

Summary Results of 2019 Acoustic Monitoring

Great Lakes Inventory and Monitoring Network

Prepared for

National Park Service
Great Lakes Inventory and Monitoring Network
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1 Introduction

Normandeau Associates Inc. (Normandeau) was tasked with creating a streamlined automated Microsoft Access-based data management system for importing and summarizing the results of automatic identification of bat species and audio files for nine parks within the Great Lakes Inventory and Monitoring Network (GLKN). The management system involved quality checking (QC) the audio files, organizing them by park, sampling site and date, performing automatic identification (AutoID) of the audio files, importing the results of the AutoID, performing a manual identification of a subset of audio files, and importing the results of the manual ID. Finally, Normandeau was tasked with summarizing the AutoID results and performing some basic statistics.

This report summarizes the results of 2019 data collection and analysis of the AutoID and manual ID along with some additional supporting statistics about the number of audio files collected.

This report is organized into the following sections:

- Audio File Inventory Summary: lists the number of audio files for each park and the results of initial processing and organizing (before automatic identification)
- Deployment Summary: summarizes the number of deployments and deployment-nights per park
- AutoID Summary: summarizes the results of the automatic identification
- Manual Vetting Summary: summarizes the comparison of manual identifications to the automatic identifications
- Appendix: lists some tables too long for the report main body
- Supplementary Documents: lists the documents that have more detailed information about some aspects of the data processing and documents with tables too large for this report

The results in this summary report are presented, in general, by park. Presenting the results by each site/deployment within a park is generally not very informative due to the large number of sites/deployments within each park. Tables of summary statistics for individual sites/deployments will be provided in supplementary documents.

Table 1-1 lists the parks where the data were collected for the 2019 season along with the abbreviations used throughout this report for those parks.

Table 1-1. Parks where acoustic monitoring was performed during the 2019 monitoring season

Abbreviation	Name	State
INDU	Indiana Dunes National Park	IN
MISS	Mississippi National River and Recreation Area	MN
SLBE	Sleeping Bear Dunes National Lakeshore	MI
APIS	Apostle Islands National Lakeshore	WI
ISRO	Isle Royale National Park	MI
GRPO	Grand Portage National Monument	MN
VOYA	Voyageurs National Park	MN

NOTE: for all tables and graphs in this report, the parks are ordered from southern-most to northern-most.

The report is not intended to be high-level analysis of the resulting data. Instead, it is intended to be a very basic summary of the numbers and species of bat calls at various parks, as determined by the AutoID. In addition, it

provides a basic analysis of the validity of automatic identification as compared to manual identification. A more advanced statistical comparison and detailed analysis is outside of the scope of this report.

Raw Data Provided:

The raw data provided by the National Park Service (NPS) for this analysis are audio files (sound recording in WAV file format). These audio files were organized into folders by location (park, site within park). In addition, the name of the audio file contained the date and time of its recording, allowing for the files to be further organized by date.

The National Park Service also supplied an initial Access database (Microsoft Access 2010) which was expanded upon to include the information extracted from the supplied audio files.

2 Audio File Inventory Summary

This section presents the results of the initial audio file processing, done before the files were run through the automatic species identification classifier.

A thorough, detailed account of the data processing methods and settings is given in a separate document: the “Data Management Plan.”

The audio files were organized into folders by location (park, site within park). The name of the audio file contained the date and time of its recording, allowing for the files to be further organized by date. **For these results the recording “date” extends from the evening (after 5:00PM) of the actual date through the following morning (before noon).** Any files recorded after 5:00PM have the same date as the recording date, while any files recorded before noon have the previous day’s date.

- File recorded at 7:00PM on 6/2 has “Date” value of 6/2
- File recorded at 7:00AM on 6/2 has “Date” value of 6/1

Also, during this process every audio file was analyzed by the SoX program to determine that the file was in fact an audio file, was not corrupted, and to optionally extract file parameters such as duration and number of channels. The audio file inventory and the results of the initial audio file processing were not stored in the original NPS Access database but were instead stored in a supplementary table created by Normandeau.

The numbers of audio files for the 2019 recording period are listed in Table 2-1. The same data in terms of percent are shown in Table 2-2. The column “Total” lists the total number of audio files collected for each park. The remaining columns show how the audio files were classified for analysis.

Analyzed Files

- **Analyzed Summer:** If at least 4 days of the deployment occurred in the range 6/1-8/15, all files for that deployment were classified as summer season files and analyzed

Excluded from analysis:

- **Spring & Fall:** If less than 4 days of the deployment occurred in the range 6/1-8/15, all the files for that deployment were classified as either spring or fall
- **Short Deployment (Summer):** If a summer season deployment was < 4 days total, no files were analyzed from that deployment
- **Extra Night (Summer):** If a summer season deployment had > 16 nights, the files in the nights beyond 16 were not analyzed. Generally, the nights not analyzed were taken from the end of the deployment, unless the deployment started before 6/1, then the nights not analyzed were taken from the beginning of the deployment.
- **Short Night (Summer):** Nights with recording time < 6 hours were not analyzed

Table 2-1. Audio file classification for analysis for 2019: Numbers of Files

Park	Total	Summer	Spring	Fall	Short Deploy ¹	Extra Night ²	Short Night ³	Bad File
INDU	98831	98611	0	0	0	205	0	15
MISS	104970	101503	0	0	0	3436	16	15
SLBE	39148	38891	0	0	3	0	102	152
APIS	35953	32307	0	0	310	3290	15	31
ISRO	7161	6920	0	179	28	29	0	5
GRPO	11534	11493	0	0	0	0	0	41
VOYA	21024	18933	0	0	0	2087	2	2
Total	318621	308658	0	179	341	9047	135	261

¹ Deployment < 4 days² Files in nights beyond 16 nights³ Recording time < 6 hours

Table 2-2. Audio file classification for analysis for 2019: Percent of Files.

Park	Total	Summer	Spring	Fall	Short Deploy	Extra Night	Short Night	Bad File
INDU	100	~100	0	0	0	~0	0	~0
MISS	100	97	0	0	0	3	~0	~0
SLBE	100	99	0	0	~0	0	~0	~0
APIS	100	90	0	0	1	9	~0	~0
ISRO	100	97	0	2	~0	~0	0	~0
GRPO	100	~100	0	0	0	0	0	~0
VOYA	100	90	0	0	0	10	~0	~0
Total	100	97	0	~0	~0	3	~0	~0

Note: In tables displaying percentages, values sometimes appear not sum to 100% due to the displayed precision.

3 Deployment Summary

3.1.1 Deployments

Within each park, detectors were deployed at a given location (site) for a given length of time. A ‘deployment’ is defined as the site combined with time period the detector was deployed.

Table 3-1 lists the number of deployments per season as well the number of short deployments for each park. Figure 3-1 graphically depicts the number of deployments by season. Almost all deployments were in the summer season but ISRO had 1 deployment in the fall. There were 3 short deployments as shown in the table. The number of deployments in the summer season ranged from as few as 18 for GRPO and VOYA to as many as 32 for SLBE. Two of the MISS summer deployments were non-protocol sites.

Table 3-1. Deployments (Sites) By Park and Season

Park	Total	Summer	Spring	Fall	Short Deploy	Date Range
INDU	30	30	0	0	0	06/07-08/06
MISS	28	28	0	0	0	05/30-08/27
SLBE	35	32	0	0	3	05/31-08/12
APIS	25	24	0	0	1	06/04-08/26
ISRO	29	27	0	1	1	06/06-08/22
GRPO	18	18	0	0	0	05/30-08/12
VOYA	18	18	0	0	0	06/11-08/13

¹ Short Deploy: summer deployments < 4 days, not analyzed

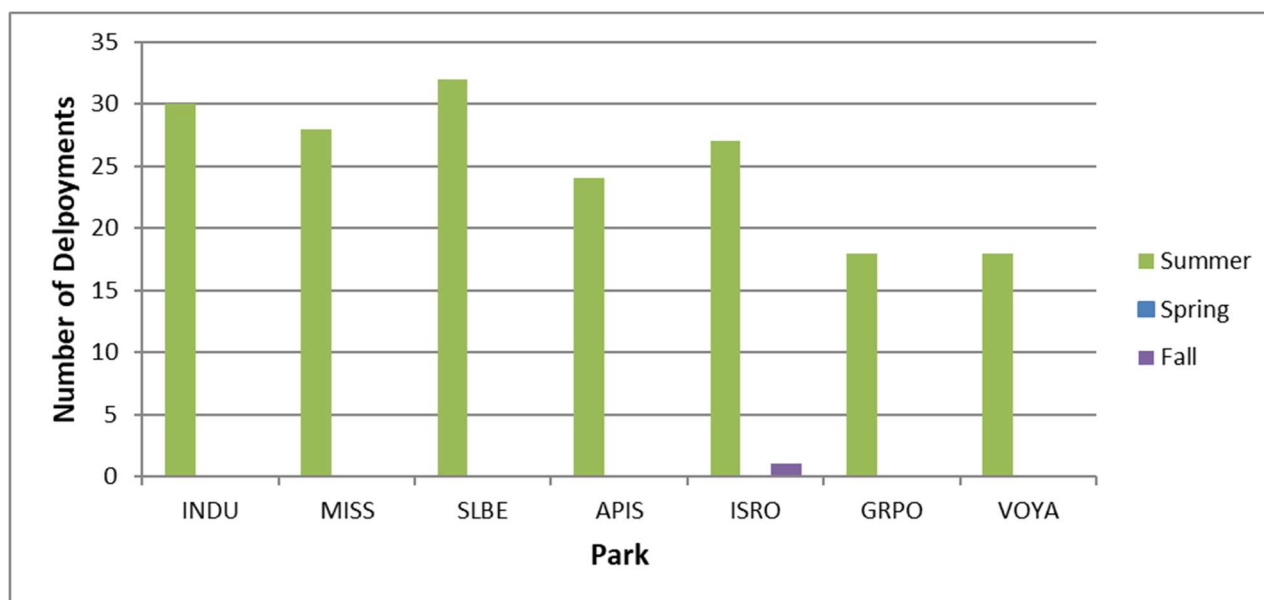


Figure 3-1. Deployments (Sites) By Park and Season

For the summer season (6/1-8/15), the number of deployments per day is shown in Figure 3-2. The table for this data is given in Appendix A because it is too big to show here. The dates shown in the figure that occur outside of the summer range belong to deployments that are considered ‘summer deployments’. If a deployment had at least 4 days in the summer date range, then all dates of the deployment were analyzed as summer dates.

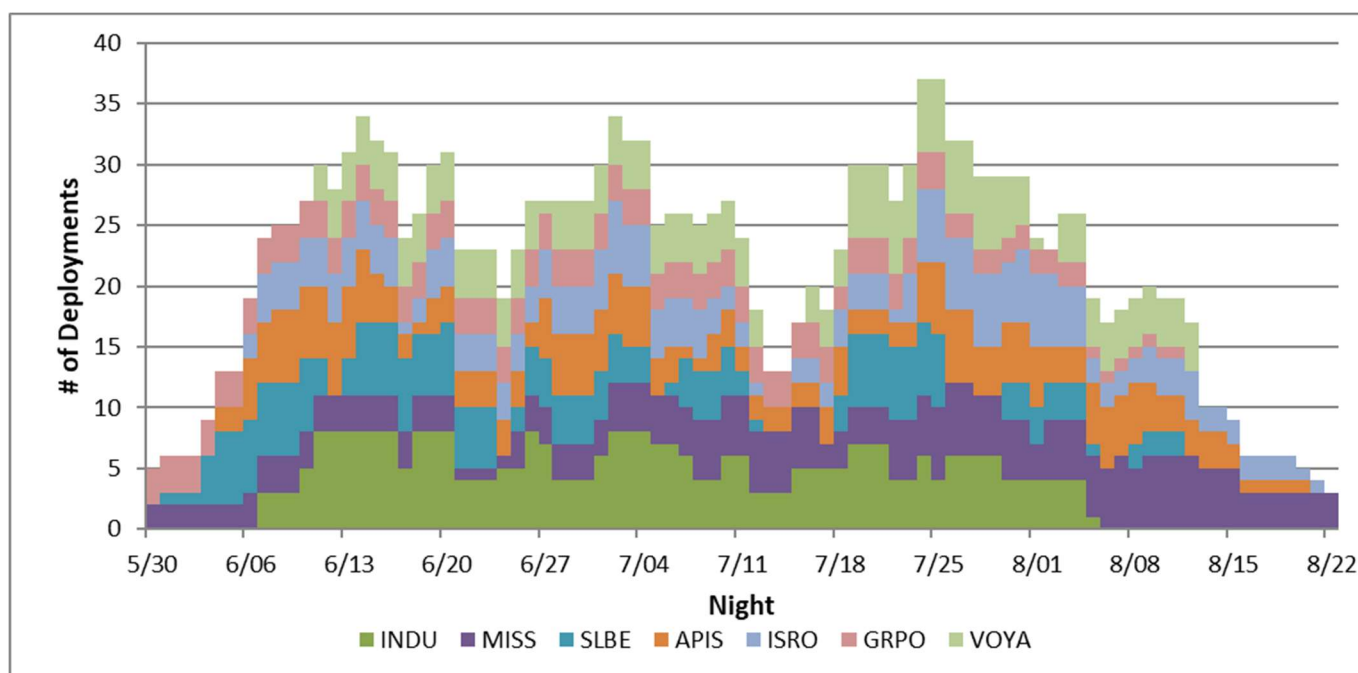


Figure 3-2. Number of Deployments by Date, during the Summer season

3.1.2 Deployment Nights

The number of ‘deployment-nights’ for a park is the sum of the number of nights for each deployment. For example, if a park had 3 deployments of 11, 6 and 10 nights, the number of deployment-nights for that park is 27 (11+6+10). Even if the deployments overlap and occurred on many of the same nights, the number of deployment-nights is still 27. If a park has 3 deployments on the same night, that would be 3 deployment-nights not 1.

Table 3-2 lists and Figure 3-3 shows the deployment-nights for each park. A few notes about the night counts:

- Nights for deployments less than 4 days are NOT counted
- Nights beyond the 16th night for single deployment are NOT counted
- Nights at the beginning or end of a deployment with a recording time of < 6 hours, are not counted.

This shows that almost all deployment-nights occurred during the summer season with ISRO having 7 deployment-nights in the fall.

Table 3-2. Deployment-Nights by Park and Season

Park	Summer	Spring	Fall
INDU	327	0	0
MISS	319	0	0
SLBE	238	0	0
APIS	273	0	0
ISRO	261	0	7
GRPO	197	0	0
VOYA	248	0	0

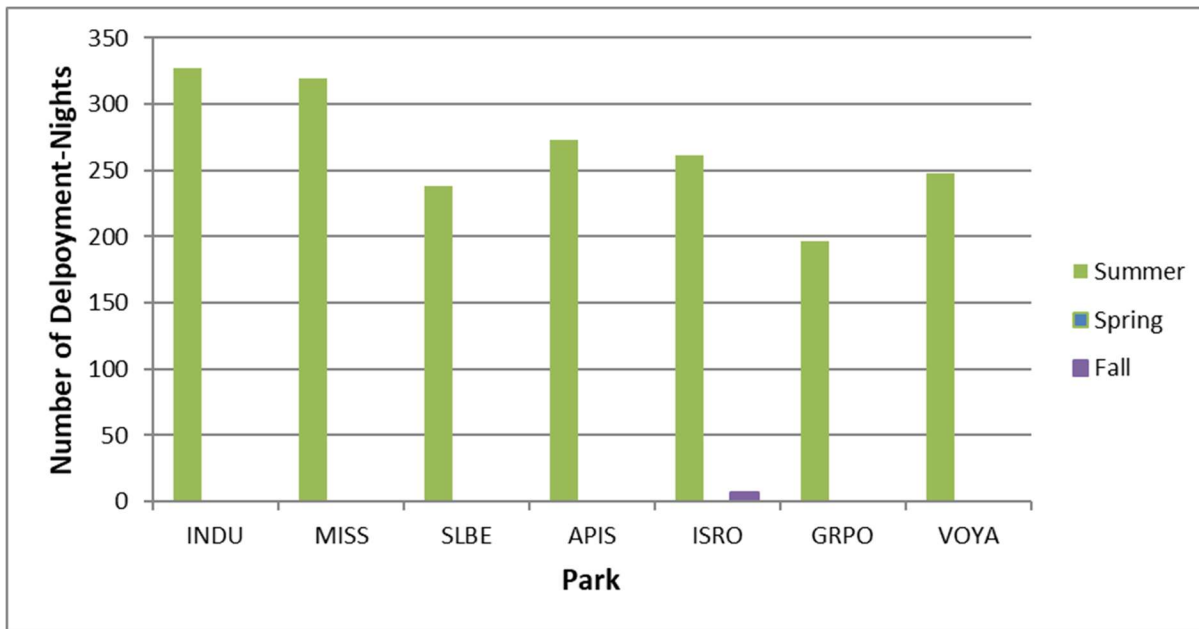


Figure 3-3. Deployment-Nights by Park and Season

4 Auto-ID Summary

The Wildlife Acoustics Kaleidoscope Pro software (KPro) version 4.0.0 was used to remove non-bat noise files and to identify all bats to species using a built-in auto classifier. Guidelines for use of auto classifier programs defined in the USFWS 2018 Indiana bat summer survey protocol* were followed. KPro has three options for setting the sensitivity of the classifier: -1 More Sensitive (Liberal); 0 Balanced (Neutral), and +1 More Accurate (Conservative). For this analysis the “-1 More Sensitive (Liberal)” setting was used, as suggested in the USFWS guidelines.

