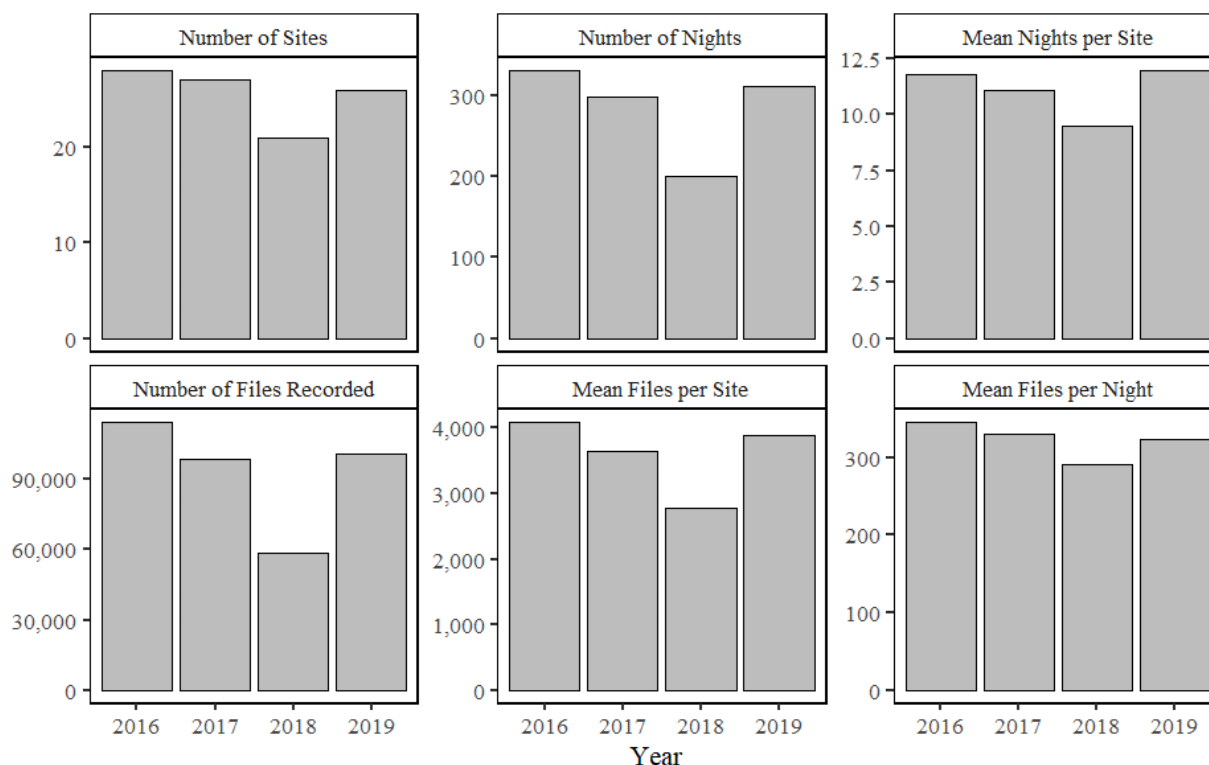


Figure 2. Yearly survey effort at Mississippi National River and Recreation Area, 2016–2019. *Top, left to right:* Number of sites, number of nights, and mean nights per site; *bottom, left to right:* total number of audio files recorded, mean files per site, and mean files per night. Number of files is prior to classification (i.e., includes noise).

Automated Classification

Most files (73%–88% per year) were identified to the species level by Kaleidoscope Pro (Figure 3, Appendix E). The proportion of files assigned to a species versus unknown bat was similar for the baseline and expanded analyses (Figure 3). The two detector models (SM3BAT and SM4BAT-FS) were similar in terms of percent noise (data from all parks combined) but noise was highly variable across the different MISS sampling sites (Appendix F).

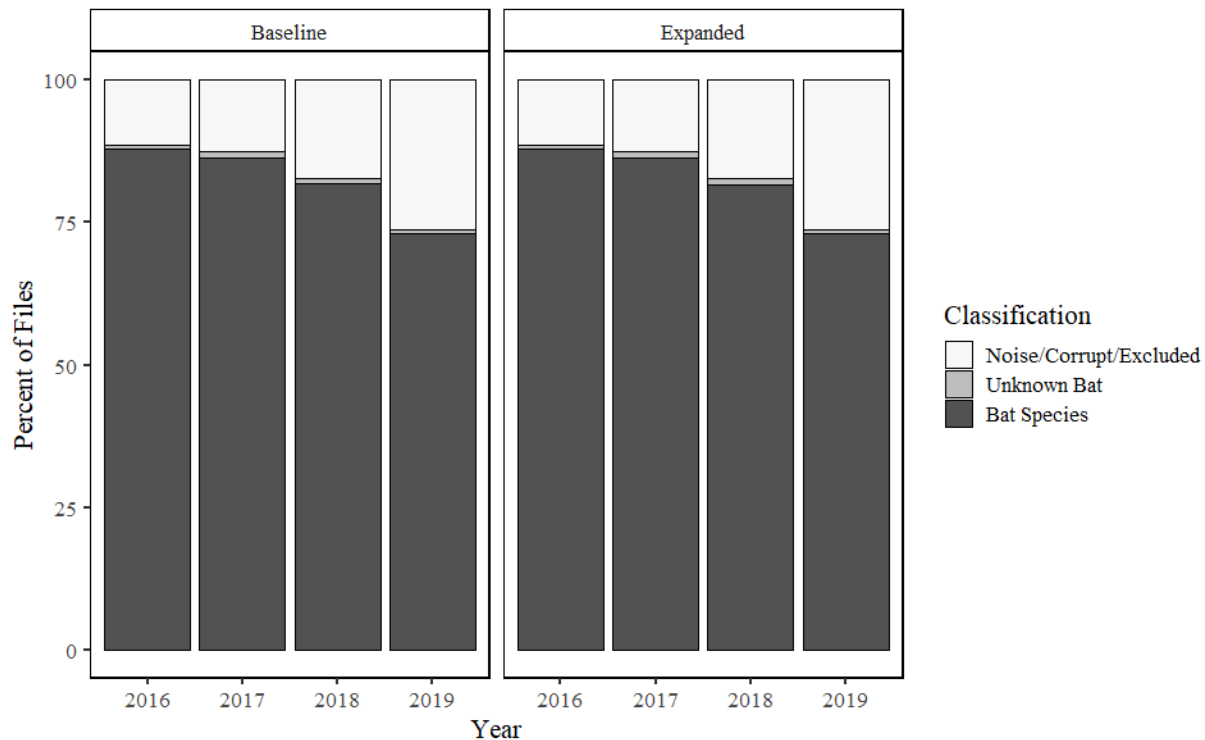


Figure 3. Percent of audio files classified by Kaleidoscope Pro as bat species vs. unknown bats vs. noise, corrupt, and excluded files, Mississippi National River and Recreation Area, 2016–2019. Proportions are shown for the baseline (*left*) and expanded (*right*) analyses.

Kaleidoscope Pro automated classification resulted in a total of seven 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 was similar between the baseline and expanded analyses but varied from year to year, particularly for the big brown bat and little brown bat (Figure 4). In both the baseline and expanded analyses, the largest proportion of files was classified to little brown bat in 2016, and big brown bat in 2017–2019. The proportion of files attributed to the three most WNS-susceptible species (little brown, northern long-eared, and tricolored bats) decreased after 2016 relative to the proportion attributed to the other species (Figure 5). The most notable changes for individual species were an increase in the percentage of big brown bat files, and a decrease in the percentage of little brown and tricolored bat files. File counts and percentages are provided in Appendix E.

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 Pro. Parkwide, total call files per recording night were highest in 2016 and lowest in 2019, suggesting a decrease in overall bat activity (Figure 6).

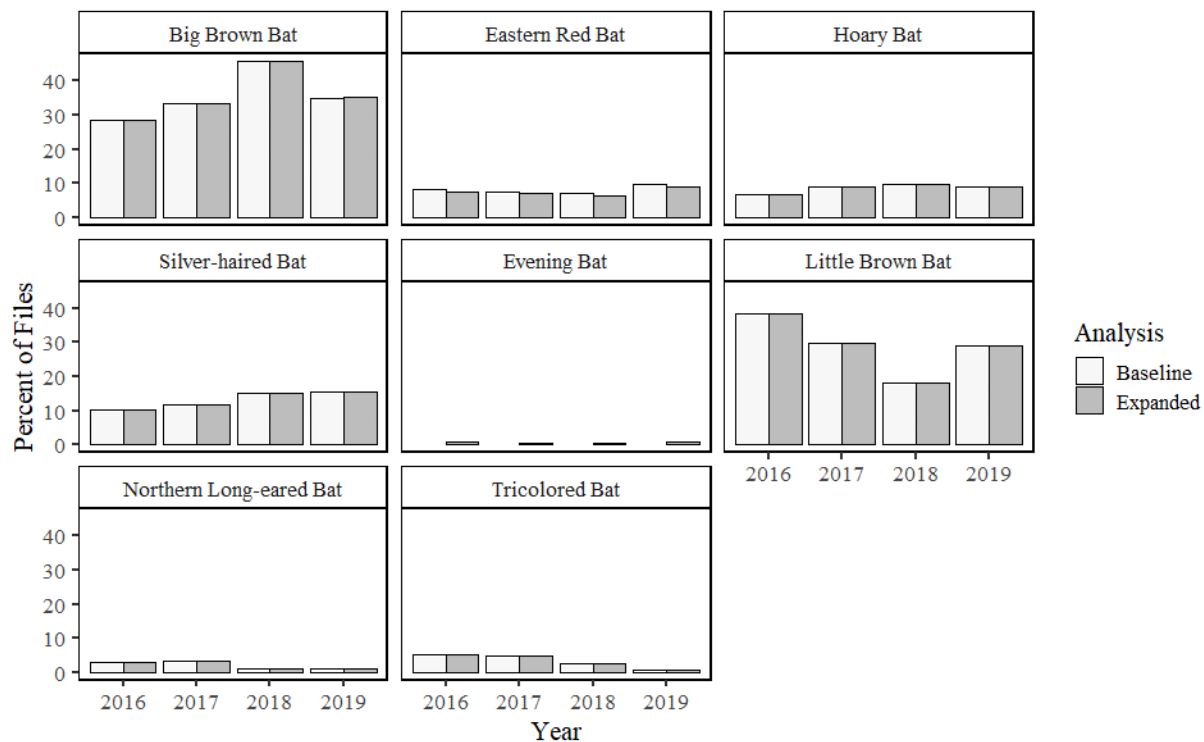


Figure 4. Proportion of files classified to each species each year in the baseline versus expanded analysis, Mississippi National River and Recreation Area, 2016–2019. Evening bat was only allowed as a possible species in the expanded analysis. Includes only the subset of files successfully assigned a species-level classification by Kaleidoscope Pro.

