

Summary Results of 2018 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 2018 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 lists the parks where the data were collected for the 2018 season along with the abbreviations used through this report for those parks.

Table 1-1. Parks where acoustic monitoring was performed during the 2018 monitoring season

Abbreviation	Name	State
INDU	Indiana Dunes National Lakeshore	IN
MISS	Mississippi National River and Recreation Area	MN
SACN	Saint Croix National Scenic Riverway	WI/MN
SLBE	Sleeping Bear Dunes National Lakeshore	MI
PIRO	Pictured Rocks 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 2018 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 2018: Numbers of Files

Park	Total	Summer	Spring	Fall	Short Deploy ¹	Extra Night ²	Short Night ³	Bad File
INDU	106912	106836	0	0	0	0	76	0
MISS	78388	58235	0	19661	362	0	126	4
SACN	76594	58246	0	18132	107	0	99	10
SLBE	54890	54867	0	0	0	0	19	4
PIRO	80719	78714	1876	0	99	0	30	0
APIS	43645	38373	0	0	86	5130	55	1
ISRO	4458	3927	0	0	428	0	48	55
GRPO	5748	5748	0	0	0	0	0	0
VOYA	8821	7788	188	0	205	308	17	315
Total	460175	412734	2064	37793	1287	5438	470	389

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

Table 2-2. Audio file classification for analysis for 2018: 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	74	0	25	~0	0	~0	~0
SACN	100	76	0	24	~0	0	~0	~0
SLBE	100	~100	0	0	0	0	~0	~0
PIRO	100	98	2	0	~0	0	~0	0
APIS	100	88	0	0	~0	12	~0	~0
ISRO	100	88	0	0	10	0	1	1
GRPO	100	100	0	0	0	0	0	0
VOYA	100	88	2	0	2	3	~0	4
Total	100	90	~0	8	~0	1	~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 MISS and SACN had a number of deployments in the fall while PIRO and VOYA had a small number of deployments in the spring. There were some 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 35 for SLBE.

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

Park	Total	Summer	Spring	Fall	Short Deploy	Date Range
INDU	30	30	0	0	0	05/31-08/06
MISS	28	21	0	6	1	05/29-08/29
SACN	30	26	0	3	1	06/05-08/21
SLBE	35	35	0	0	0	06/03-07/31
PIRO	36	34	1	0	1	05/30-08/07
APIS	28	23	0	0	5	06/01-08/16
ISRO	31	26	0	0	5	06/07-08/16
GRPO	18	18	0	0	0	06/01-08/05
VOYA	23	18	2	0	3	05/23-08/15

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

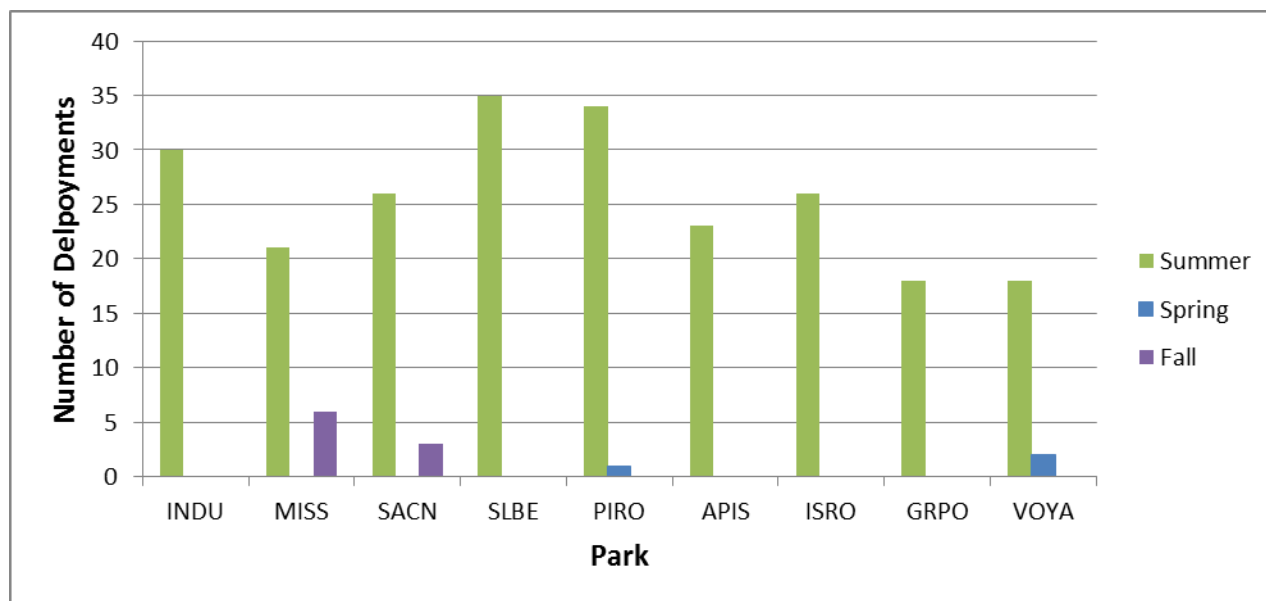


Figure 3-1. Deployments (Sites) By Park and Season

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.

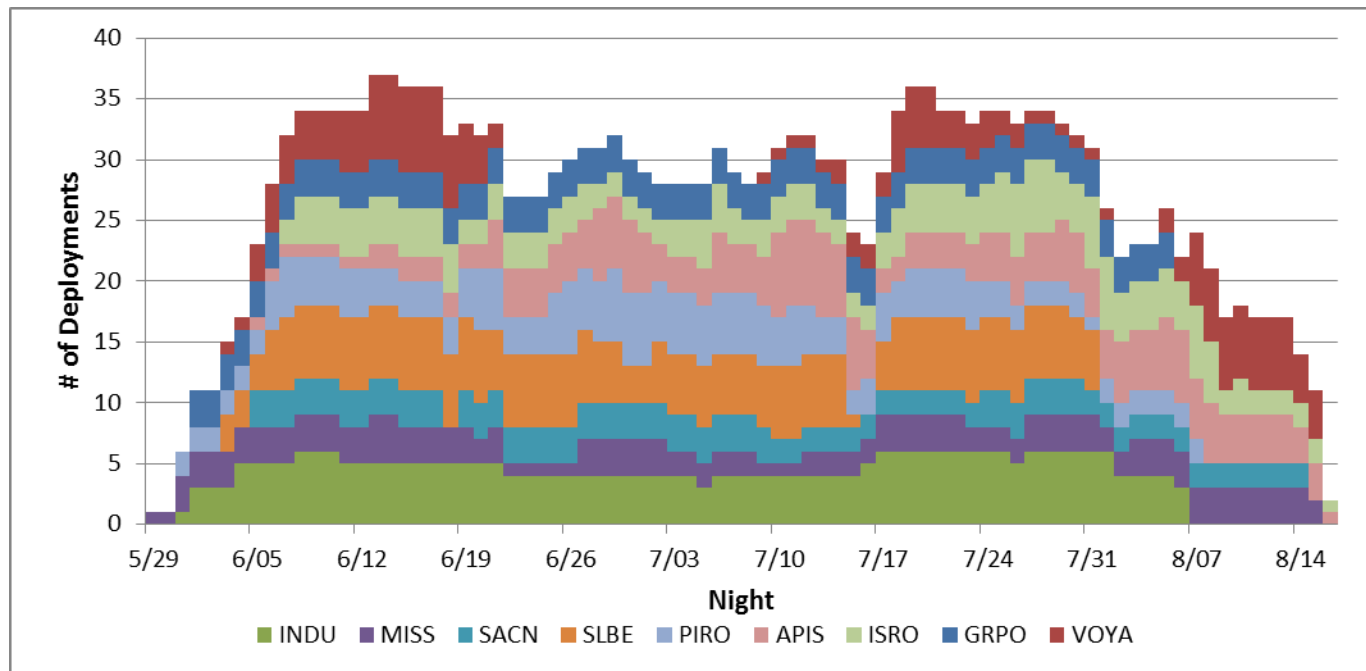


Figure 3-2. Number of Deployments by Date, during the Summer season

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 MISS and SACN having a notable number of deployment-nights in the fall and VOYA having a notable number of deployment-nights in the spring.

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

Park	Summer	Spring	Fall
INDU	317	0	0
MISS	200	0	47
SACN	181	0	21
SLBE	312	0	0
PIRO	243	1	0
APIS	269	0	0
ISRO	241	0	0
GRPO	198	0	0
VOYA	191	14	0

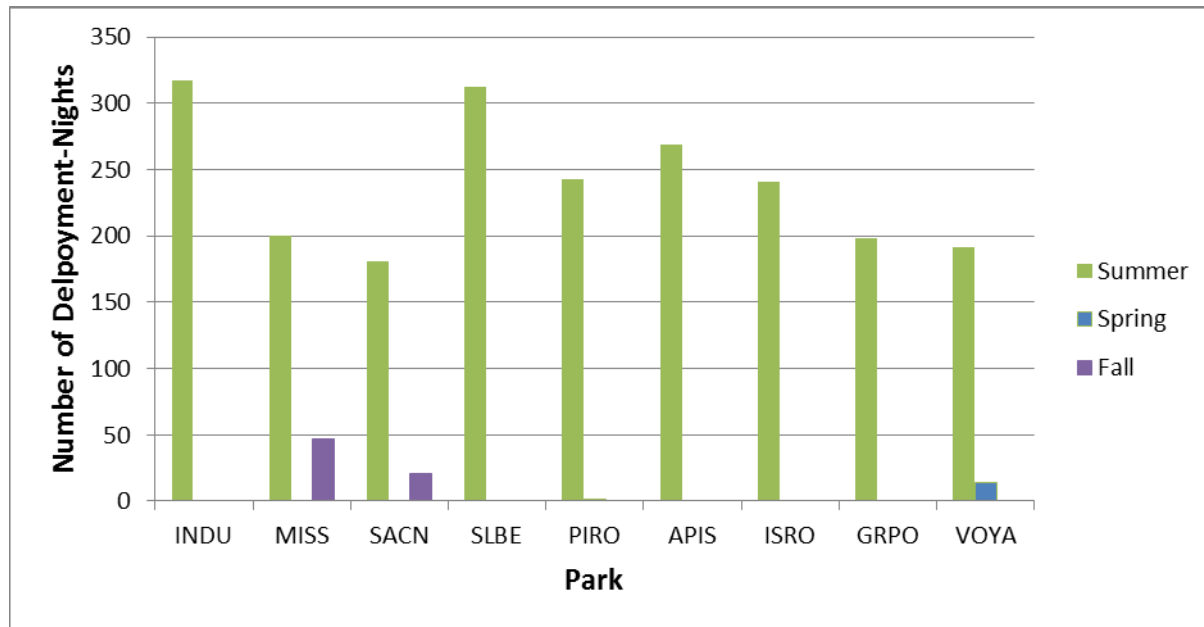


Figure 3-3. Deployment-Nights by Park and Season

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 2018 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	●	●	●	●	●	●		❄	●
SACN	●	●	●	●	●	●		❄	●
SLBE	●	●	●	●	●	●	❄		❄
PIRO	●	●	●	●	●	●			❄
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)
- Files that KPro could not analyze (KPro fail)

Some files could not be processed by KPro (KPro fail) for “corrupted header” and other cryptic reasons. For all except PIRO, this was a very tiny number of files; however for PIRO, 2.3% of the files produced “corrupted

header” error when trying to classify the ZC file. The reasons for the unusually high number of “corrupted header” errors for the PIRO files are not know at this time.

The last four columns of the table show the percentages of files for each general result. For all but 2 parks, at least 80% of files were ID’d to species with almost all the rest of the files ID’d as Noise. Only a very small number of files were ID’d as unknown bat call sequences.

PIRO park had a very high percentage (~89%) of noise files compared with the other parks. SACN had a relatively high percentage (~30%) of files classified as noise.

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	#KPro Fail ¹	%Species Id	%No Id	%Noise	%KPro Fail
INDU	106836	86444	1154	19236	2	80.9	1.1	18	~0
MISS	58235	47685	521	10029	0	81.9	0.9	17.2	0
SACN	58246	40303	620	17321	2	69.2	1.1	29.7	~0
SLBE	54867	47898	363	6606	0	87.3	0.7	12	0
PIRO	78714	6374	711	69789	1840	8.1	0.9	88.7	2.3
APIS	38373	34089	199	4082	3	88.8	0.5	10.6	~0
ISRO	3927	3151	55	720	1	80.2	1.4	18.3	~0
GRPO	5748	4609	79	1060	0	80.2	1.4	18.4	0
VOYA	7788	6630	54	1104	0	85.1	0.7	14.2	0
Total	412734	277183	3756	129947	1848	67.2	0.9	31.5	~0

¹ Files that KPro could not process (sometimes bad header, sometimes for unknown reasons)

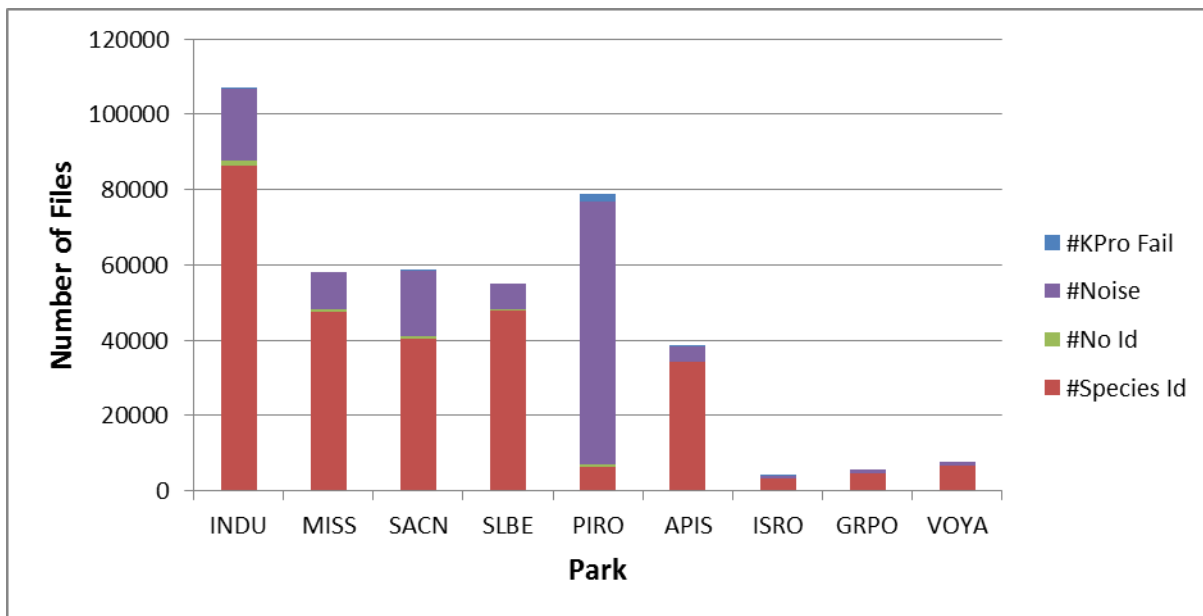


Figure 4-1. Number of Files By Park: Call Sequences vs. Noise, Summer Only, Baseline Analysis