First, full spectrum audio files were converted to zero-cross files. In this process KPro classified some files as ‘Noise’ and did not create a zero-cross file. Also, a very small number of files (10 or less per park) experienced other various errors and were not converted to zero-cross.

Second, KPro was run again to analyze the zero-cross files and produce an identification (ID): either ‘Noise’, ‘NoID’ (unknown bat call), or a specific species ID.

The bat biologists assembled a list of possible bat species for each park, as shown in Table 4-1. Those were the only species, for that park, that KPro considered in the automatic identification. The baseline analysis includes only species that have been documented within each park’s boundaries. The expanded analysis includes species that have been documented within each park’s boundaries as well as species that have been reported in nearby areas.

From this point forward, the term “Auto ID”, refers to the automatic identification of the audio file via the KPro program.

4.1 Species to be considered for Auto ID

The following tables show the species that that KPro considered for each park. For the 2019 data, both a ‘baseline’ and an ‘expanded’ species analysis were done. Both analyses were done in the exact same manner, only changing the species KPro could consider in making an ID. Table 4-1 shows the species considered for Auto ID in the baseline (●) and the expanded (✱) analyses.

* U.S. Fish and Wildlife Service (USFWS). 2018. Range-wide Indiana Bat Summer Survey Guidelines. April 2018.
<www.fws.gov/midwest/Endangered/mammals/inba/surveys/pdf/2018IndianaBatSummerSurveyGuidelines11April2018.pdf>

Table 4-1. Bat Species considered by KPro analysis, for each Park

Park	EPFU ¹	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	●	●	●	●	●	●	●	●	●
MISS	●	●	●	●	●	●		❄	●
SLBE	●	●	●	●	●	●	❄		❄
APIS	●	●	●	●	●	●			❄
ISRO	●	●	●	●	●	●			❄
GRPO	●	●	●	●	●	●			❄
VOYA	●	●	●	●	●	●			❄

¹ See Table 4-2 for bat species abbreviations

● : baseline AutoID analysis

❄ : expanded AutoID analysis

Table 4-2. Bat species abbreviations used in this analysis

Abbreviation	Scientific Name	Common Name
EPFU	<i>Eptesicus fuscus</i>	Big Brown Bat
LABO	<i>Lasiurus borealis</i>	Eastern Red Bat
LACI	<i>Lasiurus cinereus</i>	Hoary Bat
LANO	<i>Lasionycteris noctivagans</i>	Silver-haired Bat
MYLU	<i>Myotis lucifugus</i>	Little Brown Bat
MYSE	<i>Myotis septentrionalis</i>	Northern Long-eared Bat
MYSO	<i>Myotis sodalis</i>	Indiana Bat
NYHU	<i>Nycticeius humeralis</i>	Evening Bat
PESU	<i>Perimyotis subflavus</i>	Tri-colored Bat

4.1.1 Calls vs. Noise

Table 4-3 shows the numbers of specific IDs compared to unknown bat calls and noise for the Summer season files analyzed using the baseline species analysis. The table columns show:

- Number of files analyzed (Audio Files)
- Number of files ID'd as a specific species (Species ID)
- Number of files ID'd as a bat but could not determine species (No Id)
- Number of files ID'd as Noise (includes files labeled as noise during the conversion from full spectrum to zero-cross)

The last three columns of the table show the percentages of files for each general result. The percentage of files that were ID'd to species ranged from 68% to 83% with almost all the rest of the files ID'd as Noise. Only a very small percentage of files (1% or less for each park) were ID'd as unknown bat call sequences.

Figure 4-1 and Figure 4-2 are plots of the data shown in Table 4-3.

Table 4-3. Number and Percent of Files by Park: Call Sequences vs. Noise, Summer Only, Baseline Analysis

Park	#Audio File	#Species Id	#No Id	#Noise	%Species Id	%No Id	%Noise
INDU	98611	82076	1035	15500	83.2	1.0	15.7
MISS	101503	75937	763	24803	74.8	0.8	24.4
SLBE	38891	31544	291	7056	81.1	0.7	18.1
APIS	32307	26217	217	5873	81.1	0.7	18.2
ISRO	6920	4732	54	2134	68.4	0.8	30.8
GRPO	11493	7824	92	3577	68.1	0.8	31.1
VOYA	18933	14995	160	3778	79.2	0.8	20.0
Total	308658	243325	2612	62721	78.8	0.8	20.3

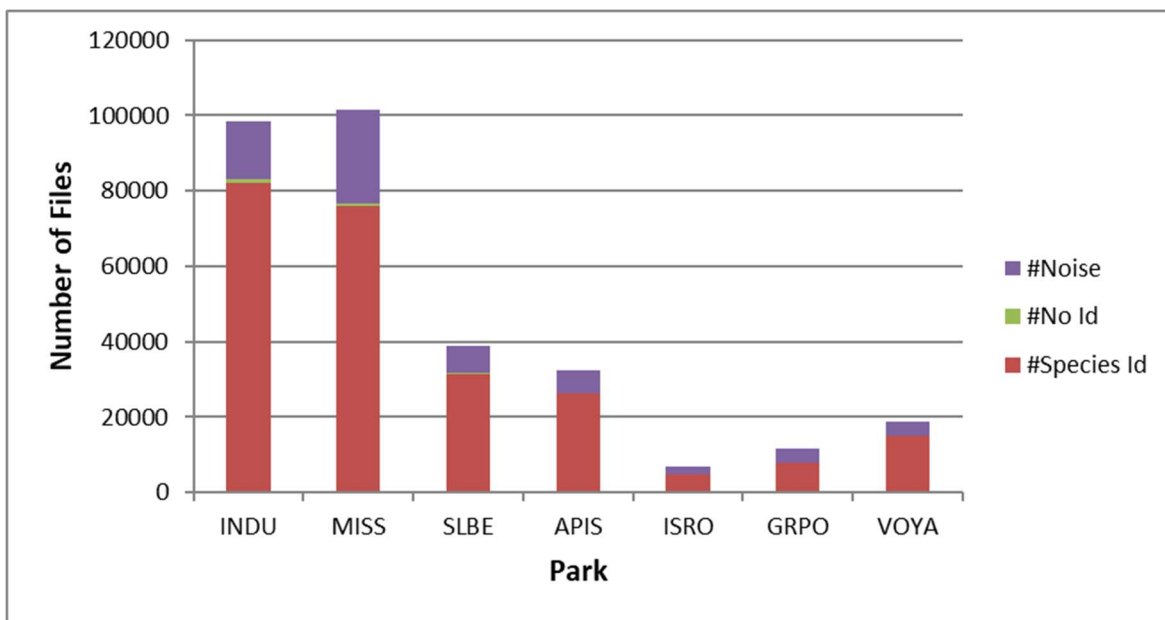


Figure 4-1. Number of Files by Park: Call Sequences vs. Noise, Summer Only, Baseline Analysis

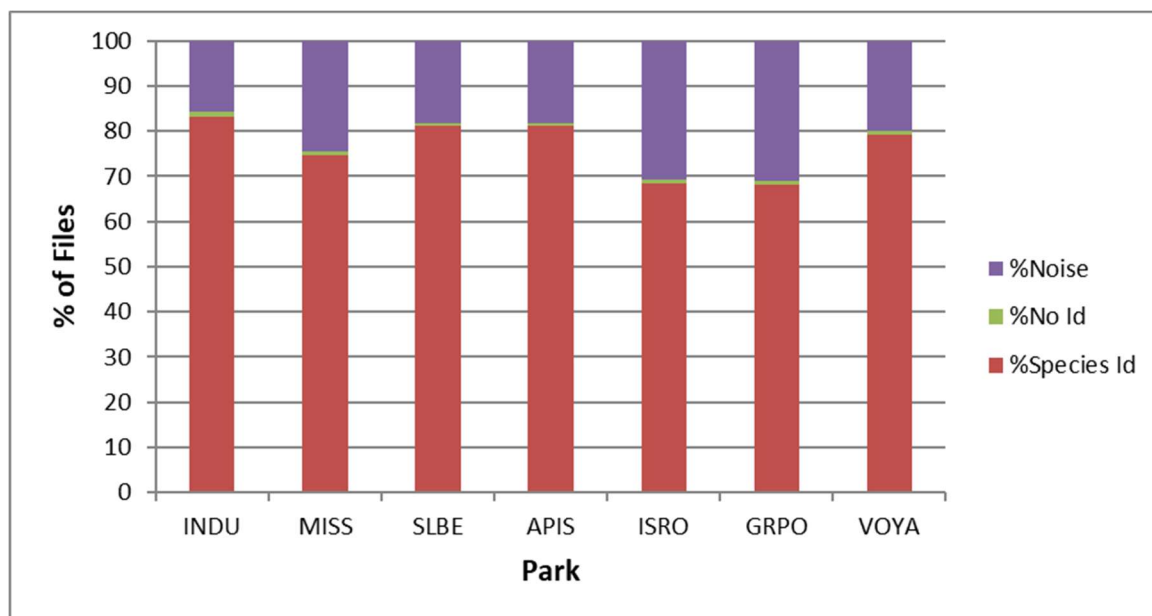


Figure 4-2. Percent of Files by Park: Call Sequences vs. Noise, Summer Only, Baseline Analysis

Table 4-4 shows the numbers of specific IDs compared to unknown bat call sequences and noise for the Summer season files analyzed using the expanded species analysis. Figure 4-3 and Figure 4-4 are plots of the data shown in Table 4-4. Compared to the baseline species analysis, in the expanded analysis a small number of call sequences with specific IDs (283) were reclassified as No Id, while the number of noise files stayed the same. Table 4-5 shows the difference between the expanded (Table 4-4) and baseline (Table 4-3) analysis results.

Table 4-4. Number and Percent of Files by Park: Call Sequences vs. Noise, Summer Only, Expanded Analysis

Park	#Audio File	#Species Id	#No Id	#Noise	%Species Id	%No Id	%Noise
INDU	98611	82076	1035	15500	83.2	1.0	15.7
MISS	101503	75870	830	24803	74.7	0.8	24.4
SLBE	38891	31458	377	7056	80.9	1.0	18.1
APIS	32307	26139	295	5873	80.9	0.9	18.2
ISRO	6920	4720	66	2134	68.2	1.0	30.8
GRPO	11493	7809	107	3577	67.9	0.9	31.1
VOYA	18933	14970	185	3778	79.1	1.0	20.0
Total	308658	243042	2895	62721	78.7	0.9	20.3

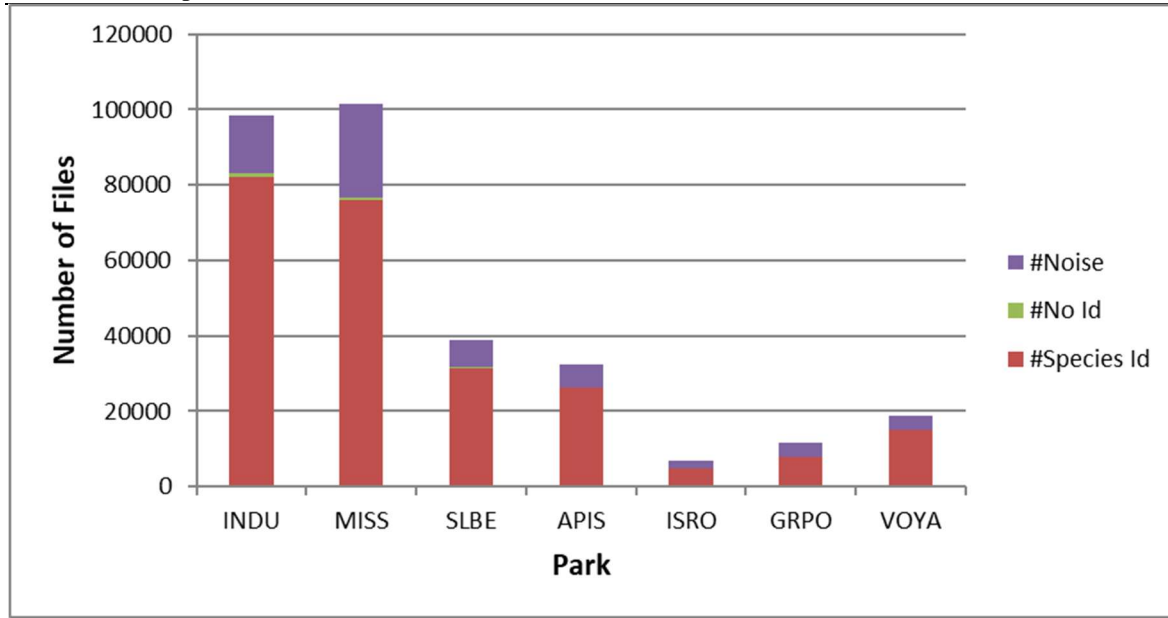


Figure 4-3. Number of Files by Park: Call Sequences vs. Noise, Summer Only, Expanded Analysis

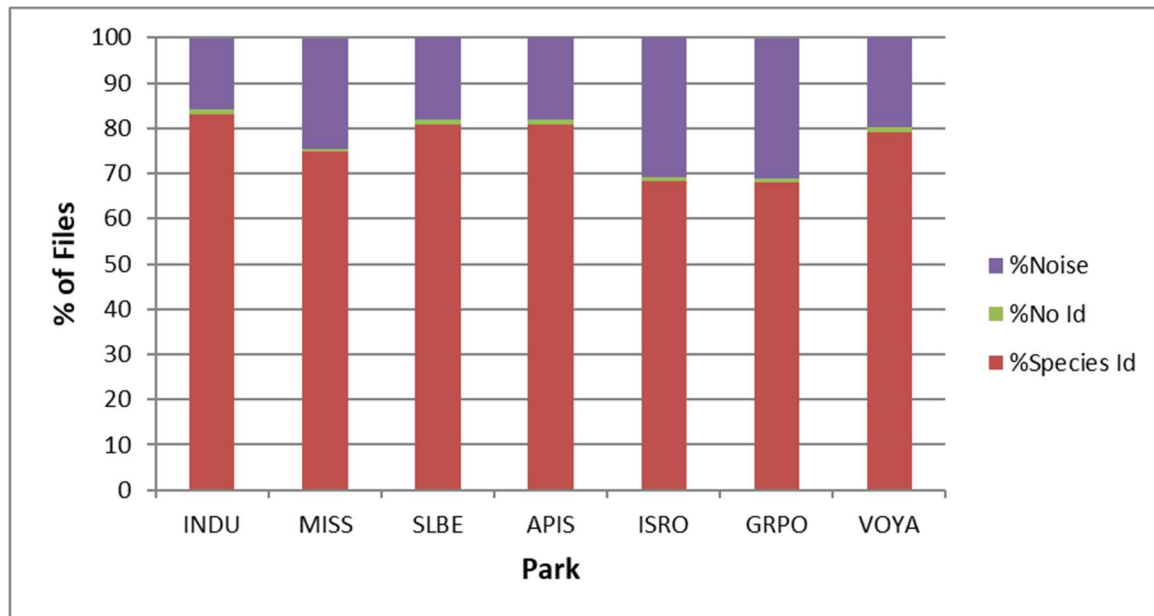


Figure 4-4. Percent of Files by Park: Call Sequences vs. Noise, Summer Only, Expanded Analysis

Table 4-5. Difference in Number and Percent of Files by Park: Call Sequences vs. Noise, Summer Only. Differences were calculated by subtracting Baseline Analysis values from Expanded Analysis values.