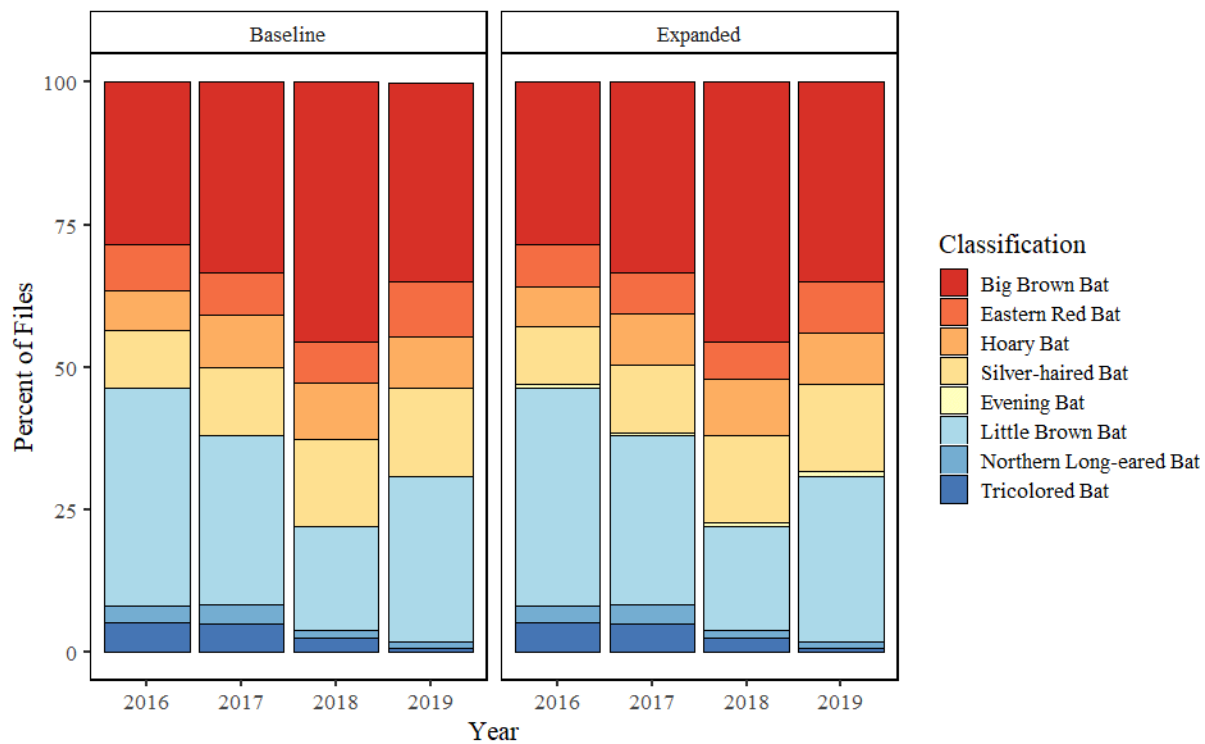


Figure 5. Proportion of files classified to each species each year relative to all other species, Mississippi National River and Recreation Area, 2016–2019. The three most WNS-susceptible species (little brown, northern long-eared, and tricolored bats) are shown in shades of blue while less susceptible species are shown in red, orange, and yellow. Evening bat was only allowed as a possible species in the expanded analysis. Includes only the subset of files successfully assigned a species-level classification by Kaleidoscope Pro.

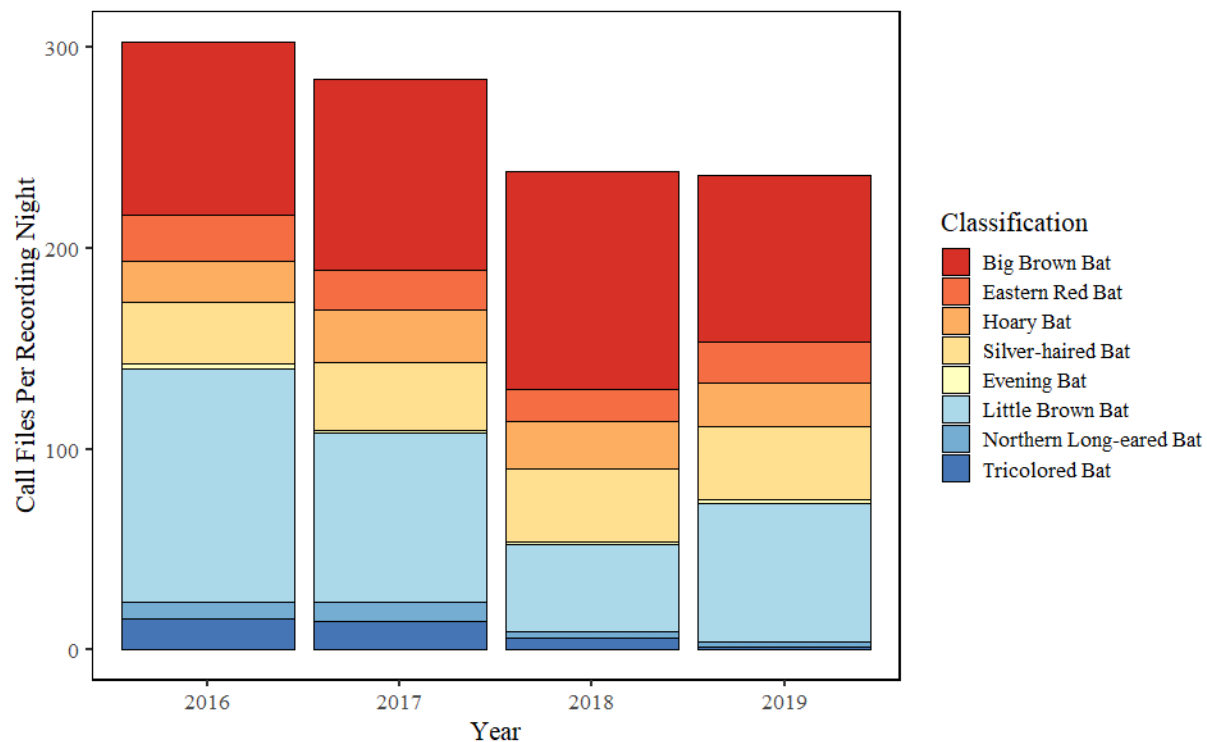


Figure 6. Parkwide call files per recording night by species and year for the expanded analysis, Mississippi National River and Recreation Area, 2016–2019. The three most WNS-susceptible species (little brown, northern long-eared, and tricolored bats) are shown in shades of blue while less susceptible 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 highest in 2017 and lowest in 2019 (Figure 7, lower left panel). Looking at individual species, the median call files per recording night was generally similar across all years for big brown bat, eastern red bat, hoary bat, silver-haired bat, and evening bat (Figure 7). For the other three species we observed decreasing trends (Figure 7). Adding the evening bat as a possible species in the expanded analysis did not substantially change the call files per recording night values for most species. The eastern red bat was the species with the greatest change in call files per recording night, due to files being reclassified as evening bat.

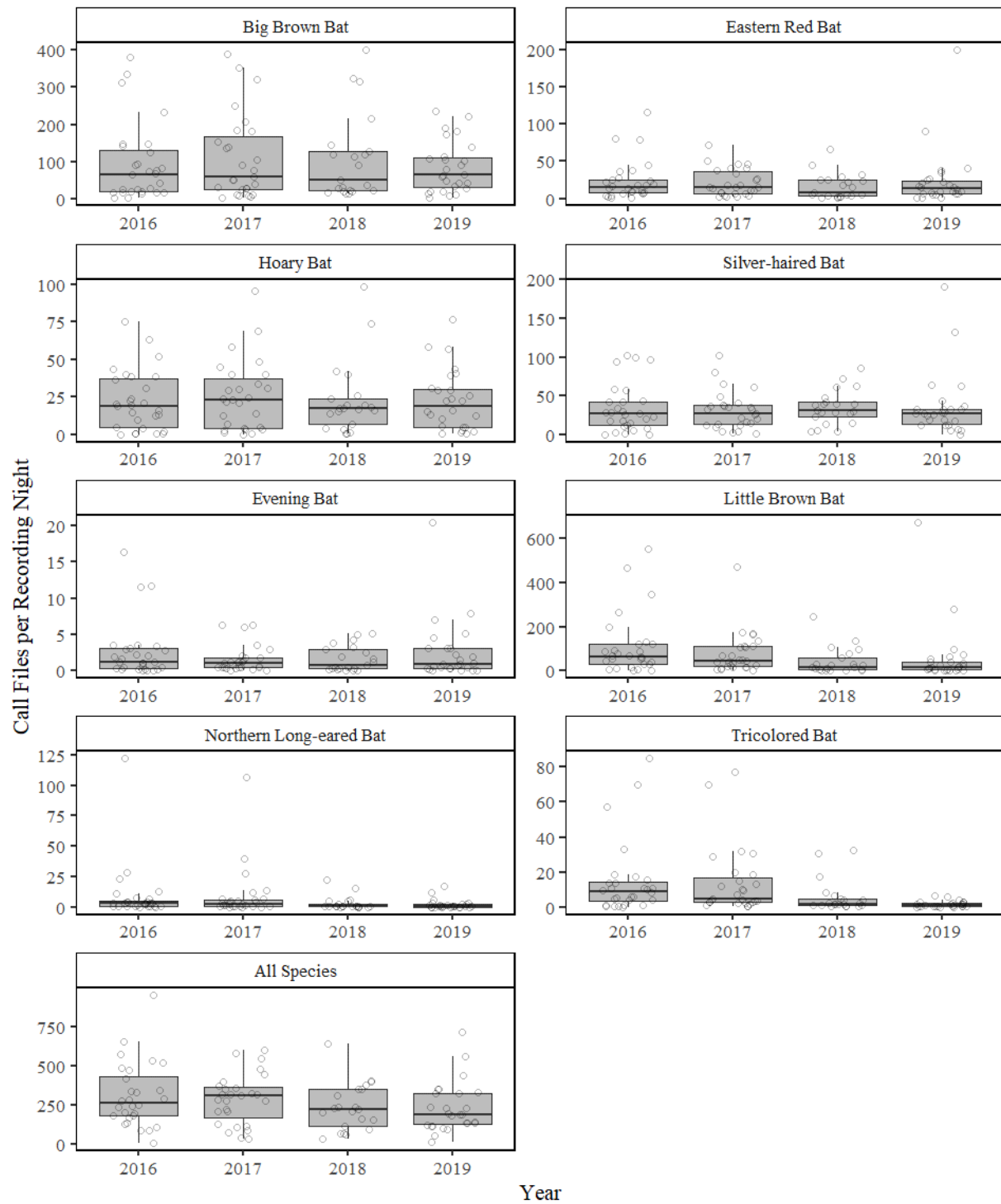


Figure 7. Call files per recording night for each species and for all species combined, by year, for the expanded analysis, Mississippi National River and Recreation Area, 2016–2019. Each point represents call files per recording night at a particular survey site. The dark line across the boxplot represents the median. Note that the y-axis scale is different for each species. Results were similar for baseline and expanded analysis so only the expanded analysis 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 if at least one audio file was classified as that species by Kaleidoscope Pro. Most species were widely distributed across the park, with detections at greater than 90% of monitoring sites in most years (Figure 8, Appendix E). The northern long-eared bat was detected at fewer sites than other species. Five species were detected on greater than 75% of recording nights each year (Figure 9, Appendix E). The remaining three species were detected on only about 45%–70% of nights, except for tricolored bat in 2016–2017, which reached 83%–85%. On average, the big brown bat was detected on the highest percentage of nights and the evening bat was detected on the lowest percentage of nights (when included in the expanded analysis).

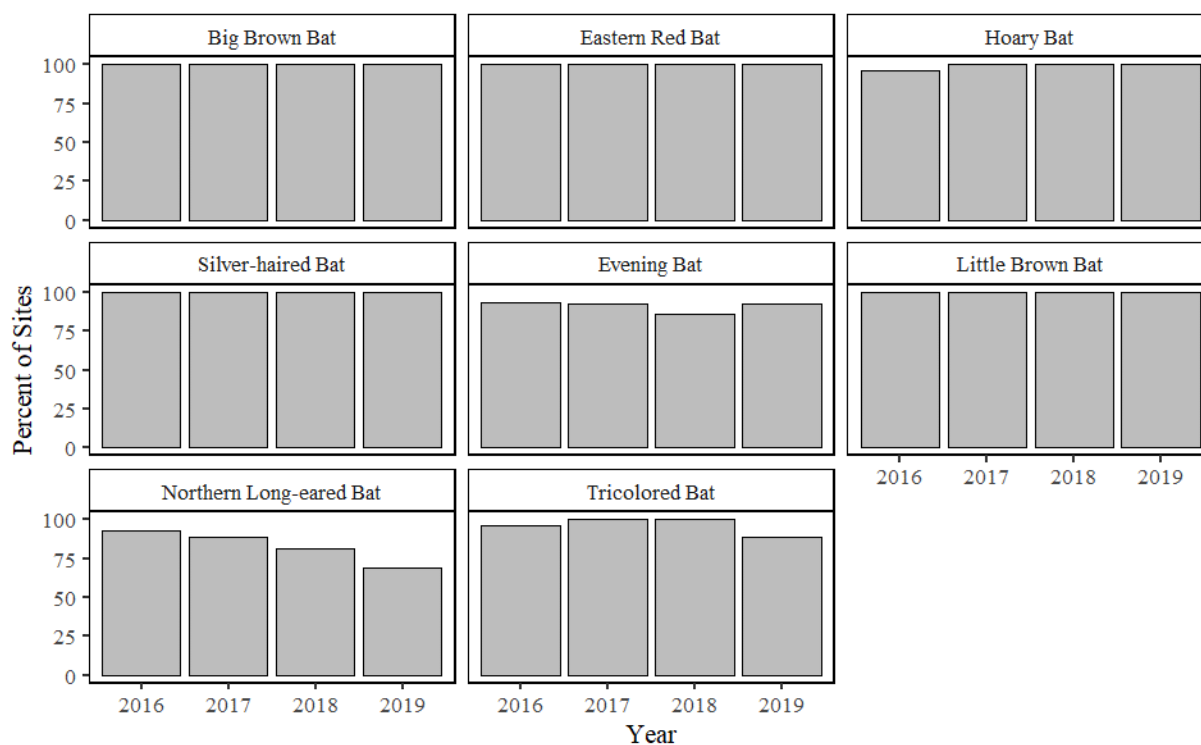


Figure 8. Proportion of monitoring sites where each species was detected each year, Mississippi National River and Recreation Area, 2016–2019. A species was considered to be detected at a site if at least one audio file was classified as that species by Kaleidoscope Pro. Results were similar for baseline and expanded analysis so only the expanded analysis is shown.