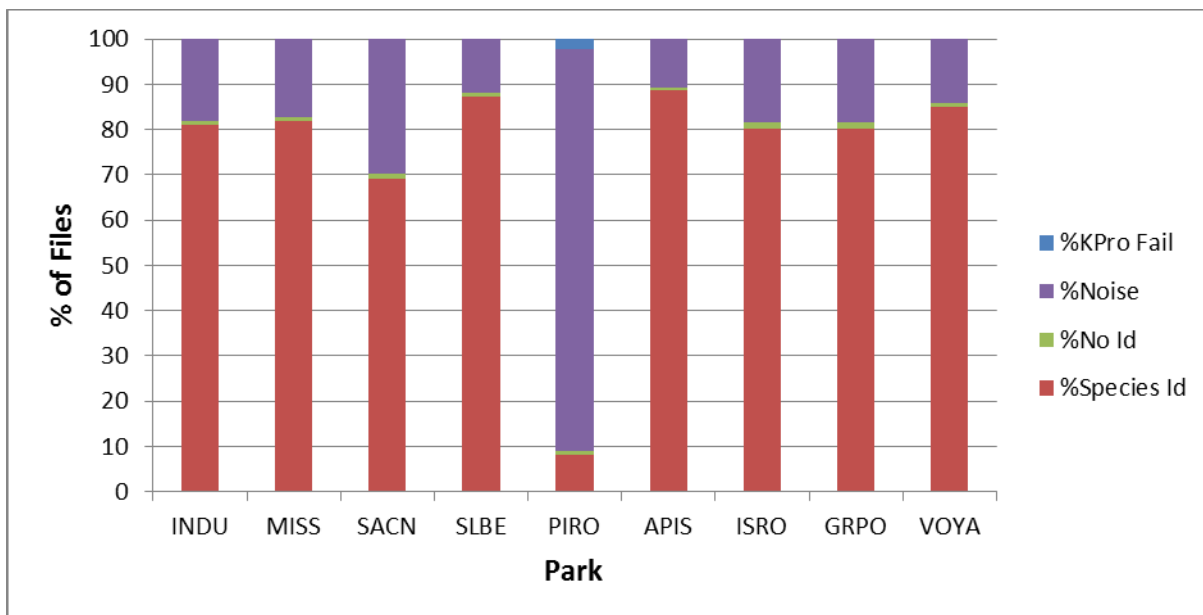


Figure 4-2. Percent of Files by Park: Call Sequences vs. Noise, Summer Only, Baseline Analysis

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 a small number (430) of call sequences 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	#KPro Fail	%Species Id	%No Id	%Noise	%KPro Fail
INDU	106836	86444	1154	19236	2	80.9	1.1	18	~0
MISS	58235	47649	557	10029	0	81.8	1	17.2	0
SACN	58246	40171	752	17321	2	69	1.3	29.7	~0
SLBE	54867	47771	490	6606	0	87.1	0.9	12	0
PIRO	78714	6373	712	69789	1840	8.1	0.9	88.7	2.3
APIS	38373	33970	318	4082	3	88.5	0.8	10.6	~0
ISRO	3927	3151	55	720	1	80.2	1.4	18.3	~0
GRPO	5748	4598	90	1060	0	80	1.6	18.4	0
VOYA	7788	6626	58	1104	0	85.1	0.7	14.2	0
Total	412734	276753	4186	129947	1848	67.1	1	31.5	~0

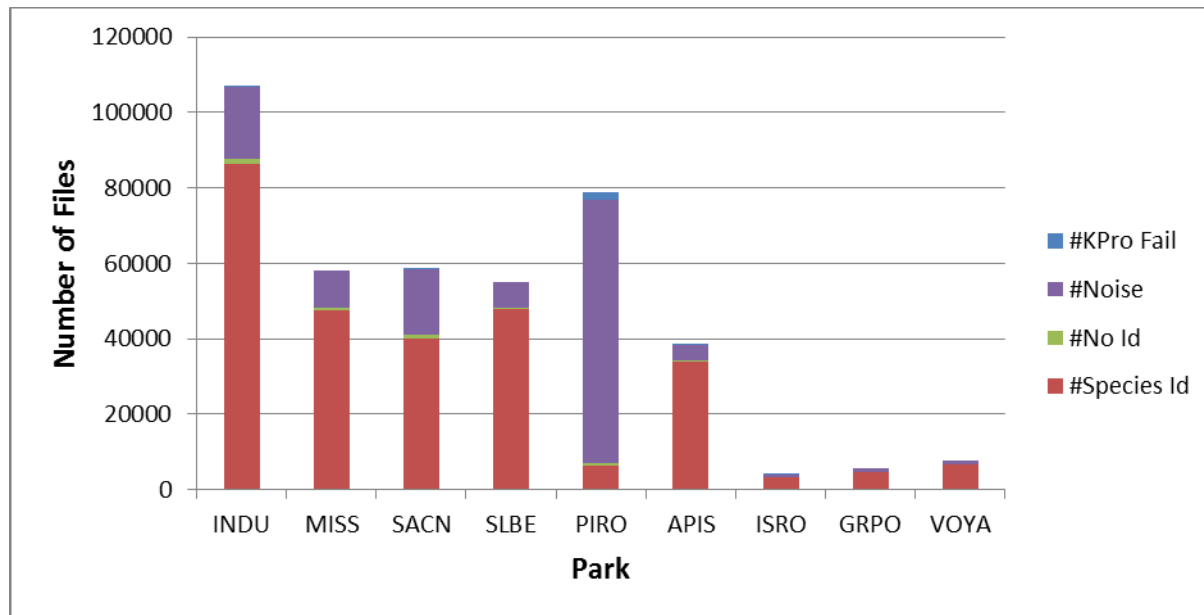


Figure 4-3. Number of Files By Park: Call Sequences vs. Noise, Summer Only, Expanded Analysis

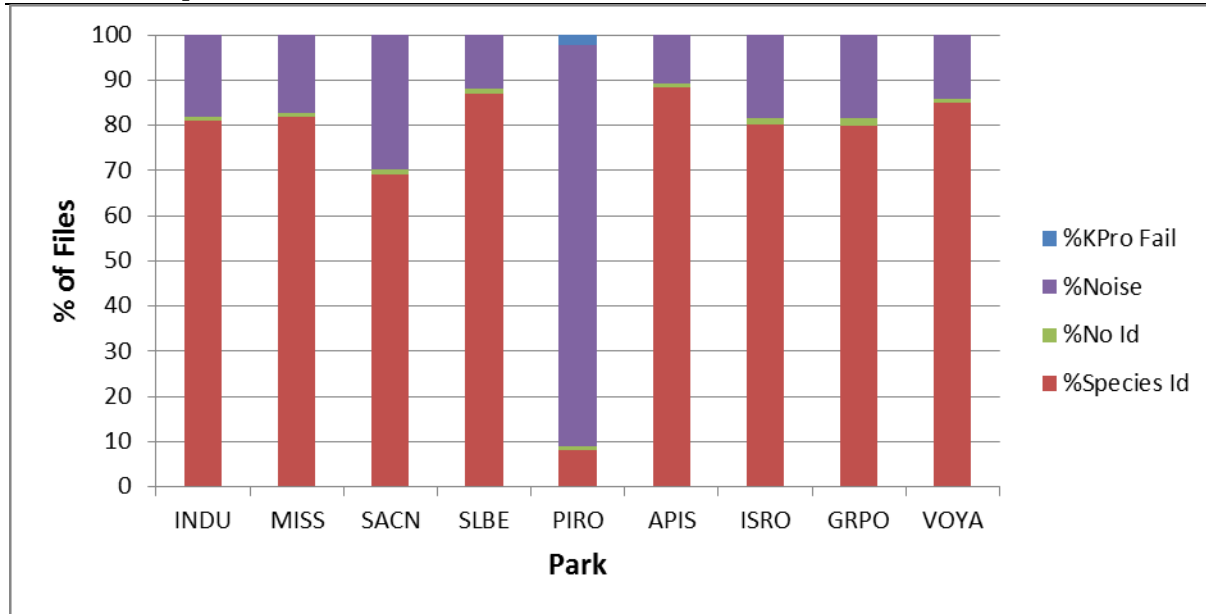


Figure 4-4. Percent of Files by Park: Call Sequences vs. Noise, Summer Only, Expanded Analysis

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	#KPro Fail	%Species Id	%No Id	%Noise	%KPro Fail
INDU	0	0	0	0	0	0	0	0	0
MISS	0	-36	36	0	0	-0.1	0.1	0	0
SACN	0	-132	132	0	0	-0.2	0.2	0	0
SLBE	0	-127	127	0	0	-0.2	0.2	0	0
PIRO	0	-1	1	0	0	0	0	0	0
APIS	0	-119	119	0	0	-0.3	0.3	0	0
ISRO	0	0	0	0	0	0	0	0	0
GRPO	0	-11	11	0	0	-0.2	0.2	0	0
VOYA	0	-4	4	0	0	0	0	0	0
Total	0	-430	430	0	0	-0.1	0.1	0	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	42372	13642	8359	17320	1242	57	74	2897	481	86444
MISS	21731	3445	4726	7277	8729	594	na	na	1183	47685
SACN	5374	5865	9474	15102	4068	119	na	na	301	40303
SLBE	9029	7491	8074	10113	12888	303	na	na	na	47898
PIRO	218	72	3771	2037	266	10	na	na	na	6374
APIS	629	10181	2590	4872	15227	590	na	na	na	34089
ISRO	349	118	275	1745	602	62	na	na	na	3151
GRPO	159	572	949	2448	313	168	na	na	na	4609
VOYA	168	593	2908	1759	1053	149	na	na	na	6630
All Parks	80029	41979	41126	62673	44388	2052	74	2897	1965	277183

na: species was not considered in the analysis

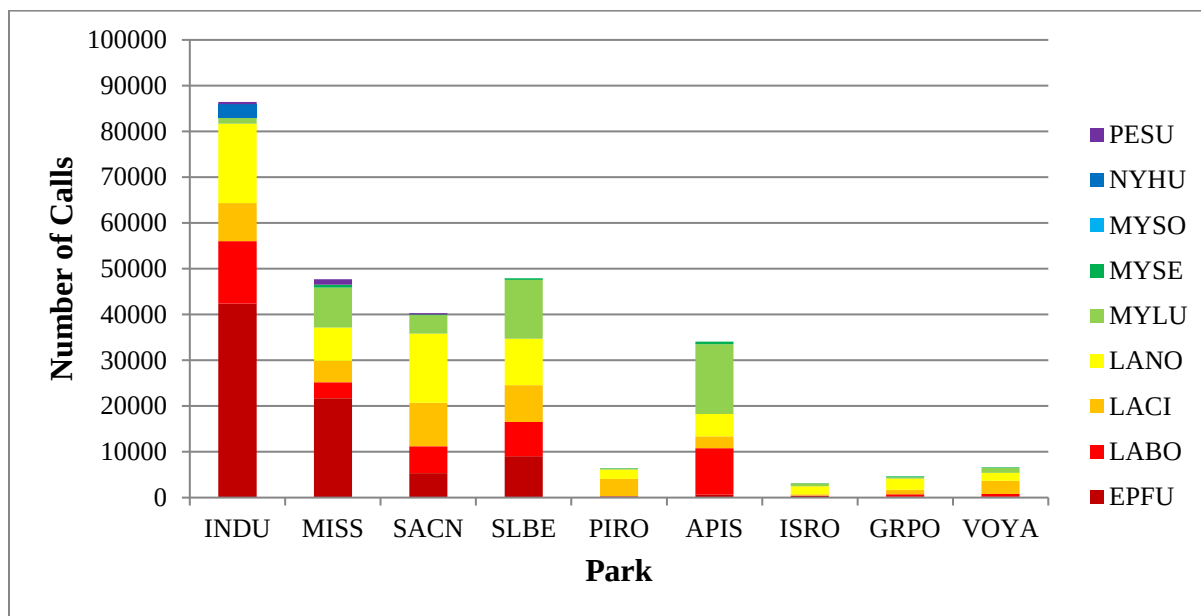


Figure 4-5. Number of Files AutoID'd to each Species by Park, Baseline Analysis

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	42372	13642	8359	17320	1242	57	74	2897	481	86444
MISS	21756	3110	4723	7266	8703	587	na	322	1182	47649
SACN	5376	5277	9502	15115	3970	119	na	503	309	40171
SLBE	9049	7014	8102	10117	11792	208	1176	na	313	47771
PIRO	217	64	3772	2037	267	10	na	na	6	6373
APIS	631	9704	2597	4873	15234	599	na	na	332	33970
ISRO	349	117	276	1744	601	62	na	na	2	3151
GRPO	158	549	949	2450	312	168	na	na	12	4598
VOYA	168	564	2908	1759	1060	154	na	na	13	6626
All Parks	80076	40041	41188	62681	43181	1964	1250	3722	2650	276753