Park	#Audio File	#Species Id	#No Id	#Noise	%Species Id	%No Id	%Noise
INDU	0	0	0	0	0	0	0
MISS	0	-67	67	0	-0.1	0	0
SLBE	0	-86	86	0	-0.2	0.3	0
APIS	0	-78	78	0	-0.2	0.2	0
ISRO	0	-12	12	0	-0.2	0.2	0
GRPO	0	-15	15	0	-0.2	0.1	0
VOYA	0	-25	25	0	-0.1	0.2	0
Total	0	-283	283	0	-0.1	0.1	0

4.1.2 Calls by Species

Table 4-6 shows the total number of files identified to each species by KPro (summer season only), using the baseline species analysis and Figure 4-5 graphs the table data.

Table 4-7 shows the total number of files identified to each species by KPro (summer season only), using the expanded species analysis and Figure 4-6 graphs the table data.

Table 4-8 shows the change in species ID from the baseline to the expanded species analysis.

Table 4-6. Number of Files AutoID'd to each Species by Park, Summer only, Baseline Analysis

Park	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU	All Species
INDU	34679	17267	9705	15052	1811	28	181	2902	451	82076
MISS	26899	7650	6704	11873	21531	770	na	na	510	75937
SLBE	7121	3960	4074	7067	9034	288	na	na	na	31544
APIS	565	4583	2296	5683	12599	491	na	na	na	26217
ISRO	206	1147	687	1542	1131	19	na	na	na	4732
GRPO	306	764	1299	4992	405	58	na	na	na	7824
VOYA	204	1170	5484	2788	4912	437	na	na	na	14995
All Parks	69980	36541	30249	48997	51423	2091	181	2902	961	243325

na: species was not considered in the analysis

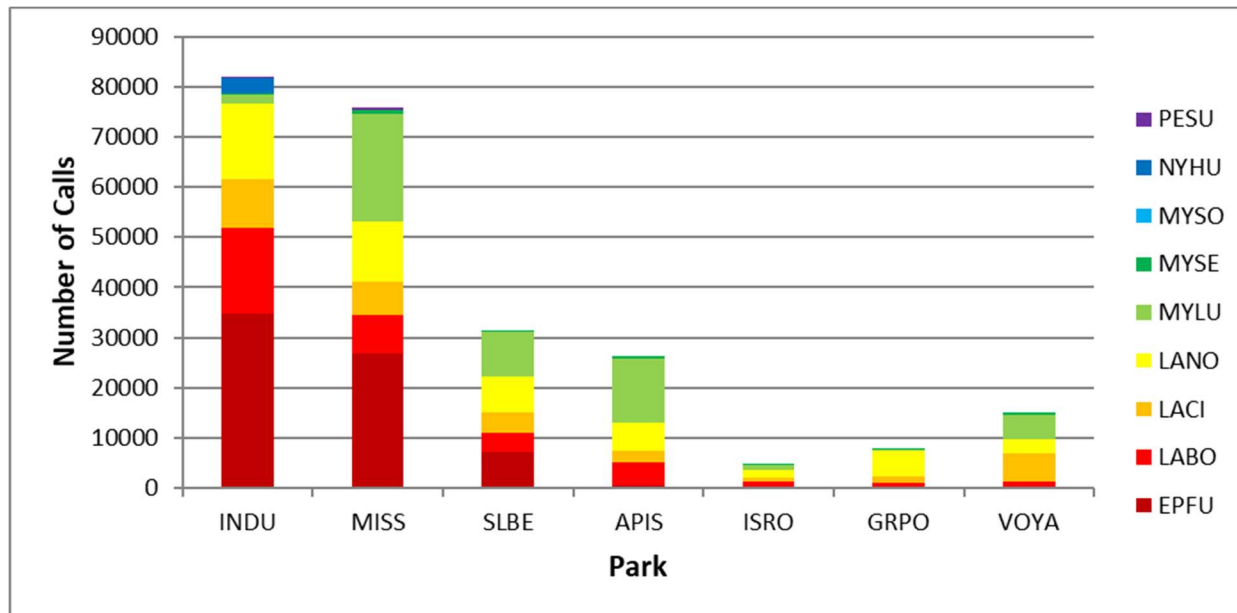


Figure 4-5. Number of Files AutoID'd to each Species by Park, Baseline Analysis

Table 4-7. Number of Files AutoID'd to each Species by Park, Summer only, Expanded Analysis

Park	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU	All Species
INDU	34679	17267	9705	15052	1811	28	181	2902	451	82076
MISS	26929	6922	6695	11860	21450	754	na	738	522	75870
SLBE	7123	3793	4081	7078	8061	186	1026	na	110	31458
APIS	565	4418	2297	5686	12503	503	na	na	167	26139
ISRO	206	1067	687	1542	1169	20	na	na	29	4720
GRPO	306	706	1296	4995	408	63	na	na	35	7809
VOYA	204	1080	5483	2788	4954	444	na	na	17	14970
All Parks	70012	35253	30244	49001	50356	1998	1207	3640	1331	243042

na: species was not considered in the analysis

Highlighted cells are species and park combinations added in the expanded analysis

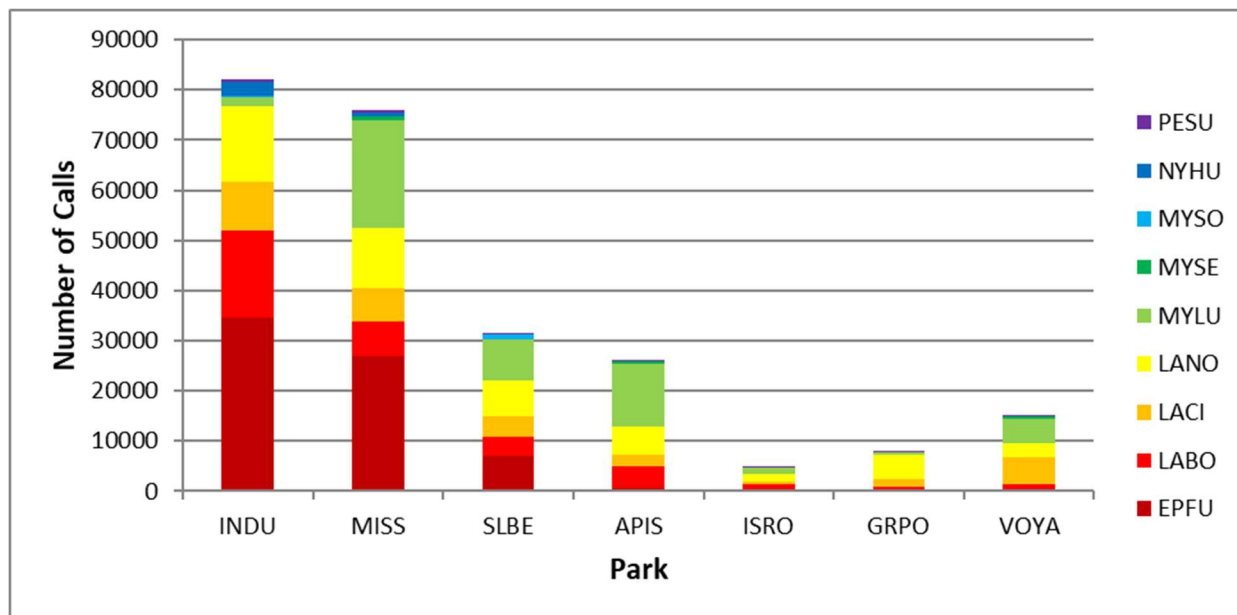


Figure 4-6. Number of Files AutoID'd to each Species by Park, Expanded Analysis

Table 4-8. Difference in Number of Files AutoID'd to each Species by Park, Summer only. Differences were calculated by subtracting Baseline Analysis values from Expanded Analysis values.

Park	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU	All Species
INDU	0	0	0	0	0	0	0	0	0	0
MISS	30	-728	-9	-13	-81	-16	na	738	12	-67
SLBE	2	-167	7	11	-973	-102	1026	na	110	-86
APIS	0	-165	1	3	-96	12	na	na	167	-78
ISRO	0	-80	0	0	38	1	na	na	29	-12
GRPO	0	-58	-3	3	3	5	na	na	35	-15
VOYA	0	-90	-1	0	42	7	na	na	17	-25
Total	32	-1288	-5	4	-1067	-93	1026	738	370	-283

na: species was not considered in the analysis

Highlighted cells are species and park combinations added in the expanded analysis

Table 4-9 shows the number of files per deployment-night identified to each species by KPro (summer season only), using the baseline species analysis and Figure 4-7 graphs the table data.

Table 4-10 shows the number of files per deployment-night identified to each species by KPro (summer season only), using the expanded species analysis and Figure 4-8 graphs the table data.

Table 4-11 shows the change in species ID per deployment-night from the baseline to the expanded species analysis.

Table 4-9. Number of Files per Deployment-Night AutoID'd to each Species by Park, Summer Only, Baseline Analysis

Park	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU	All Species
INDU	106.1	52.8	29.7	46.0	5.5	0.1	0.6	8.9	1.4	251.0
MISS	84.3	24.0	21.0	37.2	67.5	2.4	na	na	1.6	238.0
SLBE	29.9	16.6	17.1	29.7	38.0	1.2	na	na	na	132.5
APIS	2.1	16.8	8.4	20.8	46.2	1.8	na	na	na	96.0
ISRO	0.8	4.4	2.6	5.9	4.3	0.1	na	na	na	18.1
GRPO	1.6	3.9	6.6	25.3	2.1	0.3	na	na	na	39.7
VOYA	0.8	4.7	22.1	11.2	19.8	1.8	na	na	na	60.5
All Parks	37.6	19.6	16.2	26.3	27.6	1.1	0.6	8.9	1.5	130.6

na: species was not considered in the analysis

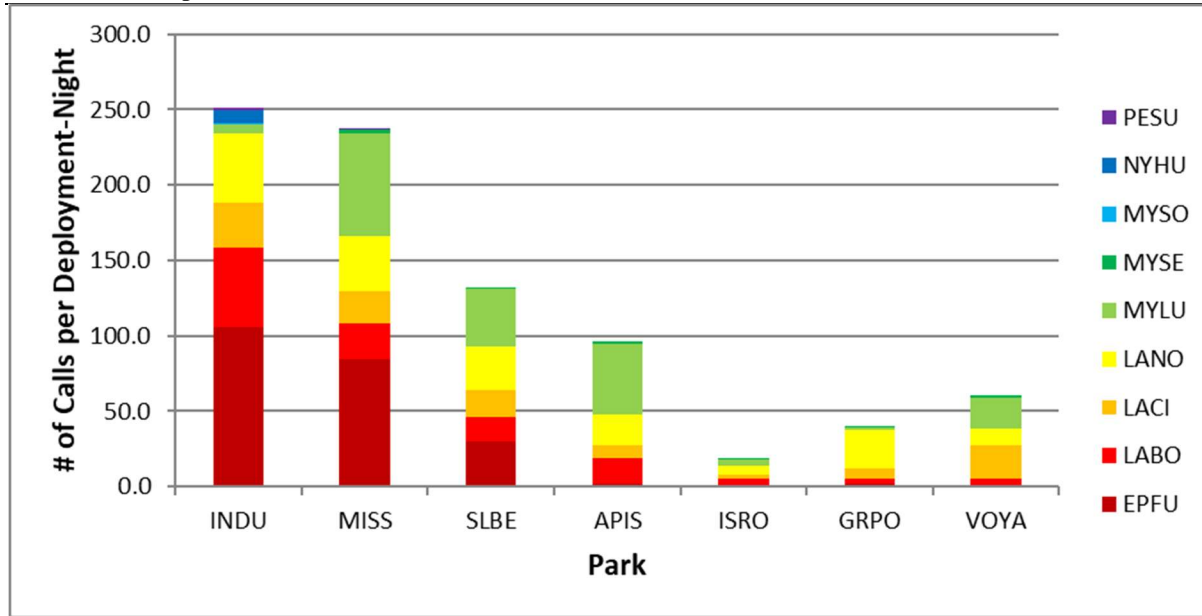


Figure 4-7. Number of Files per Deployment-Night AutoID'd to each Species by Park, Summer Only, Baseline Analysis

Table 4-10. Number of Files per Deployment-Night AutoID'd to each Species by Park, Summer Only, Expanded Analysis

Park	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU	All Species
INDU	106.1	52.8	29.7	46.0	5.5	0.1	0.6	8.9	1.4	251.0
MISS	84.4	21.7	21.0	37.2	67.2	2.4	na	2.3	1.6	237.8
SLBE	29.9	15.9	17.1	29.7	33.9	0.8	4.3	na	0.5	132.2
APIS	2.1	16.2	8.4	20.8	45.8	1.8	na	na	0.6	95.7
ISRO	0.8	4.1	2.6	5.9	4.5	0.1	na	na	0.1	18.1
GRPO	1.6	3.6	6.6	25.4	2.1	0.3	na	na	0.2	39.6
VOYA	0.8	4.4	22.1	11.2	20.0	1.8	na	na	0.1	60.4
All Parks	37.6	18.9	16.2	26.3	27.0	1.1	2.1	5.6	0.7	130.5

na: species was not considered in the analysis

Highlighted cells are species and park combinations added in the expanded analysis

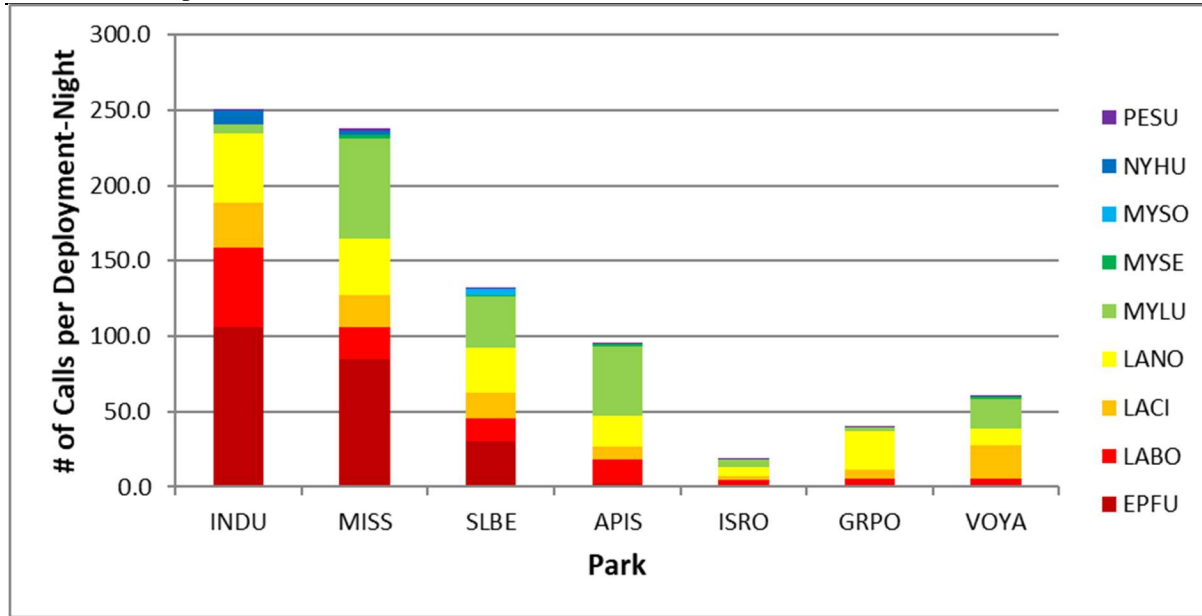


Figure 4-8. Number of Files per Deployment-Night AutoID'd to each Species by Park, Summer Only, Expanded Analysis

Table 4-11. Difference in Number of Files per Deployment-Night AutoID'd to each Species by Park, Summer Only. Differences were calculated by subtracting Baseline Analysis values from Expanded Analysis values.