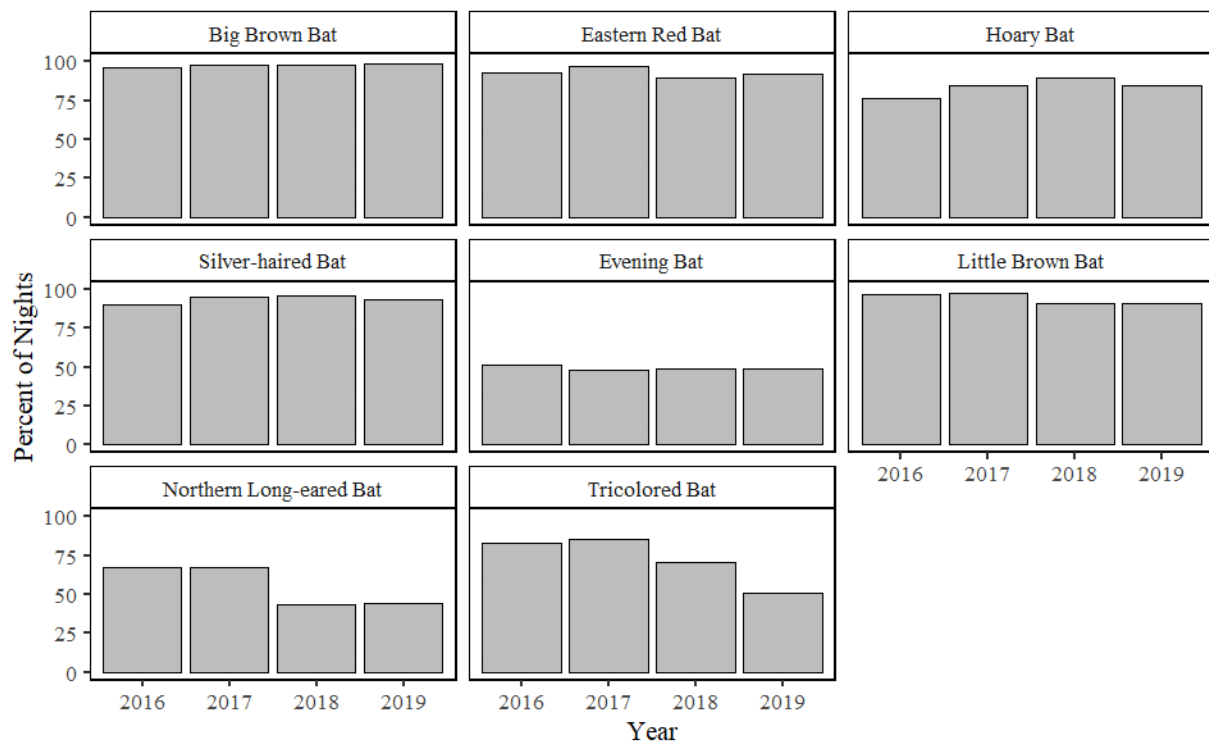


Figure 9. Proportion of recording nights on which each species was detected each year, Mississippi National River and Recreation Area, 2016–2019. A species was considered to be detected on a night if at least one audio file was classified as that species by Kaleidoscope Pro. Results were similar for 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 all eight species being verified between 2016 and 2019. 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 16% for the northern long-eared bat to 89% for the little brown 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 therefore can sometimes be identified.

Summary and Conclusions

The four bat species previously documented at MISS (see Table 1) were reconfirmed through this monitoring effort: big brown bat, hoary bat, silver-haired bat, and little brown bat. Four additional species were documented through both automated Kaleidoscope classification and manual vetting: eastern red bat, northern long-eared bat, tricolored bat, and evening bat (in the expanded analysis). With the exception of the evening bat, the presence of these species was expected since the park lies well within their known ranges.

The northern edge of the evening bat's range is generally thought to be in northern Iowa and northern Illinois (Kurta 2017). However, this species was observed for the first time in both Wisconsin and Minnesota in 2016, prompting us to include it as a possible species in our expanded analysis. Our monitoring effort yielded 12 manually verified evening bat recordings from ten different sites at MISS. In most cases, each site had only a single file in a single year, but MISS017A (Fridley private residence) had two files in 2016 and MISS034A (Fort Snelling Upper Post) had one file each in 2016 and 2019. Our results suggest that the evening bat is at least occasionally present within the park. It is important to note that only about 2% of the call files (40 files) identified by the software as evening bat have so far been manually reviewed. Conducting additional manual review on the remaining files could increase the number of locations or years with positive records.

Activity levels for five of the eight species (big brown bat, eastern red bat, hoary bat, silver-haired bat, and evening bat) appeared to be stable. Activity levels for the other three species (little brown bat, northern long-eared bat, and tricolored bat) showed decreasing trends. All three are highly susceptible to WNS and the disease is mostly likely causing the observed declines.

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 I.

Big Brown Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at 100% of survey sites each year.
- Most commonly recorded species in three out of four years. Represented 29%–46% of total files with an increasing trend.
- Recorded on more than 95% of nights each year.
- Median call files per recording night similar across all four years.

Eastern Red Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at 100% of survey sites each year.
- Percent of total files ranged from 7%–10% with little change from year to year.
- Recorded on more than 89% of nights each year.

- Median call files per recording night similar across 2016, 2017, and 2019 but lower in 2018. Site MISS034A (Fort Snelling Upper Post) had the highest call files per recording night of any site in three out of four years. Red bats will forage along forest edges and at lights in developed areas, so this site likely offers good habitat for them.

Hoary Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at over 95% of survey sites each year.
- Percent of total files ranged from 7%–10% with little change from year to year.
- Recorded on more than 75% of nights each year.
- Median call files per recording night similar across all four years.

Silver-haired Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at 100% of survey sites each year.
- Third most commonly recorded species every year. Represented 10%–15% of total files with a slightly increasing trend.
- Recorded on more than 90% of nights each year.
- Median call files per recording night similar across 2016, 2017, and 2019 but slightly higher in 2018.

Evening Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at over 85% of survey sites each year.
- Rarely recorded compared to other species. Represented less than 1% of total files each year.
- Recorded on approximately 50% of nights each year.
- Median call files per recording night similar across all four years. Site MISS034A (Fort Snelling Upper Post) had the highest call files per recording night of all sites in three out of four years. Evening bats may be foraging here or may be roosting in the buildings or nearby trees.

Little Brown Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at 100% of survey sites each year.
- Most commonly recorded species in 2016, with almost 40% of files. Second most commonly recorded species in the other three years, with 18%–30% of files.
- Recorded on more than 90% of nights each year.
- Median call files per recording night highest in 2016 and decreasing thereafter. Site MISS027A (Kaposia Park) had the highest call files per recording night of all sites in all four

years. Little brown bat activity may be high here because the forested trails provide good foraging opportunities. Another possibility is that little brown bats could be roosting in the historic pavilion located nearby.

Northern Long-eared Bat

- Documented in every year of surveys via automated identification and manually verified in 2016, 2017, and 2019.
- Less widely distributed than other species, but still present at over two-thirds of survey sites each year.
- Rarely recorded compared to other species. Represented 3% or less of total files each year, with a decreasing trend.
- Recorded on 44%–68% of nights each year.
- Median call files per recording night higher in 2016–2017, and lower in 2018–2019. Site MISS014A (Spring Lake Park Archery Range) had the highest call files per recording night of all sites in all four years. Northern long-eared bats tend to forage within closed-canopy forested areas, which this site offers.

Tricolored Bat

- Documented in every year of surveys (both automated and manual identification).
- Widely distributed: Present at over 85% of survey sites each year.
- Rarely recorded compared to other species. Represented 5% or less of total files each year, with a decreasing trend.
- Recorded on 50%–85% of nights each year.
- Median call files per recording night highest in 2016 and declining each year thereafter. Sites MISS018A (Hidden Falls Park) and MISS019A (Aggregate Industries, Upper Grey Cloud) were the two sites with the highest call files per recording night in three out of four years. The forest clearings and edges created by the trails and utility corridors at these two sites may provide good foraging habitat for this species.

Table 2. Summary of bat species documented at Mississippi National River and Recreation Area through automated classification and manual vetting of acoustic files.

Species	Year	Detected	
		Automated	Manual
Big Brown Bat	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Eastern Red Bat	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Hoary Bat	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Silver-haired Bat	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Evening Bat	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Little Brown Bat	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes
Northern Long-eared Bat	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	No
	2019	Yes	Yes

Table 2 (continued). Summary of bat species documented at Mississippi National River and Recreation Area through automated classification and manual vetting of acoustic files.

Species	Year	Detected	
		<i>Automated</i>	<i>Manual</i>
Tricolored Bat	2016	Yes	Yes
	2017	Yes	Yes
	2018	Yes	Yes
	2019	Yes	Yes

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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
Tricolored Bat <i>Perimyotis subflavus</i>	X	X
Evening Bat <i>Nycticeius humeralis</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 (2016–2018 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, Mississippi National River and Recreation Area, 2016–2019.

Year	Earliest	Latest	Deployment Category ¹							Total Files
			Early	Failed	Failed (short)	Late	Non-protocol	Valid	Valid (dupl.)	
2016	24 May	6 October	0	1	0	0	0	28	0	114,334
2017	2 May	31 August	0	0	1	0	4	27	0	110,486
2018	29 May	30 August	0	0	1	6	0	21	0	78,388
2019	30 May	27 August	0	0	0	0	2	26	0	104,970

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” = deployment was completed for park-specific monitoring goals at a location 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, Mississippi National River and Recreation Area, 2016–2019. This table corresponds to Figure 2 in the main text.