na: species was not considered in the analysis

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

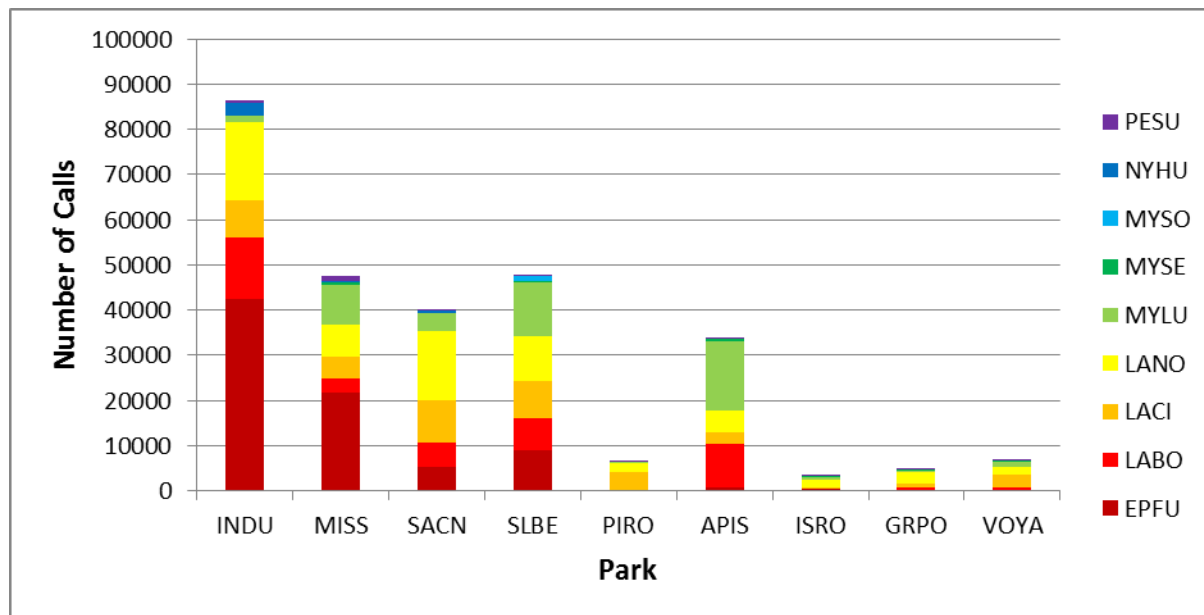


Figure 4-6. Number of Files AutoID'd to each Species by Park, Expanded Analysis

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	25	-335	-3	-11	-26	-7	na	322	-1	-36
SACN	2	-588	28	13	-98	0	na	503	8	-132
SLBE	20	-477	28	4	-1096	-95	1176	na	313	-127
PIRO	-1	-8	1	0	1	0	na	na	6	-1
APIS	2	-477	7	1	7	9	na	na	332	-119
ISRO	0	-1	1	-1	-1	0	na	na	2	0
GRPO	-1	-23	0	2	-1	0	na	na	12	-11
VOYA	0	-29	0	0	7	5	na	na	13	-4
Total	47	-1938	62	8	-1207	-88	1176	825	685	-430

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	133.7	43.0	26.4	54.6	3.9	0.2	0.2	9.1	1.5	272.7
MISS	108.7	17.2	23.6	36.4	43.6	3.0	na	na	5.9	238.4
SACN	29.7	32.4	52.3	83.4	22.5	0.7	na	na	1.7	222.7
SLBE	28.9	24.0	25.9	32.4	41.3	1.0	na	na	na	153.5
PIRO	0.9	0.3	15.5	8.4	1.1	0.0	na	na	na	26.2
APIS	2.3	37.8	9.6	18.1	56.6	2.2	na	na	na	126.7
ISRO	1.4	0.5	1.1	7.2	2.5	0.3	na	na	na	13.1
GRPO	0.8	2.9	4.8	12.4	1.6	0.8	na	na	na	23.3
VOYA	0.9	3.1	15.2	9.2	5.5	0.8	na	na	na	34.7
All Parks	37.2	19.5	19.1	29.1	20.6	1.0	0.2	9.1	2.8	128.8

na: species was not considered in the analysis

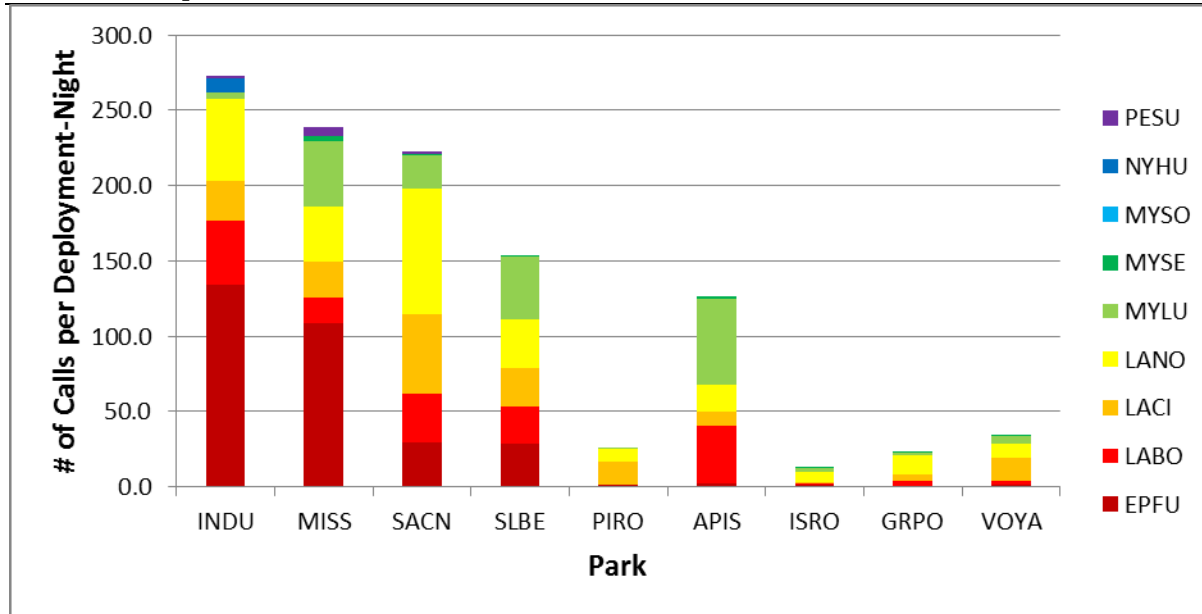


Figure 4-7. Number of Files per Deployment-Night AutoID'd to each Species by Park, Summer Only, Baseline Analysis

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	133.7	43.0	26.4	54.6	3.9	0.2	0.2	9.1	1.5	272.7
MISS	108.8	15.6	23.6	36.3	43.5	2.9	na	1.6	5.9	238.2
SACN	29.7	29.2	52.5	83.5	21.9	0.7	na	2.8	1.7	221.9
SLBE	29.0	22.5	26.0	32.4	37.8	0.7	3.8	na	1.0	153.1
PIRO	0.9	0.3	15.5	8.4	1.1	0.0	na	na	0.0	26.2
APIS	2.3	36.1	9.7	18.1	56.6	2.2	na	na	1.2	126.3
ISRO	1.4	0.5	1.1	7.2	2.5	0.3	na	na	0.0	13.1
GRPO	0.8	2.8	4.8	12.4	1.6	0.8	na	na	0.1	23.2
VOYA	0.9	3.0	15.2	9.2	5.5	0.8	na	na	0.1	34.7
All Parks	37.2	18.6	19.1	29.1	20.1	0.9	2.0	5.3	1.2	128.6

na: species was not considered in the analysis

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

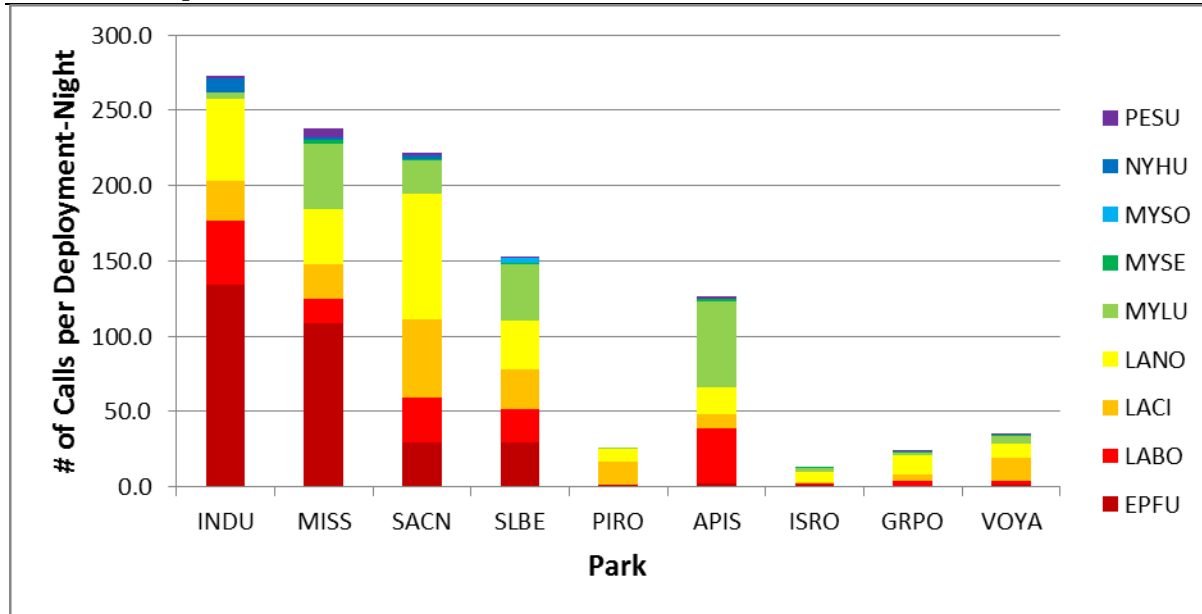


Figure 4-8. Number of Files per Deployment-Night AutoID'd to each Species by Park, Summer Only, Expanded Analysis

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	-1.6	0.0	-0.1	-0.1	-0.1	na	1.6	0	-0.2
SACN	0.0	-3.2	0.2	0.1	-0.6	0.0	na	2.8	0	-0.8
SLBE	0.1	-1.5	0.1	0.0	-3.5	-0.3	3.8	na	1	-0.4
PIRO	0.0	0.0	0.0	0.0	0.0	0.0	na	na	0	0.0
APIS	0.0	-1.7	0.1	0.0	0.0	0.0	na	na	1.2	-0.4
ISRO	0.0	0.0	0.0	0.0	0.0	0.0	na	na	0	0.0
GRPO	0.0	-0.1	0.0	0.0	0.0	0.0	na	na	0.1	-0.1
VOYA	0.0	-0.1	0.0	0.0	0.0	0.0	na	na	0.1	0.0
All Parks	0.0	-0.9	0.0	0.0	-0.5	-0.1	1.8	-3.8	-1.6	-0.2

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.

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.

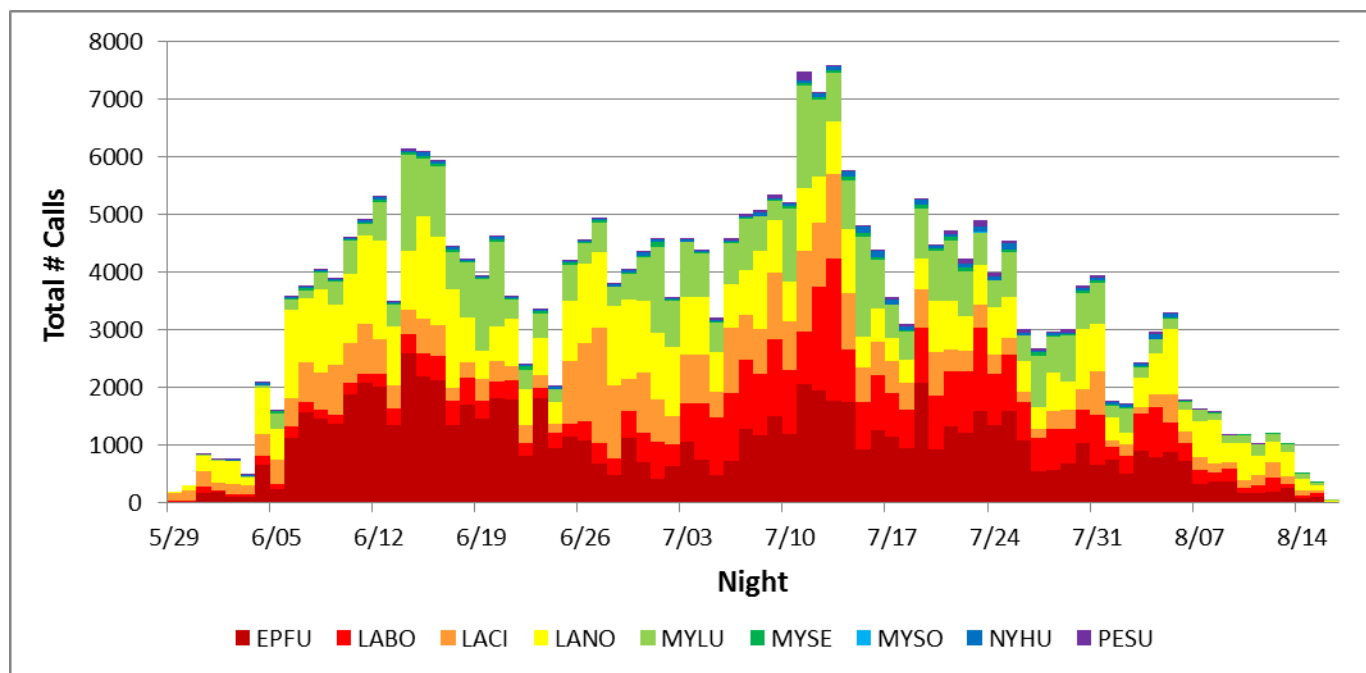


Figure 4-9. Total number of Call Sequences Recorded (All Parks Combined), for each Date and Species (Summer only), Baseline Analysis