Park	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU	All Species
INDU	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
MISS	0.1	-2.3	0.0	0.0	-0.3	0.0	na	2.3	0.0	-0.2
SLBE	0.0	-0.7	0.0	0.0	-4.1	-0.4	4.3	na	0.5	-0.3
APIS	0.0	-0.6	0.0	0.0	-0.4	0.0	na	na	0.6	-0.3
ISRO	0.0	-0.3	0.0	0.0	0.2	0.0	na	na	0.1	0.0
GRPO	0.0	-0.3	0.0	0.1	0.0	0.0	na	na	0.2	-0.1
VOYA	0.0	-0.3	0.0	0.0	0.2	0.0	na	na	0.1	-0.1
All Parks	0.0	-0.7	0.0	0.0	-0.6	0.0	1.5	-3.3	-0.8	-0.1

na: species was not considered in the analysis

Highlighted cells are species and park combinations added in the expanded analysis

4.1.3 Nightly Patterns of Activity

Figure 4-9 shows the total number of call sequences recorded for each date and species, for the baseline species analysis. This is the combined number of call sequences for all deployments in all parks on that date, during the summer season only.

Figure 4-10 shows the number of call sequences recorded per deployment-night for each date and species, for the baseline species analysis. Again, this is for all parks combined and during the summer season only.

Figure 4-11 and Figure 4-12 show the total number of call sequences and call sequences per deployment-night, respectively, recorded for each date and species, for the expanded species analysis. This is for all parks combined and summer season only.

Figure 4-13 and Figure 4-14 show the changes in species ID from the baseline to the expanded analysis for total number of call sequences and call sequences per deployment-night, respectively. This is for all parks combined and summer season only.

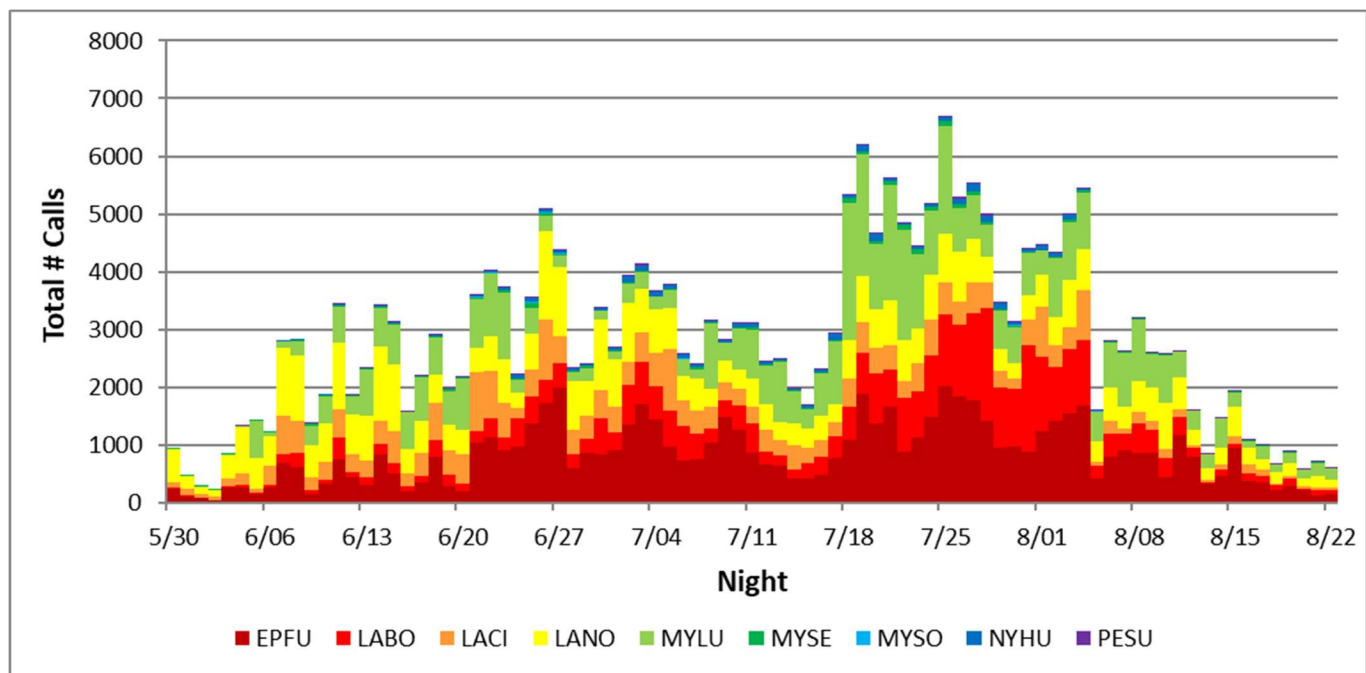


Figure 4-9. Total number of Call Sequences Recorded (All Parks Combined), for each Date and Species (Summer only), Baseline Analysis

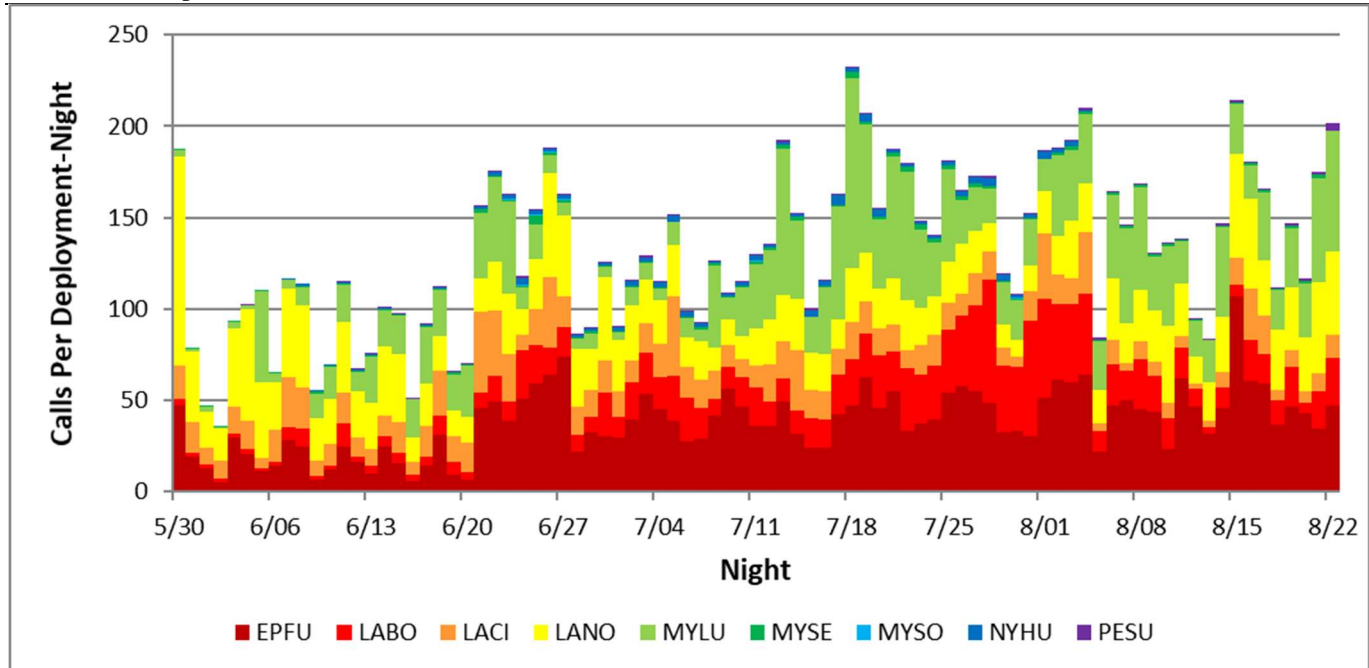


Figure 4-10. Number of Call Sequences Recorded per Deployment-Night (All Parks Combined), for each Date and Species (Summer only), Baseline Analysis

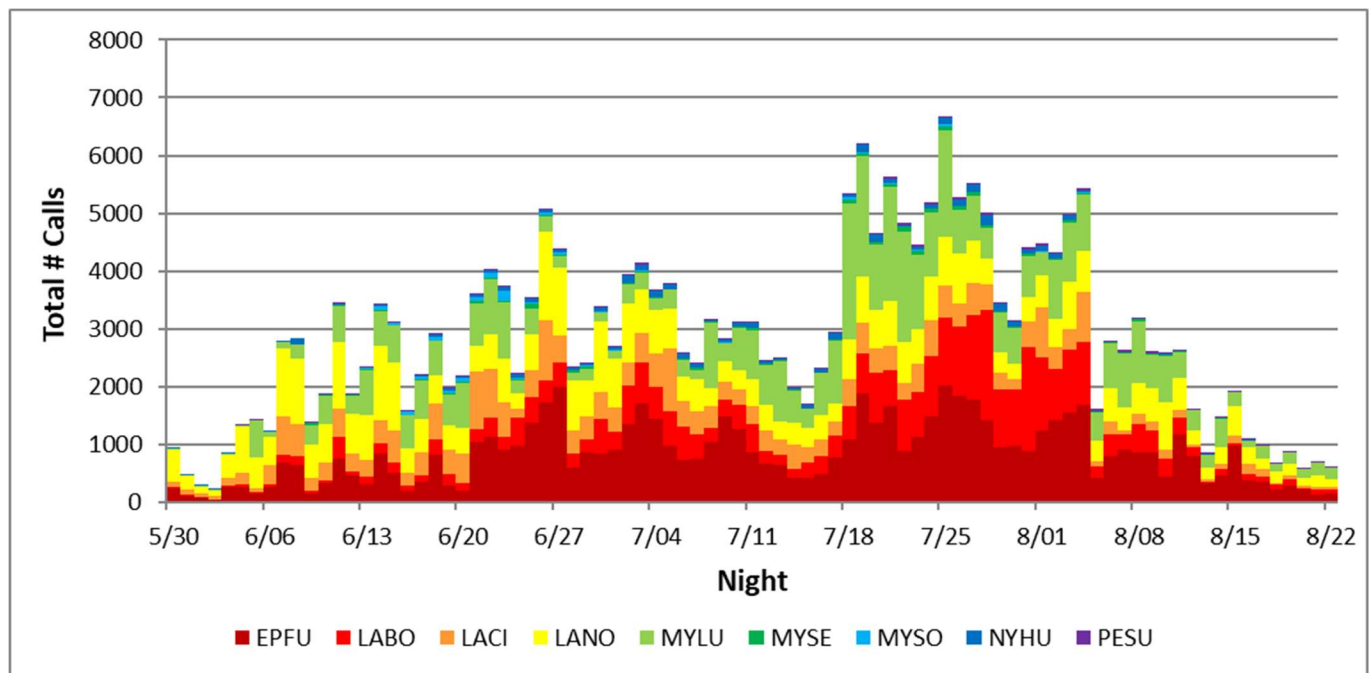


Figure 4-11. Total number of Call Sequences Recorded (All Parks Combined), for each Date and Species (Summer only), Expanded Analysis

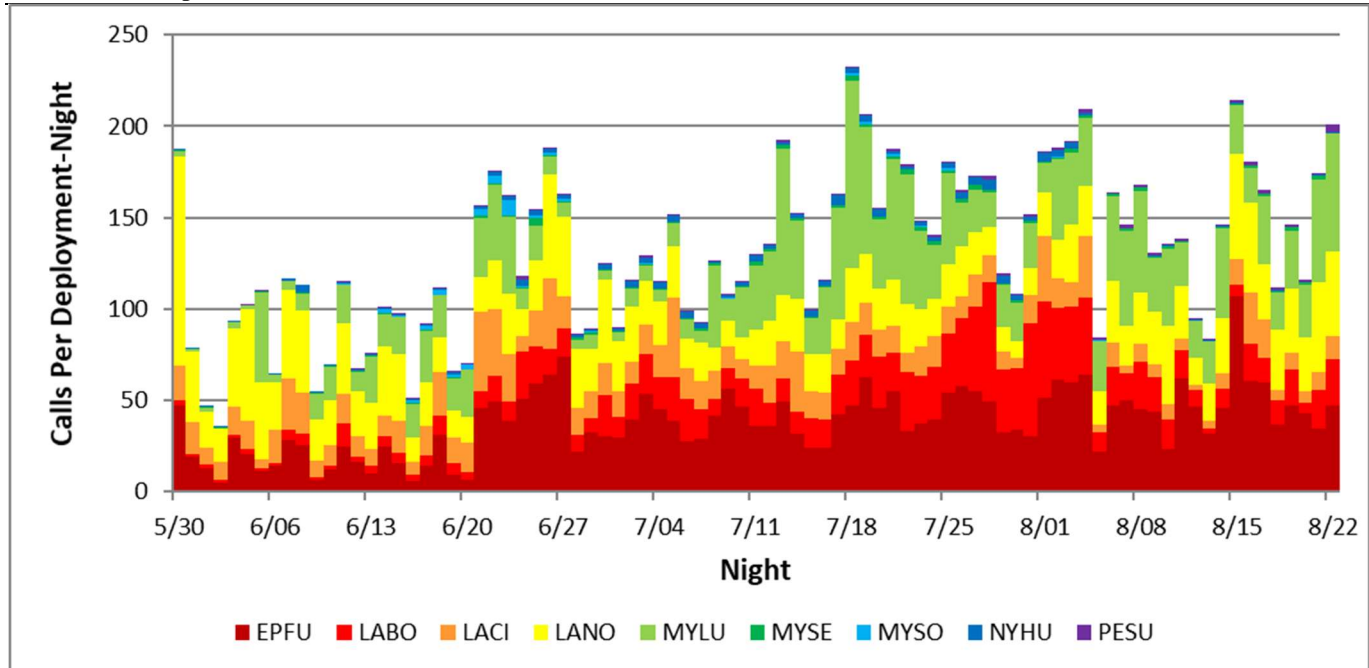


Figure 4-12 Number of Call Sequences Recorded per Deployment-Night (All Parks Combined), for each Date and Species (Summer only), Expanded Analysis

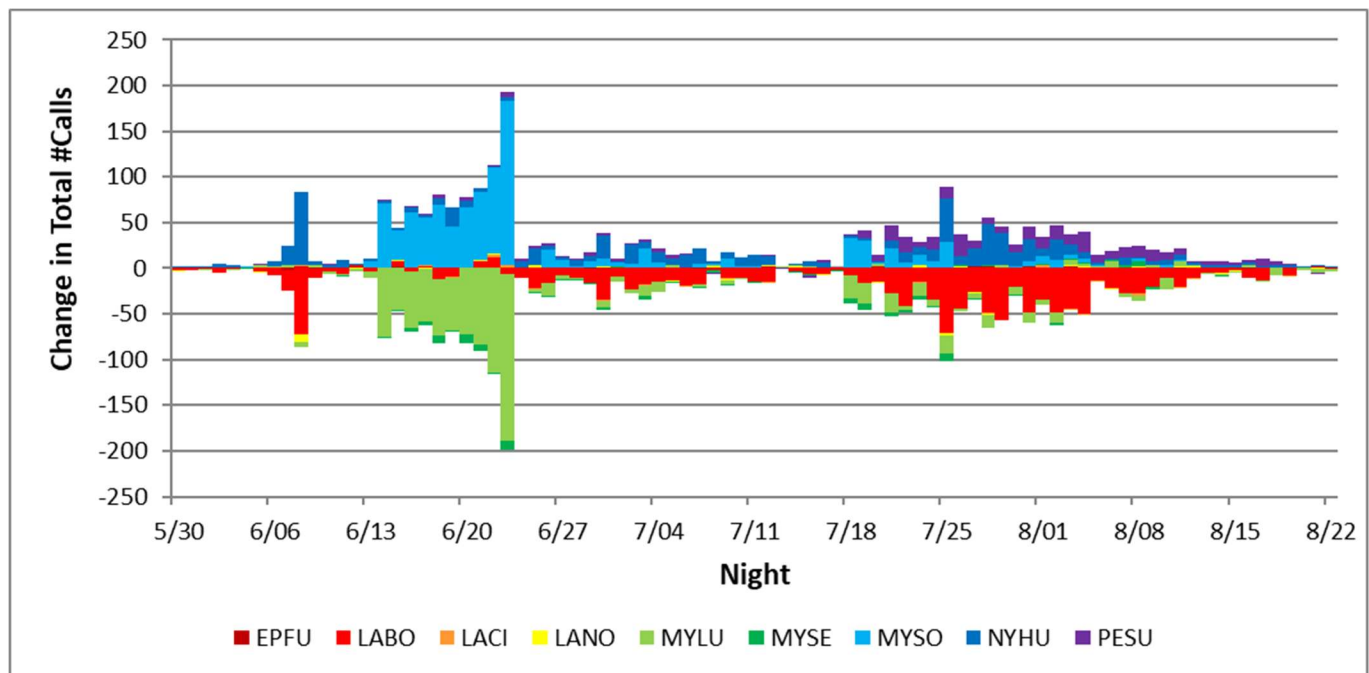


Figure 4-13. Difference in Total number of Call Sequences Recorded (All Parks Combined), for each Date and Species (Summer only. Differences were calculated by subtracting Baseline Analysis values from Expanded Analysis values.