Year	Total Sites	Total Nights	Mean	Total Files	Mean Files	Mean Files
			Nights Per Site		Per Site	Per Night
2016	28	331	11.8	114,059	4,074	345
2017	27	299	11.1	98,484	3,648	329
2018	21	200	9.5	58,321	2,777	292
2019	26	311	12.0	100,686	3,873	324

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 for each year and analysis type, Mississippi National River and Recreation Area, 2016–2019. Noise category includes files classified as noise and files that were corrupt, unreadable, or excluded because the recording night was less than six hours long. 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
2016	baseline	114,059	100,275	752	13,032	87.92	0.66	11.43
2016	expanded	114,059	100,216	811	13,032	87.86	0.71	11.43
2017	baseline	98,484	85,079	978	12,427	86.39	0.99	12.62
2017	expanded	98,484	85,028	1,029	12,427	86.34	1.04	12.62
2018	baseline	58,321	47,685	521	10,115	81.76	0.89	17.34
2018	expanded	58,321	47,649	557	10,115	81.70	0.96	17.34
2019	baseline	100,686	73,636	737	26,313	73.13	0.73	26.13
2019	expanded	100,686	73,575	798	26,313	73.07	0.79	26.13

Table E2. Total number of audio files classified as each bat species by Kaleidoscope Pro for each year and analysis type, Mississippi National River and Recreation Area, 2016–2019. Evening bat was allowed as a 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	Evening Bat	Tricolored Bat
2016	baseline	28,608	8,170	6,801	10,249	38,445	2,897	n/a	5,105
2016	expanded	28,641	7,466	6,792	10,238	38,346	2,876	767	5,090
2017	baseline	28,422	6,400	7,785	10,096	25,315	2,804	n/a	4,257
2017	expanded	28,443	6,014	7,783	10,085	25,253	2,796	399	4,255
2018	baseline	21,731	3,445	4,726	7,277	8,729	594	n/a	1,183
2018	expanded	21,756	3,110	4,723	7,266	8,703	587	322	1,182
2019	baseline	25,789	7,159	6,644	11,371	21,422	725	n/a	526
2019	expanded	25,816	6,510	6,637	11,357	21,351	710	659	535

Table E3. Percent of audio files classified as each bat species by Kaleidoscope Pro for each year and analysis type, Mississippi National River and Recreation Area, 2016–2019. Evening bat was allowed as a 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	Evening Bat	Tricolored Bat
2016	baseline	28.53	8.15	6.78	10.22	38.34	2.89	n/a	5.09
2016	expanded	28.58	7.45	6.78	10.22	38.26	2.87	0.77	5.08
2017	baseline	33.41	7.52	9.15	11.87	29.75	3.30	n/a	5.00
2017	expanded	33.45	7.07	9.15	11.86	29.70	3.29	0.47	5.00
2018	baseline	45.57	7.22	9.91	15.26	18.31	1.25	n/a	2.48
2018	expanded	45.66	6.53	9.91	15.25	18.26	1.23	0.68	2.48
2019	baseline	35.02	9.72	9.02	15.44	29.09	0.98	n/a	0.71
2019	expanded	35.09	8.85	9.02	15.44	29.02	0.97	0.90	0.73

Table E4. Total number of monitoring sites, and count of sites where each species was detected for each year and analysis type, Mississippi National River and Recreation Area, 2016–2019. A species was considered to be detected at a site if at least one audio file was classified by Kaleidoscope Pro to that species. Evening bat was allowed as a possible species only during 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	Evening Bat	Tricolored Bat
2016	baseline	28	28	28	27	28	28	26	n/a	27
2016	expanded	28	28	28	27	28	28	26	26	27
2017	baseline	27	27	27	27	27	27	24	n/a	27
2017	expanded	27	27	27	27	27	27	24	25	27
2018	baseline	21	21	21	21	21	21	17	n/a	21
2018	expanded	21	21	21	21	21	21	17	18	21
2019	baseline	26	26	26	26	26	26	18	n/a	23
2019	expanded	26	26	26	26	26	26	18	24	23

Table E5. Total number of monitoring sites, and percent of sites where each species was detected for each year and analysis type, Mississippi National River and Recreation Area, 2016–2019. A species was considered to be detected at a site if at least one audio file was classified by Kaleidoscope Pro to that species. Evening bat was allowed as a possible species only during 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	Evening Bat	Tricolored Bat
2016	baseline	28	100.00	100.00	96.43	100.00	100.00	92.86	n/a	96.43
2016	expanded	28	100.00	100.00	96.43	100.00	100.00	92.86	92.86	96.43
2017	baseline	27	100.00	100.00	100.00	100.00	100.00	88.89	n/a	100.00
2017	expanded	27	100.00	100.00	100.00	100.00	100.00	88.89	92.59	100.00
2018	baseline	21	100.00	100.00	100.00	100.00	100.00	80.95	n/a	100.00
2018	expanded	21	100.00	100.00	100.00	100.00	100.00	80.95	85.71	100.00
2019	baseline	26	100.00	100.00	100.00	100.00	100.00	69.23	n/a	88.46
2019	expanded	26	100.00	100.00	100.00	100.00	100.00	69.23	92.31	88.46

Table E6. Total number of recording nights, and count of recording nights on which each species was detected for each year and analysis type, Mississippi National River and Recreation Area, 2016–2019. A species was considered to be detected on a night if at least one audio file was classified by Kaleidoscope Pro to that species. Evening bat was allowed as a possible species only during 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	Evening Bat	Tricolored Bat
2016	baseline	331	317	307	252	298	319	224	n/a	275
2016	expanded	331	317	307	252	298	319	224	171	274
2017	baseline	299	293	290	252	284	290	202	n/a	255
2017	expanded	299	292	289	252	284	290	201	143	255
2018	baseline	200	195	178	179	192	182	87	n/a	141
2018	expanded	200	195	179	179	192	182	87	97	142
2019	baseline	311	306	288	263	289	284	140	n/a	156
2019	expanded	311	306	285	263	289	283	139	152	159

Table E7. Total number of recording nights, and percent of recording nights on which each species was detected for each year and analysis type, Mississippi National River and Recreation Area, 2016–2019. A species was considered to be detected on a night if at least one audio file was classified by Kaleidoscope Pro to that species. Evening bat was allowed as a possible species only during 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	Evening Bat	Tricolored Bat
2016	baseline	331	95.77	92.75	76.13	90.03	96.37	67.67	n/a	83.08
2016	expanded	331	95.77	92.75	76.13	90.03	96.37	67.67	51.66	82.78
2017	baseline	299	97.99	96.99	84.28	94.98	96.99	67.56	n/a	85.28
2017	expanded	299	97.66	96.66	84.28	94.98	96.99	67.22	47.83	85.28
2018	baseline	200	97.50	89.00	89.50	96.00	91.00	43.50	n/a	70.50
2018	expanded	200	97.50	89.50	89.50	96.00	91.00	43.50	48.50	71.00
2019	baseline	311	98.39	92.60	84.57	92.93	91.32	45.02	n/a	50.16
2019	expanded	311	98.39	91.64	84.57	92.93	91.00	44.69	48.87	51.13

Appendix F. Noise Assessment.

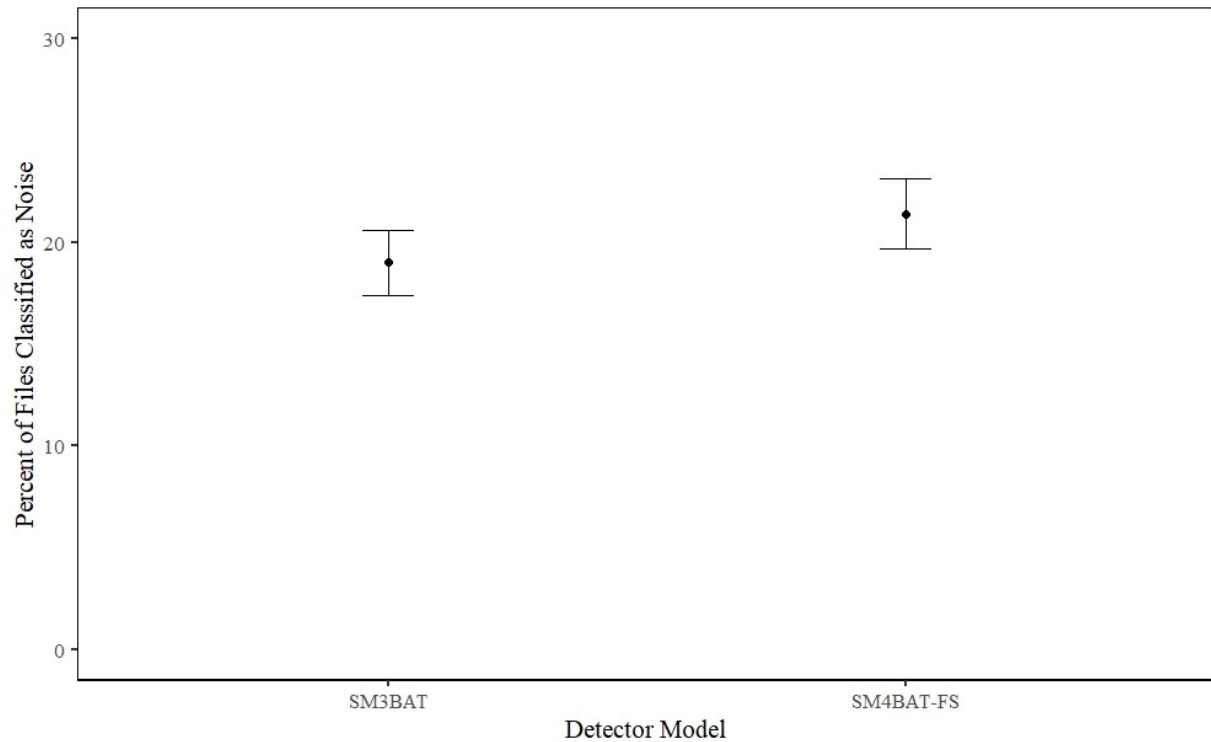


Figure F1. Percent of audio files classified as noise for each detector model (mean $\pm$ 95% confidence interval). Includes all Great Lakes Network parks in which bat monitoring occurred. Includes all deployments from 2015–2019 except failed deployments. Sample size: $n = 442$ for SM3BAT; $n = 452$ for SM4BAT-FS.

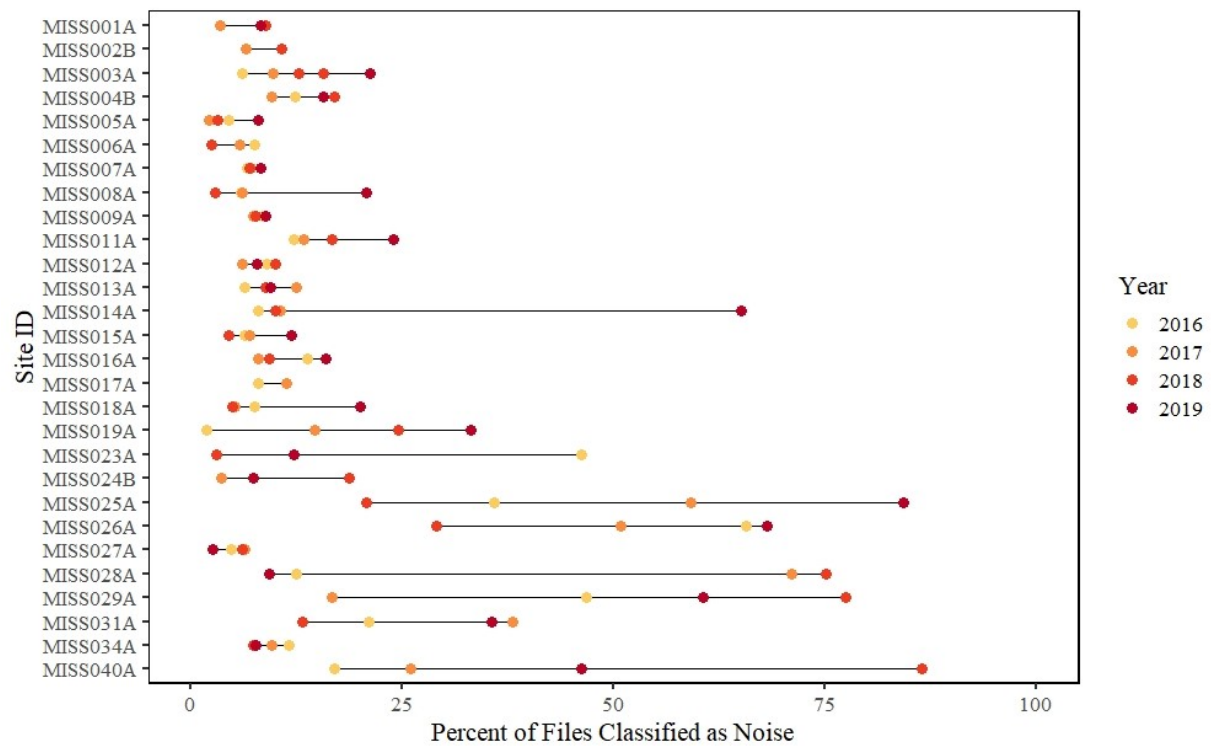


Figure F2. Percent of audio files classified as noise for each sampling site at Mississippi National River and Recreation Area, 2016–2019. Each point represents the percent noise for one year’s deployment at that sampling site. Excludes failed deployments and sites that were sampled for only one year.