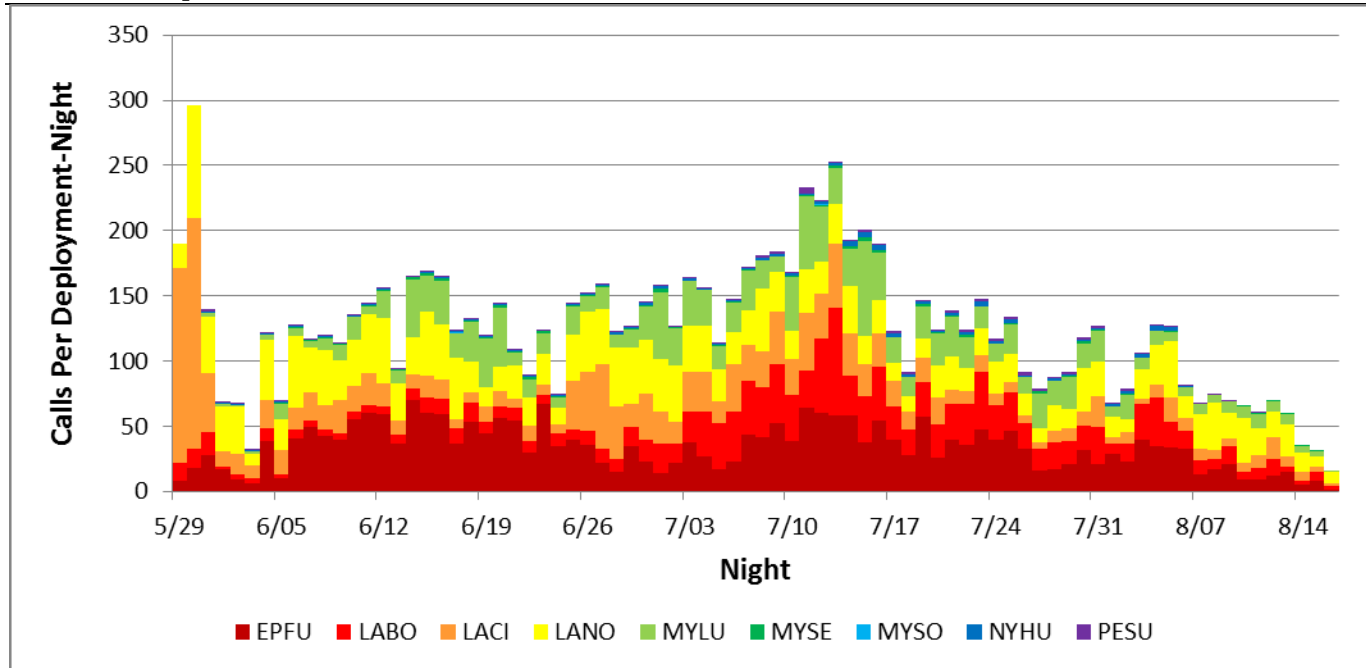


Figure 4-10. Number of Call Sequences Recorded per Deployment-Night (All Parks Combined), for each Date and Species (Summer only), Baseline Analysis

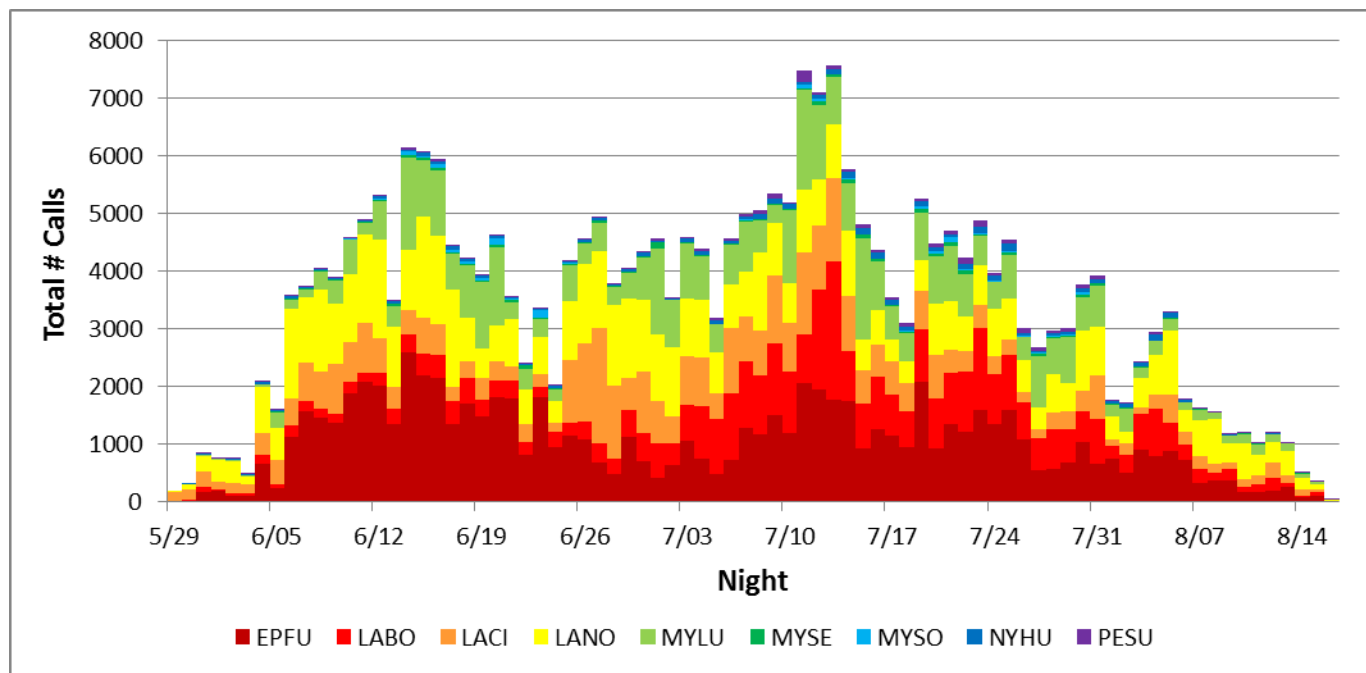


Figure 4-11. Total number of Call Sequences Recorded (All Parks Combined), for each Date and Species (Summer only), Expanded Analysis

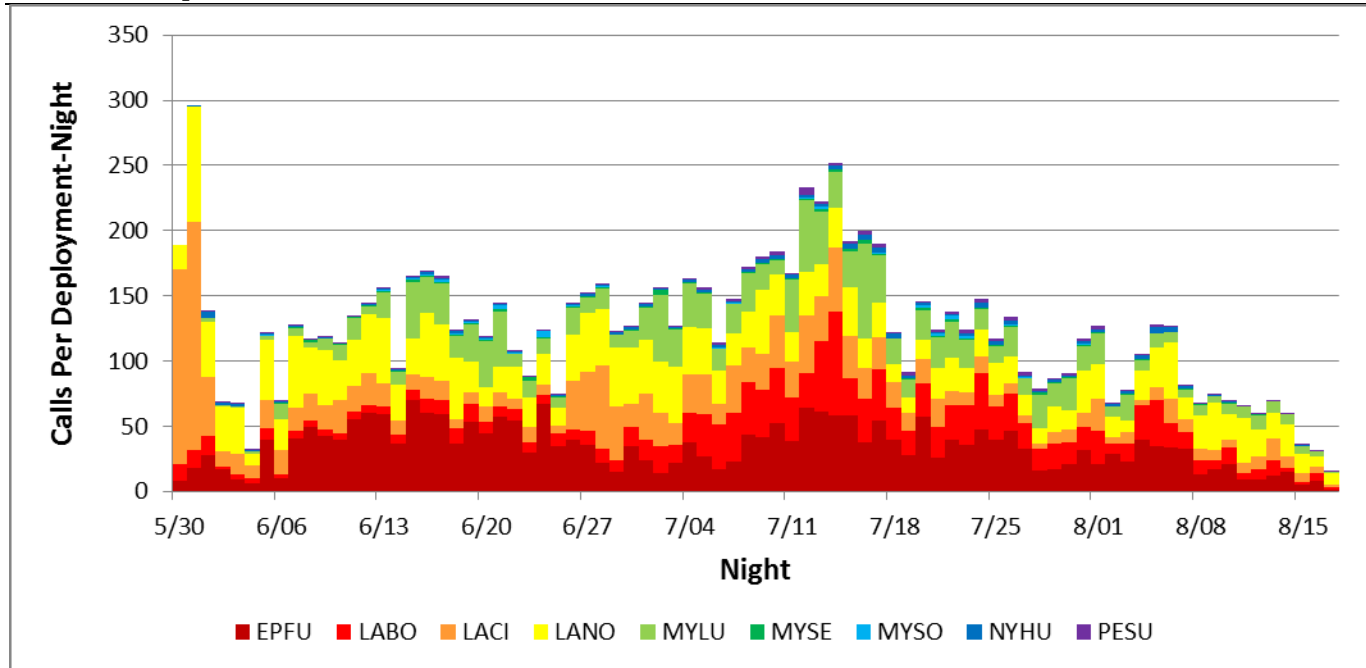


Figure 4-12 Number of Call Sequences Recorded per Deployment-Night (All Parks Combined), for each Date and Species (Summer only), Expanded Analysis

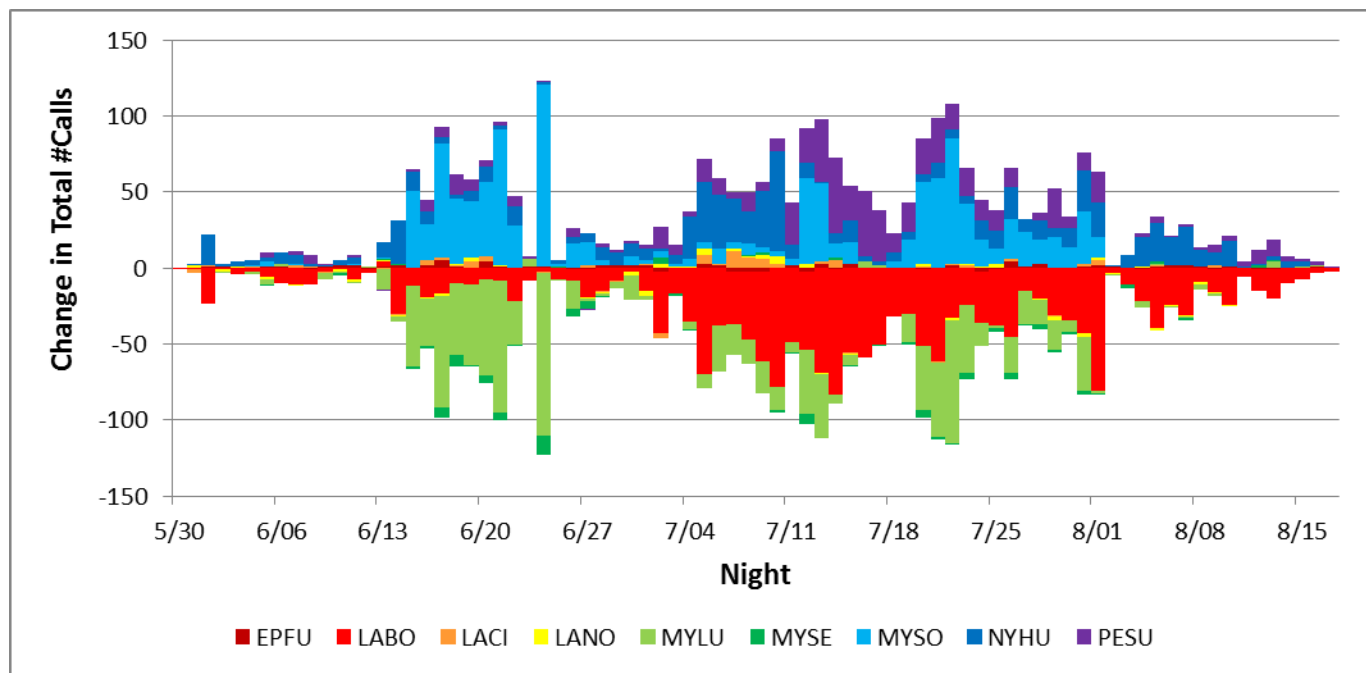


Figure 4-13. Difference in Total number of Call Sequences Recorded (All Parks Combined), for each Date and Species (Summer only. Differences were calculated by subtracting Baseline Analysis values from Expanded Analysis values.

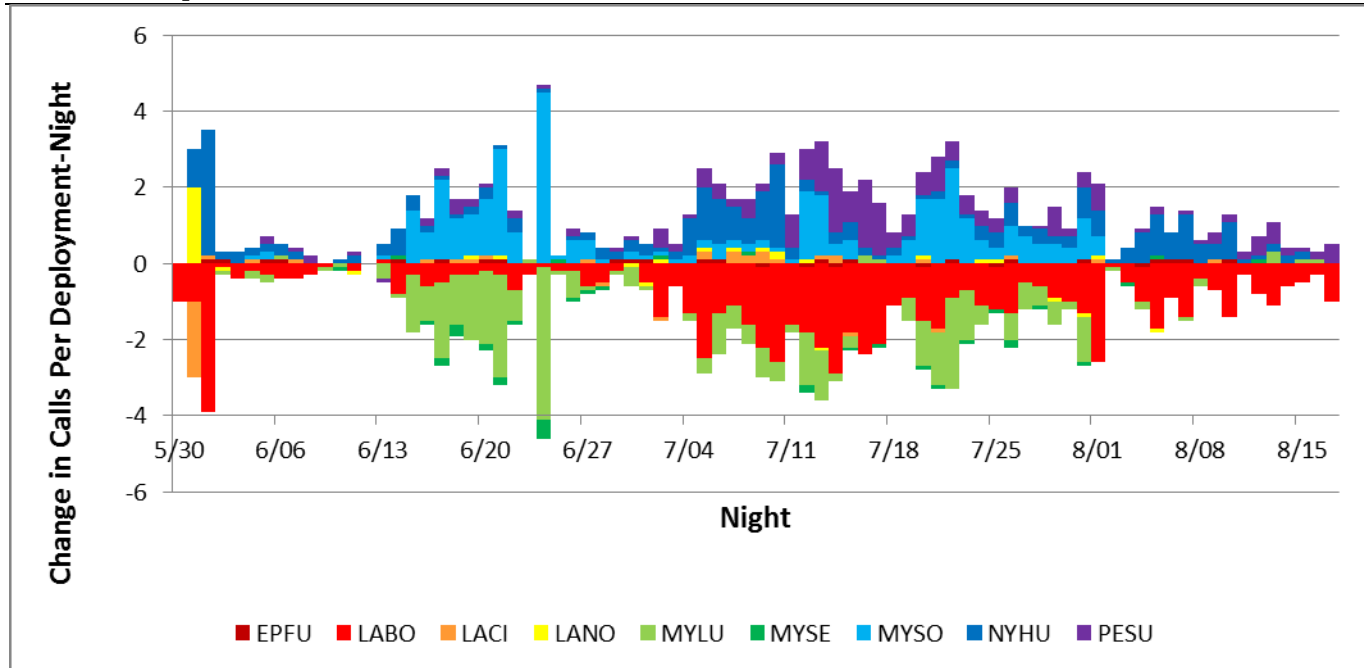


Figure 4-14. Difference in Number of Call Sequences Recorded per Deployment-Night (All Parks Combined), for each Date and Species (Summer only). Differences were calculated by subtracting Baseline Analysis values from Expanded Analysis values.