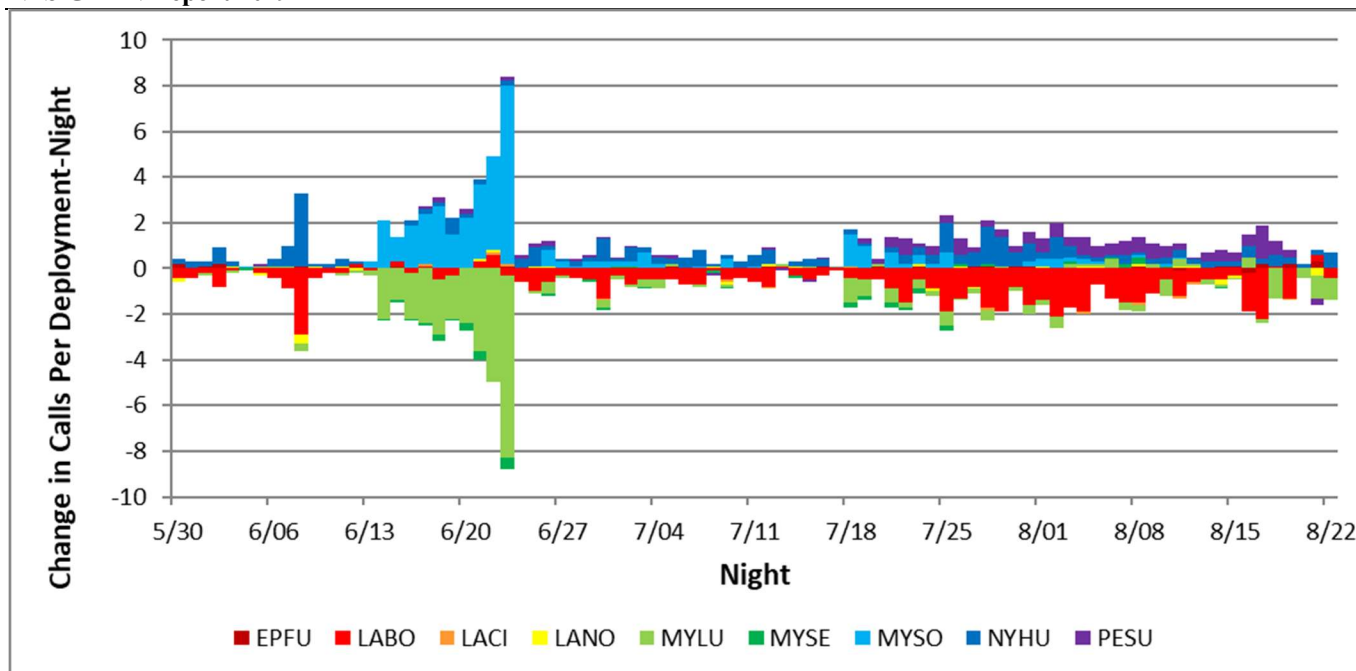


Figure 4-14. Difference in Number of Call Sequences Recorded per Deployment-Night (All Parks Combined), for each Date and Species (Summer only). Differences were calculated by subtracting Baseline Analysis values from Expanded Analysis values.

Figure 4-15 and Figure 4-16 show the total number of call sequences and the number of call sequences per deployment-night, respectively, for each date and park with all species combined. This helps illustrate the pattern of total bat activity.

Because the following graphs do not show individual species IDs, the graphs are essentially same for both the baseline and expanded analysis. Therefore, only one set of graphs for the baseline analysis is shown. (There are very small differences between baseline and expanded analysis graphs due to the changes in ID from a particular species to No ID, but those differences are not apparent on the graphs).

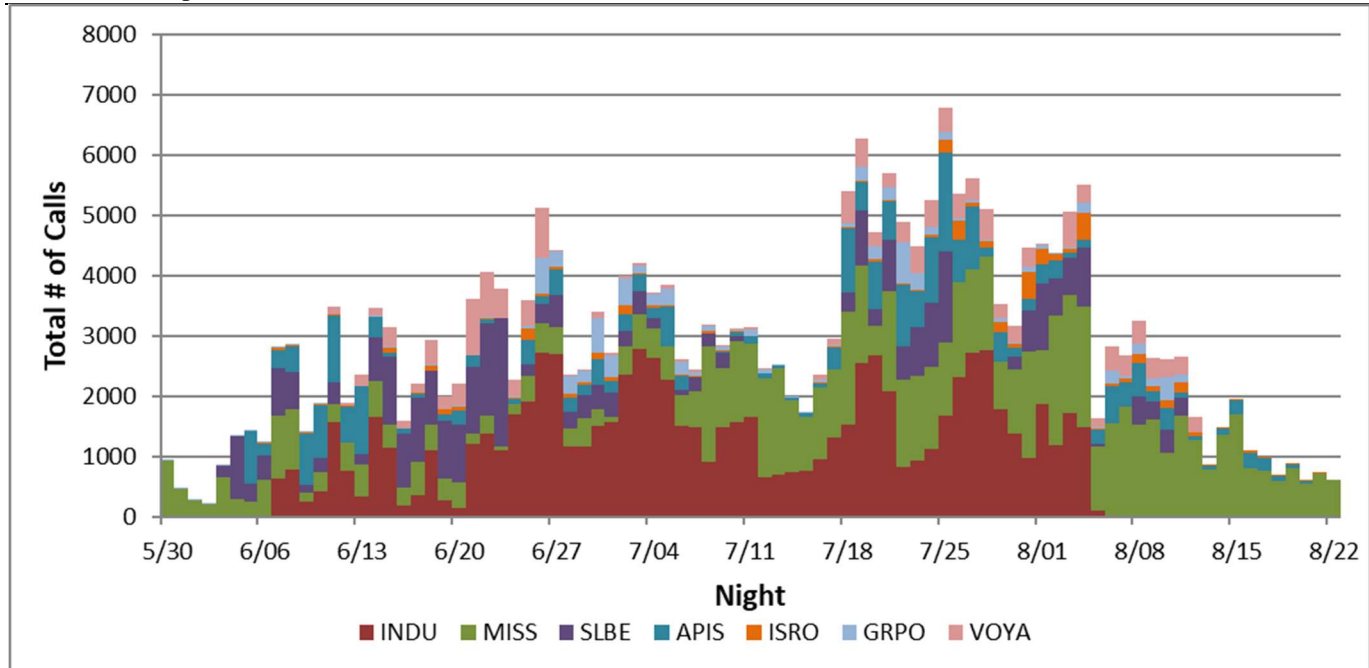


Figure 4-15. Total number of Call Sequences Recorded (All Species Combined), for each Date and Park (Summer only), Baseline Analysis

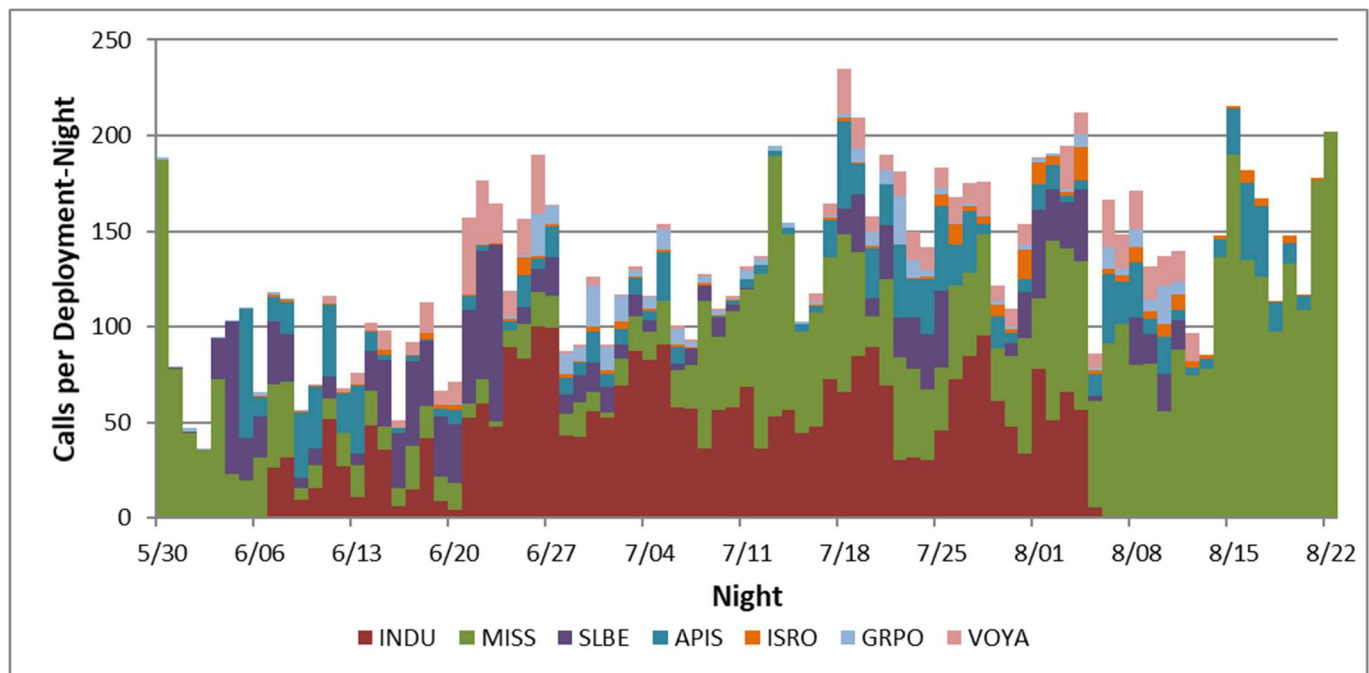


Figure 4-16. Number of Call Sequences Recorded Per Deployment-Night (All Species Combined), for each Date and Park (Summer only), Baseline Analysis

4.1.4 Percent of Deployments & Deployment-Nights with Calls

Table 4-12 lists the percent of deployments while Table 4-13 lists the percent of deployment-nights where each species was present, for the baseline species analysis. This is for the summer season only. Figure 4-17 plots the data in Table 4-13.

Similarly, Table 4-14 lists the percent of deployments while Table 4-15 lists the percent of deployment-nights where each species was present, for the expanded species analysis. This is for the summer season only. Figure 4-18 plots the data in Table 4-15.

To better highlight the differences in percentages, the table cells are highlighted using a continuous color scale based on the cell values as follows:



Table 4-12. Percent of Deployments each species was present, by Park (Summer Only), Baseline Analysis

Park	Deploy-ments	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	30	100	100	100	100	100	40	73	100	97
MISS	28	100	100	100	100	100	71	na	na	89
SLBE	32	100	97	100	100	100	53	na	na	na
APIS	24	100	88	96	100	100	96	na	na	na
ISRO	27	85	81	89	100	89	48	na	na	na
GRPO	18	94	44	100	100	94	44	na	na	na
VOYA	18	100	83	100	100	100	78	na	na	na

na: species was not considered in the analysis

Table 4-13. Percent of Deployment-Nights each species was present, by Park (Summer Only), Baseline Analysis

Park	Deploy-Nights	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	327	97	96	98	99	75	6	22	86	52
MISS	319	98	93	87	94	92	45	na	na	51
SLBE	238	86	76	83	89	78	26	na	na	na
APIS	273	48	68	62	83	83	39	na	na	na
ISRO	261	34	34	51	72	53	7	na	na	na
GRPO	197	44	18	55	83	41	10	na	na	na
VOYA	248	39	41	80	89	75	32	na	na	na

na: species was not considered in the analysis

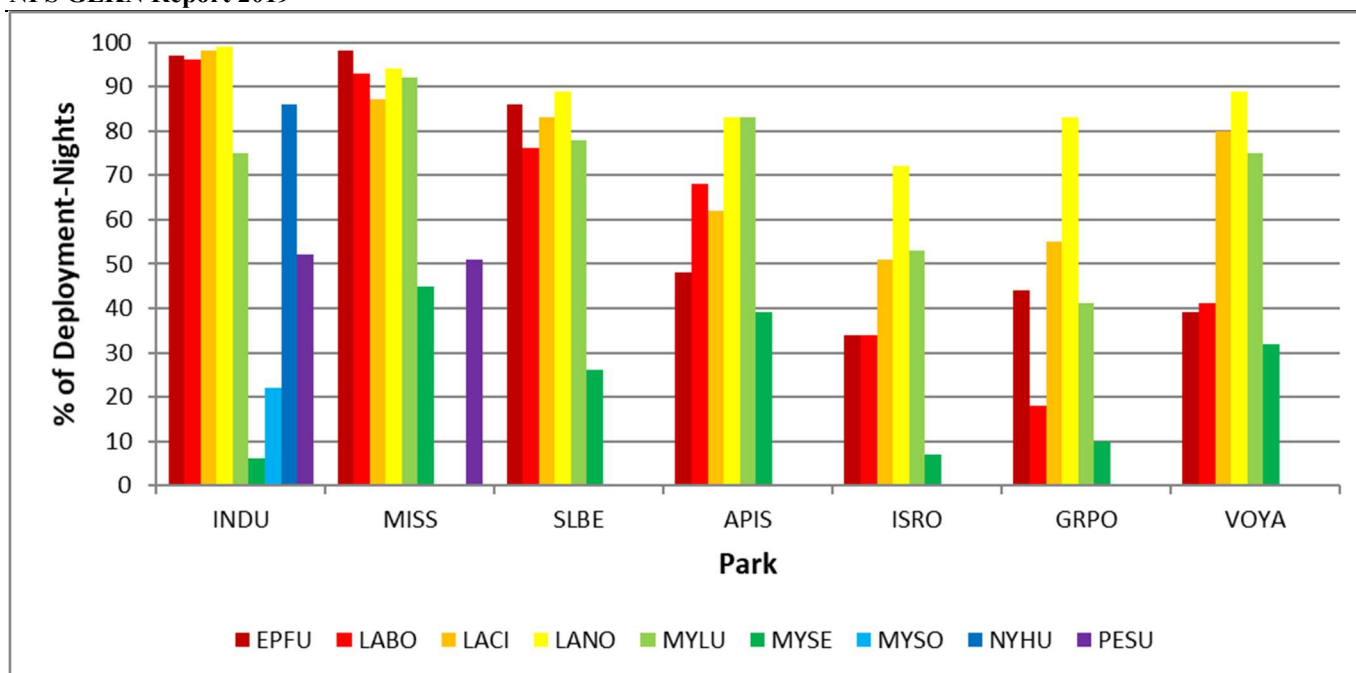


Figure 4-17. Percent of Deployment-Nights each species was present, by Park (Summer only), Baseline Analysis

Table 4-14. Percent of Deployments each species was present, by Park (Summer Only), Expanded Analysis

Park	Deploy-ments	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	30	100	100	100	100	100	40	73	100	97
MISS	28	100	100	100	100	100	71	na	93	89
SLBE	32	100	97	100	100	97	47	69	na	53
APIS	24	100	88	96	100	100	96	na	na	54
ISRO	27	85	81	89	100	89	48	na	na	11
GRPO	18	94	39	100	100	94	50	na	na	11
VOYA	18	100	83	100	100	100	78	na	na	39

na: species was not considered in the analysis

Table 4-15. Percent of Deployment-Nights each species was present, by Park (Summer Only), Expanded Analysis