Table F1. Mean percent of audio files classified as noise for each sampling site at Mississippi National River and Recreation Area, 2016–2019, including standard deviation, minimum percent noise, and maximum percent noise. Excludes failed deployments and sites only sampled for one year. The last column indicates whether the site’s mean percent noise exceeded the parkwide mean percent noise, with asterisks indicating the top five sites with the highest mean percent noise.

Site ID	Mean % Noise	St. Dev.	Min. % Noise	Max. % Noise	Exceeds Parkwide Mean
MISS001A	6.0	2.9	3.5	8.8	–
MISS002B	8.6	3.0	6.5	10.7	–
MISS003A	13.1	5.8	6.0	21.2	–
MISS004B	13.6	3.3	9.5	16.9	–
MISS005A	4.4	2.5	2.1	7.9	–
MISS006A	5.2	2.6	2.4	7.5	–
MISS007A	7.2	0.7	6.6	8.2	–
MISS008A	8.9	8.0	2.9	20.7	–
MISS009A	8.1	0.7	7.4	8.8	–
MISS011A	16.5	5.3	12.1	24.0	–
MISS012A	8.2	1.7	6.1	10.0	–
MISS013A	9.3	2.5	6.4	12.5	–
MISS014A	23.4	27.8	8.0	65.0	Yes
MISS015A	7.4	3.1	4.5	11.8	–
MISS016A	11.7	3.7	8.0	15.9	–
MISS017A	9.7	2.3	8.0	11.3	–
MISS018A	9.4	7.2	4.9	20.0	–
MISS019A	18.5	13.4	1.9	33.1	Yes
MISS023A	20.4	22.7	3.0	46.1	Yes
MISS024B	9.9	7.9	3.6	18.7	–
MISS025A	50.0	27.7	20.8	84.2	Yes*
MISS026A	53.4	18.0	29.0	68.1	Yes*
MISS027A	4.9	1.7	2.6	6.3	–
MISS028A	41.9	36.0	9.2	75.1	Yes*
MISS029A	50.4	25.7	16.7	77.4	Yes*
MISS031A	26.9	11.9	13.1	38.0	Yes
MISS034A	9.1	1.9	7.4	11.5	–
MISS040A	43.9	30.9	17.0	86.5	Yes*

Appendix G. 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 G1. Total number of files manually vetted, and the results of manual vetting for each year, analysis type, and species, Mississippi National River and Recreation Area, 2016–2019. “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
2016	baseline	Big Brown Bat	294	50	17.01
2016	baseline	Eastern Red Bat	79	44	55.70
2016	baseline	Hoary Bat	64	45	70.31
2016	baseline	Silver-haired Bat	98	47	47.96
2016	baseline	Little Brown Bat	351	312	88.89
2016	baseline	Northern Long-eared Bat	28	6	21.43
2016	baseline	Tricolored Bat	46	41	89.13
2016	expanded	Evening Bat	10	4	40.00
2017	baseline	Big Brown Bat	263	138	52.47
2017	baseline	Eastern Red Bat	58	35	60.34
2017	baseline	Hoary Bat	66	47	71.21
2017	baseline	Silver-haired Bat	87	13	14.94
2017	baseline	Little Brown Bat	226	191	84.51
2017	baseline	Northern Long-eared Bat	28	3	10.71
2017	baseline	Tricolored Bat	37	25	67.57
2017	expanded	Evening Bat	10	2	20.00
2018	baseline	Big Brown Bat	217	75	34.56
2018	baseline	Eastern Red Bat	34	28	82.35
2018	baseline	Hoary Bat	47	41	87.23
2018	baseline	Silver-haired Bat	73	15	20.55
2018	baseline	Little Brown Bat	87	81	93.10
2018	baseline	Northern Long-eared Bat	10	0	0.00
2018	baseline	Tricolored Bat	12	9	75.00
2018	expanded	Evening Bat	10	3	30.00

Year	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	baseline	Big Brown Bat	253	121	47.83
2019	baseline	Eastern Red Bat	69	51	73.91
2019	baseline	Hoary Bat	66	28	42.42
2019	baseline	Silver-haired Bat	113	8	7.08
2019	baseline	Little Brown Bat	211	185	87.68
2019	baseline	Northern Long-eared Bat	10	3	30.00
2019	baseline	Tricolored Bat	10	7	70.00
2019	expanded	Evening Bat	10	3	30.00

Appendix H. 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 H1. Total number of files manually vetted, and the results of manual vetting for each year, site, analysis type, and species, Mississippi National River and Recreation Area, 2016–2019. “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
2016	MISS001A_2016	baseline	Big Brown Bat	23	0	0.00
2016	MISS001A_2016	baseline	Eastern Red Bat	3	0	0.00
2016	MISS001A_2016	baseline	Hoary Bat	6	3	50.00
2016	MISS001A_2016	baseline	Silver-haired Bat	11	4	36.36
2016	MISS001A_2016	expanded	Evening Bat	1	0	0.00
2016	MISS002A_2016	baseline	Eastern Red Bat	2	0	0.00
2016	MISS002A_2016	baseline	Hoary Bat	7	6	85.71
2016	MISS002A_2016	baseline	Silver-haired Bat	2	1	50.00
2016	MISS002A_2016	baseline	Little Brown Bat	4	4	100.00
2016	MISS003A_2016	baseline	Big Brown Bat	6	1	16.67
2016	MISS003A_2016	baseline	Eastern Red Bat	3	1	33.33
2016	MISS003A_2016	baseline	Hoary Bat	2	2	100.00
2016	MISS003A_2016	baseline	Silver-haired Bat	2	1	50.00
2016	MISS003A_2016	baseline	Little Brown Bat	8	8	100.00
2016	MISS003A_2016	baseline	Tricolored Bat	1	1	100.00
2016	MISS004B_2016	baseline	Big Brown Bat	2	1	50.00
2016	MISS004B_2016	baseline	Eastern Red Bat	1	1	100.00
2016	MISS004B_2016	baseline	Hoary Bat	3	3	100.00
2016	MISS004B_2016	baseline	Silver-haired Bat	8	6	75.00
2016	MISS004B_2016	baseline	Tricolored Bat	1	1	100.00
2016	MISS004B_2016	expanded	Evening Bat	2	1	50.00
2016	MISS005A_2016	baseline	Big Brown Bat	30	2	6.67
2016	MISS005A_2016	baseline	Eastern Red Bat	2	1	50.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2016	MISS005A_2016	baseline	Hoary Bat	1	1	100.00
2016	MISS005A_2016	baseline	Silver-haired Bat	8	1	12.50
2016	MISS005A_2016	baseline	Little Brown Bat	2	2	100.00
2016	MISS005A_2016	expanded	Evening Bat	1	0	0.00
2016	MISS006A_2016	baseline	Big Brown Bat	16	0	0.00
2016	MISS006A_2016	baseline	Eastern Red Bat	3	3	100.00
2016	MISS006A_2016	baseline	Silver-haired Bat	4	1	25.00
2016	MISS006A_2016	baseline	Little Brown Bat	4	3	75.00
2016	MISS006A_2016	baseline	Northern Long-eared Bat	1	0	0.00
2016	MISS006A_2016	baseline	Tricolored Bat	1	1	100.00
2016	MISS007A_2016	baseline	Big Brown Bat	17	4	23.53
2016	MISS007A_2016	baseline	Eastern Red Bat	4	0	0.00
2016	MISS007A_2016	baseline	Hoary Bat	8	4	50.00
2016	MISS007A_2016	baseline	Silver-haired Bat	5	3	60.00
2016	MISS007A_2016	baseline	Little Brown Bat	17	15	88.24
2016	MISS007A_2016	baseline	Tricolored Bat	8	8	100.00
2016	MISS008A_2016	baseline	Big Brown Bat	23	8	34.78
2016	MISS008A_2016	baseline	Eastern Red Bat	13	8	61.54
2016	MISS008A_2016	baseline	Hoary Bat	7	7	100.00
2016	MISS008A_2016	baseline	Silver-haired Bat	6	3	50.00
2016	MISS008A_2016	baseline	Little Brown Bat	11	9	81.82
2016	MISS008A_2016	baseline	Northern Long-eared Bat	1	0	0.00
2016	MISS008A_2016	expanded	Evening Bat	2	0	0.00
2016	MISS009A_2016	baseline	Big Brown Bat	4	0	0.00
2016	MISS009A_2016	baseline	Eastern Red Bat	1	0	0.00
2016	MISS009A_2016	baseline	Hoary Bat	2	2	100.00
2016	MISS009A_2016	baseline	Silver-haired Bat	5	4	80.00
2016	MISS009A_2016	baseline	Little Brown Bat	9	9	100.00
2016	MISS011A_2016	baseline	Big Brown Bat	3	0	0.00
2016	MISS011A_2016	baseline	Hoary Bat	3	2	66.67