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).

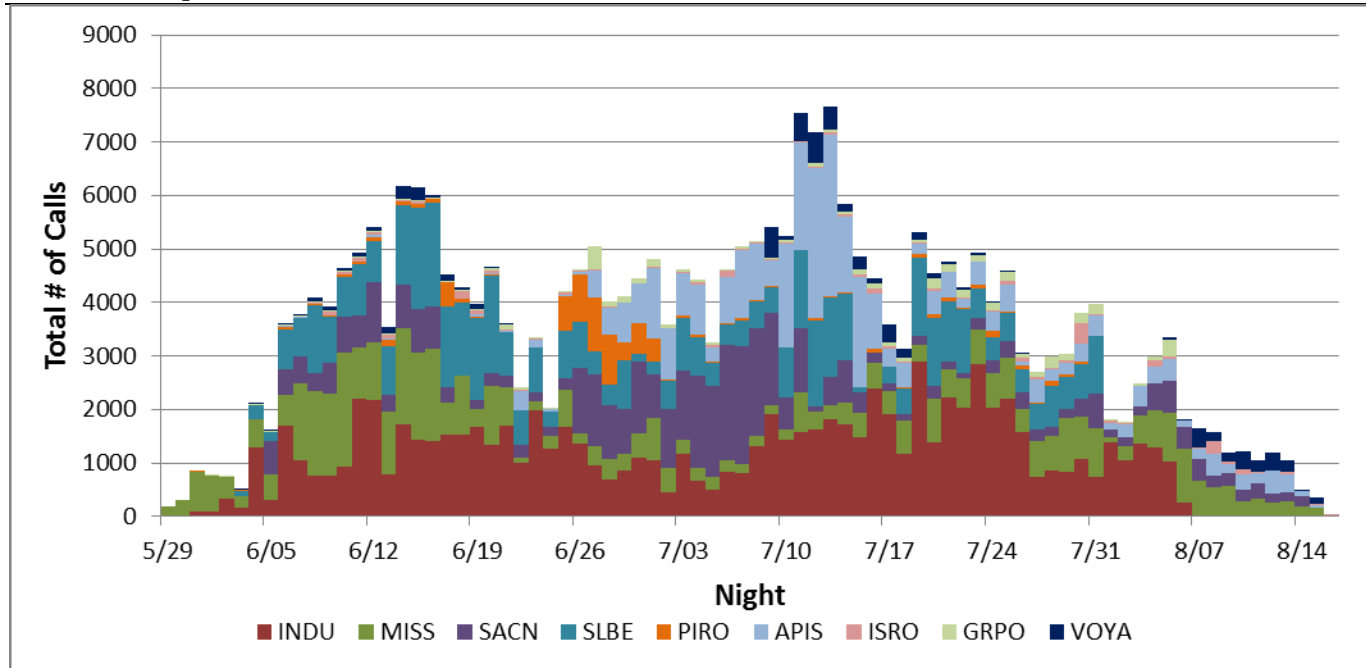


Figure 4-15. Total number of Call Sequences Recorded (All Species Combined), for each Date and Park (Summer only), Baseline Analysis

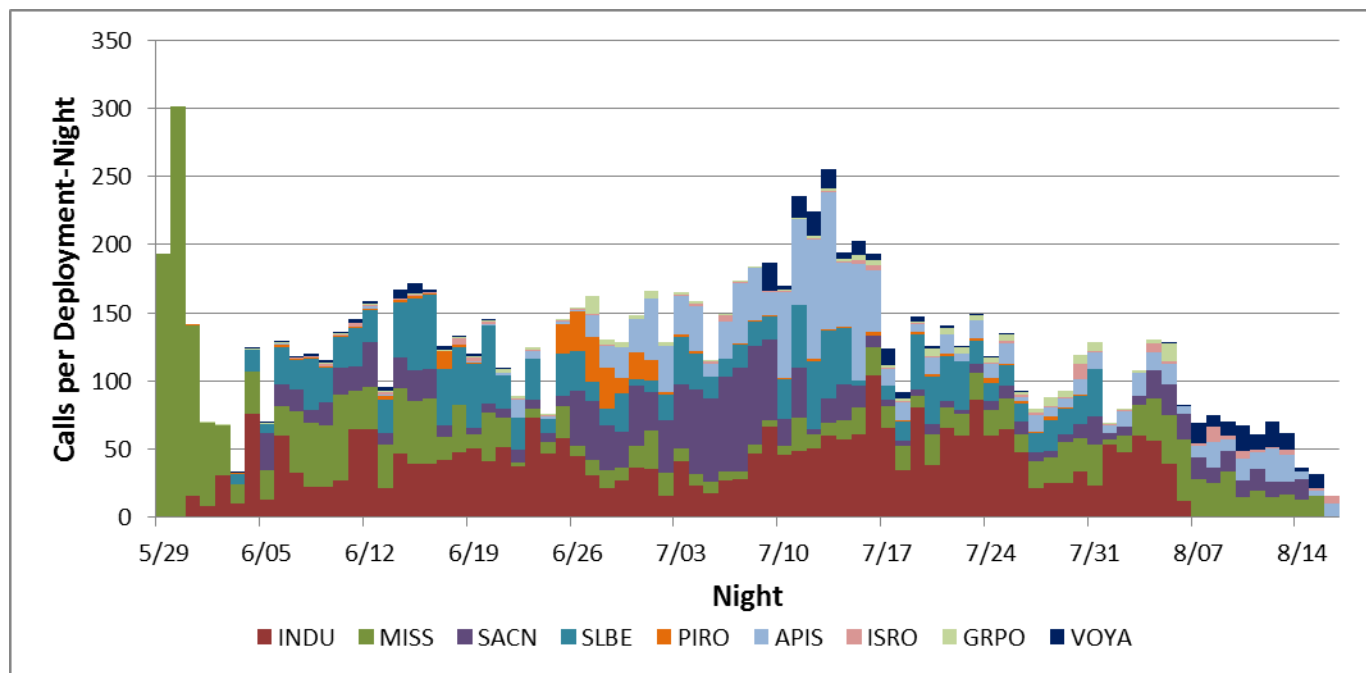


Figure 4-16. Number of Call Sequences Recorded Per Deployment-Night (All Species Combined), for each Date and Park (Summer only), Baseline Analysis

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	Deploymnts	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	30	100	100	100	100	100	37	60	100	97
MISS	21	100	100	100	100	100	81	na	na	100
SACN	26	100	100	100	100	100	73	na	na	85
SLBE	35	100	91	100	100	94	63	na	na	na
PIRO	34	41	24	62	71	44	9	na	na	na
APIS	23	91	87	91	96	96	91	na	na	na
ISRO	26	85	69	85	92	88	50	na	na	na
GRPO	18	100	67	100	100	89	67	na	na	na
VOYA	18	83	72	89	89	83	56	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	Deploymnt-Nights	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	317	99	100	99	100	77	7	14	93	62
MISS	200	98	89	90	96	91	44	na	na	71
SACN	181	96	92	97	100	93	27	na	na	36
SLBE	312	89	82	86	88	85	27	na	na	na
PIRO	243	19	10	40	44	15	3	na	na	na
APIS	269	48	69	56	73	86	47	na	na	na
ISRO	241	37	25	41	72	51	14	na	na	na
GRPO	198	37	25	57	89	49	28	na	na	na
VOYA	191	38	35	61	82	59	19	na	na	na

na: species was not considered in the analysis

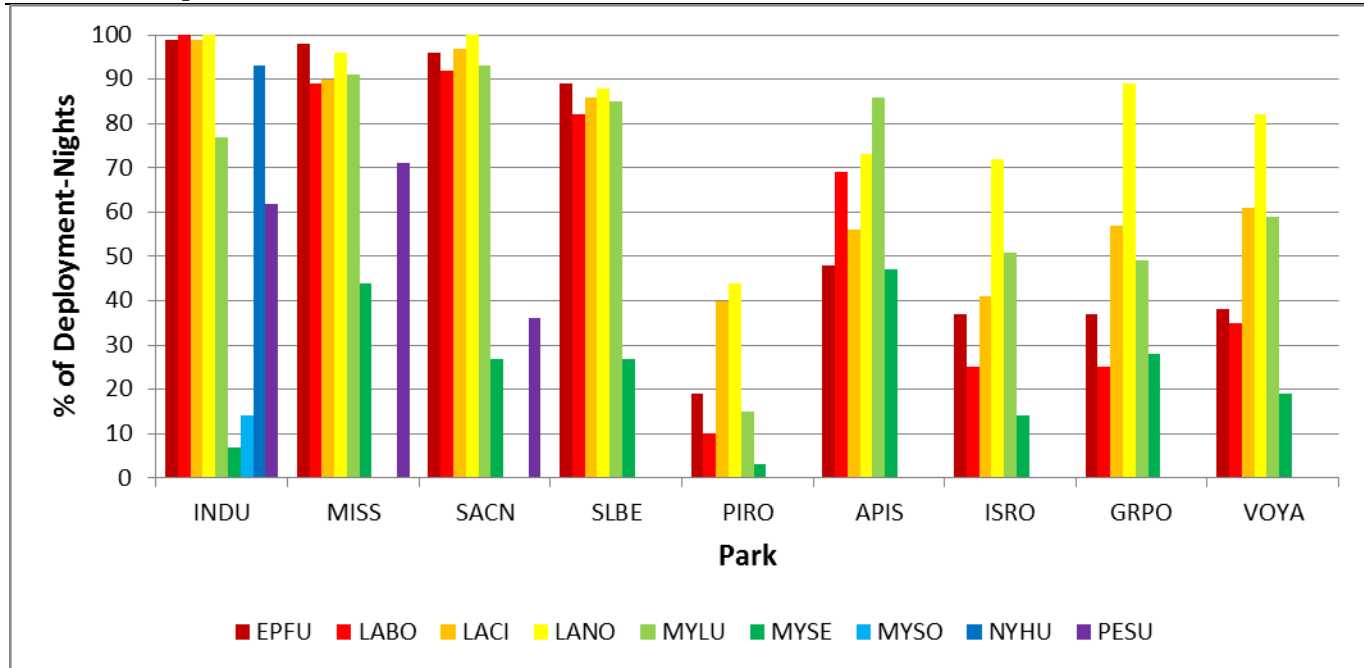


Figure 4-17. Percent of Deployment-Nights each species was present, by Park (Summer only), Baseline Analysis

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

Park	Deploymnts	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	30	100	100	100	100	100	37	60	100	97
MISS	21	100	100	100	100	100	81	na	86	100
SACN	26	100	100	100	100	100	73	na	92	85
SLBE	35	100	94	100	100	94	57	66	na	77
PIRO	34	41	24	62	71	44	9	na	na	6
APIS	23	91	87	91	96	96	96	na	na	52
ISRO	26	85	69	85	92	88	50	na	na	8
GRPO	18	100	67	100	100	89	67	na	na	17
VOYA	18	83	72	89	89	83	56	na	na	22

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	Deployment-Night	EPFU	LABO	LACI	LANO	MYLU	MYSE	MYSO	NYHU	PESU
INDU	317	99	100	99	100	77	7	14	93	62
MISS	200	98	90	90	96	91	44	na	49	71
SACN	181	96	91	97	100	93	26	na	54	36
SLBE	312	89	82	86	88	84	23	41	na	32
PIRO	243	19	9	40	44	15	3	na	na	1
APIS	269	48	68	56	73	86	48	na	na	29
ISRO	241	37	25	41	71	51	14	na	na	1
GRPO	198	36	25	57	89	49	29	na	na	3
VOYA	191	38	34	61	82	59	19	na	na	4

na: species was not considered in the analysis

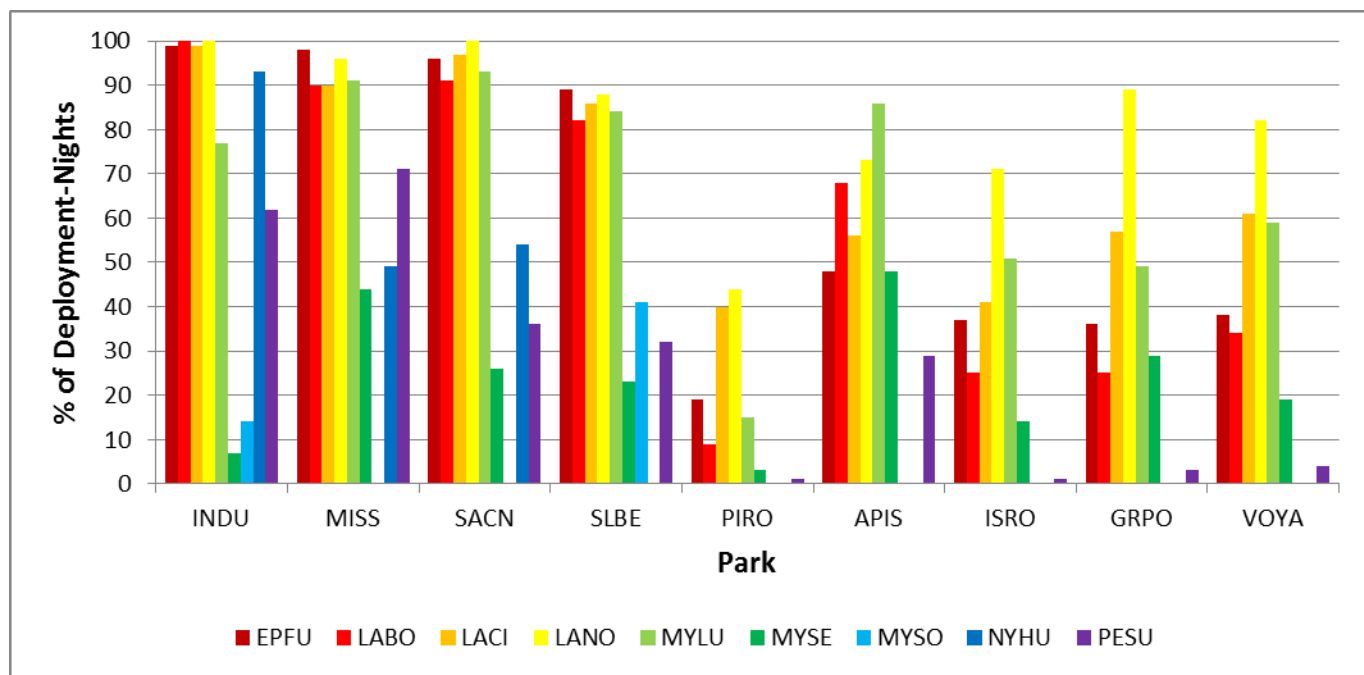


Figure 4-18. Percent of Deployment-Nights each species was present, by Park (Summer only), Expanded Analysis

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.