Park	Deploy-ments	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	327	97	96	98	99	75	6	22	86	52
MISS	319	98	92	87	94	91	45	na	52	52
SLBE	238	86	76	83	89	78	21	37	na	20
APIS	273	48	67	62	83	82	40	na	na	22
ISRO	261	34	34	51	72	56	7	na	na	3
GRPO	197	44	17	55	83	40	11	na	na	5
VOYA	248	39	38	80	89	75	32	na	na	6

na: species was not considered in the analysis

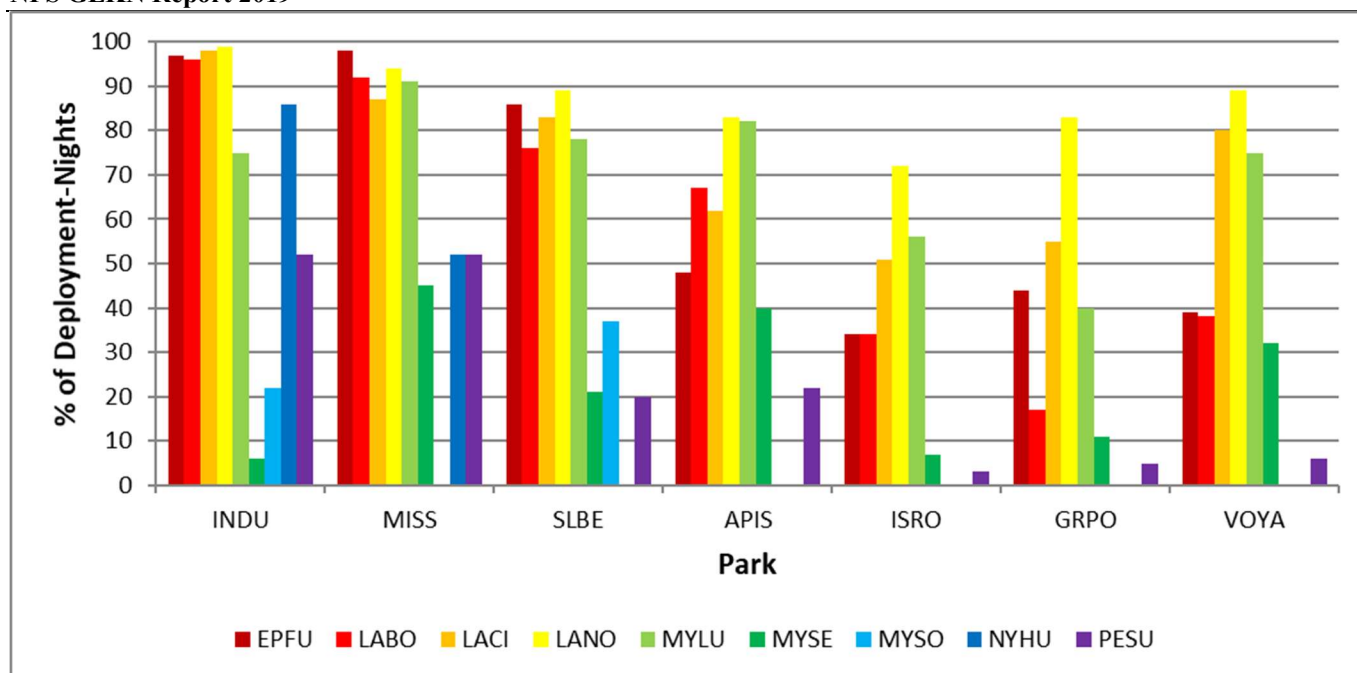


Figure 4-18. Percent of Deployment-Nights each species was present, by Park (Summer only), Expanded Analysis

5 Manual Vetting Summary

5.1.1 Manual Vetting/QC of KPro results

To manually vet the KPro IDs, at least 1% of identified (to species) files were chosen for manual vetting. To be sure that all parks and all species were proportionally represented in the manual vetting, files were NOT randomly selected at large, but instead 1% of files from within a given park and species group were randomly selected with a minimum of 10 files selected for each park and species group. The files selected for the MISS park did not include any files from the two non-protocol sites. Results for the non-protocol sites are presented separately in Section 6 below.

For example, if Park A had 5000 LABO and 6000 MYSO files, while Park B had 10000 LABO and 3000 MYSO files, the number of files selected for manual vetting would be 50 LABO files and 60 MYSO files from Park A and 100 LABO files and 30 MYSO files from Park B. In addition, if Park C had 500 LABO files, then 10 LABO files would be selected for manual vetting.

Table 5-1 shows the number of files selected for manual vetting, for each park and species, for the baseline analysis.

Table 5-1. Number of files manually vetted for species and park, Baseline analysis

Park	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU	All Species
INDU	347	173	97	151	18	10	10	29	10	845
MISS	253	69	66	113	211	10	na	na	10	732
SLBE	71	40	41	71	90	10	na	na	na	323
APIS	10	46	23	57	126	10	na	na	na	272
ISRO	10	11	10	15	11	10	na	na	na	67
GRPO	10	10	13	50	10	10	na	na	na	103
VOYA	10	12	55	28	49	10	na	na	na	164
All Parks	711	361	305	485	515	70	10	29	20	2506

For the expanded analysis, an additional manual vetting was done on the additional park/species combinations added in the expanded analysis. The numbers of files manually vetted for the additional park/species combinations in the expanded analysis are shown in Table 5-2.

Table 5-2. Number of additional files manually vetted for species and park, Expanded Analysis

Park	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	-	-	-	-	-	-	-	-	-
MISS	-	-	-	-	-	-	na	10	-
SLBE	-	-	-	-	-	-	10	na	10
APIS	-	-	-	-	-	-	na	na	10
ISRO	-	-	-	-	-	-	na	na	10
GRPO	-	-	-	-	-	-	na	na	10
VOYA	-	-	-	-	-	-	na	na	10

The files were renamed to strip any information from the file names and the files were placed into folders that indicated the possible species that were supplied to KPro for that file. This ensured that the manual analysis performed by biologists was a blind test with no information about the sites or files besides resident species.

Manual analysis was then performed using several call-viewing programs: SonoBat Viewer, Binary Acoustic Technologies SCANR, and Callviewer. Baseline call identification trees and prior knowledge or call shape, durations, and lengths were used to identify bats.

The auto classifier program, KPro, only identifies bats to singular species. Biologists were allowed to ID call sequences as species groups, such as EPFU/LANO or LABO/NYHU.

For the 2019 data, a single biologist performed all manual identifications. This is the same person who did the manual vetting for the 2016 and 2017 data, but not the same person who did the manual vetting for the 2015 and 2018 data.

5.1.2 Definition of ‘Agreement’

The KPro species identifications were restricted to a single species with the possible species for a given park as listed in Table 4-1. Species groups and unknown species were not allowed in the KPro identifications. The manual species identifications were restricted to the same species as the KPro identifications; however, in addition, the manual id allowed call sequences to be identified as species groups, unknown, unknown high frequency, unknown low frequency, unknown Myotis or no bat.

Table 5-3 shows the different manual identifications that were returned by the bat biologist in this study and the KPro identifications that would be considered in agreement.

Table 5-3. Manual ID and KPro ID conventions for agreement

Manual ID (species IDs by manual vetter)	KPro ID in ‘agreement’	KPro ID in ‘partial- agreement’
EPFU	EPFU	
EPFU/LANO		EPFU or LANO
LABO	LABO	
LABO/NYHU		LABO or NYHU
LACI	LACI	
LACI/LANO		LACI or LANO
LANO	LANO	
MYLU	MYLU	MYSE or MYSO
MYLU/MYSO ¹	MYSO	MYLU, MYSE
MYSE	MYSE	MYLU or MYSO
MYsp (unknown Myotis)		MYLU, MYSE or MYSO
NYHU	NYHU	
PESU	PESU	
UNKN_HIFREQ		MYLU, MYSE or MYSO
UNKN_LOWFREQ		
NOBAT (not a bat)		

¹ Potential MYSO are always manually identified as MYLU/MYSO and not just MYSO, because MYSO call characteristics always overlap with those of MYLU.

5.1.3 Agreement: Number of Call Sequences

Table 5-4 shows a matrix comparing the manual and KPro identifications. Cells that are highlighted in green are the agreements and cells that are highlighted in orange are the partial agreements. Cells highlighted in light red are the most common disagreements for a given KPro ID.

Table 5-5 shows the manual vetting results for species added in the expanded analysis.

Table 5-4. Manual Vetting Results – Number of Call Sequences, Baseline Analysis

ManualID ¹	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU	All Species
EPFU	344	3	2	11	1	0	0	0	0	361
EPFU/LANO	324	4	47	310	2	1	0	0	0	688
LABO	4	255	1	1	57	2	5	12	9	346
LABO/NYHU	0	22	0	0	0	0	0	6	0	28
LACI	4	1	206	5	1	0	0	0	0	217
LACI/LANO	1	0	0	1	0	0	0	0	0	2
LANO	2	1	8	120	2	0	0	0	0	133
MYLU	2	16	3	0	397	38	0	0	0	456
MYSE	0	0	0	0	0	5	0	0	0	5
MYsp	0	1	0	0	10	6	0	0	0	17
NYHU	0	23	0	0	1	0	0	10	0	34
PESU	0	2	0	0	1	0	0	0	10	13
UNKN_HIFREQ	2	24	1	0	41	18	5	0	1	92
UNKN_LOWFREQ	26	5	14	33	0	0	0	1	0	79
NOBAT	2	4	23	4	2	0	0	0	0	35
Total	711	361	305	485	515	70	10	29	20	2506

¹MYsp: unknown Myotis; UNKN_HIFREQ: unknown high frequency bat call sequence; UNKN_LOWFREQ: unknown low frequency bat call sequence; NOBAT: not a bat

: cells in light green are exact matches

: cells in light orange are partial matches

: cells in light red are most common disagreement

Table 5-5. Manual Vetting Results – Number of Call Sequences, Expanded Analysis Species

Manual ID ¹	MYSO	NYHU	PESU
LABO	0	3	37
LABO/NYHU	0	1	0
MYLU	0	0	2
MYLU/MYSO ²	7	0	2
MYsp	1	0	1
NYHU	0	3	0
PESU	0	0	2
UNKN_HIFREQ	2	0	5
UNKN_LOFREQ	0	1	0
NOBAT	0	2	1
Total	10	10	50

¹ MYsp: unknown Myotis; UNKN_HIFREQ: unknown high frequency bat call sequence; UNKN_LOFREQ: unknown low frequency bat call sequence; NOBAT: not a bat

² For manual ID all potential MYSO are ID'd as MYLU/MYSO.

: cells in light green are exact matches

: cells in light orange are partial matches

: cells in light red are most common disagreement

5.1.4 Agreement: Percent

For the baseline analysis, Table 5-6 and Table 5-7 show the agreement between the manual and KPro identifications for non-Myotis species and Myotis species, respectively.

For the additional species considered in the expanded analysis, Table 5-8 and Table 5-9 show the agreement between the manual and KPro identifications for non-Myotis species and Myotis species, respectively.

Table 5-6. Manual Vetting of KPro ID: Percent Agreement for non-Myotis, Baseline Analysis

KPro ID	Total Vetted	# Agree ¹	% Agree	Most Common Disagreements
EPFU	711	668	94.0	UNKN_LOWFREQ
LABO	361	277	76.7	UNKN_HIFREQ, NYHU, MYLU
LACI	305	206	67.5	EPFU/LANO, UNKN_LOWFREQ
LANO	485	431	88.9	UNKN_LOWFREQ
NYHU	29	16	55.5	LABO
PESU	20	10	50.0	LABO

¹Includes both exact and partial agreements

Table 5-7. Manual Vetting of KPro ID: Percent Agreement for Myotis, Baseline Analysis

KPro ID	# of Files				% of Files			Most Common Disagreements
	Total Vetted	Exact Species	Other Myotis or High Freq.	All Myotis or High Freq.	Exact Species	Other Myotis or High Freq.	All Myotis or High Freq.	
MYLU	515	397	51	448	77.1	9.9	87.0	LABO
MYSE	70	5	62	67	7.1	88.6	95.7	LABO
MYSO	10	0	5	5	0.0	50.0	50.0	LABO

Table 5-8. Manual Vetting of KPro ID: Percent Agreement for non-Myotis, Expanded Analysis

KPro ID	Total Vetted	# Agree ¹	% Agree	Most Common Disagreements
NYHU	10	4	40.0	LABO
PESU	50	2	4.0	LABO

¹Includes both exact and partial agreements

Table 5-9. Manual Vetting of KPro ID: Percent Agreement for Myotis, Expanded Analysis

KPro ID	# of Files				% of Files			Most Common Disagreements
	Total Vetted	Exact Species	Other Myotis or High Freq.	All Myotis or High Freq.	Exact Species	Other Myotis or High Freq.	All Myotis or High Freq.	
MYSO	10	7	3	10	70.0	30.0	100.0	(none)

6 Special Myotis Analysis for MISSf001 and MISSt001

For the summer 2019, there was additional interest in the potential Myotis activity at the non-protocol sites MISSf001 and MISSt001 in the MISS park. For these two sites, the number of calls identified by KPro as Myotis is separately reported in this section. In addition, for both sites, 50% of the calls identified by KPro as Myotis were manually vetted and the results are presented in this section.

6.1 Auto ID Results

For MISSf001 and MISSt001, the audio files were analyzed by KPro in the same manner as all other sites and as described in previous sections. The number of files identified by KPro as Myotis for these two sites are shown in Table 6-1.

Table 6-1. Number of Files Identified by the KPro Auto-Classifer as Myotis for MISSf001 and MISSt001

	MISSf001	MISSt001
MYLU	81	381
MYSE	1	64
Total Myotis	82	445

6.2 Manual Vetting Results

For manual vetting, 50% of files identified by KPro as Myotis were randomly chosen for manual vetting. For the MISSf001 site, 41 MYLU and 1 MYSE files were manually vetted. For the MISSt001 site, 191 MYLU and 32 MYSE calls were manually vetted. The results of the manual vetting are shown in Table 6-2 and Table 6-3 for the MISSf001 site, and in Table 6-4 and Table 6-5 for the MISSt001 site.

Table 6-2. Manual Vetting Results – Number of Call Sequences, MISSf001 Myotis Analysis

Manual ID ¹	MYLU	MYSE
LABO	28	1
MYLU	11	0
MYSE	0	0
MYsp	0	0
UNKN_HIFREQ	2	0
Total	41	1

¹MYsp: unknown Myotis; UNKN_HIFREQ: unknown high frequency bat call sequence

: cells in light green are exact matches

: cells in light orange are partial matches

: cells in light red are most common disagreement

Table 6-3. Manual Vetting of KPro ID: Percent Agreement for Myotis, MISSf001 Myotis Analysis

KPro ID	# of Files				% of Files			Most Common Disagreements
	Total Vetted	Exact Species	Other Myotis or High Freq.	All Myotis or High Freq.	Exact Species	Other Myotis or High Freq.	All Myotis or High Freq.	
MYLU	41	11	2	13	26.8	4.9	31.7	LABO
MYSE	1	0	0	0	0.0	0.0	0.0	LABO

Table 6-4. Manual Vetting Results – Number of Call Sequences, MISSt001 Myotis Analysis

Manual ID ¹	MYLU	MYSE
LABO	20	0
MYLU	171	23
MYSE	0	1
MYsp	0	5
UNKN_HIFREQ	0	3
Total	191	32

¹MYsp: unknown Myotis; UNKN_HIFREQ: unknown high frequency bat call sequence

: cells in light green are exact matches

: cells in light orange are partial matches

: cells in light red are most common disagreement

Table 6-5. Manual Vetting of KPro ID: Percent Agreement for Myotis, MISSt001 Myotis Analysis

KPro ID	# of Files				% of Files			Most Common Disagreements
	Total Vetted	Exact Species	Other Myotis or High Freq.	All Myotis or High Freq.	Exact Species	Other Myotis or High Freq.	All Myotis or High Freq.	
MYLU	191	171	0	171	89.5	0.0	89.5	LABO
MYSE	32	1	31	32	3.1	96.9	100.0	(none)

7 Conclusion and Observations

The purpose of this report was simply to summarize the results of 2019 GLKN acoustic monitoring effort and not to make conclusions about the ecological significance of the results.

A total of 318,621 audio files were collected during the 2019 monitoring season, from 7 national parks. Of these, we analyzed the 308,658 audio files from the Summer season (6/1/19-8/15/19), which were collected at 177 distinct locations during 1863 deployment nights. Using the auto-classifier Kaleidoscope-Pro (KPro), audio files were identified to species or classified as noise. Both a baseline species analysis and an expanded species analysis were performed using the auto-classifier.

For both the baseline and expanded analysis, overall ~79% of the audio files were identified to species, while ~20% were found to be noise. Less than 1% were found to be bat call sequences that could not be identified to species. For both analyses, individual parks ranged from 68-83% of audio files identified to species and from 16-31% classified as noise. The main difference between the baseline and expanded analyses was that the expanded analysis reclassified a small number of files (283 files, or ~0.1% of the total) from a specific species to an unidentifiable bat. It is not known why there was a slight increase in unidentifiable files with the expanded species analysis.

The expanded species analysis reclassified a significant number of LABO files to NYHU at MISS. LABO and NYHU are two species that overlap very closely and therefore are very difficult to distinguish. The subtle and complex characteristics that biologists use to distinguish LABO and NYHU are probably not modelled in the KPro classifier. When given the possible presence of both NYHU and LABO, KPro may simply be guessing between the two species and therefore a notable percentage of calls previously identified as LABO (when NYHU was not a possibility) will be identified as NYHU. LABO call characteristics vary a great deal and overlap with call characteristics for a great many species, thus misclassification of a species as LABO or vice versa tends to be the most common misclassification by KPro.