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2016	MISS011A_2016	baseline	Little Brown Bat	23	21	91.30
2016	MISS011A_2016	baseline	Northern Long-eared Bat	3	0	0.00
2016	MISS012A_2016	baseline	Big Brown Bat	10	3	30.00
2016	MISS012A_2016	baseline	Eastern Red Bat	3	2	66.67
2016	MISS012A_2016	baseline	Hoary Bat	5	2	40.00
2016	MISS012A_2016	baseline	Silver-haired Bat	5	1	20.00
2016	MISS012A_2016	baseline	Little Brown Bat	5	4	80.00
2016	MISS012A_2016	baseline	Tricolored Bat	1	1	100.00
2016	MISS013A_2016	baseline	Big Brown Bat	15	2	13.33
2016	MISS013A_2016	baseline	Hoary Bat	4	3	75.00
2016	MISS013A_2016	baseline	Silver-haired Bat	1	0	0.00
2016	MISS013A_2016	baseline	Little Brown Bat	6	5	83.33
2016	MISS014A_2016	baseline	Little Brown Bat	15	8	53.33
2016	MISS014A_2016	baseline	Northern Long-eared Bat	16	5	31.25
2016	MISS015A_2016	baseline	Big Brown Bat	31	15	48.39
2016	MISS015A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	MISS015A_2016	baseline	Hoary Bat	4	2	50.00
2016	MISS015A_2016	baseline	Silver-haired Bat	4	2	50.00
2016	MISS015A_2016	baseline	Little Brown Bat	8	7	87.50
2016	MISS016A_2016	baseline	Big Brown Bat	1	0	0.00
2016	MISS016A_2016	baseline	Eastern Red Bat	1	0	0.00
2016	MISS016A_2016	baseline	Little Brown Bat	15	11	73.33
2016	MISS017A_2016	baseline	Big Brown Bat	13	0	0.00
2016	MISS017A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	MISS017A_2016	baseline	Hoary Bat	6	5	83.33
2016	MISS017A_2016	baseline	Silver-haired Bat	6	4	66.67
2016	MISS017A_2016	baseline	Little Brown Bat	2	2	100.00
2016	MISS017A_2016	expanded	Evening Bat	2	2	100.00
2016	MISS018A_2016	baseline	Big Brown Bat	3	0	0.00
2016	MISS018A_2016	baseline	Eastern Red Bat	1	1	100.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2016	MISS018A_2016	baseline	Little Brown Bat	2	2	100.00
2016	MISS018A_2016	baseline	Northern Long-eared Bat	1	0	0.00
2016	MISS018A_2016	baseline	Tricolored Bat	6	5	83.33
2016	MISS019A_2016	baseline	Big Brown Bat	36	4	11.11
2016	MISS019A_2016	baseline	Eastern Red Bat	9	5	55.56
2016	MISS019A_2016	baseline	Hoary Bat	1	0	0.00
2016	MISS019A_2016	baseline	Silver-haired Bat	6	2	33.33
2016	MISS019A_2016	baseline	Little Brown Bat	24	21	87.50
2016	MISS019A_2016	baseline	Tricolored Bat	11	9	81.82
2016	MISS019A_2016	expanded	Evening Bat	1	0	0.00
2016	MISS023A_2016	baseline	Big Brown Bat	4	1	25.00
2016	MISS023A_2016	baseline	Silver-haired Bat	2	1	50.00
2016	MISS023A_2016	baseline	Little Brown Bat	14	14	100.00
2016	MISS024A_2016	baseline	Big Brown Bat	16	6	37.50
2016	MISS024A_2016	baseline	Eastern Red Bat	3	2	66.67
2016	MISS024A_2016	baseline	Little Brown Bat	24	23	95.83
2016	MISS024A_2016	baseline	Northern Long-eared Bat	1	0	0.00
2016	MISS024A_2016	baseline	Tricolored Bat	3	2	66.67
2016	MISS025A_2016	baseline	Big Brown Bat	1	0	0.00
2016	MISS025A_2016	baseline	Hoary Bat	1	0	0.00
2016	MISS025A_2016	baseline	Silver-haired Bat	6	0	0.00
2016	MISS027A_2016	baseline	Big Brown Bat	5	1	20.00
2016	MISS027A_2016	baseline	Eastern Red Bat	4	2	50.00
2016	MISS027A_2016	baseline	Little Brown Bat	64	58	90.62
2016	MISS027A_2016	baseline	Northern Long-eared Bat	3	0	0.00
2016	MISS028A_2016	baseline	Eastern Red Bat	1	0	0.00
2016	MISS028A_2016	baseline	Little Brown Bat	31	30	96.77
2016	MISS028A_2016	baseline	Northern Long-eared Bat	1	1	100.00
2016	MISS028A_2016	baseline	Tricolored Bat	1	1	100.00
2016	MISS029A_2016	baseline	Big Brown Bat	5	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2016	MISS029A_2016	baseline	Eastern Red Bat	1	1	100.00
2016	MISS029A_2016	baseline	Silver-haired Bat	7	6	85.71
2016	MISS029A_2016	baseline	Little Brown Bat	3	2	66.67
2016	MISS031A_2016	baseline	Big Brown Bat	3	0	0.00
2016	MISS031A_2016	baseline	Hoary Bat	2	2	100.00
2016	MISS031A_2016	baseline	Silver-haired Bat	1	1	100.00
2016	MISS031A_2016	baseline	Little Brown Bat	1	1	100.00
2016	MISS031A_2016	baseline	Northern Long-eared Bat	1	0	0.00
2016	MISS031A_2016	baseline	Tricolored Bat	1	1	100.00
2016	MISS034A_2016	baseline	Big Brown Bat	6	2	33.33
2016	MISS034A_2016	baseline	Eastern Red Bat	16	13	81.25
2016	MISS034A_2016	baseline	Hoary Bat	1	0	0.00
2016	MISS034A_2016	baseline	Silver-haired Bat	3	3	100.00
2016	MISS034A_2016	baseline	Little Brown Bat	8	6	75.00
2016	MISS034A_2016	baseline	Tricolored Bat	2	1	50.00
2016	MISS034A_2016	expanded	Evening Bat	1	1	100.00
2016	MISS040A_2016	baseline	Big Brown Bat	21	0	0.00
2016	MISS040A_2016	baseline	Eastern Red Bat	6	2	33.33
2016	MISS040A_2016	baseline	Hoary Bat	1	1	100.00
2016	MISS040A_2016	baseline	Silver-haired Bat	6	3	50.00
2016	MISS040A_2016	baseline	Little Brown Bat	51	47	92.16
2016	MISS040A_2016	baseline	Tricolored Bat	10	10	100.00
2017	MISS002B_2017	baseline	Big Brown Bat	17	8	47.06
2017	MISS002B_2017	baseline	Eastern Red Bat	1	1	100.00
2017	MISS002B_2017	baseline	Hoary Bat	13	10	76.92
2017	MISS002B_2017	baseline	Silver-haired Bat	11	1	9.09
2017	MISS002B_2017	baseline	Little Brown Bat	2	2	100.00
2017	MISS003A_2017	baseline	Big Brown Bat	2	2	100.00
2017	MISS003A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	MISS003A_2017	baseline	Hoary Bat	4	2	50.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	MISS003A_2017	baseline	Silver-haired Bat	3	0	0.00
2017	MISS003A_2017	baseline	Little Brown Bat	2	2	100.00
2017	MISS003A_2017	baseline	Northern Long-eared Bat	2	1	50.00
2017	MISS003A_2017	baseline	Tricolored Bat	1	1	100.00
2017	MISS004B_2017	baseline	Big Brown Bat	1	0	0.00
2017	MISS004B_2017	baseline	Eastern Red Bat	2	2	100.00
2017	MISS004B_2017	baseline	Hoary Bat	4	2	50.00
2017	MISS004B_2017	baseline	Silver-haired Bat	6	2	33.33
2017	MISS004B_2017	baseline	Little Brown Bat	2	1	50.00
2017	MISS004B_2017	expanded	Evening Bat	2	0	0.00
2017	MISS005A_2017	baseline	Big Brown Bat	27	17	62.96
2017	MISS005A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	MISS005A_2017	baseline	Hoary Bat	2	0	0.00
2017	MISS005A_2017	baseline	Silver-haired Bat	2	0	0.00
2017	MISS006A_2017	baseline	Big Brown Bat	1	1	100.00
2017	MISS006A_2017	baseline	Little Brown Bat	5	5	100.00
2017	MISS007A_2017	baseline	Big Brown Bat	3	2	66.67
2017	MISS007A_2017	baseline	Eastern Red Bat	1	0	0.00
2017	MISS007A_2017	baseline	Silver-haired Bat	2	1	50.00
2017	MISS007A_2017	baseline	Little Brown Bat	9	8	88.89
2017	MISS007A_2017	baseline	Northern Long-eared Bat	4	0	0.00
2017	MISS008A_2017	baseline	Big Brown Bat	19	9	47.37
2017	MISS008A_2017	baseline	Eastern Red Bat	4	3	75.00
2017	MISS008A_2017	baseline	Hoary Bat	3	3	100.00
2017	MISS008A_2017	baseline	Silver-haired Bat	4	1	25.00
2017	MISS008A_2017	baseline	Little Brown Bat	9	8	88.89
2017	MISS008A_2017	baseline	Tricolored Bat	2	2	100.00
2017	MISS008A_2017	expanded	Evening Bat	1	0	0.00
2017	MISS009A_2017	baseline	Big Brown Bat	4	1	25.00
2017	MISS009A_2017	baseline	Eastern Red Bat	1	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	MISS009A_2017	baseline	Hoary Bat	8	6	75.00
2017	MISS009A_2017	baseline	Silver-haired Bat	14	5	35.71
2017	MISS009A_2017	baseline	Little Brown Bat	3	3	100.00
2017	MISS011A_2017	baseline	Big Brown Bat	6	2	33.33
2017	MISS011A_2017	baseline	Eastern Red Bat	5	5	100.00
2017	MISS011A_2017	baseline	Hoary Bat	4	4	100.00
2017	MISS011A_2017	baseline	Silver-haired Bat	3	0	0.00
2017	MISS011A_2017	baseline	Little Brown Bat	21	17	80.95
2017	MISS011A_2017	baseline	Northern Long-eared Bat	3	0	0.00
2017	MISS011A_2017	expanded	Evening Bat	1	1	100.00
2017	MISS012A_2017	baseline	Big Brown Bat	12	5	41.67
2017	MISS012A_2017	baseline	Hoary Bat	3	2	66.67
2017	MISS012A_2017	baseline	Silver-haired Bat	1	0	0.00
2017	MISS012A_2017	baseline	Little Brown Bat	4	4	100.00
2017	MISS012A_2017	baseline	Northern Long-eared Bat	1	0	0.00
2017	MISS012A_2017	expanded	Evening Bat	1	0	0.00
2017	MISS013A_2017	baseline	Big Brown Bat	36	19	52.78
2017	MISS013A_2017	baseline	Eastern Red Bat	1	1	100.00
2017	MISS013A_2017	baseline	Hoary Bat	3	0	0.00
2017	MISS013A_2017	baseline	Silver-haired Bat	4	0	0.00
2017	MISS013A_2017	baseline	Little Brown Bat	3	0	0.00
2017	MISS013A_2017	expanded	Evening Bat	1	1	100.00
2017	MISS014A_2017	baseline	Eastern Red Bat	1	0	0.00
2017	MISS014A_2017	baseline	Hoary Bat	1	0	0.00
2017	MISS014A_2017	baseline	Little Brown Bat	11	11	100.00
2017	MISS014A_2017	baseline	Northern Long-eared Bat	12	2	16.67
2017	MISS015A_2017	baseline	Big Brown Bat	23	18	78.26
2017	MISS015A_2017	baseline	Eastern Red Bat	2	2	100.00
2017	MISS015A_2017	baseline	Hoary Bat	1	1	100.00
2017	MISS015A_2017	baseline	Silver-haired Bat	4	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	MISS015A_2017	baseline	Little Brown Bat	5	2	40.00
2017	MISS015A_2017	expanded	Evening Bat	1	0	0.00
2017	MISS016A_2017	baseline	Big Brown Bat	9	6	66.67
2017	MISS016A_2017	baseline	Eastern Red Bat	1	0	0.00
2017	MISS016A_2017	baseline	Hoary Bat	1	0	0.00
2017	MISS016A_2017	baseline	Little Brown Bat	22	21	95.45
2017	MISS016A_2017	baseline	Northern Long-eared Bat	1	0	0.00
2017	MISS016A_2017	baseline	Tricolored Bat	1	1	100.00
2017	MISS017A_2017	baseline	Big Brown Bat	3	0	0.00
2017	MISS017A_2017	baseline	Eastern Red Bat	2	2	100.00
2017	MISS017A_2017	baseline	Hoary Bat	5	4	80.00
2017	MISS017A_2017	baseline	Silver-haired Bat	1	0	0.00
2017	MISS017A_2017	baseline	Little Brown Bat	1	1	100.00
2017	MISS017A_2017	baseline	Tricolored Bat	3	3	100.00
2017	MISS018A_2017	baseline	Big Brown Bat	18	6	33.33
2017	MISS018A_2017	baseline	Eastern Red Bat	4	2	50.00
2017	MISS018A_2017	baseline	Silver-haired Bat	4	0	0.00
2017	MISS018A_2017	baseline	Little Brown Bat	9	8	88.89
2017	MISS018A_2017	baseline	Tricolored Bat	9	4	44.44
2017	MISS019A_2017	baseline	Big Brown Bat	23	15	65.22
2017	MISS019A_2017	baseline	Eastern Red Bat	6	4	66.67
2017	MISS019A_2017	baseline	Hoary Bat	1	1	100.00
2017	MISS019A_2017	baseline	Silver-haired Bat	3	1	33.33
2017	MISS019A_2017	baseline	Little Brown Bat	12	11	91.67
2017	MISS019A_2017	baseline	Northern Long-eared Bat	1	0	0.00
2017	MISS019A_2017	baseline	Tricolored Bat	7	5	71.43
2017	MISS023B_2017	baseline	Big Brown Bat	1	0	0.00
2017	MISS023B_2017	baseline	Eastern Red Bat	8	3	37.50
2017	MISS023B_2017	baseline	Silver-haired Bat	8	0	0.00
2017	MISS023B_2017	baseline	Little Brown Bat	7	6	85.71