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	424	136	84	173	12	10	10	29	10	888
MISS	217	34	47	73	87	10	na	na	12	480
SACN	54	59	95	151	41	10	na	na	10	420
SLBE	90	75	81	101	129	10	na	na	na	486
PIRO	10	10	38	20	10	10	na	na	na	98
APIS	10	102	26	49	152	10	na	na	na	349
ISRO	10	10	10	17	10	10	na	na	na	67
GRPO	10	10	10	24	10	10	na	na	na	74
VOYA	10	10	29	18	11	10	na	na	na	88
All Parks	835	446	420	626	462	90	10	29	32	2950

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 show 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	-
SACN	-	-	-	-	-	-	na	10	-
SLBE	-	-	-	-	-	-	12	na	10
PIRO	-	-	-	-	-	-	na	na	6
APIS	-	-	-	-	-	-	na	na	10
ISRO	-	-	-	-	-	-	na	na	2
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 2018 data, a single biologist performed all manual identifications. This was the same biologist who performed all manual identifications for the 2016 and 2017 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 to be 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/MYLU		LABO or MYLU
LABO/NYHU		LABO or NYHU
LABO/PESU		LABO or PESU
LACI	LACI	
LANO	LANO	
MYLU	MYLU	MYSE or MYSO
MYLU/MYSO	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)		

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 for Myotis species. 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.

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

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	216	0	2	7	1	0	0	0	0	226
EPFU/LANO	555	7	24	267	4	0	0	1	0	858
LABO	5	338	8	6	49	15	10	4	14	449
LABO/MYLU	0	4	0	0	11	1	0	0	0	16
LABO/NYHU	0	17	0	0	0	0	0	6	0	23
LABO/PESU	0	0	0	0	0	0	0	0	3	3
LACI	31	4	316	35	5	1	0	0	2	394
LANO	17	0	10	292	1	0	0	0	0	320
MYLU	4	39	2	0	383	55	0	0	0	483
MYSE	0	0	0	0	0	14	0	0	0	14
MYsp	0	0	0	0	0	1	0	0	0	1
NYHU	0	27	0	1	0	0	0	18	1	47
PESU	1	3	0	0	1	0	0	0	12	17
UNKN_HIFREQ	0	3	0	0	6	2	0	0	0	11
UNKN_LOWFREQ	5	4	47	15	1	1	0	0	0	73
NOBAT	1	0	11	3	0	0	0	0	0	15
Total	835	446	420	626	462	90	10	29	32	2950

¹MYsp: unknown Myotis; UNKN: unknown bat call sequence; 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
EPFU/LANO	0	1	0
LABO	0	5	38
LABO/MYLU	0	0	1
LABO/NYHU	0	4	0
LABO/PESU	0	0	5
MYLU	2	0	3
MYLU/MYSO	10	0	0
NYHU	0	9	0
PESU	0	0	1
UNKN_LOWFREQ	0	1	0
Total	12	20	48

¹UNKN_LOFREQ: unknown low frequency bat call sequence

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	835	771	92.3	LACI, LANO
LABO	446	359	80.5	MYLU, NYHU
LACI	420	316	75.2	EPFU/LANO, UNKN_LOWFREQ
LANO	626	559	89.3	LACI
NYHU	29	24	82.8	LABO
PESU	32	15	46.9	LABO

¹Includes both exact and partial agreements

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

# of Files						% of Files		Most Common Disagreements
KPro ID	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	462	383	17	400	83	4	87	LABO
MYSE	90	14	59	73	16	66	81	LABO
MYSO	10	0	0	0	0	0	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	20	13	65.0	LABO
PESU	48	6	12.5	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	12	12	0	12	100	0	100	(none)

Note: For manual ID all potential MYSO are ID'd as MYLU/MYSO, so a manual ID of MYSO/MYLU is considered to be an exact match with a KPro ID of MYSO

6 Conclusion and Observations

The purpose of this report was simply to summarize the results of 2018 GLKN acoustic monitoring effort and not to make conclusions about the ecological significance of the results.

For the 2018 Summer season (6/1/18-9/15/18), 460175 audio files were analyzed from 9 national parks. These were collected at 259 distinct locations during 2152 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 the baseline analysis, overall ~67% of the audio files were identified to species, while ~32% were found to be noise. Less than 1% were found to be bat call sequences that could not be identified to species. The PIRO park had an unusually high number of noise files with 89% being classified as noise and only 8% of files identified to species. Excluding PIRO, the remaining parks had 69-89% of audio files identified to species with 10-30% classified as noise. It is not known why the PIRO park had such a high number of noise files; however the equipment and recording settings used there are different than at the remaining parks and this may be a contributing factor. In particular, a high-pass filter was not used at PIRO which may have permitted low frequency noises to be recorded. The expanded species analysis did not reclassify any noise files to species or vice versa; however, the expanded analysis did reclassify a small number files (~0.1%) 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 ~9% of LABO to NYHU at SACN and 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 95% were identified as MYLU while ~4% were identified as MYSE and ~0.2% 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 93% were identified as MYLU while ~4% were identified as MYSE and ~3% 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 to 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 92% and but for PESU the agreement was relatively low at only 47%. Other species ranged in agreement from 75%-89%. The low agreement percentage for PESU is due in large part to the difficulty of distinguishing PESU from LABO. PESU calls are fairly distinctive 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 only 65% and for PESU only 12.5%, with a manual identification identifying all those 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 83% also manually identified as MYLU and 87% manually identified as a Myotis species call sequence. For files identified by KPro as MYSE, only 16% were also manually identified as MYSE but 81% were manually identified as a Myotis species. For files identified by KPro as MYSO, the agreement was not good, with 100% being manually identified as 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 with KPro identification 100%. For the files identified by KPro as MYSO, the manual identification was MYLU/MYSO for all files.

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% 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 four years of data collection so far completed (2015-2018) and a fifth year planned for 2019. The data analysis using the methods presented in this report has only been done for 2016-2018 data but 2015 will be completed in the near future.

7 Supplementary Documents

The following documents contain detailed information and data that are important to the 2018 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_2018_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_2018_AudioFile_Classification_byParkSite.xlsx*](#) Audio file classification (bad files, short deployment fields, etc.) for each Park and site.
- [*tables_2018_CallsvsNoise_byParkSite.xlsx*](#) Number and percent files ID'd as bats and noise files for each Park and site.

8 APPENDIX

Table 8-1. Number of Deployments By Date, during the Summer season (Figure 3-2)

Night	All Parks	INDU	MISS	SACN	SLBE	PIRO	APIS	ISRO	GRPO	VOYA
5/29/2018	1	0	1	0	0	0	0	0	0	0
5/30/2018	1	0	1	0	0	0	0	0	0	0
5/31/2018	6	1	3	0	0	2	0	0	0	0
6/1/2018	11	3	3	0	0	2	0	0	3	0
6/2/2018	11	3	3	0	0	2	0	0	3	0
6/3/2018	15	3	3	0	3	2	0	0	3	1
6/4/2018	17	5	3	0	3	2	0	0	3	1
6/5/2018	23	5	3	3	3	2	1	0	3	3
6/6/2018	28	5	3	3	5	4	1	0	3	4
6/7/2018	32	5	3	3	6	5	1	2	3	4
6/8/2018	34	6	3	3	6	4	1	4	3	4
6/9/2018	34	6	3	3	6	4	1	4	3	4
6/10/2018	34	6	3	3	6	4	1	4	3	4
6/11/2018	34	5	3	3	6	4	1	4	3	5
6/12/2018	34	5	3	3	6	4	1	4	3	5
6/13/2018	37	5	4	3	6	3	2	4	3	7
6/14/2018	37	5	4	3	6	3	2	4	3	7
6/15/2018	36	5	3	3	6	3	2	4	3	7
6/16/2018	36	5	3	3	6	3	2	4	3	7
6/17/2018	36	5	3	3	6	3	2	4	3	7
6/18/2018	32	5	3	0	6	3	2	4	3	6
6/19/2018	33	5	3	3	6	4	2	2	3	5
6/20/2018	32	5	2	3	6	5	2	2	3	4
6/21/2018	33	5	3	3	5	5	4	3	3	2
6/22/2018	27	4	1	3	6	3	4	3	3	0
6/23/2018	27	4	1	3	6	3	4	3	3	0
6/24/2018	27	4	1	3	6	3	4	3	3	0
6/25/2018	29	4	1	3	6	5	4	3	3	0
6/26/2018	30	4	1	3	6	6	4	3	3	0
6/27/2018	31	4	3	3	6	5	4	3	3	0
6/28/2018	31	4	3	3	5	5	6	2	3	0
6/29/2018	32	4	3	3	5	6	6	2	3	0
6/30/2018	30	4	3	3	3	6	6	2	3	0
7/1/2018	29	4	3	3	3	6	5	2	3	0
7/2/2018	28	4	3	3	5	5	3	2	3	0
7/3/2018	28	4	2	3	5	5	3	3	3	0
7/4/2018	28	4	2	3	5	5	3	3	3	0
7/5/2018	28	3	2	3	5	5	3	4	3	0
7/6/2018	31	4	2	3	5	5	5	4	3	0
7/7/2018	29	4	2	3	5	5	4	3	3	0
7/8/2018	28	4	2	3	5	5	4	2	3	0
7/9/2018	29	4	1	3	5	5	4	3	3	1
7/10/2018	31	4	1	2	6	4	7	3	3	1
7/11/2018	32	4	1	2	6	5	7	3	3	1

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7/12/2018	32	4	2	2	6	4	7	3	3	1
7/13/2018	30	4	2	2	6	3	7	2	3	1
7/14/2018	30	4	2	2	6	3	6	2	3	2
7/15/2018	24	4	2	2	1	2	6	2	3	2
7/16/2018	23	5	2	2	0	3	4	2	3	2
7/17/2018	29	6	3	2	4	4	2	3	3	2
7/18/2018	34	6	3	2	6	3	2	4	3	5
7/19/2018	36	6	3	2	6	4	3	4	3	5
7/20/2018	36	6	3	2	6	4	3	4	3	5
7/21/2018	34	6	3	2	6	4	3	4	3	3
7/22/2018	34	6	3	2	6	4	3	4	3	3
7/23/2018	33	6	2	2	6	4	3	4	3	3
7/24/2018	34	6	2	3	6	3	4	4	3	3
7/25/2018	34	6	2	3	6	3	4	5	3	2
7/26/2018	33	5	2	3	6	2	4	6	3	2
7/27/2018	34	6	3	3	6	2	4	6	3	1
7/28/2018	34	6	3	3	6	2	4	6	3	1
7/29/2018	33	6	3	3	6	2	5	4	3	1
7/30/2018	32	6	3	3	5	2	5	4	3	1
7/31/2018	31	6	3	2	5	1	4	6	3	1
8/1/2018	26	6	2	2	0	2	4	6	3	1
8/2/2018	22	4	2	2	0	2	5	4	3	0
8/3/2018	23	4	3	2	0	2	5	4	3	0
8/4/2018	23	4	3	2	0	2	5	4	3	0
8/5/2018	26	4	3	2	0	2	6	4	3	2
8/6/2018	22	3	3	2	0	2	6	4	0	2
8/7/2018	24	0	3	2	0	2	5	6	0	6
8/8/2018	21	0	3	2	0	0	5	5	0	6
8/9/2018	17	0	3	2	0	0	4	2	0	6
8/10/2018	18	0	3	2	0	0	4	3	0	6
8/11/2018	17	0	3	2	0	0	4	2	0	6
8/12/2018	17	0	3	2	0	0	4	2	0	6
8/13/2018	17	0	3	2	0	0	4	2	0	6
8/14/2018	14	0	3	2	0	0	3	2	0	4
8/15/2018	11	0	2	0	0	0	3	2	0	4
8/16/2018	2	0	0	0	0	0	1	1	0	0

Table 8-2. 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
5/29/2018	8	14	149	19	0	0	0	0	0
5/30/2018	18	15	177	86	0	0	0	0	0
5/31/2018	27.7	18.2	45.2	42.8	3	0.2	0	1.2	1.3
6/1/2018	16.5	2.7	11.9	34.3	1.4	0	0	0.8	1.2
6/2/2018	9	4.5	15.7	35.5	1.3	0	0	1	0.3
6/3/2018	6.6	3.3	10.5	8.5	1.7	0	0	0.9	0.5
6/4/2018	39	9.2	21.6	46.9	3	0.2	0	1.7	0.6
6/5/2018	10.1	3.4	18.4	23.7	11.9	1	0	0.1	0.2