For call sequences identified by KPro as a *Myotis* species, in the baseline analysis ~96% were identified as MYLU while ~4% were identified as MYSE and ~0.3% were identified as MYSO (which was only considered for the INDU park). For the expanded analysis, which allowed MYSO to be considered for both the SLBE and INDU parks, a number of call sequences were reclassified as MYSO in the SLBE park. For the expanded analysis, of all call sequences identified as a *Myotis* species, ~94% were identified as MYLU while ~4% were identified as MYSE and ~2% were identified as MYSO.

The baseline analysis KPro identification was quality controlled by manually vetting about 1% of the files identified to species. Additionally, species/park combinations added in the expanded analysis were separately quality controlled by manually vetting 1% of the files identified to the expanded species.

In the baseline analysis, for call sequences identified by KPro as non-*Myotis* species, the KPro and manual identifications had good agreement for some species and less for others. For EPFU, the agreement was reasonably high at 94% and but for NYHU and PESU the agreement was relatively low, at only 56% and 50% respectively. Other species ranged in agreement from 68%-89%. The low agreement percentage for PESU and NYHU is due in large part to the difficulty of distinguishing PESU and NYHU from LABO. Those species calls are fairly distinctive to an experienced human reviewer but are often misclassified by KPro as LABO. For the expanded analysis, for call sequences identified by KPro as non-*Myotis* species, manual identification did not agree well with the KPro identification. For the files identified by KPro as NYHU, the manual ID agreed on only 40% of files and for PESU the manual ID agreed on only 4% of files. In both cases, the manual identification primarily identified the expanded species as LABO.

In the baseline analysis, for call sequences identified by KPro as Myotis species, the agreement between KPro and manual identification was mixed. For files identified by KPro as MYLU, the agreement was very good; with 77% also manually identified as MYLU and 87% manually identified as a Myotis species call sequence. For files identified by KPro as MYSE, only 7% were also manually identified as MYSE but 96% were manually identified as a Myotis species. For files identified by KPro as MYSO, 50% were manually identified as unknown high frequency calls and 50% were manually identified LABO. However, there were so few MYSO files that results are difficult to interpret.

For the expanded analysis which added MYSO for SLBE, manual identification agreed well with KPro identification. For the files identified by KPro as MYSO, the manual identification was MYLU/MYSO for 70% of files and the remaining 30% of files were manually identified as unknown Myotis or unknown high frequency.

There were two non-protocol sites, MISSf001 and MISSt001, for which a more intensive manual vetting of potential Myotis recordings was performed. For the MISSf001 site, the KPro auto classifier flagged 82 calls as Myotis with all but one being classified as MYLU and the remaining 1 file classified as MYSE. Manually vetting did not confirm most of the KPro classifications for this site. Only 27% of files identified by KPro as MYLU were also manually identified as MYLU, plus another 5% of files were manually identified as unknown high frequency. The one file identified by KPro as MYSE was manually identified as LABO. Although MYLU appears to be present, the presence of MYSE at this site appears doubtful. For the MISSt001 site, the KPro auto classifier flagged 445 calls as Myotis with 381 being classified as MYLU and 64 classified as MYSE. For this site, the manual vetting **did** confirm the KPro classification in most cases. 90% of files identified by KPro as MYLU were manually confirmed to be MYLU. 100% of files identified by KPro as MYSE were manually identified as Myotis species or high frequency calls, including one file that was manually identified as MYSE. The presence of both MYLU and MYSE at this site appears confirmed.

The auto classifier programs approved by the USFWS for MYSO and MYSE projects (including KPro), are tuned to be extra sensitive towards endangered species such as MYSO and MYSE. This can explain the number of audio files manually identified as LABO but identified by KPro as MYSE and MYSO. The manual vetting did agree that the files identified by KPro as MYLU or MYSE were some type of Myotis about 86-90% of the time, thus an identification by KPro of MYLU or MYSE could at least be a flag for a potential Myotis.

Based on the data tables presented in this report, there was nothing highly unusual about distribution of species (as determined by KPro identification) among the parks or the relative nightly activity throughout the season. A thorough analysis is, of course, needed to quantify this observation, correct for discrepancies between KPro and manual identification and compare these results with bat species prevalence reported in the general literature. This is an ongoing study with five years of data collection so far completed (2015-2019) and analyzed.

8 Supplementary Documents

The following documents contain detailed information and data that are important to the 2019 reporting of results, but are too big to be included in this report and are better provided as supplementary documents:

- [*Data Management Plan.docx*](#)
 - Detailed information about the procedures for data management and processing as well as step-by-step instruction for automatic identification using KPro.
- [*tables_2019_SpeciesCalls_byParkSiteNight_AutoID.xlsx*](#)
 - Number of call sequences for each species (as ID'd by KPro for both baseline and expanded species lists) for each site and night combination
 - Total number of call sequences for each species (as ID'd by KPro for both baseline and expanded species lists) for each site with all nights combined
 - Number of call sequences per deployment-night for each site, for each species (as ID'd by KPro for both baseline and expanded species lists)
- [*tables_2019_AudioFile_Classification_byParkSite.xlsx*](#) Audio file classification (bad files, short deployment fields, etc.) for each Park and site.
- [*tables_2019_CallsvsNoise_byParkSite.xlsx*](#) Number and percent files ID'd as bats and noise files for each Park and site.

9 APPENDIX

Table 9-1. Number of Deployments by Date, during the Summer season (Figure 3-2)

Night	All Parks	INDU	MISS	SLBE	APIS	ISRO	GRPO	VOYA
5/30/2019	5	0	2	0	0	0	3	0
5/31/2019	6	0	2	1	0	0	3	0
6/1/2019	6	0	2	1	0	0	3	0
6/2/2019	6	0	2	1	0	0	3	0
6/3/2019	9	0	2	4	0	0	3	0
6/4/2019	13	0	2	6	2	0	3	0
6/5/2019	13	0	2	6	2	0	3	0
6/6/2019	19	0	3	6	5	2	3	0
6/7/2019	24	3	3	6	5	4	3	0
6/8/2019	25	3	3	6	6	4	3	0
6/9/2019	25	3	3	6	6	4	3	0
6/10/2019	27	5	3	6	6	4	3	0
6/11/2019	30	8	3	3	6	4	3	3
6/12/2019	28	8	3	0	6	4	3	4
6/13/2019	31	8	3	3	6	4	3	4
6/14/2019	34	8	3	6	6	4	3	4
6/15/2019	32	8	3	6	4	4	3	4
6/16/2019	31	8	3	6	3	4	3	4
6/17/2019	24	5	3	6	2	1	3	4
6/18/2019	26	8	3	5	1	2	3	4
6/19/2019	30	8	3	5	3	4	3	4
6/20/2019	31	8	3	6	3	4	3	4
6/21/2019	23	4	1	5	3	3	3	4
6/22/2019	23	4	1	5	3	3	3	4
6/23/2019	23	4	1	5	3	3	3	4
6/24/2019	19	5	1	0	3	3	3	4
6/25/2019	23	5	3	2	3	3	3	4
6/26/2019	27	8	3	4	2	3	3	4
6/27/2019	27	7	3	4	5	4	3	1
6/28/2019	27	4	3	4	5	4	3	4
6/29/2019	27	4	3	4	5	4	3	4
6/30/2019	27	4	3	4	5	4	3	4
7/1/2019	30	6	3	4	5	5	3	4
7/2/2019	34	8	4	4	5	6	3	4
7/3/2019	32	8	4	3	5	5	3	4
7/4/2019	32	8	4	3	5	5	3	4
7/5/2019	25	7	4	0	3	4	3	4
7/6/2019	26	7	4	1	3	4	3	4
7/7/2019	26	6	4	4	1	4	3	4
7/8/2019	25	4	5	4	1	4	3	4
7/9/2019	26	4	5	4	3	3	3	4

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7/10/2019	27	6	5	4	3	2	3	4
7/11/2019	24	6	5	2	2	2	3	4
7/12/2019	18	3	5	1	2	1	3	3
7/13/2019	13	3	5	0	2	0	3	0
7/14/2019	13	3	5	0	2	0	3	0
7/15/2019	17	5	5	0	2	2	3	0
7/16/2019	20	5	5	0	2	2	3	3
7/17/2019	18	5	2	0	3	2	3	3
7/18/2019	23	5	3	3	4	3	2	3
7/19/2019	30	7	3	6	2	3	3	6
7/20/2019	30	7	3	6	2	3	3	6
7/21/2019	30	7	3	6	2	3	3	6
7/22/2019	27	4	5	6	2	1	3	6
7/23/2019	30	4	5	6	2	4	3	6
7/24/2019	37	6	5	6	5	6	3	6
7/25/2019	37	4	6	6	6	6	3	6
7/26/2019	32	6	6	0	6	6	2	6
7/27/2019	32	6	6	0	6	6	2	6
7/28/2019	29	6	5	0	4	6	2	6
7/29/2019	29	6	5	0	4	6	2	6
7/30/2019	29	4	5	3	5	5	2	5
7/31/2019	29	4	5	3	5	6	2	4
8/1/2019	24	4	3	3	5	6	2	1
8/2/2019	23	4	5	3	3	6	2	0
8/3/2019	26	4	5	3	3	5	2	4
8/4/2019	26	4	5	3	3	5	2	4
8/5/2019	19	1	5	1	5	2	1	4
8/6/2019	17	0	5	0	5	2	1	4
8/7/2019	18	0	6	0	5	2	1	4
8/8/2019	19	0	5	2	5	2	1	4
8/9/2019	20	0	6	2	4	3	1	4
8/10/2019	19	0	6	2	3	3	1	4
8/11/2019	19	0	6	2	3	3	1	4
8/12/2019	17	0	6	0	3	4	0	4
8/13/2019	10	0	5	0	3	2	0	0
8/14/2019	10	0	5	0	3	2	0	0
8/15/2019	9	0	5	0	2	2	0	0
8/16/2019	6	0	3	0	1	2	0	0
8/17/2019	6	0	3	0	1	2	0	0
8/18/2019	6	0	3	0	1	2	0	0
8/19/2019	6	0	3	0	1	2	0	0
8/20/2019	5	0	3	0	1	1	0	0
8/21/2019	4	0	3	0	0	1	0	0
8/22/2019	3	0	3	0	0	0	0	0

Table 9-2. Number of Calls Per Deployment-Night (All Parks Combined), for each Species, Baseline Analysis (Figure 4-10)

Night	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
5/30/2019	236	16	93	573	16	2	0	0	0
5/31/2019	114	13	102	232	8	2	0	0	0
6/1/2019	76	15	53	120	14	1	0	0	0
6/2/2019	30	12	58	109	2	4	0	0	0
6/3/2019	268	15	134	389	29	3	0	0	0
6/4/2019	265	35	204	792	26	2	0	0	1
6/5/2019	145	22	68	547	639	2	0	0	0
6/6/2019	270	40	338	492	86	2	0	0	0
6/7/2019	678	165	669	1160	116	1	0	10	0
6/8/2019	627	240	554	1134	244	14	0	26	0
6/9/2019	156	57	219	571	334	32	0	5	1
6/10/2019	320	64	312	665	479	22	0	6	0
6/11/2019	754	372	493	1162	614	18	2	24	6
6/12/2019	448	82	311	691	299	22	1	15	7
6/13/2019	306	131	286	790	785	23	0	8	3
6/14/2019	836	187	391	1287	666	27	1	26	13
6/15/2019	497	179	551	1176	686	9	1	18	8
6/16/2019	190	98	224	408	641	9	0	3	5
6/17/2019	345	122	394	564	740	20	0	8	7
6/18/2019	805	283	629	491	654	15	0	23	9
6/19/2019	289	196	427	430	595	23	1	9	5
6/20/2019	201	130	512	428	870	26	4	1	6
6/21/2019	1046	202	1011	426	829	38	10	24	7
6/22/2019	1127	325	831	607	1071	17	7	38	6
6/23/2019	898	234	599	757	1159	29	9	42	4
6/24/2019	966	500	161	277	216	21	12	61	27
6/25/2019	1363	480	454	632	439	100	22	47	23
6/26/2019	1728	400	1042	1534	271	27	22	45	12
6/27/2019	1995	429	466	1182	201	27	18	61	5
6/28/2019	586	256	408	865	139	35	1	29	12
6/29/2019	870	227	404	613	213	45	1	29	10
6/30/2019	829	636	480	1214	156	13	1	41	5
7/1/2019	899	326	425	833	137	18	1	48	3
7/2/2019	1349	683	402	1031	336	18	5	92	15
7/3/2019	1710	718	518	761	288	25	1	82	38
7/4/2019	1446	568	568	757	220	16	1	93	12
7/5/2019	973	613	1084	701	312	15	1	80	20
7/6/2019	717	612	442	429	274	17	5	74	7
7/7/2019	747	447	398	547	172	32	4	53	6
7/8/2019	1033	242	386	312	1124	25	5	22	12
7/9/2019	1473	303	306	371	308	7	1	38	3

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7/10/2019	1253	435	276	331	730	15	2	50	11
7/11/2019	870	494	300	477	847	39	5	69	11
7/12/2019	650	238	369	441	676	26	0	29	11
7/13/2019	642	164	267	324	1043	24	1	18	21
7/14/2019	409	166	427	369	556	23	0	20	4
7/15/2019	415	273	260	344	331	9	0	59	16
7/16/2019	481	309	303	416	734	6	2	57	15
7/17/2019	763	394	247	294	1105	17	2	106	9
7/18/2019	1085	577	481	671	2385	79	1	54	23
7/19/2019	1878	709	528	806	2110	46	0	115	14
7/20/2019	1366	874	433	670	1131	46	2	125	14
7/21/2019	1652	656	428	766	1993	62	6	50	17
7/22/2019	887	929	281	724	1911	75	1	24	20
7/23/2019	1126	792	486	606	1303	68	1	46	25
7/24/2019	1474	1078	622	772	1106	66	3	53	25
7/25/2019	2009	1259	554	845	1863	81	3	59	25
7/26/2019	1844	1233	396	872	756	72	1	91	28
7/27/2019	1767	1503	554	735	769	71	1	115	22
7/28/2019	1419	1952	437	448	551	39	0	131	38
7/29/2019	944	1059	284	368	670	24	3	96	24
7/30/2019	972	1005	164	271	622	35	2	58	8
7/31/2019	884	1834	456	415	725	36	2	46	18
8/1/2019	1240	1294	863	558	406	9	0	95	13
8/2/2019	1409	949	376	486	1021	24	1	57	16
8/3/2019	1554	1115	360	821	1011	48	3	68	24
8/4/2019	1675	1134	882	703	980	28	0	28	25
8/5/2019	417	211	88	348	506	12	2	2	21
8/6/2019	802	386	220	580	777	19	0	0	11
8/7/2019	898	290	84	390	932	21	0	0	20
8/8/2019	857	517	188	531	1072	31	0	0	14
8/9/2019	867	402	151	563	593	21	0	0	13
8/10/2019	447	320	154	808	822	27	0	0	11
8/11/2019	1179	313	127	543	445	11	0	0	13
8/12/2019	785	172	47	255	335	10	0	0	11
8/13/2019	317	37	37	205	233	4	0	0	7
8/14/2019	455	114	86	302	492	9	0	0	8
8/15/2019	960	60	130	514	246	6	0	0	11
8/16/2019	364	132	171	293	109	9	0	0	6
8/17/2019	357	94	128	181	222	8	0	0	6
8/18/2019	219	79	34	198	131	5	0	0	4
8/19/2019	281	128	56	208	192	10	0	0	6
8/20/2019	216	27	30	149	146	7	0	0	7
8/21/2019	138	82	39	198	230	8	0	0	6
8/22/2019	142	77	38	138	197	1	0	0	11

Table 9-3. Number of Calls Per Deployment-Night (All Parks Combined), for each Species, Expanded Analysis (Figure 4-12)