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	MISS024B_2017	baseline	Big Brown Bat	19	12	63.16
2017	MISS024B_2017	baseline	Eastern Red Bat	1	0	0.00
2017	MISS024B_2017	baseline	Silver-haired Bat	2	0	0.00
2017	MISS024B_2017	baseline	Little Brown Bat	33	27	81.82
2017	MISS024B_2017	baseline	Northern Long-eared Bat	3	0	0.00
2017	MISS024B_2017	baseline	Tricolored Bat	5	3	60.00
2017	MISS025A_2017	baseline	Silver-haired Bat	2	0	0.00
2017	MISS025A_2017	baseline	Northern Long-eared Bat	1	0	0.00
2017	MISS025A_2017	expanded	Evening Bat	1	0	0.00
2017	MISS026A_2017	baseline	Big Brown Bat	2	1	50.00
2017	MISS026A_2017	baseline	Silver-haired Bat	1	0	0.00
2017	MISS026A_2017	baseline	Little Brown Bat	1	1	100.00
2017	MISS026A_2017	baseline	Tricolored Bat	1	1	100.00
2017	MISS027A_2017	baseline	Big Brown Bat	7	4	57.14
2017	MISS027A_2017	baseline	Eastern Red Bat	6	1	16.67
2017	MISS027A_2017	baseline	Silver-haired Bat	2	0	0.00
2017	MISS027A_2017	baseline	Little Brown Bat	42	36	85.71
2017	MISS027A_2017	baseline	Tricolored Bat	2	2	100.00
2017	MISS028A_2017	baseline	Little Brown Bat	2	2	100.00
2017	MISS029A_2017	baseline	Big Brown Bat	11	2	18.18
2017	MISS029A_2017	baseline	Eastern Red Bat	1	0	0.00
2017	MISS029A_2017	baseline	Hoary Bat	4	4	100.00
2017	MISS029A_2017	baseline	Silver-haired Bat	7	1	14.29
2017	MISS029A_2017	baseline	Little Brown Bat	3	0	0.00
2017	MISS029A_2017	baseline	Tricolored Bat	1	0	0.00
2017	MISS031A_2017	baseline	Hoary Bat	6	6	100.00
2017	MISS031A_2017	baseline	Silver-haired Bat	1	0	0.00
2017	MISS031A_2017	baseline	Little Brown Bat	2	2	100.00
2017	MISS031A_2017	baseline	Tricolored Bat	2	1	50.00
2017	MISS034A_2017	baseline	Big Brown Bat	6	2	33.33

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2017	MISS034A_2017	baseline	Eastern Red Bat	7	6	85.71
2017	MISS034A_2017	baseline	Hoary Bat	3	2	66.67
2017	MISS034A_2017	baseline	Silver-haired Bat	1	0	0.00
2017	MISS034A_2017	baseline	Little Brown Bat	2	1	50.00
2017	MISS034A_2017	baseline	Tricolored Bat	2	1	50.00
2017	MISS034A_2017	expanded	Evening Bat	2	0	0.00
2017	MISS040A_2017	baseline	Big Brown Bat	13	6	46.15
2017	MISS040A_2017	baseline	Eastern Red Bat	2	1	50.00
2017	MISS040A_2017	baseline	Silver-haired Bat	1	1	100.00
2017	MISS040A_2017	baseline	Little Brown Bat	14	12	85.71
2017	MISS040A_2017	baseline	Tricolored Bat	1	1	100.00
2018	MISS001A_2018	baseline	Big Brown Bat	2	0	0.00
2018	MISS001A_2018	baseline	Eastern Red Bat	2	2	100.00
2018	MISS001A_2018	baseline	Hoary Bat	9	9	100.00
2018	MISS001A_2018	baseline	Silver-haired Bat	2	0	0.00
2018	MISS001A_2018	expanded	Evening Bat	1	0	0.00
2018	MISS002B_2018	baseline	Big Brown Bat	1	0	0.00
2018	MISS002B_2018	baseline	Silver-haired Bat	2	0	0.00
2018	MISS002B_2018	baseline	Little Brown Bat	1	1	100.00
2018	MISS003A_2018	baseline	Big Brown Bat	5	3	60.00
2018	MISS003A_2018	baseline	Hoary Bat	3	3	100.00
2018	MISS003A_2018	baseline	Silver-haired Bat	8	1	12.50
2018	MISS003A_2018	baseline	Little Brown Bat	6	6	100.00
2018	MISS003A_2018	baseline	Northern Long-eared Bat	2	0	0.00
2018	MISS004B_2018	baseline	Big Brown Bat	1	0	0.00
2018	MISS004B_2018	baseline	Hoary Bat	3	3	100.00
2018	MISS004B_2018	baseline	Silver-haired Bat	3	0	0.00
2018	MISS005A_2018	baseline	Big Brown Bat	22	4	18.18
2018	MISS005A_2018	baseline	Eastern Red Bat	3	3	100.00
2018	MISS005A_2018	baseline	Hoary Bat	1	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2018	MISS005A_2018	baseline	Silver-haired Bat	4	0	0.00
2018	MISS005A_2018	baseline	Little Brown Bat	1	0	0.00
2018	MISS005A_2018	expanded	Evening Bat	1	1	100.00
2018	MISS006A_2018	baseline	Big Brown Bat	48	14	29.17
2018	MISS006A_2018	baseline	Hoary Bat	1	1	100.00
2018	MISS006A_2018	baseline	Silver-haired Bat	7	2	28.57
2018	MISS006A_2018	baseline	Little Brown Bat	1	1	100.00
2018	MISS007A_2018	baseline	Big Brown Bat	6	2	33.33
2018	MISS007A_2018	baseline	Eastern Red Bat	6	5	83.33
2018	MISS007A_2018	baseline	Hoary Bat	6	4	66.67
2018	MISS007A_2018	baseline	Silver-haired Bat	1	1	100.00
2018	MISS007A_2018	baseline	Little Brown Bat	10	8	80.00
2018	MISS007A_2018	baseline	Northern Long-eared Bat	1	0	0.00
2018	MISS007A_2018	expanded	Evening Bat	2	1	50.00
2018	MISS009A_2018	baseline	Hoary Bat	11	10	90.91
2018	MISS009A_2018	baseline	Silver-haired Bat	7	5	71.43
2018	MISS009A_2018	baseline	Tricolored Bat	1	1	100.00
2018	MISS011A_2018	baseline	Big Brown Bat	5	4	80.00
2018	MISS011A_2018	baseline	Eastern Red Bat	3	3	100.00
2018	MISS011A_2018	baseline	Hoary Bat	3	3	100.00
2018	MISS011A_2018	baseline	Silver-haired Bat	1	0	0.00
2018	MISS011A_2018	baseline	Little Brown Bat	15	14	93.33
2018	MISS011A_2018	baseline	Northern Long-eared Bat	2	0	0.00
2018	MISS012A_2018	baseline	Big Brown Bat	21	12	57.14
2018	MISS012A_2018	baseline	Eastern Red Bat	5	4	80.00
2018	MISS012A_2018	baseline	Hoary Bat	1	1	100.00
2018	MISS012A_2018	baseline	Silver-haired Bat	5	0	0.00
2018	MISS012A_2018	baseline	Little Brown Bat	3	2	66.67
2018	MISS012A_2018	baseline	Northern Long-eared Bat	2	0	0.00
2018	MISS012A_2018	baseline	Tricolored Bat	1	1	100.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2018	MISS012A_2018	expanded	Evening Bat	3	1	33.33
2018	MISS013A_2018	baseline	Big Brown Bat	34	6	17.65
2018	MISS013A_2018	baseline	Eastern Red Bat	2	2	100.00
2018	MISS013A_2018	baseline	Hoary Bat	2	2	100.00
2018	MISS013A_2018	baseline	Silver-haired Bat	8	1	12.50
2018	MISS013A_2018	baseline	Little Brown Bat	6	6	100.00
2018	MISS014A_2018	baseline	Big Brown Bat	1	1	100.00
2018	MISS014A_2018	baseline	Hoary Bat	1	0	0.00
2018	MISS014A_2018	baseline	Little Brown Bat	6	6	100.00
2018	MISS014A_2018	baseline	Northern Long-eared Bat	3	0	0.00
2018	MISS015A_2018	baseline	Big Brown Bat	15	7	46.67
2018	MISS015A_2018	baseline	Eastern Red Bat	3	3	100.00
2018	MISS015A_2018	baseline	Hoary Bat	1	0	0.00
2018	MISS015A_2018	baseline	Silver-haired Bat	2	0	0.00
2018	MISS018A_2018	baseline	Big Brown Bat	10	6	60.00
2018	MISS018A_2018	baseline	Eastern Red Bat	4	4	100.00
2018	MISS018A_2018	baseline	Little Brown Bat	4	4	100.00
2018	MISS018A_2018	baseline	Tricolored Bat	1	1	100.00
2018	MISS019A_2018	baseline	Big Brown Bat	20	7	35.00
2018	MISS019A_2018	baseline	Eastern Red Bat	5	2	40.00
2018	MISS019A_2018	baseline	Silver-haired Bat	9	1	11.11
2018	MISS019A_2018	baseline	Little Brown Bat	13	13	100.00
2018	MISS019A_2018	baseline	Tricolored Bat	8	6	75.00
2018	MISS019A_2018	expanded	Evening Bat	2	0	0.00
2018	MISS026A_2018	baseline	Big Brown Bat	1	0	0.00
2018	MISS026A_2018	baseline	Silver-haired Bat	1	1	100.00
2018	MISS026A_2018	baseline	Little Brown Bat	1	1	100.00
2018	MISS026A_2018	baseline	Tricolored Bat	1	0	0.00
2018	MISS027A_2018	baseline	Big Brown Bat	2	0	0.00
2018	MISS027A_2018	baseline	Little Brown Bat	17	17	100.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2018	MISS028A_2018	baseline	Big Brown Bat	2	2	100.00
2018	MISS029A_2018	baseline	Big Brown Bat	6	2	33.33
2018	MISS029A_2018	baseline	Eastern Red Bat	1	0	0.00
2018	MISS029A_2018	baseline	Hoary Bat	2	2	100.00
2018	MISS029A_2018	baseline	Silver-haired Bat	3	0	0.00
2018	MISS029A_2018	baseline	Little Brown Bat	1	0	0.00
2018	MISS031A_2018	baseline	Big Brown Bat	4	0	0.00
2018	MISS031A_2018	baseline	Hoary Bat	2	2	100.00
2018	MISS031A_2018	baseline	Silver-haired Bat	6	0	0.00
2018	MISS031A_2018	expanded	Evening Bat	1	0	0.00
2018	MISS034A_2018	baseline	Big Brown Bat	11	5	45.45
2018	MISS034A_2018	baseline	Hoary Bat	1	1	100.00
2018	MISS034A_2018	baseline	Silver-haired Bat	4	3	75.00
2018	MISS034A_2018	baseline	Little Brown Bat	2	2	100.00
2019	MISS001A_2019	baseline	Big Brown Bat	2	0	0.00
2019	MISS001A_2019	baseline	Eastern Red Bat	2	0	0.00
2019	MISS001A_2019	baseline	Hoary Bat	6	6	100.00
2019	MISS001A_2019	baseline	Silver-haired Bat	25	1	4.00
2019	MISS001A_2019	expanded	Evening Bat	1	0	0.00
2019	MISS003A_2019	baseline	Big Brown Bat	4	3	75.00
2019	MISS003A_2019	baseline	Hoary Bat	3	1	33.33
2019	MISS003A_2019	baseline	Little Brown Bat	2	1	50.00
2019	MISS003A_2019	expanded	Evening Bat	1	1	100.00
2019	MISS004B_2019	baseline	Big Brown Bat	7	0	0.00
2019	MISS004B_2019	baseline	Hoary Bat	3	1	33.33
2019	MISS004B_2019	baseline	Silver-haired Bat	6	0	0.00
2019	MISS005A_2019	baseline	Big Brown Bat	13	8	61.54
2019	MISS005A_2019	baseline	Eastern Red Bat	2	2	100.00
2019	MISS005A_2019	baseline	Hoary Bat	1	0	0.00
2019	MISS005A_2019	baseline	Silver-haired Bat	5	1	20.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	MISS005A_2019	baseline	Tricolored Bat	3	1	33.33
2019	MISS005A_2019	expanded	Evening Bat	1	0	0.00
2019	MISS007A_2019	baseline	Big Brown Bat	6	4	66.67
2019	MISS007A_2019	baseline	Eastern Red Bat	4	3	75.00
2019	MISS007A_2019	baseline	Hoary Bat	5	3	60.00
2019	MISS007A_2019	baseline	Silver-haired Bat	1	0	0.00
2019	MISS007A_2019	baseline	Little Brown Bat	3	3	100.00
2019	MISS007A_2019	baseline	Northern Long-eared Bat	1	0	0.00
2019	MISS008A_2019	baseline	Big Brown Bat	14	9	64.29
2019	MISS008A_2019	baseline	Eastern Red Bat	4	3	75.00
2019	MISS008A_2019	baseline	Hoary Bat	4	1	25.00
2019	MISS008A_2019	baseline	Silver-haired Bat	4	1	25.00
2019	MISS008A_2019	baseline	Little Brown Bat	1	1	100.00
2019	MISS009A_2019	baseline	Big Brown Bat	3	0	0.00
2019	MISS009A_2019	baseline	Hoary Bat	8	5	62.50
2019	MISS009A_2019	baseline	Silver-haired Bat	6	2	33.33
2019	MISS011A_2019	baseline	Eastern Red Bat	7	7	100.00
2019	MISS011A_2019	baseline	Hoary Bat	2	0	0.00
2019	MISS011A_2019	baseline	Silver-haired Bat	1	0	0.00
2019	MISS011A_2019	baseline	Little Brown Bat	5	4	80.00
2019	MISS011A_2019	baseline	Northern Long-eared Bat	1	0	0.00
2019	MISS011A_2019	baseline	Tricolored Bat	1	1	100.00
2019	MISS012A_2019	baseline	Big Brown Bat	14	7	50.00
2019	MISS012A_2019	baseline	Eastern Red Bat	5	4	80.00
2019	MISS012A_2019	baseline	Hoary Bat	3	1	33.33
2019	MISS012A_2019	baseline	Silver-haired Bat	3	0	0.00
2019	MISS012A_2019	baseline	Little Brown Bat	5	4	80.00
2019	MISS013A_2019	baseline	Big Brown Bat	14	6	42.86
2019	MISS013A_2019	baseline	Eastern Red Bat	2	2	100.00
2019	MISS013A_2019	baseline	Hoary Bat	5	1	20.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	MISS013A_2019	baseline	Silver-haired Bat	3	1	33.33
2019	MISS013A_2019	baseline	Tricolored Bat	1	1	100.00
2019	MISS014A_2019	baseline	Big Brown Bat	3	3	100.00
2019	MISS014A_2019	baseline	Hoary Bat	1	0	0.00
2019	MISS014A_2019	baseline	Northern Long-eared Bat	3	2	66.67
2019	MISS015A_2019	baseline	Big Brown Bat	19	17	89.47
2019	MISS015A_2019	baseline	Eastern Red Bat	3	2	66.67
2019	MISS015A_2019	baseline	Little Brown Bat	1	0	0.00
2019	MISS016A_2019	baseline	Big Brown Bat	10	4	40.00
2019	MISS016A_2019	baseline	Eastern Red Bat	1	0	0.00
2019	MISS016A_2019	baseline	Silver-haired Bat	2	0	0.00
2019	MISS016A_2019	baseline	Little Brown Bat	16	16	100.00
2019	MISS017B_2019	baseline	Big Brown Bat	3	2	66.67
2019	MISS017B_2019	baseline	Eastern Red Bat	2	2	100.00
2019	MISS017B_2019	baseline	Hoary Bat	1	1	100.00
2019	MISS017B_2019	baseline	Silver-haired Bat	1	1	100.00
2019	MISS018A_2019	baseline	Big Brown Bat	15	6	40.00
2019	MISS018A_2019	baseline	Eastern Red Bat	1	1	100.00
2019	MISS018A_2019	baseline	Hoary Bat	1	1	100.00
2019	MISS018A_2019	baseline	Silver-haired Bat	8	0	0.00
2019	MISS018A_2019	baseline	Little Brown Bat	2	2	100.00
2019	MISS018A_2019	baseline	Tricolored Bat	1	0	0.00
2019	MISS018A_2019	expanded	Evening Bat	1	0	0.00
2019	MISS019A_2019	baseline	Big Brown Bat	25	10	40.00
2019	MISS019A_2019	baseline	Eastern Red Bat	2	1	50.00
2019	MISS019A_2019	baseline	Hoary Bat	2	0	0.00
2019	MISS019A_2019	baseline	Silver-haired Bat	9	1	11.11
2019	MISS019A_2019	baseline	Little Brown Bat	7	5	71.43
2019	MISS019A_2019	baseline	Tricolored Bat	1	1	100.00
2019	MISS023A_2019	baseline	Big Brown Bat	6	2	33.33