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6/6/2018	40.2	7	17.1	55	6.2	0.7	0	1.3	0.3
6/7/2018	49	5.4	21.2	35.1	4.3	1.1	0	0.5	0.4
6/8/2018	42.8	4.5	18.9	42.3	8.9	0.5	0	0.8	0.3
6/9/2018	39.9	4.7	25.4	30.5	12.2	0.5	0	0.5	0.2
6/10/2018	55.4	5.8	20.1	35.1	17.1	0.6	0	0.4	0.4
6/11/2018	60.7	5.1	25.3	45.2	5.6	0.5	0	1.2	0.4
6/12/2018	59.3	6.1	17.7	50.1	20.1	1	0	1.1	0.8
6/13/2018	36.3	7.7	10.7	27.9	9.9	0.8	0	0.6	0.8
6/14/2018	69.7	9	11.4	27.9	44.7	1.6	0	0.2	1.1
6/15/2018	60.6	11.1	16.9	49.2	27.7	1.4	0	1.6	0.7
6/16/2018	59.2	11.7	14.6	42.8	33.6	1.1	0	1.2	0.9
6/17/2018	37.1	11.8	6.5	47.1	18.3	0.8	0.1	1.7	0.5
6/18/2018	53.3	14.3	8.6	23.8	29.9	0.8	0.1	1	0.7
6/19/2018	44.4	8.8	11.8	15	37.4	0.6	0.1	0.6	0.4
6/20/2018	56.7	8.8	11	19.1	45.3	1.5	0.4	1.1	0.5
6/21/2018	54.2	9.8	7.5	24.8	10.2	0.9	0.1	0.5	0.5
6/22/2018	29.9	8.4	11.8	22.4	12.9	2.3	0.1	0.6	0.3
6/23/2018	67	6.8	8.2	23.3	15.6	2	0	0.5	0.2
6/24/2018	34.9	10	6	13.7	7.9	0.4	0.2	1.1	0.2
6/25/2018	39.5	7.9	37.2	35.7	21.8	1.1	0	0.7	0.2
6/26/2018	36.1	10.5	45.1	46.1	11.9	0.6	0	1.1	0.1
6/27/2018	21.9	11.1	64.5	42.8	16.1	1.3	0	1	0.1
6/28/2018	15.1	9.3	40.7	44.9	10.3	0.3	0	1.1	0.6
6/29/2018	35	14.8	17.3	43	13.9	0.7	0	1.1	0.6
6/30/2018	23.3	16.6	35.3	41.4	25	0.8	0	2	0.5
7/1/2018	14.3	22.2	24.9	39.8	51.1	3.7	0	1.1	0.5
7/2/2018	22.2	14.1	17.1	42.8	28.9	0.5	0	0.8	0.5
7/3/2018	37.8	23.7	29.8	36	34	0.5	0	1.2	0.4
7/4/2018	26.4	34.8	30.3	35.4	27.6	0.4	0	0.7	1.2
7/5/2018	16.7	36	15.9	24.9	18.3	0.3	0	0.7	1.5
7/6/2018	23.2	38.2	36.2	24.3	23	0.5	0	1	1.2
7/7/2018	43.8	41.3	26.9	27	30.2	0.9	0.2	0.9	1
7/8/2018	41.5	38.4	27.5	48.5	20.9	0.7	0	1.8	1.5
7/9/2018	52	45.2	40.2	31.3	11.2	0.7	0	1.2	2.4
7/10/2018	38.2	35.8	27.4	22	41.1	1.1	0	2	0.4
7/11/2018	64.3	28.1	44	34	55.6	1.2	0	1.5	4.9
7/12/2018	60.7	56.4	34.7	24.7	41.9	1.5	0.1	2	0.4
7/13/2018	58.6	82.6	48.3	30.9	27.6	1.4	0	2.6	0.5
7/14/2018	58.1	30.2	32.4	37.2	28.2	2.1	0	3.4	0.7
7/15/2018	38.1	34.9	24.2	22.1	72.6	2.8	0	4.5	1.1
7/16/2018	54.7	41	25	25.8	36.5	1.6	0.1	4.7	1
7/17/2018	39.6	25.7	19.3	13.6	19.8	0.6	0	2.9	1.3
7/18/2018	27.6	19.5	14.3	11.2	14.7	0.6	0	2	1.5
7/19/2018	57.6	26.6	18.4	14.8	24.1	1.8	0.1	2.5	0.6

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7/20/2018	25.8	25.7	21	24.4	24.3	1.2	0	1.2	0.9
7/21/2018	39.1	27.6	11.4	24.9	30.5	1.9	0	1.5	1.5
7/22/2018	35.6	31.1	10.4	17.8	23	1.8	0	2.4	2.4
7/23/2018	47.8	44.2	12.2	20.7	16.4	0.6	0.2	3.2	2.8
7/24/2018	39.7	26.2	9.4	23.9	13.7	0.4	0	2.2	1.4
7/25/2018	46.5	29.2	7.9	21.4	22.6	1.6	0	2.8	1.7
7/26/2018	32.8	19.7	5.8	16.3	12.9	0.3	0.1	1	2.5
7/27/2018	15.9	17.2	4.4	11.4	26.3	1.6	0	0.6	1.3
7/28/2018	16.9	20.7	8.8	19.7	18.5	0.5	0.1	1.3	0.8
7/29/2018	20.7	18.2	9.6	14.9	24.2	1	0	0.8	2
7/30/2018	32.1	18.3	10.6	33.2	19.2	1.4	0	1.2	1.8
7/31/2018	21	28.1	24	26.8	23.2	1.1	0	1.3	1.8
8/1/2018	28.7	8.2	4.6	15.5	7.9	0.7	0	1.7	0.7
8/2/2018	23	13.9	9	9.1	19	1.2	0	2.2	1.1
8/3/2018	39.5	27.6	4.3	22.4	8.4	0.3	0	2.6	1
8/4/2018	34.5	37.3	10.1	30.4	10.4	0.4	0	3.7	1.5
8/5/2018	33.6	20	18.7	42.9	7.3	0.5	0	3	0.4
8/6/2018	33	13.5	9.9	16.6	6.4	0.5	0	0.7	0.6
8/7/2018	13.2	10.7	9.1	26	8	0.5	0	0	0.8
8/8/2018	17.2	7.5	7.3	36.3	5.3	0.4	0	0	0.1
8/9/2018	21.3	13.4	5.8	19.8	8.5	0.2	0	0	0.4
8/10/2018	9.1	5.6	7.1	34.9	8.4	0.7	0	0	0
8/11/2018	9.6	8.2	9.8	20.4	11.3	0.5	0	0	0.4
8/12/2018	11.6	13.3	16.5	20.2	7.9	0.4	0	0	0
8/13/2018	14.8	4.1	8.2	24.5	8.1	0.4	0	0	0
8/14/2018	5.6	2.4	6.7	14.9	5.4	0.4	0	0	0
8/15/2018	8.5	6.2	4.1	8.2	3.6	0.7	0	0	0
8/16/2018	1	3.5	1.5	9.5	0.5	0	0	0	0

Table 8-3. 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
5/29/2018	8	13	149	19	0	0	0	0	0
5/30/2018	18	14	175	88	0	0	0	1	0
5/31/2018	27.8	14.3	45.3	42.8	3	0.2	0	4.5	1.3
6/1/2018	16.6	2.6	11.9	34.2	1.3	0	0	1	1.2
6/2/2018	9	4.1	15.7	35.5	1.3	0	0	1.3	0.3
6/3/2018	6.6	3.1	10.6	8.5	1.5	0	0.1	1.1	0.5
6/4/2018	39.1	8.9	21.6	46.9	2.8	0.2	0.2	1.9	0.8
6/5/2018	10.2	3	18.4	23.7	12	1	0	0.4	0.2
6/6/2018	40.2	6.6	17.2	55	6.2	0.7	0	1.5	0.4
6/7/2018	49	5.1	21.2	35.1	4.3	1.1	0	0.5	0.6
6/8/2018	42.8	4.4	18.9	42.3	8.8	0.5	0	0.8	0.3
6/9/2018	39.9	4.7	25.4	30.5	12.1	0.4	0	0.6	0.2
6/10/2018	55.4	5.6	20.1	35	17.1	0.6	0	0.6	0.5

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6/11/2018	60.7	5.1	25.3	45.2	5.6	0.5	0	1.2	0.4
6/12/2018	59.3	6.2	17.7	50.1	19.7	1	0.1	1.4	0.7
6/13/2018	36.4	6.9	10.7	27.9	9.8	0.9	0	1.3	0.8
6/14/2018	69.7	8.7	11.4	27.9	43.2	1.6	1.4	0.6	1.1
6/15/2018	60.6	10.5	17	49.2	26.8	1.3	0.7	1.8	0.9
6/16/2018	59.3	11.2	14.6	42.8	31.6	0.9	2.1	1.3	1.1
6/17/2018	37.1	11.5	6.6	47.1	17	0.5	1.2	1.8	0.9
6/18/2018	53.3	14	8.7	23.9	28.2	0.8	1.2	1.2	0.9
6/19/2018	44.5	8.6	11.9	15	35.5	0.4	1.6	0.9	0.5
6/20/2018	56.8	8.5	11	19.2	42.6	1.3	3.2	1.2	0.5
6/21/2018	54.2	9.1	7.5	24.8	9.4	0.8	0.9	0.9	0.7
6/22/2018	29.9	8.1	11.8	22.4	13	2.3	0.1	0.6	0.3
6/23/2018	67	6.7	8.2	23.3	11.6	1.5	4.5	0.6	0.3
6/24/2018	34.9	9.8	6	13.7	7.8	0.5	0.3	1.1	0.2
6/25/2018	39.5	7.7	37.2	35.7	21.1	1	0.6	0.8	0.4
6/26/2018	36.1	9.9	45.2	46.1	11.8	0.5	0.5	1.3	0.1
6/27/2018	21.9	10.6	64.4	42.8	16.1	1.2	0.1	1.3	0.1
6/28/2018	15.2	9.1	40.7	44.9	10.2	0.3	0	1.3	0.7
6/29/2018	35.1	14.8	17.3	42.9	13.4	0.7	0.2	1.4	0.7
6/30/2018	23.4	16.1	35.3	41.3	24.9	0.8	0.1	2.3	0.5
7/1/2018	14.3	20.8	24.8	39.9	51.1	3.8	0.1	1.2	1
7/2/2018	22.2	13.5	17.1	42.8	28.9	0.5	0.1	1	0.7
7/3/2018	37.8	22.4	29.8	36	33.8	0.5	0.2	2.2	0.5
7/4/2018	26.5	32.3	30.5	35.5	27.2	0.4	0.2	2.1	1.7
7/5/2018	16.8	34.7	15.9	24.9	17.2	0.3	0.4	1.9	1.9
7/6/2018	23.2	37.1	36.5	24.4	22.4	0.5	0.2	1.9	1.4
7/7/2018	43.8	39.7	27.1	27	29.7	1	0.4	1.6	1.5
7/8/2018	41.4	36.3	27.8	48.6	20.1	0.7	0.2	3.1	1.7
7/9/2018	52	42.6	40.3	31.5	10.7	0.7	0.1	3.4	2.7
7/10/2018	38.2	34.2	27.4	22	40.9	1.1	0.1	2.3	1.3
7/11/2018	64.2	26.4	44	34.1	54.2	1	1.8	1.8	5.7
7/12/2018	60.8	54.2	34.8	24.6	40.6	1.5	1.7	2.1	1.7
7/13/2018	58.5	79.8	48.5	30.9	27.4	1.4	0.3	2.9	2.2
7/14/2018	58.2	28.4	32.3	37.2	27.9	2	0.5	3.9	1.5
7/15/2018	38.1	32.5	24.2	22.1	72.8	2.8	0	4.7	2.9
7/16/2018	54.7	38.9	25	25.8	36.6	1.5	0.1	4.8	2.4
7/17/2018	39.6	24.6	19.3	13.6	19.8	0.6	0.2	3.1	1.7
7/18/2018	27.6	18.6	14.3	11.2	14.1	0.6	0.6	2.1	2.1
7/19/2018	57.5	25.2	18.5	14.9	22.9	1.7	1.6	2.6	1.2
7/20/2018	25.8	24	20.9	24.4	22.9	1.1	1.7	1.4	1.8
7/21/2018	39.2	26.7	11.4	24.9	28.1	1.9	2.4	1.7	2
7/22/2018	35.6	30.4	10.4	17.8	21.7	1.7	1.2	2.5	2.9
7/23/2018	47.8	43.1	12.2	20.8	15.9	0.6	0.7	3.6	3.2
7/24/2018	39.6	25.1	9.4	24	13.7	0.3	0.3	2.6	1.8

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7/25/2018	46.6	27.9	8	21.4	21.9	1.4	0.8	3.4	2.1
7/26/2018	32.8	19.2	5.8	16.3	12.2	0.3	0.8	1.3	2.5
7/27/2018	15.9	16.6	4.4	11.4	25.8	1.5	0.5	1	1.4
7/28/2018	16.9	19.8	8.8	19.6	17.9	0.5	0.6	1.5	1.6
7/29/2018	20.7	17.2	9.6	14.9	24	1	0.4	1.1	2.2
7/30/2018	32.2	17	10.6	33.1	18	1.3	1.1	2	2.2
7/31/2018	21	25.5	24.1	26.9	23.2	1.1	0.5	2	2.5
8/1/2018	28.7	8.1	4.6	15.5	7.8	0.7	0	1.8	0.7
8/2/2018	23	13.4	9	9.1	19	1.1	0	2.6	1.1
8/3/2018	39.4	26.7	4.3	22.4	8.2	0.3	0	3.4	1.1
8/4/2018	34.6	35.6	10.1	30.3	10.4	0.5	0	4.8	1.7
8/5/2018	33.7	19.1	18.7	42.9	7.3	0.5	0	3.7	0.4
8/6/2018	33.1	12.1	9.9	16.6	6.3	0.5	0	1.9	0.7
8/7/2018	13.2	10.3	9.1	26	7.8	0.5	0	0.5	0.9
8/8/2018	17.2	6.8	7.4	36.3	5.3	0.4	0	0.4	0.4
8/9/2018	21.4	12	5.8	19.8	8.5	0.2	0	1	0.6
8/10/2018	9.1	5.3	7.1	34.9	8.4	0.7	0	0.1	0.2
8/11/2018	9.6	7.4	9.8	20.4	11.3	0.6	0	0.1	0.9
8/12/2018	11.6	12.2	16.5	20.2	8.2	0.4	0	0.2	0.6
8/13/2018	14.8	3.5	8.2	24.5	8.1	0.4	0	0.2	0.2
8/14/2018	5.6	1.9	6.7	14.9	5.5	0.4	0	0.2	0.1
8/15/2018	8.5	5.9	4.1	8.2	3.7	0.7	0	0	0.2
8/16/2018	1	2.5	1.5	9.5	0.5	0	0	0	0.5