Night	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
5/30/2019	237	14	93	572	16	2	0	1	0
5/31/2019	114	11	102	232	8	2	0	2	0
6/1/2019	77	14	53	120	13	1	0	1	0
6/2/2019	31	7	58	109	2	4	0	4	0
6/3/2019	268	14	134	390	28	3	0	2	0
6/4/2019	265	35	204	792	26	1	1	0	1
6/5/2019	146	19	68	546	641	2	0	0	1
6/6/2019	270	32	338	492	88	2	0	5	0
6/7/2019	676	143	670	1160	118	1	0	31	0
6/8/2019	629	168	556	1125	238	14	0	105	0
6/9/2019	155	48	219	572	336	33	0	8	1
6/10/2019	320	60	312	665	477	22	0	10	1
6/11/2019	754	366	493	1163	612	17	2	32	6
6/12/2019	450	84	311	690	296	22	1	16	7
6/13/2019	306	127	286	790	779	23	8	10	3
6/14/2019	837	187	391	1287	591	25	71	28	15
6/15/2019	499	185	551	1177	640	8	34	20	8
6/16/2019	190	94	224	409	580	5	60	9	6
6/17/2019	345	124	395	563	682	16	52	11	9
6/18/2019	806	271	629	491	592	7	69	29	13
6/19/2019	289	187	426	430	537	22	46	30	5
6/20/2019	201	130	512	429	798	16	70	7	11
6/21/2019	1046	209	1011	428	746	31	85	27	7
6/22/2019	1127	337	833	609	957	16	101	39	7
6/23/2019	899	228	601	757	976	19	189	46	10
6/24/2019	966	489	161	277	217	21	12	68	30
6/25/2019	1364	458	453	634	436	99	22	65	27
6/26/2019	1728	384	1042	1535	257	25	41	50	15
6/27/2019	1995	421	466	1182	197	26	27	64	6
6/28/2019	586	245	408	865	138	34	3	36	14
6/29/2019	869	212	404	614	213	43	8	34	14
6/30/2019	828	602	479	1216	149	10	9	67	8
7/1/2019	899	317	425	833	131	20	5	50	5
7/2/2019	1349	660	402	1031	332	19	9	113	16
7/3/2019	1710	700	517	762	277	21	22	89	40
7/4/2019	1446	553	568	757	209	16	7	104	16
7/5/2019	974	599	1084	700	315	14	1	86	24
7/6/2019	717	593	441	429	274	18	5	87	9
7/7/2019	746	430	398	547	169	31	9	69	6
7/8/2019	1032	241	386	314	1126	22	6	24	11

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7/9/2019	1474	292	305	370	304	6	10	45	3
7/10/2019	1253	425	276	331	729	16	3	60	11
7/11/2019	870	479	300	477	847	38	7	82	11
7/12/2019	652	223	368	442	676	26	0	39	12
7/13/2019	642	165	267	324	1044	24	1	18	20
7/14/2019	410	163	426	370	557	22	0	22	4
7/15/2019	415	266	260	344	333	8	0	64	14
7/16/2019	482	302	303	415	734	6	2	62	18
7/17/2019	763	392	247	294	1105	16	2	106	9
7/18/2019	1085	569	482	671	2360	73	33	57	24
7/19/2019	1878	693	528	806	2088	38	30	118	22
7/20/2019	1368	859	433	669	1134	46	3	126	21
7/21/2019	1652	629	428	765	1973	57	28	58	34
7/22/2019	888	887	281	724	1907	72	6	36	37
7/23/2019	1127	777	485	608	1289	64	12	55	31
7/24/2019	1474	1044	623	771	1099	65	10	65	39
7/25/2019	2009	1188	555	842	1843	73	31	107	37
7/26/2019	1843	1190	397	873	753	73	1	101	52
7/27/2019	1769	1477	554	734	763	69	1	135	30
7/28/2019	1421	1903	436	447	536	40	0	177	45
7/29/2019	944	1002	284	368	673	24	3	132	31
7/30/2019	973	984	164	271	614	34	3	74	16
7/31/2019	886	1785	456	415	714	36	8	69	33
8/1/2019	1241	1259	865	559	401	10	8	103	26
8/2/2019	1409	901	376	486	1009	22	10	80	31
8/3/2019	1556	1071	359	822	1017	49	7	80	35
8/4/2019	1675	1084	880	705	983	29	5	34	48
8/5/2019	417	197	87	349	507	12	3	5	30
8/6/2019	803	364	220	579	784	20	0	2	19
8/7/2019	898	263	84	390	927	25	0	8	31
8/8/2019	858	489	186	532	1066	37	2	2	27
8/9/2019	867	381	151	563	596	19	0	4	26
8/10/2019	447	310	154	808	809	28	2	6	20
8/11/2019	1178	293	126	545	450	12	1	6	19
8/12/2019	786	161	46	256	336	10	0	3	12
8/13/2019	317	32	37	205	231	4	0	3	11
8/14/2019	456	109	86	300	491	8	0	2	13
8/15/2019	961	58	130	513	245	6	0	2	14
8/16/2019	363	122	171	293	112	9	0	3	9
8/17/2019	358	81	128	181	221	8	0	1	15
8/18/2019	219	80	34	198	123	5	0	3	8
8/19/2019	282	120	55	208	192	10	0	2	8
8/20/2019	216	27	30	149	144	7	0	1	7
8/21/2019	139	83	39	197	226	8	0	1	5

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8/22/2019	142	76	38	138	194	1	0	2	11
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Table 9-4. Total number of Calls Recorded (All Species Combined), for each Date and Park (Summer only) (Figure 4-15)

Night	INDU	MISS	SLBE	APIS	ISRO	GRPO	VOYA
5/30/2019	0	937	0	0	0	7	0
5/31/2019	0	469	3	0	0	2	0
6/1/2019	0	267	3	0	0	12	0
6/2/2019	0	215	0	0	0	2	0
6/3/2019	0	654	193	0	0	3	0
6/4/2019	0	297	1036	8	0	1	0
6/5/2019	0	256	283	881	0	7	0
6/6/2019	0	605	401	202	11	29	0
6/7/2019	633	1049	786	299	33	35	0
6/8/2019	785	993	617	430	22	25	0
6/9/2019	244	146	133	850	20	4	0
6/10/2019	428	317	234	874	17	10	0
6/11/2019	1562	308	352	1113	20	10	118
6/12/2019	758	475	0	598	8	1	57
6/13/2019	336	532	179	1108	9	11	172
6/14/2019	1654	604	707	348	12	14	129
6/15/2019	1146	379	1126	74	87	3	331
6/16/2019	191	295	888	85	6	7	124
6/17/2019	360	543	1066	58	27	7	156
6/18/2019	1092	433	893	11	86	7	412
6/19/2019	269	372	949	116	68	5	212
6/20/2019	141	431	962	223	76	14	356
6/21/2019	1211	158	1125	178	11	2	931
6/22/2019	1381	291	1546	60	17	12	749
6/23/2019	1106	52	2129	2	6	1	482
6/24/2019	1698	163	0	95	26	16	265
6/25/2019	1920	406	205	390	212	34	430
6/26/2019	2712	487	330	134	38	590	831
6/27/2019	2687	448	550	421	47	250	14
6/28/2019	1155	314	273	237	49	299	29
6/29/2019	1154	474	394	172	25	199	24
6/30/2019	1515	267	404	435	88	574	118
7/1/2019	1579	84	389	207	51	368	34
7/2/2019	2364	464	247	280	148	443	39
7/3/2019	2786	580	368	276	33	116	44
7/4/2019	2641	479	181	157	45	187	29
7/5/2019	2275	556	0	651	27	274	57
7/6/2019	1503	515	82	225	31	213	46

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7/7/2019	1481	591	232	1	27	62	41
7/8/2019	903	1931	201	8	27	91	35
7/9/2019	1478	991	253	21	15	60	23
7/10/2019	1562	1358	81	63	13	23	29
7/11/2019	1650	1222	4	116	12	106	40
7/12/2019	657	1638	0	87	5	52	22
7/13/2019	691	1767	0	38	0	33	0
7/14/2019	733	1197	0	40	0	33	0
7/15/2019	760	900	0	60	6	17	0
7/16/2019	960	1193	0	60	20	28	95
7/17/2019	1306	1143	0	359	25	11	113
7/18/2019	1519	1890	310	1055	36	57	534
7/19/2019	2546	1616	919	476	20	220	481
7/20/2019	2685	475	290	788	28	225	234
7/21/2019	2076	1665	842	643	18	223	237
7/22/2019	815	1454	564	1024	6	683	341
7/23/2019	941	1399	802	603	18	279	452
7/24/2019	1115	1365	1070	1084	36	137	443
7/25/2019	1684	1215	1507	1634	222	110	406
7/26/2019	2316	1567	0	702	335	23	423
7/27/2019	2715	1381	0	1046	70	50	341
7/28/2019	2762	1549	0	156	101	19	510
7/29/2019	1773	797	0	495	172	57	233
7/30/2019	1385	1067	206	139	72	29	271
7/31/2019	969	1763	695	196	436	95	308
8/1/2019	1864	892	1104	324	268	62	4
8/2/2019	1183	2156	622	293	107	23	0
8/3/2019	1711	1958	624	94	48	32	601
8/4/2019	1476	2009	987	119	449	177	295
8/5/2019	109	1058	44	221	36	21	145
8/6/2019	0	1556	0	618	35	203	415
8/7/2019	0	1826	0	398	59	59	325
8/8/2019	0	1519	470	549	159	173	379
8/9/2019	0	1615	302	169	71	130	342
8/10/2019	0	1058	375	373	121	386	297
8/11/2019	0	1672	297	94	156	133	298
8/12/2019	0	1269	0	64	60	0	253
8/13/2019	0	782	0	53	16	0	0
8/14/2019	0	1364	0	96	15	0	0
8/15/2019	0	1707	0	219	15	0	0
8/16/2019	0	811	0	242	40	0	0
8/17/2019	0	758	0	222	24	0	0
8/18/2019	0	584	0	91	3	0	0
8/19/2019	0	798	0	66	22	0	0

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8/20/2019	0	545	0	37	3	0	0
8/21/2019	0	707	0	0	3	0	0
8/22/2019	0	607	0	0	0	0	0

Table 9-5. Number of Calls Per Deployment-Night Per Night (All Species Combined), for each Park (Figure 4-16)

Night	INDU	MISS	SLBE	APIS	ISRO	GRPO	VOYA
5/30/2019	0	187.4	0	0	0	1.4	0
5/31/2019	0	78.2	0.5	0	0	0.3	0
6/1/2019	0	44.5	0.5	0	0	2	0
6/2/2019	0	35.8	0	0	0	0.3	0
6/3/2019	0	72.7	21.4	0	0	0.3	0
6/4/2019	0	22.8	79.7	0.6	0	0.1	0
6/5/2019	0	19.7	21.8	67.8	0	0.5	0
6/6/2019	0	31.8	21.1	10.6	0.6	1.5	0
6/7/2019	26.4	43.7	32.8	12.5	1.4	1.5	0
6/8/2019	31.4	39.7	24.7	17.2	0.9	1	0
6/9/2019	9.8	5.8	5.3	34	0.8	0.2	0
6/10/2019	15.9	11.7	8.7	32.4	0.6	0.4	0
6/11/2019	52.1	10.3	11.7	37.1	0.7	0.3	3.9
6/12/2019	27.1	17	0	21.4	0.3	0	2
6/13/2019	10.8	17.2	5.8	35.7	0.3	0.4	5.5
6/14/2019	48.6	17.8	20.8	10.2	0.4	0.4	3.8
6/15/2019	35.8	11.8	35.2	2.3	2.7	0.1	10.3
6/16/2019	6.2	9.5	28.6	2.7	0.2	0.2	4
6/17/2019	15	22.6	44.4	2.4	1.1	0.3	6.5
6/18/2019	42	16.7	34.3	0.4	3.3	0.3	15.8
6/19/2019	9	12.4	31.6	3.9	2.3	0.2	7.1
6/20/2019	4.5	13.9	31	7.2	2.5	0.5	11.5
6/21/2019	52.7	6.9	48.9	7.7	0.5	0.1	40.5
6/22/2019	60	12.7	67.2	2.6	0.7	0.5	32.6
6/23/2019	48.1	2.3	92.6	0.1	0.3	0	21
6/24/2019	89.4	8.6	0	5	1.4	0.8	13.9
6/25/2019	83.5	17.7	8.9	17	9.2	1.5	18.7
6/26/2019	100.4	18	12.2	5	1.4	21.9	30.8
6/27/2019	99.5	16.6	20.4	15.6	1.7	9.3	0.5
6/28/2019	42.8	11.6	10.1	8.8	1.8	11.1	1.1
6/29/2019	42.7	17.6	14.6	6.4	0.9	7.4	0.9
6/30/2019	56.1	9.9	15	16.1	3.3	21.3	4.4
7/1/2019	52.6	2.8	13	6.9	1.7	12.3	1.1
7/2/2019	69.5	13.6	7.3	8.2	4.4	13	1.1
7/3/2019	87.1	18.1	11.5	8.6	1	3.6	1.4
7/4/2019	82.5	15	5.7	4.9	1.4	5.8	0.9
7/5/2019	91	22.2	0	26	1.1	11	2.3

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7/6/2019	57.8	19.8	3.2	8.7	1.2	8.2	1.8
7/7/2019	57	22.7	8.9	0	1	2.4	1.6
7/8/2019	36.1	77.2	8	0.3	1.1	3.6	1.4
7/9/2019	56.8	38.1	9.7	0.8	0.6	2.3	0.9
7/10/2019	57.9	50.3	3	2.3	0.5	0.9	1.1
7/11/2019	68.8	50.9	0.2	4.8	0.5	4.4	1.7
7/12/2019	36.5	91	0	4.8	0.3	2.9	1.2
7/13/2019	53.2	135.9	0	2.9	0	2.5	0
7/14/2019	56.4	92.1	0	3.1	0	2.5	0
7/15/2019	44.7	52.9	0	3.5	0.4	1	0
7/16/2019	48	59.6	0	3	1	1.4	4.8
7/17/2019	72.6	63.5	0	19.9	1.4	0.6	6.3
7/18/2019	66	82.2	13.5	45.9	1.6	2.5	23.2
7/19/2019	84.9	53.9	30.6	15.9	0.7	7.3	16
7/20/2019	89.5	15.8	9.7	26.3	0.9	7.5	7.8
7/21/2019	69.2	55.5	28.1	21.4	0.6	7.4	7.9
7/22/2019	30.2	53.9	20.9	37.9	0.2	25.3	12.6
7/23/2019	31.4	46.6	26.7	20.1	0.6	9.3	15.1
7/24/2019	30.1	36.9	28.9	29.3	1	3.7	12
7/25/2019	45.5	32.8	40.7	44.2	6	3	11
7/26/2019	72.4	49	0	21.9	10.5	0.7	13.2
7/27/2019	84.8	43.2	0	32.7	2.2	1.6	10.7
7/28/2019	95.2	53.4	0	5.4	3.5	0.7	17.6
7/29/2019	61.1	27.5	0	17.1	5.9	2	8
7/30/2019	47.8	36.8	7.1	4.8	2.5	1	9.3
7/31/2019	33.4	60.8	24	6.8	15	3.3	10.6
8/1/2019	77.7	37.2	46	13.5	11.2	2.6	0.2
8/2/2019	51.4	93.7	27	12.7	4.7	1	0
8/3/2019	65.8	75.3	24	3.6	1.8	1.2	23.1
8/4/2019	56.8	77.3	38	4.6	17.3	6.8	11.3
8/5/2019	5.7	55.7	2.3	11.6	1.9	1.1	7.6
8/6/2019	0	91.5	0	36.4	2.1	11.9	24.4
8/7/2019	0	101.4	0	22.1	3.3	3.3	18.1
8/8/2019	0	79.9	24.7	28.9	8.4	9.1	19.9
8/9/2019	0	80.8	15.1	8.4	3.6	6.5	17.1
8/10/2019	0	55.7	19.7	19.6	6.4	20.3	15.6
8/11/2019	0	88	15.6	4.9	8.2	7	15.7
8/12/2019	0	74.6	0	3.8	3.5	0	14.9
8/13/2019	0	78.2	0	5.3	1.6	0	0
8/14/2019	0	136.4	0	9.6	1.5	0	0
8/15/2019	0	189.7	0	24.3	1.7	0	0
8/16/2019	0	135.2	0	40.3	6.7	0	0
8/17/2019	0	126.3	0	37	4	0	0
8/18/2019	0	97.3	0	15.2	0.5	0	0

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8/19/2019	0	133	0	11	3.7	0	0
8/20/2019	0	109	0	7.4	0.6	0	0
8/21/2019	0	176.8	0	0	0.8	0	0
8/22/2019	0	202.3	0	0	0	0	0