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	MISS023A_2019	baseline	Eastern Red Bat	1	1	100.00
2019	MISS023A_2019	baseline	Silver-haired Bat	3	0	0.00
2019	MISS023A_2019	baseline	Little Brown Bat	3	3	100.00
2019	MISS024B_2019	baseline	Big Brown Bat	37	14	37.84
2019	MISS024B_2019	baseline	Eastern Red Bat	4	2	50.00
2019	MISS024B_2019	baseline	Silver-haired Bat	3	0	0.00
2019	MISS024B_2019	baseline	Little Brown Bat	48	40	83.33
2019	MISS024B_2019	baseline	Tricolored Bat	1	1	100.00
2019	MISS025A_2019	baseline	Silver-haired Bat	1	0	0.00
2019	MISS026A_2019	baseline	Big Brown Bat	6	4	66.67
2019	MISS026A_2019	baseline	Eastern Red Bat	4	1	25.00
2019	MISS026A_2019	baseline	Hoary Bat	1	1	100.00
2019	MISS026A_2019	baseline	Silver-haired Bat	2	0	0.00
2019	MISS026A_2019	baseline	Little Brown Bat	6	5	83.33
2019	MISS026A_2019	baseline	Northern Long-eared Bat	2	1	50.00
2019	MISS026A_2019	expanded	Evening Bat	1	1	100.00
2019	MISS027A_2019	baseline	Big Brown Bat	1	1	100.00
2019	MISS027A_2019	baseline	Eastern Red Bat	2	0	0.00
2019	MISS027A_2019	baseline	Silver-haired Bat	1	0	0.00
2019	MISS027A_2019	baseline	Little Brown Bat	89	82	92.13
2019	MISS027A_2019	baseline	Northern Long-eared Bat	3	0	0.00
2019	MISS028A_2019	baseline	Big Brown Bat	9	5	55.56
2019	MISS028A_2019	baseline	Hoary Bat	3	1	33.33
2019	MISS028A_2019	baseline	Silver-haired Bat	4	0	0.00
2019	MISS028A_2019	baseline	Little Brown Bat	7	7	100.00
2019	MISS028A_2019	baseline	Tricolored Bat	1	1	100.00
2019	MISS029A_2019	baseline	Big Brown Bat	14	6	42.86
2019	MISS029A_2019	baseline	Eastern Red Bat	3	3	100.00
2019	MISS029A_2019	baseline	Hoary Bat	3	2	66.67
2019	MISS029A_2019	baseline	Silver-haired Bat	3	0	0.00

Year	Site ID	Analysis	Kaleidoscope Classification	Total Files Vetted	Number Files Verified	Percent Files Verified
2019	MISS031A_2019	baseline	Hoary Bat	7	3	42.86
2019	MISS031A_2019	baseline	Silver-haired Bat	4	0	0.00
2019	MISS031A_2019	baseline	Tricolored Bat	1	1	100.00
2019	MISS034A_2019	baseline	Big Brown Bat	6	4	66.67
2019	MISS034A_2019	baseline	Eastern Red Bat	16	14	87.50
2019	MISS034A_2019	baseline	Hoary Bat	1	0	0.00
2019	MISS034A_2019	baseline	Little Brown Bat	4	1	25.00
2019	MISS034A_2019	expanded	Evening Bat	4	1	25.00
2019	MISS040A_2019	baseline	Big Brown Bat	22	6	27.27
2019	MISS040A_2019	baseline	Eastern Red Bat	4	3	75.00
2019	MISS040A_2019	baseline	Hoary Bat	6	0	0.00
2019	MISS040A_2019	baseline	Silver-haired Bat	18	0	0.00
2019	MISS040A_2019	baseline	Little Brown Bat	12	11	91.67
2019	MISS040A_2019	expanded	Evening Bat	1	0	0.00

Appendix I. Species Composition Across Parks.

Figure I1 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.

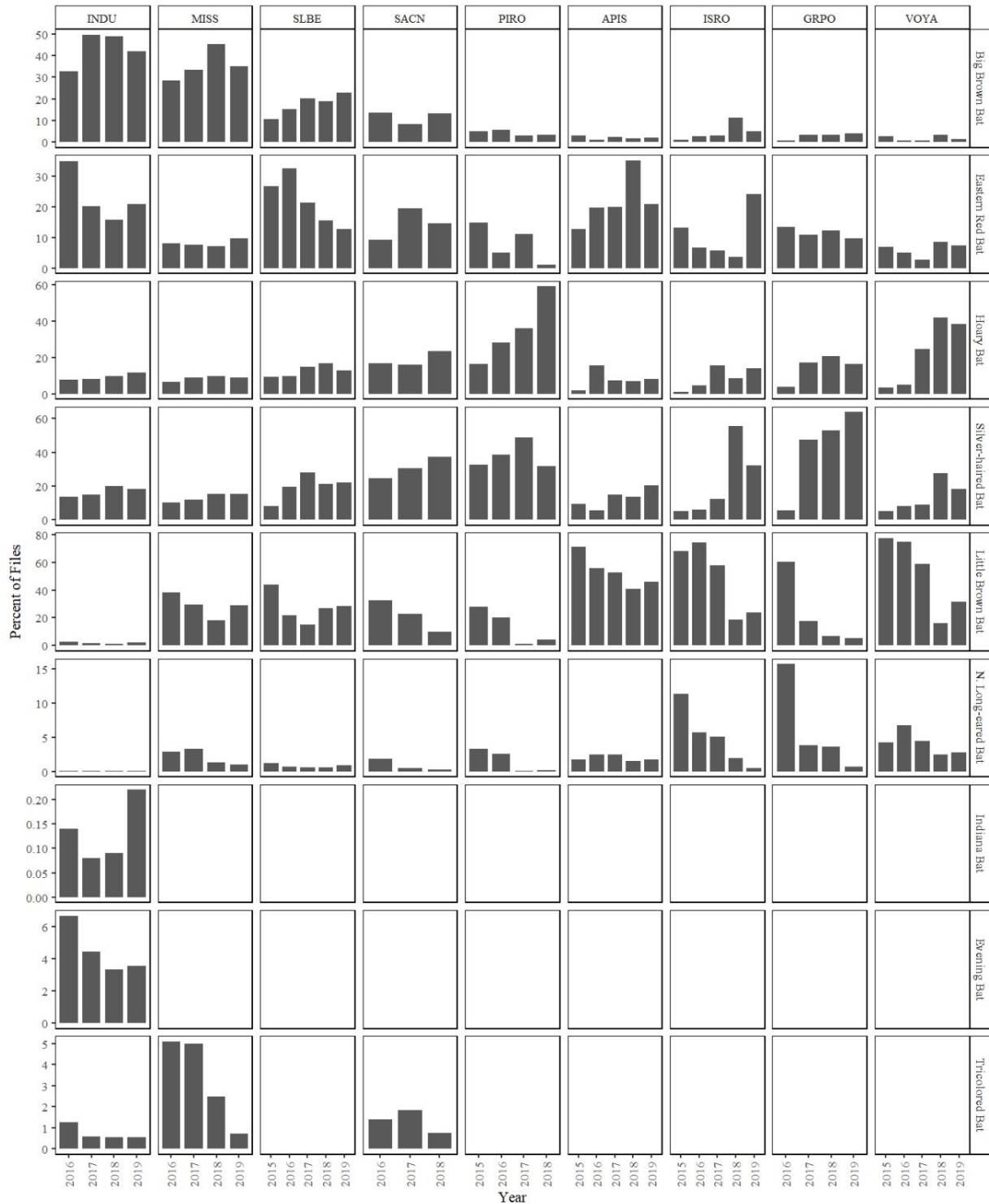


Figure 11. Percent of audio files classified as each bat species by Kaleidoscope Pro in the baseline analysis for each park and year. Note that the y-axis scale is different for each species and not all parks conducted surveys in all years. Only data from valid deployments are shown. Parks are ordered approximately by latitude, from INDU (southernmost) to VOYA (northernmost).

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NPS 607/175196, April 2021

National Park Service
U.S. Department of the Interior



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