Table 8-4. Total number of Calls Recorded (All Species Combined), for each Date and Park (Summer only) (Figure 4-15)

Night	INDU	MISS	SACN	SLBE	PIRO	APIS	ISRO	GRPO	VOYA
5/29/2018	0	193	0	0	0	0	0	0	0
5/30/2018	0	301	0	0	0	0	0	0	0
5/31/2018	94	753	0	0	1	0	0	0	0
6/1/2018	92	672	0	0	0	0	0	4	0
6/2/2018	336	411	0	0	1	0	0	1	0
6/3/2018	156	216	0	113	9	0	0	0	2
6/4/2018	1294	525	0	267	0	0	0	13	1
6/5/2018	309	487	624	156	7	3	0	11	21
6/6/2018	1695	589	460	753	57	22	0	16	25
6/7/2018	1063	1418	516	709	9	11	17	11	27
6/8/2018	767	1577	343	1257	27	1	38	10	64
6/9/2018	759	1537	565	872	25	11	69	21	66
6/10/2018	935	2129	670	752	31	13	44	12	54
6/11/2018	2197	971	583	977	42	5	65	10	86
6/12/2018	2186	1069	1122	778	55	60	39	33	60
6/13/2018	796	1165	321	902	123	16	70	31	122
6/14/2018	1730	1786	817	1482	70	2	36	16	242

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6/15/2018	1424	1636	813	1904	72	2	39	12	262
6/16/2018	1409	1719	806	1936	57	0	14	16	60
6/17/2018	1531	605	282	1517	452	0	5	24	111
6/18/2018	1536	1105	0	1360	62	0	153	27	36
6/19/2018	1668	332	172	1547	13	45	82	26	84
6/20/2018	1335	1112	225	1837	7	26	53	39	19
6/21/2018	1700	713	212	814	5	38	22	88	27
6/22/2018	1007	84	261	628	3	351	31	50	0
6/23/2018	1981	182	159	828	0	154	15	44	0
6/24/2018	1258	247	164	287	0	45	21	17	0
6/25/2018	1681	679	220	891	635	47	30	42	0
6/26/2018	1357	210	1208	874	878	42	20	38	0
6/27/2018	964	348	1335	434	1011	493	35	421	0
6/28/2018	682	387	1011	397	928	505	10	112	0
6/29/2018	867	317	834	904	343	723	7	113	0
6/30/2018	1107	458	1326	158	567	733	2	95	0
7/1/2018	1041	803	815	247	433	1306	13	155	0
7/2/2018	456	461	1085	526	40	950	9	65	0
7/3/2018	1165	261	1301	977	60	781	20	62	0
7/4/2018	662	240	1733	716	58	915	64	52	0
7/5/2018	508	239	1698	439	8	275	44	34	0
7/6/2018	832	215	2159	394	11	855	125	24	0
7/7/2018	811	169	2194	490	47	1271	26	33	0
7/8/2018	1308	198	2024	484	38	1057	16	14	0
7/9/2018	1924	157	1715	485	23	490	24	15	579
7/10/2018	1428	207	600	916	8	1951	24	27	91
7/11/2018	1568	765	1195	1446	14	2006	17	14	512
7/12/2018	1631	330	101	1597	47	2801	36	61	577
7/13/2018	1810	281	515	1494	26	3014	46	51	421
7/14/2018	1721	406	805	1241	9	1418	40	61	134
7/15/2018	1472	456	402	76	9	2055	52	87	247
7/16/2018	2405	461	200	0	60	1051	74	99	107
7/17/2018	1905	449	147	303	8	330	32	71	352
7/18/2018	1168	621	128	466	24	472	27	73	152
7/19/2018	2895	320	172	1453	59	189	34	52	150
7/20/2018	1386	826	240	1261	60	449	35	206	80
7/21/2018	2224	534	135	1133	59	480	5	148	57
7/22/2018	2031	558	101	1191	23	177	18	142	34
7/23/2018	2843	652	206	560	78	418	13	113	39
7/24/2018	2030	644	236	453	120	343	24	143	26
7/25/2018	2208	752	321	524	33	507	49	180	3
7/26/2018	1576	440	302	439	57	93	53	70	15
7/27/2018	746	660	216	490	16	433	45	92	0
7/28/2018	857	643	170	765	93	213	45	213	0

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7/29/2018	848	992	170	611	39	209	51	131	0
7/30/2018	1083	795	317	664	29	348	372	209	0
7/31/2018	738	924	631	1086	6	365	41	193	0
8/1/2018	1396	83	137	0	0	137	33	14	0
8/2/2018	1052	274	148	0	0	246	16	14	0
8/3/2018	1371	530	157	0	0	384	6	34	0
8/4/2018	1291	707	493	0	0	298	140	63	0
8/5/2018	1022	928	580	0	0	405	53	320	35
8/6/2018	270	992	407	0	0	127	4	0	12
8/7/2018	0	680	387	0	0	193	40	0	363
8/8/2018	0	540	231	0	0	396	239	0	164
8/9/2018	0	575	250	0	0	148	56	0	166
8/10/2018	0	276	219	0	0	285	103	0	340
8/11/2018	0	337	275	0	0	204	22	0	206
8/12/2018	0	253	186	0	0	415	18	0	331
8/13/2018	0	279	166	0	0	339	54	0	215
8/14/2018	0	184	204	0	0	80	4	0	41
8/15/2018	0	176	0	0	0	41	15	0	122
8/16/2018	0	0	0	0	0	20	12	0	0

Table 8-5. Number of Calls Per Deployment-Night Per Night (All Species Combined), for each Park (Figure 4-16)

Night	INDU	MISS	SACN	SLBE	PIRO	APIS	ISRO	GRPO	VOYA
5/29/2018	0	193	0	0	0	0	0	0	0
5/30/2018	0	301	0	0	0	0	0	0	0
5/31/2018	15.7	125.5	0	0	0.2	0	0	0	0
6/1/2018	8.4	61.1	0	0	0	0	0	0.4	0
6/2/2018	30.5	37.4	0	0	0.1	0	0	0.1	0
6/3/2018	10.4	14.4	0	7.5	0.6	0	0	0	0.1
6/4/2018	76.1	30.9	0	15.7	0	0	0	0.8	0.1
6/5/2018	13.4	21.2	27.1	6.8	0.3	0.1	0	0.5	0.9
6/6/2018	60.5	21	16.4	26.9	2	0.8	0	0.6	0.9
6/7/2018	33.2	44.3	16.1	22.2	0.3	0.3	0.5	0.3	0.8
6/8/2018	22.6	46.4	10.1	37	0.8	0	1.1	0.3	1.9
6/9/2018	22.3	45.2	16.6	25.6	0.7	0.3	2	0.6	1.9
6/10/2018	27.5	62.6	19.7	22.1	0.9	0.4	1.3	0.4	1.6
6/11/2018	64.6	28.6	17.1	28.7	1.2	0.1	1.9	0.3	2.5
6/12/2018	64.3	31.4	33	22.9	1.6	1.8	1.1	1	1.8
6/13/2018	21.5	31.5	8.7	24.4	3.3	0.4	1.9	0.8	3.3
6/14/2018	46.8	48.3	22.1	40.1	1.9	0.1	1	0.4	6.5
6/15/2018	39.6	45.4	22.6	52.9	2	0.1	1.1	0.3	7.3
6/16/2018	39.1	47.8	22.4	53.8	1.6	0	0.4	0.4	1.7
6/17/2018	42.5	16.8	7.8	42.1	12.6	0	0.1	0.7	3.1
6/18/2018	48	34.5	0	42.5	1.9	0	4.8	0.8	1.1

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6/19/2018	50.5	10.1	5.2	46.9	0.4	1.4	2.5	0.8	2.5
6/20/2018	41.7	34.8	7	57.4	0.2	0.8	1.7	1.2	0.6
6/21/2018	51.5	21.6	6.4	24.7	0.2	1.2	0.7	2.7	0.8
6/22/2018	37.3	3.1	9.7	23.3	0.1	13	1.1	1.9	0
6/23/2018	73.4	6.7	5.9	30.7	0	5.7	0.6	1.6	0
6/24/2018	46.6	9.1	6.1	10.6	0	1.7	0.8	0.6	0
6/25/2018	58	23.4	7.6	30.7	21.9	1.6	1	1.4	0
6/26/2018	45.2	7	40.3	29.1	29.3	1.4	0.7	1.3	0
6/27/2018	31.1	11.2	43.1	14	32.6	15.9	1.1	13.6	0
6/28/2018	22	12.5	32.6	12.8	29.9	16.3	0.3	3.6	0
6/29/2018	27.1	9.9	26.1	28.2	10.7	22.6	0.2	3.5	0
6/30/2018	36.9	15.3	44.2	5.3	18.9	24.4	0.1	3.2	0
7/1/2018	35.9	27.7	28.1	8.5	14.9	45	0.4	5.3	0
7/2/2018	16.3	16.5	38.8	18.8	1.4	33.9	0.3	2.3	0
7/3/2018	41.6	9.3	46.5	34.9	2.1	27.9	0.7	2.2	0
7/4/2018	23.6	8.6	61.9	25.6	2.1	32.7	2.3	1.9	0
7/5/2018	18.1	8.5	60.6	15.7	0.3	9.8	1.6	1.2	0
7/6/2018	26.8	6.9	69.6	12.7	0.4	27.6	4	0.8	0
7/7/2018	28	5.8	75.7	16.9	1.6	43.8	0.9	1.1	0
7/8/2018	46.7	7.1	72.3	17.3	1.4	37.8	0.6	0.5	0
7/9/2018	66.3	5.4	59.1	16.7	0.8	16.9	0.8	0.5	20
7/10/2018	46.1	6.7	19.4	29.5	0.3	62.9	0.8	0.9	2.9
7/11/2018	49	23.9	37.3	45.2	0.4	62.7	0.5	0.4	16
7/12/2018	51	10.3	3.2	49.9	1.5	87.5	1.1	1.9	18
7/13/2018	60.3	9.4	17.2	49.8	0.9	100.5	1.5	1.7	14
7/14/2018	57.4	13.5	26.8	41.4	0.3	47.3	1.3	2	4.5
7/15/2018	61.3	19	16.8	3.2	0.4	85.6	2.2	3.6	10.3
7/16/2018	104.6	20	8.7	0	2.6	45.7	3.2	4.3	4.7
7/17/2018	65.7	15.5	5.1	10.4	0.3	11.4	1.1	2.4	12.1
7/18/2018	34.4	18.3	3.8	13.7	0.7	13.9	0.8	2.1	4.5
7/19/2018	80.4	8.9	4.8	40.4	1.6	5.2	0.9	1.4	4.2
7/20/2018	38.5	22.9	6.7	35	1.7	12.5	1	5.7	2.2
7/21/2018	65.4	15.7	4	33.3	1.7	14.1	0.1	4.4	1.7
7/22/2018	59.7	16.4	3	35	0.7	5.2	0.5	4.2	1
7/23/2018	86.2	19.8	6.2	17	2.4	12.7	0.4	3.4	1.2
7/24/2018	59.7	18.9	6.9	13.3	3.5	10.1	0.7	4.2	0.8
7/25/2018	64.9	22.1	9.4	15.4	1	14.9	1.4	5.3	0.1
7/26/2018	47.8	13.3	9.2	13.3	1.7	2.8	1.6	2.1	0.5
7/27/2018	21.9	19.4	6.4	14.4	0.5	12.7	1.3	2.7	0
7/28/2018	25.2	18.9	5	22.5	2.7	6.3	1.3	6.3	0
7/29/2018	25.7	30.1	5.2	18.5	1.2	6.3	1.5	4	0
7/30/2018	33.8	24.8	9.9	20.8	0.9	10.9	11.6	6.5	0
7/31/2018	23.8	29.8	20.4	35	0.2	11.8	1.3	6.2	0
8/1/2018	53.7	3.2	5.3	0	0	5.3	1.3	0.5	0

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8/2/2018	47.8	12.5	6.7	0	0	11.2	0.7	0.6	0
8/3/2018	59.6	23	6.8	0	0	16.7	0.3	1.5	0
8/4/2018	56.1	30.7	21.4	0	0	13	6.1	2.7	0
8/5/2018	39.3	35.7	22.3	0	0	15.6	2	12.3	1.3
8/6/2018	12.3	45.1	18.5	0	0	5.8	0.2	0	0.5
8/7/2018	0	28.3	16.1	0	0	8	1.7	0	15.1
8/8/2018	0	25.7	11	0	0	18.9	11.4	0	7.8
8/9/2018	0	33.8	14.7	0	0	8.7	3.3	0	9.8
8/10/2018	0	15.3	12.2	0	0	15.8	5.7	0	18.9
8/11/2018	0	19.8	16.2	0	0	12	1.3	0	12.1
8/12/2018	0	14.9	10.9	0	0	24.4	1.1	0	19.5
8/13/2018	0	16.4	9.8	0	0	19.9	3.2	0	12.6
8/14/2018	0	13.1	14.6	0	0	5.7	0.3	0	2.9
8/15/2018	0	16	0	0	0	3.7	1.4	0	11.1
8/16/2018	0	0	0	0	0	10	6	0	0